



The Joint Board THE CONSOLIDATED HEARINGS ACT, 1981

REASONS FOR DECISION

and

DECISION

IN THE MATTER OF an application by the Regional Municipality of Halton
for:

- a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton by one of two alternative methods as follows:
 - (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
 - (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton.

Before: H.H. Lancaster, Q.C.
D.J. Kingham, Ph.D.

February 24, 1989
2300 Yonge Street
Suite 1201
Toronto, Ontario M4P 1E4
Tel: (416) 323-4806



2300 Yonge Street
P.O. Box 2382
Suite 1201
Toronto, Ontario
M4P 1E4
416/323-4806

2300, rue Yonge
C.P. 2382
Bureau 1201
Toronto (Ontario)
M4P 1E4
416/323-4806

Fax: 416/323-4997

ADDENDUM TO DECISION

The Joint Board

THE CONSOLIDATED HEARINGS ACT, 1981

IN THE MATTER OF an application by the Regional Municipality of Halton for:

- a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton by one of two alternative methods as follows:
 - (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
 - (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton.

Before: H.H. Lancaster, Q.C.
D.J. Kingham, Ph.D.

ADDENDUM TO DECISION

Numbered paragraph 2 appearing on page 149 of the Decision dated February 24, 1989, is hereby deleted and the following substituted:

2. The Joint Board does not grant approval to proceed with landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington, but does grant approval to proceed with landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton subject to the conditions set out in the section forming part of this Decision and entitled "Conditions", pursuant to the provisions of sections 12 and 14 of the Environmental Assessment Act, R.S.O. 1980, c.140, and pursuant to section 38 of the Environmental Protection Act, R.S.O. 1980, c.141. Accordingly the Approvals Director is directed to issue a Certificate of Approval in accordance with these conditions.

A new paragraph numbered paragraph 9 is added to page 150 of the Decision dated February 24, 1989, following the existing numbered paragraph 9 as follows:

9. Pursuant to the provisions of section 28(3) of the Conservation Authorities Act, R.S.O. 1980 Chapter 85 as amended and section 4 of Ontario Regulation 164 passed thereunder, permission and consent is hereby given for the diverting and rerouting of a small tributary stream traversing Site D as referred to at page 51 of the Reasons for Decision and as addressed by Condition 4.2 at page 182 of the Decision which is applicable hereto.

Dated at TORONTO this 2ND day of MARCH, 1989.

"H.H. Lancaster"
H.H. Lancaster, Q.C. Chairman

"J.D. Kingham"
J.D. Kingham, Ph.D. Member

REASONS FOR DECISION

and

DECISION

IN THE MATTER OF an application by the Regional Municipality of Halton
for:

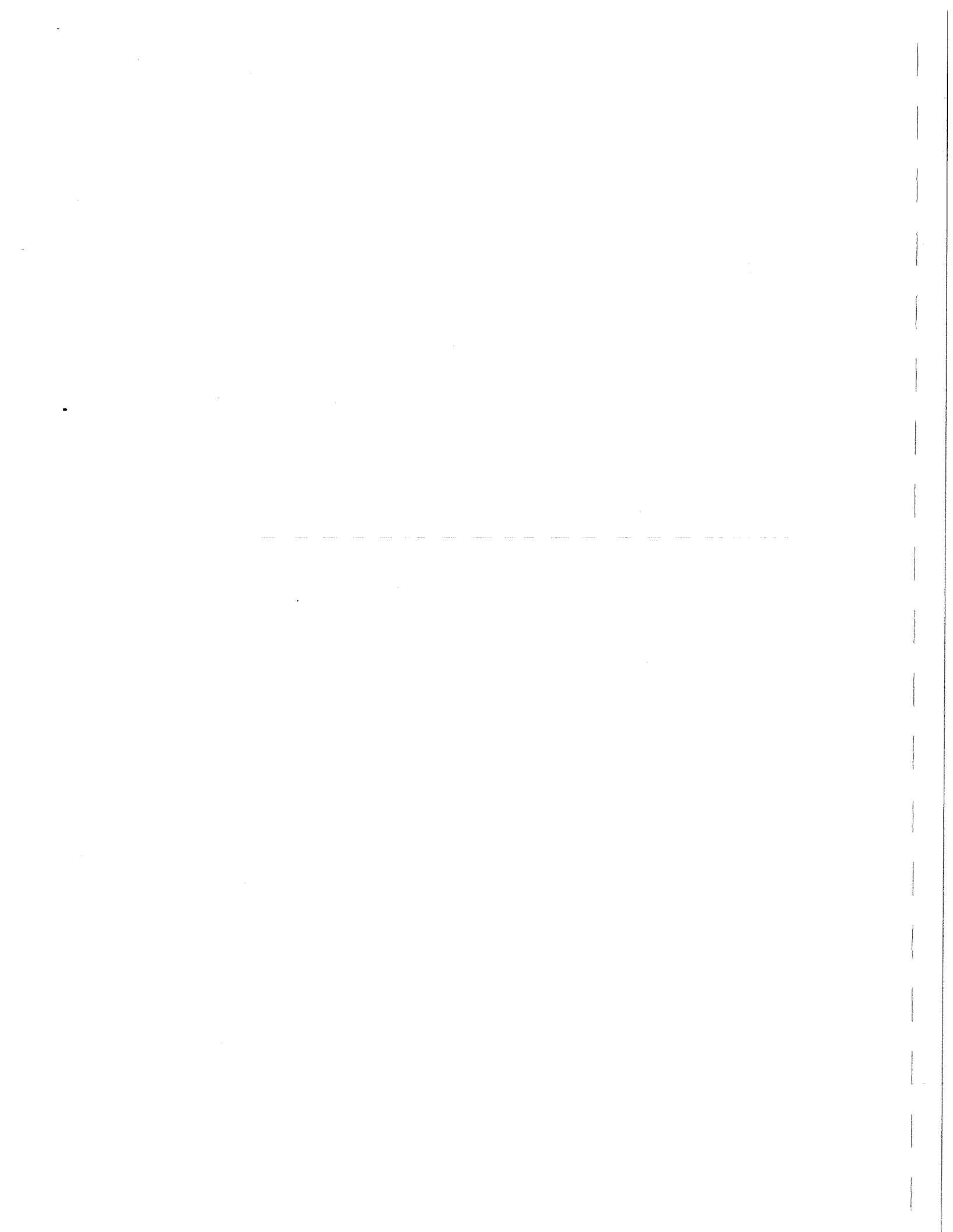
- a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton by one of two alternative methods as follows:
 - (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
 - (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton.

Before: H.H. Lancaster, Q.C.
D.J. Kingham, Ph.D.

February 24, 1989

INDEX

	Page
Appearances/Introduction	2
Background	7
Environmental Assessment Act	
Need	9
Cultural Impacts	
Archeology	14
Heritage	15
Social Impact Assessment	17
Environmental Protection Act	
Nuisance Concerns	
Air quality	28
Noise	30
Visual impact	31
Resource Policy Considerations	
Agricultural versus mineral resource policies	35
Flora and fauna	41
Public Health and Safety	
Airport bird hazard	45
Transportation	47
Leachate treatment	50
Hydrology	51
Hydrogeological matters	54
Design and operations	113
Planning Act Provisions	122
Municipal Act (Debentures) and Expropriation Act Considerations	137
Decision	149
Environmental Assessment Process Considerations	151
Conditions of Approval	172
Costs	204
Figures	
1. Key Features Map	5
2. Site D Hydrogeology	61
3. Site F Models	84



IN THE MATTER OF Sections 2 and 3 and 6(3) of the Consolidated Hearings Act, 1981, S.O. 1981, c.20;

- and -

IN THE MATTER OF Section 12(2) of the Environmental Assessment Act, R.S.O. 1980, c. 140;

- and -

IN THE MATTER OF Sections 30, 35 and 38 of the Environmental Protection Act, R.S.O. 1980, c.141, as amended;

- and -

IN THE MATTER OF Sections 24 and 61(2) of the Ontario Water Resources Act, R.S.O. 1980, c.361, as amended;

- and -

IN THE MATTER OF Section 28(3) of, and Regulation 164 under, the Conservation Authorities Act, R.S.O. 1980, c.85, as amended;

- and -

IN THE MATTER OF Section 40(12) of the Planning Act, S.O. 1983, c.1, as amended; in connection with site plan control of the sanitary landfill site;

- and -

IN THE MATTER OF Section 22(1) of the Planning Act, 1983 in connection with a referral to this Board by the Honourable Bernard Grandmaitre, Minister of Municipal Affairs, on a request by the Regional Municipality of Halton to amend the Official Plan for the Town of Milton to redesignate a parcel of land comprising Part Lots 3 and 4, Concession 2 N.S. in the Town of Milton from "Agriculture" and "Conservation and Hazard Lands" to permit the construction, operation and maintenance of a landfill site, Minister's File No. 24-OP-0208-A01;

- and -

IN THE MATTER OF Section 34(11) of the Planning Act, 1983 in connection with an appeal to this Board by the Regional Municipality of Halton for an order directing an amendment to By-law 61-85 of the Town of Milton to rezone the lands situated at Lot 3 and part of Lot 4, Concession 2 N.S., in the Town of Milton from "Agriculture" to permit a regional sanitary landfill site and ancillary uses;

- and -

IN THE MATTER OF Section 15(1) of the Planning Act, R.S.O. 1980 ch.379 in connection with a referral by the Honourable Claude F. Bennett, Minister of Housing on a request by Tremaine Britannia Citizen's Group for consideration of part of the Official Plan for the Halton planning Area with respect to Sections 1 to 5 inclusive, 7, 9 and 10 of Part III D3 Solid Waste Management, Ministers file No. OPC-0026;

- and -

IN THE MATTER OF Section 64 of the Ontario Municipal Board Act, R.S.O. 1980, c.347, as amended in connection with an application by the Regional Municipality of Halton for an order approving:

- a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton and to do so by one of two alternative methods as follows:
 - (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
 - (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton at an estimated cost of \$12,775,000.00, and the borrowing of money by way of temporary advances not exceeding in the aggregate such estimated cost pending the sale of debentures, and
- b) the issuance of necessary debentures to a maximum of \$12,775,000.00 for a term not to exceed fifteen years

- and -

IN THE MATTER OF Section 193(5) and Paragraph 84 of Section 210 of the Municipal Act, R.S.O. 1980, c.302, as amended;

- and -

IN THE MATTER OF Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1980, c.148;

- and -

IN THE MATTER OF an undertaking of the Regional Municipality of Halton to provide facilities for the purpose of receiving, dumping and disposing of waste as required by section 137 of the **REGIONAL MUNICIPALITY OF HALTON ACT**, R.S.O. 1980, c. 436, as amended, by acquiring the land for, constructing, operating and maintaining a landfill to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton

APPEARANCES:

T. Marshall, Q.C.	for the Board
T.R. Lederer and N.D. Hodgson	for the Regional Municipality of Halton (Proponent)
J.R. Tidball	for the Ministry of the Environment

T. Vigod J.F. Castrilli	for the West Burlington Citizens Group
D. Estrin, F.E. Leitch and H. Dahme	for the Corporation of the Town of Milton
S.R. Garrod and A. Nurvo	for the Milton Area Citizens Coalition and several affected Milton area landowners
R.B. Tuer, Q.C. E.A. Cronk, F. Perrier and L. J. Griffiths	for National Sewer Pipe Limited
L.F. Longo	for Azova Investments Limited
M.J. McQuaid, Q.C. and C.J. Tzekas	for the City of Burlington
C. Mansfield	for the Ministry of Natural Resources
P. Renaud	for Cumis Limited
C. Stevenson P. Hancock	for Framgard Holdings, Fosseri Investments Limited, Seriphos Investments Limited and Topic Investments
J.H. Olah	for the Halton Region Conservation Authority

Pursuant to the provisions of the Consolidated Hearings Act, 1981, the Regional Municipality of Halton, on November 20, 1986, gave written notice of an intended undertaking to the Hearings Registrar of the said Act.

In accordance with the provisions of section 4 of the Consolidated Hearings Act, 1981, the establishing authority thereunder did establish a Joint Board comprising two members of the Environmental Assessment Board and one member of the Ontario Municipal Board, the latter member to act as Chairman of the Joint Board.

Due to circumstances at the time, the Joint Board was reconstituted as of October 13, 1987, comprising two members, one from each of the two Boards.

The purpose of the Joint Board was to hear evidence and submissions regarding the matters as hereinbefore set out, and the selection, if appropriate, of a sanitary landfill site for and within the Regional Municipality of Halton.

The Regional Municipality of Halton ("Halton") is required to provide waste facilities for disposing of ashes, garbage, refuse, domestic waste, industrial solid waste and municipal waste. (Halton is not required and will not provide facilities for disposing of liquid industrial and hazardous waste).

Since mid-1982, Halton had been conducting an Environmental Assessment to identify appropriate methods of providing waste facilities. Halton had concluded that as part of its waste management system, it required sanitary landfill capacity for approximately 7.96 million cubic metres of waste during the period 1988 to 2008.

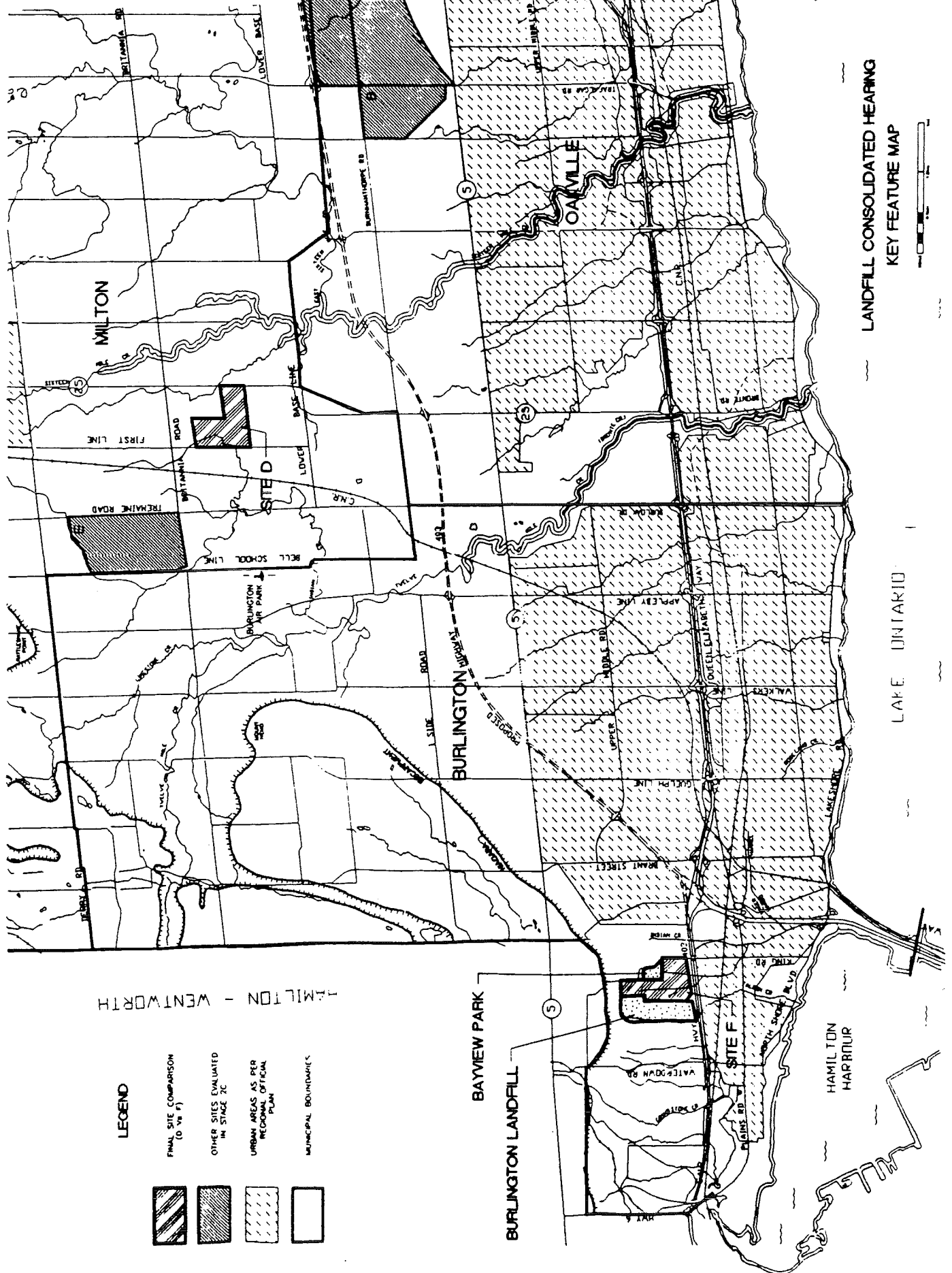
As part of its Environmental Assessment study, Halton had identified two alternative sites within its Regional boundaries which it regarded as appropriate sanitary landfill sites. These sites were identified in the Environmental Assessment as Sites D and F. Only one of these sites is required between 1988 and 2008 and Halton sought approval for either of these sites.

Site D in the Town of Milton is located between Highway 25 and First Line, approximately one-half kilometer south of Britannia Road. The proposed site is approximately 126 hectares. Site D is comprised of Lot 3, Concession 2 and part of Lot 4, Concession 2 in the Town of Milton, in The Regional Municipality of Halton, formerly in the Township of Trafalgar, in the County of Halton.

Site F in the City of Burlington is located north of Highway 403 on the northwest corner of the North Service Road and King Road. It is bounded on the west by the existing Region of Halton Landfill, and on the northeast by Bayview Park. The proposed site is approximately 96 hectares. Site F is comprised of parts of Lots 2, 3 and 4, Concession 1, part of Lot 3,

Figure 1.

Key Features Map



Concession 2, and part of the road allowance between Concessions 1 and 2 in the City of Burlington, in The Regional Municipality of Halton, formerly the Township of East Flamboro in the County of Halton.

As an aid to readers of this Decision, Sites D and F are shown on the map on the preceeding page. The other four sites evaluated in the penultimate stage of site selection, being Sites A,B,C and E, are also shown on this map, as are the current landfill site for the Region, known as the Burlington Landfill, and the former landfill site now known as Bayview Park.

The purpose of the hearing was to provide evidence to the Joint Board with respect to this undertaking, to enable the Joint Board to make decisions regarding, among other things,

- (a) the acceptance, or amendment and acceptance, of the environmental assessment;
- (b) whether approval to proceed with the undertaking should or should not be given;
- (c) whether the approval mentioned in clause (a) should be given subject to terms and conditions, and if so, the provisions of such terms and conditions;
- (d) the approval of a site plan;
- (e) whether the taking of lands is fair, sound and reasonably necessary in achieving the objectives of the applicant;
- (f) whether approval of such expropriations as may be required to carry out the undertaking should or should not be given;
- (g) the Official Plan and by-law amendments associated with this undertaking;
- (h) any approvals and consents required under the Municipal Act;
- (i) any capital expenditure approvals that may be required;
- (j) consents required under the Conservation Authorities Act and any regulations pursuant thereto;
- (k) any approvals and consents, permits and certificates required under the Environmental Protection Act.
- (l) any approvals and consents permits and certificates required under the Ontario Water Resources Act.

All of the above considerations were to be in the context of:

"the betterment of the people of the whole
or any part of Ontario by providing for
the protection, conservation and wise management
in Ontario of the environment".

(Environmental Assessment Act)

R.S.O. 1980, c. 140, s. 1.

From a citizen's perspective this hearing was about:

"something that no person wants to see
as a next door neighbour".

(Mr. Angelo Mishos,

First Line Road resident

Town of Milton, March 2, 1988)

99 p 23,844

BACKGROUND

Locating a suitable site for landfill in the Regional Municipality of Halton (RMH) has been a protracted and acrimonious process. The responsibility for doing so fell to the Regional Government, which was created in 1974.

In 1976 and 1977 RMH rejected the use of lands owned by National Sewer Pipe Limited (NSP) on the present Site F, apparently because such lands were too far from the center of waste generation in RMH. By the end of 1978, RMH was ready to proceed with an application for a site at the junction of Tremaine and Britannia Roads in Milton. The Ontario Municipal Board considered the matter and gave its approval on June 15, 1979. The approved site was in the same general area of RMH as the present Site D.

Over the next four years citizens from around the Tremaine/Britannia site, with the cooperation of the Town of Milton, fought the OMB-approved site bitterly and successfully. The Town of Milton would not amend its Official Plan and the zoning of the Tremaine/Britannia site. This action was not supportive of the Region's efforts to find the most environmentally suitable landfill site in the Region. It was decided that the new site would have to be reviewed under the Environmental Protection Act.

In the meantime, National Sewer Pipe Limited continued with its own application to operate a landfill on its property. But an April 24, 1981 letter to the then Minister of Municipal Affairs and Housing revealed that RMH "had had professional advice that the NSP lands were hydrogeologically inconclusive, meaning that they could be a source of pollution". So RMH and NSP consultants carried out an expensive hydrogeological program which led them to the conclusion that the site could be made suitable.

The City of Burlington and its citizen coalition opposed the NSP site and requested that it be subject to the same scrutiny, that is Environmental Assessment Act scrutiny, as any other site in RMH. But in the summer of 1983, the then Environment Minister said that he wouldn't subject the NSP site to such scrutiny, because he was hopeful that NSP and the City could work out their differences.

The Region then had to apply for an extension of its old site in Burlington. The Environmental Assessment Board heard the matter in 1984 and reluctantly recommended the extension under the Environmental Protection Act.

Meanwhile the RMH continued its environmental assessment to find a good site anywhere in the Region, while reassuring NSP Limited that its site would be in the evaluation stream. The night before RMH announced its intention to proceed with comparative studies that included the NSP lands in Burlington, the City of Burlington Council resolved to expropriate part of the lands that would have been required. This action was not supportive of the Region's effort to find the most environmentally suitable landfill site in the Region. The motion to expropriate these lands was passed by Burlington Council in June of 1986.

Meanwhile the Town of Milton Council decided that it would be a good idea to rezone the old Tremaine/Britannia site to agricultural uses so that landfill there would not be permitted. At the same time they would not approve the rezoning of the proposed Site D in Milton. In short, landfill would not be a permitted use anywhere in Milton.

This Joint Board Hearing began on May 5, 1987. After 194 days of evidence and argument, almost fifty thousand pages of transcript and about one thousand exhibits, the Hearing concluded on November 8, 1988. The Joint Board has now decided the matter.

REASONS FOR DECISION

ENVIRONMENTAL ASSESSMENT ACT CONSIDERATIONS

Need

Under subsection 12(2)(c) of the Environmental Assessment Act, this Board is required to hold a hearing with respect to the acceptance, or amendment and acceptance, of an environmental assessment which includes:

"an evaluation of the advantages and
disadvantages to the environment of
the ... alternatives to the undertaking"
R.S.O. 1980, c. 140, s. 5.

One of the alternatives might be not to have a landfill at all. Thus, one of the early steps in the hearing is to establish the need for the undertaking - in this case the need for a landfill as an essential part of the Region of Halton's waste management.

To this end the Region called an expert witness, Mr. C. Watson, who described how the people of the Regional Municipality of Halton had been generating approximately 800 kg of waste per person per year. Given his projection that the population of the Region would change from about 254,000 persons to between 325,000 and 409,000 persons by the year 2001, Mr. Watson deduced that 4.5 million to 5.5 million tonnes of waste would be generated between now and the

year 2001. He stated that, even if source separation was improved and significant efforts were made to reduce landfilling waste through energy from waste projects, there would still have to be a landfill.

The City of Burlington called Messrs. Stamm and Mereu to give evidence on waste quantities. Mr. Stamm's expertise was in the economic field, from which he was able to relate consumer consumption and real personal income to waste generation. Mr. Mereu was more familiar with the process of projecting waste generation figures into the future.

Mr. Stamm concluded that waste varies in direct proportion to the local economy. Commercial waste is generated in proportion to the percentage of people employed in the community. An additional factor is the extent to which a community is self-contained and thus provides its own shopping and commercial services, as opposed to being a fringe community where such services are sought from adjacent municipalities. It was Mr. Stamm's opinion that all factors suggest an increase in waste per capita for the Regional Municipality of Halton.

Mr. Stamm also felt that the Region's projection of waste quantities was wrong because it did not accommodate likely economic and land use profiles in the future. As a consequence, he felt that Halton underestimated waste generation by at least 52,000 tonnes per year or 1.04 million tonnes over the 20 year planning period.

Messrs. Stamm and Mereu concluded that the proposed landfill would have to be sized to accommodate 7.2 million tonnes in 20 years or else it would be filled to the planned 4.2 million tonne capacity in only 13 years.

Mr. Mereu agreed with a proposition put to him by counsel for the proponent that if the landfill is sized for 7.2 million tonnes of waste (as projected by Mr. Mereu) but only receives 4.2 million tonnes (extrapolated from Mr. Wastson's data) then there would not be motivation to reduce the quantity of waste destined for landfill. The Board can also agree with the proposition, but finds, as the conditions attached to this Decision indicate, that there may well be other ways to maintain public motivation for waste reduction.

Many attempts were made to project Halton's future waste generation by comparison to other communities. The Board finds that the comparisons offered were inconclusive and cannot be relied upon in projecting landfill requirements for the future.

The Board concludes that the Region's estimate of waste generation per capita is reasonable in the context of waste generation in the rest of the province, and in recognition of the past history of waste generation in Halton. Still, it may be somewhat low due to the low projection of population growth in the Region and the waste generation which could result from a higher population. Evidence on this matter seems to favour a population higher than that expected by the Region but it is not entirely conclusive.

Using the medium projections from the proponent's exhibit on waste quantities (H-15), the Board was able to appreciate the sources of waste in the Region and the anticipated changes. The data on page 105 show that Burlington has 41% of the population in the Regional Municipality of Halton; by the year 2011, this city could grow by about 47,000 persons. Oakville has 34% of the present population, with an anticipated growth of 50,000. Milton has only 11% of the population and a projected growth of 13,000 to the year 2011.

The proportion of waste from Burlington might decrease slightly, while that from Oakville might increase slightly. These trends are in the same direction as predicted by Mr. Stamm, although not as great. Mr. Stamm felt that Oakville would grow much faster because of developmental pressures in the greater Toronto region, but acknowledged that variations in population growth should not affect landfill site selection.

It was suggested to the Board that the sources of wastes within the Region should affect our decision on social equity. In large measure, we disagree with this argument. Because "environment" means "the social, economic and cultural conditions that influence the life of man or a community," (R.S.O. 1980. c. 140, s. 1) among other things, and because the continued location of a landfill in one community could affect such conditions, there will be some effect. But in this case there are so many other more important factors to consider that 'source of waste' pales by comparison.

The size of landfill required, and thus the need for the undertaking, will depend on the extent to which source separation is enhanced in the Region. It will also depend on the application of energy from waste (EFW) technology in the Region. The absence of energy from waste technology combined with failure to improve source separation measures could reduce the lifetime of the site from 20 years to about 15 years.

The Region had planned to develop an energy from waste facility. It had set aside the necessary funds to ensure that this facility could be built when needed, and by June of 1984 had concluded that an energy from waste facility was technically, environmentally and fiscally feasible.

Public hearings were held in order to consider the development of an energy from waste facility. In response to negative public reaction, private sector customers of such a facility backed away from purchasing the energy from it. The Region decided to reconsider the issue, look for new customers and plan for an operating facility by 1996. It plans to have \$19 million available by 1996 for the construction of such a facility. Working with a local group of concerned citizens (Solid Waste Advisory Council) the Region is now aiming for a 50-75% diversion of domestic waste to the EFW facility.

The Board was informed that the Ontario Ministry of Energy has a program which supports the development of EFW facilities. The Ford Motor Plant has gone ahead with its own industrial EFW facility which will result in some reduction of waste to the Halton Landfill site. An Ontario Hydro proposal (M-242) provides a more favourable economic picture, since it allows a larger payment for parallel electricity generation by Ontario Hydro. This also affects the siting of an EFW facility because environmental conditions can now predominate in site selection because the transmission of electricity is far more efficient over long distances than is the transmission of live steam. Previously the production of live steam from an EFW was considered to be the more valuable product.

Messrs. Stamm and Mereu said that the EFW facility should not be considered as a way of reducing waste volume, because it would not be constructed in the 20 year planning period -- notwithstanding the Region's environmental assessment work on such a facility. Mr. Mereu felt that it was a good working assumption for this Board to assume "no EFW" when projecting waste quantities that might have to be landfilled.

Even Mr. Watson, under cross-examination from Mr. Castrilli on behalf of Aldershot residents, allowed that the assumption of approval for an energy from waste plant is tenuous at best. This could have the effect of shortening the lifetime of the landfill facility.

Messrs. Stamm and Mereu and several others suggested that the Regional Municipality of Halton has a "comprehensive source separation" program which is projected to reduce waste by only

16%, even though various exhibits suggested that some 70% of waste ought to be amenable to source separation. The Board received very little clear evidence on this matter.

Even the Region's witness, Mr. Watson, could not explain or account for the portions of waste which come from households rather than commercial and industrial sources. There was not, therefore, a calculation of the possible effects of waste reduction programs aimed at the general population. In fact, the witness acknowledged that he knew little about specific provisions for waste reduction.

Some Burlington area residents explained to the Board that there were a number of chemicals deposited in the Burlington landfill sites over the years. In particular, Mr. Vivian had some knowledge of this type of dumping. A landfill site in the Regional Municipality of Halton could only be approved if a condition is applied to ensure that there are reception areas designated for the receipt of household hazardous wastes.

The lack of attention to other means of dealing with waste was the weakest part of the proponent's case with respect to the need for the undertaking. In our view, the proponent should have understood the alternatives to the undertaking, as called for in subsection 5 (2) of the Environmental Assessment Act. The possibilities for waste reduction through composting and source separation should have been succinctly described. The examination of options such as mandatory recycling, individual waste levies and municipal waste reduction by-laws, should have formed part of the evaluation.

In this case, the Board was convinced that the situation had deteriorated to one of "crisis management". Irrespective of what else is done now, there would still have to be a landfill component to Halton's waste management program. Thus we concluded that there is a need for the undertaking, whatever may be done subsequently about alternatives.

The Burlington experts, Messrs. Stamm and Mereu were reluctant to acknowledge that the use of rewards and penalties in a comprehensive policy framework directed towards waste reduction could produce significant results. Mr. Stamm, in particular, held to the view that as real personal disposable income increases, waste and associated disposal problems increase. The Board offers some conditions at the end of this Decision intended to cure this environmental myopia, to the extent it exists.

In summary, the Board finds that, if the problem of landfilling of waste is to be addressed head-on, so that the trauma associated with landfill assessments is not encountered every 10 to 15 years, there will have to be a concerted effort, from the personal level to the highest governmental and industrial levels, to make garbage either more valuable as a resource, or more painful, in an economic sense, as a disposable material.

Impact on Cultural Conditions

In keeping with subsection 5(2) of the Consolidated Hearings Act and subsections 1(c)(iii), 5(d) and 12(e) of the Environmental Assessment Act, this Board had the responsibility to consider the impact of the proposed landfill site on "cultural conditions that affect the life of man or a community." Two potential kinds of impact on cultural conditions were described: those which affect archaeological sites and those which affect heritage sites.

Archaeology

Dr. Pearce, an expert in archaeology, gave evidence about the aboriginal settlement of this part of North America following the retreat of polar glaciers at the end of the last ice age. His narration of events extended to the 19th century and he explained the importance of native settlements along the shores of Lake Ontario and within 200 metres of major streams discharging into Lake Ontario.

Dr. Pearce identified 76 archaeologically significant sites in or near the six candidate landfill sites (Sites A to F). He did not give specific information on locations, because current policies of the Ministry of Citizenship and Culture require that such details be kept confidential in order to prevent public damage to archaeological sites.

Dr. Pearce's main method of examining the sites was to review the literature and to walk on those areas which were cultivated, looking for artifacts from earlier times. Much of his information with respect to Site D came from on-site residents. Site F was not surveyed because the southern portion had been quarried and the northern portion was not ploughed and suitable for a visual survey. Dr. Pearce's overall ranking of the six sites was as follows: Site F was preferred as a landfill site to either A, B or C; these latter three sites were preferred to Site D or E.

In the direct comparison of the two final sites, Dr. Pearce stated that Site F was preferable to Site D for landfilling. However, whichever site was selected, it would have to undergo a detailed archaeological survey before landfilling operations begin. Dr. Pearce understood that the Regional Municipality of Halton had agreed to such studies.

Although Dr. Pearce acknowledged that his assessment of Site F was speculative because it had been based on "archaeological potential" rather than actual survey, he was not concerned about ranking it as most suitable for landfilling. He was convinced that any site selected would be subject to a more detailed archaeological study and thus could be protected if necessary.

The Board did not find this approach helpful, if the results were intended to affect site rankings. We decided to assign no weight to Dr. Pearce's evidence with respect to the final comparison between two sites. Fortunately, we were convinced that this factor would not be a crucial determinant in this case.

Dr. Pearce observed that none of the artifacts found at any of the six sites were unexpected or rare, nor were they representative of an unusual or unique settlement pattern. He felt that there was not much at risk to future generations' understanding of native settlements in southwestern Ontario. If neither site was landfilled, then Site F would gradually be archaeologically degraded by quarry operations and Site D would continue to be turned over during agricultural operations, as is now the case. This leads to the conclusion that these sites will continue to deteriorate, with or without a landfill, as they are afforded no particular protection under their current use.

Heritage

The second "cultural condition" threatened by the proposed landfill is impact on heritage sites.

Mr. Owen Scott described heritage findings in the site plan areas. He defined heritage features as man-made forms of historic value, regardless of age. From the perspective of 'possible heritage value' he ranked Site F as much less important than Site D.

Mr. Scott observed that Site F has already been greatly disturbed from quarry activity, industrial activity and the cutting of Highway 403 through the area. Site D on the other hand has been much less disturbed. Some buildings and immediate surroundings have survived intact for many years.

The Ford farm is the feature of greatest concern at Site D and the witness made recommendations for mitigation of negative effects at this site:

"It is recommended that the 'Ford farm' residence be preserved and rehabilitated for future use and that the other heritage features be documented before demolition. Consultation with heritage interest groups to ascertain interest in the use of materials from the features to be demolished should occur."

H-26 p 2

Mr. Scott stated that the Ford farm is becoming a rarer type of structure in the Regional Municipality of Halton, although it was quite common at one time. The terra cotta barn foundation is considered to be unique in the area. Because these features are not now protected by legislation, Mr. Scott acknowledged that they are at risk whether or not there is a landfill at the site.

This last observation opens the somewhat bizarre possibility that the approval of a landfill near a heritage feature, with appropriate conditions, could have the effect of preserving a heritage feature not otherwise protected. The Board gave no weight to this peculiar opportunity as such was neither the intent of the application nor the purpose of the Board. It is raised here because this is the first of a number of instances raised by various parties as illustrations of the 'advantages' of choosing a particular site - advantages extraneous to the undertaking and time-consuming for the Hearing.

The Board finds that heritage factors have been adequately assessed in this application and that the impact of a landfill on heritage features will be more severe at Site D than at Site F.

The Board also finds that, notwithstanding the intrinsic value of cultural conditions as part of an environmental assessment, they are not a crucial determinant in this particular application.

Social Impact

Dr. Myra Schiff was the Regional Municipality of Halton's expert witness on social impact. She explained that she used "the most quantitative approach possible" to rank potential sites. She had first examined the 55 sub-areas in the Region and had evaluated the population density in the vicinity of the site areas at Stage 2B. At the outset of her detailed investigation, she felt that all six sites would create moderate social impacts for adjacent communities.

Dr. Schiff explained that her calculation of the effect of dump sites on income earners whose income derived from activities on their properties was done on a weighted basis intended to equate twenty residents earning one-twentieth of their income at their places of residence to one person earning all his income at his place of residence. Unfortunately, there was no allowance for those who had no residential income, but were still credited with an income in the middle of the zero to ten percent range (her lowest category). The Board felt that this reduced the value of her economic impact evidence which, where other factors were equal, was the decisive factor in her site D and F comparison.

In an effort to achieve quantifiable objectivity in the subjective domain of 'social impact', Dr. Schiff had applied an arbitrary rule of dividing impact into categories of "low", "medium" and "high" based upon which one-third of the maximum score allowed corresponded to the score assigned. Thus, for example, if the maximum score allowed for a given factor was 30 points, a site scoring 20 points was said to have a medium impact, while another site scoring 21 points on the same factor was said to have a high impact.

Dr. Schiff's approach was strongly attacked, with good reason in the Board's view, in several aspects. For example, a low, medium or high rating in the 'population impact' factor was determined by the number of members in a household, regardless of whether the house in which they lived was right next door to the landfill site or as much as 2 kilometers away.

To narrow the sites under consideration from six to two, Dr. Schiff considered seven evaluation factors:

1. Population impact

- dislocation of households on-site
- disruption of households nearby

- emotional impacts
 - community disruption
 - special population group disruption
2. Social equity
 3. Community facilities
 4. Airborne contaminants
 5. Noise
 6. Visual impact
 7. Land use compatability

The degree of interaction between these factors is obvious. Duplication of findings is also evident (e.g. 'emotional impact' with 'social equity' or, 'disruption of households nearby' with 'noise'). What was not clear in the course of the Hearing was who had the final say as to the importance of a given impact: the planning consultant under land use compatibility, the social impact assessor under land use planning in the context of community disruption, or the senior consultant when considering social impact versus Planning Act matters.

Dr. Schiff explained that she had interviewed as many people within a half-mile radius of the sites as possible, making adjustments to the area boundaries as she felt necessary to capture what she considered to be reasonable "population communities". There was considerable challenge to her selection of revised site boundaries. It was clear that she had expanded the boundaries in the vicinity of Site D, thus increasing the social impact rating associated with this site, whilst reducing the area around Site F and its social impact rating, because of what she termed "psychological barriers". Under cross-examination Dr. Schiff acknowledged that these "psychological barriers" were developed for research in her field with regard to community development, and had not previously been applied to landfill site selection.

Throughout Dr. Schiff's testimony, it was observed that because the recent Environmental Assessment Act (1980) defines "environment" to include "the social ... conditions that influence the life of man or a community," this requires the application of new methodology for dealing with population impact, social equity and community disruption. These factors must be addressed, because Section 5 (3) (c) (ii) of the Environmental Assessment Act requires that the environmental assessment describe "the effects that will be caused, or that might reasonably be expected to be caused, to the environment."

Dr. Schiff's evidence showed that changes to the outer boundary around Site F would have added considerably to the number of people and households encompassed, had they been made in the same fashion as at Site D. In particular, had the boundary been drawn further to the south of Site F, it would have encompassed another 200 residents. Similarly, had consideration been given to industries located in the vicinity of Site F, there would have been an additional 600 workers to consider at the Cumis and Tridon facilities as well as 150 workers at the Pollard facility. In short, the views of about 950 individuals potentially affected by Site F were not included in the proponent's social impact assessment.

Dr. Schiff admitted under cross-examination that she had not given serious consideration to many submissions made to the Regional Municipality of Halton in the process of public hearings on site selection on landfills in Halton. It was argued, therefore, that Dr. Schiff's social impact assessment was based on her subjective perception of impact on individuals in the areas affected, rather than on actual expressions of concern by these individuals. The Board found that there was considerable merit in this criticism, especially when considered in the light of evidence given by West Burlington Citizens Group witnesses.

The Board recognizes that probing the depths of human emotions, to elucidate the proper weight to be given to social impact, adds a new and difficult dimension to the process of environmental assessment. But the assessor must not quarantine the population being studied in order to avoid the risk of becoming infected with its bias.

The West Burlington Citizens Group called its own expert on social impact, Professor Lang. The Board qualified this witness to give expert opinion on social impact matters, not on matters of law or social equity as it is understood in the legal sense.

Mr. Lang had reviewed the Region's social impact assessment (the Walker, Wright, Young reports, principally exhibit H-37) and the submissions made by Aldershot residents. He then prepared and administered a questionnaire designed to elicit the views of certain citizens with regard to the Site F proposal.

In Professor Lang's view, there were five critical deficiencies in the Region's social impact assessment.

1. Inappropriate Design

Mr. Lang felt that the social impact assessment had not been designed for an urban community. The public information sessions were designed to support a technical analysis, not to probe public concern.

2. Impact on Workers

Professor Lang felt that the Region had overlooked the impact on workers in the area and did not consider necessary mitigation measures. The consultants for the Region had not sufficiently considered the different levels of social impact in the Aldershot community.

3. Internal Inconsistencies

The social impact analysis was said to be internally inconsistent in many areas. This was most obvious in the setting of the study area boundaries which could have included everything from the escarpment to Lake Ontario. The people affected felt that the study area was so restricted as to be meaningless. Professor Lang also noted the inconsistent treatment accorded Brant Hospital in Burlington versus the hospital in Milton.

4. Insufficient Account of Community

Mr. Lang felt that the "psychological barrier" definition arbitrarily divided a community which did not feel itself divided. The fault was in assuming the barrier should exist, rather than establishing whether or not it was recognized by local residents.

5. Failure to Provide an Integrated Picture of Landfill Impacts

Professor Lang felt that the Region had not shown the actual cause and effect relationship between stress on a community and the perceptions of community citizens about that stress. Dust, odour, litter, visual and other environmental effects were not assessed in the social impact assessment. Rather they were left

to other experts. But the other experts assumed that societal responses to the physical changes they were predicting would be assessed in the social impact assessment.

The Board finds that Professor Lang's criticisms are supported by the weight of the evidence. We do not find such support for the social impacts he foresees and summarizes at page 4 of exhibit **WB-920**.

Mr. Lang's evidence on technical versus interactive social impact studies led the Board to conclude that the interactive component is a desirable facet of social impact analysis. But the interactive component, which requires the synthesis of community feelings from views expressed by some of its spokespersons, poses the danger of misrepresentation of the wider community. This Board carefully sorted through expressions of fear which appeared not to have a reasonable basis in fact and, while recognizing the apprehension they legitimately conveyed, did not determine the matter of fact according to the frequency with which they were expressed.

The Board heard evidence that social impacts occur when people are subject to a new situation which they perceive to be bad. We were also told that such impacts may arise as a result of expectations that a perceived bad situation would end if, in fact, that situation does not end. Aldershot residents believed that, after many years of landfilling in the vicinity of Site F, the practice was about to end. Whether or not there are physical manifestations of damage if the landfilling does not stop, social impact assessors ought not to ignore the associated emotional manifestations.

Professor Lang's evidence brought into focus the role of "expert" versus "layman" evidence in the assessment of social impacts at environmental hearings. Social impact assessment is unlike the physical sciences; for the physical sciences, the Board may need the assistance of an expert in order to understand the raw data and their meaning. Such intermediaries are not necessarily needed to understand people's feelings; people can express those feelings directly, in the forum of the Hearing. Thus, this Board was not convinced that the services of an 'emotional translator for the community' was necessary.

The Board recognizes, on the other hand, that social impact experts may agglomerate, amplify or filter the feelings of a large number of people in an attempt to categorize them and thus make them more useful for the hearing process.

Dr. Schiff noted that although the perception of risk is an important factor in environmental assessment, it ought not to be as significant a social factor as dislocation and other quantifiable physical factors. The Board agrees.

The family most seriously affected by dislocation at Site D is that of Mr. and Mrs. Watt Martin, who own a 50 acre property on the northern portion of the site.D. The property includes two runways, a hangar and a maintenance building for restoring, repairing and rebuilding antique aircraft. Despite the existence of the two runways, 40 acres of this property are rented out to other persons for farming purposes.

Mr. and Mrs. Watt Martin appeared before the Board and explained that the antique aircraft repair and rebuilding facility provides 75% of the family income. They felt that relocation would take two to three years and would require about 50 acres of land. There is no comparable land within 45 miles of the Pearson International Airport and it would be extremely difficult, if not impossible, for them to re-establish themselves. Mr. Martin is 63 years old, in good health, and feels that he can continue his business for another 12 years.

A number of other witnesses, in particular Mr. Anderson, Mr. Davies and Mr. Hems, were called in support of Mr. Martin's business. They said there was nowhere else where this kind of work could be done. It appears that Mr. Martin's services are valuable to some fifteen to eighteen owners of antique aircraft in the southwestern Ontario area.

Mr. and Mrs. Reed moved to a southwestern lot on Site D in March of 1986. They claimed that, at the time, they felt that the site selected for landfill in Halton was the Burlington site, and they were therefore safe from landfilling at Site D. They had done a great deal of work to restore the century old building in which they live. They had selected this building because it had not been reworked previously and they wanted to restore a century home.

In this building, known as the old Ford Farm and referred to earlier in the Heritage section of this Decision, the Reeds run a dog-grooming business that handles four to ten dogs per

day. They also raise, race and show rare breeds of a greyhound type of dog. The Reeds explained that about 40% of their family income comes from activities on Site D.

The Reeds stated that the signs indicating that their area might be used as a landfill site did not go up until after they had moved in. The Board is concerned about the extent to which several residents in the vicinity of Site D were apparently unaware of what was going on around them, although the Board heard no evidence to suggest that the proponent had not been thorough in providing appropriate notice.

Mr. and Mrs. Tomosky bought their "retirement house" in 1968, on the northeastern portion of the lands proposed to be acquired by Halton for a landfill at Site D. The property associated with their house is rented to a nearby farmer for hay crops. The house was constructed in about 1837 and has been designated under the Heritage Act. The Tomoskys have spent a great deal of time to restore their home, which possesses a number of unique architectural features. They want to be allowed to continue to live on the land for the rest of their lives, but feel that if a landfill is built at Site D they would have to move; they believe they would be within five hundred feet of the landfill. In fact, their residence would be almost two thousand feet from the fill area. There ought to be an obligation on someone, (Environment Ministry officials or legal counsel perhaps), to ensure that where local residents' fears do not relate to the fact situation they are properly informed at the earliest opportunity. The Tomoskys believe that their water will be polluted and they will suffer from dust, noise and odour due to their proximity to the proposed landfill.

Mr. and Mrs. Thomas Martin made an offer on a piece of property in the southwestern corner of Site D in 1986. They said that their understanding of media reports at the time was that Burlington was the preferred site, and they assumed that Site D was out of the running. They held to this belief, even though a notice had gone into the newspaper before they began construction of their house in 1987. Further, they were the recipients of a certified letter explaining that a hearing was to be held to consider landfilling on the property on which they planned to build a house. Nevertheless, the Martins put a great deal of money and effort into the construction of their house. At the Hearing they argued that they would never be able to recover their labour and effort, and financial compensation would be inadequate. They said that they asked whether there were any restrictions on construction at their site, and that officials from the Town of Milton told them there were no such restrictions.

The Board finds that adequate notice of the undertaking was given and that reasonable prudence on the part of the Martins would have removed the risk of having their labours undone.

The Board heard evidence from an additional 28 persons from the community around Site D. Their concerns about the effect of a landfill on their relatively peaceful rural society centered around noise, dust, visual impact, litter and increased traffic, as well as the loss of valuable agricultural land in what is a predominantly agricultural community. The Board finds that a number of their expressed concerns did not correspond to the facts about the proposed undertaking, and that many nearby residents had not taken the opportunity to read the environmental assessment documents prepared for their use as well as for other official uses. This makes an already unpleasant situation unnecessarily traumatic; it creates a scenario whereby any decision this Board makes will be rejected by those most affected on the basis that it places an unconscionable burden upon them.

The Board heard from about forty citizens from the West Burlington Citizen's Coalition who expressed, among other things, the following concerns:

1. Social Equity

Residents of this area feel that they have received waste from the wider community for long enough and it is somebody else's turn to receive waste now.

2. Public Consultation

Many were concerned that the environmental assessment process merely paid "lip service" to public consultation. It provided a forum for residents to express their concerns but, in their view, did not allow them to influence site selection and the evaluation of its social impact

3. National Sewer Pipe Intervention

Some residents believe that National Sewer Pipe Limited condoned the use of its property for dirt bikes so that surrounding citizens would accept landfill as a less disruptive alternate use. The Board found no evidence to support this contention.

4. Traffic

Traffic conflicts on the North Service Road are already serious. The continued use of that road by garbage trucks along with school buses and other vehicles poses a risk. Similarly, the heavy volume of traffic on connecting roads in the adjacent residential community is affected by garbage trucks on those same roads.

5. Loss of Natural Setting

There is an abundance of wildlife in the area, so it should not be considered as waste land.

6. Surface Water Contamination

There are many spring fed streams in the area, some of which emerge in the Aldershot community. Residents are concerned that the source of these spring fed streams lies beneath the dump site; contamination of that source means contaminated surface water and contaminated ground in the vicinity of their homes.

7. Lake Ontario Contamination

Leachate losses from Site F would eventually reach Lake Ontario and thus would affect the drinking water supply of millions of Ontarians. The Board finds the evidence ambiguous on this matter. Dilute leachate may reach Lake Ontario through regional groundwater flow paths, intermediate flow paths or surface water losses, but the evidence suggests that it will be so dilute by the time it does so that its effects might be undetectable.

8. Site Capacity

Many residents felt that the selection of Site F would lead to another hearing in the near future, since Site F is of restricted capacity, whereas Site D has the potential for expansion if necessary.

9. Heritage

Mr. Elston of Woodhill Farm drew the Board's attention to the fact that his farmhouse may be the oldest building in Burlington (1833) and that it has been the site of a number of significant historical meetings relating to the formation and

stability of the country. Because of this, his view is that this heritage property should not look over a landfill.

10. Vermin

Residents felt that rats in the Aldershot community came from the present and previous dump sites.

11. Study Area Boundaries

The choice of social impact study area boundaries seemed designed to deny the accommodation of legitimate concerns from Aldershot citizens.

When the Board pursued this last matter, Dr. Schiff acknowledged that there were some 950 individuals who might suffer some "very minimal effect" from the situation of a dump site at Site F within a half a mile of their daily activities. Although these 950 included 750 individuals who would spend a full work week in the vicinity of the dump site, Dr. Schiff did not feel that the impact on workers in the vicinity of an operating dump site would be as great as it would be for residents living a greater distance from it during hours of the day when the site is not fully operating (i.e. those residents living up to 1.4 miles from Site D). Nor did she feel that Aldershot residents within a half mile of the landfill would suffer as much from its presence as would Milton residents as much as 1.4 miles from the proposed Site D.

Dr. Schiff recalled that she had in fact participated in the preparation of the proponent's responses to public concerns, including those expressed by industry employees in the vicinity of Site F (Cumis, Tridon and Pollard). However, her replies to questions about the work habits of employees of local industry made it clear that she knew nothing about the day-to-day activities at those three industries. She was, nevertheless, comfortable in assigning "no impact" for the workers at those sites.

Mr. Marinacci explained another kind of social impact at Site F. The horse show activities in the Bayview Park adjacent to the proposed Site F, had already been adversely affected by the need to deal with leachate problems existing in the area. It was his opinion that approval of Site F would create significant social and economic dislocation to an activity which has attracted visitors and competitors from all over North America.

Dr. Schiff generally discounted the potential impact of a dumpsite on Aldershot residents because, in her view, that community established itself in full knowledge of the existing railway, highway, hydroelectric and industrial activity around its edges. It was, therefore, "hard to imagine Aldershot residents directing their focus towards the landfill at all". Instead, she said, residents focus their community activities and daily life to the south. This led to her opinion that the impact of a landfill at the edge of this community would be minimal.

The Board held special public sessions on May 26th and 27th, 1988 to allow those citizens not associated with any other particular group of residents to express their views. At these sessions about 33 witnesses appeared to express specific concerns about both sites. Again, the Board found that a lack of understanding about the Region's proposal and its associated mitigating measures fueled unnecessary fears about possible impacts. Ways must be found to ensure that potentially affected citizens have a good understanding of the steps being taken to minimize environmental impacts of landfill operations. The frequent and voluble vocal opposition to landfill proposals was often not matched by evidence of a willingness to reduce the problem at source, either individually or in concert with others.

One of those who spoke at the special public sessions was Ms. Ellen Baar, a professor of sociology at York University. She expressed the view that if leachate could not be contained at Site F, while it could be contained at Site D, then from a regulatory perspective the choice of the Board was clear. The Board took this perspective into account as it considered its decision.

According to Ms. Baar, social impact had not been well assessed by Dr. Schiff. Ms. Baar felt that the study area had been made artificially small in the case of Site F and excluded all sizeable populations. Ms. Baar did not impute motive in this matter, but concluded that this action could only enhance the likelihood of the selection of the Burlington site for landfill.

Ms. Baar felt that in the future, social impact and other effects need to be more carefully measured in the vicinity of landfill sites. In her view they should have been measured in the vicinity of the existing Bayview and Burlington sites, but were not.

A few residents observed that something stronger has to be done to encourage new methods for dealing with waste. In particular, witnesses Mr. Smith and Mr. Zimmerman felt that the time had come for long-term alternatives to be explored fully. The Board agrees, and has attached conditions to this Decision intended to encourage such explorations.

The Board considered all the social impact evidence carefully and found that the Region's original study was flawed in a number of respects, leading to the dismissal of certain community effects that should have been included. The result was a lower ranking of social impact in the Aldershot area than should have been the case.

On the subject of social impact in general, the Board was persuaded by the end of the Hearing that there would be a serious social impact at both sites. At Site F the impact would be more diffuse and less serious for a large number of people. At Site D social impact would be severe for a small number of people. The severity of impact would diminish with distance from the site.

ENVIRONMENTAL PROTECTION ACT CONSIDERATIONS

Section 38 of the Environmental Protection Act states that the Director may (in this case "the Board may") impose terms and conditions in approving an undertaking where it is considered:

"upon probable grounds, that the use, establishment, operation, alteration, enlargement or extension of the ... waste disposal site may create a nuisance, is not in the public interest or may result in a hazard to the health or safety of any person."

R.S.O. 1980, c. 141, s. 38

It is probable that the Halton landfill would create such problems. Specific terms and conditions will therefore be required to minimize them. To understand the conditions imposed at the end of this Decision, it is necessary to appreciate the concerns brought to the attention of the Board in the course of the Hearing.

For ease of reference the Board has grouped these concerns into three main categories, with various sub-categories, as follows:

1. Nuisance Concerns
 - (a) Air Quality
 - (b) Noise
 - (c) Visual Impact
2. Resource Policy Considerations
 - (a) Agricultural versus Mineral Resource Policies
 - (b) Flora and Fauna
3. Public Health and Safety
 - (a) Aircraft/Bird Hazard
 - (b) Transportation Risk
 - (c) Leachate Treatment
 - (d) Hydrology (surface water impact)
 - (e) Hydrogeology (ground water impact)
 - (f) Design and Operations

Nuisance Concerns

Air Quality

The Region called an expert witness, Dr. E. Koczkur, who explained technical terms related to air quality: total suspended particulates (TSP); dust fall; and, odour. The first two parameters are relatively easily quantified while the latter is qualitative. Dr. Koczkur defined an odour nuisance as the condition which exists when more than half the population affected is offended by an odour.

Dr. Koczkur had studied meteorology and climatology in the Region, measured dust fall and assessed ambient air quality. For both sites he concluded that there would be times when dust and particulates at the nearest residences might exceed the guidelines. These excesses could be reduced through measures such as reduced speed limits for vehicles producing dust, and water spraying in dusty areas.

The principal exhibit introduced by the Region to compare air quality at sites D and F (H-29A) showed that there are large scale events in Southern Ontario that make air quality at the two sites quite similar. This similarity was established by comparing revised table 4.4 for Site D with its counterpart for Site F. When TSP was high at Site D (102.5 micrograms per cubic

meter) on March 3, 1986, it was high at Site F (98.8 micrograms per cubic meter). When it was low at site D (8.0 micrograms per cubic meter) on November 6, 1985, it was low at Site F (9.2 micrograms per cubic meter). Dr. Koczur had not recognized this correlation in his original work. When it was brought to his attention in the course of the Hearing, he testified that this was evidence that air quality in the vicinity of both sites is more affected by large scale regional air quality changes than by local events. The Board is concerned that such a fundamental scientific observation was overlooked in the preparation of the environmental assessment.

Dr. Koczur then concluded that the local, incremental air quality effects of adding a landfill at either site would be comparable and quite low.

Dust increases at either site would produce levels which generally do not exceed provincial guidelines and standards found in MOE Regulation 308. When dust is seen to be blowing towards off-site residences because of unfavourable wind directions, landfill operations could be curtailed or modified, according to Dr. Koczur. The problem could be mitigated further, as landfilling proceeds, by encouraging rapid vegetative cover on the screening berms to reduce the wind erosion that would raise unnecessary dust. Although dust problems may be exacerbated by berm construction, berms offer longer-term dust mitigation advantages, as well as noise and visual impact reductions, during the operation of the landfill.

Noise

The Region's expert on noise levels, Mr. J.E. Coulter, was called to give evidence on the likely effect of a landfill on noise levels in the vicinity, in consideration of the Ministry of Environment's guideline of 55 dB Leq. The term 'Leq' concerns the averaging of sound energies, while the numerical portion and its units (dB) indicate intensity of sound. Short, loud sounds have a greater impact than longer but less intense sounds.

The 55 dB guideline applies to any new undertaking in the vicinity of residences. It requires that the undertaking create less than 55 dB of noise energy on its own. If there is already an existing 55 dB level of sound in a given area, and a proposed undertaking adds another 55 dB, the net effect is to double the sound intensity, but only raise the decibel rating from 55 to 58 dB. Mr Coulter explained that because decibel measurements are logarithmic, they do not add in the normal fashion; thus, the unexpected total.

Mr. Coulter described the noise levels expected from trucks travelling to and from the landfill and noise created by machinery such as bulldozers, compactors and trucks operating at the landfill site.

In regard to truck travel, he noted that for all sites evaluated during the selection process the sound changes would be well below the provincial sound guidelines in regard to haulage trucks.

With regard to preparation for landfilling at Sites D and F, noise would be created at both sites which would exceed the MOE guidelines during the construction of berms. In the case of Site F, there would be higher sound levels in Bayview Park during landfilling operations.

The Board finds that the noise created at both sites will exceed the MOE Guideline from time to time. For Site D, this will be a problem during berm construction. Thereafter, the noise levels at this site, while within the Guideline, will be an audible departure from the ambient noise levels and will be perceived by local citizens as a nuisance, whatever the Guideline says. For Site F, the increased noise levels will exceed the Guideline in Bayview Park for most of the lifetime of the site. Assuming that a new park is created to the east of Site F, where the present Burlington landfill is situated, sound levels in this park would also exceed the Guideline for most of the lifetime of the site. Residents nearest to Site F would not notice much of an increase in sound levels, given their proximity to the Burlington landfill and highway 403.

Visual Impact

The City of Burlington called as its expert witnesses Messrs. Myers and Herold who had produced models one one-thousandth the actual size of the landfills with no vertical or horizontal exaggeration. These witnesses had worked from the contour plans drawn from the design exhibits and elsewhere. They produced their model of the completed landfill and its surroundings for Site D. At Site F the model showing the terrain as it exists now could be modified by means of inserts which allowed the Board to see the terrain with the landfill partially complete (Year 3) and the landfill at completion. Notwithstanding the fact that screening vegetation on all models was not properly to scale, the Board found this a very useful way to visualize the proper magnitude of the proposed landform in both cases.

The Region's principal witness on visual impact, Mr. Wright, tried to visualize what the site would look like when it was finished, and established what he called 'visual isopleths' using balloons to simulate the final height of the landfill and to ascertain from which vantage points the finished site would be visible. He noted that there were two recognized viewing points in respect to Site D. One of these is Rattlesnake Point, which is visited by about 30,000 visitors per year and is about six kilometers from Site D on the brow of the Niagara Escarpment. The site would occupy 13% of the horizontal field of view of an observer at Rattlesnake Point and would lie below the horizon from this perspective. Similarly, from Mount Nemo, with about 10,000 visitors per year, also about six kilometers away, the site would occupy about 6% of the horizontal field of view.

Mr. Wright acknowledged that from either of these viewpoints, Site D would lie well within the horizon and would be hard to pick out from the general landscape after rehabilitation. The Board confirmed this observation for itself during a field trip to the area during the winter season when visibility was not obscured by vegetation. The Board finds that visual impact from these vantage points is not a major consideration.

Mr. Wright noted that residents around Site D generally have vista options which allow them to avoid looking at the landfill site, although the landform created there would clearly project above the horizon in the vicinity.

With respect to Site F, Mr. Wright considered Bayview Park as a designated viewing area. From this area, the proposed landfill would occupy virtually 100% of the horizontal field of view when the observer is looking to the southwest.

A number of residents in the vicinity of Site F do not have vista options which allow them to avoid looking directly at the landfill site. This is the case for several apartment dwellers who would find that the landfill occupies a major portion of their view. Residents on the upper floors of apartment buildings to the southeast would actually be looking down upon the landfilling operation.

The Board heard evidence that the perspective of those observers on the Bruce Trail along the brow of the Niagara Escarpment above Site F would not be significantly degraded by the presence of the landfill, because the observers' attention would be drawn to the horizon rather than to human activity below, if indeed it could be seen at all. This evidence was not successfully challenged.

The Board finds that the net environmental effect of cessation of landfilling activities at the Burlington landfill adjacent to Site F could have a positive visual impact for the area. This matter of net benefits arising from a decision that leads to the cessation of an undesirable activity in one area was not addressed here or under a number of other factors such as social impact and traffic impact. This Board considers this oversight to be a shortcoming of the environmental assessment.

The general consultant for the proponent, Mr. Walker, told the Board that the visual impact at Site D would be more serious than at Site F, because at Site D the form of the landfill would constitute a mound rising above otherwise flat lands. The Board was unable to conclude from the evidence whether the introduction of a variation in the topography is necessarily a negative visual effect or whether it might be a positive one. Clearly this is a subjective matter.

Both sites would be difficult to mitigate: Site D because of the flat topography and the extent to which the site would project above the horizon; Site F because it would be on the side of a slope, visible from both above and below.

Mr. Wright acknowledged that the impact on residences is the most important factor in his comparative analysis and he acknowledged that his treatment of apartment buildings in the area in the vicinity of Site F did not correspond to his treatment of apartment buildings in the vicinity of Site D. In fact, under cross-examination from various counsel, he acknowledged that there could be hundreds of units in the vicinity of Site F that fell well within the range described as "of moderate impact" at Site D. This would have a significant effect on his overall ranking of Sites D and F.

When the Board visited the Site F area, we observed that scores of apartment units and more than one hundred occupants could be affected. From our own observations, we did not find the view of the landfill site from the upper floors of these apartment buildings distracted by intervening objects such as commercial facilities, residential dwellings, the railway line, or Highway 403. In general, however, we find that the final landform created at Site F would blend in with the surrounding landscape and be hardly noticeable, if the landfill were to be completed and revegetated as proposed.

In summary, with respect to the evidence and cross-examination of Mr. Wright, it is clear that there are many qualitative aspects to visual impact, and that these may not have been treated in an equal fashion at the two sites. It is equally clear, however, that there will be visual impacts affecting a large number of people at both sites, and that these impacts will be more severe for some people at each site. Given the subjective nature of visual impact, the Board appreciates the difficulty in arriving at an absolute net ranking for one site over the other.

The planning expert called by the Town of Milton, Mr. Stagl, introduced computer graphic drawings overlaid on photographs taken at Site D to show the relative dimensions of the land form in the context of existing structures and vegetation in the vicinity. During cross-examination of this witness, the Board found that the visual portrayal may be distorted to some extent because of non-perspective projections on a perspective photograph. Certain inaccuracies in scale and colour intensity detracted from the potential usefulness of these exhibits.

Mr. Stagl felt there would be a recognizable land form at Site D, whereas the landform would not be so clearly visible at Site F. He was convinced that the introduction of undulating topography at Site D was inherently less desirable than the existing flat topography.

The Board got the impression from this witness and others that the philosophy "once a landfill area always a landfill area" should prevail. Indeed, witnesses argued that because the Burlington landfill and Bayview Park sites already exist, local residents should not be offended by the introduction of a third site. This Board does not accept such reasoning as it finds no foundation for it in the legislation under consideration.

The Board was presented with overlays of photographs taken by Mr. Kauffman, an expert witness called by counsel for Milton area residents, in the vicinity of Site D, which showed the effect of a landfill at this site. This witness explained that he also felt the visual impact at Site D would be greater than at Site F because of the orientation of the fill site in relation to the nearest neighbours and because of the topography in the vicinity.

Mr. Bacon, a planning expert called by counsel for National Sewer Pipe Limited, stated that a landfill on NSP lands (Site F) would blend into the undulating landform so as to be virtually

invisible from all surrounding observation points. He acknowledged that he had not considered the visual impact of Site F from the Bruce Trail in the vicinity of Kerns Road and King Road. These observation points are closer to the landfill at F, than either Mount Nemo or Rattlesnake Point are to Site D, and they present a wider view angle than those Site D observation points. In addition, Mr. Bacon had not considered visual impact on the proposed recreational area to the west of Site F.

The Board concluded that Site F when finished would be "lost" within the panorama (in essence buried within the horizon) even though it would be detectable upon careful observation by a much larger number of nearby residents than would be the case for Site D. Site D, on the other hand, would create a new feature in the landscape which, although not easily seen from official viewpoints such as Rattlesnake and Mount Nemo, would nevertheless project well above the horizon in the vicinity of the site. This would have an immediate and significant effect on residents adjacent to the site and would be obvious to others living in the area.

The Board finds that mitigation measures at Site D could significantly reduce the visual impact (e.g. undulating contours in the screening berms and the planting of different species of screening vegetation). In contrast, it would be very difficult to screen Site F from surrounding residents and nearby recreational activities during landfill operations.

Resource Policy Considerations

The Board found considerable conceptual disarray in the way in which evidence related to resource policies was introduced. We were told that agricultural considerations were introduced along with flora and fauna because these were the "predominant uses" at the two final sites. But at other times much was made of the fact that Site F was a quarry site, and was to be considered in the context of quarry rehabilitation. Clearly, the shale resource at Site F is one that might be of use to humans for physical benefit, as is the agricultural resource at Site D.

It would have been clearer to us if each resource policy consideration had been introduced in its own right, allowing a more reasoned understanding of what might be at stake between the mineral and agricultural resources, within the broader context of what flora and fauna might be lost and then regained.

The Mineral Aggregate Resources Policy is a policy statement which parallels the Foodland Guidelines to a large extent, in the sense that both acknowledge that lands designated for either mineral resources or foodlands could be used for other purposes if such use is justified. This parallel will be addressed more fully in the planning section of this Decision. At this stage, the Board will confine its observations to the expected impact on agriculture, mineral resources and flora and fauna.

Agricultural Resource Policy

The Region's principal witness on agricultural matters was Dr. E. Mackintosh. He explained that in his screening of the final six sites he recognized five of them (Sites A to E) as having significant agricultural value. Three of these (Sites A, B and C - see map at page 5) were likely to be cut off from the surrounding farming community by the completion of Highway 403 and thus could more readily be sacrificed for landfill use. When factors such as soil type, degree of fragmented ownership and special farm enterprises were considered, Site E was slightly preferred to Site D.

Dr. Mackintosh concluded that Site D could be rehabilitated to a certain extent. Crop lands would be out of production, however, for about 25 years, and this led to his assignment of a "high to moderate" assessment of impact at this site.

The Region also called Mr. Stevens to discuss the uses of the landfill sites after their capacity to receive garbage had been reached. He explained that the constraints considered in developing after uses were as follows: the sites must not compromise safety; they must reduce infiltration; they must allow for manholes for collection of leachate; vent stacks must be provided for gases; adjacent flora and fauna must be preserved to the extent possible; and, heritage features should be protected. The witness considered a long list of criteria for ranking potential uses and applied these criteria to each possible use. At the conclusion of this process he was convinced that Site D could be used for agricultural purposes when landfilling was complete; indeed he thought that it would be possible to restore agricultural uses to most of Site D.

The Town of Milton called its own expert on agricultural matters, Mr. Hoffman, who described a number of potential problems, and possible solutions, at Site D. The Board found that many of

the suggested difficulties were not as serious as portrayed, and that the proposed solutions for other problems had been adequately anticipated and dealt with in the Region's proposed design for 'after use' at Site D.

The Board considered it unreasonable for Mr. Hoffman to have changed his basis for land use assessment before and after landfilling. His pre-development assessment of soil capability, and thus yield, was based on soil classification analysis and predicted yields which did not take into account factors such as forested areas and other existing uses. His assessment after development was based on the condition in which the land would be left, and on questionable assumptions about changes in soil classification based on type of crop and yield. The Board was not convinced that the agricultural damages predicted by this witness would be as serious as he suggested.

Mr. Hoffman had erred in his assumption of areas which would be out of production because they would have topsoil berms on them or be too narrow to work. He realized subsequently that areas beneath temporary berms could be returned to productive use, although he would not allow that they might be workable as Class 1 land after use.

Under cross-examination from Mr. Lederer, Mr. Hoffman acknowledged that in comparison with other lands in southern Ontario, these Halton lands may be of lower productivity than the average for Ontario soils.

Part of the agricultural problem at Site D is the pressure of the urban fringe in the vicinity. The question is succinctly put in the Regional Municipality of Halton's 'Rural Development Policies Review' Background Paper No. 2:

"Can an agriculture industry continue
to be viable in the midst of high proportions
of rented farmland, extremely high rates
of rural-to-urban land conversion,
relatively high capital and operating costs
and the omnipresence of speculators and developers?"

B-115 p 18

The rhetorical response would appear to be "No."

Dr. Mackintosh acknowledged that the farms in the Halton Region are more fragmented than elsewhere in Ontario. In fact, the median size is half the median size for the rest of the

province. Similarly, while the rest of Ontario enjoys 75% ownership of lands being worked, the figure is less than 50% for Halton because of the current conversion of rural to urban lands. Because of speculation pressures, there is very little, if any, agricultural profitability in this area. While the Board recognizes that landfilling at Site D will add to the alternate uses problem, it is not convinced that such use would be the 'blockbuster' in the area.

The Board noted that the area of land for Site D which would be temporarily lost, and perhaps permanently impaired, for agricultural production is about one fifty-thousandth of the agricultural land in Ontario, and is evidently of reduced agricultural capability because of other pressures in the vicinity.

The reality of urban pressures was inadvertently demonstrated by evidence pertaining to the high cost of developing Site D for a landfill because of the serious real estate value reductions which might result for residential properties in the area. If the area is intended to be agricultural in the future, then residential real estate losses ought not to be of primary concern. If, instead, the prime concern is real estate losses, then the debate about the loss of valuable agricultural land loses credibility.

Even Mr. Walker's evidence, in cross-examination, led the Board to consider that the concern about loss of farmland around Site D was not necessarily valid, since the present use of those lands allow strip development which is not conducive to efficient farming operations. Although the Board gave no weight to potential ancillary benefits, it did not escape our attention that a landfill might result in the consolidation of land parcels in the area, which could ultimately assist agricultural uses both on-site and in the immediate vicinity.

Mr. Hoffman stated that he had not investigated soil conservation practices, degree of fragmentation, downstream livestock management practices and other matters specific to Site D and its surrounding area. He also acknowledged that he knew of no other landfill where a proponent had planned carefully and deliberately in advance to rehabilitate the landfilled area for agricultural after use. Such planning would allow a proponent to deal with many problems in the most positive way possible, from the perspective of agricultural uses. For example, subsidence could be dealt with by annual or biannual regrading of depressed areas.

Mr. Hoffman stated that he simply did not have enough information on specific design parameters to conclude what the final land classifications would be. In the final analysis, it appeared that his main concern was with gas concentration and build-up beneath plant roots, which could lead to crop losses as a consequence of displacing oxygen from the soil. Mr. Hoffman noted that, because the topsoil layer is not of even thickness across the site, careful and expert soil removal would be required at Site D, to separate the topsoil from the subsoil as precisely as possible.

Mr. Hoffman noted, and there was no disagreement with this observation, that neither alfalfa, with its long penetrating roots, nor soybeans, which grow poorly on rehabilitated land, would grow well on top of the landfill when it is completed. This would reduce the flexibility of crop selection for future farming at Site D.

It was clear to the Board that the Ontario Ministry of Agriculture and Food was satisfied with the Regional Municipality of Halton's environmental assessment process and evaluation of agricultural factors, and appreciated the response to an earlier request that if Site D was chosen, it should have specific plans to rehabilitate the land to agricultural uses. This reflects Ministry policy on the matter:

"The overall success of sites rehabilitated to an agricultural after-use offers encouragement and optimism for rehabilitation as one solution to the obvious future conflict between prime aggregate and prime agriculture land. Successful examples of rehabilitation provide an excellent demonstration of what can be achieved with good planning and careful practices."

B-116 p 11

With respect to Mr. Hoffman's concern about the gas poisoning problem, the Board is mindful of the design requirement, at page 11 of the appendix to exhibit H-20, which calls for "installation of a gas venting system at Site D, if required". It became clear during the Hearing that the "if required" clause relates to the extent to which agricultural after use would be successful or unsuccessful because of gas poisoning problems.

The Board finds, then, that there would be an impact on agriculture at Site D, and that the impact would be negative while the landfill is in operation. The long-term effects are less

clear. They could be negative if gas problems and farmer resistance were serious. On the other hand, they could actually be positive, if the result would be larger blocks of land being farmed under some kind of lease arrangement when landfilling is complete.

Mineral Resource Policy

On the mineral resource issue, the Board had to piece together the evidence from a number of witnesses who touched on the matter peripherally.

Mr. MacNaughton, a planner called by counsel for the City of Burlington, pointed out that the Mineral Aggregate Resources Policy (MARF) ought to have been kept as an evaluation factor. In his view, this policy has greater status than the Foodland Guidelines which have not yet become official provincial government policy. Because of this, Mr. MacNaughton was concerned about the unequal treatment between the two sites with respect to provincial resource policies. Although he concluded that the shale resource was not the best, neither was the agricultural resource. The quarry license at Site F should in itself deserve merit and weight, because it applies to what is, in his estimate, some 10-20% of the available licensed resource in southern Ontario.

On the other hand, Mr. Kentridge, a planner called by counsel for Milton area residents, said that notwithstanding the Mineral Aggregate Resource Policy statement he did not feel it would be appropriate or helpful to include this resource issue in the summary of factors comparing Sites D and F. He was comfortable, nevertheless, in including the agricultural policy which argues against establishing a site at D.

The MARF statement, as it applies to this undertaking says simply:

"It is the policy of the Province of Ontario that ... any planning jurisdiction, including municipalities and planning boards, identify and protect as much of its mineral aggregate resources as is practicable, in the context of other land use planning objectives, to supply local, regional and provincial needs."

N-305 p 3

This appears to counterbalance the agricultural policy issue. The shale at Site F is not the best in Ontario, but then the land at Site D is not the best agricultural land. Loss of shale at Site F appears to constitute about 10 years supply at current rates of consumption in

Ontario, between ten and twenty per cent of the licensed resource in Southern Ontario, or between one and two per cent of the total Ontario resource. The farmland resource lost temporarily at Site D would be about 1/500 of one per cent of the Ontario resource. The Board recognizes the non-equivalence of the two resources in question, but also recognizes the extent to which they deserve comparable consideration.

With reference to the matter of shale extraction at Site F, Ms. Mansfield, counsel for the Ministry of Natural Resources announced that the Ministry had reached agreement with the Regional Municipality of Halton and National Sewer Pipe Limited on the shale resource at Site F. The agreement on this matter was filed as exhibit MNR-538.

Mr. Kentridge explained that the mineral aggregate policy is superceded by the "greater public interest" aspect described in the policy itself. The same might be said of the agricultural policy.

Having considered both physical resource issues, the Board finds that there are impacts in both areas. There was not enough evidence to assign more importance to one resource than the other, given the possible mitigating measures and the shifting land uses in both areas.

Flora and Fauna

The first witness in this subject area was Ms. L. Hellas, called by counsel for the Regional Municipality of Halton. Ms. Hellas explained how she had considered flora and fauna throughout the Region. She had been able to draw some general conclusions about sites on similar terrain. For example, Sites A, B and C were all on the same flat agricultural terrain with some hedgerows and small woodlots. Site D is similar to Sites A, B and C but there are some shrubs and wetlands, plus an intermittent streambed, in parts of the site, and a mature forest in the center of the southern portion of the site. Site E was one in which there was a significant wildlife corridor across the site, and Site F was described by Ms. Hellas as being of a highly variable ecological nature with eroded gullies, large portions of treed areas, considerable wildlife migration, and some surface runoff.

Ms. Hellas explained how she considered these sites and rated them for all the variables important for impact assessment on flora and fauna. She thus ranked the impact on flora

and fauna as follows: Site F more important than Sites B and E, and these more important than Site C. Site A was least important and Site D second least important at this stage of site evaluation.

In her subsequent comparative analysis of Sites D and F, Ms. Hellas was looking for "uncommon" or "rare" species. She found more rare and uncommon species at Site F than at Site D, leading to the overall conclusion that "there will be major biological constraints to the development of a landfill at Site F" but only "minor biological constraints to the development of a landfill at Site D". Ms. Hellas said that there were no absolute impediments to a landfill at either site.

Although this witness acknowledged that there would be the loss of all known species, (sometimes she used the term 100% of the known species), she meant by this only all the known species within the boundaries of the site. There were sufficient other representatives in the vicinity of the site to ensure that this would not result in the loss of a rare or uncommon species from the Region or the Province as a whole.

Counsel for the City of Burlington called Dr. C. Kitchen to testify about the flora and fauna at Site F. It was Dr. Kitchen's opinion that Site F should be considered as an Environmentally Sensitive Area (ESA), because of its forest association with the adjacent Sassafras Woods complex. He felt that this area should receive at least as much protection from competing land uses as does agricultural land.

Dr. Kitchen drew the Board's attention to the criteria for the designation of an ESA. If one or more of these criteria were met, then in his view, an ESA should be established, according to the policies of the Regional Municipality of Halton. Five of the nine criteria were met at Site F, including some of the more crucial ones.

An early (1982) summary description of the Site F area says:

"... parts of the site consisted of plant communities which are unique in Canada. ... Not only did these forests contain many species which are rare in Ontario and regionally significant, but the forests themselves were also significant."

WB-107 p IV

The Proctor and Redfern report, from which the above quote was taken, continued:

"Our analysis shows that parts of
the subject property may be considered
Environmentally Significant since
they satisfy criteria 1,3,4,5, and 6."

WB-107 p 35

This was one of the reports to which Ms. Hellas referred when she said:

"Previous studies have indicated
the presence of rare plants on
part of the sub-area."

H-11 p 61

Ms. Hellas told the Board that a site would have been considered unacceptable if it met criterion 6 at the Provincial or national level. It would merit a high impact rating if it met criteria 4,5,7, or 6 at the regional status level. Since Site F met criteria 1,3,4,5 and 6, the Board considered that it would have been reasonable for the site to have been eliminated in the early screening. However, Ms. Hellas explained that because the earlier studies represented a greater level of detail than was available for the other sites, she had been instructed to deliberately ignore such studies as she pursued her site screening exercise. The Board does not accept the logic of this decision.

As counsel for Milton area residents, Mr. Garrod, established during his cross-examinations of experts on biological matters, the variety and rarity of flora and fauna in the Site F area must be considered in the context of the fact that the area is now under private ownership, and there is no guarantee of protection even without landfilling at this site. The same observation might have been made with respect to many aspects and many sites, reminding the Board that these matters are important more in a relative sense than in the absolute.

Dr. Kitchen noted that Site F shows a significant species variation from the adjacent Sassafras woods. While not contiguous with the larger Sassafras woods ESA, the most valuable 20 hectares of oak hickory forest are still considered to be "a component of the Sassafras woods complex", by association.

Dr. Kitchen stated (and noted at page 18 of exhibit B-883) that at the September 6, 1984 meeting of the Identification Subcommittee of Carolinian Canada, the Sassafras Woods and

adjacent areas were selected for inclusion in its report "Carolinian Canada (1985) Critical Unprotected Natural Areas in the Carolinian Life Zone of Canada". At that time the exact number and boundaries of such adjacent forests had not been clearly defined, although it was Dr. Kitchen's view that Site F would have, and should have, been included.

Mr Stevens, for the Region, was convinced that it would be possible to revegetate Site F with flora and fauna similar to that found there now. Attempted rehabilitation of the oak and hickory forests would have to be done very carefully to minimize risk to the integrity of the clay cap proposed for the site.

On the other hand, Dr. Kitchen offered the opinion that the valued Carolinian Forest Ecosystem at Site F could not be restored following the landfilling period. It constitutes a forest association not well represented either in the Sassafras Woods or in the general area.

In Dr. Kitchen's view, Halton's proposal for land uses after landfilling at Site F does not appreciate the complexities, difficulties and costs associated with a "natural area concept" restoration. This concept involves the establishment of a forest system resembling the naturally functioning forest ecosystem. As such, it is not a plantation and the costs of establishing such a complex system are substantial.

Dr. Kitchen explained that considerable management costs could be incurred for the first 3-5 years after the installation of a "natural area concept" forest. His estimates of such costs were not meant to be precise but rather were intended to show the substantial costs, within an "order of magnitude".

Ms. Hellas agreed that Site F should be preserved because of its diversity of habitat, but acknowledged that adjacent areas also possessed such diverse habitat.

With respect to Site D, Dr. Kitchen recommended that as much as possible of the woodlot along First Line should be saved. This could be done by narrowing the berm in the vicinity of the woodlot, both to save the woodlot and to provide visual relief along the length of the screening berm. In addition, he felt that as much as possible of the woodlot in the south-central portion of Site D should be retained.

In summary, Dr. Kitchen felt that the proposed after use for Site F would be difficult and would not replicate the "high natural value" of the present woodland.

This Board finds that official designation as an "Environmentally Sensitive Area" does not make an area environmentally sensitive: it may, if perceptive enough, recognize an intrinsic quality. Site F appears to possess that quality.

Public Health and Safety

Aircraft/Bird Hazard

Within 5 miles of Site D there is an airfield known as the Burlington Airpark, operated by Mr. Victor Kovachik. He appeared as a witness, and told the Board that there are now about 125 aircraft based at the airpark which has a 2,800 foot long paved main runway and is licensed for night flying. Mr. Kovachik noted that in the 26 years he has been flying from the airpark there have been two bird strikes, but there was no discernible damage in either case.

The main business at the airpark is servicing, repairs and maintenance, instruction and certification. Although turbo-prop aircraft use the airport, most aircraft are single engine, piston driven aircraft. The airpark is mostly used during the day, although about 8% of its use is between dusk and 11:00 p.m..

Mr. Kovachik explained that as the airport gets busier the circuits around it expand, taking aircraft nearly over Site D. He said that he can't afford bird scaring techniques which might be required, in his opinion, if Site D is selected for a landfill. Mr. Kovachik feels that costs for bird-scaring at his airport should be absorbed by the Regional Municipality of Halton.

Mr. Kovachik's evidence was that there are now 40 to 50 gulls around the airpark on a given morning even though there is no landfill nearby. He agreed with the assessment made by Dr. Richardson, an expert on bird strikes and aircraft, that a serious bird strike remains unlikely even with the establishment of a landfill at Site D.

The Board heard evidence that the highest number of aircraft movements per day occur when air cadets are using the airport for glider flight experiences on weekends. This includes 10,000 movements per year on Sundays, when the landfill site is closed and the residence time of gulls in area is expected to be reduced.

Dr. Richardson explained that gull populations in the Burlington Bay area have increased by approximately 11% per year over the last few years. The population is mostly ring-billed Gulls, and Dr. Richardson said that the flight path of these birds, from the Burlington Bay area to Site D, would cross over approach and circuit paths used by aircraft at the Burlington Airpark. In light of this, Dr. Richardson felt that the probability of collisions, and damage from such collisions, would increase. He stated that bird scaring techniques, such as pyrotechnics, would be a nuisance for residents near the landfill.

Under cross-examination Dr. Richardson acknowledged that a serious collision resulting in danger to humans is unlikely. He concluded that there would be a greater, but unmeasured and incalculably small, increase in the bird strike risk to air traffic in the vicinity of the Burlington Airpark, if a landfill were built at Site D.

The Board heard evidence that the risk posed by bird strikes to aircraft at the Burlington Airpark was not considered serious enough to persuade farmers in the vicinity to change present agricultural practices. Dr. Richardson stated that crops presently grown in the vicinity are included under the heading "moderately hazardous" (exhibit M-394, tab 7).

In the course of his cross-examination, Dr. Richardson acknowledged that other landfills as close to Burlington Bay as Site D could constitute attractive alternative feeding locations for the Burlington Bay gull colony, and that this would reduce the extent to which that gull colony would rely on Site D for its food supply. This should reduce the number of birds expected to fly from Burlington Bay to Site D.

Dr. Richardson acknowledged that there are many ways to reduce the number of gulls at landfill sites. In particular, the installation of wires over a landfill site has been demonstrated to have reduced the number of gulls at a site by 68.4% to 91.1% and on an active landfill face by 93.5% to 99.9%.

Dr. Richardson had described an increased risk based on assumptions about upgrading of the airport and increases in the number of gulls which would fly from Burlington Bay to Site D. He was unable to calculate the increased probability of bird strikes, however, and was unable to provide details about the factors which he would use to calculate such an increased risk.

Dr. Richardson concluded:

"The probability of a serious collision of a bird and an aircraft from Burlington Air Park will be increased considerably by establishment of the landfill. No numerical estimate of this increase is possible. The rarity of reported serious collisions between birds and light aircraft, even though birds often congregate near airports, suggests that even after establishment of the landfill a serious collision will be unlikely."

M-390 p 19

The Town of Milton called Mr. McDonald of Transport Canada as an expert with regard to bird hazards and aircraft, particularly with respect to bird strike data and data handling. After three days of evidence the Board concluded that although it was Transport Canada policy that one should not situate landfill sites and airports less than five miles apart, Transport Canada sometimes chose not to act in accordance with that policy in cases under its jurisdiction. The risk in such cases was apparently much greater than that posed at Site D.

Mr. McDonald was not well prepared for this Hearing in the sense that he gave many examples about bird strikes at airports which did not relate to the situation at Site D, and he had not contacted appropriate colleagues in Ontario.

Notwithstanding all the limitations and qualifications offered in regard to the bird strike risk, the odds against a collision would appear to be so low as to justify the conclusion reached by Dr. Richardson that it was unlikely that there would be a serious collision between a gull and an aircraft at the Burlington Airpark as a consequence of landfilling at Site D.

Transportation Risk

The Region's transportation expert, Mr. McLeod, described how he had calculated haulage routes from collection points to disposal sites. He then did an impact assessment based on various factors along the routes. The essential factors which he considered in his Traffic Service and Safety Evaluation was the quality of the roads, highways and arterials, the extent to which there might be interference with other traffic, and the possible effect on pedestrians in the area.

Mr. McLeod had examined all 55 candidate sub-areas and had assessed safety from the point of view of the number of intersections, laneways and road conditions. In his evaluation he included consideration of proposed modifications to the major traffic flow patterns in the area (for example, the completion of Highway 403 and its interchanges). His analysis included a service and operations component, but it did not include an environmental impact component which considered the production of pollutants associated with longer travel times and distances.

Mr. MacLeod did not consider the possible positive net effect which might occur at Site F as a consequence of the removal of existing landfill-related traffic:

"... we looked at conditions in the vicinity of the existing site and accidents and the conflicts that would be occurring ... the statement meant to suggest that the existing site is there and the high levels of trucks are already in existence and it's something that has to be kept in the background in a consideration of Site F, but there are no serious problems and we had not found any serious problems in relation to its existing conditions. We tried to divorce ourselves from that when we were generating numbers and things ..."

13 p 3,057

The Board does not agree with the proponent's approach on this matter. One must consider what the environment, including the traffic environment, will be like if the undertaking is approved. If Site D were approved, that would mean an increase in traffic around Site D and a decrease in traffic around Site F. This is perhaps the clearest example of a general problem with this two-site environmental assessment: to a large extent it failed to arrive at a net environmental impact by taking into account beneficial effects at one site if the other site were chosen

The City of Burlington called an expert witness, Mr. Blay, who had been involved in long-term traffic assessment and the likely economic effects thereof. Mr. Blay had measured all segments of the transportation routes to Sites D and F from the 10 waste centroids using a calibrated odometer. He computed differences in time and distance but had not computed the product of the number of loads times the differences in time or distance. This latter value would have been a more useful one in assessing environmental impact.

Mr. McLeod noted that the container facilities presently located throughout the Region have had a significant impact on the concentration of haulage vehicles in the traffic patterns to the present Burlington landfill. The mitigating effect of container facilities should be borne in mind for any future landfill alternative, since it offers the possibility of improved safety under any future scenario.

The need for transfer stations is reflected in the comments provided by the Ministry of Environment:

"It has consistently been the Ministry's position that the need for and location of transfer stations (both large facilities and container stations) should be dealt with in the Environmental Assessment Process."

E-110 p 20

Under cross-examination Mr. McLeod noted that many of the waste haulers whom he had interviewed would prefer Site D to Site F from the point of view of service and operations. But the proponent seemed to accord little weight to observations such as:

"Site D is seen as a good location from a business point of view because it is almost in the middle of the three business areas in Milton, Oakville, and Burlington - transportation costs would be reduced."

H-33 Appendix B

The Board does accord weight to this comment, which comes from a relatively impartial operator in the area.

The cross-examination revealed a potential problem on Highway 25 at Site D, where vehicles would be trying to get in and out of the landfill site every 43 seconds during busy periods into a high speed traffic stream where, on average, one vehicle passes the landfill entrance every 4 1/2 seconds in one direction or the other. This leads to the conclusion that there would be a need for at least an acceleration lane to the south on Highway 25, to minimize accident potentials at this site.

The most significant omission in the traffic evidence was the failure to account for the removal of the risk associated with current haulage practices to the vicinity of Site F. The

evidence thus suggested that while there would be no increased risk from continuing to haul garbage to this vicinity, there would be an increased risk if one began hauling garbage to the vicinity of Site D.

Given the approximate traffic equivalence assumed by the proponent, without this factor being properly considered, the fact that Site D is significantly closer to the Region's centre from a waste generation perspective, and the evidence given by a number of other witnesses in favour of Site D from the traffic perspective, the Board finds that Site D should have been more preferred from the Traffic/Public Health and Safety perspective than was the case.

Leachate Treatment

Leachate is the liquid which drains from the bottom of a landfill. It is composed of liquids from the waste, along with rainwater which has entered the top of the landfill and percolated through the waste. As these liquids pass through the waste they pick up chemical constituents which make the leachate toxic, to an extent which depends on the composition of the waste through which they pass and the length of time the landfill has been there. Leachate which may have an adverse effect on the environment must be collected and treated before being released to the environment. Drs. Norman and Willis gave evidence to the Board on their study of leachate treatment.

Leachate had been collected and run through a laboratory-scale sewage treatment device to determine whether carcinogenic, mutagenic and teratogenic substances were removed, and other organic compounds were reduced to levels which would be well below the threshold values for occupational health and safety. For those chemicals which were not mutagenic, teratogenic or carcinogenic, and did not exist in the U.S. EPA (United States Environmental Protection Agency) list, the assessment of risk was calculated on the basis of comparable chemical species for which the risk was known.

Drs. Norman and Willis had concluded that the leachate from either site could be safely treated in sewage treatment facilities in the Region. The quantity of leachate admitted at any such facility would have to be controlled to prevent overloading the facility, regardless of the source of the leachate.

The witnesses had arrived at the conclusion that Site D was less favoured than Site F from the point of view of leachate treatment, because the need to transfer leachate from holding ponds to trucks at Site D could create an occupational hazard which would not exist at Site F where the plan was to allow leachate to move directly to the sewage treatment facility through existing sewers.

On the other hand, these witnesses had not taken into account the possible occupational hazards to sewage plant workers arising from the differences in leachate transportation. Site D has possible advantages of "outgassing", or release of volatile gases from leachate exposed to the air in holding ponds or during transfer in an open environment, while at Site F there is a possible hazard to sewage plant workers because of the higher concentrations of such volatile gases in the confines of the plant, to which leachate had been conducted directly through the sewer system.

The Board was satisfied that for either site it is likely that the leachate can be safely treated, and that the hazards to workers will be minimal and within the bounds of acceptability for such work.

It was established during cross-examination of these witnesses that any leachate lost directly to streams adjacent to either landfill site would have to be diluted with 250 times as much water in order to pass the MOE criteria to prevent damage to fish and wildlife.

Hydrology

In this Decision we speak of hydrology primarily as the science of the movement of water on land. Hydrology is important in the selection of a landfill site because leachate may escape at the surface around the landfill and may contaminate surface waters in the vicinity.

The Region's hydrology expert was Mr. Crysler and he used what he called the "Rational Method" to accommodate storm intensities, surface cover and drainage characteristics, in calculations which led to estimates for runoff from the various sites.

Site D was shown essentially to straddle a local watershed divide rather than lying in lowlands or on hillsides. A small stream that passes through the edge of Site D is to be rerouted around it so that the only rainwater to be collected at the site would be that which

falls on the site. Mr. Crysler explained that rainwater is to be collected by a specially designed set of ditches, separate from the leachate drains. These storm water ditches would lead to retention ponds from which storm waters could subsequently be discharged into receiving streams. The retention ponds were designed allow only a negligible increase (up to 1.5%) in stormwater runoff from the site. Some of the water in the retention ponds at Site D (more than 2,200 cubic metres) is to be reserved for use by the Milton Fire Department for fire control purposes. Mr. Crysler's evidence was that these ponds would probably intercept silt in the runoff from the landfill.

Site D is situated on generally flat land, so that surface water flows and controls are relatively straightforward before, during and after landfilling. This was best shown by exhibits H-229 and H-231, from which the Board could appreciate the ease with which engineering designs could accomodate stormwater flows at Site D.

Site F is a markedly different and far more complex site, from the hydrologic perspective. Exhibits H-233 and H-237 show this complexity before and during landfilling. Six creeks run through the area, five of which drain into Indian Creek and the other drains to Falcon Creek. Three of the streams would have to be diverted around the landfill. A complex surface water control system would have to be established as the site is developed. In the early stages, solid pipe would be placed in sections of the stream valleys and covered over with earth fill, to establish the landfill base elevations. The ends of the pipe would be temporarily blocked, and stormwater which would collect above the blocked fill area would have to be pumped to diversion ditches, which would conduct it around the fill to holding ponds to the south. As landfilling progressed up the hill, more lengths of pipe would have to be laid in the river valleys as earth fill is added to establish the new base contour for the landfill. By the eleventh year of landfilling there would be a very complex surface water flow, which would require mitigating measures to control stormwater run off.

A number of Aldershot residents appeared before the Board to describe their first-hand knowledge of surface water runoff in the Site F - Aldershot area. One local resident, Mr. M. Brecht, showed the Board photographs (WB-945), and described how Falcon Creek sometimes gets plugged up where it goes below ground between Willowbrook and Plains Road in Aldershot. Mr. Brecht's concern, and that of a number of other Aldershot residents, is that leachate breakouts, or other releases of leachate through short subsurface pathways to the surface

waters in the area, could lead to contaminated water flowing through residential backyards where children and pets play.

Other residents explained that there were a number of 'subterranean streams' which emerged in Aldershot, the source of which they believe to be up the hill in the vicinity of Site F. The Board was unable to verify the source and pathways of such streams, based on the evidence, but appreciates the public concern that these streams might constitute conduits that could carry contaminants towards residences in Aldershot.

On the positive side at Site F, Mr. Crysler, the Region's expert witness, explained that the interception of streams on-site could actually stabilize storm water runoff. While this may be a positive residual effect of landfilling at Site F, it is not the objective, and so was given little weight as a rationale for site preference (using the same logic, the Board gave little weight to the preservation of the Ford farm at Site D as a rationale for developing a landfill in that area).

Although we conclude that there may be more surface water users in the immediate vicinity of Site D, in comparison with Site F, this is not considered a crucial matter, as there is no evidence that storm water runoff would be contaminated at Site D. In any event, if contaminated storm waters are found at either site, the reservoirs could be used for short-term retention of such storm waters for subsequent treatment.

Concerns about the volume of storm water runoff at either site can be addressed by adjusting the size of the retention ponds, should authorities desire to reduce such runoff to less than current values in order to reduce downstream flooding.

The Board finds that surface water problems at both sites could be adequately dealt with, although solutions at Site F would be far more difficult and prone to failure during and after landfilling. Site D is the preferred site from the hydrologic perspective.

General Principles in Law

"Experts, particularly when called en masse, will almost inevitably disagree as amongst themselves. This imposes a further caveat upon the trial judge when attempting to assess that evidence ..."

McQuaid, J. in **Holland v. Prince Edward Island School Board Regional Administrative Unit #4**
59 Nfld. & P.E.I.R. p 13

Mr. Justice McQuaid elaborated on the further caveat imposed by referring to the judgement of Middleton, J.A., in **Bennett v. Peattie**:

"When a case is complicated by the introduction of opinion evidence ... it is, I think the duty of the judge to arrive at his own opinion after carefully weighing and considering the evidence of the experts, and availing himself of all the assistance they are able to give him, and himself to determine the question of fact in the light of that evidence..."

57 O.L.R., p. 242

This Consolidated Hearing Board agrees with the view of Mr. Justice McQuaid, and takes into account two additional authorities in consideration of the weight to be given to the evidence before the Board.

"the trial Judge erred in stating ... that the theory of the defence should succeed because it was supported by a greater number of physicians."

(1929) 4 D.L.R. p. 59

and the decision of Walker, J. in **Sunnyside Nursing Home v. Builders Contract Management Ltd. et al.**:

"I have given careful consideration to the testimony of all expert witnesses ... I have heard a good deal of expert evidence, much of it in highly technical

terms. ... I have looked at, inter alia, the ... manner in which they presented their evidence and their attitude on the stand, watching for any indication that any one was arrogant, argumentative, an advocate, overreaching, overly technical or forced to retreat or retract"

(1985) 4 W.W.R. p 125

The Board was presented with all these problems in many subject areas, but most especially in the field of hydrogeology.

Many experts were clearly advocates for their clients and often did "disagree as amongst themselves." We felt it our duty therefore, even though one of the final two sites was preferred by more hydrogeologists than the other, to arrive at our own opinion after carefully weighing and considering the evidence of the experts, and availing ourselves of all the assistance they were able to provide.

Hydrogeology, for the purposes of this Decision, is simply the science of water in the ground, and the ways in which it moves through the ground, whether through sand, soil, rock, or fractures in rock. We also consider in this section the matter of hydrogeochemistry, by which we mean the science of chemicals in water in the ground, and their movement through the ground.

Although these fields are sometimes presented as complex and almost unfathomable, the Board will try to present them in a straightforward and comprehensible form here.

Seven hydrogeologists presented evidence to the Board: Messrs. Sobanski and Beechinor for the Region; Drs. Charlesworth and Rowe for the Town of Milton; Messrs. Petrie and Crutcher for the City of Burlington; and, Mr. Bowen for the West Burlington Citizen's Coalition. Mr Feenstra was called by the Region as an expert witness to present evidence on hydrogeochemistry.

Initial Screening of Sites

More information was available to this Board over the course of the Hearing than was available to hydrogeologists prior to the Hearing. Hydrogeologists considering an earlier, different proposal for landfilling in the vicinity of Site F were handicapped by having even less data than this Board had at the beginning of the Hearing.

The Board noted that witnesses supporting the selection of either site stated that one could not assess the suitability of the opposing site without additional information. This Board finds that there are adequate data to assess both sites.

The Region's hydrogeology consultants, Messrs. Sobanski and Beechinor, had essentially two kinds of sites to consider; those which existed in glacial tills, and those which were active or abandoned pits and quarries. In the course of their general overview analysis they screened all till plain areas in Halton for soil attenuation. They considered plains comprised of glacial till and clay to be better than the pleistocene complex, and the pleistocene complex better than glacial outwash. The second aspect they considered in their screening was the thickness of the overburden.

In this respect they were consistent with the Ministry of Environment position statement of 1988, to the effect that there are limitations to engineered facilities, and sites that offer a high degree of natural attenuation (e.g. thick clay deposits) are preferred (E-928, Appendix B).

But the Ministry of Environment had some difficulty with the proponent's next screening step:

"Hydrogeologic suitability was the primary evaluation criterion used at this stage (Stage 2A) to narrow the Region-wide search for "candidate areas". The seven pits and quarries sites were not subject to the same hydrogeological evaluation. Instead they were grouped together and treated as a separate type of area ... The decision to include these sites at this stage was not clearly explained ..."

(E-109 p 28)

When it came to choosing between the six sites, to arrive at the preferred site, the selection criteria which the Region's hydrogeologists were to have applied were:

- o attenuation capability
- o geologic complexity
- o overburden thickness
- o complexity of groundwater flow system
- o buried valley aquifer complexes
- o type and distribution of aquifers
- o drainage

Again the Ministry of Environment had difficulty with the unequal application of hydrogeological criteria to the quarry sites, in contrast to the plains sites:

"The consultant did not provide a clear explanation to describe the separate evaluation methodology used for pits and quarries that seemingly allowed inconsistent treatment of these sites in comparison to the clay/till plain candidate areas."

(E-109 p 29)

The Board was also concerned about the inconsistency of treatment throughout the site selection process.

When it came to choosing the order of preference of the six final sites, the Region's consultants wrote:

"It is also desirable to prevent contaminants from migrating into fractured bedrock. Contaminant transport in fractured geological materials is different than contaminant movement in a granular medium (overburden). Fractured geologic materials are anisotropic with respect to the orientation and frequency of fractures. As a result, contaminant transport in fractured rock is often not predictable. In addition, the attenuation capacity of a fractured rock environment is less than the attenuation capability of a granular environment.

(H-38 p 6)

Notwithstanding the advice against selecting a site on fractured rock, the Region ranked one such site as most favourable because of other considerations. The reason for their preference is clear from Table 1 at page 70 of exhibit H-38. By means of this table, the Board was informed that Site D was preferred from the point of view of attenuation capability, overburden thickness, drainage, site capacity and complexity to engineer site. The sites were claimed to be equivalent from the perspective of stratigraphic and groundwater flow complexity, and buried valley - aquifer complexes. But at this stage all these factors were overwhelmed by the last two factors in this table; downgradient well users, and ease of supply restoration. All other site selection criteria throughout the process were made to 'stand down', in the final analysis, to the single factor of 'adjacent well users who may be

dependent on the groundwater resource' -- regardless of the probability of threat to that resource. The Board's view on this approach to environmental assessment is presented in the section of this Decision that deals with the Environmental Assessment Act process.

At this stage in our consideration we were prepared to accept the Region's rationale and evaluate the sites on their hydrogeological merits, regardless of the off-site socio-economic considerations.

Of all the pits and quarries evaluated in Halton, that most favoured was P&Q1, "National Sewer Pipe and adjacent property". The Board noted, from the summary chart following page 34 of exhibit H-10, that this site was favoured relative to quarries numbered 2,4,5, & 6 because of its capacity to accommodate all the waste sought to be disposed, although it appears to be the only site for which "adjacent property" was included.

Another reason this site was preferred was its accessibility to a water pollution control plant for leachate treatment. This accessibility flows from the site's proximity to urban areas, an attribute which, in earlier stages of evaluation, eliminated non - pit and quarry sites from further consideration.

With respect to the evaluation factors in Table I of exhibit H-38, Mr. Sobanski noted that the consultants had not considered the influence of each factor on the other factors considered in the summary of existing constraints at the six sites under consideration. Thus the identification of a negative impact for well users, and the possible need to restore their supplies, took no account of overburden thickness, attenuation capability and the absence of buried valley - aquifers complexes. The Board is of the view that the interactive nature of these individual factors should have been considered.

The process and the criteria were explained to the Board, and then witness Beechinor described the primary concerns with the six final sites (see map at page 5) as follows:

- Site A - The primary concern was for contamination of water wells "downgradient" of the site (Burnhamthorpe Road).
- Site B - There are 30 water wells in the vicinity of this site, several of which are downgradient of the site.
- Site C - Concern again is well water effects downgradient.

- Site D - This site is geologically very simple. It possesses a thick overburden of clay till on sandy silt. The overburden generally exceeds 15 metres in thickness, and the entire site is in a groundwater recharge area.
- Site E - Here again the primary concern was for groundwater contamination. Extensive work had already been done at this site by Gardiner Lee Consultants.
- Site F - The water and groundwater flow are defined by considerable relief in this area. Groundwater at depth in the shale is already contaminated with natural ions. It exceeds provincial guidelines for hardness. The shale is relatively impermeable, but the primary concern at this site is leachate egress.

Finally, the Region's hydrogeology consultants, Messrs. Sobanski and Beechinor, assessed the agricultural capacity at sites A to E, although they noted that this factor would be more adequately and thoroughly addressed by the Region's agricultural expert.

At the end of their screening of the six sites they arrived at a ranking which was based on the "worst case scenario" of an engineered landfill system failure.

During cross-examination by counsel for the City of Burlington, Mr. M. McQuaid, it became clear that neither Mr. Sobanski nor Mr. Beechinor had previous experience with the design, evaluation and siting of landfills on other than till and clay plains. They had no previous experience with siting a landfill on fractured shale. This is understandable, given that experience to date relates to till and clay plains because of their finer grain sands, and not to "exposed rock areas which may be considered generally unsuitable for solid waste disposal" (exhibit H-57 p 15, Phase 2 Stage 2A, General Overview Analysis).

The Final Hydrogeological Comparison

The Region's consultants undertook extensive hydrogeological investigations of the two more preferred sites, of the six areas selected in the earlier round of evaluation. Their action was in response to directions from Regional officials that the top two sites should be examined in detail, rather than only the most preferred site. The rationale for this decision was explained to the Board as being the Region's view that either site would be acceptable for landfill. By the end of this Hearing the Board had reached the conclusion that only one site was acceptable. Board members think that the proponent could have reached the same conclusion fairly early in the process. Even if both sites had been acceptable, the Board is firmly of

the view that the submission of more than one site was not in the public interest. Apart from the substantial costs of submitting more than one site to the kind of exhaustive study necessary to establish the extent to which it is safe for landfill, there is an additional and serious cost in terms of human trauma for those citizens living in the vicinity of each such site, and this is compounded by unnecessary inter-community conflict.

In the course of the Region's detailed technical studies, requests were made by other parties for their experts to observe the drilling operations. This was permitted at both Site F and Site D. The Board appreciates the proponent's action in this regard, and recommends this practice be adopted for all landfill environmental assessments.

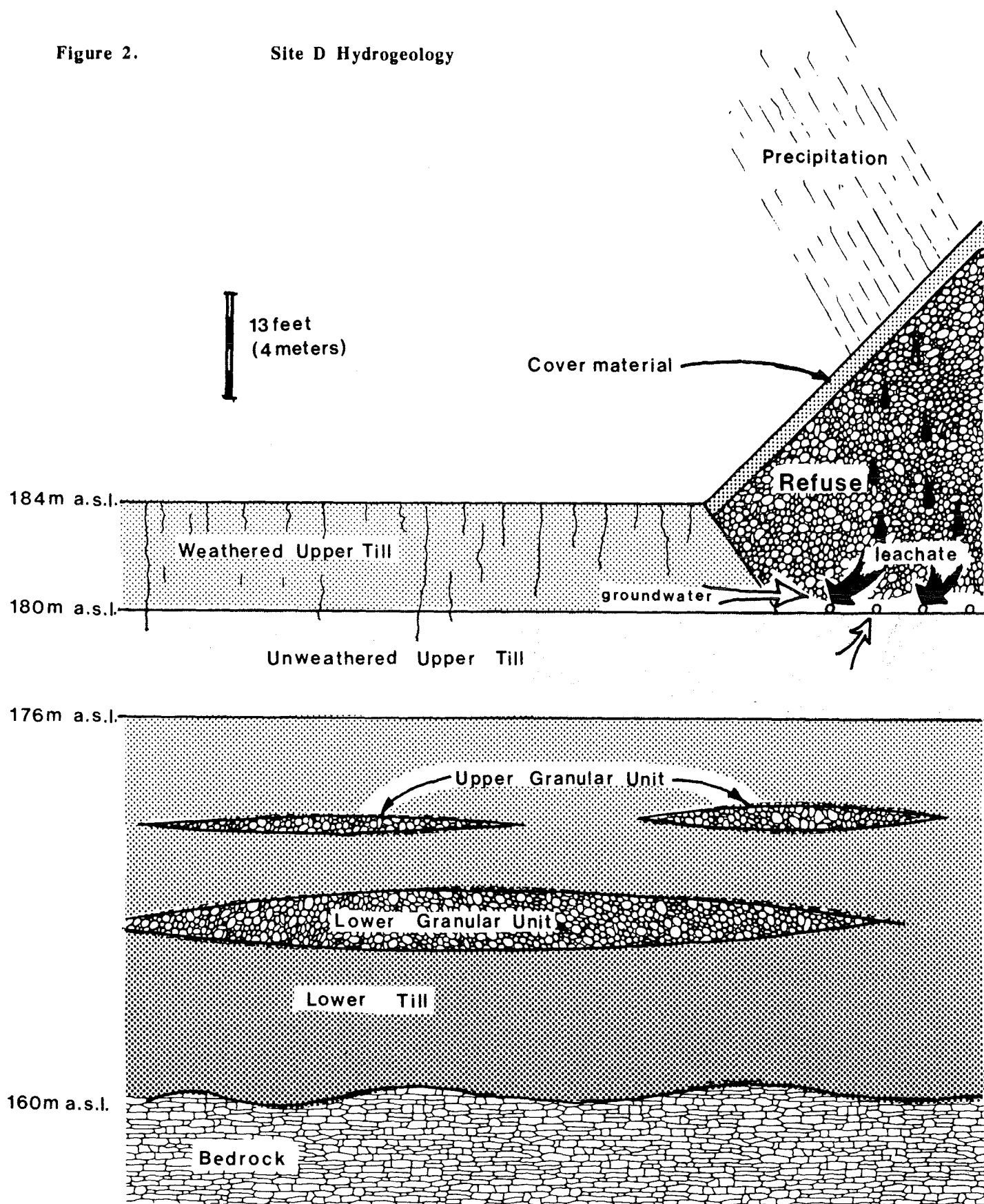
During the course of the cross-examination of the Region's principal hydrogeologists the Board's attention was drawn to exhibit B-209, wherein the geological setting of the two sites was described. From this exhibit it appears that Site D is situated in a uniform and extensive geological formation known as the "shallow lacustrine sediments of Lake Peel", and Site F is founded on a partially quarried mix of "shale and dolomite" and "Halton Till: clay or silt till."

After receiving these general comparisons on the geology and hydrogeology at the two sites, the Board was offered a plethora of hydrogeological data, from which the following brief summary was prepared for this Decision.

Site D

The Board found Mr. Petrie's description of the geology at Site D most direct and useful. The layers of ground (strata) are fairly uniform across the site. The average thickness of the top stratum, the upper till, is about 8 metres, and contains about 63% of fine-grained materials. The upper 4 meters of this till is weathered, and the lower 4 meters is not. Beneath the upper till lie 8 to 21 meters of lower till (depending on where one is on the site) which contains about 54% of fine-grained material. There are two granular units (layers which contain some sand and gravel) in the lower till: the upper granular unit is generally found at an elevation above 172 meters above sea level (m a.s.l.), and the lower is generally below 170 m a.s.l. It is from these granular units that adjacent land-owners generally draw water for domestic and agricultural uses, because water can be drawn more readily from granular materials than from tills.

Figure 2. Site D Hydrogeology



Geologists describe the depths at which they find strata in relation to a common starting point. The reference point they prefer is sea level, and strata are identified as being so many meters 'above sea level' (a.s.l.). Thus, if a granular unit is at 174 m a.s.l. and the surface of the ground is at 184 m a.s.l., then the granular unit is 10 meters (about 33 feet) lower than the ground surface, or 10 m. below ground. In the summary that follows the Board will adhere to the geologists' convention for elevations of different strata.

Extensive review of the profiles under Site D led the Board to the conclusion that the lower granular unit is an elongated east-west lens below 165 m a.s.l. within the rim of an elongated bedrock depression in the vicinity of the site. This lens thins in all directions and thus does not constitute a continuous flow path off-site. Furthermore, this lens does not extend in the true north-south direction in such a way that it threatens the wells to the southwest of First Line Road.

Given that the lower granular unit is thickest and most permeable in the middle of the bedrock depression, it appeared reasonable that this constitutes the most probable route of groundwater egress in the general area, towards the bedrock depression.

Beneath the lower till is the bedrock, the surface of which is slightly depressed beneath the site, in an elliptical shape elongated in the east-west direction.

Witness Sobanski, for the Regional Municipality of Halton, gave detailed information on the technical study of Site D. In his view, this was an excellent area for landfilling because of the thick overburden lying on top of a generally saucer shaped depression in the bedrock, which bottoms out about 30 metres below the surface in the vicinity of the northern boundary of Site D. Throughout the whole area the overburden is between 12 and 29 metres thick with a few gravelly lenses within the overburden (lenses are layers of finite area which, if small enough, are lens shaped). Mr. Sobanski noted that sand or gravel lenses entirely within a given hydrostratigraphic unit do not affect the larger unit very much. If these lenses extend horizontally and are continuous, then they could have a significant effect on adjacent areas because of their lateral hydraulic conductivity.

Hydraulic conductivity is one of the terms important in understanding the movement of contaminated water, or leachate, away from a dumpsite. Hydrogeologists describe the magnitude of hydraulic conductivity in units such as 10^{-8} cm/sec. Such units are not meaningful for the

layman's understanding of velocities. The particular example cited corresponds to a speed of 1 centimeter (less than half an inch) in 3.2 years. In the discussion that follows we will try to use more familiar terms based on the following conversions:

10^{-4} cm/sec is about 1 centimeter in 3 hours

10^{-5} cm/sec is about 1 centimeter per day

10^{-6} cm/sec is about 1 centimeter in 12 days

10^{-7} cm/sec is about 1 centimeter in 116 days

10^{-8} cm/sec is about 1 centimeter in 3.2 years

Although these conversions are offered for ease of comprehension, the Board recognizes that the movement of groundwater is based not only on hydraulic conductivity, but also on hydraulic gradients and the porosity of the ground.

The 'hydraulic gradient' is the driving force that causes water to move from one place to another. It is like having two water buckets connected by a rubber tube. When the buckets are held at the same level, water has no inclination to move from one to the other. When one is held above the other an hydraulic gradient exists, and water flows to the lower bucket.

If the connecting tube were filled with a sponge-like material there would be many pores to be filled, and water would move through the tube more slowly than if it were filled with marbles, in which case it would have a lower porosity and faster water flow.

The Board heard evidence on the relationship between these various terms and their importance in understanding possible losses of leachate at both sites D and F. The larger the hydraulic conductivity, the greater the hydraulic gradient and the less porous the ground, the faster leachate can move through it.

The Region's hydrogeologists were certain that they had not missed any significant subterranean hydrogeological features at Site D. The Board noted that all the hydrogeologists were in general agreement on the hydrogeology at Site D. After hearing all the evidence, the Board found the general hydrogeological description quite reasonable.

Drawing 15 of exhibit H-39 shows that groundwater flow tends to bypass Site D. According to Mr. Sobanski the vertical gradients for groundwater are relatively small, but they greatly exceed the horizontal ones so that groundwater tends to move downward on the site rather than

outward. As drawing 17 of exhibit H-39 shows, the vertical gradients are very small at Site D in comparison with those at Site F. The water table contours at Site D fall by about two meters across the site, and the vertical gradients in the bedrock under Site D are about one-half a meter downwards across the site.

In this regard, the most important factor in the water budget at Site D is that the groundwater recharge (rainfall entering the ground to replenish that which moves away from the area) is fairly low without a landfill in place, and is predicted to be zero with a properly functioning landfill in place. Page 65 of exhibit H-39 estimates that of the 37.6 inches of equivalent rainfall striking the land, 37.2 inches evaporates or runs off the surface of the land.

It was estimated that of the remaining 0.6 inches of precipitation that actually enters the ground, about 0.17 inches would move sideways through the soil overlying the bedrock and the remaining 0.43 inches would move down and into the bedrock.

Where the experts began to disagree as amongst themselves concerning Site D was in the matter of the extensiveness of the granular units, and the "sluggishness" of groundwater movement in the area. Dr. Charlesworth, one of the Town of Milton's experts, said that the response of the water table to local rainfall events suggested to him that groundwater movement was not as sluggish as proposed by the Region's experts.

Given the already marginal water quality of wells adjacent to Site D, Dr. Charlesworth felt it would be inconsistent with the Ministry of the Environment Drinking Water Guidelines to allow any contaminant migration which would risk further degradation of those water supplies. In addition, Dr. Charlesworth explained that fluctuations in background chloride levels in the groundwater would make the possibility of effective monitoring for leachate loss much more problematic.

The City of Burlington expert, Mr. Petrie, noted that in general the hydraulic gradients, both vertical and horizontal, are quite low, indicating sluggish groundwater movement in this area. The Board notes that this corroborates local residents' observations of large quantities of standing water on surrounding properties.

Mr. Petrie acknowledged that careful review of all of the gradient data at Site D show that there may be slight upward gradients over a large portion of the site from the bedrock into the overburden. It was his view that groundwater flow near the bedrock would more or less parallel the bedrock depression in the area.

There was considerable discussion about the validity of the groundwater hydraulic gradient estimates. The Regions' experts, Messrs. Sobanski and Beechinor, felt that in the final analysis their values were reasonable, and any variation was within the normal margin of error for hydrogeological studies. Recognizing the importance of this parameter as the driving force for leachate migration, the Board studied the evidence carefully and finds that the hydraulic gradients are indeed low in the area, and that there is little driving force to move water either downwards or laterally away from the landfill area.

Turning its attention to the hydraulic conductivities of the strata at Site D, the Board noted that the Region's experts assumed the hydraulic conductivity for the upper weathered till corresponded to about one centimeter per day, while page 62 of their main exhibit (H-39) suggested that it might be only about 1 cm. in 40 days. The latter value was based on tritium evidence, but these experts assumed a generous safety margin to arrive at the faster value for their calculations of groundwater movement away from the site.

The importance of "tritium evidence" was explained to the Board in terms of the use which hydrogeologists could make of the distribution of radioactive materials through the atmosphere as a result of nuclear weapons testing in the fifties. These radioactive substances fell onto soil that was previously non-radioactive. Although at concentrations low enough to not be of concern to human health, one of these substances, tritium (an isotope of hydrogen), can still be measured in groundwater, and provides a measure of how water has moved through the ground since the fifties.

There was considerable evidence about the importance of swelling clays in the surficial material in the vicinity of Site D. While there may be a dispute as to the relative expansion of these clays, vermiculite and smectite, Mr. Petrie said that the importance of any swelling clay in an area of such uniform geology was that it supports a hydraulic conductivity corresponding to less than about 1 cm per day. This was but one factor which, in concert with tritium readings and the measured values of conductivity, could lead to a conclusion of fairly tight surficial material.

Messrs. Petrie & Crutcher noted the Region's conservative assumptions about the hydraulic conductivity for the upper weathered till. Mr. Petrie added that the assumed porosity of 0.001 is also very conservative, and thus the combination of these factors produces an assumed groundwater migration velocity which is overly conservative. In light of this, he felt that the speed of groundwater movement through the upper weathered till should be only 7.9 cm/year, rather than the 13 metres/year assumed by THCL at this site.

Mr. Petrie noted that the next stratum down, the upper unweathered till, is not necessarily of a uniform thickness beneath Site D. The differentiation between "upper weathered till", "upper unweathered till" and "lower till" is not always clear. The thickness of the upper unweathered till may vary from less than 2.5 meters, to more than 10 meters. The Board considers that such differences may be more interpretive than real. Different geologists have drawn different conclusions from the same borehole log descriptions.

Evidence was adduced to show that other tests on 'Halton tills' (associated with a Peel landfill site) yielded similar results for lab tests in comparison with field tests and pumping tests. Thus Mr. Petrie's lab tests on the vertical hydraulic conductivity of samples of the upper unweathered till may be a reasonable representation of actual values in the field.

Under cross-examination, Dr. Charlesworth agreed that the calculated mean hydraulic conductivity for Site D unweathered till samples, referred to in exhibit B-500 (the laboratory tests ordered by Mr. Petrie's firm), is about 1 cm. in 2.3 years. But he views these measurements with great scepticism because of the age of Mr. Petrie's samples and the limited results available.

It was Mr. Petrie's evidence that the proper range for the hydraulic conductivity of the unweathered upper till at Site D is 1.4×10^{-8} cm/sec to 8×10^{-8} cm/sec with a geometric mean of 3.8×10^{-8} (that is from about 1 cm. in 2.3 years to 1 cm. in 5 months with the geometric mean being about 1 cm. in 10 months). Mr. Petrie felt that this latter value was the most reasonable value on which to base leachate egress calculations. He feels that his choice is supported by the high percentage of fine particles in this material, and thus the Region's value corresponding to 1 cm. in 2 months is unreasonably fast.

Using their geometric mean of the hydraulic conductivity values, Messrs. Petrie and Crutcher calculated that the downward migration of water at Site D would be only 1/6th of that calculated by THCL, that is 0.015 metres/year rather than 0.09 metres/year, for an unremediated failure of the engineered landfill. In their opinion, with the system in operation as designed, water flow would be upwards towards the landfill at a rate of 0.0035 metres/year and there would be no loss of leachate.

The Regional Municipality of Halton recalled Mr. Feenstra, an expert in the field of hydrogeochemistry, to introduce new evidence in reply, on hydrogeology at Site D. Mr. Feenstra expressed his belief that there may be fractures which penetrate the unweathered upper till at Site D, which could allow leachate to traverse this unit into the upper granular unit. His more recent information came from work done by a University of Waterloo graduate student. The work was done in Sarnia but Mr. Feenstra believed the findings might also apply in Halton. It was Mr. Feenstra's evidence that the original consultants for the Region, Trow Hydraulic Consultants Limited (THCL), had not done the necessary work at Site D to establish whether or not the unweathered till in the area was fractured.

Mr. Feenstra's stated that the fractures which he postulated to exist in the unweathered upper till at Site D might have been created by geological rebound after the glaciers retreated following the last ice age. He thought they might also have been created by drought conditions between glaciation times. He considered the conditions in Lambton County (around Sarnia) and Halton to be similar.

During cross-examination, Mr. Feenstra noted that the lower the clay content of till, the less likely it is to fracture as a result of weathering. He observed that the till at Site D has only about half the clay content of the till at Sarnia. Further reducing the similarity, clay at Sarnia has had a much longer period of time to 'weather' through drought periods (approximately 220,000 years versus 50,000 in Halton). Fractures which might occur in the unweathered upper till at Site D could well close up again because of the softer nature of the unweathered stratum and the weight of the landfill on top of it.

Mr. Feenstra noted that the Comcor well drilled in the vicinity of Site D suggests fracturing to a greater degree than did the THCL wells in the same area, but the weight to be given to the Comcor results should not be too great because they were seeking evidence to discourage hazardous waste landfilling in the area.

He observed that if fractures exist in the upper unweathered till at Site D there would be faster contaminant migration. This would lead to a more rapid arrival of contaminants at the upper granular unit beneath the site.

Mr. Feenstra noted that if leachate moves quickly through fractures in the unweathered upper till to the granular units below, then the time required for monitoring, sampling, sample preparation and analysis could be unacceptably long because contaminants might reach the granular units before they were detected. To avoid this problem, he recommended that purge wells be constructed at the outset, and be monitored more frequently than anticipated by THCL (the Region's original consultants). As additional safety measures, he proposed that the Region consider the provision of piped water supplies for residents in the vicinity of Site D, with or without the installation of a recompacted clay liner to prevent a continuous path for leachate between the waste and fractures beneath it.

Under cross-examination, Mr. Feenstra acknowledged that Mr. Ruland's work on fractures in clay tills was "pioneering" in the field of hydrogeology. Mr. Feenstra had taken Mr. Ruland's work a step further and had created his own hypothesis: if fractures existed through tills near Sarnia, then they might also exist through tills in Halton.

Mr. Feenstra observed that the tritium data do not support the existence of pre-1952 water in the upper granular unit. That means that if the hypothetical fractures exist, they have not allowed a significant tritium effect at depth.

Mr. Feenstra stated that his earlier model, and that of THCL consultants which defined contaminant flow paths and time frames, were wrong because they were over-simplifications which assumed that the hydraulic gradients in the area are generally downwards. Such hydraulic gradients are in some places upwards. Mr. Feenstra had discussed his concern about till fractures that might lead to the failure of containment measures with Mr. Sobanski (the Region's earlier principal hydrogeology expert) and found that Mr. Sobanski did not agree with his interpretation.

It was evident to the Board, after review of the evidence of the Milton area citizen witnesses, that there is a great deal of standing water in the vicinity of Site D. While the initial reaction to this information might be concern that such water could become

contaminated, its presence also suggests that the assumption of low hydraulic conductivity in the vicinity of Site D is valid. Furthermore, this evidence supports the conclusion that if a landfill were established at Site D and the primary engineered feature for control of leachate loss was an hydraulic trap, then it seems likely that the hydraulic trap would operate successfully given that water tends to move sluggishly around Site D.

Messrs. Petrie and Crutcher stated that the observation of ponding in the vicinity of Site D would more likely illustrate a very low hydraulic conductivity which prevents rainfall from leaving the area, than it would demonstrate a high surficial conductivity which would allow recharge of nearby ponds.

The Board notes from Mr. Feenstra's witness statement that:

"the presence of fractures through the unweathered Upper Till has not been confirmed or even suggested by field data at Site D (though test pits and angled boreholes were not used) and would appear to contradict the lack of tritium in the THCL tritium nest and the lack of tritium in the UGU (upper granular unit)."

H-936 p 3

Having considered all the evidence, the Board does not find support for Mr. Feenstra's hypothesis about fracturing in the vicinity of site D. To the contrary, the bulk of the evidence supports the conclusion that groundwater moves very slowly through the unweathered upper till. By Mr. Feenstra's own admission, there is no way to conclusively prove or disprove his hypothesis. Notwithstanding his statement on this matter, counsel for the Town of Milton sought leave to introduce test pit evidence of the sort which Mr. Feenstra had averred would not help to clarify the situation.

This Board is of the view that according great weight to an unprovable hypothesis introduced at the very end of evidence in a two-year long hearing, might be interpreted by others who may have to participate in the environmental assessment process as a strategy for success. This legacy is not one we seek.

The best way to decide the magnitude of the controlling vertical hydraulic conductivity at Site D would have been to take direct measurements across the unweathered upper till layer

in the field. Although such measurements were not performed either by the proponent or by consultants for the Town of Milton, they could be ordered as part of a site preparation process.

Mr. Feenstra introduced two other hypotheses with respect to the impermeability of the upper unweathered till at Site D. One of these, which came to be known as the "shadow effect", postulated that the presence of a landfill would cast a precipitation shadow on the ground beneath it, preventing the water table from being replenished and thus affecting the containment measures proposed. Any drought in the area could have a similar effect, he suggested. He did add, however, that the "shadow effect" of the landfill over a groundwater table might be compensated by upward flow from the bedrock and lateral flow through the lower till in the vicinity of the site.

The second of Mr. Feenstra's additional hypotheses was to postulate that the construction of the landfill could itself induce fractures in the unweathered upper till.

The Board finds that the proponent's timing for the introduction of these latter hypotheses was not the best possible. They could have been, and should have been, introduced during the proponent's original case. Similarly, the manoeuvre of Milton counsel to introduce evidence which they had collected six months earlier in the absence of experts for the other parties, the existence of which they did not acknowledge at appropriate times, had negative probative value. Had such evidence supported the existence of fractures in the unweathered upper till, we would have expected them to invite other experts to observe the test and to report it promptly.

We have dealt at some length with the hydraulic conductivity of the unweathered upper till at Site D because it is this unit that was proposed as controlling the rate of leachate loss from the landfill in the event of failure of proposed containment measures (the hydraulic trap). This layer was also to control the rate of groundwater inflow to the hydraulic trap when it was working as designed (see figure 2 on page 61).

Beneath the unweathered upper till lies the lower till and the granular units embedded in it. The possible flow of groundwater through these units to adjacent wells is of obvious importance. To measure and predict such flows, pump tests are relied upon. In general, one

pumps a well until the water level in it drops, and then observes how quickly it recovers and what effect, if any, the pumping has had on nearby wells.

It became clear during the cross-examination of Messrs. Sobanski and Beechinor that if the upper granular unit is widespread, then it can be readily identified and monitored. If it is discontinuous, then the area constitutes a typical glacial till which poses little threat to adjacent wells, given the transit time of about 1,000 years through the buffer zone.

If the gravel lenses at Site F are extensive, then they would facilitate the hydraulic trap operation by offering off-site replenishment of water removed from them; if they are limited, on the other hand, then there would be less of a threat to adjacent well users. Pumping tests were intended to indicate the extent and hydraulic connection of these granular units. In addition to providing the well recovery information sought, the pumping tests at site D confirmed that, over 25 years, tritiated water had not made its way down to the granular units beneath the site.

The witness panel called by the Town of Milton (Drs. Rowe and Charlesworth) felt the conceptual basis used by the proponent's consultants was incorrect. Dr. Charlesworth felt that the silt layers and granular units beneath Site D are more extensive than assumed, and therefore lateral migration of contaminants is a greater threat than assumed by Halton's experts. He explained that before a proper "conservative" estimate of contaminant loss could be calculated, one should consider the layer of silt as an identifiable hydrostratigraphic unit with a significant hydraulic conductivity of its own. This witness was of the view that the flow of groundwater in the area is complex, with some flow down from the surface and a portion of flow up from the bedrock. The Board observed that if this hypothesis is correct it must mean that there would be a significant lateral egress of groundwater from Site D. Such egress was not reported by any witness.

Dr. Rowe explained that for all of his models of groundwater movement he assumed that the upper granular unit extends in a westerly direction from the landfill site to the wells on the west side of First Line. He also assumed that the shale beneath Site D could not accept as much groundwater as the consultants for the Regional Municipality of Halton had assumed.

Drs. Rowe and Charlesworth acknowledged that the pump test curves for the upper granular unit correspond to a unit which does not recover quickly from drawdown and is therefore not likely

to be continuous aquifer layer. This assists the Board in arriving at the conclusion that the upper granular unit forms an east-west lens of limited extent.

Furthermore, should contaminated water reach the upper granular unit, Mr. Petrie believes that even if that unit is continuous across First Line Road the general direction of groundwater flow would be to the south and southeast, away from water wells in the area. The Region's principal hydrogeology expert, Mr. Sobanski, supported such an observation when he said that there was no reasonable pathway for precipitation at Site D to reach the wells to the west of First Line Road. But in constructing his worst case scenario, he assumed that there would be groundwater flow from Site D, rather than in the more likely direction toward the site.

If the hydraulic trap failed at Site D, Mr. Petrie calculated that it would take some 80 years for chloride to travel through the 4 meters of upper till to reach the lower till, and 125 years for the concentration of contaminants to reach 10% of their leachate concentration in the lower till. This compares with the 20 and 25 years calculated under the proponent's (THCL) model. Overall, Mr. Petrie thought it would take some 150 years for the concentration of contaminants in the upper granular unit to reach 1/100th of their leachate concentration, if the engineered hydraulic trap failed completely.

Mr. Feenstra, who had earlier been called as an expert witness on hydrogeochemistry (the movement of chemicals through subterranean strata), had observed that with the hydraulic trap operating as designed, the only migration of contaminants away from the site would be by diffusion rather than advection (where chemicals move with the bulk flow of moving groundwater). This diffusion would have to be against the flow of groundwater in the area, since such flow was to be directed towards the hydraulic trap. Contaminants diffusing away from the site against the groundwater flow would reach a dynamic equilibrium situation at a distance of about 215 centimeters (about seven feet), where the force of water flow towards the site would counterbalance the chemical driving force of diffusion.

Mr. Feenstra felt that even this estimate was quite conservative, and that chemicals would not actually migrate as far as 215 cm from the bottom of the landfill. At this depth of penetration such chemicals would not reach the granular units at all.

In his first appearance before the Board Mr. Feenstra addressed the question of the impact of porosity on contaminant migration, and concluded that while one can postulate even lower porosities and therefore higher contaminant velocities, such high velocities have not been found anywhere in Ontario. He referred to work done by University of Waterloo scientists which led to a clear understanding of linear velocities in glacial tills. The net effect of these studies was, in his opinion, that the proponent's earlier assumptions about contaminant migration times to the boundary of the site were conservative.

Mr. Feenstra suggested that even with failure of the hydraulic trap proposed at Site D, moderately absorbed contaminants would not reach the site boundaries for 225 years. While lateral migration through the upper weathered till yielded the highest concentration of contaminants soonest at the site boundaries, such migration is also the most easily intercepted.

Based on the geologic information presented in the borehole logs for Site D it is not possible to absolutely confirm or deny the existence of the upper granular unit across the site. The consultants for the Region assumed that this unit was continuous in order to be conservative, and consultants for the City of Burlington also suggest this assumption be used, if one is to be conservative when considering impact assessment.

Notwithstanding the assumption, they hold to the view that, based on the geological information available, the unit is not continuous.

Mr. Petrie explained his view that the upper granular unit at Site D exists as two separate lenses. He was convinced that one could establish from the geological and hydrogeological data that this is the case. He stated that it was highly unlikely that the sampling (done with a device called a 'split spoon') missed the existence of a gravel layer 10 meters below surface in the area between the postulated granular lenses. He added that the augering process itself should have given a clue to the drilling crew that the auger was passing through a gravel layer at such a depth. No such layer is reported in the drilling data for the area between the upper granular unit lenses.

The hydrogeologists reviewed their assessment of the hydraulics of the system in respect to the drawdown which was observed at various observation wells when a layer at a depth which corresponded to the upper granular unit was pumped at Site D. In the opinion of Messrs.

Petrie and Crutcher the observed drawdown suggests that there is not a uniform layer of granular material with a consistent hydraulic conductivity underlying Site D. It is more likely that the layer, to the extent that it exists at all, varies both in thickness and in hydraulic conductivity.

Careful review of the drawdown values from pumping and observation wells, and comparison of calculated with observed drawdown, leads to the conclusion that the well HC2-86, which is in the southern portion of Site D, should be considered to be in the same upper granular unit lens as was the pumping well HC2-85 in the northerly portion of the site. The comparison of theoretical and observed values led Mr. Petrie to the conclusion that there could be no uniform, continuous upper granular unit between the east and west sides of the site. That is to say, observation wells MB(IN)OW4 on the west side of the site, and HC4-85 to the east, are not part of one widespread upper granular unit.

Dr. Charlesworth expressed his view that the hydraulic conductivity of the upper granular unit beneath Site D is 45% greater than assumed by consultants for the Region. This means, he explained, that the rate of contaminant movement through the unit would be greater once such contaminants reached it.

Dealing with the hydraulic conductivity in the upper granular unit, Mr. Petrie noted that it is indeed less than normally expected for sands and gravelly sands. He attributes this to the significant amount of clay in this unit (4%). Mr. Petrie concluded that the upper granular unit is a lens of material rather than an extensive layer or blanket underlying the site, and that it does not extend eastward toward the Tomosky property.

On balance, having considered all the evidence concerning granular materials embedded in the lower till, the Board has come to the conclusion that, while one may assume extensive granular units for impact assessment considerations, the evidence available suggests that the lenses of granular material beneath Site D are not connected by a layer of highly conductive material

The hydrogeology experts for the Town of Milton had devoted considerable attention to the rate of leachate migration from site D when certain assumptions were made about critical hydrogeological parameters. When the assumptions all favoured increased hydraulic gradients, higher water mounding in the waste and higher hydraulic conductivities, while at the same time

decreasing parameters which might inhibit flow, then one could arrive at a much shorter time for first arrival of contaminants at the site boundaries.

Under cross-examination from proponent's counsel it became clear that this witness panel's combination of many "conservative" values led to results which were not only highly unlikely, they were very nearly impossible. If the Board is to assess a "reasonable risk" or "most likely risk" it ought not to use combinations of conservative values only.

While the values selected for each of the parameters were challenged, the probability of them all being in error by the maximum amount in the same disadvantageous direction, not only appears to be low but was confirmed by the witness panel for the Region (Messrs. Sobanski and Beechinor) to be highly unlikely. In summary, Mr. Sobanski was convinced even after thorough cross-examination that the best estimate of the hydrogeology in the area, including the values for the parameters which affect contaminant migration, was the estimate which he had provided in the Region's original exhibit (H-39 & H-39A).

Mr. Sobanski described leachate migration equations and calculations which led him to the conclusion that in the absence of mitigation measures (the hydraulic trap leachate collection system), contaminants could migrate off the site in sixty to seventy years, leading to chloride ion concentrations in the order of 35 milligrams per litre (chloride ion migration was used as conservative indicator of the behaviour of leachate in the vicinity of the landfill site).

He noted that even with no leachate collection system in operation it would take about 5 years for the less than 1% of infiltrating rainfall to migrate to the site boundary through the weathered till. It would take about 60 years for infiltrating rainwater to migrate to the granular units and through them to the site boundary, and it would take more than 360 years for such leachates to migrate through the bedrock to the site boundary. On a sliding scale of landfill site preferences ranging from "maximum natural attenuation with minimum engineering requirements" to "minimum natural attenuation with maximum engineering requirements" it was clear that Site D lies much more towards the maximum natural attenuation side of the scale.

Dr. Rowe, the Town of Milton's expert on mathematical models, elaborated on Dr. Charlesworth's hydrogeological evidence by applying his models to Dr. Charlesworth's proposed geological structures. It was his view that even with the hydraulic trap working, contaminants would migrate off-site within 32 to 46 years. He explained further that a partial failure would

result in contaminant migration off-site in 20 to 36 years, and a large scale failure would result in such migration in a 6 to 21 year time frame.

Dr. Rowe explained that his models were based on an assumption about the mass of contaminants in the landfill. The assumption was that this mass could be calculated by multiplying the concentration of contaminants expected in the leachate times the volume of the leachate. If a larger volume of leachate was collected at Site D because of the surrounding groundwater drawn into the system, and if that increased volume of leachate had a certain concentration of contaminants, then the total mass of contaminants assumed to have been in the landfill in the first place would be greater than would be case if the same concentration were observed and none of the surrounding groundwater had been drawn into the hydraulic trap. In Dr. Rowe's opinion there would be serious impact in about 30 years for well users adjacent to Site D.

He acknowledged that if the lower hydraulic conductivity of the till (corresponding to 1 cm. in 2.3 years) is used, then the time required for off-site migration of contaminants in the worst case becomes 159 years instead of 6 years. He added that if the site failed after 65 years there would still be 25 mg/litre of chloride in the leachate, and that almost all of this 25 mg/litre would reach the site boundary and adjacent wells.

On the other hand, during cross-examination by counsel for the Ministry of Environment, Dr. Rowe allowed that if the vertical hydraulic conductivity of the stratum under Site D were reduced to a value corresponding to 1 cm. in 1.6 years, then a concentration of chloride equal to 10% of that in the leachate would reach a depth of about 7 metres in 170 years. The steady state concentration for chloride in the upper granular unit would reach only 3.57 milligrams per litre, even assuming that concentrations in the landfill did not diminish with time as one might expect (i.e. a quite conservative assumption).

Another witness dealing with contaminant migration, Mr. Bowen, called by the West Burlington Citizen's Coalition, noted that while there would be diffusion of contaminants against the reversed groundwater flow of the hydraulic trap, the diminishing concentration of leachate input with time would mean that significant concentrations of contaminants would never reach the upper granular unit. In Mr. Bowen's opinion most of Dr. Rowe's scenarios at Site D would not be allowed to continue because there would be interventions by regulatory authorities, and there would therefore be no impact as a consequence of the kinds of failures depicted in Dr. Rowe's scenarios.

After introducing his hypotheses on fractures in the unweathered upper till at Site D, Mr. Feenstra had to amend his earlier computations respecting contaminant pathways and times. In his revised exhibit, **H-938R**, he said the most probable fracture hypothesis would have fractures 17 micro meters wide spaced 5 meters apart with an overall hydraulic conductivity corresponding to 1 cm. in 116 days. Based on this hypothesis he concluded that the concentration of chemical contaminants in the groundwater just below the unweathered upper till would reach 10% of the landfill leachate concentration after a little more than one year had elapsed. This suggests to the Board that analysis of samples taken at six-month intervals would be adequate to detect failure of containment technology if the till were fractured.

The Board finds that the combination of consistently unfavourable parameters used by Dr. Rowe in his models produced a misleading result. The assumptions were highly unlikely when linked in an improper fashion. By way of illustration, Dr. Rowe considered that the hydraulic conductivity of the waste could be as low as 10^{-5} cm/sec (1 cm. per day) because of the impermeability of the daily cover material, which he assumed would have a hydraulic conductivity of 10^{-7} cm/sec (1 cm. in 116 days). When he continued his calculations on the leaking of leachate through the same till, in the same run of his model, however, he assumed that its hydraulic conductivity was four to eight times higher than 10^{-7} cm/sec. Cases 2, 3, 4 and 5 of Table 2 at page 27 of exhibit **M-442** reveal this internally inconsistent approach which shows how bad the situation might be if one ignores the necessary connection between the two parameters. One cannot have it both ways: either the till is impermeable and thus prevents loss of leachate but risks increasing impermeability of the garbage, or the till is permeable and allows loss of leachate but reduces the impermeability of the cover material, and thus mounding of leachate in the waste.

With respect to Dr. Rowe's assumptions about very low hydraulic conductivity in waste, Mr. Crutcher felt that such assumptions were unsupportable and have never been observed. Mr. Petrie also felt that Dr. Rowe's model was unreasonable because for the 12 cases cited, cases 2 to 5 used an unreasonable value for the hydraulic conductivity of the waste in combination with an unreasonably high value for conductivity of surrounding strata, whilst cases 6 to 10 assume a total failure and lack of remediation of the leachate collection system. Case 1, which was Trow's assumed case, leads to a maximum chloride concentration only after 150 years, and both Cases 11 and 12, while they deal with only a partial but unremediated failure, also assume unrealistically high values for hydraulic conductivity in the surrounding strata.

This Board finds that the detailed examination of unreasonable scenarios based on impossible or highly improbable combinations is not a valuable expenditure of time.

This Board further finds that even with failure of the primary containment measures at Site D, it would likely be decades before significant concentrations of leachate would reach the site boundaries. To prevent that from happening, conditions associated with the approval of the site for landfilling would demand that appropriate contingency measures be implemented.

Landfill site design at Site D was based on a "hydraulic trap" concept intended to keep all contaminants on site. This hydraulic trap would itself be situated within a hydrogeological structure which Mr. Sobanski described as "quite favourable for landfilling" because of its low hydraulic conductivity and the absence of sand layers or fractures. He stated that the impact on water quantity in the area would be roughly equivalent to having another domestic water well on site. Over the lifetime of the landfill site it could affect adjacent wells by 6%.

On the other hand, Dr. Rowe was concerned about the viability of the hydraulic trap at Site D, and he had developed an envelope of possibilities within which he believed the actual situation would lie. In summary, Dr. Rowe believed that there will be contaminant migration off-site. This led him to the conclusion that Site F must be preferred because there are no dependent down-gradient groundwater users off-site, whereas there are such persons in the vicinity of Site D, and any off-site contaminant migration could have a negative impact on them.

Dr. Rowe feels that there is a considerable risk of clogging of the drains in the hydraulic trap, based on experimental evidence offered by others. This is especially a problem because the drains beneath Site D are proposed to have a slope of only 0.25%, which is but one-eighth of the recommended minimum slope. Thus, Dr. Rowe foresaw a possible total failure of the system.

Dr. Rowe explained that if the hydraulic trap were to be used at Site D, then it should be used under conditions which would allow for continual removal of leachate from the drainage tiles, contrary to the Region's proposal to allow leachate to build up in the collection tiles. The Board responded to this cautionary note by making it a condition of approval that

the drainage tiles be emptied, to the maximum extent possible, during the operation of the hydraulic trap.

Dr. Rowe acknowledged that the continuous pumping of the sumps at Site D would transform it to a gravity controlled leachate system, albeit at much less of a slope than the gravity-controlled system at Site F.

Continuing with his fracture hypothesis in the context of the proposed containment measures, Mr. Feenstra observed that fractures might bring on the failure of the hydraulic trap, which in conjunction with declining water levels caused by drought or the "shadow effect", could cause more rapid contamination of the upper granular unit if the unweathered upper till was actually fractured.

The Board notes that if this is the case, then it implies that lateral groundwater flow is so sluggish as to not replenish water losses beneath the landfill. While this appears to be a negative factor in terms of the possible failure of the hydraulic trap, it must be considered a positive facture in terms of the slowness of lateral migration of leachate off-site.

Dr. Rowe concluded that to be safe the leachate collection system would have to function without failure for about 80 years or more, if off-site concentrations of chloride were to be kept to less than 25 mg/litre. This assumption of safety was based on his mathematical model.

Witnesses called by the City of Burlington proposed a modification of the hydraulic trap design intended to lessen the likelihood of failure. Mr. Crutcher suggested that the primary collection feature should be "french drains" rather than tiles. Redundancy could be assured, in his opinion, by oversizing of the french drains. These drains, if two to three times larger than required, would be easier to construct and less likely to become completely clogged. In the unlikely event that a drain did become clogged across its entire cross-section, the pressure increases in leachate in the immediately adjacent refuse would result in leachate flows around the clogged portion. It is even less likely that a number of adjacent drains could become completely clogged at the same time.

According to Mr. Sobanski, the overall water balance at Site D would lead to the collection of something in excess of 90,000 gallons per day of leachate and local groundwater when the site is full.

With respect to the effect of relatively impermeable waste on the operation of the hydraulic trap, Dr. Charlesworth, acknowledged that he used a value of 10^{-5} cm/sec (about 1 cm. per day) based on a single value he had read in a 1971 paper. He admitted that 10^{-3} to 10^{-4} cm/sec was a reasonable range.

Dr. Charlesworth explained that it was not critical that the waste be permeable from top to bottom for the hydraulic trap to work at Site D, but rather that it should be at least 10^{-4} cm/sec or higher in the bottom 3 or 4 metres of waste. Ponding, as a consequence of impermeability of daily cover at higher levels in the landfill, would not affect the operation of the hydraulic trap.

Finally on this matter, Dr. Rowe, who had raised the idea of impermeable wastes being destructive to the hydraulic trap concept told the Board:

"I have no difficulty with 1×10^{-4}
as a reasonable number for the
hydraulic conductivity of waste."
167 p41,560

The Board has no difficulty in agreeing with Dr. Rowe and the other hydrogeologists on the reasonableness of this value.

The Board heard evidence about the possibility of "leachate mounding" within the waste at Site D. Evidence was inconclusive on the extent of such mounding, but the Board was satisfied that monitoring programs could be implemented to forewarn authorities of a problem, should one begin to develop

In the event that the primary engineered solution fails at Site D, Mr. Sobanski felt that natural attenuation was a good second line of defense. To provide adequate warning for public safety he proposed that monitoring of water quality both on site and in the surrounding wells should run for 40 years and could extend over a longer period of time if the Ministry of Environment requires. The monitoring wells could be analyzed for certain chemicals every 3 months and nearby wells could be monitored annually, providing adequate time for authorities to react to a failure in the engineered system.

Mr. Sobanski added that a series of monitoring wells adjacent to the waste cells to detect changes in hydrostatic pressure or water levels might be a timely, sensitive and accurate

indicator of the extent to which the hydraulic trap is functioning as intended. An increase in water level in the monitoring well could indicate that the hydraulic trap is not working and that mounding might be taking place.

Mr. Sobanski said that he was proposing to the Regional Municipality of Halton to monitor all significant zones in the vicinity of the landfill site.

Dr. Charlesworth explained that for monitoring at Site D he would suggest at least the following 5 stages:

1. Monitor the levels in the manholes;
2. Monitor leachate in the collection headers by means of flow meters;
3. Monitor pressure transducers installed at the base of the landfill;
4. Monitor piezometer installations in the cells; and
5. Monitor piezometer installations in the till both beneath and around the site.

Messrs. Petrie and Crutcher recommended that 4 piezometers be installed in each landfill cell to monitor leachate mounding should such occur. Performance of the hydraulic trap could also be monitored by means of simple water level measuring devices. Additional monitoring for a suite of indicated contaminants would constitute back-up monitoring. Finally, on the question of site suitability, these witnesses noted that contingency measures such as a perimeter drains and/or purge wells could be readily installed and easily operated.

Questions were asked about the possibility of monitoring the effectiveness of the hydraulic trap by measuring pressure head differences in the upper granular unit. The conclusion was reached that such measurements would not be reliable because natural background fluctuations could well mask the measurement of changes arising from failure of the hydraulic trap.

Dr. Rowe expressed his view that Site D would require perpetual care because it is not possible to define a time period for the decommissioning of this engineered facility, as suggested in the Ministry of the Environment document "Ministry Interim Guideline on Engineered Facilities at Landfills" (exhibit N-475).

In contrast, his colleague Dr. Charlesworth stated that although "purge wells ... are by no means proven on a long-term basis", if monitoring showed hydraulic trap failure then engineered remedies such as pumping wells in the waste itself could deal with anticipated problems. His concern was that the original proposal did not include sufficient details on monitoring and engineered solutions to potential failure. It wasn't that he thought that it would be impossible to landfill safely at Site D.

Mr. Sobanski was convinced that it would be possible to landfill safely at Site D because:

1. Good and natural attenuation of the surrounding soils constitute a first fail-safe interim measure.
2. The hydraulic trap itself would drain leachate and would in fact reverse the natural hydraulic flow in the vicinity, thus drawing in some nearby groundwater.
3. The on-going monitoring program proposed would detect contaminant migration in time to implement contingency measures.
4. The contingency plans which could be activated would be successful in preventing widespread contamination.

Messrs. Petrie and Crutcher were convinced that contingency measures are straightforward and easily implemented. The first such measure would be purge wells installed within the refuse. The second would be the installation of perimeter drains to intercept and collect all leachate which might otherwise escape from the landfill. The third contingency measure would be the installation of purge wells in the upper granular unit to control leachate egress through this unit. It was estimated that this last contingency measure, if necessary, would have no effect on surrounding wells because the present residential wells on site would no longer be in use and the purge wells would control groundwater infiltration at about that rate of infiltration. Thus, there would be a negligible lowering of groundwater levels in the vicinity.

Having studied all the evidence, the Board is persuaded, on balance, that effective monitoring and contingency measures could be ordered and implemented at Site D.

Site F

Although Mr. Sobanski acknowledged during cross-examination by Ms. Cronk that lands adjacent to Site F had been used for landfills, in keeping with an earlier decision of the Environmental Assessment Board, this Board notes that the earlier decision concerned extension of the site into the glacial till areas to the north, rather than development of a site on the gullies to the south. This Board was not swayed by the earlier Board's decision, preferring to judge the present application on the weight of the evidence before us.

Furthermore, as explained by Mr. Crutcher, the current proposal to landfill at Site F would add waste at a rate of approximately 76,000 tonnes/hectare over a large area (50 hectares), when compared to adjacent dumpsites which together averaged only 50,000 tonnes/hectare over a smaller area (44 hectares).

In general, the different opinion of hydrogeologists who examined Site F related to the extent of uniformity within strata beneath the site. All agreed that there are regions of different porosities and conductivities. The hydrogeology consultants for the Region assumed that there were several discreet continuous layers acting as surficial drains, subsurface barriers and subsurface underdrains as one goes down through the strata. Dr. Rowe assumed that these strata could be modelled as a uniform, thick, relatively impermeable layer through which leachate would not move. On the other hand, Messrs. Petrie and Crutcher, consultants with Conestoga Rovers Associates, on behalf of the City of Burlington, assumed that these strata, if they exist at all, are not continuous. Rather, in their view, the ground beneath Site F constitutes a heterogeneous mixture, with zones of impermeable matter embedded in zones of less impermeable matter. Because these impermeable zones are not continuous, they allow for the infiltration of leachate along discreet, but as yet unmeasured, significant vertically fractured areas.

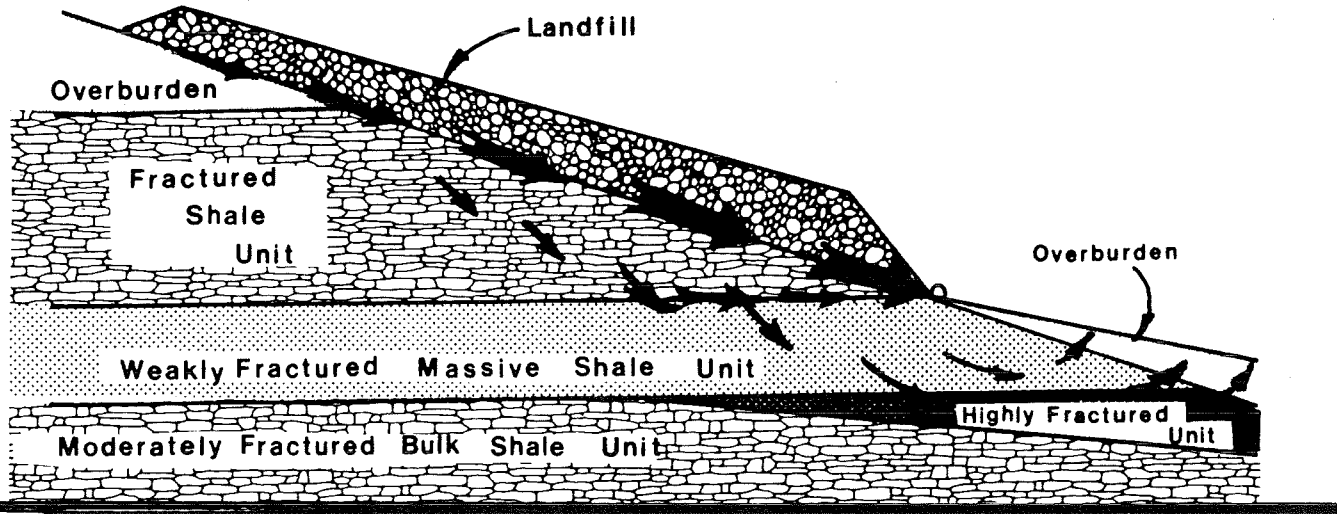
If the latter model is correct, it seems to the Board that the problem of delineating leachate flow paths at site F would be like trying to determine blood circulation patterns in a new species by inserting needles in various parts of its anatomy. If the investigator missed the main veins or arteries with the first few needles, he might conclude that the movement of blood within was very low. How different his opinion had he struck an artery on his first attempt.

Figure 3

Site F Models

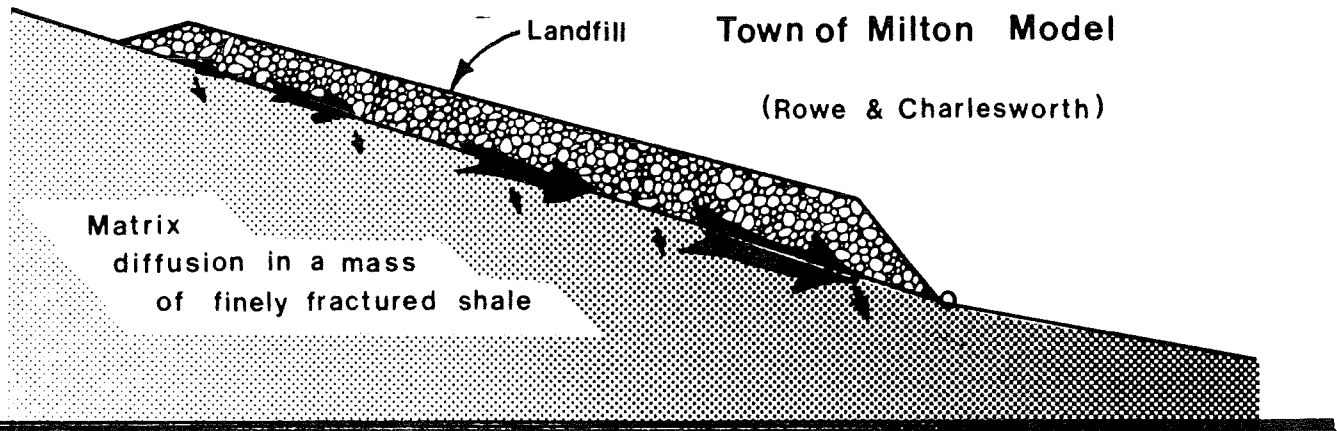
Proponent's Model

(Sobanski & Beechinor)



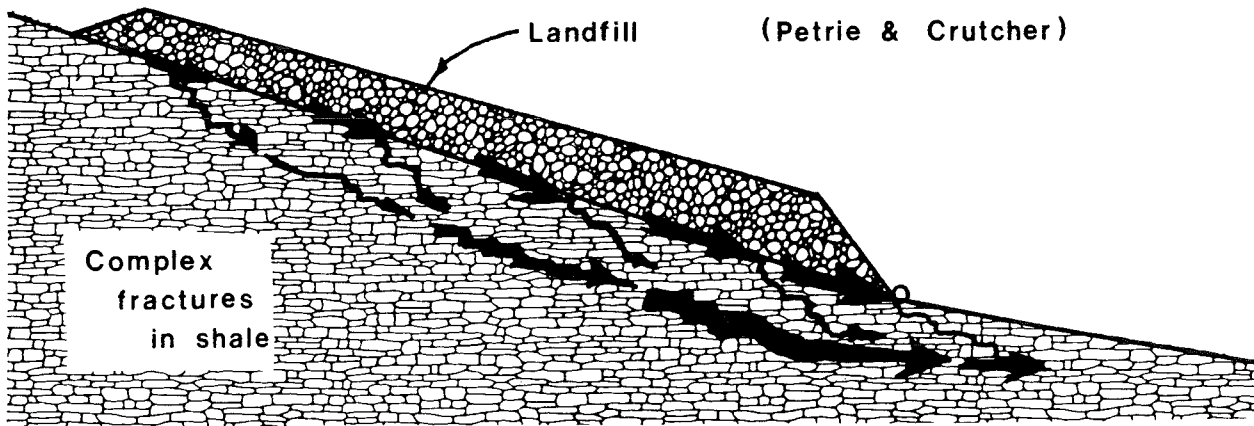
Town of Milton Model

(Rowe & Charlesworth)



City of Burlington Model

(Petrie & Crutcher)



As perceived by Messrs. Petrie and Crutcher the Board had three hypotheses to consider at Site F. The original proposal by the Region portrayed the underlying strata as three or more distinct layers with specific abilities to retard or enhance the movement of groundwater. The hypothesis put forward by consultants for the Town of Milton was to consider the entire area beneath Site F as a homogeneous and relatively impermeable stratum, such that leachate would not escape the site, for modelling purposes. The Burlington consultants' model was one of complex groundwater flow through fractured rock which could not be readily understood, monitored or modeled.

It was clear to the Board from Ms. Cronk's cross-examination of Mr. Sobanski that Site F was one of the most studied sites in Ontario, from a hydrogeological perspective. But the earlier NSP conclusions, and those of TROW, were founded on the premise that the hydrostratigraphy was relatively uniform across the site.

Trow Hydrology Consultants Limited (THCL) consultants took this assumption one step further: the uniform hydrostratigraphy extended across the site in both east-west and north-south directions like a layered cake. The ground surface could be taken as the exposed side of a gently inclined diagonal cut, from top to bottom. The assertions of safety at Site F had all been based in some measure on the validity of this model, in particular the postulated "Weakly Fractured Massive Shale Unit":

"The dominant hydrostratigraphic unit controlling leachate migration at Site F is the Weakly Fractured Massive Shale Unit. Tests show that this unit has relatively good attributes for waste disposal. It has good attenuation capability and a low hydraulic conductivity (no more than 1×10^{-7} cm/s). Farther along the flow system, the Discharge Zone Till provides additional capability for the natural attenuation of leachate."

H-40 pp xii & xiii

During his re-examination, Mr. Feenstra had redrawn subterranean chloride concentrations in an east-west orientation to illustrate hydrogeologic strata on new cross-sections at Site F. A review of these cross-sections, shown as Attachment 3 to H-936, and the revised chloride data plotted on exhibit H-659R, reveal examples of relatively fresh water both above and below the

postulated weakly fractured massive shale (at wells HC-5 and MB-11 for example), when the hypothesis calls for the water above to be relatively fresh, and that below relatively salty, at all locations on the site. On the other hand, at different locations (wells WAT-7 and HC-8 for example), it appears that there is no fresh water to speak of, even at the surface.

The revised exhibit **H-659R** also shows significant variations in the postulated 'highly fractured shale' unit where hydraulic connection is supposed to be good and chemical concentrations similar. Adjacent chemical measurements (in a cross-sectional sense) show concentrations of 1,140, 21,100, 3,410, and 810 milligrams of chloride per litre of groundwater. This evidence, and the variations across the 'weakly fractured massive shale' unit, place the original THCL hypothesis about Site F in considerable doubt.

Notwithstanding his denial of Trow's original assumptions about the hydrostratigraphy at Site F, Mr. Feenstra was of the opinion that toe drains and perimeter drains would prevent surface water contamination at the site.

Mr Feenstra's final opinion about the hydrostratigraphy was that there is a shallow active zone of varying thickness, generally between five and ten meters thick. This zone is thinner in areas of high chloride and low tritium (such as around well HC-8), and thicker in areas of low chloride and high tritium (such as in areas around well HC-4). In his view, the net effect would be exfiltration (liquid flowing out of a porous medium) at the bottom of the landfill of about ten to twenty millimeters per year, of which 90% or so would exit laterally through the shallow active zone, and the rest would move to depth. If these figures are correct, they correspond to leachate losses from about 3,017 gallons/day to about 6,035 gallons/day in total, with 302 to 604 gallons/day moving to depth. The witness did not feel that a liner was required to reduce exfiltration.

Because the proponent's consultants recognized that the shales underlying Site F have a complex fracture system both near the surface and at depth, they did some pumping tests which showed a substantial water flow, and led to the conclusion that the hydraulic conductivity in the highly fractured zone was 1.3×10^{-2} cm/sec (for comparison purposes 1.3×10^{-2} cm/sec is about 2.5 miles per year). This groundwater flow is towards Hamilton Harbour and is driven by water pressure, the force of which is reflected by hydraulic gradients ranging from 0.001 to 0.03. Groundwater contours (Drawing 14 of exhibit **H-40**) fall by about 70 meters across the site, illustrating the large magnitude of the force drawing water away from the site.

The review by the Region's consultants (Messrs. Beechinor and Sobanski) of borehole logs in the vicinity of Bayview Park to the east of Site F, revealed that for most of the holes dug there was clay overlying the rock beneath, and that the clay layers were approximately 8 feet thick at well locations LW-1 through LW-6. If such silty clay overlays the rock under the Bayview landfill, then the Board must take this into account in considering the migration of leachate beyond the site boundaries, and the postulated 'security' of Site F, based on the performance of adjacent sites. Similarly, a large portion of the Burlington Landfill site was acknowledged to be on till, whereas some 60-70% of Site F would be founded on shale.

Drawing 12 of exhibit H-40 shows a till thickness of 8 metres at borehole HC-5, towards the southern edge of the site. Mr. Feenstra's evidence is that the zone of active groundwater flow at this point is 11 m thick below the bedrock surface. Based on his evidence the Board visualized the active flow zone at Site F, in plan view, as rivulets which divide and recombine below the surface, leading to contaminant losses off site. A perimeter drain might have to be as deep as 19 meters (about 62 feet) in the vicinity of HC-5 (near the southern boundary of the site) in order to intercept such leachate egress. Even this containment measure requires a better knowledge of subsurface flow patterns than exists now. The situation has not changed much since November 15, 1982 when a hydrogeologist, Keros Cartwright wrote, in support of a proposal by National Sewer Pipe Limited to landfill on part of Site F:

"The intermediate groundwater flow interacts to some degree with the regional and local groundwater flow systems; the degree of this interaction is not well defined by the data. The local and intermediate groundwater flow needs to be considered in evaluating leachate migration at the proposed site.

N-470 p 2

Dr. Rowe, the modeling expert called by the Town of Milton, felt that a liner is not required at Site F because the groundwater migration in the vicinity of that site is very sluggish and there would be no threat to down-gradient users.

Dr. Charlesworth felt that a new landfill at Site F would have little impact on the environment because the groundwater quality under the site is quite saline already. It was his view that perhaps the best use for this already 'contaminated' environment would be as a

receptacle for contaminants from landfill leachates, notwithstanding the fact that chemical constituents presently in the groundwater at depth are of natural origin.

Mr. Petrie explained that when he examined the hydrostratigraphy in the vicinity of Site F he came to a much different conclusion than had THCL consultants. His examination of the borehole logs did not lead him to conclude that there were identifiable, distinct geological zones beneath Site F. He noted that even the proponent's hydrogeologists had proposed geologic and hydrostratigraphic zones which do not correspond to one another. In particular, he drew the Board's attention to the fact that the supposed hydraulically conductive zone of "highly fractured shale" is found in large part at an elevation at which one is supposed to find the "weakly fractured massive shale", which was to have opposite hydraulic characteristics.

Furthermore, Mr. Petrie pointed out that piezometric measurements in the area lead to equipotential contours which are at variance with the assumed geology and hydrostratigraphy. In particular, he believed that such contours refute the existence of the proposed highly fractured "geological underdrain". Mr. Petrie noted that hydraulic gradients in the postulated discharge zone are downwards, rather than upwards as predicted by the Trow model. Similarly, hydraulic conductivities at well holes HC4, HC6, HC8 and HC14 do not support the proponent's model with respect to the weakly fractured or highly fractured shale layers.

Mr. Sobanski could not explain the considerable variation in chemical contaminants in the upper till at the north end of Site F. This raised questions about the validity of the assumed homogeneous strata model in that area. One explanation could be a variation in topography, but a more likely explanation is a variation in the conductivity and porosity of underlying materials. The controlling factor was not identified to the Board's satisfaction.

During cross-examination of Messrs. Sobanski and Beechinor, Mr. Tidball, counsel for the Ministry of Environment, brought to the Board's attention the fact that the consultants had described the presence of fractures in one 10 cm (4 inch) core section, their absence in the adjacent 10 cm zone and their presence again in the next 10 cm zone. Why then was the entire area not considered fractured, if there are significant fractures in alternate 4 inch sections?

The introduction of exhibit **H-220** was a signal event in the cross-examination of witnesses Sobanski and Beechinor. Figures 2 and 4 of Exhibit **H-40** had presented a facile

representation of hydrostratigraphic units within the bedrock underlying proposed Site F. These figures were supposed to have been based largely on field data shown on the working drawing which was eventually submitted as exhibit **H-220**. When the Board examined this working drawing, however, it required a considerable leap of faith to accept it as a valid transformation device to move from figure 2 (the geological strata) to figure 4 (the hydrostratigraphic units) of exhibit **H-40**, on which the proponent's subsequent assumptions of environmental security at the site were largely based. This negated the concept of a proximate impermeable layer underlain by a conductive geological conduit which conveniently leads to a drainage spot referred to on page 49 of **H-40** as the "discharge zone till".

Neither an examination of the cores (exhibit **B-223**), nor a review of the information portrayed on exhibit **H-220**, led to the proposed conclusions concerning highly fractured and weakly fractured shale. Exhibits **H-667** and **H-668** produced by Messrs. Petrie & Crutcher also contradicted the THCL hydrostratigraphic interpretation. In addition, boreholes HC6 and HC7 show many fractures in the postulated "weakly fractured shale", and competent rock in the supposed "highly fractured shale".

Borehole HC5 shows relatively competent rock right across the proposed "highly fractured shale" unit.

Drs. Rowe and Charlesworth said that they had arrived at the same conclusions as the proponent's witnesses, and therefore the detail presented on exhibit **H-220** was not necessary for an understanding of the general flow of contaminants from Site F. Their model suggested losses of leachate of only 0.3% however, in contrast to the proponent's 5%, based on an assumption of underlying strata which could be assumed to be homogeneous and impermeable for predictive purposes.

Finally, the Board could not accept exhibit **H-220** as a reasonable transformer of field data to hydrostratigraphic model. It was found to not be a fair representation of the site. After examination by the Board it was obvious that there was no linear north/south scale. The lack of correspondence, between the real world and the portrayal of it in **H-220**, jeopardized any subsequent testimony that relied upon it to define the nature and shape of hydrostratigraphic units in the area.

Messrs. Beechinor and Sobanski were unable to give assurances that the zones depicted in different colours on exhibit H-220 did not simply disappear from place to place between the various boreholes. They assumed rather that the zones were continuous in all directions, and on this continuity they based their conclusion that this site could be safely engineered to prevent leachate losses.

With Dr. Charlesworth's assistance the Board carefully examined the cores which had been taken from the middle of Site F. These cores showed numerous fractures and groups of fractures in shale taken from the borehole in the middle of Site F. These cracks and fractures may have been caused by ancient overlying rock, and the advance and retreat of continental glaciers. The Board was impressed with the number of such fractures, and the existence of areas where many fractures close together gave the appearance of voids which might provide random conduits for leachate egress from beneath a landfill.

The extent of these fractures vertically within a given core, and the continuity of these fractures from one well to another, are the essential hydrogeological matter in debate, as the vertical and horizontal fractures are postulated to constitute the major leachate egress routes. There were two ways of characterizing the fracture frequency: one was a bar chart representation in the original borehole log, which unfortunately had a single category (that of 3 to 20 fractures per metre) for 60% of the core examined; the other characterization referred to an RQD parameter which, Mr. Petrie explained, could vary from 0% to 100% depending on whether there were 9 or 11 fractures/metre and whether these 9 or 11 fractures were in one four-inch segment or spread evenly throughout the one meter section. The Board found that neither of these measures alone was a helpful indicator of the stratigraphy of the site.

One fundamental aspect of the argument in favour of Site F is that the continuous 'highly fractured unit' beneath the landfill would conduct leachate safely to the southern end of the site. If this was the case then the hydraulic head measurements in a given area should be approximately the same throughout the area as one moves down through different strata. But witnesses observed that there were some significant hydraulic head variations in adjacent wells. Notwithstanding these differences, the Region's principal hydrogeologist, Mr. Sobanski, argued that the highly fractured unit is laterally continuous, as shown by pumping tests done in the area.

But the hydrogeology experts called by the Town of Milton, Drs. Charlesworth and Rowe, did not support Mr. Sobanski's postulated highly fractured underdrain and its associated stratigraphy:

"Trow's hydrostratigraphic definition of various units within the shale is somewhat tenuous, as are the results of the computer modelling which was based on their conceptual model of the hydrostratigraphy. ... Leachate contaminated water which moves to depth in the shale will flow laterally, in a sluggish flow system, towards Hamilton Harbour..."

M-437 p 7-1

This has significant implications: it removes the leachate pathway postulated by Trow Hydrology Consultants Limited, and it also removes the proposed contingency measure of developing purge wells down-gradient in order to intercept escaped leachate. In the context of the Charlesworth and Rowe evidence, it can be argued that the absence of the highly fractured zone supports their hypothesis that diffusion of contaminants through the strata beneath Site F would be slow. The Board could not conclusively determine what the real situation might be beneath Site F, since these experts contest the interpretation of the proponent's experts, and there was no absolute determinant to verify either their model or the proponent's.

In support of his model of complex vertical and horizontal fracturing in the surficial layer, Mr. Petrie drew the attention of the Board to the highly variable tritium data, which at well HC-5 shows the presence of pre-1952 water at great depth, whereas a nearby well, HC-8, shows the absence of such water. This contrast illustrates a lack of substantial hydraulic connection between these two wells within THCL's postulated continuous geologic underdrain at Site F.

Mr. Petrie added that in his opinion the pumping tests in the vicinity of Site F do not support the existence of a highly fractured zone underlying the site.

Of greatest concern to Mr. Petrie in regard to the pumping results was the fact that monitors at the bottom of well HC-3, below the postulated weakly fractured zone, responded to pumping at pumping well 3, above the weakly fractured zone. This led to the conclusion that there were vertical hydraulic connections through the supposed weakly fractured shale. The implications of this are that if water can be drawn upward through this presumed impermeable

layer to a pumping well above it, then leachate from waste can percolate down through this postulated zone and reach lower strata, from whence it could migrate off-site.

When Messrs. Petrie and Crutcher studied all of the slug tests and pressure packer tests they came to the conclusion that the conductivity of the postulated "weakly fractured shale" was higher than that calculated by the proponent's geologists. They assigned a value of about 2×10^{-4} cm/sec (about 7 inches per day) in this zone, which they feel constitutes an extensive weathered and fractured shale mantle.

Further supporting their concern about the integrity of the postulated "weakly fractured massive shale unit", is the fact that the second piezometer (hydraulic head measuring device) at well MB-11, which is supposed to lie entirely within the postulated zone, is a flowing well. This is inconsistent with the low hydraulic conductivity proposed for the area.

In contrast to the bulk matrix diffusion model proposed by Drs. Charlesworth and Rowe, Mr. Petrie offered the opinion that a significant volume of contaminants from Site F would move through a few discreet but serious rock fractures. Mr. Petrie concluded that "a porous medium model ... cannot adequately reproduce the complexity of the site nor provide the basis for contaminant transport modelling within the fractures".

The Petrie and Crutcher model, in contrast to that of Drs. Rowe and Charlesworth, is based on considerable inhomogeneity across the site, which results in areas or volumes of rock which are relatively impermeable, in comparison with other volumes through which leachate could percolate fairly readily.

The monitoring wells in the WAT series (University of Waterloo studies around Site F) show how small scale complexities in groundwater flow can be illustrated by means of closely spaced piezometers. Such complexities would be missed with the more traditional widely-spaced measurements. The WAT wells show that hydraulic gradients, and therefore groundwater flow directions and magnitudes, change significantly with location, time and depth.

Mr. Petrie concluded that organic nitrogen plume delineation experiments were inconclusive. The interconnected fractures beneath the site could include "fracture zones" up to 30 cm in thickness. In these fracture zones the groundwater velocities are unknown but in the witness'

view they could be quite high. According to research in similar materials, interconnecting fractures could have high velocities over short distances

Mr. Petrie's "best guess" of leachate flow under Site F is 2/3 lateral flow and 1/3 vertical flow. If his assumption of 30,000 gallons/day lost to the strata beneath Site F were valid that would correspond to 20,000 gallons/day moving in a subhorizontal fashion and 10,000 gallons/day moving in a more downward fashion. There is no evidence to support such a large estimate of leachate loss.

Mr. Petrie stated that the underlying stratum of weathered and fractured shale would likely have a hydraulic conductivity of 2×10^{-4} cm/sec (7 inches/day), and this layer would act as an underdrain, bypassing the engineered leachate collection system and allowing the release of contaminants to the surrounding environment. Even Mr. Sobanski agreed:

"We're talking about the total system capturing something in the order of 93 to 96 per cent of the leachate that will be generated at the site. Some will escape to the groundwater flow system and we can't stop that."

39 p 8,671

The Board is left with the impression that the relatively permeable layer near the ground surface would allow the entry of significant quantities of leachate which would eventually reach other permeable layers beneath the site and would then drain away from the site. Upward gradients in the vicinity of Aldershot and the absence of such gradients between Highway 403 and the CNR track suggest that leachate entering the bedrock in the vicinity of Site F could well emerge in residential areas south of the CNR tracks.

Even Mr. Sobanski, the principal hydrogeologist for the Region was prepared to agree that "groundwater pathways exist from the landfill through the shale", although he was not quite prepared to agree that "extensive groundwater pathways exist..." (exhibit E-214 p 46). He could not conclusively explain the remarkable difference between tritium levels measured in adjacent wells at approximately the same depth, although these differences could lead to uncertainties about the volume and extent of discharge in the area between Highway 403 and the CNR tracks on which his model (figure 6 of exhibit H-40) depends. From one perspective he appeared unconcerned about leachate losses, saying:

"This is domestic garbage we are talking about and we are not talking about hazardous wastes ... If some gets out of that entrapment and gets to deeper depths I am not concerned about it, not at all."

23 pp 5,295 & 5,296

Given Mr. Feenstra's evidence about chemical concentrations in Halton garbage leachate, this Board cannot adopt such a cavalier attitude.

Mr. Feenstra had originally been called to describe the movement of contaminants through the strata beneath Sites D and F. He had begun with a basic description of advection, diffusion and dispersion of contaminants from a landfill site. Advection refers to a more linear movement of contaminants while the other terms relate to contaminant spreading.

When describing the nature of contaminants present in waste in the Regional Municipality of Halton's Burlington Landfill, Mr. Feenstra explained that this waste contained several priority pollutants at higher concentrations than found at other sites in Ontario. For many chemical compounds, concentrations were much higher than found at either the Oakville or Georgetown landfills in Halton. The higher levels may be accounted for by the relatively new landfilling at Burlington and the high content of volatile components, but the witness was unable to confidently explain why the levels are so high.

Experience at North American landfill sites has shown that volatile organic substances are just about as mobile as chlorides and for this reason chlorides are often used as indicators of the leading edge of a leachate plume.

Mr Feenstra described some recent data for monitoring of contaminant plumes in the vicinity of Site F. Notwithstanding the appearance of some chemicals in the analyses of samples taken from various wells down-gradient from Site F, he was convinced that the presence of these contaminants reflected the contamination of the well or sampling equipment, rather than the existence of chemicals in the groundwater.

For his earliest calculations of leachate egress Mr. Feenstra had assumed the existence of a relatively impermeable "weakly fractured massive shale" unit, 15 metres thick. The Board does not accord great weight to this assumption, given the absence of data to support it, and Mr.

Feenstra's own denial of the proponent's hydrostratigraphic model in his final appearance before the Board.

Mr Feenstra felt that the non-detection of volatile organics at the site boundary of the present Burlington landfill and the closed Bayview landfill were not indicative of anything, since according to the proponent's own model, leachates from these sites might not yet have migrated through the relatively impermeable layer.

While cross-examining Mr. Feenstra, Ms. Cronk, counsel for National Sewer Pipe Limited, drew the Board's attention to a comparison between Site F and the approved Domtar disposal site for fly ash in shale at Mississauga. Although the disposal of fly ash had apparently been approved by another Environmental Assessment Board, we recognize the differences between the two situations, including the fact that the contaminants in fly ash are different from those in domestic wastes, and the fact that the leachate from the Domtar disposal site was non-potable and non-toxic primarily because of the presence of sulphates and chlorides. The differences were clear when the Board reviewed Table 1 of exhibit H-86A which shows thousands of micrograms per litre of volatile organics in Burlington landfill leachate.

Mr. Feenstra, in explaining the downward movement of chemical contaminants at site F stated quite unequivocally:

"We have no way of directly measuring the vertical hydraulic conductivity which is the actual important parameter with respect to downward movement through that zone."

45 p 10,169

The zone in question was the postulated 'weakly fractured massive shale', and without a reasonably reliable value for "the actual important parameter" the Board would be hard pressed to approve landfilling at Site F if this meant that it would be unable to assure the public that there could not be significant migration of contaminants away from the proposed landfill site.

The significance of this uncertainty was compounded by the many exhibits which showed downward gradients, not upward gradients, in the area between Highway 403 and the CNR tracks south of the site. Upward gradients are shown in the residential areas to the southeast. This means

that if contaminants do migrate into a more conductive stratum beneath the landfill, they could emerge, not north of the residences, but in the vicinity of the residences.

Although tritium data from exhibit H-173 reminded the Board that Site D showed no penetration of tritium through the unweathered upper till, the tritium data at Site F reveal considerable migration to lower strata. Mr. Feenstra explained that vertical fracturing through the "weakly fractured shale" would account for the highly variable tritium result.

During Ms. Vigod's cross-examination, Mr. Feenstra stated that with a failed trap at Site D, contaminants would arrive at the site boundary in approximately 60 years, but they would arrive at the site boundary in only 30 years at Site F with the proposed containment measures in operation. Because Site D suggested no contaminant loss with containment systems in operation, Mr. Feenstra opined at the end of his first appearance before the Board that this should be the preferred site. After introducing the till-fracturing hypothesis in his last appearance, he changed his preference back to Site F.

In response to cross-examination from Mr. Tidball, Mr. Feenstra acknowledged that monitoring could be done at both sites, but at Site D it would be simpler, less expensive and more reliable than would be the case at Site F. The Board was not satisfied that a monitoring system at Site F could reliably intercept all contaminant migration pathways.

One of the significant aspects of Mr. Feenstra's evidence, in conjunction with that of Messrs. Beechinor and Sobanski, is that these witnesses do not consider the case of underdrain failure at Site F. The calculations for "constant contaminant input" are based on the underdrain system working. This represents another instance of the dissimilar evaluation of the two sites in favour of site F. These witnesses acknowledge that there will be contaminant losses to the wider environment. For a weakly absorbed compound there would be losses which would reach concentrations of about 180 micrograms per litre. For certain of these chemicals, included in the United States Environmental Protection Agency list of priority pollutants for which there are drinking water standards, concentrations are supposed to be well below 200 micrograms per litre.

Using the data available to them, the Region's consultants developed a computer simulation of groundwater flow that showed considerable flow into the ground in the vicinity of Site F and

some flow out of the ground between Highway 403 and Lake Ontario. The primary migration pathway was towards Lake Ontario.

There was some confusion about the volume of discharge from Site F into the area between Highway 403 and the CNR tracks. Mr. Sobanski had given an estimate (10,000 cubic metres per year) which would have implied large wet areas in this vicinity, but a field survey made on June 21, 1987 did not reveal such areas. This also jeopardized the validity of the entire hydrogeologic model. The discharge was to occur through an area of about 62 acres at a rate of about 14,000 cubic metres per year, according to Mr. Sobanski's later testimony. But after personally exploring the area, he concluded:

"there was not much evidence of continuous discharge ... it isn't as strong as indicated by this model."

39 pp. 8,665 & 8,666

In response to cross-examination by Ms. Vigod, counsel for the West Burlington Citizens Coalition, Messrs. Sobanski and Beechinor noted that vertical fractures exist in their 'weakly fractured massive shale', and there are hydraulic connections throughout the zone (39 p 8,623). They don't have a good fix on porosities for such geological materials (i.e. fracture zones) so they could make any model fit, given the "hydrogeological uncertainties."

Because the proponent's original environmental assessment relied so heavily on the computer FLONET model, the Board examined its method of production and use carefully. Hydraulic heads had been measured and the model then applied to give a best approximation. Certain parameters were then adjusted to see if a better fit could be obtained. If the fit improved, the new parameters were used. Thus the porosities and hydraulic conductivities finally chosen, came from the model, rather than being fed into the model. Hence the conductivity value of 10^{-7} cm/sec for the 'weakly fractured shale' is an artifact of a computer program rather than a measurement in weakly fractured shale.

Because one cannot draw the boundaries of the hydrostratigraphic units with great confidence, one cannot reasonably apply any model which is dependent upon the clear delineation of such units. The complex geology at Site F doesn't allow the definition of variations in conductivity at a scale of about 50 to 100 metres. So one could miss a significant contaminant plume in a monitoring program, be unable to develop a reliable model, and be unable to use groundwater chemistry as a means of characterizing the site.

Mr. Petrie's consultant firm (Conestoga Rovers Associates) had run the FLONET model, not to simulate another arrangement of strata as though they actually existed, but rather to show that other strata could be conceived which would yield a better fit for both the potentiometric levels and the hydraulic gradients. Thus, it was argued, reliance on a model because of its' fit with one non-unique set of input points, did not constitute proof that the situation modeled was real. Mr. Petrie felt that his own assumptions about input parameters for FLONET were valid because they produced potentiometric heads and hydraulic gradients which corresponded well with measured values.

The Board noted that the model as run by the proponent's consultants eliminated the observed upward flow of groundwater in the Aldershot vicinity, and created a hypothetical upward flow between Highway 403 and the CNR tracks south of the site. Such a flow of groundwater was not measured in the area. When the landfill was superimposed on the FLONET model (figure 21 of exhibit H-40), the Board was presented with the spectacle of surface water penetrating the earth at the north end of Site F, decending to a depth about 476 feet below the surface, and 'bouncing' back up to conveniently emerge north of the residential area of Aldershot.

The Board concludes that one cannot engineer a landfill leachate collection system based on contaminant infiltration and migration assumptions which come from theoretical hydraulic conductivities drawn from a computer model, if that model may itself be faulty because its ability to predict hydraulic heads, from which its validity is inferred, is insensitive to hydraulic conductivities.

Local residents were concerned about groundwater flow paths from a somewhat more pragmatic perspective:

"Approximately 10 underground streams run through Aldershot; some already have a foul smell ... There are springs north of the railway -- one rises in the basement of the Royal Bank on Plains Road ... There are some well water users in Aldershot."

H-82 p 5

A number of Aldershot residents, including Mr. Brownlee and Ms. Filman made reference to a number of "spring fed creeks" in the Aldershot area, about one kilometer south of the proposed Site F. Their concern was that the source of these springs would be up the hill in the

vicinity of Site F, and therefore leachate from the landfill could appear in the springs south of the site.

Dr. Rowe used Dr. Charlesworth's hypothesis about subterranean strata in the vicinity of Site F to calculate the amount of leachate expected to escape from the area. Using theoretical considerations about matrix diffusion he calculated that some 0.3% of leachate would get into the rock beneath the site, rather than the 5% originally proposed by the proponent. His worst case scenario corresponded to 0.8% of leachate passing into the strata. The reason Dr. Rowe felt that the quantity of leachate entering the rock would be smaller, was because he concluded that a critical parameter, the Darcy velocity, should have been calculated as 0.05 meters per year rather than the 0.7 meters per year used by the Regional Municipality of Halton's expert witness. Taking account of the quantity of pollutants in the landfilled waste, the lower value for the Darcy velocity, and the effects of matrix diffusion, this witness concluded that there would be no discernible off-site migration of contaminants.

Drs. Rowe and Charlesworth stated that their "shallow zone" proposed for Site F was not meant to represent a recognizable geological feature of 25 metres thickness, but was rather a mathematical artifact defined by the boundary between water which was saline (containing more than 5,000 mg/litre of chloride) and water that was less saline.

Dr. Charlesworth observed that his model was not based upon actual or measured geology, gradients or conductivities, but may rather be a simplified conservative model leading to a worse conclusion than might be expected. Dr. Rowe added that the most difficult parameters to determine are aperture size and smoothness in fractured rock and hence the permeability of the rock. Their entire modelling exercise depended on assumptions about homogeneity, and a circumscribed range of values for the Darcy velocity, which may not be valid.

Dr. Rowe acknowledged that all of his scenarios were based on the assumption that it is reasonable to homogenize variables, including contaminant concentrations, throughout a uniform thickness. Thus it was assumed that if contaminants do not exist at one location down-gradient of a landfill site they must not exist anywhere down-gradient; if measured conductivities at one point are one hundred or one thousand times as great as at another point, it is fair to assume that their average applies throughout.

Dr. Rowe explained that his mathematical model, which led to the Site F worst case scenario was based on the assumption that all leachate could exist in a layer 25 meters thick beneath the site, and move downgradient. If this were the case, then monitoring wells would detect it after a certain period of time. Since it had not been detected, he concluded that the groundwater velocity must be low and infiltration must be low. But some contaminants would move out at the surface (a great deal according to his colleague Dr. Charlesworth) and some would move to depth, so the amount remaining in the layer is not great. Therefore, detection may not be a valid indicator of contaminant velocity and the model may be inadequate.

Dr. Rowe acknowledged that his model does not accommodate "local variations" that exist in the vicinity of Site F because "everything is not that simple". The Board agrees.

In the context of the analogy to the mapping of circulation by the insertion of a few needles into the specimen being examined, the Board was interested to hear Dr. Charlesworth explain that the assumption of arrival times, based on monitoring at wells down-gradient from the Burlington landfill, could be wrong because the monitoring locations selected might have missed significant downward migration pathways. The Charlesworth/Rowe homogenized model would be jeopardized if the fracture model was correct and the monitoring points selected to indicate the arrival of the leading edge of contaminant plumes had missed fracture zones which carry the bulk of the contaminants.

Mr. Petrie felt that the monitoring well for calibration of Dr. Rowe's model may not be representative of water quality everywhere south of the site and, in fact, it may not correspond to the hydrogeology at Site F. It was not, in his view, a useful calibration point for Dr. Rowe's matrix diffusion model.

Drs. Rowe and Charlesworth stated that their choice of groundwater and contaminant migration velocity beneath Site F was based largely on the assumption that since they had not detected contaminants at a well 25 metres south of the Burlington landfill, after a certain number of years, the groundwater velocity must be very slow. It was acknowledged, however, that this assumption did not accommodate the possibility that the monitoring well down-gradient of the Burlington landfill might have missed contaminant migration from that landfill site.

Dr. Rowe observed that if contaminants are removed by pathways other than that into the 25 metre thick zone beneath the Burlington landfill then the concentration of contaminants at the

start time of his model could well be less than the concentrations found in the perimeter drains. This has significant implications for the validity of his model.

The pumping tests at Site F were less than perfect because of the inhomogeneity of the strata there. The results of these tests may be more valuable as indicators of connectivity or transmissivity than they are of hydraulic conductivity. The reported drawdown in observation wells was often less than the background fluctuations in static water levels. Such measurements were not useful in assessing transmission between different locations on-site.

Pumping well responses were highly variable, reflecting the complex hydrostratigraphy of this site. Pumping well 1 showed some response at a distance of a couple of hundred meters, whereas pumping wells 2, 3 and 4 elicited quite limited responses.

Dr. Charlesworth explained that the packer tests (another means of assessing hydraulic conductivity below ground) at Site F suggested conductivities ranging from a low of 10^{-8} cm/sec (1 centimeter in 3.2 years) to a high of 1.2×10^{-3} cm/sec (4 feet per day). This information further demonstrated the inhomogeneity of the strata beneath Site F.

In support of his conclusion about the fractured nature of the substrata, Dr. Charlesworth explained exhibits showing converging and diverging hydraulic gradients beneath Site F, which reinforced the perception of a complex groundwater flow in the area. Despite this, he agreed with Dr. Rowe that leachate would not leave the vicinity, based on the performance of the Bayview and Burlington sites and their apparent lack of leakage.

Although the expert witnesses were unconcerned about possible wider effects of groundwater contamination, some Aldershot residents, including Ms. Chornook, Mr. Connell and Mr. Zimmerman expressed their concern about leachate reaching as far as Lake Ontario, and thus affecting the drinking water quality of a much wider community.

Mr. Sobanski had said that the local groundwater flow system would move leachate to areas adjacent to Site F, and that the regional groundwater flow system which runs into Lake Ontario would not be significantly affected. He did agree, albeit somewhat reluctantly, that:

"Another possibility is that if there was just a general upward gradient further south, it could well end up in the perimeter tiles around houses and in services, service trenches, and in that manner find its way down to some discharge point further down, something like foundation drains around houses."

33 p 7,085

But Mr. Sobanski was quick to qualify this:

"It would be very diffuse and spread over a large area and you would never notice it."

33 p 7,085

In Mr. Crutcher's opinion the Bayview site with its current leachate collection system in place does not pose a public health and safety threat to residents of Aldershot in a technical sense. It was his view that in comparison with other threats in the Aldershot area from other human activity, the threat from leachate contamination is not significant. Part of the reason the physical threat from contaminants in the shale bedrock is minimized for residents of Aldershot, is the intervening layer of glacial till between the shale bedrock and the homes of people on top of this till.

Although Mr. Crutcher is not an expert in toxicology or community psychosis, the Board understood from other witnesses that leachate contamination does add to the general environmental burden in the vicinity, and the combination has added the emotional stress associated with the perception of a problem. Thus, the physical threat of three landfills in Aldershot may be difficult to quantify, but the perceived psychological and social problems associated with them find ready expression by local residents. The Board noted that the emotive evidence of Milton area residents also demonstrated that the spectre of waste disposal nearby created community concern, without a measurable physical threat. The weight assigned to such considerations was the same for both communities.

With respect to losses at the adjacent Bayview Landfill site, the Board's attention was drawn to a 1982 Dillon study which showed an infiltration rate of about 6.5 inches per year, leading to surface losses of about 5 gallons per minute and groundwater losses of about 7 gallons per minute or 10,000 gallons per day. According to that report the plume was reckoned to move at

about 100 feet per year through a depth of about 100 feet for a total distance of about 2,000 feet southeast of the landfill. At that time the Ministry of the Environment did not recommend purge wells as an appropriate contingency measure at the Bayview Park site.

Messrs. Sobanski and Beechinor stated that even with the proposed tile drainage system it would not be possible to stop the downward migration of contaminants. Some leachate (estimated to be 5%) would get through the drainage tile field and into lower and surrounding strata. It was explained that it is not possible to build a "hydraulic trap" at this site because of the very high hydraulic gradients in the area. At page 132 of exhibit **H-40** the consultants observe "that the natural rate of leakage from the site to the intermediate flow system is low, at about 10,000 cubic metres per year". This corresponds to about 2.2 million gallons per year - the Board questions the use of the term "low".

Mr Petrie disagreed with the proponent's consultants about the existence of both the weakly fractured massive shale unit and the highly fractured shale unit underlying Site F. Rather, he felt that the whole area beneath the site was sufficiently fractured to receive leachate from the landfill itself.

Messrs. Sobanski and Beechinor argued that their model was conservative because it showed leachate emerging from the ground between the dump site and Lake Ontario. The implication was that the spread of contaminants to the wider environment of the waters of lake Ontario was of less concern. The Board is not persuaded that such an interpretation is consistent with the purpose of the Environmental Assessment Act.

Mr. Petrie disagreed with Mr. Sobanski's view that the discharge zone existed between Highway 403 and the CNR tracks citing, among other things, exhibit **B-621** which shows the water table well below ground surface at well HC-14, in the postulated discharge zone.

There is a dramatic deterioration of groundwater quality with depth in the shale, so much so that deeper waters do not meet drinking water criteria because of natural inorganic ions there present. For these reasons, a 1985 Gartner Lee report concluded that the leachate plume would not "cause significant off-site impact on groundwater". This quote relates to inorganic ion impact rather than organic and possibly toxic chemicals, since the 1986 Gartner Lee plume delineation study revealed that the existing Burlington landfill site has generated a plume which had migrated 45 metres south of the site.

When Dr. Charlesworth also referred to "poor quality groundwater" he qualified this by adding that its quality was poor because of natural compounds such as chlorides but not because of human activities.

The failure of leachate drains at Site F could lead to off-site migration either through the very shallow system or through deeper systems. Dr. Charlesworth excluded the possibility that there could be leachate loss through some intermediate system which would affect people downgradient. He acknowledged that there could be surface water impacts because of the very shallow flow system but he did not think the control of leachate at Site F is an essential aim because:

"the most reasonable use of the groundwater regime downgradient at Site F and its environs is for waste disposal; the poor quality groundwater of this area is a good resource for the disposal of waste"

M-444 p 39

The Ministry of Environment (MOE) witness, Dr. Hughes, stated that MOE policy was based on the assumption of some leachate loss at any landfill site. He also stated that leachate attenuation could be a reasonable use of groundwater "although (he was) unable to give an opinion on whether such a determination is appropriate in this case" (E-928 p 4).

The guidelines for protection of groundwater suggest that, in some cases, there may be reason to allow an off-site attenuation zone (ss. 3.3.2, page 12 of the attachment to E-154). The Board was told that at Site F an available zone already exists, since National Sewer Pipe Limited owns the property where discharge may occur between Highway 403 and the CNR tracks.

Dr. Hughes referred to MOE policies in general, and to the incorporation of the "Reasonable Use Concept" into MOE groundwater management activities in particular:

"The Ministry may support ... the acquisition of land or an easement for a Contaminant Attenuation Zone only ... where good supplies of water are available ... from municipal systems, and the ground water supplies in a particular unit are marginal with respect to their quality and/or their quantity"

E-154 Appendix, p 14

The Board finds that the MOE policy does not say that "the most reasonable use of the groundwater ... is for waste disposal," as suggested by Dr. Charlesworth, nor does it encourage such use where there are alternatives that could prevent groundwater contamination. On the other hand, MOE policy on "engineered solutions" at landfill sites does appear to be clear:

"It is the Ministry's position that there are limitations to engineered facilities and it prefers sites in environments with characteristics that provide a high degree of natural protection (e.g. thick clay deposits.)"

E-928 Attachment p 1

Dr. Hughes noted that the contaminating life span of an engineered facility is the time required for the concentration of contaminants in the facility to diminish to a level such that subsequent concentrations at the site boundary, after travel time to that boundary, result in acceptable environmental impacts.

Dr. Hughes stated that residents' dependence upon the local groundwater resource relates to economic and personal preferences, more than absolute scientific or technical determinations.

Mr. Bowen noted that there are a number of downgradient well users in the vicinity of Site F. Of the nearest five such users, two use well water for all purposes, and three use well water for drinking water only. In this regard, the Board noted the evidence of Mr. Langton and Mr. Schmalz who used their own wells for all purposes. These observations draw the "well water dependence" question into sharper focus, in the context of the effect of leachate losses on adjacent groundwater users. It is clear that it would be less expensive for residents in Aldershot to switch from their well supply to the municipal supply, but it would not be impossible for residents in the vicinity of Site D to do so as well. In the latter case one might expect the wider community to bear much of the cost.

The Board was presented with evidence (H-40 D-21) on the boundary layer of groundwater where more saline deep water meets fresher rainwater from above. The depth of this "fresh water rind" was taken as an indicator of leachate flow downgradient of the landfill site. The proponent's original presentation suggested that contaminants might be directed back towards the surface near the southern border of the site. When the misleading distraction of

information relating to well HC-8 was removed because this well was far from the cross-section in question, and replaced with more reasonable data pertaining to well MB 17, the Board had a different picture - one of fresher waters being directed towards the surface between wells HC-10 and HC-12, in Aldershot.

With respect to design considerations, Mr. Crutcher observed that the toe drain at Site F may have only a local effect, with most of the contaminant passing beneath it. He felt that without a liner at Site F, the site is unpredictable and therefore unacceptable. It could not be adequately monitored, and the difficulties in monitoring would lead to difficulties in assessing the effectiveness of any contingency measures. A liner was required, therefore, but he concluded that the shale on-site would not be suitable for use as a liner.

The high volumes of water obtained during pumping tests led Mr. Petrie to conclude that there was considerable uncertainty about water flow under Site F, and he supported Mr. Crutcher's view that one should not allow landfilling without a liner. This liner would add about 18 million dollars to the estimated costs for Site F.

Messrs. Petrie and Crutcher stated that if leachate exfiltration calculations done by previous consultants for the adjacent Bayview site apply to Site F, there would be about 12,000 gallons per day of leachate lost without a liner. This is within the range of extremes of 1,000 to 30,000 gallons per day, which the Board heard from various witnesses. The proponent's earlier estimate had been for daily losses of 4,500 gallons per day, being 5% of the total 90,000 gallons of leachate produced each day.

The difference in rainfall infiltration at Site F with and without a landfill could be significant, because without a landfill rainwater run-off may be greater than would be the case when the more absorbant refuse and its cover overlies the rock. Unfortunately, the Board was unable to get a clear picture of the magnitude of this effect from the evidence. A similar shortcoming was evident at Site D, where witnesses were unclear on the relative importance of water loss routes (to groundwater, evapotranspiration, and surface water run-off). It appears to the Board that this field is ready for research in aid of proper waste disposal.

In re-examination, Mr. Estrin recalled Dr. Rowe, and introduced Mr. Gray. Mr. Gray had experience with testing the permeability of clay/till borrow at the Keele Valley landfill

site. He had also studied shale around Site F, to assess its stability for stables at Bayview Park, and industrial parks nearby. In Mr. Gray's view, a one meter thick liner would lead to exfiltration of 9 millimeters per year from the landfill, rather than the 8.14 millimeters per year shown on exhibit H-653. According to exhibit H-690 this corresponds to leachate losses of about 2,460 gallons/day, rather than about 2,720 gal/day.

Mr Sobanski drew the attention of the Board to the very high concentrations of U.S.- EPA priority pollutants at the Burlington landfill site (H-40 p 92), compared to the Georgetown or Oakville landfill sites which were closed some years ago. These organics are not found in significant concentrations 25 meters from the site, and the witness could not say whether this meant the organics were not leaving the landfill, or whether there was simply an inadequate amount of time for the contaminant plume to have travelled 25 meters. The problem with loss of leachate is not just its volume, but rather the seriousness of organic contaminants therein. The waste may not be "hazardous", to use Mr. Sobanski's earlier language, but the Board heard no evidence to suggest it was benign. Conditions will be ordered to encourage actions by local governments to reduce toxic organic chemicals in domestic waste, in view of the landfill situation.

Mr. Sobanski felt that the installation of a few pumping wells near the of the North Service Road could successfully intercept and remove any leachate that might escape from the Site F landfill, assuming that the highly fractured zone exists beneath the landfill.

The firm for which Messrs. Crutcher and Petrie work had earlier (1982) recommended control of leachate egress by means of a clay key south of the Bayview site to intercept "the deeper groundwater flow". Mr. Crutcher explained that he thought that phrase meant groundwater flow to a depth of ten feet below the surface. He now considers the 'deeper groundwater flow' to be a zone between 10 feet and 20 feet below grade. Both Mr. Crutcher and Mr. Petrie explained that if the postulated discharge zone is not well defined, then it is not possible to model or monitor Site F.

Hydrogeology - Site Comparison

The fundamental flaw in the Region's hydrogeologic assessment is evident in both the early and late stages, where it appears that unlike situations were compared as though they were the same. The inappropriate comparison is seen in the comparative analysis document:

"In the 'Public Health and Safety' category, the Hydrologic/Hydrogeologic factors were revised so that greater attention could be paid to the impacts of a fully engineered site now that detailed designs have been prepared."

14 p EX-3

This revised approach circumnavigated earlier selection criteria which took account of the setting of the landfill, and replaced it with a single criterion. And even this criterion was not steadfastly adhered to, as the proponent and other critics were preoccupied with failed engineering at Site D, in contrast to the economic availability of municipal water supplies for residents adjacent to Site F.

Mr. Sobanski's letter of January 23, 1987, (Appendix A to H-14) reveals the uneven treatment of the final two sites as it shows advantages for Site D which are 'on-site', and advantages for Site F which are almost all 'off-site'. If both sites work as engineered, then the advantages foreseen for Site F are redundant, and those for Site D are real.

The Board appreciated the advice that risk is the combination of the probability of an occurrence and the consequences of that occurrence. Mr. Petrie and others allowed that the consequences of leachate egress at Site D are greater than those at Site F, from the drinking water perspective. But the probability of such an occurrence was judged to be low. On the other hand, the probability of leachate losses at Site F is a virtual certainty, although the consequences, especially from the drinking water perspective, were judged to be quite low. The Board considered this in the wider context of the Environmental Assessment Act that has to do with the wise management of the environment in Ontario.

When the Board examined, through witnesses Petrie and Crutcher, the variations in tritium, chloride and pumping well behaviour at Site F, it became abundantly clear that there were zones of high and low chloride, tritium and permeability on both sides of the postulated weakly fractured massive shale unit. The Board concludes that this unit cannot exist. Furthermore, a redrawing of the cross-section along the length of Site F in the vicinity of the old drainage basin, shows that fresh water has penetrated to considerable depth and moved south towards to the community of Aldershot and Lake Ontario, in which area it has emerged to the surface. The implications of this with respect to leachate egress cannot be ignored.

A careful analysis of the pumping test data in the vicinity of PW-1 at Site F, showed that there were significant responses in a general northwest-southeast orientation, parallel to the length of the site, whereas responses in the southwest to northeast direction across the site were weaker. These observations suggest that the strata beneath the surface may possess similar characteristics along lines parallel to the length of the site but not across the site. The implications of this with respect to the proposed parallelism of Site F and adjacent dumpsites, in the context of leachate exfiltration and interception, cannot be ignored.

The anticipated losses at Site F, with the underdrains in operation at that site, would range from 1,000 gallons/day (if Dr. Rowe's calculations of uniform matrix diffusion were valid), to 6,000 gallons/day (for THCL's assumption of 4 discreet strata), and finally to 15,000-30,000 gallons/day (for Mr. Petrie and Mr. Crutcher's assumptions of fractured flow).

All geologists agree that even with the engineered systems in operation at Site F, there will be losses. The only disagreement is with respect to the volume of such losses, and therefore their subsequent impact.

Finally, with respect to the matter of the security offered by a liner beneath Site F, the Board noted that the strongest supporter of such an expensive measure, Mr. Crutcher, could not guarantee that a liner would not become fractured as a consequence of being laid down over different areas of intact bedrock and filled river valleys. Even with a liner in place, Mr. Crutcher predicted losses ranging from 1,509 gallons per day to 2,446 gallons per day, for the relatively benign situation where the water table would exist between the upper and lower boundaries of the liner. For the less favourable situation of the water table falling below the liner, leachate losses would increase. Regardless of its integrity, the cost/benefit implications of this palliative cannot be ignored.

Amongst the many factors to be considered in assessing the hydrogeological suitability of a landfill site, this Board considered the following matters to be of considerable significance:

1. The hydrogeology of the area must be comprehensible to the Board.

The general hydrogeology of Site D was undisputed throughout the Hearing. Differences related to the extent of geological units, and the values to be

assigned to parameters important in such units. Site F hydrogeology was in dispute throughout, with the proponent withdrawing the original model as the Hearing progressed. That a degree of confusion about the hydrostratigraphy at Site F persisted to the end of the hearing is reflected in the difficulty experienced by counsel for the proponent as he tried to explain the difference between a fractured layer at depth and a permeable drain or drains within a thick, relatively impermeable, lower stratum:

" As I read, let me qualify my answer.
As I read Page 114, it reads as though there are three layers. In fact, during the cross-examination Mr. Petrie moved the third layer up and down and decided that there could be more than one drain. In fact, it says on 114 drain and drains. So, the more permeable layers can form part of the second layer."

177 p 44,065

The Board studied all the hydrogeological evidence most carefully, and concluded that although the Site F hydrogeology was never as clear as that at Site D, the model that most corresponded to the evidence was Mr. Petrie's presentation of complex fracturing beneath the site.

2. The loss of contaminants should be minimal (and preferably zero), as a result of either natural containment or engineered works.

Site D as described by the proponent is intended to release no contaminants to the wider environment. Site F is expected to release between 1,000 gallons per day and 12,000 gallons per day with the engineered containment system working. The most likely losses would be in the neighborhood of 5,000 gallons per day.

3. Natural containment and attenuation of contaminants is preferred to engineered containment and attenuation.

It is clear that Site D was originally selected for its natural containment and attenuation potential - Site F was not.

4. If it is predicted that contaminants may move away from a landfill site, then the postulated contamination migration pathways should be predictable.

"Predictive monitoring requires that anticipated monitoring results be specified in advance. This allows the level of understanding of the hydrogeologic system to be appraised by comparing the predictions with the monitoring results." (Advice to Applicants and Consultants in Preparing Hydrogeologic Reports for Proposed Landfill Sites, Ministry of the Environment, in WB-931 p 4) In the event that leachate escapes Site D, it is postulated that it would move down to the granular units in the lower till, and then off site in an easterly direction. Leachate egress at Site F would be towards the community of Aldershot and Lake Ontario, either through relatively permeable natural "drains" at unspecified locations, or through a layer of more permeable material of varying thickness at an uncertain depth, to questionable discharge areas. In the future there could be uncertainty as to whether contaminants intercepted downgradient from the Baview Park/Burlington Landfill/Site F complex, originated with Site F or one of the other sites. The litigious ramifications of such a circumstance are distressing to contemplate.

5. It should be demonstrated that predicted leachate migration from the site will have no significant adverse impact on surface waters.

The evidence led to the conclusion that there would be no surface water impact at Site D. Stormwater and surface water run-off is more difficult to control at Site F during construction and operation of the landfill, and it was predicted that landfilling at Site F could lead to local surface water impacts, but these would not be significant. Counsel for the Ministry of the Environment, Mr. Tidball, said, in his final submissions (page 9), "that the criterion for determining the acceptability of a proposed landfill site in terms of surface water impacts should be that it is demonstrated that any predicted leachate migration from the site will have no impact on surface water". Concerns were expressed that leachate egress at Site F could have a negative impact on the quality of Lake Ontario waters. Expert witnesses were convinced that this was not a serious concern, but the matter was not proven.

6. Monitoring to identify contaminant escape and migration pathways should be straightforward.

The Board was satisfied that monitoring devices could be installed to check the performance of the hydraulic trap at Site D, and to reliably intercept and measure leachate egress in the event that the trap failed. Although failure of the containment measures proposed for Site F was not a matter of extensive evidence, the Board was concerned that proposed monitoring measures might miss leachate "drains" if the subterranean strata are fractured in a complex and incompletely understood fashion, whether the engineered containment systems were functioning or not.

7. There should be the highest possible confidence in the effectiveness of contingency measures to intercept and capture lost contaminants.

Buffer zones at Site D allow for the implementation of standard contingency measures for the interception of leachate, whether in the weathered upper till or the granular units within the lower till. There remains a concern that the complexity of possible leachate egress routes at Site F might compromise the effectiveness of contingency measures proposed at this site.

Having considered these matters, among other things, the Board finds that Site F is not hydrogeologically suitable for landfilling, but Site D is hydrogeologically suitable. On the basis of this finding with respect to hydrogeology, other findings in the Public Health and Safety category, and findings in other categories, it approves the undertaking to landfill at Site D only.

Design and Operations

The Board has found that the Regional Municipality of Halton needs a new landfill site. The Region's site selection process was comprehensive and detailed, but did not run its full course to identify a single site for the undertaking.

The air quality, noise and visual impacts would be unpleasant at either site, and mitigation would have been required, whichever site was selected.

The Board's consideration of resource policies lead to the conclusion that there would be a mineral resource impact at Site F that might counterbalance the interim agricultural impact at Site D. The flora and fauna at risk at Site F are more significant and varied than those at Site D. Although the degree of preference in the resource policy category is not great, Site F is more deserving of protection.

The Board found that there would be serious social impacts at either site, with the impact at Site D being more serious for fewer people, and the impact at Site F being less serious for many more people.

It is now clear that this Board finds Site D hydrogeologically acceptable, and Site F unacceptable. From the perspective of surface water runoff, Site F would have been more difficult to engineer than would have been the case for Site D. Leachate is treatable for both sites, and Site D is slightly preferred from the point of view of transportation safety and economy. Although a potential bird/aircraft hazard exists at Site D and not at Site F, the Board has been persuaded by the experts that a serious collision between birds and aircraft, as a consequence of landfilling at Site D, is unlikely. In the Public Health and Safety category overall, this Board finds Site F clearly unacceptable, and Site D acceptable with the conceptual design proposed and appropriate conditions applied.

The Board heard a great deal of evidence on the proposed design and operation at both sites. The need for such duplication of evidence was the inevitable outcome of the proponent's decision to put forth two sites as the undertaking. Although the Board finds that the design work was seriously undertaken at Site F, little space will be given the matter here. We were satisfied that to intercept much of the leachate at Site F would have been possible but difficult. A particular problem would have been the delineation of the bottom of the supposed

"shallow active zone" and the installation of interception drains at great depth to collect leachate from the bottom of this zone. This would have been a significant design modification, but with the best engineering technology applied to the site, leachate losses might have been kept to a few thousand gallons per day.

The conceptual design for Site D calls for a hydraulic trap which is intended to collect all the leachate from the refuse and draw in a relatively small amount of surrounding groundwater. The technique is similar to that used in wet farmland areas where drainage tiles are used to draw water away from wet soil. In this case the leachate and groundwater mixture would not be allowed to drain away. Instead, it would be collected and transported, either by tank truck or sewer line, to a treatment plant, where it would be treated to render it acceptable for subsequent release to the environment. Leachate treatment has already been discussed in an earlier section of this Decision.

The conceptual design can be compared to the sump pump systems used in leaky basements. The sump pump collects groundwater that percolates in through the basement walls or floor. In the case of the landfill, it collects groundwater that percolates in through the upper weathered till (the 'walls') or through the unweathered upper till (the 'floor'). In a basement, the sump pump could collect any spilled water, such as from an overflowing washing machine, or any spilled chemicals. In this analogy, such materials would be the 'leachate'.

The principal design and operations witness for the Region was Mr. J.A. Hiraishi. He described the proposed system to the Board, and informed us that there would be 25% more liquid collected at Site D than at Site F. The Board learned that because of the similar areas of the two sites, the infiltrating water volumes would be approximately equal, but the increased efficiency of the underdrain at D, compared to that at F, would increase leachate collected by 5%, and there would be an additional 20% of clean groundwater collected from the surrounding area. The chemical load would be the same at both sites, but at Site F, 5% of the leachate and its chemical load would be lost, and no groundwater would be collected in the leachate underdrains.

Mr. Hiraishi stated that there could be leachate breakouts at Site D because of the impermeability of the cover material. This could lead ponding within levels, or 'lifts', of the landfill. To prevent this problem, he suggested that the daily cover material be 'scarified' before adding fresh waste. Daily cover is intended primarily to prevent

conditions conducive to fly larvae growth and development in waste, but it also serves other purposes such as litter and dust control.

Mr. Estrin, counsel for the Town of Milton, drew Mr. Hiraishi's attention to the fact that should fires could occur at Site D they might be difficult to extinguish because of the absence of a piped municipal water supply. The Board observed that fires could occur at either site, and in the case of a fire at Site F there are a large number of residences downwind of the site that would be adversely affected. In any event, water reservoirs for fire-fighting purposes have been planned for Site D.

Mr. Hiraishi also observed that all the advantages for Site D shown on pages 2 and 3 of Appendix "A" of exhibit H-14 are design and operation advantages, whereas only two of the seven Site F advantages are design and operation advantages and the seventh, 'sewer connection', would disappear when the final sewer connections are made at site D.

Mr. Hiraishi explained that a leachate sewer could be constructed to Milton, but the costs of landfill at Site D had been based on the most conservative (and most expensive) case of trucking leachate to the nearest discharge point.

Mr. Hiraishi had done a preliminary conceptual design for each site, to show how each would operate. These designs would have to be further refined in stages, proceeding through pre-design to final detailed design. He described the underdrains which would collect leachate in the hydraulic trap at Site D, and explained how landfilling would proceed from north to south at this site, filling Cell 1 to the north first, and filling that cell itself from the to east.

Mr. Crutcher, called by the City of Burlington, offered views on possible improvements to the design and operation of Site D. He suggested that the first layer of refuse should be material which does not contain high concentrations of fine particles. This would help to prevent clogging of the primary leachate collection system.

The 0.25% slope in the underdrain system at Site D is a minimum slope for leachate collection, but one which Mr. Hiraishi described as "a reasonable concept that we can live with".

The generation of leachate does not mean that leachate would have to be removed on a daily basis. There would be storage capacity on the landfill site, and leachate could be removed on working days. As shown in a letter signed by Mr. Hiraishi (exhibit H-273) it would cost about 3.87 million dollars for a sewer connection to Site D. This is considerably less than the estimated 10 million dollars for trucking leachate over the lifetime of the site.

In discussing 'trade-offs' at Site D, Mr. Hiraishi admitted that a trade-off was made in respect to visual impact. The experts on visual impact had recommended the landfill height be 15 meters above surrounding elevations, but the final design shows elevations ranging from 18 to 21 metres, to accommodate the anticipated volume of waste on the land area available. Mr. Hiraishi concluded that the best approximation of the extent to which the landform would protrude from the landscape it replaced, was about 17 meters.

To further reduce visual impact, it had been recommended that the side slopes be one foot rise for eight feet in the horizontal direction. But the slope had been made one foot in six in certain areas for capacity reasons. As well, there had to be a trade-off between the top surface topography. A flat topography was preferred for agriculture, but an undulating topography would offer visual improvement. The engineering design preferred the flatter topography, consistent with agricultural after use.

Using exhibit B-272, it was demonstrated to the Board that there may be alternative designs which could have the effect of increasing the protective layer of upper till beneath the landfill site whilst reducing the volume of earth to be moved, the volume of leftover till, and the cost. Such alternatives would have a beneficial side-effect of reducing leachate mounding within the base of the landfill. The Board became aware in the course of the Hearing that there could well be a number of design improvements based on the same general concept, which would have the effect of optimizing landfill construction and operation from many different perspectives at the same time.

There was considerable argument about whether or not this Board could consider design changes in the course of this Hearing. This Board finds that evidence concerning suggested improvements to the conceptual design is allowed. The concept of a hydraulic trap remains the same. There may be many ways to optimize the design to reduce the probability of leachate losses and improve the use of resources at the same time. To not allow such evidence would be to accord bliss to ignorance, and folly to wisdom.

In particular, Messrs. Crutcher and Mereu proposed a design which was intended to provide greater confidence that the hydraulic trap would drain leachate effectively from beneath the site, and ensure that the thickness of the relatively impermeable upper unweathered till was kept to the maximum possible. This latter aspect of their design was intended to inspire greater confidence in the primary natural contingency measure; namely, attenuation in the upper unweathered till.

Mr. Crutcher concluded that the Halton design allowed insufficient upper till thickness in places. There were deep cuts into the till for perforated pipe collection systems which reduced the effective thickness of the upper till in places to about 1 meter. Because the design parameter was to maintain the effective thickness at about 4 meters, the safety margin would be significantly reduced.

In their design, Messrs. Crutcher and Mereu considered three cells rather than the five proposed by the Region, and provided for French Drains as the primary hydraulic trap underdrains, to draw water from the centreline of each cell to both sides. These Drains would be about 20 meters apart, as compared to the Halton plan for perforated pipe on 30 meter centers, draining across each cell from one side to the other. Because their design would require drainage to both sides of the landfill, a system of forcemains would have to be installed to lift and pump the leachate around the landfill site to a central collecting point.

The plan put forward by these CRA consultants optimizes the trade-off between confidence in the hydraulic trap operation (as indicated by the difference between the groundwater level and the top of the leachate mound in the landfill), and confidence in the natural attenuation contingency (as determined by the thickness of the unweathered upper till). They evaluated 6 scenarios of which one was able to maintain a difference between groundwater levels and leachate mound levels of about 0.4 meters. This gave them confidence that the hydraulic trap would work. At the same time they were able to keep the thickness of the upper unweathered till at about 3 meters and deal with the excess soil problem.

These witnesses considered that the appropriate way to deal with the leachate transportation problem at Site D was by means of a dedicated sewer line. This line would be comprised mostly of a 200 mm gravity line along with portions which would be served by a 100 mm forcemain. Their design is quite similar in costs to that proposed by Halton, but it calls

for the immediate construction and operation of the dedicated sewer line, which presumably would be in place for many years after, and serve other needs. Such a decision would remove the need for leachate haulage truck traffic. There are environmental and social benefits associated with this option.

Mr. Crutcher explained that detailed design review should lead to modifications such as solid leachate transfer pipes, rather than perforated ones at depth. The use of such solid transfer pipes would mean that the effective thickness of the upper till could be kept to more than 3.3 meters. He felt that the drainage system at Site D could be cleaned regularly with either or both of rodding or jetting machines.

Mr. Crutcher explained that the alternative design details proposed by his company were intended to show the Board that steeper drainage slopes could be established at the landfill base elevation, while maintaining a till thickness of about 3 meters and a hydraulic trap head difference of 0.4 meters between the water level in the surrounding soil and the leachate mound build-up in the landfill. In his view these are the parameters which must be considered as one tries to optimize the overall system.

During cross-examination, Mr. Hiraishi acknowledged that he had no direct experience with a currently functioning engineered hydraulic trap. Given that society is just now exploring such concepts in favour of environmental preservation, the Board did not find this revelation suprising or particularly helpful. Persistent rejection of new attempts at improved design, in favour of old standards, is the antithesis of evolution.

Mr. Estrin, counsel for the Town of Milton, introduced exhibit **M-267** which dealt at length with the problem of clogging of underdrains, primarily at hazardous waste landfill sites.

Mr. Hiraishi agreed that the underdrain system could become clogged with time. A careful reading of exhibit **M-267** revealed, however, that underdrain systems for municipal, rather than hazardous, landfills appear to be working well. It was thus not convincing evidence to the Board that Site D will fail: rather, it supports the idea that a hydraulic trap properly installed, maintained and operated, could be a permanent solution for landfills in some glacial tills.

Mr. Hiraishi stated that exhibit **M-267** is not relevant, to the extent that agricultural drains described in that exhibit were generally not carefully installed and maintained, as would be

the case for underdrains in a landfill site. And Mr. Hodgson, counsel for the Region, drew Mr. Hiraishi's attention to sections of the exhibit which supported the success of such systems:

"The inspection of a section of LCS (leachate collection system) at two municipal landfills in Wisconsin indicated no evidence of clogging or deterioration after some 10 years of actual service."

M-267 Tab 4 p 20

Mr. Crutcher felt that although the French Drains and granular pads might become clogged, such blockages would be localized, and the resulting effect would not necessarily compromise the operation of the hydraulic trap at Site D. Mr. Crutcher suggested that it would be prudent to install many monitors in the first cell of Site D, and he offered the ten locations for his own design detail shown on exhibit B-860D-2R. One could apply the knowledge gained from these monitoring devices to the construction and operation of subsequent cells, said Mr. Crutcher.

In the event of a failure of the hydraulic trap, which was considered to include failure of the perforated pipe and/or the granular trenches (French Drains in which the pipes lie), then a contingency plan would be brought into play which would require the installation of perforated perimeter drains around the site. Witness Hiraishi said these drains would be pumped to prevent leachate migration outwards.

Mr. Hiraishi explained that one contingency measure which could be implemented in the event of extensive failure of a given cell at Site D, would be the installation of a purge well in the middle of the cell to remove leachate directly.

Mr. Crutcher felt that this Consolidated Hearings Board should order that the system design details be optimized and submitted to the Director of Approvals as a condition of approval for Site D.

Mr. Hiraishi agreed that the leachate collection system may have to be maintained for as much as 60 to 100 years after site closure, but he did not take into account evidence presented by witnesses Sobanski, Beechinor and Feenstra which showed a rapid decline in leachate

concentration with time. Thus, by the time Cell 5 is filled, the concentrations of chemicals from Cell 1 would have already dropped to about 1/6 of that expected at the beginning of their operation.

Mr. Crutcher also recommended a dedicated sewer line be constructed for leachate transportation as a condition of approval, but he was less certain about the need for a dedicated water supply line as a condition of approval. He considered the water supply matter to be more of a "peace of mind" issue for local residents, because he did not feel that concerns about threats to local water supplies were justified.

The conditions of approval will include protection of the drainage system while refuse is being deposited, and periodic inspections (at least seasonal), to assess the integrity of the cover material and to take mitigating measures if necessary. These conditions require examination or testing of leachate collection systems as waste is added to the site.

Under cross-examination from Mr. Tidball of the Ministry of the Environment, Mr. Hiraishi explained that the engineers preparing final designs recognize that detailed designs would have to be prepared and submitted to the Director of Approvals before the proponent could proceed with the undertaking. The 100 metre buffer zone at Site D already conforms to MOE guidelines. Mr. Hiraishi recognized that certificates of approval would have to be obtained whether the facility is operated by the Region or a private contractor. He also recognized that details would have to be provided on vermin control, seagull control, dust, noise and litter control. Mr. Hiraishi stated that final approval would be subject to negotiation between MOE, the proponent and others with respect to monitoring and contingency plans.

Mr. Crutcher explained how improvements in cell design could further reduce any risk of contamination at this site. His primary engineering enhancement concerned the shaping of the bottom of the site to maintain 0.5% slopes in all collection pipes and a minimum thickness of the upper till of 3.2 metres with an average thickness of 4.5 metres throughout. Under this configuration it would take about 120 years after an unremediated failure at the weakest point in the system, for the concentration of contaminants in the upper granular unit to reach 1/100th to 1/10th of the concentration in the leachate.

In the course of his cross-examination, Mr. Hiraishi explained that the quality of waste being deposited at either site is judged by spotters; often weigh scale operators. But he acknowledged that one cannot tell what is in a truck by looking at the outside. It is the 'nature' of the truck (for example a commercial waste hauler), rather than a visual inspection of the truck, which would trigger a more detailed investigation.

Mr. Hiraishi explained that the Regional Municipality of Halton already employs an independent environmental inspector who checks the nature of the waste, litter control measures, leachate collection and fencing, among other things. The conditions will deal with these matters. An effective on-site environmental inspector will help to reduce the likelihood of improper co-disposal of hazardous wastes.

Mr. Crutcher and others noted that the capacity of Site D could be fairly readily increased without any significant new environmental effects, whereas increases of Site F capacity could only be achieved at the risk of significant negative environmental effects. The Board assigned no weight to this factor, since it is not part of the application before us, and we will not prejudge the environmental processes and approvals twenty years down the road.

The Board is satisfied that the conceptual design for a hydraulic trap at Site D should contain and remove all leachate if the design details are carefully optimized. Careful and frequent monitoring should demonstrate the effectiveness of the design and, in the unlikely event of failure, contingency measures are straightforward, and are expected to be effective in preventing adverse impact in the surrounding environment. Details on all these matters will be spelled out in the 'Conditions' section of this Decision.

PLANNING ACT PROVISIONS

The Planning Act and the Environmental Assessment Act overlap in the area of environmental protection. In this Decision the Board considered the provisions of the Planning Act under subsections 2(a), 2(b), 2(h) and 2(i) along with subsections 1(c), 2 and 5(d) of the Environmental Assessment Act. In addition, the Board notes Section 70 of the Planning Act. Mr. Walker agreed with Mr. Leitch that the hearing by this Consolidated Hearings Board was part of the environmental assessment.

The Board noted that Site D is within a rural area and adjacent to the Parkway Belt West Plan. Conflicts are minimal with both these land uses. On the other hand, Site F is: in the Parkway Belt West Plan (minimal conflict); adjacent to an urban area; within 800 metres of the Niagara Escarpment and the zone of development regulation for the Niagara Escarpment; and, within 1,500 meters and directly upstream of the waterfront area. These relationships are shown by exhibit M-531. There could be serious conflicts between landfilling and these latter uses. From this perspective, Site F appeared to be a less desirable location overall.

When the Board examined the map of the Official Plan for the Regional Municipality of Halton (exhibit H-87), it was apparent that Site D does not conflict with any of the limited use special policy areas. Site F, in contrast, is near the junction of all four such areas, namely, the Parkway Belt, Niagara Escarpment, urban areas, and the waterfront area.

Mr. Walker took the Board through the environmental assessment Stages, and the preferences that emerged with respect to planning aspects. The main exhibit dealing with Stage 2A was exhibit H-10. This exhibit outlined many aspects of site selection, including present and proposed urban areas, biophysical effects, hydrogeological suitability, Parkway Belt Plan, and other related planning factors. In the opinion of the Board, these factors alone should have ruled out Site F as one of the final candidate sites, since it failed to be in a favourable position with respect to figures 1, 2, 4 and 7 of exhibit H-10.

The strongest of these restrictions from the planning perspective was that landfills should not be situated within an existing built-up area. Site F falls within the boundaries of built-up areas, lies at the foot of the Niagara Escarpment, and is certainly within the

Parkway Belt West Plan. This appears clearly in the last sentence on page 111 of exhibit H-10 and the final paragraph on page 114. In the Board's view, these considerations should have eliminated Site F in the preliminary stages.

But Mr. Walker stated that if he had been asked to assess the two sites only on the basis of land use planning, he would have given greater preference to Site F than currently appears in the comparative analysis. The reports from Mr. Walker's sub-contractors led to a narrowing of the preference as reported in exhibit H-14.

It is interesting to note that witness Walker did not use the same site plan area for his assessment as did witness Watson with respect to off-site adverse impacts. When the candidate site was reduced to the site plan area at Site D there was no consequent change in the site plan study area. This practice was not followed at Site F.

The City of Burlington called Mr. Ian MacNaughton as an expert witness in the planning area. He described his own evaluation framework, in which he developed his assessment of certain important aspects such as natural resources and hydrogeology. Mr. MacNaughton concluded that either site is acceptable if one took into account all factors and possibilities of engineered solutions.

In his view, the crucial criterion or "first test" is that of hydrogeologic suitability; the other categories were not nearly so significant. Mr. MacNaughton added the category of "capacity" for present and future landfill as an important social environment issue, although he did not use this as a crucial criterion in making his own decision between the two sites.

Counsel for National Sewer Pipe, Ms. Cronk, called another expert witness on planning, Mr. Max Bacon of the firm Proctor & Redfern. He had more than 20 years of experience in land use and social planning, and felt that these two aspects of planning are inextricably interwoven. In his view, planning should lead to the most appropriate use of a given parcel of land, given all matters which may have a bearing on that use; in short, optimal land use is that which allows the quiet enjoyment of adjacent uses. (The Board notes that such a definition of optimal land use evidently predates the chemical age when the long range transport of pollutants suggests that land uses in certain areas could affect people at great distance). Mr. Bacon felt that on the 'locational equity' issue, all areas of the region had received

waste in the past; thus it was fair for Burlington to receive wastes now, since much of the waste is generated by Burlington and its neighbouring municipalities in the southern portion of the region. He added that this would be the most efficient land use because of the existing infrastructure, and because the land form is economically suitable for landfill given the existing quarry and gully areas therein. The witness adhered to his sense of locational equity even though his attention was drawn to exhibit H-289, which showed that the waste centroid projected for the year 2001 would be only 2.3 miles south of Site D along Highway 25, but at a distance of some 7.5 miles from Site F.

Under cross-examination, Mr. Bacon acknowledged that his compatability chart (exhibit N-607) expresses everything in absolute "yes" or "no" terms rather than acknowledging that the degree of preference could be very slight on an item by item basis.

Through this witness the Board was able to appreciate the history of landfilling proposals at Site F, as Mr. Bacon and his firm had been engaged in dealing with the suitability of NSP lands for landfill since 1977. The Board is mindful of the fact that, in keeping with the Mineral Aggregate Resources Policy, people operating quarries are obliged to rehabilitate quarries when their uses are completed. Thus National Sewer Pipe, which has been operating a quarry in the vicinity of Site F for some 80 years, is obliged to fill in that quarry and rehabilitate the surface of the site to some use acceptable to the Ministry of Natural Resources. It is evident that the use of the site as a landfill would be another interim use, like aggregate resource extraction, which could lead ultimately to a finished, rehabilitated site.

Thus, a landfill on Site F offers significant economic opportunities for NSP. For one thing, in the absence of a landfill, NSP would have to assume the cost of some other form of rehabilitation. For another, NSP would lose the revenue that might be generated from landfill.

Under cross-examination from Mr. Tidball, Mr. Walker pointed out that he had not specifically incorporated MOE policy guidelines on a 500 meter buffer zone because these were Ministry guidelines and not government policy. These guidelines were exhibited as E-333. Although the witness thought that the policy was a good one, he felt that the application of constraints would be better conveyed in Joint Board conditions.

Mr. Stagl also acknowledged that the MOE policies regarding land use around landfills are directed to control measures which would prevent incompatible surrounding uses, and such policies were not intended for the site selection processes.

During cross-examination by Mr. Lederer, it became clear that witness Stagl, as others before him, had not considered the positive influence of traffic reductions in the vicinity of Site F when calculating the negative impact of increased traffic in the vicinity of Site D.

One facet of planning considered by the experts was the matter of compatibility with agricultural uses.

On the matter of whether or not the Official Plan of Milton allowed for a landfill on agricultural land, the Region's planning witness was of the view that subsection 4.1.4 of Milton's Official Plan allows for such use of agricultural land in a specified area. It is not a difficult matter, argued Mr. Walker, for this specific area designation to be moved from the Tremaine-Britannia site to the current Halton Site D.

With respect to the applicability of the Foodland Guidelines, Mr. Stagl stated that we could really only consider Site D for landfilling if we deem Site F to be unsuitable. He felt that a landfill at Site D is not "an appropriate use" based upon its own characteristics and he would thus not recommend a change in the current designation of lands in the vicinity.

Mr. Kentridge's evidence was also that Site D could only be selected in a fashion consistent with the Foodland Guidelines if the Board deems other sites to be unsuitable.

Mr. Zsadanyi stated that a public use could be applied in any zone, provided the necessary approvals are obtained. But he did not feel that landfill was a permitted public use in the agricultural zone, other than at the previously specified site.

Mr. Kauffman's assumptions about potential problems with agriculture was: "if you have a choice between an agricultural area and a non-agricultural area, you should choose the non-agricultural area".

Another aspect planners considered was the relationship of the sites to the Parkway Belt West Plan.

As Mr. Walker explored the effects of the Parkway Belt West Plan, he concluded that this Plan does allow the use of this belt for landfill purposes. Indeed, this fact was suggested in a letter from the Minister of Municipal Affairs.

During Ms. Cronk's cross-examination, the Board's attention was drawn to sections 5.5.1 and 5.5.2 of the Parkway Belt West Plan (exhibit H-319), which require that any change of uses in the Parkway Belt should preserve all natural features to the maximum extent possible. This clearly would not be possible for those areas which are not now part of the National Sewer Pipe Quarry license in Site F. It does raise the attention of the Board, however, to the possibility that in the quarried area at Site F there could be a second landfill for the receipt of inert rubble with subsequent rehabilitation for proper after use. As was the case for Site D at Milton in the agricultural use sense, landfill at Site F would be considered an interim use of the area consistent with the requirements of the Parkway Belt West Plan.

Section 6.2.3 of the Parkway Belt West Plan sets out some stringent conditions, in subsection Q, that would not be met by landfill. Thus, the regulations of the Parkway Belt West Plan would have to be amended.

Mr. Stagl referred to the compatibility between the use of Site F for a landfill and the complimentary uses in the Parkway Belt West Plan, and Mr. Bacon explained that he felt that the use of these lands for landfill was a "public use" under the Parkway Belt West Plan; thus, an amendment to that plan would not be required.

Planners gave the Board their opinions on the extent of compatibility of the sites with local By-laws.

Mr. Bacon felt that Site F conforms with the Burlington zoning by-law. It was his professional opinion, having reviewed many of the other studies on both Sites D and F, that Site F would be acceptable in all respects, and Site D would be unacceptable in all respects.

Under cross-examination from Mr. Lederer, Mr. Stagl confirmed that subsection (d) 3.9 of Part III of the Regional Municipality of Halton operation plan allows the use of lands less suited for landfill if such use was necessary to protect ground and surface waters elsewhere. The selection of Site D as the preferred site would conform with the official plan if the Board decided such action was necessary for the protection of water.

Mr. Walker noted that the Burlington Official Plan reflects the Regional Plan, which itself reflects the Parkway Belt West Plan; thus Site F is allowed for landfill under all three plans. The present situation then, echoes that of 1972 in that the landfill would be an interim non-urban use.

To compare the two sites, it should be noted that Burlington does have site plan control over Site F, but Milton does not have site plan control at Site D. Mr. Walker noted that Site D had been put under site plan control with respect to planning aspects, but not from the Environmental Assessment Act or Environmental Protection Act perspective. The witness felt that this could be done under the Consolidated Hearings Act by this Board.

The Foodland Guidelines, where it is left to local governments to apply the principles according to the value of the land, are less directive than other policies. In the vicinity of Milton, By-law #61-85 has come into place. Mr. Walker was of the view that this would allow the Regional Municipality of Halton and the City of Milton to place a landfill at Site D. This is because the by-law allows for a public use on agricultural lands and landfill is defined as one of the public uses. When the City of Milton was approached to delete their Tremaine-Britannia site for landfill and to amend their by-law to accept the new Site D as part of an agricultural zone in which a landfill would be accepted, the City responded to the request for the deletion, but did not agree to the amendment which would have allowed the new site.

Mr. Walker explained that the Town of Milton By-Law #61-85 (as amended) of July 2, 1985, if read in conjunction with the Official Plan, allows the establishment of a sanitary landfill in a specific area or specific areas in the agricultural zone of Milton. Such landfill is considered an interim use. Thus, the landfill could be established at Site D in Milton provided that, when finished, the land would be returned to agricultural use to the extent possible. An amendment to the Official Plan of Milton would be required for Site D, but such

an amendment would not be required for Site F, since the latter is already zoned for landfill and the Minister of Municipal Affairs has already communicated to the parties that he agrees with that interpretation.

The Town of Milton brought its own planner, Mr. Zsadanyi, to talk about his role in the development of the Milton Official Plan and the Town of Milton comprehensive zoning by-law. Mr. Zsadanyi noted that no landfill had been provided for in the new Milton plan, notwithstanding a 1977 requirement of the Ministry of Municipal Affairs and Housing to include such a site. This is found at page 82 of exhibit M-360, where the regional planner noted the omission. In response to a January 4, 1983, letter from the Ministry, the witness had inserted the site specific reference to a landfill which is now found at s.s. 4.1.4 of the Milton Official Plan (H-324). In Mr. Zsadanyi's opinion, a sanitary landfill is permitted only at the northwest corner of the Tremaine and Britannia intersection. This landfill is to be operated by the Regional Municipality of Halton to receive 1,814,000 metric tonnes of waste. In his opinion landfill is not to be permitted anywhere else.

Mr. Zsadanyi disagreed with Mr. Walker's understanding of the possible amendments. In Mr. Zsadanyi's words, Mr. Walker's approach was "weird and wonderful". Mr. Zsadanyi went on to describe the public use and the public services in the Milton by-laws. It was his evidence that a sanitary landfill could not fall under the description of public services.

In the opinion of the Board, Mr. Zsadanyi's evidence served to undermine the case of the Town of Milton against a site in that municipality. If Milton had been serious about attacking the proposed Site D, then it should have completed a detailed review of Site D for comparison with the former approved site at Tremaine and Britannia roads. This review would have explained the relative advantages and disadvantages of the two sites, leading to conclusions about whether or not Site D was actually inferior to the former Tremaine-Brittania site. Milton Council chose not to do this. Instead, the Council chose to remove any designation for a landfill site within the Town of Milton, somehow hoping that this would mean that any Halton landfill sites in the future would have to go to some other municipality. This is clearly not within the general intent for regional government in the Province of Ontario. It is also not consistent with wise environmental management in this province.

Under cross-examination by Mr. Lederer, Mr. Zsadanyi admitted that sanitary landfill is "a public service" in the broadest sense. The Town of Milton had been asked by the Regional Municipality of Halton to re-designate the Tremaine-Brittania site to agriculture and to establish the proposed Site D as a new landfill zone. Instead of following this instruction, Milton Town Council decided to re-designate the old site to agriculture while deferring consideration of the new Site D. In the opinion of Mr. Zsadanyi, exhibits **M-362**, **M-363** and **M-364** are meant to be taken collectively as Milton's detailed view on the two proposals. Given the evidence, the Board's impression is that the Town of Milton tried to "have its cake and eat it too" by removing its former landfill site and not putting in the replacement site. Mr. Zsadanyi argued that this didn't matter: even though the Town Council had instructed that the two actions be taken, the Town Planning staff chose to do neither. In short, they neither "down-designated" the former Site F nor "up-designated" the new Site D, if such is the proper terminology. Under cross-examination, Mr. Zsadanyi had to admit that a landfill at Site D, although discouraged by the Town of Milton, could be accommodated in Milton's Official Plan if it were to use the 4.1.4 type of language in the same way that the Tremaine-Brittania site had been handled in the Town of Milton's Official Plan.

The Board observed that an attempt by a municipality to zone all areas under its control so as to exclude or deny landfill works against the interests of regional municipal government. The Board cannot accept that the absence of specific zoning for landfill in municipalities comprising a given regional government is a reasonable basis for denial of the siting of a landfill. To accept this premise would be to offer faint hope to all municipalities of a false avenue to deny landfilling anywhere in the Province of Ontario.

Mr. Stagl acknowledged that it would be possible to amend the policy framework to accommodate the selection of Site D. His first choice would be to locate a landfill in an area which would not require changes to the policy framework. He stated that, from a planning perspective, the Tremaine-Brittania site (near current Site E) is now zoned for landfill on agricultural land, and that if Site D were selected in place of the Tremaine-Brittania site, then the net effect on agricultural lands in the vicinity of Milton would be negligible.

Mr. Kentridge disagreed with Mr. Stagl about the need for an amendment to the Milton Zoning By-Law. He felt that such an amendment is not required, and that the Milton Official Plan would not have to be amended. To quote from his exhibit (page 42 of **MR-546**): "a landfill

would be allowed if approved". Mr. Kentridge acknowledged that, although it might not be necessary to amend the Milton and Regional Municipality of Halton Official Plans and Zoning By-Laws, it would be prudent to do so if Site D were selected.

The planning experts offered their opinions on land use conflicts associated with the two sites.

Mr. Kentridge was an expert called by the Town of Milton to speak about the planning compatibility of the two sites. Because of the berms which are proposed along Highway 25, he chose as his study area anything close to, or within, a 500 meter band around the entire site at Site D, rather than the area to be landfilled. In contrast, at Site F he considered a 500 meter area around the landfilled space alone.

Mr. Kentridge explained that the two sites should not have been rated low on the social impact side, because people would have to move from Site D; in contrast, no residents would be forced to leave their homes at Site F. He also felt that the linking of agricultural aspects with the natural environment under the "biophysical" heading was not a reasonable combination. Each should have been assessed in its own right. In his view, however, there were not significant noise, dust or odour differences between the two sites.

Mr. Kauffman (for Milton area residents) explained that his principal work involved a compatibility assessment based on expected and potential impacts at the two sites. He explained that at Site D he found a low compatibility between landfill and rural residential uses. He also found low compatibility between landfill and agriculture and between landfill and owner-occupied agriculture. On the other hand, at Site F he found moderate compatibilities with rural residential recreational uses and moderate/high compatibility with industrial uses. In Mr. Kauffman's opinion, Site F had a high compatibility with public uses in the area.

He felt that rural residential conflicts are most important in the comparison between the two landfill sites, because residential use is full-time and non-optional whereas recreational uses are part-time and optional.

Under cross-examination from Mr. Lederer, Mr. Kauffman acknowledged that he had not done landfill work before and that he did not rely on the Regional Municipality of Halton's work

on traffic, air quality, hydrogeology, biophysical impacts or litter. Because of this he was unable to offer an opinion as to whether or not the Region's work was acceptable. This witness acknowledged that he used the MOE guidelines in an absolute sense, to assign impact within the 500 meter distance from Site D and Site F, rather than in a qualitative, graded sense which would take account the extent to which properties were within or beyond that line.

The Board had some difficulty with Mr. Bacon's conclusion that there would be a potential surface water impact at D but no such impact at F. The evidence suggested that the opposite should be the case. Similarly, the Board challenged the logic of Mr Bacon's conclusion that a landfill is unquestionably incompatible with surrounding agricultural uses at Site D even with the buffer in place, but it is, in contrast, compatible with recreational uses around Site F without a buffer there.

It became clear during the cross-examination of Mr. Bacon that Proctor & Redfern's studies on the suitability of Site F were based on earlier NSP proposals which considered a much smaller area, operated for a shorter period of time. This meant that many of the studies' conclusions with respect to visual impact, noise impact, traffic impact, dust and odour impact, and hydrogeological impact would have to be amended to accommodate the larger landfill proposal now before the Board. This fact did not change Mr. Bacon's opinion on the suitability of the new proposal; he continued to believe that, essentially, the expanded facility was as suitable as the original one.

Mr. Walker explained that he did not think that a landfill at Site F would have any effect on the future development of adjacent lands. But the Board's attention was drawn to a proposal by Boehringer & Ingelheim (Canada) (exhibit B-350) to develop lands to the east of the site. This proposal was withdrawn after the proponent was notified of the potential landfill site by Regional Officials.

We note that the correspondence between the Regional Municipality of Halton and Boehringer & Ingelheim warns the industry to be aware that "there may be some degree of nuisance despite on-site mitigation measures" related to the proposed landfill. This observation by Regional Officials obviously conflicts with the evidence presented by Dr. Schiff earlier, in which she suggested that there would be no impact on nearby industry.

Mr. Walker explained that he had not assessed possible alternative uses of the land, or the value of those uses, in the vicinity of Site F. As recently as August, 1987, a proposal was made for a subdivision and associated industrial/commercial uses which would put another 1,605 persons (820 residential and 785 industrial/commercial) into the study area. These people would certainly be within the area of social impact defined by Map 3 of exhibit H-37.

Similarly, Mr. Walker had assumed no impact for commercial or industrial uses right next to the landfill in the area between the landfill and Highway 403 to the south. This is clearly in conflict with the assumption of impact in the vicinity of Site D, where it was stated that residences and commercial users a considerable distance away from Site D would be affected by landfill activities in the area.

Mr. MacNaughton felt that alternative uses of the Site F lands had not been included as an evaluation factor in comparing Sites F and D. He thought that they should have been, since prestige industrial development, which could take place without jeopardizing the environmentally sensitive character at Site F, would be a good alternative land use.

Mr. Stagl introduced a table in his principal exhibit (M-529) in which he described the extent to which the uses on lands adjacent to the landfill were compatible with landfilling. He described these first in the sense of the policy framework and subsequently in terms of physical impacts on adjacent uses. Thus, agriculture is incompatible with an adjacent landfill in the policy sense, but it is not necessarily incompatible in a practical and operational sense. Similarly, Bayview Park may be a compatible use adjacent to Site F in a policy sense, but may not be as desirable as parkland at the personal level.

Mr. Stagl acknowledged that, in the absence of a landfill at Site F, there could well be residential development at Tyandaga (east of the Burlington to Quelp hydro transmission line), a residential development east of King Road, industrial uses south of Highway 403, residential and industrial uses south of the CNR tracks, and some industrial development immediately south of the site but north of Highway 403. If Site F were developed, it is clear that some if not all of these developments in the vicinity of Site F would be impeded, or prohibited.

Mr. MacNaughton was most offended from a planning perspective by the failure of the Regional Municipality of Halton to eliminate Site F under the environmentally sensitive area criteria in the early going. In addition, he felt that the failure to compare the agricultural resource at Site D with the mineral resource at Site F was a serious oversight.

Mr. Kentridge argued that there should be no conflicts with the natural environment from the biophysical perspective, because Site F was adjacent to natural areas at the present time and these areas constitute an alternative reserve of natural resources. This argument is weakened by the observation that the larger area from Waterdown Road to King Road constitutes a sizeable natural area of value to nearby urban residents. Landfilling in the middle of this area will minimize the extensiveness, and probably the value, of this natural area.

Although Mr. Kentridge commented on the unfairness of comparing population impacts at the Phase II, Stage 2C level of the environmental assessment, he had not considered the comparison at the Technical Studies stage, which clearly identified the differences between the two sites. He had to acknowledge that a number of individuals chose to establish businesses in the vicinity of Site D, knowing full well that the site was ranked as a potential landfill site.

Part of Mr. Bacon's argument in favour of Site F was that the rare plant species which had earlier been identified at Site F were no longer unique to that area, as they were found elsewhere in Ontario. This is too arbitrary, as it suggests that if one can identify a rare plant species elsewhere in Ontario, then it can be eradicated in the subject area. This, of course, ignores the desirability of preserving diverse flora and fauna as close as possible to populations that might enjoy such natural diversity.

The Board noted during Mr. MacNaughton's cross-examination that of the 37 environmentally sensitive areas in Halton, only 6 met more of the ESA criteria than did Site F which met 5 of the 9 criteria, including the crucial criterion #6 (these criteria are found at page 14 of exhibit B-883).

Mr. MacNaughton did not trade-off the social environment and natural environment factors, but he did realize that they lead to opposite preferences; there was a strong preference for Site F from the social environment perspective, and a strong preference for Site D from a natural environment perspective. He felt the cultural environment was not significant at either site.

Planning experts also provided opinions on the importance of the groundwater resource.

The overall driving force in the comparative study is perhaps best revealed on the 62nd page of exhibit H-14. Mr. Sobanski writes: "Site F is better from the point-of-view of public health and safety because there are no groundwater and surface water users. Therefore, we favour Site F over Site D". If this approach is valid, then the Board must consider the resulting "inevitably" of landfill siting. If landfills are only to be placed where no one has to depend on groundwater for immediate use, it may be the case that all landfills would have to be located in cities. If leachate lost to the wider environment is of no concern because there are no primary groundwater users nearby, then all landfills would be in cities and all groundwater beneath the cities would gradually become contaminated with anthropogenic substances, whether or not such groundwaters are already substandard because of natural concentrations of ionic constituents.

During Mr. Walker's cross-examination by Mr. McQuaid, the Board's attention was drawn to the quote on the 70th page of exhibit H-14. This quote explains that the Site F impact on groundwater would be unimportant because "there are no users downgradient of the site who need to be dependent on groundwater". Mr. Kentridge appeared to support this view. In this line of reasoning, whether or not downgradient residents choose to be dependent on groundwater is of little concern. It is clear that the environment would be affected by the leachate. It is suggested, instead, that it is of no concern if groundwater is contaminated by leachate when residents immediately downgradient can be provided with alternative water supplies.

In the course of Mr. MacNaughton's cross-examination, the matter of "well users dependent on groundwater" was also raised. In response to Mr. Griffith's questions, Mr. MacNaughton acknowledged that well users at Site F could easily switch to municipal water supplies if they chose to do so. Presumably, such persons do not do so now for personal, and probably economic, reasons. The same argument could be applied, but at significantly different cost, to well users at site D. These users could truck in water, buy bottled water, or build a pipeline now if they chose to do so. This issue might be more economic than philosophical.

Presumably Site D residents do not presently seek piped water for personal and economic reasons. The issue is one of scale and timing. There should be no contaminant egress at Site D; on the other hand, in the event that contaminant egress should occur sometime in the

next century, nearby residents may also "not have to be dependent upon groundwater resources". What is clear is that there will be contaminant egress from Site F with or without a liner.

Under cross-examination from counsel for the Regional Municipality of Halton, Mr. Kentridge made it clear that his essential point was that, in the event of system failure without the application or success of contingency countermeasures, there could be a risk to adjacent water supplies at Site D. In this witness' opinion, it is a clear "on-off" situation. The absence of "dependent" well users at Site F led to an "acceptable" situation. Their presence in the vicinity of Site D produced an "unacceptable" situation.

The Board does not agree with the oversimplification expressed by many planners on this issue.

Although groundwater quantity was expressed in the comparative analysis as being of a moderate concern in the vicinity of Site D, Mr. Walker acknowledged that if there were no landfill at this site, then private residences could be constructed, the combined wells of which could have a greater effect on groundwater than the hydraulic.

Mr. Walker felt that it would not be good planning to conceive of, or prepare for, reserve waste capacity at either landfill site. Thus, he would not strengthen a preference for either site based on assumptions of future capacities for additional waste.

As this Joint Board agrees to the land use amendments, we implicitly agree to the corresponding zoning amendments. Therefore, this is not a serious matter at issue.

The Board noted that the short-term "losses" at both sites are questionable losses. For example, at Site D the "loss" of the airport repair facility and the loss of private households would ultimately lead to a gain in agricultural land; this would be consistent with the agricultural policies of Ontario. Similarly, at Site F, the "loss" of the informal (trespassing) dirt bike track at Site F may be a gain for the community, since neither the owner of the land nor the surrounding community wish to see the land used for this purpose.

Mr. MacNaughton confirmed for the Board that there were no definite means of protection for aspects such as archaeology, heritage, agriculture or environmentally sensitive areas in the event the landfill was not developed at either site. These matters may not have been given great weight individually, but collectively they were taken into account.

The Board was reminded through Mr. MacNaughton's evidence that both sites rely on energy-from-waste systems coming on-stream by the eighth year of operation, if either landfill is to survive its designed 20 year life span. Therefore, one condition of approval is that the Regional Municipality proceed with urgency to secure the necessary approvals for an energy from waste facility.

An issue the Board considered was whether or not the analysis presented in exhibit H-14 held firm in light of all of the evidence. When the Board came to the comparative analysis of the two sites, it was in possession of much more thorough evidence which led to different conclusions than the Region was able to come to, based on the information available to it in 1986. As part of the rationale for selecting Site F, it was suggested to Mr. Walker by Ms. Cronk that putting the landfill in the vicinity of Milton would be like introducing a "skunk at a garden party". The Board cannot accept this rationale as the determinant in landfill site selection, for to do so would be to presuppose that future landfills can only be established adjacent to existing landfills, since this is the only way in which they would not constitute a new and disruptive factor.

MUNICIPAL ACT (DEBENTURES) AND EXPROPRIATION ACT CONSIDERATIONS

The Region's expert witnesses on economics were Mr. Rinaldo and Mr. Watson. Mr. Watson explained how the Region had examined broad-scale costs for hypothetical scenarios, using existing component studies to the extent possible (for example, Ministry of the Environment studies). After assessing various options for waste disposal, he concluded that landfilling was an economical form of waste disposal for Halton's present needs.

During cross-examination it became clear that certain assumptions about anticipated costs could shift the balance in favour of Site D, and other assumptions about future costs could shift the economic balance in favour of Site F. The Board considered what costs should be reasonably anticipated when arriving at a conclusion about the economic impact of either site.

The City of Burlington called an expert witness, Mr. Stamm, who had developed a computer model which could take a number of inputs and transform them into final landfill site costs. His model was capable of being quickly updated as the input data changed. In preparing his evidence, Mr. Stamm made assumptions about what would have to be done to make the two sites equal from the perspective of social impact and other environmental matters. He then calculated the costs of creating this assumed equality, and suggested to the Board that all other factors then being equal, the least costly site should be the preferred site.

Mr. Stamm introduced the concept of a landfill site's "sufficiency standard". This standard may be established by authorities, but could be made more stringent to minimize risk associated with a given aspect of a landfill, if society wishes to assign a higher value to certain aspects of a given site. Achieving the higher sufficiency standard then requires additional expenditure. When all standards have been met one can compare the costs required to achieve these standards, and use the costs as the subsequent sole determining factor for site selection.

Mr. O'Brien, on the other hand, suggested economic conclusions based upon a critique of the work done on behalf of the Region by Mr. Watson, and found that the Region had "double accounted" on a number of items.

Mr. Watson explained that the Region's first priority items were the present value of Regional costs, Regional debt considerations, and tipping fee considerations. The second priority item was the overall present value, the third item was the off-site property value and the last item was made up of municipal haul costs, private haul costs, and the municipal distribution of haul costs. Later in his cross-examination, Mr. Watson explained that he did not assign weightings to these priorities, since the application of reason could result in the elimination of certain minor disadvantages. For example, he said that a \$100,000 difference in municipal haul costs could be dealt with by transfers within the Regional Municipality of Halton.

There was considerable discussion about the variation in waste quantities and trucking routes to deliver waste to either landfill site. This discussion included anticipated growth in the Region, but did not fully take account of the zones in which the growth was expected. Because growth in the northern zones of Burlington, and in the north and northwestern zones of Oakville, is likely to be more rapid than growth elsewhere in these municipalities, waste generation is likely to shift towards Site D, and away from Site F. Mr. Watson advised however, that shifts in population growth would not, in his view, have any significant impact on the overall haul costs.

Mr. Stamm had used his "medium population projection" as input for his computer model. It was this projection which included rapid growth in sections of Oakville, to a greater extent than predicted by experts for the Regional Municipality of Halton. This witness had also used Mr. Blay's estimates for travel times, and costs associated with these travel times, rather than Mr. MacLeod's estimates for the Region.

It appeared that the haul costs varied considerably between October, 1983 and present time. In October, 1983, they favoured Site D by 18%, by April, 1984, they favoured Site D by 27% or \$1.37/tonne. By June of 1985, the differences had narrowed to only 2%, and by January, 1987, it was estimated that the difference was only 1.4% in favour of Site D. Messrs. Watson and Rinaldo explained that at Phase 2A and 2B the assumption was made that waste haul costs should be based on pick-up from 4 waste centroids, one each in Burlington, Oakville, Milton and Halton Hills. They then calculated how much it would cost to haul these wastes to each of 17 (of the original 30) potential zones for disposal in Halton. On this basis, it was concluded that Zone 19, near the present Site D, would be far more economical than Zone 6, near the present Site F. In fact, Site D would have ranked first, because it was nearest to the

overall regional waste centroid, whereas Site F would have ranked eighth out the 17 possible sites. When the economists went to Stage 2C however, they actually calculated the waste generated, trip times, and kilometers from the point of generation to the final sites. This was a much more precise measurement, which reflected the fact that much of the waste in the Regional Municipality of Halton is generated in Burlington, and is therefore closer to the Burlington site. Thus the favourable cost differential which appeared in the earlier estimates was compensated for by considering the quantity of waste generated zone-by-zone throughout the region.

It became clear in the cross-examination of Messrs. Watson and Rinaldo that, although the energy from waste option would reduce the total waste delivered to the landfill to about 63% of that projected beyond 1996, there would be only a 24% effect on the site operating costs and no discernable effect on the site capital costs.

Mr. Rinaldo assured the Board that the Regional Municipality of Halton was in very sound financial condition, with a triple A Canadian bond rating. He explained that the Region would be able to retire long standing debt and accommodate new programmes without increasing debts. He further explained that the Region had applied for debentures of 12.8 million dollars on the basis that if Site F were selected, then all the money would have to be required up front (as opposed to 9.5 million dollars for Site D); if Site D is chosen, then there will be an adequate provision for securing the necessary funds, since it is the cheaper site from the initial capital cost perspective.

Under cross-examination from Mr. Tidball, Messrs. Rinaldo and Watson acknowledged that they had set aside adequate funds in the contingency portion of their budget to deal with items such as leachate springs which might flow into surface waters. It was their view that the regional government could respond quickly to environmental emergencies.

Further, in cross-examination from Mr. Leitch, Mr. Rinaldo acknowledged that a 5 million dollar increase in the upfront costs would lead to a \$2.01 increase in average tax, resulting from a 14.4 to 14.9% debt capacity increase, and a corresponding tipping fee increase of \$3.90. Similarly, he explained that a 10 million dollar increase in the cost would cause a \$4.02 increase in average household tax, with the debt capacity possibly increased by as much as 15.4% and a tipping fee of \$7.94. These costs are not additive but rather consequent;

when the debt load is increased, it is paid for by the increase in tipping fees, which is in turn paid for by the average householders' tax increase for solid waste management.

On the debenture issue, Mr. Rinaldo explained that added expenses of less than 5 million dollars at present value were not felt to be insurmountable, but items which might add 10 million dollars or more to the cost of the landfill option could have significant effects on other Regional programs.

But Messrs. Watson and Rinaldo allowed that even a 10 million dollar extra cost for either landfill site, would not add unbearably to the individual tax burden in the regional municipality. It would marginally exceed the inflation rate for a short time. These witnesses added that the undertaking as defined does not include allowances for a dedicated sewer line at Site D. The Board concludes, however, that in the event that the Region finds subsequently that it is more economical to have a dedicated sewer line, that it would be in their interests to construct one.

Mr. Watson advised the Board that factors which made Site D more expensive than Site F included the increased assessment of likely off-site property losses (losses to be suffered by property owners, rather than the Regional Municipality), and leachate hauling at Site D. On the other hand, there was the loss of a portion of Ontario's shale resource at Site F, and the mitigation of operating costs at Site D as a result of the construction of a dedicated sewer line to receive Site D leachate.

A factor of some concern is that the acquisition of land in the vicinity of Site D includes the acquisition of 120 acres to be purchased but not used for the landfill. The cost to purchase this land is approximately 1/3 of the total land acquisition cost at Site D. Despite the significant cost, the Region's economists assigned a zero value to these lands, leaving the Board with the impression that they would stand idle as some additional buffer. Thus the cost to purchase would constitute a total out-of-pocket cost for which no revenues would be subsequently realized. This matter has been properly accommodated in Schedule C, attached to the "Conditions" section of this Decision.

In addition, the Region's economists had provided for a 1 million dollar real estate contingency fund for nearest neighbours at Site D, in anticipation that such neighbours would be adversely affected by landfill construction or operation.

With respect to Site D, Mr. O'Brien noted that the antique aircraft restoration business run by Mr. Wat Martin is not a commercial use recognized under the by-laws of the Town of Milton, and may not have to be compensated on that basis. He also noted that properties 9, 10, 11 and 12 in his exhibit would be better dealt with either by a partial taking of approximately 10% of the subject properties, (Parts 12, 13, 14 and 15 of Schedule C in the "Conditions" section of this Decision), or by taking all of the properties, with subsequent consolidation and resale of a single parcel of about 100 acres, being the parts of those properties not required for the landfill. Mr. O'Brien noted that if property 7 was taken in part from Wombat Investments, then the remaining part would be inaccessible without crossing another property.

During cross-examination of Mr. Watson by Mr. McQuaid, it appeared that Mr. Watson had simply postulated off-site property value declines without having done serious calculations. When he was asked to do those calculations or to explain them to the Board, the result was quite unsatisfactory, in terms of any better understanding of the likely off-site property effects in the vicinity of Site D.

On the issue of property values, the question of equivalent treatment arose again, as it had during the Social Impact and Visual Impact evidence. The assumption was made that all of the thirty nearest properties would be affected more or less to the same extent, and a similar allowance was made for each of them. One of these properties would be just 150 m from the active face of the landfill whereas another property would be on the opposite side of a major highway, on a distant crossroad some 1.3 km away. There was no allowance for different effects on different properties.

Mr. O'Brien noted that injurious affection on properties not acquired may apply to reductions in market value and/or personal and business damages resulting from the construction and not the use of the works. It was his opinion that, in the case of a landfill where there was an on-going construction activity (namely the construction of the mound itself), the law was unclear as to whether or not the filling of the mound to final grade was construction or operation.

When he evaluated other landfill sites and injurious affection claims adjacent to them, he concluded that the most comparable situation to Site D was the Beare Road landfill site. He observed that "the presence of an active landfill site did not have any effect on the building of custom homes" close to that site.

Also, Mr. O'Brien stated that at the Beare site there was little injurious affection to nearby property owners. He felt that abutting property losses were less than 20%, and those within a quarter of a mile of the site could have suffered losses of 10-15%. Of those who claimed injurious affection, only 50% of owners were successful in their claim.

It was established by Mr. Watson that the legal costs associated with expected real estate devaluation challenges at Site D would undoubtedly be higher than those at Site F. In the opinion of this witness, Site D expenses could exceed those at Site F by as much as \$450,000.

In response to questions from the Board, Mr. O'Brien acknowledged that had the owners of the major blocks of land at Site D asked for permission to establish a landfill in that area at the same time and in the same fashion as NSP had done, then the two sites would be equal, in the sense that the Region would be faced with expropriation costs at both sites which might reflect "highest and best use" as a landfill.

Under cross-examination, it became clear that Mr. O'Brien's estimates with respect to Site D were similar to those of the Region's expert. In essence, the Region had been quite prudent in its planning approach regarding the acquisition of lands at Site D. Differences between Mr. Watson and Mr. O'Brien for expropriated values at Site D related largely to different assumptions about total takings versus partial takings.

If a liner were required at Site D, it was estimated by Mr. Watson that the present value cost of a liner would be 5.7 million dollars.

The economic value of the shale resource which might be lost at Site F was said to be of no significance because the decline in new households in Ontario would lead ultimately to a decline in new housing starts, and thus to a decline in shale requirements. In any event, the shale resource at Site F was a small fraction of that available in southern Ontario, and an even smaller fraction of the total Ontario shale resources.

With respect to Site F, Mr. Watson alerted the Board to a distressing conundrum related to the basis for purchase of the lands. If they were purchased on the basis of non-landfill use, then the cost would be about 2 million dollars; but if they were purchased on the basis of the "highest and best use" for those lands as a landfill, then the cost could be much higher. Landfill use is a use for which the present owner, National Sewer Pipe Limited,

has already applied. Under this scenario, the value of Site value would be somewhat greater than 6 million dollars.

During Mr. O'Brien's cross-examination it became clear that his estimate for the highest possible expropriation cost at Site F (approximately \$27 million) was very much on the high side. Nevertheless, it is possible that the expropriation costs could well have to take account of use as a landfill, and could thus be much higher than the 2 million dollars projected by the economic consultant for the Region.

The conundrum is that if Site F were approved for landfill use and the necessary environmental and other municipal board approvals included recognition of the low cost assumed, then presumably the present owner would also have been able to secure approvals to use those same lands for landfill as well. This means that the land value as a landfill could be six or seven million dollars rather than two million. If the Board had to consider this latter acquisition cost, Site F might not have been preferred because of its high cost.

The Board noted that, during cross-examination by Ms. Vigod, the witness panel of Messrs. Watson and Rinaldo assumed no off-site real estate losses at Site F, notwithstanding complaints from residents in the area. This is in contrast to their assumption of significant off-site real estate losses in the vicinity of Site D.

The net present value cost of installing a liner at Site F, should one be required, was estimated by Mr. Watson to be in the order of 5.1 million dollars. The use of clay till already on-site for the liner could reduce that cost somewhat. The Board found an assumption of four million dollars for such a liner in the reasonable range of costs. In his analysis, Mr. Stamm stated that the clay liner at Site F was the single largest construction cost difference.

Mr. O'Brien's evidence was that notwithstanding subsection 14 (4)(a) of the Expropriations Act, which says that no account is to be taken of "the special use to which the expropriating authority will put the land", one could not ignore the special use to which the present owners intended to put the land. This Joint Board, had it decided landfilling is appropriate land use at Site F, would have indicated that operation of a landfill on the site by anyone, whether the Region or NSP, might be the highest and best use of the land. Indeed, in her

final submissions, Ms. Cronk on behalf of National Sewer Pipe Investments Limited, indicated that this would be the approach her client would take.

The essential aspect of Mr. O'Brien's evidence in this regard, had to do with the fact that NSP had applied in good faith for the development of a landfill on the site and, in response to requests by different levels of government, had agreed not to proceed with the necessary amendment because of anticipated actions under the Environmental Assessment Act. NSP had continued to pursue the matter to the best of its ability while at the same time cooperating with the various levels of government concerned.

Under cross-examination from Ms. Cronk, Mr. Watson established that if the regional government were to extract and sell the shale resource at "fire sale prices", then it would find itself in direct and potentially damaging conflict with local industries (National Sewer Pipe).

Mr. Watson told the Board that if Site F were selected, then a transfer station would have to be maintained in the northern part of the Regional Municipality of Halton, with a net cost calculated as 1.7 million dollars.

Mr. O'Brien gave evidence that the cost to the Region for Site F land acquisition could range from \$1,035,300 to \$27,395,300, depending on whether or not the highest and best use of the property is a landfill site, and is calculated on the basis of tipping fees anticipated in the vicinity. He had two intermediate values for costs under section 14 of the Expropriations Act, one being \$7,195,300 based on National Sewer Pipe's original landfill proposal, and the second being \$9,895,300 based on the revised landfill application by NSP.

Mr. O'Brien's estimate at Site F confirmed that the Region had in fact been quite prudent with respect to expropriation costs for the assumption of highest and best use of NSP lands as limited commercial development lands, in recognition of the Parkway Belt West Plan.

The main exhibit prepared by Mr. Watson was exhibit H-45, wherein the specifics of haul costs, capital costs and operating costs were set out along with possible off-site property costs. For Site D the present value capital costs were around 12 million and the operating costs around 26 million, for a total site cost of 38 million. When added to the area municipal haul costs of 10 million and the private sector costs of 15 million, the total came to about 63

million dollars. This would mean that the average householder in the Regional Municipality of Halton would be paying something in the order \$16.50 per year for waste handling and disposal. At Site F the comparable costs would be 15 million capital and 22 million for operating, plus 10.6 million for municipal haul costs and 13.2 million for private sector haul costs, giving a total of about 61 million dollars. It is evident that the costs estimated for each site were, in the opinion of Messrs. Watson and Rinaldo, approximately equal (overall Site D was approximately 2.9% more expensive than Site F).

Under cross-examination of these witnesses by Mr. McQuaid, it was brought to the Board's attention that at the end of Phase 2, Stage 2C (as illustrated by table 5 in exhibit H-44), the cash flow present value for Site D was 51.986 million whereas, the comparable cash flow for Site F was 60.773 million. The Board finds that this factor, along with other selection criteria, such as hydrogeology, should have discouraged the further consideration of Site F after stage 2C of the assessment, since the economics of the situation favoured Site D quite substantially, as did certain other critical factors. This is of concern when viewed in the context of the findings of subsequent technical and economic studies, where the distinction between the two sites appeared to narrow dramatically, making Site F appear more competitive because of economic considerations than it had seemed in the earlier stages.

In this Board's view, the effect of all the changes to site costs can be represented by the following table:

POTENTIAL CHANGES IN SITE COST (x \$1,000,000)

Item	Site D	Site F
Sewer	-1.2	
Land	-0.9	
Liner		+ 5.0
Transfer Station		+ 1.7
TOTALS	-2.1	+ 6.7
Site Cost after	62.9	61.1
Technical Studies		
FINAL TOTALS	<u>60.8</u>	<u>67.8</u>

The witness panel of Messrs. Watson and Rinaldo was unable to explain clearly how the major shift had occurred between Stage 2C of the environmental assessment and the technical studies stage. At Stage 2C, Site D was favoured over Site F by 7.8 million dollars. By the time the technical studies were completed, the costs assumed for Site D had increased by 12 million dollars, while the cost of Site F had increased by only 2.4 million. Site F was then favoured by about 1.8 million dollars. The Board was concerned that this witness panel was unable to explain this shift satisfactorily.

Under re-examination by Mr. Lederer, Mr. Watson pointed out that although a landfill at Site F would not reduce property values as it would for the surrounding property at Site D, the absence of a landfill would allow property values in the vicinity of Site F to return to their pre-landfill levels. The question of property value effects, therefore, is one which should relate to the extent to which the restoration of property values at the Burlington site are offset by the loss of property value at the Milton site. In this respect the property value question is quite comparable to the traffic question, where the reduction of traffic to and from Site F in Burlington should result in some reductions of threats to public safety, which should counterbalance to some extent the perceived increase of such threats in the vicinity of Site D when considered in terms of the net effect on the people of the Region overall.

At the end of the economic evidence, cross-examination and re-examination, the Board was left with some general conclusions. It would appear that either site is affordable for the Regional Municipality of Halton and its municipalities. It also appears that significant modifications could be undertaken at either site without creating an unconscionable burden for the residents of this regional municipality. The Board was left without adequate evidence to explain the significant changes in costs between Stage 2C in 1985, and the Technical Studies stage in 1986.

The Board also noted that between the Technical Studies stage and the Economic Update stage, the range of costs for Site F broadened, both above and below the amount assigned during the technical study, whereas the Site D costs increased over a very narrow range. The Board concludes that at Stage 2A the difference between the two sites was in the order of 3.4 million dollars based on haulage costs (differences of \$6.11/tonne for F and \$5.30/tonne for D, for 4.2 million tonnes). By Stage 2B, using the same arithmetic, this difference had grown to 4.2 million dollars, again in favour of Site D. By Stage 2C the difference had

DECISION

The Decision of the Joint Board is as follows:

1. The Environmental Assessment submitted by the proponent is amended pursuant to section 12 of the Environmental Assessment Act, **R.S.O. 1980**, c.140 to include all the evidence presented at the Hearing. The environmental assessment so amended is accepted pursuant to the said section of the Act.
2. The Joint Board does not grant approval to proceed with landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington, but does grant approval to proceed with landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton subject to the conditions set out in the section forming part of this Decision and entitled "Conditions", pursuant to section 38 of the Environmental Protection Act, **R.S.O. 1980**, c.141, s.38, and directs the Approvals Director to issue a Certificate of Approval in accordance with those conditions.
3. Pursuant to Section 40(12) of the Planning Act, **S.O. 1983**, c.1, s. 40, the Joint Board hereby approves the site plans and drawings set out in exhibit **H-41** as amended by the conditions set out in the section forming part of this Decision and entitled "Conditions".
4. The Joint Board hereby amends the Official Plan for the Town of Milton pursuant to Section 22(1) of the Planning Act, **1983**, to redesignate a parcel of land comprising Part Lots 3 and 4, Concession 2 N.S. in the Town of Milton from "Agriculture" and "Conservation and Hazard Lands" to permit the construction, operation and maintenance of a landfill site.
5. The Joint Board further amends the Official Plan for the Town of Milton to provide to the extent possible for the agricultural after use of the site in accordance with Schedule A attached to the "Conditions" section of this Decision and forming part thereof.

6. The Joint Board hereby amends By-law 61-85 of the Town of Milton pursuant to section 34(11) of the Planning Act, 1983, to rezone the lands situated at Lot 3 and part of Lot 4, Concession 2 N.S., in the Town of Milton from "Agriculture" to permit a regional sanitary landfill site and ancillary uses, such amendment to be in accordance with Schedule B attached to the "Conditions" section of this Decision and forming part thereof.
7. Pursuant to Section 64 of the Ontario Municipal Board Act, R.S.O. 1980, c.347, as amended, the Joint Board approves the application of the Regional Municipality of Halton for:
 - a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic meters of waste in the Regional Municipality of Halton by landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton at an estimated cost of \$12,775,000.00, and the borrowing of money by way of temporary advances not exceeding in the aggregate such estimated cost pending the sale of debentures, and
 - b) the issuance of necessary debentures to a maximum of \$12,775,000.00 for a term not to exceed fifteen years.
8. Pursuant to Section 193(5) and Paragraph 84 of Section 210 of the Municipal Act, R.S.O. 1980, c.302, Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1980, c.148 and Section 137 of the Regional Municipality of Halton Act, R.S.O. 1980, c.436, as amended, the Joint Board approves the acquisition of the lands as set out in Schedule C for constructing, operating and maintaining a landfill to contain 7.96 million cubic meters of waste in the Regional Municipality of Halton.

ENVIRONMENTAL ASSESSMENT PROCESS CONSIDERATIONS

Walking through the complex minefield of dumpsite selection with the Environmental Assessment Act as a guide was difficult enough; doing so while in the crossfire of rival communities only added to the tension. Mr. Walker, the principal consultant to the Region of Halton, gave quiet testimony to the toll of this tension when he said:

"I don't think the victory has been worth
all the vitriolic acid that's been spilled
... it has led to very bad feelings and
so I wouldn't do it (again)".
67, pp 15,758 & 15,759

The Board finds that the Region undertook the task with vigour and enthusiasm. Apart from the matter of multiple sites, the proponent was generally successful in understanding and applying the Act, although it did make a number of missteps along the way - with the expected result.

Experts for the proponent explained that the first step in the environmental assessment process was the preparation of a work program (Phase 1).

Consultants and regional officers then addressed the question of need, taking into account current and projected waste generation in the Regional Municipality of Halton. This was Phase 2, Stage 1. It has been dealt with in sufficient detail in an earlier section of this Decision and will not be pursued here.

Having concluded that a landfill was needed, the proponent decided that the next step was a systematic examination of all areas in the Regional Municipality in order to identify those which might prove acceptable for landfilling of wastes (Phase 2, Stage 2A). The result of this selection process, about which the Board has some concerns, was to narrow the search to 45 Candidate Areas and 7 Pits and Quarries.

A further, more detailed review, (Phase 2, Stage 2B) reduced the geographic extent of the search areas and focussed on 55 Candidate Sub Areas, including the 7 Pits and Quarries from the earlier stage. At the end of this stage, it was decided to study only six areas in further detail. These areas were referred to as Sites A,B,C,D,E, and F and are shown on the map at page 5 of this document.

The decision to proceed with an evaluation of 6 sites meant that the assessors had to restrict the level of detail. To do an exhaustive study of all 6 sites would have been too massive a task.

During Phase 2, Stage 2C the six Candidate Sites were subject to a detailed review which led to the ranking of sites in order of preference for landfilling. After discussion with Regional Council it was decided to subject the two most preferred sites (Sites D and F) to Technical Studies.

Some confusion was created for the residents of the Region, because one of the sites in contention (that of National Sewer Pipe's quarry in Burlington) was given the identification 'Site F' which had been the earlier designation of another contentious site at Tremaine and Britannia roads near Milton. The Board finds that this choice of identifier led to public confusion that could have been avoided.

In Phase 3 the technical studies were completed, environmental assessment documents were prepared, and a comparative analysis of the sites was done. Based on the information available at that time, the conclusion of the comparative analysis was that Site F was marginally preferred to Site D.

The Environment Ministry expressed concern about arbitrary "number crunching" as a method of arriving at a "hypothetically objective weighting factor". However, the applicant felt that judgement had been brought to bear along with the weighting factors when the site selection process moved from one stage to the next. Indeed, the evaluation factors varied from one phase to the next as the nature and extent of studies on remaining sites intensified.

The Board agrees with the observation that judgement had to be applied to the weighted evaluation factors in order to progress from stage to stage, but often found it difficult to relate the outcome of such 'judgements' to the data that were apparently before the consultants making the decisions. This difficulty was evidently shared by officials of the Ministry of Environment, who noted in their principle exhibit (E-109) that:

"It is difficult to trace the proponent's planning process in this Environmental Assessment because of a lack of both clarity and consistency in the documented decision-making process".

E-109 p 27

grown to 8 million dollars in favour of Site D, taking account of more detailed information on the sites and haul routes. A major change appears to have occurred between Stage 2C and the Technical Studies, putting Site D at a disadvantage of some 2 million dollars with respect to Site F.

The update created ranges for both Site D and Site F, with the gap at minimum being 700,000 dollars cheaper at Site F, and at maximum being 4.6 million dollars cheaper at Site F.

Having heard all the evidence from the Region, however, the Board finds that certain changes at Site F which might reasonably be required would increase its cost, while changes at Site D would reduce its cost. These change our final appreciation of the economic effects. A faulty assumption with regard to Site F was that the land purchase value should be in the same range as assumed for Site D, (i.e. \$600,000) rather than towards the higher (landfill use) end of the scale. That would move the land cost for Site F to the range of 4.7 million to 5.3 million dollars. The Board finds that if Site F were selected, it would be unlikely that the regional government would do away with the present transfer station at Georgetown, which is used in conjunction with the present Burlington landfill site. Retaining such a transfer station would be at a net cost to the region of an additional 1.7 million. Finally, it is likely that if Site F were approved for landfilling it would require a liner. The conservative estimate for the cost of the liner is about 4 million dollars. These factors raise the cost for Site F to the range of 68.2 million to 68.8 million.

In his analysis, Mr. Stamm had assumed that the energy from waste facility would not be built because of certain risk factors associated with it. But he accepted that the forcemain could be constructed from Site D to Oakville without serious opposition. He used a very low cost estimate for the forcemain; had he used a higher value, Site D would not have been as economically favoured in comparison to Site F. It was established under cross-examination that if one assumes no liner at Site F, the establishment of the energy from waste facility by the proposed date, and a higher cost for forcemain construction at Site D, or truck transport of leachate at Site D, then the net operational costs for the two sites would be about the same excluding site acquisition and injurious affection costs.

With respect to Site D, it is reasonable to assume that a dedicated sewer line could be installed and that the median saving from such an installation would be 1.15 million

dollars. Similarly, the Board is of the opinion that the surplus land (120 acres) must have some value. Whether it is value for lease during the lifetime of the landfill operation, value upon resale at the conclusion of landfilling operations, or value as land which would allow a future increase in the landfill's capacity beyond the year 2008, it must be assumed that there is some value to the extra 120 acres. If one assigns a value of \$500,000 to these lands, then the costs for Site D would drop by about 1.6 million to a net cost between 62 million and 62.6 million. Using this analysis, the Board finds that the cost of the landfill at Site D should be about 6 million dollars less than the cost of the landfill at Site F, in present value terms.

Given Mr. Rinaldo's evidence that anything in excess of 5 million dollars was beginning to be of concern from the point of view of the financial situation of the region, it would appear that in the final analysis the economics also favour Site D.

The 'inconsistency' concern was shared by the Board and elaborated by the Ministry of Environment in E-109, as follows:

"The consultant did not provide a clear explanation to describe the separate evaluation methodology used for pits and quarries that seemingly allowed inconsistent treatment of these sites in comparison to the clay/till plain candidate areas".

E-109 p 29

During Phase 2, stage 1 (Waste Needs and Systems Analysis) the options were evaluated on the basis of:

1. Number of years to implement the options;
2. Percentages of wastes handled;
3. Cost; and,
4. Descriptions of impact and desirability or complexity of each option.

By Phase 2, stage 2A (General Overview Analysis) the evaluation factors had changed and were set out in the following order of priority:

1. Physical factors (soils, topography, hydrogeology, natural environment);
2. Physical factors (forestry, aggregate areas, agricultural and recreational uses);
3. Social factors (population density and community services and institutions) and cultural factors (historical and archaeological); and,
4. Economic factors (haul costs and land costs).

The Board noted that these evaluation factors changed as the proponent moved through the process of site selection.

In Phase 2, stage 2B, when the candidate sites were being selected, the order of importance of evaluation factors was as follows:

1. Public health and safety (hydrologic constraints, traffic service and safety).
2. Natural environment (agriculture slightly higher than other biophysical factors).
3. Social environment (land use compatibility, population, community facilities).
4. Cultural environment (heritage features, archaeology, visual impact).
5. Costs, engineering and operations.

At Phase 2, stage 2C when preferred sites were being selected, the ranking of factors was similar to stage 2B, except for point No. 2:

1. Public health and safety.
2. Natural environment (agriculture and biophysical factors of equal significance).
3. Social environment.
4. Cultural environment.
5. Costs, engineering and operations.

In the final stage, the evaluation factors were further refined to correspond to the new level of detail contained in the technical studies. The overall framework and rating of the evaluation factors remained generally the same as in stage 2C.

The Board finds that these evaluation factors were generally quite reasonable, both in their original definition and in their subsequent transformations and ranking. We were not convinced, however, that the 'trade-off' between agriculture and the natural environment was an appropriate one. Counsel for the applicant explained that this had been done because the natural environment was the predominant feature at Site F, and agriculture the predominant use at Site D. We conclude that in this case there is a clearer conceptual link between agriculture and mineral resources (because of comparable Provincial policy instruments for their protection) than between agriculture and flora and fauna. Site F exhibits unique flora and fauna, in contrast to the other sites in the running at Stage 2B.

In the early stages of the evaluation (Stages 2A and 2B), analysis was based on desk-top studies which assimilated increasing detail at subsequent stages. One of the serious

early conflicts was that the preferred site was to be located on thick till plains, although such sites were to be eliminated because they were also the most suitable agricultural land.

As the selection process narrowed the 55 Candidate Sub Areas to 6 candidate sites one had to accept that the preferred site for landfill might be on viable farmlands. Mr. Walker noted the low probability of finding an ideal landfill site that would not conflict with other uses. This view is reflected in the waste needs and systems analysis consolidation report:

"The glacial tills in Ontario are generally considered to be one of the better disposal mediums for landfills. ... However, these clay and till sediments also often form some of the better agricultural lands in the Province, and consequently a conflict for land uses (landfill vs agriculture) often develops."

H-9 p 54

The dilemma facing the proponent was most succinctly described in exhibit H-10:

"Having eliminated all areas where landfilling would be unacceptable from a hydrogeological, biophysical and settlement area standpoint, the remaining areas of high impact for agricultural capability were eliminated as a priority item. This procedure eliminated all of the areas previously identified..."

H-10 pp 111 & 112

Site F would also have been eliminated on hydrogeological and other grounds at the 2A stage had it not been for the decision to bring in pits and quarries. One of the purposes of bringing in pits and quarries was apparently to avoid agricultural land and to rehabilitate excavated areas:

"Disposal in quarries is technically feasible and, in keeping with Ministry of Natural Resources policy, is a suitable end use and rehabilitation method for an abandoned quarry, provided that environmental concerns can be dealt with."

H-9 p55

But Mr. Walker admitted under cross-examination by counsel for Aldershot residents, that the rules for quarry rehabilitation would not normally apply to a site such as Site F, because the NSP property was not a typical excavated site waiting to be filled up and rehabilitated. Rather, for most of this site, vegetation and soil would have to be removed in order that the resulting space could be filled with garbage and then rehabilitated.

The Board finds that had the same criteria which were applied to the areas in the till plains of Halton been applied in the same fashion to Site F, it would not have survived beyond the end of Phase 2, Stage 2A, as a landfill site candidate. This is clearly evident from the Region's exhibit H-10 (Phase 2, Stage 2A General Overview Analysis) where the following contrasts are apparent:

- Figure 1. Site F is immediately adjacent to a significant biological feature in which a landfill would be unacceptable. Site D is relatively remote from any significant biological feature.
- Figure 2. Site F would have been found to be unacceptable because of its proximity to existing built-up areas and/or existing Hamlets or Rural Clusters. Site D on the other hand was remote from such areas. The fundamental flaw in this environmental assessment was not that this criterion was ignored, but rather that proponents for Site F subsequently used the site's disadvantageous proximity to a municipality and its services as the principal advantage, on the grounds that there were no down-gradient residents who had to rely on the groundwater supply.
- Figure 3. Site F is adjacent to zones considered unacceptable for landfilling from a land use perspective; Site D is remote from such areas and is closer to the regional waste centroid.
- Figure 4. Site F is in a medium and high cost part of the Region from a land value perspective, Site D is in a low cost area.
- Figure 6. Site F is not near an area interpreted to be hydrogeologically favourable

for sanitary landfilling; Site D lies partly in, and adjacent to, such areas.

Having completed this screening, which would have led to a landfill site somewhere within a wide swath across the middle third of the Regional Municipality of Halton, the proponent then decided to assess pits and quarries. These were portrayed on figure 7 of exhibit H-10 along with the observation that the consultants would next investigate environmental impacts in each candidate area, including pits and quarries, to identify potential landfill sites. In our opinion, this 'timing' decision which put pits and quarries on a selection list after initial screening would have eliminated Site F from the candidate areas, was not a reasonable one.

We believe that had all sites been evaluated with the same criteria at each stage of the process, there would have been only one site selected - Site D. Failure to do so led to the identification of two sites, either of which was set out as acceptable in the proponent's view. This two-site undertaking greatly lengthened the Hearing and the earlier assessments. The Board does not accept counsels' argument that "leaving out either site would have resulted in a hearing that was just as lengthy, because opponents would have brought in the other site as an alternative method of carrying out the undertaking." In essence, we had six sites for which there was considerable detail. The proponent should have narrowed its choice to the most suitable site. The concomitant savings in time and resources for all parties and the Board could have been considerable, without jeopardizing the fairness of the process.

Furthermore, the identification of a single site as the undertaking would have prevented unnecessary trauma and could have helped to engender public support for the environmental assessment process. It is the view of this Board that the language of the Act is clear: the "undertaking" is an enterprise or an activity, or a proposal, a plan or a program in respect of an enterprise or an activity. The transfer of responsibility to the Joint Board for deciding which of two proposals should be the undertaking was not a satisfactory or acceptable conclusion to the environmental assessment planning process.

Even within the single category of 'Pits and Quarries' the Board finds inconsistent treatment of potential sites. Under the heading of "Landfilling in Quarries" at page 52 of exhibit H-10 (October, 1983) it was stated that "most of these were rejected because of obvious deficiencies such as too small in size ...". But Figure 1 (page 13) of Exhibit M-923 shows that the licensed pit and quarry area at National Sewer Pipe was also inadequate for the volumes needed.

Notwithstanding the screening criterion to eliminate pit and quarry sites which were too small, in the case of the NSP property alone, the decision was made to consider the licensed pit area plus about twice as large an area on adjacent lands. From page 37 of exhibit H-11 it is clear that the Regional Municipality of Halton recognized this discrepancy, as it is observed that only Site F required "adjacent property" to provide adequate landfill capacity.

As the Region's consultants proceeded towards the final stage of site selection, a comparative analysis was done in Stage 2C. This comparative analysis was to have identified the preferred site from among the final 6 sites by comparing each site with every other.

Mr. Walker explained that the final comparative analysis for Sites D and F removed those factors which were assumed to be adequately dealt with by the "engineered solution" in the final technical studies stage. This is clear from the comparative analysis report:

"In the Public Health and Safety category the Hydrologic/Hydrogeologic factors were revised so that greater attention could be paid to the impacts of a fully engineered site..."

H-14 p EX - 3

Exhibit H-14 was dated January 1987, but three years earlier, in October 1983, the proponent's study team had written to the Ministry of Environment:

"The quarries have received the same level of assessment as other areas given that extensive engineering will be required."

H-65 p 9

It is the view of this Board that the Region's decision to evaluate only the final two sites on an 'as engineered' basis, after having recognized early in the process that such an approach would be required, would have invalidated the assessment had not the other four sites at the final evaluation stage coincidentally suffered serious problems not readily amenable to engineered solutions.

We conclude that, if a proponent knows early on that he is going to have to consider an intensively engineered facility, then the reduction of impact anticipated by the application of 'generic' engineering remedies ought to be considered at the earliest possible stage of

assessment. If any site can be engineered to be safe, as suggested by Mr. Sobanski, then the other four sites should have been assessed in the same fashion as Sites D and F. On the other hand, if natural inhibition of leachate egress and subsequent natural attenuation were to be early and important selection criteria, before the evaluation of engineered mitigation measures, then Site F should not have moved past the most preliminary assessment stage.

At Site F even the engineered fix is questionable, given that it contemplates daily losses of 4,500 gallons of leachate to the environment. In contrast, the engineered solution at Site D is designed to prevent any leachate losses.

During the cross-examination by counsel for Aldershot residents, Mr. Walker noted that according to the MOE Guidelines, landfill applicants should:

"establish a minimum requirement for
acceptability of hydrogeologic conditions
to prevent the assessed relative
importance of the other evaluation
criteria from overwhelming the hydrogeologic
conditions (i.e., a site which is not acceptable
hydrogeologically, should not be selected
as the preferred alternative)"
H-59 p 47

Such minimum hydrogeological requirements seem not to have been developed for site selection in Halton.

The application of standard siting criteria is critical to the perception of fairness in the site selection process. As set out by the Ministry of Environment in an early (October 15, 1982) letter to the proponent:

"Hydrogeological criteria must have a
minimum acceptable standard which all
sites must meet before being evaluated
against other criteria."
H-52 Addendum 2, p5

The proponent accepted, then appeared to prejudge, this criterion in a one paragraph response:

"siting criteria will be used to identify
minimum requirements for a potential
landfill site. The National Sewer Pipe

proposal will likely be considered as one of the potential landfill options.

H-52 Addendum 2 p6

Subsequently, on April 14, 1983, the study team wrote: "as it applies to this study there is no NSP site at this time". There appears to be a contradiction, therefore, between the October, 1982, response that NSP would "be considered", and the April, 1983, comment that there was no "NSP site".

In the Board's view the apparent predilection for one site did not bolster public confidence in the process that was about to unfold.

The Ministry of Environment called Mr. Roger Clarke, from the Environmental Assessment Branch, to describe the Ministry's involvement in the environmental assessment process. Mr. Clarke described the Halton assessment as a problem of waste disposal, rather than an opportunity for controlling or dealing with waste generation. He explained how he and his colleagues had essentially left the decision with respect to "alternatives to the undertaking" to the proponent and other affected parties.

In Mr. Clarke's view, Phase 1 of the Halton study addressed the alternatives to the landfill as described in section 5(3)(b)(iii) of the Environmental Assessment Act, whereas Phase 2 related to section 5(3)(b)(ii) of the Environmental Assessment Act. Mr. Clarke understood that the hearing process itself was part of the environmental assessment, and that it would influence the Board's conclusion with regard to the adequacy or inadequacy of the assessment done in this case.

The Board is concerned that the Ministry officials did not apply enough judgement when reviewing the environmental assessment before it was submitted to public scrutiny in the hearing. Several concerns had been expressed in the original environmental assessment review which had not been dealt with a year later when the Environmental Assessment Branch provided its supplementary review. The Environmental Assessment Branch had apparently solicited the views of other ministries and put these views together as the collective response of "possibly affected government agencies" without critically examining the substance of the integrated responses. This was clearest in the exchange between the Board and Mr. Clarke on August 24, 1988 when Mr. Clark was asked whether the uncertainties described in MOE's original environmental assessment review were removed by the time the supplementary review (E-110) was issued:

"Was that uncertainty or inconsistency
as you described it removed
in moving to E-110?

THE WITNESS:

"Not that I am aware of."
168 42,025

Perhaps Mr. Clarke's lack of concern about the unresolved inconsistencies in the Ministry's review of Halton's assessment is explained by his understanding that:

"... the review is not a basis for a right
or wrong decision. It is a critical
evaluation and it is really up to the
decision-maker, whoever that decision-
maker may be, and in this case the Board,
to identify and decide if there is the
logic that is available to them to make
a proper decision..."

168 pp 42,029 & 42,030

We agree with Mr. Clarke that it is up to the Board to decide on the issue. We feel, however, that it would have been helpful to the Board if serious unresolved inconsistencies had been thoughtfully dealt with before the environmental assessment was considered acceptable from the Ministry's perspective. Environmental Assessment Branch officials should apply reason and judgement to the information received to determine whether or not it is sufficient for a meaningful hearing process to commence. While Branch officials are not in a position to deny the hearing from taking place, they certainly are in a position to appear before the hearing to explain and support their conclusions with respect to the adequacy of the environmental assessment. By the time the hearing commences, the Branch should be satisfied at a fundamental level that the available information is sufficient and is logically and reasonably portrayed so that the hearing and all those affected by it will be in a position to consider the evidence intelligently.

The solution to this problem is not an easy one. It would require dedicated, intelligent and constructively critical involvement of members of the Environmental Assessment Branch working with all parties and their consultants to understand local concerns and to satisfy themselves that the necessary studies had been completed and shared with all parties before the hearing process begins.

All planners appearing before the Board felt that the Region's approach to the assessment was reasonable and the result was reasonable. Mr. P.J. Stagl, a planner called by the Town of Milton, felt that there is lack of understanding of the rules for environmental assessment and that this assessment took an inordinate amount of time. In response to our questions, however, he elaborated that it was not necessary for the Board or the government to establish more clearly defined rules. Rather, regional and local levels of government must work with more senior levels to understand what is required in an environmental assessment, and to avoid unnecessary steps and unnecessary detail. Knowledge of the rules under which environmental assessments should proceed will eventually emerge through experience with quantifying the nature and extent of studies required. Public participation in the process was an essential aspect.

The Board agrees with this observation and intends that these comments on process serve as an aid to those who will undertake environmental assessments in the future.

Another concern the Board has about the environmental assessment process, both before and during a hearing, relates to the extent to which information is shared between parties so that the Board may make the most informed decision. Often it seemed to us that information was withheld by one party or another for dramatic introduction late in a hearing.

During the hydrogeological evidence with respect to Site D, for example, the proponent's experts had given evidence and had been cross-examined. Those opposed to Site D had introduced their evidence and it had also been cross-examined. Then, when the opponents of Site D were cross-examining hydrogeologists in favour of the Site D location, they argued that one could not give assurances to residents around the site that leachate would not escape and affect wells, without certain measurements from the area. Counsel criticized these final consultants for not having undertaken such studies, deemed crucial to a proper assessment. If the purpose of the hearing is to allow for the most informed Board decision on the validity of the assessment, then surely there is an obligation on parties ensure that work that they consider to be essential is completed at the appropriate time.

Failure to undertake the necessary studies in a timely fashion and exchange the information between the parties, caused aggravation for citizens - aggravation subsequently directed against the process of environmental assessment itself. In this particular case, citizens in

the vicinity of Site D have been persuaded that their groundwater will be poisoned. The Board was convinced that this would not be the case.

Another aspect of public concern about the process was described by an Aldershot resident, Mr. Korney, who told the Board that the public meetings did not accommodate public concerns. Along with a number of other Aldershot residents, Mr. Korney believed that the assumed area of social impact selected by the Region was too small to be meaningful. Many Aldershot residents felt that they were affected by present and proposed landfill sites and that their perception of distress was not taken into account as a social impact factor. This is a difficult matter to deal with, since the Board must deal with realities and facts, while recognizing that perception of stress itself causes stress, and thus can cross the boundary into reality. While the Board must decide on the weight to be given to this 'reality', the proponent must be sensitive to its existence.

Citizens in the vicinity of both sites have been led to believe that the consequences of the establishment of a landfill in their area would be far more serious than the facts support. It may be that the encouragement of public apprehension supports the funding and pursuance of a case against a specific site, based on fear rather than fact. Since the Board may have to select a specific site, public authorities will have to deal with misapprehensions which may have been created to gain support for a particular position.

The Board is concerned about the extent to which individual citizen witnesses digressed in providing their non-expert evidence. In many cases the digression was not helpful to the Board. It would be useful if counsel would instruct 'non-expert' witnesses on the nature of the decision and the kinds of evidence which could assist a Board in arriving at a correct decision. Allowing such witnesses to stray into extraneous material was not helpful.

As noted earlier in this decision, the Board feels that the proponent did not evaluate alternatives to the undertaking in an imaginative, creative and serious fashion. The Region's treatment of this matter in keeping with section 5(3)(b)(iii) of the Environmental Assessment Act was perfunctory to say the least, in that the Board received no substantive evidence on:

"an evaluation of the advantages and disadvantages to the environment of ... the alternatives to the undertaking."

R.S.O. 1980, c 140, s. 5

In response to questions from the Board, it was stated to be the proponent's view that to have done more with respect to alternatives to landfill would have been unreasonable (179 pp 44,354-44,367). We beg to differ. It is our view that a proponent making application for a landfill in today's environment must have at least a rudimentary appreciation of the composition of the waste that is to be landfilled and the practicality of alternatives to landfill which might reduce environmental degradation. A reasonable consideration of alternatives under section 5(3)(d) might include: practicality of composting; residential waste reduction possibilities; anticipated waste reductions from industrial and commercial reuse and recycling; and, commercial and residential (including apartment buildings) source separation programs. There was barely sufficient evidence before this Board to conclude that, whatever else may be done with Halton's waste in the future, a landfill is required now.

The brief observations that follow represent this Board's view on matters that might be changed to improve the Hearing process.

1. Timing and Content of Reports

Several of the reports provided to the Board were incomplete or lacking in precision. To be useful, a report should provide enough clear information on the assumptions, procedures used, and conclusions drawn, to allow comprehension of the report as it stands, and fair and reasonable cross-examination. Such reports should be provided in a timely fashion to all parties.

For instance, it was discovered during Dr. Kitchen's cross-examination that he had created assumptions about the Region's cost estimates, in developing his own estimates for after use costs. It would be more helpful for a witness to base conclusions on facts obtained from those who know them, rather than construct a series of possibly incorrect assumptions.

In the case of the population reports, the Burlington witness, Mr. Stamm, had neither provided the engineering basis for his projections nor, more importantly, stated the assumptions underlying his conclusions in the "memorandum" which he submitted as his main exhibit to the Board.

Some reports were held until the last possible moment. This induced opposing parties to prolong the cross-examination of earlier witnesses to ensure that nothing would be missed if subsequent reports explored unlikely areas.

It was clear that Dr. Kitchen's material could have been delivered to other parties a year earlier. Failure to deliver the document may be an example of "games-playing" in an adversarial forum, but this approach is not helpful to the Board in the course of a hearing.

2. Relevance of Evidence

The Board was advised by Mr. Stamm that he had been working on his economic forecast for a year and a half previous to his testimony in June of 1988. Mr. Stamm allowed that he had a sense that population projections and waste quantity calculations were not critical parameters for his economic analysis. He summarized this finding at page 4-8 of his principal exhibit (B-894), at which time he noted that site selection was insensitive to his population and waste quantities scenarios. Notwithstanding this, Mr. Stamm appeared and took two weeks of the Board's sitting time to present evidence on population and on waste quantities. Costs have been awarded accordingly.

During the cross-examination of Dr. Kitchen's after use evidence, it was suggested that the approval of Site F would be one way of ensuring that there could eventually be a park in this area. Failure to approve this site could lead to its destruction because there are limited controls over alternative uses. This kind of argument is not helpful to the Board in making a decision. The undertaking is for the establishment of a landfill as a way of dealing with waste. It is not for the purpose of creating a park 20 or 30 years hence, or saving agricultural land from subsequent urban encroachment. We viewed the introduction of such arguments as time consuming and off-track.

3. Level of Detail

During the early part of the examination of the proponent's witness panel on economics, some concern was expressed by counsel for the Town of Milton as to the level of detail being sought. Counsel for the Regional Municipality of Halton explained that they felt it was important for the Board to understand the breadth of the economic study as part of the environmental assessment. The time spent was of some concern to the Board since preliminary economic assessment is not obviously crucial to protecting the broader interests of the people of Ontario with respect to the environment (as set out in section 2 of the Environmental Assessment Act).

The Board noted that at several stages in the hearing process witnesses were called upon to review fundamental techniques in a painstaking step-by-step fashion. Sometimes they were asked to read correspondence or other reports line by line, paragraph by paragraph, page by page. This took a great deal of time and yet the questions that flowed from such readings did not appear to justify the expenditure of time.

4. Use of Available Data

Mr. Walker stated that he and his colleagues had not allowed consideration of more detailed information for or against a given site, if information of a comparable level of detail was not available for other sites. He said this action was intended to avoid bias.

With respect to the site selection process which narrowed the number of sites to 6 and then subsequently to 2, the Board noted that Site F was reported to meet 5 of the 9 criteria known to be important in selecting Environmentally Sensitive Areas (ESA) as early as 1982. Notwithstanding this, the April 1984 Halton Phase 2, Stage 2B report said that the candidate areas "are not known to have the characteristics of an environmentally sensitive area, which would have been considered an unacceptable impact in Stage 2A". The 1982 Proctor & Redfern study not only identified that Site F had these characteristics, but also that criterion 6 applied to the site.

According to the site selection criteria:

"unacceptable areas are those that have either Criterion 2 or Criterion 6 (the latter signifies provincial or national status)"

H-10 p. 18

Conformity with criteria 4 and 5 would have resulted in a "high" rating as an unacceptable landfill site. In total, Site F met as many of the criteria as 22 of the 37 already-established ESA sites in Halton. It was pointed out to the Board that the Region's consultant was constrained to not use the Proctor & Redfern information because such information constituted additional biophysical work that had been done at Site F, but had not been done at other sites. For this reason it had been disallowed by the Region's consultants.

The result of this decision was to leave Site F in the running as a landfill site even though from a biophysical perspective it ought to have been eliminated as early as 1982. The Region's own witness (Ms. Hellas) felt that Site F was an ESA, and the City of Burlington witness agreed with her. In this case both agreed with the Proctor & Redfern study which was done for National Sewer Pipe Ltd., the company that owns the land.

This Board considers that an area is environmentally sensitive if the facts support this conclusion, whether or not it has been "officially designated".

The Board finds that the proponent was inconsistent when it ruled out early detailed biophysical evidence that would have eliminated Site F in the early going, but kept the site in the running because of early, "expensive" and detailed hydrogeological work done especially to establish its suitability before comparable work was done on other sites in the Region.

5. Consistency of Evaluation Treatment

The inconsistencies of site evaluation in the early stages are best illustrated by comparing tables 41 and 45 of exhibit H-10.

Table 41 deals with a candidate area that incorporates Site D. It begins with "Physical Factors" which include attenuation capability, overburden thickness, agricultural capability, slope, distance from major watercourses and infiltration. It continues with six other factors, the first of which is biophysical factors. The negative aspects of district D in this table include agricultural impacts and proximity to environmentally sensitive areas.

Table 45, on the other hand, does not even include "Physical Factors", so there are no negatives for Site F in this category. Surprisingly, this table shows "no impact" under the biophysical factor heading, despite the Proctor and Redfern work and the proximity to a well known ESA, the Sassafras Woods.

These discrepancies may have arisen because the proponent's principal consultant did not fill out the summary tables, leaving this task to his hydrogeologist. Whatever the reason, the tables do not reflect the facts available at the time and are not, therefore, a sound basis for narrowing the search area for landfill sites.

6. Advocacy 'Evidence'

Expert witnesses often appeared reluctant to provide information that would jeopardize their client's position. This attitude handicapped the Board in its effort to select the most environmentally suitable location for a landfill in Halton. This may suit the adversarial nature of hearings and the obligation of counsel to "protect clients' interests", but it is counterproductive and risky for a hearing Board to decide on environmental suitability in such a climate.

7. Environmental Assessment Timeframe

Mr. Walker elaborated on the "short timeframe" problem for the study teams, despite the length of the overall site selection process. The Board concludes that there must be better long-range planning. There needs to be time for the Ministry of the Environment to respond to environmental assessments. There also needs to be time for those preparing assessments to complete one stage before commencing the next.

8. Accountability

There were opportunities for input from the public, other consultants, city and regional staff, but the overall accountability, responsibility and "guiding intelligence" for the total environmental assessment process was not obvious. From amongst the multitude of councillors, committees and consultants, none emerged with a firm hand on the helm, asking the difficult questions and demanding meaningful answers. Mr. Walker considered certain factors in the early evaluation stages, but then "stood down" to other experts and their opinions on general effects. We conclude that in this case the evaluation was weak because, as it unfolded, the evaluators seemed to lose sight of the collective impact in the mass of minutia.

A good illustration of how important factors may be buried by detail is found in the final comparative chart where the proponent makes the same statement, without qualifiers, for both sites D and F:

"There is little potential for leachate
to migrate into the surface water flow system"

H-14 44th page

From the consultants' own evidence, however, it was clear that at Site D the intent and prediction was for no loss of leachate, whereas at Site F the expectation was that 4,500 gallons of leachate would be lost each day, to emerge at the surface somewhere south of the site. Thus the Board cannot accept the statement that the two sites are identical from the perspective of their possible impact on surface waters, whether this opinion was offered by the principal consultant or one of his sub-consultants.

9. Perception of Fairness

The leachate and surface water contamination issue described above is a minor illustration of a major problem with the Halton environmental assessment, namely, that the process must not only be fair, it must be seen to be fair by the citizens affected by it. Many of the citizen witnesses expressed frustration about the perceived 'unfairness' of the process. When the Board examined the Region's approach, it was not difficult to find examples of actions that appeared unfair:

1. The original site selection criteria favoured clay/till plain sites from a hydrogeological perspective. The criteria were changed to include pit and quarry sites even though Site F should have been ruled out on the basis of other selection criteria at the Phase 2, Stage 2A evaluation step.
2. The pit and quarry area at site F was too small for the required landfill. Only this site was evaluated with the inclusion of adjacent property.
3. The 1982 biophysical studies would have ruled out Site F. These studies were ignored because comparable work had not been done at other sites. But early hydrogeological studies suggested that Site F could be made safe for landfill. These studies were allowed to stand although comparable work had not been done on other sites.
4. The relative importance of biophysical versus agricultural selection criteria were changed in the early stages to favour agriculture;

5. The original social impact areal boundaries encompassed more people at Site F and fewer at Site D. The boundaries were changed to include fewer people at Site F and more at Site D.
6. Financial considerations transformed Site D into the more expensive option over the course of the assessment, but the approach taken to land acquisition costs at Site F made it appear less expensive than might be reasonable.
8. The proponent's hydrostratigraphic model for Site F was refuted during the Hearing. At the end of the Hearing, however, the proponent called a witness in reply to offer an hypothesis as to why its model of Site D should also be refuted, and its original preference for Site F sustained.

There were reasons offered for each of the individual actions described above, but collectively they could be taken to suggest that the proponent in this case preferred Site F before, during and after the environmental assessment process, and throughout the Hearing. We did not find supportable reasons for the resolute shifting of criteria in favour of one site only. It is not surprising, therefore, that the public often expressed their perception of a bias in the process, to the detriment of both the process and public support for Provincial policy in this area.

10. Conclusions

As the proponent's principal consultant, Mr. Walker noted:

"... landfill cannot be the long-term solution
and there are more technological advances coming
every day."

66 p 15,432

But landfill is the solution sought by the proponent before this Board. The Board is satisfied that a landfill is a necessary component of Halton's waste management program at the present time. In determining social equity on this matter we did not limit our consideration to 'who has had the most garbage in the past'.

Mr. Garrod: "I wonder whether you would agree with the position that social equity is something which is a result of the process or something that is an input to the process?"

Mr. Walker: "I think it is a result. I think the result will be here at this Board ... to let people get on with their lives."
62 pp 14,457 & 14,458

The Board agrees.

CONDITIONS OF APPROVAL**Under the Environmental Assessment Act****CONDITION 1.**

For more than a decade the Regional Municipality of Halton searched for a new landfill site to receive the waste of its citizens. A great deal of money was spent in the search, and residents of two communities felt threatened by the impending decision. In 1987 and 1988 a Hearing was held by the Consolidated Hearing Board established by the Environmental Assessment Board and the Ontario Municipal Board. This Board heard that although the Regional Corporation was responsible for disposing of waste it was not alone responsible for waste reduction, reuse and recycling measures. This Board also heard that the waste recycling objectives in the Region were modest, being less than 20%.

The Board orders, therefore, as its first condition of approval for a new landfill site in the Regional Municipality of Halton, that the Regional Corporation enter into agreements with the Municipalities of the Region to establish a Municipal-Regional Waste Management Committee having as its goal the reduction, recycling and reuse of waste so that there will be very little waste remaining to be landfilled. Through public meetings held at least twice a year the Committee should attempt to reach the goal through measures including but not limited to:

- a) paper recycling and denial of landfilling of paper products;
- b) promotion of individual, private and public composting facilities;
- c) provision of glass and metal recycling facilities for residential, apartment and commercial establishment waste, including provision of reception areas for packaging materials at point-of-sale of such materials;
- d) development of measures to encourage retail outlets to reduce to the maximum extent possible "disposable" items and packaging materials, including fast-food packaging materials.

- e) provision of reception areas for household hazardous wastes; and,
- f) consideration and development of mandatory recycling programs which include rewards and penalties for compliance and non-compliance;

Once each year the Regional Municipality shall report on the participation of area Municipalities and the extent of cooperation and progress on the work of this Committee in full-page advertisements in the newspapers having general circulation in each of the Region's constituent Municipalities, under the headline "IT'S OUR OWN GARBAGE", and is to include this condition in full at the beginning of such advertisement.

CONDITION 2.

The Regional Corporation shall make all reasonable efforts to comply with the strategy and timetable for the implementation of an Energy From Waste facility as set out in Part 3 of "Halton Region's Response to the Ontario Government Review of Halton's Environmental Assessment - Solid Waste Management System for the Regional Municipality of Halton - Landfill Component", with the objective of starting up such a facility within 8 years of the first receipt of waste at the landfill site.

CONDITION 3.

If 50 percent of the waste generated within the Regional Municipality is not diverted from the landfill site by the end of the eighth year of operation, the Regional Corporation shall immediately commence appropriate waste management studies, taking account of, but not limited to, the opportunities described in Condition 1 above, required for the approval of new waste reduction, reuse, recycling, recovery and disposal programs and facilities.

CONDITION 4.

Within one year of this approval, the Regional Corporation shall make all necessary arrangements to provide facilities for the collection and transfer of household hazardous wastes. Such facilities shall be convenient and available for use by all residents in the

Regional Municipality at least once a month, and their whereabouts and hours of operation shall be published in an appropriate fashion.

CONDITION 5.

The Regional Corporation shall establish a Review Committee to monitor waste haulage practices in the Regional Municipality. The Committee shall allow for the participation of at least one member of the public from the vicinity of the landfill and one representative of the waste haulers. Its objective shall be the improvement of general traffic safety in respect to waste haulage practices, by reviewing public concerns, haulage routes and practices, and recommending improvements as appropriate.

CONDITION 6.

The Regional Corporation shall take all reasonable steps to form a Citizen's Advisory Committee to make recommendations for the avoidance or minimization of off-site impacts from the landfill. The Committee shall consist primarily of local residents. The Regional Corporation shall provide a reasonable annual budget for the operation of the Committee.

CONDITION 7.

In light of the high concentration of chemical contaminants in leachate from landfill operations in Halton Region, the Regional Corporation shall enter into agreements with the Municipalities in the Region for the identification of the principal commercial and industrial generators of waste and the nature of their wastes intended to be landfilled in the Region. This information shall be made available to the Committee described in Condition 1 and to the Director of the Central Region of the Ministry of Environment.

CONDITION 8.

- a) Prior to site preparations, the Regional Corporation shall complete the archeological survey of the site.
- b) If Significant archeological sites are found, the Regional Corporation shall take reasonable steps to avoid them or conduct salvage operations if avoidance is not possible because of landfilling operations.

CONDITION 9.

Because the effective operation of the hydraulic trap concept of leachate containment and removal may depend in part on the avoidance of conflicting uses of lands within 500 meters of the proposed waste cells, the Regional Corporation shall, within one year of this approval, submit an application to the Town of Milton for an Official Plan Amendment to provide for the creation of a Special Policy Area pertaining to the lands surrounding Site D. The Special Policy Area shall be created in accordance with Ministry of the Environment Policy #07-07.

CONDITION 10.

The Regional Corporation shall design and operate the site in a manner that will allow for the implementation of an agricultural after-use at the site.

CONDITION 11.

The Regional Municipality shall take all reasonable steps to preserve and maintain the Ford Farmhouse and associated landscape plantings.

CONDITION 12.

Prior to the receipt of waste at the site, the Regional Corporation shall make the necessary arrangements with the Ontario Ministry of Transportation to widen Highway No. 25 at the entrance to the site with the addition of right and left hand turn lanes and sufficient acceleration and deceleration lanes.

CONDITION 13.

As soon as possible, and in any event before December 31, 1996, the Regional Corporation shall make all necessary applications for the construction of a gravity sewer or forcemain to connect the site to the Mid-Halton Water Pollution Control Plant or for the installation of leachate treatment facilities at the site.

CONDITION 14.

On or before October 1st of each year, the Regional Corporation shall submit a report to the Director of the Environmental Assessment Branch of the Ministry of the Environment for filing on the public record which describes compliance with these conditions of approval. Copies of the report shall be provided to:

- a) the Director, Heritage Branch, Ministry of Citizenship and Culture;
- b) the Manager, Electricity Section, Liaison and Planning Branch,
Ministry of Energy;
- c) the Director, Foodland Preservation Branch, Ministry of Agriculture
and Food;
- d) the Clerk of the Town of Milton;
- e) the Clerk of the City of Burlington;
- f) the Clerk of the Town of Oakville; and,
- g) the Clerk of the Town of Halton Hills

The Regional Corporation shall publish notice of the availability of this report in the principal newspapers in the Region.

Under the Environmental Protection Act**Definitions****CONDITION 1**

1.1 In these conditions,

"Approvals Director" means the Director of the Approvals
Branch of the Ministry of the Environment or
his designate;

"Board" means this Consolidated Hearings Board established
to hear the application of the Regional Municipality of
Halton for a new landfill site;

"District Officer" means the District Officer of the
Halton-Peel District of the Ministry
of the Environment;

"Regional Corporation" means the Regional Municipality
of Halton; and,

"site" means the waste disposal site.

Design and Operations

CONDITION 2

The site shall be designed and operated in a way that is in keeping with the conceptual design introduced in evidence to this Board by the proponent: that is, a hydraulic trap and associated pipes, pumps, elevations, support facilities and screening berms. The Board recognizes that in arriving at a final design certain details may be optimized. Such optimization must take place within the range allowed in these conditions. The Regional Corporation shall submit the detailed design, operations and monitoring documents to the Director for approval.

- 2.1 The documents shall be prepared to reflect conditions 3 to 14 of this approval, and the preceeding conditions of approval in this Decision to proceed under the Environmental Assessment Act, and shall contain at least the following:
- 2.1.1 A description of site preparation activities, including borehole sealing and base preparation.
 - 2.1.2 A base contour plan
 - 2.1.3 Plans and a description of the leachate collection system, including a precise definition of the maximum permissable leachate mound required for the operation of the hydraulic trap.
 - 2.1.4 A description of leachate collection system inspection and maintenance activities.
 - 2.1.5 A description of leachate flow measurement locations, facilities and methods.
 - 2.1.6 Plans and descriptions of surface water collection and containment structures.

- 2.1.7 A description of daily, intermediate and final cover activities, including depths, material characteristics, installation procedures, scarification measures for daily cover and storage locations.
 - 2.1.8 A description of stockpile activities, including use, timing, locations, erosion protection and temporary vegetation measures.
 - 2.1.9 A description of methods and procedures to be used in the construction of berms on the northwest, southwest and southeast edges of each level of waste.
 - 2.1.10 Interim and final contour plans.
 - 2.1.11 Plans and descriptions of site roads.
 - 2.1.12 A landscape plan describing the locations of interim and permanent vegetation, including types, sizes and planting schedules, and earthen, vegetative or other types of barriers for the purpose of providing windbreaks and mitigating visual impacts from the site.
 - 2.1.13 A description of daily operating activities.
 - 2.1.14 A description of litter control activities on and off the site. -
 - 2.1.15 Plans and description of site fencing.
 - 2.1.16 A description of piped water facilities.
 - 2.1.17 Plans and a description of a storage facility for suspect wastes.
 - 2.1.18 A description of vermin and gull control activities.
 - 2.1.19 A description of gas monitoring activities.
 - 2.1.20 A ground water monitoring program.
 - 2.1.21 A surface water monitoring program.
 - 2.1.22 A leachate monitoring program.
 - 2.1.23 A description of contingency plans to mitigate impacts from leachate or gas migration.
- 2.2 The Regional Corporation shall construct and operate the site and carry out monitoring activities and programs in accordance with the detailed design, operations and monitoring documents as approved by the Approvals Director and with any modifications within the range of modifications allowed under these conditions as may be approved from time to time by the Approvals Director.
- 2.3 No activity for which the approval of the Approvals Director is required under 2.1 shall be carried out without that approval.

- 2.4 As built surveyed drawings shall be submitted to the Approvals Director for all facilities, including base contours, leachate collection facilities, final cell contours and elevations, berms and monitoring installations, together with certifications from appropriately qualified persons that the facilities have been completed in accordance with the approved design.
- 2.5 Upon request, the Regional Corporation shall provide copies of the documents submitted pursuant to condition 2.1 to the Town of Milton and to the Halton Region Conservation Authority.

Inspection and Control of Waste

CONDITION 3

Appropriate measures, including at least those detailed below, in conjunction with Regulation 309 of the Environmental Protection Act and the work of the on-site environmental inspector described elsewhere in these Conditions, shall be taken to prevent to the maximum extent possible the disposal of wastes which would add unnecessarily to the potential toxicity of leachate.

- 3.1 Only 7.96 million cubic meters of domestic, commercial and non-hazardous solid industrial waste may be deposited at the site. In no case shall any hazardous or liquid industrial waste be deposited at the site.
- 3.2 The Regional Corporation shall establish a comprehensive system of incentives and penalties to enforce compliance with site operating rules by users and to ensure to the greatest extent practicable that only permissible waste is deposited at the site.
- 3.3 Prior to any receipt of waste at the site, the Regional Corporation shall establish a computerized record-keeping system at the site to continuously record details of the following information with respect to each load of waste to be landfilled at the site:
- 3.3.1 weight;
 - 3.3.2 hauler name;
 - 3.3.3 hauler certificate of approval number;

- 3.3.4 driver identification; and,
- 3.3.5 infractions of site operating rules.

3.4 Condition 3.3 does not apply with respect to waste received at the public container area but does apply to waste transferred from the public container area to the disposal area.

3.5 Prior to any receipt of waste at the site, a storage facility with appropriate environmental protection measures shall be established at the site to safely hold and contain any suspect wastes requiring either confirmation of suitability for disposal or removal and disposal at an alternate approved facility. Appropriate equipment shall be maintained on-site to immediately load and remove suspect wastes from the working face to the waste holding area.

3.6 Prior to the commencement of site preparation, the Regional Corporation shall retain a full-time environmental inspector who shall be responsible for,

- 3.6.1 monitoring compliance with these Conditions,
- 3.6.2 monitoring the installation of all works and ongoing site management and operations throughout the life of the site,
- 3.6.3 reporting to the Regional Director on all incidents of non-compliance with the regulations, these Conditions, the Conditions of Approval under the Environmental Assessment Act and the approved design, operations and monitoring documents,
- 3.6.4 reviewing the raw data associated with all groundwater, surface water and gas monitoring and reporting to the Regional Director on any data which indicate actual or potential contaminant movement,
- 3.6.5 preparing written inspection reports for submission to the Regional Director on a monthly basis, or more frequently as may reasonably be required by the Regional Director,
- 3.6.6 preparing an annual report for submission to the Regional Director summarizing his or her activities and findings, and
- 3.6.7 participating on the Citizen's Advisory Committee.

- 3.7 Detailed terms of reference concerning the activities and responsibilities of the Environmental Inspector shall be submitted to the Regional Director for review and approval no later than two months after the date of this approval.
- 3.8 The Regional Corporation shall employ at least one properly trained waste inspector to exclusively monitor the dumping of all waste at the working face.
- 3.9 The Regional Corporation shall employ traffic controllers to supervise the movement of vehicular traffic at both public disposal areas and the working face.
- 3.10 Once in each month during the first year of site operation and annually thereafter until closure, the Regional Corporation shall arrange for an inspection of the site by a pest control contractor. The annual inspection shall be increased to a monthly frequency if pest control problems occur. Records of inspections shall be maintained at the site office.

Surface Water

CONDITION 4

Appropriate measures, including at least those described below, shall be taken to protect the quality of surface waters and to minimize fluctuations in the quantities of surface waters as compared to those which would occur in the absence of a landfill at the site.

- 4.1 Surface water collection and containment structures shall be designed to,
- 4.1.1 convey, at a minimum, the fifty year design storm with erosion control protection up to the five year storm condition;
 - 4.1.2 ensure that there are no increases in post-development flow rates over pre-development flow rates for a range of storms up to and including the one in one hundred year storm;
 - 4.1.3 ensure that potential discharges of leachate to surface water can be contained and, if necessary, immediately discharged to an appropriate treatment facility; and,
 - 4.1.4 prevent potential increases in erosion along the Bronte and Sixteen Mile Creek tributaries as a result of flow from the final design.

- 4.2 The Bronte Creek tributary diversion along First Line shall be sized to convey the regional storm flow and shall be designed to maintain the existing stage storage and stage discharge for a variety of storm flows up to and including the regional storm event. The diversion shall contain a low flow channel to prevent erosion.
- 4.3 Surface water storage facilities shall have the capacity for storing surface water for at least 48 hours under average annual flow conditions.
- 4.4 Surface water collection and containment structures shall be designed using the appropriate computer modelling method of hydrological and hydraulic calculations as specified in "Flood Plain Management in Ontario, Technical Guidelines, Ministry of Natural Resources" and "Storm Water Management Guidelines, Central Region, Ministry of Natural Resources".
- 4.5 All surface water storage areas shall be inspected at least once in each year and dredged as required.

Site Preparation

CONDITION 5

Site preparations shall be undertaken to support the successful operation of the hydraulic trap conceptual design for the complete containment and removal of leachate from the site and shall include at least the following matters.

- 5.1 Schedules for the construction and installation of site facilities shall be provided in advance to the District Officer.
- 5.2 Prior to any excavation at the site, all boreholes and any other conduits for possible leachate movement within areas of landfilling shall be properly sealed to the satisfaction of the Director.
- 5.3 The Regional Corporation shall begin as soon as possible after the date of this approval to construct a series of twelve monitoring wells on the northeast side of First Line beginning with Monitoring Well nest 1 (MW-1) in the vicinity of the

environmental assessment investigation well HC1-85. This well nest shall be completed to at least 170 m a.s.l. to intercept any granular units in the lower till and shall be constructed in such a way as to allow for short term pumping tests and long term monitoring of ground water quality, in accordance with Condition 12. The next well nest (MW-2) shall be constructed the same distance from First Line and 100 meters to the south of MW-1, shall be completed to the base of the weathered upper till at about 178 m a.s.l. and shall be constructed so as to allow for the short term monitoring of response, if any, to the pumping of MW-1 and long term monitoring of ground water quality in the weathered upper till. Wells MW-3, MW-5, MW-7, MW-9 and MW-11 shall be 200, 400, 600, 800 and 1,000 meters south of MW-1 respectively, and shall be constructed in a fashion similar to MW-1, taking into account local variations, and wells MW-4, MW-6, MW-8, MW-10 and MW-12 shall be 200, 400, 600, 800 and 1,000 meters south of MW-2 respectively and shall be constructed in a fashion similar to MW-2 taking into account local variations. Wells MW-1, MW-2, MW-3 and MW-4 shall be completed, wells MW-1 and MW-3 pumped and responses at wells MW-2 and MW-4 measured and the data therefrom provided to the Approvals Director before the final detailed designs for the first landfill cell are submitted to the Approvals Director for approval. Wells MW-5 to MW-12 shall be completed in sufficient time for the Approvals Director to consider test results from these wells before approving final detailed designs for subsequent landfill cells.

- 5.4 If the results of the pump tests and response tests described in Condition 5.3 can reasonably be interpreted by the Approvals Director to correspond to a permeability for the unweathered upper till greater than 1.4×10^{-7} cm/sec, then a liner of compacted native glacial till shall be constructed at the base of the excavation by remoulding the upper one meter or more of the unweathered upper till material on site to achieve the lowest practical permeability.

- 5.5 The leachate collection system to be constructed on the base of the site shall be designed and operated to:

- 5.5.1 ensure that the maximum hydraulic head at the base of the landfill is at least 0.4 meter lower than the measured hydraulic head in the lower till and is the lowest possible having regard to the thickness of the unweathered upper till and the desire to maximize the slope of collectors and headers;

- 5.5.2 provide for a slope on all collectors and headers that will minimize clogging;
 - 5.5.3 provide maximum practical access to collectors for routine inspection; and,
 - 5.5.4 allow for continuous flow of leachate to a forcemain, sewer or leachate storage tanks.
- 5.6 Retention tanks shall be installed for the purpose of storing leachate collected in the leachate collection system. The tanks shall be sized to accomodate a minimum 72 hours of average anticipated flow volumes.
- 5.7 Leachate shall be trucked from the site so that a minimum of 48 hours of leachate retention capacity, to be calculated on the basis of average anticipated flows, shall be available in the retention tanks at all times.
- 5.8 Conditions 5.6 and 5.7 cease to apply when leachate is discharged directly to a sewer or forcemain.
- 5.9 The berm situated adjacent to First Line shall be installed in as expeditious a manner as possible and in accordance with the "Berm Assembly Procedure" contained in Appendix 1 of the "Halton Region Technical Study, Noise Analysis, Site D, Schedule J-D, September 11, 1986", prepared by Barman Coulter Swallow Associates. The Berm shall be installed with an outside slope of 6:1 except that the slope may be steeper in the vicinity of the First Line woodlot, which shall be preserved to the greatest extent possible. The side of the berm facing the First Line shall be contoured to allow slight undulations to provide some visual relief from the otherwise monotonous aspect. The berm shall be seeded and planted with an aesthetically appealing mixture of coniferous and deciduous vegetation immediately following installation.
- 5.10 The northwest, northeast and southeast perimeters of the site shall also be planted with an aesthetically appealing mixture of coniferous and deciduous vegetation as soon as possible, and the woodlot in the southeast-central portion of the site shall be preserved to the greatest extent possible.

Roads

CONDITION 6

Site roads and other vehicular areas shall be maintained to minimize dust and the tracking of earth off site.

- 6.1 The bulk bin area, all parking areas and all site roads, except those that are to be landfilled, shall be paved and shall be cleaned as necessary to prevent dust from blowing off site or earth from being tracked off site.
- 6.2 All non-paved site roads shall be treated with dust suppression materials as required in order to minimize dust generation.

Equipment

CONDITION 7

Equipment on site shall be operated and maintained to minimize downtime and noise.

- 7.1 All off-road equipment used at the site shall be operated in such a manner that sound levels from such equipment do not exceed 85 decibels at 15 meters measurement distance.
- 7.2 All off-road equipment shall be tested annually for sound levels in accordance with the procedures specified in Publication NCP-115 of the Ministry of the Environment's Model Municipal Noise Control By-Law.
- 7.3 In the event of serious equipment malfunctions which could lead to the failure to apply daily cover materials, the District Officer shall be notified immediately and the Regional Corporation shall implement a contingency plan to either cease waste collection, direct wastes to an alternate site or acquire temporary replacement equipment, so that waste is not deposited without daily cover.

General Operations**CONDITION 8**

The site shall be operated in the most efficient fashion possible to minimize visual impact, ponding, leachate breakouts, dust, odour, vermin and gull problems

- 8.1 The first layer of waste placed on the base of the landfill shall be material having a relatively low proportion of fines.
- 8.2 Prior to landfilling in each level of waste above grade in a given cell, a compacted berm of cover material shall be placed along the northwest, southwest and southeast perimeter of the cell to the maximum anticipated height of waste in that level. A layer of material with permeability greater than 1×10^{-3} cm/sec shall be placed on the interior side of this berm, extending onto the floor of the level, to ensure a positive hydraulic connection with the level below.
- 8.3 Waste shall be deposited in a manner that minimizes the size of the working face and shall be compacted before cover material is applied.
- 8.4 Cover material with a material size no greater than 25 millimeters shall be applied in a layer at least 15 centimeters thick over newly deposited and compacted waste at the end of each day that the site is open in a manner that ensures that no waste is exposed.
- 8.5 Cover material shall be applied so that vertical hydraulic connection is maintained in each cell.
- 8.6 An alternative supply of cover material for at least five working days shall be maintained at the site at all times and used when regular daily cover materials cannot satisfy conditions 8.3 and 8.4.

- 8.7 Additional cover material shall be applied in a layer at least 15 centimetres thick in areas where no further waste is to be deposited for 60 days.
- 8.8 Whenever any part of a fill area has reached its limit of fill, final cover material shall be applied and compacted. The compacted cover material shall be at least one metre thick.
- 8.9 Cover material which has cracked or eroded so that waste is exposed shall be immediately regraded and compacted.
- 8.10 Bird control measures shall be implemented at both the working face and areas of standing water on site as required. As soon as possible the Regional Corporation shall enter into an agreement with the operators of the Burlington Airpark for the reliable determination of gull populations at the airpark on a monthly average, month-by-month, basis. If the average population of gulls at the airpark doubles for a given month in comparison to the base year, bird deterrent measures at the landfill site shall be enhanced and shall include consideration of overwiring and other state-of-the-art techniques, to the satisfaction of the Approvals Director.
- 8.11 Surface ponding of water shall be minimized.
- 8.12 Grass on finished or temporarily stabilized areas shall be maintained at a minimum height of 12 centimetres to discourage bird loafing.

Public Containers

CONDITION 9

- 9.1 The public container area shall be screened from Highway No. 25.
- 9.2 Each bin in the public container area containing waste at the end of an operating day shall be closed or covered overnight.

Litter Control**CONDITION 10**

- 10.1 The Regional Corporation shall take all necessary steps to prevent the egress of litter from the site.
- 10.2 Litter shall be recovered as soon as possible and, in any event, within 24 hours.
- 10.3 In addition to the provisions of conditions 10.2, litter shall be picked up at least weekly from the following roads and ditches in the vicinity of the site:
- 10.3.1 Highway No. 25 between Lower Baseline Road and Britannia Road.
 - 10.3.2 First Line between Lower Baseline Road and Britannia Road.
 - 10.3.3 Britannia Road between Highway No. 25 and First Line.
 - 10.3.4 Lower Baseline Road between Highway No. 25 and First Line.
- 10.4 Permanent fencing to be installed at the site shall be chain link and a minimum of 3.5 metres in height.
- 10.5 Temporary fencing to be installed at the site shall be portable and a minimum of 3.5 metres in height.
- 10.6 Temporary or permanent fencing shall be placed around all tipping areas, except that snow fencing may be utilized within 30 metres of and parallel to the southwest edge of the active fill area.
- 10.7 The deposit of waste at the site shall generally progress in a southwest to northeast direction.

Soil Replacement**CONDITION 11**

- 11.1 A qualified pedologist and/or agronomist shall supervise all topsoil stripping and operations and the placement of final cover in all areas to be utilized for agricultural after use.
- 11.2 The parts of the fill area to be used for agriculture following closure of the landfill shall be covered with at least one metre of topsoil over and above the final compacted cover.
- 11.3 No agricultural use shall be permitted on any slopes greater than 8:1.

Ground Water Monitoring**CONDITION 12**

The ground water monitoring program shall be designed to identify, delineate and characterize any movement of landfill-derived contaminants and, in particular, to identify any impacts on the use of ground water for domestic or agricultural purposes off-site' which would trigger implementation of contingency measures. The results of all analyses shall be provided to the Environmental Inspector within one month of each analysis being completed. The results of analyses of each domestic well and a copy of each Annual Report shall be provided to the owners of that well. The program shall be designed in accordance with the following:

- 12.1 New well nests shall be established around the site with particular emphasis on the area adjacent to First Line, as described in condition 5.3. In addition, two new well nests shall be established on each of the northwest and southwest boundaries and four new well nests shall be established on the north east side of the fill area. Exact locations shall be selected to investigate the lateral continuity and hydraulic characteristics of the granular units and to facilitate comprehensive monitoring along major contaminant pathways. Where appropriate, new well nests shall be located and designed for contingency purge well purposes.

- 12.2 Each new well shall be installed in a separate borehole. No multilevel devices shall be employed.
- 12.3 The deepest borehole at each monitoring location shall be continuously sampled during drilling. All boreholes shall be drilled using a technique that minimizes the introduction of foreign water into the substrata and that minimizes borehole smearing.
- 12.4 At each location, wells shall be installed in at least each granular unit encountered at the location and in the weathered till.
- 12.5 The lateral continuity and hydraulic characteristics of each granular unit shall be investigated through the use of environmental isotopes and hydraulic testing methods, including pumping tests.
- 12.6 New wells are to be constructed with best available technology for subsequent detection of volatile organic compounds. In addition, its installation, and the subsequent operation procedures are to be reviewed by a qualified hydrogeologist and approved by the Approvals Director.
- 12.7 A monitoring well network, consisting of new wells, appropriate existing wells and potentially affected domestic wells, shall be established.
- 12.8 Each monitoring well shall be equipped with a dedicated sampling device. Sampling devices and techniques shall be designed to provide representative samples and to ensure sample integrity.
- 12.9 Each well in the monitoring well network shall be sampled over a period of at least one year to characterize baseline water quality.
- 12.10 Sampling and analytical procedures, including quality assurance and quality control activities, shall be documented.
- 12.11 A ground water sampling program shall be developed to ensure early detection of contaminants in the event that such contaminants escape the landfill. Ground water shall be sampled at least twice per year. The analysis shall seek to identify

chloride, nitrate and a suite of organic compounds characteristic of leachate generated at the site. Sampling frequency and parameters for analysis shall be adjusted as ground water and leachate monitoring information becomes available.

- 12.12 Equilibrium water levels shall be measured in all wells in the ground water monitoring network and other existing observation wells at a frequency sufficient to investigate short term and long term fluctuations and their influence on the ground water flow system and potential movement of contaminants in the vicinity of the site.

Surface Water Monitoring

CONDITION 13

The surface water monitoring program shall be designed in accordance with the following:

- 13.1 Permanent surface water monitoring stations shall be established to detect and quantify any impacts originating from the site. Stations shall be located to avoid other sources of contamination to the extent possible.
- 13.2 Surface water at each station shall be monitored monthly over a period of two years to establish background water quality and quantity.
- 13.3 Following the two year period of monthly monitoring, surface water shall be monitored at each station at least four times in each year. Frequency shall be increased in the event that landfill-derived contamination is suspected.

Leachate Monitoring

CONDITION 14

Because the site is based on the relatively new concept of a hydraulic trap for leachate containment and collection, leachate monitoring shall be conducted, to determine both the chemical composition of the leachate and the extent of leachate mounding within the refuse, in the following fashion.

- 14.1 Leachate samples shall be collected from the leachate collection system in order to characterize and monitor the leachate chemistry in each landfill cell during the contaminating lifespan of the site. Leachate shall be sampled at least four times per year to monitor annual trends in leachate chemistry. Leachate shall be analyzed for a full suite of inorganic and organic substances with the objective of establishing, and modifying if necessary, the suite of substances to be sought in the groundwater monitoring analysis. The frequency of sampling and parameters for analysis shall be adjusted as leachate monitoring information becomes available.
- 14.2 The flow of leachate from each cell and the total flow of leachate generated at the site shall be continuously measured where practicable. The information shall be integrated into an annual site water balance and used as part of an annual assessment of the performance of the underdrain system.
- 14.3 Following the completion of each landfill cell, wells shall be completed to the base of the waste. The configuration and construction of these wells shall allow monitoring of leachate levels and the pumping of leachate, if required. Following installation, these wells shall be developed and hydraulic tests undertaken to determine the hydraulic conductivity of the waste.
- 14.4 In the event that the leachate level monitoring suggests a failure of the hydraulic trap, leachate samples from wells indicating such failure shall be collected as frequently, and analyzed for the same parameters, as leachate samples from the leachate collection system.
- 14.5 Equilibrium leachate levels shall be measured in each well installed in the waste prior to sample collection and at the same time as equilibrium water levels are measured in the groundwater monitoring network.
- 14.6 In addition to the wells required by condition 14.3, the hydraulic head at the base of each cell shall be monitored using pressure transducers or other appropriate devices.

Contingency Plans**CONDITION 15**

If, in the opinion of the Regional Director, monitoring or other information identifies an unacceptable impact from leachate or gas migration, the Regional Corporation shall immediately take all necessary steps to implement contingency plans.

Off Site Contaminant Attenuation Contingency Zone**CONDITION 16**

The Joint Board, being persuaded that the hydraulic trap leachate containment and removal concept is viable and should be operated to prevent any leachate loss to surrounding strata, recognizes that in the event of detailed design inadequacies or operational shortcomings the adjacent properties that could be affected are those which have important subsurficial strata connections with the site, even though hydraulic gradient data indicate flows toward the site rather than toward the potentially affected properties, and requires the Regional Corporation to make offers to purchase those properties listed below from the present owners, at fair market value as of the date of this Decision as though there were no landfill at the site, for use as an off site contaminant attenuation contingency zone.

- 16.1 The offer to purchase shall be made within 90 days of the expiry of all appeal periods from the date of this Decision.
- 16.2 For the purpose of this condition, the present owners shall be deemed to be the registered owners in fee simple of the properties listed in Condition 16.3 or their spouses or heirs as of the date of this Decision. In the event that any other person acquires a property interest in any of the properties listed in Condition 16.3 after the date of this Decision, the Regional Corporation shall not be required to make an offer to purchase that interest from that subsequent owner.
- 16.3 Property owners to whom offers to purchase shall be made are:
Mr. and Mrs. K. Chaput;
Mr. and Mrs. W. Chlon;

Mr. and Mrs. G. Dhillon; and,
Mr. and Mrs. B. Pompa;

- 16.4 The offer to purchase the properties described in this Condition shall remain open until either;
- a) the offer is accepted,
 - b) the property is sold to a third party, or
 - c) three years from the date of this Decision,
- 16.5 When any of the properties described in this Condition are sold they shall have a condition incorporated in the deed to be registered against title that the property was identified pursuant to this Decision as being part of an off site contaminant attenuation contingency zone for the site.

Staff Training

CONDITION 17

The Regional Corporation shall implement a regular training program for all landfill staff and, prior to any receipt of waste at the site, shall prepare a manual of practices and procedures for landfill staff use and reference. The manual shall be updated and improved as required. A copy of the manual and any updates shall be provided to the Regional Director.

Annual Report

CONDITION 18

The Regional Corporation shall submit an annual report to the Regional Director covering each calendar year. Each report shall include the following information:

- 18.1 The raw data and an interpretive analysis of all monitoring programs.
- 18.2 A yearly summary of volumes and weights by type of all wastes received at the site including a list of all vehicles refused entry to the site together with reasons for any refusal.

- 18.3 Any environmental and operational problems encountered during the operation of the site and any mitigative actions taken.
- 18.4 A description of the quality and quantity of the leachate collected and discharged to the sanitary sewer system.
- 18.5 An assessment of the operation and performance of all leachate collection facilities.
- 18.6 The results of all routine inspections of the leachate collection facilities.
- 18.7 A statement as to compliance with all conditions of approval and with the inspection and reporting requirements of the conditions.

Closure

CONDITION 19

At least two years before closure of the site, the Regional Corporation shall submit a complete plan for the closure, long term maintenance, long term monitoring and after use of the property to the Regional Director. The plan shall include:

- 19.1 Plans for fencing and access control.
- 19.2 Details of any additional cover.
- 19.3 Details of any additional vegetative cover.
- 19.4 After use plans.
- 19.5 Plans for continued maintenance, operation and monitoring of the leachate collection system.
- 19.6 Plans for the continued monitoring of surface waters, ground waters and gas migration.
- 19.7 Plans and schedules for routine inspection and maintenance of the site after closure.

19.8 Updated contingency plans to mitigate impacts from leachate or gas migration.

Land Ownership

CONDITION 20

20.1 Prior to the receipt of any waste at the site, this certificate, including the reasons for these conditions, shall be registered by the Regional Corporation as an instrument in the appropriate Land Registry Office against the title of the site and a duplicate registered copy thereof shall be returned by the Regional Corporation to the Director.

20.2 No part of the site shall be conveyed prior to or after closure of the site to any person by the Regional Corporation or any transferee from the Regional Corporation without the prior approval of the Director.

SCHEDULE A**OFFICIAL PLAN AMENDMENT****PART 'A' - THE PREAMBLE****After-Use**

Studies have been undertaken to determine a final use or uses which may be put in place once landfilling operations are completed on all or part of the subject site. Landfilled areas are subject to a number of constraints which would prevent the erection of buildings or structures on the filled area. Rehabilitation of the Site for agriculture is the intended after-use. It is recognized that rehabilitation to agriculture is a developing technology. The studies conducted by the Region of Halton and the Town of Milton indicate certain limitations. However, an agricultural use will enable the Site ultimately to be put to productive use and will have less impact on the surrounding area than sanitary landfill facilities. This amendment, therefore, permits agriculture as the after-use and any other use would require further amendment to the Plan.

PART 'B' - THE AMENDMENT**Introductory Statement**

All of this part of the document, entitled Part 'B' - The Amendment, consisting of the following text and schedule, constitutes Amendment No. _____ to the Official Plan for the Town of Milton.

Details of the Amendment

The Official Plan for the Town of Milton is amended as follows:

Item (1)

Part 2 (Policy), existing Subsection 4.1.4 is deleted in its entirety.

Item (2)

A new Subsection 4.1.4 is inserted in Part 2 (Policy), as follows:

4.1.4 Notwithstanding any other policies of this Plan, a Sanitary Landfill Site and ancillary uses to be controlled by the Regional Municipality of Halton is permitted between First Line and Highway #25 north of Lower Base Line, located in Lot 3 and Part of Lot 4, Concession 2 N/S. For purposes other than the use of the site for Sanitary Landfilling, the "Agricultural" designation shall continue to apply, and this Plan must be amended to permit active outdoor recreation facilities, such as sports fields or golf courses, together with ancillary uses, as part of a rehabilitation program on the Sanitary Landfill Site, subject only to Section 40 of the Planning Act, S.O. 1983 and to the applicable regulations of the Ministry of the Environment with regard to use of rehabilitated sanitary landfills. The Sanitary Landfill use shall be permitted only until such time as seven point nine six (7.96) million cubic metres have been disposed of on the said lands".

Item (3)

Figure 'D', 'Land Use', is amended by deleting the symbol which designates a Sanitary Landfill Site from the location near the intersection of Tremaine Road and Britannia Road, as indicated on Schedule 'A' attached.

Item (4)

Figure 'D', 'Land Use', is amended by placing a symbol designating a Sanitary Landfill Site north of Lower Base Line between First Line and Highway #25, as indicated on Schedule 'A' attached.

SCHEDULE B

THE CORPORATION OF THE TOWN OF MILTON

BY-LAW NO. _____

A By-law to amend By-law Number 61-85 (Town of Milton) with respect to certain lands in the Town of Milton

FINALLY PASSED the _____ day of _____, 198__.

WHEREAS Section 32(3)(j) of By-law 61-85 presently permits a Sanitary Landfill in the area designated 'A1-10' on Schedule "A" to that By-law;

AND WHEREAS the area indicated in red and designated 'A1-13' on Schedule "A" attached is currently zoned "Agricultural (A1)" and "Open Space Conservation (OSC)", and is now required as a Sanitary Landfill, this use to be eventually replaced by an agricultural after use;

AND WHEREAS the above-mentioned site is no longer required as a Sanitary Landfill, and it is considered that the future use of the site should be governed by the provisions of the "Agricultural (A1)" zoning;

AND WHEREAS the proposed change is in accordance with the Official Plan for the Town of Milton, as amended;

NOW, THEREFORE, the Council of the Corporation of the Town of Milton hereby enacts as follows:

1.1 That the text of Section 32(3)(j) of By-law 61-85 of the Town of Milton is hereby deleted in its entirety, and a new Section 32(3)(j) of By-law 61-85 is inserted to read as follows:

(j) SANITARY LANDFILL DISTRICT
HIGHWAY #25 AND FIRST LINE,
NORTH OF LOWER BASE LINE

- (i) Notwithstanding any provisions of this By-law to the contrary, in the Sanitary Landfill District lying between Highway #25 and First Line to the north of Lower Base Line, which is designated 'A1-13' on Schedule "A" attached hereto, no building or structure shall be erected, altered, extended or enlarged, nor shall any land, building or structure or part thereof be used for other than one or more of the following uses:
 - (a) Sanitary Landfill and accessory uses, to be controlled by the Regional Municipality of Halton;
 - (b) Ancillary building, structures, equipment and facilities which are incidental to the principal use of Sanitary Landfill;
 - (c) Agricultural Uses as permitted by Section 32(1) of this By-law;
- 2. That in the Sanitary Landfill District which is described in Section 32(2)(j), a Sanitary Landfill Use shall be permitted only until such time as seven point nine six (7.96) million cubic metres have been disposed of on the said lands.
- 3. That the boundary and reference to that area designated 'A1-10' on Schedule "A" of By-law 61-85 be deleted so that the lands are henceforth zoned "Agriculture A1".

SCHEDULE C

The details of the properties to be acquired are best shown on the plan of survey dated April 30, 1987, and filed as exhibit **H-888**. The following page of this schedule shows a reduced copy of the parcels, lots, areas and instrument numbers as well as the legend, and the third page of this schedule is a reduced version of the plan of survey (**H-888**).

Reference should be made to the actual survey for the details.

Conditions of Approval

- 202 -

I require this plan to
be deposited under
THE REGISTRY ACT

PLAN 20R-

RECEIVED AND DEPOSITED

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1) THIS SURVEY AND PLAN ARE CORRECT AND
IN ACCORDANCE WITH THE SURVEYS ACT
AND THE REGISTRY ACT AND THE
REGULATIONS MADE THEREUNDER;

2) THE SURVEY WAS COMPLETED ON THE
29th DAY OF APRIL, 1987.

Date APRIL 30, 1987

Date CH-86-02

C.A. Harris
C.A. HARRIS

Land Registrar for the REGISTRY
Division of HALTON (Nº 20)

APRIL 30, 1987
HAMILTON, ONTARIO

Lawrence G. Woods
LAWRENCE G. WOODS
ONTARIO LAND SURVEYOR

SCHEDULE

PART	LOCATION	INSTRUMENT Nº	AREA
1	PART OF LOT 3	501385	40.2237 HA.
2		283379	36.6440 HA.
3		283381	4.0611 HA.
4		631805	0.86920 HA.
5		637896	0.4843 HA.
6		650872	0.4704 HA.
7			0.0139 HA.
8	PART OF LOT 4	357567	16.8510 HA.
9		166432	19.3332 HA.
10			0.8948 HA.
11		PART OF	0.1690 HA.
12		351607	1.3190 HA.
13		PART OF 259834	1.2009 HA.
14		PART OF 267977	0.7604 HA.
15		PART OF 267976	0.9723 HA.

REFERENCE PLAN

SHOWING

PART OF LOTS 3 AND 4
CONCESSION 2 (NEW SURVEY)

IN THE GEOGRAPHIC

TOWNSHIP OF TRAFALGAR

NOW IN THE

TOWN OF MILTON

REGIONAL MUNICIPALITY OF HALTON

SCALE ~~1:4000~~ SEE EXHIBIT # H-888 FOR DETAIL

100 0 50 100 200 METRES

AND ACTUAL SCALE

SIDNEY W. WOODS INC.

1987

BEARINGS SHOWN HEREON ARE ASTRONOMIC AND ARE REFERRED TO A
SOUTHWESTERN LIMIT OF THE KING'S HIGHWAY Nº 25 AS SHOWN ON
PLAN 831 AS N 44° 59' 30" W.

□ DENOTES A PLANTED MONUMENT
■ DENOTES A FOUND MONUMENT
S.I.B. DENOTES A STANDARD IRON BAR
I.B. DENOTES AN IRON BAR
C.M. DENOTES A CONCRETE MONUMENT
R. DENOTES A ROUND BAR
D1 DENOTES INSTRUMENT Nº 501385
D2 DENOTES INSTRUMENT Nº 350175
O/U DENOTES "ORIGIN UNKNOWN"

D3 DENOTES INSTRUMENT Nº 283379
D4 DENOTES INSTRUMENT Nº 283381
D5 DENOTES INSTRUMENT Nº 643014
D6 DENOTES INSTRUMENT Nº 357567
D7 DENOTES INSTRUMENT Nº 166432
D8 DENOTES INSTRUMENT Nº 267976
D9 DENOTES INSTRUMENT Nº 351607
D10 DENOTES INSTRUMENT Nº 259834
D DENOTES INSTRUMENT Nº 92644

METRIC NOTE: DISTANCES SHOWN ON THIS PLAN ARE IN METRES
AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048



01234567891011121314151617181920212223242526272829303132333435363738394041424344454647484950515253545556575859606162636465666768697071727374757677787980818283848586878889909192939495969798991001011021031041051061071081091101111121131141151161171181191201211221231241251261271281291301311321331341351361371381391401411421431441451461471481491501511521531541551561571581591601611621631641651661671681691701711721731741751761771781791801811821831841851861871881891901911921931941951961971981992002012022032042052062072082092102112122132142152162172182192202212222232242252262272282292302312322332342352362372382392402412422432442452462472482492502512522532542552562572582592602612622632642652662672682692702712722732742752762772782792802812822832842852862872882892902912922932942952962972982993003013023033043053063073083093103113123133143153163173183193203213223233243253263273283293303313323333343353363373383393403413423433443453463473483493503513523533543553563573583593603613623633643653663673683693703713723733743753763773783793803813823833843853863873883893903913923933943953963973983994004014024034044054064074084094104114124134144154164174184194204214224234244254264274284294304314324334344354364374384394404414424434444454464474484494504514524534544554564574584594604614624634644654664674684694704714724734744754764774784794804814824834844854864874884894904914924934944954964974984995005015025035045055065075085095105115125135145155165175185195205215225235245255265275285295305315325335345355365375385395405415425435445455465475485495505515525535545555565575585595605615625635645655665675685695705715725735745755765775785795805815825835845855865875885895905915925935945955965975985996006016026036046056066076086096106116126136146156166176186196206216226236246256266276286296306316326336346356366376386396406416426436446456466476486496506516526536546556566576586596606616626636646656666676686696706716726736746756766776786796806816826836846856866876886896906916926936946956966976986997007017027037047057067077087097107117127137147157167177187197207217227237247257267277287297307317327337347357367377387397407417427437447457467477487497507517527537547557567577587597607617627637647657667677687697707717727737747757767777787797807817827837847857867877887897907917927937947957967977987998008018028038048058068078088098108118128138148158168178188198208218228238248258268278288298308318328338348358368378388398408418428438448458468478488498508518528538548558568578588598608618628638648658668678688698708718728738748758768778788798808818828838848858868878888898908918928938948958968978988999009019029039049059069079089099109119129139149159169179189199209219229239249259269279289299309319329339349359369379389399409419429439449459469479489499509519529539549559569579589599609619629639649659669679689699709719729739749759769779789799809819829839849859869879889899909919929939949959969979989991000100110021003100410051006100710081009101010111012101310141015101610171018101910201021102210231024102510261027102810291030103110321033103410351036103710381039104010411042104310441045104610471048104910501051105210531054105510561057105810591060106110621063106410651066106710681069107010711072107310741075107610771078107910801081108210831084108510861087108810891090109110921093109410951096109710981099110011011102110311041105110611071108110911101111111211131114111511161117111811191120112111221123112411251126112711281129113011311132113311341135113611371138113911401141114211431144114511461147114811491150115111521153115411551156115711581159116011611162116311641165116611671168116911701171117211731174117511761177117811791180118111821183118411851186118711881189119011911192119311941195119611971198119912001201120212031204120512061207120812091210121112121213121412151216121712181219122012211222122312241225122612271228122912301231123212331234123512361237123812391240124112421243124412451246124712481249125012511252125312541255125612571258125912601261126212631264126512661267126812691270127112721273127412751276127712781279128012811282128312841285128612871288128912901291129212931294129512961297129812991300

COSTS

The Cost awarding powers of the Joint Board are clearly described in the legislation:

- "(4) A joint board may award costs of a proceeding before the joint board.
- (5) A joint board that awards costs may order by whom and to whom the costs are to be paid.
- (6) A joint board that awards costs may fix the amount of the costs..."

S.O. 1981, c. 20, s. 7.

In his submission on costs counsel for the City of Burlington, Mr. Tzekas, made clear his client's appreciation of the reason for its participation in the hearing, namely, to find the best site for a landfill in the Regional Municipality of Halton. The Board also felt that the purpose of all interventions should have been to assist the Board in its consideration of this matter so that the best site would be selected.

In this Hearing it was often difficult to determine whether some parties were more concerned with preventing the establishment of a landfill in their community than with finding the best site for a landfill. Actions in this regard were consistent with what has been described as the Not In My Back Yard (NIMBY) syndrome. The Board recognizes that this may be a legitimate response by individuals who feel threatened, and while recognizing it we make no judgement on the motives of the various parties. We note only that avoidance of accommodation of the needs of a wider community was not the prime objective of the Hearing.

In this unique Hearing we were confronted by an opposite 'syndrome' as well, one that might be described as IMYP (In My Yard Please). Again the Board makes no judgement on the relative importance of mutually supportive objectives, but notes that accommodating the desire to have a landfill on one's own lands was also not the prime objective of the Hearing.

These observations give rise to the identification of three types of parties to be considered with respect to the matter of costs:

1. Municipalities which are part of the Regional Municipality of Halton and have an interest,

shared with the Region, to find the best site, while at the same time accomodating the demands of their citizens to see that the site chosen is not located in their municipality;

2. Nearby residents who did not have the responsibility to select a site but felt that the site selected nearest their properties was not the best one; and,
3. National Sewer Pipe Investments Limited, who felt that the best site the Region could find would be one situated on their own property, which the Region would likely have to aquire at a higher cost if this Board were to decide that it was the best site for landfill in Halton.

It was apparent from the submissions on costs that all counsel understood the principles that Joint Boards have applied in deciding how to award costs. It was recognized that a most important principle was the extent to which the party had made a real contribution to the Hearing.

On the matter of awarding costs to Municipalities, the Board was advised that the City of Burlington did not request reimbursement if none was awarded to the Town of Milton. The Town of Milton felt that it should be awarded costs in order to redress the imbalance arising from the differing population and tax bases of the two communities. In the view of counsel for the Town of Milton, revenues from the operation of the landfill site would come from all citizens in the Region and should be used by the Region to pay the costs of the hearing. It was suggested that at the very least a net payment should be made to the Town of Milton, even if none was made to Burlington, to accomodate the differences in revenues available to the two municipalities.

The Board was not persuaded by these agruments to allow costs for either municipality. The actions of municipalities' officials over the last decade, as revealed by the evidence

presented to this Board, illustrate the difficulty in determining the extent to which their prime objective corresponded to ours and thus their net 'real contribution to the Hearing'.

On the matter of awarding costs to the citizen coalitions around both sites the Board is persuaded that the proponent's decision to identify two sites compelled them to take action to assist the Board in appreciating why the site furthest from their properties would be the better site for the Board to select. As with the municipalities in question, it was not always clear that the actions of these parties were directed to the prime objective of the exercise. Although the Board decides to award costs to them, it does not award full payment for their expenses on the basis that they must accept a significant portion of the responsibility for their own participation.

The Board recognizes that it must be fair to both groups in terms of the way in which costs are awarded. Both the Milton residents' coalition and the West Burlington coalition raised a significant portion of their financial support from the community. In the case of West Burlington residents part of the support was in the form of a grant from the city, which was not the case for Milton area residents.

The Board has decided to award costs to these residents' coalitions at the rate of about 83% to 85% of their actual expenses submitted, (\$227,313.00 of \$278,415.77 on behalf of Milton Area ratepayers and \$244,253.00 of \$287,821.87 on behalf of West Burlington ratepayers), which costs are to be paid by the Regional Corporation, the Town of Milton and the City of Burlington as hereinafter set out.

Funds are awarded as follows:

West Burlington Citizens Group

\$244,253.00 for payment of consultants fees, and legal fees at the rate of \$140.00 per hour for an assumed six hour day while in attendance at the hearing and 75% of the daily rate for preparation, for a blended legal fees total of \$1,470.00 per day of actual attendance for each of 135 days.

Distribution of funds is to be as follows:

Legal Aid Fund (CELA)	196,350.00
Repayment of Ont. loan	30,000.00
Repayment of Burlington loan	14,703.00
Repayment of Env. Def. Fund	2,500.00
WBCG Expenses	700.00

TOTAL 244,253.00

Milton Area Citizen's Coalition

\$227,313.00 for payment of consultants fees, and legal fees at the same rate as that set out for the West Burlington Citizen's Group above. The amount set aside for Leon Kentridge Associates constitutes only about 77% of that requested, as the Board was persuaded that much of the planning evidence offered was of a "backstopping" nature which essentially reinforced the proponent's evidence on the same subject and should not be fully compensated by awards against the proponent. A similar apportionment of about 78% applies to the account of Jonathan Kauffman for similar reasons. The outstanding loan to the Ministry of Environment (\$30,000.00) shall be paid from this award, and the outstanding balance to the Ontario Legal Aid Plan (\$11,035.08). In view of the Coalition's contribution to the Hearing it would appear to the Board that the Town of Milton might wish to reconsider the neccessity of recovering all or part of its loan to the Milton Area Citizen's Coalition. It is left to the discretion of the Town of Milton as to whether they wish to accept the total repayment of the loan advanced to the Milton Area Citizen's Coalition or whether they wish to transform all or part of that loan to a grant, as was done in the case of Burlington, to pay any of the Coalition's outstanding expenses.

Distribution of funds will then cover at least the following:

Garrod Assoc.(fees)	180,810.00
Leon Kentridge Assoc. Ltd.	25,000.00
Jonathan Kauffman	11,583.92
Disbursements (legal)	9,919.08

TOTAL 227,313.00

The Board awards costs against the Regional Corporation, the City of Burlington and the Town of Milton as follows:

1. The Regional Corporation

The Joint Board orders the Regional Corporation to pay \$200,153.00 to the West Burlington Citizens' Group and \$174,393.00 to the Milton Area Citizens' Coalition for a total of \$374,546.00.

As noted earlier in this section, the decision of the Regional Municipality to proceed with two sites led to the participation of two citizens groups both of which felt that they could assist the Board in determining that the site farthest from them was the best site for landfill in the Region. The Regional Corporation must therefore assume a portion of the costs of these intervenors, in this case about two-thirds of their total expenditures claimed, (total expenditures claimed by the citizens' coalitions were about \$566,237.64).

2. The City of Burlington

The City of Burlington did not request that costs be awarded to them unless costs are awarded to the Town of Milton. The Board has decided to accept this approach with respect to cost awards to either municipality.

On the other hand, having regard to the length of this Hearing and the stated objective of all parties to assist the Board in finding the best site, the Board is concerned about some actions on the part of the City of Burlington which led to unnecessary delays.

In particular, one witness provided evidence and was extensively cross-examined although he admitted quite freely to the Board that he had concluded months before his appearance that his evidence had no bearing on his own, (and by implication the Board's), determination of preference between the two sites under consideration at the time. The Board finds that this and other actions by the City of Burlington unnecessarily consumed at least the equivalent of six sitting days with at least six counsel in attendance, which at the per diem rate calculated above corresponds to \$52,920.00.

The Board orders that \$52,920.00 be paid by the City of Burlington to the Milton Area Citizens' Coalition.

3. The Town of Milton

The Board finds that the Town of Milton also consumed a considerable amount of time unnecessarily. This was most evident in the undertaking of certain tests, (which were not acknowledged at the appropriate times), and subsequent requests to introduce evidence which could not then be validated. It was also evident in frequent diversions in cross-examination on technical matters to areas where witnesses had clearly and repeatedly explained the non-applicability of distant work to the sites actually under consideration.

It is the view of this Board that such actions unnecessarily consumed at least the equivalent of five sitting days with at least six counsel in attendance which at the per diem rate calculated above corresponds to \$44,100.00. This Board is of the view that such actions should not go unchallenged when they are undertaken at public expense and in the absence of the client's taxpayers.

The Board orders that \$44,100.00 be paid by the Town of Milton to the West Burlington Citizens' Group.

On the matter of conduct of counsel at the Hearing, the Board was unable to determine whether the impetus for certain actions came from the client or counsel themselves. When, for example, the Board challenged the time lost in evidence from a witness who had formed the opinion in his own mind beforehand that the evidence would not be useful in deciding the matter at hand, the witness responded that it was not his obligation to direct counsel on how to conduct the case. The Board has not made a determination in this case whether

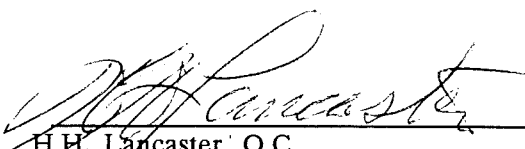
costs should actually be paid by counsel or clients, and in assigning them against the parties as described above leaves the door open to further discussions between clients and counsel on the matter.

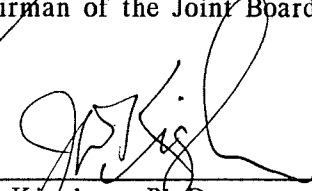
4. National Sewer Pipe Investments Limited

The Joint Board finds that the participation of counsel for National Sewer Pipe Investments Limited was most learned and helpful in matters of law and the progress of the hearing. The technical evidence introduced through cross-examination of witnesses of other parties was of limited use because it related to proposals which did not closely correspond to the matter at hand and did not accommodate the changes demanded by the withdrawal by the proponent of its initial conceptualization of the hydrogeology of the area. The planning expert called by NSP demonstrated his colours as an ardent advocate for the selection of his client's site when he described it "...as close to being a perfect site in my view in these physical terms..." - an observation on perfection not echoed by other evidence that recognized the present realities and complexities of establishing landfills.

This Joint Board was persuaded that NSP Limited had a legitimate interest to advance in this Hearing and that it would have cost at least as much to promote its interest in any other forum, as part of the normal cost of doing business. The Board is satisfied that NSP Limited has not, in this sense, lost anything as a consequence of the universe unfolding in this fashion rather than in another, and accordingly awards costs neither for nor against this party.

THE FOREGOING IS THE DECISION OF THE JOINT BOARD, delivered on the 24TH day of FEBRUARY, 1989.



H.H. Lancaster, Q.C.
Chairman of the Joint Board

D.J. Kingham, Ph.D.
Member of the Joint Board

