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# LAND POLLUTION IN THE NATIONAL CAPITAL REGION

W.A. BLACK & DOUGLAS STEWART

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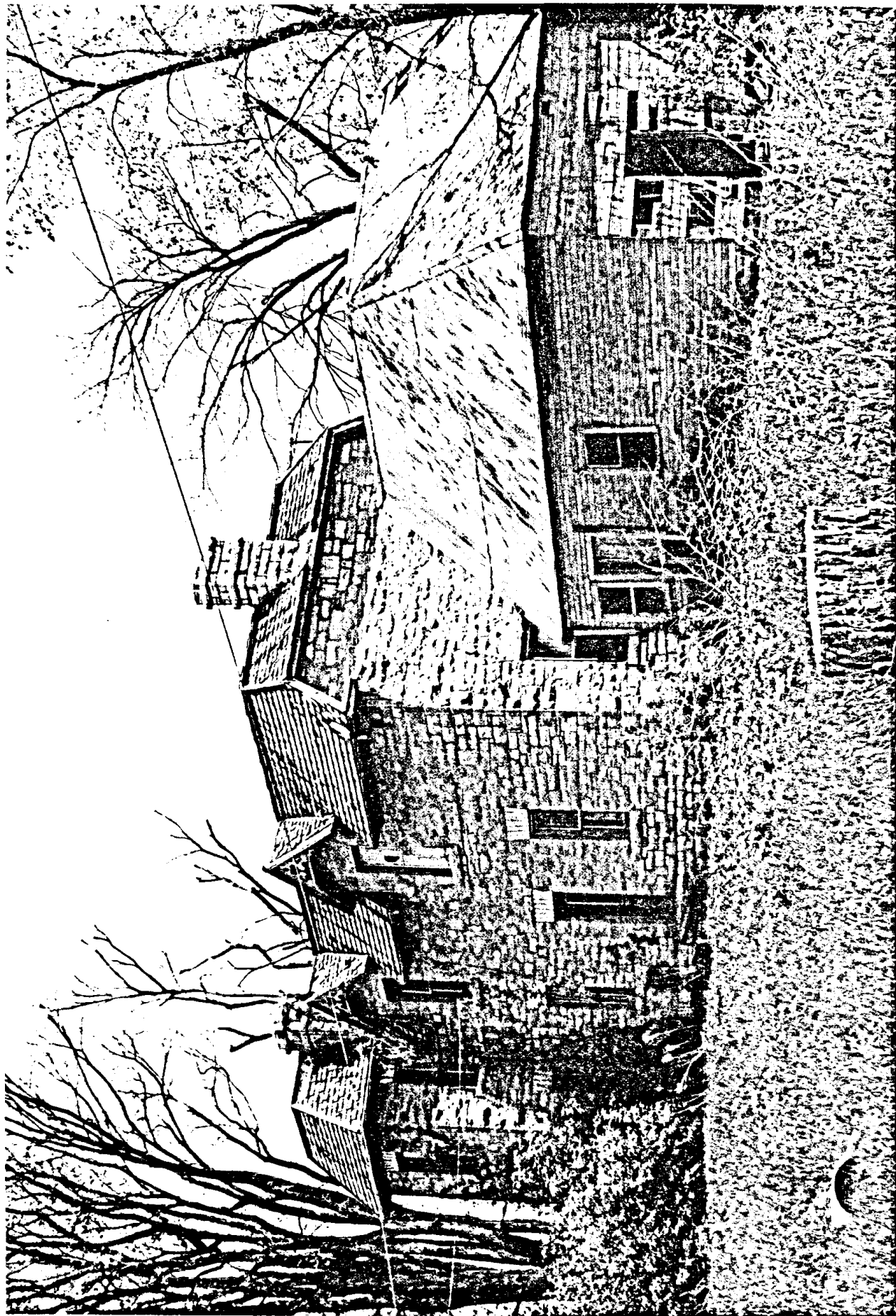


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*Frontispiece:* This well-preserved, vacant, stone house, surrounded by dead and dying elms, is located at the Antrim crossroads. The house is currently being rehabilitated.

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## PRÉFACE

Au cours des dernières années, la pollution de l'air et de l'eau a suscité beaucoup d'intérêt. Toutefois, de nombreuses études sur l'utilisation des terres ont mis l'accent sur les moyens techniques utilisés pour la collecte et l'élimination des déchets solides. Une étude bibliographique révèle un manque presque complet de renseignements sur le nombre, l'emplacement et la distribution des terres endommagées, détériorées ou polluées.

L'objet du rapport est d'évaluer un groupe choisi de polluants du sol dans la Région de la capitale nationale. L'administration de cette région présente l'avantage de relever de la Commission de la capitale nationale, organisme assurant une planification efficace pouvant tenir compte des résultats de l'étude.

Le projet a été mené sous l'égide commune de la Direction générale des terres et de la Commission de la capitale nationale. Les travaux sur le terrain et la préparation du rapport ont été confiés à un groupe de sept étudiants employés durant l'été, dont un coordonnateur dirigé par un agent de recherche. Le présent rapport constitue une revue générale de ce projet de recherche.

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R.J. McCormack  
Directeur général  
Direction générale  
des terres

## PREFACE

Air and water pollution have received considerable attention in recent years. Much investigation regarding land however, has emphasized the technical means of collecting and disposing of solid waste materials. A review of the literature reveals an almost complete lack of information concerning the amount, location and distribution of damaged, despoiled, or 'polluted' lands.

The main objective of this report is to assess a selected group of land pollutants in the National Capital Region. The NCR has the advantage of falling within the administrative purview of the National Capital Commission, which provides the framework of a comprehensive planning process and within which, the results of the work are applicable.

The project was conducted under the joint sponsorship of the Lands Directorate and the NCC. Field work and report preparation were the responsibilities of a group of seven summer students one of which acted as coordinator under the supervision of a research officer. This report provides a synopsis of this research.

R. J. McCormack  
Director General  
Lands Directorate

## RÉSUMÉ

L'air et l'eau servent de véhicules aux agents polluants alors qu'au contraire les polluants terrestres sont des agents plus spécifiques qui sont propres à un lieu; d'une façon générale, les polluants peuvent se définir comme étant les résidus des services socio-économiques destinés à l'homme. L'étude qui suit porte sur les carrières et les sablières, les déchets solides (dépotoirs), les automobiles abandonnées, les ruines, les déchets de bois et la brocaille. La distribution de ces polluants, telle qu'indiquée sur les cartes, touche les zones rurales; les centres urbains ou les agglomérations urbaines ne sont pas inclus. Dans la Région de la capitale nationale, ces résidus occupent une superficie totale de 4,400 à 4,700 acres, dont les deux tiers sont représentés par des carrières de sable et de pierre. Il s'agit en général, des terres agricoles, de boisés, de terrains résidentiels ou, d'une combinaison de ceux-ci.

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## ABSTRACT

Air and water act as media for polluting agents; whereas, in contrast, land pollutants are locational and more specific agents. Pollutants can be defined generally as the residuals of socio-economic services to man. Those considered in this study are pits and quarries, solid wastes (dumps), derelict automobiles, ruins, wood wastes and rubble. Their distribution, shown on the maps, covers rural areas; urban centers or built-up areas are not included. These residuals occupy a total area in the National Capital Region of 4,400 to 4,700 acres, of which pits and quarries account for some two-thirds of the acreage. The land affected is generally farmland, woodland, residential land or a combination of these.





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## LAND POLLUTION IN THE NATIONAL CAPITAL REGION

### INTRODUCTION AND CONCEPT

In recent years, an overwhelming interest has developed in environmental issues; particularly, deteriorating farmlands, air and water pollution, vanishing species and depleting resources. Geographers recognize man as the chief agent in altering landscape patterns. Cities and farmscapes are visible patterns of his creation. He is the chief culprit in environmental degradation that is characterized by both visibly degraded resources and waste products. Concerned citizens, interested groups, and municipal, provincial and federal governments are actively involved in studying and overcoming problems associated with our 'Throwaway Society'. This concern prompted Environment Canada and the National Capital Commission to sponsor the study 'Land Pollution: A Pilot Study in the National Capital Region'. The study, supervised by Douglas Stewart, is being published by the Lands Directorate.

Public and private concern for environmental quality has been strikingly uneven. Considerable knowledge has been gained about the nature of air and water degradation; much is understood about land degradation, particularly depleted soils and denuded land. In land pollution, however, interest has focused mainly on specific polluting agents, such as solid waste disposal or surface mining. No attention has been paid to the distributional patterns of land-polluting agents nor to their effects on the environment of a geographic area.

Perhaps land pollution has received less attention than air and water pollution, because there is no unifying medium to provide a framework for comparison and analysis. Air and water act as media for polluting agents; in contrast, land pollutants are locational and more specific agents. Pollutants

can be defined generally as the residuals of socio-economic services to man, either through production or consumption.\* Until complete recycling of all materials is possible, residuals will continue to require disposal.

The residuals approach to the study of land pollution provides a convenient medium for emphasizing the external effects of land pollutants and for focusing research on environmental quality. Whether the polluting agent is an abandoned automobile, a derelict building, a quarry or a dump, each has the same common denominator - each is a residual of man's use. This approach is used in the land-pollution survey of the National Capital Region (NCR). This survey is one of the first to show the mapped distribution of land pollutants in a Canadian urban-centered region; it has national application.

Pits and quarries, solid wastes, derelict automobiles, ruins, wood wastes and rubble have been selected as residuals in the National Capital Region. Their distribution, shown on the maps, covers rural areas; no mapping was done within urban centers or built-up areas. The residuals occupy a total area estimated from 4,400 to 4,700 acres. Land use affected is most commonly farmland, woodland, residential land or a combination of these.

There are five prerequisites for forming effective public policy to deal with residuals in a geographic area such as the NCR. These are: identify the residuals in an area, estimate the frequency of their occurrence, ascertain the intensity of the external effects, identify the bearers of the costs, and finally, evaluate economic and institutional arrangements that influence costs resulting from the external effects of the residuals.

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\* This basic concept was developed by Kneese and Herfindahl: "Quality of the Environment". Resources for the Future, Johns Hopkins Press, Baltimore, Md. 1965. p. 65 and Kneese, Ayres, and d'Arge: "Economics and Environment - A Materials Balance Approach". Resources for the Future, Johns Hopkins Press, Baltimore, Md. 1971. p. 1.

Although the list of prerequisites remains constant, the list of residuals, varies in nature and intensity in urban regions, cities and municipalities of Canada.

The distribution of the mapped sites offers a visual impression of the intensity of each pollutant. By relating the site to the surrounding land use, a preliminary step is taken toward identifying the bearers of the costs of pollution. No attempt is made to assess the economic costs and benefits of land reclamation.

The distribution of each residual, its effect on the quality of the land it occupies and on the surrounding land, and the size and severity of the polluted sites are described separately.





## PITS AND QUARRIES

Rapid growth in the National Capital Region has increased the demand for sand, gravel and rock aggregates. The use of aggregate in 1971 is estimated at 11.9 tons per capita or about 7.6 million tons for a population of 641,000. If the population continues to grow at the present rate, the production of aggregate will more than double by the year 2,001.

In the Ontario section, sand and gravel aggregates are extracted from relatively flat surface deposits, mainly old glacial and marine beaches. In Québec, because of rough terrain and for ease of accessibility, pits are located close to roads and are cut into hillsides and slopes. Rock aggregate in the region however, is mainly derived from flat-lying palaeozoic limestones.

Pits and quarries occupy about 3,200 acres in the National Capital Region; about two-thirds are situated on the Ontario side (Fig. 1). These figures, however, do not include reserve acreages, or pits less than one-quarter acre in size. The PITS AND QUARRIES map shows marked concentrations: the one furthest west, beginning near Pakenham and extending east to the Carp airport and southeast to Richmond, exceeds 1,000 acres. A second line, west of the Rideau River, extending south from Bells Corners to Kars, covers 375 acres. The area of largest and most numerous sites extends southeast in a line from the Leitrim-Ottawa airport to South Gloucester and south to Osgoode; this band contains 48 pits and 4 quarries covering 856 acres. A line of pits, occurring in the Québec section, and lying close to the highway, extends from Cantley northward to and beyond Wilson's Corners along the forks of the highway.

The largest concentration of pits (750 acres) is located contiguous to agricultural land. Farm land, natural landscape and a combination of these two account for 80% of the land use surrounding the sites (Fig. 2).

The types of costs are associated with controlling land pollution



Figure 1

Pits and quarries account for about two-thirds of the acreage affected by land pollution. Revegetation of the slopes and growth of aquatic plants has begun in this example.

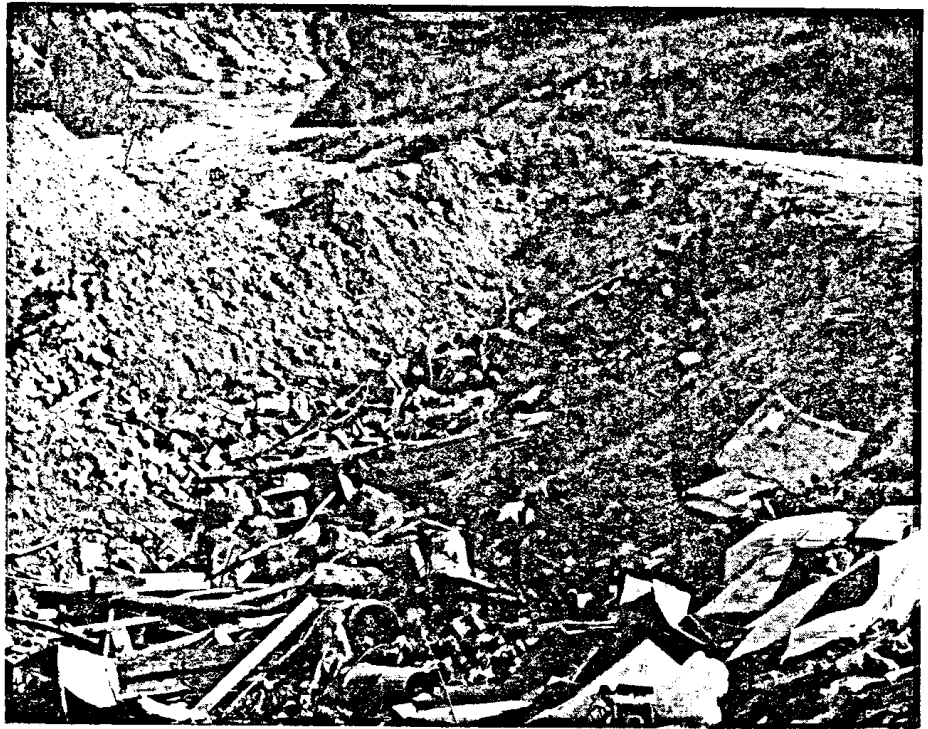


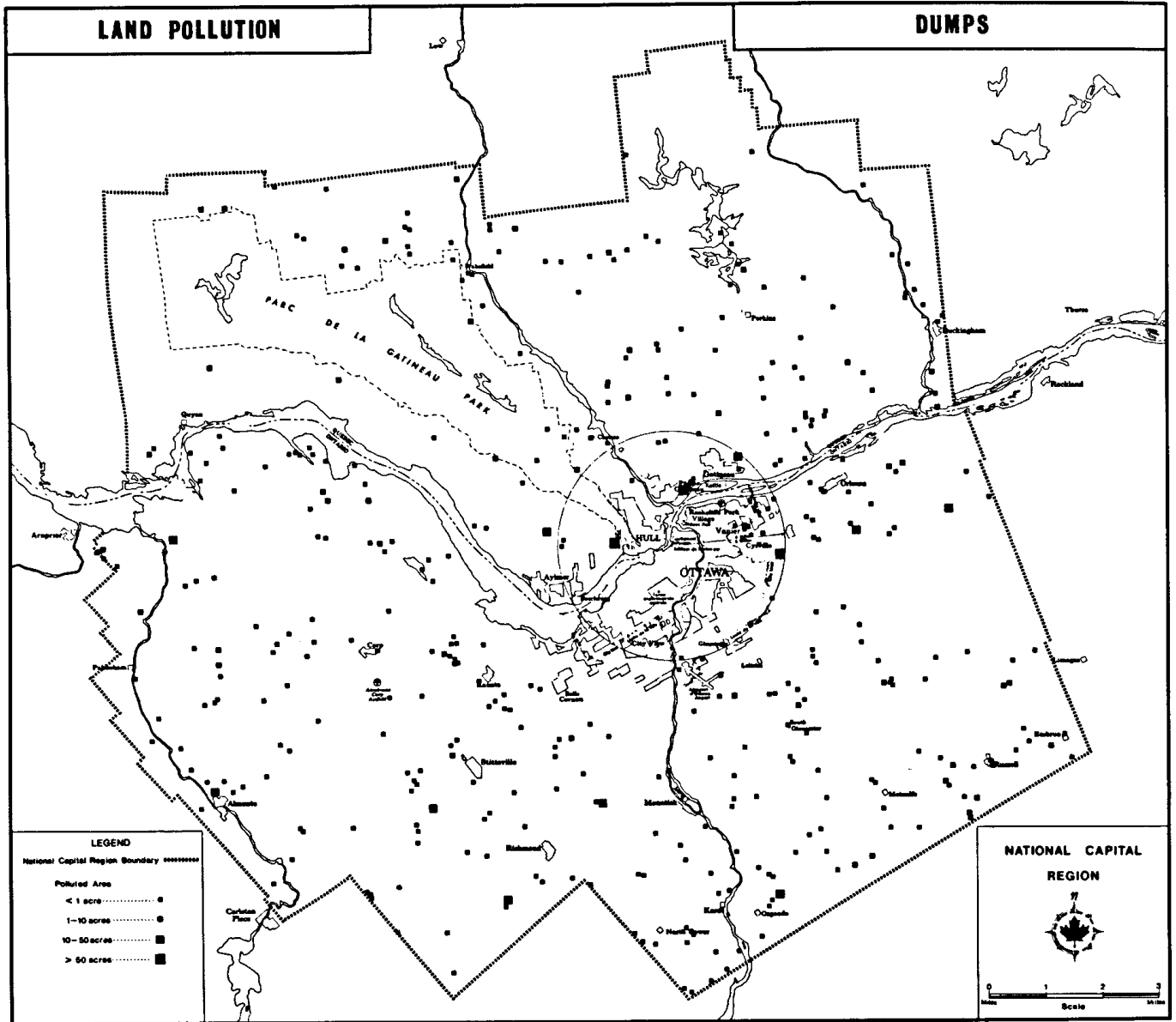
Figure 2

Agriculture is the primary land use affected by aggregate mining. Associated pollutants, wood waste and garbage, have been dumped into this pit.

in the operation of pits and quarries: the first group, nuisance effects, such as dust, noise, truck traffic and reduced aesthetic quality of the landscape, can be controlled by 'interim' rehabilitation, that is by a vegetation screen to help contain noise and dust and to hide ugliness. Ultimate rehabilitation of a pit's open space, after the exhaustion or abandonment of the deposit, is possible. Rational planning is necessary to ensure that a pit will be suitable for other uses after mining is completed. Limiting maximum slopes, preserving the top soil, controlling erosion, reducing interference with local drainage, and renewing vegetation are important elements in the final recovery of a site for future use.

The second type of cost is related to the restriction of land-use choices. When the competition over land for different uses is especially acute, the social benefits derived from a particular use must exceed the social costs of lost opportunities. Sustained urban growth, requiring large quantities of aggregate, tends to intensify the negative effects of pits and quarries. Agriculture is the primary land use affected by aggregate mining in the NCR and, therefore, the loss of agriculture land in the face of continuing world food shortages cannot be dismissed lightly. Most of the suitable agricultural lands are now fully used.

Legislation to control the operation of pits and quarries and their rehabilitation in the NCR is inadequate in some areas, outdated in others, non-existent in yet others, and the enforcement of existing regulations is inconsistent throughout the region.



## SOLID WASTES - DUMPS

These consist of residuals such as garbage, refuse or other materials which, having no further use to man, are usually disposed of in dumps. The National Capital Region contains about 413 dumps, varying in size from those less than one acre to those greater than 50 acres. In total, they are estimated to cover from 800 to 1,000 acres; agriculture, natural landscape or a combination of both are the land use types affected.

No concentrated pattern of dumps is apparent on the SOLID WASTES - DUMPS map. The largest sites are located near, but not within, areas of high population density. Communities, townships, and industrial operators dispose of their waste at municipal dumps. Since agriculture is a major producer of waste, each township maintains a large number of small public sites.

About 86% of dumps are the 'roadside' variety that are found bordering roads or in backyards (Fig. 3). They demonstrate man's propensity for dumping garbage indiscriminately, without concern for aesthetics or future use. The remaining 14% are almost evenly divided between municipal and private dumps, and between sanitary and non-sanitary landfill sites. Sanitary landfill usually tends to control the areal extent and volume of solid waste with a blanket of earth (Fig. 4), while non-sanitary wastes are uncovered and usually uncompacted.

Waste disposal sites have various restrictions to their rehabilitation: for example, the introduction of new land uses at disposal sites may be limited because the production of methane gas continues long after a site has been closed; differential settlement of wastes over a long period of time may induce structural damage to new buildings erected on the site; and rehabilitation as recreation areas involves covering the site with a layer of earth and topsoil to support vegetation.

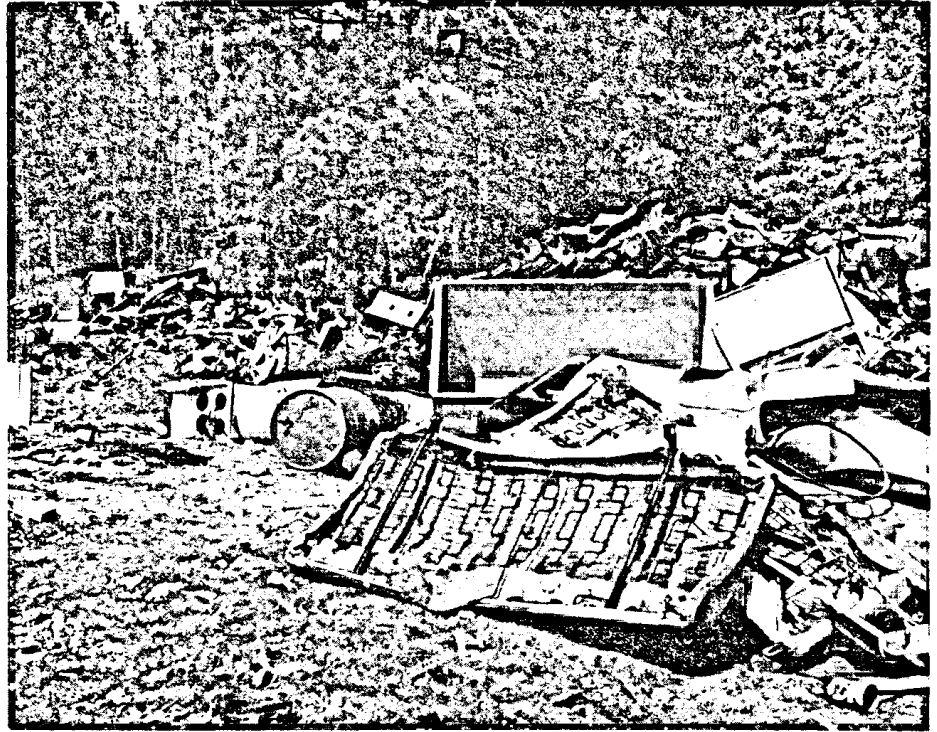


Figure 3

About 80% of the dumps in the National Capital Region are of the roadside variety; they destroy the beauty of the countryside.

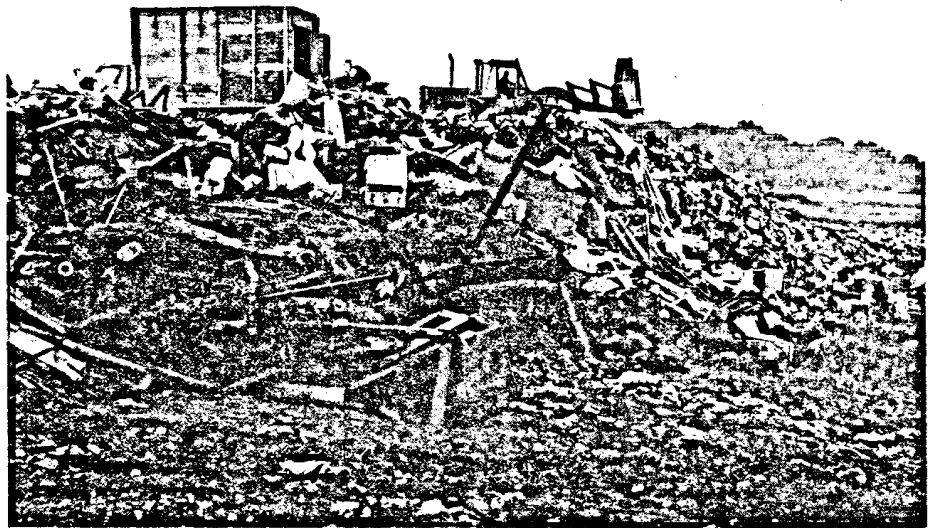


Figure 4

Trash at the Ottawa Municipal Dump is compacted and covered with soil; the site could become a potential recreation area.

A second group of effects increase rehabilitation problems because of the physical characteristics of waste. Decomposition of organic material at disposal sites produces a disagreeable odour and attracts flies and rodents. Open burning and smoke are prevalent at many sites. The ugliness of dumps generally reduces the market value of the surrounding land.

Dumps have ecological effects: the leaching of organic and inorganic chemicals and residues in dump materials generates a substantial risk of ground and surface water pollution especially since many dumps are located on low, wet land. Moreover, the porous structure of many gravel and sand pits used for dumps readily permits polluting leachate to reach groundwater. Further, as runoff reaches streams, the proximity of dumps to open water greatly increases the potential for direct contamination.

Swamps, lowlands, river bottoms, ravines, and abandoned pits and quarries are preferred sites for dumps. The topographic configuration of most dump sites renders them unsuitable for agriculture and sub-surface characteristics, due to the settling of waste, render them unsuitable for construction. When disposal sites are located in swamps and valleys, they destroy recreation potential.

Since disposal sites are necessary, it is important to reduce the negative effects of open, non-sanitary landfill by substituting sanitary landfills, as well as to plan for the future rehabilitation of sites as potential assets.

Legislation to control solid waste disposal in the NCR exists, particularly, the Waste Management Act, 1970, Ontario and the Environmental Quality Act - Bill 34, Québec. Municipalities of the NCR produce about 1,300 tons of solid waste a day, and in thirty years it is expected to reach 2,000 tons a day; thus, proper control and management of waste is a pressing issue. Intensive education of politicians, municipal managers and the public is required to produce an awareness of the seriousness of land pollution problems and the need for constructive legislation.





## AUTOMOBILE DISPOSAL

Derelict automobile sites in the National Capital Region have resulted from illegal abandonment of inoperative vehicles on public and private land, maintenance of auto-graveyards on private land and operation of commercial wrecking yards and body shops.

Derelict automobiles occupy 975 sites or about 120 acres. The sites, ranging in size from those containing less than 3 automobiles to highly concentrated sites containing more than 100 vehicles, are scattered unevenly throughout the region (AUTOMOBILE DISPOSAL map). The sites are grouped, based on four criteria: the abandoned automobile category - 3 automobiles, the auto-graveyard - from 3 to 20 vehicles, the low-density auto-wrecker - a commercial operation containing less than 20 vehicles, and the high-density auto-wrecker - a commercial operation exceeding 20 vehicles. Note that the map indicates the sites by the simpler size-classification.

Although the abandoned automobiles category accounts for 56% of all sites identified, these sites contain only 6% of all derelict automobiles (Fig. 5). The autos are abandoned along country roads and near farm buildings, particularly around population centres. In Ontario, two-thirds are located within 20-24 miles of the centre of Ottawa; in Québec, most are located north and northeast of Hull. The auto-graveyard category which accounts for 36% of all sites and 24% of all derelict automobiles, occupies about one-quarter of the land; the sites are usually located near farm buildings.

The low- and high- density auto-wreckers account for the remaining 8% of the sites and 71% of all derelict vehicles. The high-density auto-wreckers account for two-thirds of the land occupied by derelict autos. Many wrecking yards on both sides of the Ottawa River have not been mapped because they are located within built-up areas.

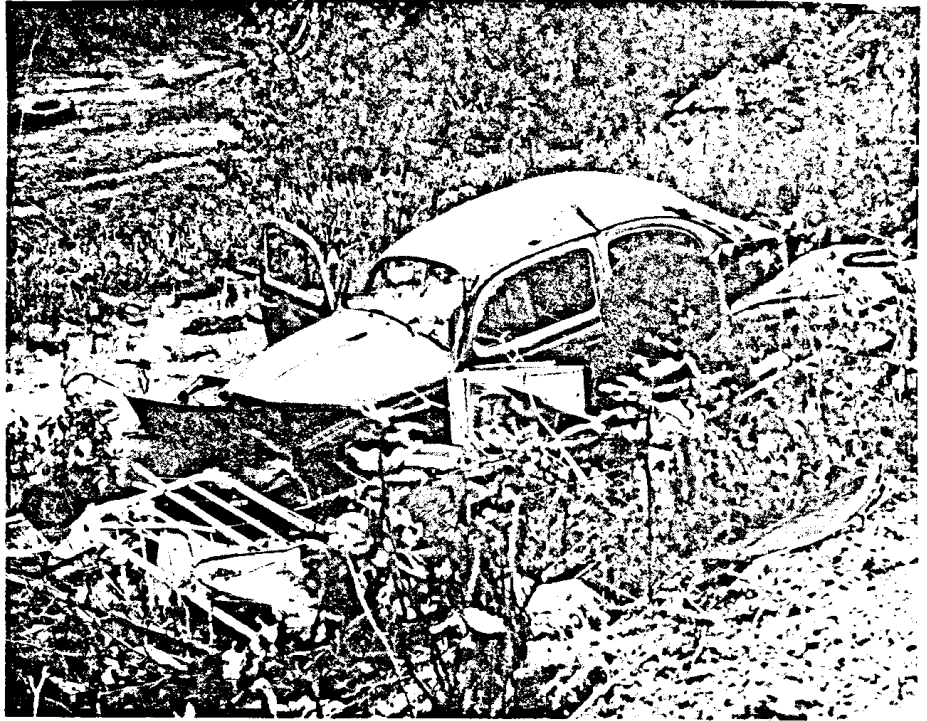


Figure 5

Most abandoned auto sites are situated along the more isolated roads near centers of population. This site includes garbage and bulky waste.



Figure 6

Auto-wrecking sites tend to downgrade residential land; however, they play an important role in the automobile-use cycle.

Of the automobile disposal sites over 50%, mainly derelict automobiles and auto-graveyards, occupy agricultural land; residential land use and natural landscape each account for about one-fifth. Both low- and high-density auto-wreckers occupy commercially-zoned or rural land adjacent to urban satellites. Derelict automobiles remove land from more productive use. They are aesthetically displeasing and may seep oil and gasoline into runoff and ground water, and provide a breeding ground for vermin. Wrecking yards, often noisy and dusty, are unsightly and tend to downgrade adjacent residential land (Fig. 6). The derelict auto as a piece of playground equipment poses a serious hazard to children.

New regulations, issued by Ontario under the Environmental Protection Act, are designed to simplify procedures for removing vehicles abandoned on public or private property without prior permission. The regulations, if applied, should reduce the number of abandoned automobiles on the Ontario side of the National Capital Region. Québec has not instituted measures to deal with the problem.



## RUINS AND ABANDONED BUILDINGS

Most deserted structures in the National Capital Region may be distinguished as either 'ruins' or 'abandoned buildings'. The former is a structure or remains of a structure which is abandoned, irreparable, and, therefore, may be a hazard; the latter, although not in use, may be restored. Although many derelict buildings are present in the NCR, most of the sites mapped could be classified as ruins.

The sites are evenly distributed along roadsides throughout the region without any particular concentration. The distribution pattern of the 805 sites, shown on the RUINS map, covers about 200 acres of the NCR. About 70% of the sites are located in Ontario and may reflect several factors; for example, a greater percentage of land on the Ontario side is in agricultural use and, therefore, the higher number of abandoned structures may result from the larger scale of farm consolidation. It may also reflect the greater population and the fact that the Ontario side is more built-up than the Québec side. No appreciable difference is noticed in the concentration of sites as the fringe of urban development is approached.

Although all sites surveyed cover less than one acre, other forms of pollution, associated with the site, may spread over a wider area. In built-up areas, the abandoned building and the area of associated pollution usually does not exceed a residential lot.

Farm buildings, consisting of abandoned frame, log and stone houses, and abandoned barns and sheds represent over 90% of derelict structures (Fig. 7). Many foundations are located in pasture lands. The condition of the sites varies considerably - some could be renovated, others could not.



Figure 7

Abandoned houses, barns and sheds represent over 90% of the derelict structures of the National Capital Region.

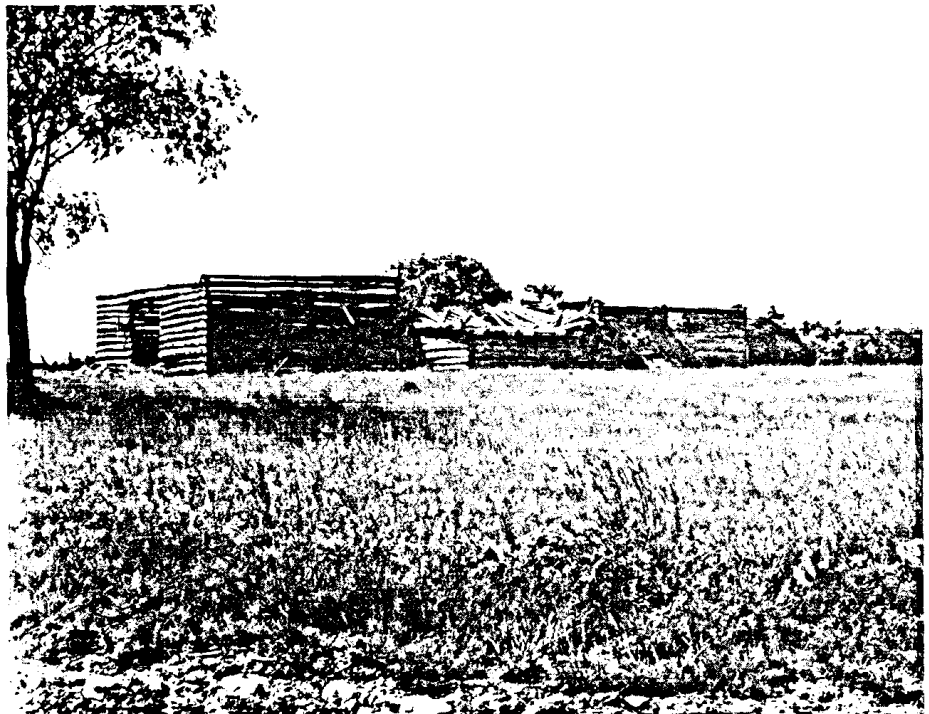


Figure 8

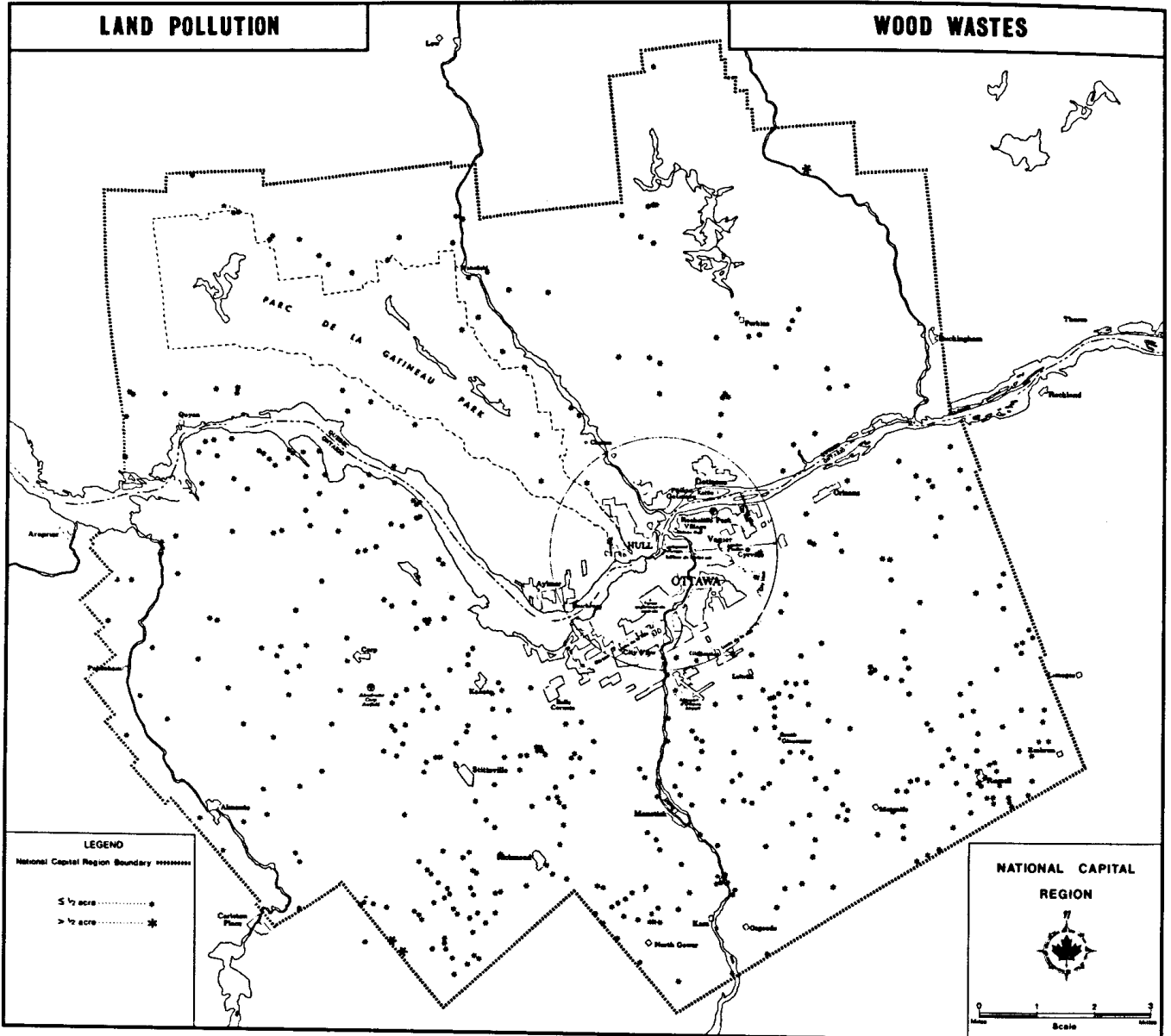
Abandoned pioneer log barns offer a potentially valuable commodity for the urban market.

Although every common land-use type is found surrounding abandoned structures, agriculture and natural landscape are the most common. Wood wastes, metal wastes, small private dumps, abandoned farm machinery and automobiles are found around many derelict structures. Many dilapidated buildings tend to be health hazards, potentially dangerous to livestock and aesthetically 'eyesores' (Fig. 8).

Generally, government, at any level, has little or no control over abandoned buildings; individual owners have full power over the disposition and disposal of abandoned structures. At the municipal and township levels, certain minimum standards for site maintenance do exist; moreover, insurance protection is not available for an unoccupied residence. Most minimum standard regulations apply only to occupied buildings; none govern derelict buildings.

This form of land pollution has had low priority in government programs. Politicians, planners and the public have not been concerned with the problem of derelict buildings; some may even view this rural condition either as an aesthetic or as a 'non' problem.

As many of the abandoned buildings are picturesque and would have considerable potential value when renovated, the private sector could be encouraged to take an interest in restoring these buildings. With regard to the removal of ruins from private land, changes in legislation would be required.





## WOOD WASTES

These pollutants consist of concentrations of dead trees, uprooted brush and stumps, abandoned lumber, sawdust and mill waste. Stranded logs litter the banks of the Gatineau, Lièvre and Ottawa rivers.

The 475 sites, shown on the WOOD WASTES map, cover an area of 120 to 150 acres in the National Capital Region. About four-fifths of the concentrations are in the Ontario section. The area of greatest concentration, is located south of an arc extending from Richmond, South Gloucester to Embrun. There are no particularly dense concentrations of wood-waste sites on the Québec side.

Almost all wood-waste concentrations occupy sites equal to or less than one-half acre; the three exceptions consist of concentrations of dying and dead trees in swampy woodland. There is little variation among the sites: small stands of blown-down trees, uprooted brush and stumps from land-clearing operations and abandoned lumber are the most common types (Fig. 9). Most wood-waste sites are located on agricultural land or woodland; some are partially overgrown with vegetation.

Wood waste on farms does not present a serious environmental or aesthetic problem since sites tend to be small and of low profile; nor does wood waste affect future land use to any appreciable degree. Much of the wood waste located on agricultural land is likely to be reused or removed in a relatively short time (Fig. 10). No attempt has been made to map the thousands of standing dead or dying elms which are distinctive 'eyesores' on farmscapes and in small towns.

The use of the Gatineau, Lièvre and Ottawa rivers for transporting logs, the accumulations of stranded logs on the shores and log jams have undoubtedly inhibited the recreation potential of these rivers.

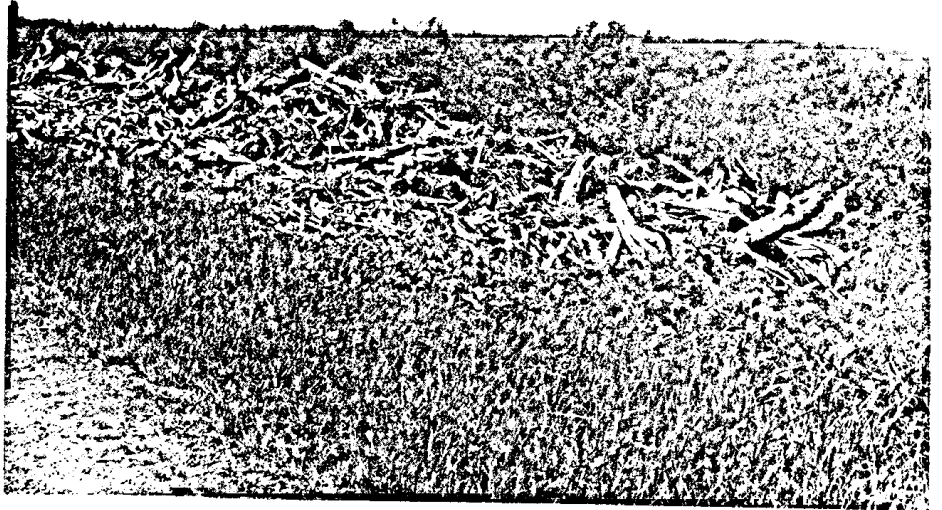


Figure 9

This windrow of wood waste, consisting of stumps, roots and branches, resulting from land-clearing operations is likely to be a temporary feature.

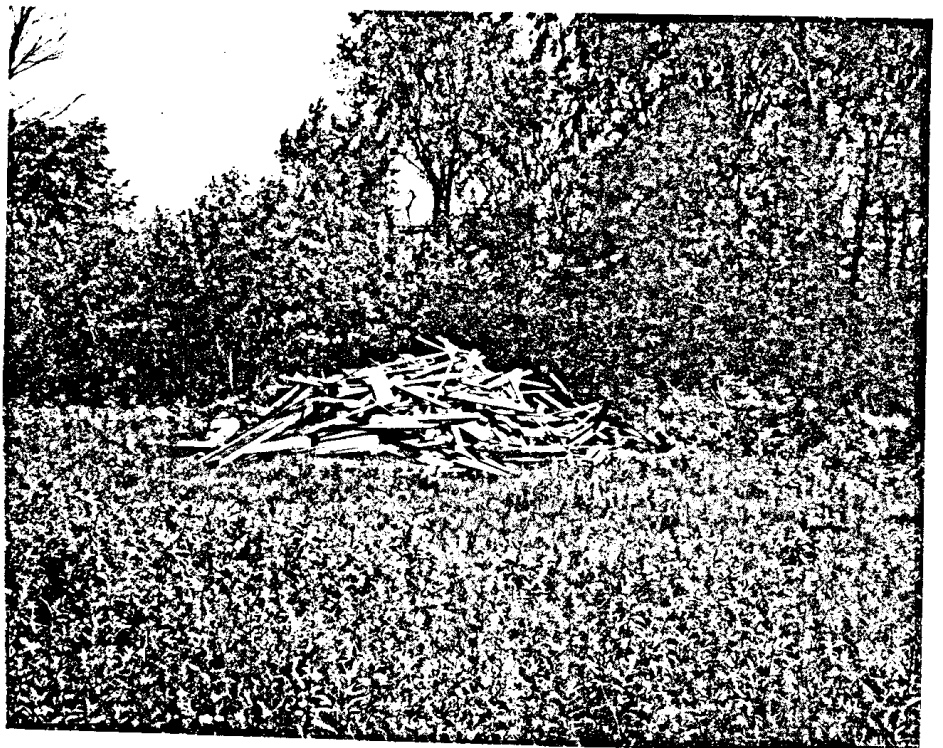


Figure 10

Wood waste resulting from demolition tends to be unobtrusive.

No attempt has been made to assess the ecological effects of the use of these rivers as log carriers nor of the costs of removing stranded and sunken logs.

As wood waste, however, does not present widespread environmental or aesthetic problems, no immediate legislative or municipal action seems necessary, except perhaps an assessment of controlling the movement of logs on the rivers.



## RUBBLE

Rubble consists of accumulations of broken masonry, building stone and rock fragments which result from both the construction and demolition of buildings. In this study, rubble does not include farm stone piles or stone fences which tend to blend into the farmscape. About 61 rubble sites, occupying about 20 acres in the National Capital Region, have been identified. The sites are small, of low profile and usually less than 100 square yards.

The RUBBLE map shows that the occurrence of rubble sites decreases with distance from population centres. The area of greatest concentration, where construction and demolition activities generate the greatest amount of rubble, is in the Ottawa-Hull area - the centre of the region's greatest growth. Although these activities could be expected to generate considerably more rubble than is shown on the map, much of the output is used for landfill or as bric-à-brac against basement walls in housing developments. In mapping the location of rubble sites, it was difficult to determine whether the sites were temporary or permanent.

Rubble sites are often unobtrusive, and of limited size, usually less than 100 square yards (Fig's 11 and 12). They do not pose a serious environmental problem because of their limited extent and relative harmlessness. Landfill provides a judicious use of rubble and should be the standard practice wherever possible. Rubble and wood wastes when compared with other land polluting agents appear to have little environmental effect.

Municipal governments should ensure that construction and demolition work in their areas of jurisdiction include adequate disposal of waste after the work is completed.



Figure 11

The construction waste at this site, consisting of broken concrete blocks, masonry and metal is aesthetically displeasing.



Figure 12

Masonry waste, somewhat like stone piles, tends to be unobtrusive. This rubble pile is in a farmer's field.

## RECOMMENDATIONS

The list of land pollutants that were surveyed reflects the interests of the researchers: it may not necessarily reflect those of other professional backgrounds or people of the National Capital Region. The more important recommendations may be listed as follows:

i) A survey should be made to ascertain what the populace would consider a land-polluting agent.

ii) As this study is concerned with the rural areas only, it is recommended that further research should deal with urban-land pollution.

iii) Although the nature of the external effects generated by each type are discussed and land use noted, it would be useful for policy makers to have the effects quantified and the ultimate incidence of all pollutants on the surrounding land determined.

iv) The lack of legislation and the inadequacies of enforcement to deal with land pollution result largely from a multiplicity of jurisdictions and interests. Present legislation should be reviewed to determine the reforms that could be instituted to improve and control land pollutants.

v) The development of a system of land-quality indicators could provide a basis for calculating the dollar-costs of each pollutant on different land uses and the ultimate bearers of pollution costs. Such an assessment of land-quality costs would aid policy makers in framing resource-allocation decisions.

vi) Finally, it is recommended that any program to deal with land pollution should not select too narrow a focus i.e. land only; provision should be made to ensure that land-quality programs mesh with air- and water-quality programs.

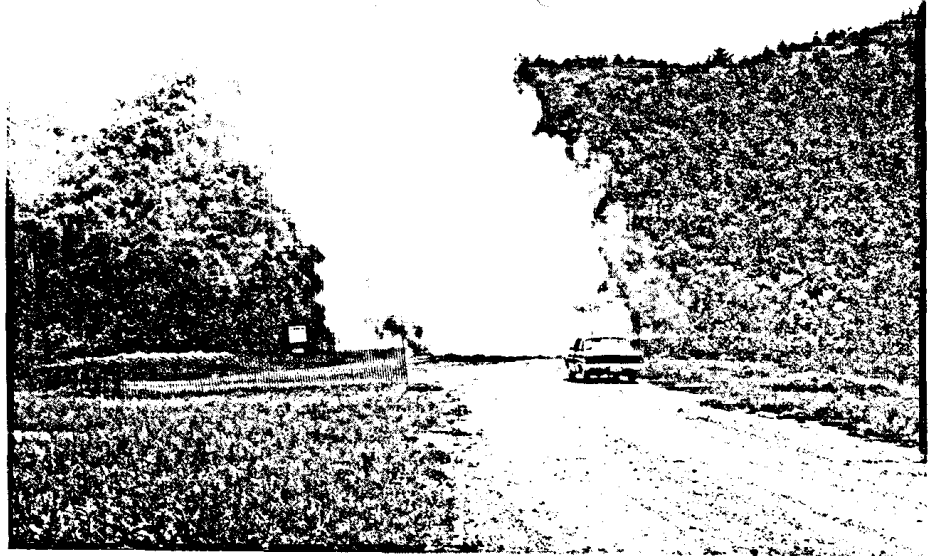


Figure 13

Smoke from the burning of organic material adds to the offensiveness of the site as it degrades aesthetically-pleasing surroundings.



Figure 14

The derelict autoes at this site may or may not be any more offensive to the eye than the dandelions.



SUMMARY

An estimate of the amount of land directly affected by land pollutants is between 4,460 to 4,690 acres (see table). Agricultural land, woodland, natural landscape or combinations of these are primarily the land-use types affected. Much more difficult to measure are the indirect or peripheral effects of land pollution, which may vary from near-site effects to an unknown distance to which toxic chemicals may be transported by groundwater, or the adverse social and economic effects of aesthetically displeasing environments.

Estimate of land affected by land pollution\* is as follows:

Pits and Quarries	3200 acres
Solid Wastes - Dumps	800 to 1000 acres
Derelict Autos	120 acres
Ruins and Buildings	200 acres
Wood Waste	120 to 150 acres
Rubble	20 acres
<hr/>	
Total Affected Land	4460 to 4690 acres

\* Land pollution information is shown superimposed on topographic maps, some of which are no longer current. Consequently, some discrepancies in location, size or labelling of individual units may occur.

The recognition that earth's resources are finite has been dramatically underlined by the energy crisis. Derelict autos, metallic waste, residual oils, chemicals, garbage and other materials can largely be reclaimed and recycled for further use. Although progress on a large scale in Canada has been slow, rapid advances by governments and by industry indicate technology is developing to recover valuable resources and to conserve raw materials.

The first step, however, is to identify and clean up land pollutants such as those described in this study. While the study area is the National Capital Region, the problems are common to any metropolitan or regional area in Canada. The National Capital Commission and Environment Canada hope that by commissioning and publishing this study, other municipalities across Canada would be encouraged to conduct similar studies with the object of cleaning up visual scars on the rural and urban landscapes of the nation.

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