

**Leicester**  
City Council

# **Contaminated Land Inspection Strategy for the City of Leicester.**

**June 2001**

Required under the provisions of the  
Environmental Protection Act 1990 Section 78B

## **Environmental Protection Act 1990, Part IIA**

**This document was formally adopted by the Leicester City Council Cabinet on 25<sup>th</sup> June 2001 in compliance with the duty under Section 78 of the Act, and in accordance with Guidance issued under this Section, by the Secretary of State for the Environment, Transport and the Regions.**

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## **Executive Summary**

Part IIA of the Environmental Protection Act 1990 introduces a new regulatory role for local authorities, aimed at controlling threats from land contamination. Local authorities are required to take a strategic and proactive approach to the identification and remediation of contaminated land within their areas. It is the intention of this legislation to ensure that the “polluter pays” principle is applied to the control of unacceptable risks from land to human health or the wider environment.

This report introduces the new contaminated land regime and details work already undertaken by the City Council Pollution Control Group in preparation for this new regulatory role. It outlines how the City Council will discharge responsibilities imposed by the Act and supporting government guidance.

The definition of contaminated land is based on the concept of suitability of land for its current use. This is determined by a scientifically robust, assessment of the risks involved. For land to be designated as contaminated land there must exist a ‘significant pollutant linkage’ consisting of:

- a ‘contaminant’ situated in, on or under the land with the potential to cause harm or to cause pollution of controlled waters
- a ‘pathway’ - one or more routes or means by, or through, which a receptor is being exposed to, or affected by, a contaminant.
- a ‘receptor’ (target) - either humans or living organisms, ecological system or property which is being or is capable of being harmed by a contaminant,

In July 2001 the Pollution Control Group will begin a five-year program of identifying and securing the remediation of contaminated land within the city. The identification of contaminated land will be carried out in an ordered, rational and efficient manner based on the principles of risk assessment. Protection of human health will be given the highest priority.

The primary task is the undertaking of a desktop exercise to identify potentially contaminated land via the use of current records and a range of digital data. The City will be zoned in terms of the likely existence of contaminated land. Resources will be first concentrated in areas where contaminated land is considered most likely to exist. A more detailed investigation of any potentially contaminated land identified will then be undertaken to inform a decision as to whether the land falls within the definition of 'contaminated land'.

Contaminated land will be formally determined and details of all such land will be held on a public register. Specified appropriate person(s) will be identified and encouraged to undertake suitable voluntary remediation. The City Council will commence formal enforcement procedures introduced by the Act if voluntary remediation cannot be secured.

In addition to its regulatory role, the City Council has legal obligations for any contaminated land risks arising from land within its ownership. Liability will also be retained for land, which is contaminated as a result of City Council activities, regardless of current ownership, unless very specific liability exclusions are in place. The report details how such City Council liabilities will be dealt with and includes a review of an extensive and ongoing, 12 year program of investigating and remediating former corporation landfill sites in order to bring them beyond the scope of this new regime.



# **Chapter 1                      Introduction**

## **1.1    Our Contaminated Land Legacy**

This country has inherited a substantial legacy of land, which has been contaminated by past industrial, mining or waste disposal activities. It is not known, in detail, how much land is contaminated. This can be found out only through wide-ranging land quality assessment, detailed site investigation and risk assessment.

The existence of contamination presents its own threats to sustainable development:

- (a) it impedes social progress, depriving local people of a clean and healthy environment;
- (b) it threatens wider damage to the environment and to wildlife;
- (c) it inhibits the prudent use of our land and soil resources, particularly by obstructing the recycling of previously-developed land and increasing development pressures on greenfield areas; and
- (d) the cost of remediation represents a high burden on individual companies, homeowners and other landowners, and the economy as a whole.

It has been the intention of successive governments to implement a regime to deal with contaminated land since the early 1990's. Following consultation on the Department of the Environment and Welsh Office (1994), white paper entitled "Paying for our Past", a new section (Part IIA) was inserted into the Environmental Protection Act 1990. Part IIA heralded the new contaminated land regime and it was implemented in April 2000. All references to the "Act" in this strategy relate to Part IIA of the Environmental Protection Act 1990. The Department of Environment, Transport and the Regions (2000) also produced guidance in this area entitled "DETR Circular 02/2000 - *Environmental Protection Act 1990: Part IIA Contaminated Land*". All references to the "Guidance" in this strategy relate to this document.

Annex 1 paragraphs 2-10 of the Guidance, detail the UK Government's stated objectives with respect to contaminated land as follows:

- (a) to identify and remove unacceptable risks to human health and the environment;
- (b) to seek to bring damaged land back into beneficial use; and
- (c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to the remediation of contaminated land, which the Government considers is the most appropriate approach to achieving sustainable development in this field.

## **1.2 The “Suitable for Use” Approach.**

The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore need to be assessed on a site-by-site basis.

In this new contaminated land regime, the "suitable for use" approach may be regarded as:

- Ensuring that land is suitable for its current use. This is achieved by identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land. Such land is then returned to a condition where such risks no longer arise - termed "remediating" the land.
- Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use. This recognises that the risks from contaminated land can be satisfactorily assessed only in the context of specific current uses of the land.

### **1.3 Explanation of Terms**

The legislation and guidance relies heavily on legal and scientific terminology. To assist in the interpretation of these an extensive glossary of terms contained in the Guidance has been reproduced in Appendix A.

### **1.4 Objectives for This New Regime**

The main objective underlying the introduction of the Part IIA Contaminated Land regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. As previously stated, land is to be assessed in the context of the current use and circumstances.

The Government's primary objectives for introducing the new regime are detailed in Annex 1 paragraphs 25-29 of the Guidance as:

- (a) to improve the focus and transparency of the controls, ensuring authorities take a strategic approach to problems of land contamination;
- (b) to enable all problems resulting from contamination to be handled as part of the same process; previously separate regulatory action was needed to protect human health and to protect the water environment;
- (c) to increase the consistency of approach taken by different authorities; and
- (d) to provide a more tailored regulatory mechanism, including liability rules, better able to reflect the complexity and range of circumstances found on individual sites.

In addition to providing a more secure basis for direct regulatory action, the Government considers that the clarity and consistency of the new regime is also likely to encourage voluntary remediation. This forms an important secondary objective for implementation of the Part IIA regime.

By referring to this strategy, person(s) who may be responsible for contamination will be able to assess the likely requirements of the City Council as regulators acting under Part IIA. They will then be able to plan their own investment programs to carry out remediation in advance of actual regulatory intervention.

Similarly, the Part IIA regime will assist in the recycling of previously developed land. The new regime cannot be used directly to require the redevelopment of land, only its remediation. However, the Government considers that implementation of the regime will assist developers by reducing uncertainties about so-called "residual liabilities", in particular the perceived risk of further regulatory intervention. In particular it will:

- a) reinforce the "suitable for use" approach, enabling developers to design and implement appropriate and cost-effective remediation schemes as part of their redevelopment projects;
- b) clarify the circumstances in which future regulatory intervention might be necessary (for example, if the initial remediation scheme proved not to be effective in the long term); and
- c) set out the framework for statutory liabilities to pay for any further remediation, should that be necessary.

## **1.5 Leicester City Council's Environmental Aims**

Land contamination is an archetypal example of our failure in the past to move towards sustainable development. This strategy has been prepared in the context of the City Council's mission to promote the integrity and sustainability of the City, as outlined in the Leicester City Council (1999) Environmental Policy. The relevant, stated aims of this Policy are as follows:

### **Improving our Environment**

Wherever possible, continuous, measurable progress will be made in our environmental performance to reduce our environmental impact, whilst maintaining the city's economic viability.

### **Environmental Legislation**

All statutory environmental responsibilities bestowed on the City will be fulfilled and all city council operations and activities carried out on behalf of the council will comply with, or exceed all statutory environmental requirements.

### **Protecting our Environment**

The principles of best practice and best technology wherever possible to improve our environmental performance and reduce environmental impacts from the release of any pollutant that may cause environmental damage to air, water or land including noise pollution and damage to our built heritage.

This will be achieved by the control of City Council activities and by using our legal enforcement powers to influence activities in the city.

Wherever possible the quality and quantity of open space will be enhanced.

The risk of causing environmental damage will be minimised by employing safe technologies and operating procedures.

## **1.6 Enforcement Policy**

Enforcement procedures form part of this new regime and the power to take enforcement action has been delegated to officers of the Pollution Control Group.

Where enforcement action is necessary to further the stated aims and objectives, the approach will be:

- Consistent
- Fair
- Transparent
- In Accordance with the Law, and
- Effective

The use of formal action, in terms of service of legal notices and/or prosecution of offenders will be the normal method by which these legislative provisions are enforced. Use of formal procedures in all cases will ensure that action taken is consistent and in accordance with the law. It is fair in that persons served with a notice are entitled to their rights of appeal against a notice. It is also effective in that informal action can be ignored without penalty.

Any enforcement action undertaken will be in accordance with Pollution Control Group Enforcement Policy. Leicester City Council (2000)

Voluntary action will be initially encouraged in all cases. Formal action will be instigated if the person(s) responsible refuses to implement a programme of compliance to the satisfaction of the City Council.

## **1.7 Role of the Local Authority**

Local Authorities are the main regulators for this regime. They have the following duties:

- To cause their areas to be inspected to identify potentially contaminated sites and in so doing produce and publish a strategy.
- To determine whether any particular site shall be defined as contaminated land.

- To determine whether any such land should be designated a ‘special site’.
- To act as enforcing authority for contaminated land not designated as a ‘special site’.
- To produce and maintain a public register of contaminated land.

The Pollution Control Group will take lead responsibility within Leicester City Council for all of the above functions.

## **1.8 Role of the Environment Agency**

With its considerable contaminated land expertise, the Environment Agency will provide the following support to local authorities:

- Assist in the identification of contaminated land, particularly where water pollution is involved.
- Provide site-specific guidance to local authorities on contaminated land where requested.
- Act as enforcing authority for contaminated land designated a ‘special site’.
- Publish periodic reports on the state of land contamination nationally.

## **1.9 Definition of Contaminated Land.**

The definition of contaminated land is given in section 78A(2) of the Act as:

‘any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that –

- a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- b) pollution of controlled waters is being, or is likely to be caused.’

### 1.10 Principles of Pollutant Linkages

The above definition aims to enable the identification and remediation of land on which contamination is causing unacceptable risks to human health or the wider environment. It will not include all land where contamination is or may be present.

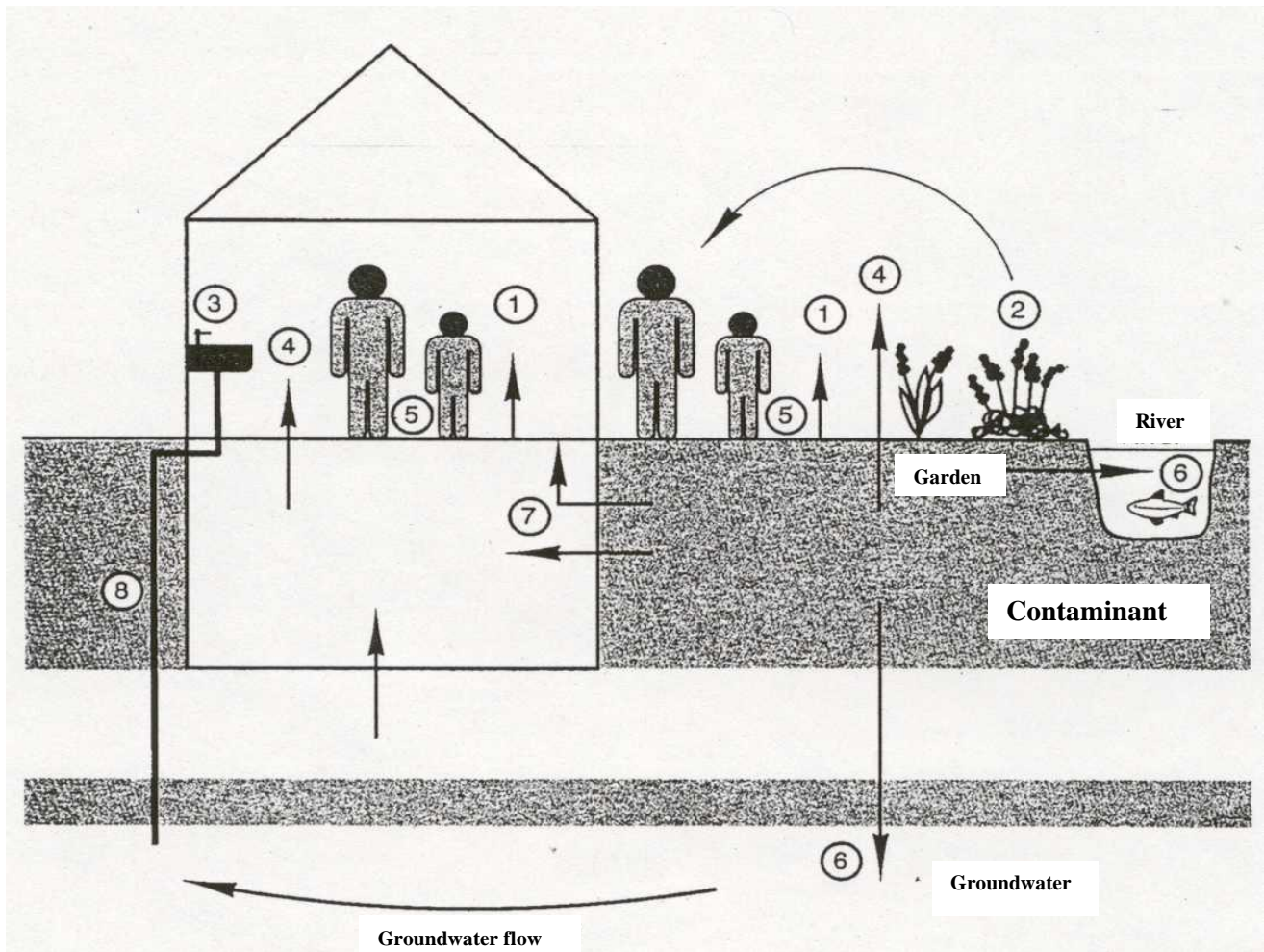
For land to be designated as contaminated land there must exist a ‘significant pollutant linkage’ consisting of:

- a ‘contaminant source’ which is situated in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters; **and**
- a ‘pathway’ of one or more routes through which a receptor is being or could be exposed to, or affected by, a contaminant; **and**
- a ‘receptor’, often referred to as a target.

The following pollutant linkage schematic highlights possible pathways between contaminant sources and receptors.



## Pollutant Linkages Schematic



### Key To Pathways

1. Ingestion of contaminated soil/dust
2. Ingestion of contaminated food
3. Ingestion of contaminated water
4. Inhalation of contaminated soil particles/dust/vapours
5. Direct human contact with contaminated soil/dust or water
6. Entry into controlled waters
7. Direct attack on building structures
8. Direct attack on services

Adapted from Harris, M.R. Herbert S.M. and Smith, M.A. (1995)

A local authority cannot determine land as contaminated land unless it is satisfied that a ‘pollutant linkage’ exists **and** it is significant.

The local authority must satisfy itself that a pollutant linkage exists in respect of a piece of land; **and** it is:

1. resulting in significant harm being caused to the receptor or there is a significant possibility of significant harm being caused to that receptor, or
2. resulting in the pollution of controlled waters which constitute the receptor, or it is likely to result in such pollution.

A receptor is specified in the Guidance as:

- a living organism, a group of living organisms, an ecological system or a piece of property which is being, or could be, harmed by a contaminant; or
- Controlled waters, which are being, or could be, polluted by a contaminant.

The Guidance defines types of receptors and also specifies the type of harm, which may be considered significant. This is reproduced in Table A of Appendix B.

### **1.11 Significant Harm**

Section 78A(4) of the Act defines ‘harm’ as:

‘harm to the health of living organisms or other interference with the ecological systems of which they form part.’

Harm to a person's property is also specifically included.

The following factors must be considered when the significance of any harm is being decided upon:

- a) the nature and degree of harm;
- b) the susceptibility of the receptors to which the harm might be caused; and
- c) the timescales within which the harm might occur.

The City Council will have full regard to the above. In addition it will regard as 'significant', only harm which is to a type of receptor listed in Appendix B, Table A, and within the description of harm specified for that type of receptor. In determining the significant possibility of significant harm arising, regard will also be made to the set of guidance listed in Appendix B, Table B.

In considering the timescales within which the harm might occur, the City Council would take into account any evidence that the current use of the land will cease in the foreseeable future.

## **1.12 Pollution of Controlled Waters**

The City Council will act in accordance with the Guidance in determining whether pollution of controlled waters is being, or is likely to be caused. Section 78A(9) defines the pollution of controlled waters as:

'the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter'.

In determining whether pollution of controlled waters is being caused, the City Council will first ascertain whether a substance is continuing to enter controlled waters or is likely to enter controlled

waters. In all such cases the advice of the Environment Agency will be sought. Land will not be designated as contaminated land where:

- a) a substance is already present in controlled waters; and
- b) entry into controlled waters of that substance from land has ceased; and
- c) it is not likely that further entry will take place.

### **1.13 Principles of Risk Assessment**

The Guidance promotes a risk-based approach to dealing with potentially contaminated land in the UK. The aim of this type of approach is to protect human health and the environment without unnecessarily wasting finances on the clean up of contamination.

Risk is defined as the combination of:

- (a) the probability, or frequency, of occurrence of a defined hazard (for example, exposure to a substance with harmful properties); and
- (b) the magnitude (including seriousness) of the consequences.

The need for and extent of any remediation is determined from an assessment of the risks posed to human health and the environment, whilst taking into account the intended use of the site.

The 'suitable for use' approach acknowledges that the risk which is presented by a level of contamination determined in relation to the current land use. The City Council will undertake any detailed risk assessment on a site-specific basis.

## **1.14 Requirements of a Strategic Approach**

The Guidance sets out the underlying principals to be applied to the development of the strategy. The City Council will follow the requirement to take strategic approach to the identification of land, which merits detailed individual inspection. The approach detailed in this strategy will be consistent with the following requirements specified in Annex 3, paragraph B.9 of the Guidance:

- a) be rational, ordered and efficient;
- b) be proportionate to the seriousness of any actual or potential risk;
- c) seek to ensure that the most pressing and serious problems are located first;
- d) ensure that resources are concentrated on investigating in areas where the authority is most likely to identify contaminated land; and
- e) ensure that the requirements for the detailed inspection of particular areas of land are efficiently identified.

## **1.15 Interaction with other Regulatory Regimes**

The Part IIA regime has been designed to form part of a wider integrated regulatory approach to deal with land contamination. The implementation of this new regime will compliment the following existing regimes.

### **Land Use Planning and Development Control**

The vast majority of contaminated land issues are currently addressed through the development control process in accordance with Planning Policy Guidance Note 23, produced by the Department of the Environment (1994).

The development control process will continue to provide the main means of redress where any proposed development or change of use would introduce potential problems of exposure to

contamination. Data obtained through the implementation of this strategy will be fed into the development control system the City Council in order to prevent contaminated land arising from development in the City.

The Pollution Control Group currently works closely with Development Control and Building Control Groups on all issues relating to pollution. The current arrangements for inter-departmental consultation are being reviewed in order to ensure that communication is optimised.

## **Water Pollution**

The Environment Agency is empowered to deal with harm to controlled waters being caused by contaminated land under the Water Resources Act 1991. Whilst the Part IIA regime does not revoke these powers, the Guidance indicates that such problems should predominantly be dealt with under the new contaminated land regime. The Water Resources Act powers will continue to be the means of dealing with controlled waters where Part IIA is not applicable.

The Groundwater Regulations 1998 provide the Environment Agency with powers to control activities, which may result in the release of prescribed contaminants to groundwater. The main emphasis of these regulations is the prevention of groundwater pollution rather than its remediation. They are not applicable in situations where the contaminating activities have ceased and their application to contaminated land may therefore be substantially restricted. There may be situations where remediation of land containing prescribed substances could potentially lead to their release to groundwater. Under these circumstances the Environment Agency have powers to restrictions on such activities.

A remediation notice cannot be used to require actions, which would conflict with the requirements of any discharge consent issued under Part III of the Water Resources Act 1991

## **Integrated Pollution Prevention and Control (IPPC).**

Under new legislation to regulate pollution from industrial processes, site operators of prescribed processes are required to undertake an initial site condition survey prior to receiving a licence to

operate. The intention is that upon surrendering the site permit the operator must ensure that the condition of the site is restored to its original state. Permits may also contain conditions aimed at preventing or minimising the release of substances to the ground.

Ground contamination issues falling outside IPPC control (for example, those identified during the initial site condition survey) but satisfying the definition of contaminated land will be addressed through the Part IIA regime.

Existing processes will be gradually brought under this IPPC legislation over the next seven years, although it will apply immediately to any new processes or any substantial change to an existing process. The City Council will be considering the associated site investigations over this period, but this does not preclude earlier detailed investigations being undertaken as part of the assessment exercise detailed in Chapter 4.

The IPPC regime gives regulators the legal power to take action to remedy harm caused by a breach of Permit condition (Section 26 of the Pollution Prevention and Control (England and Wales) Regulations 2000) which includes land contamination. The Agency currently has these powers in relation to Integrated Pollution Control (IPC) sites under section 27 of the Environmental Protection Act 1990.

## **Waste Management**

Part II of the Environmental Protection Act 1990 establishes waste management controls for the licensing of waste handling and disposal operations and the prevention of illegal deposits of waste. In addition the Refuse Disposal Amenity Act 1974 also provides Local Authorities with powers to deal with abandoned waste. The contaminated land regime cannot be applied where powers exist to deal with waste under these provisions. Action under this regime could be applied where pollution of the ground has or is occurring outside the scope of the waste legislation.

## **Risk of Harm to Persons at Work**

Where there is a risk of harm to persons at work from land contamination it should be addressed under the Health and Safety at work etc. Act 1974 and its associated regulations and guidance.

## **Radioactivity**

Part IIA does not apply to contamination caused by radioactivity (Section 78YC), but the Secretary of state has the power to make regulations to alter this aspect of the legislation. Until such time as regulations are forthcoming the Council will liaise with the Environment Agency on any site that is suspected of containing radioactive substances.

## **Organisms**

This regime does not apply to contamination caused by bacteria, viruses or protozoa, as they do not fall within the definition of substances. This could affect land contaminated with anthrax spores, E. coli etc.

## **Statutory Nuisances**

Any land contamination falling under the Part IIA definition cannot be classified as a Statutory Nuisance and is therefore exempt from action under Part III of the Environmental Protection Act 1990.



## **Chapter 2**

## **Local Characteristics**

### **2.1 Description of Leicester**

With a land area of 7309 Hectares (28.22 sq. miles) and a population of approximately 300,000, Leicester is the largest city in the East Midlands and the tenth largest in the country.

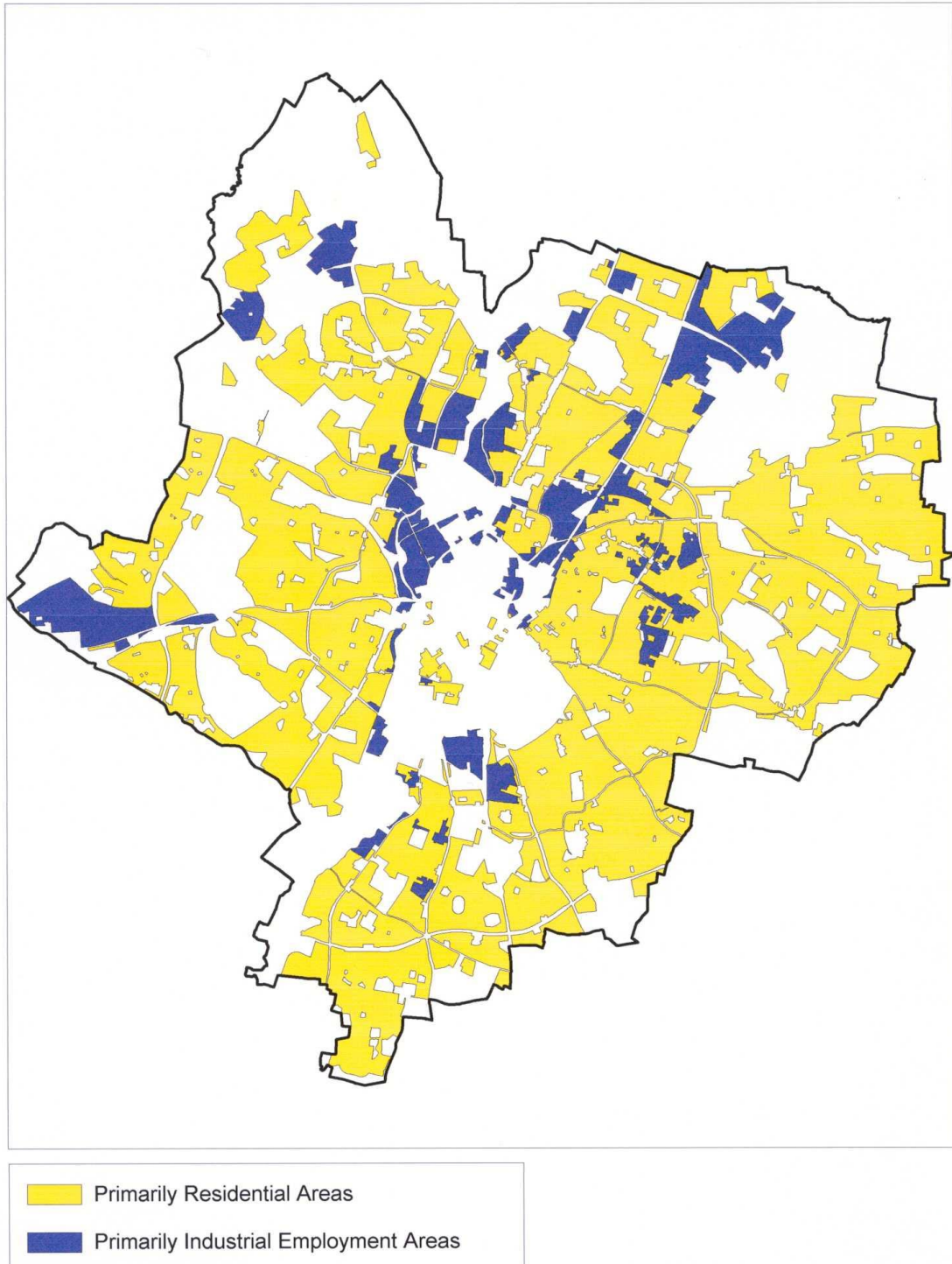
The population distribution and density reflects the urban make up of the city. Densely populated residential areas exist throughout the city as either primarily residential areas, or interspersed with long established industrial uses.

A version of the current City of Leicester Local Plan, indicating the main industrial employment areas and residential areas of the City is shown in Figure 1.

The City stands in the valley of the River Soar, which forms the dominant physical relief feature of the County. The wide, flat flood plain running from south to north has assisted the development of major north to south communication routes such as canals, railways and roads. River gravel terraces flank the margins of the flood plain. With the exception of areas of outcropping Triassic Sandstone to the east, the City is characterised by glacial till (also known as boulder clay) overlaying mercia mudstone. A detailed geological description is contained in section 2.2.

Despite the absence of coal or iron ore deposits, Leicester began the process of industrialisation and expansion as early as 1700. The 18<sup>th</sup> century brought massive expansion of the hosiery industry. Throughout the 19<sup>th</sup> century Leicester's industrial base expanded with the development of a footwear industry and light engineering.

**Figure 1 City of Leicester Local Plan - Residential and Industrial Employment Areas**



The wool trade and textile production was the foundation of Leicester's prosperity but it was the industrial revolution of the nineteenth century that had the greatest impact on the city. Industrial boom years continued in the fifties and sixties. Relative newcomers such as food processing and packaging have in recent decades, complemented established industries such as textiles, footwear, engineering and printing.

There has since been a general decline in footwear and some sectors of textiles as Leicester reflects the general downward trend in the UK of traditional manufacturing industries and the transfer of activity into the service sector. While there are still several very large employers, there has been a tendency, especially in the textile industry, for large concerns to close and be replaced by a large number of small businesses, often intimately intermixed with residential uses.

Although there are a few substantial employers in the engineering and foundry sectors, Leicester cannot in general be described as a “heavy” industrial area. The heavy chemical, heavy metallurgical/engineering and power generation industries are virtually non-existent within the City's boundaries.

To the north of the city, pits left behind from the extraction of gravel and clay which ceased in the 1960's are believed to have been subjected to landfilling of both domestic and trade waste. Many of the areas are now supporting commercial development.

## **2.2 Geology of Leicester**

The following description of Leicester's rocks by Evans (2001) is based upon 1904 British Geological Survey 6 inch paper maps and Fox-Strangways (1903), with additional data from Browne (1893) and Rice (1968). Many of the boundaries between rock units are approximate.

The City of Leicester is situated on the flood plain of the River Soar and the slopes of the surrounding valley. The solid rocks of the City are Late Triassic to Early Jurassic in age (235-200 million years in age) and are overlain by extensive superficial deposits. These are the result of the

action of glaciers during the Wolston Glaciation (ice age) between 475,000 and 415,000 years ago followed by erosion and deposition by the precursor to the modern Soar. The Triassic Mercia Mudstone Group rocks make up the majority of the bedrock, with the Liassic limestones and clays of Lower Jurassic age outcropping from Humberstone to Knighton Park. Between the two the Penarth Group of shales, marls and limestones forms a narrow band. As Leicester has been inhabited for approximately 2000 years, areas of the city centre have a significant depth of archaeological fill.

## **2.3 Triassic Rocks**

### **Mercia Mudstone Group**

Formerly known as the Keuper Marl, this is a thick succession of red and grey-green marl (a calcareous clay), with thin sandstone lenses (or skerries) and nodules of gypsum in places. It forms the bedrock of the westernmost three-quarters of the City, but is covered by superficial deposits for much of its area. Large areas are exposed in the Gypsy Lane – Northfields – Troon Industrial Estate area and in the West End. Elsewhere it is exposed in between the alluvial deposits and the glacial deposits.

### **Dane Hills Sandstone Member**

This is a thick lens of massive false-bedded sandstone within the Mercia Mudstone. Its greatest thickness is 6 metres at the former Ashleigh House quarry on the site of the present-day Christ the King Roman Catholic Primary School on Glenfield Road, but it thins out away from this point.

### **Penarth Group**

Formerly known as the Rhaetic Beds, this unit marks the transition from the desert conditions of the Mercia Mudstones to the fully marine conditions under which the Lias rocks were deposited. These beds are a mix of shales, calcareous mudstones and limestones and run in a narrow band from Highgate Drive to Hamilton where there is also a small fault. The largest exposure is in the Spinney Hills area (the park was created from former quarries) from Burnaby Avenue to St. Phillips Rd.

## **2.4 Jurassic Rocks**

### **Lias Group**

Only rocks of the Lower Lias, known as the Hydraulic Limestones, are represented within the city. These are comprised of alternating beds of limestones and shales. The outcrop runs from that of the Penarth Group across to the eastern boundary of the city, with extensive superficial cover. Surface exposures are found on the lower slopes of the valleys of the Bushby and Evington Brooks, the slopes of the Crown Hills area in between, and the Knighton area as far North as South Knighton Road.

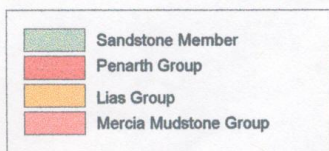
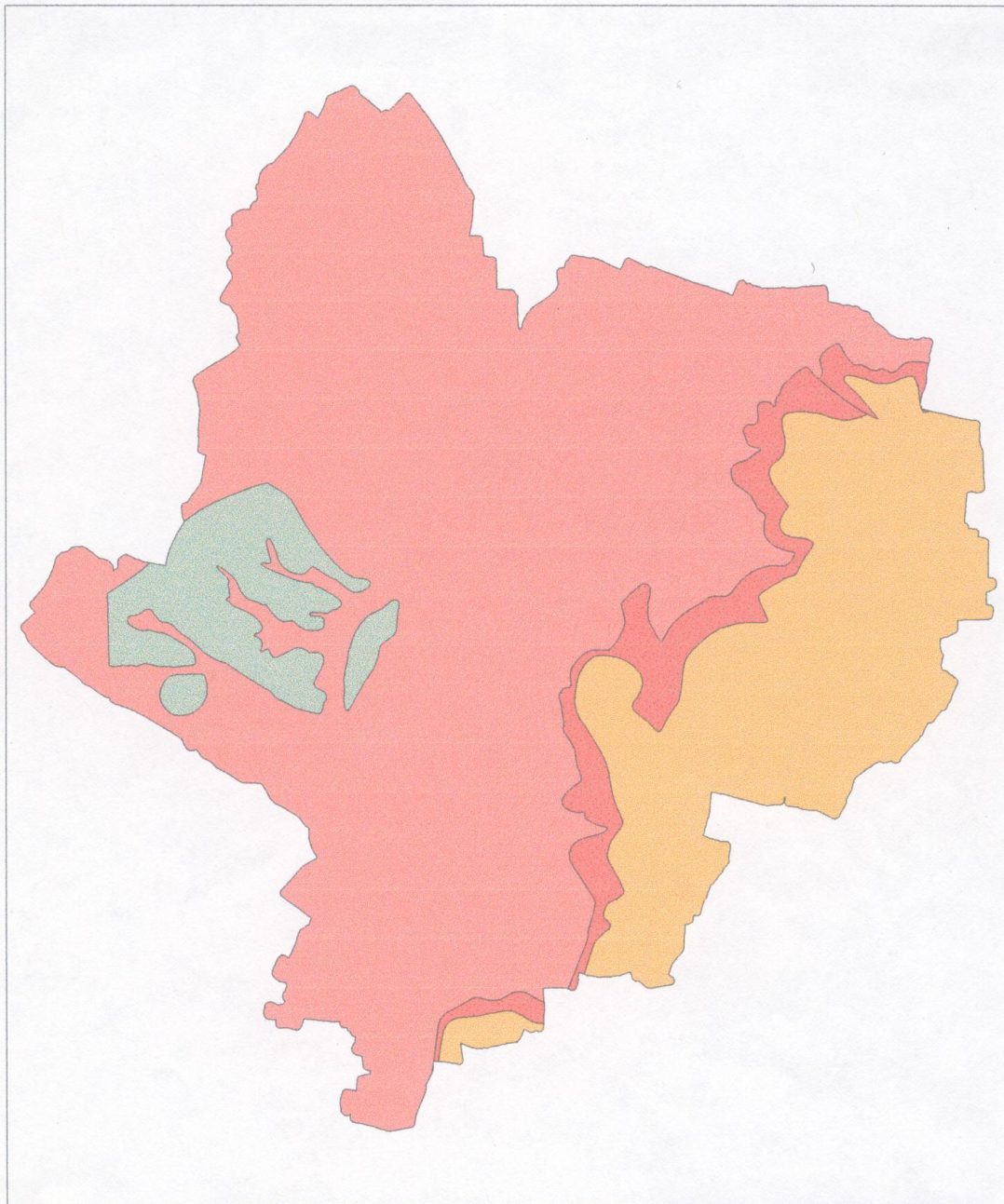
The City's solid geology is illustrated in Figure 2.

## **2.5 Superficial Quaternary Deposits**

### **Glacial Drift**

This consists of beds of sand and gravel or boulder clay. The drift was deposited during the ice ages, and has been eroded by the Soar and various brooks. It reaches its greatest thickness on higher ground. The glacial till (boulder clay) coverage is extensive and of the least significance in terms of pollution migration due to its relative impermeability. For this reason the distribution of the sands and gravels is considered in more detail. A thin band separating the man made ground from the boulder clay runs along the western slope of the Soar valley between the Redhill Allotments and Pool Road, with a patch underlying the Glengarry Way area. This band widens in the Avebury Avenue area, the site of the former Abbey Sandpit. Other such deposits exist in Braunstone, Rowley Fields (although this may be mostly terrace gravel), Hamilton and the Aylestone area. Both Evington and Humberstone villages are sited on glacial sand and gravel. A strip of sand and gravel from the Midland Mainline railway along the line of June Avenue to the City boundary was depicted as glacial in 1901, but is now thought to be a river terrace.

**Figure 2 Solid Geology of Leicester**



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British Geological Survey (2000).



### **River Terraces and Floodplain Gravel**

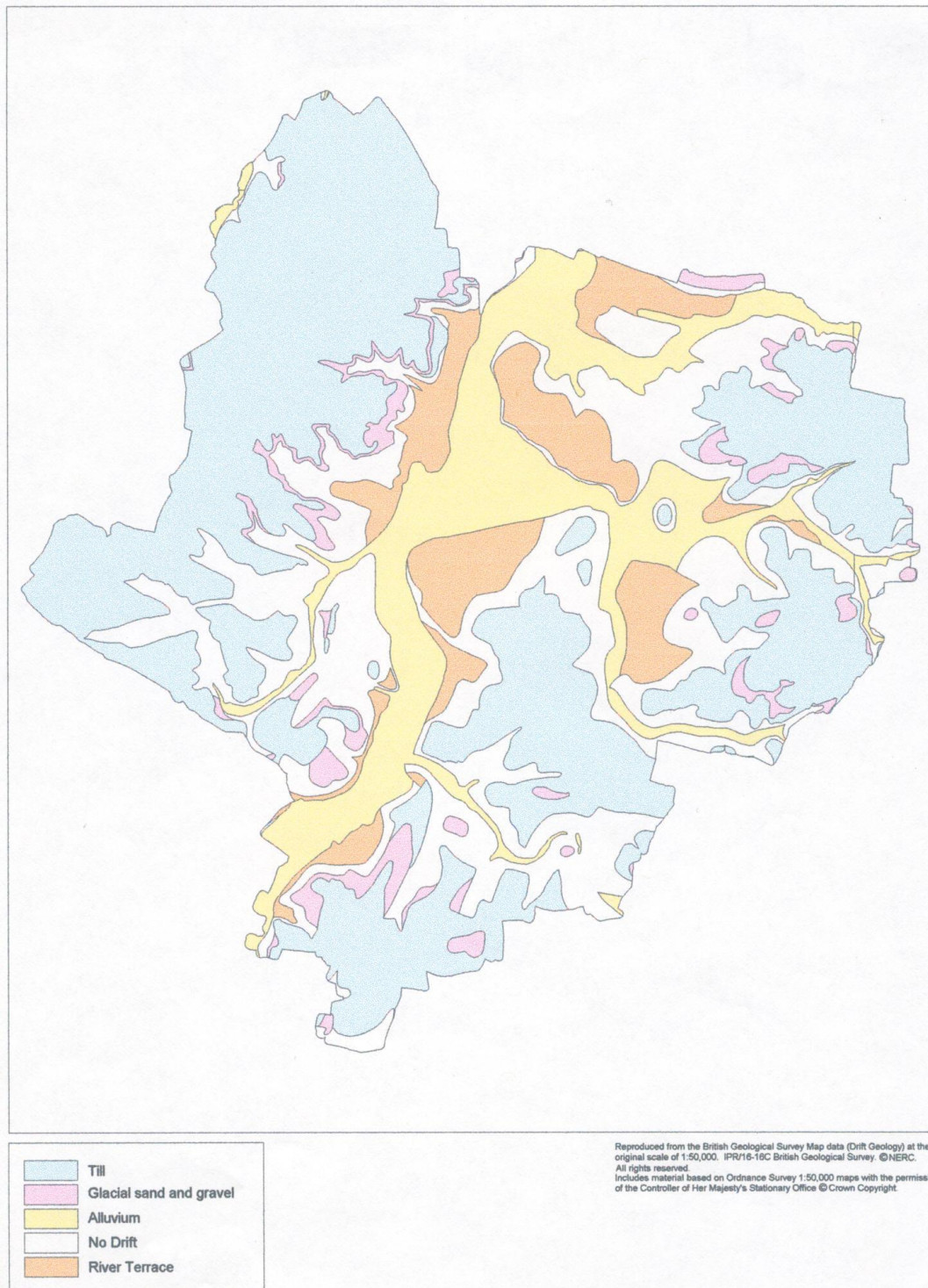
The terraces are the remnants of former Soar floodplains, and are mainly composed of gravel.

There is also a feature known as the Knighton Surface, which is an eroded plateau surface across the drift deposits covered with an intermittent veneer of up to a metre of water-laden sand and gravel. It is found in the Knighton area, with small patches in the area of the Humberstone Heights Golf course. The true river terraces reach a maximum depth of 4 metres of gravel, although 2 to 3 metres is more usual. Most of the city centre is built upon the terraces. Other significant areas include: the Abbey Lane and Woodgate areas; the area between Barkby Thorpe Road and Melton Road; the area from Bath Street to The Greenway to Hastings Road to Tranter Place; the area between Green Lane Road and Evington Lane; and the margins of the main Soar flood plain.

The Floodplain Gravel comprises 1 metre of alluvial silt and clay overlying up to 3 metres of coarse sand and gravel. This occupies the lowest ground in the City, the valleys of the Soar and its tributaries. Its thickness decreases up the valleys.

The City's superficial geology is illustrated in Figure 3.

**Figure 3 Drift Geology of Leicester**





## **2.6 Groundwater and Hydrogeology**

The majority of Leicester is underlain by low vulnerability non aquifers. The Mercia Mudstone, Lower Lias Clay, Precambrian sediments and Igneous bodies are all classed by the Environment Agency as Non Aquifers. Non Aquifers therefore account for most of the area. They are generally of low permeability and where groundwater is present, it flows through the strata extremely slowly and is present in only limited quantities.

Small outcrops of sandstone used to be known as the Dane Hills and Shoulder of Mutton Hill. In modern terms the extent is from just to the west of the junction of New Parks Way and Hinckley Rd to Dannett St in the east, and from Letchworth Rd in the North to Thurlington Rd in the South. Also limited rocks of the Lower Lias, known as the Hydraulic Limestones, are represented within the city. These are comprised of alternating beds of limestones and shales. The outcrop runs from Highgate Drive to Hamilton and then across to the eastern boundary of the city, with extensive superficial cover. Surface exposures are found on the lower slopes of the valleys of the Bushby and Evington Brooks, the slopes of the Crown Hills area in-between, and the Knighton area as far as South Knighton Road. These outcrops are classified as Minor Aquifers, but their limited outcrop means that they are not considered to be strategic groundwater resources in a regional context. Nevertheless they are potentially useful and vulnerable aquifers, and need to be protected from polluting activities.

The superficial deposits consisting of Sand and Gravel and alluvial deposits are all classed as Minor Aquifers. They are generally permeable and in hydraulic continuity with the surface water system. However, their limited thickness and distribution means that while they may provide locally important water supplies, they are unable to support large public water supply abstractions. However, given the high water table generally present in such deposits, these aquifers are vulnerable to pollution.

The sands and gravels (both glacial and alluvial) and the Danes Hill Sandstone are the most permeable of the City's strata. The Mercia Mudstone is also permeable; historically, Leicester's water supply came from wells sunk into this rock, and although the water supply was considerable it was too hard due to the gypsum. The rocks of the Penarth Group are varied; while the basal paper

shales would not appear to be very permeable, water could move in-between the thin layers of the rock. The higher limestone bands would also not be very permeable, but again there could be horizontal movement between the beds. The same holds for the Lias shales and limestones, although these are slightly more uniform. The glacial till is likely to be the least permeable of the City's drift deposits.

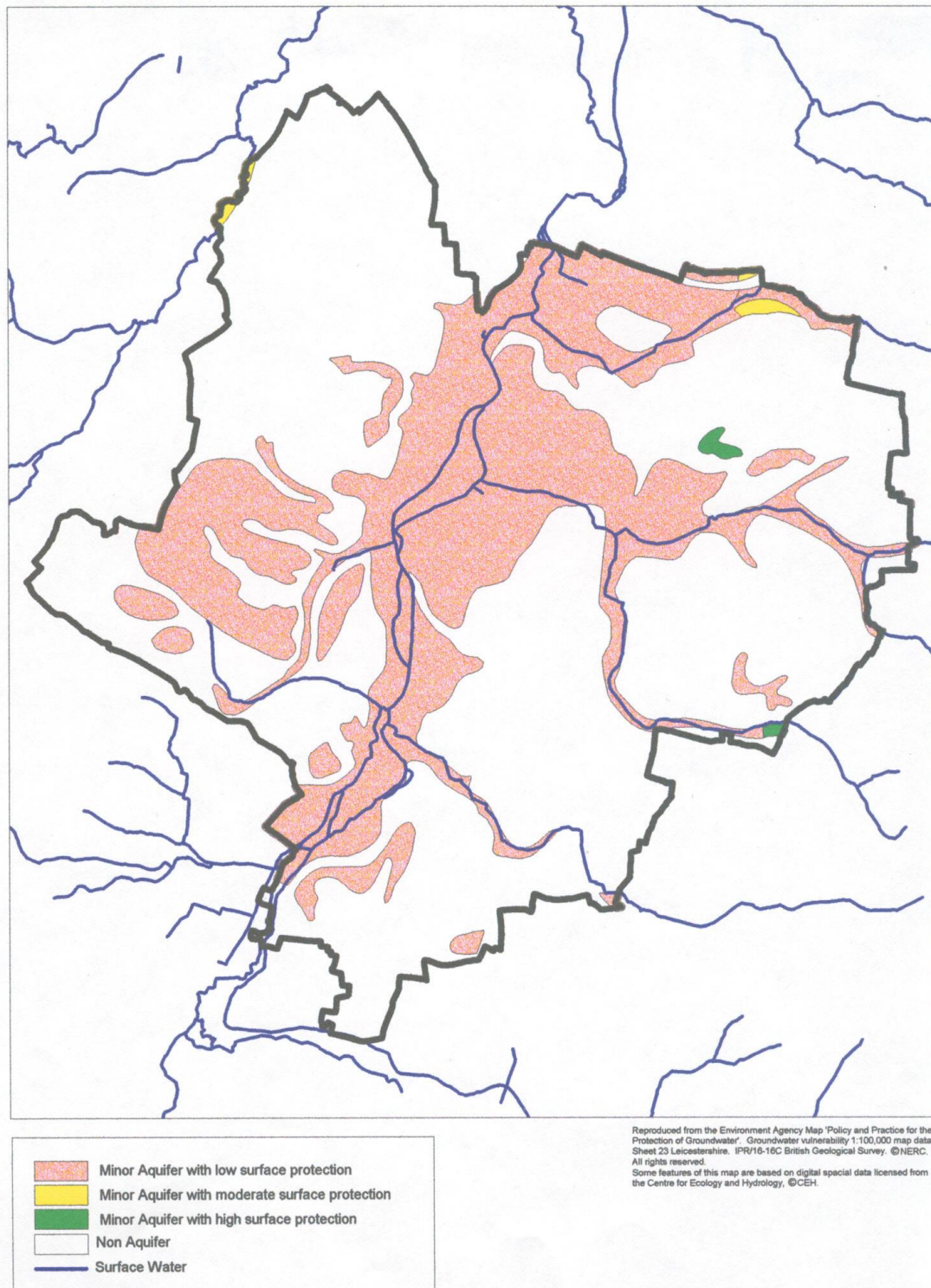
## **2.7 Surface Water**

The upper reaches of the River Soar drain a mainly rural area and are classed by the Environment Agency as of good to fair quality.

Through the City, the River Soar receives urban drainage both directly and from a number of tributaries. This brings with it associated problems of oil related pollution incidents from a variety of diffuse and point sources.

The City's hydrogeological and surface water features are illustrated in Figure 4.

**Figure 4 Aquifer Vulnerability and Surface Water of Leicester**



Environment Agency (1996) & Centre for Ecology and Hydrology (2000)

## **Chapter 3. Action Already Taken To Deal with Land Contamination**

### **3.1 The Role of the City Council's Pollution Control Group**

As a major historical and current landowner, the City Council retains a significant responsibility in terms of land contamination. Recognition of this is reflected in the actions already undertaken to deal with land contamination. The Pollution Control Group's role with respect to this area is long established and contaminated land management expertise has been developed in the following areas:

- Investigation and remediation where necessary, of local authority owned landfill and other contaminated sites: This includes - prioritising and drawing up applications for funding; design of investigation and remediation schemes; drafting of project briefs; interpretation and evaluation of investigation reports; liaison with appropriate Council departments outside bodies and members of the public.
- Post-investigation and remediation management of Council owned contaminated sites: This includes - drawing up monitoring and maintenance schedules; varying monitoring profiles in the light of incoming data; supervising field staff; maintaining records; devising and implementing procedures for reacting to incidents and emergencies.
- Preparation for the forthcoming contaminated land regime under the Act: This includes - the development of this strategy, risk evaluation procedures; development of a GIS-linked based database and extensive officer training.
- Provision of advice to the Council's Planning and Building Control functions with respect to contaminated land: Provision of advice in connection with City Council and private development projects.

- Dissemination of contaminated land information to outside bodies and members of the public.
- Enforcement of long standing statutory nuisance procedures relating to contaminated land.
- The co-ordination of an officer-working group aimed at promoting effective management of corporately owned land which likely to be affected by contamination.

The Group maintains a range of field testing equipment and has undertaken routine and reactive landfill gas monitoring for the past 10 years. This capability has been recently extended to include the in-ground measurement of fuel and solvent vapour from leaking storage tanks, pipework or spillages.

### **3.2 Landfill Gas**

In the mid eighties, a now famous house explosion at Loscoe in Derbyshire was caused by landfill gas migrating through the ground from a nearby waste site. National concern was subsequently raised regarding the past practice of the uncontrolled landfilling of household and other putrescible wastes. This was recognised as a potential problem in Leicester because a number of closed landfill sites were known to exist in close proximity to residential properties.

In 1989, the City Council began investigating potentially gassing landfill sites in Leicester. Evidence from old records and maps enabled the identification of over a hundred former ponds, pits and cuttings that had subsequently been filled. Records of landfilling associated with former clay, sand and gravel extraction, which occurred in the 60's, and 70's, were also examined. A programme of gas monitoring on and near these sites enabled the identification of sites considered to pose significant landfill gas risk. With the exception of one site, which has since been developed and made safe, all sites were found to be former landfill sites now owned by the City Council.

For the last 12 years the Pollution Control Group has undertaken a continuing program of addressing the issue of landfill gas from these sites.

In recent years prioritisation of these sites for action was based on the supplementary credit approval eligibility assessment detailed by the Department of the Environment (1996). Each site was assigned an overall numerical score based on defined risk values.

All sites in the city found to be producing landfill gas have now been, or are currently being, subjected to an intrusive site investigation and risk assessment. A number of sites were found to pose an unacceptable risk to human health. Remedial action aimed at ensuring safety has been completed at all such sites. Funding for this work was obtained from the Government's Supplementary Credit Approval Scheme, which was introduced in the early 1990's.

The outcome of this work is that the most significant and acute risks to human health, associated with contaminated land in the City, have been addressed in advance of this new regime. This work is summarised in Table 1.

**TABLE 1**

<b>Site</b>	<b>Project Details</b>	<b>Status and Approximate Capital Expenditure</b>
<b>Woodbank Recreation Ground</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"><li>• Significant offsite landfill gas risk proven</li></ul> <p><b>Remedial Action</b></p> <ul style="list-style-type: none"><li>• Installation of a perimeter gas barrier and vent system</li><li>• Removal of fill material underlying surrounding gardens</li><li>• Garden reinstatement</li><li>• Installation of gas monitoring boreholes</li><li>• Site boundary monitoring</li></ul>	<p>Completed. Routine gas monitoring at the perimeter is on going.</p> <p>Expenditure c£580,000</p>
<b>Appleton Park</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"><li>• Significant offsite landfill gas risk proven</li></ul> <p><b>Remedial Action</b></p> <ul style="list-style-type: none"><li>• Installation of a perimeter gas barrier and vent system</li><li>• Reconstruction of football clubhouse</li><li>• Football pitch reinstatement</li><li>• Removal of fill material from surrounding gardens</li><li>• Garden reinstatement</li><li>• Installation of gas monitoring boreholes</li><li>• Site boundary monitoring</li></ul>	<p>Completed. Routine gas monitoring at the perimeter is on going.</p> <p>Expenditure c£2.3 million</p>

<b>Astill Park</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>• Significant offsite landfill gas risk proven</li> </ul> <p><b>Remedial Action</b></p> <ul style="list-style-type: none"> <li>• Installation of a perimeter gas barrier and vent system</li> <li>• Site and pond reinstatement</li> <li>• Removal of fill material from surrounding gardens</li> <li>• Garden reinstatement</li> <li>• Installation of gas monitoring boreholes</li> <li>• Construction of pathway to assist monitoring</li> </ul>	<p>Completed. Routine gas monitoring at the perimeter is on going.</p> <p>Expenditure c£300,000</p>
<b>Aylestone Meadows</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>• Significant landfill gas risk proven to onsite football clubhouse.</li> </ul> <p><b>Remedial Action</b></p> <ul style="list-style-type: none"> <li>• Installation of gas monitoring boreholes</li> <li>• Installation of under floor gas barrier to clubhouse</li> <li>• Reinstatement of clubhouse</li> </ul>	<p>Completed. Routine gas monitoring at the perimeter is on going.</p> <p>Expenditure c£100,000</p>
<b>Baumont Park</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>• Significant offsite landfill gas risk proven</li> </ul> <p><b>Remedial Action</b></p> <ul style="list-style-type: none"> <li>• Installation of perimeter gas barrier and vent system</li> <li>• Site reinstatement</li> <li>• Installation of gas monitoring boreholes</li> </ul>	<p>Completed. Routine gas monitoring at the perimeter is on going.</p> <p>Expenditure c£300,000</p>
<b>Land to the Rear of Lanesborough Road</b>	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>• No significant landfill gas risk proven</li> <li>• No remedial works necessary</li> </ul>	<p>Completed</p> <p>Expenditure c£21,000</p>



<b>Stokeswood Park</b>	<b>Site investigation</b> <ul style="list-style-type: none"> <li>• No significant landfill gas risk proven</li> <li>• No remedial works necessary</li> </ul>	Completed  Expenditure c£25,000
<b>Gipsy Lane Playbarn</b>	<b>Site investigation</b> <ul style="list-style-type: none"> <li>• No significant landfill gas risk proven</li> <li>• No remedial works necessary</li> </ul>	Completed  Expenditure c£25,000
<b>Sunningdale Road</b>	<b>Site investigation</b> <ul style="list-style-type: none"> <li>• No immediate significant landfill gas risk</li> </ul>	Post investigation monitoring continuing offsite  Expenditure c£45,000
<b>Corporation Road</b>	<b>Site investigation</b> <ul style="list-style-type: none"> <li>• No immediate significant landfill gas risk</li> </ul>	Post investigation monitoring continuing offsite  Expenditure c£25,000
<b>Thurmaston Boulevard Brickworks Sites</b>	<b>Site investigation</b>	Main investigation underway

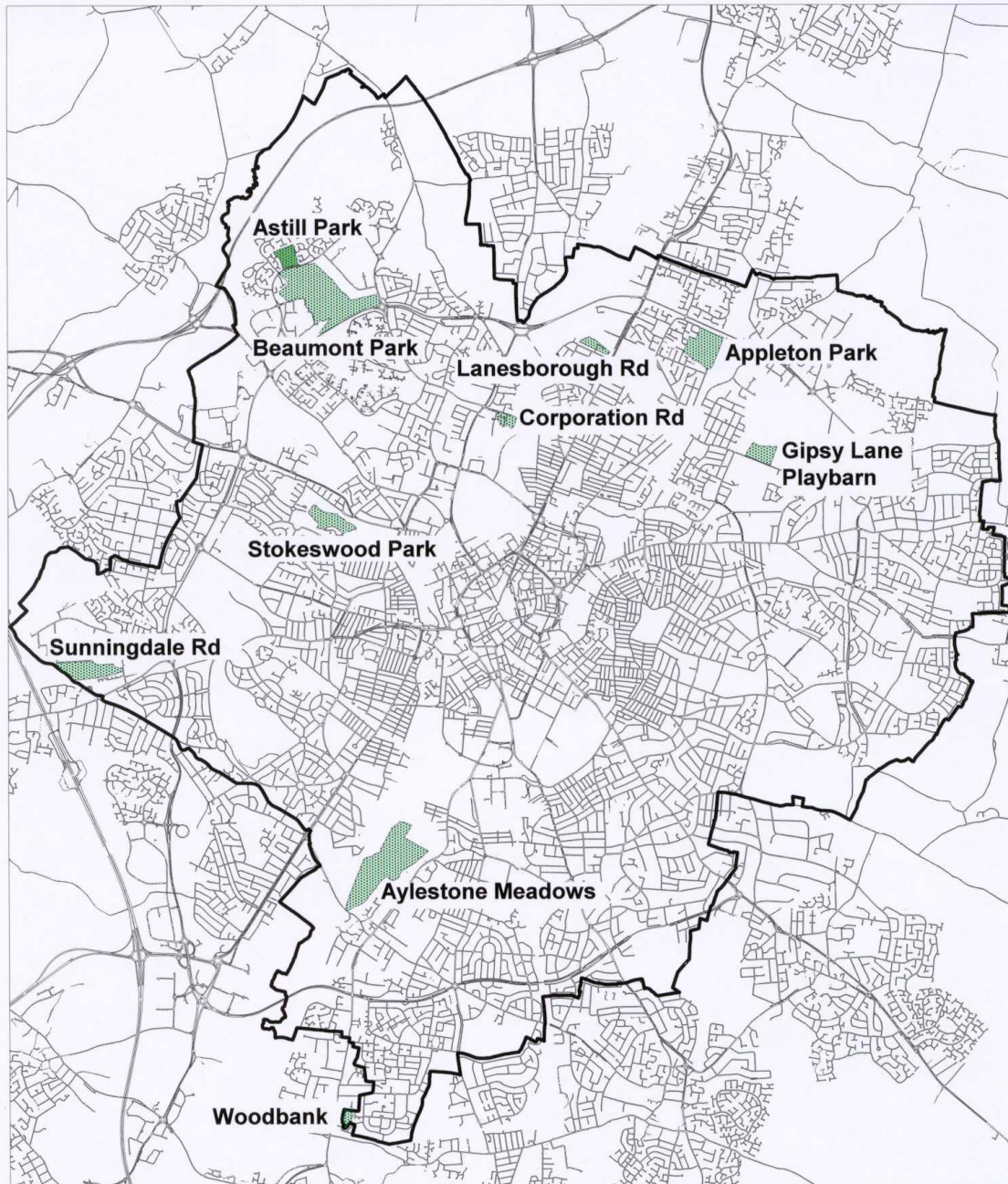
Further details of any of the above projects may be obtained from the Pollution Control Group.

The locations of all completed sites are shown in Figure 5

### 3.3 Scrap Metal Activities

Following on from landfill sites, attention has recently been directed towards potential City Council contaminated land liabilities resulting from other uses. The first of these to be considered is the City Council owned site on Whitefield Road off Abbey Lane. The site has been leased to numerous scrap metal operators for more than 25 years. A detailed contaminated land site investigation is currently underway to determine the impact of this use on nearby residents and the underlying minor aquifer.

**Figure 5 Leicester City Council - Completed Landfill Gas Projects**



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### **3.4 Development Control**

The clean up of large areas of previously contaminated land through redevelopment has resulted in a steady improvement in land quality within the City. Over the last decade in excess of 30 hectares of land affected by contamination has been cleaned up via the development control process. The most recent example being the National Space Science Centre on Exploration Drive which occupies the site of the former Wallingford Road sewage pumping station and landfilled area. Remediation works to protect the site and adjoining areas were satisfactorily incorporated into the design.

### **3.5 Bede Island North**

The City Challenge initiative led to an additional 20-hectare area of scrap metal yards and run-down factories on Bede Island to be transformed into a residential, business and leisure environment. A full site clean up preceded the development of more than two hundred homes and a student hall of residence along with associated recreation and arts facilities.

### **3.6 Voluntary Actions**

In anticipation of the new regime a private landowner is at present undertaking voluntary remediation of a 14-hectare, industrial site in the City. Prior approval of the City Council and the Environment Agency was sought and satisfactory progress is being made.

### **3.7 Environmental Information Management**

In 1997, and in anticipation of this new regime, the City Council supported a pilot trial of a computer based, environmental database dedicated to contain and process information relating to activities with the potential to cause land contamination.

Use of this system has continued and the database currently holds information on all former, local authority landfill sites and numerous potentially contaminated sites. The location and extent of these sites are shown on a linked Geographical Information System.

A site prioritisation model is contained within the database. This assigns numerical risk scores to a site and enables the objective evaluation and prioritisation of all the land subjected to past or present, potentially contaminative use(s). The outcome is a site specific, numerical risk score derived from existing data. This has formed the basis for prioritising the need for intrusive investigation of former landfill sites and will be developed to do the same for other potentially contaminated land.

This database will continue to remain the main means of data management for the vast amount of information, which is expected to be generated by the implementation of this strategy.

The workings of the site prioritisation model s explained further in Appendix C.

### **3.8 Geographical Information System**

A Geographical Information System or GIS, is a digital system that integrates both databases and maps to produce a powerful tool for identifying contaminant sources, pathways and receptors. It is possible to infer potential sources of contamination in the ground by examining maps of present and former land use in an area. GIS is a highly suitable way of managing the land-use and ground information in order to identify pollutant linkages and assess associated risks.

The City Council has developed a Geographical Information System (GIS) to assist in the implementation of this strategy.

Polygons indicating the location and extent of each City Council former landfill site and potential contaminated land entry on the database have been placed on digital maps of the city. The GIS link

with the database allows this spatial data on the maps to be linked directly to individual site information contained within the database.

To assist the preliminary assessment of contaminated land additional layers have been added to the GIS and the user is able to navigate between thematic maps. This operation will form the basis of the contaminated land identification process detailed in section 4.3.

### **3.9 Spatial Data Currently Held on the GIS**

The following table details the map layers are presently available on the GIS:

By July 2001 the system will be enhanced to include:

- Historical Ordnance Survey maps including the 1930's and 1950's
- Scheduled archaeological site data.
- Allotment data already held by the City Council

All information provided by the Environment Agency in relation to Source Protection Zones, water quality and waste management will be evaluated and where appropriate also included by this date.

Consideration will also be given to the purchase of an applied geological map of the City when such a product becomes commercially available in the near future.

Map Layers Presently Available on the GIS:

<b>Dataset</b>	<b>Description</b>
Solid Geology	Solid geology from the British Geological Survey 1:50 000 dataset
Superficial deposits	Superficial Deposits from the British Geological Survey 1:50 000 dataset
All Boreholes	All Boreholes taken from the British Geological Survey borehole database
Water Courses	All watercourses and surface water features, taken from the Institute of hydrology dataset
Water Wells	Water Wells taken from the British Geological Survey Water Well database
Water Abstraction Sites	Sites of Water Abstraction, taken from the Environment Agency dataset
Groundwater Vulnerability	Classification of groundwater (aquifers), taken from the Environment Agency dataset
Sites of Special Scientific Interest	SSSI areas assigned as sites of special scientific interest, provided by English Nature
Biodiversity Enhancement Sites	Leicester City Council Ecology Team
Sites of Importance for Nature Conservation	Leicester City Council Ecology Team
Pre-1972 landfill sites	Leicester City Council dataset
Digital OS Land-Line maps	Roads, buildings, OS lines
Aerial Photographs	Aerial photographs of the city 1981 & 1998
Historical Ordnance Survey Maps	Digitised County Series maps for c1888 & c1949
Potential Contaminated Land	Sites contained in Database
City of Leicester Local Proposals Map	Leicester City Council (1994). Replacement Local Plan to be published in Autumn 2001
Integrated and Local Authority Air Pollution Control registers	Process information for all such processes in the city.

## **Chapter 4. The Inspection Strategy for Leicester**

### **4.1 Objectives of the Strategy Document**

The key objectives of the Leicester City approach are:

- To comply with the duties imposed on every local authority by Part IIA of the Environmental Protection Act 1990
- To act in accordance with the Annex 3, paragraph B.12 of the Guidance requiring local authorities to formally adopt and publish a Part IIA strategy.
- To act in accordance with the Annex 3, paragraphs of the Guidance as detailed in 1.14 and the contents of the Guidance in general.
- To follow the advice given in the Inspection Strategies Advice Note published by the Department of Environment, Transport and the Regions/Environment Agency (2001).
- To assign the highest priority to human health risks.
- To assist the planning process in dealing effectively with any land contamination to ensure that the land is suitable for any proposed use.
- To assist the management of the City Council's existing land contamination liabilities whilst avoiding the creation of any such liabilities in the future.
- To avoid any unnecessary blight.
- To provide information to the Environment Agency for its report on Contaminated Land.

## **4.2 Identification and Prioritisation of Potentially Contaminated Land**

The identification of contaminated land will be carried out in an ordered, rational and efficient manner based on the principles of risk assessment. This will be undertaken on two levels:

1. The assessment of risk in relation to the whole City, involving the prioritisation of areas of the city for further investigation, based on the likely existence of contaminated land, and
2. Site specific risk assessments to determine the actual existence of contaminated land.

The primary task will therefore be to undertake a desktop inspection programme to identify potential sources and receptors of contamination.

The site of any past or current use listed in Appendix D will be considered as a potential contaminant source at this stage. Potential contaminant sources likely to have the greatest impact on human receptors will be assigned the highest priority.

Prior to detailed investigation, potentially contaminated land will be listed and categorised according to a preliminary assessment of risk.

Assessments at this preliminary stage are made on a limited amount of base data and information, such as old surveys, maps, geological information etc. As more information is gathered, original assessments may have to be revised. Priority category may also change accordingly.

## **4.3 Contaminant Source Identification**

To assist the systematic identification of a vast number of potential sources, the following method has been adopted.



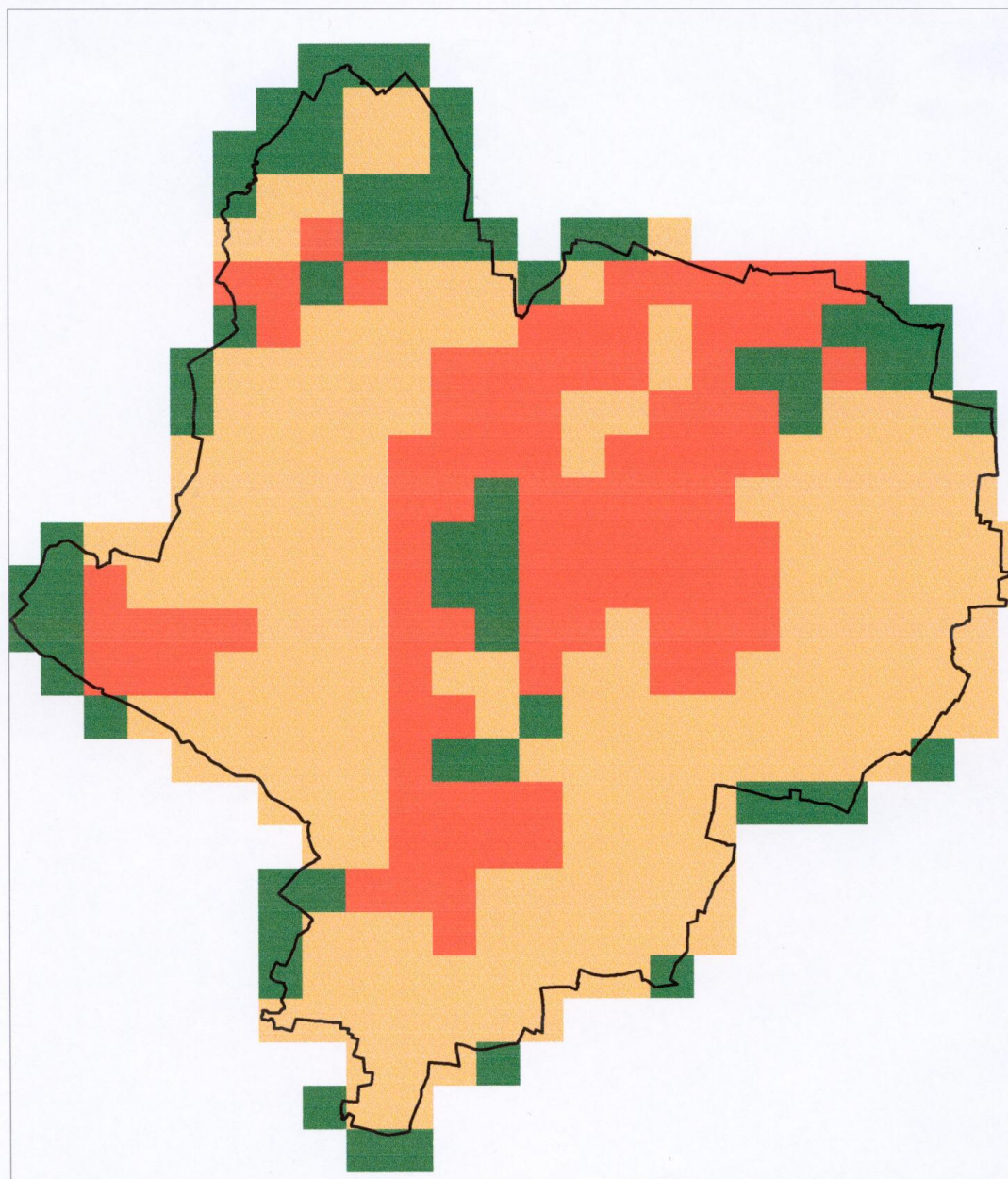
A map of the City has been subdivided by the overlaying of a 500-metre grid using the GIS. With reference to the primarily residential areas and primarily employment areas detailed in the current Leicester City Council (1994) local plan, each square is ranked in terms of the likelihood of contaminated land existing **and** affecting human receptors at dwellings or allotment gardens.

<b>Classification</b>	<b>Landuse</b>
High Priority*	Gridsquares containing any primarily residential areas or current allotment uses which occupy the site area of any former industrial activity indicated on any historical map of the City.
Medium Priority	Gridsquares incorporating both primarily residential <b>and</b> primarily employment areas
Low Priority	Gridsquares incorporating the remaining, primarily residential areas
Very Low Priority	All other Gridsquares

The outcome of this classification is shown in Figure 6.

\*The task of designating High Priority Gridsquares will commence in July 2001 in accordance with the implementation timetable detailed in section 9.3.

**Figure 6 Gridsquare Ranking for Contaminant Source Identification**



**Grid square prioritisation**

- Very Low Priority
- Low Priority
- Medium Priority
- High Priority - to be included by September 2001

In addition to targeting human health as the main priority, this system also ensures that much of the City's sand and gravel, minor aquifer is given an enhanced priority by virtue of the fact that industrial development has tended to follow this flood plain strata. As detailed in section 2.6, the sands and gravels associated with this flood plain represents the City's most significant geological pathway for mobile contaminants.

The GIS based desktop identification of contaminant sources will comprise a four stage iterative process working through the gridsquare groups in order of descending priority.

From July 2001 the task of identifying and reviewing for all HIGH priority gridsquares will commence. The location and boundary of each previous or existing, potentially contaminative use will be identified by manually reviewing the layers of GIS data detailed in section 3.9, which coincide with each grid square. The following additional information sources will be examined:

- Sites where known pollution incidents have occurred eg fuel or solvent spillage
- Sewage slurry spreading on former agricultural land
- Petroleum Licensing records for Leicester indicating the location of all previous or currently licensed petroleum tanks
- Local trade directories
- The Development Control database and archives
- Existing Environmental Health files
- Any other available site investigation data
- Borehole data
- Applied geological maps

A map polygon delineating each potential source identified will be created on a base map of the city. All available data relating to that source use will be entered into the GIS linked database.

Once each gridsquare within this group has been visited, the data will be processed as detailed in section 4.4. After such time the above exercise will be repeated for **MEDIUM, LOW** and then **VERY LOW** priority groups respectively.

Resources will first be concentrated on the risk assessment of all likely contaminated land within **HIGH** priority gridsquares before the next stage of identification begins. At some stage however it is envisaged that contaminant source identification and the data processing will operate simultaneously.

It must be noted that as new information becomes available and/or the understanding of local pollutant linkages increases it may be necessary to alter the priority of individual gridsquares to reflect any revised likelihood of contaminated land existing.

#### **4.4 Prioritisation of Potentially Contaminated Land According to Risk.**

The prioritisation of site for further inspection will be based on a model used by the Danish Environmental Protection Agency (1995). UK guidance in this area is limited however regard will be made to anticipated forthcoming guidance.

The prioritisation model is contained within the land quality database. It uses an objective scoring system to identify and prioritise potential pollutant linkages relating to defined sites. The workings of the model are detailed in Appendix C.

At the end of each of the four desktop stages detailed in section 4.3, a prioritised list of the likelihood of sites being contaminated land will be produced.

Again, if a site is encountered which presents an imminent and acute risk to human health, available resources will be temporarily redirected towards undertaking the procedures outlined in section 6.5.

## **4.5 Identification of Contaminated Land**

For contaminated land to be so defined the City Council must be satisfied that at least one pollutant linkage exists.

For each site highlighted by the prioritisation process and in order of descending numerical priority, a more detailed investigation will be undertaken to confirm whether any potential pollutant linkage identified exists and if so results in:

- significant harm being caused or a significant possibility of such harm being caused; or
- pollution of controlled waters being, or likely to be caused.

Confirmation of the above will result in the pollutant linkage being regarded as ‘significant’ and the land will be declared contaminated land in accordance with Chapter 5. It is almost inevitable that additional site specific data will be required before this can be done.

Where additional data are required to confirm the existence or significance of a pollutant linkage, it may be necessary to undertake intrusive site work. With the exception of special sites, which are considered in section 4.8, Pollution Control Group Officers will either; undertake this work directly, or commission independent consultants on a contractual basis. In every case the work will be carried out by a “suitable person”, adequately qualified to undertake the work. Suitable person requirements are detailed in Appendix E.

Intrusive investigations carried out by the City Council will be consistent with current guidance and the appropriate technical procedures to ensure:

- effectiveness;
- no unnecessary damage is caused; and
- the works themselves do not result in the formation of a new pollutant linkage, or aggravate an

existing pollutant linkage.

The utmost discretion will be used at all times to minimise the effect on occupiers of the land.

#### **4.6 Risk Assessment**

The findings of the intrusive investigation will be used to undertake a scientifically valid and robust risk assessment to determine the risks to the specified receptor. The objective will be to determine whether identified risks are acceptable or not.

Numerous methodologies exist to assess the potential health and environmental impacts of contaminated land. The risk assessment approach adopted by the City Council will be consistent with current legislation and guidance.

For the purposes of identifying contaminated land, officers from the Pollution Control Group will either: undertake this risk assessment work themselves, or act on the advice of independent and appropriate, consultants acting on their behalf.

Where applicable, human health risks from soil contamination will be considered in the context of anticipated Department of the Environment, Transport and the Regions and Environment Agency (2000)<sup>1</sup> guidance on the Contaminated Land Exposure Assessment (CLEA) model. This model however is restricted to a limited range of contaminants.

For contaminants not considered in the CLEA model, site specific, risk assessment criteria for human health will be derived from toxicity data. This will again be in accordance with anticipated Department of the Environment, Transport and the Regions and Environment Agency (2000)<sup>2</sup> guidance entitled *Model Procedures for the Management of Contaminated Land*.

This proposed approach to human health risk is explained further in Appendix G.

In making decisions about risk of harm to ecological systems, regard will be made to comments

sought from the City Council Nature Conservation Officer as well as external organisation such as:

- English Nature; and
- The Leicestershire and Rutland Wildlife Trust.

Similarly the Environment Agency will be consulted regarding all risks relating to controlled waters. It is anticipated that risk assessments of controlled waters will be carried out in accordance with the Environment Agency (1999) report entitled “ Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources”.

In situations where a pollutant linkage has been characterised to the satisfaction of the City Council, the investigation into that linkage will cease. Where an unacceptable risk is identified, the pollutant linkage will be regarded as significant. The area land associated with the contaminant source component of any significant pollutant linkage will then be delineated and declared as contaminated land.

Additional pollutant linkages on the same land may be considered separately and either investigated by the City Council or by an appropriate person via the enforcement process.

No further action will be taken if a significant pollutant linkage does not exist.

#### **4.7 Powers of Entry**

Statutory powers of entry are conferred on the City Council to enable it to carry out its functions under Part IIA. These are also considered in Appendix E. There are no circumstances in which the Council will use these powers to obtain information about the condition of land, where:

- It can obtain the information from third parties without the need for entering the site; or
- A person offers to provide the information within a reasonable and specified time, and does so.

## **4.8 Special Sites**

As indicated earlier the Environment Agency will act as enforcing authority for contaminated land designated a 'special site' as defined in Appendix F

It is considered unlikely that any such sites exist in the City, however where land highlighted by the prioritisation process for further investigation would, if declared contaminated land, be a special site, the Environment Agency will be notified in writing.

It is envisaged that the Environment Agency will wish to carry out detailed investigation of these sites on behalf of the City Council. Where this is the case, the City Council will appoint the Environment Agency as a "suitable person" to investigate the land.

The City Council may undertake joint investigation of these sites if requested to do so by the Environment Agency.

## **4.9 Undetermined Pollutant Linkages**

Situations may arise where, on the information available, it is not possible to obtain sufficient information to determine whether a pollutant linkage is significant in accordance with the Guidance. In such cases the City Council will determine that, on the balance of probabilities, it would seem the land does not fall within the statutory definition of contaminated land, but the situation will be kept under review and reopened at any time new information becomes available.

## **4.10 Avoiding Future Pollutant Linkages**

Inspections are very likely to identify contamination that would only form a significant pollutant linkage if new pathways or receptors were introduced. In such circumstances this information will be retained and the site monitored where the introduction of relevant new receptors seems likely.



Should such a site be identified for future development, the information obtained during the investigation will be used to inform the development control process and/or the building control process. The information will also be made available to any potential developer via the development control process.

## **Chapter 5      Determination and Notification of Contaminated Land**

### **5.1      Local Authority Determination**

Where the presence of contaminated land has been confirmed, the City Council will:

- Establish who should bear responsibility for remediation
- Decide after consultation what must be done in the form of remediation and ensure it is effectively carried out
- Determine liability for the costs of the remedial works

Land will be declared as contaminated land by means of a full written report prepared by the Pollution Control Group. This written record of determination will include:

- a full description of the site boundaries and the associated significant pollutant linkage(s)
- a summary of the evidence which confirms the existence of the significant pollutant linkage(s)
- a summary of the risk assessment(s) upon which the pollutant linkage(s) was considered to be significant;
- a summary of the way the requirements of the Guidance were satisfied.

### **5.2      Stakeholder Notification**

All relevant stakeholders in the site will then be notified in writing that the land has been declared contaminated. Such persons will include:

- the owner(s)

- the occupier(s)
- the 'appropriate persons' as defined in the Guidance ie those liable for remediation
- the Environment Agency

At the notification stage it may not be possible to identify all the relevant parties, particularly the appropriate persons. The Council will, however, act on the best information available to it at this time and keep the situation continually under review as more information comes to light.

The Environment Agency will also be informed of any contaminated land, which falls within the definition of a special site. It is required to then consider whether it agrees that the land should form a special site. If it does not agree it must notify the City Council and the Secretary of State within 21 days with a comprehensive statement explaining its reasons. The City Council will then refer the decision to the Secretary of State.

If the Environment Agency agrees with Council, or it fails to notify the Council it disagrees within 21 days, the contaminated land will be designated a special site. The responsibility for securing remediation then passes to the Environment Agency.

This notification procedure is designed to seek stakeholders' opinions as to what remediation might be most appropriate. To aid this process the City Council will provide as much information as possible to the relevant stakeholders, including where available:

- a copy of the written record of determination;
- copies of site investigation reports (or details of their availability)
- details of the persons considered to be the likely appropriate persons
- details of all other parties notified

The likely appropriate persons will also be provided with written explanations of the test for exclusion and apportionment as detailed below.

It may be at this stage that the Council will need further information on the condition of the site to

identify whether any additional significant pollutant linkages exist. If that is the case an informal attempt will be made to obtain this information from the appropriate persons already identified.

### **5.3 Avoidance of Unnecessary Blight**

The City Council recognises that contaminated land issues are synonymous with land blight. In implementing this strategy the City Council will seek to avoid causing any unnecessary public anxiety.

The actual identification of contaminated land, coupled with the unavailability of suitable, timely information, could cause untold problems to owners, occupiers or persons with another interest in the land. In order to combat this, the City Council will set up an early and effective means of communication when any contaminated land is identified. In addition to the procedures detailed the sections 5.1 and 5.2, the following will also be implemented:

- Designation of a named officer within the Pollution Control Group to act as the focus for information and contact for each case;
- Involvement of relevant interested parties as early as possible in any actions. This would then continue until completion;
- Use of informal methods of communication - eg face to face discussions, telephone calls, small group meetings with representatives of the community - rather than formal methods such as formal public meetings;
- Provision of full technical information to affected individuals on the nature of the hazards, remedial options, etc relating to the specific site
- Notifying property owners and occupiers of any information being provided about their properties;
- Wherever possible, communicating with the local media about sites being investigated and/or requiring remedial action, **only** with the approval of the affected property owners and/or occupiers.

## **Chapter 6        Liability and Enforcement**

### **6.1        Identification of ‘Appropriate Persons’**

Land may be declared contaminated land upon the identification of only one significant pollutant linkage. Full liability for an area of contaminated land cannot be determined until all risks relating to the significant pollutant linkages are fully characterised and understood.

Enforcement powers within the Act allow the regulator to require further investigation of contaminated land and clean up via the service of remediation notices. In the context of this regime the term remediation includes investigation work. Before any enforcement action is initiated, the City Council will first investigate the issue of liability and apportionment.

The matter of appropriate persons will be considered for each significant pollutant linkage. Therefore where a site has had a series of contaminative uses over the years, each significant pollutant linkage will be identified separately and liability considered for each.

### **6.2        Apportionment of Liability**

When all significant pollutant linkages have been identified for an area of contaminated land, a five step, apportionment of liability procedure will commence. These steps are:

- Identifying potential appropriate persons and liability groups
- Characterising remediation actions
- Attributing responsibility to liability groups
- Excluding members of liability groups
- Apportioning liability between members of a liability group

These procedures are complex and potentially cumbersome, in applying them the City Council will have full regard for the Guidance requirements relating to identifying appropriate persons and

apportioning costs. The process will commence with the establishment of liability groups. All appropriate persons for any one significant pollutant linkage are referred to as a 'liability group'. The Guidance introduces two classes of liability groups. These are:

- Class 'A' Persons - the persons that either independently or collectively, caused the significant pollutant linkage to exist i.e. the 'polluter'. Also included are persons who, "knowingly permitted" the existence of significant pollutant linkage.
- Class 'B' Persons- the owners or occupiers of the contaminated land.

Where no class 'A' persons can be found, liability reverts to class 'B' persons. In accordance with the 'polluter pays' principle enshrined within the Act, the Council will make a concerted effort to identify class 'A' persons in every case. The identification of one class 'A' person for a significant pollutant linkage will result in the exclusion of all class 'B' person liabilities for that linkage.

The City Council will have regard to any private apportionment agreements have been made between appropriate persons.

When the Council has apportioned the likely remediation costs relating to all significant pollutant linkages present on contaminated land, and before the service of any remediation notices, consideration will be given to issues of financial hardship of any appropriate person. In proven situations of financial hardship as detailed in the Guidance, the City will not serve a remediation notice on that person. The Council will instead, consider carrying out the work itself and producing a remediation statement as detailed in Appendix A.

### **6.3 Enforcement**

Remediation notices will be served only as a last resort (not withstanding urgent cases), and then after at least a three month consultation process following formal notification that the land is

contaminated, as detailed in sections 5.1 to 5.3. If it then appears that the person(s) responsible will not undertake the necessary remediation to the satisfaction of the City Council, remediation notices be served. In such cases a remediation notice will be served on each appropriate person.

Remediation notices will detail the remediation measures that required are to be carried out within a specified time.

It is an offence for a person to, without reasonable excuse, fail to comply with the requirements of a remediation notice served upon them. Any decision to prosecute such an offence would be consistent with the Pollution Control Group's, Enforcement Policy.

#### **6.4 Remediation by the Local Authority**

Prior to the service of a remediation notice, the City Council will first determine whether it has the power to carry out any of the remediation actions itself. There are five specified circumstances where this may be the case:

- Where urgent action is required (see below)
- Where no appropriate person can be found
- Where one or more appropriate persons are excluded on grounds of financial hardship
- Where the local authority has made an agreement with the appropriate person(s) that it should carry out the remediation
- In default of a remediation notice

#### **6.5 Urgent Action**

Urgent action will be commenced where the City Council is satisfied that there is imminent danger of serious harm or serious pollution of controlled waters being caused as a result of contaminated land. In such circumstances the procedures for urgent action detailed in the Guidance will be

followed. This may involve the forced entry into the premises. Appendix E details powers of entry and procedures for urgent action

The City Council will undertake the remediation in urgent cases where it is the enforcing authority if it is of the opinion that the risk would not be mitigated by enforcement action. In the case of a special site the City Council will declare the land contaminated land in accordance with the statutory procedure, and then notify the Environment Agency who will then be responsible for the remediation.

In appropriate cases the Council will seek to recover all or some costs of remediation works it has completed. This is subject to considerations of hardship and Chapter E of the Guidance

## **6.6 City Council Owned Land**

The investigation of Council-owned land will be carried out in accordance with the objective identification methodology detailed in Chapter 4, regardless of the City Council interest.

Where the Authority is the ‘appropriate person’ for contaminated land, the responsible officer from a inter departmental, corporate, contaminated land working group set up for this purpose will be identified and informed accordingly. The Pollution Control Group will administer this process. Due to its enforcement role and the potential for conflict of interest, it would be inappropriate for the Pollution Control Group to take lead responsibility for management and remediation of Council owned contaminated land. However, in order to utilise the authority's expertise and knowledge in the most efficient manner the Pollution Control Group will act as an internal adviser.

As the City Council is excluded from serving a remediation notice on itself in these cases, a remediation statement will be placed on the public register as soon as practicable, detailing the required remediation actions and the time period within which they will be done.



## **Chapter 7                    Information Management**

### **7.1    Data Handling**

A large amount of information, in the form of reports, maps, letters and documents will be required and generated during the implementation of this strategy. This data will come from a variety of sources and many different formats. The database detailed in Chapter 3 has been designed to accommodate such data and suitable library space has been allocated within the Pollution Control Group for the effective storage of paper records.

### **7.2    The Public Register**

The public register is intended to act as a full and permanent record, open for public inspection, of action taken by the City Council in respect of the remediation of all contaminated land within the City. It will include all contaminated land for which the City Council is the appropriate person. All information will to be added to the register as soon as it is reasonably practically to do so.

The register will be maintained by the City Council and contain full particulars of the following information which is specified in The Contaminated Land (England) Regulations 2000:

- remediation notices
- details of site reports obtained by the authority relating to remediation notices
- remediation declarations, remediation statements and notifications of claimed remediation
- designation of sites as “special sites”
- any appeals lodged against remediation and charging notices
- convictions

(The Glossary of Terms in Appendix A contains definitions of the above, formal terms)

Information about land may be excluded from the public register, if in the opinion of the Secretary

of State, it is against the interests of national security, is commercially confidential, relates to the affairs of an individual or business.

### **7.3 Information not contained on the Public Register**

The public register will not include details of historic land use and other records used in the investigation of potentially contaminated land. The Pollution Control Group will continue to hold existing documentation regarding these information sources. Any new information gathered as part of the investigation into contaminated land will be added to the Pollution Control Group records in a suitable form and used to respond to requests for information about specific sites as an additional local land search enquiry.

Whilst the assessment stages land within the City are underway, any requests to the City Council for information about sites which may fall within the definition of contaminated land will be met with refusal on the grounds that the investigations are incomplete. This is in line with caselaw established in *Maile v Wigan* 1999, reported in ENDS (1999).

#### **Exclusion on the Grounds of National Security**

The City Council will not include any information on its register if, in the opinion of the Secretary of State, its inclusion would be against the interests of national security. The Secretary of State can give directions specifying information, or descriptions of information, which are to be excluded from any register or referred to the Secretary of State for his determination.

#### **Exclusion on the Grounds of Commercial Confidentiality**

The City Council will not include any information on its register which:

- relates to the affairs of any individual or business; and

- is commercially confidential to that individual or the person carrying on that business.

However, information will not be excluded from the register solely on the basis that its inclusion might provide information to a prospective buyer of the land, thereby affecting the sale or the sale price.

The City Council will act in accordance with the Act and Guidance in relation to:

- inclusion of information that is in the public interest
- communication procedures with relevant parties and appeals processes
- register content for excluded material

The public register is in paper format and available for free inspection within normal office hours. It is located in:

Noise & Pollution Control Team  
Phoenix House  
1 King Street  
Leicester  
LE1 6RN

#### **7.4 Provision of information to the Environment Agency**

The Environment Agency is required to prepare a periodic report for the Secretary of State on the state of contaminated land in England and Wales.

This report will include:

- A summary of local authority inspection strategies, including progress against the strategy and its effectiveness
- The amount of contaminated land and the nature of the contamination
- Measures taken to remediate land

A memorandum of understanding has been drawn up between the Environment Agency and the Local Government Association (2001). It describes how information will be exchanged between the local authorities and the Environment Agency. The City Council will provide information to the Environment Agency in accordance with this document.

## **Chapter 8                      Review Mechanisms**

### **8.1    Triggers for Undertaking Non-Routine Inspections**

It is recognised that there may be occasions where inspections have to be undertaken outside the objective contaminated land identification process detailed in Chapter 4. Triggers for undertaking non-routine inspection will include: -

- unplanned events – for example, where an incident, such as a spill, has occurred.
- introduction of new receptors – for example, where a new protected ecosystem is designated, or there is persistent trespass on a site which otherwise does not have a sensitive receptor.
- identification of localised health effects – which appear to relate to a particular area of land.
- responding to information – from other statutory bodies, stakeholders, complaints from members of the public,, or other interested parties, which reveal that the site requires urgent action.

In such cases, resources may have to be temporarily redirected to deal with such events before returning once again to the routine identification work.

### **8.2    Triggers for Reviewing Inspection Decisions**

There may also be occasions when the findings of previous inspection decisions must be reviewed in light of external influences which may affect the outcome. Examples of these include:

- Significant changes occur in legislation
- Establishment of significant case law or other precedent
- Revision of guideline values for exposure assessment.

All decisions will be made and recorded in a consistent manner that will allow efficient review.

### **8.3 Annual Review of Strategy**

This strategy will be subject to an annual review. A progress report including any proposed changes will be presented to an appropriate cabinet meeting each year. Proposed changes will be subject to Cabinet approval. The progress reports will be prepared by the Pollution Control Group and will detail the following:

- Progress with the implementation
- Contaminated land identified
- Special sites identified
- Any City Council liabilities identified over the year.
- Voluntary remediation undertaken or proposed
- Enforcement action undertaken

## **Chapter 9 Resource Implications and Timescales**

## **9.1 Implementation of Part IIA**

The Government in-2001 - 2002 made a total of £21 million available for the combined local authorities and Environment Agency capital programmes. In addition £12 million per year has been added to the "Environmental Protection and Cultural Services" component of national totals for Standard Spending Assessments, to assist Local authorities in meeting their revenue expenditure under Part IIA.

Department of the Environment, Transport and the Regions (2001)

## **9.2 Leicester City Council Contaminated Land Liabilities.**

Insufficient information exists to enable any quantification of City Council contaminated land liabilities to be attempted at present.

The Department of the Environment, Transport and the Regions (2001) has indicated that the Supplementary Credit Approval scheme, which has been utilised by the City Council for the past decade, is to remain available to finance local authority contaminated land liabilities. Wherever possible the City Council will continue to use this scheme for any future liabilities.

## **9.3 Proposed Timetable for the Implementation of the Part IIA Regime in Leicester**

Whilst it is not possible to pre-empt the amount of work that will be generated by the forthcoming desktop inspection exercise, or predict the resource implications of any technical or legal complications which may ensue, the following timescales are considered achievable based on existing available resources.

<b>Task</b>	<b>Target</b>
<ul style="list-style-type: none"> <li>• <b>Production and publication of statutory contaminated land strategy</b></li> <li>• <b>GIS enhancement</b></li> </ul>	<b>By July 2001</b>
<ul style="list-style-type: none"> <li>• <b>Designation of high priority gridsquares</b></li> </ul>	<b>By September 2001</b>
<ul style="list-style-type: none"> <li>• <b>Desktop inspection of all the high priority gridsquares.</b></li> <li>• <b>Identification of potentially contaminated sites within priority group</b></li> <li>• <b>and prioritisation for further investigation.</b></li> <li>• <b>Detailed inspection and assessment of such sites.</b></li> <li>• <b>Determination of contaminated land within priority group</b></li> <li>• <b>Commence moves to secure remediation of contaminated land</b></li> </ul>	<b>By September 2002</b>
<ul style="list-style-type: none"> <li>• <b>Desktop inspection of all the medium priority gridsquares.</b></li> <li>• <b>Identification of potentially contaminated sites within priority group</b></li> <li>• <b>and prioritisation for further investigation.</b></li> <li>• <b>Detailed inspection and assessment of such sites.</b></li> <li>• <b>Determination of contaminated land within priority group</b></li> <li>• <b>Commence moves to secure remediation of contaminated land</b></li> </ul>	<b>By September 2003</b>
<ul style="list-style-type: none"> <li>• <b>Desktop inspection of the remainder of the City.</b></li> <li>• <b>Identification of potentially contaminated sites and prioritisation for further investigation.</b></li> <li>• <b>Detailed inspection and assessment of such sites.</b></li> <li>• <b>Determination of contaminated land within priority group</b></li> <li>• <b>Commence moves to secure remediation of contaminated land</b></li> </ul>	<b>By 2006</b>

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# **Appendices**

## **Appendix A**

### **GLOSSARY OF TERMS**

The Guidance uses a number of terms, which are defined in the Act. The meanings of the most important of these terms are set out below, along with a reference to the relevant section. All other references relate to locations within the guidance.

Terms, which are defined in statutes, are shown with underlining.

**Animal or crop effect:** significant harm of a type listed in box 3 of Table A of Chapter A.

**Apportionment:** any determination by the enforcing authority under section 78F(7) (that is, a Group of the costs of carrying out any remediation action between two or more appropriate persons). *Paragraph D.5(e)*

**Appropriate person:** defined in section 78A(9) as:

"any person who is an appropriate person, determined in accordance with section 78F..., to bear responsibility for any thing which is to be done by way of remediation in any particular case."

**Assessment action:** a remediation action falling within the definition of remediation in section 78A(7)(a), that is the doing of anything for the purpose of assessing the condition of the contaminated land in question, or any controlled waters affected by that land or any land adjoining or adjacent to that land. *Paragraph C.8(e)*

**Attribution:** the process of apportionment between liability groups. *Paragraph D.5(e)*

**Building:** any structure or erection, and any part of a building including any part below ground, but not including plant or machinery comprised in a building. Table A

**Building effect:** significant harm of a type listed in box 4 of Table A of Chapter A.

**Caused or knowingly permitted:** test for establishing responsibility for remediation, under section 78F(2); see paragraphs 9.8 to 9.14 of Annex 2 for a discussion of the interpretation of this term.

**Changes to Substances:** an exclusion test for Class A persons set out in Part 5 of Chapter D. *Paragraphs D.62 to D.64.*

**Charging notice:** a notice placing a legal charge on land served under section 78P(3)(b) by an enforcing authority to enable the authority to recover from the appropriate person any reasonable cost incurred by the authority in carrying out remediation.

**Class A liability group:** a liability group consisting of one or more Class A persons. *Paragraph D.5(c)*

**Class A person:** a person who is an appropriate person by virtue of section 78F(2) (that is, because he has caused or knowingly permitted a pollutant to be in, on or under the land). *Paragraph D.5(a)*

**Class B liability group:** a liability group consisting of one or more Class B persons. *Paragraph D.5(c)*

**Class B person:** a person who is an appropriate person by virtue of section 78F(4) or (5) (that is, because he is the owner or occupier of the land in circumstances where no Class A person can be found with respect to a particular remediation action). *Paragraph D.5(b)*

**Collective action:** a remediation action which addresses together all of the significant pollution linkages to which it is referable, but which would not have been part of the remediation package for every one of those linkages if each of them had been addressed separately. *Paragraph D.22(b)*

**Common action:** a remediation action which addresses together all of the significant pollution linkages to which it is referable, and which would have been part of the remediation package for each of those linkages if each of them had been addressed separately. *Paragraph D.22(a)*

**Contaminant:** a substance, which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters. *Paragraph A.12*

**Contaminated land:** defined in section 78A(2) as

"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that -

"(a) significant harm is being caused or there is a significant possibility of such harm being caused, or;

"(b) pollution of controlled waters is being, or is likely to be, caused."

**Contaminated Land (England) Regulations 2000:** regulations (SI 2000/227) made under Part IIA - described in Annex 4.

**Contaminative use:** any use contained on the list of industries outlined in the 1991 DoE Consultation Paper and the 1996 list of DoE Industry Profiles.

**Controlled waters:** defined in section 78A(9) by reference to Part III (section 104) of the Water Resources Act 1991; this embraces territorial and coastal waters, inland fresh waters, and ground waters.

**Cost recovery decision:** any decision by the enforcing authority whether:

- a) to recover from the appropriate person all the reasonable costs incurred by the authority in carrying out remediation, or
- b) not to recover those costs or to recover only part of those costs. *Paragraph E.8*

**Current use:** any use, which is currently being made, or is likely to be made, of the land and which is consistent with any existing planning permission (or is otherwise lawful under town and country planning legislation). This definition is subject to the following qualifications:

- (a) the current use should be taken to include any temporary use, permitted under town and country planning legislation, to which the land is, or is likely to be, put from time to time;
- (b) the current use includes future uses or developments which do not require a new, or amended, grant of planning permission;
- (c) the current use should, nevertheless, be taken to include any likely informal recreational use of the land, whether authorised by the owners or occupiers or not, (for example, children playing on



the land); however, in assessing the likelihood of any such informal use, the local authority should give due attention to measures taken to prevent or restrict access to the land; and

(d) in the case of agricultural land, however, the current agricultural use should not be taken to extend beyond the growing or rearing of the crops or animals which are habitually grown or reared on the land. *Paragraph A.26.*

**Ecological system effect:** significant harm of a type listed in box 2 of Table A of Chapter A.

**Enforcing authority:** defined in section 78A(9) as:

(a) in relation to a special site, the Environment Agency;

(b) in relation to contaminated land other than a special site, the local authority in whose area the land is situated.

**Escaped Substances:** an exclusion test for Class A persons set out in Part 5 of Chapter D.

*Paragraphs D.65 to D.67*

**Excluded Activities:** an exclusion test for Class A persons set out in Part 5 of Chapter D.

*Paragraphs D.47 to D.50*

**Exclusion:** any determination by the enforcing authority under section 78F(6) (that is, that a person is to be treated as not being an appropriate person). *Paragraph D.5(d)*

**Favourable conservation status:** defined in Article 1 of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

**Hardship:** a factor underlying any cost recovery decision made by an enforcing authority under section 78P(2). See paragraphs 10.8 to 10.10 of Annex 2 for a discussion of the interpretation of this term.

**Harm:** defined in section 78A(4) as:

"harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property."

**Human health effect:** significant harm of a type listed in box 1 of Table A of Chapter A.

**Industrial, trade or business premises:** defined in section 78M(6), for the purpose of determining the penalty for failure to comply with a remediation notice, as:

"premises used for any industrial, trade or business purposes or premises not so used on which matter is burnt in connection with any industrial, trade or business process, and premises are used for industrial purposes where they are used for the purposes of any treatment or process as well as where they are used for the purpose of manufacturing."

**Inspection using statutory powers of entry:** any detailed inspection of land carried out through use of powers of entry given to an enforcing authority by section 108 of the Act. *Paragraph B.21*

**Introduction of Pathways or Receptors:** an exclusion test for Class A persons set out in Part 5 of Chapter D. *Paragraphs D.68 to D.72.*

**Intrusive investigation:** an investigation of land (for example by exploratory excavations) which involves actions going beyond simple visual inspection of the land, limited sampling or assessment of documentary information. *Paragraph B.20(c)*

**Liability group:** the persons who are appropriate persons with respect to a particular significant pollutant linkage. *Paragraph D.5(c)*

**Local authority:** defined in section 78A(9) as meaning any unitary authority, district council, the Common Council of the City of London, the Sub-Treasurer of the Inner Temple and the Under-Treasurer of the Middle Temple.

**Monitoring action:** a remediation action falling within the definition in section 78A(7)(c), that is "making of subsequent inspections from time to time for the purpose of keeping under review the condition of the land or waters". *Paragraph C.8(g)*

**Orphan linkage:** a significant pollutant linkage for which no appropriate person can be found, or where those who would otherwise be liable are exempted by one of the relevant statutory provisions. *Paragraphs D.12, D.14 and D.17*

**Owner:** defined in section 78A(9) as:

"a person (other than a mortgagee not in possession) who, whether in his own right or as trustee for any other person, is entitled to receive the rack rent of the land, or where the land is not let at a rack rent, would be so entitled if it were so let."

**Part IIA:** Part IIA of the Environmental Protection Act 1990.

**Pathway:** one or more routes or means by, or through, which a receptor:

- (a) is being exposed to, or affected by, a contaminant, or
- (b) could be so exposed or affected. *Paragraph A.14*

**Payments Made for Remediation:** an exclusion test for Class A persons set out in Part 5 of Chapter D. *Paragraphs D.51 to D.56*

**Person acting in a relevant capacity:** defined in section 78X(4), for the purposes of limiting personal liability, as any of the following:

"(a) a person acting as an insolvency practitioner, within the meaning of section 388 of the Insolvency Act 1986 (including that section as it applies in relation to an insolvent partnership by virtue of any order made under section 421 of that Act;

"(b) the official receiver acting in a capacity in which he would be regarded as acting as an insolvency practitioner within the meaning of section 388 of the Insolvency Act 1986 if subsection (5) of that section were disregarded;

"(c) the official receiver acting as a receiver or manager;

"(d) a person acting as a special manager under section 177 or 370 of the Insolvency Act 1986;...

"(f) a person acting as a receiver or receiver and manager under or by virtue of any enactment, or by virtue of his appointment as such by an order of a court or by any other instrument."

**Pollutant:** a contaminant, which forms part of a pollutant linkage. *Paragraph A.17*

**Pollutant linkage:** the relationship between a contaminant, a pathway and a receptor. *Paragraph A.17*

**Pollution of controlled waters:** defined in section 78A(9) as:

"the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter."

**Possibility of significant harm:** a measure of the probability, or frequency, of the occurrence of circumstances, which would lead to significant harm being caused. *Paragraph A.27*

**Receptor:** either:

(a) a living organism, a group of living organisms, an ecological system or a piece of property which:

- (i) is in a category listed in Table A in Chapter A as a type of receptor, and
- (ii) is being, or could be, harmed, by a contaminant; or

(b) controlled waters which are being, or could be, polluted by a contaminant. *Paragraph A.13*

**Register:** the public register maintained by the enforcing authority under section 78R of particulars relating to contaminated land.

**Related companies:** are those which are, or were at the "relevant date", members of a group of companies consisting of a "holding company" and its "subsidiaries". The "relevant date" is that on which the enforcing authority first served on anyone a notice under section 78B(3) identifying the land as contaminated land, and the terms "holding company" and "subsidiaries" have the same meaning as in section 736 of the Companies Act 1985. *Paragraph D.46.*

**Relevant information:** information relating to the assessment of whether there is a significant possibility of significant harm being caused, which is:

- (a) scientifically-based;
- (b) authoritative;
- (c) relevant to the assessment of risks arising from the presence of contaminants in soil; and
- (d) appropriate to the determination of whether any land is contaminated land for the purposes of Part IIA, in that the use of the information is consistent with providing a level of protection of risk in line with the qualitative criteria set out in Tables A and B of Chapter A.

*Paragraph A.31*

**Relevant land or waters:** the contaminated land in question, any controlled waters affected by that land and any land adjoining or adjacent to the contaminated land on which remediation might be required as a consequence of the contaminated land being such land. *Paragraph C.8(d)*

**Remedial treatment action:** a remediation action falling within the definition in section 78A (7)(b), that is the doing of any works, the carrying out of any operations or the taking of any steps in relation to any such land or waters for the purpose:

- (a) of preventing or minimising, or remedying or mitigating the effects of any significant harm, or any pollution of controlled waters, by reason of which the contaminated land is such land, or
- (b) of restoring the land or waters to their former state. *Paragraph C.8(f)*

**Remediation:** defined in section 78A(7) as

"(a) the doing of anything for the purpose of assessing the condition of -

"(i) the contaminated land in question;

"(ii) any controlled waters affected by that land; or

"(iii) any land adjoining or adjacent to that land;

"(b) the doing of any works, the carrying out of any operations or the taking of any steps in relation to any such land or waters for the purpose -

"(i) of preventing or minimising, or remedying or mitigating the effects of any significant harm, or any pollution of controlled waters, by reason of which the contaminated land is such land; or

"(ii) of restoring the land or waters to their former state; or

"(c) the making of subsequent inspections from time to time for the purpose of keeping under review the condition of the land or waters."

**Remediation action:** any individual thing, which is being, or is to be, done by way of remediation.

*Paragraph C.8(a)*

**Remediation declaration:** defined in section 78H(6). It is a document prepared and published by the enforcing authority recording remediation actions which it would have specified in a remediation notice, but, which it is precluded from specifying by virtue of sections 78E(4) or (5), the reasons why it would have specified those actions and the grounds on which it is satisfied that it is precluded from specifying them in a notice.

**Remediation notice:** defined in section 78E(1) as a notice specifying what an appropriate person is to do by way of remediation and the periods within which he is required to do each of the things so specified.

**Remediation package:** the full set or sequence of remediation actions, within a remediation scheme, which are referable to a particular significant pollutant linkage. *Paragraph C.8(b)*

**Remediation scheme:** the complete set or sequence of remediation actions (Referable to one or more significant pollutant linkages) to be carried out with respect to the relevant land or waters.

*Paragraph C.8(c)*

**Remediation statement:** defined in section 78H(7). It is a statement prepared and published by the responsible person detailing the remediation actions, which are being, have been, or are expected to be, done as well as the periods within which these things are being done.

**Risk:** the combination of:

- (a) the probability, or frequency, of occurrence of a defined hazard (for example, exposure to a property of a substance with the potential to cause harm); and

(b) the magnitude (including the seriousness) of the consequences. *Paragraph A.9*

**Shared action:** a remediation action, which is referable to the significant pollutant in more than one significant pollutant linkage. *Paragraph D.21(b)*

**Single-linkage action:** a remediation action, which is referable solely to the significant pollutant in a single significant pollutant linkage. *Paragraph D.21(a)*

**Significant harm:** defined in section 78A(5). It means any harm, which is determined to be significant in accordance with the Guidance in Chapter A (that is, it meets one of the descriptions of types of harm in the second column of Table A of that Chapter).

**Significant pollutant:** a pollutant, which forms part of a significant pollutant linkage. *Paragraph A.20*

**Significant pollutant linkage:** a pollutant linkage, which forms the basis for a determination that a piece of land is contaminated land. *Paragraph A.20*

**Significant possibility of significant harm:** a possibility of significant harm being caused which, by virtue of section 78A(5), is determined to be significant in accordance with the Guidance in Chapter A.

**Sold with Information:** an exclusion test for Class A persons set out in Part 5 of Chapter D. *Paragraph D.57 to D.61*

**Special site:** defined by section 78A(3) as:

"any contaminated land -

"(a) which has been designated as such a site by virtue of section 78C(7) or 78D(6)...;and

"(b) whose designation as such has not been terminated by the appropriate Agency under section 78Q(4)...".

The effect of the designation of any contaminated land as a special site is that the Environment Agency, rather than the local authority, becomes the enforcing authority for the land.

**Substance**: defined in section 78A(9) as:  
"any natural or artificial substance, whether in solid or liquid form or in the form of a gas or vapour."

**APPENDIX B**

**Table A: Definitions of Receptor and Significant Harm.**

	<b>Type of Receptor</b>	<b>Description of harm to that type of receptor that is to be regarded as significant harm</b>
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1	Human beings	<p>Death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.</p> <p>This description of significant harm is referred to as a "human health effect"</p>
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2	<p>Any ecological system, or living organism forming part of such a system, within a location which is:</p> <ul style="list-style-type: none"> <li>• an area notified as an area of special scientific interest under section 28 of the Wildlife and Countryside Act 1981;</li> <li>• any land declared a national nature reserve under section 35 of that Act;</li> <li>• any area designated as a marine nature reserve under section 36 of that Act;</li> <li>• an area of special protection for birds, established under section 3 of that Act;</li> <li>• any European Site within the meaning of regulation 10 of the Conservation (Natural Habitats etc) Regulations 1994 (ie Special Areas of Conservation and Special Protection Areas);</li> <li>• any candidate Special Areas of Conservation or potential Special Protection Areas given equivalent protection;</li> <li>• any habitat or site afforded policy protection under paragraph 13 of Planning Policy Guidance Note 9 (PPG9) on nature conservation (ie candidate Special Areas of Conservation, potential Special Protection Areas and listed Ramsar sites); or</li> <li>• any nature reserve established under section 21 of the National Parks and Access to the Countryside Act 1949.</li> </ul>	<p>For any protected location:</p> <ul style="list-style-type: none"> <li>• harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or</li> <li>• harm which affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.</li> </ul> <p>In addition, in the case of a protected location which is a European Site (or a candidate Special Area of Conservation or a potential Special Protection Area), harm which is incompatible with the favourable conservation status of natural habitats at that location or species typically found there.</p> <p>In determining what constitutes such harm, the local authority should have regard to the advice of English Nature and to the requirements of the Conservation (Natural Habitats etc) Regulations 1994.</p> <p>This description of significant harm is referred to as an "ecological system effect".</p>
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3	<p>Property in the form of:</p> <ul style="list-style-type: none"> <li>• crops, including timber;</li> <li>• produce grown domestically, or on allotments, for consumption;</li> <li>• livestock;</li> <li>• other owned or domesticated animals;</li> <li>• wild animals which are the subject of shooting or fishing rights.</li> </ul>	<p>For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p> <p>The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a pollutant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss.</p> <p>This description of significant harm is referred to as an "animal or crop effect".</p>
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4	<p>Property in the form of buildings.</p> <p>For this purpose, "building" means any structure or erection, and any part of a building including any part below ground level, but does not include plant or machinery comprised in a building.</p>	<p>Structural failure, substantial damage or substantial interference with any right of occupation.</p> <p>For this purpose, the local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended.</p> <p>Additionally, in the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.</p> <p>This description of significant harm is referred to as a "building effect".</p>
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Source: Table A. p 73 of the Guidance

**Table B: Significant Possibility of Significant Harm**

	<b>Descriptions Of Significant Harm (As Defined In Table A)</b>	<b>Conditions For There Being A Significant Possibility Of Significant Harm</b>
1	<p>Human health effects arising from</p> <ul style="list-style-type: none"> <li>the intake of a contaminant, or</li> <li>other direct bodily contact with a contaminant.</li> </ul>	<p>If the amount of the pollutant in the pollutant linkage in question:</p> <ul style="list-style-type: none"> <li>which a human receptor in that linkage might take in,</li> <li>or</li> <li>to which such a human might otherwise be exposed,</li> </ul> <p>as a result of the pathway in that linkage, would represent an unacceptable intake or direct bodily contact, assessed on the basis of relevant information on the toxicological properties of that pollutant.</p> <p>Such an assessment should take into account:</p> <ul style="list-style-type: none"> <li>the likely total intake of, or exposure to, the substance or substances which form the pollutant, from all sources including that from the pollutant linkage in question;</li> <li>the relative contribution of the pollutant linkage in question to the likely aggregate intake of, or exposure to, the relevant substance or substances; and</li> <li>the duration of intake or exposure resulting from the pollutant linkage in question.</li> </ul> <p>The question of whether an intake or exposure is unacceptable is independent of the number of people who might experience or be affected by that intake or exposure.</p> <p>Toxicological properties should be taken to include carcinogenic, mutagenic, teratogenic, pathogenic, endocrine-disrupting and other similar properties.</p>

2	All other human health effects (particularly by way of explosion or fire).	<p>If the probability, or frequency, of occurrence of significant harm of that description is unacceptable, assessed on the basis of relevant information concerning:</p> <ul style="list-style-type: none"> <li>• that type of pollutant linkage, or</li> <li>• that type of significant harm arising from other causes.</li> </ul> <p>In making such an assessment, the local authority should take into account the levels of risk which have been judged unacceptable in other similar contexts and should give particular weight to cases where the pollutant linkage might cause significant harm which:</p> <ul style="list-style-type: none"> <li>• would be irreversible or incapable of being treated;</li> <li>• would affect a substantial number of people;</li> <li>• would result from a single incident such as a fire or an explosion; or</li> <li>• would be likely to result from a short-term (that is, less than 24-hour) exposure to the pollutant.</li> </ul>
3	All ecological system effects.	<p>If either:</p> <ul style="list-style-type: none"> <li>• significant harm of that description is more likely than not to result from the pollutant linkage in question;</li> <li>or</li> <li>• there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration.</li> </ul> <p>Any assessment made for these purposes should take into account relevant information for that type of pollutant linkage, particularly in relation to the ecotoxicological effects of the pollutant.</p>

4	All animal and crop effects.	If significant harm of that description is more likely than not to result from the pollutant linkage in question, taking into account relevant information for that type of pollutant linkage, particularly in relation to the ecotoxicological effects of the pollutant.
5	All building effects	If significant harm of that description is more likely than not to result from the pollutant linkage in question during the expected economic life of the building (or, in the case of a scheduled Ancient Monument, the foreseeable future), taking into account relevant information for that type of pollutant linkage.

Source: Table B. p 75 of the Guidance

## **Appendix C**

### **The Site Prioritisation Model Scoring System**

In the absence of any suitable, current UK guidance in this area, the prioritisation model used is based on that described by the Danish Environmental Protection Agency (1995).

The Site Prioritisation Model automatically calculates numerical risk scores based on inputted numerical values for a range of parameters. Three separate receptor based outputs may be produced. These are:

1. Groundwater Risk
2. Surface Water Risk
3. Site users or adjoining site users, termed Land Use Risk

The first information to be entered when a site has been registered is data concerning any potentially contaminate uses, which have taken place during the history of the site. A Pollution Control Officer will assign a suite of contaminants to each entry. This suite will be based on the relevant Department of the Environment, Industry Profile(s) or other appropriate information sources, including site specific data. The database currently contains physical and toxicological information for over 400 hazardous chemicals. Risk scores for a range of actual or potential contaminants associated with potentially contaminative uses have also been developed.

#### **PRIORITISATION OF SITES BASED ON POTENTIAL RISKS TO GROUNDWATER**

Groundwater is considered in terms of its value as a drinking water supply source.

The valuation of a sites impact on groundwater is therefore estimated having regard to:

- the groundwater class (i.e. is the site located within Groundwater Source Protection Zone);



- the level of aquifer protection provided by overlying geology;
- the chemical properties of the contaminants, mainly mobility (based on  $K_d$  or  $K_{ow}$ ), toxicity and degradability.

## **Groundwater Class**

For the purposes of the system, the extent of a groundwater problem is dependent mainly on the groundwater class. The method suggests that groundwater classes be divided up as follows:

- i. Area with special drinking water interest
- ii. Areas with drinking water interest
- iii. Areas with borderline drinking water interest

## **Aquifer Protection**

This refers to the degree of protection provided to the aquifer by the overlying geology. For example, an aquifer overlain by a thick clay layer will be much less vulnerable to contamination than one overlain by sand and gravel. The level of aquifer protection afforded is described in terms of three classes, namely;

- i. None;
- ii. Some;
- iii. Good protection.

As geology can be highly variable even at site level, the method suggests that the degree of protection of the aquifer conferred by the site geology be assessed using site specific information.

## Chemical Properties

Assessment of organic contaminants mobility is based on the  $\log K_{ow}$  (Octanol-water coefficient) while for inorganic contaminants, it is based on the  $K_d$ . A low  $\log K_{ow}$  or  $K_d$  indicates that the contaminant is highly mobile and vice versa. Examples of highly mobile organic compounds are Benzene and Trichorethylene ( $\log K_{ow} < 3$ ). Examples of organic compounds with medium mobility are Xylene and Napthalene ( $\log K_{ow}$  between 3 and 4), while low mobility organic compounds include PAH's ( $\log K_{ow}$  of approx. 5,09). Lead is an example of an immobile inorganic compound ( $K_d$  approx. 50).

In terms of threats to groundwater, the toxicity of a compound is evaluated based mainly on regulatory drinking water quality standards. Chemicals are placed into one of three toxicity indicator classes (high medium and low) based on the chemicals target concentration (i.e. Permitted Concentration and Values in drinking water).

The degradability of a chemical also greatly influences the final risk score. Compounds that are easily degraded (i.e. Benzene) will seldom migrate more than 500m away from the source whereas highly mobile chemicals such as Tri and Tetrachloroethylene may often be found many kilometres away from the source contamination. Again each chemical is placed into one of three degradability indicator classes (high medium and low) and assigned a degradation score (NB: compounds with high degradability are assigned low scores and vice versa).

Each chemical present or likely to be present on the site is therefore assigned a *Chemical Hazard Score*, which is calculated as the sum of the toxicity, mobility and degradation indicator scores assigned to it. The chemical having the highest chemical hazard score is used in the calculation of the final site risk score.

## Groundwater Risk Score

A final risk score for the site is arrived at by summing the scores awarded for each of the above site characteristics.

The method for prioritisation of sites based on risks to groundwater is summarised as:

<b>A</b>	<b>GROUNDWATER CLASS</b>		
<b>CLASS</b>	Area with special groundwater interest	Area with groundwater interest	Area with borderline groundwater interest
<b>Score</b>	12	6	0

<b>B</b>	<b>Degree of aquifer protection</b>		
<b>Protection</b>	None	Some	Good
<b>Score</b>	6	3	0

<b>C</b>	<b>Mobility</b>		
<b>Class</b>	High	Medium	Low
<b>Score</b>	6	3	0

<b>D</b>	<b>Toxicity</b>		
<b>Limit Value</b>	< 1 µg/l	1-10 µg/l	> 10µg/l
<b>Score</b>	4	2	0

<b>E</b>	<b>Degradability</b>		
<b>Class</b>	High	Medium	Low
<b>Score</b>	1	2	4

<b>F</b>	<b>FINAL SCORE A+B+max(C+D+E)</b>		
<b>FINAL SCORE</b>	Area with special groundwater interest	Area with groundwater interest	Area with borderline groundwater interest
<b>Max. Min.</b>	32 13	26 7	20 1

## **PRIORITISATION OF SITES BASED ON LAND USE ASSOCIATED HAZARDS**

Due to the differences in the nature of the potential hazards likely to be encountered, the methodology makes a distinction between

- a) current or former industrial sites - where risks are mainly contact related;
- b) waste disposal and landfill sites - where risks are associated mainly with explosive and/or toxic gases.

However, the site should be characterised for both categories of risk, where both exist.

### **Current and former Industrial Sites**

Using the method, a score is obtained for risks associated with direct contact (i.e. skin contact and ingestion of contaminants). The main factors influencing the score a site receives are:

- contaminant properties – mainly the volatility and toxicity of the contaminants;
- the risk of receptors coming into contact with the contaminants - depends primarily on the sensitivity of the landuse;
- *special conditions* existing at the site that may make the contaminants more or less accessible.

### **Contaminant Properties**

The toxicity of a contaminant in relation to the direct contact pathway (skin contact and ingestion) is evaluated based on regulatory soil quality standards. Where these are not available, the method recommends the use of factors such as Tolerable Daily Intake (TDI) and /or Acceptable Daily Intake (ADI), Preliminary Tolerable Daily Intake (PTWI) and Preliminary Tolerable Weekly Intake (PTWI) to calculate limit values. Each chemical is placed into one of three toxicity indicator classes (high, medium and low) and assigned a direct contact related toxicity score.

#### Derivation of chemical toxicity score for direct contact pathway

Class	Soil Quality Criteria (mg/kg)	ADI, TDI, PMTDI Carcinogenic $\mu\text{g/kg}$ body weight	ADI, TDI, PMTDI Non-Carcinogenic $\mu\text{g/kg}$ body weight	PTWI $\mu\text{g/kg}$ body weight	Score
High	< 10	< 0.4	< 20	< 2.8	8
Medium	10 – 200	0.4 - 8	20 - 40	2.8 - 56	4
Low	> 200	> 8	> 400	>56	2

Limit values for chemicals can be calculated using the following assumptions:

An average child ingests 0,2g of soil per day up to a maximum of 3g /day. Children with Pica ingest up to 10g/day. An average adult ingests approximately 0.025g/day up to a maximum of 0.1g/day. The ingestion pathway is most critical for children as they have low body weights and ingest the largest amounts of soil.

$$\text{Limit value (mg/kg)} = \frac{50\% * [\text{TDI } (\mu\text{g/kg bw. per day}) * \text{bodyweight (kg)}]}{[\text{daily exposure (kg /day)}]}$$

The evaluation of the toxicity of a chemical via the *inhalation pathway* is based mainly on Danish regulatory air quality standards (known as B- values). These standards lay down the permissible concentrations in air, of contaminants typically found in soil. B value chemicals consist of two groups, with those in group 1 being considered as very hazardous and those in group 2 as moderately hazardous. Using the B-values as target concentrations, chemicals are again placed into one of three, toxicity indicator classes, (high, medium and low) and are assigned inhalation related toxicity scores accordingly.

#### Derivation of chemical toxicity scores for inhalation pathway

Class	Permitted Concentration	B – Value Group 1	B – Value Group 2	Score
High	< $1\mu\text{g/m}^3$	$\leq 1\mu\text{g/m}^3$	< $10\mu\text{g/m}^3$	4
Medium	1 – $200\mu\text{g/m}^3$	> $1\mu\text{g/m}^3$	10 – $200\mu\text{g/m}^3$	2
Low	> $200\mu\text{g/m}^3$		$200\mu\text{g/m}^3$	0

The assessment of a chemical's volatility is based on its Henry's constant (H). The method distinguishes between three volatility classes.

- i. very volatile;
- ii. volatile;
- iii. non-volatile.

#### Classification of contaminant volatility

Class	Henry's Constant (H)	Score
<b>Very Volatile</b>	$H > 1 * 10^{-4}$	4
<b>Volatile</b>	$1 * 10^{-4} > H > 1 * 10^{-6}$	2
<b>Non-Volatile</b>	$H < 1 * 10^{-6}$	0

Following on from the above, volatile contaminants are assigned an inhalation related chemical hazard score, which is calculated as being the sum of indicator scores assigned to the chemical in relation to its toxicity and volatility.

#### Derivation of inhalation related Chemical Hazard Score

	<b>Toxicity</b>		
<b>Volatility</b>	<b>High</b>	<b>Medium</b>	<b>Low</b>
<b>High</b>	8	6	4
<b>Medium</b>	6	4	2
<b>Low</b>	4	2	0

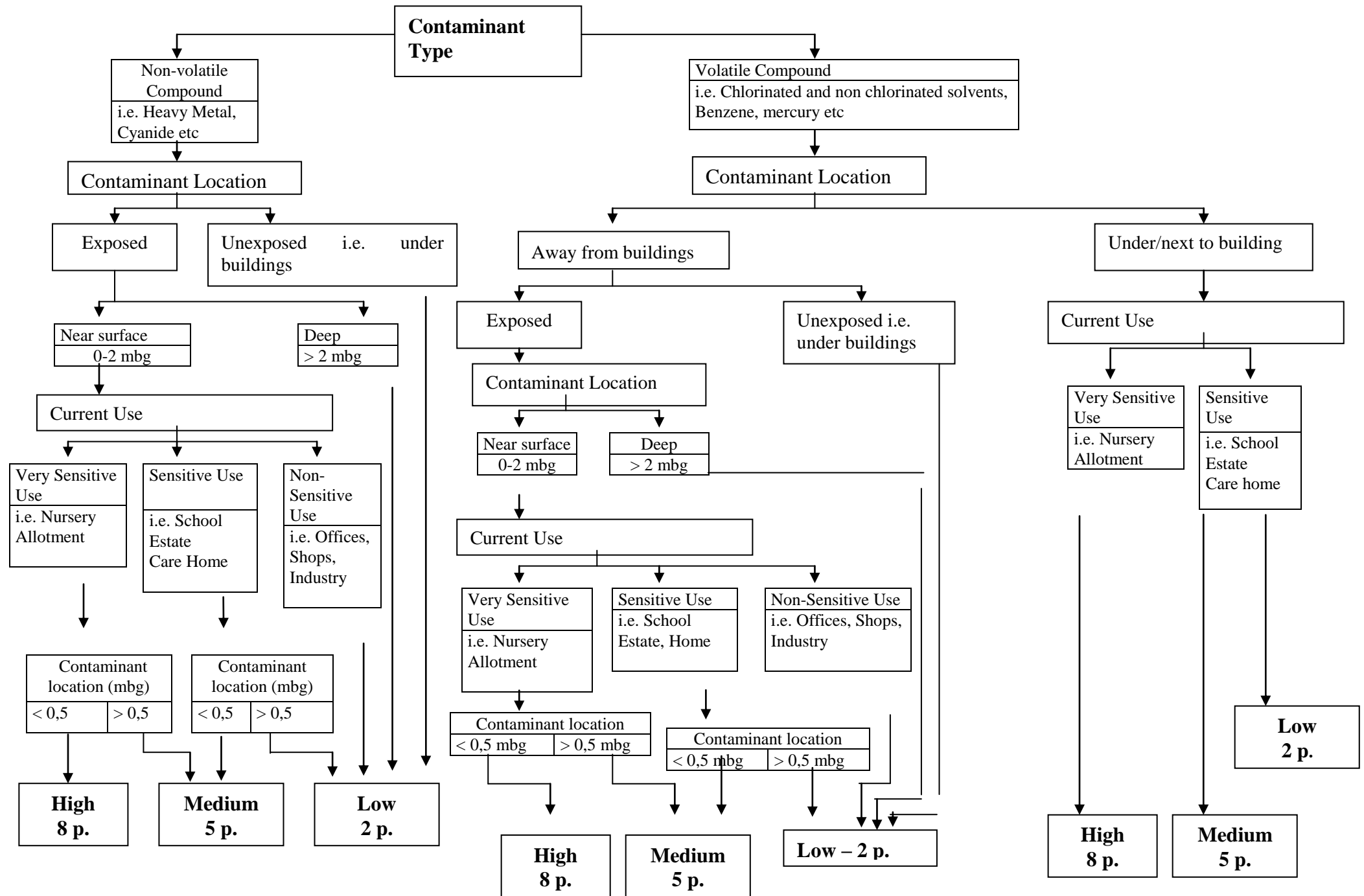
The direct contact and inhalation related chemical hazard scores are then summed to give a total hazard score for the chemical.

As in the case of the Groundwater component, the chemical with the highest *total Chemical Hazard Score* is used in the calculation of the final risk score for the site.

#### Exposure Risk

In addition to the above, the potential for humans being exposed to the contaminant is evaluated having regard to factors such as its location, its depth and the sensitivity of the land use. The process for evaluation of exposure risk is summarised overleaf

## **Evaluation of Exposure Risk**





## Special Conditions

Subsequent to calculation of an exposure risk score, the final risk score for the site is arrived at by cross-referencing the hazard and exposure scores and considering any special conditions existing on the site that indicate an increased or reduced level of hazard.

Special conditions on a particular site would include any specific local circumstances that would have an effect on the characterisation, but are not covered in the preceding sections. They could for example include evidence of visible soil contamination or signs of plant failure. The method again divides this criterion into 3 classes (aggravated, neutral and favourable circumstances).

The method for characterisation of industrial sites is summarised as:

Chemical Hazard Score	Exposure		
	8	5	2
8	16	13	10
6	14	11	8
4	12	9	6
2	10	7	4
0	8	5	2



	Special Conditions		
Class	Aggravated	Neutral	Favourable
Score	2	0	-2



	Final Score
Max. Score	18
Min. Score	0

## **Waste Disposal and Landfill Sites**

Sites that have been subject to landfilling are divided up into two categories:

- a) Sites *without* landfill gas generation potential (i.e. sites where no organic material has been deposited) - these sites are assessed using the same methodology as that described for industrial sites above.
- b) Sites *with* landfill gas generation – these are typically waste disposal sites (WDS) where organic material (i.e. animal, vegetable, paper, textiles, wood) has been deposited.

### **Landfill gas**

Assessment of landfill gas associated risks considers possible harmful health effects and explosion in a building. The assessment is based on the WDS gas generation capacity, the distance from the WDS to buildings and the type of use the buildings are being put to.

The most important factors governing a WDS gas generation capacity include its volume, age and the nature of the waste. Generally a WDS cannot be considered to be dormant unless its age is over 30 years (i.e. since close down). Although the WDS age is not considered in the initial risk characterisation, it is useful when prioritising sites with the same final risk score.

A range of other factors influence gas migration and entry into buildings (i.e. geology, pressure in the landfill, cover, underground pipes, distance to buildings and building construction etc). However, most of this information will not be available unless a field survey has been conducted.

Assessment of potential for gas migration is therefore based mainly on the distance from the WDS to the nearest building of interest and the size of the WDS. The method distinguishes between 3 different situations:

- i. Buildings are located directly on the WDS
- ii. Buildings are close to the WDS
- iii. Buildings are located far from the WDS

The method also distinguishes between the sensitivity of the building use, which is divided into:

- i. sensitive (nursery, residential etc) and;
- ii. less sensitive uses (shop, industry, offices etc).

The gas transport model used merely gives an estimate of transport time from the WDS to a given point and should be viewed as a qualitative tool. It assumes a situation where low pressure channels are available for transportation of the gas and does not take into account factors such as dilution, dispersion or circulation of gas.

Calculation of scores for buildings outside the WDS have been made under the following further assumptions:

- The methane concentration in the WDS is at least 50% v/v
- 20% of the methane in the WDS will move towards buildings during a pressure drop
- a pressure drop of 6 kPa occurs
- the pressure drop can last up to 2 days
- there is no resistance to gas entry into the building
- the soil is composed mainly of fine sand with a gas porosity of 0.2.

In general a pressure drop of 6 kPa can result in a gas front moving approximately 50m in two days provided the WDS has a minimum capacity of 130,000m<sup>3</sup> (20% of methane in the WDS contributes to the gas front).

When prioritising sites with reference to landfill gas related hazards, it should not be assumed that the building nearest to the WDS would automatically produce the highest risk score. For example, buildings far away from the site with a sensitive use can produce a higher score than

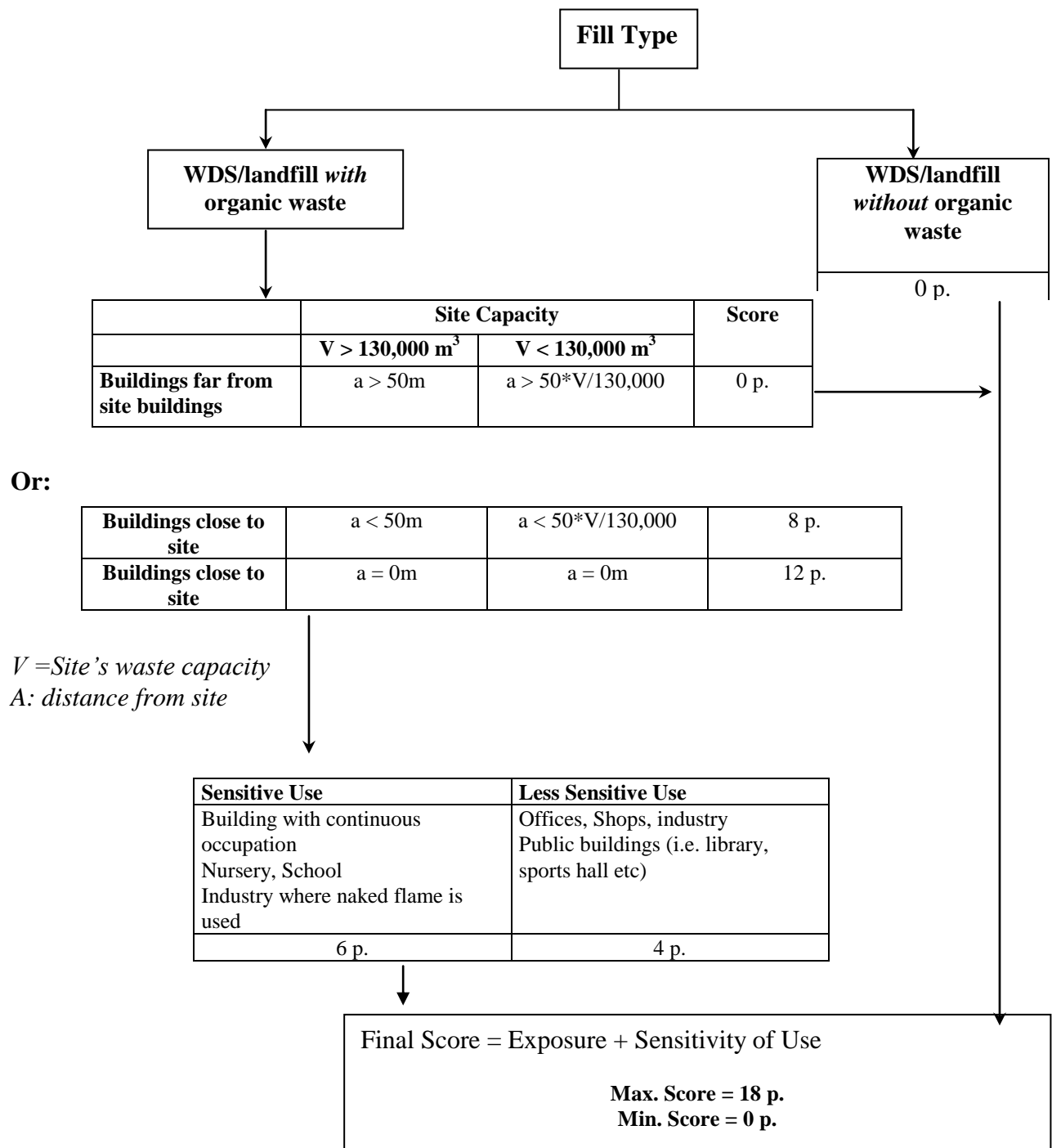
a building with an insensitive use close to the site. If there is a surface watercourse between the WDS and the building, the building should be treated as though it was situated far away from the WDS.

Exposure scores for sites with landfill gas associated hazards

	<b>V ≥ 130,000m<sup>3</sup></b>	<b>V &lt; 130,000m<sup>3</sup></b>	<b>Exposure Score</b>
<b>Building on WDS</b>			<b>12</b>
<b>Building close to WDS</b>	a ≤ 50m	a ≤ 50*V/130,000	<b>8</b>
<b>Building far from WDS</b>	a > 50m	a > 50*V/130,000	<b>0</b>

The figure overleaf summarises the procedure for characterisation of WDS.

# Procedure for derivation of final prioritisation score for waste disposal sites



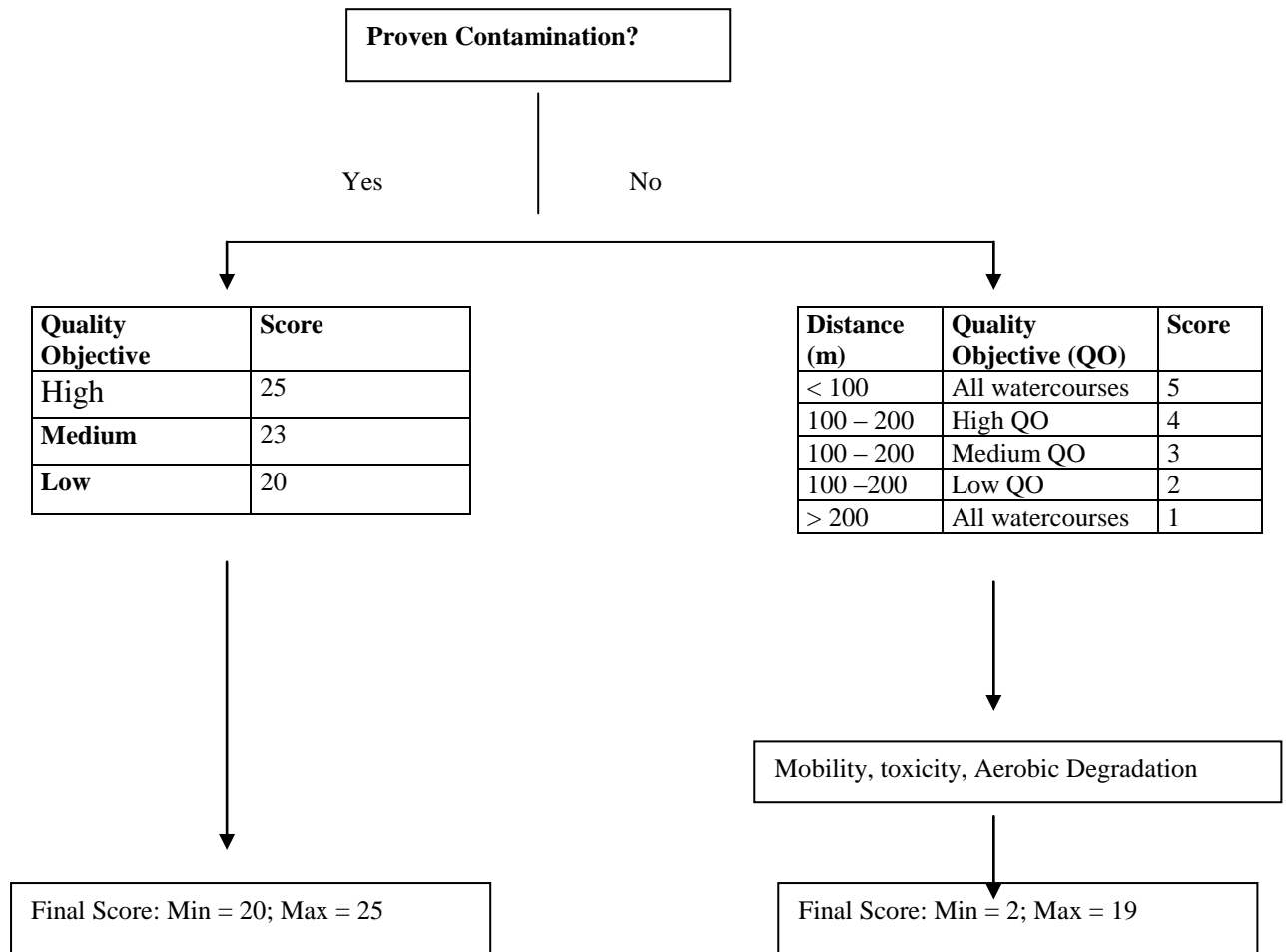
## **SURFACE WATER**

Surface waters are characterised mainly on the basis of their desired quality objectives and their distance from the pollution point source. However, quality objectives for water bodies in the UK are closely linked to drinking water quality objectives. Sites that are close to surface water bodies with high quality objectives receive high scores.

As for the other components, the method when considering surface water also takes into account the contaminants chemical properties (mobility, toxicity and degradation). However, due to the lack of acceptable eco-toxicological guideline values, the contaminant hazard score used for surface water component are the same as those used for groundwater component, with the exception that the degradation processes occurring in surface water will be primarily aerobic.

The above factors become irrelevant if the water body has been subject to proven episodes of contamination arising from the site. In such cases, the final risk score is based entirely on the water body's desired quality objective. The procedure for characterising sites according to their impact on surface waters is summarised as:

## Summary of procedure for deriving surface water risk scores



## TERMINOLOGY

The following gives short definitions of the meaning of certain terms as they are used in the report and in this document.

*Contact Risk:* refers to the possibility that humans will come into contact with polluted soil or gases. The possibility of humans coming into contact with polluted water is not considered in the methodology.

*Degradation:* refers to breakdown of potentially hazardous contaminants to their harmless derivatives in the natural environment.

*Hazard:* a substance, property or situation that in particular circumstances could lead to harm. The hazardousness of a chemical is valued according to its mobility, toxicity, degradability and volatility.

*Mobility:* the mobility of a contaminant in soil is defined relative to groundwater velocity and is a function of dispersion, sorption, ion exchange, solubility etc.

*Pathway:* the mechanism by which the receptor and source can come into contact.

*Receptor:* the entity that is vulnerable to the adverse effects of the hazardous substance or material.

*Risk:* a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

*Risk characterisation:* a preliminary evaluation of risks on a site. Risk characterisation differs from risk assessment in that the level of information required to carry out a characterisation can be a fraction of that required to carry out a risk assessment.



*Risk Screening:* identification of all major hazards and receptors

*Source:* the hazardous site, substance or material

*Source strength:* refers to the gas generation ability of a waste disposal site at any given moment.

*Toxicity:* refers to the relative ability of a particular chemical substance to cause harm to a living organism. The toxicity of the chemical is dependent on the environmental receptor being considered.

*Volatility:* This is defined as the propensity of a chemical to vapourise and is measured using Henry's Constant.

Geokon (2001)

## **Appendix D**

### **Potential Contaminant Sources as defined by the series of Industry Profiles produced by the Department of the Environment (Various years)**

The Department of the Environment has produced a series of individual Industry Profiles which detail potentially contaminative uses and list contaminants of concern which are may arise from activities associated with each of the following industries:

- Airports
- Animal and animal products processing works
- Asbestos manufacturing works
- Ceramics, cement and asphalt manufacturing works
- Chemical works: coatings (paints and printing inks) manufacturing works
- Chemical works: cosmetics and toiletries manufacturing works
- Chemical works: disinfectants manufacturing works
- Chemical works: explosives, propellants and pyrotechnics manufacturing works
- Chemical works: fertiliser manufacturing works
- Chemical works: fine chemicals manufacturing works
- Chemical works: inorganic chemicals manufacturing works
- Chemical works: linoleum, vinyl and bitumen-based floor covering manufacturing works
- Chemical works: mastics, sealants, adhesives and roofing felt manufacturing works
- Chemical works: organic chemicals manufacturing works
- Chemical works: pesticides manufacturing works
- Chemical works: pharmaceuticals manufacturing works
- Chemical works: rubber processing works (inc. works manufacturing tyres or other rubber products)
- Chemical works: soap and detergent manufacturing works
- Dockyards and dockland
- Engineering works: aircraft manufacturing works

- Engineering works: electrical and electronic equipment manufacturing works (inc. works manufacturing equipment containing PCB's)
- Engineering works: mechanical engineering and ordnance works
- Engineering works: railway engineering works
- Engineering works: shipbuilding, repair and shipbreaking (inc. naval shipyards)
- Engineering works: vehicle manufacturing works
- Gas works, coke works and other carbonisation plants
- Metal manufacturing, refining and finishing works: electroplating and other metal finishing works
- Metal manufacturing, refining and finishing works: iron and steelworks
- Metal manufacturing, refining and finishing works: lead works
- Metal manufacturing, refining and finishing works: non-ferrous metal works (excluding lead works)
- Metal manufacturing, refining and finishing works: precious metal recovery works
- Oil refineries and bulk storage of crude oil and petroleum products
- Power stations (excluding nuclear power stations)
- Pulp and paper manufacturing works
- Railway land
- Road vehicle fuelling, service and repair: service and filling stations
- Road vehicle fuelling, service and repair: transport and haulage centres
- Sewage works and sewage farms
- Textile works and dye works
- Timber products manufacturing works
- Timber treatment works
- Waste recycling, treatment and disposal sites: drum and tank cleaning and recycling plants
- Waste recycling, treatment and disposal sites: hazardous waste treatment plants
- Waste recycling, treatment and disposal sites: landfills and other waste treatment or waste disposal sites
- Waste recycling, treatment and disposal sites: metal recycling sites
- Waste recycling, treatment and disposal sites: solvent recovery works
- Profile of miscellaneous industries incorporating:

- Charcoal works
- Dry cleaners
- Fibreglass and fibreglass resins manufacturing works
- Glass manufacturing works
- Photographic processing industry
- Printing and bookbinding works

## **Appendix E**

### **POWERS OF ENTRY AND THE APPOINTMENT OF “SUITABLE PERSONS”**

Section 108 of the Act gives the local authority power to authorise, in writing, “suitable persons”, to investigate potentially contaminated land. These powers are extensive and will be considered in detail with the Legal Services Team prior to any resisted entry being attempted. It should be noted that these powers are not available to the Environment Agency. The powers which a person may be authorised to exercise include:

- To enter at any reasonable time (or in urgent cases, at any time, if need be by force) any premises / land to make such examination and investigations necessary.
- To take samples, photographs, carry out tests, install monitoring equipment etc.

At least seven days notice must be given to residential occupiers and to occupiers of land where heavy plant is to be used. Consent must be obtained to enter from the occupier, or failing that, a warrant obtained under Schedule 18 of the Act.

It should be noted that there are no circumstances in which the City Council will use these powers to obtain information about the condition of land, where:

- It can obtain the information from third parties without the need for entering the site; or
- A person offers to provide the information within a reasonable and specified time, and does so.

## **URGENT ACTION**

Urgent action must be authorised where the City Council is satisfied that there is imminent danger of serious harm or serious pollution of controlled waters being caused as a result of contaminated land. In such circumstances the procedures identified in the statutory guidance will be followed which may involve the forced entry into the premises.

The City Council will undertake the remediation in urgent cases where it is the enforcing authority if it is of the opinion that the risk would not be mitigated by enforcement action. In the case of a special site the Council will declare the land contaminated land in accordance with the statutory procedure, and then notify the Environment Agency who will then be responsible for the remediation.

In appropriate cases the City Council will seek to recover costs of remediation works it has completed.

All intrusive investigations will be carried out in accordance with appropriate technical procedures to ensure:

- effectiveness;
- no unnecessary damage is caused; and
- the works themselves do not result in the formation of a new pollutant linkage, or aggravate an existing pollutant linkage.

## **COMPENSATION**

Schedule 18 of the Act makes clear the circumstances when a local authority must pay compensation for loss or damage as a result of the use of these powers. The responsible officer will therefore ensure that only appropriate technical procedures are deployed, the utmost care is taken at all times, and the conditions carefully recorded before, during and after completion of the necessary works.

## **“SUITABLE PERSONS”**

The science and associated technical procedures relating to the investigation and assessment of contaminated land are extremely complex. Knowledge of several specialised disciplines is required together with an ability to interpret significant volumes of data and make a reasoned judgement, often in difficult circumstances.

Neither the Act nor the guidance considers what may constitute a, “suitable person”, for the purposes of the investigation and assessment of contaminated land. There is no list of approved consultants or any professional organisation, which oversees the training of contaminated land specialists. There is no minimum qualification and no recognised qualification. Consultants come from a range of backgrounds including:

Environmental health

Other environmental science disciplines (several)

Surveyors

Engineers

Geologists

Hydrologists

Soil scientists

Chemists

Ultimately, the responsibility for determining what land may and may not be declared contaminated, by definition, lies with the relevant officer of the Pollution Control Group. S/he will, however, often need to rely on the advice of appointed, “suitable persons”. Under these circumstances criteria have been developed to assist in their selection.

## **PROCEDURE FOR THE APPOINTMENT OF “SUITABLE PERSONS” FOR THE PURPOSES OF PART IIA**

There are two prerequisites to commencing the process of appointing suitable external consultant / contractors, firstly:

- Adequate funding to support the process; and secondly
- A well qualified person, 'in house', to act in the Client role

Such a person, as well as having sufficient knowledge and experience to specify the contract, must have sufficient time to monitor it also.

Pollution Control Group Officers are suitably qualified to undertake this task.

Pollution Control Group Officers will produce a comprehensive, unambiguous but succinct draft specification for each contract which clearly identifies the work to be carried out, its purpose, timetable and Client / Contractor responsibilities. The standard City Council contract procedures will then commence.

Once appointed the Pollution Control Group Officer will be responsible for monitoring the contract to ensure:

- The contractors are kept fully aware of their responsibilities at all times
- Quality control requirements are met
- Amendments are quickly agreed and documented
- The time table is strictly adhered to
- The aim of the contract is achieved

Braithwaite (2000)



## **Appendix F**

### **Special Sites**

Special sites are defined in the Contaminated Land (England) Regulations 2000 and include:

- Polluting controlled waters
- On sites subject to Integrated Pollution Control (see Environmental Protection Act 1990 Part I - Prescribed Processes and Substances Regulations 1991 schedule 1 part A);
- With waste sulphuric acid tar lagoons (on sites used for refining benzole, used lubricants or petroleum);
- Used as an oil refinery;
- Used to manufacture or process explosives;
- Used to manufacture or dispose of atomic, chemical or biological weapons (non biological contamination only);
- Used for other nuclear purposes;
- Owned or occupied by a defence organisation for naval, military or air force purposes (not off base housing / NAFFI);

## Appendix G

### Contaminated Land Exposure Assessment (CLEA) Model

Department of the Environment, Transport and the Regions (2000)<sup>1</sup> details the CLEA model as being developed for the purpose of calculating the concentration of contaminants in soil below which risks to human health are considered negligible. The model uses data on the human toxicological effects of contaminants, which have been collated and published in Department of the Environment, Transport and the Regions and Environment Agency (2000)<sup>3</sup> *Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans*. The toxicological information is also self-standing and can be used in site specific investigations.

The CLEA model uses Monte Carlo simulations to examine different pathways by which humans can be exposed to soil contaminants and a range of site uses. It can therefore be used to assess risks for several pollutant linkages forming part of the conceptual model of the site.

The advantages of the CLEA model are that it is based on risk assessment; it also specifically provides for uncertainty and so provides an objective basis for decision making.

CLEA has been used to calculate a series of guideline values for soils contained in the forthcoming, Department of the Environment, Transport and the Regions and Environment Agency (2000)<sup>4</sup> *Guideline Values for Contamination in soils*. When published, these will replace the 'trigger' concentrations produced by the Interdepartmental Committee on the Reclamation of Contaminated Land (1987).

When concentrations of contaminants fall below the appropriate guideline value or site-specific criterion calculated using the model, individual contaminants or areas of the site can be considered not to pose unacceptable risks to human health and can be eliminated from further consideration.

Where concentrations of contaminants exceed the appropriate guideline value, the presumption is that there is sufficient evidence for the potential existence of an unacceptable

risk to warrant further action.

## **Derivation of Site Specific Criteria for Human Health**

Where guideline values are not available or the basis from which they are derived is not considered appropriate for a particular site it will be necessary to estimate site-specific assessment criteria, based on toxicity data and calculated exposure. Comprehensive guidance on this is provided in Department of the Environment, Transport and the Regions/Environment Agency (2000)<sup>2</sup> *Model Procedures for the Management of Contaminated Land*, currently under preparation. The procedure, in brief, involves derivation of site-specific criteria for human health. The stages are:

- description and reference of models used;
- description of all relevant pollution linkages and justification for any assumptions made;
- identification of appropriate toxicological and related effects data;
- calculation of estimated daily intake (EDI) of each contaminant via each pollution linkage, expressed in terms of an unknown concentration of X in the soil;
- calculation of the total estimated daily intake from site soils (TEDI);
- identification of the tolerable daily soil intake (TDSI) taking into account data on background and tolerable daily intakes, possible intakes from other soils (off-site) and different types of toxic effect; and
- setting TEDIss equal to TDSI and calculation of the critical soil concentration value (CSCrit), which is then designated as the site specific assessment criterion, which is used in the same way as the generic criteria (that is the guideline values).

Environment Agency/National House Building Council (2001)