FINAL

2016

Dundee City Council Contaminated Land Strategy

Dundee City Council

EXECUTIVE SUMMARY

Local authorities were given the primary regulatory role for the inspection of sites that have historically been affected by contamination by the insertion of Part IIA into the Environmental Protection Act 1990 in 2000 [1]. This is with a view to identifying, and ensuring remediation at any sites identified as Contaminated Land.

Contaminated Land is defined 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) significant pollution of the water environment is being caused or there is a significant possibility of such pollution being caused."

Dundee City Council set out its approach to contaminated land in the 2001 version of this Strategy [2]. A strategic approach has enabled the Council to inspect land that merits detailed investigation, identifying the most pressing and serious problems first and concentrating resources on the areas where contamination is more likely to be found.

Dundee City Council seeks to:

- Protect human health
- Protect the water environment
- Protect designated ecosystems
- Protect property
- Ensure all new developments subject to planning control are made suitable for use
- Promote the re-use and development of brownfield land
- Respond to enquiries from the public, other agencies and interested parties

Dundee City Council is the lead regulatory authority under the Contaminated Land regime, except where a ‘special site’ is designated, in which case responsibility passes to SEPA.

Land considered as meeting the definition of contaminated land following detailed inspection and risk assessment by Contaminated Land Officers will be recommended for formal identification by the relevant committee. If accepted, the Council will enter a record in the Contaminated Land Register. Records are maintained of land that has been inspected and which is considered to be suitable for its current use.

Progress to Date

- Collation of information to identify areas that may be subject to historical contamination
- Digitisation of the cancelled petroleum licences archive and infilled land database.
- Prioritisation of candidate sites for detailed assessment

- Creation of databases to record actions in relation to Part IIA of the Environmental Protection Act and the Planning regime.
- Creation of reporting tool to enhance responses to enquiries under Environmental Information Regulations. 43 such enquiries were addressed during April 2015 to March 2016.
- Use of Greenspaces land-use database to reprioritise investigations in key areas of sensitive receptors.
- 1216 sites have been identified for further consideration under the Development Management system; risk assessment information has been submitted for 745; remediation strategies agreed for 172 sites and completed with verification for 99. Advisory notes and lesser conditions, including those requiring a gas membrane only, have been applied to 408 sites. Further pre-application consultations are carried out on request.
- 64 intrusive site investigations under Part IIA; 23 with GPR (ground penetrating radar). 29 sites demonstrated suitable for use; 1 remediated following identification as contaminated land; 1 remediated voluntarily without identification; 2 remediated voluntarily and subject to ongoing monitoring.

Changes since the 2001 strategy

Revisions were made to the Regulations in 2005 [3], and updated statutory guidance was published in 2006 [4] to incorporate changes in legislation, in particular to align the contaminated land regime with the Water Environment and Water Services (Scotland) Act (2003) [5], and to unify Scottish policy with the objectives of the Water Framework Directive [6]. Further statutory guidance was issued in 2007 [7] to cover the extension of the contaminated land regime to include radioactivity. The Regulatory Reform (Scotland) Act (2014) [8] further amended the Environmental Protection Act 1990, giving SEPA the option to terminate the designation of a special site no longer meeting the requirements of being designated as such. In these circumstances, the local authority resumes responsibility as the lead regulator of the site.

Contaminated Land was a relatively new discipline, and as knowledge and understanding of the subject grows, this has come with considerable additions and changes to technical guidance, enhanced availability of information and software tools to aid the risk assessment process which has altered working methods. In particular, Geographical Information Systems (GIS) are now the primary tool to collate and manage information, and to inform decision making, including the prioritisation of sites for detailed inspection.

Contents

Figures

Appendices

Appendix 1: Site Investigation procedures

1 Introduction

The requirement for local authorities to prepare an inspection strategy for contaminated land is contained in Part IIA of the Environmental Protection Act 1990 [9]. This was brought into force in 2000, accompanied by statutory guidance and planning advice which created a regime for the assessment and management of land that may be contaminated. This regime provides a system for the identification of land that poses an unacceptable risk to health or the wider environment and for securing remediation as considered appropriate. It also provides for control of land contamination risk during the Development Planning process.

A great deal of industrial activity took place before environmental legislation caught up, and as industries closed down, the pollution they created and released to the land and water environment was often left behind.

Brownfield land is defined as land that has previously been developed. Not all brownfield land will be affected by contamination, but the likelihood of contamination being present is related to how the site was used. For example, a chemical works or fuel storage depot is more likely to leave contamination than housing. All contaminated land risk assessments start with a review of how the site was used. If necessary, soil and water samples are taken for analysis, which then allows an assessment of how significant contamination may be and what can be done to remedy the situation.

The contaminated land regime provides two ways for local authorities to ensure risks associated with land contamination are assessed and appropriately managed.

The Council controls the redevelopment of brownfield land using planning conditions, where required, to ensure developers demonstrate appropriate management of land contamination risks. On completion of development, the land should be shown to be suitable for its new use.

The Council also has a duty under Part IIA of EPA 1990 to inspect its area to identify land that may not be suitable for its current use. This includes assessments of land which was redeveloped before the current regime came into force. In view of Dundee's long industrial history there is much brownfield land to consider and it is therefore necessary to prioritise detailed assessment of sites with greatest risk of significant contamination.

This Contaminated Land Strategy sets out a revision of the original Strategy published in 2001 and details the policies and procedures that have been put in place to effectively control land contamination risks during Development Planning and through the Council's own programme of inspections under Part IIA.

The formal duty to inspect the city area and deal with Contaminated Land is a technical and often complex process. This Strategy reflects the Councils' commitment to an informed and open approach.

1.1 Regulatory Context

The contaminated land regime, provided by Part IIA of the Environmental Protection Act 1990 [9], as inserted by section 57 of the Environment Act 1995 [10] came into force in Scotland on 14 July 2000. The Contaminated Land (Scotland) Regulations (2000) [11] places a duty on local authorities, as the primary regulators, to identify and secure the remediation of contaminated land in their respective areas. It also made provision in relation to the circumstances in which contaminated land requires to be designated as a special site, and provides for a remediation regime, regulated by the Scottish Environment Protection Agency (SEPA), in that regard.

Statutory guidance was published in 2000 [12] by the Scottish Executive detailing how local authorities should set about identifying and securing remediation of contaminated land in Scotland. The guidance established a clear link with the Development Planning system where addressing land contamination is a policy matter. It also established land contamination as a "material consideration" during Development Management, when making decisions and conditioning planning applications. Planning Advice Note 33 – Development of Contaminated Land [13] was updated in October 2000 to reflect this new interaction of Development Management with the Contaminated Land Regulations.

The statutory guidance also set out the responsibility for SEPA to provide an advisory role to local authorities, relating in particular to their regulatory control of the water environment (see section 1.1.3).

Revisions were made to the Regulations in 2005 [3], and updated statutory guidance was published in 2006 [4] to incorporate changes in legislation, in particular to align the contaminated land regime with the Water Environment and Water Services (Scotland) Act (2003) [5], and to unify Scottish policy with the objectives of the Water Framework Directive [6]. Further statutory guidance was issued in 2007 [7] to cover the extension of the contaminated land regime to include radioactivity. The Regulatory Reform (Scotland) Act (2014) [8] further amended the Environmental Protection Act 1990, giving SEPA the option to terminate the designation of a special site no longer meeting the requirements of being designated as such. In these circumstances, the local authority resumes responsibility as the lead regulator of the site.

The primary aim of the regime is that land should be "suitable for use" by:

a) **Ensuring that land is suitable for its current use.**

b) **Ensuring that land is made suitable for any new use, as planning permission is given for that new use.**

The regime also requires:

c) **Limiting requirements for remediation to work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought**

This document sets out how Dundee City Council has developed and implements a Strategy for the effective control of land contamination risks through an ongoing program of prioritised inspections and during planned development.

1.1.1 Definition of Contaminated Land

While previously used industrial land may be impacted by contamination it does not necessarily constitute contaminated land, unless it fits the statutory definition of Contaminated Land.

Section 78A(2) Part IIA EPA 1990 **[9]** as amended by The Contaminated Land (Scotland) Regulations 2005 **[3]** provides the following definition:

> **"Contaminated land" is 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) significant pollution of the water environment is being caused or there is a significant possibility of such pollution being caused."**

The statutory definition of contaminated land is based upon the principles of risk assessment. To complete a risk assessment of potentially contaminated land the Council must identify the following criteria:

A **contaminant**: - is a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of the water environment.

A **receptor** - is a living organism, a group of living organisms, an ecological system or a piece of property or a water environment which is being, or could be, polluted by a contaminant.

A **pathway** - is one or more routes or means by, or through, which a receptor is being exposed to, or affected by, a contaminant, or could be so exposed or affected.

A risk exists only if there is a source of contamination which can impact a receptor by coming into contact with it through a pathway. This is known as a pollutant linkage. When any of these criteria is absent or present to only a small degree then risks are either absent or minimal.

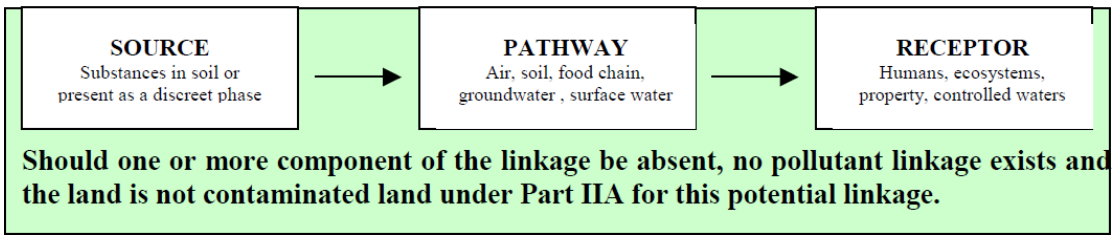


Figure 1 Source Pathway Receptor linkage

The statutory guidance [4] provides detailed guidance on the construction of risk assessments for the purposes of Part IIA of EPA 1990, using contaminants, pathways and receptors (Chapter A, Part 2). Specific definitions are also provided of what is to be considered a receptor and detailed criteria to determine what may be constituted significant

harm or the significant possibility of significant harm or significant pollution of the water environment. (Chapter A, Part 3, Table A & B)

The criteria for determining significant harm and the significant possibility of such harm has been further defined by numerous technical guidance documents published since the regime came into effect. A number of these are available at the website of the Environment Agency in the UK national archives [14]. Criteria for determining significant pollution of the water environment have been augmented by publications under the Water Framework Directive available at the Scottish Environment protection Agency website [15].

1.1.2 Dundee City Council Policy

Dundee City Council, Neighbourhood Services administers the contaminated land regime in the city area. This includes responsibility for inspecting its area to identify historic land contamination, which may be currently causing significant harm or pollution, as well as ensuring that new developments are suitable for their planned land-use.

Since its implementation in 2000 the objectives of the contaminated land regime have been incorporated into a number of Dundee City Council policy areas.

The Single Outcome Agreement 2012-2017 **[16]** and the Council Plan 2012–2017 **[17]** includes

outcome 11 - "Our People will live in a low carbon, sustainable city"

and

intermediate outcome - 11d "Dundee has a clean, healthy and safe environment with improved air, land and water quality."

Part of the regime involves management of land contamination risks through Development Management. Neighbourhood Services routinely liaises with case officers in the City Development department to request information, and if required, that planning conditions be applied to planning permission, to control land contamination risks, and to ensure the land is suitable for the proposed new use.

The contaminated land regime forms part of the Scottish Government's Policy on Sustainable Development [13], which is carried into regional context for Dundee in the TayPlan Strategic Development Plan [18] (TSDP). The TSDP seeks to prioritise development to existing settlements with the focus on brownfield land. The aims of the TSDP are unified with those of the Dundee Local Development Plan (LDP) [19].

The Dundee Local Development Plan 2013 **[19]** states that :

> **"All brownfield land has the potential to be brought back into use, even though contamination may have impacted the land. In the majority of cases appropriate remedial treatment can be proposed and approved as a requirement of the Development Management process. This ensures that planned brownfield redevelopment includes remediation of land contamination, achieves regulatory approval and the land is demonstrated to be suitable for use."**

Policy 45: Land Contamination states.

> **a) Development of potentially contaminated brownfield or statutorily identified contaminated land will be considered where:**
>
> **(1) a site investigation is submitted establishing the nature and extent of**

contamination; and

(2) the Council is satisfied that remediation measures proposed for the development, adequately address contamination risks to all receptors, such that the land demonstrably does not meet the statutory definition of contaminated land and is suitable for the planned use.

b) An alternative use to that identified in the Local Development Plan will be considered where the above criteria are satisfied and:

(1) an economic appraisal establishes that the site cannot be economically developed for the allocated use due to the level or type of contamination; and

(2) the proposed use meets the requirements of other relevant policies of the Local Development Plan.

The policies presented by the Council fit with the requirements of the Contaminated Land Regulations [11] and Scottish Government policy [13] to maintain the quality of Scotland's land resource, while progressively regenerating land where it has been degraded in the past.

1.1.3 Regulatory Role of SEPA

SEPA has powers [20] to regulate activities which impact on the water environment, including circumstances where the pollution arises from contamination in the land.

SEPA has four principal roles with respect to contaminated land **[10] [11]**:

(a) it will provide advice on request in relation to the identification and designation of special sites;

(b) it may issue site-specific advice to local authorities on contaminated land;

(c) it will act as the "enforcing authority" for any land designated as a "special site" (the descriptions of land which are required to be designated in this way are prescribed in the Regulations [11] and detailed in Chapter 5.4); and

(d) it will publish periodic reports on contaminated land.

The latest report on contaminated land compiled by SEPA was published in 2009 and is available online. [here.] [21]

Since the implementation of the contaminated land regime, a considerable amount of rationalisation of the measurement and control of pollution to the water environment has been undertaken by SEPA to align regulatory practice with the requirements of the Water Framework Directive [22] (WFD). This is a comprehensive piece of legislation brought into force in Scotland through the Water Environment and Water Services (Scotland) Act (2003) [5] covering rivers, lochs, wetlands and groundwater.

A River Basin Management Plan (RBMP) has been established for the whole of Scotland, within which are a number of sub Basin Districts. Dundee falls within the Tay sub Basin District. The RBMP aims to protect and improve the water environment in Scotland; ensuring that economic development is sustainable and the interests of all who depend upon the water environment are protected.

SEPA is the lead authority for River Basin Management planning, however, the Water Environment and Water Services (Scotland) Act [5] requires that every public body must have regard to the desirability of protecting the water environment.

1.2 Development of the Strategy

To develop the first strategy, a detailed consultation process was conducted with various Council departments, external public bodies and stakeholder groups. A large amount of data was collected on the history and environment of the city to enable the Council to inspect its land in accordance with the criteria in the statutory guidance detailed in Chapter B, Part 3 B9 –B17 [4]. The first Strategy described in detail what data would be collected and how it would be compiled and interrogated to determine priority locations for investigation, where land contamination could be causing significant harm or pollution.

Since implementation of the original strategy, much has been achieved to ensure the industrial land-use legacy does not present unacceptable risks to current day land-users or the wider environment, including the completion of a first stage inspection across its whole area. With considerable amounts of data to process and prioritise, a variety of systems and procedures have been established to maintain a rational, ordered and efficient approach.

This revised Strategy document sets out how the work of implementing the regulations continually evolves, and how procedures have been streamlined to increase efficiency and value of the contaminated land inspection programme. These have been facilitated, in part, by continual development in use of Geographic Information Systems (GIS). The GIS is the principal tool used by the Contaminated Land team to manage the Strategy, inform judgements, and to record decisions. The framework of how this is achieved is explained in this document.

1.2.1 Objectives of the Strategy Document

The document sets out the Strategic approach taken in Dundee to evaluate land which may be contaminated with reference to the statutory guidance (Paragraphs B.9-17) [4] and the Scottish Executive Environment Group Advice for Scottish Local Authorities [23].

Through publication of this Strategy document the Council aims to openly demonstrate its compliance with the regulations, and its continued commitment to follow an efficient strategic approach to inspection.

1.2.2 Achievements To Date

The introduction of Part IIA brought for the first time a mechanism with legislative backing, for addressing the issue of historically contaminated land. It also provided inherent incentive and encouragement to land owners to use development as a means to bring land up to the ‘suitable for use’ standard. The legislation underpins the requirement upon developers to ensure that land does not become contaminated land under Part IIA by virtue of development and the introduction of new receptors.

As the city is continuously undergoing re-development, land contamination risks are being controlled on these sites through Development Management. The progress of such remediation is recorded using a dedicated database within the GIS system.

Land which has not been dealt with through development, has been the subject of the council’s Part IIA programme of prioritisation and inspection, the detail of which is in the chapters that follow.

Key achievements of the Strategy so far include:

1. **Stakeholder consultations and data collection.**
2. **DREAM prioritisation and risk prioritisation across the whole city.**

3. **Area wide risk screening of 31 Dundee City housing areas.**
4. **Adoption of Geographic Information Systems (GIS) for regulatory status record keeping and prioritisation.**
5. **Creation of PartIIA and Planning databases to record and maintain risk assessment and management actions on specific sites**
6. **Digitisation of the cancelled petroleum licences archive and infilled land database.**
7. **Creation of reporting tool to enhance responses to enquiries under Environmental Information Regulations. 43 such enquiries were addressed during April 2015 to March 2016.**
8. **Use of Greenspaces land-use database to reprioritise investigations in key areas of sensitive receptors.**
9. **1216 sites have been identified for further consideration under the Development Management system; risk assessment information has been submitted for 745; remediation strategies agreed for 172 sites and completed with verification for 99. Advisory notes and lesser conditions, including those requiring a gas membrane only, have been applied to 408 sites. Further pre-application consultations are carried out on request.**
10. **There have been 64 intrusive site investigations under Part IIA; 23 with GPR (ground penetrating radar). 29 sites demonstrated suitable for use; 1 remediated following identification as contaminated land; 1 remediated voluntarily without identification; 2 remediated voluntarily and subject to ongoing monitoring.**

1.3 Data collection

Ground investigation reports, containing records of soil, water and ground-gas monitoring, chemical analyses and risk assessments are submitted to the Council in support of planning applications, and Neighbourhood Services generates its own information from investigations at sites that have been prioritised for inspection. This is collated, and some of this may be made available to members of the public and relevant parties. Further details of this process is given in 8.3.

2 Characteristics of the Local Area

2.1 Setting

Dundee City comprises a predominantly urban landscape of approximately 6300 hectares (63 km^2) with a population of 148,170 (2013) [24].

The city occupies the north shore of the Firth of Tay on the East coast. It is Scotland's fourth largest city lying approximately 60 miles north of Edinburgh, 90 miles East of Glasgow and 60 miles South of Aberdeen.

The city generally comprises a town centre of Victorian and Edwardian stone buildings, surrounded to the west, north and east by extensive mid to late 20th century suburban residential areas. At its eastern extremity lies the former seaside resort town of Broughty Ferry with its satellite town centre of Victorian and Edwardian stone buildings, shingle and sand beaches, castle and yachting harbour.

The whole waterfront of the city, apart from Broughty Ferry, comprises substantially reclaimed shoreline. From west to east this includes the Riverside Nature Park, Dundee City airport, university playing fields, Magdalen Green, Seabraes commercial area, the Central Waterfront including the location of the new V & A museum, the newly regenerated harbour area of City Quay and remaining industrial port area.

Much of the west and central portions of the city overlook the Tay Estuary, as the land rises up the slopes of the ancient volcanic cones, which form Balgay Hill and The Law. The tops of these hills emerge above the cityscape forming the characteristic twin peak profile of Dundee, when seen from the South.

On ascending the lower slopes of The Law, the Victorian tenements of the city centre give way to Edwardian and mid 20th century residential areas, which extend around the hill to the north. At the foot of Balgay Hill the stone built houses and tenements of the Perth Road and Blackness Road area give way to mid 20th century housing higher up and late 20th century to the north. The western part of the city behind the airport comprises the less prominent summit of Menzies Hill which accommodates Ninewells Hospital and extensive areas of late 20th century residential development. Behind Menzies Hill the land dips to the old industrial satellite town of Lochee, now ostensibly rebuilt.

The city hills and Lochee are flanked to the north by the east-west Kingsway trunk road, north of which lies much of the post war residential development, covering farmland and surrounding the previously outlying area of Downfield and the old mill communities which line the Dighty water as it flows east to the Tay through Broughty Ferry.

2.2 Climate

Situated on the east coast, Dundee is in the rain shadow of prevailing westerly weather patterns, receiving considerably less rainfall and more sunshine than central and western areas of the country. Conversely it is more influenced by the North Sea which can bring periods of cold air and fog.

The following statistics are from the Meteorological Office, Mylnefield weather station in Dundee, for the period 1981 – 2010:

Statistic	Max	Min
Sunshine hours per month	191.2 (May)	43.1 (December)
July average temperature	19.3C	11C
January average temperature	6.4C	0.7C

Total annual rainfall of 722mm	82mm (October)	46.3mm (April)
Average wind speed at 10m	7.8 knots	5.9 knots
124 days per year of more than 1mm rainfall.		
An average of 48 days of air frost per year.		

2.3 Regional Geology, Hydrogeology and Hydrology

Dundee is predominantly underlain by a massive formation of sandstone, into which igneous rocks have been extruded and intruded, the most noticeable being the Law and Balgay Hill comprising the plugs of former volcanic cones.

Relatively recent deposits of glacial till overlie bedrock in many areas of the city, though alluvial and late glacial fluvial deposits are found on the banks of the Tay Estuary and the Dighty Water, particularly in the Broughty Ferry area.

Along the shoreline of Dundee, man made deposits are typically found as evidence of the long history of reclamation of the Tay Estuary coastline.

2.3.1 Geology

The sandstone which underlies much of the city is known locally as the Dundee Flagstone Formation. (Arbuthnott - Garvock Group of Lower Devonian age). It is significant in being a massive sandstone, with only subordinate layers of conglomerate, siltstone and mudstone and is characteristic of the UK wide sequence of Lower Devonian Sandstone strata, which are all water containing aquifers.

The sandstones are cut across by numerous Lower Devonian igneous intrusions of mixed geochemistry (including felsites, porphyrites and olivine-dolerites), some of which have been responsible for creating significant topographic features such as the Law and Balgay Hill.

To the east of the city and predominantly in the Broughty Ferry area volcanic lavas of the same age are classified as part of the Ochil Volcanic Formation, and comprise typically andesitic lava overlying the Dundee Flagstone Formation.

The drift (Quaternary) geology is typically glacial till deposits, comprising heavily compacted, gravelly sandy clay and in places very clayey gravel. Closer to the Estuary in the Broughty Ferry area raised marine deposits are found, with localised alluvium recorded on the banks of the Dighty Water and Murroes Burn in the north-east of the city.

A large section of the coastal boundary to the city from the Invergowrie Burn in the west to the Stannergate in the east comprises man-made deposits which have accumulated since land reclamation began in the 17th century, though predominantly occurring during the 18th, 19th and ceasing only at the close of the 20th century.

From the Stannergate east, the city coastline is graced by the seaside town of Broughty Ferry which occupies a broad low lying and level sand and shingle bank on the mouth of the Tay.

2.3.2 Hydrogeology

The Dundee Flagstone is categorised as a highly permeable, locally important aquifer, [25] [26] with water flow predominantly in fissures and discontinuities. Drinking water is not currently abstracted for potable supply from the aquifer within the city, though there are a number of boreholes within the Council area, which abstract water for commercial purposes.

Beyond Dundee, the Lower Devonian sandstone which underlies large parts of Angus is utilised as a potable aquifer and, 10 miles north of Dundee in the Vale of Strathmore, it has been abstracted and bottled since 1880. This water is known today as Strathmore Water. The aquifer is also used for crop irrigation as well as private water supplies.

Devonian sandstones, which occur across the UK are typically permeable and can contain substantial quantities of water. They are often abstracted for potable water supply, making Devonian sandstone an important part of the protected UK water environment.

In view of the aquifer's resource importance any land causing significant pollution of Devonian sandstone groundwater is required by the Regulations [11] to be identified as contaminated land and designated as a special site.

The Ochil Volcanic Formation in the east of the city is described as "generally impermeable to groundwater, but rare springs may occur from systems fo near surface dilated joints" [26]. This formation seldom produces large quantities of water for abstraction, however it can be important for local supplies and in supplying base flows for rivers.

Local quaternary deposits of highly or moderately permeable sand and gravel are found, associated with coastal and river alluvium. Although of limited lateral extent, these can present aquifers with local potential. One abstraction, providing drinking water for domestic purposes, is recorded at Pitkerro House in the north-east of the city, where a well provides water from the unconsolidated glacial sands and gravels of the Murroes Burn.

Elswewhere, Dundee is underlain by generally low permeability drift deposits of over-consolidated glacial clay and gravel [25]. Borehole evidence proves that clayey deposits are generally less than 5m in thickness. In certain coastal areas there is less data available and high variability in the drift sequence both laterally and vertically means there is potential for localised deposits that may reach 5m thickness.

Groundwater supply is a major component of river baseflow and groundwater quality will be ultimately reflected in river water quality.

It is considered likely that the regional groundwater flow direction will be southward toward the Tay Estuary, though local geographic features such as The Law and Balgay Hill distort this regional gradient and introduce watersheds which will contribute base flow to minor watercourses such as the Dighty Water, Lochee Burn and Invergowrie Burn.

2.3.3 Hydrology

The Tay Estuary, otherwise known as the Firth of Tay, is the surface water body of primary importance within the local authority area. The estuary is tidal, hence saline and is classified and monitored by SEPA as a transitional waterbody.

Various small watercourses flow in and around the city, though most are culverted beneath built up areas. The Dighty Water is the most prominent of these and flows for most of its course above ground approximately south-eastward within the northern boundary of the Council area. It is joined by the Fithie Burn and Murroes Burn before entering the Tay estuary through Broughty Ferry. The Invergowrie Burn enters the Tay at the western edge of the city. A small part of the catchment of this burn lies within the city, notably a tributary known as the Lochee Burn arising from the Lochee / Charleston area.

SEPA monitor selected watercourses and water bodies for quality and in some cases flow including; the Tay Estuary, Dighty Water, Fithie Burn, Murroes Burn and Invergowrie Burn. This data contributes to SEPA's classification of water bodies which takes into consideration a number of criteria to describe their status. Water quality classification looks at both biological and chemical indicators of pollution. Water bodies with low levels of pollution are classified as high or good water quality, whereas those with high levels of pollution are classified as poor or bad. 'Overall' status refers to how much their condition differs from near natural conditions, reflecting modification by human activities and consequent ecological potential.

A comprehensive survey of known watercourses within the city was undertaken as part of a flood study. The location of these is shown below in **Figure 2**, and includes SEPA water

quality classifications from 2014 where available. Up-to-date information can be found either through the SEPA website, or on the Scottish Government's website at: http://www.environment.scotland.gov.uk/get-interactive/data/water-body-classification/ **[27]**

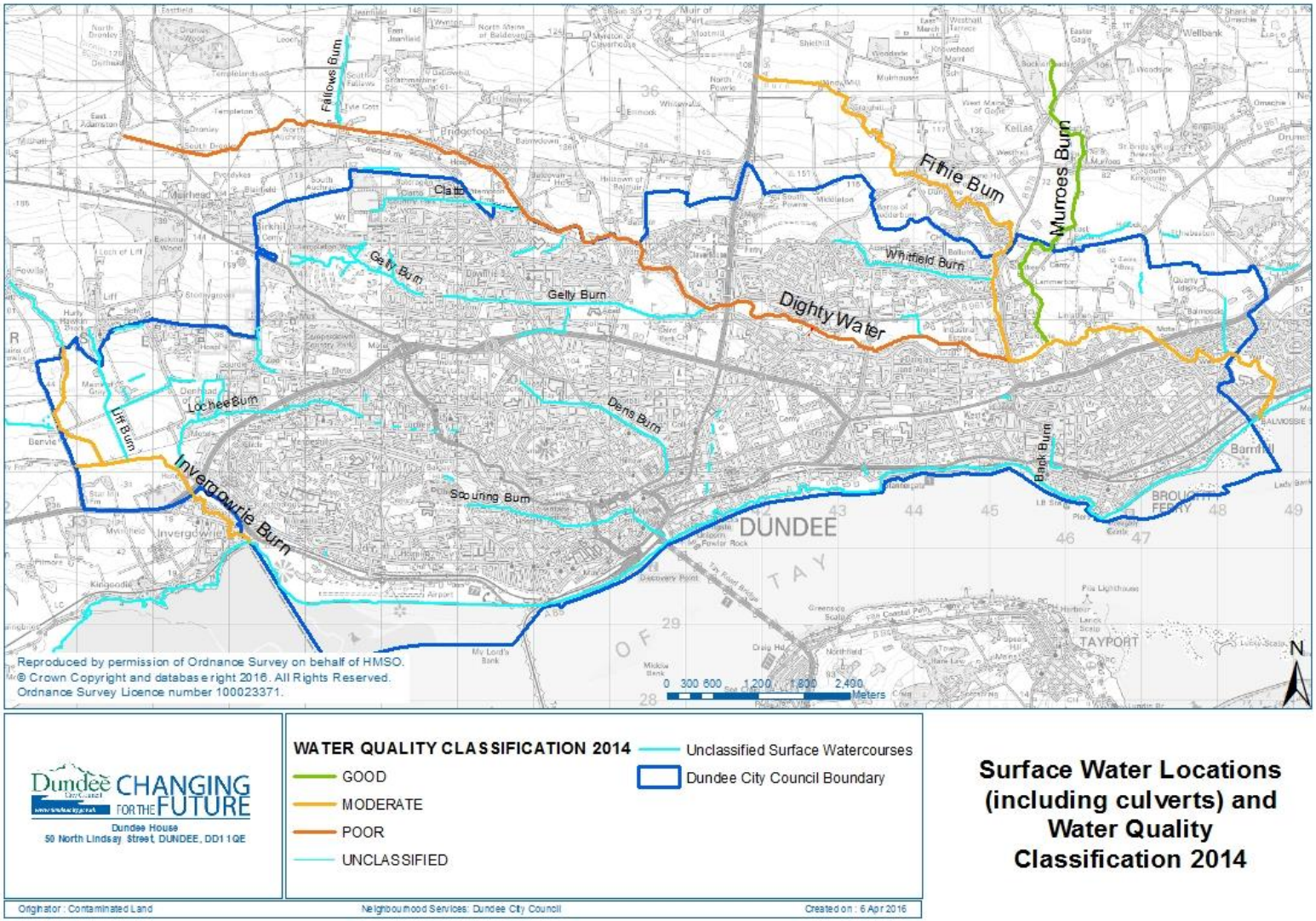


Figure 2 Water Quality Classification

2.4 Industrial History

For approximately 250 years the industrial revolution saw increasingly large scale industrial and commercial development in the UK, before declining over the last 40 years. Dundee played a large part in that industrial history, principally as a centre of textile manufacture.

Dundee City was established as a whaling port in the mid 1700s. Its commercial significance as a maritime port increased quickly through ease of access to London and trade from colonies of the rapidly expanding British Empire. The harbour and docks were established with ship building facilities by 1821 and expanded steadily with substantial land reclamation along the foreshore which continued until the late 20th century.

Around 1830 the city had an established linen manufacturing industry, importing flax from the Baltic States. Textile manufacturing rapidly grew when locally available whale oil proved useful for processing jute, newly imported from the Indian subcontinent. In the following 10 years the city's population increased 12 fold and by the end of the 19th century the majority of the city's 125,000 population were employed in the textile industry.

In addition to textiles, Dundee acquired many of the ancillary processes and industries synonymous with an industrialised city. These include gas works, garages, petrol stations, printing works, laundries, furniture factories, dye works, metal foundries, timber yards, laundries, landfill sites and many others. Dundee's industrial heritage in terms of potentially contaminating industry is therefore quite rich.

Shipbuilding also reached its peak at the end of the 19th Century, with 156 ships being built in Dundee between 1871 and 1881. Jute manufacture and shipbuilding remained the most prominent industries throughout the 20th century until the 1970s, when Indian competition in jute manufacture forced the closure of many works and diversification of others into the production of linoleum and synthetic fibres.

These industries shaped the city, while other industries, for which Dundee is famous, such as Jam and Journalism left less of a legacy upon the landscape. Opening of the second Tay rail bridge in 1887, and completion of the Edinburgh to Aberdeen railway, allowed further expansion of port activities which continued to shape the city foreshore during most of the 20th Century.

Victorian suburbs were developed to the east, west and north along main road arteries into the city, with much of the sandstone being quarried locally and within what became the city boundary. This has led to a number of areas of in-filled quarry close to and underlying later residential developments.

The city continued to expand in the last half of the 20th Century, primarily with new housing to the north on previously greenfield areas. However with cessation of shipbuilding, decrease in port activities and the decline of the textile industry much of the city centre and foreshore area fell into dereliction. New industrial estates developed on the outskirts of the city with a range of diverse uses including another of Dundee's heritage industries: cash register manufacture.

Over the last 40 years however much of the former industrial heart of the city has been transformed into residential property, while the city centre shopping areas have been modernised and pedestrianised. The outskirt estates have changed with the move from manufacturing and industry to service and retail business, leaving many derelict sites. Businesses have also relocated in the city with creation of more modern premises, especially on the western edge, better suited to the digital age.

The first decade of the 21st century also saw redevelopment of much of the former docks and railyards along the foreshore with commercial and residential property.

2.5 Details of Council Ownership of Land

Dundee City Council is one of the major land owners within the local authority area with a wide and varied portfolio of land including;

- agricultural land;
- amenity and landscaped recreational areas;
- gap sites;
- housing estates;
- industrial estates; and
- landfill sites.

The Council's land holding is constantly changing with the acquisition and disposal of parcels of land during routine Council business. The City Development Department of the Council maintains a register of local authority owned land.

2.6 Protected Locations

The following protected locations which are present within the city Council area are identified as ecological receptors in the statutory guidance [4] :

- 1 Special Area of Conservation (SAC) site (Firth of Tay and Eden Estuary).
- 1 Special Protection Area (SPA) site (Firth of Tay and Eden Estuary).
- 2 Sites of Special Scientific Interest SSSI): Monifieth Bay (at Broughty Ferry) and Inner Tay Estuary (west of the rail bridge)
- 1 Ramsar site: Firth of Tay and Eden Estuary. A Ramsar site is a site designated under the Ramsar Convention (the *The Convention on Wetlands of International Importance, especially as Waterfowl Habitat*).

The following locally designated areas are recognised and protected within Dundee under the Local Development Plan [19] :

- Local Nature Reserves: Trottick Mill Ponds, Broughty Ferry and Inner Tay Estuary.
- 54 Sites of Interest for Nature Conservation.
- Wildlife Corridors along the Dighty Water and Riverside Drive.

3 Local Authority Strategy: Aims, Objectives and Priorities

3.1 Aims of Strategy

The aims of Dundee City Council's Contaminated Land Strategy reflect outcome 11d of Dundee City Council's Local Plan that "Dundee has a clean, healthy and safe environment with improved air, land and water quality", and meet the requirements laid out in Paragraph B.9 of the statutory guidance. The approach to inspection of contaminated land will be:

- Rational, Efficient, and Ordered.
- Proportionate to the seriousness of any actual or potential risk.
- Seek to ensure that the most pressing an serious problems are located first.
- Ensure that resources are priorities on investigating areas where the authority is most likely to identify contaminated land.
- Ensure that the local authority efficiently identifies requirements for the detailed inspection of particular areas of land.

The specific aims of the Contaminated Land Strategy are as follows:

(a) To comply with all relevant statutory obligations and associated guidance with regard to the Part IIA Contaminated Land regime.
(b) To ensure that all contaminated land in Dundee is suitably investigated and remediated where appropriate.
(c) To perform site-specific risk assessment.
(d) To ensure effective communication and liaison between relevant services and agencies.

3.2 Objectives of the Strategy

The following key objectives have been set by Dundee City Council to achieve the above aims:

(i) To prioritise the inspection of potentially Part IIA contaminated land and ensure that those sites identified as representing an unacceptable risk to human health are given first priority, whilst also taking into account unacceptable risks to all other statutory receptors *e.g.* the water environment, protected areas, and property.

(ii) To ensure all new developments subject to planning control are made suitable for use.

(iii) To promote the re-use and redevelopment of brownfield land in keeping with Scottish Government Planning Policy [24] and the Dundee Local Development Plan [19]. In Dundee the availability of greenfield land is limited and a large amount of planned new development is necessarily built on brownfield land.

(iv) To ensure the council fulfils its obligations as a responsible land owner.
(v) To respond to enquiries from the public, other agencies and interested parties.

3.3 Dundee City Council Priorities

Dundee has a considerable industrial history and as a result, many current residential developments are in areas with a potentially contaminative history. Old industrial sites often had multiple potential sources of land contamination; from large fuel tanks and coal stores to effluent disposal systems and waste heaps. There is very limited documentary evidence to tell us if land redeveloped prior to the introduction of the contaminated land regime is suitable for its current use, and this means we have to consider that contamination may still be still be present.

Dundee City Council has agreed the Scottish Government's Single Outcome Agreement and insofar as this relates to mitigating the effects of contaminated land the Council aims to ensure a sustainable city with a safe and healthy environment where people will experience fewer health inequalities and have improved physical and mental well-being.

The Council's principal concern carried forward from the original Strategy is to protect the health of citizens from the effects of land contamination. Resources are focused in areas where there is the greatest likelihood of finding contaminated land that may affect human health, although consideration is also given to the likelihood of significant pollutant linkages affecting other receptors as risk assessments are compiled and during the design of site investigation for detailed inspection.

The Council's priorities are given in the following order to:

- Protect human health
- Protect the water environment
- Protect designated ecosystems
- Protect property

3.3.1 Human Health

Local Authorities are the only regulatory body responsible for the protection of human health from unacceptable risks from contaminated land. In addition to work under Part IIA of the EPA, these risks are managed through the planning control system, often with the use of planning conditions in keeping with PAN33 [13].

The Council's inspection strategy ensures priority is given to residential and recreational areas, followed by commercial and industrial areas.

3.3.2 The Water Environment

Within Dundee, the types of water environment considered within this strategy include; rivers, streams, lades, underground streams, groundwater and coastal water. Their importance is considered in terms of potential water supply, the interconnectivity between water bodies that means quality of one may affect another, and as an integral part of aquatic ecosystems.

The Council aims to protect and improve water quality through reducing potential pollution sources, thereby enhancing future potential. The Council follows relevant guidance from SEPA [28] which harmonises groundwater and surface water protection under the River Basin Management Plan (chptr 1.1.3) and the Water Framework Directive.

Particular consideration within Dundee is given to the fact that the Lower Devonian aquifer is specifically named in the regulations [11] (Schedule 1; part 3). When significant pollution of the aquifer is being caused by statutorily identified contaminated land then that land will be designated as a special site (chptr 5.6).

3.3.3 Ecological Receptors

The Tay Estuary forming the Dundee waterfront comprises two areas of internationally protected wetland. The Council ensures that during planned development of brownfield land along the waterfront area the risks associated with land contamination are considered in relation to these protected areas.

Other locally protected Sites of Importance for Nature Conservation are present within the city area. Most of these remain un-developed. Where they lie in proximity to brownfield land, the inspection strategy allows priorities to be established relative to the likelihood of them being affected by land contamination.

3.3.4 Property

Significant harm to property include effects upon the material of buildings which prevents their normal use. Property also includes certain animals, livestock and crops. The Council aims to consider these effects where they are found to be occurring during inspections.

3.4 Evidence of Actual Harm or Significant Pollution

Where evidence of significant harm or pollution of the environment is found, the Council shall seek to ensure timely remediation in proportion with the pollution and as appropriate to the circumstances of that land. If required, the Council shall identify that land as Contaminated Land. Further details are given in Chapter 5.

4 Local Authority Priority Actions and Timescales

4.1 Actions

In meeting the aims and objectives of this Strategy the Council have established the following priority actions.

4.1.1 Locate Potentially Contaminated Sites

Action	
1	Continue to compile, update and maintain GIS databases of environmental information for the city, including source and receptor sites.
2	Continue to liaise with planning officers to ensure planned developments are successfully controlled, where necessary, via planning conditions and that satisfactory investigation, remediation and verification evidence is provided to demonstrate a site is suitable for its planned use.
3	Maintain a record of the land quality status at all sites dealt with through planning conditions and the Council's inspection program.
4	Further develop database queries to extract and prioritise for inspection potentially contaminated land sites that have not been dealt with through planning.

4.1.2 Prioritise Sites

A revised methodology has been developed since publication of the previous strategy, using GIS to bring together newly available data on specific hazards, revised receptor classifications and earlier prioritised sites.

Action	
5	Apply revised prioritisation and categorisation methodology to align all candidate sites with the one priority list. Human health receptors will receive top priority unless specific information becomes available necessitating reprioritisation.
6	Review and reprioritise as necessary when information comes available (e.g. from preliminary ground investigation) to ensure resources continue to be directed to areas where land contamination is most likely to be found.

4.1.3 Undertake Detailed Inspection of Land

Action	
7	Continue investigation of prioritised sites. Although priority is given to human health, all receptors are considered during the assessment process ensuring appraisal of available evidence and allocation of appropriate priorities to all potential pollutant linkages.
8	Ensure, during detailed inspection, that consideration is given to pollution of the water environment, especially on former industrial land where Schedule 1 substances [29] may have been used.
9	Apply up to date statutory and technical guidance as necessary to complete detailed quantitative risk assessments, including statistical analysis.

4.1.4 Undertake Statutory Identification of Contaminated Land

Action	
10	Where detailed inspection shows the necessary criteria for identification of contaminated land exists, the Council will make such identifications. The appropriate details of the contaminated land will be maintained in a public register.

4.1.5 Maintain a record of sites considered Suitable for Use.

Action	
11	Where inspection shows the land does not meet the criteria of contaminated land, and is considered to be suitable for the current use (for which it has planning permission), this shall be recorded and owners and occupiers informed.

4.1.6 Act on non-routine information

Sometimes information becomes available from sources outwith the routine Part IIA and planning routes, indicating the possible presence of contaminated land. This information may come from a variety of sources including other statutory bodies, members of the public and other council departments. Information may include evidence of harm, unexpected uncovering of contamination or news of leaks or spills. Where this information suggests that hazards could present significant risk of harm or pollution of the environment, the contaminated land team will consider the information and take further actions as appropriate, which may include alerting other organisations, such as SEPA or Scottish Water.

Where the situation is not covered by other legislation, the contaminated land team will apply relevant prioritisation and categorisation methodology to accommodate it within overall priorities.

Actions	
12	Act on information that becomes available about hazards that may constitute a significant risk of harm to human health or pollution of the environment.

4.1.7 Secure Remediation

Where land appears to be statutorily Contaminated Land due to the presence of significant pollution linkages the Council will seek to secure remediation by the best available techniques not entailing excessive cost. The process of establishing the appropriate person (par 78F 1990 Act [30] and statutory guidance [4]) who may be liable for remediation can be a protracted process due to changes in ownership of land and companies. When appropriate persons are identifiable, the Council shall pursue remediation at the earliest opportunity, either by negotiated agreement, or the serving of a remediation notice. In some circumstances the Council shall undertake remediation of a site, in which case it will seek to recover reasonable costs it has incurred.

In certain circumstances, it may be necessary for the Council to intervene and take urgent remediation action to mitigate significant risks prior to completing the statutory identification of a site.

Actions	
13	Seek to identify at an early stage appropriate persons liable for land contamination. Secure timely remediation. Where necessary issue enforcement notices.
14	Where work is undertaken by the council, seek to recover reasonable costs incurred by way of remediation.

4.2 Timescales

	Timescale
Update environmental databases in GIS to maintain currency of prioritised inspection program.	Ongoing
Record and update status of all developments being controlled with contaminated land planning conditions.	Daily / Weekly
Progress Prioritisation of candidate detailed inspection sites.	Ongoing
Record decisions and update status of sites following detailed inspections.	Ongoing
Arrange detailed inspections of prioritised sites within available budget.	Annually
Review and republish the Contaminated Land Strategy.	5 years

5 Procedures

5.1 Collection and maintenance of sources of Information

A wide range of environmental and historical information is used to inform contaminated land risk assessment. The ready availability of this data is important to the efficient function of the contaminated land team. This information is used during assessment of Development Planning applications on the weekly planning list and for the purpose of prioritising and managing the detailed Part IIA inspection programme.

The risk assessment process requires the management of considerable environmental information and datasets such as the location of private water supplies, aquifers, watercourse and geology. Detailed information is held on the current use of land along with possible sources of contamination, such as the location and type of former industrial land, fuel storage, known quarries and infilled land is recorded. Use has been made of various new databases as they have been created through the ongoing Openscotland Information Age Framework (OSIAF) [31], as well as more traditional sources, such as published historical mapping and trade directories.

The majority of this information is available as geo-spatial data. This is data in a format where map locations are linked to tabulated records of information that can be displayed on an interactive map such as in GIS.

The data used includes:

Data	Source
Ordnance Survey Master Map and Historical maps	Ordnance Survey
Trade Directories, Historic land-uses	Dundee City archives, Landmark Information Group
Former petroleum licenses	DCC Petroleum Officer digitised from archives
Surface watercourse locations and classification	DCC and Scottish Water, SEPA
Aerial photography	Royal Commission on Ancient and Historic Monuments and Getmapping plc
Geological maps, Radon Potential	British Geological Survey
Historical radioactivity licenses	DCC Environmental Health archives
Historical information and photography	Dundee City archives
Infilled Land	DCC Building Control, DCC Contaminated Land Officer compiled databases
Greenspaces	DCC Greenspaces survey
Private water abstractions and supplies	SEPA and DCC
Local Development Plan 2013	DCC City Development

Ground investigation data submitted in support of planning applications and collected during Part IIA investigations is stored in association with the site location, as is information from other sources, such as the City Engineers, Building Standards, members of the public, or from news sources. The Contaminated Land Officers work alongside Environmental Health Officers, who deal with public health complaints. When members of the public raise relevant issues relating to land or water quality, they are able to refer these directly to the contaminated land team.

The Council Contaminated Land web page contains contact information so members of the public can get in touch with information or concerns.

5.2 Evaluation of Information

The format for all evaluations is to establish a Conceptual Site Model (CSM). This involves identifying a possible source of contamination, a receptor which may be affected and a pathway through which the contamination may reach the receptor. This is known as a pollutant linkage. Where a CSM shows at least one potential pollutant linkage, this may be tested with an intrusive ground investigation. This typically includes checking ground conditions, obtaining samples of the soil and/or water to assess the presence of contaminants, and testing for ground gas.

Site investigation and assessment is typically an iterative process. Basic site investigations often provide enough information to allow us to rule out significant contamination issues. Where there is some evidence of contamination, further rounds of site investigation, analysis and assessment may be required to fully characterise the situation. This approach is in keeping with the statutory guidance [4] and allows resources to be focused more efficiently where required, and limits unnecessary disturbance to residents.

Further details on the risk assessment process are in Chapter 7.

5.3 Use of Powers of Entry and Investigation

Powers of entry are granted to the Council for the purpose of fulfilling its inspection obligations by the Environment Act 1995 [32]. Powers may also be used to require the provision of records and relevant information.

5.4 The Formal Identification of Contaminated Land

After detailed inspection and risk assessment, if Contaminated Land Officers consider that an area of land meets the statutory definition described in Chapter 1.1.1 then it goes forward to the relevant committee for approval. If the recommendation is accepted, the Council will enter a record on its contaminated land register to include:

a) the location and extent of the contaminated land sufficient to enable it to be identified; its address; area in hectares; a National Grid reference and a plan to a suitable scale;

b) the significant harm or significant pollution of the water environment by reason of which the land is contaminated land;

c) the substances by reason of which the land is contaminated land and, if any of the substances have escaped from other land, the location of that other land;

d) the current use of the land in question;

e) the name and address of the person on whom the notice is served;

f) what each appropriate person is to do by way of remediation, and the periods within which they are required to do each of the things;

Where detailed information has been compiled, such as site investigation reports the register will include:

a) a description of the information,

b) the date on which it was prepared,

c) the person by whom and for whom it was prepared, and

d) where it is available to be inspected or copied.

The following relevant parties will be notified in writing that the land has been identified as contaminated,

- The owner(s)
- The occupier(s)
- Those who may be liable for remediation (appropriate persons)
- The Scottish Environment Protection Agency

5.5 Role of the Enforcing Authority

After the Council has identified contaminated land and carried out the necessary notifications its role is to take further action to secure remediation of that land.

5.5.1 Consultation with Appropriate Persons

Consultation is necessary with the landowner, occupier and the appropriate person for undertaking the remediation to establish whether a Remediation Statement can be delivered which provides an acceptable solution within an appropriate time. The Council will make available during this consultation all documentary evidence associated with the identification of the contaminated land.

In this process the Council will consider whether urgent and perhaps temporary remediation action needs to be taken to mitigate harm or pollution while a longer term solution is derived.

The Council will encourage appropriate persons to reach voluntary agreement on remediation, before considering use of statutory powers. However, should negotiation prove unsuccessful, after a period of three months, enforcement action, including the issue of a Remediation Notice will be served as necessary.

5.5.2 Securing Remediation

The term remediation as used in the legislation [10] has a wider meaning than commonly used and includes assessment action as well as remedial treatment and monitoring in order to fully determine the appropriate action necessary to prevent significant harm or pollution occurring.

If an acceptable Remediation Statement is received it will be entered onto the contaminated land register and shall include:

a) the things which are being, have been, or are expected to be, done by way of REMEDIATION in the particular case;

b) the name and address of the person who is doing, has done, or is expected to do, each of those things; and

c) the periods within which each of those things is being, or is expected to be done.

A Remediation Notice if served upon the appropriate person shall specify:

a) Details of what is required to be done by way of remediation.

b) The time period within which each of the things required by way of remediation shall be carried out.

5.5.3 Establishing Liability for the Costs of Remediation

When it becomes apparent that land will be statutorily identified as contaminated land, the Council are required to make reasonable enquiries to identify the 'appropriate persons'. These persons, should they differ from the current owner and occupier, must also be provided with the notice of identification of Contaminated Land.

In the first instance liability falls to a class A appropriate person who caused or knowingly permitted the contaminants to be present in, on or under the land. Liability extends to necessary remediation which is referable to the contaminating substances in question.

If, following reasonable enquiry, a class A person cannot be found, the owner or occupier of the land may be held responsible for the cost of land remediation. This is a class B appropriate person. A Class B appropriate person is excluded from liability in relation to pollution of the water environment under the Part IIA legislation [10], since this is considered under the Water Resources Act 1991 [33].

Each contaminated land site will be considered on its own merits and account taken as necessary of multiple ownership and occupation over time and the contribution of each to any significant pollutant linkages that may be present. Liability may thus need to be apportioned separately for each significant pollutant linkage identified.

5.6 Designation of Special Sites

The following categories of contaminated land mean that land determined as contaminated land may further be designated as a special site.

Water Pollution cases include:

a) Land where the water environment is affected by land resulting in those waters not meeting or being not likely to meet relevant surface water criteria.

b) Cases where particular substances are affecting key highly permeable aquifers. This includes pollution of Devonian Sandstones or Permo-Triassic Sandstones by substances listed in paragraph 1 of Schedule 1 **[29]**

Industrial cases include contaminated land:

c) which has been used for waste acid tar lagoons, oil refining or explosives manufacture.

d) which has become contaminated which is already regulated by central control such as Integrated Pollution Control or Pollution Prevention and Control licenses and for which SEPA is the appropriate authority.

e) which has had a nuclear site license and for which the licensees responsibility has not ended.

f) Forming part of the Ministry of Defence (MOD) estate including current military, naval and airforce bases and other properties, including those of visiting forces.

In these circumstances, the local authority should always seek the advice of SEPA before making a decision. If SEPA accept the local authority's decision that land should be designated as a special site, SEPA become the enforcing agency for all pollutant linkages.

5.6.1 Termination of designation of special sites

The Regulatory Reform (Scotland) Act (2014) [8] amended the Environmental Protection Act 1990, giving SEPA the option to terminate the designation of a contaminated land site if it considers the site no longer meets the requirements of being designated as a special site. In such cases, SEPA will issue a notice to that effect. In these circumstances the local authority resumes responsibility as the lead regulator of the site.

5.7 Radioactively Contaminated Land

SEPA act as the enforcing authority for the investigation, identification, characterisation, and regulation of remediation of radioactively contaminated land. There is no requirement for local authorities to inspect their areas for the purpose of identifying radioactive contaminated land, however where a local authority considers that land in its area may be radioactive contaminated land, it has a duty to notify SEPA [7].

5.8 Development Management

Development on formerly industrial land may introduce new receptors or create new pathways for exposure, meaning the potential for harm may be enhanced. Scottish Government advises via Planning Advice Note 33 (2000) [13] that local authorities should take measures to ensure that new developments on sites that may have a contaminative history are demonstrated to be suitable for the proposed use. Whether confirmed or suspected, contamination is a material planning consideration and should be considered as one of the factors in the preparation of development plans, as well as in the determination of planning applications. The Dundee Local Development Plan is reviewed every five years and the team within Planning Division liaise with Contaminated Land Officers within Neighbourhood Services to identify potential development sites comprising previously used land, which could reasonably be affected by contamination.

Contaminated Land Officers within Neighbourhood Services scrutinise the weekly list of planning applications and supporting information to identify applications where developments are proposed on previously used land, which could reasonably be affected by contamination. In such cases, the department alerts the team within the Planning Division dealing with the application. In practice the Council typically uses one of the following measures:

Advisory Note	Applied to planning consent, requiring that if any contamination is encountered the Council shall be informed and a strategy to deal with contamination implemented.
Pre-determination Preliminary Risk Assessment	Required prior to planning consent, requiring the applicant to demonstrate consideration of potential land contamination risks at the planning stage and provide, as necessary, appropriate proposals for further work to more fully assess and manage these risks.
Suspensive Conditions	Condition included with planning consent requiring that a scheme to assess and deal with land contamination is submitted to and approved by the Council. This comprises two parts: The first part prevents the development commencing until the scheme is agreed by the Council. The second part prevents occupation or use of the development prior to the scheme being satisfactorily implemented and agreed by the Council.

In keeping with PAN33 [13], it is normal to require that a Preliminary Risk Assessment is submitted for approval prior to determination. Where there are reasonable concerns that remediation may prove difficult or inadequate, or is particularly complex, additional site investigation information and remediation proposals may be required prior to determination.

The following text is a typical example of a suspensive condition used following the submission of a suitable preliminary risk assessment:

1 Development shall not begin until the investigation and risk assessment proposed in the submitted Stage I Desk Study are completed and, if necessary, a remediation strategy to deal with any contamination at the site has been submitted to and approved in writing by the planning authority. The strategy shall contain proposals to deal with contamination to include:

I. the nature, extent and type(s) of contamination on the site.
II. measures to treat/remove contamination to ensure the site is fit for the use proposed and does not contain any significant pollution linkages.
III. measures to deal with contamination during construction works.
IV. verification of the condition of the site on completion of decontamination measures.

2 Before any unit is occupied the remediation strategy shall be fully implemented and a verification report with relevant documentation demonstrating that the objectives of the remediation strategy have been achieved shall be submitted to and approved by the planning authority"

The Council welcomes informal and pre-application discussions with developers and other interested parties in order to identify issues at the earliest possible stage and to minimise risks to the project as well as to the environment.

5.9 Building Standards

Section 3: Environment, of the Building (Scotland) Regulations 2004 [34] state:

Site preparation – harmful and dangerous substances

3.1 Every building must be designed and constructed in such a way that there will not be a danger to the building nor a threat to the health of people in and around the building due to the presence of harmful or dangerous substances.

Contaminated Land Officers within Neighbourhood Services do not scrutinise the weekly Building Standards list, however, Building Standards Officers may contact Contaminated Land Officers if they are seeking specialist advice on contaminated land aspects of any site of concern to them. In certain cases where contaminated land concerns have not been properly addressed by the developer, it may be possible for Building Standards Officers to

reject the completion certificate. In certain cases where Contaminated Land Officers have concerns that are suited to building control measures, such as radon or other ground gas, they may alert Building Standards Officers to an issue.

5.10 Liaison with NHS Tayside and medical professionals

If information is presented to the Council, suggesting that actual or suspected harm is taking place as a result of exposure to possibly contaminated land, the council will notify the consultant in public health medicine at NHS Tayside. Where individuals express concern about an existing illness they will be advised to speak with their GP.

The Council will work with relevant health professionals as required.

5.11 Voluntary Information

In some situations an organisation or land owner may undertake to clean up or remediate in some way, land for which they are responsible without prompting from the Local Authority. The Council wishes to support organisations and individuals who take responsibility for the environmental quality of their land holdings and welcome information about voluntary land quality management that is or will be undertaken. In some cases it may be possible to initiate a planning application for the purpose of facilitating statutory approval of remediation work when undertaken as part of enabling works.

When land which has not been formally identified as Contaminated Land is remediated outwith a planning application, such work falls outwith the statutory responsibility of the Council in regard to land contamination. In such situations the Council are unable to enter into confirmatory agreements over the standard of work undertaken, or the suitability of the land quality.

Whatever the situation, the Council are prepared to view information submitted voluntarily, provide comment and discuss options regarding land quality management.

5.12 Dealing with Council Owned land

The contaminated land regime is a risk based approach and does not differentiate between council owned land and privately owned land. Potential Part IIA sites are prioritised accordingly and planning applications are dealt with in the same way as any other application.

Contaminated Land Officers within Neighbourhood Services provide factual information and general advice to other council departments wherever possible, being careful to avoid potential conflicts of interest with their regulatory role.

6 General Liaison and Communication Procedures

6.1 General Interaction within Dundee City Council

Elected members will be informed when ground investigations are to be undertaken in their ward. When land is likely to be identified as contaminated land, elected members will be informed and a report prepared for the relevant Council Committee for approval prior to statutory identification of contaminated land.

The Environment Protection Team have a dedicated legal advisor who may be consulted on matters concerning interpretation and implementation of the legislation and regulations.

6.2 Interaction with Statutory Consultees and Others

The statutory guidance advises consultation with the following :

Consultee	Circumstance
Scottish Executive	For revenue support in carrying out duties under the regime.
SEPA	For advice in relation to pollution of the water environment and in designation of special sites.
Local Enterprise Companies	Financial support for remediation in connection with development.
Historic Scotland	When substantial damage may be posed by land contamination to an Ancient Monument.
Scottish Natural Heritage	To determine what constitutes significant harm to a protected ecosystem or natural habitat.
Health and Safety Executive	Risks to the public or employees arising as a result of land contamination
Food Standards Agency Scotland	For prohibition of specified agricultural activity in a designated area order to protect consumers from exposure to contaminated food. Food and Environment Protection Act 1985, Part 1.

Proprietary databases are available from SEPA, Historic Scotland and Scottish Natural Heritage detailing protected areas and associated criteria under their designations. The Council consults these databases periodically to obtain updates such as those included in the Local Development Plan [19].

6.3 Liaison with SEPA

The Scottish Environment Protection Agency (SEPA) are also regulators under the contaminated land regime. The following are typical categories of liaison and communication with SEPA which occurs at various times:

- Obtaining/providing relevant water quality data from SEPA's River Basin Management Plan;
- Consultation where significant pollution or the significant possibility of significant pollution of the water environment is encountered during development management or the Council's inspection program.

- In relation to designation of special sites and sites potentially contaminated by radioactivity;
- Providing SEPA with information as required for the State of Contaminated Land report

SEPA has published a framework for Local Authority/SEPA liaison under Part IIA. Consultation with SEPA will follow this formal route but will also continue to be made informally where required for specific projects.

6.4 Liaison with Other Authorities

The Contaminated Land Officers attend quarterly liaison group meetings with other local authority officers involved in contaminated land regulation in the East of Scotland. This liaison allows for sharing methods and comparison of approach, as well as feedback on best practice. Furthermore this liaison group provides a forum for discussion of any cross boundary issues that may occur with neighbouring authority areas.

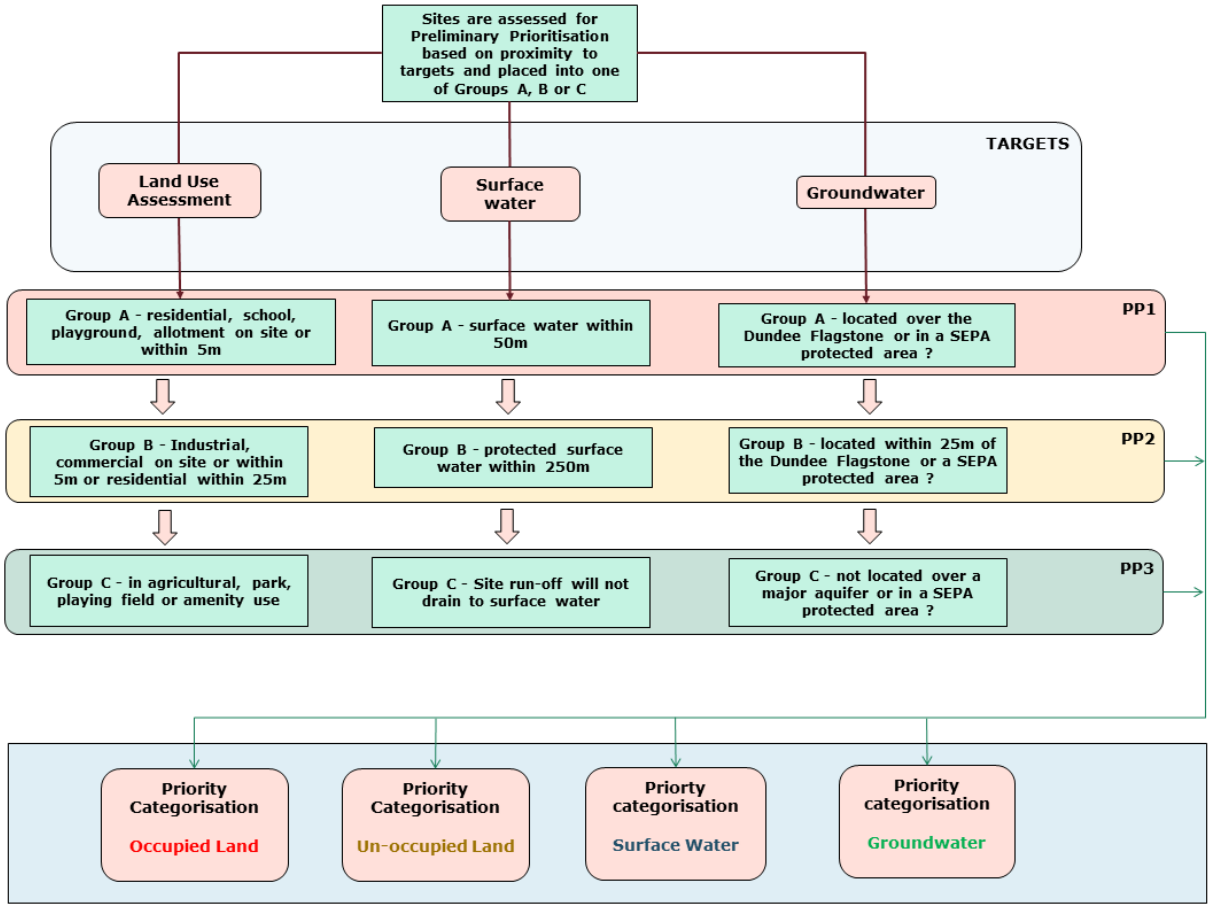
Tayside NHS may also be of assistance as experts in epidemiology regarding the prevalence of ill health in society and protection of public health.

7 Programme for Inspection

7.1 Prioritisation

In keeping with the priorities given in Chapter 3, particular consideration is given to the assessment of land that has a potentially contaminative history that might impact on residential areas that were redeveloped prior to the current planning requirements. Where the concern is that residents may come into contact with contaminated soils, directly, or through the consumption of home grown vegetables, sampling is focused on shallow soils in garden areas. If there are concerns from ground gas or vapour, investigation of deeper soil is required.

Department of the Environment Industry Profiles [35] are used along with experience gained from previous investigations to evaluate the likely severity of pollution that is associated with the historical land use. Figure 3 below outlines how end-use sensitivity is assessed.



PP1 = Preliminary Priority 1 - Screen these sites first unless other information comes to light which enable regrouping
PP2 = Preliminary Priority 2 - Screen these site second unless other information comes to light which enable regrouping
PP3 = Preliminary Priority 3 - Screen these site second unless other information comes to light which enable regrouping

The site should be placed in the highest group identified under any of the above headings. For example if assessment under "Land Uset" results in the placement of the site in Group A, assessment under "Surface water" results in the placement of the site in Group B and assessment under "Groundwater" results in the placement of the site in Group B, the site should be placed in Group A at the end of this part of the procedure.

Figure 3 Example of initial site screening process

A1 Sites with the most contaminative history are considered for detailed assessment first. This information is recorded in the GIS for each new site evaluated.

7.2 Stages of Investigation

The purpose of a contaminated land inspection is to establish whether or not suspected contamination is present, and if this presents a significant problem for relevant receptors. Once a site has been prioritised, investigation is typically carried out in following the stages:

1. Preliminary Risk Assessment
    - Desk-study
    - Develop Conceptual Site Model
        - Are there possible Source-Pathway-Receptor (SPR) pollutant linkages?
2. Intrusive investigations – exploratory, main, supplementary
    - Test and refine Conceptual Site Model
        - Are there actual pollutant linkages?
    - Risk evaluation
        - Are these pollutant linkages 'significant'?
3. Remediation strategy
    - How to break pollutant linkages
4. Validation/Verification report
    - Demonstrate pollutant linkages have been successfully broken

Stage 2 is often carried out in phases, starting with an exploratory investigation to test the main hypotheses, including geology, and to allow a main investigation to be more efficiently and cost effectively designed. Further, supplementary investigations may also be required, targeting particular areas or issues of concern. Where technically possible, preference given to the use of hand-digging, or the smallest practical rigs as this is less disruptive for residents.

Further details of what must be considered at each stage of the investigation are given in Appendix 1.

7.3 Conceptual Site Model

A conceptual site model (CSM) is a written, pictorial or network diagram representing the environmental system and the biological, physical and chemical processes that affect the transport of contaminants from sources through various media (pathways) to receptors. The CSM below illustrates the potential sources, pathways and receptors present on an example site.

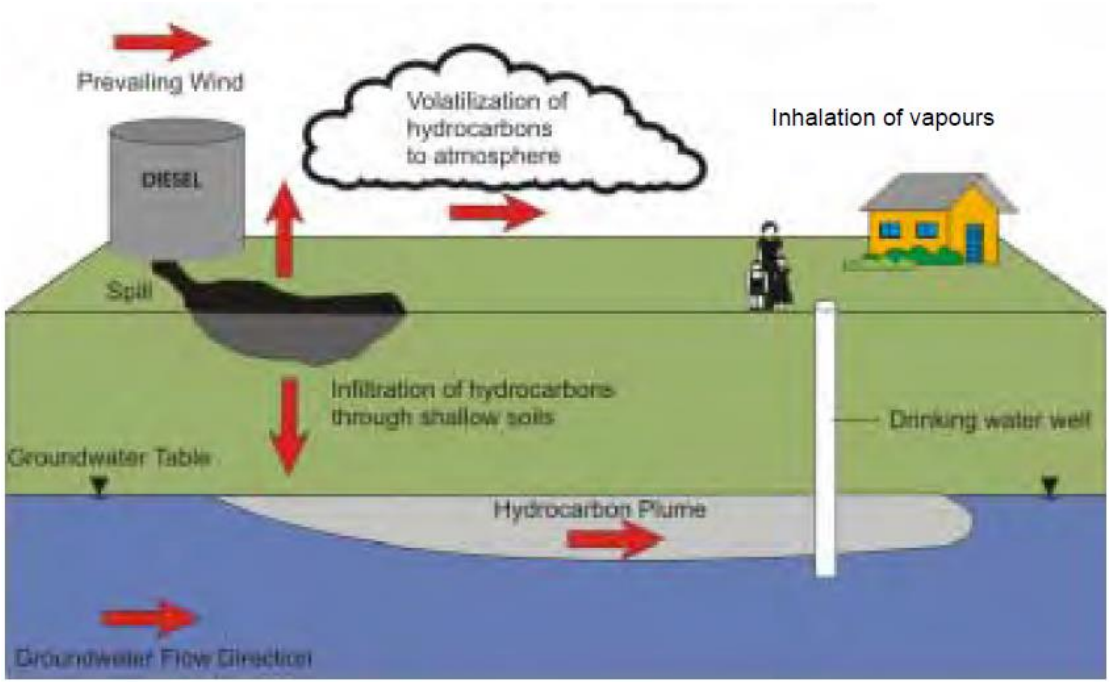


Figure 4 Example of Conceptual Site Model

A conceptual site model aims to:

- Characterise the physical, biological and chemical systems present on or within a particular area of land;
- Describe the processes that determine the chemical releases, migration and the exposure of receptors to the contamination; and
- Identify the potential exposure routes present.

The CSM allows the key pollutant linkages to be readily identified andenable resources to be targeted at those which are most significant.

7.4 Requirements of the Inspection Programme

The Council's Prioritisation Strategy identifies the sites where contamination is suspected, and puts them into an order according to predicted level of risk, ensuring that high risk sites are address first.

In keeping with the statutory guidance, the Council aims to follow an efficient strategic approach to inspection. The guidance (Paragraph B.9) [4] requires that the approach should:

(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 prioritised on investigating areas where the authority is most likely to identify contaminated land; and

(e) ensure that the local authority efficiently identifies requirements for the detailed inspection of particular areas of land.

The council should consider the following criteria:

a) Any available evidence that significant harm or pollution of the water environment is actually being caused.

b) The extent to which any receptor (as defined by the statutory guidance) is likely to be found in any of the different parts of the city area.

c) The extent to which any of those receptors is likely to be exposed to a contaminant (as defined in the statutory guidance) e.g. as a result of the use of the land or of the geological and hydrogeological features of the area.

d) The extent to which information on land contamination is already available.

e) The history, scale and nature of industrial or other activities which may have contaminated the land in different parts of the city.

f) The nature and timing of past redevelopment in different parts of the city.

g) The extent to which remedial action has already been taken by the authority or others to deal with land contamination problems or is likely to be taken as part of an impending redevelopment.

h) The extent to which other regulatory authorities are likely to be considering the possibility of harm being caused to particular receptors or the likelihood of any pollution of the water environment being caused in particular parts of the city.

7.5 Ensuring efficiency and cost effectiveness

Experience gained since the introduction of the Contaminated Land Regime has allowed the council to carry out more work in-house, and to target resources more efficiently. Contaminated Land Officers design and review the vast majority of site investigations and risk assessments carried out for Part IIA, with contractors employed directly. This not only saves money, but in many cases improves turn-around times, as the lead contaminated land officer is involved at all stages. Specialist consultancy services are only sought when unusual, difficult, or particularly sensitive issues arise.

7.6 Communicating with Owners, Occupiers and Other Interested Parties

The Council recognises that the possibility of living on, or owning potentially contaminated may cause alarm, both in terms of the possible risks to health and the disruption required to undertake sampling. The Council endeavours to avoid raising unnecessary alarm in relation to land that requires investigation.

Prior to undertaking any physical ground investigation works in an area, the Council will give reasonable advance warning of its intentions to the owner, occupier or appropriate person responsible for the land, explaining the site history and giving an overview of the council's plans. Where entry is required to a particular area of land, access requirements will be assessed and affected persons will be contacted with an explanation of the work required, what distruption, if any, is anticipated, and the expected standard of reinstatement to the land following the work. If required, a member of staff will visit their premises to discuss concerns, including site specific aspects of the work.

The Council will be sensitive to concerns of owners and occupier and will adapt site investigation proposals, where reasonable, in order to minimise disruption and concern. Consideration will also be given to information provided by owners/occupiers about the land.

The Council provides contact details and asks that any queries or comments are directed to the appropriate member of staff organising the work.

7.7 Communication of Risk

The communication of risk in relation to land contamination can be complex, especially when contamination may be an unseen factor, hidden within soil, or groundwater beneath a site. Good risk communication can be time consuming and resource intensive, but it is important to building and maintaining trust.

Detailed inspection of land can be a time consuming process, and in many cases does not find significant contamination. There is a wide range and severity of theoretical health risks and possible remediation requirements, and so detailed speculation of these at the start of such a project is likely to be confusing, and may mis-represent the probable outcome to residents. Nevertheless, it is important that residents and relevant parties know that they can come to us for further information or to discuss any aspect of the investigation and possible consequences in greater detail if desired.

Experience has shown that a phased approach to inspections is more efficient and less alarming to affected persons than carrying out a full investigation from the outset. Although more efficient and less intrusive, this approach can become drawn out, and the Council is mindful that waiting for answers can be distressing.

Throughout the process of detailed inspections, the Council keep stakeholders informed by written communication, and in person where required. Where properties are found to be suitable for their current use, owners and occupiers are informed in writing, and advised to keep a copy of the correspondence for their records. In some cases, preliminary site investigation may rule out some pollutant linkages, and if reasonable, residents are given updates to this effect. For example, site investigation in areas of former quarries may rule out ground gas concerns, while investigation into the quality of garden soil continues. If requested, owners and occupiers will be provided with all relevant factual information relating to their property.

When elevated levels of contamination are found it is necessary to effectively communicate the level of risk associated with the specific types of contamination in the context of a site's use. This is potentially concerning and confusing for householders, tenants, property owners and other affected parties, and a sympathetic approach is required. It is important to be as open and transparent as possible, and the Council will aim to share as much information as is practicable with relevant stakeholders, while *being mindful of privacy issues.*

If appropriate, the council will request a collaborative approach to communicating health risks with NHS Tayside.

The SNIFFER (Scotland & Northern Ireland Forum for Environmental Research) document Communicating understanding of contaminated land risks from May 2010 provides detailed advice on the subject. [36]

7.8 Health & Safety

Contaminated Land site investigations are covered by the Construction (Design and Management) Regulations, 2015. The City Engineers appoint suitably qualified contractors

on behalf of Neighbourhood services, using only those that have demonstrated Health & Safety competency.

Prior to work commencing on site, the City Engineers provide contractors with a Pre-Construction Information Pack. The contractors will then submit a Construction Phase Plan, including their Health & Safety assessment. Each site must be considered individually, but plans are likely to consider traffic management, personal protective equipment (PPE) and the location of services, such as gas and electricity.

Work cannot start on site until this has been agreed to be sufficient.

8 Information Management and Review Procedures

The Council collects and maintains large volumes of information in order to support effective risk assessment of potentially contaminated land. Efficient management of this is essential, and is done primarily through the use of Geographical Information Systems (GIS) software and associated databases. The status of all land assessed during the planning process, or inspected under the Council's Part IIA inspection strategy is recorded in databases along with the location of associated ground investigation and risk assessment reports.

8.1 Retention of Information

All information collected and held by the council in relation to progressing the Strategy is subject to a retention schedule. Much of this information remains useful indefinitely and may be required to inform future risk assesssments and so factual information particularly is subject to unlimited retention, where appropriate. Where possible, all new information is collected in digital format, but many records exist in hard copy only. Physical files are stored temporarily at the Council Offices, with older records stored in Council archives.

8.2 Review Procedures and Ongoing Prioritisation

8.2.1 Evolving technical guidance

Contaminated Land is an emerging discipline, and so the technical guidance underpinning the regime is subject to frequent additions and updates.

To keep abreast of changes and developments in contaminated land, officers attend regular meetings of the Scottish Pollution Control Co-ordinating Committee, Pollution Liaison sub-group for Contaminated Land, undertake continuing professional development, attend industry conferences, training workshops and Scottish Government seminars. Being aware of best practice guidance and technologies allows the team to regularly assess and evaluate innovations in techniques and procedures with a view to incorporating or amending procedures and thus continuously improve the efficiency of Dundee's Inspection Strategy.

8.2.1 Reprioritisation

When new guidance or information is made available the Council can retrieve the relevant candidate sites from the database for re-evaluation and further assessment. For example, since the initial prioritisation, the GIS databases have been queried to identify new candidate sites for inspection, which includes residential property and gardens built on former petroleum licensed land, in proximity to underground tanks (Figure 5 Petroleum licensed land now under residential development (Figure 5) and over infilled ground (Figure 6).

8.2.2 Changes in Land Use

Under Part IIA, risks are assessed in accordance with the *current* land use. This typically means all reasonable use of the land under the current planning status. For example, private gardens of sufficient size are expected to be suitable for frequent use by small children and for growing vegetables, while commercial premises are expected to be suitable for that use and higher concentrations of contaminants may be acceptable. Any change of use will

require planning permission, and the suitability of the site for the new use will be considered at that stage.

In cases where a specific site is considered to be suitable for its current actual use, but may not be suitable for all uses under the current planning status, then the site may be subject to an ongoing monitoring programme with time-tabled follow-up.

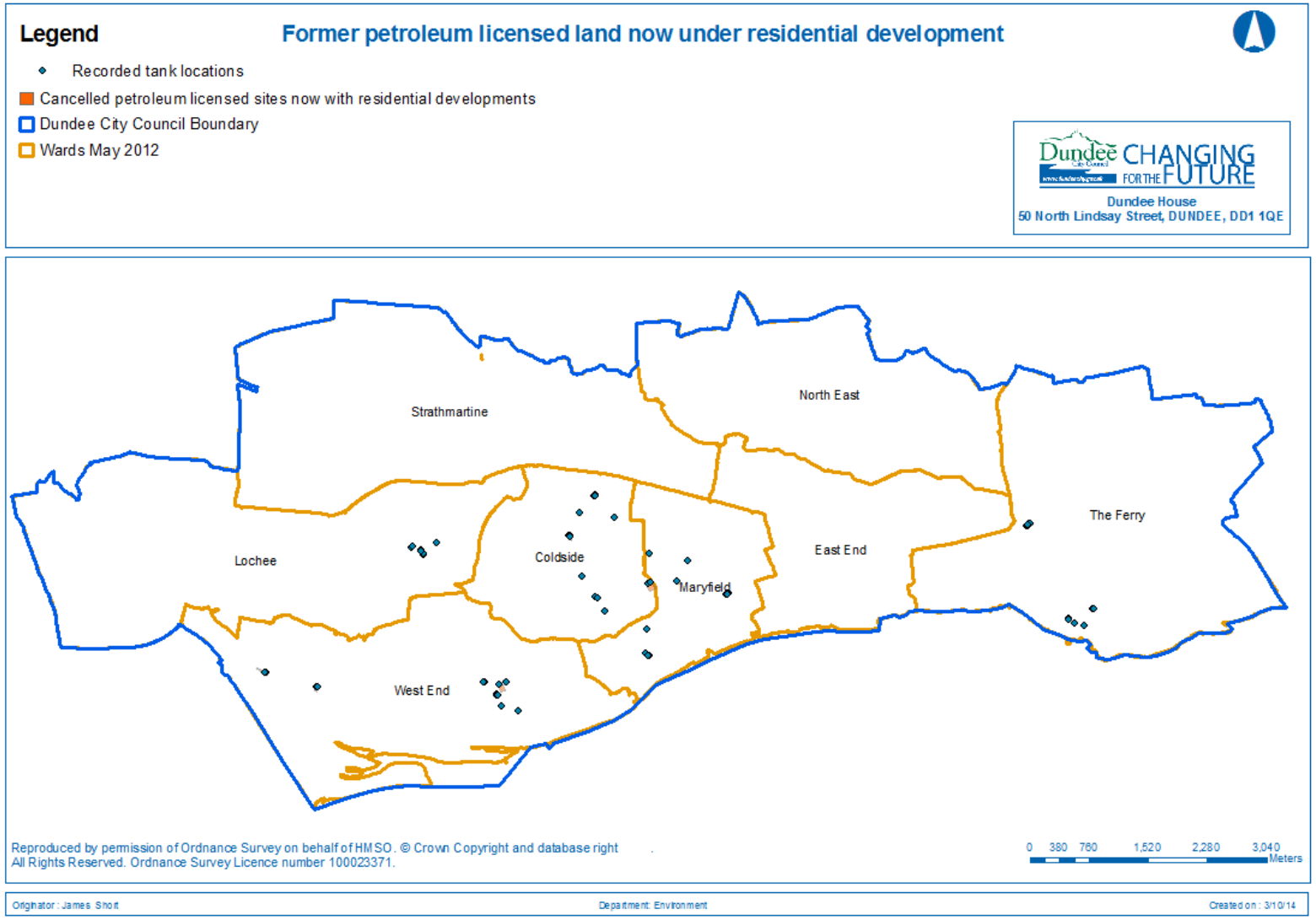


Figure 5 Petroleum licensed land now under residential development

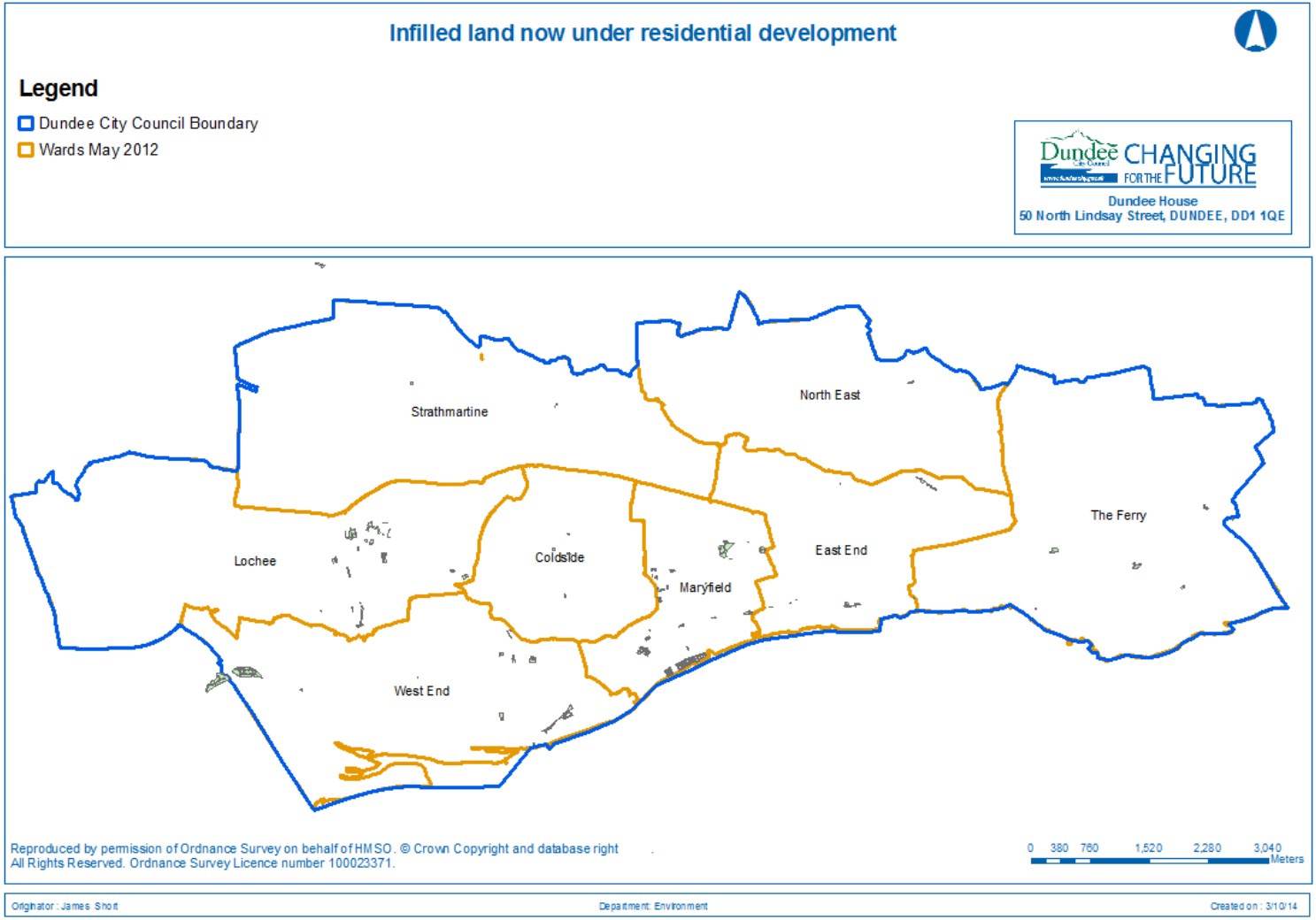


Figure 6 Infilled land now under residential development

8.3 Public Access to Information

Access to this information is available in the following ways.

8.3.1 Information Submitted in Support of Planning Applications

The City Development Department is required to maintain a planning register as a matter of public record. This information is made available online here [37] and is also available for consultation in person at Dundee House.

The Planning Online service has been in use since 2007 and contains information on applications since then. Older information is gradually becoming available online, however appointments can still be made at Dundee House to request access to paper archives.

8.3.2 The Public Register of Contaminated Land

Part IIA of the Environment Protection Act 1990 requires that every enforcing authority shall maintain a register containing prescribed particulars regarding the identification and remediation of contaminated land. Information on the register may include:-

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

The register does not include:

- details of historical land use or
- other records used or compiled during investigation of land within the Council’s area
- records of land contamination that was cleaned up during redevelopment under the control of Planning Conditions.

At the time of writing there is one site on the contaminated land register for Dundee. This site covers 3.7 hectares and was formerly a dry goods distribution depot. It is located at Baird Avenue, Dryburgh Industrial Estate NGR: 33794 73266. The site was identified as contaminated land and designated a special site in 2008. Regulation of remediation at this site was under control of SEPA until May 2014 when, following completion of remediation SEPA issued a notice terminating the Special Site Designation. Information remains on the Register.

The register of land that has been statutorily identified as “contaminated land” is available for consultation at the offices of Neighbourhood Services.

8.3.3 The Environmental Information (Scotland) Regulations 2004 (as amended)

These Regulations require Scottish public authorities to take reasonable steps to organise and keep up to date the environmental information, relevant to its functions. In relation to contaminated land, this covers information held by the Council and compiled for the purpose of identifying areas of potential land contamination.

Relevant information held by Neighbourhood Services on particular areas of land is available, typically in the form of an *Environmental Information* report. Requests should be submitted in writing (preferably email), including a plan identifying the boundary of the area of interest to:

Neighbourhood Services
Community Safety and Protection
3 City Square
Dundee, DD1 3BA
Tel: 01382 433710
contaminated.land@dundeecity.gov.uk

An Environmental Information Regulations (EIR) report provided by Contaminated Land Officers in fulfilment of obligations under these regulations is derived from environmental data held for the purpose of implementing the contaminated land regime. Information typically available includes areas of known landfilling, internationally and locally protected nature sites, former petroleum licensed sites, land which has been investigated under Planning or Part IIA, public nuisance, private water abstractions, radon potential and waste management facilities.

Data provided includes information held and maintained by the Contaminated Land and Public Health Officers and should not be considered exclusive or exhaustive in content. The Council are not the holders of all information required to complete a contaminated land risk assessment. Such information as includes historical, geological or hydrogeological mapping, aerial photography, historic trade directories etc are available from other providers.

The Council's Environmental Information reports are automatically generated from GIS databases using the provided site boundary location. Where more detailed, factual information is available on specific locations, the report refers to where and how this may be obtained.

8.4 Review of the Strategy Document

This revised Strategy document brings together a number of significant changes to the implementation of the Regulations [11] that have occurred since its first publication.

This document sets out the procedures which are now standard for management of land contamination issues in Dundee. In addition it sets out the ongoing process of developing an integrated data management system for recording, assessing and re-prioritising candidate sites for inspection. The Strategy shall be reviewed every five years to reflect developments in procedures and outline what further changes are to be incorporated. Should special circumstances dictate, the Strategy may be reviewed at an earlier date. Such circumstances may include significant changes in legislation or guidance, or case law precedents which

Appendix 1 – Site Investigation Design

The purpose of a contaminated land inspection is to establish whether or not suspected contamination is present, and if this presents a significant problem for relevant receptors. This is carried out in phases, in accordance with the relevant British Standard (currently BS 10175:2011+A12013 Investigation of potentially contaminated land sites) and typically follows the stages outlined below:

Phase I – Desk Study
This is a preliminary qualitative risk assessment and encompasses the desk study methodology referred to in the relevant technical guidance including Appendix 1 of Scottish Enterprise (1998) "How to Approach Contaminated Land". At this stage, the following factors are considered:

- Former potentially-contaminative activities on and surrounding the site
- The environmental setting including predicted geology, hydrogeology, hydrology and ecology
- Consultation of records from Development Services, SEPA, SNH, Historic Scotland, RCAHMS, etc.
- Any potential liabilities relating to the site in terms of Council Ownership
- An economic assessment of the site
- Possible development opportunities

Phase II – Site Investigation
The purpose of an intrusive site investigation is to test the assumptions made in the Phase I desk study. A Phase II investigation involves an assessment on the contamination present. Trial pits and / or boreholes are installed to create a three-dimensional picture of the ground conditions of the site. The investigation may include gas testing for methane, carbon dioxide and volatile or potentially explosive organic compounds. There may also be a hydrological assessment, and geophysical exploration may be used on larger sites to determine the outline of underground structures. The report at Phase II includes the following:

- An updated Conceptual Site Model
- An updated Qualitative Risk Assessment
- Supplementary Site Investigations (where applicable)
- Quantitative Risk Assessment and / or Numerical Analysis
- Identification of Unacceptable Risks

Phase II incorporates a quantitative risk assessment based on the findings of the intrusive investigation. This considers contamination hazards, migration pathways and human and environmental receptors. Among the factors that have to be considered in the risk assessment are:

- Underlying Geology, drift deposits and made ground
- Surface and Groundwater (perched waters, drift system, bedrock aquifers)
- Distribution of Contaminants (diffuse or point sources, water soluble or Dense/Light non-aqueous phase liquids)
- Geotechnical parameters (particle size, permeability to water and gas, strength, deformability)
- Chemical properties (behaviour of contaminants, acidity/alkalinity (pH), red-ox potential (eH), organics)
- Biological Properties including indigenous microbial populations

The sampling design for site investigations is in accordance with the guidance contained within the DEFRA publication "Sampling Strategies for Contaminated Sites". Sampling methods ensure that sampling techniques are appropriate to the media investigated. They should be supplimented by visual/olfactory evidence, use procedures to prevent cross contamination and be sufficient to delineate the extent of contamination.

Sampling patterns can be either targeted (found/identified) or non-targeted (systematic grid *e.g.* "herringbone" pattern). Selection of the appropriate sampling pattern is dependent on the Conceptual Site Model devised during the Phase I study, considering the need to locate potential "hot spots" of contamination and more diffuse pollution.
The guidance on chemical analysis includes the following requirements:

- Appropriate laboratory methods
- The importance of detection limits
- The importance of laboratory QA/QC
- Tailored to previous and current site uses
- Consideration of adjacent land uses
- Evidence for modifying mechanisms
- Identification of microbial species or bio-toxins
- Interpretation of results

This ensures that the interpretation of results is both reliable and valid. The results should seek to confirm or dispute the anticipated main pollutant linkages and contain distribution and behaviour characteristics of any particular contaminants. They should represent accurately the concentrations of any contaminants of concern as defined. Any available dilution or attenuation factors should be evaluated.

Interpretation of the relevant results should eventually lead to selection of the most effective remedial solution (if applicable). Selection of the relevant options is based on the following factors:

- Economics
- Sustainability
- Technical Feasibility / Liability
- Permanence (residual risk/liability)
- Long term management/liability

Phase III – Remedial Options
The criteria against which the assessment takes place are drawn from the risk assessment and the required physical and chemical site conditions defined previously. Published information concerning each option, such as technical reviews, statements of capability and the relative cost implications are used as required to complete the assessment. Considerations at Phase III include:

- The identification of Final Options
- Detailed Remediation Design
- Constraints to Future Use
- The desired End Condition

Phase IV – Verification of successful remediation

Evidence to demonstrate remediation has been carried out to the required standards should be recorded. This reporting should also consider any unexpected conditions and how these were addressed and make clear any ongoing site contraints to ensure the remediation remains valid – for example maintenance of the integrity of gas protection measures.

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