A guide to small brownfield sites and land contamination

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Where we are

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A guide to small brownfield sites and land contamination

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Summary

Small brownfield sites pose particular challenges to landholders, developers, builders and their advisors and funders. Development of brownfield sites can be hindered by derelict structures, below-ground obstructions or voids, land contamination, poor ground, archaeological features and buried services because they have been previously used. Small sites can have difficulties with access, and space for storage of materials, vehicles and plant, and are particularly vulnerable to programme delays and unforeseen technical and engineering issues, which can threaten the viability of the project. However, small sites can be developed relatively quickly if they have been planned and managed well. This leads to quicker return on investment than large sites, and often does not need significant infrastructure development to support the site.

This guidance provides advice to help readers overcome the barriers and issues that can obstruct the development and management of small brownfield sites. It gives general guidance on the technical, financial and planning issues, with an emphasis on managing land contamination.

- Small-scale developers who do not routinely develop brownfield sites, or who are up-scaling into small development sites will find it a useful entry-level guide to finance and the planning process, and an accessible introduction to dealing with land contamination and other technical issues.
- Advisors, including engineers, geoenvironmental consultants, architects, planners, surveyors and solicitors, will find it a useful cross-disciplinary overview of small brownfield site preparation and land management.
- Landowners will find **Chapter 8** useful where they hold portfolios of small brownfield sites that require ongoing management.

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Glossary

Abnormal costs	Costs over and above the 'norm'. These can include the cost of carrying out ground treatment works, site remediation works, diverting existing services within the property, and the cost of bringing services to the boundary of the property.
Beneficial owner	A legal term where specific property rights ('use and title') in equity belong to a person even though legal title of the property belongs to another person (Garner, 2001).
Brownfield land	Land previously used for industrial, commercial or residential uses. Such land may have been contaminated with hazardous waste or pollution or is feared to be so.
Building regulations	Building regulations are minimum standards for design, construction and alterations to virtually every building. They are developed by the government and approved by Parliament.
CL:AIRE Definition of Waste Code of Practice	A process that facilitates the reuse of excavated materials on site or their movement between sites.
Construction (Design and Management) Regulations 2015	The main government regulations for managing the health, safety and welfare of those working on construction projects.
Cluster project	Under CL:AIRE (2011), this manages the treatment and reuse of soils from a number of sites located close by sharing an environmental permit for treatment, located on a single Hub site.
Community infrastructure levy	A planning charge on a development, introduced by the Planning Act 2008, which acts as a tool for local authorities in England and Wales to help deliver infrastructure to support the development of their area.
Conceptual site model	A representation of the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (Defra and Environment Agency, 2004).
Contaminated land	*"A legal term to define 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 controlled waters is being caused, or there is a significant possibility of such pollution being caused."* (Defra, 2012).
Desk study	An examination of all existing information concerning a site (eg geological maps, previous borehole records, historical mapping) to develop a preliminary understanding of ground conditions and previous land use (Gaba *et al*, 2017).
Detailed quantitative risk assessment	Risk assessment carried out using detailed site-specific information to estimate risk or to develop site-specific assessment criteria (Defra and Environment Agency, 2004).
Development plan	A development plan comprises a set of documents that set out the local authority's policies and proposals for the development and use of land in their area. The plan guides and shapes daily decisions as to whether or not planning permission should be granted, under the system known as development control.
Ecologically designated sites	Internationally, nationally or locally-designated sites of ecological importance, for example Ramsar Sites (wetlands of international importance designated under the Ramsar Convention), Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), and Local Nature Reserve (LNR).

Environmental due diligence	An assessment of potential environmental liabilities in order to understand exposure to risk. Aspects can include land contamination, environmental legal compliance, flood risk, ecology and asbestos.
Environmental risk assessments	The formal process of identifying, assessing and evaluating the health and environmental risks that may be associated with a hazard (Defra and Environment Agency, 2004).
Generic quantitative risk assessment	Risk assessment carried out using generic assumptions to estimate risk or to develop generic assessment criteria (Defra and Environment Agency, 2004).
Ground investigation	The sub-surface field investigation, with the associated sampling, testing and factual reporting, see site investigation (Gaba *et al*, 2017).
Ground model/conceptual ground model	A conceptual model based on the known geology, geotechnics, chemistry and morphology of the site, used to speculate on likely ground and groundwater conditions and their variability.
Hazard	An event, process or mechanism that could affect the viability of the site, the environment or safety and well-being of the public and construction workers (Gaba *et al*, 2017).
Land (affected by) contamination	Land that might have contamination present which may, or may not, meet the statutory definition of contaminated land (Defra and Environment Agency, 2004).
Legal charge	A legal charge (a type of mortgage) is the means by which lenders enforce their rights to a property, registered at HM Land Registry.
Loan-to-value ratio	A financial term used by lenders to express the ratio of a loan to the value of an asset purchased. Developers frequently enter into loan-to-value (LTV) covenants with lenders, which require the developer to maintain a specified LTV ratio during the development.
Made ground	Any artificially-placed material, including topsoil, sub-soil or fill materials.
Materials management plan	Under CL:AIRE (2011), this document describes how soils will be reused at a site, provides specific evidence that the materials can be considered non-waste, and details how material movements will be tracked and verified.
Naturally-occurring soil	Clean naturally-occurring soil and mineral materials, as defined by CL:AIRE (2011), includes: ● soil, both topsoil and subsoil ● parent material ● clays, silts, sands and gravels ● underlying geology ● made ground consisting of only these materials, such as an embankment which is to be removed and is suitable for use without any processing. The materials must be sourced from: ● greenfield sites not subject to past contaminative use ● brownfield sites where the natural soils have been extensively characterised and proven to be clean.
New homes bonus scheme	This is paid to local authorities by central government, with the aim of encouraging local authorities to grant planning permissions for the building of new houses in return for additional revenue. Under the scheme, the government matches the council tax raised on each new home built for a period of six years.
Opportunity cost	Choosing the best alternative value (cost) when making a decision.
Pathway	A route or means by which a receptor could be, or is, exposed to, or affected by, a contaminant (Defra and Environment Agency, 2004).

Permission in principle	This is a new consent route, which is an alternative way of obtaining planning permission for housing-led development. It *"separates the consideration of matters of principle for proposed development from the technical detail of the development"* (MHCLG, 2017). It is government-led initiative to speed-up housing delivery and provide greater certainty of the development potential of residential sites.
Permitted development	Permitted development rights are a national grant of planning permission that allows certain building works and changes of use to be carried out without having to make a planning application. Rights are subject to conditions and limitations to control impact and to protect local amenity.
Phase 1	Usually comprises a desk study and site walkover to identify sources, pathways and receptors and site topography/geology and access.
Phase 2	The main investigation and risk assessment, comprising intrusive ground investigation, soil groundwater and gas sampling and environmental risk assessment.
Phase 3	Development of the remediation strategy. Selecting the best options to remediate contamination and planning the verification works.
Phase 4	Remediation implementation.
Planning conditions	These are applied to a planning permission, and may include the need to carry out phase 1 to 4 as appropriate. Planning conditions should only be imposed where they are 'necessary', *"relevant to planning and to the development to be permitted, enforceable, precise and reasonable in all other respects"* (DCLG, 2012).
Pollutant link(age)	Where a source (of contamination) and a receptor are linked by a pathway, so that the receptor is at risk from the source (Defra and Environment Agency, 2004).
Preliminary risk assessment	First tier of risk assessment that develops the initial conceptual model of the site and establishes if there are any potentially unacceptable risks (Defra and Environment Agency, 2004).
Principal contractor	Lead contractor with duties under CDM 2015 to plan, manage, monitor and co-ordinate health and safety (H&S) in the construction phase of a project (for projects with more than one contractor in the construction phase).
Principal designer	Lead designer with duties under CDM 2015 to plan, manage, monitor and co-ordinate health and safety in the pre-construction phase of a project (for projects with more than one contractor in the construction phase).
Receptor	In general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body (Defra and Environment Agency, 2004).
Remediation	Action taken to prevent or minimise, or remedy or mitigate the effects of any identified unacceptable risks (Defra and Environment Agency, 2004).
Residual value	The process of valuing land with development potential. The sum of money available for the purchase of land can be calculated from the value of the completed development minus the costs of development (including profit).
Risk	A combination of the probability and consequences of a hazard occurring (Gaba *et al*, 2017).
Risk register	A list of risks arising from relevant hazards and the means management and benefits of mitigating them (Gaba *et al*, 2017).

Scheduled monument	An historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Culture, Media and Sport, and accessible on the Historic England website. Once a monument is scheduled any works to it (including flooding and tipping operations that might affect it, with a few exceptions) require scheduled monument consent from the Secretary of State.
Section 106 (S106)	Planning obligations under S106 of the Town and Country Planning Act 1990 are a legal mechanism that makes a development proposal acceptable in planning terms that would otherwise not be acceptable.
Site investigation	The assessment of the site, including desk study, planning and directing the ground investigation, and interpretation of the factual report (Gaba *et al*, 2017).
Site waste management plan	A plan for delivering materials and resource efficiency. It provides a structured approach to waste minimisation and management during the construction and demolition of buildings, structures and infrastructure.
Special area of conservation	These are strictly protected sites designated under Council Directive 92/43/EEC (Habitats Directive).
Special purpose vehicle	A legal entity (usually a limited company) created to fulfil narrow, specific or temporary objectives. They are typically used by companies to isolate the firm from financial risk.
Verification	The process of demonstrating that the risk has been reduced to meet remediation criteria and objectives based on a quantitative assessment of remediation performance (Defra and Environment Agency, 2004).
Verification plan	A plan setting out the requirements for gathering data to demonstrate that remediation meets the objectives and criteria (Defra and Environment Agency, 2004).
Walkover survey	Visual inspection carried out on foot, of a site or linear route to collect data regarding surface conditions, topography, past and present land use etc. It is usually conducted as part of desk-based assessment.

Abbreviations and acronyms

BBA	British Board of Agrément
BCB	Building control body
BOPAS	Buildoffsite Property Assurance Scheme
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CCNP	Construction compliance and notification plan
CIL	Community infrastructure levy
CML	Council of Mortgage Lenders
CSM	Conceptual site model
DoWCoP	Definition of Waste Development Industry Code of Practice
EHO	Environmental health officer
EIA	Environmental Impact Assessment
EWC	European Waste Catalogue
GAC	Generic assessment criteria
GI	Ground investigations
GP	General practitioner
HBF	Home Builders Federation
JV	Joint venture
LNR	Local nature reserve
LoW	List of Wastes
LTV	Loan to value
MCERTS	Monitoring Certification Scheme
MMP	Materials management plan
MNA	Monitored natural attenuation
NERC	Natural Environment Research Council
NIEA	Northern Ireland Environment Agency
NPPF	National Planning Policy Framework
NQMS	National Quality Mark Scheme
NRW	Natural Resources Wales
PC	Principal contractor
PCC	Professional consultant's certificate
PD	Principal designer
PIP	Permission in principle
POP	Persistent organic pollutant
PPE	Personal protective equipment
QP	Qualified person
RPS	Regulatory position statement
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SiLC	Specialist in Land Condition
SNRH	Stable non-reactive hazardous
SPV	Special purpose vehicle
SSAC	Site-specific assessment criteria
SSSI	Site of Special Scientific Interest
SuDS	Sustainable urban drainage systems
SuRF-UK	UK Sustainable Remediation Forum
SVE	Soil vapour extraction
SWMP	Site waste management plan
TDC	Technical details consent
TPO	Tree preservation orders
UKAS	United Kingdom Accreditation Service
UXO	Unexploded ordnance
VAT	Value added tax
VP	Verification plan
WAC	Waste Acceptance Criteria
WRAP	Waste and Resources Action Programme

1 Introduction

This guidance provides clear and simple advice to steer a path through the various barriers and issues that can hinder the development and management of small brownfield sites, whether for commercial, residential, parks/green spaces, or industrial use. It provides a general guide to technical, financial and planning issues, with an emphasis on dealing with land contamination.

It is intended that the guidance will help promote the development of small brownfield sites and return them to beneficial use.

Small brownfield sites pose particular challenges to landholders, developers, builders and their advisors and funders. Development of brownfield sites can be hindered by derelict structures, below-ground obstructions or voids, land contamination, poor ground, archaeological features and buried services because they have been previously used. Ecology, in the form of invasive or protected species, can also affect project programme and cost.

Small sites can have difficulties with access, and space for storage of materials, vehicles and plant. Party wall issues and the effect of construction on neighbours may need special consideration, and there may be off-site issues that need managing such as protecting the roots of trees beyond the site boundary, or managing pollution that has migrated from a neighbouring site. The options for dealing with land contamination and waste materials may be limited by the space available. Small sites are particularly vulnerable to programme delays and unforeseen technical and engineering issues, as small profit margins and limited space constrain management options, and can threaten the viability of the project. However, if well planned and managed, small sites can be developed relatively quickly, giving a faster return on investment than large sites, and often do not need significant infrastructure development to support the site. **Table 1.1** shows the benefits and challenges of developing small brownfield sites.

Table 1.1 Benefits and challenges of small brownfield sites

Benefits	Challenges
• less capital is locked up • access to existing infrastructure (eg roads and utilities) • close to employment, services, shops, schools, general practitioners (GPs) • less likely to require financial contributions, for example, to school provision or highways • less local opposition.	• securing finance • navigating planning system • managing risks associated with former use • boundary and party wall issues may be prominent • neighbours are closer and construction impacts are more likely to cause nuisance • securing access is critical • spatial constraints may limit what can be built.

Development of brownfield land is a key part of the UK Government's strategy to increase house building across the country. A number of financial initiatives have recently been introduced (see **Section 3.5**), and there have been significant changes in the planning system. These aim to solve the problem of low profit margins and planning delays.

This guide also provides information for landowners and their advisors who hold small brownfield sites that are not intended for immediate development, but require ongoing management to ensure that risks are appropriately addressed.

1.1 WHAT IS SMALL?

Development sizes are defined differently in various legislation and guidance (see **Table 1.2**). In practice, many developers view sites of less than 50 homes as small. While this guidance is specifically aimed at developers of small sites, the issues discussed here will be relevant to many larger sites.

Table 1.2 Definitions of small sites

Source	Definition
Minor development	
Town and Country Planning (Development Management Procedure) (England) Order 2010 (S2)	(a) the number of dwelling houses to be provided is less than 10; or (b) the development is to be carried out on a site having an area of less than 0.5 hectares and it is not known whether (a) is true; (c) the provision of a building or buildings where the floor space to be created by the development is less than 1000 square metres; or (d) development carried out on a site having an area of less than 1 hectare.
Town and Country Planning (Development Management Procedure) (Wales) Order 2012	(a) the number of dwelling houses to be provided is less than 10; or (b) the development is to be carried out on a site having an area of less than 0.5 hectares and it is not known whether (a) is true; (c) the provision of a building or buildings where the floor space to be created by the development is less than 1000 square metres; or (d) development carried out on a site having an area of less than 1 hectare.
Major development	
Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009[1]	**Housing** Construction of buildings, structures or erections for use as residential accommodation. (a) the development comprises 50 or more dwellings; or (b) the area of the site is or exceeds 2 hectares. **Business and general industry, storage and distribution** Construction of a building, structure or other erection for use for any of the following purposes: (a) as an office; (b) for research and development of products or processes; (c) for any industrial process; or (d) for use for storage or as a distribution centre. (a) the gross floor space of the building, structure or other erection is or exceeds 10 000 square metres; or (b) the area of the site is or exceeds 2 hectares.

Note

1 In Scotland, all development other than national developments and major developments belongs to the category of local developments. The category of national developments are development or classes of development designated as such in the NPF under section 3A(4)(b) of the Town and Country Planning (Scotland) Act 1997, as inserted by S1 of the Planning etc. (Scotland) Act 2006.

Source	Definition
The Planning (Development Management) Regulations (Northern Ireland) 2015	**Housing** (a) development that comprises 50 units or more, or (b) the area of the site exceeds 2 hectare For retail, community, leisure and culture (a) development that comprises less than 1000 square metres gross floor space outside town centres, or (b) the area of the site is less than 1 hectare. **Business, industry** (a) development that comprises less than 5000 square metres gross floor space, or (b) the area of the site is less than 1 hectare.
Small-scale development	
Lewis (2014)	...developments of 10 units or less, and which have a maximum combined gross floor space of no more than 1000 square metres (gross internal area).

1.2 WHAT IS BROWNFIELD?

For the purposes of this guide, brownfield is defined as any land that has previously been developed. This is consistent with the definitions given in national planning policy (eg DCLG, 2012, Scottish Government, 2014, Welsh Government, 2016 and DOENI, 2015a).

This guide may also be useful for sites that have not been previously used, but are potentially affected by contamination.

1.3 WHO SHOULD USE THIS GUIDE?

This guide is intended to help developers of small brownfield sites, landowners, and their advisors. It is applicable to all kinds of development including domestic, commercial, and industrial use, and for self-build projects and extensions.

- Small-scale developers who do not routinely develop brownfield sites, or who are up-scaling into small development sites will find it a useful entry-level guide to finance and the planning process, and an accessible introduction to dealing with land contamination and other technical issues.
- Advisors, including engineers, geoenvironmental consultants, architects, planners, surveyors and solicitors, will find it a useful cross-disciplinary overview of small brownfield site preparation and land management.
- Landowners will find **Chapter 8** useful where they hold portfolios of small brownfield sites that require ongoing management.

The guide is intended to be useful across the UK. Where practices and regulations differ across the devolved administrations of Wales, Scotland and Northern Ireland, the reader is signposted to relevant regional guidance. In all cases, it is recommended that developers, landowners and their agents seek the most up-to-date advice from the relevant authorities in the location of the development site.

1.4 SMALL BROWNFIELD PROJECTS

This guide is structured around the key phases of a development project, which are:

- **Before buying.** Assessing whether the project is viable and managing risks.
- **Planning applications.** Engaging with planners and their consultees, warranty providers and building control surveyors, and developing technical reports (for example, environmental risk assessments).
- **Preparing for building works.** Dealing with land contamination, environmental mitigation, licences and permits.
- **Construction.** Site remediation, ground improvement, managing waste, site inspections.
- **Closeout.** Important details once the building phase is completed, such as discharging planning conditions.
- Management of dormant brownfield sites.

The issues are categorised under financial, planning and technical as shown here:

	Chapter and section				
	3	4	5	6	7
Financial	3.1, 3.4, 3.5			6.6	7.4
Planning	3.3	4.1, 4.3	5.2	6.5	7.5
Technical	3.2, 3.6	4.2, 4.4, 4.5	5.1, 5.3 to 5.9	6.1 to 6.4, 6.7	7.1 to 7.3, 7.6 to 7.8

Throughout the guide the following symbols are used along with the text to help identify the types of information being presented:

Figure 1.1 shows the phases of a typical project, and the key issues for each phase.

The guide is focused on land-related issues, with an emphasis on dealing with land contamination. It also provides information on the planning process and an overview of property finance. The issues discussed are specific to small brownfield sites, and the following topics are either not covered, or not covered in detail:

- initial market demand and perceived need assessments
- procurement and supply chain
- planning policy, urban design, local plans, community consultation, master planning, transport and access

- design and construction of buildings
- drainage strategy, utilities strategy, noise, and demolition
- flood risk, ecology and archaeology.

Box 1.1
Construction (Design and Management) Regulations 2015 and small brownfield sites

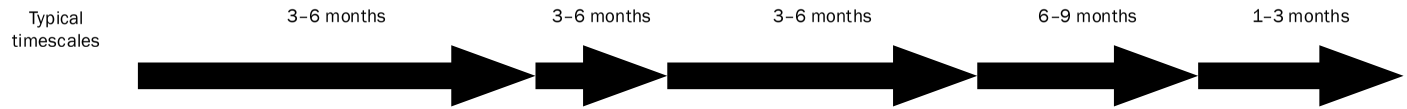
The Construction (Design and Management) Regulations 2015 (CDM 2015) ensure that health and safety issues are considered at all stages of a project, from initial considerations, through to use, maintenance and final disposal.

For small brownfield sites, it is important that a principal designer (PD) is appointed early in the process (where there is the likelihood of two or more contractors being engaged during the construction phase).

In addition to the client/developer's duty to provide information to the PD, many pre-construction activities such as site investigation or remediation are covered by CDM 2015.

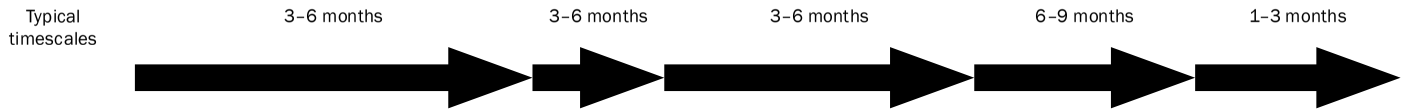
There must be a written health and safety (H&S) file, which must be produced for and retained by the building owner. The file contains information so that future work (including cleaning, maintenance, alterations, refurbishments and demolition work) can be carried out on the site or structure. It is important that information about contamination remaining on site is recorded in the H&S file. For example, it may be appropriate to encapsulate soils affected by asbestos below an area of hardstanding, but this must be recorded so that future work can be safely managed.

HSE (2015) provides comprehensive guidance on CDM (2015).



Phases	Pre-acquisition	Pre-planning	Planning submission	Post-planning	Construction	Close-out
Contamination	Due diligence (may require Phase 1 preliminary investigation report) **Section 3.2**	Phase 1 preliminary investigation report (planners may require a Phase 2 intrusive investigation) **Section 4.2.2**		Agree scope with EHO and undertake Phase 2 intrusive investigation. (May be cost-effectively combined with geotechnical investigation) **Section 5.3** *Note that gas monitoring can take between six weeks and 12 months.* Prepare remediation strategy and verification plan **Section 5.4**	Remediation works Maintain record of works and verification testing and monitoring Deal with any unexpected contamination **Section 6.1**	Verification testing and collation of all records in accordance with verification plan Prepare the verification report *Long-term monitoring may be required* **Section 6.1** **Section 7.2**
Planning	Planning context **Section 3.3**	Planning strategy Pre-application discussion with planners **Section 4.1**	Application Validation Consultation Determination	Identify pre-start and pre-occupation conditions and sequence	Submit minor or major amendments to scheme if changes are needed to plans **Section 6.5**	Submit verification report to discharge planning condition(s) **Section 7.5**
Warranty providers and building control surveyors		Engage with warranty providers **Section 4.4** Engage with building control body **Section 4.5**		Building control full plans submission	Building control site inspections **Section 6.7**	Final inspections **Section 7.1** Provision of warranties to purchasers **Section 7.1** Building control completion certificate

Figure 1.1 Phases of a typical project and key issues



Phases	Pre-acquisition	Pre-planning	Planning submission	Post-planning	Construction	Close-out
Finance	Obtain funding Allow contingency Plan funding mechanisms throughout the life of the project including exit strategy **Section 3.4**	Determine CiL and Section 106 contributions **Section 4.3**		Design contracts to achieve appropriate risk allocation Ensure draw-down of funds ties in with programme	Draw-down funds Site inspections by funders Assess whether contingency is still adequate	Implement exit strategy
Other technical and engineering	Due diligence. Prepare risk register considering contamination, geotechnical, archaeology, ecology, flooding, access etc **Section 3.2**	Commission reports required by planners to support the submission Update the risk register Use site designs to minimise waste soil generation		Ensure foundation, drainage, SuDS, ecology and landscape designs tie in with remediation strategy Update risk register	Waste management **Section 6.3** Update risk register	Waste management verification
Key decisions	Project viability assessment – will it make a profit? What is the right purchase price? **Section 3.1**	Select project team Review site layout/ use in light of technical information and constraints		Will a more detailed Phase 2 investigation lead to a more cost effective remedial solution? Should construction plans be changed due to new information?	Should construction plans be changed to accommodate site conditions?	

Note

The colour coding indicates financial, planning, technical issues (see page 5)

Figure 1.1 Phases of a typical project and key issues (contd)

2 The project team

Any development requires input from a range of professionals and getting the team right is important to the success of the project.

Figure 2.1 shows the make-up of a typical project team.

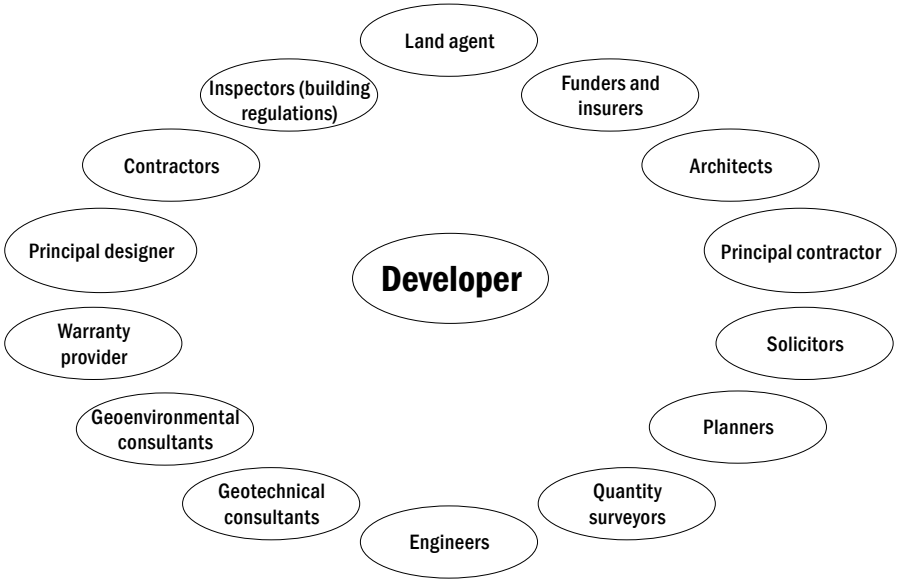


Figure 2.1 The project team for brownfield development

It is important to work with practitioners who are suitably experienced and provide valuable, effective and applicable advice relevant to the appropriate development phase. Selection on price alone may lead to poor guidance, resulting in project delay costs that far outweigh the savings made on professional fees in the early project stages. It is also worth bearing in mind the size of the organisation. Larger companies may be able to provide a wider range of staff and have resilience, whereas smaller organisations are more likely to provide personal continuity and may be better able to respond flexibly to smaller projects. Developing a network of professionals who can work together is extremely valuable. In this way, early advice can be sought at relatively low cost. Getting good quality professional advice at the right time will help a small brownfield site achieve success, as well as developing an early understanding of likely risks.

2.1 HOW TO DEVELOP A PROJECT TEAM

The following tips will help with finding good quality and reliable professionals:

- Ask for recommendations from other contacts in the industry.
- Search online with chartered institutions and accreditation bodies.
- Check the qualifications and accreditations of individuals and/or firms.
- Ask potential team members for references.

With regard to land that may be contaminated, the National Planning Policy Framework (NPPF) requires that *"adequate site investigation information, presented by a competent person, is presented"* (DCLG, 2012). Guidance from experts or specialist consultants who are suitably qualified and competent should be sought. They will normally be chartered members of an appropriate professional body who can show that they have relevant knowledge and experience. Typical qualifications and/or accreditation for the project team members are given in **Appendix A1**.

Case study 2.1

Getting professional advice saves time and money

A small office development was planned at a riverside site. The development was to convert existing commercial premises into an eco-office building through part refurbishment and part new build. The developer employed a drilling contractor to undertake ground investigations and to submit contamination reports to the local authority to fulfil planning conditions.

The reports were rejected by the local authority as they had failed to properly address environmental risks to groundwater and the river. Testing had focused on geotechnical testing and soil contamination testing, and no groundwater levels or quality information had been collected. An environmental consultant was then employed to meet the requirements of the local authority. It became evident that the original ground investigation work had not gained the necessary information, and further drilling works had to be undertaken to install groundwater monitoring wells at the site. The developer would have saved both time and money by employing the appropriate consultant earlier in the process, to ensure the ground investigation would provide the necessary information, and the correct assessments were prepared for the planning authority.

Planning policies

Note that the planning policies of the devolved administrations do not explicitly mention the competency of the people undertaking the work. However, they do require the impacts of development on land that is contaminated to be assessed and for land to be remediated to make it suitable for use.

3 Before buying a small brownfield site

3.1 IS THE PROJECT VIABLE?

Many large developers often self-fund projects, but smaller sites are usually developed by smaller firms that require external funding. So it is important to demonstrate financial viability, not only to ensure the success of the project, but to show funders and other third parties that the project can succeed.

First, carry out a project appraisal to estimate income and costs. This detailed document requires considerable input derived from industry experience, internal cost data, and expertise from the project team.

A well-informed assessment will detail likely project timescales and possible delays, which will help to keep project budgets. For brownfield sites this means understanding the technical issues (for example, ecology, archaeology, land contamination, poor ground conditions, monitoring requirements, and waste management) that may affect project progress, and planning for them accordingly (see **Section 3.2**).

3.1.1 Estimating income

Income is estimated as the income from selling or renting the stock at the end of the project. Market conditions can change dramatically over the possible 12 to 24 months it takes to complete a typical small project, and sales values can rise or fall dramatically in that time. The estimate should take into account numerous comparable data and even the 90-day forced sale valuation (see **Box 3.1**). It is important to assess scheme viability against less optimistic predictions, not only for an organisation's protection, but to ensure that the estimates accord with lenders' criteria.

Box 3.1
90-day forced sale valuation

The 90-day forced sale valuation is the figure a property sale would achieve in a 90-day marketing period and usually in the case of repossession or foreclosure, when the property asset needs to be disposed of quickly. This figure is usually significantly lower than the open market value figure.

3.1.2 Estimating costs

The appraisal document will identify and estimate all significant costs that the project may incur. A two-column appraisal will include best- and worst-case scenarios for each cost line, allowing a range of values to be generated. Sensitivity analysis will help identify the factors that could have the biggest impact on the margin and viability of the proposed development. A quantity surveyor can assist small developers speed up this process, from initial estimates to preparing a detailed bill of quantities.

Commercial lenders will not fund professional fees or VAT. This may pose cash-flow challenges for developers, as a significant proportion of professional costs are

incurred at the start of a project, with no guarantee that the project will proceed. Such costs can include, but are not limited to:

- site survey
- ground investigation reports
- environmental reports including asbestos surveys
- traffic reports
- planning consultants' fees
- pre-application and planning fees
- design fees
- quantity surveying services' fees
- legal costs.

Case study 3.1

The pitfalls of starting development without a project appraisal

A developer in Milford Haven, South Wales, purchased a site with planning permission for 30 units, but did not adequately estimate the costs in advance. The developer used private finance to acquire the site for £500 000, which appeared to be below market value. Work was started on site, putting in foundations, but the developer then required commercial development finance to undertake the construction. Due to the lack of an appraisal and the realisation that project costs were going to exceed initial estimates, the application for finance was declined. Foundation and earthworks contractors had been deployed on site and could not be paid. Consequently, the developer went into receivership, with the site being seized. A good project appraisal before purchase, using professional services, would have revealed that the project was not viable at the purchase price. The appraisal would have entailed some financial cost, which would either have to be written off or enabled renegotiation on purchase price.

3.1.3 Residual values

An understanding of residual values is essential for brownfield developers, as profit depends as much from buying land at the right price as controlling build costs (see **Box 3.2**). The residual land value can be calculated from the value of the completed development minus the costs of the development (including profit). To arrive at a viable land purchase price, work backwards from achievable sales value, including modelling the effect of the 90-day forced sale valuation as a precaution.

Cost of demolition

Brownfield sites may have existing structures that can be renovated, but where these are unsafe or inappropriate, demolition may be required to clear the site for the new development. Demolition costs can significantly affect project viability, and an early and robust assessment of the structural soundness of the buildings, and any necessary demolition costs, is vital.

To adequately assess the residual value of the land, and project viability, it is important that brownfield issues such as land contamination, invasive plant species and difficult ground conditions are considered early on. Costs can vary greatly from site to site, and are difficult to quantify without site-specific information. So it is vital to undertake environmental due diligence before acquiring brownfield land.

Box 3.2
Residual valuation

Residual valuation is the process of valuing land with development potential. The sum of money available for the purchase of land can be calculated from the value of the completed development minus the costs of development (including profit).

Figure 3.1 Completed brownfield development

3.2 ENVIRONMENTAL DUE DILIGENCE

Due to their historic uses, brownfield sites can be affected by a range of issues and challenges including:

- asbestos – many existing (possibly derelict) buildings may contain it
- unexploded ordnance (UXO)
- land contamination, including soils affected by asbestos and ground gas
- made ground that may present geotechnical and contamination issues
- neighbouring industrial/derelict sites
- underground infrastructure such as services, foundations, basements and potentially buried tanks and voids
- sensitive ecological habitats or protected species, particularly on derelict sites which can provide a haven for flora and fauna
- fly-tipped wastes
- archaeological legacy
- mineral extraction, including coal mining
- invasive plant species such as Japanese knotweed and Himalayan balsam.

There is not always a record of polluting activities

Land may be affected by contamination arising from activities for which there is no record, such as informal disposal of waste effluent, fly-tipping or illegal burial of waste materials. Pre-acquisition environmental due diligence should consider how likely it is that activities such as these took place on the site, given the knowledge of the former site use.

Early preliminary assessment of these factors is important to identify the main risks and potential abnormal costs or programme delays. This will allow informed investment decisions to be made (including a decision not to proceed). Gaining knowledge of ground-related risks can also help when acquiring a site, such as:

- negotiation on price
- contingency planning and budgeting
- changes in layout
- risk management and planning.

Case study 3.2

Buying a brownfield site without due diligence investigations

A housing developer purchased a site in an urban area in south Lancashire. No pre-acquisition study was carried out although the past industrial uses were readily apparent. Later desk study and ground investigation revealed that the site had been a former mill with ponds for wash water, which had subsequently been infilled. The infill was tested and found to be contaminated with a range of hydrocarbons that were affecting the underlying aquifer. Carbon dioxide and methane were also found. Also, the infill to the ponds, which occupied a significant proportion of the site, was four metres thick and found to be unsuitable for foundations. The unforeseen abnormal costs were significant, and had a major impact on the project viability and profit. The project eventually proceeded some 12 months later than planned, with significant abnormal costs including remediation and significant ground improvement works.

Box 3.3
Naturally-occurring contamination

Some soil contaminants are naturally occurring, and soils can require remediation to render them suitable for use even where there has not been a previous land use, or polluting activities. Arsenic and lead are commonly found at high concentrations in soils in certain parts of the country where the naturally-occurring rock types contain high concentrations of these metals. Risks arising for lead and arsenic are typically evaluated through ground investigation and risk assessment.

Radon is a naturally-occurring gas that is generated by radioactive decay of minerals in the underlying rocks. This colourless, odourless gas can cause lung cancer if present at high concentrations. In some parts of the country, buildings are more likely to be affected by high radon concentrations, due to the nature of the underlying geology. Risks can be easily mitigated through building design. Developers of small brownfield sites should be aware of radon risks, check whether they are in a radon-affected area, and ensure buildings have radon protection measures included if required.

Guidance on protecting new buildings from Radon can be found in BRE (2015).

Further information can be found at: **www.bre.co.uk/radon**

3.2.1 Models for environmental and ground risk management

Due diligence information allows the project team to make an appropriate response to environmental risks. The following options are available to manage environmental risk:

- Avoid: abort the transaction on the subject site.
- Transfer:
  - from client to contractor, via contract
  - to vendor through negotiation or price reduction
  - via site-specific insurance
  - via design and build contract

- Mitigate: by modifying design or further investigation and assessment.
- Accept: consider that risks are manageable and controlled, and proceed with project.

There is a choice to be made regarding how much investigation should be done, including intrusive ground investigation, before the site is purchased. A ground investigation will provide more information and a comprehensive understanding of risk. However, the initial costs can be significant with the risk of abortive costs should the purchase not proceed, and for small sites this may be prohibitive. **Table 3.1** shows different options for due diligence.

Table 3.1 Environmental due diligence options for the buyer

Approach	Advantages	Disadvantages
Vendor supplies site information	Low cost	Buyers beware – the information may be biased, unreliable or of low quality, and should be reviewed by a competent person
Simple screening study	Low cost, provides some understanding of likely risks	Risks are not fully known and cannot be properly accounted
Full ground investigation and surveys before purchase	Risks are well understood	Up-front cost that may be written off if the project does not proceed
Use of an Escrow arrangement whereby the vendor agrees to set aside funds to be drawn down by the developer against the cost of ground investigations with an agreed abnormal costs list (these arrangements can be continued to include remediation costs)	Low cost and low risk to the developer (with respect to land contamination)	Contractual complexity
An open-book approach whereby the developer and vendor agree to co-fund ground investigation and remediation before agreeing a purchase price	Shared costs	Money may be lost if the site sale does not proceed

3.2.2 Simple screening assessment

Undertaking a simple screening study will give some understanding of geoenvironmental risks at minimal cost. The acquisition, understanding and assessment of this data should be carried out by a geoenvironmental or geotechnical specialist to help make informed decisions. It is important that the site is inspected for the presence of existing buildings/infrastructure and visible signs of possible contamination, including asbestos. This approach is considered particularly appropriate for small brownfield sites, where cost control is paramount, but hazards from poor ground and past uses are distinct possibilities.

The data required, as a minimum, are:

- geological maps (**Figure 3.2**)
- historical maps (**Figure 3.3**)
- environmental data

- any data that the vendor has (although the buyer should beware of vendor-supplied data, which may not be independently derived, and might be misleading)
- local authority planning data for the site or neighbouring sites
- site walkover.

Geological maps and geological hazard data can be purchased from:

- **Geological maps: www.bgs.ac.uk/data/maps/home.html**
- **Borehole logs: www.bgs.ac.uk/GeoIndex**

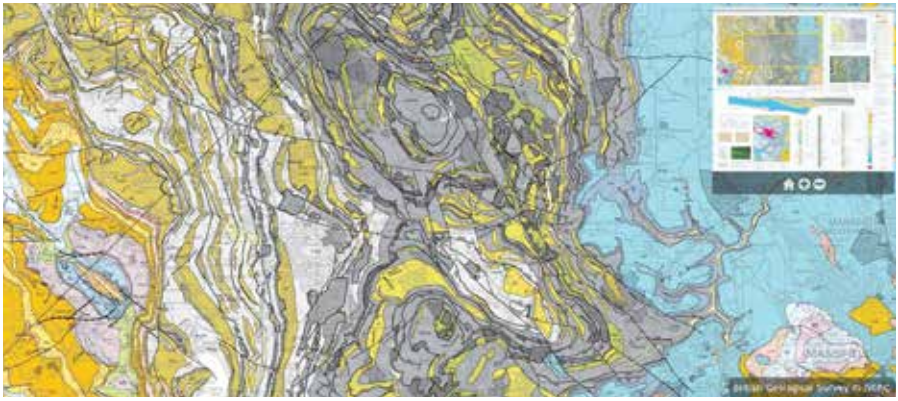


Figure 3.2 Geological map

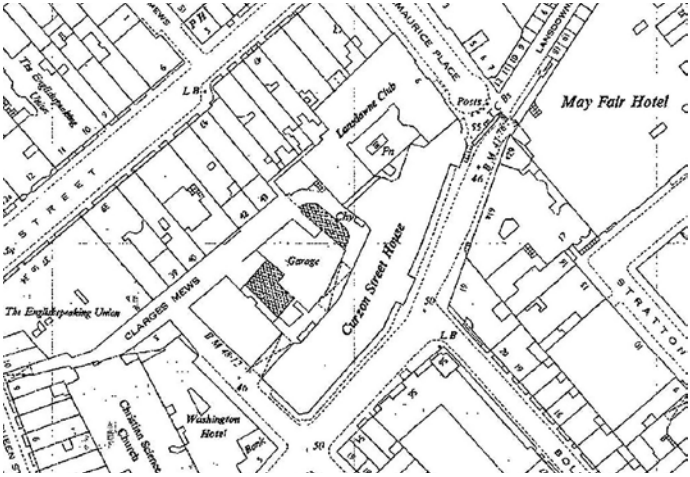


Figure 3.3 Historical map

Historical maps and environmental data for a small site can be purchased online at relatively low cost. Some local authorities will undertake environmental searches, often for a fee. The **Magic website** holds a wide range of information on ecological designations, species and habitats, along with maps and aerial photographs. Note that it does not cover Northern Ireland.

Go to: www.natureonthemap.naturalengland.org.uk

Use of existing reports

Existing reports will be copyright protected, so cannot be copied without the author's permission. Reports can be quoted if they are in the public domain, however technical reports will usually restrict the use to the original client. Written agreement from the author should be obtained.

For land that has been developed or premises that have been worked on since 2007, there should be a H&S file for the site. This should provide information on land contamination, previous remediation, and details of materials moved onto the site.

Existing reports on the site or neighbouring sites can provide useful information, however the age and quality of the reports should be given careful consideration as technical approaches, regulatory standards and site conditions will change over time. There may also be historic surveys of buildings that are/were on the land, for example asbestos surveys and management plans.

Case study 3.3

Phase 1 at pre-acquisition to control project risks

A pre-acquisition study in Warwickshire revealed that a small brownfield site had a varied history revealing a number of potential risks to the housing development. Past uses included:

- A depot understood to be a builder's yard (potential pollutants include fuel, chemicals, asbestos etc).
- Railway buildings and sidings (potential pollutants include fuel, oils and solvents and asbestos).
- An electricity substation. Transformers have commonly used polychlorinated biphenyls (PCBs).
- Vehicle repair and motor servicing businesses (potential contaminants include fuel, oil, solvents, asbestos).
- Methane and carbon dioxide from natural organic materials (eg peat) within the terrace deposits.

The geology was alluvium with potential for soft compressible soils.

The phase 1 study informed a preliminary risk assessment and enabled an effective intrusive ground investigation to be designed and executed. This later informed the mitigation with respect to contaminated land issues and the assessment of foundation requirements. Early identification of these issues enabled project risks to be managed and controlled.

The output can be a brief letter report or email outlining the key issues identified and an outline of the potential risks to the development. Typically, the report will include:

- current site and surrounding land use, including environmental permits and licences
- historic land use for the site and surrounds
- records of infilled land and waste disposal activity
- assessment of likely contamination issues, including soil, groundwater, soil vapour, ground gas and asbestos
- identification of potentially difficult ground conditions
- invasive plant species
- coal mining, mineral extraction

- radon
- archaeological features
- ecology, protected habitats and species
- screening for flood risk
- access constraints.

The screening assessment should not replace the phase 1 preliminary investigation (see **Section 4.2.2**), which will be required if the project is to proceed, usually as part of a planning application. (Note that the site walkover and data acquired as a part of this screening assessment can be used for the preliminary risk assessment.)

3.3 PLANNING CONTEXT

It is important to identify early on whether the development is likely to get planning permission. The planning context should be researched to find out:

- the designated use for the site
- if there are any policies that will restrict the site's development
- the planning history of the site.

The local authority's development plan (local development plan in Scotland and Wales) contains information on local planning policy and specific site designation, and can be found on the local authority's website (**Figure 3.4**). A proposals map is usually available to show land use designations. The most likely common designations are:

- residential
- employment
- town centre uses
- mixed-use development.

Figure 3.4 Development plan example

Planning guidance in England, Wales, Scotland and Northern Ireland

Planning regulations and practices are different across the regions of the UK. England, Wales and Northern Ireland have online planning portals where information on the planning system can be found. For England and Wales, applications can be made online through the planning portal, and for Northern Ireland, planning application forms are provided.

- England and Wales: **www.planningportal.co.uk**
- Northern Ireland: **www.planningni.gov.uk**
- Scotland: **www.eplanning.scot/ePlanningClient**

https://beta.gov.scot/publications/guide-planning-system-scotland

The development plan should provide additional information about the scale and specific type of development that is advised. If the site is shown as 'white land' on the proposals map then it is not designated for any particular use, however, planning policies will still apply. In this instance, the existing use can provide a steer on what type of development would be acceptable in the future.

Site use designations are particularly important for brownfield sites where land contamination may restrict some forms of development. For example, if contamination restricts development of residential housing on a site, it might be appropriate to include some mixed use. However, land use designations in planning may preclude this use. Early discussions with planners should help identify whether there is any flexibility in proposed land uses.

There may be other site-specific designations that can affect the development of a site. These may have slightly different names depending on the authority, and include:

- green belt
- open space
- conservation area
- safeguarded land
- regeneration area.

The first four have potential designations that will have a restrictive effect on the proposed development of a site. However, the regeneration area designation will actively encourage redevelopment.

For brownfield sites, it is particularly useful to look at the site's planning history (ie what planning consents have been previously granted or refused). Conditions attached to, and reports submitted with previous planning permissions can provide useful information about the ecological, geotechnical and contaminated land status of a site. Searches can be carried out either by contacting the council and paying a nominal fee to obtain a list of prior applications, or through the council's website using an address or map-based search.

Not all developments require planning permission, and some can proceed using permitted development rights. Most commonly permitted development applies when the existing and the proposed use falls within the same 'use class'.

In England and Wales, a simplified version of the permitted changes of use can be viewed on the planning portal website. Advice on permitted development in Scotland and Northern Ireland can be found online:

- **England and Wales: www.planningportal.co.uk**
- **Scotland: https://beta.gov.scot/publications/permitted-development-guidance-flowcharts**
- **Northern ireland: www.planningni.gov.uk/pps07_addendum_annexb_permitted**

3.4 FUNDING

Smaller developers may not have the ability to self-fund, requiring investment to progress a project. The most common methods of funding a project are described in **Sections 3.4.1 to 3.4.5**. It may be advantageous to use one type of funding to initiate a project, and to then refinance at a later stage with an alternative product. When external finance is needed, lenders will usually require robust and detailed information about the development before agreeing finance. For brownfield sites, this will include land contamination and geotechnical assessments, with different lenders requiring varying levels of detail.

3.4.1 Cash

The easiest way to finance projects is cash from retained earnings, although many developers may not have such resources available. If cash is available, there will be an opportunity cost associated with it. A developer may be more likely to use cash for site acquisition and then leverage it with commercial finance to undertake a development, rather than undertaking a smaller project which could be fully cash funded.

3.4.2 Joint venture

A developer can team up with a joint venture (JV) partner who has the financial resources to part or fully fund the project. Projects can be fully or partially funded by the JV partner, or a vendor can become a JV partner by contributing the site. The JV partner should take a share of the project, both profit and risk.

3.4.3 Private equity lending

Private equity lenders lend money at a fixed rate of interest, secured against the land and/or other assets held by the developer. The lender benefits from security and certainty, whilst the developer may find that profit margins are increased as the project is not shared. Private equity lenders require security, so may be averse to lending on sites without planning permission.

3.4.4 Commercial lenders

High street banks do not typically fund small developments, however several 'challenger banks' specialise in lending to small developers. These are typically approached via

commercial finance brokers who have the technical knowledge and experience to assess and process applications. Finance is generally available for both site acquisition and development, though the criteria vary from lender to lender.

3.4.5 Crowd funding

This is a relatively new phenomenon allowing investors to pool resources and invest in property projects. Developers can attract investment from small investors who are seeking higher returns than traditional high street deposit accounts can provide. This approach can work for acquisition, though timescales may not be fast. As with most lending, a legal charge will be held over the site and a similar level of due diligence will be required.

3.5 GRANTS AND GOVERNMENT INCENTIVES

Government policy recognises the need for housing and successive governments have made grant funding available to developers, as well as providing incentives for small sites by reducing financial contributions usually made by the developer. The available schemes vary across the UK, and are usually time limited over some years.

3.5.1 Home Building Fund (England)

The Home Building Fund is run by the Homes and Communities Agency (HCA) and provides:

- development finance (loan funding to meet the development costs of building homes for sale or rent)
- infrastructure finance (loan funding for site preparation and the infrastructure needed to enable housing to progress and to prepare land for development).

Loans are typically secured against property assets, with loans from £250 000 up to £250 million available. Small loans are considered for innovative housing solutions and serviced plots for customised housing.

Applicants need to demonstrate that without this funding the scheme would not progress as quickly, or at all, and the project will deliver at least five homes. At the point at which a loan offer is made, applicants are normally required to have a controlling interest in the land and a clear route to achieving planning consent.

Go to: www.gov.uk/government/publications/home-building-fund

Case study 3.4

Project funding through the project cycle

Project funding and cash flow demands vary from project to project. It is important that the developer ensures that the various stages of the project have been planned and adequate funding is in place from the outset. Bridging and commercial development finance is highly structured, but rarely covers all the costs.

In the south-east of England, a developer purchased a five-unit site for £350 000 using a mixture of private equity (£110 000) and bridging finance (£240 000). The initial bridging loan was only available for three months, giving the developer a very short window to plan the build, assemble a team, and arrange to pay back the bridging loan. After the three month period, the bridging loan was replaced with a nine month development finance facility, which was insufficient to complete the build, necessitating additional more expensive private equity finance.

More comprehensive planning of the funding through the project lifespan would have reduced the costs of financing the project.

3.5.2 Help to Buy scheme (England)

The Help to Buy scheme allows new home purchasers to access an equity loan of up to 20 per cent outside of London and up to 40 per cent within London of the purchase price subject to a maximum purchase price of £600 000. The equity loan is funded by the HCA. Developers must be registered with the HCA to be part of the scheme.

Go to: www.helptobuy.gov.uk

3.5.3 Help to Buy scheme (Scotland)

The Help to Buy (Scotland) scheme allows new home purchasers to access an equity loan of up to 15 per cent of the purchase price subject to a maximum purchase price of £200 000. The equity loan is funded by the Scottish Government. Developers must be registered with the Scottish Government to be part of the scheme.

Go to: www.gov.scot/Topics/Built-Environment/Housing/BuyingSelling/lift/FTBOMSEP

3.5.4 Property development fund loan (Wales)

Finance Wales can provide loans of between £250 000 and £1 million to construction companies developing small-scale, non-speculative commercial and residential property, such as:

- new housing developments
- new office, industrial and warehouse developments
- refurbishment projects.

Go to: https://developmentbank.wales/get-business-finance/property-development-loans

3.5.5 Community Infrastructure Levy (CIL) exemptions (England and Wales)

The Community Infrastructure Levy (CIL) can have a considerable impact on the viability of small development sites, so the government has responded by reducing these costs, as follows:

- For sites of 10 units or less, and which have a maximum combined gross floor space of 1000 m^2, affordable housing and tariff style contributions (eg CIL) should not be sought.
- For designated rural areas, authorities may choose to implement a lower threshold of five units or less, beneath which affordable housing and tariff style contributions should not be sought. This will also apply to all residential annexes and extensions.
- Within these designated rural areas, if the five unit threshold is implemented then payment of affordable housing and tariff style contributions on developments of between six and ten units should also be sought as a cash payment only and be commuted until after completion of units within the development.

It will be necessary to contact the local planning authority or seek the advice of a planning agent at an early stage in the project to assess likely costs of CIL and S106 agreements, and factor these into the project viability assessment.

The CIL Regulations apply to England and Wales only. See **Section 4.3** for more detail on CIL and S106.

3.5.6 Land remediation tax relief

Companies can claim £150 tax relief for every £100 spent on clean-up and remediation costs (this equates to a subsidy towards the remediation costs of about 10 per cent and is paid via a reduction in the company's tax bill). As well as soil remediation, eradication of Japanese knotweed is eligible for tax relief under this scheme, provided the knotweed and infested soils are not landfilled. Remediation of naturally-occurring contaminants such as radon is also eligible. Note that the person claiming the tax relief must have acquired a major interest in the land (ie with more than a seven year lease) before remediation. Also, polluters or anyone connected to them cannot claim tax relief.

Go to: https://www.bdo.co.uk/en-gb/services/tax/capital-allowances/land-remediation-relief

3.5.7 Local authority developments

There are many examples of development that are led by local authorities, either as landowner, funder or partner, often to promote social objectives. There are numerous models for this type of activity – **Case studies 3.5 and 3.6** provide examples.

Case study 3.5

Collaboration with local authority for small brownfield site development

The site was previously a dead-end garage area, which was the subject of frequent antisocial behaviour. The local authority had a requirement for affordable housing provision, including a wheelchair-accessible dwelling to meet the needs of a particular family on the housing waiting list.

The design team worked alongside the local authority and local community to devise a scheme that opened up the previously 'closed' area and created access to the green open space of Hitchin Square. This open space, which previously had no natural surveillance or active frontages, is now transformed giving much needed amenity space for the entire community. The site now contains five new three-bedroom family houses and one new three bedroom wheelchair adapted house, overlooking a mews-style street.

The scheme not only developed the site and provided vital housing provision, but resulted in a wider regeneration effect on the surrounding area. The project demonstrates the way that high quality, affordable housing can be provided, which integrates into the existing urban fabric, while also bringing innovative and striking design and improved public realm. This example shows how a collaborative approach between the client, community and local authority can deliver regeneration on a tricky and challenging site that might have otherwise been perceived to be undevelopable.

Case study 3.6

Developing 'stuck' sites

The planning service at Sheffield City Council used its planning enforcement powers to unblock some of the most difficult 'stuck' inner city housing sites in Sheffield. Since its inception in 2012, the project has already been successful in securing applications for 777 homes, some of which are now built and occupied.

The ground-breaking elements in the project are:

- S215 of the Town and Country Planning Act 1990 is used with large-scale direct action by the local authority. If housing owners do not comply with the requirements of S215 notices, the local authority demolishes derelict buildings or makes them wind and watertight, and then recovers its costs from the property owners. Many owners, faced with enforcement action, choose to either maintain or demolish derelict buildings. This project encourages owners to bring sites and buildings back into use, with a particular focus on their housing potential.
- The project creates a virtuous funding circle. In England, the new homes bonus (Wilson *et al*, 2017) is invested in the project, to generate future funding, council tax and business rates.

The project is helping to create a sustainable city. It is focused on maximising the use of brownfield rather than greenfield land for new housing, and it helps support community cohesion by removing amenity problems such as antisocial behaviour. By providing new housing and other land uses, new residents are encouraged to move in, bringing vitality to these areas, formerly blighted by dereliction.

This project demonstrates how planning can shape housing markets, by developing investor confidence, reducing risk and transforming developer's attitudes and behaviour. Owners who neglect their assets are reminded that there are unavoidable maintenance costs if they are waiting for the economy to improve, and a risk of missing opportunities for profit. Other owners who already wanted to carry out development are given the confidence that the local authority will not allow other property owners to blight the area, reducing the risk of investment.

3.6 DEVELOPING A RISK REGISTER

It is important to understand the project risks early in the development process, and update this understanding as more information becomes available. The most effective way to capture and manage risks to the site development is by using a risk register. It does not need to be a complex process and should ideally be carried out in collaboration with the appointed professional advisors.

A PD should be appointed early on (if there is going to be more than one contractor in the construction phase). The PD should co-ordinate the development of a risk register, and should seek to minimise health and safety risks as well as the project performance risks.

Risks are considered in terms of the probability of an occurrence and the consequence of it happening. The probability is ranked from unlikely to high likelihood, and consequence from minor to severe. **Figure 3.5** shows the resulting risks, which are described as very low, low, moderate/low, moderate, high and very high (Rudland *et al*, 2004). This approach is recommended as a transparent method of managing risks throughout the development process.

Table 3.2 presents an example of a completed risk register. For each event, a probability and consequence are identified, and a resulting risk is attributed. Mitigation measures are then identified to reduce the risk, and resulting risk level is identified.

A list of typical project risks and potential mitigation measures is presented in **Appendix A3**.

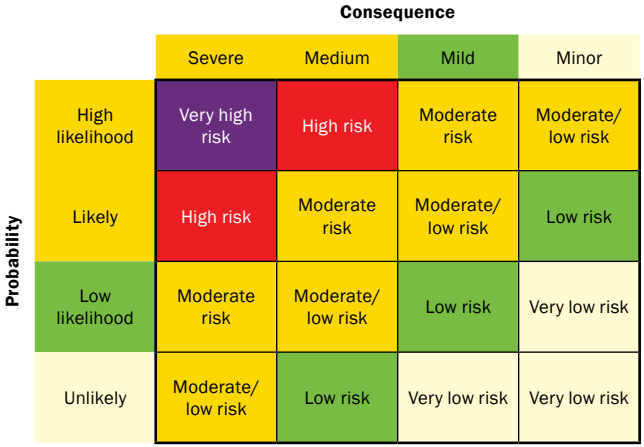
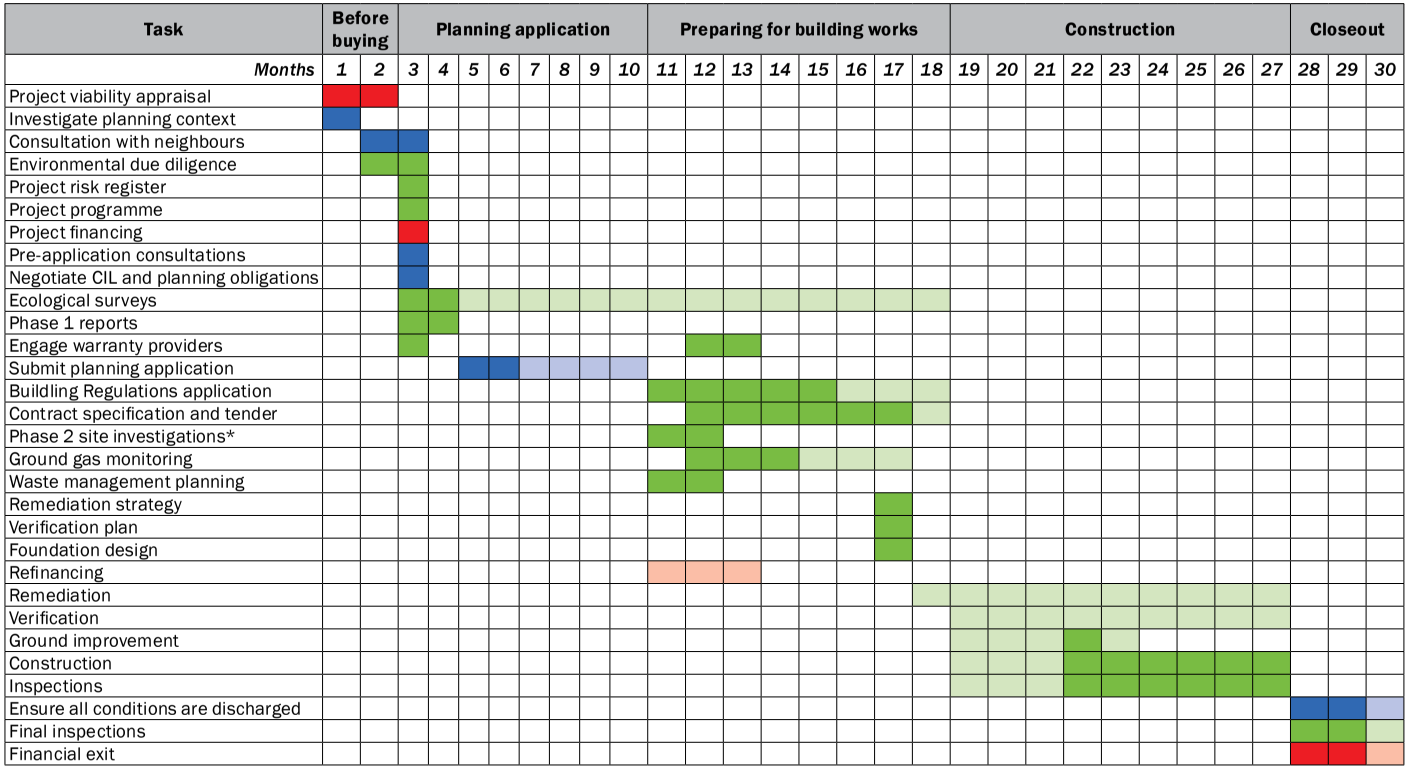


Figure 3.5 Project risks

Table 3.2 Example risk register

Risk description	Risk owner	Consequence	Probability	Consequence	Risk level	Mitigation/ response strategy	Stage	Resulting risk level
Project is 'down-valued' by banks' surveyors	Developer	Breach of banking loan-to-value (LTV) covenants, penalty finance rates, repossession	High likelihood	Severe	Very high risk	Ensure contingency finance is available to restore covenants and complete project	Acquisition, pre-construction	Low risk
Failure to start project on time	Developer	Breach of acquisition finance terms, financial penalties, repossession	Unlikely	Severe	Moderate/ low risk	Allow contingency time to transition from acquisition finance to development finance facilities	Construction through to completion	Low risk
Planning permission refused	Developer	Project cancellation or significant delay	Low likelihood	Severe	Moderate risk	Secure option or lock-out clause on site	Pre-acquisition	Low risk
Building regulations approval not given	Developer	Significant impact on saleability of development	Low likelihood	Medium	Moderate/ low risk	Early engagement with building control body to establish requirements and build into schedule Transfer risk to contractor	Post-planning through to close-out	Low risk
Warranty not approved	Developer	Impact on saleability of development	Low likelihood	Medium	Moderate/ low risk	Early engagement with warranty provider to establish requirements and build into schedule Transfer risk to contractor	Pre-planning through to close-out	Low risk
Difficult ground conditions	Developer	Unforeseen and significant costs may threaten viability of project	High likelihood	Severe	Very high risk	Early desk study, ground investigation	Pre-acquisition through to pre-planning	Moderate/ low risk
Asbestos in soils	Developer	Health risks, remediation costs	High likelihood	Medium	High risk	Ground investigation and risk assessment/remedial strategy	Pre-acquisition through to pre-planning	Moderate/ low risk
Land contamination	Developer	Health risks, environmental pollution, remediation costs	Likely	Medium	Moderate risk	Early desk study, ground investigation	Pre-acquisition through to pre-planning	Moderate/ low risk
Unexploded ordnance	Developer	Explosion during excavation, risk to workers	Low likelihood	Severe	Moderate risk	Desk study and risk mitigation	Pre-construction	Low risk
High groundwater levels	Contractor	Impact on excavations and temporary works	Low likelihood	Mild	Low risk	Desk study, ground investigation	Post-planning	Very low risk

Table 3.3 Project programme



Note that engagement with regulators, building control bodies and warranty providers may take longer than shown, depending on the complexity of the project, the sensitivity of the setting, and the quality of the technical information that is provided.

* In Northern Ireland, phase 2 investigations will be required before submitting a planning application.

3.6.1 Project programme

A key aspect of managing project risks is to develop a project programme and monitor progress as the project develops. Significant delays can be avoided through robust planning, and managed where they do occur. **Table 3.3** is an example project programme, showing the issues discussed in this guide. Block colours show typical timescales, and shaded areas represent commonly-encountered delays or extensions in project programmes.

Note that in Northern Ireland, councils and the Northern Ireland Environment Agency (NIEA) will expect to see contaminated land site investigations and risk assessments accompanying a planning application. Elsewhere in the UK these reports may be required as a condition of the planning permission. Phase 2 site investigations should be carried out before the planning application is submitted.

4 The planning application

4.1 DEVELOPING A PLANNING STRATEGY

A good strategy needs to be in place to obtain planning consent for the development. This should be informed by the knowledge gained about the site's planning context (**Figure 4.1**).

Points to consider include:

- The type of application (see **Appendix A4** for a list).
- The supporting documents to be submitted.

  This information can be found from the local authority's validation checklist, or from the planning history of the site if similar applications have been made in the past. For sites that are known or suspected to be contaminated, at least a phase 1 preliminary investigation report will be needed, and intrusive surveys will be required during the post application phase.

  Heads of Planning Scotland have produced validation guidance for applicants in Scotland (HOPS, 2013).

  In Northern Ireland, if site(s) are known to be, or suspected of being contaminated, then suitable site assessments and an outline remediation strategy (if required) need to be submitted with the application.
- The timescales for submission.

  If required, an ecological survey will need to be undertaken at a certain time of year, potentially affecting the timing of the application. The timings required to meet any contractual requirements with finance lenders should also be borne in mind.
- Pre-application consultation with the local authority.

  Most authorities make a charge for pre-application consultations. It is advisable to be familiar with the local authority's validation checklist, so that discussions can focus on site-specific issues that can be fed directly into the application. The planning officer should consult all relevant internal departments, such as environmental health and highways, and provide details of stakeholders, such as the regional environment agencies (Environment Agency, Scottish Environmental Protection Agency [SEPA], Natural Resources Wales [NRW], NIEA), to allow appropriate scoping and consultation. Once pre-application discussions have opened, consultation can continue until the point of submission. For example, an applicant can ask the council to confirm the calculation of the application fee, so that validation will not be delayed.
- Consultations with other stakeholders.

  There may be a requirement to consult with local residents, and it may be advisable to do so even where there is not a formal obligation. Local services (eg police, fire) may also be interested in the application.

Note that some authorities in England may be operating permission in principle (PIP) for brownfield sites (see **Box 4.2**).

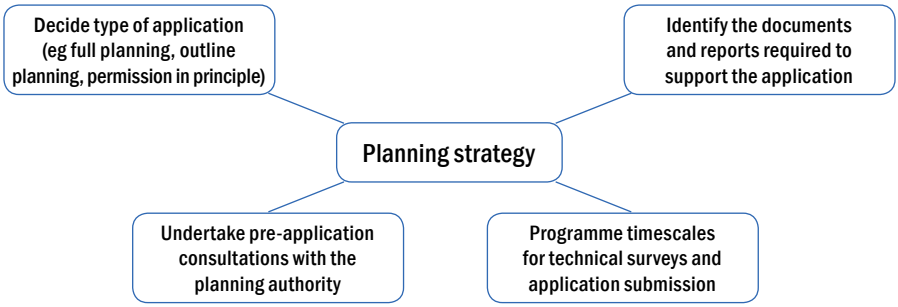


Figure 4.1 Planning strategy

Box 4.1
Phased site assessment

Many site assessments are undertaken in phases. Phase 1 consists of a desk study, site inspection and preliminary risk assessment, and phase 2 includes more detailed investigation and assessment. Phasing is applied to land contamination, geotechnical appraisal, ecological and archaeological assessment, and flood risk assessment. **Sections 4.2.2 and 5.3** give more information on phase 1 and phase 2 geoenvironmental and geotechnical site assessments.

Case study 4.1

Securing a change of land use through planning

A groundwork and civil engineering contractor wished to build 15 houses on an irregular shaped brownfield site in Greater Manchester. However, the site was allocated within the local unitary development plan as an 'established employment area'. At the time of submission, there was also an extant planning permission for employment floorspace at the site.

The planning application for residential properties was supported by an employment land report developed by a planning consultant, which demonstrated that sufficient land existed in the local area to meet employment demand. A marketing report was also published to demonstrate that there was no demand for employment uses at the application site.

Despite the fact that the site was allocated for employment use, with active industrial uses in the immediate area, the application for residential use was unanimously approved at planning committee.

Box 4.2
Permission in principle (England)

From April 2017, every local authority in England is required to keep and maintain a register of developable brownfield sites, which is in two parts:

- **Part 1** lists previously developed land with an area of at least 0.25 ha (or land which is capable of supporting at least five dwellings) that is 'suitable' and 'available' for residential development, and where residential development is 'achievable' (suitable, available and achievable are defined in the Town and Country Planning (Brownfield Land Register) Regulations 2017).
- **Part 2** lists land allocated for residential-led development, which will automatically be given permission in principle (PIP) for development, for five years (or a different length of time if the local planning authority so chooses). The decision to enter a site on 'part 2' lies with the local planning authority.

Note that each local planning authority had to publish its register before 31 December 2017.

For sites with PIP, technical details consent (TDC) will be required before development going ahead. Technical details may include infrastructure and affordable housing provision, layout, access, landscaping and design matters, and potentially land contamination issues. If a site has PIP, the local authority may refuse an application for the technical details needed to implement it (the PIP sets the requirements for the TDC and no additional conditions can be required). However, it cannot revisit the principle of development granted in the PIP. Usefully, PIP can be granted for the conversion and extensions of existing buildings to housing-led development as well as the redevelopment of sites for new housing.

The aim of PIP is to give more certainty to developers and boost development of brownfield land by increasing awareness over the suitability of brownfield land. It is ultimately the aim that authorities will have 90 per cent of brownfield sites with planning permission for housing by 2020, although this can be met through PIP or any other form of planning permission.

The lists of sites have to be reviewed at least annually.

Further information is given in Appendix A5.

Go to: **www.gov.uk/guidance/permission-in-principle**

Make room in the project schedule for an extended planning approval process

In England, planning authorities should determine planning applications within eight weeks, or 13 weeks for major developments. However, many 'major' applications typically take six months to determine, as planning authorities may request more information throughout the determination period. Planning applications for both minor and major development have the same statutory consultation periods, which is 21 days from the date of validation. During that time, the application cannot be determined. For sites with contamination and other issues, it is normal for local authorities to ask for an extension of the statutory time limit. Developers should build realistic time frames into their project programmes, not rely on the statutory guidelines. They should also be proactive in resolving issues early in the process, to reduce delays. Planning authorities are expected to act in a positive and proactive manner, and explain how they have done this in their decision notices.

In Scotland, local developments should be determined in two months (four months for major developments). In Wales, most planning applications are decided within eight weeks, unless they require an Environmental Impact Assessment (EIA), in which case the time limit is extended to 16 weeks. In Northern Ireland, most applications are decided within eight weeks unless they are large or complex – applicants should check with their local planning office.

4.1.1 Planning conditions

For all planning applications, it is normal to have conditions attached that:

- limit the time for which the planning permission is valid
- control the form of development (ie layout, appearance and quantum)
- control the order that the development can be progressed
- mitigate the impact of the construction phase
- require additional detailed surveys and reports (detailed ecological surveys, phase 2 environmental and geotechnical surveys, flood risk assessment, lighting strategy, detailed drainage design etc)
- mitigate the impact of the operational phase.

It is advisable to ask planning officers for the list of draft conditions before the planning committee meeting or the finalisation of their delegated report, so that any onerous or unnecessary conditions can be discussed and removed. Some conditions will incur additional expenditure, and it is important that the implications are understood. For example, some authorities require renewable energy generation to be included in a scheme, or specify sustainability measures such as bicycle parking spaces or thermal performance. It is usual that planning approvals for brownfield sites will include conditions for ground investigations, to be undertaken before works start. If contamination is found, remediation and verification will also be required (note that in Northern Ireland, if site(s) are known to be, or are suspected of being contaminated, then suitable site assessments and an outline remediation strategy (if required) need to be submitted with the application).

Box 4.3
Tests for planning conditions

The NPPF (DCLG, 2012) sets out a series of tests that planning conditions should meet if they are being imposed (paragraph 206) and further guidance on them is contained within planning guidance on the use of conditions (see paragraph 004 of MHCLG, 2014). The tests are that they have to be:

- necessary
- relevant to planning
- relevant to the development to be permitted
- enforceable
- precise
- reasonable in all other respects.

The same requirements are set out in Scottish Government (1998) (Scotland) Welsh Government (2014) (Wales) and DOENI (2015b) (Northern Ireland).

Planning authorities are also expected to limit the use of conditions requiring approval of further matters after permission has been granted 'other than where it will clearly assist with the efficient and effective delivery of development' (paragraph 006 of MHCLG, 2014).

Note that any planning conditions should be communicated to the PD (CDM 2015) so that they can identify whether there are implications for management of health and safety.

The period of time within which development must start is important. Until recently, planning authorities would allow a planning permission to be updated if the permission expired. Now however, if the permission expires, a new application must be made with full fees paid (see **Appendix A2**).

4.2 TECHNICAL REPORTS

A range of technical reports is likely to be requested to support a planning application, including:

- land contamination/geotechnical
- asbestos surveys (a refurbishment/demolition survey is required where the premises, or part of it, need upgrading, refurbishment or demolition)
- phase 1 ecological walkover survey (to include for invasive plant species such as giant hogweed and Japanese knotweed. Other ecological surveys are likely to be required, see **Section 4.2.1**).
- flood risk assessment
- transport statement or assessment (depending on the scale of development)
- framework green travel plan (sometimes this can be requested by a planning condition. Pre-application discussions will establish if that is possible)
- noise survey
- air quality assessment (depending on location)
- archaeological assessment (if in an area likely to have archaeological remains)
- conservation area statement (if in a conservation area)
- structural survey (if demolishing an existing building in part or full)
- lighting assessment (if proposing external lighting and close to sensitive receptors such as existing housing)
- SWMP (this can be requested for both the construction and operational phases)
- utilities statement timeframe (to demonstrate adequate supply)
- drainage strategy (detailed drainage design tends to be with conditions)
- construction environmental management plan.

The requirement for many of these reports depends on the site-specific circumstances. The need for the different documents can be ascertained during pre-application consultation discussions with the local authority. For some surveys, it can be time and cost effective to undertake an initial survey to negate the possibility of having to do a full survey post-planning. It may also be useful in terms of risk management to have gained the understanding that the surveys bring.

In some instances, sites may be bought that have already had surveys undertaken, whether ecological, geotechnical or others. It may be possible to obtain a letter of reliance from the original author so that the reports can be used rather than commissioning a new survey or assessment.

Box 4.4
Flood risk assessment

A flood risk assessment (FRA) is required on most development sites – not just brownfield sites. To satisfy national planning policies, a FRA or flood consequence assessment (FCA) (Wales) with planning applications for any site over 1 ha needs to be submitted. In addition, a FRA or FCA should be submitted for any property or development of any size that is being planned in a zone 2 or 3 flood risk area.

Further information can be found at:

- UK: **www.gov.uk/guidance/flood-risk-assessment-for-planning-applications**
- Scotland: **www.sepa.org.uk/environment/land/planning/advice-for-developers**
- Wales: **https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/development-and-flood-risk/?lang=en**
- Northern Ireland: **www.planningni.gov.uk/index/policy/planning_statements/pps15/pps15_devcontrol.htm**

4.2.1 Ecological surveys

Ecological surveys are likely to be required where the characteristics of the site and its surrounds suggest suitable habitat for protected species, or where there are ecologically designated sites on or near the proposed development. Commonly, a phase 1 survey to assess potential habitats will be required with a planning application. If the survey results indicate that protected species may be present, full surveys might be required either before planning or as a planning condition.

Many surveys will have constraints in terms of the seasons during which the full survey should be undertaken. This can have significant impacts on project schedules, so ensure that ecological surveys are programmed into the project plan.

Set out here are the optimum timings for the different types of ecological survey:

- Bats – end of April to end of August.
- Reptiles – end of March to end of September.
- Great Crested Newts – early March to end of June.
- Badgers – all year round.
- Otters – all year round.
- Nesting birds – early March to end of August.
- Dormice – April to end of October.
- Water voles – end March to mid-October.

Surveys for invasive plant species such as Japanese knotweed (**Figure 4.2**) will also be undertaken.

Further information on surveys is given in Charles and Edwards (2015).

Figure 4.2 Japanese knotweed

Box 4.5
Trees and TPOs

The retention of existing healthy trees on a new development can greatly improve its appearance, giving instant maturity and increasing property values. However, retained trees can be damaged during the construction process. This may not be immediately apparent, and they often die slowly, over several years.

Similarly, if new buildings, structures or paving are constructed too close to existing mature trees, or the trees are of an inappropriate size or species for their new surroundings, they can become a continual source of complaint, leading to demands for repetitive pruning or even removal.

Small sites can be disproportionately affected by trees, as roots from trees on neighbouring properties may need to be protected, and exclusion zones around retained trees can limit space that is already constrained.

Tree preservation orders (TPOs) can affect developments of all scales. These prohibit cutting down, topping, lopping, uprooting, wilfully damaging or destroying a tree without the written permission of the local authority. A data search to find out if any trees on the site have TPOs on them should be undertaken. A survey of trees on the site should be undertaken to identify tree species and likely full height, to inform foundation design. During construction, measures may be required to protect trees and tree roots from damage.

BS 5837:2012 provides guidance on tree care throughout the construction process, including initial surveys, designing a development to protect trees, and protection and monitoring during construction.

4.2.2 Land contamination and geotechnical assessment – phase 1 preliminary assessment

Land assessments are usually undertaken in one or more phases. A phase 1 investigation, or preliminary risk assessment, is largely desk based, with a site walkover, as described in **Table 4.1**. Further phases of assessment are then scheduled, with design of site investigations based on the information identified in the phase 1 study.

Table 4.1 summarises the activities undertaken during a preliminary assessment. Note that a cursory assessment of ecology and archaeology are usually included in a phase 1 geoenvironmental study, to assess whether they are potential environmental receptors that might be affected by land contamination. Separate specialist studies for ecology, archaeology and flood risk assessment may also be required. Some of the information required may have already been gathered as part of due diligence assessments when buying the site (see **Section 3.2**). Defra and Environment Agency (2004), commonly referred to as 'CLR 11', provides industry good practice guidance for managing land contamination, and has further information on preliminary risk assessments.

Table 4.1 Preliminary assessment

Step	Activity
Desk study	Documentary research including: ● site history ● site setting (location, surroundings, topography) ● site use (including adjacent areas) ● site geology, hydrogeology, geochemistry, hydrology ● site ecology and archaeology ● asbestos register(s) if available ● radon risk ● UXO ● future plans for the site ● consultations with regulators ● records of tanks held by local authority petroleum officer.
Site walkover	● detailed site inspection ● interviews ● limited ad hoc sampling and field measurements if appropriate.
Preliminary risk assessment	● formulate initial conceptual model ● assess the need for and scope of further investigations ● preliminary risk assessment ● reporting.

It is common for a phase 1 land contamination report (preliminary assessment report) to be required with a planning application, with further phases of investigation required by planning conditions. In some cases, where contamination is known to be a significant issue that might affect the viability of the development, phase 2 assessment reports might be required before planning permission is granted. In Northern Ireland, full risk assessment and outline remediation strategy reports usually accompany the planning application.

The preliminary risk assessment will develop the site's conceptual model which describes contamination sources, pathways and receptors (see **Box 4.6**). Further phases of investigation will refine this conceptual model. It is good practice to include a schematic diagram of the site conceptual model. An example is shown in **Figure 4.3**.

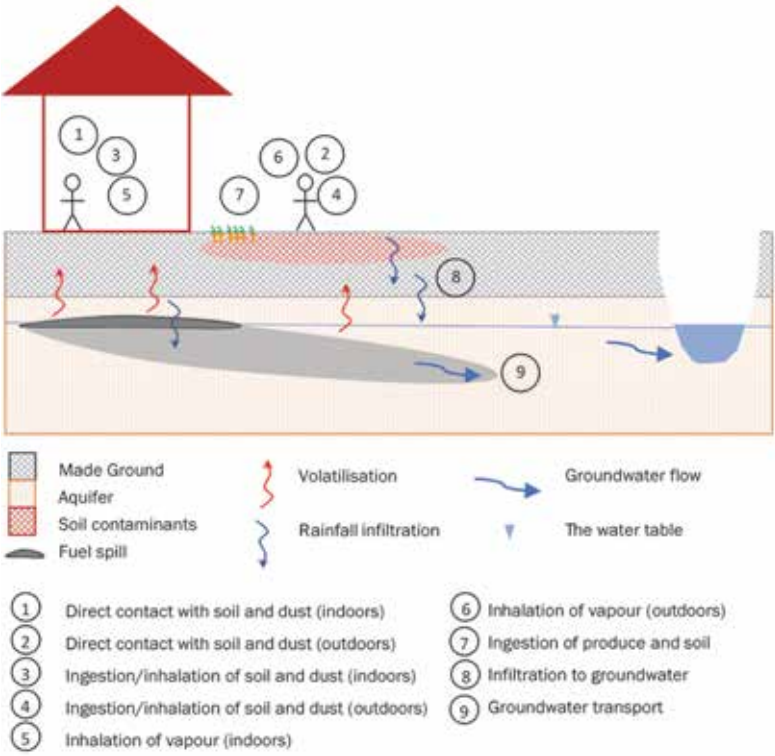


Figure 4.3 Conceptual site model

Box 4.6
Pollutant links

For risks to be present due to land contamination, three elements must be present:

A **contaminant** source (the hazard) – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.

A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

A pollutant link comprises a source and receptor that are linked by a pathway, so that the receptor is potentially at risk from the source (Figure 4.4). A schematic showing the configuration of all sources, receptors and pathways on a site is called a site conceptual model (see Section 4.2.2).

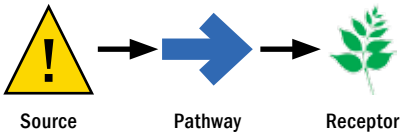


Figure 4.4 Potential pollutant link

If contamination is present, but there are no pollutant links, there is not a risk. It is also possible that a pollutant link is present, but risks to receptors are not high enough to warrant remediation. For example:

- asbestos is buried on site, but at such depth that it would never be disturbed
- heavy metals are present in made ground, but the concentrations are so low that the risk to human health and the environment is minimal.

Geotechnical investigations are undertaken to assess ground conditions so that foundations can be designed appropriately, and any difficult or hazardous ground conditions identified and mitigated. For example, dissolution features, mineral extraction works and coal mining features can all create significant costs for a development project, and should be properly assessed at each stage of the project, as should buried services, obstructions from previous developments and voids.

Heritage value and demolition

Some derelict buildings and substructures on small brownfield sites may have heritage value that restricts the options for demolition. Always check with the local planning authority before undertaking demolition works.

Go to: **www.historicengland.org.uk/advice/hpg/consent/permissonandhas**

While vitally important to ensure a safe development, phase 1 geotechnical reports are not routinely required as part of the planning process. A notable exception is for a basement development, where some local authorities require a ground investigation and geotechnical assessment to accompany planning applications. Where ground conditions are known to be problematic, some authorities may require additional geotechnical information before granting planning permission.

Figure 4.5 Site survey

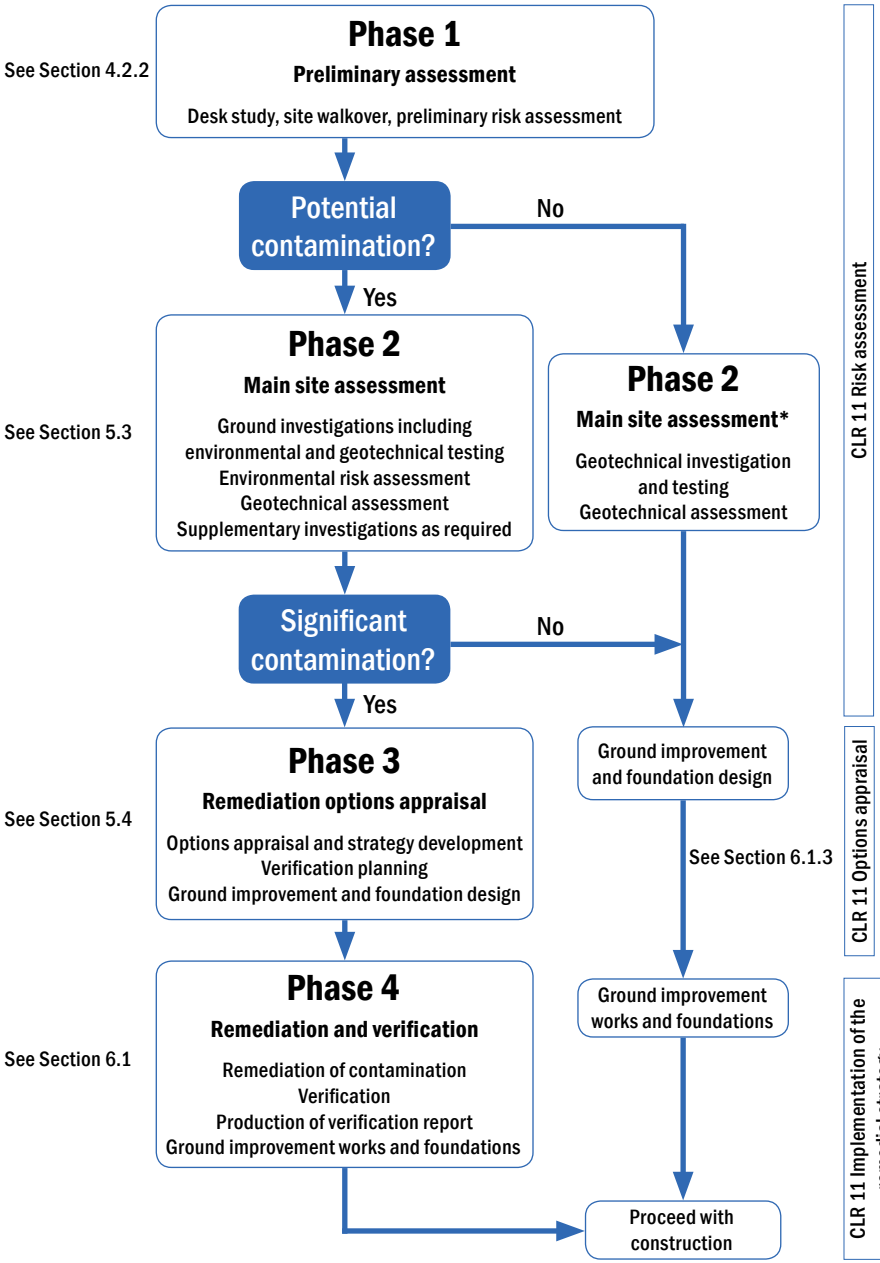
It is generally cost effective to combine investigations for land contamination and geotechnical assessment. In this case, the phase 1 report would enable the preliminary assessment of geotechnical hazards and risks such as dissolution features, mineral extraction and mining, made ground and slope stability, as well as development of the site conceptual model and potential pollutant links.

Figure 4.6 summarises the process for investigating and managing land contamination and geotechnical issues at a development site. Note that some warranty providers will require a limited suite of contamination testing whether or not the phase 1 study indicates that contaminants are likely to be present. Also, made ground is almost always present on brownfield sites, and should always be considered as being potentially contaminated unless there is good evidence to indicate otherwise.

CDM 2015 regulations

Note that CDM 2015 regulations may apply to survey work, for example, if structures are dismantled or excavations made, the regulations must be followed and the right personnel should be appointed. If a PD has been appointed early in the project, they will be able to advise on what is required.

Further information is given in BS 10175:2011+A1 2013 (desk study and site walkover), BS 5930:2015, Defra and Environment Agency (2004), Clayton and Smith (2015), NHBC and Environment Agency (2008), and Scottish Government (2000).



* Note that some warranty providers will expect to see the results of soil testing to demonstrate that there is no contamination, in which case geotechnical site investigations should include some tests for contamination to show the site is clean.

This figure shows how the guidance is mapped with CLR 11 (Defra and Environment Agency, 2004).

Figure 4.6 Management of land contamination

4.3 COMMUNITY INFRASTRUCTURE LEVY (CIL) AND PLANNING OBLIGATIONS

Planning conditions are not the only mechanism for mitigating the impact of a development.

The CIL is a levy allowing local authorities in England and Wales to raise funds from owners or developers of land undertaking new building projects in their area. Most new development that either creates net additional floorspace of 100 m^2 or more, or creates a new dwelling, is potentially liable for the levy if the local authority has set a charge in its area. The levy is based on a charge per square metre. Note that the CIL applies only in England and Wales. Details of exemptions for small sites are given in **Section 3.5.5**.

Planning obligations can sometimes apply to small sites and are legally enforceable obligations entered into under S106 of the Town and Country Planning Act 1990 in England and Wales, S76 of the Planning Act (Northern Ireland) 2011 in Northern Ireland, and S75 of the Town and Country Planning (Scotland) Act 1997 in Scotland, usually between a council and a developer. In Northern Ireland, planning obligations are referred to as planning agreements and are becoming more widely used since planning responsibility has moved to local councils. S106, S76 and S75 agreements are drafted when it is considered that a development will have significant impacts on the local area that cannot be moderated by the imposition of a planning condition. The most common obligations include contributions for:

- public open space
- affordable housing
- education
- highways
- town centre improvements
- public art.

Apply early for CIL exemptions

A project may be exempt from CIL, but an application for exemption must be made early in the application process or the exemption will not apply. Developments of less than 10 houses (or five houses in rural areas) are exempt from CIL. Check with the planning authority before submitting a planning application. See **Appendix A6** for CIL exempt developments.

Unilateral undertakings are often used for smaller developments to ensure that works are undertaken on the developer's own land. For example, if a development proposes a connection to an adjacent footpath using land within their ownership, a unilateral undertaking may be provided to ensure that it is delivered to the required specification.

4.3.1 When do they apply, and what are the tests for applying them?

CIL can only be charged if local authorities have adopted a charging schedule and are not designed to wholly replace S106 agreements. Whereas S106 agreements are focused on addressing the site-specific mitigation measures required to make the development acceptable, CIL has been developed to address the broader implications of development. There should be no circumstance where CIL and S106 payments are asked for to pay for the same infrastructure.

In the case of CIL, the levy rates are set by the charging authority within their charging schedule and the rate set should not threaten the ability to develop the site viably.

For S106 agreements, there are tests that should be applied to ascertain whether a legal agreement should be entered into. Those tests are set out in Paragraph 204 of the NPPF (DCLG, 2012):

> *"Planning obligations should only be sought where they meet all of the following tests:*
>
> - *Necessary to make the development acceptable in planning terms;*
> - *Directly related to the development; and*
> - *Fairly and reasonably related in scale and kind to the development."*
>
> *Where obligations are being sought or revised, local planning authorities should take account of changes in market conditions over time and, wherever appropriate, be sufficiently flexible to prevent planned development being stalled."*

Note that the Scottish Government (1998) (Scotland), Welsh Government (2016) (Wales) and DOENI (2015a) (Northern Ireland) stipulate the situations in which planning obligations and planning agreements should be used.

Case study 4.2

S106 negotiations and viability

If a potential planning obligation may threaten the wider viability of a scheme, the council may request that a viability assessment is prepared to accompany a planning application and assist S106 negotiations. The following are examples of S106 agreements being sought and associated negotiations:

- **Affordable housing.** In relation to an affordable housing provider seeking planning permission for residential development on a brownfield site, the council requested a particular type of dwelling (large, four-bedroomed). This request was made based on the local demographic and a requirement for large family houses. This request was accepted by the client, partly based on demonstration of market need. The request formed a component of an associated S106.
- **Highways.** In the lead up to a retail planning consent at a brownfield site, a council requested a 'sustainable highways' contribution in-line with an emerging local supplementary planning document. The planning agents requested confirmation of what projects/schemes the proposed contribution would support. Councils are required to provide this information if it is requested. The planning agents also argued the contribution should be lower given the site's strong accessibility via public transport and being in walking distance from town and district centres. The council accepted this argument and the contribution was lowered.
- **Education.** A county council requested an education contribution to support a hybrid planning consent on a brownfield site. The applicant and agents successfully argued the contribution should be lower. This argument was based on the county council contribution having been calculated on the number of properties and not taking account the number of bedrooms within each property across the development. This argument considered that some types of property (such as apartments) would be unlikely to trigger the same need for education facilities as larger properties.

4.3.2 Other sectional agreements

Infrastructure works (highways and drainage) completed as part of any new development may require technical approvals or sectional agreements to be sought from the relevant and respective authorities, ie the local highways authority or water authorities. These sectional agreements are legally binding and are intended to serve as a mechanism by which the responsibility for maintenance of various assets, eg roads or drains, is assigned. These can be existing, eg creating a new access road off a highway, or proposed assets, eg development of

a new access road to serve a planned development. Owing to variations in the way sectional agreements are applied across the UK, it is always advised that discussions with the relevant authorities are started early on within a project to gauge their specific requirements. Employing a suitably qualified and experienced civil engineer is prudent to ensure timescales, costs and local conditions can be forecast as early on as possible within a project.

Examples of common sectional agreements include, but are not limited to:

- adoption of a new highway
- planned work on an existing highway
- adoption of a new sewer
- connection to an existing sewer
- closure of an existing sewer
- diversion of an existing sewer.

4.4 ENGAGING WITH WARRANTY PROVIDERS

Homeowners are given insurance from the warranty provider, which is typically for a period of 10 years after construction. This covers repairs to physical damage to a home caused by the builder failing to comply with the warranty provider's standards. The provider will often want to be involved with a project early on in the development process. Applications for a warranty usually need to be made up to eight weeks before construction begins. For brownfield sites, information regarding the site history, ground investigation and contamination assessments are likely to be required with the application, and further details of ground investigations, remediation and verification will be required to enable the provider to issue warranties on the finished buildings.

Warranty providers may offer their own guidance regarding the types of ground investigations required, and may stipulate that environmental assessment is undertaken by suitably-qualified engineers that are acceptable to the warrantor.

The Council of Mortgage Lenders (CML) makes the following recommendations to sellers/builders of new or newly-converted properties:

- A warranty or a professional consultant's certificate (PCC) needs to be in place if accepted by the lender.
- Information about the warranty schemes and PCCs that are accepted by each lender can be found in CML (2017) for England and Wales.
- If the property is to be sold or occupied for the first time, then a disclosure of incentives form should be completed. This form should be made available to the valuer at the time of their visit.
- If the property is a non-traditional construction, lenders will require that it meets certain key criteria, as this may affect the lending decision. It may help to obtain certification for the property from one of the major bodies such as the British Board of Agrément (BBA), the Building Research Establishment (BRE), or Buildoffsite Property Assurance Scheme (BOPAS).

4.5 ENGAGING WITH BUILDING CONTROL (ENGLAND AND WALES)

In England, the building regulations are minimum standards for design, construction and alterations to virtually every building, including the following:

- The erection or extension of a building.
- The installation or extension of a service or fitting which is controlled under the regulations.
- An alteration project involving work that will temporarily or permanently affect the ongoing compliance of the building, service or fitting with the requirements relating to structure, fire, or access to and use of buildings.
- The insertion of insulation into a cavity wall.
- The underpinning of the foundations of a building.
- Work affecting the thermal elements, energy status or energy performance of a building.

Some types of development are exempt from the building regulations although most small brownfield development sites will fall under the regulations:

- England: **www.planningportal.co.uk/info/200128/building_control**
- **Wales: http://gov.wales/topics/planning/buildingregs/?lang=en**

The role of checking that building regulations are being complied with falls to building control bodies (BCBs). There are two types of BCBs, a local authority building control service and a private sector approved inspector building control service. The BCB will inspect the project at key stages during development and will issue a completion certificate (local authority) or final certificate (approved inspector) to demonstrate compliance with the building regulations. The developer should give notice to the BCB to inspect the site at key stages (see **Box 4.7**).

Box 4.7
Notice required by local authority building control inspectors

Build stage	Notice required
Start	Two days
Excavation of foundations	One day
Foundations laid	One day
Over-site preparation	One day
Damp proof course	One day
Drains testing	One day
Occupation before completion	Within five days of occupation
Completion	Within five days of occupation

If a local authority is chosen to undertake building control services, rather than an approved inspector, there are two options to apply for building regulations approval:

1 Full plans application. Full plans and drawings are submitted to the authority for approval within five weeks, or two months with consent of the applicant.

2 Building notice. Notice is given to the local authority 48 hours before works start. Inspections are carried out as for the full plans application. The process is quicker, but carries with it the risk that the plans do not meet the building regulations, in which case works may have to be altered or removed, and the developer may be liable to prosecution.

HM Government (2004) provides practical guidance on meeting the requirements of the building regulations with respect to land contamination. It is a developer's responsibility to ensure the development is suitable for use whether or not a planning condition has been applied.

It is usual to wait until planning approval is obtained before applying for building regulations approval, as the necessary technical drawings will not normally be developed before planning approval. However, each local authority area has specific guidance and information available regarding their requirements for building regulations approval, and it is advisable to check these requirements early, to minimise delays later in the programme.

4.5.1 Building control in Scotland and Northern Ireland

There are different regulations governing building control in Scotland, and Northern Ireland. The Scottish Government (2017) also provides details.

- **Scotland: https://beta.gov.scot/policies/building-standards**
- **Northern Ireland: www.buildingcontrol-ni.com**

5 Preparing for building works

5.1 BUILDING REGULATIONS APPROVAL APPLICATION

Once planning permission is granted, more detailed plans can be prepared, for building regulations approval. Approval is given within five weeks (or two months if an extended time frame has been agreed). If a building notice is submitted instead of full plans, work can start within 48 hours. However, this is usually only used for small work as there is a risk with this approach that the work will not comply with building regulations, and will have to be corrected.

5.2 DISCHARGE OF PLANNING CONDITIONS

It is important to be organised and systematic over the discharge of conditions. It is useful to set up a schedule that has been organised in order of when the conditions have to be discharged:

- before starting works
- before operation and/or first occupation
- other.

There is a charge for each application made to discharge conditions, so it makes sense to group them into as few submissions as possible. (In Northern Ireland, there is no charge for discharge of planning conditions). However, it is recommended that conditions for undertaking phase 1 contaminated land assessments are discharged before carrying out a phase 2 assessment, to ensure the authority is in agreement with the approach (note that in Northern Ireland, the phase 1 and phase 2 assessments will be submitted together with the planning application, and pre-application discussions can be held to discuss the intended phase 2 approach if appropriate). It is possible for local authorities to part-discharge a condition.

Sometimes one condition is dependent on another, for example, a phase 2 site investigation may not start until an ecological survey has been completed.

With respect to brownfield sites, it is common for planning conditions to require:

- phase 2 land contamination survey (also a phase 1 study if not submitted with the planning application)
- remediation scheme
- verification report
- statement of how the developer will deal with unexpected contamination discovered during construction.

If the phase 2 report finds no requirement for remediation, the remediation scheme and verification report will not be required. Land contamination conditions usually have to be met before construction starts on site (ie they are usually set as 'pre-commencement' conditions). However, remediation methods such as gas protection measures and

clean cover systems form part of the development and can only be completed as the development is built. This should be discussed with the planning officers to avoid delays in starting construction.

Case study 5.1

Failure to discharge a remediation planning condition

A developer purchased a small parcel of land from another developer to build six new homes. Historically, the land had been used for town gas production, and more recently for gas storage in two small holders.

The boundary between the two developers' land cut across a buried former gasholder tank. A planning condition required the developer to fully investigate the extent of land contamination and design mitigation measures for agreement with the local authority. Significant contamination of the near surface geology was observed within both holder tanks, and near surface groundwater contained elevated concentrations of hydrocarbons including coal tars. It was agreed that the remedial scheme would involve selective removal from site of hot spots of contaminated soil. Conditions relating to remedial treatment would be deemed satisfied once there was a sustained reduction in groundwater concentrations of these hydrocarbons, which the developer argued would be demonstrated by ongoing monitoring.

After completion of the soil removal programme, groundwater hydrocarbon concentrations remained elevated. Supplementary investigation was carried out, which found that the gasholder, which straddled the site boundary, was filled with refuse heavily contaminated with oils and tars. The developer claimed that the remedial plan had been agreed with the local planning authority and would not be extended. However, the local authority maintained that the developer was responsible for the safe development of the site and had agreed the 'end state' of the site after completion of the development. This included a measurable reduction in groundwater contaminant concentrations.

The developer was obliged to undertake a joint exercise with the adjoining developer to remove and treat this material after the properties had been built, delaying occupation of the dwellings. Some additional costs were incurred in maintaining the integrity of a gas main that crossed the site at this point. It was only after completion of the work that improvements in groundwater chemical quality were observed.

Box 5.1
Deemed discharge of planning conditions (England)

The Town and County Planning (Development Management Procedure) (England) Order 2015 came into force in England on 15 April 2015. This Order allows developers to serve notice on local planning authorities, to deem that planning conditions have been discharged. Planners must make a decision to approve an application to discharge a planning condition within eight weeks, but this process is sometimes delayed. Now, if 'deemed discharge notice' is served by the developer, the conditions are deemed discharged within 14 days of the notice, or eight weeks of the application, whichever is the later.

However, it must be noted that some conditions cannot be deemed discharged, including:

- conditions attached to a planning permission relating to a development that is subject to an EIA
- conditions designed to manage flood risk
- conditions attached to an outline planning permission requiring the approval of reserved matters
- conditions attached to a planning permission relating to development within a SSSI
- conditions relating to the investigation and remediation of contaminated land
- conditions requiring the completion of a S106 agreement or a S278 agreement.

5.3 PHASE 2 ASSESSMENT

Phase 2 assessments involve intrusive investigations into the subsurface (often called ground investigations [GI] or site investigations), and quantitative risk assessments. This is required for two purposes:

1 To establish the geotechnical site conditions (eg the strength/compressibility of the ground, the location of the water table), which will allow foundations to be designed and hazards to be identified.

2 To assess whether the site is affected by contamination, including ground gas, which will allow risk assessments to be undertaken and remediation to be carried out if required.

Phase 2 investigations usually include:

- A main ground investigation to examine geology, groundwater, soil vapour, ground gas, land contamination and geotechnical properties.
- Supplementary investigations as required.
- Environmental risk assessments to determine the risk to human health and controlled waters (groundwater and surface water), and risks from soil vapours and ground gases.
- Geotechnical assessment, interpretation and outline foundation design.

Failure to carry out an appropriate ground investigation can put project viability at risk, affecting cost, schedule, durability, health and safety of workers, the public and the environment. Other consequences may include loss of archaeology, ecological damage and negative publicity for the client and project team.

5.3.1 Soils and rocks

A range of methods are used to investigate soils and rocks for their geotechnical properties and chemical quality. The most commonly used are trial pitting and drilling. Trial pits and trenches enable the soil profile to be observed in detail and samples to be taken easily, but are shallow (typically less than three to four metres). They also disrupt the ground, require significant re-instatement and may not be appropriate for operational sites.

Drilling techniques are used to probe to greater depths, and usually return soil to the surface as loose spoil or in core sleeves, depending on the technique. Samples can be taken from these for laboratory analysis. Geotechnical tests can also be performed on the soils during drilling. Drilling is usually more expensive than trial pitting or trenching, but necessary if groundwater or gases are to be investigated. It is also required to assess soils or rocks at greater depths, for example to investigate geo-hazards such as mining, or to design deeper foundation solutions.

Targeted sampling focuses on specific known or suspected sources of contamination. Non-targeted sampling aims to characterise a wider area or zone. Typical densities

of non-targeted sampling grids can vary from 25 m to 50 m centres for exploratory investigations, and 10 m to 25 m centres for main investigations (BS 10175:2011+A1:2013). For very small sites, a closer spacing might be needed to get enough samples – with too few samples it is difficult to tell whether specific results are representative of the site, or anomalous.

Changing site levels

Note that site levels may change during development, and it is often important to have samples from within the top 0.5 m of the finished site levels. If surface materials are going to be moved, the sampling strategy should be adjusted depending on whether the soils are going to be reused or disposed of.

Sites are often zoned, and different sampling strategies undertaken in each zone. For example, an area downwind of an industrial chimney might have increased sampling for contaminants deposited from atmospheric fallout, or areas of no known historic use might have less sampling than other areas. In practice on small sites, zoning may not be appropriate. Samples should be taken where there is visual or olfactory evidence of contamination.

Planning ahead for waste management

Most developments will create some waste soils that could be reused or disposed of. There are strict controls on what happens to waste, and costs of disposing of waste soils on a small site can make a big difference to the bottom line. It is useful to include tests to characterise soils for waste disposal during phase 2 investigations, so that waste management can be properly planned. See Section 3.3.

Samples should be taken from a range of depths, depending on the site conditions and development proposals. Soil samples are typically taken from the surface layer or upper 0.5 m, from made ground (often at intervals of 0.5 m), and at regular intervals from natural materials below the made ground, depending on the conceptual model. For geotechnical purposes, boreholes should be deep enough to give information for the proposed foundation depths. Eurocode 7 provides useful geotechnical guidance on depths of investigation, and spacing of boreholes for high-rise developments (BS EN 1997-1:2004+A1:2013, BS EN 1997-2:2007).

Shell and auger drilling

Dynamic sampling

Trial pitting

Rotary drilling

Figure 5.1 Ground investigation methods

5.3.2 Groundwater

It is necessary to know whether groundwater is present below the site and at what depth. This will inform the management and control of groundwater during construction, so that buildings and foundations can be properly designed. Groundwater below brownfield sites may be contaminated, presenting risks to site users and the environment.

Figure 5.2 Groundwater measurement

Groundwater levels are measured by installing monitoring wells in boreholes and measuring the depth to groundwater. They can vary significantly over time. In some situations, it may be necessary to take measurements often enough and for a long enough period to understand how groundwater responds to rainfall and long-term seasonal variations (levels tend to be higher in winter). Note that groundwater levels measured in boreholes during the drilling process should not be taken as a reliable estimate of the true groundwater level. See **Figure 5.2**.

Where contamination is suspected, groundwater samples should be taken for chemical analysis. Groundwater quality varies over time, so where groundwater contamination is discovered, more than one set of samples will be required to assess how the results change.

Groundwater data

It is good practice to survey in borehole locations so that they can be easily found on repeat monitoring visits. Elevations should also be surveyed so that groundwater levels from different wells can be compared with each other. A minimum of three boreholes are required to determine the direction of groundwater flow. Tall well covers make it easier to find boreholes in grassed areas, while flat well covers flush with the ground are more appropriate for sites with traffic. It is important when measuring groundwater levels that a note is made of whether the measurement is from ground level or the top of the casing, and how high the casing is above ground level. The borehole name and location should also be noted.

5.3.3 Ground gas and soil vapour

Ground gases, carbon dioxide and methane, are often present underground from a variety of natural and man-made sources. Made ground is a common source of ground gas, and is present on most brownfield sites. Ground gases can also arise from hydrocarbon contamination in the soil and are more commonly referred to as soil vapour. Sources of ground gases are shown in **Figure 5.3**.

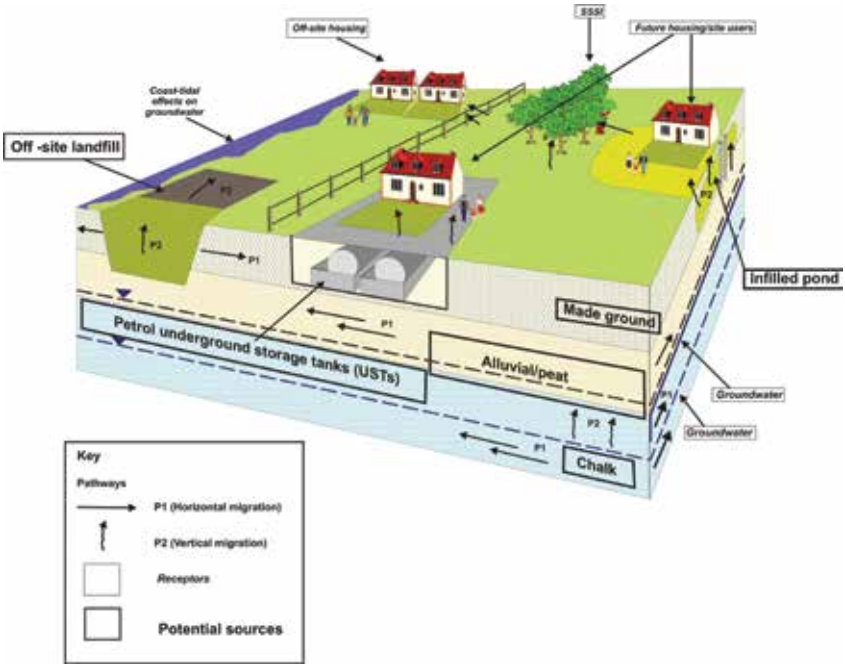


Figure 5.3 Sources of ground gas

The site conceptual model should identify potential sources of ground gas at the site. Different sources will have different gas generation potential. Common sources of ground gas include landfill sites, made ground, foundry sands, sewage sludge, burial grounds, industrial sites, natural gas supply, soil, coal measures, peat/bog areas, alluvium, radon-emitting rocks, carbonate rich strata, oil and gas fields, and oil shales. In certain situations, other gases may be present such as carbon monoxide and hydrogen sulphide.

Ground gas concentrations and flows should be measured from monitoring wells installed at the site for that purpose. The measurements should be made over a range of weather conditions, and at least once during times of falling and low ambient air pressure. For low-risk sites, monitoring over one to two months may be sufficient, but for higher risk sites, gas monitoring over 6 to 12 months may be necessary. It is important to build likely gas monitoring periods into the project schedule, as final building designs may include gas protection measures that cannot be finalised until monitoring is complete.

Soil vapours are typically measured using a hand-held meter, and can also be sampled and analysed at a laboratory.

There is a lot of guidance available on the investigation, assessment and remediation of ground gas. The most widely used and authoritative standards are provided in the further reading section.

Table 5.1 Top tips for ground investigations

Access	Hand-held equipment or small drilling rigs can be used where access is difficult or limited on small sites or on slopes. Note that this may limit the type of geotechnical information that can be obtained. The diameter and quality of cores obtained with hand-held or dynamic sampling equipment may be unsuitable for geotechnical laboratory tests. Beware confined space conditions and asbestos risk if drilling inside. Also, beware underground voids, including mine workings in mining areas.
CDM 2015	It is important to appoint a PD and/or PC for intrusive ground investigations. These works are subject to CDM 2015. The developer is the 'client' under the regulations, however a developer may also by default become PD or PC for these works unless a formal appointment is made. These roles carry potentially significant liabilities. Duty holders under CDM regulations need to consider the health and safety risks associated with, for example, underground services, contaminants, ground stability, and preventing falls into excavations. They must plan how the work will be carried out, kept safe and made good.
Land contamination	Plan ahead to manage the health and safety risks to workers, and to manage contaminated soil and water wastes. BDA (2008) provides guidance on how to manage risks from land contamination. Provision should be made to classify waste soils and water and dispose of them appropriately. Manage all site activities to avoid causing pollution – boreholes can act as pathways for migration of pollution, so special methods should be used if drilling through waste or contamination to lower strata. Placement of contaminated trial pit or drilling arisings on the ground can cause pollution, these should be contained. Trial pits should be reinstated such that materials affected by contamination are not present at the ground surface.
Drilling and ground gases	Special precautions may be required to drill safely on gassing sites such as landfill sites, or near coal mines or deposits (ESA, 2006) and CA, HSE, BDA, FPS, AGS (2012).
Services and structures	Identify buried and overhead services and buried structures before undertaking intrusive investigations. Plans of services are available from many online sources, and ground investigations should be planned to avoid these. However, many private services may not be shown, and on-site checks should be made before breaking ground. Speak to site personnel on operational sites. HSE (2014) provides useful guidance. PAS 128:2014 and PAS 256:2017 provide specifications for utility surveys, and for recording information on underground utilities.
UXO	Make sure all site personnel are aware of the risks of UXO at a site, and undertake risk assessment and mitigation measures as necessary. In high-risk areas, it may be necessary to carry out on-site surveys before intrusive investigations, and maintain a watching brief during the works (Stone *et al*, 2009).
Ecology and archaeology	Plan ahead and work with ecologists/archaeologists/regulators to ensure site works do not disturb protected species or archaeological remains. Killing, injuring or disturbing protected species or destroying their shelter or protection is a criminal offence. Spreading invasive species such as Japanese knotweed is a criminal offence. Undertaking works to a scheduled monument without consent, where one is required, is a criminal offence.
Existing buildings	Where existing buildings limit access for GI, use a phased approach. A second phase of GI can be undertaken once the buildings are no longer occupied, or demolished.

GI on a tight budget	Use a 'lines of evidence' approach – multiple sources of data and information can help characterise the site. For example, data from nearby sites, local knowledge, anecdotal evidence, and desk study data can support GI data. Combine geotechnical and geoenvironmental investigations, but retain what is necessary for each purpose. The location, depth and number of boreholes will be different for each – some boreholes will be useful for both. Trial pits are less expensive than boreholes (but inappropriate for gas or groundwater assessment, or assessments for deep foundations such as piles). Samples can be analysed for 'screening' suites, but it is important to retain enough sample for full analysis if required, otherwise further GI might be needed to get additional samples. Monitoring wells can be used for both gas and groundwater monitoring in some circumstances. The screened section of the monitoring well should not be entirely submerged below the water table if it is to be used for gas monitoring. Wells used to monitor deeper groundwater bodies are less likely to be suitable for gas monitoring. Include some waste/soils reuse classification tests in the schedule of testing, so that the options for dealing with surplus soils can be considered and costs reduced during the construction phase.
Expertise	Always engage a competent and experienced engineer to design and supervise ground investigations. They will decide how many samples are needed, at what locations and depths, what these samples should be tested for, and how much groundwater and gas monitoring/sampling is needed (including which strata monitoring wells should target and whether they can be used for both gas and groundwater monitoring). These decisions will be informed by the conceptual site model. Site investigation contractors should work to a specification compiled by the designer.
Damage	Take photographs before and after site investigations, and in situations where neighbours or site owners may be concerned about damage to property.
Sampling	Make sure sample data is reliable and accurate, and it will be acceptable to regulators. Strict protocols should be observed for sampling soil and groundwater for contamination testing, including whether glass or plastic containers should be used, whether special containers are required, whether preservatives should be used, keeping the samples at low temperatures and getting the samples to an accredited laboratory. Analytical methods should be MCERTS accredited. **www.gov.uk/government/collections/monitoring-emissions-to-air-land-and-water-mcerts**
Asbestos	The Control of Asbestos (CAR) 2012 regulations apply to soils as well as buildings. However, while many site investigations may not fall under CAR 2012, some will and remediation works may be included. Guidance is given in Studds and Bell (2017) and Nathanail *et al* (2014), and from CL:AIRE: **www.claire.co.uk/asbestos**
Avoiding cross-contamination and false evidence of contamination	Mineral oil should not be used to lubricate drilling equipment, as it may contaminate the soil or groundwater and give false evidence of contamination.

Case study 5.2

Problems encountered from poor GI

A ground investigation was carried out on a former manufacturing site in the West Midlands, but its focus was on the geotechnical aspects, and both the investigation and the report failed to address the site's potential for land contamination. The site was later put up for sale due to changes in the client's priorities. The purchaser's due diligence highlighted potential risks and associated abnormal costs. The purchaser carried out phase 1 and phase 2 studies and calculated the abnormal costs, which included excavation and treatment of contaminated soils, at £800 000. This resulted in protracted litigation against the vendor's geoenvironmental adviser, delays in the land sale, additional costs and the loss of profit for the vendor.

GI in hard to reach locations

Access improvements were required for a new housing site, including a new bridge across a canal. GI fieldworks were required on public highways as well as land managed by the Canal & River Trust. The location was challenging due to steep slopes and a lack of formal access. Risks to the stability of a sub-critical slope under temporary load, and the potential effects of the investigation on the slopes' drainage or long-term stability had to be considered. The use of standard and specialised portable investigation equipment enabled access to otherwise inaccessible locations and recovery of adequate classes of soil and rock samples to support detailed geotechnical design.

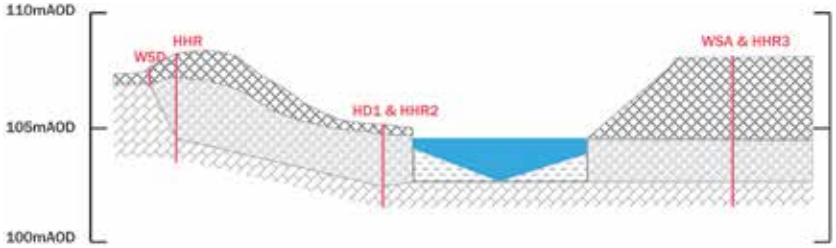


Figure 5.4 Cross section showing borehole locations

Figure 5.5 Hand-held portable drilling equipment

5.3.4 Laboratory testing

For most brownfield sites, both geotechnical (**Figures 5.6**), and environmental (**Figure 5.7**) testing will be required. The testing should be scheduled with an appropriate understanding and knowledge of the expected and encountered ground conditions, the past use of the site and the nature of the proposed development.

For land contamination assessment, it is important to undertake tests that can be used in subsequent risk assessment and to look for a wide range of contaminants. Scheduling the most economical tests may produce data that cannot be used for anything else, except for qualitative screening and if contamination is found, further drilling and sampling will be required at additional expense.

All laboratory testing should be undertaken by UKAS-accredited laboratories. Soil chemistry data should be accredited by MCERTS.

UKAS: www.ukas.com/services/accreditation-services/laboratory-accreditation-isoiec-17025

Laboratory turnaround times are typically around 10 days, but may be longer for certain tests. Reduced turnaround times are available for some tests, but at additional costs.

Figure 5.6 Geotechnical laboratory testing

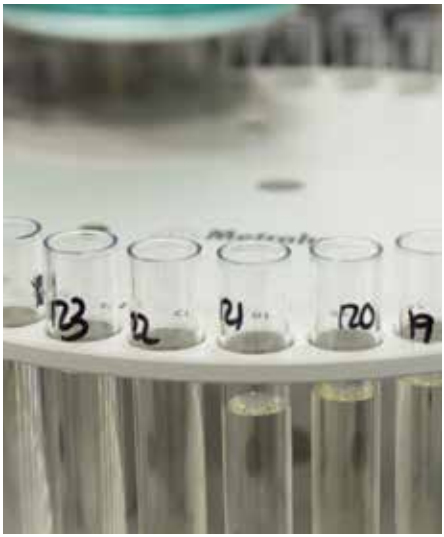



Figure 5.7 Environmental laboratory testing

5.3.5 Environmental risk assessments

Environmental risk assessments are undertaken to establish whether the levels of contamination or ground gas are acceptable for the proposed land use, or whether remediation is required to lower risks. A well-executed risk assessment can result in significant savings in remediation costs.

Note that risk assessments concerning the health and safety of construction workers, or the environmental impacts of construction activities are important, but separate assessments. This section relates to risks arising from contamination already in place to future users of the site, or environmental receptors.

Initially, the site conceptual model is updated with the site investigation information. For example, the thickness and properties of geological layers, the location and concentrations of sources of contamination, and the depth to the water table will all be known with greater certainty. Soil and groundwater concentrations are then screened against generic assessment criteria (GAC), sometimes using statistical analysis of the data. These soil or water concentrations are conservative, and derived for a typical site use. If site concentrations are lower than GAC, it can be assumed that risks are acceptable, provided the site conforms to the assumptions underlying the criteria. If site concentrations are higher than the GAC, site-specific assessment criteria (SSAC) may be needed to establish whether remediation is required.

5.3.6 Geotechnical assessment and outline foundation design

The results of the ground investigation should provide sufficient data for the selection and design of foundations. The desk study/screening report may have already provided information that suggests particular foundation types. At this later stage, aspects such as allowable bearing capacity and settlement should be developed and recommendations provided. Soil and/or clay shrinkability should be assessed and mitigation measures identified. Where ground conditions are favourable and loadings/tolerances allow, shallow foundations such as strip footings or pads will be appropriate. An understanding of shallow excavation stability will allow informed decisions to be made about the use of trench fill. Where shallow foundations are not feasible consideration will be given to engineered foundations, eg rafts, piles and ground beams. Alternatively, ground improvement measures may be appropriate such as lime or cement stabilisation (particularly for non-structural uses such as highways or general earthworks), or the use of vibro-replacement or vibro-stabilisation and vibro-concrete columns (see **Section 6.2**).

The geotechnical findings and recommendations for the site development will need to take the land contamination assessment into consideration, and vice versa. Ground improvements may mitigate contaminant risks (for example, cement stabilisation may reduce contaminant mobility), conversely piles may open new pathways to underlying groundwater, or to the site surface. A piling risk assessment is sometimes required as a planning condition before works start, to ensure that risks to the environment can be mitigated (see Westcott *et al*, 2001).

In addition to foundation design, the results of the ground investigation should allow the design of mitigation measures for other geo-hazards such as dissolution features, mineral extraction works and coal mining features.

5.4 PHASE 3 REMEDIATION STRATEGY AND VERIFICATION PLAN

The findings of the ground investigation and subsequent environmental risk assessment may indicate that soil or groundwater remediation is required to make the site suitable for use, or to protect the wider environment. Also, gas protection measures may be required to protect site users from soil vapours or ground gases.

5.4.1 Geoenvironmental remediation strategy

It is common for a remediation strategy report to be requested for submission by the planning authority as part of planning conditions attached to planning consent, and it would normally have to be approved before work starts on site. A remediation strategy is also commonly required by the warranty provider as part of their technical assessment,

and may be required by the building control body for building regulations compliance, particularly if gas protection measures are needed.

Remediation techniques fall into three categories:

1 Treating the source.

2 Breaking the pathway between the source and receptors.

3 Protecting or removing the receptor.

Figure 5.8 shows some common remediation methods.

Further information on remediation techniques is provided in **Section 6.1.1**. Further details on remediation options appraisal and strategy development can be found in Defra and Environment Agency (2004), in Rudland and Jackson (2004) and from SuRF-UK: **www.claire.co.uk/projects-and-initiatives/surf-uk**

Before developing the remediation strategy, a remediation options appraisal is undertaken to establish the most suitable and relevant remediation techniques for the site, given the site constraints. Depending on the complexity of the site and the contamination issues, this may be a sophisticated assessment that takes into consideration a wide range of potential issues. Such issues usually include cost, effectiveness, access to land, timescales and sustainability.

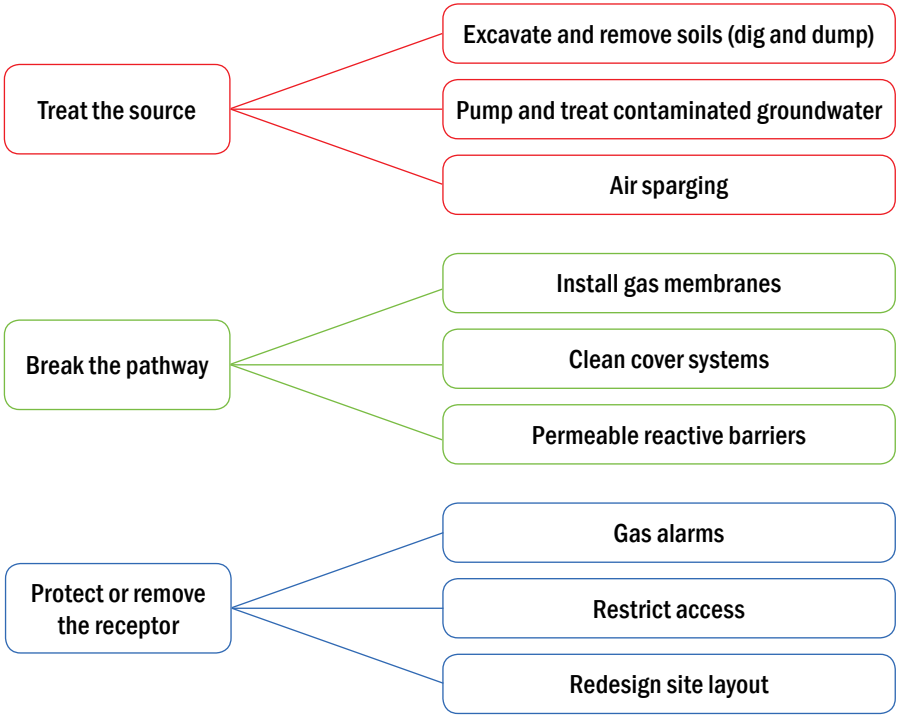


Figure 5.8 Common remediation methods

5.4.2 Verification plans

Planning conditions often require that a verification plan is submitted alongside (or as part of) the remediation strategy. A verification plan describes what evidence will be collected to demonstrate that the remediation has been effective. For example, it might state that photographs will be taken of remediation works, or that soil sampling, or topographical surveys will be undertaken to demonstrate the placement of a clean cover layer.

5.5 WATER SUPPLY INFRASTRUCTURE

There is a risk of contaminants leaching from soils into plastic water supply pipes and degrading the water pipes and the quality of water supply. This is of particular concern for drinking water supplies.

UK Water Industry Research (UKWIR, 2011) published guidance on selecting water supply pipes for brownfield sites. This was later supported by a set of supplementary guidance and protocols published by Water UK and the Home Builders Federation (Water UK and HBF, 2014).

Water UK and HBF (2014) stipulates that any application for new water supplies to a development in land potentially affected by contamination shall be accompanied by a risk assessment. The signatories to the application form and risk assessment should ensure that the risk assessment is undertaken by, or under the direction of, a suitably-qualified competent person (a chartered member of an appropriate professional body, or a SiLC).

Ensure all the required contaminants are included in soil tests

Check the requirements of Water UK and HBF (2014) before undertaking ground investigations. Testing of some chemical parameters may be required that are not highlighted by the phase 1 study.

5.6 SUDS

Sustainable drainage systems (SuDS) are commonly required via planning conditions, with detailed designs required before starting construction on site. There are some particular considerations with respect to small brownfield sites, namely:

- SuDS should not promote infiltration of surface water to areas of poor soil quality, which might then leach to groundwater or surface water bodies.
- Options for SuDS may be restricted where soil types do not readily allow infiltration of water.
- The size of the site may restrict the options for SuDS.
- On sloping sites, emergence of infiltrated water downslope may affect neighbouring properties.
- Building control bodies will, and warranty providers may, require design details of the proposed scheme.

5.7 ARCHAEOLOGICAL MITIGATION

Typically, if a phase 1 report has identified archaeological heritage as an issue that requires mitigation, activities will typically comprise one or more of the following:

- Design alterations to prevent disturbance of the asset, eg foundations design.
- Archaeological excavation before construction.
- Maintaining a watching brief during construction (which may vary from partial to comprehensive, depending on the nature of the site).

Historic England (2017) has produced guidance that highlights the need for early assessment and consultation, information sharing and collaborative working, and the opportunities for combined assessment of contaminated land and archaeological features. It has also published information about piling and archaeology (Historic England, 2007).

If archaeological remains are discovered during construction, there may be a requirement to investigate further, and if the remains are significant, they may become a scheduled monument. Insurances are available to developers to protect the project from delays introduced by the discovery of significant archaeological remains.

Go to: https://historicengland.org.uk/listing/the-list

5.8 ECOLOGICAL MITIGATION

Ecological mitigation activities typically involve one or both of the following:

- Mitigation by altering designs or timings to protect ecological assets (eg retaining trees and hedges, avoiding piling, moving development from ecologically-sensitive areas of the site).
- Compensation by providing alternative habitats off site.

It is usually appropriate that plans for ecological mitigation and compensation are adopted before construction takes place.

5.9 LICENCES AND PERMITS

The following licences and permits may be required:

- **Demolition licence.** If demolition is not explicitly included in the planning application.
- **Environmental permit/mobile treatment licence** for mobile treatment plant involved in land remediation. The remediation contractor must hold the relevant licences to operate the remediation equipment.
- **Discharge consent.** To discharge any waste water to sewer or to receiving water bodies (may be temporary and needed for only a short part of the construction programme).
- **Asbestos licence.** High-risk work with asbestos must be undertaken by an asbestos licence holder. Note that a refurbishment/demolition asbestos survey is required where the premises, or part of it, need upgrading, refurbishment or demolition.

- **Waste carriers' registration.** Hauliers of waste materials must be registered on the public register of waste carriers, brokers and dealers.
- **Wildlife licences.** If wildlife is going to be disturbed or removed, or habitats damaged, a licence is required.
- **Materials management plan and qualified persons declaration.** Both of these will be required if waste materials are to be reused under the CL:AIRE (2011) DoWCoP (England and Wales only, see **Section 6.3.3**).
- **Coal Authority licence/permission.** These are required for works on mining infrastructure.
- **Scheduled monument consent.** Works that include scheduled monuments will need consent.

Check which licences and permits are required to undertake any planned remediation activities with the local environmental agency. Plan enough time in the project programme to obtain these permissions.

Box 5.2
Insurance

It should be noted that many insurance policies have exclusion clauses for pollution or for work with asbestos, both of which occur commonly on brownfield sites. Anyone involved with developing and managing brownfield land should ensure that their insurances adequately cover the type of work involved.

6 Construction

6.1 REMEDIATION AND VERIFICATION

Remediation may take place before construction begins, during construction or afterwards, depending on the requirements and methods used. Careful planning will be required to co-ordinate the remediation activities with the site construction activities, to prevent delays and optimise waste and materials management. Detailed design of remediation may be undertaken by consultants, design and build contractors, specialist contractors or in-house experts.

Brownfield construction hazards

Brownfield sites may have short-term risks that require management during the construction phase, even though the final site design deals with those risks. For example, ground gases may create hazards in confined spaces, asbestos in soils may require special H&S precautions, and soil contamination or soil vapour may require personnel to use personal protective equipment (PPE).

It must be remembered that remediation activities will fall under CDM 2015, and the developer has duties, including:

- making appropriate management arrangements
- appointing a PD and PC
- providing information
- ensuring that the PC has developed a construction phase H&S plan before work starts.

6.1.1 Common remediation techniques

Remediation techniques commonly used on small brownfield sites are described here.

Figure 6.1 Remediation by design

The most economical way to manage land contamination is to design the development so that pathways between contaminants and receptors are broken. For example, placing hard cover instead of soft landscaping, or ensuring that gardens are located on an appropriate part of the site that complies with the assessment criteria. Geotechnical risks can also be dealt with through design, for example locating buildings away from steep slopes or localised weak or voided ground.

Figure 6.2 Clean cover systems and encapsulation

Contaminated materials are covered with clean subsoil and/or topsoil. A gravel layer is sometimes included as a 'no-dig' layer and to prevent capillary rise of contaminated soil moisture. Also, a brightly-coloured membrane is sometimes included to separate clean materials and provide a 'no dig' marker. Materials can be encapsulated by other methods, such as burial below roadways.

Figure 6.3 Materials management

There may be parts of the site where high-quality soils are required and others where lower quality is acceptable. Materials management ensures that soils are properly segregated so that they can be reused most effectively on the site, reducing the need for imported materials or soil remediation. Soils arising from construction often meet the definition of waste and as such may be subject to waste management legislation (see **Section 6.3**).

Figure 6.4 Ground gas protection systems

Gas protection measures typically use a combination of physical barriers (floor slabs and membranes) and ventilation (passive air flow through sub-floor voids) to prevent ground gases and vapours entering a building. Sites with higher gas flows and concentrations may use forced ventilation and gas alarms, although these active systems are not suitable for housing if long-term maintenance cannot be guaranteed.

Figure 6.5 Excavation and disposal

Also known as 'dig and dump', soils are removed from site and taken to landfill. More recently, 'soil hospitals' at waste treatment facilities can treat the soils so that they can be reused, although they are not suitable for all contaminant types. Waste soils must be transported in accordance with legislation.

Figure 6.6 In situ soil and groundwater remediation

Various techniques exist for treating soil and/or groundwater *in situ*. Chemicals, nutrients and/or air can be added to assist the breakdown of contaminants (chemical oxidation). Air sparging forces air through the sub-surface, stripping out volatile gases. Soil vapour extraction (SVE) collects contaminated soil vapour to be treated above ground, and dual-phase SVE removes vapour and groundwater. This technique is commonly used on former petrol stations, or where groundwater is affected by fuels or solvents.

Figure 6.7 Soil solidification and stabilisation

Soils are solidified by mixing with cementitious material to create a low-permeability material that binds contaminants within the soil matrix. This technique will not be suitable for all sites, particularly where space is limited, and if the treated area is not suitable for construction. Also, the effect of this technique may be to increase the bulk of soil which, together with foundation construction, can increase the amount of surplus soil. Soil stabilisation treats the soil so that contaminants are present in a less mobile form.

Figure 6.8 Bio-remediation of soils (ex situ)

Various techniques exist for treating soils on site by allowing naturally-occurring or artificially-added organisms to break down contaminants. Oxygen and/or nutrients can be added to aid the process. In some cases, soil piles are turned to assist oxygen entry. Techniques include bio-piling, windrows, or land farming, depending on its use. It requires space, so may not be appropriate for small sites, unless there is ample time to treat the soil before construction begins. Alternatively, soils could be treated off site.

Monitored natural attenuation (MNA) *"describes a range of physical and biological processes that, unaided by deliberate human intervention, reduce the concentration, toxicity, or mobility of chemical or radioactive contaminants"* (CPEO, 2018). It demonstrates that natural decay processes are reducing contamination, and receptors are not at risk. MNA can be a relatively low-cost solution, but can take a long time to demonstrate and may not be appropriate for small sites if the contamination extends beyond the site boundary, restricting the ability to monitor the entire contaminant plume. Monitoring may need to continue for some time after construction is complete.

Box 6.1
Planning permission and EIA for remediation works

Some remediation works will require planning permission and in some circumstances an EIA will need to be completed. However, this is unusual for small projects.

Many other remediation methods are successfully used on brownfield sites, but they may be restricted on small sites. CLR 11 (Defra and Environment Agency, 2004) provides a comprehensive overview.

6.1.2 Verification of remediation

It is important that remediation is accompanied by robust verification reports to provide evidence that works have been undertaken and the site is suitable for use. This will be required by the planning authority, and building control body, in order to discharge planning conditions and demonstrate compliance with the building control regulations respectively. Verification reports may be required by warranty providers, who may not provide warranties if they consider that risks remain on the site. Building control officers and warranty providers may also need to inspect remediation works as they progress, so regular contact should be maintained with these parties throughout the remediation works. In some cases, local authority or environment agency officers, for example, Environment Agency, Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW), NIEA will also want to inspect remediation works.

In most cases, it will be appropriate to engage an independent consultant to verify remediation measures. Where complex processes or earthworks are involved, or where it is probable that further contamination will be discovered, it may be necessary to appoint a consultant to maintain a watching brief during the works.

Verification of materials' reuse

If waste soils are being reused on site (in accordance with CL:AIRE, 2011), a separate verification report will be required to provide information on import and/or reuse of materials on site (see **Section 6.3.3**).

The Environment Agency (2010) provides guidance on remediation verification.

Case study 6.1

Reuse of materials during remediation of an ecologically-sensitive site

The Abercarn Gasworks is situated along the River Ebbw in the valleys north of Newport, south Wales. Historically, the site was a coal gas production facility.

Ground investigation had identified significant contamination with tar materials and polycyclic aromatic hydrocarbons (PAHs) close to the river. Through anecdotal evidence from the local community and a suite of ecological appraisals, the site was identified as a potentially sensitive site due to various protected and/or notable habitats and species.

The remedial strategy was based on the following objectives:

- Maximise the reuse of materials on site through segregation and treatment (stabilisation/solidification) of soils with multi-stakeholder input.
- Remove soils affected by Japanese knotweed and asbestos to an off-site facility.
- Reduce the potential for contamination to leach and affect the River Ebbw.

640 tonnes of material was excavated and reused, with an additional 216 tonnes of Japanese knotweed and asbestos-contaminated material disposed of to a licensed facility.

The treatment and reuse of 75 per cent of material on-site significantly decreased haulage traffic, reducing noise, vehicle emissions and nuisance on the community of Abercarn compared to using traditional off-site solutions.

To minimise the impacts to the resident reptile population and avoid any accidental killing/injury during the works, suitable habitat was cleared under specialist supervision and slow-worms 'flushed' into retained fringe habitat bordering the site. The remedial works were then segregated from this corridor with high-quality reptile fencing, which remained *in situ* until completion of the works, demonstrating that good practice was employed at the site.

Clean cover systems

Many brownfield developments, particularly residential plots with gardens, require the placement of a clean cover system to break the pathway between contaminated soils and site users (**Figure 6.9**). Typically, these comprise a 'no-dig' membrane layer, and/or gravel (capillary break) layer, and a specified thickness of subsoil and/or topsoil. It is important that these systems are properly verified, as follows:

- photographic evidence of placement of the materials
- a desk study and/or contamination test to verify the quality of the imported soil
- verification of the depth of the material, by direct measurement or by topographic survey of 'before' and 'after' levels
- muck away for soils removed to create reduced levels
- topsoil delivery tickets.

The chemical quality of the soils being imported will have to meet criteria that are specific to the site, and it may be necessary to undertake specific tests other than those provided by a topsoil provider. The remediation strategy should indicate the quality of soils required.

Figure 6.9 Verifying the depth of a clean cover system

Ground gas protection measures

Gas protection measures are frequently required on brownfield sites. The performance of gas protection membranes is entirely dependent on the quality of the installation. They are vulnerable to rips and tears, poor sealing along joints and around service entry ducts, and other discontinuities in the fabric of the membrane.

Mallett *et al* (2014) describe a risk-based approach for deciding how gas protection measures should be verified and who by. The following aspects should be considered:

- number of plots/buildings
- skills level of the workforce
- gas regime
- complexity of the design.

The higher the risk associated with the site, the more important it is that the verification is undertaken by an independent and qualified inspector. High-risk sites will also require frequent inspections, whereas it may be acceptable to inspect a small sample of work for low-risk sites. BS 8485:2015 requires independent verification of installation for high-risk sites. BS 8485:2015 states that any gas membrane needs to be verified in accordance with Mallet *et al* (2014).

Box 6.2
Qualifications for installers of gas membranes

The relevant qualification for installers of gas membranes is the Cskills Awards L2 NVQ *Diploma in sub-structure work occupations (construction) – installation of gas membranes.*

Go to: **www.citb.co.uk/awards/i-am-learner/qualification-search/viewqualification/?q=qun846**

6.1.3 Long-term monitoring and maintenance

Long-term monitoring is often required to demonstrate that pollution has been effectively managed by the remediation works. Some forms of remediation are ongoing, such as pump and treat systems or permeable reactive barriers, and the structures and plant involved will need maintenance. Gas protection systems that involved alarms or monitors are useful if long-term maintenance can be guaranteed. These should be undertaken in accordance with a monitoring and maintenance plan developed for the site, and signed off under planning. Some monitoring programmes may continue after construction and may delay the final sign-off and discharge of the contaminated land planning conditions.

Case study 6.2

Small-site remediation

A small brownfield site had previously been used for commercial purposes, and was to be developed for housing. After site investigation and risk assessment, it was agreed with the local authority that remediation should comprise excavation of soils within garden areas, placement of a membrane and 600 mm of clean topsoil.

Figure 6.10 Remediation on a small site, excavating soils (a), laying membrane and topsoil (b), verifying the depth of topsoil (c) completed remediation, before laying turf (d)

6.2 GROUND IMPROVEMENT AND FOUNDATION DESIGN AND CONSTRUCTION

The use and suitability of different foundations has been briefly described in **Section 5.3.6**. Shallow foundations may not be appropriate because:

- the underlying soils are too weak
- the underlying soils are highly compressible
- imposed loads are high
- the presence of shallow mineworkings
- the foundations are required to take tension, eg piled foundations if clay heave is possible due to tree removal
- there are services that cannot be subjected to additional load, eg water, gas or other similarly sensitive services or subterranean assets
- there is a high water table and extensive temporary works are required making it less cost effective than piled foundations

or a combination of these factors.

Remediation by design for mineshafts

Case study 6.3

During a programme of ground investigations, it became apparent that a mine entry was likely to be located on site, further to a review of available archaeological reporting (**Figure 6.11**). The site had previously been considered to present a 'low risk' from mine workings, and fortunately the ground investigation consultant had some experience of mine entry treatment works. Ground investigation activities could be easily re-directed to not only pin-point the location of the mine entry, but also obtain the design data required to inform treatment options. This meant there was no need to return to site for additional fieldworks, saving time and money. Rather than undertake significant treatment works, the development layout was altered to accommodate the newly-found mine entry. With the local highway authority's approval, a road was planned across the mine entry, reducing the treatment requirements and delivering a safe development.

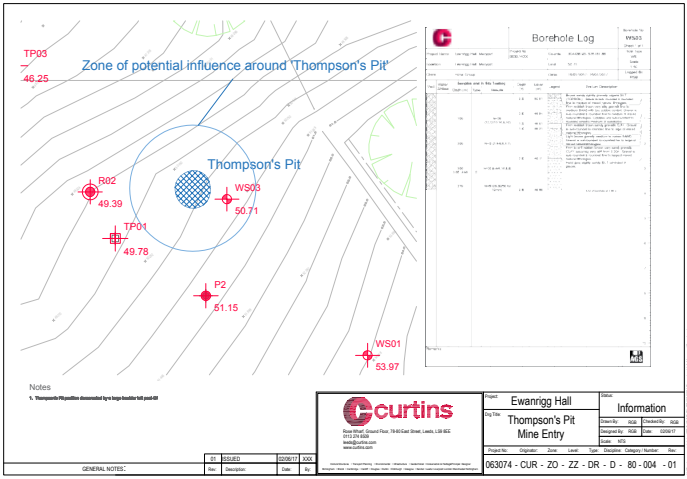


Figure 6.11 Site investigation of Thompson's Pit

Unimproved made ground should never be used as a founding stratum because of its inherent variability, potential for unacceptable levels of settlement, and difficulty in characterisation (see Watts and Charles, 2015).

If engineered foundations (such as piles and ground beams, rafts etc) are selected, specialist design will be required to suit the specific ground conditions, and to manage access and environmental issues. Piles should be designed and installed by a specialist contractor. Testing arrangements should be designed by the foundation specialist and agreed with the warranty provider, the designer of the foundation system and local authority building control requirements. This may include integrity testing, static load tests and, where appropriate, dynamic load tests. The need here will depend on ground risk and the variability of the ground conditions. Further guidance is given in FPS (2006).

It may be necessary to undertake ground improvement works to ensure that the ground is suitable for the proposed construction infrastructure and foundations. These typically include:

- dynamic compaction
- engineered fill
- soil stabilisation
- surcharging
- grouting
- reinforced soil.

The use of these techniques will depend upon the ground conditions, groundwater regime, topography, and the nature and needs of the development. All will need to be designed and constructed by specialist sub-contractors and should be verified by suitably-designed testing arrangements, in agreement with the building control body and warranty provider, before foundation works starting on site.

Typical uses are given in **Table 6.1**.

Many of the approaches given in the table benefit significantly from trials to assess their effectiveness and design. Foundation design, structural design and environmental protection are closely linked. Good communication between engineers is required to ensure that the foundation solution meets the structural requirements and accommodates environmental protection needs. Note that foundation arisings will require waste classification if they are to be disposed of off-site (see **Box 6.4**).

Table 6.1 Ground improvement techniques appropriate for small sites

Technique	Brief description and typical uses
Engineered fill	Methodical compaction of site-won or imported soils, to raise ground levels and/or improve ground characteristics.
Soil stabilisation	Use of lime/cement and admixtures to improve engineering performance of fill. Treatment of wet and/or soft soils. Treatment of foundation soils and subgrade to highways etc.
Surcharging	Pre-loading of the ground with (usually) a mound of earth to effect increases in soil strength and reduce compressibility. Improvements in subgrade and possible use of shallow foundations.
Grouting	Injection of grout into underground voids or poor ground. Improvement of soils engineering performance. Treatment of mineworkings and other subsurface voids.
Reinforced soil	Use of geogrids to improve overall soil strength. Slope stabilisation/steepening. Subgrade improvements.

Case study 6.4

Landslip at Bewdley

Following rain storms in Worcestershire, movement occurred in retaining walls and steep slopes in the garden behind a house in Bewdley, west Midlands (Figure 6.12a). Power supply poles were displaced and foul sewer pipes fractured with the inevitable hazardous and unpleasant consequences.

The site was small and access problems challenging, constraining both the site investigation works needed to characterise the soils in the slope, and limiting the options for remedial works. Site investigation was carried out using windowless sampling and probing, together with topographic and geomorphological mapping so that the geometry of the failure and the resulting features could be modelled.

Remedial design solutions involved a system of drainage to manage water in the slope, and reinforced soil to replace the failed material. A proprietary facing block system was also used to ensure long-term stability, minimise maintenance, and to provide an aesthetically-pleasing finish.

A large amount of material had to be removed, which required great skill and planning by the contractor because of both access limitations to the site and its location, which was next to a busy main road. Site investigation was augmented during the excavation using an observational approach to identify potential slip surfaces within the slope. The soil reinforcement and facing block system was flexible to accommodate layout changes to maximise the effectiveness of the solution as the variations in the ground profile were exposed (Figure 6.12b).

Note that handrails were included in the design as an important safety feature, but were not installed at the time of the photograph.

Figure 6.12 The site before (a) and after (b) remediation

6.3 MANAGING WASTE

Surplus construction arisings and/or discarded soils (and other construction materials) are legally considered waste and subject to waste legislation, unless its subsequent use is allowed under an agreed Environment Agency framework and a regulatory position statement (RPS), or it meets the requirements of an end-of-waste protocol after appropriate treatment.

Box 6.3
Exclusion for excavated naturally-occurring material

Uncontaminated soils and other naturally-occurring materials excavated during construction activities are excluded from waste legislation, providing they are to be used for construction in their natural state on the site on which they were excavated.

There are strict requirements about handling, transporting and disposing of waste materials with a legal 'duty of care' for the safe management of waste to protect human health and the environment. This duty applies to anyone who imports, produces, carries, keeps, treats, or disposes of waste. Under this duty it is a requirement to:

- prevent illegal treatment or disposal of waste – check where the waste is going
- prevent breach of an environmental permit/waste management licence
- ask to see a copy of the relevant documentation
- prevent waste escaping – plan handling and temporary storage of waste to avoid nuisance/and or environmental pollution. Waste soils generated on brownfield sites can be contaminated and require special handling
- ensure waste is only transferred to an authorised person – use online public registers search facility, which includes links on the 'about' page for other jurisdictions to check evidence of any authorisations supplied
  Go to: https://environment.data.gov.uk/public-register/view/index
- provide an accurate description of the waste (see **Box 6.4**).

Retention of waste documentation

Non-hazardous waste transfer notes must be kept for two years and hazardous waste consignment notes for three years.

Waste must be transported by registered waste carriers, and for each load of waste transported, waste transfer notes (non-hazardous waste) or consignment notes (hazardous waste) must be completed. These should include a description of the waste (including European Waste Catalogue [EWC] code) and a declaration that the duty to apply the waste hierarchy has been fulfilled (see **Figure 6.13**).

Go to: www.wastesupport.co.uk/ewc-codes

Common waste classification misconception

The purpose of a waste acceptance criteria (WAC) test is not to determine whether a waste is hazardous or non-hazardous. **See Box 6.4.**

Waste must be classified to ascertain if it is or hazardous or non-hazardous, and disposed of at an appropriately licenced facility (see **Box 6.4**).

Management of waste on small sites can be onerous due to a lack of space for stockpiling, but disposal of surplus soils, particularly contaminated soils, to landfill where the standard rate of landfill tax applies can be a significant cost. Considering waste early may enable the design to be modified to prevent waste being generated, or to find other sites that may have a soils deficit allowing reuse of surplus materials. Fixed-soil treatment plants are often a cost-effective alternative to landfill for contaminated soils as no landfill tax is applied. CL:AIRE keeps a register of materials, which includes these facilities and receiver sites (ie sites that need surplus soils).

Go to: www.claire.co.uk/projects-and-initiatives/cl-aire-register-of-materials

Formalising waste management planning can be a benefit and a site waste management plan (SWMP) may be a requirement of planning or required for BREEAM. The SWMP is a live document produced by the designer describing how materials will be managed efficiently and disposed of legally during the construction of the works. It also explains how the reuse and recycling of materials will be maximised, and is implemented and updated by the PC through the construction works, to record how the waste was handled.

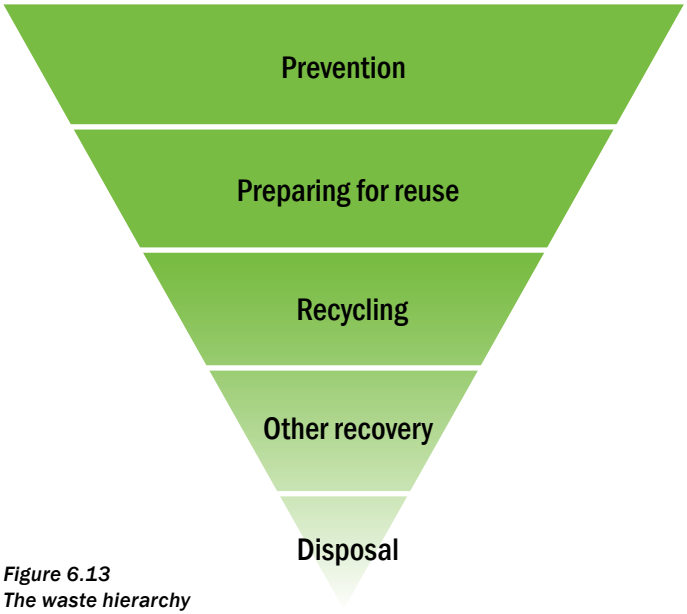


Figure 6.13
The waste hierarchy

From 1 April 2018, anybody disposing of waste and anyone who knowingly facilitates the disposal/transfer of soil to sites without appropriate environmental permits or are not compliant with an approved reuse mechanism may be liable to landfill tax. Also, all parties involved could face penalties or criminal prosecution.

Go to: https://www.gov.uk/government/publications/landfill-tax-disposals-not-made-at-landfill-sites/landfill-tax-disposals-not-made-at-landfill-sites

Box 6.4

Waste classification and suitability for use

All waste requires the waste producer to assign a List of Wastes code (LoW), also known as a EWC code to their waste. The full list of LoW/EWC codes and detailed guidance on how to classify waste can be found in Environment Agency (2015).

For example, Chapter 17 of the LoW identifies two codes that can be applied to a waste soil:

- 17 05 03* soil and stones containing hazardous substances (the hazardous entry)
- 17 05 04 soil and stones other than those mentioned in 17 05 03 (the non-hazardous entry).

Determining which code applies to a particular waste soil is required before the waste soil can be sent for disposal at a suitably-licensed facility. This is usually done by a laboratory analysis of all the substances, eg metals or hydrocarbons in the soil that have hazardous properties (see Environment Agency, 2015).

If the classified waste (ie hazardous/non-hazardous) is to be disposed of to landfill (rather than recycling, reuse etc) the hazardous, stable non-reactive hazardous (SNRH) and inert classes of landfill each have a set of WAC thresholds that have to be passed before the waste management company can accept them. The non-hazardous class of landfill does not have any numerical WAC.

Waste classified as hazardous can go to a hazardous landfill. However, if this waste does not meet the hazardous WAC, then it may need treatment or some other form of disposal, eg incineration. Certain hazardous wastes such as asbestos may be acceptable if they meet the WAC for the SNRH class of landfill.

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC. A subset of non-hazardous wastes, which includes soils, can be categorised as inert and be sent to the inert class of landfill, as long as the waste does not exceed the inert WAC. If the waste fails the inert WAC (because of total organic carbon [TOC] or loss on ignition [LOI] for example), this does not make the waste hazardous, but it means that the waste:

- cannot be disposed of to the inert class of landfill
- can be sent to a non-hazardous class of landfill
- can undergo treatment to meet the particular WAC.

Some materials may be accepted, without testing, as non-hazardous, inert waste (eg concrete, bricks, tiles and ceramics, and mixtures of bricks, concrete, tiles and ceramics), but not if they are contaminated by a hazardous material such as oil or asbestos.

Black top

Black top that has a coal tar-based binder are classified as hazardous. More modern black tops, which have a bitumen binder, are typically non-hazardous. Note that roads are layered, so the deeper or older layers of black top are more likely to be coal tar based. When classifying black top, each individual layer in the black top has to be identified and assessed. Coal tar-based black top will be significantly more expensive to dispose of.

Environment Agency (2015) includes some guidance on assessing black top. It states that where the concentration of benzo[a]pyrene in the binder of a particular layer of black top (ie excluding the aggregate) is at or above 50 mg/kg, then the amount of coal tar should be considered to be sufficient (0.1 per cent or more) for the material to be hazardous and coded 17 03 01*.

Reuse of soils

To identify whether a clean or contaminated soil is suitable for use, a human health risk assessment is carried out to screen soils against specific criteria appropriate for the site. Note that neither a WAC test nor a waste classification (Environment Agency, 2015) will determine whether a soil is suitable for reuse.

* Note that thresholds above which disposing persistent organic pollutants (POPs) to hazardous landfill is no longer acceptable are given at:
www.gov.uk/guidance/dispose-of-waste-containing-persistent-organic-pollutants-pops

6.3.1 Exemptions from environmental permitting

Certain activities and volumes of waste are exempt from licensing under The Environmental Permitting (England and Wales) Regulations 2010. The main exemptions that apply to brownfield site development are:

- **Exemption T5:** temporarily treating waste on a small scale to produce aggregate or soil (up to 50 000 tonnes of bituminous mixtures for making roadstone, or up to 5000 tonnes of other specified wastes). (Note that if the material is not proven to be bituminous and there is cause to believe the material may contain coal tar then this exemption is not allowed until all materials are shown to be non-hazardous).
- **Exemption T7:** treating waste bricks, tiles and concrete by crushing, grinding or reducing size (this should be registered with the local authority).
- **Exemption U1:** using waste in construction (up to 1000 tonnes of soil and stones, dredging waste or solid waste from remediation (not containing hazardous substances) or soil from washing fruit and vegetables, and up to 5000 tonnes of other specified waste types).

Further information should be sought on the types of waste material that can be reused or treated, for example:

- **www.gov.uk/guidance/waste-exemptions-using-waste**
- **www.gov.uk/guidance/waste-exemption-t5-screening-and-blending-waste**

It is a usual practice to register the exemption with the local authority in whose area the activity takes place, or the relevant environment agency, before work starts.

6.3.2 Exemptions from waste management licensing (Scotland and Northern Ireland)

Where waste is to be used in construction projects, it can be exempt from waste licensing if it meets the guidance, definitions, operational policy and strategy for registering a paragraph 19 exemption. This is a complex exemption that must be registered (for a fee) with the relevant regulator 21 days before starting on site.

Scotland:

- **www.sepa.org.uk/regulations/authorisations-and-permits/application-forms/#Waste**
- **www.sepa.org.uk/regulations/waste/activities-exempt-from-waste-management-licensing**

Northern Ireland:

- **www.daera-ni.gov.uk/topics/waste/waste-management-licensing-exemptions**

Note that in Northern Ireland, the waste types that may be used under the paragraph 19 exemption are listed in Table 8, Schedule 2 of the Waste Management Licensing Regulations (Northern Ireland) 2003 (as amended). The waste must be used in accordance with the planning permission granted.

6.3.3 Reusing soils on site

In England and Wales the CL:AIRE (2011) definition of waste development industry code of practice (DoWCoP) allows the:

- reuse of excavated materials on the site of origin
- transfer of 'clean, naturally-occurring soils and minerals' for reuse between development sites
- reuse of excavated materials on other development sites via a permitted treatment facility.

It has become a common approach for the management of excavated materials on development sites.

It supports the establishment and operation of fixed-soil treatment facilities and it enables the reuse of both contaminated and uncontaminated materials on their site of origin, and between sites within defined cluster projects (CL:AIRE, 2012).

The DoWCoP allows waste materials to be deemed not waste, if they meet certain criteria. A materials management plan (MMP) must be prepared to demonstrate that the soils meet the criteria, and it must be signed off by a qualified person (QP), as accredited by CL:AIRE.

An important aspect of the MMP is to demonstrate that local authority contaminated land officers and Environment Agency/NRW waste/contaminated land officers are aware of the project, have had the opportunity to review the MMP, and have no objections. Obtaining written evidence to this effect should be scheduled into the programme, as it may take some weeks.

The DoWCoP also allows waste materials to be transported between sites, or to be treated off-site at 'hub' sites within a cluster of sites. This can be particularly useful on small sites where space for treatment is limited.

In Scotland, reuse of construction arisings is covered by exemptions from waste management licensing (see **Section 6.3.2**).

Box 6.5
Criteria for reuse of materials

Protection of human health and of the environment. Measures to protect the environment and prevent harm to human health, must be adequate given the proposed use of the materials.

Suitability for use without further treatment. Both the chemical and geotechnical properties of the material must be demonstrated to be suitable, and the relevant specification for its use must be met.

Certainty of use. It must be a certainty not a probability that the material will be used for the stated use.

Quantity of material. Materials should only be used in the quantities necessary for that use and no more.

See CL:AIRE (2011).

6.3.4 WRAP protocols (England, Wales, Northern Ireland)

The WRAP quality protocols set out steps that must be taken for certain waste materials to become a non-waste product or material that can be either reused by business or industry, or supplied into other markets. There are two quality protocols applicable to development sites, for the production of aggregates from inert waste (Environment Agency, 2013), and for pulverised fuel ash (Environment Agency, 2010).

It should be noted that the WRAP requirements cover a range of geotechnical, chemical and physical testing to be carried out. Reference should be made to the relevant volumes of the Highways Agency Specification for Highway Works (SHW), British and European Standards, Environment Agency publications (eg Environment Agency, 2015) and any other documentation alluded to within the WRAP quality protocol.

6.3.5 Recycled aggregates from inert waste (Scotland)

The SEPA has also published guidance on the use of recycled aggregates manufactured from inert waste, clarifying the point at which they cease to be waste and waste management controls are no longer required (SEPA, 2013).

Purchasing recycled aggregate

Check that the supplier has appropriate WRAP quality protocol documentation in place to show compliance with protocols otherwise there is a risk of importing a waste, which would be subject to waste legislation.

Request and check test certificates for the recycled products. Beware that that there have been cases of recycled aggregate contaminated by asbestos. Aggregate should be free of visible asbestos-containing material and should not contain asbestos at concentrations above 0.001 per cent (above this concentration, a site-specific risk assessment would be required).

Remember that concrete is susceptible to sulphate attack, and to consider the sulphate concentrations at the site when specifying recycled aggregate. Sulphate attack causing disintegration of crushed concrete is expensive to remediate.

6.4 MANAGING THE EFFECTS OF CONSTRUCTION

Small sites are disproportionately affected by boundary issues, due to their location to neighbouring sites. Issues that require careful management include:

- **Dust, air quality and odour.** Monitoring may be necessary to support control of off-site dust nuisance during excavations. Dust can usually be controlled by wetting.
- **Noise mitigation.** This can be achieved by using quieter equipment, modifying equipment, good maintenance, noise barriers, and work activity scheduling.

- **Traffic management.** There is often a planning requirement to park all construction traffic on site, which can be difficult to achieve on smaller sites. Careful planning of where workers and contractors will park, and how loads will be delivered to site should be undertaken. Where site access is constrained, a banksman may be needed to monitor all arrivals at the site and ensure that traffic outside the site is not disrupted and safety is maintained.
- **Storage and security.** On a small site there can be a lack of space for secure storage of plant and equipment, and site security may have to be improved to protect the whole site.
- **Neighbour relations.** Significant delays can arise from party wall issues, or other neighbour disputes. Developers should communicate openly with neighbours about site activities and endeavour to minimise disruption and inconvenience.
- **Health and safety risks associated with brownfield sites.** These include contaminated soils and water, ground gas and soil vapour, derelict structures, underground voids or weak ground.
- **Working hours.** These are likely to be restricted due to the location of neighbours.

6.5 CHANGES TO PLANS

In many instances, as the construction phase of development progresses, it will become apparent that alterations are required to the scheme that has planning consent. So the planning consent must be amended for the revised scheme to be legal. This can be done in three ways:

1 Make a S96a (England and Wales) application, more commonly called a non-material minor amendment. These applications are for dealing with very small alterations. (S42 amendment in Scotland, and S67 amendment in Northern Ireland)

2 Make a S73 (England and Wales) application to remove or vary a planning condition, for minor material amendments (S42 amendment in Scotland, and S54 amendment in Northern Ireland).

3 Submit a new application for major amendments to the scheme.

If several minor and/or non-material amendments are required, it is possible to apply for them all in one go rather than submitting several applications.

6.6 MANAGING CONSTRUCTION PHASE FINANCING

A typical development loan will be drawn down in stages, often on a monthly basis. The contract between lender and developer will have made provision for payment to be made in arrears for work done that month. However, before agreeing the payment on the contractor's invoice, the lender will send their monitoring surveyor to certify the work. This is something the developer should carefully check as the lender is not only keen to ensure

that the developer is not paying too much, but crucially that the project overall remains within LTV covenants. If the value of the development is lower than expected such that the LTV ratio breaches the loan covenant, the lender may withdraw their support and require full repayment of the loan. The developer will then have to urgently find additional investment to improve the LTV ratio, or refinance the project. This is particularly relevant for small brownfield projects where remediation works or abnormal ground conditions may cause costly delays.

6.7 SITE INSPECTIONS

Throughout construction, the project will be inspected by various interested parties, including:

- local authority building control officers or approved inspectors
- financier's monitoring surveyor
- warranty provider.

It is important to maintain good communications with inspectors, so that inspections are made at the right time, and inspectors are given sufficient notice of key events.

Building control inspections and land contamination

Building regulations state that it is the builder's responsibility to ensure that the development is suitable for use whether or not a land contamination planning condition has been applied. Remember that building control inspectors must be given notice to inspect key points in the development. HM Government (2004) provides practical guidance on meeting the requirements of the building regulations with respect to land contamination (England and Wales). In Scotland, a construction compliance and notification plan (CCNP) will be issued by the local authority, which details the inspections that will be made during construction.

7 Closeout

7.1 FINAL INSPECTIONS

Once the construction is complete, building control inspectors, warranty providers and funders will require a final inspection to verify the quality and value of the buildings.

Before obtaining building control approval, all design, construction and verification report issues must be resolved to the satisfaction of the building control body. The building control inspector (or approved inspector) will inspect the project at key stages during development, and will issue a completion certificate (local authority) or final certificate (approved inspector) on completion, to demonstrate compliance with the Building Regulations 2010 (England, Wales and Northern Ireland). For the equivalent process in Scotland see Scottish Government (2017).

Warranties will be issued to the new building owner, usually on a plot by plot basis as the project proceeds. All design, construction and verification report issues should be resolved to the satisfaction of the warranty provider before the appropriate documents are issued.

7.2 VERIFICATION REPORTS

Verification reports may have been prepared for remediation of contamination (**Section 6.1.2**) and/or to verify reuse of materials using the CL:AIRE DoWCoP (2011). In some cases, the same report may provide verification of both activities. Typically, a verification report will summarise the aims of the remediation/reuse of materials, and describe the works undertaken, including any changes to the plans in response to site conditions. Appendices will typically include full records of the works completed such as:

- photographs
- quantities of materials treated/excavated/reused
- waste disposal volumes and tickets
- materials tracking sheets
- laboratory testing certificates
- changes in site levels
- final drawings.

7.3 HEALTH AND SAFETY FILE

Under CDM 2015, the PD must prepare a H&S file during the pre-construction phase of the project, and update the file with relevant information throughout the project (see **Box 1.1**). When the project ends, the file is handed over to the client, who must make it available to anyone who may need it when working on the site in future. If the land is sold on or transferred, the file must be handed over to the purchasers/beneficial owners. If the development is of separate units such as housing, relevant information must be supplied

to the purchasers/beneficial owners of the units. Where relevant, information concerning residual contamination should be included in the file. Verification reports should also be included where any residual hazards remain.

7.4 FINANCIAL EXIT

Development finance is provided in the form of a facility, agreed in advance. A development loan facility is fixed and finite, so if a project incurs further costs, these funds need to be raised outside the development facility. If a loan is not repaid on time, the rate of interest will default to a penalty rate. Ultimately, failure to repay the development loan on time or in full could result in the developer forfeiting their project and possibly facing liquidation.

The developer should ensure that they have planned the exit as soon as they agree a loan facility. The primary strategy will usually be to sell the project. However, this may be vulnerable to changes in the economic environment. Unforeseen events such as financial crises (eg collapse of the banking sector in 2008 to 2009), political turmoil (eg Brexit vote outcome), legislative or regulatory change (eg increments in stamp duty, alterations to the tax regime) can all dramatically affect the saleability of a project. It is prudent to consider alternative exit strategies to protect against failure to sell the project.

7.4.1 Developer's exit finance

One tactic a developer can adopt is to refinance out of the development facility, onto an exit product designed specifically for the task. This is a useful tool for developers, allowing them to pay off the development loan facility even if they have not sold the development. As the project has finished, the riskiest phase is over and the project can be valued accurately on the open market.

7.4.2 Commercial mortgage

Another exit route may be to refinance the project onto a commercial mortgage, then rent out the properties. This would suit a developer in the purpose-built rental sector, although other developers may find it a useful back-up strategy if the sales route does not materialise. Timing is critical, as the process of obtaining the refinance can take months. Lenders want to see the project as close to completion as possible, but it is important that all the paperwork has been submitted well in advance.

7.5 DISCHARGE OF PLANNING CONDITIONS

The developer should ensure that there are records of the discharge of all planning conditions for the development, as legal searches by future purchasers will highlight outstanding conditions, which may delay or prevent the sale of the property. This is

particularly important for sites where land contamination conditions have been imposed. Thorough checks should be made that remediation verification reports have been received and accepted by the planning authority.

Case study 7.1

Discharge of planning conditions

Overlooking the verification stage of a project can be expensive. Where land contamination mitigation measures include remediation by design such as gas protection and clean cover, the verification process may be inadvertently overlooked, particularly if some properties are sold before all the properties on site are completed. On one such housing development, this only emerged when one of the first buyers of a property decided to sell their home and the purchaser's legal searches revealed that the planning conditions relating to remediation had never been discharged. It quickly became apparent that there was no evidence to show that the clean cover had been imported. A post-construction investigation was required, which confirmed the absence of clean cover, and testing found the presence of unacceptable levels of contamination that even a site-specific risk assessment could not remedy. The house builder had to install the clean cover as previously specified and carry out the necessary validation testing and verification reporting to enable the planning condition to be discharged. The costs of post-construction remedial works were considerably more in terms of additional investigation, consultancy fees and remobilising a contractor to site than if the works had been undertaken and completed in accordance with the original remediation strategy.

7.6 WASTE RECORDS

Waste consignment notes (hazardous waste) and transfer notes (non-hazardous waste) should be retained, and it is good practice to include these as part of the verification report. Some local authorities stipulate that these should be included in reports, in which case they will be needed to discharge any remediation verification conditions.

It is also good practice to obtain documentation from the waste carriers to demonstrate that the waste was received at an appropriately-licensed landfill.

7.7 ASBESTOS REGISTER

Under the CAR (2012), there is a requirement to maintain a register of asbestos and asbestos-containing materials on a site. If such materials have been encapsulated on site, there is a requirement to make sure this is recorded in the asbestos register. Relevant information should be included in the H&S file.

7.8 HOMEOWNER PACKS

For residential properties, homeowner packs are often prepared detailing how the house was built, information on fire safety and utilities. For brownfield sites where remediation has been carried out, these would normally include information on the remediation works. Homeowner packs usually fulfil the requirements of the H&S file (CDM 2015), provided they include sufficient relevant information.

8 Managing dormant brownfield sites

8.1 TYPES OF SITES – REASONS FOR 'DORMANCY'

There are many small pieces of land held by public or private estates, companies and individuals that are not in active use and not scheduled for development. These sites benefit from, and often require, ongoing management to control vegetation growth, maintain boundaries and prevent trespass. However, brownfield sites need more consideration and management to control hazards such as above ground or in-ground structures, and to maintain and sometimes re-assess land contamination issues arising from former site uses. Understanding and managing ecology is often a significant issue on dormant sites.

Brownfield sites may become dormant, some common examples include:

- Sites that are part of wider operational landholdings, but have limited development potential due to remoteness, access, or land value.
- Sites that are land-banked for future development or awaiting funding.
- Land parcels that are part of local authority land assembly schemes awaiting final investment.
- Public open space that is part of a re-developed industrial site.
- Utilities companies often own sites that contain infrastructure (eg gas pressure reduction installations, electricity substations), but have little potential for development.

8.2 REASONS FOR ACTIVE SITE MANAGEMENT

All dormant brownfield sites require management, and funds should be set aside to ensure that site hazards, assets and ecology are adequately understood, so that appropriate management measures are developed and adopted. Reasons for management include:

- Compliance with environmental legislation and regulations.
- Maintenance of site security (eg boundary fencing) to prevent unwanted trespass, both in terms of protecting the public from harm and preventing occupation of land, and also to prevent fly-tipping.
- Management of plant growth and habitats, to deter or encourage colonisation by protected species.
- Management and elimination of invasive species. There are legal duties to control invasive plant species such as Japanese knotweed, Himalayan balsam and Giant hogweed.
- Characterisation of potentially hazardous ground conditions. There are legal obligations to prevent pollution and harm to people and the environment.
- Site owners may be liable to clean up contaminated land, under Part 2A of the Environmental Protection Act 1990 (see **Box 8.1**).
- Structures on the site may contain contamination, and deterioration of these structures could result in pollution or harm.

- Above and below ground structures may present a hazard sometimes due to deterioration, which will require management and potentially additional security measures.
- There are legal requirements to remove disused fuel tanks from sites where there is a need to prevent danger. Fuel tanks are common in many former industrial sites and petrol filling stations.
- Management of environmental liabilities.

Local authorities have a variety of tools available to enforce action on these issues, including the Environmental Protection Act 1990, S215 of the Town and Country Planning Act 1990 and various environmental health powers. In addition, the Environment Agency has powers to prevent pollution under the Water Resources Act 1991. Under the Environmental Protection Act 1990, local authorities have a duty to inspect their areas, and to enforce remediation where land is deemed to be contaminated (see **Box 8.1**).

Box 8.1
Definition of contaminated land

Part 2A of the Environmental Protection Act 1990, as inserted by S57 of the Environment Act 1995, was brought into force on 1 April 2000 in England and Wales and 14 July 2000 in Scotland.

The legal definition of contaminated land (as of April 2012 from Section 78A(2) of Part 2A of the Environmental Protection Act 1990) 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:*

- *significant harm is being caused or there is the significant possibility of such harm being caused; or*
- *significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused."*

Controlled waters include all surface watercourses or bodies, including those which are man- made, and also groundwater.

Note that the Northern Ireland equivalent, Part III of the Waste and Contaminated Land (Northern Ireland) Order 1997, is not yet enacted.

In some cases, it may be necessary to undertake works to clean up land contamination, or to remove or manage redundant infrastructure. There may be opportunities to undertake remediation techniques that are effective over longer timescales than would normally be considered for development sites.

8.3 CAUSES OF DETERIORATION IN SITE CONDITION

Several factors can lead to deterioration in site condition, such as:

- Actual deterioration:
  - structural failure of below ground redundant structures due to weathering/ structural degradation or third-party interference, causing the release of contamination to an uncontrolled environment and/or increasing the physical hazard arising from the structure
  - migration of mobile contaminants via groundwater flow either to legally protected water bodies or beneath occupied properties

- migration of contamination onto site from off-site sources
- erosion of river-banks/coastal boundaries to uncover structures or contaminated soils
- vandalism and arson
- invasive plant species.

- Theoretical deterioration:
  - elevation of the inherited risk status for a site from updated assessments, often through identifying previously unknown historical structures or sources
  - elevation of the risk status for a site from changes in legislation and associated lowering of thresholds for limits of contamination that cause the attribution of statutory risks.
- Climate change.

  Wetter winters, hotter, drier summers and changing ground and groundwater conditions may have several effects, such as to:
  - mobilise contaminants or increase off-site transport
  - undermine structures through erosion or soil volume changes
  - degrade land quality by, for example, subsidence or landslide
  - encourage wildfires
  - alter the ecology.

It is important that potential future changes in site condition are assessed and considered when managing dormant sites. It is also important that there is an ongoing programme of inspection for sites where there is a risk of site deterioration or significant change in condition. Where site condition has deteriorated to the extent that it presents a danger, the local authority may serve orders on the site owner to remove hazards and demolish buildings that are in a dangerous condition. This may incur a cost or charge on the property if action is not taken within a reasonable time.

8.4 ASSESSMENT OF DORMANT SITES

Management of dormant sites can take many forms, and it is useful to apply a standard process in evaluating the management measures that will be required. **Figure 8.1** shows the decision process to be followed in managing dormant sites.

All dormant brownfield sites should be subject to a preliminary assessment to understand the hazards, assets/liabilities, ecology and (in some cases) archaeology of the site. From a land contamination perspective, a preliminary risk assessment should be undertaken to identify potential sources, pathways and receptors at the site. This should include a site walkover and a desk study followed by development of the site conceptual model.

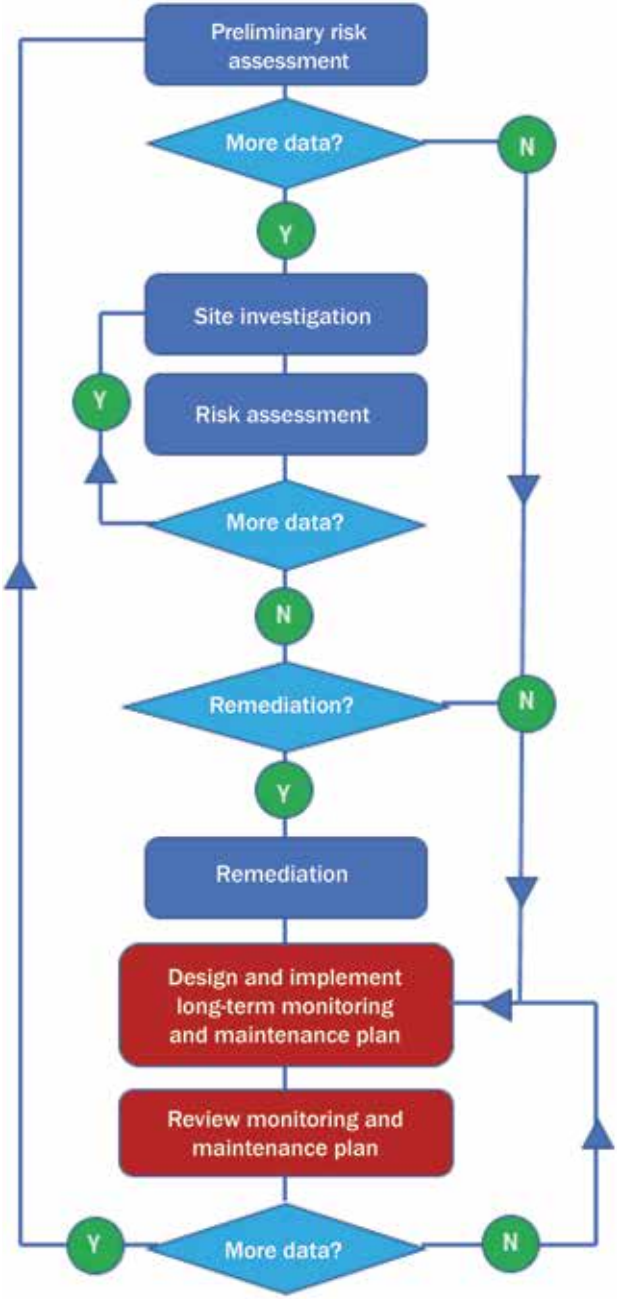


Figure 8.1 Managing dormant sites

The amount of investigation and risk assessment required for each site will depend on the nature of the site, its assets and liabilities, the amount of data and assessment already available, and on-site setting and risks. The age of the available data is also an important factor, as data may become out of date due to changing site conditions, quality expectations and changes in the regulatory framework. Investigation may include soil sampling and the installation of groundwater and ground gas monitoring, which will allow ongoing assessment of changes in site hazards and associated risks.

Once the hazards and risks associated with each site have been identified, and steps taken to manage any unacceptable risks or liabilities, the site should be monitored and maintained on an ongoing basis.

Japanese knotweed liability

Landholders are advised to re-think their approach to Japanese knotweed after a landmark court ruling, Waistell v Network Rail (PLA, 2017). Claimant Robin Waistell told courts he was unable to sell his property because of Japanese knotweed on neighbouring land owned by Network Rail. Network Rail was ordered to pay £15 000 compensation, despite the fact that no physical damage had been done to Mr Waistell's property. The implications are that landholders may be liable to claims for damages from neighbours, even where knotweed has not spread across site boundaries or caused physical damage to property. Management and control of Japanese knotweed growth should be included in site management and maintenance.

8.5 MONITORING AND MAINTENANCE PLANS

A monitoring and maintenance plan should be maintained for each site. The level of complexity will depend on the level of risk associated with the site. The plan should include a full specification of the following:

- regular maintenance activities
- site walkover inspections
- regular monitoring activities
- accountable personnel
- plan review periods.

Maintaining good records of monitoring and maintenance will assist ongoing efforts to maintain the site, and will also prove valuable as marketing information should an opportunity arise to sell the landholding.

8.6 MONITORING AND MAINTENANCE ACTIVITIES

The following are examples of monitoring and maintenance activities. The types of activities undertaken will depend on the risks identified at the site:

- updating desk study data
- regular site inspection to monitor vegetation/site boundary, security/integrity of site structures

- maintaining monitoring infrastructure
- groundwater level monitoring
- soil gas monitoring
- groundwater/surface water quality sampling
- repeat detailed site inspection, including soil sampling and new boreholes to refresh dataset
- refreshing risk assessments in light of any new regulatory standards or site data.

Monitoring boreholes are vulnerable to damage from vandalism, ingress of water, and invasion by wildlife, eg blockages due to insects' nests. They are also easily lost in undergrowth. Replacing boreholes is expensive, so regular inspection and maintenance, the use of 'Top Hat' type covers to make them easy to find and prevent invasion of wildlife, and redevelopment of wells that have not been used for some time can all save costs.

8.7 PORTFOLIO OF SITES

For a portfolio of sites, it may be appropriate to prioritise the sites in order of likely risk, by undertaking a simple desk study for each one and ascribing scores to various aspects of the site. A total risk score can then be ascribed to each site, and the sites ordered by score.

Many such scoring systems have been developed by local authorities, who are required to inspect their areas for land affected by contamination.

It is noted that local authorities may view a site as high risk in their geographic area, but which a landowner considers low risk across a much wider land portfolio over multiple local authority boundaries and counties. A conflict of priority may arise and will need to be discussed to satisfy the regulator that the site is within a well-managed programme. However, the site owner may need to consider re-prioritising, based on external regulator influence.

Box 8.2
Redundant fuel storage equipment

Former retail petrol stations are frequently redeveloped, however these sites often remain dormant for a considerable amount of time due to the complex operations required to remove underground tanks and pipework.

There are statutory responsibilities that fall to the owners of sites that contain unused but serviceable fuel tanks, because of the risk of a fire and/or an explosion from highly flammable liquids that can discharge vapour. There is also the risk of the loss of fuel from abandoned tanks which later enters local watercourses or migrates to adjoining property. Whereas storage of petroleum at workplaces that store petrol and dispense fuel is covered by the requirements of the Petroleum (Consolidation) Regulations 2014, S73 of the Public Health Act 1961 says:

> *"...where a fixed tank or other fixed container which has been used for storage of petrol, and is no longer used for that purpose is kept on any premises, the occupier of the premises shall take all such steps a as reasonably necessary to prevent danger from that container."*

For the purposes of this legislation where the premises are unoccupied 'owner' is substituted for 'occupier'.

Tanks not in use can be water filled for up to one year, but they need to be checked by a responsible person on a regular basis and their observations recorded. Water sealing of disused tanks is usually accepted by petroleum regulatory authorities only as a short-term measure where the site is still occupied. It is usual for the local authority petroleum officer to continue to certify disused tanks to enable control to be maintained or insist on solid filling immediately if practical.

Figure 8.2 Work in progress to remove a disused underground tank (courtesy Curtins)

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Appendices

A1 Professional accreditations

Table A1.1 presents a selection of chartered institutions and professional bodies whose professional members are commonly involved with development of brownfield sites. Table A1.2 provides selected trade associations and regulating bodies.

Table A1.1 Professional bodies and chartered institutions

Project role	Accreditation/trade bodies
Land agents	Royal Institution of Chartered Surveyors: **www.rics.org/uk**
Planners	Royal Town Planning Institute: **www.rtpi.org.uk**
Solicitors	The Law Society Conveyancing quality schemes: **www.lawsociety.org.uk/support-services/accreditation/conveyancing-quality-scheme** Accreditation: **www.lawsociety.org.uk/support-services/accreditation**
Architects	Royal Institute of British Architects: **https://www.architecture.com**
Quantity surveyors	Royal Institution of Chartered Surveyors: **www.rics.org/uk**
Geoenvironmental consultants	Association of Geotechnical and Geo-Environmental Specialists: **www.ags.org.uk** Chartered Institution of Water and Environmental Management: **www.ciwem.org/about** CL:AIRE NQMS: **https://www.claire.co.uk/projects-and-initiatives/nqms** CL:AIRE DoWCoP Qualified Person register: **https://claire.co.uk/projects-and-initiatives/dow-cop/.../117-qualified-person-register** Institute of Environmental Management and Assessment: **https://www.iema.net** Institute of Materials, Minerals and Mining: **www.iom3.org** Institution of Civil Engineers: **https://www.ice.org.uk** Institution of Environmental Sciences: **https://www.the-ies.org** SiLC: **https://www.silc.org.uk/about-us** The Geological Society: **https://www.geolsoc.org.uk** UK Radon Association: **www.radonassociation.co.uk**
Engineers	Chartered Institution of Building Services Engineers: **https://www.cibse.org** Chartered Institution of Civil Engineering Surveyors: **https://www.cices.org** Chartered Institution of Highways and Transportation: **www.ciht.org.uk** Chartered Institution of Water and Environmental Management: **www.ciwem.org/about** Institute of Highway Engineers: **https://www.theihe.org** Institute of Materials, Minerals and Mining: **www.iom3.org** Institution of Structural Engineers: **https://www.istructe.org** Institution of Civil Engineers: **https://www.ice.org.uk**
Contractors	Chartered Institute of Housing: **www.cih.org** Chartered Institute of Plumbing and Heating Engineering: **https://www.ciphe.org.uk** Chartered Institution of Building Services Engineers: **https://www.cibse.org** Institute of Demolition Engineers: **https://ide.org.uk**

Table A1.2 Trade associations and regulating bodies

Project role	Accreditation/trade bodies
Funders	Financial Conduct Authority: **https://www.fca.org.uk** National Association of Commercial Finance Brokers: **https://www.nacfb.org**
Contractors	Build UK: **https://builduk.org** Considerate Constructors Scheme: **https://www.ccscheme.org.uk** Construction Industry Training Board: **https://www.citb.co.uk** Civil Engineering Contractors Association: **www.ceca.co.uk** Federation of Master Builders: **https://www.fmb.org.uk** The Guild of Builders and Contractors: **www.buildersguild.co.uk** Home Builders Federation: **https://www.hbf.co.uk** HSE Asbestos licence holders: **https://webcommunities.hse.gov.uk/connect.ti/asbestos.licensing/view?objectId=8516** National Federation of Builders: **https://www.builders.org.uk/home** National House-Building Council: **www.nhbc.co.uk**
Building inspectors	Construction Industry Council: **http://cic.org.uk**
Warranty providers	Council of Mortgage Lenders: **https://www.cml.org.uk/about-us**
Drillers	British Drilling Association: **www.britishdrillingassociation.co.uk**

A2 Permitted changes of land use

Table A2.1 shows permitted changes of land use in England.

Table A2.1 Permitted changes of land use

From	To
A1 (shops)	A2, or up to 150 m^2 A3 subject to approval, or up to 200 m^2 D2 subject to approval and only if the premises were in A1 use on 5 December 2013. A mixed use comprising a A1 or A2 and up to two flats may be permitted subject to meeting certain conditions. C3 if the cumulative floor space of the building is under 150 m^2 and subject to approval
A2 (professional and financial services) when premises have a display window at ground level, but excluding betting offices or pay day loan shops	A1, or up to 150 m^2 A3 subject to approval, or up to 200 m^2 D2 subject to approval and only if the premises were in A2 use on 5 December 2013. A mixed use comprising A1 or A2 and up to two flats may be permitted subject to meeting certain conditions. C3 if the cumulative floor space of the building is under 150 m^2 and subject to approval
A3 (restaurants and cafes)	A1 or A2
A4 (drinking establishments)	A1, A2 or A3 except buildings that may be defined as 'community assets'.
A5 (hot food takeaways)	A1, A2, A3
B1 (business)	Up to 500 m^2 B8
B2 (general industrial)	B1
B2 (general industrial)	Up to 500 m^2 B8
B8 (storage and distribution)	Up to 500 m^2 B1
C3 (dwelling houses)	C4 (small houses in multiple occupation)
C4 (small houses in multiple occupation)	C3 (dwelling houses)
Sui generis (casinos and amusement arcades/centres)	D2, or only if existing building is under 150 m^2 A3, or subject to approval. C3 if the cumulative floor space of the building is under 150 m^2 and subject to approval
Sui generis (betting offices and pay day loan shops)	A1 or A2. C3 if the cumulative floor space of the building is under 150 m^2 and subject to approval. A mixed use comprising a betting office or a pay day loan shop, or an A1 or A2, and up to two flats may be permitted subject to meeting certain conditions
Sui generis (agricultural buildings)	A1, A2, A3, B1, B8, C1, C3, D2 all subject to meeting relevant criteria and approval

A3 Project risks

Table A3.1 Common project risks and mitigation measures

Risk description	Consequence	Mitigation/response strategy
No planning granted	Commercial lenders will not support venture	Secure option or lock-out clause on site
Full planning not granted	Commercial lenders will not support venture	Conditional exchange on site
Economic shocks, eg Brexit, interest rate increments	Commercial lenders become nervous, reduced LTV	Ensure contingency finance is in place, have multiple exit routes
Contractors go into liquidation	Project progress interrupted, potential loss of money paid in advance	Robust contracts, payment in arrears, alternative contractors kept 'warm'
Project is 'down-valued' by bank's surveyors	Breach of banking LTV covenants, penalty finance rates, repossession	Ensure contingency finance is available to restore covenants and complete project
Failure to start project on time	Breach of acquisition finance terms, financial penalties, repossession	Allow contingency time to transition from acquisition finance to development finance facilities
Failure to complete project on time	Breach of finance terms, penalties, repossession	Allow contingency time, apply for exit finance at start of project
Invasive species	Nuisance to site users, prosecution, damage to hard-standings, cost of treatment/removal	Phase 1 investigation, treatment/ removal
Protected species	Prosecution, damage to ecology, reputational damage, cost of mitigation	Phase 1 investigation, mitigation/ translocation
Uncertainty over ground conditions	Unforeseen costs and impacts	Phase 1 investigation, intrusive investigation
Weak soils	Foundation failure or settlement issues	Desk study, intrusive investigation
Soft compressible deposits	Unacceptable settlement of buildings	Phase 1 ground investigation and foundation assessment
Shallow mineworkings	Unacceptable settlement of buildings, collapse, foundations failure	Phase 1 ground investigation
Mineral workings	Foundation failure or settlement issues, possible infilled ground	Phase 1 ground investigation
Solution features	Unstable ground, collapse, foundation failure	Phase 1, ground investigation
Asbestos in buildings	Health risks, remediation costs	Inspections, management or removal
Asbestos in soils	Health risks, remediation costs	Inspections, ground investigation and risk assessment/remedial strategy
Buried tanks	Unacceptable settlement of buildings, health risks, remediation costs	Phase 1 ground investigation
Reworked ground	Differential settlement, variable ground conditions	Phase 1 ground investigation

Risk description	Consequence	Mitigation/response strategy
High groundwater levels	Impact on excavations and temporary works, basements, foundation design and performance	Phase 1 ground investigation
Land contamination	Health and environmental risks, remediation costs	Site investigation and risk assessment/ remedial strategy
Unstable slopes	Unacceptable settlement of buildings, foundation failure, safety risks, third-party damage	Phase 1 ground investigation and risk assessment/remedial strategy
Shrink/swell of soils	Unacceptable settlement of foundations, heave, linked to removal of trees/bushes	Phase 1 ground investigation

Permitted development rights in the devolved administrations

England: https://www.planningportal.co.uk/info/200187/your_responsibilities/37/planning_permission/2

Scotland: https://beta.gov.scot/publications/permitted-development-guidance-flowcharts

Wales: https://www.planningportal.co.uk/wales_en/info/3/common_projects/6/change_of_use/2

Northern Ireland: The Planning (General Development Order) (NI) 1993

A4 Types of planning application

The most common types of application that would be needed for developing on small brownfield sites are presented here. This is not an exhaustive list, and a full list is given on the planning portal.

- Full planning permission. Applications for planning permission to erect new buildings can be made. A full planning application can also be submitted to change the use of land or a building (for example to change the use of a building used as a house to use as an office). Note that where new buildings are proposed a full planning application requires the submission of all details of the proposal, usually including full floor plans, elevations, and other supporting information.
- Outline planning applications and reserved mattes applications. An outline planning permission application is used to establish that a proposed development is acceptable in principle. A proposal to use a piece of land for housing is first submitted as an outline application. As the application is made in outline not all information is provided with the submission and these are known as the reserved matters, which include the access to a site, the appearance of the proposed buildings, and the layout of a development.
- Outline applications cannot be submitted for the conversion of buildings, for changes in land or building use, or for any development that is proposed within a conservation area.
- If outline planning permission is granted it is necessary to submit a further application to gain approval for the reserved matters before the development is carried out.
- Removing or varying a planning condition and minor material amendments. Planning permissions and other consents are often granted subject to conditions that need to be complied with. It is possible to make an application to remove or vary a condition that has been imposed by the planning authority. Examples of why an application may be made include the fact that circumstances have changed since the condition was imposed, or alternatively an applicant simply does not agree with the requirements of a condition.
- A condition will usually be attached to planning permission that specifies the approved plans and drawings. It is possible to make an application to modify a planning permission by applying to amend the condition that specifies the approved plans so that it refers to modified plans. These are referred to as applications for minor material amendments. Where the proposed alterations are considered more than minor a new full application for planning permission is required. Very minor alterations that are not material can be approved as non-material amendments.
- Approval of details reserved by planning conditions. Some planning permissions or other consents are granted subject to conditions that require further details to be submitted to and approved by the planning authority. For example, when it is not made completely clear in the application, conditions may be imposed that requires all final building materials to be used in the development, to be approved.
- Non-material amendments to planning permissions. Following a grant of planning permission, it may be necessary to make minor changes to the approved scheme.

Where these are very minor in nature (ie non-material amendments) an application can be made to gain approval for the change. Whether or not a proposed change is non-material will depend on the circumstances of the case. There is no statutory definition of non-material, but in general, the planning authority needs to be satisfied that the change would only have a small effect on planning considerations, and that the change to the scheme is unlikely to be something that others would wish to comment on or have concerns about.

- If an application is successful, no new planning permission is created. The original permission still stands and should be read along with the decision letter sent in response to the non-material amendment application.
- Permission for more significant alterations to a scheme may be obtained by applying for a 'minor material amendment' to a planning permission. Applications should be made to the planning condition that specifies the approved plans. Where the proposed alterations are considered more than minor a new full application for planning permission is required.
- Listed Building consent. If a property is a Listed Building, consent is needed from the council for works to extend, alter or demolish it. The internal features of a Listed Building are protected as well as the external features. It is a criminal offence to undertake unauthorised works to a Listed Building.
- Relevant demolition of an unlisted building in a conservation area. This may be required when it is proposed to partly or wholly demolish an unlisted building in a conservation area.
- Lawful development certificates. These provide a formal decision that an existing or proposed development is lawful. There are two different types of certificate:
    - **Certificates for a proposed development or a proposed use**

      This type of application is used to apply for a certificate that will establish whether a proposed building, an extension, or the use of a building or land, would require planning permission. A certificate can be of particular use to demonstrate to any future purchaser of the property that the development undertaken did not require planning permission. If seeking informal advice from the council on the need for planning permission, planning officers may in some cases advise to apply for a certificate for a proposed development or use, however, based on the information available to them, it cannot easily be established whether planning permission is required or not.

      It is also possible to obtain a lawful development certificate for proposed works to a Listed Building.
    - **Certificates for an existing use or an existing development.**

      Developments that perhaps did not have planning permission in the first instance can become lawful with the passage of time. Development can become lawful where:

        - there has been a continuous use of land or buildings (other than a dwelling) for more than 10 years

- a condition or limitation on a planning permission has not been complied with for more than 10 years
- a building or other physical works have been completed for more than four years
- a building has been used as a dwelling for more than four years.

If granted, the certificate will prove that the development or use is now immune from enforcement action. It is important to note that the onus is on the applicant to prove the case by supplying sufficient, clear and precise evidence. If the evidence provided is inadequate, then the application is likely to be refused. A refusal does not prevent a further application being made with more clear and precise evidence.

- **Demolition works.** The Application for Prior Notification of Proposed Demolition form should be used for proposals to demolish a building or structure. Upon receipt of the notification the council will make a decision on whether it requires further information on the method of demolition and any proposed restoration of the site. Planning controls over demolition do not apply to all buildings and the local authority can advise. The purpose of this control is to give the council the opportunity to regulate the details of demolition to minimise the impact of that activity on local amenity.

Go to: https://www.planningportal.co.uk/info/200126/applications/60/consent_types

A5 Permission in principle sites

The Town and Country Planning (Brownfield Land Register) Regulations 2017 and The Town and Country Planning (Permission in Principle) Order 2017 require local authorities to prepare and maintain registers of brownfield land that is suitable for residential development.

Each local planning authority must prepare and maintain a register of previously-developed land, which is within their area, and:

- has an area of at least 0.25 hectares or is capable of supporting at least five dwellings
- is suitable for residential development
- is available for residential development
- where residential development of the land is achievable.

Part 1 of the brownfield registers will be a comprehensive list of all brownfield sites in a local authority area that are suitable for housing, irrespective of their planning status. However, registers will also be a vehicle for granting permission in principle (PIP) for suitable sites where authorities have followed the relevant procedures. If the authority considers that PIP should be granted for a site, the local authority is required to enter that site in Part 2 of their register. Part 2 is a subset of Part 1 and will include only those sites that have PIP granted. Developments that are subject to an EIA would not have PIP awarded.

Local authorities will be required to update the information relating to each entry and review the sites on their registers at least once a year. Authorities will be encouraged to conduct more frequent updates of the register where they wish to do so. Local authorities will be expected to have compiled their registers by 31 December 2017.

The Order provides that sites entered on Part 2 of the new brownfield registers will be granted PIP.

PIP will settle the fundamental principles of development (use, location, amount of development etc) for the brownfield site giving developers and/or applicants more certainty. However, a developer cannot proceed with development until they have also obtained technical details consent.

The technical details consent, which is obtained from the local authority, will assess the detailed design, ensure appropriate mitigation of impacts and that any contributions to essential infrastructure are secured.

The government is expected to bring in legislation to allow PIP to be granted by application for minor developments in the future.

No fee will be payable for PIP granted through a brownfield register. There will however be a fee for an application for technical details consent for sites granted PIP through the brownfield register.

Go to: https://www.gov.uk/guidance/permission-in-principle

A6 CIL exempt developments

The following is a list of developments that do not pay CIL (DCLG, 2012, paragraph 003). Note that these are from The Community Infrastructure Levy Regulations 2010 and Amendment 2014:

- Developments of less than 100 m^2 – unless this is a whole house, in which case the levy is payable (see Regulation 42).
- Houses, flats, residential annexes and residential extensions which are built by 'self builders' (see Regulations 42A, 42B, 54A and 54B (Amendment 2014)).
- Social housing that meets the relief criteria set out in Regulation 49 or 49A (Amendment 2014).
- Charitable development that meets the relief criteria set out in Regulations 43 to 48.
- Buildings into which people do not normally go (see Regulation 6(2)).
- Buildings into which people go only intermittently for the purpose of inspecting or maintaining fixed plant or machinery (see Regulation 6(2)).
- Structures that are not buildings, such as pylons and wind turbines.
- Specified types of development that local authorities have decided should be subject to a 'zero' rate and specified as such in their charging schedules.
- Vacant buildings brought back into the same use (see Regulation 40, Amendment 2014).

Where the levy liability is calculated to be less than £50, the chargeable amount is deemed to be zero, so no levy is due.

Mezzanine floors, inserted into an existing building, are not liable for the levy unless they form part of a wider planning permission that seeks to provide other works as well.

Go to: https://www.gov.uk/guidance/community-infrastructure-levy

CIRIA members

ABG Geosynthetics Ltd
AECOM Ltd
AMC Environmental Ltd
Arcadis Consulting (UK) Ltd
ARL Training Services Ltd
Arup Group Ltd
Atkins Consultants Ltd
Balfour Beatty Group
BAM Nuttall Ltd
Barratt Developments plc
Black & Veatch Ltd
BSG Ecology
Buro Happold Engineers Ltd
BWB Consulting Ltd
CH2M
Costain Ltd
COWI UK Ltd
Dynasafe BACTEC Ltd
Environment Agency
ESRI UK Ltd
Farrow Walsh Consulting Ltd
Galliford Try Plc
Gatwick Airport Ltd
Geotechnical Consulting Group
Golder Associates (UK) Ltd
Highways England Company Ltd
High Speed Two (HS2) Ltd
HR Wallingford Ltd
Hydro Water Management Solutions Ltd
Imperial College London
Institution of Civil Engineers
J Murphy & Sons Ltd
Kier Group plc
London Underground Ltd
Loughborough University
Maccaferri Ltd
Marshalls Plc
Ministry of Justice
Mistras Group Ltd
Morgan Sindall Construction and Infrastructure Ltd
Mott MacDonald Group Ltd
Multiplex Construction Europe Ltd
MWH
National Grid UK Ltd
Network Rail
Northumbrian Water Ltd
Polypipe Middle East FZE
Rail Safety and Standards Board
Royal HaskoningDHV Ltd
RSK Group Plc
Sir Robert McAlpine Ltd
SLR Consulting Ltd
Southern Water Services Ltd
Stuart Michael Associates
Temple Group Ltd
Thames Water Utilities Ltd
TOPCON (Great Britain) Ltd
Transport Scotland
UK Green Building Council
United Utilities Plc
University College London
University of Reading
University of Southampton
Wessex Archaeology
WYG Group (Nottingham Office)

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Small brownfield sites pose particular challenges to landholders, developers, builders and their advisors and funders. Development of brownfield sites can be hindered by derelict structures, below-ground obstructions or voids, land contamination, poor ground, archaeological features and buried services because they have been previously used. Small sites can have difficulties with access, and space for storage of materials, vehicles and plant, and are particularly vulnerable to programme delays and unforeseen technical and engineering issues, which can threaten the viability of the project.

This guidance provides advice to help readers overcome the barriers and issues that can obstruct the development and management of small brownfield sites. It gives general guidance on the technical, financial and planning issues, with an emphasis on managing land contamination.

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