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Beneficial Use of Old Landfills as a Parkland Amenity

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ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

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- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

EPA RESEARCH PROGRAMME 2014–2020

Beneficial Use of Old Landfills as a Parkland Amenity

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EPA Synthesis Report

End of project report available for download on http://erc.epa.ie/safer/reports

Prepared for the Environmental Protection Agency

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A number of other authors contributed to the preparation of this document, reflecting the multifaceted aspects required to be considered – converting an old landfill to parkland amenity. These include Laura Dowdall, Ashley O'Toole, Angela Treanor, Ray Holbeach, Neasa Kane-Fine and Jim Gannon (all from within RPS Group). The varied disciplines of the authors who contributed reflects the technical, environmental, energy, planning, landscaping and communication disciplines that are covered in the related main report and this synthesis report.

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Executive Summary

This synthesis report arises from the findings of the research project, known as “The Beneficial Use of Old Landfills As a Parkland Amenity”, and was funded through the Environmental Protection Agency (EPA) Research Programme 2014–2020.

The desk study research project was commissioned by the EPA in response to the number of landfills that are closed or near closure and are awaiting final restoration. The conversion of suitable closed landfills to parkland amenities presents an opportunity to make beneficial use of land that would have previously been considered sterile from social, environmental and economic perspectives. A number of these landfills that could provide a parkland amenity post closure are located in areas either under strong urban influence or adjacent to designated conservation areas [i.e. Natura 2000 sites comprising Special Areas of Conservation (SACs) designated under the EU Habitats Directive (1998), Special Protection Areas (SPAs) designated under the EU Birds Directive (2009) and Natural Heritage Areas (NHAs)]. Historically, in many instances, landfills were located adjacent to SACs and SPAs prior to recognition of the area’s environmental importance and before legislation to protect such areas had been enacted. In addition to these situations, development within urban areas has expanded outwards in recent years and, as a result, many historical landfills that were once remote are now in close proximity to the urban environment.

This synthesis report provides a reference and guidance document on the decision-making process and master plan development of landfills being considered for conversion to a parkland amenity. The main report should be referred to on SAFER (http://erc.epa.ie/safer/reports).

A review of national and international landfills that have been converted to parkland or are planned to be converted to parkland was undertaken through a desk study to obtain information on the types of parkland chosen and any lessons learned during the landfill conversion process. In addition, Ballyogan landfill is presented as a case study, as it is situated in an area that has come under strong urban influence since the landfill commenced operation. Ballyogan landfill is also capped and is only just entering into the decision-making stage for conversion to parkland amenity. In this project, a particular focus has also been placed on the Kinsale Road landfill (Cork City Council) and Kilbarry landfill (County Waterford).

The report concludes that landfill master plans for conversion to a parkland amenity will need to consider a range of factors, including the long-term aftercare and maintenance requirements for the parkland and landfill, planning policy and stakeholder input. Local authorities and organisations considering converting their landfill to a parkland amenity should first evaluate the setting of the landfill and complete a risk assessment for the site (or review a completed risk assessment if available).

1 Introduction

This synthesis report provides a reference and guidance document on the decision-making process and master plan development for landfill conversion to parkland amenity. The main report is available on SAFER (http://erc.epa.ie/safer/reports).

For the purposes of this report, landfills include those that accept inert, hazardous and non-hazardous waste; and a parkland amenity can be described as an area of open space provided for recreational use by the public and/or for the protection of wildlife and natural habitats with or without sources of revenue generation.

1.1 Project Need

There are 61 municipal solid waste landfills licensed by the Environmental Protections Agency (EPA) (B. Donlon, EPA, personal communication, 24 February 2017). Six of these were accepting waste for disposal in the final quarter of 2016. Those that have permanently ceased require restoration to an extent not yet completed. The majority of these sites are located within 2 km of an urban settlement.

According to the EPA (P. Chan, EPA, personal communication, 24 February 2017), Ireland also has 491 landfills recorded on the Section 22 Register [in accordance with the requirements of the Waste Management Act (1996), as amended] that were not subject to waste authorisation during their operational lifetime. This includes the following:

- 37 illegal sites;
- 285 local authority sites [as defined by the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)];
- 63 pre-1977 sites; and
- 106 private sites.

Of the 285 local authority sites, one site in County Cork has received a certificate of authorisation and 25 sites have applied for certificates. Fifty-three of the local authority sites are currently classified as high-risk sites. Of the 285 sites, 97 are greater than 1 ha in size and are located within approximately 2 km of urban settlements [as defined by the Central Statistics Office (CSO, 2014)].

Therefore, on the basis of the number of landfills quoted above, many landfills are or will become available for afteruse consideration in the coming years. The conversion of suitable landfills to parkland presents an opportunity to make beneficial use of land that would have previously been considered sterile, from social, environmental and economic perspectives. RPS undertook this research study to identify a process that could assist landfill owners and operators in determining if their landfills would be suitable for conversion to parkland and to provide guidance on the master plan development of the landfill to a parkland amenity.

1.2 Project Aim and Methodology

The overall aim of the research project was to provide a reference document to assist landfill owners and operators in the decision-making process for the conversion of their landfill to a parkland amenity. The main report was compiled based on the key findings and outputs of the following studies undertaken for this project:

- completion of a comprehensive desk study on the review of national and international landfills that have been converted to parkland or are planned to be converted to parkland to obtain information on the types of parkland chosen and any lessons learned during the landfill conversion process;
- assessment of specific landfill case studies with particular focus on Ballyogan landfill (County Dublin), Kinsale Road landfill (Cork City Council) and Kilbarry landfill (County Waterford);
- direct consultation with landfill operators and owners in Ireland to obtain information on their experiences on landfill conversion to parkland amenity;
- a desk study assessment of landfill and parkland features that require consideration in landfill conversion projects;

- a desk study assessment of risk, financial and planning considerations in landfill conversion projects;
- development of a public engagement strategy for landfill conversion to parkland amenity projects;
- development of a step-by-step process for master planning of landfill conversion to parkland amenity.

1.3 Policy, Regulation and Guidance

There is no policy that prescribes the afteruse that should be applied to closed landfills. However, the July 2012 National Policy Statement on Waste Management, "A Resource Opportunity" (DECLG, 2012) recognises that former landfill sites possess significant potential for beneficial use.

> Options in relation to the beneficial use of closed landfill facilities will be considered in light of the outcome of projects under the Environmental Protection Agency Research programme, Science, Technology, Research and Innovation for the Environment (STRIVE), and other research.

Much valuable information on the beneficial use of landfill sites is contained within the EPA's *Landfill Manual – Restoration and Aftercare* (EPA, 1999), which provides "guidance on all aspects of landfill restoration and aftercare to afteruses such as amenity and nature conservation, woodland, agriculture and hard afteruses". It states that "For existing landfills, the afteruse must be determined as early as possible prior to restoration plans being developed." The manual also includes information on the consultation processes required in selecting an appropriate afteruse and the critical factors in determining the choice of afteruse of the landfill.

The Waste Management (Licensing) (Amendment) Regulations 2002 (S.I. No. 336 of 2002), which give effect to Council Directive 1999/31/EC on the landfill of waste, requires all landfills in possession of a Waste Licence to maintain a financial provision for the closure, restoration and aftercare of the facility.

The Landfill Directive (Article 10) requires that there is sufficient financial provision to cover the cost of closure and aftercare for a period of at least 30 years. According to the *Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities* (EPA, 2011), in Ireland, adequate financial provision is required for at least 30 years and possibly for 50 years and longer in the case of facilities accepting (or which in the past accepted) appreciable quantities of wastes having the potential to produce leachate and landfill gas. In the case of hazardous waste landfill facilities, the *BAT Guidance Note* highlights that there is no end date for financial liabilities and aftercare.

The EPA report *Focus on Landfilling in Ireland* (EPA, 2010) states that:

> landfills that are subject to high standards of closure, restoration and aftercare have the potential to provide amenity value, e.g. through the development of sports pitches or areas of nature conservation. Significant investment is required to fund the closure, restoration and aftercare of a landfill and it is important that adequate financial provision is made.

All waste-licensed sites are required [under Articles 7 and 8 of the Landfill Directive (1999/31/EC)] to prepare a closure, restoration, aftercare and management plan (CRAMP) and an environmental liabilities risk assessment (ELRA) and to maintain financial provision. Historical landfill sites not subject to waste authorisation during the operational phase will be required to apply for a certificate of authorisation[1] for the remediation, restoration and aftercare of the site in accordance with the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations (S.I. No. 524 of 2008).

Ideally, to cover the cost of aftercare, financial provisions have to be made during the construction and operation of the landfill. However, such financial provisions were only required for landfills that were licensed by the EPA; many of the 479 sites included on

1 According to http://www.epa-pictaural.com/media/waste09/pdf/patChan.pdf, the Agency will issue a draft certificate of authorisation within approximately four months of making an application, or later if required, on receipt of the compliant application [Regulation 7 (5)]. The local authority will have 30 days in which to make representations regarding the proposed draft certificate. The final certificate of authorisation will be issued as soon as practicable after the expiry of the 30-day period, and following consideration of any representations.

the Section 22 Register were built and operated prior to the commencement of the licensing regime or were closed down when the licensing regime commenced and no finance would have been set aside to cover the costs of aftercare.

In larger local authorities, converting closed landfills to parkland amenity can both spread the costs of aftercare across two or more departments (e.g. Environment, Parks) and provide a possible revenue stream (see Chapter 8 of the main report) to supplement aftercare costs.

Other relevant guidance considered during the course of this study include the EPA *Landfill Manuals*: *Landfill Site Design* (EPA, 2000), *Landfill Restoration and Aftercare* (EPA, 1999) and *Landfill Monitoring* (EPA, 2003).

1.3.1 Readership

This synthesis report [and the main report available on SAFER (http://erc.epa.ie/safer/reports)] will be of interest to the following main groups:

- landfill owners and operators;
- local authorities;
- policymakers; and
- landscape architects and others involved in the master planning of landfill conversions to parkland amenity.

1.4 Report Content and Structure

This report includes the following:

- outline of the decision-making process (Chapter 2);
- risk assessment approach for landfill conversion projects (Chapter 3);
- information with respect to the type of parkland amenities and how these amenities can be best integrated with the landfill (Chapter 4);
- Ballyogan landfill – case study of landfill conversion to a parkland amenity (Chapter 5); and
- conclusions and recommendations (Chapter 6).

The main report [available on SAFER (http://erc.epa.ie/safer/reports)] includes the following:

- master plan development mechanism for operators to determine the master plan best suited to their facility;
- information on the landfill engineering features (e.g. pollution control systems) and landfill aftercare management requirements, including information on the integration of such features into a parkland amenity proposal. This information is equally relevant to historical unregulated landfill sites, as pollution control systems may be required as part of the remediation and aftercare of the site;
- further information with respect to the type of parkland amenities and how these amenities can be best integrated with the landfill;
- national and international examples of landfills that have been or are proposed to be converted to a parkland amenity;
- financial consideration for landfill conversion to a parkland amenity, including information on cost-effective treatment options for the control of landfill emissions [e.g. leachate and landfill gas (LFG)];
- planning and policy considerations for landfill conversion to a parkland amenity;
- public engagement strategy for landfill conversion to a parkland amenity;
- Ballyogan landfill – case study of landfill conversion to a parkland amenity; and
- conclusions and recommendations.

A summary of the findings is also presented for the key chapters. The reader is also strongly encouraged to refer to the EPA *Landfill Manuals* on landfill site design (EPA, 2000), landfill restoration and aftercare (EPA, 1999), and landfill monitoring (EPA, 2003).

1.4.1 Case study – Ballyogan landfill

A primary case study has been used as part of this research study to show relevance and to demonstrate the applicability of the main findings of the study. Ballyogan landfill is located in the functional area of Dún Laoghaire–Rathdown County Council (DLRCC) in the south of County Dublin and is a landfill that has come under strong urban influence, with extensive retail and residential development having taken place in its vicinity since the late 1990s. In addition to this, further provision has been made for additional development in the future to the south of the facility.

The Ballyogan landfill has been fully capped since 2010 and the County Council has now started the process of considering conversion of the site to parkland amenity. In Chapter 5 of this report, a description of the landfill is provided along with an assessment of its potential reuse options as a parkland amenity as part of the development of a concept master plan.

2 Master Plan Development for Parkland Amenity – Step-by-step Approach

2.1 Introduction

The purpose of this chapter is to provide a road map on the decision-making and master plan development for landfills considering conversion to a parkland amenity. The steps involved are outlined in Figure 2.1 and draw on the information provided in the following chapters of this report. Sections 2.4 to 2.9 describe the seven steps of the road map.

- Steps 1 and 2 form the decision-making stage, including suitability assessment (step 1) and risk assessment (step 2).
- Step 3 is the master plan development stage.
- Steps 4 and 5 relate to the planning of the parkland amenity.
- Steps 6 and 7 relate to the construction and management of the amenity.

RPS has outlined a proposed master plan roadmap for landfill conversion projects. Part of this road map, particularly the development of the matrix (see Figure 5.4), was based on RPS's development of a first draft of the master plan for the Ballyogan landfill.

Sections 2.2 and 2.3 outline the value of parkland amenity and the value of converting landfills to a parkland amenity.

2.2 Value of Parkland Amenity

For the purpose of this report, a parkland amenity can be described as an area of open space provided for recreational use by the public and/or for the protection of wildlife and natural habitats. Such areas can also be considered sources of revenue generation through carbon and energy management.

The Commission for Architecture and the Built Environment (CABE) was created to help decision-makers and professionals to create great buildings, places and spaces, and to inspire public demand for good design. "CABE Space" is a specialist unit within CABE that aims to bring excellence to the design, management and maintenance of parks and public space in towns and cities. CABE was the UK government's advisor on architecture, urban design and public space from 1999 to 2011 (CABE, 2013).

CABE Space produced a document entitled "Does Money Grow on Trees?" (CABE Space, 2005). This document demonstrates how expenditure on green space represents an investment that produces long-term dividends. The report illustrates the contribution of parks in terms of the desirability of a local area for residents and businesses.

CABE Space outlines that parks can enhance the quality of life and health (both mental and physical) of the local community and add to the character of places where people want to live, work and visit. Open spaces can also incorporate vital green infrastructure (GI) such as flood protection and mitigation against climate change, while providing wildlife habitats, community facilities and beautiful spaces. The benefits of parks and green spaces are therefore aesthetic, economic, social and environmental, with interrelations between these aspects.

In 2013, the European Commission put forward new plans for encouraging the use of GI to help create good-quality, healthy and sustainable places in which people and wildlife can live. GI is an approach to the planning of land use and plays a critical role in ensuring that human environments are resilient to environmental, social and economic challenges. The types of physical features that contribute to GI include parks and amenity areas.

One of the case studies assessed for this research project was Mile End Park, London, which is located on a site contaminated by industrial waste. In the case of Mile End Park, it was noted that derelict plots and crumbling warehouses that had previously surrounded the park now boast high-quality apartment complexes. Vacant shop units have been taken over by cafes, estate agents, solicitors and restaurants. Some of the key findings for Mile End Park were that there was a 7% uplift in property prices for residential properties overlooking the park and that improvements to the park boosted local business. See Appendix D of the main report for further details on Mile End Park.

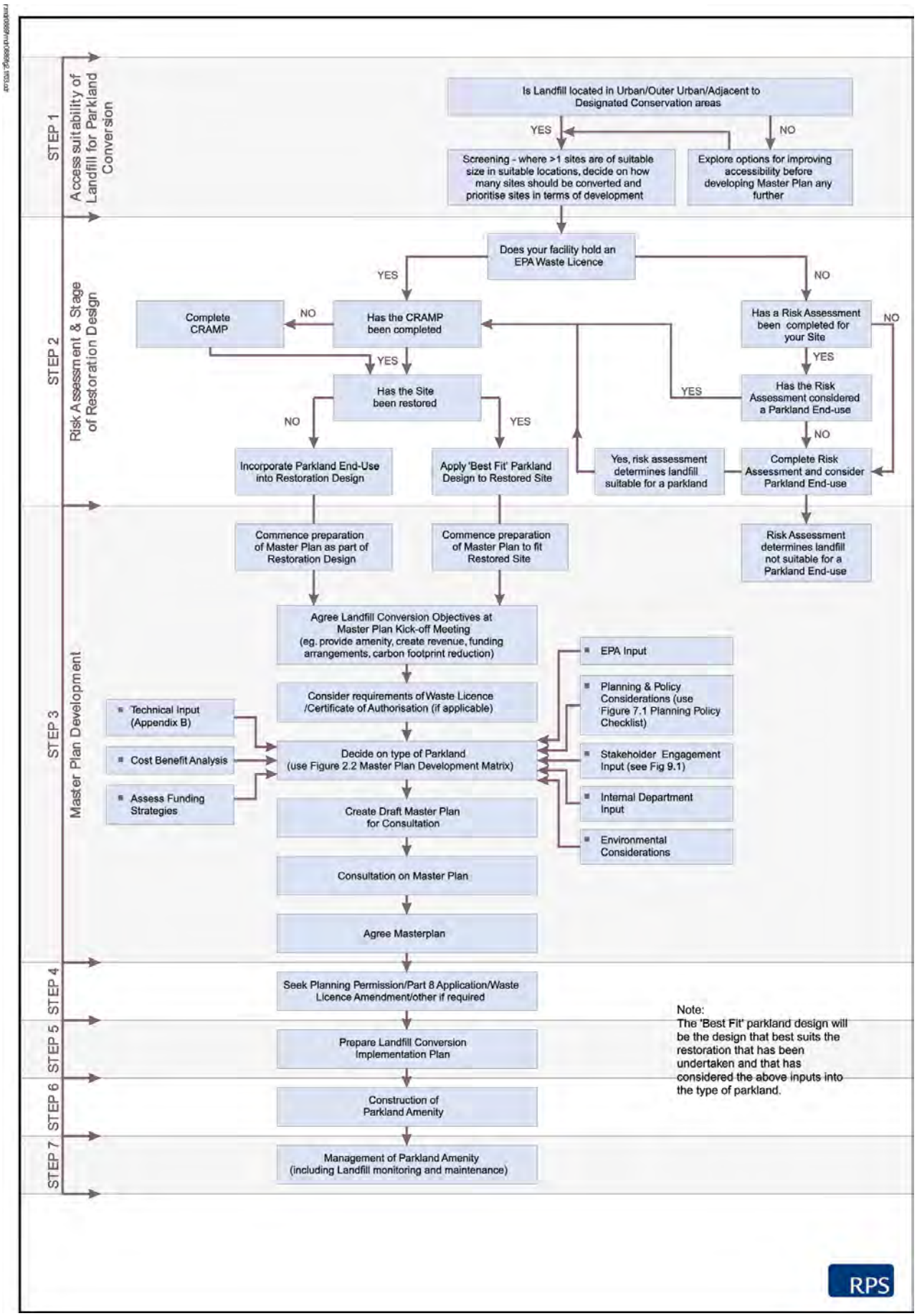

Figure 2.1. Road map to master plan development for landfill conversion to a parkland amenity. Note that the references to Figures 2.2, 7.1 and 9.1 are to the main report (http://erc.epa.ie/safer/reports).

2.3 Value of Parks on Former Landfills – Why Convert?

In the past, many landfills negatively impacted on their surrounding communities and environment. However, after closure and restoration of many of these sites, their positive potential for providing an open area, potentially at limited capital cost, particularly when located in an easily accessible area, should be seen as an opportunity for local authorities to give something positive back to the surrounding communities and the environment.

"From dumps to destinations. The conversion of landfills to parks" by Harnik *et al*. (2006) describes how closed landfills in the USA present excellent new park sites for three reasons – size, location and cost. The same paper outlines how the San Francisco-based Trust for Public Land launched a national campaign to promote the conversion of landfills into parks. The campaign promotes the message that planners and landscape architects should not wait until the sites are closed to get involved.

The International Solid Waste Association Key Paper on Landfill Aftercare states that "Landfill operators can be considered as temporary users of a part of land, providing a service to the community, until this land will be given back to society for natural or domestic purposes" (Scharff *et al*., 2013).

2.4 Master Plan Development – Step 1: Assess Suitability of Landfill for Parkland Conversion

When considering whether or not a former landfill is suitable for conversion to a parkland amenity, the following questions should be asked as part of the decision-making process.

1. Where is the landfill located, i.e. what is its setting?
    - Is it rural, urban, outer/urban, adjacent to a designated conservation area?
2. What size is the landfill?
    - Depending on the location of the landfill there may be certain minimum size requirements when considering conversion to parkland amenity.

The size and location of the landfill will determine its suitability for overall parkland conversion. For example, if the landfill is less than 1 ha in size and is located in a rural area with little accessibility, then the potential for converting it to parkland use may not be warranted because of its size and remote location. However, a similar-sized site located in an urban area may be suitable. In any case, decision-makers should assess the size, setting and accessibility of each landfill on a site-specific basis.

Landfills within or adjacent to designated conservation areas, regardless of their size and rural/urban setting, should be considered for parkland conversion to an ecological afteruse, either with or without access to the conservation area, depending on the sensitivity of the surrounding environment to access and resulting impacts.

Some urban areas may have one or more former landfill within close proximity. Where this is the case, a decision will be required on the number and most suitable site(s) for conversion.

2.5 Master Plan Development – Step 2: Risk Assessment and Stage of Restoration Design

This step examines the waste authorisation status of the landfill (i.e. waste licence or certificate of authorisation for historical landfills) to understand if a risk assessment plan/CRAMP has been completed for the site. If a parkland amenity afteruse is being considered, then it is important that such a proposed afteruse was considered in the risk assessment. Where a risk assessment has not yet been completed, it will be required to consider the proposed afteruse. Further information on risk assessment is provided in Chapter 3 of this report.

In accordance with the advice provided in the EPA's *Landfill Manual Landfill Restoration and Aftercare* (1999), the afteruse will ideally have been determined prior to the development of the restoration plan; the options for parkland amenity can then be incorporated into the restoration design. However, where the site has been capped without determining the afteruse in advance, the parkland amenity will have to be integrated into the existing cap design unless the

landfill operator wishes to amend or augment the capping system.

Once the conversion to a parkland amenity is considered viable, the development of the master plan can commence.

2.6 Master Plan Development – Step 3: Develop Master Plan

2.6.1 Set the objectives

One of the first steps to be taken in the master plan development is to determine what the best solution for the landfill is and then to set the objectives for converting it to a parkland amenity. Examples of objectives are:

- provide a recreational afteruse with minimum maintenance requirements;
- provide recreational/biodiversity afteruse with options for revenue streams to fund landfill aftercare of the site; and
- provide ecosystem to integrate with surrounding environment.

There are several high-level factors that will need to be considered when deciding on the overall objectives of the landfill conversion project. These include:

- setting within a local community when located adjacent to a designated conservation area (i.e. convert site to provide a benefit/biodiversity use);
- development costs and parkland maintenance costs;
- landfill aftercare maintenance and associated costs of integrating aftercare systems into the landfill conversion project;
- relevant waste licence conditions and associated costs to meet compliance; and
- potential revenue generation (e.g. an entry fee for access to facilities) to fund the long-term aftercare of the site.

At this stage of the project, a decision should be made on the appointment of experts to prepare the master plan and to provide a preliminary design for its constituent elements. The type of experts that may be required will also depend on the afteruse chosen.

2.6.2 Waste licence considerations

It will be imperative that consultation with the EPA takes place on the master planning for the site. Although converting the site to a parkland amenity will be the main objective, the conditions attached to any existing facility waste authorisation (i.e. waste licence or certificate of authorisation) will still need to be maintained throughout the operation of the parkland. The parkland will also need to integrate with all landfill engineering and pollution control systems (see Chapter 4 of the main report).

2.6.3 Type of afteruse

Parkland

Several questions should be considered in determining the type of parkland amenity for the landfill. These include:

1. What type of parkland would best suit the landfill location and setting? (See Chapter 5 of the main report.)
   (a) Consider local, regional and national policies (see Chapter 7 of the main report).
   (b) Consider existing local amenities, i.e. parks, playground, walking trails, etc.
2. What landfill-related issues, e.g. settlement and gas management, require consideration when deciding on the afteruse? (See Chapters 4 and 5 of the main report.)
3. How much will it cost to develop the parkland and how will the parkland development and maintenance be funded? (See Chapter 8 of the main report.)
4. How much land is available for development?

To answer question 1, a matrix of parkland afteruses outlined in Figure 5.4 can be used to assist in informing the decision on the type of afteruses that can be included in the master plan. The purpose of this matrix is to identify existing amenities within the surrounding area. These amenities are grouped into the types of facilities available within walking distance and within driving distance. For example, if a

playground exists within walking distance of the former landfill site, then another playground may not always be required in the area unless the need for further playgrounds has been identified, e.g. as part of a local area plan (LAP) objective. Other amenities such as BMX tracks may exist within easy driving distance, e.g. 10 km from the site; as these are the types of amenities that one would expect to drive to, another BMX track would not always be required at the site.

In relation to question 2, this matrix also serves to stimulate the provision of high-level information on landfill settlement (see Chapters 3 and 5) in terms of what can be expected and what development will require additional ground improvement works (see Appendix A of the main report). Further information is provided in Appendix B of the main report in terms of the specific issues and risks associated with developing on a landfill and the corresponding mitigation measures, e.g. LFG, groundwater, surface water and cost issues.

Energy generation

The types of energy generation options available are outlined in Chapter 5 of the main report. Where possible, all landfill conversion projects should consider some form of energy generation to reduce the carbon footprint of the site and to assist with financing the maintenance of the site going forward. Some sites may be more suitable for revenue generation than for development as an amenity, e.g. if the site is poorly positioned for access.

Biodiversity

When a former landfill site is located directly adjacent to a designated conservation area, the development of the former landfill should always consider ways to enhance the natural biodiversity of that area in consultation with the National Parks and Wildlife Service (NPWS) and other relevant organisations. Depending on the objectives of the management plans for the designated conservation areas, the former landfill could also consider parkland-type amenities along with energy generation schemes.

It should be noted that biodiversity can also be considered in its own right and is not dependent on being adjacent to a designated area. Many local authorities have local biodiversity action plans and parkland is also an opportunity to achieve those aims.

2.6.4 Cost–benefit analysis

As outlined in Chapter 1, financial provisions are required for landfills that have been licensed by the EPA. However, such financial provisions only relate to the aftercare of the landfill and not to the conversion of the landfill to a parkland amenity. Therefore a cost–benefit analysis will be critical in informing the type of parkland and how it will be funded.

Information on the type of costs associated with restoring, converting and maintaining a parkland amenity, along with potential revenue streams and funding options, are provided in Chapter 8 of the main report.

2.6.5 Public consultation

As soon as the operators become aware and are satisfied that the conversion to parkland amenity is viable, it will be of crucial importance for them to start stakeholder consultation to ensure that the local community and other stakeholders are aware of the project and are given the opportunity to provide valuable input into the development of the master plan. Further information on public engagement is outlined in Chapter 9 of the main report.

As outlined in Chapter 9 of the main report, it is important that a draft master plan is presented for consultation to obtain stakeholder feedback in a structured manner prior to agreeing on the final master plan.

2.7 Step 4: Seek Planning Permission

The next step will be to determine whether or not the afteruses proposed require planning permission. The specific requirements will differ depending on whether the landfill owner is a local authority or a private owner. Chapter 7 of the main report provides further information on planning permission requirements and exempted development.

2.8 Step 5: Implementation Plan

As a result of the desk research undertaken as part of this project (see Chapter 6 of the main report),

it is recommended that an implementation plan is prepared once the master plan has been finalised. The implementation plan should set out what should be achieved on a stage-by-stage basis, depending on how the conversion is to be financed. Where funding is limited in the initial stages of a project, the elements of the master plan that have the lowest costs should be progressed where possible. This demonstrates a commitment to the development of the parkland amenity rather than waiting for the provision of a large amount of funds to complete some of the bigger elements of the scheme. This staged development approach has been used at other landfill conversion projects, as outlined in Chapter 6 of the main report.

2.9 Steps 6 and 7: Construction and Management

Steps 6 and 7 relate to the construction and management of the parkland, which are not the focus of this report, although issues relating to construction safety and stakeholder engagement in the construction stage are briefly addressed.

3 Risk Assessment

As outlined in Chapter 1, there are 479 closed (Section 22 Register) landfills in Ireland, which pose risks to the environmental and public health of their surrounding area. Before the European Landfill Directive (1999/31/EC) was implemented, historical landfill sites were often poorly engineered and normally integrated few environmental protection measures, such as basal lining and collection systems for leachate and LFG. Unlike licensed landfill sites, which have been thoroughly evaluated in the course of the authorisation process and, where appropriate, pollution control systems have been installed and operated, these historical sites will need to be assessed to protect against the potential impacts associated with such former landfills. In addition, even when the operator of a closed, licensed landfill has adhered to the relevant management standards during its operational life and has implemented adequate mitigation measures, the site still has the potential to have a negative effect on the environment if not properly designed, restored and maintained during the conversion process from a landfill to a parkland amenity.

The purpose of this chapter is to give an overview of the risk assessment processes that should be considered when converting landfills to parkland amenities. It also describes potential landfill hazards and the associated mitigation measures that should be considered in the design process from a public safety perspective.

3.1 Risk Assessment Process

The risk assessment process should be considered in a two-stage approach for landfill conversion projects. The first stage requires the completion of an appropriate risk assessment to determine the level of risk posed by the landfill site itself and the type of remediation required to minimise risks on the surrounding environment. A detailed risk assessment will already have been undertaken for a licensed landfill and appropriate pollution control measures will have been incorporated into the licence conditions. The second stage requires a further and more detailed risk assessment to evaluate the risks in relation to the proposed afteruses associated with the conversion of the former landfill site to a parkland amenity. For example, in the case where buildings are proposed, the risk of gas migration will need to be assessed in detail.

3.1.1 Stage 1 – remedial solution

Licensed landfills

Waste-licensed sites are required to prepare a CRAMP and an ELRA, and to maintain financial provision (as outlined in section 1.3 of this report). The EPA's Guidance on *Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision* (EPA, 2006) outlines a systematic step-wise approach to the preparation of these three elements, which are mutually dependent. That document has recently been replaced by *Guidance on Assessing and Costing Environmental Liabilities* (EPA, 2014) and *Guidance on Financial Provision for Environmental Liabilities* (EPA, 2015). However, financial provisions relate only to the aftercare of the landfill and not to the conversion of the landfill to a parkland amenity.

The EPA's *Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites* (EPA, 2013) includes a risk-based approach for the assessment and remediation of contaminated land and groundwater at EPA-licensed sites. The report outlines that "the principal aim in dealing with contaminated land and groundwater related issues is to secure the protection of human health, water bodies (including groundwater) and the wider environment."

Historical unregulated waste disposal sites and illegal landfills

The EPA's *Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites* (EPA, 2007) outlines the differing approaches to environmental risk assessment methodology that should be applied to historical unregulated waste disposal sites (in operation between 1977 and 1997) and illegal landfills. In the case of an illegal site, the *Code of Practice* states that the remediation plan should centre on the removal of waste from the site

and describes the manner in which this is to be done. The only circumstance in which waste can remain on an illegal site is where it can be clearly demonstrated that this approach will lead to greater protection of the environment or enhancement of the environment as well as greater protection of the health of the local population.

Applications for a certificate of authorisation as set out in the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008) are required to be made to the EPA for these sites.

The EPA's *Code of Practice* provides guidance on completing the environmental risk assessments and sets out a framework within which the intrinsic risk posed by the site to the environment can be assessed. The intrinsic risk relates to the risk that is posed when no mitigation measures have been put in place to reduce the risk.

Consideration of the impact of the site on the environment is based on a risk assessment process using the Source–Pathway–Receptor (SPR) model, in which the probability of damage occurring is considered in the context of the severity of consequence of that event actually happening.

The *Code of Practice* utilises a structured, phased approach to identify the SPR components and conduct a risk assessment of the potential linkages between the elements. The process involves preliminary site investigations and initial screening to identify the range of high to low risk factors. Areas requiring further investigation are identified and, finally, the model is fine-tuned. At each stage, the information and risks are reviewed and assessed before progressing to the next phase.

This process facilitates the development of environmental engineering design controls to manage, mitigate, protect and/or remediate the situation.

3.1.2 Stage 2 risk – afteruse risk assessment

There are various documents that set out the main risk factors associated with the development of old landfills and it is not the intention to reproduce that detail here, but instead to give an insight into some specific examples of how these may be used. The reader is referred in particular to the CIRIA documents C557 *Remedial Engineering for Closed Landfill Sites* (Barry *et al*., 2001) and C665 *Assessing Risks Posed by Hazardous Ground Gases to Buildings* (Wilson *et al*., 2007).

The most significant risks relating to development on landfill sites are those posed by settlement and gas. Settlement can result in damage to capping systems, while gas migration can result in particularly hazardous conditions if the gas were to accumulate in a confined space. Other risks do, however, have to be taken into account, such as the possibility of contamination of surface water and groundwater systems by leachate.

On a number of landfill sites, various initiatives and alternative design techniques have been developed to overcome the challenges that arise on landfill sites with regard to building on waste as well as the challenges presented by the need to manage surface water, gas and leachate that is generated in the landfill site. Typically, the design at sites such as these was developed using an environmental design risk assessment process in which each element of the development is considered and the risk and mitigation measures relating to that element are assessed and designed accordingly. The risks could be related to gas migration, settlement, surface water contamination, etc. A summary of some of the main risks and examples of mitigation measures is provided in Table 3.1. Other aspects include risks and mitigation for groundwater, leachate management, etc. A full description of the risks associated with development on former landfills is provided in Appendix B of the main report.

Further information in relation to ground improvement techniques and foundation options in relation to the mitigation of risk associated with settlement has been provided in Appendix A of the main report [available on SAFER (http://erc.epa.ie/safer/reports)].

3.2 Public Safety

The remediation of the landfill should eliminate the pathways for any significant risks to park users. However, other risks to the public using the site also need to be examined and the parkland should be designed to ensure that such risks can be avoided.

The practicality of monitoring a closed landfill and access to monitoring infrastructure should be balanced with its integration into the public space. Key items

Table 3.1. Examples of LFG and settlement risks and mitigation measures for development on former landfill sites

Element	Gas		Settlement	
	Risk	*Mitigation measure*	*Risk*	*Mitigation measure*
Building foundation	Build-up of gas below slab	1. Void below slab. Options for active or passive venting of gas layer depending on gas concentrations 2. Gas membrane below slab 3. Online gas monitoring alarms in buildings	Uncertainty regarding risk of differential settlement between buildings and pavements/services	1. Flexible joints
Pavements and road drainage	Migration of gas into drainage system	1. Install gas collection system (collection pipes in subbase/geocomposite below subbase) (low cost and moderate risk)	Cracking of pavements leading to reduced performance, gas migration and surface water infiltration	1. Flexible and thicker capping and pavement layers 2. Use of geocells or geogrids
Services	Risk of gas migration through services	1. Connection points into buildings to be sealed 2. Single duct option (“service highway”) 3. Possible overhead services to reduce gas migration 4. Online gas monitoring alarms in buildings	1. Backfalls in pipes due to excessive settlement 2. Breakage of pipe joints due to settlement leading to surface water inundation	1. Steeper falls/ gradients to minimise risk of backfalls and water ponding 2. Flexible joints in pipes

such as monitoring wells, leachate management systems and lagoons can be designed in such a manner to have minimal impact, for example, making provision for flush covers, i.e. covers that are level with the surrounding ground, integration into planted areas and maintaining distance from public trails.

LFG, as discussed above, can pose significant threats to public safety and human health. LFG emissions should be adequately controlled through mitigation measures such as a gas extraction system or gas membranes beneath structures.

Construction activities on a former landfill site pose further hazards and risks to construction workers and public safety. The construction workers will need to be made aware of all existing landfill features, including location and depth of services and utilities, landfill-monitoring infrastructure and impermeable membranes.

3.3 Summary of Findings

Risk assessment is an important step in the development of a master plan for a landfill. It is essential that the remedial solution chosen considers not only the level of risk posed by the site itself, but also the overall afteruse of the site, which in the majority of cases will be for public use. This is why it is important that the risk assessment process is considered in the decision-making process on the various types of afteruses. The most significant risks relating to development on landfill sites are those posed by settlement and gas.

Box 3.1. Case studies – various sites

Design measures to mitigate risks of LFG and settlement

Examples of effective mitigation measures that have been employed on sites in Ireland that were developed on former landfills include:

- *The Athlone Civic Amenity Centre*. Completed in 2004, this site was constructed on what was once a waste disposal site; it required specific design techniques to deal with issues of gas generation and ground improvement. These included placement of waste into landscaping berms to reduce export off site, use of geogrids to reduce long-term differential settlements and the incorporation of a gas control network into the subbase layer (the transfer of residual gas to a venting system around the perimeter consisting of upstand pipes with rotating cowls). Radon barrier protection for structures on site was also a requirement.
- *Scotch Corner Landfill and Recycling Facility*. In 1999–2000, a materials recovery facility (MRF) was constructed above an area of previously filled waste (in an unlined cell). The MRF was founded on piles driven into the underlying boulder clay and the concrete base slab to the MRF was used as a "surrogate" capping layer. Gas control measures included the placement of an impermeable gas barrier across the top of the slab and a continuous gas-monitoring system in the building to detect any localised gas build-up. The system, which included a network of sensors to detect CO_2, CH_4 and O_2, was installed at various key points within the buildings and was linked to a central alarm system, which is activated if certain pre-defined trigger levels are exceeded. A similar system has been installed in buildings at a number of landfill sites. The roads and pavements to the entrance area at Scotch Corner were also constructed on top of an area where old waste was placed, using a standard pavement design that needed no additional measures installed.
- *Kyletalesha Landfill*. In 2006, a civic amenity facility was built on a site comprising a former landfill site and soft peaty soils. The foundation to the pavements included the use of geocells to minimise future differential settlements and a gas control system similar to that at the Athlone centre was incorporated into the subbase layer using slotted pipes connected to a perimeter venting system, with venting aided by rotating cowls housed on solid high-density polyethylene (HDPE) upstands.
- *Kinsale Road Landfill*. As referenced in section 6.2.1 of the main report, accommodation for the foundations of future building on the landfill is being made in the form of piles being installed as part of the final remediation of the landfill.
- *North Foreshore Landfill*. A waste transfer station was developed in the southern area in 2009 on top of an area where waste had been deposited. Following capping of the area, dynamic compaction was implemented and a lime and cement mix was pumped into the subsurface for ground stabilisation.

4 Parkland Amenity Options for Landfill Conversion

This chapter provides a high-level summary overview of some of the different types of parkland afteruses that can be achieved at former landfill sites [see Chapter 5 of the main report at SAFER (http://erc.epa.ie/safer/reports) for further information]. In addition, the relevant landfill issues (see Chapter 4 of the main report) that should be considered when determining the afteruse type are outlined, e.g. settlement, as these can have a major impact on hard afteruses. The purpose of this chapter is to assist the landfill operator/owner in understanding the type of afteruse that would be best suited to each landfill conversion project and the level of capital and maintenance costs (including maintenance requirements) that will influence the decision-making on the type of afteruses. Table 4.1 provides summary details of high-level capital and maintenance costs for the different types of afteruses and the landfill issues for consideration.

From the desk research undertaken (see Chapter 6 of the main report), the major impediment to redevelopment as a parkland amenity across the board appears to be a lack of available funding. This lack of funding can be successfully addressed though the phased implementation of the proposed master plan and the integration of revenue-generating amenities, such as events areas and commercial centres, and energy generation revenue. There appears to be a greater focus on energy generation and recovery in the international examples assessed as part of the study than is replicated in the Irish examples. As part of the consideration to convert to parkland amenity, it is important to consider both the integration of cost-effective means for treating LFG and leachate and a means of revenue generation, such as energy generation.

Table 4.1. High-level estimate of costs for development and maintenance of afteruses (including maintenance requirements)

Afteruse	Capital costs	Main landfill issues for consideration	Maintenance requirements	Maintenance costs
Sports pitch	Medium	Settlement, integration of pollution control systems away from pitch area	Vegetation and use management	Low to medium[a]
Golf, pitch and putt courses	High	Settlement, integration of pollution control systems away from golf course	Vegetation and use management	Medium
Buildings	High	Settlement, LFG, requirement for ground treatment	Energy and maintenance requirements	High
Trails	Medium	Settlement, integration of pollution control systems away from trail area	General upkeep	Low
Playground	High	Settlement, requirement for ground treatment	General upkeep	Low to medium
Wildflower and grassland meadows	Low	–	Vegetation and habitat management	Low to medium
Heathlands	Low	–	Vegetation and habitat management	Low to medium
Woodlands	Medium	Settlement, integrity of the capping system	Vegetation and habitat management	Low to medium
Wetlands and ponds	Medium	Settlement if on waste footprint	Vegetation and habitat management	Low

[a]Cost will depend on finish; for example, AstroTurf would be more expensive and may not be suitable at more recently filled landfills because of settlement

In the development of all the master plans that were looked at in both the national and international examples, a significant consideration in the development of those plans has been the location of the facility in the context of its surrounding areas as well as engagement with local stakeholders.

5 Ballyogan Landfill Conversion to Parkland Amenity – Case Study

5.1 Introduction

This chapter presents a case study of Ballyogan landfill, which is located in the functional area of DLRCC in South County Dublin. Ballyogan landfill is considered a landfill that has come under strong urban influence, with extensive retail and residential development having taken place in its vicinity since the late 1990s. In addition to this, further provision has been made for additional future development to the south of the facility. The landfill has been fully capped and the Council has now started the process of considering conversion to parkland amenity.

This chapter considers Ballyogan landfill under the following headings, which reflect the subjects that have been addressed in the previous chapters of this report:

- landfill in the context of the County Development Plan (CDP) and LAP;
- park ownership and management;
- master plan development;
  - draft master plan;
  - next steps for master plan;
    - stakeholder engagement;
    - financial considerations;
    - waste licence review.

The following additional information is included in Appendix G of the main report [available on SAFER http://erc.epa.ie/safer/reports)]:

- landfill engineering features:
  - age of waste and phases of filling:
    - settlement;
  - lining and capping systems;
  - pollution control systems:
    - gas management systems;
    - leachate management systems;
    - monitoring systems.

Table 5.1 summarises the background information for Ballyogan landfill. Figure 5.1 provides information on the site infrastructure and the various capping systems installed across the site, which varied as a result of site constraints, e.g. overhead electricity lines.

5.2 Landfill in Context of the CDP, LAP, Other Plans and Strategies

The following sections describe Ballyogan landfill in the context of existing CDP and LAPs. Figure 5.2 shows the location and setting of Ballyogan landfill in an outer urban environment.

5.2.1 Dún Laoghaire–Rathdown County Development Plan

A number of council policies and objectives concerning Ballyogan landfill and the surrounding area were included in the Dún Laoghaire–Rathdown 2010–2016 CDP (DLRCC, 2012a).

- The development of a comprehensive network of county greenways, i.e. “shared-use routes for non-motorised users, (walkers, cyclists, roller skaters, horse riders) for pleasure, recreation, tourism and daily journeys” (DLRCC, 2012a). Greenways are generally routes that predominantly utilise established green spaces, but which can also cross and link to public roads. They provide recreational opportunities for walking, jogging and cycling and can often coincide with river/ stream corridors and can promote free passage for wildlife. A greenway has been proposed connecting the areas of Lamb’s Cross and Stepaside to Carrickmines, which is adjacent to Ballyogan landfill.
- The comprehensive remediation of the former Ballyogan landfill site following completion of the rehabilitation works as a new public park (Jamestown Park). The intention is to develop a master plan for Jamestown Park that will allow the land to be developed as a significant recreational facility, forming an important linkage between a network of open spaces.

Table 5.1. Background information for Ballyogan landfill

Landfill type	Unlined landfill
Quantity and nature of waste	3,079,673 tonnes municipal waste (RPS Group, 2011)
EPA waste licence no.	W0015-01 (Licensee – DLRCC)
Waste disposal period	1975–2005
Location status	The surrounding area is characterised by a mixture of agricultural, recreational, residential and commercial land use (RPS Group, 2011) A civic amenity site, former baling station and depot (including offices) are located on site
Site area	Total site area is approximately 62 ha, 43 ha of which is used for landfilling (RPS Group, 2011)
Final capping status	Completed and fully grassed Naturally occurring low-permeability boulder clay underlying the landfill site provides a natural liner for the landfill. Bund walls were constructed from imported clay to act as lateral containment
Emissions management	Leachate is collected via a network of pipes, which are directed to the leachate sump. The leachate lagoon has been replaced with a new system of leachate management comprising a leachate storage tank and methane stripping plant, both of which are located adjacent to the leachate sump. Leachate from the site is discharged to the Carrickmines sewer, which runs through the northern part of the site A stormwater management system exists on site, consisting of wetlands to manage water from the recycling park. There is also an active gas extraction system (which includes above and below ground pipework), which has been running one engine since May 2012 (it previously ran two engines)
Master plan status	Master plan in development

- The provision of a 350-space park-and-ride facility at Carrickmines. This facility has been provided and is operational.
- The provision of a multi-purpose community/ sports/recreation facility (Samuel Beckett Civic Campus) in the Ballyogan area. This is to include:
  - a regional library
  - swimming pool
  - sports building
  - two-storey car park
  - three grass sports pitches
  - four new synthetic sports pitches
  - playground
  - skating area
  - landscaped civic space with transportation set-down area and events area
  - new attenuation pond at Ballyogan Road.
- The site for this development is located on the opposite side of the road from the Ballyogan facility. The development will proceed in two phases. Phase 1 officially commenced in June 2016; it consists of new community rooms and childcare facilities as well as a new leisure centre, including gymnasium, dance and fitness studios and three all-weather AstroTurf sports pitches.
- Additional services will be provided as part of phase 2, including an expanded leisure centre, public library and a skate park.
- The development of the Kiltiernan/Glenamuck area in accordance with the policies and objectives of the adopted LAP.

The consideration of the conversion of a facility to parkland amenity as part of the CDP and/or LAP can help remove a potential barrier from a planning perspective for the redevelopment of that facility.

Later in this chapter, Ballyogan shall also be assessed in terms of local public amenities; consideration will also be given to the local authority's open space strategy and biodiversity plan.

The Ballyogan site has three zoning objectives under the DLRCC Development Plan 2010–2016 (DLRCC, 2012a):

- Objective E – to provide for economic development and employment;
- Objective F – to preserve and provide open space with ancillary active recreational amenities; and
- Objective G – to protect and improve high-amenity areas.

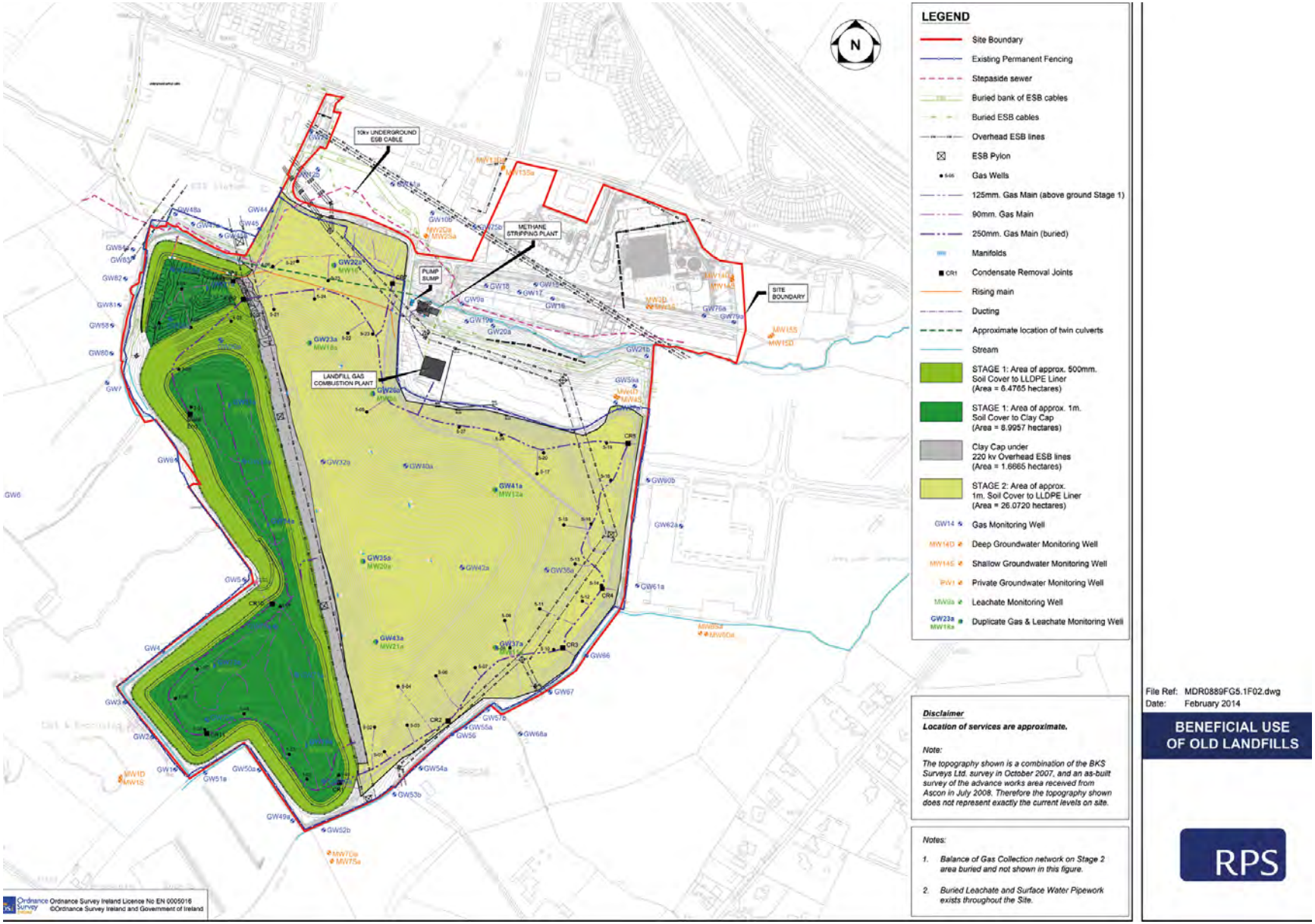

Figure 5.1. Ballyogan landfill infrastructure and capping system detail.

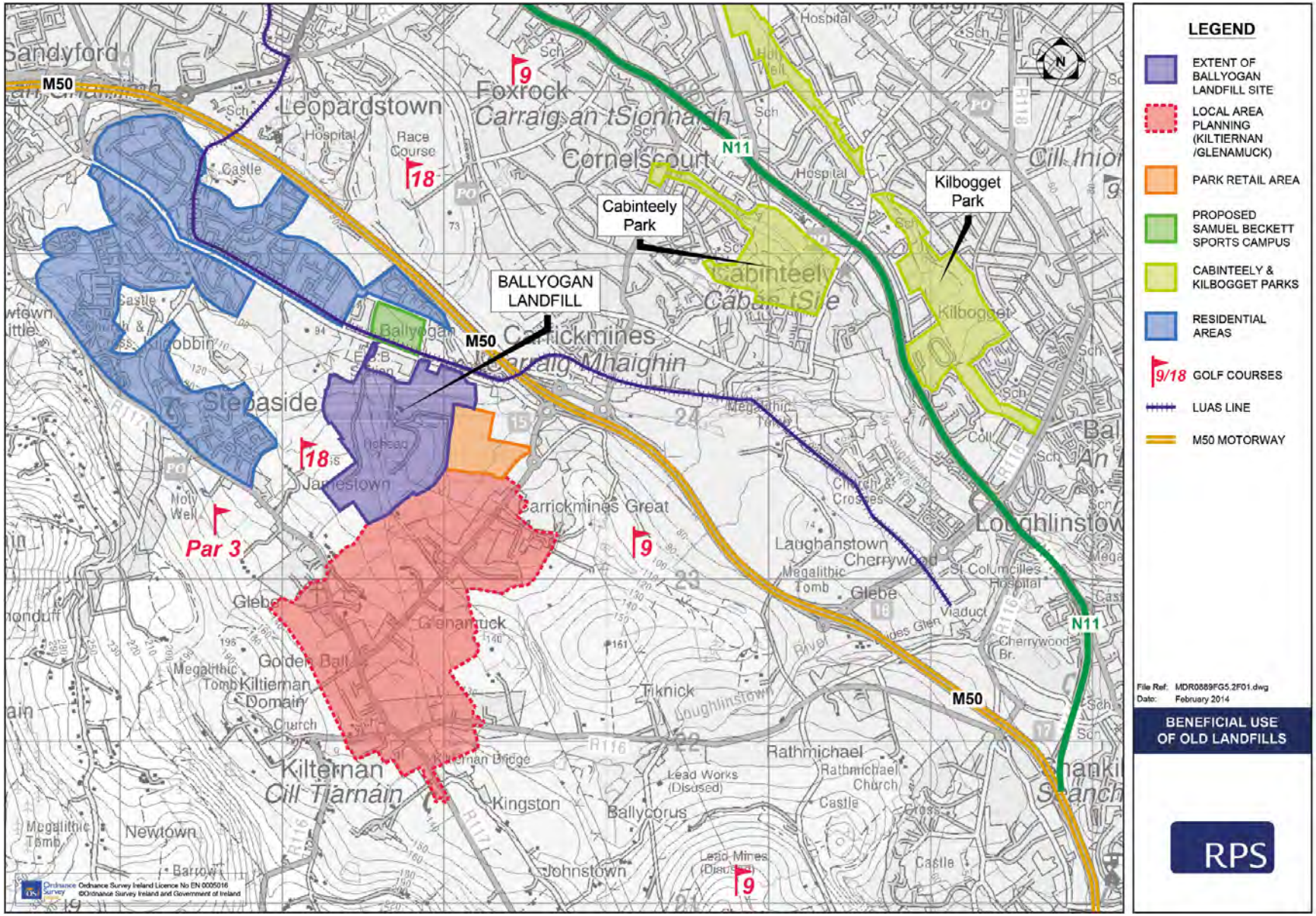

Figure 5.2. Ballyogan landfill – location and setting.

The zoning matrix table in Appendix G of the main report details the “Permitted in Principle” and “Open for Consideration” uses.

5.2.2 Local area plan

The Kiltiernan/Glenamuck LAP was developed in 2007 (DLRCC, 2007). The plan covers an area of approximately 100 ha, bounded to the north-west by the Stepaside Golf Course and decommissioned Ballyogan landfill, to the north-east by the M50 motorway corridor, to the west by the high-amenity foothills of the Dublin Mountains and to the south by a relatively fertile agricultural plain stretching to an area known as “the Scalp”.

Refer to Figure 5.2 for the location of Ballyogan landfill in relation to the Kiltiernan/Glenamuck LAP (DLRCC, 2007).

Ballyogan landfill is located just outside the boundary of the Kiltiernan/Glenamuck LAP. However, the Kiltiernan/Glenamuck LAP 2013–2019 does acknowledge it in section 5.9.9 in relation to waste management:

> There are no landfills within the Draft LAP area boundary. The Ballyogan landfill site which abuts the Draft LAP is now closed and undergoing a remediation. When this is finished, the land will be used as a large public recreational space for the increasing population in Kiltiernan/Glenamuck. There are no recycling facilities within the Draft LAP boundary. However, there is a recycling facility in Ballyogan. It processes household and commercial waste, collected by, and on behalf of, the local authority.

Section 6.5 of the final adopted LAP on waste management and landfills relates to landfills in the area; it also mentions the Ballyogan landfill site:

> Further to the opening of the Ballyogan recycling facility off Ballyogan Road in November 2004, the Ballyogan landfill, which had been in operation for some 20 years, was closed. It is intended that the landfill site will be restored to a public amenity area. A portion of this area abuts the north-western boundary of the LAP area. The restoration of the former Ballyogan landfill includes being capped (covered) and restored to a recreational parkland (Jamestown Park). The rehabilitation of the landfill is substantially underway with a phased development anticipated. Subject to available finance, it is planned to provide facilities for mountain biking …

5.2.3 Other plans and strategies

As mentioned previously, in addition to the assessment of CDPs and LAPs, it is also important to consider the potential for the conversion of a landfill to a parkland amenity in the context of other strategies and plans that may have been developed within separate departments of the local authority. Such plans and strategies in the case of Ballyogan landfill include open space strategies, green space strategies and biodiversity plans.

Ballyogan landfill is located within the functional area of DLRCC. The Dún Laoghaire–Rathdown Open Space Strategy (DLRCC, 2012b) included a public consultation and an independent technical audit, both of which indicate that DLRCC is relatively well provided with public open spaces of good quality and accessibility. For example, there are already five flagship parks: Marlay Park, Cabinteely Park, People’s Park, Blackrock Park and Killiney Hill Park. However, the Dún Laoghaire–Rathdown Open Space Strategy indicated that certain areas require improvements, for example by:

- providing playgrounds that are locally accessible, as opposed to having to drive to a regional playground;
- maintaining the current high standard of quality of public playgrounds, e.g. in terms of overall quality (75% of the sample of play sites scored “average” and above, with Cabinteely Park scoring “excellent”);
- catering to young people, a demographic that was under-represented in the consultation survey relative to their proportion in the DLR population; and
- exploiting the open space network to link safe, off-road cycling routes to other transport modes.

In addition to this, the Dún Laoghaire–Rathdown Biodiversity Plan (DLRCC, 2009) lists four main objectives:

- Objective 1 – gather information on the biodiversity resources of Dún Laoghaire–Rathdown, e.g. information on local wildlife habitats, protected species, Special Protection Areas (SPAs), etc.
- Objective 2 – manage the resources – prepare policies, guidelines and management plans to protect and enhance biodiversity.
- Objective 3 – educate and make aware – promote and disseminate biodiversity-related information.
- Objective 4 – co-operate to achieve objectives – engage with local community groups, residents associations, non-governmental organisations (NGOs) and businesses to ensure implementation of the biodiversity plan.

5.2.4 Ballyogan landfill and CDP/LAP/other plan considerations

When developing an outline park master plan for the Ballyogan landfill within the Dún Laoghaire–Rathdown catchment area, it will be important to marry the requirements of the Dún Laoghaire–Rathdown Open Space Strategy and Biodiversity plan with those of the Dún Laoghaire–Rathdown CDP and Kilternan/Glenamuck LAP. For example, the Open Space Strategy has identified the linkage of shared use greenway routes for walkers, cyclists, etc., as an objective, as has the CDP, which is a correlation. Likewise, it is important to consider objectives that do not correlate with the objectives of the other plans and to ensure that they are also included in the master plan for the park. There does not appear to be any conflict between the plans and strategies for Ballyogan; however, a possible conflict for a site could involve one plan requiring residential development and another plan requiring the protection of biodiversity, where the site is adjacent to a Special Areas of Conservation (SAC). This will be true for any parkland development in any region depending on the plans and strategies that have been developed for that region.

5.3 Park Ownership and Management

It is also important to consider the objectives of all relevant local authority departments when considering the redevelopment of a landfill as a parkland amenity. This aspect was considered as part of the redevelopment plans of the Kinsale Road landfill in County Cork. One of the early objectives of the planning stage was to identify the preferred ownership/operational structure for the new park. The decision was made that ownership of the park will remain with Cork City Council (because of the limitations imposed by the waste licence). However, portions of the site may be leased under contract, with a right of access for Cork City Council (for all aspects pertaining to maintenance of waste licence operation compliance and facility maintenance). Once it was decided that the ownership will remain with the local authority, the decision then had to be taken to which local authority department the management and maintenance of the landfill will be assigned once it has been developed as a parkland amenity. Given the fact that there will be ongoing requirements in terms of compliance with the waste licence, there may be a need to develop a cross-departmental partnership. For Ballyogan landfill, following the conversion of the landfill to a parkland amenity, it is the intention that the Parks Department will manage the parkland in close liaison with the Waste Management Section in order to ensure compliance with the waste licence.

In addition to this, as part of any parkland redevelopment activity, the Parks Department will focus on the master plan for developing the park into a local amenity that caters to the community, while the Environment Department will focus on issues related to landfill maintenance and waste licence compliance. This may only be possible for larger local authorities with Parks and Environment Departments; however, for smaller local authorities, one section may develop the master plan and also focus on landfill maintenance and waste licence compliance. It is important to note that the waste licence requires a competent person to act as landfill manager and deputy manager, including during the aftercare phase. A cross-departmental partnership and knowledge sharing will greatly facilitate the incorporation of all needs into the ultimate plan for the park. Again, this applies to larger local authorities including Parks and Environment Departments, with smaller local authorities facilitating this within a single department.

5.4 Outline Draft Master Plan for Ballyogan Landfill

Ballyogan landfill is considered to be in an outer urban setting and is also easily accessible by road

and footpath. Facilities within walking distance and driving distance (5 km and 10 km radius) of Ballyogan landfill were reviewed using the Outline Master Plan Development Matrix (see Figure 5.3). Public facilities at Cabinteely Park and Marley Park were reviewed because they are located within a distance of approximately 5 km and 8 km, respectively, from Ballyogan landfill. The Samuel Beckett Civic Campus was also taken into account during this process, as it is the closest park to Ballyogan landfill. The public facilities available at Cabinteely and Marley Park include playgrounds, extensive walking paths, cycle paths, woodland trails, an outdoor summer concert venue, GAA and soccer pitches, tennis courts, cricket grounds and a golf course.

Using the Outline Master Plan Development Matrix (Figure 5.3), the facilities in bold are those understood to be unavailable within 2 km, 5 km or 10 km from Ballyogan landfill; therefore, this list of facilities can be considered further in the master plan development. The purpose of presenting this list of facilities is to aid in the development of the concept master plan. This does not mean that all these facilities should be developed and it does not preclude other potentially suitable facilities (that may not be on the list) from being considered. The purpose of the matrix is to identify existing facilities within the surrounding environs, the resulting list of which will assist in the decision-making on the types of facilities that are needed or that would benefit the immediate surroundings of the site under consideration. As outlined below, in some cases, for example, there may be many playgrounds in the locality, but developing another playground would meet LAP objectives.

A draft master plan has been prepared by RPS for Ballyogan (see Figure 5.4). The Ballyogan master plan was based on a “best fit” concept for the site, as the site has already been remediated to grassland, i.e. without the parkland afteruse being incorporated into the restoration design [step 2 of road map (see Figure 2.1)]. The development of the best fit concept requires consideration of the relevant LAPs, distance to local amenities and expected landfill settlement at the site to determine what afteruse features will best fit the landfill.

RPS met with DLRCC Parks Department at the beginning of this project to discuss the concept master plan development. Following a review by RPS of the location of the landfill and nearby public facilities, e.g. Cabinteely and Marley Park (see Figure 5.3), and the nature of the landform, a draft outline master plan was developed by RPS for Ballyogan landfill. The concept master plan includes soft landscaping features that can be easily accommodated at the site with no buildings; this is because of the difficulty of integrating infrastructure. For this reason, facilities that would require infrastructure, such as club houses and tennis courts, were not included in the concept master plan. Similarly, the soft landscaping features have had to consider the existing electricity pylons. The master plan has also used the existing landform to include viewing points across the surrounding environment.

The master plan includes a children’s playground, pedestrian paths and cycle paths, which link to the cycle network already in place around Ballyogan landfill. This links to the areas of improvement that were highlighted in the Dún Laoghaire–Rathdown Open Space Strategy (DLRCC, 2012b). The master plan also includes an open grass space for passive recreation, wildflower meadows and a trim trail, i.e. a fitness trail equipped with exercise stations distributed along its length to promote good health, linking to the objectives of the Dún Laoghaire–Rathdown Biodiversity Plan (DLRCC, 2009).

The DLRCC Open Space Strategy 2012–2015 (DLRCC, 2012b) identifies an underprovision of play facilities in parts of Dún Laoghaire. For this reason, a playground was also incorporated into the draft Ballyogan master plan (although not identified as a priority on the matrix). As the playground has a high impact on the level of settlement of the deposited waste, the playground is situated at the entrance of the landfill where there was limited infill of waste; therefore, minimal settlement is expected.

As such, while the Ballyogan landfill is located in an outer urban area that is easily accessible, in terms of the level of development that has taken place and is proposed in its environs, it is also within the functional area of an authority that already has a significant resource in terms of recreation parks. Therefore, given the location, an ecology/nature park incorporating some passive recreational elements and a playground facility is the best fit for Ballyogan in terms of its conversion to a parkland amenity. The nature of this development is in keeping with all the objectives of the local authority. It is particularly in line with the improvement measures as identified in the

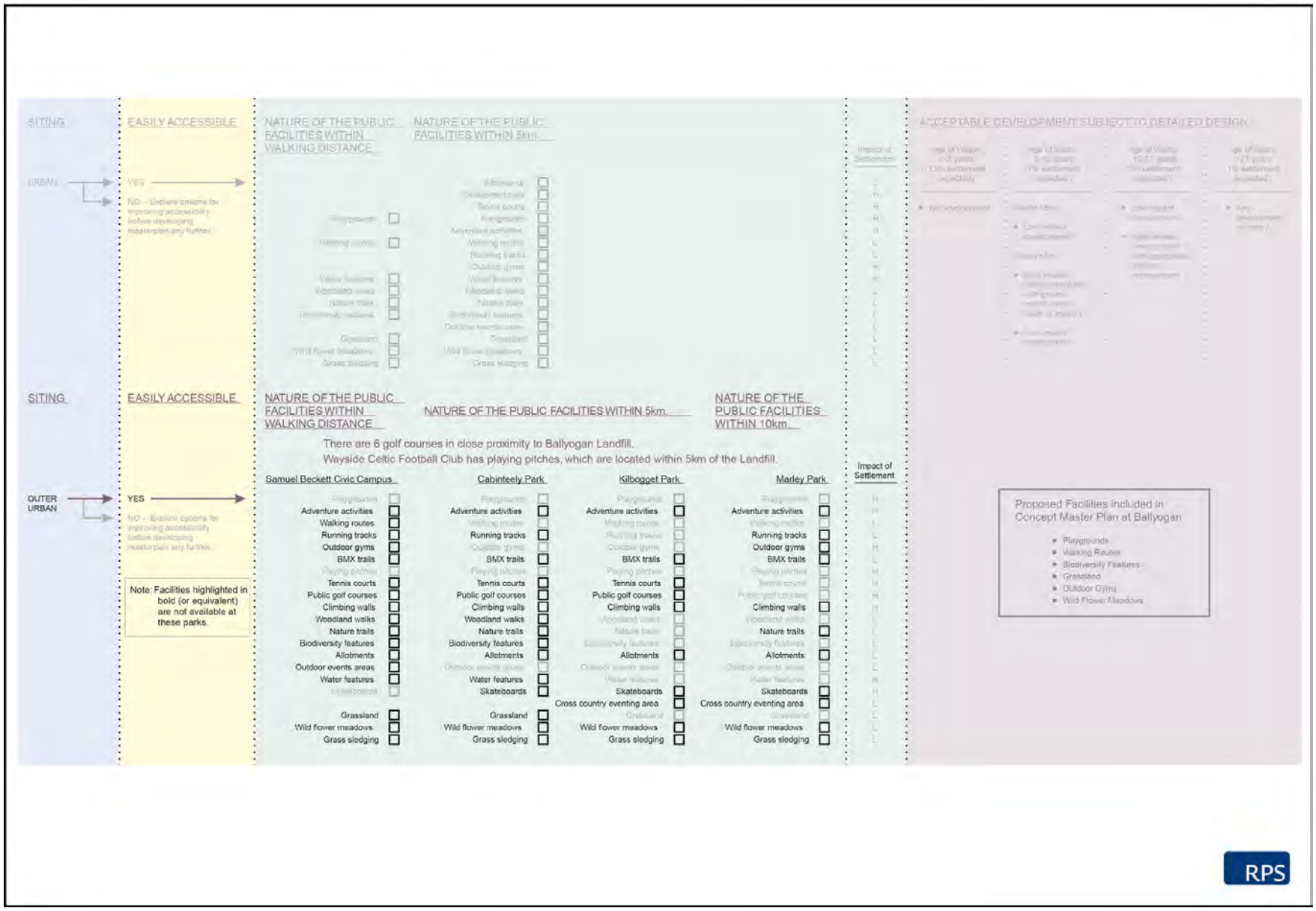

Figure 5.3. Ballyogan landfill – concept master plan.

Figure 5.4. Outline master plan development matrix – Ballyogan landfill case study.

2012 DLRCC open space strategy document (DLRCC, 2012b).

The concept master plan is still at the concept stage; further development will require consideration under Step 3 of the road map (Figure 2.1) before the master plan is finalised. This concept master plan can form the basis of detailed discussion with DLRCC Parks Department to further develop the outline master plan options, taking into account the site constraints prior to entering the public consultation phase.

5.5 Next Steps for Master Plan

5.5.1 Public/stakeholder engagement

Following agreement of the draft master plan for Ballyogan, a public/stakeholder engagement strategy will need to be developed to inform the public/ stakeholders of the proposed master plan and collate any feedback and input.

5.5.2 Funding

A cost–benefit analysis of the draft master plan will be required and funding opportunities will need to be examined.

5.5.3 Waste licence review

As Ballyogan landfill ceased accepting waste in 2005 and has now been fully capped for some years, DLRCC, following consultation with the EPA, may be in a position to reduce some monitoring requirements.

5.6 Summary of Ballyogan Case Study

Ballyogan landfill is representative of many landfill sites in Ireland that have reached the aftercare phase. In addition to this, it is a landfill that has come under strong urban influence since its establishment with extensive residential and commercial development having taken place in its vicinity. The rate of future development is set to continue with the boundary of the Kiltiernan and Glenamuck LAP adjoining the southern boundary of the landfill. As such, it presents a significant opportunity to turn the landfill into a valuable community asset. However, the afteruses of landfills such as Ballyogan are more limited because of settlement issues and their impact on buildings and other afteruses that require built infrastructure.

The depth and age of waste across the Ballyogan landfill varies and particular consideration will need to be given to this as part of the development of parkland proposals because of the potential for settlement to impact on future developments. In addition, while Ballyogan is well served in that it has a discharge to sewer consent for leachate generated on site, and this should provide future certainty in terms of the disposal of leachate from the site, there will come a stage in the aftercare phase when new measures with respect to the management of a lower calorific value LFG will be required, e.g. microturbine. This will need to be considered as part of the master planning for the conversion of the facility to a parkland amenity. Other existing constraints on site, such as steep side slopes, high-voltage electricity lines and the presence of monitoring and gas extraction infrastructure, will all need to be considered as part of the conversion of the facility to parkland amenity. At the very least, pipework will need to be buried at a minimum in the areas where the public have access to the park.

Because of its location in an outer urban area, the CDP, LAP and other plans and strategies that relate to the site require consideration in the master plan development. The next steps in the road map (Figure 2.1) are now required to be considered to progress the master plan development.

6 Conclusions and Recommendations

This report provides an approach to aid decision-making and master planning for landfill conversion to parkland amenity projects. The following are the main conclusions.

- Landfill master plans for conversion to a parkland amenity will need to consider a range of factors, including the long-term aftercare and maintenance requirements for both the parkland and landfill, planning policy and stakeholder input.
- Local authorities and organisations considering converting their landfill to a parkland amenity (or other use) should first evaluate the setting of the landfill and complete a risk assessment for the site before progressing to the development of a master plan.
- The lack of available and necessary funding appears to be the main impediment to the conversion to parkland amenity as demonstrated in the review of national and international case studies of landfills.

A number of needs identified and recommendations arising from the research project and the development of this reference document are provided below.

- There is a need for the development of national policy to promote the reuse of former landfills as valuable areas. This could include the requirement for planning departments to consider all old landfills in association with options for parkland/ green spaces or consideration of the beneficial use of former landfill sites in the regional waste plans.
- There is a need to examine the funding options for the parkland development, e.g. tax relief on expenditure made for the parkland development.
- There is a need for engagement with and dissemination of information on European funding options/initiatives such as the SufalNet4EU Project (administered through the INTERREG IVC programme) by local authorities individually or as regional groupings.
- There is a need for preparation of a “site manual” for landfill operators to hand over to the parkland operators so that they are aware of all landfill engineering features and pollution control systems.
- There is a need for addressing the social and economic benefits of landfill afteruse as part of the CRAMP.
- There is a need for updating the EPA’s *Landfill Manual – Landfill Site Design* (2000) and *Landfill Manuals – Landfill Restoration and Aftercare* (1999):
  - to better promote conversion to an afteruse and incorporate a master planning stage to decide on the afteruse as early as possible in the decision-making process;
  - to outline all technical guidelines for building on/adjacent to landfills.
- There is a need to maintain a register of landfill sites and their end-use conversion status, including information on any lessons learned during their development. This would be useful for other operators considering conversion.
- The adoption of a phased implementation approach for master plans is required so that work continues on a progressive basis rather than waiting for funding to complete all works.
- Master plans should consider integrating revenue generation schemes, such as sustainable carbon and energy management options or events areas and commercial centres, into the final afteruse.

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Abbreviations

CABE	Commission for Architecture and the Built Environment
CDP	County development plan
CRAMP	Closure, restoration, aftercare and management plan
DLRCC	Dún Laoghaire–Rathdown County Council
ELRA	Environmental liabilities risk assessment
EPA	Environmental Protection Agency
GI	Green infrastructure
LAP	Local area plan
LFG	Landfill gas
MRF	Materials recovery facility
SAC	Special Area of Conservation
SPA	Special Protection Area
SPR	Source–Pathway–Receptor
SufalNET	Sustainable use of former and abandoned landfills Network

Glossary

Aftercare	Any measures that are necessary to be taken in relation to the facility for the purpose of preventing environmental pollution following the cessation of waste deposition and the final capping of the landfill.
Afteruse	The use to which a landfill is put following restoration.
Amenity	For the purposes of this report, an amenity can be described as a desirable or useful feature or facility or place that brings convenience and pleasure to an area.
Berm	A mound usually of clay or other inert material used to define limits of cells, phase or roadways; or to screen the operation of a landfill from adjacent properties (with the aim of reducing noise, visibility, dust and litter impacts).
Capping	The covering of a landfill, usually with low-permeability material (landfill cap). See the EPA's *Landfill Manuals – Landfill Restoration and Aftercare* (1999).
Certificate of authorisation	Each local authority is required under the Waste Management Act 2008 to carry out a risk assessment of closed landfills that operated and closed between 1977 and 1997 in their functional area. On completion of the risk assessment, the local authority must apply to the EPA for a certificate of compliance with the Regulations of the Waste Management Act 2008. This certificate, known as the certificate of authorisation, is then issued by the EPA to the local authority and determines the adequacy of the risk assessment, specifies further measures to be taken by the local authority to protect human health and the environment and also requires the local authority to compile a validation report.
Designated conservation areas	These are prime wildlife conservation areas in the country, considered to be important at European as well as at Irish level (SAC, SPA, Natural Heritage Areas). Ireland is required under the terms of the EU Birds Directive (2009/147/EC) to designate SPAs for the protection of endangered species of wild birds. The legal basis on which SACs are selected and designated is the EU Habitats Directive, transposed into Irish law in 1997, as amended in 1998, 2005 and 2011. The basic designation for wildlife is the Natural Heritage Area.
Dynamic compaction	Dynamic compaction is a method that is used to increase the density of the soil when certain subsurface constraints make other methods inappropriate. The process involves dropping a heavy weight repeatedly on the ground at regularly spaced intervals.
Environmental Liability Directive	The purpose of the Environmental Liability Directive is to establish a framework of environmental liability, based on the "polluter pays" principle, to prevent and remedy environmental damage.
Geogrids	A geogrid is geosynthetic material used to reinforce soils and similar materials.

Hazardous landfill	Landfill that accepts only hazardous waste that fulfils the criteria set out in Article 6 of Council Directive 1999/31/EC on the landfill of waste.
Inert landfill	Landfill that accepts only inert waste that fulfils the criteria set out by Council Directive 1999/31/EC on the landfill of waste.
Landfill gas (LFG)	All gases generated from the landfill waste.
Leachate	Any liquid percolating through the deposited waste and emitted from or contained within a landfill as defined in Section 5(1) of the Waste Management Act.
Non-hazardous landfill	Landfill that accepts non-hazardous waste, i.e. waste that does not pose substantial or potential threats to public health and that fulfils the criteria set out in Article 6 of Council Directive 1999/31/EC on the landfill of waste.

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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Beneficial Use of Old Landfills as a Parkland Amenity

Authors: Cathriona Cahill and Cora Plant

Identifying Pressures

The desk study research project was commissioned by the EPA in response to the number of landfills that are closed or near closure and are awaiting final restoration. The conversion of suitable closed landfills to parkland amenities presents an opportunity to make beneficial use of land that would have previously been considered sterile from social, environmental and economic perspectives. A number of these landfills that could provide a parkland amenity post closure are located in areas either under strong urban influence or adjacent to designated conservation areas [i.e. Natura 2000 sites (SACs, SPAs), Natural Heritage Areas (NHAs)]. Historically, in many instances, landfills were located adjacent to such designated conservation areas prior to recognition of the area's environmental importance and before legislation to protect such areas had been enacted. In addition to these situations, development within urban areas has expanded outwards in recent years and, as a result, many historical landfills that were once remote are now in close proximity to the urban environment.

Informing Policy

There is no policy that prescribes the afteruse that should be applied to closed landfills. Much valuable information on the beneficial use of landfill sites is contained within the EPA's Landfill Manual – Restoration and Aftercare (EPA, 1999), which provides guidance on all aspects of landfill restoration and aftercare to afteruses such as amenity and nature conservation. This research project identifies that there is a need for the development of national policy to promote the reuse of former landfills as valuable areas. This could include the requirement for planning departments to consider all old landfills in association with options for parkland/green spaces or consideration of the beneficial use of former landfill sites in the regional waste plans.

Developing Solutions

This research highlights that landfill master plans for conversion to a parkland amenity will need to consider a range of factors, including the long-term aftercare and maintenance requirements for the parkland and landfill, planning policy and stakeholder input. Local authorities and organisations considering converting their landfill to a parkland amenity should first evaluate the setting of the landfill and complete a risk assessment for the site (or review a completed risk assessment if available). The lack of available and necessary funding appears to be the main impediment to the conversion to parkland amenity. Therefore, there is a need to examine the funding options for the parkland development, e.g. tax relief on expenditure made for the parkland development could be one option. There is also a need to address the potential social, environmental and economic benefits of landfill afteruse as part of the Closure, Restoration, Aftercare Management Plans.

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