Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects.

June 2006

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Section 1: Introduction:

1.1 Background

The purpose of these Guidelines is to promote an integrated approach to construction and demolition (C&D) waste management, throughout the duration of a project. They are designed to promote sustainable development, environmental protection and optimum use of resources. The Guidelines provide guidance on the preparation of Project Construction and Demolition Waste Management Plans for certain classes of project, which exceed specified threshold limits. The requirement for such Plans extends equally to both public and private sector developments. They provide clients, developers, designers, practitioners, contractors, sub-contractors and competent authorities with an agreed basis for determining the adequacy of C&D Waste Management Plans.

Construction and demolition waste is defined as waste which arises from construction, renovation and demolition activities, together with all waste categories mentioned in chapter 17 of the European Waste Catalogue (EWC). Also included within the definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

The construction/demolition industry is one of the largest waste producers in Ireland. Landfill has been the traditional disposal mechanism for C&D waste, but in accordance with the waste management hierarchy and having regard to the resource value of the discarded materials and the current exhaustive pressures on landfill space, recycling must take over as the main management route for this waste stream. The recycling of C&D waste has been recommended in all of the Regional Waste Management Plans, which the local authorities are now implementing, with many setting a target of c. 80% recycling of C&D waste by 2006. The *National Waste Report 2004* estimates the total quantity of construction and demolition waste collected in 2004 was approximately 11 million tonnes. This remarkable increase since 2001 (when 3.6 million tonnes were reported as collected) is likely due to increased infrastructure and housing development and improved reporting. This latest estimate is based on compilations of local authority collection permit reports. However, as the *National Waste Report 2004* points out, there are some uncertainties in relation to the validity of the data. While circa 11 million tonnes of C&D waste was reported as collected in 2004, a total of circa 9.5 million tonnes was recovered and disposed of by waste licensees and permit holders. The discrepancy of circa 1.5

million tonnes highlights the need for further auditing the actual fate of collected C&D waste. The Report also highlights that of the 8.5 million tonnes of soil and stones collected, 90% is recovered while the remaining 10% is unaccounted for. In relation to C&D waste which excludes soil and stones, it is estimated that only 69% undergoes recovery/disposal at Environmental Protection Agency (EPA) and local authority permitted sites. The remaining 31% is unaccounted for.

The Report estimates the recovery rate for C&D waste at 85.2% at EPA licensed landfills and at local authority permitted sites throughout the country. In the Report, the EPA indicates that the recovery figures for 2004 are provisional. The Agency will carry out detailed research in 2006 to corroborate the provisional findings. A report from the EPA is due in 2006 allowing progress with regard to construction and demolition waste to be accurately assessed.

Prudent and proper management of this waste stream will be required in order to significantly improve the recycling rates of core construction and demolition waste materials other than soil and stones.

An illustration of the rapid rise in construction and demolition waste arisings is outlined in the current Waste Management Plan for the Dublin Region. The Plan identified a total of 3.9 million tonnes of C&D waste which was generated in the Dublin Region in 2003. Much of the increase is attributed to growth in the construction industry itself, but improved reporting as a result of the waste permitting and licensing systems is also responsible for identifying C&D waste arisings that previously went unrecorded. This pattern of higher C&D waste arisings is reflected throughout the country.

The recycling of C&D waste is essential in order to reduce our dependency on finite natural resources such as geological and energy reserves. While recycling of such material has the added benefit of controlling the extent of waste disposal and reducing overall transportation costs, prevention is the most desirable approach to waste management, since the elimination of waste removes the need for subsequent handling, transportation and treatment of discarded materials.

The Government's policy statement on waste management – *Changing Our Ways* (October 1998) - specifically addresses the management of C&D waste. This statement set out an initial 50% recycling target by the end of 2003 with a progressive increase to 85% by 2013.

Task Force B4 - charged with investigating "Recycling of Construction and Demolition Waste" - was set up by the Forum for the Construction Industry in October 1999 in response to the challenge posed in *Changing Our Ways*. Following publication of the *Task Force B4 Report*, the National Construction and Demolition Waste Council (NCDWC) was established in June 2002 as a voluntary industry body with an objective of achieving compliance with the policy document *Changing Our Ways* and such other policies that may be launched from time to time. The main purpose of the NCDWC was to oversee the implementation of the recommendations of Task Force B4. The Council produces annual reports which monitor progress towards achieving the recommendations of the *Task Force B4 Report*.

While good progress has been made in pursuit of the Government targets for the recycling of construction and demolition waste, this has been largely achieved through the use of C&D waste for engineering works at landfill sites and in land reclamation activities. The performance achieved in the prevention of waste on site developments as well as the preparation and use of suitable C&D waste derived aggregates in construction works has been limited to date. Many permitted facilities are conditioned to accept only soil and stones in the land reclamation activity and it is essential to ensure that other categories of C&D waste materials which are unsuitable for the purposes of land reclamation are not deposited at these sites in contravention of permit conditions. Furthermore, it should be an objective to ensure that the resource of C&D waste is employed in the most beneficial manner practicable through optimal reuse and recycling activities.

Construction projects, even with good prevention practices, will generate significant quantities of waste on a once-off basis. The identification and provision of facilities for the reception of such waste arisings should be integrated into the project planning and design processes. The preparation of a Project C&D Waste Management Plan should begin in the early stages of project development to facilitate suitable arrangements for the proper and orderly management of the wastes and surpluses that are liable to arise in the course of the development works.

1.2 Waste Management Policy and Legislation

The Waste Management Acts (WMA) 1996 to 2005 and associated regulations create a "cradle to grave" responsibility for the management of waste. Under the waste management regulatory code, an authorisation is required to carry out any waste-related activity. The WMA sets out the following provisions:

- specific authorisations are needed for both the collection of waste and its recovery/disposal;

- section 34 of the WMA imposes a general obligation on any person/contractor (other than a local authority) to obtain a waste collection permit, where they are engaged in the collection of waste on a commercial basis. These authorisations are issued under the Waste Management (Collection Permit) Regulations 2001 (S.I. No. 402 of 2001) and the Waste Management (Collection Permit)(Amendment) Regulations 2001 (S.I. No. 540 of 2001);

- sections 39-41 of the WMA and associated regulations govern the process of licensing by the Environmental Protection Agency, of specified waste recovery and disposal activities. These authorisations are issued under the Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended; and

- under the Waste Management (Permit) Regulations 1998 (SI No. 165 of 1998) certain waste disposal and recovery activities, generally those of low volume and which are perceived to pose a low risk to the environment, do not need a waste licence and instead require a permit from a local authority or a Certificate of Registration from the EPA/local authority.

It is essential that the conditions attached by competent authorities to these authorisations are fully complied with by licensees and permit holders. In particular, the requirement for the preparation and submission of Annual Environmental Reports in respect of activities undertaken by authorised operators should be rigorously applied.

From the perspective of site developers, it is imperative that all hauliers engaged for the removal of waste material from site and each facility used for the consignment of C&D waste possess the requisite authorisations and are compliantly adhering to the conditions imposed on their permits and licences.

Sub-Committee D of the NCDWC has sought a simplification of the permitting process and a reduction in the time period needed for determination of applications. The Draft Waste Management (Facility Permit and Registration) Regulations (July 2005) were issued for public consultation with a view to simplifying and streamlining the existing system and propose a number of amendments to existing Regulations. These proposals attempt to resolve a number of issues raised by construction industry stakeholders and have the objective, where feasible, of making

authorisation applications for reuse and recycling of C&D waste-related activities a more attractive proposition for developers. Proposed amendments include:

- a reduction in the time allowed for local authorities to acknowledge receipt of a valid application and the period within which the application must be determined;
- a requirement for applicants to provide details of traffic management systems; and
- a proposed maximum threshold of 25,000 tonnes per annum in respect of a "Certificate of Registration" for the recovery of C&D waste for land reclamation.

1.3 Purpose of Guidelines

The Guidelines contained in this report are intended to:

- promote a coherent, integrated approach, whereby the management of construction and demolition waste is given due consideration throughout the duration of a project;

- outline the manner in which clients, planners, designers, contractors, sub-contractors and suppliers can act co-operatively in order to reduce C&D waste arisings and to improve the manner in which any waste generated is managed;

- provide designers, developers, practitioners and competent authorities with an agreed basis for determining the adequacy of Construction and Demolition Waste Management Plans; and

- provide both general and specific guidance in relation to the preparation of satisfactory Project Construction and Demolition Waste Management Plans for certain classes of projects which exceed a specified threshold size (see Section 3.1).

Section 2: Methodology

2.1 Best Practice

The management of C&D waste should reflect the waste management hierarchy, with waste prevention and minimisation being the first priority succeeded by reuse and recycling. During site clearance and reconstruction works, there are numerous opportunities for the beneficial reuse and recycling of the demolition materials. The subsequent use of recycled materials in reconstruction works also reduces the quantities of waste which ultimately needs to be consigned to landfill sites.

Prevention of Waste

The primary effort therefore should be to engage in waste prevention and reduce the amount of waste generated in the first place i.e. minimise the resources needed to do the job. Prevention is financially advantageous as it reduces the purchase of construction materials and obviates the need to remove wastes from site. It is important to emphasise the potential for certain purchasing procedures to contribute to a reduction in excessive material wastage on site. Examples include:

- ensuring materials are ordered on an "as needed" basis to prevent over supply to site;
- purchasing coverings, panelling or other materials in shape, dimensions and form that minimises the creation of excessive scrap waste on site;
- ensuring correct storage and handling of construction materials to minimise generation of damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;
- ensuring correct sequencing of operations; and
- assigning individual responsibility (through appropriate contractual arrangements) to sub-contractors for the purchase of raw materials and for the management of wastes arising from their activities, thereby ensuring that available resources are not expended in an extravagant manner at the expense of the main contractor.

Renovation which retains and repairs existing structural and decorative elements, with the introduction only where necessary of new items, contributes greatly to a reduction in C&D waste arisings. In the case of protected structures, demolition is permitted only in exceptional circumstances. Designers and developers should consult the Department of Environment, Heritage and Local Government publication *Architectural Heritage Protection Guidelines for Planning Authorities* (2005) for advice on

procedures relating to the development, demolition and architectural salvage of protected structures.

Reuse of Waste

Material that is generated should be reused on site or salvaged for subsequent reuse to the greatest extent possible and disposal should only be considered as a last resort. Initiatives should be put in place to maximise the efficient use/reuse of materials. Excavated spoil/topsoil can be carefully set aside and used as landscaping material in the completed development. Innovative initiatives to avoid the need for disposal should be investigated:

- architectural features should ideally be reused in the refurbishment of retained structures on the same site;
- the warehousing of salvaged material can facilitate its reuse on future projects; and
- "architectural salvage sales" can allow the public to acquire material resources that have been removed from decommissioned buildings.

Recycling of Waste

There are a number of established markets available for the beneficial use of C&D waste:

- waste timber can be
    - recycled as shuttering or hoarding, or
    - sent for reprocessing as medium density fibreboard;
- waste concrete can be utilised as fill material for roads or in the manufacture of new concrete when arising at source; and
- in addition, the technology for the segregation and recovery of stone, for example, is well established, readily accessible and there is a large reuse market for aggregates as fill for roads and other construction projects. Bitmac and Asphalt can also be recycled in roads projects.

In this regard, Sub-Committee B of the NCDWC is actively exploring the development of markets and specifications for C&D waste-derived materials. In addition, the Market Development Group has been established at national level, with a mandate to investigate market opportunities for the beneficial reuse of materials recovered from waste streams, including C&D waste.

Overall Management of C&D Waste

Waste minimisation, reuse and recycling can best be managed operationally by nominating a "C&D Waste Manager" to take responsibility for all aspects of waste management at the different stages of the Project. This C&D Waste Manager may well be a number of different individuals over the life-cycle of the Project, but in general is intended to be a reliable person chosen from within the

Planning/ Design /Contracting Team, who is technically competent and appropriately trained, who takes the responsibility to ensure that the objectives and measures within the Project Waste Management Plan are delivered and who is assigned the requisite authority to secure achievement of this purpose. Specifically, the function of the C&D Waste Manager will be to communicate effectively with colleagues in relation to the aims and objectives for waste management on the Project. The primary responsibility for delivery of the objectives of the Waste Management Plan will fall upon the C&D Waste Manager designated at the demolition/ construction stage. A key objective for the C&D Waste Manager should be to maintain accurate records on the quantities of waste/surpluses arising and the real cost (including purchase) associated with waste generation and management.

The preparation, application and documentation of a Project Waste Management Plan should enable all parties - including contractors, designers and competent authorities - to learn from the systematic implementation and assessment of best practice, particularly through the recording of summary information on performance outcomes.

Section 3: Guidelines on Content of Plans

3.1 Thresholds:

It is best practice to address C&D waste management issues within the project planning, or pre-contract stage, as this allows optimum scope for waste prevention and recycling aspects in the subsequent phases of the scheme. Initial formulation of the approach to be adopted in the management of C&D waste should therefore commence at the pre-planning or conceptual stage. Indeed, this general approach is important since the optimum C&D waste management solutions may have broader impacts on the surrounding area, which may need to be addressed in a planning context - for example the alteration of the topographical profile of the development site or the creation of particular traffic movement patterns.

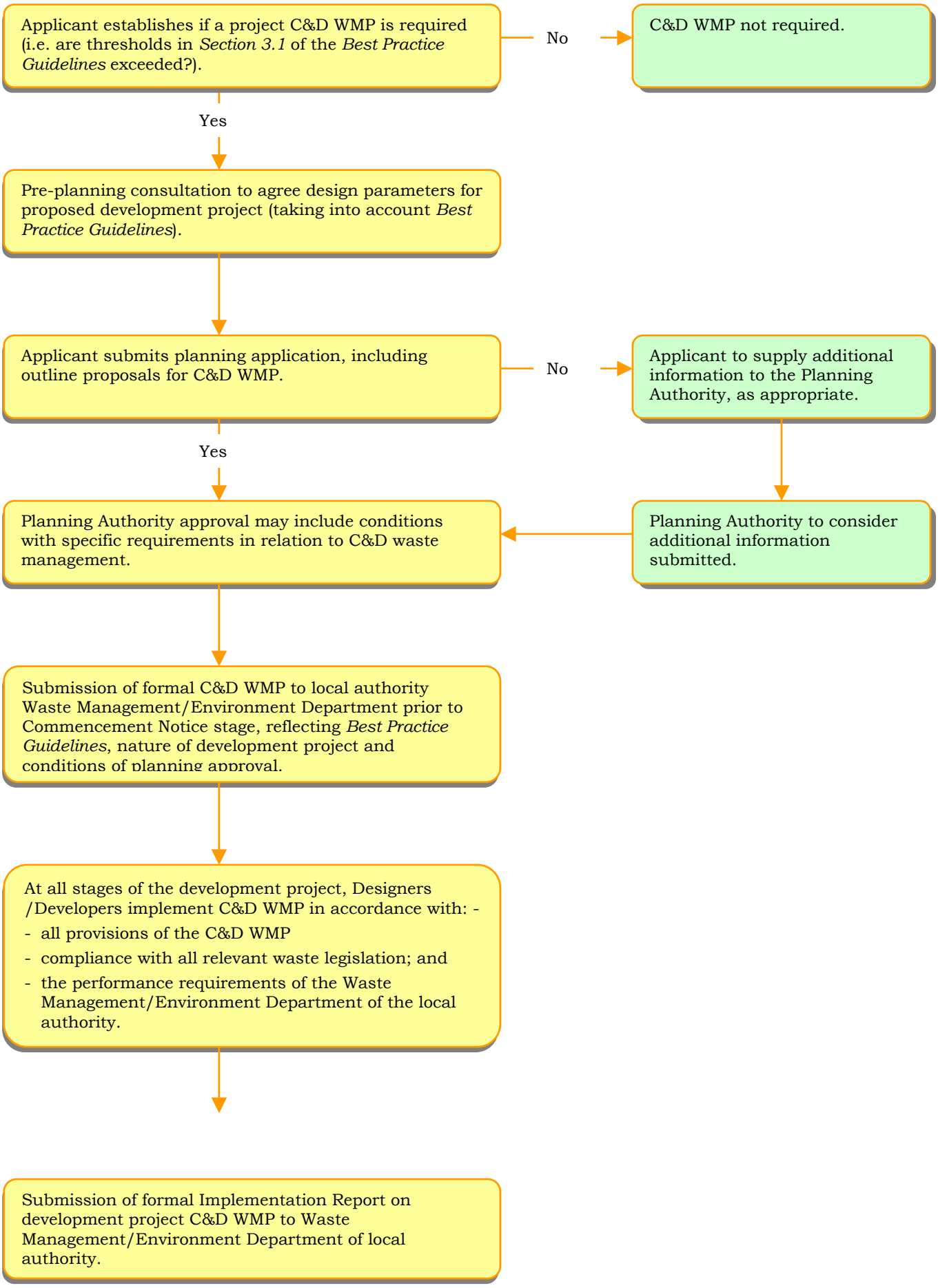
Designers should provide the Client at an early stage with clear advice in relation to the prevailing policy, legislation and best practice in C&D waste management. By securing agreement from the Client on the implementation of environmentally sound management of C&D waste at the outset of the project, this commitment can be imposed on all construction industry stakeholders over the entire duration of the scheme.

Developers of projects with significant potential for the generation of C&D waste can best address the associated issues and the application of best practice through the preparation of a Project C&D Waste Management Plan. It is entirely appropriate that the essential requirement to prepare such a Plan extends equally to both public and private sector developments.

In particular, Project C&D Waste Management Plans should be prepared for projects in excess of <u>any</u> of the following thresholds -

(1) New residential development of 10 houses or more;
(2) New developments other than (1) above, including institutional, educational, health and other public facilities, with an aggregate floor area in excess of 1,250 m^2;
(3) Demolition/renovation/refurbishment projects generating in excess of 100m^3 in volume, of C&D waste;
(4) Civil Engineering projects producing in excess of 500m^3 of waste, excluding waste materials used for development works on the site.

SYSTEMS FLOW FOR CONSIDERATION OF C&D WASTE THROUGHOUT A DEVELOPMENT PROJECT



Local authorities have adopted non-hazardous Waste Management Plans, either on a county or regional basis. These Plans are based on extensive research and analysis into the waste management needs of the county/region and set out the proposed actions to be taken by the local authority and implemented by relevant construction industry stakeholders in pursuit of these objectives. The Plans prescribe the measures necessary to ensure the proper management of C&D waste.

Planning authorities are also empowered, when considered appropriate under Section 34(4)(l) of the Planning and Development Act 2000, to attach conditions relating to C&D waste management to developments which require planning approvals.

A possible draft for the condition to be attached is as follows:

> *"Prior to the commencement of development, the developer shall submit a formal Project Construction and Demolition Plan to the local authority for agreement prior to Commencement Notice stage. This plan shall, inter alia, include the information recommended in sections 3.2, 3.3 and 3.4 of the document titled "Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects" published by the Department of the Environment, Heritage and Local Government.*
>
> *Reason: In the interests of the reduction and best practice management of construction and demolition waste from the proposed development."*

The formal Project C&D Waste Management Plan as referred to in the systems flow chart under Section 3.1 of this Guidance Note, should be submitted to the local authority's Waste Management/Environment Department. The developer will be entitled to proceed to implement the Plan as submitted unless the Authority indicates, within 6 weeks from the date of receipt of the Plan, that there is a difficulty with the submitted plan.

The need for Project C&D Waste Management Plans may be waived in circumstances where the local authority considers it impractical to operate such a plan due to technical reasons i.e. Health & Safety. The consideration of such a waiver can be raised during the normal course of processing a planning application of this kind.

Outline proposals for a Project C&D Waste Management Plan should also be prepared by public sector bodies in the case of their own projects which exceed the above thresholds and which involve a statutory public consultation process or where such projects have to undergo a formal approval process. In the case of the latter, a Project C&D Waste Management Plan should, as appropriate, accompany the documentation submitted to the relevant authority and be made publicly available. The Plan should be made available by the public body where this is requested and the fee charged should not exceed the reasonable cost of making a copy of the plan. Prior to the commencement of construction the contracting public sector body should seek the preparation and submission of a formal Project C&D Waste Management Plan from the main contractor in accordance with these guidelines; this plan should be agreed in writing by the contracting authority before construction work commences.

It is considered that all construction industry stakeholders - including in particular Clients and all professionals such as Architects, Engineers and Quantity Surveyors - should be pro-active in relation to the systematic reduction and proper management of C&D waste, a matter which is clearly in the public interest. Project C&D Waste Management Plans should, therefore, be prepared for all but minor site developments.

In terms of Project C&D Waste Management Plan execution, it is imperative that all Plans which are prepared should be routinely implemented. The Waste Management\Environment Department of each local authority should ensure the Project C&D Waste Management Plan is adhered to by requiring (once the Plan is approved and the project is underway) the submission of appropriate summary reports from the contractor detailing the extent of actual reuse, salvage, recycling and solid waste disposal taking place, together with an estimate of the amount of waste diverted from landfill through the C&D Waste Management Plan. The local authority should also, when appropriate to ensure Plan implementation, carry out periodic monitoring and inspection of construction and demolition sites.

Effective construction and demolition prevention and recovery practices lead to substantial cost savings when current gate fees at waste management facilities, haulage and labour costs are taken into account. Though proper segregation, sorting and storage of waste materials for recycling and salvage require additional labour, it must be recognised that high transport and disposal costs serve to make material recovery economical.

3.2 General Guidelines:

To optimise approach and effectiveness, formulation of a Project C&D Waste Management Plan must start at the earliest possible stage of a project. Formal production and presentation of the Plan may be at a later stage but a clear "waste management philosophy" needs to be adopted by the designer/planner at the initial conceptual stage of the Project and to be documented for subsequent inclusion within the formal Plan.

A Project C&D Demolition Waste Management Plan should ideally be written to a scope and level of detail which is commensurate with the type and size of the project. It should also include matters relating to the hours of construction, transport routes or such other key issues as might be of interest to adjoining property owners or persons affected by a development. The waste management hierarchy should be carefully assessed and applied against the following five phases in the life of the construction project:

1. Project Conception/ Resource Analysis Phase
2. Preliminary Design/ Planning Phase
3. Detailed Design and Tendering Phase
4. Pre-construction Demolition Phase
5. Construction Phase

Clients can greatly assist by requiring the application of environmental criteria for the project objectives and so determine the conditions under which projects are implemented. In doing so they can ensure that the key stakeholders in the development Project prioritise all aspects of C&D waste minimisation – prevention, reuse and recycling.

During the inception and preliminary planning stages of the project, special attention should be given to the development of a C&D waste management approach, which should establish goals for the diversion of waste from landfill and focus upon waste prevention, reuse and recycling opportunities.

Waste Prevention

All stages of the project should consider opportunities for the prevention of waste, particularly since a successful prevention approach can eliminate obligations to comply with onerous planning conditions with respect to the recovery and disposal of C&D waste.

Initially, existing buildings should be assessed against project needs, with a view to avoiding unnecessary demolition activities and

minimising new construction requirements, thereby preventing waste generation.

The design stage offers scope to reduce the production of waste materials by prioritising waste prevention as a criterion. In essence, it is important to apply the design and construction decisions which will allow the recovery of valuable resources that will be generated from building removals in the decades ahead and beyond. For example, suitable choice of finished ground and floor levels can greatly reduce the amount of excavated spoil generated. Modular construction, open floor plans, the use of recyclable materials such as concrete, stone, steel and glass contributes positively to sustainable building. Building design should consider the whole life-cycle of the building. Designers can therefore reduce resources used in construction, aid site waste minimisation through appropriate design and influence the use of reclaimed materials.

Constructors can plan the construction process to eliminate/reduce waste. They can minimize the volume arising on-site, use reclaimed materials in the works and influence wastage caused by poor materials handling.

Reuse of Waste

Full advantage should be taken of all opportunities for the reuse of construction materials. The inclusion of period architectural features salvaged from old buildings can greatly enhance the aesthetics and appeal of new construction. Excavated soil can also be used creatively in the landscaping of developments and for the construction of embankments and screening/noise abatement berms in civil engineering projects.

Waste Recycling

It is imperative that C&D waste arisings are recycled to the greatest practicable extent. C&D waste-derived aggregates can be used as dry filling, hardcore or as granular fill in construction works. Besides cost savings, use of on-site crushers to produce such aggregates can reduce the transportation impacts of a project associated with the removal of C&D waste from site and the importation of quarried aggregates.

3.3 Construction & Demolition Waste Management Plans

General Guidance

The initial formulation of a Project C&D Waste Management Plan should investigate the inclusion of provisions within the Contract Documents for the project which relate to the manner in which waste arisings are to be controlled and managed during the course

of the project. The contractual arrangements should be stated in a manner so as to ensure that contractors are encouraged to prepare a Project C&D Waste Management Plan which sets out the necessary arrangements to minimise waste, manage materials on site effectively, prioritise reuse and recycling on site and make sub-contractors responsible for procurement of materials where practicable.

It is important to nominate a C&D Waste Manager, who is considered to be a reliable team member of the construction industry stakeholder most able to direct decisions at the various stages of the Project, to take responsibility for the C&D waste management practices. It is considered appropriate that the C&D Waste Manager would be assigned from the following stakeholders:

- ***Preliminary Design/Planning Phase***: Project Planner's staff;
- ***Design/Tender Phase***: Designer's staff; and
- ***Demolition/Construction Phase***: Contractor's staff.

Choosing an appropriate C&D Waste Manager at the various stages of the Project can ensure that the C&D waste management issues of prevention, reuse and recycling are given adequate priority.

At the pre-construction stage, the C&D Waste Manager (Project Planner/Designer representative) should be in a position to require fellow designers to take full advantage of all reasonable C&D waste prevention, reuse and recycling opportunities.

Once the development commences, for both the demolition and the construction phases, the importance of adherence to the Plan must be explained to all relevant parties by the C&D Waste Manager (Contractor representative) – including the personnel of both main and sub-contractors. The practicalities of waste prevention, salvaging re-useable materials, and the need to synchronise the recycling of waste materials through the timing of their use in the new construction works should be emphasised

Waste Prevention

During the construction phase, builders can prevent waste by tight estimating to ensure that large surpluses of construction materials are not delivered to site; supplier co-ordination (requiring the supplier to take back/buy back surplus and sub-standard/rejected materials); operate a "just in time" delivery system (co-ordinating material delivery with its use). On-site waste can be minimised by careful storage and handling of materials and by centralising cutting operations. Waste prevention principles can be further reinforced by specifying that the individual builders working on-site conform to the requirements of the Project C&D Waste Management Plan for all operations.

Waste Minimisation

Waste minimisation – including prevention, reuse and recycling - requires careful planning of selective demolition and waste reuse activities on-site. In order to maximise the effectiveness of C&D waste recycling, it is essential that recovered material is economically competitive with equivalent primary raw material. Currently a number of waste management companies are extending their range of services by developing C&D waste management centres for the recovery of construction waste. Essentially they are becoming permitted reprocessors of materials for use as inputs in the construction sector. This is a positive development, but it is imperative that all legislation is complied with in order to ensure that the recovery system – including transport, handling and treatment of the C&D waste and use of the recycled materials - is operated in a safe, environmentally friendly and commercially feasible manner.

New European Standards for aggregates have already been developed (EN 13285[1] and EN 13242[2]) which serve to reduce the level of uncertainty which sometimes exists in relation to the potential uses of C&D waste-derived aggregates that are produced by the recovery process, thus increasing its attractiveness to potential users when compared to equivalent primary raw material. Reference to these new European Standards, operational since 1 June 2004, has been included in the National Roads Authority (NRA) general *Specification for Road Works*, which forms the cornerstone of Project Specifications in road construction and other civil engineering contracts.

3.4 C&D Waste Management Plans - Specific Guidelines on Content

A Project Construction and Demolition (C&D) Waste Management Plan should address the following aspects of the Project:

- analysis of the waste arisings/material surpluses;
- specific waste management objectives for the project;
- methods proposed for prevention, reuse and recycling of wastes;
- material handling procedures; and

[1] *EN 13285: Unbound Mixtures – Specification*, National Standards Authority of Ireland, 2003.
[2] *EN 13242: Aggregates for Unbound and Hydraulically Bound Materials for Use in Civil Engineering Work and Road Construction,* National Standards Authority of Ireland, 2003.

- proposals for education of workforce and plan dissemination programme.

C&D Waste Management Plans do not need to be complicated documents and should concentrate on those reasonable measures that can be taken to improve the management of waste within projects. They can also be provided as a resource to contractors and subcontractors who may have been required by both specification and contractual requirements to prepare C&D Waste Management Plans. Designers and Developers shall have regard to the legislative requirements in terms of waste licensing and permitting as set out in Section 1.2 of these guidelines.

The effectiveness of the C&D Waste Management Plan and its implementation should be tracked through regular checks and audits carried out on site, which should focus on material inputs to the project and the waste outputs for each unit operation. Such internal auditing may be carried out by an appropriately trained and technically competent "C&D Waste Manager". The audits should also investigate the operational factors and management policies that contribute to the generation of waste and identify appropriate corrective actions. It is essential that reviews of waste management practices take place through each stage of the project.

Future development of C&D Waste Management Plan content should be based upon the successes of previous Plans and take account of review findings on implementation of existing plans.

The Plan should document proposals for the management of C&D waste as concisely as possible. For clarity, besides assisting assessment and implementation, the Project C&D Waste Management Plan should be organised systematically. Individual headings should be provided, describing the following:

- description of the Project;
- wastes arising including proposals for minimisation/reuse/recycling;
- estimated cost of waste management;
- Demolition Plan;
- roles including training and responsibilities for C&D Waste;
- record keeping procedures; and
- waste auditing protocols.

It is imperative that the measures described in a C&D Waste Management Plan are both entirely reasonable and practicable. If this is not the case, such measures are unlikely to be implemented in the urgency to get a project constructed on time and within budget. The C&D Waste Management Plan should address each of the individual headings within the Project.

Description of the Project

The following details should be included:

- the description of the project, including the location, design, size or scale of the development;

- details of the waste types expected to be produced and an account of how C&D waste surpluses/deficits are liable to arise;

- particular categories of materials to be described should at least include soil, concrete / brick, stone excavated materials, wood, glass, metal and others. [Note: excavations, concrete, masonry and wood together constitute over 90% of all C&D waste arisings]; and

- special attention should be paid to anticipated hazardous waste arisings and the manner in which such materials will be identified, assessed, handled, stored, treated and removed.

Wastes arising including proposals for minimisation/reuse/ recycling:

Concise summary details should be provided in relation to anticipated material surpluses/deficits and waste arisings.

The anticipated uses of wastes and surpluses within the project site should be summarized as follows:

- where such wastes/surpluses are to be used beneficially in other projects, tracking and authorisation documentation should be outlined which should be adequate to ensure traceability of the material;

- where disposal of C&D waste is proposed, justification should be provided.

Estimated Cost of Waste Management:

It has been established in recent research[3] that it is of particular benefit to contractors when all cost components associated with waste production are identified and highlighted. This will be effective in enhancing internal cost control procedures for the contractor and helping to ensure that unproductive and readily avoidable costs of C&D waste management are eliminated. Details of such costs enable the true cost of waste management activities within the project to be determined.

Cost components should include:

- the purchase cost of waste materials (including imported soil);
- handling costs;
- storage and transportation costs;
- revenue generated from sales; and
- disposal costs including landfill tax.

In this manner, it is possible to estimate:

- total waste concrete management costs;
- total waste soil management costs; and
- total waste masonry management costs.

This is a useful costing mechanism and is of primary benefit for the contractor. It has been established by Skoyles and Skoyles[4], and confirmed in more recent research[5], that some 18%/19% of construction materials purchased from merchants are never paid for by the client as work performed in accordance with the specification.

Demolition Plan

A coherent Demolition Plan should be included as an integral part of the Project C&D Waste Management Plan.

A principal objective of a Demolition Plan is to ensure that in projects where a building or structure requires demolition, the sequence of operations to be followed is predetermined and documented, thereby ensuring that an appropriately selective dismantling/demolition methodology is employed.

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[3] Value Green Construction Scheme – EPA: CGPP 2004/3

[4] Skoyles, E.R. and Skoyles, J.R; *Waste Prevention on Site*, London: Mitchell, 1987.

[5] *Investing in Sustainability*, London: Upstream, 2005 – Report carried out on behalf of WWF and Insight Investment.

Special attention should be paid to the sorting/segregation arrangements employed to separate the demolished structure into individual material fractions. In addition, the transportation and reception arrangements associated with the movement of materials to other construction sites for reuse or reprocessing should also be considered.

Health and Safety procedures should be adhered to in accordance with the requirements of the relevant authorities in the removal of hazardous waste material during the demolition process. The procedures and processes for removal of hazardous waste material should be identified in the Project C&D Waste Management Plan.

- The Waste Management (Hazardous Waste) Regulations 1998 (S.I. 163 of 1998) stipulate general conditions for the management of hazardous waste.

- The Carriage of Dangerous Goods by Road Act 1998 (No. 43 of 1998) and associated Regulations outline conditions for the transport of hazardous waste.

- UK Guidance Notes 29/1-4 outline Health and Safety requirements in Demolition Work.

Special or hazardous wastes should be retained in isolation from other wastes to avoid further contamination. Certain C&D materials are hazardous e.g. lead, tars, adhesives, sealants. Construction materials containing asbestos are classified as hazardous (see European Waste Catalogue Codes in Appendix 2 of these Guidelines for a schedule of hazardous construction materials). If such materials are mixed with non-hazardous materials e.g. lead based paint tins discarded onto a stockpile of brick and concrete, the entire quantity of material becomes hazardous and must be managed as hazardous waste.

It should be noted that demolition of a protected structure (which includes structures within the curtilage) is permitted only in exceptional circumstances. Demolition of part of a protected structure is not exempted development, unless a declaration to that effect is obtained under Section 5 or Section 57 of the Planning & and Development Act 2000. If it is found necessary during a project to demolish a part of a protected structure then, prior to proceeding, advice should be obtained from the local authority and a further grant of permission obtained where appropriate.

Roles including training and responsibilities for C&D Waste

The C&D Waste Manager(s) assigned the responsibility for waste minimisation, reuse and recycling during the various stages of the

Project has the overall task of implementing the objectives of the Project C&D Waste Management Plan. The on-site role will include the important activities of conducting waste checks/audits and adopting demolition methodology that is designed to facilitate maximum reuse and/or recycling of waste. The contractor will have primary responsibility to ensure that the Plan is adhered to, with the added bonus that value for money will be obtained from improved waste management practices on site.

The Plan should make provision to ensure that the C&D Waste Manager is appropriately trained and is assigned the authority to require measures to be taken to fulfil the Plan's objectives and targets for each stage of the project.

The role of the C&D Waste Manager should ensure that the opportunity is taken to educate all colleagues (at the planning and design phases of the Project), site staff, including external contractors and suppliers, about alternatives to conventional construction waste disposal. The Plan should make provision for the C&D Waste Manager and site crew to be trained in materials management thereby being in a position to:

- distinguish reusable materials from materials suitable for recycling;
- ensure maximum segregation at source;
- co-operate with site manager on the best locations for stockpiling reusable materials;
- separate materials for recovery; and
- identify and liaise with operators of recovery outlets.

Record keeping

The Plan should provide for systems that will ensure that details of all arisings, movement and treatment of C&D waste are recorded. Special consideration should be given to the provision of a computerised monitoring tool, which can provide for convenient recording of information in a useful format and ultimately contribute to waste reduction through benchmarking of waste arisings.

Essentially such a system enables the contractor to measure and record the quantity of waste being generated, thereby allowing wastage to be more readily identified. It can highlight the most significant areas where waste products arise and the percentage of

new material that is wasted. It identifies successes or failures as measured against performance targets and enables realistic Action Plans for waste reduction to be drawn up. The system could also be used to compare waste quantities arising from similar development projects.

All materials being transferred from the site, whether for recycling or disposal, should also be subject to a documented tracking system which can be verified and validated.

Waste Audit

A Waste Audit represents a systematic study of the waste management practices applied in the Project. The purpose of waste auditing is to highlight the problems that waste can cause and the benefits of prevention and minimisation. It is vital therefore to determine the quantity and types of waste which are being produced. When materials arrive on site, they are generally recorded but often there is no proper recording system for the assignment of materials to specific uses within the works. Where this occurs, the quantity of waste being produced at a particular location is unknown and it is difficult to calculate/estimate the overall waste levels arising on site. Waste auditing is required to obtain this information and also, if required, to allow the contractor to monitor the quantity and type of waste produced by different sub-contractors. Each waste audit should be carried out in accordance with an Audit Plan. This Audit Plan should be clearly defined in the Project C&D Waste Management Plan.

- The self-audit should consist of a systematic study of all waste management practices which have been adopted on-site.

- Special attention should be dedicated to obvious opportunities for waste reduction, but all areas and stages within the project should be reviewed.

- Details of raw material inputs and the quantity, type and composition of all waste from the site should be identified.

- The audit findings should highlight corrective actions that may be taken in relation to management policies or site practices in order to bring about further waste reductions. The data can be used to assist designers in the reduction of waste on future projects.

- A tracking system should be stipulated to determine the success or failure of corrective actions.

Summary audit reports outlining types, quantities of waste arisings and their final treatment method should be sent t o the Waste Mangement\Environment Section of the appropriate local authority. These summary reports should be prepared within three months of the end of each calendar year. Where the period of construction is greater than one year, reports should be submitted as required by the local authority.

3.5 Interaction with Other Bodies

Consultation and dialogue offers the opportunity to share experiences and gain advice and help from State bodies, organisations, individuals and interest groups on a formal or informal basis prior to formulation of the Project C&D Waste Management Plan. Construction designers and developers may find it useful to consult with and take advice from the following:

- authorities with a statutory responsibility for waste matters e.g. local authorities and the EPA;

- experts such as waste practitioners, recyclers or members of academic or research institutions;

- National Construction and Demolition Waste Council (NCDWC);

- other designers/developers/conservation architects and engineers who have implemented successful measures for improving waste management practices on similar projects.

Appendix 1: Glossary of Technical Terms

Aggregates: A granular product obtained by processing natural materials. It may be sand or gravel produced by natural disintegration of rock, or it may be manufactured as a graded material by passing rock through a series of crushers.

C&DWMP: Construction and Demolition Waste Management Plan.

C&D Waste: Construction and Demolition Waste

Development Plan: A Plan within the meaning of Section 9(1) of the Planning and Development Act 2000 which sets out an overall strategy for the proper planning and sustainable development of the area of the development plan indicating the development objectives of the area. It is the responsibility of the planning authority to secure the objectives of the plan.

EPA: Environmental Protection Agency, Ireland.

EWC: European Waste Catalogue. The European Waste Catalogue and Hazardous Waste List are used for the classification of all wastes and are designed to form a consistent waste classification system across the EU.

Hazardous Waste: Waste listed as hazardous in the European Waste Catalogue. Hazardous Waste is defined in Section 4(2) of the Waste Management Acts 1996 to 2005, as having the following meaning;

"(a) (i) hazardous waste for the time being mentioned in the list prepared pursuant to Article 1(4) of Council Directive 91/689/EEC of 12 December, 1991, being either—

(I) Category I waste that has any of the properties specified in *Part III* of the *Second Schedule*, or

(II) Category II waste that—

(A) contains any of the constituents specified in *Part II* of the *Second Schedule*, and

(B) has any of the properties specified in *Part III* of the said *Schedule*,

(ii) such other waste, having any of the properties specified in *Part III* of the *Second Schedule*, as may be prescribed for the purposes of this definition.

(*b*) For the purposes of the definition in this subsection—

"Category I waste" means waste specified in any of the following paragraphs of *Part I* of the *Second Schedule*, namely

paragraphs 1 to *18*;

"Category II waste" means waste specified in any of the following paragraphs of the said *Part I*, namely *paragraphs 19* to *40*."

Landfill: Waste disposal facilities where waste is deposited onto or into land (i.e. underground). The Waste Management Acts 1996 to 2005, gives the EPA responsibility for the licensing of landfill sites - both private sites and those operated by local authorities.

Project C&D Waste Management Plan: A Plan which promotes an integrated approach, whereby the management of construction and demolition waste is given due consideration and priority throughout the duration of a project.

Recovery: The recovery of value from a waste stream either in the form of raw materials or energy. "Recovery" is defined in Section 4(4) of the Waste Management Acts 1996 to 2005, as having the following meaning:

> "- any activity carried on for the purposes of reclaiming, recycling or re-using, in whole or in part, the waste and any activities related to such reclamation, recycling or re-use, including any of the activities specified in the *Fourth Schedule*, and "waste recovery activity" shall be construed accordingly."

Recycling: A process where materials are collected, processed and remanufactured into new products or use as a raw material substitute. To recycle is defined as the returning of material to a previous stage in a cyclic process or the conversion of wastes into reusable materials. "Recycling" is defined in Section 5 of the Waste Management Acts 1996 to 2005, as having the following meaning:

> "- the subjection of waste to any process or treatment to make it re-usable in whole or in part."

Reuse: Reducing the amount of waste being discarded by using a product/material on more than one occasion, either for the same purpose or for a different purpose, without the need for reprocessing.

Selective Demolition Methodology: Removal of recyclable materials from a demolition site in a pre-defined sequence of operations and in accordance with pre-determined methodology in order to maximise recovery and recycling performance.

Waste Audit: Check of waste to determine amount generated, type, sources and potential means to avoid or reduce waste production. *Delivering Change* defines a Waste Audit as having the following meaning:

"an evaluation of the manner in which an activity is carried on with a view to identifying opportunities for-

- preventing or minimising the production of waste from the activity concerned or the harmfulness of any waste produced from the activity, and
- recovering any waste so produced, having regard to the results of a waste audit conducted in relation to the activity."

Waste Hierarchy: When considering waste, the following options should be taken as a matter of priority (in this order): prevent, minimise, reuse, recycle, recover and dispose.

Waste Management Plan: A Plan devised by a local authority or a number of local authorities acting co-operatively, for their area(s), to prevent and minimise waste and to encourage and support the recycling and recovery of waste. The Plan shall include policies, objectives and priorities in relation to prevention, minimisation and recovery of waste.

Waste Segregation: Waste segregation is the practice whereby waste is segregated at source into different types of materials. In the case of C&D waste, source segregation takes place on the building site. The contractor should provide and clearly label skips for wood, bricks, metals, hazardous waste, etc. Where separation of mixed wastes takes place subsequently off-site, the activity is regarded as a sorting, rather than segregation, operation.

Appendix 2: European Waste Catalogue, Chapter 17

Construction and Demolition Waste (including excavated soil from contaminated sites)

17 01	**Concrete, bricks, tiles, ceramics**
17 01 01	Concrete
17 01 02	Bricks
17 01 03	Tiles and ceramics
17 01 06*	Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances
17 01 07	Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	**Wood, glass and plastic**
17 02 01	Wood
17 02 02	Glass
17 02 03	Plastic
17 02 04*	Glass, plastic and wood containing or contaminated with dangerous substances
17 03	**Bituminous mixtures, coal tar and tarred products**
17 03 01*	Bituminous mixtures containing coal tar
17 03 02	Bituminous mixtures containing other than those mentioned in 17 03 01
17 03 03*	Coal tar and tarred products
17 04	**Metals (including their alloys)**
17 04 01	Copper, bronze, brass
17 04 02	Aluminium
17 04 03	Lead
17 04 04	Zinc
17 04 05	Iron and Steel
17 04 06	Tin
17 04 07	Mixed metals
17 04 09*	Metal waste contaminated with dangerous substances
17 04 10*	Cables containing oil, coal tar and other dangerous substances
17 04 11	Cables other than those mentioned in 17 04 10
17 05	**Soil (including excavated soil from contaminated sites), stones and dredged spoil**
17 05 03*	Soil and stones containing dangerous substances
17 05 04	Soil and stones other than those mentioned in 17 05 03
17 05 05*	Dredging spoil containing dangerous substances

17 05 06	Dredging spoil other than those mentioned in 17 05 05
17 05 07*	Track ballast containing dangerous substances
17 05 08	Track ballast other than those mentioned in 17 05 07
17 06	**Insulation materials and asbestos-containing construction materials**
17 06 01*	Insulation materials containing asbestos
17 06 03*	Other insulation materials consisting of or containing dangerous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	Construction materials containing asbestos
17 08	**Gypsum-based construction material**
17 08 01*	Gypsum-based construction materials contaminated with dangerous substances
17 08 02	Gypsum-based construction materials other than those mentioned in 17 08 01
17 09	**Other construction and demolition waste**
17 09 01*	Construction and demolition waste containing mercury
17 09 02*	Construction and demolition waste containing pcb (for example pcb-containing sealants, pcb-containing resin-based floorings, pcb-containing sealed glazing units, pcb-containing capacitors)
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing dangerous substances
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

* Any waste marked with an asterik (*) is considered as a hazardous waste pursuant to Directive 91/689/EEC on hazardous waste 26 European Waste Catalogue and Hazardous Waste List (valid from 1/1/2002) Environmental Protection Agency, Ireland.

APPENDIX 3: Example of an Indicative Project Waste C&D Waste Management Plan for a Development/Redevelopment Project

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PROJECT C&D WASTE MANAGEMENT PLAN

(Project Name)

[Insert/Add/Delete to Detail as appropriate]

Description of Project

The Project consists of the _____(development/redevelopment etc.) of a _____ (housing/commercial/institutional/roads/water/wastewater etc.) scheme on a _____ (greenfield/infill/redevelopment/brownfield etc.) site. The project is situated at _____, _____, Co. _____, in the administrative area of _____ Council. The site of the works is located approximately _____ (metres/kilometres) from _____ (town/village/main road etc.) and access will be via the_____ (local/regional/national) road. The work will generally consist of the demolition of ___ (m^3) of _____ and the construction of _____ (No./m^2) of _____ (houses/offices/institutional/roads etc.).

In the course of the Project, it is estimated that the following quantities of C&D wastes/material surpluses will arise:

C&D Waste Material	**Quantity** (tonnes)
Clay and Stones	
Concrete	
Masonry	
Wood	
Packaging	
Hazardous Materials	
Other Waste Materials	
TOTAL Arisings	

Table SF1: Estimated C&D Waste Arisings on Site

Proposals for Minimisation, Reuse and Recycling of C&D Waste

C&D waste will arise on the Project mainly from _____ (excavation/demolition) and _____ (unavoidable construction waste/material surpluses/damaged materials). The _____ (Purchasing Manager etc.) shall ensure that materials are ordered so that the quantity delivered, the timing of the delivery and the storage is not conducive to the creation of unnecessary waste.

Excavated clay will be _____(carefully stored in segregated piles on the site for subsequent re-use/removed from site for direct beneficial use elsewhere). Concrete waste will be _____ (source segregated/collected in receptacles with mixed C&D waste materials, for subsequent separation and recovery at a

remote facility). Masonry and wood will be _____ (source segregated/collected in receptacles with mixed C&D waste materials, for subsequent separation and recovery at a remote facility). Packaging will be _____ (source segregated for recycling or return to suppliers). Hazardous wastes will be _____ (identified, removed and kept separate from other C&D waste materials in order to avoid further contamination). Other C&D waste materials will be _____ (collected in receptacles with mixed C&D waste materials, for subsequent separation and disposal at a remote facility).

Excavation clay and C&D waste-derived aggregates are considered suitable for certain on-site construction applications. It is proposed that the following quantities, corresponding to all C&D waste arisings from the project, will be used within the works:

C& D Waste Type **Proposed Use**	**Clay and Stones** (t)	**Concrete** (t)	**Masonry** (t)	**TOTALS**
Earthworks				
General Fill/Hardcore				
PIPE BEDDING				
Selected Trench Backfill				
Fill to Structures				
Beneath Paths Structure				
Beneath Road Structure				
Other Site Use A				
Other Site Use B				
Off-Site Use				
TOTAL				

Standard Form SF2: Proposals for Beneficial Use/Management of C&D Material Surpluses/Deficits and Waste Arisings on and off the Project

It is anticipated that waste materials _____(will/will not) have to be moved off site. It __(is/is not) the intention to engage specialist waste service Contractors, who will possess the requisite authorisations, for the collection and movement of waste off-site, and to bring the material to a facility which currently (holds/does not hold) a _____(Waste Licence/Waste Permit/Certificate of Registration). Accordingly, it will be necessary to arrange the following waste authorisations specifically for the Project:

Authorisation Type	Specific Need for Project (Yes/No?)	
Waste Licence	Yes □	No □
Waste Permit	Yes □	No □
Waste Collection Permit	Yes □	No □
Transfrontier Shipment Notification	Yes □	No □
Movement of Hazardous Waste Form	Yes □	No □

Table SF3: Specific Waste Authorisations Necessary for the Scheme

Demolition Procedures
The demolition works shall be undertaken in a manner which maximises the potential for recycling, including source segregating waste where appropriate. Activities shall be carried out in the following sequence:

Demolition Activity Sequence	General Description
Disconnection of Services/Vermin Control	Shutoff of E.S.B., Gas etc.
Inventory of Hazardous Wastes	e.g. Asbestos etc.
Removal of Abandoned Furniture/Equipment	e.g. Furniture/White Goods
Removal of Asbestos/Hazardous Materials	e.g. Application of H&S Procedures
Removal of Fixtures	e.g. Fitted Presses etc.
Removal of Timber	e.g. Removal of Floors, Trusses, Rafters
Demolition of Structure Shell	Manual or Mechanical Demolition
Source Segregation of Material Fractions	Separation into Designated Material Fractions
Transport of Material from Site to Treatment Facilities	e.g. C&D Waste Recycling Facility
Transport of Material from Site to Controlled Disposal Sites	e.g. Inertised Hazardous Landfill Site
Site Preparation/Restoration	e.g. Hardstanding, Landscaping

Assignment of Responsibilities
A _____ (Site Engineer/Manager/Assistant Manager etc.) shall be designated as the C&D Waste Manager and have overall responsibility for the implementation of the Project C&D Waste Management Plan. The C&D Waste Manager will be assigned the authority to instruct all site personnel to comply with the specific provisions of the Plan. At the operational level, a _____ (Ganger etc.) from the main contractor and _____ (appropriate personnel) from each sub-contractor on the site shall be assigned the direct responsibility to ensure that the discrete operations stated in the Project C&D Waste Management Plan are performed on an on-going basis.

Training
Copies of the Project C&D Waste Management Plan will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the Project C&D Waste Management Plan and informed of the responsibilities which fall upon them as a consequence of its provisions. Where source segregation, selective demolition and material reuse techniques apply, each member of staff will be given instructions on how to comply with the Project C&D Waste Management Plan. Posters will be designed

to reinforce the key messages within the Project C&D Waste Management Plan and will be displayed prominently for the benefit of site staff.

Waste Auditing

The C&D Waste Manager shall arrange for full details of all arisings, movements and treatment of construction and demolition waste discards to be recorded during the construction stage of the Project. Each consignment of C&D waste taken from the site will be subject to documentation, which will conform with Table SF4 and ensure full traceability of the material to its final destination.

Detail	**Particulars**
Name of Project of Origin	e.g. New Harbour, Motorway
Material being Transported	e.g. Soil, Demolition Concrete, Crushed Asphalt etc.
Quantity of Material	e.g. 20.50 tonnes
Date of Material Movement	e.g. 01/01/2007
Name of Carrier	e.g. Authorised Carriers Ltd.
Destination of Material	e.g. Newtown Residential and Office Development
Proposed Use	e.g. Use as Hardcore in Dwelling Floors

Table SF4: Details to be Included within Transportation Dockets

Details of the inputs of materials to the construction site and the outputs of wastage arising from the Project will be investigated and recorded in a Waste Audit, which will identify the amount, nature and composition of the waste generated on the site. The Waste Audit will examine the manner in which the waste is produced and will provide a commentary highlighting how management policies and practices may inherently contribute to the production of construction and demolition waste. The measured waste quantities will be used to quantify the costs of management and disposal in a Waste Audit Report, which will also record lessons learned from these experiences which can be applied to future projects. The total cost of C&D waste management will be measured and will take account of the purchase cost of materials (including imported soil), handling costs, storage costs, transportation costs, revenue from sales, disposal costs etc. Costs will be calculated for the management of a range of C&D waste materials, using the format shown in Table SF5 below:

Material	**Estimated Quantities & Costs (**tonnes & Euro)
SOIL	
Quantity of Waste Soil (tonnes)	
Purchase Cost i.e. Import Costs (€)	
Materials Handling Costs (€)	
Material Storage Costs (€)	
Material Transportation Costs (€)	
Revenue from Material Sales (€)	
Material Disposal Costs (€)	
Material Treatment Costs (€)	
Total Waste Soil Management Costs (€)	
Unit Waste Soil Management Costs (€)	

Table SF5: Standard Record Form for Costs of C&D Waste Management (Sample relates to Soil – separate record forms should be compiled in respect of each waste material)

Final details of the quantities and types of C&D Waste arising from the Project will be forwarded to _____ (Environmental Protection Agency, local authority, NCDWC etc.).

Appendix 4: Further Reading

Construction Industry, Task Force B4 Report **Recycling of construction & demolition waste** (2001)

National Construction and Demolition Waste Council - Annual Report 2002/2003 and Annual Report 2004/2005

A FÁS & Construction Industry Federation Initiative **Construction and Demolition Waste Management – A Handbook for Contractors & Site Managers** (2002)

Dublin City Council - **Built to Last: The Sustainable Reuse of Buildings** (2004)

Department of Environment, Heritage & Local Government:

- Waste Management: Changing Our Ways (1998)
- Preventing and Recycling Waste - Delivering Change (2002)
- Waste Management -Taking Stock and Moving Forward (2004)
- Architectural Heritage Protection Guidelines for Planning Authorities (2005)

Environmental Protection Agency:

- National Waste Report (1995, 1998, 2001 and 2004)
- National Waste Database Fact Sheet on Construction and Demolition Waste 2001
- National Waste Prevention Programme 2004-2008

Skoyles E.R. and Skoyles J. R., *Waste Prevention on Site*; London: Mitchell, 1987.

Upstream, *Investing in Sustainability-* – Report carried out on behalf of WWF and Insight Investment, London, 2005.

Relevant Websites:

Department of the Environment, Heritage and Local Government:	www.environ.ie
Environmental Protection Agency	www.epa.ie
Construction Industry Federation	www.cif.ie

AggRegain (UK)	www.aggregain.org.uk
Waste and Resources Action Programme (WRAP)	www.wrap.org.uk
CIRIA (a UK based Research Association. Reference material on recycling of C & D Waste)	www.ciria.org.uk
Recycling Directory of Ireland	www.irelandrecycling.ie

National Construction and Demolition Waste Council (NCDWC) www.ncdwc.ie