NORTH WEST cambridge

Sustainable Resource and Waste Management Strategy
Addendum - March 2012

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Executive Summary

1. This document provides additional information on the proposed underground bin scheme for the Proposed Development and forms an addendum to the "Sustainable Resource and Waste Management Strategy" (hereafter referred to as the "Waste Strategy") which has been submitted as part of the Planning Application (OPA). The scheme has been selected based on the desire to minimise the visual impact of waste collection infrastructure on the Proposed Development, and meets the requirements of the Area Action Plan to incorporate innovative waste strategies and a range of council policy and guidance promoting the use of underground bins.
2. The proposal for underground bins represents a departure from the conventional waste collection methods used currently by Cambridge City Council (CCC) and South Cambridgeshire District Council (SCDC). Whilst the current proposals have been developed in conjunction with the authorities through a series of joint task group meetings between the University, SCDC and CCC from 2009 to 2011, a number of queries have been raised following submission of the OPA. This document has been prepared in response to these queries and provides further information on the proposals.
3. The use of underground bins is well established on the continent although relatively new to the UK. They offer a number of benefits including:
    - Reduced visual impact of waste collection infrastructure by incorporating waste storage below ground and removing the need for surface bin compounds / wheelie bins for each dwelling. This will provide a significant benefit to the Proposed Development by removing the need for bin compounds for each house and block, and preventing bins from littering the streets on collection day.
    - Reduced collection costs through a 10% reduction in collection time due to the efficiencies of a small number of large waste containers.
    - Reduced operation costs through the need for one vehicle operative only. The design of the proposed development will ensure that health and safety considerations are met to allow the use of a single operative, and maximise the operational benefits of the scheme.
    - Improvements in recycling by promoting separation at source, helping to build on the already strong rates of recycling in Cambridge.
    - Encouragement of community responsibility; there is evidence of reduced fly tipping and vandalism in other schemes.
4. As with any communal bin scheme, it is important that the bins are located within an acceptable distance of the dwellings, and the proposals here are based on 90% of homes being within a distance of 30m from bin stores, and all homes being within 35m, This is in line with the Code for Sustainable Homes, but allows a small degree of flexibility with Building Regulations Part H, and the Cambridgeshire and Peterborough RECAP guide. Calculations demonstrate that by fulfilling these distances, the capacity of each bin location can be well matched to the homes in the catchment area, resulting in no significant oversupply or undersupply of capacity for all of the proposed residential areas. This demonstrates the suitability of this method across the Proposed Development. In higher density areas, underground bins are a direct replacement for the alternative bin compounds with similar operation for residents. In the mid density and low density areas, underground bins provide significant visual impact benefits though the removal of intrusive wheelie bin storage. Therefore the underground scheme is proposed for all residential areas providing a single consistent waste collection method for all residents, and a single collection method for the waste collection authority to maximise vehicle utilisation.
5. A system of three bins for the three waste streams currently collected by the City Council is proposed. This method has been shown to be effective by the City Council with strong recycling rates and provides consistency with other parts of the City. By limiting the number of streams to three, the impact of waste collection on the external environment is also minimised with no impact on recycling rates. An optional scheme of two bins with separate food waste collection is also presented, and will be investigated further if Cambridge City Council is successful in a bid to DCLG for funding a weekly food waste collection scheme in Cambridge.

6. The use of communal collection systems can pose an issue for those who are elderly or infirm and require assisted collection. However the analysis in this report demonstrates that the numbers of homes requiring assisted collection is likely to be low at around 44 homes in total out of 3,000. Underground collection is simpler for the elderly and infirm to operate, removing the need for manoeuvring heavy wheelie bins and instead requiring the carrying of small waste bags. Therefore the need for assisted collection is reduced in the first place. However for those requiring assisted collection, a number of options are proposed including council assisted collection combined with greater in-dwelling storage, a University collection service, or a community and voluntary approach facilitated by the University.

7. Collection from the underground bins will require the use of a specially equipped vehicle. The type of vehicle will depend on the specific system selected but all systems will require a crane to remove the bin from the ground. This report discusses the various issues with the requirement for a vehicle. The Application Site will make use of a vehicle almost full time once fully developed providing a good utilisation rate. During the phased construction of the Proposed Development, and as a back up, there are a number of options proposed including the use of vehicles from other authorities (both Peterborough and Bedford have suitable vehicles) or private contractors. A collection vehicle for the Proposed Development can also be used for other underground bin sites in the City such as those proposed on the Southern Fringe, which will be installed in line with the requirement from the City Council for recycling centres to use an underground system.

8. The Proposed Development will be designed in a way which allows the scheme to be operated by a single person. Road layouts will ensure that no reversing of waste collection vehicles is required, and lay-bys on main transport routes mean the waste collection vehicle will be off the carriageway during collection. Remote crane operation and temporary barriers allow a single operator to ensure the collection area is safe and monitored during the collection process.

9. An economic analysis of the underground scheme compared with the baseline wheelie bin option demonstrates that over a 25 year period, the underground system can result in net annual savings of circa £95,000. The total capital cost of the underground scheme is lower than the baseline, primarily through the removal of bin compounds and associated structures. The collection costs are around half of the baseline scheme through a 10% time saving and the need for only one operative. The maintenance and replacement costs of the underground scheme are only 10% higher than for the baseline scheme, and are offset by the other savings. The scheme therefore represents a more economic solution to waste collection on the Proposed Development than the alternative of surface wheelie bins.

1 Introduction

Scope of this document

10. This document forms an addendum to the “Sustainable Resource and Waste Management Strategy” (hereafter referred to as the “Waste Strategy”) which has been submitted as part of the Planning Application (OPA) for the Proposed Development at North West Cambridge. The Waste Strategy examines the drivers and policy for waste management on the Proposed Development, leading to the assessment of a number of waste collection options. The Waste Strategy establishes the use of underground bins as the preferred solution for the residential elements of the Proposed Development. This system provides significant advantages to the Proposed Development over the conventional option of wheelie bins, helping to create a quality environment where sustainable waste management is paramount, but does not dominate the streetscape. However, whilst common place across Europe in residential and commercial developments, where communal waste collection is more common, the underground bin scheme is relatively new to the UK with relatively few installations. The proposals for the Application Site will constitute the largest underground bin scheme in the UK so far.

11. The proposal for underground bins represents a departure from the conventional waste collection methods used currently by Cambridge City Council (CCC) and South Cambridgeshire District Council (SCDC). Whilst the current proposals have been developed in conjunction with the authorities through a series of joint task group meetings between the University, SCDC and CCC from 2009 to 2011, a number of queries have been raised following submission of the OPA. This document has been prepared in response to these queries and provides further information on the proposals.

12. At the outline stage of design, there are many detailed aspects of the scheme which cannot be fully assessed. This document aims to identify and assess the strategic issues raised by the Council Officers following the submission of the OPA, to provide assurances on the basis of the proposals, and the foundations of a scheme for taking forwards. Due to the strong interest in the underground scheme from both the University with a design perspective, and the Councils with an operation perspective, the development of detailed proposals will require close collaboration between the Council Officers and project design team.

13. The information in this note is based on the following sources:

    - Observations by the University and design team including from a site visit to Peterborough and research into other sites.
    - Discussions with the local waste authorities (Cambridge City, South Cambridgeshire, and Cambridgeshire County).
    - Discussions with suppliers of underground systems including SULO, Sotkon and Otto / ESE

Structure of this document

14. This document is set out into the following sections:

    - Drivers for sustainable waste management and the proposal for underground bins
    - Description of the proposed collection method
    - Proposals for North West Cambridge
    - Non economic considerations
    - Economic considerations
    - Conclusions

2 Drivers for sustainable waste management

Policy Drivers

15. The Proposed Development is guided by policy in the Area Action Plan (AAP), adopted in October 2009. This sets high aspirations for meeting exemplar sustainability standards, including the promotion of waste reduction and the use of well designed integrated refuse and recycling systems. To ensure that the Proposed Development meets these policies, the design team and University have held regular meetings with a joint planning task group made up of officers from the Cambridge City, South Cambridgeshire, and County councils. One of these teams has concentrated on waste, and in particular waste collection methods for the Application Site. The University has been challenged from the outset by the waste task group with introducing an innovative waste collection system which helps to maximise recycling whilst minimising the impact of waste infrastructure on the Application Site. The selection of underground bins for the residential areas has been partially driven by the desires of the waste task group.

16. Full details of policy drivers at a national and local scale are provided in the full Waste Strategy document.

17. In addition to the local and national policy identified in the Waste Strategy, Cambridge City Council has an approved [1] (Environmental Committee, March 2011) 'Household Waste and Recycling Policy'. Policy 7 (New Developments) which states:

7.3 **Underground banks or bins** provide for the storage of waste and recycling under the ground and therefore, in certain circumstances, can be beneficial in terms of:-
- being aesthetically more pleasing than above ground facilities
- reducing flytipping
- certain systems provide efficiencies as they can be emptied less frequently i.e. the underground container is larger than some used above ground

7.4 The council recognises the need for flexibility and does not want to be prescriptive about when the underground systems are appropriate to use. However, it does require underground banks for public recycling points on all new developments of 1000 properties or more. Developments between 200 and 1000 will be assessed on a site by site basis but consideration will be given to the potential for incorporating small underground mini recycling facilities related to the scale of the development.

7.5 Section 106 contributions will be required in respect of all residential developments for the provision of waste and recycling receptacles and underground systems. Further detail about these financial contributions is available in the Planning Obligations Strategy.

[1] Environment Scrutiny Committee Tuesday, 15th March, 2011 9.30 am.
http://www.cambridge.gov.uk/democracy/ieListDocuments.aspx?CId=177&MId=284&Ver=4

7.6 Underground bins should also be considered by developers for high-density housing/developments.
7.7 It is more cost-effective to include these facilities in the initial design than to retrofit them at a later stage. Efficiencies may also be achieved through reduced frequency of emptying as underground containers are usually larger than above-ground containers.
7.8 Underground systems can also be fitted with locks and other mechanisms to control access and frequency of use. If required, access cards can be issued to the residents for whom the system is provided.
7.8 These underground systems are innovative, but are becoming more popular with local authorities in this country. They are being used extensively in mainland Europe, for example in Germany, Denmark, Spain and Portugal.

18. This policy promotes the potential benefits of underground bins in particular, and requires underground bins for recycling banks on all new developments of over 1000 homes. In addition it states that the "council recognises the need for flexibility and does not want to be prescriptive about when underground systems are appropriate to use" and encourages consideration by developers of high density housing developments.

19. Finally, the Cambridgeshire and Peterborough Waste Partnership has developed a waste management design guide for new developments (the "RECAP Guide"). This provides information on the design and selection of waste collection schemes and includes specific guidance and support for underground bin collection systems:

> "*As an alternative [to conventional collection schemes] developers are encouraged to consider underground storage of waste. Such systems may be particularly suitable for use within multi-occupancy residential developments"* (5.2 Underground Storage of Waste).

20. Throughout the guide, there is an emphasis of working closely with the relevant authority to ensure the proposals are practical.

Design aspirations

21. In addition to the policy drivers, the University has high aspirations for the quality of the Application Site, and wishes to reduce the visual impact of waste collection infrastructure whilst maximising the opportunities for waste segregation and recycling.

22. In many existing parts of Cambridge, as with other towns and cities, waste collection systems can dominate medium and high density areas of housing. In existing parts of Cambridge with terraced housing, wheelie bins are often stored in front gardens between collections, and obstruct pavements on collection days. This problem is increased by each home having three bins for different waste streams.

Figure 1: Photographs taken on collection day on a typical Cambridge terraced street. The bins are positioned as left by the residents, and show how the pavement can become blocked and unsightly.

24. In new developments, it can be possible to 'design in' the waste collection. This can be either via the use of bin stores or compounds, or rear access for waste collection vehicles. Neither of these solutions is particularly desirable – the use of stores and compounds can dominate the streetscape and take up large amounts of space for each dwelling. Designing rear access means that road infrastructure requirements are increased, resulting in a reduction of open space and private gardens.

25. To reduce the impact on the Proposed Development and to meet the aspirations of both the Councils and the AAP to use innovative systems, the University has proposed to use an underground bin collection system across the Application Site. Underground bins store the waste in an underground container, leaving only a small receptacle at the surface. The large storage volumes enable communal collection to provide all residents with a conveniently located segregated collection system close to their front doors so there is minimal impact on the streetscape, and no requirements for bin storage in separate buildings.

3 Underground bins – description of the system

Wheeled collection versus underground bins

26. Existing wheeled collection systems present a number of disadvantages due to the form of collection:
    - The bins need to be stored, resulting in visual impact and the requirement for compounds.
    - The waste volume is limited by the size of the container which needs to be easily man-handled for removal from the place of storage to the waste collection vehicle.

27. Underground bins can help overcome these disadvantages by enabling a large volume of waste to be stored in a single container, whilst keeping it out of sight below ground. The system originates from Continental Europe, where the prevalence of flats instead of houses means that communal bin systems are prevalent. The basic system comprises a concrete bunker set in the ground, a bin-liner or container which holds the waste and is located in the bunker, and a surface entry point or input receptacle (which often looks like a conventional street waste bin) mounted on a section of paving or platform. All that is visible at street level is the input receptacle, and the dedicated paving section or platform which covers the main underground container. Figure 2 shows the basic components and Figure 3 a number of input receptacle options from a sample of suppliers.

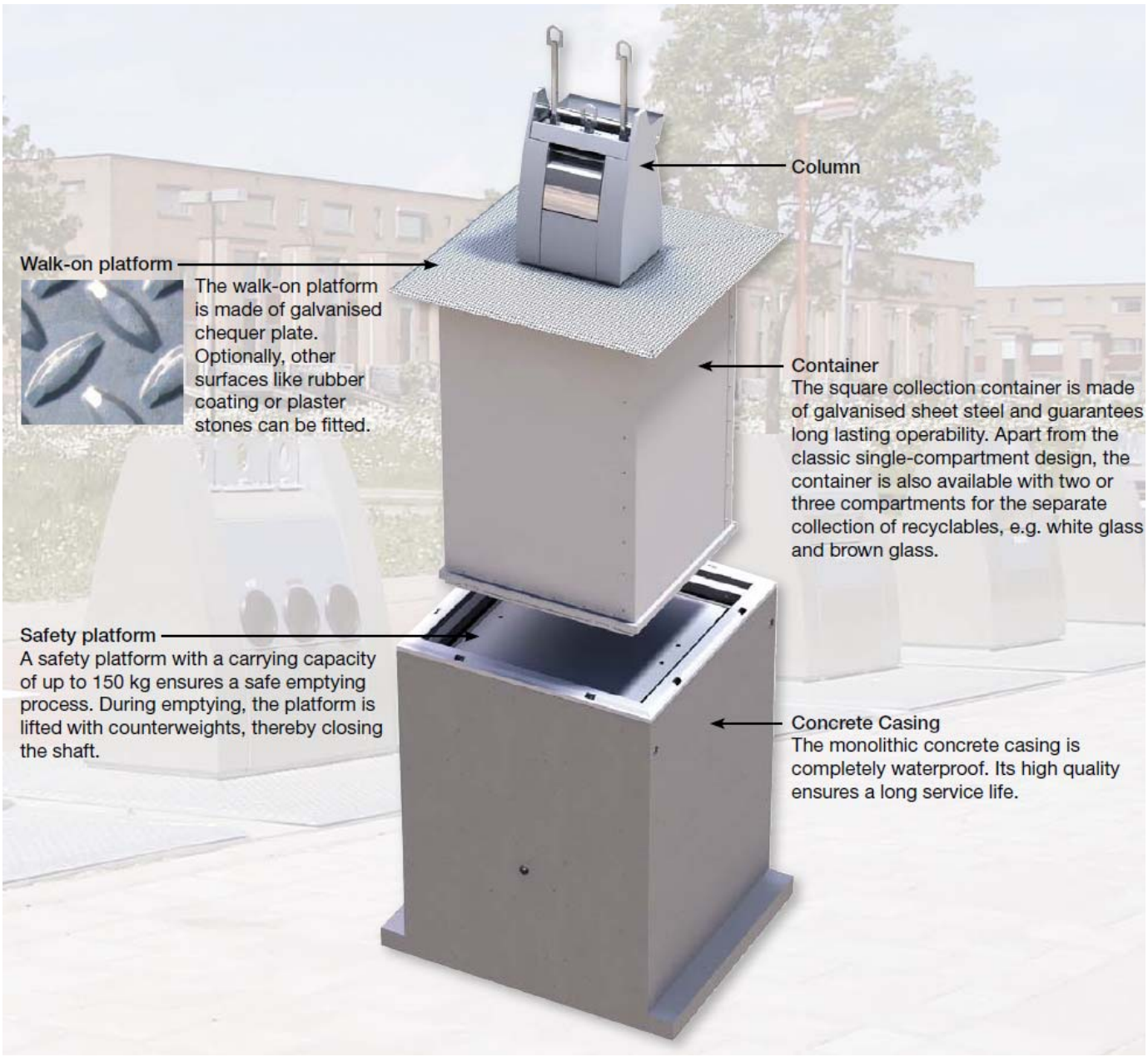

Figure 2: Components of an underground bin (based on the SULO Iceberg system). This is typical of most suppliers.

Figure 3: A range of input bin styles. The upper two rows are from SULO and the lower two from Sotkon.

28. The storage volumes are typically between 3,000 and 5,000 litres which mean that fewer bins are required than if wheelie bins were used, and / or a larger period between collections is adequate. Collection of the bins requires a waste collection vehicle equipped with a crane which can remove the container from the bunker and empty into the collection vehicle. There are two different collection methods available depending on the manufacturer:

    - SULO and Otto / ESE. The system used by these two manufacturers is based around a bottom-opening waste container. The underground system is in a single unit and the entire assembly is lifted from the ground. A crane is attached to the top of the input receptacle, and the input bin, platform, and container is lifted from the bunker and above the waste collection vehicle. The crane operates a mechanism which opens the bottom of the container allowing the waste to discharge. This system therefore requires the crane to be capable of lifting the whole system mass (including waste) to a height which allows positioning above the top of the collection vehicle. The vehicle therefore requires an open top or hopper to collect the falling waste.

    - Sotkon. The Sotkon system uses a hinged platform and input receptacle assembly, allowing the crane to access the container. This reduces the overall mass which is lifted. For all capacities in the Sotkon system, the container is a simple plastic “bucket” which is lifted to surface level and then attached to a standard hydraulic tipper at the rear of the collection vehicle to empty the waste into the vehicle. Thus the overall mass is reduced and the lift height is reduced as well. This allows a smaller crane to be retrofitted to a standard compactor collection vehicle.

29. With both systems, a spring loaded safety platform is raised automatically when the container is removed to prevent people falling into the empty concrete bunker.

30. A third system exists for underground bins where instead of the dedicated waste collection vessel, a standard Euro-type bin is housed underground on a hydraulic platform. This offers the advantages of being underground and out of sight making it more attractive for public areas. It can also allow the use of standard collection vehicles. However the volume benefits of a dedicated underground system are lost and around 3 – 5 times the number of collection sites would be required. The system is also considerably more expensive for the equivalent collection volume.

31. A benefit of the hydraulic system from an operational perspective is that the system can be collected by a single waste operative. In a conventional waste collection round for wheelie bins, a crew will typically use three members for the collection and emptying of bins, and driving the vehicle. With the underground system, the vehicle will be stationary during collection and the crane and bin mechanisms can be operated by a single person. A need for additional operatives may depend on other factors such as vehicle manoeuvring, but in general, one operative is adequate, providing large cost savings to the waste collection authority.

Existing UK experience of underground bin systems

32. Whilst underground systems can be seen on mainland Europe in residential developments, town and city centres, and at the roadside, there has been little uptake in the UK until now. The following sections provide a brief discussion of other sites in the UK where the system is being employed.

Peterborough

33. Peterborough waste authority has recently installed a large number of underground bins in residential areas of the city, primarily in areas of low-rise flats and high density housing. In addition, the authority is adopting this as the preferred method of waste collection in urban new development, promoting its use over standard bin

compounds. Representatives of the University and its consultants visited Peterborough on the 21st July 2010 to observe the system and collection.

Figure 4: Installation of two underground bins at Peterborough in a low rise flat residential area.

Figure 5: Collection and emptying of waste from a bin located in the local centre. A safety platform is raised automatically on the bin being lifted. Note that with the SULO Iceberg system, the bin container, combined with platform / pavement section and the input bin are all lifted.

A single waste collection operator is used on the Peterborough scheme.

Figure 6: Emptying of the waste through trap doors located in the base of the container. Note that the bin has to be lifted above the top of the collection vehicle.

34. The Peterborough scheme is still at a relatively small scale and only serves a small part of the city. However it is perhaps the most relevant installation for the Proposed Development as it is installed in areas of relatively low housing density. Overall the system has been incredibly successful and the waste management personnel at the council could not fault the system. The following benefits were noticed:

- Reduction in collection costs due to the need for one vehicle operator only. Health and safety concerns are addressed through the use of temporary barriers, and a remote wireless crane control, giving the operator full view of the bin and surrounding area. The use of one operator is normal in Continental European schemes.
- Simple maintenance with periodic inspection combined with oiling of safety platform occasionally required. (It should be noted that the installation is only a year or so old and so one would not expect significant maintenance in this period).
- No vandalism experienced.
- Widespread acceptance by residents.
- Evidence of social improvements – since the bins have been installed, there has been a significant improvement in the local areas with reduction in fly tipping and antisocial behaviour.
- Increases in recycling. The visible nature of the bins means that residents are less likely to fly tip around the bins, or use the wrong bin for their waste – there has even been informal policing of use by residents.

- Easily accessible by waste collectors, unlike bin compounds. Bin compounds were often miss-used due to residents simply throwing bags into the area and not into the actual bins. This problem is removed in areas with underground bins.

35. On the back of the success of the existing installations, Peterborough Council is promoting the use of underground collection in new developments, providing support advice and guidance to design teams. The waste authority is working with the planning department to ensure guidance is provided at the early stages to allow the bins to be incorporated into new development designs. This offers the advantages of increased lettable / saleable area, and better access to the bins for collectors.

36. The overall impression of the Peterborough scheme is very positive and the waste management team at the Council are keen to roll the scheme out on a wider scale.

Other Councils

37. **Tower Hamlets** led a trial of underground bins in social housing areas in the Borough, and this has now been rolled out on a wider scale using the SULO system with crane lift bins:

http://www.letsrecycle.com/news/latest-news/waste-management/major-revamp-for-tower-hamlets-underground-bins

38. In light of the scale of the Tower Hamlets scheme, contact has been made with both the Borough Council and the local housing association to obtain further information on the scheme and lessons learnt, but no responses have been provided.

39. **Hastings** Council has installed a couple of underground bins in the town centre for recyclables. The selection was made on the basis of space saving and visual impact:

http://www.letsrecycle.com/news/latest-news/councils/hastings-installs-underground-bins-to-boost-glass-recycling

Figure 7: Installation of hydraulic raise underground bins at Hastings.

40. The system installed at Hastings is a hydraulic raise version of the SULO Iceberg system. This makes use of the platform and surface input bin, but instead of a crane lift bin, a standard Euro bin of 1100 litres is mounted on a hydraulically operated platform allowing conventional collection in a waste vehicle.

41. This offers the advantage of being underground and out of sight, and can be collected by a conventional vehicle. However there is a significant reduction in storage volume (from 3,000 – 5000 litres to 1,100 litres) and there is the added expense and complexity of a hydraulic raise platform.

42. **Edgbaston.** Underground bins have been proposed for a large housing development in Edgbaston consisting of a range of housing densities including detached housing. We understand that Sotkon have been working with the developer and council to design the scheme and it is expected that contracts will be in place during early 2012.

43. **Bedford Borough Council** has recently installed an underground glass recycling centre in the Kempston area. This appears to use dedicated underground units (making use of a large collection vessel rather than hydraulically raised Euro-type bin) from Taylor Bins.

4 Proposals for North West Cambridge

Options appraisal

44. The Waste Strategy details of a range of options available to the Proposed Development for waste collection in different building types, including a criteria based assessment. In general the waste collection options fall into three basic types:

    - Conventional system comprising wheelie bins for individual houses and compounds for flats and non-domestic buildings.
    - Underground communal systems
    - High density systems comprising chutes or centralised vacuum collection.

45. On many metrics the conventional system performed well. This was mainly due to cost (the system is relatively cheap), operation issues (being the current system, the collection operations are optimised for this), and acceptability (existing users are all well acquainted with the systems). Unsurprisingly, any departure from the current norm will require some changes to be made in terms of operation and user acceptance. It is also likely that a non-conventional system involving more than simple waste bins will have some form of capital cost penalty, but this may be offset by operation improvements.

46. Out of the alternative systems, the underground option was rated highly for the residential development on average, covering both the higher and lower density areas. This provides a number of benefits over the conventional system as discussed in the previous section on design aspirations, and also later in this report.

47. The Waste Strategy outlines the options for other areas of the Proposed Development, and due to the current stage of design, the detail around these still needs to be finalised. However in summary:

    - Student accommodation. This may be catered for by conventional bin compounds with Euro-type bins, or alternatively underground bins. Both will be similar in terms of operation with University staff responsible for waste collection from rooms and disposal into the bins. The use of an underground system will be consistent with the residential proposals providing economics of scale through increased vehicle utilisation. This will therefore be the preferred option.
    - Academic and commercial research buildings. These may use either conventional Euro-type bins in compounds or underground bins. Additional specialist collection may be required for certain uses, for example, laboratories.
    - Recycling centres. These will make use of underground bins, are required in the Cambridge City Council Household Waste and Recycling Policy.
    - Other uses. There are a number of other individual uses on the Proposed Development. The strategy for these will depend on the building type and will be defined as part of the reserved matters application for each plot.

48. In all cases, the use of underground bins will be the preferred option where practicable, allowing the economics of scale in the scheme to be maximised through reduced collection times and increased vehicle utilisation.

Underground systems for residential areas

49. The residential areas on the Proposed Development comprise a mix of housing densities, made up of flats, terraced, semi-detached, and detached houses. These types can be represented by areas of high, medium and

low density housing. However it is important to note that these densities are relative across the site, and in comparison with many existing areas of Cambridge, all of the site could be considered relatively high density. In particular, the areas containing semi-detached and detached housing, whilst providing large accommodation spaces, will still be highly urban characterised by narrow frontages and compact plot layouts.

50. Communal bin systems are in general more suited to higher density areas. If the area is too low in density, then the communal bins may have a small collection volume to provide acceptable walking distances to individual residences, requiring less efficient collection. Alternatively if the collection volume is large enough to provide efficiencies of collection, the walking distances may be unacceptably far.

51. The design testing conducted on the Proposed Development for all housing areas demonstrates that the housing densities are sufficient in all areas for the use of a communal underground system. This is summarised in Table 1 below:

Table 1: Summary of applicability for communal collection in all housing typologies.

Density	**Typologies**	**Rationale for a communal underground collection scheme**
'High' density	Flats	Communal collection is the norm for flats. Underground bins will be similar in operation for residents whilst providing the advantages of the removal of bin compounds.
'Medium' density	Terraced houses	Communal underground collection provides a design benefit, removing bin storage infrastructure from individual dwellings and streets. Narrow frontages will mean collection volumes can be optimised with acceptable walking distances.
'Low' density	Semi-detached and and detached houses	These areas will have limited on plot storage space resulting in the potential for obtrusive bin storage. Narrow frontages combined with adjacencies with higher density parts of the Application Site (most detached housing is likely to be located opposite terraced housing areas) allow optimisation of collection volume with acceptable walking distances of 30m or less.

52. Given the suitability for a communal bin system in all residential areas of the Proposed Development and the advantages apparent for all the different typologies, the underground system is proposed for all residential development on the Application Site. This allows optimisation of the scheme with a single collection strategy for the waste collection authority.

53. The remainder of this report provides further information on the underground systems in general, and the economic and non-economic issues applicable to the Proposed Development.

Waste collection streams – the base case

54. The Proposed Development is located in both South Cambridge District Council and Cambridge City Council's administrative boundaries. These authorities have 4 and 3 segregated collection streams respectively. During

the joint planning task group meetings, the issue of who will be the collection authority was discussed, but at present no decision has been made between the authorities.

55. A decision has been taken for the base case proposals to design the waste collection infrastructure for the Proposed Development around 3 segregated waste streams:

    - Mixed waste
    - Dry recyclables
    - Bio-degradable waste

56. This is in line with the system currently operated by CCC and therefore provides consistency across the City and with a scheme which is currently demonstrated as effective resulting in the high recycling rates exhibited in the City. This strategy limits the number of bins required which is an important factor on a dense urban development where space is at a premium. Limiting to three streams also reduces the operation costs in terms of collection time and manoeuvres.

57. Collection for other waste streams, including batteries and textiles (a complete list will be defined for the reserved matters application), will be facilitated using a number of recycling centres distributed across the Application Site.

58. In general, the underground collection system is unique and displays a number of differences from the current schemes operated by both CCC and SCDC, providing the best scheme for the Proposed Development. The scheme provides flexibility by not favouring one collection authority over another.

Waste collection streams – optional proposals

59. Cambridge City Council is currently applying for funding from the Department of Communities and Local Government to instigate a weekly food waste collection across Cambridge. This will collect segregated food waste, via kitchen caddies provided to each home, for separate waste treatment and potentially use in waste treatment plants such as anaerobic digestion.

60. If successful in their bid, CCC has shown interest in developing the food waste collection scheme on the Proposed Development for on-site treatment. Food waste will be collected by CCC from each home, and delivered to the proposed on-site in-vessel composing unit for treatment.

61. Other aspects of the optional proposals promoted by CCC include:

    a. The reduction in underground bins on each location to 2 for mixed waste and dry recycleables. With the separate collection of food waste and on-site composing in gardens (market homes) and site grounds maintenance and composting (key worker homes), the generation of garden waste is likely to be low, and a third collection bin for green waste un-necessary.

    b. Enhancement of the current proposals for on-site composting with a more managed approach to assist with the collection of excess waste and sales of compost. The aim would be to create a closed cycle site for green waste as far as possible.

    c. With the reduction in bins at each location to two, the third position could be retained (with a concrete bunker installed) for future flexibility.

The decision to proceed with this option will be dependent on CCC being successful with their bid to DCLG, and on the economic viability based on further economic modelling with input from CCC around the food waste collection.

5 Non-economic considerations

Introduction

62. This section provides an overview of some of the non-economic considerations associated with installing underground bins on the Proposed Development.

Visual impact

63. The physical and visual impact of each home having three wheelie bins could be high, especially considering the relatively high density nature of much of the housing (terraced). In many areas of Cambridge individual bins blight the streetscape, and on collection day they can block the pavements.

64. It is possible to incorporate bin stores into dwelling designs, but there is a space penalty and cost associated with this (included in the economic analysis set out in section 6). There will remain a visual and physical impact on collection day when bins are required to be left on the pavements.

65. The use of underground bins removes this visual impact, apart from the input bins located throughout the Application Site in convenient locations. These can be incorporated into the planned streetscape (for example, installed as part of traffic calming chicanes).

Fly tipping and user acceptance

66. There is potential concern over inappropriate use of the underground bin system. Some recycling centres and communal waste collection centres exhibit large amounts of waste which is dumped, sometimes unsorted, by the bins. It is difficult to address this issue with categorical evidence, however the Peterborough experience has been exactly the opposite, with large improvements in compliance with recycling and reductions in tipping.

67. The following options on the Application Site will seek to prevent inappropriate use of the system:

    - The bins will be regularly collected (potentially with the assistance of some form of automatic fill measuring system). This means that there will always be spare capacity preventing tipping. If for any reason there was a full bin, a neighbouring set may have capacity.
    - Most people using the bins will be local to the compound and therefore take care not to litter the area. Most problems with existing waste collection sites are that they are not for local residents and there is less of a desire by users to maintain them.
    - Additional community capacity will be available in the recycling centres located around the Application Site which will also provide collection for other waste streams.
    - It is possible to restrict use of the bins to certain people using key tags which allow selective access.
    - There is no culture shift needed on the Application Site for the use of the bins. All residents will be new to the Application Site, and the bins will only represent one change from the status quo amongst many. Therefore this will become part of living on the Proposed Development and not a change from an existing system.

68. The Peterborough experience demonstrates that user acceptance can be high, with local residents even policing the use of the bins and making sure that other residents use them correctly. This is in areas where there has been a history of antisocial behaviour.

Recycling rates

69. Recycling rates in Cambridge are high with widespread acceptance of the separated waste stream collection system. It is important that an underground system can maintain or even increase this level of recycling.

70. At present, residents may separate waste in the house and then store for a short period before disposing of it in the wheelie bin, or place it directly in the correct wheelie bin. The move to an underground system will mean that waste will be stored for a short time in the dwelling and then transferred to the underground bin. As part of the Waste Strategy for the site, all dwellings will be equipped with segregated waste storage bins providing residents with a means to separate waste at point of generation. Therefore the approach to waste separation is the same as currently applied across CCC and SCDC.

71. Transferring waste to the underground bins will require the resident to carry three smaller bags of waste rather than one large bag of mixed waste – there is no difference in convenience, and no reason to suggest that recycling rates will be reduced.

Locations and distances

72. Guidance in the Code for Sustainable Homes, Building Regulations Part H, and the RECAP waste guidelines for Cambridgeshire and Peterborough suggest that the maximum distance between a residence (external door) and waste storage is 30m. The Code does allow for up to 50m in certain circumstances subject to the Code assessor's discretion.

73. Initial layouts and estimates for the Proposed Development suggest that this 30m rule can in general be accommodated on the majority of the Application Site with the correct capacity of bins, with only small areas requiring additional bin capacity (over-supply) to meet the rule. Figure 8 shows an extract from the illustrative masterplan for the Eastern end of the Application Site showing indicative underground bin locations in an area of detached, semi-detached, and terraced houses. This demonstrates at an indicative level that it is possible to locate underground bins within 30m of the majority of homes.

74. There are a few homes which fall slightly outside of 30m in this drawing and accurate location of bins at the detailed design stage will allow positions to be optimised. To prevent significant overcapacity in certain areas of the proposed development, an allowance for up to 10% of the dwellings (up to 300) to fall within a 35m radius of the nearest bin location is propsoed. This provides the design a small degree of flexibility. The Code for Sustainable Homes provides for flexibility up to 50m, and therefore extending beyond 30m in limited circumstances will require flexibility within the RECAP guidance and Building Control.

75. In many areas of the Application Site, the housing density may mean that the distance will be less than 30m to ensure that the correct capacity is available. Examples include some higher density areas of terraced houses and flats.

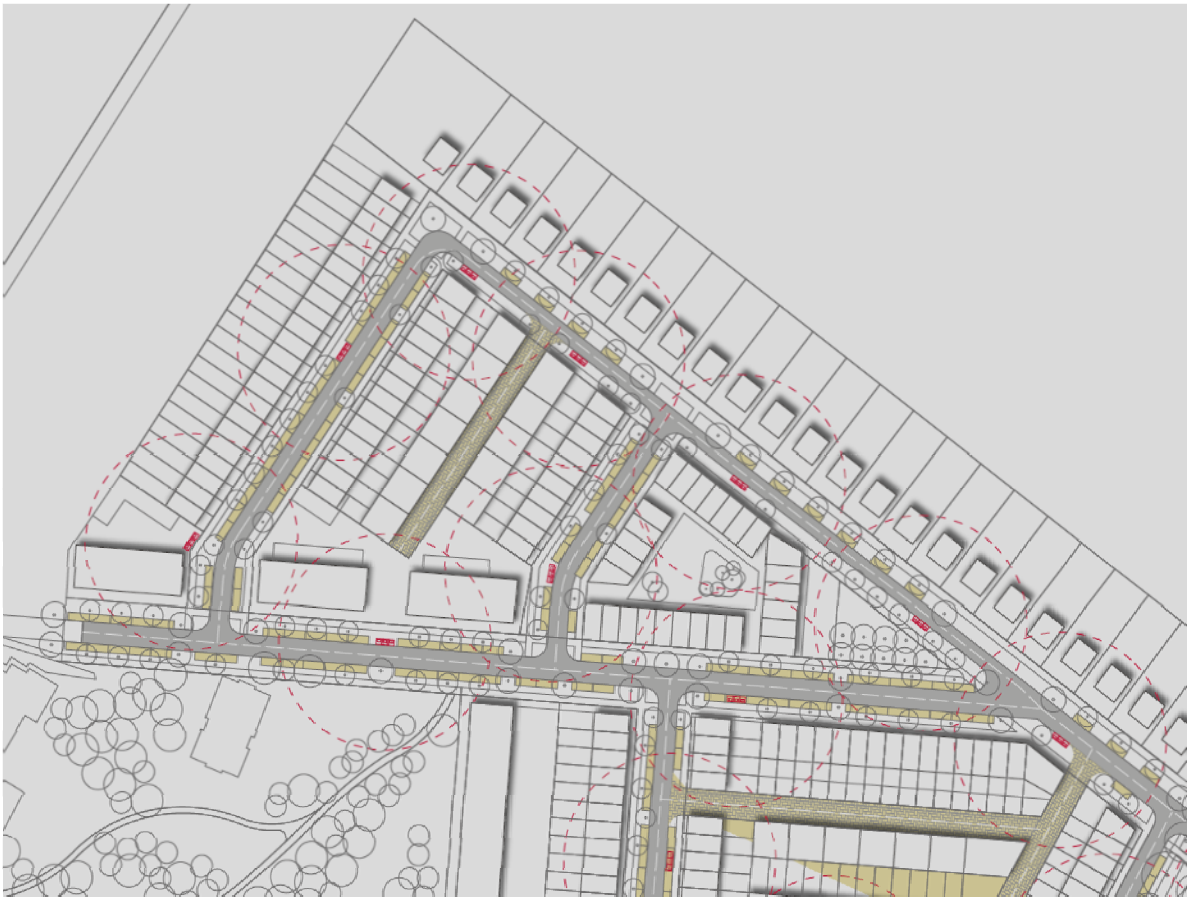

Figure 8: Extract from the illustrative masterplan plan showing indicative locations for underground bins (red sites) and a 30m radius (red dashed line).

Assisted collection

76. In a conventional waste collection system, assisted collection is provided by the waste collection authority to residents who are unable to transport their wheelie bin to the street. This typically involves a waste operative entering the private plot, and collecting the bin from close to the home's entrance.

77. With an underground system, the trip frequency to the bins will be higher than wheelie bin collection, with in-property collection vessels accommodating a few days worth of waste. An assisted collection in this instance would therefore require more frequent visits. However the need for assisted collection will be reduced with residents having to only carry small bags, and not manoeuvre heavy wheelie bins.

78. One option is to provide homes requiring assisted collection with a conventional wheelie bin system, and this is the method proposed for the Edgbaston housing development identified earlier. However, this presents a challenge in terms of bin storage, and will require two collection rounds with potentially different vehicle types which is neither an efficient or desirable solution for the Proposed Development

79. This section therefore seeks to understand the likelihood of future residents to require assisted collection and identifies the alternative options available to respond to individual needs. Assisted collection is generally

required by the elderly and infirm, and disabled residents where mobility issues prevent handling of a wheelie bin. Where other residents in the same dwelling are deemed capable of handling the bin, assisted collection is not provided. Assisted collection is not provided in flats and the underground bin proposals for the Proposed Development do not represent a departure from the status-quo in this case. For the purposes of this discussion, it is also assumed that assisted collection will be provided for all the senior living accommodation through site staff. Therefore assisted collection is primarily a requirement for mid and low density housing areas (ie terraced, semi-detached and detached housing).

80. In Appendix 1: Assisted collection assessment, the methodology to estimate the number of residences that may require assisted collection is set out. We estimate that approximately 44 homes may require some level of assisted collection (about 1% of the dwellings on the Proposed Development). Of the 44 homes, the majority are likely to be in areas of market housing. The need for assisted collection with the underground system is likely to be less than with a wheelie bin system – carrying a small waste bag for 30/35 metres maximum is likely to be less challenging than manoeuvring a full wheelie bin. Therefore the numbers may be significantly lower than suggested. Options available for assisted collection may include:

    - Providing greater internal waste storage in these dwellings and having a direct collection by the local waste collection authority (similar to the current system). This would not necessitate large wheelie bins, because most assisted collection would be from one or two person households with low waste generation. The waste could be collected weekly (all streams) by council operatives to be emptied into the underground bins.
    - A community / voluntary approach where the community body helps provide assistance through a buddy scheme. In its simplest form, this may simply be partnering those requiring assistance with neighbours. There will be a strong emphasis on the development of a community and community activities on the proposed development. In coordination with the estate management service, community support for assisted collection could be facilitated and encouraged.
    - The University could provide an assisted collection service to the relatively small number of homes identified. This would be on a similar basis to the council assisted collection, based on weekly collection from homes.

81. Given the number of potential assisted collection requirements, and the options identified, it is not believed that the requirement for assisted collection is a barrier to the take up of an underground bin collection system.

Collection vehicles

82. Underground bins require specially equipped collection vehicles which can lift the bins from the ground. The use of underground bins at the Proposed Development will therefore require an additional vehicle to be available within the collection authority. The type of vehicle will depend on the collection system selected (see below).

83. The City Council Household Waste and Recycling Policy requires the use of Underground systems in all new large residential developments, and it is understood that underground bins are being promoted on other sites around the City. Therefore the proposed development will not be the only site requiring a specialist vehicle in the future.

84. The two collection systems identified differ as follows in relation to collection vehicles:

Bottom opening bins:

85. A system is required with a HIAB-type crane capable of lifting the container, platform, and input bin to a height allowing disposal above the collection vehicle. The following points are noted:

- The vehicle will require an open top or hopper which can accept waste falling from the bin. Modification of a standard waste collection vehicle to include the crane and hopper will reduce the vehicle capacity and payload and make the vehicle less suited to standard collections. Therefore a dedicated vehicle type is preferable. These types of top-loading vehicle differ from the standard waste collection vehicles and cannot be used for emptying wheelie bins.
- These types of vehicles are currently used for emptying 'igloo' recycling bins in Cambridge City. This service is currently contracted out by the council, demonstrating the existing demand for such a vehicle within Cambridge. By contracting out, the contractor is required to provide back up as and when required.
- Both Peterborough and Bedford Councils have similar vehicles which could be used as a backup if the council decided to take on the collection with a single vehicle.
- By using a dedicated vehicle type, the capacity and payload can be optimised. Compaction is also viable on this vehicle type.

Top opening bins:

86. Only the container is lifted, and to a surface height allowing coupling to the hydraulic raise on a standard waste collection vehicles. The following points are noted:
    - A standard hydraulic tail lift vehicle could be retrofitted to include a crane. This provides the council with a multi-use vehicle.
    - The additional crane weight may cause a reduction in payload, and therefore a larger vehicle may be required than usually used in Cambridge (The city uses narrow chassis vehicles whereas a standard width vehicle may be necessary.)
    - The standard hydraulic raise mechanism used on collection vehicles may not have sufficient capacity for larger bins (4,000 and 5,000 litre units), especially when loaded with heavier waste streams. Therefore a more substantial raise mechanism may be required.

Vehicle utilisation

87. The calculations conducted as part of this work show a total collection time for the completed Proposed Development of 8 days. Assuming a two-weekly collection cycle, the vehicle is therefore almost fully utilised assuming some down time for maintenance. This means that for the completed Proposed Development, should a dedicated vehicle be required, it will have a high utilisation and therefore not pose a financial burden.
88. During the build out of the Proposed Development, the vehicle will not have full utilisation. If the vehicle is dedicated to the Proposed Development, this could pose a potential economic burden. However, if the vehicle was used for other sites around Cambridge (and will be required for recycling centres in all large new developments), or was from a private contractor (only during the build out of the Application Site), then utilisation will be less of an issue.
89. The current phasing proposals for the Proposed Development indicate residential development commencing in 2014, and completing in 2020, with a roughly uniform build-out rate during this period. Therefore it will take up to 7 years for the waste collection vehicle to become fully utilised.

Vehicle back-up

90. The waste collection vehicle will require maintenance, although there is time within the utilisation for standard maintenance schedules. However a back up strategy will be required for times when the vehicle is unavailable.

With both of the vehicle types identified differing to some extent from a standard collection vehicle, access to an additional vehicle may be required. This could be from neighbouring authorities (such as Peterborough and Bedford) or from private contractors, and does not necessitate the purchase of a back up vehicle. In the longer term as the uptake of underground bins increases, an increase in the number of day to day vehicles required will help reduce the demand for back up vehicles.

Manoeuvres

91. The Proposed Development will be designed to ensure that collection vehicles can safely navigate the Application Site with appropriate junction design to accommodate standard size vehicles (rather than the narrow chassis vehicles currently used in Cambridge). The road design will ensure all roads requiring waste vehicle access are designed to be suitable in terms of width, turning circles, and weight capacity.

92. On major roads, off-highway parking dedicated to bin collection will be provided adjacent to the underground bin banks. Measures will be in place to prevent car parking in these areas to ensure that access is always available for the collection vehicle. On minor roads, similar parking control measures will be used to prevent the parking of private vehicles adjacent to the bins.

93. The road layout will ensure that reversing of vehicles is not required with turning circles provided where necessary. All roads with bin locations will be constructed to adoptable standards to address accessibility issues associated with the waste collection vehicle.

94. The location of all bins will allow easy access by the waste collection vehicle. By allowing the vehicle to park alongside the bins, temporary spring loaded extendable barriers (potentially attached to the collection vehicle) can be erected to limit pedestrian access to the immediate area. With remote control of the crane mechanism, the operator will be in a position to view the collection area. This means that a single operator will be adequate for collection as demonstrated in schemes elsewhere in the UK and Continental Europe.

Maintenance

95. In principle, the underground systems are low maintenance but they will undoubtedly require some form over their lives. Potential maintenance includes:

    - Maintenance of the hydraulic safety platform – hinges etc.
    - Maintenance of the input bin, possibly including selective entry security system
    - General cleaning and tidying
    - Possible repair or maintenance to the collection vessel.
    - Cleaning and washing of the concrete bunker. In theory the systems are designed in a way which prevents the entry of liquids and solids into the concrete bunker, but over time, this may happen. Leakage from the trap doors of bottom-opening systems could cause greater contamination of the bunker than for the plastic bucket systems which are sealed.

96. The manufacturers consulted provide a standard maintenance contract service which includes an annual inspection, service of serviceable parts, and replacement of parts requiring routine replacement. Cleaning can also be provided as part of this contract if required. This maintenance service is advised to maximise lifetimes of the units and reliability of the mechanisms. A safety check would also be conducted of the lifting mechanism where necessary. Due to the scale of the Proposed Development, the service contract is likely to be bespoke, and would be considered during the tendering process.

97. The supplier Otto / ESE has confirmed that a LOLER (Lifting Operations and Lifting Equipment Regulations) test is not required for the bins, and this has been agreed with Cambridge City Council. This is due to the bins (from this manufacturer) being designed and constructed to relevant European standards. A LOLER test of the collection vehicle crane would be required.

98. One supplier has indicated the potential to cap maintenance requirements under contract, demonstrating their confidence in the scheme. If routine maintenance and replacement parts were required beyond a certain point, these would be provided free of charge. This would exclude external damage (vehicles running into the collection receptacles is the most common problem).

99. It is proposed that in principle, the waste collection authority will be responsible for the ongoing maintenance and replacement of the underground bins.

Waste streams

100. It is important that the underground system is capable of taking the correct waste streams. In general dry and bagged waste is not a problem and all systems can be used. Two suppliers discussed in this document mentioned that glass can be heavy, and bins would typically be limited to 3,000 litres for a glass-only stream to reduce weight for the crane to lift. For mixed recyclables including glass, large volumes could be used.

101. One area requiring special consideration is the disposal of biodegradable waste. This concerns:

- Intermediate storage and transfer of waste to the bins.
- Storage in the underground bins.

102. Biodegradable waste is by its nature wet and liable to decompose. A sealed bucket type system (as used by Sotkon) offers advantages, reducing the potential for liquids to collect in the concrete bunker. With bottom-opening systems, there is potential for liquids to leak though the door openings. Manufacturers are trialling ways of addressing this including:

- The use of a reservoir attached to the doors which collects a sufficient volume of liquids for emptying into the waste collection vehicle, and;
- Filtration grilles below the doors and collection of liquids in the concrete bunker to be pumped or drained into the foul water drains or pumped out.

103. An advantage of the bins being located underground is that they will be kept at a lower temperature than surface bins in the summer. This may therefore help to reduce the level of degradation compared with surface bins. The design of the bins means that any odours will be sealed in. Consideration will need to be given as to how organic waste is transferred to the bins. Options could include the use of caddies (for food waste) or biodegradable paper bags (food and some garden waste) which provide a small amount of in-dwelling storage combined with a transport mechanism.

104. In general, garden waste is unlikely to form a significant waste stream for the underground system. Most dwellings with gardens will be equipped with on-plot composting facilities. If the optional proposal is adopted pending Cambridge City Council being successful in securing funding for a weekly food waste collection, the third bin for green waste will not be installed.

Single site strategy

105. The use of underground bins is suited better to some areas and types of dwelling than others. In general the higher density parts of the Application Site, in particular terraced housing where visual impact from bins is potentially a problem, are best suited and benefit most from this system. However the discussion in this report demonstrates that the underground system is viable for all residential areas and provides a benefit to all areas.

106. Advantages of a single site solution are:

- Only one collection round is required for the entire Application Site. This will reduce collection costs and increase vehicle utilisation.
- The use of underground bins across the Application Site offers a visual improvement. Even in the lower density parts of the Proposed Development such as the detached housing, the density is still significant enough for underground bins to offer space and visual benefits.
- The co-location of lower and higher density homes means that the 30m rule can be accommodated in all areas.
- A single solution should increase the level of acceptability to residents across the Application Site, providing everybody with the same method, rather than discriminating (although it is not clear which system may be deemed inferior if there was a mix of wheelie and underground bins).

107. For these reasons, a single system of underground bins is proposed across the entire Application Site. This view has been endorsed by Cambridge City Council who stated that a single site solution, including non-domestic buildings and student accommodation will maximise vehicle utilisation and collection efficiencies.

6 Economic considerations

Introduction

108. In general, it is perceived that underground systems can be more expensive to install than the purchase of wheelie bins, but can offer collection savings through reduced collection time and manpower.

109. This section aims to establish approximate capital and operation costs for each system. It should be noted that operational cost information for wheelie bins has been difficult to obtain, and that the underground bin solution is relatively immature (with very few installations in the UK) and therefore cost information is sparse.

110. A key reason for the proposal of underground bins is the reduction of waste collection infrastructure. The baseline requirement of three wheelie bins per a house can be intrusive and pose design difficulties in higher density areas, for example through the provision of bin housing and access routes. By removing these and replacing with a number of communal underground facilities, the requirement for housing or hiding wheelie bins is removed. This is not a direct cost advantage, but will have cost benefits in relation to the removal of bin housing, and land area.

111. This section presents a summary of the cost analysis conducted for the Proposed Development baseline underground bin option for the residential components. Full details can be found in Appendix 2 and capital cost assumptions in Appendix 3.

Capital costs

Capital costs – baseline solutions

112. In the baseline situation, a mix of 1100 litre bins (for flats) and 240 litre bins (for individual houses) would be used for waste collection. In each location, 3 sets of bins are required for mixed waste, dry recyclables, and compostable recyclables.

113. The costs of a baseline solution have been calculated based on these numbers and following a detailed costing exercise by cost consultants Gardiner and Theobald of a similar project. For individual dwellings, the costs of bins, enclosures and services have been calculated using architects' proposals for bin enclosures, which allow integration of wheelie bins in a less visually intrusive manner. For flats, an assumption of secure bin compounds to house 1100 litre bins has been made.

114. The total baseline cost of waste storage and collection infrastructure has been estimated at £5,198,000.

Capital costs – underground solution

115. Underground bins are available in 3,000, 4,000 and 5,000 litre versions. The selection will depend on the waste stream which the bin is used for, and the local requirement. For example, in lower density areas, 3,000 litre bins may provide sufficient capacity, whereas in higher density areas, the 5,000 litre version will be required.

116. A costing exercise has been conducted on using a 50:50 split between 3,000 and 5,000 litre bins, based on the worst case scenario requirement of 465 bins (155 locations around the site). This includes the capital cost of the bin infrastructure, and installation including the civils work associated with constructing holes in which to locate the bins. The costs vary between different bin suppliers but are all comparable. It is assumed that each location comprises three bins as per the current CCC collection.

117. The total cost of underground bin waste storage and collection infrastructure has been estimated at £4,464,000. The underground system therefore has a capital cost saving of circa £734,000 over the baseline scheme.

Operation / collection costs

Baseline scheme

118. Information on collection costs for the baseline scheme has been provided by Cambridge City Council. The annual collection cost budget per house for 2010/11 is estimated at £54 per house. Based on circa 3,000 dwellings, this gives an annual collection cost of £162,000. This includes vehicle fuel and maintenance, manpower, and time taken to get to and from the Application Site.

Operation / collection costs – underground scheme

119. A model has been developed base on information from Sotkon, and in collaboration with the waste officers from Cambridge City Council. This provides a like-for-like comparison of the collection for each scheme taking into account various components of the collection time. The model calculations suggest that there will be an overall 10% saving in time using the underground system.

120. The other main area where collection cost savings can be made is in the number of personnel. The underground systems are designed (and operated in Peterborough) to use one person, and this is common across Continental Europe. The council waste officers have stated that one person operation will require consideration of the health and safety implications, in particular the need for vehicle manoeuvring. The proposed development and scheme will be configured in a way which means these requirements are met and one operator is adequate.

121. In light of these proposals, the operation modelling assumes 1 operator. The total annual operation costs for the underground system are circa £81,500, a saving of £80,500 per year from the baseline system, or around 50% reduction.

Maintenance costs

Maintenance costs – baseline scheme

122. Maintenance costs for the baseline scheme are based on replacement of the bins and bin compounds. The total annualised maintenance costs for the baseline scheme are circa £144,000.

Maintenance costs – underground scheme

123. The total annual maintenance and replacement cost for the underground scheme is predicted to be circa £159,000. This is based on an allowance of £75 per bin per year service and maintenance contract, and replacement of the removable bin components on a 15 year lifecycle period.

Payback and savings

124. The following table summarises the costs associated with both bin options. It splits the costs out into those attributed to the University and those to the councils on a baseline scenario of capital costs being incurred by the University, and operation and maintenance costs of the bins being incurred by the councils.

Table 2: Summary of lifecycle costs of the baseline scheme vs. underground scheme.

Costs	**Baseline**			**Underground**		
	Total cost	Council component	Non-council component	Total cost	Council component	Non-council component
Capital (£)	£5,198,000	*£0*	*£5,198,000*	£4,464,000	*£0*	*£4,464,000*
Annual collection (£ / yr)	£162,000	*£162,000*	*£0*	£81,521	*£81,521*	*£0*
Annual maintenance and replacement (£ / yr)	£144,410	*£35,500*	*£108,910*	£158,875	*£158,875*	*£0*
Total costs over 25 years	£12,858,250	*£4,937,500*	*£7,920,750*	£10,473,891	*£6,009,891*	*£4,464,000*
Net annual cost (£ / yr)	£514,330	*£197,500*	*£316,830*	£418,956	*£240,396*	*£178,560*
Net annual saving (£ / yr)				**£95,374**	***-£42,896***	***£138,270***

125. The analysis demonstrates that, under the assumptions used, there is a net annualised cost saving over the 25 year assessment period of circa £95,000 for the underground system. This indicates that the underground system is more cost effective over this assessment period taking into account all operation, maintenance, collection, capital and replacement costs. This demonstrates that the underground scheme could be installed and operated with a net cost saving compared with the baseline solution of wheelie bins.

126. The additional modification costs for a vehicle (estimated to be circa £50,000) have not been included in the current assessment due to uncertainties around vehicle specification. However the cost savings demonstrate that this can be accommodated.

127. The vehicle costs and the overall cost balance will be discussed in the ongoing Section 106 negotiations with the Councils. This paper demonstrates that the scheme can be operated economically.

7 Conclusions

128. The proposal for underground bins represents a departure from the conventional waste collection methods used currently by CCC and SCDC. The use of underground bins is well established in Continental Europe although relatively new to the UK. They offer a number of benefits including:

- Reduced visual impact of waste collection infrastructure by incorporating waste storage below ground and removing the need for surface bin compounds / wheelie bins for each dwelling. This will provide a significant benefit to the Proposed Development by removing the need for bin compounds for each house and block, and preventing bins from littering the streets on collection day.
- Reduced collection costs through a 10% reduction in collection time due to the efficiencies of a small number of large waste containers.
- Reduced operation costs through the need for one vehicle operative only. The design of the Proposed Development will ensure that health and safety considerations are met to allow the use of a single operative, and maximise the operational benefits of the scheme.
- Improvements in recycling by promoting separation at source, helping to build on the already strong rates of recycling in Cambridge.
- Encouragement of community responsibility; there is evidence of reduced fly tipping and vandalism in other schemes.

129. As with any communal bin scheme, it is important that the bins are located within an acceptable distance of the dwellings, and the proposals here are based on 90% of homes being within distance of 30m of communal bins, and all homes being within 35m, This is in line with the Code for Sustainable Homes, but allows a small degree of flexibility with Building Regulations Part H, and the Cambridgeshire and Peterborough RECAP guide. Calculations demonstrate that by fulfilling these distances, the capacity of each bin location can be well matched to the homes in the catchment area, resulting in no significant oversupply or undersupply of capacity for all of the proposed residential areas. This demonstrates the suitability of this method across the Proposed Development. In higher density areas, underground bins are a direct replacement for the alternative bin compounds with similar operation for residents. In the mid density and low density areas, underground bins provide significant visual impact benefits though the removal of intrusive wheelie bin storage. Therefore the underground scheme is proposed for all residential areas providing a single consistent waste collection method for all residents, and a single collection method for the waste collection authority to maximise vehicle utilisation.

130. A system of three bins for the three waste streams currently collected by the City Council is proposed. This method has been shown to be effective by the City Council with strong recycling rates and provides consistency with other parts of the City. By limiting the number of streams to three, the impact of waste collection on the external environment is also minimised with no impact on recycling rates. An optional scheme of two bins with separate food waste collection is also presented, and will be investigated further if Cambridge City Council is successful in a bid to DCLG for funding a weekly food waste collection scheme in Cambridge.

131. The use of communal collection systems can pose an issue for those who are elderly or infirm and require assisted collection. However the analysis in this report demonstrates that the numbers of homes requiring assisted collection is likely to be low at around 44 homes in total out of 3,000. Underground collection is simpler for the elderly and infirm to operate, removing the need for manoeuvring heavy wheelie bins and instead requiring the carrying of small waste bags. Therefore the need for assisted collection is reduced in the first place. However for those requiring assisted collection, a number of options are proposed including council assisted collection combined with greater in-dwelling storage, a University collection service, or a community and voluntary approach facilitated by the University.

132. Collection from the underground bins will require the use of a specially equipped vehicle. The type of vehicle will depend on the specific system selected but all systems will require a crane to remove the bin from the ground. This report discusses the various issues with the requirement for a vehicle. The Application Site will make use of a vehicle almost full time once fully developed providing a good utilisation rate. During the phased construction of the Proposed Development, and as a back up, there are a number of options proposed including the use of vehicles from other authorities (both Peterborough and Bedford Councils have suitable vehicles) or private contractors. A collection vehicle for the Proposed Development can also be used for other underground bin sites in the City such as those proposed on the Southern Fringe, which will be installed in line with the requirement from the City Council for recycling centres to use an underground system.

133. The Proposed Development will be designed in a way which allows the scheme to be operated by a single person. Road layouts will ensure that no reversing of waste collection vehicles is required, and lay-bys on main transport routes mean the waste collection vehicle will be off the carriageway during collection. Remote crane operation and temporary barriers allow a single operator to ensure the collection area is safe and monitored during the collection process.

134. An economic analysis of the underground scheme compared with the baseline wheelie bin option demonstrates that over a 25 year period, the underground system can result in net annual savings of circa £95,000. The total capital cost of the underground scheme is lower than the baseline, primarily through the removal of bin compounds and associated structures. The collection costs are around half of the baseline scheme through a 10% time saving and the need for only one operative. The maintenance and replacement costs of the underground scheme are only 10% higher than for the baseline scheme, and are offset by the other savings. The scheme therefore represents a more economic solution to waste collection on the Proposed Development than the alternative of surface wheelie bins.

Capabilities on project:
Building Engineering

Appendices

Appendix 1: Assisted collection assessment

135. This appendix describes the assessment of the likely numbers of dwellings which will require some form of assisted collection.

136. The overall resident profile for the Proposed Development suggests that assisted collection demands will be lower than average:

- Half of the homes are for key workers from the University. These will be for qualified University and College Staff (consistent with the Key Worker Housing Statement that supports the OPA). As set out in the University's housing needs survey and in the Key Worker Housing Statement, the majority of this accommodation will be for contract research staff, who tend to be more junior in their career and younger. By definition, all of the key workers accommodated on the Application Site will be of working age. Houses for key workers will be three or four bedrooms, and the allocations policy (see Key Worker Housing Statement) establishes that these properties will only be allocated to key workers with children and will not be allocated to single occupiers. Assisted collection for key worker homes is therefore most likely to be due to disability, for a relatively small proportion of occupiers where the key worker is a single parent.
- The market housing will have a mix of older and younger residents. A large number of the market homes are family homes and will most likely accommodate more than one person, limiting the demand for assisted collection.

137. The Health Impact Assessment submitted as part of the OPA provides a breakdown of likely age composition for the Proposed Development. Excluding senior living provision, the study estimates there to be 83 residents aged 75 – 84 by 2026, and 21 residents aged 85 plus by 2026. Table 3 outlines the potential requirement for assisted collection based on age. It identifies that around 20 homes may require assisted collection.

Table 3: Assessment of assisted collection requirements for residents based on age.

	75 – 84 years	**85 plus years**	**Assumptions**
Total number of residents	83 Market: 73 Key Worker: 10	21 Market: 18 Key Worker: 3	
Number resident in houses (not flats)	49 Market: 47 Key Workers: 2	12 Market: 12 Key Workers: 0	Indicative mix suggests 65% of market dwellings are 2, 3, 4 and 5 bedroom houses Indicative mix suggests 15% of key worker dwellings are 3 or 4 bedroom houses (see Socio economic Assessment)
Number of households eligible for assisted collection	16 Market: 16 Key Workers: 0	12 Market: 12 Key Workers: 0	Market Housing: Assumes that 2/3 of 75 – 84 are co-habiting. Assumes that all 85 plus are single. Key Worker Housing: All occupants outside working age would be an associated occupant with a qualifying University Key Worker, therefore assumed to have mobility needs assisted by other household occupants (either partners or adult children).
Assumed need for assisted collection.	50%	100%	Cambridge City Council assume 50% of 75 plus households require assisted collection. We have assumed that 100% of 85 plus require assisted collection.
Total number of homes	8	12	

138. Disability is the other factor which may influence the number requiring assisted collection. Allowances are made in the design of the Application Site for a proportion of homes to be Lifetime Homes compliant and wheelchair accessible, though the exact proportion has not been set. Statistics showing types of disability are also sparse – it is believed that there are around 11 million people in the UK (around 20% of the population) with some form of disability which includes mental ability, mobility, auditory conditions and sight. However a large number of these conditions may be relatively minor and not require assisted bin collections.

139. It is not possible to state how many people of which type of disability may require assisted collection without making some simple assumptions. Even with detailed statistics, the distribution of disabled people is not uniform with a higher percentage living in economic deprivation and out of work. This would suggest the proposed development will have a lower percentage than average. Information published by the Papworth Trust states that the majority of impairments are not visible and that only 8% of disabled people use wheelchairs (less than 1 million) equating to around 1.4% of the population[2]. Another measure is the number of blue badges

[2] Disability in the United Kingdom 2010. The Papworth Trust.

issued which is around 2.46 million or 4% of the UK population. Most usefully, the information suggests that disability rates for those having problems walking or using a bus are around 5% for 16 – 49 year olds, and 45% for over 70 year olds.

140. Based on this information, a simple value of 5% has been assumed for a disability rate, which considering the socio-economic profile of the proposed development is probably high. The assessment in Table 4 is used to identify the potential number of assisted collection requirements. It identifies that around 24 households may require some form of assisted collection due to disability.

Table 4: Assessment of assisted collection requirements for disabled residents between 19-74 years.

	Number of residents	**Notes**
Total number of residents	6490	
Number of residents in age band of interest	5,171 Market: 2,430 Key Worker: 2,741	This excludes less than 19, and more than 75 (which is included in the discussion on elderly or infirm).
Number with a mobility disability causing problems with walking or catching a bus.	260 Market: 122 Key Worker: 137	Assumes 5% disability rate.
Number of disabled residents in terraced, semi-detached or detached accommodation.	100 Market: 79 Key Worker: 21	Indicative mix suggests 65% of market dwellings are 2, 3, 4 and 5 bedroom houses Indicative mix suggests 15% of key worker dwellings are 3 or 4 bedroom houses (see Socio economic Assessment)
Number of disabled residents without in-home assistance for waste collection	24 Market: 20 Key Worker: 4	Market Housing: Assumes that 75% of 19-74 living in houses are co-habiting with someone else able-bodied. Key Worker Housing: All occupants in houses have children. Expected that a proportion of these will be of sufficient age to provide waste removal assistance. Assume 80% have partners or children who can assist.

http://www.papworth.org.uk/downloads/disabilityfactsandfigures2010_100202152740.pdf

Appendix 2: Cost Analysis

141. This section provides a detailed discussion on the economic assessment of the underground bin scheme. It provides a comparison of the scheme for the residential development only.

Capital costs

Capital costs – baseline solution

142. In the baseline situation, a mix of 1100 litre bins (for flats) and 240 litre bins (for individual houses) would be used for waste collection. In each location, 3 sets of bins are required for mixed waste, dry recyclables, and compostable recyclables. The total number of bins required for the residential sector (excluding student accommodation) are:

Type	Number of bins
240 litre wheelie bins	3,568
1100 litre bins	494

143. The costs of a baseline solution have been calculated based on these numbers and following a detailed costing exercise by cost consultants Gardiner and Theobald of a similar project. For individual dwellings, the costs of bins, enclosures and services have been calculated using architects' proposals for bin enclosures, which allow integration of wheelie bins in a less visually intrusive manner. For flats, an assumption of secure bin compounds to house 1100 litre bins has been made.

144. The total baseline cost of waste storage and collection infrastructure has been estimated at £5,198,000. Further details are provided in Appendix 3:

- Table 10 shows a summary of the capital cost
- Table 11 shows a summary of costs for dwellings.
- Table 12, Table 13, and Table 14 show a breakdown of costs for different dwelling types.
- Table 15 shows the baseline costs for apartments.

Capital costs – underground solution

145. Underground bins are available in 3,000, 4,000 and 5,000 litre versions. The selection will depend on the waste stream which the bin is used for, and the local requirement. For example in lower density areas, 3,000 litre bins may provide sufficient capacity, whereas in higher density areas, the 5,000 litre version will be required. At this stage is it not possible to state which capacity is required and therefore numbers for each capacity are given.

Table 5: Summary of number of bins required for each capacity.

Type	Number of bins
3,000 litre bins	465
4,000 litre bins	349
5,000 litre bins	279

146. A costing exercise has been conducted on using a 50:50 split between 3,000 and 5,000 litre bins, based on the worse case scenario requirement of 465 bins (155 locations around the site). This includes the capital cost of the bin infrastructure, and installation including the civils work associated with constructing holes in which to

locate the bins. The costs vary between different bin suppliers but are all comparable. It is assumed that each location comprises three bins as per the current CCC collection.

147. The total cost of underground bin waste storage and collection infrastructure has been estimated at £4,464,000._Further details are provided in the appendices:

- Table 16 shows a breakdown of capital costs for the underground bin solution.
- Table 10 shows a summary of the total capital cost including comparison with baseline scheme.

148. The underground system therefore has a capital cost saving of circa £734,000.

Operation / collection costs

Baseline scheme

149. Information on collection costs for the baseline scheme has been provided by Cambridge City Council. The annual collection cost budget per house for 2010/11 is estimated at £54 per house. Based on circa 3,000 dwellings, this gives an annual collection cost of £162,000. This includes vehicle fuel and maintenance, manpower, and time taken to get to and from the Application Site.

Operation / collection costs – underground scheme

150. At present there is very little uptake of underground collection systems in the UK, with only a small number of schemes (for example, Peterborough and Tower Hamlets). Due to the size of the schemes, the current costs experienced in the UK are not necessarily representative of a wide-scale scheme.

151. Information on operating costs has been obtained from Sotkon, a Portuguese manufacturer of underground bins who are looking to enter the UK market. Their cost information is based on a breakdown of costs collected from some Portuguese authorities who use the underground system across the entire authority. The calculations provided by Sotkon break down the collection system into a number of components and assess the impact of the underground system compared with the baseline system.

152. Using this Sotkon model as a basis, a model has been developed for the Proposed Development in collaboration with the waste officers from Cambridge City Council. This provides a like-for-like comparison of the collection for each scheme taking into account various components of the collection time. The model calculations suggest that there will be an overall 10% saving in time using the underground system.

153. The other main area where collection cost savings can be made is in the number of personnel. The underground systems are designed (and operated in Peterborough) to use one person, and this is common across Continental Europe. The council waste officers have stated that one person operation will require consideration of the health and safety implications, in particular the need for vehicle manoeuvring. The proposed development and scheme will be configured in a way which means these requirements are met and one operator is adequate:

- The Application Site will be designed to ensure that waste vehicles are not required to reverse.
- Underground bins will be located in areas with easy access for waste vehicles, including the use of lay-bys on high traffic routes.

- The availability of wireless crane controls ensures the operator has full visibility of the bins and surrounding areas, and combined with temporary barriers, this will remove the need for an additional operator to keep the collection area safe.

154. In light of these proposals, the operation modelling assumes 1 operator. The following table shows the results of the calculations and demonstrates that the total annual operation costs for the underground system are circa £81,500, a saving of £80,500 per year from the baseline system, or around 50% reduction.

Table 6: Collection cost calculations for the underground bins (costs are rounded to 3 significant figures).

	Human Resources	**Fuels**	**Vehicle Maintenance**	**Notes**
Baseline cost split (information from Cambridge City Council)	66%	9%	25%	
Savings with underground system	70%	10%	10%	Assumes reduction from 3 to 1 operatives and 10% time saving
Baseline costs	£106,900	£14,600	£40,500	£162,000 total
Underground system costs	£32,000	£13,100	£36,400	£81,500 total

Maintenance costs

155. The ongoing maintenance and operation costs are discussed in this section to allow comparison between the two schemes. To allow transparency, the cost information presented is actual costs minus any preliminaries or profit margins. This means that they can be applied to either the councils, University, or external contractor. A 25 year period is assumed for the assessment when considering replacement units.

Maintenance costs – baseline scheme

156. Maintenance costs for the baseline scheme are based on replacement of the bins and bin compounds. A 10 year life is assumed for the bin containers, and a maintenance and replacement regime of 2% per year (equivalent to a 50 year life) for bin compound structures. **Error! Reference source not found.** shows a summary of the maintenance costs with a total annualised figure of circa £144,000

Table 7: Summary of maintenance costs for the baseline scheme.

Activity	**Annual Cost**	**Assumptions**
Replacement of bins at 10% per year.	£35,500	Based on a total capital cost of £355,000 for wheelie bins and Euro bins with a 10 year life.
Replacement of bin compounds and infrastructure	£96,910	Based on the replacement / refurbishment of bin compounds over a 50 year life.
Annual clean	£12,000	Allowance of £4 per house
Total annual cost	**£144,410**	

Maintenance costs – underground scheme

157. The annual maintenance cost for a single underground bin is circa £75 - £100 based on discussions with Otto / ESE and SULO. This includes an inspection, lubrication, and replacement of routine service parts. Given the scale of development, it is likely based on discussions that a cost towards the lower end can be negotiated due to reduced travelling time and economies of scale. This gives a total service cost of £34,875 for the 465 bins assumed.

158. The concrete bunkers have a design life of 25 years, and are expected to last longer than this. Therefore no replacements are included in the 25 year assessment.

159. Information on the lifetimes of the bin units (container, platform, and input receptacle) is sparse, but all manufacturers contacted stated they have a minimum design life of at least 10 years with an expectation for typically 15 years or more with routine maintenance. Sulo suggested that with careful use and regular maintenance, a 25 year life may be achievable. A 15 year life is assumed in this assessment. Assuming a capital cost of circa £5,500 (there is some variation between suppliers) and an allowance of circa £1,500 for the concrete bunker (Sotkon provided a value of £1,630, one other supplier gave an estimate of "about £1000"), the replacement unit cost is circa £4,000. This gives an annual replacement cost of £186,000.

Table 8: Summary of maintenance and replacement costs for the underground system.

Activity	**Annual Cost**	**Assumptions**
Annual service	£34,875	Based on £75 per bin per year service and maintenance contract.
Replacement of bin mechanism	£124,000	Based on a replacement parts cost of £4,000 per bin over a 15 year period.
Total annual cost	**£158,875**	

160. The total annual maintenance and replacement cost for the underground scheme is predicted to be circa £159,000.

Payback and savings

161. The following table summarises the costs associated with both bin options. It splits the costs out into those attributed to the University and those to the councils on a baseline scenario of capital costs being incurred by the University, and operation and maintenance costs of the bins being incurred by the councils.

Table 9: Summary of lifecycle costs of the baseline scheme vs. underground scheme.

Costs	**Baseline**			**Underground**		
	Total cost	Council component	Non-council component	Total cost	Council component	Non-council component
Capital (£)	£5,198,000	*£0*	*£5,198,000*	£4,464,000	*£0*	*£4,464,000*
Annual collection (£ / yr)	£162,000	*£162,000*	*£0*	£81,521	*£81,521*	*£0*
Annual maintenance and replacement (£ / yr)	£144,410	*£35,500*	*£108,910*	£158,875	*£158,875*	*£0*
Total costs over 25 years	£12,858,250	*£4,937,500*	*£7,920,750*	£10,473,891	*£6,009,891*	*£4,464,000*
Net annual cost (£ / yr)	£514,330	*£197,500*	*£316,830*	£418,956	*£240,396*	*£178,560*
Net annual saving (£ / yr)				**£95,374**	***-£42,896***	***£138,270***

162. The analysis demonstrates that, under the assumptions used, there is a net annualised cost saving over the 25 year assessment period of circa £95,000 for the underground system. This means that the underground system is more cost effective over this assessment period taking into account all operation, maintenance, collection, capital and replacement costs. This demonstrates that the underground scheme could be installed and operated with a net cost saving compared with the baseline solution of wheelie bins.

163. The additional modification costs for a vehicle (estimated to be circa £50,000) have not been included in the current assessment due to uncertainties around vehicle specification. However the cost savings demonstrate that this can be accommodated.

164. The vehicle costs and the overall cost balance will be discussed in the ongoing Section 106 negotiations with the Councils. This paper demonstrates that the scheme can be operated economically.

Capabilities on project:
Building Engineering

Appendix 3: Cost Assumptions

165. The following tables present detailed costing of the baseline and underground schemes.

Table 10: Capital cost of baseline and underground bin infrastructure. (Information provided by Gardiner and Theobald)

HOUSES					
					Total Capital Costs
Traditional Solution					
Houses					**£3,717,000**
Apartments					
1100 litre bins (set of three)					
494 nr / 3 = 165 installations					
	165 nr	@	£7,330	£1,209,000	
Bin costs per apartment					
	1811 nr	@	£150	£272,000	
					£1,481,000
Traditional Solution (houses & apartments)					**£5,198,000**
Underground Bins: mix of 3m3 and 5m3 bins (50:50 split)					
Houses					
Based upon 465 bins in 3 bin locations, say 155 locations					
Civils work: 3 bin underground tank					
size - 3m3	233 nr	@	£570		£133,000
size - 5m3	232 nr	@	£1,010		£234,000
Bins					
size - 3L	233 nr	@	£8,617		£2,008,000
size - 5L	232 nr	@	£9,005		£2,089,000
					£4,464,000
Total Cost Saving for underground bins					**-£734,000**

Table 11: Summary of costs for the baseline solution. (Information provided by Gardiner and Theobald)

Baseline Scheme

				Total Capital Costs
Houses				
We have investigated the design provisions for bin stores to houses: based upon Stage D design report for a similar scheme within Cambirdge City boundaries.				
Bin Enclosures				
Three types have been identified and each costed :				
1) Bin store within the footprint of the Building with sliding doors to roadside access	736 nr	@	£3,500	£2,576,000
2) Bin store located within access area to Lifetime Homes	48 nr	@	£990	£48,000
3) Bin store located within boundary wall of building plot	404 nr	@	£2,500	£1,010,000
Total bin enclosure costs				**£3,634,000**
Wheelie bins				
Total wheelie bin costs	**1189 nr**	**@**	**£70**	**£83,000**
TOTAL COST OF TRADITIONAL SOLUTION				**£3,717,000**

Table 12: Baseline costs – Terraced houses. (Information provided by Gardiner and Theobald)

Baseline Scheme

Bin Store : Terrace Unit

				Total Capital Costs
Size	2.40m x 1.00m	within footprint of the building		
Footings to enclosure	4.4 m	@	£100	440
Slab area: ground	2.4 m2	@	£60	144
E/O shared cost of insulated floor slab above	2.4 m2	@	£30	72
Solid side wall	3 m2	@	£150	450
Sliding louvred doors	7.2 m2	@	£150	1,080
Extra: rails / channels: top and bottom	4.8 m	@	£50	240
Extra: lock	item		£50	50
Extra: light	item		£100	100
External wash down paint	item		£100	100
Extra: drainage gulley and spur drain	item		£220	220
				2,896
Preliminaries, overheads & proft			20%	579
				3,475

Table 13: Baseline costs – larger terraced units with on plot parking. (Information provided by Gardiner and Theobald)

Baseline Scheme

Bin Store : Larger Terraced unit: on plot car parking

				Total Capital Costs
Size 2.40m x 0.50m	within car space provision			
Footings to enclosure	1 m	@	£100	100
Slab area	1.2 m2	@	£60	72
Solid side wall	3 m2	@	£150	450
Sliding louvred doors	0 m2	@	£150	0
Extra: rails / channels: top and bottom	0 m	@	£50	0
Extra: lock	item		£50	0
Extra: light	item		£100	100
External wash down paint	item		£100	100
Extra: drainage gulley and spur drain: elsewhere	item		£220	0
				822
Preliminaries, overheads & proft			20%	164
				990

Table 14: Baseline costs for plots with external boundary wall. (Information provided by Gardiner and Theobald)

Baseline Scheme

				Total Capital Costs
Bin Store : Incorporated as part of external plot boundary wall				
Size 2.40m x 0.75m	within car space provision			
Footings to enclosure	3.9 m	@	£100	390
Slab area	1.8 m2	@	£60	108
Solid side wall (say 2m high)	7.8 m2	@	£150	1,170
Sliding louvred doors	0 m2	@	£150	0
Extra: rails / channels: top and bottom	0 m	@	£50	0
Extra: lock	item		£50	0
Extra: light	item		£100	100
External wash down paint	item		£100	100
Extra: drainage gulley and spur drain: elsewhere	item		£220	220
				2,088
Preliminaries, overheads & proft			20%	418
				2,500

Table 15: Baseline costs for apartments. (Information provided by Gardiner and Theobald)

Apartment Bin Stores

				Total Capital Costs
Common to both solutions: part of building block costs				
Size	5000 x 1400 x full storey height			
Enclosure				
Footings to enclosure	7.8 m	@	£100	780
Slab area: ground	7 m2	@	£60	420
E/O shared cost of insulated floor slab above	7 m2	@	£30	210
Solid side wall	8.4 m2	@	£150	1,260
Sliding louvred doors	15 m2	@	£150	2,250
Extra: rails / channels: top and bottom	10 m	@	£50	500
Extra: lock	item		£50	50
Extra: light	item		£150	150
External wash down paint	item		£150	150
Extra: drainage gulley and spur drain	item		£340	340
				6,110
Preliminaries, overheads & proft			20%	1,222
TOTAL COST OF ONE BIN STORE LOCATION				7,330
Bins				
Cost of bins per apartment, as advised by Aecom	1,811 No	@	£150	272,000
TOTAL COST OF BINS FOR ALL APARTMENTS				272,000
			cost of bins per bin store location	**£1,648**

Table 16: Breakdown of costs for underground bin solution. (Information provided by Gardiner and Theobald)

UNDERGROUND BINS
Based upon 465 bins in 3 bin locations, say 155 locations

3000L 3m3 1.75 x 1.75 x 2m deep

			3m3 size		5m3 size	
Reinforced concrete pit			qty	£	qty	£
PCC Bin Assembly (included below)	item			0		0
Exavation and disposal	m3	£20	13.5	270	24	480
Prepared Base	m3	£20	4	80	9	180
Backfill around PCC unit	m3	£30	4	120	6	180
				470		840
Preliminaries, overheads & proft		20%		100		169
				570		**1,010**

Bin Combination (3000 litres)	3000 L	5000 L
Underground bins + metal box + PCC enclosure		
Double hook open bottom	5,193	5,581
Optional extras		
granite paving	118	118
automatic lid	746	746
Y BIN Trap door (add)	77	77
Y BIN Pedal (add)	77	77
Kit Current supply 220V (1 per island)	1,397	1,397
Remote control emitter (1 per operation)	1,009	1,009
Kit current supply: none		
	8,617	**9,005**

Note:
Typical Bin replacement at 10 year intervals assumed to be £4,000/bin (remainder of capital cost is for PC Concrete bin say £1,500/unit)

Capabilities on project:
Building Engineering