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HDL Croft Waste Management Facility Tender Proposal

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1 Executive Summary

HDL Croft submits the following tender to design, construct, and operate a waste management facility for a period of 25 years. In response to Doddington City Council's published Invitation to Tender, this proposal fully complies with all requirements, including landfill diversion targets, visitor centre provision, and asset handback obligations.

The proposed facility incorporates efficient front-end sorting to maximise recycling and advanced emissions control to ensure flue gas emissions remain significantly below Environment Agency standards. Heat generated through the aforementioned processes will be used to generate electricity and power a district heating network.

Acceptance of this tender by the council is an affordable and low-risk choice with clear opportunities for money saving and a guarantee of full refurbishment prior to the scheduled handover after 25 years of operation.

The proposal is informed by a comprehensive stakeholder analysis, with identified risks mitigated through operational, design, and stakeholder engagement strategies.

Power generation from the facility totals 21MW through a Combined Heat and Power system, supplying electricity to be sold to the national grid and heat to nearby industry at high overall efficiency following commissioning optimisation.

Community engagement and environmental sustainability exist at the core of HDL Croft's mission. Extensive front-end recycling methods, regulation beating emission cleaning processes, and a comprehensive visitor center give evidence to this fact.

Doddington City Council listed a number of sites available for the facility; AngryPool is a seven acre site located away from the city centre and near to existing heavy industry. It has been chosen due to its comparatively low cost per acre, defined demolition costs, and location; a full community consultation programme is planned to understand and alleviate potential concerns.

Construction and operation of such an extensive project is an expensive undertaking. A projected Initial Capital Investment (CapEx) of £212 million and annual operating cost of £13.2 million is to be financed through a Private Finance Initiative (PFI). Under this structure, the Council makes a fixed annual service payment, providing cost certainty and simplified long-term budgeting.

A total of £120.5 million is expected to be raised through a HDL Croft led investment consortium to cover CapEx costs, on top of an existing £10 million contribution from HDL Croft. HDL Croft will charge an annual fee of £9 million to Doddington City Council, in line with PFI scheme regulations. This is offset by a proposed profit sharing scheme, wherein 30% of the annual profits generated by the site will be given to the council for reinvestment in Doddington after the point of private equity recovery.

Furthermore, HDL Croft commits to a full refurbishment of the site prior to handback after 25 years. Additional details regarding this commitment are described in the tender. Such an agreement reduces the burden shouldered by the council at a time when cash is scarcely available across all public sector industries.

Recent government changes to immigration policy have significantly affected the construction industry. All salaries are assumed to be 30% above usual and rising at 3% above inflation to attract and retain workers. Increased construction times are mitigated by taking a modular approach to development. All labour market volatility risk arising from national policy change is borne by HDL Croft under the PFI structure, with no impact on the council's annual service charge. Financial calculations have taken these figures into consideration and the far-reaching effects of the policy are explained in detail throughout the tender.

2 Key Benefits to Council

HDL Croft reasonably assumes the existence of multiple rival entities bidding to win the contract for Doddington's new waste disposal strategy. Naturally, it considers its own proposal to be the best option available and as such will use the following section to describe key benefits the council can expect in this tender.

2.1

The facility proposal considers all aspects of the waste lifecycle, from sorting through to post-incineration repurposing. Blue Phoenix, a pre-identified partner, uses incinerator bottom ash in construction aggregate. Advanced sorting methods separate a significant majority of recyclables from the waste stream, both adding to the site's sustainability credentials and lowering overall costs.

2.2

HDL Croft will stage a significant public consultation and education campaign to understand the needs of the community. Only through understanding the concerns of local residents can a successful facility be developed.

2.3

Comprehensive analysis of Doddington Council's invitation to tender led to a thorough understanding of both stakeholder and facility requirements, evident in Section 4. Attention to detail can be expected from all aspects of HDL Croft's work, particularly evidenced through an in-depth human factors risk assessment.

By choosing this tender the council will guarantee themselves a competitively costed, safe, energy-efficient waste management system capable of extracting significant amounts of recyclables from waste streams and recovering energy from the rest. Despite perhaps carrying a negative stigma, incineration is an effective alternative to the current landfill strategy. Furthermore, extensive environmental protection systems will be built into the facility to prevent the release of chemicals dangerous to humans and surrounding ecosystems.

3 Stakeholder Analysis

3.1 Doddington City Council

Doddington City Council's existing waste management strategy centers on sending waste to landfill, an unsustainable strategy to champion long-term. A new method is required to handle the city's waste in the form of a long term sustainable management strategy.

3.1.1

Doddington residents currently sort household waste into recyclables and municipal solid waste (MSW) at home. The council is legally responsible to ensure regular collection of all waste and must therefore find an alternative. By 2039 the viability of landfill disposal is almost zero. Factors including, but not limited to, capacity and sustainability have played a role in the council's own requirement to move to a new strategy. Ensuring future plans are in line with the Waste Framework Directive as set out by the Environment Agency will be a key aspect of any successful tender.

3.1.2

Discussions with the council revealed it to be run by the Green Party. As a democratically elected entity, the council must consider itself in future elections; and as such a successful project championing core values of sustainability will be crucial. Considerations must include the environmental impact of the project alongside financial viability to ensure the product delivery exceeds expectations.

3.2 HDL Croft

A project of this magnitude is well within the capabilities of HDL Croft, having delivered upon large scale tenders in the past. Acting on key deliverables and exceeding expectations is part of the company culture and the opportunity to take on another significant development will further cement its professional reputation as a reliable partner.

3.2.1

HDL Croft must be convinced the project is financially viable. As a private company, securing a return on investment is an essential consideration. As stated in the tender document, Doddington's new waste strategy will be paid for using a PFI Scheme, requiring initial investment from HDL Croft and private investors before receiving payment across the 25 year lifespan of the developed facility. Key considerations will include, but are not limited to:

- How much risk will HDL Croft be undertaking?
- How long will it take for the project to turn profitable?
- Are the performance metrics outlined in the tender clear, achievable, and measurable?
    - PFI Schemes rely on continuous performance analysis by the issuing body to private contractor
- To what degree will expected fluctuations in interest rates affect borrowing costs?
- What costs will be associated with planning, procurement, and construction and how might they be affected by supply chain disruptions?

3.2.2

The project will have a key focus on recycling and sustainability. Advanced sorting methods will be employed to separate delivered MSW into recyclable and non-recyclable elements. Extra costs may be incurred as a result of this focus, but it is the view that a Green-led council, operating in a media environment actively promoting a circular economy, will look favourably upon projects seeking to mitigate ecological impacts [1]. However, changing public opinion in the future could devalue the proposal.

3.3 Doddington City Residents

3.1.3.1

Key concerns of local residents can be traced to three main issues. The first of these is ensuring day to day activities are unchanged; bin collection must remain unchanged during the construction and introduction of the new waste management strategy. There is no reason for waste pick ups to be mishandled during the transition period to the new facility. Clear communication and collaboration with the existing waste collection teams will ensure a smooth process.

3.3.2

The site itself must not be intrusive. This encompasses both the construction and operation of the facility. While noise and increased industrial activity will be inevitable in surrounding areas the effects of locals can and must be minimised. Building during normal daytime hours and ensuring lorries do not use busy roads consistently will support this effort. Some opposition can be expected to the operation of a waste incinerator. Negative stigma associated with Energy from Waste (EfW) plants is ingrained in society and will prove to be a roadblock with the community [2]. Residents do not want their lives impacted by a large industrial facility, either through sight, smell, sound, or otherwise. This must be taken into account when choosing the facility's location and architectural design.

3.3.3

The cost of the site must be acceptable to the community. At a time when budgets across the country are stretched, Doddington being no exception, large price tags have potential to drum up fears of financial mismanagement. All information regarding the project should be communicated to the community in a constructive manner. Education to inform residents about how PFI schemes work in favour of the taxpayer should be conducted [3]. Furthermore, highlighting the necessity of this development will further convince Doddington locals to support the project.

3.3.4

A significant part of integrating the community will depend on the facility's Visitor Center. High quality audio visual aids will be used alongside guided tours and a function room for group activities. The center should be open weekdays and accessible by the council, corporate groups, and Doddington residents. Furthermore, accessibility will be of paramount importance to allow all community members to be welcomed.

3.4 The National Grid

3.4.1

For the project to be profitable it is essential that the electrical energy produced by the plant can be sold and distributed to potential clients. Existing power transmission infrastructure must be utilised for this purpose, making the National Grid a key stakeholder. Purchasing the facility's energy will be dependent on a consistent supply and a fair price. While it is possible to integrate fluctuating energy sources into the national power supply - inconsistent renewable sources, for example - a steady flow eliminates the need for potentially expensive energy storage infrastructure.

3.4.2

National Grid operators will not want to add a new power plant unnecessarily. It must be shown that there is a need for expanded power supply in Doddington and its surrounding areas. Given expected population growth, governmental industrial development plans in the

Midlands and North of England, and expansion of an electrified economy, the need for more electricity is clear. Ensuring a fair deal is struck for the purchase of HDL Croft's facility's energy will therefore take precedence.

3.5 Zones under District Heating

3.5.1

The plant will be supplying energy to local industry via combined heat and power (CHP) and an underground pipeline network to achieve district heating. This will provide local heavy industry with a more reliable heat energy source, and also provides the benefit to the plant itself of not requiring the conversion to electrical energy. In turn, a higher overall efficiency through decreased energy losses is achieved. Therefore, the surrounding industries will also have a stake in the plant's energy production and consistency.

3.5.2

During the construction stage, pipelines must be built to distribute the thermal energy to these zones. This construction will cause disruption, as the pipes will likely have to be below ground to remain unobtrusive. These industries should be collaborated with to reduce any inconveniences caused by this process.

3.6 Environment Agency

3.6.1

The Environment Agency periodically sets out the Waste Framework Directive, a series of guidelines for local authorities to follow when developing waste management strategies. It roughly follows the 2008/98/EC Waste Directive set out by the European Parliament [4]. Key items include an obligation by local authorities to dispose of waste in a manner that does not negatively impact the environment or health of local populations. Significant sections are devoted to outlining the handling and costing of commercial waste, something that the facility is not obligated to account for.

3.6.2

It must be clear to the Environment Agency that regulations are followed and best practice undertaken to mitigate any environmental or ecological damage. The inclusion of an Environmental Impact Assessment will be crucial to showing this consideration and obtaining planning permission.

3.7 Construction Subcontractors

3.7.1

HDL Croft has extensive experience delivering exceptional products of a similar scale to Doddington's future EfW plant. Previous endeavours have shown the necessity of subcontractors for bringing expert opinions to the table. It is the policy of HDL to provide the best possible project and understanding when a portion of work should be outsourced to a more experienced subcontractor is standard practice.

3.7.2

HDL Croft's reputation will assure subcontractors of the validity of the project and payment. Significant considerations for these entities will be a profitable contract (for the subcontractor), clear guidelines and fixed targets, and guarantee of work. Strict legal documents and regular quality checks to certify milestones are achieved will cornerstone this effort.

3.7.3

Approval from the council will be required prior to the approval of any subcontractor. Proposals will be evaluated in tandem with HDL and the council to ensure all objectives will be met. It is the responsibility of the subcontractor to provide their own proposal to HDL for any project deemed necessary for outsourcing.

3.8 Existing Waste Collection Contractors

3.8.1

Current waste collection is undertaken by the council. MSW is picked up from local residences and delivered to the landfill for disposal. This arrangement need not change; simply the destination will be altered from the landfill to the new facility once operational. Within this switch waste collectors must be assured of fair compensation; the chosen site is not in a similar location to the landfill and collection/extraction routes will be changed.

3.8.2

Shift times may change - becoming longer or shorter - which may irritate workers. Liaising with the relevant trade union to allow for a smooth transition is necessary. Pay may change due to operating hours differing; any difference must be quantified and agreed upon with workers. Opportunities for professional advancement or retraining must be an option for workers seeking to advance or change their respective employment situation.

3.9 Doddington Recycling Plant

3.9.1

HDL Croft's proposed facility focuses on extracting recyclable materials from the incoming MSW stream and sorting it into different types. It will not have the ability to process those materials in-house. Doing so would require a significant additional capital investment in land, construction, and personnel. Therefore, extracted recyclables will be processed elsewhere; Doddington's existing recycling infrastructure will prove indispensable for this effort. Metals may find an alternative destination as various companies can be contracted to solve this issue.

3.9.2

The key concern for Doddington's Recycling Plant will surround its existing capacity. Based on HDL Croft's projections, the amount of recyclable material sent to the recycling plant will roughly double. Currently ~30% of waste is recycled but improved sorting methods at the proposed facility will push that to ~60% [5]. It is unlikely Doddington alone can handle such a sharp increase, and as such excess sorted recyclables can be diverted to other per-identified sites further afield.

3.10 Blue Phoenix

Leftover material from the incineration process is known as bottom ash and can be repurposed as an aggregate source for the production of concrete [6]. Utilising bottom ash's second life as a construction material removes the need for landfill and contributes to an efficiently resourced circular economy. Blue Phoenix specialises in exactly this process, and HDL Croft will seek a contract to offload solid incineration waste products. Blue Phoenix have processed over 13 million tonnes of incinerator bottom ash already and have proven themselves to be a significant component of the UK's waste management plan [7]. Already having partnered with multiple EfW sites across the country, HDL Croft believes it is feasible to continue this trend at the proposed Doddington site.

3.11 Logistics Subcontractors

Infrastructure is already in place to collect and transport household waste; the destination will simply change from the landfill to the new EfW facility. Throughout construction, operation, and maintenance of the site HDL Croft must have systems and contractors in place to move material when necessary. For example, HGVs will be required to move sorted recyclables from the facility to Doddington's - and possibly other - recycling plants. Additionally, moving bottom ash from the facility to Blue Phoenix's nearest location will require a logistics plan not yet in place. As such, a logistics subcontractor will be required to ensure smooth operation.

3.12 Other Stakeholders

All stakeholders, including those described above and those not, are listed in a Stakeholder Matrix within the Appendix section (12.1)

4 Requirements

4.1 Headline Requirements

4.1.1

Meet future landfill diversion targets; align with national and local waste strategies

4.1.2

Interface with the council's existing waste collection services

4.1.3

Provide a Visitor Centre for use by the Council and the general public

4.1.4

Process all municipal waste within the council boundaries and be responsible for the ultimate disposal of residual materials

4.1.5

Minimise whole-life cost to the council, balancing CapEx, OpEx, and long-term liabilities such as landfill tax

4.1.6

The facility must be robust to future changes in waste figures and policies, implementing a modular design where possible

4.1.7

Ensure the safety of staff, contractors, and the public

4.1.8

Support council objectives for public education and transparency

4.1.9

The proposal must be realistically capable of obtaining planning permission

4.1.10

Stakeholder and facility requirements are listed in the Appendix sections (12.2.1) and (12.2.2) respectively.

4.2 Forecasts and Landfill Diversion Compliance

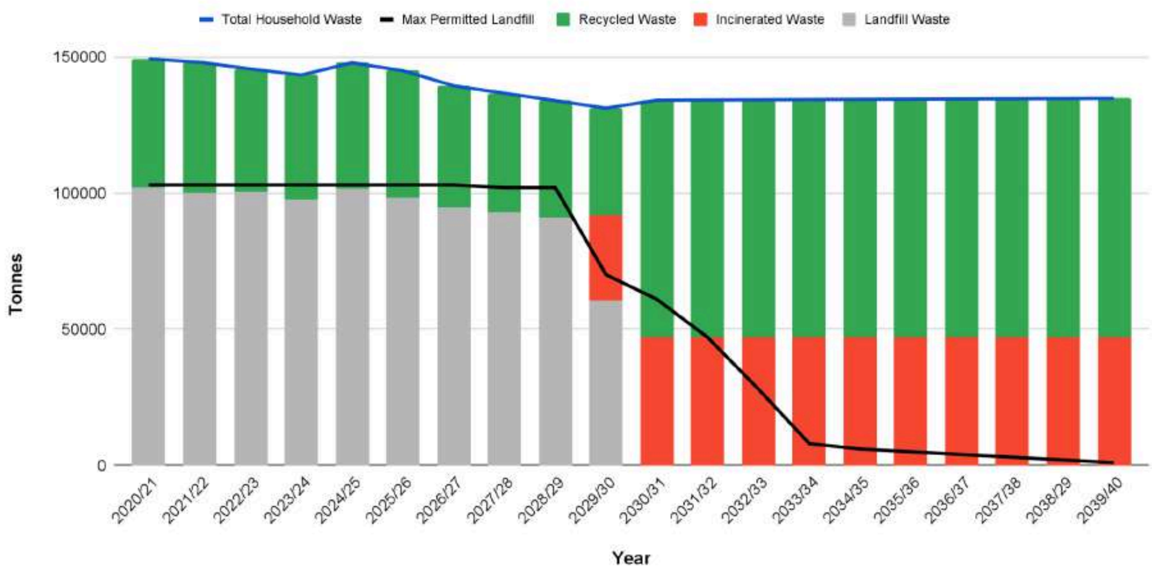


Figure 1 - Projected Waste to Landfill Under HDL Croft's Proposal

4.2.1

The total household waste has been forecasted taking into account birth and death rates, expected outward immigration following national policy shift, and recent waste figures.

4.2.2

The EfW incineration facility will become operational in 2029; 31,250 tonnes are expected to be incinerated by the end of the financial year 2029/30.

4.2.3

Waste sent to landfill is always in compliance with max permitted landfill data provided by the Council [5].

4.2.4

Recycled waste is expected to be maintained at a minimum total rate of 65% for the entire city i.e. including pre-sorted municipal waste at residential homes.

5 Facility Proposal

5.1 Site Choice

Descriptions below explain the justification behind HDL Croft's site choices. Two locations have been identified as suitable, with a clear ranking between them [5][8]. Angry Pool has the most potential and HDL Croft will proceed with developing it. In the extremely unlikely scenario that unforeseen circumstances prevent Angry Pool's development Thiefsmoore will be the alternate option.

5.1.1 Top Choice - Angry Pool

After comprehensive site investigations and surveys, HDL Croft has concluded the Angry Pool brownfield site offers the highest return on investment. Key characteristics set it apart from other options and, while not without drawbacks, proved it to be the correct choice for the facility.

5.1.1.1

Sitting outside the city limits, it proves a waste management facility would be unobtrusive to residents in terms of traffic, visual impact, noise, smell, and disturbance. Furthermore, maps of Doddington show the site is located near other heavy industry plants. Grouping industrial facilities together improves traffic flow and reduces impact on surrounding residential areas. In the case of Angry Pool there are no residential areas within a significant radius.

5.1.1.2

Utilising existing infrastructure including, but not limited to, sewage, water, and electricity connections is a further advantage to building near other industrial sites.

5.1.1.3

Comparatively to other site options, Angry Pool has a low cost per acre. It is the second cheapest option of the five available and, despite demolition and access costs, HDL Croft believes it is cost effective. Additionally, defined costs for demolition of existing structures, clearing, and building of access roads is a bonus. Other sites, such as Startcliffe, have ambiguous requirements regarding derelict buildings and as such may contain hidden renovation and clearance costs. HDL Croft can give a more detailed description of site acquisition costs by proceeding with Angry Pool.

5.1.1.4

Despite Angry Pool sitting outside Doddington council limits HDL Croft does not expect this to be an issue. Site purchase and obtaining planning permission for a significant development such as this facility is often elevated above council level for expediency.

5.1.2 Second Choice - Thiefsmoore

5.1.2.1

Thiefsmoore's river access is a key benefit to the site and allows the possibility for effluent disposal and cooling applications. Close proximity to Trunk Road further develops the location's logistical potential as HGV routes will be simple to implement. While road links remain unclear the short distance from site to main road seen on the map implies a simple connection.

5.1.2.2

Thiefsmoore is listed as a pre-cleared brownfield site. Avoiding possible demolition and clearance - in terms of both cost and time required to complete the task - is a significant benefit.

5.1.2.3

Despite the aforementioned advantages Thiefsmoore sits near to residential developments classed by the council as affluent compared to other parts of the city. Given negative stigma associated with waste management and incineration in particular, this provides an avenue for discontent from residents.

5.1.2.4

Residents living in upscale areas are more likely to oppose the development of HDL Croft's proposed facility. Secondly, Thiefsmoore's cost per acre is more than double that of Angry Pool. Despite the costs associated with demolition in Angry Pool it is more cost effective.

5.2 Design considerations

5.2.1

Financial feasibility is a key consideration in the development of the proposed design. It is essential that the projected finances adhere to the council expectations while delivering long-term economic growth. This balance is achieved through:

- Site selection; acquiring the best available, value-for-money space that is of sufficient size.
- Technology choice; selecting automated, reliable equipment may increase initial capital cost, but the reduction in labour demand and improved recyclate yield provide long-term financial benefit.
- Revenue generation; energy recovery from incineration later sold to the grid also provides a source of income, contributing to an eventual net profit.

5.2.2

The facility design must then be easily applicable to the selected site; modular plant components reduce construction risks and local disruption, and trunk road connections are imperative to ensure efficient delivery and access. It is not only the construction period that requires this level of access, as Doddington waste lorries and potential RDF imports will require constant daily access during the operational phase.

5.2.3

The visitors centre is a key component of the waste management facility, as Doddington Council has presented a strong view on the necessity of public accessibility and education. The integration of this centre must allow the public to view the facility as it operates, providing guided tours and information. However, the design and nature of this feature must simultaneously maintain the level of public accessibility required by the council and provide separate access routes for delivery and staff and emergency services.

5.2.4

In addition to modular implementation and easy accessibility, the proposed concept design must crucially align with the tender goals. A heavy focus on recyclate recovery embeds sustainability throughout the design; an increase in recycling rates equally means a reduction in incineration and consequential carbon emissions.

5.2.5

Facility operation only succeeds with necessary safety measures in place. Compliance with the acquired EA permit and Industrial Emissions Directive safety requirements ensure this is the case [9][10]. The facility must implement shutdown procedures in case of emergency, and protection of the public in a potentially dangerous environment is paramount.

5.2.6

It is also of high priority that the proposed concept design is future-proofed; modular EfW capacity and additional sorting lines allow for adaptation and handling of variations in waste collection. Furthermore, the potential to import RDF to operate at incinerator capacity is a testament to the facility's flexibility.

5.2.7

In summary, the chosen concept must reflect a balanced response to Doddington's technical, economic, and environmental constraints. Affordability and sustainability were central to the decision-making process, leading to a design that is aligned with the council's requirements. In conjunction with the Pugh matrix assessment, found in the Appendix section (12.3) these considerations have been used to select and refine the chosen concept design.

5.3 Construction Plan

5.3.1 Project Timeline

Figure 2 - Modular Format Construction Timeline

The national government immigration policy expected to double construction time has been largely mitigated with extra costs. However, the overall construction time has been largely delayed, with the visitors centre construction expected to be delayed until after the commissioning date.

5.3.1.1

Pre-construction activity is expected to last 18 months with 6 month contingency; this consists primarily of planning and permit acquisition. Planning of district heating pipe network to be prioritised.

5.3.1.2

Construction of the district heat pipe network begins in Q3 of 2026 and runs in parallel with the remainder of pre-construction activity and on-site preparation; to be finished by 2028.

5.3.1.3

Facility construction is expected to commence immediately after site preparation and last just over one year until 2029.

5.3.1.4

Delivery and installation of machinery in the incinerator section of the facility to commence first and become operational before 2030.

5.3.1.5

Sorting machinery and installation follows shortly and operational before commissioning date July 2030.

5.3.1.6

Visitor centre construction takes place after commissioning date and 'Project Completion' is expected to be achieved by June 2031, with latest completion by 2032.

5.3.1.8

All waste will be accepted and incinerated from the start date. Sorting capabilities will be incorporated into the system when they are completed. See Section 5.3.2 for further details.

5.3.2 Modular Build Process

5.3.2.1

HDL Croft is building the facility in a modular format. Units are to be constructed independently and integrated on site where possible.

5.3.2.2

Some parts of the site have the capacity to operate while others are still being built. For example, the visitors centre is to be built after the sorting and incineration processes are commissioned to ensure resources are used to allow the acceptance of waste by the required tender date.

5.3.2.3

Such a method provides the opportunity for additional modules to be added should it be deemed necessary. Regular reassessments of the site's opportunities for improvement will be undertaken to find shortfalls and areas for improvement.

5.3.2.4

Changes in Doddington City population size or needs can be accounted for with appropriate planning and modular expansion at the AngryPool site. All decisions for expansion will be discussed with the council to ensure a shared vision continues.

5.4 Sorting Methods & Recyclables

HDL Croft's vision for this facility is centered around maximizing the volume of input waste that is diverted to recycling centres, allowing for a greener and more sustainable process. This is why our facility has dedicated significant time and resources into refining and perfecting the sorting and pre-sorting stages of our process. An effective sorting process both reduces emissions, fuel consumption, and necessary size of incinerator as well as increasing recycled material.

The full process flow diagram can be found in section 12.7.

5.4.1 Pre Treatment

5.4.1.1

Pre-treatment of the waste stream has major effects on the effectiveness and longevity of the subsequent sorting machines alike; allowing a uniform dry stream to be fed through at a manageable rate skyrockets efficiency and hence possible throughput.

5.4.1.2

Pre-treatment commences as soon as the municipal waste enters the facility where it is held in buffer storage before processing commences. This grants the ability to control when it is to be processed, distributing the delivered waste evenly between then and the next arrivals input.

5.4.1.3

Large items or utilities are manually extracted at this point and moved to their correct locations as these are far too large to be wholly processed by our machines.

5.4.1.4

A bale bin opener is then used to process the black bag waste, tearing it up and revealing what is inside. The choice to employ the use of this machine and not to do it manually is mainly rooted in the safety of the workers, cutting open these bags by hand is a risk that could easily result in injury from sharp or potentially harmful unknown objects spilling out of these bags and causing harm. These machines are of low capital cost (usually around £11,000 - £30,000) and would both automate the process and reduce potential risk so it is a justified investment.

5.4.1.5

The waste then undergoes pre shredding in an effort to make the waste stream more uniform and reduces volume or bulkier problematic objects. This results in a large increase in efficiency and reduced risk of damage to machines further down the line.

5.4.1.6

A dust extraction system is also implemented at this stage as debris/dust or other harmful inhalants could be produced from this process; this reduces the potential risks to health that come with this stage.

5.4.1.7

Convection drying then removes a significant amount of moisture content of the waste objects (to ~20wt%) to again ensure proper optimised operation of the latter machines and a reduction in wasted energy from the incinerator [11]. This process involves the propulsion of heated air over the waste stream in order to dry it out.

5.4.1.8

The waste stream has now been processed enough and is ready to be fed through a hopper into the designed combination of sorting systems where the recyclable materials can be extracted.

5.4.2 Sorting Process

5.4.2.1

The first stage of the sorting process intends to remove metallic components from the stream, first separating ferrous metals and then subsequently non-ferrous metals. Metals are the first to be extracted due to their hard and sometimes sharp nature which could cause damage to later machines.

5.4.2.2

An overbelt electromagnet is used to separate ferrous metals, this is best suited to the job due to its appropriate level of strength and proportional cost and maintenance. This differed from the likes of a magnetic drum separator or crane mounted magnet which are too weak and strong respectively; too weak allows waste to slip through unsorted and too strong creates interference with nearby machines providing no extra advantages. The overbelt electromagnet provides a middle ground between the two machines. Using an electromagnet means it can demagnetise on command, allowing an operator to control this and maneuver the magnet over the ferrous metal collection bin and then return it back to the belt. Due to the in demand nature of metals, the separated metal can be either sent to the recycling centre or sold to third party metal salvagers/buyers in order for them to process it themselves (ensuring sustainability is maintained) and also generating profit.

5.4.2.3

Eddy current separators were chosen for the separation of the non ferrous metals via rapidly rotating magnetic fields. This is the only method for specific non ferrous separation based on its properties, it has moderate strength which is sufficient for its role as the primary metals that it shall encounter will be copper and aluminium - aluminium has a very low density and despite coppers higher density it is mostly used in wiring or other small quantity applications resulting in low mass objects. In the event of a non ferrous metal passing through the system with a mass too high to be extracted there will be a trained worker stationed after this to manually remove it from the stream and place it in the correct location. As with ferrous metals, these can be either sold to a third party or sent to the recycling centre for further processing.

5.4.2.4

The next stage of the sorting process is a ballistic separator, this is a reliable machine that sorts materials based on physical properties such as rigidity and flexibility using a series of paddles on an inclined screen. This is by far the best choice for post metal material separation as it produces three product streams as opposed to the two that nearly all other machines provide, this earlier specialisation enables more tailored following streams facilitating a complete sort quicker and cheaper with fewer machines or stages. Since the ballistic separator sorts by rigidity and flexibility, the common three streams that emerge from it consist of: paper, plastic and film; bottles, cans and hard plastics; and organics, glass and grit.

5.4.2.5

The final stage of the sorting process utilises optical sorters to separate the recyclable constituents of the three remaining streams. Optical sorters use an array of cameras and sensors in combination with AI - this allows materials to be categorised by size, shape, color, and composition. Since the streams have already been split up into similar properties by the bulk separator there is less variation of items so more detailed requirements and filters can be specified which further increases the efficiency of each stream. This system controls a robotic arm which picks the individual items off the conveyor belt and deposits them in the correct location based on what it is. With current trends in the improving technology underpinning AI, new updates will be available to the software and constantly improving it; this is great as improvements can be made regularly without the need for purchase of new hardware or machines making it a very future friendly safe investment.

5.4.2.6

Once the streams have passed through this last station it will be fully sorted and only non recyclable elements will be present for post recycling treatment before it is burnt in the incinerator and converted into energy.

5.4.3 Post Recycling

5.4.3.1

Based on estimates that 80% of household bulk waste can be recycled [12], we will initially aim for 80% of that 80% to be recycled pre-incineration, leaving a maximum of 33% of total input waste given to the incinerator during operation[13].

5.4.3.2

There were multiple options considered regarding the system to transform the non-recycleable waste into a fuel with constant calorific value for the incinerator. The most efficient option would be the creation of RDF - ‘Refuse derived fuel’. The process involves multiple shredders, drying and pelletisation machines to create an almost perfect fuel with constant calorific value. However, this is extremely unaffordable, with cost estimates at roughly £20,000,000. The alternative, a simpler calorific control system consisting of a feedback loop with microwave and infrared sensors is far more cost-effective , and is the system that HDL Croft has decided on [14].

5.4.3.3

Post ballistic separator and optical sorters, the waste will be in three streams, each stream will be made up of different materials, having a different calorific value and moisture content. Highly accurate microwave and infrared sensors will then scan each stream, feeding back the data to an automated CV control system. This system will be manned in a control room, with two skilled workers monitoring the data. Data from the CV control system is then fed back to conveyor belts and hoppers with adjustable speeds, which then accordingly recombine the streams to create a final stream with a constant CV value. This final stream is now suitable fuel to allow the incinerator to operate at a near constant energy input and output.

5.4.3.4

The hoppers each have a throughput of 15 tonnes/hr although only operating on flows of 5tonnes/hr. This allows them to also operate as buffer storage units at this stage. Any excess material surges can also be removed manually and placed into a storage area. The material can later be recombined when its specific calorific or moisture content is required. Finally, the recombined stream passes through a compressor to increase fuel density and flows into the incinerator.

5.5 CHP System

5.5.1 Principles of Operation

5.5.1.1

A CHP System, a common energy source used within District Heating networks, is a method to maximise power generation from a given energy source with leftover heat unused in the steam turbine. This addition leads to far higher efficiencies, increasing a turbine-only plant from 40-50% to 60-90% efficient [15].

5.5.1.2

Heat produced is initially used to generate electricity through the classical steam turbine method. Instead of directly feeding the post-turbine flow stream back into the system it is first passed through a heat exchanger.

5.5.1.3

Heat transferred to the new stream is carried through a network of underground piping to nearby residential or industrial buildings. Climate control systems utilise the high-temperature flow to heat the buildings.

5.5.1.4

The now cooled flow is then recycled back to the plant to be used again. The system is completely circular and does not require a constant material feed input to maintain fluid levels in the CHP system.

5.5.2 Application in Doddington

5.5.2.1

AngryPool - the site of the proposed facility - surrounds existing heavy industry. Hence, this provides a customer base for the facility to supply heat energy to. It is projected that 15MW of energy can be obtained with this system.

5.5.2.2

A new piping system to deliver energy to surrounding buildings must be installed, generating a significant cost. Further details are examined in Section 10: Finances. CHP is a major source of revenue for the facility needed to pay back the Initial Capital Expenditure (CapEx).

A full payback timeline and cashflow analysis is conducted in Section 10, which reveals the impact of CHP.

5.5.2.3

While it is assumed this industry has an existing heating solution HDL Croft believes it can provide a more cost effective alternative. Moreover, further development at the industrial site could commission an additional purpose built extension.

5.5.3 Construction Process

5.5.2.1

HDL croft will fully manage construction of the 3 km CHP pipeline, construction will start prior to plant construction as specified by the project timeline in section 5.3.1

5.5.2.2

The CHP will be built through existing council brownfield sites, with all construction straightforward except for the crossing of Sheffield road. The pipeline will not be dug under greenfield and private land, meaning there is no need for land acquisition and the impact of the construction on the environment is minimised.

5.5.2.3

If authorised by the council, the work on Sheffield road will be carried out in one swift period, with work 24/7 for the necessary period of time in order to minimise disruption. A detailed disruption plan will be made with the highways authority .

5.6 Incineration & Waste Handling

The full process flow diagram can be found in section 12.7.

5.6.1 Energy Generation

5.6.1.1

The proposed Doddington Energy-from-Waste (EfW) facility plans to process 75,000 tonnes of general waste per annum (8.5 tonnes per hour), with an average lower heating value (LHV) of around 8 MJ/kg [16].

5.6.1.2

This equates to a thermal input of approximately 18.89 MW.

5.6.1.3

Taking into account boiler and turbine efficiencies, the facility is expected to achieve a net electrical output of 5-6 MW (25-32% overall efficiency).

5.6.1.4

CHP will account for 15-16 MW (80% efficiency).

5.6.1.5

Total thermal and electrical energy 20-22 MW.

5.6.1.6

Electrical energy sold to the National Grid and thermal energy to the nearby heavy industry.

5.6.2 Incineration Process

5.6.2.1

Compressed waste is delivered to the incinerator from the sorting facility and pushed into the incinerator using hydraulic rams.

5.6.2.2

The incinerator is a moving-grate design, providing uniform mixing and steady burnout.

5.6.2.3

Primary air (60%) enters from below the grate, and secondary air (40%) from above the flame zone; this ensures complete oxidation and turbulence.

5.6.2.4

The flue gas exiting from the incinerator will be maintained at >850°C for at least two seconds before being fed into the boiler to comply with the 'Industrial Emissions Directive (IED, 2010/75/EU)' and the EA permit conditions for waste incineration [17].

5.6.2.5

Approximately 23% mass of the input waste stream will be residual bottom ash requiring water-quenching and then conveyed to the Incinerator Bottom Ash (IBA) storage silos. The bottom ash is then collected by Blue Phoenix for treatment and processing.

5.6.3 Energy Process

5.6.3.1

The hot flue gas leaving the furnace is used to heat the water residing in the boiler (75-80% efficiency), generating saturated steam at 60 bar and 400°C.

5.6.3.2

The steam then drives a turbine (35-40% efficiency) coupled to a 5-6 MW generator, providing energy able to be exported to the National Grid.

5.6.3.3

The turbine exhaust steam is condensed back into water at approximately 40°C in a closed loop.

5.6.3.4

The turbine system integrates Combined Heat and Power (CHP), enabling a much higher efficiency of energy recovery.

5.7 Material Procurement

5.7.0.1

HDL Croft will ensure that during product and material procurement, Doddington City Councils specifications will be thoroughly reviewed, including products and systems that comply with requirements and regulations whilst staying within budget.

5.7.0.2

HDL Croft will use pre approved suppliers vetted by the company to evaluate:

- ➢ Costing of materials
- ➢ Availability of materials
- ➢ Installation and maintenance of equipment and machinery
- ➢ Performance

5.7.0.3

A supplier procurement plan will also be developed to evaluate the feasibility of using each specific supplier. The quantity of both material and product will be assessed to ensure the supplier is capable of delivering the amounts for the plant needed. Delivery dates and potential long lead in times will also be discussed to confirm that wait times for materials will not impact the delivery of the project.

5.7.0.4

Stock availability will be assessed with all materials and products, in addition to reserve options should failure or damage occur in transit or delivery. All products will also meet all current and future legislation ensuring future proofing for whole lifecycle costs.

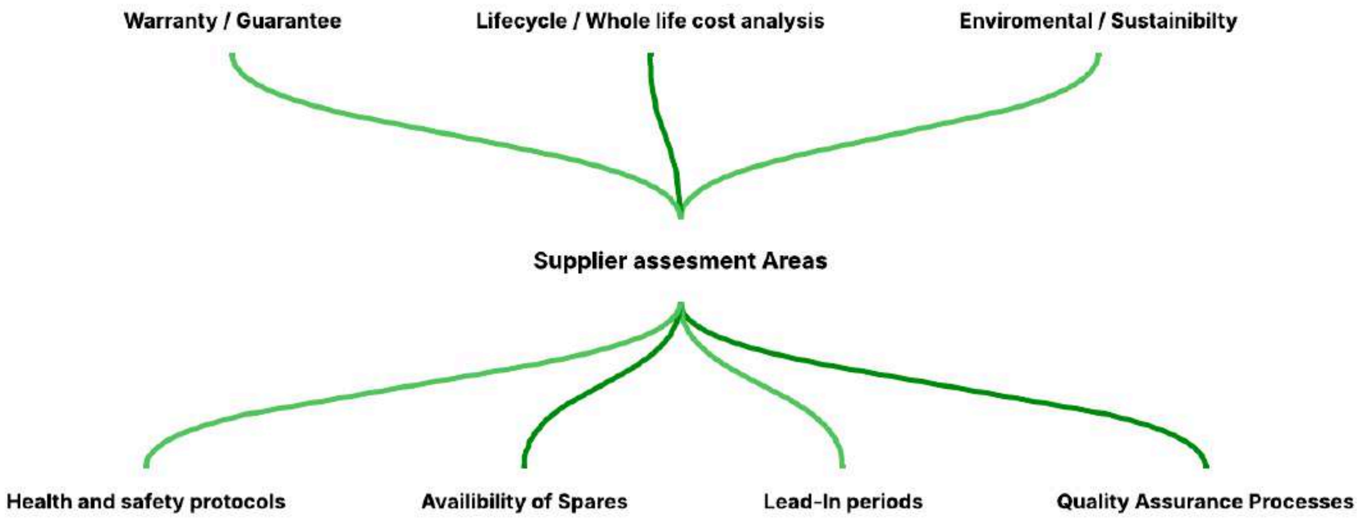


Figure 3: Assessment criteria for each supplier used

5.7.0.5

Pre-procurement HDL Croft will develop a quality management plan, mandating quality checks for all products and materials received during the construction and maintenance of the facility. This will be achieved by comprehensive inspections upon delivery and pre/post installation by a quality assurance (QA) and quality control (QC) team. These teams will also be responsible for the verification of conformity with orders, specifications and certification.

5.7.0.6

All suppliers will be managed to ensure standards are met, requiring all manufacturers and suppliers compliance with criteria set by HDL Croft.

5.7.1 Ethical Standards

5.7.1.1

All suppliers will comply with strict ethical standards, Modern Slavery Act (2015) [18] and the Equality Act (2010) [19], to ensure safe and fair working conditions, and that forced or child labour are not used.

5.7.1.2

HDL Croft will confirm conformity before, during and after all procurement from companies by means of regular audits and verification.

5.7.2 Environmental Standards and Sustainable Practices

5.7.2.1

All suppliers will adhere to environmental and sustainable practices under the Environmental Act 2021[20].

5.7.3 Quality Transparency

5.7.3.1

Suppliers used will be investigated by the QA and QC teams, researching the manufacturing capability and track record from previous projects.

5.7.3.2

Each product will be traceable with material test certificates (MTC) to confirm product reliability and performance. All supplier documentation including quality, traceability, MTC and warranty will be uploaded to a secure system to allow access from both HDL Croft and Doddington City Council should any problems arise.

5.7.4 Health and Safety Standards

5.7.4.1

All suppliers will be vetted to ensure compliance with the Health and Safety at Work etc Act (1975)[21], and must provide evidence of a health and safety management plan. All suppliers will take full responsibility for all health and safety management.

5.8 Visitor Centre

5.8.1 Floorplan and Design

As stated by the invitation to tender, the plant shall have a visitor center that presents information regarding plant operation and its positive impacts on the community in an engaging and exciting manner. The centre will facilitate tours intended for council members, school groups, and other members of the public. These sessions will be accessible between 0900 - 1900 at least once per week.

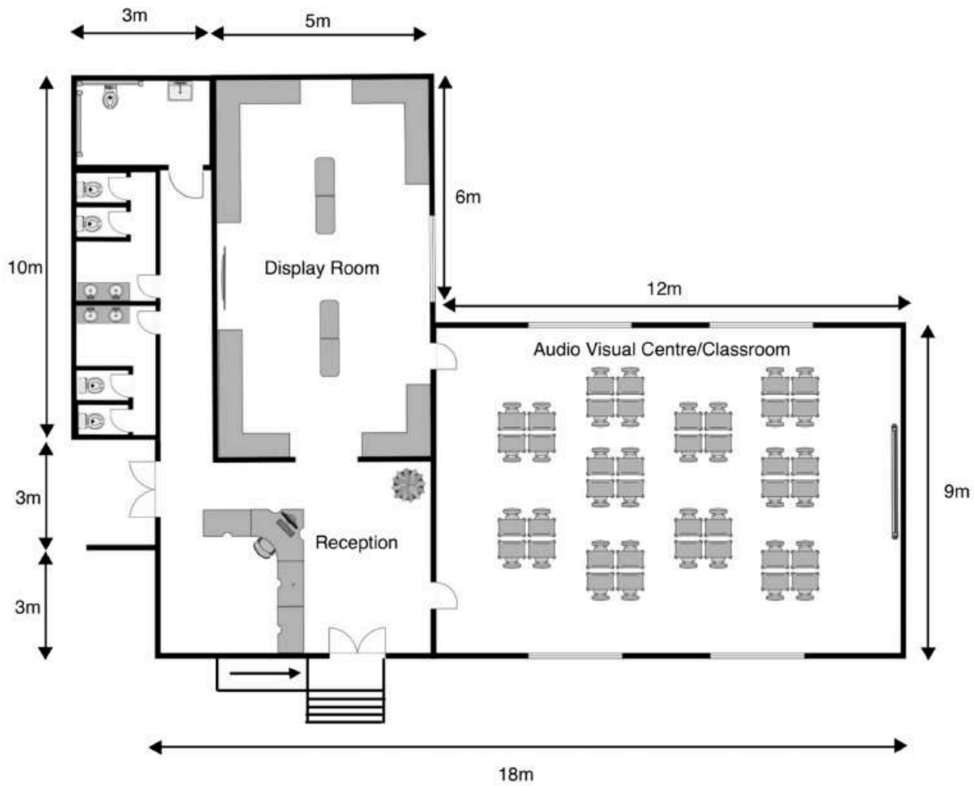


Figure 4: Visitor Centre Floor Plan

5.8.2 The Classroom

The Visitor Centre's hub includes a large multi-purpose room equipped with AV equipment and teaching facilities, dubbed 'The Classroom'. It provides a base for tours, a space to conduct lectures, and teach visitors about the site's operations. A capacity of 40 persons further fulfills the requirements of the council.

5.8.3 The Tour

Tours will be run to inform visitors - students, council representatives, and members of the public - of the site's operations. Group demographic will be considered when delivering the tour; a more professional audience might appreciate a greater stream of information. It shall be a complete loop starting and ending at the Visitor Centre.

5.8.4 The display/ information room

The display room will be available for public viewing as long as the visitor centre is open (0900-1900) and acts as an interactive informational room. Screens and posters will contain relevant information; this supports the tour. Guests will wait in the display room prior to beginning their experience.

5.8.5 Safety

Visitor safety is a key concern. Upon arrival it is imperative that directions for visitors are clear; this will be achieved through a "tramlines" paint scheme to highlight safe walkways throughout the experience. Furthermore, a safety briefing will be conducted before any customer is allowed to begin. Active machines and under construction areas will be highlighted as key no-go zones for viewers along with regular signage to reinforce protocols. Clear emergency exit signs will be posted throughout.

5.8.6 Social Impact and Community Outreach

5.8.2.1

Making a significant impact on the recycling and waste in Doddington isn't just affected by what goes on in the facility. It starts at the grassroots of the community, as educating residents on how and what to recycle is vital. Improvements in household recycling avoids excess energy being used to separate the waste at the facility. This is one of the significant tasks of the Visitor Centre and can be achieved primarily through audiovisual tours capable of providing insight into both plant operations and what visitors can do themselves to work towards a clean, sustainable future. Tours will be open to the public, with school or other clubs/groups as a target audience. Educating the next generation will ingrain positive green behaviour for the future.

5.8.2.2

Leaflets will also be regularly sent to the residents of Doddington in order to grasp their opinions, criticism and feedback on our project as well as a means to keep them informed on this large scale operation. These also include key guidance and advice on household recycling and what they can do to have a positive impact on the world around them. Their feedback will be read and reviewed after every cycle and actioned upon to ensure the project runs smoothly and gels well with the surrounding community and environment to minimise disturbance and pushback.

5.9 Flue Gas Cleaning Process

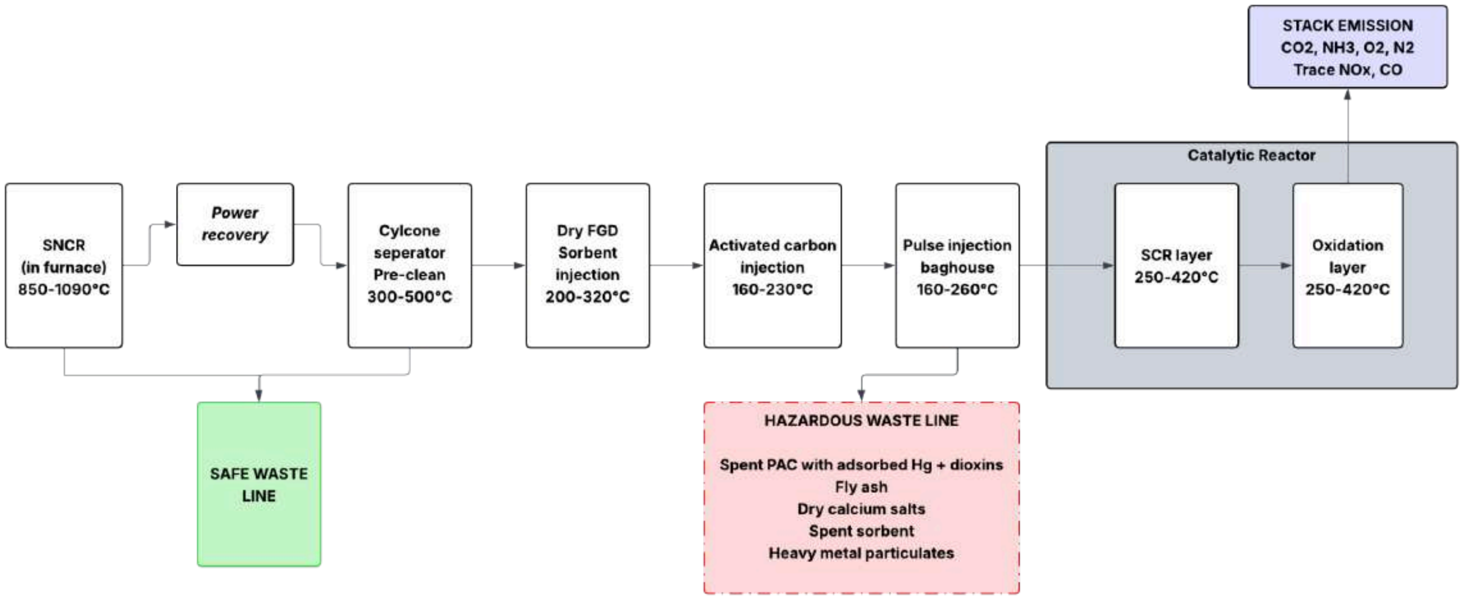


Figure 5: Gas Emission Cleaning Process

HDL Croft commits to an extensive emission cleaning system that will result in all emissions being below regulatory standards for the lifecycle of the incineration plant. The waste streams will be separated into a safe waste line and a hazardous line. The safe line consists of small debris and dust that could cause potential damage to downstream systems and the baghouse. The safe waste line is a very small fraction of total waste handled by the facility and will be disposed of at a landfill facility.

5.9.1 SNCR Injection in Furnace - Primary NOx Removal

5.9.1.1

Selective non-catalytic reduction (SNCR) is the bulk reduction method to cut NOx emissions. NOx is converted to nitrogen in the furnace by injection of aqueous urea, which is converted to ammonia. Excess ammonia will leave as gas emission.

5.9.1.2

Typical SNCR systems in waste management have an efficiency of approximately 30-50% NOx removal [22]. Use of just the SNCR module alone would still result in NOx emissions below the legal limits, however, the council has the option to include an additional SCR module to significantly boost NOx removal rates.

5.9.1.3

Using a hybrid system will allow the plant to reach similar NOx removal percentage rates as using a full SCR system with lower overall reagent use and maintenance.
Both installation and running costs for the hybrid system is significantly less than installing a full-size SCR, due to the smaller catalyst volume and less load on the catalyst. The hybrid system will support fluctuating waste intake, as load on the SCR can increase depending on demand, but on regular days can be used to ‘polish’ any excess NOx not captured by the SNCR.

5.9.2 Cyclone Separator (Pre Clean) - Coarse Particulate Removal

5.9.2.1

Cyclone particle removal systems use centrifugal force to separate larger coarse particles from the gas. This will be used to protect downstream equipment from coarse glass and larger particles that join the gas stream as fly ash.

5.9.2.2

Maintenance required for our main particulate removal system will be reduced as a result of this. Cyclone systems have very low capital investment cost and will reduce risk of other downstream components becoming damaged, such as the catalytic bed in upstream SCR being fouled and having to be replaced. The filtrate from this will join the filtrate from SNCR in the safe waste line to be later disposed of.

5.9.3 Dry Flue Gas Desulfurization - Sulfur and Acidic Compound Removal

5.9.3.1

Dry Flue Gas Desulphurisation (FGD) will be used to cut sulphur emissions throughout operation. A powdered alkaline sorbent is injected into the flue gas, leaving solid by products such as calcium sulfate which will be collected in the primary particle removal with 80% efficiency.

5.9.3.2

Although using a wet or semi-wet FGD method would result in >90% efficiency, dry FGD methods still have comparable efficiency when handling waste with low sulfur content, which should coincide with the heavy sorting approach used in the facility. Additionally, dry systems have significantly less water consumption, smaller footprint and reduced capital and running coasts, indicating this is the favourable option over a wet/semi-wet FGD system.

5.9.4 Activated Carbon Injection - Mercury and Dioxin Removal

5.9.4.1

Activated Carbon Injection (ACI) will be used to reduce mercury emissions in the plant. Mercury molecules will adhere to the surface of activated carbon particles and then be filtered out during the primary particle filtration.

5.9.4.2

Research from the ICAC Mercury Control Technology survey indicates an injection of activated carbon upstream from a particulate filtration system has demonstrated mercury removal efficiencies between 80-95% [23]. Although mercury levels in MSW vary, heavy sorting will lead to reduced levels of mercury in the incinerated waste, meaning smaller ACI doses will be required to target this removal efficiency.

5.9.5 Pulse Jet Bag House Filter- Primary Particle Removal

5.9.5.1

Pulse jet baghouse filter systems are key parts in most modern EfW air pollution control systems. Short, high pressure air pulses knock off accumulated fly ash and particulates from bags without interrupting gas flow. They offer high efficiency for various particle sizes and reduced maintenance frequency due to automated cleaning.

5.9.5.2

Bags will require little maintenance, only needing changing every 1-3 years [24]. Due to the nature of our process and protection gained from including the upstream cyclone separator, bags are expected to require replacement towards the upper end of this range. The baghouse will be equipped with leak sensors to detect broken bags and differential pressure gauges for real time monitoring, allowing technicians to know when filters are blinded and require change

5.9.6 Catalytic Reactor (Optional)

5.9.6.1

The catalytic reactor module is proposed as an option to the council if they wish to increase the budget to commit to the best environmental performance. The reactor consists of 2 sections which should sit in the same housing, as they both operate within similar temperature ranges and must both be positioned downstream from the major filtration systems as they require a clean, non-acidic gas intake. This dual layer reactor is common in advanced air pollution control systems.

5.9.6.2

This proposed step will heavily reduce all emissions to far below regulatory standards.

5.9.7 SCR Catalyst Layer - Secondary NOx Removal

A smaller selective catalytic reduction unit would make up the 2nd half of the hybrid NOx removal system if included. SCR systems have much higher NOx removal efficiencies (>90%) [25]. A smaller SCR used in conjunction with the main SNCR will lead to greater flexibility, where the SCR only needs to 'polish' NOx levels when the plant is operating at greater demand to meet regulations.

5.9.8 Two Way Catalytic Converter Layer - CO and VOC Removal

Carbon monoxide and hydrocarbons will be converted to CO2 and water vapour, which will exit into the stack with the gas emissions.

5.9.9 Commitment to Sustainability

The final section of the flue gas treatment process, the 2 layer catalytic reactor, is optional. Including the module would result in very low CO, VOC and NOx emissions which would significantly beat legal standards and would ensure the best environmental performance even during unstable periods. It would also protect the council from future risk if emissions regulations become stricter over the next 25 years. However, adding the catalytic reactor is not cheap and has a significant effect on both the OPEX and CapEx. During operation, catalysts within the vessel require replacement every 3-5 years. An additional gas reheater must also be included after the baghouse filter to ensure intake gas is safely within the operating temperature range of the catalytic reactor. Many EfW plants of similar size do not include additional NOx and CO polishing systems, as the SNCR will ensure NOx emissions remain below regulation limits most of the time. Good combustion control in the incinerator will mean most VOCs and carbon monoxide are fully oxidised before they leave the furnace. Therefore the catalytic reactor module is an optional improvement if the council justify its long term environmental priorities over the increase in expenditure.

5.10 Hazardous waste line management

5.10.1

Fine particulate material collected from baghouses is classified as hazardous APC residue by EWC 19 01 07 [26], and therefore must be managed carefully and under strict regulation.

5.10.2

Residue discharged from baghouse hoppers will be transferred to dedicated concrete silos designed specifically for APC storage via pneumatic transfer to ensure there is no open transfer of hazardous material. Each silo will be labelled as hazardous APC residue, and fitted with pressure and temperature monitoring systems and filtered vents to reduce the risk of explosion.

5.10.3

The site will have capacity to store silos for up to 3 days before being transferred to a licensed hazardous waste management contractor. HDL Croft will work with regional companies to ensure APC residue is neutralized off site and converted to inert material suitable for reuse in cement/ concrete products. This approach will ensure hazardous by-products are converted into reusable material and landfill disposal is minimised.

6 Sustainability

6.1 Health impacts

During the design of the facility, HDL Croft prioritised minimising potential negative health impacts to both site operatives and the surrounding community. Key health risks have been identified in the Appendix. A range of comprehensive control measures will be implemented to reduce risk of any negative health impacts, described below.

6.1.1 Complete Combustion

HDL Croft's facility employs modern moving grate incinerator technology, operating at temperatures ~850°C. The system's feed and extraction speed ensures waste is completely combusted and breaks down volatile organic compounds and long chain hydrocarbons. Furthermore, the system prevents the formation of similar harmful compounds.

6.1.2 Safety Procedures

6.1.2.1 Extensive flue gas cleaning process

All pollutants and particulates will be reduced to trace amounts well below regulation emission limits during the cleaning process. This means the emissions from the plant will have little to no effect on local air quality.

6.1.2.2 Closed hazardous waste handling

APC residue will be moved into dedicated storage silos via pneumatic transfer in a fully closed system. This approach eliminates open handling and operator exposure to the hazardous waste and prevents contamination of the surrounding environment.

6.1.2.3 Continuous Emissions Monitoring (CEMS)

Key pollutant and particulate emission levels will be regularly monitored. CEMS data shall be reported annually and published publicly to maintain public transparency.

6.1.2.4 Regular maintenance and inspections

Routine inspections and maintenance of all systems will ensure consistent safe operation and quick detection of component failure/ leakage.

6.1.2.5 Emergency Procedures

Controlled shut down procedures and alarmed leak detection systems will be in place in the event of abnormal and potentially dangerous readings. This ensures quick contaminant isolation leading to minimised potential exposure.

6.1.2.6 Employee training

All staff involved in waste handling will receive regular training in safe practice and emergency procedures. Employees involved in waste handling will be issued PPE and have regular health checks

6.2 Environmental Impact Assessment

This environmental impact assessment (EIA) presents HDL Croft's mitigation and prevention techniques for the construction and operation of the proposed incinerator plant at Angrypool. This has been prepared in accordance with the relevant environmental agency regulations and technical recommendations.

6.2.1 Screening Process

6.2.1.1

Initial assessment**:** When a developmental proposal is received, it undergoes a preliminary assessment to evaluate its characteristics and potential environmental impacts. This assessment is based on established screening criteria, which may vary by jurisdiction.

6.2.1.2

Categorisation - Projects are typically classified into categories based on their potential environmental significance. For example, Category A projects, which are likely to have significant impacts, automatically require a full EIA, while smaller projects need only minimal assessment.

6.2.1.3

Consultation - The screening process often includes consultation with relevant authorities, stakeholders and communities to gather input and ensure all potential impacts are considered.

6.2.1.4

Decision making - The outcome of the screening process determines whether a full EIA is required, a simplified assessment is sufficient, or no further assessment is needed at all.

6.2.1.5

In each of these cases, an EIA is needed to meet current environmental policies and local and national planning frameworks.

6.2.2 EIA Requirements

6.2.2.1 Thermal Power Plants

Thermal power stations and other combustion installations with a heat output of 300 megawatts or more require an EIA in all cases. As a moving grate incinerator is being used, expected heat output is expected to be roughly 18.9 MW, so the EIA does not need to consider the thermal output of the plant.

6.2.2.2 Construction of Purpose built road

Construction of a road with 4 or more lanes, or widening of an existing road to provide 4 or more lanes requires an EIA in all cases. As the site at Angrypool requires the construction of a purpose built access road from Sheffield Road for frequent use of HGVs, this criteria should be considered.

6.2.2.3 Large waste installations

Waste installations for the incineration or chemical treatment of non-hazardous waste with a capacity exceeding 100 tonnes per day need an EIA in all cases. As the expected capacity is ~200 tonnes per day, a full EIA considering the waste treatment aspect of the facility will be needed.

6.2.2.4 Construction of overhead power lines

Construction of overhead electrical lines with a voltage 220 kV for more than 15 km need an EIA in all cases. HDL Croft will be exporting energy generated to the heavy industry within the area, hence overhead electrical lines will need to be constructed from the plant. The environmental impact of this construction will need to be assessed throughout the building procedure of the plant.

6.2.3 Scoping Process

6.2.3.1

HDL Croft will commence the completion of a complete environmental scoping survey of the Angrypool site to highlight any constraints that the project may have - both environmental and site specific. This will ensure that all environmental and site specific concerns are highlighted and addressed in accordance with all relevant environmental agency regulations. The objectives of this scoping are as follows:

6.2.3.2

Identify all environmental receptors on site to ensure the appropriate mitigation can be carried out

6.3.3.3

Highlight any physical, ecological or biological contamination risks that may hinder the construction of the site. Construct baseline environmental data to support the EIA and Construction Environmental Management Plan.

6.3.3.5

Surveyors will identify key factors of the surrounding area, such as: Air Quality, Water Resources, Wildlife Habits, Noise levels, Soil Conditions.

6.3.3.4

This will ensure that should any of these factors fall below the level expected by the relevant environmental regulations, HDL Croft can put in place the necessary mitigations to adhere to the policy.

6.3.3.5

HDL Croft also recognises the importance of consistent and regular stakeholder consultation throughout the construction and operation of the waste management facility. Frequent targeted consultation sessions with major stakeholders will ensure that all relevant local environmental data is confirmed and accurate, any environmental concerns are identified and the list of environmental data to be focused in or out of the EIA is confirmed.

6.3.3.6

Frequent meetings after initial sessions will ensure that any periodic updates on environmental considerations are conveyed to both HDl Croft and the stakeholders.

6.2.4 Impact Assessment and Mitigation

6.2.4.1

HDL Croft will use a systematic approach to assessing and mitigating environmental issues that arise after scoping the site. This aims to address all major environmental impacts before the commencement of construction of the waste management facility.

6.2.4.2

Each potential effect is evaluated in terms of:

- ➢ Magnitude of impact;
- ➢ Sensitivity of receptor;
- ➢ Probability of occurrence;
- ➢ Permanence of the effect.

This significance will then be evaluated in terms of severity and likelihood.

Severity	**Description**
Negligible	Below detection thresholds
Minor	Small effect that does not exceed regulations
Moderate	Mitigation is required to meet regulations
Major	Significant effect requiring redesign to meet regulations
Severe	Unacceptable impact that may prevent the construction of the plant without intervention

Table 1: table of severity used in evaluation

6.2.4.3

The key impact areas that HDL Croft will assess will be:

- ➢ Emissions of the construction and maintenance of the plant;
- ➢ Noise and vibration that may occur during the construction and operation of the plant;
- ➢ Local water environment and drainage systems;
- ➢ Biodiversity of the chosen site;
- ➢ Visual and landscape impact.

The appendix contains a table of all potential pollutants that will be considered (12.1.9), as well as the mitigation that HDL Croft will use to ensure they do not breach regulatory standards.

6.2.4.4

During transient conditions, combustion profiles and emission data can vary. To try and mitigate this, HDL Croft will implement the OTNOC management plan aligned with the Best Available Technique environmental reports (BAT), ensuring continuous CEMS operation. HDL Croft will ensure that early abatement systems are in place, as well as training for early intervention should OTNOC occur.

6.2.4.5

The facility's emergency response plan will ensure that the activation of any emergency valves or unplanned shutdowns are investigated, documented and reported in compliance with the environmental agency's permit conditions. These preventative measure plans ensure that the emissions of the plant during OTNOC are minimised and still fall within the amount allowed by the relevant regulations.

6.2.4.6 Noise and Vibration

A noise and vibration plan will be developed and implemented based on BS 5528 and BS 4142 regulatory requirements. This will be combined with a pre construction noise baseline study of the local area to ensure that the noise level does not exceed stakeholder agreed levels and maintains compliance with the local authority. Continuous monitoring of noise and vibration levels will also be undertaken at periodic intervals of the project's duration.

6.2.4.7 Local water environments

Installation of sealed drainage systems to prevent surface runoff and groundwater contamination. This will be combined with an emergency spill response, as well routine inspection of the site by the site environmental coordinator.

6.2.4.8 Biodiversity and Ecology

To help manage the environmental aspects of the site, an appointment of an Ecological Clerk of Works will be hired to oversee the protection of habitats within the proposed site. They will be responsible for the mitigation of any moderate or greater effects that are highlighted as to minimise disruption to the local biodiversity environment, as well as the assessment of the Angrypool site to investigate whether SSSI status can be applied.

6.2.4.9 Visual and Landscape impact

To ensure visual impact of the plant is minimal, the stack of the incinerator will be designed to not protrude the skyline of the local area. Odours from the plant will be removed by using a chemical treatment wash on the MSW stream. A negative pressure environment will also be used to prevent dust and odour leakage.

6.2.4.10 Hiring Commitments

HDL Croft will also commit to the hiring of multiple officers to assist in the maintaining of strict environmental standards.

- ➢ An Environmental Manager will be assigned to the project.
    - ○ This employee will be responsible for the implementation of the environmental management system. This will include constant

communication with the local authority and all relevant stakeholders, as well as managing the monitoring of data and compliance reports.

- A Site Environmental Coordinator
    - Responsible for the daily inspection of the worksite to assess control measures and mitigation standards.
- An Ecological Clerk of Works
    - Ensure legal compliance with all works within the proposed site
- Independent Auditors
    - Recurring audits to confirm compliance with all relevant regulatory standards.

Further information on the annual cost to HDL Croft this generates is included in the appendix.

7 Waste Collection Integration and Diversion Strategy

7.1 Continuity of Existing Collection Services

The facility is designed to integrate seamlessly with Doddington City Council's existing waste collection services. This ensures continuity of service for residents and commercial waste producers through operation. All waste collection services will continue to operate on the same days as those prior to facility commissioning.

7.2 Transitional Arrangements

7.2.1

During the construction phase, all collected municipal solid waste will continue to be directed to the council's existing waste management outlets under current contractual arrangements.

7.2.2

HDL Croft will work in coordination with the council to implement a phased transition as facility operationality is approached, ensuring no disruption to collection schedules or reliability

7.2.3

Contingency arrangements will remain in place to divert waste to alternative facilities in the event of commissioning delays

7.3 Waste Diversion during Steady-State Operation

Once operational, all contract waste collected by existing services will be delivered directly to the HDL Croft facility. No changes to existing household separation methods are required, ensuring minimal disruption.

8 Planning Permission

It is essential that the proposed incineration plant within Doddington adheres to all relevant local authority planning policies. To ensure this, HDL Croft will certify that throughout construction and maintenance of the plant, the following criteria will be met:

8.1 Plant Location

8.1.1

Local traffic will not be disrupted;

8.1.2

Purpose built access from Sheffield Road able to support the HGVs traffic;

8.1.3

The scale of operations and visual intrusion within the local area will be minimised to reduce any public concern of the construction of the plant. HDL Croft will routinely conduct community consultations to address apprehensions;

8.1.4

The location of the facility will be designed to ensure minimal losses when exporting energy to the national grid, ensuring cheaper energy for the residents of Doddington;

8.1.5

The site will be assessed before construction starts to ensure the protection of any endangered species on site.

8.2 Environmental Standards

The plant will ensure environmental standards are met during construction and operation. The EIA discusses in detail the following ideas:

8.2.1

Dust and odor will be reduced by ensuring all operations occur under controlled conditions indoors;

8.2.2

The facility will adhere to all relevant emissions guidelines during construction and operation, further discussed in the EIA;

8.2.3

The plant will have a negative pressure environment powered by air demand of the combustion process;

8.2.4

The plant will have an comprehensive air ventilation system;

8.2.5

HDL Croft will undertake a noise impact assessment and develop solutions to mitigate noise disruption to nearby residents.

8.3 Vermin and Pests

8.3.1

The plant will ensure vermin and pests are controlled to avoid disruption of facility operations or the local area;

8.3.2

Best practice in waste tipping and storage areas will be adhered to during the operation of the plant to prevent attraction of vermin;

8.3.3
Litter on site will be reduced by ensuring that transport vehicles are covered;

8.3.4
Employees will receive training in waste handling and containment procedures.

8.4 Water Usage and Effluent Management

8.4.1
Any and all effluent generated during plant operation will be collected and disposed of in compliance with environmental regulations;

8.4.2
All bottom ash produced in the incinerator will be subcontracted to Blue Phoenix to be safely repurposed into construction aggregates;

8.4.3
Contamination of surrounding areas by surface runoff will be minimised with a dedicated drainage system on site;

8.4.4
An all-encompassing water management plan will be developed to guarantee protection of local water resources.

8.5 Design and Visual Impact

8.5.1
HDL Croft will ensure that the design of the incinerator matches the local style of architecture to not appear as an eyesore;

8.5.2
HDL Croft will ensure that the height of the stack of the incinerator will be limited to the skyline of the local area while still performing its role effectively.

8.6 Public Concerns

8.6.1
The plant will address public concerns**,** including submitting an environmental impact assessment as part of the application process;

8.6.2
A comprehensive public consultation process will be conducted to ensure that local residents, business and stakeholders are engaged;

8.6.3
Throughout construction and operation processes HDL Croft will address any and all concerns to build public trust and support.

9 Risk Management

9.1 Construction & Operational Risks

Key risks to site construction and operation are explained in detail below. The appendix section (12.4) contains a comprehensive Risk Register which labels the severity of each risk while summarising mitigation measures.

9.1.1.1

Construction of the whole facility carries risks for some of the stakeholders involved. The strict regulations used for similar sized building sites around the UK will be used in this project.

9.1.1.2

As explained in the risk register, the only construction hazards for the site which may require further health and safety planning prior to operation are the movements and installation of the high-voltage machines and the construction of the tall exhaust chimney.

9.1.1.3

The hazards associated with the high-voltage machines and chimney are unique to the site, so a specialised health and safety coordinator will be hired to plan and maintain strict standards and develop thorough plans for the construction of these areas.

9.1.1.4

HDL Croft considers problems with the incinerator and sorting systems as the most significant operational running risks. Ensuring that the fuel flow into the incinerator has constant calorific value is of paramount importance for site safety.

9.1.1.5

In order to alleviate concerns of combustion instability, two highly skilled control system and process engineers will monitor the input flow at all times. There will also be safety measures in place to abort the flow if a surge in fuel energy is detected. All machines used in the waste streams will be brand new and optimised for use on the site, employees will also be trained thoroughly on the machines for one month prior to operation.

9.1.1.6

Operational risks are not limited to safety. Another key risk is machine failure causing an overflowing backlog of waste. HDL Croft is aware of the average specific downtimes for the components of the system as shown in Figure 8. To combat this, there is a large amount of buffer storage at multiple stages through the system.

9.1.1.7

The system has been designed to handle a 15tonne/hr throughput when the worst possible on average needed throughput is 12tonnes/hr. This allows the system to operate at a significantly increased speed to catch up on backlogs when for example a machine has broken down.

9.1.1.8

Additional waste taken through the gate free from private sources will be assessed for toxic materials to prevent machine failure. The waste will only be processed if it is similar in composition to normal municipal household waste, and will only be taken from trusted sources.

9.2 Disaster Recovery Plan

9.2.1 Protester Action

9.2.1.1

Energy from Waste sites often are mired by poor publicity. Stigma surrounding incineration and an emphasis on air quality risks can elicit opposition from local residents. A proposed EfW plant in Wiltshire faced years of sustained messaging and anti-incineration campaigns prior to construction. Protests against EfW sites are not uncommon and HDL Croft must be prepared to deal with such actions.

9.2.1.2

Alleviating the concerns of the community must be a top priority which can be achieved through consultations and community involvement. Utilising 'Town Hall' discussion formats in which HDL Croft and Doddington Council Representatives field questions from residents will allow issues to be addressed and key concepts about the site to be clearly explained. Furthermore, HDL Croft will provide full transparency of environmental performance to ensure local residents are informed and confident in the performance and operation of the plant. This will include annual publication of emissions data with accessible summaries detailing how emissions are below regulation thresholds. This reinforces HDL Croft's commitment to provide a plant with the best environmental performance.

9.2.1.3

In the event of organized protest action, operations will continue as normal where possible. HDL Croft will engage directly with the council and leaders of protester organizations, offering opportunities for discussion to try to come to an agreement. Multiple measures will be employed to prevent unauthorised persons gaining site access in order to ensure complete safety of all site personnel. A fence will surround the entire Angry Pool site at a minimum height of 8 feet. A top layer of spikes will further prevent intruder attempts. Comprehensive CCTV systems will be placed throughout the site to monitor and record the perimeter. Finally, an on-site security time will be employed at all times, able to respond to threats.

9.2.2 Natural Disasters

9.2.2.1

Although Doddington is not at risk from major natural disasters such as seismic activity or coastal hazards, it is at risk of flooding. A large river flows directly through Doddington city centre and the city's location, surrounded by hills, naturally increases its chance of flooding. With climate change giving rise to more unpredictable and harsh weather conditions, the likelihood of future flooding will increase, with events becoming more frequent and severe.

9.2.2.2

HDL Croft will make it a priority to ensure the waste management plant is well equipped to operate safely in the event of a severe flood. Any areas containing chemicals or hazardous residues will be constructed with impermeable bases to prevent the release of potential contaminants. APC residue silos are fully sealed and will be stored in an area at a low-risk of flooding. The site will include segregated drainage systems to make sure any potential contaminated run off is contained and does not come into contact with the surrounding environment. Critical infrastructure will be elevated or protected where necessary. These measures will minimize plant downtime in the event of a severe flood and ensure maximum safety of all those who could be potentially affected.

9.2.3 Major fire

There are multiple possible sources providing risk of a fire within the plant, mainly the incinerator itself, machine failure and any electrical devices. Regardless of the source of the fire the response of the plant and staff is largely the same.

9.2.3.1 Standard fires

The majority of fires within the plant, such as standard electrical fires, will have the same response system. Plant staff will be drilled on a standard procedure to evacuate to the fire assembly point in the car park and are then counted to check no one is still in the plant. A sprinkler system and smoke alarms will also be installed across the plant in an attempt to prevent smaller fires from growing to a major scale and causing significant damage. This is complimented by the standard distribution of fire extinguishers in employee areas to allow immediate response when it is possible.

9.2.3.2 Incinerator risks

The incinerator is an obvious potential source of fire as it would consistently be burning waste to remain effective. Designed with these risks in mind, the incinerator has a very low chance of failure or combustion, however due to the magnitude of the potential damages they should be prepared for. There is always a risk of malfunction of the component machines which could potentially lead to the input or output systems releasing enough heat to cause a fire beyond its fire proofed limits. Although less likely, there is potential that the insulating shell of the incinerator could be damaged and release significant amounts of heat to the rest of the plant. Similar to this, the following components that deal with the high temperature steam output also have potential to release their heat improperly in a manner that would cause a fire.

9.2.3.3 Incinerator response

The incinerator is under constant human surveillance from the control room in the reactor building as well as automated checks by a system of sensors and computers (5.4.3.3). This means that if the containment of the incinerator becomes compromised, response can be initiated as quickly as possible. The system will be stopped, stopping the amount of fuel input to the incinerator and a deluge system will be in place in an attempt to stop or at least reduce the size of the fire.

9.2.3.4 Material Storage

Dangerous materials are separated out in the sorting system meaning there is little chance of chemical reaction causing ignition elsewhere in the system. The large waste storage areas are also a potential fire risk as they have potential to self heat and if they do catch fire, from whatever source, they will burn for an extended period of time. Because of this they are spaced out from one another and contained in separate buildings to the components dealing with heat. The silos will be enclosed anyway to reduce particulates and smells moving across the plant, but this also ensures that none of the smaller fires pose a threat to their ignition.

9.2.3.5 Further Considerations

External sources of fire have also been considered but these cannot be mitigated as such and the response for plant and staff remains the same. The only scenario in which the protocol changes is if the fire assembly point is at risk itself and the incident fire on the plant is so large or located at the assembly point that the workers must be evacuated further away.

9.2.4 Serious data security breach

9.2.4.1

The proposed plant relies on many digital control and monitoring systems to ensure safe and efficient operation, for example many of the flue gas treatment systems, CEMS and other process control systems all have heavy reliance on digital control. Recent cyber security incidents involving other critical infrastructure systems show EfW facilities may be considered attractive targets for attackers due to their critical role in waste management operations. While the actual likelihood of a serious data security breach affecting the Doddington facility is low, the severity of the potential consequences mean comprehensive mitigation measures must be in place.

9.2.4.2

HDL Croft will use complex cyber security methods to limit access to critical operational systems and isolate them from other networks in the plant. Control engineers are on site to constantly monitor operation and have the ability to manually override key systems in the event of digital system malfunction. All systems will remain protected by independent safety systems and physical safeguards.

10 Financing

10.1 CapEx Requirements

An initial estimate for the Capital Expenditure (CapEx) of the project was estimated using the six tenths rule, using data derived from multiple current Efw facilities in the United Kingdom, selected for their similarities in equipment and operation. Upon obtaining this general estimate, adjustments and scaling were applied to the outputted result as a consequence of the government's plan to implement their anti-immigration policy.

10.1.1 Six-tenths Rule

The formula for the six-tenths rule can be seen below; the exponent typically used to model economy of scale for waste processing facilities is 0.6 so has been selected for this purpose. It is a generalised initial evaluation of CapEx that usually carries an uncertainty of $\pm 30 - 50\%$, qualifying its use as a ballpark estimate. Further, more detailed breakdowns with better methods are detailed below, and validated as within range.

$$C_2 = C_1\left(\frac{S_2}{S_1}\right)^{0.6}$$

A calculated value of 165,000 is used for processed tonnage per year, S_1 is used for the proposed Doddington facility.

Facility	Commision date	Capital investment (£Million)	Capital investment (inflation adjusted), C_1 (£Million)	Tonnes Processed per year, S_1	Calculated C_2 value (£Million)	Adjusted Final C_2 value, (£Million)
Allington Quarry Management Facility	2005	150	286	325000	190.40	266.56
Leeds Recycling and energy recovery facility	2012	140	212	215000	180.90	253.26
Glasgow RREC plant	2019	154	186	200000	165.90	232.26

Table 2 - Reference Facilities Used in Calculations

These calculations were performed for three similar uk based plants, outputting a mean value for CapEx of £179.1 million. However, due to the soon to be implemented immigration policy a scalar value of 2.5 must be applied to the construction labour portion (20%) of these predicted values. Scaling by 2.5 produces a realistic estimate of increased costs. With values for design and contingency also scaling accordingly, a final value for CapEx predicted by the six tenths rule was £250.69 million. Due to the trend in cost decreasing with time and the proposed plants significantly lower percentage of waste incinerated, the detailed cost estimation found in Section 10.1.2.1 predictably sits below this value but within its uncertainty range.

10.1.2 Cost Breakdown

10.1.2.1

Through the later discussed methods, an accurate final value for CapEx of £212 million was obtained, with contingency built into all individual aspects of the cost.

10.1.2.2

Upfront cost of each constituent plant unit does not consider transportation, installation, connection, and more 'secondary' costs. A Lang Factor is a scaling factor applied to some equipment price tag x to estimate its additional hidden costs. A Lang Factor is traditionally applied to the entire project's costs.

10.1.2.3

HDL Croft will instead, to estimate the cost of its equipment, use a 'Lang-style' factor applied to each individual equipment piece denoted as the *Installation Factor*. This ensures a more accurate and tailored costing projection; the Equipment Cost Table in the Appendix displays all relevant items and associated installation factors.

10.1.2.4

Using this method, it is estimated a total of £110 million of CapEx is required for the purchasing and installation of equipment.

10.1.2.5

A complete CapEx breakdown chart exists in Figure 14 in the Appendix, displaying the proportion of funds spent on each aspect of the construction and commissioning phase.

10.1.2.6

It is important to note that **10**% of the budget (£**21.2** million) is earmarked as contingency funds able to cover design changes and support construction should unforeseen issues arise. Supply chain issues, extended construction time, flooding, and more are examples of possible problems.

10.1.2.7

Government immigration policy is factored into the CapEx estimation. While it is entirely possible that barring of foreign nationals from UK soil is vetoed in Parliament, HDL Croft is planning under the assumption that it will come into effect and will have a policy stress-test during the tender period. Should it not become law, costs and construction time will fortunately drop.

10.1.3 Raising Funds

10.1.3.1

A 'payback timeline' style analysis was conducted and is outlined in Section 10.3.4: Cumulative equity cash flow graph, due to the profit sharing mechanism in place it does not fit a traditional payback model, it instead shows equity recovered and gained annually. A corporation tax and depreciation inclusive profit and loss analysis of the first 13 years (until year on year stability is reached) was conducted. This showed that, through the staggering of costs, it is estimated that £120.5 million will need to be raised through an initial private financing round on top of an initial £10 million capital input from HDL Croft. Associated expenses and annual allocation of cost is available in the Appendix to justify this investment.

10.1.3.2

Projected annual investment from private sources is displayed through Figure 16 in the Appendix. This decision on the payment structure was made as a result of the distribution of required capital forecast by the annual cash flow projections and profit & loss table (seen in Table 21 and Table 24 in the Appendix) over the construction period.

10.1.3.2

Under the rules of a PFI Scheme (dictated by the council as the required payment structure) no debt can be taken on by the council. Therefore private partners - such as GB Energy, the state-owned energy operator actively looking to invest in projects such as this one - are being explored as potential partners to join a HDL Croft led investment consortium.

10.1.3.3

The option of a loan was ruled out; inflation over the course of the payback period would significantly increase the interest required to be paid back, possibly to the point of causing insolvency. Furthermore, capital used to pay back the loan would leave Doddington and move instead be amalgamated into a corporate capital pool, harming Doddington.

10.1.3.4

Money paid back to GB Energy as a partner would, while not directly benefitting Doddington, be re-invested in UK key energy infrastructure and help provide better services across the country; such a move would indirectly benefit Doddington residents.

10.2 Cost to Council & Profit Sharing

10.2.1

HDL Croft commits to a profit sharing scheme with Doddington Council. A negotiable percentage of annual profit - which HDL Croft recommends to be 30% - will be given to the council for reinvestment in Doddington to benefit the city and the local economy. Profit sharing will commence after 'payback' of private investors. Until equity is recovered, 95% of profits will be paid to private investors with 5% to HDL Croft for reinvestment. After the point of equity recovery, profit sharing distribution will change. 30% of future profits will then go to the council; 30% to private investors; and 40% to HDL Croft. Of HDL Croft's profits, 68.8% will be reinvested into the plant's refurbishment upon handover.

10.2.2

HDL Croft prides itself on its transparency and stakeholder relations, as a consequence of this all financial data on cumulative profit for all parties is available in Figure 17 in the Appendix along with a visual representation of savings to the council via landfill tax and profit sharing in Figure 18 and Table 25 in the Appendix.

10.2.3

Profit sharing to the council is predicted to begin in the first quarter of year 16, this can be seen in Figure 17.

10.2.2

Through a PFI, HDL Croft will build and operate the facility for a period of 25 years with the council paying an annual fee for services rendered. Under PFI rules the council cannot take on any risk, hence lowering the risk for the taxpayer.

10.2.3

HDL Croft will charge a fee of £9 million per financial year as compensation to be paid in equal quarterly instalments

10.2.4

This affordable fee is a low-cost solution for Doddington City Council. Initial expenses to design and build the site are covered through investment partners, including GB Energy. Annual profits are shared with the council to improve quality of life in Doddington.

10.2.5

Given the complex and modern nature of the project an annual contribution of £9 million (offset through profit sharing) is a competitive price.

10.3 Operational Cost Analysis (OPEX)

10.3.1 Labour Costs

10.3.1.1

Government immigration policy changes have significantly changed the employment landscape. Recent announcements move to remove all non-British residents from the country. Usual salaries per role will be increased 20%, and set to rise at 3% above inflation.

10.3.1.2

The Facility must run 24 hours a day. As such, higher salaries for night shift workers must be accounted for. HDL Croft will pay night workers 50% higher salaries than their daytime counterparts.

10.3.1.3

HDL croft has committed to hiring 74 full time employees with competitive salaries and benefits, including apprentices. In order to attract and retain workers a 30% increase will be applied to salaries - 10% above the market standard. A complete list of employees is contained in Table 18 in the Appendix. A total of £4.875 million must be dedicated annually to employee salaries. Key roles are defined as follows.

10.3.1.4

A site General Manager oversees all operations and is responsible for liaising with the council and the HDL Croft head office. This role earns £95,000 per annum.

10.3.1.5

15 labour workers are required for cleaning, manual sorting, and related tasks for cumulative annual compensation of £450,000.

10.3.1.6

10 apprentices and 1 apprentice trainer are employed full time. HDL Croft offers blue collar and degree apprenticeship schemes, therefore securing future skills in all levels of plant operation. Each apprentice is paid £20,000 per annum - above regulation levels - leading to a total cost of £255,000 per annum, including trainer.

10.3.2 Equipment Running Costs

10.3.2.1

The machines and systems within the plant require maintenance to ensure efficient operation and utility access. Figures 9 and 10, contained in the Appendix, display the proportion of total funds required for each individual unit.

10.3.2.2

The total annual cost of running the sorting, incineration, and associated systems is £4.8 million.

10.3.2.3

This value is unaffected by government immigration policy changes. Scaling factors have been applied to costs defined earlier, such as salaries, but are not required here as import and export controls are unaffected.

10.3.2.4

Unit lifespan is included within Table 10. Most items function for between 15-20 years before needing full replacement. The cost of refurbishment is included in future sections discussing HDL Croft's commitment to handing over a modern facility at the end of the 25 year operating period.

10.3.3 Projected Improvements

10.3.3.1

The location of AngryPool is a potential site for future urban development should the size of Doddington increase significantly. HDL Croft has committed that should significant housing developments occur in the area, they are contractually obligated to use the CHP system for our plant to heat those homes. This will provide a new revenue stream later in the lifecycle of the plant as domestic energy rates are typically higher per kWh.

10.3.3.2

Carbon Capture technology is currently economically unviable but will not always remain so. Investment in a workable proposal at the facility will be considered should the opportunity present itself.

10.3.3.3

Equipment used tends to have a life expectancy of between 15-20 years. During HDL Croft's operation of the facility it is expected that all equipment will need to be replaced. It is entirely possible that new solutions will have been developed to improve efficiency and results. All viable alternatives to current solutions will be considered.

10.3.4 Revenue

10.3.4.1

HDL Croft will accept additional waste up to a maximum of 5 tonnes/hr from private sources such as commercial waste. This leaves 3 tonnes/hr in the recycling system free to deal with backlogs.

10.3.4.2

HDL Croft will charge a gate fee of £60/tonne for this waste. This lower end figure is an intentional decision to guarantee supply security and ensure constant maximum capacity hence efficiency incineration. Filling the system provides more income from the corresponding electricity generation, CHP, and recycling sale profit streams. The gate fee will generate a maximum of £ 2,500,000 per annum if the system is at capacity. The gate fee will increase with inflation year on year as shown in Figure 19.

10.3.4.3

Most waste imputed privately through the gate fee will be organised through recurring contracts. This allows the waste to be accurately predicted.

10.3.4.4

Recycling will be sold to companies, coordinated by the sales team. It has been assumed that mixed metals will be able to be sold for £120/tonne, cardboard £60/tonne and mixed plastic £100/tonne. If the minimum (42%) of the waste is recycled, £5,000,000 per annum of additional revenue is generated.

10.3.5 Payback Timeline

The nominal annual Op-Ex is forecast to be £13.2 million when the plant reaches its fully operational state. Due to the delayed construction of the plant, the respective running costs start once their systems are completed and functioning.

10.3.6 Handback Scheme

HDL Croft commits to handing back the incineration plant to Doddington council after 25 years in a safe operating condition. After 20 years of ownership, HDL Croft will reinvest £75 million of profits made from the facility to ensure that all equipment is new and in good working order. This will ensure that the handback scheme will occur without issue.

10.4 HDL Croft Solvency Considerations

To protect the council's investment and ensure the continuity of the Doddington Waste Management Facility project in the unlikely event of contractor insolvency or bankruptcy, this section outlines the contingency measures in place. They have been assessed with a strong regard to minimising disruption and protecting public funds.

10.4.1 Measures reducing the risk of bankruptcy

The following measures will be put in place from the project commencement to reduce any potential risk of bankruptcy occurring

10.4.1.1

Complete financial transparency/monitoring of HDL Croft upon request

10.4.1.2

Complete disclosed set of contract documents, such as collateral warranties and guarantees

10.4.1.3

Complete disclosed list of contractor's management team

10.4.1.4

Provision of step-in rights to council to temporarily take over works

10.4.1.5

PCG (Parent Company Guarantee) of 10% of contract value payable to council upon insolvency

10.4.1.6

Obligation to notify the council immediately in the event of anticipated insolvency

10.4.1.7

All design concepts and documents to be accessible to a replacement contractor in the event of insolvency

10.4.2 In the event of Bankruptcy

It is also crucial to outline the subsequent series of events in the unlikely event of insolvency

10.4.2.1

Doddington Council, Environmental Agency, insurers and funders immediately notified

10.4.2.2

Site security: unsafe work halted, stored materials protected

10.4.2.3

Financial verification: assessment of situation and unpaid suppliers and subcontractors

10.4.2.4

Activate PCG: release emergency funds to fund interim management

10.4.2.5

Activate step-in rights: council to take temporary control

10.4.2.6

Engage warranty holders: notify subcontractors of insolvency

10.4.2.7

Audit and documentation: record project progress for continuity and insurance claims

10.4.2.8

Public statement: HDL Croft and the council to issue a coordinated statement

These procedures ensure that, even in the event of contractor insolvency, the construction and operation of the Doddington Waste Management Facility can continue with minimal disruption.

11 Legal Considerations

11.1

The operation of the proposed Doddington Waste Management Facility must adhere to all relevant legal requirements; this section outlines all key, legal considerations in advance of the project commencement. Compliance with all applicable UK legislation, standards and requirements is integral to safely constructing and operating the facility.

11.2

- **Environmental Protection Act 1990/Industrial Emissions Directive (2010/75/EU) [17]:** defines pollution control, waste duties and environmental regulations
- **Health and Safety at Work Act 1974 [21]:** sets employer and contractor duties to ensure worker and public safety

- **Environmental Permitting Regulations 2016 [27]:** requires environmental permits for waste treatment and incineration operations
- **Contracts Act 1999 [28]:** provides relevant framework for collateral warranties and subcontractor obligations
- **Town and Country Planning Act 1990 [29]:** governs planning permission for site construction and use

11.3

The acquisition of all relevant permits will be completed in the pre-construction phase. These include; planning permission from the council; an environmental permit issued by the Environment Agency (subject to assessment); discharge consents; waste carrier licenses; grid connection agreements.

11.4

All contractual agreements will be governed by standard 'NEC4 Engineering and Construction Contract' provisions.

11.5

All data management will comply with the 'UK General Data Protection Regulation (UK GDPR)' and the 'Data Protection Act 2018' [30].

11.6

Any contract waste that is unable to be accepted at the facility will fall under the liability of HDL Croft

11.7

In summary, throughout all phases of the project, HDL Croft will maintain strict adherence to all relevant and applicable laws. HDL Croft will operate with legal transparency at all times; any further queries can be sought by contacting the designated lawyers.

12 Appendix

12.1 Stakeholder matrix

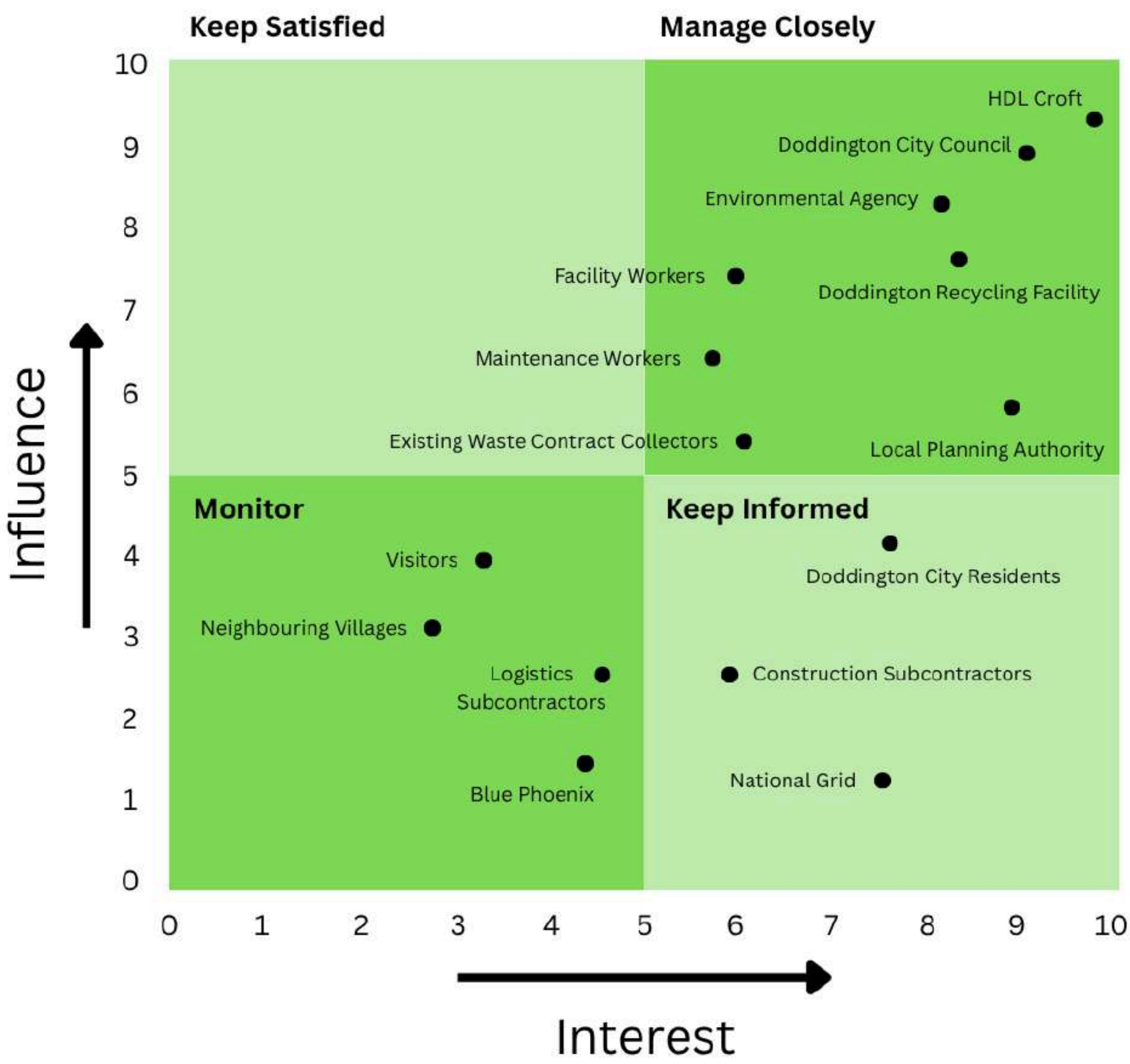


Figure 6 - Stakeholder Matrix

The above Stakeholder Matrix displays all entities described above and more to show relative importance. HDL Croft, Doddington City Council, and the Environment Agency are shown as the three most important stakeholders with both high interest and influence over the project. Resultingly, they sit within the "Manage Closely" section.

12.2 Requirements

12.2.1 Stakeholder Requirements

Requirement ID	Requirement	Stakeholder(s)
SR001	The contractor shall be responsible for the capture and diversion of recyclables from collected MSW streams	HDL Croft Doddington Council
SR002	The contractor shall be responsible for the design, construction, and operation of the facility throughout the 25 year contract lifespan including financial, operational, and personnel management	HDL Croft Doddington Council
SR003	The contractor shall provide to the council a facility capable of handling all contract waste	HDL Croft
SR004	Contract waste shall be defined as all domestic waste the council is legally obliged to collect	Doddington Council
SR005	The facility shall include a visitor center for the public and council's use, operated by the contractor, accessible weekdays from 0900 to 1900 excluding public holidays	HDL Croft Doddington Council Doddington Residents
SR006	The contractor shall develop and implement a Disaster Recovery Plan	HDL Croft
SR007	The contractor shall provide an alternative waste disposal strategy in the event of a facility issue preventing the processing of more waste	HDL Croft
SR008	The contractor shall hand the facility over to the council in good order at the end of the 25 year contract	HDL Croft Doddington Council
SR009	The contractor shall continually review practices to improve efficiency	HDL Croft
SR010	The contractor shall be responsible for choosing, purchasing, and maintaining the facility site. Demolition of existing structures (if any) and development of access roads shall be included in this remit	HDL Croft
SR011	The Contractor shall ensure that not less than 96.5% of Processable Contract Waste is diverted from landfill	HDL Croft
SR012	The contractor shall provide the council access to the facility Monday Saturday between 0700 and 1800 except for Christmas Day, Boxing Day, and New Year's Day	HDL Croft Doddington Council
SR013	The facility should be situated in a non-intrusive location to minimise disturbance of the local population	Doddington Residents
SR014	The facility shall not cause contamination to waterways and groundwater reserves	Doddington Residents Environment Agency
SR015	The facility shall abide by all ecological and environmental rules set out by the Environment Agency	HDL Croft Environment Agency
SR016	The facility should not cause undue noise, smell, or have an obstructive appearance which decreases quality of life for nearby residents	Doddington Residents HDL Croft

SR017	HDL Croft should consult with local residents to understand and mitigate concerns in relation to the construction and operation of the facility	HDL Croft Doddington Residents
SR018	Through consultations with the community HDL Croft should highlight the necessity and benefits of the project to mitigate (possible) negative public opinion	HDL Croft Doddington Residents
SR019	Key information regarding the planning, construction, and operation of the facility should be made publicly available, where possible	Doddington Council HDL Croft Doddington Residents
SR020	The visitor center, operated by HDL Croft, will provide accessible educational benefits for the local population	HDL Croft Doddington Residents
SR021	The facility should produce a consistent supply of electricity at a rate and price agreed upon by HDL Croft and National Grid operator	HDL Croft National Grid
SR022	Guidelines and directives published by the Environment Agency must be followed throughout the planning, construction, and operation of the facility	Environment Agency
SR023	HDL Croft shall complete an Environmental Impact Assessment to understand the implications of the facility and specify methods through which damage can be mitigated	HDL Croft Environment Agency
SR024	Possible subcontractors shall be approved for the project by both HDL Croft and the council	HDL Croft Doddington Council Subcontractor
SR025	Possible subcontractors shall adhere to the terms of their respective contracts and complete work to the agreed upon quality within the allocated time frame	HDL Croft Subcontractor
SR026	The subcontractor shall be responsible and cover for any overruns in cost and timing	Subcontractor
SR027	The subcontractor will be paid fairly and on time for work completed on the facility	Subcontractor
SR028	HDL Croft will pay Blue Phoenix to process incinerator ash on a by-tonne basis	Blue Phoenix HDL Croft
SR029	Changes to waste collection routes and plans shall be clearly communicated to collection workers	Waste Collection
SR030	Changes in worker hours and pay as a result of route changes shall be negotiated with the relevant representative union	Waste Collection HDL Croft

Table 3: Stakeholder Requirements

12.2.2 Facility Requirements

Requirement ID		Requirement	Stakeholder (s)	Type
001		The facility shall process all contract waste MSW	Doddington City Council	Functional
	001a	The facility shall pre-mix MSW streams to ensure an average calorific value per unit volume	HDL Croft	Non Functional
	001b	The fuel shall have a calorific value of greater than 15 MJ / kg	HDL Croft	Non Functional
	001c	The incineration unit shall have the capacity to process 75000 tonnes of MSW per annum	HDL Croft Doddington City Council	
002		The facility shall be able to sort all types of recyclable materials from MSW streams, including but not limited to, ferrous and non-ferrous metals, paper and card, all recyclable types of plastic, and glass	HDL Croft	Functional
	002a	The facility shall recover at least 50% of all recyclable materials from intake MSW streams	HDL Croft	Non Functional
	002b	Extracted recyclable waste shall be diverted to Doddington's recycling facility, or an external site depending on capacity	HDL Croft Doddington Recycling	Non Functional
003		The facility shall remove toxins and polluting chemicals from flue gas ejection streams	HDL Croft Doddington Residents	Functional
	003a	Damaging chemicals will not be released in the flue gas stream in excess of Environment Agency regulations	HDL Croft Environment Agency	Non Functional
	003b	Sensor arrays will be placed to monitor flue gas stream composition	HDL Croft	
004		The facility shall contain an incineration unit to combust non-recyclable MSW	HDL Croft	Functional
	004a	The combustion chamber shall maintain a temperature above 850∘C during operation using	HDL Croft	Non Functional
	004b	The facility shall use moving grate incineration technology	HDL Croft	Non Functional
005		The facility shall include a visitors center available from 0900 to 1900 on weekdays, excluding public holidays	HDL Croft	Functional
	005a	The visitor center shall be large enough to accommodate 40 persons	HDL Croft	Non Functional
	005b	The visitor center shall run guided tours of the facility	HDL Croft	Non Functional
006		The facility shall implement and maintain an environmental	HDL Croft	Functional

	management system certified to ISO140001	Environment Agency	
007	The facility shall remove toxins and polluting chemicals from flue gas ejection streams in accordance with Environment Agency regulations	HDL Croft Environment Agency	Functional
007a	A multi stage cleansing process will be employed, described below in the **Flue Gas** section	HDL Croft	Non Functional
008	The facility shall utilise incinerator combustion heat to produce electricity	HDL Croft	Functional
008a	An onsite closed loop steam powered turbine generator shall achieve this aim	HDL Croft	Non Functional
008b	The facility shall have a 5MW generation capacity	HDL Croft National Grid	Non Functional
009	The incineration chamber shall not accumulate bottom ash in its basin	HDL Croft	Functional
009a	Bottom ash will be removed in a steady state flow	HDL Croft	Non Functional
009b	HDL Croft will work with a third party company to repurpose bottom ash	HDL Croft Blue Phoenix	Non Functional
010	The facility shall be successful in diverting and processing waste from landfill	HDL Croft Doddington City Council	Functional
010a	Maximum annual landfill usage targets shall be adhered to	HDL Croft	Non Functional
010b	In the event of a waste overrun HDL Croft shall be responsible for providing a solution third solution beyond the facility and landfill	HDL Croft	Non Functional
010c	At least 96.5% of Processable Contract Waste shall be diverted from landfill		
011	The facility will have robust practices in place to ensure the surrounding environment is not contaminated	HDL Croft	Functional
011a	The facility will be housed within a full enclosed containment structure	HDL Croft	Non Functional
011b	Cooling water streams will be isolated from any contaminants and will be released back to water sources after cooling to a regulated level	HDL Croft Environment Agency	Non Functional
011c	Equipment shall be regularly inspected to detect possible faults	HDL Croft	Non Functional
012	The facility should have separate entrances for waste collection vehicles and civilian carpark	HDL Croft	Functional
013	The facility shall have emergency recovery protocols	HDL Croft	Functional

	013a	A simple and easy to use method of “turning off” the plant shall be accessible from the control room in the event of emergency	HDL Croft	Non Functional
014		The facility shall harness waste heat to power a CHP system	HDL Croft Doddington City council	Functional
	014a	The district heat system shall have an output of 14MWh	HDL Croft	Non functional
	014b	The district heat system shall have an efficiency of at least 80%	HDL Croft	Non Functional
015		The facility shall distribute heat to heavy industry via insulated pipeline from the plant	HDL Croft	Functional
	015a	The pipeline shall have an efficiency of 90%	HDL Croft	Non Functional
	015b	The pipeline shall have leak prevention measures	HDL Croft	Non Functional
016		The CHP pipeline system shall be a closed loop between the customer and the facility	HDL Croft District Heating Customers	Functional
	016a	The system shall not require constant fluid input	HDL Croft	Non Functional
017		Heat for the CHP system shall be obtained from the electricity generation flowstream via a heat exchanger	HDL Croft	Functional
	017a	The CHP fluid flow and steam generation flow shall be distinct and insulated from each other	HDL Croft	Non Functional
	017b	A counter flow double pipe heat exchanger shall be used to transfer heat energy efficiently	HDL Croft	Non Functional

Table 4: Facility Requirements

12.2.3 Waste Forecasts and Compliance with Landfill Limits

Data	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Total Household Waste	149270	148053	145596	143332	147852	144947	142210	139472	136735	133998
Commercial imported waste	0	0	0	0	0	0	0	0	0	0
Landfill Waste	102026	100202	100388	97494	101722	98564	96703	94841	92980	52433
Incinerated Waste	0	0	0	0	0	0	0	0	0	42209
Front end recycled waste	47244	47851	45208	45838	46130	46383	45507	44631	43755	40199
On site recycled waste	0	0	0	0	0	0	0	0	0	0
Max Permitted Landfill	103000	103000	103000	103000	103000	103000	103000	102000	102000	70000
Theoretical population	367000	367184	367367	367551	367735	367918	368102	368286	368471	368655
Deportation	0	0	0	0	0	7000	7000	7000	7000	7000
Adjusted Population	367000	367184	367367	367551	367735	360918	354102	347286	340471	333655
Waste Diverted from Landfill %	0	0	0	0	0	0	0	0	0	44

Data	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/29	2039/40
Total Household Waste	134072	134146	134220	134294	134368	134443	134517	134591	134665	134740
Commercial imported waste	65000	65000	65000	65000	65000	65000	65000	65000	65000	65000
Landfill Waste	1430	1430	1431	1431	1432	1432	1432	1433	1433	1434
Incinerated Waste	71483	71506	71529	71553	71576	71599	71623	71646	71670	71693
Front end recycled waste	40222	40244	40266	40288	40311	40333	40355	40377	40400	40422
On site recycled waste	87368	87396	87425	87453	87482	87510	87539	87568	87596	87625
Max Permitted Landfill	61000	47000	28000	8000	6000	5000	4000	3000	2000	1000
Theoretical population	368839	369024	369208	369393	369577	369762	369947	370132	370317	370502
Deportation	0	0	0	0	0	0	0	0	0	0
Adjusted Population	333839	334024	334208	334393	334577	334762	334947	335132	335317	335502
Waste Diverted from Landfill %	98	98	98	98	98	98	98	98	98	98

Tables 5 and 6 - HDL Croft's Waste Volume Forecast

12.2.3.1
Assuming a total 32% recycling rate prior to operational facility and 65% recycling rate for Doddington from commencement of sorting facility operation.

12.2.3.2
Population modelled as 0.05% YoY growth (only natural change i.e. no inward migration following UK policy change).

12.2.3.3
Assuming 10% of the population (~35000) are deported between 2025/26 and 2030/31 (7000 YoY).

12.2.3.4
Shows clear compliance with landfill limits and % of waste diverted from landfill

12.3 Pugh Matrix

Evaluation Criteria	**Importance Weighting**	Baseline Concept A Conventional Incineration (Mass-Burn EfW)	Concept B Mechanical Biological Treatment (MBT) + EfW	Concept C MBT + Advanced Thermal Treatment (Pyrolysis)	Concept D Mechanical + AI Sorting + EfW + potential RDF import	Concept E MBT + RDF Export
Technology Maturity & Reliability	5	0	3	-3	1	6

High Energy Recovery Efficiency	10	0	-1	6	0	-6
Low Carbon Emissions	15	0	3	6	9	3
High Landfill Diversion / Recyclate Recovery	20	0	6	6	9	3
Safety	5	0	1	-3	0	6
Low CAPEX/OPEX	20	0	3	-6	-3	6
High Revenue Potential	5	0	-1	3	3	-6
Planning Feasibility	10	0	1	-6	3	6
Community Acceptance	5	0	1	0	6	6
Scalability / long-term adaptability	5	0	3	3	6	3
Weighting Total	100	**0**	**260**	**90**	**365**	**300**

Figure 7 - Pugh Matrix of Considered Design Concepts

To determine the most suitable concept for the proposed Doddington waste management facility, it was necessary to construct a Pugh Matrix - a systematic tool designed to take multiple criteria into account, weighted by importance. Following on from the stakeholder/council meeting, ‘High landfill diversion / recyclate recovery’, alongside ‘Low CAPEX/OPEX’ were deemed the most important criterion (20). While all alternative concepts improve upon the baseline incineration model, Concept D - combining advanced mechanical and AI-based sorting with a smaller, flexible EfW unit - scores the highest. Although it carries slightly higher costs than other concepts, its versatility and strong focus on sorting make it incredibly sustainable and the best option for Doddington.

12.4 Risk Register

Hazard	**Affected Parties**	**Control Measures**	**Risk Rating**		
			L	**S**	**RR**
Site Construction					
Bodily injury or death due to construction equipment malfunction	Construction workers and site attendees	Equipment shall be purchased from reputable suppliers and inspected regularly to ensure proper function	2	4	8
Injury or death due to debris around site floor	Construction workers and any of those on the construction site	Conduct regular cleaning operations of roads and paths around the facility to ensure safety of users.	1	5	5

Electrocution during construction of high voltage systems	Equipment maintenance engineers	Relevant PPE provided and worn correctly. Safety training provided and protocols adhered to strictly. All machines must be completely shut off to prevent high voltage or current flow.	2	5	10
Improper construction methods or miscalculations can lead to falling rubble or structure collapse	Construction workers or anyone on site	Making thorough checks and appropriate planning before construction and then ensure correct construction techniques and practices to minimise risk	1	4	8
Improper construction or set-up of machines can drastically reduce plant efficiency	HDL croft	Have plans to reroute waste stream to avoid faulty component, regularly test machines to ensure	2	4	8
Bodily injury or death from road accident caused improper material transport precautions	HGV drivers, other road users, and pedestrians	HGVs will only transport volumes of material within their capacity. Drivers should take regular breaks and not work long shifts	1	5	5
Visitor Centre					
Risk of burns or death from fire	All members within the Visitor Centre building	Fire alarms and sprinklers will be used as necessary. Clearly marked fire extinguishers will be present in every room.	1	5	5
Excessive noise from Audio Visual (AV) system damaging hearing	Parties within the educational room	Sound will be limited at or below 70 dB, the recommended limit for safe listening.	1	2	2
Epileptic episodes due to AV system	Parties within the educational room	Warnings will be included prior to any video showing. Videos will seek to avoid containing sequences of flashing lights.	1	3	3
Bodily harm due to slip hazards within the Visitors Ventre	Any person passing through the affected area. Elderly visitors most at risk	"Wet Floor" signs will be placed around any section wet, due to cleaning or otherwise.	2	2	4
Lack of access for low mobility visitors	Low mobility visitors	Access to the main entrance is possible with a ramp. The visitor centre itself is all on one level.	1	1	1
Slip hazard due to icy or wet conditions on entrance steps to the centre	Any visitor entering the centre. Elderly visitors most at risk	Include a handrail along the entrance steps and ramp.	3	2	6
Safeguarding concerns for employees	Employees	Protocols will be in place to deal with rude or abusive visitors. On site security teams can be called if necessary.	2	3	6
Safeguarding concerns for visiting minors	Visitors under the age of 18	All employees will undergo background checks before employment.	1	5	5

Manual Sorting					
Exposure to toxic items within waste stream	Manual sorting plant workers	Relevant PPE, e.g. masks, will be worn while working. Workers will be trained not to open closed waste bags.	1	4	4
Bodily harm due to sharp objects within waste stream	Manual sorting plant workers	Relevant PPE, e.g. gloves, will be worn at all times. Training will be provided to handle dangerous-appearing items properly	2	3	6
Bodily harm to due to waste items falling off of conveyor belt	Manual sorting plant workers	Guard rails will follow either side of the belt to prevent items rolling off. The conveyor belt will not move at excessive speeds.	2	2	4
Bodily harm as a result of moving machinery parts	Manual sorting plant workers	Relevant PPE will be worn at all times. Safety training will be provided to all workers	1	5	5
Transmission of diseases from waste stream to workers	Manual sorting plant workers	Relevant PPE will be worn at all times. Cleaning stations & showers will be available on site to promote good hygiene. Any worker who believes themselves to be exposed to dangerous chemicals shall report it.	2	4	8
Rodent infestation of waste processing facilities	Manual sorting plant workers	All facilities will be regularly monitored to ensure high hygiene standards. All COSHH regulations will be followed. Pest control will be alerted if necessary.	2	2	4
Hearing damage/loss due to machinery noise	Manual sorting plant workers	Relevant PPE will be worn. Shift schedules will be developed to give workers sufficient downtime.	1	2	2
Inhalation of toxic fumes	Manual sorting plant workers	Relevant PPE will be worn at all times.	1	5	5
Injury from worker falling into waste conveyer belt	Manual sorting plant workers	Emergency stop buttons will be located along the length of the conveyor belt. Workers shall receive training to respond to this situation.	2	3	6
Equipment Operation & Maintenance					
Bodily injury from equipment while performing maintenance	Equipment maintenance engineers	Relevant PPE provided and worn correctly. Safety training provided and protocols adhered to strictly. All machines must be completely shut off to prevent injury from moving parts.	2	3	6
Electrocution during maintenance of high voltage systems	Equipment maintenance engineers	Relevant PPE provided and worn correctly. Safety training provided and protocols adhered to strictly. All machines must be completely shut off to prevent high voltage	2	5	10

		or current flow.			
Falls from large heights while maintaining elevated machinery	Equipment maintenance engineers	All safety equipment regularly checked and maintained to a high standard. Only qualified workers undertaking high elevation work.	1	5	5
Bodily injury from power tools	Construction and maintenance workers	Relevant training undertaken on the use of power tools safely. Regular checks that equipment is safe to use.	2	2	4
Incineration and Related Processes					
Environmental and health damage due to biogas	Workers, surrounding population, surrounding ecosystem	All pre-sorting waste containment units will employ seals to prevent the escape of dangerous fumes. Sensors will be present across the entire HDL Croft facility to identify leakages.	2	3	6
Burns or risk of death from accidental combustion of biogas	Site workers and surrounding residents	Prior to sorting waste will be stored in safe environments meeting any regulatory requirements.	1	5	5
Process blockage due to material buildup	Site workers	Any stoppage of a single part of the conveyor belt will trigger an immediate slowdown or stop of other processes to ensure the system does not become overloaded.	2	4	8
Burns due to extreme heat of combustion chamber	Site workers	Safety training will be given to all workers. Safe distances from machinery will be marked on the floor at all locations. Relevant PPE must be worn at all times.	1	4	4
Lack of fuel supply to incinerator preventing combustion	Site workers	Combustion will cease and prior processes will slow down/stop as required. Maintenance will be carried out as soon as possible.	2	4	8
Environmental and health damage from flue gas	Site workers and surrounding residents	Flue gas will be cleaned to an approved Environment Agency standard prior to release. Sensors will be present throughout the release stack to monitor chemical levels.	1	5	5
Environmental damage to discharging plant cooling water at high temperatures	Surrounding ecosystem, particularly in waterways	Water will not be discharged to waterways above regulatory temperatures (25°C).	2	4	8
Bodily injury from moving parts within the conveyor process	Site workers	Safety training will be given to all workers. Safe distances from machinery will be marked on the floor at all locations. Relevant PPE must be worn at all times.	2	4	8
Hearing damage from	Site workers	Relevant PPE will be worn at all times.	2	2	4

system noise					
Death by falling into incinerator	Site workers	Guardrails will surround the incineration unit entrance. Emergency stop buttons will be available.	1	5	5
Power Generation					
Injury or death high voltage or current electrocution	Site workers	Dangerous items will be enclosed to prevent accidental contact. Safety training will be provided to relevant workers.	2	5	10
Injury or death due to fast moving generation machinery	Site workers	Housing for these parts will be restricted access areas. Any worker required to enter will have specialist training.	1	5	5
Site Security					
Damage to site due to unauthorised personnel gaining access	Any employees on site. Equipment which may be damaged.	Erect a fence around the site perimeter and have CCTV in operation at all times. Contracted on-site security presence to deter and deal with breaches.	2	5	10
Bodily harm or death of unauthorised intruder	Intruder and any employee on site	Erect a fence around the site perimeter and have CCTV in operation at all times. Contracted on-site security presence to deter and deal with breaches.	1	5	5
Cyber Security					
Theft of employee data through a variety of cyber attacks	Employees of HDL Croft	All staff to complete relevant cyber security training in order to mitigate the risks of attack. Hiring of a cybersecurity team to employ protocols and identify vulnerabilities	2	2	4
HDL CROFT held at ransom after the event of a cyberattack.	The whole company and employees. Relevant entities if HDL Croft temporarily becomes inoperational.	All staff to complete relevant cyber security training in order to mitigate the risks of attack. Hiring of a cybersecurity team to employ protocols and identify vulnerabilities.	2	5	10
Subcontractors					
Service not provided or done to an inadequate standard	Subcontractor and HDL Croft	Subcontractors will be thoroughly vetted and previous work examined prior to contract awarding	2	4	8
Dangerous persons allowed site access due to subcontractor not having completed adequate background	Subcontractor and HDL Croft	Subcontractors must submit evidence of the completion of industry standard background checks prior to work beginning. Failure to do so may result in breach of contract.	2	4	8
General Site Safety					

Collision of operating vehicles	Workers operating or inside of relevant vehicles	Ensure the site has a clearly detailed right of way system as well as ensuring all those operating vehicles have passed relevant safety courses and have necessary qualifications.	2	2	4
Pedestrian injury due to vehicle impact	Pedestrians on foot walking around site	Pedestrians must be informed of sticking to signposted pathways and those on tours are always under a responsible adult's supervision.	2	4	8
Injury or damage to machinery due to debris around site floor	Pedestrians and workers on foot walking around site	Conduct regular cleaning operations of roads and paths around the facility to ensure safety of users.	1	2	2
Bodily harm or death due to bursting of high pressure pipes	Site workers and visitors	Conduct regular inspections of equipment to identify possible issues. Any issues shall be dealt with immediately.	1	5	5
Injury or death due to falls from height while working	Site workers	Harnesses and other PPE will be worn when working at height. Specialist training will be given	2	4	8

Table 7 - Risk Register for Construction and Running of the Facility

	Likelihood (L)					
Severity (S)		**1**	**2**	**3**	**4**	**5**
	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Table 8 - Standard Scoring of Risk Register

12.4.1

Tables 7 and 8 work in conjunction to categorise project risks during both construction and operation phases. A standard risk scoring system combines the likelihood and severity of a given event.

12.4.2

Comprehensive mitigations are described in each case. The highest graded risk after considering mitigations is 10.

12.5 Financial Data

12.5.1 Capital Expenditure

12.5.1.1 Equipment Cost and Data

Component	Max Served Capacity (Tonne/hr)	Power Consumption (kW)	Water (L/day)	Process Efficiency	Space required(m²)
Convection Drying	20	100	0	87%	30
Bulk Shredding	20	60	0	92%	15
Dust Extractor 1	20	8	0	99%	6
Hopper	15	10	0	100%	10
Overbelt electromagnet	15	10	3.3	90%	6
Eddy Current Separator	15	12	0	90%	8
Ballistic Separator	20	20	0	90%	20
Dust Extractor 2	15	10	0	99%	6
Optical sorters x 3	5	69	0	93%	30
Microwave sensors x 3	5	0.3	0	100%	3
Infrared sensors x 3	5	0.3	0	100%	3
CV regulator control system	15	2	0	100%	4
Hopper x3	15	30	0	100%	30
Compressor	15	120	0	100%	20
Conveyor belts	15	120	0	100%	60
SNCR	10	3	0	50%	15
Cyclone separator	10	1.5	0	80%	20
Dry FGD sorbent injection	10	7	0	99%	40
Activated carbon injection	10	2	0	99%	15
Baghouse	10	10	0	100%	100
Stack	10	0	0	100%	15
CEMNS	10	0	0	100%	10
Moving grate Incinerator	10	250	15000	85%	400
CHP Piping (3km)	15 (MWth)	0	0	98%	-
Boiler	10	180	20000	90%	350
Heat exchangers	15 (MWth)	30	0	95%	120
Condensor	7 (MWe)	90	0	95%	250
Power Generation Turbine	7 (MWe)	40	2000	30%	200
Electrical Substation	7 (MWe)	10	0	99%	150
Skip x2	0	0	0	100%	20
Forklift x3	10	0	0	100%	5
Sprinkler System	1	-	3	100%	-
Totals	**N/A**	**571.6**	**3.3**	**N/A**	**1,961**

Component	Downtime	Annual running cost (£)	Equipment Purchase (£)	Instillation Factor (F)	Installed Cost (£)	Lifespan (Years)
Convection Drying	7%	240,000	550,000	2.2	1,210,000.00	20
Bulk Shredding	2%	80,000	300,000	2.6	780,000.00	20
Dust Extractor 1	1%	11,000	60,000	2	120,000.00	20
Hopper	5%	13,000	100,000	1.8	180,000.00	15
Overbelt electromagnet	5%	16,000	120,000	1.6	192,000.00	15-25
Eddy Current Separator	7%	27,000	200,000	1.7	340,000.00	15-25
Ballistic Separator	5%	39,000	250,000	2	500,000.00	20
Dust Extractor 2	4%	2,000	80,000	2	160,000.00	20
Optical sorters x 3	5%	147,000	1,100,000	2.2	2,420,000.00	20
Microwave sensors x 3	2%	2,400	18,000	1.3	23,400.00	20
Infrared sensors x 3	2%	2,400	15,000	1.3	19,500.00	20
CV regulator control system	1%	5,200	60,000	1.6	96,000.00	20
Hopper x3	5%	39,000	300,000	1.8	540,000.00	15
Compressor	7%	200,000	300,000	1.7	510,000.00	20
Conveyor belts	2%	120,000	170,000	2	340,000.00	20
SNCR	0.30%	50,000	500,000	2.8	1,400,000.00	20
Cyclone separator	1%	10,000	300,000	2.4	720,000.00	30
Dry FGD sorbent injection	1%	150,000	2,000,000	3	6,000,000.00	25
Activated carbon injection	1%	100,000	300,000	2.6	780,000.00	25
Baghouse	3%	1,000,000	2,000,000	3.2	6,400,000.00	25
Stack	0.10%	5,000	100,000	2.5	250,000.00	50
CEMNS	1%	15,000	120,000	2	240,000.00	10
Moving grate Incinerator	8%	1,200,000	13,000,000	3.5	45,500,000.00	30
CHP Piping (3km)	1%	120,000	6,000,000	1	6,000,000.00	40
Boiler	5%	600,000	2,000,000	3.2	6,400,000.00	30
Heat exchangers	2%	60,000	1,200,000	1.8	2,160,000.00	25
Condensor	2%	150,000	3,500,000	2.4	8,400,000.00	25
Power Generation Turbine	4%	350,000	6,000,000	2.5	15,000,000.00	30
Electrical Substation	1%	80,000	2,000,000	1.8	3,600,000.00	40
Skip x2	0%	0	10,000	1.2	12,000.00	40
Forklift x3	4%	2,000	45,000	1	45,000.00	25
Sprinkler System	1%	2,500	100,000	1	100,000.00	15
Totals	**N/A**	**£4,838,500.00**	**£42,798,000.00**	**2.119354839**	**£110,437,900.00**	**N/A**

Tables 9 and 10 - Data of Necessary Equipment

12.5.1.1.1

Tables 9 and 10 list relevant data items of all equipment needed for operation. Both list different attributes of the same equipment.

12.5.1.1.2

Tables 9 and 10 were used to produce Figures 8, 9, 10, and 11 to visually compare downtimes and share of costs, both as individual units and of component groups.

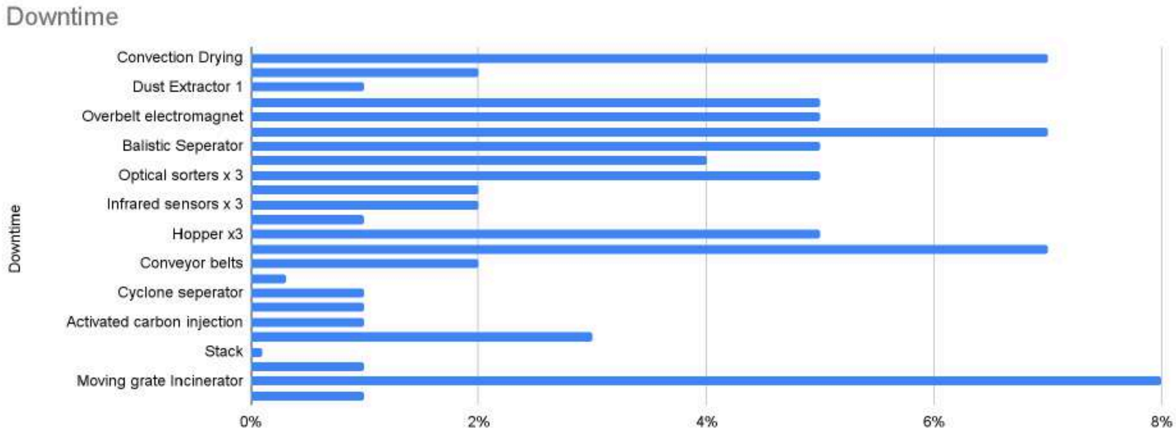


Figure 8 - Estimated Annual Downtime of Key Equipment Pieces

12.5.1.1.3

The moving grate incinerator requires the most downtime. A storage area prior to incineration (whose use levels will be autonomously controlled by the CV system) has been included in the plan to combat this.

12.5.1.1.4

The whole system has capacity for a throughput of 15 tonnes/hr for recycling and 10tonnes/hr for incineration to handle periods of downtime, allowing the systems to operate at a far higher rates than the required 7 tonnes/hr and 4.5tonnes/hr respective rates.

12.5.1.1.5

The system will operate at higher rates when a backlog of material needs to be cleared, such adjustments will be made in the CV and Incineration control rooms.

12.5.1.1.6

The downtimes for cleaning system components such as the cyclone separator are largely insignificant as these components are more robust when operating for large extended periods.

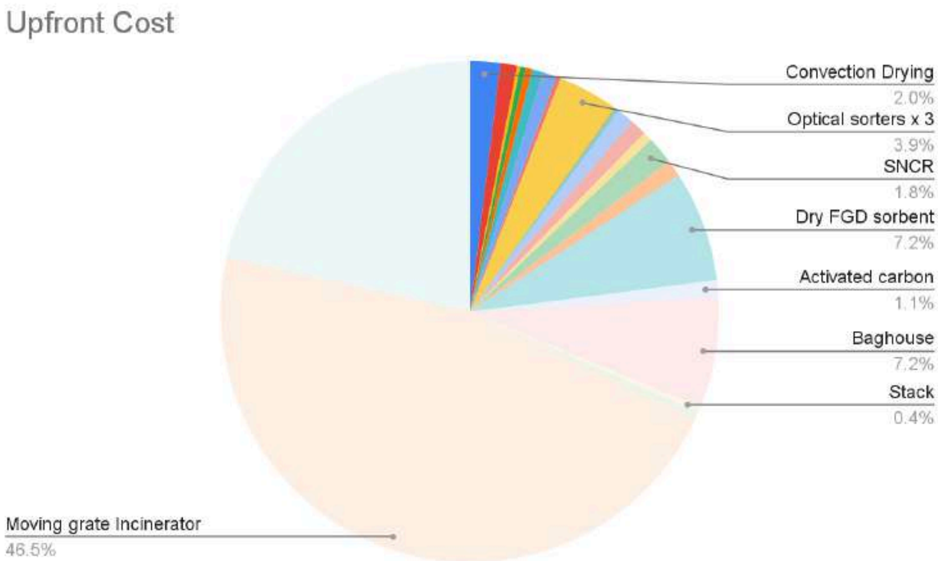


Figure 9 - Facility Equipment Budget Allocations

12.5.1.1.7

A total cost of £43 million is associated with equipment purchase, including the incinerator. The incinerator is the most expensive individual component.

12.5.1.1.8

Comparative costing shows sorting equipment is the lowest required investment.

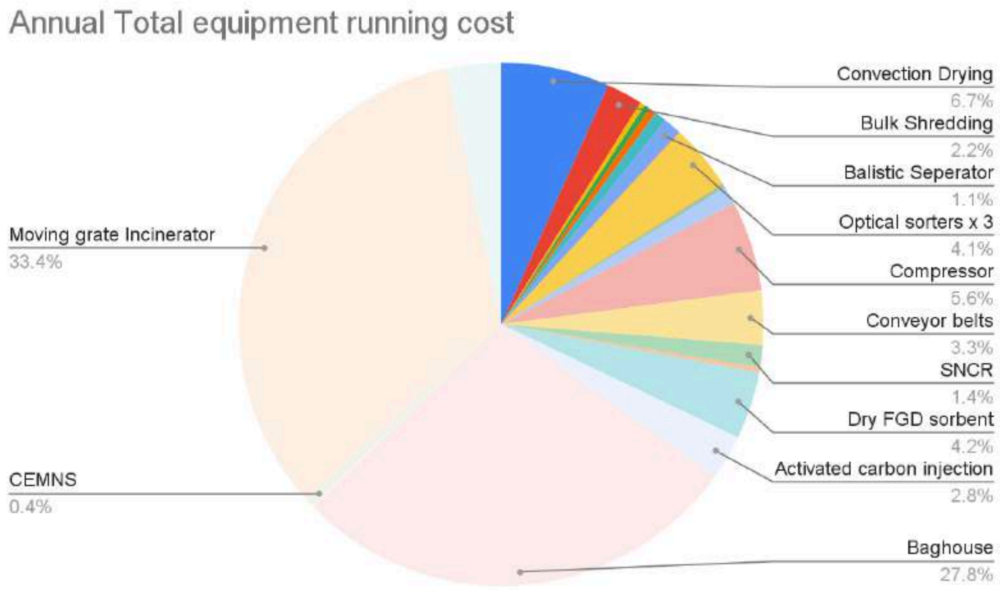


Figure 10 - Allocations of Annual Equipment Operating Budget

The annual running costs for the individual components slightly vary compared to the same upfront cost percentages. The baghouse holds a much larger share of annual running costs compared to upfront costs. Convection drying also holds a far more significant share, as heating the air requires a much larger power consumption of 100 KW when compared to other sorting processes.

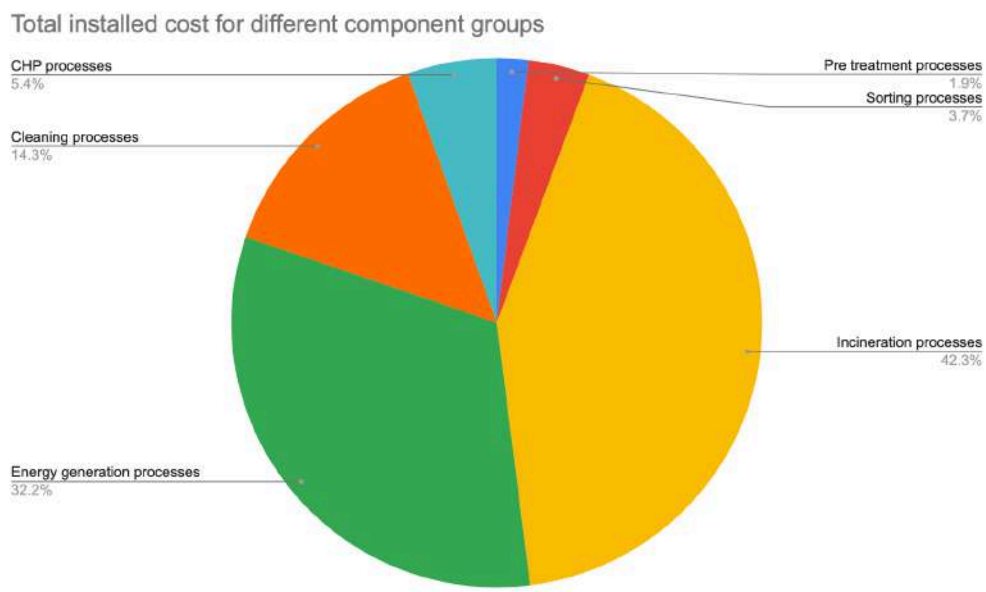


Figure 11 - Relative Installation Costs of Component Groups

Figure 11 broadly compares the total installation costs for different component groups in HDL Croft's system. The most expensive component system to install is incineration, followed by energy generation processes. These two systems take up 74.5% of the overall installation cost. The sorting processes take up less than 4% of the overall share, making their costs less significant for considering modular upgrades to the recycling system made in the future.

12.5.1.2 Construction Costs and Data

Construction type	Unit cost (/m²)	Application	Area (m²)	Cost of area
Heavy industrial / warehouse-type shell	£2,000.00	Sorting building	3,000	£6,000,000.00
Specialist industrial building (EfW hall)	£2,900.00	Incineration building	3,000	£8,700,000.00
Admin / visitor centre	£2,100.00	Visitor centre, reception and client areas	800	£1,680,000.00
Car park	£55.00	Car park and visitor centre car park	4,500	£247,500.00
Asphalt surfacing	£105.00	Road connections	1,080	£113,400.00
Total			**12,380**	**£16,740,900.00**

Table 11 - Details of Building Construction Costs

Civils package	Required properties	Cost
Waste bunker RC structure + tipping slab	Thick reinforced walls/slabs	£4,000,000.00
Deep foundations/piling allowance	Heavy loads, variable ground	£4,000,000.00
Turbine hall + boiler hall heavy slabs/plinths	Precise reinforced plinths	£2,000,000.00
Stack foundations + heavy baseworks	Tall weather resistant structure	£800,000.00
Internal platforms, stairs, access steel	Maintenance and safety	£2,000,000.00
Firewater tank / drainage / bunding	Strict fire and environmental guidelines	£1,200,000.00
Total		**£14,000,000.00**

Table 12 - Capital Expenditure for Given Facility Civil Works

In Tables 11 and 12 site construction costs were obtained from standard industry unit costs [31] [32] being applied to their corresponding area of application followed by the costing of the necessary reinforcements for the requirements[33].

Category	Pre-Immigration Law	Post-Immigration Law	Change
Raw Materials	£16,907,495.00 (55%)	£16,907,495.00 (33%)	£0 (0x)
Labour	£13,833,405.00 (45%)	£34,583,512.50 (67%)	+£20,750,107.50 (2.5x)
Total	**£30,740,900.00**	**£51,491,007.50**	**+£20,750,107.50 (+67.5%)**

Table 13 - Difference in Capital Expenditure pre and post Legislation Change

A 2.5x multiplier has been placed on forecast labour costs due to the national policy change implemented by the government. As a result the total cost for raw materials and labour has increased by 67.5% and the share of costing allocated to labour has increased from 45% to 67%.

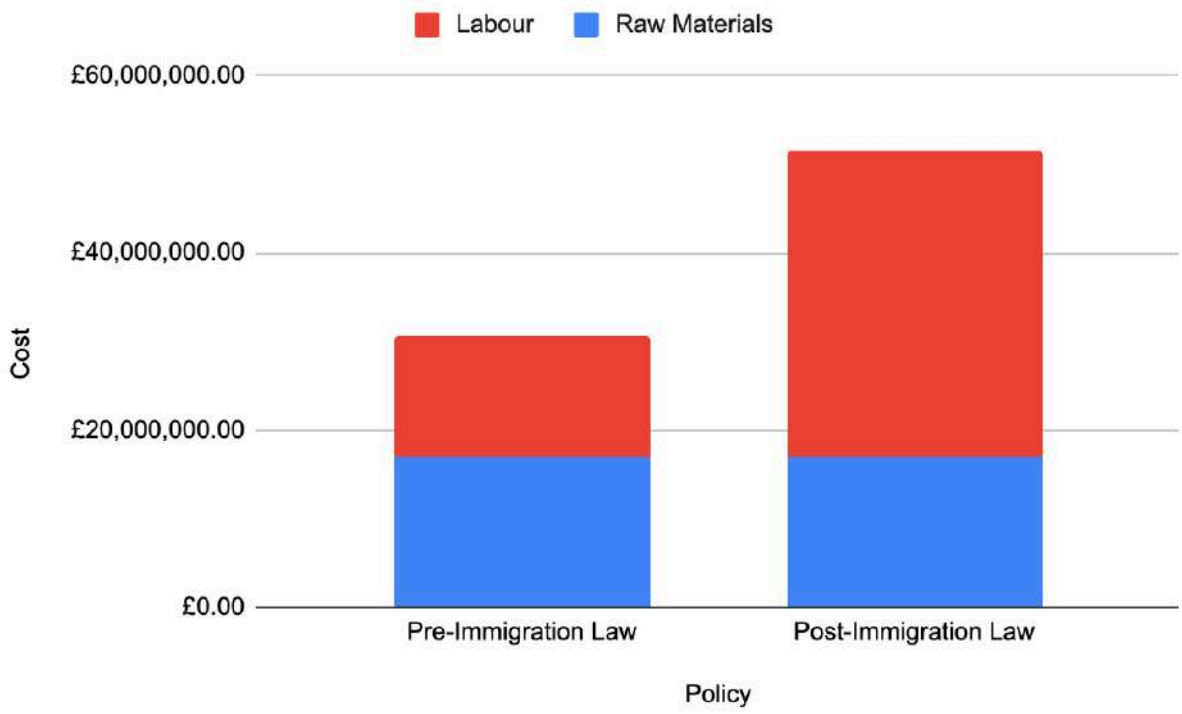


Figure 12 - Stacked Bar Chart of Capital Expenditure pre and post Legislation Change

Category	Weighting	Cost
Raw Materials & Site Construction	24%	£50,971,338.46
Process equipment and construction	52%	£110,437,900.00
Management & Administrative	9%	£19,114,251.92
Permitting & Legal	4%	£8,495,223.08
Land Acquisition & Access	1%	£2,123,805.77
Contingency Funds	10%	£21,238,057.69
Total	100%	**£212,380,576.92**

Table 14 - Breakdown of Total Capital Expenditure by Category

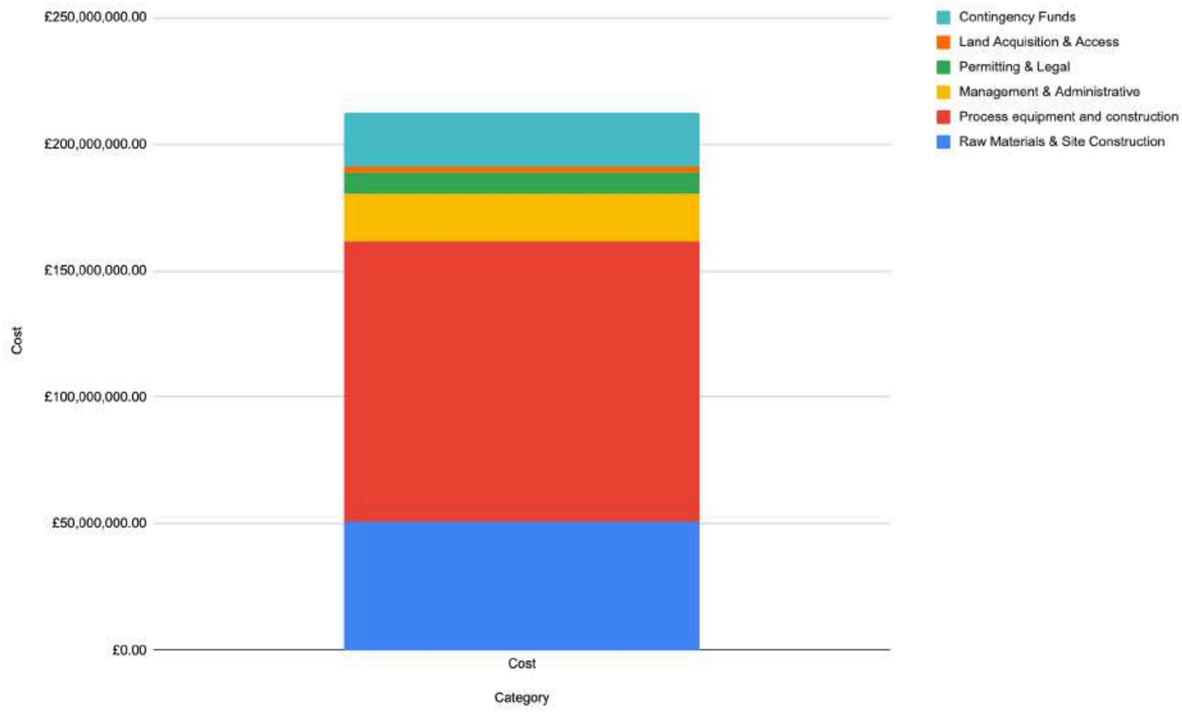


Figure 13 - Stacked Bar Chart of Capital Expenditure by Category

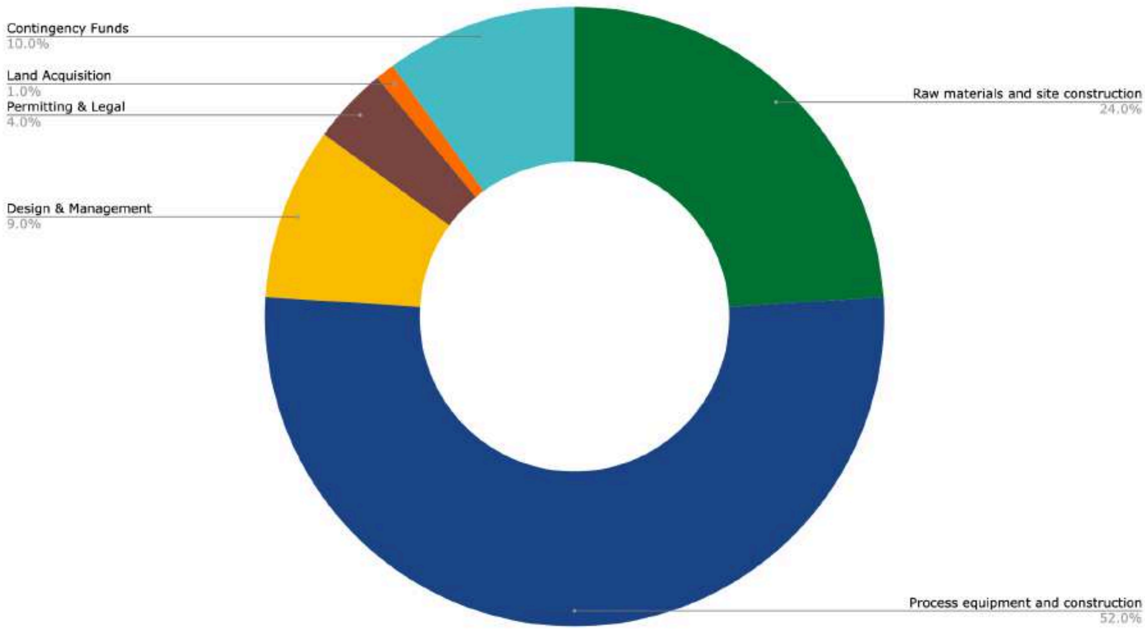


Figure 14 - Piechart of Capital Expenditure Percentage Breakdown by Category

12.5.2 Operational Expenditure

Consumables	Cost / tonne	Usage t/t waste	Usage p.a. (tonnes)	Cost p.a.
Hydrated Lime	£440.00	0.010	750	£330,000.00
Activated Carbon	£4,000.00	0.001	75	£300,000.00
Ammonia	£700.00	0.002	150	£105,000.00
Minor Items				£65,000.00
Total				**£800,000.00**

Table 15 - Consumable Costs

Consumables consist of materials that are intentionally used up during normal operation. The flue gas cleaning train consumables consist of, as specified in section 12.10.1; hydrated lime ($Ca(OH)_2$) [34], activated carbon (PAC) [35], ammonia, baghouse filter elements and various other minor items. The annual consumable cost was calculated by multiplying the consumption per annum with the cost per tonne.

Utilities	Usage p.a.	Rate	Theoretical Cost p.a.	Savings	Net Imported Cost p.a.
Water (L)	13,507,299.50	£0.002	£27,014.60	£0.00	£27,014.60
Electricity (kWh)	10,469,076.00	£0.18	£1,884,433.68	£1,884,433.68	£0.00
Total			£1,911,448.28	£1,884,433.68	**£27,014.60**

Table 16 - Utilities Costs

The power usage of the facility would be the vast majority of the utilities expenditure, however this cost will be offset by the facility's own power generation (calculated using the power output data in tables 9 and 10 section 12.5.1.1). Therefore, the power generation used for this facility has been removed from the total energy generated available for sale to the national grid/district. As a result, the only utility expenditure is water, which has been calculated using standard industry rates and the water usage figures from tables 9 and 10 in section 12.5.1.1.

Disposal	Tonnes p.a.	Removal cost / tonne	Landfill tax / tonne	Total Cost / tonne	Total Cost p.a.
APCr / Fly Ash	2,250	£70.00	£126.15	£196.15	£441,337.50
Bottom Ash	17,250	£40.00	£0.00	£40.00	£690,000.00
Total	**19,500**	**£110.00**	**£126.15**	**£236.15**	**£1,131,337.50**

Table 17 - Disposal Costs

The disposal of ash from the incineration process is crucial. The facility process flow diagram (section 12.7) demonstrates the proportion of input waste that ends up as fly ash and bottom ash (3% and 23% respectively). The bottom ash is repurposed as construction material/aggregate so a landfill tax is not required, however the fee arises from the payment to an external contractor (Blue Phoenix) to collect and recycle it. On the other hand, the fly ash is hazardous waste and must be disposed of in landfill, therefore a landfill tax is required; the company dealing with this waste will be Augean, who run a higher collection and disposal rate per tonne due to the hazardous waste.

Role	Quantity	Wage p.a.	Annual cost
General Manager (Plant Director)	1	£95,000.00	£95,000.00
Environmental Manager	1	£60,000.00	£60,000.00
Site Environmental Coordinator	1	£40,000.00	£40,000.00
Ecological Clerk of Works (ECoW)	1	£45,000.00	£45,000.00
Independent Auditors (external)	n/a	£17,500.00	£17,500.00
Control Systems Engineers	2	£100,000.00	£200,000.00
Chemical / Process Engineers	2	£90,000.00	£180,000.00
IT Support Engineer	1	£55,000.00	£55,000.00
Lab / Emissions Technician	1	£45,000.00	£45,000.00
Mechanical Engineers	4	£60,000.00	£240,000.00
Gatehouse Operator	2	£32,000.00	£64,000.00
Incinerator Operator	2	£45,000.00	£90,000.00
Incinerator Supervisor	1	£55,000.00	£55,000.00
Sorting Supervisor	1	£50,000.00	£50,000.00
Health & Safety / Compliance Officer	1	£50,000.00	£50,000.00
Maintenance Manager	1	£65,000.00	£65,000.00
Electrical Technician	2	£45,000.00	£90,000.00
Mechanical Technician	3	£45,000.00	£135,000.00
Shift Managers	3	£50,000.00	£150,000.00
Manual Operatives	15	£30,000.00	£450,000.00
Security Guards	6	£28,000.00	£168,000.00
Logistics Representative	1	£40,000.00	£40,000.00
Caretakers	3	£25,000.00	£75,000.00
Stakeholder / Community Engagement Officers	4	£40,000.00	£160,000.00
HR Team	2	£35,000.00	£70,000.00
Visitor Centre Guides	2	£28,000.00	£56,000.00
Apprentices	10	£20,000.00	£200,000.00
Apprentice Trainer	1	£55,000.00	£55,000.00
Total	74		£3,000,500.00
Scaled Total (1.25 x 1.30)			**£4,875,812.50**

Table 18 - All Employees by Role and Corresponding Salary.

Table 18 demonstrates all the roles required at the HDL Croft facility and annual salaries have been estimated based on industry standards. The roles also include ten apprenticeship roles and training staff that have been included following the change in national immigration policy. As a contingency, a salary multiplier has been included, which accounts for the expected wage rises due to worker demand (1.3x), and also expected for contingencies such as worker sickness, holiday pay, pension payments etc. (1.25x).

OpEx	Cost p.a.
Wages	£4,875,812.50
Utilities	£27,014.60
Running	£4,838,500.00
General Site	£500,000.00
Consumables	£800,000.00
Disposal	£1,131,337.50
Insurance	£1,274,283.46
Total	**£13,446,948.06**

Table 19 - Breakdown of Total OpEx by Individual Category.

Table 19 and figures 15 and 16 show a summary breakdown of our expected total operational expenditure per annum.

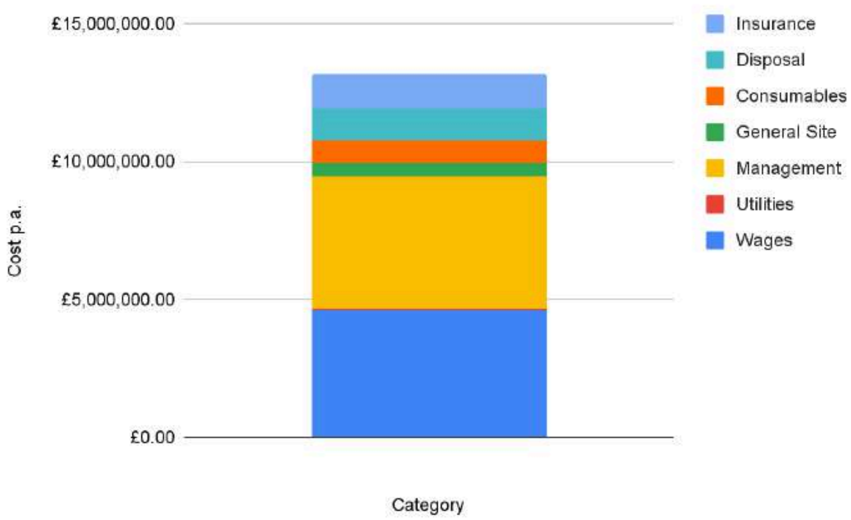


Figure 15 - Stacked Bar Chart of OpEx Costs

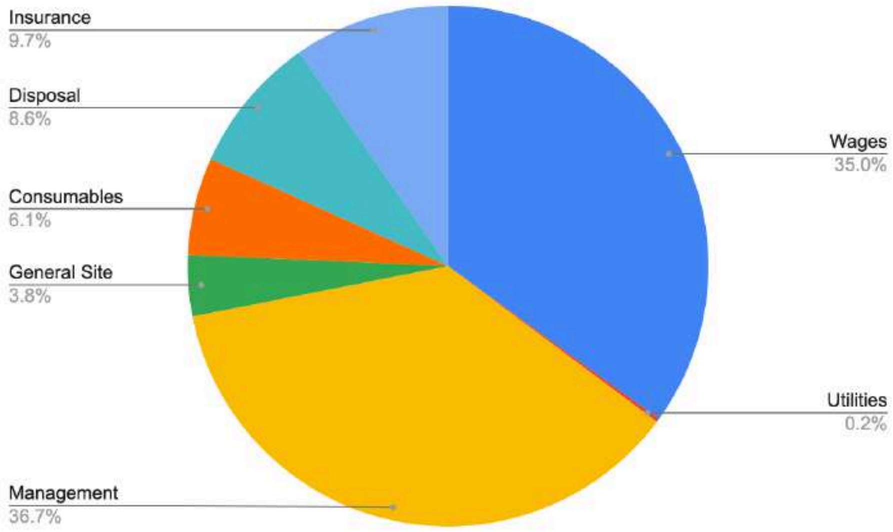


Figure 16 - Breakdown of OpEx Proportions

Year	Wages	OpEx (excl wages)	OpEx (wage inclusive)
1	£4,615,838.50	£8,571,135.56	£13,186,974.06
2	£4,920,714.63	£8,871,125.31	£13,791,839.94
3	£5,245,727.83	£9,181,614.69	£14,427,342.53
4	£5,592,208.16	£9,502,971.21	£15,095,179.36
5	£5,961,573.51	£9,835,575.20	£15,797,148.70
6	£6,355,335.44	£10,179,820.33	£16,535,155.77
7	£6,775,105.34	£10,536,114.04	£17,311,219.38
8	£7,222,601.05	£10,904,878.03	£18,127,479.08
9	£7,699,653.85	£11,286,548.76	£18,986,202.61
10	£8,208,215.99	£11,681,577.97	£19,889,793.96
11	£8,750,368.65	£12,090,433.20	£20,840,801.85
12	£9,328,330.50	£12,513,598.36	£21,841,928.86
13	£9,944,466.73	£12,951,574.30	£22,896,041.03
14	£10,601,298.76	£13,404,879.40	£24,006,178.16
15	£11,301,514.54	£13,874,050.18	£25,175,564.73
16	£12,047,979.58	£14,359,641.94	£26,407,621.52
17	£12,843,748.63	£14,862,229.41	£27,705,978.04
18	£13,692,078.23	£15,382,407.44	£29,074,485.66
19	£14,596,439.99	£15,920,791.70	£30,517,231.69
20	£15,560,534.85	£16,478,019.41	£32,038,554.26
21	£16,588,308.18	£17,054,750.09	£33,643,058.27
Total	**£197,852,042.94**	**£259,443,736.52**	**£457,295,779.46**

Table 20 - OpEx forecast over Relevant 21 Year Period (not inc. CapEx)

The operational expenditure has been forecast for the necessary 21 years; 4 years have been allocated for construction prior to operation, and the relevant costing has been attributed to CapEx (12.5.1). In table 20, the wage forecasts have been assumed to grow 3% above inflation (3.5%), whereas the remainder of the OpEx has been forecast to grow solely with inflation. This has been calculated using

$$Wage = W_0 \times (1.03 \times 1.035)^y$$
$$OpEx = O_0 \times (1.035)^y$$

12.5.3 Total Expenditure

Category	Cost
OpEx	£457,295,779.46
CapEx	£212,380,576.92
Total	**£669,676,356.38**

Table 21 - Total Expenditure over 25 Year HDL Croft Operating Period

12.5.4 Projected Income Statement and Corporation Tax Calculation

Year	Revenue (Generated) (£m)	Revenue (Unitary and Private) (£m)	Yearly Cash Expenditure (£m)	EBITDA (£m)	Depreciation (£m)
1	0	19	18.5	0.5	0
2	0	59	55.14	3.86	1.54
3	0	39	40.94	-1.94	2.33
4	0	31.5	14.04	17.46	4.091
5	18.1	27	48.34	-3.24	5.53
6	23.1	9	27.8	4.3	5.53
7	23.1	9	27.8	4.3	5.53
8	23.1	9	27.8	4.3	5.53
9	23.1	9	19	13.1	5.53
10	23.1	9	13.5	18.6	5.53
11	23.1	9	13.5	18.6	5.53
12	23.1	9	13.5	18.6	5.53
13	23.1	9	13.5	18.6	5.53

Year	Tax loss brought forward (£m)	Taxable Profit After Losses (£m)	Corporate Tax Paid (25%) (£m)	Net Profit (£m)	Tax loss carried forward (£m)
1	0	0.5	0.125	0.375	0
2	0	2	0.5	1.5	0
3	0	-3	0	1.94	-0.39
4	-0.39	-4.39	-1.0975	-3.2925	0
5	0	-5	0	-3.24	-8.77

6	-8.77	-14.77	0	4.3	-10
7	-10	-17	0	4.3	-11.23
8	-11.23	-19.23	0	4.3	-12.46
9	-12.46	-21.46	-5.365	-16.095	-4.89
10	-4.89	-14.89	-3.7225	-11.1675	0
11	0	-11	-2.75	-8.25	0
12	0	-12	-3	-9	0
13	0	-13	-3.25	-9.75	0

Table 21 - Tax

12.6.5 Private Investment

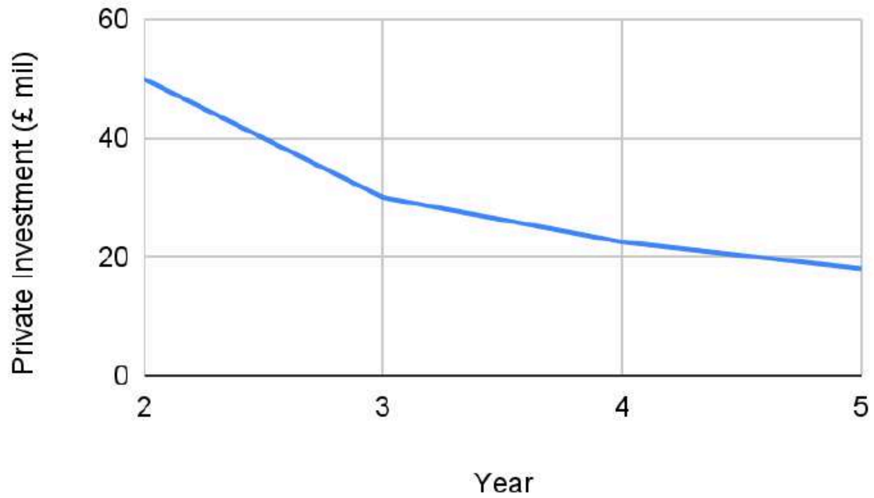


Figure 16 - Necessary Private Investment YoY Across Years 2-5

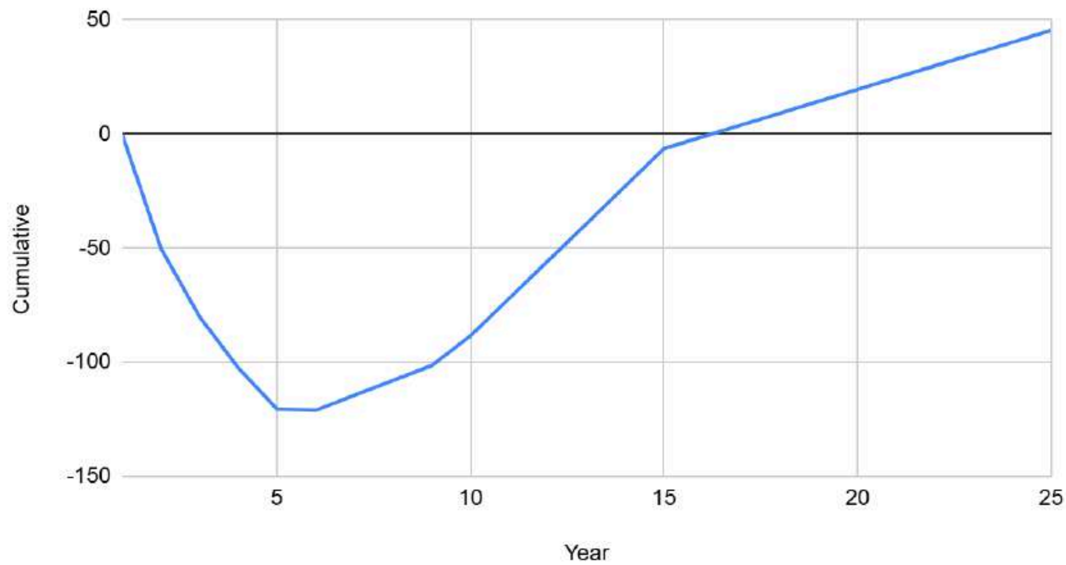


Figure 17 - Cumulative Equity Cash Flow Graph

12.5.6 Annual Allocation of Costs

Year 1 Expenditure	Cost (£ mil)	Year 2 Expenditure	Cost (£ mil)	Year 3 Expenditure	Cost (£ mil)	Year 4 Expenditure	Cost (£ mil)	Year 5 Expenditure	Cost (£ mil)
Contingency	4.24	Contingency	4.24	Contingency	4.24	Contingency	4.24	Contingency	4.24
Land acquisition and access	2.1	Legal and permitting	4.3	Management, design and administrative	1	Management, design and administrative	1	Management, design and administrative	1
Legal and permitting	4.2	Management, design and administrative	8.1	Site Construction (70% of site construction)	35.7	Incinerator purchase and instillation (40% of process construction) (5 year payment plan begins)	8.8	Incinerator purchase and instillation (2nd year of payment plan)	8.8
Management, design and administrative	8	Pipe network instillation (35% of process construction)	38.5					Sorting process purchase and instillation (25% of process construction) (5 year payment plan begins)	5.5
								Operational Expenditure	13.5
								Visitor centre construction (30% of site construction)	15.3

Year 6 Expenditure	Cost (£ mil)	Year 7 Expenditure	Cost (£ mil)	Year 8 Expenditure	Cost (£ mil)	Year 9 Expenditure	Cost (£ mil)	Year 10 Expenditure	Cost (£ mil)
Incinerator purchase and instillation (3rd year of payment plan)	8.8	Incinerator purchase and instillation (4rd year of payment plan)	8.8	Incinerator purchase and instillation (Last year of payment plan)	8.8	Sorting process purchase and instillation (Last year of payment plan)	5.5	Operational Expenditure	13.5
Sorting process purchase and instillation (2nd year of payment plan)	5.5	Sorting process purchase and instillation (3nd year of payment plan)	5.5	Sorting process purchase and instillation (4nd year of payment plan)	5.5	Operational Expenditure	13.5		
Operational Expenditure	13.5	Operational Expenditure	13.5	Operational Expenditure	13.5				

Table 22 and 23 - 10 Year Allocation of Costs, beyond year 10 the only regular cost is OpEx

12.5.7 Annual Cash Flow Projection

Costs in £ Million	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Operating Cash Balance	0	0.375	3.655	1.715	16.905	16.295	23.195	30.095	36.995	50.655	67.935	85.215	102.495
Cash Inflows													
Council	9	9	9	9	9	9	9	9	9	9	9	9	9
Private investment	0	50	30	22.5	18	0	0	0	0	0	0	0	0
Generated Revenue	0	0	0	0	20.73	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
HDL Croft Investment	10	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	19	59	39	31.5	47.73	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
Cash Outflows													
Site Construction	0	0	35.7	0	15.3	0	0	0	0	0	0	0	0
Equipment	0	38.5	0	8.8	14.3	14.3	14.3	14.3	5.5	0	0	0	0
Operating Expenditure	0	0	0	0	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Other Expenses	18.5	16.64	5.24	5.24	5.24	0	0	0	0	0	0	0	0
Corporation Tax Paid	0.125	0.58	0	2.27	0	0	0	0	2.04	3.92	3.92	3.92	3.92
Total Outflow	18.625	55.72	40.94	16.31	48.34	27.8	27.8	27.8	21.04	17.42	17.42	17.42	17.42
Net Cash Flow	0.375	3.28	-1.94	15.19	-0.61	6.9	6.9	6.9	13.66	17.28	17.28	17.28	17.28
Closing Cash Balance	0.375	3.655	1.715	16.905	16.295	23.195	30.095	36.995	50.655	67.935	85.215	102.495	119.775

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Operating Cash Balance	119.775	137.055	154.335	171.615	188.895	206.175	223.455	240.735	258.015	275.295	292.575	309.855
Cash Inflows												
Council	9	9	9	9	9	9	9	9	9	9	9	9
Private investment	0	0	0	0	0	0	0	0	0	0	0	0
Generated Revenue	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
HDL Croft Investment	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
Cash Outflows												
Site Construction	0	0	0	0	0	0	0	0	0	0	0	0
Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Operating Expenditure	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Other Expenses	0	0	0	0	0	0	0	0	0	0	0	0
Corporation Tax Paid	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
Total Outflow	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42
Net Cash Flow	17.28	17.28	17.28	17.28	17.28	17.28	17.28	17.28	17.28	17.28	17.28	17.28
Closing Cash Balance	137.055	154.335	171.615	188.895	206.175	223.455	240.735	258.015	275.295	292.575	309.855	327.135

Table 24 - Annual Cash Flow Projection Across 25 Year HDL Croft Operating Period

12.5.8 Savings to Council

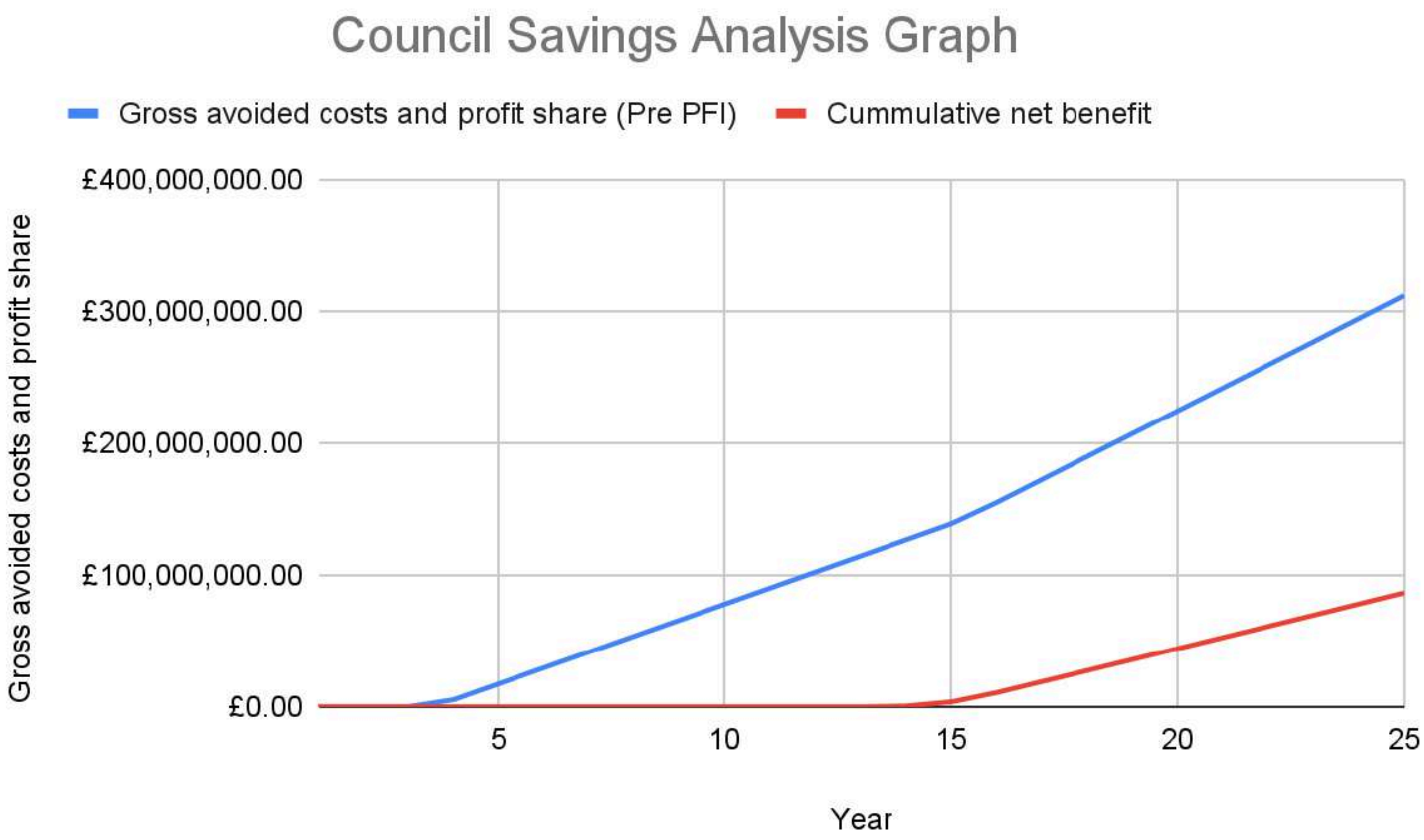


Figure 18 - Visual representation of council savings and benefits

Year	Cumulative PFI payments	Yearly net benefit to the council	Cumulative net benefit to the council	Yearly gross avoided costs and profit share	Tonnes diverted from landfill	Landfill savings	Proft shared to council	Tonnes sent to landfill	Council waste received (Tonnes)	Cumulative gross avoided costs and profit share
1	£9,000,000.00	£0.00	£0.00	£0.00	0	£0.00	£0.00	96703	96703	£0.00
2	£18,000,000.00	£0.00	£0.00	£0.00	0	£0.00	£0.00	94841	94841	£0.00
3	£27,000,000.00	£0.00	£0.00	£0.00	0	£0.00	£0.00	92980	92980	£0.00
4	£36,000,000.00	£0.00	£0.00	£5,408,604.50	41366	£5,408,604.50	£0.00	52433	93799	£5,408,604.50
5	£45,000,000.00	£3,083,915.00	£0.00	£12,083,915.00	92420	£12,083,915.00	£0.00	1430	93850	£17,492,519.50
6	£54,000,000.00	£3,090,714.00	£0.00	£12,090,714.00	92472	£12,090,714.00	£0.00	1430	93902	£29,583,233.50
7	£63,000,000.00	£3,097,382.25	£0.00	£12,097,382.25	92523	£12,097,382.25	£0.00	1431	93954	£41,680,615.75
8	£72,000,000.00	£3,104,181.25	£0.00	£12,104,181.25	92575	£12,104,181.25	£0.00	1431	94006	£53,784,797.00
9	£81,000,000.00	£3,110,718.75	£0.00	£12,110,718.75	92625	£12,110,718.75	£0.00	1432	94057	£65,895,515.75
10	£90,000,000.00	£3,117,648.50	£0.00	£12,117,648.50	92678	£12,117,648.50	£0.00	1432	94110	£78,013,164.25
11	£99,000,000.00	£3,124,447.50	£0.00	£12,124,447.50	92730	£12,124,447.50	£0.00	1432	94162	£90,137,611.75
12	£108,000,000.00	£3,131,115.75	£0.00	£12,131,115.75	92781	£12,131,115.75	£0.00	1433	94214	£102,268,727.50
13	£117,000,000.00	£3,137,784.00	£0.00	£12,137,784.00	92832	£12,137,784.00	£0.00	1433	94265	£114,406,511.50
14	£126,000,000.00	£3,144,713.75	£551,225.25	£12,144,713.75	92885	£12,144,713.75	£0.00	1433	94318	£126,551,225.25
15	£135,000,000.00	£3,157,004.25	£3,708,229.50	£12,157,004.25	92979	£12,157,004.25	£0.00	1433	94412	£138,708,229.50
16	£144,000,000.00	£7,053,633.75	£10,761,863.25	£16,053,633.75	93045	£12,165,633.75	£3,888,000.00	1433	94478	£154,761,863.25
17	£153,000,000.00	£8,358,132.50	£19,119,995.75	£17,358,132.50	93110	£12,174,132.50	£5,184,000.00	1433	94543	£172,119,995.75
18	£162,000,000.00	£8,368,592.50	£27,488,588.25	£17,368,592.50	93190	£12,184,592.50	£5,184,000.00	1433	94623	£189,488,588.25
19	£171,000,000.00	£8,380,360.00	£35,868,948.25	£17,380,360.00	93280	£12,196,360.00	£5,184,000.00	1433	94713	£206,868,948.25
20	£180,000,000.00	£8,399,580.25	£44,268,528.50	£17,399,580.25	93427	£12,215,580.25	£5,184,000.00	1433	94860	£224,268,528.50
21	£189,000,000.00	£8,410,694.00	£52,679,222.50	£17,410,694.00	93512	£12,226,694.00	£5,184,000.00	1433	94945	£241,679,222.50
22	£198,000,000.00	£8,418,669.75	£61,097,892.25	£17,418,669.75	93573	£12,234,669.75	£5,184,000.00	1433	95006	£259,097,892.25
23	£207,000,000.00	£8,434,752.00	£69,532,644.25	£17,434,752.00	93696	£12,250,752.00	£5,184,000.00	1433	95129	£276,532,644.25
24	£216,000,000.00	£8,500,388.50	£78,033,032.75	£17,500,388.50	94198	£12,316,388.50	£5,184,000.00	1433	95631	£294,033,032.75
25	£225,000,000.00	£8,510,979.25	£86,544,012.00	£17,510,979.25	94279	£12,326,979.25	£5,184,000.00	1433	95712	£311,544,012.00

Table 25 - Council Savings Data Compared to Current Waste Management System with HDL Croft's Proposal

Stakeholder	Projected profit share at the end of the 25 year project span
Council	£51,840,000.00
Private investors	Invested equity recovered + £45,800,000.00
HDL Croft's refurbishment fund	£75,000,000.00
HDL Croft	£33,900,000.00
Total	£327,135,000.00

Table 26 - Share of Profits Generated Received by Each Stakeholder

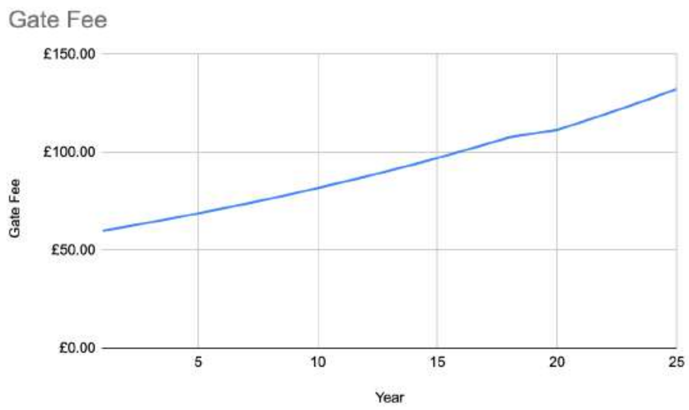
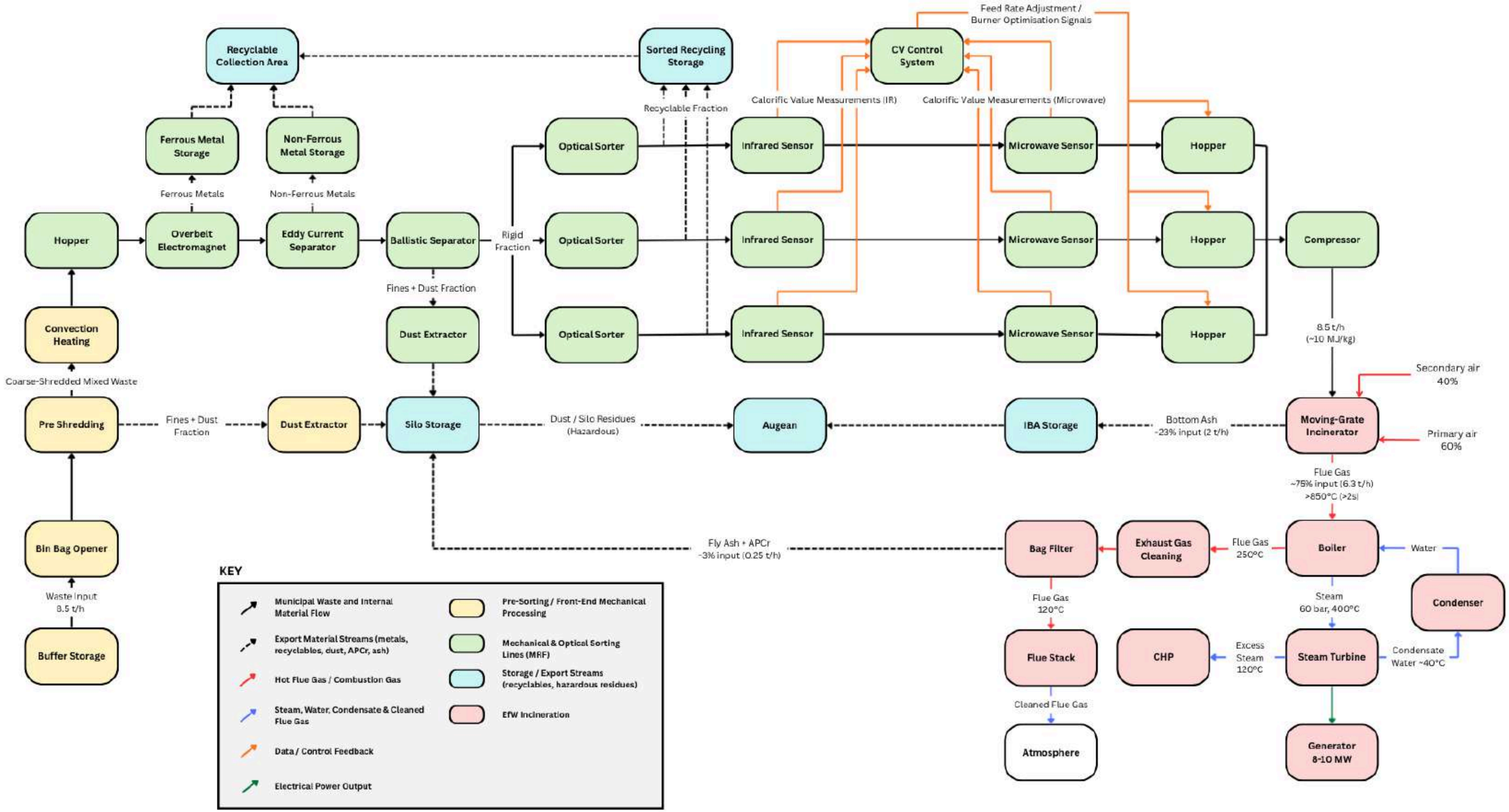


Figure 19 - Projected Gate Fee increase with inflation

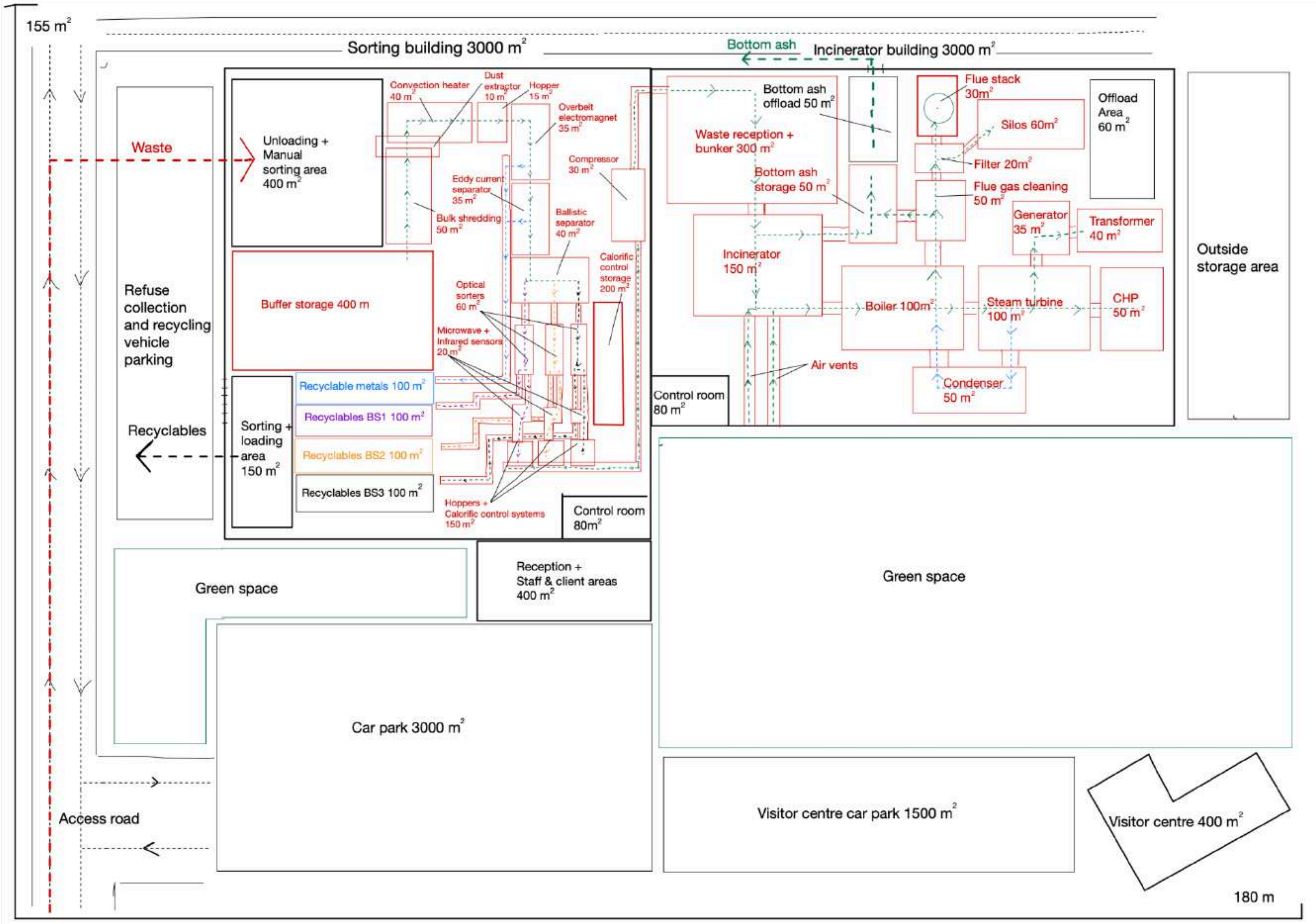
12.6 Process Flow Diagram

(Below) Figure 20 - Process Flow Diagram



12.7 Facility Floor Plan

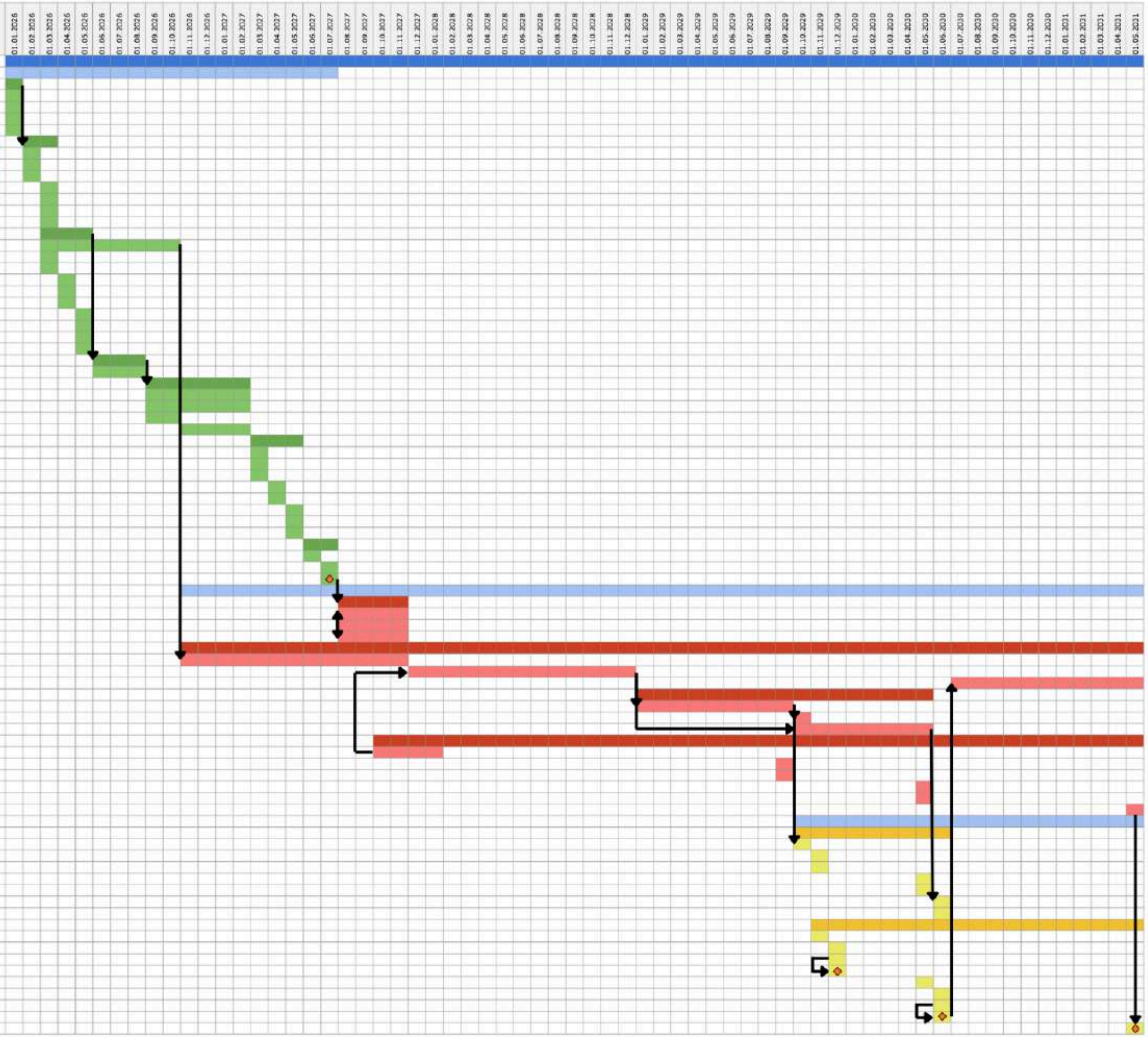
(Below) Figure 21 - Facility Floor Plan



12.8 Gantt Chart

(Below) Figure 22 - Construction Timeline

Task name	Start date	End date	Status
HDL Croft Waste Management Plant (pre operation)	01.01.2026	31.05.2031	Open
1. Pre-Construction Activity	01.01.2026	31.07.2027	Open
1.1 Project Initiation and Governance	01.01.2026	31.01.2026	Open
Appoint project director and core team	01.01.2026	31.01.2026	Done
Stakeholder meeting with council and Environment Agency	01.01.2026	31.01.2026	Open
Confirm funding route	01.01.2026	31.01.2026	In process
Draft project execution plan	01.01.2026	31.01.2026	In process
1.2 Strategy	01.02.2026	31.03.2026	In process
Analyse waste composition and tonnage forecasts	01.02.2026	28.02.2026	In process
Model recycling and residual fractions (baseline scenario)	01.02.2026	28.02.2026	In process
Develop concept design alternatives/selection justification	01.02.2026	28.02.2026	In process
Conduct site options appraisal	02.02.2026	31.03.2026	In process
Prepare initial cost model	02.02.2026	31.03.2026	In process
Conduct risk assessment	02.02.2026	31.03.2026	Open
Stakeholder mapping	02.02.2026	31.03.2026	In process
1.3 Site Selection	01.03.2026	31.05.2026	Open
District Heat Network Planning	01.03.2026	31.10.2026	Open
Confirm preferred site	01.03.2026	31.03.2026	Open
Acquire land deeds and confirm ownership/lease terms	01.03.2026	01.03.2026	Open
Topographical survey	01.04.2026	30.04.2026	Open
Contamination testing	01.04.2026	30.04.2026	Open
Flood-risk and drainage study	01.04.2026	30.04.2026	Open
Utility-capacity assessment	01.05.2026	31.05.2026	Open
Noise baseline survey	01.05.2026	31.05.2026	Open
Ecology and biodiversity assessment	01.05.2026	31.05.2026	Open
Transport and traffic assessment	01.05.2026	31.05.2026	Open
1.4 Concept and Preliminary Design	01.06.2026	31.08.2026	Open
Develop PFDs for sorting, EfW, power export and residual feed	01.06.2026	31.08.2026	Open
1.5 Environmental and Planning	01.09.2026	28.02.2027	Open
Undertake full Environmental Impact Assessment (EIA)	01.09.2026	28.02.2027	Open
Public consultation / community engagement	01.09.2026	28.02.2027	Open
Identify relevant regulations	01.09.2026	31.10.2026	Open
Planning and Environmental permit application	01.11.2026	28.02.2027	Open
1.6 Procurement and Financial Close	01.03.2027	31.05.2027	Open
Develop/decide procurement strategy	01.03.2027	30.03.2027	Open
Enquire contractors and technology vendors	01.03.2027	30.03.2027	Open
Evaluate and select vendor proposals	01.03.2027	30.03.2027	Open
Finalise capital cost estimates (CapEx/OpEx)	01.04.2027	30.04.2027	Open
Develop financial model	01.04.2027	30.04.2027	Open
Secure insurance and bonding	01.05.2027	31.05.2027	Open
Legal review	01.05.2027	31.05.2027	Open
Achieve financial close, contracts signed	01.05.2027	31.05.2027	Open
1.7 Detailed Design	01.06.2027	31.07.2027	Open
Site plan and facility schematic drawings	01.06.2027	30.06.2027	Open
Final risk assessment	01.07.2027	31.07.2027	Open
Issue final design for construction	01.07.2027	31.07.2027	Open
2. Construction	01.11.2026	01.05.2031	Closed
2.1 Site Preparation	01.08.2027	30.11.2027	Closed
Mobilise contractors and establish site compound	01.08.2027	30.11.2027	Closed
Install temporary welfare facilities	01.08.2027	30.11.2027	Closed
Carry out necessary demolition/landscaping/preparation	01.08.2027	30.09.2027	Closed
2.2 Civil and Structural Construction	01.11.2026	31.05.2031	Closed
Construct District Heating Network	01.11.2026	30.11.2027	Closed
Erect EfW and Sorting facility	01.12.2027	31.12.2028	Closed
Erect/integrate visitor centre	01.07.2030	31.05.2031	Closed
2.3 Mechanical and Electrical Installation	01.01.2029	31.05.2030	Closed
Deliver and install required EfW machinery/software	01.01.2029	30.09.2029	Closed
Establish electrical grid connection	01.10.2029	31.10.2029	Closed
Deliver and install required sorting machinery/software	01.10.2029	31.05.2030	Closed
2.4 External and Site Infrastructure	01.10.2027	31.05.2031	Closed
Construct external works and staff facilities	01.10.2027	31.01.2028	Closed
Connect permanent utilities (EfW)	01.09.2029	30.09.2029	Closed
Implement acoustic/odour mitigation works (EfW)	01.09.2029	30.09.2029	Closed
Connect permanent utilities (Sorting)	01.05.2030	31.05.2030	Closed
Implement acoustic/odour mitigation works (Sorting)	01.05.2030	31.05.2030	Closed
Connect permanent utilities (Visitor's Centre)	01.05.2031	31.05.2031	Closed
3. Post-Construction Activity	01.10.2029	31.05.2031	Closed
3.1 Commissioning and Performance Testing	01.10.2029	30.06.2030	Closed
Emissions and performance testing (EfW)	01.10.2029	31.10.2029	Closed
Environmental Agency inspection/validation	01.11.2029	30.11.2029	Closed
Performance guarantee test (throughput, output) (EfW)	01.11.2029	30.11.2029	Closed
System calibration using sample waste streams	01.05.2030	31.05.2030	Closed
Performance testing (Sorting)	01.05.2030	31.05.2030	Closed
Performance guarantee test (throughput, output) (Sorting)	01.06.2030	30.06.2030	Closed
Prepare report	01.06.2030	30.06.2030	Closed
3.2 Training and Handover	01.11.2029	31.05.2031	Closed
Develop manuals and training materials (EfW)	01.11.2029	30.11.2029	Closed
Train facility operators and staff (EfW)	01.12.2029	31.12.2029	Closed
Finalise health and safety operations (EfW)	01.12.2029	31.12.2029	Closed
Commence commercial operations (EfW)	01.12.2029	31.12.2029	Closed
Develop manuals and training materials (Sorting)	01.05.2030	31.05.2030	Closed
Train facility operators and staff (Sorting)	01.06.2030	30.06.2030	Closed
Finalise health and safety operations (Sorting)	01.06.2030	30.06.2030	Closed
Commence commercial operations (Sorting)	01.06.2030	30.06.2030	Closed
Project Completion	01.05.2031	31.05.2031	Closed



12.8.1 Summary

12.8.1.1

This chart outlines the expected timeline for the pre-operation phase of the proposed Doddington waste-management facility. Timings are based on realistic delivery durations of medium-scale infrastructure projects across the UK, with overlapping workstreams where possible to ensure an optimal programme timeline.

12.8.1.2

This project has been given a 65-month timeline, scheduled to finish by June 2031 - twelve months after the Doddington Council commissioning date of 1 July 2030.

12.8.1.3

The waste management part of the facility will be fully operational in June 2030.

12.8.1.4

Exeter ERF was used as a key point of reference, as there are lots of similarities in the scale and premise of HDL Croft's proposed project for Doddington, and the pre-existing EfW facility owned by Viridor [36].

12.8.2 Pre-construction Phase (Green)

12.8.2.1

Approximately 18 months have been allocated for this stage - requires detailed thought and the acquisition of relevant permits.

12.8.2.2

The timeline begins with general project initiation, followed by strategic planning and making initial finance considerations.

12.8.2.3

Subsequently, concept design begins, creating preliminary layouts and process diagrams.

12.8.2.4

Once the concept is defined, the Environmental Impact Assessment and collecting planning permission stage is imperative.

12.8.2.5

Final stages are heavily dependent on permit acquisition from the Environmental Agency and the Doddington City Council.

12.8.2.6

Milestone of 'issue final design for construction' is achieved, and the construction stage can begin.

12.8.3 Construction Phase (Red)

12.8.3.1

Total construction time has been allocated as 55 months.

12.8.3.2

Begins with the construction of the 3km district heating network and site preparation for the facility.

12.8.3.3

District heating network construction will commence well before the on-site construction of the facility; site's preparation is independent of the external piping network.

12.8.3.4

As there is no interdependence between the erection of the EfW and recycling plants, or too with the visitor's centre, time can be well-managed by simultaneous construction.

12.8.3.5

Civil works on the facility must be completed before mechanical and electrical installation can begin.

12.8.3.6

The construction of the visitors centre does not affect the site's operationality, so this construction period will take place after the original commissioning date.

12.8.3.7

Due to the strong dependency on construction termination and facility operation, any delays in this stage would affect the service-commencement date.

12.8.4 Post-Construction Phase (Yellow)

12.8.4.1

Expected to last around 20 months due to the staggered operationality; this includes performance testing, calibration, training and handover.

12.8.4.2

The final target milestone of 'Project Completion' is achieved - this reflects a controlled transition from construction into full operation.

12.9 Environmental Mitigations

12.9.1 Pollutant Mitigation

Pollutant	**Source**	**Mitigation**
Carbon Monoxide (CO)	Incomplete combustion of the MSW stream	Optimised combustion + TWC oxidation layer in catalytic reactor (>90% efficiency).
Carbon Dioxide (CO_2)	Complete combustion of the MSW stream	Monitored for GHG emission data
Nitrogen Oxides (NO_x)	Thermal/fuel NO_x creation	Primary removal via upstream SNCR, extra NO_x emissions during peak load polished by SNCR layer.
Sulphur oxides (SO_x)	Waste streams containing sulphur	Heavy sorting approach decreases total emissions + dry flue gas desulphuriser
Hydrogen fluoride (HF) and Hydrogen chloride (HCl)	Fluorinated and chlorinated materials	Powdered lime injection during dry FGD. Spent sorbents and salts captured in baghouse hazardous waste stream

Mercury	Waste composition	Adsorbed during the ACI and captured in the baghouse hazardous waste stream. Oxidised mercury captured in dry FGD
Ammonia (NH_3)	SCNR reagent slip	Hybrid polishing SCR
Particulate matter (PM)	Fly ash entrapment	Coarse fraction filtered out in the cyclone pre-clean, fine PM captured in baghouse
Dioxins and furans (PCDD/F)	Cooling zone can have trace amounts of synthesis	Adsorbed during the ACI and captured in the baghouse hazardous waste stream
Heavy Metals	Waste composition	Adsorbed during the ACI and captured in the baghouse hazardous waste stream
Volatile organic compounds	Incomplete oxidation	The TWC oxidation layer in the catalytic reactor should lead to >95% VOC removal efficiency at all loads.
Polycyclic aromatic hydrocarbons	Ash residues	Complete combustion

Table 27 - Pollution Mitigation Methods

12.9.2 Operating Contingencies

Failure	**Impact**	**Mitigation**	**Monitoring / Response**	**Risk**
Lime feed system failure	Increased SO_2 and HCl emissions	Dual lime feed lines	Continuous monitoring via CEMS	Negligible
Bag filter burst	Increased particulate emissions	Compartmentalised filters	CEMS and pressure differential data	Negligible
Power loss triggering emergence release valve	Short term pollutant increase	UPS on abatement systems	Event logged	Minor

Table 28 - Equipment Failure Protocols

12.10 Fulfillment of Requirements

ITT Ref.	Requirement	Tender Section(s)
4	Provide services for the treatment of Contract Waste	5.4, 5.6
5.1	Obtain and manage all property, planning, and statutory consents	5.3, 8
5.2	Deliver all works including enabling works, design, construction, testing, and commissioning	5, 6, 8, 9
5.3	Provide full project financing	10, 12.5
5.4	Capture and divert recyclable materials from Contract Waste	3.8, 7
5.5	Manage health and safety and environmental performance	5.9, 5.10, 6
5.6	Interface with the Council's existing waste collection services	3.8, 7
5.7	Manage and maintain the Facility	5.2, 8, 9.1, 10.3.2, 12.5.2
5.8	Hand back the Facility in good order at contract end	10.3.6
5.9	Provide and operate a Visitor Centre	5.8
6.1	Arrange financing with no capital investment from the Council (PFI)	10.1.3, 10.2
6.2	Design and construct all buildings and facilities, including permissions and leases	5, 8.1, 12.5.1
6.3	Process all municipal waste within the Council boundaries and dispose of residual materials	5.6.2.5, 7, 12.5.2
6.4	Manage, maintain, and monitor all facilities	5, 8, 9
6.5	Return facilities and staff in good condition at contract termination (25 years)	10.2.1, 10.3.6
6.6	Design facilities with due regard to aesthetics, local character, and community experience	3.1, 3.3, 5.8, 8.5, 8.6
6.7	Achieve full operation of the Facility by the Commissioning Date	5.3.1, 12.8
7.1	Specify method and rationale for calculating cost to the Council over the contract term	10.2, 12.5.8
7.2	Identify risks to the Facility, the Council, and statutory obligations, with mitigation measures	6.1, 9, 12.4
7.3	Specify Facility design including site layout	5.8.1, 12.7
7.4	Provide contingency plans in the event of Contractor bankruptcy	10.4
8	Accept Third Party Waste where this does not prevent delivery of Contract Waste	9.1.1.8, 10.3.4.2

9	Provide a high-quality Visitor Centre for public engagement activities	5.8
10.1	Provide an accessible explanation of Facility processes	5.4, 5.5, 5.6
10.2	Provide guided tours of the Facility commencing on Commissioning	5.8.3
11	Demonstrate positive interdisciplinary working and integrated design	5.8.2, 5.8.3, 5.8.6
12	Review and improve operational efficiency and report annually	5.3.2.3, 5.4.2.5, 6.1.2.3, 10.3.3
13	Design and construct the Works to meet ITT requirements	5
14	Provide sufficient capacity to accept, manage, and process all Contract Waste	5.3, 5.6.1.1
14.3	Accept all Contract Waste delivered to the Facility	5.6.1.1, 12.7
14.3.1	Bear liability for alternative disposal costs if unable to accept Contract Waste	11.6
15	Meet the definition of “Recovery” under the Waste Framework Directive	5.4
16	Identify and undertake all enabling works required	5
17	Demolish existing structures and make redundant infrastructure safe	5.1, 5.3
19	Undertake annual performance review and address identified issues	6.3.3.6, 12.2.1
20	Divert at least 96.5% of Processable Contract Waste from landfill	4.2, 12.2.3
20.1	Comply with Maximum Permitted Landfill Tonnages	4.2, 12.2.3
21	Recover a minimum of 10% of Processable Contract Waste through front-end recycling	5.4, 12.2.3
22	Deliver recyclable materials to sustainable markets	5.4.2.2
23	Provide a Disaster Recovery Plan	9.2
24	Include disaster scenarios within the Disaster Recovery Plan	9.2.1, 9.2.2, 9.2.3, 9.2.4
25	Accept and process all Contract Waste	4.2, 5, 12.2.3
26	Provide Facility access for waste delivery during specified hours	10.3.1.2
27	Make the Visitor Centre available during specified hours	5.8.1
28	Provide personnel to lead guided tours	5.8.3
29	Hand back the Facility capable of 10 further years of operation without major capital expenditure	10.3.6, 12.5
30	Provide full handback information including assets, consents, liabilities, and staff arrangements	10.3.6, 11

Table 29 - Proof of Fulfillment of Requirements

13 References

[1] Green Party of England and Wales, *Green Party 2024 General Election Manifesto*, London, UK, 2024. [Online]. Available: https://www.greenparty.org.uk/app/uploads/2024/06/Green-Party-2024-General-Election-Manifesto-Long-version-with-cover.pdf

[2] M. Astrup *et al.*, "Incineration of municipal solid waste," *Waste Management*, vol. 102, pp. 1–9, 2020. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/32283464/

[3] HM Revenue & Customs, *Business Income Manual: BIM64005*, UK Gov., 2024. [Online]. Available: https://www.gov.uk/hmrc-internal-manuals/business-income-manual/bim64005

[4] European Parliament and Council of the European Union, *Directive 2008/98/EC on Waste*, 2008. [Online]. Available: https://eur-lex.europa.eu/eli/dir/2008/98/oj/eng

[5] Doddington City Council, *GEE201 Invitation to Tender for Residual Waste Processing and Treatment Project*, 2025, unpublished document.

[6] J. M. Chimenos *et al.*, "Upgraded MSWI bottom ash as aggregate in concrete," *Construction and Building Materials*, vol. 36, pp. 843–850, 2012. [Online]. Available: https://www.researchgate.net/publication/257792748

[7] Blue Phoenix Group, *IBA Processing in the United Kingdom*, 2024. [Online]. Available: https://www.blue-phoenix.com/united-kingdom/iba-processing/

[8] Doddington City Council, *Map of Doddington Area*, unpublished cartographic material.

[9] UK Government, *Waste Environmental Permits*, 2024. [Online]. Available: https://www.gov.uk/guidance/waste-environmental-permits

[10] UK Government, *Industrial Emissions Standards and Best Available Techniques*, 2024. [Online]. Available: https://www.gov.uk/guidance/industrial-emissions-standards-and-best-available-techniques

[11] M. Sabbas *et al.*, "Management of municipal solid waste incineration residues," *Waste Management*, vol. 23, no. 1, pp. 61–88, 2003. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/26774396/

[12] Recycling Bins Ltd., *Recycling Facts*, 2024. [Online]. Available: https://www.recyclingbins.co.uk/pages/recycling-facts

[13] WRAP, *Good Practice Guidance: Residual Waste*, 2025. [Online]. Available: https://www.wrap.ngo/system/files/2025-08/WRAP-Good-Practice-Guidance-Residual-Waste.pdf

[14] Viridor, *Exeter Energy Recovery Facility*, 2024. [Online]. Available: https://www.viridor.co.uk/energy/energy-recovery-facilities/exeter-erf/

[15] Veolia UK, *A Complete Guide to Combined Heat and Power*, 2024. [Online]. Available: https://www.veolia.co.uk/complete-guide-chp

[16] YouTube, *How Waste-to-Energy Plants Work*, video, 2020. [Online]. Available: https://www.youtube.com/watch?v=ITPVai8QCJI

[17] International Energy Agency, *Industrial Emissions Directive (2010/75/EU)*, 2023. [Online]. Available: https://www.iea.org/policies/17701-industrial-emissions-directive-201075eu

[18] UK Parliament, *Energy Act 2015*, 2015. [Online]. Available: https://www.legislation.gov.uk/ukpga/2015/30/contents

[19] UK Parliament, *Environmental Permitting (England and Wales) Regulations 2010*, 2010. [Online]. Available: https://www.legislation.gov.uk/ukpga/2010/15/contents

[20] UK Parliament, *Environment Act 2021*, 2021. [Online]. Available: https://www.legislation.gov.uk/ukpga/2021/30/contents

[21] UK Parliament, *Health and Safety at Work etc. Act 1974*, 1974. [Online]. Available: https://www.legislation.gov.uk/ukpga/1974/37/contents

[22] U.S. Environmental Protection Agency, *Clean Air Act Overview*, 2020. [Online]. Available: https://www.epa.gov/sites/default/files/2020-07/documents/cs4-2ch1.pdf

[23] U.S. Senate Committee on Environment and Public Works, *Clean Air Act of 2010*, 2010. [Online]. Available: https://www.epw.senate.gov/public/_cache/files/6/a/6a99e537-8f7a-431f-9bb8-b7e8a63ef314

[24] Baghouse.com, *How Often Should Baghouse Filters Be Changed?*, 2024. [Online]. Available: https://baghouse.com/how-often-should-baghouse-filters-be-changed/

[25] U.S. Environmental Protection Agency, *SCR Cost Manual*, 2017. [Online]. Available: https://www.epa.gov/sites/default/files/2017-12/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf

[26] Dsposal Ltd., *EWC Code 19 01 07**, 2024. [Online]. Available: https://dsposal.uk/ewc-codes/19/19-01/19-01-07star/

[27] UK Parliament, *Environmental Permitting (England and Wales) (Amendment) Regulations 2016*, 2016. [Online]. Available: https://www.legislation.gov.uk/uksi/2016/1154/contents

[28] UK Parliament, *Landfill Tax Regulations 1999*, 1999. [Online]. Available: https://www.legislation.gov.uk/ukpga/1999/31/contents

[29] UK Parliament, *Environmental Protection Act 1990*, 1990. [Online]. Available: https://www.legislation.gov.uk/ukpga/1990/8/contents

[30] UK Parliament, *Taxation (Cross-border Trade) Act 2018*, 2018. [Online]. Available: https://www.legislation.gov.uk/ukpga/2018/12/contents

[31] *UKPropertyData*, Propertydata.co.uk, 2024. https://propertydata.co.uk/sqft-figures

[32] T. Hamlett, *Building Costs Per Square Metre in 2025*, Kingsmead, Sep. 23, 2025. https://kingsmeadconsultants.co.uk/post/building-costs-per-square-metre/

[33] G. P. Towler and R. K. Sinnott, *Chemical engineering design : principles, practice and economics of plant and process design. Amsterdam: Elsevier/Butterworth-Heinemann*, 2022.

[34] Singleton Birch, *Ultralime Hydrated Lime Product Specification*, 2024. [Online]. Available: https://www.londonlimemortar.co.uk/singleton-birch-ultralime-hydrated-lime-pallet-of-40-bags-1-ton-610-p.asp

[35] Finest Filters, *Activated Carbon 25kg*, 2024. [Online]. Available: https://www.finest-filters.co.uk/25kg-activated-carbon/

[36] Viridor, *Exeter Energy Recovery Facility*, 2024. [Online]. Available: https://www.viridor.co.uk/energy/energy-recovery-facilities/exeter-erf/