Environment Agency

Evidence

Waste crime interventions and evaluation project

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We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local councils, other agencies, civil society groups and the communities we serve.

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Evidence at the Environment Agency

Evidence underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us, and helps us to develop tools and techniques to monitor and manage our environment as efficiently and effectively as possible. It also helps us to understand how the environment is changing and to identify what the future pressures may be.

The work of the Environment Agency's Research, Analysis and Evaluation group is an important ingredient in the partnership between research, guidance and operations that enables the Environment Agency to protect and restore our environment by:

- **Setting the agenda**, by providing the evidence for decisions.
- **Maintaining scientific credibility**, by ensuring that our programmes and projects are fit for purpose and executed according to international standards.
- **Carrying out research**, either by contracting it out to research organisations and consultancies or by doing it ourselves.
- **Providing information, advice, tools and techniques**, by making appropriate products available.

Doug Wilson

Director of Research, Analysis and Evaluation

Executive summary

Background and objectives

After calls from the waste industry to do more to tackle waste crime, in 2014 HM Government allocated £5 million savings from the Landfill Community Fund to the Environment Agency for additional work. As a result, the 'Waste crime interventions and evaluation project' was set up with the aim of tackling three priority outcome areas: reducing the risk from illegal waste sites, reducing the illegal export of waste and reducing the misdescription of waste.

In March 2015, HM Government announced a further £4.2 million of additional 'top up' funding for the Environment Agency to address waste crime, and over the project period £788,000 of this was made available for the three outcome areas.

The Environment Agency was asked to organise a full impact evaluation of the additional funding. The objectives were to assess the outcomes, economics and effectiveness, and lessons learned.

The evaluation comprised the following stages:

- Stage 1: The development of logic models for each outcome area to identify their inputs and outcomes and the metrics to be used.
- Stage 2: Data collection from Environment Agency systems and contextual data and a targeted survey of waste management site operators.
- Stage 3: Developing the counterfactual to identify the outcomes that would have been achieved without the additional funding.
- Stage 4: Modelling and valuation including the development of scenarios to test the impact of less tangible outcomes.
- Stage 5: Validation of the model with key Environment Agency staff and refinement of outcome data and the predicted counterfactual.

The findings of the evaluation in each outcome area are presented as a series of three tiers to reflect the level of confidence in the estimated values. Tier 1 is the value of the additional outcomes that were directly evidenced by internal Environment Agency data, while Tier 2 adds in outcomes in the pipeline, and Tier 3 adds in less tangible outcomes such as deterrence and legacy effects.

Illegal waste sites

Stopping illegal waste sites is a core activity for the Environment Agency and this area received the greatest proportion of the additional funding (just under 54%). The potential value of the outcomes achieved with the additional funding to tackle illegal waste sites is approximately £10.5 million (Tier 1). It was estimated that 530 additional sites were stopped as a direct result of the additional funding during the 2-year project period. The greatest beneficiary of the intervention was HM Government who saw potential benefits of £6.5m over the project period. Potential social and environmental benefits were at least £3.5m. The regulated waste sector saw a potential increase in profits of at least £0.7 million, generated from increased revenue of £14.5m.million over the project period.

Misdescription of waste

Misdescription of waste occurs when an operator fails to assess, characterise and classify a waste correctly. That includes the failure to apply the correct waste

classification code or provide an adequate written description of the waste. This is sometimes done deliberately in order to reduce disposal costs and evade paying the correct rate of landfill tax. People misdescribing waste in this way could be putting communities and the environment at risk if there is failure to dispose of the waste in a safe and proper manner.

The misdescription of waste outcome area received 32% of the extra funding. Our work to quantify the scale of this type of waste crime identified 630kt of potentially misdescribed waste and led to 63 site or individuals being referred to HMRC for tax investigations. Our central estimate of the potential benefits of this work is £18m (Tier 1), which means that a potential £9.50 is generated for each £1 invested. HM Government was the most significant beneficiary of the interventions with additional tax revenues.

Illegal waste exports

Illegal waste exports received 13% of the additional funding. An estimated 191 illegal exports were prevented across the 2-year period. The estimated values of the outcomes achieved with the additional funding to tackle illegal waste exports range between the Tier 1 estimate of approximately £0.4 million and the Tier 3 estimate of approximately £1.4 million. The greatest beneficiary of the interventions are HM Government with potential additional revenues from Landfill Tax of between £0.3m (Tier 1) and £1.2 million (Tier 3).

Combined benefits

Analysis was also made of the combined values of the outcome areas and the distribution of the values between different stakeholder groups. The three activities funded by the project produced potential combined benefits of £29m to UK plc (Tier 1). This means that for each £1 invested by the project we have generated £5. The biggest proportion of these potential benefits came in the form of tax receipts (£23.5m) followed by avoided harm to the environment and society (£4.6m); businesses saw an additional profit of £0.7m, generated from additional revenue of £14.5m.

Recommendations

The evaluation resulted in a number of recommendations, both from the data analysis and from the collection of insights from staff that have been involved in the delivery of the project. These are grouped under three headings.

Internal data collection and reporting

- It is important that the data collected is relevant and consistent. As far as possible, the Environment Agency should seek to ensure that staff recording data do so consistently and accurately as small improvements in data quality could allow the information to be used to gain greater insight into a range of factors such as trends in waste crime or effectiveness of interventions.
- The type of data collected should also be considered in more detail if the Environment Agency wishes to continue or extend the evaluation of outcomes in the future. At present, most data collected is linked to monitoring operational activities but data on the impact and outcomes of interventions such as the tonnage of waste on illegal waste sites is less common and less likely to be provided by officers.
- The most effective interventions (in terms of both human and environmental health, as well as money) are those where the offence is avoided completely and therefore the Environment Agency is not directly involved, as demonstrated by work with illegal waste exports where illegal shipments

are stopped by the industry rather than through direct intervention of the regulator. Collecting data on the effect of interventions that may prevent crimes higher up the 'pipeline' is important to ensure that the Environment Agency's work in these areas is properly recognised and prioritised, even though it may not be reflected in the usual operational data that is recorded.

- The evaluation showed that data collected by the Environment Agency can be combined and analysed to provide a great deal of insight into waste crime to identify trends and potential offenders. Although the value of internal data has already been demonstrated, it is clear there is potential to better use data in this way.
- Much of the data collected and reported by the Environment Agency is effectively operational metrics to monitor activities. Discussions with staff have demonstrated how these metrics can lead to undesirable priorities and activities. When setting metrics, the Environment Agency should be careful to avoid unexpected consequences.

Use of resources

- Possibly the most important learning point of this evaluation has been the negative effect of short-term funding cycles. Effective staff time can be greatly curtailed by time lost to recruitment, training and vacancies. Thus, the outcomes that can be achieved by funding could be significantly improved by extending funding cycles for as long as possible.
- There was much discussion during the evaluation around the allocation of resources between local and national teams. For less common crimes or specialist waste streams such as illegal waste exports, the concentration of resource to fund a specialist and dedicated team appears to result in an efficient use of resources. Misdescription of waste is another area in which the concentration of skills and experience into a specialist team may result in greater effectiveness and efficiency, particularly as it would facilitate consistent communication with HMRC which has a key role in the investigation and enforcement of tax avoidance. For more general waste crime, the balance between local and national resources is more subtle and it is clear that information and priorities need to flow between the two to ensure that local priorities are serviced while maintaining a national overview of waste crime and expertise.
- In some cases, where resources to tackle specific crimes or activities were allocated as just a part of a person's job, it was felt that this had a negative impact on efficiency due to competing priorities and time potentially lost switching between issues and work areas. This should therefore be minimised where possible.

Working with partners

- The partnership with HMRC to tackle the misdescription of waste and potential Landfill Tax fraud could yield significant revenue for HM Government. Although in its early stages, it provides a model for partnership working with other organisations such as the Health & Safety Executive. In both cases there are links and intelligence about waste crime and factors linked to it and therefore the Environment Agency should consider whether closer sharing of intelligence and joint working could make interventions more targeted, resource efficient and effective.
- A better understanding of the priorities and internal systems of partnership organisations has the potential to assist both partners in achieving joint

objectives. The Environment Agency is an expert in waste management and waste regulation; however, partner organisations may not have the same depth of understanding and will require more support. If the Environment Agency can gain a better insight into the skills, resources and data needed by partner organisations to intervene to prevent or stop waste crime, it could increase the chances of action being taken more rapidly and effectively.

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1 Introduction

1.1 Background of the project

After calls from the waste industry to do more to tackle waste crime, at Budget 2014 HM Government allocated £5 million savings from the Landfill Community Fund to the Environment Agency to fund additional work to address waste crime. As a result, the 'Waste crime interventions and evaluation project' ('the project') was set up with the aim of tackling three priority outcome areas. These are:

- reducing the risk from illegal waste sites, enabling the Environment Agency to stop more sites, more quickly
- reducing the misdescription of waste
- reducing the illegal export of waste

In March 2015, HM Government announced a further £4.2 million of additional 'top up' funding for the Environment Agency to address waste crime. Over the project period, £788,000 of this was made available for the three outcome areas and the impacts and outcomes of this additional funding have been included in the scope of this project.

The evaluation methodology was designed and applied in compliance with HM Treasury's (2011) 'Magenta Book'.

1.2 Objectives

The purpose of the evaluation was to assess five objectives, these being:

- **Impact**: To evaluate the policy impacts of the £5 million additional funding plus an additional £788,000.
- **Economics and efficiency**: Conduct a cost-benefit analysis and assess the cost-effectiveness and efficiency.
- **Effectiveness**: Evaluate the effectiveness of the project interventions and collect evidence about what works to demonstrate the additional outcomes and benefits of the additional funding.
- **Learning**: Collect lessons and good practice to inform future activity to tackle waste crime.
- **Evaluate all three outcomes**: Misdescription of waste, illegal waste sites and illegal waste exports.

1.3 Approach

The evaluation methodology has involved a number of sequential steps that are explained in more detail in the following sections. In summary, the approach was broken down into the following stages:

- Stage 1: The development of logic models for each outcome area to identify the inputs and outcomes of each priority area. This was used to identify the metrics that were to be used in the assessment (e.g. number of illegal waste sites stopped).

- Stage 2: Data collection from Environment Agency systems and contextual data and a targeted survey of waste management site operators.
- Stage 3: Developing the counterfactual (i.e. using contextual data on the waste management, the economy, the work of the Environment Agency and other factors to make a statistical determination of the outcomes that would have been achieved without the additional funding).
- Stage 4: Modelling and valuation including the development of scenarios to test the impact of less tangible outcomes such as the impact of any deterrence factor generated by the Environment Agency's interventions.
- Stage 5: Validation of the model with key Environment Agency staff and refinement of outcome data and the predicted counterfactual.

This assessment has involved a great deal of discussion with key members of the project team and the staff that were involved in its delivery. This was important to ensure that the impact of the funding has been fully recognised as there are many positive outcomes that are not directly recorded by the Environment Agency such as the changes in behaviour resulting from increased inspections, publicising enforcement action etc. It has also been important to capture the many examples of innovative approaches to tackling waste crime facilitated by the additional funding.

1.4 Technical Steering Group

The evaluation project was overseen by a Technical Steering Group mainly comprising Environment Agency staff with a range of relevant expertise and experience in evaluation, operations and/or waste crime interventions and enforcement. The members of the Technical Steering Group are listed in Table 1.1.

Table 1.1 Technical Steering Group

Staff member	Role	Organisation
Anna Lorentzon	Senior social scientist and evaluation specialist	Environment Agency
Anna Maria Giacomello	Economics manager	Environment Agency
Jamie Warmington	Team Member member	Ricardo Energy & Environment
Jon Greaves	Evaluation team manager	Environment Agency
Matthew Hess	Evaluation specialist and Environment Agency project manager for the evaluation	Environment Agency
Peter Bailey	Social science manager	Environment Agency
Simone Aplin	Project manager	Ricardo Energy & Environment
Steve Townhill	Project Manager manager for the Waste crime interventions and evaluation project	Environment Agency
Stuart Homann	Chief statistician	Environment Agency

Source: Ricardo Energy & Environment

2 Outcome areas

2.1 Illegal waste sites

2.1.1 Definition

The Environment Agency's definition of an illegal waste site, which was used for the evaluation, is set out below:

> *A site operating without the appropriate permit for the activity being carried out where multiple loads of waste are deposited, treated, stored or disposed of, and where activity is, or appears to us to be taking place in an organised manner. The activities at the site will generally (but not always) be known to the landowner or the legal occupier of the site and will often be run as a business.*

Illegal sites can present a significant risk to the environment and human health and result in a loss of amenity. These sites also impact on the legitimate waste industry and the overall economy, often undercutting gate fees, avoiding Landfill Tax etc.

2.1.2 Objectives and scope

The aim of the 'Waste crime interventions and evaluation project' was to reduce the number of active, high risk illegal waste sites each quarter and to stop 45% of new illegal waste sites within 90 days. The project supported activities and interventions designed to reduce the number of illegal waste sites and increase the amount of waste managed by legitimate industry. These activities included:

- Gathering intelligence and evidence to assist Environment Agency staff to stop illegal waste sites and deter illegal operations. This includes partnership work with industry, local authorities and Crimestoppers.
- Giving advice and guidance to stop or deter illegal waste sites.
- Communications work with the public and industry. This includes responding to complaints and undertaking campaigns work.
- Undertaking enforcement activity to stop illegal waste sites. This includes referring cases to partner agencies to take enforcement action where appropriate.

For this outcome area, the project funding topped up existing resource and, had it not been forthcoming, the overall resources would have been reduced because of budget constraints. The funding allowed the Environment Agency to maintain previous levels of resource focused on tackling illegal waste sites and set more stretching targets to stop more illegal waste sites more quickly, diverting more waste into legitimate industry as a result.

2.1.3 Resource allocation

A breakdown of where the project funding was spent by the Environment Agency over the 2 years is shown in Table 2.1. The outcome area that received the greatest proportion (just under 54%) of the funding was illegal waste sites. Misdescription of waste received 32% and illegal waste exports around 13% of the overall total.

Table 2.1 Breakdown of resources across the three outcome areas 2014–2016

Outcome area	2014/15	2015/16	'Top up' funding from HM Government	Total
Illegal waste sites	£1,663,000	£934,000	£543,000	£3,140,000
Illegal waste exports	£341,000	£383,000	£92,000	£816,000
Misdescription of waste	£989,000	£750,000	£153,000	£1,892,000
Total:	£2,993,000	£2,067,000	£788,000	£5,848,000

Source: Ricardo Energy & Environment

2.1.4 Logic model

The logic model for illegal waste sites is shown in Figure 2.1. The evaluation design is based on the logic model framework. The model reflects the theory of change from project inputs and activities through to the intended outcomes and impacts.

2.2 Illegal waste exports

2.2.1 Definition

The illegal export of waste is defined as a breach of the 'Waste Shipment Regulations (EU)' (Regulation (EC) No. 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste), Transfrontier Shipment of Waste Regulations 2007 or the Waste Electrical and Electronic Equipment Regulations 2006[1] depending on the type of waste that is involved. The project targeted illegal exporting of two priority waste streams, these being household waste (paper and plastic) and electronic waste (WEEE).

2.2.2 Project activities

The project funding shown in Table 2.1 (£0.8million over 2 years) was used to supplement existing resources and increase the level of activity. This included:

- additional port officers to enable more containers to be stopped, checked and investigated
- additional resource to inspect sites suspected of illegally exporting waste
- additional intelligence gathering and support to enforcement activity

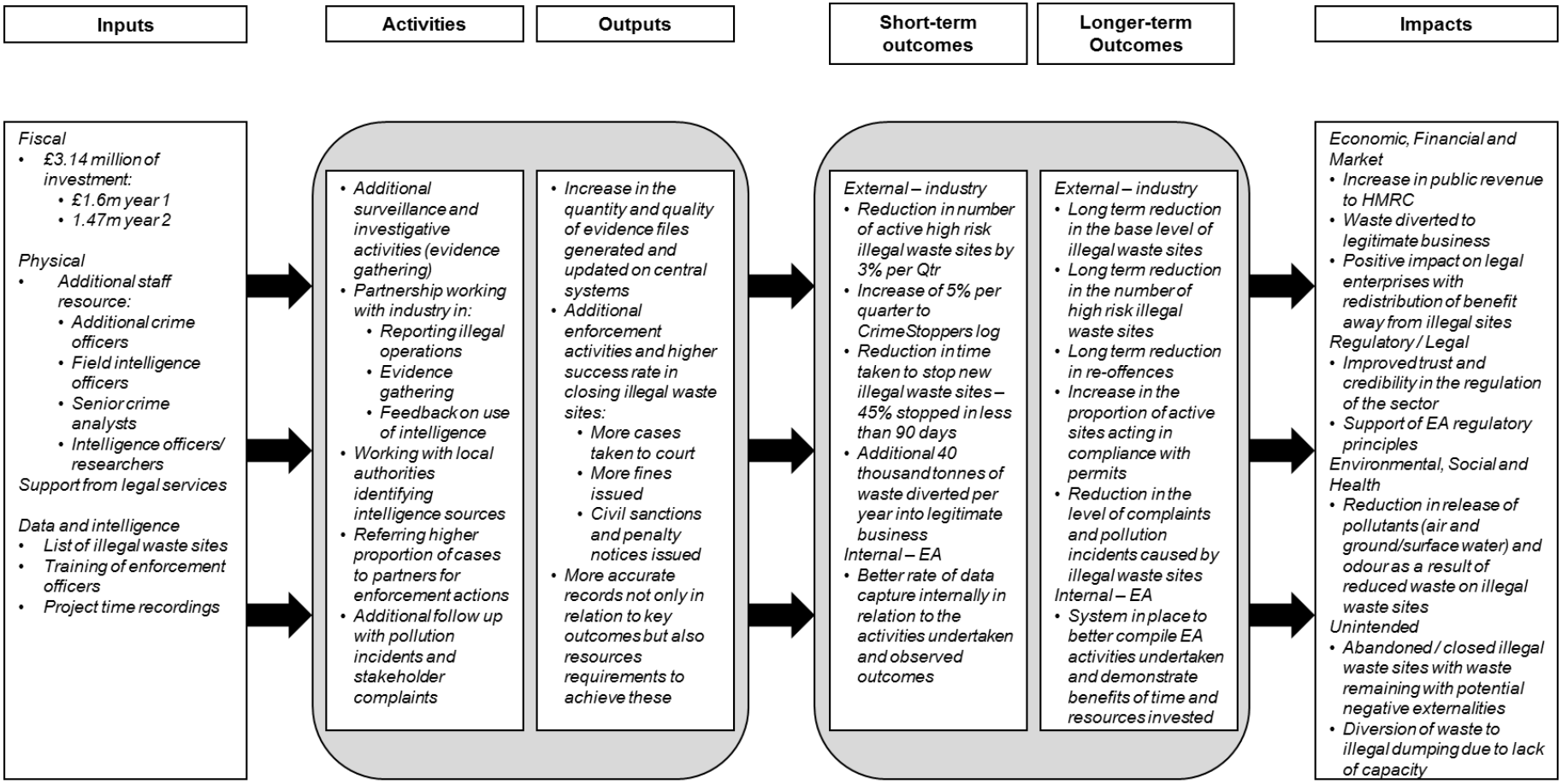
Like the work on illegal waste sites, this outcome area was facing a reduction in resources had the additional funding not been made available. The additional funding allowed dedicated and experienced staff to continue and expand activities in this area, building on an innovative approach, which involved close working with partners to effectively and efficiently identify suspect containers and investigate whether or not illegal export activity was being undertaken.

2.2.3 Logic model

The logic model for illegal waste exports is shown in Figure 2.2. The evaluation design is based on the logic model framework. The model reflects the theory of change from project inputs and activities through to the intended outcomes and impacts.

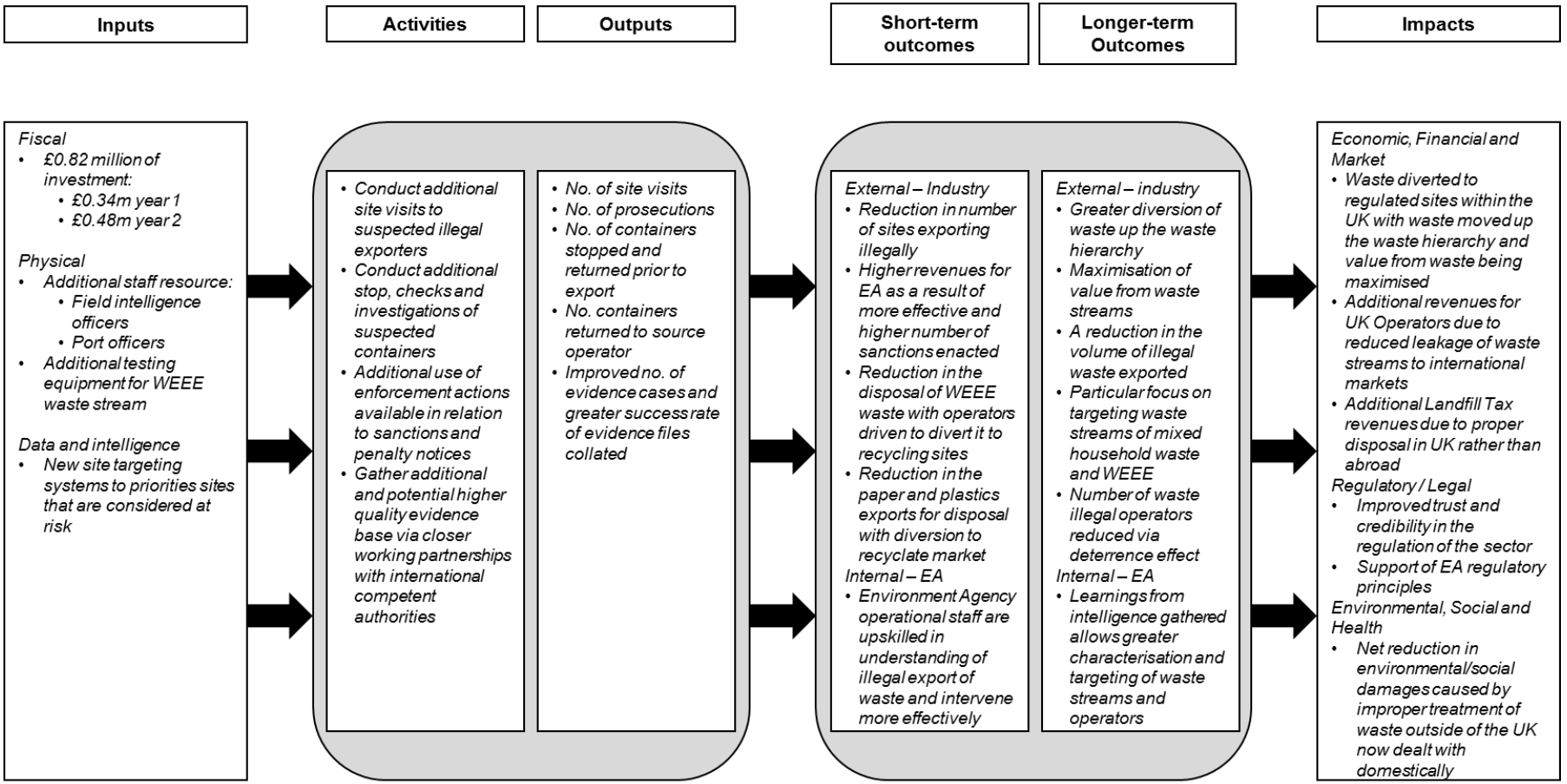
[1] These regulations are available at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006R1013-20160101&qid=1454069470717&from=EN, http://www.legislation.gov.uk/uksi/2007/1711/pdfs/uksi_20071711_en.pdf and http://www.legislation.gov.uk/uksi/2006/3289/pdfs/uksi_20063289_en.pdf respectively

Figure 2.1 Logic model for the illegal waste sites priority area



Source: Environment Agency

Figure 2.2 Logic model for the illegal waste exports priority area



Source: Environment Agency

2.3 Misdescription of waste

2.3.1 Definition

Misdescription of waste occurs when an operator fails to assess, characterise and classify a waste correctly. That includes the failure to apply the correct waste classification code or provide an adequate written description of the waste. This is sometimes done deliberately in order to reduce disposal costs and evade paying the correct rate of landfill tax. People misdescribing waste in this way could be putting communities and the environment at risk if there is failure to dispose of the waste in a safe and proper manner.

Describing waste incorrectly or falsely constitutes an offence under Duty of Care, which states that:

- 'They [waste producers] bear the main responsibility for ensuring that the description of the waste which leaves them is accurate and contains all the information necessary for safe handling, disposal, treatment or recovery.'
- '[waste] holders must be provided with a description of the waste that is full enough to enable them to manage the waste properly'
- 'The description should always mention any special problems, requirements or knowledge'
- 'The description must provide enough information to enable subsequent holders to avoid mismanaging the waste.'

Accurately describing waste using the List of Waste (LoW) or European Waste Catalogue (EWC)[2] can be complex and mistakes are relatively common; however, some operators deliberately misdescribe waste for financial gain, to circumvent the standard rate of Landfill Tax, which was £80.00 per tonne from 1st April 2014 and £82.60 from 1st April 2015 while the corresponding lower rates of Landfill Tax (for inert or inactive waste) were £2.50 and £2.60 respectively. The focus for the purpose of the project has primarily been on the deliberate misdescription of waste.

2.3.2 Objectives and scope

The project funding shown in Table 2.1 (£1.9m over 2 years) was used to fund activities to tackle misdescription of waste at transfer, treatment and disposal sites. The activities that were funded by the additional resource included:

- 30 waste stream audits from a sample of around 100 transfer and treatment sites that had been identified as potentially misdescribing waste.
- The referral of sites that were suspected to be misdescribing waste to circumvent the standard rate of Landfill Tax to Her Majesty's Revenue and Customs (HMRC). This included new, joint investigations with HMRC, as well as historical investigations that the Environment Agency had concluded. It was expected that a minimum of 60 referrals would be made to HMRC to target non-compliance.
- Investigations of a number of sites identified by Environment Agency area teams because of suspected permit breaches and the taking of enforcement actions if these breaches were confirmed.

The additional funding allowed the Environment Agency to target and investigate the deliberate misdescription of waste and to improve understanding of this aspect of waste crime. A significant element of the work was the establishment of a new partnership with

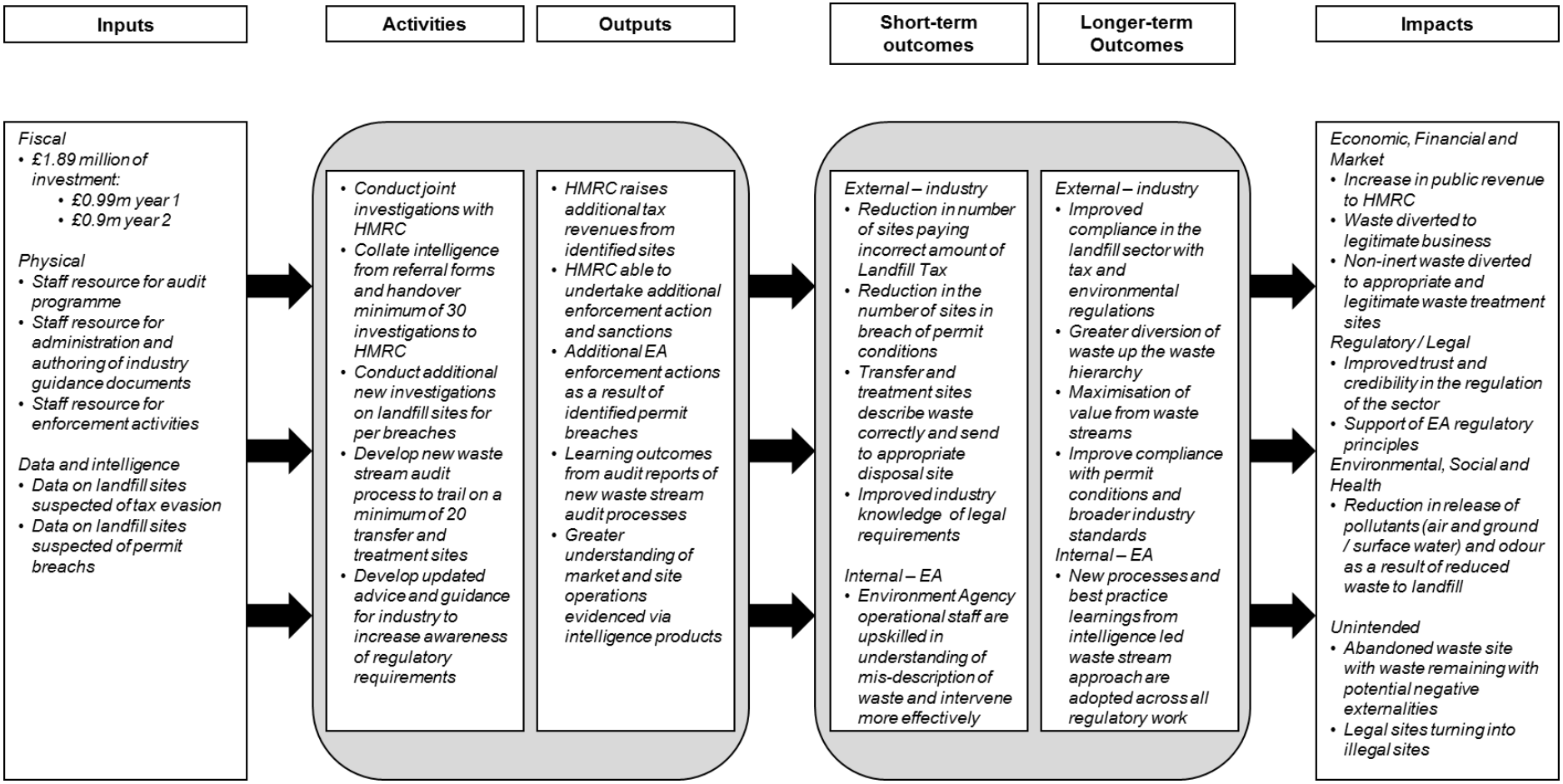
[2] Available at https://www.sepa.org.uk/media/139107/euro_waste_catalogue.pdf

HMRC to investigate cases of potential Landfill Tax fraud involving misdescription and to ensure a complementary approach to addressing waste crime. Co-operation and data sharing between the EA and HMRC represented a new approach to tackling these crimes.

2.3.3 Logic model

The logic model for misdescription is shown in Figure 2.3. The evaluation design is based on the logic model framework. The model reflects the theory of change from project inputs and activities through to the intended outcomes and impacts.

Figure 2.3 Logic model for the misdescription of waste priority area



Source: Environment Agency

3 Evaluation design and methodology

3.1 Overview

The objective of this evaluation was to identify, quantify and value the outcomes that have been achieved by the interventions the Environment Agency has taken to disrupt waste crime as a result of the additional funding that was received from HM Government. The assessment was broken down into a number of distinct steps as set out below:

- Step 1: Evaluation design – the evaluation design for each outcome area was developed.
- Step 2: The collection of qualitative and qualitative data for the assessment.
- Step 3: Survey of waste management site operators.
- Step 4: Developing the baseline (counterfactual).
- Step 5: Modelling.

More detail on each of these steps is set out below.

3.2 Step 1: Evaluation design

A bespoke evaluation design was developed for each outcome area. They included four core elements of data review and analysis. These were:

- The identification of key metrics for each outcome with which impacts can be measured; for example, the number of illegal waste sites closed, the number of illegal exports prevented, enforcement actions etc. These were used to indicate how the 'additional' funding has had observable effects.
- Analysis of the outcome metrics both before and during the project period (time series analysis), including regression analysis. These outcome metrics, together with other data such as the internal spend on resources by the Environment Agency and selected contextual data such as waste arisings and recyclate prices, were analysed to estimate the link between expenditure on enforcement activity and the outcomes observed. This relationship was then used to develop a counterfactual baseline with which the actual observed impacts of the additional investment can be compared.
- Quantification and valuation of direct and indirect impacts related to metrics monitored through data collection.
- Additional evidence gathering from enforcement teams and active staff members to compare their experience with the quantitative analysis undertaken and to develop an understanding of the elements of the funding that may be contributing most significantly to the outcomes achieved.

In order to undertake an efficient evaluation, it was important to first refine a set of consistent key outcome metrics that would be measured. These metrics of impact should:

- relate to the core aims of the additional funding

- be clearly definable
- be consistently reported throughout the duration of the funding programme
- have clear and direct links to impacts of the activities resourced by the additional funding
- be clearly linked to the evaluation objectives

It was important to use outcome metrics that had been consistently monitored prior to the project and are likely to continue to be monitored and recorded on a regular basis to ensure a robust and accurate evaluation. This provided the basis for trend analysis and comparisons to be made within the assessment and will aid the development of a consistent monitoring and evaluation framework for the Environment Agency to use beyond the time frame of this evaluation. The key outcome metrics for each priority area are set out in Table 3.1.

Table 3.1 Key outcome metrics for each priority area

Illegal waste sites	Illegal waste exports	Misdescription of waste
No. of active illegal waste sites	No. of containers stopped and returned or sent for additional processing prior to export	No. of illegal operations stopped
No. of high risk illegal waste sites	Tonnes of waste diverted to UK legitimate businesses	No. of prosecutions
No. of stopped illegal waste sites		Quantity of waste diverted to legitimate business
No. of occurrences where enforcement action has been taken		Quantity of waste diverted back up the waste hierarchy
Diversion of waste to legal activity per annum due to stopped illegal sites		
Time taken to stop illegal waste sites		

3.2.1 Time series analysis

To identify and assess the impacts that have resulted from interventions resourced by the additional funding requires an understanding of the historical relationship between the funding of waste crime activities and the outcomes that are achieved. The Environment Agency records a wide range of data about the environment, regulated activities and its own operations and has done this over an extended period. This information was used to construct a baseline (the counterfactual or 'what would have happened if the additional funding had not been received') against which the impact of the additional investment can be assessed. This is a requirement for Magenta Book evaluations (HM Treasury 2011) and ensures that the net 'additional' impacts observed are a result of the additional funding rather than a reflection of all funding used to tackle waste crime and external variables such as increases in waste arisings, changes in material prices or changes in costs of disposal and treatment of waste.

As part of this time series analysis, statistical relationships between these external variables and the impact being monitored was also assessed to understand whether they have an influence on the observed outputs and whether this can be quantified and explained within the evaluation process. As an example, times series analysis may demonstrate that an increase in the number of high risk waste sites being identified may be 80% due to the increase in funding and 20% due to an increase in the illegal management of waste. Where statistically significant relationships between variables were identified, a baseline for the time period was developed for each impact. This baseline represents the counterfactual scenario

that is what would have happened had the additional funding not been available. This scenario only reflects the natural change in monitored factors that can be explained by uncontrolled variables in the waste sector.

A detailed explanation of how the counterfactual scenario has been developed for this assessment and the results is set out in section 3.5 of this report.

3.2.2 Quantification and valuation of direct and indirect impacts

Following time series analysis of the key outcome metrics, the net changes in outcomes that resulted from the additional funding could be identified. The final step of the evaluation was to generate an estimate of the financial, market and environmental impacts that were directly related to this change.

The average unit values per site closed or per tonne of waste diverted to legal sites were developed using broader datasets, in-house knowledge and literature review where necessary. An important aspect of the process was the analysis of impacts from a variety of stakeholder perspectives, including the legitimate waste industry, HMRC and broader social society. For each perspective, the costs and benefits of the additional funding may be different with both private and social gains as well as distributional impacts between groups. As a result, it was important to present findings for each sector in isolation rather than a sum of benefits for the waste industry or UK plc due to the risk of double counting and the inclusion of transfer payments, which provide no net additional benefit in economic terms.

This framework can be used by the Environment Agency to monitor key metrics and unit values can be maintained and updated for future reporting and evaluation purposes. As described above, care will need to be taken in the sum of these costs and benefits to various operators in the economy to account for transfer payments which may act in redistributing value rather than providing net benefit to the economy. Differentiation may need to be drawn between a cost-effectiveness study for HM Government and an economic evaluation which would reflect the broader economic and socio-economic benefits of the additional funding.

Capturing as many as possible of the impact factors above was important in identifying the effect of the funding programme, and each metric can show something different about how effective the additional funding has been. It should be noted that not all benefits of the additional funding may be additional when calculating the net economic benefit of the scheme. Key to understanding the overall benefits has been the treatment of benefits to the UK economy as a whole. A potentially large proportion of the benefits received via additional taxation could be considered transfer payments as they are a transfer of benefits between industry and/or HM Government that do not create any net additional benefit in economic terms to UK plc. Although identifying these impacts has been important to understand the potential additional revenues for HM Government and the cost-effectiveness of the programme in relation to its net expenditure versus outputs, this effect may have limited value to the UK economy in net additional value terms.

3.2.3 Gathering additional evidence

It should be noted that the full scope of financial and environmental benefits that will have resulted from the additional funding will not be shown in the quantifiable metrics that are reported by the Environment Agency. This is because these metrics cover only the outcomes that were directly identified or achieved by the organisation. They do not provide any information on the illegal activities that have been prevented by work to address waste crime or outcomes that are ultimately achieved by other organisations. These include:

- Directly prevented crimes – in some cases, the additional funding has allowed the Environment Agency to take innovative approaches to tackling waste crime that involved working ‘higher up the pipeline’ to prevent crimes before they happen.

- Indirectly prevented crimes – some crimes are prevented by the deterrence factor created by publicity about the enforcement activity of the regulator and others such as HMRC and the impact of this has been considered in the assessment through an operator survey. However, the work resourced by the additional funding has allowed for a more direct prevention.
- Outcomes passed to others – particularly relating to cases of suspected Landfill Tax evasion identified by the work to tackle the misdescription of waste and passed to HMRC to maximise enforcement action.

In order to collect information on these impacts and others that have resulted from the additional funding, the evaluation gathered evidence through workshops and meetings with key Environment Agency staff. This will provide the qualitative evidence that helps underpin the process evaluation and learning outcomes of the 2-year project. Some of the questions asked of staff included:

- Do quantitative outputs from the analysis correlate with experience and expectations of operational staff?
- Have the additional activities been targeted and implemented in the most efficient way?
- Were all relevant parties engaged and appropriately trained in order to implement the activities efficiently?
- Has the additional funding allowed staff to take an innovative approach to preventing or tackling waste crime?
- Do the current internal data systems provide a comprehensive way of capturing and recording key information on the activities undertaken and are they reflective of additional actions implemented?
- Could anything have been done differently to improve the effectiveness in relation to visible impacts?

A process evaluation approach was used to capture internal learning resulting from the project work as a whole. This collected information about what worked well and what did not, relating to the implementation of the project in order to improve operations in the future. Lessons and good practice examples were collected from project staff, through a series of workshops and meetings. These are explained in more detail in the individual sections for each outcome area.

3.3 Step 2: Collection of quantitative and qualitative data

The Environment Agency collects a large range of operational and regulatory data across systems that have been developed over time for specific purposes. An initial scoping exercise was undertaken to identify all the data collection systems in use by the Environment Agency and review their contents to determine whether they would be useful to the evaluation. The datasets that were included in this review are listed below:

- Case Management System (CMS)
- National Incident Recording System (NIRS)
- MEMEX criminal intelligence database
- Flycapture
- Surveillance Authorisation Database (SAD)

- Proceeds of Crime (PoCA)
- Operational Risk Appraisal (Opra) – permit compliance
- Compliance Classification Scheme (CCS)
- National Compliance Assessment Database (NCAD)
- CLEAR Info
- Monthly Environment Agency area reports
- Time recording data
- International Waste Shipments (IWS) (formerly Transfrontier Shipments)
- Waste returns

Each dataset was assessed for its usefulness with a number of questions, scoring between 1 and 5 for each, 1 being totally unsuitable for the evaluation and 5 being highly suitable. The questions were as follows:

- How does the record-level completeness of the dataset support the evaluation, i.e. are there records missing from the dataset?
- How does the field-level completeness of the dataset support the evaluation, i.e. are the relevant fields complete?
- Is the dataset up to date and maintained with the right timeliness to support this application?
- Can the records in this dataset be uniquely identified sufficiently to support this application?
- Is the data consistently populated across the parts of the dataset needed for this application?
- Is the dataset under sufficient version control to support this use?

The results of this review are set out in Appendix A, where the crosses in the three final columns of the table indicate the suitability of each dataset for the three outcome areas (illegal waste sites, IWS; misdescription of waste, MD; illegal waste exports, IE). Throughout the project, data from these systems was collected and analysed to collect information on the key metrics for the evaluation. More details of the key metrics and data sources used for each outcome area are set out in the following sections.

The qualitative data collected by the Environment Agency does not fully describe or represent the comprehensive range of outcomes that will result from the waste crime interventions enabled by the additional funding. The Environment Agency's systems are designed to record data required for operational and monitoring purposes and therefore they do not provide all of the data required for the evaluation such as the illegal activities that have been prevented by the funded interventions. This is particularly the case for interventions that are made higher up the 'pipeline' of waste crime, as demonstrated by the partnership working with industry in the case of illegal waste exports. In other cases, although the Environment Agency undertakes the intervention, the final outcome is achieved by another organisation, as is the case with enforcement action taken by HMRC against operators suspected of the deliberate misdescription of waste to circumvent the standard rate of Landfill Tax.

There are also less tangible impacts that needed to be considered in the assessment, such as the general deterrence effect caused by publicity and awareness of the Environment Agency's actions and the legacy effects on sites that have been directly and indirectly affected by interventions. This qualitative data was collected using two approaches, the first being a survey of waste management operators which is described in more detail in section 3.4 and in full in section 7. The second method of collecting qualitative data was to conduct a number of interviews with a range of staff involved in the management and delivery of waste crime interventions. These interviews were used to develop some of the assumptions around qualitative data and, importantly, to collect information on how the resources were used to tackle waste crime in each outcome area, the effectiveness of the interventions, lessons learnt and any good practice examples of innovative or particularly effective approaches that were made possible with the additional funding.

Some of the interventions to prevent and take action against the deliberate misdescription of waste were delivered in partnership with HMRC. The Environment Agency was involved in the identification and investigation of suspected incidents of misdescription through its regulatory activities while HMRC was responsible for assessing compliance with Landfill Tax. Information on the details and outcomes of HMRC's actions were required for the evaluation; however, data protection and confidentiality issues made it difficult for HMRC to share this data with the Environment Agency for use in the evaluation. The approach that was taken to overcoming these challenges is discussed in more detail in section 6. A summary of the data analysis is set out in Table 3.2.

Table 3.2 Summary of the data analysis

Evaluation objective	Type of analysis	Evidence
Impact	For illegal waste sites and illegal waste exports a quantitative analysis of current and historical datasets was undertaken to establish relationships between key variables. A counterfactual for the project period was then developed based on identified historical relationships. Actual observed data was then recorded with the net impact of additional funding being equal to the anticipated outputs of the baseline minus the actual impacts of the observed dataset. For the misdescription of waste, the baseline activity by the Environment Agency was considered to be zero and all impacts were considered to be attributable to the additional funding.	Key monitored outcome metrics are set out in Table 3.1 and data requirements included: • historical dataset for recorded outcome metrics • historical datasets for exogenous (control) variables such as waste arising, disposal costs per tonne, GDP growth rate • ongoing recording of these two datasets for the evaluation time frame • qualitative supporting evidence as fed in by Environment Agency operational staff.
Economics and efficiency	The economic analysis was a two-stage process: • Stage one was a test of efficiency looking at investment per key impact	Stage one: combination of net impact resulting from above analysis combined with estimated expenditure profile of the scheme.

	metric (e.g. prosecution of illegal waste site, or diversion of 1 tonne of waste). • Stage two was monetisation of impacts in order to look at the net benefit or cost of the additional funding (including social costs).	Stage two: additional source evidence to be reviewed in relation to assigning unit values representative of the social impacts resulting from the outputs of new actions undertaken. These relate to environmental costs of waste streams as well as amenity costs for residents in the locality of sites closed.
Effectiveness	This is strongly linked to the outputs from the above two pieces of analysis and included a review of outputs versus forecast or expected outcomes. These focused on what could have been improved, why results may not be as expected, what could have been done better etc.	
Learning	This was developed throughout the evaluation process taking account of a broad range of factors.	Qualitative evidence gathered throughout the evaluation process. Key learning outcomes of the funding with input at regular intervals from Environment Agency operational staff.

Source: Ricardo Energy & Environment

3.4 Step 3: Survey of waste management site operators

In order for the evaluation to take comprehensive account of all the outcomes that have been achieved with the additional funding, it was hoped that some of the more intangible impacts could be better understood, such as the deterrence effect on the activities of operators not directly affected by the actions of the Environment Agency.

Deterrence can be defined as "the omission or curtailment of a crime from fear of legal punishment." (Gibb 1975[3]). There are two basic types of deterrence – general and specific (Gray and Shimshack 2011[4]). Specific deterrence refers to the effect of a sanction on the individual who is in breach of the law, whereas general deterrence refers to the effect (e.g. change of behaviour) of that sanction on the general population. General deterrence can also be considered in terms of the impact that it has on individuals already part of the system (e.g. illegal waste site operator) and the impact is has deterring new people from entering the system (e.g. those tempted to become an illegal operator).

As previously discussed, information on the deterrence effect of Environment Agency activity does not exist in any current datasets, surveys or estimates and therefore a bespoke survey was included in the methodology for the evaluation. One of the aspects that is difficult to quantify is the potential deterrence effect of the project work, particularly more visible actions such as targeted audits and enforcement action. The impact of the deterrent among the

[3] Gibb, JP. (1975) Crime, Punishment and Deterrence. *New York: Elsevier.*
[4] Gray, WB and Shimshack, JP. (2011). The Effectiveness of Environmental Monitoring and Enforcement: A review of the Empirical Evidence. *Review of Environmental Economics and. Policy,* 5 (1), pp. 3-24.

waste industry takes the form of either a fear of sanctions or a focusing of attention on compliance.

There are several reasons why general deterrence may be less effective:

- Prosecution of large businesses may have less impact on small operators as they consider themselves as different, and vice versa.
- The details of enforcement cases may not be published and therefore the wider industry may find it difficult to relate them to their own operations.
- Opinion that those punished are the 'bad guys' of the industry who are fundamentally different in the way that they choose to ignore the law.

Quantifying the deterrence effect is challenging for a number of practical reasons e.g. illegal and legitimate operators being unwilling to engage with an Environment Agency funded project for fear of detection through to the time pressures of operating a business. For these reasons, we focused our effort on trying to quantify the general deterrence among operators regulated by the Environment Agency under the Environmental Permitting Regulations.

In order to assess whether the project work has impacted on the behaviour of waste management site operators both directly and indirectly and to estimate the potential scale of these impacts, the evaluation team undertook a limited survey. The purpose of the survey was to collect information regarding the operators' awareness of the project and their attitudes and behaviours both before and at the end of the funding period. It was intended that this information would subsequently be used to generate assumptions about the less quantifiable outcomes that have been achieved. The impact of the deterrence effect is relevant to all three priority areas.

The questions that the survey sought to answer were as follows:

- What is the perceived level of illegal activity within the waste sector?
- How visible are the funded activities undertaken by the Environment Agency among the waste sector?
- Are the funded activities providing enough of a deterrence effect to reduce illegal activity?
- Has the deterrence effect changed over time?
- What specific activities result in the greatest deterrence effect?

The survey questionnaire was developed in conjunction with the Technical Steering Group of the evaluation project and a copy is included in Appendix E. In designing the questionnaire, it was important to ensure that the questions were clear and concise and that the number of questions was kept to a minimum in order to maximise the response rate. It was also important to remove any sense of bias in the questions or to rework any questions that may be considered leading.

Details of all waste management sites with an environmental permit are available through the Environment Agency's Waste Data Interrogator, which is published annually and contains details of site returns, and data relating to the quantity and type of waste received and dispatched by each site. This database was used to create a matrix of the permitted estate by site type and size, based on the tonnage of waste received in 2014. The breakdown is shown in Table 3.3. The survey aimed to obtain responses from approximately 100 operators, which would achieve a confidence interval of ±9.72 at a confidence level of 95%. The 100 responses were allocated across the site types on a pro-rata basis depending on their proportion in the total population.

Table 3.3 Breakdown of the permitted estate in 2014

Site category	Site type	No. of permitted sites	% of total	No. of responses required	No. of responses received	No. in the sample
In/on land	Deposit of waste to land (recovery)	175	2.83	3	1	15
	Lagoon	5	0.08	0	0	0
	Deep injection	2	0.03	0	0	0
Landfill	Hazardous merchant landfill	11	0.18	0	0	0
	Hazardous restricted landfill	2	0.03	0	0	0
	Inert landfill	128	2.07	2	1	10
	Non-hazardous (SNRHW[1]) landfill	45	0.73	1	0	5
	Non-hazardous landfill	137	2.22	2	0	10
Metal recycling site (MRS)	Car breaker	553	8.94	9	2	45
	Metal recycling	495	8.01	8	2	40
	Vehicle depollution facility	225	3.64	4	0	20
Transfer	Civic amenity site	629	10.17	10	4	50
	Clinical waste transfer	94	1.52	2	0	10
	Hazardous waste transfer	393	6.36	6	1	30
	Inert waste transfer	83	1.34	1	0	5
	Non-hazardous waste transfer	1,217	19.68	20	5	100
Treatment	Anaerobic digestion	46	0.74	1	0	5
	Biological treatment	189	3.06	3	2	15
	Chemical treatment	22	0.36	0	0	0
	Clinical waste transfer/treatment	4	0.06	0	1	0
	Composting	261	4.22	4	1	20
	Hazardous waste transfer/treatment	44	0.71	1	0	5
	Inert waste transfer/treatment	103	1.67	2	2	10
	Material recycling facility	234	3.78	4	0	20
	Mechanical biological treatment	3	0.05	0	0	0
	Non-hazardous waste transfer/treatment	240	3.88	4	0	20
	Physical treatment	515	8.33	8	3	40
	Physical-chemical treatment	121	1.96	2	2	10
	WEEE[2] treatment facility	65	1.05	1	0	5
Use of waste	Construction	76	1.23	1	0	5
	Reclamation	61	0.99	1	0	5
	Timber manufacturing	5	0.08	0	0	0
Total:		6,183	100.00	100	27	500

[1] Stable non-reactive hazardous waste cell

[2] Waste electrical and electronic equipment

Source: Environment Agency's Waste Data Interrogator 2014

It was assumed that the survey would achieve a response rate of approximately 20%. Therefore, a list of 500 sites were randomly selected from each of the site types to ensure that the sample size was large enough to achieve the required number of 100 responses. This list was reviewed by the Environment Agency to remove sites that should not be contacted. This included sites that had recently been surveyed for other purposes, sites subject to enforcement action and any hostile sites.

The Environment Agency was prevented from sharing the names and contact details for the sample population due to data protection law and therefore these were collected through a combination of desk-based research and in-house knowledge, particularly for the larger operators with multiple sites.

Initially, the survey methodology involved calling individual site operators, explaining the purpose of the survey and asking them to participate. They were then asked to complete the questionnaire over the telephone or return it electronically. If necessary, the sites were contacted a number of times to encourage them to participate. The number of responses received using this approach was lower than anticipated due to problems getting through to the most appropriate person to complete the survey, time constraints etc. This led the team to reconsider the approach and instead develop a tailored email that was sent to all operators in the sample population and then followed up with a telephone call. This approach was more successful as it meant that the follow-up call was not a 'cold call' and often the email was forwarded to the most appropriate person to respond, negating the need to call numerous members of staff before reaching them.

3.5 Step 4: Developing the baseline (counterfactual)

3.5.1 Overview

The counterfactual scenario represents the best estimate of what outcomes would have been achieved by the Environment Agency's interventions in waste crime had the additional funding not been available. This baseline is required so that the additional outcomes that can be attributed to the funding can be identified. A key part of the process to develop the counterfactual is to assess whether there is any correlation between a number of waste-related and economic variables and the outcomes that are achieved by the Environment Agency. Should a correlation be identified between these variables and outcomes, it can be used to estimate what outcomes would have been achieved had the additional funding not been available.

A counterfactual scenario was required for the illegal waste sites and illegal waste exports outcome areas as this work was part of the core work undertaken by the Environment Agency and therefore it was necessary to separate which outcomes were attributable to 'core funding' and which could be attributed to the additional funding from HM Government. No counterfactual was required for the misdescription of waste as this was a new area of work for the Environment Agency and therefore the baseline was effectively zero with all outcomes being attributable to the additional funding.

To develop the counterfactual scenario for illegal waste sites and illegal exports, the following steps were taken:

- Step A– Identify the range of variables which could influence key indicators for each outcome area.
- Step B – Undertake statistical correlation tests for each variable independently and test the significance of relationships.
- Step C – Refine the 'long list' of variables to a 'short list' of the strongest related variables to model the counterfactual in each case (the hypothetical baseline).

As mentioned above, a different approach was required to evaluate the additional outcomes that have been achieved with the funding for the misdescription of waste area as this was a new area of work for the Environment Agency. Before the additional funding became available, no resources were specifically targeted at tackling the deliberate misdescription of waste although a very limited number of misdescription incidents may have been identified during routine audits. There is therefore no counterfactual scenario against which the outcomes achieved over the project period should be compared: all of the outcomes are effectively additional to the baseline. The project worked closely with Environment Agency areas to assist with the identification of sites that were suspected of the misdescription of waste and to undertake audits to establish whether this was the case. Details of all the sites that were audited, details of the type and quantities of waste involved and the enforcement action taken were collected by the project team. This dataset, together with additional information from Environment Agency areas and HMRC, to whom referral cases were made, was used to quantify the direct and indirect impacts that have been achieved with the additional funding.

3.5.2 Variables used in the analysis

The 'long list' of variables used in the analysis is set out in Appendix C. These include a range of metrics that cover waste-related aspects such as the economic performance of the waste management sector, recyclate prices, waste arisings, waste recycled/disposed of and contextual information such as the overall population, number of dwellings, Consumer Price Index, Retail Price Index etc. Added to the analysis were key outcome indicators such as the number of illegal sites identified, the number of illegal sites stopped, the number of illegal waste exports identified etc., together with the overall spend on waste crime interventions by the Environment Agency.

Where available, data for each variable was collected for the period 2008 to the end of the assessment period (March 2016).

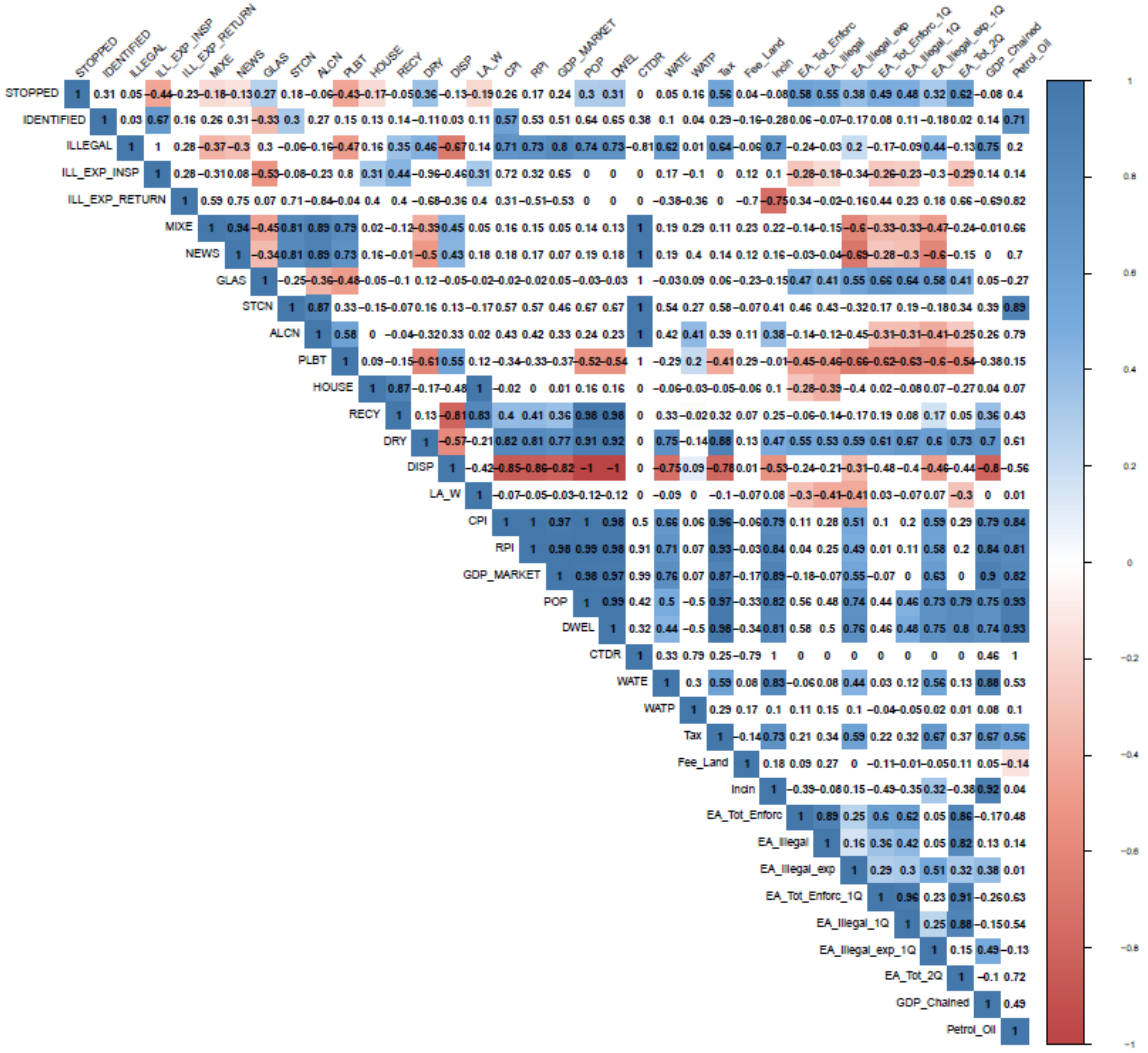
3.5.3 Correlation tests

Correlation tests measure the strengths of association between two variables. Each variable was analysed independently against the key outcome indicators to generate an 'R value' or correlation coefficient. This is a number between +1 and -1 which measures the degree of correlation between the two variables. A positive number indicates that if one variable increases, the other will also increase, with a higher number indicating a stronger relationship. The same is true for a negative number although in this case as one variable increases, the other will decrease. A correlation coefficient of +1 or -1 indicates a direct linear relationship between the variables so that if one is known the other can be accurately predicted.

The assessment used statistical software package R to measure correlation between the variables and a correlation matrix was produced for each outcome area. The matrices also screened for statistical significance. Although they showed evidence of some strong correlation between some variables, the limited number of data points for some (e.g. waste sector specific turnover or dwelling numbers in the UK for which data was only available annually rather than quarterly) resulted in a mean low statistical significance for these. As a result, they were excluded from the tests.

The correlation matrix for the illegal waste outcome area is shown in Figure 3.1. A glossary of the variable labels used in the diagram is included in Appendix D. Shaded cells within this matrix represent results which can be deemed statistically significant, with red representing negative correlation and blue positive correlation.

Figure 3.1 Correlation matrix for illegal waste sites identified and illegal export events



Source: Ricardo Energy & Environment

Once the correlation between variables had been calculated it was possible to generate a shortlist of those variables that had a statistically significant relationship with the key outcomes in the illegal waste sites and illegal waste exports work areas. This 'shortlist' of the variables showing the greatest correlation is given in Table 3.4.

Table 3.4 'Shortlist' of variables used for each outcome area

Illegal waste sites	Illegal waste exports
Environment Agency spend on illegal waste site enforcement	Environment Agency spend on tackling illegal waste exports
Gate fee for incineration	Gate fee for incineration
Landfill Tax (£ per tonne)	Landfill Tax (£ per tonne)
Gross Domestic Product (current prices)	Recycling price of dry mixed recyclables
Retail Price Index (RPI) (base year 2005)	Consumer Price Index (base year 2005)
Local authority collected waste (tonnes)	Revenue of the Water Supply, Sewerage, Waste Management and Remediation Sector
Typical retail process of petroleum products (fuel)	Proportion of all waste collected recorded as Disposal

Source: Ricardo Energy & Environment

The most influential factor was understandably the resources spent by the Environment Agency on tackling waste crime but another influential factor was the gate fee for incineration in England. Landfill Tax, the cost of fuel (transportation costs of waste) and the CPI were less influential overall. It is understandable that the cost of disposing of waste through incineration and landfill is likely to influence the number of illegal waste sites as the primary driver for illegal operators is financial savings. As the cost of legitimate disposal increases, so the motivation to reduce costs increases. The CPI is also related to the cost of legitimately managing waste as it reflects increasing costs through inflation.

3.5.4 Weighted multiple regression analysis

The defined relationship between the shortlisted variables and outcomes can then be combined to generate an estimate of what outcomes would have been achieved had the additional funding not been received. This calculation uses the formula set out bellow.

Counterfactual outcome = C + (a x EA <u>NEW</u> spend) + (b1 x variable 1) + (b2 x variable 2) + (b3 x variable 3) + … (bn x variable n).

Where C = Intercept and a, b1, b2, b3…bn = the coefficient calculated for each variable

Note: NEW spend in this counterfactual calculation refers to the Environment Agency's expenditure profile that would be expected had no additional funding been made available. Therefore, it is a new dataset reflecting the anticipated spending cut linked to the Environment Agency's Strategic Reviews Response Programme (SRRP) re-organisation in 2014/15.

The process utilised to calculate these coefficients is multiple regression using statistical software. Through shortlisting the associated variables based on their statistical significance and correlation, we then construct the formulae and datasets and run multiple regression to analyse the combination of variables and how well the time series data and the changes in data points over time describe/influence the key output criteria of illegal waste sites stopped or illegal export events identified.

It is this process which uses the known information to calculate a line of best fit which we can compare to the actual data collected for the number of illegal sites stopped. This is important as undertaking this process means that with all other variables being the same in the time period, we can then vary the key Environment Agency spend profile to estimate how many sites would have been stopped without the additional provision of funding.

With these coefficients identified, the baseline spend can be updated for the time series (i.e. excluding the additional spend and based on the Environment Agency's forward planning

documents (SRRP)) to reflect anticipated reduced spending and manpower to attempt to statistically model what the outcomes would have been should no additional resources have been available (the counterfactual). It should be noted that although the statistical models cannot perfectly predict what would have been achieved without the additional funding, they do present the results within a known confidence interval, rather than basing results on assumption driven quantification.

The upper and lower confidence intervals represent the variance that has been calculated for the key variables within the statistical modelling process. Each individual coefficient calculated will have a known level of variance and when all upper or lower bounds are applied the models can be re-run to provide the upper and lower bounds of anticipated outcomes for the Environment Agency. These will be represented in two identically formatted models, but with alternative event modelling undertaken to reflect the possible variance in the model developed.

The results of the modelling to define the counterfactual for each outcome area are presented in their respective sections in this report.

3.6 Step 5: Modelling

3.6.1 Structure of the model

A model was developed in MS Excel to analyse all of the internal and external data collected as part of this project in order to identify the outcomes that were achieved with the additional funding and value them. A schematic overview of the model is set out in Figure 3.2. The model consists of a series of tabs which present the underlying data and show how this is used in a series of sequential steps to identify the additional outcomes that were achieved with the funding, over and above the calculated counterfactual. It also shows the valuation of these outcomes and clearly sets out the assumptions used in the assessment. This methodology follows the core guidance documents of the Magenta Book (HM Treasury 2011), modelling both the actual achieved outcomes of the project using Environment Agency recorded data and a baseline or counterfactual scenario developed from a combination of industry variables and contextual data. The two are then valued in economic terms and the counterfactual is subtracted from the actual achieved outcomes in order to generate the net positive effect of the additional funding over the period of the project.

The results are presented as a series of three tiers to reflect the level of confidence in the estimated value of potential outcomes in each outcome area should all corresponding assumptions be fulfilled. The scope of the estimates in each tier are set out in Table 3.5. The purpose of presenting the results in these tiers is to enable users to understand more about the levels of confidence that can be applied to the estimates that are generated and to see the relative effects on values when factors that are less certain are considered within them. The makeup of the tiered estimate for each outcome area is described in detail in the following sections.

Table 3.5 Structure of the valuation estimates

Tier	Description
Tier 1	The value of the additional potential outcomes that were directly evidenced by internal Environment Agency data and/or expert opinion
Tier 2	Tier 1 PLUS projected outcomes (i.e. throughput prevented at stopped sites, or ongoing investigations for which we have detailed information on impacts such as waste type/tonnage) and specific deterrence (i.e. operators changing their behaviour because they have directly experienced an EA intervention).
Tier 3	Tier 2 PLUS less tangible outcomes, e.g. general deterrence effect (i.e. change in behaviour of operators caused by awareness of EA activity, not because they have been directly targeted) and legacy effects resulting from interventions enabled by the additional funding

The results for the Tier 1 estimate are presented with an upper and lower value based on the variance and margin for error present within the statistical modelling undertaken for the counterfactual. Due to the increased number of assumptions involved in the calculation of Tier 2 and Tier 3 estimates, it is not possible to generate a statistically significant estimate of confidence and therefore, in these cases, high level sensitivity testing has been undertaken to understand the impact of various aspects on the final estimate (Appendix B).

3.6.2 Modelling challenges

There are a number of challenges that were considered when building the model. The following paragraphs describe the most significant of these and how they were addressed during the modelling process.

Time lags

It can take a long time to see outcomes from some waste crime work due to the length of time that is required to complete. In the case of prosecutions, this can take months or even years from the date of the original offence. Outcomes are still being seen from work done by the Illegal Waste Sites Taskforce, which was active in 2012/13, long before the period of this assessment, as prosecutions are processed through the courts. In addition, stopping an illegal waste site may not remove or stop the environmental impacts from the site immediately. This is because stopping a site does not mean the site has been cleared of waste. The long potential lag time (approximately 120 days on average based on internal data) between an illegal waste site being put on the National Incident Recording System (NIRS) and full details appearing on the Case Management System (CMS) needs to be taken into consideration when compiling data on illegal waste sites. Therefore, it may be that impacts in year are more closely related to the sum of investments in the last two quarters of the previous year rather than the in-year spend. These types of delayed effects have been considered when reviewing relationships within the data.

The tiered structure of estimate was adopted in some part to address the issue of time lags, as the outcomes that will be achieved by work that was made possible by the additional funding but that has not yet come to a resolution is intrinsically uncertain. In this assessment, only outcomes that have been realised in the 2-year project period were included in the Tier 1 estimate while the projected outcomes of interventions that have not yet resolved, but were considered likely to, were included in the Tier 2 estimates.

Legacy and specific deterrence effects

Waste crime interventions by the Environment Agency would be expected to have a legacy effect as operators that receive a direct intervention (such as advice and guidance or some kind of sanction) improve their practices and maintain the standard over an indefinite period of time. There is no data on which to base estimates of how many operators will make these improvements and for how long they will be sustained and therefore it was necessary to make assumptions to take account of the potential legacy and specific deterrence effects. The high degree of uncertainty around legacy effects means that they were included only in the Tier 2 estimates which take account of these less tangible outcomes.

Due to the limitations of the survey results, and not being able to directly observe the effect, we have estimated the level of legacy and specific deterrence effects as a proxy value in tier 2 for each outcome area

General deterrence effect

Similarly to legacy and specific deterrence effects, the actions of the Environment Agency enabled by the additional funding are likely to have some impact on the actions of operators that have not received a direct intervention but that are aware that others have as a result of media coverage and other communication routes. Again, there was no strong evidence on which outcomes resulting from the potential deterrence effect could be based although there was anecdotal evidence in some cases. A survey of waste management site operators has been undertaken as part of this assessment in an attempt to improve the understanding of the potential deterrence effect in this case and provide a basis for estimated outcomes.

Due to the limitations of the survey results, and not being able to directly observe the effect we have estimated the level of general deterrence as a proxy value in tier 3 for each outcome area.

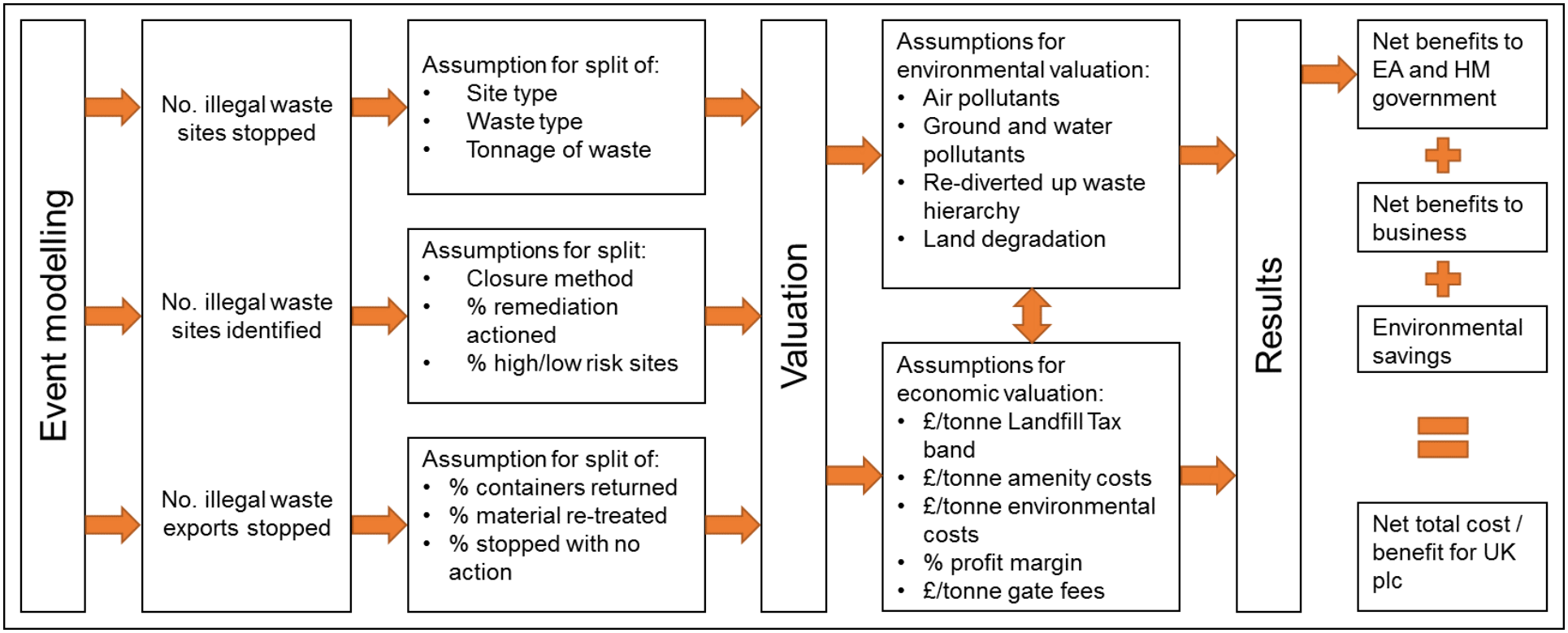
Scaling effects

Aside from the further impacts of legacy and deterrence effects there are also additional scaling measures applied to reflect possible underestimations in the scale of benefits that have resulted from the closure of illegal waste sites. This draws on the fact that data recorded within the Environment Agency's Case Management System (CMS) is based on site case files which record the amount of waste present on site or removed from sites at the time of closure. This only captures a snapshot of the waste that may have passed through the sites. The actual benefit of stopping illegal waste sites is not only the redirection of the waste on site at the time to legitimate operators but also the avoided damage to the environment and the economy had that site been allowed to continue. Another issue relating to scaling effects is the fact that closing a greater number of illegal sites, and doing so more quickly and earlier in their development, leads to potentially less illegal waste activity being undertaken as they are shut before they can accept the waste they would have received if they were operating for longer. The length of time after a site has been closed from which benefits can be valued and the tonnage of waste involved must be set out in the assessment. In this case, we have assumed that the illegal sites would have carried on operating for 12 months after the date of closure had no intervention been made and that the site would have received the same tonnage over these 12 months as it had on site at the time of closure.

Avoidance of double counting benefits

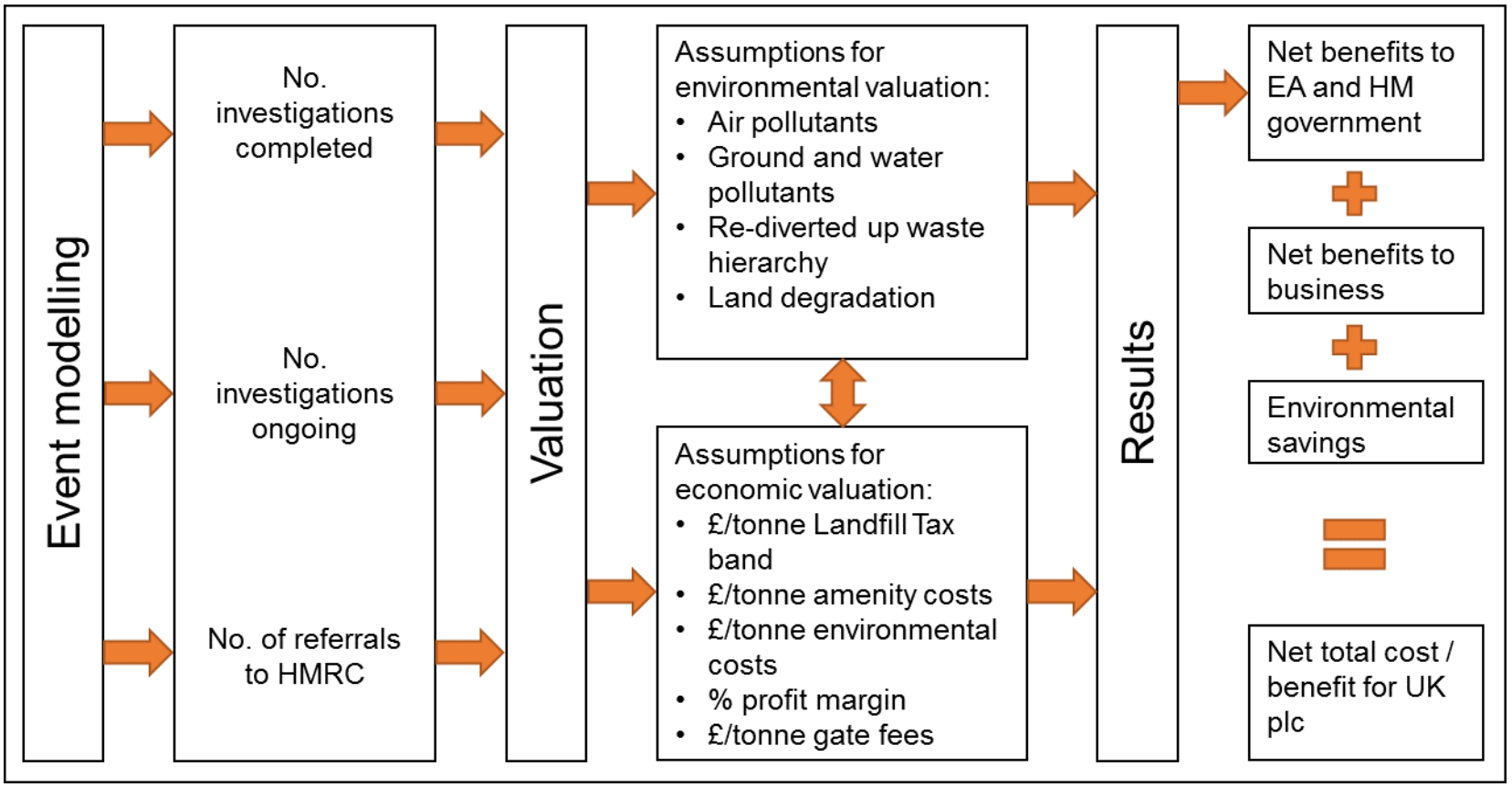
When assessing the economic benefits associated with the greater efforts to tackle waste crime in the UK there is the need to account for benefits from different perspectives. For example, the 'legal and compliant' waste management companies will benefit from the diversion of waste back into the legal system and the resulting commercial equity between legitimate operators. Similarly, from the perspective of HMRC, tax revenues as well as additional landfill taxes will form the majority of the benefits accrued. However, when calculating benefits for different stakeholders in the market, it is also important not to double count benefits and to therefore overinflate the results. An example of this would be to account for both private sector revenues and the Corporation Tax received by HMRC. In this case, although the value of benefits will be significantly different for each operator the net benefit to UK plc will only be equal to that of the additional revenues to the private sector as the tax will only act as a transfer payment. Therefore, these transfer payments that exist will be excluded from the results reported as they do not add value to the UK economy but only move capital between operators in the market.

Figure 3.2 Schematic overview of the illegal waste sites and illegal waste exports model



Source: Ricardo Energy & Environment

Figure 3.3 Schematic overview for the misdescription of waste model



Source: Ricardo Energy & Environment

4 Illegal waste sites

4.1 The baseline (counterfactual)

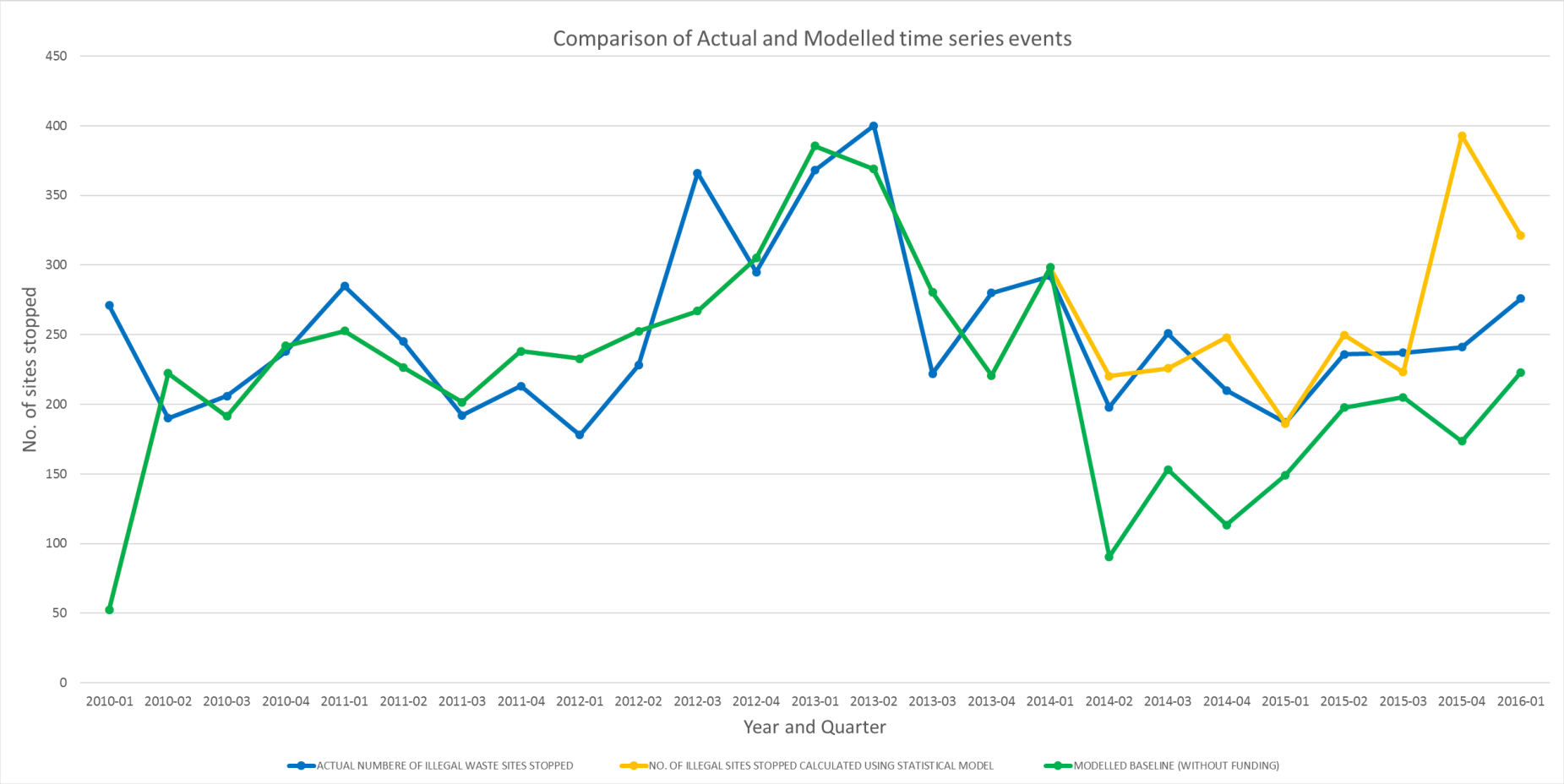
The baseline or counterfactual (i.e. the outcomes that would have been achieved without the additional funding) has been calculated using the methodology described in section 3. Figure 4.1 shows the calculated counterfactual for the period of the project and the evaluation (April 2014 to March 2016) with the number of sites stopped and the baseline modelled back to 2010 from when the contextual data was collected. The actual number of sites that were stopped in each quarter are plotted in blue and show a significant fluctuation from as low as 178 sites in the first quarter of 2012 to 400 sites in the second quarter of 2013. However, this has to be considered in the context of the factors that influence the number of sites that are identified and stopped. For illegal waste sites, the factors that were seen to have the strongest relationships to the number of illegal waste sites were:

- Environment Agency spend on illegal waste site enforcement
- gate fee for incineration
- Landfill Tax
- recycling price of dry mixed recyclables
- Consumer Price Index
- the quality of waste collected by local authorities

It was possible to collect accurate data for all of the factors including the planned spend on illegal waste site enforcement as the Environment Agency had undertaken its annual business planning cycle and decided how and where the budget available at the time would be spent before the additional funding was announced. This provided a realistic insight into the allocation of resources had the additional funding not become available.

The green line on the graph in Figure 4.1 shows the number of illegal waste sites that would have been identified had the additional funding not been available and represents the counterfactual during the project period. The line has been extended backwards to cover the period over which the contextual data was collected and assessed (i.e. from the first quarter of 2010) and shows the expected modelled projection of the number of illegal waste sites stopped based on the funding available at the time. This does not directly track the actual number of sites stopped (blue line) but the difference will be explained in the upper and lower estimates that are understood and included within the statistical modelling process. These upper and lower bounds will be generated by re-running the baseline analysis with inclusion of the variance around each variable factor. This will provide three statistically modelled versions of the model, the upper and lower and central estimates, reflecting the variance and margin for error that exist when constructing modelled scenarios from limited datasets. The variance between these upper and lower estimates as well as the sensitivity testing of key variables will provide an accurate indication of the potential range of benefits accrued, as well as the key impact variables which are driving the outcomes through the model. The yellow line on the graph shows the statistical model for generating the baseline which was created using the actual data from the Environment Agency.

Figure 4.1 Comparison of actual and modelled time series events for illegal waste sites



Source: Ricardo Energy & Environment

4.2 Data used in the assessment

4.2.1 Quantitative data

The Environment Agency collects a great deal of intelligence and operational data relating to the identification of illegal waste sites and the actions taken to stop their operation and remove waste from the site. This data has been collected over a significant number of years as action to stop these sites has been a priority area of work for many years, protecting the environment and human health and working to ensure a level playing field for legitimate waste operators. This has meant that a large amount of data has been available to identify trends and provide the bases for the development of the counterfactual and to identify the outcomes that have been achieved during the period of the project.

The key metrics for which data has been collected are as follows:

- the number of illegal waste sites identified
- the number of illegal waste site stopped
- the number of prosecutions

All relevant datasets were interrogated to collect detailed information about each of the illegal waste sites identified over the project period and before to create an in-depth understanding of the scale of the sites (in terms of the tonnage of waste on site), the types of waste being treated and stored at illegal waste sites and other key parameters to assist with the identification and valuation of the outcomes that were achieved by the Environment Agency's interventions. This modelling data included for example:

- the average tonnage of waste on illegal waste sites stopped
- the composition/type of waste on illegal waste sites stopped
- the number of illegal waste sites on which the waste is cleared

A summary of the Environment Agency's datasets that were investigated to determine whether they could provide the data required and the reason for their use are set out in Table 4.1.

Table 4.1 Data sources for the illegal waste sites priority area

Role in the evaluation	Data	Data source
Baseline data *(not including data for the counterfactual)*	List of illegal waste sites to include number of active high risk illegal waste sites, new illegal waste sites	CMS
	Time taken to stop new illegal waste sites	CMS
	Amount of waste diverted to legitimate industry	CMS for data on waste on site at the point of closure
	Staff time spent on project activities	OTL data and SRRP report on resourcing[1]
Economics and efficiency	Survey responses to specific economics questions (see section 7)	Survey
	The value of waste at illegal and legal waste sites	CMS
	Clean up and treatment costs associated with illegal waste sites	Market intelligence cross checked against internal Environment Agency assumptions
General deterrence	Awareness of project interventions and level of confidence if regulation in waste sector	Survey
	Amount and cost to stop an illegal waste site	CMS and OTL
Environmental impacts	Environmental impact to ground water and soil	Environmental cost and disamenity costs estimated by recognised sources
Learning	Lessons and good practice	Project staff

[1] *OTL – Oracle Time and Labour, SRRP – Strategic Reviews and Response Programme*

Source: Ricardo Energy & Environment

4.2.2 Qualitative information

The operational metrics that are recorded by the Environment Agency do not tell the full story in terms of the full range of beneficial outcomes and learning that has been achieved with the additional funding. In order to capture this information, it was important to speak to staff throughout the Environment Agency to collect their thoughts and experiences of how the additional funding was used, its effectiveness, learning points to improve the efficient and effectiveness of future waste crime interventions, and good practice examples of innovative approaches or effective interventions that were facilitated by the additional funding and would not otherwise have been possible.

Interviews were held with Environment Agency area and national staff involved in the planning, management and delivery of interventions to close illegal waste sites. The findings of these discussions were used to inform the modelling, and key points are reported in section 4.4.

4.2.3 Key assumptions

A small number of assumptions were used in the modelling and valuation of outcomes in the illegal waste sites area. These assumptions are set out in Table 4.2. They were developed in conjunction with the Environment Agency; specifically, specialist staff involved in delivering the outcomes.

Table 4.2 Assumptions used for illegal waste sites model

Assumption	Value	Source
Tier 1		
Length of time an illegal waste site would operate had it not been stopped	1 year	Estimated that an illegal site would operate for at least 1 year if not detected by the regulator. This is supported by officer experience and CMS data showing that sites can operate for significant periods
Composition and tonnage of waste on illegal waste sites	Variable	Calculated from CMS data
Fate of waste removed from stopped illegal waste sites	Landfill	Modelling assumption
Tier 2		
The avoided tonnage of waste managed illegally in the future by stopping illegal waste sites. This assumes that all future waste destined for the stopped illegal site is diverted to a legitimate business i.e. the intervention completely deterred all activity on site.	50% of waste managed illegally at each site[1].	Modelling estimate developed with Environment Agency staff and with reference to CMS data on the tonnage of waste at illegal sites
Tier 3		
Tonnage of waste prevented from being treated illegally on non-target sites through the general deterrence effect of the Environment Agency's interventions	10% of the future tonnage (Tier 2) stopped from entering the illegal system	Estimate based on the visibility of Environment Agency interventions to stop illegal sites as supported by responses to the survey

[1] There isn't any data on the throughput of waste at illegal waste sites. The proxy value used assumes annual throughput of waste on an illegal waste site is equal 50% of waste that we record when it's discovered.

4.3 Results

4.3.1 Additional outcomes achieved

Table 4.3 shows the estimated additional outcomes that have been achieved by Environment Agency interventions enabled by the additional funding. These are calculated by subtracting the counterfactual (i.e. the number of illegal waste sites that would have been stopped by the Environment Agency using core funding alone) from the total number of illegal waste sites closed over the project period with the benefit of the additional funding. This results in an estimate of the additional sites that were stopped as a direct result of the additional funding, which totals 530 sites across the 2-year period. As the total funding for tackling illegal waste sites over the project period was £3.14 million, this equates to an average cost to stop each illegal waste site and take enforcement action where necessary of approximately £5,900.

Table 4.3 Additional outcomes achieved in tackling illegal waste sites

	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Tier 1 estimate									
Actual	198	251	210	187	236	237	241	276	1,836
Counterfactual	91	153	113	149	198	205	173	223	1,306
Variance	107	98	97	38	38	32	68	53	530
Tier 2 estimate									
Variance[1]	107	98	97	38	38	32	68	53	530
Tier 3 estimate									
Variance	107	98	97	38	38	32	68	53	530

[1] The number of sites remained the same in this estimate but the scaling factor of 1.5 was applied to take account of the waste that was prevented from being illegally managed in the future if the illegal site had continued to operate

Source: Ricardo Energy & Environment

The additional illegal waste sites stopped (i.e. those sites stopped over and above the sites that would have been stopped with baseline core funding) were broken down by site type based on the relative proportions of each type of site stopped in the overall dataset. This resulted in the breakdown shown in Table 4.4 for the Tier 1 estimate of outcome value. Again, the negative figures reflect the variation between the counterfactual and actual data. The most prevalent types of illegal waste sites were estimated to be 'storage above ground' (135 sites) and 'burning' (131 sites). These were followed by illegal waste transfer stations (88 sites).

Table 4.4 Breakdown of numbers of additional illegal waste sites stopped by site type (Tier 1 estimate)

Site type	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Landfill	7	6	7	2	2	2	3	3	32
Storage above ground	25	24	22	10	13	8	18	15	135
Burning	22	24	24	8	10	9	20	15	131
Recycling	14	11	8	3	2	3	3	3	46
Transfer	16	14	18	6	7	6	10	11	88
Other treatment	17	15	13	7	3	3	12	4	74
Spreading	4	3	4	1	1	1	2	2	19
Composting	2	0	0	0	0	0	0	0	2
Other	0	0	0	0	0	0	0	0	0
Total	**107**	**98**	**97**	**38**	**38**	**32**	**68**	**53**	**530**

Source: Ricardo Energy & Environment

Using the same approach, the tonnage and type of waste that could be assumed to be on each site could also be extrapolated from the existing dataset. The estimated tonnage of waste on each site type for the Tier 1 estimate is shown in Table 4.5. This shows that the types of illegal site on which the greatest quantities of waste were found were 'burning' (approximately 116,000 tonnes), 'transfer stations' (93,000 tonnes) and 'storage above ground' (67,000 tonnes).

Table 4.5 Tonnage of waste on illegal waste sites stopped by site type (Tier 1 estimate)

Site type	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Landfill	31,178	1,315	1,232	63	4,303	355	3,077	611	42,134
Storage above ground	6,846	12,748	8,984	2,841	13,733	2,024	2,455	17,746	67,378
Burning	8,886	40,421	4,895	30,629	4,845	4,518	18,250	4,237	116,681
Recycling	24,946	4,123	3,616	4,551	101	306	411	3,316	41,370
Transfer	5,514	14,281	38,587	2,164	16,384	8,908	3,775	3,692	93,306
Other treatment	3,938	28,228	13,206	3,045	4,330	2,657	2,735	2,271	60,411
Spreading	1,521	80	139	1,602	1,845	18	225	1,466	6,896
Composting	521	0	4	0	0	0	0	5	531
Other	0	0	0	0	0	0	0	0	0
Total	83,350	101,198	70,663	44,895	45,542	18,787	30,927	33,346	428,707

Source: Ricardo Energy & Environment

The estimated composition of waste on illegal waste sites stopped by the Environment Agency is shown in Table 4.6. This breakdown is derived from data on the composition of waste on stopped sites taken from the Environment Agency's CMS. The results show that commercial waste made up the greatest proportion of waste on illegal sites (approximately 19.6%), followed by inert construction and demolition waste (approximately 17.5%), vehicles (approximately 16.3%) and household waste (approximately 12.9%).

Table 4.6 Composition of waste on illegal waste sites stopped by waste type (Tier 1 estimate) (tonnes)

Waste type	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Agricultural	832	1,328	184	935	424	159	566	275	4,702
Asbestos	4,315	2,293	1,746	279	2,008	682	643	1,032	12,998
Biodegradable	1,232	995	506	559	647	182	387	522	5,030
C&D[1] inert	25,136	9,808	11,066	3,821	10,793	2,603	4,125	7,728	75,080
C&D non-inert	6,868	5,117	4,728	1,898	2,990	1,125	1,567	1,887	26,181
Clinical	489	77	59	–	–	–	–	–	625
Commercial	7,624	19,758	13,654	14,252	9,032	4,801	9,240	5,850	84,212
Contaminated water	118	62	49	–	–	–	–	–	229
Green	1,266	4,349	843	2,241	688	418	1,347	583	11,733
Household	6,065	13,437	13,298	5,531	6,283	3,219	3,954	3,331	55,119
Liquid wastes	798	789	866	349	694	283	196	542	4,517
Metal	3,749	2,817	2,988	1,290	1,899	859	796	1,449	15,847
Packaging	657	1,527	438	1,015	259	161	506	414	4,976
Tyres	3,255	3,402	2,426	1,271	1,899	626	919	1,819	15,617
Vehicles	15,927	22,696	12,487	4,572	4,701	2,089	2,374	5,110	69,958
WEEE/Electrical	–	–	–	–	–	–	–	–	–
Wood	5,017	12,742	5,326	6,882	3,224	1,579	4,309	2,804	41,884
Total	83,350	101,198	70,663	44,895	45,542	18,787	30,927	33,346	428,707

[1] *C&D – construction and demolition*

Source: Ricardo Energy & Environment

The outcomes identified in the assessment were converted into economic values using the factors set out in Table 4.7.

Table 4.7 Factors used in the economic valuation of illegal waste site outcomes (£ per tonne)

Valuation factor	Value 2015	Value 2016	Source
Landfill Tax (standard rate)	£80.00[1]	£82.60[1]	HMRC[1]
Landfill Tax (lower rate)	£2.50[1]	£2.60[1]	HMRC[1]
Gate fees and treatment costs: Landfill gate fee (active) Landfill gate fee (inactive) Storage above ground Burning Recycling Transfer Spreading Composting	 £20.00 £20.00 £10.00 £80.00 £6.00 £10.00 £24.00 £43.00	 £23.00 £23.00 £10.00 £90.00 £6.00 £10.00 £24.00 £43.00	WRAP Gate Fees reports[2]
Environmental cost of waste on illegal waste site	£1.86–£1.88	£1.86–£1.88	Cambridge Econometrics, EFTEC and WRc (2003)
Disamenity cost of waste on illegal site	£6.12–£6.18	£6.12–£6.18	Enviros Consulting Ltd and EFTEC (2004)
Profit margin of waste industry	5%	5%	Apex Insight reports[3]
Corporation Tax	21%	21%	HMRC.[4] This assumed that all businesses are eligible for Corporation Tax

[1] HMRC Landfill Tax rates apply from 1st April in each given year and are available at https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013

[2] WRAP Gate Fees reports are available at http://www.wrap.org.uk/content/comparing-cost-alternative-waste-treatment-options-gate-fees-report-2015 and http://www.wrap.org.uk/content/comparing-cost-alternative-waste-treatment-options-gate-fees-report-2016

[3] Apex Insight reports (UK Waste Management: Market Intelligence) are available from https://www.apex-insight.com/product/uk-waste-management-market-insight/#!prettyPhoto

[4] HMRC Corporation Tax rates are available at https://www.gov.uk/corporation-tax-rates/rates

Source: Ricardo Energy & Environment

The results of the evaluation are shown in Table 4.8. The potential value of the outcomes achieved with the additional funding to tackle illegal waste sites range between the Tier 1 estimate of £10.5 million and the Tier 3 estimate of £12 million. The greatest beneficiary of the interventions was HM Government that saw potential benefits of £6.5m over the project period, this increases to £7.1m when outcomes in the pipeline and less tangible effects of the legacy and deterrence factors are considered. Potential social and environmental benefits range between £3.5m at Tier 1 and £4m at Tier 3. The regulated waste sector saw a potential increase in profits of at least £0.7 million, generated from increased revenue of £14.5m.million over the project period.

Table 4.8 Potential benefits for the illegal waste sites outcome area

Metric	Tier 1 estimate	Tier 2 estimate	Tier 3 estimate
*Additional revenue for the regulated waste sector**	*£14,476,905*	*£16,648,441*	*£16,865,594*
Additional profit for the regulated waste sector	£723,845	£832,422	£840,307
Additional corporation tax	£152,008	£174,809	£176,464
Additional landfill Tax Revenues recovered	£3,392,417	£3,594,661	£3,614,885
Additional VAT recovered	£2,895,381	£3,329,688	£3,373,119
Avoided cost of Environmental damage	£803,363	£923,867	£935,918
Avoided cost of Disamenity effects	£2,642,757	£3,039,170	£3,078,812
Total:	**£10,609,771**	**£11,894,617**	**£12,019,505**

Source: Ricardo Energy & Environment

** Additional revenue presented here because it is used to derive business profits and taxes, but it is not included in the totals*

This table represents the value of potential benefits available to UK plc. It is understood that other tax accessibility and recoverability requirements may mean that not all of this value will be recovered with prosecutions (i.e. Corporation Tax) as well as the dynamic model in which tax is recovered (i.e. the extent to which VAT is currently already recovered with waste diverted to legitimate businesses).

4.4 Application of resources and learning points

The budget available to the Environment Agency to tackle illegal waste sites has varied annually as has the approach taken. Therefore, it is difficult to analyse trends in the historical data. The additional funding made it possible for the Environment Agency to maintain the resources for tackling illegal waste sites at previous levels. Without the additional funding, the budget and therefore the staff resources that would have been available to identify and stop illegal waste sites would have been cut. As previously mentioned, these cuts had been identified and planned to begin in the financial year of 2014, before the additional funding became available. Instead of identifying the additional outcomes and impacts which were expected to increase against the baseline of 'normal funding', the evaluation instead required the assessment of those outcomes and impacts that would not have been achieved without the additional funding. It was likely that there would be no discernible increase in the number of illegal waste sites as the level of resource remained similar in previous years and the approach taken to tackling these sites did not significantly change.

The budget available to tackle waste crime has fluctuated significantly in the years leading up to the period of the project and therefore there is no consistent baseline of funding against which the trend in the number of illegal waste sites stopped can be compared. In the period before 2014, the Environment Agency had established the Illegal Waste Sites Taskforce, which prioritised work in this area and led to a spike in the number of illegal waste sites identified by Environment Agency areas. In 2013, the Environment Agency started work on a major change programme, the Strategic Reviews and Response Programme (SRRP) in response to a planned 10% cut in its budget by HM Government from April 2014. The review sought efficiencies across the organisation and removed the regional tier of services and administration. This would have had a significant effect on the resources available to tackle waste crime had the additional funding not become available and the resource projections

have been used in the development of the counterfactual for this project. The additional funding meant that, in effect, the Environment Agency area enforcement teams saw little change to the resources available to tackle illegal waste sites before and during the project period. The approach to tackling illegal waste sites also remained mostly the same with no significant change in how resources were applied (i.e. identify sites and take enforcement action to close them down). However, in some Environment Agency areas more innovative approaches were used to maximise the effectiveness of the resources made available by the additional funding, such as 'Operation Rooster' described in Figure 4.2.

Figure 4.2 Good practice example: Operation Rooster

Good practice example #1 – New ways of working: Operation Rooster

The South East areas of the Environment Agency (the South East Hub) took an innovative approach to tackling illegal waste sites after finding it difficult to recruit staff with the right experience quickly enough to make an impact over the project period. Instead, they used the additional resources made available to fund experienced officers to work on a series of weekends under the name 'Operation Rooster'. Resources were used flexibly between areas to fund 4 days of action where all six areas would dedicate officers on the ground to disrupting, preventing or gathering evidence against illegal waste activities.

Overall, 233 illegal waste sites were visited as part of Operation Rooster. Of these 233 sites, 127 (55%) were substantiated as active illegal waste sites, 99 (42%) were confirmed as not present or no longer active at inspection and 6 (3%) required a revisit. Of the substantiated illegal wastes sites visited during Operation Rooster, 21 (17%) were closed before the end of March 2016. A further eight illegal waste sites, some of these considered high risk and significant, were found while officers were out in the field

Although funding this as 'overtime' was more costly than salaried work, it led to a new way of working to tackle illegal waste sites in the area. Staff were able to focus their time on a single issue and work more effectively and increase the relevant skill levels. It also led to more illegal sites being identified as some consider that they are less likely to be caught at the weekend as Environment Agency officers are not on duty.

4.4.1 Key learning points from staff

The resource to tackle waste crime during the project period was split between Environment Agency area and national staff that were able to provide intelligence on waste crime and co-ordinate and work on major investigations. Interviews with staff reported mixed views on this division of resources and roles when tackling illegal waste sites. One view was that now local intelligence work had been replaced with a national approach there was a significant knowledge gap as the National Enforcement Service (NES) had different priorities, focusing on major, organised crime rather than smaller scale offenders. This affected the efficiency of local staff as they felt that local intelligence gave them an opportunity to intervene earlier in the development of an illegal waste site, preventing or at least minimising the risk to health and the environment and the loss to legitimate operators.

The split between national and area teams was also highlighted in the case of leadership and the application of resources to tackle illegal waste sites. One member of staff felt that there remained a significant number of illegal waste sites operating in England and that operators considered that the Environment Agency's work to stop them is only 'scratching the surface'. Instead of focusing staff time on tackling this 'baseload' of cases, pressure from national team to resource their new projects and initiatives took resources away from this work. There was genuine concern that the waste management industry considered that the Environment Agency was not sufficiently resourced to tackle illegal waste sites quickly and effectively, reducing the deterrent for illegal waste site operators and undercutting legitimate businesses. However, it should be noted that this was not an opinion that was shared by all.

Other staff reported that communication with the NES was very good and that area and national enforcement staff worked more effectively as ‘one enforcement community’.

One of the key learning points that has emerged for discussions with area and national staff concerns the poor efficiency of resource use when funding is allocated for short periods and particularly when it became available relatively late in the business planning process. Staff reported that with these short funding cycles of, for example, 12 months, it may take 4–5 months to recruit a new member of staff and then they need to go through a period of training and go through a process of obtaining a warrant to undertake enforcement activities. In some cases, this long lead in time has resulted in the targeted recruitment of ex-police officers with the necessary enforcement experience to reduce the amount of training required. However, this has not always been successful due to cultural differences between the police force and the Environment Agency. If staff are aware that their contract or placement will end when funding expires, they often seek another position before this time for security. Altogether, this means that the period of time over which they can work at full capacity is significantly reduced. Anecdotal evidence from staff interviewed as part of this project suggests that this temporary funding approach also leads to the loss of experienced and effective staff that had gained their experience and capability as part of the Illegal Waste Sites Taskforce as they sought positions that were thought to be more secure and is a demotivating factor among wider staff.

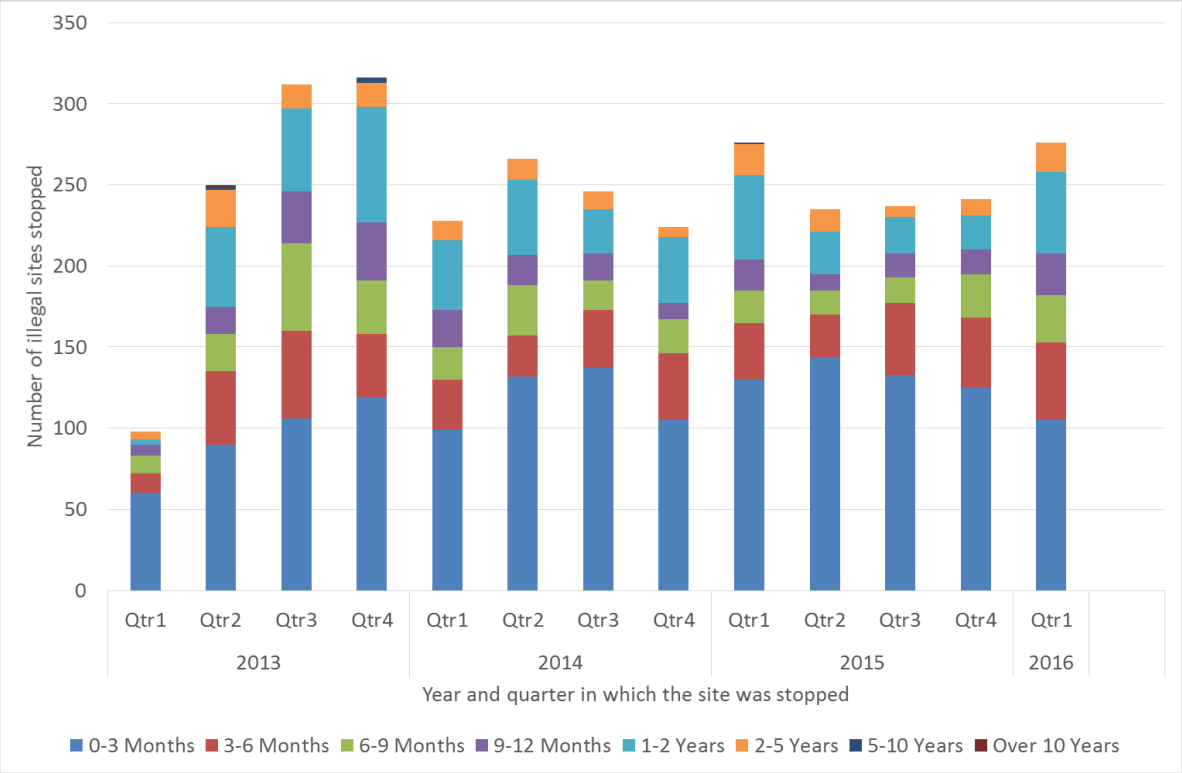
4.4.2 Analysis of the outcomes achieved

Using data from the Environment Agency’s CMS database, it was possible to review the effectiveness and outcomes that were achieved during the project to understand the nature of the interventions and, to some extent, how effective they were. As CMS data was collected before the start of the project, it was also possible to compare interventions during the project with historical interventions. Some of the key messages that can be drawn from the data are set out in the following sections.

Length of time taken to stop sites

Figure 4.3 shows the number of illegal waste sites that were stopped by the Environment Agency each quarter since 2013 and how long the site had been operating. The total number of sites closed in each year remains relatively static at 976 in 2013, 964 in 2014 and 989 in 2015; however, there is a significant fluctuation between the number of sites closed per quarter. This is likely to reflect the operational priorities of the Environment Agency and the time required to intervene and effect a closure. As an example, at the start of the Illegal Waste Sites Taskforce project in 2012, Environment Agency areas were asked to focus on identifying new illegal sites at the start of the year, then priority was given to stopping those sites through the remainder of the year; therefore, the number of sites stopped increased in the following three quarters. There is less fluctuation between quarters during the period of the project. In all quarters, the majority of illegal sites stopped have been operating for less than 3 months reflecting the proactive approach taken by the Environment Agency to intervene at an early stage to limit risks to the environment and human health and potentially reducing the cost and effort required to stop these sites had they had time to become more established.

Figure 4.3 Comparison of the length of time taken to close sites from Q1 2013 to Q1 2016



Source: Ricardo Energy & Environment

Figure 4.4 shows the average number of days that it took the Environment Agency to stop illegal waste sites after they were identified. The number of days taken to stop a site is shown in the quarter that it was stopped. This graph shows that the average time taken to stop illegal sites has decreased since 2013 as shown by the trend line marked in red. Linked to this, Figure 4.5 shows the trends in the number of illegal waste sites stopped by age of the site. It shows that there has been a slight upward trend in the number of illegal waste sites that have been stopped within 3 months of being identified, potentially a more effective use of resources and limiting risk. The number of sites stopped between 1 and 2 years of being identified has remained relatively static whereas the number of much more established illegal waste sites that have been operating between 2 and 5 years has declined. Overall this demonstrates a more responsive and effective approach by the Environment Agency to tackle this issue. It is not possible to identify from the data which sites were closed as a result of the additional funding and which closure interventions were resourced by core funding; however, in this case, the additional funding was used to maintain resources at the level of previous years rather than to provide a significant increase in interventions and therefore outcomes during the project period can be reasonably compared to the period before.

Figure 4.4 Average number of days taken to stop illegal waste sites (IWS) from Q1 2013 to Q1 2016

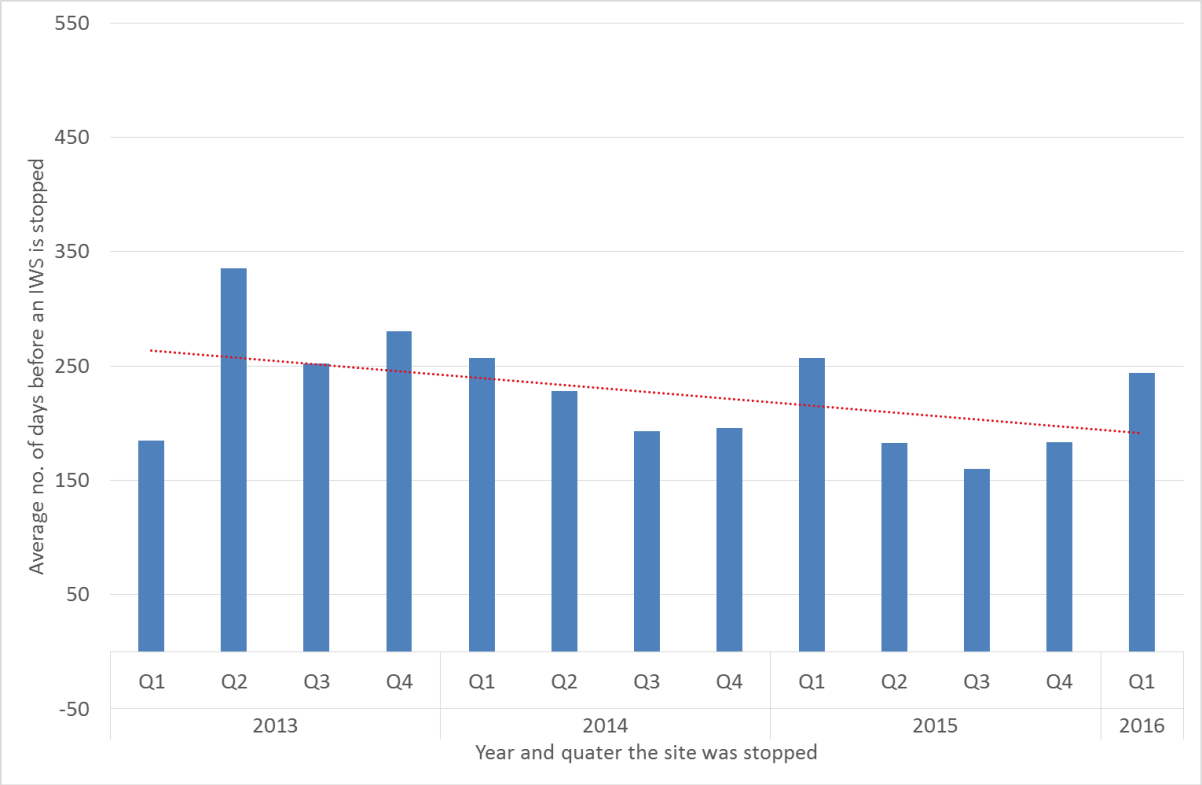
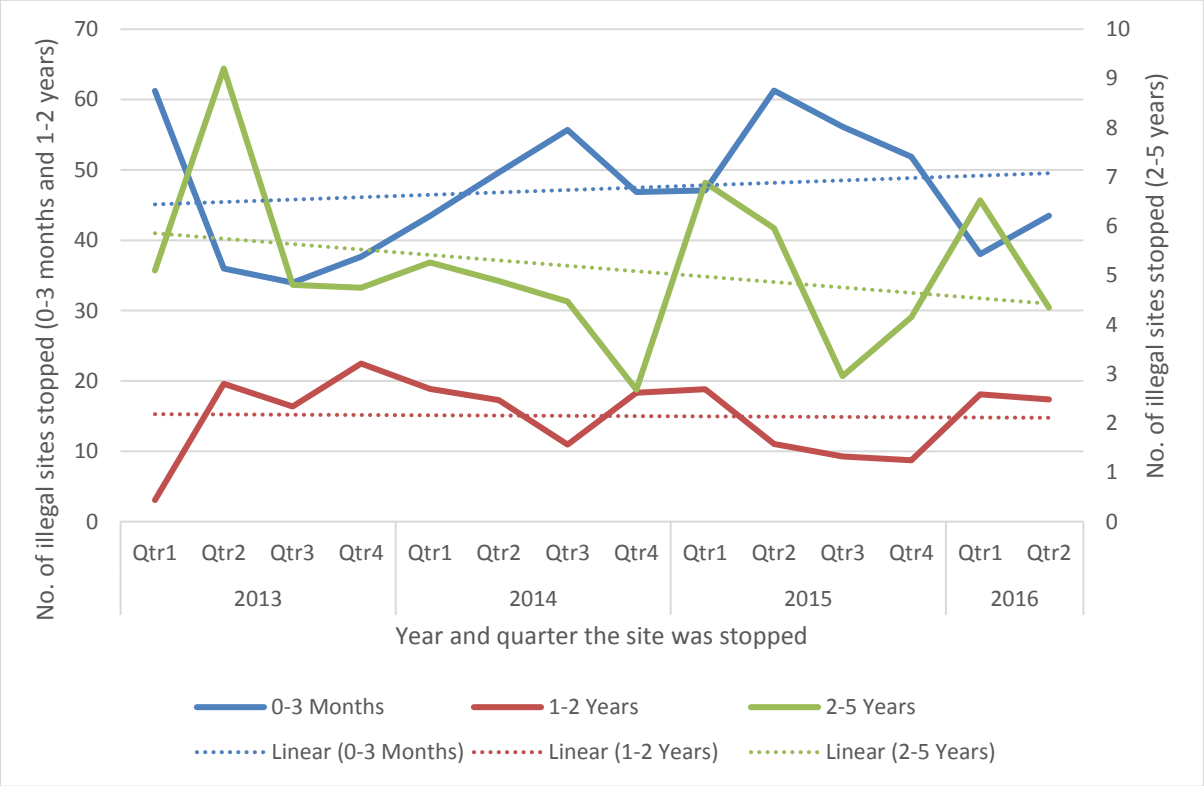


Figure 4.5 Trends in the time taken to stop illegal sites after they are identified



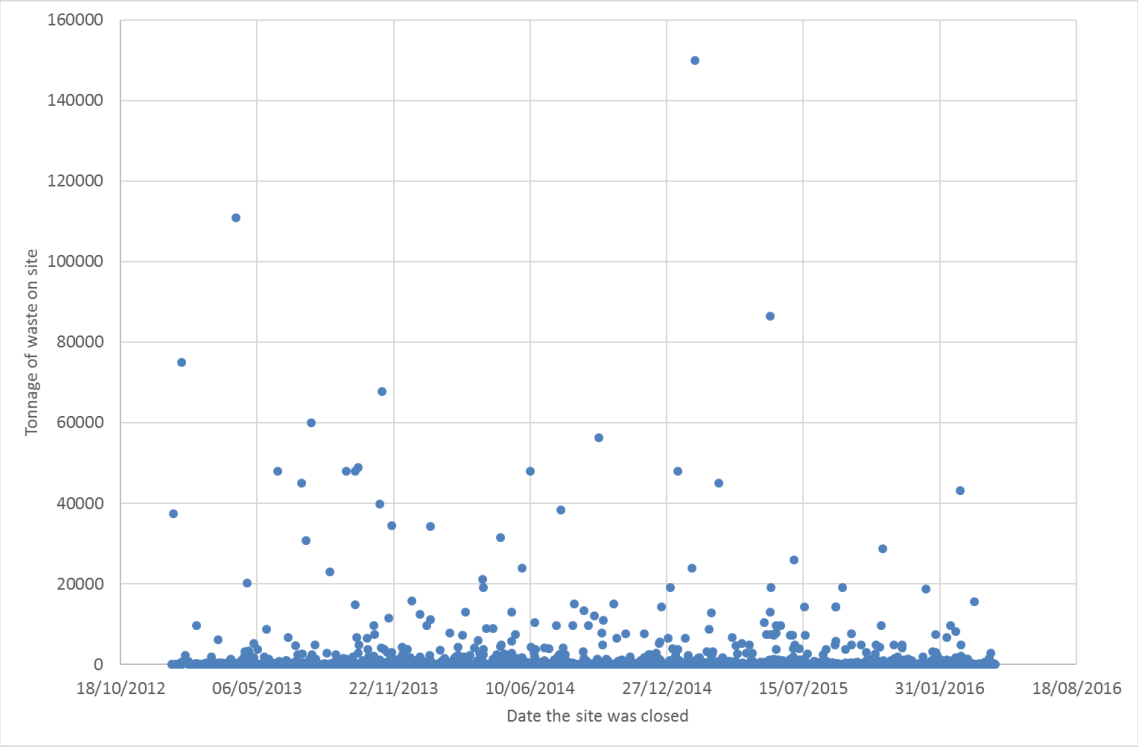
Source: Ricardo Energy & Environment

Tonnage of waste on illegal waste sites

CMS data was analysed to determine whether there had been any change in the tonnage of waste on illegal waste sites. It is assumed that the more quickly an illegal waste site can be stopped, the less waste will be on the site, reducing the risks associated with a larger site and minimising remediation costs. The tonnage of waste on each site closed before and during the project period was plotted in order to determine any trends. The results are shown in Figure 4.6. One site has been removed from this graph, an outlier site that contained approximately 400,000 tonnes of waste and took between 1 and 2 years to close, being stopped in December 2013. There are no discernible trends in the tonnage of waste on illegal waste sites when they were stopped. The data shows that there was very little waste on the majority of stopped sites. Of the almost 2,300 sites stopped since the beginning of 2013 and used for the graph, 14% had less than 2 tonnes of waste and approximately 65% had less than 50 tonnes of waste.

The data was also analysed to determine whether there was a relationship between how long the sites were open and the quantity of waste on the site when they were stopped. The results are presented in Table 4.9. This shows that, on average, sites between 0 and 3 months old contain less waste and that the average quantity of waste on sites increases significantly after 3 months as they become more established. This supports the view that early intervention reduces the potential harm that can be caused by illegal waste sites and minimises remediation costs. Overall, the Environment Agency has achieved the greatest impact for the environment by addressing sites between 0 and 3 months old, recovering approximately 750,000 tonnes of illegally managed waste and returning it to regulated sites.

Figure 4.6 Tonnage of waste on illegal sites stopped Q1 2013 to Q2 2016



Source: Ricardo Energy & Environment

Table 4.9 Tonnage of waste on illegal waste sites by duration (Q1 2013 to Q2 2016)

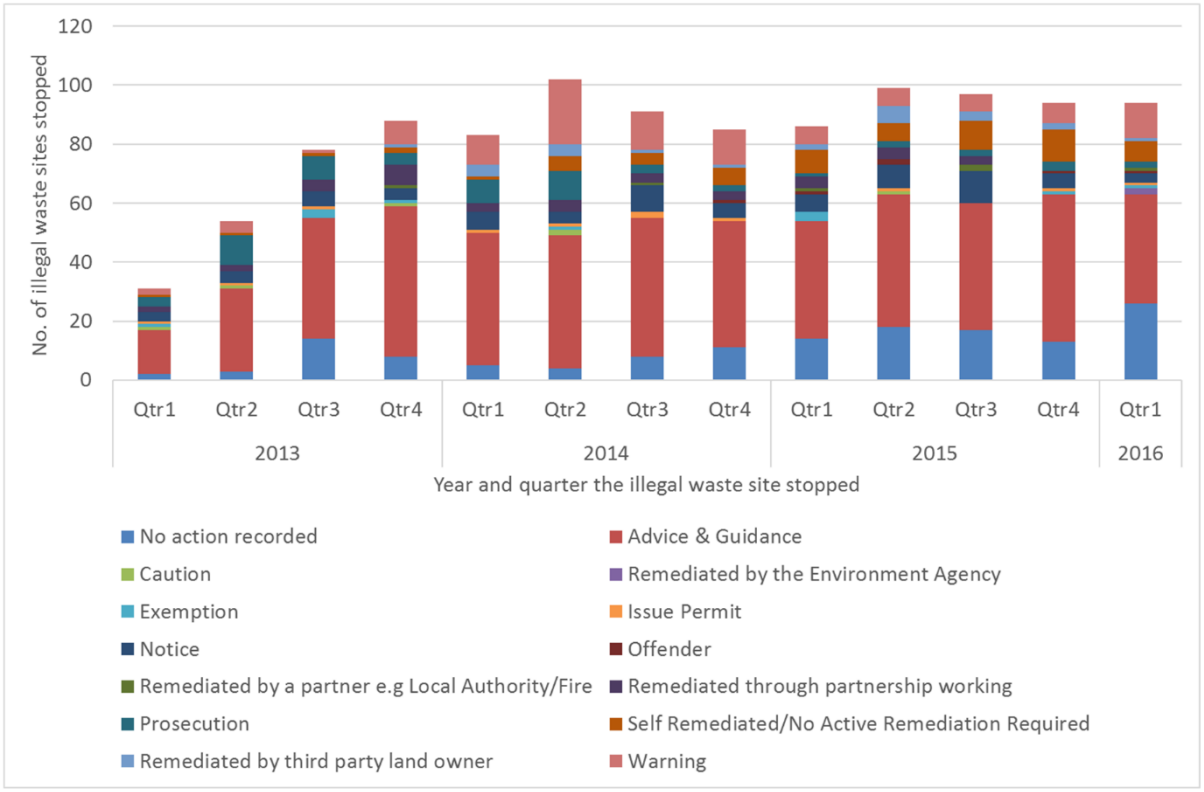
Duration of the illegal site	Average tonnage on sites of this age	Total tonnes on sites of this age
0–3 months	507	748,973
3–6 months	1,452	693,896
6–9 months	1,377	440,780
9–12 months	1,293	316,754
1–2 years	906	452,937
2–5 years	1,238	206,815
5–10 years	659	3,953
Over 10 years	65	65
Total		2,864,173

Source: Ricardo Energy & Environment

Changes in the type of interventions used

When illegal waste sites are remediated, the methods employed are recorded by officers on the CMS system. This information is presented in Figure 4.7 and shows that a significant majority of illegal waste sites identified were given advice and guidance. It can be assumed that this advice recommended that the operator either came into regulation by registering an appropriate exemption or applying for an environmental permit, or ceased the activity.

Figure 4.7 Actions taken to remediate illegal waste sites Q1 2013 to Q1 2016

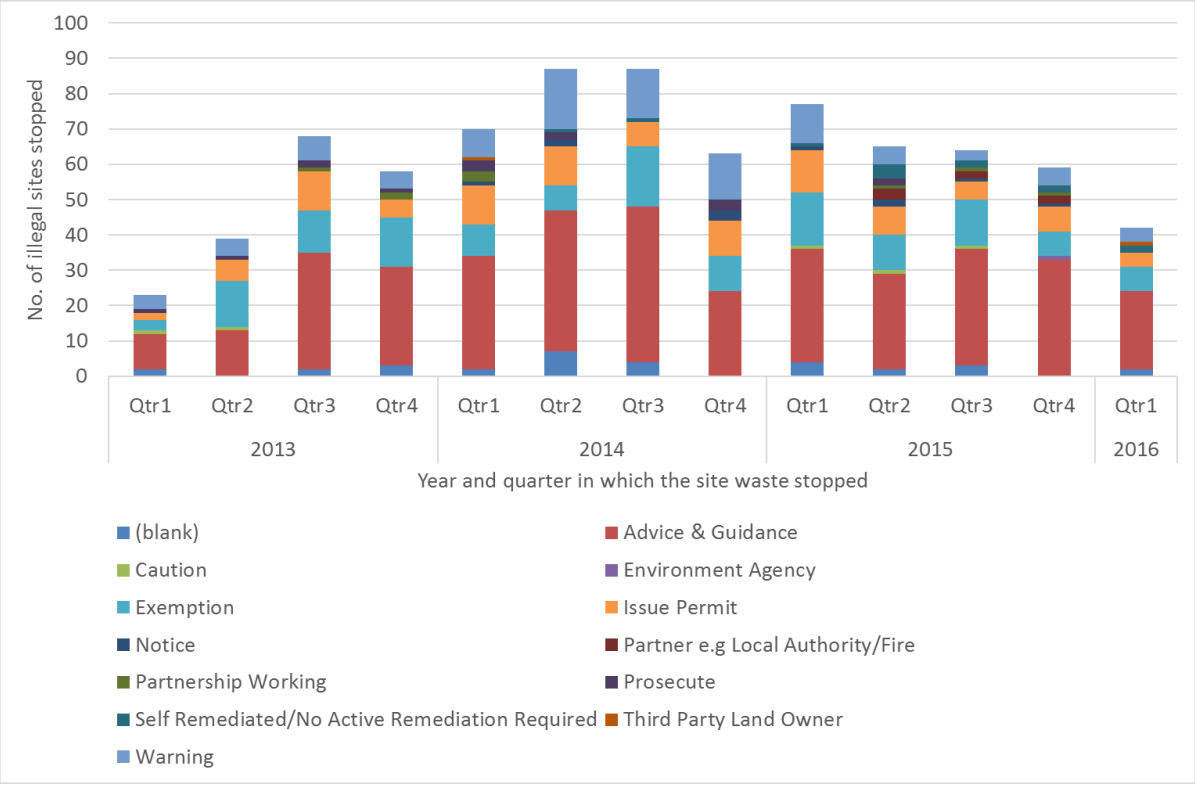


Source: Ricardo Energy & Environment

The CMS database records indicate the actions taken where illegal waste sites were brought into regulation and this information is shown in Figure 4.8. Again, the largest proportion were given advice and guidance, followed by sites registering an exemption or being issued with an environmental permit to carry out their activities legally.

The number of prosecutions against illegal waste sites, those that were regulated and those that were not brought into regulation (i.e. closed) increased from 12 in 2013 to 16 in 2014 and falling to 9 in 2015 with one prosecution in the first quarter of 2016.

Figure 4.8 Methods used to bring operational sites into regulation



Source: Ricardo Energy & Environment

5 Illegal waste exports

5.1 The baseline (counterfactual)

The baseline or counterfactual (i.e. the outcomes that would have been achieved without the additional funding) has been calculated using the methodology described in section 3. Figure 5.1 shows the calculated counterfactual for the period of the project and the evaluation (April 2014 – March 2016) with the number of sites stopped and the baseline modelled back to 2010 from when the contextual data was collected. There were three main metrics used by the Environment Agency to monitor the outcomes in this area. These were the number of containers inspected and allowed to continue, the number of containers returned to the originator and the number of containers evidenced for enforcement action. For the purpose of developing the counterfactual, the latter two were combined to give one overall metric for the number of illegal waste exports that were stopped.

The actual number of illegal waste exports that were identified and stopped in each quarter are plotted in blue on Figure 5.1 and show a significant increase over time from an average of less than 50 per quarter in the first few years of the illegal waste exports team to a high of 330 in the fourth quarter of 2015, during the project period. The resources allocated to the work area have by improved working methods developed by the team.

For illegal waste exports, the factors that were seen to have the strongest relationships to the number of illegal exports stopped are as follows:

- Environment Agency spend on tackling illegal waste exports
- gate fee for incineration
- Landfill Tax
- recycling price of dry mixed recyclables
- Consumer Price Index
- revenue of the water supply, sewerage, waste management and remediation sector
- tonnage of local authority collected waste disposed

These are very similar to those for the number if illegal waste sites, with the addition of the annual revenue generated by the water supply, sewerage, waste management and remediation sector and the total tonnage of waste disposed of (i.e. landfilled).

As before, accurate data for all of the above factors was available for the assessment including the planned spend on illegal waste exports enforcement as the Environment Agency had undertaken its annual business planning cycle and decided how and where the budget available at the time would be spent before the additional funding was announced. This provided a realistic insight into the allocation of resources had the additional funding not become available.

The green line on Figure 5.1 shows the number of illegal waste exports that would have been identified had the additional funding not been available and represents the counterfactual during the project period. The line has been extended backwards to cover the period over which the contextual data was collected and assessed (i.e. from the first quarter of 2010). Over this period, there was no additional funding and the line shows the expected modelled projection of the number of illegal waste exports that would have been prevented based on the funding available at the time. This does not directly track the actual number of

illegal exports prevented (blue line) but the difference will be explained in the upper and lower estimates that are understood and included within the statistical modelling process. The variance between these upper and lower estimates as well as the sensitivity testing of key variables will provide an accurate indication of the potential range of benefits accrued, as well as the key impact variables which are driving the outcomes through the model. The yellow line on the graph shows the statistical model for generating the baseline which was created using the actual data from the Environment Agency.

5.2 Data used in the assessment

5.2.1 Quantitative data

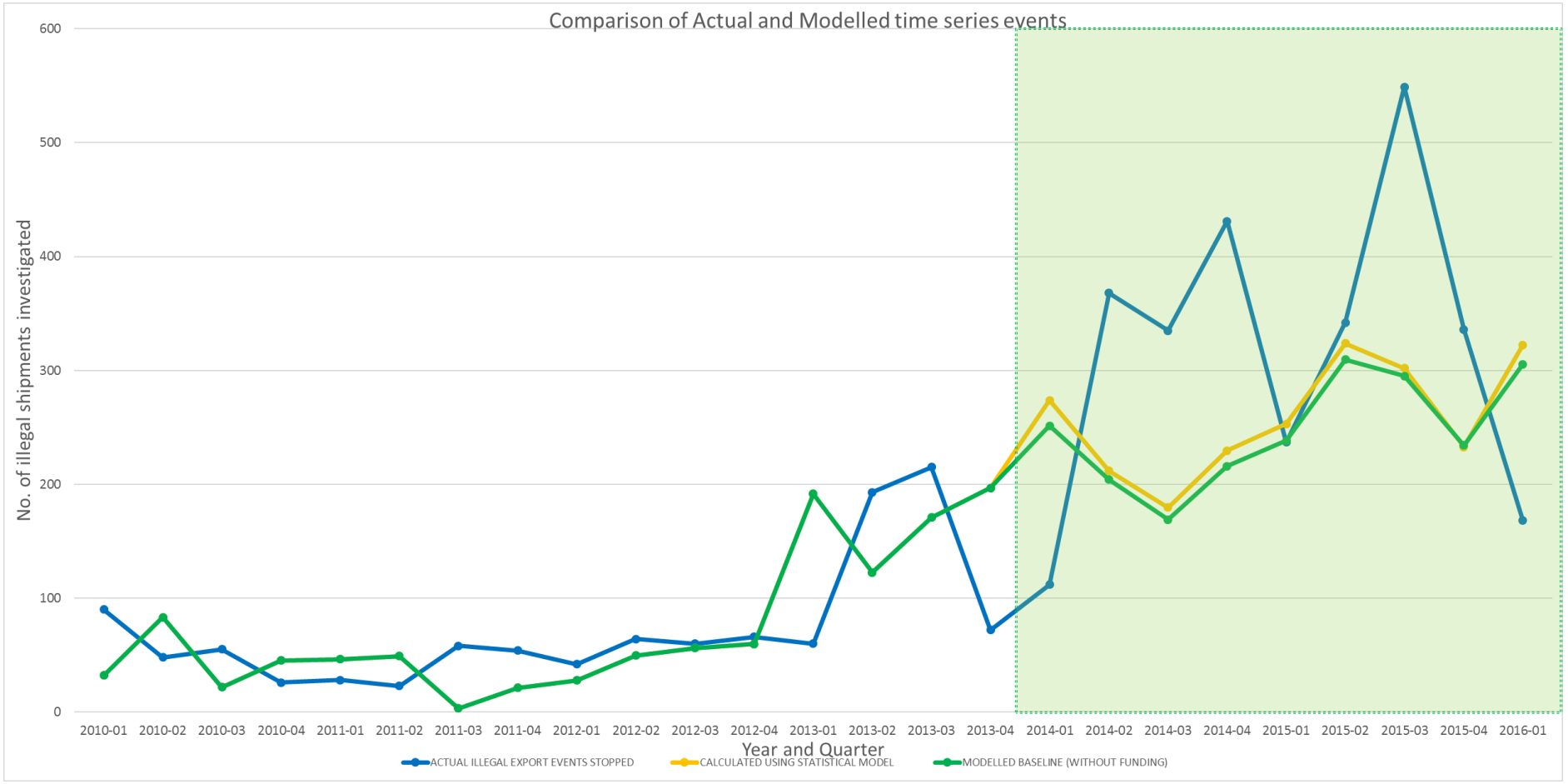
The national team responsible for the co-ordination and delivery of interventions to prevent illegal waste exports collect and collate data on a range of metrics to monitor their impacts and effectiveness. This data has been collected since the second quarter of 2012 when a project was established to specifically target this area of waste crime. Relevant data is also collected by generic recording systems such as CMS if enforcement action is pursued. The key metrics for which data has been collected are as follows:

- the number of illegal waste exports returned to the originator
- the number of illegal waste exports evidenced for enforcement action

All relevant datasets were interrogated to collect detailed information about each of the illegal waste exports identified and prevented over the project period and before to create an in-depth understanding of the type and weight of waste involved. This assisted with the identification and valuation of the outcomes that were achieved by the Environment Agency's interventions. This modelling data included, for example:

- the average tonnage of waste per container
- the composition/type of waste involved in illegal exports
- the number of illegal waste exports prevented

Figure 5.1 Comparison of actual and modelled time series events for illegal waste exports



Source: Ricardo Energy & Environment

A summary of the Environment Agency's datasets that were investigated to determine whether they could provide the data required and the reason for their use are set out in Table 5.1.

Table 5.1 Data sources for the illegal waste exports priority area

Role in the evaluation	Data	Data source
Baseline data	Baseline and progress data related to the logic model columns. Most notably the number of case files opened, number of illegal export events investigated and number of illegal events stopped	Internal International Waste Shipments database HMRC
	Staff time spent on project activities	OTL data and SRRP report on resourcing[1]
	Survey responses to specific economics questions (see section 7)	Survey
Elicitation of expert opinion	Expert opinion to support update of exports estimation methodology	Elicitation techniques
General deterrence	Awareness of project interventions and level of confidence in regulation in waste sector	Survey
Learning	Lessons and good practice	Project staff

[1] *OTL – Oracle Time and Labour, SRRP – Strategic Reviews and Response Programme*

Source: Ricardo Energy & Environment

5.2.2 Qualitative information

The operational metrics that are recorded by the Environment Agency do not tell the full story in terms of the full range of beneficial outcomes and learning that has been achieved with the additional funding. This is certainly the case for the work that has been undertaken to tackle illegal waste exports. The resources provided by the additional funding were concentrated in a small team of expert staff based in the National Enforcement Service, supported by port inspection officers. Over time, the team has established strong relationships with companies involved in the shipping of waste in containers that assist in the identification and prevention of illegal waste exports. This approach of targeting potentially illegal waste exports higher up the 'pipeline', in some cases before an illegal export is attempted, means that the usual metrics and data recording systems used by the Environment Agency do not collect information on the true range of outcomes that have been achieved by these interventions. More detail on this methodology is set out in section 5.4

In order to capture this information it was important to speak to staff in the national team and those supporting the work in Environment Agency areas to collect their thoughts and experiences of how the additional funding was used, its effectiveness, learning points to improve the efficient and effectiveness of future waste crime interventions, and good practice examples of innovative approaches or effective interventions that were facilitated by the additional funding and would not otherwise have been possible.

Interviews were held with area and national staff involved in the planning, management and delivery of interventions to stop illegal waste exports. The findings of these discussions were used to inform the modelling, and key points are reported in section 5.4.

5.2.3 Assumptions

A small number of assumptions were used in the modelling and valuation of outcomes in the illegal waste exports area. These assumptions are set out in Table 5.2. They were developed in conjunction with the Environment Agency, specifically specialist staff involved in delivering the outcomes.

Table 5.2 Assumptions used for illegal waste exports model

Assumption	Value	Source
Time-based assumptions		
No. illegal exports prevented through liaison with shipping industry (Tier 1) per quarter	10 containers	Estimate from discussions with illegal waste exports team
No. illegal exports prevented through direct liaison with waste industry (Tier 2) per quarter e.g. specific deterrence	20 containers	Estimate based on limited survey
Number of illegal exports prevented by the general deterrence effect of Environment Agency intervention (Tier 3) per quarter	40 containers	Estimate based on limited survey
Changes in total waste notified for export from the UK	-0.5%	Estimated change from 2014 baseline
Non-time-based assumptions		
Average tonnage of waste in a container	22 tonnes	Estimate based on the density of WEEE/mixed wastes

Source: Ricardo Energy & Environment

5.3 Results

Table 5.3 shows the estimated additional outcomes that have been achieved by Environment Agency interventions enabled by the additional funding. These are calculated by subtracting the counterfactual (i.e. the number of illegal waste exports that would have been stopped by the Environment Agency using core funding alone) from the total number of illegal waste exports stopped over the project period with the benefit of the additional funding. This results in an estimate of the number of additional illegal waste exports that were prevented as a direct result of the additional funding, which totals 192 illegal exports across the 2-year period. It should be noted that in some quarters the variance is a negative figure. This is a result of the variation between the actual number of illegal exports stopped and the calculated counterfactual and because of this the number of additional illegal exports stopped should be considered over the period of the project as a whole rather than for individual quarters. When outcomes in the pipeline are considered, in addition to the potential deterrence effect and other intangible factors, it is estimated that 672 illegal waste exports were prevented. It should be noted that the Environment Agency's approach to tackling illegal waste exports has been increasingly focused on preventing offences before they are attempted or occur and there is no system for reporting these outcomes. The number of illegal exports estimated to have been prevented through direct liaison with industry is included in the Tier 2 estimate. The Tier 3 estimate includes the number of additional illegal waste exports that were prevented through the deterrence effect and other less tangible factors.

Table 5.3 Additional outcomes achieved in tackling illegal waste exports (number of illegal exports stopped)

	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Tier 1 estimate									
Actual	115	64	89	31	73	42	46	20	480
Counterfactual	39	35	28	51	24	40	31	41	288
Variance	**76**	**29**	**61**	**-20**	**49**	**2**	**15**	**-21**	**192**
Tier 2 estimate									
Variance	**96**	**49**	**81**	**0**	**69**	**22**	**35**	**-1**	**352**
Tier 3 estimate									
Variance	**136**	**89**	**121**	**40**	**109**	**62**	**75**	**39**	**672**

Source: Ricardo Energy & Environment

The Environment Agency's data includes details about the tonnage and type of waste that was identified as involved in the illegal export events that were prevented. This data was applied to the additional incidents to give a breakdown of waste prevented from leaving the UK illegally by type and tonnage as shown in Table 5.4. The targeted approach of the illegal waste exports team is reflected in the data which shows that the waste types involved were limited to household waste and WEEE. It should be noted, however, that household waste is a broad category and can encompass a wide range of materials. Household waste represented 65% of the 4,174 tonnes of waste prevented from being illegally exported.

Table 5.4 Type and tonnage of waste prevented from leaving the UK illegally

Waste type	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Household	1,087	417	869	-284	705	2	219	-301	2,713
WEEE	585	224	468	-153	380	1	118	-162	1,461
Total:	**1,672**	**641**	**1,337**	**-436**	**1,085**	**3**	**337**	**-463**	**4,174**

Source: Ricardo Energy & Environment

The Tier 2 scenario includes the estimated number of containers (20) that were prevented from being exported by industry because of their partnership and engagement with the Environment Agency. When this is considered, the analysis shows that approximately 3,520 tonnes of additional illegal waste exports could have been prevented. If an estimate of the deterrence effect is also considered, in this case the prevention of another 40 containers from being exported, the total tonnage that was stopped or prevented from being exported equals approximately 14,734 tonnes.

The outcomes identified in the assessment were converted into economic values using the factors set out in Table 5.5.

Table 5.5 Factors used in the economic valuation of illegal waste exports outcomes (£ per tonne)

Valuation factor	Value 2015	Value 2016	Source
Landfill Tax (standard rate)	£80.00[1]	£82.60[1]	HMRC[1]
Landfill Tax (lower rate)	£2.50[1]	£2.60[1]	HMRC[1]
Landfill gate fee (active)	£20.00	£23.00	WRAP Gate Fees reports[2]
Landfill gate fee (inactive)	£20.00	£23.00	WRAP Gate Fees reports[2]
Environmental cost illegal waste exports	£1.86–£1.88	£1.86–£1.88	Cambridge Econometrics, EFTEC and WRc (2003)
Disamenity cost of illegal waste exports	£6.12–£6.18	£6.12–£6.18	Enviros Consulting Ltd and EFTEC (2004)
Profit margin of waste industry	5%	5%	*Apex Insight reports*[3]
Corporation Tax	21%	21%	HMRC[4]

[1] *HMRC Landfill Tax rates apply from 1st April in each given year and are available at https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013*

[2] *WRAP Gate Fees reports are available at http://www.wrap.org.uk/content/comparing-cost-alternative-waste-treatment-options-gate-fees-report-2015 and http://www.wrap.org.uk/content/comparing-cost-alternative-waste-treatment-options-gate-fees-report-2016*

[3] *Apex Insight reports (UK Waste Management: Market Intelligence) are available from https://www.apex-insight.com/product/uk-waste-management-market-insight/#!prettyPhoto*

[4] *HMRC Corporation Tax rates are available at https://www.gov.uk/corporation-tax-rates/rates*

Source: Ricardo Energy & Environment

The results of the evaluation are shown in Table 5.6. The potential value of the outcomes achieved with the additional funding to tackle illegal waste exports range between the Tier 1 estimate of approximately £0.4 million and the Tier 3 estimate of approximately £1.4 million. The greatest beneficiary of the interventions are HM Government with potential additional revenues from Landfill Tax of between £0.3m (Tier 1) and £1.2 million (Tier 3). Potential social and environmental benefits range between £34k at Tier 1 and £120k at Tier 3. The regulated waste sector saw a potential increase in profits of up to £22k, generated from increases in revenue of up to £444k over the project period.

Table 5.6 Potential benefits for the illegal waste exports outcome area

Metric	Tier 1 estimate	Tier 2 estimate	Tier 3 estimate
*Additional revenue for the regulated waste sector**	*£149,816*	*£247,798*	*£443,763*
Additional profit for the regulated waste sector	£7,491	£12,390	£22,188
Additional corporation tax	£1,573	£22,149	£14,432
Additional landfill Tax Revenues recovered	£336,428	£622,604	£1,194,956
Additional VAT recovered	£29,963	£49,560	£88,753
Avoided cost of Environmental damage	£7,838	£14,432	£27,622
Avoided cost of Disamenity effects	£25,783	£47,477	£90,867
Total:	**£409,075**	**£768,612**	**£1,438,818**

Source: Ricardo Energy & Environment

** Additional revenue presented here because it is used to derive business profits and taxes, but it is not included in the totals*

This table represents the value of potential benefits available to UK plc. It is understood that other tax accessibility and recoverability requirements may mean that not all of this value will be recovered with prosecutions (i.e. Corporation Tax) as well as the dynamic model in which tax is recovered (i.e. the extent to which VAT is currently already recovered with waste diverted to legitimate businesses).

5.4 Application of resources and learning points

The Environment Agency has targeted resources at tackling illegal waste exports since 2008/09 when there were a number of high profile repatriations of waste exported illegally by local authorities with the costs being met by Defra. As with the work on illegal waste sites, the annual budget available for this work has varied over time. Even with the additional funding from HM Government, the relative budget available for tacking illegal waste exports fell in the project period compared to previous years. Since 2010, the Environment Agency has resourced a small team of officers dedicated to preventing and taking enforcement

action against operators illegally exporting waste. This involved at least eight officers from the regions including port inspectors to inspect containers at the dockside. At that time the team targeted illegal exports of waste electrical and electronic equipment (WEEE) and was funded on a 2-year rolling cycle. Approximately 3 years ago, the scope expanded to include 'green list' wastes (see https://www.gov.uk/guidance/importing-and-exporting-waste) and from April 2016, beyond the scope of this evaluation, the work will continue for a further 4 years.

When the Environment Agency started to proactively target illegal waste exports in 2010, the work was led and directed by regional staff and any investigations and/or casefile were passed to them from area staff. At that time, it was limited to a pilot project in the North East to test whether a nationally co-ordinated intelligence approach would be more effective than the previous approach, led by areas.

Over the period of this project, since the additional funding has been available, a central team based in the National Enforcement Service was established to control and co-ordinate resources. This resulted in a significant increase in efficiency and the outcomes that were achieved include not only prosecutions but also civil sanctions such as enforcement undertakings. In choosing the sanctions that are applied, the team focuses on those that have the greatest financial impact on the companies found to be exporting waste illegally in order to provide a strong deterrent to others.

HMRC operates the CHIEF system (Customs Handling of Import and Export Freight) for inputs and outputs (see https://www.gov.uk/guidance/chief-trader-import-and-export-processing-system). Companies exporting waste are required to report it through this system and describe the material being exported but historically those descriptions have not been checked and typically the term 'household goods' has been used to describe some wastes, making it impossible to quantify how much waste is exported.

Access to this data has allowed the Environment Agency to focus inspections on the small number of English ports through which waste is exported, one of the largest being Felixstowe, and to target sites that are suspected of illegal activity. This intelligence is also combined with information collected by field staff through their work with waste management site operators dispatching waste for export. The staff have gained an in-depth understanding of the factors that motivate operators to attempt illegal exports, the most influential being the UK economy, currency exchange rate and legislation. The increasing export of refuse derived fuel (RDF) has also had a significant impact on illegal waste exports as it has provided a legal export route for mixed wastes that can be misused. The team inspect containers where they have intelligence suggesting that waste may be being illegally exported. Illegal containers are either evidenced for enforcement action or returned to the originator (if permitted) with advice and guidance. If an operator is suspected of an illegal export, the originating site will be inspected in addition to any subsequent containers being exported. The team also works with industry to improve high risk sites. This approach means that many potential illegal exports are prevented before containers reach the ports, also preventing the risk of environmental damage or risks to human health. However, this raises challenges for the evaluation as the metrics recorded by the Environment Agency do not take account of the illegal exports that are prevented. Returned containers are recorded but prevented exports are not. In order to truly represent the value of all outcomes that have been achieved with the additional funding, assumptions around prevented exports have been included in the model as described in section 5.2.3.

The Environment Agency has some data evidence to show that the team's work on illegal waste exports has had some deterrence effect among the waste sector, particularly for the exports of WEEE. In the past, 'WEEE tourists' from developing countries, particularly Africa, have come to the UK to buy containers of WEEE which are exported and treated without proper control. It was also the case that UK nationals were exporting WEEE illegally to the Far East. The Environment Agency actively stops WEEE shipments and requires the

exporter to put the onus on the buyer to confirm that it is no longer waste (e.g. items are working) before it can be exported. This can cost exporters between £2,000 and £3,000, which acts as a sufficient deterrent to illegitimate exporters and has resulted in a reduction in the number of people trying to export WEEE although there is concern that these items are being dispersed into smaller, mixed loads. Over time, experience has shown that the number of genuine errors made by exporters has reduced as practices have improved, leaving the team to focus resources on more organised criminals.

In previous phases of the illegal waste exports team's work, the resource was spread between a small central team in the National Enforcement Service and one full-time equivalent (FTE) in each region. However, this was not found to be effective as not all regional staff had the required skills and experience and their time was under pressure from other work. In 2011/12, the resource model changed to 12 FTEs in a centralised and dedicated team which was felt to be much more effective and efficient. As with the illegal waste sites outcome area, the short-term nature of the funding was seen to be a significant barrier to recruiting and retaining staff with the skills and experience required to be effective.

6 Misdescription of waste

6.1 The baseline (counterfactual)

As previously discussed, there is no baseline and no counterfactual was calculated for the misdescription of waste as this was a new work area for the Environment Agency, facilitated by the additional funding from HM Government. All identified outcomes are considered to be 'additional' to the baseline as the baseline is effectively zero.

6.2 Data used in the assessment

6.2.1 Quantitative data

The Waste Crime Interventions and Evaluation team co-ordinated the collection and analysis of data on interventions relating to the misdescription of waste. This primarily consisted of records and data relating to the following:

- waste stream audits
- cases of suspected misdescription referred to HMRC
- ongoing investigations undertaken by the Environment Agency

This data has been collected since the second quarter of 2014 when the project was established. Relevant data is also collected by generic recording systems such as the Case Management System (CMS) where enforcement action was pursued.

The record of each audit, case and referral was reviewed to collect detailed information about each case of potential misdescription and create an in-depth understanding of the type and weight of waste involved and the outcome/likely outcome. As there is no counterfactual in this outcome area, and the number of sites that received interventions were limited, it was possible to use these records directly to identify and value the outcomes without the need to make assumptions or projections.

A summary of the Environment Agency's datasets that were investigated to determine whether they could provide the data required and the reason for their use are set out in Table 6.1.

Table 6.1 Data sources for the misdescription of waste priority area

Role in the evaluation	Data	Data source
Baseline data *(not including data for the counterfactual)*	List of sites that have been subject to audits, referrals and investigations	Waste Crime Interventions and Evaluation team
	Time taken to stop operators misdescribing waste	Waste Crime Interventions and Evaluation team
	Amount of waste diverted to legitimate industry	Waste Crime Interventions and Evaluation team HMRC
	Staff time spent on project activities	OTL data and SRRP report on resourcing[1]
Economics and efficiency	Survey responses to specific economics questions (see section 7)	Survey
	The value of being misdescribed in terms of gate fees and Landfill Tax	Waste Crime Interventions and Evaluation team HMRC
General deterrence	Awareness of project interventions and level of confidence in regulation in waste sector	Survey
	Amount and cost to investigate and stop sites misdescribing waste	CMS and OTL
Environmental impacts	Environmental impact to groundwater and soil	Environmental cost and disamenity costs from recognised sources
Learning	Lessons and good practice	Project staff

[1] *OTL – Oracle Time and Labour, SRRP – Strategic Reviews and Response Programme*

Source: Ricardo Energy & Environment

6.2.2 Qualitative information

As previously mentioned, the operational metrics that are recorded by the Environment Agency do not tell the full story in terms of the full range of beneficial outcomes and learning that has been achieved with the additional funding. This is particularly true for the work to tackle the deliberate misdescription of waste as it involved new and close partnership working with HMRC. This work included joint investigations of cases identified by the Environment Agency and the referral of suspected cases of misdescription to HMRC to investigate and take appropriate enforcement action.

In order to capture this information, it was important to speak to staff throughout the Environment Agency to collect their thoughts and experiences of how the additional funding was used, its effectiveness, learning points to improve the efficient and effectiveness of future waste crime interventions, and good practice examples of innovative approaches or effective interventions that were facilitated by the additional funding and would not otherwise have been possible. Interviews were held with Environment Agency area and national staff involved in the planning, management and delivery of interventions to identify possible cases of deliberate misdescription.

HMRC expertise was also sought to gather more information on the outcomes and likely outcomes of cases referred to them by the Environment Agency and to understand more about the efficiency and effectiveness of the partnership. The findings of these discussions were used to inform the modelling and key points are reported in section 6.4.

6.2.3 Assumptions

A small number of assumptions were used in the modelling and valuation of outcomes for the misdescription interventions that have been made. These assumptions are set out in Table 6.2. They were developed in conjunction with the Environment Agency, specifically specialist staff involved in delivering and monitoring the outcomes.

Table 6.2 Assumptions used for misdescription of waste model

Assumption	Value	Source
Tier 1 estimates		
The tonnage of misdescribed waste found on each site was received in equal amounts over the 8 quarters of the Project. Only those tonnages with completed investigations where included within tier 1 of the valuation.	-	Tonnage data for misdescribed waste provided by EA from case files Apportionment across the evaluation modelling assumption
Tier 2 estimates		
The tonnage of misdescribed waste found on each site was received in equal amounts over the 8 quarters of the Project. Those tonnages with investigations ongoing where added as part of the tier 2 valuation.	-	Tonnage data for misdescribed waste provided by EA from case files Apportionment across the evaluation modelling assumption
Tier 3 estimates		
The proportion of identified misdescription activities that were avoided as a result of the general deterrence effects of the Environment Agency's interventions. Worked out as a proportion of tier 1 tonnages, these were then added as part of the tier 3 valuation.	5%	There will be some deterrence effect from the knowledge amongst operators that the Environment Agency is investigating and taking action against suspected misdescription. The estimate is very low at present but as cases come to court and publicity increases, so the deterrence effect is likely to increase.

Source: Ricardo Energy & Environment

6.3 Results

Table 6.3 shows the estimated additional outcomes that have been achieved by Environment Agency interventions enabled by the additional funding.

Table 6.3 Quantity of waste identified as being misdescribed (tonnes) [1]

	2014-Q2	2014-Q3	2014-Q4	2015-Q1	2015-Q2	2015-Q3	2015-Q4	2016-Q1	Total
Tier 1 estimate									
Tonnes	**78,672**	**78,672**	**78,672**	**78,672**	**78,672**	**78,672**	**78,672**	**78,672**	**629,378**
Tier 2 estimate									
Tonnes	**183,026**	**183,026**	**183,026**	**183,026**	**183,026**	**183,026**	**183,026**	**183,026**	**1,464,210**
Tier 3 estimate									
Tonnes	**186,960**	**186,960**	**186,960**	**186,960**	**186,960**	**186,960**	**186,960**	**186,960**	**1,495,679**

[1] The quarterly tonnages are the same as the tonnage of waste identified as having been misdescribed during investigations and are split equally between each quarter of the project

Source: Ricardo Energy & Environment

The results of the evaluation are shown in Table 6.4. The potential value of the outcomes achieved with the additional funding to tackle the misdescription of waste range between the Tier 1 estimate of approximately £18 million and the Tier 3 estimate of approximately £42.5

million. HM Government was the most significant beneficiary of the interventions with potential additional tax revenues of between £17 million (Tier 1) and £40 million (Tier 3).

Table 6.4 Potential benefits for the misdescription outcome area

Metric	Tier 1 estimate	Tier 2 estimate	Tier 3 estimate
Additional revenue for the regulated waste sector[2]	*£0*	*£0*	*£0*
Additional profit for the regulated waste sector	£0	£0	£0
Additional corporation tax	£0	£0	£0
Additional landfill Tax Revenues recovered[1]	£16,787,777	£38,897,180	£39,736,569
Avoided cost of environmental damage	£1,180,054	£2,744,840	£2,755,835
Avoided cost of disamenity effects[3]	£0	£0	£0
Total:	**£17,967,831**	**£41,642,020**	**£42,492,405**

[1] In calculating these estimates of recoverable Landfill Tax revenues, a realism factor of 33% has been applied in the base case. This takes into account various losses in the process of recovery, meaning that the true potential value of misdescribed waste is much higher, but unrecoverable due to barriers to recovery.

[2]There is a lack of available data to quantify the benefits to business of tackling misdescription of waste, although there are potential routes for additional revenue, and subsequently profit. These would be expected to be generated from variations in gate fees and other handling fees associated with correctly describing waste. However we were unable to determine what these might be and have not included them in the above analysis.

[3]Misdescription of waste can have environmental impacts (as it can lead to the treatment or disposal of waste via an inappropriate route). For the purpose of this calculation we have assumed that misdescription does not have an amenity impact (because the waste is still being processed at a permitted treatment or disposal site). The true situation is likely to be more complex'

Source: Ricardo Energy & Environment

6.4 Application of resources and learning points

The Environment Agency has been aware that some waste site operators may be motivated to misdescribe waste for a number of reasons (e.g. describing hazardous waste as non-hazardous waste to dispose of it more easily and/or at lower cost or describing standard rate waste as lower rate waste to circumvent the significantly higher rate of Landfill Tax on these materials). The evasion of the higher rate of Landfill Tax is thought to be the most prevalent form of deliberate misdescription.

Before the additional funding was available, there was no specific work stream or metric targeting the deliberate misdescription of waste. One reason for this was the fact that misdescription crimes were motivated primarily by tax fraud and therefore the belief held by the Environment Agency was that HMRC only should take the lead role in any enforcement action. This was also compounded by the fact that, in most cases, direct environmental damage was limited as in effect, the waste was being disposed of in a regulated landfill, just at the wrong rate of tax. However, misdescription and Landfill Tax avoidance does have environmental consequences which are often seem upstream from the final disposal site as a result of poor practice and negative impacts on the legitimate waste market although this is not fully understood. Despite a few high profile examples of potentially deliberate misdescription, there had been little cross working between HMRC and the Environment Agency on this type of case.

In 2014/15, a dedicated resource to tackle deliberate misdescription was put in place as a result of the additional funding. The application of resources varied across Environment Agency areas: some had resources that were dedicated to tackling this issue, some combined it with wider waste crime enforcement and some did not do any work specific to misdescription. The central project team did not direct the activities of areas but provided advice and guidance.

Areas had undertaken approximately 60 waste stream audits in 2013/14 and this gave them some of the intelligence required to prioritise sites. This consisted of three sources of information:

- Analysis of site returns from permitted sites targeting those with differences between the tonnage of waste soil input and output, especially at sites accepting large tonnages of wastes from treatment facilities (EWC code 19 12 12) and then claiming to be dispatching inert soil.
- Existing data from historical waste stream audits.
- Local knowledge (i.e. cases where the operator has access to an in-house landfill and therefore there is no third-party scrutiny of waste being disposed of).

This methodology was then developed further by some Environment Agency areas that pulled in additional data to identify high risk sites. This included information such as the distance travelled by waste to landfill, data on large-scale producers of refuse derived fuel (RDF) and indicative waste density for waste disposed of at landfills in the area.

The areas then undertook a series of bespoke waste stream audits to investigate and gather evidence where required. They reported the findings of the audits to the central project team but the sites targeted and the approach to the audits and investigations was decided by the areas themselves. A range of sanctions were applied to those sites suspected of misdescription, from advice and guidance to enforcement action. In some cases, sites that were found to be misdescribing waste were audited a second time during the project period to ensure that the practice was no longer being undertaken.

A key element of this work was the development of partnership working with HMRC, which also received HM Government funding to support work to tackle the misdescription of waste, in this case potential large-scale Landfill Tax fraud. HMRC and Environment Agency operational teams are working together to tackle non-compliance and waste crime more effectively. Cross-departmental strategic direction is overseen by a steering group with representatives from HMRC, Defra, the Environment Agency and the Treasury, to ensure a more joined up approach. Cases of suspected misdescription that were identified during the period of the project, and cases that had been identified previously, were referred to HMRC to take the most appropriate compliance intervention. In some cases, this involved joint investigation with the Environment Agency. There have been a number of high profile investigations during the project which have raised awareness of the action being taken and Environment Agency staff believe that these have acted as a significant deterrent for operators considering misdescribing waste. In one such case in Yorkshire in September 2015, around 180 officers from HMRC, supported by the Environment Agency and local police forces, made 14 arrests as part of an investigation into a £78 million Landfill Tax fraud. This gained extensive media coverage.

Once cases are passed to HMRC, it is often not possible for HMRC to share information about its investigation and its outcomes with the Environment Agency because of complex legal considerations[5]. This has presented a challenge for the project team and this

[5] Both organisations are legally obliged to handle personal information according to the requirements of the Data Protection Act 1998 and the Human Rights Act 1998. HMRC has specific legislation within the Commissioners for Revenue and Customs Act (2005), which covers the confidentiality of information held by the department, when it

evaluation, as the revenue outcomes that result from work enabled by the additional funding will accrue to HMRC rather than the Environment Agency. In order to fully value the outcomes that have been achieved, it is necessary to evaluate the outcome of the enforcement action and other key details such as the tonnage of waste involved and the tax recovered and/or fines invoked. This is especially important as the relative value of Landfill Tax received may be high compared to the value of outcome from the other priority areas, illegal waste sites and illegal waste exports.

To add to the complexity of valuing outcomes from this area, the type referrals made to HMRC means that appropriate enforcement action may not address Landfill Tax but other HMRC tax regimes. A key strand of HMRC's enforcement and compliance response was the launch of a waste sector taskforce in April 2015. HMRC taskforces bring together expertise from different areas of tax for intense bursts of activity targeted at specific sectors and locations where there is evidence of a risk of tax evasion and fraud. Taskforces consider all tax risks including Corporation Tax, VAT and Income Tax, as well as Landfill Tax.

There is the potential for a significant legacy effect from the targeted misdescription work that was enabled by the additional funding, especially when the first criminal and civil investigations come to fruition. Awareness of the issue and the potential offence has increased significantly among operational staff and it is likely that they will now be looking for potential misdescription offences during routine audits. This, combined with an established protocol to refer these cases to HMRC, should mean that these offences will continue to be identified and acted upon in the future.

is lawful to disclose that information and legal sanctions for wrongful disclosure. For HMRC, disclosure of information is precluded except in certain limited circumstances (broadly, for the purposes of its functions, where there is a legislative gateway or with customer consent).

7 Survey of waste operator behaviour

7.1 Responses

The survey received completed questionnaires from 27 operators in total. This was significantly less than the 100 responses that were sought; however, they offer and interesting insight into the perceptions held by the waste industry on the Environment Agency's work on waste crime and how this may have changed over the period when the additional funding was in place. The breakdown of responses by site type is shown in Table 7.1. Responses are spread over a wide range of site types but unfortunately no responses could be obtained from landfill operators accepting non-inert wastes. Complete responses were received from all operators that provided them.

Table 7.1 Breakdown of survey responses by site type

Site type	No. of responses received
Physical treatment	3
Physical-chemical treatment	2
Biological treatment	2 (1 being anaerobic digestion)
Inert waste transfer / treatment	2
Non-hazardous transfer station	5
Clinical waste transfer station	1
Hazardous waste transfer station	1
Composting	1
Metal recycling site	2
Deposit of waste to land (recovery)	1
Civic amenity site	4
Car breaker	2
Inert landfill	1
Total:	27

7.2 Results

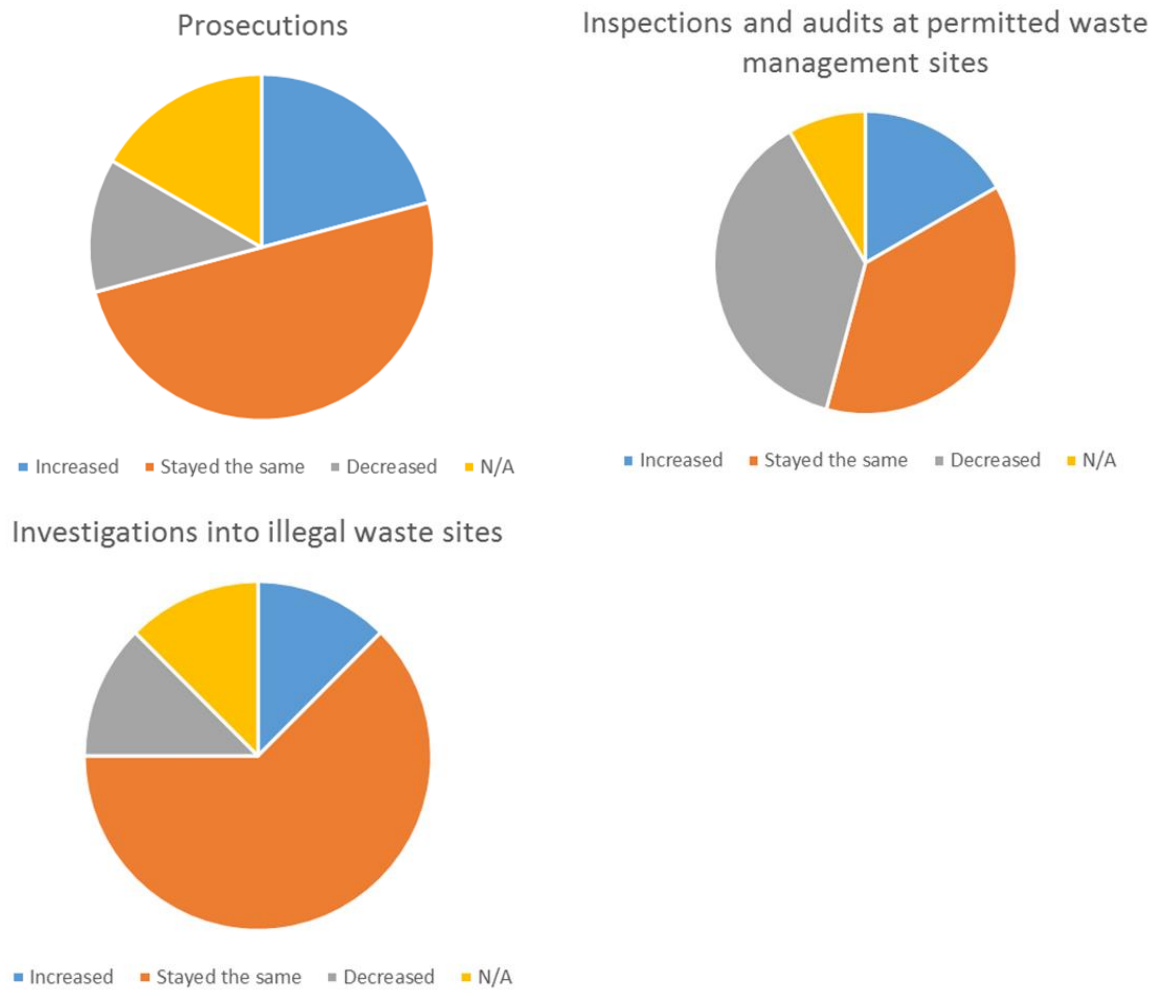
The first question asked operators whether they thought there had been a change in frequency of specific waste crime interventions and sanctions undertaken by the Environment Agency since 2014. The responses are set out in Table 7.2 and Figure 7.1.

Table 7.2 Responses to Question 1

Question 1 – Do you think there has been a change in frequency in the following types of activities since 2014?	Increased	No change	Decreased	N/A or don't know
Inspections and audits at permitted waste management sites	4	11	10	2
Enforcement at ports regulating the export of waste	4	11	1	11
Investigations into illegal waste sites	3	17	4	3
Investigation into the misdescription of waste	5	15	2	5
Prosecutions	5	14	4	4
Other enforcement sanctions such as formal cautions, warning letters, civil penalties	7	12	4	4

Source: Ricardo Energy & Environment Survey

Figure 7.1 Operator perception of the level of Environment Agency interventions in waste crime since 2014



Source: Ricardo Energy & Environment Survey

The responses indicate that for all interventions the majority of operators who responded to the survey considered that the level of activity had remained the same since 2014. This is understandable as a significant proportion of the additional resource has been targeted at illegal waste sites and, in this area, the funding has been used to maintain staffing and resources at pre-2014 level, avoiding planned budget cuts. One of the largest perceived reductions in activity was for inspections at permitted waste sites. Again this is understandable as the Environment Agency is using a more risk-based approach to regulation and therefore sites with a good compliance record, and those which are more likely to respond to the survey, may see a reduction in the number of inspections they receive. The most significant increase in activity seen by operators was in the use of other enforcement sanctions including civil sanctions, where 56% of respondents reported an increase. This is also understandable as the use of these sanctions are increasing since they became available in 2011.

The second question asked operators whether their perception of the waste crime related issues had changed before and after 2014 and this was expressed by scoring each issue from 1 to 5, 1 being very high and 5 being very low. The results are shown in Figure 7.2. The results show little change in perception across the issues that the operators were asked to consider. Overall, the responses suggest that operators consider that illegal waste management activities had a greater impact on their business since 2014 while the ability of

the Environment Agency to detect illegal sites and the visibility and likelihood of it taking enforcement action is perceived to have declined.

Question 3 asked if they could recall a waste management company or an individual being prosecuted for breaking waste legislation in the last 2 years. Of the 27 respondents, 17 operators (63%) answered that they had. The number of cases they could recall varied significantly in this group, with some being able to list 2 or 3 and others being able to list more than 10. Seven operators could not recall any prosecutions in the last 2 years. There was no pattern in the type of sites these operators managed. This question shows that awareness of prosecutions achieved by the Environment Agency varies significantly across the industry.

Those operators that could recall at least one prosecution were asked about the most memorable case. They were asked if they could recall what the person/company had done that had led to the penalty, what the penalty was, when and where the event occurred and where they had heard about it. The cases they mentioned were wide-ranging, including offences involving waste electrical and electronic equipment (WEEE), refuse derived fuel (RDF), illegal waste sites and breaches of permit conditions. The majority of this information was gained through sector publications including *Let's recycle* (http://www.letsrecycle.com/) and communications from the Chartered Institution of Wastes Management (CIWM), together with local newspapers. One operator identified its most memorable case as one in which the alleged offender was not prosecuted by the Environment Agency despite there being evidence of a crime. When asked about the most memorable aspect of the case, of the 14 operators that responded only three stated that it was the fine/prison sentence that the offender received. Other comments mentioned the negative impacts on the company both during the court process and afterwards. Five operators identified negative perceptions of the Environment Agency's role in the case, two of which criticised the length of time it took the Environment Agency to take enforcement action when it had been aware of the illegal activity for some time, one the lack of action despite clear evidence, one the lack of a successful prosecution despite clear evidence and one stated that the Environment Agency would not have identified the site had it not been for intelligence from a local third party.

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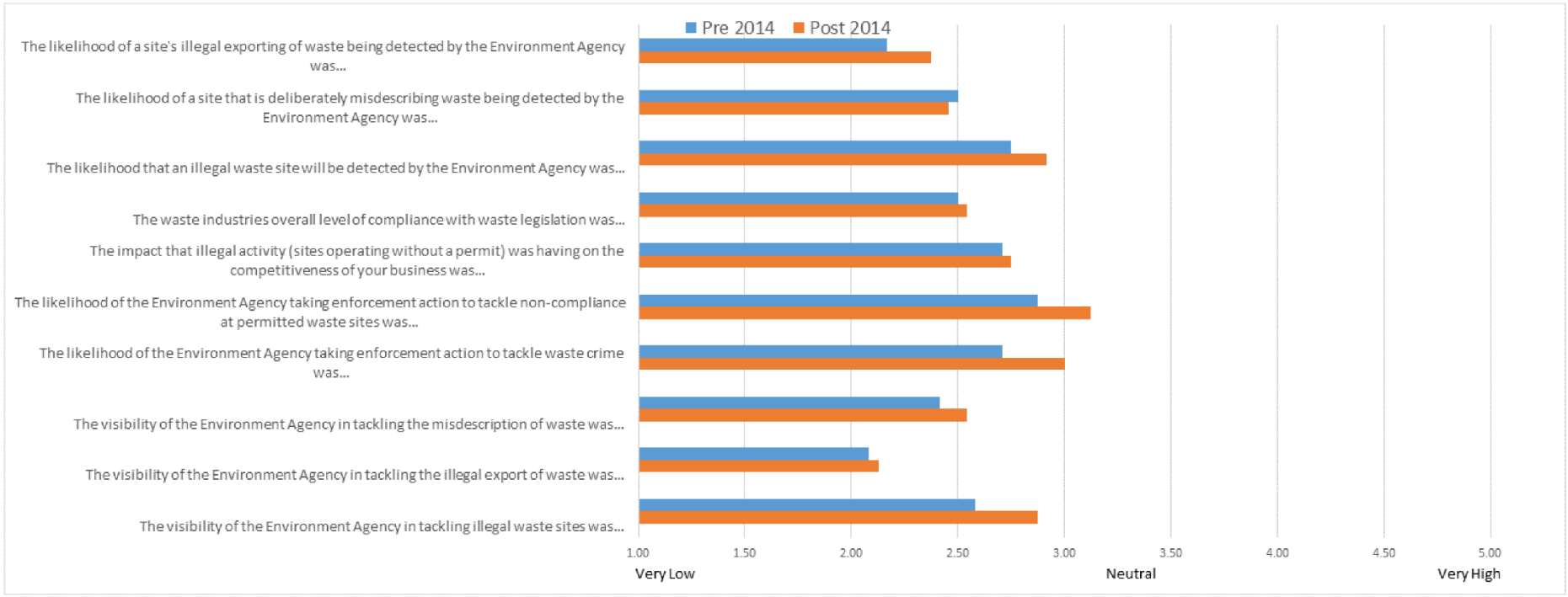
Figure 7.2 Operator perceptions of issues relating to waste crime



Source: Ricardo Energy & Environment Survey

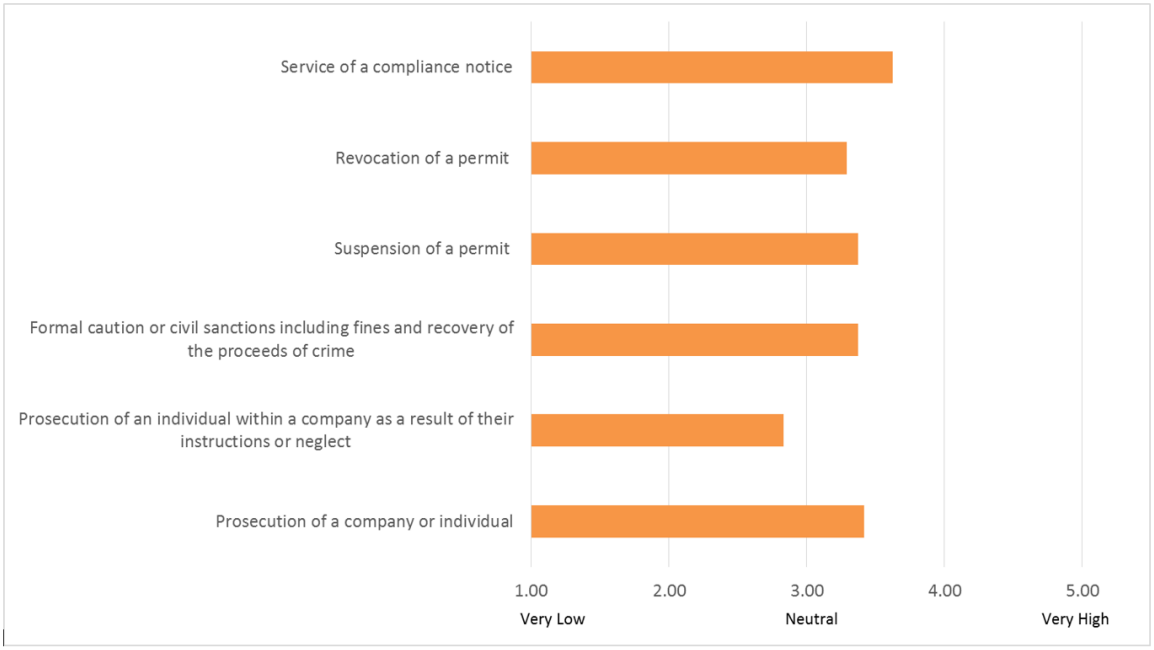
Finally, as part of question 3, operators were asked about the impact of hearing about these cases on their own level of compliance. Of the 25 operators that responded, 10 said that they had no impact as they are confident that their businesses are already compliant. However, six confirmed the value of this publicity as it helped them to inform and remind their managers and review their own procedures. In one case the operator employed consultants to review its operations noting that 'in the past the Environment Agency would advise you, now they just tell you to interpret legislation and what you have to do, then write you up when they don't agree with your interpretation'.

Question 4 asked operators to rate, on a scale of 1 to 5 (1 being low and 5 being high), what that they thought the chances were that illegal activity and non-compliance would lead to a list of sanctions available to the Environment Agency. The results are presented in Figure 7.3.

While all responses averaged around '3', the most likely sanction expected by operators was a compliance notice, requiring operators to take actions to comply with their environmental permit, which averaged just over 3.5. Other sanctions such as the suspension or revocation of a permit, and the prosecution of a company or individual were considered equally likely. The least likely sanction was considered to be the prosecution of an individual within a company due to their instructions or neglect.

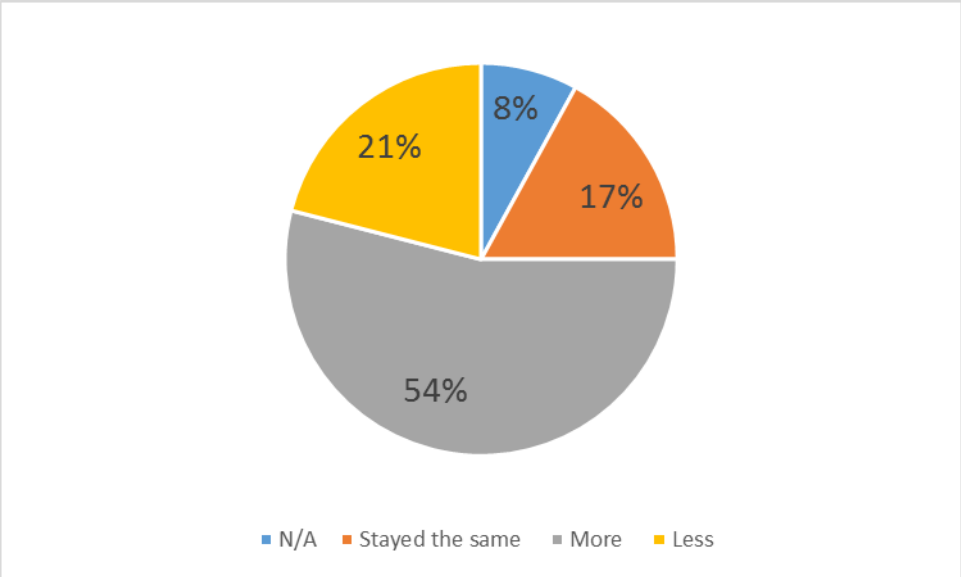
Question 5 asked operators whether the Environment Agency was more or less likely to take enforcement action now than in 2014 and before. Initially respondents were not given the option of choosing 'stayed the same' as this was added mid-way through the survey as it became clear that this was the perception that some held. Overall, the majority of respondents considered that the Environment Agency was more likely to take enforcement action since 2014, when the additional funding was in place and being utilised. Those that recorded a change (more and less) were asked to weight the change. The responses were polarised with most of those reporting an increase considering that there had been a significant uplift in enforcement activity while those reporting a decrease considered that the Environment Agency was very unlikely to take enforcement action. The relative proportions of the responses to question 5 are shown in Figure 7.4.

Figure 7.3 Likelihood of illegal activity resulting in sanctions by the Environment Agency



Source: Ricardo Energy & Environment Survey

Figure 7.4 Likelihood of enforcement action



Question 6 asked operators what factors influence their level of compliance with waste management legislation. For each of the factors they identified, they were asked to indicate the strength of its influence between 1 and 5 (1 being very low and 5 being very high). A breakdown of the factors identified and their relative significance is set out in Table 7.3. The two most often cited drivers for compliance were the legal duty to comply with the regulations (eight mentions) and the need to protect the reputation of the company (seven mentions). The fear of being 'shut down' and fear of prosecution were not cited as often as may have been expected, being cited only by two operators in each case; however, the fear of prosecution is linked to potential damage to a company's reputation. It is also related to the avoidance of fines and legal costs which was cited by five operators and given a high degree of influence. It should be noted that the responses also show a strong theme of personal responsibility and commitment to ensuring compliance, with operators citing personal price, a moral duty and career progression in the suite of responses.

Table 7.3 Factors driving compliance among waste operators

Factor influencing compliance	No. of times identified	Strength of the driver (if given)[1]
The legal requirement to comply with regulations	8	3, 5, 5, 5, 3, 5
Fear of being 'shut down'	2	5, 5
Fear of prosecution	2	5, 5
The avoidance of fines and other legal costs	5	5, 5, 4, 5
Personal responsibility	2	5
Career development	1	5
Company reputation	7	5, 5, 5, 4, 3, 5
Compliance with contracts	3	5, 5, 5
Adherence with internal policies and procedures	2	4, 5
Maintenance of external accreditations (ISO 14001)	2	5, 4
Attitude of the CEO and senior management	1	4
In the hope of achieving a level playing field	1	-
A good relationship with the Regulator	2	5, 5
Efficiency and productivity	2	5, 5
Safety of staff and site users	1	5
Professional pride	1	-

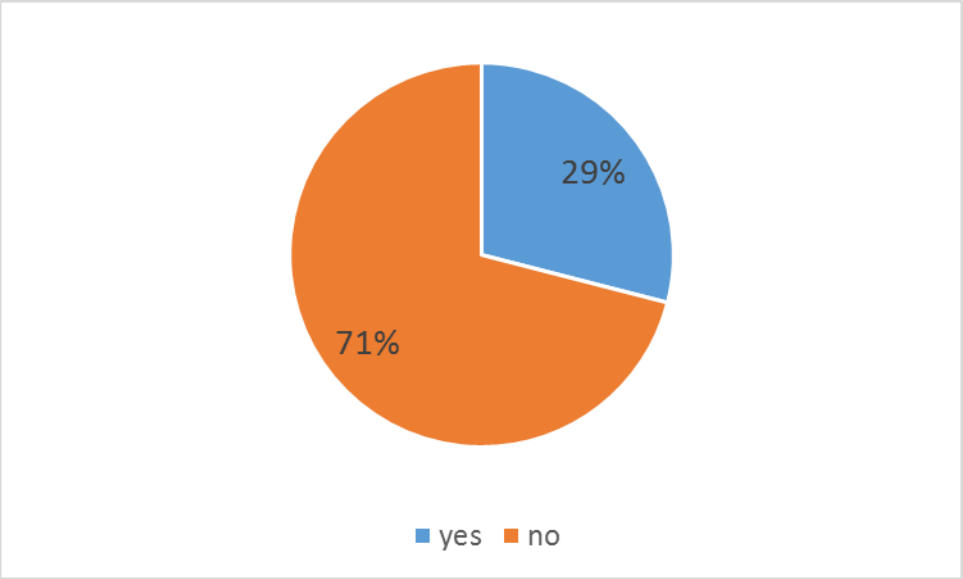
[1] *some drivers were identified from free text responses rather than being scored explicitly. This means that the number of values in the "strength of driver" column doesn't always match the "number of times identified" value.*

Source: Ricardo Energy & Environment

The second half of question 6 asked operators how much time they spent ensuring compliance with waste management legislation. Of the 23 responses, seven operators stated that they spent 100% of their time thinking about it as it was such an important part of their role and responsibilities. Other responses varied greatly, from an hour a day to around 80% of the day. Some operators cited specific teams or individuals in their organisations that have responsibility for environmental compliance and, in some cases, health and safety.

Question 7 asked operators whether they had been aware of any significant changes in the funding available to the Environment Agency for tackling waste crime. Figure 7.5 shows that almost 30% of respondents were aware of the additional funding, suggesting that it is something that is of interest to them and the Environment Agency's funding position is a point of note.

Figure 7.5 Operator awareness of the additional funding received by the Environment Agency



Source: Ricardo Energy & Environment

Question 8 asked operators whether they had been aware of increased activity by the Environment Agency to tackle waste crime in the last 2 years. The responses were split, with 50% indicated that they were and 50% indicating that they were not. As previously discussed, this may be due to the fact that the additional funding to tackle illegal waste sites, an issue that is perhaps most visible to site operators, only maintained previous levels of activity by the Environment Agency rather than enabling a significant increase.

7.3 Using the results

Unfortunately, because of the low number of survey responses, 27 in total, it is not possible to draw any statistically significant conclusions from the information collected. However, the results do provide an interesting insight into how the work of the Environment Agency is perceived by waste site operators and can be used to add to the qualitative assessment of the impact of the additional funding.

8 Summary of results and conclusions

8.1 Summary of results

The combined results of the evaluation for the three outcome areas are shown in Table 8.1. This table presents the high, central and low estimate of the financial value of the outcomes that have been achieved. The central scenario represents the best estimate of this assessment, with the high and low estimates based on the confidence levels in the estimated counterfactual as described in section 3.6. The table shows the potential benefits for each stakeholder group and as a net benefit to HM Government, communities and the environment. The latter does not represent a total of all stakeholder benefits, rather the net benefit overall when taking account of the transfer of benefits between stakeholders and avoiding double counting (e.g. transferring revenue from illegal to legal businesses would have no overall impact on the economy).

Table 8.1 Potential value of outcomes achieved with the additional funding by stakeholder group

Stakeholder	Low	Central	High
Tier 1 estimate			
Additional revenue to business	*£3,566,061*	*£14,626,721*	*£25,687,380*
Additional profits to businesses	£178,303	£731,336	£1,284,369
Benefits to HM Government	£19,388,797	£23,595,547	£27,802,297
Social and environmental benefits	£2,194,547	£4,659,794	£7,125,041
Net value of potential benefits (HM Government, profit to business and, social and environmental benefits)	**£21,761,647**	**£28,986,677**	**£36,211,707**
Tier 2 estimate			
Additional revenue to business	*£3,797,237*	*£16,896,239*	*£29,236,754*
Additional profits to businesses	£203,247	£844,812	£1,475,223
Benefits to HM Government	£41,290,649	£46,690,650	£50,625,424
Social and environmental benefits	£3,852,436	£6,769,787	£9,522,504
Net value of potential benefits (HM Government, protfit to business and, social and environmental benefits)	**£45,346,332**	**£54,305,250**	**£61,623,151**
Tier 3 estimate			
Additional revenue to business	*£4,328,016*	*£17,309,358*	*£30,099,353*
Additional profits to businesses	£289,452	£862,495	£1,570,209
Benefits to HM Government	£42,192,036	£48,199,178	£51,617,299
Social and environmental benefits	£3,988,915	£6,889,054	£9,732,941
Net value of potential benefits (HM Government, profit to business and, social and environmental benefits)	**£46,470,403**	**£55,950,727**	**£62,920,449**

Source: Ricardo Energy & Environment

The results show that the total potential value of the outcomes achieved in the Tier 1 estimate range between £22 million and £36 million, with the central estimate being £29 million. This estimate is the most conservative estimate of the benefits that have been achieved, being based on directly evidenced outcomes from Environment Agency data and not including outcomes that are in the pipeline such as outstanding prosecutions. The stakeholder that may benefit the most from the Environment Agency's interventions in waste

crime was HM Government from increased tax revenue collected via Landfill Tax and Corporation Tax as waste is moved from illegal sites to legitimate waste management businesses. This is reflected in the increased revenue for legitimate businesses. The benefits to HM Government and the waste sector do not increase on the same trajectory as business benefits between the low, central and high scenarios. This is because the latter is generated by comparing outcomes with the counterfactual while the benefits to HM Government are heavily influenced by the recovery of Landfill Tax from misdescribed waste. As there is no counterfactual in this case, the outcomes achieved vary less. The potential value of social and environmental benefits ranged between £2.2 million and £7.1 million.

Table 8.2 shows the potential value of the benefits achieved per £1 of additional funding. This indicates that for the Tier 1 estimates the net benefits equated to a payback of between £3.72 and £6.19 per £1, with a central estimate of £4.96. This compares favourably with the ESAET's estimate in its report *Waste crime: tackling Britain's dirty secret* (2014), that every pound invested in tackling waste crime would benefit UK plc by £4.60.

When outcomes that are in the pipeline and likely to be delivered are included in the estimates (Tier 2), the potential value of the net benefit increased from between £45 million and £62 million with a central estimate of £54 million. This equates to a return of between £7.75 and £10.58, with a central estimate of £9.29 per £1 invested in tackling waste crime. This almost doubles the Tier 1 estimates but is again based on directly evidenced outcomes and qualified estimates of outcomes in the pipeline.

The Tier 3 estimates attempt to reflect the wider benefits that have been achieved by the Environment Agency through its interventions in waste crime such as the general deterrence effect on waste operators and legacy effects of the project. Although this evaluation included a limited survey of waste operators in an attempt to understand the scale of the potential deterrence and legacy effects, the small number of respondents did not provide sufficient evidence to quantify the effects. Therefore, conservative assumptions have been made to acknowledge that the effects exist without overestimating their impacts. This results in a small increase in the estimates to between £46 million and £63 million with the central estimate being £56 million or a payback of £9.57 for every £1 invested in tackling waste crime.

Table 8.2 Potential payback for each £1 of additional funding to tackle waste crime by stakeholder group

Stakeholder	Low	Central	High
Tier 1 estimate			
Additional revenue to business	*£0.61*	*£2.50*	*£4.39*
Additional profits to businesses	£0.03	£0.13	£0.22
Benefits to HM Government	£3.32	£4.03	£4.75
Social and environmental benefits	£0.38	£0.80	£1.22
Net value of potential benefits (HM Government, profit to business and, social and environmental benefits)	£3.72	£4.96	£6.19
Tier 2 estimate			
Additional revenue to business	*£0.65*	*£2.89*	*£5.00*
Additional profits to businesses	£0.03	£0.14	£0.25
Benefits to HM Government	£7.06	£7.98	£8.66
Social and environmental benefits	£0.66	£1.16	£1.63
Net value of potential benefits (HM Government, profit to business and, social and environmental benefits)	£7.75	£9.29	£10.54
Tier 3 estimate			
Additional revenue to business	*£0.74*	*£2.96*	*£5.15*
Additional profits to businesses	£0.05	£0.15	£0.27

Benefits to HM Government	£7.21	£8.24	£8.83
Social and environmental benefits	£0.68	£1.18	£1.66
Net value of potential benefits (HM Government, profit to business and, social and environmental benefits)	**£7.95**	**£9.57**	**£10.76**

Source: Ricardo Energy & Environment

8.2 Benefits by stakeholder group

The following graphs show how the benefits for each stakeholder group varied over the period of the project. It should be noted that, in some cases, the benefits appear to be negative; however, this is an effect of the modelling and appears where the outcomes achieved dip below the modelled counterfactual. Although the achieved outcomes should be considered with caution when broken down by quarters for the reason described in section 3.6, they do indicate general trends in when the outcomes were achieved. The figures show that, understandably, no outcomes were achieved in the first quarter as the project had recently started.

In the case of avoided environmental costs (Figure 8.1), the outcomes were relatively evenly spread with a slight peak in the first year of the project. Avoided environmental costs are linked to the tonnage of waste diverted from illegal activities to the legitimate waste industry and therefore this reflects the tonnage of waste on illegal waste sites when they were stopped and, to a much lesser extent, the tonnage of waste prevented from being illegally exported.

Avoided disamenity costs (Figure 8.2) follow a similar profile to avoided environmental costs as they too are linked to the tonnage of waste diverted back into the legitimate waste management sector. However, the value of the outcomes is on a smaller scale than avoided environmental costs. The third quarter shows a peak value of just over £700,000 (Tier 2 and Tier 3), falling to just over £100,000 in the third quarter of 2015.

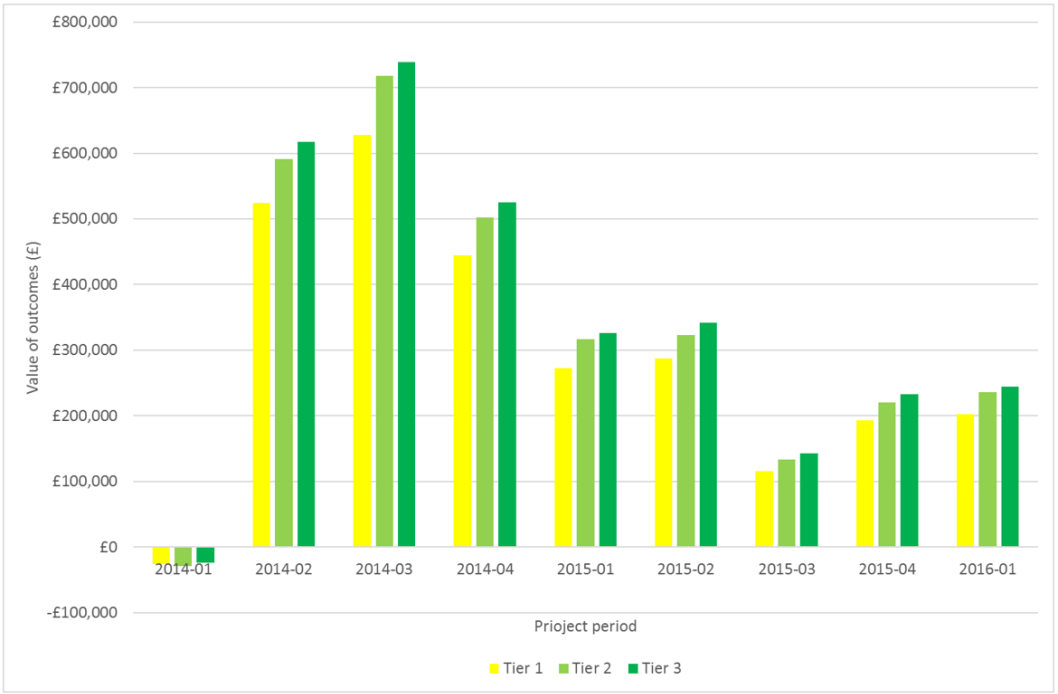
Figure 8.3 shows the value of the additional revenue passed to legitimate waste operators each quarter as a result of the Environment Agency's interventions. This revenue results from the additional gate fees generated by businesses on receipt of the waste that was, or in the case of Tier 3 estimates would be, managed illegally if it was not for the interventions of the Environment Agency.

Figure 8.4 shows the profile of additional Landfill Tax revenues that were achieved over the project period. This shows a stable trend but is slightly misleading as the outcomes, in this case tonnes of waste for which the difference between the higher and lower rate of tax was recoverable, were split evenly across the quarters rather than as a single point as none of the cases identified during the project period has yet been resolved and the tax recovered.

Figure 8.1 Summary of avoided environmental costs per quarter during the project period (central scenario)

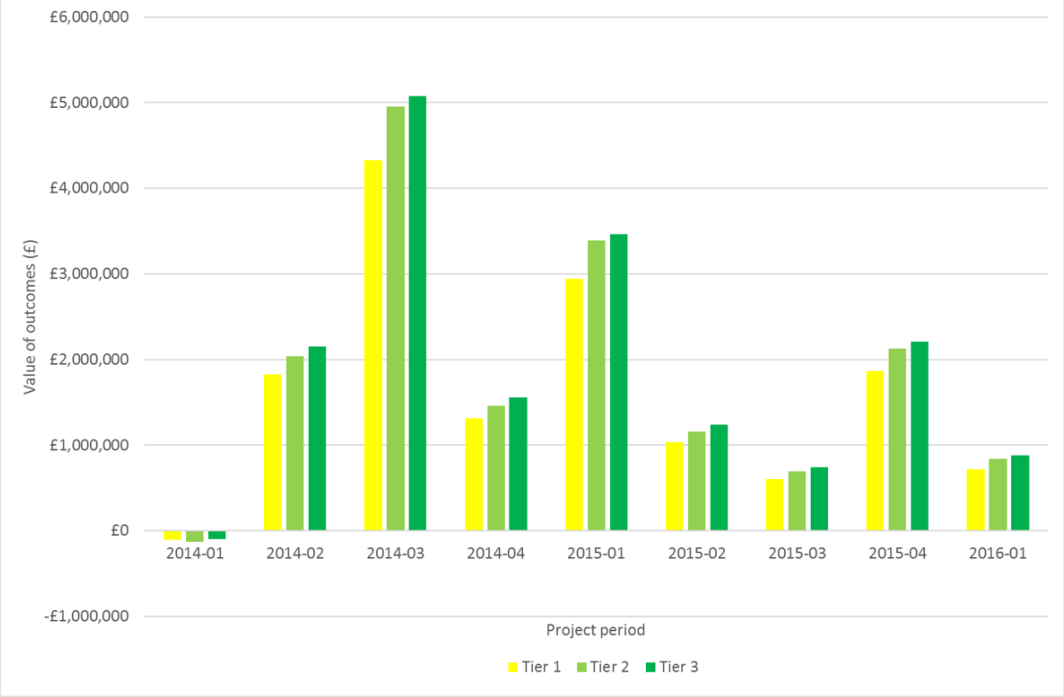
Source: Ricardo Energy & Environment

Figure 8.2 Summary of avoided disamenity costs per quarter during the project period (central scenario)



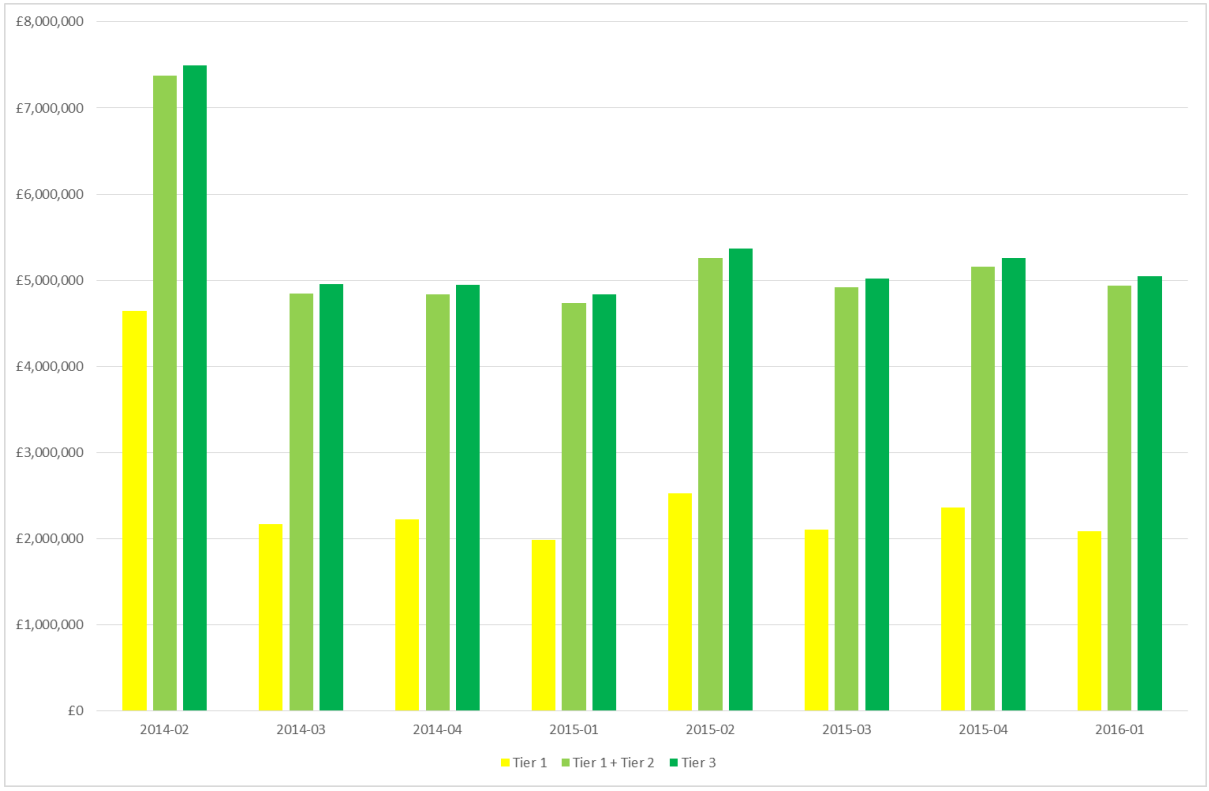
Source: Ricardo Energy & Environment

Figure 8.3 Summary of additional revenues to legitimate waste management businesses per quarter during the project period (central scenario)



Source: Ricardo Energy & Environment

Figure 8.4 Summary of additional Landfill Tax revenues to HM Government per quarter during the project period (central scenario)



Source: Ricardo Energy & Environment

8.3 Benefits by outcome area

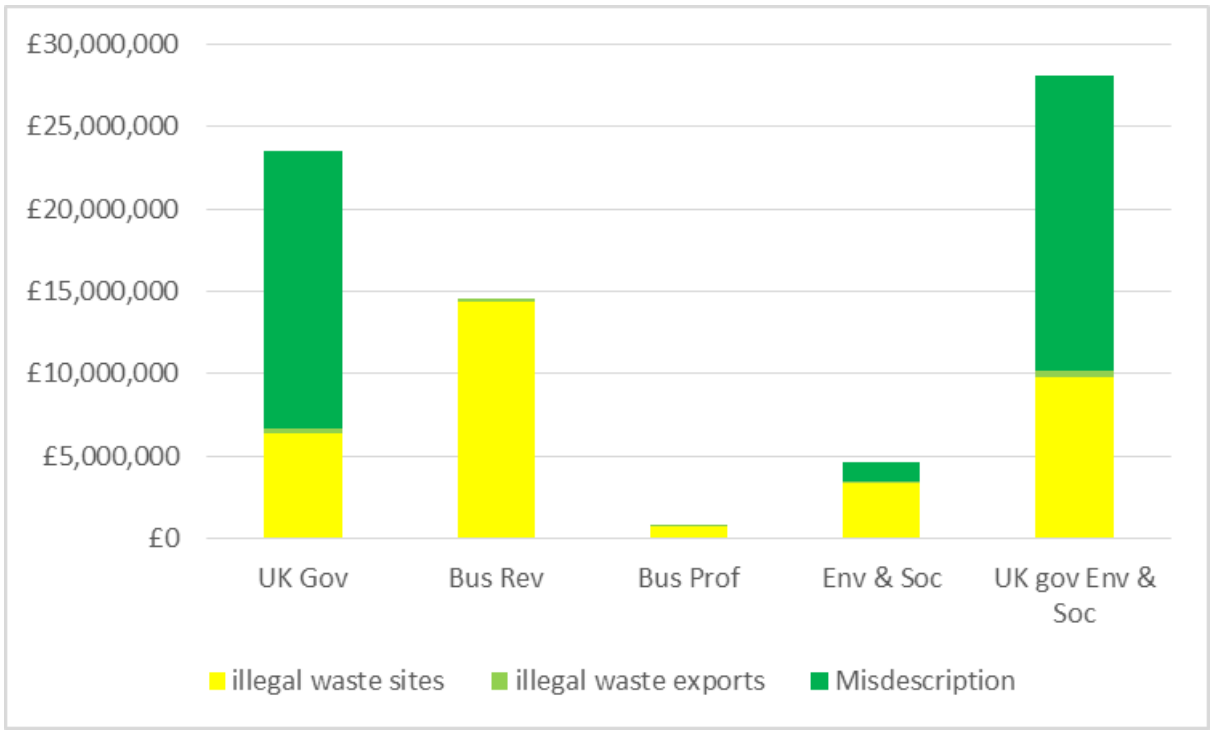
Table 8.3 shows the potential benefits by outcome area, while Figures 8.5, 8.6 and 8.7 show how each outcome area contributed to the benefits at the three tier levels. The outcome area that delivered the greatest proportion of the potential benefits was the misdescription of waste. This was due to the significant value of the additional Landfill Tax that may be recovered by HMRC. The interventions that delivered the highest value outcomes were those targeting the misdescription of waste. These interventions resulted in potential increase in Landfill Tax revenue of between approximately £16.8 million and £39.7 million for the central estimate. In the Tier 1 estimate, based on the valuation of outcomes recorded directly by the Environment Agency, the additional Tax revenues accounted for 81% of the total value (the vast majority of these revenues are Landfill Tax, but it also includes VAT and Corporation Tax). Interventions to stop illegal sites resulted in between £10.6 million and £12.0 million of potential benefits, with additional tax revenue to HM government and social and environmental benefits accounting for the largest proportions. Finally, work to prevent illegal waste exports yielded between £0.4 million and £1.4 million of potential benefits.

Table 8.3 Analysis of potential benefits by outcome area (central)

Stakeholder	Illegal waste sites	Illegal waste exports	Misdescription
Tier 1 estimate			
Additional revenue to Business	*£14,476,905*	*£149,816*	*£0*
Additional profits to businesses	£723,845	£7,491	£0
Benefits to HM Government	£6,439,806	£367,964	£16,787,777
Social and environmental benefits	£3,446,120	£33,620	£1,180,054
Net value of benefits	**£10,609,771**	**£409,075**	**£17,967,831**
Tier 2 estimate			
Additional revenue to Business	*£16,648,441*	*£247,798*	*£0*
Additional profits to businesses	£832,422	£12,390	£0
Benefits to HM Government	£7,099,157	£694,313	£38,897,180
Social and environmental benefits	£3,963,038	£61,910	£2,744,840
Net value of benefits	**£11,894,617**	**£768,612**	**£41,642,020**
Tier 3 estimate			
Additional revenue to Business	*£16,865,594*	*£443,763*	*£0*
Additional profits to businesses	£840,307	£22,188	£0
Benefits to HM Government	£7,164,468	£1,298,141	£39,736,569
Social and environmental benefits	£4,014,730	£118,489	£2,755,835
Net value of benefits	**£12,019,505**	**£1,438,818**	**£42,492,405**

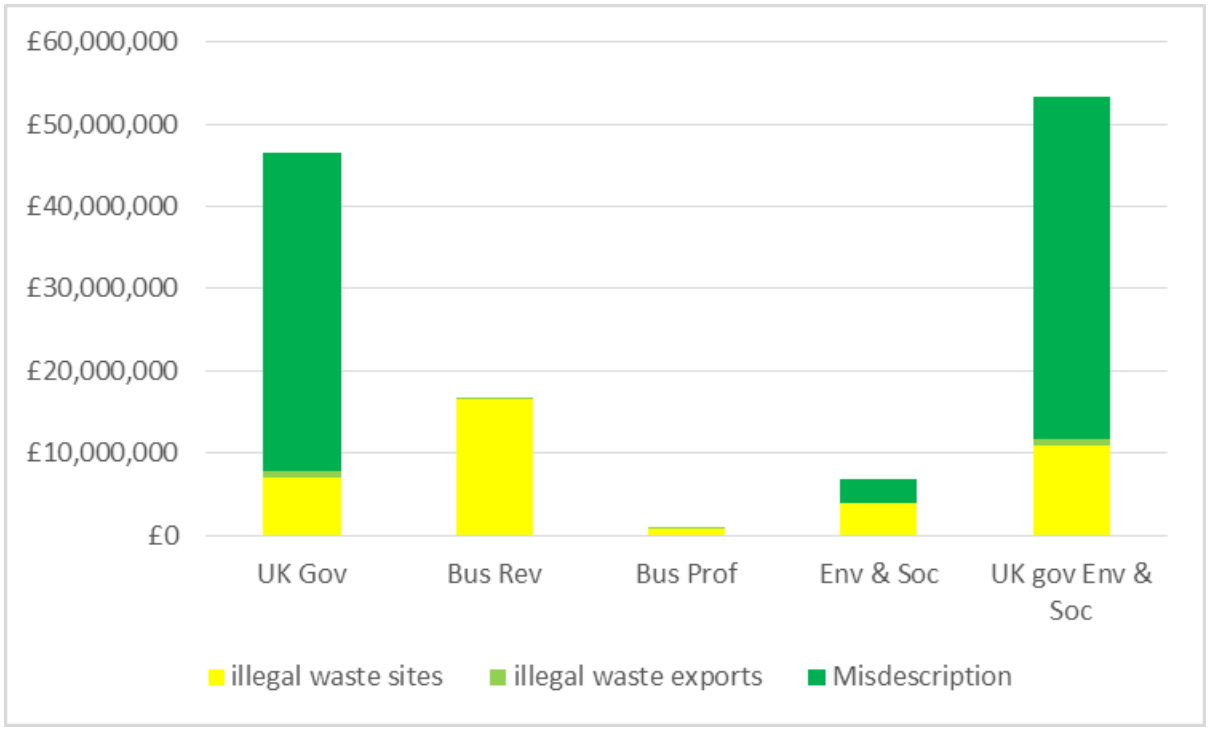
Source: Ricardo Energy & Environment

Figure 8.5 Contribution of each outcome area to the Tier 1 benefits estimate (central)



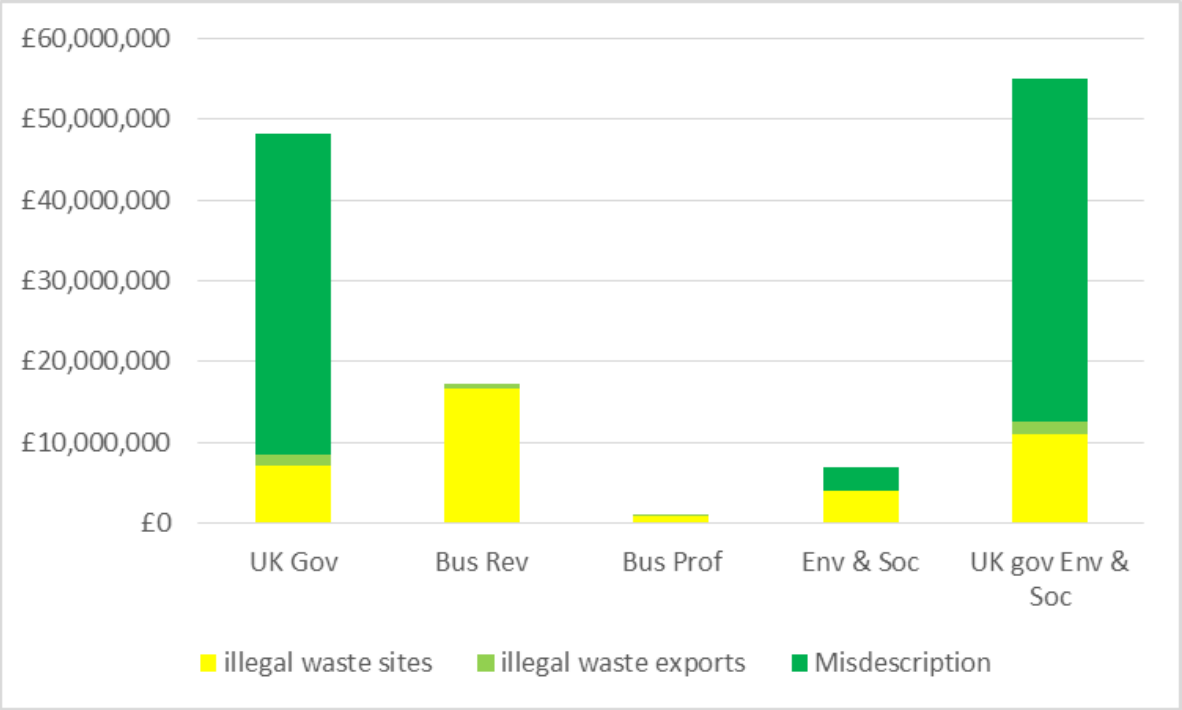
Source: Ricardo Energy & Environment

Figure 8.6 Contribution of each outcome area to the Tier 2 benefits estimate (central)



Source: Ricardo Energy & Environment

Figure 8.7 Contribution of each outcome area to the Tier 3 benefits estimate (central)



Source: Ricardo Energy & Environment

Overall, misdescription contributed 62% of the total net benefit, illegal waste sites contributed 36.5% and illegal waste exports contributed just 1.4%. The relative payback on the resources allocated for each outcome area are shown in Table 8.4.

Table 8.4 Potential payback on investment for each outcome area

	Illegal waste sites	Illegal waste exports	Misdescription	Overall
Total net benefit	£10,609,771	£409,075	£17,967,831	£28,986,677
Resources	£3,140,000	£816,000	£1,892,000	£5,848,000
Payback ratio	3.35	0.5	9.5	£ 4.96

Source: Ricardo Energy & Environment

8.4 Key learning

The evaluation project aimed to collect insight into how the additional funding was used and where it was most effective and to collect key learning points from staff involved in planning and undertaking the interventions. The objective was to share this learning more widely to increase the impact and efficiency of interventions in the future. The specific learning points for each outcome area are discussed in detail in earlier sections of this report; however, it is useful to summarise them and identify those that have the greatest potential to improve ways of working. The key learning points can be grouped into the following categories, which are discussed in more detail in the paragraphs below:

- Allocation of resources:

- duration of funding rounds
- dedicated/specialist resources versus generalised resources.

- The impact of performance metrics:
  - priority setting and unexpected consequences
  - short termism.
- Partnership working with other organisations.

8.4.1 Allocation of resources

Comments on how resources are planned and allocated were perhaps the most commonly reported learning points. By far the most significant was the short-term nature of the funding and the impact this had on the efficiency of the Environment Agency's interventions. During this project, as in previous years, officers often reported that additional funding for waste crime intervention and other work at short notice, sometimes even after the financial year had started, left them little time to plan how best it could be used. It often took time to recruit suitably skilled staff which meant that there was a delay before work could start, and one member of staff reported that it took 4 months to recruit an officer for a 12-month post, significantly reducing the work that could be achieved in the remaining time. As well as delays starting projects, effective time was also lost towards the end of the funding period as staff filling these roles on a temporary basis often found other roles that offered them greater security rather than remaining in post until the end of the project. One Environment Agency area reported that this was particularly the case for experienced area staff tackling illegal waste sites. As a result they were forced to bring in less experienced staff who needed more training and support, significantly reducing what they could achieve. Anecdotal evidence suggested that in a 1-year funding cycle, approximately 4–5 months of effective time could be lost due to the time required to recruit staff, the time for the staff to become fully effective and the time lost at the end of a project as staff seek a more secure position. If funding cycles could be extended and more foresight given to staff, this would result in a significant improvement in the effectiveness of the resources and the beneficial outcomes that could be achieved.

There was a great deal of discussion around the split of funding between national and local teams. In the case of illegal waste exports, the allocation of resources appeared to be successful in that they were focused on a small, highly experienced and specialised team of individuals that had established relationships with industry partners and through this and a small network of port officers in the areas, had been able to collect intelligence and target resources very effectively. This centralised team had been created a number of years before this project and the additional funding allowed it to continue and develop further. Not all areas have major ports from which waste is exported, and therefore pooling resources to create a specialist team has resulted in consistent, targeted and effective interventions that could not have been achieved had the resources been allocated only to areas.

There was less agreement over the split of resources between national and local staff in the case of illegal waste sites. Some officers reported that they felt disempowered by the movement of resources and roles, particularly intelligence gathering, to national teams. In this example, the officers felt that they had been more effective in the past where they had a dedicated member of staff collecting and analysis intelligence information in their area, allowing them to make effective interventions. This had ceased and instead, they had to rely on national staff to provide intelligence. They felt that this focused only on 'national level', high profile waste businesses and that they had lost the local insight that they once had. Other officers reported the opposite experience and felt that having national staff, dedicated to the collection and analysis of data, was more effective and gave them a better oversight of the waste sector and the factors that might influence criminal behaviour. Linked to this was

the support and guidance given to area staff by the National Enforcement Service. Some officers felt that their focus on larger, cross-regional waste businesses was detrimental as it meant that enforcement resources were focused on these businesses while there was little support for officers wanting to take action against local businesses. Again, others reported the opposite point of view and valued the skills and experience of the team, who were more able to support and progress potentially larger and more complex cases for which areas would not have the resources or experience.

It should be noted, however, that the allocation of enforcement resources is a consequence of the Strategic Reviews and Response Programme (SRRP) not of this project. The SRRP sought to centralise the intelligence resource, introduce new governance arrangements for major investigations and take other measures to ensure that the reduced core resources are used as effectively as possibly. The Environment and Business function of the Environment Agency undertook a survey of all 351 enforcement staff in the organisation to collect views on the effectiveness of the changes in 2015, shortly after they were implemented. A total of 152 (43%) members of staff responded to the survey and the key findings were that:

- 34% of respondents disagreed that enforcement decisions were more effective than before the SRRP and 20% of respondents agreed with this
- 43% of respondents felt that the intelligence team was not effective compared to 21% who agreed
- 53% of respondents felt that the enforcement resource was not distributed effectively
- only 15 respondents, out of 152, agreed that the enforcement structure was fit for purpose

These findings are reflected in some of the feedback from staff collected as part of this project. In response, the Environment Agency has taken steps to make improvements and is focusing on four key areas, these being:

- resourcing
- delivering intelligence
- how major investigations are run
- the governance of serious and significant investigations

8.4.2 The impact of performance measures and metrics

Operational performance measures are vital to monitor and report the work of the Environment Agency and the outcomes that are achieved. However, these metrics can influence the priorities and actions of staff, especially if there are targets for some metrics. One example of this is shown in Phase 1 of the Illegal Waste Sites Taskforce project, which was designed to establish the true scale of illegal waste sites, and therefore the focus of the work initially was to identify as many sites as possible. As a result, the number of illegal sites identified increased significantly and this was viewed positively. In more recent years, staff feedback suggests the opposite is true in some Environment Agency areas in which high numbers of illegal waste sites are considered to reflect negatively on their effectiveness despite significant pressure on resources available for enforcement. In terms of influencing the actions of Environment Agency staff, performance metrics can play a significant role. For example, one area had a target for the number of casefiles that should be prepared on potentially illegal waste sites. However, as the target was for casefiles rather than prosecutions, many of these did not progress to court and it may have been more appropriate to have used alternative sanctions. The likelihood and effect of unexpected

consequences should be considered carefully when considering performance metrics and targets.

Some officers felt that the short-term nature of funding had also led to 'short-term thinking' among staff. When funding is only available over a short term it tends to focus on the impacts that can be achieved, measured and reported over that period in order to show value for money. This means that outcomes that may be potentially more beneficial to the environment and stakeholders can often be overlooked as the 'payback' period is not soon enough. One example of this was the short-term focus on closing individual illegal waste sites, whereas there may be fewer illegal waste sites in the future and greater benefit to the environment if resources were aimed at educating waste producers and strengthening the Duty of Care to reduce the risk of waste being managed illegally. Continual short-term rounds of funding left some staff feeling that the Environment Agency was missing the chance to step back and take a long-term view of what could be achieved and how this might be done, which has the potential to be much more effective in the long term.

Similar to the impact of 'short-term thinking' is the impact of metrics more generally. There was a concern that the pressure on the Environment Agency to report outcomes meant that effort was focused on actions and impacts that can easily be measured while some of the most significant environmental benefits may be less tangible and therefore avoided. Using site-based metrics and focusing on preventing illegal activity rather than tackling it when it occurs is an example of this.

8.4.3 Partnership working with other organisations

The benefits of working with partner organisations with shared interests in ensuring legal compliance has been demonstrated by the Environment Agency's partnership with HMRC to tackle the misdescription of waste. Before the project, the Environment Agency's intervention in the misdescription of waste was limited as the principal motivation for misdescribing waste is to avoid the standard rate of Landfill Tax, currently (2016) £84.40 per tonne versus the lower rate of £2.65 per tonne. This issue has been considered tax fraud and therefore a matter for HMRC. However, the Environment Agency recognises that misdescription of waste can result in environmental damage if waste is handled inappropriately, and negatively impact the legitimate waste market as compliant operators struggle to compete. The additional funding has allowed the Environment Agency and HMRC to work together to tackle non-compliance in the waste sector, and follow intelligence leads to counter misdescription of waste.

Although over 60 cases have been referred to HMRC which potentially could recover a significant amount of Landfill Tax to HM Government, challenges remain. At Budget 2016 HM Government announced additional funding over the next 5 years to increase HMRC's compliance activity to tackle tax evasion in the waste sector. The investment will enable HMRC to increase its collaborative work with other enforcement agencies, following intelligence leads that point to the involvement of serious, organised criminals to counter misdescription of waste. Other tax fraud such as VAT has been identified in the referrals and action taken; however, due to restrictions on data confidentiality, it has not been possible for HMRC to share trader-specific data on the tax recovered from these businesses for the evaluation.

The benefits of this partnership are clear in the long term as the value of potentially recoverable Landfill Tax is high and is one of the most significant economic outcomes identified by this evaluation. HMRC and the Environment Agency are committed to sharing information and expertise to tackle Landfill Tax fraud more effectively and efficiently in the future. There may be similar synergies with other organisations that have a regulatory interest in the waste management sector, such as the Health & Safety Executive (HSE). Waste operators with a poor compliance record often have a similarly poor record of health

and safety controls and intelligence sharing could assist both organisations in regulating sites more quickly and effectively if a joint approach is taken.

8.5 Recommendations

There are a number of recommendations that have been drawn out of this evaluation, both from the data analysis and from the collection of insights from staff that have been involved in the delivery of the project and interventions at a national and local level.

8.5.1 Internal data collection and reporting

- In order to fully understand the outcomes that have been achieved through the application of resources it is important that the data collected is relevant and consistent. The data collected by the Environment Agency and the systems used to record it has changed a number of times as priorities change and systems are updated. This inconsistency can present challenges for evaluations that look at data collected over time making it more difficult to compare 'like for like' and establish trends over time. As far as possible, the Environment Agency should seek to ensure that staff recording data do so consistently and accurately as small improvements in data quality could allow the information to be used to gain greater insight into a range of factors such as trends in waste crime, effectiveness of interventions etc.

- The type of data collected should also be considered in more detail if the Environment Agency wishes to continue or extend the evaluation of outcomes in the future. In some cases, the internal systems such as the time recording system could have collected important data for evaluation (e.g. if separate fields had been included such as the amount of time officers spent on specific activities) but were not set up to do so in all cases. If new projects or priorities were established, the data needed to provide a robust evaluation of the outcomes achieved should be considered during the planning period. At present, the majority of data collected is linked to monitoring operational activities but data on the impact and outcomes of interventions such as the tonnage of waste on illegal waste sites is less common and less likely to be provided by officers.

- The most effective interventions mean that the offence is avoided completely and therefore the Environment Agency is not directly involved as demonstrated by its work with illegal waste exports where illegal shipments are stopped by the industry rather than through direct intervention of the regulator. In this case, no data is recorded at all although it represents a much better outcome for the environment and human health overall and therefore better value for money. Collecting data on the effect of interventions that may prevent crimes higher up the 'pipeline' is important to ensure that the Environment Agency's work in these areas is properly recognised and prioritised, even though it may not be reflected in the usual, operational data that is recorded.

- This project has demonstrated that the data collected by the Environment Agency can be combined and analysed to provide a great deal of insight into waste crime to identify trends and potential offenders. Although the value of internal data has been demonstrated through the use of site returns to identify potential misdescription, it is clear there is potential to better use data in this way (e.g. linking hazardous waste data with site returns to track waste as it passes between those managing it).

- Much of the data collected and reported by the Environment Agency is effectively operational metrics to monitor activities. Discussions with staff have demonstrated how these metrics can lead to undesirable priorities and activities.

When setting metrics, the Environment Agency should be careful to avoid unexpected consequences.

- The deterrence effect is an important factor in the Tier 2 (specific deterrence) and Tier 3 (general deterrence) modelling assumptions. Whilst this project attempted to gauge the general deterrence of the Environment Agency's activity, it was unable to generate enough data to robustly quantify it (and is why those assumptions are represented by proxy values). The Environment Agency should consider research to quantify the deterrent effect of its enforcement activities so it can better exploit their potential as a tool to reduce waste crime.

8.5.2 Use of resources

- Possibly the most important learning point of this evaluation has been the negative effect of short-term funding cycles. Effective staff time can be greatly curtailed by time lost to recruitment, training and vacancies. Thus, the outcomes that can be achieved by funding could be significantly improved by extending funding cycles for as long as possible.

- There was a great deal of discussion around the allocation of resources between local and national teams. For less common crimes or specialist waste streams such as illegal waste exports, the concentration of resource to fund a specialist and dedicated team appears to result in an efficient use of resources. Otherwise staff time is lost to training more diverse staff and ensuring they are up to date with issues, and their resources may potentially be lost to other work that Environment Agency areas feel is more of a priority. Misdescription of waste is another area in which the concentration of skills and experience into a specialist team may result in greater effectiveness and efficiency, particularly as it would facilitate consistent communication with HMRC which has a key role in the investigation and enforcement of tax avoidance. For more general waste crime, the balance between local and national resources is more subtle and it is clear that information and priorities need to flow between the two to ensure that local priorities are serviced while maintaining a national overview of waste crime and expertise.

- In some cases, where resources to tackle specific crimes or activities were allocated as a proportion of an FTE (full-time equivalent), there was a general feeling that this had a negative impact on efficiency as in many cases competing priorities meant that this resource was often diverted to other issues or not used as effectively as it could have been had a member of staff been dedicated to that issue alone. This was something that was supported anecdotally during the project, although it was not possible to prove that this was the case due to differences in the use of time recording codes. It is likely, however, that this would have an effect, as would time potentially lost switching between issues and work areas, and should therefore be minimised where possible.

8.5.3 Working with partners

- The partnership with HMRC to tackle the misdescription of waste and potential Landfill Tax fraud could yield significant revenue for HM Government. Although in its early stages, it provides a potential model for partnership working with other organisations such as HSE. In both cases there are links and intelligence about waste crime and factors linked to it and therefore the Environment Agency should consider whether closer sharing of intelligence and joint working could make interventions more targeted, resource efficient and effective.

- A better understanding of the priorities and internal systems of partnership organisations has the potential to assist both partners in achieving joint objectives. The Environment Agency is an expert in waste management and waste regulation; however, partner organisations may not have the same depth of understanding and will require more support. If the Environment Agency can gain a better insight into the skills, resources and data needed by partner organisations to intervene to prevent or stop waste crime, it could increase the chances of action being taken more rapidly and effectively.

References

CAMBRIDGE ECONOMETRICS, EFTEC AND WRC (2003) *A study to estimate the disamenity costs of landfill in Great Britain*. Report for Defra. Available at http://webarchive.nationalarchives.gov.uk/20130402151656/http:/archive.defra.gov.uk/environment/waste/strategy/legislation/landfill/documents/landfill_disamenity.pdf

ENVIROS CONSULTING LTD AND EFTEC (2004) *Valuation of the external costs and benefits to health and environment of waste management options*. Report for Defra. Available at http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/environment/waste/research/health/pdf/costbenefit-valuation.pdf

ESAET (2014) *Waste crime: tackling Britain's dirty secret*. Environmental Services Association Education Trust. Available at http://www.esauk.org/esa_reports/ESAET_Waste_Crime_Tackling_Britains_Dirty_Secret_LIVE.pdf

HM TREASURY (2011) *The Magenta Book: Guidance for evaluation*. HM Treasury. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220542/magenta_book_combined.pdf

GIBB, JP. (1975) Crime, Punishment and Deterrence. New York: Elsevier.

GRAY, WB and SHIMSHACK, JP. (2011). The Effectiveness of Environmental Monitoring and Enforcement: A review of the Empirical Evidence. Review of Environmental Economics and. Policy, 5 (1), pp. 3-24.

Appendix A: Environment Agency datasets reviewed for use in the evaluation

The crosses in the three final columns of the table indicate the suitability of each dataset for the three outcome areas (illegal waste sites, IWS; misdescription of waste, MD; illegal waste exports, IE).

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
Case Management System	CMS	CMS is a mandatory system completed by anyone involved in the investigation of offences and enforcement action taken against offenders. It is a single system used to record all of the Environment Agency's informant activity. It supports this work from start to finish, tracking current activity and storing historical details. It is linked to the NIRS and CCS and relevant cases automatically transfer across from these systems when necessary.	• Types of intervention (e.g. advice and guidance, self-remediation) •CICS/CMS categories • Incident type • Dates and times • Enforcement tool uses (e.g. warnings, cautions, prosecutions) • Type and volume of waste	CMS is a relatively new system to the Environment Agency (introduced around December 2012) and there have been technical and cultural teething problems. Some data is incomplete or missing. It replaced the National Enforcement Database – though this data was not pulled through onto CMS. CMS is not suitable for the most severe or complex cases.	**X**	**X**	**X**

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
National Incident Recording System	NIRS	NIRS is the data capture tool that supports incident management. A record starts when the Incident Communication Service (ICS) receives a report of a potential incident. The report is then passed to the appropriate competent officer to undertake the assessment and determine the incident response. The assessment, using the Common Incident Classification Scheme (CICS) and details of the incident response and post-incident activities, such as legal action and cost recovery, are all then recorded on NIRS.	• Reported incidents (substantiated and unsubstantiated) • Complaints • Incident details (impact, cause, time and date, source, Environment Agency response etc.)	NIRS is a dated system designed for recording and managing incidents. It was not designed as a data gathering and reporting tool. However, it generates lots of data that is used for a variety of Environment Agency reporting measures where the evaluation must be comparable.	**X**	**X**	
MEMEX	MEMEX	MEMEX is an Environment Agency system for storing intelligence. It is a national system and securely stores information including confidential details about suspects and their operations.	• Emerging threats • Case studies • Aggregated information (e.g. priority offenders, repeat offenders)	Access to the system is highly restricted and it is not likely that contractors will be given access to it. However, by developing and understanding of its contents it may be possible to derive relevant anonymised data and information from it (e.g. offender profiles).	**X**	**X**	**X**

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
Flycapture	n/a	Flycapture is a web-based database for the Environment Agency and local authorities to record incidents of fly-tipping in Great Britain. The database was created in April 2004 and is managed on behalf of Defra.	The Environment Agency receives summarised data from councils on: •No. of fly-tipping incidents •Waste type dumped	There are inconsistencies across the local authorities that can cause issues when reporting at a national level.	X	X	
Surveillance Authorisation Database	SAD	The SAD is a central record of all applications and authorisations for directed surveillance operations under the Regulation of Investigatory Powers Act 2000 (RIPA).	RIPA applications	The Environment Agency might be able to use data from SAD to show that the input of resources has increased surveillance activity at illegal waste sites.	X		
Proceeds of Crime	PoCA	This information sits within the CMS.	• No. referrals received • No. ongoing investigations (internal led) • No. ongoing investigations (external led) • No. restraints • Value of restraints • No. confiscation orders • Value of confiscation orders • Income received		X	X	X

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
Operational Risk Appraisal – permit compliance	Opra	The Opra assessment provides a risk rating which the Environment Agency can use to allocate its regulatory resources. Opra looks at what activity is being done, where it is done and how it is done. This allows the Environment Agency to target resources at those facilities that pose the greatest risk to the environment.	• Risk scores • Permit compliance scores • Site location • Sector • Broad waste type information	This database covers all sites with an Environmental Permitting Regulations (EPR) permit. Each site is in one of six bands between A and F (A being the best performers and F being the worst). Sites with criminal intentions are often at the lower end of the compliance ratings, although there have been reports of sites appearing compliant at a glance but running deliberate misdescription operations on site.	**X**	**X**	
Compliance Classification Scheme	CCS	CCS is a simple and consistent means of assessing and classifying the seriousness of any non-compliances. The non-compliances with permit conditions arise from compliance assessment work at Environment Agency permitted sites.	• Reason for breach of permit • Date and time		**X**	**X**	

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
National Compliance Assessment Database	NCAD	NCAD is a system for recording details of audits and inspections at permitted installations and waste sites. It allows you to access your compliance reports from any Environment Agency office. NCAD also automatically uploads details of any non-compliance to the CCS database on a nightly basis.	NCAD may hold quantitative information about events on site.	It is a recent system and is not used consistently around the Environment Agency.	**X**	**X**	
CLEAR Info		The data the Environment Agency holds on the environmental performance of businesses is often held at site level. When businesses are owned and operated by a parent company, collating and using data held at individual sites can be difficult. CLEAR Info was an EU LIFE+ funded project that aimed to improve how businesses implement environmental legislation. It began in September	The CLEAR Info analytical database allows us to (theoretically) look at the links between businesses and see if particular parent companies oversee good/bad performance.	The use of this tool is still developing but it may allow us to investigate any links between sites/businesses that are illegally exporting waste or involved in misdescription of waste.		**X**	**X**

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
		2011 and ran until December 2014.					
Monthly Environment Agency area reports	n/a	Each Environment Agency area produces a monthly report containing: • number of containers stopped • number of containers returned to site • number of containers 'evidenced' • number of prosecutions	This data is combined into a single data dashboard by the Environment Agency's Enforcement Once team.				**X**

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
Time recording data	n/a	Environment Agency area staff will be able to record time spent on activities under this project against the 'WCIE' project code.	Time recording against the project is recorded against four codes: • Task 1 Illegal waste sites • Task 2 Illegal waste exports • Task 3 Deliberate misdescription of waste • Task 4 General expenditure	Project resources have been allocated to areas where they will have the biggest impact so we should expect to find geographical variations in time recording.	X	X	X
International Waste Shipments (formally Transfrontier Shipments)	IWS	IWS are the import and export of wastes across international boundaries. These movements of waste are subject to the controls outlined in the Waste Shipments Regulations. These regulations also aim to prevent the unauthorised disposal/recovery of hazardous waste shipments in countries where they are not able to handle the waste in an environmentally sound manner, without hindering the legitimate trade in waste.	IWS from England can be subject to notification controls. These apply to all imports and exports of: • hazardous waste moving for recovery • any type of waste moving for disposal • some imports and exports of non-hazardous wastes for recovery Where these controls apply the customer will need Environment Agency written permission before moving the waste.	More information is available at: https://www.gov.uk/importing-and-exporting-waste#page-navigation			X

Datasets and systems	Acronym	Description	Measures	Notes	IWS	MD	IE
Waste returns	WIRS	Waste returns are required under permit condition. Submissions are dealt with centrally by WIRS, checked for lateness (and breaches scored if they are).	Types and volume of waste.		**X**	**X**	**X**

Appendix B: Sensitivity tests run on key variables and assumptions made within the modelling process

In undertaking the modelled assessment of the waste crime intervention funding, certain modelling assumptions were made concerning variables where only limited data or information is available as a guide. Therefore, some sensitivity analysis has been conducted on the central scenario (see Table 8.1) to demonstrate the significance of these variables in their influence over the final total value of return on investment. Accompanying this is discussion on the variability of the outcomes, and how these could be envisaged to come about with changes after the completion of the funding or, for example, when greater publicity is made of the Environment Agency's activities in tackling misdescription of waste.

Key variable or assumption	Why is it key to test this?	Sensitivity analysis undertaken
Scaling factor for Landfill Tax recovery	One of the largest potential benefits of the additional intervention is the identification of additional Landfill Tax avoidance that should be recoverable. In making the assessment the proportion of actual tax revenues recovered is uncertain because of various breaks within the system through which revenues can fall unrecovered. The extent to which revenues can be recovered does have a large impact on the overall payback of the additional investment.	Baseline 33%, lower 15%, upper 60%
Deterrence factor of interventions in the misdescription of waste stream	As with the discussion on recoverability of Landfill Tax via misdescription above, and equally unknown, is to what extent currently non-evidenced misdescription activities will reduce because of the deterrence effect of greater prosecution of companies misdescribing.	Baseline 5%, lower 0%, upper 20%

Scaler for waste removed from site to the flow of material stopped from illegal treatment	Although the amount of waste on site when closed is calculated from real CMS data, the quantity of illegal treatment of waste prevented from entering that site in its duration of operability is assumed to be higher than simply the waste on site when stopped. The extent to which this is true can influence the overall benefit of the investment.	Base 1.5, lower 1, upper 2.5
Number of illegal exports prevented through direct liaison with shipping companies rather than Environment Agency activity in the stopping and redirection of containers at port	The number of shipments stopped through intelligence activities without physical activity at ports is uncaptured in the waste data on illegal shipments inspected and returned to the appropriate re-processing.	Base 20, lower 10, upper 40

The tables below show how using the lower or higher (upper) factors noted above would affect the benefits I at Tier 3 in each of the four cases in the table above.

Test 1: Scaling factor for Landfill Tax recovery

	Lower	Central	Higher
Benefits to HM Government	£25,230,175	£46,904,667	£85,437,098
Additional revenue to business	£17,213,685	£17,213,685	£17,213,685
Additional profits to business	£929,830	£929,830	£929,830
Social and environmental benefits	£6,860,928	£6,860,928	£6,860,928
HM Government, **social and environmental benefits**	**£32,091,103**	**£53,765,596**	**£92,298,026**

The recoverability of tax revenues from the misdescription of waste is the most significant assumption made within the report, and although the baseline estimate of 33% recovery of available tax avoided is a reasonable estimate taking into account the range of reasons for failure to recover, variance in this factor can have significant

impacts on the results of the evaluation. At the lower end of the recoverability envelope (15%), the overall benefit of the funding package could be reduced by as much as £21 million. If as much as 60% of tax were recovered, however, almost £40 million more could be recovered for HM Government. It is anticipated that the baseline estimate of 33% is a sensible assumption and results produced are reflective of the potential value of work conducted within the funding period. This is especially true given the nature of HMRC activities in that if Landfill Tax is not recovered some other form of tax, such as VAT or Capital Gains Tax, may be pursued in order to recover value from illegal activities conducted.

Test 2: Deterrence factor of interventions in the misdescription of waste stream

	Lower	Central	Higher
Benefits to HM Government	£46,065,279	£46,904,667	£49,422,834
Additional revenue to business	£17,213,685	£17,213,685	£17,213,685
Additional profits to business	£929,830	£929,830	£929,830
Social and environmental benefits	£6,860,928	£6,860,928	£6,860,928
HM Government**, social and environmental benefits**	**£52,915,211**	**£53,765,596**	**£56,316,749**

Secondary to the availability of tax recovery is the level of misdescription currently happening unseen and not evidenced by the Environment Agency. Assumptions within the model were set very cautiously equal to 5% of the currently evidenced tax avoidance; however, it is highly likely that this is a low estimate that will underestimate the deterrence effect that will kick in once prosecutions of operators for misdescription start to meet their completion. If the value of the deterrence effect were to rise in this way then significant further value could be recovered leading to further enhanced paybacks on the current waste crime investments.

Test 3: Scaler for waste removed from site

	Lower	Central	Higher
Benefits to HM Government	£46,188,402	£46,904,667	£48,337,199
Additional revenue to business	£14,843,855	£17,213,685	£21,953,344
Additional Profits to business	£814,380	£929,830	£1,160,731

Social and environmental benefits	£6,297,864	£6,860,928	£7,987,057
HM Government, **social and environmental benefits**	**£52,486,265**	**£53,765,596**	**£56,324,256**

Aside from misdescription activities, the model also extends the scope of illegal waste sites to account for the quantity of waste which would have been mistreated on site had it not been closed down. This captures the value of closing down waste sites more rapidly through more proactive procedures. Accounting for this scaler means that the lifetime of the illegal site can be captured rather than just the point in time value. The scaler ranges from 1 (essentially no accounting for additional benefits) to 2.5 accounting for an additional 1.5 times the tonnage on site when closed.

Test 4: Additional illegal containers prevented

	Lower	Central	Higher
Benefits to HM Government	£46,894,869	£46,904,667	£46,924,264
Additional revenue to business	£17,164,693	£17,213,685	£17,311,667
Additional profits to business	£920,032	£929,830	£949,427
Social and environmental benefits	£6,846,783	£6,860,928	£6,889,218
HM Government, **social and environmental benefits**	**£53,741,653**	**£53,765,596**	**£53,813,482**

As a final test of the model, the sensitivity of illegally exported material was tested via the lever of the number of containers stopped via indirect actions undertaken by the Environment Agency, rather than direct activity at port services. This variable is sensitive but, based on the range presented within the tests undertaken, its variability would have to be significant to cause large variance in the results.

Appendix C: 'Long list' of variables used in the development of the counterfactual

Variable	Units	Source	Period
Illegal waste sites stopped	No.'s	Environment Agency	
Illegal waste sites identified	No.'s	Environment Agency	
Illegal export event	No.'s	Environment Agency	
Illegal exports inspections	No.'s	Environment Agency	
Illegal exports returned to for re-treatment	No.'s	Environment Agency	
The price of mixed recyclable	£ per tonne	WRAP Market Reports	
The recycling price of paper	£ per tonne	WRAP Market Reports	
The recycling price of glass	£ per tonne	WRAP Market Reports	
The recycling price of steel cans	£ per tonne	WRAP Market Reports	
The recycling price of aluminium cans	£ per tonne	WRAP Market Reports	
The recycling price of dry mixed recyclables	£ per tonne	WRAP Market Reports	
Household waste arisings	Tonnes	WasteDataFlow[6]	2008- 2016
The tonnage of household waste recycled	Tonnes	WasteDataFlow	
The tonnage of waste landfilled	Tonnes	Waste Data Interrogator	
Local authority collected waste arisings	Tonnes	WasteDataFlow	2008- 2016
Consumer Price Index	Indexed values	Office of National Statistics	2008-2016
Retail Price Index	Indexed values	Office of National Statistics	2008-2016
Gross Domestic Product (current market price)	£	Office of National Statistics	
Population	Number	Office of National Statistics	
Number of dwellings	Number	Office of National Statistics	
Turnover(£M)_Collections & Treatment & Disposal & Recovery	£	Annual Business survey data	
E : Water Supply; Sewerage, Waste Management and Remediation Activities (Index) (Seasonally adjusted) (2012 index year)	£	Office of National Statistics	

[6] WasteDataFlow. Available at http://www.wastedataflow.org/

Variable	Units	Source	Period
Water Supply; Sewerage, Waste Management & Remediation Act (period-period growth (Seasonally adjusted) index 2012	% change	Office of National Statistics	
Landfill tax	£	HMRC	2008-2016
Landfill Gate Fee	£		
Gate fee for incineration	£ per tonne	WRAP Gate Fees Reports	
Environment Agency Total spend on waste crime	£	Environment Agency	2010-2016
Environment agency spend on stopping illegal waste site	£	Environment Agency	2010-2016
Environment agency spend on stopping illegal waste exports	£	Environment Agency	2010-2016
Environment Agency Total spend on waste crime (delayed 1 Q)	£	Environment Agency	2010-2016
Environment agency spend on stopping illegal waste site (delayed 1 Q)	£	Environment Agency	2010-2016
Environment agency spend on stopping illegal waste exports (delayed 1 Quarter)	£	Environment Agency	2010-2016
Environment Agency Total spend on waste crime (delayed 2 Quarters)	£	Environment Agency	
GDP chain linked values	£	Office of National Statistics	
Typical retail prices of petroleum products and a crude oil price index	Indexed values	Gov.uk statistical data-sets	

Appendix D: Glossary of labels used in the correlation matrix (Figure 3.1)

Label	Variable	Units	Source	Period
STOPPED	Illegal waste sites stopped	No.'s	Environment Agency	
IDENTIFIED	Illegal waste sites identified	No.'s	Environment Agency	
ILLEGAL	Illegal export event	No.'s	Environment Agency	
ILL_EXP_INSP	Illegal exports inspections	No.'s	Environment Agency	
ILL_EXP_RETURN	Illegal exports returned to for re-treatment	No.'s	Environment Agency	
MIXE	The price of mixed recyclable	£ per tonne	WRAP Market Reports	
NEWS	The recycling price of paper	£ per tonne	WRAP Market Reports	
GLAS	The recycling price of glass	£ per tonne	WRAP Market Reports	
STCN	The recycling price of steel cans	£ per tonne	WRAP Market Reports	
ALCN	The recycling price of aluminium cans	£ per tonne	WRAP Market Reports	
PLBT	The recycling price of dry mixed recyclables	£ per tonne	WRAP Market Reports	
HOUSE	Household waste arisings	Tonnes	WasteDataFlow[7]	2008-2016
RECY	The tonnage of household waste recycled	Tonnes	WasteDataFlow	
DISP	The tonnage of waste landfilled	Tonnes	Waste Data Interrogator	
LA_W	Local authority collected waste arisings	Tonnes	WasteDataFlow	2008-2016
CPI	Consumer Price Index	Indexed values	Office of National Statistics	2008-2016
RPI	Retail Price Index	Indexed values	Office of National Statistics	2008-2016
GDP_MARKET	Gross Domestic Product (current market price)	£	Office of National Statistics	
POP	Population	Number	Office of National Statistics	
DWEL	Number of dwellings	Number	Office of National Statistics	

[7] WasteDataFlow. Available at http://www.wastedataflow.org/

Label	Variable	Units	Source	Period
CTDR	Turnover(£M)_Collections & Treatment & Disposal & Recovery	£	Annual Business survey data	
WATE	E : Water Supply; Sewerage, Waste Management and Remediation Activities (Index) (Seasonally adjusted) (2012 index year)	£	Office of National Statistics	
WATP	Water Supply; Sewerage, Waste Management & Remediation Act (period-period growth (Seasonally adjusted) index 2012	% change	Office of National Statistics	
Tax	Landfill tax	£	HMRC	2008-2016
Fee_Land	Landfill Gate Fee	£		
Incin	Gate fee for incineration	£ per tonne	WRAP Gate Fees Reports	
EA_Total_Enforc	Environment Agency Total spend on waste crime	£	Environment Agency	2010-2016
EA_illegal	Environnement agency spend on stopping illegal waste site	£	Environment Agency	2010-2016
EA_illegal_exp	Environnement agency spend on stopping illegal waste exports	£	Environment Agency	2010-2016
EA_Total_Enforc_1Q	Environment Agency Total spend on waste crime (delayed 1 Q)	£	Environment Agency	2010-2016
EA_illegal_1Q	Environnement agency spend on stopping illegal waste site (delayed 1 Q)	£	Environment Agency	2010-2016
EA_illegal_exp_1Q	Environnement agency spend on stopping illegal waste exports (delayed 1 Quarter)	£	Environment Agency	2010-2016
EA_Tot_2Q	Environment Agency Total spend on waste crime (delayed 2 Quarters)	£	Environment Agency	
GDP_Chained	GDP chain linked values	£	Office of National Statistics	
Petrol_Oil	Typical retail prices of petroleum products and a crude oil price index	Indexed values	Gov.uk statistical data-sets	

Appendix E: Waste operator survey questionnaire

Waste Crime Intervention and Evaluation Project

Introductory Script

Good morning/afternoon.

I am *(insert name)* calling from Ricardo Energy & Environment on behalf of the Environment Agency. We are contacting permitted waste management sites as part of work to assess the impact of the Agency's work to tackle waste crime. We would like to understand your perception of the Environment Agency's enforcement activities. Do you have 5–10 minutes to answer a few questions?

If no, can I call back at a more convenient time?

If yes, continue as below:

There are 8 questions, some with sub-questions within them. All your answers will be treated as confidential and we will not keep a record of your name or the name of your site or business.

The questionnaire will take between 5 and 10 minutes to run through. If you would prefer, I can email you a copy of the questionnaire which you can complete and email back to me or I can call you back and collect your answers over the phone.

Questions

Contextual information *(this information will be prepopulated using Environment Agency data)*	
Site type (landfill, Transfer, AD, MRF etc.)	
Permitted capacity of the site (tpa) *(maximum annual throughput)*	
Throughput of the facility in 2014	
Date the permit was issued	
Environment Agency region	
Single-site operator or multi-site operator	

Q1. We would like to understand if you think there has been a change in frequency in the following types of activities since 2014 (please tick either increased, stayed the same or decreased)	Increased	Stayed the same	Decreased
a. Inspections and audits at permitted waste management sites			
b. Enforcement at ports regulating the export of waste			
c. Investigations into illegal waste sites			
d. Investigation into the misdescription of waste *(relating to Landfill Tax fraud, illegal waste exports, breaches of the Duty of Care etc.)*			
e. Prosecutions			
f. Other enforcement sanctions such as formal cautions, warning letters, civil penalties (please describe)			

** Tick appropriate boxes you think are relevant*

Q2. We would like to understand whether your perception of waste crime related issues has changed in the last few years

Please circle the number that best reflects your opinion on the following issues both in 2014 and now (1 – very high, 2 – high, 3 – average, 4 – low, 5 – very low)

Pre 2014						Post 2014				
1	2	3	4	5	The visibility of the Environment Agency in tackling illegal waste sites was…	1	2	3	4	5
1	2	3	4	5	The visibility of the Environment Agency in tackling the illegal export of waste was…	1	2	3	4	5
1	2	3	4	5	The visibility of the Environment Agency in tackling the misdescription of waste was…	1	2	3	4	5
1	2	3	4	5	The likelihood of the Environment Agency taking enforcement action to tackle waste crime was…	1	2	3	4	5
1	2	3	4	5	The likelihood of the Environment Agency taking enforcement action to tackle non-compliance at permitted waste sites was…	1	2	3	4	5

Q2. We would like to understand whether your perception of waste crime related issues has changed in the last few years Please circle the number that best reflects your opinion on the following issues both in 2014 and now (1 – very high, 2 – high, 3 – average, 4 – low, 5 – very low)										
Pre 2014						Post 2014				
1	2	3	4	5	The impact that illegal activity (sites operating without a permit) was having on the competitiveness of your business was…	1	2	3	4	5
1	2	3	4	5	The waste industries' overall level of compliance with waste legislation was…	1	2	3	4	5
1	2	3	4	5	The likelihood that an illegal waste site will be detected by the Environment Agency was…	1	2	3	4	5
1	2	3	4	5	The likelihood of a site that is deliberately misdescribing waste being detected by the Environment Agency was…	1	2	3	4	5
1	2	3	4	5	The likelihood of a site's illegal exporting of waste being detected by the Environment Agency was…	1	2	3	4	5

Q3. Visibility of enforcement actions	Answer
Can you recall a waste management company or an individual being prosecuted for breaking waste legislation in the last 2 years? *If yes, how many?*	
Thinking of the most memorable case, please describe the following: • What the person/company had done that had led to a penalty? • What was the penalty? • When and where the event occurred? • Where you heard about it?	

Q3. Visibility of enforcement actions	Answer
What aspects of the case were the most memorable and why?	
Has hearing about a penalty against another company in your sector ever made you change your practices, e.g. increasing staff training etc.? *If yes, please describe*	

Q4. On a scale of 1 to 5, what do you think the chances are that illegal activity and non-compliance will lead to:	Please score out of 1 to 5 (1 low, 5 high)
a. Prosecution of a company or individual	
b. Prosecution of an individual within a company as a result of their instructions or neglect	
c. Formal caution or civil sanctions including fines and recovery of the proceeds of crime	
d. Suspension of a permit	
e. Revocation of a permit	
f. Service of a compliance notice	

Q5. Do you think that the Environment Agency are more or less likely to take enforcement action now than in 2014 and before?	Please score out of 1 to 5 (1 very unlikely, 5 very likely)
a. If more, how much more likely do you perceive enforcement action to be?	
b. If less, how much less likely do you perceive enforcement action to be?	

Q6. Drivers for compliance
What drives your business to comply with waste management legislation? Please score each between 1 and 5 (1 very weak driver and 5 a very strong driver)
Roughly what percentage of time do you spend on compliance with environmental regulation?

Q7. Have you been aware of any significant changes in funding available to the Environment Agency in tackling waste crime?	Please tick
1. Yes	
2. No	

Q8. Have you been aware of increased activity by the Environment Agency to tackle waste crime in the last 2 years?	Please tick
1. Yes	
2. No	

Would you like to find out more about us or about your environment?

Then call us on
03708 506 506 (Monday to Friday, 8am to 6pm)

email
enquiries@environment-agency.gov.uk

or visit our website
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