BADGER INTERVENTION ANALYSES – CALCULATION ASSUMPTIONS

1. Overview of Analysis Approach

1.1 Introduction

1.1.1 This document outlines the assumptions underpinning the calculations undertaken to consider the economic costs of possible approaches to badger intervention, and the value of a breakdown avoided (i.e. steps 1 and 2a of the calculations, as described below in section 1.2.1). Note the assumptions should not be interpreted as epidemiological forecasts, rather they are practical assumptions to allow costings and related analyses. Box 1 clarifies some terminology which will aid understanding of the discussion.

Box 1: Explanation of some terminology used

- **Herd breakdown** refers to a cattle herd that has Officially Tuberculosis Free (OTF) status removed for disease reasons.

    - OTF herd status is the default unrestricted legal status for cattle herds that have passed all mandatory TB tests, show no clinical signs or suspicion of disease and these herds are free to trade normally. When OTF status is removed, the herd status is downgraded to one of two non-free categories, either OTS (OTF Status Suspended) or OTW (OTF Status Withdrawn).

    - OTS is triggered when the TB status of a herd is uncertain, either because TB is suspected but has not been definitively confirmed, or because herd testing is not up to date. E.g. OTS status is given in the case of a herd with 1 skin test reactor which has not been confirmed with disease at postmortem or lab testing and/or no more than 5 animals with unconfirmed lesions at routine slaughter (LRSs).

    - OTW status means the herd is being treated as a confirmed TB breakdown. E.g. a herd with more than 1 skin test reactor even if there is no postmortem of lab confirmation; or a herd with any animal where disease is confirmed; or if ,there is a total of more than 5 unconfirmed LRSs during the course of the breakdown; or when it is considered epidemiologically prudent; or when an animal shows

clinical signs of TB; or when a herd test is overdue by a specified period.[1]

In the context of badger intervention:
- Proactive means carrying out badger intervention across the entirety of a bTB hotspot area, not just around farms with herd breakdowns.

- Reactive means carrying out badger intervention in a localised area around farms with herd breakdowns.

- Non-selective means the removal of badgers regardless of their disease status, i.e. A "cull" intervention is non-selective as all badgers found are removed.

- Selective means the removal of badgers based on their disease status, i.e. the Test and, Vaccinate or Remove (TVR) intervention is selective as only test-positive badgers are removed.

NB: In regard to the options discussed later in this document:
- Options 2-5 relate to Proactive and Non-Selective Culls. All badgers found/trapped are removed across the entirety of the large bTB hotspot area chosen for intervention;
- Options 6-8 relate to Proactive and Selective Culls using the Test and Vaccinate or Remove approach. Badgers are trapped, anaesthetised, tested for bTB, with test-positive badgers removed, and the remainder vaccinated, where this approach is carried out across the entirety of the large bTB hotspot area chosen for intervention; and
- Options 9-11 relate to Proactive Vaccination. Badgers are trapped and vaccinated across the entirety of the large bTB hotspot area chosen for intervention (no badgers are removed).

1.1.2 This paper explains the approach used for calculations, but while the broad cost assumptions are explained, the full details are not provided in order to avoid compromising any potential future procurement exercise. Also, for this reason, in the Badger Intervention Options Analysis **(Annex VIII)**, government oversight costs are not separated out from 'on the ground' deployment costs (rather the total variable cost of each option is provided).

1.1.3 As outlined in the Options Analysis, the shortlisted options are:

- Option 1: Do Nothing (i.e. no badger intervention);

[1] See DAERA website for more information: TB Herd Statuses & TB Testing Requirements | Department of Agriculture, Environment and Rural Affairs

- Option 2: Proactive **non-selective cull**, trapping badgers using **cages**, deployed by the **public** sector (costed using Department of Agriculture, Environment and Rural Affairs (DAERA's) experience of its cage trap Test and Vaccinate or Remove (TVR) pilot, adjusted for a cull);
- Option 3: Proactive **non-selective cull**, trapping badgers using **cages**, deployed by the **private** sector (costed using DAERA's knowledge of cage trapping TVR, adjusted for a cull, and using Annual Survey of Hours and Earnings (ASHE) statistics[2] to estimate a potentially lower private sector wage rate);
- Option 4: Proactive **non-selective cull**, trapping badgers using **stopped restraints**, deployed by the **private** sector (using high level cost information from the Republic of Ireland (ROI) on a private sector delivered stopped restraint-based cull);
- Option 5: Proactive **non-selective cull**, with **predominant controlled shooting** of free-roaming badgers (complemented by cage trap and shoot where the terrain is not suitable for controlled shooting), deployed by the **private** sector (using high level information from the Department for Environment, Food & Rural Affairs (DEFRA) website[3] on a predominant controlled shooting cull by private sector farmer-controlled companies)
- Option 6: Proactive **selective cull** using **Test and Vaccinate or Remove (TVR)**, trapping badgers using **cages**, deployed by the **public** sector (costed using DAERA's experience of its cage trap TVR pilot);
- Option 7: Proactive **selective cull** using **TVR**, trapping badgers using **cages**, deployed by the **private** sector (costed using DAERA's experience of its cage trap TVR pilot, and using ASHE statistics[4] to estimate a potentially lower private sector wage rate);
- Option 8: Proactive **selective cull** using **TVR**, trapping badgers using **stopped restraints**, deployed by the **private** sector (costed using high level information from the ROI on a private sector deployed stopped restraint-based cull and adjusting it for a TVR approach);

[2] NISRA: Annual Survey of Hours and Earnings, Annual Survey of Hours and Earnings | Northern Ireland Statistics and Research Agency
[3] DEFRA's 2019 Value for Money Analysis
[4] NISRA: Annual Survey of Hours and Earnings, Annual Survey of Hours and Earnings | Northern Ireland Statistics and Research Agency

- Option 9: Proactive non-selective **vaccination**, trapping badgers using **cages,** deployed by the **public** sector (costed using DAERA's experience of its cage trap TVR pilot, adjusted for a vaccination only approach);
- Option 10: Proactive non-selective **vaccination**, trapping badgers using **cages,** deployed by the **private** sector (costed using DAERA's knowledge of cage trapping TVR, adjusted for a vaccination only approach, and using ASHE[5] statistics to estimate a potentially lower private sector wage rate);
- Option 11: Proactive non-selective **vaccination**, trapping badgers using **stopped restraints**, deployed by the **private** sector (costed using high level information from the ROI on a private sector deployed stopped restraint-based cull, adjusting it for a vaccination approach).

1.1.4 DAERA has experience of cage trapping TVR as it carried out a pilot of this approach in Banbridge during 2014-2018. As such, the TVR options (Options 6, 7 and 8) will be discussed first. Then the assumptions of the non-selective cull options will be described (Options 2, 3, 4 and 5), which are followed by a discussion of the vaccination options (Options 9, 10 and 11).

1.1.5 It is acknowledged that badger intervention is only one aspect of a wider bTB eradication programme. In tandem with any introduction of badger intervention, the bTB eradication programme will continue to evolve. The evolution of cattle and people focused measures (e.g. relating to improving biosecurity) are outside of the scope of these analyses.

1.2 Calculating breakeven number of herd breakdowns avoided for benefits of badger intervention to at least offset the costs of intervention

1.2.1 The economic analyses were conducted following these main steps:

1.2.1.1 **Step 1**: The cost of each shortlisted badger intervention option was estimated. The assumptions underpinning the cost estimations are outlined in section 2.

[5] *Ibid*

1.2.1.2 **Step 2**: In theory, the benefit arising from badger intervention is the value of herd breakdowns avoided over a period as a result of badger intervention. This would require an estimate of:

a) The value of a herd breakdown avoided. The assumptions underpinning the cost estimations are outlined in section 3. This includes estimates of breakdown costs borne by both government / taxpayers and farmers, *multiplied by*;
b) The number of years over which one would expect to see a reduction in herd breakdowns as a result of badger intervention, *multiplied by*;
c) The average number of herd breakdowns avoided for each year in this period.

1.2.1.3 While it is possible to provide an estimate for a), and to consider potential estimates for b), the number of herd breakdowns that would be avoided in an intervention area specifically as a result of badger intervention (i.e. c)) is unknown. In such circumstances, it is appropriate to use **breakeven analysis** to determine how many herd breakdowns would ***need*** to be avoided for the benefits of badger intervention to at least offset its cost[6].

1.2.1.4 **Step 3**: The next step was to consider the question "**Does the breakeven number of herd breakdowns avoided for each shortlisted option appear achievable**?". To consider this, the following steps were undertaken:

a) Firstly, the breakeven number of herd breakdowns avoided for each option was compared against the outputs from a NI parameterised model. It is useful to some degree in sense-checking the achievability of the number of herd breakdowns avoided that would need to be achieved to offset the cost of badger intervention;

[6] The use of Breakeven Analysis is aligned to DEFRA's approach. DEFRA (2005) "Cost benefit analysis of badger management as a component of bovine TB control in England". See para. 9

b) Secondly, to bring real-world experience to bear, the breakeven number of herd breakdowns avoided for cull options were compared with the results from one of the large scale replicated badger cull research trials, i.e. the Four Areas Trial that was conducted in the ROI.

1.2.2 This document outlines the assumptions underpinning steps 1 and 2a. Steps 2 (b and c) and Step 3 (a and b) are discussed in the Badger Intervention Options Analysis **(Annex VIII)** and are not repeated here.

2. Cost estimation – underpinning assumptions

2.1 Opportunity cost and residual values

2.1.1 An opportunity cost was estimated for all resources required to implement each shortlisted option, usually based on market values.

2.1.2 In economic calculations, residual values are usually attributed to large value capital items with re-sale opportunity. For public sector deployed options (i.e. Options 2, 6 and 9), it is assumed that jeeps and trailers are purchased to transport the heavy cages to badger runs. Residual values have been included for these two items[7]. For private sector deployed options, it is assumed that their charge for services would cover transport.

2.2 Value Added Tax

2.2.1 All cost estimates exclude VAT.

2.3 Price basis

2.3.1 All cost estimates are presented in 2026/27 prices. Where the information source for a cost relates to an earlier year, the cost estimate was inflated to reflect 2026/27 prices, usually by applying an inflation increase derived from the HM Treasury GDP deflator indices (as published in March 2026).

[7] The initial purchase value of the item is divided by its useful life, to get an annual value, and this is multiplied by the numbers years of its useful life remaining at the end of year 5. The useful life of the jeeps and trailers is assumed to be 10 and 15 years respectively.

2.4 Public sector labour cost estimates, where relevant

2.4.1 Where costs relate to public sector labour, a DAERA Staff Cost Ready Reckoner was used to calculate the yearly, monthly, weekly, daily or hourly cost for each grade of staff required. In the first instance, public sector labour costs are presented as financial costs using the 'paybill' column of the Staff Cost Ready Reckoner. This is average salary of each grade plus average National Insurance and Employer's Superannuation. Secondly, an economic cost adjustment is included separately which covers overheads such as central services and accommodation for staff. When the economic cost adjustment is added to paybill costs, this means that the full economic cost of staff is reflected in the economic cost analyses.

2.4.2 Note that the economic cost adjustment is a notional cost, not a cash cost. Also it varies by each grade of staff in the DAERA Ready Reckoner. So, to keep the calculations more straight forward, the average adjustment for the usual Veterinary Service and Animal Health Group staff grades likely to be involved in bTB badger interventions is used. That resulted in an average economic cost adjustment of 30%.

2.4.3 This means that the financial costs of all public sector labour (paybill values), no matter the grade, are later multiplied by 30% to derive a notional economic cost adjustment. As previously discussed, the inclusion of this adjustment uplifts the financial (paybill) cost of staff to their full economic cost. It is advantageous to have them separated in this manner as later, if and when a preferred option is determined, then the paybill costs are inserted into the financial cashflows for the preferred option and annual inflation estimates added.

2.5 Focus on variable costs

2.5.1 The cost of the vast majority of labour and items required for badger intervention deployment vary in proportion to the number and size of areas

chosen for deployment. In other words, most badger intervention costs are 'variable' with scale of deployment.

2.5.2 However, a couple of 'fixed' cost items have been identified: (i) An underpinning IT database for recording data, e.g. the location of badger setts, location of traps, badgers trapped, treatment(s) applied, and other monitoring information, as required; and (ii) ongoing maintenance of this IT database. These fixed costs will remain the same no matter the size and/or number of areas chosen for badger intervention.

2.5.3 These fixed costs are relatively small. For instance, it is assumed that the IT database will be constructed for another DAERA bTB project and can be transferred to this project with no significant additional cost. The IT staff input to keep the database operational is estimated to be around £5,000 per year in financial cost terms, and £6,000 per year in full economic cost terms. Not only are these costs very small relative to other implementation costs, but they are also the same across all options. Therefore, the comparison of shortlisted options on economic costs is focused on the **variable costs of each badger intervention option**. [Later, when a financial cashflow is required for any preferred option, the cashflow will include both variable and fixed costs, and funding sources explored for both.]

2.6 Comparison of shortlisted options on discounted (present) cost

2.6.1 There is a difference in approach between the "economic analysis' of shortlisted options and the "financial analysis" of what becomes the eventual preferred option. At a point in the future (i.e. when a preferred option is eventually chosen), the annual financial costs of the preferred option, including inflation uplifts, will be provided.

2.6.2 However, at this stage, the economic cost of a number of shortlisted options are being compared. This is the "economic analysis". This compares costs over time in real terms (i.e. without inflation).

2.6.3 Also, as people prefer to receive goods and services today, rather than tomorrow, this 'social time preference' is taken account of by applying a discount factor to the profile of real economic costs. The discount rate used in public sector projects is 3.5% in real terms, where this discount rate reflects the social rate of time preference. Therefore, the projected future economic cost for each badger intervention option in each year (n) is multiplied by a discount factor[8]. The discounted costs in each year are then added together to derive the 'present cost' of the option.

2.7 Area selection

2.7.1 The two main badger culling research trials, England's Randomised Badger Control Trial (RBCT) and ROI's Four Areas Trial, which showed positive impacts on the number of cattle herd breakdowns, carried out proactive non-selective badger culling over relatively large areas (average size of 100 km^2 and 240 km^2 respectively[9]). This suggests that badger interventions should be carried out over relatively large areas of **at least** 100 square kilometres[10]. In addition, results from modelling simulations prior to the DAERA TVR pilot project suggested no apparent substantial benefit from increasing the area of management over 100km^2[11].

2.7.2 Given that this is a preliminary analysis, the actual areas for intervention in NI have not been identified at this stage. If it is decided to proceed with badger intervention, criteria for area selection will be set at some stage in the future.

[8] Discount factor using a 3.5% discount rate is $1/(1+0.035)^n$, where n is the year in question.
[9] Four Areas Trial – size of badger removal areas was 188 km^2 (Cork), 215 km^2 (Donegal), 252 km^2 (Kilkenny) and 305 km^2 (Monaghan), which averages 240 km^2. Therefore, its smallest size was 188km^2 and as far as possible it used natural geographical boundaries to each removal area such as rivers, mountain ranges and sea inlets to reduce any potential risk of triggering a perturbation effect.
[10] For instance, authors analysing the results of the RBCT suggest areas larger than 141 square kilometres. Jenkins et al (2010) The Duration of the Effects of Repeated Widespread Badger Culling on Cattle Tuberculosis Following the Cessation of Culling | PLOS One
[11] Smith, G.C., Budgey, R., and Delahay, R.J. (2013) "A simulation model to support a study of test and vaccinate or remove (TVR) in Northern Ireland. National Wildlife Management Centre, Animal Health and Veterinary Laboratories Agency. fera-tvr-modelling-report.pdf

By way of example, some potential factors that will require consideration include the existence of established large cattle bTB hotspots; higher than average badger social group density; available physical boundaries which would limit badger ranging behaviour, local veterinary epidemiological assessment and extent of land access. In the meantime, the cost for each option is estimated based on a standard 100km^2 area which is simply a convenient unit of analysis that allows the cost of options to be considered on a 'like for like' basis[12].

2.8 Sett survey

2.8.1 Once an intervention is proposed in an area, the whole area needs to be surveyed to identify the locations of badger setts, with each one being georeferenced in a suitable database. It is advantageous for survey work to be undertaken when vegetation is relatively low. The sett survey will assist in directing deployment effort to the optimum areas for accessing badgers.

2.8.2 The cost estimates for all shortlisted options include an economic cost for the effort involved in this sett survey. At this stage, it has not been determined if the sett survey would take place during the winter prior to deployment (which would be in an earlier financial year), or at the start of the deployment phase. So, for the purposes of estimating costs, it is assumed that the cost of the sett survey would be incurred in the same financial year as deployment.

2.9 Time period for the initial badger intervention

2.9.1 For costing purposes, it is assumed that each initial intervention option operates for five years. This time-period is chosen because it is consistent with the intervention period in two large-scale research trials: England's Randomised Badger Control Trial (RBCT) and the ROI's Four Areas Trial.

2.10 Access to badgers

[12] A consequence of expressing costs per a standard 100km^2 area is that no account is taken of scale effects. In reality, the scale of operation of each option may alter its cost-effectiveness. However, as this would affect all options shortlisted, it should not affect the relative rank of options.

2.10.1 For badger intervention, generally the most effort (and therefore the most cost) is related to badger trapping. The exception is England's predominant controlled shooting approach which involves trained marksmen shooting free roaming badgers at night. It is, however, complemented with some cage trapping, especially where the terrain is not suitable for shooting. This option has lower deployment effort, and therefore, lower cost. All other options require badgers to be trapped prior to "treatment", whether that treatment is cull, TVR or vaccination.

2.11 Badger trapping – the ROI uses stopped restraints

2.11.1 Stopped restraint traps are used in the ROI for both research and deployment. They involve a bar, shackle, chain and stopped restraint. They are mainly sited around setts and are inspected each morning when any captured badgers can be treated (whether via a cull, TVR or vaccination approach). The advantages of stopped restraints are that they are relatively lightweight and can be easily transported and positioned. Also, no baiting is required, and they can trap badgers from the first night of deployment. The disadvantage is that the stopped restraint has a fixed diameter when triggered and smaller badgers can slip through. Therefore, they work best with a long open season such as that in place in the ROI.

2.12 Badger trapping – DAERA used cages in TVR Pilot

2.12.1 Cages can also be used to trap badgers. DAERA used cage trapping in its TVR Pilot project. Cage trapping has not been a predominant feature of either the ROI's[13] or England's[14] badger interventions, however as discussed, some cages were deployed alongside England's predominant controlled shooting approach, especially where the terrain was not suited to a controlled shooting approach.

2.12.2 Compared to stopped restraints, cages are large and heavy and need to be transported with jeeps and trailers to the required locations with supplementary equipment (spades, picks, etc.) required to dig them in and to secure them in

[13] The ROI mainly uses stopped restraint traps.
[14] England mainly uses controlled shooting of free roaming badgers.

place. Also, as badgers are naturally cage-shy, bait (peanuts) needs to be inserted into each cage for a period to encourage badgers to enter the cages. Then cages are primed to close for a number of nights, and any trapped badgers treated. The advantages of using cages are that they can trap badgers of all sizes and the trapped badgers are shielded from predators.

2.12.3 The cage trapping approach used during DAERA's TVR Pilot project involved a period of deployment during the existing badger "open season" (see below), which was preceded by two weeks of preparation and followed by one week of 'tidy up' activities per 100km^2 area. For deployment within the 100km^2, one labour team could deploy cages trapping over one sixth of the area over three weeks (roughly involving two weeks of pre-baiting and four nights of cage trapping in the third week). It took six cycles of this three-week trapping deployment to cover the 100km^2.

2.12.4 However, the TVR Pilot field work experts found that the bait was being removed by badgers early during the pre-baiting period. On that basis, for the purposes of deriving deployment cost estimates, it is DAERA's expert veterinary opinion that the effort for deployment could be reduced from three weeks of effort per each of 6 cycles used in the TVR research pilot, to two weeks of effort per cycle (i.e. one team would carry out at least five nights of pre-baiting followed by four nights of trapping per cycle, and it would take six cycles of this reduced cage-trap effort to cover 100km^2).

2.13 Badger intervention open seasons

2.13.1 Table 1 outlines the current policies on badger intervention open seasons in NI, the ROI, England and Wales.

Table 1: Badger intervention windows (open seasons)

	NI	ROI[15]	England – Controlled Shooting[16]	England – Cage trap and shoot[17]	England – Cage trap and vacc[18].	Wales[19]
Open	1 Jul. – 30 Nov.	New areas for badger intervention: 1 Apr. – 31 Jan.	1 Jun. – 31 Jan.	1 Jun. – 30 Nov.	1 May - 30 Nov.	1 Jul. – 30 Nov.
Closed	1 Dec. – 30 Jun.	New areas for badger intervention: 1 Feb. – 31 Mar.	1 Feb. – 31 May	1 Dec. – 31 May	1 Dec. - 30 Apr.	1 Dec. – 30 Jun.
Note		In the ROI, existing intervention areas are “open” all year round. Little culling takes place in the summer months due to vegetation growth.				

2.13.2 The open seasons differ between countries. For example, the ROI can deploy stopped restraint trapping during 10 months of a year for new areas, and all year round for areas already under intervention. As the stopped restraints are set to capture badgers of a certain size, this allows time for smaller badgers to mature to the stage where they have a chance of being caught for treatment (cull or vaccination in the ROI). In contrast, NI’s current short open season would likely limit the effectiveness of the stopped restraint trapping approach as smaller badgers would be missed.

2.13.3 A pragmatic approach needs to be taken to extrapolate high level intervention costs from England and the ROI to a 100km^2 indicative area, and therefore it is assumed that the open season in NI could, in theory, be changed to mirror that of the country where the option approach is currently operational. For instance, when considering options using cage traps, as this trapping approach has been used in the DAERA TVR Pilot in NI, it is assumed that the open season is as per the NI current open season. When considering options involving stopped

[15] Parliamentary Question No. 221 from Maureen O’Sullivan to Minister for DAFM (Simon Coveney) 20/2/2014. Answer includes “Capturing of badgers is not permitted during the months of February and March (the breeding season) in new capture areas.” Newsletter Spring 2014
[16] Badger cull FAQs | Badger Trust
[17] Badger cull FAQs | Badger Trust
[18] Summary of badger vaccination in 2024 - GOV.UK
[19] Natural Resources Wales / Badger licensing

restraint traps, it is assumed that the open season could be changed to mirror that used for stopped restraint trapping in the ROI. When considering the option involving a predominant controlled shoot approach, as this method has been used by DEFRA in England, it is assumed that the open season mirrors that used in England for controlled shooting. With this open season assumption, it is also assumed that each method could achieve access to broadly the same percentage of badgers (discussed in para. 2.14.5 for cage trapping, 2.16.3 for restraint trapping, and 2.20.8 for controlled shooting).

2.13.4 The issue of open season will be revisited in the future, as necessary, depending on what option ends up being "preferred" for deployment.

2.14 Cost assumptions for Option 6: Proactive selective cull via a TVR approach using cage trapping, deployed by the public sector

2.14.1 Having piloted the TVR approach with cage trapping in Banbridge between 2014 and 2018, DAERA has 'on the ground' intervention experience which can be used to inform assumptions. However, in reality, many metrics will differ from area to area, and access to badgers can also be affected by a number of factors, such as residual badger density and population demographics, the immigration rate (affected by boundaries and surrounding badger density), food abundancy and weather conditions. Therefore, pragmatic assumptions must be made to estimate the likely intervention costs in an indicative 100km^2. Note that assumptions are not forecasts.

Badger population estimate

2.14.2 For an indicative 100km^2 area, a starting population of 423 badgers is assumed[20].

Badger *Mycobacterium bovis* prevalence (before intervention)

[20] QUB / Reid model outputs. Reid, N., Etherington, T.R., Wilson, G.J., Montgomery, W.I. and McDonald, R.A. (2012). Monitoring and population estimation of the European badger *Meles meles* in Northern Ireland. *Wildlife Biology*, **18**, 46-57.

2.14.3 Byrne et al (2024)[21] explains that while accurate figures on the prevalence of *Mycobacterium bovis* in badgers are recognised as being difficult to assess given likely regional variation and the lack of sensitivity of diagnostic investigation tools, multiple surveys in recent years have indicated that a substantial proportion (12%–43%[22] depending on the protocols used) of the Irish badger population is infected with *Mycobacterium bovis.* The NI survey of badgers found dead due to Road Traffic Accidents suggests that badger prevalence is ~20%. The results from the DAERA TVR Pilot in Banbridge estimated prevalence of 14%[23]. As a pragmatic assumption to allow an estimation of costs of each option, an initial *M. bovis* prevalence rate of 25% is assumed.

Badger *Mycobacterium bovis* prevalence (after intervention)

2.14.4 Modelling of bTB intervention strategies in NI has indicated that a TVR approach should be as effective as non-selective culling, provided it does not cause a perturbation effect[24]. The Banbridge pilot analysed the ranging behaviour of badgers and concluded that the TVR approach did not induce a perturbation effect in that area[25]. Furthermore, in the TVR Pilot project conducted in Banbridge, the estimated annual badger *Mycobacterium bovis* infection prevalence was shown to fall from a starting level of 14% to 2% by the end of the five years of TVR intervention[26]. This is an annual decline of 39.1% in the estimated annual badger *Mycobacterium bovis* infection prevalence, and

[21] Byrne, Andrew W., Allen, Adrian, Ciuti, Simone, Gormley, Eamonn, Kelly, David J., Marks, Nikki J., Marples, Nicola M., Menzies, Fraser, Montgomery, Ian, Newman, Chris, O'Hagan, Maria, Reid, Neil, Scantlebury, David M., Stuart, Peter, Tsai, Ming-shan, Badger Ecology, Bovine Tuberculosis, and Population Management: Lessons from the Island of Ireland, Transboundary and Emerging Diseases, 2024, 8875146, 18 pages, 2024. https://doi.org/10.1155/2024/8875146

[22] Byrne A. W., Kenny K., Fogarty U., O'Keeffe J. J., More S. J., McGrath G., Teeling M., Martin S. W., and Dohoo I. R., Spatial and temporal analyses of metrics of tuberculosis infection in badgers (*Meles meles*) from the Republic of Ireland: trends in apparent prevalence, *Preventive Veterinary Medicine*. (2015) **122**, no. 3, 345–354, https://doi.org/10.1016/j.prevetmed.2015.10.013, 2-s2.0-84949654731.

[23] Arnold ME, Courcier EA, Stringer LA, McCormick CM, Pascual-Linaza AV, Collins SF, et al. (2021) A Bayesian analysis of a Test and Vaccinate or Remove study to control bovine tuberculosis in badgers (Meles meles). PLoS ONE 16(1): e0246141. https://doi.org/10.1371/journal.pone.0246141. A Bayesian analysis of a Test and Vaccinate or Remove study to control bovine tuberculosis in badgers (Meles meles) | PLOS One

[24] Smith, G.C., Delahay, R.J., McDonald, R.A. and Budgey, R. (2016). Model of selective and non-selective management of badgers (*Meles meles*) to control bovine tuberculosis in badgers and cattle. *PLoS ONE*, **11 (Nov)**, e0167206.doi:10.1371/journal.pone.0167206.

[25] O'Hagan MJH, Gordon AW, McCormick CM, et al. Effect of selective removal of badgers (Meles meles) on ranging behaviour during a 'Test and Vaccinate or Remove' intervention in Northern Ireland. Epidemiology and Infection. 2021;149:e125. doi:10.1017/S0950268821001096. Effect of selective removal of badgers (Meles meles) on ranging behaviour during a 'Test and Vaccinate or Remove' intervention in Northern Ireland | Epidemiology & Infection | Cambridge Core

[26] Arnold, M.E., Courcier, E.A., Stringer, L.A., McCormick, C.M., Pascual-Linaza A.V., Collins, S.F., Trimble, N.A., Ford, T., Thompson, S. Corbett, D. and Menzies, F.D. (2021). A Bayesian analysis of a test and vaccinate or remove study to control bovine tuberculosis in badgers. *PLoS ONE*, **16**, e0246141. https://doi.org/10.1371/journal.pone.0246141

this annual percentage decline is assumed for the purposes of deriving cost estimations.

Badger cage capture rate (NI open season 1 Jul – 30 Nov.)

2.14.5 An annual badger capture rate of 55% is proposed for options involving cage trapping. This capture rate is similar to that calculated during the TVR project[27]. Therefore, in year 1, the number of unique badgers captured is estimated to be 233.

Sett-side test and number of badgers removed

2.14.6 It is assumed that all unique badgers captured (i.e. not in-year re-captures) will be anaesthetised to allow blood to be drawn from the jugular vein. This will be applied to a sett side test which is used to determine if a badger is infected with bTB.

2.14.7 For the purposes of estimating costs, it is assumed that the Dual Platform Path (DPP) test is deployed sett-side. The test characteristics of the DPP test (band 1 only) with whole blood samples is estimated to have a sensitivity of 70% and a specificity of 97%[28]. For example, in year 1, if 233 badgers are captured, and if *Mycobacterium bovis* prevalence is 25%, then the true number of infected badgers is likely to be 58. With a DPP test (band 1) sensitivity of 70%, around 41 will be identified (true positives). In addition, some false positive badgers will be removed so, for costing purposes, it is assumed that the total number of badgers removed in year 1 is 46.

2.14.8 As badgers are anaesthetised to allowing the drawing of blood for the sett-side test, it is relatively easy to implant a microchip for identification purposes, and this is the form of identification assumed for badgers in the TVR options similar

[27] Menzies, F.D., McCormick, C.M., O'Hagan, M.J.H., Collins, S.F., McEwan, J., McGeown, C.F., McHugh, G.E., Hart, C.D., Stringer, L.A., Molloy, C., Courcier, E.A., Burns, G., McBride, S.J., Doyle, L.P., McBride, K.R., McNair, J., Thompson, S., Corbett, D.M., Harwood, R.G. and Trimble, N.A. (2021). Test and vaccinate or remove: methodology and preliminary results from a badger intervention research project. *Veterinary Record*, **189**, e248. https://doi.org/10.1002/vetr.248.

[28] Arnold, M.E., Courcier, E.A., Stringer, L.A., McCormick, C.M., Pascual-Linaza A.V., Collins, S.F., Trimble, N.A., Ford, T., Thompson, S. Corbett, D. and Menzies, F.D. (2021). A Bayesian analysis of a test and vaccinate or remove study to control bovine tuberculosis in badgers. *PLoS ONE*, **16**, e0246141. https://doi.org/10.1371/journal.pone.0246141

to the previous TVR trial[29] (note that this is not possible for the vaccination only options as badgers are not anaesthetised).

Number of badgers vaccinated

2.14.9 For vaccination, it is assumed that BCG Danish (human equivalent to BadgerBCG) will be used. It is chosen as it is unlikely to interfere with the results of future DPP tests[30]. For consistency, the BCG Danish is also assumed to be used for all options involving vaccination (i.e. the other TVR options, and the vaccination only options).

2.14.10 There is no clear evidence on the length of time BCG Danish provides protection for a newly vaccinated badger and, therefore, it is unclear if annual boosters are required, or if they have a beneficial effect. However, for the purposes of estimating intervention costs, and considering the licence recommendations for BCG Danish, it is assumed that unique badgers caught that have a DPP negative test result will be vaccinated once per year[31].

Regeneration rate

2.14.11 As the cost calculations require an estimate of the number of badgers caught and treated over five years, a regeneration rate needs to be assumed. The regeneration rate encompasses births, deaths and migration of badgers into and out of the population. In practical terms, the TVR approach has a relatively low level of badger removals (46 in year 1 which is 11% of the estimated starting population), so it is assumed that the badger population returns to its normal population size (i.e. 423 badgers) at the start of each year. (This is aligned to what was observed in the TVR study where a stable population of 560 was estimated over the five years[32]).

[29] Menzies, F.D., McCormick, C.M., O'Hagan, M.J.H., Collins, S.F., McEwan, J., McGeown, C.F., McHugh, G.E., Hart, C.D., Stringer, L.A., Molloy, C., Burns, G., McBride, S.J., Doyle, L.P., Courcier, E.A., McBride, K.R., McNair, J., Thompson, S., Corbett, D.M., Harwood, R.G. and Trimble, N.A. (2021), Test and vaccinate or remove: Methodology and preliminary results from a badger intervention research project. Veterinary Record, 189: no-no e248. https://doi.org/10.1002/vetr.248

[30] Another vaccination (BCG Sofia) is available but as it may interfere with DPP test, it is not assumed to be used for the purposes of deriving cost estimates.

[31] DEFRA Guidance on Badger Vaccination: BV-Vet-guidance-2-page-version_18.08.2025.pdf

[32] Menzies, F.D., M^{c}Cormick, C.M., O'Hagan, M.J.H., Collins, S.F., McEwan, J., M^{c}Geown, C.F., McHugh, G.E., Hart, C.D., Stringer, L.A., Molloy, C., Courcier, E.A., Burns, G., McBride, S.J., Doyle, L.P., M^{c}Bride, K.R., McNair, J., Thompson, S., Corbett, D.M., Harwood, R.G. and Trimble, N.A. (2021). Test and vaccinate or remove: methodology and preliminary results from a badger intervention research project. *Veterinary Record*, **189**, e248. https://doi.org/10.1002/vetr.248

Recaptures

2.14.12 In the second year, with the population assumed to be regenerated to 423 badgers, again 55% (233) are assumed to be caught. Of those remaining after the DPP test is carried out (202 badgers), it is assumed that 50% (101) of these will have been caught in the previous year (i.e. are recaptures). Therefore, 50% of vaccinated badgers are not recaptured. This is in line with the experience of the TVR Pilot[33].

2.14.13 This differentiation helps with various costs assumptions, for example, microchips are assumed to be applied only to unique badgers caught in a year that have not previously been caught and microchipped; but the vaccination cost assumes that each unique badger caught within a year (with a DPP negative result) will be given a vaccination, whether previously vaccinated or not.

Badger number estimates used to underpin cost assumptions

2.14.14 The data in the yellow columns of table 2 below provide the badger numbers used in the cost assumptions for this TVR option.

[33] In the TVR Pilot, 46% and 54% of badgers were caught in consecutive years (2015/16 & 2016/17). DAERA (2017). Test and vaccinate or remove (TVR) wildlife intervention research project - year 4 report. https://www.daera-ni.gov.uk/publications/tvr-wildlife-intervention-research-project-year-4-report-2017

Table 2: Pragmatic assumptions for a TVR intervention using cage trapping over a 100km^2 area for 5 years.

Year	No. of badgers start	No. of badgers captured	No. of DPP Positive Badgers	In year - No. of badgers vaccinated – on every recapture	In year – No. of badgers vaccinated – unidentified only	Badger bTB Prevalence (%)	No. of badgers bTB infected and captured	No. of badgers DPP +ve (true positives)	No. of badgers DPP +ve (false +ve)
1	423	233	46	187	187	25%	58	41	5
2	423	233	31	202	101	15%	35	25	6
3	423	233	21	211	106	9%	22	15	6
4	423	233	16	217	108	6%	13	9	7
5	423	233	12	220	110	2%	8	6	7
Total		**1,165**	**126**	**1,037**					

Costs

2.14.15 The main costs items included were: purchase of jeeps/trailers to transport cages and their running costs, power washing, badger capture labour, treatment labour (vets to apply TVR), training, travel/subsistence, personal protective equipment and disinfection, mobile phones/tariffs, purchase of cages, their delivery to NI, equipment for their digging in and immobilisation, leasing a site with facilities to store the cages, bait (peanuts) to attract badgers into the cages, and for the disposal and rendering of the carcases of badgers removed, as well as the TVR specific costs relating to tests/drugs, microchips/applicators/readers, static and mobile fridges for drug storage, peli cases, sampling kits as well as some recovery boxes.

2.15 Cost assumptions for Option 7: Proactive selective cull via a TVR approach using cage trapping, deployed by the private sector

2.15.1 DAERA could not source any estimates of private sector cage trapping for the cost analyses. So, to derive a private sector equivalent cost estimate, most costs from the public sector option were carried forward into the private sector option, including the cage trapping and TVR labour effort estimates (hours of labour deployed by grade of staff), and a private sector equivalent was estimated by:

a) Reducing the labour cost / hour of labour effort[34];
b) Including a proxy rental value for the use of jeeps/trailers (instead of assuming vehicles/trailers are purchased which is the assumption under the public sector deployed option);
c) Adding in a proxy profit margin; and
d) Other minor adjustments[35].

[34] NISRA's Annual Survey of Hours and Earnings (ASHE) statistics were considered to derive a percentage adjustment to public sector labour costs to reflect the lower level of private sector wage rates. Annual Survey of Hours and Earnings | Northern Ireland Statistics and Research Agency
[35] To PPE cost estimates to reflect short-term use; no subsistence payments; no phone purchase/tariffs.

2.15.2 If a private sector option was to be taken forward in reality, it is likely that a market testing exercise would be undertaken to ascertain contractor interest and the range of indicative costs. This would allow private sector cost estimates to be reconsidered before proceeding.

2.15.3 As discussed earlier, the details of the assumptions used are not outlined in detail in order to avoid compromising any potential future procurement exercise.

2.16 Cost assumptions for Option 8: Proactive selective cull via a TVR approach using stopped restraint trapping, deployed by the private sector

2.16.1 DAERA does not have any experience of using stopped restraint trapping. It is the approach predominantly used for badger intervention in the ROI where a private sector company traps badgers under a contract with the Department of Agriculture, Food and the Marine (DAFM) contract. DAERA secured some high-level information from DAFM in the ROI which allows an estimation of the cost per badger trapped in euros, which is then converted to sterling.

2.16.2 As previously discussed, the ROI's trapping open season is 10 months for new intervention areas, and all year round for existing areas. To extrapolate this cost per badger trapped to a 100km^2 intervention area, it must be assumed that NI's open season could, in theory, be changed to align with the ROI's which would then accommodate the ROI's stopped restraint trapping approach.

2.16.3 As the TVR Pilot project is used to understand the number of badgers likely to be accessed for TVR using cage trapping, it is assumed that the stopped restraint trapping approach (complemented with the ROI's longer open season) would allow a similar number of badgers to be treated in a year. This appears to be a reasonable assumption on the basis that the ROI achieved a trapping rate of around 35% per trapping cycle and carry out two trapping cycles per

year[36]. So, the ROI's cost per badger trapped using stopped restraints, once converted to sterling, is then applied to the number of badgers that were assumed to be trapped under the cage trap TVR approach (as outlined in table 2 above).

2.16.4 It is also assumed that the badger captured in the stopped restraint can be immobilised to allow the application of anaesthetic, which in turn allows the TVR approach to be applied.

2.16.5 From the information from DAFM, it is assumed that the extrapolated ROI cost per badger trapped includes the provision of a private sector contractor's transport (jeep use), personal protective equipment for catching staff, any vehicle power washing required, and all other costs associated with trapping badgers, as well as carcase disposal (bags, transport and rendering).

2.16.6 A separate cost is inserted for the purchase of stopped restraints, assuming that 1,500 stopped restraints are required per 100km^2. Separate costs are also included for the TVR treatment costs (e.g. Vet time, PPE, microchips including applicators and readers, anaesthetic, DPP test, euthanising drug, vaccinations, recovery boxes, etc.), training time/fees (as the contract might require specific training that contractors do not currently hold). As bait is only required for cage trapping, there is no bait cost included in the estimated cost for stopped restraint options.

2.17 Cost assumptions for Option 2: Proactive non-selective cull approach using cage trapping, deployed by the public sector

2.17.1 Except for the predominant controlled shooting option, the other non-selective cull options assume that the badgers are first trapped, then removed (shot).

[36] Cage trapping rate of 55% assumed, based on DAERA TVR project (Menzies, et al (2021). Test and vaccinate or remove: methodology and preliminary results from a badger intervention research project. Veterinary Record, 189, e248. Test and vaccinate or remove: Methodology and preliminary results from a badger intervention research project - Menzies - 2021 - Veterinary Record - Wiley Online Library). ROI achieved ~35% per trapping cycle (Byrne et al. (2012) Population Estimation and Trappability of the European Badger (Meles meles): Implications for Tuberculosis Management. PLoS ONE 7(12): e50807. Population Estimation and Trappability of the European Badger (Meles meles): Implications for Tuberculosis Management | PLOS One. The ROI carries out two trapping cycles per year in contrast to the NI TVR project which relied on one trapping cycle per year. Therefore, the restraint annual trapping rate is not dissimilar to that assumed for cage trapping.

Options 2 and 3 assume badgers are first trapped in cages. DAERA understands the effort involved in cage trapping badgers from its experience of the TVR Pilot conducted in Banbridge. Generally, the same trapping effort was assumed to apply to trapping badgers for a non-selective cull, except that the three-week trap cycle used in the pilot is reduced to a two-week trap cycle (see paragraphs 2.12.3 and 2.12.4).

2.17.2 Many of the main assumptions for the TVR approach are also applied to non-selective cull options, such as the starting badger population estimate, *M. bovis* prevalence before and after intervention, cage capture rate, etc.

Regeneration rate

2.17.3 The suggested target with a non-selective culling approach is to reduce and maintain the badger population within an area to less than 30% of its original population[37,38]. The working assumption used was that this would be achieved by the end of Year 4 of a non-selective cull. Therefore, through back-calculation, the regeneration rate (which, for the purposes of these assumptions, is defined as the net overall annual change in badger numbers caused by births, deaths and immigrant badgers) is 45%, assuming a linear relationship. The decrease in badger numbers is postulated to result in an excess food abundance, which would lead to enhanced regeneration rates (70%) in later years of culling.

Badger number estimates used to underpin cost assumptions

2.17.4 The pink column of Table 3 below provides the badger numbers used in the cost assumptions.

Table 3: Pragmatic assumptions for a Non-selective Cull intervention using cage trapping over a 100km^2 area for 5 years.

Year	No. of badgers start	No. of badgers captured	No. of badgers remaining	Regeneration rate

[37] TBSPG (2016). TBSPG Bovine TB Eradication Strategy NI | Department of Agriculture, Environment and Rural Affairs
[38] Woodroffe, R., Gilks, P., Johnston, W.T., Le Fevre, A.M., Cox, D.R., Donnelly, C.A., Bourne, F.J., Cheeseman, C.L., Gettinby, G., McInerney, J.P. and Morrison, W.I. (2008). "Effects of culling on badger abundance: implications for tuberculosis control". Journal of Zoology, 274, 28-37.

1	423	233	190	0.45
2	276	152	124	0.45
3	180	99	81	0.45
4	118	65	53	0.7
5	90	49	40[39]	0.7
Total		**598**		

Differences from TVR

2.17.5 As this option is a proactive non-selective cull, labour, gun and ammunition costs are included for trapped badgers to be shot in the trap. As a larger number of badgers are removed, the disposal/rendering costs are higher for this option compared to TVR. However, the TVR specific costs listed at the end of para. 2.14.15 are not applicable to non-selective cull options.

2.18 Cost assumptions for Option 3: Proactive non-selective cull approach using cage trapping, deployed by the private sector

2.18.1 The estimates for option 2 (public sector deployed non-selective cull) were mostly carried forward for Option 3 (private sector deployed non-selective cull), except for the adjustments described in section 2.15 which were used to approximate the indicative potential cost of private sector deployment.

2.19 Cost assumptions for Option 4: Proactive non-selective cull approach using stopped restraint trapping, deployed by the private sector

2.19.1 Section 2.16 describes how the costs of the cage trap TVR approach is converted to the stopped restraint trap TVR approach. The same conversion process is used for cull options. Therefore, it is assumed that the stopped restraint trapping approach (complemented with the ROI's longer open season) would allow a similar number of badgers to be culled as a cage trap option in a year. So, the ROI's cost per badger trapped using stopped restraints, once converted to sterling, is then applied to the number of badgers that were assumed to be trapped under the cage trap non-selective cull approach (as outlined in table 3 above).

[39] Calculates to 41, but some rounding changes.

2.19.2 As discussed in section 2.16, from the information from DAFM, it is assumed that the extrapolated ROI cost per badger trapped includes the provision of a private sector contractor's transport (jeep use), personal protective equipment for catching staff, any vehicle power washing required, and all other costs associated with trapping badgers, as well as carcase disposal (bags, transport and rendering).

2.19.3 A separate cost is inserted for purchase of stopped restraints. Separate costs are also included for training time/fees (as the contract might require specific training that contractors do not currently hold). As bait is only required for cage trapping, there is no bait cost included in the estimated cost for stopped restraint options.

2.20 Cost assumptions for Option 5: Proactive non-selective cull approach using a predominant controlled shoot approach, deployed by the private sector

2.20.1 DAERA does not have any experience of using a predominant controlled shooting approach. It was the approach used for England's initial approach to badger intervention, where controlled shooting was the predominant deployment method but was complemented with some cage trap and shoot deployment, especially in terrain not suitable for controlled shooting[40].

2.20.2 In England, government sets licence conditions and protocols for deployment, etc. Farmer controlled companies apply for a licence to undertake deployment in their area. The Animal and Plant Health Agency (APHA) provide training, mentoring and advice, and Natural England processes the licence applications and undertakes monitoring. The farmer-controlled companies employ trained marksmen to shoot badgers as they roam fields in the late evenings / night.

[40] Around 70% of badgers removed in 2019 were by C.S; 30% removed by cage trapping.

2.20.3 The DEFRA Value for Money Analyses published show that the cost of the Predominant Controlled Shoot intervention reduced over time. The DEFRA 2019 VFM assessment costs were used as the source costs for this option as it was one of the most recent assessments that provided both an estimate of the cost to government and to industry[41]. The 2019 cost estimates were for an area of average size 632km^2. They were adjusted pro-rata to 100km^2 and were uplifted by inflation to 2026/27 prices.

2.20.4 From the information from DEFRA, it is assumed that the extrapolated England predominant controlled shoot cost (adjusted pro-rata to 100km^2) includes the provision of a transport, personal protective equipment, as well as carcase disposal (bags, transport and rendering).

2.20.5 Separate costs are included for GPS tracking devices. Compared to Option 2 (cage trapping non-selective cull), 30% of the cage requirement is assumed as well as their delivery to NI. No site leases are included for cage storage as it is assumed that they are stored at no additional cost on farms.

2.20.6 It is assumed that the private sector deployment companies would conduct their own training, so the APHA training cost (once adjusted pro-rata to 100km^2, adjusted from a full economic cost to a paybill cost, and uplifted for inflation) is adjusted by ASHE statistics[42] to reflect lower private sector labour rates.

2.20.7 As previously discussed, and outlined in table 1, England's open season is different (longer) than that current used in NI. So to extrapolate England's deployment cost to a 100km^2 intervention area, it must be assumed that NI's open season could, in theory, be changed to align with England's.

2.20.8 When England commenced their proactive non-selective cull in 2013, the percentage split of badgers removed was 66% by controlled shooting and 34%

[41] DEFRA appears to use broadly similar industry (farmer deployment) in the 2019 and 2020 VFM assessments. Subsequent DEFRA VFM Assessments do not provide estimates of industry costs. For example, the 2021 assessment says "In previous years estimates of costs to industry were included in the VfM analysis but this data is not available for the analysis in 2021 so industry costs have not been monetised as part of this VfM statement."

[42] NISRA: Annual Survey of Hours and Earnings, Annual Survey of Hours and Earnings | Northern Ireland Statistics and Research Agency

by cage trapping in Gloucestershire, and 46% by controlled shooting and 54% by cage trapping in Somerset[43]. It is estimated that this cull removed somewhere between 43.0% and 55.7% of the badger population in Gloucestershire and between 37.0% and 50.9% in Somerset (based on 95% confidence intervals)[44]. For costing purposes, it is assumed that a 100% cage trapping approach would trap 55% of the estimated population (where the 55% is an estimate from the TVR project, as discussed under section 2.14.5). Therefore while it is perhaps rather optimistic to assume that the predominant controlled shooting approach would remove the same number of badgers in a year as assumed for Option 2 (cage trapping non-selective cull), this is a pragmatic assumption for the purposes of costing options on the basis that 55% is at the upper end of the range for Gloucestershire and just beyond the upper end of the Somerset range, and that the approach had just started in 2013. Ultimately, while the TVR cage trapping efficiency estimate of 55% is used for option 2, it also can vary (e.g. a Welsh analysis of cage trapping on three different farms suggested cage trapping efficiency of 38%, 53% and 55%)[45]. Therefore, there is likely to be a range of trapping efficiencies in reality for all options, and as such, the pragmatic assumption to use the same badger numbers for costing purposes seems reasonable.

2.21 Cost assumptions for Option 9: Proactive non-selective vaccination approach using cage trapping, deployed by the public sector

2.21.1 The estimates for Option 6 (public sector deployed TVR) were mostly carried forward for Option 9 (public sector deployed vaccination). For instance, the same trapping effort is required, however instead of needing veterinary labour (tests, drugs, microchips, etc.) for TVR, it is assumed that the Animal Health

[43] During the entire period of industry-lead culling in 2013, a total of 924 badgers were reported culled under licence in the Gloucestershire pilot area, 610 of which were taken by controlled shooting. The total number reported culled in the Somerset pilot area was 955, 439 of which were taken by controlled shooting. The efficacy of badger population reduction by controlled shooting and cage trapping, and the change in badger activity following culling from 27/08/2013 to 28/11/2013

[44] Animal Health and Veterinary Laboratories Agency (2014). "The efficacy of badger population reduction by controlled shooting and cage trapping, and the change in badger activity following culling from 27/08/2013 to 28/11/2013". Report to DEFRA. The efficacy of badger population reduction by controlled shooting and cage trapping, and the change in badger activity following culling from 27/08/2013 to 28/11/2013

[45] Animal & Plant Health Agency (2014). "Estimating abundance and collecting evidence for population change in badgers, following trapping and testing interventions on Welsh farms". https://www.gov.wales/sites/default/files/publications/2020-09/bovine-tb-badger-population-survey.pdf

and Welfare Inspectors (AWHIs) who trap badgers, also vaccinate them. If this option was to be implemented, legislation would need to be put in place to allow this 'lay' vaccination of badgers.

2.21.2 For consistency with the TVR options, the vaccine assumed is BCG Danish, and it is assumed that each unique badger caught in a year is vaccinated. As badgers are not anaesthetised for vaccination, it is not possible to identify them with implanted microchips. Therefore, it will not be known if the badger has been caught and vaccinated in a previous year. Instead, vaccinated badgers are given a mark (e.g. clip mark / spray paint) so that badgers recaptured in the same year are not re-vaccinated. But this mark will not generally be visible the following year.

2.21.3 In contrast to the TVR and cull options, no badgers are removed, and therefore there is no carcase disposal / rendering cost.

2.21.4 The pink column of Table 4 below provides the badger numbers used in the cost assumptions.

Table 4: Pragmatic assumptions for a Vaccination intervention using cage trapping over a 100km^2 area for 5 years.

Year	No. of badgers start	No. of unique badgers captured and vaccinated in a year
1	423	233
2	423	233
3	423	233
4	423	233
5	423	233
Total		**1,165**

2.22 Cost assumptions for Option 10: Proactive non-selective vaccination approach using cage trapping, deployed by the private sector

2.22.1 The estimates for option 9 (public sector deployed vaccination) were mostly carried forward for option 10 (private sector deployed vaccination), except for

the adjustments described in section 2.15 which were used to approximate the indicative potential cost of private sector deployment.

2.22.2 In addition, as discussed for Option 9, vaccination costs are included rather than TVR costs (see section 2.21), and the assumptions on the number of badgers vaccinated per year are as outlined in Table 4.

2.23 Cost assumptions for Option 11: Proactive non-selective vaccination approach using stopped restraint trapping, deployed by the private sector

2.23.1 Section 2.16 describes how the costs of the cage trap TVR approach is converted to the stopped restraint trap TVR approach. The same process is used to convert the cost of cage trap vaccination to stopped restraint trap vaccination. Therefore, it is assumed that the stopped restraint trapping approach (complemented with the ROI's longer open season) would allow a similar number of badgers to be vaccinated in a year as a cage trap option. So, the ROI's cost per badger trapped using stopped restraints, once converted to sterling, is then applied to the number of badgers that were assumed to be trapped under the cage trap vaccination approach (as outlined in table 4 above).

2.23.2 The general vaccination method is described in section 2.21.

2.24 Summary of cost items considered to derive the variable cost of each shortlisted option

2.24.1 Indicative total variable costs are provided in the Badger Intervention Options Analysis **(Annex VIII)** for each shortlisted option. Table 5 provides an overview of the items included within the total variable cost for which a cost is assumed.

Table 5: List of items for which a cost is assumed for each shortlisted option.

Item	Opt. 2. Non-selective Cull – Cage Trap by Public Sector	Opt. 3 Non-selective Cull – Cage Trap by Private Sector	Opt. 4. Non-selective Cull – Restr. Trap by Private Sector	Opt. 5. Non-selective Cull – Controlled Shoot by Private Sector	Opt. 6. Select. Cull via TVR – Cage Trap by Public Sector	Opt. 7. Select. Cull via TVR – Cage Trap by Private Sector	Opt. 8. Select. Cull via TVR – Restr. Trap by Private Sector	Opt. 9 Vacc– Cage Trap, Public sector	Opt. 10 Vacc– Cage Trap, Private sector	Opt. 11 Vacc– Restr. Trap, Private sector
Trapping labour	Staff: AWHIs, Group 4, HSO[46]	AWHI, Group 4, HSO with a reduction based on ASHE[47] Stats. to represent cheaper private sector labour.	Labour incl. in estimated private sector cost (based on info. from ROI)	Farmer Company estimated deployment cost from info. from DEFRA[48]. (Assumed this incl. 30% of badgers removed via cage-trapping).	Staff: AWHI, Group 4, HSO, Vet	AWHIs, Group 4, HSO, Vet with a reduction based on ASHE Stats. to represent cheaper private sector labour.	Labour incl. in estimated private sector cost (based on info. from ROI). Added on TVR treatment costs from Opt. 7	As Opt. 2 Added on Vacc. costs	As Opt. 3 Added on Vacc. costs	As Opt 4. Added on Vacc. costs
Treatment	Shoot AHWI (+ gun & ammunition)	Shoot AHWI (+ gun & ammunition)	Shoot AHWI (+ gun & ammunition)	Predominantly involves marksmen shooting free roaming badgers. (Assumed 30% trapped in cages then shot)	From TVR Pilot: Vets (+Microchips incl. applicators & readers; drugs & vaccine; etc.)	From TVR Pilot: Vets (+Microchips incl. applicators & readers; drugs & vaccine; etc.)	From TVR Pilot: Vets (+Microchips incl. applicators & readers; drugs & vaccine; etc.)	Vacc. inject. into conscious badger, mark applied so no in-yr repeat. Next yr repeats if re-caught.	Vacc. inject. into conscious badger, mark applied so no in-yr repeat. Next yr repeats if re-caught.	Vacc. inject. into conscious badger, mark applied so no in-yr repeat. Next yr repeats if re-caught

[46] Animal Health and Welfare Inspector (Group 1 Inspector staff equivalent); Group 4 Inspector; Health and Safety Officer (Staff Officer equivalent).
[47] NI Annual Survey of Hours and Earnings (ASHE) statistics
[48] DEFRA 2019 Value for Money Analysis.

Item	Opt. 2. Non-selective Cull – Cage Trap by Public Sector	Opt. 3 Non-selective Cull – Cage Trap by Private Sector	Opt. 4. Non-selective Cull – Restr. Trap by Private Sector	Opt. 5. Non-selective Cull – Controlled Shoot by Private Sector	Opt. 6. Select. Cull via TVR – Cage Trap by Public Sector	Opt. 7. Select. Cull via TVR – Cage Trap by Private Sector	Opt. 8. Select. Cull via TVR – Restr. Trap by Private Sector	Opt. 9 Vacc– Cage Trap, Public sector	Opt. 10 Vacc– Cage Trap, Private sector	Opt. 11 Vacc– Restr. Trap, Private sector
Training Time & fees	Based on DAERA TVR Pilot, adjusted for cull	Based on DAERA TVR Pilot, adjusted for cull, and private sector deployment	Based on DAERA TVR Pilot, adjusted for cull, and private sector deployment	Based on DEFRA info., adjusted to 100km^2	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot, adjusted for private sector deployment	Based on DAERA TVR Pilot, adjusted for private sector deployment	As Opt. 2 Added on Vacc. costs	As Opt. 3	As Opt 4.
Field equipment	Based on DAERA TVR Pilot, adjusted for cull	Based on DAERA TVR Pilot, adjusted for cull	Ass. equip incl. in ROI private sector cost estimate	Assumed incl. in Farmer Cull Co. Estimated Cost	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Ass. equip incl. in ROI private sector cost estimate (adj. for TVR)	As opt. 2	As opt. 3	As opt. 4
Phones & Tariffs	Based on DAERA TVR Pilot, adjusted for cull	N/A (Private sector would have own phones.)	N/A (Private sector would have own phones.)	As Opt. 3 + Added in a one-off cost for DEFRA live location feed GPS devices in yr 1 (pro-rata 100km^2)	Based on DAERA TVR Pilot	As opt. 3.	As opt. 4	As opt. 2	As opt. 3.	As opt. 4
Vehicle/Trailer costs & power washing	Based on DAERA TVR Pilot, which is the same for cage-cull	Based on DAERA TVR Pilot, which is the same for cage-cull	Assumed incl. in estimated ROI private sector cost	Assumed incl. in Farmer Cull Co. Estimated Cost	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Assumed incl. in estimated ROI private sector cost	As opt. 2	As opt. 3.	As opt. 4
Travel & Subsistence	Based on DAERA TVR Pilot, adjusted for cull	Based on DAERA TVR Pilot, adjusted for cull. Exclude subsistence.	Assumed incl. in estimated ROI private sector cost	Assumed incl. in Farmer Cull Co. Estimated Cost	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot. Exclude subsistence.	Assumed incl. in estimated ROI private sector cost, adjusted for TVR Vets	As opt. 2	As opt. 3.	As opt. 4

Item	Opt. 2. Non-selective Cull – Cage Trap by Public Sector	Opt. 3 Non-selective Cull – Cage Trap by Private Sector	Opt. 4. Non-selective Cull – Restr. Trap by Private Sector	Opt. 5. Non-selective Cull – Controlled Shoot by Private Sector	Opt. 6. Select. Cull via TVR – Cage Trap by Public Sector	Opt. 7. Select. Cull via TVR – Cage Trap by Private Sector	Opt. 8. Select. Cull via TVR – Restr. Trap by Private Sector	Opt. 9 Vacc– Cage Trap, Public sector	Opt. 10 Vacc– Cage Trap, Private sector	Opt. 11 Vacc– Restr. Trap, Private sector
Equipment for immobilising cages, digging in, bait, etc.	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	N/A as no cages	Assumed any cage trapping cost is incl. in Farmer Cull Co. Estimated Cost	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	N/A as no cages	As opt. 2	As opt. 3.	N/A as no cages
Carcase disposal (bags, transport, rendering)	Est. from TVR pilot, and from a contract DAERA currently has for an. collection & rendering	As per Opt. 2	Assumed incl. in estimated ROI private sector cost	As per Opt. 2	As per Opt. 2	As per Opt. 2	Assumed incl. in estimated ROI private sector cost	N/A as no removals	N/A as no removals	N/A as no removals
Jeeps/trailers	Assumed these would be purchased - based on DAERA TVR Pilot	Assumed an annual charge for these. (Using purchase price, and likely useful life, calculated indicative annual charge / yr.)	Assumed incl. in estimated ROI private sector cost	Assumed incl. in Farmer Cull Co. Estimated Cost	Assumed these would be purchased - based on DAERA TVR Pilot	Assumed an annual charge for these. (Using purchase price, and likely useful life, calculated indicative annual charge / yr.)	Assumed incl. in estimated ROI private sector cost	As opt. 2	As opt. 3.	As opt. 4
Storage site for cage storage	Est. site cost from quotes for another project	As for Opt. 2	N/A as no cages	Assumed any cage trapping cost is incl. in Farmer Cull Co. Estimated Cost	Est. site cost from quotes for another project	As for Opt. 6	N/A as no cages	As opt. 2	As opt. 3.	N/A as no cages

Item	Opt. 2. Non-selective Cull – Cage Trap by Public Sector	Opt. 3 Non-selective Cull – Cage Trap by Private Sector	Opt. 4. Non-selective Cull – Restr. Trap by Private Sector	Opt. 5. Non-selective Cull – Controlled Shoot by Private Sector	Opt. 6. Select. Cull via TVR – Cage Trap by Public Sector	Opt. 7. Select. Cull via TVR – Cage Trap by Private Sector	Opt. 8. Select. Cull via TVR – Restr. Trap by Private Sector	Opt. 9 Vacc– Cage Trap, Public sector	Opt. 10 Vacc– Cage Trap, Private sector	Opt. 11 Vacc– Restr. Trap, Private sector
Cages & Deliv to NI	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	N/A as no cages	Assumed 30% of badgers removed caught by cages, so used 30% of Opt. 2 cage & cage deliv. cost	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	N/A as no cages	As opt. 2	As opt. 3.	N/A as no cages
Stopped Restraints	N/A	N/A	Est. from info. from ROI	N/A	N/A	N/A	Est. from info. from ROI	N/A	N/A	Est. from info. from ROI
Sett survey labour	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot	Based on DAERA TVR Pilot
Monitoring - labour for data analysis, project leadership	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated
Monitoring – labour for monitoring standard of deployment	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated

3. TB Programme Costs and Estimation of the Cost of a Herd Breakdown Avoided

3.1 Overview of calculation approach

3.1.1 The first step is to estimate the cost of the bTB Programme to both government and farmers. The next is to attribute each of those costs, or a percentage of such, to breakdown specific effort. This breakdown cost can be divided by the number of unique cattle herd breakdowns currently happening in a year to derive the benefit of a "breakdown avoided".

3.2 Estimating the cost of the bTB Programme to Government

3.2.1 The cost of the bTB programme to DAERA in 2024/25 was around £60m. Of this, £30m relates to programme effort (e.g. PVP and DAERA staff involved in testing, tuberculin, haulier costs, etc.). The remaining £30m is the net compensation cost[49], i.e. £43m paid out in compensation for the compulsory removal of certain animals[50], for which the Department received some salvage value (-£13m), for example, where parts of the carcase were utilised by the meat processor. Compensation is paid at 100% of the market value of the animal compulsorily removed, where the market value is attributed to the animal on the assumption that it is healthy.

3.2.2 The estimates for 2025/26 and 2026/27 adds in inflation adjustments to each non-staff cost category to estimate their cost in 2025/26 and 2026/27 prices respectively. The staff numbers of the grades involved in bTB work within the boundary of the published statistics have been estimated by VSAHG for 2024/25 and 2025/26. The 2025/26 staff number estimates are carried forward for 2026/27. The estimated staff numbers for each grade in each year are multiplied by the DAERA Staff Cost Ready Reckoner for that year/grade to update the staff cost estimates. However, note that the main factors underpinning the programme's cost in 2024/25 are assumed to remain the same in 2025/26 and 2026/27. For example, it is assumed that:

- The number of cattle, and cattle herds in NI remain constant.

[49] Compensation minus salvage value is the "net" compensation cost.
[50] Skin test reactor animals, at risk skin test negative in-contact animals, animals which have been IFNG tested and are skin test negative, but IFNG positive.

- The level of disease, which affects the number of breakdowns, risk testing and the number of animals removed, remains as it is currently. This is assumed to be a reasonable assumption as the herd incidence rate for the financial year 2024/25 was 10.6%, and at the end of October 2025 (the most up to date statistic when this analysis was carried out), the rate for the previous 12 months was also 10.6%.[51]

3.2.3 The table below outlines the published bTB programme cost for 2024/25, and the estimates made for 2025/26 and 2026/27.

Table 6: 2024/25 bTB programme cost and estimates for 2025/26 & 2026/27[52]

		2024/25		2025/26		2026/27
	Non- Staff Costs	As Published		Est.		Est.
i	AFBI Vet. Science Div. Costs	£3,331,280		£3,464,531		£3,603,112
ii	Private Vet. Practitioner Costs	£13,041,816		£13,464,218		£13,734,275
iii	Haulier Costs	£740,440		£764,422		£779,754
iv	Miscellaneous	£76,849		£79,338		£80,929
v	Tuberculin	£928,378		£958,446		£977,670
vi	Condemnation Costs	£204,365		£210,984		£215,216
A=sum(i:vi)	**Subtotal Non-Staff Costs**	**£18,323,128**		**£18,941,940**		**£19,390,958**
B	**Subtotal Staff Costs - Financial**	**£8,803,587**		**£9,619,768**		**£10,045,850**
C=A+B	**Programme Effort Cost - Financial Cost**	**£27,126,715**		**£28,561,708**		**£29,436,808**
D	Programme Effort Cost - Econ. O'head Adj.	£2,641,076		£2,885,930		£3,013,755
E=C+D	**Programme Effort Cost - Economic Cost**	**£29,767,791**		**£31,447,638**		**£32,450,563**
F	Value of an. Removed prematurely	£43,140,314		£53,738,650		£53,738,650
G	Salvage value	-£12,823,681		-£14,251,836		-£14,251,836
H=F+G	**Net Animal Removed Cost**	**£30,316,633**		**£39,486,814**		**£39,486,814**
I=C+H	**Total Programme Cost Financial**	**£57,443,348**		**£68,048,522**		**£68,923,622**
J=D	Total Programme Econ. Cost Adjustment	£2,641,076		£2,885,930		£3,013,755
K=I+J	**Total Programme Econ. Cost**	**£60,084,424**		**£70,934,452**		**£71,937,377**

3.2.4 NB: The published 2024/25 figures (and estimates for 2025/26 and 2026/274) do not include the cost of senior management in disease branches of Veterinary Service's Animal Health Group, the element of Research & Development expenditure on bTB, or staff travel and subsistence. The estimated values for compensation and salvage (i.e. of animals removed) are as published for 2024/25, but have been uplifted to reflect higher cattle values in 2025/26, with the 2025/26 estimate carried forwarded for 2026/27. For the purposes of this economic analysis, some extra costs that are outside the boundary of the published figures are also considered:

[51] https://www.daera-ni.gov.uk/publications/tuberculosis-disease-statistics-northern-ireland-2025
[52] NB: Does not include the cost of a bTB Regionalisation Research Pilot Project that is to commence in early 2026.

- Research and development expenditure on bTB projects is outside the boundary of bTB dedicated programme costs. The cost of bTB R&D varies year or year, depending on the number of projects ongoing, and their stage of completion. The average expenditure on bTB related projects is estimated to be around £700-£800k per year;
- For 2025/26 and 2026/27, costs arising from the increase (and further planned increase) to the number of IFNG tests to be carried out in breakdown herds. Around 17,000 IFNG tests were conducted in 2024/25. This number increased by ~7,000 to ~24,000 in 2025/26, and the number is expected to increase by a further 6,000 in 2026/27, when ~30,000 IFNG tests will be conducted per year. This brings additional staff costs, laboratory costs, and the compulsory removal of animals that are skin test negative, but IFNG test positive, for which a salvage value may be received (see table 7 for cost estimates); and
- Travel and subsistence costs are not separated out for bTB related staff. For the purposes of this analysis, a broad-brush estimate of £250,000 per year is used.

3.2.5 It should also be noted that the DAERA staff cost in the row labelled as “B” in table 6 is underestimated as around 22 posts relating to bTB work were unfilled in 2024/25 (i.e. ~22 vacant full time equivalent posts). When these posts are filled, the programme cost will increase. This would add another £1.5-1.6m to programme costs in financial (cash) cost terms, and when the costs of staff overheads are added (i.e. the staff economic cost adjustment), the cost of the programme would increase by around £1.9-£2.1m in economic cost terms.

3.2.6 Table 7 below shows what the cost of the programme would have been in 2024/25 if the vacant posts had been filled, and what the estimated cost of the bTB programme is when the additions discussed above are included for 2025/26 and 2026/27.

Table 7 Est. of the full economic cost of the bTB programme, with additions (e.g. vacancies filled etc.)

	Extra costs	2024/25		2025/26		2026/27
L	bTB Prog. Staff Vacancies - Financial Cost	£1,455,609		£1,560,712		£1,615,695
i	Extra 25/26 IFNG test - Staff Fin. Cost	£0		£27,831		£28,916
ii	Extra 26/27 IFNG test - Staff Fin. Cost	£0		£0		£22,555
M=i+ii	Subtotal Extra IFNG Staff - Financial Cost	£0		£27,831		£51,472
iii	Extra 25/26 IFNG test - Lab. Cost	£0		£246,759		£251,709
iv	Extra 26/27 IFNG test - Lab. Cost	£0		£0		£196,341
N=iii+iv	Subtotal Extra IFNG Lab Cost	£0		£246,759		£448,049
v	bTB Travel and Subsistence Cost Estimate	£250,000		£250,000		£250,000
vi	bTB R&D Estimate	£758,876		£789,231		£820,800
O=v+vi	Subtotal T&S and R&D	£1,008,876		£1,039,231		£1,070,800
P=L+M+N+O	Extra Prog. Effort - Financial Cost	£2,464,485		£2,874,533		£3,186,016
vii	Vacancies - Staff Econ. Oh'd Adj.	£436,683		£468,214		£484,709
viii	Extra 25/26 IFNG test - Staff Econ. Oh'd Adj	£0		£8,349		£8,675
ix	Extra 26/27 IFNG test - Staff Econ. Oh'd Adj	£0		£0		£6,767
Q=vii+viii+ix	Subtotal Economic O'head Adjustment	£436,683		£476,563		£500,150
R=P+Q	Extra Prog. Effort - Economic Cost	£2,901,167		£3,351,096		£3,686,166
	Net Animal Removed Cost Calculation					
x	Extra 25/26 IFNG test - Addit. Comp.	£0		£1,662,350		£1,662,350
xi	Extra 25/26 IFNG test - Addit. Salvage	£0		-£440,866		-£440,866
xii	Extra 26/27 IFNG test - Addit. Comp.	£0		£0		£1,296,684
xiii	Extra 26/27 IFNG test - Addit. Salvage	£0		£0		-£343,889
S=sum(x:xiii)	S'total Extra Net An. Removed Cost	£0		£1,221,484		£2,174,279
T=P+S	Subtotal Extra Cost (FINANCIAL)	£2,464,485		£4,096,017		£5,360,295
U=Q	Sub.Extra Staff Cost Econ. Oh'd Adjust.	£436,683		£476,563		£500,150
V=T+U	Total Prog. Extra Costs - Economic	£2,901,167		£4,572,579		£5,860,445
W=I+T	Published & Extra costs - FINANCIAL	£59,907,832		£72,144,538		£74,283,917
X=J+U	Published & Extra costs -ECON O'HD ADJ	£3,077,759		£3,362,493		£3,513,905
Y=W+X	Published & Extra Costs - ECONOMIC	£62,985,591		£75,507,032		£77,797,823

NB: Excludes the cost of senior management in disease branches of Veterinary Service's Animal Health Group

3.2.7 The early removal of animals causes a loss to the NI economy. A pragmatic approach to quantifying this loss is to assume that the market value of an animal removed is reflective of its future economic potential and, therefore, the estimate of the economic loss associated with removing animals early equates to the sum of their market values minus the sum of their salvage values (i.e. the net compensation cost).

3.3 Breakdown related element of the Government cost of the bTB Programme

3.3.1 The government database recording bTB effort shows that 35,591 herd tests were conducted in 2024/25. Of this, 11,136 were classified as “routine”, 12,741 as “risk” which are breakdown related, and 11,714 as “restricted”, which are also breakdown related.

3.3.2 The minimum bTB testing surveillance effort required by legislation varies depends on a country’s bTB annual herd incidence. When the annual herd incidence is above 1%, as was the case in NI (10.6% in 2024/25), then all herds must be tested at least once per year. Hence, this is a relatively “fixed” testing requirement, as even if bTB herd incidence levels should reduce substantially but remain above 1%, annual testing of all herds remains a requirement.

3.3.3 There are around 21,493 cattle herds in NI. Therefore, while only 11,136 of NI’s total herd tests were classified as “routine”, if follows that 10,357 of the remaining risk/restricted herd tests would be required anyhow if all herds must be tested at least once while annual herd incidence rates are above 1%. To calculate the cost of this fixed requirement, it is assumed that one test per herd per year is carried out by Private Veterinary Practitioners (PVPs). This allows an allocation of a proportion of the PVP and tuberculin costs to ‘fixed’ annual herd testing. The remainder of the testing effort is assumed to be breakdown related.

3.3.4 As regards the other bTB programme costs, assumptions can be made on each as to the percentage which is related to herd breakdowns. For example, the work undertaken by DAERA’s staff mainly emanates from herd breakdowns and their knock-on impacts; the labour allocated to IFNG testing (which takes place in breakdown herds), haulier, AFBI Veterinary Science Division IFNG lab analysis work,

condemnation costs, and the net animal removal cost, etc. are all breakdown related (i.e. 100% of these costs are allocated to the breakdown cost category).

3.3.5 Table 8 shows the allocation of published bTB programme costs to three categories:

- fixed - these costs do not vary with the level of disease, e.g. the requirement for annual herd tests;
- semi-fixed - these are costs that do not directly vary with the level of disease, but may reduce at intervals if disease levels were to reduce, e.g. some AfBI VSD work; and
- variable (i.e. breakdown) - these costs are breakdown related and do vary with the level of disease.

3.3.6 Table 9 shows how the 'extra' costs previously discussed are also allocated to these cost categories. Table 10 combines the breakdown costs from tables 8 and 9

Table 8: Allocation of published bTB programme costs to fixed, semi-fixed & variable (i.e. breakdown related)

Published Costs	**2024/25**		**2025/26**		**2026/27**
Fixed Costs (that do not vary by herd incidence)	Published		Est.		Est.
Fixed annual herd test labour costs (for 1 herd test/herd/yr. as if all carried out by PVPs)	£7,455,853		£7,697,336		£7,851,725
Fixed annual herd test tuberculin costs (for 1 herd test/herd/yr.)	£475,877		£491,290		£501,144
Staff Cost Fin (fixed)	£3,792		£0		£0
AfBI VSD Fixed	£786,940		£818,417		£851,154
Misc. Fixed (repl. of test equip etc.)	£76,849		£79,338		£80,929
Subtotal Fixed Prog. Costs - FIN.	**£8,799,312**		**£9,086,382**		**£9,284,952**
Semi-fixed Costs					
Staff Cost Fin (semi-fixed)	£0		£0		£0
AfBI VSD Semi-Fixed	£1,515,780		£1,576,412		£1,639,468
Misc. Semi-fixed (repl. of test equip etc.)	£0		£0		£0
Subtotal Semi-Fixed Prog. Costs - FIN	**£1,515,780**		**£1,576,412**		**£1,639,468**
Variable Costs (i.e. varies with disease levels)					
PVP (balance figure)	£5,585,962		£5,766,882		£5,882,551
Tuberculin (balance figure)	£452,500		£467,156		£476,526
Staff Cost Fin (Variable (BD))	£8,799,794		£9,619,768		£10,045,850
AfBI VSD Var (BD)	£1,028,560		£1,069,702		£1,112,490
Misc. Var	£0		£0		£0
Haulier	£740,440		£764,422		£779,754
Condemnation of carcass cost	£204,365		£210,984		£215,216
Subtotal Var. (BD) Prog. Costs - FIN	**£16,811,622**		**£17,898,914**		**£18,512,388**
Variable Costs Net Value of An. Removed					
Value of An. Removed	£43,140,314		£53,738,650		£53,738,650
Salvage Value of An. Removed	-£12,823,681		-£14,251,836		-£14,251,836
Subtotal Var. (BD) Net An. Remov. - FIN	**£30,316,633**		**£39,486,814**		**£39,486,814**
Total Financial Cost of bTB Prog. Govt	**£57,443,348**		**£68,048,522**		**£68,923,622**
Econ. Adjustment Fixed	£1,138		£0		£0
Econ. Adjustment Semi-fixed	£0		£0		£0
Econ. Adjustment Var. (BD)	£2,639,938		£2,885,930		£3,013,755
Total Econ. Adjustment to staff costs	**£2,641,076**		**£2,885,930**		**£3,013,755**
Total Econ. Cost of bTB Prog.	**£60,084,424**		**£70,934,452**		**£71,937,377**
Of which: Fixed Costs Economic	*£8,800,450*		*£9,086,382*		*£9,284,952*
Of which: Semi-fixed Costs Economic	*£1,515,780*		*£1,576,412*		*£1,639,468*
Of which: Variable (i.e. Breakdown) Costs Economic	*£49,768,194*		*£60,271,659*		*£61,012,957*
Check back to TOTAL ECON. COST	*£60,084,424*		*£70,934,452*		*£71,937,377*

Table 9: Allocation of extra costs to fixed, semi-fixed & variable (i.e. breakdown related)

Extra Costs included for these analyses	**2024/25**		**2025/26**		**2026/27**
Extra Fixed Costs					
Staff Vacancies - Fixed - Financial	£0		£0		£0
bTB Travel and Subsistence Cost Estimate	£92		£0		£0
bTB R&D Estimate	£0		£0		£0
Subtotal Extra Fixed Costs - Financial	**£92**		**£0**		**£0**
Extra Semi-Fixed Costs					
Staff Vacancies - semi-fixed - Financial	£0		£0		£0
bTB Travel and Subsistence Cost Estimate	£0		£0		£0
bTB R&D Estimate	£758,876		£789,231		£820,800
Subtotal Extra Semi-Fixed Costs - FIN	**£758,876**		**£789,231**		**£820,800**
Extra Variable (breakdown) Costs					
Staff Vacancies - Var. (Breakdown) - FIN	£1,455,609		£1,560,712		£1,615,695
Extra IFNG Tests 25/26 - Staff - Financial	£0		£27,831		£28,916
Extra IFNG Tests 26/27 - Staff - Financial	£0		£0		£22,555
Extra IFNG Tests 25/26 - Lab. Cost	£0		£246,759		£251,709
Extra IFNG Tests 26/27 - Lab. Cost	£0		£0		£196,341
bTB Travel and Subsistence Cost Estimate	£249,908		£250,000		£250,000
bTB R&D Estimate	£0		£0		£0
Subtotal Extra Var. (Breakdown) Costs -FIN	**£1,705,517**		**£2,085,302**		**£2,365,216**
Extra Net Animal Var (Breakdown) Costs					
Extra IFNG Tests 25/26 - An. Removed Value	£0		£1,662,350		£1,662,350
Extra IFNG Tests 25/26 - An. Salvage Value	£0		-£440,866		-£440,866
Extra IFNG Tests 26/27 - An. Removed Value	£0		£0		£1,296,684
Extra IFNG Tests 26/27 - An. Salvage Value	£0		£0		-£343,889
Subtotal Net Animal Var. (Breakdown) Cost	**£0**		**£1,221,484**		**£2,174,279**
Subtotal Extra Financial Costs	**£2,464,485**		**£4,096,017**		**£5,360,295**
Staff Economic Overh'd Cost Adjustment					
Econ. Adjustment Fixed	£161		£0		£0
Econ. Adjustment Semi-fixed	£0		£0		£0
Econ. Adjustment Var. (BD)	£436,521		£476,563		£500,150
Subtotal Extra Econ. Overh'd Cost Adj.	**£436,683**		**£476,563**		**£500,150**
Subtotal Extra Effort Economic Costs	**£2,901,167**		**£4,572,579**		**£5,860,445**
Of which: Fixed Costs Economic	*£254*		*£0*		*£0*
Of which: Semi-fixed Costs Economic	*£758,876*		*£789,231*		*£820,800*
Of which: Variable (i.e. Breakdown) Costs Economic	*£2,142,038*		*£3,783,349*		*£5,039,645*

Table 10: Estimated total breakdown costs

	2024/25		2025/26		2026/27
Original & Extra Var.(Breakdown) Costs -FIN	£48,833,772		£60,692,515		£62,538,697
Original & Extra Var. (BD) O'head Econ. Adj.	£3,076,460		£3,362,493		£3,513,905
Original & Extra Var. (Breakdown) Costs - ECON	**£51,910,232**		**£64,055,008**		**£66,052,602**

3.3.7 As outlined in Table 7, for 2025/26, the estimated programme cost becomes £75.5m if adjusted for potential extra cost items (e.g. filling vacancies, additional IFNG tests, R&D expenditure, T&S, etc.). Of this, £64.1m (85%) are estimated to be costs that relate to herd breakdowns (table 10).

3.3.8 When the cost of the programme is uplifted to 2026/27 prices (and the extra potential costs discussed above are included), the programme is expected to cost around £77.8m in 2026/27 (table 7). Of this, it is estimated that ~£66.1m will relate to herd breakdowns (table 10).

3.4 Estimating the farmer cost of complying with bTB Programme rules

3.4.1 The 2009 Better Regulation Survey (BRS) measured the time effort required for farm businesses to comply with each aspect of bTB programme rules. Time effort was provided for both farm managers and farm workers (helpers). The main aspects of the bTB programme have not changed since 2009 (herd tests, individual animal tests, presenting animals for valuation, presenting animals for collection and transport to slaughter, etc.). Therefore, the time estimates are considered relevant to the 2026/27 situation.

3.4.2 However, the value of the farmer and worker time needs to be updated, and to do this, ASHE statistics[53] were used to estimate the opportunity cost for each hour of farmer manager and worker time spent complying with TB programme requirements. The effort for each compliance action (e.g. whether a fixed cost per test, or a variable cost per animal tested) was multiplied up by the 2026/27 estimated relevant herd/animal statistic. The total farmer compliance cost is estimated to be **£20.2m** in 2026/27.

3.5 Breakdown related element of the farmer cost of complying with the bTB Programme rules

3.5.1 As was the case when calculating government costs, the fixed annual herd test proportion of the compliance cost was estimated, with the residual identified as breakdown related. Of the £20.2m farmer compliance cost, it is estimated that £10.6m is fixed (i.e. relates to 1 herd test per herd per year), and £9.5m is breakdown related.

3.6 Calculation of "other" costs to farmers

3.6.1 In addition to the compliance cost, there are "other costs" falling to farm businesses that are not covered by compensation for animals compulsorily removed. To estimate these costs, the DEFRA methodology was followed[54]. These costs include:

[53] For farmer manager and worker time value: Took October 2025 provisional mean hourly gross pay per hour for "Other Managers and Proprietors" and for "Skilled Agric. and related Trades" respectively, as broken down by Occupation (2-digit Standard Occupational Classification 2010). i.e. £23.88 and £14.37/hr respectively. Industry, occupation, age, public/private sector and skill level | Northern Ireland Statistics and Research Agency The percentage uplift in these rates between 2024 and 2025 was then applied to the 2025 figures to uplift them to 2026/27 estimates, which gave rates of £25.66 and £15.69.

[54] DEFRA's methodology is based on underpinning work by a specialist animals disease economist, Richard Bennett (Reading University). DEFRA (2011) "Measures to address bovine TB in badgers. Impact Assessment.

- **Movement restriction costs**[55] – these costs apply to all animals in a restricted herd, and, for example, include costs arising due to marketing problems, restricted outlets, and the devaluation of cattle (as they are from a herd that has had a breakdown), including administration costs.
- **Isolation costs for reactor, negative in-contacts removed, and skin test negative but IFNG positive animals** – these include: (i) additional labour requirements (e.g. for feeding, milking, etc. of isolated cattle); (ii) additional straw required for bedding isolated animals; and (iii) costs incurred for presenting cattle for valuation and removal (loading and administration etc.). As DAERA has a separate Better Regulation Survey (BRS) derived estimate for (iii), it is deducted from the total isolation cost estimate[56];
- **Extra isolation cost for inconclusive animals** – inconclusive animals need to be isolated while awaiting their retest, which is a minimum of 42 days after the test at which they were classified inconclusive[57];
- **Residual cost of animals removed to slaughter** – to, for example, find replacement animals, temporary loss of output, etc. DEFRA's 2010/11 estimate was £320[58] per animal compulsorily removed. In 2026/27 prices, this cost is £489[59] per animal.

3.6.2 Table 11 shows how the original DEFRA data was inflated to 2026/27 prices and applied to the NI cattle herd breakdown situation.

[55] DEFRA (2014) "Options to increase the change of achieving OTF status for the TB Low Risk Area, Impact Assessment. No. DEFRA 1786. Date: 18/12/14. See page 17. Its original source was APHA SAMS 2013 data.
[56] DEFRA (2014) "Options to increase the change of achieving OTF status for the TB Low Risk Area, Impact Assessment. No. DEFRA 1786. Date: 18/12/14 but note that this is an inflated figure from the original Richard Bennett TB farm cost survey in 2003. https://consult.defra.gov.uk/bovine-tb/bovine-tb-cattle-controls-post-movement-testing/supporting_documents/DEFRA%20IA%20No%201786%20Measures%20to%20achieve%20OTF%20for%20the%20LRA.pdf
[57] If they are positive or inconclusive at the retest, they are treated as reactors.
[58] See para. 6.42 of DEFRA (2011) "Measures to address bovine TB in badgers. Impact Assessment.
[59] Uplifted by the GDP deflator Mar. 2026.

Table 11: Extrapolation of DEFRA data on other (non-compensated) losses arising from herd breakdowns.

Other Farmer Costs	Orig. Cost	Per?	Orig. cost date	New Cost in 2026/27 prices	Applied to:	Descr.	Applied to:	Descr.	Subtotal	Minus	Total
Movement restriction costs per animal (applied to whole herd)	£1.97	per an.	2013/14	£2.84	2,276	herds	120.24	Av. No. An. Per Risk/Restr. Herd	£777,360	£0	£777,360
Isolation cost per animal - reactors, negative in contacts removed and IFNG +ve (skin test -ve)	£1.44	per an. Per day	2014	£2.07	23,509	An. Compulsorily removed	17.1	Av. days of isolation	£833,247	£339,782	£493,465
Extra isolation cost per inconclusive animal	£1.44	per an. Per day	2014	£1.23	807.00	Inconcl. An.	42	Av. days of extra isolation	£41,606	£0	£41,606
Residual cost of animals removed to slaughter	£320	per an. Removed	2010/11	£489.41	23,509	An. Compulsorily removed	N/A	N/A	£11,505,376	£0	£11,505,376
Subtotal											**£12,817,808**

3.6.3 The “other” farmer costs outlined in table 11 above add to around £12.8m in 2026/27 prices (at current disease levels). Therefore, **the total cost to farmers is £33.0m** in 2026/27 prices[60], i.e. compliance cost estimate of £20.2m plus ‘other costs’ estimate of £12.8m[61].

3.7 Breakdown related element of the “other” farmer costs

3.7.1 As outlined in table 12 below, of this £33.0m farmer cost, it is estimated that £22.4m is relates to herd breakdowns.

[60] Assumes 2024/25 cattle numbers and disease levels persist into 2025/26. i.e. The original calculations are based on the 2024/25 year, as statistical data is available for this year. The statistics for 2025/26 or 2026/27 were not available at the time of writing. Therefore, effort is assumed to be the same in 2026/27 as in 2024/25. 2024/25 costs (and costs derived in earlier years) have been uplifted by inflation to 2026/27 prices.

[61] NB: Note that The Andersons Centre has recently published a report entitled “Review of the indirect costs borne by farmers as a result of bovine TB” on the cost of bTB to farmers. This report was commission by the LMC, Dairy Council NI, and the UFU. Its aggregated estimate of total indirect bTB costs across all NI farms is £96.1m. Of this, £49.4m is the estimated cost incurred by farms with no breakdowns, and £46.7m relates to farms with breakdowns. However, this report was published after the calculations in these analyses were carried out. As such, note that the farmer costs discussed above use other sources of data, and they are significantly lower than the Andersons Centre’s estimates.

Table 12: Breakdown of Farmer Costs between “fixed” (surveillance herd test) and “variable” (breakdown related).

BD = Breakdown related			
Farmer Compliance Cost	**No.**	**Unit cost**	**2026/27**
Surveill. Herd Test Cost (1 test per yr per herd)	**21,493**	**£495.29**	**£10,645,361**
BD Herd Test Cost (remainder of herd tests)	14,098	£628.79	£8,864,745
BD Indiv. An. Test Cost	661	£47.57	£31,443
BD Pres. An. For Valuation	5,356	£41.70	£223,367
BD Pres. An. For Collection	5,234	£22.24	£116,415
BD Helping with Epi. Investigation	2,276	£83.41	£189,837
BD Other Minor bTB Prog. Compliance Costs			£100,244
BD Standalone IFNG Herd Tests Existing	47	£316.66	£14,883
BD Standalone IFNG Herd Tests Additional 25/26	14	£326.77	£4,430
BD Standalone IFNG Herd Tests Additional 26/27	9	£326.77	£2,898
S'total Breakdown Cost (Derived from BRS Times)			**£9,548,264**
Other Costs			
BD: Costs due to Restriction (e.g.marketing issues, restricted outlets, devaluation of cattle from restricted herds)	2,276 herds * 120 An/herd	£2.84	£777,360
BD Costs due to Isolation of An. Removed	23,509 An *17.1 iso.days	£1.23	£493,465
BD Costs due to Isolation of Inconclusives	807 An *42 extra iso.days	£1.23	£41,606
BD Residual Cost per An. Removed (finding replacement animals, temporary loss of output, etc.)	23,509 An	£489.41	£11,505,376
S'total Breakdown "other" costs			**£12,817,808**
Total Farmer Cost (FIN & ECON)			**£33,011,432**
Of which BD related (FIN & ECON)			**£22,366,072**

3.9 Total cost of the bTB Programme to Government and Farmers

3.9.1 The total cost of the bTB Programme to Government and Farmers is estimated to be around £111m in 2026/27 prices. Of this, it is estimated that **£88.4m is related to herd breakdowns**.

Table 13: Total Government and Farmer Cost, and Breakdown Element

	bTB Programme Cost estimate in 2026/27 prices	**% of total cost**		**2026/27 Of which Breakdown Cost (Est.)**	% of Government or Farmer or total costs that is breakdown related
Government Cost	**£78m**	70%		£66.1m	85%
Farmer Cost	**£33m**	30%		£22.4m	68%
Total Cost	**£111m**			**£88.4m**	80%

NB: Excludes the cost of senior management in disease branches of Veterinary Service's Animal Health Group

3.10 Cost of a unique herd breakdown

3.10.1 A "new" herd breakdown is defined as a herd having at least one bTB reactor animal in the month, and no bTB reactor animals in the previous 12 months. In the financial year 2024/25, there were 2,276 new herd breakdowns. This is also the estimate used for 2026/27. If total Government and farmer variable (breakdown related) cost is divided by this figure, the estimated average cost of a **new** breakdown in 2026/27 is around £39,000.

3.10.2 However, the NI Parameterised Model used to consider the achievability of breakeven herd breakdowns avoided figures estimates the number of unique herd breakdowns avoided. Therefore, the variable of interest is the value of a unique herd breakdown avoided in 2026/27 prices.

3.10.3 A "unique" herd breakdown is defined as a herd having at least one bTB reactor animal in the month irrespective of any bTB reactors during the previous 12 months. It is only published in the NI bTB statistical reports for a calendar year (not a financial year). For the 2024 calendar year, there were 3,270 unique herd breakdowns. If this is taken as a percentage of the calendar year number of new herd breakdowns (2,314) and then multiplied by the 2024/25 financial year number of new herd breakdowns (2,276), it is

estimated that the number of unique herd breakdowns in 2024/25 was 3,216. This estimate is also used for the programme when it is costed in 2026/27 prices.

3.10.4 If total Government and farmer breakdown related cost is divided by this figure, the estimated average cost of a **unique** herd breakdown in 2026/27 prices is around £27,500. This is relevant to the breakeven analysis calculations discussed in the next section.

4. Illustration of how to use Equivalent Annual Cost Factors for Breakeven analysis

4.1 Converting a discounted cost (i.e. present cost) to a constant stream of values over a period

4.1.1 The Present Cost of each badger intervention can be converted into its "smoothed out" Equivalent Annual Cost (EAC) over a proposed benefit scenario period. By way of example, if a 9-year benefit period is assumed, the EAC factor is used to convert the Present Cost of the 5-year badger intervention into an equivalent 9-year average value. When those average values in each of the 9-years is multiplied by the discount factor relevant to each year, and the discounted values added, the sum would equal the original Present Cost.

4.1.2 For a 9-year benefit period, and assuming a 3.5% discount rate, the EAC factor is derived by the formula:

$$\frac{0.035}{1 - 1 / (1+ 0.035)^{9}}$$

$$= 0.1314$$

4.1.3 Table 14 shows how the EAC factor is applied to the Present Cost to calculate the Equivalent Value over a 9-year period. Essentially, this shows the average annual benefit value that would need to be achieved for each year of a 9-year period for the Present Cost of badger intervention and Present Benefit to match exactly.

Table 14: Example of converting a present cost to an equivalent annual value

Calcs	Year		n	1	2	3	4	5	6	7	8	9	10	11	12		Total
Y	Deployment variable econ. costs			£0.938	£0.455	£0.460	£0.458	£0.337									£2.648
Z	Policing			£0.000	£0.000	£0.000	£0.000	£0.000									£0.000
a= Y + Z	Subtotal An. Cost			£0.938	£0.455	£0.460	£0.458	£0.337									£2.648
b = 1/(1+r)^n	Discount Factor	3.50%		0.966	0.934	0.902	0.871	0.842									
c =a*b	**Discounted Annual Cost**			**£0.906**	**£0.425**	**£0.415**	**£0.399**	**£0.284**									**£2.429**
	Disc. Cost Cumulative			*£0.906*	*£1.331*	*£1.746*	*£2.145*	*£2.429*									
d =sum of c	Present Cost			£2.429													
e	No. of yrs for benefit	9															
f = r/(1-[1/(1+r)^9])	Equiv. Annual Cost Factor	0.13															
g=f*d	Equiv. Annual Value is	£0.319															
	Show this EAC disc equals Pres. Cost			1	2	3	4	5	6	7	8	9	10	11	12		
h = f each yr	Breakeven benefit over 9yrs			£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319					£2.873
i= b	Discount Factor	3.50%		0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734					
j = h * i	**Discounted Annual Benefit**			£0.308	£0.298	£0.288	£0.278	£0.269	£0.260	£0.251	£0.242	£0.234					£2.429
	Disc. Benefit Cumulative			*£0.308*	*£0.607*	*£0.894*	*£1.173*	*£1.442*	*£1.701*	*£1.952*	*£2.195*	*£2.429*					
k = sum of j	Present Benefit			£2.429													

4.1.4 Taking the Present Cost of the TVR cage trap option as deployed by the public sector as an example (i.e. 5 yr discounted cost of £2.4m), if this is multiplied by 0.1314, it gives an EAC (or Equivalent Annual Value (EAV) if referring to benefits) of £0.319m over nine years. If this stream of annual values of £0.319m were assumed for 9 years and were multiplied by the discount factor relevant to each year, and totalled, it provides a present value of £2.9m. In this way, therefore, discounted benefits over nine years would be exactly equal to discounted costs incurred over five years.

4.2 Calculating how many herd breakdowns would need to be avoided if the discounted cost (i.e. present cost) of intervention was to equal (i.e. just be offset) by discounted benefits

4.2.1 The next step is to divide the EAV of benefit that is required to offset costs by the value of a herd breakdown avoided, which will give the number of herd breakdowns that would need to be avoided per annum to make the Present Costs and Present benefits exactly match. In this example, when £0.319m is divided by £0.0275m (the value of a

breakdown when the cost to government and farmers is considered), the breakeven number of herd breakdowns avoided is ~12 per year for nine years (i.e. 11.6/yr).

4.2.2 As illustrated in table 15 below, this is the number of herd breakdowns avoided that would need to be achieved in each of nine years for the Present Value of Benefits to offset the Present Value of Badger Intervention Costs.

Table 15: Illustration of breakeven of benefits to costs

Calcs	Year		n	1	2	3	4	5	6	7	8	9	10	11	12		Total
Y	Deployment variable econ. costs			£0.938	£0.455	£0.460	£0.458	£0.337									**£2.648**
Z	Policing			£0.000	£0.000	£0.000	£0.000	£0.000									**£0.000**
a= Y + Z	**Subtotal An. Cost**			**£0.938**	**£0.455**	**£0.460**	**£0.458**	**£0.337**									**£2.648**
b = 1/(1+r)^n	Discount Factor	3.50%		0.966	0.934	0.902	0.871	0.842									
c =a*b	**Discounted Annual Cost**			**£0.906**	**£0.425**	**£0.415**	**£0.399**	**£0.284**									**£2.429**
	Disc. Cost Cumulative			*£0.906*	*£1.331*	*£1.746*	*£2.145*	*£2.429*									
d =sum of c	**Present Cost**			**£2.429**													
	Value of a herd BD avoided			£0.0275													
	Breakeven no. of herd BDs Avoided/yr			11.61													
	Show this EAC disc equals Pres. Cost			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
	No. of herd BDs avoided per yr			11.61	11.61	11.61	11.61	11.61	11.61	11.61	11.61	11.61					
	Value per Herd BD avoided	£0.0275															
	Annual value of benefit			£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319	£0.319					**£2.873**
	Discount Factor	3.50%		0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734					
	Discounted Annual Benefit			£0.308	£0.298	£0.288	£0.278	£0.269	£0.260	£0.251	£0.242	£0.234					**£2.429**
	Disc. Benefit Cumulative			*£0.308*	*£0.607*	*£0.894*	*£1.173*	*£1.442*	*£1.701*	*£1.952*	*£2.195*	*£2.429*					
	Present Benefit			**£2.429**													