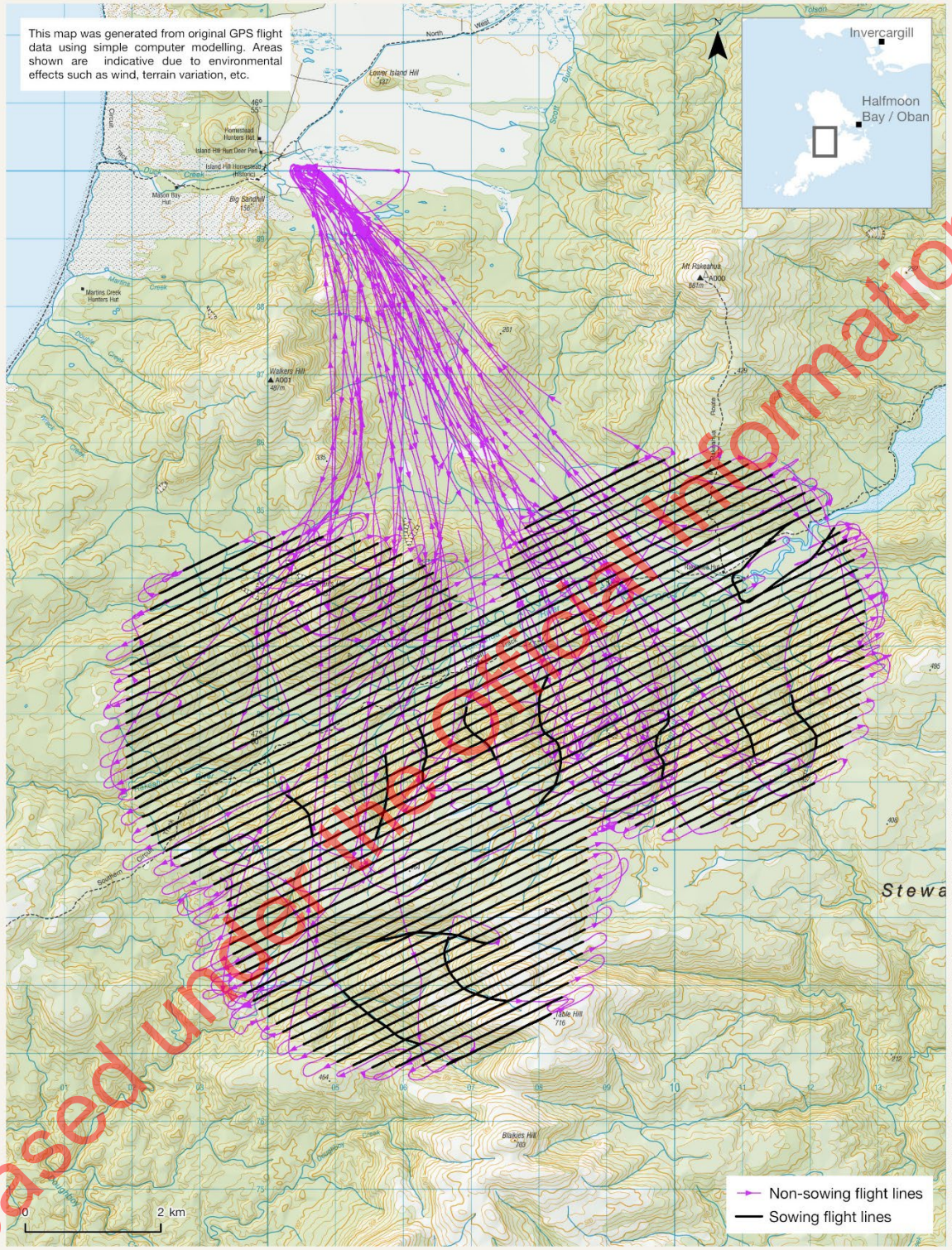
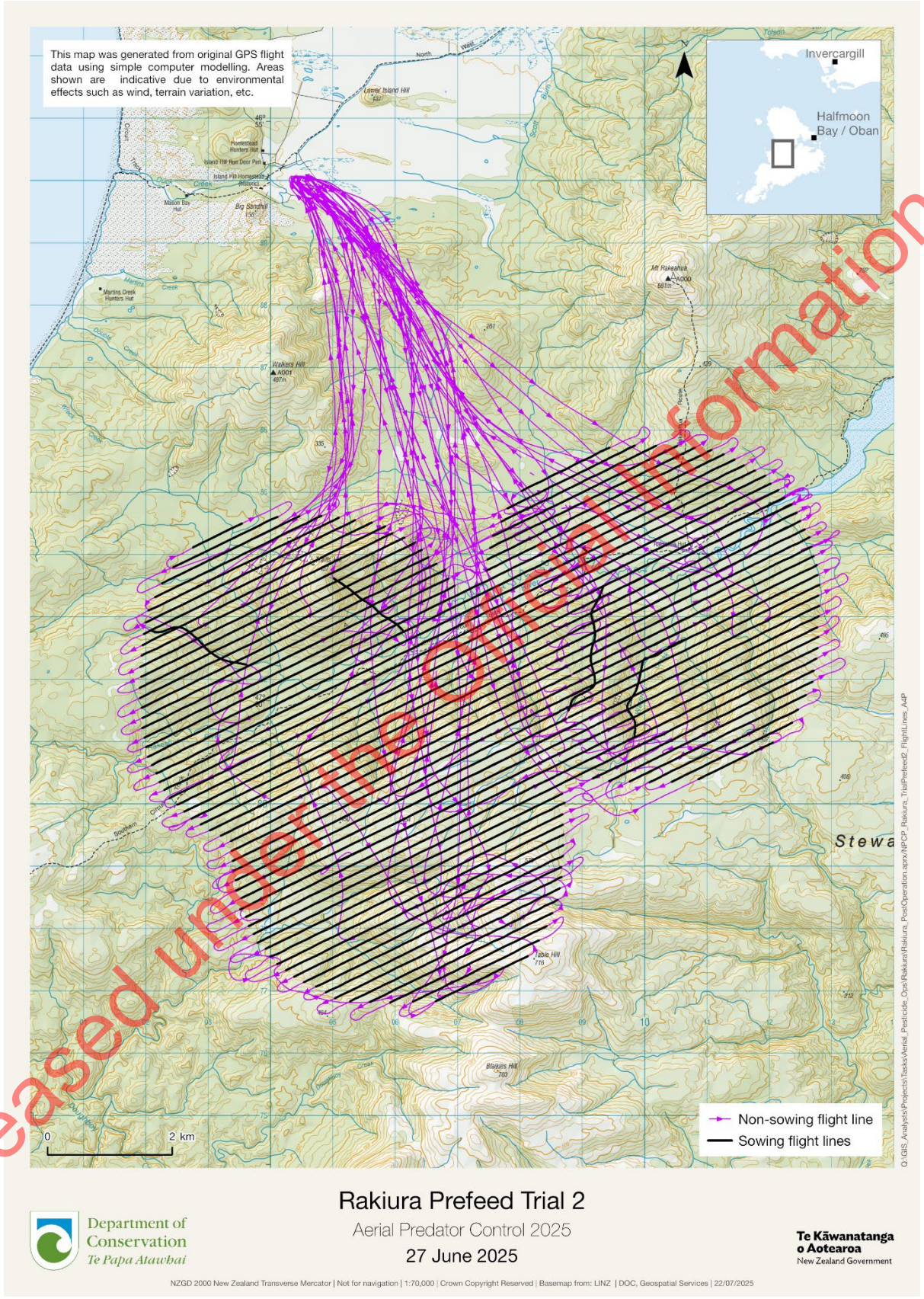
**OIAD – 5388 - Appendix One – Flight Data and Weather Conditions**

| Date | Prefeed or Toxic Bait | Wind | Rain | Fog | Cloud | Sowing Details | Flight Data |
|---|---|---|---|---|---|---|---|
| 16th June 2025 | Prefeed | Light and variable | Nil | No | Light and variable | Sowing commenced 12.08pm, ended 4.05pm | See **Map 1** with Flight Data |
| 17th June 2025 | Prefeed | Light and variable | Nil | Yes | Light and variable | Sowing commenced 10.14am, ended 1.30pm | See **Map 1** with Flight Data |
| 27th June 2025 | Prefeed | Light at the start of the day building to 13 km/h when bait application was completed | Nil | Yes – Light | Light at the start of the day, building as the day progressed | Sowing commenced 10.17am, ended 2.48pm | See **Map 2** with Flight Data |

## Map 1 - Prefeed 16th and 17th June



## Map 2 – Prefeed 27th June 2025



Item 2

# Method Best practice for National Predator Control Programme Aerial 1080 baiting

Version 2.0 April 2024

## Contents



## Introduction

These guidelines provide best practice recommendations for DOC's National Predator Control Programme (NPCP) aerial 1080 operations to be applied at the relevant steps in the Operational planning for animal pest operations SOP DOCDM-1488532. They draw on the existing Current Agreed Best Practice System and from lessons learned from previous NPCP operations. They have been evaluated and agreed to by the NPCP Technical Advisory Group

This method best practice guidance applies to operations using aerially applied 1080 cereal pellets to target rats and/or possums and those that also target stoats (through secondary poisoning) as a beneficial by-kill.

Best practice is guidance you should follow unless you have very good reason not to. Unlike SOP standards which must be adhered to, best practice is there to provide the current benchmark for doing a good job but recognises that some adaptation may be required to suit different circumstances. If you think you cannot or should not follow best practice, this is a signal that you need to discuss the issue with technical staff (e.g., NPCP TAG) and managers. Operations in kea habitat are required as a condition of the DOC permission to comply with the standards identified in the aerial 1080 in kea habitat SOP.

## Summary

Key elements of this current agreed best practice are summarised in the box below. Each point and variations are further explained in the numbered points following [and identified in brackets in the summary]. The main topic of each numbered point is **bold**.

- **To optimise rat kills, the timing of bait application should avoid mast seeding periods [1.]**
- **Always use 6 gram (16mm) cereal bait single lured [4.]**
- **In normal conditions use 1.5kg/ha prefeed and sow 1.5kg/ha toxic bait as soon as possible after 5 days [5, 6, 8,10, 11, 12].**
- **When possums are >15% RTCI use 2kg/ha prefeed and 2kg/ha toxic bait [7,9.]**
- **A prefeed to toxic bait application interval of up to 8 weeks is acceptable when rat populations are not growing. Toxic bait should be applied within 4 weeks of the prefeed application if rat populations could be growing. If these intervals may be exceeded seek TAG advice to consider if prefeed application should be repeated [13.].**
- **Overlap swathes of bait in both the prefeed and toxic applications by 20m [17.]**

## Design

1. Baiting when rats have abundant natural food (e.g., during seed availability periods of beech mast events) risks a poor kill. Rat kills can be optimised by baiting when natural food resources are low, and the population is not growing. These conditions are also likely to result in high mouse kills. Designing operations to ensure that few non-toxic rodents remain (i.e., high kill rates of rats and mice collectively), will help to optimise stoat kills.

2. The aerial 1080 in kea habitat SOP DOC-2612859 includes performance standards that constrain the timing of operations in kea habitat to prevent a stoat irruption. Refer to the aerial 1080 in kea habitat SOP to determine the performance standards that apply to your operation.

3. Be clear about which pests are targeted and why by working through the animal pest framework preparing phase steps 1-5. Advice to support these steps can be found in the Outcomes, Targets and Control Design Spreadsheet (DOC-7200348). For guidance on legal aspects of **selecting target pests**, refer to technical advice on target pests for aerial 1080 operations DOC- 2649524.

4. The following **bait formulations** are available:
    - Pronature DF ('RS5' (Orillion))
    - Pestex (PCR)
    - Pronature WF (Wanganui No. 7 (Orillion)).
    - Prodeer Possum and Rat Bait (RS5 with deer repellent (Orillion)
    - Prodeer WF (Wanganui No.7 with deer repellent (Orillion))
    - Pestex DR (Pestex with deer repellent (PCR))

Always use 6 gram (16mm) **sized** baits when targeting rats containing 0.15% **1080 concentration** (1.5g/kg) and 0.15% cinnamon **lure** (i.e., single lure). Higher concentrations of lure may reduce the palatability of baits to rats, lower concentration of 1080 may reduce efficacy against possums.

The aerial 1080 in **kea habitat** SOP DOC-2612859 includes performance standards that limit the bait type to only cinnamon-lured Pronature DF (RS5) or Pestex prefeed and toxic baits in kea habitat.

## Prefeed application

5. Pre-feeding is compulsory. Use the same **formulation of non-toxic pre-feed** as the toxic bait. Normally pre-feed is un-dyed but it should contain the lure at 0.15%w/w. If pre-feed is dyed it is more easily confused with toxic bait.

6. Apply **prefeed** at an average **rate** of 1.5 kg/ha (250 baits/ha). This rate has proven successful at a range of rat abundances during periods when natural food satiation is not high.

7. When **possums** are at moderate to **high** abundance (>15% RTCI) apply **prefeed** at an average **rate** of 2kg/ha to ensure all possums access prefeed before it is eaten or stashed by other animals.

## Toxic bait application

8. Apply **toxic bait** at an average **rate** of 1.5 kg/ha (250 baits/ha), unless possums are at moderate to high abundance.

9. When **possums** are at moderate to **high abundance** (>15% RTCI) apply **toxic bait** at an average **rate** of 2kg/ha (333 baits/ha). This should improve the chances of possums encountering a second bait before the onset of poisoning symptoms.

## Timing – prefeed and toxic

10. **Toxic baiting** should occur no sooner than 5 days **after prefeeding** but as soon as possible after 5 days. This should allow enough time for prefeed to be fully consumed and/or cached so rodents encounter only toxic bait on the ground and not a mixture of prefeed and toxic which would allow them to compare baits and reject toxic.

11. Operations should consider **forecast weather** and logistics of both prefeed and toxic operations at the time a decision is made to go with prefeeding. Prefeed will require reasonably good weather after it has been laid with a maximum of 20mm cumulative rainfall forecast at the site over the first two nights.

12. **Toxic bait** should be available for at least 2 **fine nights** (defined as not more than 10mm cumulative rainfall over the nights) immediately following application. Application should only take place if the weather forecast indicates there is a very high probability of this. When toxic bait application will occur over more than 1 day the weather forecast will also need to indicate 2 fine nights beyond the last day of application. Analysis of operational results indicates that fine 2 nights is a sufficient interval for rats to find and consume the toxic bait while it remains in good condition (both toxicity and palatability).

13. Long delays in laying toxic bait after prefeeding can lead to rodents not being exposed to prefeed and therefore much less likely to accept and consume toxic bait in lethal

quantities. Repeating the prefeed after long delays may be necessary to achieve high kill rates.

The impact of delays on rat kill rates will depend on the rats' natural food supplies/hunger. Measuring food supplies/hunger is tricky, and a useful proxy is the rate of population growth at the time.

**If rodent populations are not growing** (as expected during low food conditions when operations should ideally occur), application of toxic bait within **8 weeks** of the prefeed should ensure high bait acceptance and kill rates. Seek TAG advice if there are anticipated delays beyond 8 weeks under these conditions.

**If rodent populations are growing or could be growing** then TAG advice should be sought if there are anticipated delays in toxic bait application beyond **4 weeks** of applying prefeed.

## Planning and pre-operational tasks

14. Minimise **exclusion zones** within the block wherever possible or treat them by other methods. Untreated areas will leave survivors.

15. **Coordinate with monitoring** staff to ensure aerial application area, exclusion zones and the location of monitoring lines are compatible. If established tracking tunnel lines fall into and near un-baited areas, the data collected from them cannot be used in result analysis. Pre and post result monitoring (for rodents) should be within 6 weeks of the toxic bait application.

16. Bait quality must be high when it reaches the rat. This means taking good care of the bait from point of manufacture to point of sowing at the site. Refer to the label for advice on storage and shelf life. **Bait handling best practice** is in DOCDM-636448

17. **Calibration** trials with the correct bait size are required to determine the appropriate bait sowing swath width of each individual bait bucket used. The appropriate **flight path spacing** for your operation is determined by the effective swath width of the bucket used minus 20 metres. Flight path spacing should be stated in the Helicopter Statement of Works. See guidelines for bucket calibration for more information DOC-2827796.

    Analyses of all past operations suggest that where flight path spacing is 90% of calibrated useable swath, we get better results. A minus 20m standard is pragmatic to apply. For example, a 160m flight path spacing is close to 90% of a 180m swath. Such an overlap reduces the likelihood of gaps in bait coverage due to wind or bucket swing which would not be mapped by GPS recording.

18. The ideal **bucket design** should:
    - Produce a consistent swath pattern and constant rate of spread whether full or near empty.
    - Be a purpose-built bait bucket, and use a spinner specifically designed for distributing cereal pellets.
    - Have a proven, reliable system for the pilot to start & stop bait sowing (e.g., bucket on/off switch is interfaced with the GPS system) which minimises the risks of bait gaps undetectable in the GPS data and sowing bait outside the treatment area.
    - Have an agitator to maintain constant flow of baits going into the spinner.

- Be easy to clean with no places for 'stray' baits to collect and accidentally drop outside the treatment area.
- Have an easy to open and secure cover for use when the loading site is outside the treatment area. This prevents bait loss out of the top of the bucket when flying outside the treatment area.

19. **Spare buckets** and associated equipment should be available on site during the operation to minimise downtime due to blockage or breakdown.

20. Someone with expertise in GIS and knowledge of how flight paths are flown must be present throughout bait application. It is essential to **download and check bait coverage** regularly throughout the operation (e.g., during pilot rest breaks) to iden ify gaps in bait coverage or over-sows requiring further action.

21. Use available **guidance** on choosing and setting up a **helicopter loading site** DOC-1560571 to ensure safe and efficient operation of the loading site.

## Bait application days

22. Use available **guidance** on **managing aerial baiting operations** DOC-2651365 to ensure bait is applied correctly and necessary data is captured.

23. **Avoid gaps** in coverage. Total bait coverage is required to achieve high rat kills because gaps allow rats to avoid treatment.

24. **Avoid** baiting in **gusty winds** where possible. Accurate bait application is achieved in average wind speeds up to 20 km/h (11 knots). Operating in higher winds may be necessary as trade-offs are made between present and forecast weather conditions and seasonal timing of the operation. In higher winds bucket swinging and bait drift can result in gaps in the coverage or risk bait being applied beyond treatment boundaries. Maintaining a steady ground speed (which affects sowing rate) can be more difficult with headwinds/tailwinds.

25. Maintaining **constant ground speed** is critical to achieving consistent sowing rates.

26. Lower **flight height** that can be achieved safely and reasonably will reduce the risk of leaving gaps. Discuss with pilot. Wind affects where bait lands, this effect is greater when bait is sown from higher, despite it looking better on the GPS.

## Glossary

Terms used in the text of this document are defined here. These definitions are extracted from Animal Pests SOP Definitions and FAQs DOCDM-51708 where a more comprehensive list of definitions can be accessed.

| | |
|---|---|
| **Aerial application area** | The area over which bait is to be aerially applied. This is the shape file given to the pilot to be flown. May have exclusion zones or no fly zones within its perimeter. It doesn't include the areas of the buffers. |

| | |
|---|---|
| **Aerial application boundary** | The boundary of the area where bait is to be aerially applied. May be buffered in from the treatment area boundary. |
| **Airspeed** | The velocity of the aircraft through the air when flying. |
| **Boundary sow** | Sowing bait near and parallel to the aerial application boundary with a full swath or a deflector bucket. This technique is used to cover the ends of sow lines where there may be gaps in coverage. It can also be used to move sow lines further away from sensitive boundaries. Sometimes referred to as 'parallel sow', 'headland run' or 'boundary run'. |
| **Bucket gate** | The mechanism on the sowing bucket which controls ba t flow from the hopper to the spinner. Normally this system is linked to the GPS Navigational guidance to record sow lines when the gate is open |
| **Buffer (aerial application)** | An area where bait is not to be applied aerially, but if bait is unintentionally applied there is no breach of permission conditions, i.e. the area between the aerial application boundary and either:<br>• The treatment area/block boundary<br>• The boundary of an exclusion zone<br>• The boundary of a no fly zone |
| **Buffer zone (hunting)** | The area **outside** the boundaries of the treament area from which meat for human consumption should not be procured.<br>(The defintion from the Animal Products Notice: Specifications for Products Intended for Human Consumption is "the land situated between the bounda ies of an area of land that has been exposed to poison and an area of land where it is acceptable for animals to be procured, measured as a straight line on a horizontal plane".) |
| **Deflector bucket** | A bait sowing helicopter bucket modified to only allow bait to be spread to one side of the flight line. |
| **Exc usion zone** | An area that is within the treatment boundaries of an operation, but which is excluded from the operation – i.e. no pesticides are laid within the exclusion zone. |
| **Flight corridor** | Designated area between the loading site and the aerial application area which all helicopters with buckets must use when travelling between the two. |

| | |
|---|---|
| | Corridors are generally only necessary where the loading site is outside the Treatment area but can also be identified for transiting between treatment blocks. |
| **Flight line** | Line of travel by the helicopter recorded by GPS regardless of whether or not the bucket is sowing |
| **Flight path spacing** | Distance between sow lines set as a parameter into the GPS. This distance is decided on with reference to the useable swath of the bucket being used. |
| **Flow rate** | The rate at which baits pass through the bucket apeture onto the spinner. This figure affects sowing rate. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for further detail on how it is measured. |
| **Ground speed** | The velocity of the aircraft over the ground. This figure affects sowing rate. |
| **Maximum swath** | Identified during bucket calibration, this is the maximum distance baits are thrown at right angles to the flight line multiplied by 2. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for further detail on how it is measured. This figure is used to determine flight paths near boundaries. |
| **No fly zone** | An area where aircraft may not traverse with a bait bucket. This may be because of a consent condition, consultation agreement or as an operational planning decision. |
| **Over fly** | Fly a helicopter with a bucket attached below 500 feet over areas specified in the Treatment Area map as No-Fly zones. This includes flying outside designated flight corridors. |
| **Over Sow** | Misapplication of bait outside the Treatment Area or into an exclusion zone |
| **Recorded sow line** | The GPS data of flight line recorded when the bucket gate is open (i.e., usually when the bucket is actually sowing bait). Recorded sow lines will be the underlying data for bait coverage maps produced by GIS Analysts. |
| **Safe Handling Sheet** | Part of the Safe Handling of Pesticides SOP used in the field to provide standards on handling pesticides and personal protective equipment. |

| | |
|---|---|
| **Sensitive boundary** | A Treatment Area boundary which is particularly important to avoid over sowing. This could be for various reasons such as risk to livestock, a high public use area or road, relationship risk etc. Usually extra precautions are taken around sensitive boundaries such as increased buffers or trickle/deflector bucket sowing. |
| **Site lead (aerial operations)** | The person in charge of an aerial baiting operation during baiting operations. This person has decision making authority over field operations on the day(s) of aerial baiting. It can be the Operational planner, the Incident Controller, or the Air operations manager. Because these terms are not used consistently in DOC operations the term site lead has been developed. |
| **Sow line** | Parallel flight path generated by the navigational guidance GPS inside the aerial application area along which the helicopter applies (or sows) bait. Most GPS system number each line for ease of communication.<br><br>See also 'Recorded sow line' |
| **Treatment area** | The area for which permission (DOC and Public Health) is sought or held to apply pesticides. This is the area entered into the DOCgis Pesticides Application and used for public notification. Treatment area boundary has a corresponding meaning. |
| **Treatment area**<br><br>**(performance reporting definition)** | The area where animal pests are controlled in any one financial year. Total number of hectares, consisting of one or more treatment blocks. It could include the land covered by search effort if that effort was part of controlling them (eg for heli-hunting it means the area you cover and would shoot target species if encountered). |
| **Treatment block** | A subset of a treatment area. A treatment area is broken down into treatment blocks when blocks are physically separated **or** when different management methods are applied. Treatment block boundary has a corresponding meaning. |
| **Trickle bucket** | A bait sowing helicopter bucket modified to only allow a narrow bait swathe either side of the flight line. |
| **Useable swath** | Identified during bucket calibration, this is the distance most baits reach at right angles to the flight line (at the desired sowing rate) multiplied by 2. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for |

further detail on how it is measured. This figure is used to determine flight path spacing.

Sometimes referred to as 'effective swath'.

## Resource links

Aerial 1080 in kea habitat Standard Operating Procedure DOC-2612859 .

Guidelines for aerial 1080 baiting #1: Bucket calibration DOC-2827796.

Guidelines for aerial 1080 baiting #2: Managing air operations DOC-2651365 .

Guidelines for aerial 1080 baiting #3: Considerations for setting up a helicopter loading site for aerial baiting using cereal pellets DOC-1560571

Operational planning for animal pest operations SOP DOC-1488532

Target pests for aerially applied 0.15% 1080 Pellets and 0.08% 1080 Pellets: Technical advice for Battle for our Birds 2016 programme DOC- 2649524

NPCP site outcomes spreadsheet DOC-7200348

Timing of mast-response aerial 1080 in upland masting ecosystems DOC-7083017

## References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3 Innes, J.; Warburton, B.; Williams, D.; Speed, H.; and Bradfield, P. 1995. Large scale poisoning of ship rats (*Rattus rattus*) in indigenous forests of the North Island, New Zealand. *New Zealand Journal of Ecology* **19**(1):5-17.

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6 Henderson, R. J.; Frampton, C. M.; Morgan, D. R.; and Hickling, G. J. 1999. The efficacy of baits containing 1080 for control of brushtail possums. *Journal of Wildlife Management* **63**(4):1138-1151.

## Document history

| Amendment date | Amendment details | DOCCM | Amended by |
|---|---|---|---|
| July 2018 | Updating BP | Version 1.5 DOC-2749355 | 9(2)(g)(ii) |
| 10/10/18 | Approved 9(2)(g)(ii) | Version 1.5 DOC-2749355 | 9(2)(g)(ii) |
| April 2020 | Updated | Version 1.6 | 9(2)(g)(ii) |
| 6/4/21 | New definition in glossary; added table of contents | Version 1.7 | 9(2)(g)(ii) |
| 5/7/21 | Revised content and formatting following TAG review of latest data | Version 1.8 | 9(2)(g)(ii) |
| 15/08/22 | Revised content and formatting following TAG review of latest data.<br><br>Approved by Michelle Crowell Director Threats (Acting). | Version 1.9 | 9(2)(g)(ii) |
| 2 April 2024 | Revised content and formatting follow TAG review of latest data. | Version 2.0 | 9(2)(g)(ii) |
| 30 June 2025 | Updated bait formulations information and changed 1080 in kea habitat COP to SOP. | Version 2.0 | 9(2)(g)(ii) |

Item 3

# Guidelines for aerial 1080 baiting #2

## Managing Air Operations.

**Version 1.6 April 2021**

# Contents

## Introduction

This information is to help DOC staff control aerial baiting operations on the day(s) of operation. It assumes the contract for aviation services has identified a DOC ranger filling the position of Air Operations Manager. If the contract leaves management of air operations up to a contractor or third party it will help DOC Site Leads understand what should be happening.

To help understand the language around these operations there is a glossary in appendix 2. Words used in the text which have a glossary definition are *underlined in italics*.

For information on how GIS Analysts can support NPCP operations in planning and managing operations see DOC-3031667 'Role of a GIS Analyst in supporting NPCP operations.'

## Planning and briefing

1. Aerial baiting operations are 90% planning and 10% doing. Become familiar with all the planning well before the operation is due to be implemented. This includes boundaries, exclusion zones, safety plans and consent conditions as well as the operational plan. Read DOCDM-1560571 'Guidance for helo loading sites for aerial baiting' and any loading site task specifications relevant to your operation. Have all this material readily on hand throughout bait application days.
2. Plan briefings for pilots and loading site supervisors. Use the compliance checklist to filter out consent conditions applicable to bait loading, flying and clean up. Follow the process and standards for 'Operational Phase step 1 Brief operators before field work' from the Operational planning for animal pest operations SOP (DOC-1488532).
3. Ensure *sensitive boundaries* are discussed thoroughly with all pilots and ensure your agreement on how they will be managed is noted down in the operations log.

## Understanding boundaries and getting the map right

4. For every operation, there will be places you do want bait and places you don't. We need to show these on the operational maps clearly and all speak the same language when discussing them. Refer to the glossary in appendix 2 for definitions of *Treatment area; treatment boundary; Aerial application area and boundary; exclusion zone; no fly zone; sensitive boundary and buffer*. Take a leadership role in ensuring these terms are used correctly by yourself and others.
5. Consider what places should be *exclusion zones* and what should have the extra precaution of *no-fly zone*. Ensure no-fly zones are practical to achieve and are there for good reason.
6. *Buffers* on your boundaries and exclusion zones need to be appropriate to the situation. The standard buffer on a treatment boundary should be 50m. You may decide to increase this buffer size for one or more of the following reasons:
    a. Your permission says you must
    b. The terrain and flying conditions are difficult.
    c. It is a *sensitive boundary* or *no fly zone*.

7. You may decide to reduce the *buffer* size for one or more of the following reasons:
    a. The boundary is between two adjacent *aerial application areas*
    b. A *deflector* or *trickle* bucket will be used
    c. The *aerial application boundary* is relatively easy to distinguish and fly and conditions are favourable.
8. The *aerial application area* can be treated with different buckets and flying techniques to give the best result and avoid sowing baits over boundaries (*over-sows*). The details of how each block is to be sown is best done in discussion with the chief pilot well ahead of bait application days.
    a. *Deflector buckets* sow bait to one side of the helicopter *flight line* – this can allow the helicopter to locate a *flight line* near the *aerial application boundary* and fly along it with half a normal swath (e.g. 80m) sowing into the block. These buckets limit the direction of flight depending on which side the bait is sown. Calibration is required to understand swath, *flow rates* and to ensure the bucket does not sow bait to the side not intended. Some manipulation of the GPS and data will be required to map it correctly.
    b. *Trickle buckets* usually operate without a spinner so that the bait 'trickles' out of the bucket in a narrow swath (e.g. 10m) allowing the pilot to fly close to an *aerial application boundary* or corner of a block. *Trick e buckets* usually have limitations in their sowing rates and the narrow swath can be inefficient.
    c. When working near boundaries with full swath buckets the *flight line* closest (and parallel) to the *aerial application boundary* needs to be at least half the *maximum swath* inside the boundary.
    d. It is often easier to fly parallel to a boundary than it is to approach a boundary at right angles to it and shut off the sowing bucket in exactly the right place to get baits to the boundary but not beyond. Baiting a 'safety margin' parallel to the *aerial application boundary* can sometimes be useful in these circumstances depending on terrain.
    e. *Aerial application boundaries* very obviously seen from the air can be easier for the pilot to get right than those in which s/he must rely entirely on instruments. Similarly, straight boundaries are easier to fly parallel to (if terrain allows) than others.
9. As per point 2 above it is compulsory to fly the boundaries with the pilot(s) before baiting commences to:
    a. ensure the *aerial application boundary* is correct in the GPS,
    b. familiarise the pilot(s) with the landscape and where the *treatment boundary* and *exclusion* or *no fly zones* are,
    c. discuss any changes required to the plan of how the area will be flown (which are recorded in the operational log),

## Understanding sowing rates

10. Read DOC-2651373 'Guidelines for aerial 1080 baiting #1: Bucket calibration' to gain an understanding of swath widths and sowing rates. Refer to bucket calibration information available for the buckets used in your operation to calculate some basic parameters you will be using to manage sowing rates.
    a. What *useable swath* width does the bucket deliver?
    b. What average sowing rate is required on the ground?
    c. What percentage overlap of swaths is planned?
    d. What *flow rate* out of the bucket do you need to deliver the required average sowing rate?
    e. What is the *flight line spacing* in the pilot's GPS?
    f. What *ground speed* are the bucket calibration figures based on?
    g. What *airspeed* does this *ground speed* correspond to (in knots) when flying into a 15kt headwind or 15kt tailwind?
    h. What area should a bucket load cover at the correct sowing rate and overlap?
    i. What area figure will the pilot see on his/her GPS for that same load?
    j. About how long should it take for that same load to be sown?

    An example showing how these answers might be calculated are given in Appendix 1.

## Managing sowing rates during the operation.

11. You need answers to the questions in 10 above for each sowing bucket being used, including any spare bucket or specialised bucket (trickle sowing or 'deflector bucket'). The *ground speed* used for bucket calibration should be the target *ground speed* used on the operation.
12. The *flow rate* will change whenever bait or weather conditions differ from those at the time of calibration. The sowing rate will change as a consequence of this or because of a change in *ground speed*. When managing sowing rates during an operation you cannot expect to get it perfect, but by tracking it you can make modifications to keep it close to the desired rate.
13. Ask the pilot to radio in the hectares shown on his/her GPS screen at the end of each load. Compare this to the target number of hectares that should be showing if the sowing rate was perfectly applied.
14. Small changes are best addressed by changing *ground speed*. Larger changes are better fixed by changing aperture size in the bucket. If the *ground speed* required to deliver the correct rate is too high and the aircraft is dealing with head/tail winds or substantial climbs/descents whilst sowing, it will become too difficult for the pilot to manage a consistent ground speed and a change in disc size will bring the required rate into line. For more information on how changes in ground speed influence sowing rates see DOC-2651396 Sheet "speed vs sowing rate".
15. Not maintaining *ground speed* is fatal to sowing rate. For example if a bucket sowing at a rate of 1.5kg/ha using a 120m swath when calibrated at 50 knots meets a 5 knot head wind and fails to compensate for it (ie they maintain 50kt airspeed but their *ground speed* slows to 45kt), this will increase their sowing rate by 11%. When they turn and do the next *sow line* downwind, they will be applying bait 9% less than the prescribed rate. This situation

quickly gets worse with increasing winds. For a 10kt wind the same scenario increases to +25% upwind and -17% downwind. For 15kt winds this jumps to +43% and -23%. These figures are indicative only as they will change with swath width, calibrated sowing rate and calibrated ground speed but they illustrate the critical importance of consistent *ground speed*.

## Wind and other effects on bait distribution

16. Wind moves the bait swath, the extent of this is influenced by:
    a. Wind strength and direction (cross wind gives more displacement off the GPS *recorded sow line*)
    b. Size of baits (heavier baits are less affected than lighter)
    c. Height above ground when leaving the bucket (Higher above ground sowing gives more displacement off the GPS *recorded sow line*).
17. For 16mm baits released at 90m or less in a 10 to 25km/hr cross wind the *useable swath* is displaced about 10 to 20m. The *maximum swath* is displaced about 30m downwind in these circumstances. These figures are estimates only, individual results may vary.
18. The momentum of the helicopter can affect where bait lands at the beginning and ends of each *sow line*. This 'throw forward' effect can be up to 100m but experienced pilots can usually anticipate the turn-on/turn-off points to reduce this to about 30m. This will influence how the bait is mapped from GPS downloads.

## Managing downloads

19. GPS data downloads should be taken early in the day (e.g. after the first load) to ensure the information is being collected, transferred and displayed correctly. Thereafter timing downloads for helicopter refuelling times or breaks will give a reasonable flow of information to the GIS technician while allowing the pilot to achieve a rhythm.
20. Ensure flight lines are given careful scrutiny on screen at a scale which will readily show gaps greater than 20m. Keep a log of areas to re-sow at the end of the day. Ensure time is allowed to complete this work at the end of each day's flying (unless more pragmatic times arise to fill such gaps).
21. Examine *ground speed* data from *sow lines* to look for consistency throughout each load and highlight major deviations from the target *ground speed* used in calibration of the bucket.
22. Ensure raw data is immediately backed up as it is retrieved from the helicopter GPS, always work on a copy of the data. Where necessary use a fool-proof system of safeguarding the data card when transporting it from the helicopter to the GIS laptop.
23. Do not allow aircraft to leave the area until you have all applicable data downloaded from the aircraft and have checked it is displaying correctly in the laptop.
24. Data from each download must include:
    a. Helicopter registration number
    b. Bucket identification

c. Type of bucket (e.g. full swath, deflector, trickle)
d. Ground speed
e. Time
f. Helicopter location & altitude

## Data collection

25. Delegate someone to maintain a log of helicopter loads and timing using the best practice bait log template (DOC-5543475). This is particularly important for operations using multiple aircraft. Pay particular attention to changes in routine such as returning early due to problems, changes in the size of loads or bucket apertures, changes in weather or wind direction.
26. Delegate someone from the loading crew to maintain a count of loads flown off the loading site, number of loads open and ready to go and number of loads available unopened on site. This information should be made available to you via radio at any time upon request.

## Communications

27. Maintain air to ground contact with pilots but keep radio traffic on that channel to a minimum. Discuss with pilots at the briefing when best to talk with them on the radio. They will be busy with the aircraft controls when coming into the loading site, when hovering while the bucket is being loaded and when lifting out of the loading site. Time your radio messages to avoid these times if possible- eg speak to them when they are returning to the loading site but have not yet reached it, when they have cleared the loading site with a new load but have not yet started sowing, or when they have settled down to refuel but have not yet left the aircraft.
28. Have a clear understanding with loading crew supervisors to what extent you will relay messages to pilots through them and under what circumstances you will talk to them directly.

## Dealing with bait misapplication and spills

29. When bait ends up in places it's not meant to be (misapplication) or is laid inside the *Treatment area* but not as per the operational plan (spills) there are a number of things to do. The legal requirements are given in Situation 2 on every *Safe Handling Sheet* e.g. DOCDM-22712. It is critical that these requirements are met.
30. As part of the risk management for the project, an Emergency Response Plan covering what to do, who to report to; and what information to collect to assist an investigation – should be prepared. An example of this is available on DOC-3009483.
31. Because the situation of every incident will be unique, any pre-prepared emergency response plan will need adapting to meet the critical issues. Use a Team Process to revise the action plan and implement it effectively.
32. Create and maintain a log of all communications and actions from the time of first awareness of the incident.

# Appendix 1. Information needed to manage sowing rates

**a. What useable swath width does the bucket deliver?**

See DOC-2651373 'Guidelines for aerial 1080 baiting #1: Buckets calibration' sections 3 and 4 for how to measure this during calibration.

**b. What average sowing rate is required on the ground?**

See operational plan for this figure.

**c. What percentage overlap of swaths is planned?**

See operational plan for this figure

**d. What flow rate out of the bucket do you need to deliver the required average sowing rate?**

See DOC-2651373 'Guidelines for aerial 1080 baiting #1: Buckets calibration' section 7 for how to calculate this

**e. What is the flight path spacing in the pilot's GPS?**

This can be calculated from the useable swath and degree of overlap. For example if the useable swath is 120m and the required overlap is 20m the *sow lines* will be spaced 100m apart.

**f. What ground speed are the bucket calibration figures based on?**

Refer to the bucket calibration data for this.

**g. What airspeed does this ground speed correspond to (in knots) when flying into a 15kt headwind or 15kt tailwind?**

When flying into a headwind of 15kt the airspeed will have to increase by 15kt to maintain the correct ground speed. For example, if the bucket was calibrated at 50kt the upwind airspeed will need to be 65kt.

**h. What area should a bucket load cover at the correct sowing rate and overlap?**

This will depend on the quantity of bait in the bucket load, the flight path spacing and the average on-ground sowing rate. For example, a 600kg load with 120m swath which is using a 20m overlap (*sow lines* are 100m apart) and an average on-ground sowing rate of 2kg/ha (ie 1.5kg/ha flow rate out of the bucket), - will cover 600kg /2kg/ha = 300ha.

**i. What area figure will the pilot see on his/her GPS for that same load?**

This may depend on how the GPS is configured. Usually they calculate area by tracking the length of *sow line* sown multiplied by the *flight path spacing*. For example, a 600kg load with 100m *flight path spacing* will go 40km sowing bait at a rate of 1.5kg/ha. 40,000m x 100m = 400ha.

**j. About how long should it take for that same load to be sown?**

This will depend on the bucket flow rate and ground speed data derived from bucket calibration trials. For example, a 600kg load sowing bait at a rate of 1.5kg/ha calibrated at 50kt ground speed (92.6km/hr or 1543m per minute) will travel 40km to deliver the load. It will take 40000/1543 = 26 minutes to go that far plus time lost in each turn and transit time to/from the loading site. If s/he comes back inside a half hour there's obviously a problem.

# Appendix 2 Glossary of terms

Terms used in the text of this document which are *underlined in italics* are defined here. These definitions are extracted from Animal Pests SOP Definitions and FAQs DOCDM-51708 where a more comprehensive list of definitions can be accessed.

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| **Aerial application area** | The area over which bait is to be aerially applied. This is the shape file given to the pilot to be flown. May have exclusion zones or no fly zones within its perimeter. It doesn't include the areas of the buffers. |
| **Aerial application boundary** | The boundary of the area where bait is to be aerially applied. May be buffered in from the treatment area boundary. |
| **Airspeed** | The velocity of the aircraft through the air when flying |
| **Boundary sow** | Sowing bait near and parallel to the aerial application boundary with a full swath or a deflector bucket. This technique is used to cover the ends of sow lines where there may be gaps in coverage. It can also be used to move sow lines further away from sensitive boundaries. Sometimes referred to as 'parallel sow', 'headland run' or 'boundary run'. |
| **Bucket gate** | The mechanism on the sowing bucket which controls bait flow from the hopper to the spinner. Normally this system is linked to the GPS Navigational guidance to record sow lines when the gate is open. |
| **Buffer (aerial application)** | An area where bait is not to be applied aerially, but if bait is unintentionally applied there is no breach of permission conditions, i.e. the area between the aerial application boundary and either:<br>• The treatment area/block boundary<br>• The boundary of an exclusion zone<br>• The boundary of a no fly zone |
| **Buffer zone (hunting)** | The area **outside** the boundaries of the treament area from which meat for human consumption should not be procured.<br>(The defintion from the Animal Products Notice: Specifications for Products Intended for Human Consumption is "the land situated between the boundaries of an area of land that has been exposed to poison and an area of land where it is acceptable for animals to be procured, measured as a straight line on a horizontal plane".) |
| **Deflector bucket** | A bait sowing helicopter bucket modified to only allow bait to be spread to one side of the flight line. |

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| **Exclusion zone** | An area that is within the treatment boundaries of an operation, but which is excluded from the operation – i.e. no pesticides are laid within the exclusion zone. |
| **Flight corridor** | Designated area between the loading site and the aerial application area which all helicopters with buckets must use when travelling between the two. Corridors are generally only necessary where the loading site is outside the Treatment area but can also be identified for transiting between treatment blocks. |
| **Flight line** | Line of travel by the helicopter recorded by GPS regardless of whether or not the bucket is sowing |
| **Flight path spacing** | Distance between sow lines set as a parameter into the GPS. This distance is decided on with reference to the useable swath of the bucket being used. |
| **Flow rate** | The rate at which baits pass through the bucket apeture onto the spinner. This figure affects sowing rate. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for further detail on how it is measured. |
| **Ground speed** | The velocity of the aircraft over the ground. This figure affects sowing rate. |
| **Maximum swath** | Identified during bucket calibration, this is the maximum distance baits are thrown at right angles to the flight line multiplied by 2. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for further detail on how it is measured. This figure is used to determine flight paths near boundaries. |
| **No fly zone** | An area where aircraft may not traverse with a bait bucket. This may be because of a consent condition, consultation agreement or as an operational planning decision. |
| **Over fly** | Fly a helicopter with a bucket attached below 500 feet over areas specified in the Treatment Area map as No-Fly zones. This includes flying outside designated flight corridors. |
| **Over Sow** | Misapplication of bait outside the Treatment Area or into an exclusion zone. |

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| **Recorded sow line** | The GPS data of sow line recorded when the bucket gate is open (i.e., usually when the bucket is actually sowing bait). Recorded sow lines will be the underlying data for bait coverage maps produced by GIS Analysts. |
| **Safe Handling Sheet** | Part of the Safe Handling of Pesticides SOP used in the field to provide standards on handling pesticides and personal protective equipment. |
| **Sensitive boundary** | A Treatment Area boundary which is particularly important to avoid over sowing. This could be for various reasons such as risk to livestock, a high public use area or road, relationship risk etc. Usually extra precautions are taken around sensitive boundaries such as increased buffers or trickle/deflector bucket sowing. |
| **Site lead (aerial operations)** | The person in charge of an aerial baiting operation during baiting operations. This person has decision making authority over field operations on the day(s) of aerial baiting. It can be the Operational planner, the Incident Controller, or the Air operations manager. Because these terms are not used consistently in DOC operations the term site lead has been developed. |
| **Sow line** | Parallel flight path generated by the navigational guidance GPS inside the aerial application area along which the helicopter applies (or sows) bait. Most GPS system number each line for ease of communication.<br>See also 'Recorded sow line' |
| **Treatment area** | The area for which permission (DOC and Public Health) is sought or held to apply pesticides. This is the area entered into the DOCgis Pesticides Application and used for public notification. Treatment area boundary has a corresponding meaning. |
| **Treatment area (performance reporting definition)** | The area where animal pests are controlled in any one financial year. Total number of hectares, consisting of one or more treatment blocks. It could include the land covered by search effort if that effort was part of controlling them (eg for heli-hunting it means the area you cover and would shoot target species if encountered). |
| **Treatment block** | A subset of a treatment area. A treatment area is broken down into treatment blocks when blocks are physically separated **or** when different management methods are applied. Treatment block boundary has a corresponding meaning. |

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| **Trickle bucket** | A bait sowing helicopter bucket modified to only allow a narrow bait swathe either side of the flight line. |
| **Useable swath** | Identified during bucket calibration, this is the distance most baits reach at right angles to the flight line (at the desired sowing rate) multiplied by 2. See 'Guidelines for aerial 1080 baiting#1 Bucket calibration' DOC-2651373 for further detail on how it is measured. This figure is used to determine flight path spacing.<br><br>Sometimes referred to as 'effective swath'. |