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Reducing the impacts of development on New Zealand lizards

Guidance for developers, consenting authorities and
ecologists/herpetologists

Department of Conservation Lizard Technical Advisory Group



Department of
Conservation
Te Papa Atawhai



Te Kāwanatanga
o Aotearoa
New Zealand Government

Cover: Jewelled gecko (*Naultinus gemmeus*), Otago. Photo: Sabine Bernert, sabine.bernert@gmail.com

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Reducing the impacts of development on New Zealand lizards

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Executive summary

The aim of this document is to reduce the impact of development on native lizards. Its key messages are:

- Native lizards (skinks and geckos) may be present at sites of interest to developers.
- All native lizard species and significant lizard habitats are protected by law. There are Wildlife Act penalties for deliberately disturbing or destroying (killing) native lizards.
- Development is a threat to lizards. However, with advance planning and expert advice, potential impacts on lizards and their habitats can be avoided, reduced or compensated for.
- Developers must complete an Assessment of Environment Effects (AEE) for any development proposal. An AEE must include a habitat assessment or lizard survey if native lizards or potential lizard habitats are present in the development area. A 'Wildlife Permit' (a Wildlife Act Authority) from the Department of Conservation may also be required.
- Developers need to seek expert advice at an early stage of their proposal to avoid potential conflicts and project delays.
- Lizards are cold-blooded. This means that surveys, salvage and relocation of lizards can **ONLY** be done during their active season (between October and April for most New Zealand species).
- New habitat can be created for lizards but plantings and other work must be planned and carried out with expert input to ensure the lizards' needs are addressed.



West Coast green gecko (*Naultinus tuberculatus*). Photo: M. Lettinck

1. Introduction

This document advises developers and consenting authorities on their legal obligations (see Box 1) and the steps they need to take when making decisions about land use on sites that may contain native lizard populations. It was prepared by the Department of Conservation (DOC) Lizard Technical Advisory Group. It is not a substitute for site-specific advice from an expert.

1.1 Development threatens New Zealand's native lizards and their habitats

New Zealand is home to 105 lizard species in two groups: skinks and geckos. All 104 known native (naturally occurring) species are protected under the Wildlife Act¹. Most native lizard species (85%) are ranked as Threatened or At Risk of extinction² under the New Zealand Threat Classification System (NZTCS).

Not only does development threaten lizards directly, but it also endangers them indirectly by harming or destroying their habitats – many of which are already small, fragmented and isolated. However, with careful planning, appropriate expertise and enough time, impacts of development on lizards and their habitats can be avoided, reduced or compensated for. Lizard habitat enhancement and mitigation activities can even provide positive publicity for a project.



Skinks (left) have shiny, sinewy bodies, smooth and overlapping scales, and no obvious neck. They are able to blink. Most species are ground-dwelling (terrestrial) and active by day (diurnal). This is a scree skink (*Oligosoma waimatense*). Photo: M. Lettink



Geckos (right) have baggy, velvety skin with granular scales. They cannot blink and use their tongues to clean their eyes. May live on the ground or in trees and shrubs. They are mostly nocturnal, but the so-called 'green geckos' are active by day. This day-active jewelled gecko (*Naultinus gemmeus*) lives in twiggy native shrubs. Photo: M. Lettink

¹ The only species not protected by law is the rainbow or plague skink, an accidental introduction from Australia.

² The current figure is 85%, or 88 out of 104 native lizard species (2015 assessment). All species in New Zealand are assessed against NZTCS criteria according to their threat of extinction. For more information, see Hitchmough, R.; Barr, B.; Lettink, M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. *New Zealand Threat Classification System Series 17*, Department of Conservation, Wellington; and <http://www.doc.govt.nz/nztcs>.

Box 1: Know your legal obligations

Native lizards and their habitats are both protected by law:

- All native lizards are absolutely protected by the Wildlife Act 1953 (and amendments). No one may kill, hunt, capture, deliberately disturb or possess native lizards, unless they have a permit to do so. DOC is responsible for enforcing the Wildlife Act.
- Significant habitats of native lizards and other indigenous fauna are protected by the Resource Management Act 1991 (RMA); 1991 and amendments). The RMA is the main piece of legislation that prescribes how the New Zealand environment should be sustainably managed³. Under this Act, local government (regional, district, city and unitary councils) is responsible for managing indigenous biodiversity (including native lizards) on private land⁴.

Meeting your legal obligations ensures you avoid penalties under the Wildlife Act; these can include imprisonment and/or fines.

Local government is the consenting authority for most development projects. It has a vital role in implementing policy and non-statutory national and regional biodiversity strategies. These include the Government's Proposed National Policy Statement on Indigenous Biodiversity, Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land (otherwise known as 'Protecting our Places') and the New Zealand Biodiversity Strategy (MfE, 2000)⁵.

Nationally-significant proposals (e.g. large wind farms, geothermal power stations, roads of national significance) are assessed by the Environmental Protection Agency (EPA).

³ Impacts of resource use on biodiversity are currently recognised under sections 5, 6(c), 7(d), 30(1)(c)(iiiia), 30(1)(ga) and 31(b)(iii) of the Resource Management Act 1991 (and amendments).

⁴ The RMA also applies to conservation land (about a third of New Zealand's total land area), but biodiversity management in those areas is chiefly influenced by other legislation.

⁵ These documents can be obtained from the Ministry for the Environment (www.mfe.govt.nz/publications/biodiversity).

2. Where are lizards found?

Lizards live in forests, shrublands, grasslands, wetlands and rocklands, from sea level up to 2000 m high in mountains! They also occupy some suburban and urban areas (e.g. gardens, parks, shelterbelts, empty lots, vegetated road and railway embankments). Even tiny scraps of habitat on land that at first glance seems totally unsuitable may be providing vital refuge for lizards (see Boxes 2 and 3).

Habitats where lizards are found may sometimes appear to have low or no ecological value. These include:

- **native and exotic scrub and shrublands.**
- **rocklands** – stone/boulder fields, tors, karst, scree, river terraces and risers, rock outcrops and bluffs. Even very tiny and isolated areas of stones can provide vital refuge and basking sites for lizards.
- **unused weedy lots** – lizards like scruffy sites with lots of cover that is rarely disturbed, such as:
 - empty, overgrown lots with rank grass.
 - weedy areas – pampas, rough kikuyu grass, blackberry, tree lupin and gorse.
 - Rubbish – piles of cardboard, broken concrete, tyres, garden waste etc. can accommodate surprisingly large numbers of native lizards.



Only one side of this fence (the scruffy side) offers suitable habitat for lizards. Photo: M. Lettink

Box 2: Where do lizards live?



Native forest and shrubland remnants such as these in Wairarapa provide vital refuge for lizards in modified landscapes. *Photo: M. Lettink*



This jewelled gecko (*Naultinus gemmeus*) seems perfectly at home living in what can be a problem weed; the prickly gorse probably provides protection from predators. *Photo: Bob Webster*



The weedy bank next to these manicured golf course greens supports a healthy skink population. *Photo: M. Lettink*



Small strips of rank grass bordering railway lines and roads (such as these in Christchurch) may harbour skink populations. *Photo: M. Lettink*



Rocks that were dug up from neighbouring paddocks and dumped by the roadside when this farmland was developed provide the last and only refuge remaining for skinks. *Photo: Hermann Frank*



Dumped rubbish provides lizards with numerous safe homes. *Photo: M. Lettink*



Native small-leaved shrubs ('grey scrub') like these on Banks Peninsula provide habitat for arboreal (tree-dwelling) geckos. *Photo: M. Lettink*



Undisturbed, overgrown and weed-infested sites such as these at South Beach, Timaru, can provide excellent lizard habitat. *Photo: M. Lettink*

Box 3: Lizards are hard to find

Lizards are rarely obvious in their environment. Most are masters of camouflage like (A) this harlequin gecko (*Tukutuku rakiurae*) on a mānuka bush and (B) this southern grass skink (*Oligosoma* aff. *polychroma* Clade 5) in a riverbed. Lizards are much harder to find than most birds. Surveys MUST be done by experts and at times when they are active.



Photo: M. Lettink



Photo: M. Lettink

3. All parties are responsible for considering lizards in development proposals

Although developers are ultimately responsible, all parties involved in a proposed development (in particular developers, councils and expert advisers) must meet their statutory responsibilities (see Box 1). The key responsibilities of developers, councils and ecologists/herpetologists are outlined in Table 1. Other parties may also be involved (especially iwi and DOC if a Wildlife Permit is required, lizards need to be disturbed and/or the site is on conservation land).

Table 1. Key responsibilities of developers, councils and ecologists/herpetologists (assuming that the site is on private land owned by the developer).

Developers	<ul style="list-style-type: none"> • Determine if their proposed development is permitted under local council plan(s) • If not, identify and consult potentially affected parties • Engage an ecologist/herpetologist to conduct a lizard survey and/or Assessment of Environmental Effects (AEE) • Obtain a resource consent and a Wildlife Permit (if required) • Finance the proposed development and all associated costs
Councils	<ul style="list-style-type: none"> • Ensure resource consent applications meet legal obligations • Determine if effects on native lizards have been identified • Decide if consent requires public notification • Decline or approve consent with appropriate conditions • Monitor consent conditions and enforce any violations
Ecologist/herpetologist	<ul style="list-style-type: none"> • Identify lizard values and best outcomes for lizards • Ensure their own activities are covered by a Wildlife Permit
DOC	<ul style="list-style-type: none"> • Assess and approve Wildlife permit applications with appropriate conditions

4. Consult a lizard expert as early as possible

A lizard expert (herpetologist; Fig. 1) should be consulted as early as possible in the project (except for sites that do not contain any native lizards or significant habitats for native lizards). See the flowchart (Fig. 2). The lizard expert then becomes responsible for identifying lizards or lizard habitat within the project (see Box 4) and can help develop a suitable strategy to address actual or potential impacts on lizards.

If information about lizards is not included in resource consent or Wildlife Permit applications, councils and/or DOC may request that a habitat assessment or lizard survey is carried out.

4.1 Do I need a lizard expert?

The decision tree (Fig. 2) will help you decide if you need a lizard expert to help you meet your legal obligations:

4.2 How do you find a lizard expert?

Local councils or the DOC Lizard Technical Advisory Group may be able to provide advice on reputable herpetologists operating in your area. Your chosen expert should have a good reputation for producing high-quality management plans. Appendix 1 provides details of the information and processes that may be needed.



Figure 1. A herpetologist inspecting a rock outcrop for lizards and their sign. *Photo: M. Lettink*

Box 4: How do I know if the site of a proposed development contains lizards or significant lizard habitat?

You must consider native lizards and their habitats in any development proposal. Do not assume the absence of any published or other record of lizards means no lizards are present: many areas have never been surveyed for lizards and most councils do not have access to lizard records.

Seek site-specific advice from a reputable lizard expert (herpetologist) early in your project. A lizard expert can:

- Check repositories (e.g. DOC Herpetofauna database) for lizard records and other relevant information from the site of interest and its general area before planning a survey, keeping in mind that absence of record does not mean absence of lizards.
- Conduct a well-designed lizard survey to determine species' presence and distribution.
- Assess whether the site contains significant lizard habitat, using the methods that apply to that area (e.g. significance criteria set out in the local, regional and/or district plan). Nationwide, councils use different methods to identify significant sites and/or habitats of indigenous fauna. The most common technique is to use criteria that are the same as, or very similar to, criteria used under DOC's Protected Natural Areas Programme.
- Advise on how to manage your development for lizards as part of an Assessment of Environmental Effects (AEE – also known as an Environmental or Ecological Impact Assessment). An AEE is a written statement that identifies and evaluates the actual and potential effects of the proposed development activities on the environment, including lizards and their habitats. It also identifies ways to avoid or reduce any adverse effects. See Appendix 1 for more details.
- Ensure all legal obligations relating to lizards are met (see Box 1). A Wildlife Permit from DOC will be required if native lizards are going to be disturbed or killed by the proposed activities. Projects with significant impacts may also require a Lizard Management Plan.

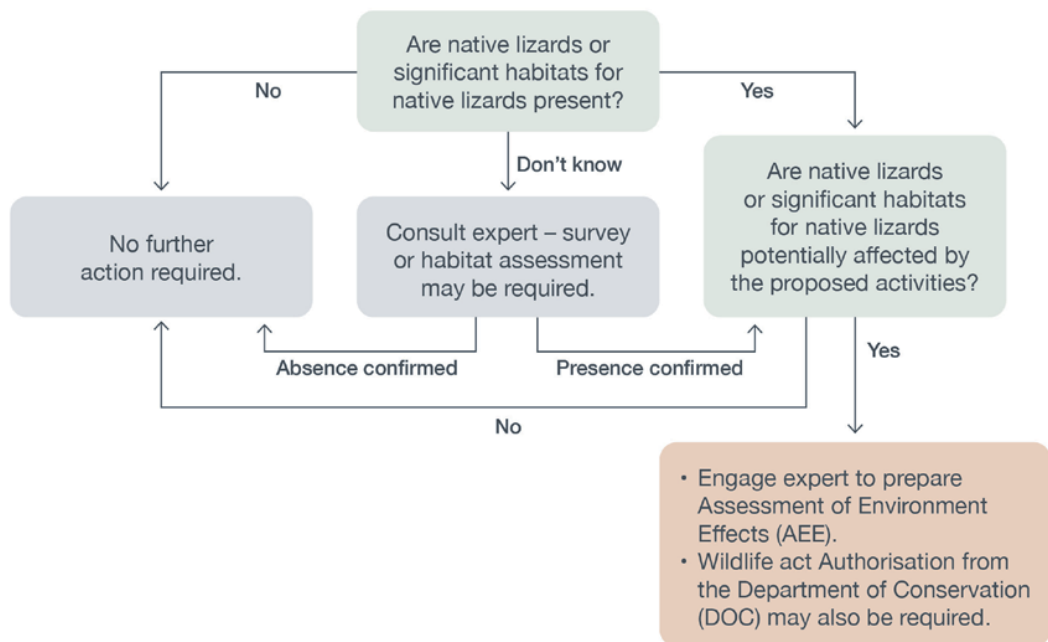


Figure 2. This decision tree will help you decide if you need a lizard expert to help you meet your legal obligations.

5. Developments can have negative effects on lizards and their habitats

The most common potential adverse effects are listed in Table 2. It is easier to determine the extent of habitat that may be affected by a proposed development, but not the number of lizards affected. This is because it is very difficult to estimate population size for most lizard species.

Table 2. Potential adverse effects of development on lizards and their habitats.

POTENTIAL EFFECT	NATURE AND DURATION OF THE EFFECT
Mortality and injury	Land clearance and earthworks (e.g. for housing, infrastructure, mining, agriculture (Fig. 3)) can cause death or injury to lizards using the habitat. A direct effect limited to the construction phase.
Habitat loss	Reduction in the amount (quantity) of habitat available to lizards. All development proposals that involve earthworks (Figs 3, 4) or vegetation clearance have the potential to cause habitat loss. This occurs when vegetation, rocks and/or other habitat features used by lizards are removed. Displaced animals: <ul style="list-style-type: none"> • are forced to seek resources (e.g. food, refuge, basking sites) elsewhere. • may compete and fight with other lizards, resulting in the death of some displaced individuals if adjoining habitat is already occupied. • may also be more vulnerable to predation while moving through unfamiliar areas. A permanent indirect effect, unless habitat is rehabilitated.
Habitat fragmentation	Subdivision of habitat into smaller fragments through habitat clearance or construction of physical barriers (e.g. dams, irrigation canals, roads). Fragmentation isolates individuals because they cannot cross unsuitable habitat to breed with other animals nearby. Fragmentation due to roads and tracks can also give predators greater access to lizard habitat. A permanent indirect effect, unless connectivity is restored.
Habitat degradation	Removal of key habitat features that are important to lizards (including 'tidying' of dumped rubbish), damage caused by livestock (e.g. over-grazing, fouling, pugging, soil compaction), edge effects, weeds or other factors (e.g. dust, noise, light pollution, plantation forestry (Fig. 4)). Reduces the quality of habitat available to lizards. A permanent indirect effect, unless the causal factor(s) is removed.
Invasive exotic plants	Non-native plant species can become invasive weeds or monocultures that displace native vegetation and/or degrade lizard habitat by shading. This includes exotic plantation forestry species, which are often planted through habitats occupied by lizards (e.g. native shrublands). A permanent indirect effect, unless exotic plants are removed or controlled.
Increased predation	An increase in the numbers and/or association of animals that prey on lizards (pest mammals and some bird species). For example, new housing developments may increase domestic cat numbers, and attract rodents to compost heaps and other human refuse. An indirect effect that can be reduced by predator control and other measures (e.g. cat-free subdivisions and cat curfews).
Restoration plantings	Restoration plantings undertaken in many development projects to restore vegetated areas or bird habitat can have detrimental impacts on resident lizard populations: <ul style="list-style-type: none"> • e.g. if thick ground cover is replaced with bark chips and small seedlings, which lack sufficient resources for lizards. • introduction of the pest plague skink, as eggs of this skink have been found in potting mix from nurseries in the Auckland area that grow plants for restoration, and this highly invasive species has accidentally been spread to new areas. An indirect effect that can be avoided by staging plantings, retaining habitat features important to lizards, and by screening potting mix.
Vehicle strike	Vehicles can kill or injure animals crossing roads and tracks. Development may create new roads or result in increased traffic along existing roads. The impact of vehicle strike on New Zealand lizards has not been studied. An Australian study estimated that c. 5.5 million reptiles and frogs were killed by vehicle strike in just one year. A permanent direct effect.



Figure 3. Example of mortality, injury and habitat loss. Skinks will not survive the removal of stone rows on this farm. The stone rows are being removed because they impede the passage of centre pivot irrigators. *Photo: Hermann Frank*



Figure 4. Example of habitat degradation and habitat loss. Exotic forestry trees can outgrow native vegetation (in this case, small-leaved shrubs) within 5–10 years. Geckos have two choices once their shrubs are shaded by emergent trees: move up or move out. Any animals remaining in the plantation when it is harvested are likely to be killed or injured. *Photo: M. Lettink*

6. Making new habitat for lizards

Developers may need to create new lizard habitat to make up for that lost during development. **This work requires a lizard expert and will also require plenty of time for the new habitat to be established before the existing habitat is damaged or destroyed.**

New habitat needs to provide lizards with:

- **food** – a variety of small insects, and plants that produce berries and/or nectar
- **shelter** – protection from the elements and secure over-wintering sites
- **basking areas** – lizards are cold-blooded and need to bask in the sun to warm up
- **protection from predators** – introduced pest mammals (mice, rats, stoats, weasels, ferrets, cats and hedgehogs) eat lizards, as do some bird species. Rock piles, woody debris and vegetation (dense grasses, vines and shrubs) all provide good cover.

New lizard habitat may be made to:

1. accommodate animals salvaged from a development site at a later date; and/or
2. allow a resident population to expand into, to make up for losses elsewhere.

The new habitat should ideally be similar in size and structure to that lost during development, and be created at least 12 months in advance (ideally longer) of any lizards being released into it. Late autumn/winter is the best time for planting. Unless the site is secure, formal protection will be needed to protect the new habitat from future development.

Please remember

When creating new habitat for lizards, avoid:

- mulching with bark chips, as these do not provide any resources for lizards (see Box 5).
- excessive maintenance – lizard habitats are best left undisturbed (Box 5) or with minimal maintenance (e.g. removing problem weeds while allowing vital cover to remain). Many weed species are beneficial to lizards because they provide protective cover.

There is no one-size-fits-all solution for creating new lizard habitat because different species have different requirements. Some habitats cannot be replaced (e.g. mature native forest and fissured bluffs) and most will take a long time (years or decades) to mature. Designing habitats for lizards will usually require a lizard expert.

Box 5: Mulching for lizards

Bark chips are commonly used as mulch. While they may look neat and tidy, they do not provide any of the resources that lizards need for their survival (food, shelter and protection from predators). More appropriate alternatives for mulch in lizard habitats are river cobbles and woody debris (viewed as scruffy or unattractive by some but perfectly good from a lizard's perspective).



The bark mulch used in this area keeps weeds under control but doesn't provide habitat for lizards.

Photo: Marieke Lettink



Cobbles and logs are used here for both mulch and lizard habitat. Lizard-appropriate plants have been established.

Photo: Marieke Lettink



This area was designed for lizards. While the carefully placed rocks provide a mowing edge to keep the lawn neat, dead and dying vegetation from the lizard-appropriate plants is not cleared away. *Photo: Marieke Lettink*



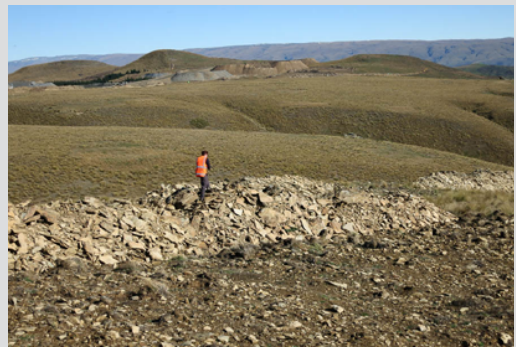
Many ground-dwelling lizards live in plant litter and debris. Deliberately cut or gathered branches and other plant material can be used as mulch for lizards.

Photo: G.R. Parrish

Box 6: Lizard habitat creation



This reserve was originally an old gravel pit, and is now a sanctuary for lizards and dryland plants. Restoration planting with hardy dryland natives and predator control will ensure the site benefits both its resident lizards and animals salvaged from the wider area. *Photo: Marieke Lettink*



Freshly-created 10 m long and 2 m high artificial lizard habitat created from unsorted schist rock at OceanaGold's Macraes site in Otago are currently being vegetated. Even at this early stage the rock piles were being used by two species of skink. *Photo: Mike Thorsen.*

Box 6: Lizard habitat creation continued



Planted vegetation should be well-established before lizards need to move in. This may take some years to achieve. *Photo: Marieke Lettink*



Eco-sourced plants should preferentially be used in producing new habitat. Collecting and propagating the vegetation can take time. *Photo: Marieke Lettink*

The following series of images shows how copper skink habitats can be created using the resources available at the development site. Mature trees can be sliced up into wooden discs which can then provide the base layer of a complex habitat for ground-dwelling skinks. As the wooden discs break down they attract a variety of insects (lizard food) and create the cool, moist and protective conditions that are favoured by these secretive animals. This is a great alternative to mulching or burning vegetation as well. The first step is to clear the ground of leaf litter and place the discs (A) over the area you plan on putting lizards into. Then fill all the gaps and cracks with as much leaf litter as can be found (B), and proceed to add layer upon layer of felled vegetation on top (C, D). The scale of the habitat created depends on the scale of impacts so more habitat needs to be created for larger projects.

Photos: Jacqui Wairepo, Wildlands



Box 6: Lizard habitat creation continued



During the translocation of green skinks to Orokonui Ecosanctuary, Dunedin in 2016, the gorse around a grassy clearing where the skinks were released had to be removed to prevent it from gradually encroaching onto the clearing and degrading the habitat. The cut gorse was used over a wide area to create additional habitat complexity in areas that were fairly barren (just short-ish grass) by placing it over these areas, mixed in with a few rocks and old logs. Over time the gorse sunk down and grass grew through, creating a dense matrix of sticks/logs/rank grass. The green skinks soon colonised the created habitat and have continued to use it over the following years. In this situation it proved to be a simple way to both control the weeds and make use of the cut gorse. *Photos: Carey Knox, Wildlands.*

7. Frequently asked questions

Box 7 provides a list of frequently-asked questions about lizards and development. This list was compiled with the help of professional herpetologists working with New Zealand lizards.

Box 7. I haven't seen any lizards living in the footprint of my development – how do I know if any are there?

Just because you haven't seen any doesn't mean that they are not there – lizards are cryptic animals that often remain unnoticed. It is best to seek professional advice, ideally during the project planning phase.

What happens if lizards are found during a survey?

You will need to work with a herpetologist to find a solution. This could include avoiding lizard habitat, minimising habitat loss, relocating lizards to another part of the site that contains suitable and secure habitat, or moving lizards off-site (in that order of preference). A Wildlife permit and Lizard Management Plan may be required.

Why do we need to apply for a Wildlife Act permit and who issues them?

A Wildlife permit is a legal requirement for any projects that will deliberately disturb or kill native lizards. Wildlife Act permits are issued by DOC.

What happens if we go ahead without a Wildlife permit?

If you know that native lizards are present and the development proceeds without a permit, you are breaking the law and could be prosecuted under the Wildlife Act. DOC can require that work be halted until a permit is obtained (this can take 6 weeks to several months).

Won't lizards just run away when the bulldozers come?

Lizards respond to threats by hiding so they seldom run away when threatened. Most will seek cover or 'go to ground'. Some may run small distances (metres) before finding cover elsewhere. Lizards can't move when it is cold.

Can't we just scare them away?

If only it was that easy! Lizards are more likely to hide than to run away when frightened.

Box 7 continued

Can't we just mow the grass to make the lizards move away?

Most lizards are reluctant to leave their homes. Mowing kills many animals in the blades (40% loss in one study). The survivors will not have anywhere to go if there is no habitat nearby and may struggle to survive if adjacent habitat is inadequate for their needs or already occupied by other lizards.

Can't we just develop the lizard habitat, then buy some lizards and release them into our replanted areas?

No. This will destroy the resident lizard population along with its habitat. In any case, you cannot buy native lizards (it is illegal to buy, sell or export them under the Wildlife Act).

8. For further information

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8.5 Predator control

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[Note: there are currently no best-practice guidelines for predator control to protect lizards, beyond complete eradication. The example in the above report is of a predator control programme that demonstrated benefits for lizards].

8.6 Other (non-New Zealand) information

Edgar P.; Foster, J.; Baker 2010: Reptile habitat management handbook. Amphibian and Reptile Conservation, Bournemouth (<http://www.arc-trust.org/resources/RHMH.php>).

English Nature 2004. Reptiles: guidelines for developers. Belmont Press, Peterborough, UK.

Gleeson, J.; Gleeson, D. 2012: Reducing the Impacts of Development on Wildlife. CSIRO Publishing, Collingwood, Australia.

Appendix 1

Processes to reduce the effects of development on native lizards and habitats

This section explains processes that may be required to reduce the impacts of development on native lizards and their habitats to meet statutory requirements. It is divided into seven consecutive stages: background preparation, survey, Assessment of Environmental Effects (AEE), avoiding impacts, reducing impacts, offsetting residual impacts and environmental compensation. The actual number of stages required will depend on the site values, potential impacts and the planning provisions in your area.

Note: this is a basic guide – it should not be used as a substitute for site-specific advice from a herpetologist (lizard expert).

Background preparation	
Aim	Identify known lizard values and survey needs (often referred to as a 'desktop' review)
Methods	<ul style="list-style-type: none"> • Check relevant databases (e.g. DOC Herpetofauna database), survey reports and local knowledge for lizard records for the site of interest and the surrounding area. Many areas have not been surveyed – absence of information (i.e. no result) does not mean lizards are not present. • Decide whether a lizard survey is required based on available information and the presence of potential lizard habitat at the site. If a survey is required, submit a Wildlife Permit application to DOC or engage an ecologist/herpetologist who holds an appropriate Wildlife Permit.
Outcome	Prepared for survey with knowledge of lizard values that may be present and a Wildlife Permit. Alternatively, it has been determined that a survey will not be required because the site does not contain lizard habitat.

Survey	
Aim	Determine species' presence and distribution
Methods	<ul style="list-style-type: none"> • Carry out a lizard survey in suitable weather conditions. Late spring-to-early summer is generally the best time of year to conduct a lizard survey. The 'active season' for most New Zealand lizard species is October to April. • Ensure survey effort and methods used are appropriate for the site. Best-practice guidelines for the main field methods used in New Zealand are available on DOC's website: (http://www.doc.govt.nz/publications/science-and-technical/doc-procedures-and-sops/biodiversity-inventory-and-monitoring/herpetofaunaherpetofauna). • Report findings, including any previous lizard records for the site and surrounding area, survey results, an acknowledgment of any limitations (eg unsuitable weather, access restrictions, scant survey coverage) and an assessment of the importance of the site in a local, regional and/or national context. Submit lizard records to the DOC Herpetofauna database. DOC may require a copy of the survey report: reporting on survey findings is a standard condition of most Wildlife Act authorisations.
Outcome	Lizard values are known and have been documented and reported.

Assessment of Environmental Effects (AEE)	
Aim	Determine the actual and potential effect of development activities on lizard values and identify ways to avoid, remedy or mitigate any adverse effects. Provide enough information to inform a biodiversity offset for significant residual adverse effects, if appropriate.
Methods	<ul style="list-style-type: none"> • All applications for resource consent must include an AEE (the council will not process the application without one). The only type of activity for which an AEE is not required is a 'permitted activity', as specified in the council plan(s); check with your council if you are not sure. • The following information should be included in an AEE: (1) a description of the proposed activity; (2) an assessment of the proposal's actual and potential effects on lizards and their habitats; (3) consideration of alternatives; (4) identification of means whereby any adverse effects may be avoided, remedied or mitigated; (5) identification of affected parties and the outcomes of any consultation; (6) methods for monitoring any adverse effects that need to be controlled; and (7) quantitative measures suitable for the development of a Good Practice Biodiversity Offset (see: http://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/) if required by a council plan or volunteered.

Assessment of Environmental Effects (AEE)	
Methods contd	<ul style="list-style-type: none"> Report findings, including any previous lizard records for the site and surrounding area, survey results, an acknowledgment of any limitations (eg unsuitable weather, access restrictions, scant survey coverage) and an assessment of the importance of the site in a local, regional and/or national context. Submit lizard records to the DOC Herpetofauna database. DOC may require a copy of the survey report: reporting on survey findings is a standard condition of most Wildlife Act authorisations.
Outcome	Lizard values are known and have been documented and reported.

Avoiding impacts	
Aim	Avoid adverse effects of development activities on lizard values.
Methods	<ul style="list-style-type: none"> Ecological values should be considered at the earliest possible stage (ideally, before making land-purchase decisions so that sites with high values can be avoided). Councils may be able to advise on known values. It is best practice to first consider all options for avoiding negative effects on lizard values, by considering all alternatives and carefully designing the development to avoid sensitive habitats within the project area. Using avoidance measures may be more cost-effective than managing adverse effects because they eliminate the need for more laborious (and expensive!) offsets or compensation. The construction phase of a development is likely to cause the greatest harm to the environment and also, therefore, to lizards. Consequently, it is the best opportunity to prevent such harm with a thoughtful design process. Common construction activities that can have adverse effects on lizards and their habitats include earthworks, and the removal of native and exotic vegetation, rocks and/or other important habitat features (see Table 1). Avoidance measures include relocating or re-designing the development (eg containing lizards in the reserve allocation of a proposed subdivision; re-routing a road, trench or power line away from lizard habitat), and identifying and removing hazards to lizards (eg covering and/or regular checking of holes and open trenches, which can act as death traps). In many cases, lizards occupy discrete areas that can be retained without compromising the development (eg rock outcrops in dryland areas of interest to wine growers may harbour lizard populations). A setback distance or buffer may be required to protect such features (eg from human disturbance, herbicides, irrigation or shading). It is also important to ensure that connectivity to surrounding habitat patches is maintained. If avoidance is not possible, consider whether the effect can be mitigated (reduced) or remedied (restored or rehabilitated).
Outcome	Where possible, adverse effects of development on lizard values are avoided.

Reducing impacts	
Aim	Remedy or mitigate adverse effects of development activities on lizard values.
Methods	<ul style="list-style-type: none"> Because remedial and mitigation measures⁶ are often applied, they are jointly considered here as means to reduce residual adverse effects of development on lizard values. If avoidance is not possible, consider whether lizards can be accommodated on-site, either in their original habitat or in alternative, nearby habitat. If the adjoining habitat is already occupied, its ability to support additional lizards (ie carrying capacity) will need to be increased, for example by habitat enhancement. New habitat (eg restoration plantings, rock piles) will take time to establish and develop sufficient resources for lizards. The outcomes for this sort of reduction measure is uncertain. Lizards may need to be temporarily held in captivity if new habitat cannot be created in advance (eg by staging the development). Lizard habitat can be enhanced by planting appropriate species, adding natural or artificial refuges (eg logs, rocks, concrete slabs) and removing threats (eg excluding livestock or predators by fencing). Legal protection may be required to protect lizard habitat from future development (see: http://www.doc.govt.nz/publications/conservation/protecting-and-restoring-our-natural-heritage-a-practical-guide/legal-protection/). Transfer to other sites should only be considered if lizards cannot be accommodated on site. Release site(s) should be as close to the salvage site as possible (and within the species' natural range), have sufficient habitat (size and quality) and capacity to accommodate salvaged animals, and be monitored for at least 5 years to determine translocation success. Habitat enhancement and/or predator control will be needed if the release site contains a resident lizard population.

⁶ There is some overlap between these terms, depending on the interpretation used. 'Remedy' can mean to restore a site to how it was prior to development (e.g. recreating the landscape, soils, fauna and vegetation). It can also be interpreted in a legal sense to mean to provide redress or environmental compensation. 'Mitigate' means 'to make milder or less intense or severe, moderate' (Oxford Concise Dictionary 1990).

Reducing impacts	
Methods contd	<ul style="list-style-type: none"> • Predator control programmes for salvaged lizards should target multiple pest species (cats, mustelids, hedgehogs and rodents), use approved traps and/or poisons (eg http://www.predatortraps.com/ and http://www.connovation.co.nz/), follow best-practice methods, and be monitored to ensure their effectiveness. Following commonly-used targets for pest control (e.g. controlling rats to < 5% tracking index) does not necessarily guarantee benefits to lizards; this can only be determined by 'outcome monitoring' (monitoring the lizards). There is no certainty that lizard populations receive any long-term benefits from short-term predator control. • Lizard salvage and relocation requires significant planning and resources. A Wildlife Act Authority is required for salvage and transfer (including return of animals to the site from which they were taken if temporarily held in captivity). Iwi consultation may be required if moving animals off-site. • Salvage and relocation is problematic for large sites occupied by lizard species that are hard to detect and/or low population densities (eg arboreal geckos living in 200-ha area proposed for vegetation clearance). For such sites, it will be very difficult and expensive to recover more than a small portion of the population (thereby achieving few benefits at the population level). Consider impact management, by means of a biodiversity offset or environmental compensation, instead. • Contingency measures should be identified if outcomes are not certain (eg restoring another site if salvaged lizards have failed to establish).
Outcome	<ul style="list-style-type: none"> • Adverse effects of development on lizard values are reduced, residual adverse effects are identified, monitoring is in place to determine the effectiveness of the reduction measures employed and contingencies have been agreed on.

Offsetting significant residual impacts	
Aim	No net loss and preferably a net gain in biodiversity (including lizard values), with respect to ecosystem type, structure and condition.
Methods	<ul style="list-style-type: none"> • A biodiversity offset compensates for any left-over or 'residual' adverse effects that remain once avoidance, mitigation and remediation measures have been applied. It is usually carried out at another site that has similar values to the impact site (ie a 'like-for-like' offset). The overall aim is to achieve no net loss and preferably a net gain in biodiversity with respect to ecosystem type, structure and condition. While offsetting is not currently required under the RMA, it has already been adopted in case law and local government policy (eg in some regional council plans). • In 2014 the Minister for Conservation launched the government's 'Guidance on Good Practice Biodiversity Offsets in New Zealand'. This work is closely aligned with the standards and principle-based guidelines developed by the international Business and Biodiversity Offsets Programme (BBOP; see http://bbop.forest-trends.org). • Offsets must be able to deliver measurable conservation outcomes resulting in no net loss or a net gain. This requires the ability to measure losses at the impact site and gains at the offset site, and to demonstrate that management is able to balance these losses and gains (ie the values must be responsive to management and it must be possible to measure the gains). The point of no net loss is calculated in an offset accounting system, or model, in which the losses and gains are balanced. • All of these stages are problematic when it comes to native lizards. This is because: (1) the science and practice is new and there are no examples to learn from; (2) it is very difficult to collect the required data (counts and other measures); (3) response to management is largely unknown. • Despite these difficulties, it is recommended that lizards be included in biodiversity offset models wherever knowledge is sufficient and adaptive management is appropriate, with all uncertainties clearly acknowledged. In particular, a positive response to predator control should not be assumed for lizards, because there are very few sites where this has been demonstrated on New Zealand's mainland. An adaptive management framework that includes robust monitoring is the only way to make advances in knowledge for lizards. • Where losses and gains and responses to management cannot be quantified with enough certainty, a biodiversity offset is not possible. Environmental compensation should be considered instead. • Further information on offsetting can be obtained from the DOC website (http://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/) and BBOP (http://bbop.forest-trends.org).
Outcome	A biodiversity offset that demonstrates that no net loss and preferably a net gain in lizard values is implemented, or environmental compensation used when technical limitations render an offset not possible.

Background preparation	
Aim	Take actions that recompense for a loss of lizard values.
Methods	<ul style="list-style-type: none"> • Compensation does not mean simply writing out a cheque for damages done! Environmental compensation means taking actions to 'make good' for biodiversity losses caused by a project. It differs from an offset in that it does not set out to achieve no net loss.

Background preparation	
Methods contd	<ul style="list-style-type: none"> • Compensation measures are undertaken at another site (if done at the impact site, it is mitigation or remediation). These can include: <ul style="list-style-type: none"> – restoration plantings to increase habitat quality and/or quantity for lizards – legal protection (eg by conservation covenant) of key sites – management of pest animal and plant species, – research – adaptive management. • As it is not possible to quantify exact gains and losses, deciding if/when compensation is sufficient (acceptable to all affected parties) can be a lengthy and rather subjective process. For this reason, affected parties should generate a clear statement of the compensation measures that have been agreed on that includes objectives, time-frames and a budget.
Outcome	An improvement in lizard values at a site(s) away from the impact site.