Department of Transport and Main Roads

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Manual

Fauna Sensitive Transport Infrastructure Delivery Chapter 1: Introduction

June 2024

Queensland Government

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Acknowledgements

This document is the result of considerable joint work, and we would like to recognise the following distinct contributions.

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Key Points

- The *Fauna Sensitive Transport Infrastructure Delivery* manual is a new version of the previous Department of Transport and Main Roads *Fauna Sensitive Road Design* manuals, revised to incorporate new information and best practice guidelines.
- Fauna Sensitive Transport Infrastructure Delivery (FSTID) values biodiversity as an asset, rather than a regulatory issue or problem to solve.
- This manual is intended to guide the planning, design, construction, operation and maintenance of roads and railway infrastructure in a way that will also improve and enhance outcomes for wildlife, habitat, and landscape connectivity.
- The *Fauna Sensitive Transport Infrastructure Delivery* manual will enable Transport and Main Roads to meet its legislative requirements and environmental sustainability targets.

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1 Objectives and outcomes

The *Fauna Sensitive Transport Infrastructure Delivery* manual provides evidence-based information and recommendations to guide the planning, design, construction, operation and maintenance of roads and rail to ensure that they are as 'fauna-sensitive' as possible. By adopting the processes, principles and advice outlined in this manual, Transport and Main Roads will be able to meet its legislative requirements and ensure the roads and rail built today achieve positive ecological outcomes.

This manual aims to:

- Be accessible and easy to read, understand and apply.
- Provide information that is thorough, comprehensive and evidence-based.
- Provide advice and recommendations that are practicable and reasonable.
- Guide monitoring and evaluation to inform adaptive management.

This manual is a best practice guideline, it is not a prescription of the specifics of what must be done on a project. However, it is recommended that the principles, processes, and practices outlined in this manual should be adopted wherever possible.

The potential overall outcomes of adopting the recommendations in this manual are:

- Greater likelihood of meeting legislative requirements and conditions of approval.
- Improved functional connectivity for native fauna and ecosystem processes.
- Improved conservation outcomes for biodiversity.
- Reduced rates of Wildlife-Vehicle Collision (WVC) resulting in lower rates of wildlife injury and mortality and improved motorist safety.
- A best practice cost effective approach to mitigating and managing fauna impacts.

Adopting the recommendations in this manual will also help Transport and Main Roads achieve its environmental sustainability ambitions as FSTID contributes to the department's ability to:

- Manage its environmental interactions and incorporate sustainable and innovative solutions to minimise its environmental footprint.
- Continuously improve environmentally sustainable practices.
- Meet the needs of the current generation while minimising environmental impacts on future generations.
- Contribute to the sustainability of the natural environment, while delivering a single integrated transport network accessible to everyone.

2 What is Fauna Sensitive Transport Infrastructure Delivery?

Fauna sensitive road and rail design has at its core the integration and valuing of biodiversity as an asset, rather than viewing biodiversity as a regulatory issue or problem to solve. The goal of FSTID is to build and operate a transportation network that minimises impacts and maximises benefits to wildlife, habitats and ecosystems and contributes positively to the overall sustainability of the natural environment.

The four key steps in FSTID are:

1. **ASSESS**: Comprehensive environmental assessments ensure that the biodiversity values of the transport corridor and the adjacent areas are well understood, as is the nature and severity of impacts from the project. Additionally, locations for fauna infrastructure retrofits are identified and prioritised through systematic landscape assessments of biodiversity values within the transport corridor and adjacent areas. The ecological objectives for the site and species impacted are identified and committed to during the planning of FSTID.
2. **MANAGE**: The impact management hierarchy is used during project delivery to effectively avoid, minimise, mitigate, and offset impacts in accordance with set objectives.
3. **IMPLEMENT**: The effectiveness of FSTID interventions is ensured through effective construction and asset management systems.
4. **REVIEW**: The effectiveness of FSTID interventions is assessed through scientifically robust monitoring and evaluation, and an adaptive management framework aligned with the project objectives is implemented.

3 How to read and use this manual

This manual has been designed and written to enable departmental staff, agents and contractors involved in the planning, design, construction, operation, and maintenance of roads and rail to integrate fauna sensitive design into all stages of their project. Table 3 gives an overview of this manual.

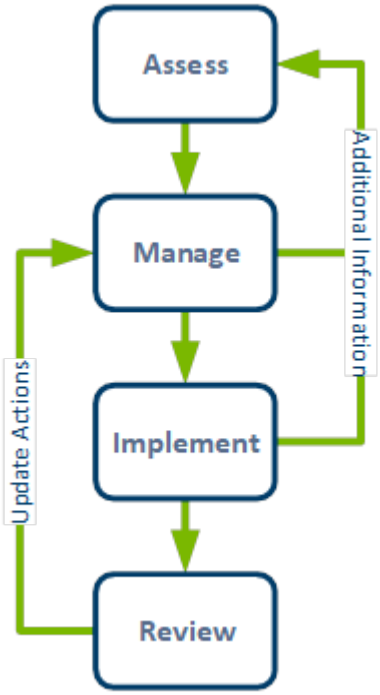
Table 3 – Structure of this manual

Chapter	Title	Detail
1	Introduction	Description of FSTID, integration with project management and environmental process
2	Ecology concepts	High-level summary of relevant ecological topics and issues.
3	Ecological monitoring, evaluation, reporting and adaptive management	Detailed advice and guidance to design and implement ecological monitoring and evaluation programs, adaptive management and transport ecology research.
4	Impacts of roads, railways, traffic, and trains on fauna	Description of the potential ecological impacts of roads, railways, vehicles and trains.
5	Planning and design	Planning and design considerations when doing FSTID, including survey methods, setting goals, and offsetting impacts.
6	Mitigation	Description of different types of mitigation measures, including specifications.
7	Construction	How to avoid and minimise injury and mortality of wildlife during construction.
8	Maintenance	How to maintain transport networks, including mitigation measures, so they remain ecologically effective.
9 – 21	Species profiles	Summary of the ecology and biology of species and species groups and specific advice on relevant impacts and effective mitigation techniques.
Appendix	Fauna survey methods	Accepted best practice method and survey effort required to detect the target species or group of target species.

3.1 Integrating Fauna Sensitive Transport Infrastructure Delivery into project delivery

The *Environmental Processes Manual* describes the environmental process for transport infrastructure projects delivered by Transport and Main Roads. Figure 3.1(a) shows, at a broad level, the environmental process within the department. This process is based on the Plan-Do-Check-Act (PDCA) Model in AS/NZS ISO 14001 *Environmental Management Systems* and is scalable and adaptable for any type of departmental project. A key principle of the environmental assessment process is to start the assessment as early as possible in the project lifecycle.

Figure 3.1(a) – Overview of Transport and Main Roads Environmental Process



Source: *Environmental Processes Manual*, Transport and Main Roads

The Transport and Main Roads project management framework has five distinct phases:

1. Planning
2. Concept
3. Development
4. Implementation, and
5. Finalisation.

Generally, the environmental assessment will begin in the Concept Phase of projects (Figure 3.1(b)). The environmental assessment starts with a desktop assessment to determine the level of risk for each environmental factor that is included in the assessment. A detailed assessment will be completed if the desktop assessment identifies that there is a moderate or high risk for the environmental factor. Detailed assessments are completed in either the Concept or Development phase of the project.

Figure 3.1(b) – Typical relationship between project life cycle and environmental process

Source: *Environmental Processes Manual*, Transport and Main Roads

This manual will support the environmental assessment process for the following environmental factors:

- Ecosystems and habitats, and
- Fauna.

4 Abbreviations

ABBREVIATION	DEFINITION
ABL	Australian Bat Lyssavirus
ADR	Accepted Development Requirements
ADS	Animal Detection System
ALAN	Artificial Light at Night
AWE	Ancillary Works and Encroachments
B(D)ACI	Before, (During), After at Control and Impact sites
DA	Development Application
DAF	Department of Agriculture and Fisheries (Queensland)
dB	Decibels
dB(A)	A-weighted decibel scale
DCCEEW	Department of Climate Change, Energy, the Environment and Water (formerly DAWE)
DES	Department of Environment and Science (Queensland)
eDNA	Environmental DNA
EMP(C)	Environmental Management Plan (Construction)
EO Act	*Environmental Offsets Act* 2014 (Queensland)
EO Policy	*Environmental Offsets Policy* (Version 1.12, 2022) (Queensland)
EO Regulation	Environmental Offsets Regulation 2014 (Queensland)

ABBREVIATION	DEFINITION
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999 (Commonwealth)
EWP	Elevated Work Platform
FSTID	Fauna Sensitive Transport Infrastructure Delivery
GIS	Geographic Information System
Hz	Hertz
ISC	Infrastructure Sustainability Council
MER	Monitoring, Evaluation and Reporting
MNES	Matters of National Environmental Significance (Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999)
MRTS	Main Roads Technical Specifications
MSES	Matters of State Environmental Significance (Queensland *Environmental Offsets Act* 2014)
NC Act	*Nature Conservation Act* 1992 (Queensland)
NC Regulation	Nature Conservation (Animals) Regulation 2020
PIT tag	Passive Integrated Transponder tag
PUP	Public Utilities Plant
RADS	Roadside / Railside Animal Detection System
RE	Regional Ecosystem
REZ	Road- and Railway-Effect Zone
SAT	Spot Assessment Technique
SDAP	State Development Assessment Provisions
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound (goals)
SMP	Species Management Program
SRIA	Significant Residual Impact Assessment
SRI Guideline	*Significant Residual Impact Guideline* (Queensland)
TEC	Threatened Ecological Community
TPZ	Tree Protection Zones
VM Act	*Vegetation Management Act* 1999 (Queensland)
WVC	Wildlife-Vehicle Collision

5 Glossary

TERM	DEFINITION
Adaptive management	Adaptive management is a formalised approach to monitoring, evaluation and reporting that includes a feedback loop to update and improve project or program management.
Administering Authority	An Authority with legislative jurisdiction.
Alignment	The positioning of the centreline of the proposed highway or road.

TERM	DEFINITION
Amphidromous	Fish species that migrate between fresh and marine water as part of their life cycle for purposes other than breeding.
Anadromous	Fish species that are born in fresh water, mature in the ocean and return to fresh water to spawn.
Ancillary Works and Encroachments	Activities and structures within the boundaries of state-controlled roads that are regulated by the *Transport Infrastructure Act* 1994.
Animal Ethics Committee	A committee at a university, or from within government, that must approve research involving fauna.
Approval	Any permit, authority, licence, self-assessable code, statutory exemption with conditions, protocol, agreement or plan, or other statutory instrument with conditions.
Apron	A surface that is placed between a culvert and channel to improve capacity and reduce erosion.
Arch culvert	Half-circle shaped culvert with a flat base.
Authorised wildlife carer	A person qualified to take and keep protected wildlife under a current rehabilitation permit in accordance with the Nature Conservation (Administration) Regulation 2006.
Baffles	Structures within a culvert that modify flow patterns to allow fish to use a burst-rest swim strategy to move upstream through the structure.
Benthic fish	Fish that live on the bottom of seas or lakes (i.e. stream bed specialists).
Benthopelagic fish	Fish species that occupy mid-water (i.e. stream bed generalists).
Biodiversity / Biological diversity	The variety of life on Earth. There are three levels of biodiversity, including genetic, species, and ecosystem diversity.
Box culvert	Rectangular shaped culvert, generally constructed of reinforced concrete.
Catadromous	Fish species that migrate to the sea for breeding and back to freshwater to feed and grow.
Community	All the populations of different species occupying a given area.
Conformance	Fulfilment of a requirement, either contractual or legislative.
Construction	Any work on or in the vicinity of a construction site carried out in connection with the construction, alteration, conversion, improvement, re-alignment, widening, extension, fitting out, commissioning, renovation, repair, maintenance, de-commissioning, demolition or dismantling of any structure.
Construction footprint	The total area of ground or vegetation disturbance associated with a project, including all areas of permanent and temporary impact.
Construction project	A project involving construction work, including the design, preparation, and planning.
Construction site	The place where construction work occurs. Includes other areas where plant or construction materials are located or stored. The extent of the construction site is defined by the construction footprint.
Corridor	Area of land formally reserved or identified for roads and railways, and includes existing infrastructure.
Crepuscular	Species with peaks of activity at around dawn and dusk.
dB(A)	A-weighted decibel scale. A logarithmic system of measuring sound as the human ear experiences the sound.

TERM	DEFINITION
Diadromy	Fish species that migrate between fresh water and salt water habitats. They are further classified into catadromous, amphidromous and anadromous species.
Diurnal	Species that are mostly active during daylight hours.
Dispersal	Often used as a generic term to describe species movements, but more accurately refers to a once-in-a-lifetime event, such as offspring leaving their area of birth to establish a new territory.
Early Works	Certain construction tasks that are undertaken outside of the main contract. For example, when large or complicated tasks are required before the main contract can commence, or if work must be conducted at a specific time of year, such as habitat clearing when a threatened species of fauna is absent from the site.
Echolocation	The use of high-frequency soundwaves that bats use to locate objects, such as their prey, trees, buildings, and other obstacles.
Ecosystem	All living things in a given area, interacting with each other and with the abiotic factors in their environment.
Ecosystem diversity	The variety of different habitats, communities and ecological processes in a given place.
Ecosystem services	The benefits people derive from ecosystems. Besides provisioning services such as food, water and other raw materials, plants, animals, fungi and micro-organisms provide essential regulating and supporting services such as pollination of crops, prevention of soil erosion and water purification, as well as cultural services, like recreation and a sense of place.
Ectotherm	Species of fauna that are unable to produce their own body heat and must obtain it from external sources such as the roads, warm rocks, etc. Body temperature will fluctuate according to the ambient temperature.
Edge effect	A phenomenon where edges of fragmented habitat patches experience altered environmental and biological conditions (i.e. light, temperature, wind) compared to areas further inside the patch.
Environmental Assets (ECHO)	The Transport and Main Roads asset management database that triggers routine and exceptional inspections. The database captures information relating to the asset including its location, its ecological objective, design drawings and the date of installation.
Environmental DNA	Genetic material obtained directly from environmental samples such as soil, sediment and water or from hair, faeces or carcasses.
Environmental Management Plan (Construction)	The primary document for the Contractor to manage the environmental risks during the construction of the project. It explains in detail the measures to be undertaken to manage the environmental factors of the project and explains in detail the means for addressing the department's administrative requirements.
Endemism	Refers to the distribution status of a species as belonging to a single location, state or country.
Endotherm	Species of fauna that maintain their body at a metabolically favourable temperature, primarily through the use of internal heat generation.
Environmental Infrastructure assets	Are a purpose-built structure or thing intended for a nature conservation purpose such as fauna exclusion, connectivity or education to reduce the risk of animal vehicle collisions.

TERM	DEFINITION
Exclusion zone	An area not to be entered by a person or machine for the duration of the contract or otherwise designated period of time or restricted access for authorised persons.
Extirpation	The local extinction of a species from a particular area, but which continues to exist elsewhere.
Facultative migration	Movement between habitats that is advantageous but not necessary for species survival.
Fauna spotter / catcher	A person authorised under a current rehabilitation permit to take and/or keep a protected animal whose habitat is about to be destroyed by human action.
Ford	A road running below the water level of a stream or river that provides a simple and low impact way for people, vehicles and animals to cross a waterway.
Frugivore	An animal that thrives mostly on raw fruits or succulent fruit-like produce of plants such as roots, shoots, nuts and seeds.
Functional connectivity	The amount of movement that occurs between areas of habitat in a landscape, usually assessed by tracking the movement of wildlife or measuring gene flow.
Genetic diversity	The variety of genetic makeup within a population.
Habitat	The area in which a species is able to live, either temporarily or permanently.
Habitat degradation	The decline in the quality of fauna habitat due to the presence and operation of a road or railway.
Habitat fragmentation	The breaking up of patches of habitat into multiple smaller patches that become divided and are separated by barriers to movement, ranging from a complete barrier for some species through to a filter that reduces movement for other species.
Habitat loss	The process by which a natural habitat is altered to the point where it is no longer capable of supporting the native species that naturally occur in the area.
Headloss	The vertical drop between inlet and outlet of a culvert – i.e. a measure of the slope of a culvert
Hertz	A measure of the frequency of sound and light.
Home range	The daily movement over a specific area which a species regularly travels in search of food, resources or mates.
Hypoxic event	When high levels of organic matter in waterways, combined with warm weather, cause oxygen levels in the water to drop, harming or killing fish and other creatures in the waterway. Also known as a blackwater event.
Impact Management Plan	Details the project, the nature of the impacts, the avoidance and minimisation measures undertaken in the planning and design phase, and the management measures to be utilised throughout the construction phase of a project. Required to be submitted with a Species Management Program (high-risk of impacts) application.
Indicator species	A species whose presence, absence or abundance reflects a specific environmental condition in a given area, usually a microorganism or a plant.
Inferential strength	The ability to detect a significant effect in an experiment or statistical test if a significant effect actually exists.

TERM	DEFINITION
Invasive survey technique	Survey methods that require the capture and/or handling of fauna.
Keystone species	A species that has a disproportionately large impact on their community or ecosystems relative to their abundance because of the role or function of that species in the system.
Limits of Clearing	The outside boundary of areas specified for clearing and ground disturbance within the contract.
Management hierarchy	The order of steps to document efforts to achieve no net loss or net gain in biodiversity value. Also referred to as the mitigation hierarchy, the sequence of steps are: 1. avoid 2. minimise 3. mitigate 4. restore and rehabilitate 5. offset and compensate.
Metapopulation	A set of subdivided populations interacting at a landscape or regional scale, also sometimes referred to as a population of populations.
Migration	Relocation of animals from one area, or body of water, to another.
Migratory species	A species from which a significant proportion of the entire population or a geographically separate part of the population undertake regular and typically predictable movements between areas in response to food, climate or other conditions.
Minimum viable population	The number of individuals necessary to ensure the long-term survival of a species.
Nectivorous	An animal which derives its energy and nutrient requirements from a diet consisting mainly or exclusively of the sugar-rich nectar produced by flowering plants.
Nocturnal	Species that are active mostly at night.
Nomad / nomadims	Species that have no fixed territories and no stable home range.
Non Conformance	A failure to comply with a requirement of a contract.
Non-invasive survey technique	Survey methods that do not require the capture and/or handling of fauna.
Obligatory migration	Movement between habitats that is necessary for species survival (e.g. breeding).
Pelagic fish	Open water fish specialists.
Permanent Environmental Infrastructure	Environmental management measures that consist of a structure or other hard engineering feature that forms part of the network beyond the duration of the Contract. (i.e. sediment basins, glider poles, fauna underpasses, overpasses, permanent exclusion fencing and ladders).
Pipe culvert	A culvert rounded in shape, either set on the waterway bed or partly buried.
Population	All the members of a species that occupy a particular area at the same time.
Potamodromy	Fish species that move and complete their life cycle entirely within freshwater.

TERM	DEFINITION
Precocial	Young animal species that 'hatch' or are born in an advanced state and able to feed itself and move independently almost immediately.
Public Utilities Plant	Plant permitted under legislation to be on a road. This can include powerlines, pipelines and telecommunications cables. Also referred to as utility infrastructure or utility assets.
Replacement Habitat	Habitat that can be installed to replace or offset the loss of specific habitats that are removed or destroyed during construction.
Riparian corridor	Linear links of existing wetlands, watercourses and drainage lines, with or without native vegetation.
Road- and railway-effect zone	The area where the effects of the transport infrastructure can be detected.
Routine management	Were the results of monitoring trigger a routine management response. For example, fence repair or de-silting a culvert.
Sedentary	Species having stable home ranges or territories, where an individual occupies a relatively small area compared to the population distribution.
Sedimentation	Sand and silt carried in suspension in water.
Significant vegetation	An individual plant or group of plants which is protected under State or Commonwealth legislation.
Species diversity	The variety of species in a given area.
Species Management Program	A requirement when an animal breeding place has been identified and activities are proposed that would tamper with the breeding places of protected animals. An entity must apply in writing to the Department of Environment and Science for the approval of a Species Management Program.
Stepping stone	Typically smaller-sized patches of native vegetation or habitat that allow for some connectivity for certain species by providing resources and refuge that assist them with moving through the landscape between larger patches of habitat.
Structural connectivity	The physical relationship between landscape elements that connect areas of habitat without any regard to the species that may use those structural elements.
Study area	The extent of area assessed for ecological values in relation to the proposed alignment of a project. Usually includes a specified buffer distance from the proposed alignment impact area. Can also be referred to as an investigation area.
Subpopulation	A subset of individuals from within a larger population or metapopulation that operate somewhat independently from the remainder of the population.
Suitably qualified and experienced person	Definition varies depending on the context that is used. Refer to C7558 *Terms of Reference for Review of Environmental Factors* for various definitions.
Supplementary habitat	Additional habitat that is provided to increase the population size or make the population more resilient and reduce the likelihood of negative impacts during construction.
Terrestrial corridor	A linear strip of vegetation that provides a continuous, or near continuous, pathway between two larger areas of habitat.

TERM	DEFINITION
Threatened species	Species listed as Extinct, Critically Endangered, Endangered, Vulnerable and Near Threatened under the *Environment Protection and Biodiversity Conservation Act* 1999 and/or the *Nature Conservation Act* 1992.
Torpor	A controlled reduction in body temperature and metabolic rate and is used by microbats during periods of cold stress and when food supply is limited.
Translocation	The human-mediated and intentional movement of living organisms from one area to another as a wildlife management tool.
Wing wall	Angled walls at the entry and exit of a culvert or bridge that prevent scour, retain the embankment adjacent to the culvert, control grade elevations and direct water flow.