CITY OF PERTH
City of Light

Managing PSHB

City of Perth's Experience and Insights

Executive Summary

Polyphagous Shot Hole Borer (PSHB) represents one of the greatest emerging threats to Western Australia's urban forests, biodiversity, and horticultural industries.

The City of Perth's learnings and on-ground experience in managing PSHB have been consolidated into this guide to support tree managers with their response to managing PSHB. These insights reinforce that with coordinated, evidence-based management, it is possible to preserve trees and strengthen the resilience of Perth's Urban Forest.

Key principles for successful management:

1. **Early detection is critical**
   Surveillance is the foundation of a successful management program. Multiple methods (traps + ground inspections + aerial surveys) can provide comprehensive coverage.
2. **Proportionate response protects trees**
   A Tree-first approach balances beetle control with tree retention. Value trees appropriately before making irreversible decisions.
3. **Integrated methods work best**
   Combining treatments (pruning + chemical + tree health support) offers the best hope for protecting high-value specimens.
4. **Document everything**
   Systematic data recording supports efficiency, justifies decisions to community, and builds sector knowledge.
5. **Collaborate and adapt**
   Share findings, learn from others, modify approaches as knowledge grows.

The City of Perth's response has shown:

- An effective response will require appropriate funding
- An evidence-based approach can protect canopy
- Early intervention reduces pest populations
- Targeted treatments maintain tree benefits for community
- Proportionate management preserves urban forest value

Most effective tools:

- Regular surveillance
- Early detection
- Rapid intervention
- Collaborative approach
- Sustained commitment

With these approaches, we can safeguard Western Australia's urban forest and natural landscapes for future generations.

Our team is here to help:

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Introduction

The PSHB incursion in Western Australia was first confirmed in August 2021 in East Fremantle. Native to Southeast Asia, PSHB is a highly invasive beetle that threatens urban forests, native ecosystems, and horticultural industries.

How it Lives

The beetle bores into living trees, introducing a symbiotic fungus (Fusarium euwallaceae) that disrupts water and nutrient flow, often leading to tree decline via obvious foliage and branch die back. This can be minimal to start and progressively engulfs entire trees.

Why it spreads

- The beetle's reproductive rate above 23 degrees Celcius is quick; each beetle can produce approximately 30 offspring every 30 days.
- Left uncheck, beetle populations can explode.
- PSHB is a poor flyer, so natural spread is slow.
- Human-assisted spread is a major factor.

Following detection, the response has included the establishment of quarantine zones, extensive surveillance, public awareness campaigns, and targeted tree removals. While early efforts focused on eradication, the pest's adaptability and spread have made long-term management the more realistic goal.

International Context

Internationally, PSHB has had severe ecological and financial consequences, with long-term costs impacting urban forestry, biodiversity, infrastructure, and public safety.

California, USA:
In the Los Angeles region, PSHB has impacted more than 200 tree species. A 2019 study estimated the cost of damage to urban trees, including removals, replacements, and lost ecosystem services, at over USD $1.2 billion (AUD $1.8 billion).

South Africa:
Major infestations in urban centres like Johannesburg have resulted in widespread canopy loss and tree mortality. The estimated long-term cost is over ZAR 25 billion (AUD $2 billion), factoring in removal, replanting, infrastructure repair, and the loss of ecological benefits.

These figures underline the enormous economic burden PSHB can impose. Costs extend beyond direct tree removal and replacement to include:

Loss of ecosystem services (shade, cooling, air quality)

Increased urban heat island effect

Reduced property values

Heightened risk of infrastructure damage from falling limbs or tree failures

Increased maintenance costs for public and private landholders

These international experiences serve as a strong warning and guide for long-term management planning in Western Australia.

Role of Local Government

Local governments across Western Australia collectively manage large areas of land that are socially, environmentally, and ecologically significant at local, national, and international levels.

Why Local government response matters

Whether urban or rural, local governments must be prepared to respond to the threat of PSHB. This requires:

- Immediate actions that integrate within a coordinated state response.
- Agile management of infestations on both public and potentially private land
- Improved data sharing and coordination

Building Capacity

We recognise that many local governments lack internal arboricultural expertise and may not have historically prioritised tree management. We strongly encourage all Councils to invest in arboriculture and urban forest management, given the unknown long-term impacts of PSHB.

While we have adopted international best practice, PSHB remains a recent arrival in Western Australia and much remains to be learned about how to manage it in our unique environment.

Supporting Research

We acknowledge and support the State Government-funded research led by the Western Australian Agricultural Research Collaboration (WAARC). However, we stress the need for immediate, proportionate, and proactive tree-focused responses while research outcomes evolve—likely over years, not months.

PSHB Management Summary

This guide shares the City of Perth's practical experience managing PSHB infestations across urban parks and streetscapes. We offer these insights as a resource to encourage other tree managers across Western Australia to develop their own monitoring programs and share findings.

Intended users:

- Local government arboriculture and parks staff
- Tree management decision-makers
- Councils beginning PSHB response planning
- Land managers with susceptible tree assets

This guide reflects findings and activities up to December 2025 and will be updated when relevant.

Key Findings and Success Metrics

What we've learned

- Early detection and rapid response are highly effective at reducing impacts
- Targeted Bifenthrin applications show strong results across multiple species
- Integrated monitoring (traps + ground inspections + aerial surveys) identifies more infestations
- Most infested trees maintain good health with appropriate intervention
- Chemical treatments eliminated local beetle populations in 75% of treated locations

Our response by numbers

- 160 monitoring traps across city parks
- Almost 100 Heritage trees are successfully being managed
- Zero significant branch failures from PSHB damage to date
- Treatment costs are substantially lower than removal costs for high-value specimens
- Three severely infested trees identified and removed in 24/25, two so far in 25/26

Quick Reference to Treatment Outcomes

Treatment Method	Best For	Effectiveness	Resource Level
Targeted Bifenthrin	Low-Moderate infestations, high-value trees	High (local eradication in most cases)	Medium-High
Pruning + Chipping	Isolated branch infestations	High (eliminates beetles)	Low-Medium
Systemic treatments	Under trial	Early results promising elsewhere	Medium
Tree removal	Severe infestations, low-value amplifiers	Complete	High

Section 1

Decision Making

PSHB Management

Eradicating an invasive haplodiploid insect like PSHB is extremely challenging due to the need to detect and destroy every female beetle to eradicate it from our environment.

The aim of management is to protect our urban forest and ensure a proportionate response. Response plans require implementation to prevent tree loss and provide clear evidence of the attempts taken to retain trees until it is no longer feasible, and the efforts have been recorded.

What Guides Our Decisions

While we have adopted international best practice where possible, PSHB remains a recent arrival in Western Australia. Much remains uncertain about how to manage it in our unique environmental conditions.

Key findings that should guide management efforts are:

- Because PSHB is a poor flyer, natural spread is slow. Every effort should be made to prevent human-assisted spread.
- Left unchecked, beetle populations can explode and cause severe damage to urban forests and natural areas. (Examples include the near total loss of certain species from Johannesburg, Los Angeles, Orange County and San Diego and the collapse or severe degradation of several riparian ecosystems in southern California.)
- Most importantly, **early detection and prompt action** have been shown to be highly effective at reducing impacts.

Considering our findings, we encourage tree managers to implement an arboriculturally informed Integrated Pest Management response aimed at:

1. Preventing human-assisted spread
2. Maintaining healthy tree populations through arboricultural best practice
3. Reducing beetle populations
4. Minimising PSHB's impact on tree health.

Surveillance is the foundation of any management program. Early detection and rapid response are our best tools for protecting our trees.

Management Framework

Visual Overview of Integrated Approach

The PSHB management cycle operates on four integrated principles:

Prevent

Stop human-assisted spread

- Chip all infested material to 2.5cm
- Grind stumps to 100mm below soil
- Follow biosecurity protocols

Detect

Find infestations early

- Ground inspections of susceptible species
- Monitoring trap network
- Aerial inspections of high-value trees
- Community and staff training

Treat

Respond proportionately

- Targeted chemical applications
- Pruning infested branches
- Tree health supplements
- Systemic treatments (under trial)

Monitor

Track and adapt

- Regular reinspections
- Data recording
- Evaluate treatment effectiveness
- Share learnings

Decision-Making Principles

Tree-first approach

Every decision prioritises tree retention where possible while acknowledging responsibility to protect the wider urban forest.

Proportionate response

Actions scaled to:

- Resources available
- Tree value (via valuation methods)
- Infestation severity
- Success likelihood
- Community impact

Evidence-based

Decisions supported by:

- Systematic surveillance data
- Tree valuations (amenity and ecosystem services)
- Track treatment outcomes
- International best practice
- Local trial results

Transparent and documented

Clear record of:

- Why decisions were made
- What actions were taken
- What resources were invested
- What outcomes were achieved

Adaptive management

Willingness to:

- Learn from experience
- Modify approaches
- Share findings
- Collaborate across sector

Building capacity

Start with ground surveillance and trap monitoring. Add aerial inspections and chemical treatments as expertise and resources develop.

Collaboration opportunities for local councils

- Joint trap monitoring programs
- Shared chemical treatment contractors
- Combined training sessions
- Equipment sharing arrangements

Resource requirements by approach

Approach	Staff Time	Equipment	External Costs	Suitable For
Ground surveillance	Medium-High (ongoing)	Low (binoculars, torch, tablet)	None	All programs
Trap monitoring	Medium (fortnightly)	Medium (traps, lures, stakes)	Low-Medium (materials)	Most programs
Aerial inspections	Low (periodic)	High (EWP or climbing gear)	High (if contracted)	High-value trees
Pruning + chipping	Medium	Medium (chipper essential)	Medium (if contracted)	Most infestations
Targeted chemical	High (multiple visits)	Medium (PPE, applicators)	Medium-High (chemical, permits, safety)	High-value trees
Tree removal	Low (one-time)	High (heavy equipment)	High (removal + grinding)	Severe cases

Surveillance and Detection

Asset Vulnerability Assessment

Understanding susceptibility

Get familiar with DPIRD's host list and susceptibility ratings and check regularly for updates. Learn to identify host species rated Moderate and above.

- The inclusion of susceptibility rating since November 2024 makes the WA host species list a valuable management tool
- Beetle reproduction has been confirmed in species rated Moderate and above - these hosts can contribute to beetle population growth

If you have tree asset data

Cross-reference tree species with susceptibility rating and assign each category a colour so you can see at a glance where most susceptible trees are.

Prioritising Your Surveillance

High-priority monitoring targets

Extreme category individuals

- *Acer negundo*
- *Erythrina x sykesii*
- *Robinia pseudoacacia*

Susceptible significant trees

Examples in WA may include *Ficus macrophylla, Ficus rubiginosa, Delonix Regia, Quercus spp*

High diversity/concentration areas

- Parks or areas with high species diversity
- High concentration of susceptible species
- Don't forget susceptible shrubs like *Coprosma repens, Taliparitiliaceum, Ricinocarpos pinifolius*

Vulnerable natural areas

- Wetlands and natural areas with susceptible *Melaleuca, Casuarina* and *Banksia* spp
- Riparian areas are known to be at risk

Monocultural plantings

Examples include avenues of *Platanus x acerifolia, Erythrina x sykesii, Calophylla ficifolia*

Botanical garden characteristics

Botanical gardens in invaded regions have experienced high infestation rates, including Kings Park in Perth. Likely related to:

- High species diversity
- Planting density
- Irrigation levels
- Specimen age

In the City for example, Harold Boas Gardens (having all these characteristics) has high infestation rates.

Tree Valuation for Decision Support

Why valuation matters

Tree amenity and ecosystem services valuations are imperative to guiding proportionate response. They provide actual dollar value that guides potential costs of intervention supporting overall budget estimate.

Tree valuation

Process of assigning financial or amenity value to individual trees or tree populations. Commonly required for:

- Insurance claims
- Compensation disputes
- Development assessments
- Asset management
- Urban greening strategies

Methods vary depending on whether the focus is amenity value, ecological services, or replacement costs. Individual trees of significance, whether that be size, heritage, cultural or generally recognised by your community need to be valued to support the response. The City of Perth Tree Valuation Method is based on a modified version of the Maurer-Hoffman formula.

Minimum Industry Standards MIS506 Tree Valuation is another among many options. Choose one, document why you have chosen it and use it!

Ecosystem services valuation

iTree eco is free online tool providing plethora of ecological values trees and collective urban forests provide. This is additional value, not alternative to tree valuation method. These values will support both immediate and long-term budgetary decisions.

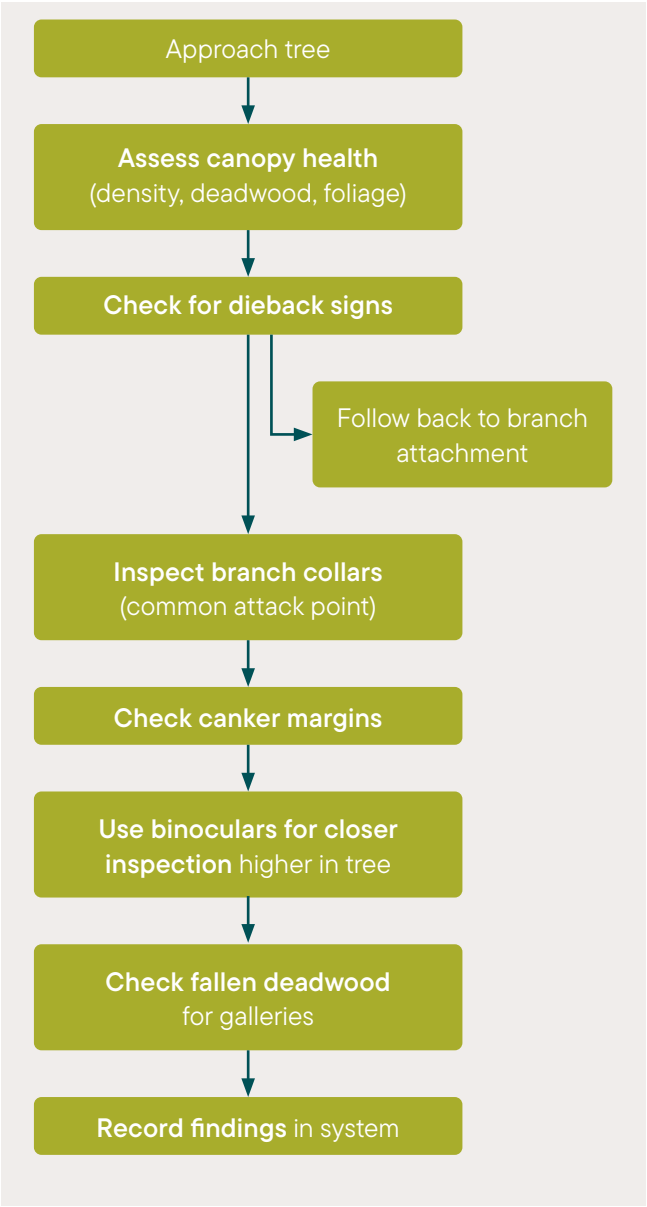
Multi-Method Monitoring System

Ground-Based Visual Inspection

Foundation of surveillance

Regular inspections should be systematic and logged.

Inspection workflow



Equipment checklist

- [ ] Binoculars
- [ ] Scale/rule
- [ ] High-powered adjustable torch
- [ ] Smartphone or tablet
- [ ] Paint marker (if counting holes)

Recording data

System should capture:

- Date of inspection
- Tree species
- Tree health: Good / Fair / Poor
- Signs of PSHB: No Obvious Signs / Suspect / Obvious
- Photos with timestamps
- Location (GPS coordinates if available)

In natural/densely planted areas

May not be practical to log inspection for every tree. Log results by area instead. Mark infested trees for removal or treatment as required.

Critical success factors

- Good light conditions (avoid early winter mornings)
- Multiple viewing angles
- Systematic coverage
- Regular frequency
- Traffic/hazard awareness

Aerial Inspection Methods

When to use:

- Closer investigation of suspect signs from ground inspections
- Regular inspections of large, high-value trees
- Species where signs unlikely visible from ground (Figs, Oaks)

Method comparison

Climbing:

PROS
- Access to variety of positions
- Good for large trees

CONS
- Required good skills
- Time intensive

BEST FOR
- Complex canopy access
- Precise investigation

Elevated Work Platform (EWP)

PROS
- Faster positioning
- Good for systematic scanning

CONS
- Limited by access routes
- Can't reach all positions

BEST FOR
- Methodical inspection of outer canopy

Combined approach

Because each facilitates access to different parts of tree, combining both can be efficient for large trees.

Equipment

- Headlamps (essential)
- Handheld torch for supplemental illumination
- Coloured paint or flagging tape for marking locations
- Tablet/phone for photos and recording
- Climbing gear or EWP as appropriate

Tracking multiple infestations

In large *Ficus*, we have found multiple small infestations throughout the canopy more often than large, localised infestations.

Challenge: Keeping track of multiple infestation locations

Solutions

- Marking location in tree with coloured paint or flagging tape
- Spreadsheet with location descriptions, hole numbers, treatment actions
- 3D digital modelling for large, very high-value trees (allows annotation with holes, treatments, photos, tracking over time)

Trap Program Visual Guide

Trap Components and Assembly

A sticky panel trap consists of the following components, many of which are available at local hardware stores:

- Garden stake
- Information/do not touch label
- Replaceable sticky panel
- Plastic cage (to prevent bycatch of microbats, etc.)
- Quercivorol lure
- Twist ties (to secure lure)
- Cable ties (to secure cage and label)

Assembly sequence

1. Secure garden stake firmly in ground
2. Secure cage to stake with cable ties
3. Insert sticky panel into cage and close (cage hinges can be reinforced with cable ties)
4. Attach lure to top of cage with twist tie
5. Attach information tag

Strategic Placement

Spacing requirements

- Minimum 30 metres between traps
- Placing traps too close together may reduce their effectiveness
- Higher lure concentrations caught fewer beetles in trials
- Assumed working range: approximately 40 metres

Site selection criteria

Good locations:

- ✅ Open space with adequate airflow
- ✅ Position at least 20m from highly susceptible hosts
- ✅ Away from irrigation sprinklers
- ✅ Accessible for regular inspection
- ✅ Protected from vandalism

Avoid:

- ❌ Under tree canopies
- ❌ Too close to susceptible hosts
- ❌ Direct irrigation spray zones
- ❌ Heavy dust/detritus sources
- ❌ Very close to water features

City's trap network: see page 19.

160 traps providing comprehensive coverage of parks and open spaces.

Inspection Protocol

Each trap is inspected on a fortnightly cycle, counting any PSHB beetles and logging the results in a custom-made app. The app calculates a "hit rate" (No. of beetles/days since last inspection) on positive traps to develop a heat map showing levels of activity in each area. The larger the purple circle, the higher the hit rate. This helps us identify and track areas of beetle activity in our parks and helps direct our inspection efforts.

Fortnightly cycle

Day 1-14: Traps accumulating beetles

Inspection day:

1. Approach trap carefully
2. Check both sides of sticky panel
3. Move to multiple angles to see behind cage bars
4. Count PSHB beetles (see identification guide)
5. Record count and calculate hit rate
6. Replace panel if beetles present, or retain if clean and sticky
7. Note if trap missing/compromised (null result, distinct from zero)

Panel replacement

- With beetles: Next inspection period must start with no beetles. Replace entire panel or remove beetles and safely dispose on site
- Without beetles: Retain if still sticky enough to be effective
- Damaged/missing: Replace immediately and record null (not zero)

Beetle Identification

PSHB characteristics

- Small but distinctive shape
- Reliable field ID possible with practice
- Only females on traps (males can't fly)

Inspection technique

- Look at both sides of panel
- Check behind cage bars at various angles
- Use tweezers to roll beetles for better view
- Magnifying lens helpful

Identification challenges

At least three beetles present in WA are hard to distinguish from *Euwallacea fornicatus* without training and powerful magnification.

Managing uncertainty

- Potential for false positives exists
- City has had opportunity to confirm IDs via DPIRD lab (good accuracy)
- If not confident, Xytovet offers diagnostic testing
- Remember: trap results are one aspect of surveillance, perfect accuracy not necessary for usefulness

Lure Sourcing

Quercivorol lures not currently manufactured in Australia. Reputed manufacturers:

- Chemtica (Costa Rica)
- Synergy Semiochemicals (Canada)

Infestation Confirmation Protocols

Non-Wounding Assessment

Visual confirmation

PSHB entry hole characteristics:

- 0.85mm diameter
- Perfectly round
- Entry tunnels perpendicular to branch surface

Characteristic but not diagnostic - some lookalike holes don't extend beyond bark layer.

Beetle sighting:

- May sit at gallery entrance (torch illuminates shiny backsides)
- Not uncommon to see beetles walking on bark surface, especially midday
- Confirms PSHB presence

Tools for non-wounding inspection

- Plastic paint scraper (remove loose bark)
- Stiff brush (improve visibility)
- Fine-nosed tweezers (remove frass, grab beetles)
- Torch (illuminate beetle backsides)

Hole Activity Test

Purpose: Non-wounding test useful for confirming

PSHB presence and infestation severity.

Procedure:

1. Cover each entry hole with dab of white water-based paint
2. Create airtight seal over entrance
3. Wait 24 hours
4. Check which holes reopened

Results:

- Active hole (living adult female): Cleared within 24 hours
- Deserted gallery: Paint seal remains

City's experience:

- Generally good results
- Not unusual for beetles to emerge immediately
- Some ambiguous results (partial opening, expected holes not opening)
- Bark nature may affect airtight seal achievement
- 24-hour wait can be logistical burden with aerial access

Current use: Found very instructive early in Bifenthrin application. Now mainly use on infestations accessed from ground.

Recommendation: Use before taking major management actions. Example: Early removal of *Erythrina* due to 80-hole infestation in dead stub - careful dissection found no living beetles or life stages. Activity test may have proven historical infestation, providing grounds to retain tree.

When to Sample

Consider sampling if:

- Non-wounding methods insufficient
- Laboratory confirmation would significantly affect management decisions
- Scientific/regulatory requirements
- Use of cutting tools wounds tree - weigh against potential benefits:
  - Can you take sample with pruning cut rather than wounding trunk?
  - Is tree value sufficient to justify wound?
  - Will confirmation change decision?

In practice, we have made most of our management decisions without diagnostic confirmation of PSHB. It takes time in the field to build confidence in your observations and ID skills. Not every case is clear cut, but signs will become more obvious as infestations worsen.

Under a management framework, if there's only a small number of holes and you're uncertain that PSHB is the cause, one option may be to monitor a potential infestation. Be sure to monitor frequently, especially in the warmer months, so you can act if the infestation grows. DNA from a beetle (or larvae or egg) or wood colonised by the symbiont fungus can be used to confirm PSHB. Instructions for taking samples can be found below. Sanitise cutting tools to avoid spreading fungal infections.

Click here or scan for more information

Diagnostic services are available in Perth through Xytovet. They also offer training, movement authorisation and sampling kits. Take care not to infringe the BAM act (2007) if taking and transporting samples. Check with DPIRD for the latest restrictions.

Section 2

City of Perth Process/Steps

Process Overview

STEP 1: Understand your assets

Action

Assess vulnerability via databases, mapping, staff/ community knowledge and cross-reference susceptible host species.

Key tasks

- Get familiar with DPIRD's WA host list and susceptibility ratings
- Identify tree species in your area (if you have asset data, cross-reference with susceptibility ratings)
- Establish priority list of:
  - Iconic trees or natural areas of historical importance
  - Trees with aesthetic value, ecosystem services value
  - Trees of community importance

Decision point

Do you need arboricultural expertise?

We highly recommend a strong relationship with trusted tree advice and your response be a 'tree first' approach. Proportional response based on tree species, size, heritage and degree of infestation are essential.

Helpful tools

Tree valuation system
(e.g., MIS506 Tree Valuation Method)

iTree eco for ecosystem services calculations

Tree asset management system - we have found this to be an invaluable tool for planning surveillance, tracking infested trees and recording management actions

What to identify

If you don't have tree asset data, at minimum know locations of:

- Any individuals in the Extreme category: *Acer negundo, Erythrina x sykesii, Robinia pseudoacacia*
- Susceptible significant trees of high amenity/ heritage value
- Parks or areas with high species diversity and/or high concentration of susceptible species
- Wetlands and natural areas with susceptible *Melaleuca, Casuarina* and *Banksia* species
- Monocultural plantings of susceptible species

Resource allocation

A proportionate response is relative to your resources. Consider the location and impact the outcome of potential tree works will have on your community.

Outcome: Triaged asset list and priority areas for surveillance

STEP 2: Train your team

Action

Train staff, community groups and interested parties in beetle identification and symptoms across tree species.

Training priorities

1. **Tree identification** - focus time on species more likely to be infested
2. **Signs of PSHB infestation** - complex skill requiring field practice
3. **Beetle recognition** - reliable field ID possible with practice

Learning to identify signs

Each tree species presents differently, and signs can be extremely subtle, especially in early stages of infestation. Distinguishing PSHB holes from other borers can be difficult even for experienced inspectors.

Training resources

DPIRD | UCANR | More information:

Who should get training?

- All Parks staff
- Arborists/tree contractors
- Regular maintenance crews working on susceptible species

Inspection opportunities

Regular pruning and tree maintenance works on susceptible species are opportunities to inspect.

Check pruning wounds and cut ends. On some species (*Melaleuca, Quercus*), entry holes can be hard to spot but internal galleries are obvious.

Outcome: Trained team able to recognise susceptible species and PSHB signs

STEP 3: Deploy monitoring systems

Action

Set out sticky traps across your area and establish inspection cycles.

Trap deployment

- Deploy at locations where host species are diverse or specific species are in concentrations
- Maintain at least 30 metres between traps
- Target trap layout providing good overall coverage (assume ~40m working range)
- Install trap cages 1.3-1.5 metres above ground

Trap components

- Garden stake (1.8m wooden stakes recommended)
- Information/do not touch label
- Replaceable sticky panel
- Plastic cage (prevents microbat bycatch)
- Quercivorol lure
- Twist ties and cable ties

Important considerations

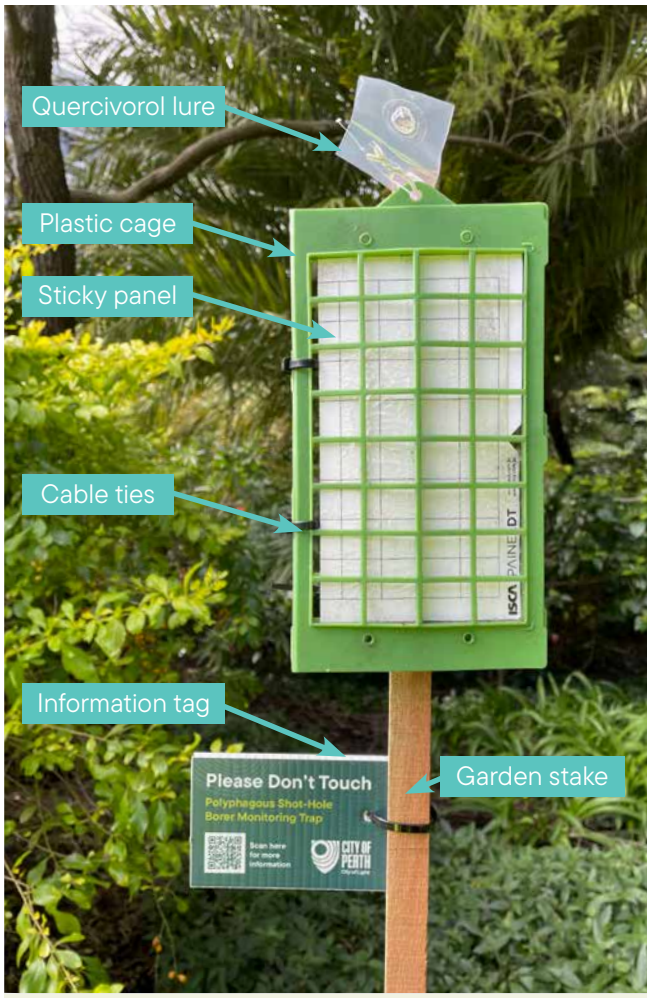
- Ensure sufficient space around traps for adequate airflow
- Avoid placing under tree canopies or too close to susceptible hosts
- Consider wind, dust sources, irrigation sprinklers
- Traps near water or vegetation tend to pick up more bycatch

The City's trap network

We began deploying PSHB monitoring traps in January 2025 and now maintain a network of 160 traps across parks and open spaces.

Inspection cycle

- Each trap inspected fortnightly
- Count any PSHB beetles
- Calculate "hit rate" (beetles/days since last inspection)
- Replace panels with beetles; retain clean sticky panels if still effective
- Record beetles numbers, including zero if none found. If trap is missing or has been tampered with (lure missing, trap on ground, etc.), record null data (not zero) and replace



Value of traps

Traps are a powerful monitoring tool but should not replace regular visual inspections which form the backbone of surveillance.

Traps are particularly effective for:

- Monitoring inaccessible areas (wetlands, dense bush)
- Identifying beetle population growth
- Tracking pest spread
- Confirming treatment effectiveness

City of Perth Trapping Program

Immediate success (Stirling Gardens)

Trap near large Quercus lusitanica immediately started accumulating beetles. High hit rate prompted aerial inspections finding several Low-Moderate infestations.

Finding subtle signs (Stirling Gardens)

Trap revealed growing infestation in Heptapleurum actinophyllum likely otherwise not found. Confirmation required two thorough inspections by experienced observers over two consecutive days. Only tell-tale sign: tiny frass noodle in spider web.

Monitoring treatment effectiveness (JH Abrahams Reserve)

February 2025:

Trap showing hit rate of 3.25 beetles/day.
Aerial inspections found Severe infestation in dead limb → immediately pruned, chipped, treated with Bifenthrin. Three weeks later: hit rate dropped to 0.25, suggesting successful beetle reduction.

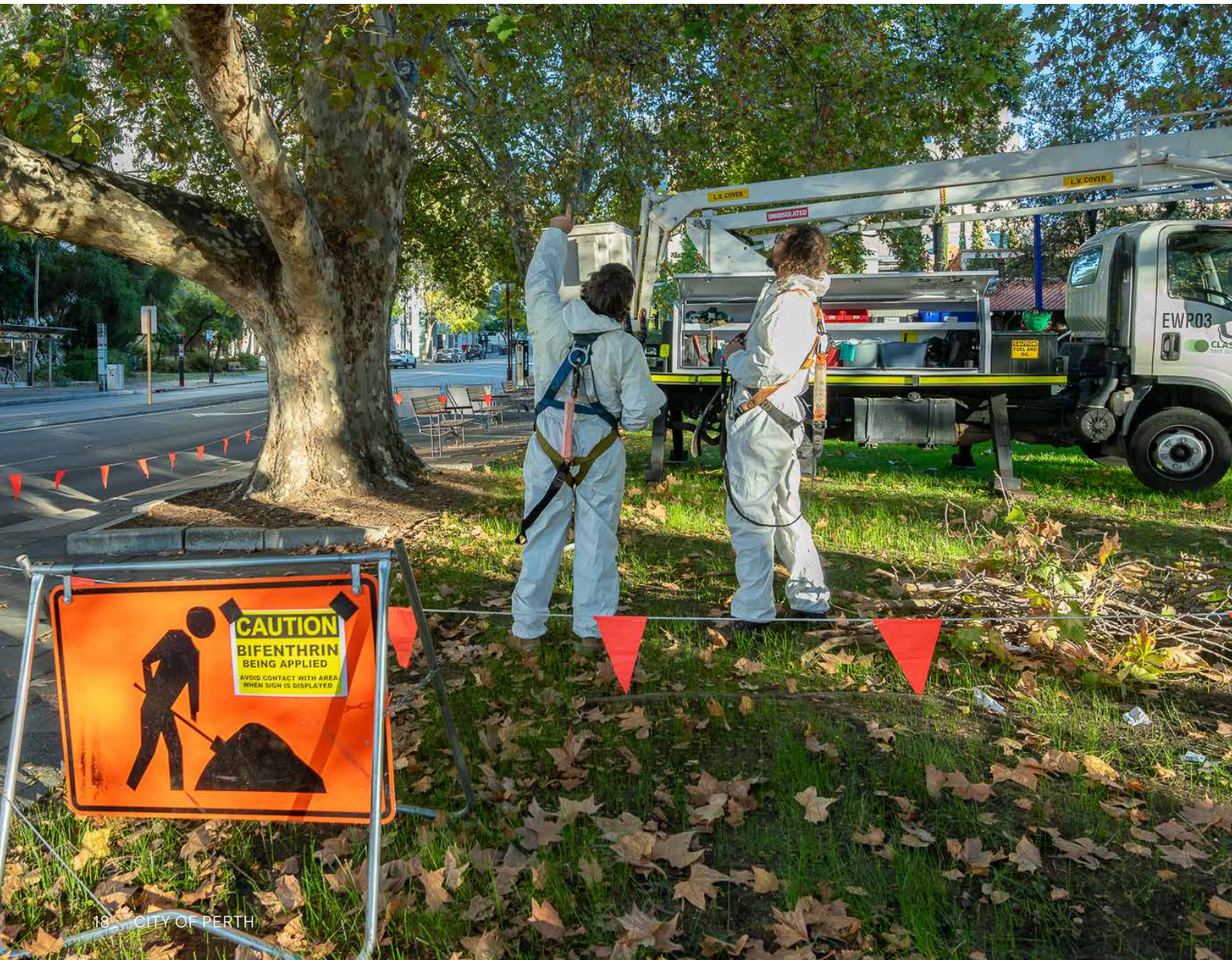
Identifying trends

Data identifies:

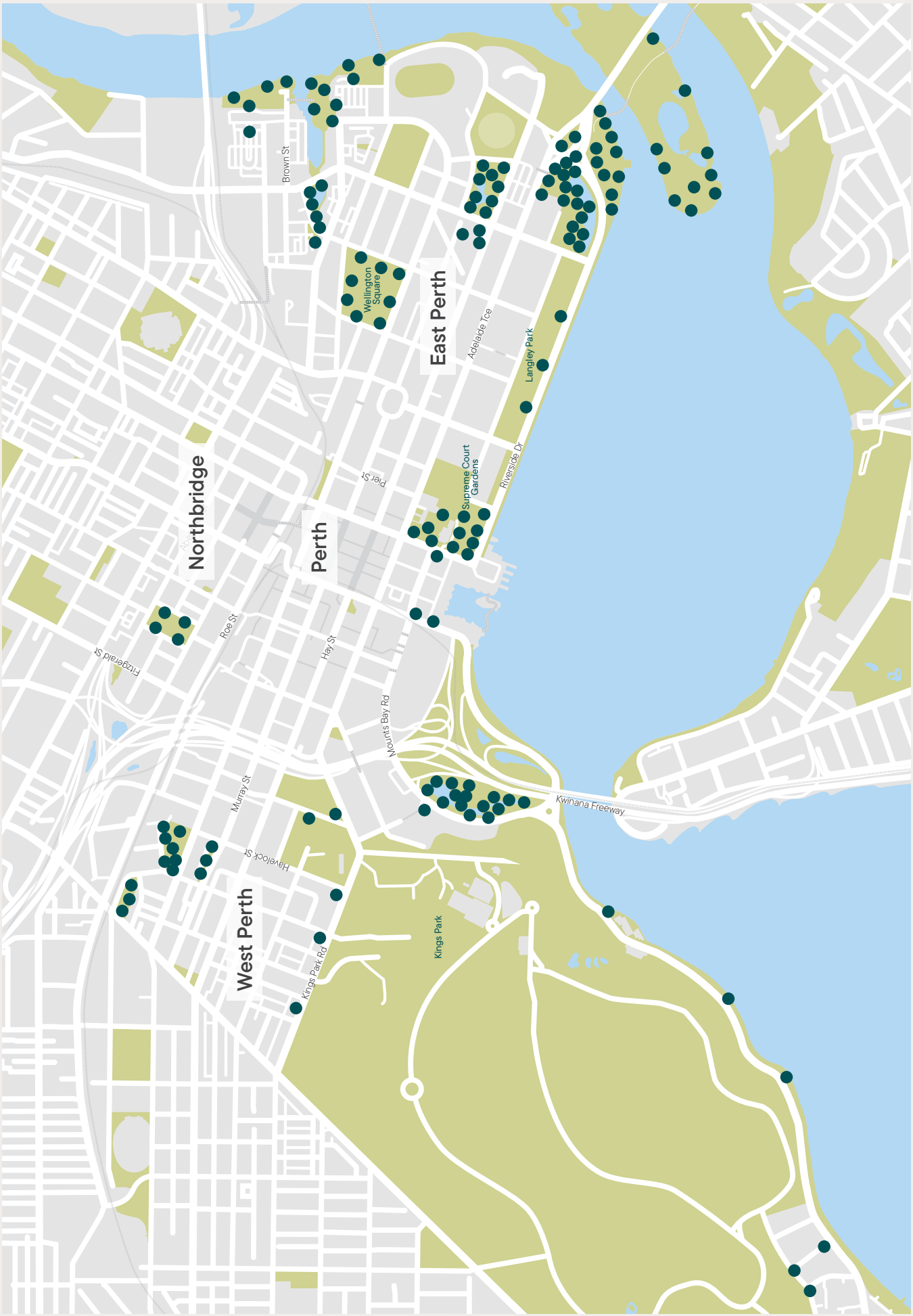
- Seasonal peaks and troughs
- Dispersal events
- Correlations with temperature/weather
- Overall population growth or reduction

Reality check

We also have traps near known infested trees that never caught beetle. This proves combination of trapping and visual inspections is most effective way to identify infested trees.



Trap locations around the City



STEP 4: Conduct regular inspections

Action

Establish cyclical regime of inspections for traps and ground-based surveillance

Ground inspection system

Inspections of susceptible trees should be regular and systematic.

Data to record

- Date of inspection
- Tree species
- Tree health - Good, Fair, Poor
- Signs of PSHB - No Obvious Signs, Suspect, Obvious
- Photos (useful for tracking over time)

Equipment needed

Inspection process

1. Check canopy health status (density, deadwood, foliage size/colour)
2. Check for signs of dieback and follow back to branch attachment
3. Check around branch collars (common attack point)
4. Check canker margins
5. Use binoculars for closer inspection and scanning higher in tree
6. Look for fallen deadwood and check butt ends for galleries

Lessons learned

- Good light conditions essential - avoid early winter mornings
- Torch useful at any time of day
- Inspect from as many angles as possible
- Many lookalike and ambiguous signs exist
- Maintain awareness of traffic, trip hazards

Aerial inspections

Good for:

- Closer investigation of suspect signs from ground inspections
- Regular inspections of large, high-value trees where signs unlikely visible from ground

Methods

- Climbing inspections: Require good skills for variety of positions
- Elevated Work Platforms (EWPs) - different access points
- Combined approach can be efficient

Equipment for aerial work

- Headlamps recommended
- Can combine with handheld torch in EWP
- Coloured paint or flagging tape for marking locations
- Consider 3D digital modelling for large, very high-value trees

Outcome: Regular surveillance data identifying infestations early

STEP 5: Confirm and rate infestations

Action

When infestation identified, determine degree and classify severity

Confirmation methods

Non-wounding inspection:

- Plastic paint scraper and stiff brush to remove loose bark
- Fine-nosed tweezers to remove frass from holes or grab beetles
- Look for beetles at gallery entrance (torch illuminates shiny backsides)
- Beetles may walk on bark surface, especially midday

Hole activity test:

- Cover each entry hole with dab of white water-based paint (airtight seal)

- Living adult female should clear entrance within 24 hours
- Painted entry holes of deserted galleries will not reopen
- Useful before major management actions

Sampling (if needed)

Using cutting tools wounds the tree - weigh against potential benefits:

- Can you sample with pruning cut rather than wounding trunk?
- Is it high-value tree in prominent location?
- Will laboratory confirmation significantly affect decisions?

In practice

At the City of Perth, we have had to make the majority of our management decisions without laboratory confirmation of PSHB. Our confidence in positively identifying the pest has increased alongside our experience, but there there is always some uncertainty when interpreting ambiguous signs, especially with lower level infestations.

Having a system for rating the severity of infestations is essential for monitoring, communication and management. The need for such a system became obvious soon after we took a proactive role in PSHB management. We decided to adopt a system developed in California that rates severity based on the number of active holes.

Infestations are rated as follows:

Low: < 50 entry hole
Moderate: ≥ 50 and < 150 entry holes
Heavy: ≥150 entry holes
Severe: ≥150 + PSHB-related dieback

Note that the difference between Heavy and Severe is the absence or presence of PSHB-related dieback.

City of Perth modifications and considerations

Though we use the ratings for communication and decision making, we often record precise hole counts because, when applying treatments, it is useful for monitoring whether an infestation is growing and at what rate.

The City's aerial inspections have picked up a lot of early-stage infestations. For this reason, we have introduced a new category for fewer than 10 holes. We refer to these as "Single Digit" and note down the precise number of holes in our records. A six-hole infestation, for example, would be recorded as SD-6.

The Californian system is useful for classifying infestations in one location within a tree, but it doesn't capture the overall beetle load in some of our large Ficus, which might have one Moderate, multiple Lows and tens of Single Digit infestations.

Precision versus practicality

Since the rating system is based on the number of active holes, its precision depends on how accurately you determine activity.

Most precise: Strict application of hole activity test (time consuming)

Moderate precision: Count holes deemed active based on visual signs (beetles, staining, frass). Use paint marker to dab each hole counted. Counting app helps with larger infestations.

Least accurate: Estimating based on area (very imprecise - count varied infestations first to calibrate)

Important: Take time to accurately assess before irrevocable actions like removals or major pruning.

The level of precision required depends on your purpose. An estimate may be good enough if you are trying to make a management decision (i.e. removal vs prune/ treat) where other factors have more weight (tree value or public safety) but if you are evaluating the effectiveness of a chemical treatment, a precise count is necessary to determine whether an infestation continues to grow.

Outcome: Classified infestation with severity rating guiding response

STEP 6: Take proportionate action

Action

Apply tree-first approach balancing multiple factors.

Decision factors

- Host susceptibility (DPIRD's host list and susceptibility ratings)
- Severity of infestation (assess and rate)
- Tree health (many infested trees remain in very good health)
- Tree value (amenity, heritage, ecosystem services)
- Public safety (extensive tunnelling weakens large limbs)
- Location of infestation (often dictates if pruning is option)
- Options and restrictions for chemical treatment

Key principle

Proportionate management aims to maximise beetle elimination while minimising impact on tree and wider environment.

Treatment options

1 Targeted Bifenthrin application

- Best for: Low-Moderate infestations, high-value trees
- Effectiveness: High confidence in beetle reduction and local eradication
- Process: Apply to infestation locations, cyclical reinspection, potential further applications

2 Pruning out infestation

- Best for: When infestation can be removed with appropriate pruning cut
- Critical requirements:
  - Pruning to arboricultural best practices essential
  - Treat subsequent pruning wounds with Bifenthrin (wounds have higher risk of beetle entry)
  - Caution around cumulative effects of pruning in high-profile locations
  - Cyclical inspections (ground and aerial) as required
- Always chip pruned material to 2.5cm

3 Tree removal (only if):

- Severe infestations where previous approaches unsuccessful
- Small, low-value trees clearly supporting beetle population growth
- Must include stump grinding. Stumps left in place risk re-infestation

4 Systemic chemical application

- Suitable for natural areas
- Lower value trees
- Early trials in WA that require higher resourcing

5 Monitor infestation

- Lower level infestation in lower value trees with limited risk posed to surrounding trees assets
- Frequency of re-inspection throughout the summer is recommended at least once month, per tree.

Special considerations

High-value heritage trees

We have fought to retain several highly significant trees in city parks despite evidence of Severe infestations and beyond, because of enormous amenity, heritage, ecosystem and aesthetic value they offer. We are committed to trialling every possible solution.

Amplifier trees

Consider all factors to make pragmatic decisions. No agreed definition of "amplifier" exists, so label is of little use. Instead, evaluate:

- Tree size and beetle load
- Surrounding susceptible trees
- Success likelihood of treatment
- Your quarantine zone location

Outcome: Appropriate intervention balancing tree protection and beetle control

STEP 7: Record data and monitor

Action

Build systematic data supporting efficiency and justification.

Why data matters

Building data supports efficiency and justification for your community in the decision-making process. Documenting the response based on resources available is essential.

What to track

- Inspection dates and findings
- Infestation severity ratings
- Treatment actions taken
- Treatment dates and methods
- Follow-up inspection results
- Tree health observations
- Resource costs

System options

Many approaches depending on your existing systems and resources.

City's approach

We utilised our existing ESRI suite of software, ArcGIS and their mobile field maps application. This provides:

- Ability to customise data collection fields
- Clear record keeping
- Overview dashboarding
- Flexibility to pivot as response changes

Reinspection frequency

- Treated trees - check 3-4 weeks after treatment, then as needed
- Monitored infestations - more frequent in warmer months
- Surrounding trees of treated specimens - regular checks
- Trap network - fortnightly cycle
- High-value trees - consider aerial inspections seasonally

Learning and adapting

As response has and will change, systems can pivot to reflect changes and support ongoing improvement.

Outcome: Documented response demonstrating due diligence and informing future decisions

Section 3

Findings and Actions

Treatment and Management

Decision Framework

After confirming and rating the infestation, consider two key questions:

1. How many beetles will this action eliminate?
2. What are impacts on tree (and wider environment)?

Proportionate management aims to:

- Maximise the former
- Minimise the latter

Factors to evaluate:

Factor	Considerations
Host susceptibility	Reference DPIRD's list
Infestation severity	Use classification system
Tree health	Many infested trees remain in very good health
Tree value	Amenity, heritage, ecosystem services
Public safety	Extensive tunneling weakens large limbs
Infestation location	Often dictates whether pruning is option
Treatment options	Chemical restrictions, available resources

These decisions should be made on a case-by-case basis in consideration of all factors.

Management Options by Severity

Based on California system, adapted for City of Perth context.

Low:
< 50 entry hole

Moderate:
≥ 50 and < 150 entry holes

Heavy:
≥150 entry holes

Severe:
≥150 + PSHB-related dieback

LOW INFESTATION (< 50 active holes):

High-value trees:

- Treat with targeted Bifenthrin AND/OR
- Remove infested branches (if prune-able)
- Cyclical reinspection

Low-value trees:

- Monitor
- Remove infested branches if hazard present

MODERATE INFESTATION (50-149 active holes):

High-value trees:

- Treat with targeted Bifenthrin AND/OR
- Remove infested branches where appropriate
- Regular monitoring

Low-value trees:

- Monitor and remove infested branches
- Consider removal if natural area with surrounding same species

HEAVY INFESTATION (≥150 active holes):

High-value trees:

- Treat with targeted Bifenthrin AND/OR
- Remove infested branches where safe
- Intensive monitoring

Low-value trees:

- Remove infested branches or
- Consider tree removal if surrounding trees at risk

SEVERE INFESTATION (≥150 holes + dieback):

High-value trees:

- Evaluate: Can treatments realistically protect this tree?
- If yes: Intensive treatment program
- If no: Removal (protect other trees)

Low-value trees:

- Remove tree and stump

Important notes

- Tree value and hazard level are not binary considerations
- Host susceptibility rating more informative than simple reproductive status
- Public safety requires rational risk assessment, not fear-based approach
- Tree risk assessments should be conducted as usual with PSHB infestation as additional factor
- To date: No significant branch failures where PSHB tunneling played a role

Invasive Shot Hole Borers (ISHB) Infestation Level & Management Options for Low Value Trees

Host Type	Hazard Level	No Infestation	Low Infestation	Moderate Infestation	Heavy Infestation	Severe Infestation
Reproductive Host	Low	Monitor	Monitor	Monitor and remove infested branches*	Monitor and remove infested branches*	Remove tree and stump
Reproductive Host	High	Monitor	Monitor & remove hazard branches	Monitor and remove infested / hazard branches*	Remove infested / hazard branches*, or remove tree and stump	Remove tree and stump
Non-Reproductive Host	Low	Monitor	Monitor	Notify your local UCCE office; consult with ISHB-FD experts to determine if species is a new reproductive host		
Non-Reproductive Host	High	Monitor	Monitor	Notify your local UCCE office; consult with ISHB-FD experts to determine if species is a new reproductive host		

ISHB Infestation Level & Management Options for High Value Trees

Host Type	Hazard Level	No Infestation	Low Infestation	Moderate Infestation	Heavy Infestation	Severe Infestation
Reproductive Host	Low	Monitor	Treat and/ or remove infested branches*	Treat and/or remove infested branches*	Treat and/or remove infested branches*	Remove tree and stump
Reproductive Host	High	Monitor	Treat and/ or remove infested/ hazard branches*	Treat and/or remove infested branches*	Remove infested branches* or remove tree and stump	Remove tree and stump
Non-Reproductive Host	Low	Monitor	Monitor	Notify your local UCCE office; consult with ISHB-FD experts to determine if species is a new reproductive host		
Non-Reproductive Host	High	Monitor	Monitor	Notify your local UCCE office; consult with ISHB-FD experts to determine if species is a new reproductive host		

It's a useful guide to making management decisions, but we have never followed it precisely. Tree value and hazard level are not binary considerations, and we have more information now about host species susceptibility than simple reproductive status. Use host susceptibility and infestation severity to judge the chances of successful treatment and the threat posed to surrounding trees. Tree value will determine how many resources you are willing to commit to a tree in treatment. Public safety should always be front of mind but requires a rational assessment of risk, not a fear-based approach. Tree risk assessments should be conducted as usual with additional consideration of PSHB infestation as a factor in susceptible species. To date, we have not had any significant branch failures in which PSHB tunnelling has played a role.

Treatment Methods Compared

Removal + Stump Grinding

Best for:

- Severe infestations where treatment unlikely successful
- Small, low-value trees clearly supporting beetle population growth
- "Amplifier trees" in strategic locations

Effectiveness: Complete beetle elimination

Requirements:

- Chip to 2.5cm (kills 99.9% of beetles)
- Grind stump to 100mm below soil level
- Have chipper on site

Considerations:

- Most drastic option
- Last resort for high-value trees
- Essential for protecting wider tree population
- Every case different - weight factors based on learnings

Pruning + Chipping

Best for:

- Infestation confined to branch
- Isolated infestations that can be removed with appropriate cuts

Effectiveness: High (eliminates beetles if material chipped)

Requirements:

- Make final cut at natural target pruning location
- Follow arboricultural best practices
- Always chip infested material to 2.5cm
- Consider treating pruning wounds with Bifenthrin (wounds have higher re-attack risk)

Considerations:

- Removes food-producing foliage
- Severe pruning can inhibit tree's ability to sustain/defend
- Affects tree biomechanics
- Creates wounds (pathway for other pathogens, potential further PSHB attack)
- Critical: Beware cumulative effects of "minor pruning" over time

Targeted Bifenthrin Application

Best for:

- Species trait needs to be factored as in some cases high infestation rates have proven to be successful
- High-value trees
- Infestations in non-prune-able locations

Effectiveness: High (strong confidence in beetle reduction and local eradication)

Methods:

- Hole-by-hole injection (gold standard where bark conditions allow)
- Spray application (highly effective, especially for rough-barked species)
- Combined approach

Requirements:

- DPIRD emergency use permit (PER91631) or equivalent
- Significant PPE (coveralls, mask, face shield, gloves, boots)
- Cordon off area during application
- Multiple visits for reinspection and reapplication
- Systematic recording

City's results:

- Fewer active holes each visit
- Most sites completely inactive after third treatment
- No evidence of re-attack at treated locations
- Success across multiple species: *Platanus, Ficus, Erythrina, Delonix regia*

Tree Health Supplements

Best for:

- Susceptible high-value trees (proactive)
- Infested trees (supportive)

Effectiveness: Supportive role (not standalone treatment)

Approach:

- BioPrime Trace soil drench
- Glutathione injection (antioxidant/detoxifier)
- Address soil chemistry issues (e.g., elemental Sulphur for alkaline soils)

Rationale:

- Trees adapted to defend against boring insects
- Healthy trees have more resources to fight infestation
- Attacks often start small - months before affecting health
- Infestations grow very quickly in stressed trees (especially poisoned trees)
- Evidence of trees (*Platanus x acerifolia*) overcoming infestations without human intervention

Caution: Enriched Tree Hypothesis Nutritionally enriched or over-irrigated trees can be more susceptible because they provide good environment for beetle and fungus.

Example: Tijuana River Valley - worse infestations near sewerage outlets.

Balance: "Goldilocks zone" of appropriate tree health, irrigation and nutrition minimises likelihood and effects.

Systemic Treatments

Status: Under trial

Approach:

- Applied at base of tree
- Chemicals reach infested areas via vascular system

Advantages:

- Overcomes challenges of targeted applications
- Together with targeted treatments, will be invaluable tools

City's experience:

- Tested one experimental solution (mixed results)
- Minimal direct experience
- Several overseas trials had good results with variety of insecticides and fungicides
- City of Canning's systemic trials showing promising early results
- City of Perth plans own systemic trials coming spring

Future: Targeted and systemic treatments together will provide comprehensive PSHB management toolbox.

Targeted Chemical Application Trial

In early 2024, the City ground inspections spotted dark staining in several large, high-value Platanus x acerifolia. Aerial inspections confirmed PSHB to be the cause. In most cases, the infestations were centred around a branch collar and extended into the trunk. Since the entire infestation could not be eliminated by pruning, we had to find a way to target the beetles in situ or potentially lose the trees. Based on the research of Mayorquin et al, we decided to trial a local application of Bifenthrin under DPIRD's emergency use permit.

The Trial

Day 1:

- Prune dead/declining branch
- Conduct hole activity test

Day 2:

- Count active holes
- Inject each hole with Bifenthrin (blunt syringe)
- Paint entire area with Bifenthrin (collar, stub, pruning cut face)

Three weeks later:

- Count new holes
- Repeat hole activity test on new holes and previously injected holes

Following day:

- Count and inject active holes
- Topical application to entire area

The Results

4 trial trees, Apr-Jul 2024

- Fewer and fewer active holes each visit
- Most sites completely inactive after third treatment
- Continued monthly monitoring
- No evidence of re-attack at treated locations
- Following summer: saw attacks in nearby trees (not same locations)

Tree #	Location	Infestation identified	Potential canopy loss	Visit 1	Visit 2	Visit 3	Visit 4	Follow up aerial inspections
3177	Claisebrook	10 Apr 2024	183m²	**18 Apr 2024** Prune to remove ~4 holes Active holes: 84 Bifenthrin	**7 May 2024 (19 days)** 6 new/2 active Bifenthrin	**5 Jun 2024 (29 days)** 2 new/11 active Bifenthrin	**19 Jul 2024 (44 days)** 0 new/1 active Bifenthrin	**Aug, Sept, Oct** • No further signs of activity • Ground inspections Dec, Feb • Occlusion of holes
6429	Rod Evans	13 Mar 2024	365m²	**19 Apr 2024** Prune to remove ~12 holes Active holes: 57 Bifenthrin	**7-8 May 2024 (19 days)** 16 new/10 active Bifenthrin	**4-5 Jun 2024 (28 days)** 0 new/ 4 active Bifenthrin	**19 Jul 2024 (44 days)** 0 new/ 0 active Bifenthrin	**Aug, Sept, Oct x 2, Dec, Jan, Feb** • Seeping from wounds continues • No signs of beetle activity • Occlusion of entry holes
6430	Rod Evans	13 Mar 2024	685m²	**19 Apr 2024** Prune to remove ~20 holes Active holes: 105 Bifenthrin	**8 May 2024 (19 days)** 10 new/4 active Bifenthrin	**5 Jun 2024 (28 days)** 6 new/3 active Bifenthrin	**19Jul 2024 (44 days)** 0 new/ 0 active Bifenthrin	**Aug, Oct x 2, Dec, Jan, Feb** • Seeping from wounds continues • No signs of beetle activity • Occlusion of entry holes
6939	Mounts Bay Road	27 Mar 2024	190m²	**24 Apr 2024** Prune to remove 200+ holes Active holes: 50 Bifenthrin	**16 May 2024 (22 days)** 5 new/4 active Bifenthrin	**13 Jun 2024 (28 days)** Separate infestation identified and pruned out	**22 Jul 2024 (39 days)** 3 new/0 active Bifenthrin	**Sep, Oct, Dec** • No signs of activity

On each visit, we recorded fewer and fewer active holes and most sites appeared to be completely inactive after the third treatment. There were suggestions that previously infested sites were prone to re-infestation, so we continued to monitor each site monthly. We never saw any evidence that these locations were attacked again, although the following summer we saw attacks in nearby trees.

Expansion to Other Species

Encouraged by these results, we began trialling in *Ficus macrophylla, F. rubiginosa, Erythrina x sykesii, Delonix regia*.

In all species, we saw good evidence of the effectiveness of the treatment. In some cases, beetles would evacuate their galleries after injection and expire. In others, we would find dead beetles sitting in entry holes on repeat visits. It wasn't surprising that applying Bifenthrin in this way was effective. Since PSHB don't ingest the wood when tunnelling and spend most of their lives protected inside their host, the challenge for chemical treatments was always about ensuring enough contact with the insecticide. Our method ensured maximum contact by literally flooding PSHB galleries.

Improving efficiency

Once confident in the efficacy of Bifenthrin:

- Stopped hole activity test in most cases (still used for ground-accessible infestations)
- More efficient to treat every hole without confirming beetle presence
- Continue counting and marking holes (classify severity, check if growing via new unmarked holes)

Recent modifications

In November 2024, we discovered signs of heavy infestations in several Quercus spp in Stirling Gardens. Quercus present a particular challenge for inspections and treatment because entry holes are often not visible in the rough bark. Often staining and frass caught in bark furrows are the only visible signs. In one destructive test of a 150mm diameter Quercus petraea branch, a careful visual inspection found two holes visible on the surface.

Stripping away the bark uncovered 38 holes in the same 30 cm section. This characteristic makes hole by hole injection impossible. Topical applications with a paint brush were trialled but the rough and furrowed nature of the bark made this difficult also. Eventually we switched to paint spray applicators and have found this method to be very effective. Spraying has several advantages over paint brush application, and we now use spray applicators for topical applications in all host species. Meanwhile, we have adjusted our Bifenthrin mixture to better suit this new method of application.

As part of ongoing improvement efforts, we recently trialled a spray-only treatment of a Moderate infestation (129 holes) in a Platanus x acerifolia, forgoing hole-by-hole injections entirely. Results look good, with no evidence of new holes after two applications. Monitoring continues

Application in managing PSHB

Best applications

- High-value trees with infestations in non-prune-able locations
- When combined with pruning, offers best hope for controlling beetle populations in large susceptible trees
- Continue until effective systemic treatment found

Resource reality

Due to time and resources required (especially if aerial access required), main use will be high-value specimens.

Methods

- Hole-by-hole injection: Gold standard for high-value trees where bark conditions allow
- Spray-only treatments: Proving highly effective
- Combined approaches: Optimal for many situations

Many tree owners and land managers will be relieved these options exist under management framework.

PPE requirements

Any Bifenthrin application requires:

- Coveralls
- Mask
- Face shield
- Gloves
- Boots
- Cordon off surrounding area

Modifications to mixture aimed at reducing environmental risks and (to lesser degree) PPE requirements.

The City conducted chemical trials under DPIRD's emergency use permit for Bifenthrin (PER91631).
Note: Bifenthrin, as Restricted Chemical Product, cannot be applied under PER7250.

What We've Learned

About the beetle

- Natural spread is slow (poor flyer)
- Human-assisted spread is main concern
- Population can explode if unchecked
- Reproduction confirmed in species rated Moderate susceptibility and above

About detection

- Multiple methods essential (traps don't catch everything, visual inspections miss some)
- Botanical garden-like characteristics correlate with high infestation rates
- Aerial inspections find infestations invisible from ground
- Training and field time build identification confidence

About trees

- Many infested trees maintain good health with intervention
- Some trees (Platanus x acerifolia) show evidence of overcoming infestations without human intervention
- Tree health supplements appear to support resilience
- Cumulative pruning effects can be significant in high-profile locations

About treatments

- Early intervention most effective
- Targeted Bifenthrin highly effective for beetle reduction and local eradication
- Spray application viable alternative to hole-by-hole injection
- Combination of methods (pruning + chemical) offers best results
- No significant branch failures from PSHB tunnelling to date

About management

- Proportionate response requires clear tree valuation
- Data recording essential for justifying decisions
- Community values matter in decision-making
- Flexibility and adaptation important as knowledge grows

Questions We're Still Exploring

About susceptibility

- Why do some botanical gardens experience particularly high infestation rates?
- What is optimal tree health "goldilocks zone" for minimising susceptibility?
- How does irrigation level affect susceptibility?

About treatments

- How long does Bifenthrin protection last in treated locations?
- What is optimal treatment interval for different species?
- Can spray-only treatment fully replace hole-by-hole injection?
- Which systemic treatments will prove most effective?

About monitoring

- What trap density provides optimal cost/benefit ratio?
- How do seasonal patterns affect surveillance strategy?
- What early indicators predict tree transition from Low to Severe infestation?

About decision-making

- How do we better quantify "amplifier tree" risk?
- What metrics best guide removal vs. treatment decisions?
- How do we optimise resource allocation across entire tree asset?

Integration with Tree Health Programs

Maintaining Optimal Tree Health

Maintaining optimum tree/plant health is one of the fundamentals of Integrated Pest Management. This gives the plant's own defences the best chance to fend off the pest.

Why it matters for PSHB

Although PSHB (unlike most ambrosia beetles) regularly attacks healthy trees, still try to maintain best possible health because:

- Trees adapted to defend against boring insect attacks
- Healthy trees have more resources to fight infestation
- Attacks often start with few galleries, may take many months before affecting tree health
- Infestations can grow very quickly in stressed trees (particularly poisoned trees)
- Evidence of trees (Platanus x acerifolia) overcoming infestations without human intervention

Tree health supplements

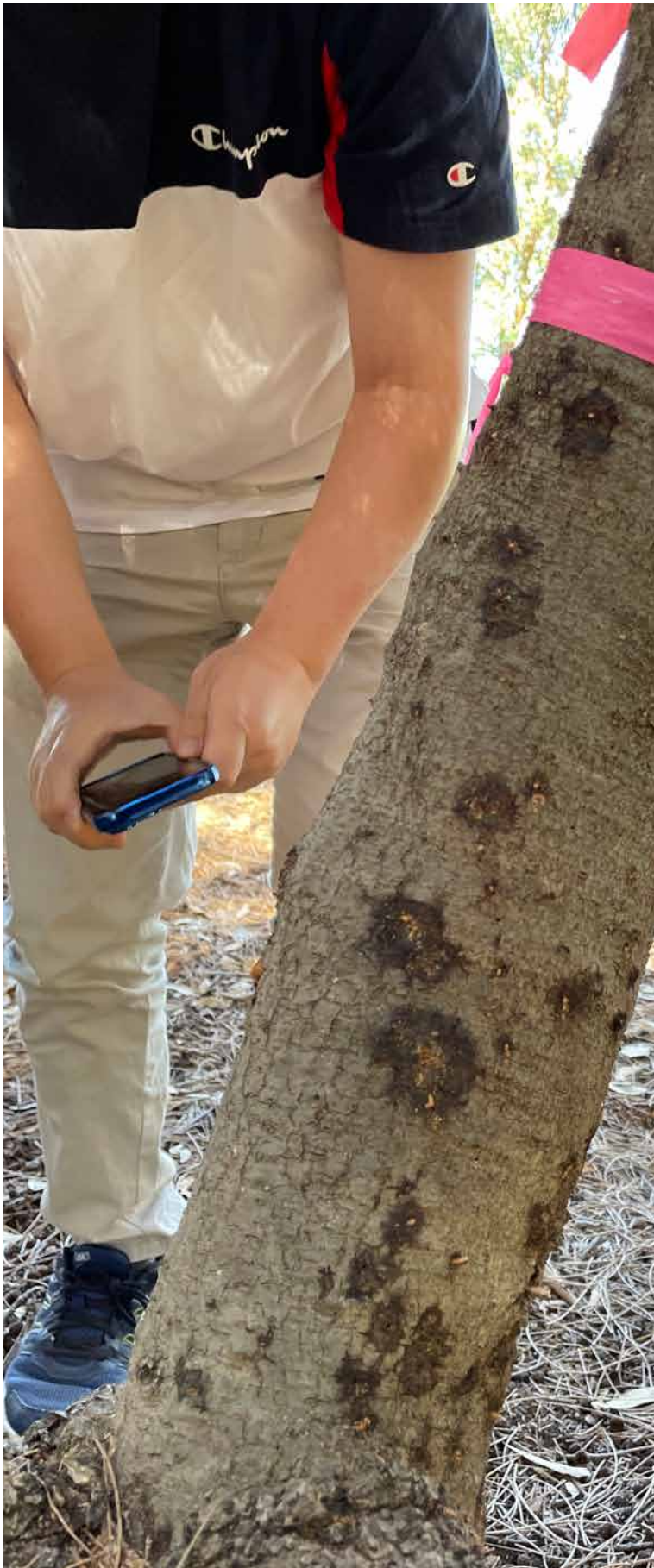
We have aimed to support the health of susceptible, high-value trees with proactive applications of BioPrime Trace. When discovered, infested trees are given a BioPrime Trace soil drench and an injection of glutathione, an antioxidant and detoxifier that has shown promise as a tree health supplement in certain applications.

In the case of the Council House Ficus, we also trialled an application of elemental Sulphur after testing found soils in the area were highly alkaline. Alkalinity reduces the availability of Manganese, which is essential for tree health and function. Sulphur applications lower soil pH and increase Manganese availability.

Since these supplemental actions occurred alongside other treatments, it is difficult the isolate their effects. As mentioned previously, however, some of our infested trees continue to display excellent health and vitality months or even years after their discovery. We believe that appropriate tree health supplements can be a net positive and have a role to play in successful PSHB management.

It should be noted, however, that too much of a good thing can be detrimental. The Enriched Tree Hypothesis suggests that nutritionally enriched or over-irrigated trees can be more susceptible to infestation because they provide a good environment for the beetle and its fungus. An example of this phenomenon is in the Tijuana River Valley, where infestation levels were worse in nutritionally enriched trees near sewerage outlets.

The higher susceptibility of stressed and enriched trees would seem to be point to a "goldilocks zone" of appropriate tree health, irrigation and nutrition that minimises the likelihood and effects of PSHB infestation.



Planned Trials and Developments

Systemic treatments:

- We are planning our own systemic chemical trial
- Monitoring City of Canning's promising results
- Evaluating various insecticides and fungicides
- Testing different application methods

Chemical refinement:

- Adding fungicide to Bifenthrin mixture
- Testing bark penetrating surfactants (Pentra-bark)
- Optimising formulation for different species
- Continuing efficiency improvements

Monitoring enhancement:

- Refining trap placement strategies based on data
- Improving identification training programs
- Developing better data visualisation tools
- Exploring 3D modelling for complex trees

Collaboration:

- Sharing findings with other local governments
- Contributing to WAARC research
- Participating in state coordination efforts
- Building industry knowledge base

Research needs:

While the City supports WAARC-funded research, immediate proportionate proactive responses needed while research outcomes evolve over years.

Priority research areas:

- Effective systemic treatments
- Host species susceptibility refinement
- Natural area management strategies
- Cost-benefit analysis of intervention approaches
- Long-term population dynamics

Commitment:

We are committed to:

- Continue our response
- Be dynamic to pivot when required
- Continue to provide updates
- Share learnings across sector

Summary

The Polyphagous Shot Hole Borer represents one of the greatest emerging threats to Western Australia's urban forests, biodiversity, and horticultural industries. International experience demonstrates that without coordinated, proactive management, the long-term ecological and financial costs can be profound. The City of Perth's response has shown that a tree-first, evidence-based approach can protect canopy, reduce pest populations, and maintain the benefits trees provide to community wellbeing, climate resilience, and cultural identity.

Surveillance, early detection, and rapid intervention remain our most effective tools. With collaboration, foresight, and sustained commitment, we can safeguard Western Australia's urban forest and natural landscapes for future generations.

We are committed to continue our response, be dynamic to pivot when required and continue to provide updates.

Our team are here to help and can be contacted via:

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Accidents
happen
Stephen Browne

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