# Strategic Waterways

A tool to categorise and prioritise waterway investments

water by design

an initiative of Healthy land & water

# Contents

# Introduction | What is Strategic Waterways?

Strategic Waterways is a support tool that helps waterway managers assess their local catchments, understand risks and manage priorities accordingly.
The excel based tool is available for download from waterbydesign.com.au/resources

## Why is it needed?

Waterway management is complex. There are often many competing objectives and it is very difficult for council and private industry to find the best solutions. Furthermore the current Water Sensitive Urban Design (WSUD) policy in Queensland focuses solely on sediment and nutrient reduction. It applies 'one-size-fits all' to complex issues like waterway management. Therefore, new tools are needed to adequately address the risks and benefits to waterways.

## How does it work?

Strategic Waterways uses a colour coding system to represent complex interactions between hazards, values and needs. These three dimensions form a diagnosis of the catchment condition and can assist in planning potential treatment strategies and recovery pathways for the waterway.


Strategic Waterways follows a 5-step process similar to the medical model as outlined below:

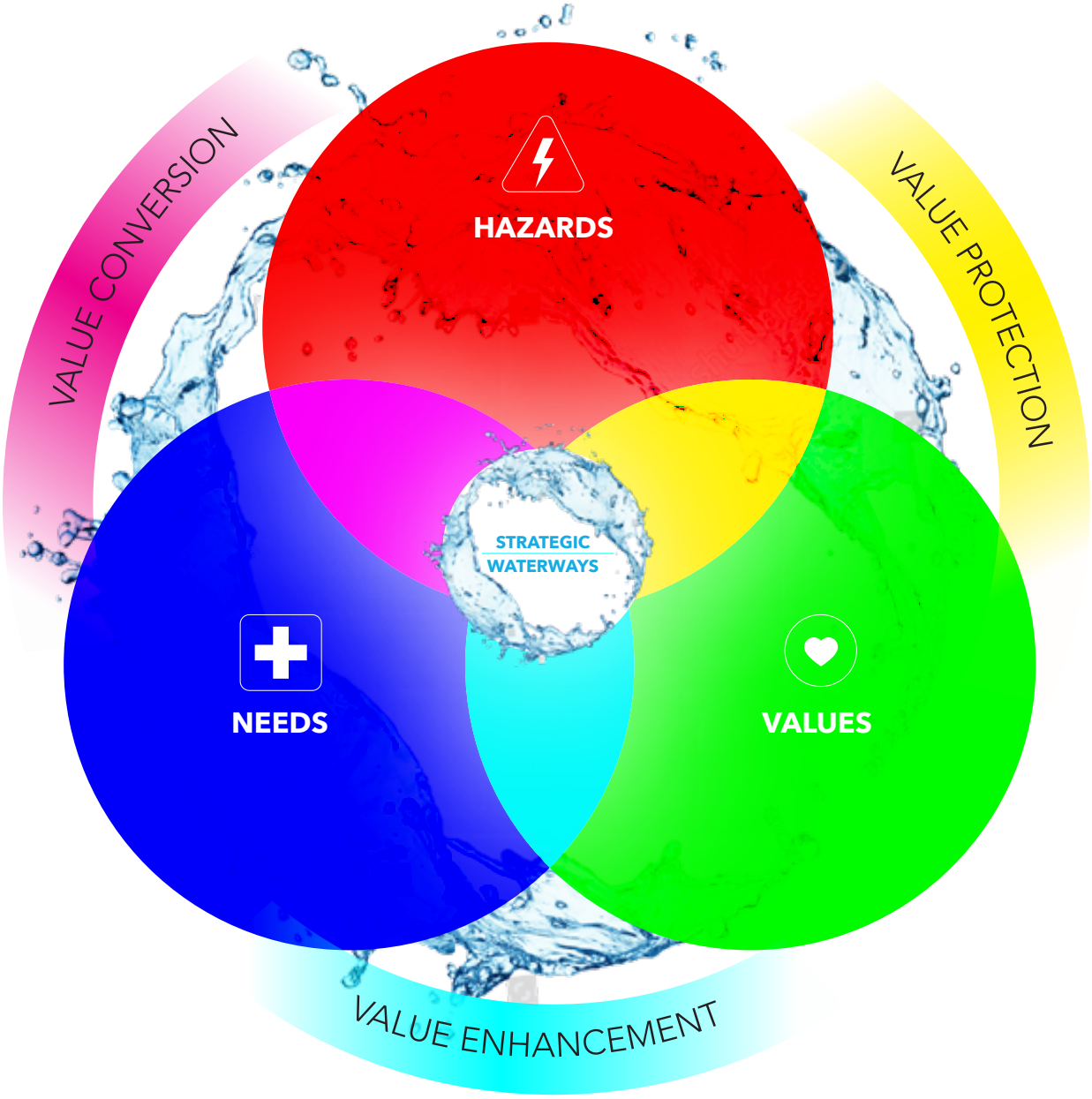
**Step 1**
Condition Assessment
What is the current health status of the waterway?

**Step 2**
Diagnosis
What is causing poor waterway health?

**Step 3**
Treatment Strategy
What treatment options should be used?

**Step 4**
Triage
Which section of waterway has the highest priority

**Step 5**
Monitoring
How effective is our strategy?

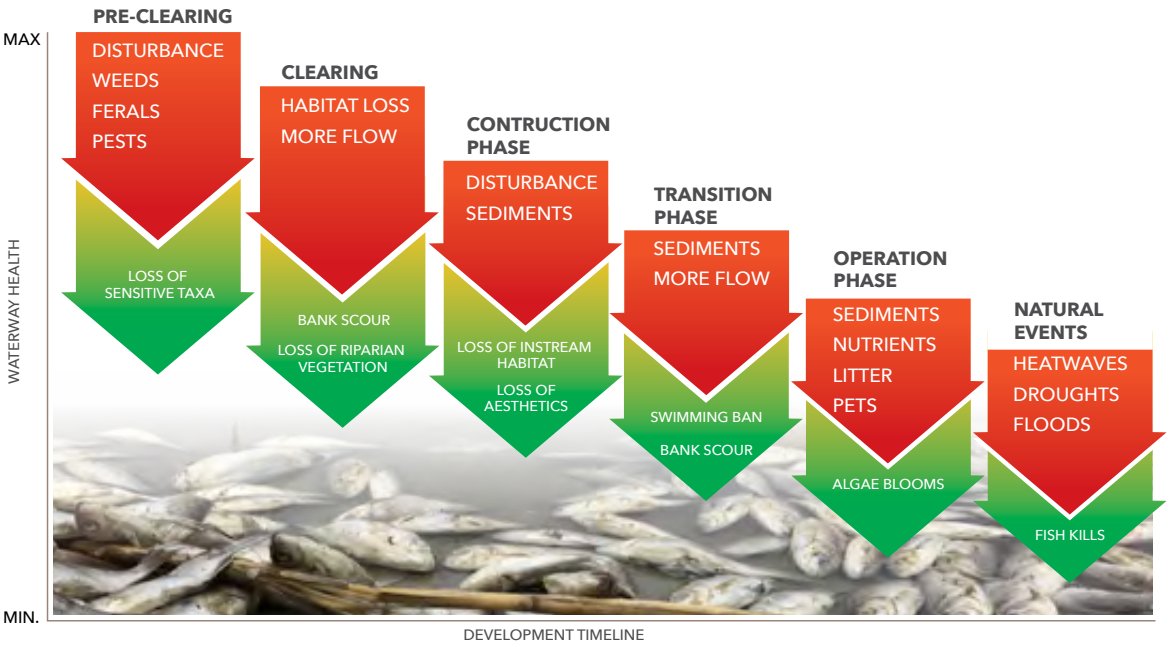



As waterway managers our two main goals are to protect and enhance waterway values. With this visualisation tool, users are able to assess risk and opportunity and create a balanced portfolio of catchment and waterway projects to maximise the return on investment.

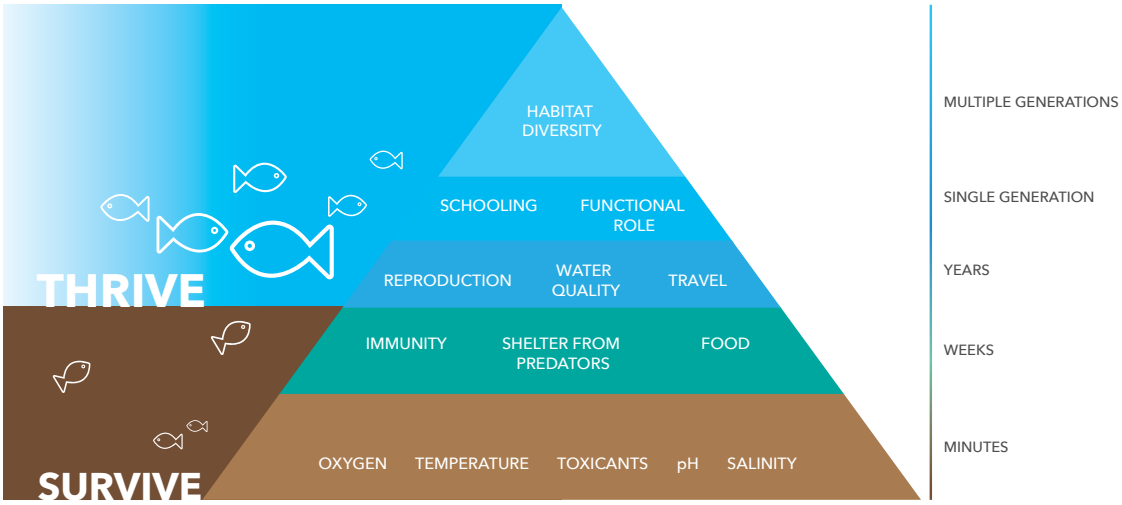
The tool uses a colour coding system and spectrum analysis to help diagnose what the waterway actually needs:

- Red indicates how hazardous the catchment is
- Where a hazard overlaps with a value it forms a risk (yellow)
- Green indicates how valued the catchment / waterway is
- Where a value overlaps with a need it forms an opportunity (cyan)
- Blue indicates where there is the opportunity to recover or enhance value
- Where a hazard can fulfil a need it forms a gamechanger (magenta)
- The brightness score indicates importance of this waterway/catchment

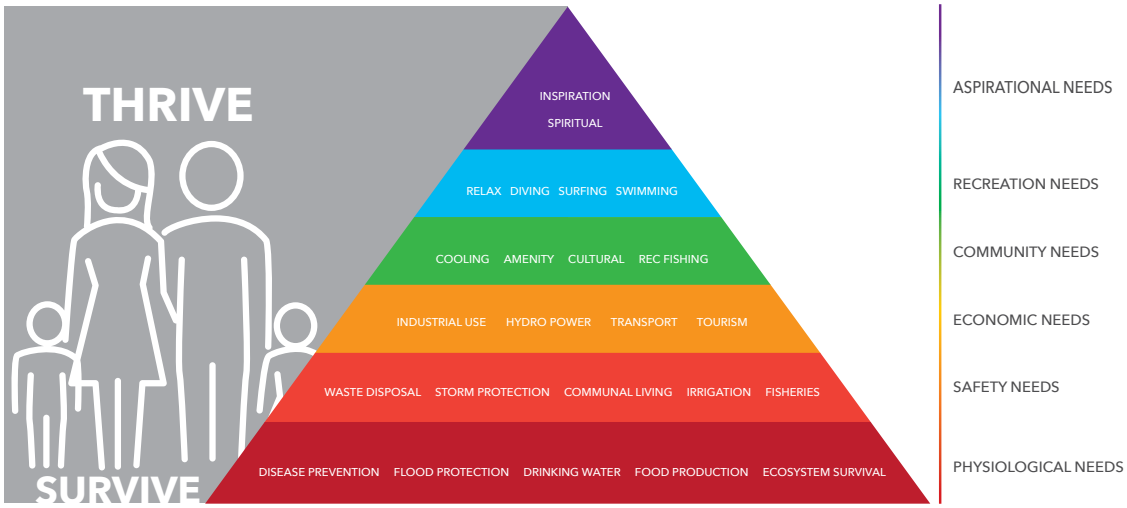
# Why we need to think differently




## HIERARCHY OF NEEDS FOR FISH




## HIERARCHY OF WATER NEEDS (FOR PEOPLE)



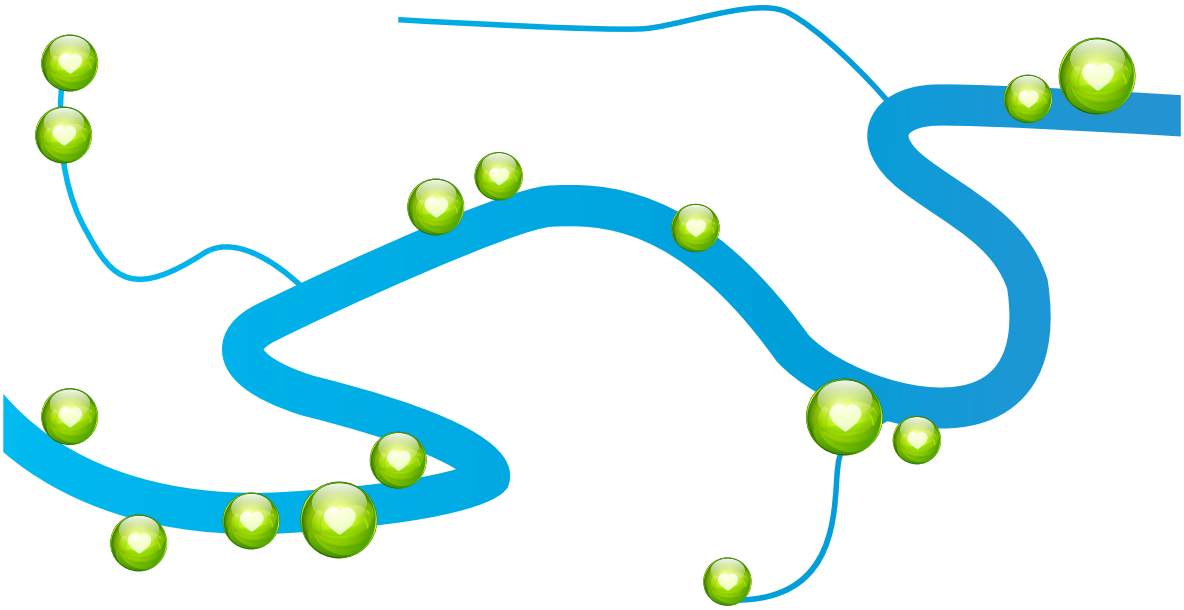
# Values | vary across the catchment

From the clean water we drink, the rivers we swim in and the diverse marine life in the Great Barrier Reef, every living thing relies on healthy waterways for survival. We often take waterway health for granted, so it is important to understand their values.

Some parts of waterways are of high value because they are where plants and animals flourish. Other parts can be considered low value, such as areas where the waterway has been neglected by the local community (e.g. stormwater channels in industrial areas).

To manage these values, we need to take inventory of the waterways within the catchment. These include lakes, wetlands, rivers, ponds, estuaries and the wider ocean. We can then prioritise high and low value areas to improve their health or protect them from external threats like pollution. We also need to understand the processes that preserve their function.

We then allocate resources for their protection, prioritised by the parts of the waterway that require the most attention to the least.  Strategic Waterways assists managers in understanding the values of each waterway so they can adequately preserve these catchment's values.



## Some common waterway values

| ENVIRONMENTAL VALUES | SOCIAL VALUES | ECONOMIC VALUES |
|---|---|---|
| Healthy ecosystems | Cultural values | Commercial fishing |
| Habitat | Recreational use | Drinking water |
| Food webs | Recreational fishing | Irrigation water |
| Biodiversity | Aesthetics | Tourism |
| Ecosystem services | Relaxation | Transportation |
| Water for life | Spiritual values | Adjacent land value |

COMMERCIAL FISHING

# The Values we are trying to preserve

We need to protect waterway values as they support all life on earth

WILD LIFE

CLEAN WATER

RECREATION

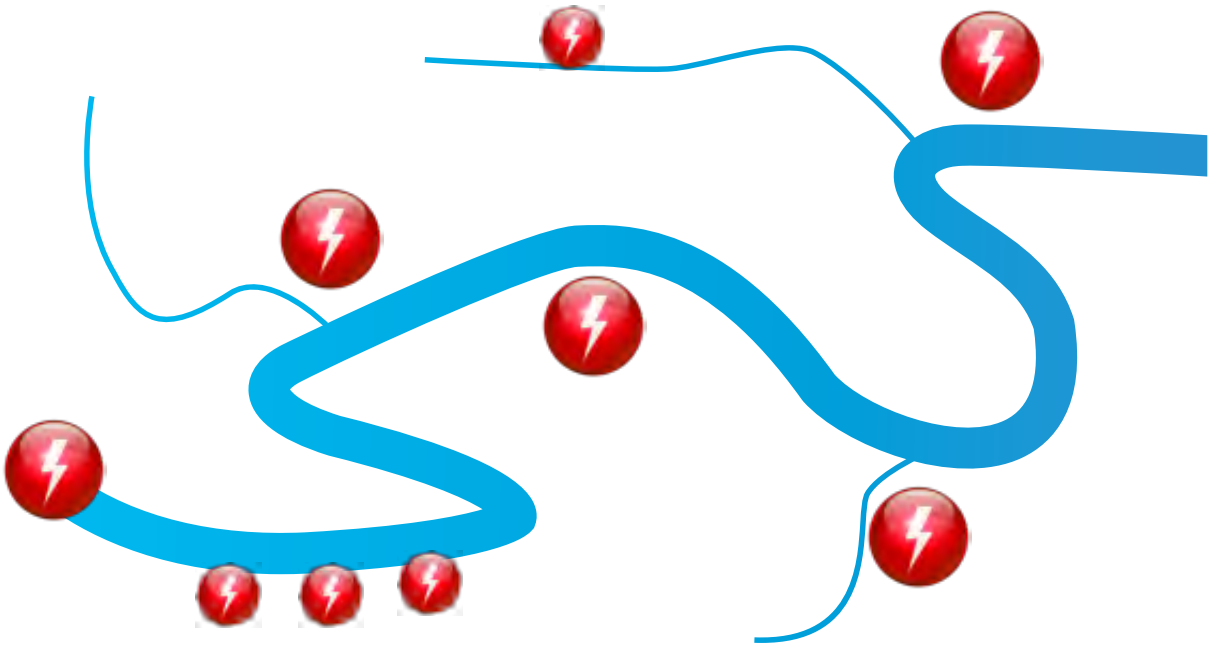
HABITAT

RECREATIONAL FISHING

# Hazards | vary across the catchment

Every year we invest millions of dollars in treating water pollution. We build, operate and maintain expensive wastewater treatment systems and for every new subdivision that is built, the polluted runoff from the roads, roofs and carparks is filtered through bioretention systems, gross pollutant traps or constructed wetlands. The stormwater industry is able to manage sediment and nutrients, but these are just some of the hazards threatening our waterways. In order to protect these vital ecosystems, we need to understand a wide range of potential threats, such as oxygen depletion and high temperatures, which can lead to mass fish kills.

Research suggests 90% of pollution flows from just 10% of the catchment, indicating we need to focus on these critical hotspots (McClain et al, 2003). We also need to monitor long-term threats like temperature increases and climate change. Strategic Waterways helps managers prioritise waterway hazards and develop an action plan to improve and preserve the catchment's health.



## Some common waterway hazards

| POLLUTANTS / TOXICITY | FLOW CHANGE | DISTURBANCE |
|---|---|---|
| Sediment | Urbanisation can cause: | Clearing of riparian areas |
| Phosphorus and nitrogen | Excessive flow increases | Piping of flowpaths |
| Gross pollutants | Concentration of flow | Weeds and pest species |
| Plastics | Redirection of flow | Pets and livestock |
| Heavy metals | Too much flow | Unintended public access |
| Hydrocarbons | Too little flow | Motor bikes and SUVs |
| Pesticides and herbicides | Reduced groundwater | Bush fires |
| Physical parameters | infiltration | Boat wake |

GROSS POLLUTANTS/
LITTER

FLOOD/
SEDIMENT

# The Hazards we are trying to manage

We need to protect and manage our waterways from harm to ensure they continue to function

NITROGEN &
PHOSPRORUS

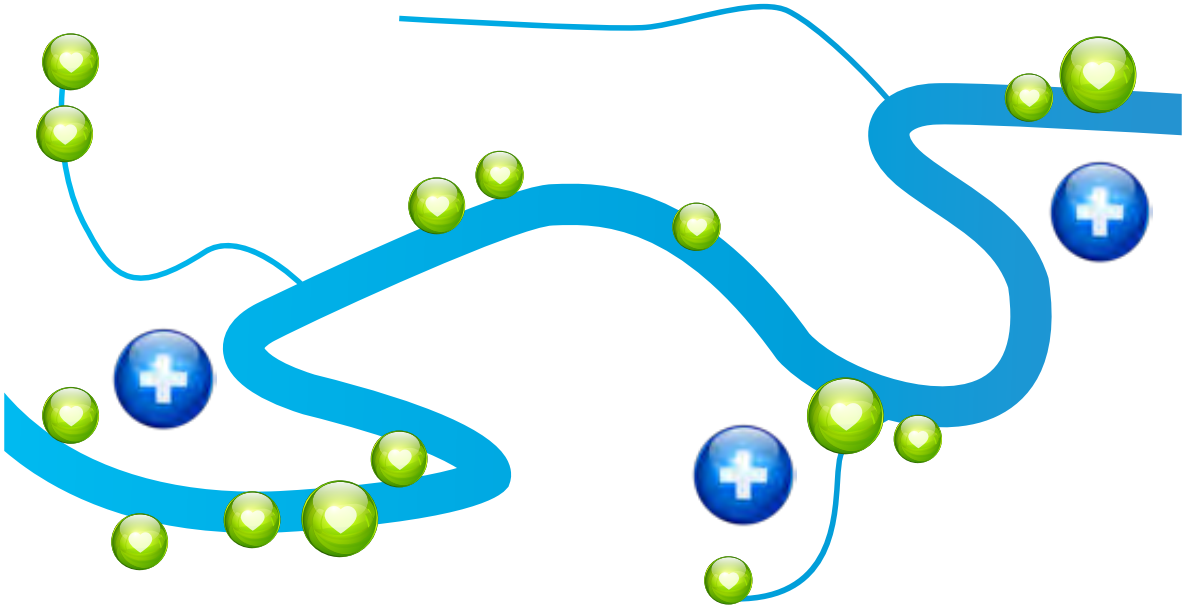
POINT SOURCE/
HEATWAVE

LAND CLEARING/
DISPERSIVE SOIL/DROUGHT

# Needs | vary across the catchment

Australia has been modifying and polluting waterways for over 200 years and extensive work is needed to improve their health. Urbanisation has also increased demand for recreational parks and waterways, threatening the natural processes of the ecosystem. We need to manage these demands with the needs of the ecosystem.

Similar to understanding the values of catchments, we need to understand the waterways' needs to identify projects that will provide short and long-term benefits. In particular, we need to be on the lookout for catalyst projects that will spur on further waterway value increases (e.g. community education, empowerment and action).



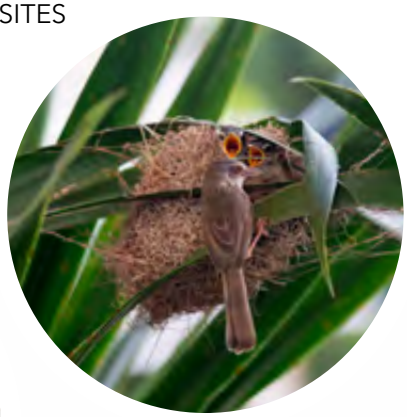
## Some common waterway needs

| ENVIRONMENTAL | SOCIAL | ECONOMIC |
|---|---|---|
| Revegetation | Access to creek | Potable water offset |
| Habitat restoration | Connection with nature | Establishing eco business |
| Habitat reconnection | Microclimate cooling | Lower maintenance cost |
| Stormwater disconnection | Recreation space | Improve fish stocks |
| Fish barrier removal | Education | River land value |

ALTERNATIVE WATER SUPPLY

COMMUNITY ACCESS

NESTING SITES



RECREATION

# Waterway needs we are trying to meet

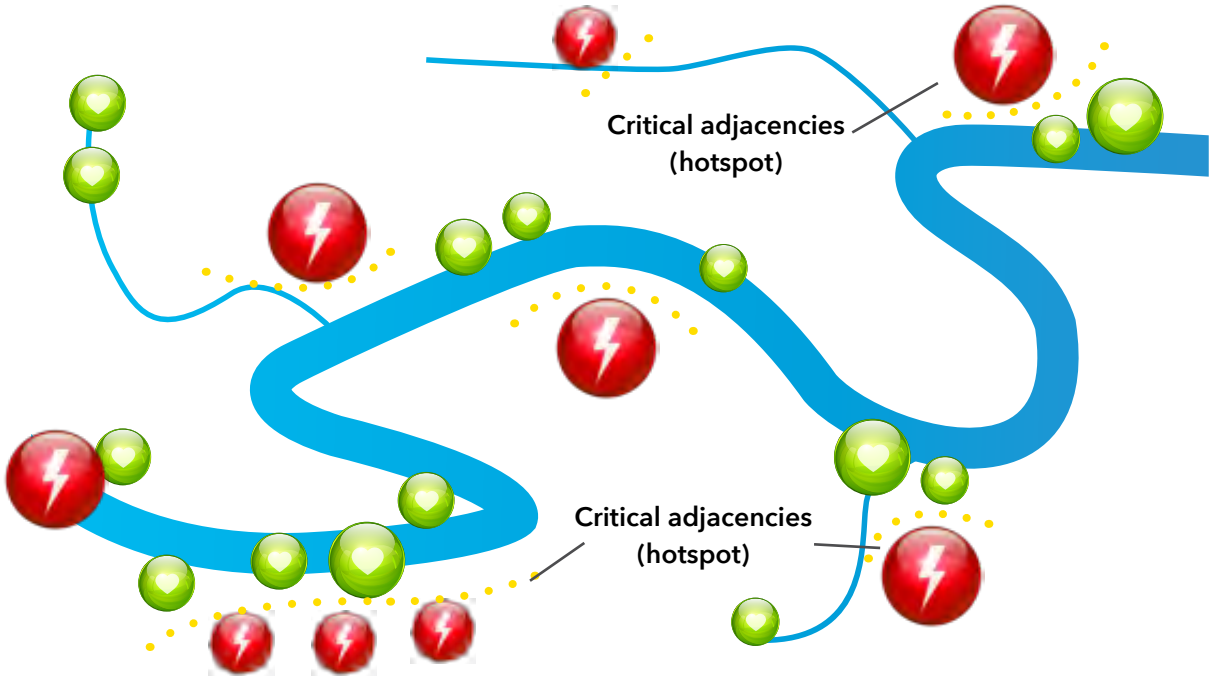
We need to look for ways to improve the waterway so that it can help us meet our own needs


## Why shouldn't risk management vary across the catchment?

Risk management and mitigation are an important part of waterway management and should always be front of mind. Waterway risks will vary considerably across the catchment and our mitigation strategies should take this into account.

Risk and hazard are distinct from one another, and it is only when a hazard overlaps with an environmental, social or economic value that it forms a risk. For example, where an area of high hazard (e.g. a construction site) is adjacent to a high value area (e.g. a fishery) it forms an area of high risk or a critical vulnerability. These are known as 'hotspot' sites.

Risk management can be classified into risk avoidance, mitigation or repair (offset).




## Some common risk management strategies

| AVOIDANCE | MITIGATION | REPAIR (OFFSET) |
|---|---|---|
| Land management | Sediment basins | Creek sediment removal |
| Riparian fencing | Constructed wetlands | Bank stabilisation |
| 'At source' control | Bioretention basins | Weed eradication |
| Green roofs | Gross pollutant traps | Pest eradication |
| Permeable paving | Detention basins | Litter removal |
| Rainwater harvesting | Flood control dams | Rehabilitation |

# The solution suite

BIORETENTION

HIGH EFFICIENCY SEDIMENT BASINS

BUFFER STRIPS AND SOAKAGE BASINS



SWALES

RAIN GARDENS

FLOATING WETLANDS

GROSS POLLUTANT TRAPS

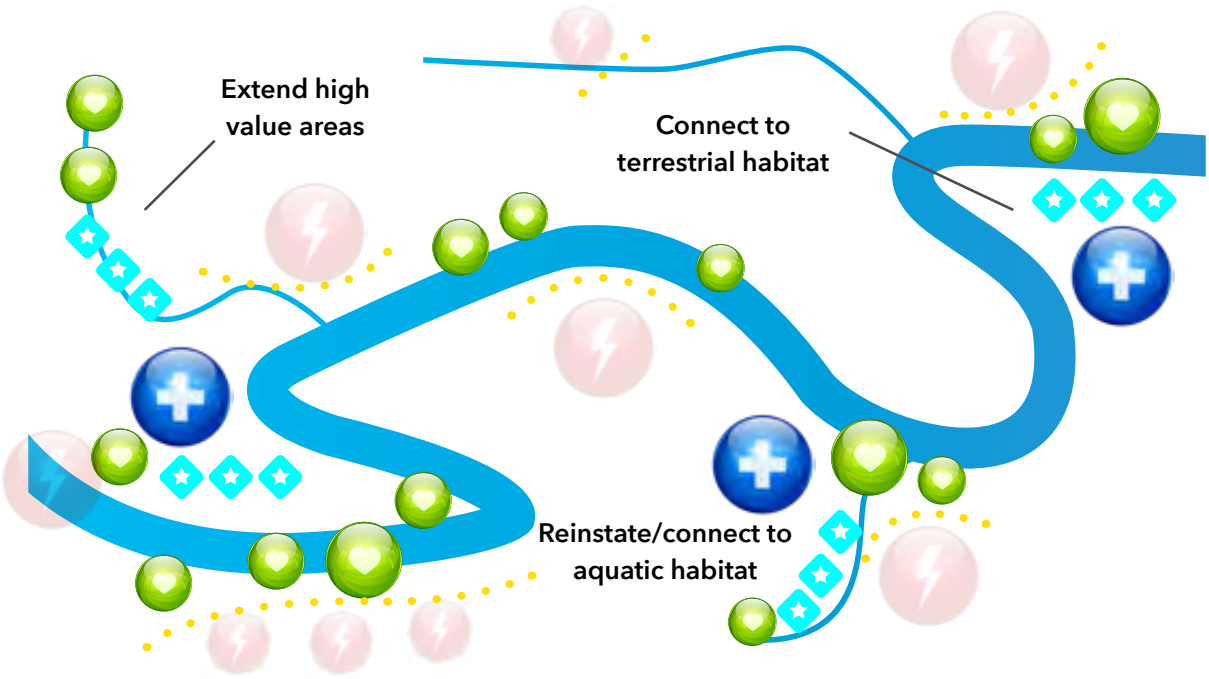
WETLANDS

MANAGED WATERBODIES


## Why should management just focus on risk?

Sometimes waterway managers focus on hazard mitigation rather than the potential to create new values. Similarly, catchment and waterway works are usually reactive measures that treat symptoms rather than the source of the problem. These approaches fail to recognise the potential to improve the environmental, social and economic value of the waterway.

Where an area of high need adjoins an area of high value this forms a critical adjacency, which becomes an opportunity to create value beyond the stand alone project. By finding the synergies within the catchment, we can invest in solving a problem and creating long term value simultaneously.




## Some common opportunities

| ENVIRONMENTAL | SOCIAL | ECONOMIC |
|---|---|---|
| Fish passage | Improve amenity | Increased tourism access |
| Habitat reinstatement | Active and passive recreation | Increased fishing revenue |
| Rehabilitation | Education and appreciation | Non-potable water supply |
| Reduce excess flow | Stewardship programs | Reduced lifecycle costs |
| Reinstate flushing | | Circular economy |

# Other solutions

FISH PASSGE

BANK STABILISATION

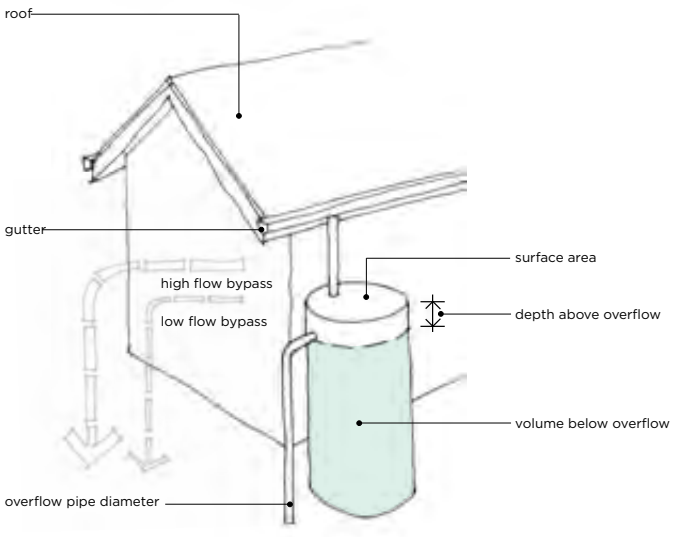
WEEDING &
REPLANTING

CREEK STABILISATION
REVEGETATION


## Is it possible to turn a hazard into something that fulfils a community or ecological need?

Where an area of high hazard intersects an area of high need it may be possible to find a solution that neatly addresses the hazard and simultaneously fulfils a community and ecological need. For example, stormwater harvesting converts a hazard (too much high-nutrient water) into a need (it provides an alternative water supply, among other benefits).

Waterway managers can find 'gamechangers' by assessing catchments for unique opportunities like the ones listed below.




### BENEFITS

- WATER AND NUTRIENT RECYCLING
- FLOW RETENTION
- IRRIGATION SUPPLY FOR LANDSCAPE
- MICROCLIMATE COOLING

**Rainwater tanks are a perfect example of gamechanger technology.**

## Some common gamechanger strategies

| HAZARD → | GAMECHANGER → | BENEFIT |
|---|---|---|
| Excess flow | Rainwater Tank | Non-potable water |
| Excess flow | Infiltration | GW replenishment |
| Excess flow | Permeable paving | Reduced pipes |
| Excess flow | Passive irrigation | Non-potable water |
| Nutrient laden water | Passive irrigation | Tree vitality |
| Heatwaves | Passive irrigation | Cooler microclimate |
| Sediment laden floodwater | Floodplain wetlands | Soil retention |

# The solution suite

WICKING LAWN

WATER WISE
STREET TREE

RAINWATER TANKS

STORMWATER
HARVESTING

PERMEABLE PAVING

HAZARDS

# Step 1a | Hazard Assessment

The first step in the Strategic Waterways approach is to assess the current (and proposed) condition of the catchment. A three-part questionnaire is provided below as a starting point.

Waterway managers can modify this questionnaire based on local knowledge and priorities. We would encourage organisations to assemble a diverse range of ecology and waterway health experts to conduct a full hazard assessment and calculate appropriate weightings for each item below. Some of the answers may be drawn from waterway health report cards or Water Quality Improvement Plans. Hazard ratings can also be found from flood maps, soil maps, contaminated land registers and aerial photos.

The Davidson Street Project has been used as an example of scoring. For more information, refer to **page 32.**

*What are the existing & proposed hazards in the catchment / waterway? (0=best case 10=worst case)*

| Theme | Hazard Intensity | Score | Available |
|---|---|---|---|
| ***Water*** | Has the catchment been cleared or will it be? | *8* | *10* |
| Maintain / improve | Are fragile soils present? Is erosion likely? | *6* | *10* |
| water quality | Are pollution sources (nutrients and other) present? | *6* | *10* |
| | Are litter sources (e.g. fast food, schools) present? | *6* | *10* |
| | Flow increases have occurred or are likely? | *6* | *10* |
| | Are large impervious areas present or likely? | *7* | *10* |
| | Is flooding present? | *8* | *10* |
| ***Environment*** | Has riparian clearing occurred or will it? | *1* | *10* |
| Protect and restore | Does the riparian edge suffer disturbance or will it? | *8* | *10* |
| waterway health | Are weeds present? | *8* | *10* |
| | Are exotic fish / pests present? | *5* | *10* |
| | Have habitat niches been removed or likely? | *8* | *10* |
| | Are there fish barriers present or likely? | *8* | *10* |
| ***Community*** | Are safety hazards present or likely? | *8* | *10* |
| Enhance community | Is poor aesthetics an issue? | *2* | *10* |
| quality of life | Is lack of green space an issue? | *0* | *10* |
| | Is the area unwelcoming or unfriendly? | *0* | *10* |
| | No community access to waterway? | *2* | *10* |
| | Is the community apathetic? | *4* | *10* |
| | Is there inequality in community? | *0* | *10* |
| ***Economy*** | Is the WSUD strategy expensive compared to average? | *1* | *10* |
| Maintain/ improve | Is land being underutilised? | *0* | *10* |
| the economic benefit | Does proposal have short life cycle / low durability (<25years)? | *3* | *10* |
| of waterways | Is proposal ecologically unsustainable? | *0* | *10* |
| | Does proposal represent low Triple Bottom Line value? | *4* | *10* |
| | | *0 to 10* | |

*"Red" hazard intensity* **109** ***250***

Download the excel tool from waterbydesign.com.au/download/strategic-waterways-tool


# Step 1b | Value Assessment

The existing values for a catchment can be found from sources such as:

- High Ecological Value Waterways and Wetlands Mapping (DES)
- Matters of State Environmental Significance (MSES) Mapping
- The Blue Maps (GBRMPA)
- Remnant Ecosystem Mapping
- Threatened Species Registers
- Cultural Herritage Mapping
- Walking the Landscape Approach (DES)
- River Styles Assessments
- Ecosystem Services Framework (HLW)

*What are the existing values in the catchment / waterway? (0=worst case 10=best case)*

| Theme | Value Intensity | Score | Available |
|---|---|---|---|
| ***Water*** | Does waterway inflow need to be sediment-free? | 7 | 10 |
| | Does waterway inflow need to be nutrient-free? | 7 | 10 |
| | Is local flood conveyance a key requirement? | 7 | 10 |
| | Is provision of low cost water of high importance? | 4 | 10 |
| | Are there important groundwater resources? | 0 | 10 |
| ***Environment*** | Natural lakes and / or wetlands are present? | 0 | 10 |
| | Flow paths & ephemeral creeks are present? | 10 | 10 |
| | Creeks and rivers are present? | 10 | 10 |
| | Aquatic structure (incl food & shelter) are present? | 5 | 10 |
| | Terrestrial structure (incl food & shelter) are present? | 5 | 10 |
| | Waterway connectivity is present? | 5 | 10 |
| | Functional ecosystems are present? | 5 | 10 |
| **Community** | Is community Access to creek is important? | 10 | 10 |
| | Is community Appreciation of creek is important? | 10 | 10 |
| | Is community Relaxation near creek is important? | 10 | 10 |
| | Is community Recreation near creek is important? | 10 | 10 |
| | Is Community Interaction with waterway is important? | 10 | 10 |
| | Is community Education of waterway values is important? | 10 | 10 |
| | Is inspiring and fostering community action is important? | 10 | 10 |
| **Economy** | Is commercial and recreational fishing important? | 4 | 10 |
| | Is recreation and tourism locally important? | 2 | 10 |
| | Is land value locally high? | 8 | 10 |
| | Does site have long term asset life (<25years)? | 6 | 10 |
| | Does site have low maintenance needs? | 9 | 10 |
| | Does site have high triple bottom line value? | 7 | 10 |
| | | *0 to 10* | |

| *"Green" value intensity* | **171** | ***250*** |
|---|---|---|

NEEDS

# Step 1c | Need Assessment

Because waterway management is often reactive, many key waterway needs can go unrecognised. However, consultations with ecologists, landscape managers, planners, economists and engineers can determine what needs are of highest priority.

Information can be sourced from waterway health report cards, aerial photos and land zoning maps.

*What is the potential to recover or enhance waterway / site value? (0=worst case 10=best case)*

| Theme | Need Intensity | Score | Available |
|---|---|---|---|
| ***Water*** | Is there high max temperatures require microclimate cooling? | *2* | *10* |
| | Are there sports fields, ovals or gardens requiring irrigation? | *6* | *10* |
| | Is non-potable water required for home use? | *2* | *10* |
| | Does the groundwater reserves need to be replenished? | *4* | *10* |
| | Is the riparian area is disconected and require watering? | *10* | *10* |
| ***Environment*** | Is there potential to create new terrestrial habitat adjacent to creek? | *10* | *10* |
| | Is there potential to link terrestrial habitat to creek? | *10* | *10* |
| | Is there potential to create new aquatic habitat? | *10* | *10* |
| | Is there potential to link aquatic habitat? | *10* | *10* |
| ***Community*** | Does general waterwiseness need to be improved? | *10* | *10* |
| | Does connection with creek need to be improved? | *10* | *10* |
| | Is Indigenous & non-indigenous history represented? | *10* | *10* |
| | Is a community facility / park in need of attractive WSUD? | *10* | *10* |
| | Are care facilities nearby and in need of water features? | *10* | *10* |
| | Can WSUD supply a nearby school with learning opportunities? | *10* | *10* |
| | High population centres nearby in need of green assets? | *10* | *10* |
| | Can links between waterway and cycleway be made? | *10* | *10* |
| | Are there sports fields close by in need of stormwater harvest? | *5* | *10* |
| | Is aesthetic amenity important for site? | *10* | *10* |
| ***Economy*** | Are there waste water reduction (via reuse) opportunities? | *2* | *10* |
| | Are there opportunities to reduce demand on potable water? | *2* | *10* |
| | Can we reduce catchment toxicity and improve circular economy? | *2* | *10* |
| | Can we improve potential TBL value for land? | *6* | *10* |
| | Are we providing highest value use of water? | *2* | *10* |
| | Do we provide lowest running costs? | *10* | *10* |

| *"Blue" need intensity* | **183** | ***250*** |
|---|---|---|

# Step 2 | Catchment Diagnosis

After a thorough assessment of the catchment and waterway we can accurately determine its needs. For example, does waterway value need to be preserved or is hazard minimisation or creating new value a bigger priority? Often catchments will require several different strategies to achieve the best outcome and return on investment.

Strategic Waterways uses the 'RGB' system of combining colours to diagnose a given waterway. Note that the secondary colour (e.g. Yellow) score is the average of the adjacent colours (Red and Green). The brightness score is the average of all values (Red, Green and Blue) and indicates the overall importance of the waterway. This helps waterway managers decide which waterways to prioritise first.

**Condition assessment score:**

| COLOUR | INTENSITY | |
|---|---|---|
| RED | 109 | Red = Hazard |
| YELLOW | 145 | Yellow = Risk (Where hazard overlaps a value) |
| GREEN | 181 | Green = Value |
| CYAN | 182 | Light Blue = Opportunity (Where value overlaps a need) |
| BLUE | 183 | Blue = Needs |
| MAGENTA | 146 | Purple = Gamechanger (Where a hazard can fulfil a need) |
| WHITE | 173 | |
| | /250 | |

**Catchment diagnosis:**

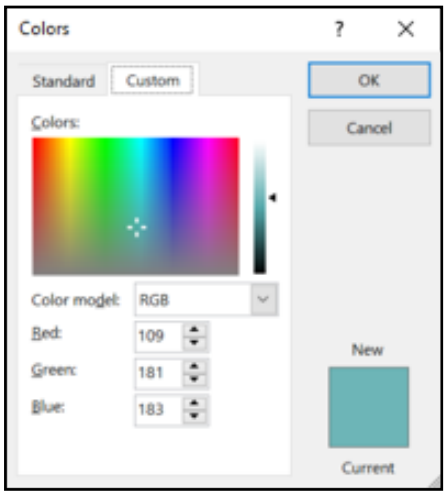
**Combined Colour**

This diagnosis produced a dull cyan hue indicating a moderate amount of waterway value and moderate opportunity to create new value.

**How do we calculate a combined colour?**

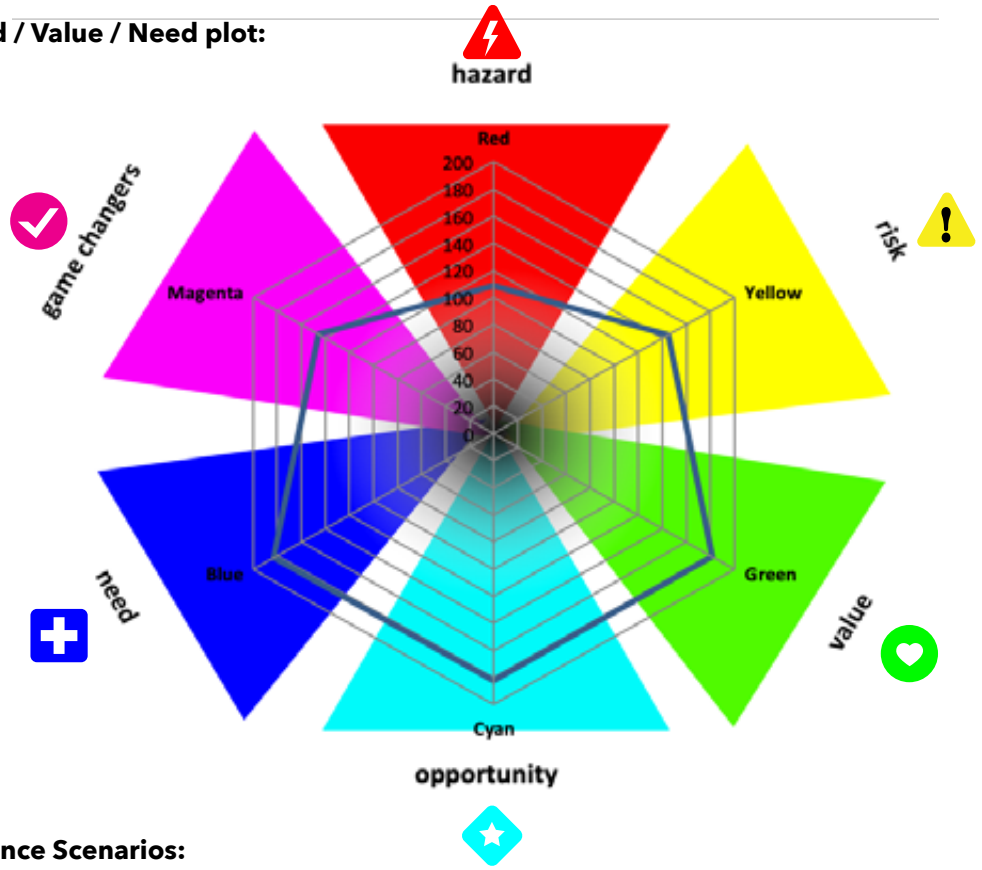
Combined colours can be calculated in most Microsoft applications by choosing
> more colours > custom

or using this online
> RGB colour generator



# Step 2 | Catchment Diagnosis

**Hazard / Value / Need plot:**

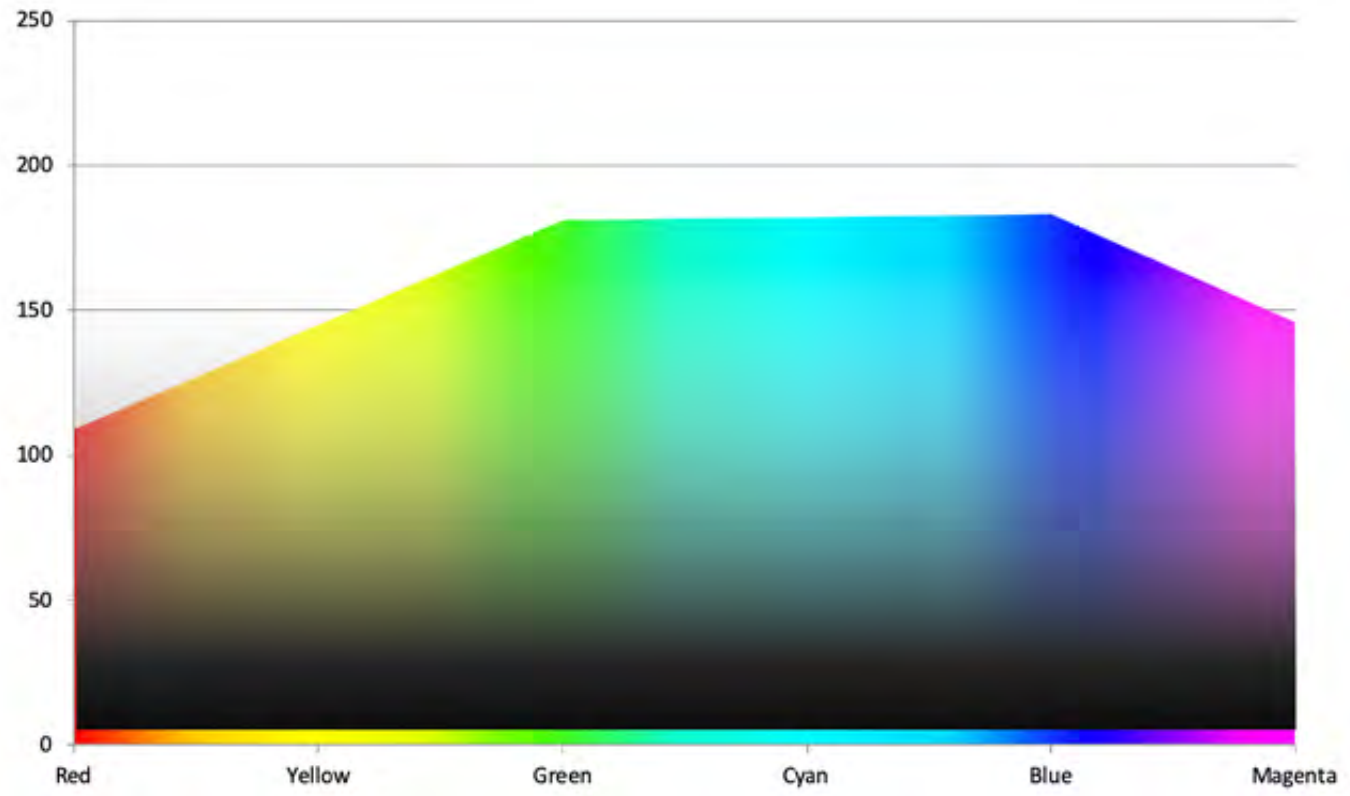



**Reference Scenarios:**

| Hazard Exposure | Waterway Condition | Recovery Potential | Combined Colour | Category | Triage Strategy |
|---|---|---|---|---|---|
| 250 | 0 | 0 | Red | Hazard | **Correct** existing hazards |
| 250 | 250 | 0 | Yellow | Risk | **Reject** new hazards |
| 0 | 250 | 0 | Green | Value | **Perfect** value condition |
| 0 | 250 | 250 | Cyan | Opportunity | **Reconnect** value |
| 0 | 0 | 250 | Blue | Need | **Resurrect** value |
| 250 | 0 | 250 | Magenta | Gamechanger | **Respect** value |
| 250 | 250 | 250 | White | Bright | **Protect** high value |
| 150 | 150 | 150 | Light Grey | Light | **Accept** current value |
| 100 | 100 | 100 | Grey | Neutral | **Redirect** investment |
| 50 | 50 | 50 | Charcoal | Dark | **Redirect** investment |
| 0 | 0 | 0 | Black | Black | **Redirect** investment |

The following plots help to visualise the distribution hazards, values and needs for a given catchment.

**Spectrum Analysis**




| Treatment Strategy | How to invest | Policy Setting |
|---|---|---|
| Poison reduction | Projects to reduce key hazard sources | Redirect offset investment here |
| Vaccine + Antidote | Projects to mitiogate risk hotspots | No net loss of value / no offsets |
| Vaccine | Conservation of waterway value | No net loss of value |
| Catalyst | Projects that catalyse value improvement | Redirect offset investment here |
| Elixir | Projects that fulfil a waterway need | Redirect offset investment here |
| Gamechanger | Projects that transform hazard into value | Redirect offset investment here |
| Vaccine | Candidate to receive additional funding | No net loss of value |
| Antidote | Business as usual / standard practice | Standard pollutant load reductions |
| Transfusion + Vitamins | Candidate to donate funding elsewhere | Contribute to offsets scheme |
| Transfusion + Vitamins | Candidate to donate funding elsewhere | Contribute to offsets scheme |
| Transfusion + Vitamins | Candidate to donate funding elsewhere | Contribute to offsets scheme |

# Step 3 | Waterway Treatment Options

Once a category is known for a given catchment we can assign an ideal treatment option.
There are nine key waterway treatment strategies available to waterway managers as listed below.
The strategies range from hazard and risk focus to value protection and creation focus.

Each strategy is likened to a medicinal treatment approach for clear identification.

**PREVENTATIVE MEDICINE**

R0 | G250 | B0

**STRATEGY 1**
**VALUE CONSERVATION**

**VACCINE**

R0 | G200 | B0

**STRATEGY 2**
**VALUE PROTECTION**

**POISON REDUCTION**

R250 | G0 | B0

**STRATEGY 3**
**HAZARD REDUCTION**

**ELIXIR**

R0 | G0 | B250

**STRATEGY 4**
**NEED INVESTMENT**

**ANTIDOTE**

R250 | G250 | B0

**STRATEGY 5**
**RISK MITIGATION**

**CATALYST**

R250 | G0 | B0

**STRATEGY 6**
**OPPORTUNITY INVESTMENT**

**POTION**

R250 | G0 | B250

**STRATEGY 7**
**GAMECHANGER INVESTMENT**

**TRANSFUSION**

R100 | G100 | B100

**STRATEGY 8**
**OFFSETS**

**VITAMINS**

R50 | G50 | B50

**STRATEGY 9**
**MIN REQ'D INVESTMENTS**

# Waterway Value Decline

## When should each treatment option be triggered?

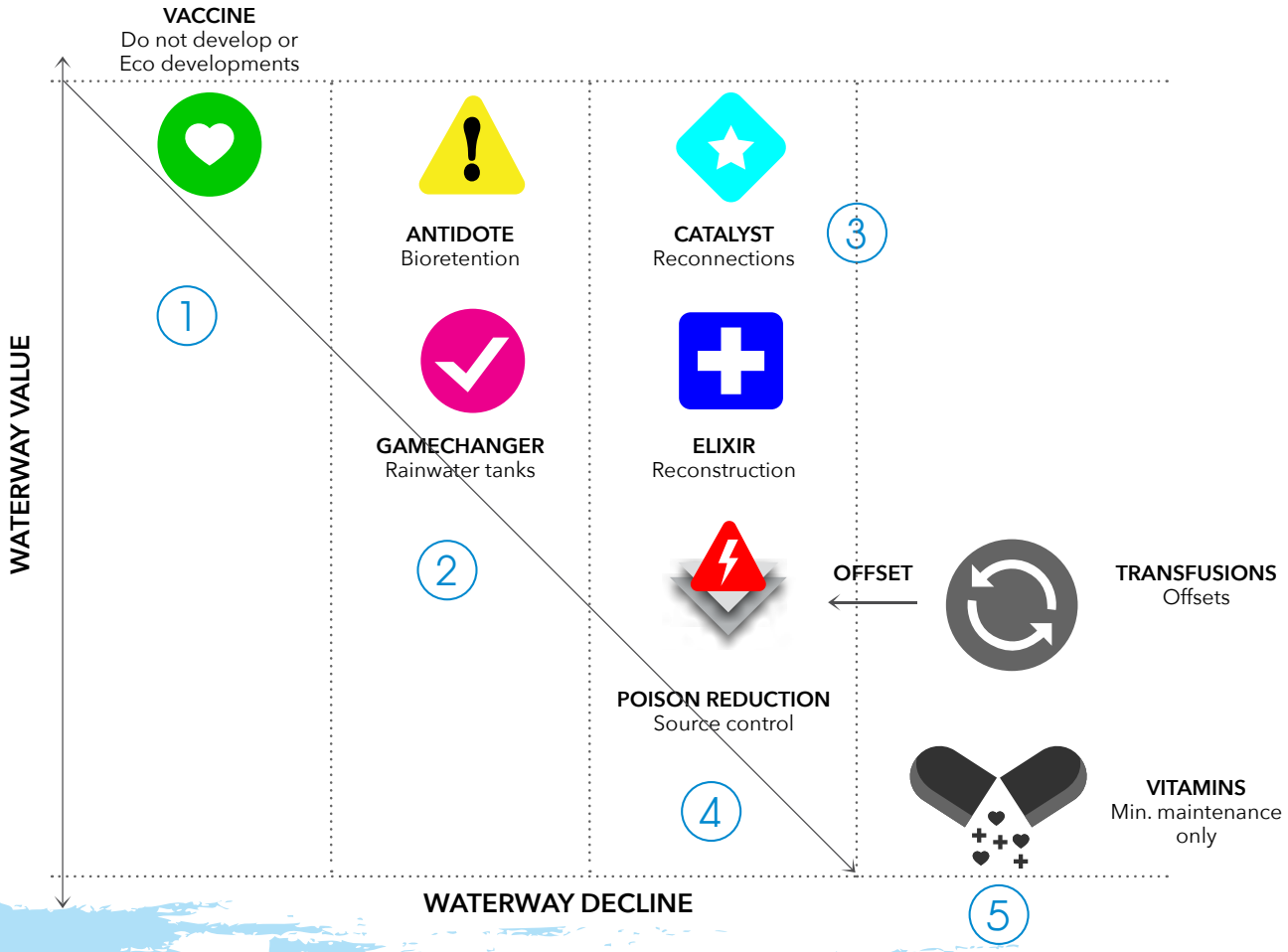
1. The strategy we select needs to match the catchment and waterway condition, otherwise we risk wasting limited resources. For example, the extra money required to build an eco-development would be wasted on a waterway once it has declined to a certain point. These funds could be better spent on a higher value catchment.

2. As the level of hazard increases it is now appropriate to look at hazard (i.e. poison) reduction, risk mitigation (i.e. antidote) and hazard conversion (i.e. gamechanger).

3. It is only once the waterway value has decreased somewhat that there is more opportunity to restore value (i.e. catalysts and elixirs) and achieve an ecological return on investment. Where there is a linkage to an area of high value a catalyst should be applied. Where there is no linkage, but a significant benefit could be realised, an elixir should be applied.

4. In resilience science there is a tipping point where the value has declined so much that it is no longer viable to return it to its former value because there will be less biodiversity. At this point, focus should shift from protection and recovery projects to hazard reduction.

5. If there is not a high hazard, value or need within the catchment, investment money should be redirected to higher priority catchments as this is more appropriate and beneficial. However, there should always be a small portion of funding available to service every waterway's critical needs.



| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **0** | **250** | **0** | **GREEN** |

| | |
|---|---|
| Management Strategy #1: | Value Conservation |
| Strategy Aims: | To maintain existing values,<br>Manage generic threats,<br>Protect from future development,<br>Safeguard perceived value and justify protections,<br>Celebrate intrinsic value. |
| Qualifying Criteria: | Waterways and catchments are in pristine condition. |
| Site Profile: | "Eden" |
| Examples: | Daintree Rainforest, Noosa River. |
| How to invest: | Fund value maintenance activities. |
| Policy Setting: | Do not develop. |
| Remedy: | "Preventative Medicine" |

**Preventative medicine** – Prevent disturbance in the first instance Prevention is often cited as the best cure. One option to preserve waterway value at the original (maximum) level is to prohibit development to occur at all. This option is best applied in pristine catchments in the local area. Funding should also be allocated to protect these catchments from threats such as climate change, invasive species and fire.

These areas can also be used as inspiration for the local community to build on conservation goals. Investment in programs such as **Environmental Education** (to foster environmental stewardship) and **Access for Appreciation** (evidence a waterway is appreciated in its natural state) will see long-term rewards.

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **0** | **200** | **0** | **GREEN** |

| | |
|---|---|
| Management Strategy #2: | Value Protection |
| Strategy Aims: | To maintain existing waterway values,<br>Manage generic threats,<br>Insulate waterways from development threats. |
| Qualifying Criteria: | Waterways have high value scores.<br>Small portions of the catchment may already be cleared of vegetation and have development potential. |
| Site Profile: | "The Shire" |
| Examples: | Gold Coast Hinterland (e.g. Currumbin Ecovillage). |
| Policy Setting: | Neutral or Beneficial Effect. |
| Remedy: | "Vaccine" |

**Vaccines** – Change the way development occurs
A vaccine is required to maintain waterway value while permitting development. This should be considered the ultimate goal for all waterways and relies on buildings and roads that replicate natural conditions as best as possible.

While this is a long-term goal, green roofs, permeable roads and rainwater tanks are helping make the step towards sustainable development. Examples of these low impact designs are the Currumbin Eco Village and the Noosa Flexi Learning Centre.

"Eden"

"the Shire" (Photo: Sheila Thomson)

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **250** | **0** | **0** | **RED** |

| | |
|---|---|
| Management Strategy #3: | Hazard Reduction |
| Strategy Aims: | To control hazards at their source,<br>To reduce pollutant toxicity and prevalence. |
| Qualifying Criteria: | Catchments with high pollutant loads. |
| Site Profile: | "A catchment detox" |
| Examples: | Industrial areas such as Pinkenba, Port of Brisbane, Rocklea,<br>Wacol, Archerfield, Slacks Creek and Underwood. |
| How to invest: | Target key hazard types and sources.<br>Project can be funded with offsets finance. |
| Policy Setting: | Legislate against hazards creation.<br>Enforce minimum standards. |
| Remedy: | "Poison reduction" |

**Poisons** – Reduce the toxicity of the catchment
Poison reduction programs rely on broadscale behaviour changes, such as elimination of pesticide, fertiliser, animal faeces and surfactants (from car washing) in stormwater runoff. Their focus can also be on reduced pollutant generation through erosion control (cover management) rather than sedimentation treatment. Their initiation can be via legal changes such as the single use plastic ban or via good environmental design such as fencing off waterways to prevent disturbance.

**Types of Hazard Reduction:**
**Legislation** - plastic bag bans, pesticide bans, minimum water quality standards

**Proactive environmental design** – design that prevent environmental hazards – riparian fencing, stock watering points, sustainable homes

**Behaviour change initiatives** – plastic straw disuse, reusable water bottles and coffee cups, clean up after dogs, wash car on lawn

**Incentive schemes** – container deposit schemes, green star schemes.

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **0** | **0** | **250** | **BLUE** |

| | |
|---|---|
| Management Strategy #4: | Need Investment |
| Strategy Aims: | To meet the immediate needs of the community and the local ecology.<br>Create new naturalised waterways and establish wildlife refuges. |
| Qualifying Criteria: | Catchments limited existing waterway value and a need for improved waterway value. |
| Site Profile: | "The Blank Canvas" |
| Examples: | Mackay's Cane Drains, Small Creek - Raceview. |
| How to invest: | Use offset money to fund value creation projects. |
| Policy Setting: | Use strategic plan to identify key opportunities. |
| Remedy: | "Elixir" |

**Elixirs** – Enhance waterway value
Elixirs are management actions that can improve waterway value, such as bank stabilisation, restoration of fish connectivity as well as community stewardship projects that can help promote the active resilience of a waterway. A good source of funding for elixirs is via offsets (transfusions); which enable resource transfers to create the best outcome.

Cane Drain, Mackay

Management Strategy #4

Small Creek - Raceview

**Case study – Small Creek- Raceview, Queensland**
Ipswich City Council have been investing significant sums of money to re-naturalise a creek at Raceview, Qld.

The project fulfils several key habitat and community needs including:

- Removal of a concrete drain and replacement with a naturalised creek
- Treatment of stormwater via litter collection and nutrient filtration
- Extended habitat corridor up from Deebing Creek
- Reconnecting to indigenous heritage – weaving circle / yarning circle
- Allowance for flooding / slows velocities allowing for settling and reduced scour
- Partly funded via offsets
- A co-design approach to inspire community ownership and long-term maintenance
- A bike path connecting to the local school encourages active transport

This project significantly increased the waterway value and showcases a 'resurrection' of an urban waterway returning towards its predevelopment condition.

waterbydesign.com.au/case-study/small-creek-ipswich-city-council

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **250** | **250** | **0** | **YELLOW** |

| | |
|---|---|
| Management Strategy #5: | Risk Mitigation |
| Strategy Aims: | To reduce harm to waterways through hazard mitigation,<br>Reduce the duration and frequency of a hazardous event,<br>Reduce proximity and connectivity of hazard to value. |
| Qualifying Criteria: | Sites where a hazard flows to an area of high value forming a critical vulnerability. |
| Site Profile: | "The Flash Point" |
| Examples: | Bells Creek, Mango Hill. |
| How to invest: | Additional funds for risk mitigation. |
| Policy Setting: | Strategic plan to identify hotspots.<br>Do not permit offsets in areas of high value.<br>Enforce water quality standards. |
| Remedy: | "Antidote" |

**Antidotes** – Treat waterway pollution
The development industry in Queensland typically uses stormwater treatment (antidote) options, including Bioretention Basins and GPTs to manage waterway risks. While this technology is important, antidotes only slow the degradation of a waterway. Hazards must first be generated for them to be effective.

Quite often money can be saved on Antidote treatment solutions by first investing in pollutant source reduction (e.g. minimising ground disturbance and cover control) will lead to lower end of line sediment basin costs.

Management Strategy #5

Pristine waterways become polluted with construction sediment.

**Water Quality Treatment Solutions**

- Water wise street trees
- Rain gardens
- Bioretention basins
- Constructed wetlands
- Floating wetlands
- Gross pollutant traps
- Buffer strips
- Sediment basins
- High efficiency sediment basins

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **0** | **250** | **250** | **CYAN** |

| | |
|---|---|
| Management Strategy #6: | Opportunity Investment |
| Strategy Aims: | To improve the value of the waterway,<br>Encourage value restoration and expansion.<br>Improve value reconnection and synergies. |
| Qualifying Criteria: | Waterways must have a section with high value and opportunity to expand or improve value. |
| Site Profile: | "The Missing Link" |
| Examples: | Davidson Street Project, Bancroft Weir, Barry's Weir. |
| How to invest: | Fund key catalyst projects.<br>Redirect offset investment here. |
| Policy Setting: | Use strategic plan to identify key opportunities.<br>Remove potential project barriers. |
| Remedy: | "Catalyst" |

**Catalyst** – Enhance waterway value
Catalyst projects are management actions that can improve existing waterway value, such as bank stabilisation, restoration of fish connectivity as well as community stewardship projects that can help promote the active resilience of a waterway. A good source of funding for catalysts is via offsets (transfusions), which enable resource transfers to create the best outcome.

**Case Study – Davidson Street Creek Revegetation, Newmarket**
The Davidson Street project builds on an existing creek with high value and key community needs. The project acknowledges that further increase in waterway value is not likely without community backing. Therefore, its main aim is to reconnect the community to the creek, inspire community action and waterway stewardship.

Features of this project include:
- Weed management and revegetation
- Stormwater filtering and infiltration via a soakage basin
- A co-design approach to inspire community ownership and long-term maintenance
- Education initiatives – inspire long term stewardship
- Increased amenities to capitalise on natural beauty
- Habitat enhancement

This project represents a moderate increase in short-term habitat value and aims to empower the local community toward long-term waterway stewardship.

waterbydesign.com.au/case-study/davidson-street-newmarket

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **250** | **0** | **250** | **MAGENTA** |

| | |
|---|---|
| Management Strategy #7: | Gamechanger Investment |
| Strategy Aims: | To use a waterway hazard to fulfil a community or ecological need. |
| Qualifying Criteria: | Sites need to produce a suitable form of waterway hazard,<br>There needs to be a mechanism to convert this hazard into a useful product,<br>There must also be a particular demand for the product close by. |
| Site Profile: | "Turning Trash into Treasure" |
| Examples: | Redbank Plains Recreational Reserve, Jim Donald Park. |
| How to invest: | Redirect offset investment here. |
| Policy Setting: | Specify game-changing technology in development guidelines. |
| Remedy: | "Potion" |

**Potions** – Transform a hazard into a benefit
The perfect example of a gamechanger investment is stormwater harvesting, as it converts a hazard (i.e. too much high nutrient water) into a **need** (i.e. it, it provides alternative water supply). A good source of funding is via offsets (transfusions); this will enable transfer of resources and effort to where it can make the biggest impact.

Gamechanger investment is aligned with the 'Circular Economy' principle, which turns a waste product into a resource. This mimics a natural system where the waste products (i.e. fallen trees) are decomposed and become the fertiliser that helps the next generation of plants establish.

**Case Study – Redbank Plains Recreational Reserve, Ipswich**
Ipswich City Council had issues with downstream flooding near the Redbank Plains Recreational Reserve. To solve the issue, a combined stormwater detention and stormwater harvesting wetland was constructed within the recreational reserve.

This infrastructure converted a threat into a reliable irrigation supply for the local sports fields, which subsequently saves the council thousands each year.

waterbydesign.com.au/case-study/redbank-plains-recreational-reserve-wetland

Management Strategy #7

Redbank Plains Recreation Reserve
Integrated stormwater treatment, detention, harvest and reuse (Photo: ICC)

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **100** | **100** | **100** | **GRAY** |

| | |
|---|---|
| Management Strategy #8: | Strategic Offsets |
| Strategy Aims: | To redirect finance to areas where they will have a much bigger impact. |
| Qualifying Criteria: | The donor site should not discharge to a high value waterway,<br>It should be relatively stable (i.e. established urban areas),<br>Adjacent waterways should have limited prospects for future recovery.<br>WSUD projects would have higher than average infrastructure cost or a high missed opportunity cost. |
| Site Profile: | "The Underperformer" |
| Examples: | Infill development in the Lower Norman Creek and Kedron Brook catchments. |
| How to invest: | Local Government to actively collect funds from here to reinvest elsewhere. |
| Policy Setting: | Strategic plan to identify area as offset zone.<br>Minimum onsite controls for litter etc still apply. |
| Remedy: | "Transfusion" |

**Transfusions** – Transfer investment to create value
Much like blood transfusions, the transfer of resources from a low value creek to a high needs creek can maximise the impact of the investment. While the transfer will 'weaken' the 'donor' creek, the high needs creek will gain significantly.

Ideally offsets can be taken from sites where there is:
**Limited benefit** to a local waterway (e.g. outfall direct to ocean, highly disturbed ecosystems, concrete channels, underground pipes)

**Higher than average infrastructure cost** to provide stormwater treatment infrastructure (e.g. due to underground services, land slope, retaining walls, high maintenance needs).

**High missed opportunity cost** where another project on the same site would create a much bigger return on investment. (Funds from commercial land in the CBD could contribute to a larger impact outside the CBD).

| 'R' INTENSITY | 'G' INTENSITY | 'B' INTENSITY | 'RGB' INTENSITY |
|---|---|---|---|
| HAZARD EXPOSURE | WATERWAY CONDITION | RECOVERY POTENTIAL | COMBINED COLOUR |
| **50** | **50** | **50** | **CHARCOAL** |

| | |
|---|---|
| Management Strategy #9: | Minimum Investment |
| Strategy Aims: | To provide just the minimum amount of investment to:<br>Prevent public safety risks and contain threats,<br>Maintain thresholds and avoid total sterilization of the waterway,<br>To sew "seeds of change". |
| Qualifying Criteria: | Every waterway should have a minimum amount of funding available to avert emergencies. |
| Site Profile: | "Left to their own devices" |
| Examples: | Parts of the Bremmer, Oxley, Logan and Brisbane Rivers |
| How to invest: | Minimum investment to sustain life only.<br>Local Government can collect funds from these catchments to reinvest elsewhere. |
| Policy Setting: | Sites identified via strategic planning. |
| Remedy: | "Vitamins" |

**Vitamins** – Minimum required investment
Vitamins represent the minimum required investment in any given waterway. Their purpose is to address key safety issues and waterway health deficiencies.

Actions could include:
**Public safety issues** to prevent risk to human life (e.g. culvert blockage, flood risk, e coli outbreak)

**Containment of threats** to prevent their spread into high value areas (e.g. weeds and invasive species, rapid 'head cut' scour in creeks)

**Seeds of change** – low cost measures that can have long-term positive impacts (eg. education)

# WATERWAY TREATMENT PLAN

## WATER

| POISON | CATCHMENT CLEARING | EROSION | POLLUTION |
|---|---|---|---|
| POISON REDUCTION | catchment clearing | cover control | pollution reduction programs (e.g fines) |
| ANTIDOTE | street tree quotas | sediment basins | stormwater treatment (e.g. bioretention) |
| VACCINE | do not permit development | no cut/fill housing | source control; ban plastic etc |
| CATALYST | ecodevelopment | industry R&D into ESC | passive irrigation of street trees and lawns |
| ELIXIR | demolish and re-wild | soil conservation education programs | behaviour change programs |
| GAMECHANGER | urban forest / green roofs | sediment harvest and reuse (e.g. lakes) | nutrient harvest and reuse (e.g. SWH) |

## ENVIRONMENT

| POISON | RIPARIAN CLEARING | DISTURBANCE | WEEDS |
|---|---|---|---|
| POISON REDUCTION | reduce / slow riparian clearing | reduce disturbance (e.g. feral animals) | weed eradication programs |
| ANTIDOTE | set min riparian buffers | repair disturbance | regular maintenance |
| VACCINE | do not permit clearing | fence riparian areas | source control and quarantine |
| CATALYST | link waterway to conservation areas | facilitated access points | biological control programs |
| ELIXIR | riparian restoration | restore waterway | riparian replanting |
| GAMECHANGER | empower community habitat groups | eco-tourism to fund eco repair | use weeds as pioneer plants or fertiliser |

## COMMUNITY

| POISON | SAFETY HAZARDS | POOR AESTHETICS | NO GREEN SPACE |
|---|---|---|---|
| POISON REDUCTION | reduce safety hazards | reduce ugliness (e.g graffiti) | reduce concrete jungle |
| ANTIDOTE | fencing and softfall | set min aesthetic standard | set min green space quota |
| VACCINE | safety in design | ensure architects deliver design | biophilic design |
| CATALYST | work & play safe education | initiate gentrification | combine PoS with redevelopment |
| ELIXIR | retrofit safer environments | subsidise beautification | resumption and park creation |
| GAMECHANGER | "safe risk" teaching | street art (e.g. Melbourne laneways) | verge community gardens/parklets |

## ECONOMY

| POISON | WATERWAY BENEFIT NOT SHARED EQUALITY | HIGH COST TO BENEFIT RATIO | HIGH MAINTENANCE COST |
|---|---|---|---|
| POISON REDUCTION | reduce inequality (e.g. only private access) | reduce WSUD costs (relax standards) | reduce level of service |
| ANTIDOTE | regulate public access | build WSUD only to economic constraints | design for maintenance |
| VACCINE | neighbourhood diversification | lotscale and at source WSUD | self sustaining natural systems |
| CATALYST | affirmative action | industry R&D (min cost + max benefit) | proactive maintenance / capacity building |
| ELIXIR | value redistribution | government to subsidise WSUD | maintenance funded by SW levy |
| GAMECHANGER | neighbourhood commons | strategic offsets to maximise ROI | community stewardship |

ROI = return on investment
SW = stormwater
SWH = stormwater harvest
TBL = triple bottom line
WSUD = water sensitive urban design

n/a = not applicable
CCTV = security monitoring
CPTED = crime prevention through environmental design
PoS = public open space
R&D = research and development

### FLOW INCREASE

reduce flow increase (SW detention)

rainwater tanks

net zero (flow)

stormwater harvest and reuse

retrofit flood mitigation

stormwater harvest and reuse

### IMPERVIOUS AREA

regulate impervious area

infiltration systems

permeable development

rainwater harvesting

retrofit urban infiltration

aquifer storage and recovery

### FLOODING

reduce flood risk (e.g. levees)

stormwater detention

flood friendly development

catchment reforestation

preservation and restoration of wetlands

resilient housing / house boats

---

### EXOTIC FISH

reduce exotic fish sources (quarantine)

eradication

reinstate native friendly habitat

reinstate fish passage, flushing

fish restocking

carp as pet food / fertiliser

### HABITAT REMOVAL

regulate habitat (i.e snags) removal

permit habitat offsets

ban habitat removal and educate

link waterway to conservation areas

habitat reinstatement

land for wildlife

### FISH BARRIERS

reduce and remove fish barriers

install fishways upon culvert renewal

design fish friendly crossings

combine fish ladders with infrastructure upgrades

retrofit fish ladders + fish restocking

sustainable aquaculture

---

### UNFRIENDLY WATERWAY CORRIDORS

reduce crime (e.g. CCTV, neighbourhood watch)

design with CPTED standards

design for community interaction

community engagement with redevelopment

community building programs

co-design redevelopment

### NO ACCESS OR INTERACTION WITH WATERWAY

reduce fencing

designate public access points

designate public commons

combine PoS with redevelopment

construct new river walkways

discovery trails

### APATHY ABOUT WATERWAY

target negative attidudes (e.g. dumping rubbish)

environmental education

engage with existing env. stewards

community grants / co-design projects

community spirit festivals e.g. riverfire

nature play

---

### SHORT ASSET LIFE

reduce non-durable materials

set design life standards

flexible, adaptable, resilient design

industry R&D to extend design life

asset management and renewal plans

natural self sustaining systems

### NON-SUSTAINABLE MATERIALS

reduce catchment toxicity

treat and contain toxic materials

eco-design standards

community education and incentives

retrofit houses with waterwise items

use circular economy approach

### MISSED OPPORTUNITY COST

broaden focus of WSUD

cost benefit analysis / offsets

use living waterways approach

catalyst redevelopment projects

subsidise investment to improve site value

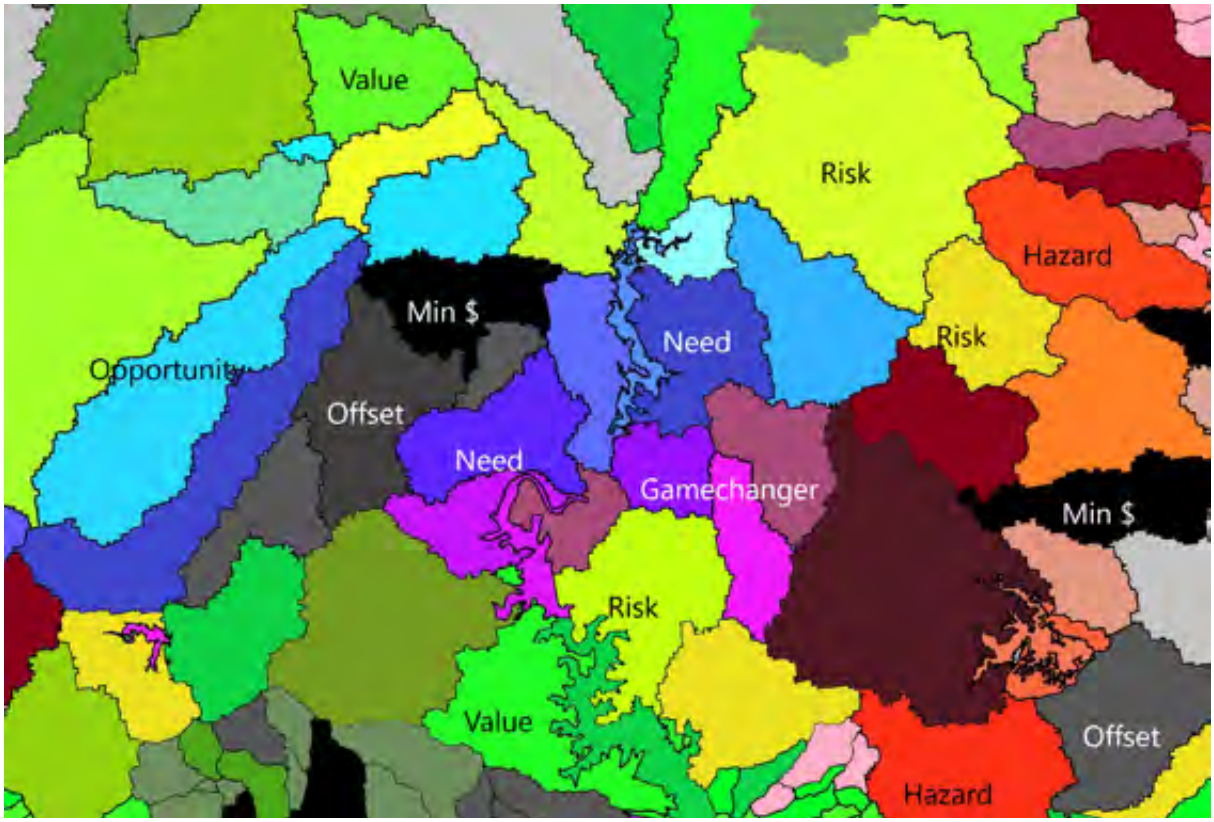
holistic design funded by SW levy

# Step 4 | Waterway Prioritisation and Triage

Once a waterway assessment has been undertaken, each sub-catchment can be assigned a colour and strategy depending on its combined 'RGB' score (Step 2) and a treatment strategy can then be assigned. This helps waterway managers build a picture of overall waterway health, enabling them to interpret a single GIS layer and identify high priority areas.

Waterway management is unlikely to have enough funding to cover every project identified in this process. It will therefore be necessary to prioritise actions (Step 4) in order to gain the biggest ecological (and social) return on investment.

**Figure 1 – Example: GIS Mapping Using Strategic Waterways**



**Selecting Winning Projects**

The Queensland Environmental Protection (Water) Policy (EPP) (DES 2009) has two key objectives:

1. **Protect Waterway Values**
2. **Enhance Waterway Values**

The Strategic Waterways Tool can help waterway managers efficiently protect and enhance waterway values by following the 'rules' described in the table below.

These rules form an algorithm for determining high priority waterway projects.

**Table 1 – Rules for optimising waterway value**

| **OBJECTIVE # 1** | **PROTECT WATERWAY VALUES** |
|---|---|
| **How?**<br>Protect Green Score | **Which Strategies?**<br>Maintain Green, Reduce Red Score, Reduce Yellow Score |
| **Strategy?**<br>1&2. Green Zones<br>(Maintain Value Score) | **Why?**<br>It is cheaper to protect existing ecosystems than to build new ones.<br>Once a species is extinct it is irreversible |
| 3. Red Zones<br>(Reduce Hazard Score) | Limiting Hazard creation (e.g. pollution source control) is the most effective way to manage risks and limit damage to a value |
| 4. Yellow Zones<br>(Protect Green from Red) | Identify key risk 'hot spots' and prevent existing Green Zones from being degraded by Red Zones |
| **OBJECTIVE # 2** | **ENHANCE WATERWAY VALUES** |
| **How?**<br>Enhance Green Score | **Which Strategies?**<br>Convert Cyan, Blue or Magenta into Green zones |
| **Strategy?**<br>5. Cyan Zones<br>(Convert Cyan to Green) | **Why?**<br>Identify key 'cold spots' or reconnection opportunities and transition them from Cyan to Green.<br>Catalyst projects harness natural resilience and have a self-restoring potential. |
| 3. Blue Zones<br>(Convert Blue to Green) | Where Blue Zones (e.g. high environmental, social or economic needs) exist in the catchment, investment here will create new Green (High Value) Zones.<br>This is usually more expensive than a Cyan project |
| 4. Magenta Zones<br>(Convert Red to Green via Blue) | Nominally, this could provide a 2 to 1 benefit ratio.<br>The one investment will convert a hazard into a benefit.<br>i.e. reduce the Red score and convert Blue to Green |

Strategic Waterways aims to achieve the above objectives while maximising the net ecological, social and economic return on investment. This allows us to stretch environmental funding further and create more impact in the catchment.

# Step 5 | Monitoring of strategy effectiveness

One of the leading reasons quoted for the 'failure' of Water Sensitive Urban Designs is the breakdown of the project implementation chain. That is the effectiveness of the chosen risk mitigation strategy is diluted due to poor planning, design, construction compliance and/or asset maintenance. If one link in the chain is broken then it could lead to complete project failure.

**The Project Implementation Chain:**


This is important to recognise, as the same issue could occur to any of the nine potential value management strategies. If projects are poorly executed than the ecological return on investment will be reduced.

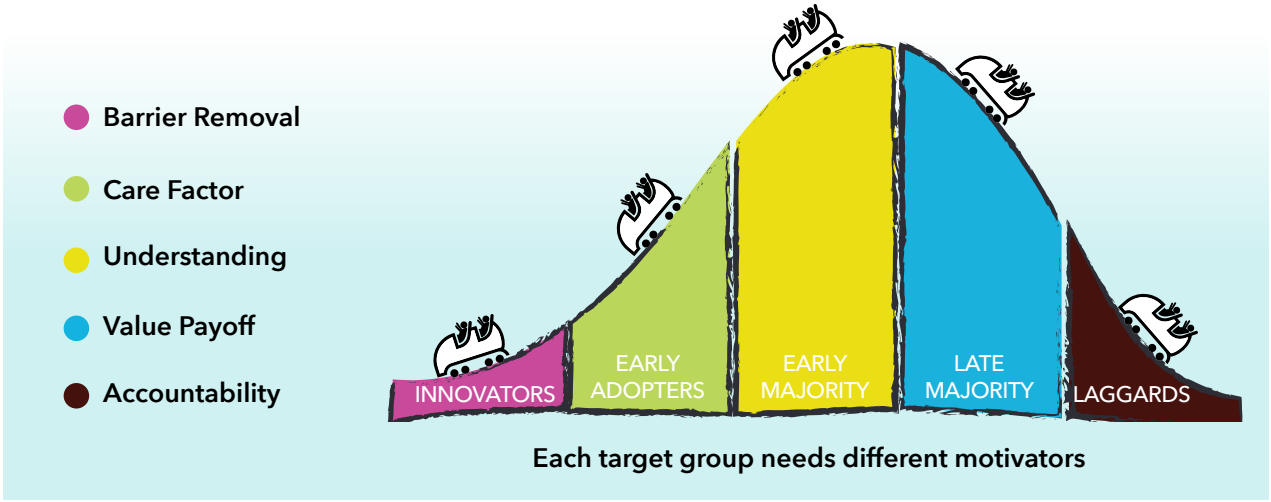
How can we measure potential project uptake and delivery effectiveness?
Strategic Waterways assumes different sectors of the development industry respond to different incentives, penalties and motivators, which leads to a variety of project outcomes (ranging from full adoption and perfect execution of WSUD through to poor adoption and incomplete execution of WSUD).

These sectors can be characterised by different stages in Rogers Adoption Curve (below). This concept has been applied to associate a key motivator for each sector, as illustrated on Page 41.

**Why do people still pollute? > What can we do?**

| | | |
|---|---|---|
| Don't care | > | Promote reconnection to nature |
| Don't know better | > | Provide more education programs |
| Don't have time/opportunity | > | Better environmental/urban design |
| Don't have the money | > | Provide incentives/polluter pays |
| It's not illegal | > | More regulation/enforcement |

**Key motivators relating to each segment of the stormwater Industry**




**Each target group needs different motivators**

For example, engineers within the 'late majority' category are most likely to respond to the 'value payoff' motivator, which means they need to see the clear economic benefits before they pursue a strategy. Similarly, it can be assumed those in the 'laggard' category will only respond to penalties and accountability.

To use the Strategy Effectiveness Tool, waterway managers answer a simple questionaire to test how a potential strategy will perform for each market sector across the different phases of a project. This can be helpful for waterway managers to re-evaluate a strategy deemed unviable due to administration challenges.

**Visualising strategy effectiveness**

The properties of colour can again be utilised to measure the potential success of project. The score from the implementation questionaire can be converted to an opaqueness percentage. For example, if a project faces significant administrative challenges and has a lower score, the colour will be less opaque. Therefore, a higher opaqueness percentage indicates the higher potential success in converting financial investment into ecological gain.

| min strategy effectiveness (0%) | median strategy effectiveness (50%) | max strategy effectiveness (100%) |
|---|---|---|

This tool is useful in evaluating new technology and strategies so managers can assess the likelihood of success compared to a more conventional approach.

**Monitoring and adaptive management**
Waterway managers need to review catchment strategies regularly to measure progress, impact and growth in the RGB score. This allows for timely optimisation and adjustment to ensure sustained return on investment.

**Limitations of the tool**
Strategic Waterways is a high level tool that can help waterway managers visualise risks and opportunities within their catchment and help them to decide spending priorities. Most project sites will be a combination of mid-range scores, resulting in a dull grey that requires a diverse range of strategies.

Ground-truthing is also needed to establish the viability of a project. If waterways cross local government boundaries or mixed land tenure exists, it may reduce the chances that an identified hotspot can be acted upon. Managers can begin to explore these issues using the implementation questionaire.

**In summary**
With environmental budgets declining and waterway issues increasing, it is imperative that we maximise return on investment in waterway projects. This warrants an innovative, new approach that challenges traditional methods of treatment.

Strategic Waterways, developed by Water by Design, uses the properties of colour to help assess and diagnose waterway condition. The tool will enable waterway managers to interpret a single GIS layer and quickly identify hotspot areas (key risks are identified by bright yellow zones) and/or cold spots (key opportunities identified by bright cyan zones).

This tool benefits managers and waterways by simplifying complex interactions between hazards, values and needs. It allows managers to prioritise and optimise their portfolio of catchment management projects. This revolutionary system is adaptable, efficient and paves a way forward in ecological, financial and social waterway sustainability.

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- **Browning G.D**., "Let's Get Our Priorities Straight" WIT Transactions on Ecology and the Environment, Vol 228 WIT Press, 2018, ISSN 1743 3541
- **Browning G.D.**, "Let's Get Our Ducks in a Row: Novel tools for Waterway Prioritisation" International Journal of Environmental Impacts, Vol 2 WIT Press, 2019
- **Browning G.D.**, "50 Shades of Risk: A tool to analyse and prioritise complex waterway management" World Engineering Conference, Melbourne 2019



**Healthy Land and Water**
Healthy Land and Water is an independent organisation dedicated to improving and protecting South East Queensland's environment. As experts in research, monitoring, evaluation and project management, we deliver innovative and science-based solutions to challenges affecting our landscapes, waterways and biodiversity.

Our Water by Design initiative was established in 2005 and builds the capacity of the water and urban development sectors to help successfully implement sustainable cities through better urban water management. Find out more at www.waterbydesign.com.au

For further information on this guideline or other projects, or to provide feedback, please email info@hlw.org.au or telephone (07) 3177 9100.

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Strategic Waterways is a new guideline and tool to help waterway managers to assess and prioritise actions across the catchment. It takes a fresh look at the hazards damaging waterway health and strategies to manage our water values.

It's unique colour-coding and scoring system means it is easy to:

- visualise waterway hazards, values and needs;
- diagnose what type of action is needed most;
- decide which sites are highest priority; and
- keep track of restoration progress for each section of waterway.

For a new perspective on ecological risk management, explore the Strategic Waterways tool at:
www.waterbydesign.com.au/news/strategic-waterways
www.livingwaterways.com.au/

For other products by Water by Design go to www.waterbydesign.com.au/resources


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