

Waterway Knowledge & Prioritisation Tool

- Methodology -

Supporting Effective Waterway Decision Making For River & Wetland Recovery



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1.0 Goal

The Waterway Knowledge & Prioritisation Tools (WKPT) goal is to assist in the protection and enhancement of the ecological values of Logan City Councils waterways by determining their prioritisation level, through the identification of the waterways current level of naturalness and their potential risk profile.

2.0 Objective

The WKPT is designed to achieve the following objectives:

- Determine a waterways current level of naturalness in comparison with other LCC catchments
- Identify a catchments potential risk profile in comparison with other LCC catchments
- Calculate a catchments ecological prioritisation level to assist with social and economic prioritisation
- Support Council's decision-making processes when considering projects that affect LCC waterways and for projects that protect or enhance LCC waterways
- To ensure another level of transparency in project selection and funding decisions

3.0 Scope

The WKPT is a GIS based tool following an asset management framework to determine the prioritisation level for all of the catchments within Logan City Councils boundary. The WKPT looks at the ecological naturalness and the potential risk to this naturalness to produce a prioritisation level for the catchment. Economic and social criteria can then be used for further prioritisation of the catchments and the management actions outside the GIS tool.

The current version of the WKPT is dependent on the GIS information available for all catchments within LCC. Therefore the current data used is based on what data is currently available. Through a critical review of the WKPTs methodology OPUS provided recommendations for more or modified criteria in further iterations of the tool once data becomes available.

4.0 Design

Research into the practice of prioritisation of waterway rehabilitation as part of the WKPT's development has led to the adoption of the following key principles for its design:

- It should incorporate risk management principles including an analysis of the relative values and threats to a particular waterway management unit (WMU).
- WMUs should be based on catchments or sub-catchments that are manageable in size and which individually can be represented by a single naturalness/risk profile (encompassing values and threats).
- The values and threats should be based on attributes measurable by existing data, knowledge or information easily collected in the future.
- The prioritisation process of catchments and rehabilitation projects should be based on resource responsible decision making that takes account of socio-economic criteria.

A value verse risk methodology was produced with a draft framework to prioritise the catchments set out. Upon request this methodology and framework was peer reviewed by OPUS. OPUS also was asked to help enhance the WKPT framework and methodology.

This document is a culmination of the Councils draft framework of the WKPT methodology and framework, the recommendations from the OPUS peer review and enhancement report and a final review of the methodology over the last 12 months.

Numerous other models for prioritisation exist such as severity, preservation and request based models but they each have their shortcomings and lack the rigour that a risk management based process provides.

5.0 Framework

The above design principles closely align with modern asset management practices. Waterways are natural assets and their management (rehabilitation, protection or maintenance) should logically conform to such practices or at least the principles behind them.

The framework also aligns with the following asset management principles; these will be discussed in greater detail further in the document:

- defined current and target level of service,
- risk management and;
- optimised decision making.

6.0 Process

The methodology follows a risk management process (see figure 1). Determining a WMU's current level of service (we have substituted this term with level of naturalness) and determine a risk profile for the WMU looking at consequence and likelihood. Combining these two will allow us to determine the WMUs target level of service (we have substituted this term with management goals). Also the results of the level of naturalness and risk profile can be put into a prioritisation matrix to determine the WMUs prioritisation level.

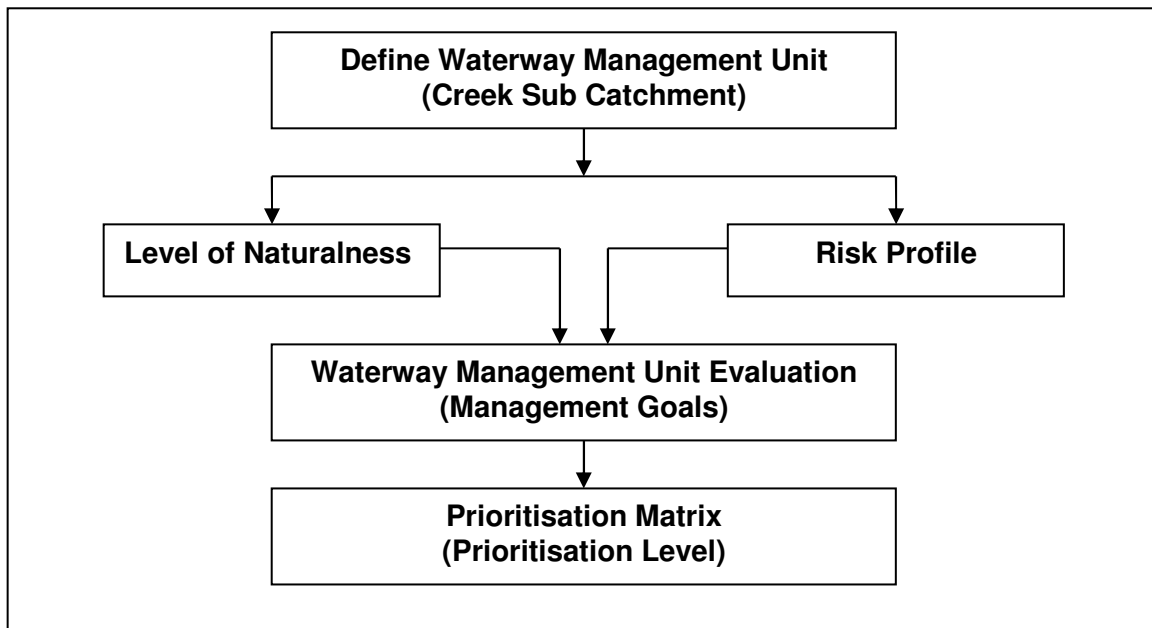


Figure 1: WKPT Process to determine a WMUs prioritisation level

Economic and social criteria will need to be included when determining the final prioritisation level of catchments and when projects are being prioritised. Due to the complex nature of economic and social criteria these are not included in the WKPT.

The next stage of the project after the catchment prioritisation level will be to put the WMU's through a social and economic prioritisation process. The level of naturalness criteria and risk profile criteria can also be used separately to assist in the planning of projects that may affect waterways within LCC and target management actions to address certain criteria results.

In the following section the methodology for each key step will be explained. The key steps and a worked example are available in [Appendix A - Framework for WKPT and example](#).

Validation of the WKPT results has been recognised as a very important process for the development and continual revision of the WKPT.

7.0 WKPT Methodology Development

The WKPT methodology has been reviewed by OPUS (2009), with the provided recommendations assisting in the development of the final WKPT methodology developed over the last 12 months. The following section will detail the key steps in the WKPT.

7.1 Defining the Waterway Management Unit (WMU)

Rastermatics data received in 2010 that delineated both creek catchments and finer sub-catchments were used to develop 131 creek sub-catchment WMUs within LCC refer to [Appendix B](#). A WMU is an area of land based on defined waterways that can reasonably be represented by a single naturalness/risk

profile and is of an appropriate scale for developing rehabilitation or management goals, plans and projects.

A WMU is defined by the extent of all waterways contained within its catchment area. Each WMU will contain a minor creek; this level of sub catchment will allow for more homogenous characteristics over the catchment, compared to the major creek size catchments. E.g. Scrubby creek which has a large range of land uses and vegetation cover throughout its catchment. However when you divide Scrubby Creek into the minor creeks feeding into it, the land uses breaks into more clustered areas of industrial, residential, commercial etc and their common vegetation cover, etc.

Some catchments will not be fully contained within Logan City Council's Boundaries. These catchments that either flow from or into Scenic Rim, Brisbane City Council, Ipswich City Council or Redland City Council will still be included in the WKPT. These catchments level of naturalness and risk profile will be based on the area within LCC.

Due to the WMUs being topographically delineated the sizes of the catchments will vary. This variation of size has been factored into the criteria so that some will be related to catchment area or length of waterway (e.g. ERA emission score per catchment area or number of stormwater outlets per kilometre length of waterway).

With Logan's catchments being divided into WMUs the cumulative affect of the risks are not currently being considered. This may be looked at in future iterations of the WKPT. Within the Naturalness criteria potential in-stream pollutants the cumulative affect of water quality has been considered with the flow of catchments mapped within the Music model used.

Refer to [Appendix B](#) for a map and the details for the WMUs in Logan City Council.

7.2 Level of Naturalness

The level of naturalness is based on waterway 'value' criteria within each WMU, these are waterway specific attributes. This will provide a snapshot of the current state of naturalness of the waterway.

The level of naturalness will be measured against 16 criteria that are divided in to the following 4 criteria groups:

- Waterway Management and Modification
- Water Quality
- Natural Environment
- Land use and Human Activity

A flow chart illustrating a structured hierarchy of naturalness criteria is provided as [Appendix C - Hierarchy of Naturalness and Threat Criteria](#).

A detailed discussion on the naturalness criteria is provided in [Appendix D - Level of Naturalness Criteria](#) and a copy of the level of naturalness matrix excel sheet is provided in [Appendix L - Level of Naturalness Criteria Matrix](#). For the Level of Naturalness results of each criterion please refer to [Appendix Q](#).

7.2.1 Naturalness criteria scores

Each WMU will be scored against each of the 15 criteria. This is based on the measure of the extent that a particular criteria occurs within a WMU.

A fundamental concept of the WKPT's design is that available GIS layers can be used to measure spatially or numerically the extent that a particular naturalness criteria occurs in the WMU. Using the excel matrix the GIS then assigns a number (the criteria score) that reflects this extent for each WMU. The range of numbers is 0-4, as detailed below in Table 1:

Table 1: Description of Naturalness Criteria Score

Naturalness Criteria Score	Definition
----------------------------	------------

4	Very High contribution to level of naturalness (VHN)
3	High contribution to level of naturalness (HN)
2	Medium contribution to level of naturalness (MN)
1	Low contribution to level of naturalness (LN)
0	Very Low or No contribution to level of naturalness (VLN)

Each criteria score will relate to a particular spatial or numerical range for a measurable parameter (eg. 16% to 50% of drainage lines is piped). The criteria scores range will be obtained through the natural break method in EasiMaps. The natural break method identifies groupings that naturally exist in the data. The method identifies break points by picking the class breaks that best group similar values and maximize the differences between classes.

This method was chosen due to Logan's catchments not being in pristine condition and will help prevent the results skewing to either end of the level of naturalness spectrum. We will be comparing Logan's catchments with each other instead of comparing them with pristine environments.

7.2.2 Naturalness criteria weightings

In order to determine the relative level of naturalness of each WMU, the criteria contributing to this measure must be weighted to reflect their relative importance. The weighting will be decided on by an internal panel of council officers representing a balanced range of views on the issues in question.

This process will involve scoring each of the criteria so that their total score for all the criteria adds to 100. The difference in score between each criterion should be a reflection of the relative importance of these parameters.

7.2.3 Determining overall Level of Naturalness

An overall naturalness score is then calculated for each WMU by multiplying each criteria weighting by the criteria score to achieve a weighted criteria score. These are then summed to obtain the overall naturalness score. Based on a criteria score range of 0 to 4 and summed criteria weightings of 100, the maximum naturalness score achievable for a particular WMU is 400 and the lowest is 0.

Overall naturalness scores are then grouped into five levels of naturalness classifications A – E using the natural break method, as follows in Table 2:

Table 2: Level of Naturalness classification and score range

LON Classification	Score Range	Definition
A	348 – 400	Very High level of naturalness
B	309 – 348	High level of naturalness
C	259 – 309	Medium level of naturalness
D	150 - 259	Low level of naturalness
E	0 - 150	Very Low or No level of naturalness

Please refer to **Figure 3** for the layout of the Level of Naturalness matrix and an example of calculating the level of naturalness for WMUs.

Criteria	Weighting	Criteria Score (Influence)				
		No or Very Low - 0	Low 1	Medium 2	High 3	Very High 4
N1 Drainage Network	4	0	4	8	12	16
N4 Stormwater Outlets	5	0	5	10	15	20
N7 ERA Properties	8	0	8	16	24	32
N8 Sewage Treatment	6	0	6	12	18	24
N11 Bank Stability	13	0	13	26	39	52
Level of Naturalness Class		0-150	150-259	259-309	309-348	348-400
		E	D	C	B	A
36	$(4*4)+(4*5)+(3*8)+(4*6)+(4*13)+x =$				372	A

23	$(4*4)+(4*5)+(3*8)+(4*6)+(3*13)+x =$	329	B
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Figure 2: Level of naturalness matrix

7.3 Risk Profile

Risk Management, as defined by AS/NZ 4360:2004, is “the product of likelihood and consequence of a process on an asset”. Whereas the concept of level of naturalness is based on a “snapshot” of the naturalness criteria within a WMU at a particular time, risk, in the context of the WKPT, is the chance of something happening (a threat) that will impact adversely upon this level of naturalness. A threat requires an action to occur such as sewer overflow before it has an impact.

When describing the threats to a WMU, attributes are more likely to be catchment based as activities within the catchment can threaten the naturalness of a waterway.

The Risk Profile will be measured against 14 criteria that are divided in to the following 4 criteria groups:

- Waterway Management and Modification
- Water Quality
- Natural Environment
- Land use and Human Activity

A flow chart illustrating a structured hierarchy of threat criteria is provided as [Appendix C - Hierarchy of Naturalness and Threat Criteria](#).

A detailed discussion on the naturalness criteria is provided in [Appendix M - Risk Profile Criteria](#) and a copy of the risk profile matrix excel sheet is provided in [Appendix P - Risk Profile Criteria Matrix](#). For the Risk Profile results of each criterion please refer to [Appendix R](#).

7.3.1 Risk criteria scores

Similar to the process adopted for the naturalness matrix each WMU must be scored in relation to each criteria to calculate an overall risk score for the WMU. In this instance, the ‘likelihood’ of an incident or event having an influence on naturalness values is the basis for assigning a score for each criteria.

A fundamental concept of the WKPT’s design is that available GIS layers are to be used to measure spatially or numerically the likelihood that a particular risk parameter has an influence on the naturalness values of the WMU. Using the excel matrix the GIS then assigns a number (the criteria score) that reflects this likelihood for each WMU. The range of numbers is 0-4, as detailed below in table 3:

Table 3: Description of Risk parameter scores

Threat Parameter Score	Definition
4	Very High likelihood (VHL)
3	High likelihood (HL)
2	Medium likelihood (ML)
1	Low likelihood (LL)
0	No or Very Low Likelihood (VL)

Each criteria score will relate to a particular spatial or numerical range for a measurable parameter (eg. 20% to 30% of catchment area). The criteria scores range will be obtained through the natural break method in EasiMaps. The natural break method identifies groupings that naturally exist in the data. The method identifies break points by picking the class breaks that best group similar values and maximize the differences between classes.

This method was chosen due to Logan's catchments not being in pristine condition and will help prevent the results skewing to either end of the level of naturalness spectrum. We will be comparing Logan's catchments with each other instead of comparing them with pristine environments.

7.3.2 Risk criteria weightings

In order to determine the relative risk that applies to each WMU, the threats contributing to this measure must also be weighted to reflect their relative importance. This weighting is taken to be equivalent to the

'consequence' of an incident or event on naturalness values. This process will be the same as the naturalness weighting.

7.3.3 Determining overall Risk Profile

An overall risk score is then calculated for each WMU by multiplying each threat criteria weighting by the threat criteria score (i.e. consequence x likelihood) to achieve a weighted criteria score. These are then summed to obtain the overall risk score for the WMU.

Based on a parameter score range of 0 to 4 and summed parameter weightings of 100, the maximum overall risk score achievable for a particular WMU is 400 and the lowest is 0. Overall risk scores are then grouped into four risk categories a – e using the natural break method, as follows in Table 4:

Table 4: Risk classification and score ranges

Risk Classification	Score Range	Definition
a	212-400	Very High Threat Risk (VHR)
b	159-212	High Threat Risk (HR)
c	128-159	Medium Threat Risk (MR)
d	70-128	Low Threat Risk (LR)
e	0-70	No or Very Low Threat Risk (VLR)

Please refer to **Figure 4** for the layout of the Level of Risk Profile matrix and an example of calculating the Risk profile for WMUs.

Criteria Score (Likelihood)						
Criteria	Weighting	No or Very Low 0	Low 1	Medium 2	High 3	Very High 4
R1 Stormwater Treatment	6	0	6	12	18	24
R5 Extraction Sites	7	0	7	14	21	28
R7 Steep Slopes	8	0	8	16	24	32
R11 Weeds	4	0	4	8	12	16
R13 Litter Hot Spots	4	0	4	8	12	16
Risk Profile Class		e	d	c	b	a
WMU 36	$(4*6)+(0*7)+(3*8)+(0*4)+(0*4)+x =$				182	a
WMU 23	$(4*6)+(0*7)+(4*8)+(0*4)+(0*4)+x =$				150	c

Figure 3: Risk Profile Matrix

7.4 Prioritisation Matrix

Applying the methodology described above, each WMU is assigned a particular level of naturalness classification (A to E) and a particular risk classification (a to e) resulting in each WMU being described by two letters, one upper case and one lower case. For example a WMU with the classification of Aa, has a very high level of naturalness and a very high threat risk and a WMU with the classification of Bc has a high level of naturalness and a medium threat risk.

Having two descriptors for each WMU is important when it comes to determining what rehabilitation management goals are appropriate. WMUs are then prioritised through a prioritisation matrix based on their overall level of naturalness and risk profile, see **Table 5**. WMUs with a LON and/or a risk profile classification of E/e will not be included in the prioritisation. These catchments will need further investigation. It is believed no catchments will fall into these categories as the criteria are based off data sets that cover the whole of LCC.

Using the example above, a WMU with a classification of Aa would have a very high priority level and WMU with Bc would have a medium priority level.

Table 5: WKPT Prioritisation matrix to determine each WMU priority level

Level of Naturalness	Risk Profile			
	a	b	c	d
A	Very High	Very High	High	Medium
B	Very High	High	Medium	Medium

C	High	Medium	Medium	Low
D	Medium	Medium	Low	Low

WMU 36	Aa	Very High
WMU 23	Bc	Medium

It is understood that the process described above is quite a coarse sieve and further refinement through a social and economic prioritisation is needed.

For the results of the prioritisation please refer to [Appendix S](#).

7.5 Setting Management Goals

To help address the question of what types of projects should be implemented to help achieve the overall WKPT goal and how they should be ranked it is necessary to set WMU management goals for each overall classification that is for each Level of Naturalness/Risk combination. These provide a surrogate for target LON. At a simplistic level, the management goals for WMUs might be as described in **table 6**.

Table 6: Possible high level management goals for prioritisation classification

Level of naturalness/ Risk profile	Management Goal
Aa - Ad	Focus on threat reduction (protection)
Ba- Bd	Focus on threat reduction initially and consider enhancement for medium levels
Ca - Cd	Focus on enhancement initially and consider threat reduction for high levels
Da - Dd	Focus on Enhancement

7.6 Social and Economic Prioritisation

After the WKPT process, the WMU's can be further prioritised by looking at social and economic criteria. The social and economic prioritisation process will be refined and discussed in greater detail once the WKPT methodology is finalised. Council's first priority is to understand the catchments naturalness and risk. The following discussion is an introduction to how socio-economic criteria can be included in the prioritisation process; this is at a project scale, however gives a framework to consider for catchment scale prioritisation.

OPUS provided Council with a process that involves scoring specific projects against a set of benefit criteria, which includes a mixture of social and economic criteria. This process could be used to help compare risk reduction projects with enhancement projects, as quite often enhancement is highly favoured due to the visible results.

Finalisation of a project benefit score will require agreement on a list of benefit criteria, including socio-economic criteria, and their weightings, against which all projects can be scored.

In terms of scoring projects against benefit criteria OPUS provided Council with a simple system that scores each project out of 10 in relation to the level of benefit attributable to the project for each criterion, see table 7:

Table 7: General description for score

Score	General Description
0	No applicable benefit
2	Very low level of benefit attributable to project
4	Low level of benefit attributable to project
6	Moderate level of benefit attributable to project
8	High level of benefit attributable to project
10	Very high level of benefit attributable to project

By scoring the benefit of each project out of 10 and using benefit weightings summed to 100, the total benefit points assigned to a project could range between 0 and 1000.

To illustrate how this can be applied please see the following example used by OPUS within their review. The following table shows example scores assigned to four projects with costs ranging from \$15,000 to \$50,000, see table 8. Each benefit score is multiplied by its applicable benefit weighting to calculate a total benefit point score for each project. The total project cost is then divided by the benefit point score attributable to that project to determine a cost / benefit point ratio. An overall project ranking is then obtained with the highest ranked project having the lowest cost/benefit point ratio.

Table 8: Project Prioritisation Scoring

Project		1	2	3	4
Cost		\$15,000	\$25,000	\$30,000	\$50,000
Benefit	Weighting				
B1	20	2	6	5	9
B2	20	2	2	5	8
B3	20	0	0	3	7
B4	5	1	1	2	7
B5	10	6	5	2	8
B6	10	8	4	7	2
B7	25	4	2	3	7
Total Benefit Points		285	285	405	720
Coast/Benefit point		53	88	74	69
Project Ranking		1	4	3	2

In the above scenario it can be seen that Project 1 is the highest ranked project on both cost only and cost / benefit whereas Project 4 is ranked lowest on cost only but is ranked second highest on cost benefit. It must be stressed that these rankings are not absolute in that they are derived from a process that involves significant subjectivity. However, OPUS believe that the process itself is logical and well-structured, and provided there is an appropriate and consistent range of views represented for the setting of the relative weightings for naturalness, threats and benefits and also for the project scoring then the process described should provide a transparent, repeatable and rigorous means of ranking projects.

7.6.1 Socio-economic Criteria

Opus drew guidance from a number of strategic documents when considering appropriate socio-economic criteria, including LCC's current Corporate Plan which identifies Council's Four Priority Issues: A Vibrant Community, A Strong Economy, A Sustainable Environment and a Well Managed City. The proposed list of criteria is provided in **table 9** along with suggested weightings. While the development of the WKPT is itself seen as supporting the priority issue A Sustainable Environment, the inclusion of a criterion that measures the extent to which an individual project supports the WKPT goal (in terms of the project's impact and exposure) is considered important.

OPUS suggests that the final list of project prioritisation criteria be limited to approximately seven. It is, again, recommended that weighting of these criteria be based on rating their cardinal importance in the manner described above for weighting the naturalness and threat criteria. These weightings are given by way of example only and should be subjected to review by the panel.

Table 9: Justification of Benefit criteria recommended by OPUS

	Criterion	Reason for Inclusion	Relative Weighting
B1	Contributes to the WKPT goal	Helps identify the best projects to meet the stated management goals and support the overall WKPT goal. Supports the Priority Issue A Sustainable Environment.	20
B2	Enhanced health and wellbeing	Supports Priority Issue <i>A Vibrant Community</i> which aims for an enjoyable, active healthy and safe living environment.	20
B3	Builds community capacity and	Supports Priority Issue <i>A Strong Economy</i> through investing in local employment opportunities or capacity	20

	employment	building.	
B4	Increased property values	Supports Priority Issue <i>A Strong Economy</i> by encouraging private investment.	5
B5	Compatible with existing plans and strategies	Supports Priority Issue <i>A Well Managed City</i> by promoting working together with other parts of Council or with other organisations (eg Healthy Waterways).	10
B6	Few impediments to implementation (eg project on council owned or controlled land)	Projects are easier to implement with shorter time frames. Demonstrates progress.	10
B7	Increased community satisfaction/ decreased complaints	Supports Priority Issue <i>A Well Managed City</i> by advocating the needs of the community and setting clear directions through transparent practices and open engagement.	15
			100

8.0 Project Team

2009-2013 Environment and Sustainability Branch

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- Donald Mackenzie - Principal Environment Officer
- Renee Domalewski - Senior Environment Officer
- Barnaby Resch - Senior Environment Officer
- Britt Rogers - Environment Officer
- Fatih Dur - Environment GIS Analyst

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- Andre Taute - Senior GIS Consultant
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2009 OPUS Review and Enhancement

- Philip Chalk, Branch Manager ~ Milton
- Tracey Birt, Work Group Manager ~ Environment
- Tony Loveday, Senior Civil / Environmental Engineer
- Rob Blakemore, Principal Environmental Engineer, Manager ETC

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Appendix A: Framework for WKPT and example

Table 10: Framework and worked example

Define Sub Creek Catchment
131 Sub creek catchments identified

Creek Sub Catchment ID	River Catchment	River Catchment ID	Catchment Area	Waterway Length	Property Proportion
36	Logan River	3	11.997	26.971	14.231
23	Logan River	3	7.283	17.822	2.768

Level Of Naturalness (LON)
16 Level of Naturalness Criteria
Finalise criteria scores through GIS using natural break
Develop LON Matrix with relative weightings
Determine WMU LON Value

Criteria Score (Influence)						
Criteria	Weighting	No or Very Low - 0	Low 1	Medium 2	High 3	Very High 4
N1 Drainage Network	4	0	4	8	12	16
N4 Stormwater Outlets	5	0	5	10	15	20
N7 ERA Properties	8	0	8	16	24	32
N8 Sewage Treatment	6	0	6	12	18	24
N11 Bank Stability	13	0	13	26	39	52
Level of Naturalness Class		E	D	C	B	A
36	$(4*4)+(4*5)+(3*8)+(4*6)+(4*13)+x =$				372	A
23	$(4*4)+(4*5)+(3*8)+(4*6)+(3*13)+x =$				329	B

Risk Profile
14 Risk criteria
Finalise criteria scores through GIS using natural break
Develop RP Matrix with relative weightings
Determine WMU Risk Profile

Criteria Score (Likelihood)						
Criteria	Weighting	No or Very Low 0	Low 1	Medium 2	High 3	Very High 4
R1 Stormwater Treatment	6	0	6	12	18	24
R5 Extraction Sites	7	0	7	14	21	28
R7 Steep Slopes	8	0	8	16	24	32
R11 Weeds	4	0	4	8	12	16
R13 Litter Hot Spots	4	0	4	8	12	16
Risk Profile Class		e	d	c	b	a
36	$(4*6)+(0*7)+(3*8)+(0*4)+(0*4)+x =$				182	a
23	$(4*6)+(0*7)+(4*8)+(0*4)+(0*4)+x =$				150	c

Determine Overall Naturalness/ Risk for catchment

Prioritisation Value	
36	Aa
23	Bc

Assess Priorities
Develop Priority Matrix
Map Management Unit Classifications

Level of Naturalness	Risk			
	a	b	c	d
A	Very High	Very High	High	Medium
B	Very High	High	Medium	Medium
C	High	Medium	Medium	Low
D	Medium	Medium	Low	Low
	36	Aa	Very High	
	23	Bc	Medium	

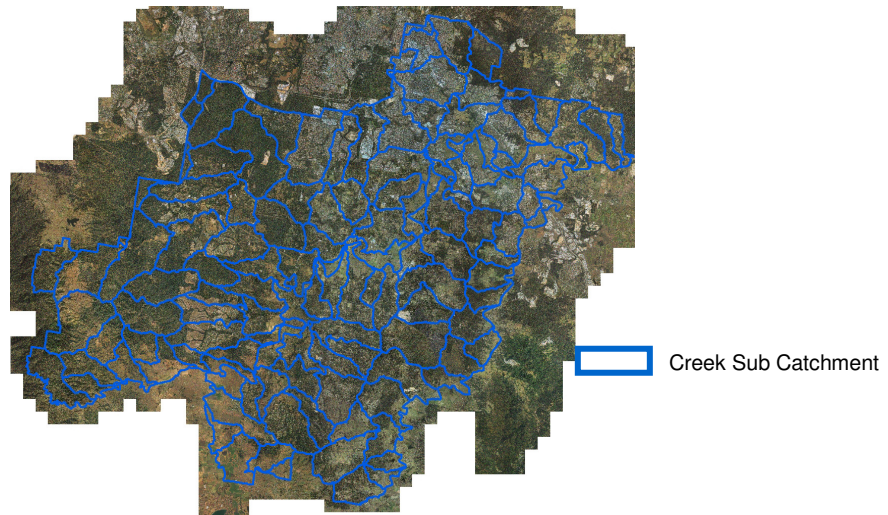


Figure 4: Water Management Units or Creek Sub-Catchments

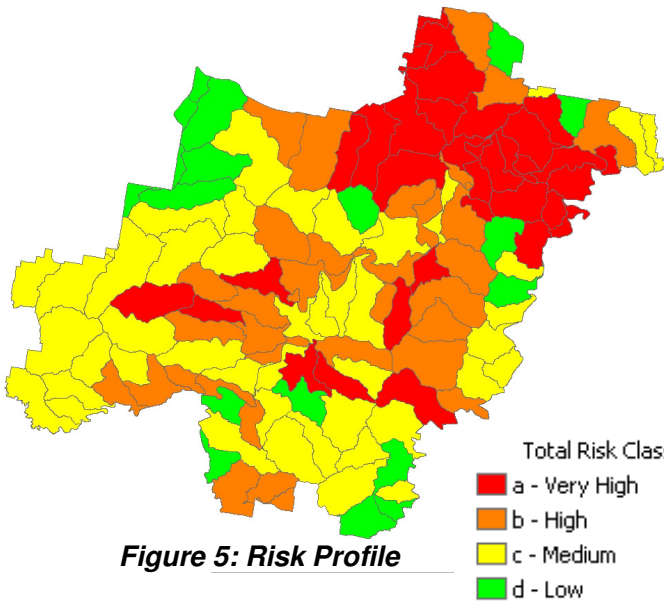


Figure 5: Risk Profile

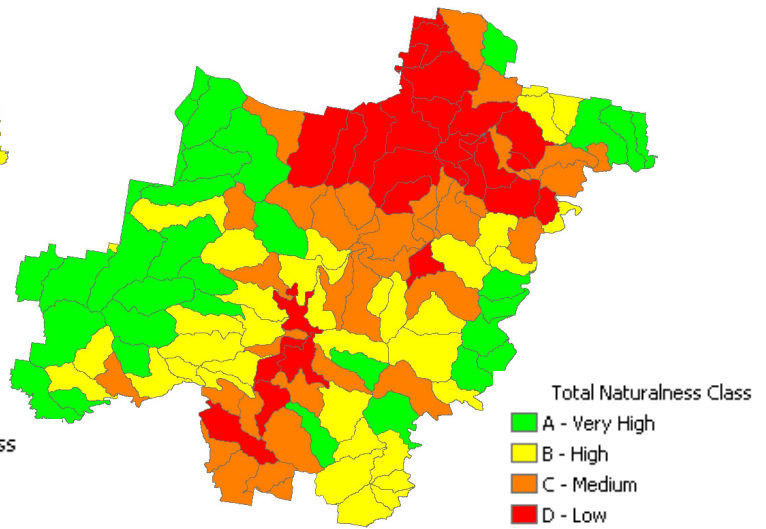


Figure 6: Level of Naturalness

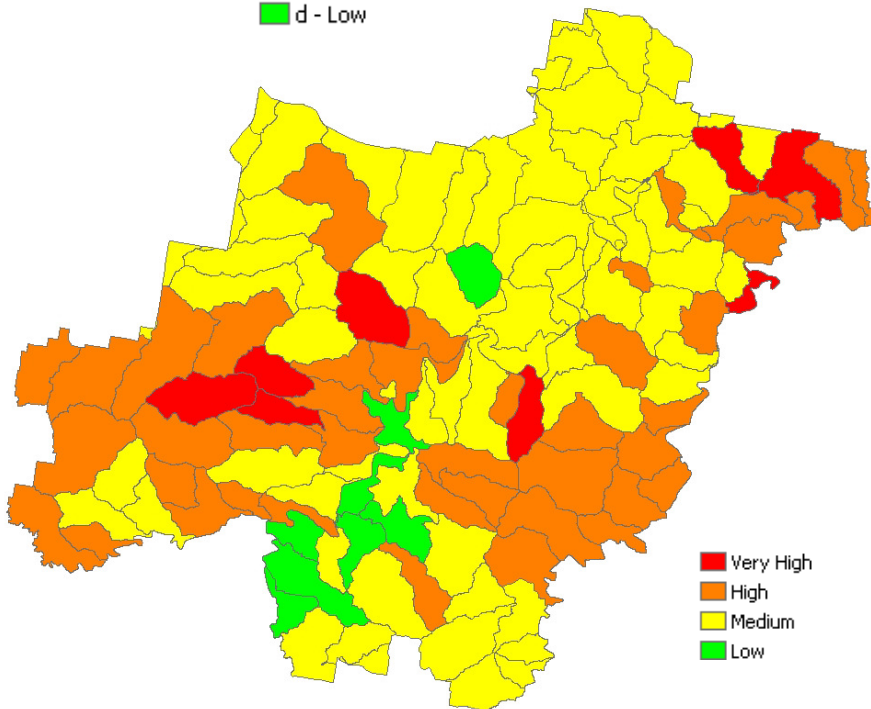


Figure 7: Prioritisation Level

Appendix B: Waterway Management Units or Creek Sub-Catchment Details & Map

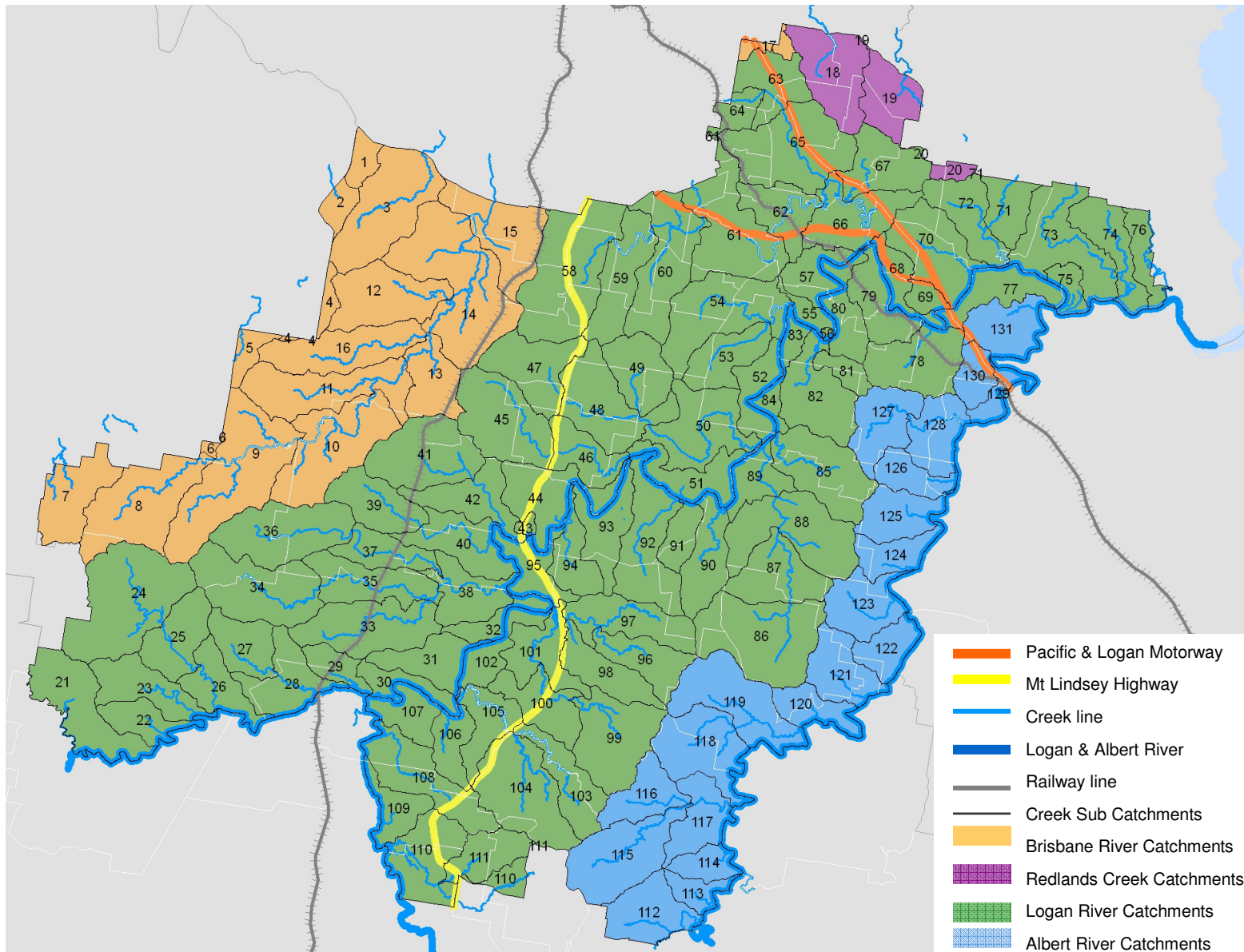


Figure 8: Creek Sub-Catchment Map

Table 11: Creek Sub-Catchment Details

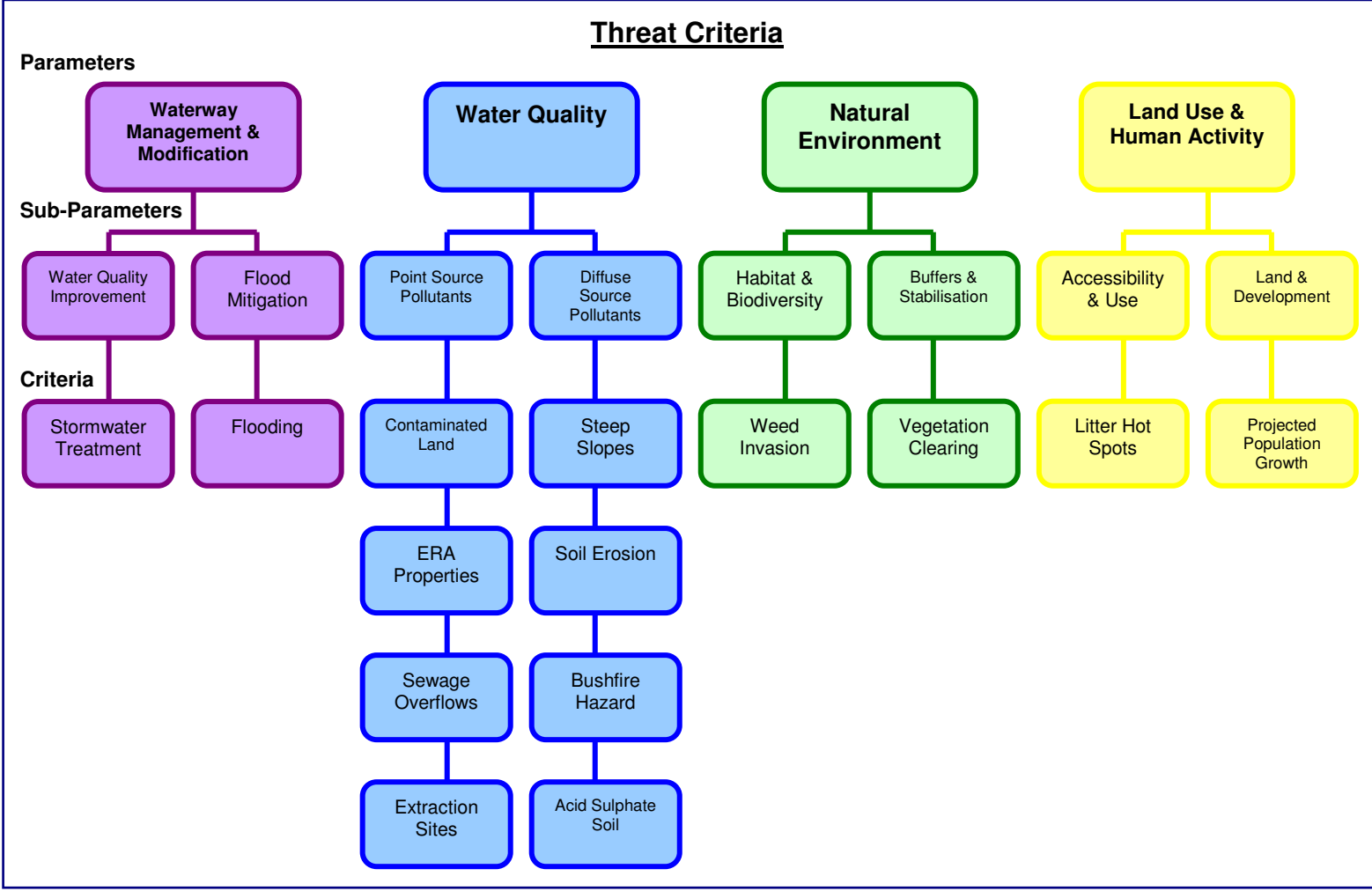
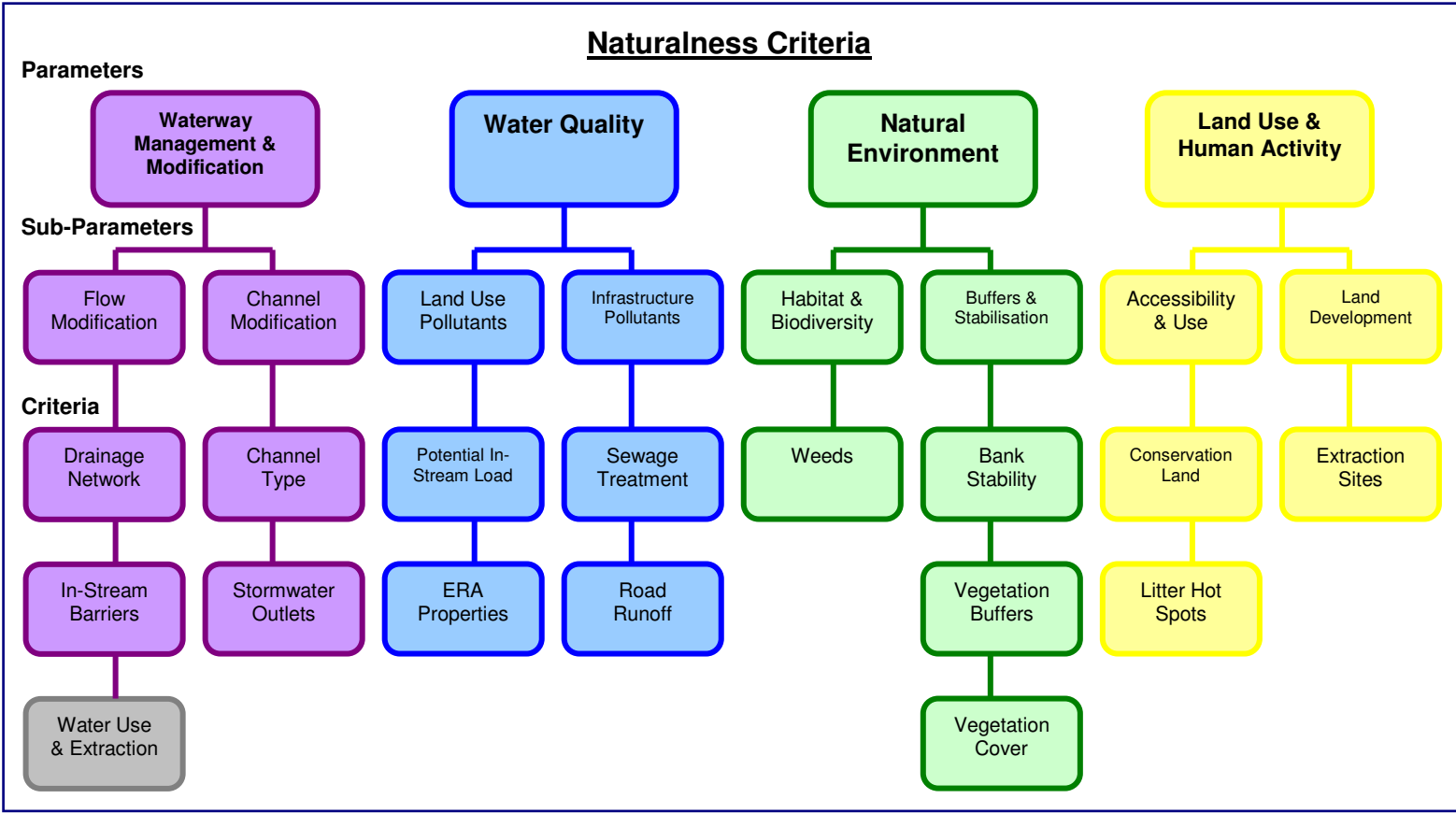
Tool ID	Creek Catchment	Creek Catchment ID	River Catchment	Catchment Area	Waterway Length	Property Proportion	DERM Gazetted Name	Division	Suburbs
1	Bullock Head Creek	1	Brisbane River	2.259	3.322	0.048		7	Greenbank
2	Sandy Creek	2	Brisbane River	2.226	3.941	0.047		7	Greenbank
3	Blunder Creek	3	Brisbane River	13.818	27.350	0.313		7	Greenbank
4	Opossum Creek	4	Brisbane River	1.564	1.965	87.802		7,11	Greenbank
5	Mountain Creek	5	Brisbane River	2.237	4.254	2.081		11	Greenbank
6	O'Briens Gully	6	Brisbane River	0.417	1.972	0.627		11	Greenbank
7	Bundamba Creek	7	Brisbane River	8.138	20.654	9.414		11	Lyons, Undullah
8	Oxley Creek	8	Brisbane River	13.694	34.660	9.432	Yes	11	Lyons, Undullah, Greenbank
9	Oxley Creek	8	Brisbane River	18.217	45.649	37.509	Yes	11	Lyons, Greenbank, New Beith
10	Oxley Creek	8	Brisbane River	13.876	34.672	547.873	Yes	7,11	Lyons, Greenbank, New Beith
11	Oxley Creek	8	Brisbane River	11.784	30.511	718.261	Yes	7,11	Greenbank, New Beith
12	Oxley Creek	8	Brisbane River	10.253	22.562	241.590	Yes	7	Greenbank
13	Oxley Creek	8	Brisbane River	6.445	15.060	231.879	Yes	7,11	Greenbank, New Beith
14	Oxley Creek	8	Brisbane River	20.270	42.510	93.735	Yes	7	Greenbank, Boronia Heights
15	Oxley Creek	8	Brisbane River	10.031	16.761	1225.825	Yes	7	Forestdale, Boronia Heights, Hillcrest, Greenbank
16	Crewes Creek	9	Brisbane River	10.054	22.900	431.729		7,11	Greenbank
17	Bulimba Creek	10	Brisbane River	1.427	0.570	1241.748		1, 2	Rochedale South, Underwood
18	Priest Gully	11	Redlands	9.839	13.517	3978.361	Yes	1, 3	Rochedale South, Priestdale, Springwood, Daisy Hill
19	Buhot Creek & Stockyard	12	Redlands	6.566	13.760	34.878	Yes	1, 10	Priestdale, Daisy Hill, Shailer Park
20	Tingalpa Creek	13	Redlands	1.228	1.437	319.900		10	Cornubia, Shailer Park
21	Woollaman Creek	14	Logan River	10.752	32.835	17.182		11	Undullah
22	Unnamed_15	15	Logan River	4.387	12.219	2.925		11	Undullah
23	Unnamed_16	16	Logan River	7.283	17.822	2.768		11	Undullah
24	Undullah Creek	17	Logan River	17.471	44.028	24.640	Yes	11	Undullah
25	Undullah Creek	17	Logan River	7.144	17.353	6.844	Yes	11	Undullah
26	Undullah Creek	17	Logan River	5.910	16.263	8.179	Yes	11	Undullah, Kagaru
27	Unnamed_18	18	Logan River	5.756	15.058	0.995		11	Undullah, Kagaru
28	Unnamed_18	18	Logan River	7.505	20.781	14.629		11	Kagaru, Undullah, Jimboomba
29	Unnamed_19	19	Logan River	3.174	8.589	47.779		11	Jimboomba, Undullah, Kagaru
30	Unnamed_20	20	Logan River	3.571	10.263	12.502		11	Jimboomba
31	Unnamed_21	21	Logan River	5.922	14.216	103.535		11	Jimboomba

Tool ID	Creek Catchment	Creek Catchment ID	River Catchment	Catchment Area	Waterway Length	Property Proportion	DERM Gazetted Name	Division	Suburbs
32	Unnamed_22	22	Logan River	3.124	10.539	34.325	Yes	11	Jimboomba, South Maclean
33	Sandy Gully	23	Logan River	11.223	26.611	755.264		11	Jimboomba, Undullah
34	Sandy Creek	24	Logan River	12.945	30.137	6.226	Yes	11	Lyons, Undullah, New Beith
35	Sandy Creek	24	Logan River	8.168	18.653	664.129		11	New Beith, Jimboomba, Undullah, South Maclean
36	Flagstone Creek	25	Logan River	11.997	26.971	14.231	Yes	11	New Beith, Lyons
37	Flagstone Creek	25	Logan River	5.098	12.069	41.044	Yes	11	South Maclean, New Beith, Jimboomba
38	Flagstone Creek	25	Logan River	6.718	16.235	312.483	Yes	11	South Maclean, Jimboomba
39	Abade Creek	26	Logan River	7.032	15.380	48.848		11	New Beith, North Maclean, South Maclean
40	Abade Creek	26	Logan River	7.694	19.351	243.632		11	South Maclean, North Maclean, New Beith
41	Unnamed_27	27	Logan River	11.276	23.949	942.739		7, 11	North Maclean, New Beith, Greenbank
42	Unnamed_27	27	Logan River	7.093	16.095	225.601		7, 9, 11	North Maclean, New Beith, Greenbank
43	Thompson Gully	28	Logan River	0.590	1.303	22.701	Yes	9, 11	North Maclean
44	Unnamed_29	29	Logan River	8.812	25.029	202.772		7, 9	North Maclean, Munruben, Greenbank
45	Norris Creek	30	Logan River	11.845	25.118	534.095	Yes	7	Munruben, Park Ridge South, Greenbank, North Maclean
46	Norris Creek	30	Logan River	5.537	10.634	358.405	Yes	7, 9	Munruben, Chambers Flat
47	Chambers Creek	31	Logan River	8.725	16.660	339.394		7, 8	Park Ridge South, Greenbank, Munruben, Park Ridge
48	Chambers Creek	31	Logan River	11.063	25.480	834.844		7, 8, 9	Park Ridge South, Munruben, Chambers Flat, Park Ridge, Greenbank
49	Chambers Creek	31	Logan River	6.968	13.432	261.001		8, 9	Park Ridge, Park Ridge South, Chambers Flat
50	Chambers Creek	31	Logan River	10.502	19.474	385.708		9	Chambers Flat, Logan Reserve
51	Unnamed_32	32	Logan River	6.351	21.189	141.776		9	Chambers Flat
52	Unnamed_33	33	Logan River	4.820	13.693	171.935		9	Logan Reserve, Chambers Flat
53	Schmidts Creek	34	Logan River	6.365	11.484	219.565		8, 9	Logan Reserve, Park Ridge, Chambers Flat
54	Schmidts Creek	34	Logan River	12.962	23.229	4377.214	Yes	5, 8, 9	Crestmead, Waterford West, Park Ridge, Logan Reserve, Marsden, Chambers Flat
55	Tygum Lagoon	35	Logan River	1.889	4.997	394.842		5, 9	Waterford West
56	Baumann Lagoon	36	Logan River	0.234	0.989	56.742	Yes	5	Waterford West
57	Unnamed_37	37	Logan River	4.442	12.137	1879.142		5, 9	Loganlea, Waterford West
58	Scrubby Creek	38	Logan River	17.291	19.489	9414.943	Yes	7, 8	Hillcrest, Regents Park, Boronia Heights, Browns Plains, Park Ridge, Forestdale, Greenbank
59	Scrubby Creek	38	Logan River	8.585	13.800	3270.922	Yes	5, 7, 8	Heritage Park, Browns Plains, Regents Park, Park Ridge, Berrinba, Greenbank
60	Scrubby Creek	38	Logan River	11.837	20.556	2409.648	Yes	5, 8, 9	Berrinba, Heritage Park, Crestmead, Marsden, Park Ridge, Browns Plains
61	Scrubby Creek	38	Logan River	13.410	18.043	7455.174	Yes	2, 5, 9	Marsden, Kingston, Berrinba, Logan Central, Waterford West, Loganlea, Woodridge, Crestmead
62	Scrubby Creek	38	Logan River	6.343	9.210	3326.263	Yes	2, 3, 5, 6	Kingston, Loganlea, Meadowbrook, Logan Central, Slacks Creek
63	Slacks Creek	39	Logan River	6.237	5.656	4937.242	Yes	1, 2, 3	Underwood, Woodridge, Rochedale South, Springwood, Slacks Creek

Tool ID	Creek Catchment	Creek Catchment ID	River Catchment	Catchment Area	Waterway Length	Property Proportion	DERM Gazetted Name	Division	Suburbs
64	Slacks Creek	39	Logan River	2.649	2.396	2215.161	Yes	2, 3	Woodridge, Underwood
65	Slacks Creek	39	Logan River	14.384	14.687	11849.664	Yes	1, 2, 3, 10	Woodridge, Logan Central, Slacks Creek, Springwood, Daisy Hill, Shailer Park, Kingston
66	Slacks Creek	39	Logan River	8.932	17.923	2983.298	Yes	3, 5, 6, 10	Loganlea, Meadowbrook, Slacks creek, Shailer Park, Tanah Merah
67	Centenary Creek	40	Logan River	7.493	15.259	3002.883	Yes	1, 3, 10	Shailer Park, Daisy Hill, Slacks Creek
68	Unnamed_41	41	Logan River	3.614	11.361	1616.570		6	Tanah Merah, Loganholme
69	Omaru	42	Logan River	1.822	2.815	982.485	Yes	6	Loganholme, Tanah Merah
70	Unnamed_43	43	Logan River	9.806	19.793	3699.929		6, 10	Loganholme, Tanah Merah, Shailer Park, Cornubia
71	California Creek	44	Logan River	4.689	12.567	227.827	Yes	10	Cornubia
72	California Creek	44	Logan River	6.886	15.381	1789.804	Yes	6, 10	Cornubia, Shailer Park, Carbrook
73	Native Dog Creek	45	Logan River	11.746	31.558	293.520	Yes	10	Carbrook, Cornubia
74	Native Dog Creek	45	Logan River	6.787	22.139	73.113	Yes	10	Carbrook
75	Boomerang Creek	46	Logan River	2.391	10.800	16.806	Yes	10	Carbrook
76	Serpentine Creek	47	Logan River	3.523	7.948	109.957	Yes	10	Carbrook
77	Unnamed_48	48	Logan River	6.163	12.239	948.946		12	Eagleby, Beenleigh
78	Unnamed_49	49	Logan River	9.373	18.785	3743.076		4, 12	Holmview, Beenleigh, Edens Landing, Mount Warren Park
79	Unnamed_50	50	Logan River	6.265	10.956	2777.976		4, 6, 12	Edens Landing, Bethania, Holmview, Beenleigh
80	Pookgoor Creek	51	Logan River	5.237	7.695	1783.529	Yes	4, 6	Waterford, Bethania
81	Cambogan Creek	52	Logan River	2.336	4.886	557.802		4	Waterford, Buccan, Bahrs Scrub
82	Dairy Creek	53	Logan River	9.367	22.125	376.901	Yes	4	Buccan, Waterford, Bahrs Scrub
83	Unnamed_54	54	Logan River	1.818	2.615	30.688		4	Waterford, Buccan
84	Unnamed_55	55	Logan River	1.598	2.091	53.157		4	Buccan
85	Ooah Creek	56	Logan River	10.486	24.475	236.684	Yes	4	Buccan, Logan Village, Wolfdene, Belivah, Bahrs Scrub
86	Quinzeh Creek	57	Logan River	15.417	32.476	142.885		4	Yarrabilba, Logan Village, Tamborine, Cedar Creek
87	Quinzeh Creek	57	Logan River	8.300	18.710	380.176		4	Logan Village, Yarrabilba, Cedar Creek
88	Quinzeh Creek	57	Logan River	12.937	26.754	530.873		4, 9	Logan Village, Yarrabilba, Cedar Creek
89	Quinzeh Creek	57	Logan River	4.534	7.395	279.883	Yes	4, 9	Logan Village, Buccan
90	Allans Creek	58	Logan River	6.999	14.315	189.393	Yes	4, 9	Logan Village, Stockleigh
91	Kooruhman Creek	59	Logan River	3.402	6.478	125.208		9	Stockleigh, Logan Village
92	Buandah Creek	60	Logan River	11.356	21.354	240.858	Yes	4, 9	Stockleigh, Jimboomba, Logan Village
93	Mimi Creek	61	Logan River	6.471	10.374	113.184		9	Stockleigh, Jimboomba
94	Rockford Creek	62	Logan River	5.059	10.020	181.137		9	Stockleigh, Jimboomba, South Maclean
95	Unnamed_63	63	Logan River	5.228	6.204	166.157		9, 11	South Maclean, Stockleigh, Jimboomba
96	Jimboomba Creek	64	Logan River	6.178	15.463	204.265		4, 9	Jimboomba, Tamborine
97	Jimboomba Creek	64	Logan River	8.250	21.389	266.495	Yes	4, 9	Jimboomba, Logan Village
98	Strachan Creek	65	Logan River	6.179	15.077	471.822		4, 9, 11	Jimboomba, Tamborine

Tool ID	Creek Catchment	Creek Catchment ID	River Catchment	Catchment Area	Waterway Length	Property Proportion	DERM Gazetted Name	Division	Suburbs
99	Henderson Creek	66	Logan River	11.296	30.114	351.594	Yes	4, 11	Jimboomba
100	Henderson Creek	66	Logan River	6.597	15.818	322.915	Yes	11	Jimboomba
101	Henderson Creek	66	Logan River	6.665	14.515	362.272	Yes	9, 11	Jimboomba
102	Unnamed_67	67	Logan River	4.425	6.160	171.438		11	Jimboomba
103	Scrubby Creek	68	Logan River	6.925	19.445	205.693	Yes	11	Cedar Vale, Jimboomba
104	Scrubby Creek	68	Logan River	12.959	35.347	861.240	Yes	11	Cedar Vale, Veresdale Scrub, Cedar Grove, Woodhill
105	Scrubby Creek	68	Logan River	5.630	16.679	127.087	Yes	11	Cedar Grove, Jimboomba, Cedar Vale
106	Roberts Waterhole	69	Logan River	4.249	9.029	389.308	Yes	11	Cedar Grove
107	Unnamed_70	70	Logan River	4.753	9.879	49.195		11	Cedar Grove
108	Days Creek	71	Logan River	10.170	24.126	408.588		11	Woodhill, Cedar Grove, Cedar Vale
109	Unnamed_72	72	Logan River	4.396	14.259	18.782		11	Woodhill, Cedar Grove
110	Cyrus Creek	73	Logan River	11.200	33.019	133.327	Yes	11	Veresdale, Woodhill, Veresdale Scrub
111	Hinchcliffe Creek	74	Logan River	5.304	13.052	43.743		11	Veresdale Scrub, Veresdale
112	Flagstone Creek	75	Albert River	7.732	23.058	108.446	Yes	4	Mundoolun
113	Flagstone Creek	75	Albert River	2.760	9.516	8.860		4	Mundoolun
114	Unnamed_76	76	Albert River	3.286	9.803	9.312		4	Mundoolun
115	Collins Creek	77	Albert River	11.713	30.630	100.582		4	Mundoolun
116	Collins Creek	77	Albert River	5.918	14.931	129.213		4	Mundoolun
117	Collins Creek	77	Albert River	6.359	18.532	25.786		4	Mundoolun
118	Clutha Creek	78	Albert River	10.338	27.625	269.437		4	Mundoolun, Tamborine
119	Clutha Creek	78	Albert River	11.709	31.533	266.598		4	Tamborine, Yarrabilba
120	Unnamed_79	79	Albert River	4.621	12.056	17.641		4	Tamborine, Yarrabilba
121	Unnamed_80	80	Albert River	6.929	14.916	44.671		4	Yarrabilba, Tamborine, Cedar Creek
122	Unnamed_81	81	Albert River	4.501	13.088	82.604		4	Cedar Creek, Tamborine
123	Small Creek	82	Albert River	7.203	17.986	65.707	Yes	4	Cedar Creek, Wolffdene, Logan Village
124	Unnamed_83	83	Albert River	4.541	11.816	50.678		4	Wolffdene, Logan Village
125	Dunn Creek	84	Albert River	6.283	17.059	57.076		4	Wolffdene, Bannockburn, Belivah, Logan Village, Buccan
126	Belivah Creek	85	Albert River	4.199	10.812	221.234		4	Belivah, Bannockburn, Bahrs Scrub, Buccan
127	Windaroo Creek	86	Albert River	7.284	17.272	143.193		4	Bahrs Scrub, Buccan, Belivah
128	Windaroo Creek	86	Albert River	6.527	12.246	2083.822	Yes	4	Windaroo, Bannockburn, Bahrs Scrub, Mount Warren Park, Belivah
129	Unnamed_87	87	Albert River	2.639	10.138	784.432		4, 12	Mount Warren Park, Beenleigh, Eagleby
130	Salt Water Creek	88	Albert River	3.546	3.460	2115.227	Yes	4, 12	Mount Warren Park, Beenleigh, Eagleby
131	Unnamed_89	89	Albert River	6.819	14.967	3740.073		12	Eagleby, Beenleigh

Appendix C: Hierarchy of Naturalness & Threat Criteria



Appendix D: Level of Naturalness Criteria

General Principles	<ul style="list-style-type: none"> ♦Naturalness Criteria provide a “snapshot” of the current level of naturalness for particular waterway within a WMU/creek sub catchment. ♦Naturalness Criteria focus on the attributes of the waterway, including in-stream and riparian zone attributes. ♦Naturalness Criteria should only be based on catchment attributes where: <ul style="list-style-type: none"> - There is no other means of representing an important aspect of waterway naturalness based on currently available data; or - Where there is an ongoing influence on naturalness not associated with a particular incident (eg. Diffuse source pollution in runoff from roads and urban development). ♦Scoring of Naturalness Criteria aims to ensure there is a reasonable distribution of WMUs across the Criteria Score categories of Very Low, Low, Medium, High and Very High for each Criteria. 	
Categories & Sub-criteria	<ul style="list-style-type: none"> ♦Waterway Management & Modification: <ul style="list-style-type: none"> - Flow Modification - Channel Modification ♦Water Quality <ul style="list-style-type: none"> - Land Use Pollutants - Infrastructure Pollutants ♦Natural Environment <ul style="list-style-type: none"> - Habitat & Biodiversity - Buffers & Stabilisation ♦Land Use & Human Activity <ul style="list-style-type: none"> - Accessibility & Use - Land Development 	
Waterway Management & Modification:		
Flow Modification		
Parameter	Reasoning	Score Criteria
N1 - Drainage Network	<ul style="list-style-type: none"> ♦Although a catchment-based attribute it is considered appropriate for waterway naturalness ♦In the absence of direct data relating to changes in stream flows within specific waterways, this parameter provides a measure of the degree of change to natural flow regimes within a waterway based on the dominant means of conveying upstream flows within the catchment. ♦ This criterion looks at the natural drainage paths verse the amount of pipe network 	<p>% of the catchment drainage network is piped</p> <p>Lower the % the higher the LON</p> <p>Formula = $(\text{Total Piped km} / \text{Total Drainage km}) * 100$</p>
N2 - In-stream Barriers	<ul style="list-style-type: none"> ♦Waterways containing fewer barriers are more likely to support more natural flow regimes, in-stream habitat composition, and facilitate the natural migrations of in stream fauna. ♦ Due to limited information of in-stream barriers, this criterion is based on where a road intersects a waterway line. ♦To improve accuracy in the future this parameter can incorporate data on barriers other than roads (eg. weirs, barrages, pedestrian / cycle paths) if available. 	<p># of waterway barriers per km of waterway</p> <p>Lower the # the higher the LON</p> <p>Formula = $\# \text{ road \& waterway crossing} / \text{total length of waterway in catchment}$</p>
N3 - Water Use & Extraction Not used in this version	<ul style="list-style-type: none"> ♦A measure of changes to natural flow regimes could be based on the amount of water extracted from ground water and surface water across the WMU ♦Based on Water Licences and Permits which should detail land subject to a Water Licence or Permit for the extraction of water and the allowable volume of extraction. ♦WMUs containing approvals to extract more water could be considered less natural as more water is being used for purposes other than environmental flows into waterways. 	<p>Volume of water extraction licences issued within catchment (per catchment area km²)</p> <p>(Use in possible future version of tool)</p>
Channel Modification		
N4 - Stormwater Outlets	<ul style="list-style-type: none"> ♦The number of stormwater outlets along a waterway would highlight catchments where significant bank disturbance has occurred within waterways to construct outlets. ♦Stormwater outlets also indicate points of concentrated discharge to waterways where scouring and modification of in-stream habitat is likely to occur. ♦This criterion is based on the mapped headwalls within a catchment. 	<p># of stormwater outlets per km of waterway</p> <p>Lower the # the higher the LON</p> <p>Formula = $\# \text{ of stormwater outlets} / \text{total}$</p>

	<ul style="list-style-type: none"> Future versions of the tool may include the many pipes that enter our creeks without headwalls. 	<i>length of natural waterway in catchment</i>
N5 - Channel Type	<ul style="list-style-type: none"> The presence of concrete and grass channels provides an indication of the level of natural channel modification that has occurred. Channel modification results in altered natural flow regimes, loss or modification of in stream and riparian habitat, reduced buffering of peak flows and decreased water quality. The waterway modification score is based on calculating the kilometres of each waterway within a catchment that is unmodified (natural), green modified (grass & rock), modified (concrete & pipe). The km total length for each category is then multiplied by a score for that category (unmodified (natural = 1), green modified (grass = 0.5 & rock = 0.4), modified (concrete = 0.2, pipe = 0.1) to calculate a waterway modification score. The higher the score the higher the level of naturalness. Refer to Appendix E for example of modification & score calculations 	<p>Waterway Modification Score - weighted ratio of natural, grass, rock, concrete & pipe channel</p> <p>Higher the score the higher the LON</p> <p>Formula = $\frac{\{(natural\ km^*1) + (grass\ km^* 0.5) + (rock\ km^* 0.4) + (concrete\ km^* 0.2) + (pipe\ km^* 0.1)\}}{Total\ waterway\ km}$</p>
Water Quality		
Land Use Pollutants		
Parameter	Reasoning	Score Criteria
N6 - Potential In-stream Pollutants	<ul style="list-style-type: none"> Given that actual water quality data is not available, potential in-stream pollutant loadings will be adopted as an interim naturalness parameter until actual water quality data becomes available. Due to WSUD and development guidelines for WQOs only recently being adopted by LCC it could be reasonably assumed that the vast majority of runoff is not being treated to reduce nutrients and sediments. The treatment that does exist is captured in risk criteria 1 - Stormwater Treatment. Pollutant loads entering waterways could therefore be assumed to be comparable to a cumulative calculation of typical pollutant loads / concentrations for each land use source. Average pollutant loads for catchment runoff has been calculated for each creek sub-catchment by using MUSIC Modelling Guidelines for South East Queensland, Water By Design 2010. Refer to Appendix F for more information on MUSIC modelling 	<p>Natural break of combined ranking TSS, TN, TP & GP score</p> <p>Higher the score the higher the LON</p> <p>Formula = <i>Pollutant Rank = Natural Break of pollutant ML/yr/km²</i> <i>Combined Ranking Score = TSS_rank + TP_rank + TN_rank + GP_rank</i> <i>Final potential pollutant rank = Natural break combined ranking score</i></p>
N7 - ERA Properties	<ul style="list-style-type: none"> An ERA is an activity that is required to be approved by either Council or State Government due to its potential to damage or pollute the environment. Operation of an ERA does not in itself necessarily mean a greater impact on the environment but it means there is a greater threat of an impact occurring. The presence of ERA records on properties adjoining a waterway provides a useful measure of the naturalness of a waterway. ERA records represent both a decrease in waterway naturalness as well as a threat to further degradation of waterway naturalness. Notifiable Activities - are identified as likely to cause land contamination and are listed in Schedule 3 of the EPA 1994. Land that has been or is being used for a notifiable activity is recorded on the Environmental Management Register. These sites are covered under Risk Criteria 3 Contaminated Sites. ERA Properties that are adjacent to a park that is adjacent to a waterway are weighted 0.5. These properties stormwater leaves the site directly to the park & into the waterway. A number of documents have been used to determine a weighted ratio for the different ERAs, please refer to Appendix G for more information on ERA emission score. ERA emission score is based on the ERA list under the Environmental Protection Regulation 2008 before 31 March 2013. Properties are counted as a proportion of the property in the catchment 	<p>ERA Emission Score (Weighted ratio of ERA type along the waterway & adjacent to a park) per waterway length</p> <p>Lower the score the higher the LON</p> <p>Formula = <i>Total {(ERA prop adj to ww* weighting) + (ERA Prop adj to park adj to ww* weighting)} / km of waterway in catchment</i></p>
Infrastructure Pollutants		

N8 - On site sewage	<ul style="list-style-type: none"> ♦Un-sewered areas have an ongoing influence on water quality and are not dependent on a particular incident occurring for there to be a change in naturalness. ♦Failure of a septic system may be considered a threat but no useable data is available to measure this threat at this time ♦Pollutants include nutrients, bacteria, viruses and oxygen demanding substances ♦Categorisation of the level of influence has been enhanced by distinguishing between septic systems and higher level treatment systems (secondary or advanced secondary HSTPs) within the catchment as the levels of pollutants vary depending on treatment system type. ♦This criterion used recommended water quality specifications for Class A-D recycled water to work out scores. ♦ The catchments with Sewage Treatment Plants that release to land are calculated through using the EPs (equivalent properties) it services. Therefore Loganholme and Beenleigh that release to river are not included. ♦Refer to Appendix H for investigation into on site sewage and sewage treatment plants. ♦ Properties are counted as a proportion of the property in the catchment 	<p>Sewage Load Score (weighted ratio of different sewage sources) per catchment area</p> <p>Lower the # the higher the LON</p> <p>Formula = $\frac{\{SUM [(# \text{ of HSTPs } *1) + (\# \text{ Septic Licensed Props } *4) + (\# \text{ STP } *EPs * WQ \text{ Weighting})]\}}{\text{catchment area km}^2}$</p>
N9 - Road Runoff	<ul style="list-style-type: none"> ♦Runoff from roads across the catchment also has an ongoing influence on water quality. ♦ High use roads and highways are a large pollution contribution to a waterway, this includes wear and tear from vehicles, accidental spills, wear of road surface, adjacent maintenance practices, fuel emissions and through construction. ♦The Road Runoff score is based on calculating the total area of each road within the five categories of the catchment. ♦The total area for each category is then multiplied by a score for that category (between 10-1). ♦ The higher the road pollution score the less natural the catchment ♦Refer to Appendix I for example calculations and investigations into the weightings. 	<p>Road Pollution Score (weighted road area based on car use) per catchment area</p> <p>The lower the score the higher the LON</p> <p>Formula = $\frac{[SUM (\text{area of road } * \text{ weightings})]}{\text{catchment area km}^2}$</p>
Natural Environment		
Habitat & Biodiversity		
Parameter	Reasoning	Score Criteria
N10 - Weed Invasion	<ul style="list-style-type: none"> ♦The presence of noxious weed (NOX) records on properties adjoining a waterway provides a useful measure of the naturalness of a waterway. ♦The data that exists is based on reports and is not the full extent of weeds within the catchment. ♦The records are based on properties not exact location of the weeds. ♦Weeds can affect local ecology, waterway processes and even hydrological character of a catchment. ♦ This criterion includes both private and public records within a single GIS table. ♦ Using data since 01/01/2005 and counting multiple records individually. ♦ Properties with a NOX record that are adjacent to a park that is adjacent to a waterway are weighted 0.5. These properties have no structured buffer to the park & waterway. ♦ Properties are counted as a proportion of the property in the catchment 	<p># of properties that intersect a waterway with a NOX record per km of waterway</p> <p>Lower the # the higher LON</p> <p>Formula = $\frac{\# \text{ of properties with NOX record that intersect ww} + (\text{NOX prop adj to park} \text{ adj to ww} * 0.5)}{\text{length km of waterway}}$</p>
Corridors, Buffers & Stabilisation		
N11 - Riparian Vegetation - Bank Stability	<ul style="list-style-type: none"> ♦ Waterways with retained riparian vegetation are likely to be more valuable as ecological corridors and habitat, while the presence of riparian vegetation also assists in maintaining bank stability, thermal levels and water quality. ♦ Vegetation includes remnant, regrowth & Chris Power Vegetation or ALS generated Vegetation. 	<p>% of land within 5m of waterway containing vegetation</p> <p>Higher the % the higher the LON</p> <p>Formula =</p>

		<i>(Vegetated 5m buffer ww Area km2/ww buffer 5m area km2) *100</i>
N12 - Riparian Vegetation - Ecological Corridors & Buffers	<ul style="list-style-type: none"> ♦ The presence of vegetation within 75m of a waterway indicates that the waterway may perform a natural function as an ecological corridor and habitat. ♦ The presence of vegetation also indicates that the vegetation provides buffering to maintain water quality and other ecological values in the waterway. ♦ Vegetation includes remnant, regrowth & Chris Power Vegetation or ALS generated Vegetation. 	<p>% of land within 75m of waterway containing vegetation</p> <p>Higher the % the higher the LON</p> <p>Formula = <i>(Vegetated 75m buffer ww Area km2/ ww buffer 75m area km2) *100</i></p>
N13 - Vegetation Cover	<ul style="list-style-type: none"> ♦ Catchments containing a high proportion of vegetation cover are likely to have more natural features, including less impervious area, which impacts on water quality. ♦ Vegetation includes remnant, regrowth & Chris Power Vegetation 	<p>% of catchment vegetated</p> <p>Higher the % the higher the LON</p> <p>Formula = <i>(Vegetated area km2/ catchment area km2) *100</i></p>
Land Use & Human Activity		
Accessibility & Use		
Parameter	Reasoning	Score Criteria
N14 - Conservation Status of Adjoining Land	<ul style="list-style-type: none"> ♦Parks provide an integral protection and buffer zone to many of Logan's waterways. ♦However some categories of park adjoining a waterway may also represent a threat to waterway naturalness as active parks and recreation areas supporting high levels of human activity and public access to waterways can degrade the naturalness of the waterway as much as many other land uses. ♦Therefore this parameter will be limited to measuring protected areas, bushland or conservation areas. ♦ Used the environmental parks in Parks Network ♦ This criterion was difficult to develop due to the sporadic declared waterway parcels that buffer the waterway centreline. ♦Refer to Appendix J for a list of Environmental parks 	<p>% of waterway length adjoining a conservation reserve</p> <p>Higher the % the higher the LON</p> <p>Formula = <i>(Conservation Pk ww bank km/ catchment ww bank km)* 100</i></p>
N15 - Litter Hot Spots	<ul style="list-style-type: none"> ♦The presence of litter hotspots within a waterway provides a useful measure of the naturalness of a waterway. ♦Litter has numerous effects on the environment, physically, ecologically and visually. ♦The litter hot spots identified are both actual information from contractors and theoretical known hotspots, e.g. skate parks, shopping centres, takeaways and transport centres. ♦Identifies litter hot spot properties adjacent to a waterway or adjacent to a park that is adjacent to a waterway, as per previous criteria those hot spots adjacent to the parks are multiplied by 0.5. ♦Refer to Appendix K for a list of litter hot spots 	<p>Weighted score of litter hot spots adjacent to a waterway per km of waterway</p> <p>Lower the # the Higher the LON</p> <p>Formula = <i>[(sum litter hot spots adj ww)+ (sum litter hot spots adj to park adj to ww* 0.5)]/ Total ww km</i></p>
Land Development		
N16 - Extraction Sites	<ul style="list-style-type: none"> ♦The presence of extraction activities within a waterway provides a measure of the naturalness of a waterway in terms of the level of disturbance to bed and banks, impacts on water quality, degradation of riparian and in-stream vegetation and habitat etc. ♦ The areas of the disturbance was manually interpreted and developed from aerial photography, this could be improved in future GIS iterations. 	<p>% of disturbed land from extraction within 75m of waterway</p> <p>Lower the % the Higher the LON</p> <p>Formula = <i>(Disturbed ww buffer 75m area km2 / total ww buffer 75m area km2)* 100</i></p>

Appendix E: Level of Naturalness Criteria - N5 Channel Modification

Table 12: Example Calculations
Please refer to DM#8195402 for original example

Modification type	Modification Score	Natural catchment	Score	Moderate Catchment	Score	Modified Catchment	Score
Natural	1	5	5	1	1	1	1
Grass	0.5	3	1.5	6	3	1	0.5
Rock	0.4	1	0.4	1	0.4	0.5	0.2
Concrete	0.2	0.5	0.1	1.5	0.3	6	1.2
Pipe	0.1	0.5	0.05	0.5	0.05	1.5	0.15
Total		10	7.05	10	4.75	10	3.05
			0.705		0.475		0.305
Natural	1	3	3	1	1	0.5	0.5
Grass	0.5	1	0.5	3	1.5	0.5	0.25
Rock	0.4	0.5	0.2	0	0	0.5	0.2
Concrete	0.2	0.5	0.1	0.5	0.1	2.5	0.5
Pipe	0.1	0	0	0.5	0.05	1	0.1
Total		5	4.505	5	3.125	5	1.855
			0.72		0.52		0.36

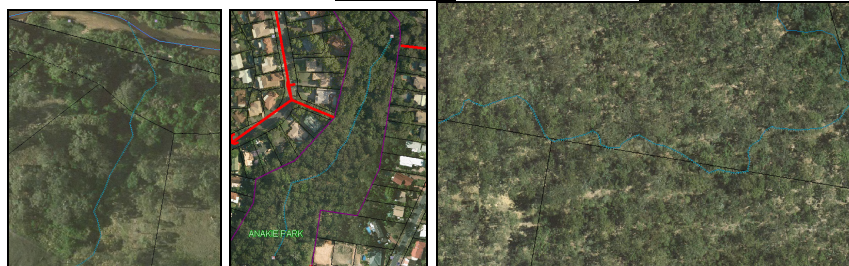


Figure 9: Channel Type: Natural



Figure 10: Channel Type: Grass



Figure 11: Channel Type: Concrete

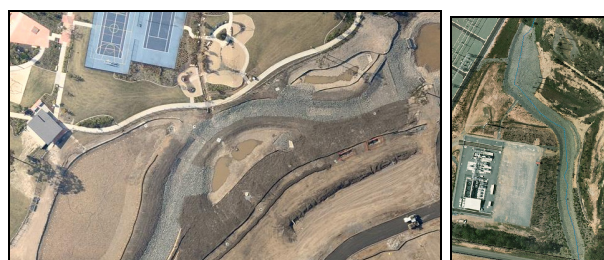


Figure 12: Channel Type: Rock

Appendix F: Level of Naturalness Criteria - N6 Potential In-stream Pollutant Load

Methodology

The eWater MUSIC Modelling software package was used to determine the stormwater pollution concentration for the existing land use within the creek sub-catchments using the five River Catchments (Brisbane, Redlands, Albert North Logan River and South Logan River) as the model.

The methodology outlined in the MUSIC Modelling Guidelines (Water by Design, 2010) was applied in the development of the MUSIC models. The modelling land use classifications adopted are summarised in table 13 below. As per the MUSIC Modelling Guidelines, rainfall data from the Greenbank 40659 BOM station for Brisbane River, Beenleigh 40406 BOM station for Albert River and Shailer Park 40715 BOM station for Logan River and Redlands Creek models. A 10 year climate period between 1980 and 1989 was selected also in accordance with the guidelines. This period presents the most representative dataset based on the long term average rainfall and has the least amount of missing data. It is therefore the most reliable dataset available for the purposes of this modelling exercise.

Using the MUSIC generated stormwater flows and loads, and the area of each land usage classification within each creek sub-catchment, an annual flow and pollution concentration per hectare was calculated. Models can be seen in figure 15-19.

Using GIS software, these loads were then used to produce thematic maps for each flow and pollution load parameter according to land uses. These were then categorised through GIS natural break, for cut offs see Table 14.

Table 13: Land Use Classification Table
(Please refer to the original Document DM# 6208887)

Current Land Use	MUSIC Source Node		Impervious Fraction (%)	GIS notes
Child Care	Commercial		90	
community protection centre	Commercial		90	
Drive in Shopping Centre	Commercial		90	
Funeral Parlour	Commercial		90	
Group of more than 6 shops	Commercial		90	
Group of Shops 2 - 6	Commercial		90	
Hospital or convalescent home	Commercial		90	
hotel/tavern	Commercial		90	
licensed club	Commercial		90	
Motel	Commercial		90	
office/s	Commercial		90	
outdoor sales area	Commercial		90	
restaurant	Commercial		90	
retail warehouse	Commercial		90	
shop/s - main retail	Commercial		90	
shop/s - secondary retail	Commercial		90	
single shop	Commercial		90	
special tourist attraction	Commercial		90	
transformer	Commercial		90	
wharves	Commercial		90	
No Land-Use or Land-Use = Strata Titled (BUP, GTPs) or Land-Use = "other clubs (non business)" + zoned (Principle Centre, Neighbourhood Centre, Local Centre, Major Centre, District Centre, Specialised Centre)	Commercial		90	
Car Park	Industrial		90	
Cold stores/iceworks	Industrial		90	
General Industry	Industrial		90	
Light industry	Industrial		90	
Noxious/offensive industry	Industrial		90	
Nursery	Industrial (nursery)	Garden Industry	50	Overwrites landuse with OverWriteLandUse.tab

oil depot	Industrial		90	
Railway	Industrial (railway)	Railways	65	Use Property type "Railway Property"
service station	Industrial		90	
transport terminal	Industrial		90	
warehouse or bulk store	Industrial		90	
No Land-Use or Land-Use = Strata Titled (BUP,GTPs) or Land-Use = "other clubs (non business)" + zoned (Mixed Use, Industry)	Industrial		90	
small crops & fodder (irrigated)	Agricultural		2	Overwrites landuse with OverWriteLandUse.tab
small crops & fodder (non-irrigated)	Agricultural		2	
sugar cane	Agricultural		2	
turf farm	Agricultural		2	
Forestry & Logs	Forested		0	
reservoir/dam/bore	Forested		0	Overwrites landuse with OverWriteLandUse.tab
Roads	Road		70	Include properties like "%Logan Motorway%" into the PSX Roads layer and remove from PSX_Zones include Group title/Building Unit strata roads Lot_Plan like "%/0"
Cattle Breeding & Fattening	Agricultural/Forested	Join together and calculate the land that is vegetated and not vegetated. If vegetated = Forested (0%) and not vegetated = Agricultural (2%).	0-2	W:\Dev\HltEnv\PlanEnvPol\Editing\Ren ee_RAW\WRPT\source\MUSIC\Over WriteLandUse.TAB. This table overwrites the music allocation that is sourced from the property land use table and if the property already has an agriculture land use (green in DM# 6208887) and is not in OverWriteLandUse.tab then the land use allocation needs to be removed and the properties zone used.
Cattle Fattening	Agricultural/Forested		0-2	
Cattle Grazing/Breeding	Agricultural/Forested		0-2	
dairy cattle (milk Not Quota)	Agricultural/Forested		0-2	
dairy cattle (milk Quota)	Agricultural/Forested		0-2	
orchard	Agricultural/Forested		0-2	
rural use- animals special	Agricultural/Forested		0-2	
rural use- horses	Agricultural/Forested		0-2	
rural use - pigs	Agricultural/Forested		0-2	
rural use - poultry	Agricultural/Forested		0-2	
Extractive Industry	Agricultural/Forested		0-2	
cemetery	Agricultural/Forested		0-2	
vacant land - large site	Agricultural/Forested		0-2	
vacant rural land	Agricultural/Forested		0-2	
No Land-Use or Land-Use = Strata Titled (BUP,GTPs) or Land-Use = "other clubs (non business)" + zoned (Rural, Environmental Conservation and Management, UDA Zone)	Agricultural/Forested			
Builders Yard	Urban Residential		50	
religious	Urban Residential		50	
sports club/facilities	Urban Residential		50	
Advertising Housing	Urban Residential		50	
Caravan Park	Urban Residential		50	
Educational	Urban Residential		50	
residential institution	Urban Residential		50	
Multiple Dwelling (flats)	Urban Residential		50	
welfare home/institution	Urban Residential		50	
parks & gardens	Urban Residential		50	
No Land-Use or Land-Use = Strata Titled (BUP,GTPs) or Land-Use = "other clubs (non business)" + zoned (Recreation, Recreation and open space)	Urban Residential		50	
- With the following LandUse & zoning irrelevant : * single dwelling * single dwelling - large site * Non-allocated land	Res 80	<185m2	85	May need to assign title area to these based on cartesian area if they don't have a title area
	Res 40	185 - 458	65	
	Res 15	458 - 833	55	

* Vacant urban land * Outbuilding - No Land Use - zoned either Rural Residential Emerging Communities, Residential Living, Residential Choice, Apartment Residential, Community Purposes - No Land Use and No Zone	Res 10	833 - 2000	45	
	Rural Res Small	2000 - 4000	20	
	Rural Res Large	4000 - 10000	10	
	Agricultural/Forested	>10000	0-2	Properties that meet these land use types but area greater than 10000m2 are treated like Ag/Forest "Join together and calculate the land that is vegetated and not vegetated. If vegetated = Forrest (0%) and not vegetated = Agriculture (2%)."
no land use, owned by CROWN RESERVE, "Council", "State" or Tenure = "NP"	Rural Res Large	Recreational parks	10	Based on Parks Strategy. Environmental parks + unallocated -> forested, all others to Rec parks. (Except two golfcourses which were switched from environment to recreation)
	Forest	Conservation Parks	0	
no land use listed				Are covered in each node assigned by zone and title area
Following Land use is from table - W:\DevHltEnv\PlanEnvPol\Editing\Renee\ RAW\WRPT\source\MUSIC\OverWriteLandUse.TAB				
4. (a) Poultry Farming >1,000 - 200,000 birds	Agricultural/Forested	Join together and calculate the land that is vegetated and not vegetated. If vegetated = Forrest (0%) and not vegetated = Agriculture (2%).	0-2	
4. (b) Poultry Farming >200,000 birds	Agricultural/Forested		0-2	
Aquaculture Fish Farm	Agricultural/Forested		0-2	
Intensive Animal Husbandry - Aquaculture	Agricultural/Forested		0-2	
ERA 1 Aquaculture	Agricultural/Forested		0-2	
ERA 25 Meat Processing	Agricultural		2	
ERA 26 Milk Processing	Industrial		90	
Open Field	Agricultural		2	
Shade House	Agricultural		2	
Shade House and Open Field	Agricultural		2	
Old Quarry	Agricultural/Forested		0-2	
Golf Course Location	Rural Residential Large		10	

Music Models

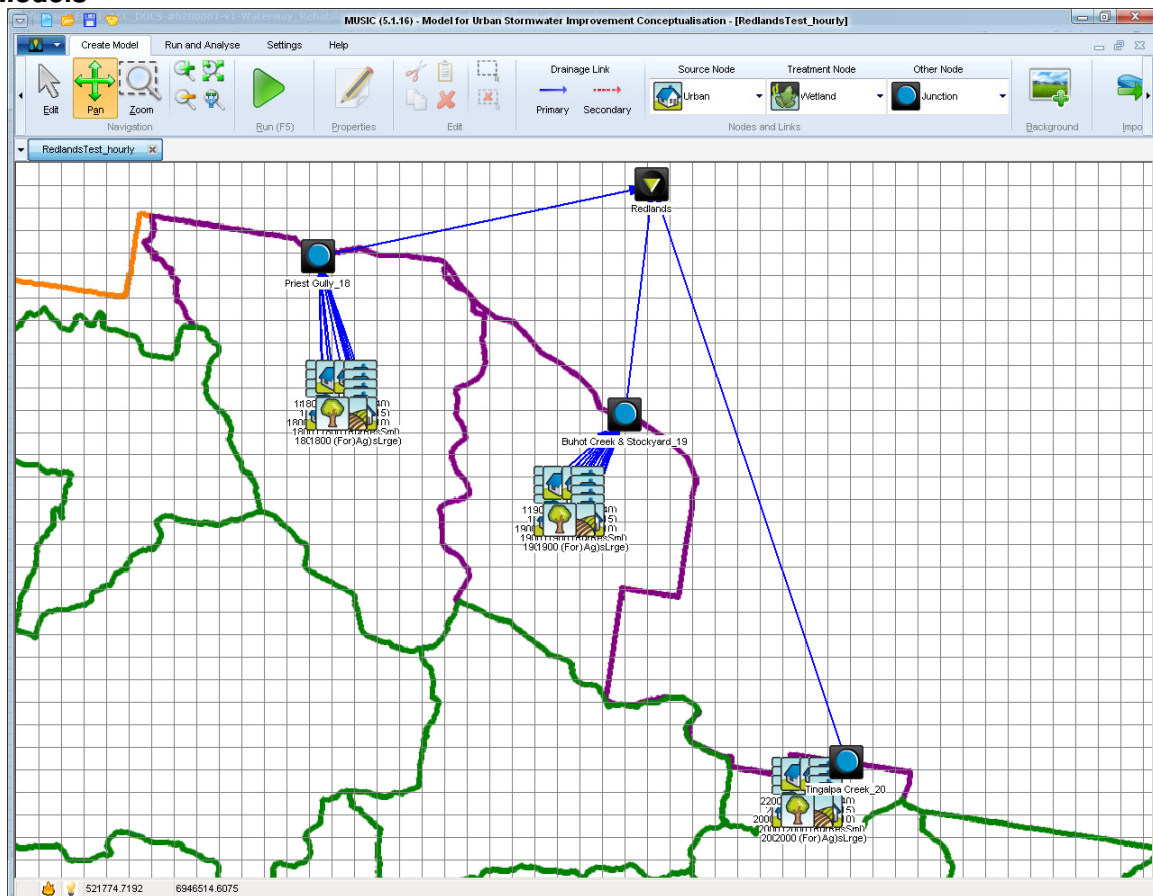


Figure 13: Redlands Creek Catchments Music Model

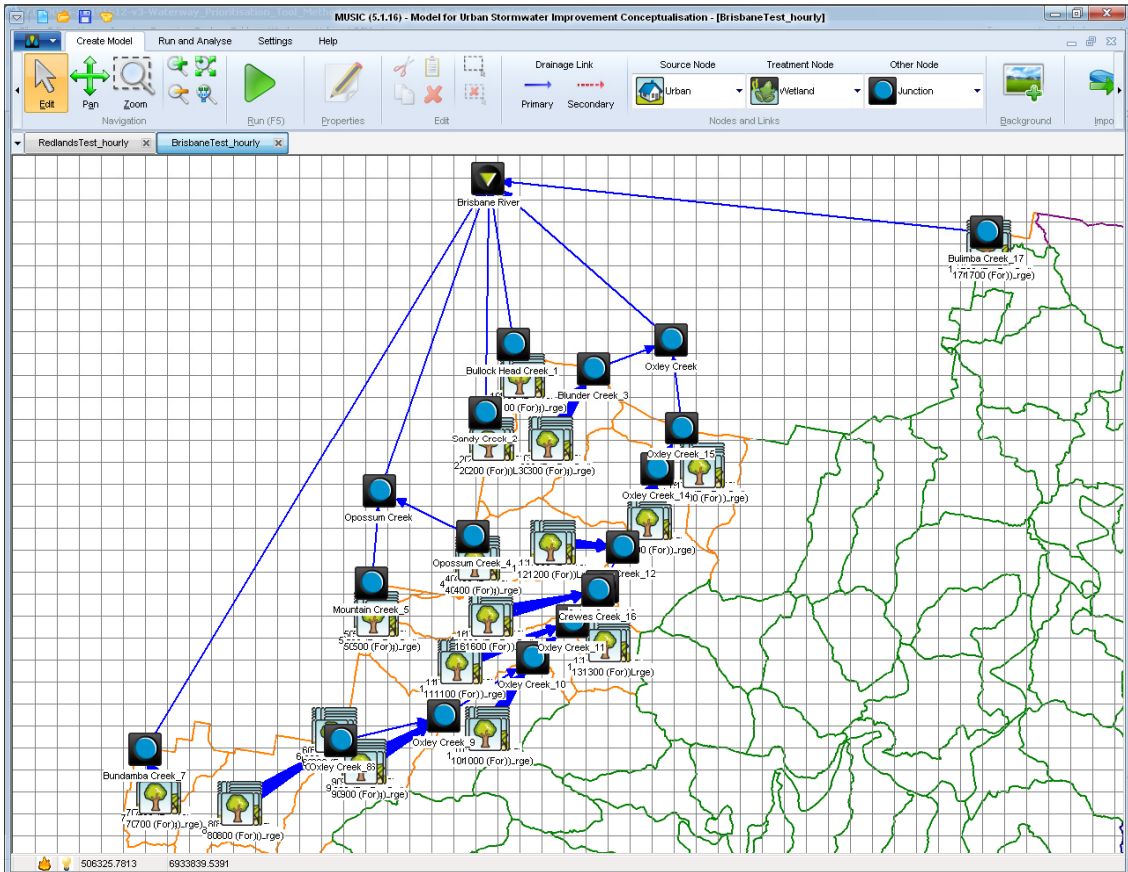


Figure 14: Brisbane River Catchment Music Model

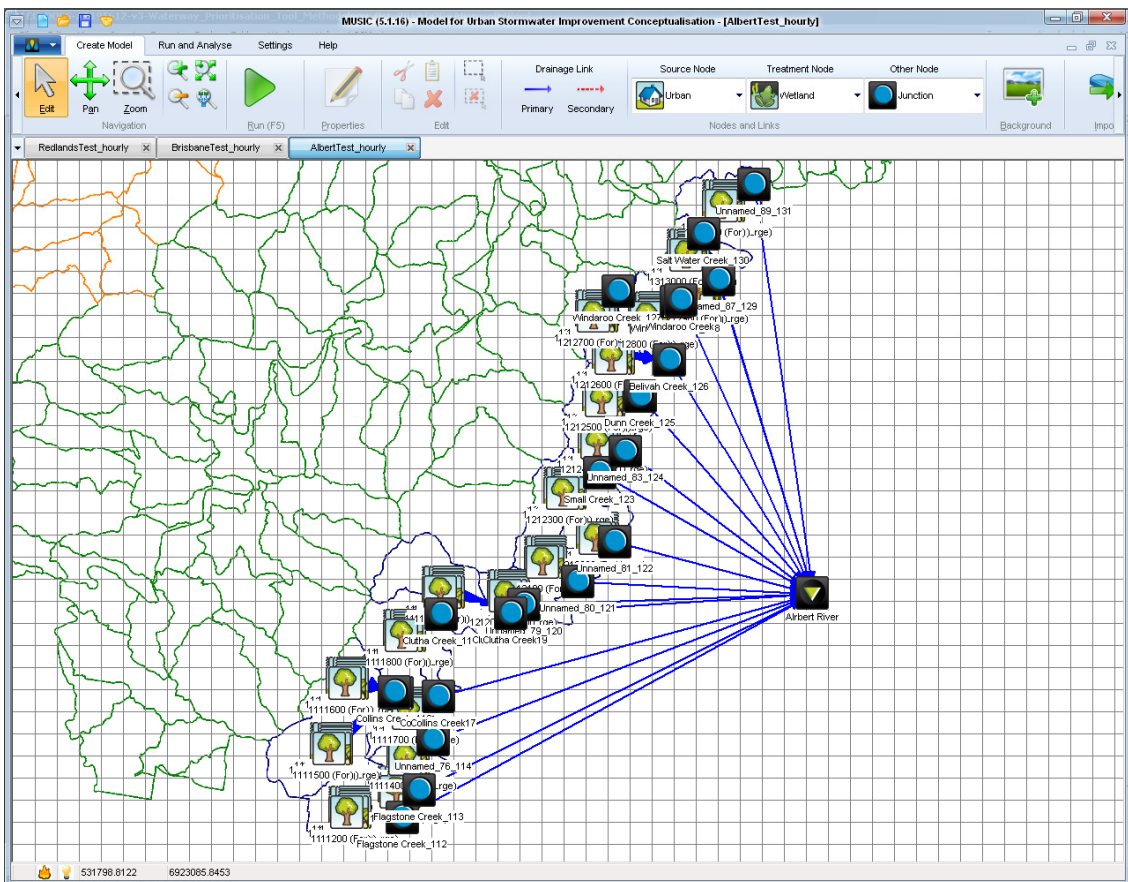


Figure 15: Albert River Catchment Music Model

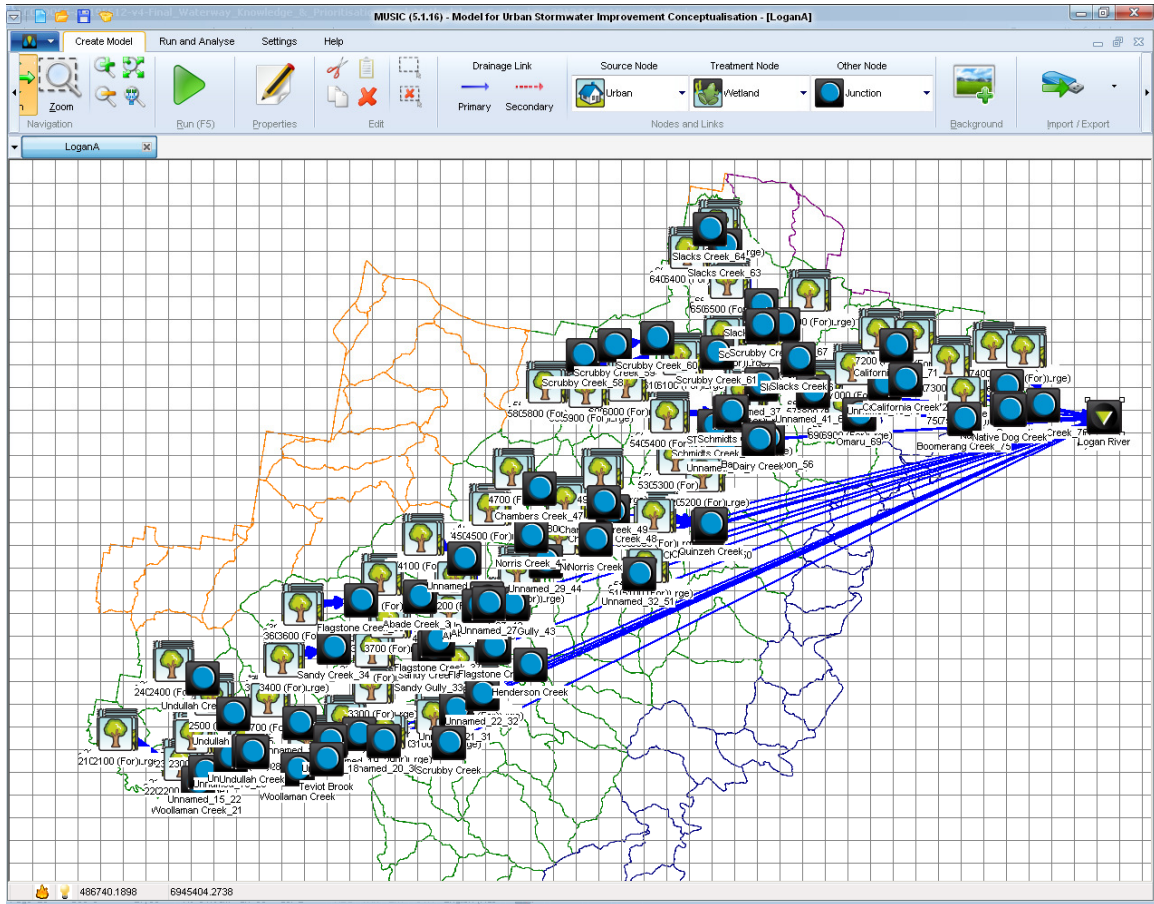


Figure 16: Logan River North Catchment Music Model

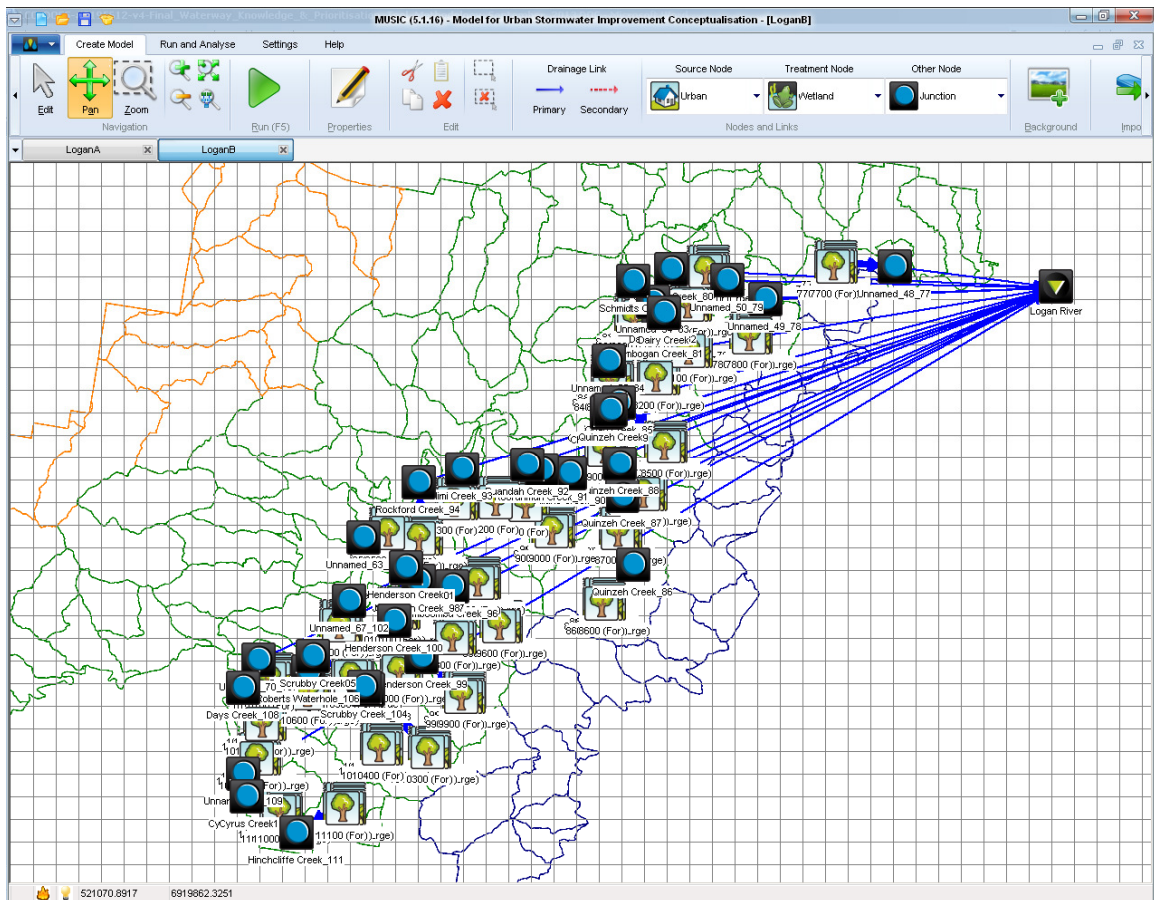
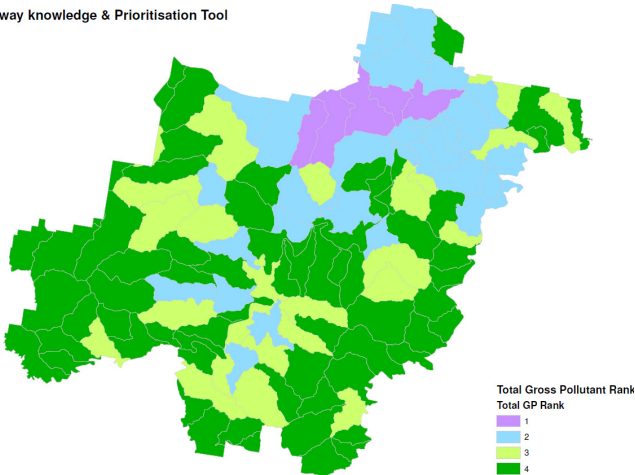


Figure 17: Logan River South Catchment Music Model

Table 14: Pollutant Load Cut offs

	Low - 1	Medium - 2	High - 3	Very High - 4
Total Suspended Solids ML/Year/Catchment Area (km2)	<= 17,465,823	8,734,100 - 17,465,823	2,440,503 - 8,734,100	< 932,474
Total Phosphorus ML/Year/Catchment Area (km2)	<= 28,662	7,261 - 28,662	2,134 - 7,261	< 982 - 2,134
Total Nitrogen ML/Year/Catchment Area (km2)	<= 138,831	110,824 - 138,831	18,603 - 110,824	< 7,574 - 18,603
Gross Pollutants ML/Year/Catchment Area (km2)	<= 1,309,937	337,080 - 1,309,937	64,809 - 337,080	< 23,133 - 64,809
Potential Pollutant Load Score	<4	4 - 9	9 - 12	12 - 15

Waterway knowledge & Prioritisation Tool



Waterway knowledge & Prioritisation Tool

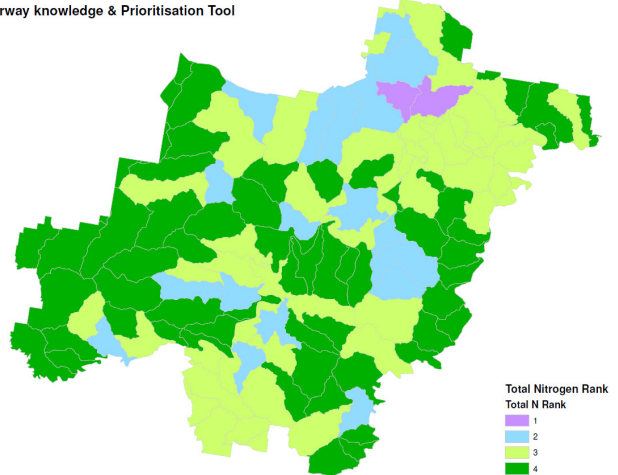
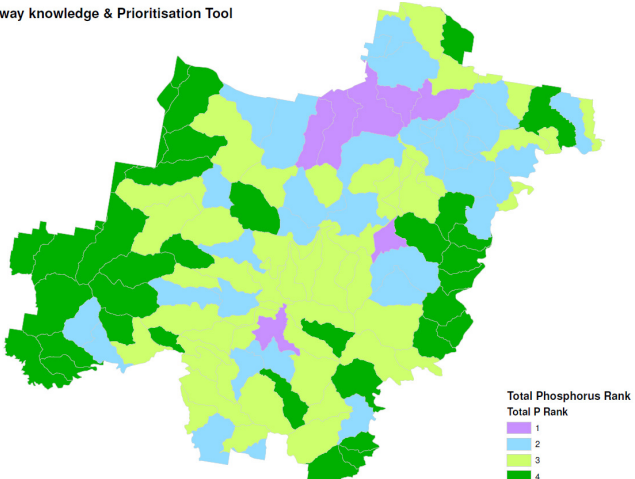


Figure 18: Total Gross Pollutant Rank & Figure 19: Total Nitrogen Rank

Waterway knowledge & Prioritisation Tool



Waterway knowledge & Prioritisation Tool

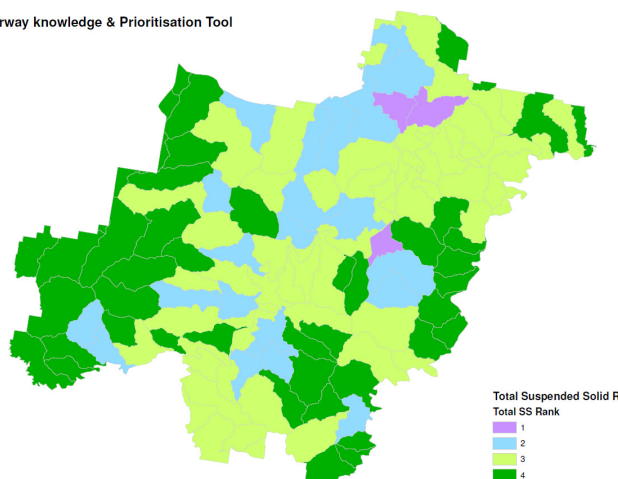


Figure 20: Total Phosphorus Rank & Figure 21: Total Suspended Solid Rank

Appendix G: Level of Naturalness Criteria - N7 ERA Properties

Table 15: ERA List

Please refer to the original Document DM# 7846237

ERA #	ERA Code	Sub ERA	ERA Description	Resp.	AES	Est. AES	Water Emission	Weighting	# of ERAs	Notes
4	ERA4	a	Poultry Farming >1,000-200,000 birds	LCC	NS		NS	1	13	
18	ERA18		Boiler Making or Engineering	LCC	NS	Yes	NS	1	43	only 2 options (NS or 46)
19	ERA19		Metal Forming 10,000t/yr or more	LCC	NS		NS	1	18	
20	ERA20	1	Metal Recovery <100t/day	LCC	NS		NS	1	13	
20	ERA20	3	Metal Recovery	State	NS		NS	1	3	
37	ERA37	a	Printing 200-1,000t/yr	LCC	NS		NS	1	12	
38	ERA38	2a	Metal Surface Coating: coating, painting	LCC	NS		NS	1	11	
48	ERA48	1	Wooden Product Manufacturing	LCC	NS		NS	1	44	
48	ERA48	1	Wooden and Laminated Product Manufacture	State	NS		NS	1	1	
52	ERA52		Battery Recycling	State	NS		NS	1	1	
59	ERA59		Tyre Recycling	State	NS		NS	1	3	
4	ERA4	b	Poultry Farming > 200,000 birds	LCC	9		0	2	2	
5	ERA5		Alcohol Production	State	48		0	2	1	
12	ERA12	a	Plastic Manufacturing	LCC	28		0	2	12	
12	ERA12	b	Plastic Manufacturing	LCC	54		0	2	9	
17	ERA17		Abrasive Blasting- Perm location or mobile	LCC	16		0	2	6	
21	ERA21		Motor Vehicle Workshop Operation	LCC	7		0	2	301	
21	ERA21		Motor Vehicle Workshop Operation	State	7		0	2	4	
29	ERA29	2	Metal Foundry Operation	State	13		0	2	1	
35	ERA35		Plaster Manufacturing	State	47		0	2	2	
38	ERA38	1a	Metal Surface Coating: anodising, electro	LCC	10		0	2	11	
43	ERA43		Concrete Batching 200t/yr or more	LCC	30		0	2	9	
43	ERA43		Concrete Batching	State	30		0	2	3	
49	ERA49		Boat Maintenance or Repair Facility	LCC	17		0	2	2	
55	ERA55	1	Regulated Waste Recycling or Reprocessing	State	9		0	2	1	
56	ERA56		Regulated Waste Storage	State	21	Yes	0	2	9	only 2 options (9 or 21) - BP tip is 9 & 21
57	ERA57	2a	Regulated Waste Transport	State	7		0	2	3	4 options (NS, 7, 21, 42) - one of 3 was 2a
1	ERA1	1a	Aquaculture	State	11		5	3	1	
7	ERA7		Chemical Manufacturing	State	96	Yes	9	3	10	Average AES & WE
8	ERA8	3a	Chemical Storage	LCC	NS		NS	3	84	Higher weighting due to expert opinion
8	ERA8		Chemical Storage	State	42	Yes	1	3	11	Average of AES (NS, 31, 51, 85) & WC
15	ERA15		Fuel Burning	State	35		1	3	5	
16	ERA16	2c	Extractive and Screening Activities	State	35	Yes	2	3	11	Average AES & WE
25	ERA25	2c	Meat Processing	State	66		6	3	5	Teys Bros Beenleigh
26	ERA26		Milk Processing	State	37		6	3	1	
46	ERA46		Chemically Treating Timber	State	42		4	3	3	
60	ERA60	2f (1)(b)	Waste Disposal	State	58	Yes	11	3	2	58 BP tip
62	ERA62		Waste Transfer Station Operation	State	31		3	3	1	
63	ERA63		Sewage Treatment	State	61	Yes	33	3	27	Average AES & WE
Historical Flammable and Combustible properties with no current ERA Licence								3		These sites are not annually monitored
Historical Flammable and Combustible property with a State or LCC ERA								Weighting +1		

AES from the Schedule 2 of the Environmental Protection Regulation 2008 Reprint 2E effective 1 August 2012

WE from the Environmental Emission Profiles, A tool to profile the relative risk of ERAs under the Environmental Protection Regulation 2008, Queensland - Appendix 5

LGAQ - Greentape Reduction - Reforming Licensing Under the Environmental Protection Act 1994 - DM # 7965530

ERA emission score is based on the ERA list under the Environmental Protection Regulation 2008 before 31 March 2013.

N7 - ERA Emission Score Example

ERA Emission Score - Weighted ratio of Water Emission Score for ERA properties along the waterway & ERA properties adjacent to a park that's adjacent to a waterway

Formula = Total {(ERA prop adj to ww* weighting) + (ERA Prop adj to park adj to ww* weighting)}/ km of waterway in catchment
Total

Table 16: Example Score calculations

Water Emission Score	Weighted Emission Score	Natural catchment	Score	Moderate Catchment	Score	Modified Catchment	Score
No Score	1	6	6	2	2	1	1
Zero Score	2	3	6	6	12	2	4
1-33 Score	3	1	3	1	3	6	18
Total		10km	15	9km	17	8km	23
			1.5		1.89		2.88
No Score	1	3	3	1	1	1	1
Zero Score	2	1	2	3	6	1	2
1-33 Score	3	1	3	1	3	3	9
Total		5km	9.5	5km	11.89	5km	14.88
			1.9		2.38		2.98

R4 - ERA Emission Score Example

ERA Emission Score - Weighted ratio of Water Emission Score

Formula = Total {(ERA prop* weighting) + (ERA Prop with F&C*weighting +1)}/ area of catchment

Table 17: Example Score calculations

Water Emission Score	Weighted Emission Score	Natural catchment	Score	Moderate Catchment	Score	Modified Catchment	Score
No Score	1	6	6	2	2	1	1
Zero Score	2	3	6	6	12	2	4
1-33 Score	3	1	3	1	3	6	18
Total		10km2	15	9km2	17	8km2	23
			1.5		1.89		2.88
No Score	1	3	3	1	1	1	1
Zero Score	2	1	2	3	6	1	2
1-33 Score	3	1	3	1	3	3	9
Total		5km2	9.5	5km2	11.89	5km2	14.88
			1.9		2.38		2.98

Appendix H: Level of Naturalness Criteria - N8 On Site Sewerage

Table 18: On site Sewerage investigation

Please refer to the original Document DM#6484391

	Loganholme	Beenleigh	Flagstone	Jimboomba	Logan Village	Mt Cotton
Equivalent Population	230,000	60,000	2,000	1,500	320	5,000
Equivalent Properties (~estimated)	83,035	~ 22,222	~ 740	~ 555	~ 118	~ 1,851
Capacity (ML/D)	44 - increasing to 66	15	0.5	0.3	0.06	1.2
Current Load	36	8.5	0.23	0.25	0.03	0.6
% Effluent reuse	18% reclaimed 11% irrigation	30% land disposal and industrial	100% land disposal	100% land disposal	100% land disposal	100% land disposal
Licence compliance	Faecal, total N and P not always meeting licence	Within typical range - faecal does go over	Meets dry land irrigation	Meets dry land irrigation	Performs poorly - wet weather influx	Meets EPA standards
Release location	71% - Logan River 18% - Reclamation 11% - irrigation	70% - Albert River 30% - Rocky point and Staplyton Dam	No direct water release 33ha irrigation site	No direct water release Golf course at Hills international college	No direct water release Adjacent Cattle property irrigation	No direct water release Feeds to a 8 acre holding pond at the Carbrook Golf Course for irrigation
Class	B	B	C	C	D	B
Upgrade	Currently upgrading capacity and treatment	No more room for upgrade	Going through review	Going through review	Upgrade	Investigating Carbrook golf course management of effluent

Table 19: Recommended water quality specifications for Class A-D recycled water

Class	E. coli (median) cfu/100mL2	BOD5 mg/L median	Turbidity NTU 95% ile (max.)	SS, mg/L median	TDS, mg/L or EC, µS/cm medians TDS / EC3	pH
A	< 10	20	2 (5)4	5	1000/1600	6-8.5
B	< 100	20	—	30	1000/1600	6-8.5
C	< 1,000	20	—	30	1000/1600	6-8.5
D	< 10,000	—	—	—	1000/1600	6-8.5

Weighting

- 1 - Class B - HSTP, Mt Cotton
- 2 - Class C - Flagstone, Jimboomba
- 3 - Class D - Logan Village
- 4 - Class E - Septic

Notes

- HSTPs licence records comes from Pathway (does contains double ups so reduced through property key)
- Septic is the licence recorded and everything that is left over (doesn't have sewerage, HSTPs or septic licence) and has a wheelie bin collection. Undulla some residents don't have wheelie bin (searching for properties in public ownership, where land use is single dwelling, outbuilding or light industry and finally aerial photography).
- Also a list of parks that are septic was received from Parks (DM#8198481), as these weren't getting picked up.
- Loganholme and Beenleigh STP are not included as the majority of treated sewage is released to River and therefore has limited affect on the creek catchments naturalness.

Irrigated area

Flagstone - Not irrigating on property key 288039 anymore, instead they have moved the irrigation area to an area approx 33 ha on property keys - 288810 and 288811 - See doc number 6484870 for plans. By 2019 the current treatment plant is likely to become a pump station for a new treatment plant west of the railway line, and the current irrigation area will become residential development.

Jimboomba - property key - 285354

Logan Village - property key - 291626

Mt Cotton Treatment Plant - property key - (227947 & 232509 - majority of property is in the wrong catchment)

update 2/11/11 to property key 227946

*The above properties may change in the near future due to encroaching urban development

Appendix I: Level of Naturalness Criteria - N9 Road Run Off

The inclusion of this criterion was based on a study "Impacts of stormwater runoff from roads in SEQ" by ME Barry, AB McAlister, TR Weber, E Abal and N Scott and published in WSUD 2004. To determine weightings and categories data from both BCC and LCC Road hierarchy information and actual Road use data were used.

Table 20: Brisbane City Council - Subdivision and Development Guidelines

Part B Infrastructure Elements, Chapter 1 Roads and Paths, p6 & 14, October 2006

VPD	Road Category
0-750	Minor Road - Local Access
750-3,000	Minor Road - Neighbourhood Access
3,000-15,000	Major Road - District Access
15,000-35,000	Major Road - Suburban Route
>35,000	Major Road - Arterial Route

Table 21: Logan City Council Planning Scheme 2006 - Schedule 2 Infrastructure Hierarchy

Part 1 Roads, Section 1.1

Road Hierarchy	Road Type	Traffic (VPD)
Urban Road (Local Government)	Urban Access	Access to residences & properties
	Minor Urban Access	<3,000
	Major Urban Collector (access permitted)	>3,000
Major Road (Local Government)	Major Urban Collector (limited access)	>3,000
	Urban Arterial (single carriageway)	6,000-15,000
	Urban Arterial (dual carriageway)	>15,000
Major Road (state controlled)	Urban Arterial	6,000-30,000
	Main Road	10,000-30,000
	Highway	>30,000
Industrial Road (local government)	Industrial access	Serve industrial areas 120 lots or 12 Ha
	Industrial collector	Serve industrial areas 300 lots or 30 Ha
Non-Urban Road	Rural and rural residential	Low volume roads through rural residential areas

Table 22: Weighting

Hierarchy	Weighting	AADT
Very High	10	>30,000 + all main roads
High	6	15,000 - 30,000
Medium	3	3,000 - 15,000
Low	2	750 - 3,000 + all unformed roads (due to sediment and pollutants)
Very Low	1	0 - 750

Table 23: Calculation example

Formula = (SUM (area of road * weighting))/catchment area km2

Road Use AADT	Weighting	Natural catchment	Score	Moderate Catchment	Score	Less Natural Catchment	Score
Very High	10	0 km2	0	0 km2	0	10 km2	100
High	6	1 km2	6	2 km2	12	3 km2	18
Medium	3	2 km2	6	10 km2	30	2 km2	6
Low	2	3 km2	6	3 km2	6	1 km2	2
Very Low	1	10 km2	10	1 km2	1	0 km2	0
Sum Score			28		49		126
Catchment Area & Score		25 km2	1.12	25 km2	1.96	25 km2	5.04
		15 km2	1.87	20 km2	2.45	25 km2	5.04
		25 km2	1.12	20 km2	2.45	15 km2	8.4

Appendix J: Level of Naturalness Criteria - N14 Conservation Status of adjoining land

Table 24: Environmental Parks - Developed from the Parks Strategy 2012

Park ID	Park Name	Park ID	Park Name	Park ID	Park Name
533	Albert Valley Park	1177	Cochrane's Bridge Park	968	Hogan Park
535	Alexander Watt Park	738	Cockatiel Park	709	Homestead Park (Jimboomba)
1193	Alfred Shailer Park	101	Collie Park	962	Horseshoe Park
13	Anakie Park	898	Collins Park	207	Hubner South Park
17	Archery Park	103	Columbia Park	1004	Hughes Park
969	Aviemoore Park	109	Cooberrie Park	819	Huntingdale Reserve
540	Bahrs Scrub Estate Park	110	Coorang Park	602	Jasmina Park
541	Bahrs Scrub Parklands	114	Cornubia Forest Park	955	Jerry's Downfall Reserve
977	Baker Reserve	118	Crescent Park	890	Joadie Park
542	Barber Court Reserve	121	Cronulla Park	1192	John Markwell Park
33	Bayes Park	124	Daisy Hill Conservation Park	1137	Joy Park
360	Beenleigh-Redland Bay Rd Env. Park	935	Dandaraga Reserve	26	Juanita Park
476	Bega Road Park	470	Demeio Park	938	Jude Lookout
491	Berrinba Wetlands Park	130	Demeio Road Park	221	Jules Park
1166	Birnam Range Reserve	1009	Dennis Park	1112	Kensington Park
724	Blackwood Reserve	856	Drover Reserve	229	Kilkenny Street Corridor
1157	Bluff Parkway	1100	Duncan Park	232	Kimberley Forest Park
1141	Bluff Reserve	925	Dungaree Park	233	Kimberley Grove Park
994	Bombala Reserve	1093	Durigan Park	959	Kings Park
53	Boronia Bushland Reserve	945	Edelsten Reserve	236	Kingston Rd Scrubby Ck Park
1005	Bottlebrush Park	953	Edgewater Park	804	Klipspringer Park
796	Briner Park	581	Edward Courbould Reserve	238	Koolan Park
910	Brown Beech Park	1061	Eildon Park	862	Kooruhman Park
711	Brumby Wallow Park	961	Fern Park	499	Kruger Park
1031	Brushwood Park	478	Ficus Park	240	Kununurra Park
1168	Buccan Conservation Park	164	Fischer Park	1220	Kuranda Reserve
765	Buccan Reserve	722	Flagstone Creek Reserve Park	243	Lake Dennis
1010	Burnett Park	928	Flessner Reserve	490	Lakeside Park
68	California Creek Corridor	169	Forestdale Bushland Park	690	Lance Road Park
67	California Creek Linear Park	858	Fraser Park	609	Laura Anne Drive Reserve
908	Callistemon Park	174	Gavin Park	931	Laurina Park
763	Camel Reserve	586	Gaynor Reserve	930	Laurina Park Drive
1062	Campbell Park	175	Gillian Park	254	Leslie Parade Park
73	Carbrook Wetlands	803	Glen Park	932	Lilly Reserve
74	Carinya Park	178	Glenvale Park	257	Lilygreen Park
950	Carter Laneway	1076	Glynton Park	613	Lima Park
562	Carter Park	885	Golden Grove Park	1114	Lindesay Park
1153	Cascara Reserve	1013	Goodna Park	260	Lisbeth Park
926	Cassowary Park	944	Grassway Park	725	Logan Village Park
1116	Cattle Camp Reserve	1199	Greenbank Recreation Reserve	1180	Logan West Parklands
79	Cavillon Park	973	Greenvale Park	1154	Logyard Park
747	Cedar Creek Reserve	477	Greenwood Lakes	1044	Lorikeet Park
700	Cedar Grove Park	943	Hall Park	617	Luscombe Park
1082	Cedar Vale Reserve	1026	Harrison Reserve	783	Lyndale Reserve
1224	Cerina Park	887	Hastings Reserve	619	Mahogany Reserve
1148	Chadwick Park	947	Hawkins Reserve	939	Marsh Park
1068	Chambers Flat Park	1133	Henderson Reserve	622	Mathews Park
83	Chambers Flat Road Park	592	Hendrix Street Reserve	287	Maximir Park
85	Chantilly Park	594	Herses Park	844	Mctaggart Reserve
1219	Coalstoun Park	199	Hideaway Mountain Bushland Reserve	291	Meakin Park

Park_ID	Park_Name	Park_ID	Park_Name	Park_ID	Park_Name
292	Meakin Road Scrubby Creek	956	Rose Almond Drain	684	Wolfdene North Reserve
1121	Millstream Park	652	Rosemount Reserve	685	Wolfdene South Reserve
297	Minutus Park	838	Rossmore Reserve	1008	Woodfall Park
299	Moffatt Park	721	Samuel & Agnes Smith Park	686	Wuraga Parklands
952	Monmouth Park	1176	Saunders Park	830	Wyatt Park
732	Mount Elliot Park	655	Schmidt Park	1159	Yellowstone Park
1167	Mt Perry Conservation Park	656	Schneider Road Reserve		
628	Mt Warren Oval Park	1077	Scott Laneway		
305	Murrays Environmental Reserve	916	Scribbly Gum Reserve		
308	Nealdon Park	388	Scrubby Creek Corridor Park		
309	Neville Lawrie Reserve	1164	Serengetti Park		
851	New Beith Park	660	Sharon Park		
631	Nexus Reserve	661	Skene Road Park		
310	Noffke Park (Meadowbrook)	1103	Skyline Park		
312	Nujooloo Road Slacks Creek	402	Slacks Creek Environmental Park		
315	O'gorman Park	702	Spring Mountain Forest Park		
1017	Old Pub Lane Park	854	Spring Mountain Park		
1039	Olson Park	703	Spring Mountain Reserve		
636	Olympic Park	410	Springwood Conservation Park		
638	Overland Reserve	720	Stockleigh Environmental Park		
639	Overland Reserve East	663	Stubbin Reserve		
870	Pakenham Park	1125	Sugarwood Reserve		
327	Paradise Road Drain	755	Swanborough Reserve		
328	Pardoo Park	1086	Sycamore Reserve		
640	Park Lane Parklands	942	Sylvan Reserve		
333	Parker Park	835	Tall Timber Park		
1183	Parrot Reserve	666	Tallagandra Rd Park		
1057	Payne Park	712	Tea Tree Waterhole Park		
1064	Philippa Park	1107	Teak Park		
642	Pimpama Street Park	927	Thomas Park		
791	Pineview Park	743	Thornbill Reserve		
1184	Platypus Reserve	671	Thwaites Reserve		
1169	Plunkett Conservation Park	794	Tigercat Park		
749	Plunkett Historical Cemetery	872	Travis Reserve		
820	Pole Park	983	Tremayne Reserve		
348	Priests Gully Park	852	Tuggerah Park		
988	Pub Lane Park	761	Tully Reserve		
924	Quandong Park	730	Undullah Reserve		
353	Queens Road Scrubby Creek	745	Veivers Park		
767	Quinzeh Creek Gravel Reserve	1119	Victoria Park		
727	Quinzeh Creek Park	900	Virginia Park		
753	Randle Reserve	912	Walkabout Park		
923	Red Ash Reserve	698	Wearing Park		
896	Red Gum Reserve	36	Wedgewood Park		
1012	Remmington Park	718	Wendt Park		
719	Richard Wilson Park	461	West Carbrook Park		
370	Ridgepointe Park	1128	Wharf Park		
371	Riedel Park	1172	Wickham Forest Reserve		
964	River Oak Drain	1170	Wickham Timber Reserve		
1198	Roberts Park	815	Willandra Park		

Appendix K: Level of Naturalness Criteria - N15 Litter Hot Spots

Please refer to the original Document DM# 6208887

Table 25: Litter Hot Spot Investigations

Pathway	Title	Code
Cafes/Restuarants	Footpath dining permit	FDIN
	Takeaway Food	116
	Café/Restaurant	112
	Food Shop	FS
Charitable Bins	Charitable Bin Donations	ZPHCHARBIN
GIS Layers		
GIS Layers	Title	Location
GPTs	Selection of GPT devices in Logan (refer to DM# 8090029)	W:\CityWorks\Infrastructure\sw_pits.TAB - query out GPTs
SQIDs	All of the WSUD and SQID devices Jack recorded	W:\DevHltEnv\PlanEnvPol\Editing\Kate\prioritisationtool\STD\LatestWSUDassetregister_JackApril2012\Edited\LatestWSUDAssetRegisterSW12012_ed.TAB
		W:\DevHltEnv\PlanEnvPol\Editing\Kate\prioritisationtool\STD\LatestWSUDassetregister_JackApril2012\Edited\LatestWSUDAssetRegisterPrivate2012_ed.TAB
Street Bins	A number of Bins types to be looked at - need to be extracted from pathway	W:\DevHltEnv\PlanEnvPol\Editing\Kate\prioritisationtool\STD\LatestWSUDassetregister_JackApril2012\Edited\LatestWSUDAssetRegisterMisc2012_ed.TAB
		W:\DevHltEnv\PlanEnvPol\Editing\Kate\prioritisationtool\STD\LatestWSUDassetregister_JackApril2012\WSUD_Asset_Katie_Nov2012.TAB
Transport Hubs	Bus routes and stops	Extract from Pathway - Michael Davies did on 1/11/12 Refer to Excel Sheet DM#8084133 - location by property key
	Train Stations	W:\CityWorks\TechServ\Transport\Bus_Stops.TAB W:\CityGovPolCoord\StratServ\Editing\Planning Scheme Mapping\Strategic Framework\Transport\Transport_Existing_Rail.TAB
Commercial Zone	Planning Scheme zoning - industrial, retail, commercial	PS13_Base_split
Educational Institutions	Schools, University, TAFE	W:\CorpServ\InfoSysServ\LGReform\GCCC\Schools_GCCC.TAB
		W:\CorpServ\InfoSysServ\LGReform\BSC\Schools_BSC.TAB W:\ComServ\Sport_Rec\Schools.TAB
Sport	Sports facilities - ovals	W:\ComServ\Parks\Project_Data\ParkS_Strategy_2012\Parks_Network\PSX_Parks_Network.TAB
	BMX & skate parks	http://www.logan.qld.gov.au/facilities-and-recreation/sport-and-leisure/bmx & http://www.logan.qld.gov.au/lcc/logan/sportrec/skateparks.htm List below
	Boat Ramps	List below
Hospitals	Logan Hospital - Cnr Armstrong & Loganlea Roads, MEADOWBROOK, 4131	
High Use Parks	Parks Strategy and High Litter Parks	See Below for on ground list
High Use Roads	Roads Hierarchy - use high & very high, count is 1:1km of road.	W:\DevHltEnv\PlanEnvPol\Editing\Renee_RAW\Wildlife_Barrier_Mitigation\Version2\Data\Roads\Road_Blocks_Buff_Sides.tab

Table 26: Parks Notes on Litter

Hot spot contributors	Logan area- boystown contractors	Zone 2 Verge Mowing	
skate facility,	skate bowls,	Millers rd- Underwood Rd	very low, medium
Sports Club,	all of parks,	Logan Rd- Underwood Rd - the M1	New beith Road
boat ramp	basketball courts and	The whole of Baker St	Bardon Road
shopping centre	some cricket nets	Compton Rd from Logan Rd to Railway line at Allingham St	Loganlea Rd from Pacific Hwy to Armstrong Rd.
		Kingston Rd	Queens St
		Wembley Rd	Paradise Rd
Park Id	Name	Address	Suburb
442	Underwood Park	982-1006 Underwood Road	Priestdale
419	Sutton Park	18 Basie Court	Browns Plains
453	Waller Park	1-45 Waller Road	Browns Plains
465	Woodridge Adventure Park	173-193 Kingston Road	Woodridge
472	Sturdee Park	73 Station Road	Loganlea

120	Crestmead Park	26 Lilly pilly creek	Crestmead
828	Village Green	18-22 Wharf Street	Logan Village
723	Jimboomba Park	1-17 South Street	Jimboomba
574	Doug Larsen Park	41-61 Logan road	Beenleigh
567	Chris Green Park,	39 Boundary Street	Beenleigh
616	Logan River Parklands	Lot 2 pacific highway	Beenleigh
598	Hugh Muntz Gardens	Reisers Road	Beenleigh
532	Albert River Park	35 Distillery Road	Eagleby
634	Noyer Park	Beaudesert beenleigh road	Mount Warren Park
728	Activity Park	49 Kaiser Road	Windaroo
562	Carter Park	77 Bannockburn Road	Bannockburn
535	Alexander Watt Park	28 Richland Drive	Bannockburn
583	Federation Dr Reserve	Federation Drive	Bethania
310	Noffke Park	111-129 Armstrong Road	Meadowbrook
611	Leighton Fields	10-18 Loane Drive	Edens Landing
578	Eddy Avenue Park	123 Castile Crescent	Edens Landing
681	Willow Park	14 Buller court	Beenleigh
582	Emerald Park	36-38 Crest Street	Beenleigh
530	Adelaide Circuit Park West	13 Adelaide Circuit	Beenleigh
546	Beenleigh Arena	2-36 Milne Street	Mount Warren Park
83	Chambers flat road park	13-33 chambers flat road	Marsden
180	Gould Adams Park	558-612 Kingston road	Kingston
401	Slacks Creek 1	70-72 Moss street	slacks creek
97	coffey park	2-78 Bayliss road	Crestmead
34	Bayliss Park	2-78 Bayliss road	Crestmead
312	Nujooloo Rd Slacks Crk	19-25 Nujooloo Road	slacks creek
269	Loganlea Picnic Grounds	2-22 Golf Course Drive	Meadowbrook
254	Leslie Parade Park	31-33 Leslie Parade	slacks creek
305	Murrays Env'mental Reserve	23-35 Murrays Road	slacks creek
364	regents park	21-23 Bennett drive	regents park
Prop_key	Description	Address	Suburb
206388	Marsden Library/Shopping Centre/Scrubby Creek	57-77 Chambers Flat Road	Marsden
197422	Gould Adams Park	558-612 Kingston Road	Kingston
188732	SLACKS CREEK 1		Slacks Creek
188745	SLACKS CREEK 1		Slacks Creek
270009	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270010	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270011	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270017	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270002	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270003	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270004	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270005	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270006	Creek Line from Loganlea Road to Murrays Environmental Reserve		
270012	Creek Line from Loganlea Road to Murrays Environmental Reserve		
Park Id			
401	SLACKS CREEK 1		Slacks Creek
97	coffey park	2-78 Bayliss road	Crestmead
34	Bayliss Park	2-78 Bayliss road	Crestmead
Fishing line Issue - add to litter hot spot list			
371	Riedel Park	Riedel Road	Carbrook
477	Greenwood Lakes	Paradise Road	Forestdale
718	Wendt Park	Wendt Road	Chambers Flat
85	Chantilly Pk	Excalibur Road	Cornubia
1135	Glenlogan Lakes	Alannon Place	Jimboomba

637	Oppermann Park	Federation Drive	Bethania
493	Berrinba Wetlands	Fifth avenue	Berrinba
470	Demeio Park	Demeio Road	Marsden
1178	Lions Riverside Pk	Cusack lane	Jimboomba
535	Alexander Watt Park	28 Richland Drive	Bannockburn
574	Doug Larsen Park	41-61 Logan road	Beenleigh
Boat Ramp - already included			
400	Skinner's Park	skinner road	Carbrook
423	Tansey Park	Tansey Dr	Tanah Merah
608	Larry Story Park	Albert Street	Waterford
710	Henderson Park	Henderson St	Logan Reserve
583	Federation Dr Reserve	Federation Drive	Bethania
Pontoon - add to boat ramp list			
10	Alexander Clark Park	Dewar Dr	Loganholme
440	Tygum Park	Tygum Rd	Waterford West
721	Samuel & Agnes Smith Park	Waterford-Tamborine Road	Buccan
372	Riverdale Park	Armstrong Rd	Meadowbrook
577	Eagleby Wetlands	Logan Street	Eagleby
532	Albert River Park	Ramu Street	Eagleby
535	Alexander Watt Park	Old Mill Road	Bannockburn
616	Logan River Parklands	Lot 2 pacific highway	Beenleigh
442	Underwood Park	982-1006 Underwood Road	Priestdale
1181	Lawrence Park	Wharf Road	Eagleby
		Already in Boat Ramp list	
		Already in litter hot spot list above	

Table 27: BMX Parks

<http://www.logan.qld.gov.au/facilities-and-recreation/sport-and-leisure/bmx>

Suburb	Park name	Address
Beenleigh	Doug Larsen Park	33 - 35 Boundary Street
Boronia Heights	Tovey Park	Parklands Drive
Browns Plains	Waller Park	Waller Road
Cornubia	Cornubia Forest Park	Parkview Crescent
Crestmead	Crestmead Park	Gimlet Street
Kingston	Eridani Park	Eridani Avenue
Meadowbrook	Nealdon Park	Meakin Road
Priestdale	Underwood Park	Underwood Road
Underwood	Akers Park	Dorinda Crescent
Woodridge	Elm Park	Elm Avenue
Woodridge	Woodridge Adventure Park	Kingston Road

Table 28: Skate Parks

<http://www.logan.qld.gov.au/facilities-and-recreation/sport-and-leisure/skate>

Suburb	Park name	Address
Beenleigh	Doug Larsen Park	Logan Street
Bethania	Federation Drive Reserve	Federation Drive
Boronia Heights	Highland Park	Eugene Street
Boronia Heights	Tovey Park	Parklands Drive
Browns Plains	Waller Park	Waller Road
Crestmead	Crestmead Park	Gimlet Street
Crestmead	Coffey Park	Coffey Street
Eagleby	Albert River Park	Ramu Street
Edens Landing	Chatfield Park	Lindau Street
Greenbank	Ison Park	Ison Road
Jimboomba	Jimboomba Park	South Street
Logan Village	Village Green	River Street
Loganholme	Tudor Park	Clarks Road
Marsden	Pauline Park	Pauline Street
Munruben	Wearing Park	Greenhill Road

Priestdale	Underwood Park	Underwood Road
Rochedale South	Karoonda Park	Karoonda Crescent
Shailer Park	Roselea Park	Roselea Street
Springwood	Barbaralla Park	Barbaralla Drive
Windaroo	Activity Park	Ernest Street
Woodridge	Oates Park	Oates Avenue
Woodridge	Woodridge Adventure Park	Kingston Road (Corner of Smith Road)

Table 29: Street Bins

Service code	Service Desc	SumOfnumber of services	Michael Davies description
CM1000W	Com. 1000L Ind. Waste	1	Commercial - Private
CM1100R	Com. 1100L Ind. Recycling	8	Commercial - Private
CM1100W	Com. 1100L Ind. Waste	2	Commercial - Private
CM1500W	Com. 1500L Ind. Waste	5	Commercial - Private
CM2000W	Com. 2000L Ind. Waste	5	Commercial - Private
CM3000W	Com. 3000L Ind. Waste	4	Commercial - Private
CP1100R	Council Prop 1100L Ind. Recycling	10	Council Property - Private
CP140W	Council Prop 140L Waste	1	Council Property - Private
CP1500W	Council Prop 1500L Ind. Waste	7	Council Property - Private
CP2000W	Council Prop 2000L Ind. Waste	6	Council Property - Private
CP240R	Council Prop 240L Recycle	15	Council Property - Private
CP240W	Council Prop 240L Waste	28	Council Property - Private
CP3000W	Council Prop 3000L Ind. Waste	5	Council Property - Private
CPOA140W	Council Prop Outdoor Area 140L Waste	1	Council Property Outdoor Area - Public Use
CPOA240W	Council Prop O/Door Area 240L Waste	6	Council Property Outdoor Area - Public Use
CS1000W	C/Serv 1000L Ind. Waste	13	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS1100R	C/Serv 1100L Ind. Recycling	3	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS1100W	C/Serv 1100L Ind. Waste	6	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS1500W	C/Serv 1500L Ind. Waste	34	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS2000W	C/Serv 2000L Ind. Waste	20	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS240R	C/Serv 240L Recycle	19	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS240W	C/Serv 240L Waste	163	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
CS3000W	C/Serv 3000L Ind. Waste	18	Community Service - Public (e.g Soccer Field, Scout/Girl Guides)
DOG60	Park 60L Dog Waste Litter Bin	75	Dog Droppings - Public Use
PK140W	Park 140L Waste Wheelie Bin	12	Parks - Public Use
PK240R	Park 240L Recycle Wheelie Bin	6	Parks - Public Use
PK240W	Park 240L Waste Wheelie Bin	316	Parks - Public Use
PK60W	Park 60L Litter Bin	388	Parks - Public Use
STR140W	Street 140L Waste Wheelie Bin	2	Street litter - Public Use
STR240W	Street 240L Waste Wheelie Bin	13	Street litter - Public Use
STR60W	Street 60L Litter Bin	382	Street litter - Public Use
Grand Total		1574	

Stormwater treatment devices

SQID_Private by Asset_Type	
■	Bioretention Basin (3)
■	Bioretention (2)
■	Bioretention Basin (47)
■	Bioretention Basin (204)
■	Bioretention Pod (5)
■	Bioretention Swale (40)
■	Bioretention/ Detention (1)
■	Bioretention/ Detention Basin (1)
■	Bioretention Swale (1)
■	Bioretention Basin (2)
■	Dam (4)
■	Detention (49)
■	Detention Basin (4)
■	Detention (1)
■	Ecosol RSF 100 (2)
■	Ecosol RSF 4000 (1)
■	GPT (36)
■	Humceptor STC3 (1)
■	Hydrofilter HF100 (1)
■	Infiltration (2)
■	Litter basket (5)
■	Many, see notes (1)
■	Pond/ Lake (2)
■	Potential Bioretention (1)
■	Potential Bioretention Swale (3)
■	Retention Basin????? (1)
■	Retention Tank????? (1)
■	Stormwater 360 Enviropod (8)
■	Swale (16)
■	Wetland (1)

SQID_LCC by Asset_Type	
■	Bioretention (38)
■	Bioretention Basin (29)
■	Bioretention Swale (33)
■	Bioretention (2)
■	Detention (19)
■	Detention Basin (5)
■	Detention/ Infiltration (1)
■	Drainage Cell (1)
■	GPT (19)
■	Pond (6)
■	Sediment Basin (2)
■	Swale (18)
■	Wetland (13)

SW pits		
Energy Dissipater	DRFA	4
Extended Rock Detention Basin	DRDA	7
Extended Sleeper Detention basin	DRDB	20
Major Gross Pollutant Trap	DRDA or blank	45
Minor Gross Pollutant Trap	DRBB or blank	118
Oil/Sediment Separator	DRCA	4
Sediment Settlement Basin	DREA or blank	13
Trash Racks - Offline	DRAB	3
Trash Racks - Online	DRAA or blank	5
Suspected Sqid	blank	4
		223

Appendix L: Level of Naturalness Criteria Matrix

For original please refer to [LCC DOCS-#6208887-Waterway Rehabilitation Prioritisation Tool WRPT level of naturalness and risk profile matrix](#)

Please see next page for

Table 30: Level of Naturalness Criteria Matrix

	Parameter	Sub-parameter	Criteria	Criteria Description	Unit	Weighting	Naturalness Criteria Score Cut Offs				
							No or Very Low	Low	Medium	High	Very High
							0	1	2	3	4
N1	Waterway Management & Modification	Flow Modification	Drainage Network	% of the catchment drainage network is piped	%	4	>=95.25	55.75-95.25	16.11-55.75	3.9-16.11	<3.9
N2	Waterway Management & Modification	Flow Modification	In-stream Barriers	# of waterway barriers per km of waterway	#/km	6	>=3.76	1.53-3.76	0.65-1.53	0.24-0.65	<0.24
N3	Waterway Management & Modification	Flow Modification	Water Extraction	Currently no data available		0	0	0	0	0	0
N4	Waterway Management & Modification	Channel Modification	Stormwater Outlets	# of stormwater outlets per km of waterway	#/km	5	>=22.8	7.66-22.8	2.78-7.66	0.61-2.78	<0.61
N5	Waterway Management & Modification	Channel Modification	Channel Type	Waterway Modification Score (which is the weighted ratio of natural, grass, rock & concrete channel) per waterway length	Score/km	8	<54	54-73	73-85	85-93	>=93
N6	Water Quality	Land Use Pollutants	Potential Instream Load	Potential Instream Pollutant Load Score (which uses natural break for TSS, TN, TP and GP Loads) per catchment area	Score/km2	8	<4	4-9	9-12	12-15	>=15
N7	Water Quality	Land Use Pollutants	ERA Properties	ERA Emission Score (Weighted ratio of ERA type along the waterway & adjacent to a park) per waterway length	Score/km waterway	8	>=999	470-999	83-470	5-83	<5
N8	Water Quality	Infrastructure Pollutants	Sewage Treatment	Sewage Load Score (weighted ratio of different sewage sources) per catchment area	Score/km2	6	>=776	244-776	68-244	17-68	<17
N9	Water Quality	Infrastructure Pollutants	Road Runoff	Road Pollution Score (weighted road area based on car use) per catchment area	Score/km2	5	>=42	21-42	8-21	3-8	<3
N10	Natural Environment	Habitat & Biodiversity	Weeds	# of properties with NOX records along a waterway per km of waterway	#/km	5	>=15.58	6.15-15.58	2.06-6.15	0.37-2.06	<0.37
N11	Natural Environment	Corridors, Buffers & Stabilisation	Bank Stability	% of land within 5m of waterway containing vegetation	%	13	<2.394	2.394-37.194	37.194-58.214	58.214-78.434	>=78.434
N12	Natural Environment	Corridors, Buffers & Stabilisation	Vegetation Buffers	% of land within 75m of waterway containing vegetation	%	8	<0.801	0.801-31.526	31.526-50.058	50.058-71.193	>=71.193
N13	Natural Environment	Corridors, Buffers & Stabilisation	Vegetation Cover	% of catchment vegetated per catchment area	%	6	<1.218	1.218-32.231	32.231-50.271	50.271-76.403	>=76.403
N14	Land Use & Human Activity	Accessibility & Use	Conservation Land	% of waterway length adjoining conservation park	%	5	<0.13	0.13-3.684	3.684-11.775	11.775-31.946	>=31.946
N15	Land Use & Human Activity	Accessibility & Use	Litter Hot Spots	Weighted score of litter hot spots adjacent to a waterway per km of waterway	score/km	4	>=64.88	45.26-64.88	8.9-45.26	1.78-8.9	<1.78
N16	Land Use & Human Activity	Land Development	Extraction Sites	% of disturbed land from extraction within 75m of waterway	%	9	>=25.857	25.857-25.857	4.423-25.857	0.207-4.423	<0.207

100

	E	D	C	B	A
Level of Naturalness Class	<150	150-259	259-309	309-348	>=348

Appendix M: Risk Profile Criteria

General Principles	<ul style="list-style-type: none"> ♦Threat Criteria are generally considered to be factors that could potentially impact negatively on waterway naturalness. ♦Threat Criteria are generally catchment-based attributes that require a change or incident in order to become a threat to naturalness. ♦For Threat Criteria to be relevant, they must be definable by an element of likelihood and consequence of an occurrence. 	
Categories & Sub-criteria	<ul style="list-style-type: none"> ♦Waterway Management & Modification: <ul style="list-style-type: none"> - Water Quality Improvement - Flood Mitigation ♦Water Quality <ul style="list-style-type: none"> - Point Source Pollutants - Diffuse Source Pollutants ♦Natural Environment <ul style="list-style-type: none"> - Habitat & Biodiversity - Corridors, Buffers & Stabilisation ♦Land Use & Human Activity <ul style="list-style-type: none"> - Accessibility & Use - Land Development 	
Waterway Management & Modification		
Water Quality Improvement		
Parameter	Reasoning	Score Criteria
R1 - Stormwater Treatment Devices	<ul style="list-style-type: none"> ♦Polluted stormwater runoff from a catchment is a threat to water quality and SQIDs, particularly devices other than GPTs, are a means of reducing this threat. The presence of SQIDs is therefore an indicator of the level of threat mitigation that has occurred in a catchment and conversely, can also be used as a measure of the level of threat that remains. ♦GPTs primarily remove only litter and not other pollutants such as nutrients and sediment, which also influence overall water quality. ♦The contribution of GPTs to improving water quality over the long term is questionable as effectiveness is entirely dependent on maintenance and poorly maintained GPTs have been reported to contribute to worsening of water quality. ♦ Only very small parts of the Logan City area are treated by SQIDs (other than GPTs) that remove sediment and nutrients such as bio-retention facilities. ♦ This criterion uses the catchment of GPTs, Private WSUD and Public WSUD. These treatment catchments may cover an area over multiple creek catchments; therefore these are split along the catchment boundary. This split is due to calculating the area of treatment not where the water is flowing too. 	<p>% of the catchment that has no stormwater treatment</p> <p>Higher the % the higher the Risk</p> <p>Formula = $\frac{[(Catchment\ area\ km^2 - treatment\ area\ km^2)]}{catchment\ area\ km^2} * 100$</p>
Flood Mitigation		
R2 - Flooded Properties	<ul style="list-style-type: none"> ♦The flooding of properties is likely to trigger the undertaking of flood mitigation works which will impact on waterway naturalness. ♦The likelihood of flood mitigation works occurring is related not just to the % of the catchment that floods but more so to the types of properties that flood. ♦ Therefore this criterion has different weightings for different zoned flood properties. ♦ Weightings - Not flooded = 0, flooded and rural = 1 and flooded and urban = 5; these weightings are based on the assumption that if there is flooding in an urban area there will be more complaints and the area is more likely to undergo mitigation works which have the potential to cause risk to waterways. The weighting increased from 2: urban & 1: rural as the map is picking up the Logan and Albert River as very high and did not account for the urban areas. 	<p>Flood mitigation score (weighted on urban or rural zone) per catchment area</p> <p>Higher the # the higher the Risk</p> <p>Formula = $\frac{[(Urban\ area\ flooded\ km^2 * urban\ weighting) + (Rural\ area\ flooded\ km^2 * rural\ weighting)]}{catchment\ area\ km^2}$</p>
Water Quality		
Point Source Pollutants		
Parameter	Reasoning	Score Criteria
R3 - Contaminated Sites	<ul style="list-style-type: none"> ♦ The occurrence of contaminated sites within a catchment is a potential threat to the waterway naturalness. ♦ The Contaminated Land Register (CLR) is a register of 'risk' sites - proven contaminated land which is causing or may cause serious 	# of contaminated properties per catchment area

	<p>environmental harm.</p> <ul style="list-style-type: none"> ♦ 'Contaminated land' refers to land contaminated by hazardous substances (such as arsenic, DDT, or oil) which may pose a risk to human health or the environment. ♦ The Environmental Management Register (EMR) is a land-use planning and management register. Land that has been or is being used for a notifiable activity, and about which the department is notified, is recorded on the EMR. ♦ Properties are counted as a proportion of the property in the catchment 	<p>Higher the # the higher the Risk</p> <p>Formula = <i>Total properties classified as contaminated / catchment area km2</i></p>
R4 - ERA Licences	<ul style="list-style-type: none"> ♦The presence of ERAs within a catchment represents a potential threat to waterway naturalness if there is an incident that results in an unauthorised discharge to the environment. ♦Operation of an ERA does not in itself necessarily mean a greater impact on the environment but it means there is a greater threat of an impact occurring. ♦ERAs involving licensed discharges to waterways represent both a decrease in waterway naturalness as well as a threat to further degradation of waterway naturalness. ♦ Notifiable Activities - are identified as likely to cause land contamination and are listed in Schedule 3 of the EPA 1994. Land that has been or is being used for a notifiable activity is recorded on the Environmental Management Register. These sites are covered under Risk Criteria 3 Contaminated Sites. ♦ A number of documents have been used to determine a weighted ratio for the different ERAs, please refer to Appendix G for more information. ♦ ERA emission score is based on the ERA list under the Environmental Protection Regulation 2008 before 31 March 2013. ♦ Properties are counted as a proportion of the property in the catchment 	<p>ERA Emission Score - Weighted ratio of ERA type per catchment area</p> <p>Lower the score the higher the LON</p> <p>Formula = <i>Total (ERA prop* weighting)/ area of catchment km2</i></p>
R5 - Extraction Sites	<ul style="list-style-type: none"> ♦The presence of extraction activities within the broader catchment provides a measure of the level of threat to waterways naturalness in terms of the risk of erosion and sedimentation and other pollutants entering the drainage network. ♦ Extraction sites include - sand mining, tip disturbance and gravel. ♦ The areas of the disturbance was manually interpreted and developed from aerial photography, this could be improved in future GIS iterations 	<p>% of land within the catchment that is disturbed by extraction</p> <p>Higher the % the higher the Risk</p> <p>Formula = <i>(disturbed area km2/catchment area km2) *100</i></p>
R6 - Sewage Overflow	<ul style="list-style-type: none"> ♦There are currently 29 Sewage Discharge Outlets (SDO) and 58 Sewage Pump Stations (SPS) in Logan, the majority of them discharge via stormwater drainage to creeks or directly to creeks within Logan. Some overflows have been fitted with bunds or emergency storage. ♦The SDOs are designed components in the sewerage network where overflows occur. These overflows can occur in wet weather conditions from stormwater inflows or dry weather conditions from failure of pump stations and blockages. ♦Limited Dry weather events have occurred over the last 5 years due to improved SCADA and response time for dry weather situations. However the wet weather events occur often. ♦Pollutants from these structures include nutrients, bacteria, viruses and oxygen demanding substances ♦ The weighting of risk for the SPS and SDO is determined by the type of structure, Logan Waters Risk Assessment and previous spill data. The score is multiplied by 100 to round the number off. ♦ Refer to Appendix N for more information on weighting of these devices 	<p>Sewage Spill risk (weighted by risk assessment) per catchment area km2</p> <p>Higher the # the higher the Risk</p> <p>Formula = <i>[(SPS * weighting + SDO * weighting)/ catchment area]* 100</i></p>
Diffuse Source Pollutants		
R7 - Steep Slopes	<ul style="list-style-type: none"> ♦Steep slopes are a threat to waterway naturalness where erosion and sedimentation occurs. ♦The likelihood of erosion occurring is dependent upon a number of interrelated factors; e.g. soil type, exposure & geology. Due to the complexity of using these in one criterion, they have been separated into individual criteria. ♦ The steep slopes has been identified using ALS data & planning scheme 	<p>% of catchment classified as Steep Slope</p> <p>Higher the % the higher the Risk</p> <p>Formula =</p>

	and are areas > or = 15%.	<i>(Steep Slope Area km2/ catchment areakm2] * 100</i>
R8 - Erosion Risk	<ul style="list-style-type: none"> ♦Certain soil types and geology are more highly prone to erosion than others. ♦Highly erodible soils are a potential threat to waterway naturalness in that erosion can cause sedimentation and decreased water quality. ♦Catchments containing a high proportion of highly erodible soils are more of a threat to waterway naturalness than catchments containing less erodible soils. ♦ This criteria focuses on the Marburg formations, clays and silts from basalts, lamington volcanic, Walloon and Woogaroo Sandstone formations identified from a literature review of the Logan and Albert Region. ♦ Please refer to Appendix O for more information on erosion risk research 	<p>% of catchment classified as Highly Erodible Geology</p> <p>Higher the % the higher the Risk</p> <p>Formula = $(\text{Erodible area km}^2 / \text{catchment area km}^2) * 100$</p>
R9 - Bushfire Hazard Risk	<ul style="list-style-type: none"> ♦ Regular fires leaves the earth bare and increases the catchments erosive risk ♦ This criterion uses the medium & high bushfire hazard mapping from ALS & the Planning Scheme. 	<p>% of catchment classified as Bushfire Hazard Area</p> <p>Higher the % the higher the Risk</p> <p>Formula = $(\text{Bushfire Hazard Area km}^2 / \text{catchment area km}^2) * 100$</p>
R10 - Acid-Sulphate Soil Risk	<ul style="list-style-type: none"> ♦If Potential Acid-Sulphate Soil (PASS) and Acid-Sulphate Soil (ASS) is not managed properly it could harm surrounding waterways and hamper rehabilitation efforts ♦Once ASS is exposed to air, these soils produce sulfuric acid (battery acid), often releasing aluminium and heavy metals. These can leach into waterways, kill fish, other aquatic organisms and vegetation and can even degrade concrete and steel pipes and structures to the point of failure. ♦ This criterion uses the medium & high bushfire hazard mapping from ALS & the Planning Scheme. 	<p>% of catchment classified ASS</p> <p>Higher the % the higher the Risk</p> <p>Formula = $(\text{ASS PASS area km}^2 / \text{catchment area}) * 100$</p>

Natural Environment

Habitat and Biodiversity

Parameter	Reasoning	Score Criteria
R11 - Weed Invasion	<ul style="list-style-type: none"> ♦The likelihood of noxious weeds (NOX) being introduced to a waterway is just as closely if not more closely related to the presence of weeds in upstream waterways than it is to the presence of weeds in a catchment. ♦Nevertheless, in the absence of more detailed data, it is considered reasonable to retain the use of reported weed invasion within the catchment as a possible threat to waterway naturalness. ♦Weeds can affect local ecology, waterway processes and even hydrological character of a catchment. ♦The data that exists are based on reports and is not the full extent of weeds within the catchment and the records are based on properties not exact location of the weeds. ♦ This criterion includes both private and public records. ♦ Using data since 01/01/2005 and counting multiple records individually. ♦ In the future this criteria can be enhanced by Council Officer knowledge of hot spots around LCC ♦ Properties are counted as a proportion of the property in the catchment 	<p># of properties with NOX records per catchment area</p> <p>Higher the % the higher the Risk</p> <p>Formula = $\text{NOX properties} / \text{catchment area km}^2$</p>

Waterway Buffers

R12 - Vegetation Clearing	<ul style="list-style-type: none"> ♦ This criterion measures the likelihood of vegetation clearing occurring in the catchment. ♦The less vegetation that is protected, the higher the threat that vegetation cover could be reduced through clearing in the future. ♦ Vegetation cover provides value in stabilising land within the catchment, reducing the erosion and sedimentation threat. ♦ Vegetation includes 2011 planning scheme vegetation management overlay, remnant, regrowth and Chris Power vegetation or ALS generated Vegetation. 	<p>% of vegetation unprotected in the catchment</p> <p>Higher the % the higher the Risk</p> <p>Formula = $(\text{Veg unprotected area km}^2 / \text{veg in$</p>
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		<i>catchment area km²)*100</i>
Land Use & Human Activity		
Accessibility and Use		
Parameter	Reasoning	Score Criteria
R13 - Litter Hot Spots	<ul style="list-style-type: none"> ♦The presence of litter hot spots within the broader catchment provides a useful measure of the level of threat to waterway naturalness. ♦Litter has numerous effects on the environment, physically, ecologically and visually. ♦The litter hot spots identified are both actual information from contractors and theoretical known hotspots, e.g. skate parks, shopping centres, takeaways and transport centres. ♦Refer to Appendix K for a list of litter hot spots 	<p># of litter hot spots per catchment area</p> <p>Higher the # the higher the Risk</p> <p>Formula = <i>Sum litter hot spots/ catchment area km²</i></p>
Land Development		
R14 - Projected Population Growth	<ul style="list-style-type: none"> ♦ Waterways in catchments projected to have high rates of population growth might be more at threat than catchments not projected to experience high rates of population growth. ♦ This will be based on data from the current population projection models being prepared for Council's new Planning Scheme. ♦This is based on an increase of population from 2011 to 2031 	<p>% increase in projected population growth within catchment</p> <p>Higher the % the higher the Risk</p> <p>Formula = <i>[(Pop 2031- Pop 2011)/ Pop 2011] * 100</i></p>

Appendix N: Risk Profile Criteria - R6 Sewage Overflows

Investigation into Sewage Overflow

- Weighting -
- 15 - SDO is a device designed to overflow
 - 10 - Top 20 SPS sites on LWA ranking or a WWTP outfall
 - 8 - SPS sites 21-40 on LWA ranking
 - 6 - SPS sites 41-60 on LWA ranking
 - 4 - SPS sites 61-80 on LWA ranking
 - 2 - SPS sites 81-88 on LWA ranking & history of spill
 - 1 - SPS has no record obtained of a spill

SDO Risk - calculated by Logan Water 2010 DM # 6461425, summarised in DM #6471941

SPS Spill - An analysis of SPS SCADA data in Logan North during 2009 and a storm event in 2010 DM# 59792509, summarised in DM #6471941

LWA Ranking - Ranking from the LWA developed Sewage Overflow Management Strategy #6845000, summarised in DM #7504551

Table 31: Weighting for Sewage Overflow Risk

Original Document #7504551

Weighting	Asset ID	Sewer Pump Station	SDO Risk	SPS Spill	LWA Ranking	Overflow too
15	SDO29463		2			Stormwater Drain to Logan River
15	SDO29817		5			Unnamed Tributary to Logan River
15	SDO29843		11			Scrubby Creek to Logan River
15	SDO29854					Scrubby Creek
15	SDO29859		2			Unnamed Tributary to Logan River
15	SDO29865		15			Scrubby Creek to Logan River
15	SDO29907		11			Priest Gully to Tingalpa Reservoir
15	SDO29921		8			Priest Gully to Tingalpa Reservoir
15	SDO29952		2			Into Logan River
15	SDO29972		1			Stormwater Drain to Logan River
15	SDO29976		8			Unnamed Tributary to Priest Gully
15	SDO30502		8			Priest Gully to Tingalpa Reservoir
15	SDO30509					Scrubby Creek
15	SDO30510		11			Priest Gully to Tingalpa Reservoir
15	SDO30511		6			Slacks Creek to Logan River
15	SDO30515					Into Logan River
15	SDO30516					Into Logan River
15	SDO30517					Open Drain
15	SDO30518					To Storm Water
15	SDO30519					To Storm Water Culvert
15	SDO30520					To Storm Water Culvert
15	SDO30521					To Storm Water Culvert
15	SDO30522					To Storm Water Pit
15	SDO30523					To Storm Water Manhole
15	SDO30524					To Storm Water Drain
15	SDO30525					To Storm Water Culvert
15	SDO30526					To Storm Water Culvert
15	SDO30527					
15	SDO30529					
15	SDO30530					
15	SDO30531					
15	SDO30532					
15	SDO30533					
15	SDO30534					
15	SDO30535					
15	SDO30536					
15	SDO30537					
15	SDO30538					
10	SPS29295	SPS02		53.74	1	Near creek line - from LCC lead to Scrubby

Weighting	Asset ID	Sewer Pump Station	SDO Risk	SPS Spill	LWA Ranking	Overflow too
10	SPS26323	SPS42			2	
10	SPS28404	SPS41		24.86	3	California Creek Corridor
10	SPS30121	WA02			4	0 Snedden Court
10	SPS28263	SPS46			5	
10	SPS02211	SPS13		44	6	near Schmidt's creek but not in drainage line
10	SPS29143	SPS48		29.83	7	to Bowman creek
10	SPS21842	SPS39			8	
10	SPS28282	SPS52			9	
10	SPS29379	SPS16		10.17	10	Drainage line to Logan River
10	SPS16653	SPS29		9.83	11	Drainage line to Schmidt's creek through Jame Fitzgerald park
10	SPS28414	SPS56			12	
10	SPS30105	SPS66			13	
10	SPS01697	SPS22			14	
10	SPS27932	SPS43			15	
10	SPS27943	SPS09		23.61	16	California Creek
10	SPS28400	SPS04		1.74	17	
10	SPS28409	SPS21			18	
10	SPS30123	WA05			19	1 Logan River Road
10	SPS19996	SPS40		18.33	20	Drainage line to logan river
10	WPC30192	Loganholme WWTP			na	
10	WPC30193	Beenleigh WWTP			na	
10	WPC30194	Logan Village WWTP			na	
10	WPC30195	Jimboomba WWTP			na	
10	WPC30196	Flagstone WWTP			na	
8	SPS09452	SPS24		21.96	21	Drainage line to logan river - horticulture dam
8	SPS29403	SPS10		0.02	22	
8	SPS28130	SPS32		1	23	
8	SPS27858	SPS50		82.6	24	Slacks creek catchment
8	SPS30153	DA07			25	234 Unnamed Road
8	SPS29464	SPS57			26	
8	SPS28309	SPS11		15.83	27	Drainage line to logan river - Danyenah Park
8	SPS30130	BE14			28	444 Pacific Highway
8	SPS28214	SPS33		6.6	29	
8	SPS30098	SPS61			30	
8	SPS28074	SPS44		3.84	31	
8	SPS30149	BE34			32	52C Carl Heck Boulevard
8	SPS28398	SPS17		8	33	Seaton Park beside Brisbane Sydney rail line
8	SPS30146	BE42			34	29 Wilhelm Drive
8	SPS28387	SPS53			35	
8	SPS29383	SPS59			36	
8	SPS27931	SPS55		11.4	37	Drainage line and pipe to logan river via Loganholme wetlands
8	SPS28395	SPS12		11	38	Drainage line to Slacks Creek
8	SPS26391	SPS28		12.71	39	Drainage line and pipe to logan river via Loganholme wetlands
8	SPS30135	BE20			40	1 River Hills Road
6	SPS30150	WA15			41	500 Eira Crescent
6	SPS28075	SPS45			42	
6	SPS28073	SPS08		6.17	43	
6	SPS28072	SPS38			44	
6	SPS29064	SPS47			45	
6	SPS02734	SPS27			46	
6	SPS30162	WA21			47	941 Black Diamond Crescent
6	SPS30147	BE08			48	7 Bardyn Halliday Drive

Weighting	Asset ID	Sewer Pump Station	SDO Risk	SPS Spill	LWA Ranking	Overflow too
6	SPS30163	WA04			49	118 Pimpama Street
6	SPS27872	SPS30		3.06	50	
6	SPS28050	SPS25		5.44	51	
6	SPS29022	SPS20		7.17	52	
6	SPS30156	WA17			53	501 Rochelle Court
6	SPS30126	BE19			54	7 Eagleby Road
6	SPS30107	SPS67			55	
6	SPS30129	BE15			56	71 Quarrian Crescent
6	SPS27859	SPS51		10.33	57	Drainage line to Slacks Creek
6	SPS29394	SPS05		8.24	58	Drainage line to logan river through Riverdale park
6	SPS30142	WA10			59	257 Benjul Drive
6	SPS30145	BE07			60	7 Bardyn Halliday Drive
4	SPS27220	SPS54		2.5	61	
4	SPS30118	SC03			62	454 Federation Drive
4	SPS30137	BE04			63	1 George Street
4	SPS30136	BE48			64	13 Main Street
4	SPS27844	SPS3			65	
4	SPS29062	SPS23			66	
4	SPS30139	BE13			67	4 Kokoda Street
4	SPS28327	SPS07		2.83	68	
4	SPS27843	SPS34			69	
4	SPS30160	BE47			70	1 Boundary Street
4	SPS30140	BE03			71	3 Boundary Street
4	SPS27833	SPS6			72	
4	SPS30099	SPS62			73	
4	SPS27893	SPS19			74	
4	SPS30148	BE36			75	996 Yvonne Crescent
4	SPS30132	BE01			76	2 Alamein Street
4	SPS30120	SC01			77	73 Turquoise Street
4	SPS02533	SPS18			78	
4	SPS30122	BE17			79	7 Bellfinch Road
4	SPS30127	BE37			80	71 Stoten Pathway
2	SPS28675	SPS1			81	
2	SPS30133	BE23			82	1 Ramu Street
2	SPS30124	WA11			83	328 Eddy Avenue
2	SPS30101	SPS63			84	
2	SPS30117	SC02			85	807 Turquoise Street
2	SPS30161	BE51			86	902 Teys Road
2	SPS30134	BE21			87	1 River Hills Road
2	SPS30144	BE11			88	382 Pacific Highway
2	SPS27560	SPS49		10.33	na	Minor Creek through golf course lakes to California Creek
1	SPS29480	SPS58			na	
1	SPS30102	SPS64			na	
1	SPS30103	SPS35			na	
1	SPS30104	SPS65			na	
1	SPS30106	SPS68			na	
1	SPS30108	SPS79			na	
1	SPS30109	SPS75			na	
1	SPS30110	SPS73			na	
1	SPS30111	SPS74			na	
1	SPS30112	SPS77			na	
1	SPS30113	SPS71			na	
1	SPS30114	SPS72			na	
1	SPS30115	SPS70			na	

Weighting	Asset ID	Sewer Pump Station	SDO Risk	SPS Spill	LWA Ranking	Overflow too
1	SPS30116	SPS78			na	
1	SPS30119	WA03			na	462 Edinburgh Drive
1	SPS30125	BE18			na	33 Wren Street
1	SPS30128				na	159 High Road
1	SPS30131	BE32			na	2 Pacific Highway
1	SPS30138				na	8 Main Street
1	SPS30141	BE22			na	2 Logan Street
1	SPS30143	BE12			na	37 Martens Street
1	SPS30151	BE39			na	996 Yvonne Crescent
1	SPS30152	WA16			na	901 Kummara Road
1	SPS30154				na	999 High Road
1	SPS30155	BE03A			na	3 Boundary Street
1	SPS30157	BE46			na	999 Albert Valley Drive
1	SPS30158				na	900 High Road
1	SPS30158				na	
1	SPS30159	WA20			na	900 Windaroo Road
1	SPS30164	JMSP-4			na	
1	SPS30165				na	
1	SPS30166	WA23			na	
1	SPS30167	JMSP-6			na	
1	SPS30168				na	
1	SPS30169				na	
1	SPS30171				na	
1	SPS30172				na	
1	SPS30173				na	

Appendix O: Risk Profile Criteria - R8 Erosion Risk

Table 32: Geology with higher potential to erode in Logan City Council Area

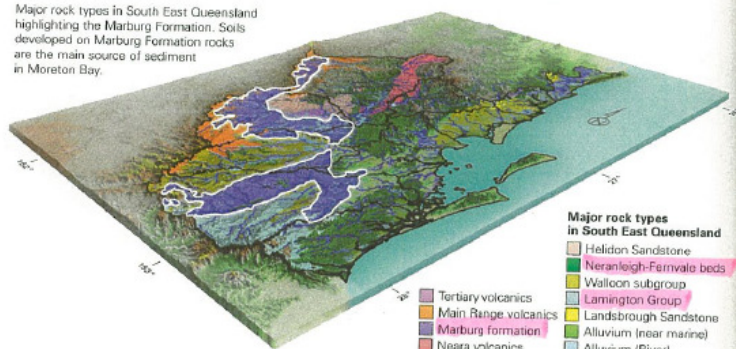
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Key	Rock Name	Area	Age	Lith Summary	Rock Type	Sequence no	Dominant Rock
5518	Gatton Sandstone	303.77	JURASSIC	Lithic labile and feldspathic labile sandstone	STRAT	1450	ARENITE
643	Heifer Creek Sandstone Member	1.33	JURASSIC	Sublabile to quartzose sandstone, siltstone, shale	STRAT	1450	ARENITE
10422	Beaudesert beds-Te3 (claystone)	2.07	TERTIARY	Claystone, sandstone, conglomerate, basalt, dolerite sills, minor carbonaceous shale	STRAT	706	ARENITE-MUDROCK
7769	Walloon Coal Measures	13.73	JURASSIC	Shale, siltstone, sandstone, coal seams	STRAT	1450	ARENITE-MUDROCK
10423	Beaudesert beds-Te1 (basalt)	5.05	TERTIARY	Basalt, dolerite sills, minor carbonaceous shale	STRAT	990	BASALT
5509	Eight Mile Plains Basalt Member	0.8	TERTIARY	Olivine basalt	STRAT	706	BASALT
10407	Tv/2-SEQ	0.42	TERTIARY	Basalt, minor volcanic breccia	STRAT	990	BASALT
8939	Tv-SEQ	1	TERTIARY	Mainly basalt flows	STRAT	706	BASALT
349	Corinda Formation	3.65	TERTIARY	Lacustrine and some fluvial greenish claystone, mudstone, siltstone, shale, minor limestone, intraformational conglomerate, fine argillaceous sandstone; basalt flows at top and bottom; (locally lateritised)	STRAT	706	MUDROCK
679	Ipswich Coal Measures	22.68	TRIASSIC	Shale, conglomerate, sandstone, coal, siltstone, basalt, tuff	STRAT	1560	SEDIMENTARY ROCK
10454	Marburg Subgroup-ferruginous oolite	0.31	JURASSIC	Oolitic ironstone	STRAT	1450	SEDIMENTARY ROCK
9132	Ts-SEQ	5.18	TERTIARY	Quartzose to sublabile sandstone, claystone, conglomerate, minor olivine basalt	STRAT	706	SEDIMENTARY ROCK
1545	Woogaroo Subgroup	82	TRIASSIC - JURASSIC	Quartzose sandstone, siltstone, shale conglomerate, coal	STRAT	1540	SEDIMENTARY ROCK

Healthy Waterways - Healthy Catchments

Soils developed on Marburg Formation rocks are the *main sediment sources*

Major rock types in South East Queensland highlighting the Marburg Formation. Soils developed on Marburg Formation rocks are the main source of sediment in Moreton Bay.



The modelling predicts that about 70% of the sediment is generated from subcatchments that occupy less than 30% of the region as a whole. This outcome is consistent with spatial tracing results, which show that most of the sediment produced in the Brisbane and Logan catchments originates from soils developed on Marburg Formation rocks.

The chemical properties of sediments can be used to determine their origins. This includes major and minor elements, as well as trace elements. Soils developed on major rock types normally

Catchment Soil End Member	% of soils derived from Catchment Soil End-Member		
	Central Bay	Southern Bay	Logan River
Marburg Formation	58 ± 9	54 ± 7	45 ± 7
Walloon Subgroup	13 ± 10	5 ± 1	3 ± 2
Neranleigh-Fernvale Beds	9 ± 9	13 ± 1	8 ± 9
Lamington Group	0 ± 1	3 ± 10	42 ± 8
Main Range Volcanics	19 ± 4	23 ± 7	0 ± 5
Neera Volcanics	1 ± 1	2 ± 2	2 ± 1

have distinct geochemical signatures, as do the sediments derived from them. Geochemical tracing therefore involves sampling all of the major source types, and determining the relative source contributions in the resultant mix of sediment deposited further downstream in a river, estuary, or bay.

Samples were collected from soils developed on all of the major rock types. Soil sample measurements were then used in a mixing model to estimate the relative contributions of the sources to the fine sediment deposited in the Bay. They show that the dominant source of sediment (>50%) is soils developed on Marburg Formation rocks. This outcome confirms that the fine sediment deposited in the central and southern parts of Moreton Bay comes from the Brisbane River.

Sediment collected from the mouth of the Logan River also originates mainly from the Marburg Formation (50%), but this sediment also has contributions from soils developed on Neranleigh-Fernvale Beds (21%), and Lamington Group volcanic rocks (17%).

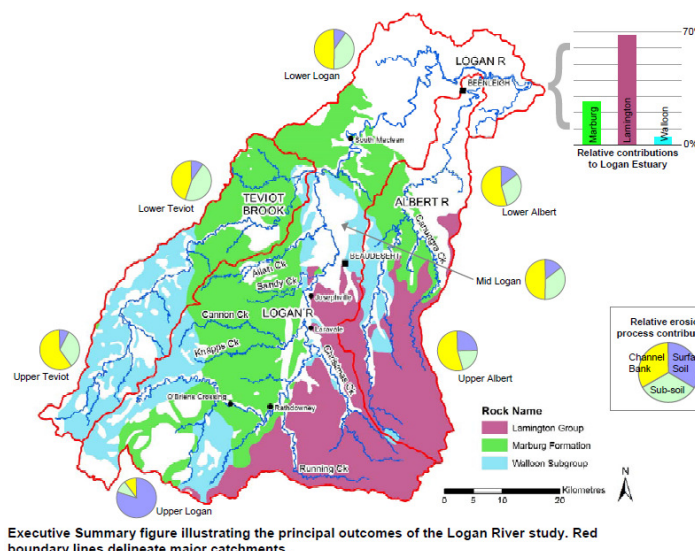
Hancock G and Caitcheon G 2010. **Sediment sources and transport to the Logan- Albert River estuary during the January 2008 flood event.** CSIRO: Water for a Healthy Country National Research Flagship.

Table 2. Proportions (as %) of sediment transported from the three major geological source areas in the Logan-Albert catchment to sediment deposition zones. Uncertainties are approximately one standard deviation. "Estuary (event)" refers to the sediment collected from the January 2008 flood event. "Estuary (long-term)" includes sediment collected from in-channel and bank deposition sites

Sediment deposition zone	Marburg	Lamington	Walloon
Estuary (event)	21 ⁺⁵ ₋₅	74 ⁺¹⁰ ₋₅	5 ⁺⁵ ₋₅
Estuary (long-term)	27 ⁺⁵ ₋₅	68 ⁺¹⁰ ₋₅	5 ⁺⁵ ₋₅
Lower Logan	16 ⁺¹⁰ ₋₅	75 ⁺¹¹ ₋₅	9 ⁺⁵ ₋₅
Upper Logan	0 ⁺¹⁰ ₋₅	87 ⁺⁵ ₋₅	13 ⁺⁵ ₋₅
Lower Albert	0 ⁺¹⁰ ₋₅	100 ⁺⁰ ₋₁₀	n.a.*
Upper Albert	0 ⁺⁵ ₋₅	100 ⁺⁰ ₋₅	n.a.*
Upper Teviot Brook	0 ⁺¹⁰ ₋₅	n.a.*	100 ⁺⁰ ₋₁₀
Lower Teviot Brook	25 ⁺¹⁰ ₋₁₀	n.a.*	75 ⁺¹⁰ ₋₁₀

n.a. These sources were not included in the mixing model since their spatial coverage in the catchment is very small or absent.

Three major rock types were selected (Figure 18); the Marburg Formation (9 surface soils samples), Lamington Group (10 samples) and the Walloon Subgroup (8 samples). Although other geological groups are present, the area covered by them is relatively small and they occur mainly in the lower catchment where rainfall, river flow velocities and hillslope gradients are relatively low. Thus it is unlikely that these parts of the catchment are contributing a significant amount of sediment to the estuary, and they have not been included in the analysis.



Executive Summary figure illustrating the principal outcomes of the Logan River study. Red boundary lines delineate major catchments.

Healthy Waterways: Non Urban Diffuse Waterways Restoration Project - Prepared by S Mooney, N Saxton & C Freeman 2008

Healthy Waterways: Non Urban Diffuse Waterways Restoration Project

Identifying Candidate Areas in each of the Three Priority Catchments

This brief outlines the process used in identifying candidate areas for the priority catchments of the Logan River, Bremer River and Lockyer Creek. Three candidate areas were chosen for each of the catchments. Further analyses and input will be required from regional and local committees to make a final selection of one candidate area for each catchment. The subsequent selection of one focal area within each candidate area will also be confirmed by the local and regional committees.

SEQ Catchments and the SEQ Healthy Waterways Partnership compiled available information (data sets) and reports as per the literature review and gap analysis component of the project. Biophysical, social and economic information were assessed and utilised to form the criteria for selection of candidate areas. The catchments were presented in a GIS platform as a series of maps, which depicted a series of information overlays.

EMSS and Sednet models have, in the past, been generated for the priority catchments that identify sub-catchments contributing sediment and nutrient loads to the receiving waterways of Moreton Bay. The modelled outputs were used as a first cut in identifying candidate areas. Sediments or total suspended solids information identified a number of suitable sub-catchments, where load contributions were highest. SEQ Healthy Waterways Partnership and WBM Oceanics Consulting have further prioritised EMSS and Sednet sub-catchments based on landuse and future scenarios. Prioritised sub-catchments were also considered for selection of candidate areas.

Monitoring of landscape change through changes in water quality and ecosystem health was considered to be a significant component to the overall success of the project. Freshwater Ecosystem Health Monitoring Program (EHMP) sites and SEQ Event Monitoring sites were identified and depicted in the overlay diagrams. In some of the areas identified as contributing high sediment loads, existing monitoring sites were also noted.

Social capital and the 'community will' to undertake natural resource management activities was captured through past and current SEQ Catchments' funded projects and property management planning locations in the overlay diagrams. Further social input will be gathered and collected throughout the project. However including what is currently known for the selection of candidate areas was deemed necessary.

Grass cover and bare earth data is new information coming from analysis of the Statewide Landcover and Tree Study Program (SLATS) and the mapping of woody vegetation. Grass cover is a secondary element of the SLATS program with areas of good grass cover being identified using Landsat Imagery.

To obtain grass cover information for the region, a 3 year average was generated to take into account yearly variations in pasture condition and weather factors (e.g. drought). Much discussion is occurring over what good grass cover equates to, however for this process less than 70% coverage was considered poor. This

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information was overlaid with EMSS and Sednet modelling at a sub-catchment scale.

For alignment with regional planning and investment, the confluence of issues data set was used in the spatial overlay process. This information identifies geographic areas where several threats are impacting on one or a number of assets. The three natural asset layers biodiversity, landscape and water quality were combined to produce the confluence of issues map. This approach has been previously utilised to target the investment of available Natural Heritage Trust funds through the Regional Investment Strategies (RIS) developed by SEQ Catchments for on-ground works. The confluence of issues diagram was used to capture additional biophysical data for candidate area identification.

Through the combination of modelled sediment sub-catchments, monitoring and project locations, grasscover and confluence of issues data sets a composite information layer was generated in a GIS platform. The non urban diffuse composite layer identified broad landscape areas where biophysical and social records were present.

Queensland Landuse Mapping Program 1999 (QLUMP) and the 2006 Landcover datasets were used in addition to the composite layer to aid identification of candidate areas. Mixed landuses were specifically sought across the catchments, to maximise the benefit of strategies developed for sustainable land management as a component of the project.

Stream bank hazard was derived from the SEQ Healthy Waterways Partnership Stream Order Mapping and the SLATS 2003 Woody Vegetation mapping. The stream data was used to mask woody vegetation and generate a map of streams with and without vegetation (25 m grids).

Numerous reports and studies were cited and where data was available integrated into the GIS platform. Recent groundtruthing studies of the EMSS and Sednet models in the Lockyer Creek and Logan/Albert Rivers provided local information on catchment condition. Thompson (2007) reporting on the Logan and Albert Rivers, identified severely erodible soils derived from the Marburg Sandstone group of geologies which have produced soils of limited fertility and structural integrity. The report noted that 11% of the catchment area surveyed has major or severe erosion causing irreversible degradation with active examples of these landscapes represented in the sub-catchments of Knapps and Cannon Creek.

Aerial and satellite imagery were used to capture local land features and where possible land condition. The high resolution nature of aerial photography and SPOT 5 satellite imagery, enable further desktop analysis of stream condition, pasture health, land use and erosion identification.

Priority was also given to mid to upper reaches within the target catchments, aligning with other land management models of working from the headwaters to lower stream reaches.

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Candidate areas were then identified where a number of features overlapped with the non urban diffuse composite layer. Initially, four areas have been identified in each target catchment. (three primary and one secondary choice for backup)

The following GIS and Prioritisation Structure further outlines the process used.

- Erosion - 50% channel bank erosion
25% Surface soil
25% hillslope scalds, rills or cultivation.
- Geology - clay + silt from Basalt in upper regions.
Members of marburg formation - Gatton Sandstone + Heifer Creek Sandstone.
- hamington volcanics - marburg + woogaroo sandstone.
- Bare earth or < 70% grass cover.
- Land use.

- Focus on criteria for tool.
- Geology - 10423, 10422, 349, 5509, 679, 9132, 10407, 8939 - Basalt - Upper reaches.
 - 5518, 643 - Marburg members in Logan.
 - 1054, 11545 - Marburg + Woogaroo in Albert.
- Criteria = % of catchment classified as highly erodible soils.
- Oxley - geologies + erosion??

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GIS and Prioritisation Structure

(Non-urban diffuse)

- + Sediment Loads (Modelled)
 - EHMP and Event Monitoring Sites
 - Project and Property Management Planning Locations
- + Grass Cover
- + Confluence of Issues
- ⇒ Non Urban Diffuse Composite Layer
 - Landuse
 - Landcover
 - Stream Bank Hazard
 - Catchment Studies and Reports (e.g. LRAM Erosion Study)
 - Aerial Photography (NR&W Scenes dating 1996 - 2005)
 - Satellite Imagery (SPOT 5 2.5 m resolution)
 - Topography (mid to upper catchment reaches)
 - Geology
- ⇒ Candidate Areas identified
 - 4 in each target catchment (3 Primary; 1 Secondary)
 - Logan River
 - Sandy Creek, Cannon/Knapps Creek, Oaky Creek - Primary
 - Widgee Creek - Secondary
 - Bremer River
 - Upper Bremer River, Upper Warrill Creek, Purga Creek - Primary
 - Mid Warrill Creek - Secondary
 - Lockyer Creek
 - Tenthill Creek, Sandy Creek, Laidley Creek - Primary
 - Flagstone Creek - Secondary

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Biophysical Characteristics of the Lockyer, Bremer and Logan-Albert Catchments

Logan-Albert

The Logan and Albert catchments contribute significant sediment loads to the southern part of Moreton Bay. Sediment loads entering Moreton Bay are originally sourced from catchments sited over the Marburg-Walloon formations (SEQ Healthy Waterways Partnership, 2007c). The areas exporting major amount of sediments are the Gattton and Heifer Creek members of the Marburg Formation. These members have mostly sandstone geology and largely infertile sodic duplex soils where sheet and gully erosion dominates with high frequency of bare areas (Land Resource Assessment and Management, 2009). Logan River sediments tend to be from two sources: either sand from the Marburg sandstone formations or clays and silt from basalts in the upper regions. The Albert River systems sediments are derived from the Lamington volcanics and Marburg or Woogaroo sandstone formations (SEQ Healthy Waterways Partnership 2007b), Modelling and other sources

indicate the main process involved in generating this sediment is channel erosion (SEQ Healthy Waterways Partnership, 2007b).

Table 3. Geology of the Logan-Albert catchment.

Time Period	Processes
410 million years ago	Marine sands and clays with some basaltic lava flows
215 – 345 million years ago	Carboniferous / Permian/ Triassic periods Folding, uplifting of ranges, metamorphism
135 – 215 million years ago	Triassic / Jurassic periods Deposition of sandstone, shale and conglomerate sediments into lakes and swamps
2- 65 million years ago	Tertiary period Volcanic activity from Mt Warning and the Main ranges – covered the older sediments. Uplift and rivers and streams dissecting the landscape, climatic cycles of arid and humid conditions altered alluvial terraces.

Source: Noble (1996)

Soil and land types

The underlying geology and complex topography of the Logan-Albert Catchment have given rise to a highly variable soil distribution at a local level (Logan-Albert Rivers Catchment Association, 2009). Noble (1996) has classified the Moreton Region in relation to Land Resource Areas (LRAs). These landscape areas have a characteristic landform, geology, soil and vegetation.

Reports from the South East Queensland Healthy Waterways Strategy 2007-2012 indicate that the Logan-Albert Catchment is contributing 30% of the sediment load to Moreton Bay and over 75% of this sediment is coming from gully and bank erosion (SEQ Healthy Waterways Partnership 2007c). Concave slopes and sodic duplex soils are highly prone to sheet erosion, especially where ground cover is less than 40%.

Thompson (2007) assessed erosion status of 60 field sites across the catchment in 2006 to 2007. The Gattton Marburg soil types showed major to severe erosion over 30% of their area. A hotspot within this geology is the Heifer Creek sandstones, especially along the Knapps Creek – Greenhill Road in the Cannon catchment (Thompson, 2007). Up to 30% of the Albert basalt group along the eastern lower foothills of the Logan River are severely eroded. Approximately 75% of the Walloon forest landscapes are moderately eroded. This includes 50% of the Knapps Catchment and 25% of the Cannon Catchment (south of Greenhills Road) with predominantly Heifer Creek and Marburg sandstones. The Widgee Catchment has a high incidence of landslips. Management strategies outlined by Thompson (2007) to reduce erosion include managing fire regimes, strategic location of stock water points and pasture reestablishment. Long term spelling may be required in some of the infertile Marburg sandstones.

Figure 8. Soil map of the Logan Albert Land Resource Areas.

Source: Noble, 1996.

Table 4. Land Resource Areas in the Logan-Albert Catchment.

Landform	Vegetation and soil type	Land Resource Area
Alluvial Plains and terraces	Self-mulching black earths and grey clays, alluvial soils (alluvial loams, sandy alluvials, alluvial red brown earths, grey clays) Previously blue gum woodlands, now largely cleared. Eg. Logan River alluvium. Limitations include waterlogging, flooding, sodicity, salinity.	Fine Textured Alluvial Plains (1b)
	Coarser clays, alluvial soils, solodics, solochs, red-brown earths, earthy sands, red earths, tea tree clays. Eg. Logan River Gum-topped box woodlands and open forests of blue gum/Moreton Bay ash/ ironbark, some swamp tea tree shrubs. Limitations include waterlogging, acidity, erodibility, salinity, hard-setting	Mixed Alluvial Plains (1c)
Undulating plains and plateaus; hill slopes	Basaltic krasnozems, xanthozems Mixed rainforests, eucalypt open forest now largely cleared. High erosion potential.	Red Volcanics (2a)
Undulating hills and rises	Grey and brown clays, solodics. Softwood scrub, brigalow.	Scrub Walloons (6b)
	Sandy and loamy solodics, solochs, yellow and red podzolics, non-calcic brown soils, lithosols. Eucalypt open forest, sometimes softwood scrub.	Marburg Forest (7a)
	Red and yellow earths, red yellow and lateritic podzolics, earthy sands, lithosols. Eg. Tamborine. Eucalypt open forest to woodland of narrow leaved ironbark, bloodwood, swamp mahogany and rough-barked apple. Limitations include slope, low fertility and erosion.	Helidon Forest (7b)
Steep mountains, hills and rises	Shallow black earths and clays, clay loams, lithosols. Eucalypt open forest to woodland, some mixed rainforest. Limitation include slope, erodibility, shallow soils, surface rockiness.	Basaltic Uplands (2b)
	Lithosols, shallow clays and clay loams solochs, solodics, earthy sands (stony). Eucalypt open forest, sometimes softwood scrub. Limitations slope, rockiness, soil depth, low fertility.	Volcanic Peaks (3a)

Source: Noble, 1996.



Appendix P: Risk Profile Criteria Matrix

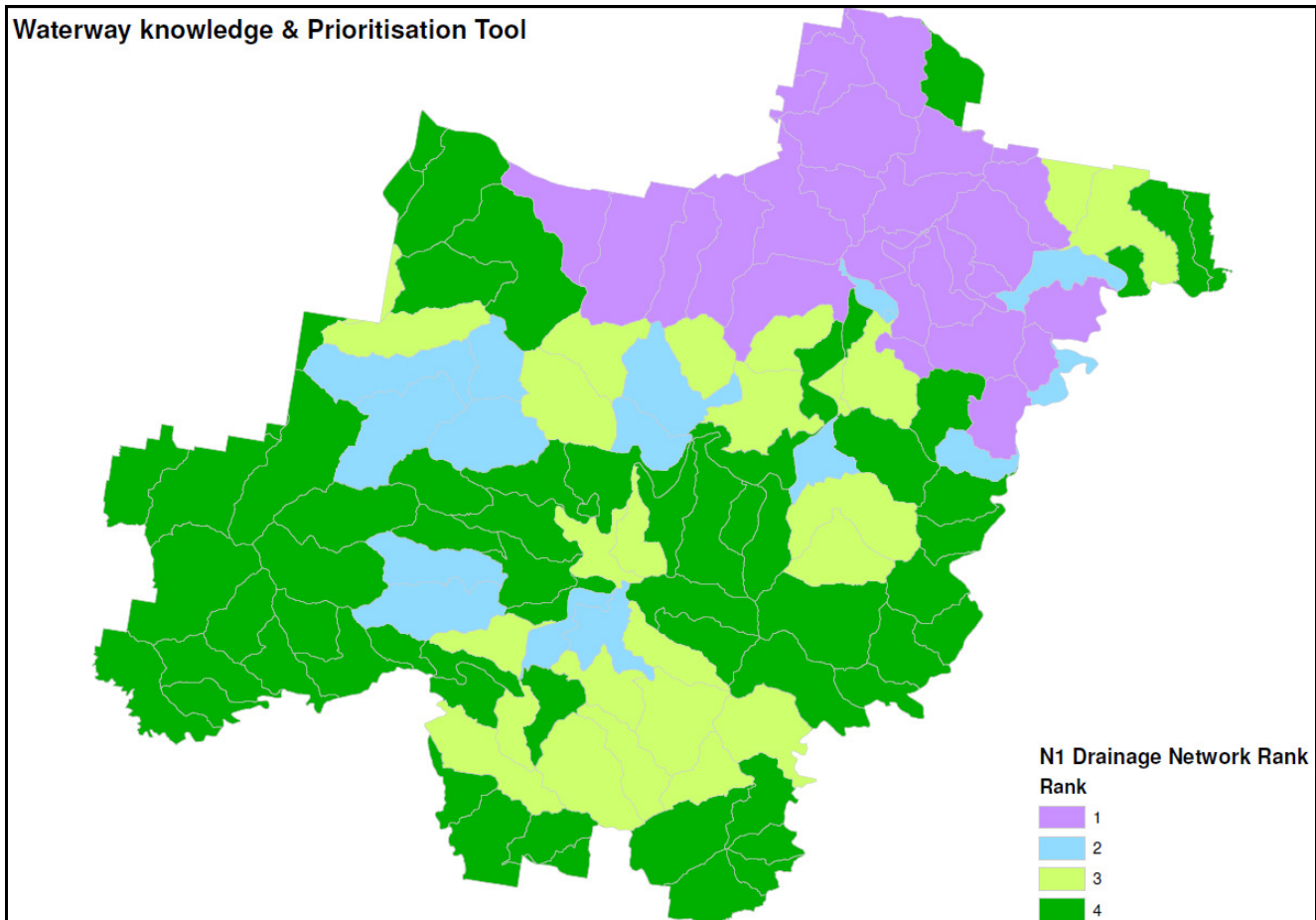
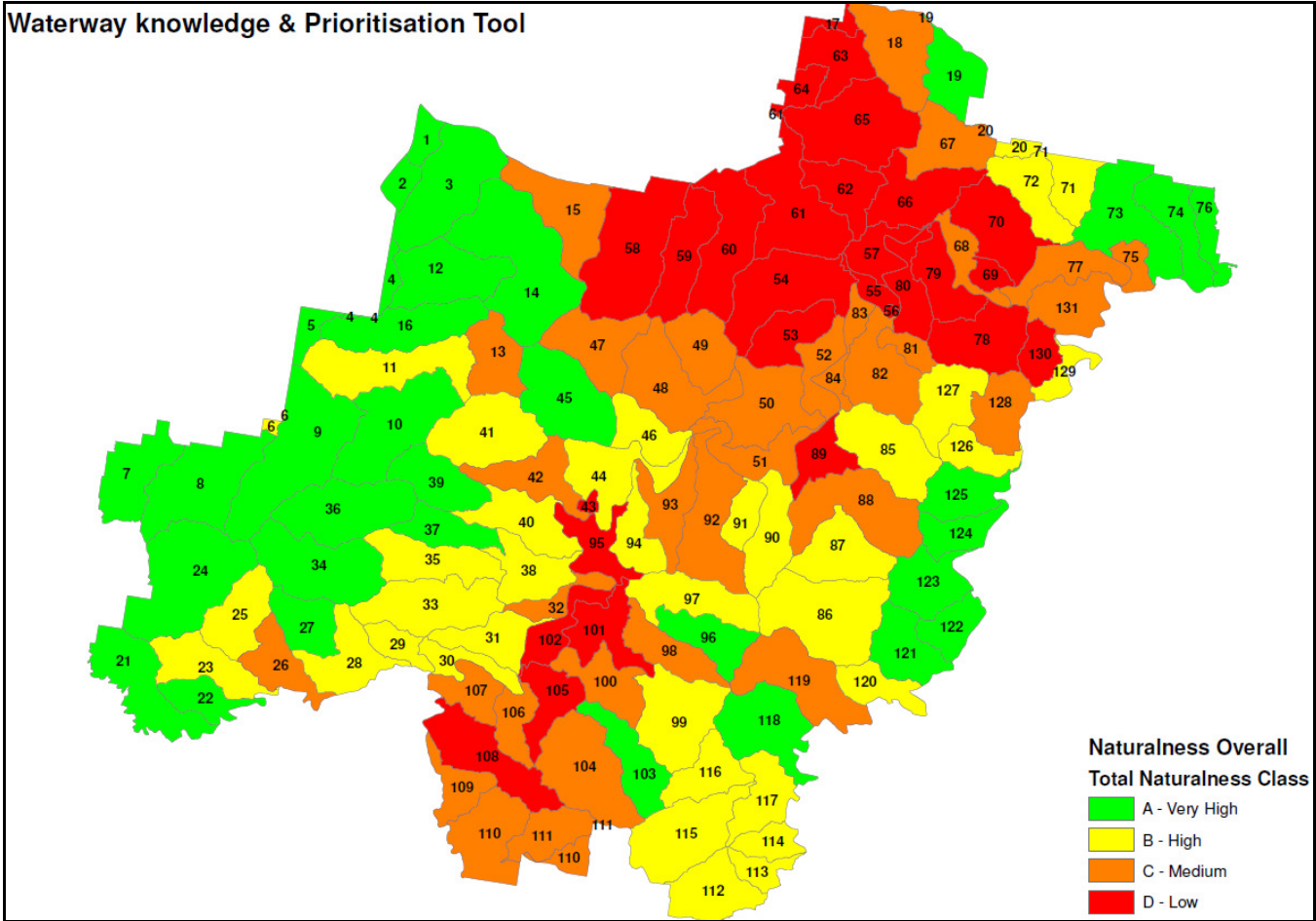
For Original Please refer to [LCC DOCS-#6208887-Waterway Rehabilitation Prioritisation Tool WRPT level of naturalness and risk profile matrix](#)

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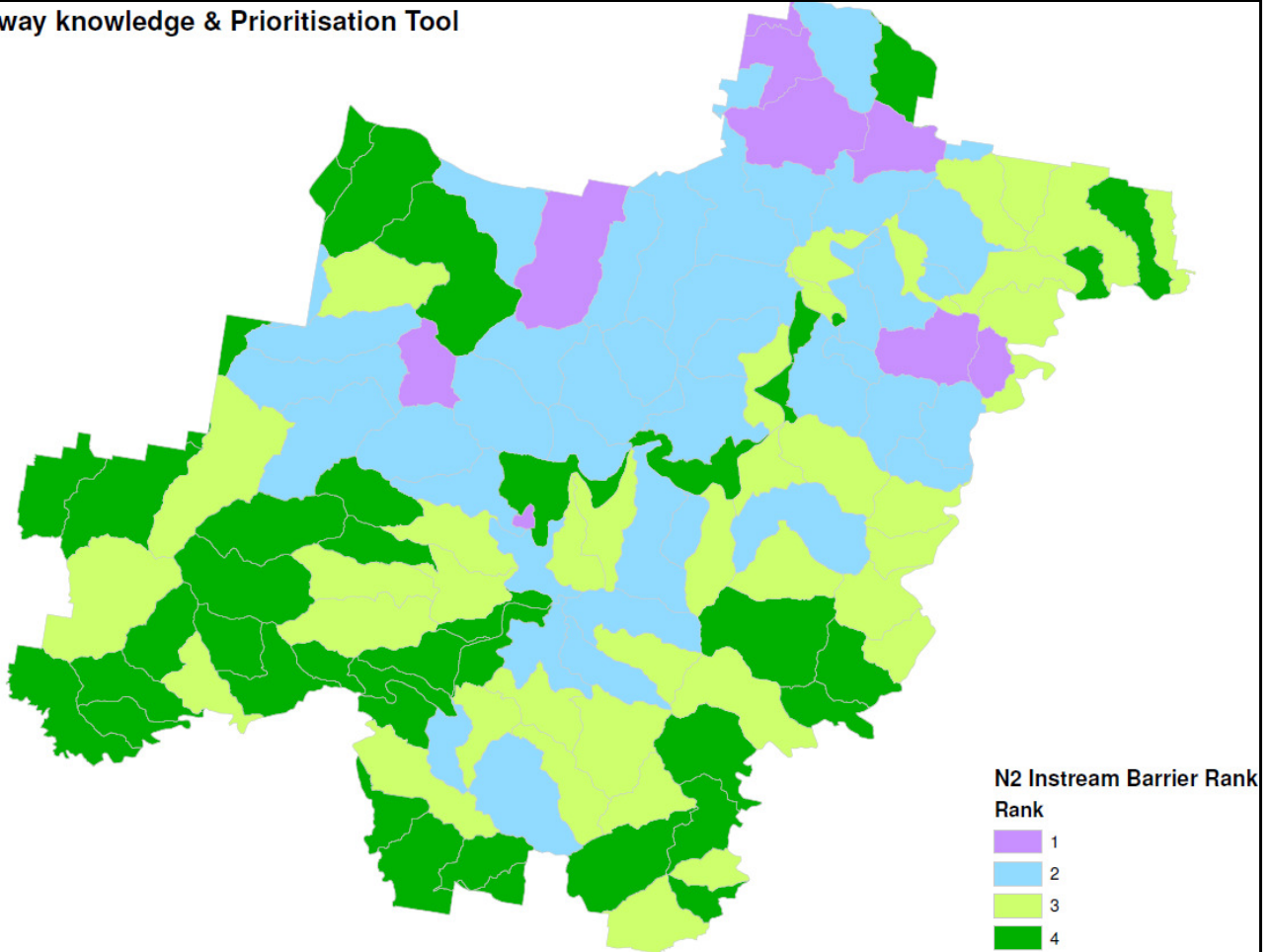
Table 33: Risk Profile Matrix

	Parameter	Sub-parameter	Criteria	Criteria Description	Unit	Weighting	Risk Criteria Score Cut Offs				
							No or Very Low	Low	Medium	High	Very High
							0	1	2	3	4
R1	Waterway Mangement & Modification	Water Quality Improvement	Stormwater Treatment	% of the catchment that has no stormwater treatment	%	6	<73.19	73.19-91.08	91.08-97.2	97.2-100	>=100
R2	Waterway Mangement & Modification	Flood Mitigation	Flooding	Flood Mitigation Score (weighted on land zone) per catchment area	Score/km2	8	<1	1-14	14-31	31-63	>=63
R3	Water Quality	Point Source Pollutions	Contaminated Land	# of contaminated properties per catchment area	#/km2	6	<0.002	0.002-0.216	0.216-0.616	0.616-1.902	>=1.902
R4	Water Quality	Point Source Pollutions	ERA Properties	ERA Emission Score (Weighted ratio of Score for ERA type) per catchment area	Score/km2	6	<1	1-56	56-275	275-1730	>=1730
R5	Water Quality	Point Source Pollutions	Extraction Sites	% of catchment area that is disturbed from extraction	%	7	<0.002	0.002-0.814	0.814-2.411	2.411-25.793	>=25.793
R6	Water Quality	Point Source Pollutions	Sewage Overflows	Sewage Spill Risk Score (weighted by potential risk) per catchment area	Score/km2	8	<9	9-395	395-679	679-1697	>=1697
R7	Water Quality	Diffuse Source Pollutions	Steep Slopes	% of catchment classified as Steep Slope	%	8	<0.487	0.487-8.602	8.602-23.542	23.542-51.952	>=51.952
R8	Water Quality	Diffuse Source Pollutions	Soil Erosion	% of catchment classified as Erosion Prone Geology	%	10	<0.1	0.1-27.45	27.45-60.626	60.626-83.742	>=83.742
R9	Water Quality	Diffuse Source Pollutions	Bushfire Hazard	% of catchment classified as Bushfire Hazard Area	%	6	<0.045	0.045-25.225	25.225-46.398	46.398-73.46	>=73.46
R10	Water Quality	Diffuse Source Pollutions	Acid Sulphate Soils	% of catchment classified as Acid Sulphate Soils	%	7	<0.002	0.002-6.948	6.948-33.97	33.97-68.08	>=68.08
R11	Natural Environment	Habitat & Biodiversity	Weeds	# of properties with NOX records per catchment area	#/km2	4	<0.01	0.01-3.04	3.04-14.88	14.88-39.98	>=39.98
R12	Natural Environment	Corridors, Buffers & Stabilisation	Vegetation Management	% of vegetation unprotected in the catchment	%	10	<0.119	0.119-7.057	7.057-24.66	24.66-86.476	>=86.476
R13	Land Use & Human Activity	Accessibility & Use	Litter Hot Spots	# of litter hot spots per catchment area	#/km2	4	<8.54	8.54-225.57	225.57-1070.36	1070.36-4235.44	>=4235.44
R14	Land Use & Human Activity	Land Development	Projected Population Growth	% increase in projected population growth	%	10	<2	2-648	648-4236	4236-142800	>=142800
100											
							e	d	c	b	a
Risk Profile Class							<70	70-128	128-159	159-212	>=212

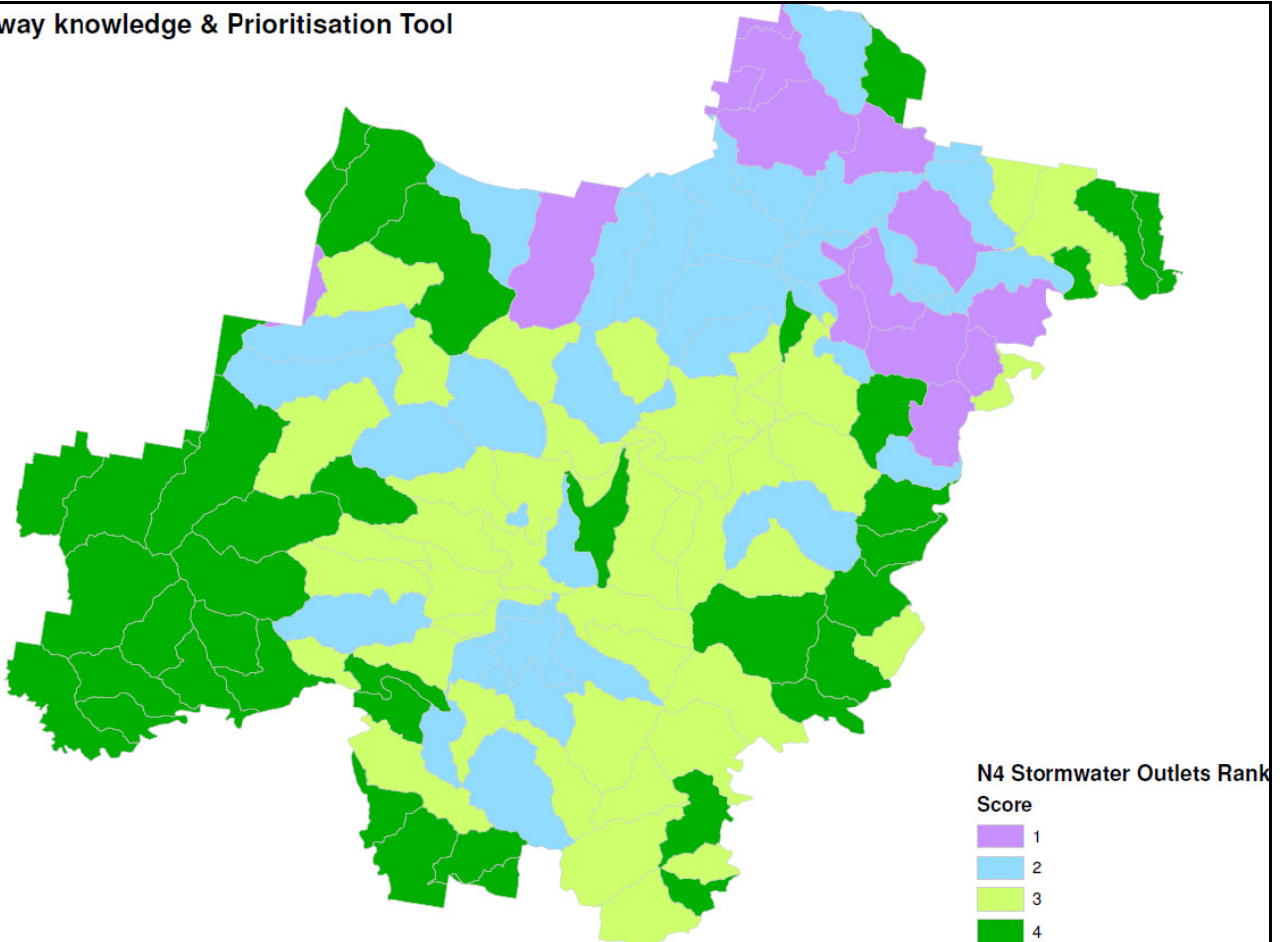
Appendix Q: Level of Naturalness Criteria Results



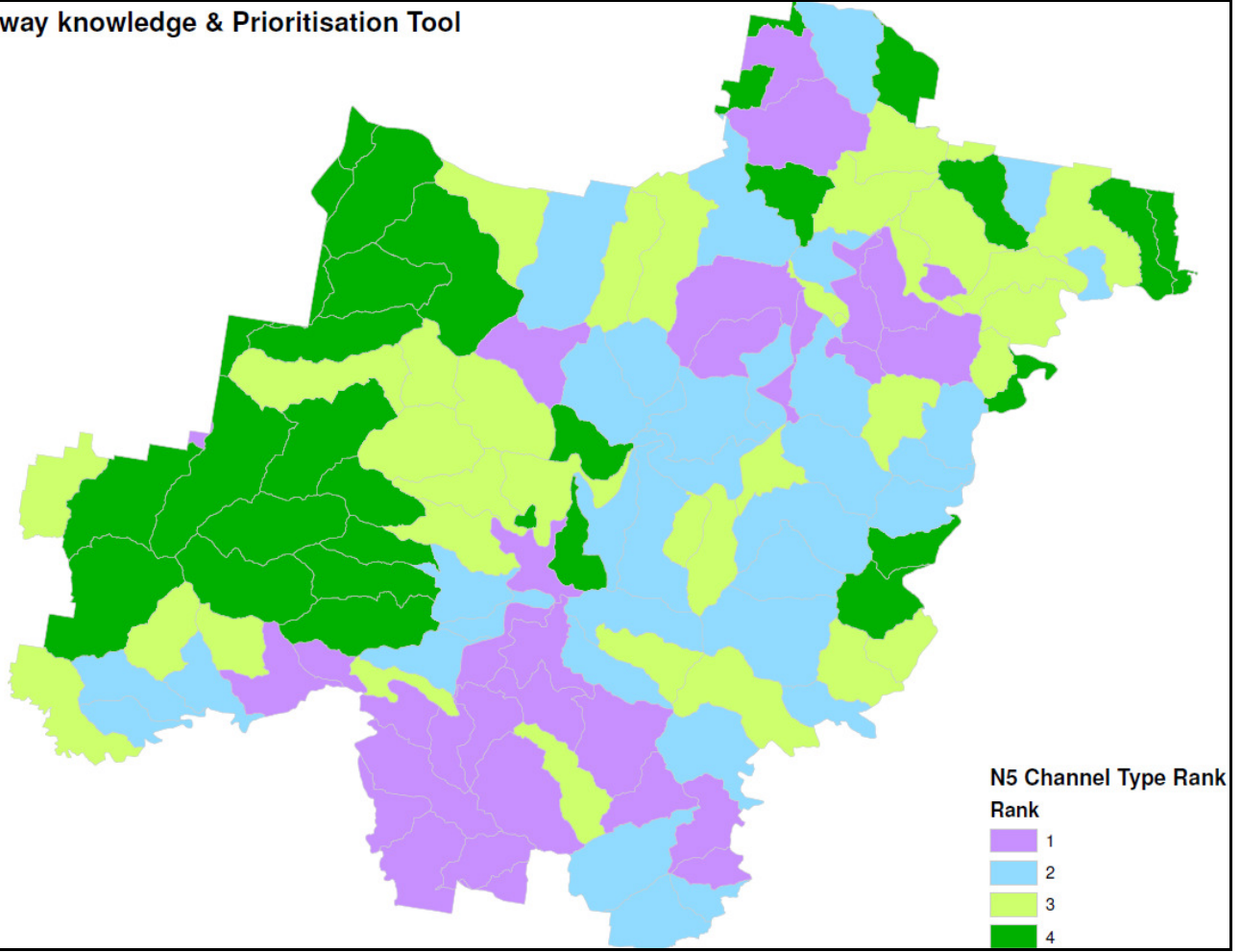
Waterway knowledge & Prioritisation Tool



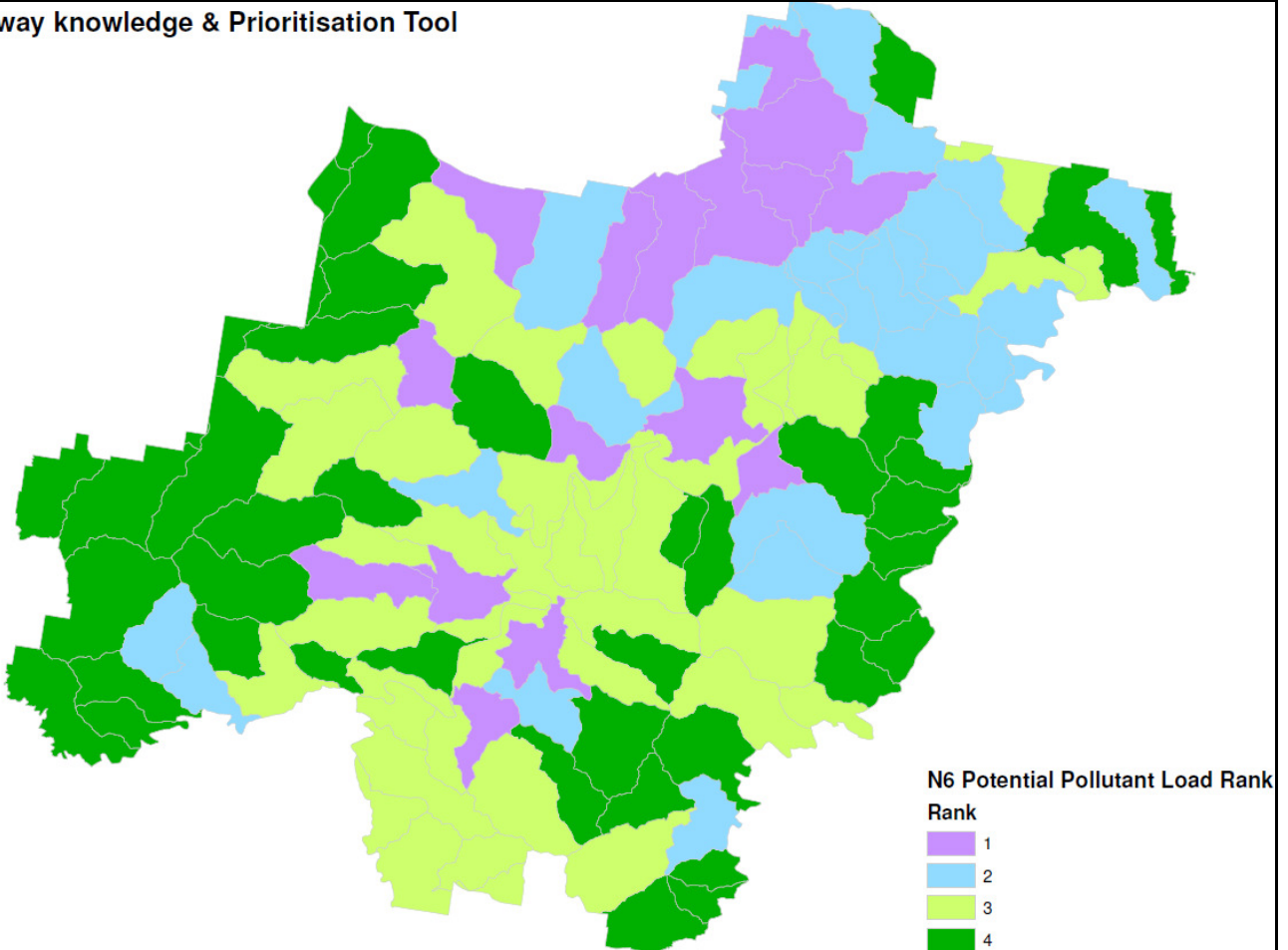
Waterway knowledge & Prioritisation Tool



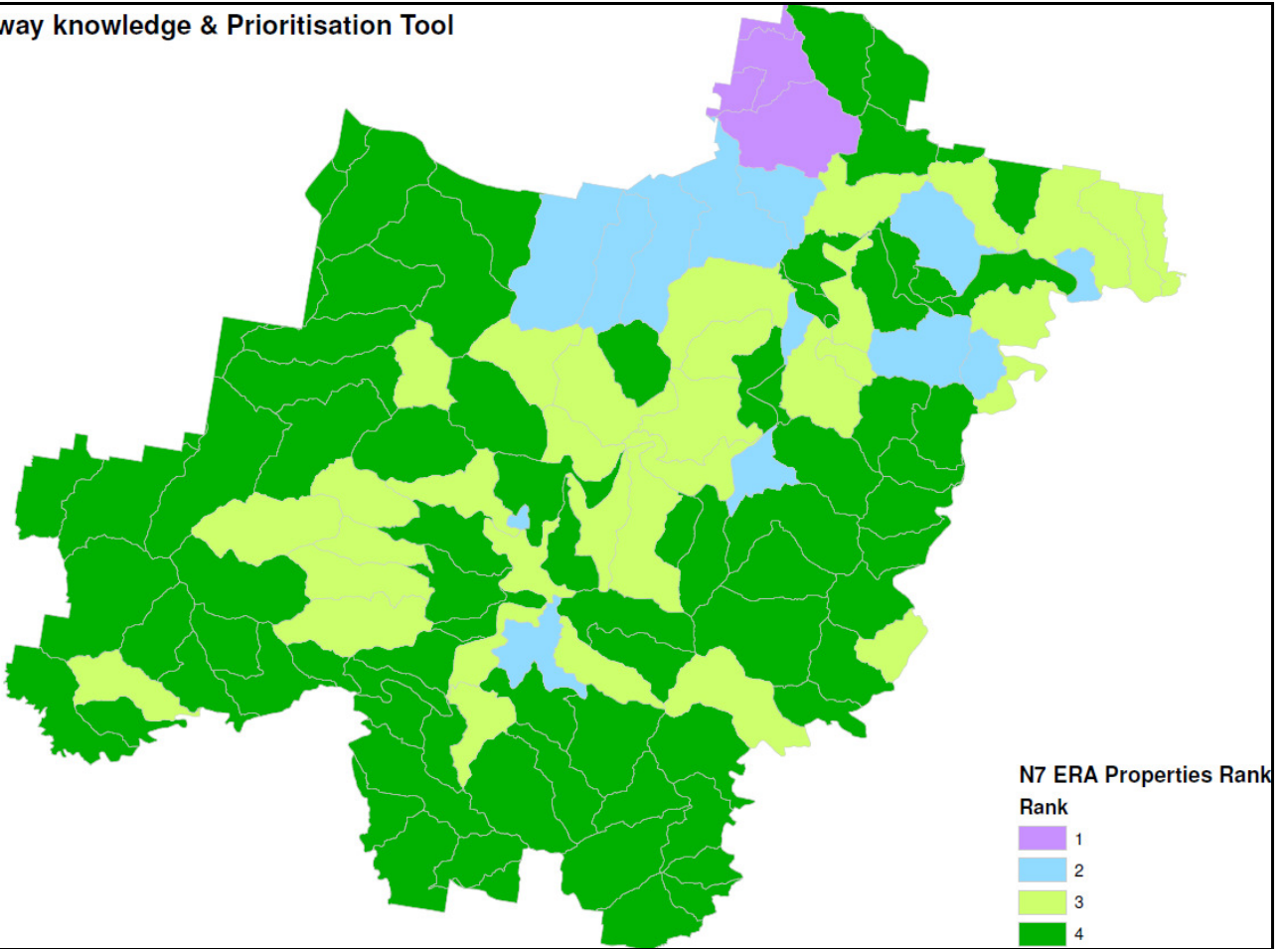
Waterway knowledge & Prioritisation Tool



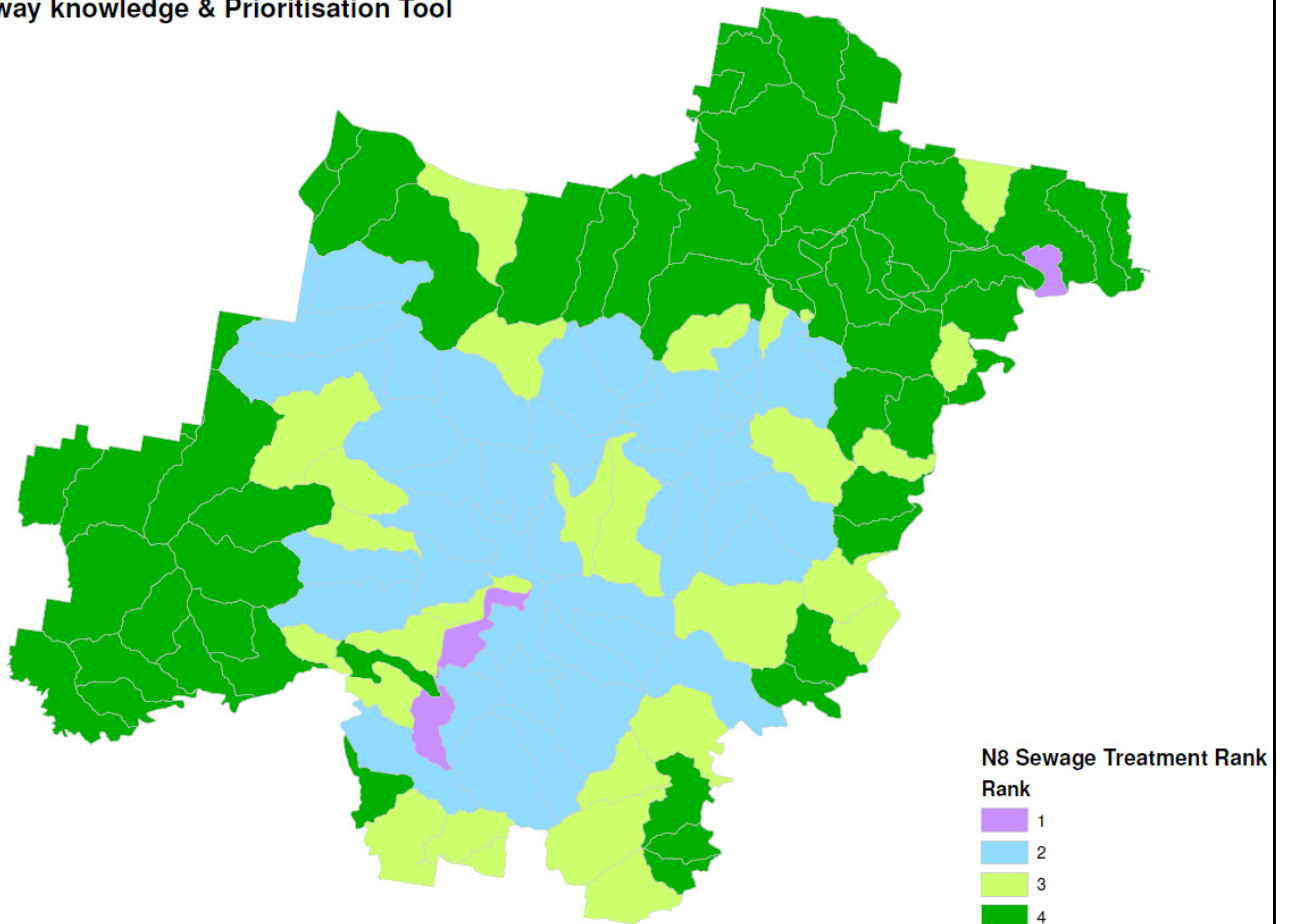
Waterway knowledge & Prioritisation Tool



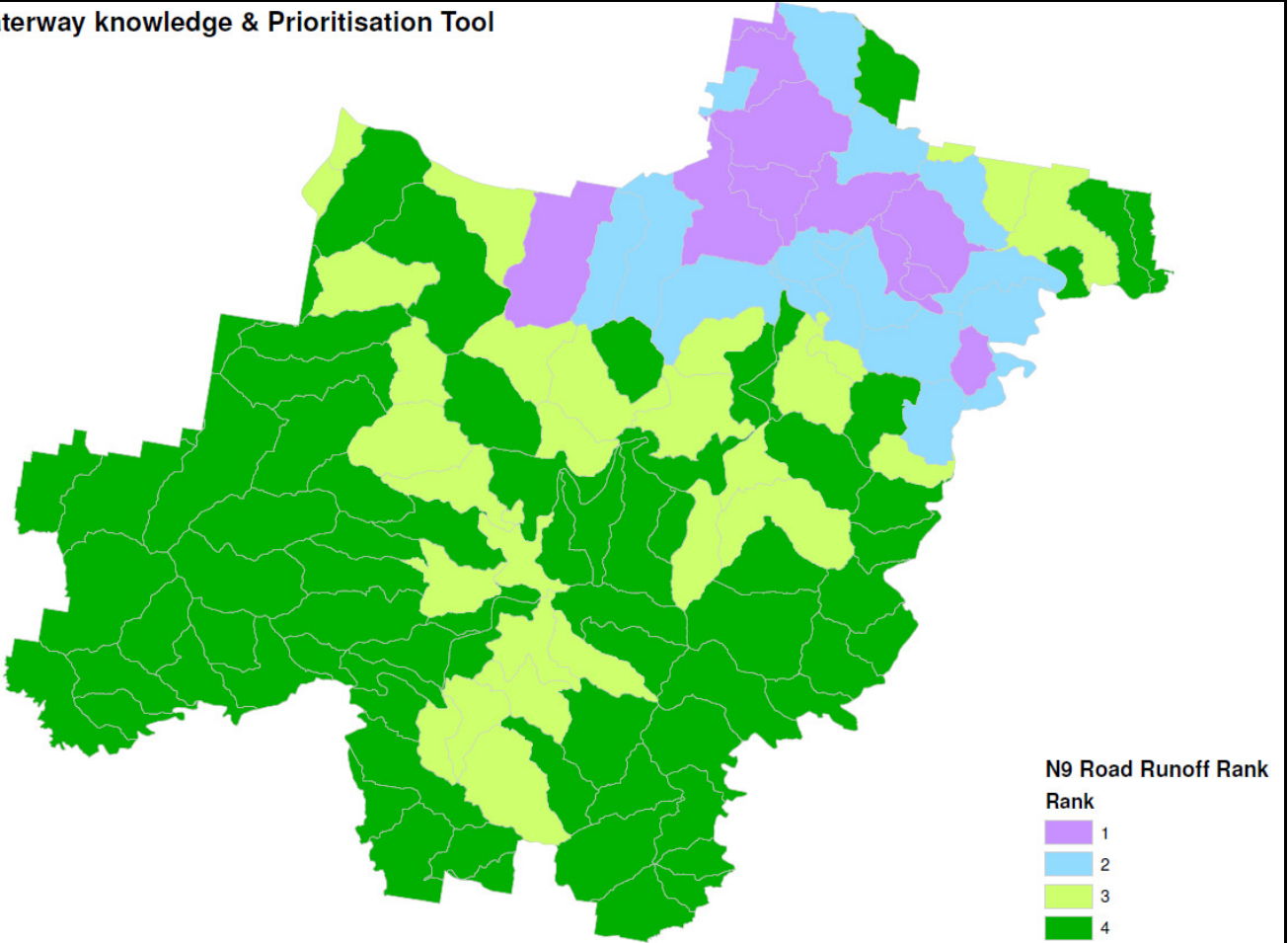
Waterway knowledge & Prioritisation Tool



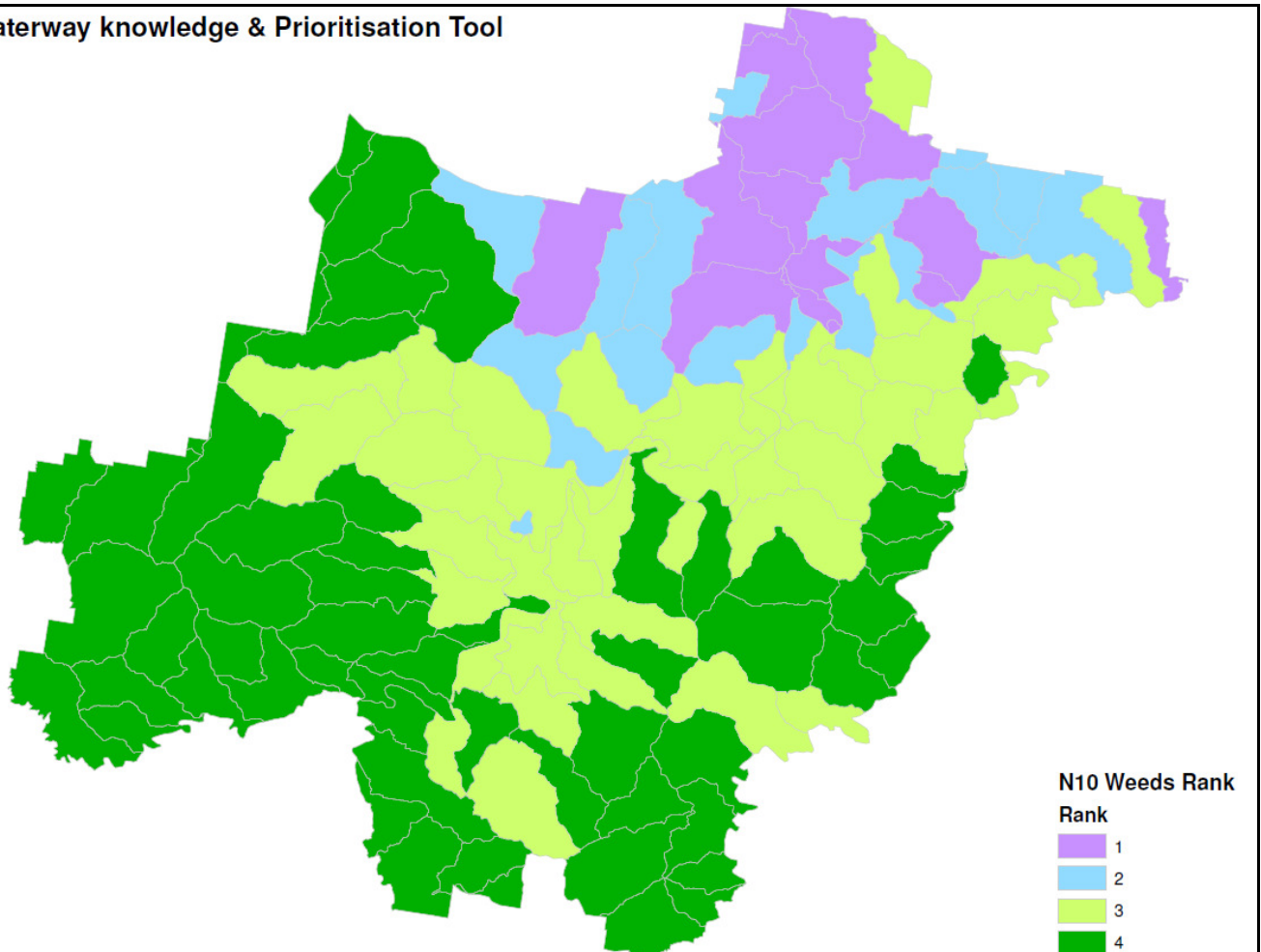
Waterway knowledge & Prioritisation Tool



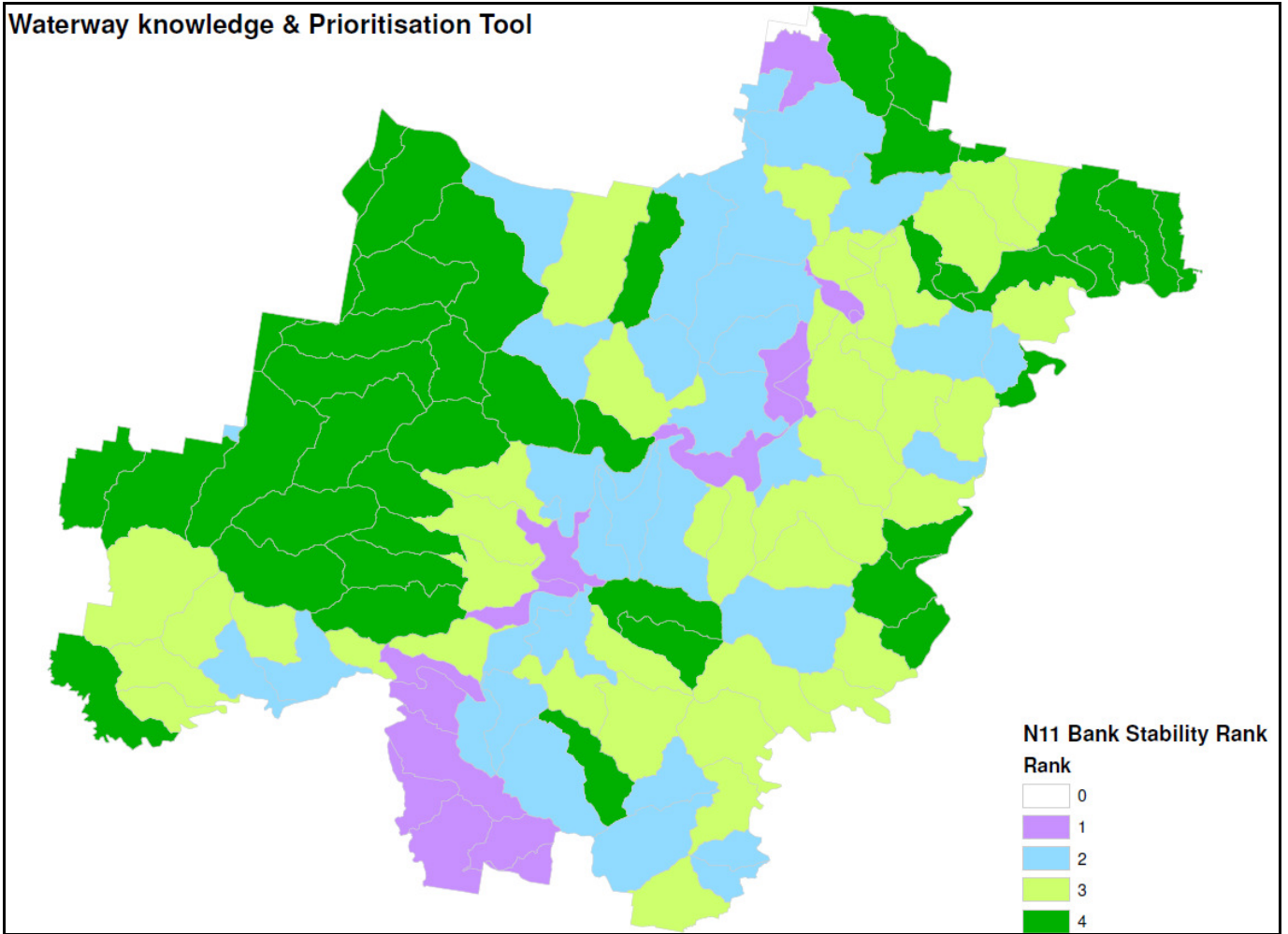
Waterway knowledge & Prioritisation Tool



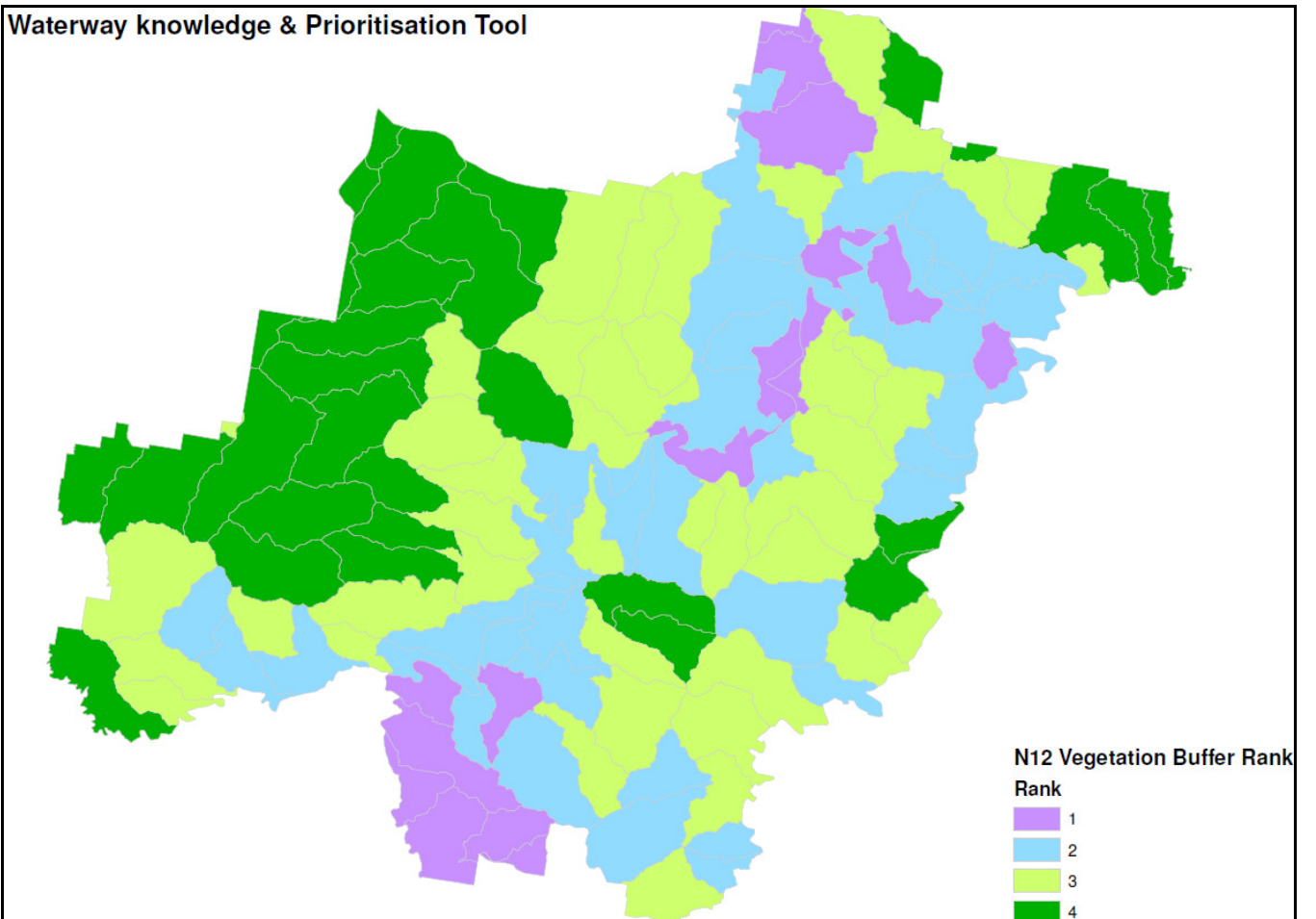
Waterway knowledge & Prioritisation Tool



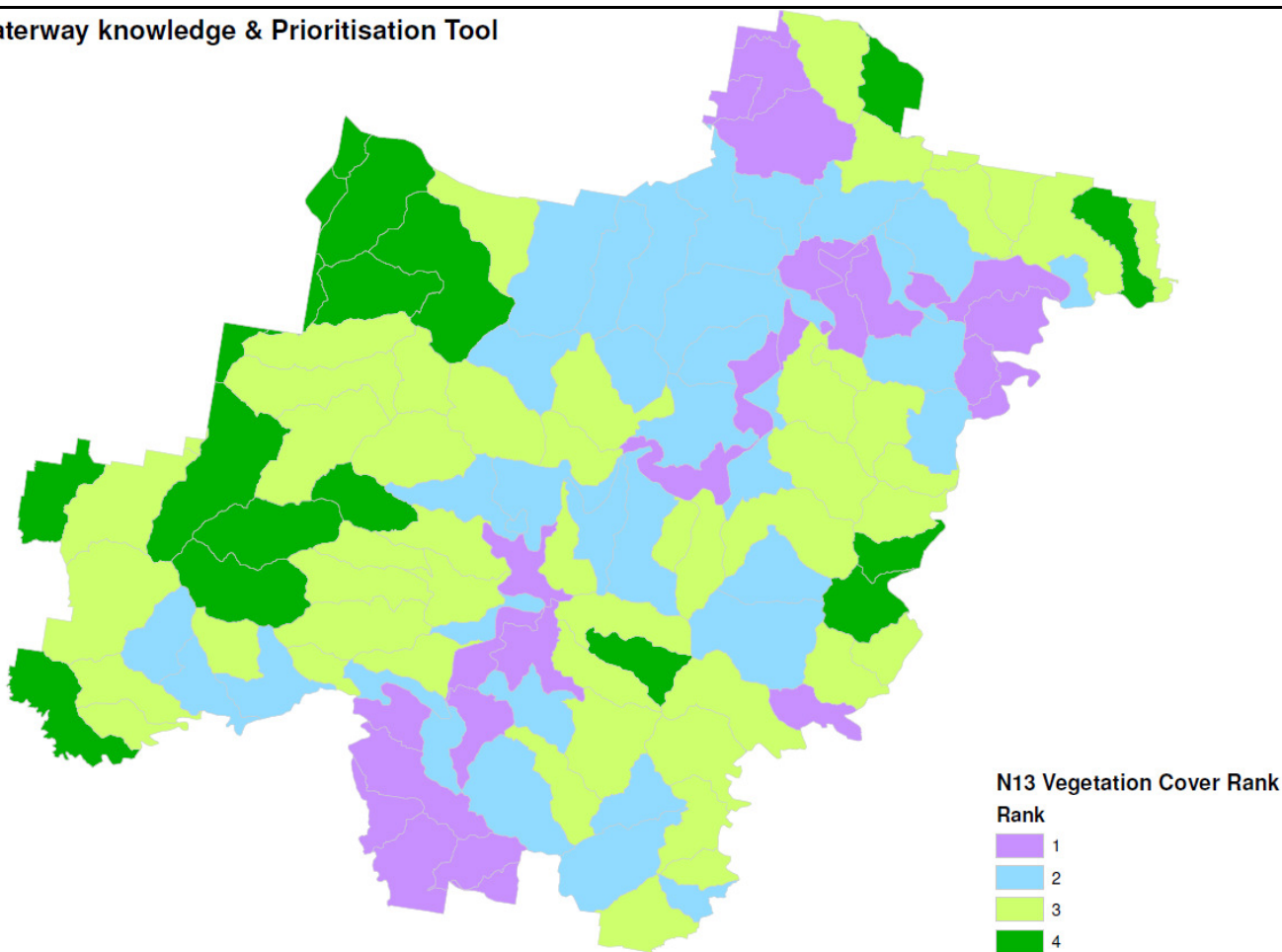
Waterway knowledge & Prioritisation Tool



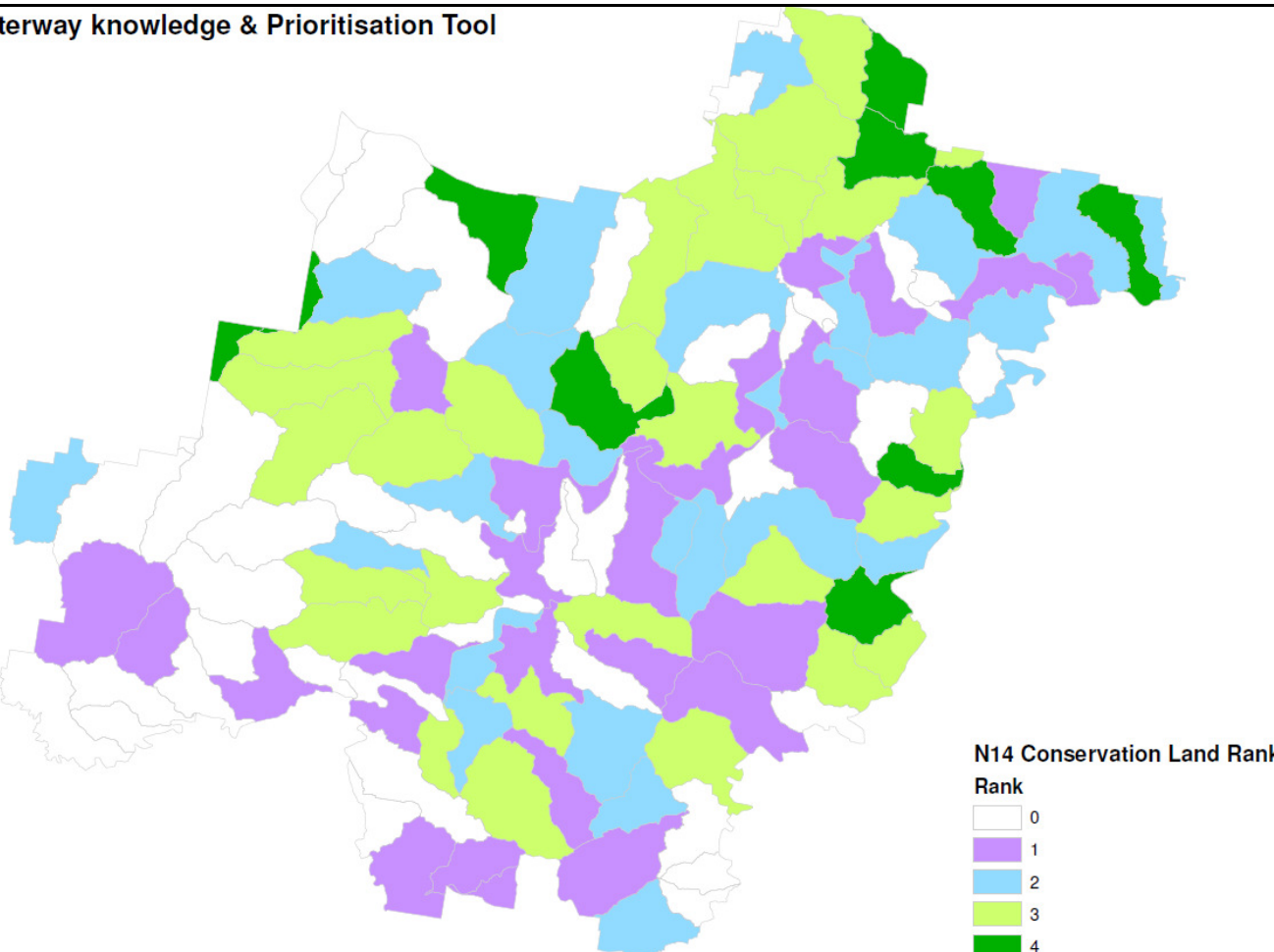
Waterway knowledge & Prioritisation Tool



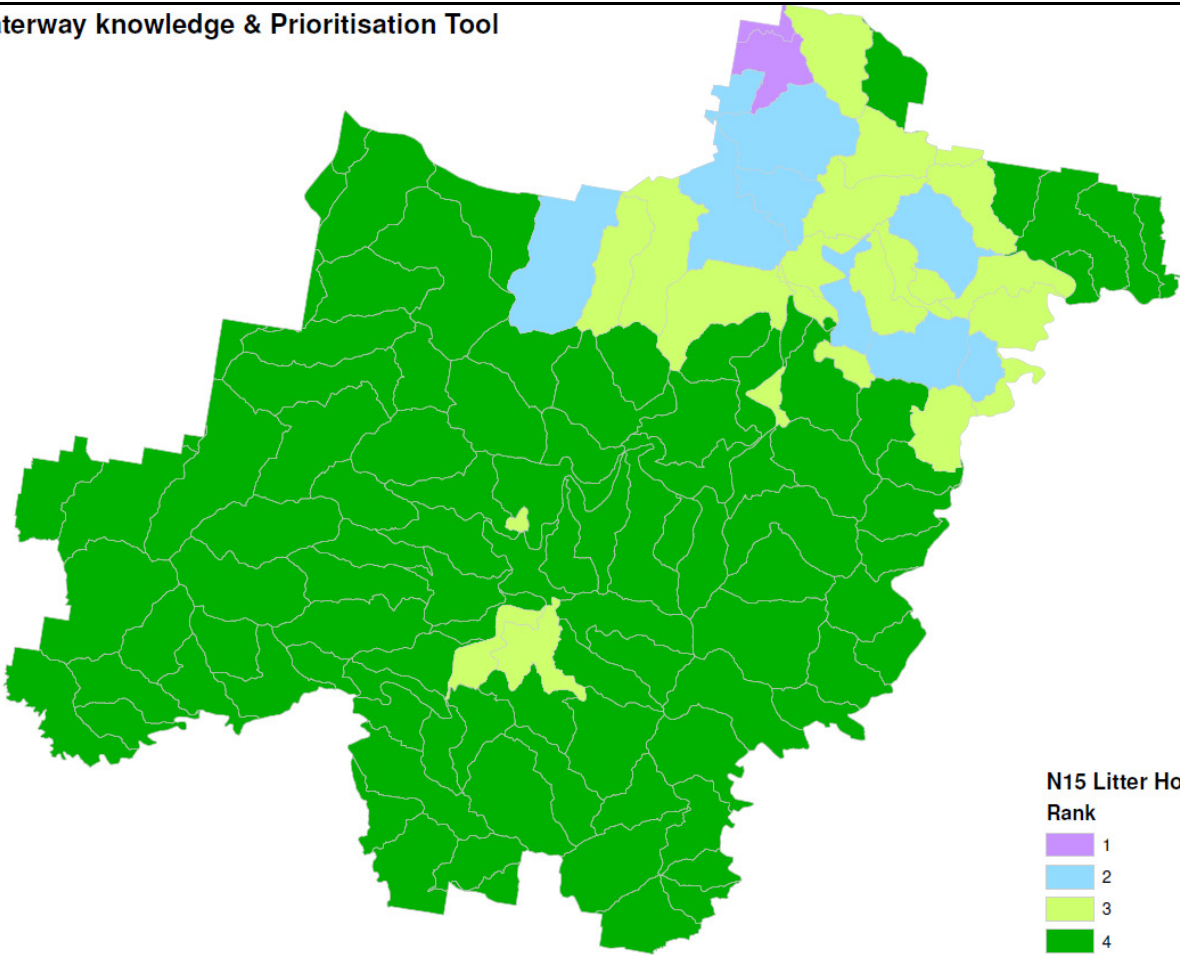
Waterway knowledge & Prioritisation Tool



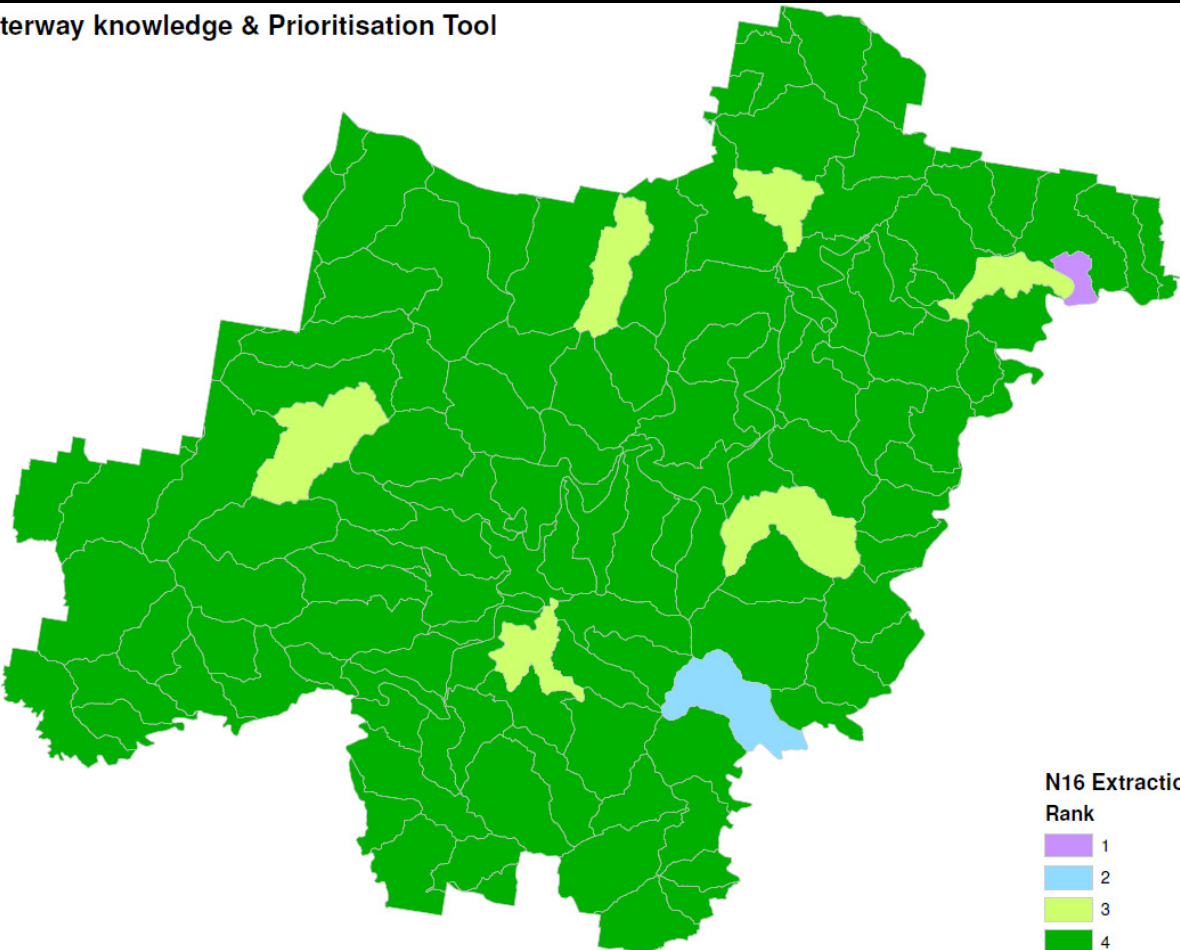
Waterway knowledge & Prioritisation Tool



Waterway knowledge & Prioritisation Tool

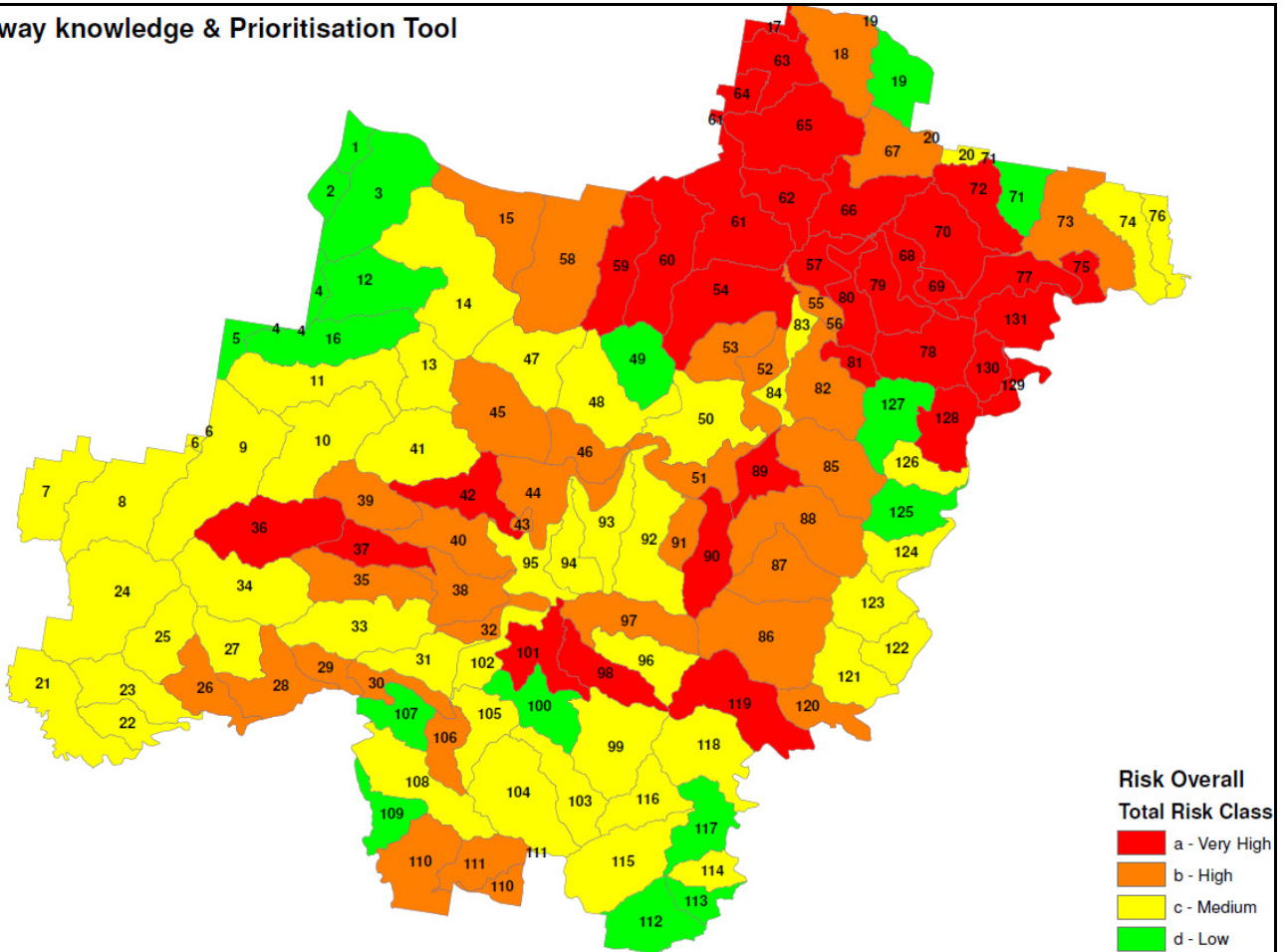


Waterway knowledge & Prioritisation Tool

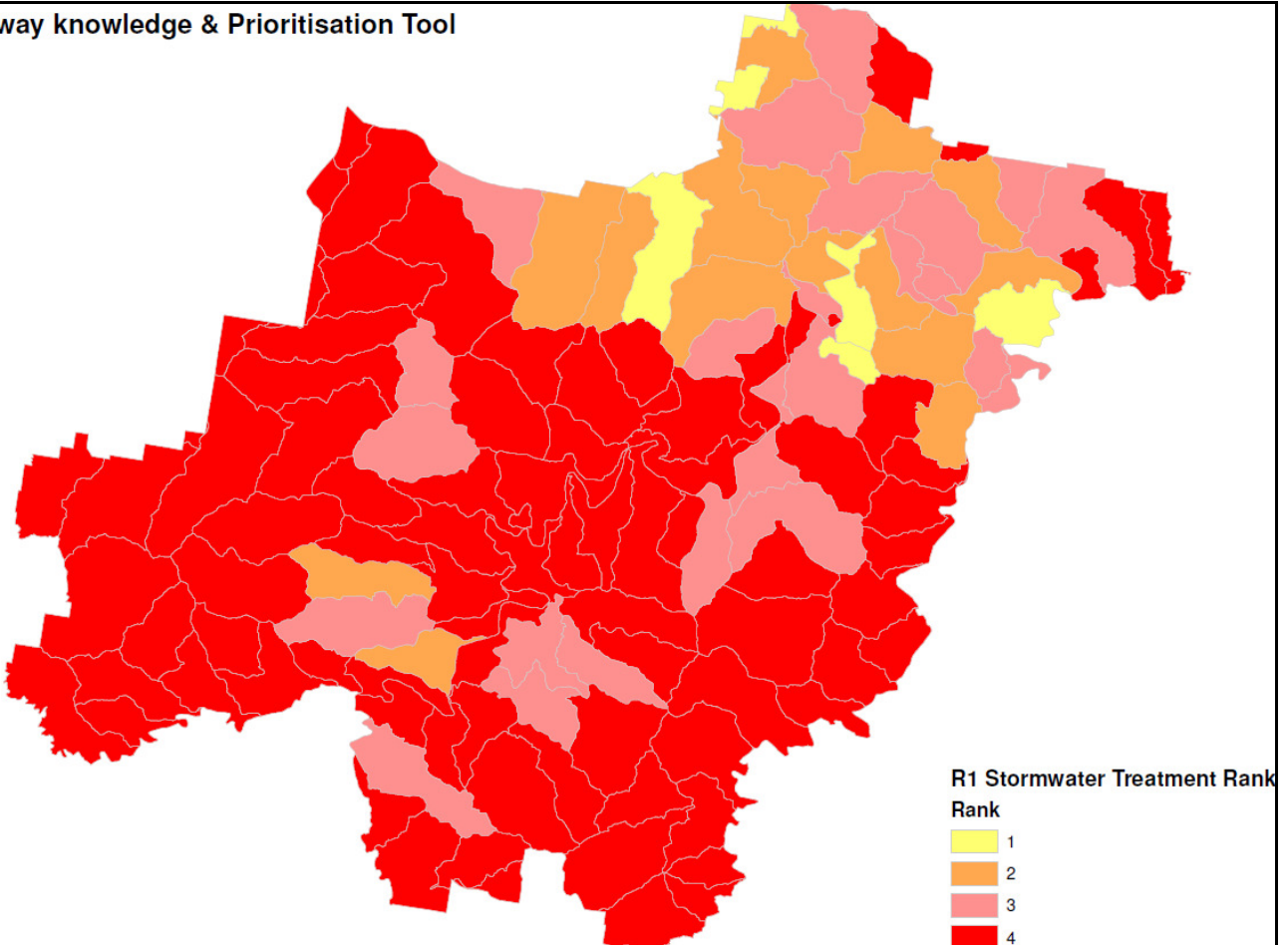


Appendix R: Risk Profile Criteria Results

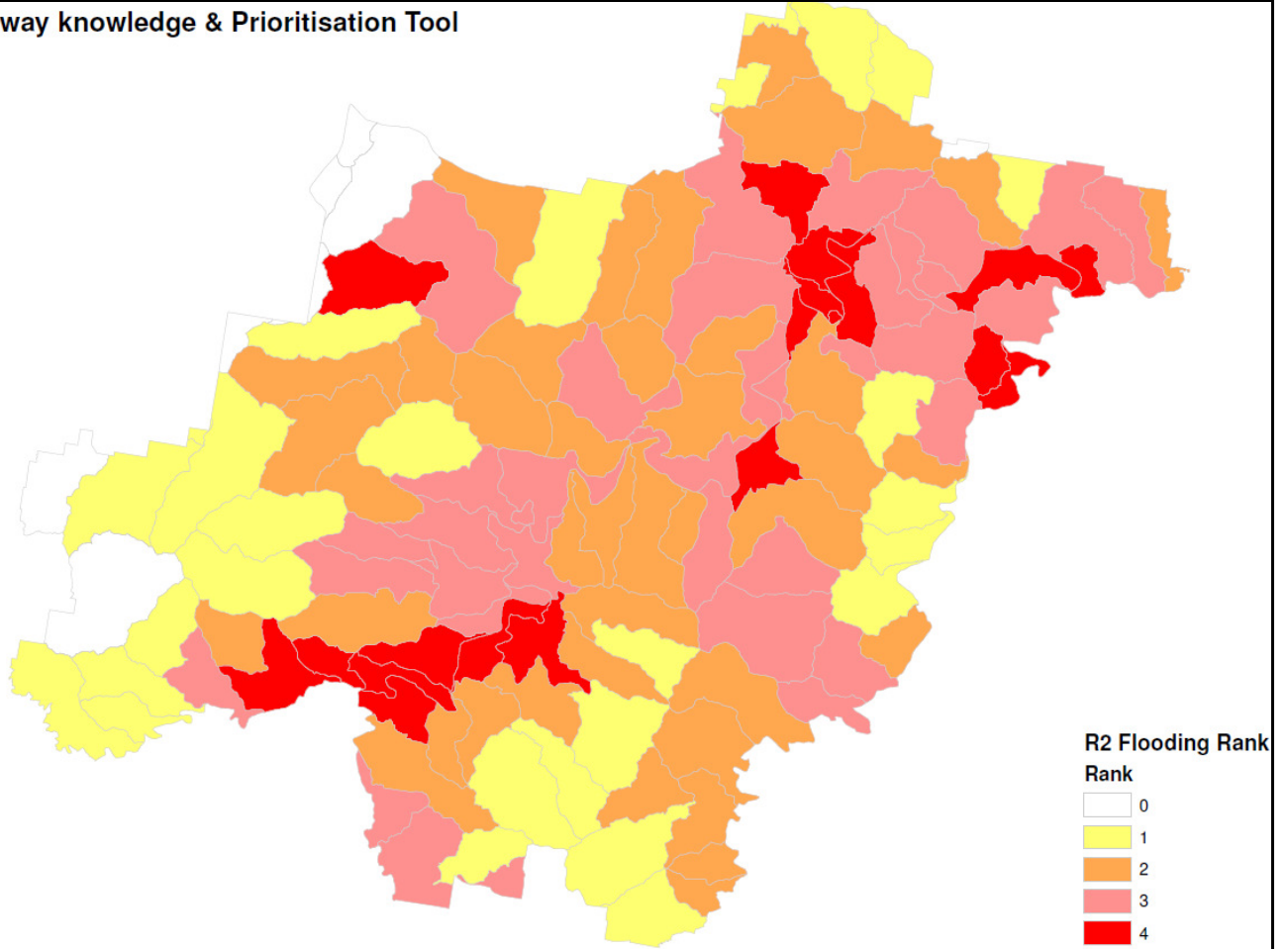
Waterway knowledge & Prioritisation Tool



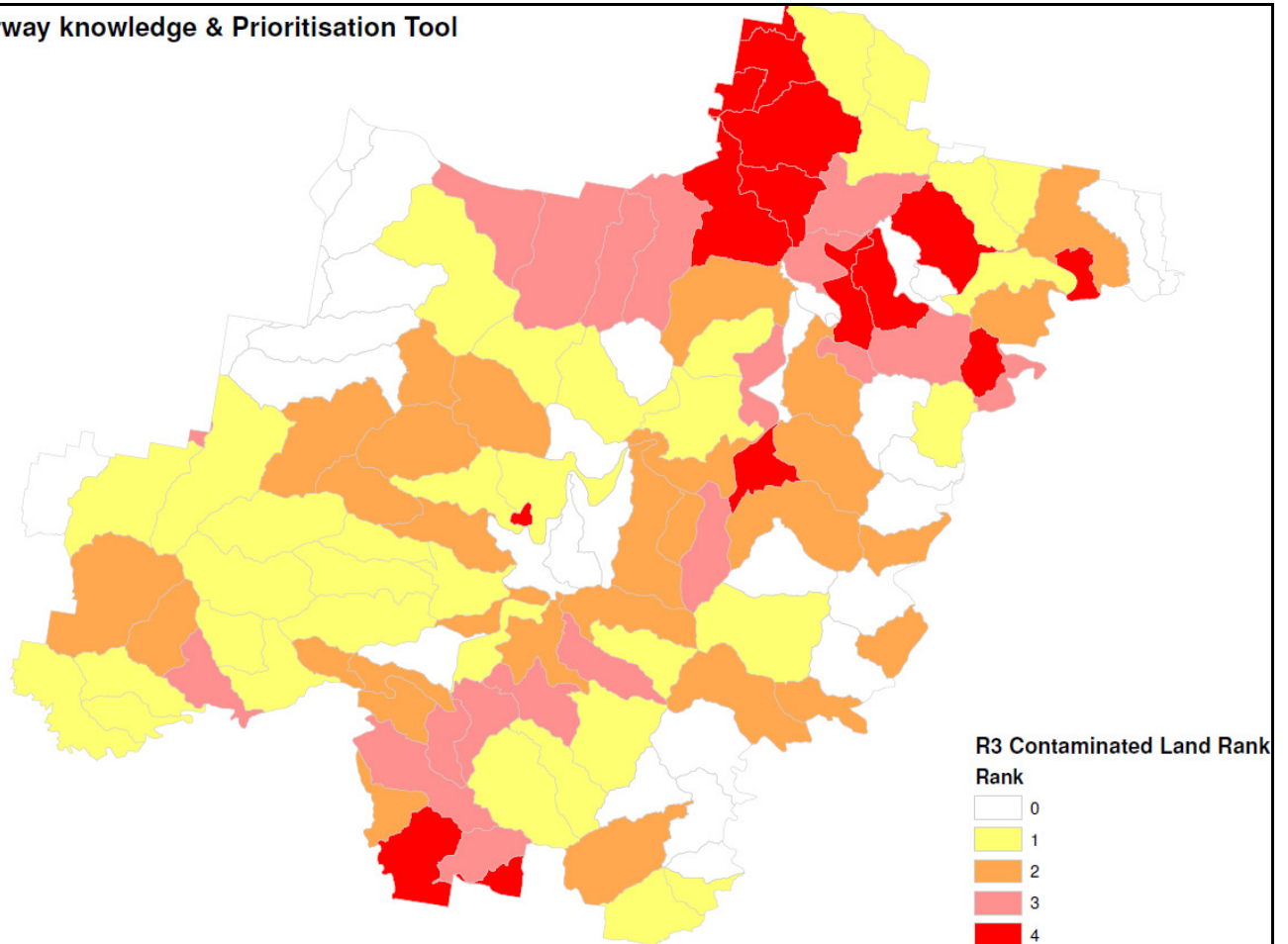
Waterway knowledge & Prioritisation Tool



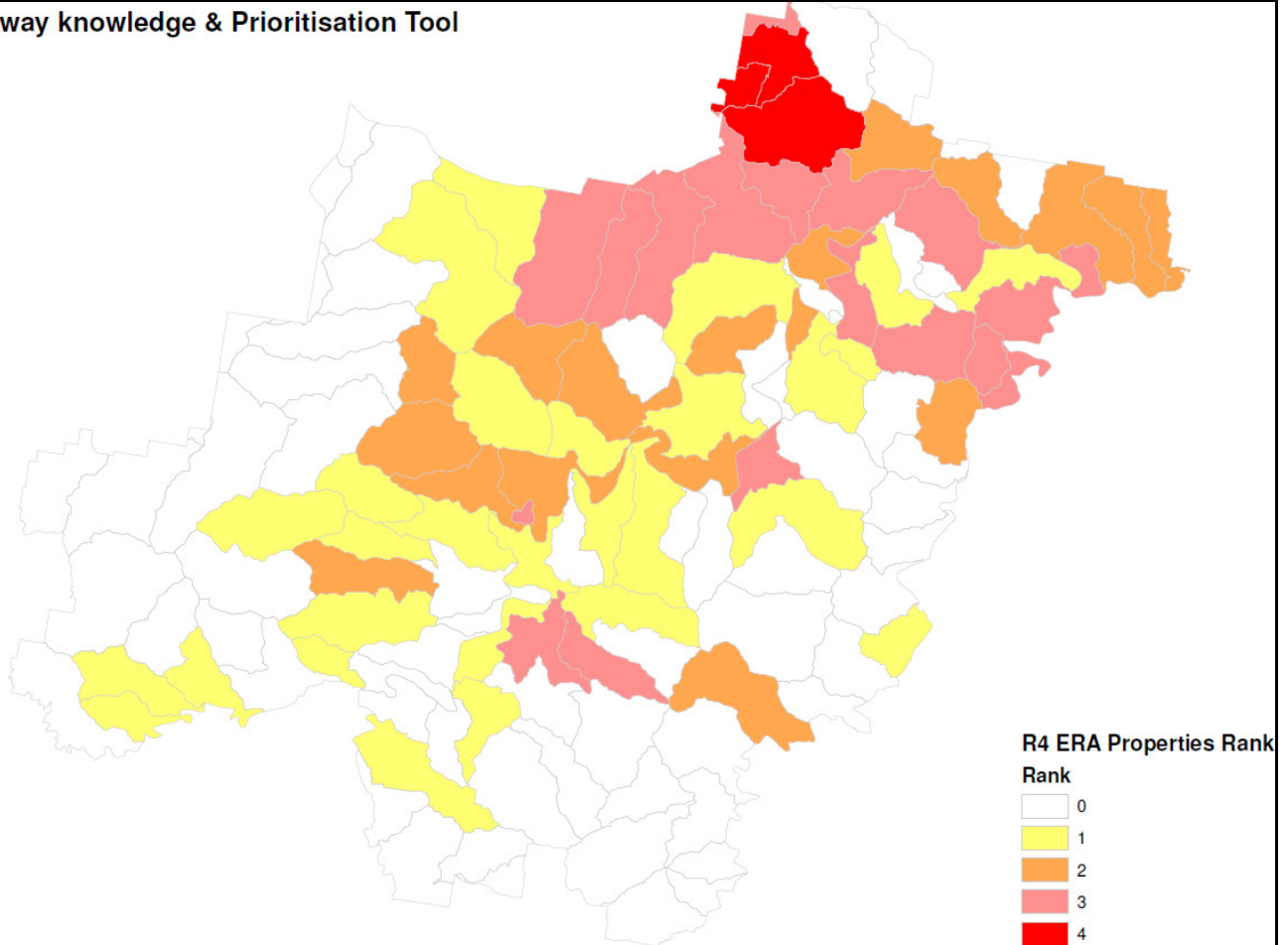
Waterway knowledge & Prioritisation Tool



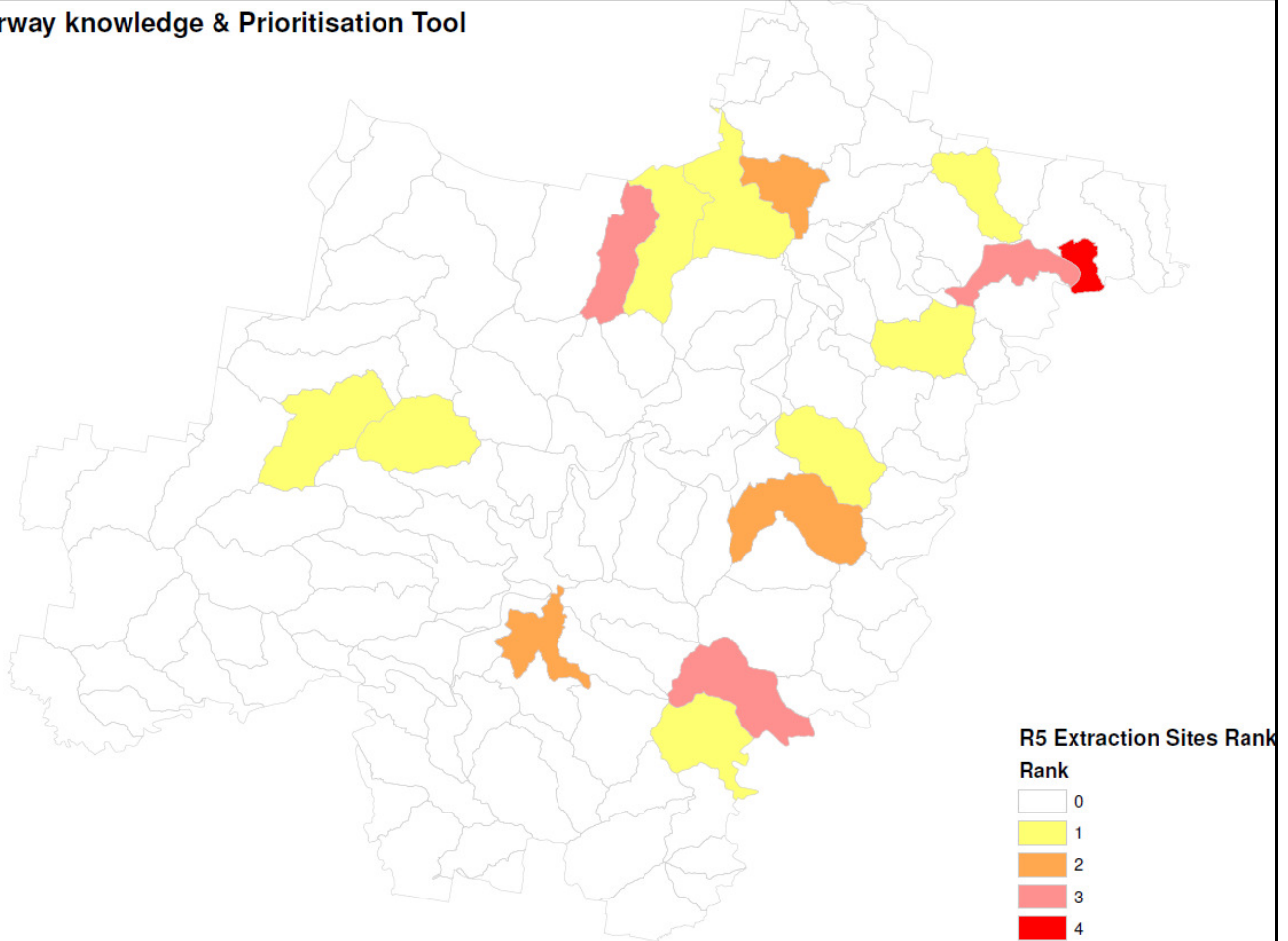
Waterway knowledge & Prioritisation Tool



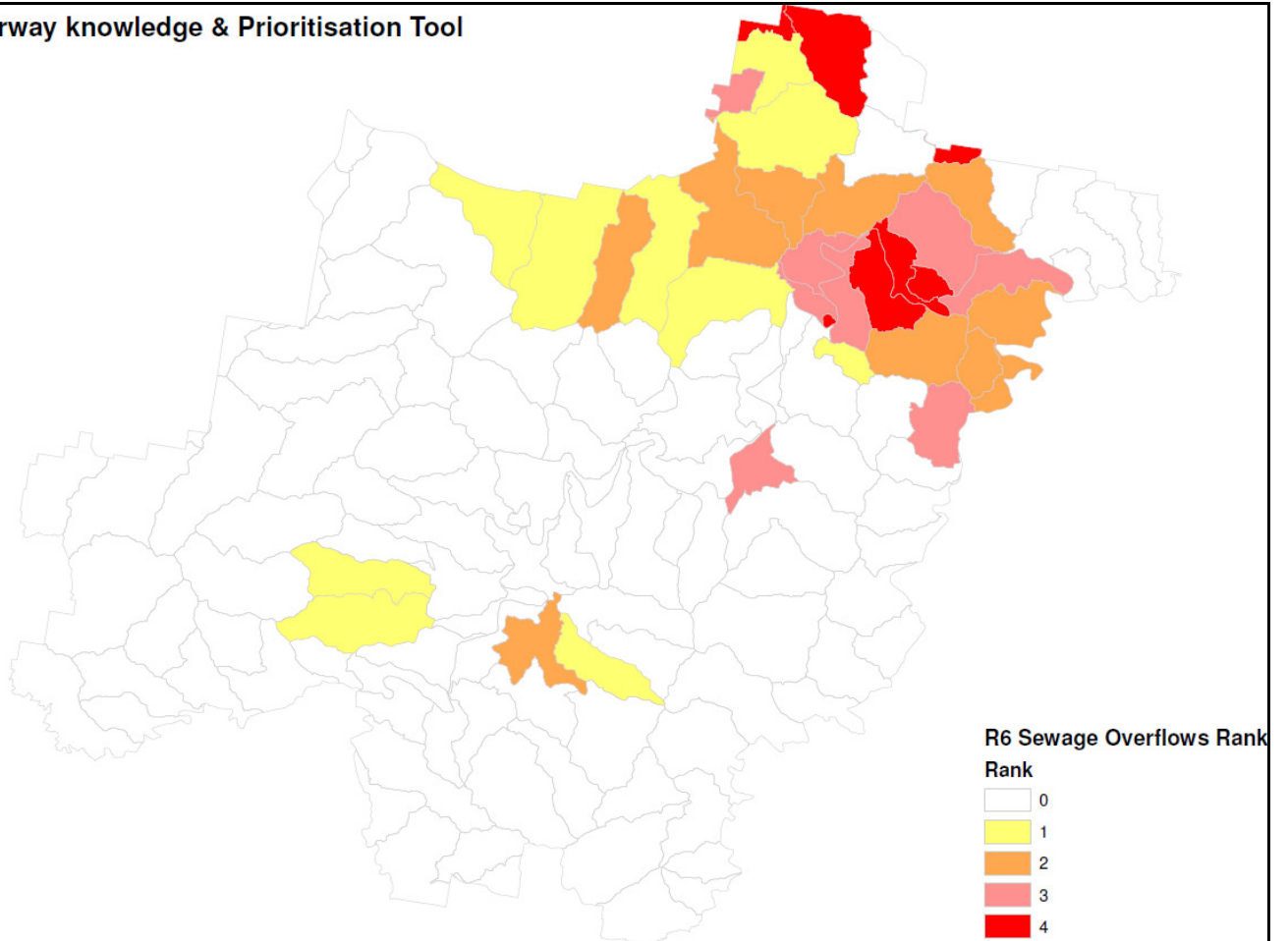
Waterway knowledge & Prioritisation Tool



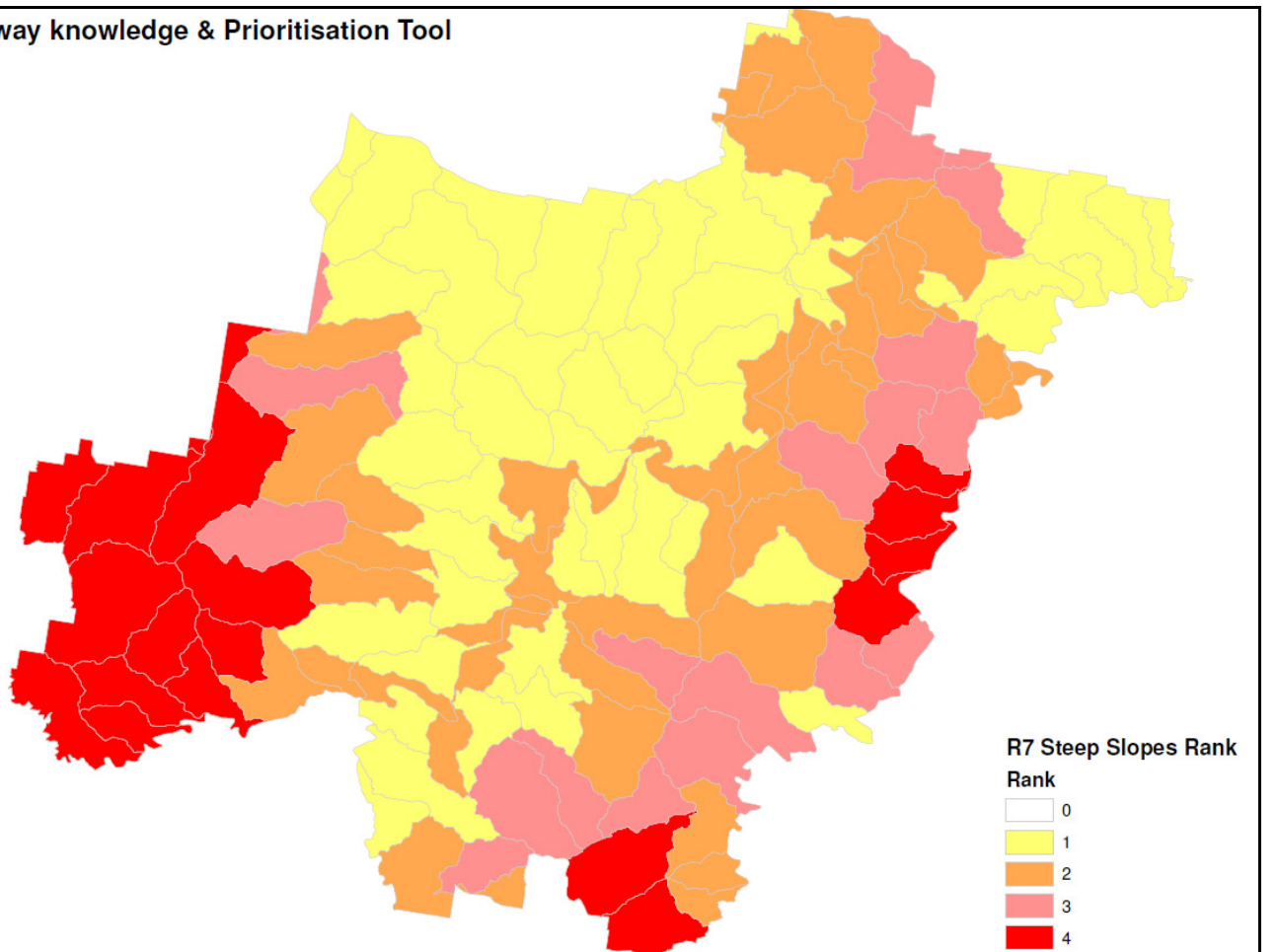
Waterway knowledge & Prioritisation Tool



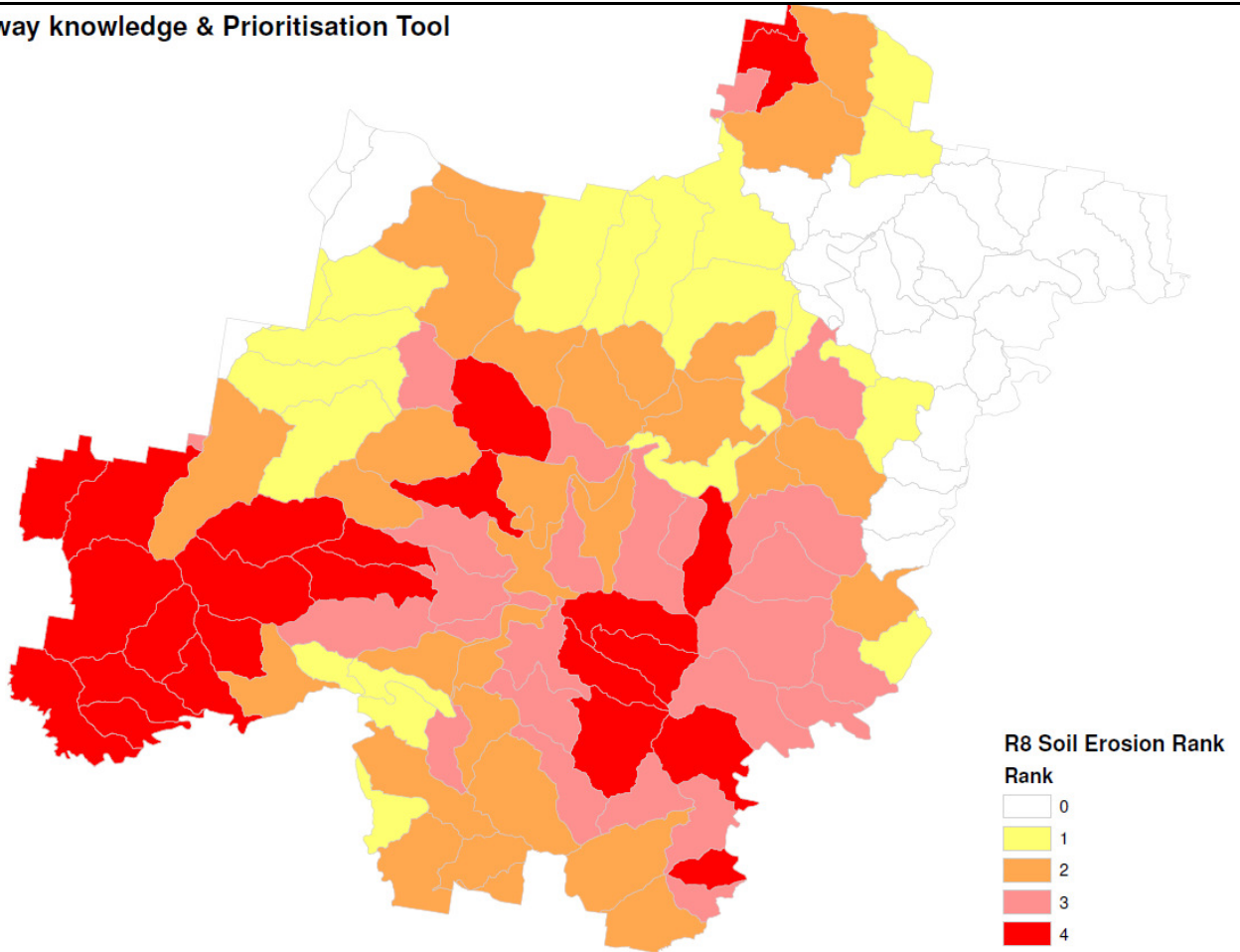
Waterway knowledge & Prioritisation Tool



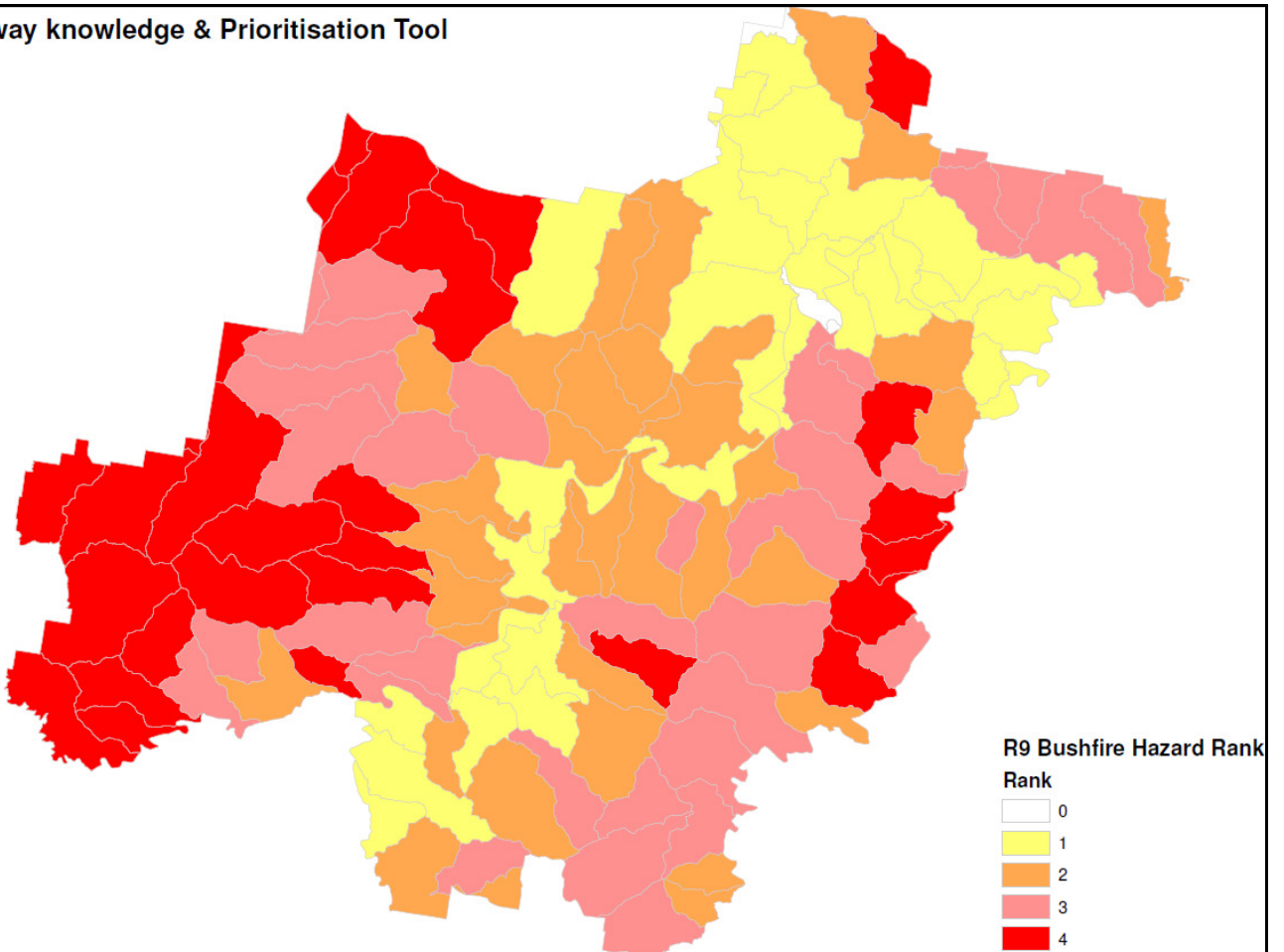
Waterway knowledge & Prioritisation Tool



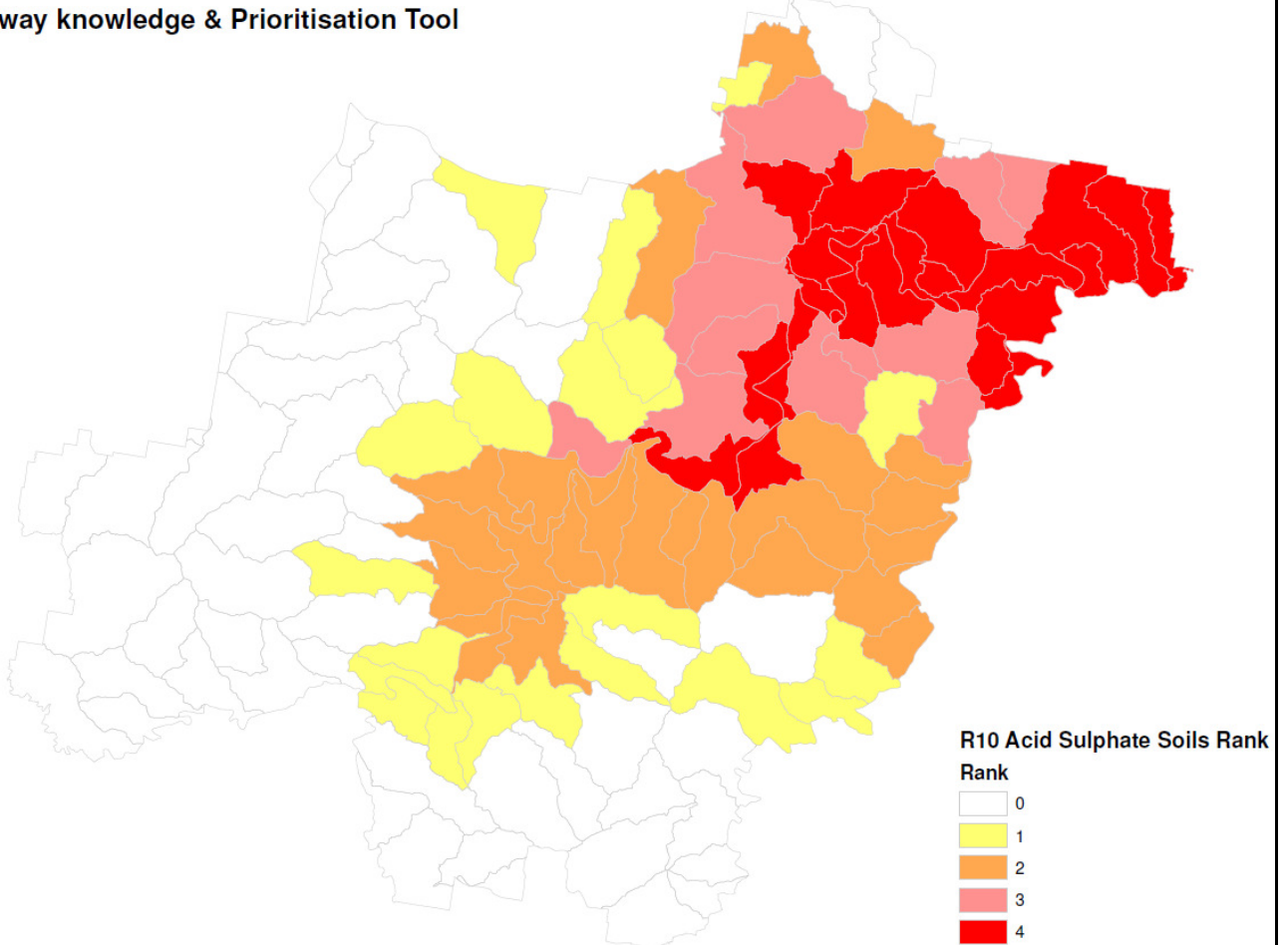
Waterway knowledge & Prioritisation Tool



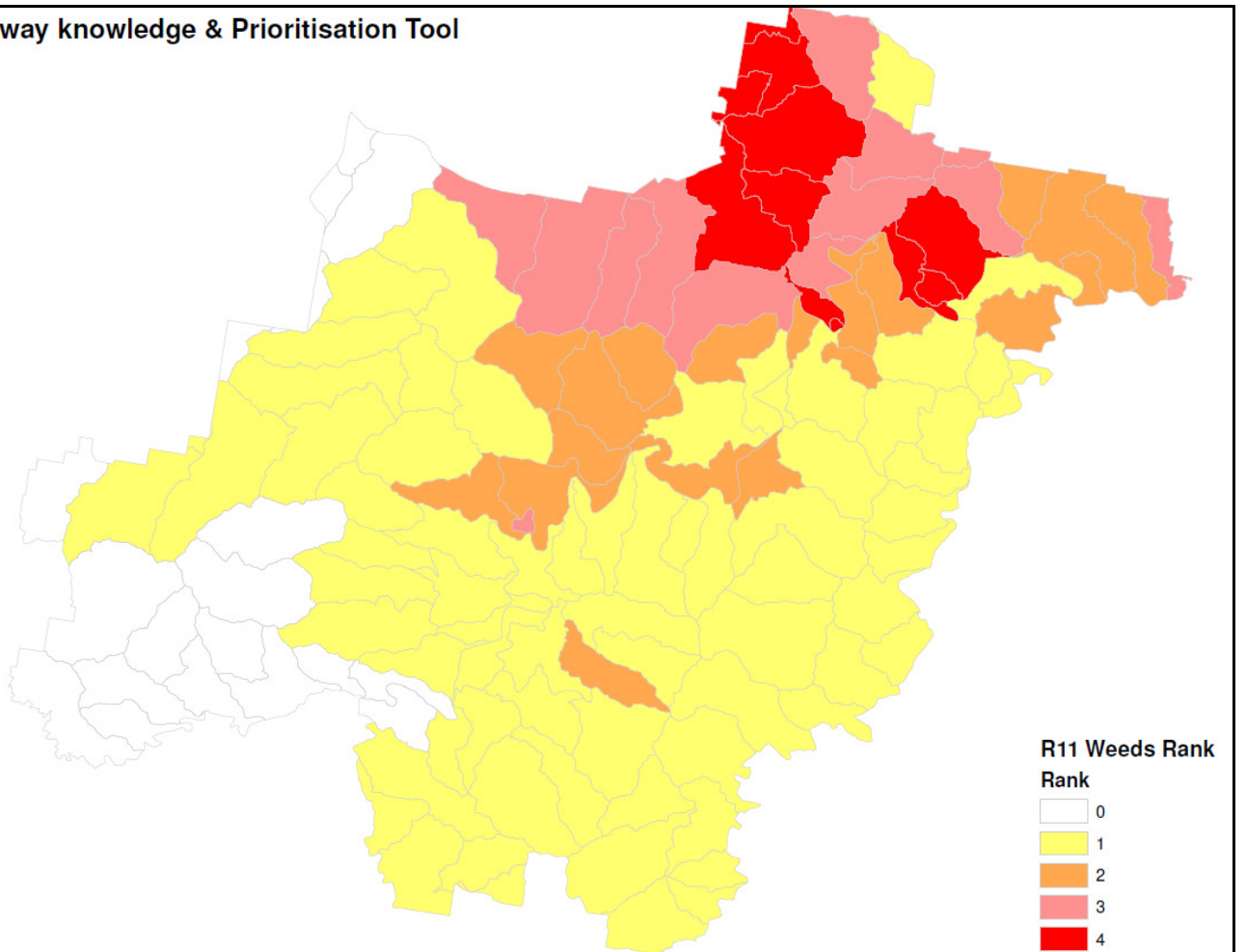
Waterway knowledge & Prioritisation Tool



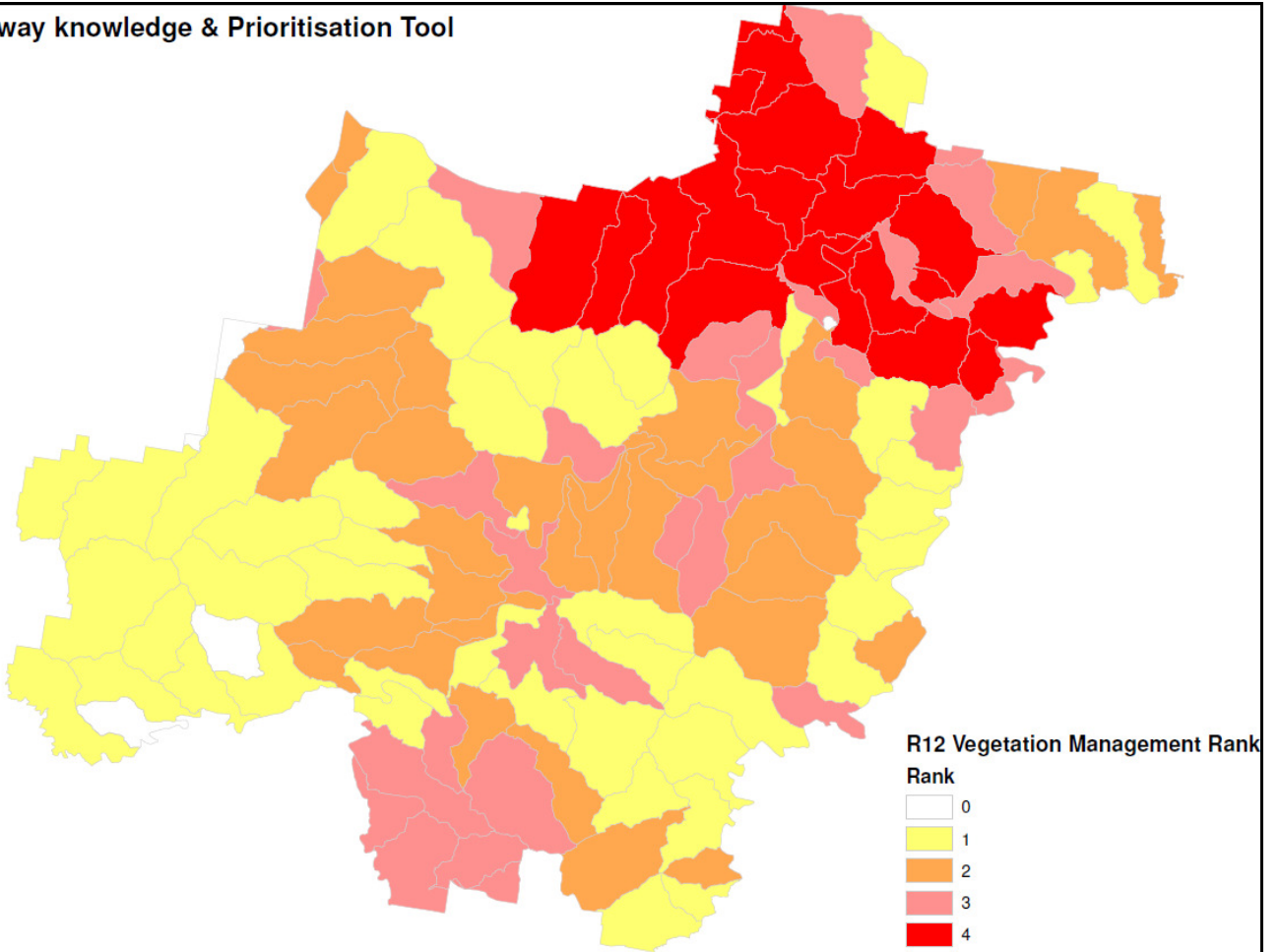
Waterway knowledge & Prioritisation Tool



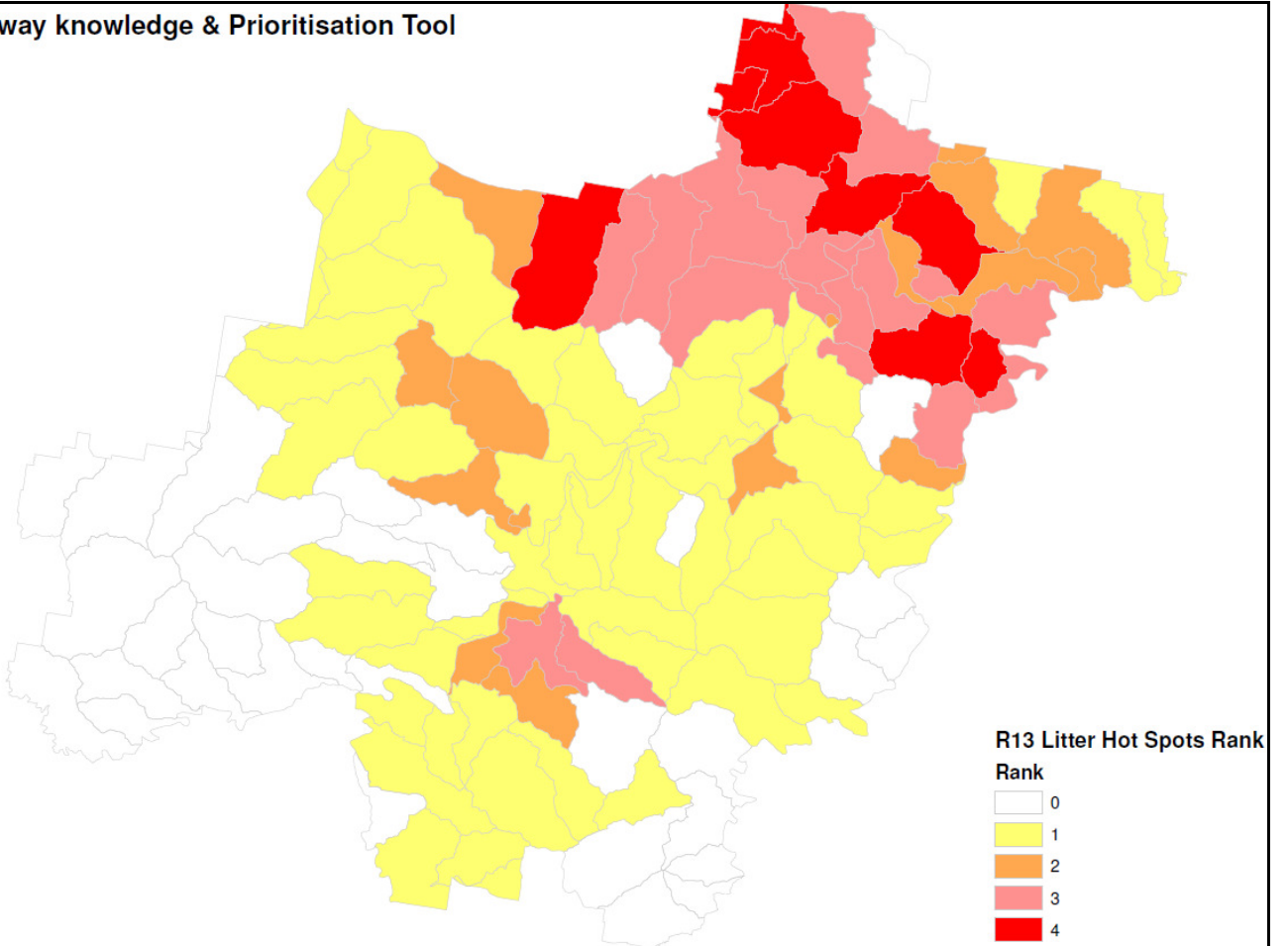
Waterway knowledge & Prioritisation Tool



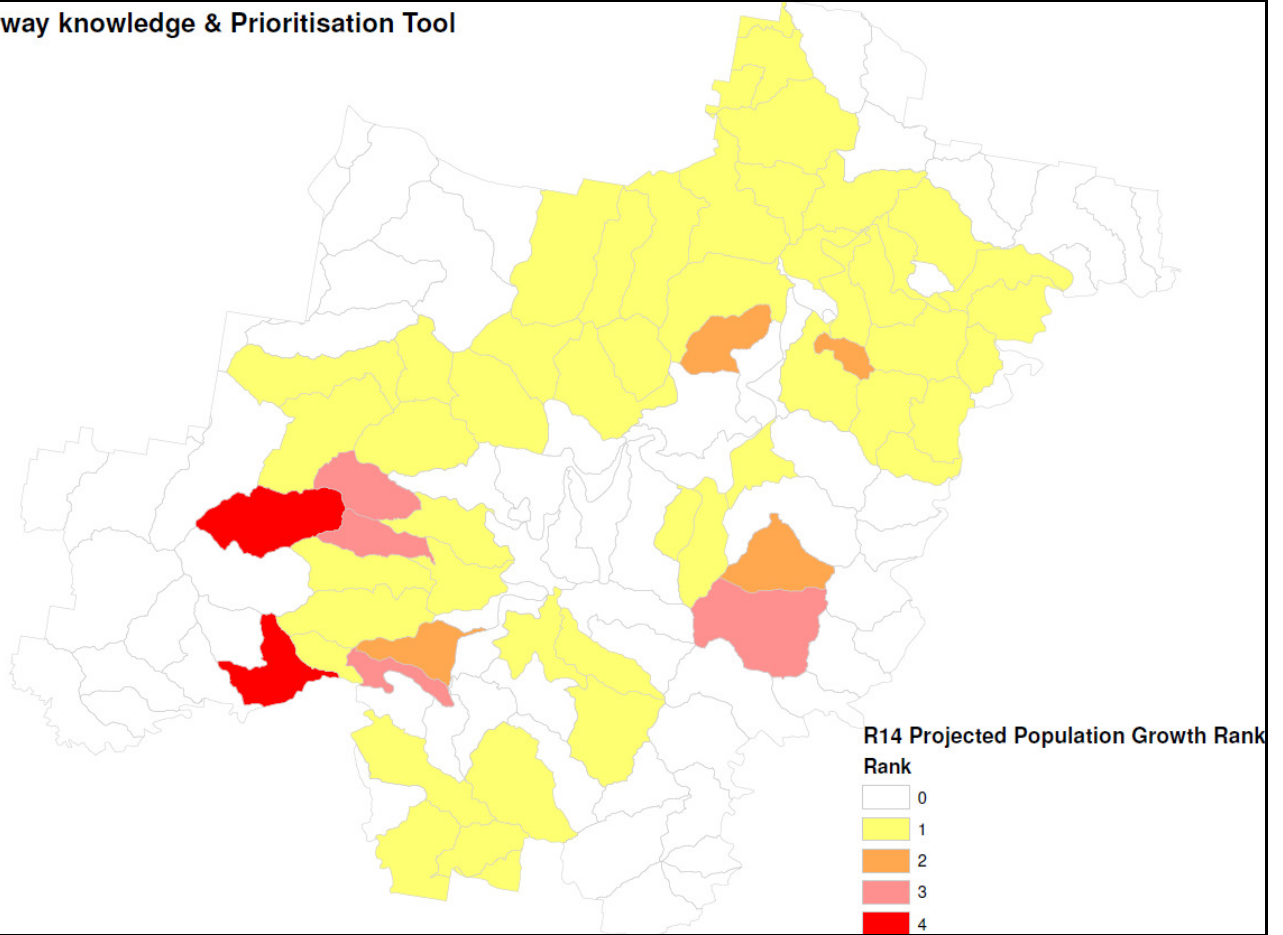
Waterway knowledge & Prioritisation Tool



Waterway knowledge & Prioritisation Tool



Waterway knowledge & Prioritisation Tool



Appendix S: Prioritisation Results

Waterway knowledge & Prioritisation Tool

