

ANNUAL NUTRIENT SURVEY for Local Government Authorities

Results 2018



**An initiative of the South East Regional Centre for Urban Landcare's
Phosphorus Awareness Project**



Department of Biodiversity,
Conservation and Attractions



Annual Nutrient Survey for Local Government Authorities 2018

The Swan and Canning River systems, and many wetlands, are suffering from regular, and sometimes toxic, algal blooms. These blooms occur due to excessive inputs of nutrients, particularly phosphorus and nitrogen, combined with low water flows. The Phosphorus Awareness Project (PAP), supported by the Rivers and Estuaries Branch, Department of Biodiversity, Conservation and Attractions and managed by the South East Regional Centre for Urban Landcare (SERCUL), aims to raise awareness of the sources of nutrients, the need to minimise their use, and how this can be achieved.

Local authorities are responsible for nutrient use on turfed areas, reserves and in local planning decisions and thus have the opportunity to lead the community by setting examples in best practice. The Annual Nutrient Survey for Local Government Authorities was designed to determine Local Government Authority (LGA) practice with respect to nutrient use and to inform the local community.



Upper Canning River at Thompson Road, Roleystone

The Swan-Canning Catchment consists of thirty Local Government Authorities (LGA's). This was the seventeenth survey of all LGA's in the Catchment (previously the nine LGA's of the Canning Catchment had been surveyed). Twenty-one of the thirty LGA's responded to the survey. The LGA's that responded in 2018 were: Armadale, Bayswater, Belmont, Cambridge, Canning, Claremont, Cockburn, Cottesloe, Joondalup, Kalamunda, Kwinana, Melville, Nedlands, Perth, Rockingham, South Perth, Stirling, Subiaco, Swan, Victoria Park and Vincent. Eighteen of the twenty-one LGA's that responded this year also participated in the 2017 survey. Fremantle and Mosman Park LGA's participated in 2017, but not this year, and Cottesloe, Joondalup and Swan participated this year but not in 2017. It is important that all LGA's take the opportunity to participate in this annual survey each year as a way of monitoring their management practices over time and the impact they may be having on the catchment.

The results of the survey indicate that LGA's in the Swan-Canning Catchment are conducting varying degrees of Best Management Practices (BMP's) in nutrient management. Overall the majority of LGA's conducted a high level of BMP's in the areas of nutrient monitoring, turf type and nutrient education. A medium level of BMP's was achieved in the areas of fertiliser applications, nutrient management, water quality monitoring, development control and waste water systems. Compared to the 2017 survey overall there has been a slight increase in the use of BMP's, but there is definitely room for improvement.

It is strongly recommended that every LGA reads the recommendations section at the end of this report. This recommendations section outlines the strategies that need to be implemented to achieve a high level of nutrient best management practice for all questions asked in this survey. All LGA's are encouraged to compare their individual responses to each question and implement recommendations that they do not currently undertake. Score Cards will be provided to LGA's that responded to this year's survey that clearly show where and how improvements can be made for each area.

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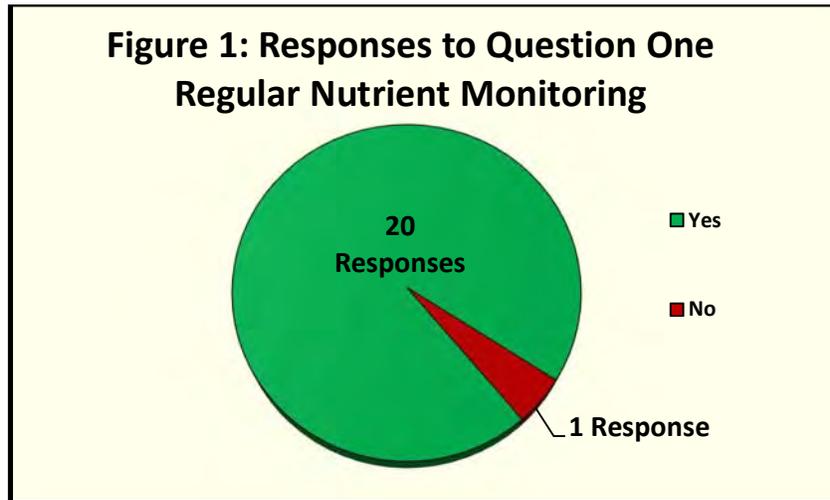
Websites: www.sercul.org.au & www.fertilisewise.org.au

Nutrient Monitoring

Questions One and Two

Questions One and Two related to soil tests, leaf tissue analysis and moisture testing of nutrients in grassed and turf areas.

Figure 1 shows that of the twenty-one LGA's that responded to Question 1, only one did not carry out any type of soil, leaf tissue and/or moisture testing in grassed and turf areas. Compared to the 2017 survey, the number of LGA's conducting soil, leaf tissue analyses and/or moisture testing has decreased slightly.



All LGA's are encouraged to conduct nutrient testing. This testing is extremely important as it provides information to determine whether nutrients are required and if required, the application rate and types of nutrients and fertiliser needed. It is strongly recommended that all LGA's regularly conduct these tests before applying fertiliser, so that unnecessary nutrient applications can be avoided. The leaf tissue nitrogen content should be maintained between 1.5% - 2% for passive turf and 2% - 3% for sports fields while the leaf tissue phosphorus content should be maintained between 0.2% - 0.4% (Ruscoe, Johnston & McKenzie, 2004). It is also strongly recommended that Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training courses that are hosted by the Phosphorus Awareness Project in 2019 to fully understand the results of testing that may occur in the LGA's area.

Figure 2a shows the number of LGA's who performed at least one type of testing – soil, leaf and/or moisture – in each of the different areas.

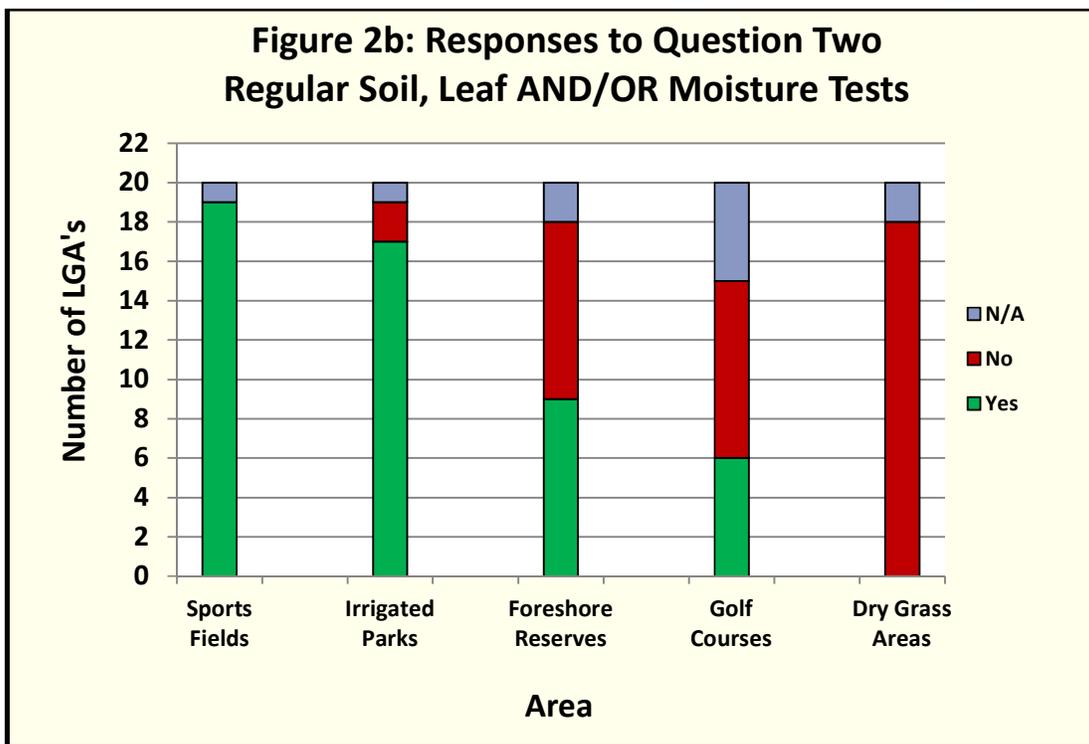
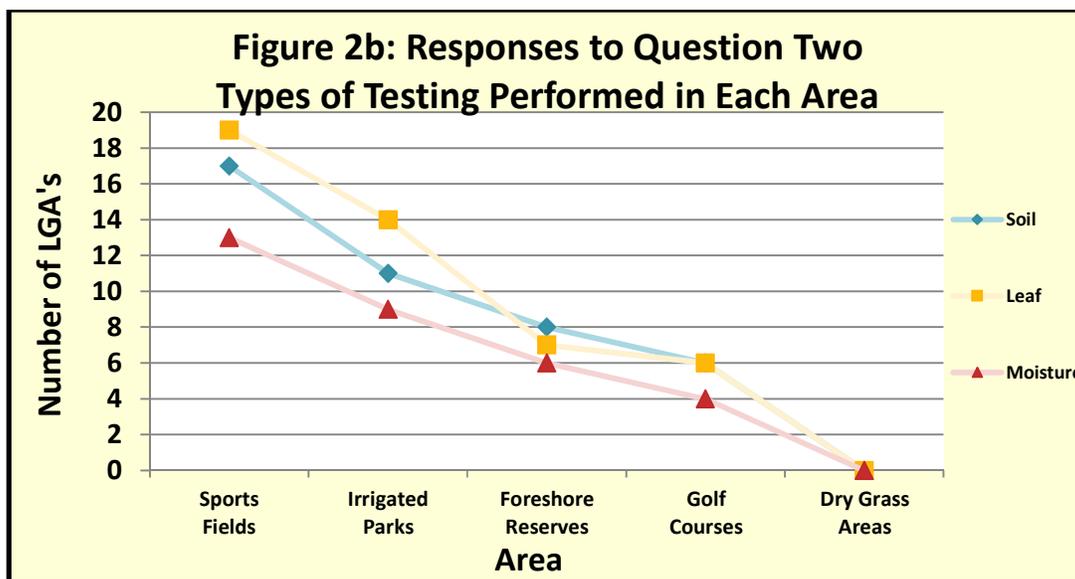


Figure 2b shows the number of LGA's that performed each of the different types of testing – soil, leaf tissue or moisture - in the five areas – sports fields, irrigated parks, foreshore reserves, golf courses and dry grass areas.



Of the twenty LGA's that conducted testing in the 2018 survey, nineteen LGA's performed at least one type of testing (soil, leaf and/or moisture) on their sports fields, with leaf tissue analysis performed by twenty LGA's, soil testing by nineteen LGA's and moisture testing being undertaken by only thirteen LGA's. Seventeen LGA's tested irrigated parks, with leaf tissue analysis being the most common test performed in this area, followed by soil testing and then moisture testing. Foreshore reserves were tested by nine LGA's, with soil testing being the most common type performed followed by leaf tissue analysis and then moisture testing. Six LGA's performed at least one type of test on their golf courses, most commonly soil and leaf tissue analysis, followed by moisture testing. No LGA's performed any type of test in their dry grass areas.

Compared to the 2017 survey, the number of LGA's testing sports fields, foreshore reserves and golf courses decreased slightly, the number of LGA's testing irrigated parks increased moderately and the number of LGA's testing dry grass areas decreased moderately. For the different tests that LGA's conducted, the use of soil tests in one or more of the areas mentioned decreased slightly from 2017 to 2018, whilst the number of LGA's analysing leaf tissue and conducting moisture testing in at least one area remained the same.

These results are somewhat discouraging with testing decreasing in each of the different areas, except irrigated parks where it increased moderately. It is encouraging that most LGA's perform at least one type of testing on their sports fields, however it would be preferable to see soil testing and leaf tissue analysis backed up with increased moisture testing. It is recommended that all LGA's conduct soil, leaf tissue and moisture content tests on sports fields as they are high use areas requiring good quality turf where overfertilising and overwatering could occur if not monitored appropriately. The large and increased number of LGA's testing irrigated parks is encouraging, however the number performing soil and moisture tests lags behind the number conducting leaf tissue analysis. Over watering and/or overfertilising of turfed areas can result in nutrients being leached beyond the root zone to groundwater. It is strongly recommended that irrigated parks are regularly tested, especially for moisture, so that irrigation schedules can be adjusted accordingly to avoid leaching of nutrients from these areas and the wasting of water.

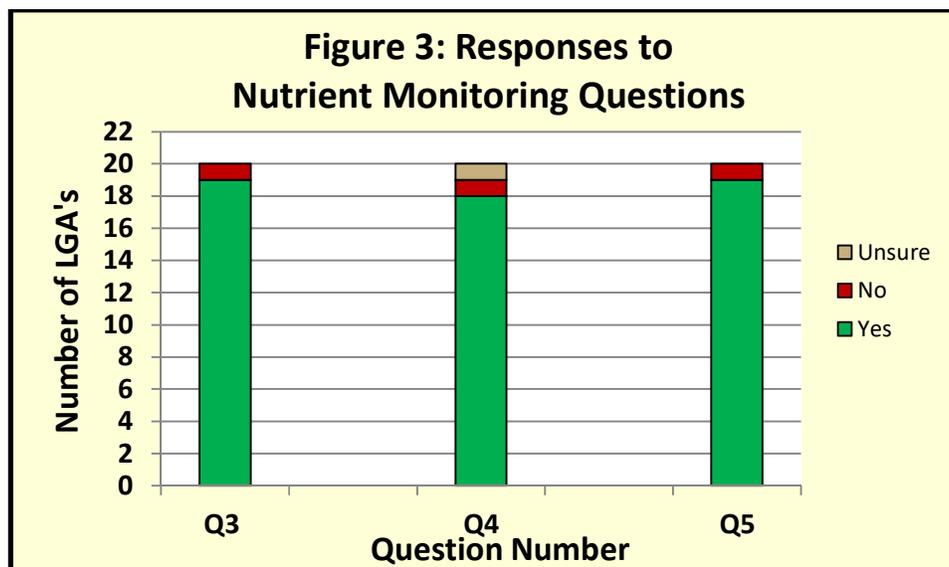
It is disappointing that the number of LGA's conducting testing of foreshore reserves has decreased to an even lower level in 2018. Of the 21 LGA's who responded, only two did not have foreshore reserves, making this question applicable to 19 LGA's. Two of the LGA's that have foreshore reserves but don't fertilise still test, with one conducting all three types of test/analysis and the other conducting soil and moisture testing. Of the ten that have foreshore areas but don't test, three of them don't fertilise, but the other seven do, indicating that the lack of testing is in general not due to them not fertilising. It is recommended that before fertiliser is applied to foreshore reserves that they are tested for nutrients, to avoid overuse of fertiliser, due to the close proximity of waterways.

The relatively low number of LGA's performing any type of testing on golf courses is discouraging as they are another area where inappropriate fertilising and watering could result in the leaching of nutrients, particularly given the large number of golf courses located near and around natural and man-made waterbodies. The low number who test, combined with the number who stated that this question was not applicable to their LGA, suggests that the maintenance of golf courses may be tendered out or that the golf course is acting independently of the LGA. It is recommended that all LGA's promote testing of golf courses in their areas because they can be a significant source of nutrients to waterways. The absence of dry grass areas testing could be an indication that fertiliser is not applied to these areas. If fertiliser is applied, it is recommended that regular testing occur as nutrients can leach to groundwater from these areas in the wetter months.

It is encouraging that most of the LGA's that responded are conducting soil tests and leaf tissue analysis in at least one of the areas that they are responsible for managing. This indicates that in those areas the majority of LGA's have scientific information to know exactly how much and what type of nutrient needs to be applied. Thus it is very unlikely that overfertilising would occur in these areas. However, it is disappointing that moisture testing is only conducted by just over half of the LGA's. If areas are overwatered then it is highly likely that nutrients in the soil will be washed past the root zones of turf and plants and enter the groundwater system. Thus, it is recommended that all areas that are irrigated have regular moisture testing to ensure that leaching does not occur.

Question Three

Figure 3 shows the responses from Questions Three, Four and Five.



Question Three asked whether the LGA had its analyses conducted by a laboratory affiliated with the *Australian Soil and Plant Analysis Council* (ASPAC). Nineteen of the twenty LGA’s that carry out tests have their analyses conducted by these affiliated laboratories. This figure remains unchanged from 2017.

It is encouraging that the majority of LGA’s that are testing are using ASPAC laboratories. ASPAC laboratories are independent, offer quality assurance and standard procedures from experienced staff. It is recommended that LGA’s use these laboratories for their analyses to ensure accurate information is received.

Questions Four and Five

Questions Four and Five were directly related to the monitoring of phosphorus. Question Four asked whether available phosphorus was measured by the standard Colwell method. Question Five was about measuring of the Phosphorus Retention Index (PRI). Eighteen of the twenty LGA’s measured the available phosphorus in the soil by the standard Colwell method. Nineteen of the twenty LGA’s tested the Phosphorus Retention Index of the soil. Compared to the 2017 survey the number of LGA’s that used the standard Colwell method has decreased slightly, whilst those who measure the PRI of the soil has remained the same.

It is encouraging that in most cases both the Colwell method (standard method for Western Australian conditions) and the PRI of the soil are being measured together to determine phosphorus levels in soils. Without both tests being conducted, an accurate interpretation of phosphorus levels cannot be achieved and thus inappropriate fertiliser regimes may be used. It is recommended that all LGA’s use both tests, in conjunction, to determine phosphorus levels in soils and then apply results to the following table to determine if phosphorus applications are necessary. As a minimum, these tests should be conducted every second year.

Phosphorus Recommendations		
PRI (Allen & Jeffery method)	Soil Test P (Colwell test)	Recommendations
O or negative		Do not apply P
0.1 - 0.5	< 5 ppm	Apply up to 5 kg P/ha
	> 5 ppm	Do not apply P
0.5 - 2	< 7 ppm	Apply up to 5 kg P/ha
	> 7 ppm	Do not apply P
3 - 5	< 10 ppm	Apply up to 10 kg P/ha
	> 10 ppm	Do not apply P
> 5	< 10 ppm	Apply up to 20 kg P/ha

Source: Ruscoe, Johnston & McKenzie 2004, *Turf Sustain – A Guide to turf management in Western Australia*. Sports Turf Technology, WA.

Table 1: Phosphorus recommendations using PRI and P soil test results

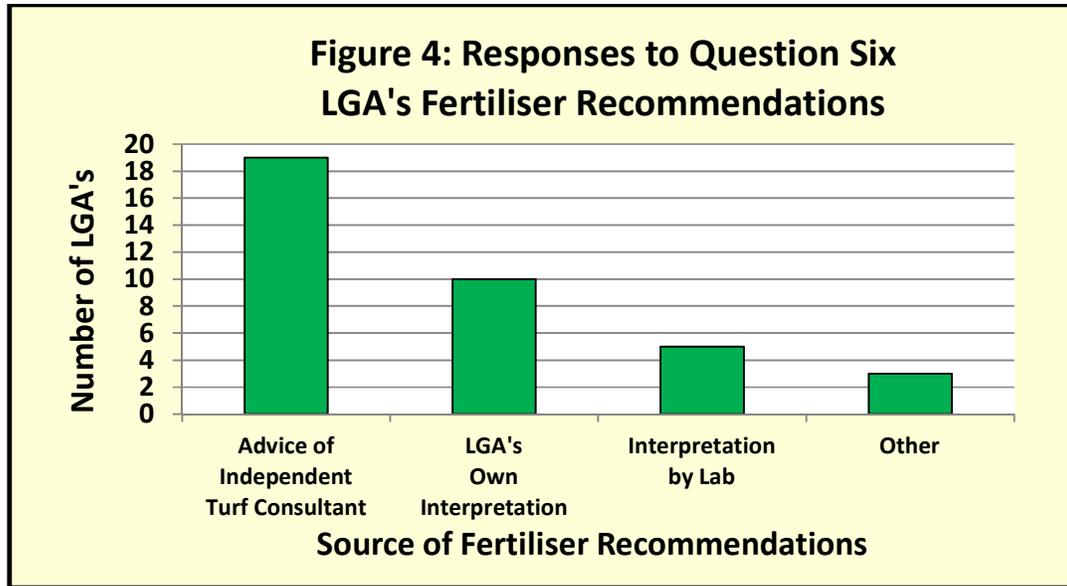
Fertiliser Applications

Question Six

Question Six asked where the LGA’s obtained their fertiliser recommendations. Twelve LGA’s had more than one response to this question. Figure 4 shows nineteen of the LGA’s received advice from independent turf consultants, ten interpreted the results themselves, five received interpretation from the laboratory and three indicated other which included recommendations from the fertiliser supplier, Manager of Parks or periodically as required. Compared to the 2017 survey, LGA’s obtaining their fertiliser recommendations from turf consultants and interpretation by the laboratory has increased slightly, LGA’s interpreting the results themselves decreased moderately and recommendations from other sources has increased moderately.

The multiple responses from some of the LGA’s to this question indicated that experienced turf managers used their own judgement, blended with a consultants or the laboratories advice, to decide on a fertiliser program for different turfed areas. It is encouraging that a range of opinions were utilised to determine application rates of fertiliser, rather than single sources, and it is recommended that this

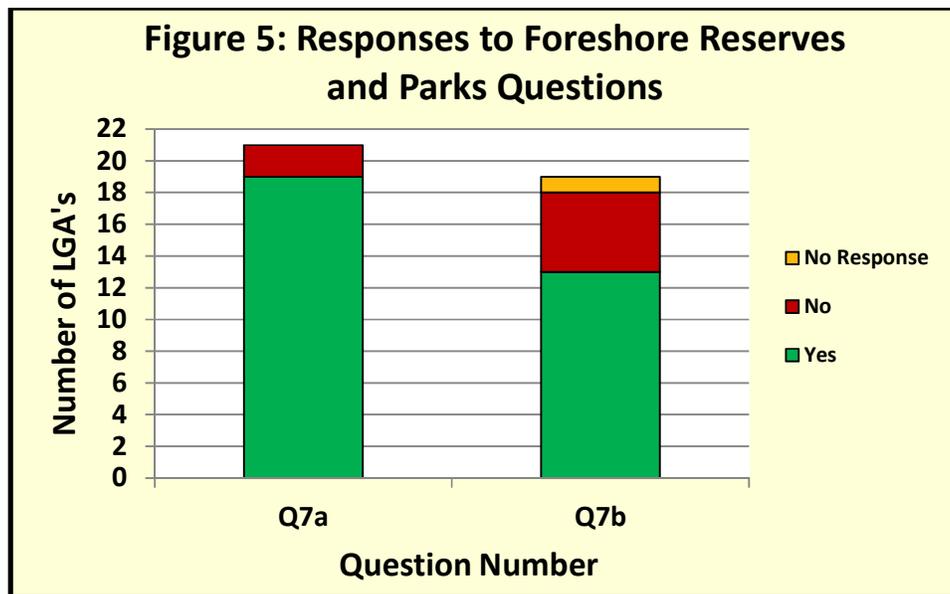
continue. The high level of advice from turf consultants who are specifically trained in turf management and usually with many years of on ground experience is highly desirable, and it is recommended that LGA's use their expertise to determine appropriate fertiliser regimes. It is also strongly recommended that Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course hosted by the Phosphorus Awareness Project in 2019 to obtain a greater understanding of appropriate fertiliser and nutrient applications.



Question Seven

Question Seven asked if LGA's have foreshore reserves and parks and if they did whether fertiliser was added to foreshore reserves and parks. As can be seen from Figure 5 Question 7a, nineteen LGA's did have foreshore reserves and parks. Figure 5 Question 7b shows that of the nineteen, thirteen LGA's added fertiliser to foreshore reserves and parks, with five LGA's not adding fertiliser and one not responding. Compared to the 2017 survey, the number of LGA's fertilising foreshore reserves and parks has increased slightly.

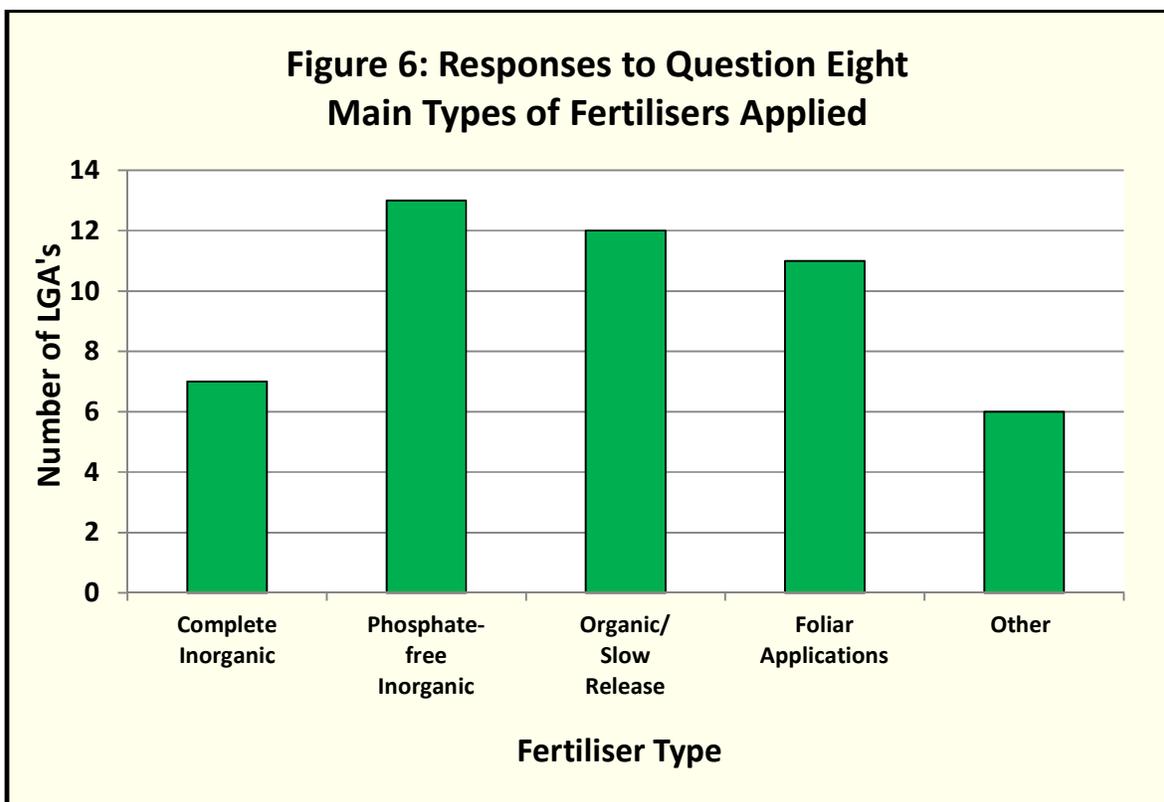
This response is discouraging due to the large number of LGA's applying fertiliser to these potentially high risk areas where nutrients can enter waterways. Due to the high number of LGA's applying fertilisers in these areas it is recommended that all LGA's test foreshore reserves before they apply fertiliser to these sensitive areas to avoid unnecessary nutrient applications. If nutrients are required then controlled release or low water soluble fertilisers should be applied. Fertiliser should not be applied in the winter months when heavy rainfall can wash nutrients into the waterway and irrigation needs to be carefully monitored so that overwatering does not add to the nutrients being washed into the waterway. If possible, a 50 metre buffer zone should be established between fertilised areas and waterways (DoW, 2004-2007). LGA's can refer to 'Fertiliser application on pasture or turf near sensitive water resources (2010)' available from the Department of Water and Environmental Regulation for further information.



Question Eight

Question Eight determined exactly what types of fertilisers the LGA's applied to turfed areas as well as the percentage of Nitrogen (N) and Phosphorus (P) of the fertiliser, average application rates of the fertiliser, area (hectares) that was fertilised and the number of applications per season of the fertiliser that was applied. LGA's were asked to provide answers to these questions for fertiliser applications to active turf eg. sports ovals, passive turf eg. parks, foreshore areas, non-native gardens, native gardens and other areas.

Seventeen of the LGA's had more than one response to the fertiliser type question. As can be seen from Figure 6, seven of the LGA's used complete inorganic fertiliser, thirteen used phosphate-free inorganic, twelve used organic/slow release, eleven used foliar applications and five used other types of fertilisers. Compared to the 2017 survey the use of complete inorganic has decreased moderately, phosphate free inorganic and organic/slow release use has decreased slightly, foliar applications have increased moderately and other applications have increased significantly.



For the fertiliser type question more than one response from the majority of the LGA's indicated they were using specific fertilisers according to the soil's condition rather than using the same fertiliser for all conditions. It is recommended that the LGA's continue to apply fertilisers in this way. The decrease in the use of complete inorganic fertilisers is encouraging. Complete inorganic fertilisers can contain high levels of phosphorus and nitrogen and should only be applied if soil and leaf tissue testing reveal these nutrients are required. It is encouraging that phosphate-free inorganic fertiliser is being used by a large proportion of the LGA's that responded to the survey, although it is disappointing that it is being used by slightly less LGA's than last year. Many turfed areas do not require phosphorus and thus it should only be applied if testing reveals that it is needed. It should also be noted that high nitrogen levels in fertiliser can also cause problems in waterway systems. Thus LGA's should only apply nitrogen when testing indicates that it is required. It is discouraging that the use of organic/slow release fertilisers has decreased slightly. These fertilisers generally release their nutrients slowly over a period of time, though some nutrients in the fertiliser may not be slow release, thus plants and turf have an extended opportunity to take up all the nutrients released. The use of organic fertilisers could also have the added benefit of improving the soil. Foliar applications are only being used by just over half of the LGA's who responded, although this number has increased from last year. This method of spraying nutrients on to the foliage of turf means that nutrients will mostly be taken up into the leaves, with only minimal amounts entering soil where it can be leached to groundwater and waterways. Five of the LGA's indicated that they use other types of fertilisers. As stated previously, soil and leaf tissue testing should be conducted before any nutrients are applied to turf to reduce the risk of leaching of nutrients to groundwater.

The responses from the twenty LGA's to the percentage of Nitrogen (N) and Phosphorus (P) of the fertiliser, average application rates of the fertiliser, area (hectares) that was fertilised and the number of applications per season were collated and analysed to provide the results in Table 2 for each of the application areas including active turf, passive turf, foreshore reserves, non-native gardens, native gardens and other areas.

The average nutrient application rate of nitrogen and phosphorus for each area was calculated by multiplying the amount of fertiliser applied per hectare (application rate in kg/ha) by the percentage of nutrient (either N% or P %) in the fertiliser, divided by 100 for each fertiliser that the LGA applied. The results from all LGA's who provided their data in the requested unit of measurement were collated in this way and then averaged. The applications per season were totalled from each LGA for each season and then expressed as percentages for each application area. The average annual nutrient rate of nitrogen and phosphorus was calculated for each area by multiplying the average nutrient application rate for each fertiliser applied by the number of times it was applied over the year. The results from all LGA's who provided their data in the requested unit of measurement were collated in this way and then averaged. The total nutrient applied on total area for nitrogen and phosphorus was calculated by multiplying the average annual nutrient rate for each fertiliser (kg/ha/yr) by the number of hectares it was applied to each year. The results from all LGA's were then added together.

Average Nutrient Application Rate (kg/ha)		Applications per Season				Average Annual Nutrient Rate (kg/ha/yr)		Total Nutrient Applied on Total Area (kg/yr)	
Nitrogen	Phosphorus	Winter	Spring	Summer	Autumn	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Applications to active turf (e.g. Sporting ovals)									
27.80	3.52	11%	34%	25%	30%	77.88	9.61	11 791	1 572
Applications to passive turf (e.g. Parks)									
38.94	1.65	11%	31%	23%	35%	50.83	2.62	16 187	19
Applications to foreshore areas									
40.82	1.15	16%	45%	13%	26%	77.27	4.60	701	0
Applications to non-native gardens									
49.32	10.26	25%	25%	17%	33%	55.32	13.26	8	1
Applications to native gardens									
49.85	4.53	4%	36%	24%	36%	102.40	9.10	22	0.4
Applications to other areas									
No usable results									

Table 2: Analysed responses from the twenty LGA's to fertiliser questions for each application area.

As can be seen from Table 2 there was significant variation between the average nutrient application rates for nitrogen between the different application areas, which is to be expected as different areas have different requirements. The maximum recommended application rate of nitrogen is 40 kg/ha (Ruscoe, Johnston & McKenzie, 2004) though 30 kg/ha is usually sufficient. Average nitrogen application rates for active turf and passive turf were under the recommended rate of 40 kg/ha. Applications to other areas were above the recommended rate. An analysis of the raw data showed that some LGA's were applying rates of nitrogen at levels up to three times greater than the recommended rates. The highest rates of nitrogen applied for each area include 56 kg/ha on active turf, 80 kg/ha on passive turf, 80 kg/ha on foreshore reserves, 120 kg/ha on non-native gardens and 97 kg/ha on native gardens. No usable results were obtained from any of the LGA's regarding the application rates of fertilisers to other areas due to some data not being provided or being provided in the wrong units of measurement. Compared to the 2017 survey the average nitrogen application rate for active turf has increased moderately and increased significantly for passive turf, non-native gardens, native gardens (where it more than doubled) and foreshore areas (where it almost tripled).

It is encouraging that average nitrogen application to active turf is below both the recommended (40 kg/ha) and sufficient (30 kg/ha) rates as this is a large turfed area within most LGA boundaries. This result probably reflects the high level of nutrient testing performed in these areas as shown in Figures 2a and b. Average application rates to passive turf are only just under the maximum recommended application rate of nitrogen, whilst those for foreshore areas are just above and both are above what is usually considered sufficient. It is very concerning that excessive rates of nitrogen are being applied to native and non-native gardens, although these results are skewed somewhat by the fact that only three LGA's provided usable data for these areas and two of those LGA's were applying extremely high rates of nitrogen. It is highly recommended that every LGA determines the rate of nitrogen they are applying when they apply a particular fertiliser at a particular rate and do so before the fertiliser is applied so that the amount of nitrogen that is applied at one time does not exceed 40 kg/ha and is preferably closer to 30kg/ha.

There was also some variation between the average nutrient application rates for phosphorus between the different application areas. The maximum recommended application rate for phosphorus is 5 kg/ha (J. Forrest, pers. comm). As can be seen from Table 2 average applications to non-native gardens are over double this recommended rate while all other average applications were below recommended rates. An analysis of the raw data showed that some LGA's were applying rates of phosphorus at levels a lot higher than the recommended rates. The highest rates of phosphorus applied for each area include 24.5 kg/ha on active turf, 10 kg/ha on passive turf and foreshore areas, 20 kg/ha on non-native gardens and 9 kg/ha on native gardens. Compared to the 2017 survey average phosphorus applications to all assessable areas have increased significantly.

It is encouraging that average phosphorus application rates to active turf, passive turf, foreshore reserves and native gardens are below the recommended 5 kg/ha application rates as they are large turfed areas within LGA control. However, it is very concerning that high rates of phosphorus are being applied to non-native gardens, although as with the nitrogen results discussed above these results are based on a very small number of LGA responses. It is highly recommended that every LGA determines the rate of phosphorus they are applying when they apply a particular fertiliser at a particular rate and do so before the fertiliser is applied so that the amount of phosphorus that is applied at one time does not exceed 5 kg/ha.

The response to the number of applications per season question, as revealed by Table 2, shows that the majority of fertiliser applications are being made in the spring and autumn months for most of the application areas apart from non-native gardens which has the majority being applied in autumn followed by an equal number of applications being made in winter and spring. There are however, a large number of fertiliser applications being made in the summer months. An analysis of the raw data revealed that the majority of LGA's are applying fertiliser by multiple applications over the year rather than one large application per year. Compared to the 2017 survey fertiliser applications to native gardens has remained the same throughout the seasons. Application rates during winter have increased to the foreshore areas and non-native gardens but decreased to passive turf. During spring, the applications to the active and passive turf and non-native garden areas have decreased, but increased in the foreshore areas. Summer applications of fertiliser have risen in active, passive and foreshore turf areas but decreased to non-native gardens. While in autumn the applications to passive turf and non-native gardens have increased, whilst those to active turf and foreshore areas have decreased.

The responses to this question are promising with a large number of LGA's applying fertiliser in the spring and autumn months when turf and plants are actively growing. Some LGA's applied fertiliser in the winter months which is disappointing as it is likely that nutrients applied will be leached from the soil in heavy rain. The majority of LGA's also have warm season grasses which are dormant during the winter months, thus any fertiliser applied will not be taken up by the grass during this period of dormancy.

Although we didn't receive enough usable data for the other areas category, what was provided suggested that when planting trees fertiliser was often applied in winter. Planting trees in the winter months is highly recommended so they can establish themselves before the dry summer months so this is the only instance when applying fertiliser during winter is acceptable. A large number of LGA's stated that they fertilised in the summer months, though an analysis of the raw data revealed that only a small percentage of this fertiliser was from foliar applications. It should be noted that fertiliser should only be applied in summer if nutrient testing indicates it is required. Many turf types during the summer months will not take up nutrients from fertiliser if there is an extended period of high temperatures. It is encouraging that the majority of the LGA's are applying fertiliser by multiple applications over the year, rather than one large application per year, and it is recommended that this practice continues.

The average annual nutrient rate responses, as shown in Table 2, reveal that the average annual active turf rates of 78 kg/ha/yr of nitrogen and 9.6 kg/ha/yr of phosphorus are either below or within the recommended levels of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr of phosphorus for high maintenance active turf (Department of Environmental Protection & Water and Rivers Commission, 2001). For passive turf the average annual nutrient rate of 51 kg/ha/yr of nitrogen was just above the recommended rate of 0-50 kg/ha/yr for nitrogen and the 2.6 kg/ha/yr of phosphorus applied fell within the recommended rate of 0-5 kg/ha/yr for phosphorus (Department of Environmental Protection & Water and Rivers Commission, 2001). The foreshore areas average annual application of 77 kg/ha/yr for nitrogen is well above the recommended rate which is 0-50 kg/ha/yr while the 4.6 kg/ha/yr average annual rate of phosphorus is within the recommended rate for this area which is 0-5 kg/ha/yr for phosphorus (Department of Environmental Protection & Water and Rivers Commission, 2001). The average annual nutrient rates for non-native gardens and native gardens can be viewed in Table 2 and it was difficult to determine if levels have been exceeded due to the vast variety of different plant species that fit into these categories. The average annual nutrient rates of 102 kg/ha/yr of nitrogen and 9.1 kg/ha/yr of phosphorus applied to native gardens and 55 kg/ha/yr of nitrogen and 13 kg/ha/yr of phosphorus applied to non-native gardens are excessive, although the raw data suggests that these results are skewed by the small number of LGA's that provided usable data and the excessive application rates of a few of them. Compared to the 2017 survey, average annual nitrogen and phosphorus rates applied to active turf, passive turf, foreshore areas and non-native gardens have all increased, while for native gardens the average annual nitrogen rate has decreased, but the average annual phosphorus rate has increased.

It is encouraging that the average annual nitrogen and phosphorus rates applied to active turf areas are below or within the recommended levels for these areas and it is recommended that this continue. It is disappointing that the average annual nitrogen application rate has increased to passive turf areas, which has pushed it just above the recommended rate. More concerning is the steep increase in the average annual application of nitrogen to foreshore areas from 17 kg/ha/yr in 2017 to 77 kg/ha/year this year. Thankfully the application rate of phosphorus to passive turf and foreshore areas remains within the recommended rates. All LGA's are encouraged to keep a log book of their nitrogen and phosphorus applications over the year for all application areas to ensure that recommended rates for these areas are not exceeded. This may prevent excessive amounts of nutrients, like has occurred with respect to the average annual amount of nitrogen being added to both passive turf and foreshore areas from occurring in the future.

The total nutrient applied on total area figures, as can be seen in Table 2, revealed that 11 791 kg/yr of nitrogen and 1 572 kg/yr of phosphorus have been applied on 340 ha of active turf by the LGA's. Passive turf had 16 187 kg/yr of nitrogen and 19 kg/yr of phosphorus applied to 283 ha, foreshore areas had 701 kg/yr of nitrogen and 0 kg/yr of phosphorus to 15 ha, non-native gardens had 8 kg/yr of nitrogen and 1.4 kg/yr of phosphorus to 0.2 ha, native gardens had 22 kg/yr of nitrogen and 0.4 kg/yr of phosphorus to 2 hectares. Thus overall 28 709 kg/year of nitrogen and 1 592 kg/yr of phosphorus has been applied by the LGA's to a total of 641 ha. This does not take into consideration the areas that LGA's stated that they were fertilising, however did not provide enough information to enable a calculation of the amount of nitrogen and phosphorus being applied to be made. When comparing the calculations made with the available data it appears that overall less nitrogen and more phosphorus were applied to a smaller area when compared with the 2017 survey.

The Swan Canning Water Quality Improvement Plan states that the maximum acceptable load of total nitrogen to the Swan and Canning Rivers is 130 tonnes per year and total phosphorus is 14 tonnes per year (Swan River Trust, 2009). The 28 709 kg/year (29 tonnes) of nitrogen and 1 592 kg/year (1.5 tonnes) of phosphorus that has been applied by the LGA's has the potential to enter the rivers through leaching to groundwater and by runoff onto hard surfaces and into stormwater drains or directly into waterways. It is recommended that LGA's implement the best management practices for fertiliser/nutrient applications recommended in this report to ensure that the majority of these applied nutrients do not enter the rivers.

Due to the difficulty in assessing overall level of best management practices because of differences in LGA areas including (but not limited to): soil type, turf type, passive vs active turf, age of turf, location of turf, percentage of nutrients in fertiliser and whether nutrient monitoring of turf occurred, it is recommended that LGA's implement the following strategies to ensure management practices approach a high level:

- Determine the rate of each nutrient of the fertiliser they intend to apply before application to ensure that over application of phosphorus and nitrogen does not occur. The formula to determine the rate of nutrient is to multiply the amount of fertiliser to be applied per hectare by the percentage of that nutrient (either N% or P%) in the fertiliser, divided by 100.
- The maximum nitrogen rate for a single application is 40 kg nitrogen/hectare (Ruscoe, Johnston & McKenzie, 2004) though 30 kg nitrogen/hectare is usually sufficient.
- The maximum phosphorus rate for a single application is 5 kg phosphorus/hectare (J. Forrest, pers. comm).
- High maintenance active turf should not exceed applications of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr for phosphorus.
- Passive turf and foreshore area applications should not exceed 0-50 kg/ha/yr for nitrogen and 0-5 kg/ha/yr for phosphorus.
- Keep a log book to record details of fertiliser and nutrient applications over the year for each application area including details such as weather conditions and monitoring information.
- If fertiliser is required, apply in spring and/or early autumn (September, October, November, March and April) when grass grows rapidly. Apply the fertiliser in small amounts and often over these months instead of a single application. This will ensure all nutrients can be utilised by the turf.

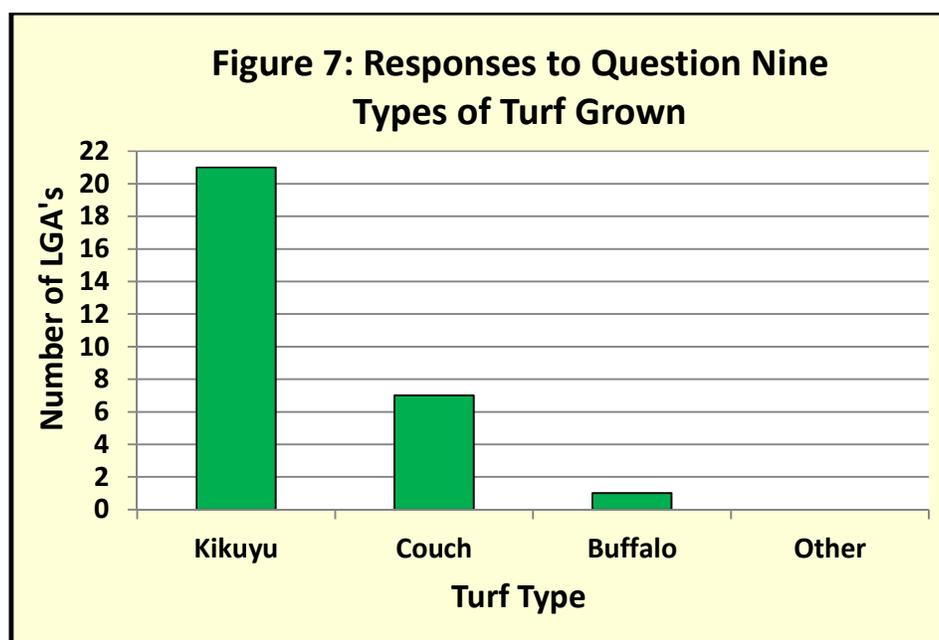
- Do not fertilise in summer or winter (with the exception of native trees that are planted in winter). Summer fertilising encourages over use of water and turf may grow excessively while fertiliser applied during winter will be washed into stormwater drains or leached into groundwater.
- Do not apply fertiliser too close to hard surfaces such as roads. Fertiliser on hard surfaces will be washed into stormwater drains and end up in waterways. Also, do not apply fertiliser around the edges of wetlands and rivers where it can directly be washed into these waterways.
- Avoid applying fertiliser before heavy rainfall and do not over water turf as both actions could result in leaching of nutrients to groundwater and waterways.
- LGA Parks and Gardens Officers should attend the Fertilise Wise Fertiliser Training, which is hosted by the Phosphorus Awareness Project, in 2019 to learn fertiliser best management practices specific for the Perth Metropolitan Area.
- LGA's should refer to the following publications (see Reference section for full publication details) to obtain more information on fertiliser and irrigation best management practices:
 - * *Turf Sustain – A guide to turf management in Western Australia*
 - * *Western Australian environmental guidelines for the establishment and maintenance of turf grass areas (2014)*
 - * *Stormwater Management Manual for Western Australia.*

Turf Type

Question Nine

Question Nine asked for the main type of turf grown in the LGA's area. Seven of the LGA's had more than one response to this question. As can be seen from Figure 7, twenty-one LGA's had kikuyu as their main turf type, seven LGA's also used couch and one LGA used buffalo. Compared to the 2017 survey the number of LGA's using kikuyu increased slightly, the number using couch increased moderately and the use of buffalo remained the same.

The response to this question is very encouraging with the majority of LGA's using kikuyu. It is recommended that LGA's continue to use kikuyu as their first choice for turfed areas due to its low fertiliser requirements, medium water usage, drought and wear tolerance and long growing season. Using kikuyu results in less nutrients and water having to be applied to turfed areas with less chance of leaching of nutrients occurring compared to other turf types. The LGA's that stated that they have couch and buffalo in their area should note that fertiliser should not be applied to these areas in the winter months as the couch and buffalo could be dormant and thus would not take up nutrients.



Nutrient Management

Question Ten

Question Ten Part A enquired if measures are in place to prevent grass clippings from entering stormwater drains and if so Part B asked respondents to list these measures. As can be seen from Figure 8, eighteen of the twenty-one LGA's stated that they did have measures in place preventing grass clippings from entering stormwater drains. Seventeen LGA's had more than one response to this question. The measures the LGA's have taken can be seen in Table 3. Compared to the 2017 survey the numbers of LGA's with measures in place has increased slightly, whilst the types of measures taken have remained similar.

The high number of LGA's that have measures in place to prevent grass clippings from entering stormwater drains is promising. It is recommended however, that all LGA's implement measures, as grass clippings are high in nutrients that will end up in waterway systems if they are left on hard surfaces and enter stormwater drains. Most measures that the LGA's indicated they undertook to prevent clippings from entering drains are best management practices. It should be noted, however, that Gross Pollutant Traps, grates over drains, drainage sumps and soakwells will not prevent nutrients from grass clippings from entering waterways.

Measure Taken	Number of LGA's Using Measure
Street sweeping	9
Clippings cleared/blown from hardstand areas	8
Put debris back on lawn	7
Direct debris away from road/path/waterways	6
Frequency of mowing	4
Gross Pollutant Traps	3
Vegetated drains	3
Catchers used on mowers	3
Clippings removed from site	2
Mulching decks/blades	2
Storm water drain e-ducting	1
Use of sumps and soakwells	1
Turf machinery cleaned down after use	1
Mowing practices, clean up procedures, equipment	1
Tool box meetings to inform of correct procedures	1
Water Sensitive Urban Design (WSUD) Development	1
Sweeping of ovals when windrow builds up	1
Application of Primo growth retardant	1
Grates over drains	1
'Wetlands & Waterways Buffer Zone Plan' implemented to create vegetated buffer zones around lakes	1
Lab testing of debris collected by street sweepers for petroleums and hydrocarbons	1

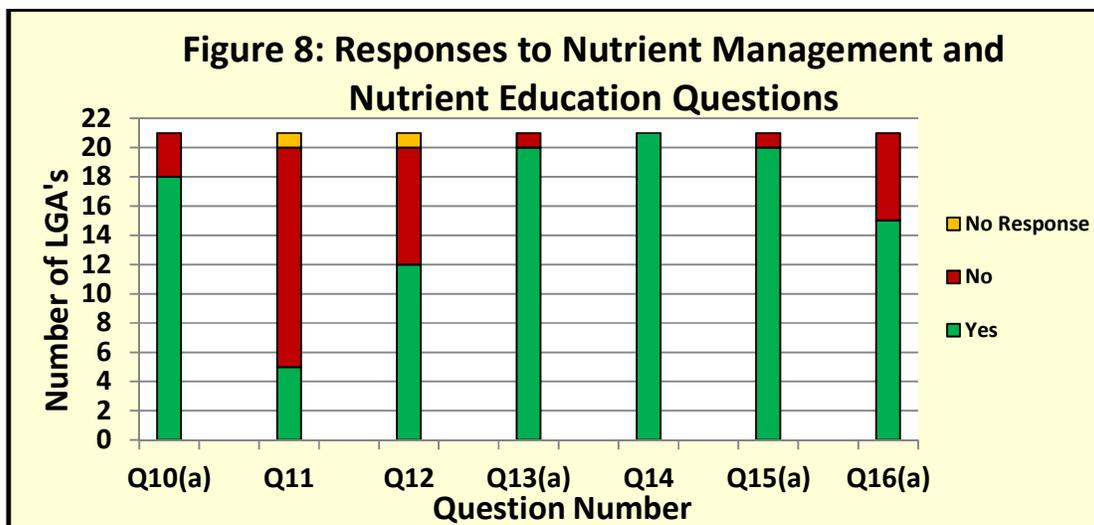
Table 3: Measures taken by the Eighteen LGA's to prevent grass clippings entering stormwater drains.

It is recommended that LGA's take the following measures to prevent grass clippings entering stormwater drains:

- Where practical LGA's should leave grass clippings on the mowed turf which returns the nutrients contained in the clippings back to the soil thus reducing fertiliser requirements. Clippings left in piles should be removed to disperse clippings.
- When mowing, clippings should be thrown away from hard surfaces and waterways.
- When mowing median strips and small areas near hard surfaces or waterways a catcher should be used.
- If clippings need to be removed they should be composted and then utilised as a soil amendment.
- Grass clippings that end up on hard surfaces such as roads and driveways should be swept up and removed (either manually or with a street sweeper) or blown off the hard surface back onto the turfed area.
- Grass clippings should never be blown, hosed or swept onto hard surfaces such as roads or driveways as they can be washed or blown into stormwater drains ending up in waterway systems.
- Mowing equipment should be cleaned down before going to the next location.
- When hosing down mowing equipment ensure that this water does not enter stormwater drains.

Further information can be obtained from the Department of Water's 'Stormwater Management Manual for Western Australia' and the Swan River Trust's (Fertiliser Partnership Urban Users Working Group) 'Western Australian Environmental Guidelines for the Establishment and Maintenance of Turf Grass Areas'.

Figure 8 shows the responses to Questions Ten through to Sixteen.



Question Eleven

Question Eleven asked if Nutrient and Irrigation Management Plans (NIMP) are implemented for streetscapes. Five of the twenty LGA's that responded had a NIMP for their streetscapes. Compared to the 2017 survey the number of LGA's with NIMP for their streetscapes has decreased moderately.

It is disappointing that less than a quarter of the LGA's have NIMP for their streetscapes and it is recommended that NIMP be implemented by all LGA's for streetscapes. Streetscapes include median strips, roundabouts, entry statements, car park landscaping and road verges, which when combined are large areas within an LGA where nutrients and water usage should be controlled more appropriately. The use of local native species in streetscapes would reduce the need to water and fertilise in these areas. Refer to question twelve for information on using local native species in streetscapes.

Information about NIMP is available from the Department of Water and Environmental Regulation's website where the following documents can be located:

* *Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans*

* *Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist*

Question Twelve

Question Twelve asked if LGA's have a policy to use local native plants as the first choice in public and private (Developers) landscaping. Twelve LGA's had a local native plant policy as the first choice in landscaping. Compared to the 2017 survey the number of LGA's with local native plant policies has increased moderately.

Although the number of LGA's utilising local native plants has increased, it is recommended that every LGA adopts this policy. The use of local native species in landscaping is encouraged as they require low levels of water and fertiliser and once established may require no further applications. This will result in reduced applications of water and nutrients in landscaped areas with less chance of leaching of nutrients from these areas.

Information on local native plant policies and using local native species is available from the Eastern Metropolitan Regional Council's Landscaping with Local Plants Policy and Guidelines section of their '*Local Government Natural Resources Management Policy Manual*' and from '*Sustainable Landscaping: Using Local Plants for Nutrient Reduction and Water Conservation*' available from Perth NRM. SERCUL's Phosphorus Awareness Project produces '*Grow Local Plants*' leaflets for the five main soil types in Perth. These leaflets contain species lists of local plants that are found on each soil type from groundcovers and climbers through to trees.

Question Thirteen

Question Thirteen asked if LGA's have deciduous trees in parks or streetscapes and if so what measures are taken to prevent deciduous leaves from entering stormwater drains. Twenty LGA's had deciduous trees in parks or streetscapes. Nineteen of these had measures in place to prevent leaves from entering stormwater drains. Ten LGA's had more than one response to this question. The responses to what measures are taken to prevent leaves from entering drains can be seen in Table 4. Compared to the 2017 survey the number of LGA's with deciduous trees has increased slightly as has the number of LGA's with measures in place to prevent leaves from entering drains.

Measure Taken	Number of LGA's Using Measure
Regular road/park/path sweeper	15
Sweeping during leaf drop	10
Road gullies/drains cleaned	3
Use of Gross Pollutant Traps	3
Maintenance program	2
Blowing leaves into sweeper	1
Drains are independent sumps/soak wells and therefore do not flow back into the river	1
Vegetated drains	1
Use of sumps and soakwells	1
Peruzzo or mowers with catchers that pick up leaves	1
Grates over drains	1
Leaf litter collection	1
Manual raking of leaves	1

Table 4: Measures taken by the nineteen LGA's to prevent deciduous leaves from entering stormwater drains.

It is disappointing that nearly all of the LGA's have deciduous trees in parks and streetscapes as the soft leaves that fall from these trees in the late autumn/early winter months decompose quickly releasing excessive nutrients in waterways. It is recommended that LGA's minimise the use of deciduous trees to prevent leaves from entering waterways and that LGA's do not plant deciduous trees along roads where their falling leaves can enter stormwater drains and then waterways. The use of local native plants would be an alternative to deciduous trees. Refer to question twelve for information on using local native species in parks and streetscapes.

It is encouraging that all but one of the LGA's that have deciduous trees in their localities have measures in place to prevent leaves from entering drains. Most of the measures that the LGA's indicated they undertook to prevent leaves from entering drains are best management practices. It should be noted however, that in the late autumn/early winter months that street sweeping would need to be increased. Also Gross Pollutant Traps; soakwells and sumps; and grates over drains would not prevent deciduous leaves (or nutrients from leaves) from entering waterways unless they are cleaned out on a regular basis during the autumn and early winter months as deciduous leaves decompose readily.

Question Fourteen

Question Fourteen asked whether the council provided dog poo bins and bags in parks and foreshore reserves. All twenty-one LGA's provided these bags and bins in their parks. Compared to the 2017 survey the number of LGA's providing bins and bags has remained the same.

The results from this question are encouraging, and should be continued, as dog poo is the second greatest source of phosphorus to waterways after fertiliser in urban areas. It is recommended that every park or reserve have dog poo bins and bags provided.

Nutrient Education

Question Fifteen

Question Fifteen Part A asked if measures are taken in foreshore reserves and parks to educate the public about not feeding bread to waterbirds and if yes Part B asked what measures are taken. Twenty of the LGA's had measures in place and ten LGA's had more than one response to what measures are taken. The measures that the LGA's used to educate the public on not feeding bread to waterbirds can be seen in Table 5. Compared to the 2017 survey the number of LGA's with measures in place to educate the public increased slightly, while the measures being taken have remained similar.

Measure Taken	Number of LGA's Using Measure
Informative signage	19
Website information	7
Pamphlets	5
Education program	2
Community events	2
Council newsletters	1
Participation in the EMRC's Healthy Wildlife, Healthy Lives project	1
Workshop	1
Signage stating that feeding ducks attracts a \$100 fine (Urban Environment and Nuisance local law)	1

Table 5: Measures taken by the nineteen LGA's to educate the public about not feeding bread to waterbirds.

The response to this question is promising with the majority of the LGA's implementing measures to educate the public about not feeding waterbirds. The high use of interpretative signage is very encouraging with information about the effects of feeding being provided at the site where it is occurring. The use of enforcement by one LGA is an important strategy to deter persistent bird feeders and it is recommended that other LGA's use this tool also. As a minimum, it is strongly recommended that all LGA's erect signage in foreshore reserves and parks educating the public about the effects of bread on waterways (eg. increased phosphorus levels and algal blooms) and waterbirds (eg. malnutrition, botulism and aggressive behaviour). SERCUL's Phosphorus Awareness Project has a brochure which outlines this issue that could be the basis for signage. It is also recommended that LGA's use other strategies to educate ratepayers about the effects of bread on waterways and waterbirds such as local media, environmental workshops, LGA newsletters, websites and brochures, Rangers advising people of disadvantages and the introduction of Local Laws (and enforcement of those laws) that prohibit the feeding of birds.

Question Sixteen

Question Sixteen Part A asked if advice was provided to ratepayers about best practice in fertiliser management according to soil type and if so Part B provided the strategies used to provide this advice. Fourteen of the LGA's stated that they provide advice to their ratepayers and eight had more than one response to this question. One LGA answered no to Part A of the question but then listed ways that the city provides advice to ratepayers, so their response to Part A of the question has been changed to a Yes bringing the total responses in the affirmative up to fifteen. The responses as to how they provided this advice can be seen in Table 6. Compared to the 2017 survey the number of LGA's providing advice has increased slightly while how they provided this advice is similar.

Measure Taken	Number of LGA's Using Measure
Workshops (regarding Responsible Gardening, Gardening for a Healthy River, Waterwise Irrigation, Beyond Gardens, Great Gardens and Frog Friendly Gardens workshops)	7
Verbal advice	5
Information on website	5
SERCUL/Fertilise Wise information on website	4
Information at community events	4
Pamphlets	3
Catchment Friendly Garden Competition category	1
Native plant sales	1
Rural property stocking rates	1
Policies and subsidy schemes promoting use of native plants	1

Table 6: Measures taken by the fifteen LGA's to advise ratepayers about best practice in fertiliser management.

It is encouraging that over two thirds of the LGA's who responded are providing this advice to their ratepayers and the strategies for providing this advice are commendable. Ratepayer's lawns, when combined, would form the largest turfed area in a LGA. Householders generally have limited knowledge of best practice fertiliser management. It is recommended that LGA's provide

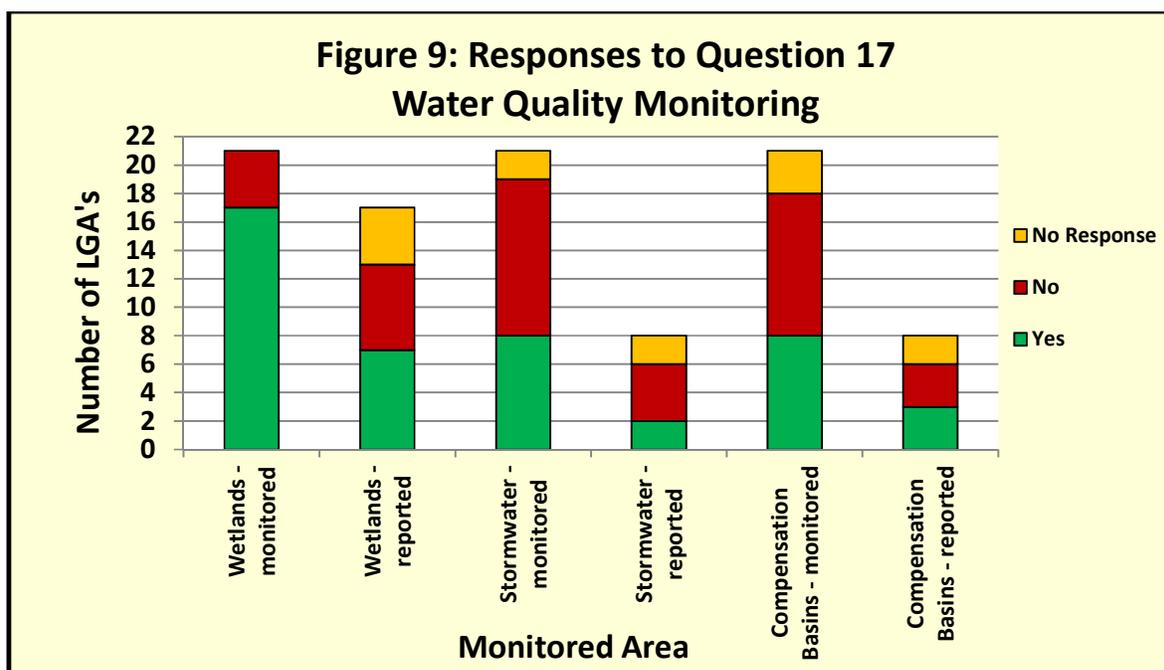
advice to ratepayers on fertiliser practices. This will help to reduce the high levels of nutrients from fertilisers that leach through the sandy soils of the Swan Coastal Plain and into groundwater and waterways.

The Phosphorus Awareness Project produces ‘Fertilise Wise’ leaflets for the five main soil types in Perth. These leaflets contain information on fertiliser best management practices targeted at homeowners and are available for LGA’s to distribute to their ratepayers. The PAP and SERCUL have also developed a website, www.fertilisewise.org.au, that contains Fertilise Wise and other gardening information specific to the Perth region. LGA’s are encouraged to link this website to their own website. The ‘Sustainable Landscaping: Using Local Plants for Nutrient Reduction and Water Conservation’ initiative is available to help LGA’s provide information to ratepayers on using local plants in gardens. LGA’s could also host a ‘Great Gardens’ or ‘Beyond Gardens’ workshop to educate ratepayers on fertiliser and water management and other garden issues. Workshops can be organised by contacting The Forever Project or the Beyond Gardens team.

Water Quality Monitoring

Question Seventeen

Question Seventeen Part A asked whether regular monitoring of wetlands, stormwater drains and compensation basins was performed for nutrient levels and if so, Part B asked whether these results were reported to the local community. As can be seen from Figure 9, seventeen LGA’s monitored wetlands and eight monitored stormwater drains and compensation basins. Two LGA’s did not respond to the stormwater part of this question while three LGA’s did not respond to whether compensation basins were monitored. Of those that monitored the various areas, seven reported on the results of at least one area, with seven reporting their wetland monitoring results, two reporting their stormwater monitoring results and three reporting their compensation basin monitoring results. Compared to the 2017 survey monitoring of wetlands has increased significantly and monitoring of stormwater drains and compensation basins has increased moderately. Overall, reporting of these results to the community has decreased significantly, with a significant decrease in the reporting of wetland monitoring results, a slight increase in the reporting of stormwater monitoring results and a slight decrease in the reporting of compensation basin results.



It is encouraging that there has been an increase from 2017 in the number of LGA’s monitoring in each of these areas. However, the number of LGA’s monitoring stormwater and compensation basins is still quite low. It is recommended that monitoring of all these areas occur as they are sensitive areas that may be influenced by fertiliser applications on surrounding turf. This monitoring could also indicate if pollution is entering these systems from other sources upstream. Stormwater drains, compensation basins and wetlands are connected to the river systems through ground or surface water. There is a high potential that nutrients, algal blooms or other pollutants from these areas could enter the rivers.

Greater reporting of the results of this monitoring to the public is to be encouraged. Reporting these results to the community would reflect the LGA’s commitment to the environment and provide important information to community catchment and environment groups. These groups could use this information to determine where rehabilitation of waterways and education of general community members needs to occur.

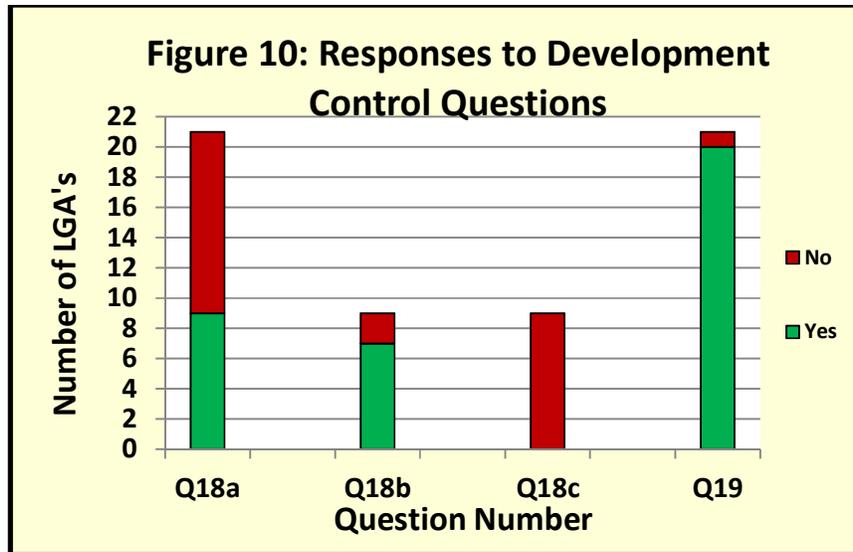
Development Control

Questions Eighteen and Nineteen

Questions Eighteen and Nineteen related to new developments. Question Eighteen asked if conditions are imposed on developments which include a Nutrient and Irrigation Management Plan. Monitoring for compliance as well as prosecution for lack of compliance was also addressed by this question. As can be seen from Figure 10, nine LGA’s imposed conditions on developments, seven of the nine LGA’s monitored these for compliance and none had made a prosecution for lack of compliance in the last 12 months.

Compared to the 2017 survey the number of LGA's imposing conditions and monitoring have both increased slightly with the prosecutions remaining at zero.

It is disappointing that a low number of LGA's imposed conditions on development with it being imperative that all LGA's impose these conditions. Potentially these conditions are being imposed but they are included in Urban Water Management Plans and are not clearly defined as a NIMP. It is encouraging that nearly all the LGA's who imposed conditions monitored the developments for compliance. Many new developments, especially subdivisions, are major sources of nutrients to waterways and this could be reduced by monitoring for compliance. The fact that none of the LGA's prosecuted for lack of compliance could be an indication that developers are adhering to the conditions put on them. If this is not the case it is recommended that LGA's prosecute developers for their lack of compliance, not only to recoup costs for environmental damage but to deter the developers from not complying on future projects.



Question Nineteen asked if the LGA had provisions in the Town Planning Scheme or Planning Policies to enforce environmental conditions on development. Twenty of the twenty-one LGA's had provisions to enforce environmental conditions. Compared to the 2017 survey the number of LGA's that have these provisions has increased significantly.

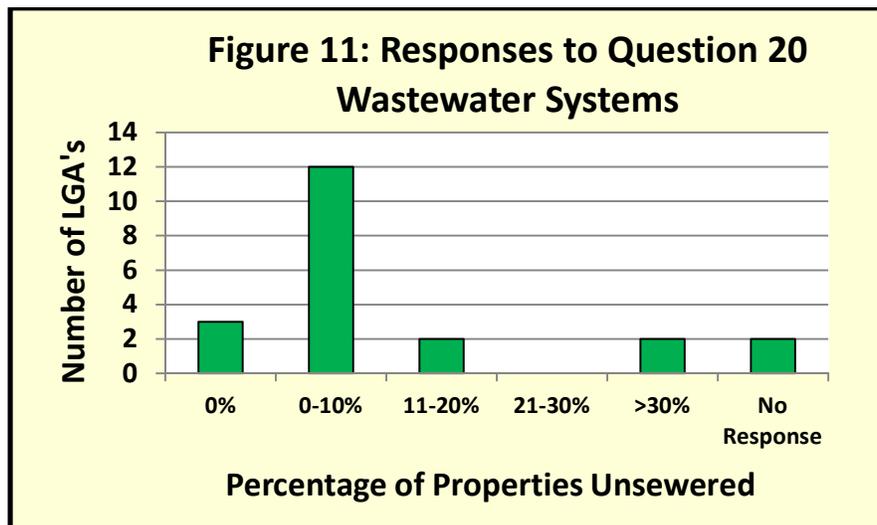
The increase in, and total number of, LGA's that have provisions to enforce environmental conditions is very encouraging and it is recommended that the other LGA's introduce provisions to enforce these conditions. This may prevent environmental harm from occurring and will allow the LGA to prosecute if developers are not adhering to best management practices.

Wastewater Systems

Question Twenty

Question Twenty asked what percentage of properties in the LGA's urban zone were not connected to the sewer. As can be seen from Figure 11, three LGA's had 0% not connected to sewer, twelve had 0-10%, two had 11-20%, none had 21-30%, and two had greater than 30% while two LGA's did not respond. Compared to the 2017 survey, the LGA's with 0% not connected to sewer has decreased moderately, 0-10% not connected has increased moderately, 11-20% and no response have decreased slightly, greater than 30% has increased slightly while the 21-30% has remained the same. The slight changes in the responses to this question could be due to different LGA's and Officers responding to the survey than in 2017.

Over the next few years, it is expected that the infill sewerage program will increase the number of LGA's that have 0% of properties unsewered. It is recommended that LGA's encourage householders to connect to the main sewerage line as leaking septic tanks can contribute nutrients to the river systems.



Annual Nutrient Survey for Local Government Authorities 2018

Recommendations

The following recommendations for each question, if implemented, will help LGA's to achieve a high level of nutrient best management practice.

Nutrient Monitoring

Question One – Does your LGA conduct regular soil tests and/or leaf tissue analysis for nutrients in grassed and turf areas?

Recommendations

1. LGA's should regularly conduct soil tests and/or leaf tissue analysis before applying fertiliser to determine if nutrients are required, and if required, the application rate and type of nutrients needed. This testing will result in unnecessary fertiliser applications being avoided.
2. The leaf tissue nitrogen content should be maintained between 1.5% - 2% for passive turf and 2% - 3% for sports fields (Ruscoe, Johnston & McKenzie, 2004).
3. The leaf tissue phosphorus content should be maintained between 0.2% - 0.4% (Ruscoe, Johnston & McKenzie, 2004).
4. LGA Parks and Gardens Officers should attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2019.

Question Two – If yes for question no.1, for which areas? Areas - sports fields, golf courses, irrigated parks, dry grass areas and foreshore reserves. Tests – soil tests, leaf tissue analysis and moisture testing.

Recommendations

1. LGA's conduct soil testing and leaf tissue analysis of sports fields, irrigated parks, dry grass areas and foreshore reserves before applying fertiliser. This will result in unnecessary fertiliser applications being avoided.
2. LGA's regularly conduct moisture testing of these areas to avoid overwatering and the potential leaching of nutrients from these areas.
3. LGA's promote testing of golf courses in their areas because they can be a significant source of nutrients to waterways.

Question Three – Are analyses carried out by a laboratory affiliated with the *Australian Soil and Plant Analysis Council (ASPAC)*?

Recommendations

1. LGA's use ASPAC laboratories for their analyses so that accurate information is received.

Question Four - Is available phosphorus in the soil measured by the standard Colwell method?

Recommendations

1. LGA's measure the available phosphorus in the soil using the Colwell method (standard method for Western Australian conditions) to determine accurate levels of phosphorus, thus preventing unnecessary nutrient applications.

Question Five - Is the Phosphorus Retention Index (PRI) of soil measured?

Recommendations

1. LGA's measure the PRI of soil to determine the capacity of the soil to hold on to phosphorus, thus preventing unnecessary nutrient applications.
2. LGA's apply the analyses obtained from the Colwell method and PRI to the following table to determine if phosphorus applications are necessary. As a minimum, these tests should be conducted every second year.

Phosphorus Recommendations		
PRI (Allen & Jeffery method)	Soil Test P (Colwell test)	Recommendations
O or negative		Do not apply P
0.1 - 0.5	< 5 ppm > 5 ppm	Apply up to 5 kg P/ha Do not apply P
0.5 - 2	< 7 ppm > 7 ppm	Apply up to 5 kg P/ha Do not apply P
3 - 5	< 10 ppm > 10 ppm	Apply up to 10 kg P/ha Do not apply P
> 5	< 10 ppm	Apply up to 20 kg P/ha

Source: Ruscoe, Johnston & McKenzie 2004, *Turf Sustain – A Guide to turf management in Western Australia*. Sports Turf Technology, Como, Western Australia.

Fertiliser Applications

Question Six - Are fertiliser recommendations based on either: advice from an independent turf consultant, LGA's own interpretation of results and experience, interpretation by the laboratory or other?

Recommendations

1. LGA's use a range of opinions to determine application rates and types of fertiliser, rather than single sources to ensure appropriate fertiliser regimes are being conducted.
2. LGA's use a turf consultant's expertise to determine fertiliser regimes as they are specifically trained in turf management, usually with many years on ground experience.
3. LGA Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2019.

Question Seven – (a) Do you have foreshore reserves and parks? (b) Do you add fertiliser to foreshore reserves and parks?

Recommendations

1. If LGA's have foreshore reserves and parks they test these areas before applying fertiliser to avoid unnecessary nutrient applications which could leach into groundwater and nearby waterways.
2. If nutrients are required then controlled release or low water soluble fertilisers should be applied to reduce leaching.

- Fertiliser should not be applied in the winter months when heavy rainfall can wash nutrients into the waterway and irrigation needs to be carefully monitored so that overwatering also does not wash nutrients into the waterway.
- If possible, establish a 50 metre buffer zone between fertilised areas and waterways (DoW, 2004-2007).
- LGA's refer to 'Fertiliser application on pasture or turf near sensitive water resources (2010)' available from the Department of Water and Environmental Regulation.

Question Eight - In general, what are the main types of fertilisers applied to established turf and other areas either: complete inorganic, phosphate-free inorganic, organic/slow release, foliar applications or other? If applied: Fertiliser brand name, N%, P%, Average application rate in kg/hectare, Area, Number of applications per season - winter, spring, summer, autumn? Applications were categorised in the following areas: active turf, passive turf, foreshore areas, non-native gardens, native gardens and other areas.

Recommendations

- LGA's use specific fertilisers according to the soil and leaf tissue analyses for each site rather than using the same fertiliser for all sites to ensure that all the nutrients are utilised by the turf and not leached into groundwater.
- LGA's only apply phosphorus and nitrogen when testing indicates it is required to avoid leaching of nutrients that are not required by the turf.
- LGA's determine the rate of each nutrient of the fertiliser they intend to apply before application to ensure that over application of phosphorus and nitrogen does not occur. The formula to determine the rate of nutrient is to multiply the amount of fertiliser to be applied per hectare by the percentage of that nutrient (either N% or P%) in the fertiliser, divided by 100.
- The maximum nitrogen rate for a single application is 40 kg nitrogen/hectare (Ruscoe, Johnston & McKenzie, 2004) though 30 kg nitrogen/hectare is usually sufficient.
- The maximum phosphorus rate for a single application is 5 kg phosphorus/hectare (J. Forrest, pers. comm).
- High maintenance active turf should not exceed applications of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr of phosphorus.
- Passive turf and foreshore area applications should not exceed 0-50 kg/ha/yr for nitrogen and 0-5 kg/ha/yr for phosphorus.
- Keep a log book to record details of fertiliser and nutrient applications over the year for each application area including details such as weather conditions and monitoring information.
- If fertiliser is required, apply in spring or early autumn (September, October, November, March and April) when grass grows rapidly. Apply the fertiliser in small amounts and often over these months instead of a single application. This will ensure all nutrients can be utilised by the turf.
- Do not fertilise in summer or winter. Summer fertilising encourages over use of water and turf may grow excessively while fertiliser applied during winter will be washed into stormwater drains or leached into groundwater.
- Do not apply fertiliser too close to hard surfaces such as roads. Fertiliser on hard surfaces will be washed into stormwater drains and end up in waterways.
- Avoid applying fertiliser before heavy rainfall and do not over water turf as both actions could result in leaching of nutrients to groundwater and waterways.
- LGA Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2019.
- LGA's refer to the following publications (see Reference section for full publication details) to obtain more information on fertiliser and irrigation best management practices:
 - Turf Sustain – A guide to turf management in Western Australia*
 - Western Australian environmental guidelines for the establishment and maintenance of turf grass areas (2014)*
 - Stormwater Management Manual for Western Australia.*



Turf Type

Question Nine - What is the main type of turf grown in your area: kikuyu, couch, buffalo or other?

Recommendations

- LGA's use kikuyu as the first choice for turfed areas as it has low fertiliser requirements, requires a medium water usage and is drought and wear tolerant.
- LGA's with couch and buffalo in their area should not fertilise this turf in the winter months as it could be in its dormant phase.

Nutrient Management

Question Ten - Do you have measures in place to prevent grass clippings from entering stormwater drains? If yes, please state what measures are taken.

Recommendations

- LGA's have measures in place to prevent grass clippings from entering stormwater drains as they are high in nutrients and will end up in waterway systems.
- Where practical LGA's should leave grass clippings on the mowed turf which returns the nutrients contained in the clippings back to the soil thus reducing fertiliser requirements. Clippings left in piles should be removed to disperse clippings.
- When mowing clippings should be thrown away from hard surfaces.
- When mowing median strips and small areas near hard surfaces or waterways a catcher should be used.
- If clippings need to be removed they should be composted and then utilised as a soil amendment.
- Grass clippings that end up on hard surfaces such as roads and driveways should be swept up and removed (either manually or with a street sweeper) or blown off the hard surface back onto the turfed area.
- Grass clippings should never be blown, hosed or swept onto hard surfaces such as roads or driveways as they can be washed or blown into stormwater drains ending up in waterway systems.
- Mowing equipment should be cleaned before going to the next location.
- When hosing down mowing equipment ensure that this water does not enter stormwater drains.



Question Eleven - Do you have a Nutrient and Irrigation Management Plan (NIMP) implemented for your streetscapes? (i.e. for median strips, roundabouts, entry statements, car park landscaping, road verges, etc.)

Recommendations

1. LGA's implement NIMP for streetscapes, as they are large areas within a LGA where nutrients and water usage should be controlled more appropriately.
2. Information about NIMP is available from the Department of Water and Environmental Regulation's website where the following documents can be located:

* 'Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans'

* 'Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist'

Question Twelve - Do you have a policy to use local native plants as the first choice in public and private (Developers) landscaping?

Recommendations

1. LGA's have a local native plant policy and plant local native species in their management areas as they require low levels of water and fertiliser and once established may require no further applications.
2. Information on local native plant policies and using local native species is available from the Eastern Metropolitan Regional Council's Landscaping with Local Plants Policy and Guidelines section of their 'Local Government Natural Resources Management Policy Manual', from 'Sustainable Landscaping: Using Local Plants for Nutrient Reduction and Water Conservation' available from Perth NRM and the Phosphorus Awareness Projects 'Grow Local Plants' leaflets.



Question Thirteen - Do you have deciduous trees in your parks or streetscapes? If yes, please state what measures, if any, are taken to prevent deciduous leaves from entering stormwater drains.

Recommendations

1. LGA's minimise the use of deciduous trees as their leaves decompose quickly releasing excessive nutrients in waterways.
2. LGA's do not plant deciduous trees along roads where their falling leaves can enter stormwater drains and then waterways.
3. LGA's use a street sweeper, on a regular basis, during the autumn months when deciduous leaves lose their leaves to prevent leaves entering stormwater drains and then waterways.

Question Fourteen - Do you provide dog poo bins and bags in your parks and foreshore reserves?

Recommendations

1. LGA's provide dog poo bins and bags in parks and foreshore reserves as dog poo is a major contributor of nutrients to groundwater and waterways.

Nutrient Education

Question Fifteen - Are measures taken in foreshore reserves and parks to educate the public about not feeding bread to waterbirds? If yes, please state what measures are taken.

Recommendations

1. LGA's erect signage in foreshore reserves and parks educating the public about the effects of bread on waterways (eg. increased phosphorus levels and algal blooms) and waterbirds (eg. malnutrition and aggressive behaviour). The Phosphorus Awareness Project has a brochure which outlines this issue that could be the basis for signage.
2. LGA's distribute information to their ratepayers about the effects of bread on waterways and waterbirds through local media, environmental workshops, LGA newsletters, website, brochures and Rangers talking to people about the disadvantages of feeding when it occurs.
3. LGA's introduce Local Laws (and enforce those laws) that prohibit the feeding of birds.



Question Sixteen - Do you provide advice to ratepayers on best practice in fertiliser management according to soil type? If yes, please state how advice is provided to ratepayers.

Recommendations

1. LGA's provide advice to ratepayers on fertiliser practices as ratepayers generally have limited knowledge of fertiliser management and would, when combined, have the largest turf area in the LGA.
2. 'Fertilise Wise' leaflets are available from the Phosphorus Awareness Project to distribute to ratepayers.
3. LGA's link the Fertilise Wise website - www.fertilisewise.org.au to their own website.
4. LGA's host a 'Great Gardens' or 'Beyond Gardens' workshop to educate their ratepayers on fertiliser and water management and other garden issues. Workshops can be organised by contacting The Forever Project or the Beyond Gardens team.
5. 'Sustainable Landscaping: Using Local Plants for Nutrient Reduction and Water Conservation' initiative is available from Perth NRM to help LGA's provide information to ratepayers on using local plants in gardens.

Water Quality Monitoring

Question Seventeen - Do you regularly monitor the following areas under your control for nutrient levels and do you report these results to your local community? Areas: wetlands, stormwater drains, compensation basins.

Recommendations

1. LGA's regularly monitor wetlands, stormwater drains and compensation basins for nutrient levels to determine if pollution is occurring and potentially pinpoint sources.
2. LGA's report these results to the local community reflecting their commitment to the environment and providing important information to community catchment and environment groups to determine where rehabilitation of waterways and education of general community members needs to occur.

Development Control

Question Eighteen – (a) Do you impose conditions on developments which include Nutrient and Irrigation Management Plans (NIMP)?

(b) Do you monitor these for compliance?

(c) Have you made any prosecutions for lack of compliance in the last 12 months?

Recommendations

1. LGA's impose NIMP conditions on developments, monitor these for compliance and prosecute for lack of compliance as new developments are potentially major sources of nutrients to groundwater and waterways.

Question Nineteen - Do you have provisions in the Town Planning Scheme or Planning Policies to enforce environmental conditions on development?

Recommendations

1. LGA's introduce Town Planning Scheme provisions or Planning Policies to enforce environmental conditions on developments to prevent environmental harm and allow the LGA to prosecute if developers are not adhering to best management practices.

Wastewater Systems

Question Twenty - What percentage of properties in your urban zoned land is either unsewered or if sewerred is not connected to sewer? (Subdivisions less than 1 ha) Percentages - 0%, 0-10%, 11-20%, 21-30% or >30%.

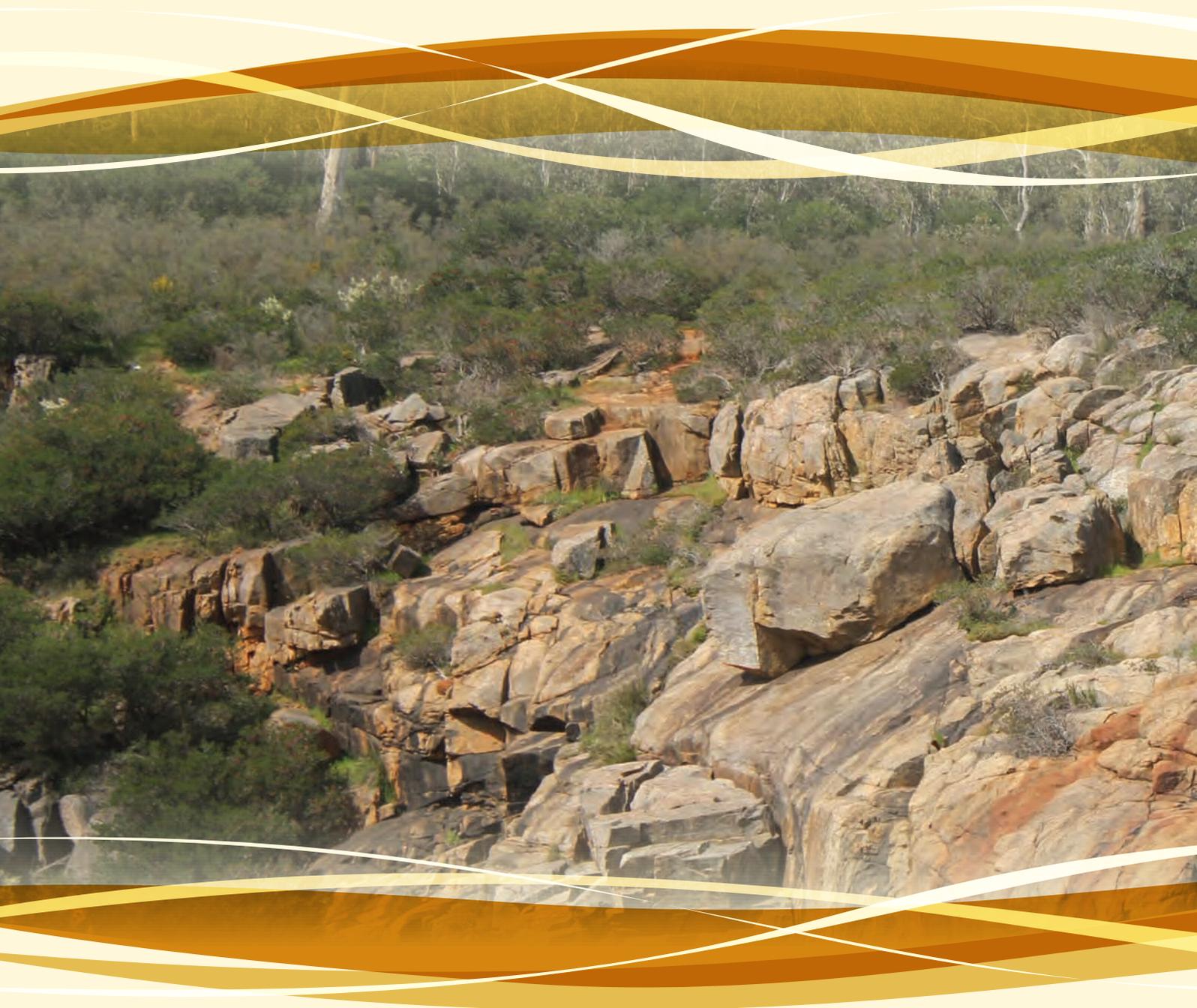
Recommendations

1. LGA's encourage householders to connect to the main sewerage line when or if the infill sewerage program comes into the area as leaking septic tanks can contribute nutrients to groundwater and waterways.

References and Contacts for Further Information

- Beyond Gardens Workshops
Available from the Beyond Gardens team - www.beyondgardens.com.au or by phoning 1300 369 833.
- Department of Water (2004-2007) *Stormwater Management Manual for Western Australia*. Department of Water, Perth, WA.
Available from the Department of Water and Environmental Regulation - www.water.wa.gov.au
- *Fertiliser application on pasture or turf near sensitive water resources (2010)*
Available from the Department of Water and Environmental Regulation - www.water.wa.gov.au
- Fertilise Wise Fertiliser Training, Fertilise Wise guides, Fertilise Wise website, Grow Local Plants leaflets and Feeding Water Bird brochures.
Available from the Phosphorus Awareness Project, South East Regional Centre for Urban Landcare – www.fertilisewise.org.au and www.sercul.org.au/our-projects/pap/ or by phoning 9458 5664.
- Great Gardens Workshops
Available from The Forever Project – www.theforeverproject.com.au or by phoning 0409625299.
- *Landscaping with Local Plants Policy and Guidelines - Local Government Natural Resources Management Policy Manual*.
Available from the Eastern Metropolitan Regional Council by phoning 9424 2222.
- Ruscoe, Johnston & McKenzie (First Published 2004, Reprinted 2014) *Turf Sustain – A Guide to turf management in Western Australia*. Sports Turf Technology, Como, WA.
Available from Sports Turf Technology - www.sportsturf.net.au or by phoning 9367 1600.
- *Sustainable Landscaping: Using Local Plants for Nutrient Reduction and Water Conservation*
Available from Perth NRM by phoning 9374 3333.
- Swan River Trust (2009) *Swan Canning Water Quality Improvement Plan*. Swan River Trust, East Perth, WA.
Available from the Department of Biodiversity, Conservation and Attractions - www.dpaw.wa.gov.au or by phoning 9219 9000.
- Swan River Trust (2014) *Western Australian environmental guidelines for the establishment and maintenance of turf grass areas*.
Swan River Trust with support from organisations represented on the Fertiliser Partnership Urban Users Working Group, Kensington, WA.
Available from the Department of Biodiversity, Conservation and Attractions - www.dpaw.wa.gov.au or by phoning 9219 9000.
- *Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans*
Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist
Available from the Department of Water and Environmental Regulation - www.water.wa.gov.au





This report has been prepared for the Phosphorus Awareness Project,
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www.sercul.org.au and www.fertilisewise.org.au