Long Jetty Waterwatch Data Review

2010-2015

An independent review of community data undertaken by Wyong Shire Council's Waterways and Coastal Team

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tuggerah lakes estuary

Wyong Shire Council

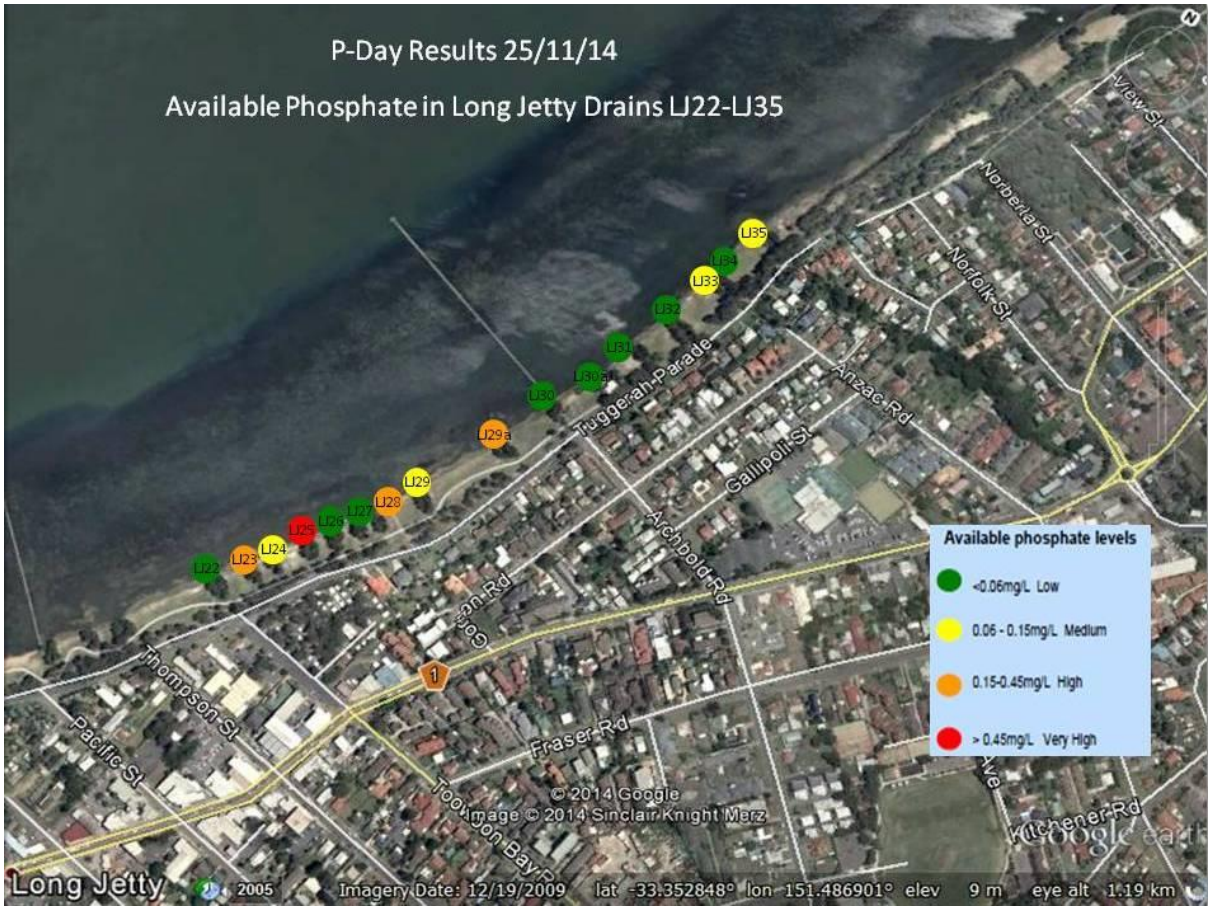
Background

The Long Jetty Waterwatch group has been collecting water samples at 40 sites along the Long Jetty Foreshore since 2010. The group consists of a small number of keen local residents who meet up most weeks to take water samples.

Sampling is undertaken in accordance with the *Waterwatch Estuary Filed Manual* and *Senior Field Manual* which are prepared and endorsed by NSW Waterwatch and relevant State and Federal Government departments. The group operate under the supervision of the local Waterwatch Coordinator. A quality assurance program is implemented to ensure that in-situ measurements are similar to laboratory tested samples. It is reported that this group's data are very reliable (S. Willis, Waterwatch Coordinator, pers. comm).

Drain numbering system

The aerial images below show the drain identification system used by the group to identify individual drains.



Sampling methodology

The sampling procedure involves collecting and analysing water samples from a few drains each month which averages out at around one or two samples per drain per annum. If a drain performs particularly badly one month, the group will typically increase the sampling intensity at the affected site for a period of time until the issue appears to reduce.

The group record basic information at each site including recent rainfall, number of volunteers, sampling hours, site observations and water flow (refer to Waterwatch manuals for details). A grab sample from each drain is then tested in-situ for the following values: dissolved oxygen (mg/L and % concentration), water temperature (C^{o}), pH, turbidity (NTU), available phosphate (mg/L), air temperature (C^{o}), electrical conductivity (µs/cm) and coliform count (#/100ml).

ANZECC Guidelines

This report interrogates the parameters to which a trigger value is available under the *Australian and New Zealand guidelines for Fresh and Marine Waters* (ANZECC, 1992). ANZECC is the guiding document under the National Water Quality Management Strategy (NWQMS) and provides information to water managers on key water quality indicators.

ANZECC and the NWQMS aim to achieve the sustainable use of Australian water resources and can be viewed at: https://www.environment.gov.au/water/quality/publications/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1

Parameters evaluated in this report include dissolved oxygen, pH, turbidity and available phosphorus.

Analysis methodology

The data was provided to Council in a spreadsheet which was firstly quality checked and any obvious errors were removed or corrected where possible. Data were then grouped for each site and assessed against the ANZECC guidelines to determine any significant issues over the six years of sampling.

For each site, all samples were averaged and the standard deviation and error calculated. Dissolved oxygen, pH, turbidity and available phosphorus were each plotted for all 40 sites to allow for comparison. These graphs are shown in the figures below and give some indication of the sites which perform worst on average and would benefit from further more in-depth assessment.

The level of additional *apriori* analysis was limited by the absence of replication within sites, absence of reference site data and limitations of temporal replication (i.e. seasonal and annual replication were absent in most cases).

It was not possible to perform multivariate analyses on the data set nor determine the level of variability within or between sites at a given temporal scale.

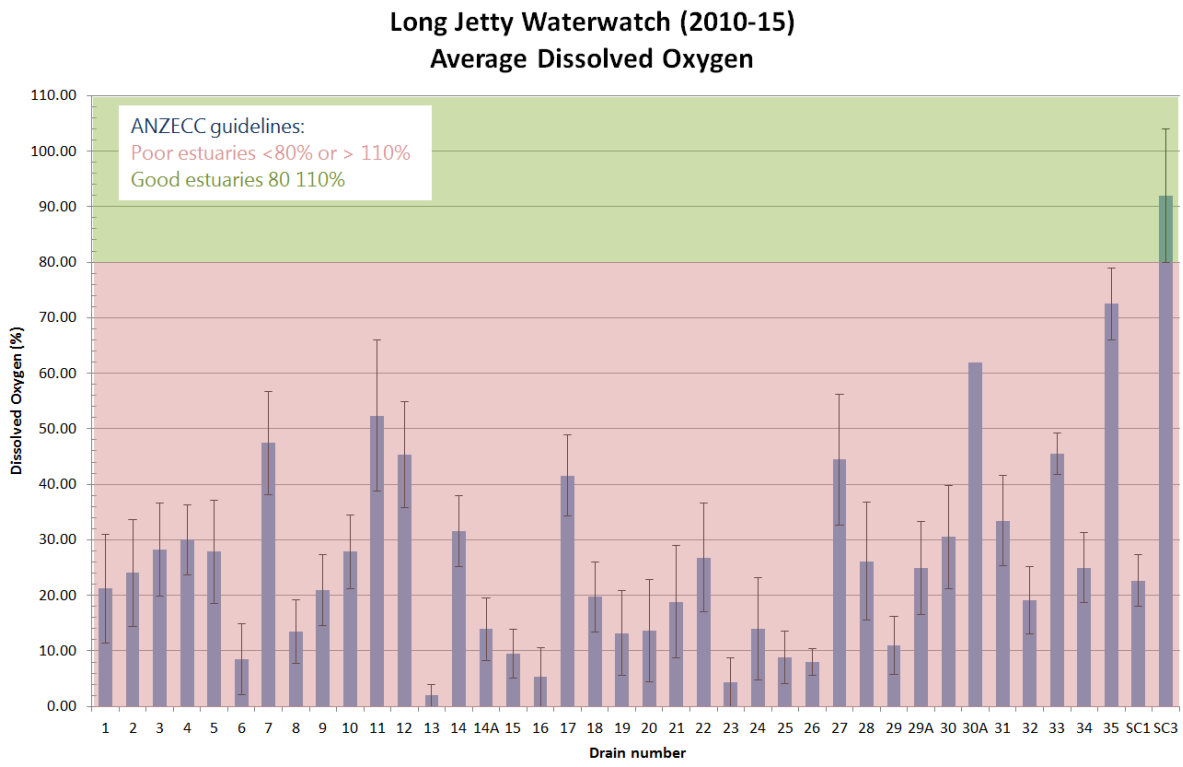
Further information is provided in the concluding section regarding additional sampling, detailed pilot studies and modifications to the existing program that may allow for more in depth analysis of the data set in the future.

Dissolved Oxygen

Dissolved oxygen (DO) varies diurnally in response to primary production within the water column i.e. DO can be affected by bioavailable organic carbon flux and the rate at which bacteria use up this material. It is also affected by the daily inputs of oxygen diffused into the water from the atmosphere. DO is a direct stressor which can have a toxic effect on biota. Given the shallow nature of Tuggerah Lakes and the inflowing drainage lines, depth is not a factor contributing to changes in DO levels in this system.

Healthy estuaries generally have DO levels between 80 and 110% depending on the time of day that the sampling is undertaken.

The following graph shows the average DO at each drain over the 6 years of sampling. The green area indicates the range of values expected from a healthy estuary. Hyper- or hypo-saturation can be an indicator of an ecological imbalance within the system and a risk factor for aquatic fauna.



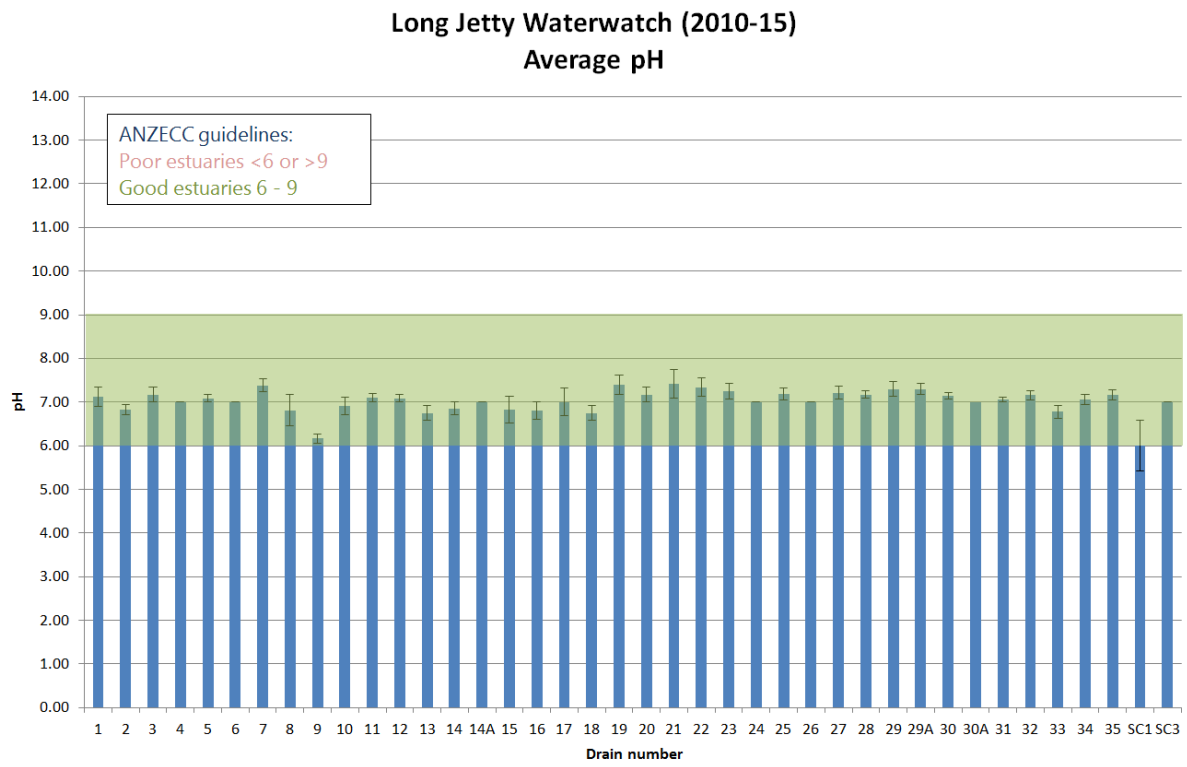
All site except SC3 (upstream of the Central Coast Highway on Saltwater Creek) recorded values below the ANZECC trigger value of 80%. It is likely that this is a result of pooling stagnant water and could be an indicator of excessive aquatic plant growth.

High concentrations of nutrients, particularly phosphorus and nitrogen can result in excessive growth of aquatic plants (phytoplankton, filamentous and attached algae, cyanobacteria, macrophytes, and to an extent seagrasses). This can lead to reduced DO as the plants die and decompose as well as reduced amenity and changes in biodiversity.

pH

pH is a measure of acidity or alkalinity of water and is a direct stressor which can have a toxic effect on biota. The pH scale is logarithmic so an increase of one unit can represent and significant change in the value recorded. pH 6-7 is considered neutral and brackish estuarine waters typically fall between 7 and 9 depending on the salinity. Marine waters tend to have a slightly higher pH due to the presence of a carbonate buffering system within these waters.

The following graph shows the average pH at each drain over the 6 years of sampling. The green area indicates the range of values expected from a healthy estuary. Water that is too acidic or too basic can seriously impact the ecology of the waterway.



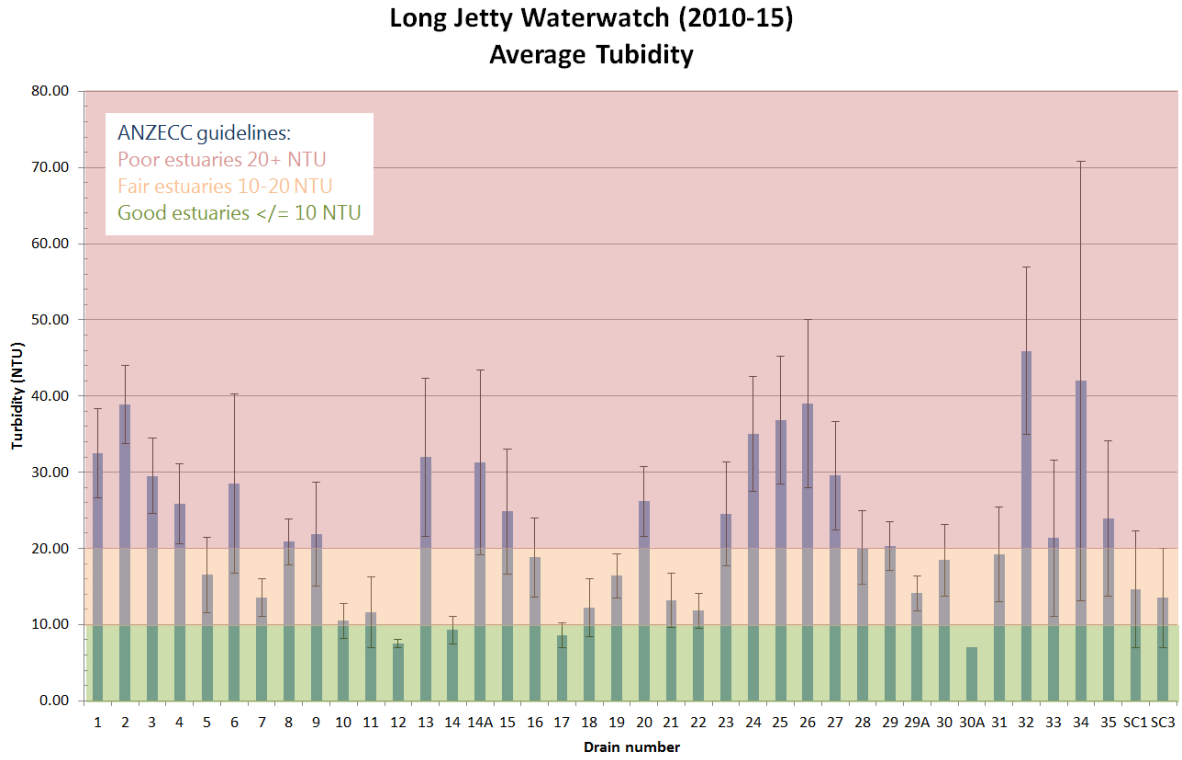
All sites except SC1 (the mouth of Saltwater Creek) fell within the ANZECC guidelines for healthy estuaries. SC1 has a very large catchment and is likely to have been influence by the lower pH of freshwater flowing through this site. A pH level below 6 would be cause for further investigation and should be monitored by the group in upcoming sampling periods.

Turbidity

Turbidity is an indicator of water clarity and is an indirect stressor which can affect ecosystems and biota. Turbidity can reflect the amount of particulate material suspended in the water column and can give an indication of the amount of clay, silt, sand or algae suspended in the water sample. Clay particles can also carry with them bound nutrients which further contribute to nutrient pollution of the receiving waters. In combination with secci depth, turbidity gives an indication of the light climate at a particular site. The light climate impacts upon the ability of seagrasses and other photosynthetic macrophytes to survive in a certain area, and this can change over time based on persistent changes in turbidity and total suspended solids.

Tuggerah Lakes typically records high but also highly variable turbidity levels. This is dues to the silty nature of the estuary and the significance of wind driven circulation across the lakes. High turbidity water flowing into the estuary however, is undesirable and may highlight the need to better manage stormwater within the treatment train. High sediment loads are a significant burden on the estuary and management of sediment runoff is considered one of the highest priorities in the *Tuggerah Lakes Estuary Management Plan*.

The following graph shows the average turbidity at each drain over the 6 years of sampling. The green area indicates the range of values expected from a healthy estuary. The orange band shows the values that represent fair quality and the red band is considered poor quality water within an estuary.



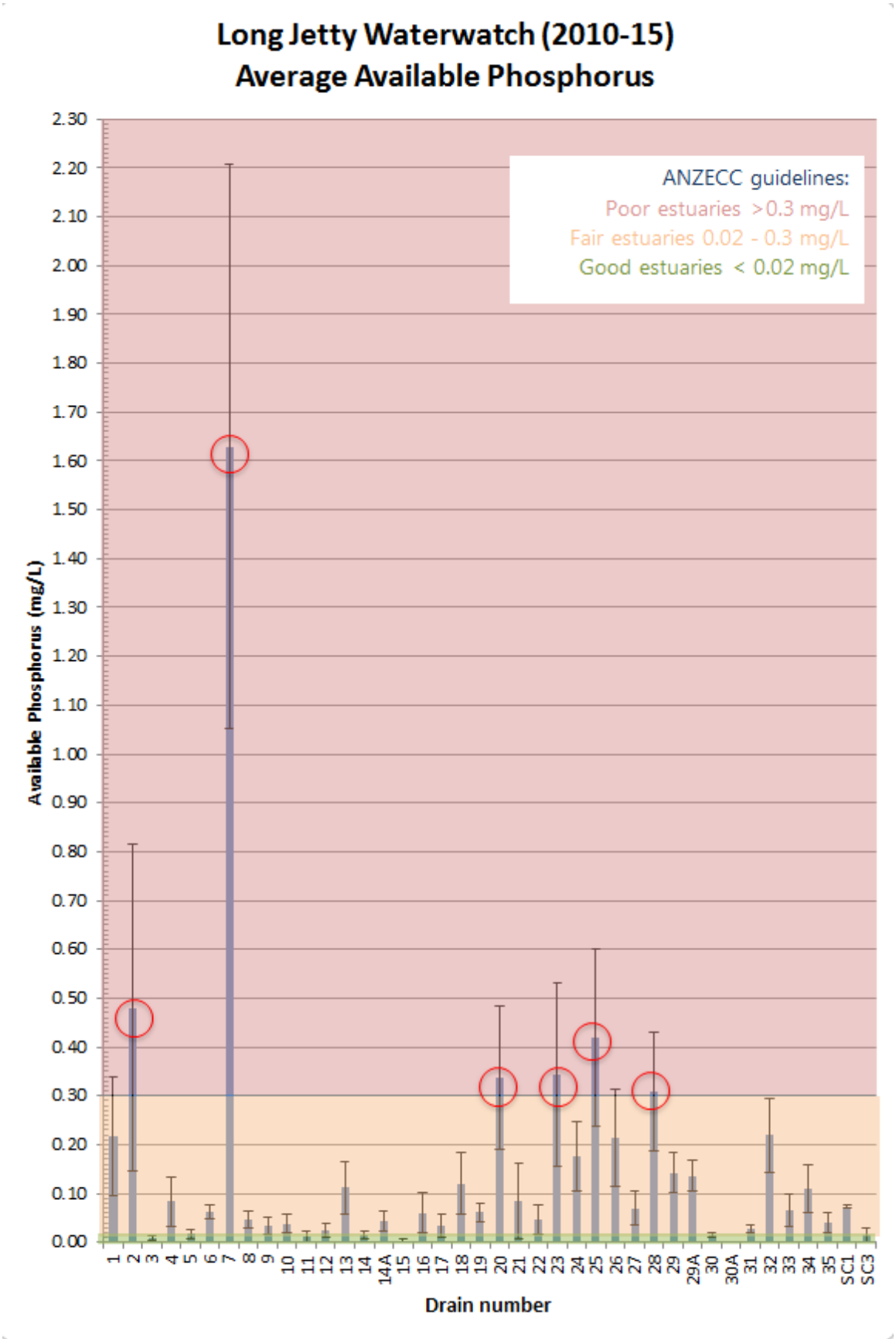
Few sites can be considered healthy based on average turbidity. Sites 12, 14, 17 and 30A are the only sites which fall within the healthy range for estuaries. These sites also exhibit lower levels of available phosphorus as shown in the next section of the report and therefore represent the best quality inputs along the Long Jetty foreshore. All other sites can be considered fair to poor in terms of turbidity and further investigation is recommended.

Available Phosphorus

Available phosphorus is a measure of the concentration of phosphate compounds which are biologically available for uptake by plants and algae. Nutrient runoff from the catchment is a significant driver of pollution and excessive plant growth in the Tuggerah Lakes estuary. This issue is compounded by the limited mixing of nearshore and basin waters resulting in the excessive growth of filamentous macroalgae and phytoplankton in the nearshore zone, smothering of seagrass and formation of black ooze along the shoreline.

Management of nutrient inputs from stormwater, rivers and overland flow are of the highest importance and is highlighted as a priority program under the *Tuggerah Lakes Estuary Management Plan* (2006).

The following graph shows the average available phosphorus at each drain over the 6 years of sampling. The narrow green band indicates the range of values expected from a healthy estuary (less than 0.02mg/L). The orange band shows the values found in a fair condition estuary and the red band shows poor quality results.



Six of the 40 sites recorded average available phosphorus levels greater than 0.3mg/L which represent poor results. These sites include 7, 2, 25, 23, 20 and 28 respectively. Site 7 has performed

consistently badly over the six years of testing. The site has been tested 21 times and has scored a good rating 9% of the time, a fair rating 29% of the time and a poor rating 62% of the time. This coupled with fair turbidity ratings makes site 7 the worst performing site along with those listed above. Further investigation is encouraged to try to reduce pollutant inputs at the source and improve water quality entering the vulnerable Long Jetty nearshore zone.

Catchment review – Best 6 sites

Site 10

Site 10 drains Thelma St, Swadling St and Gladstan Ave. This drain recorded relatively low turbidity (mean 10.5 NTU, median 7 NTU) and available phosphorus (mean 0.04 mg/L, median 0.03 mg/L) across all sampling occasions.

Site 12

Site 12 drains a very small catchment along Tuggerah Parade between Surf St and Stella St. All recent recordings show healthy ratings aside from dissolved oxygen which is low (mean 45.3%, median 44%). This may be due to limited flow through this drainage line as a result of the small catchment size.

Site 14

Site 14 drains a small section of Stella St with much of the remaining catchment draining to 14A . Dissolved oxygen was low on all occasions (mean 31.5%, median 36%) however all other parameters are generally good. Recent high coliform levels may warrant further investigation to determine a likely source.

Site 17

Site 17 drains a large catchment along Elsiemer St up to Watkins St. The performance of this catchment relative to its size is good with pH, turbidity and available phosphorus readings on most occasions. Lower dissolved oxygen (mean 41%, median 52%) is again typical of this site which is an issue for aquatic life in the channel and during significant outflows where a plume of low oxygen water is released from the drain.

Site 30A (only tested once)

Site 30A performed well on the one occasion that it was tested in 2013. A catchment review indicates that this site is not connected to the stormwater system and may have been a localised overland flow path. No further testing has been undertaken at this site.

Site 11

Site 11 drains a very small catchment along Surf St. Recent results showed elevated turbidity following light rainfall (30 NTU) and dissolved oxygen is typically lower than desirable (mean 52.4%, median 54%). However all other parameters have been good including available phosphorus which is of key interest in this area.

Catchment review – Worst 6 sites

Site 7

Site 7 drains the length of Oaks Ave and Venice Street including the detention basins for the Shelly Beach Golf Course. The remainder of the catchment is medium density residential development. Persistently high levels of available phosphorus (mean 1.63 mg/L, median 0.53mg/L) at this site indicate a potential issue with inadequate on-site treatment of runoff from the golf course which warrants further, more detailed investigation. Aerial images (Dekho, 2014) show significant algal blooms in the golf course detention basins which indicate high light and nutrient availability. This site has recently been retrofitted with Saltmarsh Swales to reduce nutrient and sediment runoff from the catchment.

Site 2

Site 2 drains a small section of Tuggerah Parade including the Lakeview Tourist Park. Give the small size of the catchment, its relative contribution of sediment and phosphorus appears to be high. The site routinely records high turbidity (mean 38.8 NTU, median 40 NTU) and moderate to high available phosphorus levels (mean 0.48 mg/L, median 0.08 mg/L). A more detail catchment investigation to determine the source of the pollution is advisable.

Site 25

Site 25 drains a small section of Tuggerah Parade including the northern section of Duncan's Lakefront Tourist Park. Consistently high turbidity (mean 36.9 NTU, median 25 NTU) and moderate to high available phosphorus (mean 0.42 mg/L, median 0.23 mg/L) have been recorded at this site. Low dissolved oxygen (mean 8.8%, median 5.0%) is a concern for aquatic fauna within the drain and in the immediate downstream area.

Site 23

Site 23 drains a small catchment along Tuggerah parade including the southern end of Duncan's Lakefront Tourist Park. The site has recorded moderate to high turbidity (mean 24.5 NTU, median 17.5 NTU), moderate to high available phosphorus (mean 0.34 mg/L, median 0.11 mg/L) and particularly low dissolved oxygen (mean 4.3%, median 0%). This is a significant issue for aquatic

fauna both within the drainage line and during outflows where a pulse of oxygen depleted water is released into the estuary. Dissolved oxygen levels this low are toxic to fish and invertebrates which are unable to move into adjacent water quickly enough. A further investigation into this site is recommended. Poor results are also evident for Sites 24 and 25 which capture runoff from the same catchment area.

Site 20

Site 20 drains a small section of Tuggerah Parade between Pacific St and Thompson St. This site recorded low dissolved oxygen levels (mean 13.7%, median 0%), high turbidity (mean 26.2 NTU, median 30 NTU) and moderate to high available phosphorus (mean 0.34 mg/L, median 0.21 mg/L).Further investigation may be beneficial in combination with a targeted education program for local residents regarding sediment and nutrient pollution and the impacts on estuary health in their immediate vicinity.

Site 28

Site 28 has a moderate size catchment for area and drains the vicinity of Gordon Rd up to the Entrance Road including medium and high density residential development. The site recorded low dissolved oxygen levels (mean 13.7%, median 0%), high turbidity (mean 26.2 NTU, median 30 NTU) and moderate to high available phosphorus (mean 0.34 mg/L, median 0.21 mg/L). A targeted education campaign in this area would be beneficial to try to reduce point source pollutant loads from this catchment.

Largest catchments

The largest catchments draining to the Long Jetty foreshore flow to Saltwater Creek and sites 7, 8 (Venice St), 10, 12, 14, 14A, 17, 21, 22, 28, 29a (south side of proposed Long Jetty beach) and 35 (site of Tuggerah Pde GPT).

The average results for turbidity and available phosphorus are shown below. High pollutant loads and potentially high runoff volumes due to catchment size highlight the need to manage larger catchments as a means of reducing pollutant loads to the estuary. The catchments draining to sites 7 and 28 are the worst performing in the Long Jetty area.

Site	Average turbidity (NTU)	Average available P (mg/L)
7	13.5	1.63
8	20.9	0.05
10	10.5	0.04
12	7.5	0.03
14	9.3	0.02
14A	31.3	0.04
17	8.6	0.03
21	13.2	0.09
22	11.8	0.05
28	20.1	0.31
29A	14.1	0.14

35	23.9	0.04

Key: Green = healthy, orange = fair, red = poor

Recent Stormwater Upgrades

Venice St Wetland – LJ 7, 8 & 9

Wyong Shire Council recently completed construction of two saltmarsh swales under the Tuggerah Lakes Clean-Up Project funding. These swales took in sites 7, 8 and 9. Both sites have recorded poor average turbidity scores and fair average available phosphorus scores. The capacity of the structures to remove gross pollutants, sediment and some nutrients will have a beneficial effect on the water quality of the nearshore zone in this location and contribute to a healthier estuary.

Tuggerah Parade GPT – LJ 35

In 2013, Council constructed a large open GPT at the northern end of Tuggerah Parade. This device takes in site 35 and treats water from a large catchment area. Recent water quality monitoring for this site has shown heathy ratings for dissolved oxygen, pH, turbidity and available phosphate. This is an excellent outcome for the works and demonstrates the impact of retrofitting inadequate stormwater infrastructure to achieve better downstream conditions.

Recommendations

Following review of the extensive data set, the following recommendations are provided for consideration:

- Undertake a more thorough review of nutrient concentration vs expected volume of flow to determine hotspots for improved point source control and stormwater treatment.
- Undertaken further investigation into catchments and sites with poor water quality records. Use this information to tailor education and compliance programs to target point source polluters.
- Undertake a more extensive program of monitoring at target sites which incorporates greater replication at different scales (both spatial and temporal). This information could be used to assess the feasibility of building a predictive model of pollution based upon catchment conditions (e.g. seasonality, correlation with rainfall).
- Replicate samples within sites to allow for analysis of within site variability OR use a composite sampling technique to ensure each sample gives a better estimate of the true sample mean.
- Consider including Chlorophyll-a in sampling program as an indicator of primary productivity.

Appendix 1 – Q/A checked raw data – all data, all sites

Drain ID	Parameter	15/05/2015	15/04/2015	18/03/2015	18/02/2015	3/02/2015	21/01/2015	17/12/2014	19/11/2014	22/10/2014	21/08/2014	20/08/2014	11/06/2014	9/04/2014	19/03/2014	25/02/2014	19/02/2014	4/12/2013	13/11/2013	23/10/2013	28/08/2013	12/08/2013	31/07/2013	3/07/2013	22/05/2013	10/04/2013	20/03/2013	6/02/2013
1	Percent Dissolved Oxygen %			18						76								0		0.6							0	
	pH			7						8								7		6							7	
	Turbidity NTU's			20						10								30		50							30	
	Available Phosphate mg/L			0.2						0								0.04		0.95							0	
	E coli/ total coliforms/100ml			-						-								1600		-							3000	
2	Percent Dissolved Oxygen %			5						85								6		0.7							10	
	pH			7						7								6		7							7	
	Turbidity NTU's			20						60								50		30							40	
	Available Phosphate mg/L			0.08						0								0.02		0.04							0.15	
	E coli/ total coliforms/100ml			-						-								-		-							1000	
3	Percent Dissolved Oxygen %			16														0									27	
	pH			7														7									7	
	Turbidity NTU's			7														40									30	
	Available Phosphate mg/L			0.02														0									0	
	E coli/ total coliforms/100ml			-														200									1300	
4	Percent Dissolved Oxygen %			45														0									33	
	pH			7														7									7	
	Turbidity NTU's			15														40									30	
	Available Phosphate mg/L			0.07														0.19									0	
	E coli/ total coliforms/100ml			-														100									6500	
5	Percent Dissolved Oxygen %								0									22									21	
	pH								7.5									7									7	
	Turbidity NTU's								40									15									15	
	Available Phosphate mg/L								0									0									0.05	
	E coli/ total coliforms/100ml								-									100									1400	
6	Percent Dissolved Oxygen %																	0									0	
	pH																	7									7	
	Turbidity NTU's																	40									30	
	Available Phosphate mg/L																	0.08									0.05	
	E coli/ total coliforms/100ml																	-									-	
7	Percent Dissolved Oxygen %		32			-			5	48		-	72			0	-	28	-		62	44			54	29		
	pH		7			-			8	8		-	8			7.5	-	7	-		7	7			8	7		
	Turbidity NTU's		7			-			15	10		-	15			30	-	7			30	7			7	7		
	Available Phosphate mg/L		0.29			2.69			0	0		1.49	0.05			0.07	0.65	2.01	1.96		2.33	0.9			0.09	0.39		
	E coli/ total coliforms/100ml		-			-			-	-		-	-			-	-	300	-		-	-			-	200		
8	Percent Dissolved Oxygen %		0						36							0										0		
	pH		7						6							6.5										7		
	Turbidity NTU's		15						30							30										20		
	Available Phosphate mg/L		0.12						0							0.1										0		
	E coli/ total coliforms/100ml		-						-							-										0		
9	Percent Dissolved Oxygen %								4							0										26		
	pH								6							6.5										6		
	Turbidity NTU's								40							40										7		
	Available Phosphate mg/L								0.07							0										0.1		
	E coli/ total coliforms/100ml								-							-										800		
10	Percent Dissolved Oxygen %								48							25										35		
	pH								7							7.5										7		
	Turbidity NTU's								20							15										7		
	Available Phosphate mg/L								0							0										0.07		
	E coli/ total coliforms/100ml								-							-										-		
11	Percent Dissolved Oxygen %								54							10												
	pH								7							7.5												
	Turbidity NTU's								30							7												
	Available Phosphate mg/L								0							0												
	E coli/ total coliforms/100ml								-							-												
12	Percent Dissolved Oxygen %							44								24										16		
	pH							7								7.5										7		
	Turbidity NTU's							10								7										7		
	Available Phosphate mg/L							0.01								0										0.06		
	E coli/ total coliforms/100ml							0								-										200		
13	Percent Dissolved Oxygen %							0							0											0		
	pH							6.5							7											7		
	Turbidity NTU's							30							80											15		
	Available Phosphate mg/L							0.01							0.34											0.18		
	E coli/ total coliforms/100ml							900							0											200		
14	Percent Dissolved Oxygen %							0		36					26										38			
	pH							7		7					6										7			
	Turbidity NTU's							7		7					10										7			
	Available Phosphate mg/L							0.04		0					0										0			
	E coli/ total coliforms/100ml							300		-					-										0			
14A	Percent Dissolved Oxygen %							22		22					0											0		
	pH							7		7					7											7		
	Turbidity NTU's							100		30					30											15		
	Available Phosphate mg/L							0.02		0					0.13											0.09		
	E coli/ total coliforms/100ml							1600		-					1000											-		

Drain ID	Parameter	16/01/2013	5/12/2012	31/10/2012	19/09/2012	22/08/2012	18/07/2012	27/06/2012	9/05/2012	2/05/2012	14/03/2012	15/02/2012	25/01/2012	2/11/2011	12/10/2011	31/08/2011	10/08/2011	13/04/2011	16/03/2011	23/02/2011	15/12/2010	21/09/2010	9/06/2010	5/05/2010	14/04/2010	10/03/2010	3/02/2010	13/01/2010
1	Percent Dissolved Oxygen %						0						41				34											
	pH						7						8				7											
	Turbidity NTU's						60						20				40											
	Available Phosphate mg/L						0.51						0				0.04											
	E coli/ total coliforms/100ml						0						-				-											
2	Percent Dissolved Oxygen %						0						32			54	24											
	pH						7						7			6.5	7											
	Turbidity NTU's						40						30			20	60											
	Available Phosphate mg/L						0.57						0.27			0.07	3.12											
	E coli/ total coliforms/100ml						0						-			-	-											
3	Percent Dissolved Oxygen %						24.7						58				44											
	pH						7						8				7											
	Turbidity NTU's						40						30				30											
	Available Phosphate mg/L						0						0				0.03											
	E coli/ total coliforms/100ml						100						-				-											
4	Percent Dissolved Oxygen %						38						34				30											
	pH						7						7				7											
	Turbidity NTU's						40						10				20											
	Available Phosphate mg/L						0.27						-0.04				0.01											
	E coli/ total coliforms/100ml						0						-				-											
5	Percent Dissolved Oxygen %						50.4					14					60											
	pH						7					7					7											
	Turbidity NTU's						15					7					7											
	Available Phosphate mg/L						0					0.02					0.03											
	E coli/ total coliforms/100ml						900					0																
6	Percent Dissolved Oxygen %						0					0					39										12	
	pH						7					7					7										7	
	Turbidity NTU's						80					7					7										7	
	Available Phosphate mg/L						0.1					0					0.08										0.06	
	E coli/ total coliforms/100ml						0					900					-										-	
7	Percent Dissolved Oxygen %	11	16	75.7	166	68.9						38				56												
	pH	7	7	7	7	9						7				7												
	Turbidity NTU's	7	7	20	40	7						7				7												
	Available Phosphate mg/L	0.1	2.16	10.4	7.68	0.59						0.39				0.03												
	E coli/ total coliforms/100ml	-	0	0	-	-						800				-												
8	Percent Dissolved Oxygen %					11.6						0				34											26	
	pH					9						7				6											6	
	Turbidity NTU's					15						30				20											7	
	Available Phosphate mg/L					0						0				0.09											0.06	
	E coli/ total coliforms/100ml					-						2200				-											-	
9	Percent Dissolved Oxygen %					23.8						36				36												
	pH					6						6.5				6												
	Turbidity NTU's					7						30				7												
	Available Phosphate mg/L					0						0				0.03												
	E coli/ total coliforms/100ml					-						-				-												
10	Percent Dissolved Oxygen %					0						35				24												
	pH					6						7				7												
	Turbidity NTU's					7						7				7												
	Available Phosphate mg/L					0.1						0				0.06												
	E coli/ total coliforms/100ml					-						-				-												
11	Percent Dissolved Oxygen %					68.9						39				90												
	pH					7						7				7												
	Turbidity NTU's					7						7				7												
	Available Phosphate mg/L					0						0				0.06												
	E coli/ total coliforms/100ml					-						-				-												
12	Percent Dissolved Oxygen %					71.9						44				72												
	pH					7						7				7												
	Turbidity NTU's					7						7				7												
	Available Phosphate mg/L					0						0				0.08												
	E coli/ total coliforms/100ml					-						-				-												
13	Percent Dissolved Oxygen %					0					0			12														
	pH					6					7			7														
	Turbidity NTU's					7					30			30														
	Available Phosphate mg/L					0.1					0			0.04														
	E coli/ total coliforms/100ml					-					-			-														
14	Percent Dissolved Oxygen %				50.7						24			46														
	pH				7						7			7														
	Turbidity NTU's				20						7			7														
	Available Phosphate mg/L				0.03						0			0.04														
	E coli/ total coliforms/100ml				600						-			-														
14A	Percent Dissolved Oxygen %				39.3						0			14														
	pH				7						7			7														
	Turbidity NTU's				7						7			30														
	Available Phosphate mg/L				0						0			0.06														
	E coli/ total coliforms/100ml				500						-			-														

Drain ID	Parameter	Mean	Median	SD	n	SE	Upper 95% limit	Lower 95% limit	Rated good (%)	Rated fair (%)	Rated poor (%)	Rated bad (%)
1	Percent Dissolved Oxygen %	21.20	9.30	27.62	8	9.77	40.3	2.1			100%	
	pH	7.13	7.00	0.64	8	0.23	7.6	6.7	100%			
	Turbidity NTU's	32.50	30.00	16.69	8	5.90	44.1	20.9	13%	25%	63%	
	Available Phosphate mg/L	0.22	0.04	0.34	8	0.12	0.5	0.0	38%	38%	25%	
	E coli/ total coliforms/100ml	1533.33	1600.00	1501.11	3	866.67	3232.0	-165.3	33%			67%
2	Percent Dissolved Oxygen %	24.08	10.00	28.91	9	9.64	43.0	5.2	11%		89%	
	pH	6.83	7.00	0.35	9	0.12	7.1	6.6	100%			
	Turbidity NTU's	38.89	40.00	15.37	9	5.12	48.9	28.8		22%	78%	
	Available Phosphate mg/L	0.48	0.08	1.01	9	0.34	1.1	-0.2	11%	67%	22%	
	E coli/ total coliforms/100ml	500.00	500.00	707.11	2	500.00	1480.0	-480.0	50%			50%
3	Percent Dissolved Oxygen %	28.28	25.84	20.47	6	8.36	44.7	11.9			100%	
	pH	7.17	7.00	0.41	6	0.17	7.5	6.8	100%			
	Turbidity NTU's	29.50	30.00	12.06	6	4.92	39.2	19.8	17%		83%	
	Available Phosphate mg/L	0.01	0.00	0.01	6	0.01	0.0	0.0	67%	33%		
	E coli/ total coliforms/100ml	533.33	200.00	665.83	3	384.42	1286.8	-220.1		67%		33%
4	Percent Dissolved Oxygen %	29.99	33.50	15.58	6	6.36	42.5	17.5			100%	
	pH	7.00	7.00	0.00	6	0.00	7.0	7.0	100%			
	Turbidity NTU's	25.83	25.00	12.81	6	5.23	36.1	15.6	17%	33%	50%	
	Available Phosphate mg/L	0.08	0.04	0.12	6	0.05	0.2	0.0	50%	50%		
	E coli/ total coliforms/100ml	2200.00	100.00	3724.24	3	2150.19	6414.4	-2014.4	33%	33%		33%
5	Percent Dissolved Oxygen %	27.91	21.50	22.77	6	9.30	46.1	9.7			100%	
	pH	7.08	7.00	0.20	6	0.08	7.2	6.9	100%			
	Turbidity NTU's	16.50	15.00	12.16	6	4.96	26.2	6.8	33%	50%	17%	
	Available Phosphate mg/L	0.02	0.01	0.02	6	0.01	0.0	0.0	50%	50%		
	E coli/ total coliforms/100ml	600.00	500.00	668.33	4	334.17	1255.0	-55.0	25%	25%		50%
6	Percent Dissolved Oxygen %	8.50	0.00	15.69	6	6.41	21.1	-4.1			100%	
	pH	7.00	7.00	0.00	6	0.00	7.0	7.0	100%			
	Turbidity NTU's	28.50	18.50	28.89	6	11.79	51.6	5.4	50%		50%	
	Available Phosphate mg/L	0.06	0.07	0.03	6	0.01	0.1	0.0	17%	83%		
	E coli/ total coliforms/100ml	450.00	450.00	636.40	2	450.00	1332.0	-432.0	50%			50%
7	Percent Dissolved Oxygen %	47.42	44.00	38.56	17	9.35	65.7	29.1			100%	
	pH	7.38	7.00	0.60	17	0.15	7.7	7.1	94%		6%	
	Turbidity NTU's	13.53	7.00	10.39	17	2.52	18.5	8.6	65%	18%	18%	
	Available Phosphate mg/L	1.63	0.59	2.64	21	0.58	2.8	0.5	10%	29%	62%	
	E coli/ total coliforms/100ml	260.00	200.00	328.63	5	146.97	548.1	-28.1	40%	20%	20%	20%
8	Percent Dissolved Oxygen %	13.45	5.80	16.10	8	5.69	24.6	2.3			100%	
	pH	6.81	6.75	1.00	8	0.35	7.5	6.1	88%		13%	
	Turbidity NTU's	20.88	20.00	8.56	8	3.03	26.8	14.9	13%	50%	38%	
	Available Phosphate mg/L	0.05	0.03	0.05	8	0.02	0.1	0.0	50%	50%		
	E coli/ total coliforms/100ml	1100.00	1100.00	1555.63	2	1100.00	3256.0	-1056.0	50%			50%
9	Percent Dissolved Oxygen %	20.97	24.90	15.57	6	6.36	33.4	8.5			100%	
	pH	6.17	6.00	0.26	6	0.11	6.4	6.0	100%			
	Turbidity NTU's	21.83	18.50	16.65	6	6.80	35.2	8.5	50%		50%	
	Available Phosphate mg/L	0.03	0.02	0.04	6	0.02	0.1	0.0	50%	50%		
	E coli/ total coliforms/100ml	800.00	800.00		1		800.0	800.0				100%
10	Percent Dissolved Oxygen %	27.83	30.00	16.17	6	6.60	40.8	14.9			100%	
	pH	6.92	7.00	0.49	6	0.20	7.3	6.5	100%			
	Turbidity NTU's	10.50	7.00	5.65	6	2.31	15.0	6.0	67%	33%		
	Available Phosphate mg/L	0.04	0.03	0.04	6	0.02	0.1	0.0	50%	50%		
	E coli/ total coliforms/100ml				0		0.0	0.0				
11	Percent Dissolved Oxygen %	52.38	54.00	30.27	5	13.54	78.9	25.8	20%		80%	
	pH	7.10	7.00	0.22	5	0.10	7.3	6.9	100%			
	Turbidity NTU's	11.60	7.00	10.29	5	4.60	20.6	2.6	80%		20%	
	Available Phosphate mg/L	0.01	0.00	0.03	5	0.01	0.0	0.0	80%	20%		
	E coli/ total coliforms/100ml				0		0.0	0.0				
12	Percent Dissolved Oxygen %	45.32	44.00	23.40	6	9.55	64.0	26.6			100%	
	pH	7.08	7.00	0.20	6	0.08	7.2	6.9	100%			
	Turbidity NTU's	7.50	7.00	1.22	6	0.50	8.5	6.5	100%			
	Available Phosphate mg/L	0.03	0.01	0.04	6	0.01	0.1	0.0	67%	33%		
	E coli/ total coliforms/100ml	100.00	100.00	141.42	2	100.00	296.0	-96.0	50%	50%		
13	Percent Dissolved Oxygen %	2.00	0.00	4.90	6	2.00	5.9	-1.9			100%	
	pH	6.75	7.00	0.42	6	0.17	7.1	6.4	100%			
	Turbidity NTU's	32.00	30.00	25.42	6	10.38	52.3	11.7	17%	17%	67%	
	Available Phosphate mg/L	0.11	0.07	0.13	6	0.05	0.2	0.0	33%	50%	17%	
	E coli/ total coliforms/100ml	366.67	200.00	472.58	3	272.85	901.4	-168.1				
14	Percent Dissolved Oxygen %	31.53	36.00	16.93	7	6.40	44.1	19.0			100%	
	pH	6.86	7.00	0.38	7	0.14	7.1	6.6	100%			
	Turbidity NTU's	9.29	7.00	4.86	7	1.84	12.9	5.7	86%	14%		
	Available Phosphate mg/L	0.02	0.00	0.02	7	0.01	0.0	0.0	57%	43%		
	E coli/ total coliforms/100ml	300.00	300.00	300.00	3	173.21	639.5	-39.5	33%		33%	33%
14A	Percent Dissolved Oxygen %	13.90	14.00	15.03	7	5.68	25.0	2.8			100%	
	pH	7.00	7.00	0.00	7	0.00	7.0	7.0	100%			
	Turbidity NTU's	31.29	30.00	32.07	7	12.12	55.0	7.5	29%	14%	57%	
	Available Phosphate mg/L	0.04	0.02	0.05	7	0.02	0.1	0.0	43%	57%		
	E coli/ total coliforms/100ml	1033.33	1000.00	550.76	3	317.98	1656.6	410.1			33%	67%

Drain ID	Parameter	15/05/2015	15/04/2015	18/03/2015	18/02/2015	3/02/2015	21/01/2015	17/12/2014	19/11/2014	22/10/2014	21/08/2014	20/08/2014	11/06/2014	9/04/2014	19/03/2014	25/02/2014	19/02/2014	4/12/2013	13/11/2013	23/10/2013	28/08/2013	12/08/2013	31/07/2013	3/07/2013	22/05/2013	10/04/2013	20/03/2013	6/02/2013	16/01/2013	5/12/2012	31/10/2012	19/09/2012	22/08/2012	18/07/2012	27/06/2012	9/05/2012	2/05/2012	14/03/2012	15/02/2012	25/01/2012	2/11/2011	12/10/2011	31/08/2011	10/08/2011	13/04/2011	16/03/2011	23/02/2011	15/12/2010	21/09/2010	9/06/2010	5/05/2010	14/04/2010	10/03/2010	3/02/2010	13/01/2010
15	Percent Dissolved Oxygen %							10							0										3							26.3						0			18														
	pH							7							7										8							6						7			6														
	Turbidity NTU's							30							60										30							15						7			7														
	Available Phosphate mg/L							0							0										0							0						0			0.02														
	E coli/ total coliforms/100ml							200							1800										0							100						-			-														
16	Percent Dissolved Oxygen %							0							0										0							26.3						0																	
	pH							7							7										7							6						7																	
	Turbidity NTU's							7							30										30							7						20																	
	Available Phosphate mg/L							0							0.09										0.21							0						0																	
	E coli/ total coliforms/100ml							300							100										100							0						-																	
17	Percent Dissolved Oxygen %							54							52										52							16.9						33																	
	pH							7							6										8							7						7																	
	Turbidity NTU's							15							7										7							7						7																	
	Available Phosphate mg/L							0							0.04										0							0.13						0																	
	E coli/ total coliforms/100ml							-							500										0							100						-																	
18	Percent Dissolved Oxygen %							0							30										6							39.3					13					30													
	pH							7							6.5										7							6					7					7													
	Turbidity NTU's							30							7										7							7					7					15													
	Available Phosphate mg/L							0.06							0										0.03							0					0.27					0.36													
	E coli/ total coliforms/100ml							-							-										200							-					1,800					-													
19	Percent Dissolved Oxygen %						0			0					6								80		14				6		0	0					13					13													
	pH						7			7					7								7		8				7		8	9					7					7													
	Turbidity NTU's						15			15					20								40		7				15		15	15					7					15													
	Available Phosphate mg/L						0.04			0.11					0								0.11		0				0		0	0.15					0.06					0.14													
	E coli/ total coliforms/100ml						-			-					100								-		0				-		600	1900					900					-													
20	Percent Dissolved Oxygen %						29							53											0						0						0					0													
	pH						7							8											7						7						7					7													
	Turbidity NTU's						30							30											7						30						20					40													
	Available Phosphate mg/L						0.03							0.12											0.24						0.18						0.43					1.02													
	E coli/ total coliforms/100ml						-							-											-						0						0					-													
21	Percent Dissolved Oxygen %						9							11										65							0						28					0													
	pH						7							7.5										7							9						7					7													
	Turbidity NTU's						10							15										10							7						7					30													
	Available Phosphate mg/L						0.04							0										0							0						0					0.47													
	E coli/ total coliforms/100ml						-							-										-							0						0					-													
22	Percent Dissolved Oxygen %						22							34										60						1							44					0													
	pH						7							8										7						7							7					8													
	Turbidity NTU's						7							15										15						20							7					7													
	Available Phosphate mg/L						0.04							0										0						0							0.06					0.18													
	E coli/ total coliforms/100ml						-							-										-						1100							-					-													
23	Percent Dissolved Oxygen %						0							0										26						0						0						0													
	pH						7							7.5										7						8						7						7													
	Turbidity NTU's						20							15										15						50						7						40													
	Available Phosphate mg/L						0.75							0										0						0.06						0.16						1.09													
	E coli/ total coliforms/100ml						-							-										-						2100						0						-													
24	Percent Dissolved Oxygen %						0						0											52						0						0						32													
	pH						7						7											7						7						7						7													
	Turbidity NTU's						50						40											15						60						15						30													
	Available Phosphate mg/L						0.07						0.3											0.01						0						0.27						0.41													
	E coli/ total coliforms/100ml						-						-											-						100						0						-													
25	Percent Dissolved Oxygen %						10						11											39						0						0										0								0	11
	pH						7						7											7						7						7										7								7.5	8
	Turbidity NTU's						20						20											15						80						60										50								30	20
	Available Phosphate mg/L						1.09						0.41											0.04						1.32						0.41										0.02								0.04	0.02
	E coli/ total coliforms/100ml						-						-											-						900						100										-								-	-
26	Percent Dissolved Oxygen %						10						10																	6						0										14									
	pH						7						7																	7						7										7									
	Turbidity NTU's						40						15																	30						80										30									
	Available Phosphate mg/L						0.12						0.34																	0.05						0.54										0.02									
	E coli/ total coliforms/100ml						-						-																	0						1										-									
27	Percent Dissolved Oxygen %												20										40						70							25										8								50	98
	pH												7										7						7							7										7								8	7.5
	Turbidity NTU's												10										20						7							40										30								40	60
	Available Phosphate mg/L												0.25										0.04						0							0										0.06								0.02	0.12
	E coli/ total coliforms/100ml												-										-						-							-										-								-	-
28	Percent Dissolved Oxygen %												64										85						0							0										15		50	0		10		11		
	pH												7										7						7							7.5										7		7.5	7		7.5		7		
	Turbidity NTU's												7										15						20							30										15		30	50		7		7		
	Available Phosphate mg/L												0.23										0.22						0.51							0.44										0.04		0.03	1.16		0.08		0.07		
	E coli/ total coliforms/100ml												-										-						-							-										-		-	-		-		-		
29	Percent Dissolved Oxygen %												24										60						0						27.2											0		10	0		0	0	0	0	11
	pH												7										7.5						7						7											7		7.5	7		7.5	7	7	7	9
	Turbidity NTU's												20										15						7						15											40		40	20		20	7	15	15	30
	Available Phosphate mg/L												0.16										0.07						0						0.3											0		0.06	0.44		0	0	0.23	0.25	0.2
	E coli/ total coliforms/100ml												-										-						-						-											-		-	-		-	-	-	-	-
29A	Percent Dissolved Oxygen %				18						66												73						8						43.7											15	0		10		0		16		
	pH				7.5						7												7.5						8						7											7	7		7		8		7		
	Turbidity NTU's				30						10												15						15						7											15	15		20		7		7		
	Available Phosphate mg/L				0.03						0.19												0.36						0.18						0.02											0.11	0.11		0.21		0.06		0.09		
	E coli/ total coliforms/100ml				300						-												-						-						-											-	-		-		-		-		
30	Percent Dissolved Oxygen %				20						-												90					24									11										10	58	70		11	11	0		
	pH				7						7												7.5					7									7										7	7.5	7		7	7	7.5		
	Turbidity NTU's				60						7												7					15									15										30	20	7		15	7	20		
	Available Phosphate mg/L				0						0												0.03					0									0.04										0.02	0.02	0.02		0.01	0	0.04		
	E coli/ total coliforms/100ml				100						-												-					0									-										-	-	-		-	-	-		

Drain ID	Parameter	Mean	Median	SD	n	SE	Upper 95% limit	Lower 95% limit	Rated good (%)	Rated fair (%)	Rated poor (%)	Rated bad (%)
15	Percent Dissolved Oxygen %	9.56	6.50	10.76	6	4.39	18.2	0.9			100%	
	pH	6.83	7.00	0.75	6	0.31	7.4	6.2	100%			
	Turbidity NTU's	24.83	22.50	20.11	6	8.21	40.9	8.7	33%	17%	50%	
	Available Phosphate mg/L	0.00	0.00	0.01	6	0.00	0.0	0.0	83%	17%		
	E coli/ total coliforms/100ml	525.00	150.00	853.91	4	426.96	1361.8	-311.8	25%	50%		25%
16	Percent Dissolved Oxygen %	5.27	0.00	11.78	5	5.27	15.6	-5.1			100%	
	pH	6.80	7.00	0.45	5	0.20	7.2	6.4	100%			
	Turbidity NTU's	18.80	20.00	11.52	5	5.15	28.9	8.7	40%	20%	40%	
	Available Phosphate mg/L	0.06	0.00	0.09	5	0.04	0.1	0.0	60%	40%		
	E coli/ total coliforms/100ml	125.00	100.00	125.83	4	62.92	248.3	1.7	25%	50%	25%	
17	Percent Dissolved Oxygen %	41.58	52.00	16.23	5	7.26	55.8	27.4			100%	
	pH	7.00	7.00	0.71	5	0.32	7.6	6.4	100%			
	Turbidity NTU's	8.60	7.00	3.58	5	1.60	11.7	5.5	80%	20%		
	Available Phosphate mg/L	0.03	0.00	0.06	5	0.03	0.1	0.0	60%	40%		
	E coli/ total coliforms/100ml	200.00	100.00	264.58	3	152.75	499.4	-99.4	33%	33%	33%	
18	Percent Dissolved Oxygen %	19.72	21.50	15.60	6	6.37	32.2	7.2			100%	
	pH	6.75	7.00	0.42	6	0.17	7.1	6.4	100%			
	Turbidity NTU's	12.17	7.00	9.30	6	3.80	19.6	4.7	67%	17%	17%	
	Available Phosphate mg/L	0.12	0.05	0.16	6	0.06	0.2	0.0	33%	50%	17%	
	E coli/ total coliforms/100ml	1000.00	1000.00	1131.37	2	800.00	2568.0	-568.0		50%		50%
19	Percent Dissolved Oxygen %	13.20	6.00	24.18	10	7.65	28.2	-1.8	10%		90%	
	pH	7.40	7.00	0.70	10	0.22	7.8	7.0	90%		10%	
	Turbidity NTU's	16.40	15.00	9.18	10	2.90	22.1	10.7	20%	70%	10%	
	Available Phosphate mg/L	0.06	0.05	0.06	10	0.02	0.1	0.0	40%	60%		
	E coli/ total coliforms/100ml	700.00	600.00	764.85	4	382.43	1449.6	-49.6		25%		75%
20	Percent Dissolved Oxygen %	13.67	0.00	22.49	6	9.18	31.7	-4.3			100%	
	pH	7.17	7.00	0.41	6	0.17	7.5	6.8	100%			
	Turbidity NTU's	26.17	30.00	11.32	6	4.62	35.2	17.1	17%	17%	67%	
	Available Phosphate mg/L	0.34	0.21	0.36	6	0.15	0.6	0.0		67%	33%	
	E coli/ total coliforms/100ml	0.00	0.00	0.00	2	0.00	0.0	0.0	100%			
21	Percent Dissolved Oxygen %	18.83	10.00	24.83	6	10.14	38.7	-1.0			100%	
	pH	7.42	7.00	0.80	6	0.33	8.1	6.8	17%		83%	
	Turbidity NTU's	13.17	10.00	8.75	6	3.57	20.2	6.2	67%	17%	17%	
	Available Phosphate mg/L	0.09	0.00	0.19	6	0.08	0.2	-0.1	67%	17%	17%	
	E coli/ total coliforms/100ml	0.00	0.00	0.00	2	0.00	0.0	0.0	100%			
22	Percent Dissolved Oxygen %	26.83	28.00	23.90	6	9.76	46.0	7.7			100%	
	pH	7.33	7.00	0.52	6	0.21	7.7	6.9	100%			
	Turbidity NTU's	11.83	11.00	5.60	6	2.29	16.3	7.4	50%	50%		
	Available Phosphate mg/L	0.05	0.02	0.07	6	0.03	0.1	0.0	50%	50%		
	E coli/ total coliforms/100ml	1100.00	1100.00		1		1100.0	1100.0				100%
23	Percent Dissolved Oxygen %	4.33	0.00	10.61	6	4.33	12.8	-4.2			100%	
	pH	7.25	7.00	0.42	6	0.17	7.6	6.9	100%			
	Turbidity NTU's	24.50	17.50	16.72	6	6.83	37.9	11.1	17%	50%	33%	
	Available Phosphate mg/L	0.34	0.11	0.46	6	0.19	0.7	0.0	33%	33%	33%	
	E coli/ total coliforms/100ml	1050.00	1050.00	1484.92	2	1050.00	3108.0	-1008.0	50%			50%
24	Percent Dissolved Oxygen %	14.00	0.00	22.59	6	9.22	32.1	-4.1			100%	
	pH	7.00	7.00	0.00	6	0.00	7.0	7.0	100%			
	Turbidity NTU's	35.00	35.00	18.44	6	7.53	49.8	20.2		33%	67%	
	Available Phosphate mg/L	0.18	0.17	0.17	6	0.07	0.3	0.0	33%	50%	17%	
	E coli/ total coliforms/100ml	50.00	50.00	70.71	2	50.00	148.0	-48.0	50%	50%		
25	Percent Dissolved Oxygen %	8.88	5.00	13.27	8	4.69	18.1	-0.3			100%	
	pH	7.19	7.00	0.37	8	0.13	7.4	6.9	100%			
	Turbidity NTU's	36.88	25.00	23.75	8	8.40	53.3	20.4		50%	50%	
	Available Phosphate mg/L	0.42	0.23	0.52	8	0.18	0.8	0.1		50%	50%	
	E coli/ total coliforms/100ml	500.00	500.00	565.69	2	400.00	1284.0	-284.0		50%		50%
26	Percent Dissolved Oxygen %	8.00	10.00	5.29	5	2.37	12.6	3.4			100%	
	pH	7.00	7.00	0.00	5	0.00	7.0	7.0	100%			
	Turbidity NTU's	39.00	30.00	24.60	5	11.00	60.6	17.4		20%	80%	
	Available Phosphate mg/L	0.21	0.12	0.22	5	0.10	0.4	0.0		60%	40%	
	E coli/ total coliforms/100ml	0.50	0.50	0.71	2	0.50	1.5	-0.5	100%			
27	Percent Dissolved Oxygen %	44.43	40.00	31.29	7	11.83	67.6	21.2	14%		86%	
	pH	7.21	7.00	0.39	7	0.15	7.5	6.9	100%			
	Turbidity NTU's	29.57	30.00	18.83	7	7.12	43.5	15.6	29%	14%	57%	
	Available Phosphate mg/L	0.07	0.04	0.09	7	0.03	0.1	0.0	29%	71%		
	E coli/ total coliforms/100ml				0		0.0	0.0				
28	Percent Dissolved Oxygen %	26.11	11.00	31.88	9	10.63	46.9	5.3	11%		89%	
	pH	7.17	7.00	0.25	9	0.08	7.3	7.0	100%			
	Turbidity NTU's	20.11	15.00	14.39	9	4.80	29.5	10.7	33%	33%	33%	
	Available Phosphate mg/L	0.31	0.22	0.36	9	0.12	0.5	0.1		67%	33%	
	E coli/ total coliforms/100ml				0		0.0	0.0				
29	Percent Dissolved Oxygen %	11.01	0.00	18.29	12	5.28	21.4	0.7			100%	
	pH	7.29	7.00	0.58	12	0.17	7.6	7.0	92%		8%	
	Turbidity NTU's	20.33	17.50	11.02	12	3.18	26.6	14.1	17%	58%	25%	
	Available Phosphate mg/L	0.14	0.12	0.14	12	0.04	0.2	0.1	33%	58%	8%	
	E coli/ total coliforms/100ml				0		0.0	0.0				
29A	Percent Dissolved Oxygen %	24.97	15.50	26.51	10	8.38	41.4	8.5			100%	
	pH	7.30	7.00	0.42	10	0.13	7.6	7.0	100%			
	Turbidity NTU's	14.10	15.00	7.14	10	2.26	18.5	9.7	40%	50%	10%	
	Available Phosphate mg/L	0.14	0.11	0.10	10	0.03	0.2	0.1		90%	10%	
	E coli/ total coliforms/100ml	300.00	300.00		1		300.0	300.0			100%	
30	Percent Dissolved Oxygen %	30.50	15.50	30.73	11	9.27	48.7	12.3	10%		90%	
	pH	7.14	7.00	0.23	11	0.07	7.3	7.0	100%			
	Turbidity NTU's	18.45	15.00	15.57	11	4.69	27.7	9.3	36%	45%	18%	
	Available Phosphate mg/L	0.02	0.02	0.02	11	0.00	0.0	0.0	45%	55%		
	E coli/ total coliforms/100ml	50.00	50.00	70.71	2	50.00	148.0	-48.0	50%	50%		

Drain ID	Parameter	15/05/2015	15/04/2015	18/03/2015	18/02/2015	3/02/2015	21/01/2015	17/12/2014	19/11/2014	22/10/2014	21/08/2014	20/08/2014	11/06/2014	9/04/2014	19/03/2014	25/02/2014	19/02/2014
30A	Percent Dissolved Oxygen %																
	pH																
	Turbidity NTU's																
	Available Phosphate mg/L																
	E coli/ total coliforms/100ml																
31	Percent Dissolved Oxygen %				10						63						
	pH				7						7						
	Turbidity NTU's				60						7						
	Available Phosphate mg/L				0.03						0						
	E coli/ total coliforms/100ml				300						-						
32	Percent Dissolved Oxygen %	0			25						51						
	pH	7			7						7						
	Turbidity NTU's	30			60						7						
	Available Phosphate mg/L	0.26			0.23						0.31						
	E coli/ total coliforms/100ml	-			0						-						
33	Percent Dissolved Oxygen %		45		30						61						
	pH		7		7						7						
	Turbidity NTU's		7		100						7						
	Available Phosphate mg/L		0		0.31						0						
	E coli/ total coliforms/100ml		-		0						-						
34	Percent Dissolved Oxygen %		0		14						31						
	pH		7		7						7						
	Turbidity NTU's		20		300						7						
	Available Phosphate mg/L		0.15		0.53						0.04						
	E coli/ total coliforms/100ml		-		1600						-						
35	Percent Dissolved Oxygen %		98								95						
	pH		7								7						
	Turbidity NTU's		7								7						
	Available Phosphate mg/L		0								0.02						
	E coli/ total coliforms/100ml		-								-						
SC1	Percent Dissolved Oxygen %																
	pH																
	Turbidity NTU's																
	Available Phosphate mg/L																
	E coli/ total coliforms/100ml																
SC3	Percent Dissolved Oxygen %																
	pH																
	Turbidity NTU's																
	Available Phosphate mg/L																
	E coli/ total coliforms/100ml																

Drain ID	Parameter	4/12/2013	13/11/2013	23/10/2013	28/08/2013	12/08/2013	31/07/2013	3/07/2013	22/05/2013	10/04/2013	20/03/2013	6/02/2013	16/01/2013	5/12/2012	31/10/2012	19/09/2012	22/08/2012	18/07/2012	27/06/2012	9/05/2012	2/05/2012	14/03/2012	15/02/2012	25/01/2012
30A	Percent Dissolved Oxygen %											62												
	pH											7												
	Turbidity NTU's											7												
	Available Phosphate mg/L											0												
	E coli/ total coliforms/100ml											200												
31	Percent Dissolved Oxygen %				58							42												
	pH				7							7												
	Turbidity NTU's				15							7												
	Available Phosphate mg/L				0.02							0												
	E coli/ total coliforms/100ml				-							0												
32	Percent Dissolved Oxygen %				22							0							0					
	pH				8							7							7					
	Turbidity NTU's				30							15							40					
	Available Phosphate mg/L				0							0.07							0.42					
	E coli/ total coliforms/100ml				-							100							4800					
33	Percent Dissolved Oxygen %				59							41							50.7					
	pH				7							7							6					
	Turbidity NTU's				7							20							30					
	Available Phosphate mg/L				0							0.14							0.03					
	E coli/ total coliforms/100ml				-							100							600					
34	Percent Dissolved Oxygen %				57							0							32					
	pH				8							7							6.5					
	Turbidity NTU's				7							7							10					
	Available Phosphate mg/L				0							0.06							0.08					
	E coli/ total coliforms/100ml				-							0							300					
35	Percent Dissolved Oxygen %				78							78							77.8					
	pH				8							7							7					
	Turbidity NTU's				20							7							7					
	Available Phosphate mg/L				0.01							0.17							0					
	E coli/ total coliforms/100ml				-							-							600					
SC1	Percent Dissolved Oxygen %	32									19				17									
	pH	6									7				5									
	Turbidity NTU's	7									7				30									
	Available Phosphate mg/L	0.07									0.08				0.07									
	E coli/ total coliforms/100ml	100									1000				-									
SC3	Percent Dissolved Oxygen %										80				104									
	pH										7				7									
	Turbidity NTU's										20				7									
	Available Phosphate mg/L										0				0.03									
	E coli/ total coliforms/100ml										-				-									

Drain ID	Parameter	2/11/2011	12/10/2011	31/08/2011	10/08/2011	13/04/2011	16/03/2011	23/02/2011	15/12/2010	21/09/2010	9/06/2010	5/05/2010	14/04/2010	10/03/2010	3/02/2010	13/01/2010
30A	Percent Dissolved Oxygen %															
	pH															
	Turbidity NTU's															
	Available Phosphate mg/L															
	E coli/ total coliforms/100ml															
31	Percent Dissolved Oxygen %					0		0		46	49			33		
	pH					7		7		7	7			7.5		
	Turbidity NTU's					15		40		7	7			15		
	Available Phosphate mg/L					0.04		0.04		0.09	0.01			0.02		
	E coli/ total coliforms/100ml					-		-		-	-			-		
32	Percent Dissolved Oxygen %					11		0	46		38	0	56	0		
	pH					7		7	7		7	8	7	7		
	Turbidity NTU's					40		30	40		15	150	10	30		
	Available Phosphate mg/L					0.01		0.16	0.04		0.05	0.28	0.01	1.01		
	E coli/ total coliforms/100ml					-		-	-		-	-	-	-		
33	Percent Dissolved Oxygen %					34					54		35			
	pH					6					7		7			
	Turbidity NTU's					7					7		7			
	Available Phosphate mg/L					0.02					0.02		0.07			
	E coli/ total coliforms/100ml					-					-		-			
34	Percent Dissolved Oxygen %					10			46		44		16			
	pH					7			7		7		7			
	Turbidity NTU's					40			7		15		7			
	Available Phosphate mg/L					0.08			0.02		0.12		0.01			
	E coli/ total coliforms/100ml					-			-		-		-			
35	Percent Dissolved Oxygen %					63			64		66		33			
	pH					7			7.5		7		7			
	Turbidity NTU's					40			20		100		7			
	Available Phosphate mg/L					0			0.1		0.07		0			
	E coli/ total coliforms/100ml					-			-		-		-			
SC1	Percent Dissolved Oxygen %															
	pH															
	Turbidity NTU's															
	Available Phosphate mg/L															
	E coli/ total coliforms/100ml															
SC3	Percent Dissolved Oxygen %															
	pH															
	Turbidity NTU's															
	Available Phosphate mg/L															
	E coli/ total coliforms/100ml															

Drain ID	Parameter	Mean	Median	SD	n	SE	Upper 95% limit	Lower 95% limit	Rated good (%)	Rated fair (%)	Rated poor (%)	Rated bad (%)
30A	Percent Dissolved Oxygen %	62.00	62.00		1		62.0	62.0			100%	
	pH	7.00	7.00		1		7.0	7.0	100%			
	Turbidity NTU's	7.00	7.00		1		7.0	7.0	100%			
	Available Phosphate mg/L	0.00	0.00		1		0.0	0.0	100%			
	E coli/ total coliforms/100ml	200.00	200.00		1		200.0	200.0		100%		
31	Percent Dissolved Oxygen %	33.44	42.00	24.33	9	8.11	49.3	17.5			100%	
	pH	7.06	7.00	0.17	9	0.06	7.2	6.9	100%			
	Turbidity NTU's	19.22	15.00	18.53	9	6.18	31.3	7.1	44%	33%	22%	
	Available Phosphate mg/L	0.03	0.02	0.03	9	0.01	0.0	0.0	33%	67%		
	E coli/ total coliforms/100ml	150.00	150.00	212.13	2	150.00	444.0	-144.0	50%		50%	
32	Percent Dissolved Oxygen %	19.15	11.00	21.90	13	6.08	31.1	7.2			100%	
	pH	7.15	7.00	0.38	13	0.10	7.4	6.9	100%			
	Turbidity NTU's	45.92	40.00	39.46	13	10.94	67.4	24.5	15%	15%	69%	
	Available Phosphate mg/L	0.22	0.16	0.27	13	0.08	0.4	0.1	23%	54%	23%	
	E coli/ total coliforms/100ml	1633.33	100.00	2742.87	3	1583.60	4737.2	-1470.5	33%	33%		33%
33	Percent Dissolved Oxygen %	45.52	45.00	11.32	9	3.77	52.9	38.1			100%	
	pH	6.78	7.00	0.44	9	0.15	7.1	6.5	100%			
	Turbidity NTU's	21.33	7.00	30.61	9	10.20	41.3	1.3	67%	11%	22%	
	Available Phosphate mg/L	0.07	0.02	0.10	9	0.03	0.1	0.0	33%	56%	11%	
	E coli/ total coliforms/100ml	233.33	100.00	321.46	3	185.59	597.1	-130.4	33%	33%		33%
34	Percent Dissolved Oxygen %	25.00	23.50	19.97	10	6.31	37.4	12.6			100%	
	pH	7.05	7.00	0.37	10	0.12	7.3	6.8	100%			
	Turbidity NTU's	42.00	8.50	91.24	10	28.85	98.6	-14.6	60%	20%	20%	
	Available Phosphate mg/L	0.11	0.07	0.16	10	0.05	0.2	0.0	20%	70%	10%	
	E coli/ total coliforms/100ml	633.33	300.00	850.49	3	491.03	1595.8	-329.1	33%		33%	33%
35	Percent Dissolved Oxygen %	72.53	77.80	19.40	9	6.47	85.2	59.9	22%		78%	
	pH	7.17	7.00	0.35	9	0.12	7.4	6.9	100%			
	Turbidity NTU's	23.89	7.00	30.64	9	10.21	43.9	3.9	56%	22%	22%	
	Available Phosphate mg/L	0.04	0.01	0.06	9	0.02	0.1	0.0	56%	44%		
	E coli/ total coliforms/100ml	600.00	600.00		1		600.0	600.0				100%
SC1	Percent Dissolved Oxygen %	22.67	19.00	8.14	3	4.70	31.9	13.5			100%	
	pH	6.00	6.00	1.00	3	0.58	7.1	4.9	67%		33%	
	Turbidity NTU's	14.67	7.00	13.28	3	7.67	29.7	-0.4	67%		33%	
	Available Phosphate mg/L	0.07	0.07	0.01	3	0.00	0.1	0.1		100%		
	E coli/ total coliforms/100ml	550.00	550.00	636.40	2	450.00	1432.0	-332.0		50%		50%
SC3	Percent Dissolved Oxygen %	92.00	92.00	16.97	2	12.00	115.5	68.5	100%			
	pH	7.00	7.00	0.00	2	0.00	7.0	7.0	100%			
	Turbidity NTU's	13.50	13.50	9.19	2	6.50	26.2	0.8	50%	50%		
	Available Phosphate mg/L	0.02	0.02	0.02	2	0.02	0.0	0.0	50%	50%		
	E coli/ total coliforms/100ml				0		0.0	0.0				