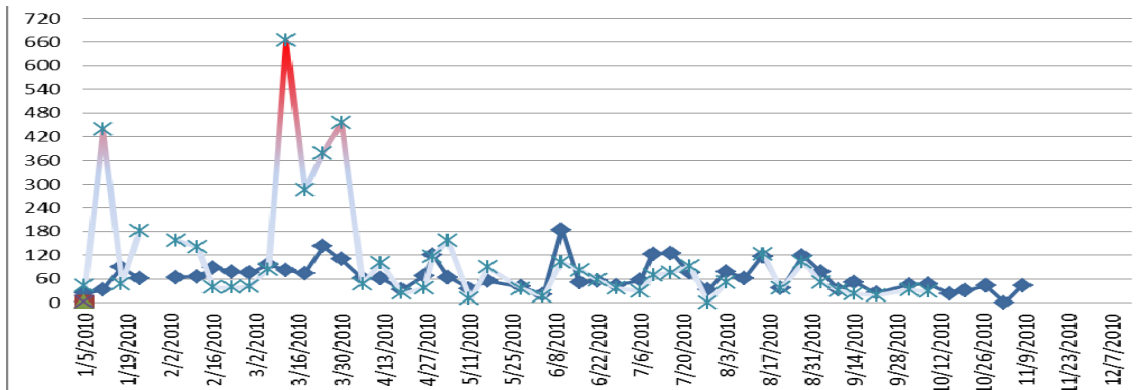




2011 Ambient Air Quality Report

Monitoring Ambient Air Quality in Jamaica



Prepared by
National Environment and Planning Agency
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2011 Ambient Air Quality Report

Prepared by

National Environment and Planning Agency

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Jamaica

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List of Abbreviations

Alpart	Aluminium Partners of Jamaica
APDL	Air Pollutant Discharge Licence
AQMP	Air Quality Management Programme
CAMS	Cross Roads Ambient Monitoring Station
CAPs	Criteria Air Pollutants
CCCL	Caribbean Cement Company Limited
CO	Carbon Monoxide
JAM	Jamalco
JAAQS	Jamaica Ambient Air Quality Standards
JAQMP	Jamaica Air Quality Management Programme
JBGL	Jamaica Broilers Group Limited
JEP	Jamaica Energy Partners
JPSCo	Jamaica Public Service Company Limited
KSA	Kingston and St. Andrew
LNG	Liquid Natural Gas
NEPA	National Environment and Planning Agency
NO ₂	Nitrogen Dioxide
NOR	Noranda Jamaica Bauxite Partners
NRCA	Natural Resources Conservation Authority
MLW	Mud Lake West
PAPs	Priority Air Pollutants
Pet	Petrojam
PM ₁₀	Particulate Matter less than 10 microns
RAMS	Rockfort Ambient Monitoring Station
SO ₂	Sulphur Dioxide
TSP	Total Suspended Particulates
ULDF	Ultra Low Diesel Fuel
WIN	Windalco

Appendices

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- Figure 40 Map of monitoring Network in Kingston and St. Andrew
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Executive Summary

The second report provides quantitative and qualitative analysis of the ambient concentrations of:

- Total Suspended Particulate (TSP)
- Particulate Matter Less than 10 Microns (PM₁₀)
- Sulphur Dioxide (SO₂)
- Nitrogen Dioxide (NO₂)
- Carbon Monoxide (CO)

The report outlines the amount of stations now in operation across the island. The locations of these stations, the parameters monitored as well as the operator and date of commission of each station is also given. In addition, this report breaks down the monitoring responsibility shared across the island by sectors.

In the first section of the report a statistical analysis is done for the fifty eight (58) monitoring sites across Jamaica. This represents an increase of one monitoring site over the previous year. The status of the ambient air is given for each site monitored during 2011 along with an analysis of the causes and trends. The hourly ambient levels, twenty four (24) hour average ambient levels and average annual levels are also analyzed quantitatively and compared with the National Standards set by the Natural Resources Conservation Authority. In addition, the communities that are impacted are identified in some cases.

The report goes on to statistically compare the annual average ambient air quality between 2010 and previous years for all the sites that have historical data available and outlines the trends. It also seeks to identify why ambient levels have increased or decreased in some areas.

The report concludes by giving a qualitative analysis of the ambient air in Jamaica specific to each type of pollutant and mentions strategies the Agency will undertake to maintain and improve the country's air quality

2.0 Current Ambient Monitoring Network Status

Table 1 below shows:

- ❖ The current stations now operational across the island
- ❖ Their status
- ❖ Their operator
- ❖ The parameters monitored
- ❖ Parish location
- ❖ Approximate year of commission

Table1: Jamaica's Ambient Monitoring Network

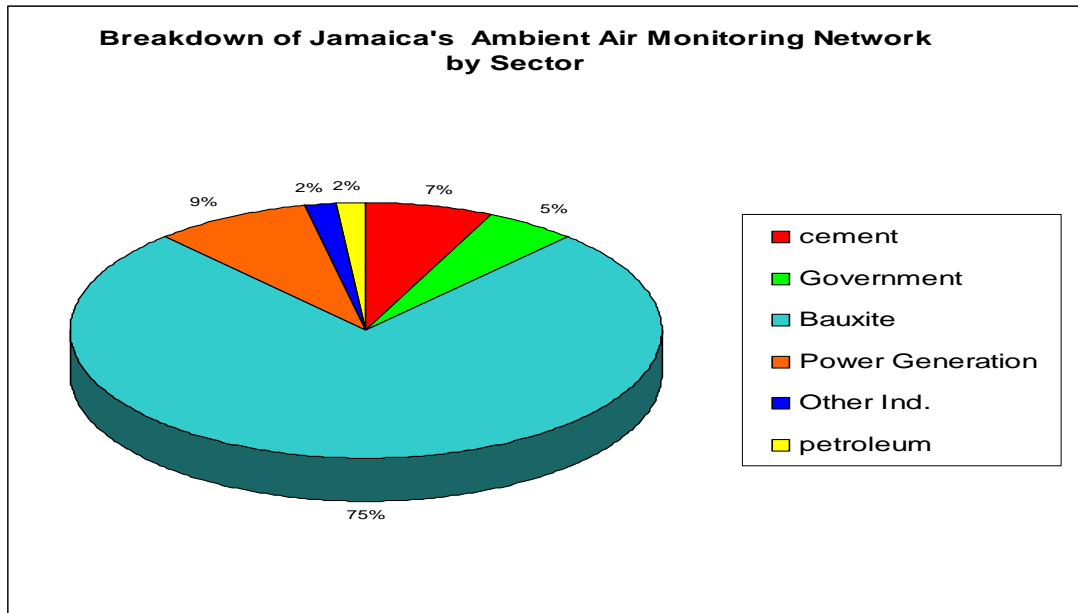
STATION	PARISH, LOCATION	PARAMETERS	OPERATOR	STATUS	Commission
1	KIN, Crossroads	TSP, PM10	NEPA	ON	2006
2	KIN, Harbour View	TSP,	NEPA	ON	2006
3	KIN, Hope Road	TSP, PM10	NEPA	ON	2006
4	KIN, Harbour View	PM10	CCCL	ON	2011
5	KIN, Collage Commons	PM10	CCCL	ON	2008
6	KIN, Rock Fort	PM10	CCCL	ON	2008
7	KIN, Maritime Institute	PM10	CCCL	ON	2008
8	KIN, Marcus Garvey Dr	SO2, NO2	JEP	ON	2009
9	KIN, Garmex	SO2, NO2	JEP	ON	2009
10	KIN, Garmex	SO2, NO2, PM10	JPSCO	ON	2009
11	KIN, Petrojam	SO2, NO2, PM10	Pet	ON	2009
12	KIN, Bournemount Dr.	SO2, NO2, PM10	JPPC	ON	2010
13	St. CAT, Terminal	SO2, NO2, PM10	JPSCO	OFF	2011
14	*St. CAT, Port Esquivel	TSP	WIN	ON	post 2007
15	*St. CAT, Port Esquivel	TSP	WIN	ON	post 2007
16	St. CAT, Bunting Prop.	PM10	WIN	OFF	post 2007
17	St. CAT, Free Town	PM10	JBGL	ON	2011
18	St. CAT, Longville Park	SO2, NO2, PM10	JEP	ON	2009
19	St. CAT, Lauder wood	SO2, NO2, , O3	JPSCO	ON	2008
20	St. CAT, Orangefield	SO2, NO2, TSP	WIN	ON	post 2007
21	*St. CAT, Mud stacking	TSP	WIN	ON	post 2007
22	St. CAT, Hayfield Close	SO2, NO2, TSP	WIN	ON	post 2007
23	St. CAT. Amity Hall	TSP	WIN	ON	post 2007
24	St. CAT, Brighton St.	TSP	WIN	ON	post 2007
25	St. CAT, Clapham	TSP	WIN	ON	post 2007
26	St. CAT, Faith's Pen	PM10	WIN	ON	post 2007
27	St. CAT, Hayfield Club	PM10	WIN	ON	post 2007
28	CLA, New Bowens	SO2, NO2, CO, PM10	JAM	ON	post 2007
29	CLA, Haise Corn piece	SO2, NO2 CO, PM10	JAM	ON	post 2007
30	CLA, Kemp's Hill	SO2, NO2	JAM	ON	post 2007
31	*CLA, Rocky Point	TSP	JAM	ON	post 2007
32	MAN, Ballynure	PM10	JAM	ON	post 2007

33	MAN, Broadleaf	PM10	JAM	ON	post 2007
34	MAN, Windsor	PM10	JAM	ON	post 2007
35	MAN, Asia	PM10	JAM	ON	post 2007
36	MAN, Mile Gully	PM10	JAM	ON	post 2007
37	MAN, Kendal	TSP SO2, NO2, CO	WIN	ON	post 2007
38	MAN, Kendal 2	TSP	WIN	ON	post 2007
39	MAN, Mud lake South	TSP	WIN	ON	post 2007
40	MAN, Mud lake East	TSP	WIN	ON	post 2007
41	*MAN, Mud lake West	TSP	WIN	ON	post 2007
42	ST. Elz, Lower Warminster	TSP	Alpart	ON	2010
43	ST. Elz, Brinkley	TSP	Alpart	ON	post 2007
44	ST. Elz, Steven Run	TSP	Alpart	ON	2010
45	ST. Elz, Myersville	TSP	Alpart	ON	post 2007
46	ST. Elz, Gazeland	TSP	Alpart	ON	2010
47	ST. Elz, Sports club	TSP	Alpart	ON	post 2007
48	ST. Jam, Bogue	SO2, NO2	JPSCO	ON	2009
49	ST. ANN, Farm Town	TSP	NOR	ON	post 2007
50	ST. ANN, Old Folly	TSP	NOR	ON	post 2007
51	ST. ANN, Bengal	TSP	NOR	ON	post 2007
52	ST. ANN, Queens Road	PM10	NOR	ON	post 2007
53	ST. ANN, Clinic	TSP	NOR	ON	post 2007
54	ST. ANN, Rousseau	TSP	NOR	ON	post 2007
55	ST. ANN, Farm Town	TSP	NOR	ON	post 2007
56	ST. ANN, Calderwood	TSP	NOR	ON	post 2007
57	ST. ANN, Clydesdale	TSP	NOR	ON	post 2007
58	ST. ANN, Greens Hill	TSP	NOR	ON	post 2007

* Represent stations that are located within a facility's boundary of operation and are not technically defined as Ambient Monitoring Stations. Data from these stations are still reported to the Agency because they provide useful information. These stations are included in this report only for information and analysis and are not to be considered by the reader as ambient stations.

Jamaica currently has fifty-eight (58) monitoring stations spread across the island. Forty-six (46) of these stations are located outside of the Kingston and St. Andrew region. The Bauxite companies own and operate 44 of these stations which represent 95% of the ambient monitoring done in the parishes outside of the country's capital Kingston. Figure 1 shows the breakdown of the ambient monitoring network by sector in the country.

Figure1: Chart Showing Breakdown of Jamaica’s Ambient Monitoring Network by Sectors



Pollutants Monitored

Jamaica focuses directly on the ambient concentrations of Criteria Air Pollutants (CAP)¹. These pollutants all have ambient air quality standards. Standards are reflected by time base averaging periods. Table 2 below is the current Jamaica Ambient Air Quality Standards (JAAQS).

Table 2: Ambient Air Quality Standards for Jamaica

Pollutant	Averaging Time	Standard (maximum concentration in ug/m ³)
TSP	Annual	60
	24h	150
PM10	Annual	50
	24h	150
Lead	Calendar Quarter	2
Sulphur Dioxide	Annual	80 primary, 60 secondary
	24h	365 primary, 280 secondary
	1h	700
Photochemical Oxidants (Ozone)	1h	235
Carbon Monoxide	8h	10,000
	1h	40,000
Nitrogen Dioxide	Annual	100
	1h	400

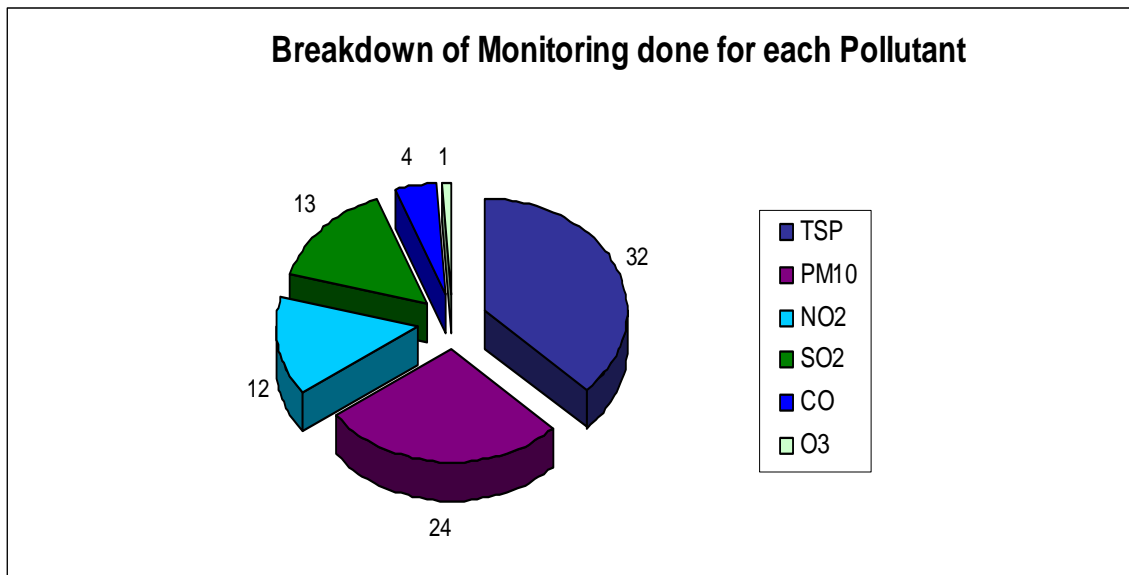
¹ Criteria Air Pollutants are listed as Sulphur Dioxide (SO₂), Nitrogen Dioxides (NO₂), lead (Pb), Carbon Monoxide, Ozone, Total Suspended Particulate (TSP) and Particulate Matter less than 10 microns (PM₁₀)

Standards also have been set for a wide range of Priority Air Pollutants (POPs). A list of these POPs can be obtained from the Natural Resources Conservation Authority (Air Quality) Regulations, 2006. Although standards have been in place for these pollutants since 2006, the levels of most of these pollutants are yet to be quantified in the country's ambient air. Currently monitoring is only being undertaken for the CAPs with the exception of Lead. The CAPs being measured currently have been the main focus of monitoring because:

- ❖ These pollutants are the main emissions produced from the air pollution discharge sources existing in the Jamaica.
- ❖ The country's main energy source is Oil which produces significant quantities of these pollutants
- ❖ Equipment and technology is more affordable and available to monitor these types of pollutants
- ❖ Air Dispersion models done for all the major industries in the country show these pollutants as having the greatest impact on the environment and the public

Figure 2 shows the percentage of monitors currently equipped to monitor each type of pollutant. Appendix A, Figures 41-46 show the location of these sites by parish

Figure 2: Breakdown of Stations Equipped to Monitor Air Pollutants



It is important to note that although there are 58 stations in the country 16 of these stations are multi-stations that monitor more than one pollutant. Hence figure 2 indicates a sum of 86 monitors divided among 58 stations.

3.0 Ambient Air Quality Tracking and Analysis for 2011

Total Suspended Particulates (TSP)

Figure 3: Graph showing trend in ambient air quality for TSP at the six stations in the Kingston and St. Andrew area from January to December 2011

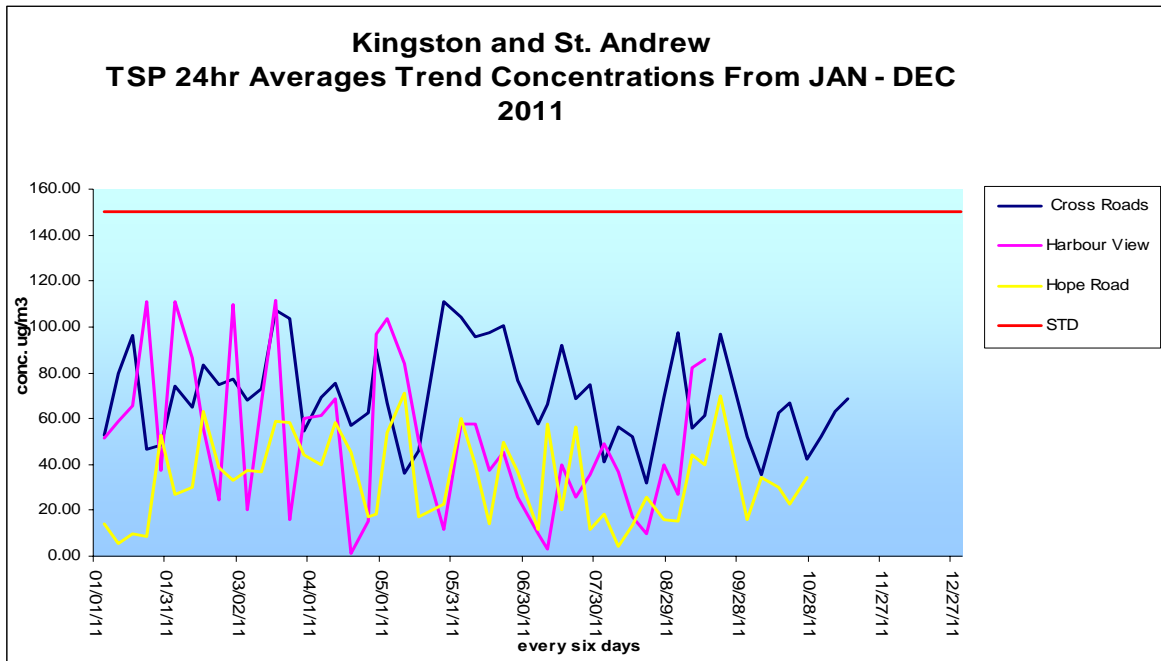


Figure 4: Graph showing Annual TSP average concentrations at all monitoring stations in the Kingston and St. Andrew area for 2011

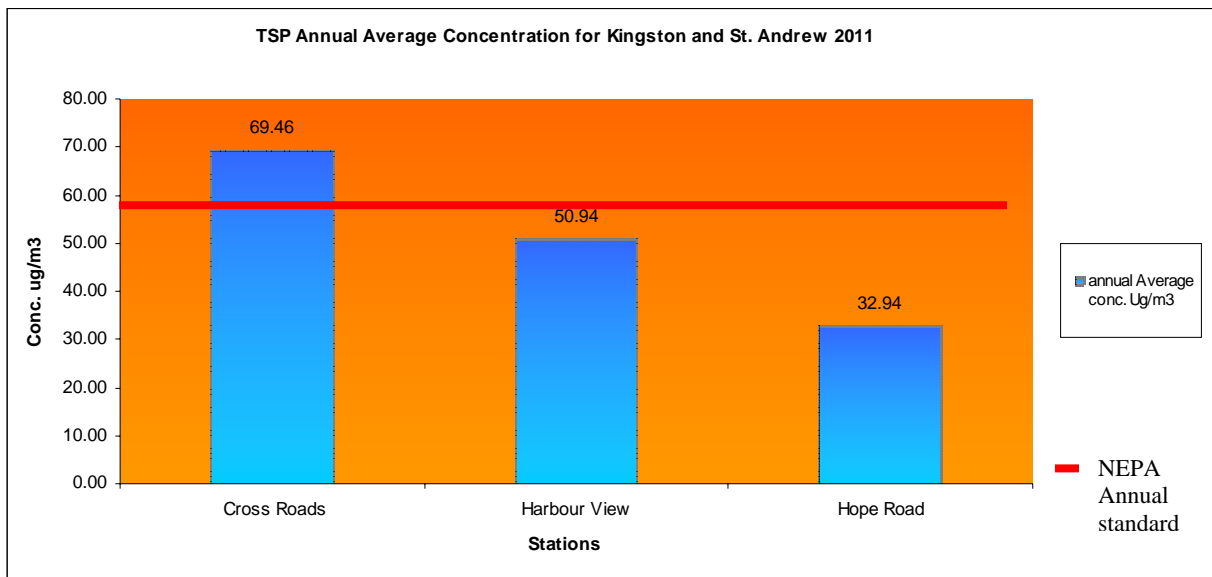


Figure 3 above shows that there was no exceedance of the country’s 24 hour ambient standard for TSP over 2011. This represents a 100% increase in compliance compared to 2010 when five (5) exceedances of the 24 hour standard were recorded. The stations most affected were Crossroads and Harbour View.

Figure 4 shows clearly that the annual ambient standard for TSP, $60\mu\text{g}/\text{m}^3$, has been exceeded at the Crossroads monitoring station. This average exceeded the annual standard for TSP by approximately $9.5\mu\text{g}/\text{m}^3$.

The station located at Crossroads is down wind of a cement plant and is located beside a major intersection that carries high traffic levels each day. Fugitive dusting from the road ways, vehicular emissions and dusting from an open lot adjacent to the stations property is the major source of high levels of TSP in this area. The station is also exposed to emissions from an incinerator at a supermarket close to the stations property. The effects of this source though, cannot be quantified at this time as information on its operation is limited.

Strategies to combat these high concentration levels will be discussed further in this report as well as trends over the past five years.

Figure 5: Graph showing trend in ambient air quality for TSP at the six stations in the South St. Elizabeth area from Jan-Dec 2011

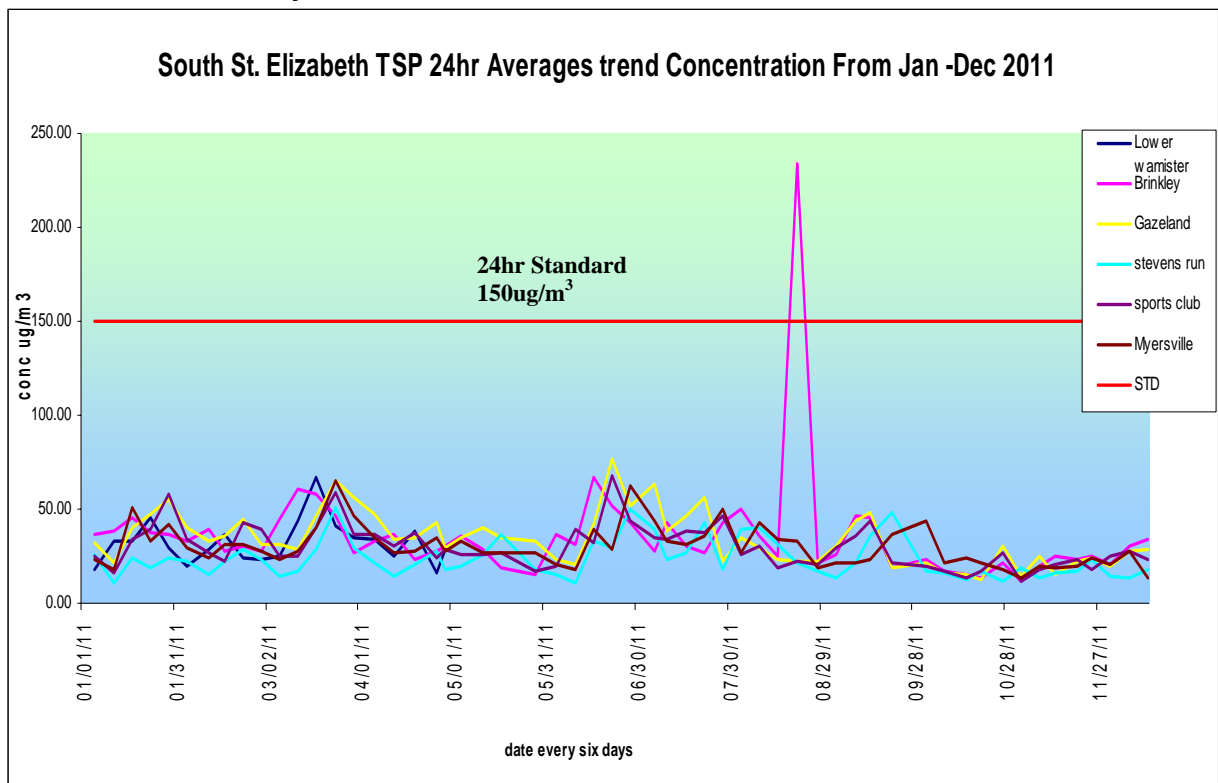
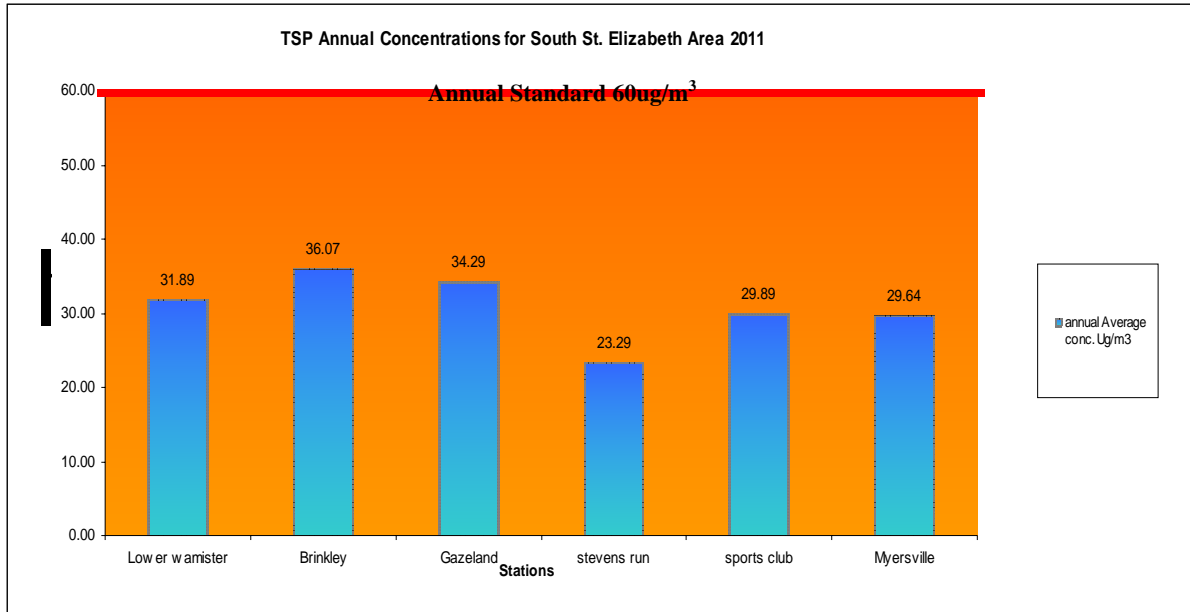


Figure 6: Graph showing Annual TSP average concentrations at all monitoring stations in the South St. Elizabeth for 2011



Figures 5 indicate that there was one exceedance of the 24 hour standard for TSP at the Brinkley site during August. Brinkley is the closest site to the red mud disposal area operated by Alpart. The 24 hour value recorded for that day was 6 times the sites average annual concentration. From time to time there is drying of the surface of the disposal area. This coupled with elevated wind speeds for extended hours of the day may result in heavy emissions of particulate matter from the site. The annual average concentrations however were well within the national standards. The stations located in this area of the country are in the communities surrounding a major Alumina plant. During 2011 there was no production at this plant. TSP levels were mainly as a result of fugitive dusting from the 700 hectare red mud storage area which experienced dry spells especially during the first quarter of the year. Dusting which leads to TSP concentrations could also have resulted from the disturbance of roadways by farming equipment such as trucks and other light motor vehicles.

Figure 7: Graph showing trend in ambient air quality for TSP at the five stations in the Kirkvine and Battersea Manchester area from Jan-Dec 2011

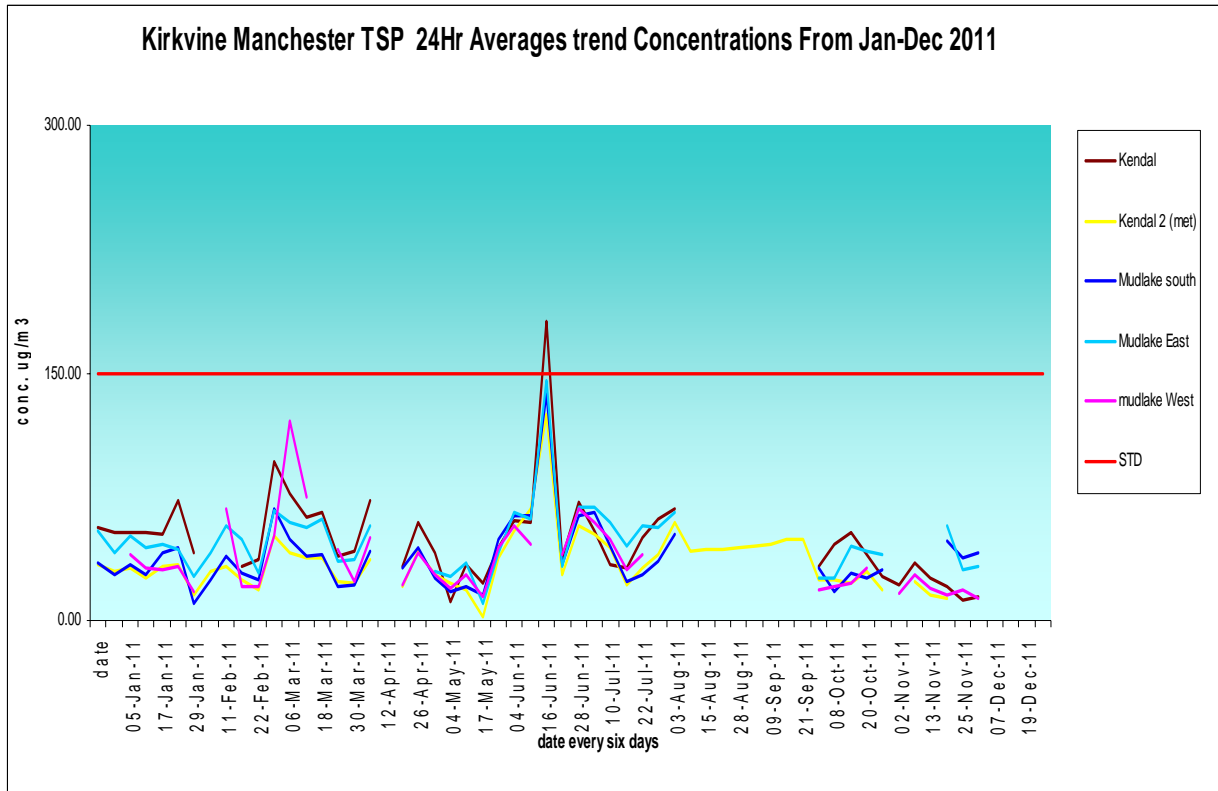


Figure 8: Graph showing Annual TSP average concentrations at all monitoring stations in Kirkvine and Battersea Manchester for 2011

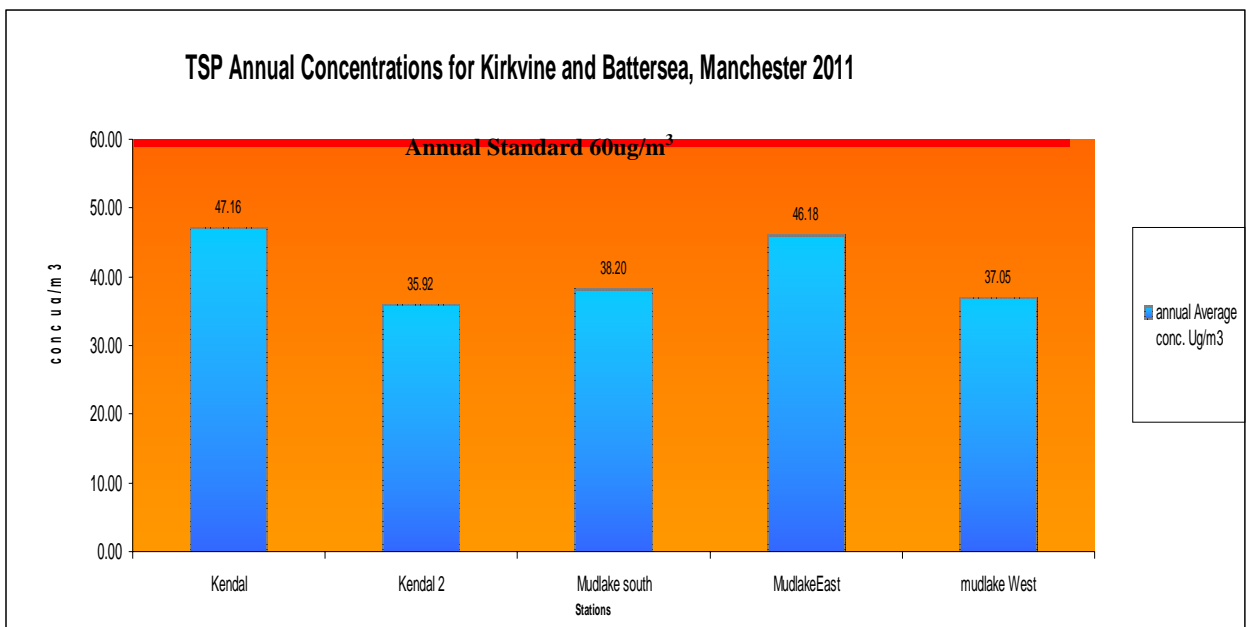


Figure 7 indicates that during 2011 all stations located in the Kirkvine Battersea area, which are impacted by the Mud-lake, did not exceed the 24 Hour average ambient standard. A spike in the levels of TSP was however observed at all the stations on the 16 July 2011. This resulted in the 24 Hour standard being surpassed at the Kendal Station and may have been due to dry conditions on the mud lake coupled with increased wind speeds. The result was an increase of three times the normal TSP average at the Kendal site. The monitoring network within the Kirkvine Battersea area recorded eight exceedances in the previous year and hence this single exceedance represents a major improvement in the number of exceedances recorded within the network. All eight exceedances were recorded at the Mudlake west station which saw none in 2011 and whose average annual concentration has reduced from 110ug/m³ to 37ug/m³ a reduction of 66%. Figure 8 shows that all five (5) sites were compliant with the JAAQS annual average of 60ug/m³.

Figure 9 Graph showing trend in ambient air quality for TSP at the seven stations in the Ewarton and Port Esquivel area of St. Catherine from Jan-Dec 2011

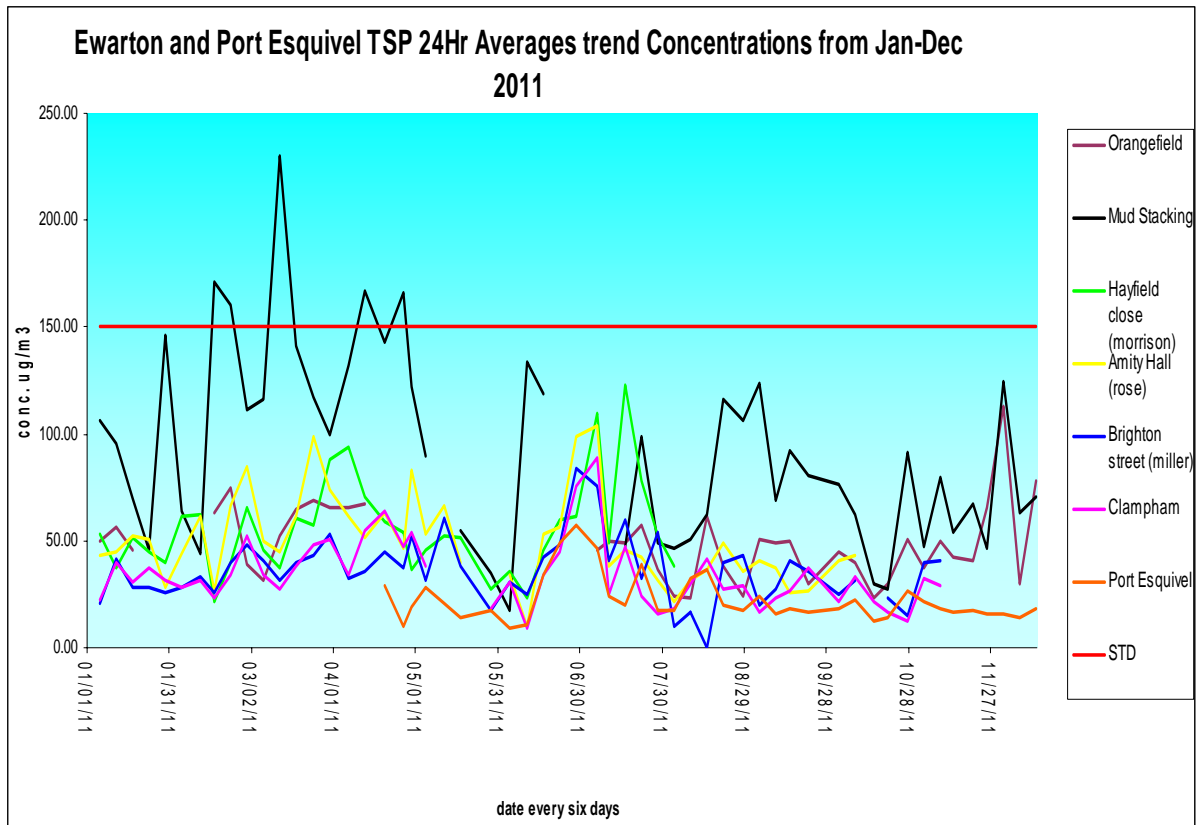
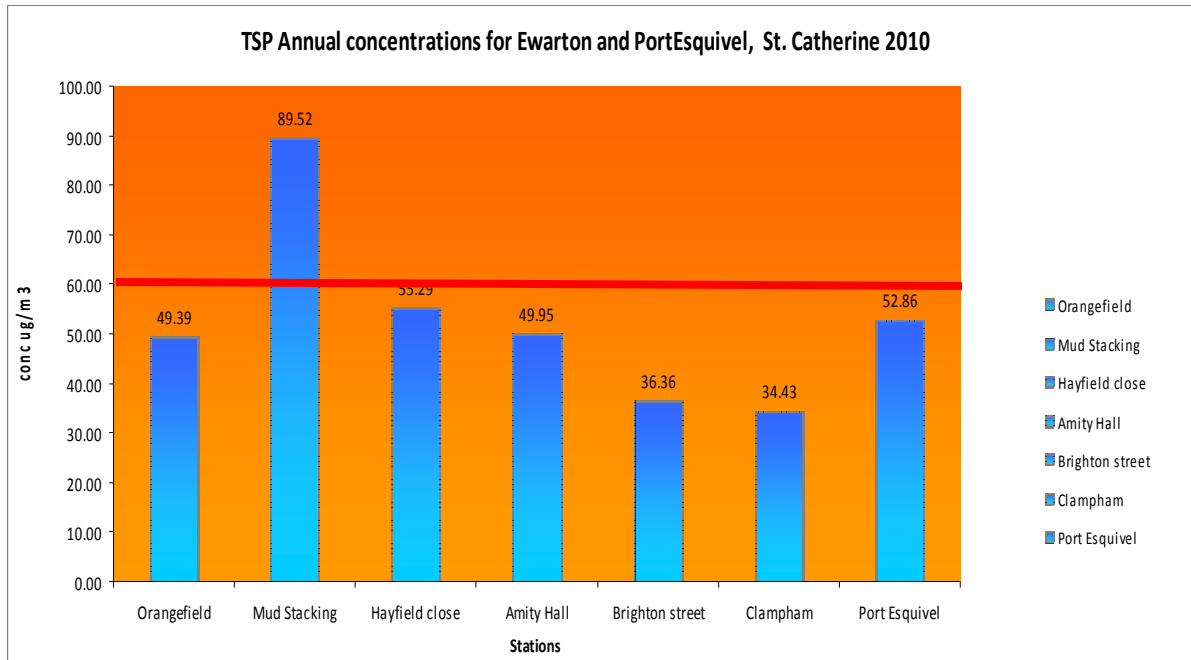


Figure 10 Graph showing Annual TSP average concentrations at all monitoring stations in Ewarton and Port Esquivel, St. Catherine for 2011



In figure 9 at least five (5) exceedances of the 24 hour standard occurred during 2011. This was similar to 2010. These all occurred at the mud stacking area site which is stationed between the refinery and the mud stacking area. As discussed previously in the 2010 report technically this station cannot be classified as an Ambient Monitoring Station. It provides, however, indications as to the quantity of TSP leaving the facility. The stations in the Ewarton area are:

- ❖ Orangefield
- ❖ Mud Stacking
- ❖ Hayfield
- ❖ Amity Hall
- ❖ Brighton Street
- ❖ Clampham

These are all affected by an Alumina Refinery, Bauxite Mining Haul roads as well as other Bauxite mining activities. TSP levels at Orangefield and Hayfield were close to the annual standard. Figure 10 shows the annual average for TSP at monitoring sites within the St. Catherine area. TSP concentrations at all the stations in Ewarton are impacted significantly by the Refinery and the Haul roads. The impact from the construction of the second leg of Highway 2000 in the area shows little impact on the stations at Clampham and Amity Hall, which are closest to it. With the exception of the mud stacking area site all annual averages as well as the 24 hour trends have remained below the standard.

The major source of TSP at the Port Esquivel region is the Port during off loading of material from trains and loading to ships or vice versa. Alumina, hydrate and grains are some of the sources of TSP in this area. The Port has put in place strategies to reduce the effects of TSP. These strategies were implemented during 2011 and the results show a reduction in the concentrations of TSP at the site which is now compliant. The annual average shows a reduction in TSP from 82ug/m³ to 53ug/m³.

Figure 11 Graph showing trend in ambient air quality for TSP at the eight stations in the Discovery bay area of St. Ann from Jan-Dec 2011

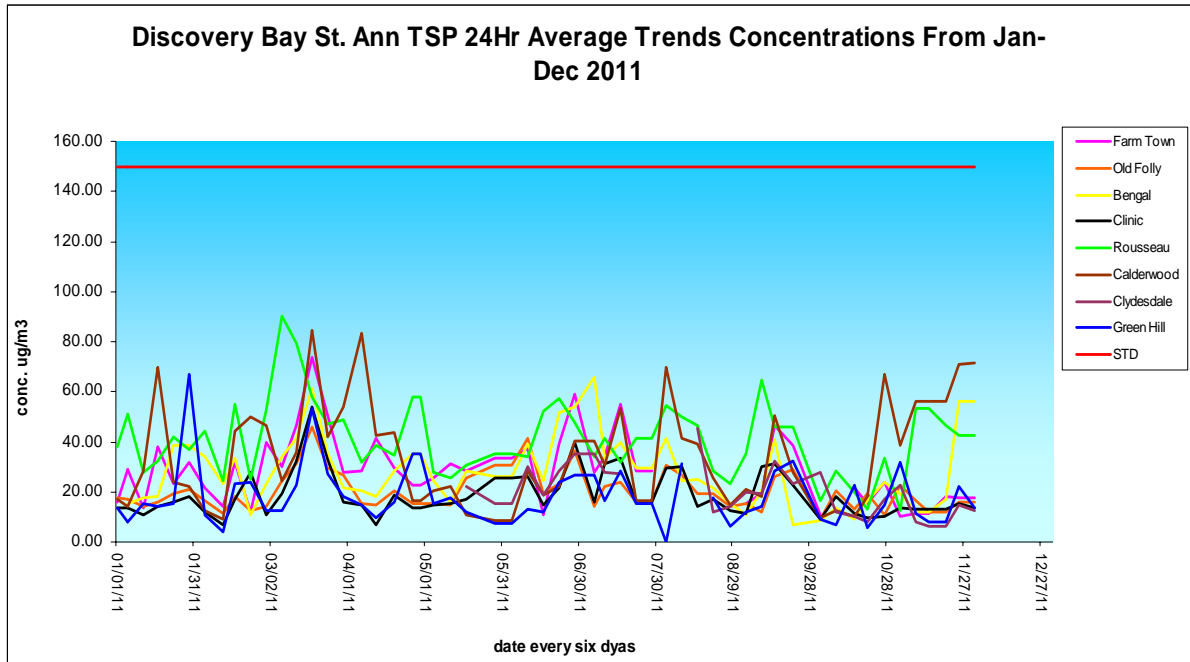
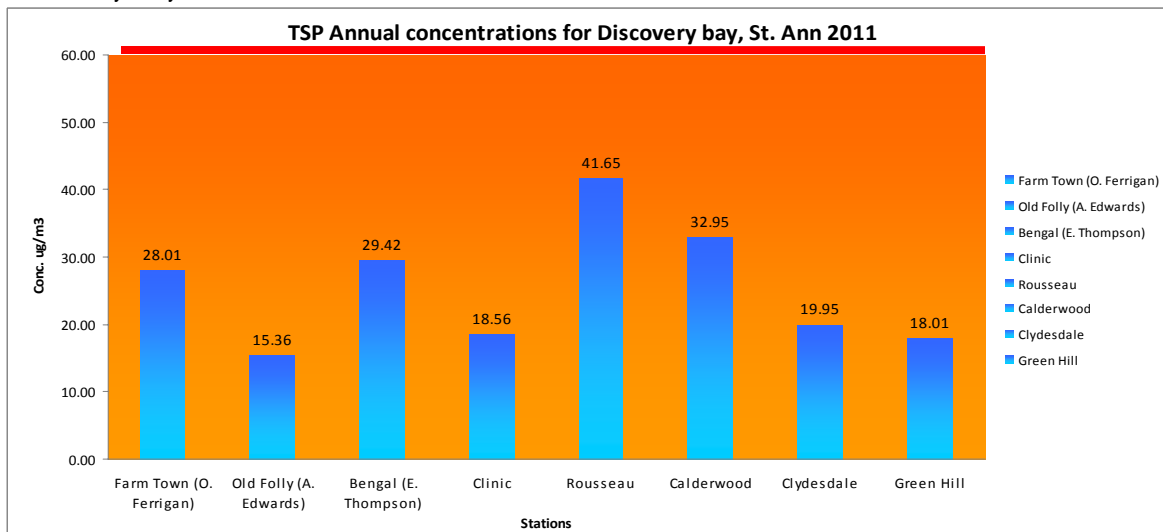


Figure 12: Graph showing Annual TSP average concentrations at all monitoring stations in Discovery Bay, St. Ann for 2011



The Discovery Bay area is affected by one major source, the bauxite facility in that area. Drying of Bauxite, transfer, ship loading and mining are the major sources of TSP. Figures 11 and 12 indicates that the network set up in communities across the area, did not record any exceedances in either the 24 hour ambient standard or the annual standard. The trend analysis in Figure 11 indicates that all the stations are affected by the same source judging from the peaks on the graph. The stations affected by the plant and port operations are:

- Farm Town
- Old folly
- Bengal
- Clinic
- Rousseau

These stations all peak with different maximums during the same time period on the graph, showing clearly that these peaks are from a specific source. The same goes for the mining region but with much less clarity this may be as a result of fugitive dusting created by the trucks traversing the mining haul roads. The stations directly impacted by mining are:

- Calderwood
- Clydesdale
- Green Hill

The Bauxite Company has also put in place more strategies to reduce the emissions which will be assessed in 2012.

Particulate Matter Less than 10 Microns (PM₁₀)

Figure 13 shows the 24 hour trend analysis for PM₁₀ at all the monitoring stations within the Kingston and St. Andrew region. The amount of exceedances decreased from eleven (11) in 2010 to ten (10) in 2011. The Rock Fort station which is impacted significantly by the fallout from a cement plant had five exceedances for the year. The site at Petrojam and Crossroads recorded two exceedances each, while the station on Old Hope Road recorded only one exceedance for the year. None of these were sustained or consecutive. It is assumed that these exceedances were as a result of increased source activity at some facilities at the time. It should be noted that the two 24 hour exceedances recorded at Crossroads were in the same time period as a fire at the Riverton Disposal site in October 2011.

The Rockfort station (RAMS) is also located beside a roadway which is a receiving body for the fallout from the cement plant. Vehicles travelling on the road at high speeds will disturb the surface and create further releases of PM₁₀. Figure 13 shows the trend analysis for 24 hour concentrations of PM10 at all monitoring stations within the Kingston and St. Andrew region.

Figure 13: Graph showing trend in ambient air quality for PM₁₀ at the seven stations in the Kingston and St. Andrew region from Jan-Dec 2011

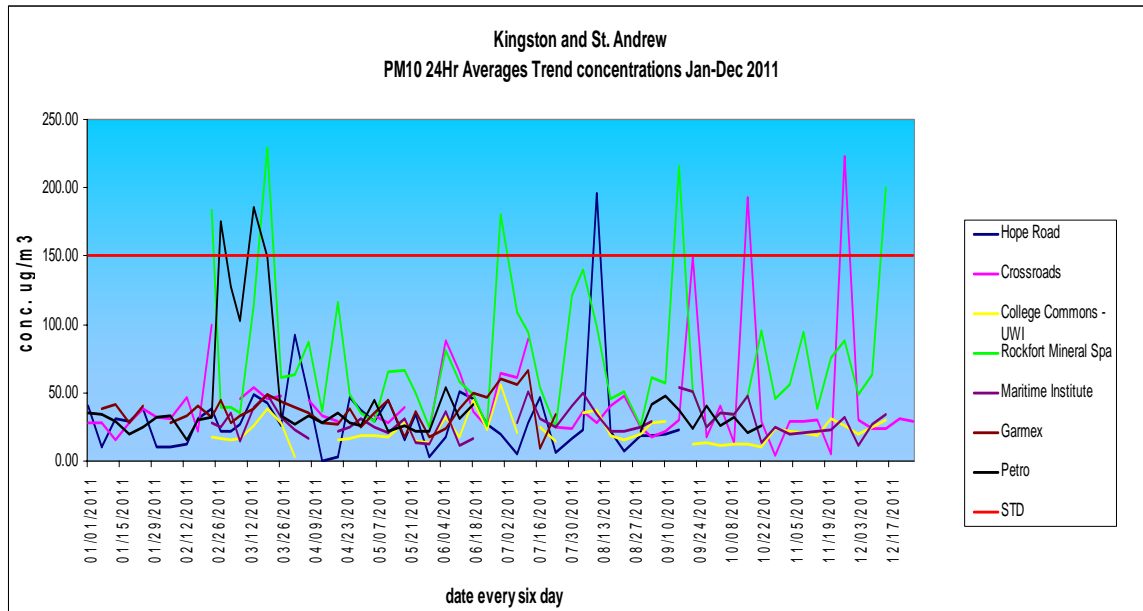


Figure 14 highlights the trends with the Cross Roads and Rockfort monitors. Though data from these sites were not collected on the same days; the graph shows a similar pattern. This indicates that whenever the Rockfort station is impacted the crossroad station is also impacted but to varying degrees. It should be noted however that the Cross Roads area is heavily trafficked and hence this monitoring station is also affected by vehicular emissions as well as a number of smaller sources around the area. Irrespective of the breeches of the 24 hour standard, the only station that breached the annual standard was the Rockfort station and this was as a result of consistently high readings from fugitive dust (Figure 15)

Figure 14: Comparison of PM₁₀ trends between Crossroads and Rock Fort from January to December 2011

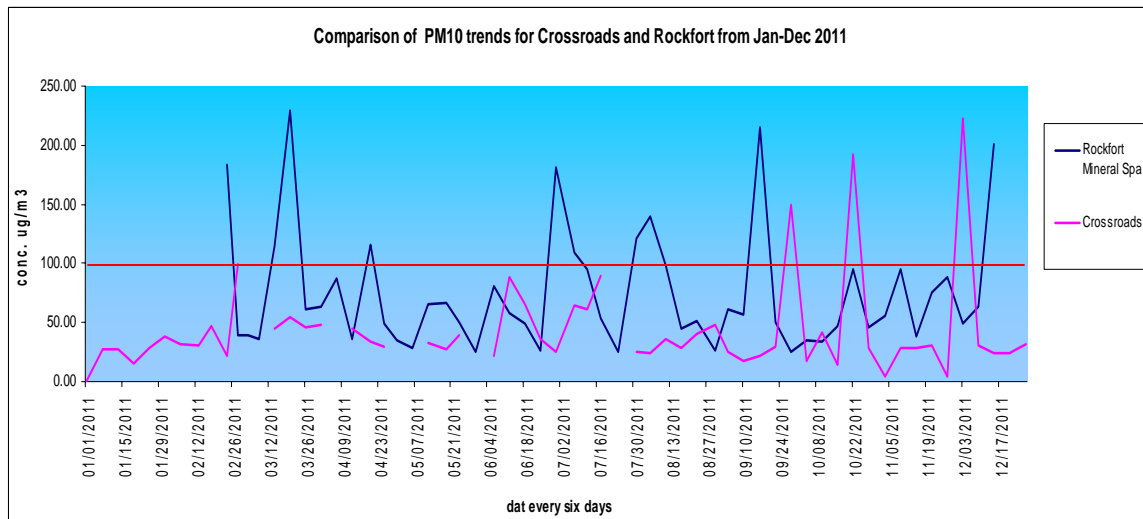


Figure 15: Graph showing Annual PM₁₀ average concentrations at all monitoring stations in Kingston and St. Andrew for 2011

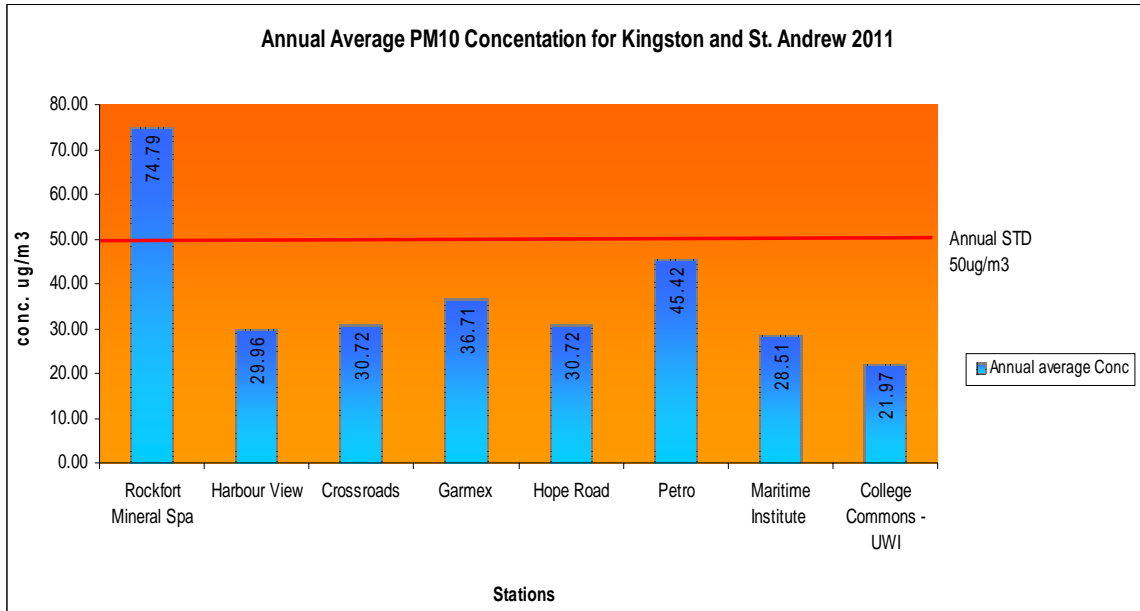
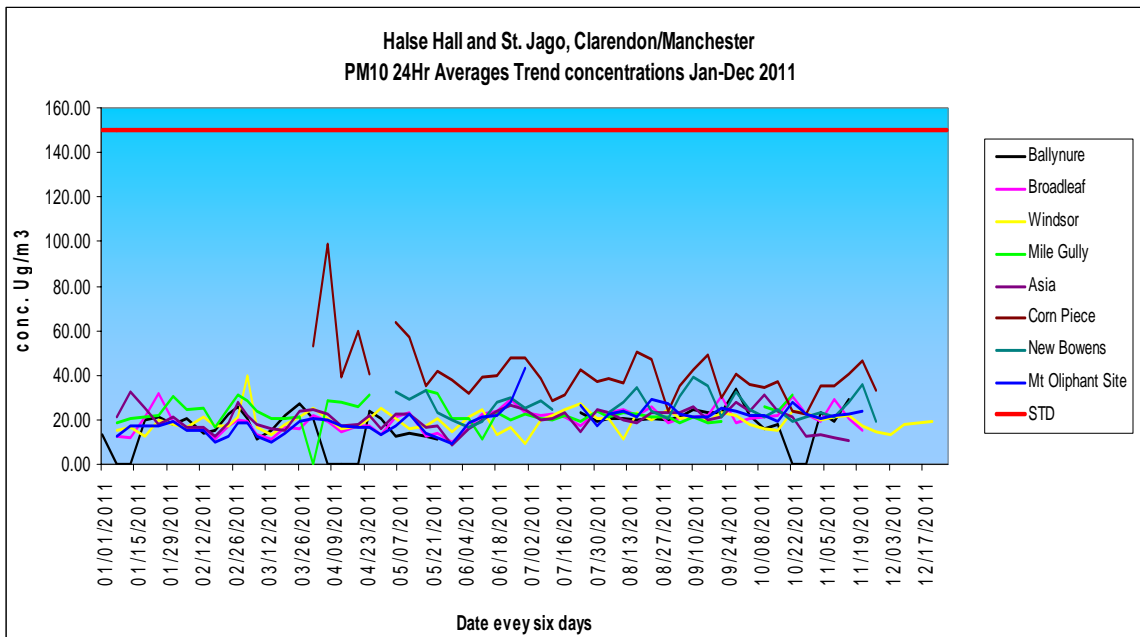


Figure 16: Graph showing trend in ambient air quality for PM₁₀ at the eight stations in the Halse Hall, Clarendon and St. Jago, Manchester Bauxite mining areas from Jan-Dec 2011

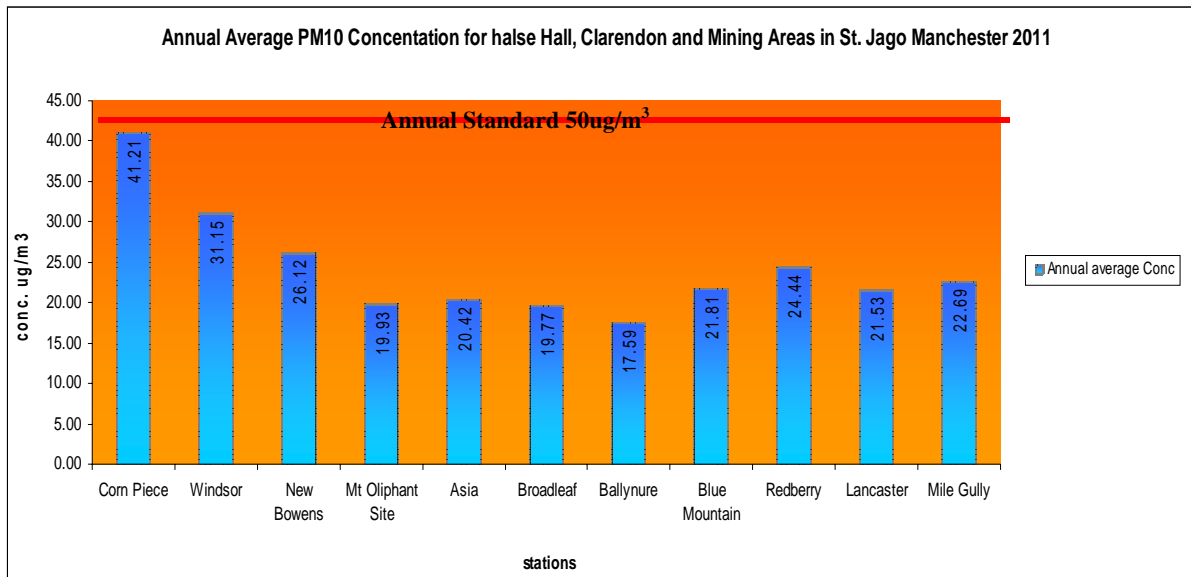


The Hayes Corn Piece Station and the New Bowers Station are directly impacted by the major Alumina Refinery in Clarendon. These stations are located in the communities surrounding this facility. Fugitive dusts as well as stack emissions affect the PM₁₀ concentrations in these communities and this is reflected in the stations readings. In 2011

data gathered indicates that the 24 Hour standard for PM₁₀ was not exceeded on any occasion. Figure 16 however shows the Corn Piece station trending above the other sites. The consistent spikes that were identified in 2010 have not recurred in 2011. This has resulted in the station recording an annual average below the annual ambient standard of 50ug/m³ for PM₁₀ (see figure 17).

All other stations presented on the graph in Figure 17 monitor areas in the mining lease lands of the same bauxite company. These stations are directly affected not only from open mining pits but from loaded trucks transporting bauxite along the haul roads. The bauxite company has put in place strategies to mitigate the effects of dusting in these areas. Control is however extremely difficult as some residential homes are as close as fifty (50) meters to the nearest pit and even closer to haul roads.

Figure 17: Graph showing Annual PM₁₀ average concentrations at all monitoring stations in Halse Hall, Clarendon and Mining areas in St. Jago, Mt. Oliphant and Mile Gully Manchester for 2011



All stations operating in the Ewarton and Port Esquivel area of St. Catherine recorded 24 hour averages that were well within the 24 hour ambient standard for PM₁₀ in 2011 (see Figure 18). It should also be noted that the annual ambient standard for PM₁₀, 50ug/m³, was not exceeded at any of the monitoring sites (see Figure 19). The two stations located at Hayfield and Faiths' Pen are generally impacted by the major activities of the Alumina refinery and Bauxite mining while the Bunting Property station is set up to assess impacts from the activities at the port in St. Catherine, Port Esquivel.

Figure 18: Graph showing trend in ambient air quality for PM10 at the two stations in Ewarton, St. Catherine and the station located at Port Esquivel from Jan-Dec 2011

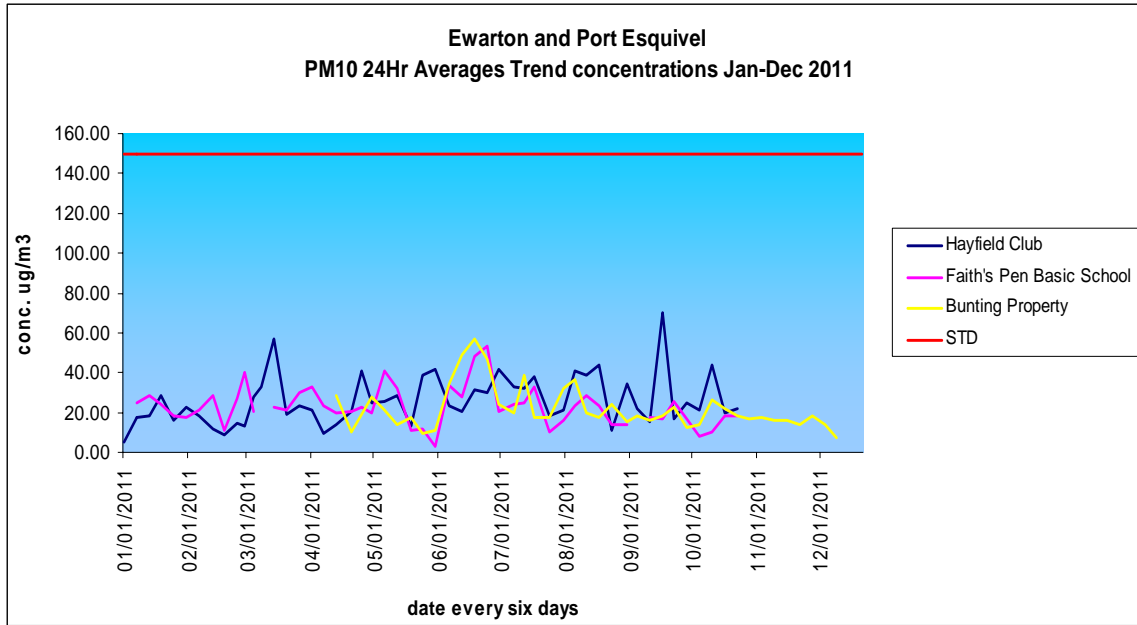


Figure 19: Graph showing Annual PM₁₀ average concentrations at all monitoring stations in Ewarton, St. Catherine for 2011

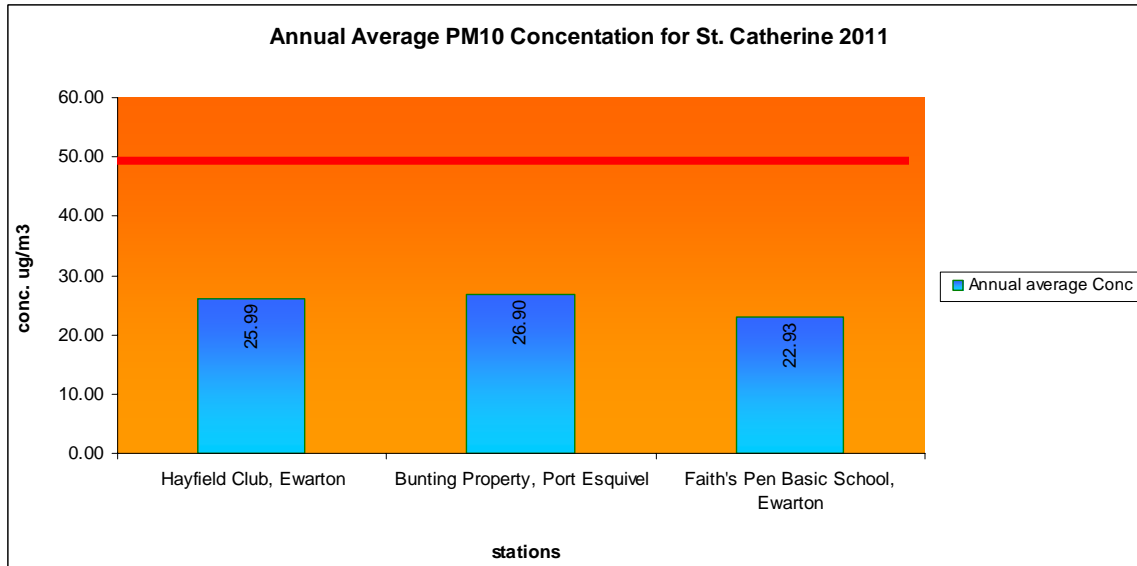
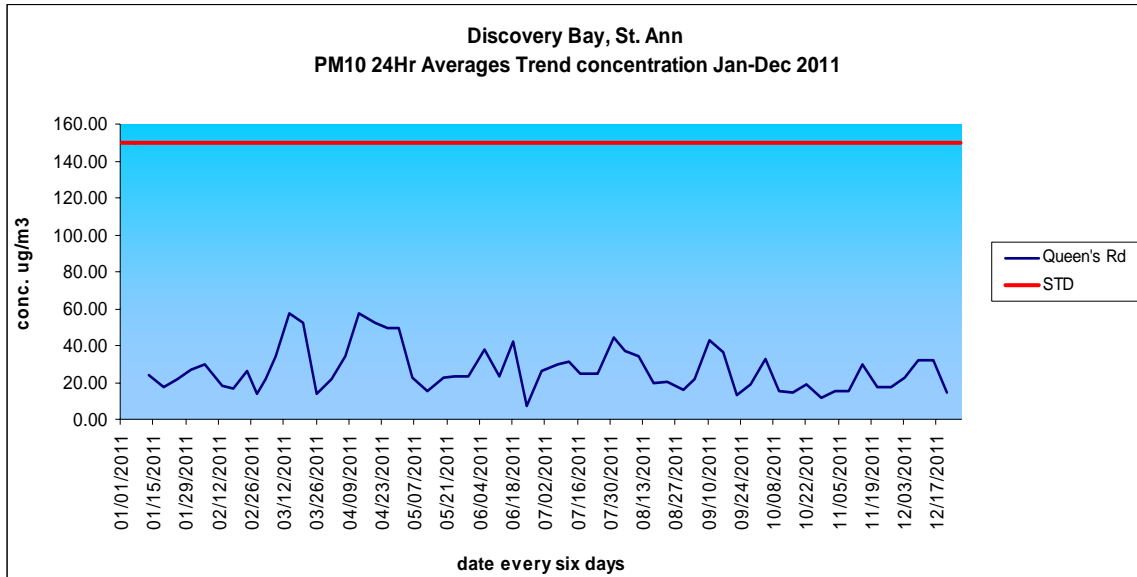
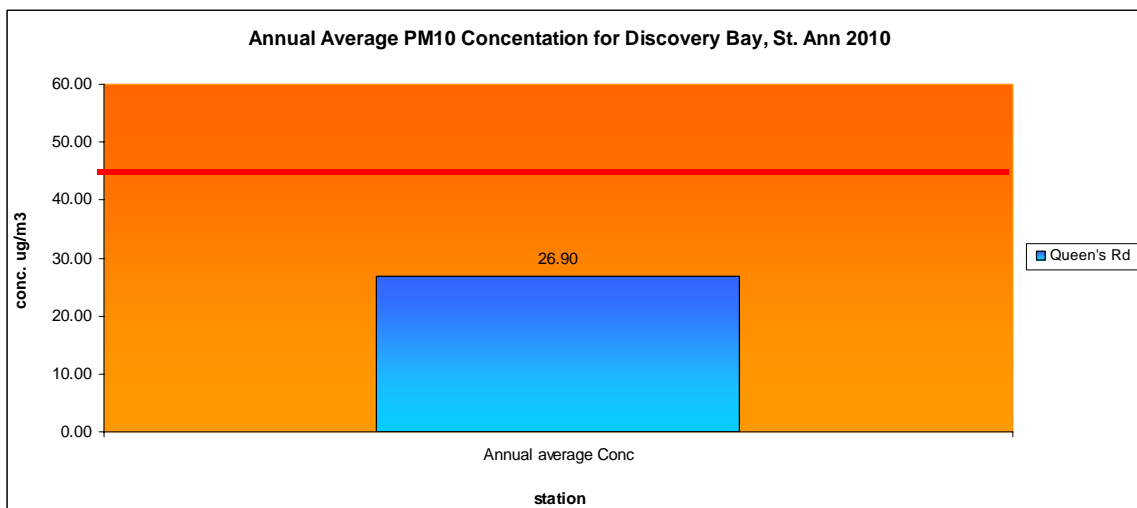


Figure 20: Graph showing trend in ambient air quality for PM₁₀ at the station in Discovery Bay St. Ann from Jan-Dec 2011



The station located at Queens Road is impacted by the major bauxite refinery in the area. It is also located close to the North Coast Highway and could also be affected by the release of particulates from the road surface. The old road which has lost most of its surface is also adjacent to the station. Residents who access their homes from this road could also create an impact on this station while traversing this roadway. This station did not record any breaches of either the 24 hour standard or the annual standard for PM₁₀ during 2011 (see Figure 20 and Figure 21).

Figure 21: Graph showing Annual PM₁₀ average concentrations at the monitoring station in Discovery Bay, St. Ann for 2011



Sulphur Dioxide

Hourly trends for daily concentrations of Sulphur Dioxide (SO₂) recorded at the ten SO₂ monitoring stations during 2011 did not show any exceedance of the 700ug/m³ ambient standard.

Figure 22: Graph showing trend in ambient air quality for Sulphur Dioxide at the stations in Jamaica's two cities Kingston and Montego Bay from Jan-Dec 2011

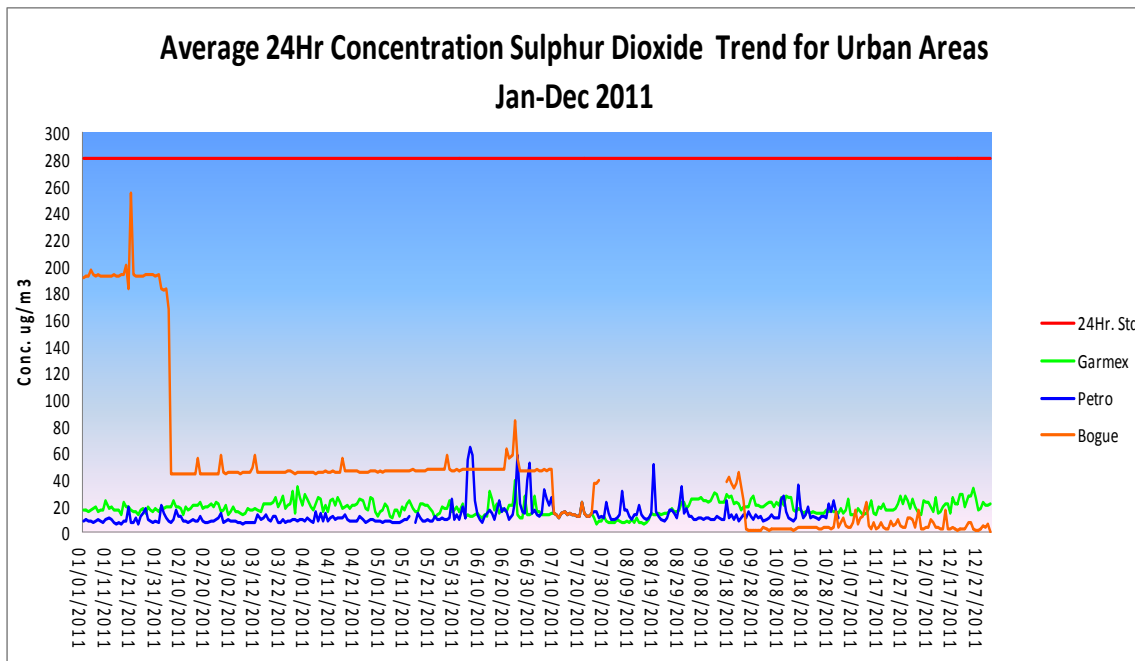
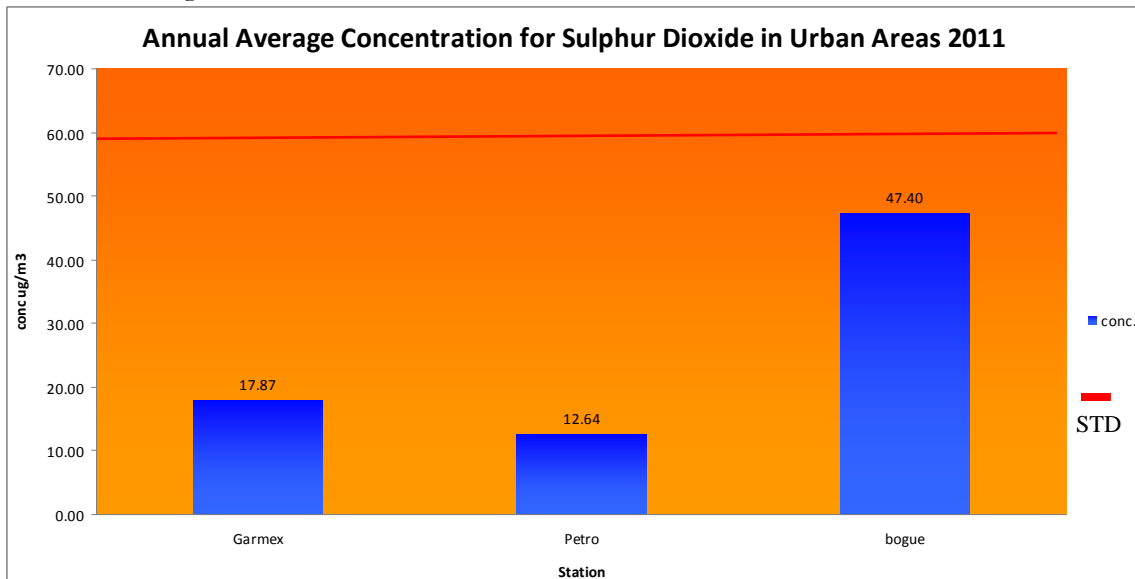


Figure 23: Graph showing Annual Sulphur Dioxide average concentrations at all monitoring stations in Kingston for 2011



During 2011 there were only two SO₂ stations operating in Kingston and one operating in Montego Bay. Both Kingston stations are impacted by industrial activities along the Marcus Garvey Drive area. There is minimal impact from traffic because of the siting of the monitors. No breach in the average 24 hour concentration was recorded in 2010 at the two stations. The annual average was also well below the standard of 60ug/m³ (see Figure 22 and Figure 23).

Analysis for the station located at Bogue, St. James showed neither breaches in the 24 hour concentrations nor any breach of the hourly standard of 700ug/m³. There was a significant fall in concentration in February. It is assumed that the data collected during the January to February months may be erroneous as the equipment was recently repaired after being down for almost the entire period of 2010.

Although SO₂ levels monitored during 2011 were below the standards set by the Natural Resources Conservation Authority (NRCA), the Agency will aim to reduce Sulphur emissions from industry and fuel use. The limit placed on industry, namely 2.2% Sulphur in Heavy Fuel Oil for new facilities and 3% Sulphur in Heavy Fuel Oil for existing facilities, is one of the reasons for these low levels of SO₂. The NRCA has also limited the Sulphur content in diesel oil to 0.5%. The imminent upgrade in the country's oil refinery which should result in the production of Ultra Low Diesel Fuel (ULDF) will further reduce the levels of Sulphur in the ambient environment. A shift in the main energy source to Liquid Natural Gas (LNG) is now in the early stages and if fully implemented will continue to reduce the levels of Sulphur emissions released by industries.

Figure 24: Graph showing trend in ambient air quality for Sulphur Dioxide at the stations in Ewarton, St. Catherine from Jan-Dec 2011

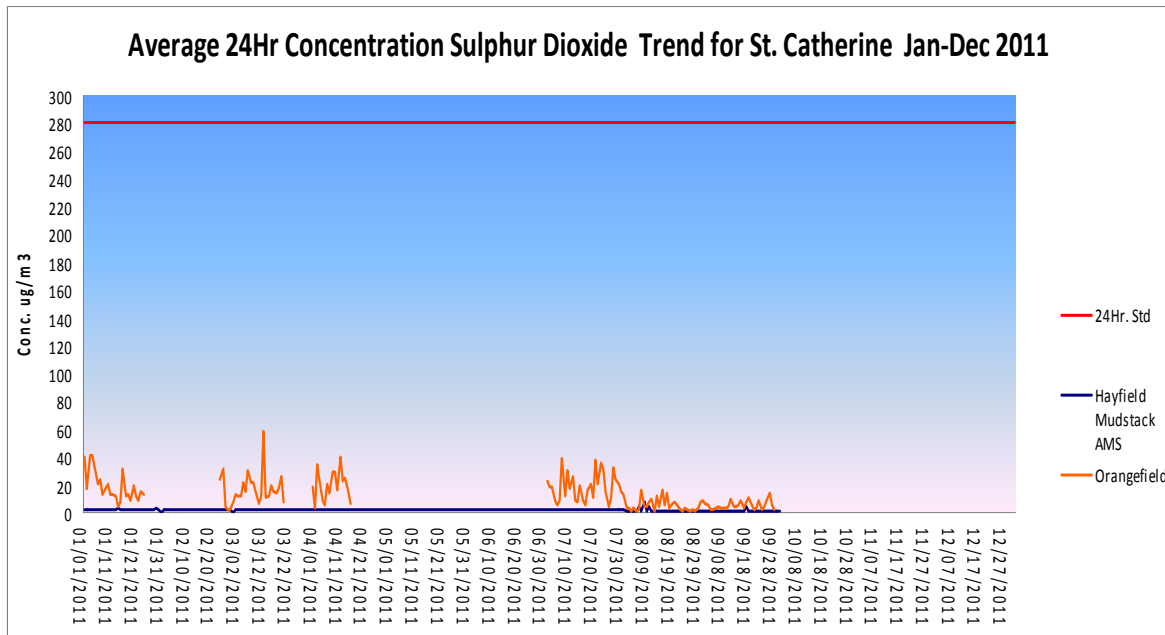
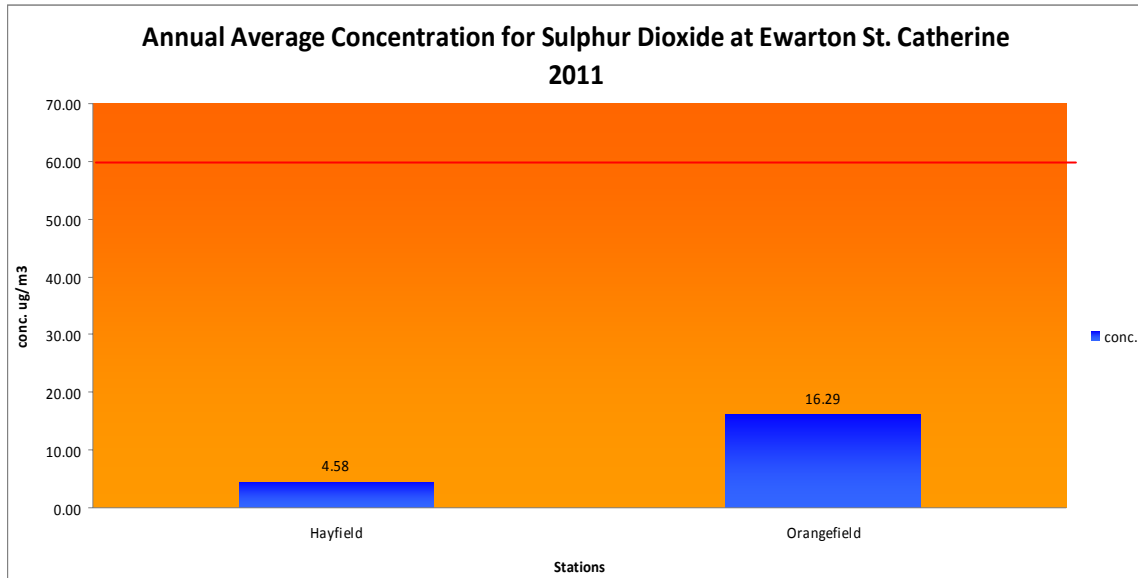


Figure 25: Graph showing Annual Sulphur Dioxide average concentrations at all monitoring stations in St. Catherine for 2011



The stations located in St. Catherine are impacted by the major bauxite industry in Ewarton. Levels of SO₂ recorded in 2011 show that there was no breach of the hourly, 24 hour and annual standards. The NRCA has also imposed the 3% sulphur content limit in the fuel used at the facility to further ensure that levels remain low (see Figure 24 and Figure 25).

Figure 26: Graph showing trend in ambient air quality for Sulphur Dioxide at the stations in Clarendon and Kirkvine Manchester from Jan-Dec 2011

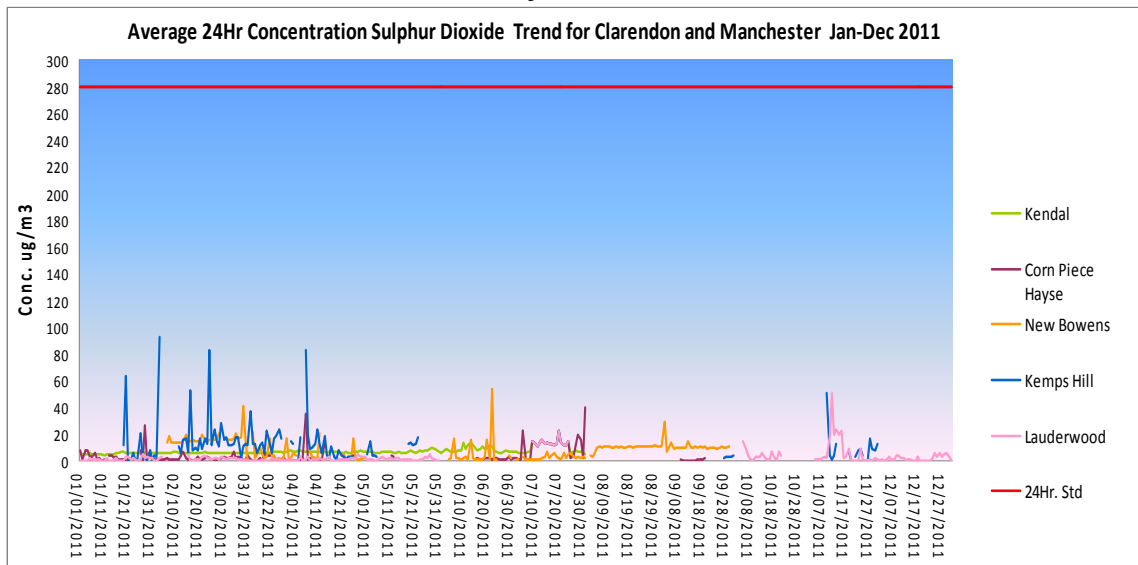
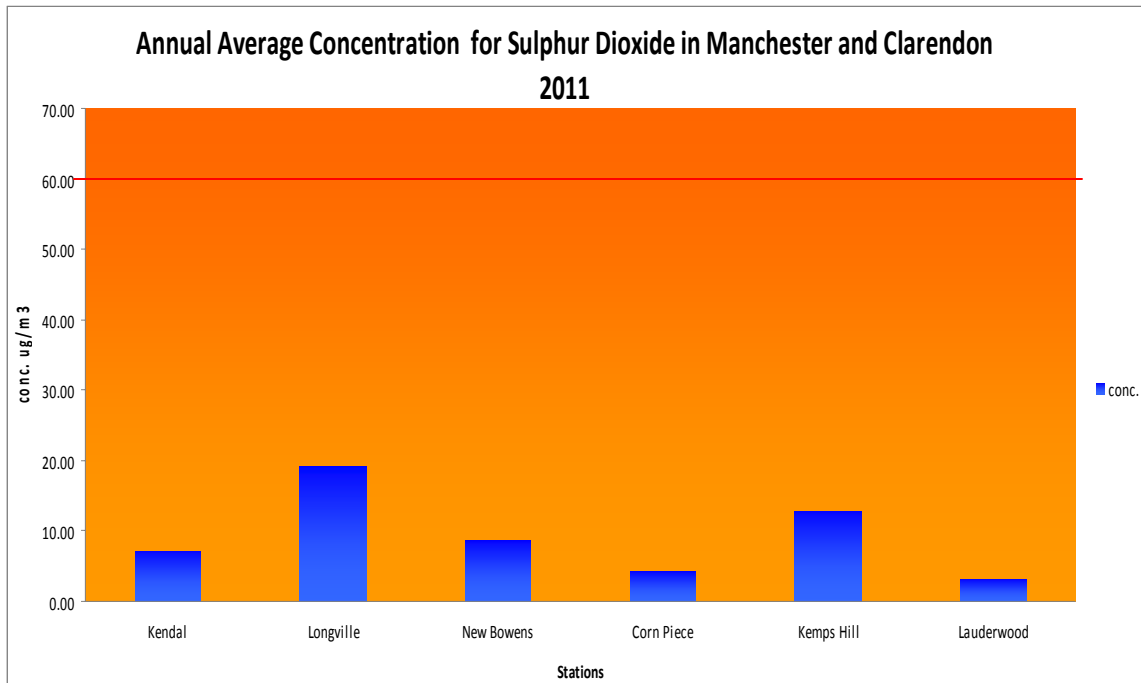


Figure 27: Graph showing Annual Sulphur Dioxide average concentrations at all monitoring stations in Clarendon and Manchester for 2011



Stations located in Clarendon are impacted by the Alumina Refinery, the Sugar estates and the power producing plants in Old Harbour Bay. The station located in Manchester is only impacted by the alumina refinery in the area. This refinery was not in operation during 2011 so all measurements recorded at the monitoring sites in Manchester were due to other sources such as vehicular traffic.

The stations located in Clarendon recorded no breaches during 2011 for all averaging periods (see Figure 26 and 27). All the major facilities impacting these stations have also been limited to the sulphur content of the fuel used to carry out production.

Nitrogen Dioxide

Figure 28: Graph showing trend in ambient air quality for Nitrogen Dioxide at the stations in Jamaica's two Cities Kingston and Montego Bay from Jan-Dec 2011

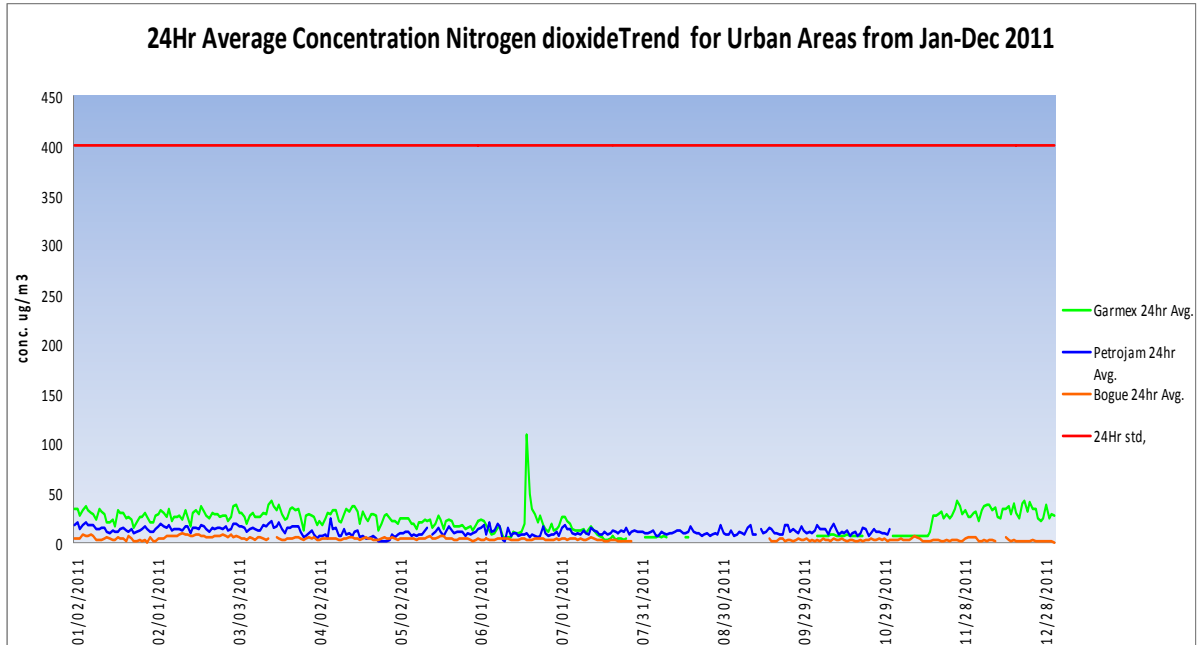
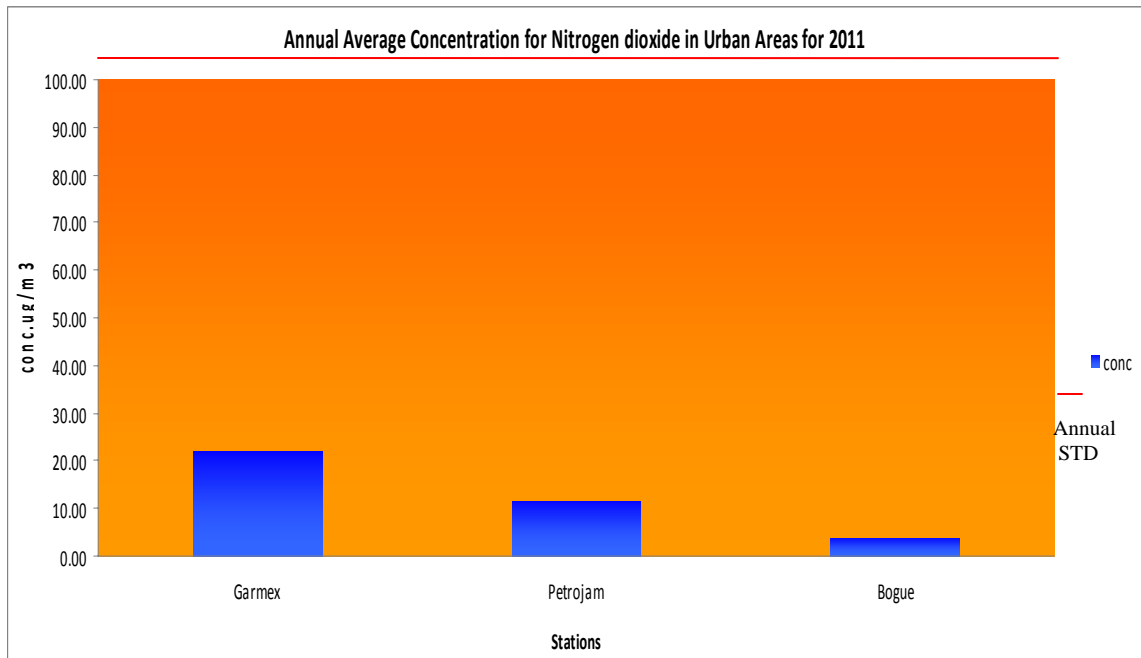
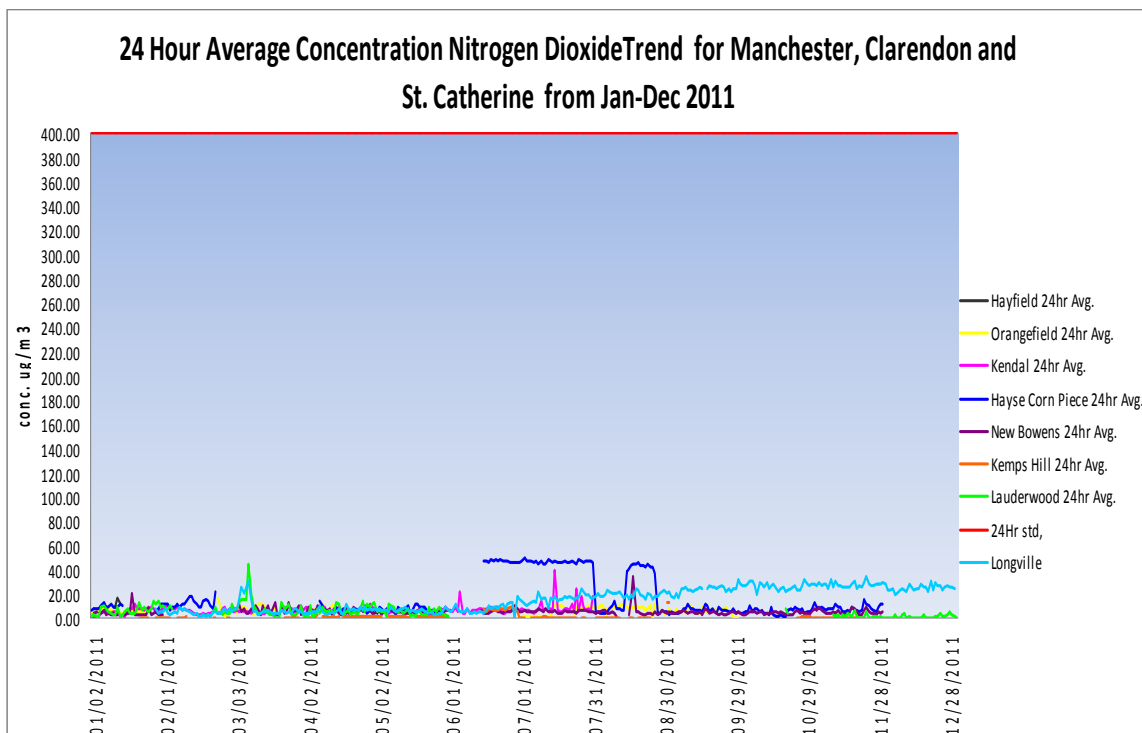


Figure 29: Graph showing Annual Nitrogen Dioxide average concentrations at all monitoring stations in Jamaica's two Cities Kingston and Montego Bay for 2011



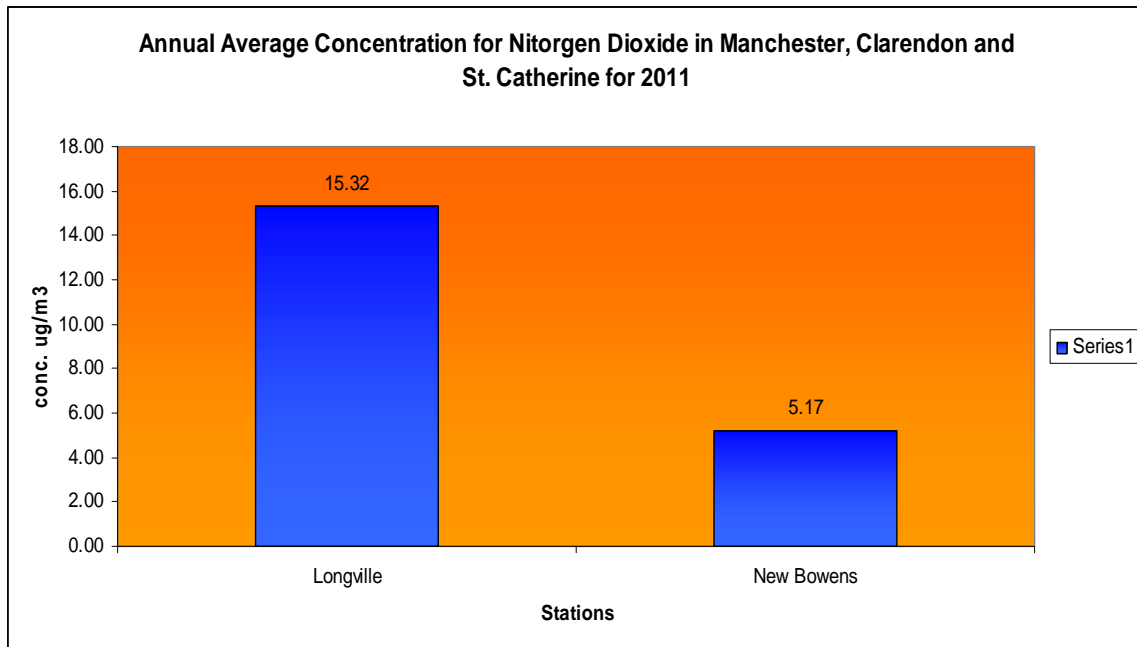
Ambient average 24 hour concentration for Nitrogen Dioxide as well as the annual average did not exceed the standard at the stations monitored in Kingston and Montego Bay (see Figure 28 and Figure 29). The stations in Kingston are impacted significantly by the industries along Marcus Garvey Drive. Nitrogen Dioxide is produced from the combustion of fuel. Traffic is a significant contributor of Nitrogen Dioxide but the stations that monitored in 2011 were not directly impacted by traffic. Hourly trends in data however, could identify some relation with traffic peak hours and spikes in the readings. This data as well as Nitrogen Dioxide emissions from vehicular traffic will be investigated further in 2012.

Figure 30: Graph showing trend in ambient air quality for Nitrogen Dioxide at the stations in Manchester, Clarendon and St. Catherine from Jan-Dec 2011



All the stations shown in Figure 30 are impacted by the same sources mentioned in previous sections of this report. None of the stations recorded any exceedances in the ambient standard for 24 hour averages in 2011. Only two of the stations achieved the 75% threshold to make an accurate analysis of the annual average concentration impacting the areas. The stations faced both logistics and electrical difficulties during 2011 some of them carrying over from 2010. These were audited by the Agency and recommendations made for their improvement. Most of the companies have brought in overseas experts to resolve the issues

Figure 31: Graph showing Annual Nitrogen Dioxide average concentrations at the stations in Manchester, Clarendon and St. Catherine from Jan-Dec 2011



Carbon Monoxide

There were four sites monitored in 2011, namely:

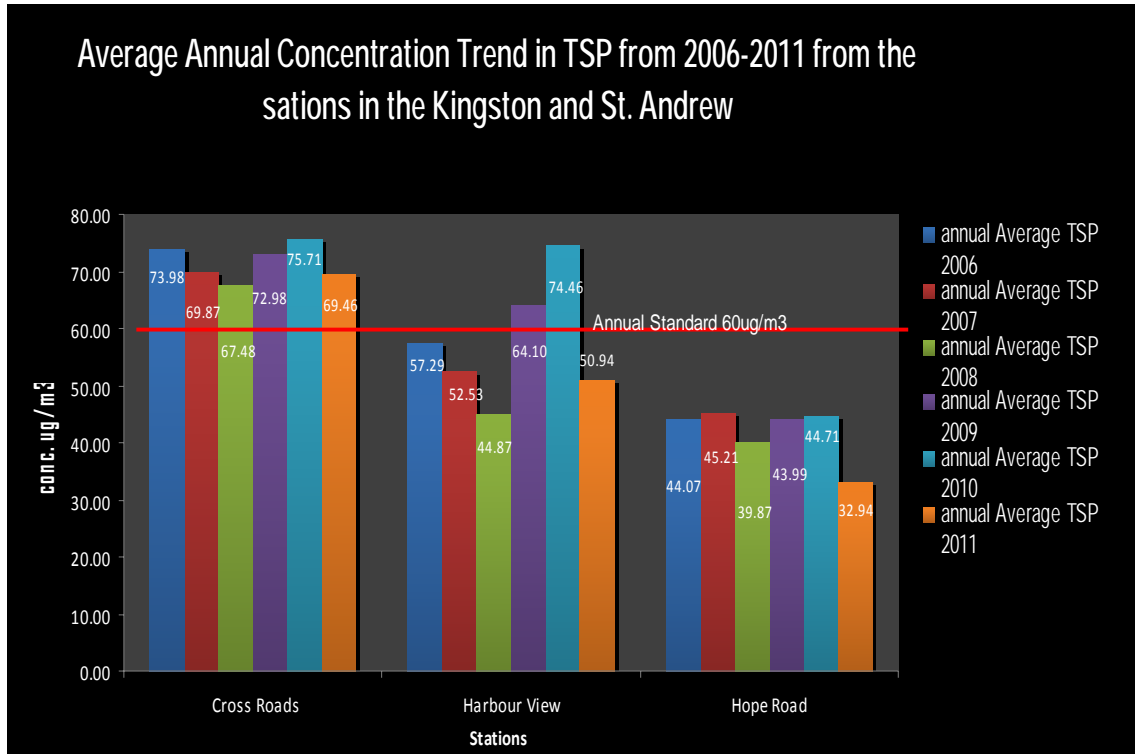
- Hayes Corn piece, Clarendon
- New Bowens, Clarendon
- Kemps Hill, Clarendon
- Orange field, Clarendon

None of the four monitoring sites recorded a breach in the 1 hour and 8 hour standards. Data recovery from these analyzers, however, continues to be a problem

4.0 Analytical Trends in Concentrations

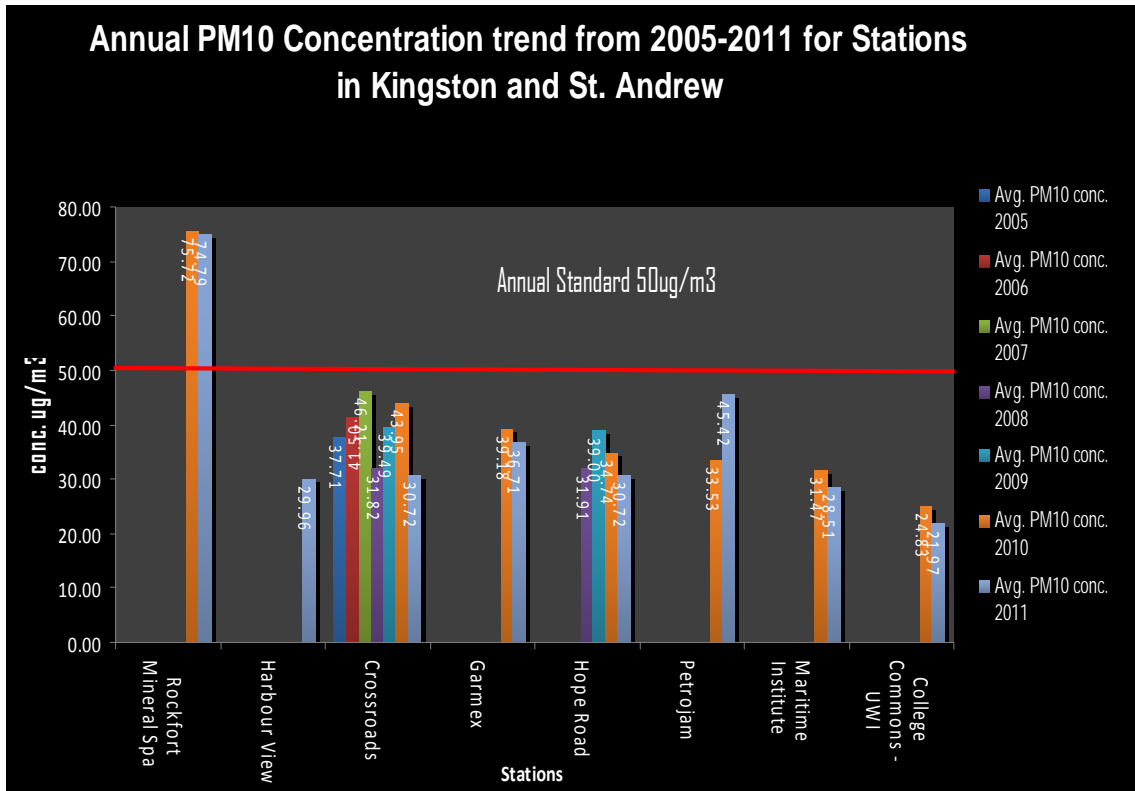
Urban Area Trends

Figure 32: Shows concentrations for TSP at stations across Kingston and St. Andrew from 2006-2011



The analysis shows that Crossroads continues to experience annual concentrations above the annual average since 2006. There was however a reduction seen in the average annual TSP levels at all three sites in 2011. The Harbour view station which is stationed in a residential area has averaged below the standard this year. Crossroads is a heavily trafficked commercial area. There is also a fugitive source in the form of an open lot which has little or no vegetative cover. There has been some improvement in the traffic situation with works done by the NWA, it appears however that an in depth study is needed to identify the cause of this continuous poor ambient air quality in the Crossroads area.

Figure 33: Shows concentrations for PM₁₀ at stations across Kingston and St. Andrew from 2005-2011



The analysis shows that Rockfort area has breached the standard for the annual average concentration for the past two years. In general the analysis shows a decline in PM₁₀ readings with the exception of the site located at Petrojam on Marcus Garvey Drive. This site is located close to the Kingston Harbour and the Kingston Port activity. The spike is suspected to be as a result of shipping activity, this will be closely watched during 2012 as the site did not record a breach in the annual standard.

The Rockfort site is still experiencing heavy out fall from the industrial activity in that area. Despite measures to curtail the fugitive emissions on the cement facility; the annual standard at this site continues to average at approximately 25ug/m³ above the ambient annual standard. This trend is extremely worrying and every effort must be made to identify the source and implement strategies to reduce the ambient levels.

Figure 34: Shows concentrations for Sulphur Dioxide at stations across Urban Areas in Jamaica (Kingston and Montego Bay) from 2010-2011

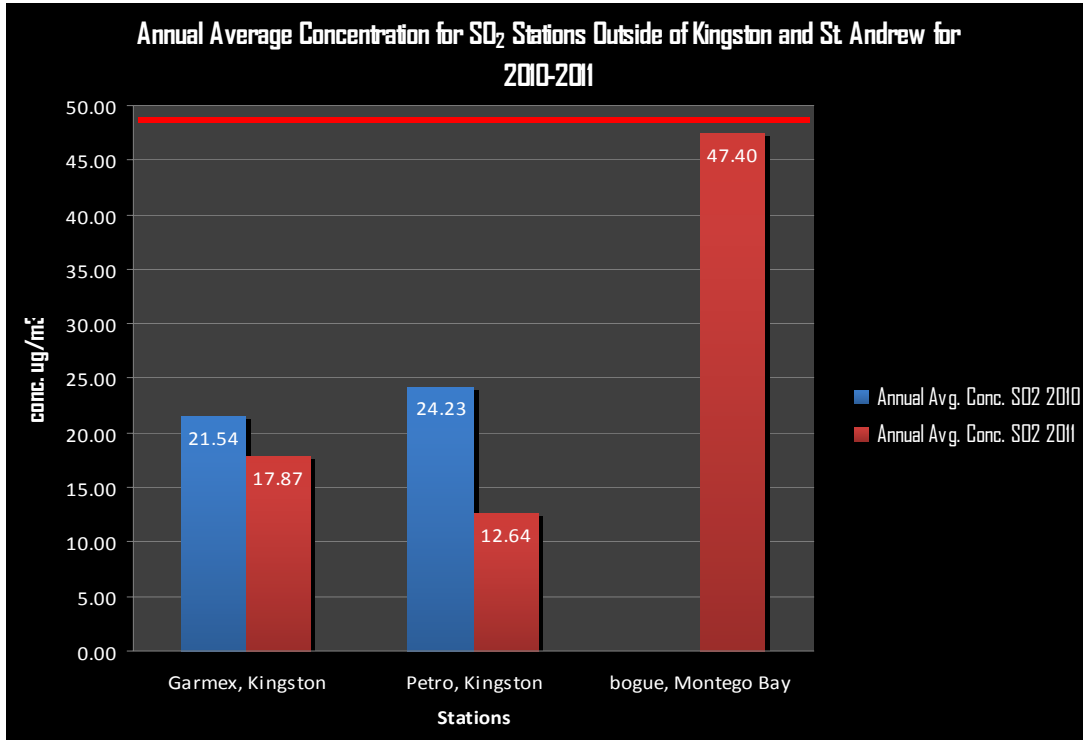
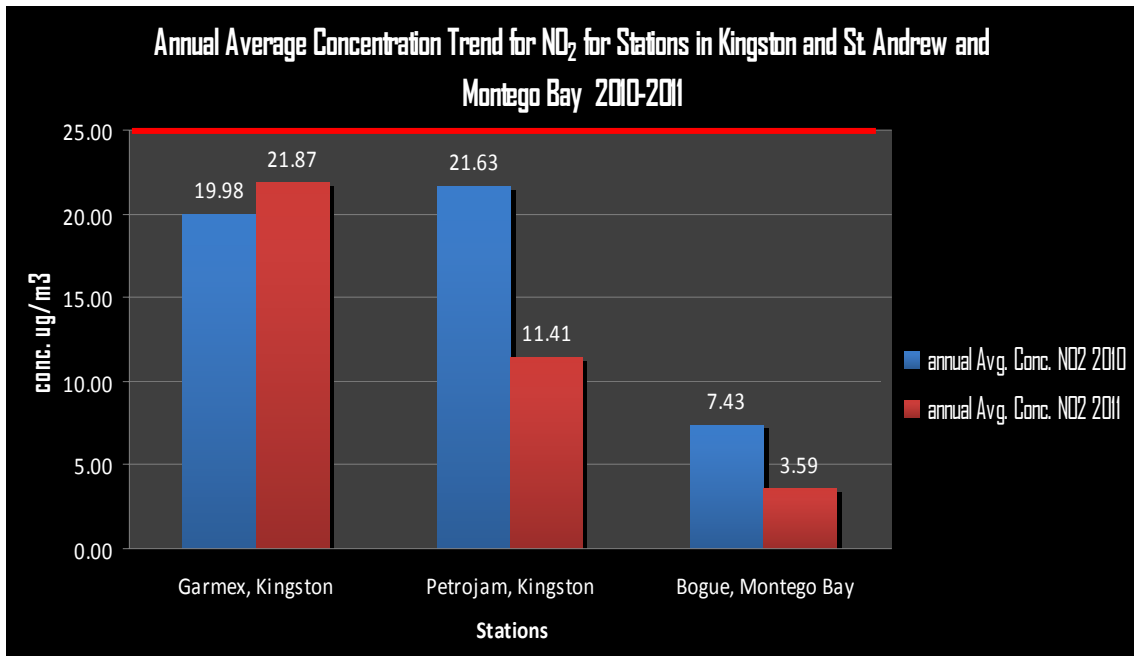
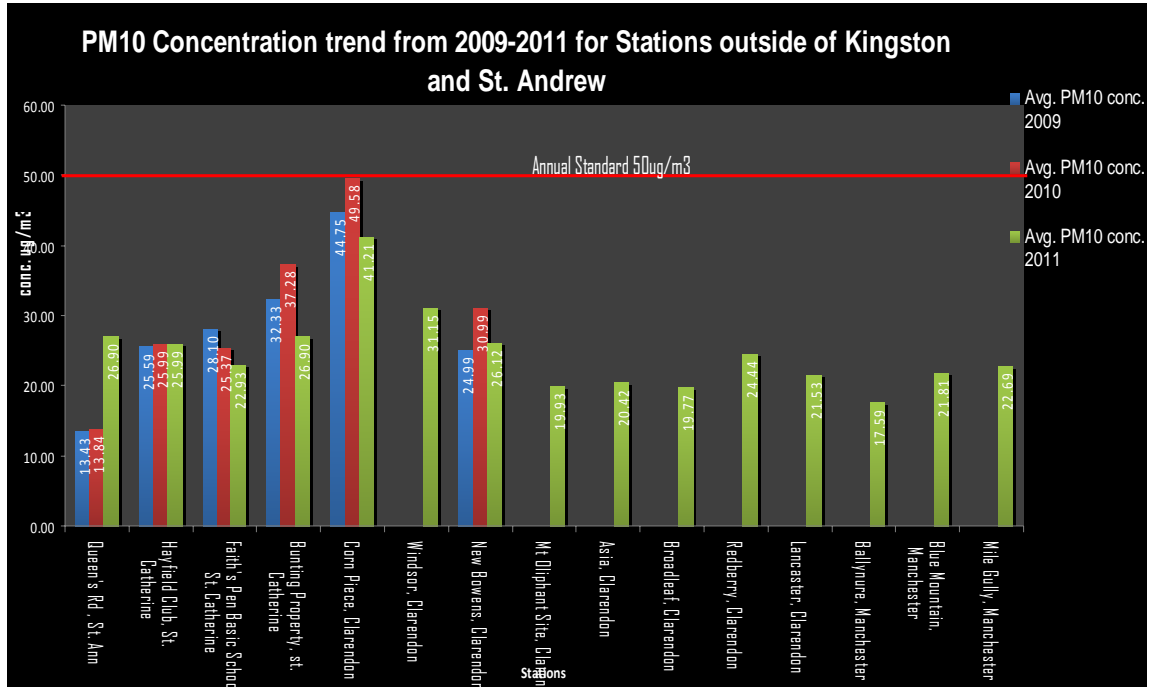


Figure 35: Shows concentrations for Nitrogen Dioxide at stations across Urban Areas in Jamaica (Kingston and Montego Bay) from 2010-2011



In general, levels of sulphur dioxide at all sites in the KMA trended downwards with no recorded breaches of the annual standard. Nitrogen Dioxide also trended downwards for all sites except Garmex which recorded an increase of 2ug/m³. In general the country's urban areas seem to have limited impact from the emissions of NO₂ and SO₂ at this time. Further analysis is however required, in order to make a more definitive statement about the ambient levels of SO₂ and NO₂ in these areas.

Figure 36: Shows concentrations for PM₁₀ at stations outside Urban Areas from 2009-2011



Ambient PM₁₀ concentrations outside of Kingston and St. Andrew are mainly impacted by the Alumina industries across the island. Except for Rosseau, all the monitoring stations in St. Ann, which actually showed improvement in ambient levels last year, were now showing an increase in the ambient PM₁₀ levels. Three major reductions have come at Hayfield in St. Catherine, Kendal Manchester and Mudlake West, Manchester. All these sites recorded levels below the ambient annual average during 2011. This indicates that the daily levels have trended down significantly

Figure 37: Shows concentrations for TSP at stations outside of Kingston and St. Andrew from 2009-2010

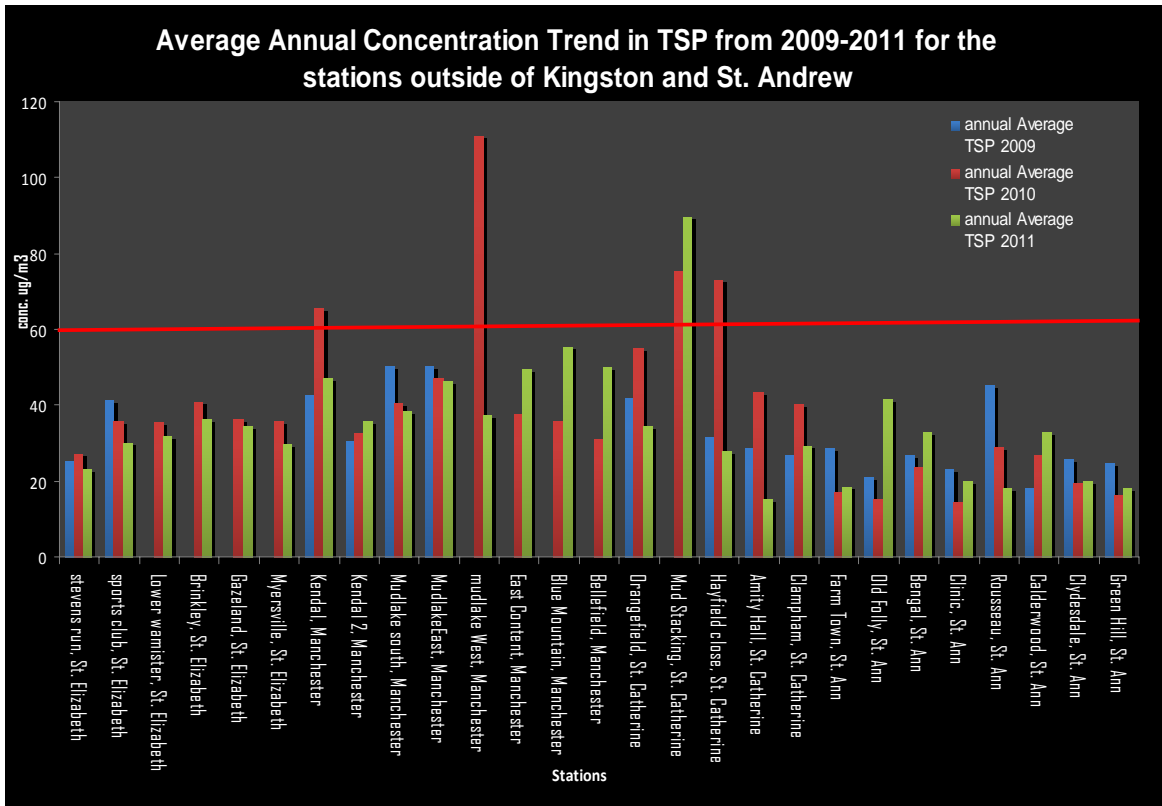


Figure 38: Shows concentrations for Sulphur Dioxide at stations outside of Kingston and St. Andrew from 2009-2010

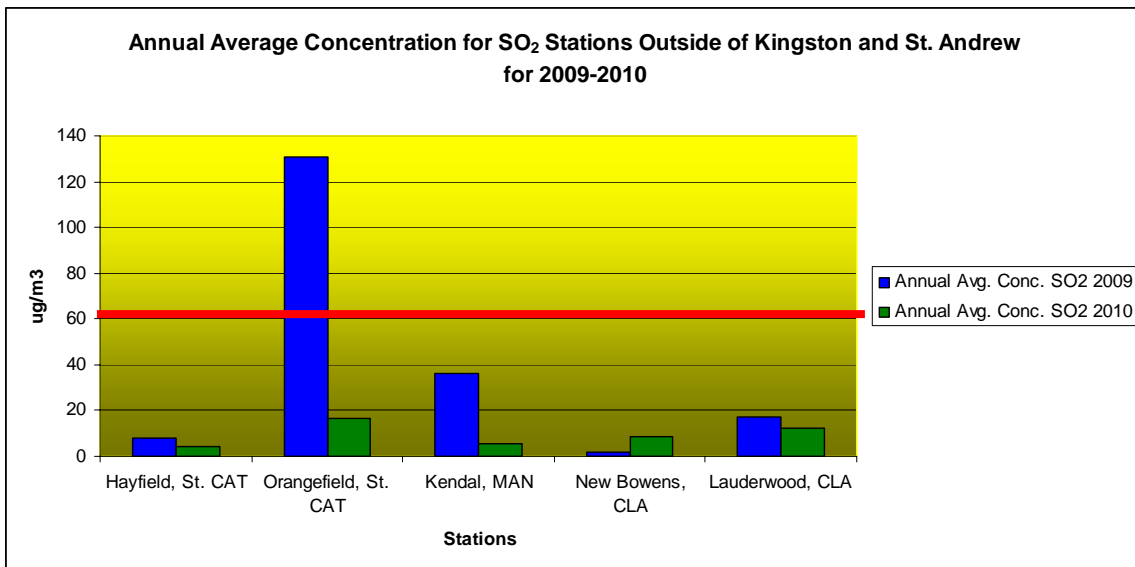
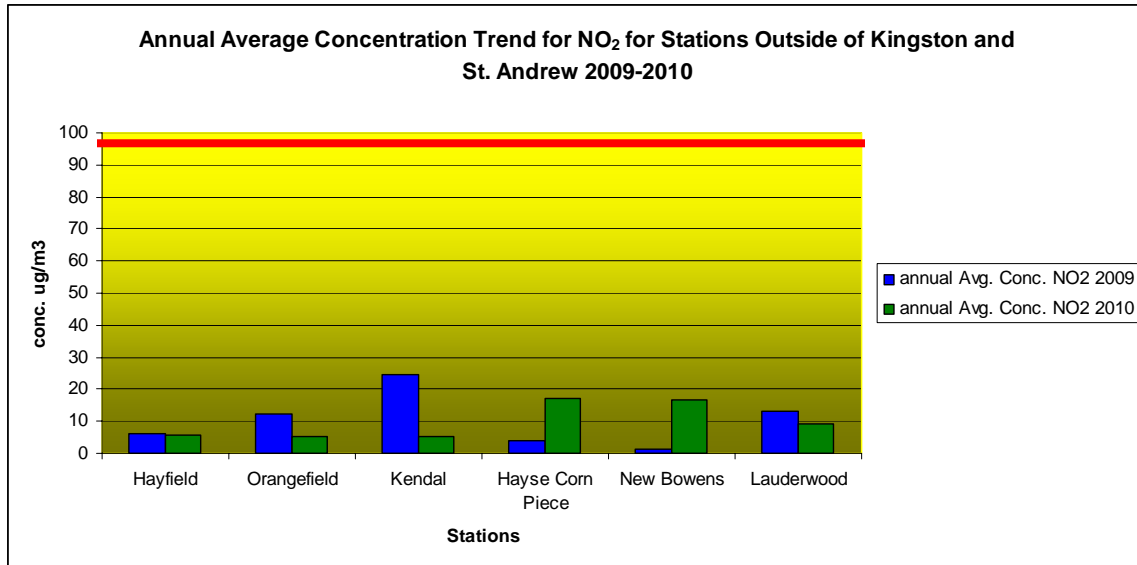


Figure 39: Shows concentrations for Nitrogen Dioxide at stations outside of Kingston and St. Andrew from 2009-2010



Concentration trends in Sulphur Dioxide, across the country have shown decreases from 2009 to 2010 mainly because of the partial shut down of the bauxite industry that affects the areas that the stations are located. The only station that recorded an increase was the one located near the only facility that was still in operation.

Nitrogen Dioxide levels also trended downwards for the stations that have historical data. The two stations that trended upwards are located beside the only Alumina refinery that was in full operation during 2010.

5.0 Conclusion

Ambient air quality in some sections of Jamaica's capital, Kingston, is poor. Trends in some of these areas show that without appropriate intervention they will remain above the ambient standard and continue to pose a threat to human health and the environment. The commercial area in Crossroads and the industrial area in Rockfort are two such areas that require this intervention. Concentrations of TSP and PM₁₀ in these areas threaten the health of ambient air quality. Annual exposure concentrations in these two areas are above the Ambient Air Quality Standards for Jamaica and have been so since 2006 which is as far back as historical data represents. Overall the other sites in Kingston and St. Andrew average annually in the low to mid thirties which is approximately 10ug/m³ above the reference background level in the country's NRCA Ambient Air Quality Guidelines 2006. Irrespective of the fact that the annual ambient standard at some of these sites was breached; the country saw a reduction in the number of exceedances of the daily standards for both PM₁₀ and TSP, the latter having three times less exceedances than during 2010.

Outside of the urban centers particulate matter concentrations in ambient air is impacted significantly by the bauxite industry which generated approximately 7000 tonnes of particulate matter during 2010. Significant reductions in the annual averages at sites in Kendal, Manchester and Hayfield, St. Catherine were experienced in 2011. The concentrations in ambient air recorded at these stations all averaged in the mid to low thirties. The only concern was the Hayes Corn Piece station, which is located in a residential area close to a bauxite facility. This site averaged in the forties and has been like this for the last three years.

Kingston and St. Andrew and Montego Bay continued to see minimal impact from Sulphur Dioxide and Nitrogen Dioxide. Despite SO₂ and NO₂ recording the highest amount of emissions released into the atmosphere at approximately 76000 tonnes and 36000 tonnes respectively in 2010, ambient concentrations at the sites monitored still do not reflect a significant impact. The entire island has recorded on average good ambient air quality for Sulphur Dioxide and Nitrogen Dioxide. Carbon Monoxide levels also showed no significant impact in the areas monitored.

Levels of ozone in ambient air could not be determined as Jamaica only operates one ozone analyzer and this did not operate during 2011 due to maintenance issues.

6.0 Recommendation

In order to further assess the levels and impact of CAPs and POPs in ambient air in Jamaica it is being recommended that:

- The National Environment and Planning Agency seek funding to increase not only monitoring sites but to monitor for more pollutant parameters such as lead (Pb), and Volatile Organic Compounds (VOCs).
- The data recovery of the current network be improved. The current data recovery stood at 60% for 2011. This needs to be improved to no less than 75% to improve the accuracy of annual assessments
- A study be launched in all the critical areas identified in this report such as Crossroads, Rock Fort, Harbour View and Hayes Corn Piece in order to provide a mitigation report for Particulate Matter with recommendations to reduce levels in these areas.
- The Monitoring network be expanded to capture impact in other urban centers in the country
- The Monitoring network be expanded to capture impact from the Sugar Industry
- Detailed modeling of the Kingston Metropolitan Area (KMA) should be undertaken and the results should support the data collected to inform policy and improve the ambient air of the area. This model should be transferred to the rest of the island to aid in the effort to improve and maintain the country's ambient air quality in 2012-2013 and beyond.

Appendix A

Location of Ambient Monitors in Monitoring Networks across the Country

Figure 40: Map of monitoring Network in Kingston and St. Andrew

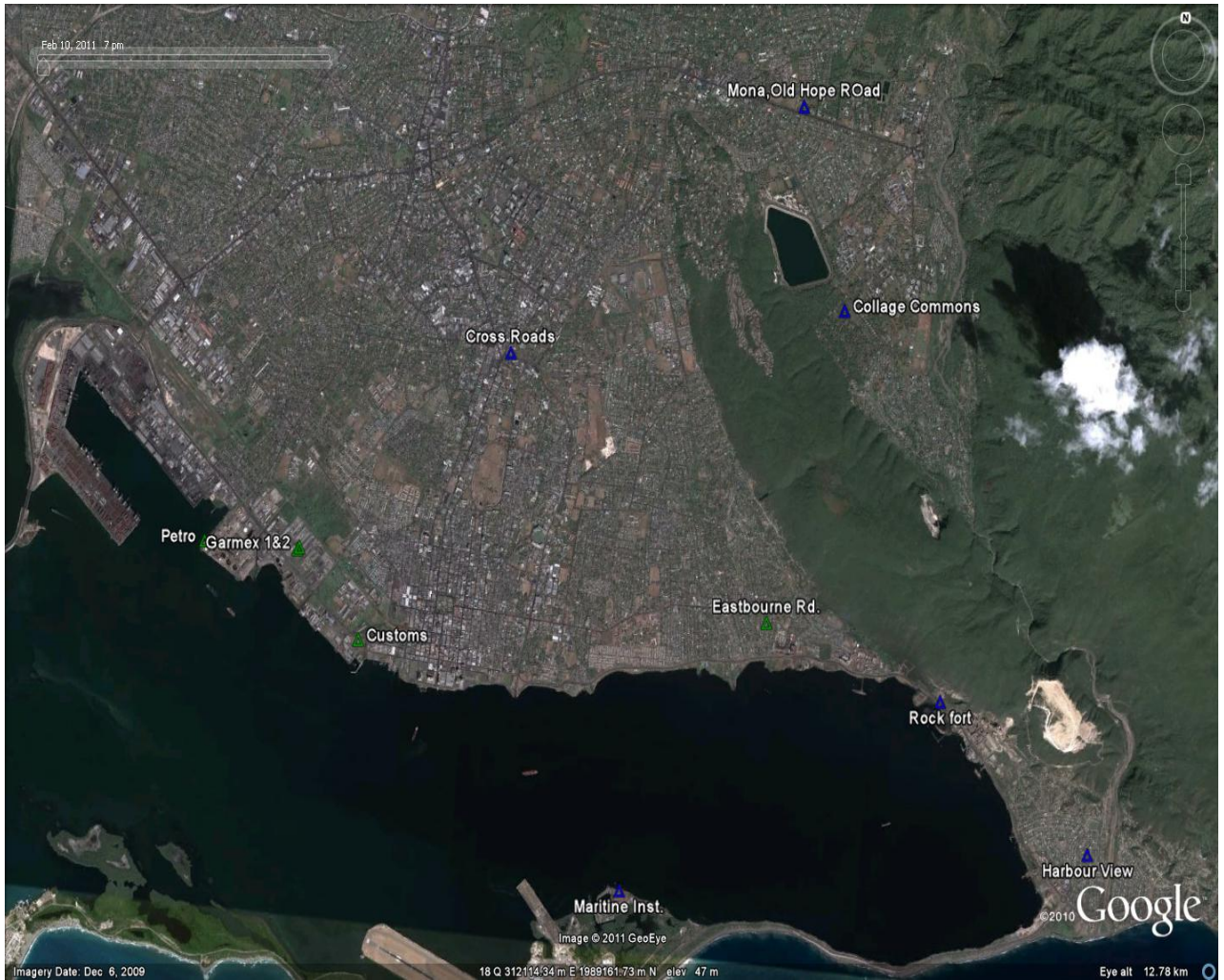


Figure 41: Map of monitoring Network in Ewarton, St. Catherine



Figure 42: Map of monitoring Network in Kirkvine, Manchester

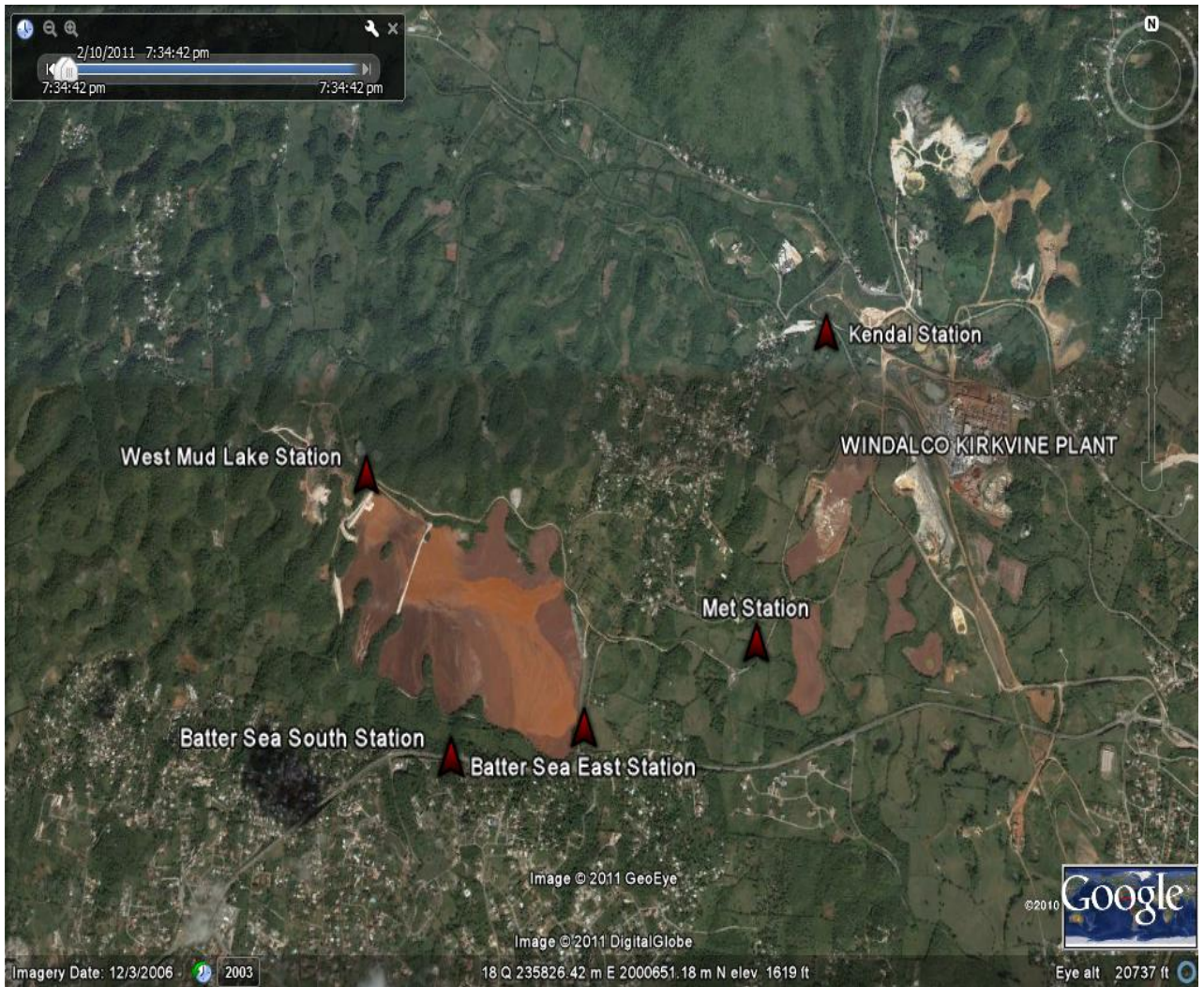


Figure 43: Map of monitoring Network in South, St. Elizabeth

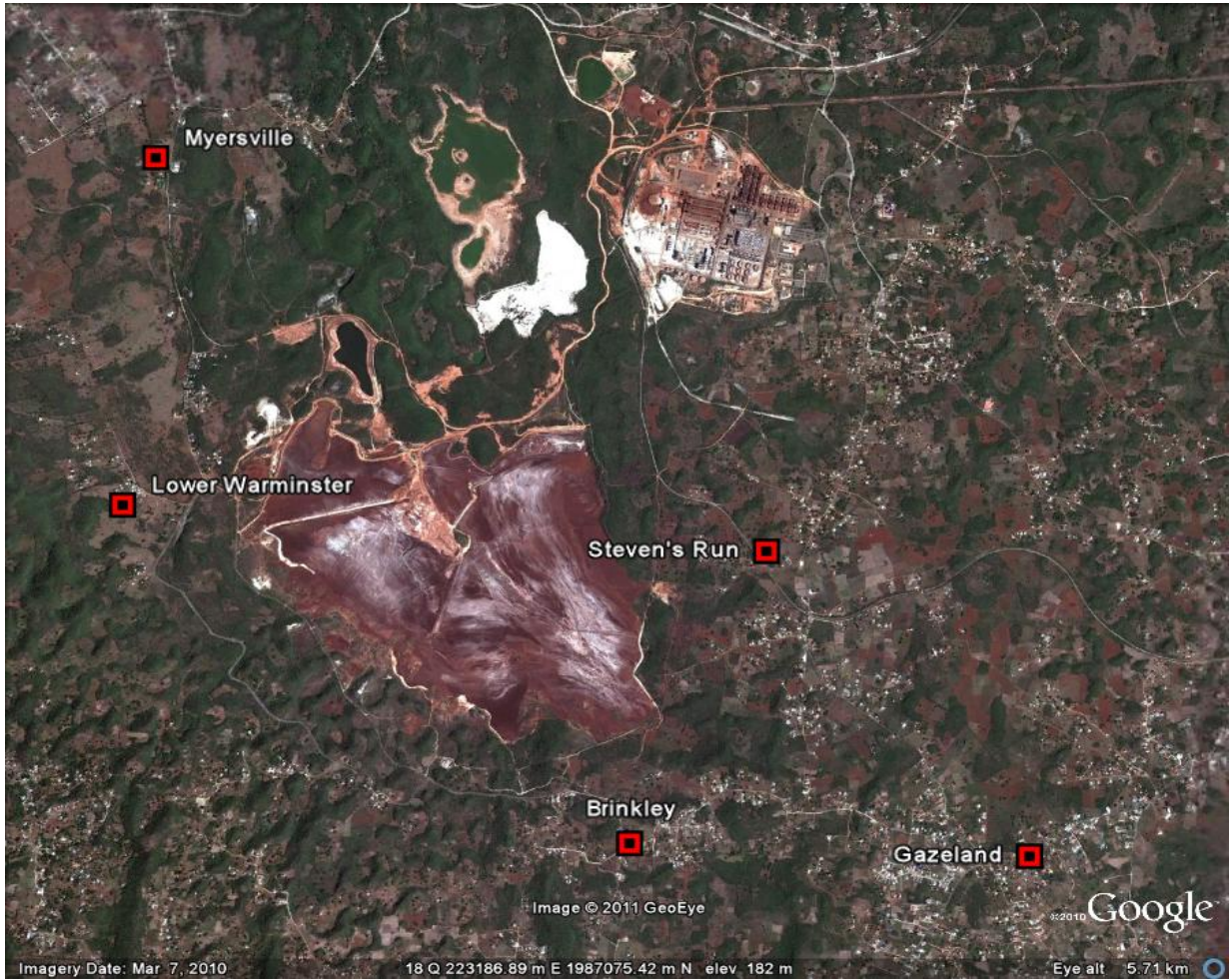


Figure 44: Map of monitoring Network in Discovery Bay, St. Ann



Figure 45: Map of monitoring Network in, South St. Catherine and Clarendon

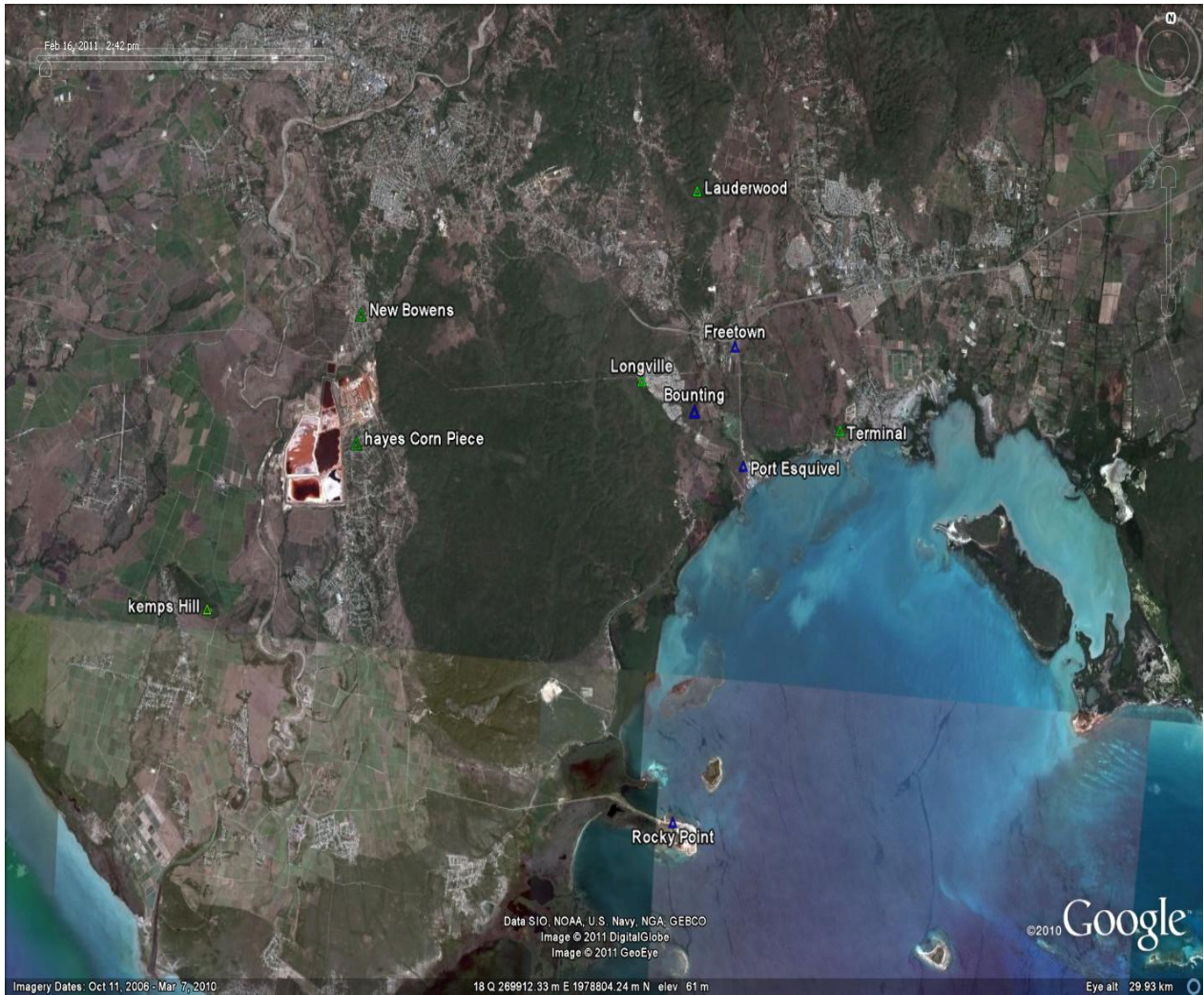


Figure 46: Map of monitoring Network in Bogue, St. James

