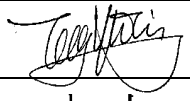
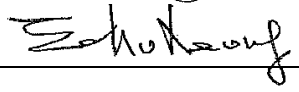
China Harbour Engineering Company Limited

Contract No. HY/2010/02

Hong Kong – Zhuhai – Macao Bridge Hong Kong Boundary Crossing Facilities – Reclamation Works

Quarterly EM&A Summary Report for June 2016 – August 2016

[7/2017]

	Name	Signature
Prepared & Checked:	Y T Tang	
Reviewed, Approved and Certified:	Echo Leong (ETL)	

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RAMBOLL ENVIRON

Ref.: HYDHZMBEEM00_0_5227L.17

3 April 2017

By Fax (3698 5999) and By Post

Ove Arup & Partners
Chief Resident Engineer's Office
5 Ying Hei Road, Tung Chung, Lantau
Hong Kong

Attention: Mr. Paul Appleton

Dear Sir,

Re: Agreement No. CE 48/2011 (EP)
Environmental Project Office for the
HZMB Hong Kong Link Road, HZMB Hong Kong Boundary Crossing Facilities, and Tuen Mun-Chek Lap Kok Link – Investigation

Contract No. HY/2010/02 – HZMB HKBCF – Reclamation Works
Quarterly EM&A Report for June 2016 to August 2016

Reference is made to the Environmental Team's submission of the Quarterly Environmental Monitoring & Audit Report for June 2016 to August 2016 certified by the ET Leader (ET's ref.: "60249820/C/RMKY17033101" dated 31 March 2017) and provided to us via e-mail on 31 March 2017.

We are pleased to inform you that we have no adverse comment on the captioned Quarterly Environmental Monitoring & Audit Report for June 2016 to August 2016.

Please be reminded that our verification to your report does not release any of your obligations in the EM&A Manual under the applicable Environmental Permit(s) for this Project.

Thank you very much for your attention and please feel free to contact the undersigned should you require further information.

Yours faithfully,
For and on behalf of
Ramboll Environ Hong Kong Limited

Raymond Dai
Independent Environmental Checker

c.c.	HyD	Mr. Vico Cheung	(By Fax: 3188 6614)
	HyD	Mr. Wai-Ping Lee	(By Fax: 3188 6614)
	AECOM	Ms. Echo Leong	(By Fax: 2317 7609)
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EXECUTIVE SUMMARY

Contract No. HY/2010/02 – Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Reclamation Works (here below, known as "the Contract") mainly comprises reclamation at the northeast of the Hong Kong International Airport of an area of about 130-hectare for the construction of an artificial island for the development of the Hong Kong Boundary Crossing Facilities (HKBCF), and about 19-hectare for the southern landfall of the Tuen Mun - Chek Lap Kok Link (TMCLKL). It is a designated Project and is governed by the current permits for the Project, i.e. the amended Environmental Permits (EPs) issued on 11 April 2016 (EP-353/2009/K) and 13 March 2015 (EP-354/2009/D) (for TMCLKL Southern Landfall Reclamation only).

Ove Arup & Partners Hong Kong Limited (Arup) was appointed by Highways Department (HyD) as the consultants for the design and construction assignment for the Project's reclamation works (i.e. the Engineer for the Contract).

China Harbour Engineering Company Limited (CHEC) was awarded by HyD as the Contractor to undertake the construction work of the Contract.

Ramboll Environ Hong Kong Limited. was employed by HyD as the Independent Environmental Checker (IEC) and Environmental Project Office (ENPO) for the Project.

AECOM Asia Co. Ltd. (AECOM) was appointed by CHEC to undertake the role of Environmental Team for the Contract for carrying out the environmental monitoring and audit (EM&A) works.

The construction phase of the Project under the EPs was commenced on 12 March 2012 and will be tentatively completed by early Year 2017. The EM&A programme, including air quality, noise, water quality and dolphin monitoring and environmental site inspections, was commenced on 12 March 2012.

This report documents the findings of EM&A works conducted in the period between 1 June 2016 and 31 August 2016. As informed by the Contractor, major activities in the reporting quarter were:-

Marine-base

- Sloping Seawalls
- Rubble Mound Seawall
- Maintenance of silt curtain

Land-base

- Surcharge removal & laying
- Deep Cement Mixing
- Installations of Precast Culverts except sloping outfalls
- Construction of Permanent Seawall
- Maintenance works of Site Office at Works Area WA2
- Maintenance works of Public Works Regional Laboratory at Works Area WA3
- Maintenance of Temporary Marine Access at Works Area WA2

A summary of monitoring and audit activities conducted in the reporting quarter is listed below:

24-hour Total Suspended Particulates (TSP) monitoring	16 sessions
1-hour TSP monitoring	16 sessions
Noise monitoring	12 sessions
Impact water quality monitoring	39 sessions
Impact dolphin monitoring	6 surveys
Joint Environmental site inspection	13 sessions

Breaches of Action and Limit Levels for Air Quality

All 1-Hour TSP and 24-Hour TSP results were below the Action and Limit Level in the reporting quarter.

Breaches of Action and Limit Levels for Noise

For construction noise, no exceedance was recorded at all monitoring stations in the reporting quarter.

Breaches of Action and Limit Levels for Water Quality

For impact water quality monitoring, no exceedance was recorded at all monitoring stations in the reporting quarter.

Breaches of Action and Limit Levels for Impact Dolphin Monitoring

One (1) Limit Level exceedance of dolphin monitoring was recorded in the reporting quarter. After investigation, it was concluded that the HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual marine contracts) cannot be quantified nor separate from the other stress factors. Event Action Plan for Impact Dolphin Monitoring was triggered. For detail of investigation, please refer to appendix L.

Implementation Status and Review of Environmental Mitigation Measures

Most of the recommended mitigation measures, as included in the EM&A programme, were implemented properly in the reporting quarter.

The recommended environmental mitigation measures effectively minimize the potential environmental impacts from the Project. The EM&A programme effectively monitored the environmental impacts from the construction activities and ensure the proper implementation of mitigation measures. No particular recommendation was advised for the improvement of the programme.

Moreover, regular review and checking on the construction methodologies, working processes and plants were carried out to ensure the environmental impacts were kept minimal and recommended environmental mitigation measures were implemented effectively.

Complaint, Notification of Summons and Successful Prosecution

1 complaint about marine litter near Tuen Mun Ferry Pier was received on 16 Jul 2016, 9:19am. The complainant complained that pollution was observed at Tuen Mun Ferry Pier and queried whether the pollutant came from the construction sites of the Lantau area or bridge construction. After investigation, it is considered the marine litter floating near the Tuen Mun Ferry Pier is unlikely to be related to this Contract.

No notification of summons or prosecution was received in the reporting period

1 INTRODUCTION

1.1 Background

1.1.1 Contract No. HY/2010/02 – Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Reclamation Works (here below, known as "the Contract") mainly comprises reclamation at the northeast of the Hong Kong International Airport of an area of about 130-hectare for the construction of an artificial island for the development of the Hong Kong Boundary Crossing Facilities (HKBCF), and about 19-hectare for the southern landfall of the Tuen Mun - Chek Lap Kok Link (TMCLKL).

1.1.2 The environmental impact assessment (EIA) reports (Hong Kong – Zhuhai – Macao Bridge Hong Kong Boundary Crossing Facilities – EIA Report (Register No. AEIAR-145/2009) (HKBCFEIA) and Tuen Mun – Chek Lap Kok Link – EIA Report (Register No. AEIAR-146/2009) (TMCLKLEIA), and their environmental monitoring and audit (EM&A) Manuals (original EM&A Manuals), for the Project were approved by Environmental Protection Department (EPD) in October 2009.

1.1.3 EPD subsequently issued the Environmental Permit (EP) for HKBCF in November 2009 (EP-353/2009) and the Variation of Environmental Permit (VEP) in June 2010 (EP-353/2009/A), November 2010 (EP-353/2009/B), November 2011 (EP-353/2009/C), March 2012 (EP-353/2009/D), October 2012 (EP-353/2009/E), April 2013 (EP-353/2009/F), August 2013 (EP-353/2009/G), January 2015 (EP-353/2009/H), July 2015 (EP-353/2009/I), February 2016 (EP-353/2009/J) and April 2016 (EP-353/2009/K). Similarly, EPD issued the Environmental Permit (EP) for TMCLKL in November 2009 (EP-354/2009) and the Variation of Environmental Permit (VEP) in December 2010 (EP-354/2009/A), January 2014 (EP-354/2009/B), December 2014 (EP-354/2009/C) and March 2015 (EP-354/2009/D).

1.1.4 The Project is a designated Project and is governed by the current permits for the Project, i.e. the amended EPs issued on 11 April 2016 (EP-353/2009/K) and 13 March 2015 (EP-354/2009/D) (for TMCLKL Southern Landfall Reclamation only).

1.1.5 A Contract Specific EM&A Manual, which included all Contract -relation contents from the original EM&A Manuals for the Contract, was issued in May 2012.

1.1.6 Ove Arup & Partners Hong Kong Limited (Arup) was appointed by Highways Department (HyD) as the consultants for the design and construction assignment for the Project's reclamation works (i.e. the Engineer for the Contract).

1.1.7 China Harbour Engineering Company Limited (CHEC) was awarded by HyD as the Contractor to undertake the construction work of the Contract.

1.1.8 Ramboll Environ Hong Kong Limited was employed by HyD as the Independent Environmental Checker (IEC) and Environmental Project Office (ENPO) for the Project.

1.1.9 AECOM Asia Co. Ltd. (AECOM) was appointed by CHEC to undertake the role of Environmental Team for the Contract for carrying out the EM&A works.

1.1.10 The construction phase of the Project under the EPs was commenced on 12 March 2012 and will be tentatively completed by early Year 2017.

1.1.11 According to the Contract Specific EM&A Manual, there is a need of an EM&A programme including air quality, noise, water quality and dolphin monitoring and environmental site inspections. The EM&A programme of the Contract commenced on 12 March 2012.

1.2 Scope of Report

1.2.1 This is the eighteenth quarterly EM&A Report under the Contract No. HY/2010/02 Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Reclamation Works. This report presents a

summary of the environmental monitoring and audit works, list of activities and mitigation measures proposed by the ET for the Contract from 1 June 2016 to 31 August 2016.

1.3 Contract Organization

1.3.1 The Contract organization structure is shown in Appendix A. The key personnel contact names and numbers are summarized in Table 1.1.

Table 1.1 Contact Information of Key Personnel

Party	Position	Name	Telephone	Fax
Engineer's Representative (ER) (Ove Arup & Partners Hong Kong Limited)	Chief Resident Engineer	Paul Appleton	3698 5889	2698 5999
IEC / **ENPO** (Ramboll Environ Hong Kong Limited)	Independent Environmental Checker	Raymond Dai	3465 2888	3465 2899
	Environmental Project Office Leader	Y. H. Hui	3465 2850	3465 2899
Contractor (China Harbour Engineering Company Limited)	Environmental Officer	Louie Chan	36932254	2578 0413
	24-hour Hotline	Alan C.C. Yeung	9448 0325	--
ET (AECOM Asia Company Limited)	ET Leader	Echo Leong	3922 9280	2317 7609

1.4 Summary of Construction Works

1.4.1 The construction phase of the Project under the EP commenced on 12 March 2012.

1.4.2 As informed by the Contractor, details of the major works carried out in the reporting quarter are listed below:-

Marine-base

- Sloping Seawalls
- Rubble Mound Seawall
- Maintenance of silt curtain

Land-base

- Surcharge removal & laying
- Deep Cement Mixing
- Installations of Precast Culverts except sloping outfalls
- Construction of Permanent Seawall
- Maintenance works of Site Office at Works Area WA2
- Maintenance works of Public Works Regional Laboratory at Works Area WA3
- Maintenance of Temporary Marine Access at Works Area WA2

1.4.3 The 3-month rolling construction programme of the Contract is shown in Appendix B.

1.4.4 The general layout plan of the Contract site showing the detailed works areas is shown in Figure 1.

1.4.5 The environmental mitigation measures implementation schedule are presented in Appendix C.

2 SUMMARY OF EM&A PROGRAMME REQUIREMENTS

2.1 Monitoring Parameters

2.1.1 The Contract Specific EM&A Manual designated 4 air quality monitoring stations, 2 noise monitoring stations, 21 water monitoring stations (9 Impact Stations, 7 Sensitive Receiver Stations and 5 Control/Far Field Stations) to monitor environmental impacts on air quality, noise and water quality respectively. Pre-set and fixed transect line vessel based dolphin survey was required in two AFCD designated areas (Northeast and Northwest Lantau survey areas). The impact dolphin monitoring at each survey area should be conducted twice per month.

2.1.2 For impact air quality monitoring, monitoring locations AMS2 (Tung Chung Development Pier) and AMS7 (Hong Kong SkyCity Marriott Hotel) were set up at the proposed locations in accordance with Contract Specific EM&A Manual. The conditional omission of Monitoring Station AMS6 was effective since 19 November 2012. For monitoring location AMS3 (Ho Yu College), as proposed in the Contract Specific EM&A Manual, approval for carrying out impact monitoring could not be obtained from the principal of the school. Permission on setting up and carrying out impact monitoring works at nearby sensitive receivers, like Caribbean Coast and Coastal Skyline, was also sought. However, approvals for carrying out impact monitoring works within their premises were not obtained. Impact air quality monitoring was conducted at site boundary of the site office area in Works Area WA2 (AMS3B) respectively. Same baseline and Action Level for air quality, as derived from the baseline monitoring data recorded at Ho Yu College, was adopted for this alternative air quality location.

2.1.3 For impact noise monitoring, monitoring locations NMS2 (Seaview Crescent Tower 1) was set up at the proposed locations in accordance with Contract Specific EM&A Manual. However, for monitoring location NMS3 (Ho Yu College), as proposed in the Contract Specific EM&A Manual, approval for carrying out impact monitoring could not be obtained from the principal of the school. Permission on setting up and carrying out impact monitoring works at nearby sensitive receivers, like Caribbean Coast and Coastal Skyline, was also sought. However, approvals for carrying out impact monitoring works within their premises were not obtained. Impact noise monitoring was conducted at site boundary of the site office area in Works Area WA2 (NMS3B) respectively. Same baseline noise level, as derived from the baseline monitoring data recorded at Ho Yu College was adopted for this alternative noise monitoring location. Reference is made to ET's proposal of relocation of air quality monitoring station (AMS7) dated on 2 February 2015, with no further comment received from IEC on 2 February 2015 and no objection received from EPD on 5 February 2015, the impact air quality monitoring station AMS7 (Hong Kong SkyCity Marriott Hotel) has been relocated to AMS7A (Chu Kong Air-Sea Union Transportation Company Limited) on 3 February 2015. Action Level for air quality, as derived from the baseline monitoring data recorded at Hong Kong SkyCity Marriott Hotel, was adopted for this alternative air quality location.

2.1.4 As informed by the premises owner of (AMS7A) - Chu Kong Air-Sea Union Transportation Co. LTD would not grant us the permission to install air quality monitoring equipment (High volume sampler) and conduct 1-hour TSP/24 hour TSP monitoring at the premises of Chu Kong Air-Sea Union Transportation Co. LTD after December 2015. In order to fulfil the EM&A requirement of this Contract, as permission to conduct impact air quality monitoring at the premise of Hong Kong SkyCity Marriott Hotel has been granted in December 2015, ET proposed relocation of air quality monitoring station (AMS7A) on 15 December 2015, with no further comment received from IEC on 15 December 2015 and no particular comment received from EPD on 21 December 2015, the impact air quality monitoring station AMS7A (Chu Kong Air-Sea Union Transportation Company Limited) has been relocated to AMS7 (Hong Kong SkyCity Marriott Hotel) on 30 December 2015. The impact air quality monitoring for December 2015 was conducted before the relocation of AQM Station from AMS7A to AMS7. The impact air quality monitoring has been conducted at AMS7 (Hong Kong SkyCity Marriott Hotel) since 1 January 2016, Action Level for air quality, as derived from the baseline monitoring data recorded at Hong Kong SkyCity Marriott Hotel will be adopted for this air quality monitoring location.

2.1.5 In accordance with the Contract Specific EM&A Manual, twenty-one stations were designated for impact water quality monitoring. The nine Impact Stations (IS) were chosen on the basis of their proximity to the reclamation and thus the greatest potential for water quality impacts, the seven Sensitive Receiver Stations (SR) were chosen as they are close to the key sensitive receives and the

five Control/ Far Field Stations (CS) were chosen to facilitate comparison of the water quality of the IS stations with less influence by the Project/ ambient water quality conditions.

2.1.6 Due to safety concern and topographical condition of the original locations of SR4 and SR10B, alternative impact water quality monitoring stations, naming as SR4(N) and SR10B(N), were adopted, which are situated in vicinity of the original impact water quality monitoring stations (SR4 and SR10B) and could be reachable. Same baseline and Action Level for water quality, as derived from the baseline monitoring data recorded, were adopted for these alternative impact water quality monitoring stations.

2.1.7 The monitoring locations used during the reporting quarter are depicted in Figures 2, 3 and 4 respectively.

2.1.8 The Contract Specific EM&A Manual also required environmental site inspections for air quality, noise, water quality, chemical, waste management, marine ecology and landscape and visual impact.

2.2 Environmental Quality Performance (Action/Limit Levels)

2.2.1 The environmental quality performance limits (i.e. Action and/or Limit Levels) of air and water quality monitoring were derived from the baseline air and water quality monitoring results at the respective monitoring stations, while the environmental quality performance limits of noise monitoring were defined in the EM&A Manual.

2.2.2 The environmental quality performance limits of air quality, noise and water monitoring are given in Appendix D.

2.3 Environmental Mitigation Measures

2.3.1 Relevant environmental mitigation measures were stipulated in the Particular Specification and EPs (EP-353/2009/K and EP-354/2009/D) (for TMCLKL Southern Landfall Reclamation only) for the Contractor to adopt. A list of environmental mitigation measures and their implementation statuses are given in Appendix C.

3 MONITORING RESULTS

3.1 Air Quality Monitoring

3.1.1 In accordance with the Contract Specific EM&A Manual, impact 1-hour Total Suspended Particulates (TSP) monitoring was conducted for at least three times every 6 days, while impact 24-hour TSP monitoring was carried out for at least once every 6 days at the 4 monitoring stations (AMS2, AMS3B, AMS6 and AMS7).

3.1.2 The monitoring locations for impact air quality monitoring are depicted in Figure 2. However, for AMS6 (Dragonair/CNAC (Group) Building), permission on setting up and carrying out impact monitoring works was sought, however, access to the premise has not been granted yet on this report issuing date.

3.1.3 As informed by the premises owner of (AMS7A) - Chu Kong Air-Sea Union Transportation Co. LTD would not grant us the permission to install air quality monitoring equipment (High volume sampler) and conduct 1-hour TSP/24 hour TSP monitoring at the premises of Chu Kong Air-Sea Union Transportation Co. LTD after December 2015. In order to fulfil the EM&A requirement of this Contract, as permission to conduct impact air quality monitoring at the premise of Hong Kong SkyCity Marriott Hotel has been granted in December 2015, ET proposed relocation of air quality monitoring station (AMS7A) on 15 December 2015, with no further comment received from IEC on 15 December 2015 and no particular comment received from EPD on 21 December 2015, the impact air quality monitoring station AMS7A (Chu Kong Air-Sea Union Transportation Company Limited) has been relocated to AMS7 (Hong Kong SkyCity Marriott Hotel) on 30 December 2015. The impact air quality monitoring for December 2015 was conducted before the relocation of AQM Station from AMS7A to AMS7. The impact air quality monitoring for this report quarter were conducted at AMS7 (Hong Kong SkyCity Marriott Hotel), Action Level for air quality, as derived from the baseline monitoring data recorded at Hong Kong SkyCity Marriott Hotel will be adopted for this air quality monitoring location.

3.1.4 The weather was mostly fine and sunny, with occasional cloudy in the reporting quarter. The major dust source in the reporting quarter included construction activities from the Project, as well as nearby traffic emissions.

3.1.5 The number of monitoring events and exceedances recorded in each month of the reporting quarter are presented in Table 3.1 and Table 3.2 respectively.

Table 3.1 Summary of Number of Monitoring Events for 1-hr & 24-hr TSP Concentration

Monitoring Parameter	Location	No. of monitoring events		
		June 16	July 16	August 16
1-hr TSP	AMS2	18	15	15
	AMS3B	18	15	15
	AMS7	18	15	15
24-hr TSP	AMS2	6	5	5
	AMS3B	6	5	5
	AMS7	6	5	5

Table 3.2 Summary of Number of Exceedances for 1-hr & 24-hr TSP Monitoring

Monitoring Parameter	Location	Level of Exceedance	Numbers of Exceedance		
			June 16	July 16	August 16
1-hr TSP	AMS2	Action	0	0	0
		Limit	0	0	0
	AMS3B	Action	0	0	0
		Limit	0	0	0
	AMS7	Action	0	0	0
		Limit	0	0	0
		Total	***0***	***0***	***0***
24-hr TSP	AMS2	Action	0	0	0
		Limit	0	0	0

	AMS3B	Action	0	0	0
		Limit	0	0	0
	AMS7	Action	0	0	0
		Limit	0	0	0
		Total	***0***	***0***	***0***

3.1.6 All 24-Hour TSP and 1-Hour TSP results were below the Action and Limit Level in the reporting quarter.

3.1.7 The event action plan is annexed in Appendix K.

3.1.8 Meteorological information collected from the wind station during the monitoring periods on the monitoring dates, as shown in Figure 2, including wind speed and wind direction, is annexed in Appendix H of monthly EM&A report June 2016, July 2016 and August 2016 respectively.

3.1.9 Due to electricity failure, the 24-hour TSP monitoring at Station AMS2 - Tung Chung Development Pier was rescheduled from 4 Aug 2016 to 5 Aug 2016 due to electricity failure.

3.2 Noise Monitoring

3.2.1 Impact noise monitoring was conducted at the 2 monitoring stations (NMS2 and NMS3B) for at least once per week during 07:00 – 19:00 in the reporting quarter.

3.2.2 The monitoring locations used during the reporting quarter are depicted in Figure 2.

3.2.3 No Action or Limit Level Exceedance of construction noise was recorded in the reporting quarter.

3.2.4 Major noise sources during the noise monitoring included construction activities of the Project and nearby traffic noise.

3.2.5 The number of impact noise monitoring events and exceedances are summarized in Table 3.3 and Table 3.4 respectively.

Table 3.3 Summary of Number of Monitoring Events for Impact Noise

Monitoring Parameter	Location	No. of monitoring events		
		June 16	July 16	August 16
	NMS2	4	4	4
	NMS3B	4	4	4

Table 3.4 Summary of Number of Monitoring Exceedances for Impact Noise

Monitoring Parameter	Location	Level of Exceedance	Level of Exceedance		
			June 16	July 16	August 16
	NMS2	Action	0	0	0
		Limit	0	0	0
	NMS3B	Action	0	0	0
		Limit	0	0	0
		Total	***0***	***0***	***0***

3.2.6 The graphical plots of the trends of the monitoring results are provided in Appendix F. No specific trend of the monitoring results or existence of persistent pollution source was noted.

3.2.7 The event action plan is annexed in Appendix K.

3.3 Water Quality Monitoring

3.3.1 The monitoring locations used during the reporting quarter are depicted in Figure 3.

Table 3.5 Summary of Water Quality Exceedances in June 2016 – August 2016

Station	Exceedance Level	DO (S&M)		DO (Bottom)		Turbidity		SS		Total	
		Ebb	Flood	Ebb	Flood	Ebb	Flood	Ebb	Flood	Ebb	Flood
IS5	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS(Mf)6	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS7	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS8	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS(Mf)9	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS10	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS(Mf)11	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS(Mf)16	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
IS17	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR3	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR4(N)	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR5	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR6	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR7	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR10A	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
SR10B (N)	Action	0	0	0	0	0	0	0	0	0	0
	Limit	0	0	0	0	0	0	0	0	0	0
Total	**Action**	0	0	0	0	0	0	0	0	0	
	Limit	0	0	0	0	0	0	0	0	0	

Note: S: Surface;
M: Mid-depth;

3.3.2 For impact water quality monitoring, no exceedance was recorded at all monitoring stations in the reporting quarter.

3.3.3 Due to tropical cyclone warning signal no.3 or above was hoisted during the water quality monitoring scheduled on 1 August 2016 was cancelled except the monitoring locations named CSA, CS6, SR10B(N) and SR10A during Mid-Ebb Tide.

3.3.4 The event action plan is annexed in Appendix K.

3.4 Dolphin Monitoring

3.4.1 In accordance with the Contract Specific EM&A Manual, pre-set and fixed transect line vessel based dolphin survey was required in two AFCD designated areas (Northeast Lantau (NEL) and Northwest Lantau (NWL) survey areas). The impact dolphin monitoring at each survey area should be conducted twice per month.

3.4.2 The impact dolphin monitoring conducted is vessel-based and combines line-transect and photo-ID methodology, which have adopted similar survey methodologies as that adopted during baseline monitoring to facilitate comparisons between datasets.

3.4.3 The layout map of impact dolphin monitoring have been provided by AFCD and is shown in Figure 4.

3.4.4 The effort summary and sighting details during the reporting quarter are shown in the Appendix H. A summary of key findings of the dolphin surveys completed during the reporting quarter is shown below:

Table 3.6 Summary of Key Dolphin Survey Findings in June 2016 – August 2016

Number of Impact Surveys Completed^	6
Survey Distance Travelled under Favourable On- Effort Condition	639.7km
Number of Sightings	13 sightings (9 sightings are ”on effort” (which are all under favourable condition), 4 sightings are “opportunistic”)
Number of dolphin individual sighted	3.7 individuals (the best estimated group size)
Dolphin Encounter Rate#	NEL: 0 NWL: 2.1
Dolphin Group Size	Average of NEL: 0 Average of NWL: 3.7 Varied from 1-9 individuals
Most Often frequent dolphin sighting area	Northern Sha Chau and Lung Kwu Chau Marine Park, the western limit of NWL and Tai O area.

Remarks:
^ Completion of line transect survey of NEL and NWL survey area once was counted as one complete survey.
# Dolphin Encounter Rate = (Sum of 1st 2nd, 3rd month’s total sighting/ Sum of 1st , 2nd, 3rd month’s total effort)*100km (encounter rates are calculated using on effort sightings made under favourable conditions only.)

3.4.5 One (1) Limit Level exceedance of dolphin monitoring was recorded in the reporting quarter. After investigation, it was concluded that the HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual marine contracts) cannot be quantified nor separate from the other stress factors. Event Action Plan for Impact Dolphin Monitoring was triggered. For detail of investigation, please refer to appendix L.

Table 3.7 Summary of STG and ANI encounter rates in June 2016 – August 2016

	NEL	NWL	Level Exceeded
STG*	0	1.4	Limit
ANI**	0	4.6	

*Quarterly Average Encounter Rate of Number of Dolphin Sightings (STG) presents averaged encounter rates of the three monitored months in terms of groups per 100km per survey event.
STG Encounter rate = (Average of (total number sighting/total effort) of 1st and 2nd completed survey# of 1st month+ Average of (total number sighting/total effort) of 1st and 2nd completed survey# of 2nd month + Average of (total number sighting/total effort) of 1st and 2nd completed survey# of 3rd month)/3*100km
**Quarterly Average Encounter Rate of Total Number of Dolphins (ANI) presents averaged encounter rates of the three monitored months in terms of individuals per 100km per survey event.
ANI Encounter rate = (Average of (total number of Individual/total effort) of 1st and 2nd completed survey# of 1st month+ Average of (total number of Individual/total effort) of 1st and 2nd completed survey# of 2nd month + Average of (total number of Individual/total effort) of 1st and 2nd completed survey# of 3rd month +)/3*100km

3.4.6 Details of the comparison and analysis methodology and their findings and discussions are annexed in Appendix H.

3.5 Environmental Site Inspection and Audit

3.5.1 Site Inspections were carried out on a weekly basis to monitor the implementation of proper environmental pollution control and mitigation measures for the Project. In the reporting quarter, 13 site inspections were carried out. Recommendations on remedial actions were given to the Contractors for the deficiencies identified during the site audits.

3.5.2 Particular observations during the site inspections are described below:

Air Quality

3.5.3 The Contractor was reminded to affix a proper exception/approval label to the power pack at Portion E2 under NRMM regulation last reporting quarter. The Contractor subsequently rectified the situation in the reporting quarter. (Closed)

3.5.4 An excavator was observed without NNRM label. The Contractor was reminded to properly affix NNRM label to the excavator. The Contractor subsequently affix NRMM label onto the excavator. (Closed)

3.5.5 Idle ground breaking works area was observed, the Contractor was reminded to provide mitigation measures when there are active ground breaking activities last reporting quarter. The Contractor subsequently watering to the concerned area when there were active ground breaking activities. (Closed)

3.5.6 Fugitive dust was observed when vehicle passed through roads on site. The Contractor was reminded to provide mitigation measures such as dust suppression measures to effectively prevent generation of fugitive dust. (Reminder)

3.5.7 An excavator was observed without NNRM label at TKO fill bank area 137 sorting facility. The Contractor was reminded to properly affix NNRM label to the excavator. The Contractor subsequently affix NNRM label to the excavator. (Closed)

3.5.8 Fugitive dust generated during loading and unloading of rock materials was observed at Portion B on 14 July 2016 and near seawall on 21 July 2016. The Contractor should provide watering during the loading and unloading works properly. The Contractor subsequently provided watering during loading and unloading works. (Closed)

3.5.9 Fugitive dust was observed during handling of rock. The Contractor was reminded to provide dust suppression measures such as watering to during the handling of rock. The Contractor subsequently rectified the situation. (Closed)

3.5.10 An excavator was observed without NRMM label. The Contractor was advised to affix NRMM label properly onto the excavator. The Contractor subsequently affix NRMM label to the excavator. (Closed)

Noise

3.5.11 No relevant adverse impact was observed in the reporting quarter.

Water Quality

3.5.12 Silt curtain was observed temporarily disconnected near Portion D. The Contractor was reminded to ensure mitigation measures such as the silt curtain is properly maintained and implemented. The Contractor subsequently rectified the disconnected part of the silt curtain. (Closed)

3.5.13 Damaged drip tray was observed at Portion D. The Contractor should repair and replace the drip tray to avoid potential leakage. The contractor subsequently repaired the drip tray. (Closed)

3.5.14 Insufficient bunding was observed at entrance area of an idle landing barge 德大 1, the Contractor was reminded to provide measures to prevent runoff of turbid water to the sea when there are operations on this barge. (Reminder)

Chemical and Waste Management

3.5.15 The Contractor was reminded to dispose of general refuse regularly at Portion E2 properly. The Contractor subsequently cleared the generation refuse at Portion E2 in the reporting quarter. (Closed)

3.5.16 The Contractor was reminded to provide drip tray for the moveable light generator at Portion E2 last reporting quarter. The Contractor subsequently provided drip tray to the moveable light generator in the reporting quarter. (Closed)

3.5.17 Oil drums were observed without drip tray at workshop area of HKBCF Reclamation Works, the Contractor was advised to provide drip tray to all oil drums. The Contractor subsequently provided drip tray to oil drums. (Closed)

3.5.18 Chemical container placed on ground was observed at portion D. The Contractor should store the chemical containers with drip tray properly. The chemical container was subsequently removed by the Contractor from Portion D. (Closed)

3.5.19 General refuse was observed on southern edge of lands area near Portion B. The Contractor was reminded to keep the site clean and tidy. The Contractor subsequently collected the general refuse on southern edge of lands area near Portion B. (Closed)

3.5.20 Floating refuse was observed at Portion D, the Contractor was reminded to collect them and dispose them and dispose them of properly. The Contractor subsequently collected the general refuse on sea. (Closed)

Landscape and Visual Impact

3.5.21 No relevant adverse impact was observed in the reporting quarter.

Others

3.5.22 Rectifications of remaining identified items are undergoing by the Contractor. Follow-up inspections on the status on provision of mitigation measures will be conducted to ensure all identified items are mitigated properly.

4 ADVICE ON THE SOLID AND LIQUID WASTE MANAGEMENT STATUS

4.1 Summary of Solid and Liquid Waste Management

4.1.1 The Contractor registered as a chemical waste producer for this project. Sufficient numbers of receptacles were available for general refuse collection and sorting.

4.1.2 As advised by the Contractor, 156m^3 hard rock and large broken concrete, 96759.2m^3 of inert C&D Materials generated and reused in other Projects; 101149.4m^3 of Imported fill; 420kg paper/cardboard packaging, 182m^3 other C&D waste such as general refuse were generated and disposed of in the reporting period. Monthly summary of waste flow table is detailed in Appendix I.

4.1.3 The Contractor is advised to properly maintain on site C&D materials and wastes collection, sorting and recording system, dispose of C&D materials and wastes at designated ground and maximize reuse / recycle of C&D materials and wastes. The Contractor is reminded to properly maintain the site tidiness and dispose of the wastes accumulated on site regularly and properly.

4.1.4 The Contractor is reminded that chemical waste containers should be properly treated and stored temporarily in designated chemical waste storage area on site in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

4.1.5 The treated marine sediment and/or treated excavated filling material specified by Contract no. HY/2013/01 has been received as public fill for Contract no. HY/2010/02's reclamation filling works since January 2015. As informed by the Contractor in the last reporting quarter, such site arrangement has been discontinued since 24 February 2016.

4.1.6 After checking with the Contractor, 539857.2m^3 of surcharge material was removed off site to Macau during the reporting quarter and it is continued in the reporting quarter. Surplus surcharge was exported to Macau during the reporting quarter. The Contractor was reminded to ensure consistency in quantities in case of any C&D material disposed off-site and/or no surcharge material removed off site.

5 IMPLEMENTATION STATUS OF ENVIRONMENTAL MITIGATION MEASURES

5.1 Implementation Status of Environmental Mitigation Measures

5.1.1 In response to the site audit findings, the Contractors carried out corrective actions.

5.1.2 A summary of the Implementation Schedule of Environmental Mitigation Measures (EMIS) is presented in Appendix C. Most of the recommended mitigation measures are being upheld. Moreover, regular review and checking on the construction methodologies, working processes and plants were carried out to ensure the environmental impacts were kept minimal and recommended environmental mitigation measures were implemented effectively.

5.1.3 Training of marine travel route for marine vessels operator was given to relevant staff and relevant records were kept properly.

5.1.4 Regarding the implementation of dolphin monitoring and protection measures (i.e. implementation of Dolphin Watching Plan, Dolphin Exclusion Zone and Silt Curtain integrity Check), regular checks were conducted by experienced MMOs within the works area to ensure that no dolphins were trapped by the silt curtain area. There were no dolphins spotted within the silt curtain during this quarter. The relevant procedures were followed and all measures were well implemented. The silt curtains were also inspected in accordance to the submitted plan.

5.1.5 Acoustic decoupling measures on noisy plants on construction vessels were checked regularly and the Contractor was reminded to ensure provision of ongoing maintenance to noisy plants and to carry out improvement work once insufficient acoustic decoupling measures were found.

5.1.6 Frequency of watering per day on exposed soil was checked; with reference to the record provided by the Contract, watering was conducted at least 8 times per day on reclaimed land. The frequency of watering is the mainly refer to water truck. Sprinklers are only served to strengthen dust control measure for busy traffic at the entrance of Portion D. As informed by the Contractor, during the mal-function period of sprinkler, water truck will enhance watering at such area. The Contractor was reminded to ensure provision of watering of at least 8 times per day on all exposed soil within the reporting period.

5.1.7 As informed by the Contractor, the perimeter silt curtain near Portion B of HKBCF has been arranged on 3 February 2016. A notification on the concerned site arrangement of the perimeter silt curtain of Contract HY/2010/02 was sent to IEC/ENPO by the ET for their review on 8 March 2016, IEC/ENPO issued comments on 10 March 2016 and the notification of realignment of perimeter silt curtain is under ET's further review in the reporting quarter. The concerned notification on the concerned site arrangement of the perimeter silt curtain of Contract HY/2010/02 will be sent to the Authority once the review is completed.

5.1.8 Further to our letter (ET's letter's ref.: 60249820/rmky16033001) dated 30/3/2016 regarding the notification of silt curtain removal programme and arrangement, as informed by RSS on 18 May 2016, the Contractor provided an updated programme on 17 May 2016 to indicate the current site situation. According to CHEC's latest removal programme during the reporting quarter, stage 1 (southern section of Portion B) removal work was rescheduled and therefore not carried out in June 2016. Tentative completion for stage 1 removal work and dates for the subsequent stages have also been updated in the reporting quarter, while the overall phasing arrangement has not changed. A notification letter was prepared in the reporting quarter and sent to IEC/ENPO on 1 June 2016 via email to inform them that the removal of perimeter silt curtain of Stages 1, 2, 3 and 4 has been rescheduled. IEC/ENPO expressed on 7 June 2016 that the update on the proposal is mainly on time schedule and as such, they have no objection in principle. However prior to IEC/ENPO's reply to confirm ET's updated proposal, ET was requested to provide site photos to show ET's checking of the current site condition with respect to the reminders given in their previous letter (Our Ref.: HYDHZMBEEM00_0_4102L.16 dated 22 April 2016). After checking, it is noted that seawall and reclamation filling at the concerned section were completed and as informed by the Contractor, Stages 1 removal of the perimeter silt curtain has been completed on 20 August 2016.

5.1.9 After review, 1 floating grout production was in operation at any time in this reporting quarter for Contract No.HY/2010/02. Condition 3.26A of EP-353/2009/K for Contract No.HY/2010/02 is complied with during the reporting quarter.

6 SUMMARY OF EXCEEDANCES OF THE ENVIRONMENTAL QUALITY PERFORMANCE LIMIT

6.1 Summary of Exceedances of the Environmental Quality Performance Limit

6.1.1 All 1-Hour TSP and 24-Hour TSP results were below the Action and Limit Level in the reporting quarter.

6.1.2 For construction noise, no exceedance was recorded at all monitoring stations in the reporting quarter.

6.1.3 For impact water quality monitoring, no exceedance was recorded at all monitoring stations in the reporting quarter.

6.1.4 One (1) Limit Level exceedance of dolphin monitoring was recorded in the reporting quarter. After investigation, it was concluded that the HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual marine contracts) cannot be quantified nor separate from the other stress factors. Event Action Plan for Impact Dolphin Monitoring was triggered. For detail of investigation, please refer to appendix L.

6.1.5 1 complaint about marine litter near Tuen Mun Ferry Pier was received on 16 Jul 2016, 9:19am. The complainant complained that pollution was observed at Tuen Mun Ferry Pier and queried whether the pollutant came from the construction sites of the Lantau area or bridge construction. After investigation, it is considered the marine litter floating near the Tuen Mun Ferry Pier is unlikely to be related to this Contract.

6.1.6 No notification of summons or prosecution was received in the reporting period.

6.1.7 Cumulative statistics on exceedances is provided in Appendix J.

7 SUMMARY OF COMPLAINTS, NOTIFICATION OF SUMMONS AND SUCCESSFUL PROSECUTIONS

7.1 Summary of Environmental Complaints, Notification of Summons and Successful Prosecutions

7.1.1 The Environmental Complaint Handling Procedure is annexed in Figure 5.

7.1.2 A complaint about marine litter near Tuen Mun Ferry Pier was received on 16 Jul 2016, 9:19am, also refer to below photo. The complainant complained that pollution was observed at Tuen Mun Ferry Pier and queried whether the pollutant came from the construction sites of the Lantau area or bridge construction.

7.1.2.1 Investigation actions:

1: Review of the information and provided by the complainant
2: Review the work activities conducted by Contract HY/2010/02 HKBCF Reclamation on 16 July 2016.
3. Review site condition

7.1.2.2 Investigation results:

- The photo provided by the complainant was reviewed and it shows that marine litter floating on sea near Tuen Mun Ferry Pier.

- Information provided by the Contractor was checked, marine activities being conducted by Contract HY/2010/02 on 16 July 2016 were accroprode/rock-fill placement for the construction of the seawall by using a pelican with mechanical grab. In addition, since the location of Tuen Mun Ferry Pier is approximately 5km away from the active works contract HY/2010/02, these construction activities are unlikely related to the floating litter on sea observed near Tuen Mun Ferry Pier on 16 July 2016.

- Joint site inspection was also conducted on 21 July 2016 with the Contractor, IEC, ET and RSS. No litter was observed on sea during the inspection of the perimeter of HKBCF reclamation works.

- As such, it is considered the marine litter floating near the Tuen Mun Ferry Pier is unlikely to be related to this Contract.

7.1.2.3 Nevertheless, the Contractor was reminded to continue to fully maintain all waste management mitigation measures.

7.1.3 No notification of summons or prosecution was received in the reporting quarter.

7.1.4 Statistics on complaints, notifications of summons and successful prosecutions are summarized in Appendix N.

8 COMMENTS, RECOMMENDATIONS AND CONCLUSIONS

8.1 Comments on mitigation measures

8.1.1 According to the environmental site inspections performed in the reporting quarter, the following recommendations were provided:

Air Quality Impact

- All working plants and vessels on site should be regularly inspected and properly maintained to avoid dark smoke emission.
- All vehicles should be washed to remove any dusty materials before leaving the site.
- Haul roads should be sufficiently dampened to minimize fugitive dust generation.
- Wheel washing facilities should be properly maintained and reviewed to ensure properly functioning.
- Temporary exposed slopes and open stockpiles should be properly covered.
- Enclosure should be erected for cement debagging, batching and mixing operations.
- Water spraying should be provided to suppress fugitive dust for any dusty construction activity.
- Regular review and provide maintenance to dust control measures such as sprinkler system.

Construction Noise Impact

- Quieter powered mechanical equipment should be used as far as possible.
- Noisy operations should be oriented to a direction away from sensitive receivers as far as possible.
- Proper and effective noise control measures for operating equipment and machinery on-site should be provided, such as erection of movable noise barriers or enclosure for noisy plants. Closely check and replace the sound insulation materials regularly
- Vessels and equipment operating should be checked regularly and properly maintained.
- Noise Emission Label (NEL) shall be affixed to the air compressor and hand-held breaker operating within works area.
- Acoustic decoupling measures should be properly implemented for all existing and incoming construction vessels with continuous and regularly checking to ensure effective implementation of acoustic decoupling measures.

Water Quality Impact

- Regular review and maintenance of silt curtain systems, drainage systems and desilting facilities in order to make sure they are functioning effectively.
- Construction of seawall should be completed as early as possible.
- Regular inspect and review the loading process from barges to avoid splashing of material.
- Silt, debris and leaves accumulated at public drains, wheel washing bays and perimeter u-channels and desilting facilities should be cleaned up regularly.
- Silty effluent should be treated/ desilted before discharged. Untreated effluent should be prevented from entering public drain channel.

- Proper drainage channels/bunds should be provided at the site boundaries to collect/intercept the surface run-off from works areas.
- Exposed slopes and stockpiles should be covered up properly during rainstorm.

Chemical and Waste Management

- All types of wastes, both on land and floating in the sea, should be collected and sorted properly and disposed of timely and properly. They should be properly stored in designated areas within works areas temporarily.
- All chemical containers and oil drums should be properly stored and labelled.
- All plants and vehicles on site should be properly maintained to prevent oil leakage.
- All kinds of maintenance works should be carried out within roofed, paved and confined areas.
- All drain holes of the drip trays utilized within works areas should be properly plugged to avoid any oil and chemical waste leakage.
- Oil stains on soil surface and empty chemical containers should be cleared and disposed of as chemical waste.
- Regular review should be conducted for working barges and patrol boats to ensure sufficient measures and spill control kits were provided on working barges and patrol boats to avoid any spreading of leaked oil/chemicals.

Landscape and Visual Impact

- All existing, retained/transplanted trees at the works areas should be properly fenced off and regularly inspected.
- Control night-time lighting and glare by hooding all lights.

8.2 Recommendations on EM&A Programme

8.2.1 The impact monitoring programme for air quality, noise, water quality and dolphin ensured that any deterioration in environmental condition was readily detected and timely actions taken to rectify any non-compliance. Assessment and analysis of monitoring results collected demonstrated the environmental impacts of the Project. With implementation of recommended effective environmental mitigation measures, the Project's environmental impacts were considered as environmentally acceptable. The weekly environmental site inspections ensured that all the environmental mitigation measures recommended were effectively implemented.

8.2.2 The recommended environmental mitigation measures, as included in the EM&A programme, effectively minimize the potential environmental impacts from the Project. Also, the EM&A programme effectively monitored the environmental impacts from the construction activities and ensure the proper implementation of mitigation measures. No particular recommendation was advised for the improvement of the programme.

8.3 Conclusions

8.3.1 The construction phase and EM&A programme of the Project commenced on 12 March 2012.

8.3.2 All 1-Hour TSP and 24-Hour TSP results were below the Action and Limit Level in the reporting quarter.

8.3.3 For construction noise, no exceedance was recorded at all monitoring stations in the reporting quarter.

8.3.4 For impact water quality monitoring, no exceedance was recorded at all monitoring stations in the reporting quarter.

8.3.5 One (1) Limit Level exceedance of dolphin monitoring was recorded in the reporting quarter. After investigation, it was concluded that the HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual marine contracts) cannot be quantified nor separate from the other stress factors. Event Action Plan for Impact Dolphin Monitoring was triggered. For detail of investigation, please refer to appendix L.

8.3.6 Environmental site inspection was carried out 13 times in the reporting quarter. Recommendations on remedial actions were given to the Contractors for the deficiencies identified during the site audits.

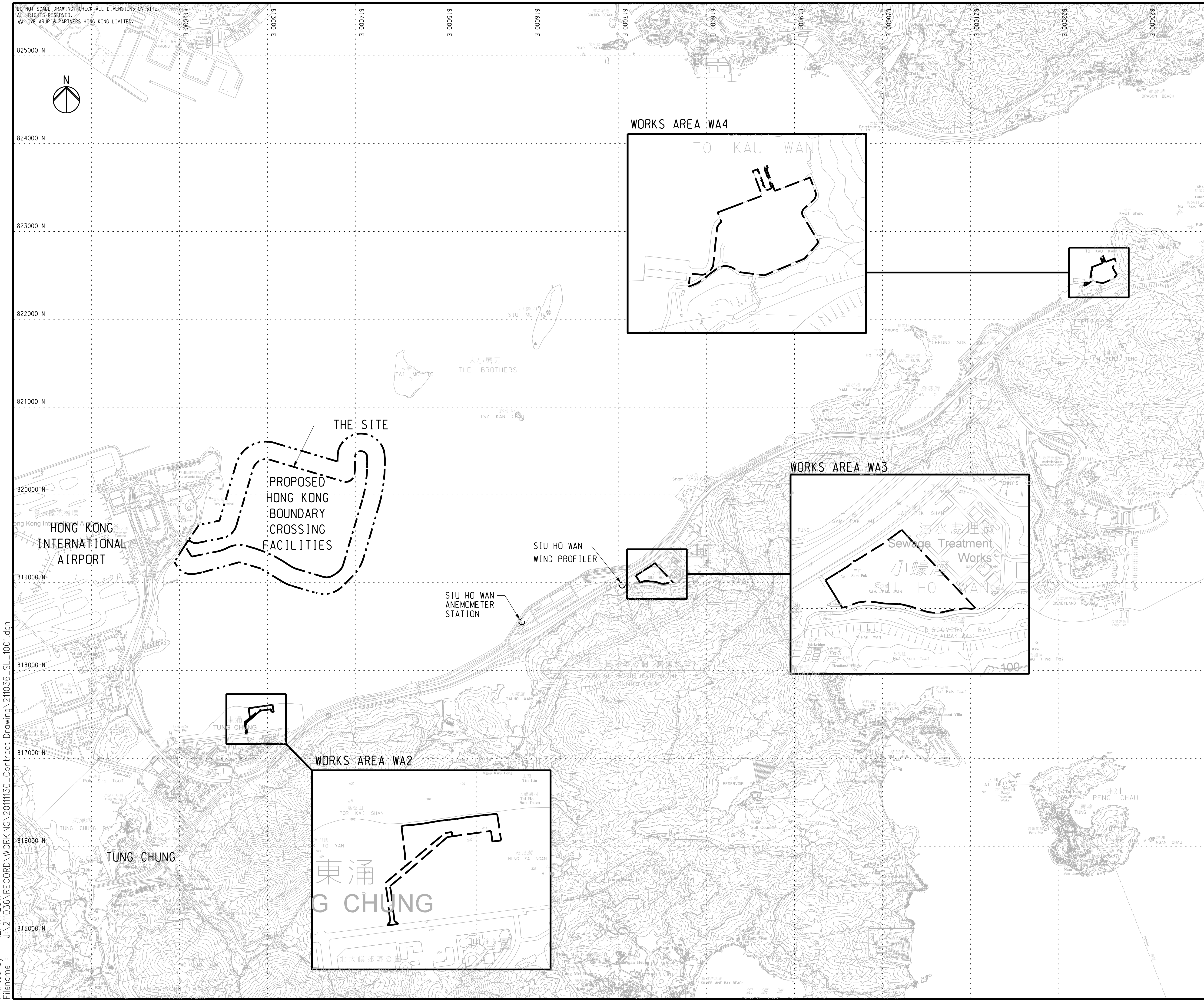
8.3.7 1 complaint about marine litter near Tuen Mun Ferry Pier was received on 16 Jul 2016, 9:19am. The complainant complained that pollution was observed at Tuen Mun Ferry Pier and queried whether the pollutant came from the construction sites of the Lantau area or bridge construction. After investigation, it is considered the marine litter floating near the Tuen Mun Ferry Pier is unlikely to be related to this Contract.

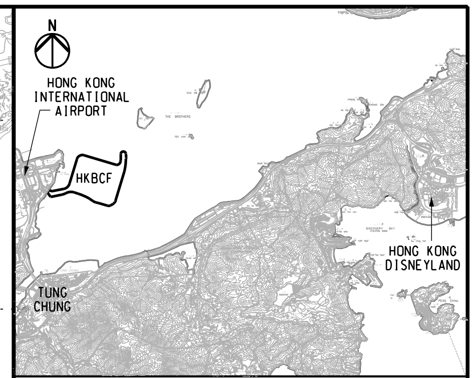
8.3.8 No notification of summons or prosecution was received in the reporting quarter.

8.3.9 Apart from the above mentioned monitoring, most of the recommended mitigation measures, as included in the EM&A programme, were implemented properly in the reporting quarter.

8.3.10 The recommended environmental mitigation measures effectively minimize the potential environmental impacts from the Contract. The EM&A programme effectively monitored the environmental impacts from the construction activities and ensure the proper implementation of mitigation measures. No particular recommendation was advised for the improvement of the programme.

8.3.11 Moreover, regular review and checking on the construction methodologies, working processes and plants were carried out to ensure the environmental impacts were kept minimal and recommended environmental mitigation measures were implemented effectively.





KEY PLAN

NOTES

1. ALL COORDINATES ARE RELATED TO HONG KONG 1980 GRID.
2. ALL LEVELS ARE IN METRES ABOVE HONG KONG PRINCIPAL DATUM (mPD).
3. REFER TO DRG NO. 211036/SL/1002 FOR THE DEFINITION OF SETTING OUT LINE (SOL) FOR THE HONG KONG BOUNDARY CROSSING FACILITIES (HKBCF) RECLAMATION SITE.
4. REFER TO DRG NO. 211036/SL/1004 FOR DETAILS OF SITE BOUNDARY.
5. FOR EXTENT OF SORTING FACILITIES AT FILL BANK AT TSEUNG KWAN O AREA 137 REFER TO DRG NO. 211036/SL/1015.

LEGEND

- SITE BOUNDARY
- SETTING OUT LINE (SOL)
- WORKS AREA BOUNDARY

Rev	Description	By	Date
-	FOR CONSTRUCTION	HYJL	11/11

Consultant

ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Supported By : Ecosystems Ltd.
EDA Marine Ltd.
Geotechnical Consulting Group (Asia) Ltd.
Hong Kong Cetacean Research Project
InteliBuild Technyx Asia Limited
Tony Gee and Partners LLP

Contract No. and Title:

Contract No. HY/2010/02
Hong Kong-Zhuhai-Macao Bridge
Hong Kong Boundary Crossing Facilities
- Reclamation Works

Drawing title

KEY PLAN

Drawing no.	Rev.
211036/SL/1001	-

Drawn	Date	Checked	Approved
RL	11/09	KKY	DML

Scale 1:20000 @A1 1:40000 @A3

Status WORKING

路政署
HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

Printed by : 12/17/2011
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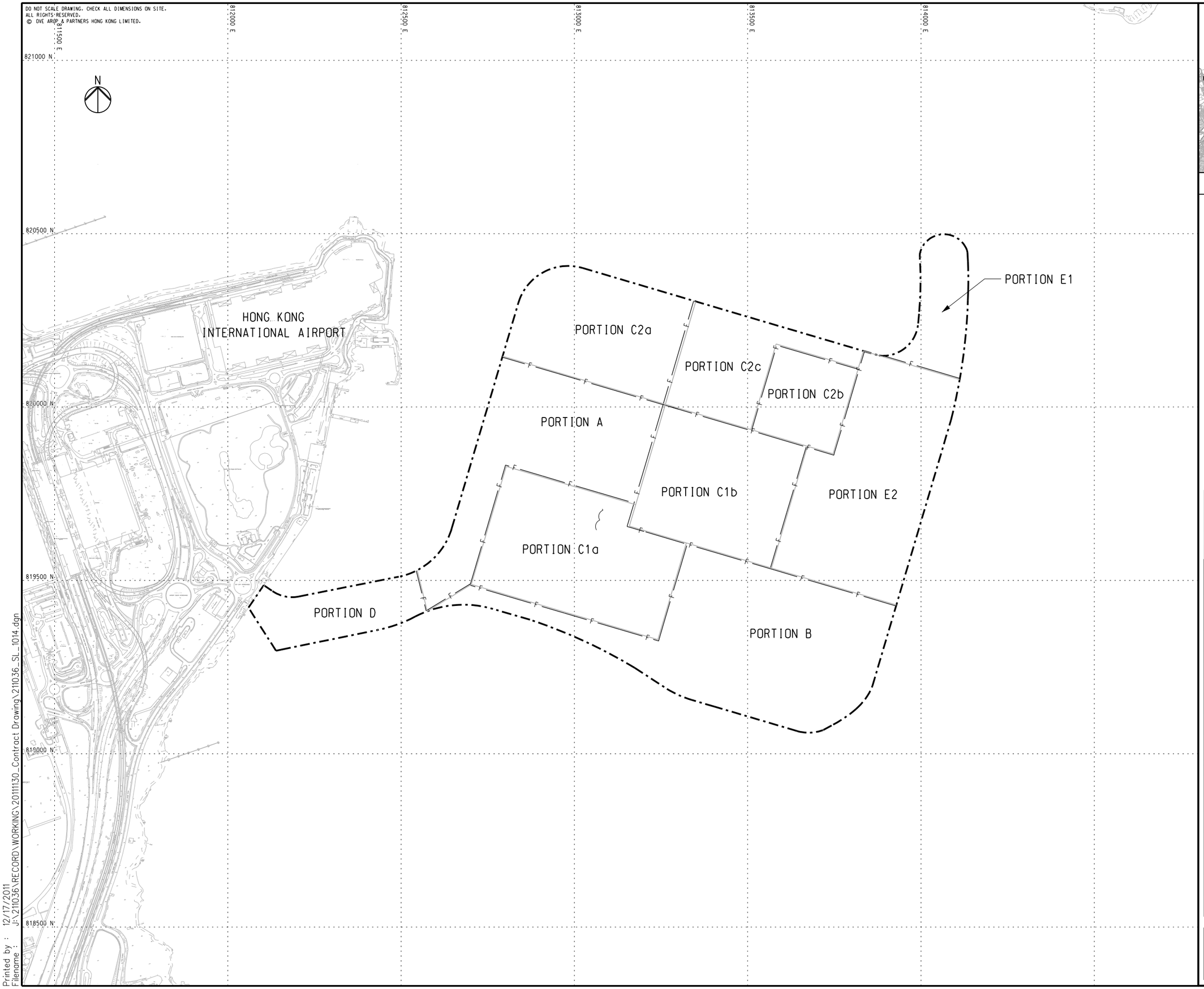

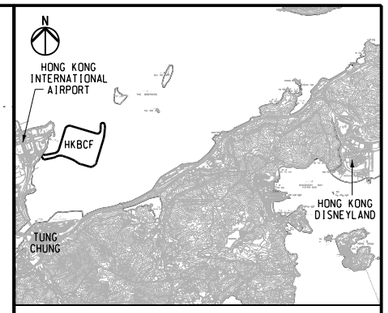

KEY PLAN

NOTES

1. FOR LEGENDS AND NOTES FOR CHAIN LINK FENCE AND GATE REFER TO DRG NO. 211036/SL/1013.
2. THE ERECTION OF CHAIN LINK FENCE AND GATES SHALL BE COMPLETED BY THE HANDOVER DATE OF EACH PORTION OF SITE, OR AS INSTRUCTED BY THE ENGINEER.
3. FOR SETTING OUT COORDINATES OF DIFFERENT PORTIONS OF SITE REFER TO DRG NO. 211036/SL/1003.
4. ACCESS POINTS BETWEEN PORTIONS SHALL BE PROVIDED BY THE CONTRACTOR. AND THE LOCATIONS SHALL BE AGREED WITH THE ENGINEER ON SITE.
5. FOR HOARDING AND FENCE AT FILL BANK AT TSEUNG KWAN O AREA 137 REFER TO DRG NO. 211036/SL/1015.

LEGEND

- SETTING OUT LINE (SOL)
- WORKS AREA BOUNDARY
- PORTIONS BOUNDARY LINE

Rev	Description	By	Date
-	FOR CONSTRUCTION	HYJL	11/11

Consultant

ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Supported By :
- Ecosystems Ltd.
- EDA Marine Ltd.
- Geotechnical Consulting Group (Asia) Ltd.
- Hong Kong Cetacean Research Project
- InteliBuild Technyx Asia Limited
- Tony Gee and Partners LLP

Contract No. and Title:
Contract No. HY/2010/02
Hong Kong-Zhuhai-Macao Bridge
Hong Kong Boundary Crossing Facilities
- Reclamation Works

Drawing title
WORKS AREA LAYOUT
AND HORADING PLAN
(SHEET 2 OF 3)

Drawing no.	Rev.
211036/SL/1014	-

Drawn	Date	Checked	Approved
RL	06/10	KKY	DML

Scale 1:5000 @A1 1:10000 @A3
Status WORKING

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

Printed by : 12/17/2011
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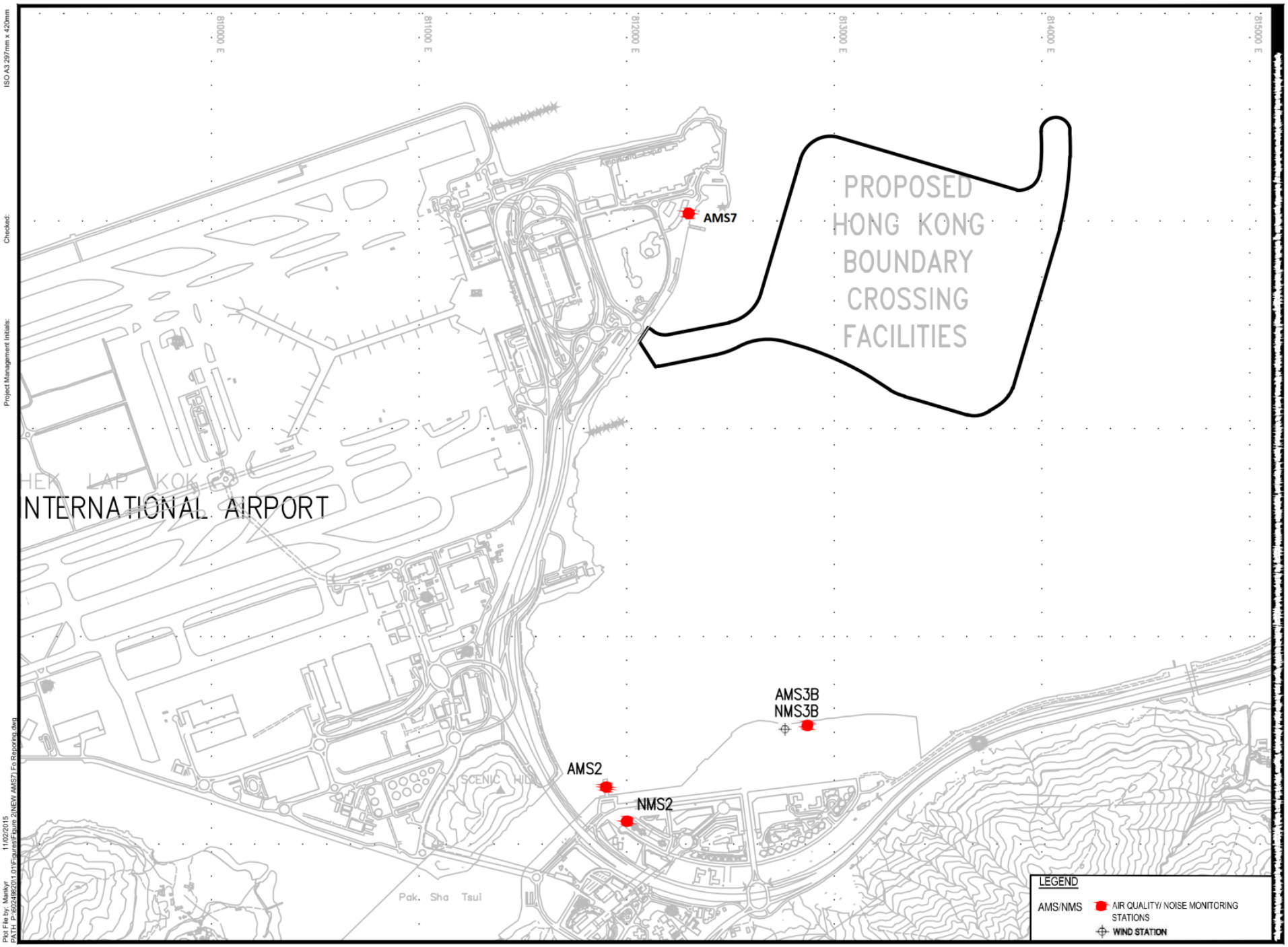

AIR QUALITY AND NOISE MONITORING STATIONS FOR HKBCF

HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

Project No.: -

Date: JANUARY 2015

Figure 2

ISO A3 297mm x 420mm

Checked:

Project Management Initials:

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Plot File by: Kwokhc
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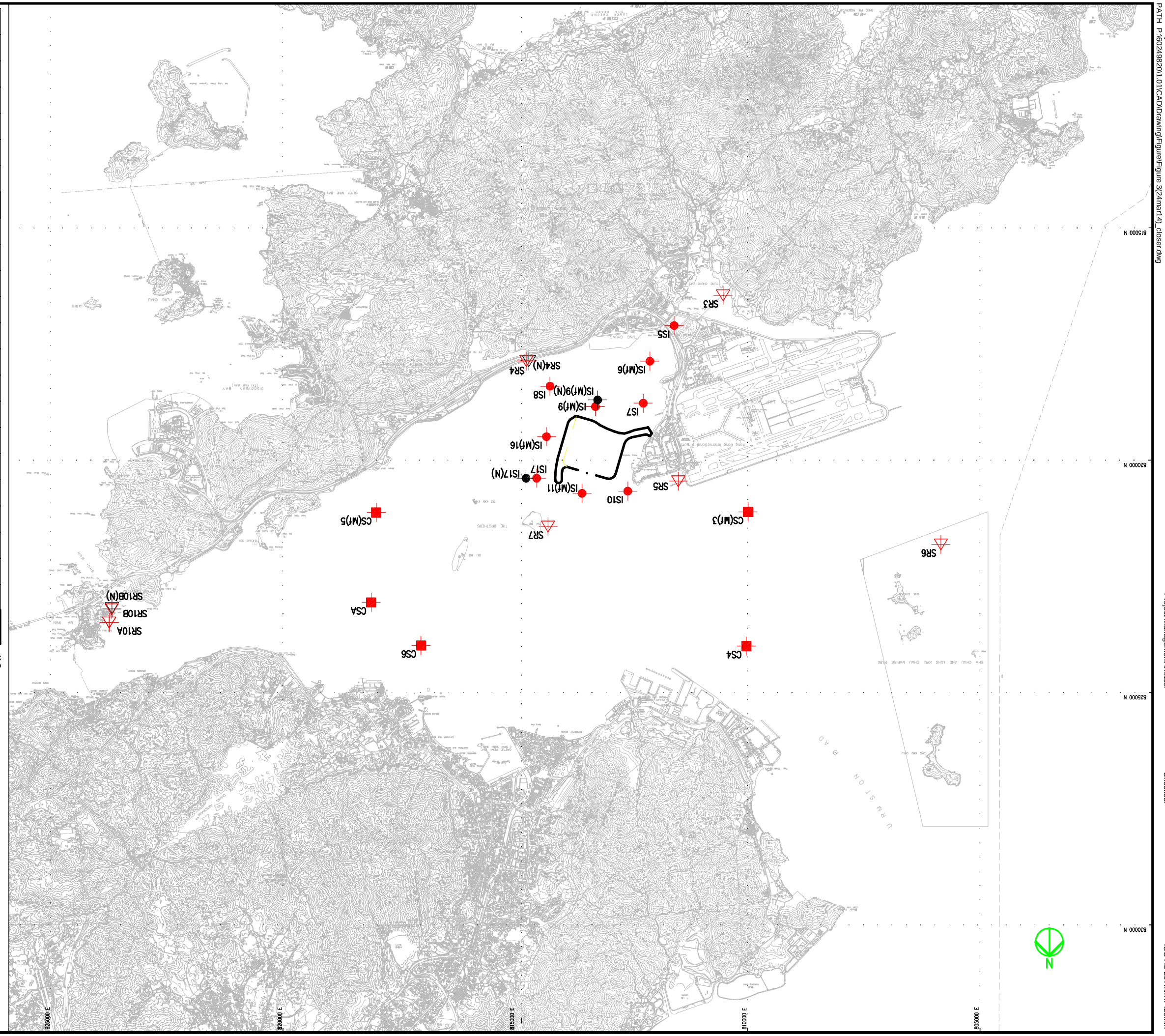
25/03/2014

Project Management Initials:

Checked:

ISO A3 297mm x 420mm



MONITORING STATIONS	CO-ORDINATES	
	EASTING	NORTHING
IS5	811579	817106
IS(M)6	812101	817873
IS7	812244	818777
IS8	814251	818412
IS(M)9	813273	818850
IS(M)9(N)	813226	818708
IS10	812577	820670
IS(M)11	813562	820716
IS(M)16	814328	819497
IS17	814539	820391
IS17(N)	814767	820391
SR3	810525	816456
SR4(N)	814705	817859
SR5	811489	820455
SR6	805837	821818
SR7	814293	821431
SR10A	823741	823495
SR10B(N)	823683	823187
CS(M)3	809989	821117
CS(M)5	817990	821129
CS4	810025	824004
CS6	817028	823992
CSA	818103	823064

SETTING OUT SCHEDULE

LEGEND

- IS — IMPACT STATIONS
- CS — CONTROL / FAR FIELD STATIONS
- SR — SENSITIVE RECEIVERS STATIONS
- SR — SENSITIVE RECEIVERS STATIONS (RELOCATED)
- IS — IMPACT STATIONS (RELOCATED)

HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

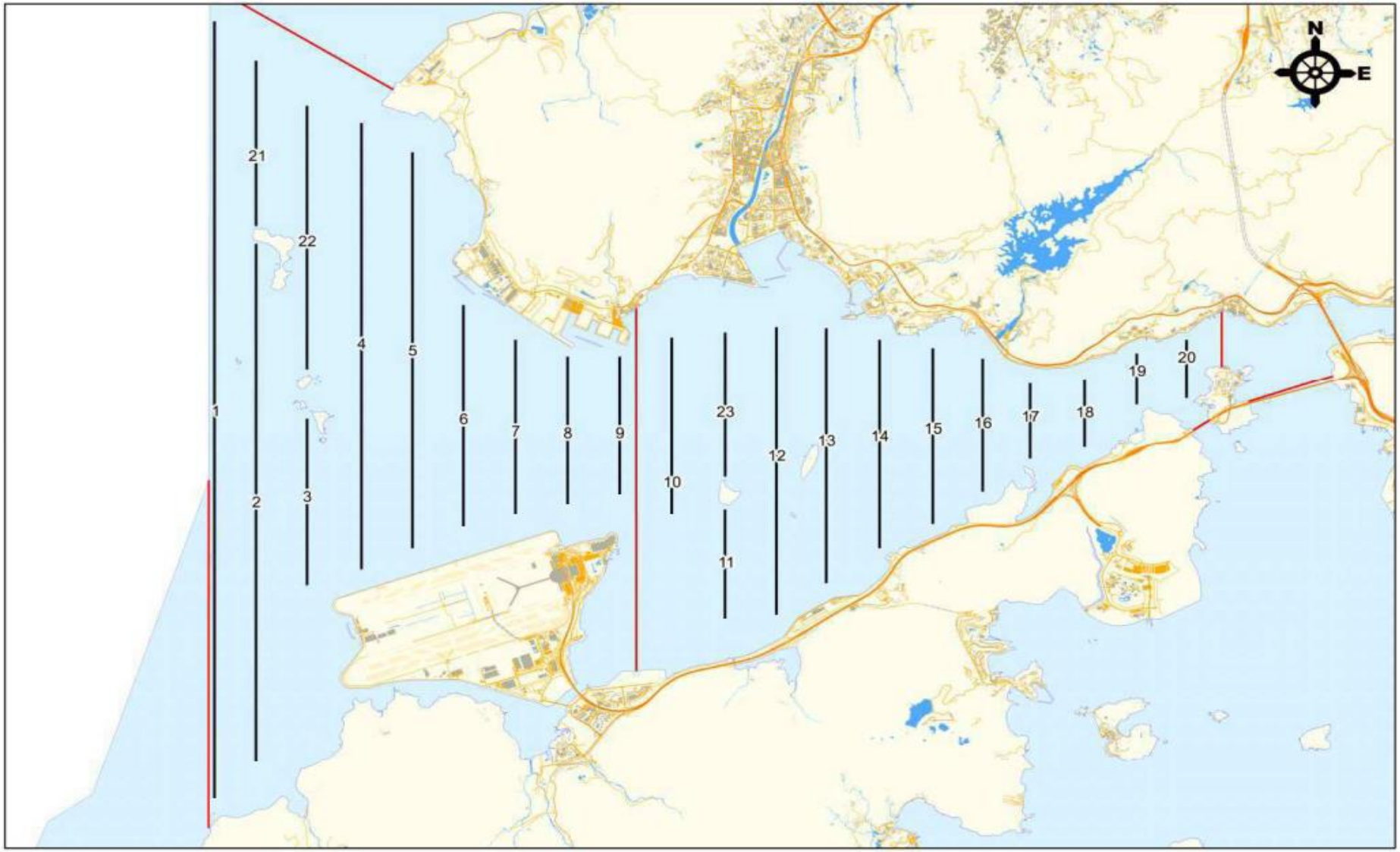
Project No.: -

Date: MAR 2014

WATER QUALITY MONITORING STATION

AECOM

Figure 3



Remarks:

***Transect 10 is now 3.6km in length due to the HKBCF construction site.**

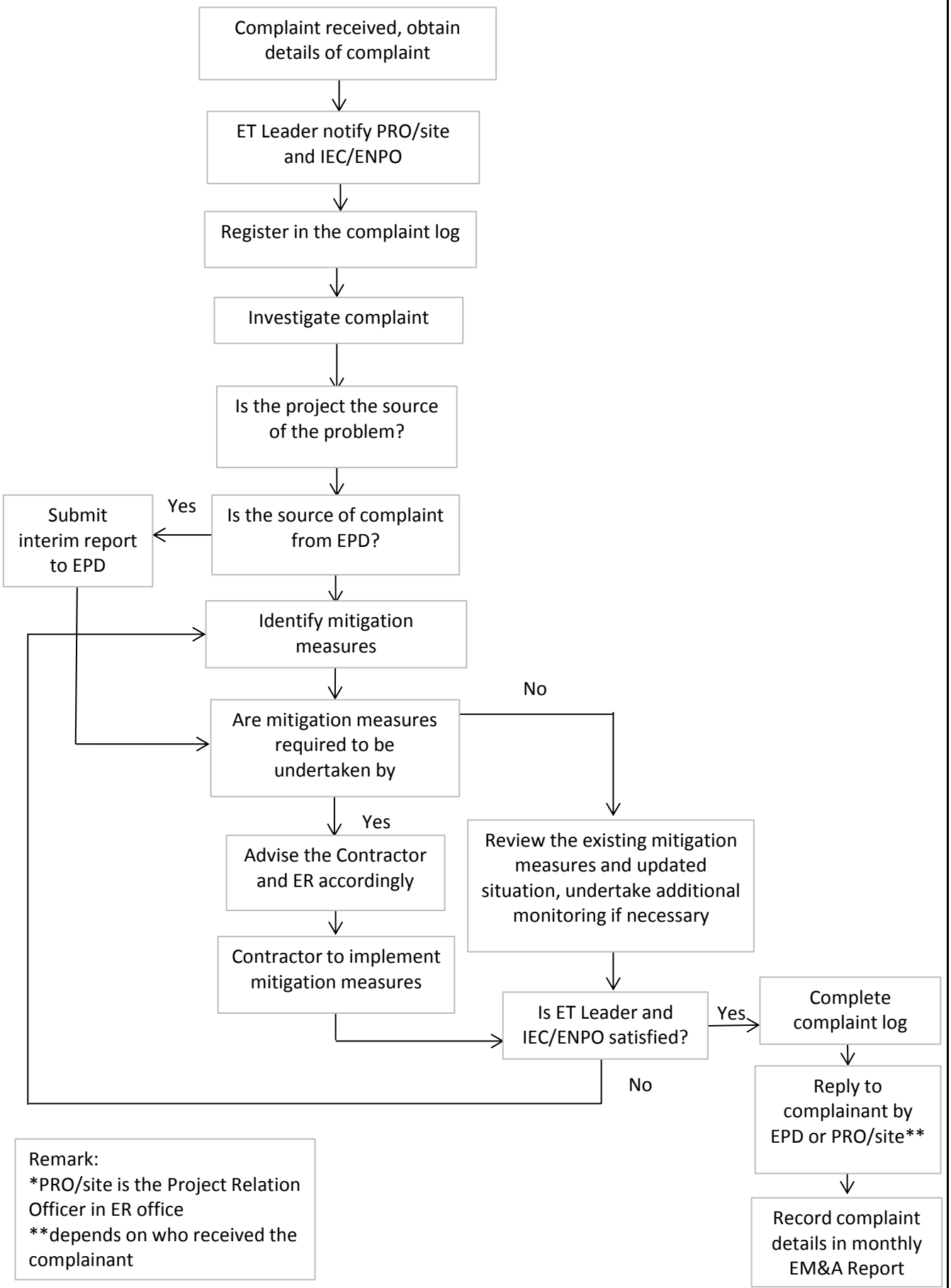
^Coordinates for transect lines 1, 2, 7, 8, 9 and 11 have been updated in respect to the Proposal for Alteration of Transect Line for Dolphin Monitoring approved by EPD on 19 August 2015. The total transect length for both NEL and NWL combined is 108km.

HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS
Project No.: 60249820 Date: November 2015

Impact Dolphin Monitoring
Line Transect Layout Map

AECOM

Figure 4



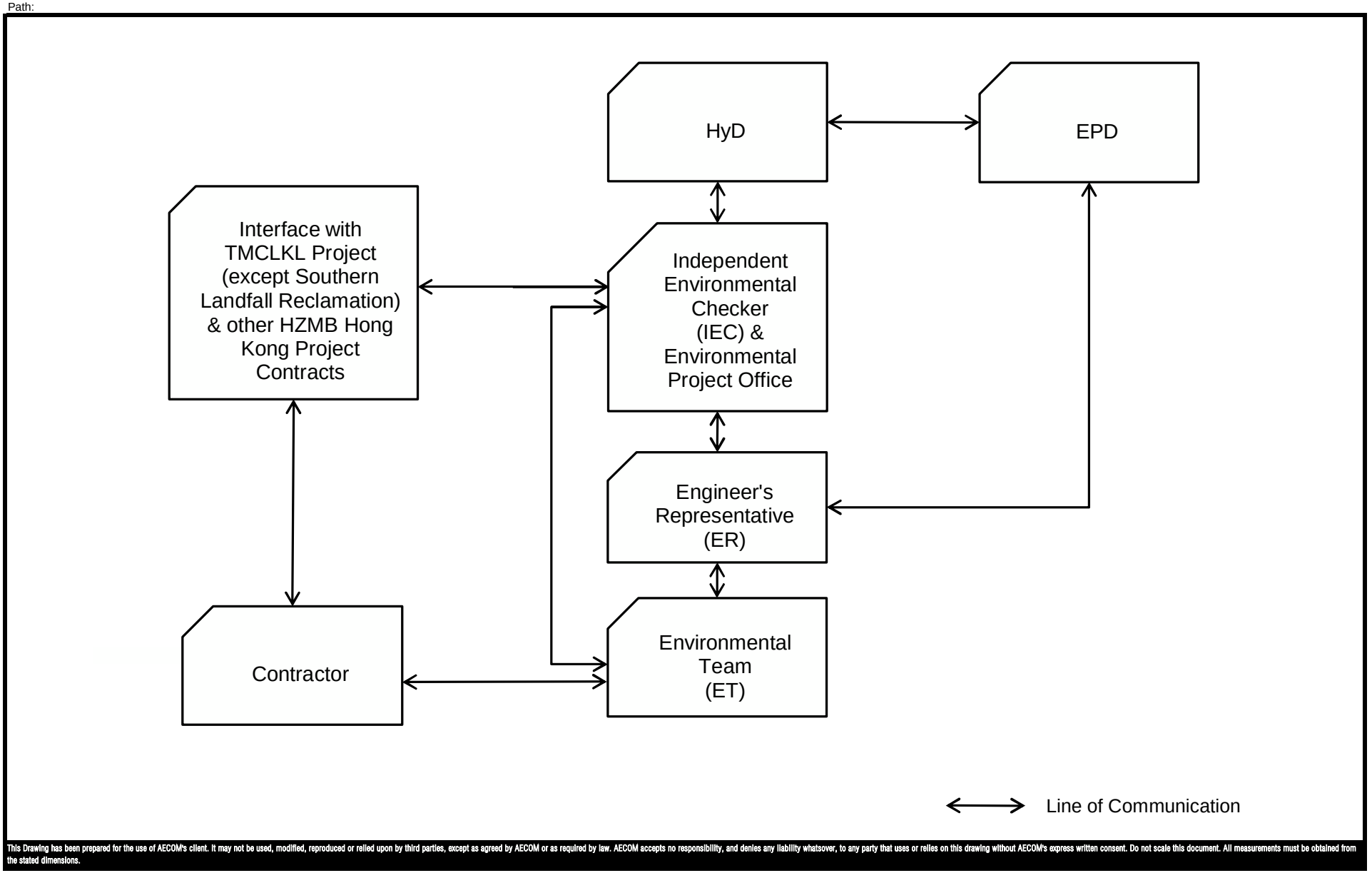
HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CORSSING FACILITIES
- RECLAMATION WORKS

AECOM

Environmental Complaint Handling Procedure

Project No.: 60249820 **Date: July 2012**

Figure 5



HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
--RECLAMATION WORKS
Project No.: 60249820 Date: April 2013

Contract Organisation for

Environmental Works

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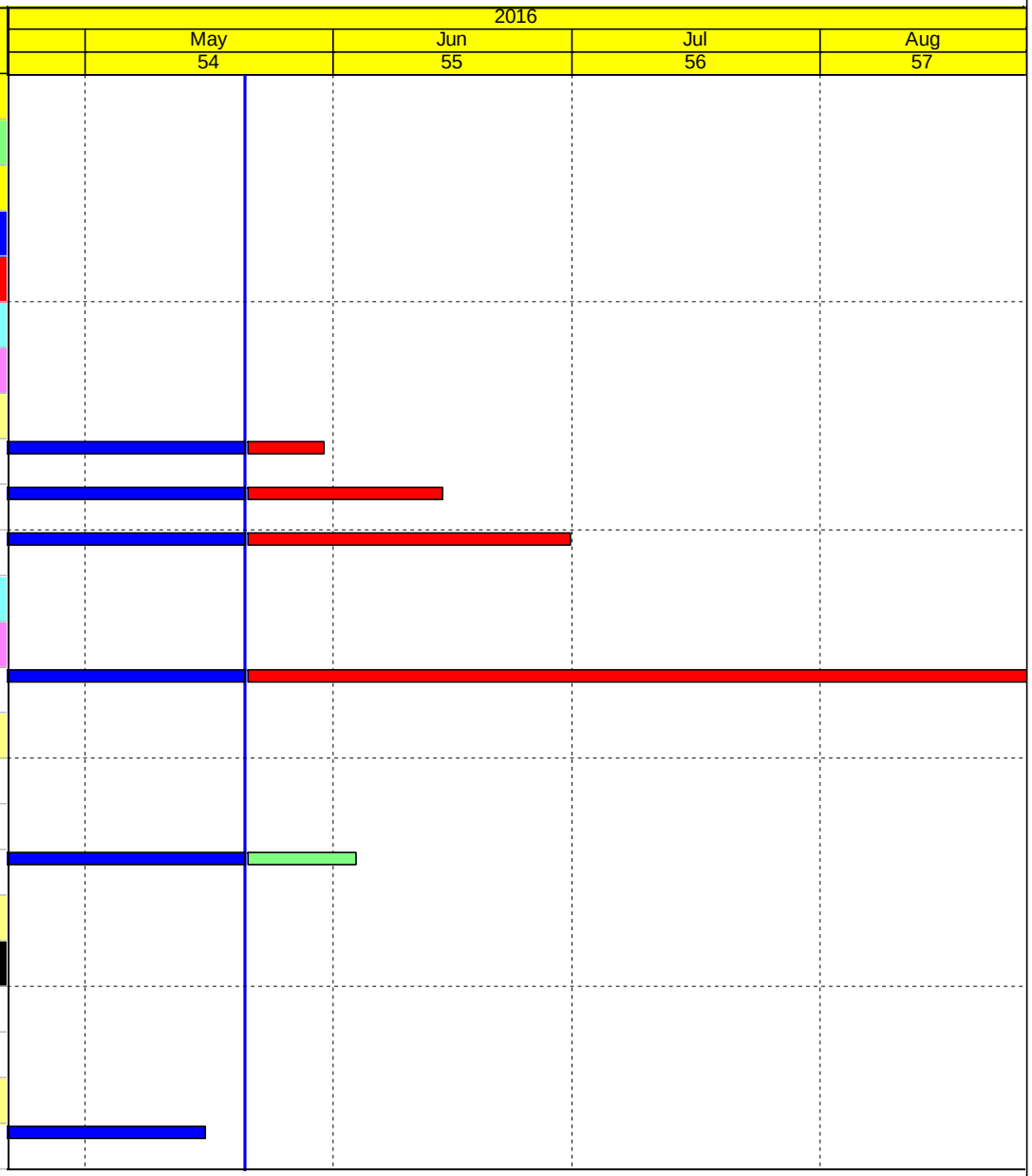
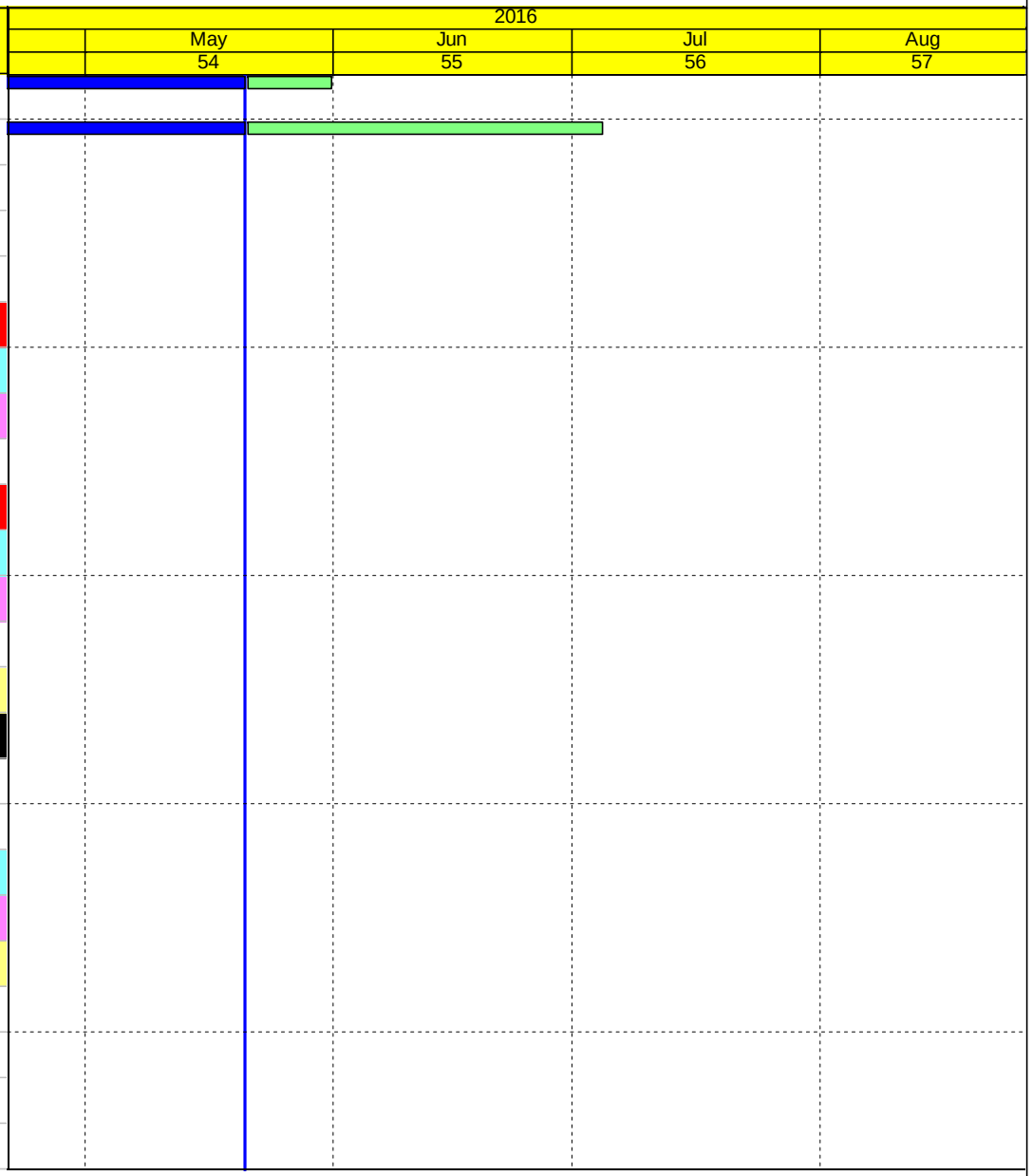
Appendix A

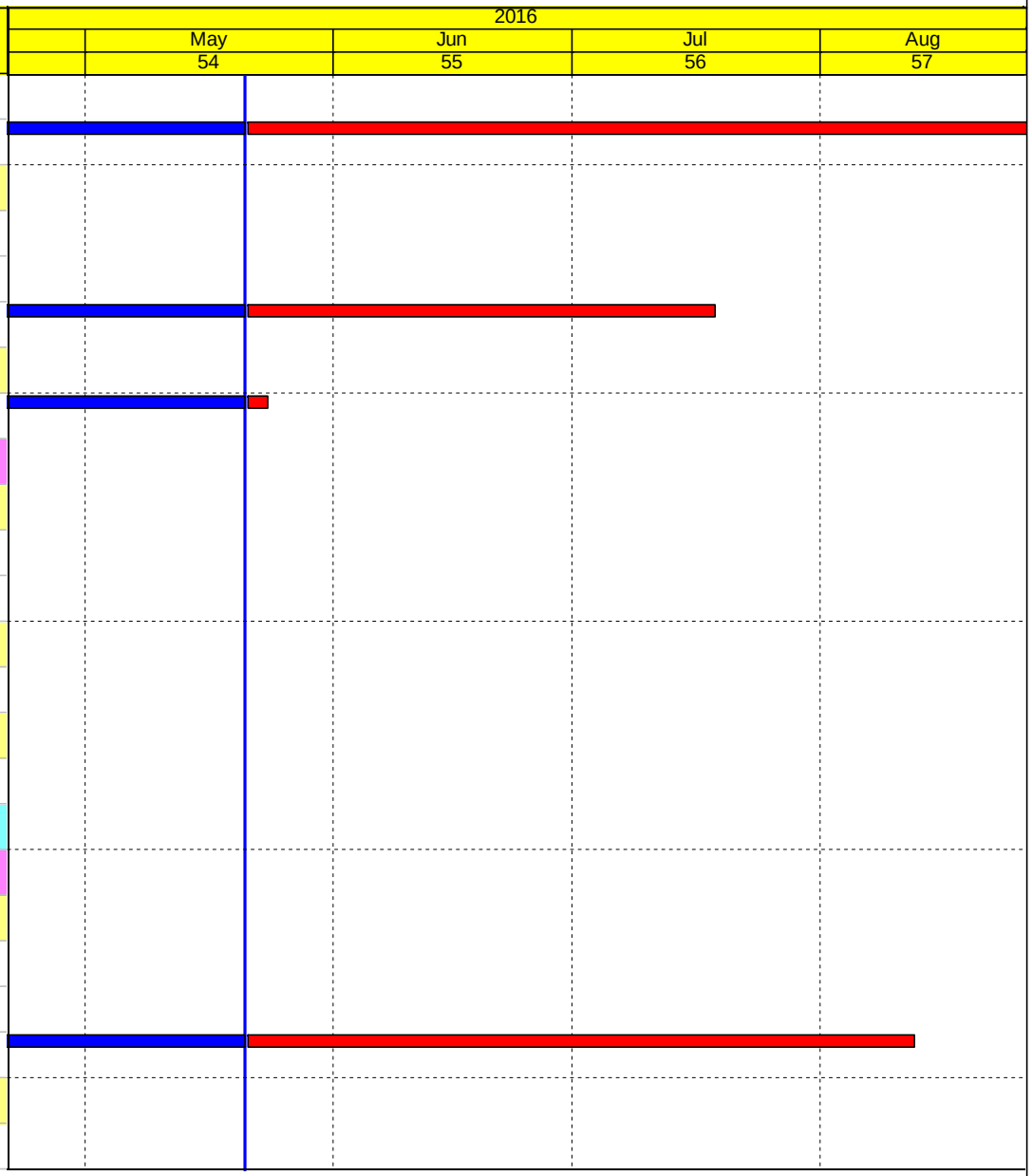
Activity ID	Activity Name
	54th_8 Monthly Progress Report Status as on 21May2016
	Work Zone, as defined in PS Clause 1.03(6)
	Portion A, B, C & E
	Portion A, B, C & E
	Seawall
	Optimizing Rubble Mound Seawalls
	Rock Armour
	Seawall Portion A C120-C134 Ch5+050 - Ch5+650
RFA0-010	PA at C118 - C134 Removal of Temporary Rockfill (170,000m3, 1,500m3/day)
RFA0-020	PA at C118 - C134 Underlayer (21,600m3 1,000m3/day)
RFA0-030	PA at C118 - C134 Rock Armour (1-3ton 30,840m3 & 0.3-1ton 14,466m3 244m3/day)
	Conforming Sloping Seawalls
	Rock Armour - Before Surcharge Period
ACP1-00030	Precasting Accropode (18,092nos), 90nos/day
	Portion B At K028 - K039 (Ch1+102 - Ch1+600)
BF-RFB1-040	PB at K028 - K039 in front of cells Removal of temporary rockfill 10205m3 190m3/day
BF-RFB1-050	PB at K028 - K039 in front of cells Geotextile & Underlayer 10-60kg 15m/day
BF-RFB1-060	PB at K028 - K039 in front of cells Rock Armour 0.3-1ton 11,244m3 244m3/day
	Portion E1 & E2 In Front of Cells Ch1+990 - 3+810
	Portion E2 Ch1+990 - Ch2+260
BF-RFE2-040	PE2 Ch1+990 - Ch2+260 in front of cells Removal of temporary rockfill 25,648m3
BF-RFE2-050	PE2 Ch1+990 - Ch2+260 in front of cells Geotextile & Underlayer 10-60kg 15m/day
	Portion C2c & C2b At C090 - C101 (Ch3+810 - Ch4+262)
BF-RFC2c-010	PC2c at C091 - C101 on cells Removal of temporary rockfill



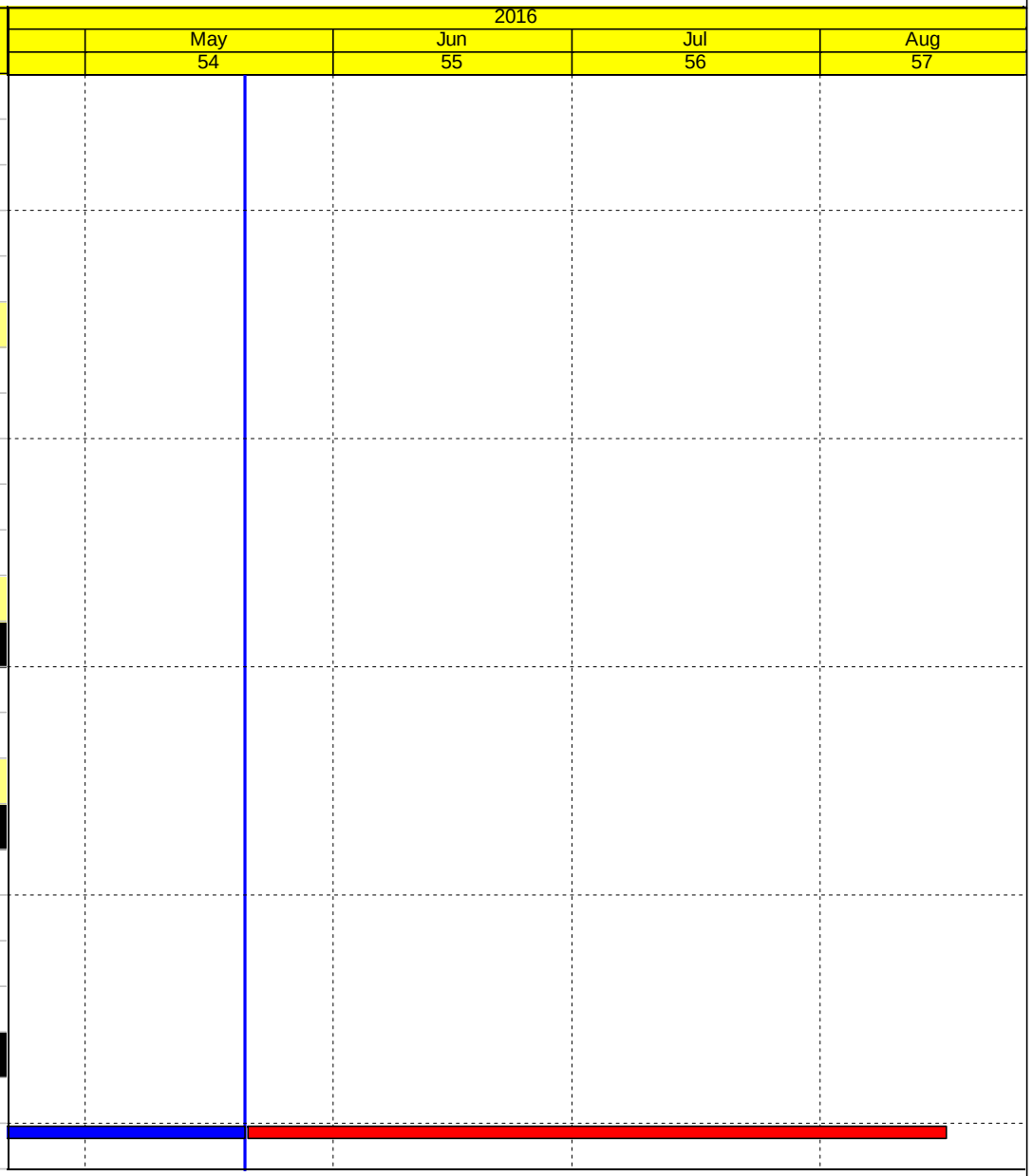
Activity ID	Activity Name
BF-RFC2c-020	PC2c at C091 - C101 on cells Geotextile & Underlayer 10-60kg 12,393m3 200m3/day
BF-RFC2c-030	PC2c at C091 - C101 on cells Rock Armour 2-5ton m3 25771m3 221m3/day
BF-RFC2c-040	PC2c at C091 - C101 in front of cells Removal of temporary rockfill 41,188m3
BF-RFC2c-052	PC2c at C091 - C101 Accropode Installation Trial stg1 180nrs 10nrs/day
BF-RFC2c-054	PC2c at C091 - C101 Accropode Installation Stg2 900nrs 30nrs/day
Reclamation	
Earthwork Fill	
Land Portion E1	
EFE1-010	PE1 Type D Earthwork Sand Fill upto +5.5mPD 118,263m3 5,000m3/day
Surcharge	
Portion A Surcharge	
Edge Area From SOL offset within 180m to 50m	
SUEA0-199	Completion of Section A at Edge Area 0 - 40m
CH5+110 to 5+440 Portion A North	
Area of 0 to 50m from Offset	
SUEA1-2185	PA North Area CH5+110 - CH5+440 Issue of Surcharge Removal
SUEA1-2190	PA North 73m-10m Surcharge Sand Removal 80,000m3 10,000m3/day
Land Portion B	
Edge Areas	
at K013 - K027	
SUEB0-032	PB Edge Area K013-K027 Sand Surcharge Checking at +9.5mPD
SUEB0-034	PB Edge Area K013-K027 Sand Surcharge upto 10.5mPD 38,102m3 5,000m3/day by Dump Trucks
SUEB0-036	PB Edge Area K013-K027 Sand Surcharge Checking at +10.5mPD
SUEB0-038	PB Edge Area K013-K027 Sand Surcharge up to 11.5mPD 38,103m3 5,000m3/day by Dump Trucks (8Jan2016)



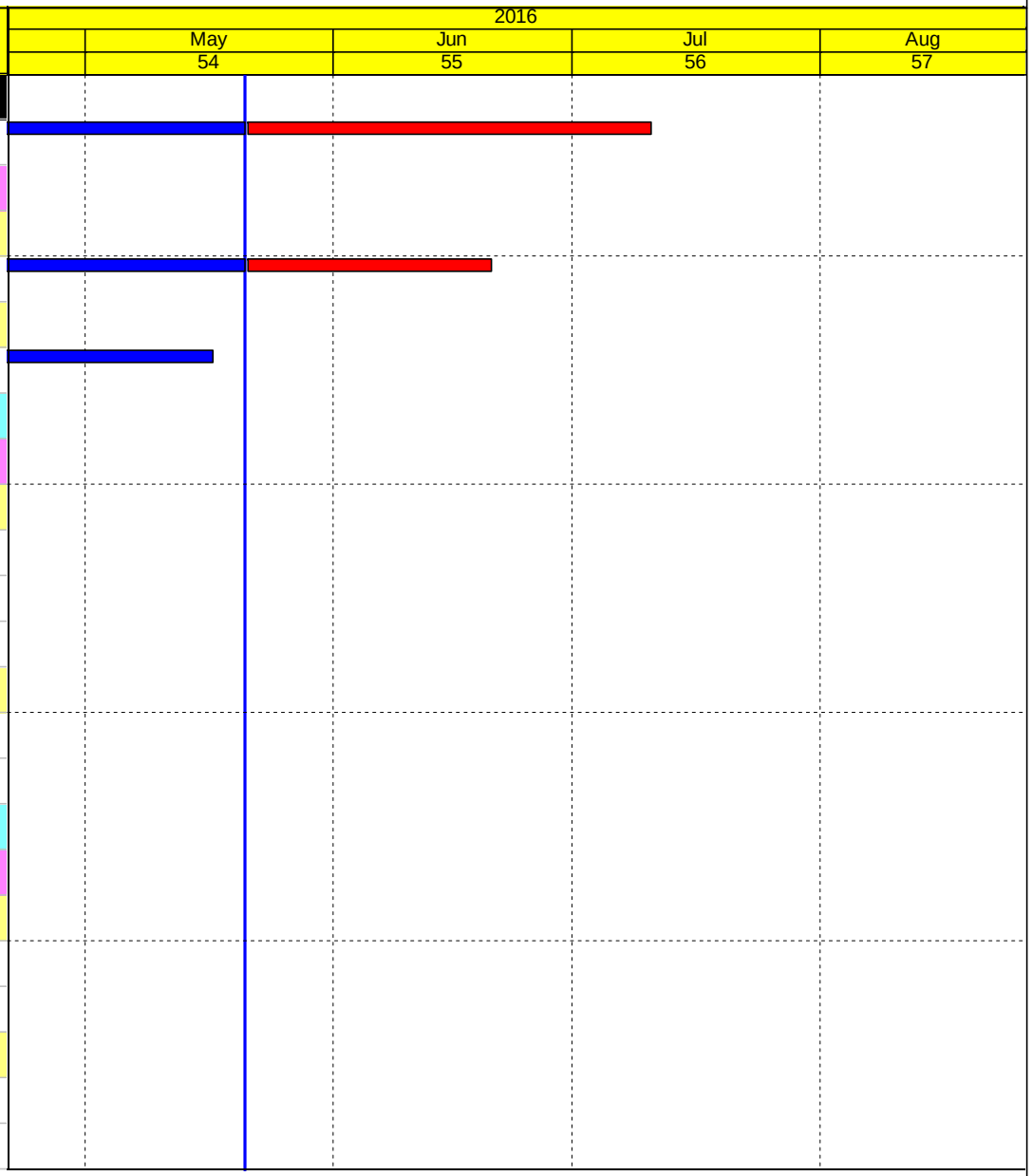
Activity ID	Activity Name
SUEB0-039	PB Edge Area K013-K027 Sand Surcharge Survey Inspection
SUEB0-040	PB Edge Area K013-K027 Sand Surcharge Period at +11.5mPD 8mths (4Sep2016)
at K028 - K035	
SUEB0-072	PB Edge Area K028-K035 Surcharge Strength Test Achievement (Await compliance for filling upto +11.5mPD)
SUEB0-080	PB Edge Area K028-K035 Sand Surcharge Laying up to 11.5mPD 45,440m3 5,000m3/day by Dump Trucks
SUEB0-090	PB Edge Area K028-K035 Sand Surcharge Period +11.5mPD 5mths
at K047 - K052 (w Deep Cement Mixing)	
DCM-2070	PB Edge Area K047-K052 36-73m Surcharge Period 7mths (23May2016)
Reclamation Areas	
at West of Main Area stg1	
SURB1-034	PB Main Area West final sand surcharge instruction of removal by RE
SURB1-040	PB Main Area West-S Sand Surcharge Removal 291,223m3 10,000m3/day
at West of Main Area stg2	
SURB2-040	PB Main Area West-N Sand Surcharge Removal 335,714m3 10,000m3/day
at North- East of Main Area	
SURB3-030	PB Main Area North Sand Surcharge Period +11.5mPD 7mths (16Feb2016)
Land Portion C2a	
Edge Areas	
Deep Cement Mixing Works at C101 - C103	
DCM-3052	PC2a Edge Area C101-C103 CPT Test
DCM-3060	PC2a Edge Area C101-C103 Filling up to +11.5mPD Surcharge (30m width, 14,607m3 5,000m3/day at DCM
DCM-3070	PC2a Edge Area C101-C103 Surcharge Period 8mths (Land Side) (12Aug2016)
VO - Deep Cement Mixing Works at C104 - C107	
DCM-4140	PC2a Edge Area C104-C107 Hardening & Pause Period



Activity ID	Activity Name
DCM-4150	PC2a Edge Area C104-C107 Filling up to +5.5mPD Type D (73m width, 17094m3) 5,000m3/day at DCM
DCM-4155	PC2a Edge Area C104-C107 Completion of 0-43m
DCM-4160	PC2a Edge Area C104-C107 Filling up to +8.5mPD Surcharge (30m width, 16889m3 5,000m3/day at DCM
DCM-4162	PC2a Edge Area C104-C107 Surcharge CPT Test
DCM-4170	PC2a Edge Area C104-C107 Filling up to +11.5mPD Surcharge (30m width, 16889m3 5,000m3/day at DCM
VO - Deep Cement Mixing Works at C108 - C109	
DCM-5100	PC2a Edge Area C108-C109 Relocation of Cement Plant
DCM-5110	PC2a Edge Area C108-C109 43m width Installation 471nrs 11nrs/day
DCM-5120	PC2a Edge Area C108-C109 Hardening & Pause Period
DCM-5130	PC2a Edge Area C108-C109 Filling up to +5.5mPD Type D (73m width, 8547m3) 5,000m3/day at DCM
DCM-5140	PC2a Edge Area C108-C109 Completion of 0-43m
at C110 - C112 Cellular Seawall	
VO - Deep Cement Mixing Works at C110 - C112	
DCM-4202	PC2a Edge Area C110-C112 Variation Order by the Engineer
DCM-4210	PC2a Edge Area C110-C112 23m width Installation 597nrs 15nrs/day (w CNY)
CH4+710 - CH5+110 Rubble Mound Seawall	
Deep Cement Mixing at CH4+710 - CH4+880	
DCM-5010	PC2a Ch4+710 - Ch4+880 DCM Mobilization from E2 K067
DCM-5012	PC2a Ch4+710 - Ch4+880 DCM Formation Level
DCM-5020	PC2a Ch4+710 - Ch4+880 DCM Installation 111nrs 6nrs/day
DCM-5030	PC2a Ch4+710 - Ch4+880 Hardening & Pause Period
10-73m Ch4+880 - Ch5+010	
SUEC2a-1110	PC2a Ch4+880 - Ch5+010 Surcharge Sand to +11.5mPD 7,210m3 5,000m3/day
SUEC2a-1120	PC2a Ch4+880 - Ch5+010 Surcharge Sand Period 8mths (16Aug2016)

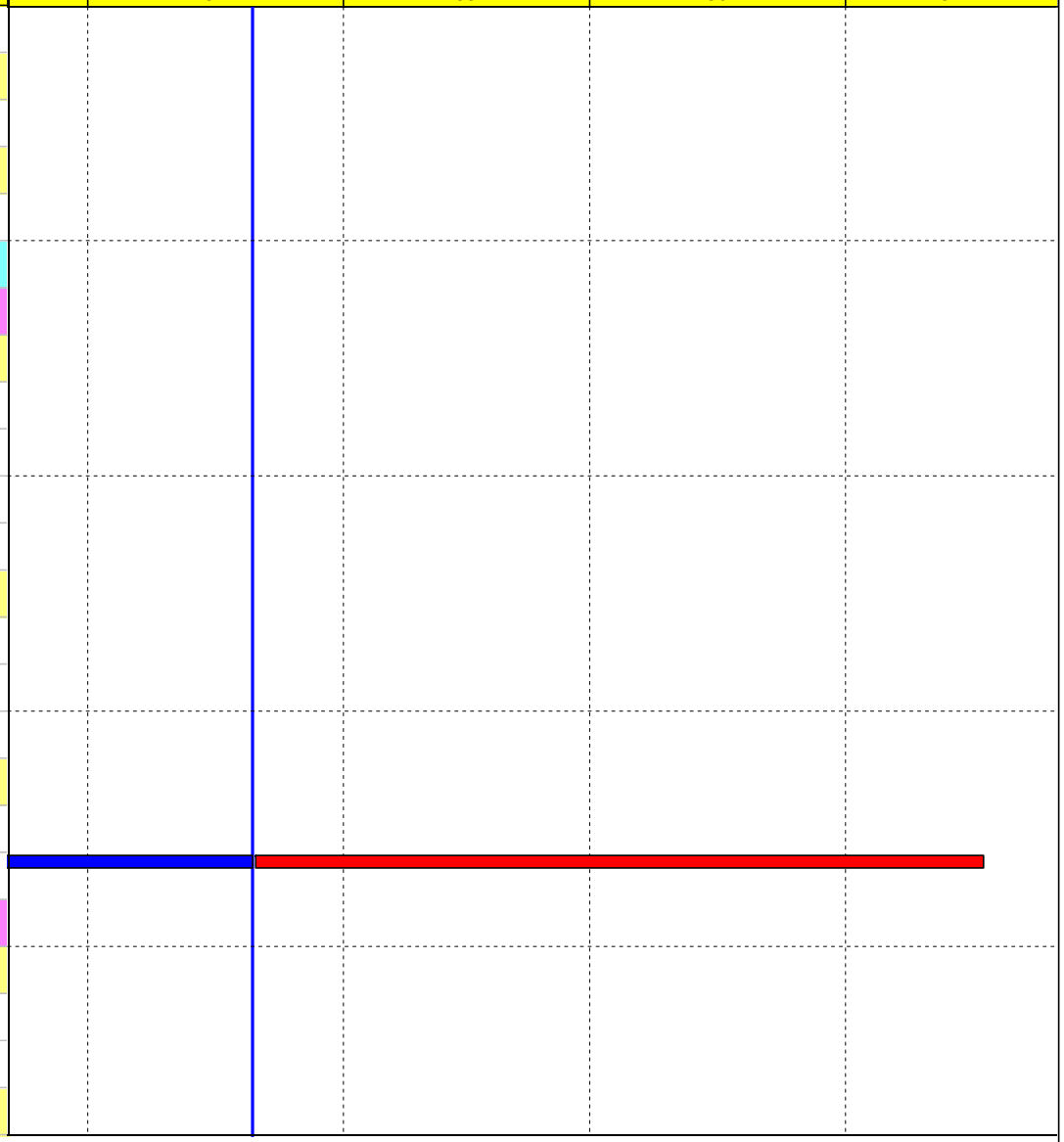


Activity ID	Activity Name
73-120m	
SUEC2a-2090	PC2a C113-C117 73m-120m Surcharge Sand Period 8mths (10Jul2016)
Reclamation Areas	
C2aC1	
SURC2aC1-07	PC2a C2aC1 Sand Surcharge Period 8mths (20Jun2016)
C2aC2	
SURC2aC2-07	PC2a C2aC2 Sand Surcharge Period 8mths (17May2016)
Land Portion C1a	
Reclamation Areas	
C3	
SURC1a-025	PC1a North East Land Area Sand Surcharge Instruction Removal by RE
SURC1a-030	PC1a North East Land Area Sand Surcharge Removal 280,000m3 10,000m3/day
SURC1a-040	PC1a North West Land Area Sand Surcharge Removal 297,616m3 10,000m3/day
C4	
SURC1a-140	PC1a South East Land Area Sand Surcharge Period at +11.5mPD 7mths (15Feb2016)
SURC1a-150	PC1a South West Land Area Sand Surcharge Period at +11.5mPD 8mths (16Mar2016)
Land Portion C1b	
Reclamation Areas	
West (1/4 Areas)	
SURC1b-024	PC1b West Instruction of Surcharge Removal stg2 by the Engioneer (Assumption)
SURC1b-030	PC1b West Sand Surcharge Removal 336,434m310,000m3/day
East (3/4 Areas)	
SURC1b-055	PC1b East Instruction of Surcharge Removal by the Engioneer (Assumption)
SURC1b-060	PC1b East Sand Surcharge Removal 336,435m3 10,000m3/day



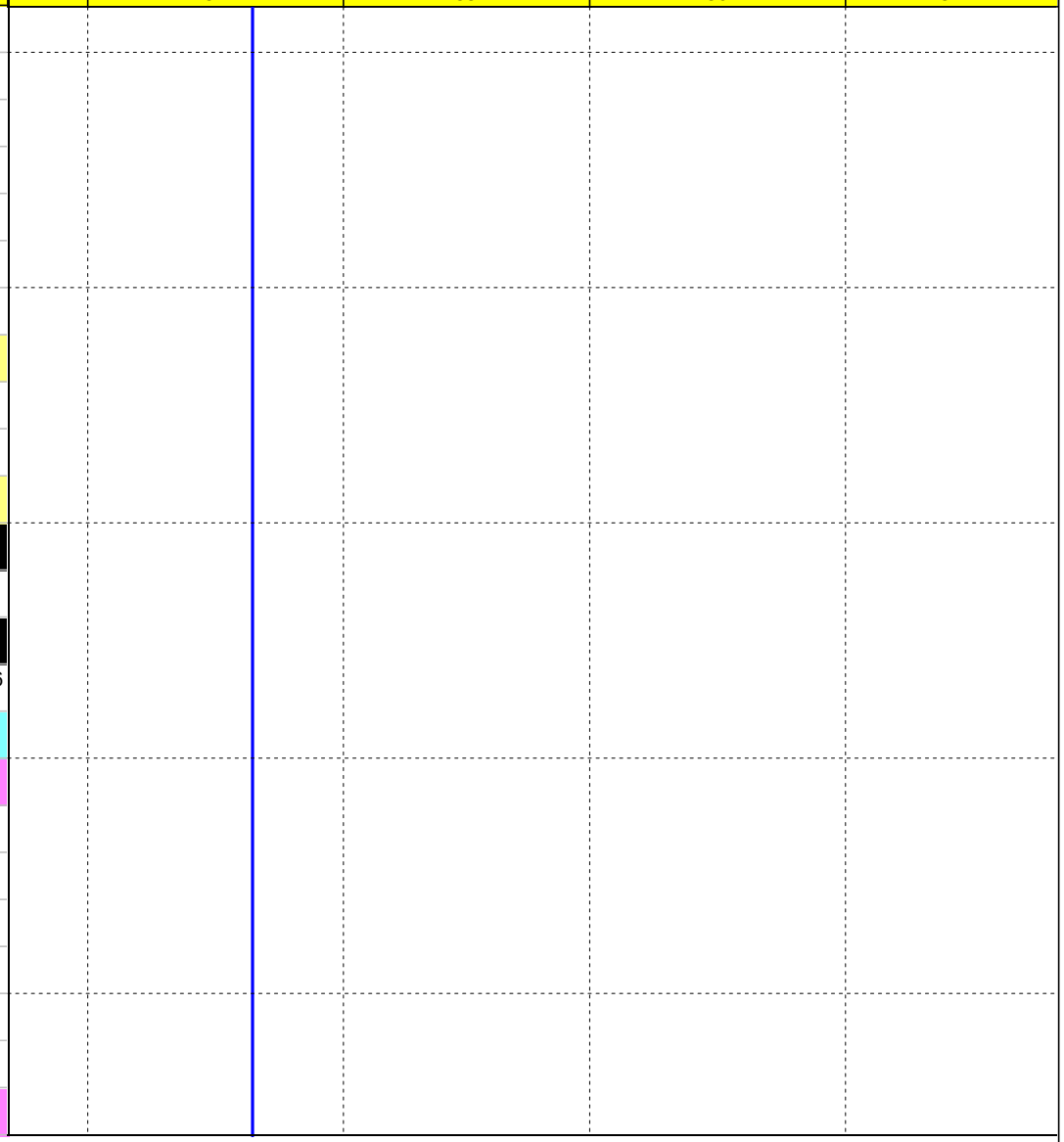
Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

Activity ID	Activity Name
SURC1b-095	Completion of Section PC1b
North Side close to Portion C2b	
SURC1b-1030	PC1b Main Area Sand Surcharge Period as +11.5mPD 7mths (12Mar2016)
North Side close to Portion C2c	
SURC1b-1080	PC1b Main Area Sand Surcharge Period as +11.5mPD 7mths (28Mar2016)
Land Portion E2	
North Part	
Edge Areas - North (TM)	
SUEE2-440	PE2 North Edge TM Sand Surcharge Laying up to 8.5mPD 18248m3 5,000m3/day
SUEE2-450	PE2 North Edge TM Sand Surcharge Period as +8.5mPD 4.5mths
SUEE2-460	PE2 North Edge TM Surcharge CPT Test
SUEE2-470	PE2 North Edge TM Sand Surcharge Laying up to +11.5mPD 18,248m3 5,000m3/day
Edge Areas - East (TM) C064-C067	
SUEE2-130	PE2 East Edge C064-C067 Sand Surcharge Period as +8.5mPD 4.5mths
SUEE2-135	PE2 East Edge C064-C067 Surcharge CPT Test
SUEE2-140	PE2 East Edge C064-C067 Sand Surcharge Laying up to +11.5mPD 18,249m3 5,000m3/day
Land Areas - West (C3)	
SURE2-170-50	PE2 Land C061-C064 Non-Tunnel Sand Surcharge non tunnel area Laying upto 11.5mPD stg2 60,000m3 5,000m3/day
SURE2-180	PE2 Land C061-C064 Non-Tunnel Sand Surcharge Period as +11.5mPD non tunnel area 7mths 17Aug2016
South Part	
Edge Areas East C058 to C063	
SUEE2-025	PE2 Edge C058-C063 Sand Surcharge Strength Test
SUEE2-030	PE2 Edge C058-C063 Sand Surcharge Laying up to +11.5mPD 62259m3 5,000m3/day
VO DCM Edge Areas East C056 to C057	

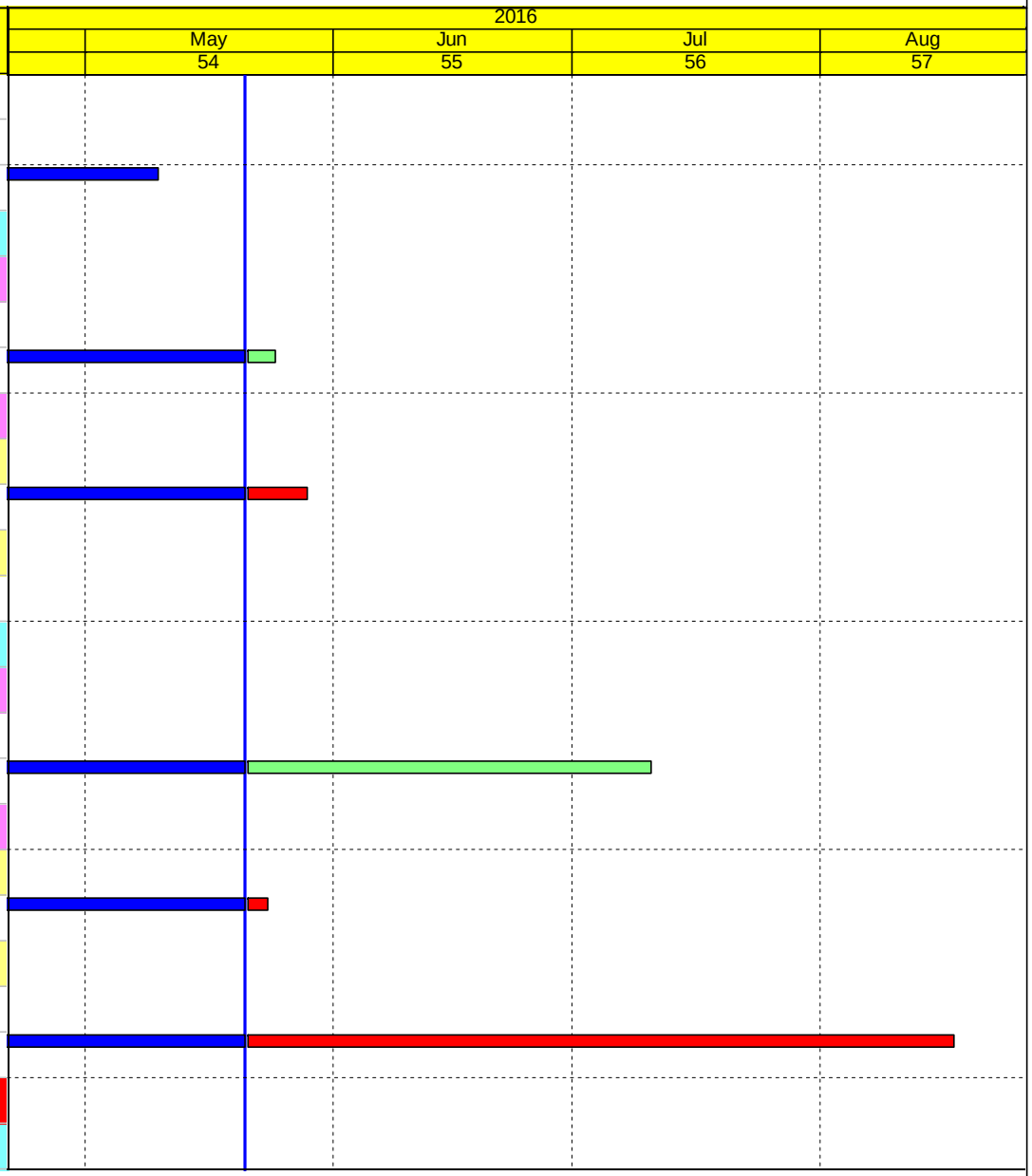


Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

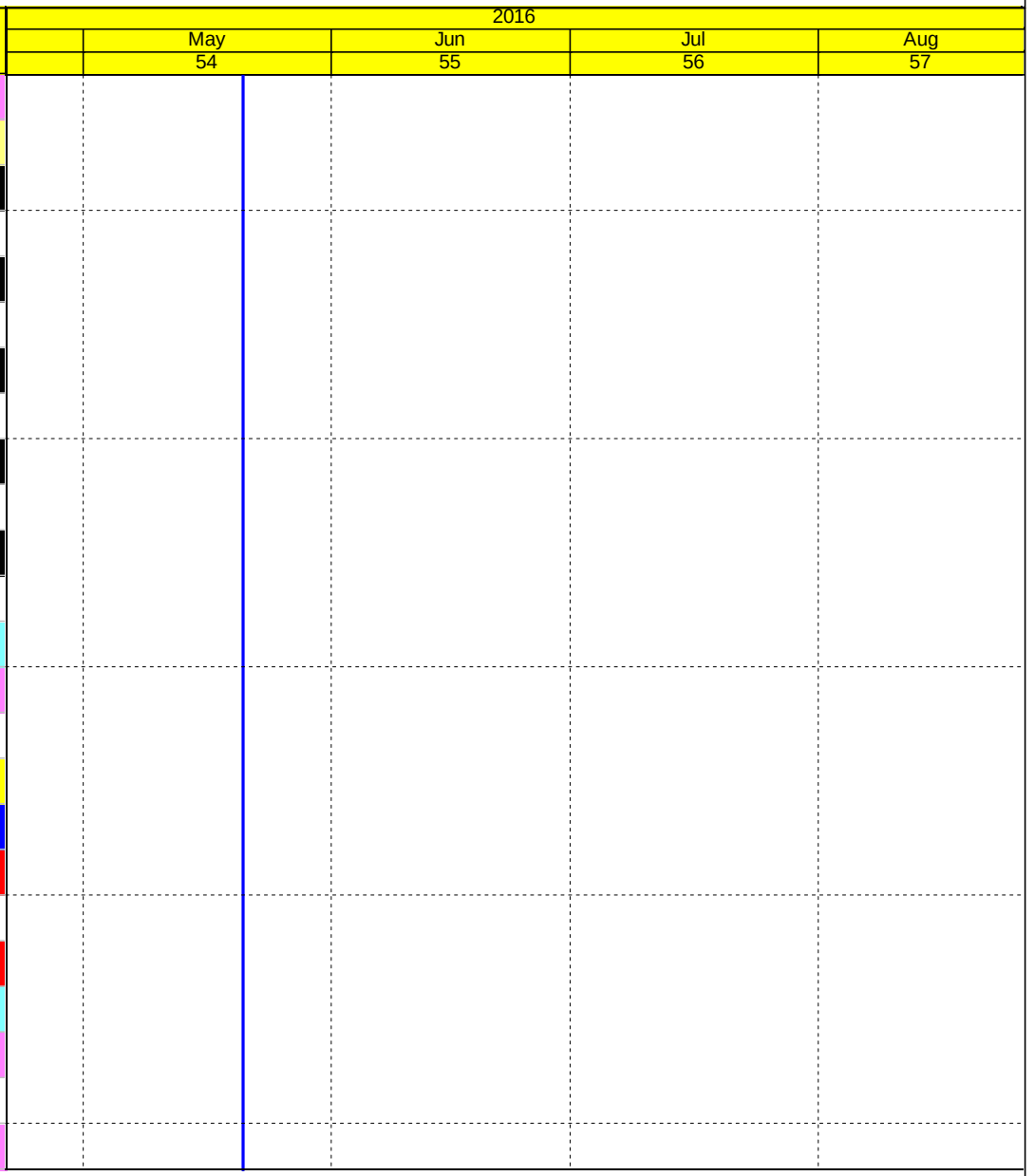
Activity ID	Activity Name
DCM-4310	PE2 Edge C056-C057 43m width Installation 229nrs 10nrs/day
DCM-4320	PE2 Edge C056-C057 Hardening & Pause Period
DCM-4330	PE2 Edge C056-C057 Filling up to +5.5mPD Type D (73m width, 8,547m3) 5,000m3/day at DCM by Dump Trucks
DCM-4340	PE2 Edge C056-C057 Completion of 0-43m with DCM
DCM-4350	PE2 Edge C056-C057 Filling up to +8.5mPD Surcharge (30m width, 8,547m3 5,000m3/day at DCM by Dump Trucks
DCM-4360	PE2 Edge C056-C057 Surcharge CPT Test
DCM-4370	PE2 Edge C056-C057 Filling up to +11.5mPD Surcharge (30m width, 8,547m3 5,000m3/day at DCM by Dump Trucks
Edge Areas East C052 to C055	
SURE2-420	PE2 Edge C052-C055 300m Zone Sand Surcharge Pause Period at 8.5mPD 4.5mths (27Feb2016)
SURE2-425	PE2 Edge C052-C055 300m Zone Sand Surcharge CPT Test at 8.5mPD
Land Areas	
300m to 100m Zone	
SURE2-530	PE2 Land C052-C056 300m Zone Sand Surcharge Period as +11.5mPD 7mths 18Apr2016
Out of K052 300m	
SURE2-020	PE2 Land C052-C060 Non-Tunnel Sand Surcharge Period as +11.5mPD 7mths 13Mar2016
Land Portion E1	
Deep Cement Mixing C077 - C080 150m (Exclude VB & RS)	
DCM-4010	PE1 Edge Area DCM Mobilization from PC2a DCM plant and PE2 cement barge
DCM-4020	PE1 Edge Area DCM Installation 415nrs 10nrs/day
DCM-4050	PE1 Edge Area DCM Hardening
DCM-4060	PE1 Edge Area DCM Flling upto +5.5mPD 25,000m3 5,000m3/day
DCM-4080	PE1 Edge Area Surcharge Filling up to +8.5mPD (10,000m3) 10,000m3/day at interface of non DCM area
DCM-4083	PE1 Edge Area Surcharge Pause Period 4.5mths at interface of non DCM area 19Jun2016
Edge Areas Excluded 150m of DCM Area	



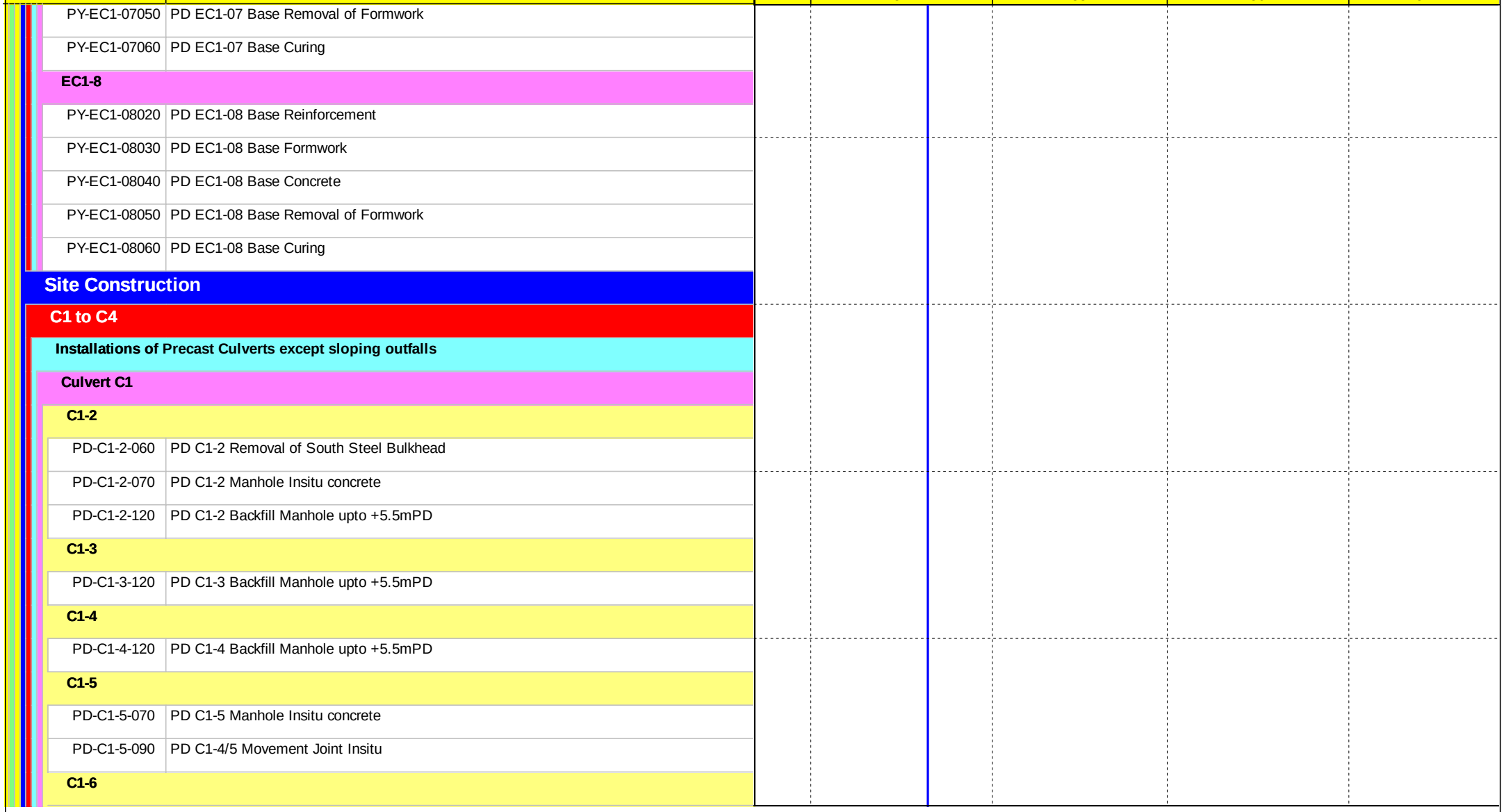
Activity ID	Activity Name
SUEE1-005	PE1 Edge +5.5mPD Strength Test
SUEE1-010	PE1 Edge Sand Surcharge Laying up to 8.5mPD 126,529m3 10,000m3/day
SUEE1-020	PE1 Edge Sand Surcharge Period +8.5mPD 4.5mths 10May2016
Land Portion C2b	
Edge Areas	
SUEC2b-050	PC2b Edge Area PBF Surcharge w compaction upto 8.5mPD 12,054m3 5,000m3/day
SUEC2b-060	PC2b Edge Area Surcharge Period as +8.5mPD 4.5mths 24May2016 (Del)
Reclamation Areas	
North	
SURC2b-020	PC2b Main Area North Public Surcharge Period as +11.5mPD 7mths (28May2016)
South	
SURC2b-034	PC2b Main Area South PBF Surcharge Period as +11.5mPD 7mths (9Apr2016)
Land Portion C2c	
Edge Areas	
SUEC2c-010	PC2c Edge Area PBF Surcharge w compaction upto 8.5mPD 43,395m3 5,000m3/day
SUEC2c-020	PC2c Edge Area PBF Surcharge Period +8.5mPD 4.5mths 10Jul2016 (Del)
Reclamation Areas	
West	
SURC2c-W030	PC2c Main Area PBF Surcharge Period 7mths (23May2016)
East	
SURC2c-E020	PC2c Main Area Sand Surcharge Laying upto 11.5mPD stg2 109,120m3 5,000m3/day by Dump Trucks
SURC2c-E030	PC2c Main Area PBF Surcharge Period 7mths (17Aug2016)
Geotechnical Instrumentation Works	
Geotechnical Instrumentation Works for Seawalls	



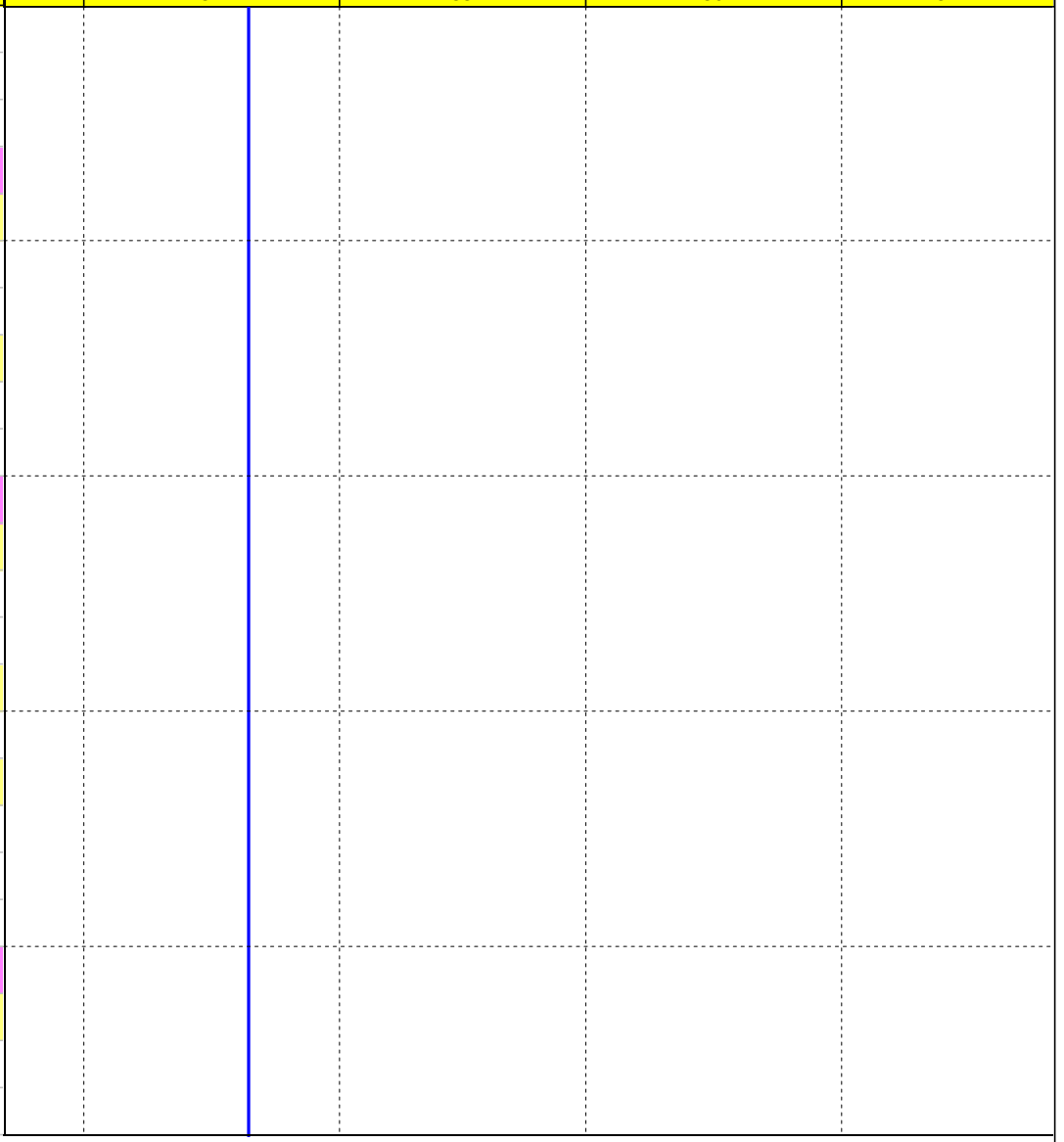
Activity ID	Activity Name
	Cluster Type SD 26nrs Instrumentation and CPT Cluster behind cells
	Portion E1
	SD-13 C071
CTSD-130	Installation of SD-13 (C071) PE1
	SD-14 C074
CTSD-140	Installation of SD-14 (C074) PE1
	SD-15 C078
CTSD-150	Installation of SD-15 (C078) PE1
	SD-16 C084
CTSD-160	Installation of SD-16 (C084) PE1
	SD-17 C089
CTSD-170	Installation of SD-17 (C089) PE1
	Geotechnical Instrumentation Works for Reclamation RA & RB
	Settlement Marker Type 2
SMT2-100	M2 - Installation of Settlement Marker Type2 at PE1
	Portion D
	Precast Yard for Seawall Blocks & Culverts
	Concrete Blocks
PD-PY1-0200	Precast Seawall Blocks for Permanent construction 1,990nrs (3,180 - 1190)
	Culverts
	Culverts EC1
	EC1-6
PY-EC1-06060	PD EC1-06 Base Curing
	EC1-7



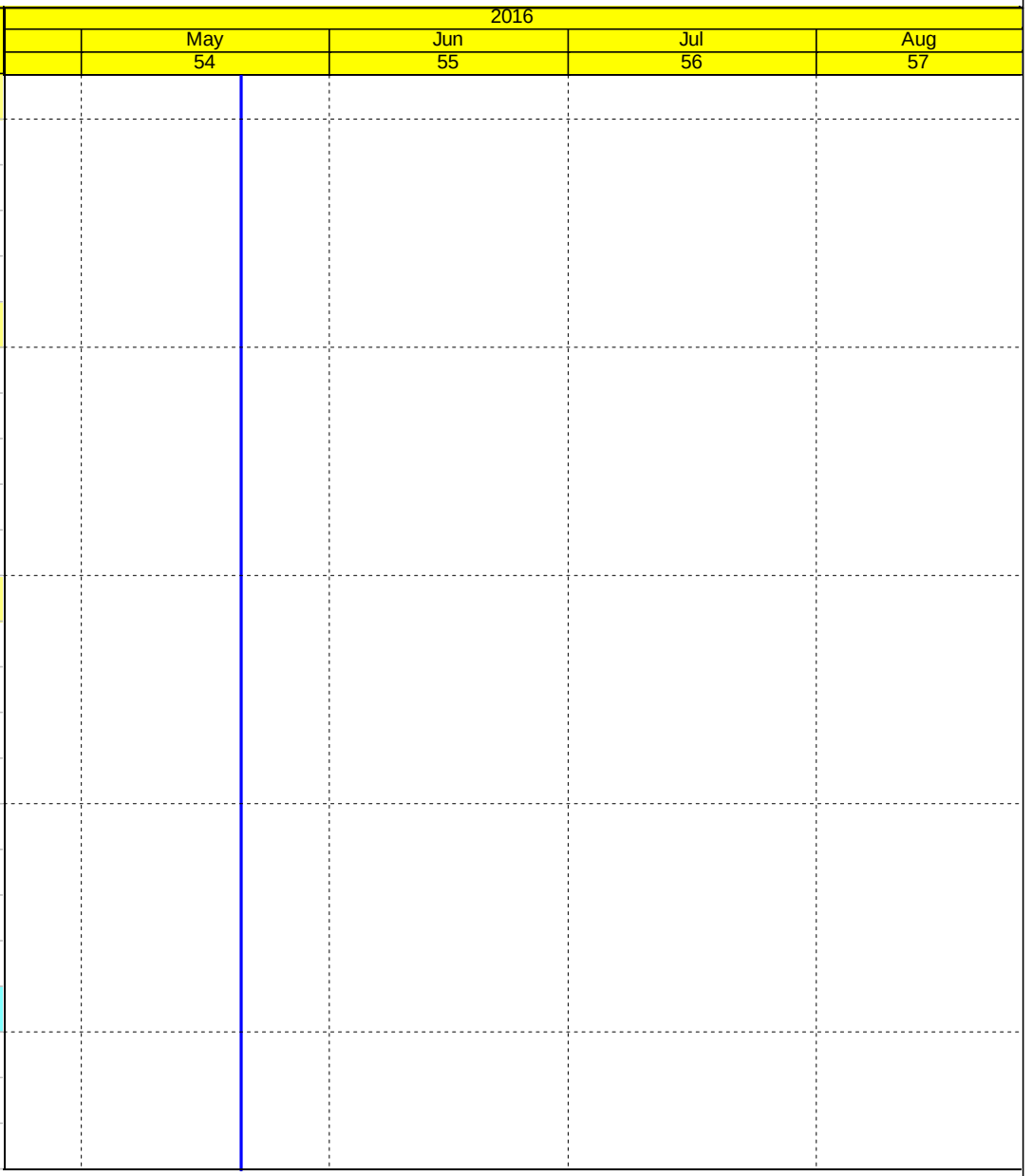
Activity ID	Activity Name
PY-EC1-07050	PD EC1-07 Base Removal of Formwork
PY-EC1-07060	PD EC1-07 Base Curing
EC1-8	
PY-EC1-08020	PD EC1-08 Base Reinforcement
PY-EC1-08030	PD EC1-08 Base Formwork
PY-EC1-08040	PD EC1-08 Base Concrete
PY-EC1-08050	PD EC1-08 Base Removal of Formwork
PY-EC1-08060	PD EC1-08 Base Curing
Site Construction	
C1 to C4	
Installations of Precast Culverts except sloping outfalls	
Culvert C1	
C1-2	
PD-C1-2-060	PD C1-2 Removal of South Steel Bulkhead
PD-C1-2-070	PD C1-2 Manhole Insitu concrete
PD-C1-2-120	PD C1-2 Backfill Manhole upto +5.5mPD
C1-3	
PD-C1-3-120	PD C1-3 Backfill Manhole upto +5.5mPD
C1-4	
PD-C1-4-120	PD C1-4 Backfill Manhole upto +5.5mPD
C1-5	
PD-C1-5-070	PD C1-5 Manhole Insitu concrete
PD-C1-5-090	PD C1-4/5 Movement Joint Insitu
C1-6	



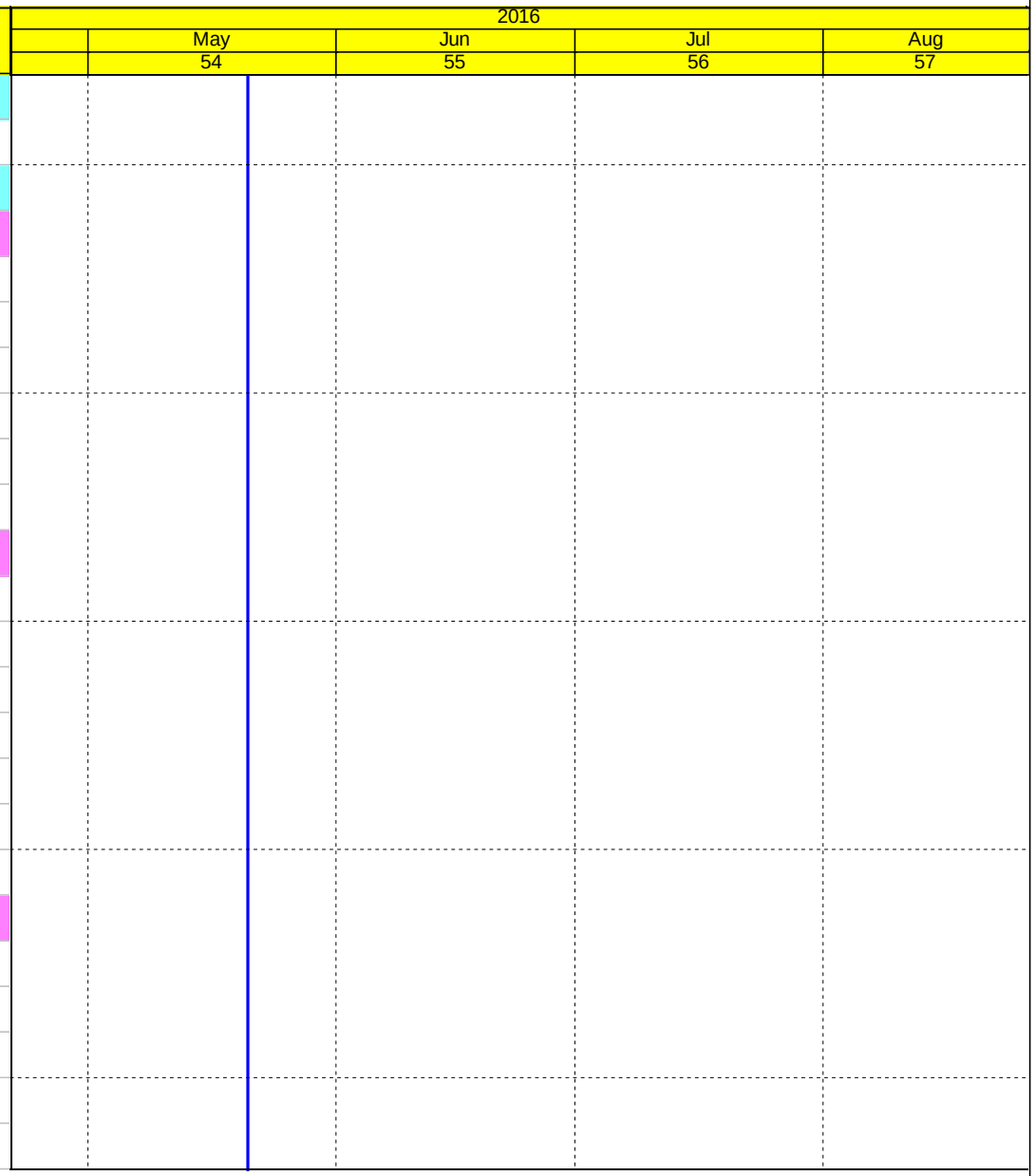
Activity ID	Activity Name
PD-C1-6-050	PD C1-6 Removal of North Steel Bulkhead
PD-C1-6-070	PD C1-6 Manhole Insitu concrete
PD-C1-6-090	PD C1-5/6 Movement Joint Insitu
Culvert C2	
C2-2	
PD-C2-2-060	PD C2-2 Removal of South Steel Bulkhead
PD-C2-2-070	PD C2-2 Manhole Insitu concrete
C2-5	
PD-C2-5-050	PD C2-5 Removal of North Steel Bulkhead
PD-C2-5-070	PD C2-5 Manhole Insitu concrete
Culvert C3	
C3-2	
PD-C3-2-060	PD C3-2 Removal of South Steel Bulkhead
PD-C3-2-070	PD C3-2 Manhole Insitu concrete
C3-4	
PD-C3-4-070	PD C3-4 Manhole Insitu concrete
C3-5	
PD-C3-5-050	PD C3-5 Removal of North Steel Bulkhead
PD-C3-5-070	PD C3-5 Manhole Insitu concrete
PD-C3-5-090	PD C3-4/5 Movement Joint Insitu
Culvert C4	
C4-2	
PD-C4-2-050	PD C4-2 Removal of North Steel Bulkhead
PD-C4-2-070	PD C4-2 Manhole Insitu concrete



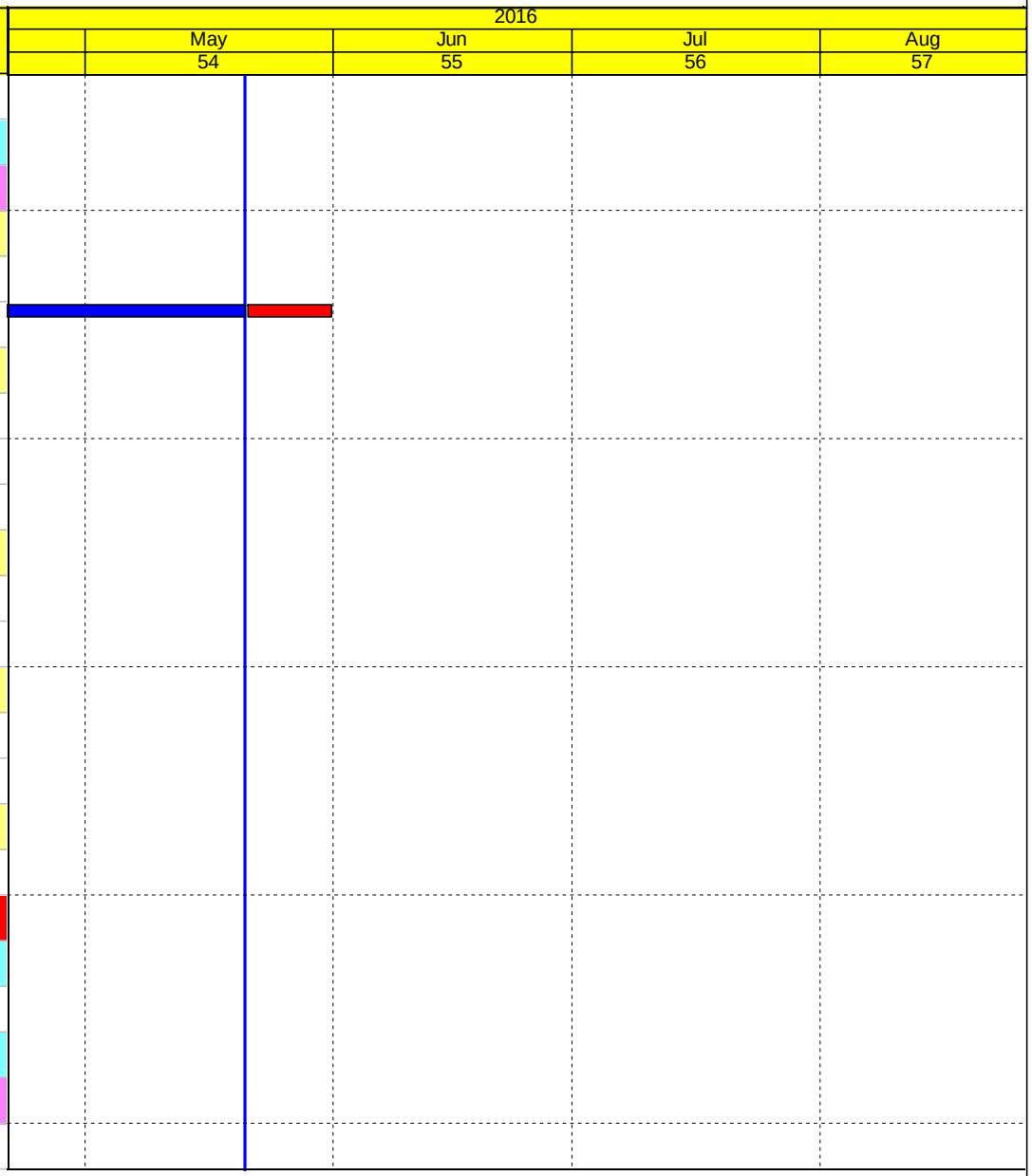
Activity ID	Activity Name
C4-3	
PD-C4-3-070	PD C4-3 Manhole Insitu concrete
PD-C4-3-080	PD C4-2/3 Movement Joint Installation
PD-C4-3-090	PD C4-2/3 Movement Joint Insitu
PD-C4-3-110	PD C4-3 Backfill upto +3.5mPD except Manholes
C4-4	
PD-C4-4-070	PD C4-4 Manhole Insitu concrete
PD-C4-4-080	PD C4-3/4 Movement Joint Installation
PD-C4-4-090	PD C4-3/4 Movement Joint Insitu
PD-C4-4-100	PD C4-4 Backfill Beside of Culvert
PD-C4-4-110	PD C4-4 Backfill upto +3.5mPD except Manholes
C4-5	
PD-C4-5-050	PD C4-5 Removal of North Steel Bulkhead
PD-C4-5-060	PD C4-5 Removal of South Steel Bulkhead
PD-C4-5-070	PD C4-5 Manhole Insitu concrete
PD-C4-5-080	PD C4-4/5 Movement Joint Installation
PD-C4-5-090	PD C4-4/5 Movement Joint Insitu
PD-C4-5-100	PD C4-5 Backfill Beside of Culvert
PD-C4-5-110	PD C4-5 Backfill upto +3.5mPD except Manholes
PD-C4-5-130	PD C4 Handover to Hy/2013/02
Permanent Access to Portion A	
PD-A2090	PD - C2 Divert Access
PD-A2110	PD - C4 Divert Access
PD-A2140	Completion of Access to PA



Activity ID	Activity Name
	Removal of Temporary Access to Portion A
PD-A1110	PD C2 - Removal of Temporary Access
	Construction of Sloping Outfalls
	Culvert C1 Sloping Outfall
PD-C1-0110	PD C1-1 Outfall Excavation
PD-C1-0120	PD C1-1 Outfall Formation
PD-C1-0125	PD C1-1 Buoyancy
PD-C1-0130	PD C1-1 Outfall Installation
PD-C1-0140	PD C1-1 Outfall Removal of Buoyancy & Bulkhead
PD-C1-0150	PD C1-1 Outfall Insitu Concrete
	Culvert C2 Sloping Outfall
PD-C2-0110	PD C2-1 Outfall Excavation
PD-C2-0120	PD C2-1 Outfall Formation
PD-C2-0122	PD C2-1 & C3-1 Back & Delivery Stg18
PD-C2-0125	PD C2-1 Buoyancy
PD-C2-0130	PD C2-1 Outfall Installation (20Feb2016)
PD-C2-0140	PD C2-1 Outfall Removal of Buoyancy & Bulkhead
PD-C2-0150	PD C2-1 Outfall Insitu Concrete
	Culvert C4 Sloping Outfall
PD-C4-0110	PD C4-1 Outfall Excavation
PD-C4-0120	PD C4-1 Outfall Formation
PD-C4-0125	PD C4-1 Buoyancy
PD-C4-0130	PD C4-1 Outfall Installation
PD-C4-0140	PD C4-1 Outfall Removal of Buoyancy & Bulkhead



Activity ID	Activity Name
PD-C4-0150	PD C4-1 Outfall Insitu Concrete
Construction of Permanent Seawall	
Vertical Seawall Type V2 6+136 to 5+650	
Foundation Leveling	
PD-V2-0065	PD C3/C4 - Vertical Seawall V2 VSOP10-05 Foundation Leveling 3,000m2 and Geotextile
PD-V2-920	PD C4 East - Vertical Seawall V2 VSOP04-01 Foundation Leveling 3,000m2 and Geotextile
Seawall Blocks Installation	
PD-V2-0090	PD C1/C2 - Vertical Seawall Blocks V2 VSOP19-16 Type 2A5, 2A4 & 2A3 606nrs (30nrs/day)
PD-V2-0110	PD C2/C3 - Vertical Seawall Blocks V2 VSOP15-11 Type 2A x3 & 2D 772nrs (30nrs/day)
PD-V2-0130	PD C3/C4 - Vertical Seawall Blocks V2 VSOP10-05 Type 2A x4, 2AC 905nrs (30nrs/day)
Rockfill Type 2 behind seawall	
PD-V2-0190	PD C1/C2 - Vertical Seawall V2 Rockf ill Type 2 VSOP19-16 2,100m3
PD-V2-0200	PD C2/C3 - Vertical Seawall V2 Rockf ill Type 2 VSOP15-11 3,400m3
Geotextile Type 1	
PD-V2-0240	PD C1/C2 - Vertical Seawall V2 Geotextile Type 1 VSOP19-16 1,500m2
PD-V2-0250	PD C2/C3 - Vertical Seawall V2 Geotextile Type 1 VSOP15-11 2,400m2
Reclamation upto +3.25mPD	
PD-V2-0290	PD C1/C2 - Vertical Seawall V2 backfill with compaction upto +3.25mPD VSOP20-16
Extension Culvert EC1	
Excavation & Supporting	
PD-EC1-0-050	PD EC1 Formation of Foundation EC1-7 & EC1-8
Insitu Concrete	
EC1-1	
PD-EC1-1-040	PD EC1-1 Removal of Buoyancy

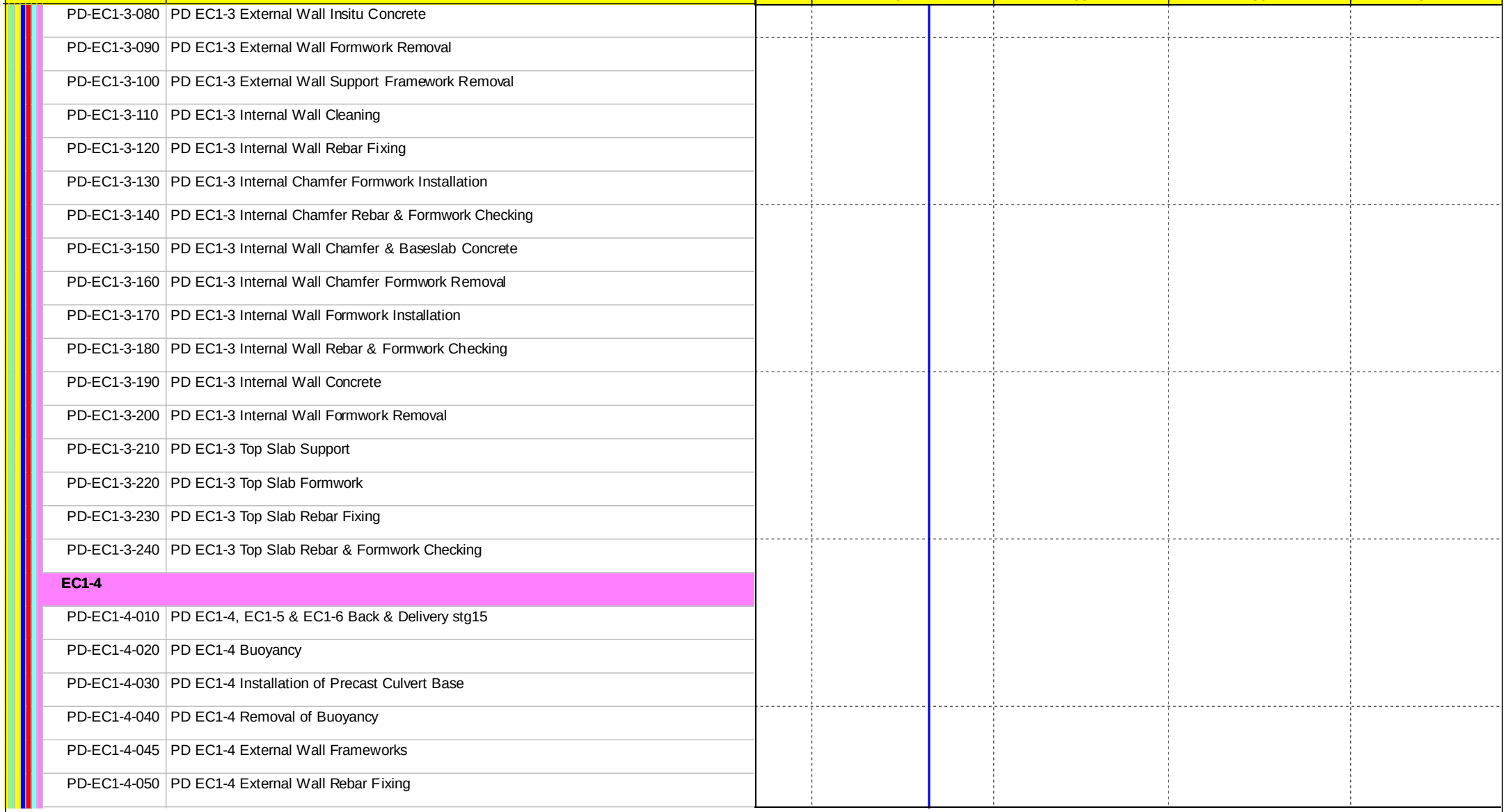


Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

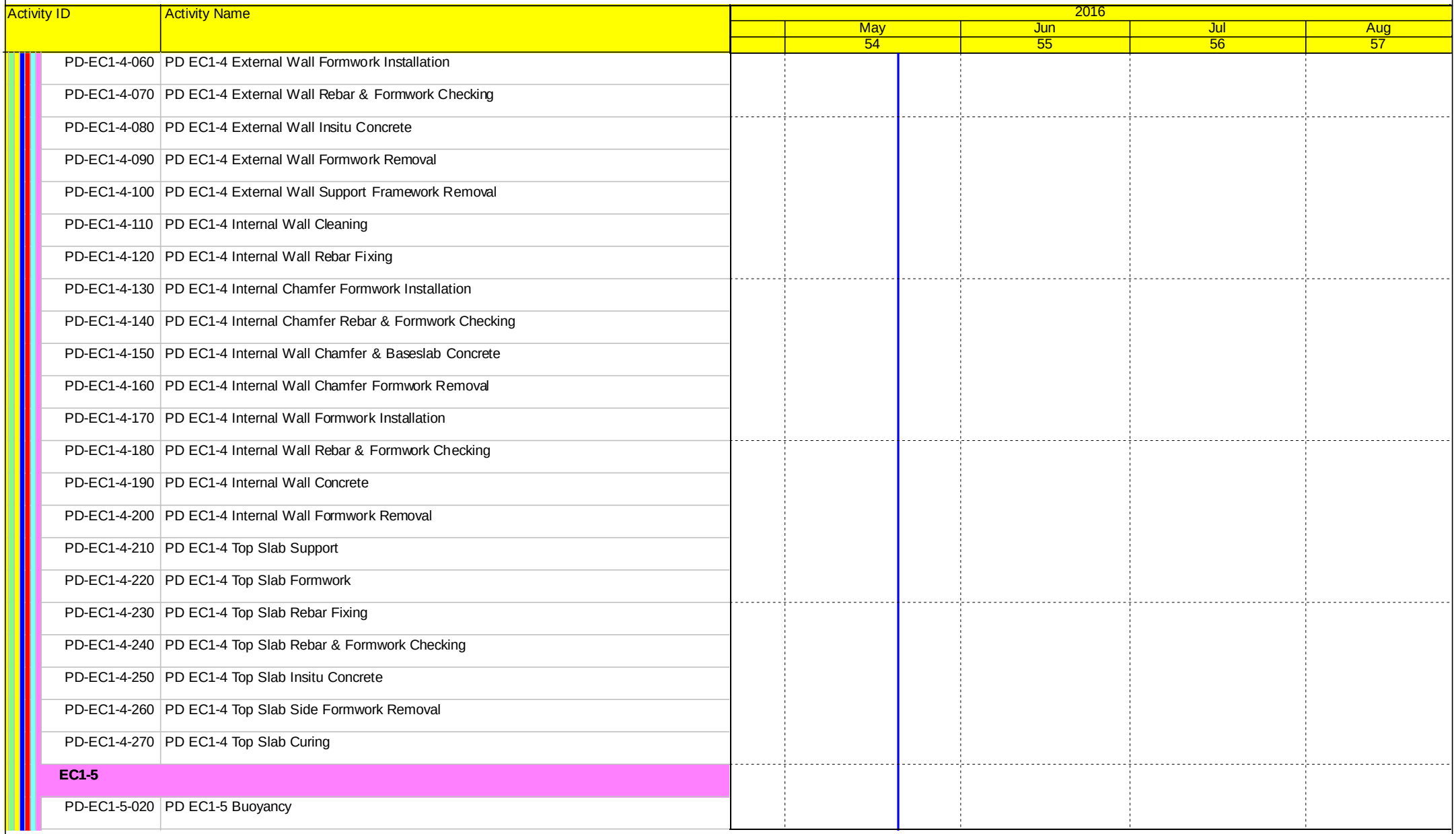
Activity ID	Activity Name
PD-EC1-1-045	PD EC1-1 External Wall Frameworks
PD-EC1-1-050	PD EC1-1 External Wall Rebar Fixing
PD-EC1-1-060	PD EC1-1 External Wall Formwork Installation
PD-EC1-1-070	PD EC1-1 External Wall Rebar & Formwork Checking
PD-EC1-1-080	PD EC1-1 External Wall Insitu Concrete
PD-EC1-1-090	PD EC1-1 External Wall Formwork Removal
PD-EC1-1-100	PD EC1-1 External Wall Support Framework Removal
PD-EC1-1-110	PD EC1-1 Internal Wall Cleaning
PD-EC1-1-120	PD EC1-1 Internal Wall Rebar Fixing
PD-EC1-1-130	PD EC1-1 Internal Chamfer Formwork Installation
PD-EC1-1-140	PD EC1-1 Internal Chamfer Rebar & Formwork Checking
PD-EC1-1-150	PD EC1-1 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-1-160	PD EC1-1 Internal Wall Chamfer Formwork Removal
EC1-2	
PD-EC1-2-030	PD EC1-2 Installation of Precast Culvert Base
PD-EC1-2-040	PD EC1-2 Removal of Buoyancy
PD-EC1-2-045	PD EC1-2 External Wall Frameworks
PD-EC1-2-050	PD EC1-2 External Wall Rebar Fixing
PD-EC1-2-060	PD EC1-2 External Wall Formwork Installation
PD-EC1-2-070	PD EC1-2 External Wall Rebar & Formwork Checking
PD-EC1-2-080	PD EC1-2 External Wall Insitu Concrete
PD-EC1-2-090	PD EC1-2 External Wall Formwork Removal
PD-EC1-2-100	PD EC1-2 External Wall Support Framework Removal
PD-EC1-2-110	PD EC1-2 Internal Wall Cleaning

Activity ID	Activity Name
PD-EC1-2-120	PD EC1-2 Internal Wall Rebar Fixing
PD-EC1-2-130	PD EC1-2 Internal Chamfer Formwork Installation
PD-EC1-2-140	PD EC1-2 Internal Chamfer Rebar & Formwork Checking
PD-EC1-2-150	PD EC1-2 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-2-160	PD EC1-2 Internal Wall Chamfer Formwork Removal
PD-EC1-2-170	PD EC1-2 Internal Wall Formwork Installation
PD-EC1-2-180	PD EC1-2 Internal Wall Rebar & Formwork Checking
PD-EC1-2-190	PD EC1-2 Internal Wall Concrete
PD-EC1-2-200	PD EC1-2 Internal Wall Formwork Removal
PD-EC1-2-210	PD EC1-2 Top Slab Support
PD-EC1-2-220	PD EC1-2 Top Slab Formwork
PD-EC1-2-230	PD EC1-2 Top Slab Rebar Fixing
PD-EC1-2-240	PD EC1-2 Top Slab Rebar & Formwork Checking
PD-EC1-2-250	PD EC1-2 Top Slab Insitu Concrete
PD-EC1-2-260	PD EC1-2 Top Slab Side Formwork Removal
PD-EC1-2-270	PD EC1-2 Top Slab Curing
EC1-3	
PD-EC1-3-020	PD EC1-3 Buoyancy
PD-EC1-3-030	PD EC1-3 Installation of Precast Culvert Base
PD-EC1-3-040	PD EC1-3 Removal of Buoyancy
PD-EC1-3-045	PD EC1-3 External Wall Frameworks
PD-EC1-3-050	PD EC1-3 External Wall Rebar Fixing
PD-EC1-3-060	PD EC1-3 External Wall Formwork Installation
PD-EC1-3-070	PD EC1-3 External Wall Rebar & Formwork Checking

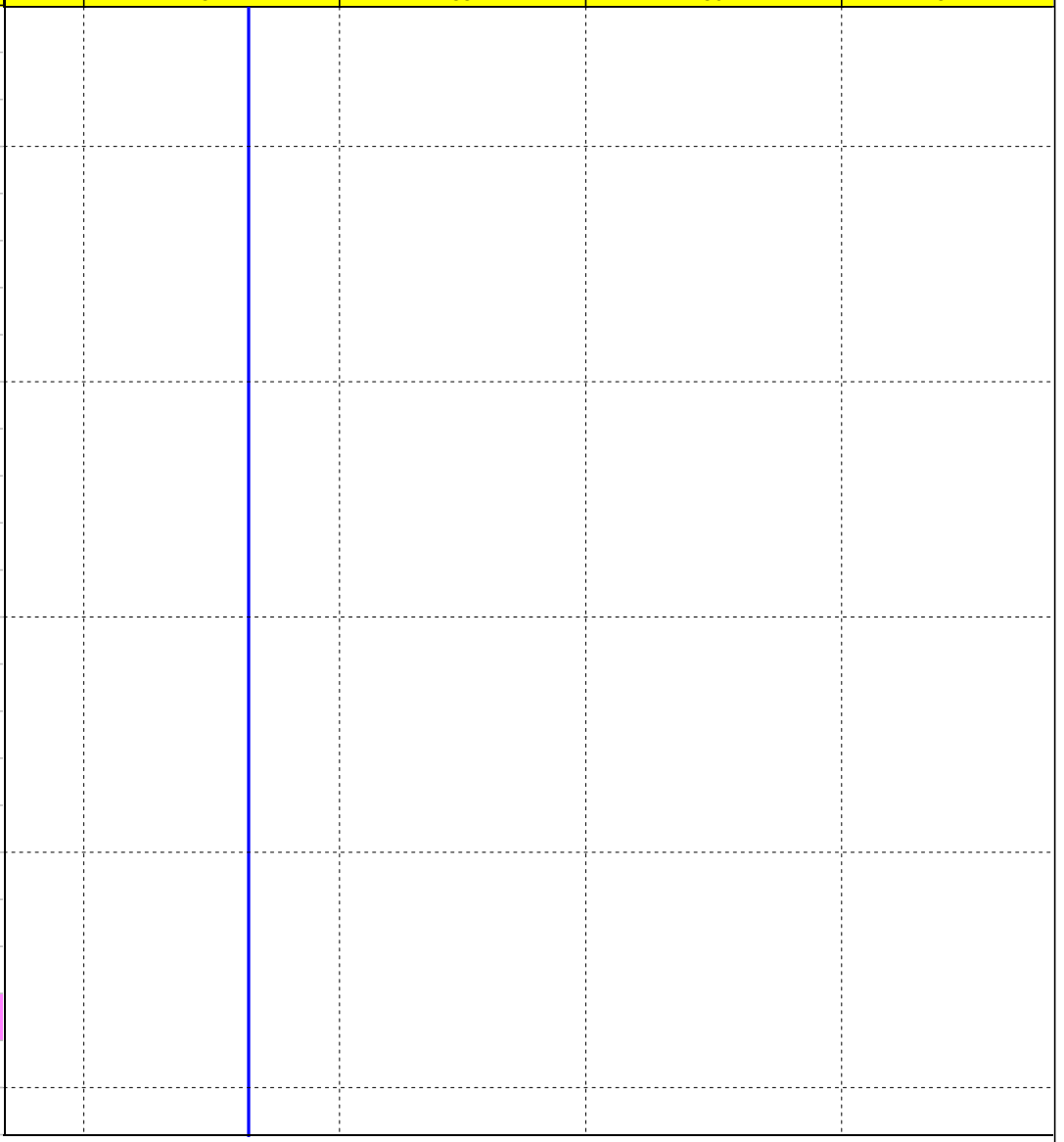
Activity ID	Activity Name
PD-EC1-3-080	PD EC1-3 External Wall Insitu Concrete
PD-EC1-3-090	PD EC1-3 External Wall Formwork Removal
PD-EC1-3-100	PD EC1-3 External Wall Support Framework Removal
PD-EC1-3-110	PD EC1-3 Internal Wall Cleaning
PD-EC1-3-120	PD EC1-3 Internal Wall Rebar Fixing
PD-EC1-3-130	PD EC1-3 Internal Chamfer Formwork Installation
PD-EC1-3-140	PD EC1-3 Internal Chamfer Rebar & Formwork Checking
PD-EC1-3-150	PD EC1-3 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-3-160	PD EC1-3 Internal Wall Chamfer Formwork Removal
PD-EC1-3-170	PD EC1-3 Internal Wall Formwork Installation
PD-EC1-3-180	PD EC1-3 Internal Wall Rebar & Formwork Checking
PD-EC1-3-190	PD EC1-3 Internal Wall Concrete
PD-EC1-3-200	PD EC1-3 Internal Wall Formwork Removal
PD-EC1-3-210	PD EC1-3 Top Slab Support
PD-EC1-3-220	PD EC1-3 Top Slab Formwork
PD-EC1-3-230	PD EC1-3 Top Slab Rebar Fixing
PD-EC1-3-240	PD EC1-3 Top Slab Rebar & Formwork Checking
EC1-4	
PD-EC1-4-010	PD EC1-4, EC1-5 & EC1-6 Back & Delivery stg15
PD-EC1-4-020	PD EC1-4 Buoyancy
PD-EC1-4-030	PD EC1-4 Installation of Precast Culvert Base
PD-EC1-4-040	PD EC1-4 Removal of Buoyancy
PD-EC1-4-045	PD EC1-4 External Wall Frameworks
PD-EC1-4-050	PD EC1-4 External Wall Rebar Fixing



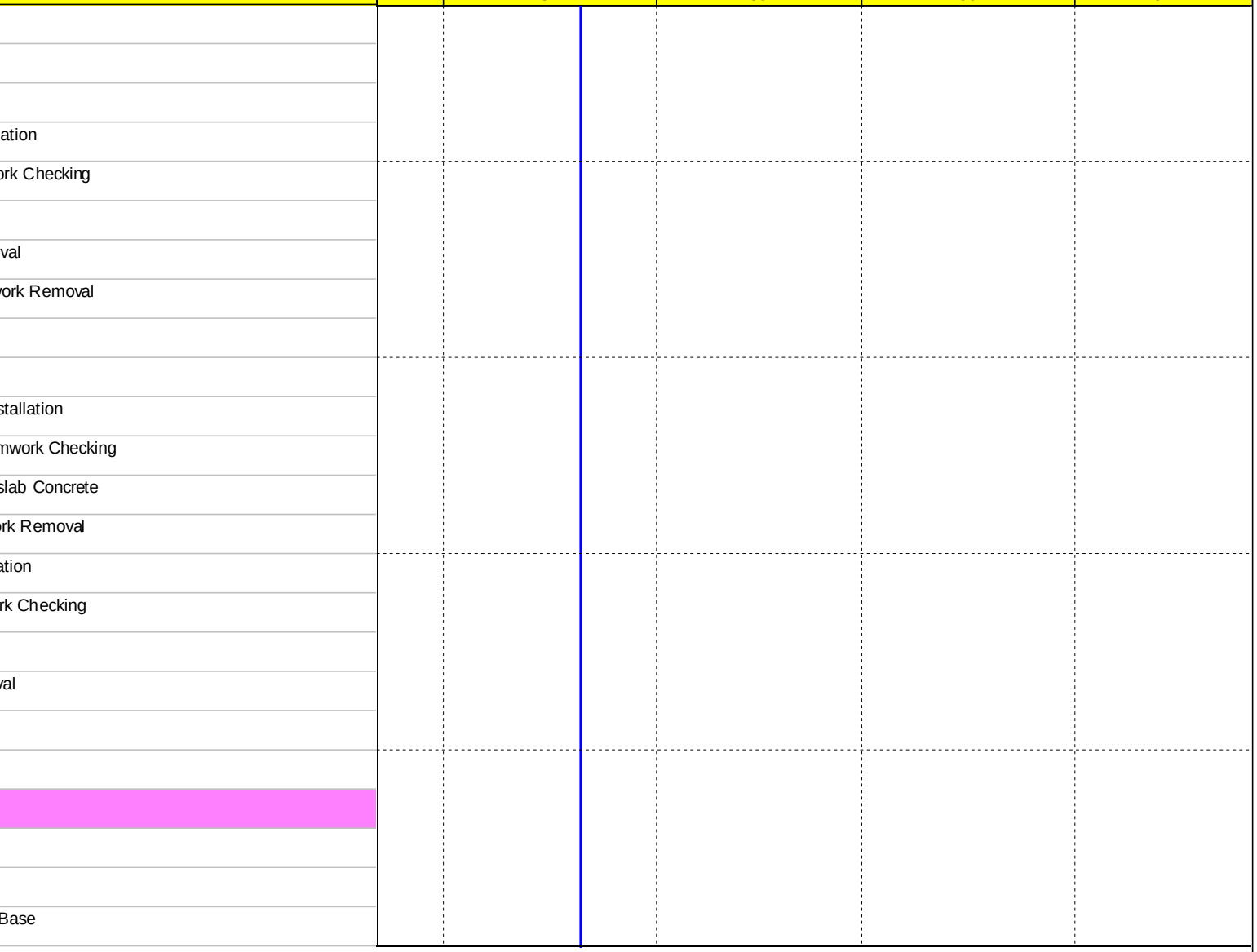
Activity ID	Activity Name
PD-EC1-4-060	PD EC1-4 External Wall Formwork Installation
PD-EC1-4-070	PD EC1-4 External Wall Rebar & Formwork Checking
PD-EC1-4-080	PD EC1-4 External Wall Insitu Concrete
PD-EC1-4-090	PD EC1-4 External Wall Formwork Removal
PD-EC1-4-100	PD EC1-4 External Wall Support Framework Removal
PD-EC1-4-110	PD EC1-4 Internal Wall Cleaning
PD-EC1-4-120	PD EC1-4 Internal Wall Rebar Fixing
PD-EC1-4-130	PD EC1-4 Internal Chamfer Formwork Installation
PD-EC1-4-140	PD EC1-4 Internal Chamfer Rebar & Formwork Checking
PD-EC1-4-150	PD EC1-4 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-4-160	PD EC1-4 Internal Wall Chamfer Formwork Removal
PD-EC1-4-170	PD EC1-4 Internal Wall Formwork Installation
PD-EC1-4-180	PD EC1-4 Internal Wall Rebar & Formwork Checking
PD-EC1-4-190	PD EC1-4 Internal Wall Concrete
PD-EC1-4-200	PD EC1-4 Internal Wall Formwork Removal
PD-EC1-4-210	PD EC1-4 Top Slab Support
PD-EC1-4-220	PD EC1-4 Top Slab Formwork
PD-EC1-4-230	PD EC1-4 Top Slab Rebar Fixing
PD-EC1-4-240	PD EC1-4 Top Slab Rebar & Formwork Checking
PD-EC1-4-250	PD EC1-4 Top Slab Insitu Concrete
PD-EC1-4-260	PD EC1-4 Top Slab Side Formwork Removal
PD-EC1-4-270	PD EC1-4 Top Slab Curing
EC1-5	
PD-EC1-5-020	PD EC1-5 Buoyancy



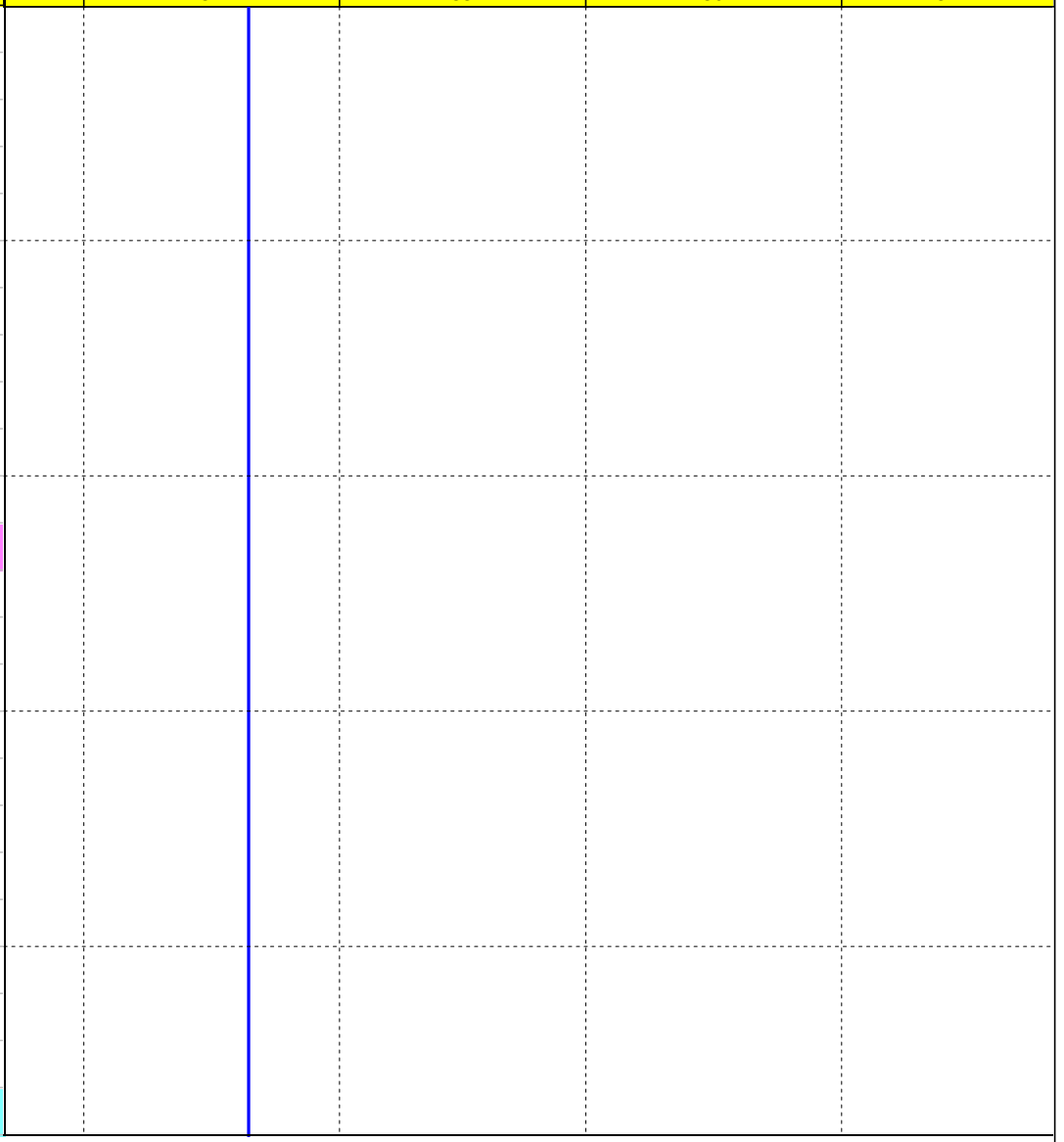
Activity ID	Activity Name
PD-EC1-5-030	PD EC1-5 Installation of Precast Culvert Base
PD-EC1-5-040	PD EC1-5 Removal of Buoyancy
PD-EC1-5-045	PD EC1-5 External Wall Frameworks
PD-EC1-5-050	PD EC1-5 External Wall Rebar Fixing
PD-EC1-5-060	PD EC1-5 External Wall Formwork Installation
PD-EC1-5-070	PD EC1-5 External Wall Rebar & Formwork Checking
PD-EC1-5-080	PD EC1-5 External Wall Insitu Concrete
PD-EC1-5-090	PD EC1-5 External Wall Formwork Removal
PD-EC1-5-100	PD EC1-5 External Wall Support Framework Removal
PD-EC1-5-110	PD EC1-5 Internal Wall Cleaning
PD-EC1-5-120	PD EC1-5 Internal Wall Rebar Fixing
PD-EC1-5-130	PD EC1-5 Internal Chamfer Formwork Installation
PD-EC1-5-140	PD EC1-5 Internal Chamfer Rebar & Formwork Checking
PD-EC1-5-150	PD EC1-5 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-5-160	PD EC1-5 Internal Wall Chamfer Formwork Removal
PD-EC1-5-170	PD EC1-5 Internal Wall Formwork Installation
PD-EC1-5-180	PD EC1-5 Internal Wall Rebar & Formwork Checking
PD-EC1-5-190	PD EC1-5 Internal Wall Concrete
PD-EC1-5-200	PD EC1-5 Internal Wall Formwork Removal
PD-EC1-5-210	PD EC1-5 Top Slab Support
PD-EC1-5-220	PD EC1-5 Top Slab Formwork
EC1-6	
PD-EC1-6-020	PD EC1-6 Buoyancy
PD-EC1-6-030	PD EC1-6 Installation of Precast Culvert Base



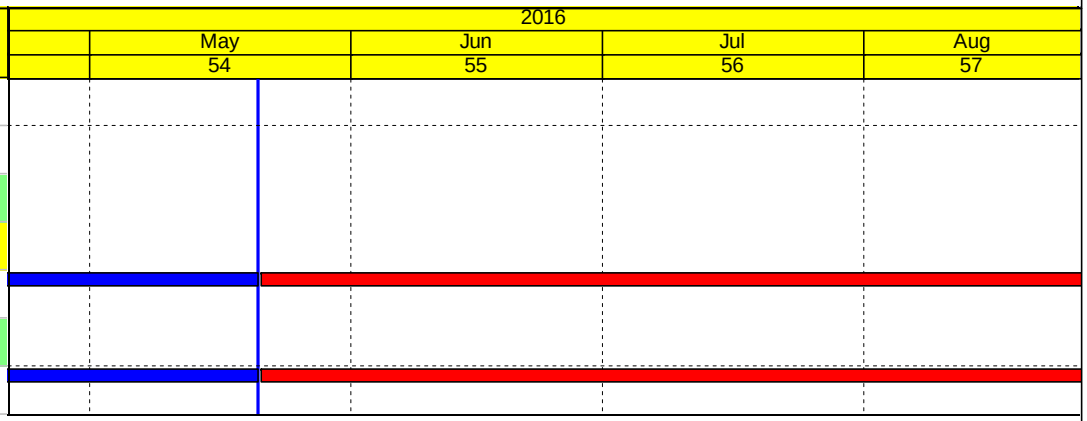
Activity ID	Activity Name
PD-EC1-6-040	PD EC1-6 Removal of Buoyancy
PD-EC1-6-045	PD EC1-6 External Wall Frameworks
PD-EC1-6-050	PD EC1-6 External Wall Rebar Fixing
PD-EC1-6-060	PD EC1-6 External Wall Formwork Installation
PD-EC1-6-070	PD EC1-6 External Wall Rebar & Formwork Checking
PD-EC1-6-080	PD EC1-6 External Wall Insitu Concrete
PD-EC1-6-090	PD EC1-6 External Wall Formwork Removal
PD-EC1-6-100	PD EC1-6 External Wall Support Framework Removal
PD-EC1-6-110	PD EC1-6 Internal Wall Cleaning
PD-EC1-6-120	PD EC1-6 Internal Wall Rebar Fixing
PD-EC1-6-130	PD EC1-6 Internal Chamfer Formwork Installation
PD-EC1-6-140	PD EC1-6 Internal Chamfer Rebar & Formwork Checking
PD-EC1-6-150	PD EC1-6 Internal Wall Chamfer & Baseslab Concrete
PD-EC1-6-160	PD EC1-6 Internal Wall Chamfer Formwork Removal
PD-EC1-6-170	PD EC1-6 Internal Wall Formwork Installation
PD-EC1-6-180	PD EC1-6 Internal Wall Rebar & Formwork Checking
PD-EC1-6-190	PD EC1-6 Internal Wall Concrete
PD-EC1-6-200	PD EC1-6 Internal Wall Formwork Removal
PD-EC1-6-210	PD EC1-6 Top Slab Support
PD-EC1-6-220	PD EC1-6 Top Slab Formwork
EC1-7	
PD-EC1-7-010	PD EC1-7 & C1-1 Back & Delivery stg16
PD-EC1-7-020	PD EC1-7 Buoyancy
PD-EC1-7-030	PD EC1-7 Installation of Precast Culvert Base



Activity ID	Activity Name
PD-EC1-7-040	PD EC1-7 Removal of Buoyancy
PD-EC1-7-045	PD EC1-7 External Wall Frameworks
PD-EC1-7-050	PD EC1-7 External Wall Rebar Fixing
PD-EC1-7-060	PD EC1-7 External Wall Formwork Installation
PD-EC1-7-070	PD EC1-7 External Wall Rebar & Formwork Checking
PD-EC1-7-080	PD EC1-7 External Wall Insitu Concrete
PD-EC1-7-090	PD EC1-7 External Wall Formwork Removal
PD-EC1-7-100	PD EC1-7 External Wall Support Framework Removal
PD-EC1-7-110	PD EC1-7 Internal Wall Cleaning
PD-EC1-7-120	PD EC1-7 Internal Wall Rebar Fixing
PD-EC1-7-130	PD EC1-7 Internal Chamfer Formwork Installation
EC1-8	
PD-EC1-8-010	PD EC1-8 & C4-1 Back & Delivery stg17
PD-EC1-8-020	PD EC1-8 Buoyancy
PD-EC1-8-030	PD EC1-8 Outfall Installation of Precast Culvert Base
PD-EC1-8-040	PD EC1-8 Removal of Buoyancy
PD-EC1-8-045	PD EC1-8 External Wall Frameworks
PD-EC1-8-050	PD EC1-8 External Wall Rebar Fixing
PD-EC1-8-060	PD EC1-8 External Wall Formwork Installation
PD-EC1-8-070	PD EC1-8 External Wall Rebar & Formwork Checking
PD-EC1-8-080	PD EC1-8 External Wall Insitu Concrete
PD-EC1-8-090	PD EC1-8 External Wall Formwork Removal
PD-EC1-8-100	PD EC1-8 External Wall Support Framework Removal
Backfilling & Reclamation	



Activity ID	Activity Name
PD-EC1-0100-01	Backfill west side of EC1-2 to EC1-6 for Handover to Other Contractors
PD-EC1-0100-01	Handover 40m strip to other Contractor
Works Area WA2 (Tung Chung)	
Zone A	
A1880	Maintenance of Engineer's Accommodation
Works Area TKO Fill Bank	
WA-TKO-1040	Operate and Maintain Public Fill Sorting Facilities in Zone A, B1 & B2



Appendix C - Implementation Schedule of Environmental Mitigation Measures

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
Air Quality				
S5.5.6.1 of HKBCFEIA	A1	The contractor shall follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation	All construction sites	V
S5.5.6.2 of HKBCFEIA and S4.8.1 of TKCLKLEIA	A2	Proper watering of exposed spoil should be undertaken throughout the construction phase: • Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading; • Any dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads; • A stockpile of dusty material should not be extend beyond the pedestrian barriers, fencing or traffic cones. • Where practicable, vehicle washing facilities with high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores; • When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period; • The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials; • Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously; • Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after the activities so as to maintain the entire surface wet; • Where a scaffolding is erected around the perimeter of a building under construction, effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building, or a canopy should be provided from the first floor level up to the highest level of the scaffolding; • Any skip hoist for material transport should be totally enclosed by impervious sheeting; • Every stock of more than 20 bags of cement or dry pulverised fuel ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides;		

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• Cement or dry PFA delivered in bulk should be stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed; • All unpaved roads/exposed area shall be watered which results in dust suppression by forming moist cohesive films among the discrete grains of road surface material. • No burning of debris or other materials on the works areas is allowed; • Water spray shall be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created; • Open dropping heights for excavated materials shall be controlled to a maximum height of 2m to minimise the fugitive dust arising from unloading; • During transportation by truck, materials shall not be loaded to a level higher than the side and tail boards, and shall be dampened or covered before transport. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards; • Loading, unloading, transfer, handling or storage of bulk cement or dry PFA should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with an effective fabric filter or equivalent air pollution control system; and		

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• Exposed earth should be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabiliser within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies.		
S5.5.6.3 of HKBCFEIA and S4.8.1 of TKCLKLEIA	A3	The Contractor should undertake proper watering on all exposed spoil and associated work areas (with at least 8 times per day) throughout the construction phase.	All construction sites	V
S5.5.6.4 of HKBCFEIA and S4.11 of TKCLKLEIA	A4	Implement regular dust monitoring under EM&A programme during the construction stage.	Selected representative dust monitoring station	V
S5.5.7.1 of HKBCFEIA	A5	The following mitigation measures should be adopted to prevent fugitive dust emissions for concrete batching plant: • Loading, unloading, handling, transfer or storage of any dusty materials should be carried out in totally enclosed system; • All dust-laden air or waste gas generated by the process operations should be properly extracted and vented to fabric filtering system to meet the emission limits for TSP; • Vents for all silos and cement/ pulverised fuel ash (PFA) weighing scale should be fitted with fabric filtering system;	All construction sites	N/A

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• The materials which may generate airborne dusty emissions should be wetted by water spray system; • All receiving hoppers should be enclosed on three sides up to 3m above unloading point; • All conveyor transfer points should be totally enclosed; • All access and route roads within the premises should be paved and wetted; and • Vehicle cleaning facilities should be provided and used by all concrete trucks before leaving the premises to wash off any dust on the wheels and/or body.		
S5.5.2.7 of HKBCFEIA	A6	The following mitigation measures should be adopted to prevent fugitive dust emissions at barging point: • All road surface within the barging facilities will be paved; • Dust enclosures will be provided for the loading ramp; • Vehicles will be required to pass through designated wheels wash facilities; and • Continuous water spray at the loading points.	All construction sites	N/A (Construction in process)
Construction Noise (Air borne)				
S6.4.10 of HKBCFEIA	N1	Use of good site practices to limit noise emissions by considering the following: • only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme; • machines and plant (such as trucks, cranes) that may be in intermittent use	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		should be shut down between work periods or should be throttled down to a minimum; • plant known to emit noise strongly in one direction, where possible, be orientated so that the noise is directed away from nearby NSRs; • silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works; • mobile plant should be sited as far away from NSRs as possible and practicable; • material stockpiles, mobile container site officer and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.		
S6.4.11 of HKBCFEIA	N2	Install temporary hoarding located on the site boundaries between noisy construction activities and NSRs. The conditions of the hoardings shall be properly maintained throughout the construction period.	All construction sites	V
S6.4.12 of HKBCFEIA	N3	Install movable noise barriers (typically density @14kg/m^2), acoustic mat or full enclosure close to noisy plants including air compressor, generators, saw.	For plant items listed in Appendix 6D of the EIA report at all construction sites	N/A
S6.4.13 of HKBCFEIA	N4	Select “Quiet plants” which comply with the BS 5228 Part 1 or TM standards.	For plant items listed in Appendix 6D of the EIA report at all construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
S6.4.14 of HKBCFEIA	N5	Sequencing operation of construction plants where practicable.	All construction sites where practicable	V
S5.1 of TMCLKLEIA	N6	Implement a noise monitoring under EM&A programme.	Selected representative noise monitoring station	V
Waste Management (Construction Waste)				
S12.6 of TMCLKLEIA	WM1	The Contractor shall identify a coordinator for the management of waste.	All construction sites	V
S12.6 of TMCLKLEIA	WM2	The Contractor shall apply for and obtain the appropriate licenses for the disposal of public fill, chemical waste and effluent discharges.	All construction sites	V
S12.6 of TMCLKLEIA	WM3	EM&A of waste handling, storage, transportation, disposal procedures and documentation through the site audit programme shall be undertaken.	All construction sites	V
S8.3.8 of HKBCFEIA and S12.6 of TMCLKLEIA	WM4	*Construction and Demolition Material* The following mitigation measures should be implemented in handling the waste: • Maintain temporary stockpiles and reuse excavated fill material for backfilling and reinstatement; • Carry out on-site sorting; • Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate; • Adopt ‘Selective Demolition’ technique to demolish the existing structures and	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		facilities with a view to recovering broken concrete effectively for recycling purpose, where possible; • Implement a trip-ticket system for each works contract to ensure that the disposal of C&D materials are properly documented and verified; • Implement an enhanced Waste Management Plan similar to ETWBTC (Works) No. 19/2005 – "Environmental Management on Construction Sites" to encourage on-site sorting of C&D materials and to minimize their generation during the course of construction; • In addition, disposal of the C&D materials onto any sensitive locations such as agricultural lands, etc. should be avoided. The Contractor shall propose the final disposal sites to the Project Proponent and get its approval before implementation; and • The surplus surcharge should be transferred to a fill bank.		
S8.3.9-S8.3.11 of HKBCFEIA and S12.6 of TMCLKLEIA	WM5	*C&D Waste* • Standard formwork or pre-fabrication should be used as far as practicable in order to minimise the arising of C&D materials. The use of more durable formwork or plastic facing for the construction works should be considered. Use of wooden hoardings should not be used, as in other projects. Metal hoarding and falsework should be used to enhance the possibility of recycling. The purchasing of construction materials will be carefully planned in order to avoid over ordering	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		and wastage. • The Contractor should recycle as much of the C&D materials as possible on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. Where practicable, concrete and masonry can be crushed and used as fill. Steel reinforcement bar can be used by scrap steel mills. Different areas of the sites should be considered for such segregation and storage.		
S8.2.12-S8.3.15 of HKBCFEIA and S12.6 of TMCLKLEIA	WM6	*Chemical Waste* • Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. • Containers used for the storage of chemical wastes should be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed; have a capacity of less than 450 liters unless the specification has been approved by the EPD; and display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the regulation. • The storage area for chemical wastes should be clearly labelled and used solely for the storage of chemical waste; enclosed on at least 3 sides; have an impermeable floor and bunding of sufficient capacity to accommodate 110% of the volume of the largest container or 20 % of the total volume of waste stored in that area, whichever is the greatest; have adequate ventilation; covered to prevent	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		rainfall entering; and arranged so that incompatible materials are adequately separated. • Disposal of chemical waste should be via a licensed waste collector; be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Centre which also offers a chemical waste collection service and can supply the necessary storage containers; or be to a reuser of the waste, under approval from the EPD.		
S8.3.16 of HKBCFEIA and S12.6 of TMCLKLEIA	WM7	*Sewage* • Adequate numbers of portable toilets should be provided for the workers. The portable toilets should be maintained in a state, which will not deter the workers from utilizing these portable toilets. Night soil should be collected by licensed collectors regularly.	All construction sites	V
S8.3.17 of HKBCFEIA and S12.6 of TMCLKLEIA	WM8	*General Refuse* • The site and surroundings shall be kept tidy and litter free. General refuse generated on-site should be stored in enclosed bins or compaction units separately from construction and chemical wastes. • A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to minimize odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.	All construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated and made easily accessible. Separate labelled bins for their deposit should be provided if feasible. • Office wastes can be reduced through the recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered by the Contractor. In addition, waste separation facilities for paper, aluminum cans, plastic bottles etc., should be provided. • Training should be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including reduction, reuse and recycling of wastes. • Sufficient dustbins shall be provided for storage of waste as required under the Public Cleansing and Prevention of Nuisances By-laws. In addition, general refuse shall be cleared daily and shall be disposed of to the nearest licensed landfill or refuse transfer station. • All waste containers shall be in a secure area on hardstanding.		

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
Water Quality (Construction Phase)				
	W1	Mitigation during the marine works to reduce impacts to within acceptable levels have been recommended and will comprise a series of measures that restrict the method and sequencing of backfilling, as well as protection measures. Details of the measures are provided below: • Reclamation filling for the Project shall not proceed until at least 200m of leading seawall at the reclamation area formed above +2.2mPD, unless otherwise agreement was obtained from EPD, except for the 300m gaps for marine access. All underwater filling works shall be carried out behind seawalls to avoid dispersion of suspended solids outside the Project limit; • Except for the filling of the cellular structures, not more than 15% public fill shall be used for reclamation filling below +2.5mPD during construction of the seawall; • After the seawall is completed except for the 300m marine access as indicated in the EPs, not more than 30% public fill shall be used for reclamation filling below +2.5mPD, unless otherwise agreement from EPD was obtained; • Upon completion of 200m leading seawall, no more than a total of 60 filling barge trips per day shall be made with a cumulative maximum daily filling rate of 60,000 m3 for HKBCF and TMCLKL southern landfall reclamation during the filling operation; and • Upon completion of the whole section of seawall except for the 300m marine	During filling	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		access as indicated in the EPs, no more than a total of 190 filling barge trips per day shall be made with a cumulative maximum daily filling rate of 190,000 m3 for the remaining filling operations for HKBCF and TMCLKL southern landfall reclamation. • Floating type perimeter silt curtains shall be around the HKBCF site before the commencement of marine works. Staggered layers of silt curtain shall be provided to prevent sediment loss at navigation accesses. The length of each staggered layers shall be at least 200m; • Single layer silt curtain to be applied around the North-east airport water intake; • The silt-curtains should be maintained in good condition to ensure the sediment plume generated from filling be confined effectively within the site boundary; • The filling works shall be scheduled to spread the works evenly over a working day; • Cellular structure shall be used for seawall construction; • A layer of geotextile shall be placed on top of the seabed before any filling activities take place inside the cellular structures to form the seawall; • The conveyor belts shall be fitted with windboards and conveyor release points shall be covered with curtain to prevent any spillage of filling materials onto the surrounding waters; and • An additional layer of silt curtain shall be installed near the active stone column		

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		installation points. A layer of geotextile with stone blanket on top shall be placed on the seabed prior to stone column installation works.		
S9.11.1.3 of HKBCFEIA and S6.10 of TMCLKLEIA	W2	<u>Land Works</u> General construction activities on land should also be governed by standard good working practice. Specific measures to be written into the works contracts should include: • wastewater from temporary site facilities should be controlled to prevent direct discharge to surface or marine waters; • sewage effluent and discharges from on-site kitchen facilities shall be directed to Government sewer in accordance with the requirements of the WPCO or collected for disposal offsite. The use of soakaways shall be avoided; • storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks; • silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically	All land-based construction sites	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		at the onset of and after each rainstorm; • temporary access roads should be surfaced with crushed stone or gravel; • rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities; • measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage system; • open stockpiles of construction materials (e.g. aggregates and sand) on site should be covered with tarpaulin or similar fabric during rainstorms; • manholes (including any newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers; • discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system; • all vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay should be provided at every site exit; • wheel wash overflow shall be directed to silt removal facilities before being discharged to the storm drain;		

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• the section of construction road between the wheel washing bay and the public road should be surfaced with crushed stone or coarse gravel; • wastewater generated from concreting, plastering, internal decoration, cleaning work and other similar activities, shall be screened to remove large objects; • vehicle and plant servicing areas, vehicle wash bays and lubrication facilities shall be located under roofed areas. The drainage in these covered areas shall be connected to foul sewers via a petrol interceptor in accordance with the requirements of the WPCO or collected for offsite disposal; • the contractors shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately; • waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance; • all fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank; and • surface run-off from bunded areas should pass through oil/grease traps prior to discharge to the storm water system..		
S9.14 of HKBCFEIA and S6.10 of	W3	Implement a water quality monitoring programme	At identified monitoring location	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
TMCLKLEIA				
S6.10 of TMCLKLEIA	W4	All construction works shall be subject to routine audit to ensure implementation of all EIA recommendations and good working practice.	All construction site areas	V
Ecology (Construction Phase)				
S10.7 of HKBCFEIA and S8.14 of TMCLKLEIA	E1	• Install silt curtain during the construction • Limit works fronts • Construct seawall prior to reclamation filling where practicable • Good site practices • Strict enforcement of no marine dumping • Site runoff control • Spill response plan	Seawall, reclamation area	V
S10.7 of HKBCFEIA	E2	• Watering to reduce dust generation; prevention of siltation of freshwater habitats; Site runoff should be desilted, to reduce the potential for suspended sediments, organics and other contaminants to enter streams and standing freshwater.	Land-based works areas	V
S10.7 of HKBCFEIA and S8.14 of TMCLKLEIA	E3	• Good site practices, including strictly following the permitted works hours, using quieter machines where practicable, and avoiding excessive lightings during night time.	Land-based works areas	V
S10.7 of	E4	• Dolphin Exclusion Zone	Marine works	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
HKBCFEIA and S8.14 of TMCLKLEIA		• Dolphin watching plan		
S10.7 of HKBCFEIA and S8.14 of TMCLKLEIA	E5	• Decouple compressors and other equipment on working vessels • Proposal on design and implementation of acoustic decoupling measures applied during reclamation works • Avoidance of percussive piling	Marine works	V
S10.7 of HKBCFEIA and S8.14 of TMCLKLEIA	E6	• Control vessel speed • Skipper training • Predefined and regular routes for working vessels; avoid Brothers Islands	Marine traffic	V
S10.10 of HKBCFEIA and S8.14 of TMCLKLEIA	E7	• Vessel based dolphin monitoring	Northeast and Northwest Lantau	V
Fisheries				
S11.7 of HKBCFEIA	F1	• Reduce re-suspension of sediments • Limit works fronts • Good site practices • Strict enforcement of no marine dumping	Seawall, reclamation area	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
		• Spill response plan		
S11.7 of HKBCFEIA	F2	• Install silt-grease trap in the drainage system collecting surface runoff	Reclamation area	V
Landscape & Visual (Construction Phase)				
S14.3.3. 3 of HKBCFEIA and S10.9 of TMCLKLEIA	LV1	*Mitigate Landscape Impacts* G1/CM4 Grass-hydroseed or sheeting bare soil surface and stock pile areas. G9 Reserve of loose natural granite rocks for re-use. Provide new coastline to adopt "natural-look" by means of using armour rocks in the form of natural rock materials and planting strip area accommodating screen buffer to enhance "natural-look" of new coastline.	All construction site areas	N/A
S10.9 of TMCLKLEIA	LV2	*Mitigate Landscape Impacts* CM7 Ensure no run-off into water body adjacent to the Project Area.	All construction site areas	V
S14.3.3. 3 of HKBCFEIA	LV4	*Mitigate Visual Impacts* V1 Minimize time for construction activities during construction period.	All construction site areas	V
S10.9 of TMCLKLEIA	LV5	*Mitigate Visual Impacts* CM6 Control night-time lighting and glare by hooding all lights.	All construction site areas	V
EM&A				
S15.2.2 of HKBCFEIA	EM1	An Independent Environmental Checker needs to be employed as per the EM&A Manual.	All construction site areas	V

EIA Ref.	EM&A Log Ref	Environmental Mitigation Measures	Location	Implementation Status
S15.5 - S15.6 of HKBCFEIA	EM2	• An Environmental Team needs to be employed as per the EM&A Manual. • Prepare a systematic Environmental Management Plan to ensure effective implementation of the mitigation measures. • An environmental impact monitoring needs to be implementing by the Environmental Team to ensure all the requirements given in the EM&A Manual are fully complied with.	All construction site areas	V

Legend: V = implemented; x = not implemented; N/A = not applicable

Appendix D - Summary of Action and Limit Levels

Table 1 – Action and Limit Levels for 1-hour TSP

Location	Action Level	Limit Level
AMS2	374 μg/m^3	500 μg/m^3
AMS3B*	368 μg/m^3	500 μg/m^3
AMS6	360 μg/m^3	500 μg/m^3
AMS7	370 μg/m^3	500 μg/m^3

Remarks: * Action Level set out at AMS3 Ho Yu College is adopted.

Table 2 – Action and Limit Levels for 24-hour TSP

Location	Action Level	Limit Level
AMS2	176 μg/m^3	260 μg/m^3
AMS3B*	167 μg/m^3	260 μg/m^3
AMS6	173 μg/m^3	260 μg/m^3
AMS7	183 μg/m^3	260 μg/m^3

Remarks: * Action Level set out at AMS3 Ho Yu College is adopted.

Table 3 – Action and Limit Levels for Construction Noise (0700-1900 hrs of normal weekdays)

Location	Action Level	Limit Level
NMS2	When one documented complaint, related to 0700 – 1900 hours on normal weekdays, is received from any one of the sensitive receivers	75 dB(A)
NMS3B		*65 / 70 dB(A)

*Daytime noise Limit Level of 70 dB(A) applies to education institutions, while 65dB(A) applies during school examination period.

Table 4 – Action and Limit Levels for Water Quality

Parameters	**Action**	**Limit**
DO in mg L^{-1} (Surface, Middle & Bottom)	Surface and Middle 5.0 Bottom 4.7	Surface and Middle 4 .2 (except 5 mg/L for FCZ) Bottom 3.6
SS in mg L^{-1} (depth-averaged)	23.5 and 120% of upstream control station's SS at the same tide of the same day	34.4 and 130% of upstream control station's SS at the same tide of the same day and 10mg/L for WSD Seawater intakes
Turbidity in NTU (depth-averaged)	27.5 and 120% of upstream control station's turbidity at the same tide of the same day	47.0 and130% of upstream control station's turbidity at the same tide of the same day

Notes:

1. "depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
2. For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
3. For turbidity, SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

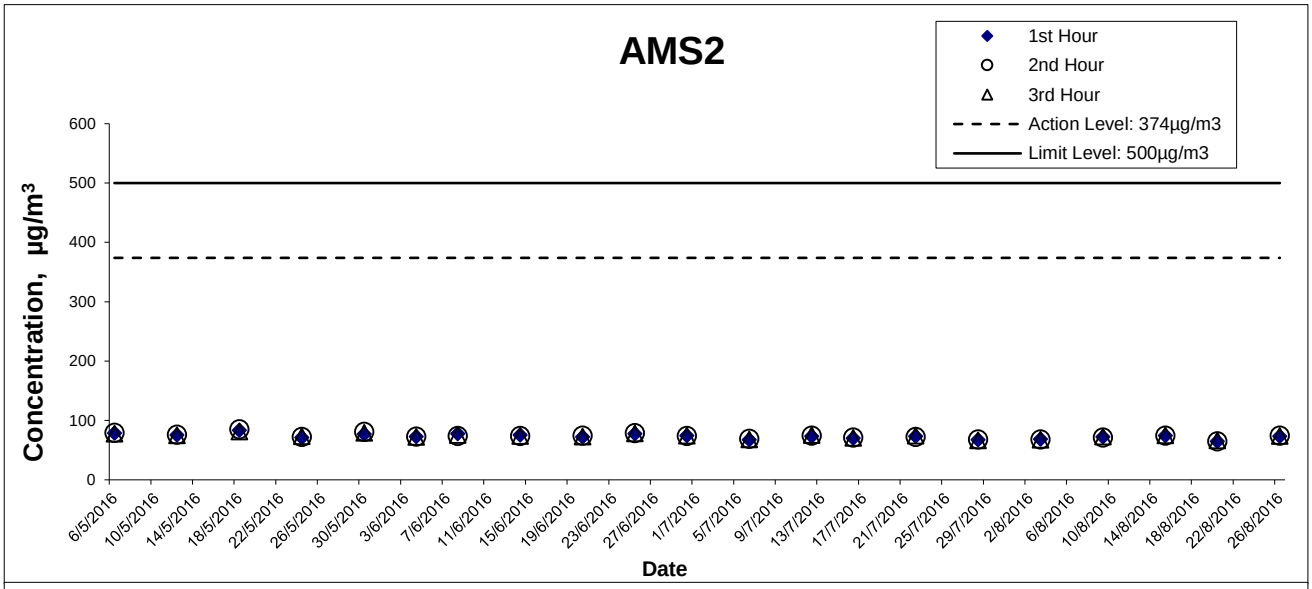
Table 5(a) Action and Limit Levels for Chinese White Dolphin Monitoring - Approach to Define Action Level (AL) and Limit Level (LL):

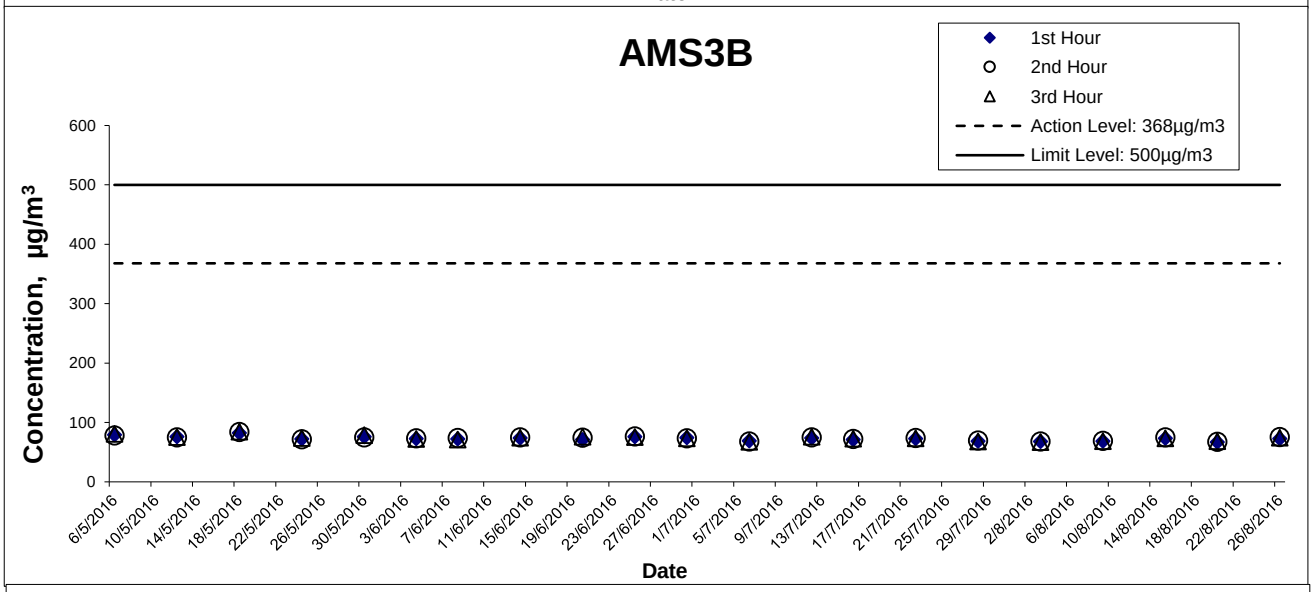
	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	(STG < 70% of baseline) & (ANI < 70% of baseline)	(STG < 70% of baseline) & (ANI < 70% of baseline)
Limit Level	[(STG < 40% of baseline) & (ANI < 40% of baseline)] AND [(STG < 40% of baseline) & (ANI < 40% of baseline)]	

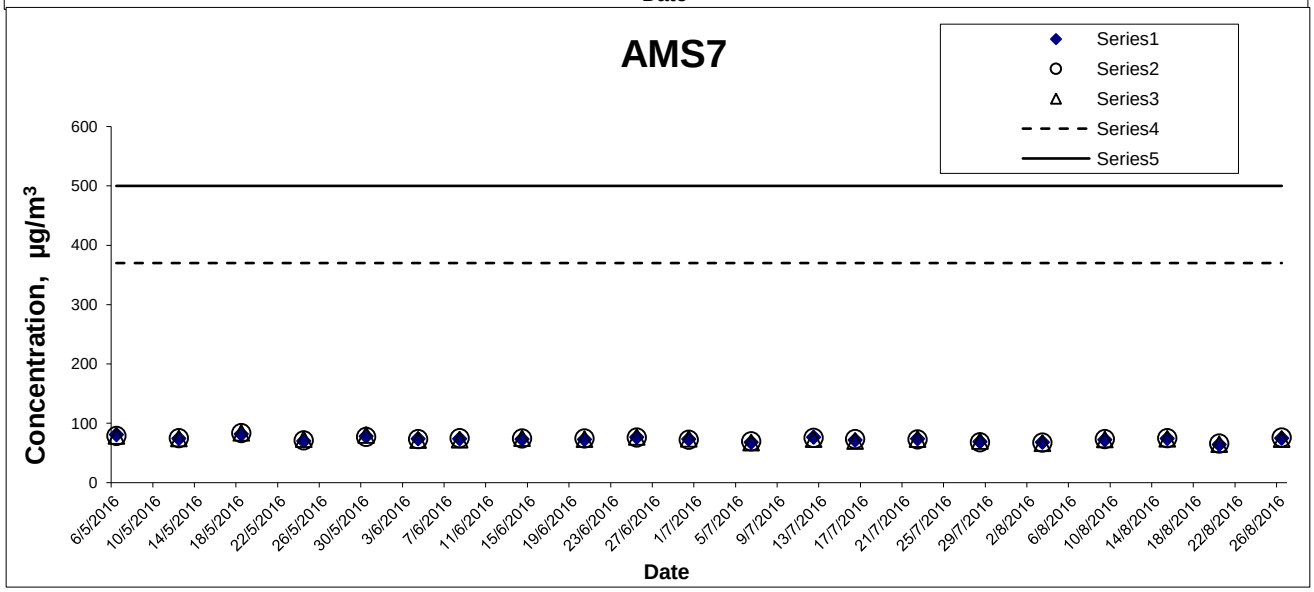
For North Lantau Social Cluster, action level will be trigger if either NEL **or** NWL fall below the criteria; limit level will be triggered if both NEL **and** NWL fall below the criteria.

Table 5(b) Derived Value of Action Level (AL) and Limit Level (LL) for Chinese White Dolphin Monitoring

	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	(STG < 4.2) & (ANI < 15.5)	(STG < 6.9) & (ANI < 31.3)
Limit Level	[(STG < 2.4) & (ANI <8.9)] AND [(STG < 3.9)& (ANI < 17.9)]	







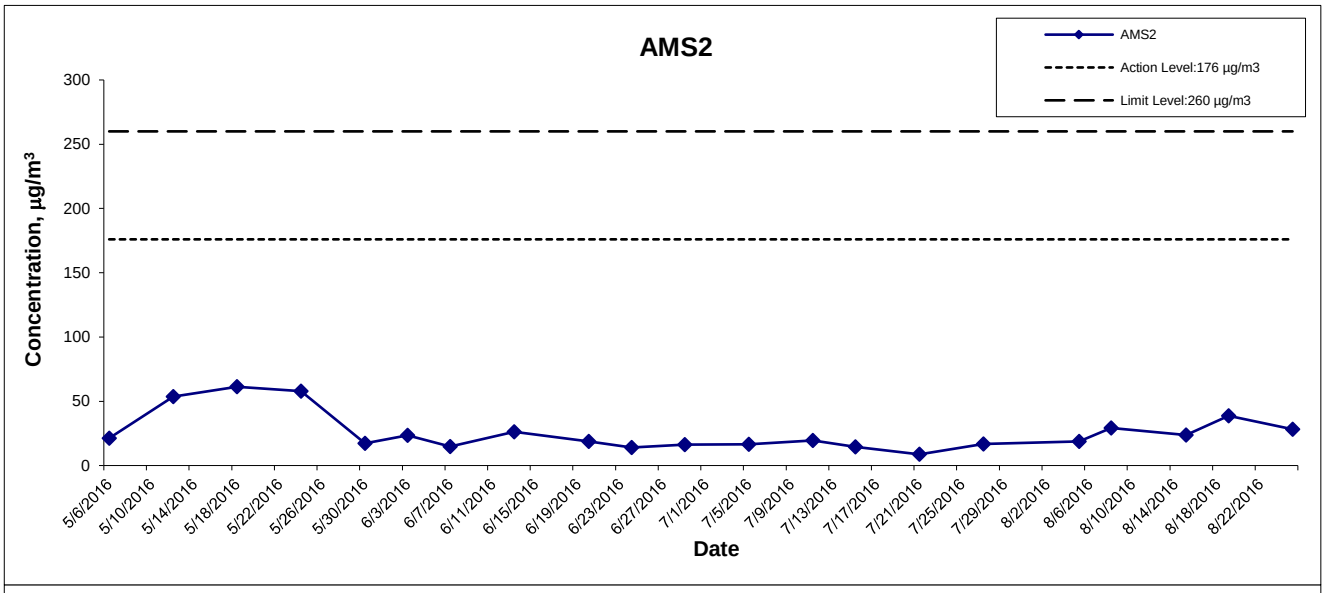
HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

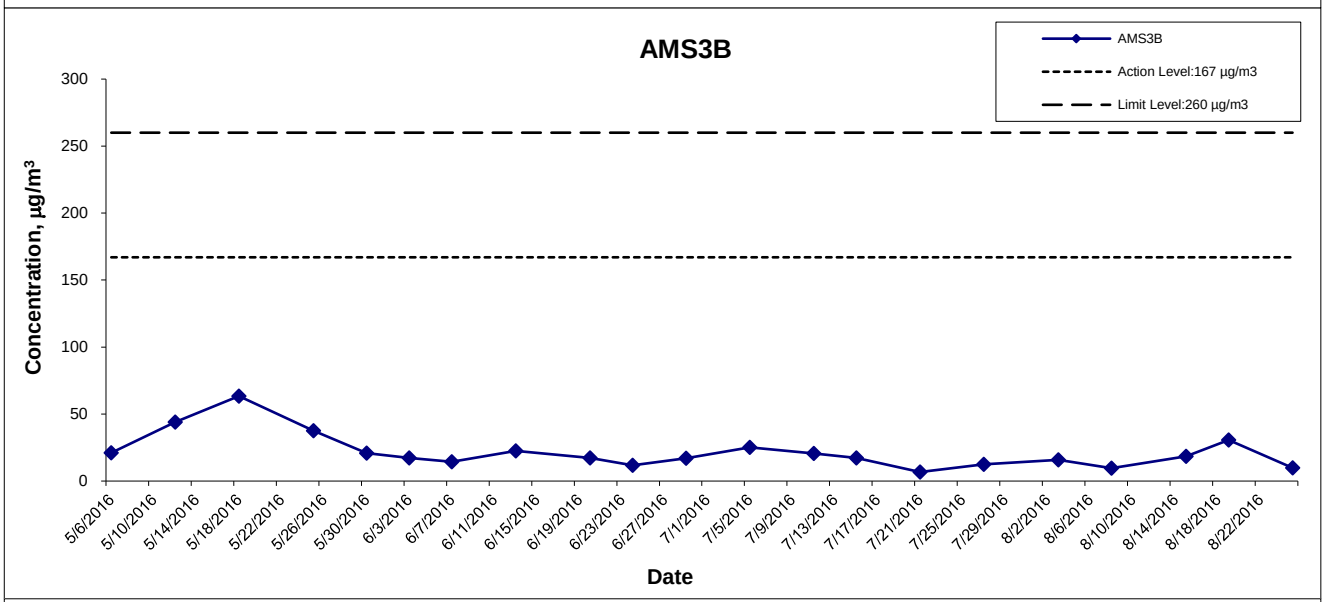
AECOM

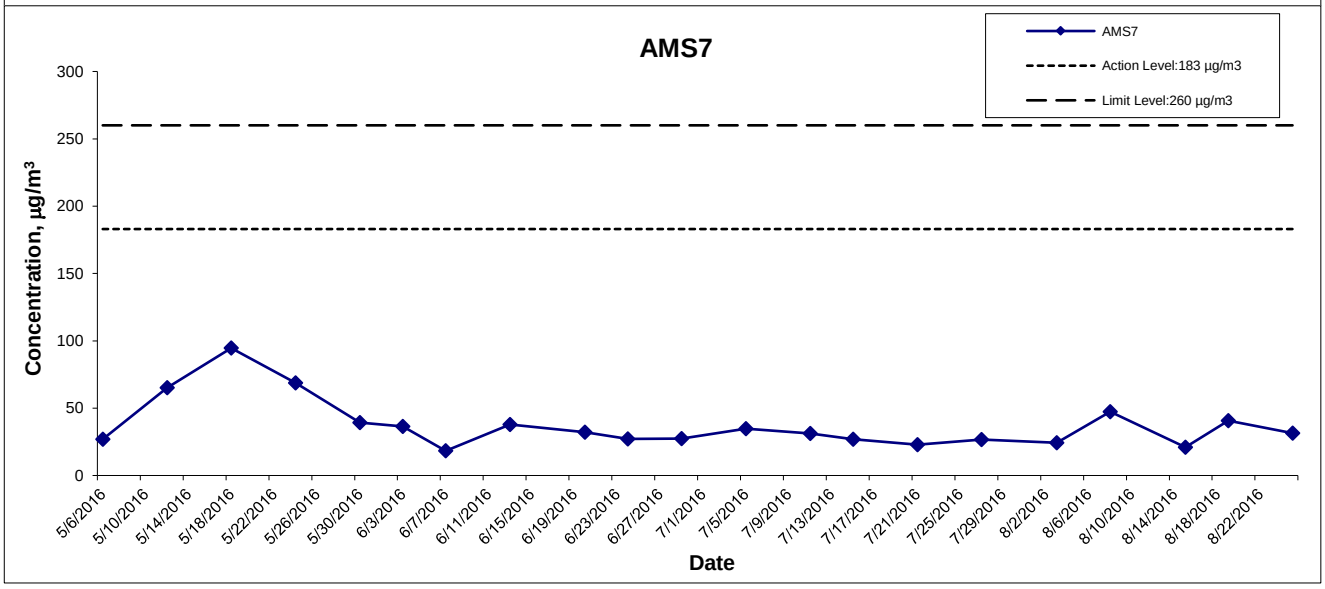
Graphical Presentation of Impact 1-hour TSP Monitoring Results

Project No.: 60249820 **Date: September2016**

Appendix E







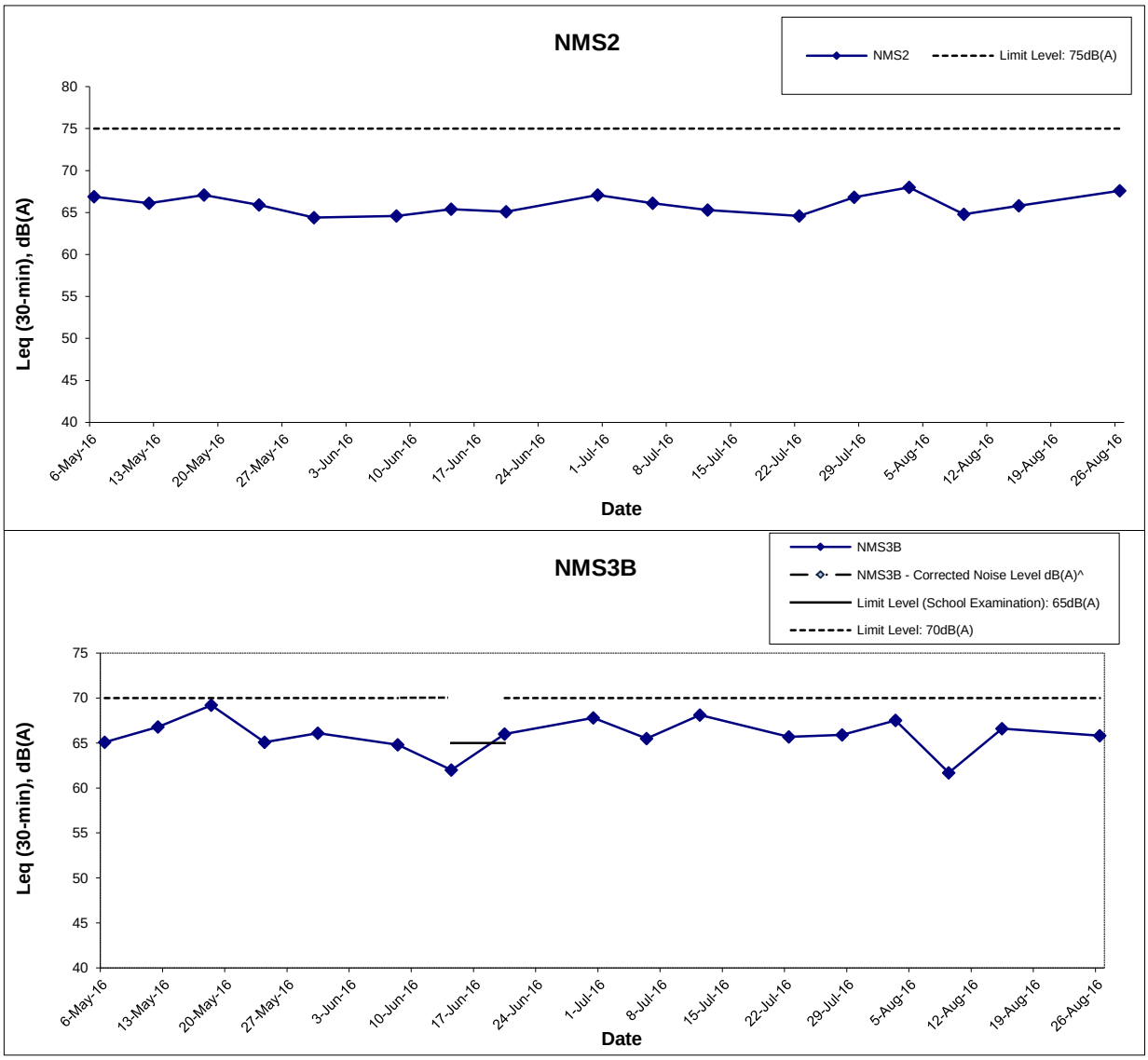
HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

AECOM

Graphical Presentation of Impact 24-hour TSP Monitoring Results

Project No.: 60249820 **Date: September 2016**

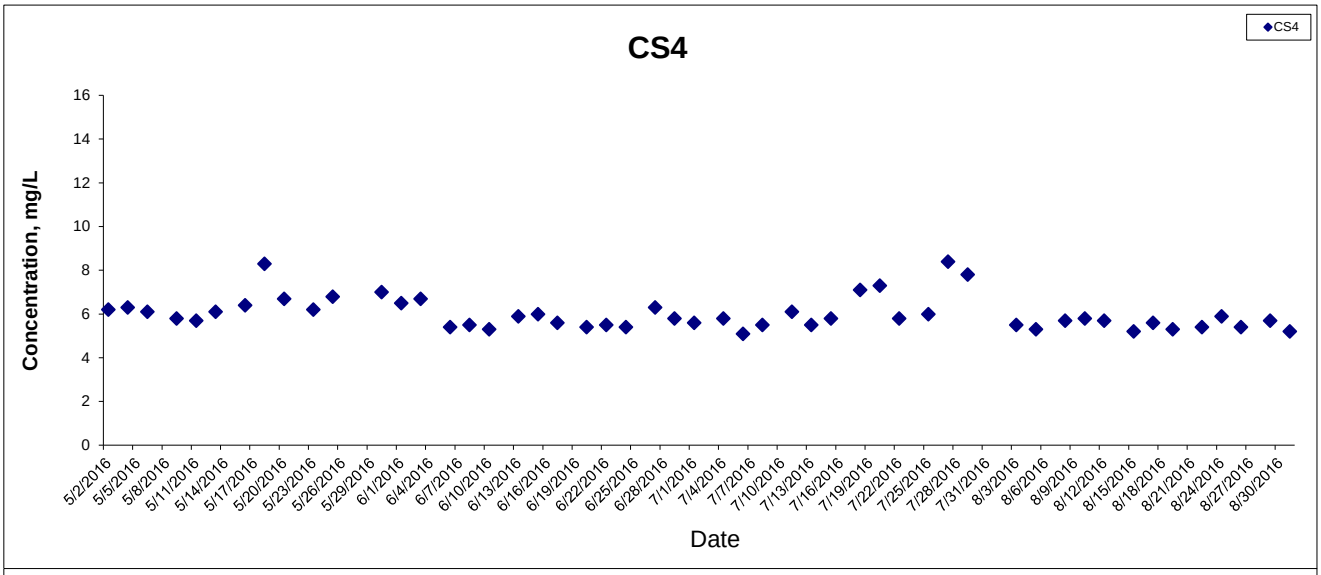
Appendix E

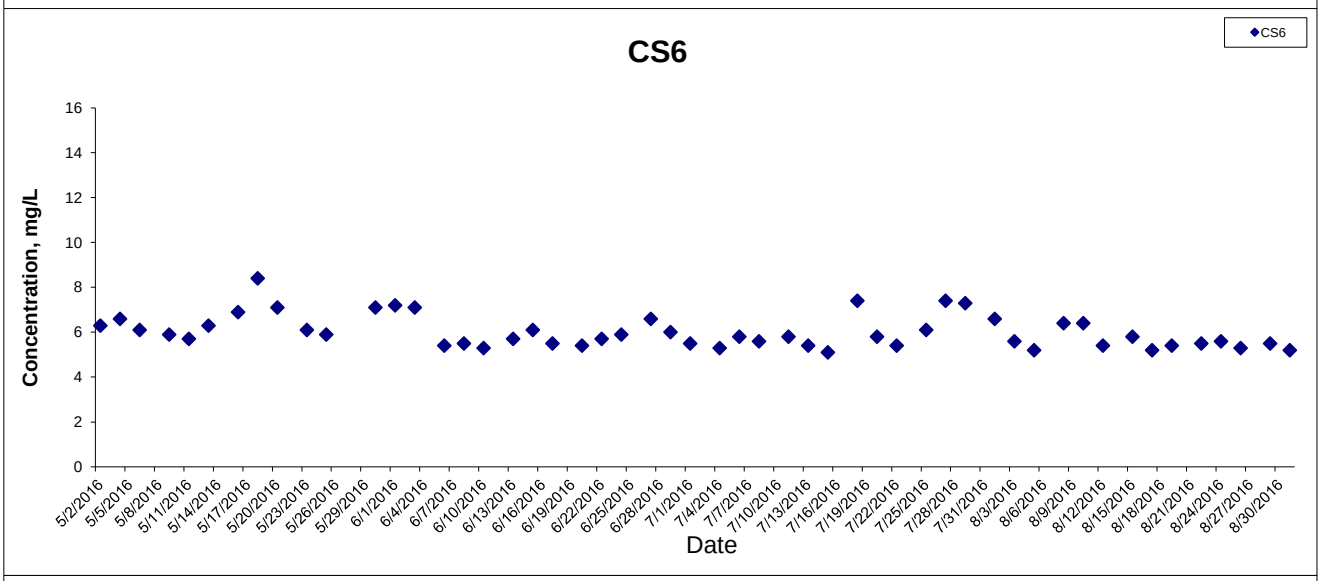


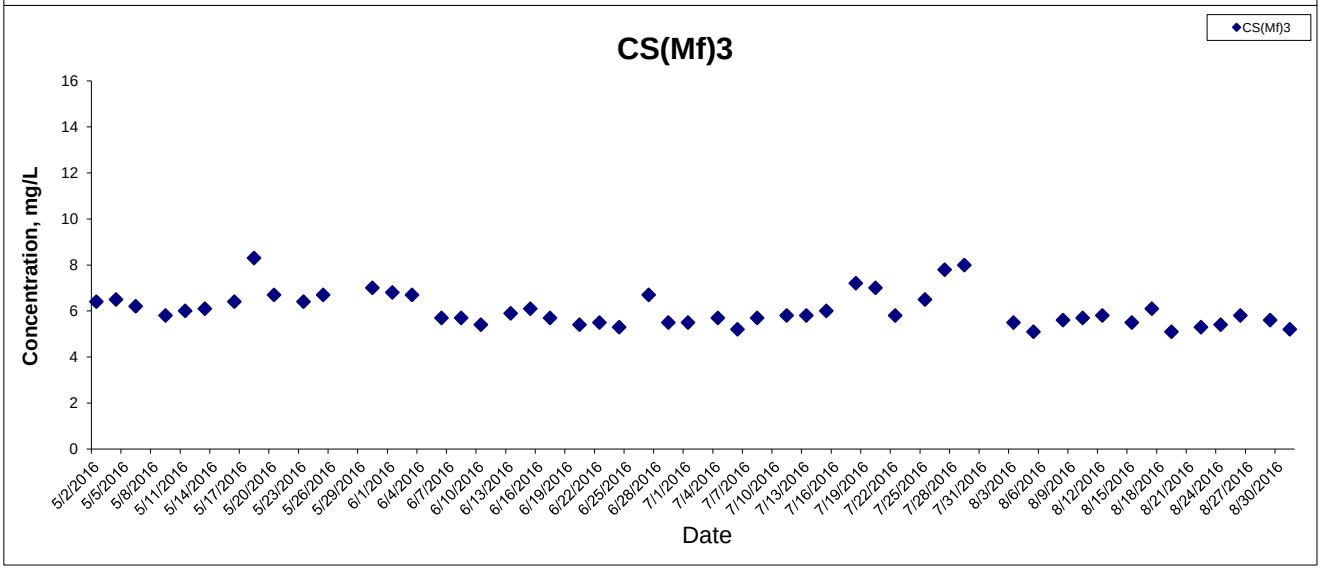
Remarks: Effective from July 2012, the Limit Level at NMS3A was revised to 70dB(A). Daytime noise Limit Level of 70 dB(A) applies to education institutions, while 65dB(A) applies during school examination period.

V The measured noise level on 20 Jun 2016 exceeded the noise level of 65dB(A) during examination period on 20 Jun 2016 but it is below the baseline level. Therefore, it is not considered as an exceedance. As such the EAP was not triggered.

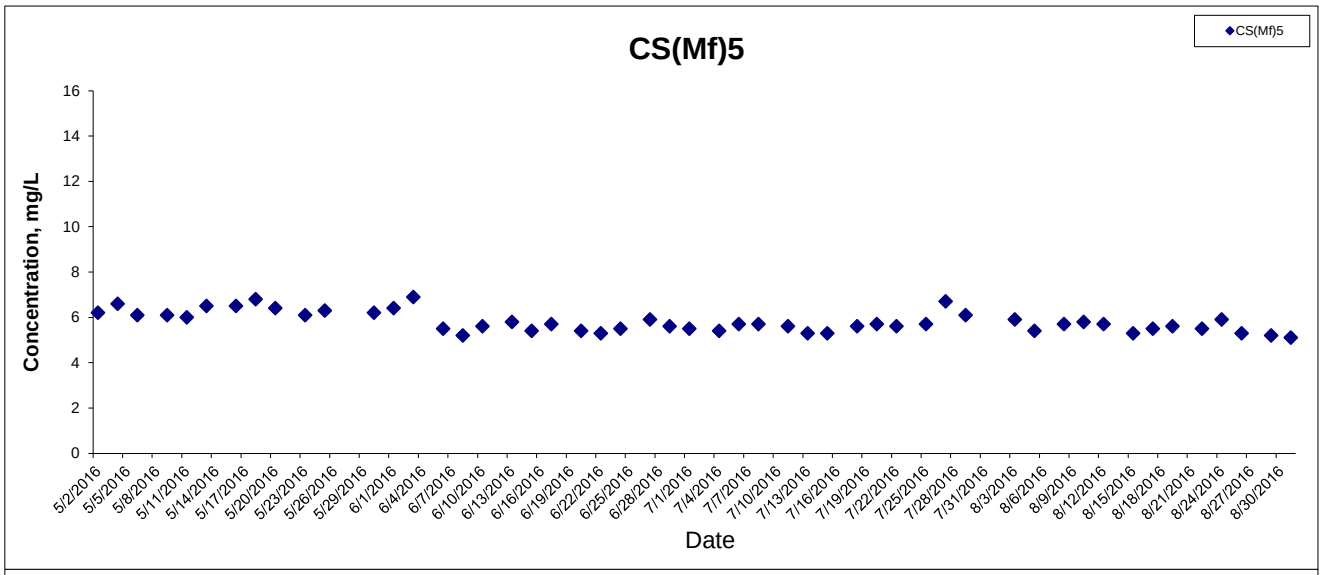
Dissolved Oxygen (Surface & Middle) at Mid-Ebb Tide

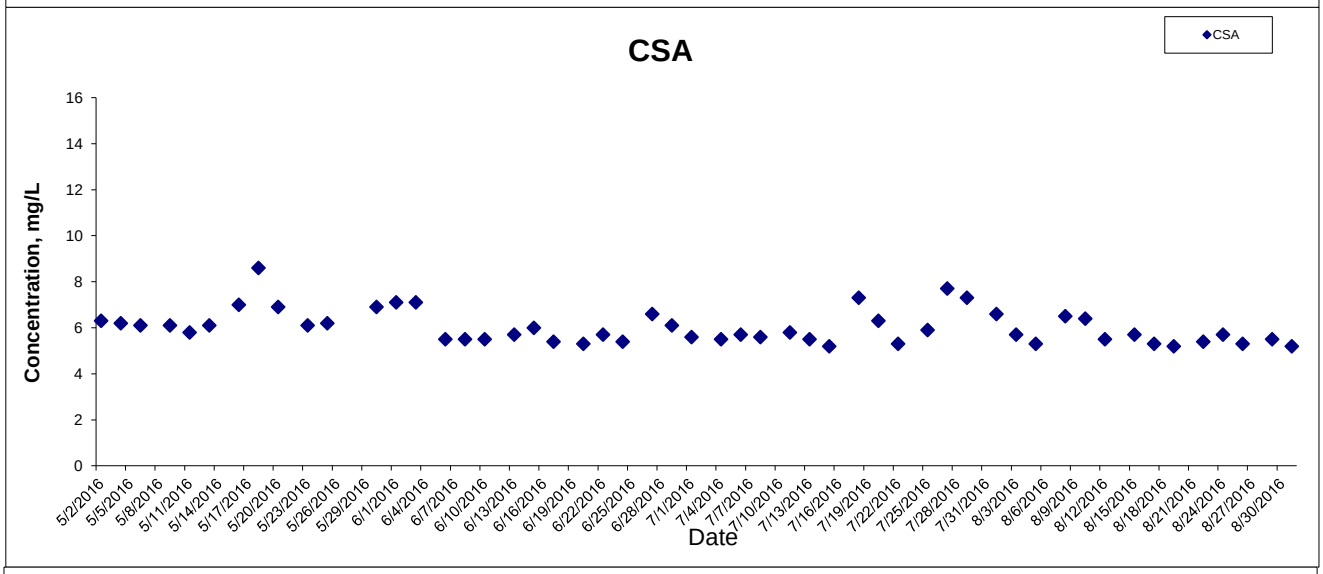


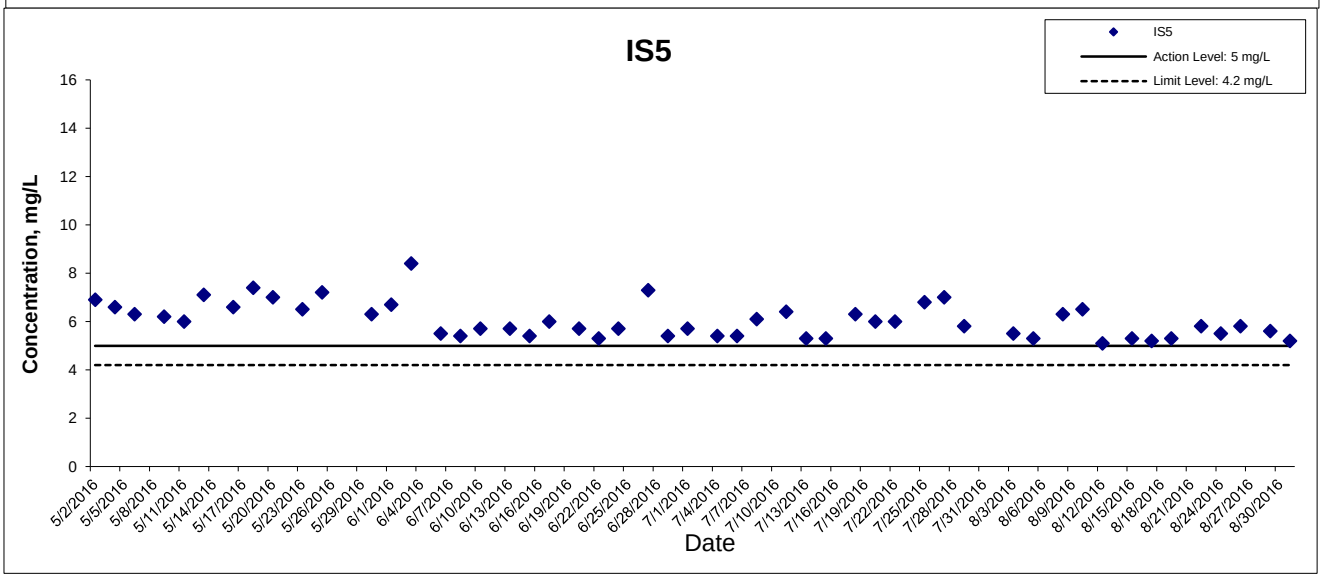




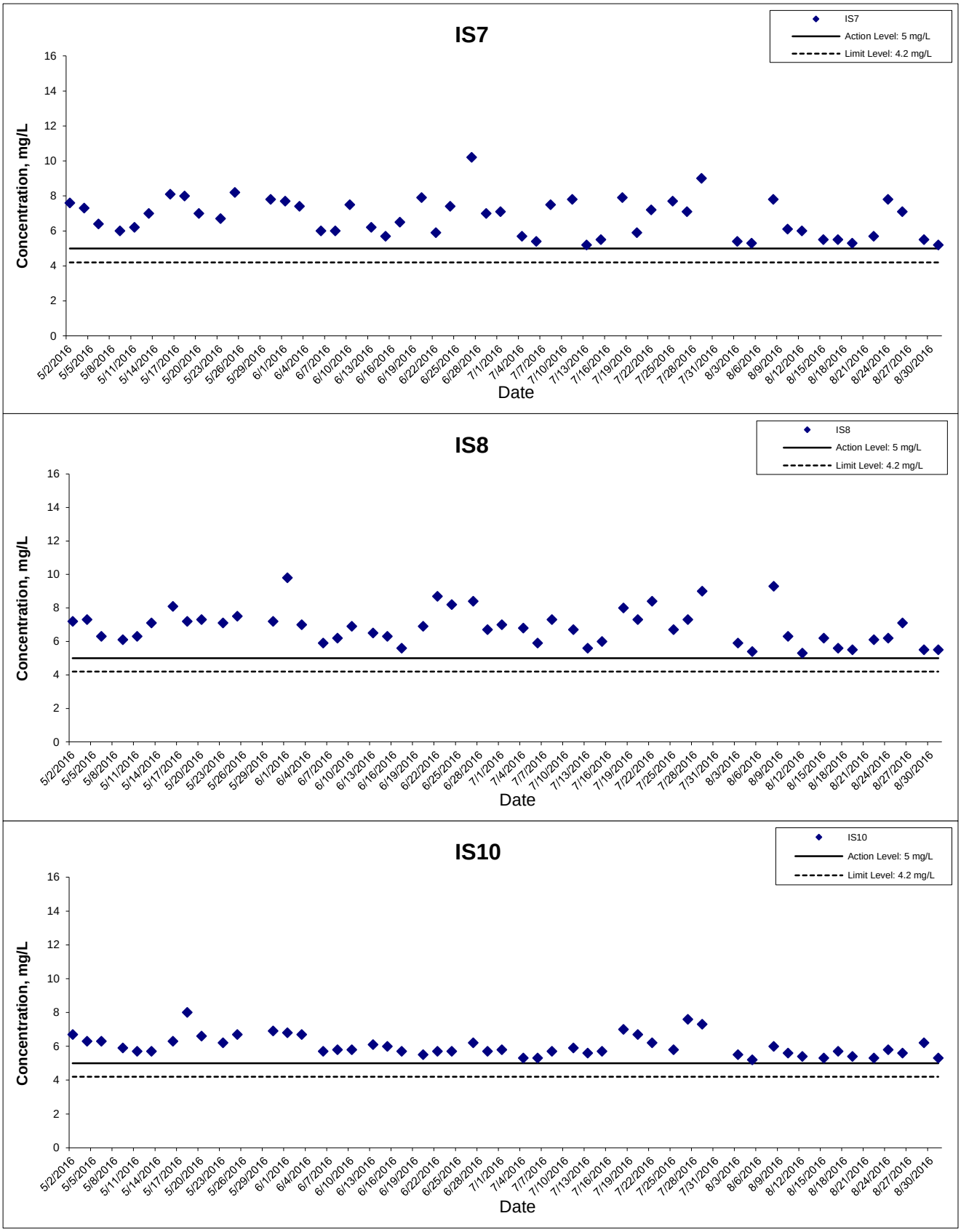
Dissolved Oxygen (Surface & Middle) at Mid-Ebb Tide



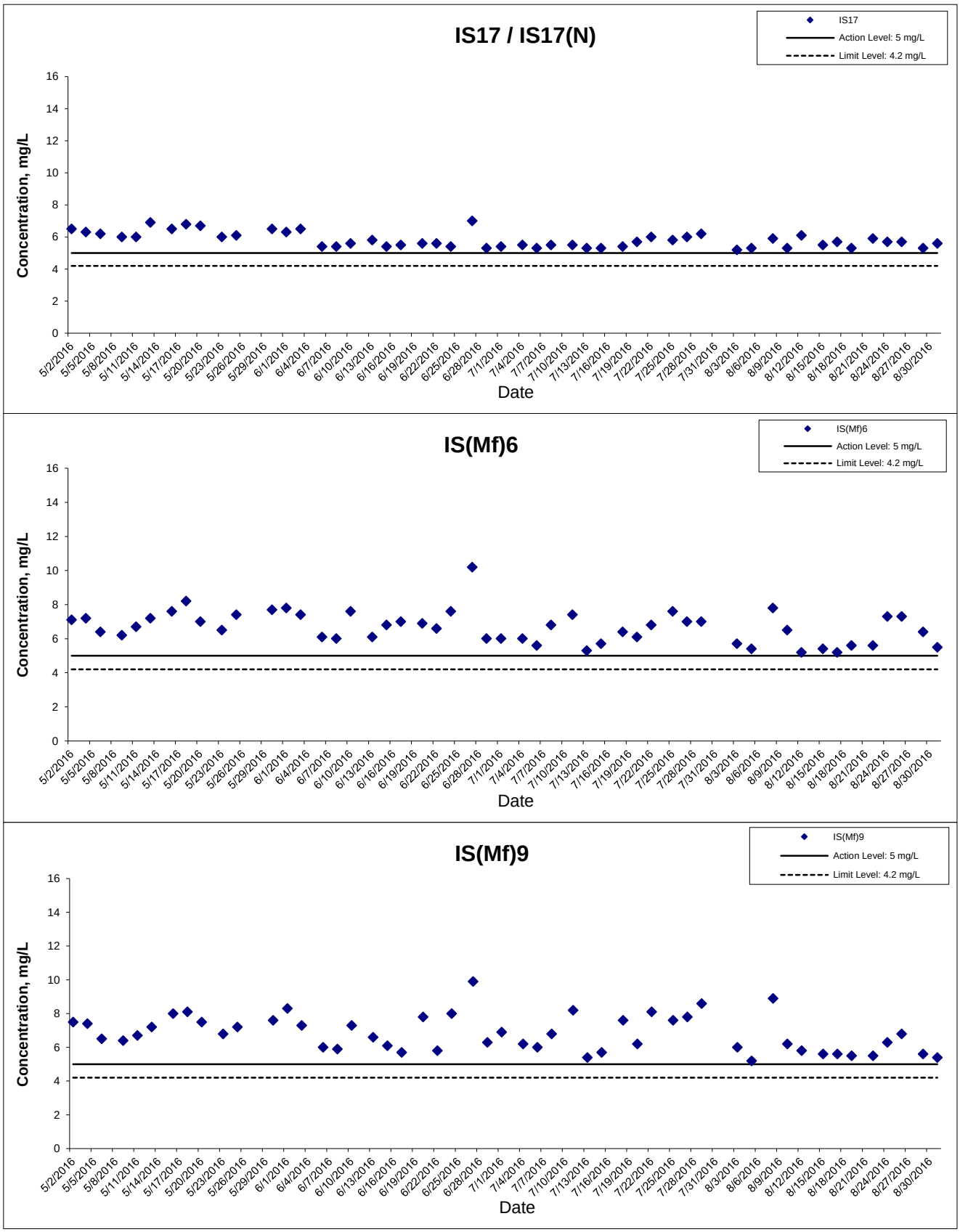


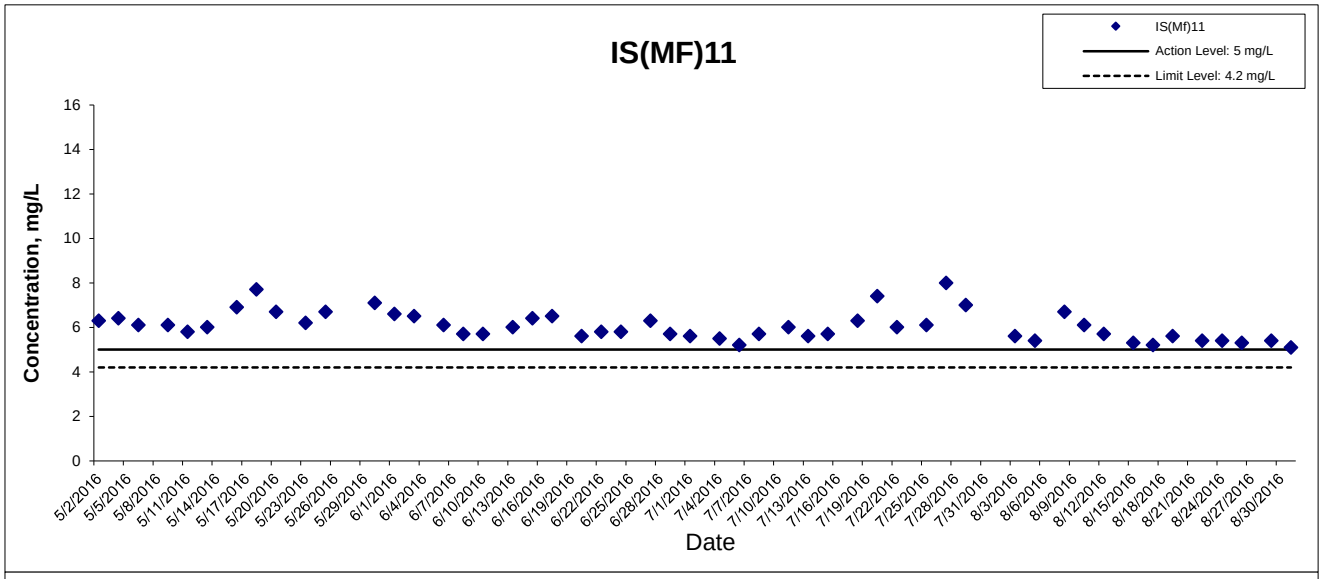


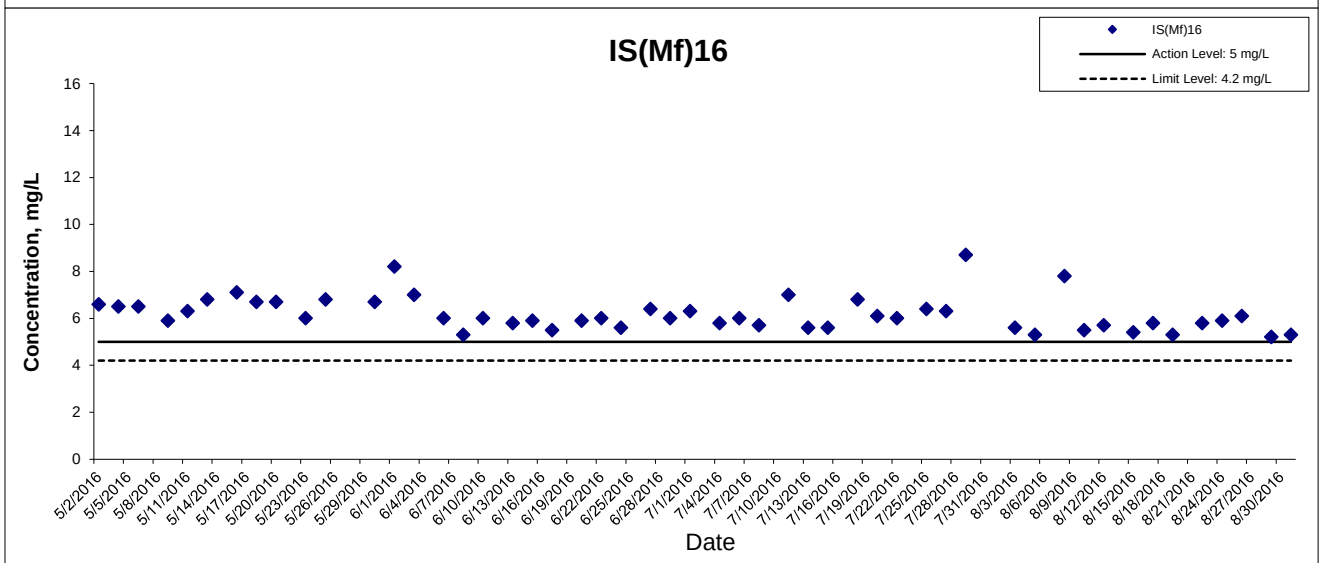
Dissolved Oxygen (Surface & Middle) at Mid-Ebb Tide

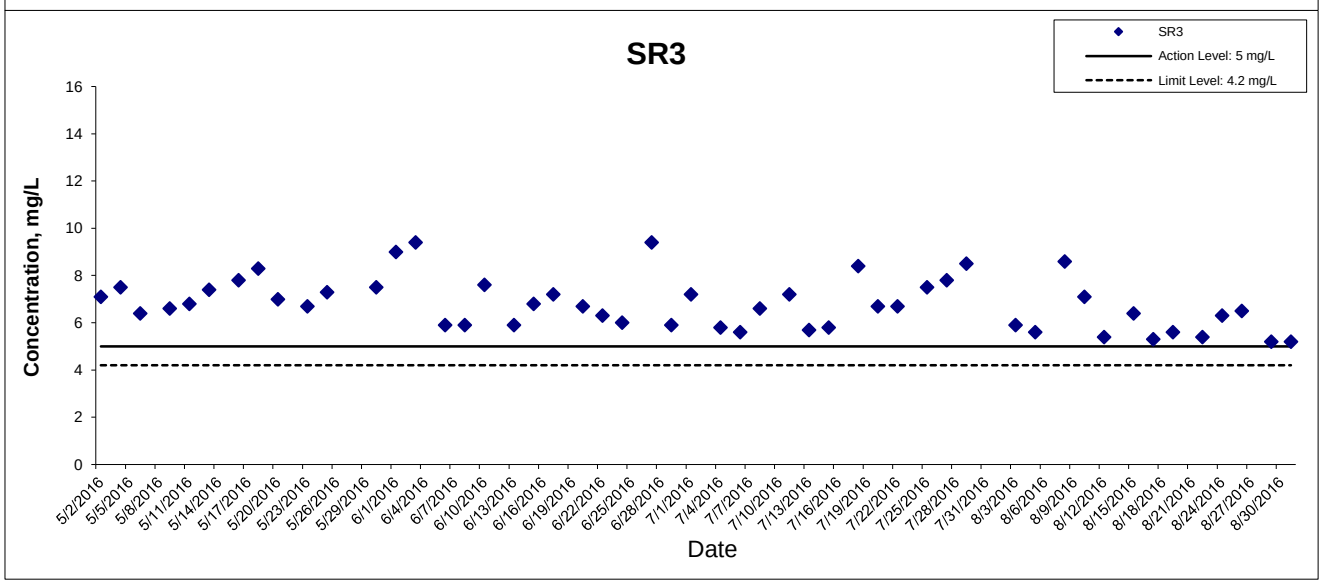


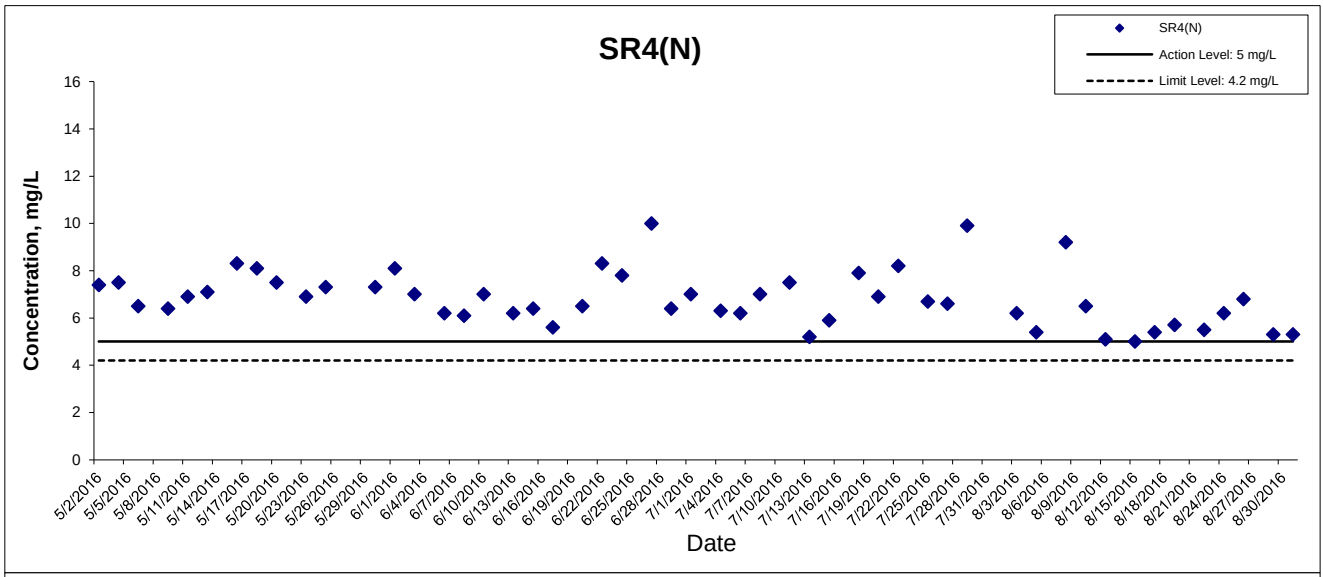
Dissolved Oxygen (Surface & Middle) at Mid-Ebb Tide

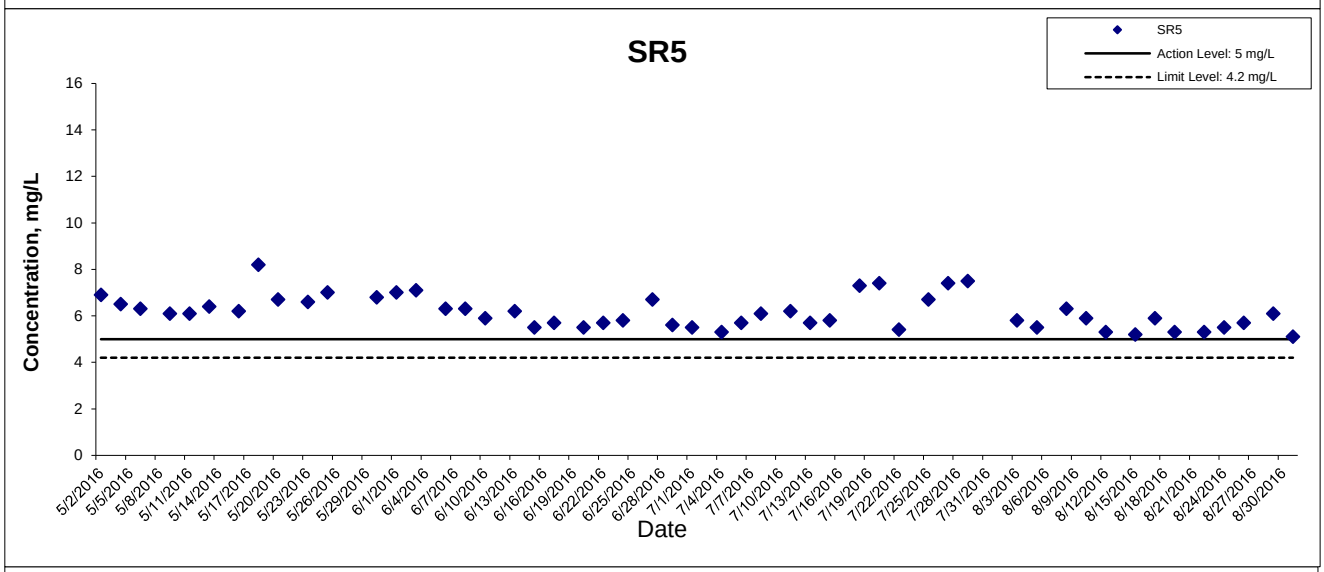


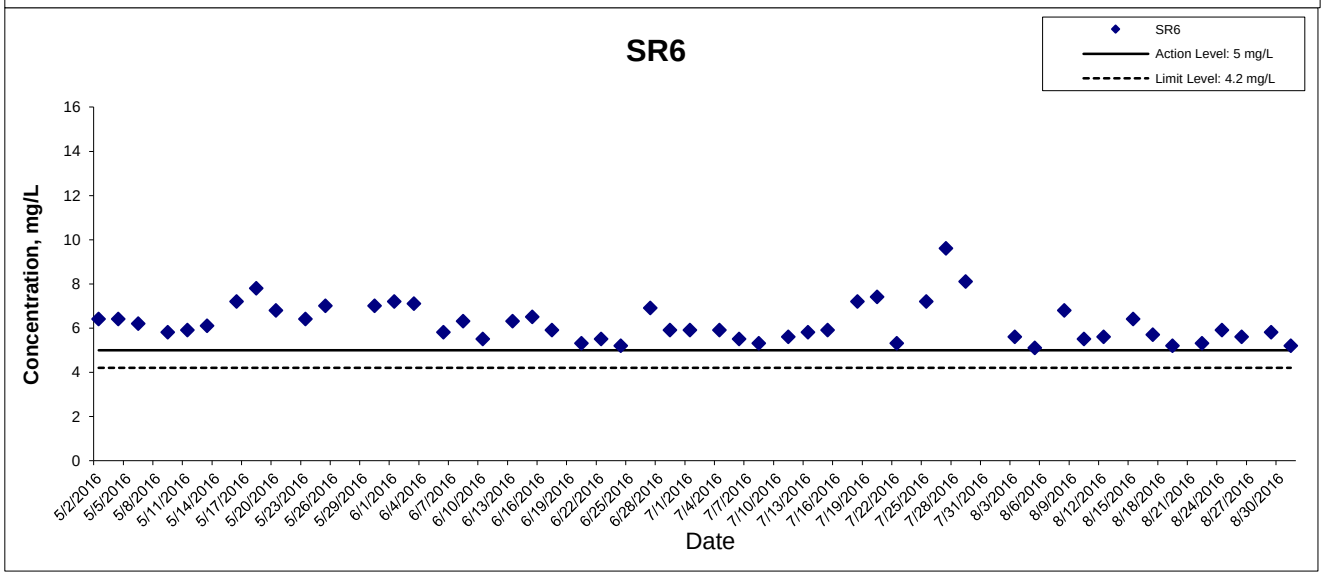








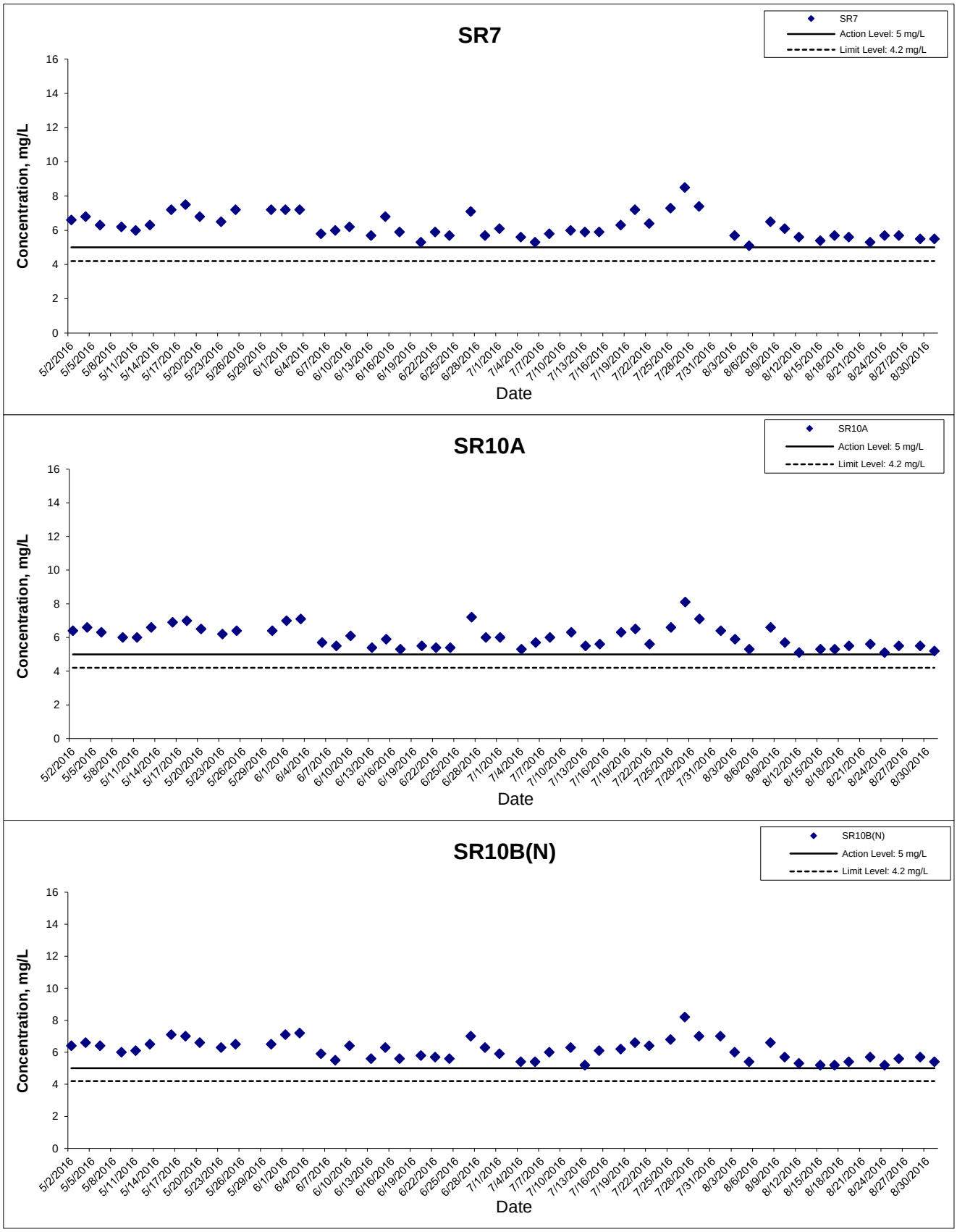




HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

Graphical Presentation of Impact Water Quality Monitoring Results

Project No.: 60249820 **Date: October 2016** **Appendix G**



HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

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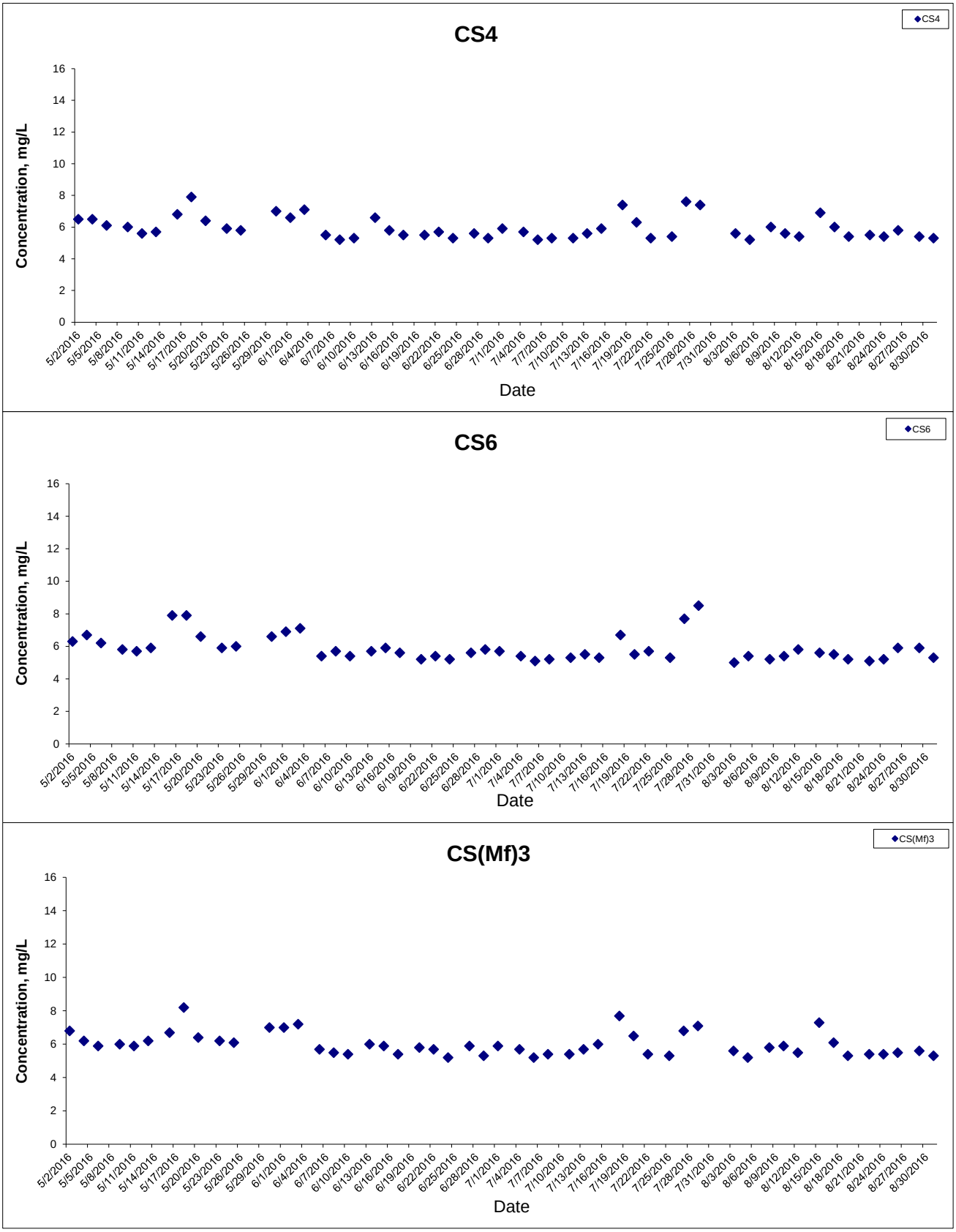
Graphical Presentation of Impact Water Quality Monitoring Results

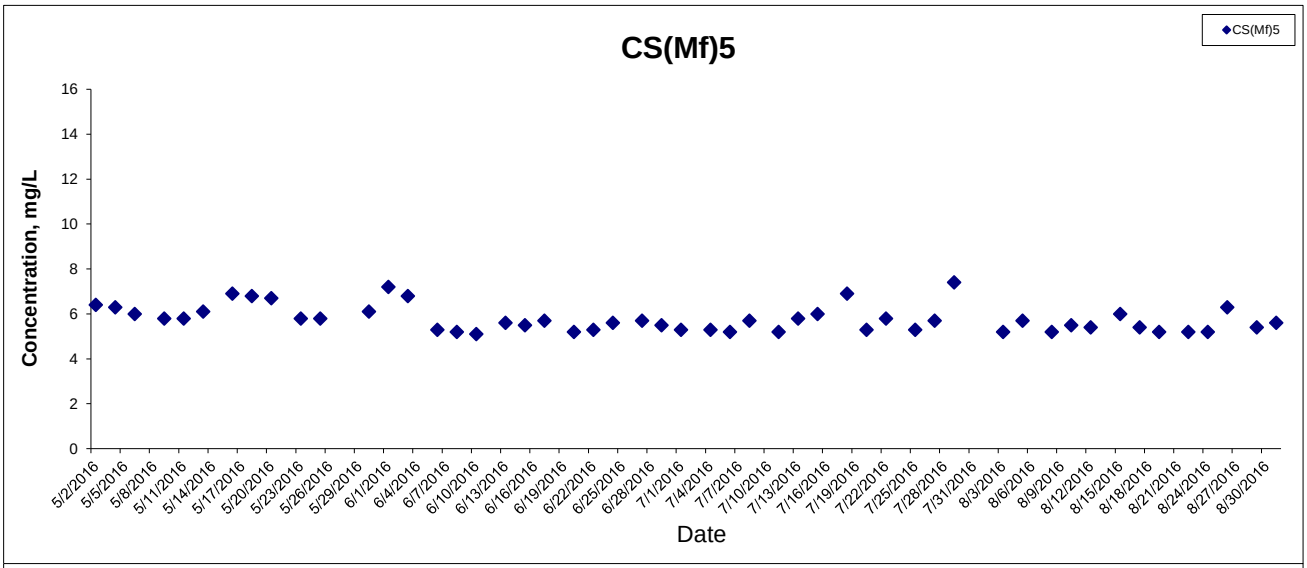
Project No.: 60249820 **Date: October 2016**

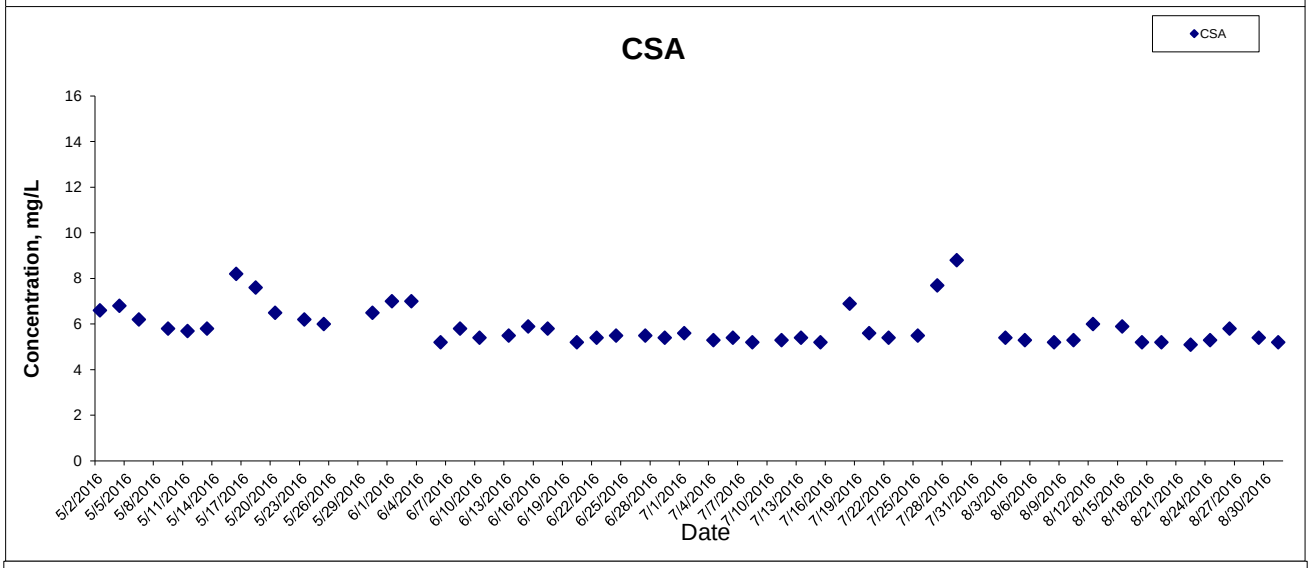
Appendix G

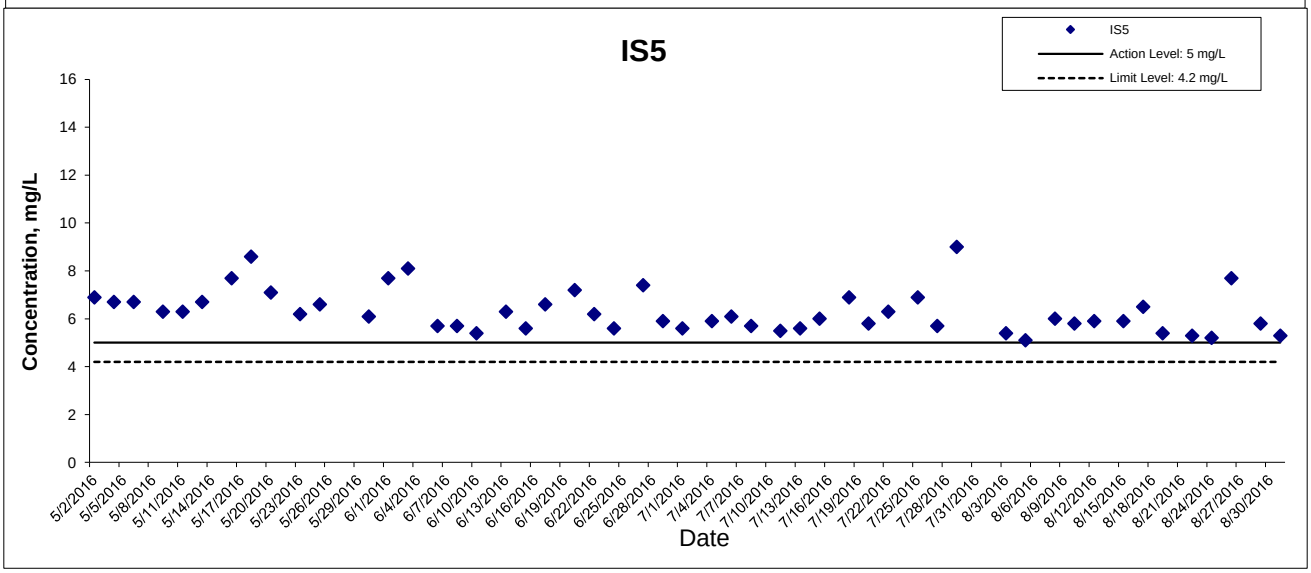
Dissolved Oxygen (Surface & Middle) at Mid-Flood Tide



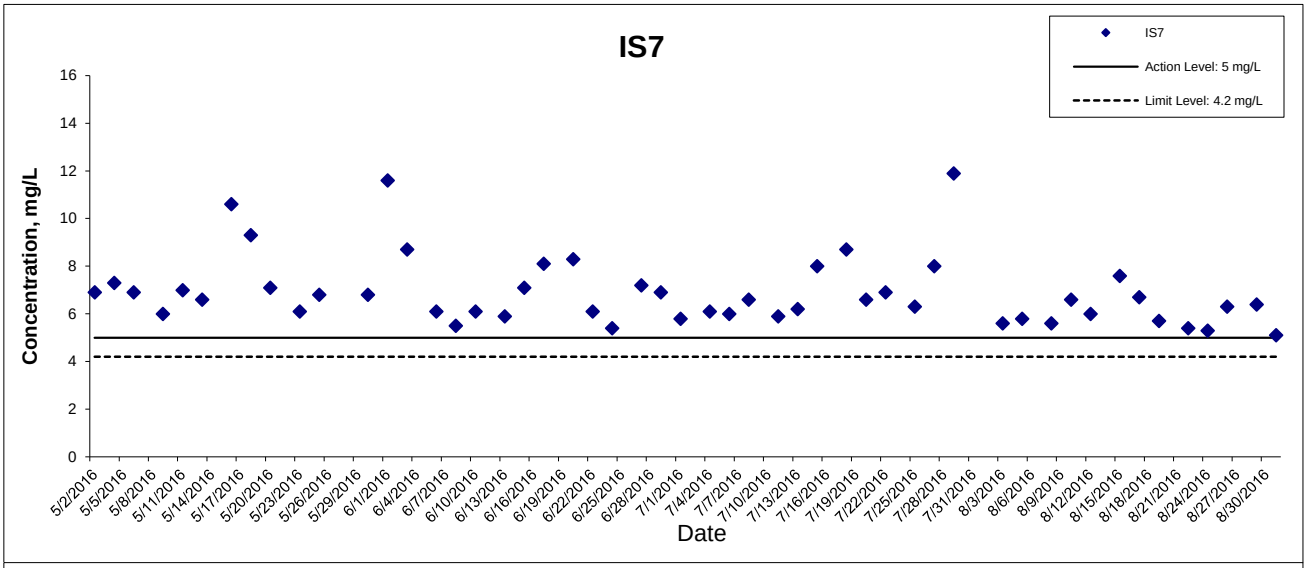
Dissolved Oxygen (Surface & Middle) at Mid-Flood Tide

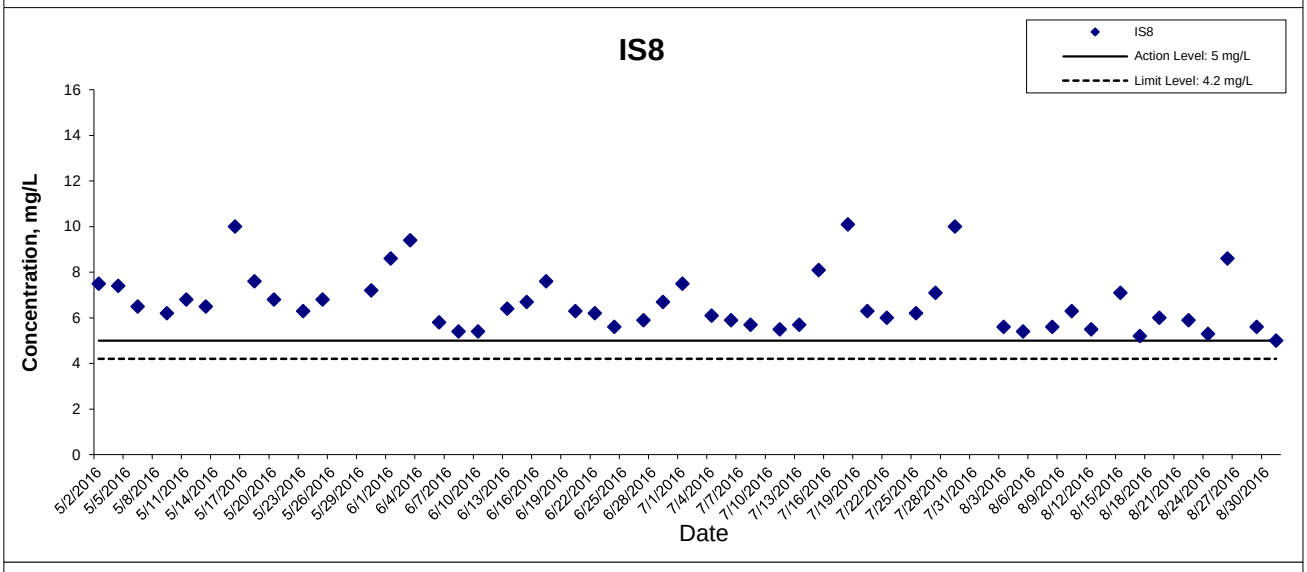


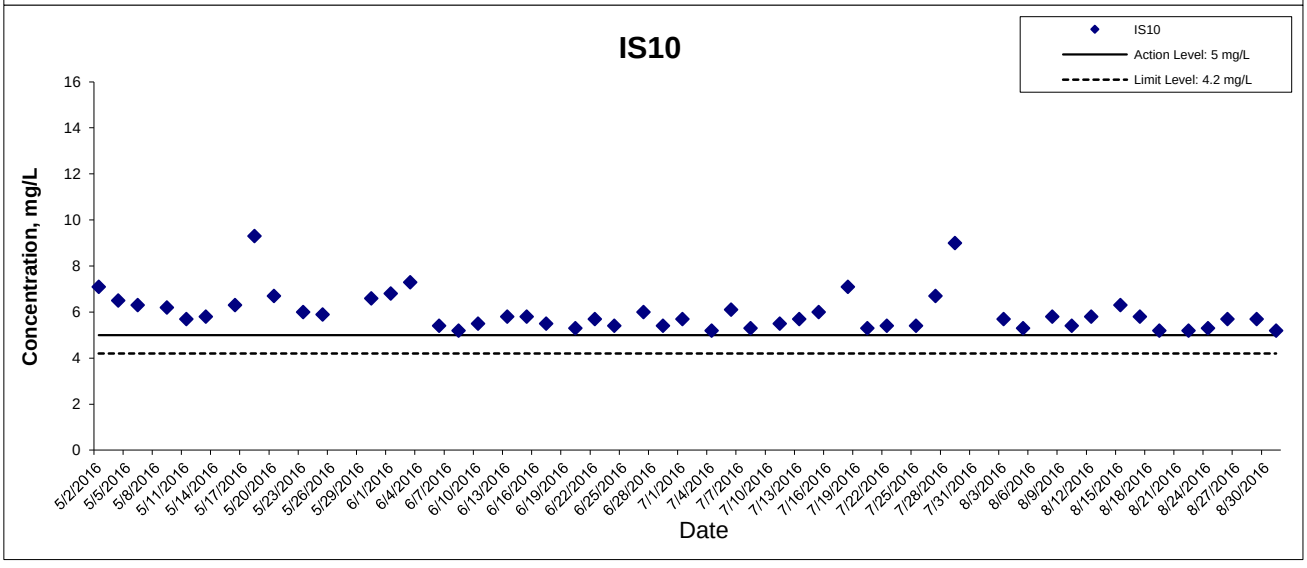




Dissolved Oxygen (Surface & Middle) at Mid-Flood Tide







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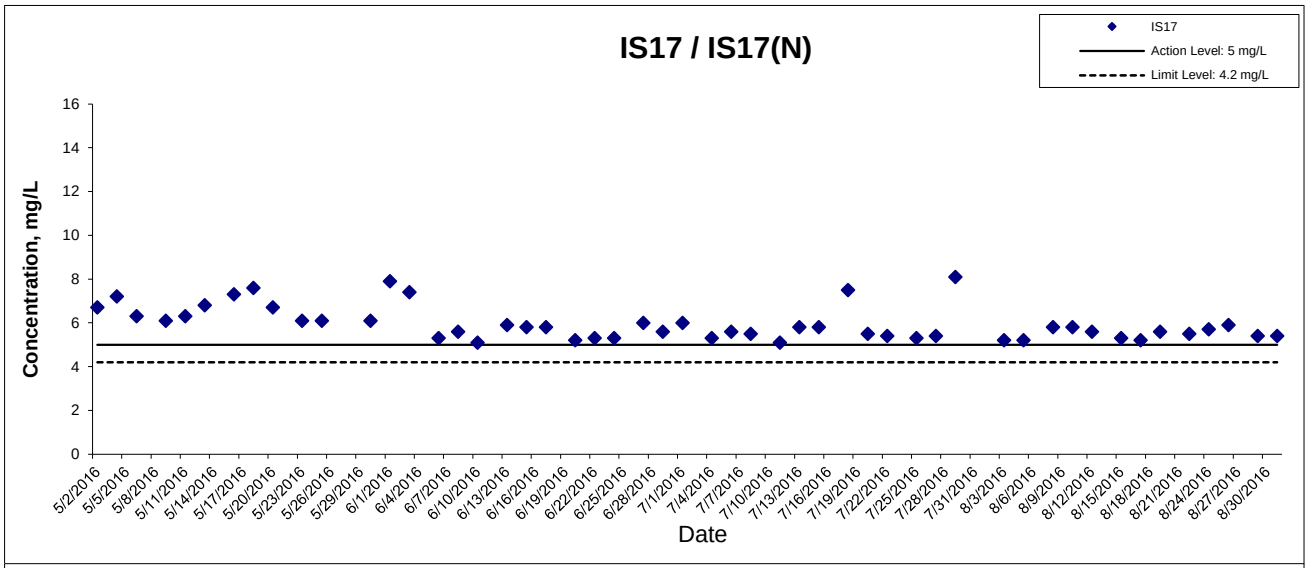

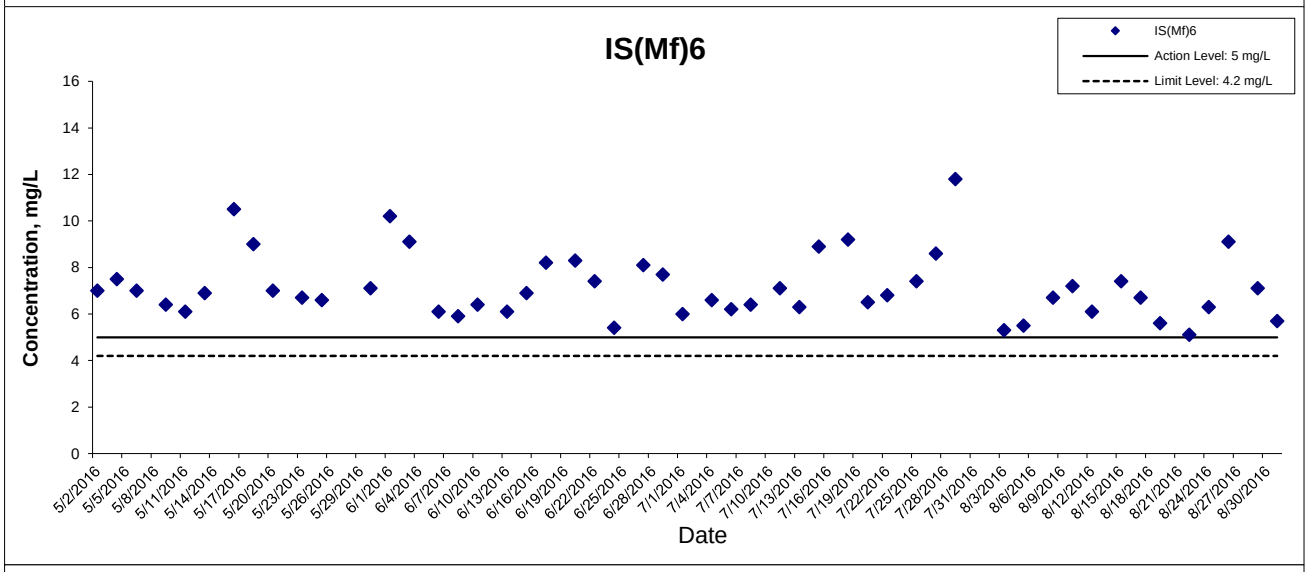

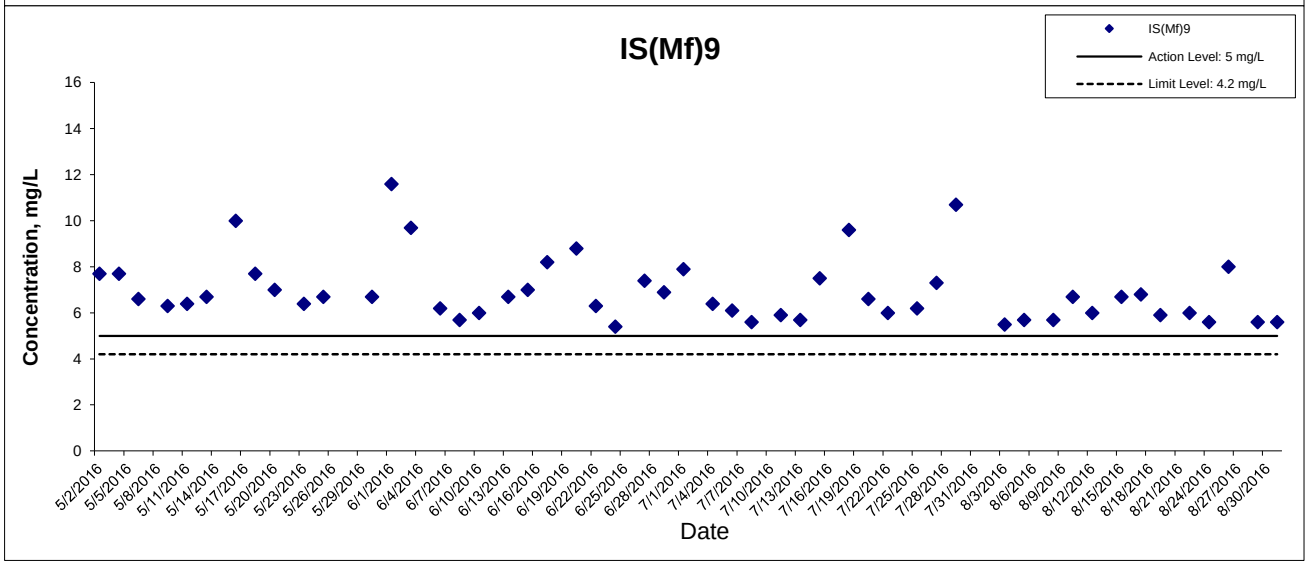

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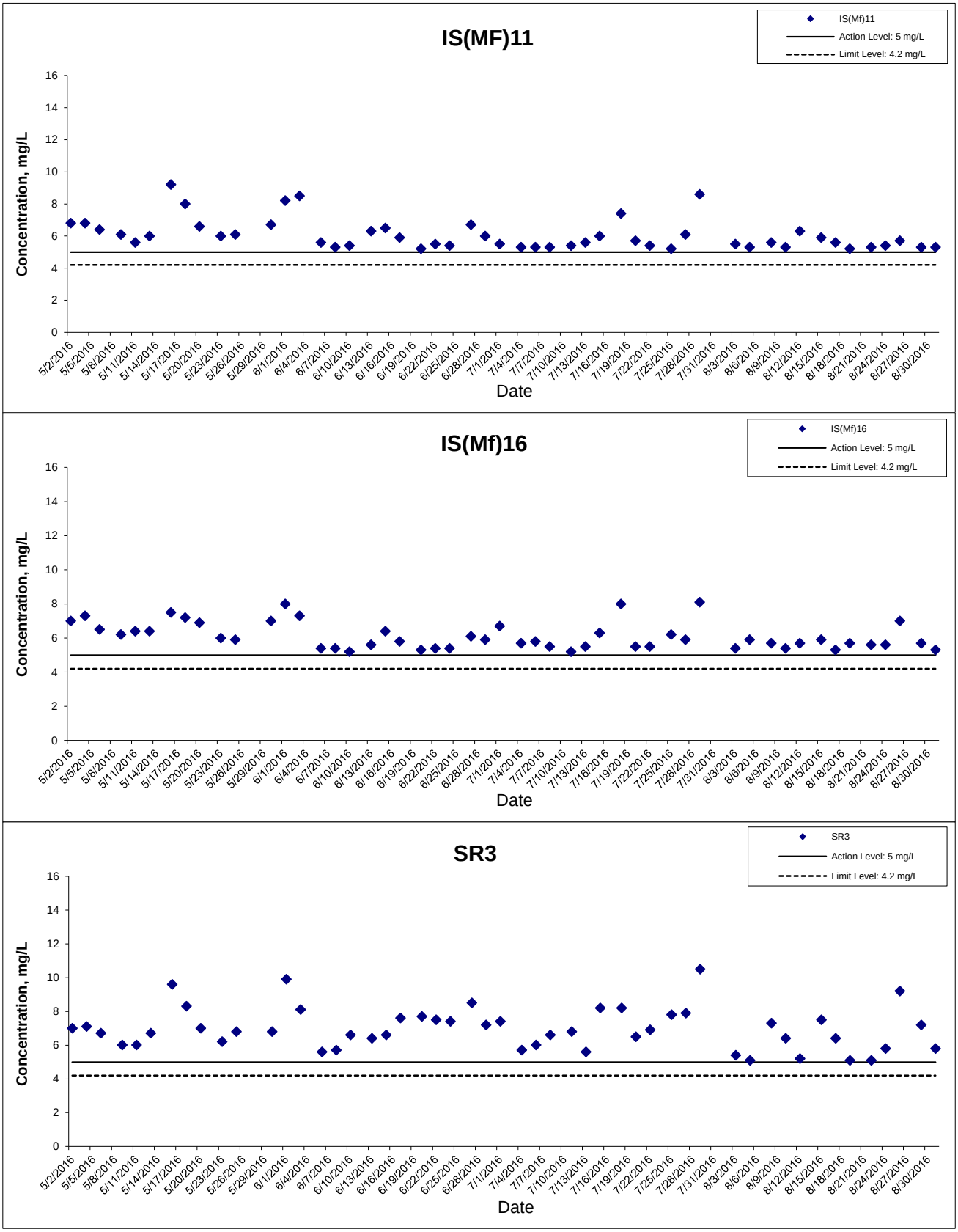

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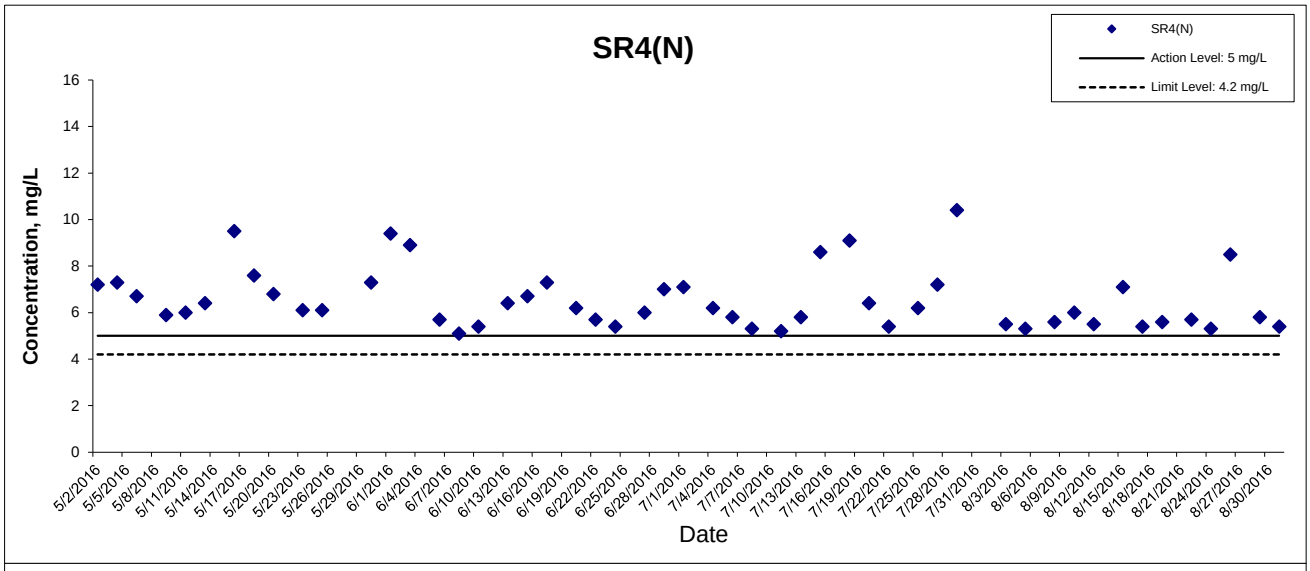

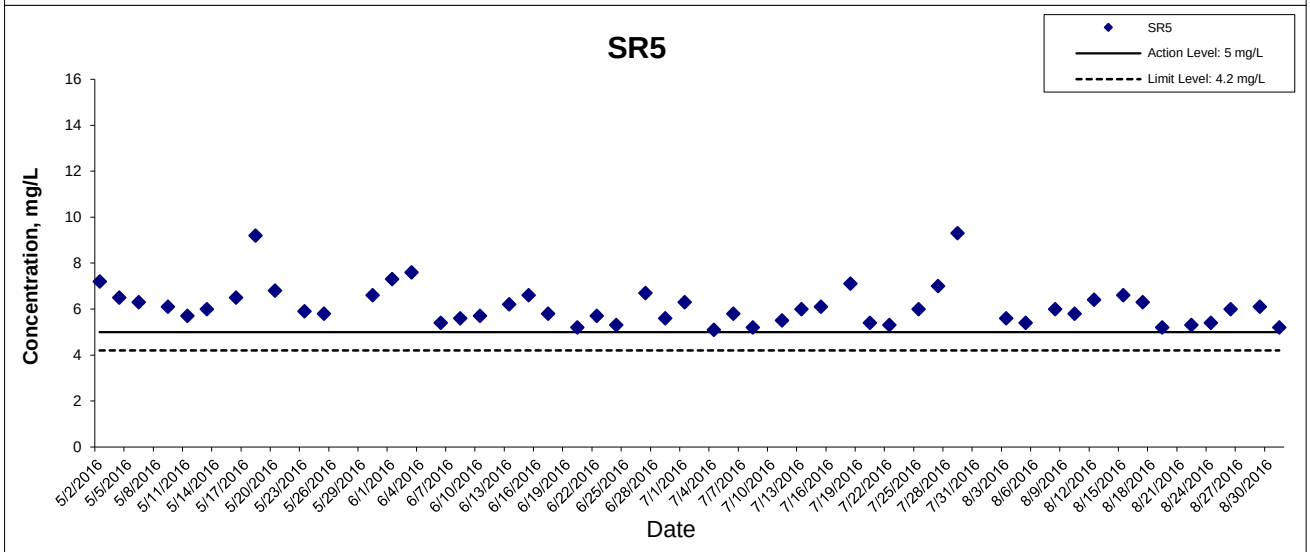

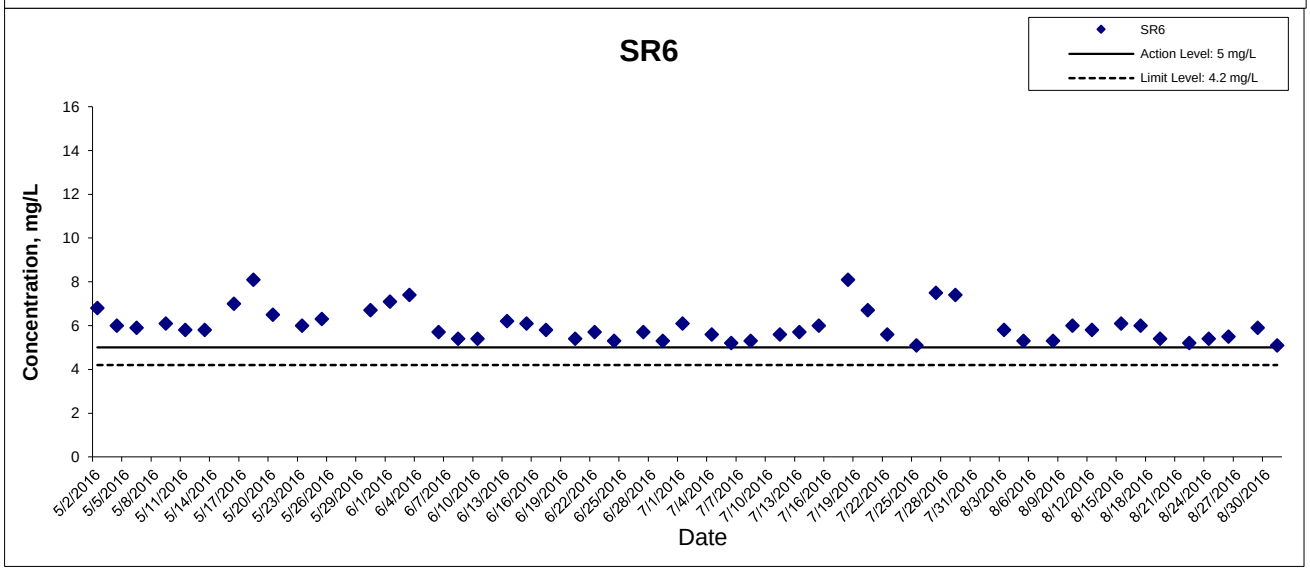

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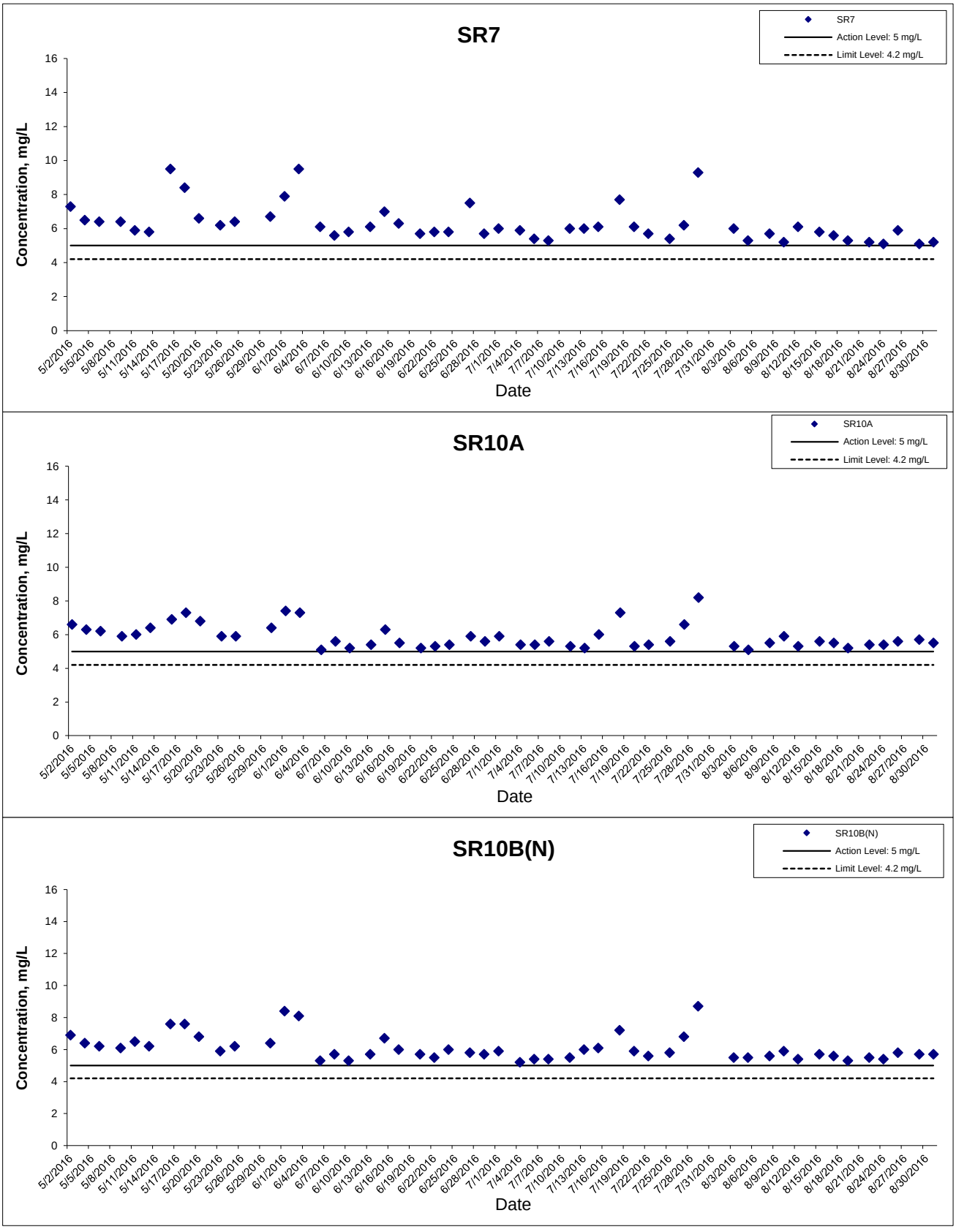

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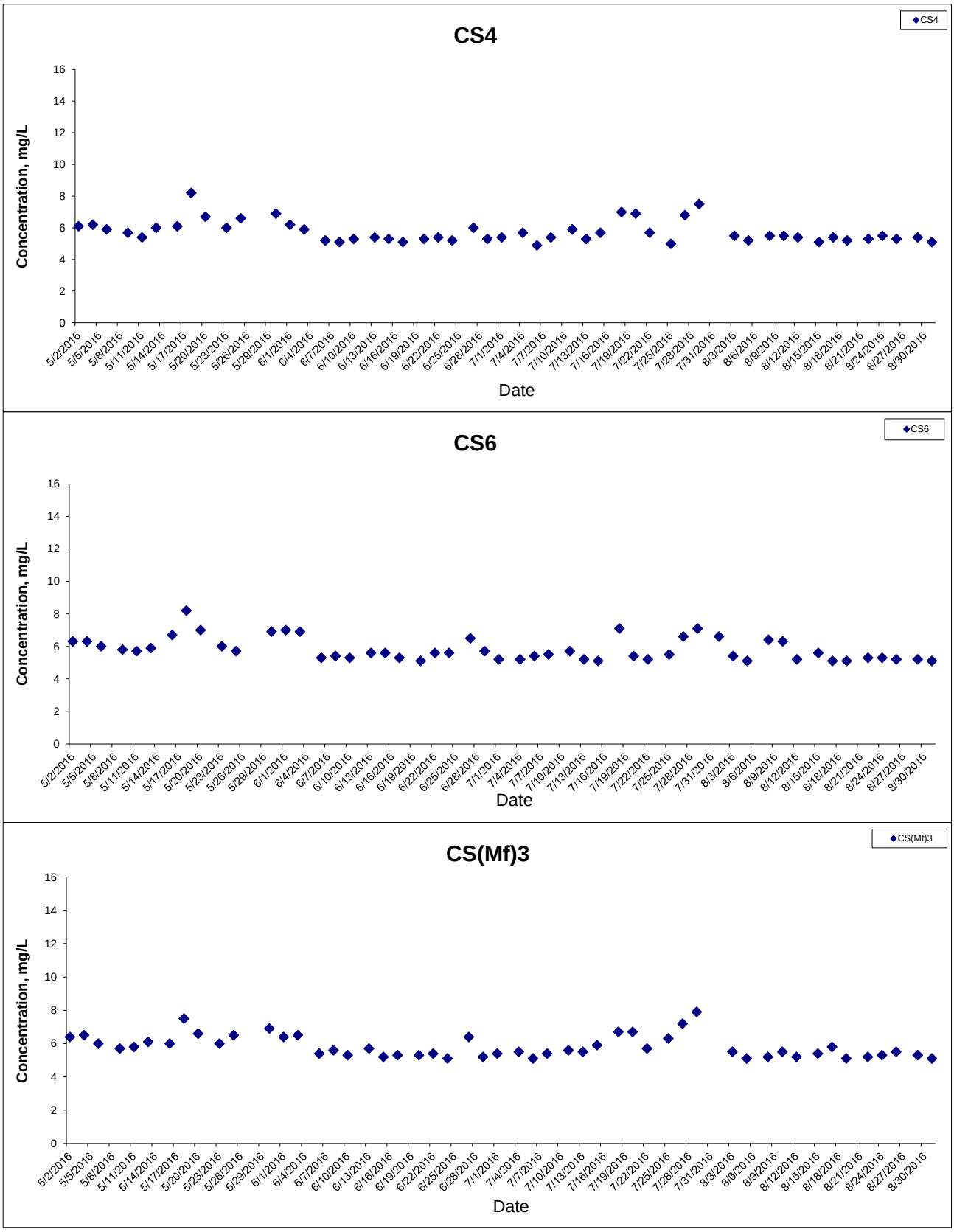
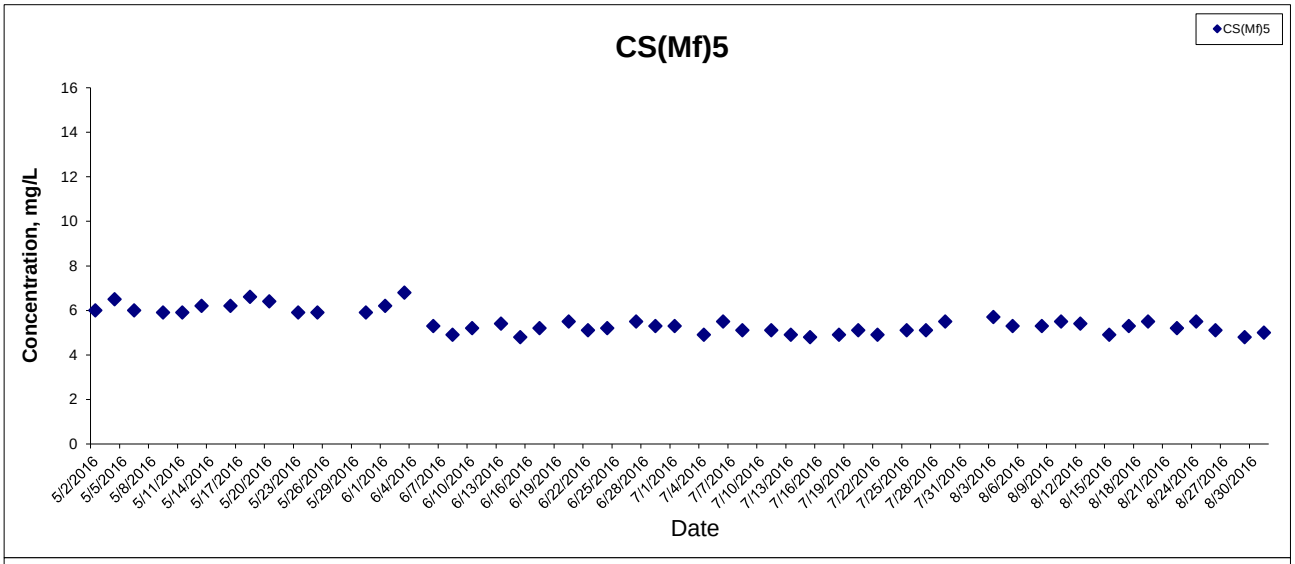
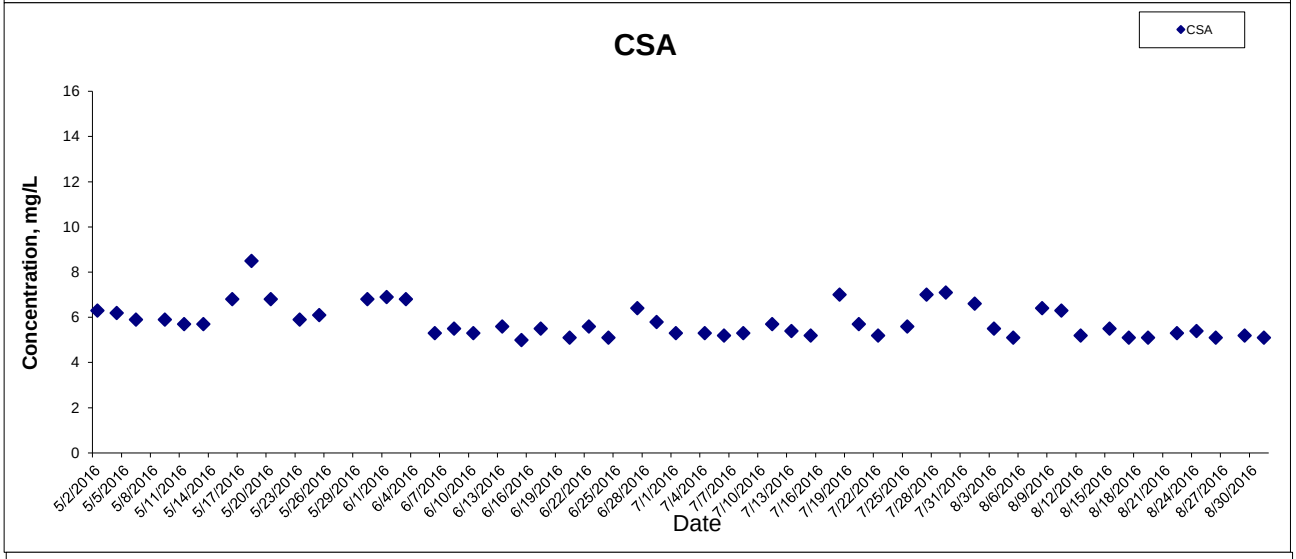
Appendix G

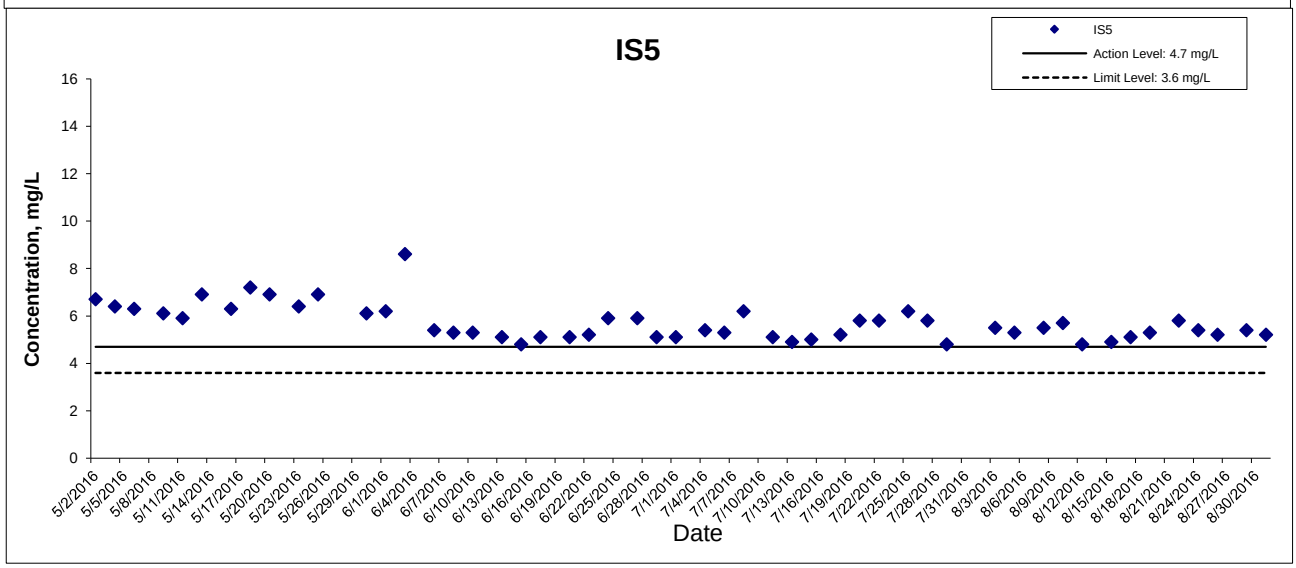
Dissolved Oxygen (Bottom) at Mid-Ebb Tide



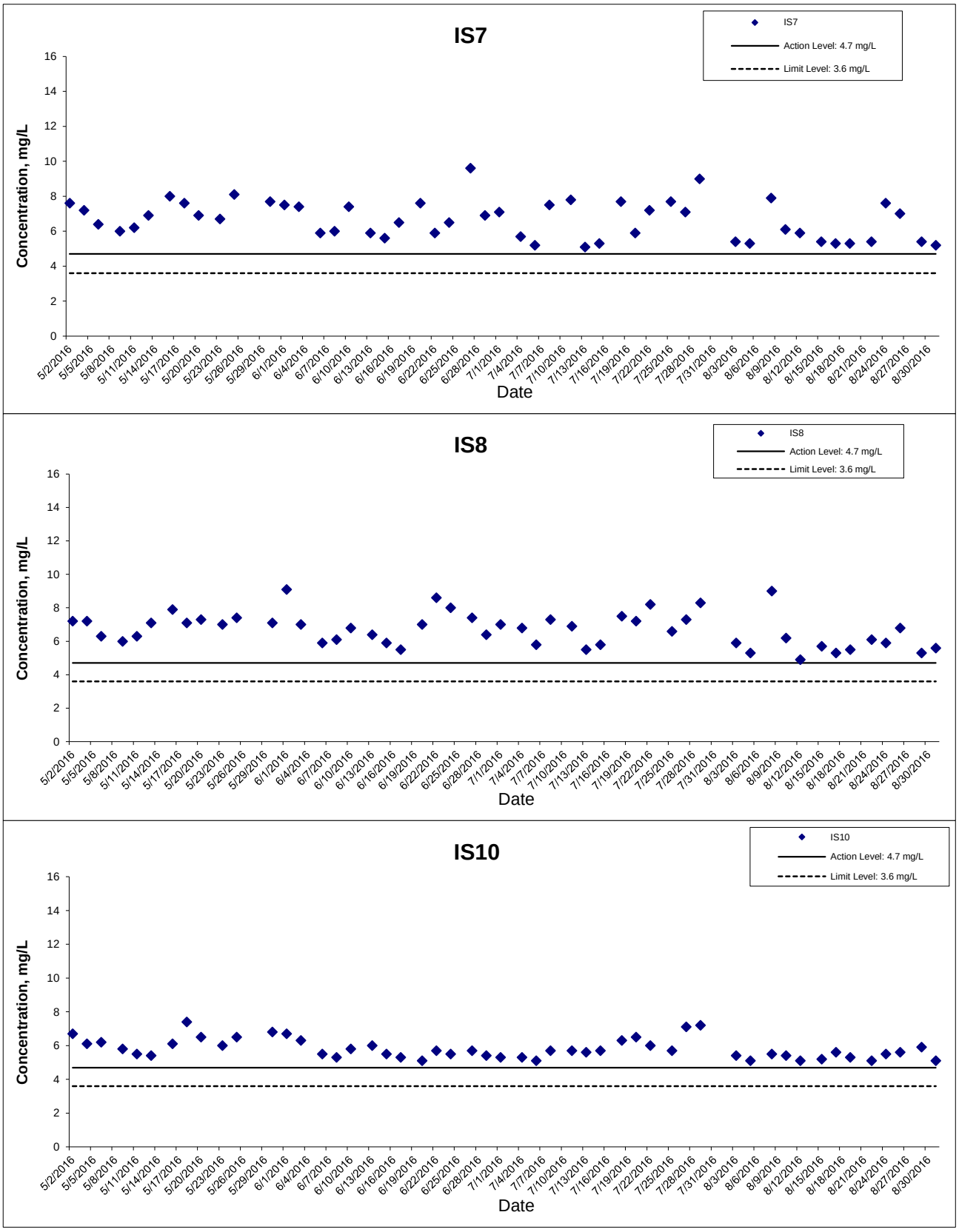
Dissolved Oxygen (Bottom) at Mid-Ebb Tide



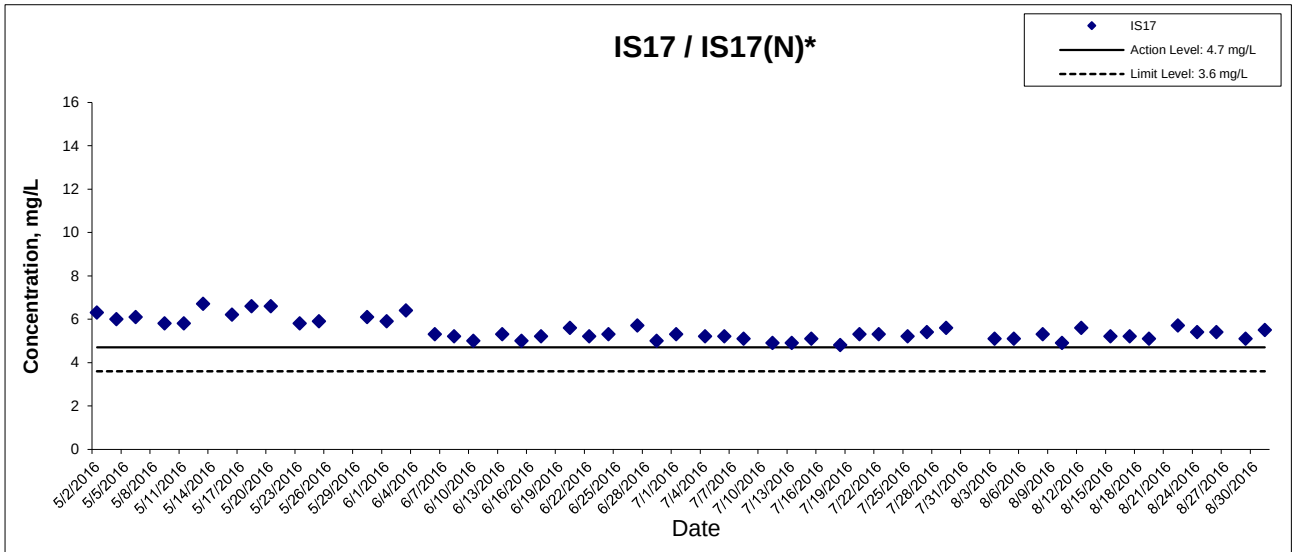


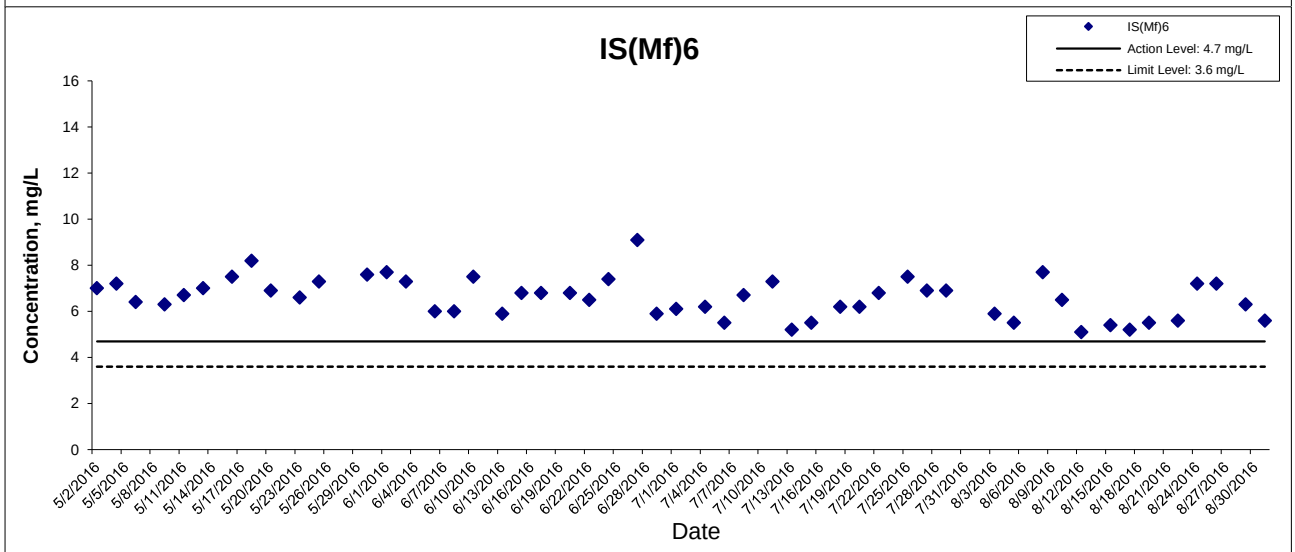


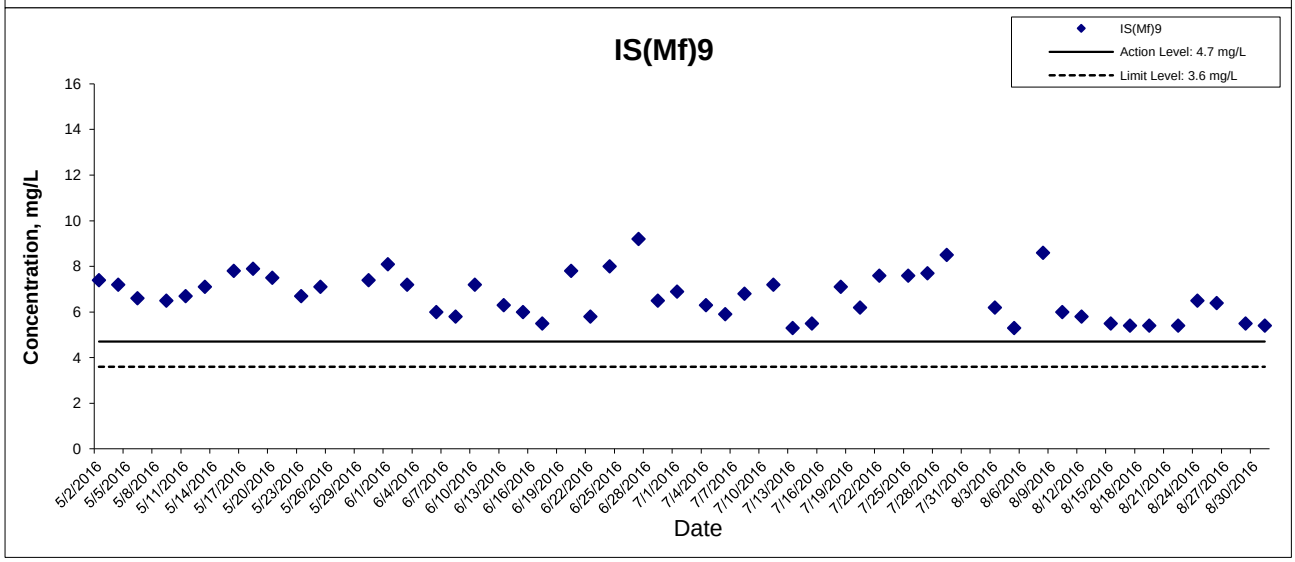
Dissolved Oxygen (Bottom) at Mid-Ebb Tide



Dissolved Oxygen (Bottom) at Mid-Ebb Tide







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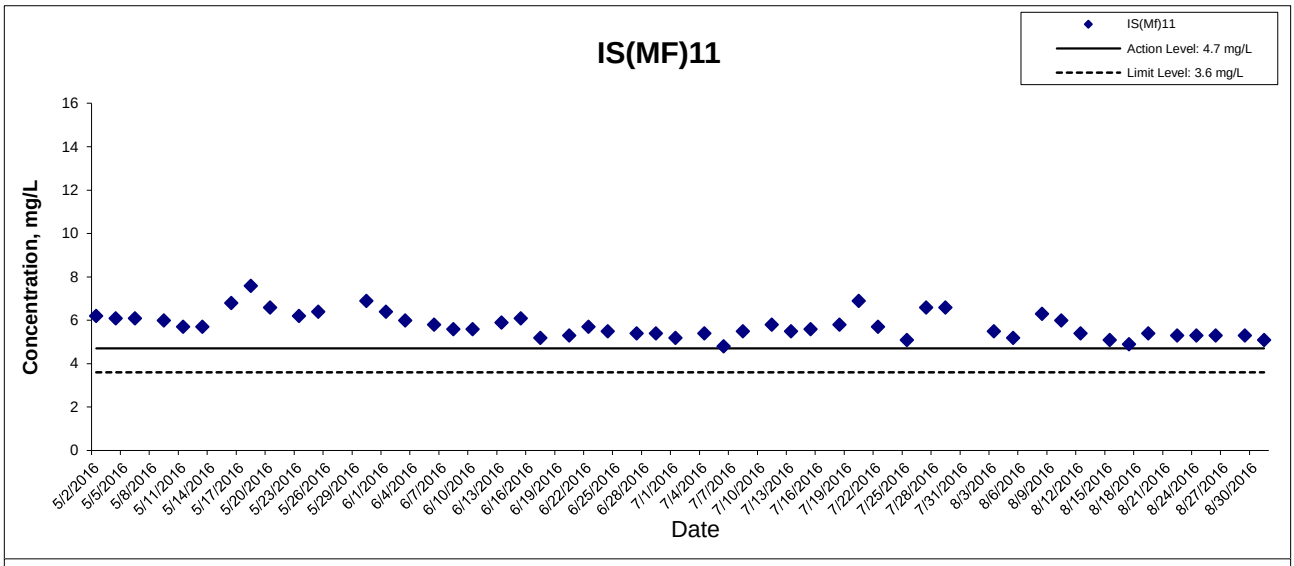

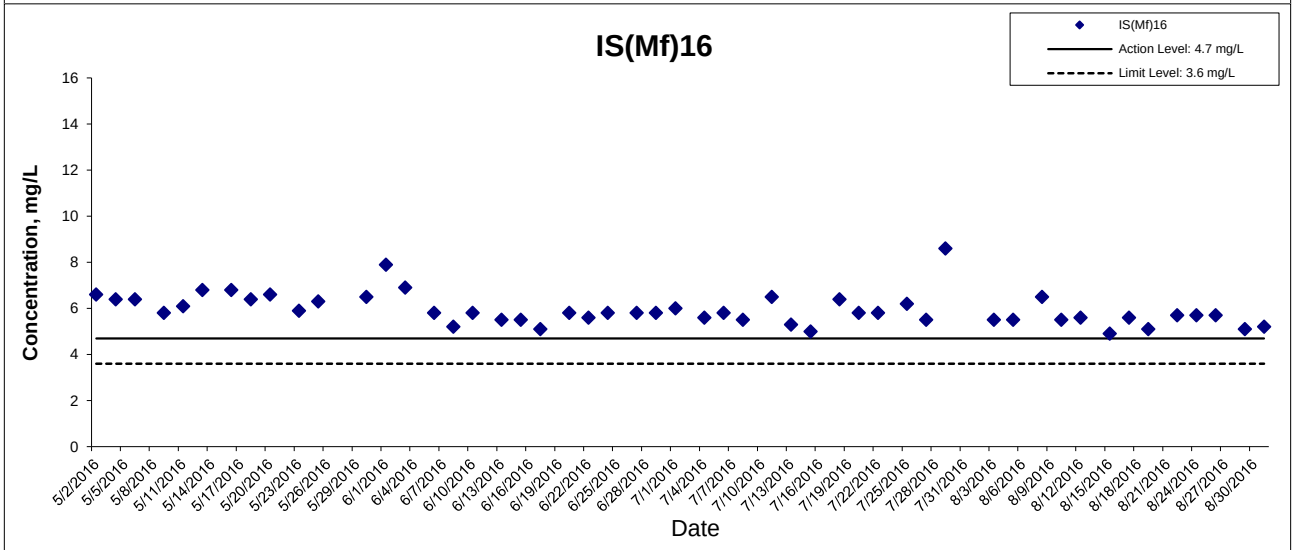

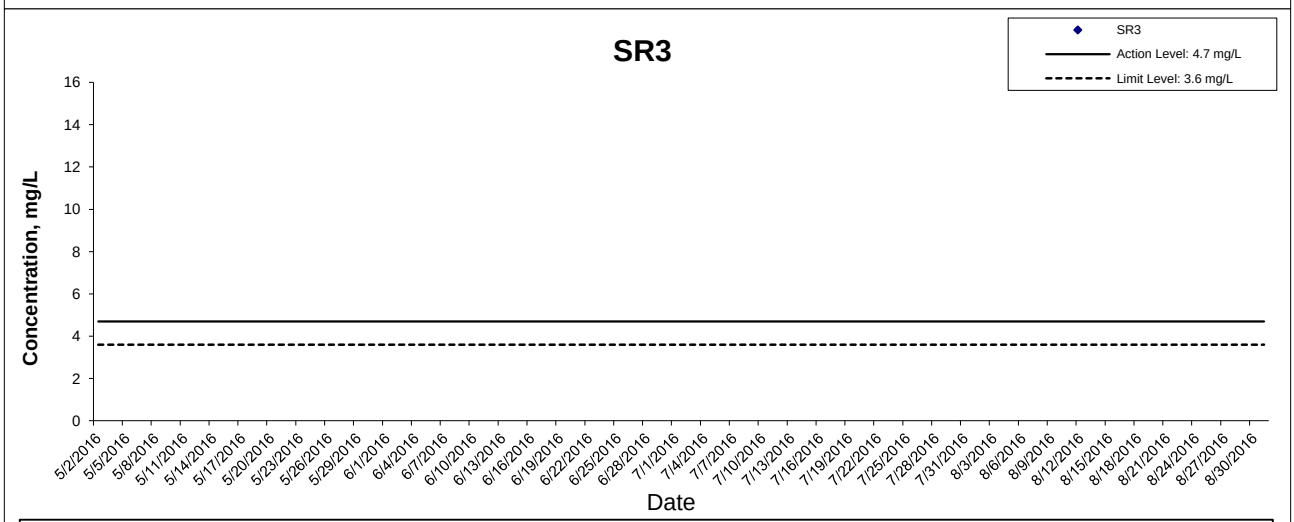

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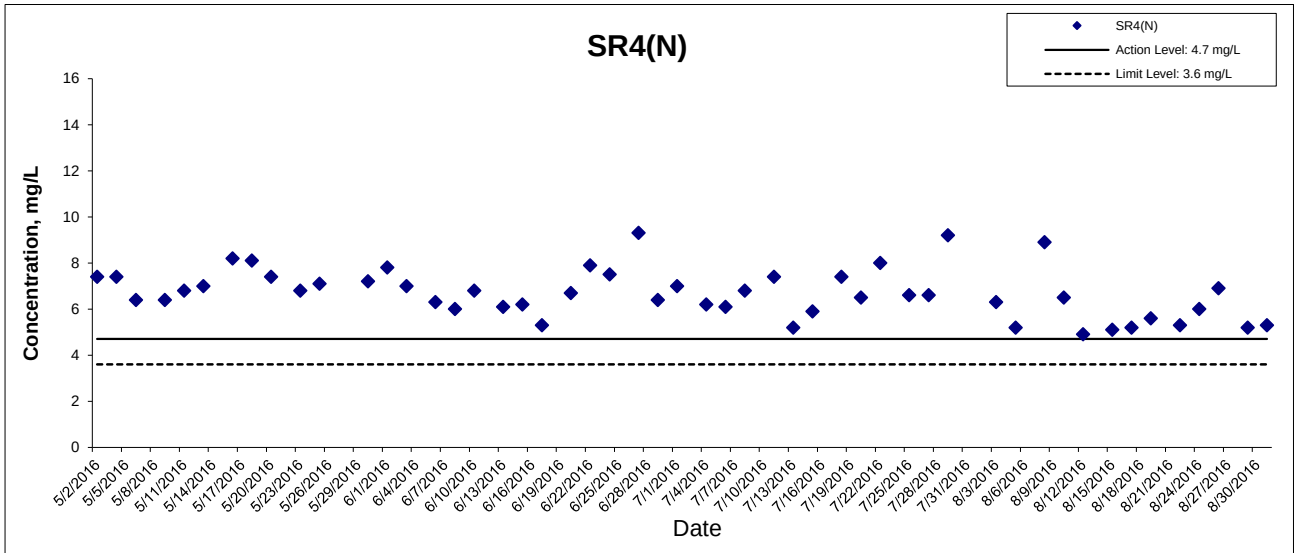
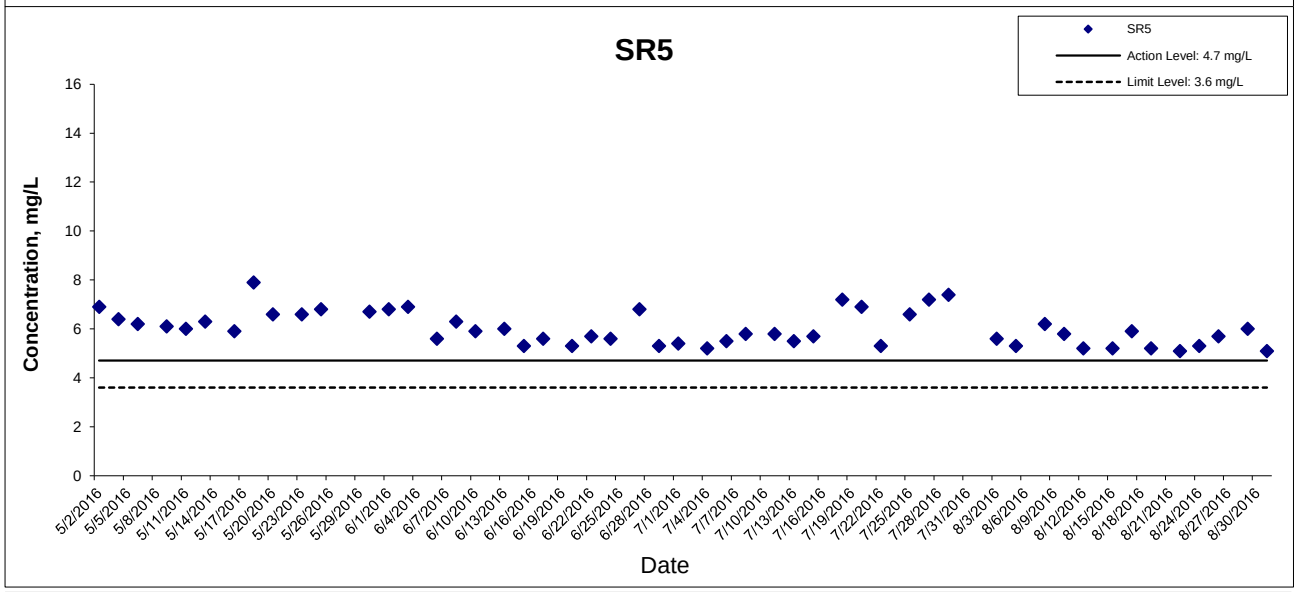
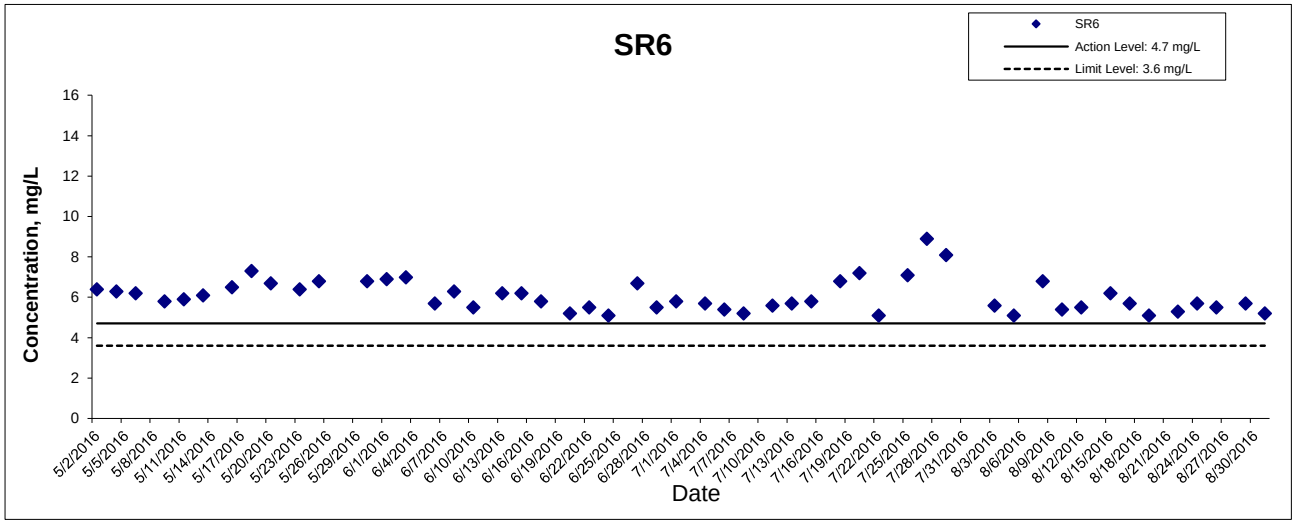
Dissolved Oxygen (Bottom) at Mid-Ebb Tide







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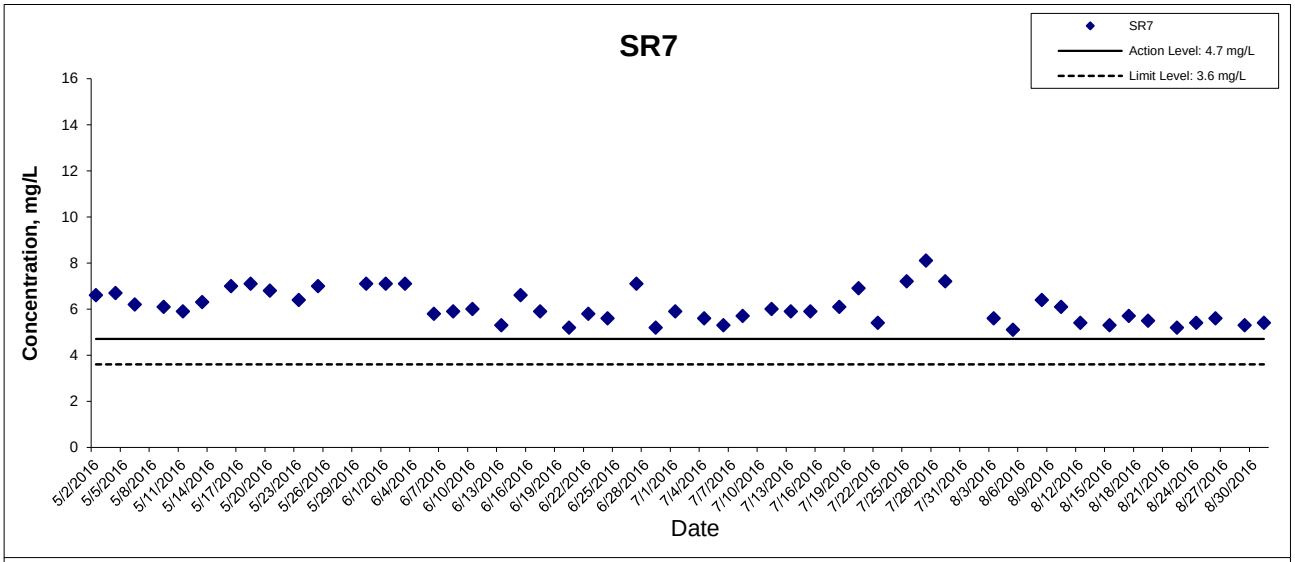
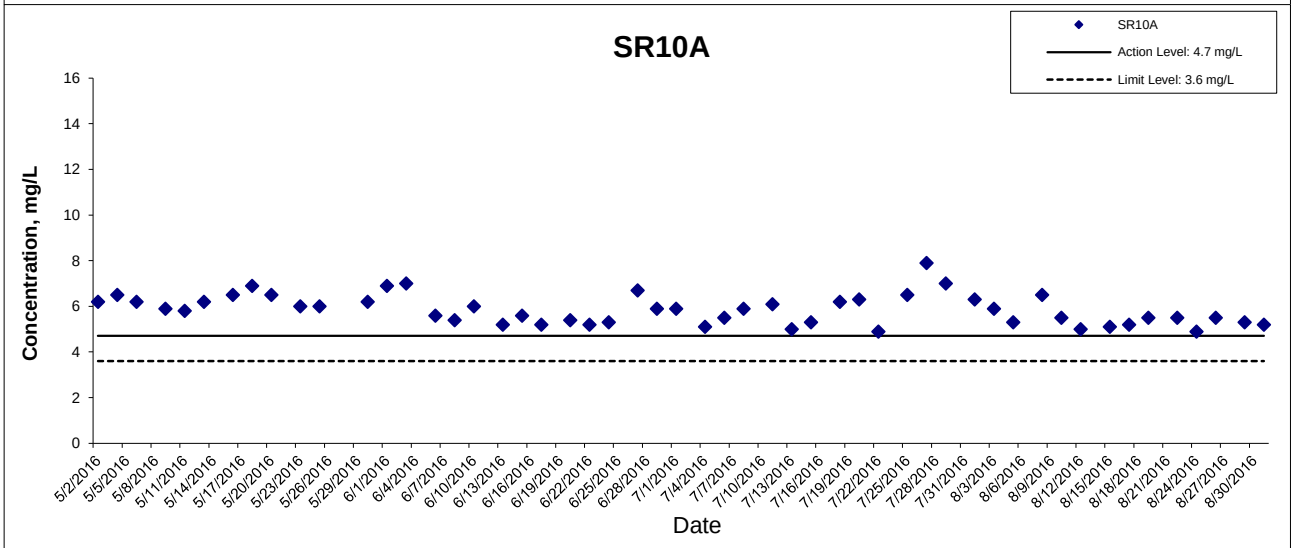
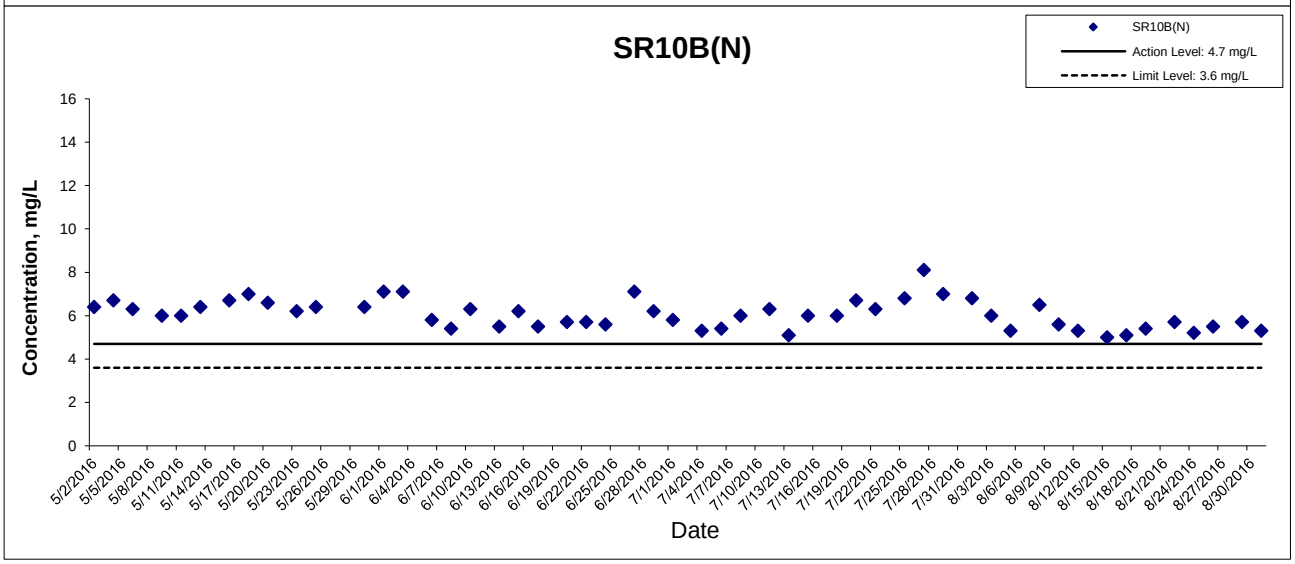
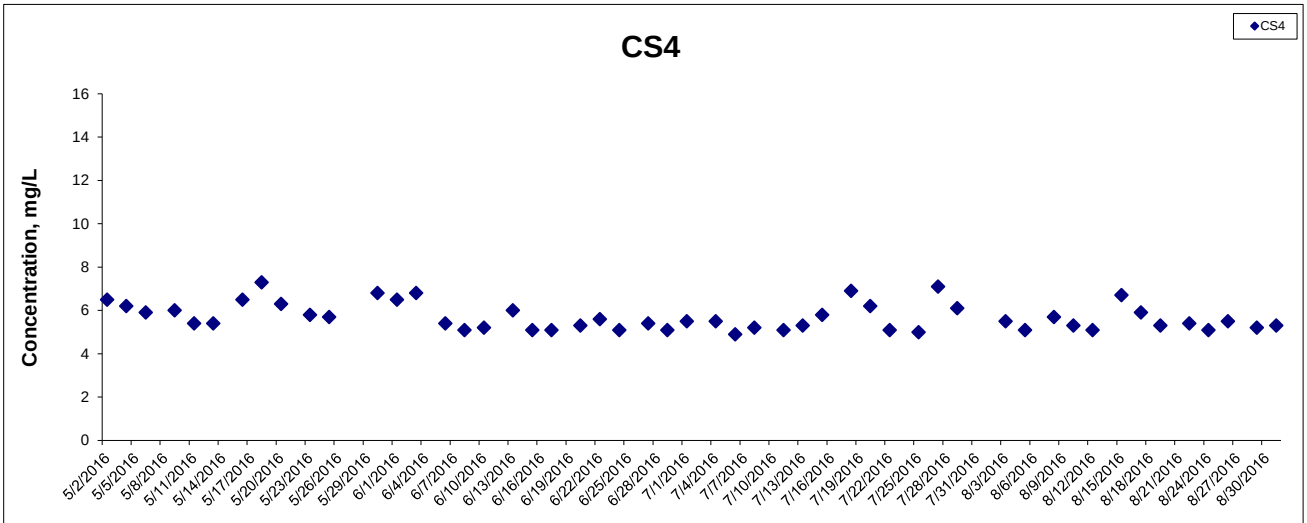
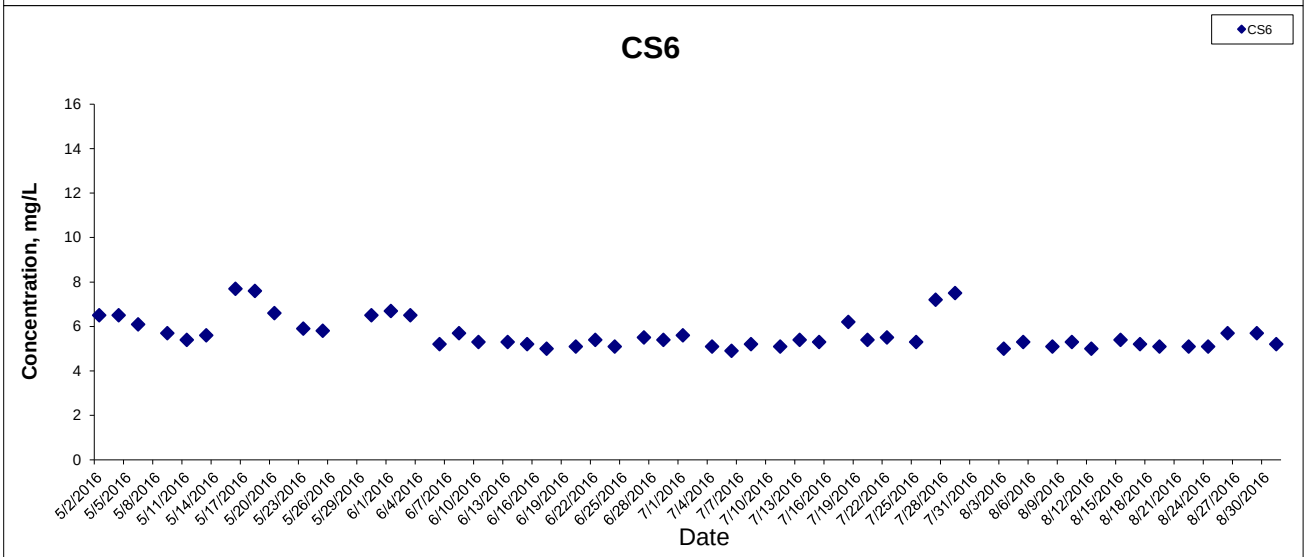


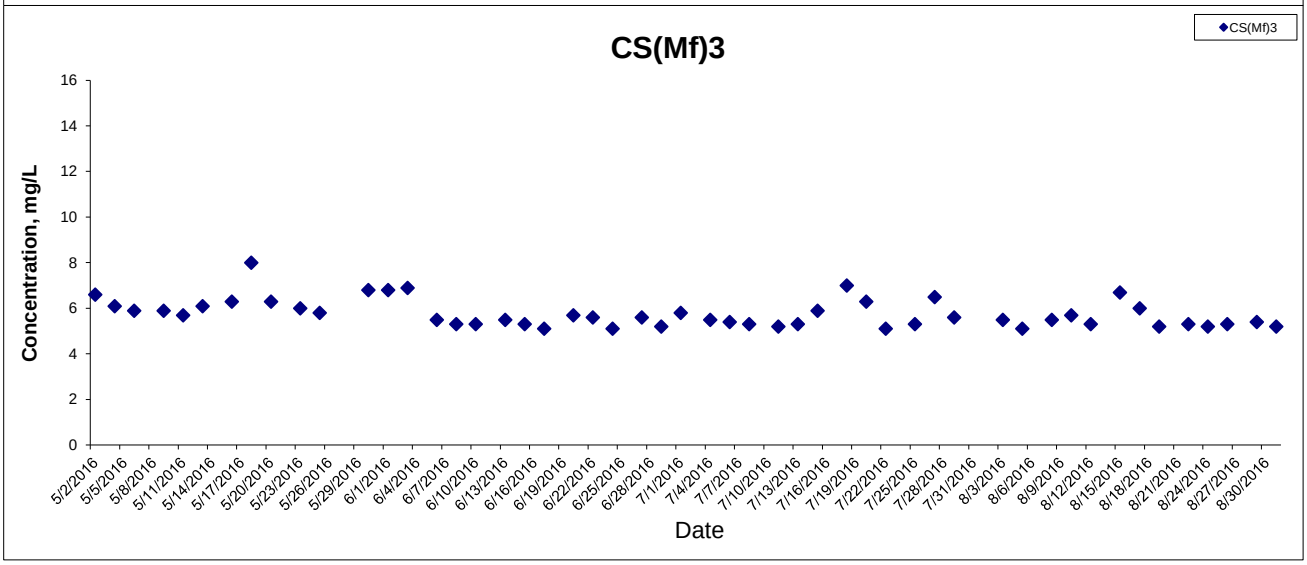




Dissolved Oxygen (Bottom) at Mid-Flood Tide







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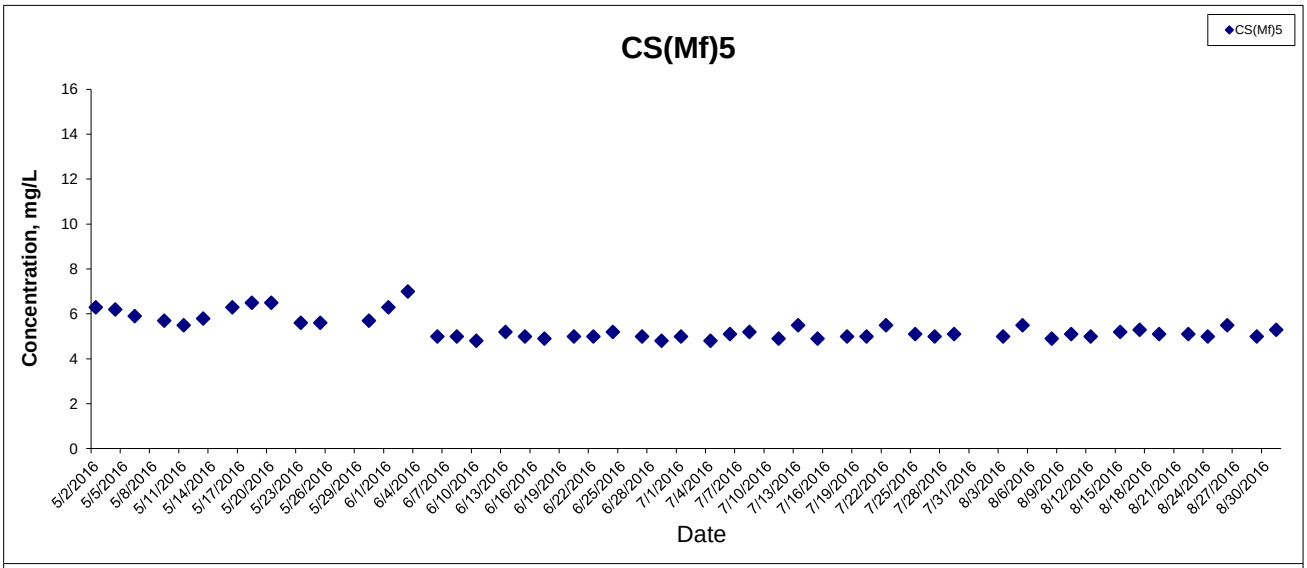

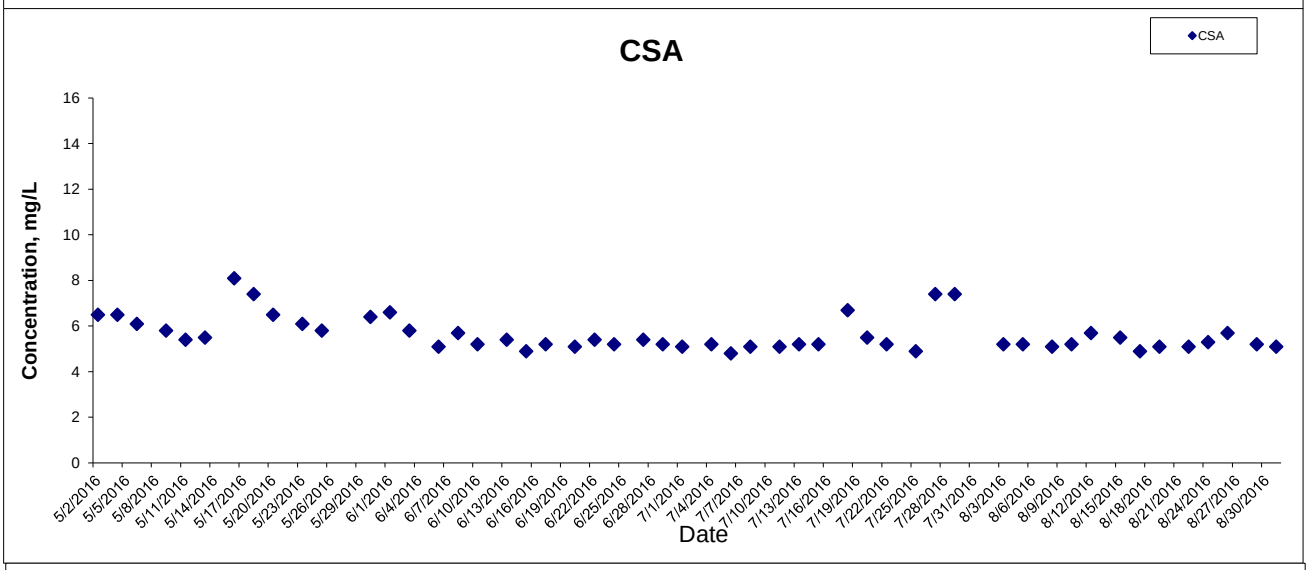

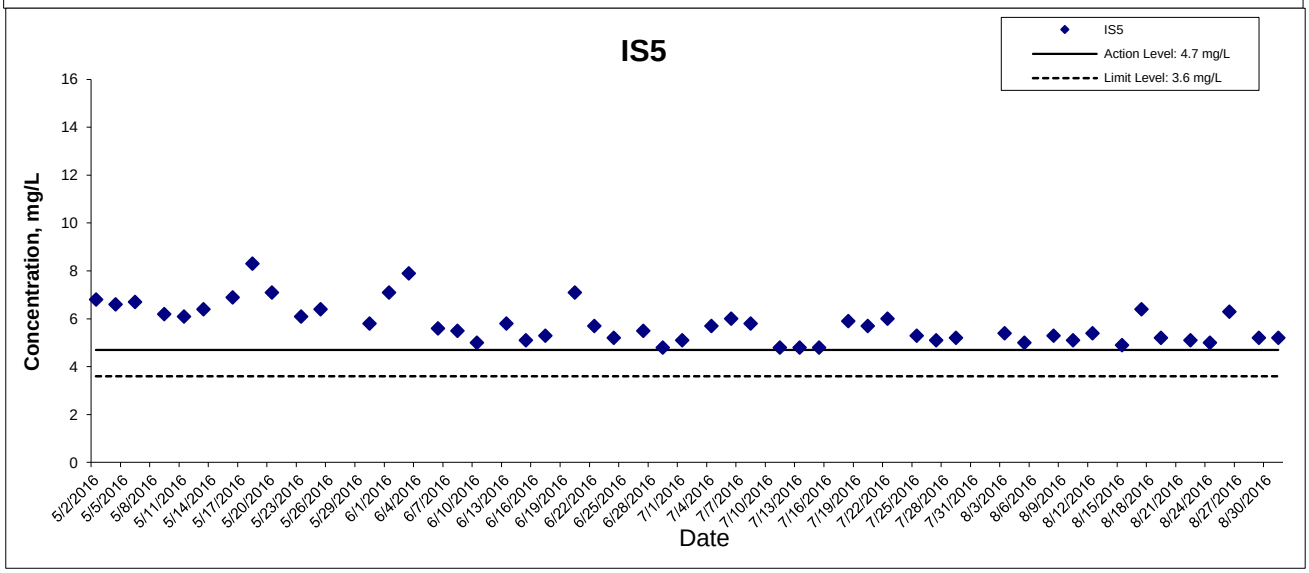

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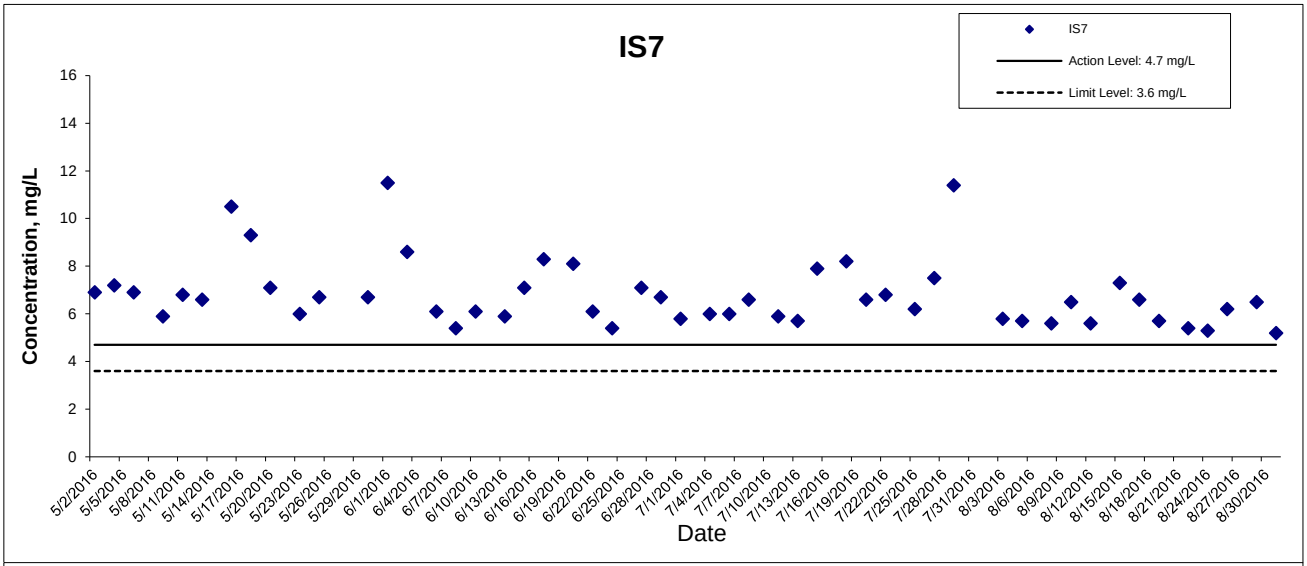

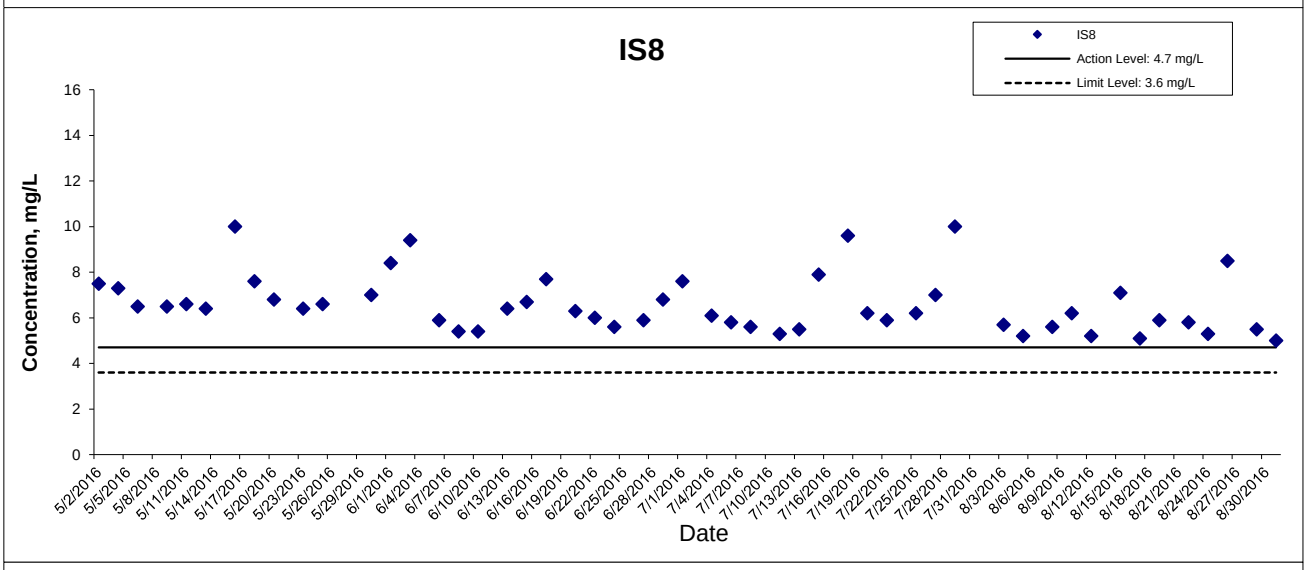

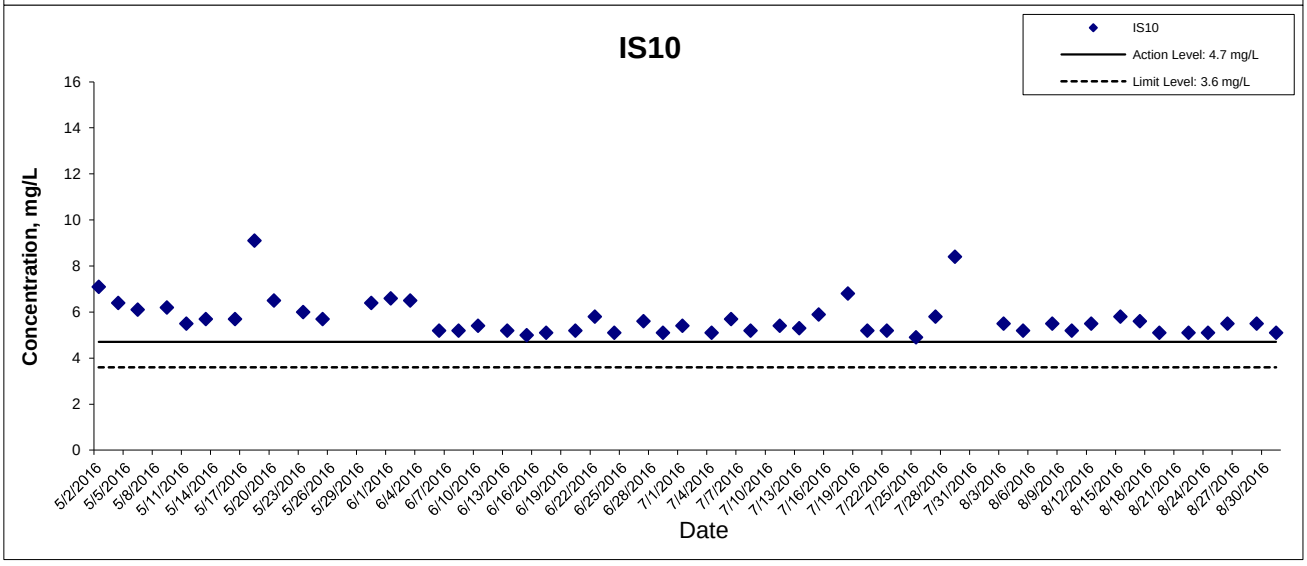

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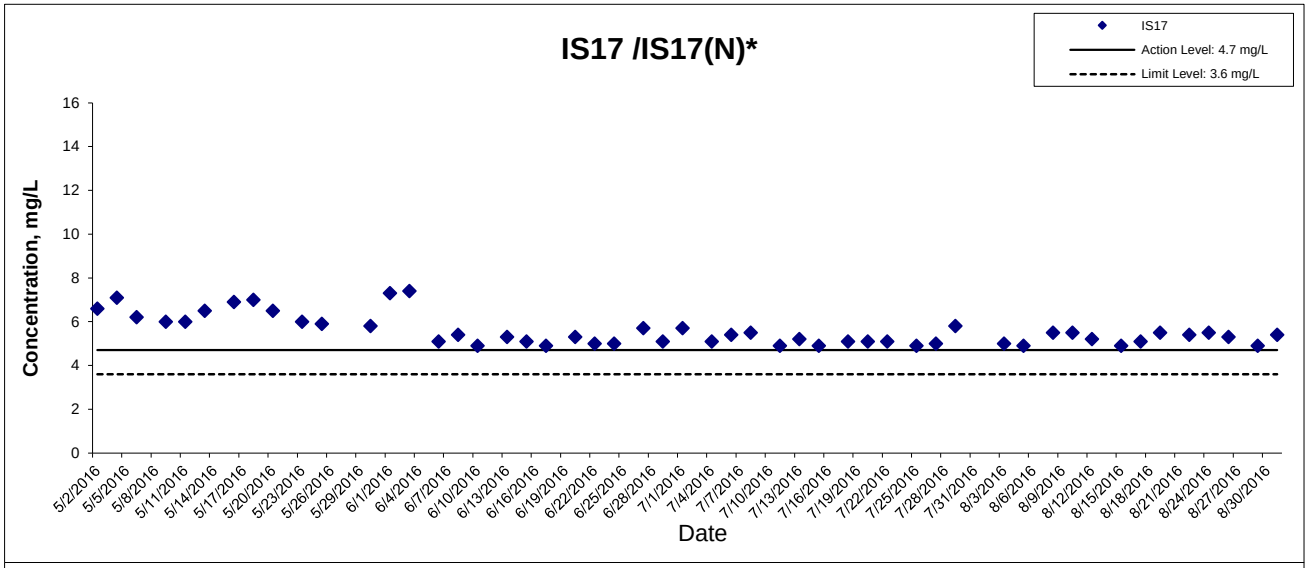

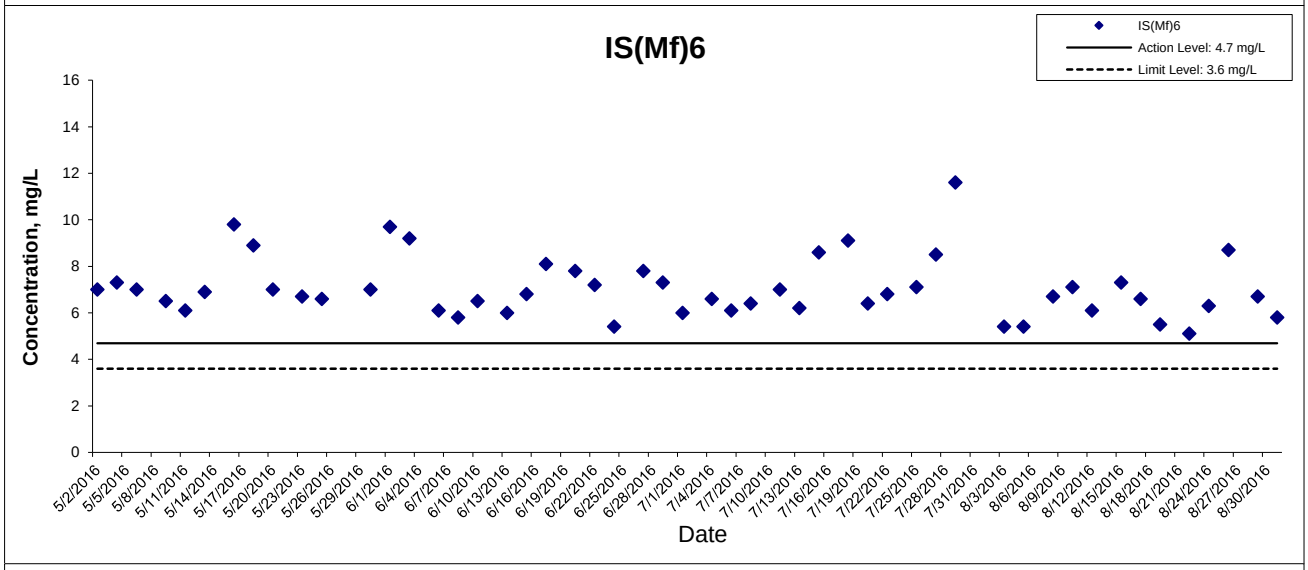

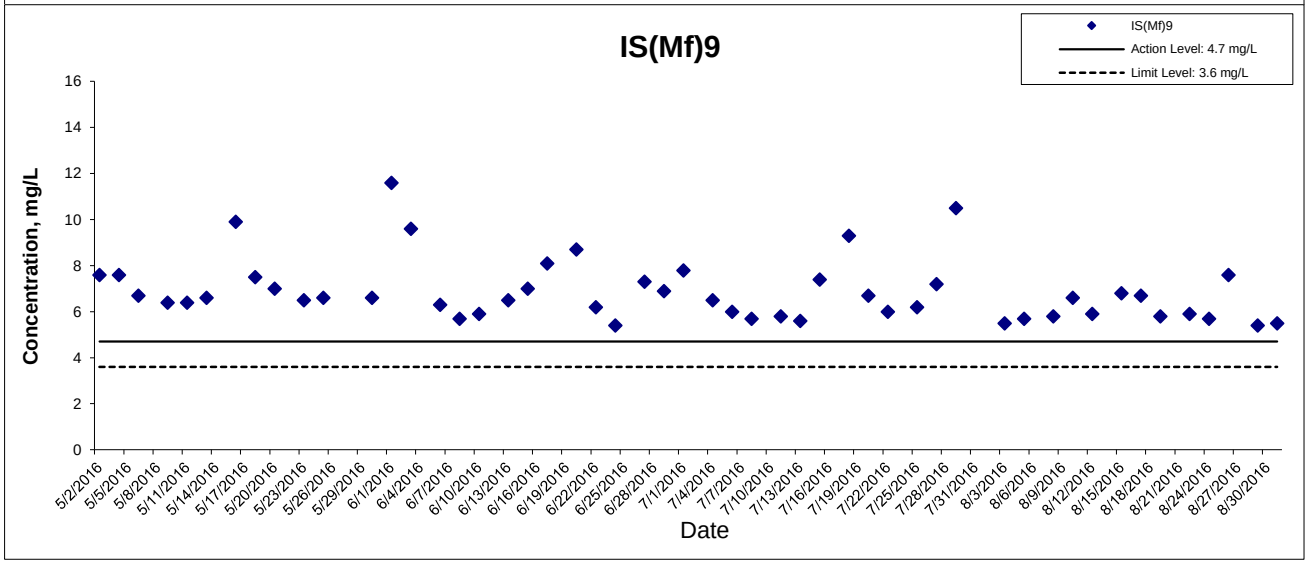

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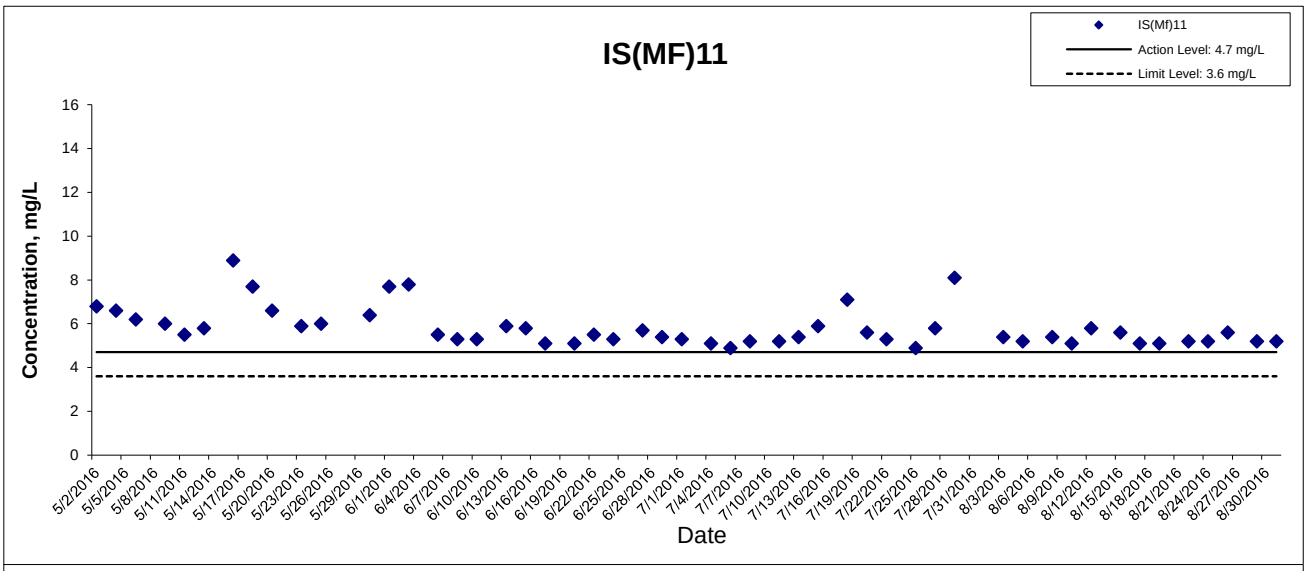

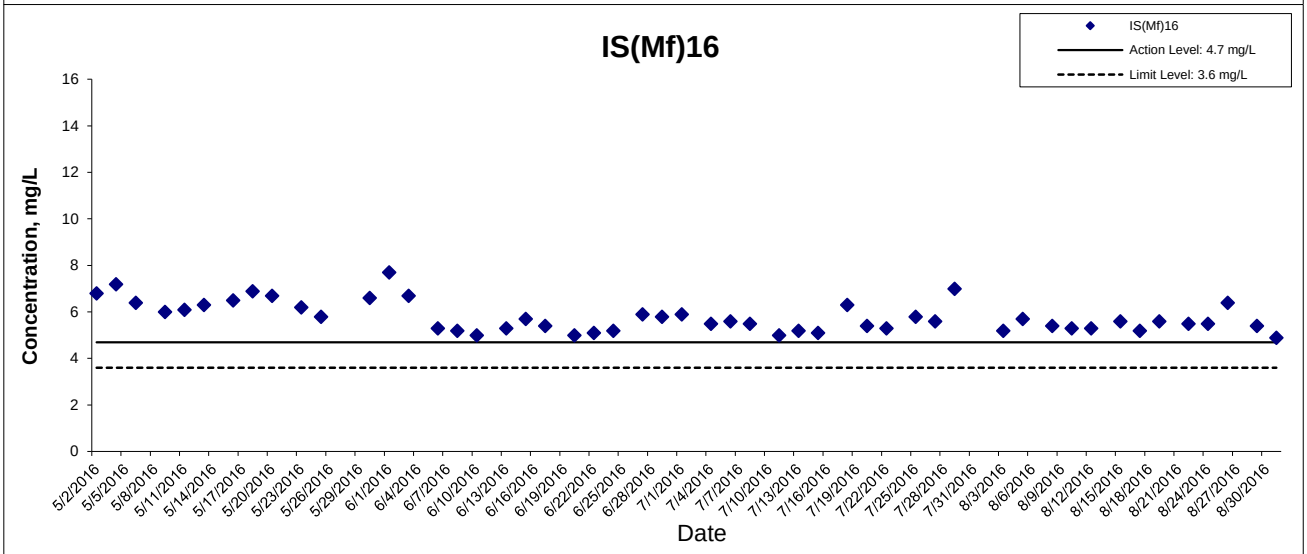

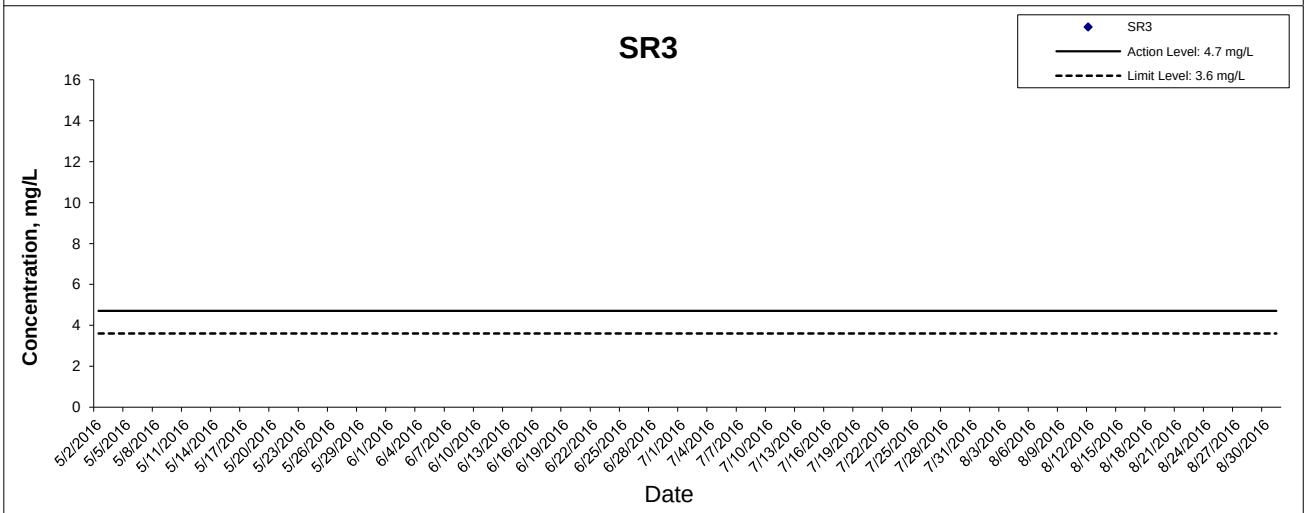

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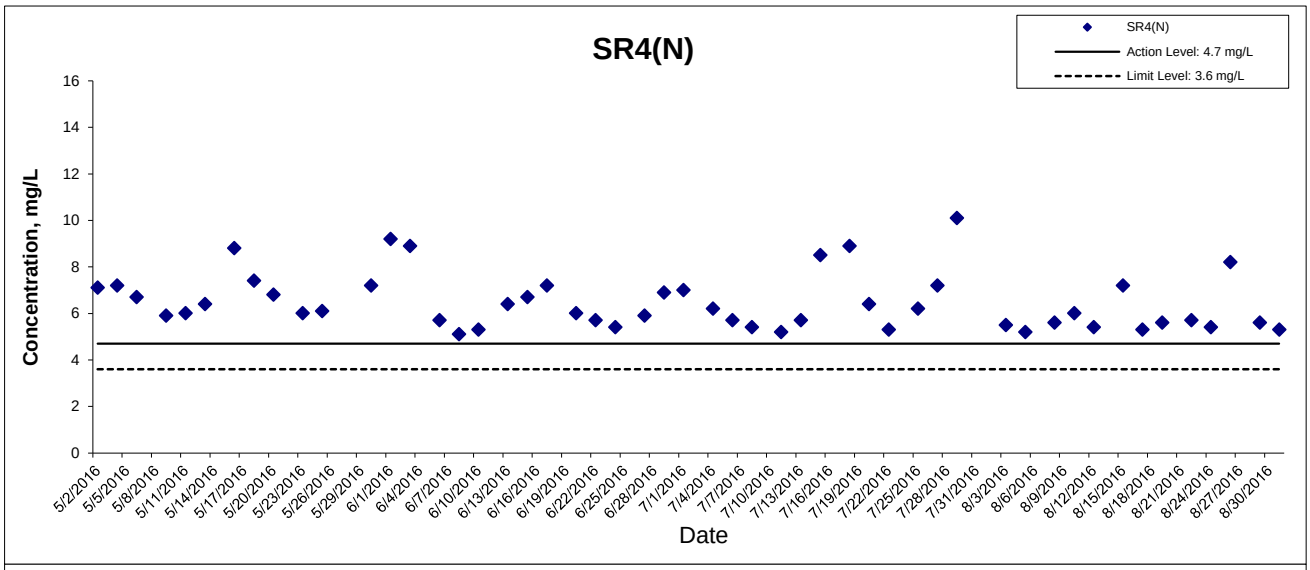
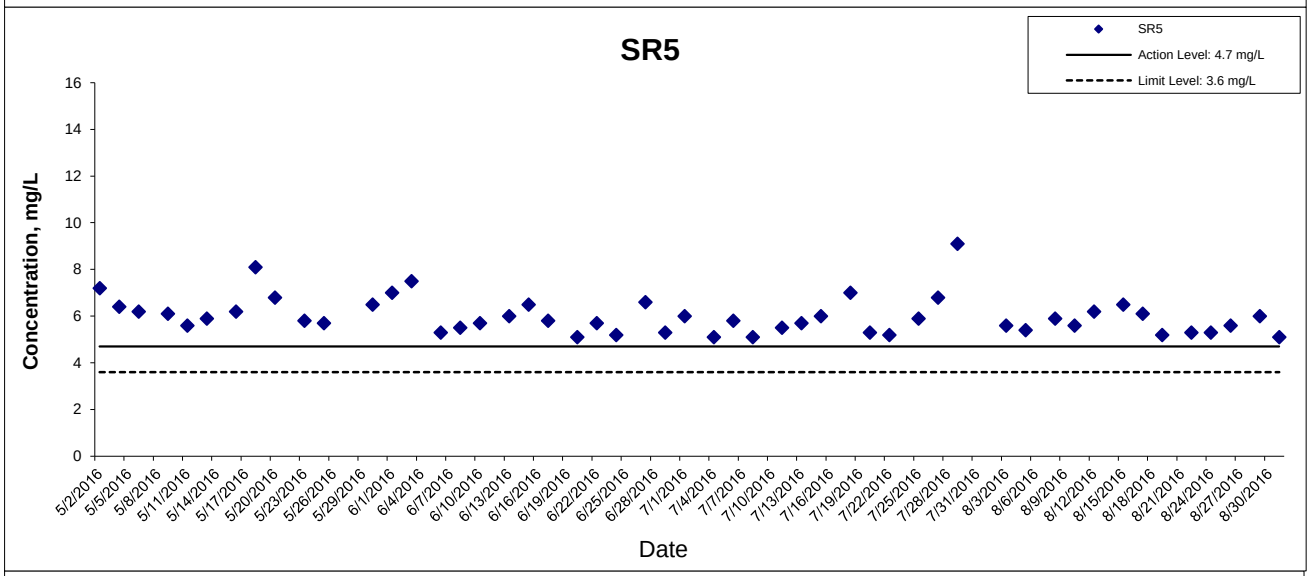
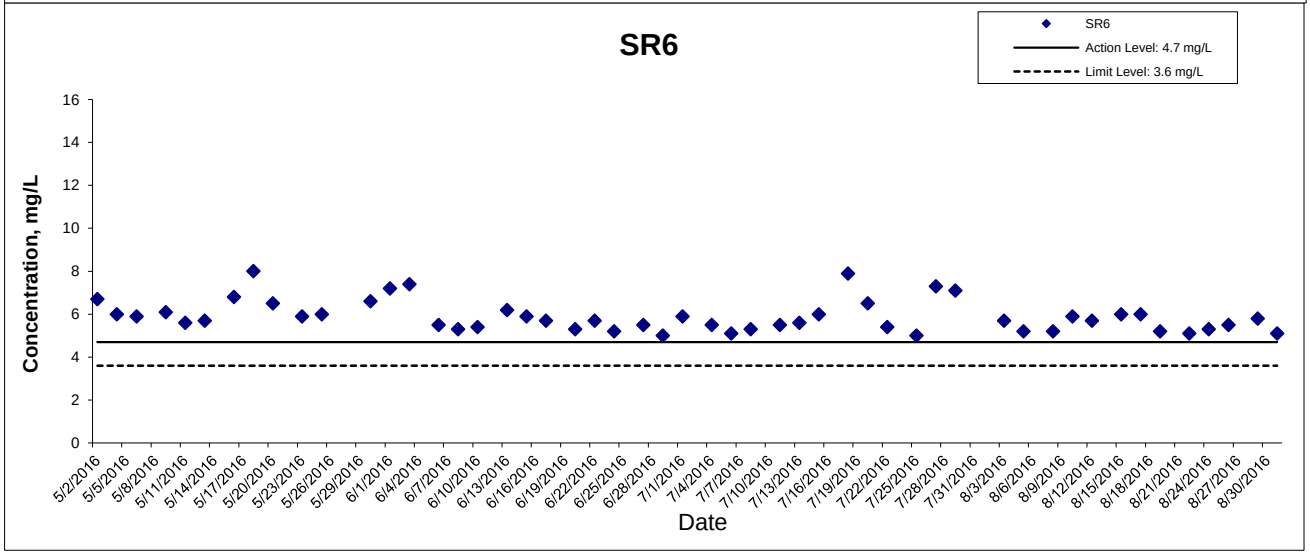
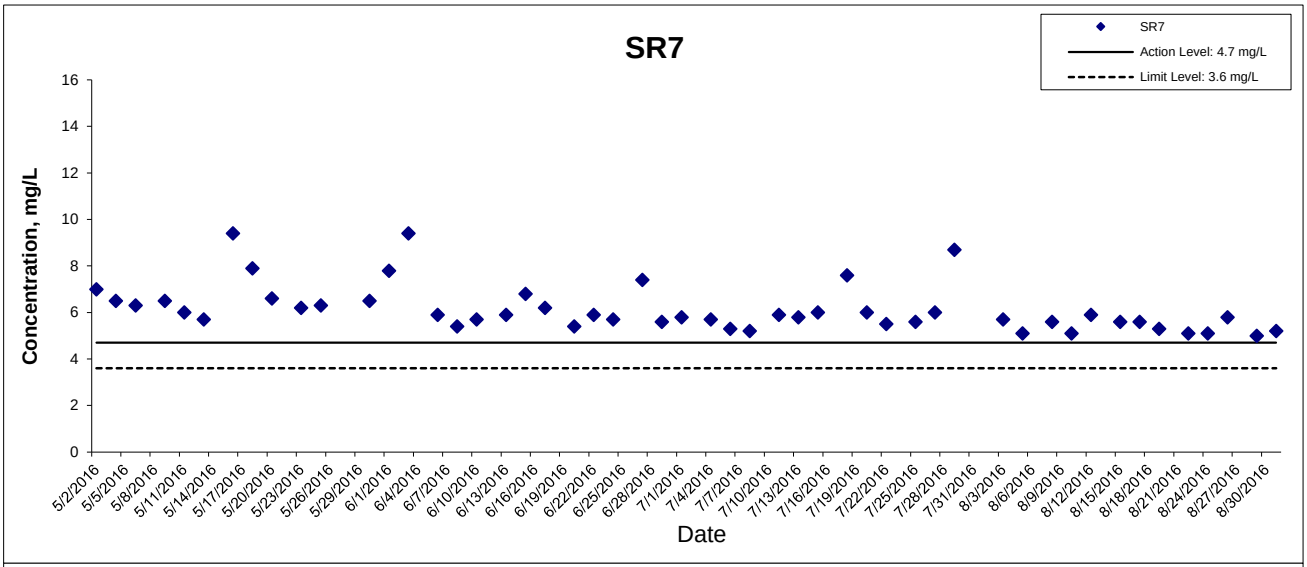
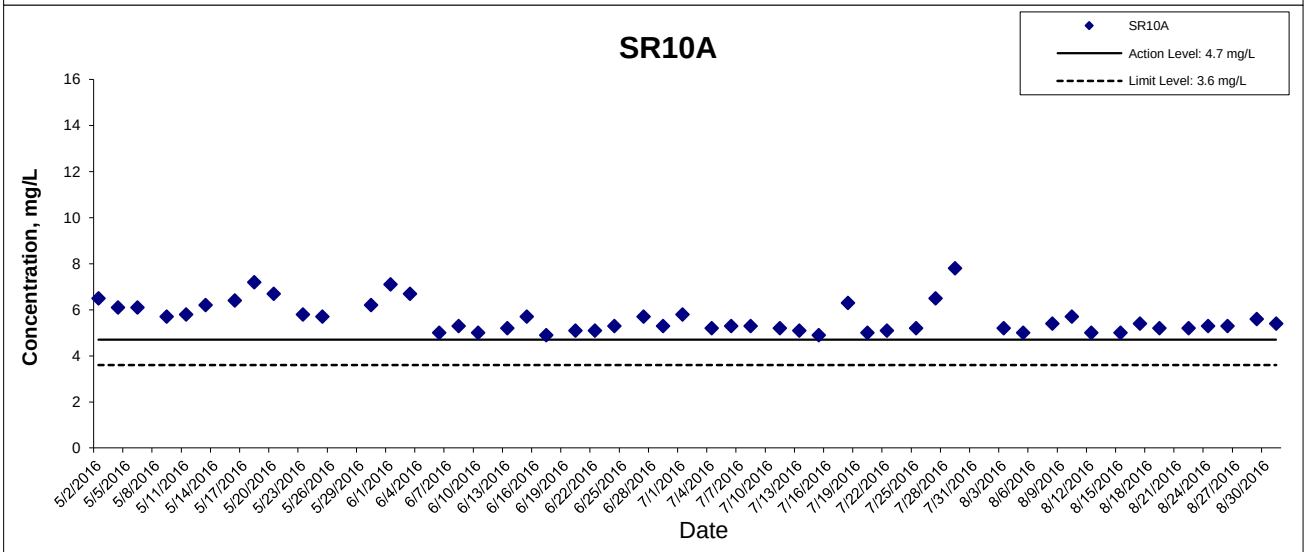


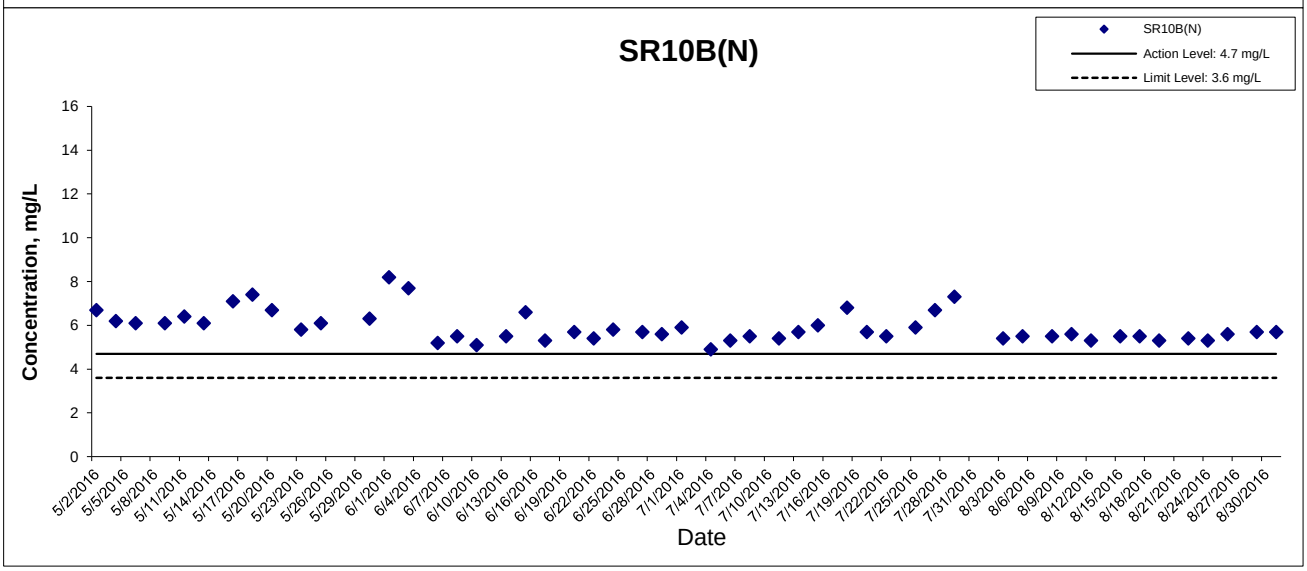




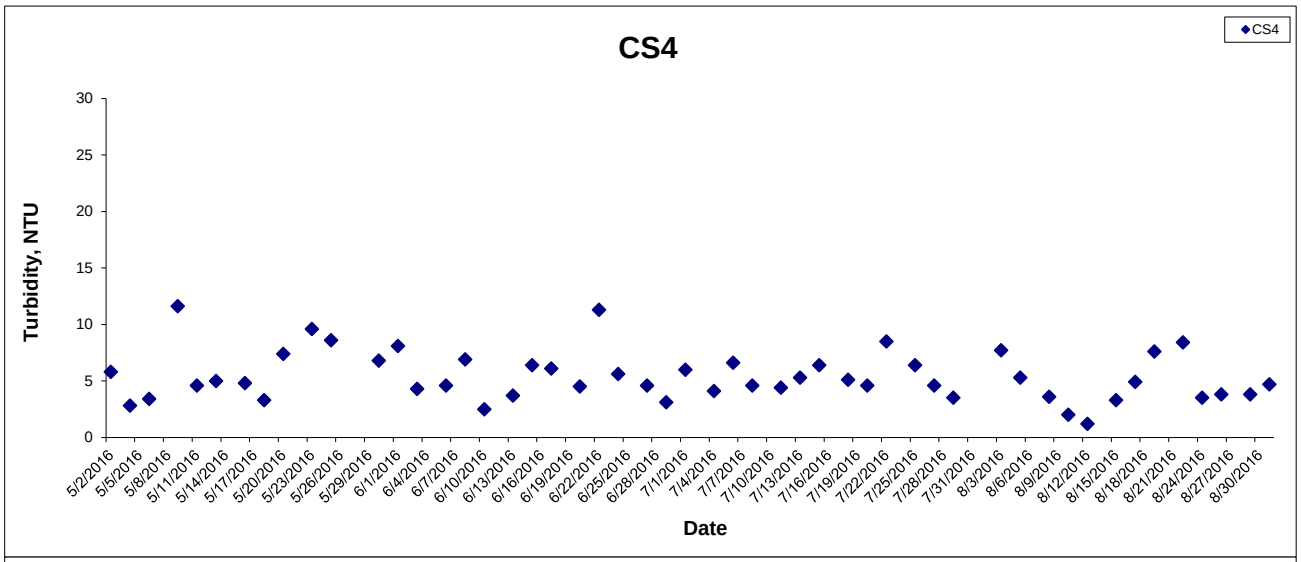
Dissolved Oxygen (Bottom) at Mid-Flood Tide

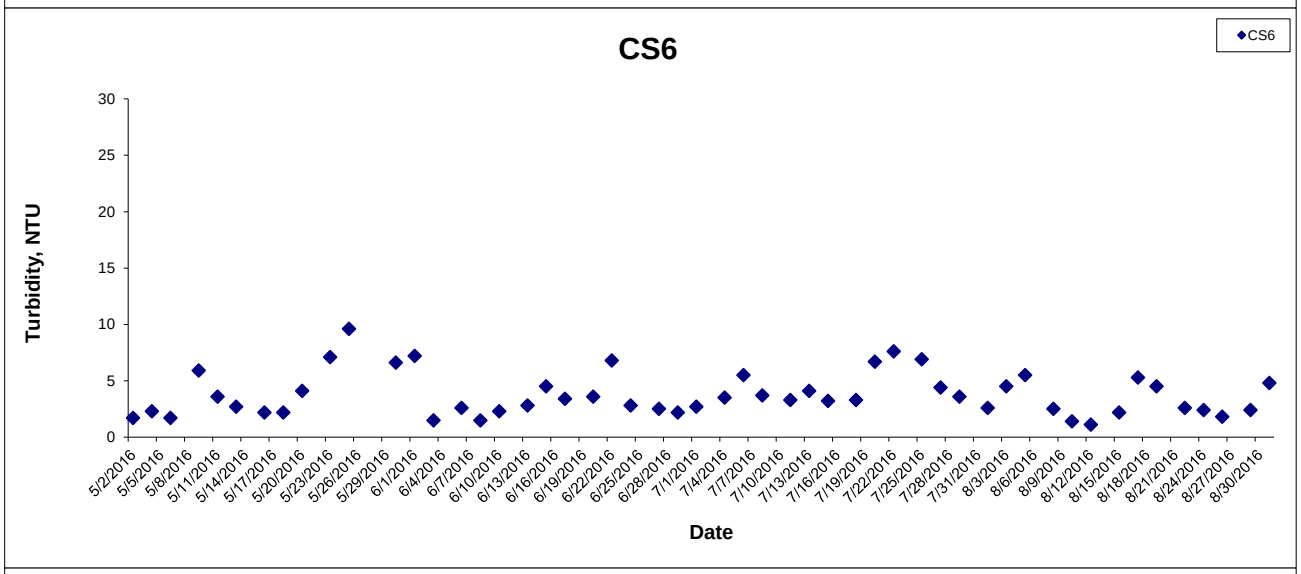


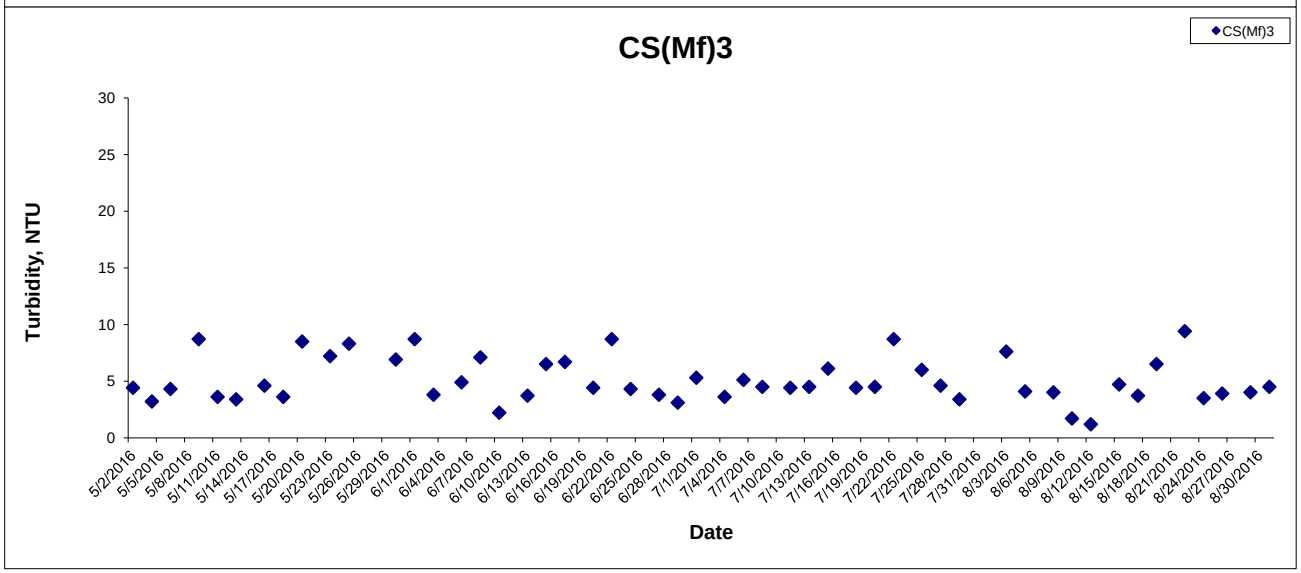




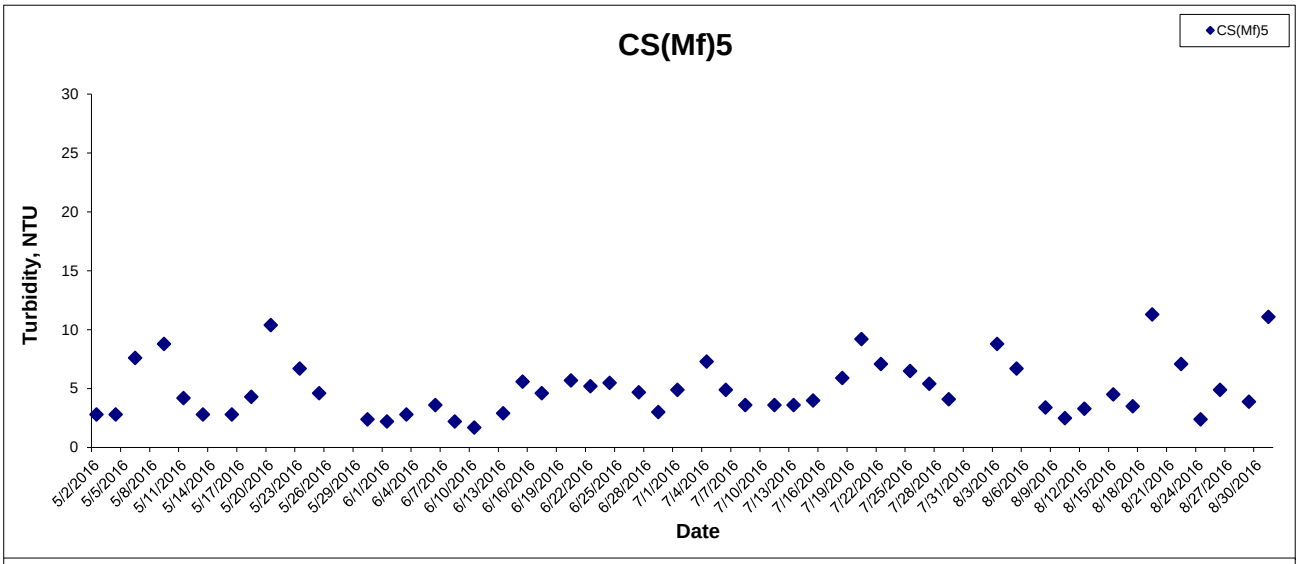
Turbidity at Mid-Ebb Tide

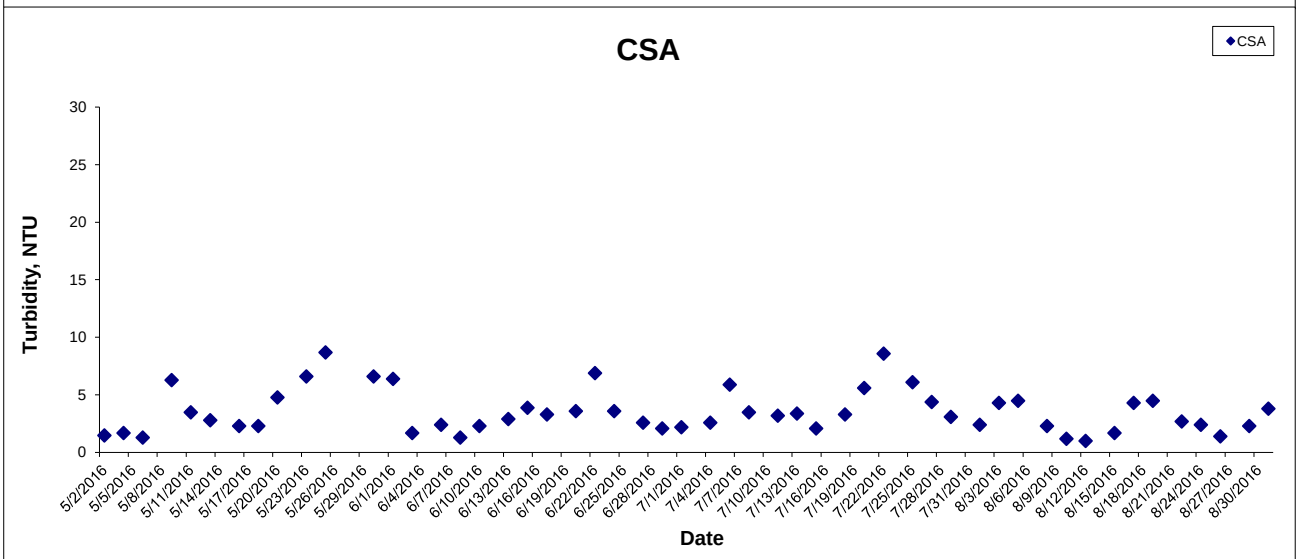


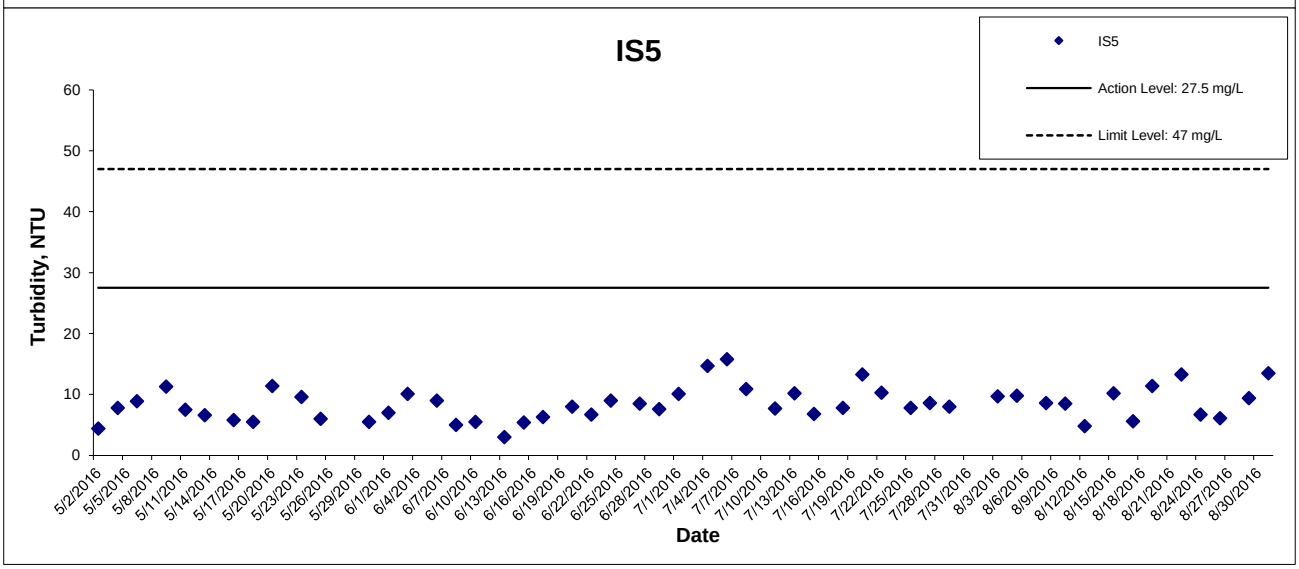




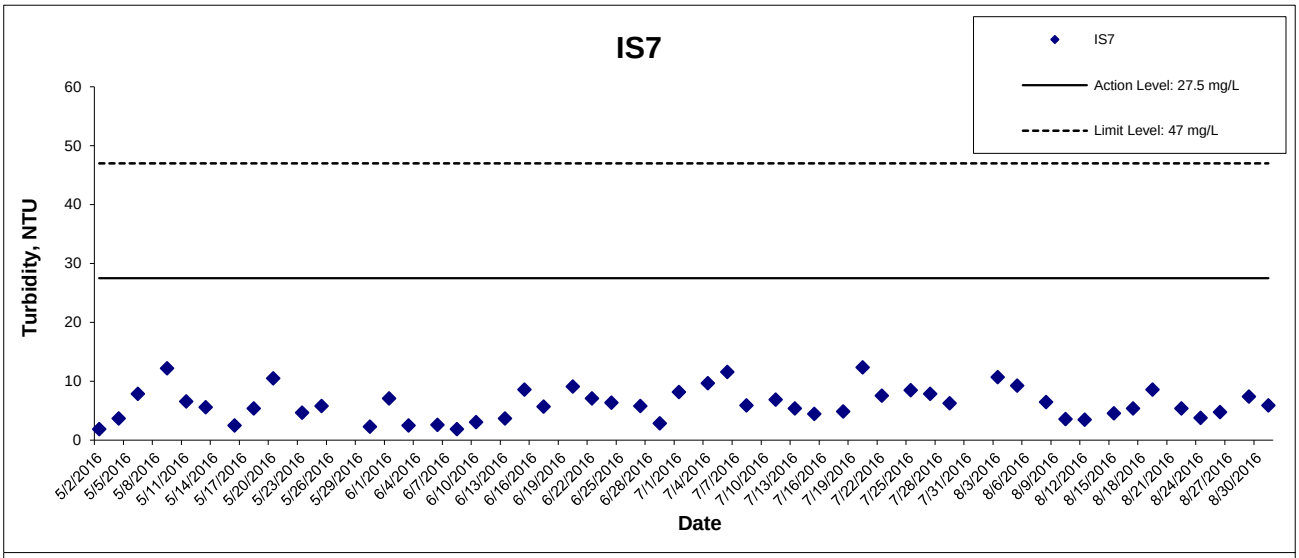
Turbidity at Mid-Ebb Tide

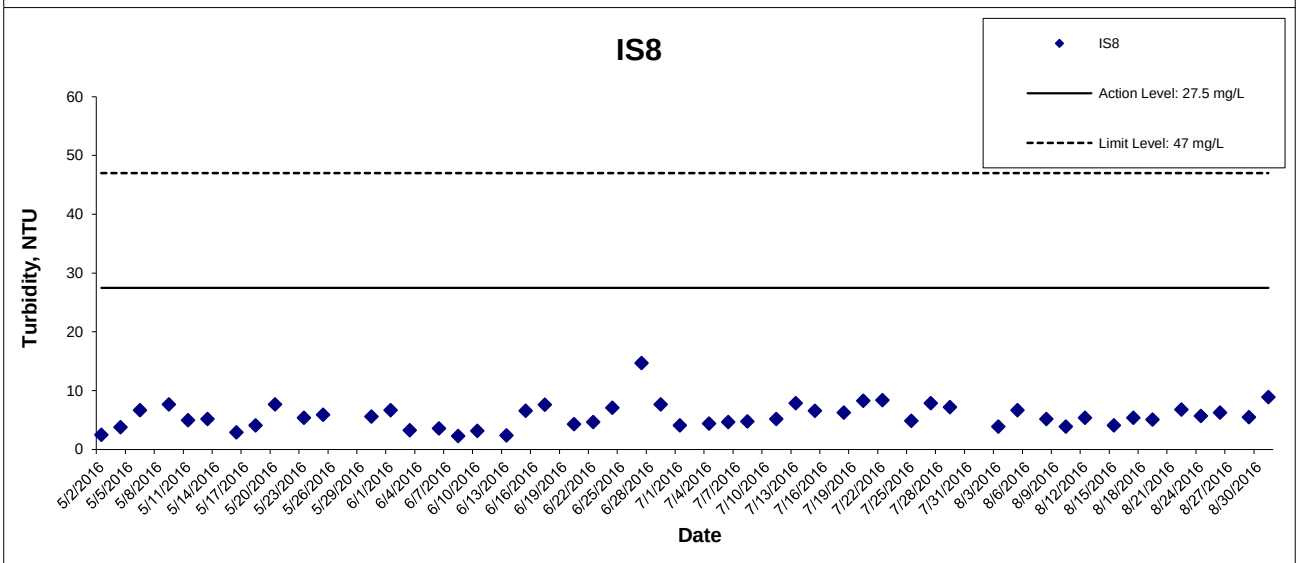


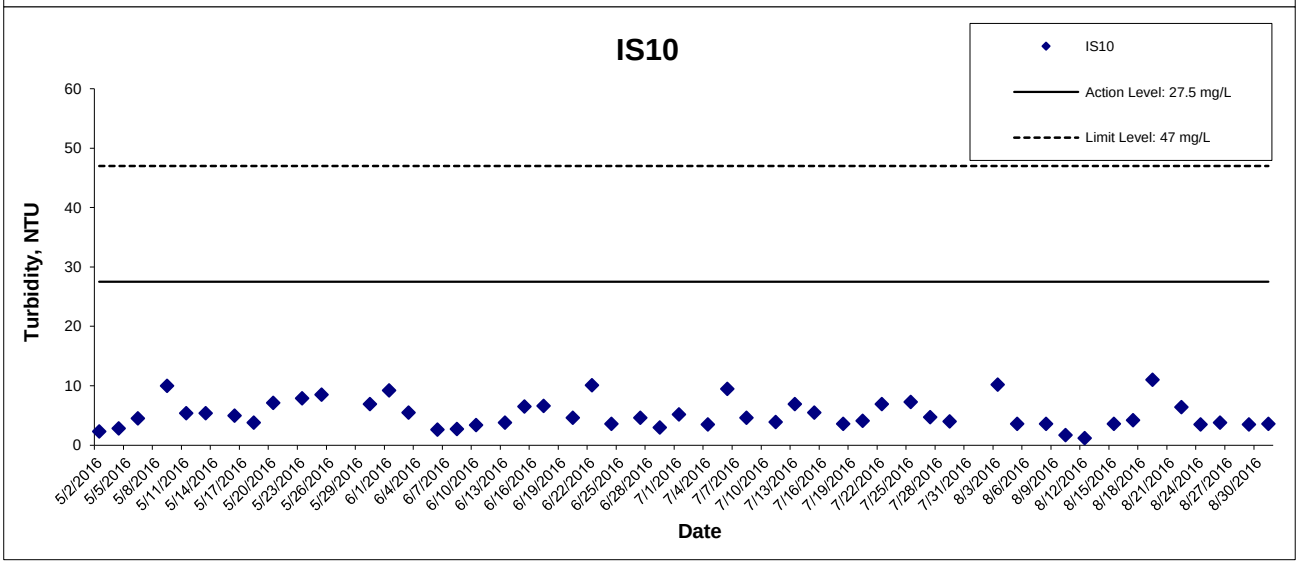




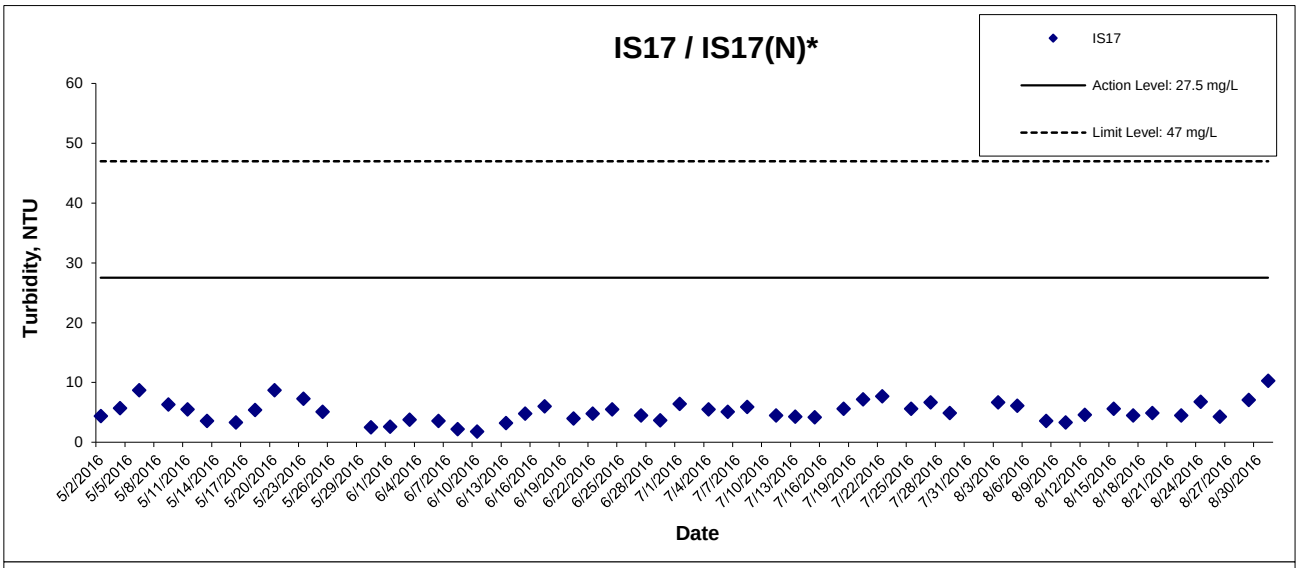
Turbidity at Mid-Ebb Tide

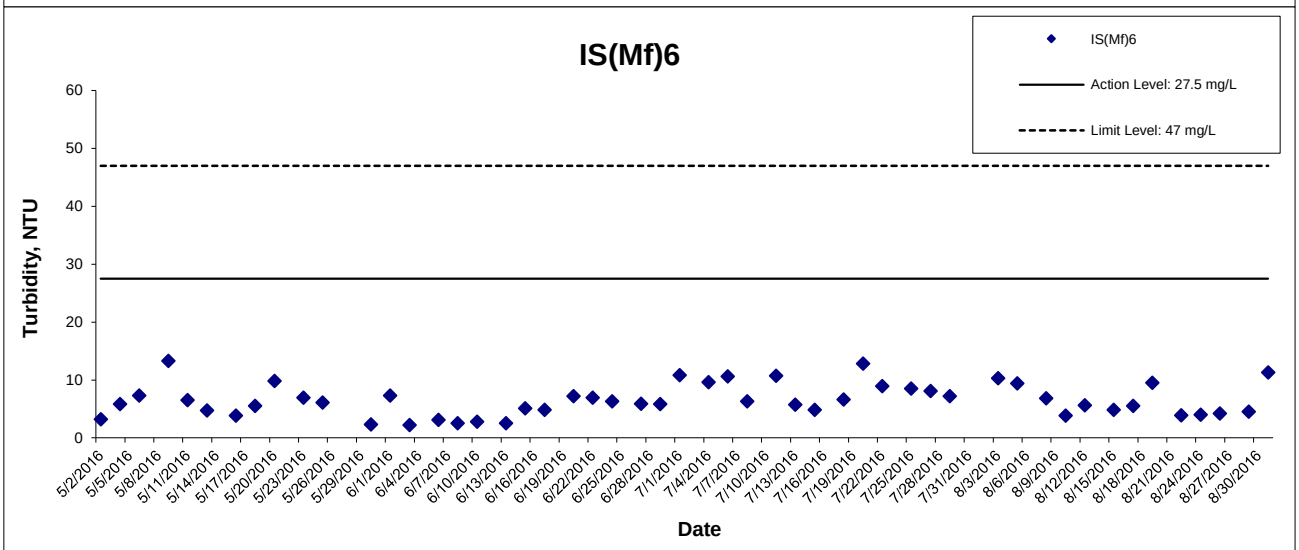


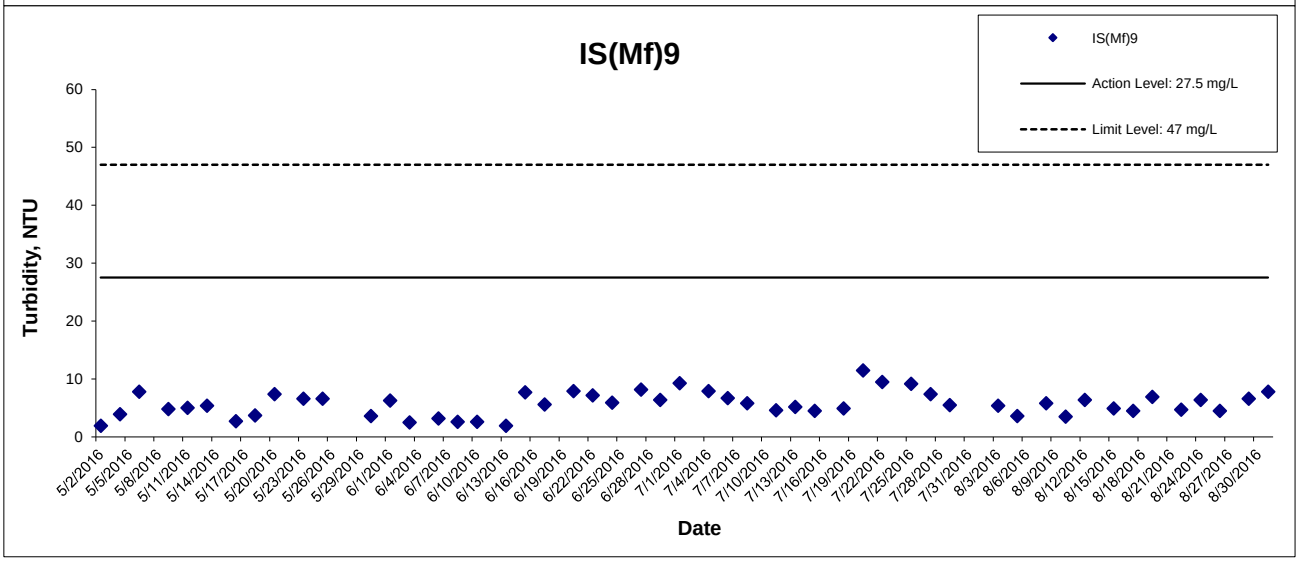




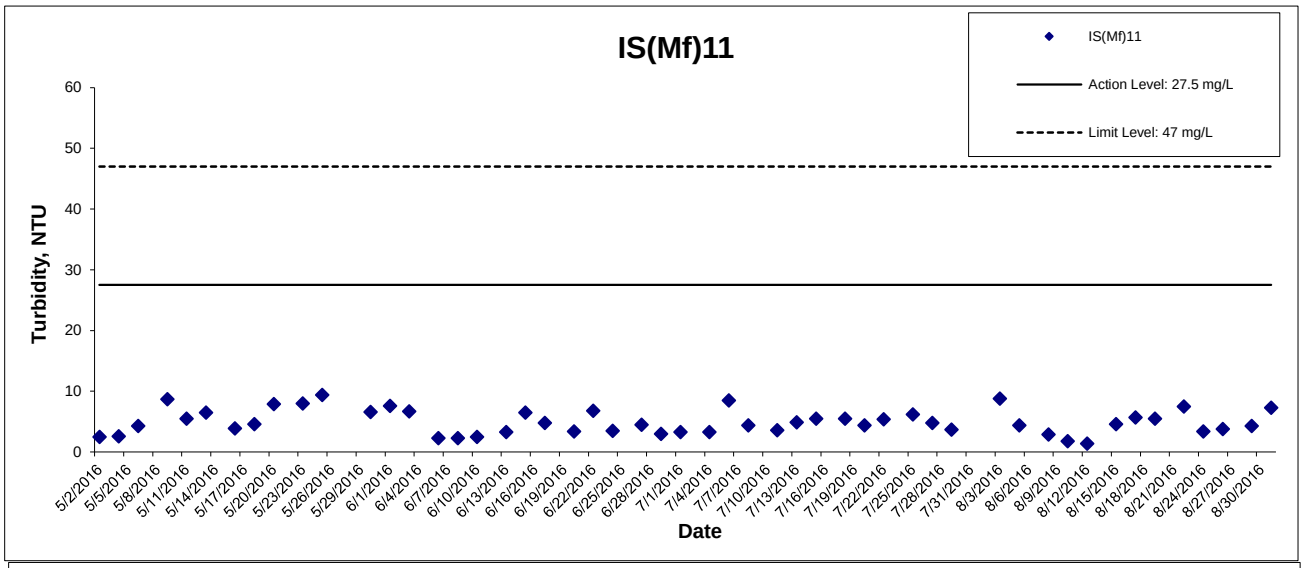
Turbidity at Mid-Ebb Tide

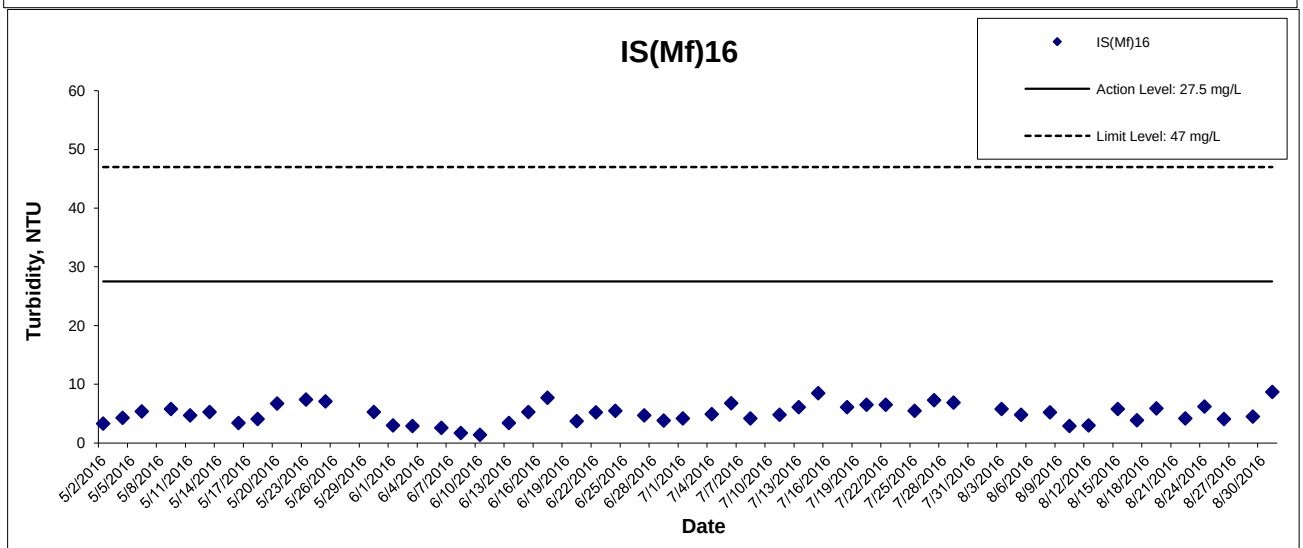


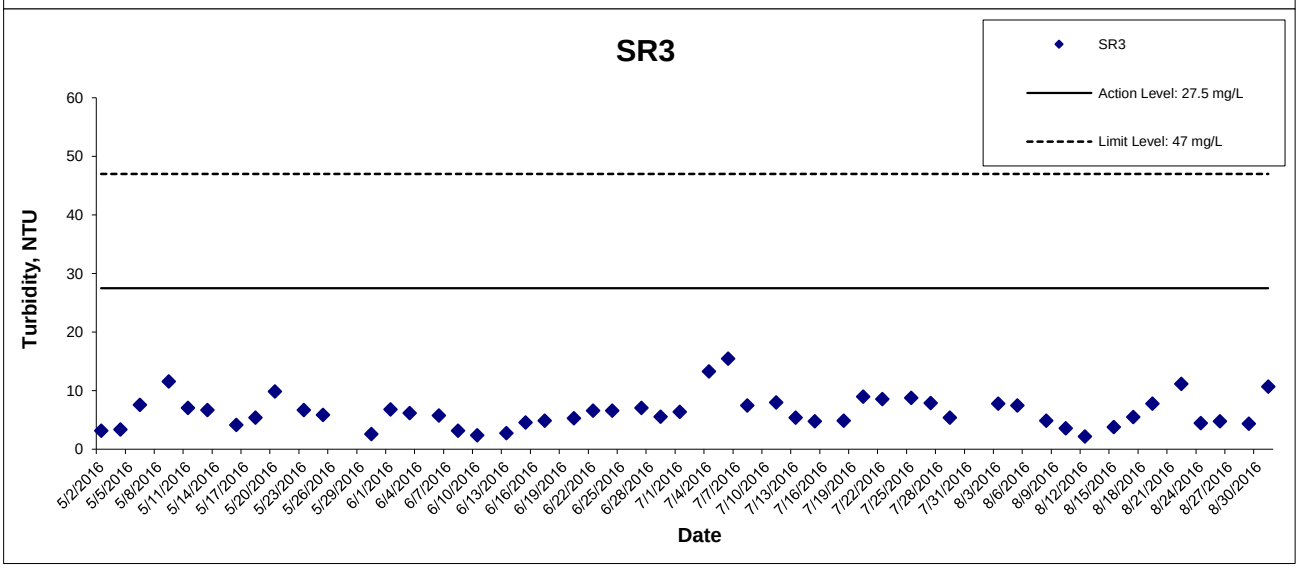




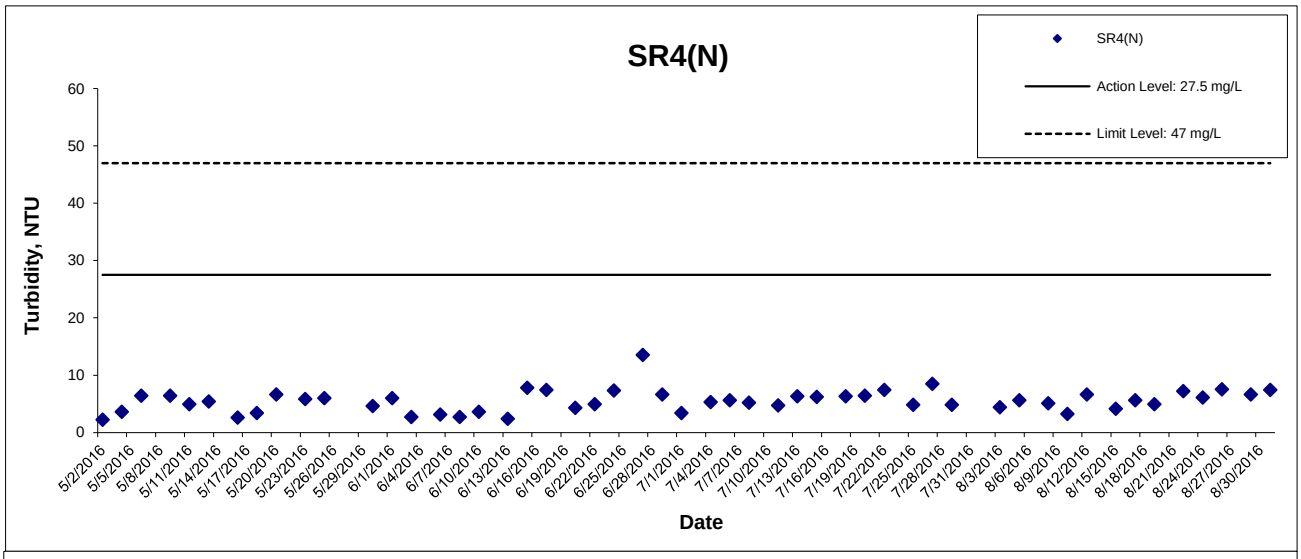
Turbidity at Mid-Ebb Tide

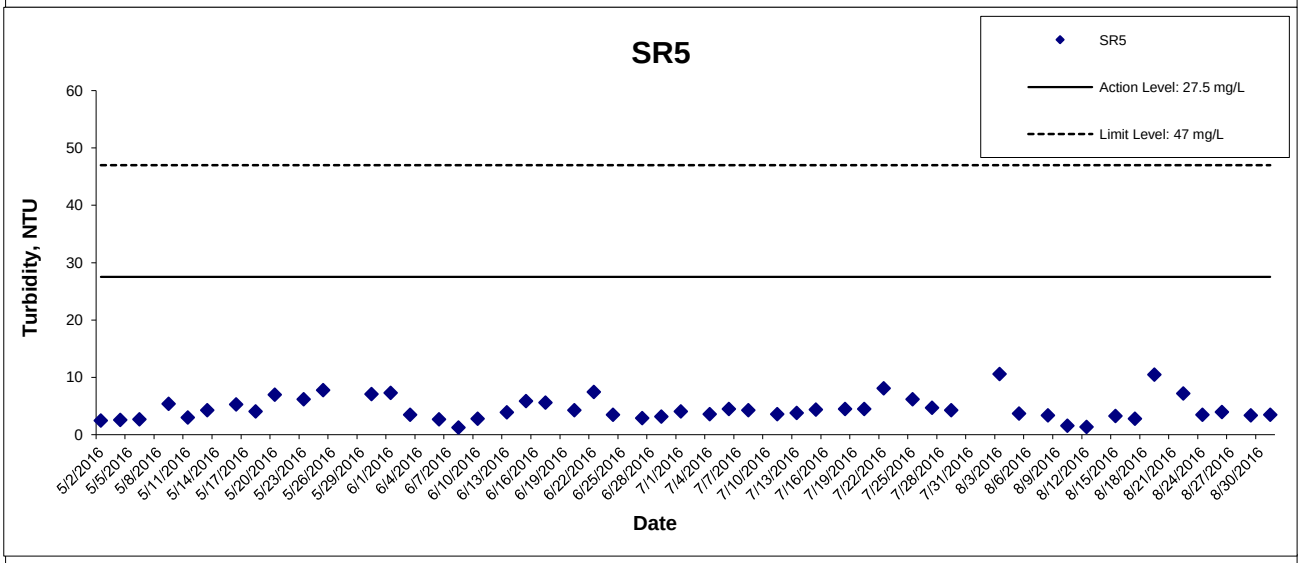


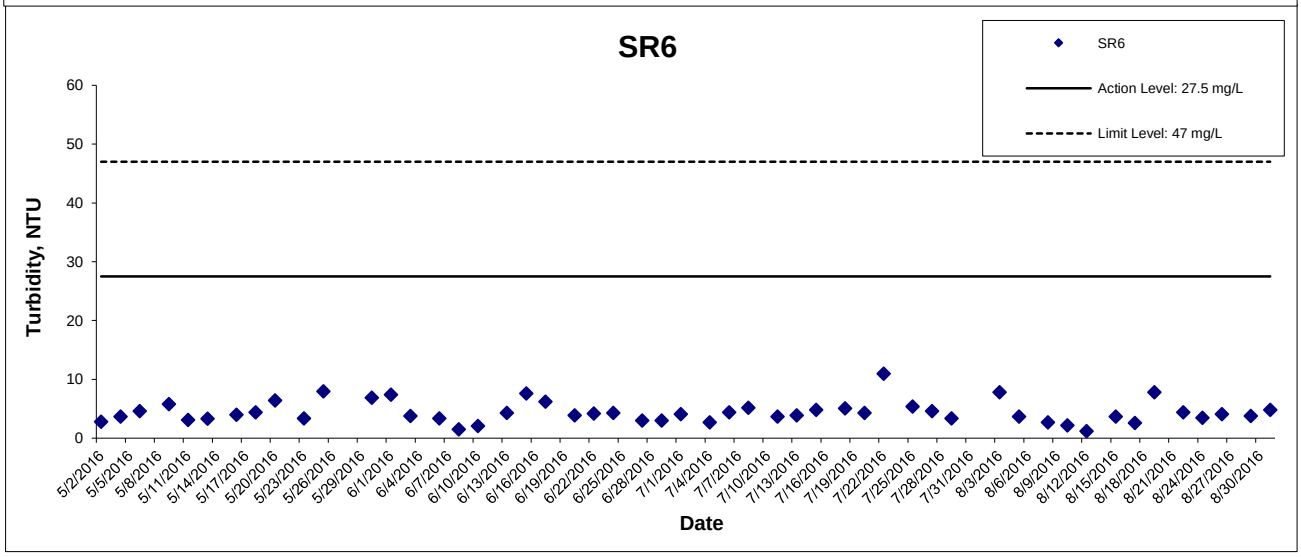




Turbidity at Mid-Ebb Tide







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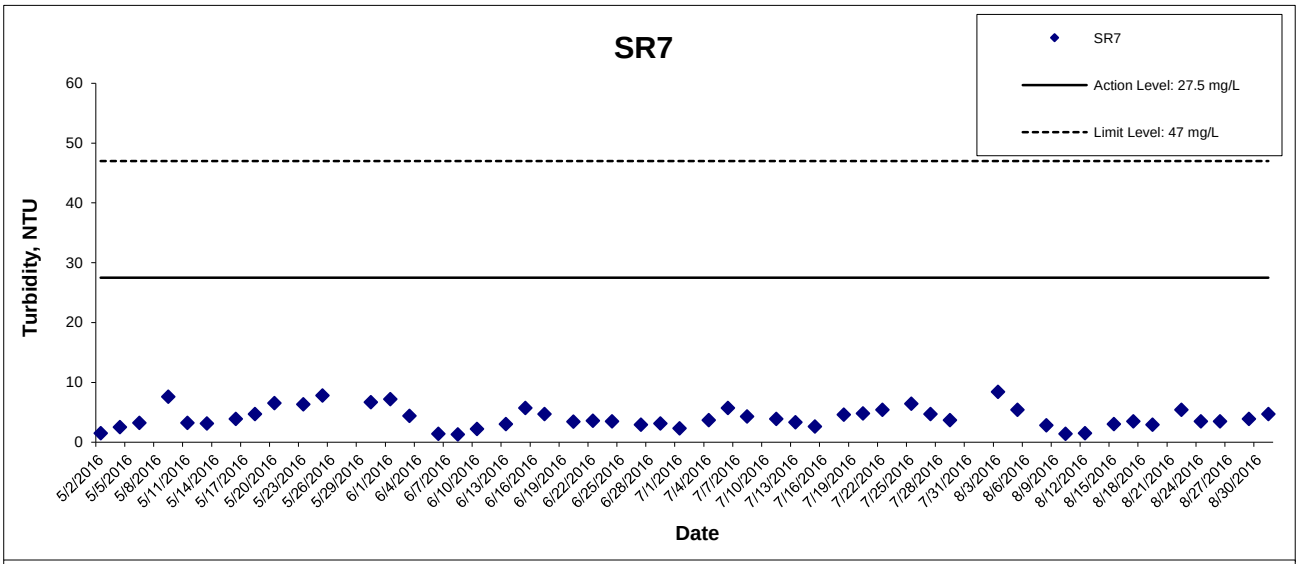
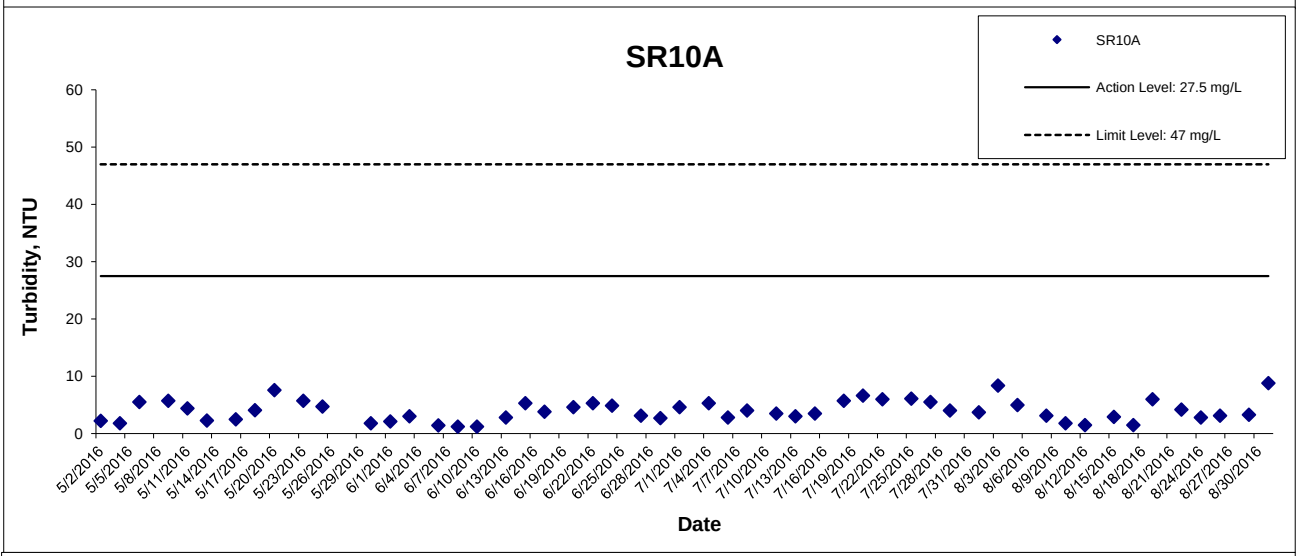
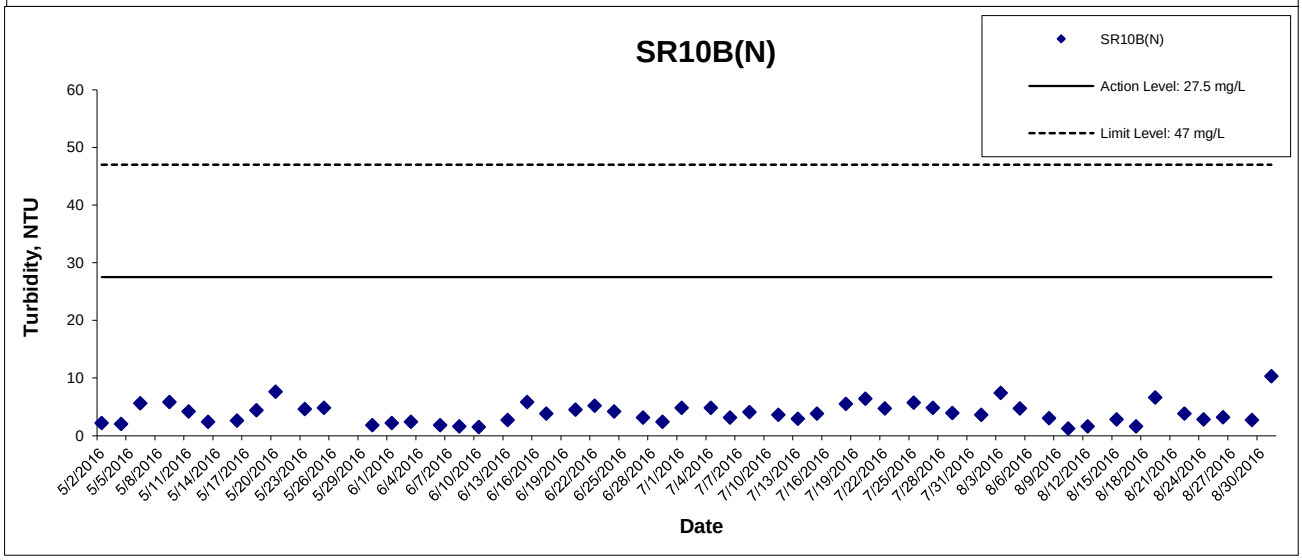
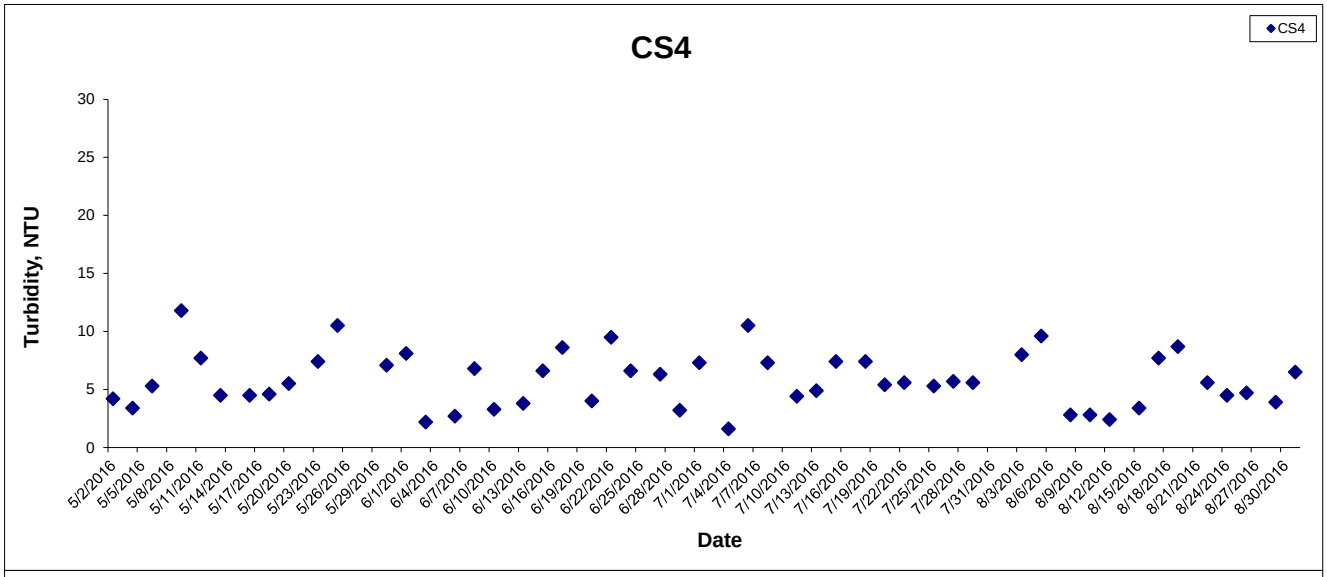
Turbidity at Mid-Ebb Tide

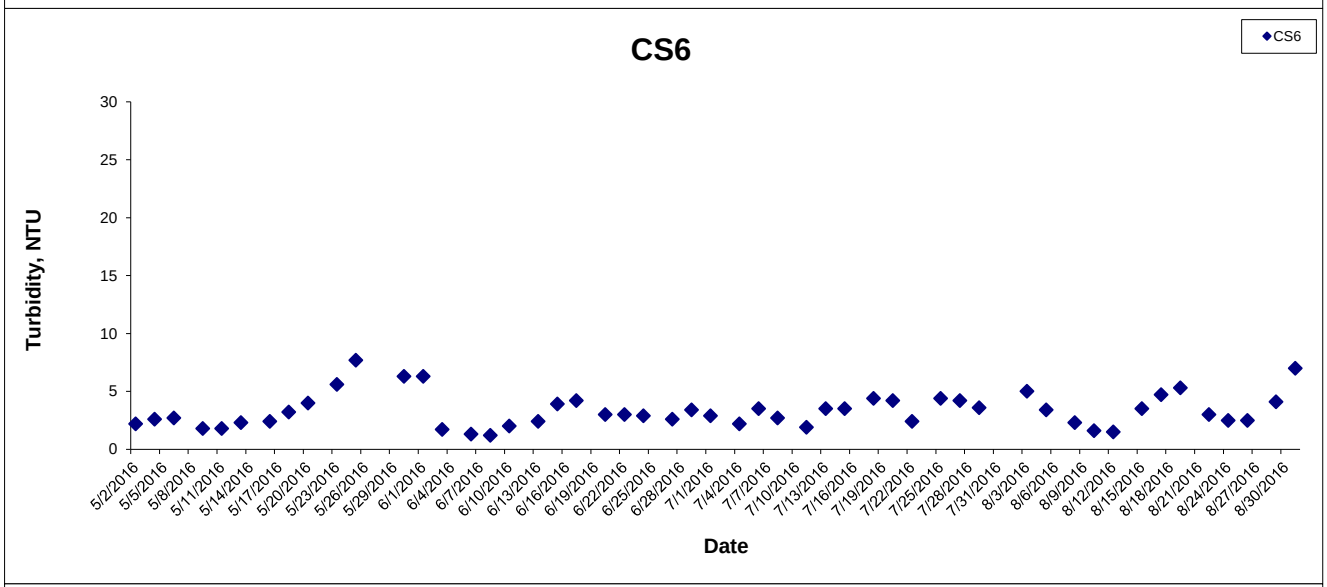


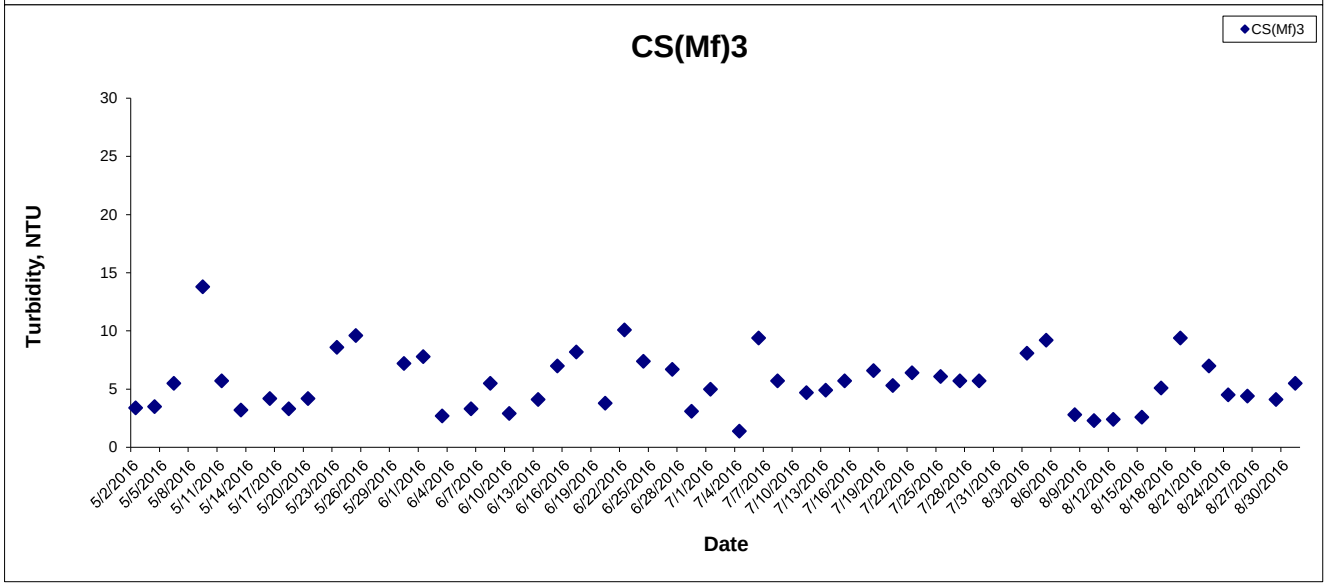




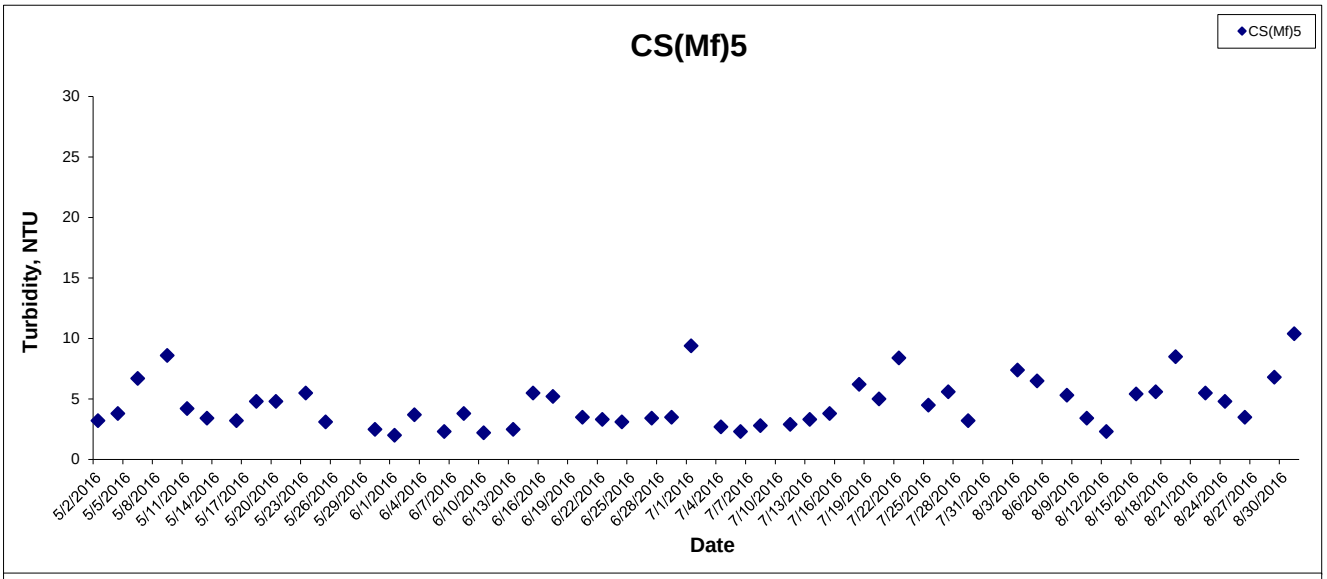
Turbidity at Mid-Flood Tide

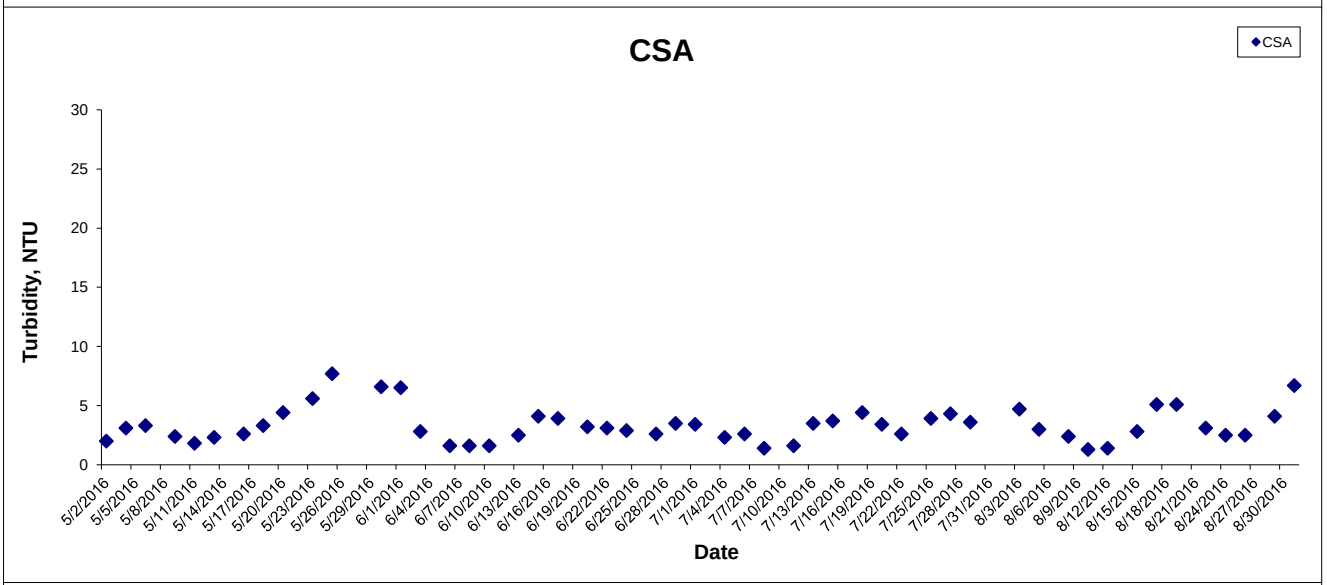


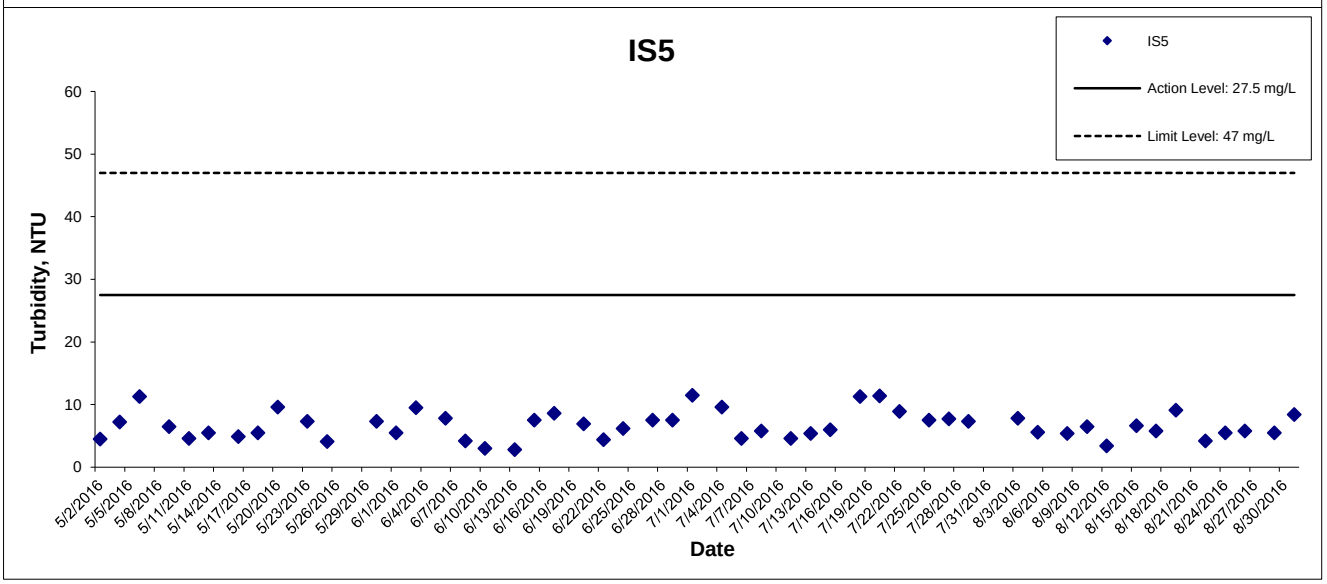




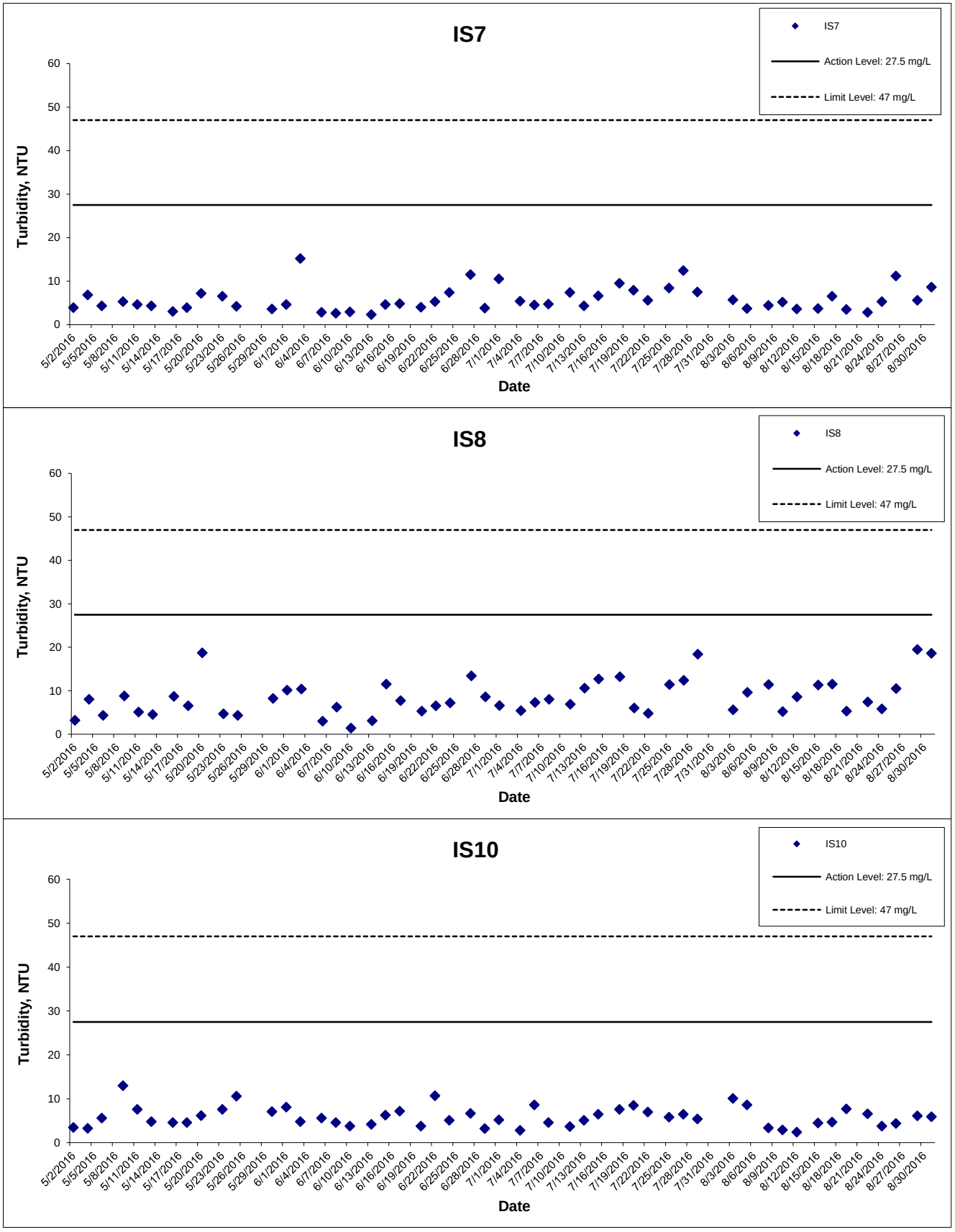
Turbidity at Mid-Flood Tide



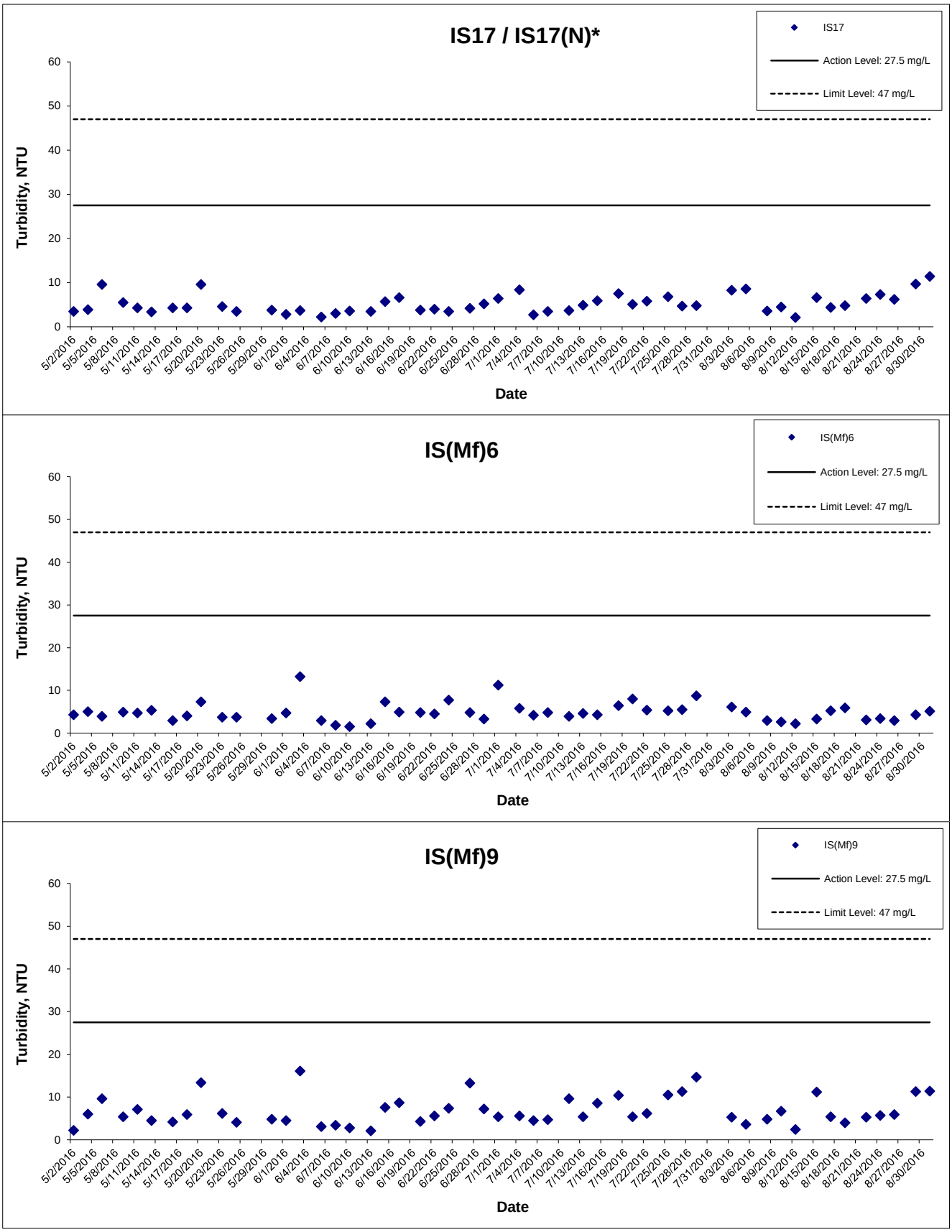




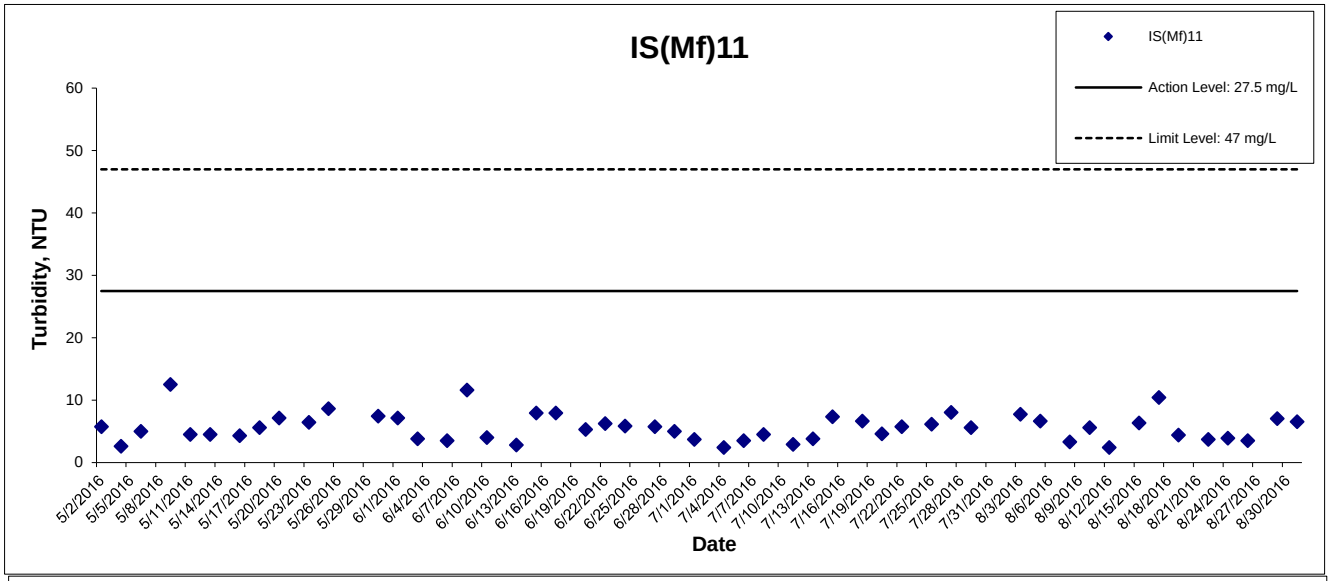
Turbidity at Mid-Flood Tide

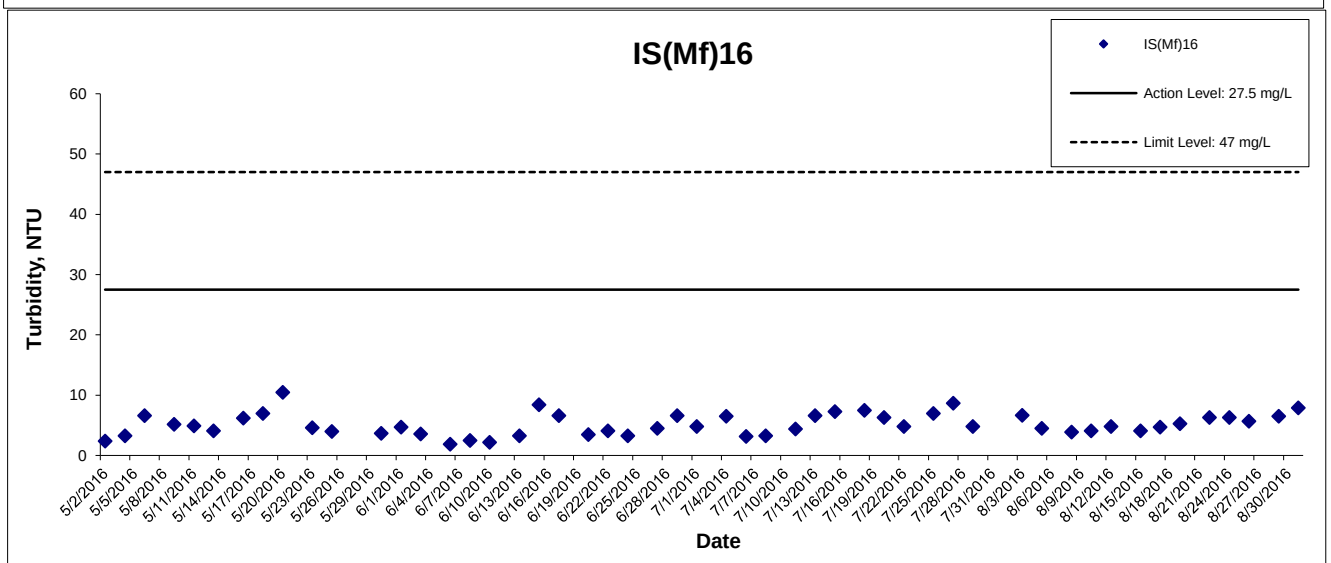


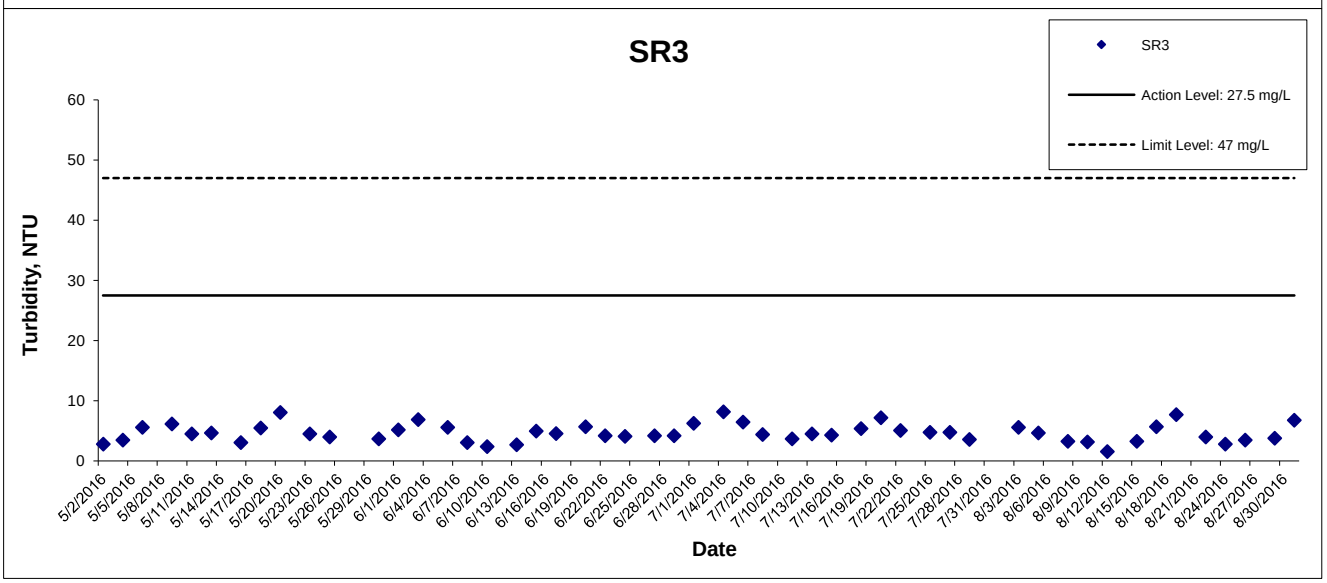
Turbidity at Mid-Flood Tide



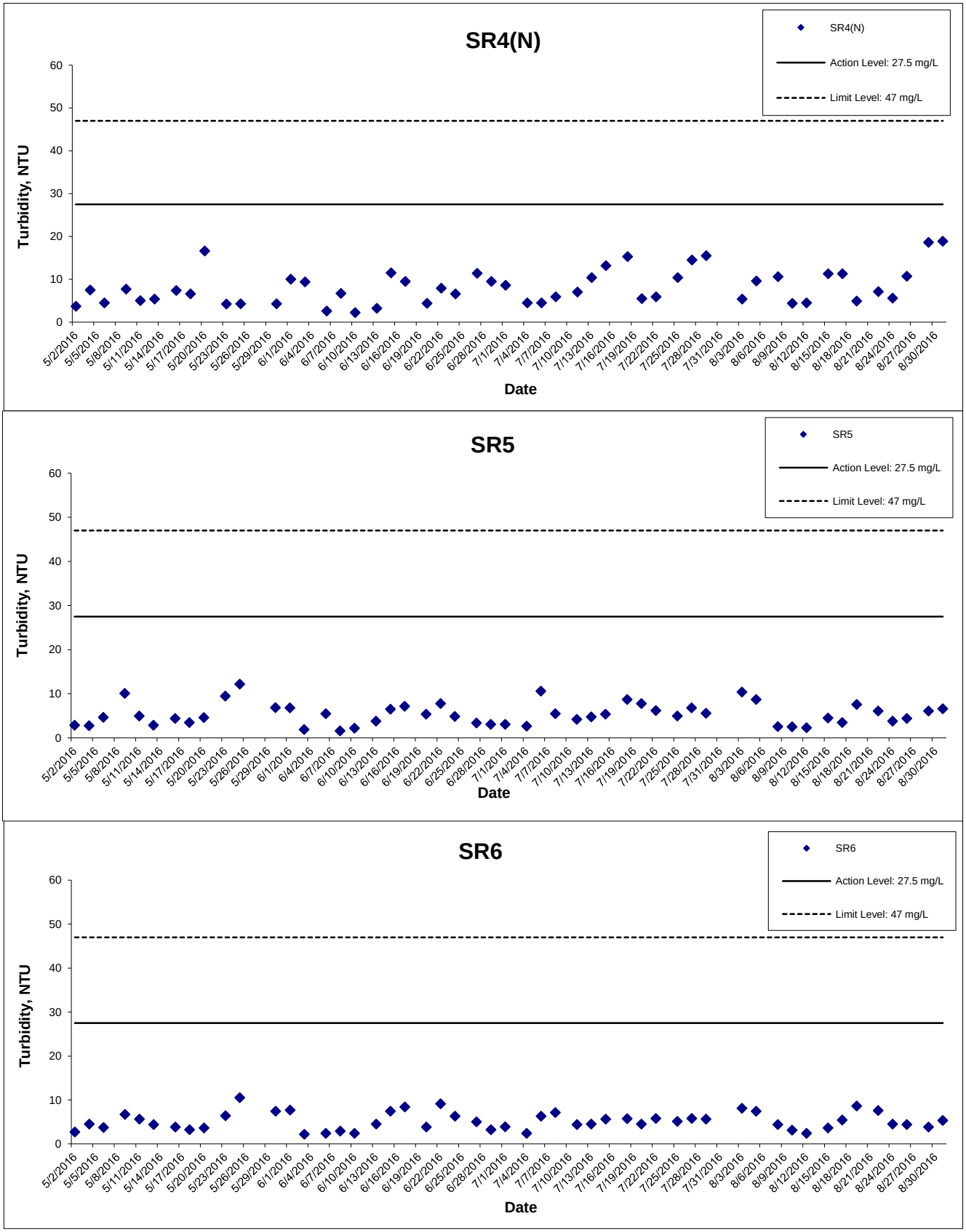
Turbidity at Mid-Flood Tide



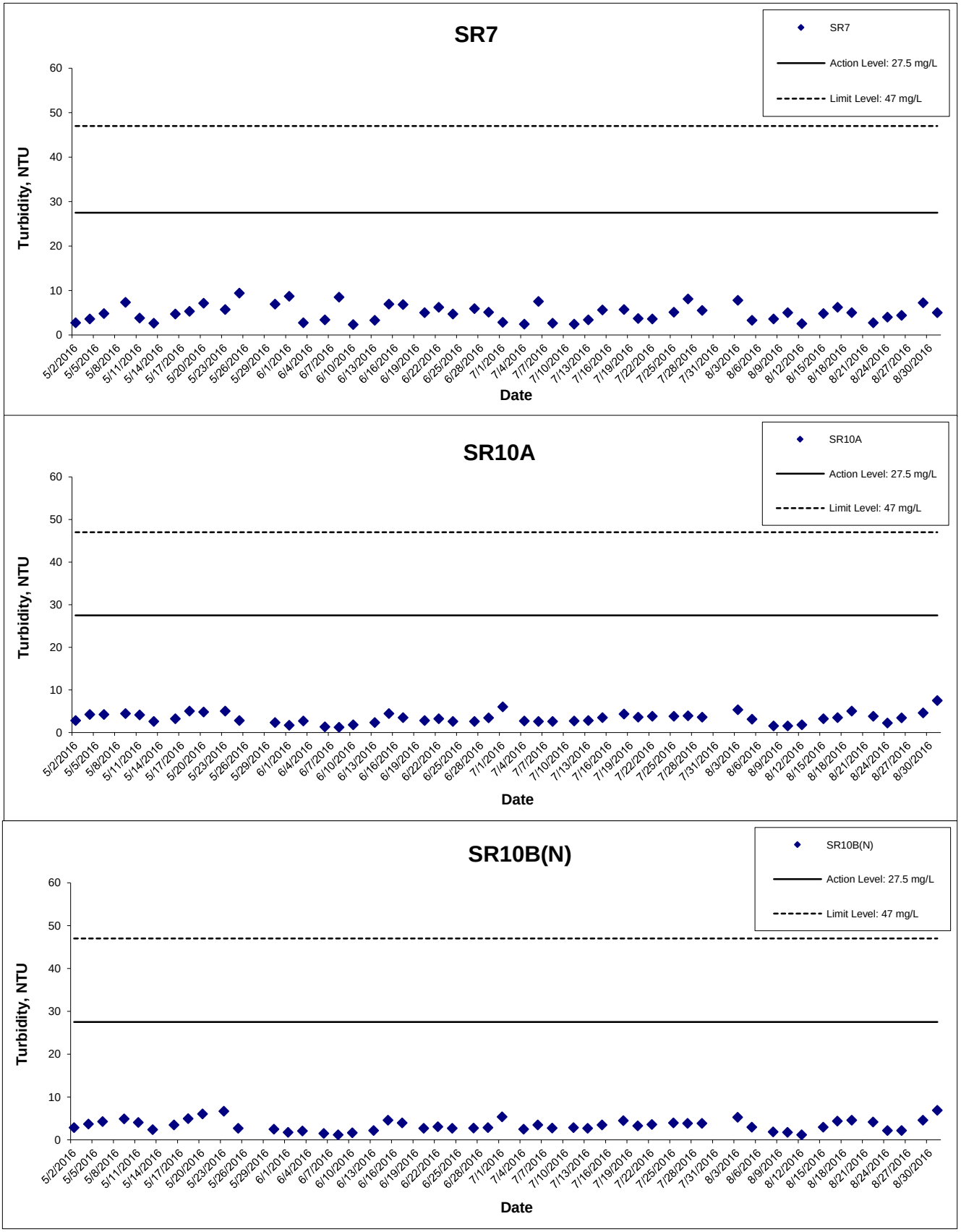




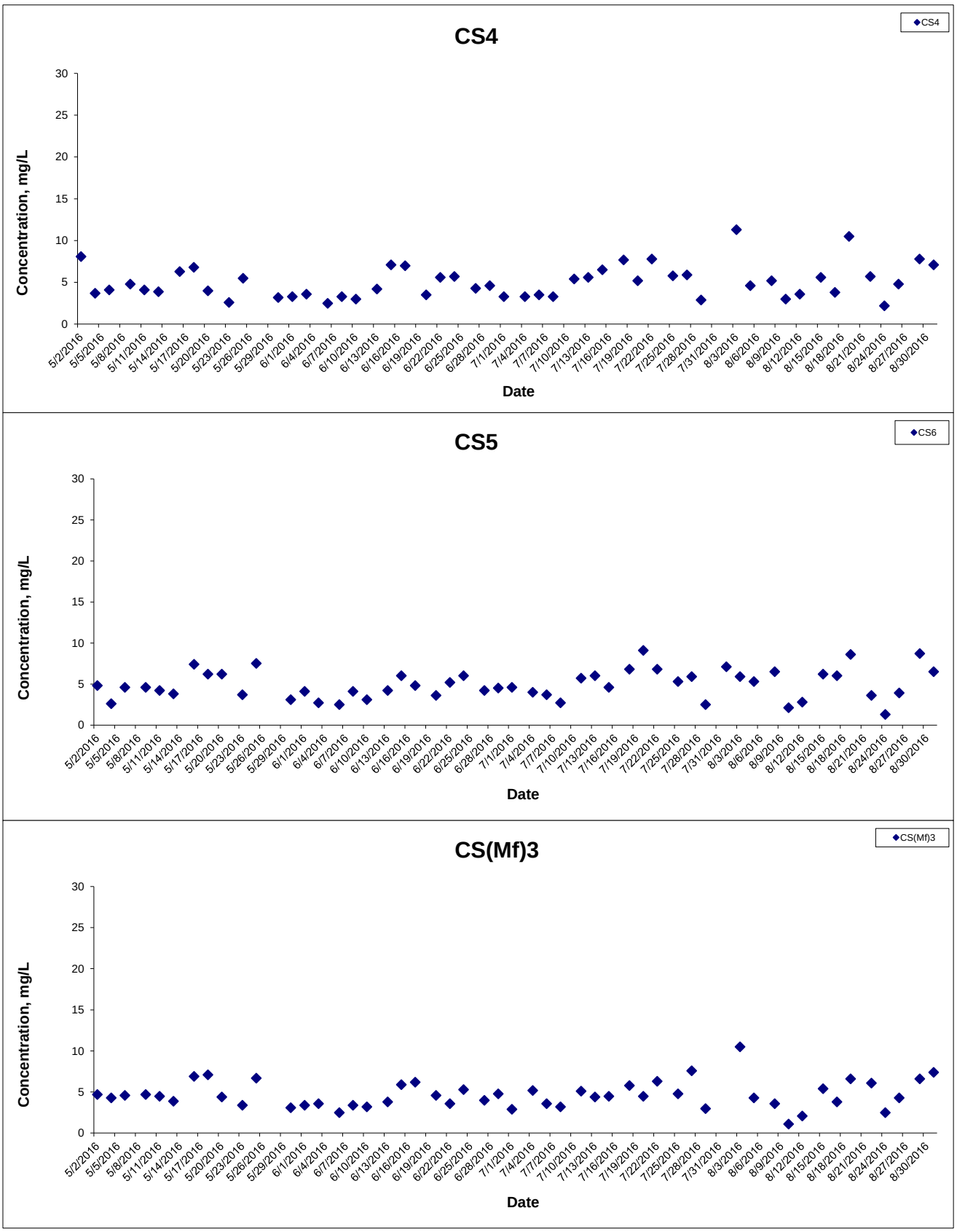
Turbidity at Mid-Flood Tide



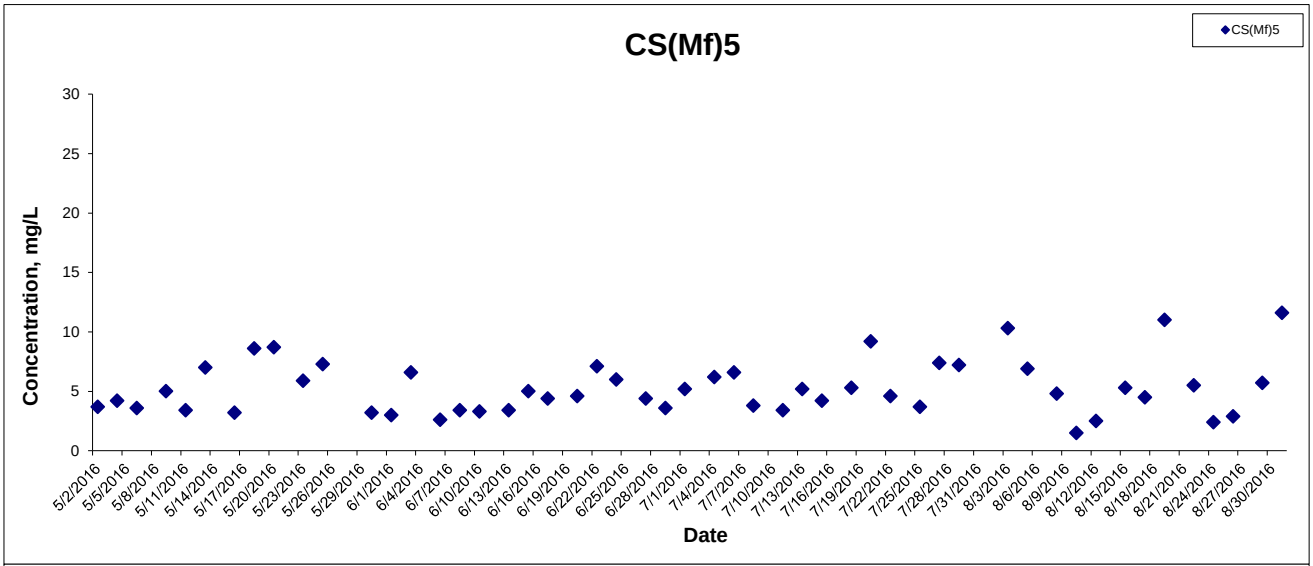
Turbidity at Mid-Flood Tide

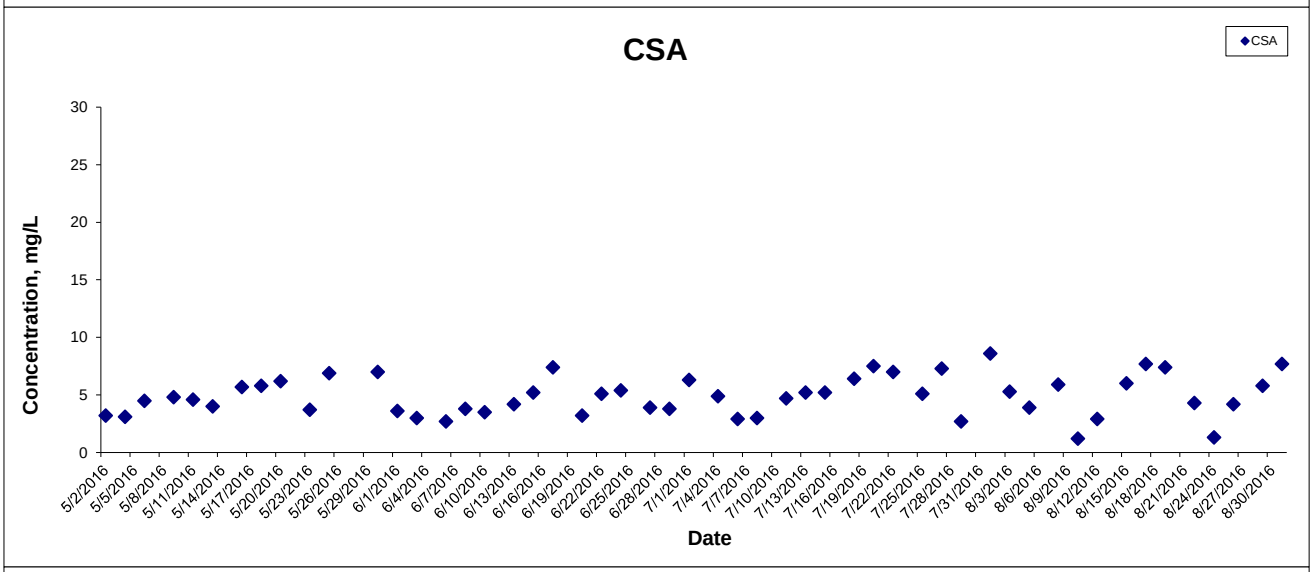


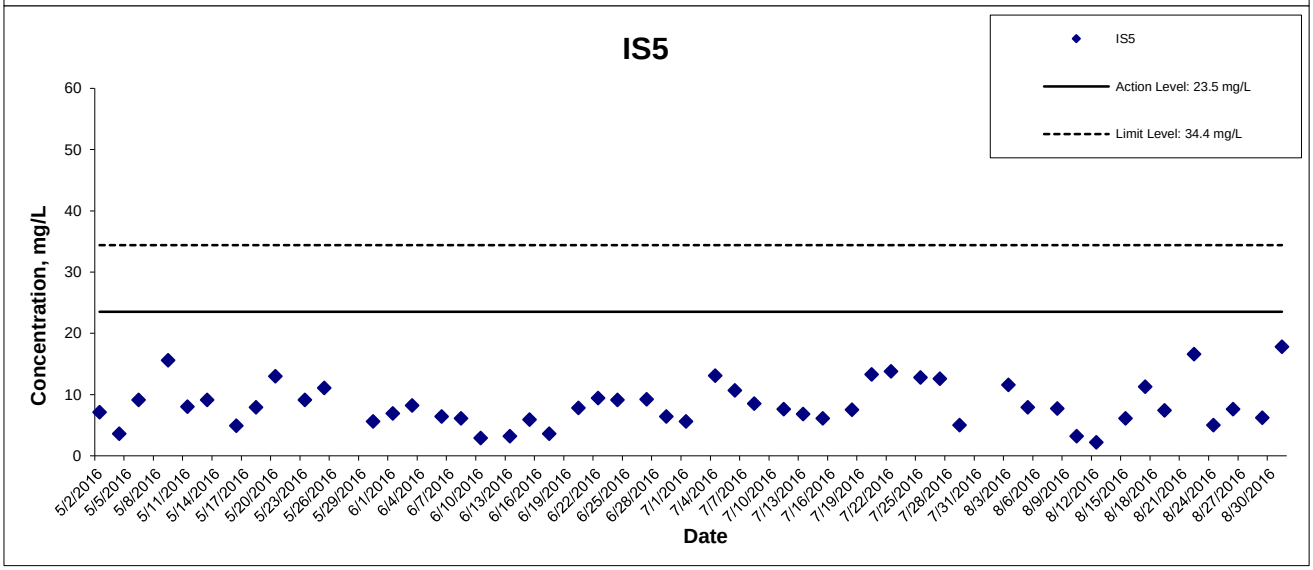
Suspended Solids at Mid-Ebb Tide



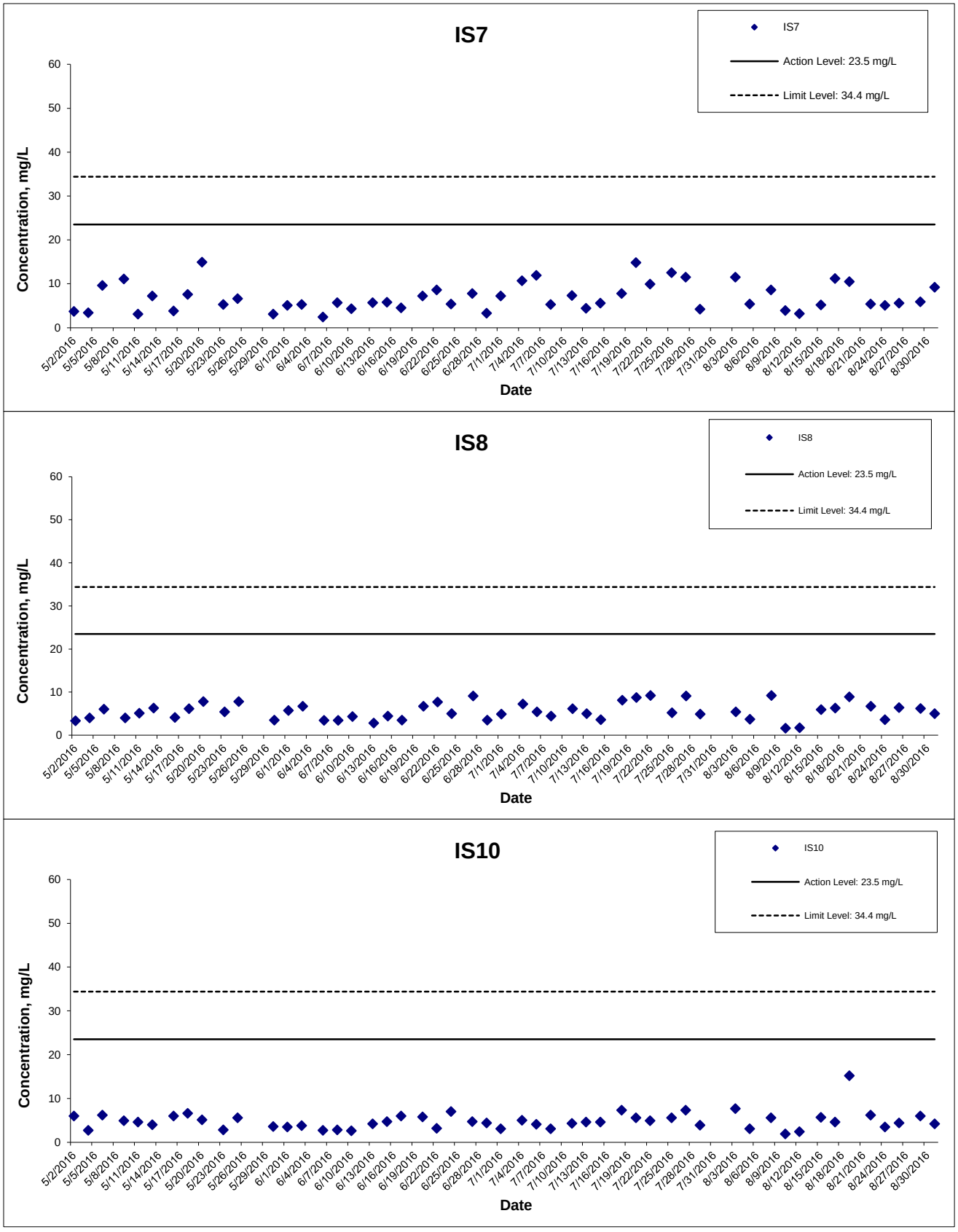
Suspended Solids at Mid-Ebb Tide







Suspended Solids at Mid-Ebb Tide



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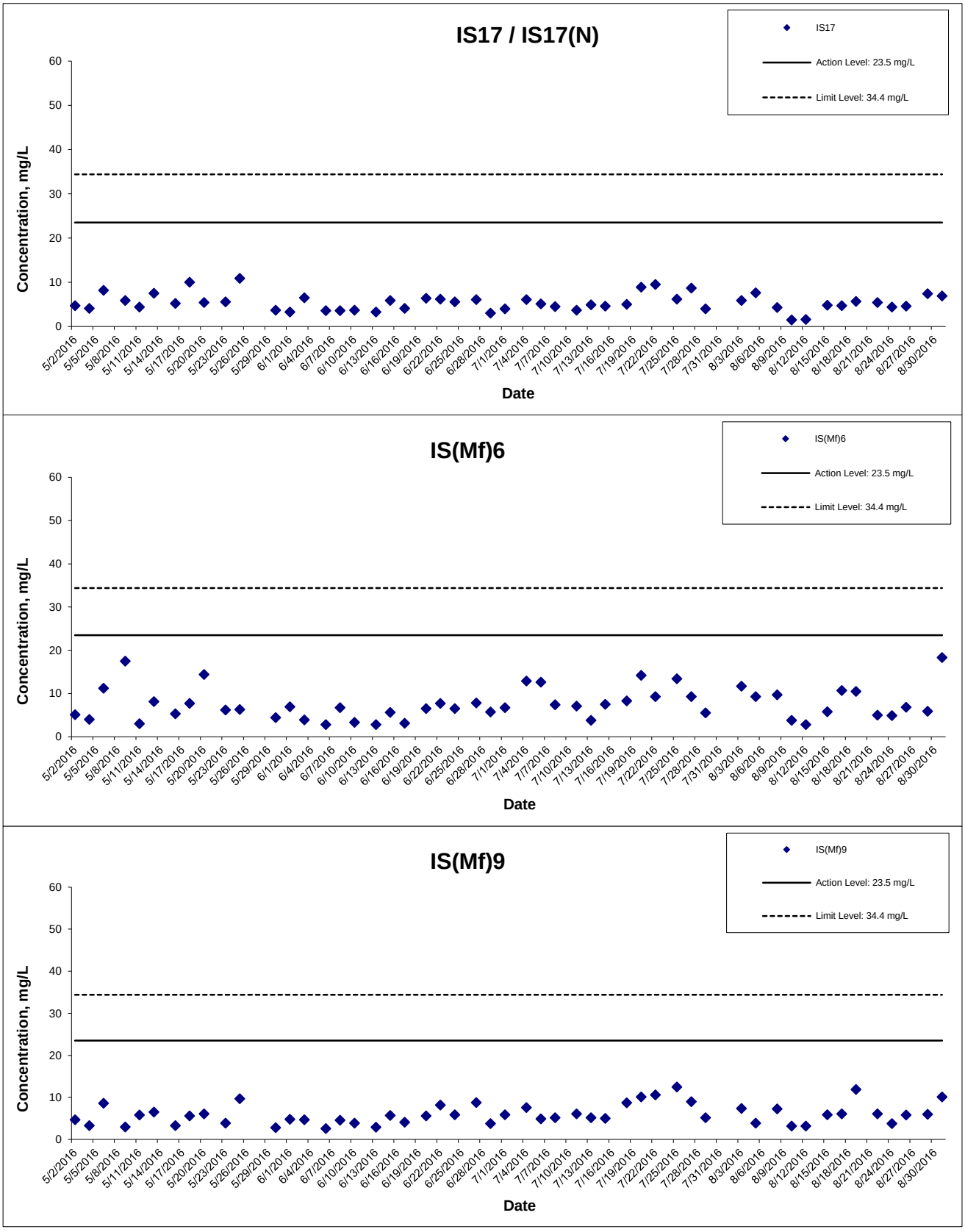
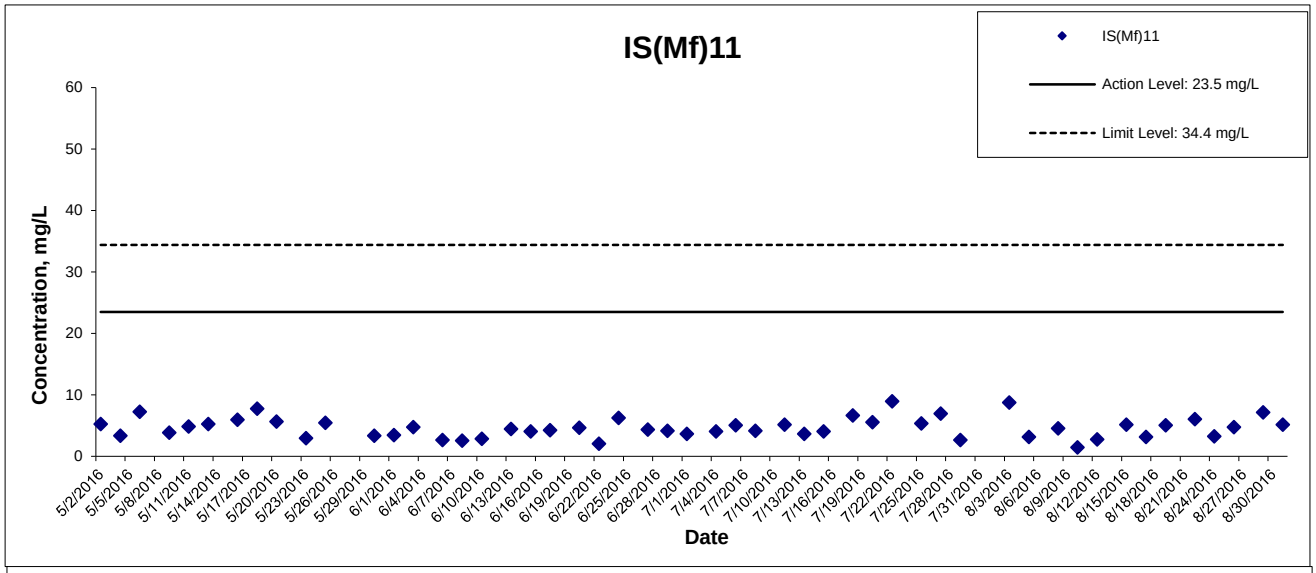
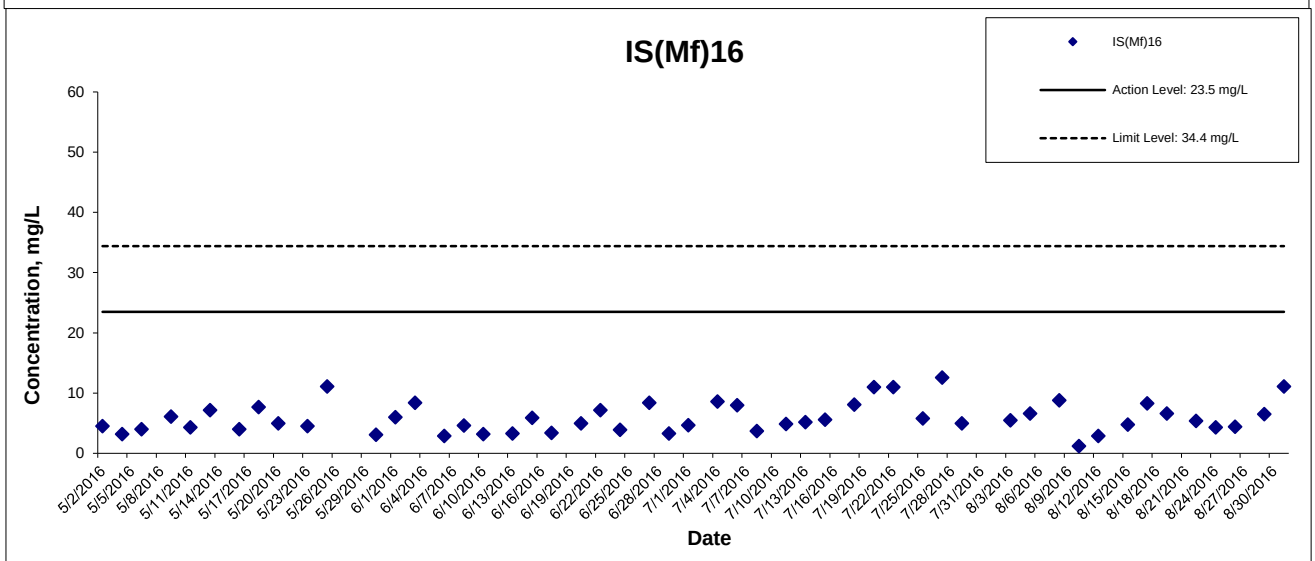
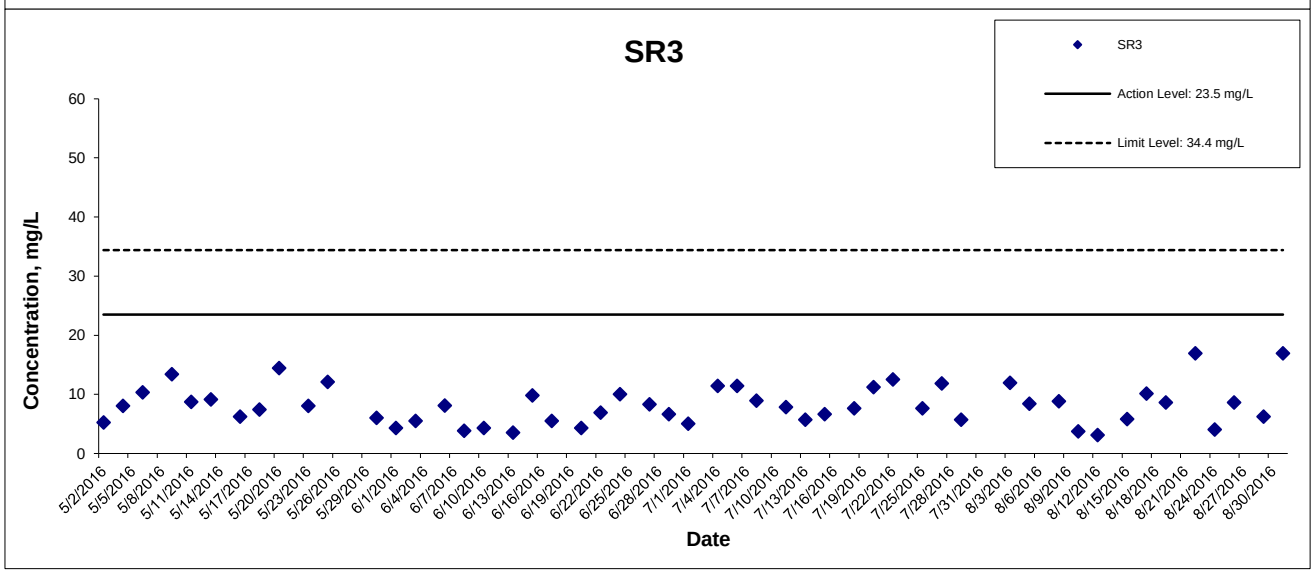


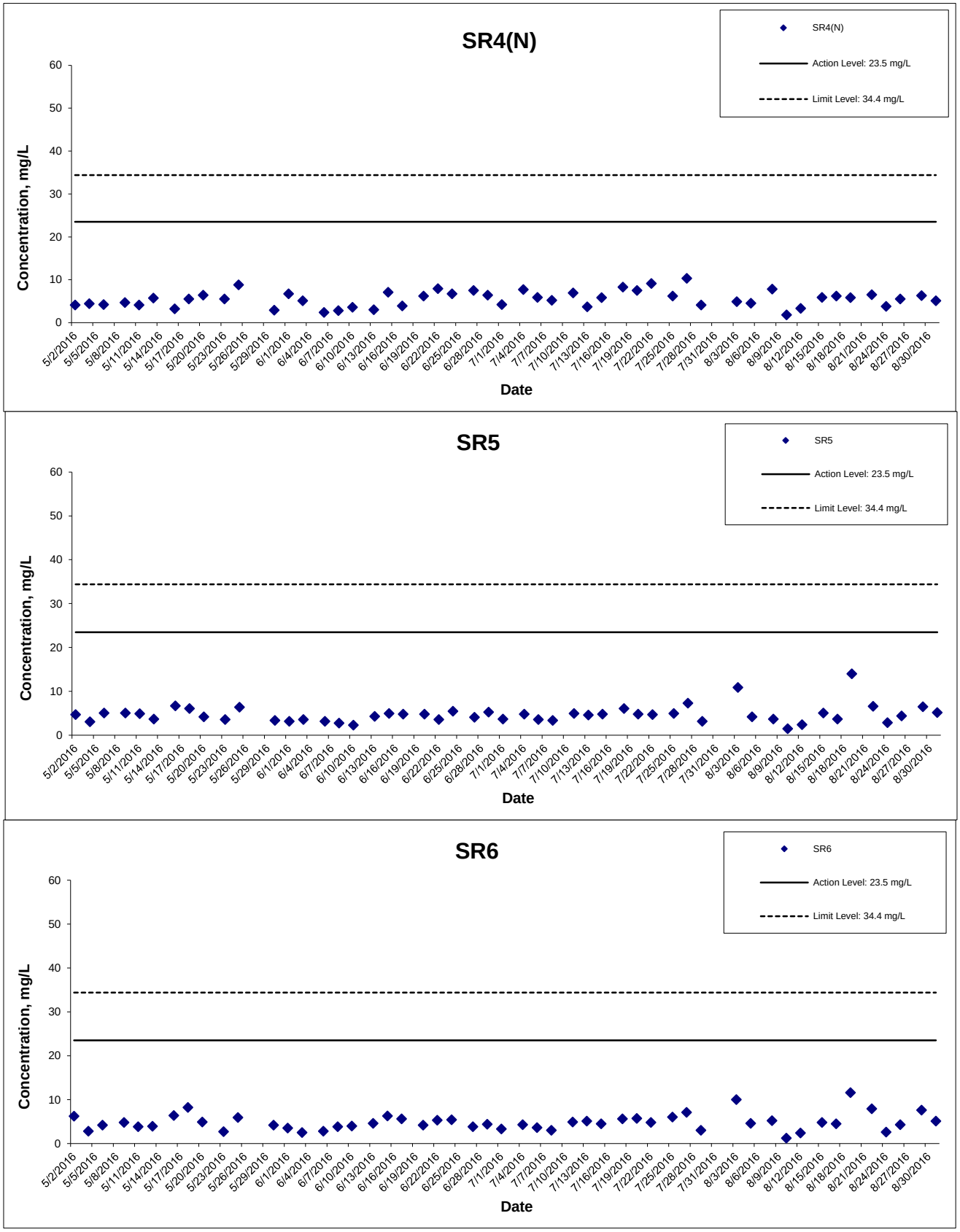
Suspended Solids at Mid-Ebb Tide







Suspended Solids at Mid-Ebb Tide



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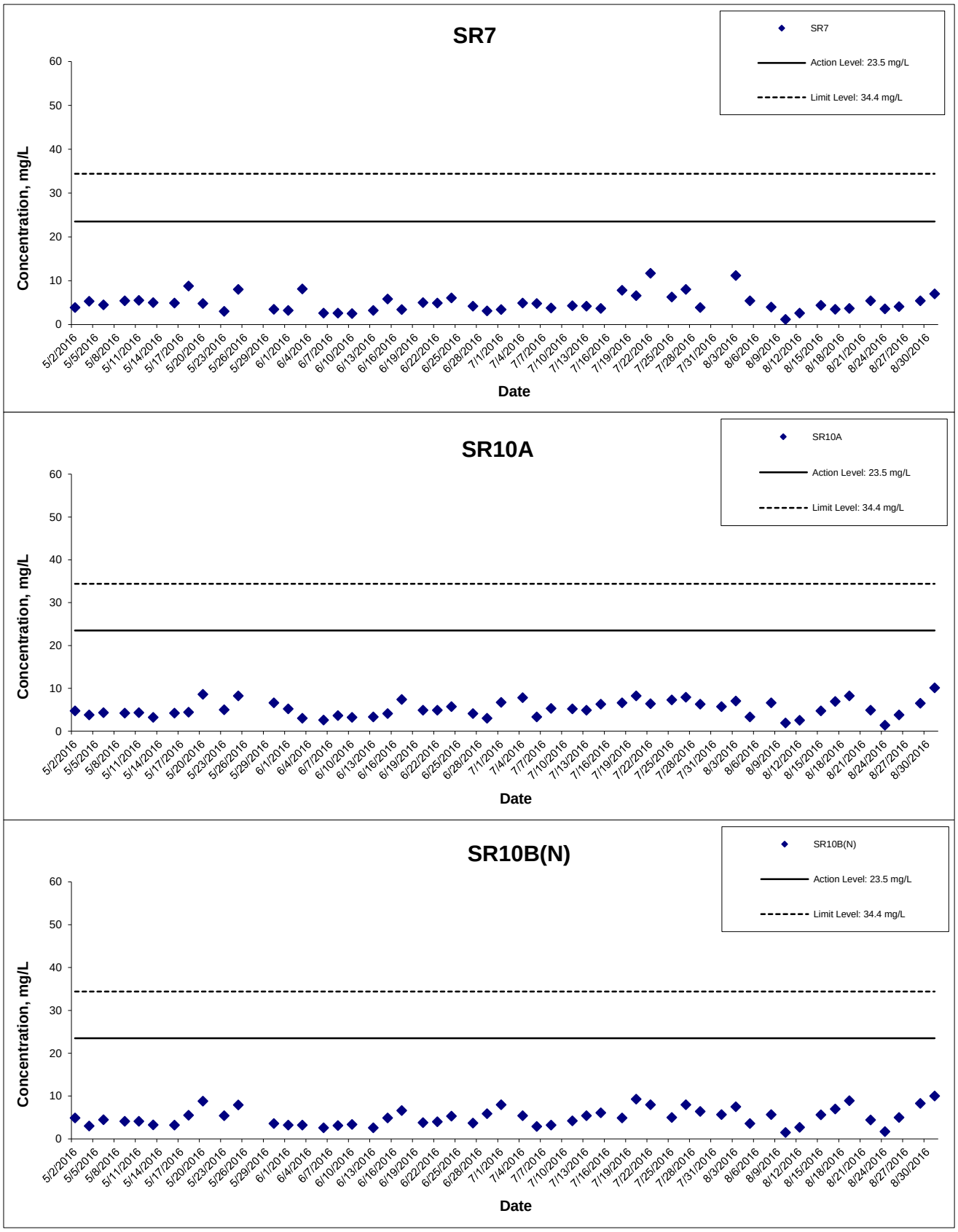
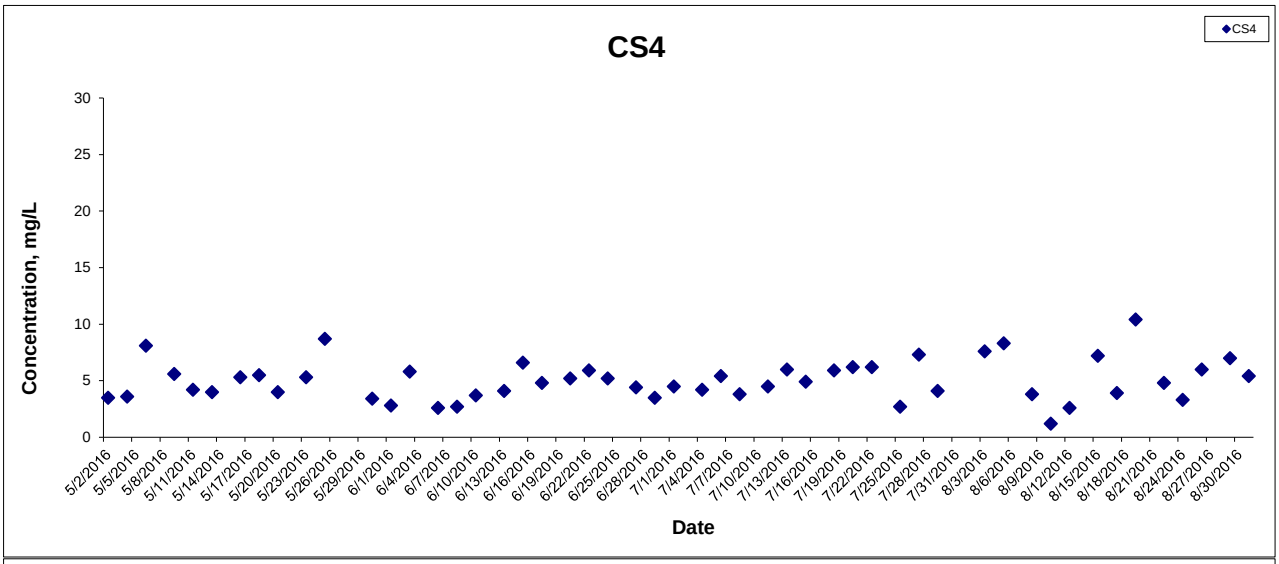
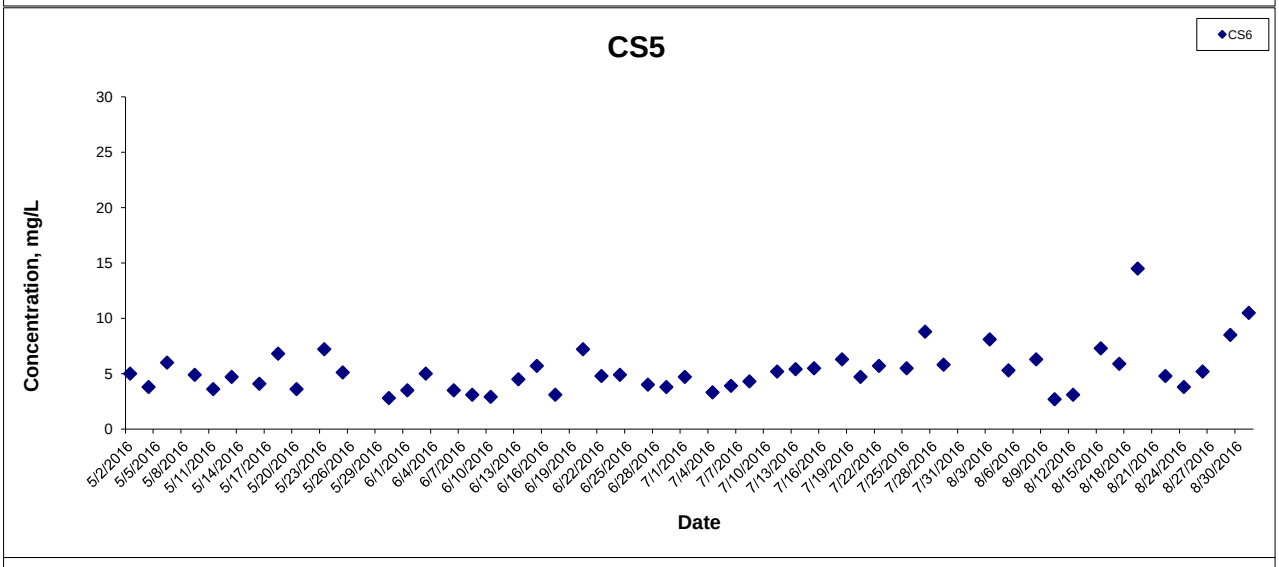
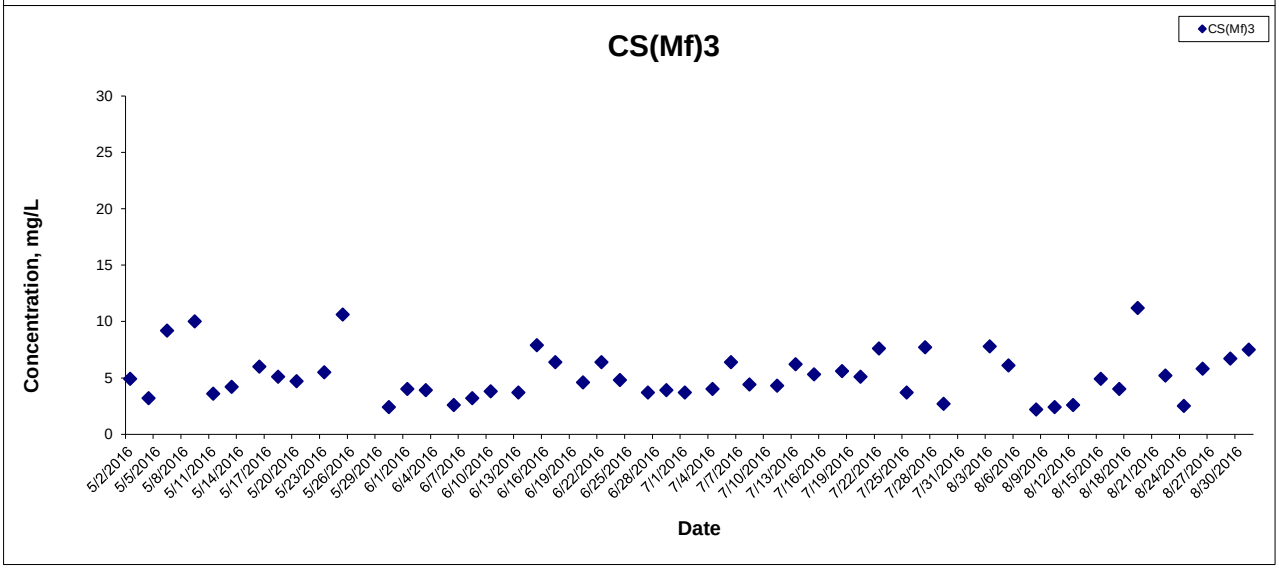


Suspended Solids at Mid-Flood Tide







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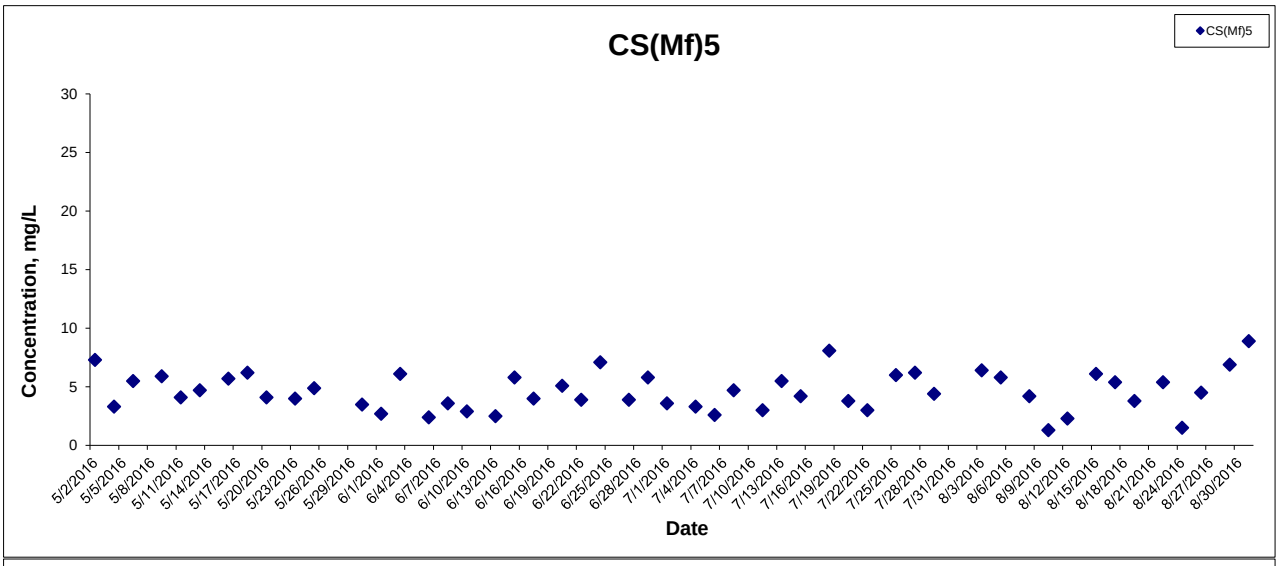
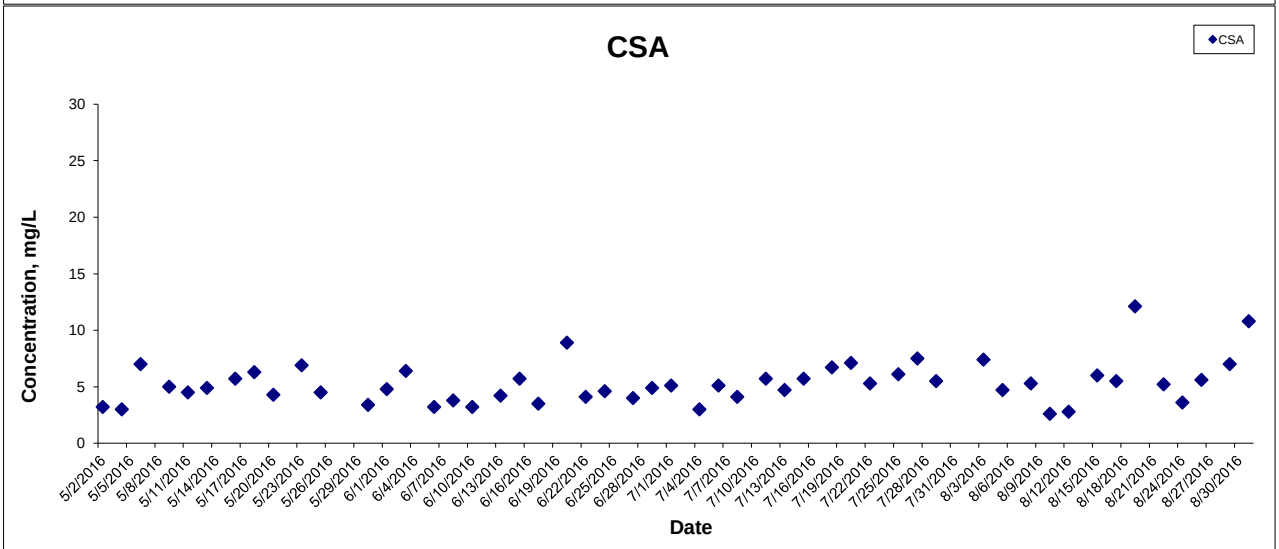
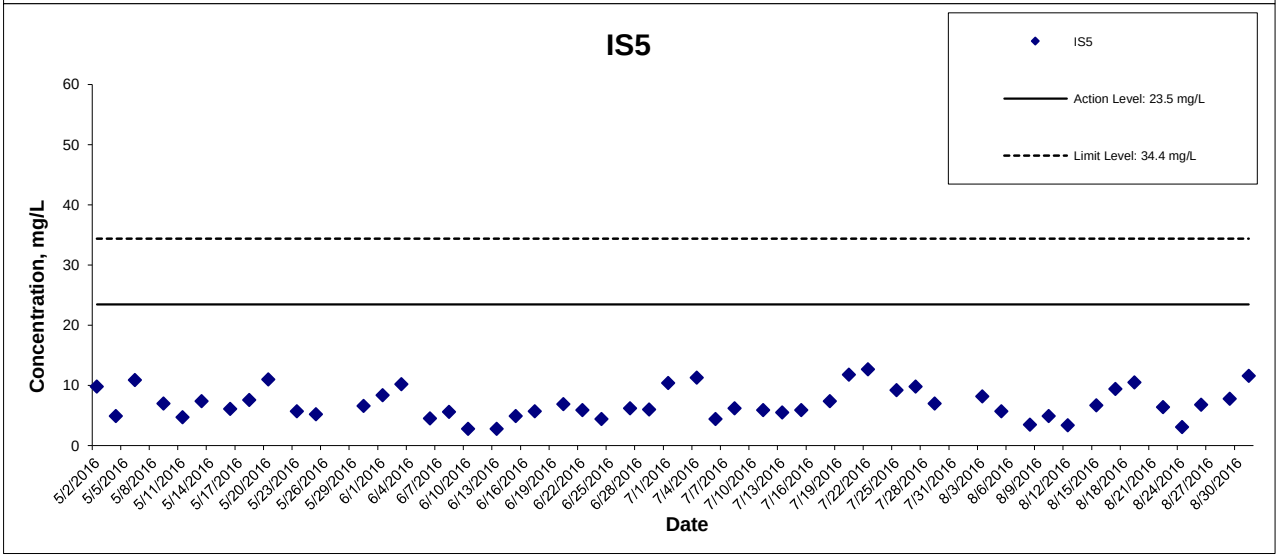
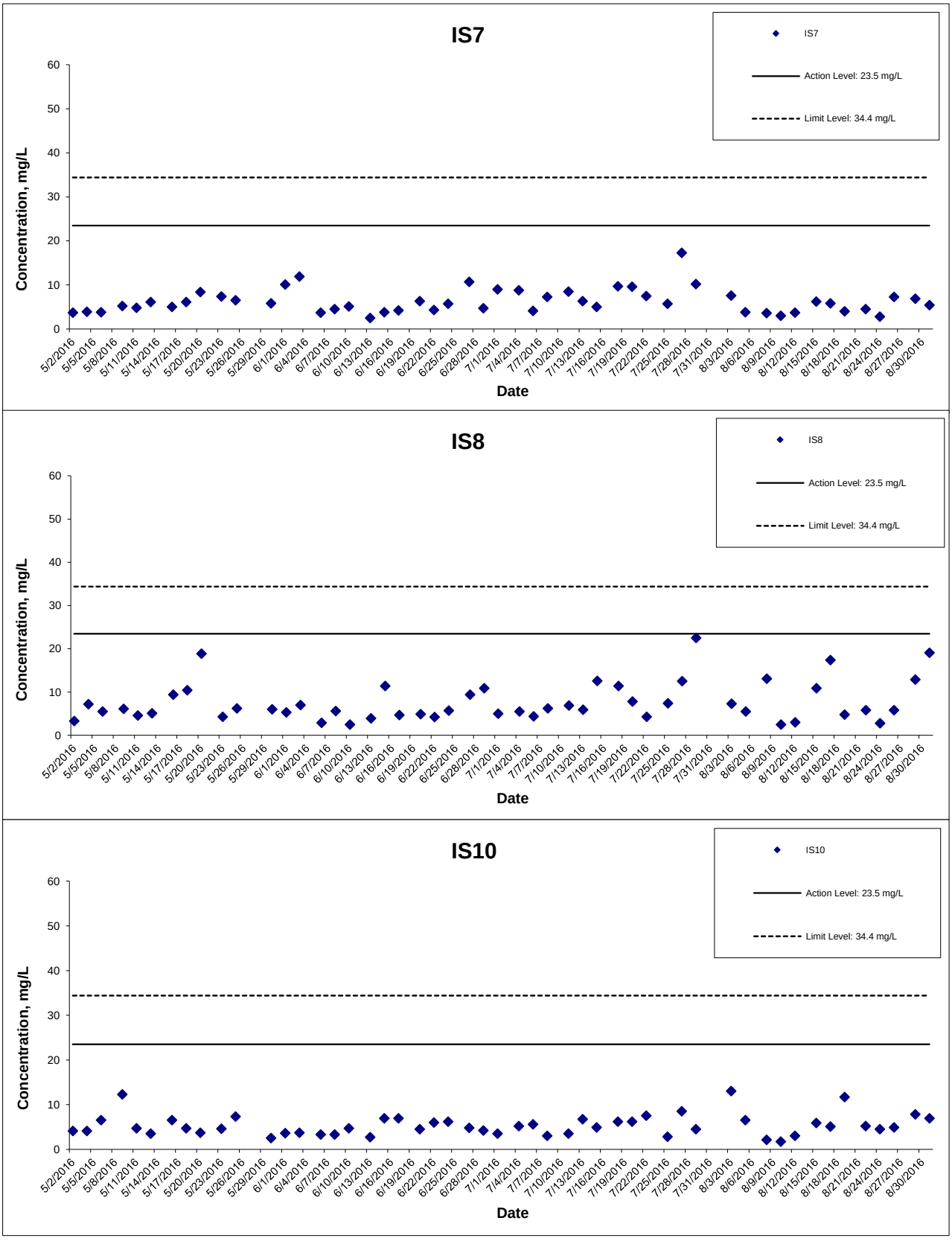






Suspended Solids at Mid-Flood Tide



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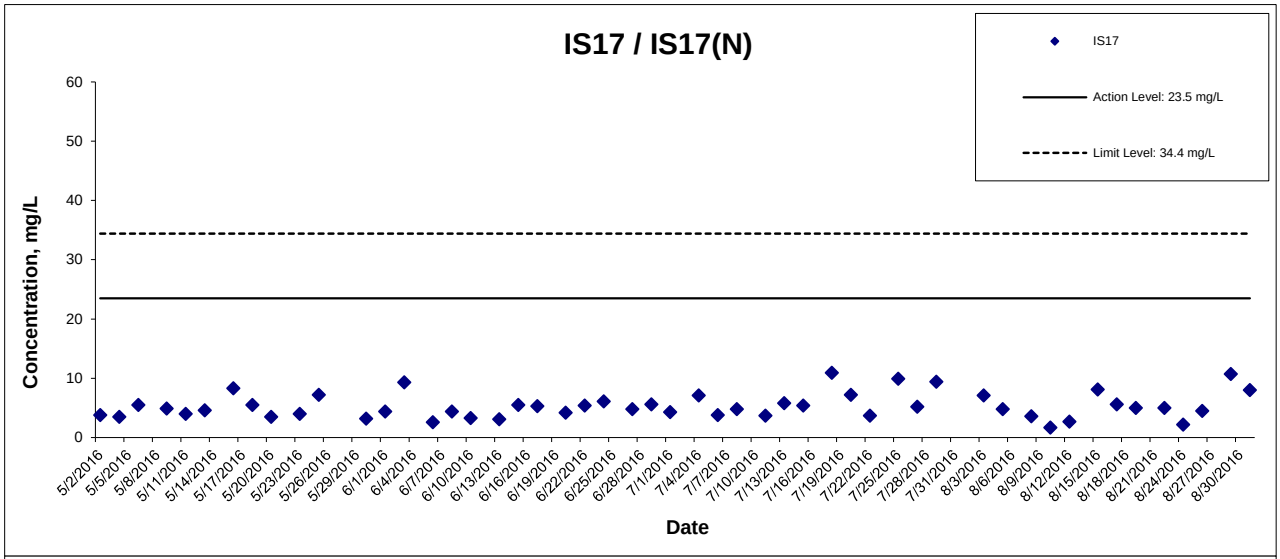
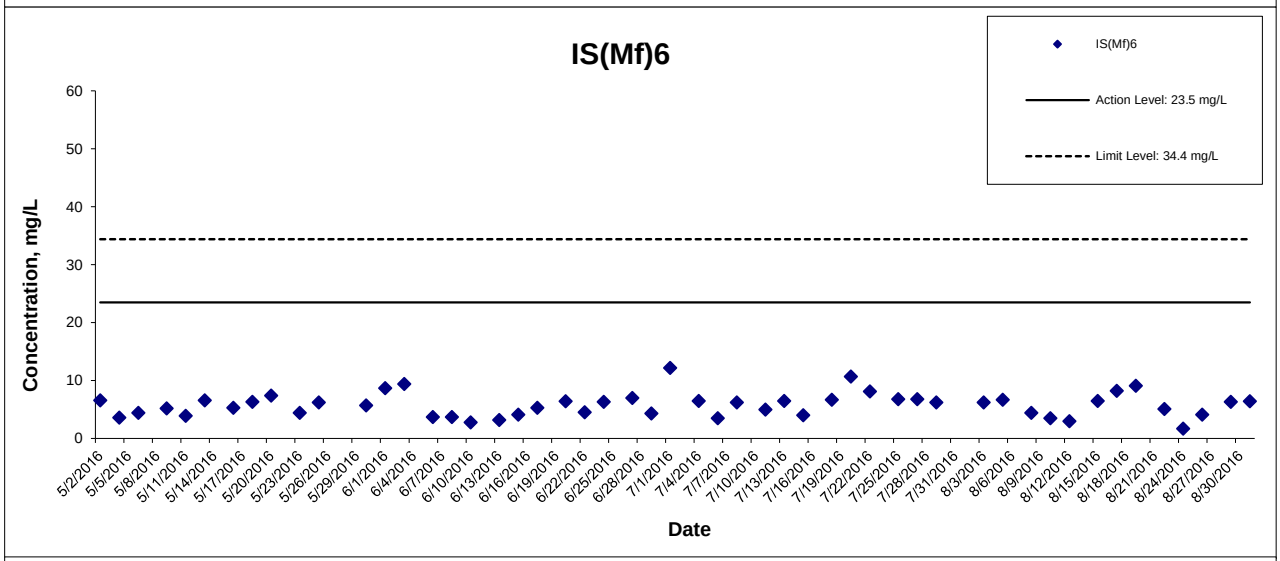
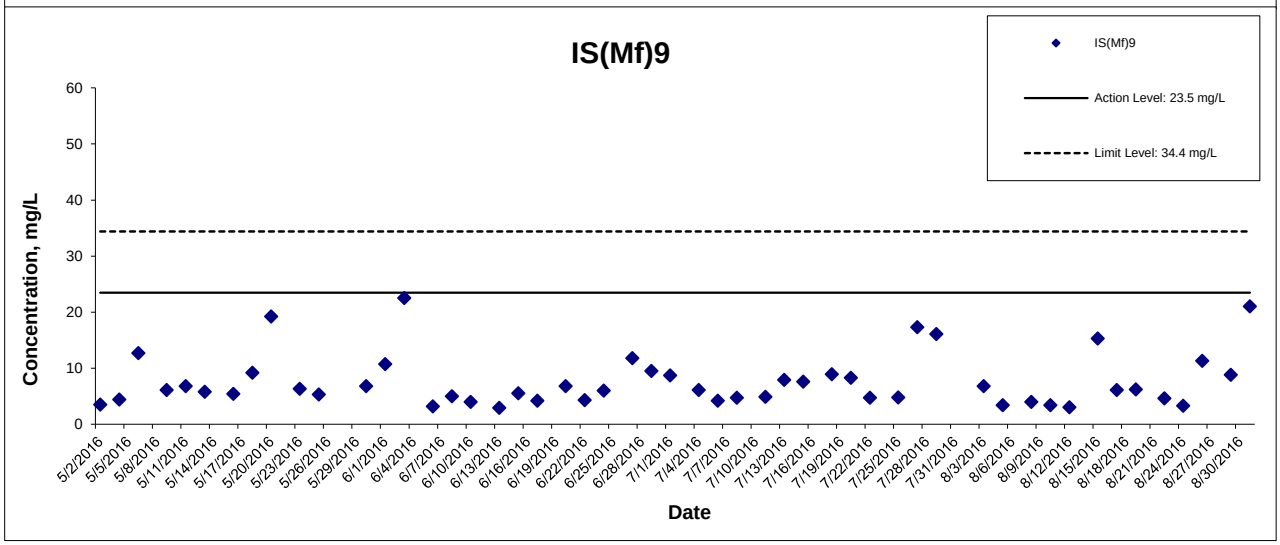






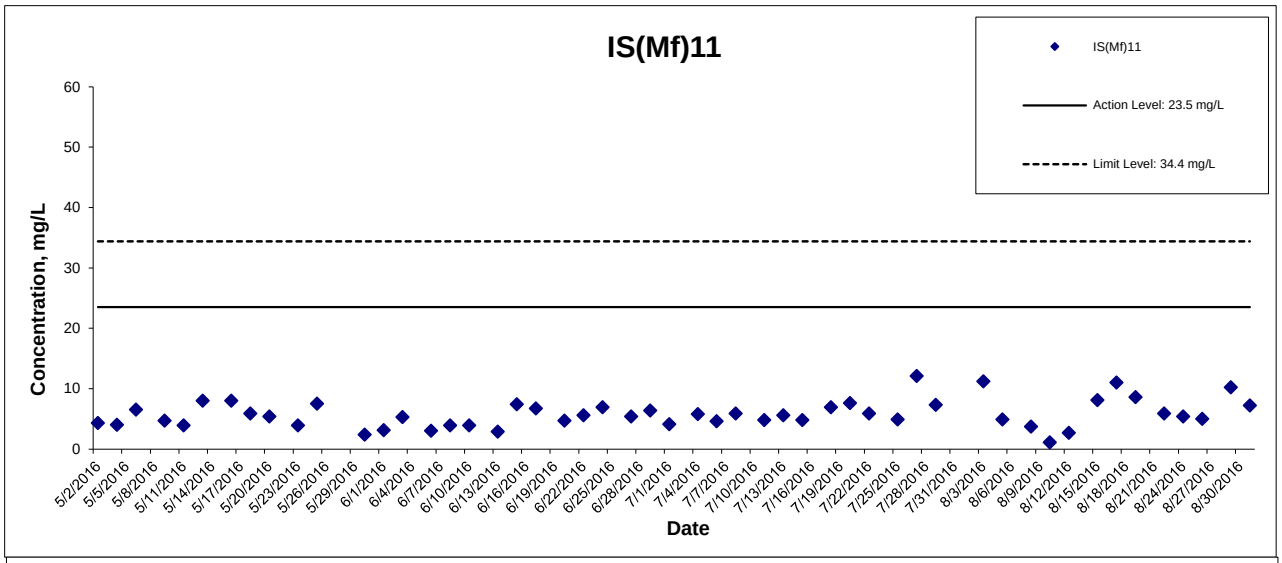
HONG KONG - ZHUHAI - MACAO BRIDGE
HONG KONG BOUNDARY CROSSING FACILITIES
- RECLAMATION WORKS

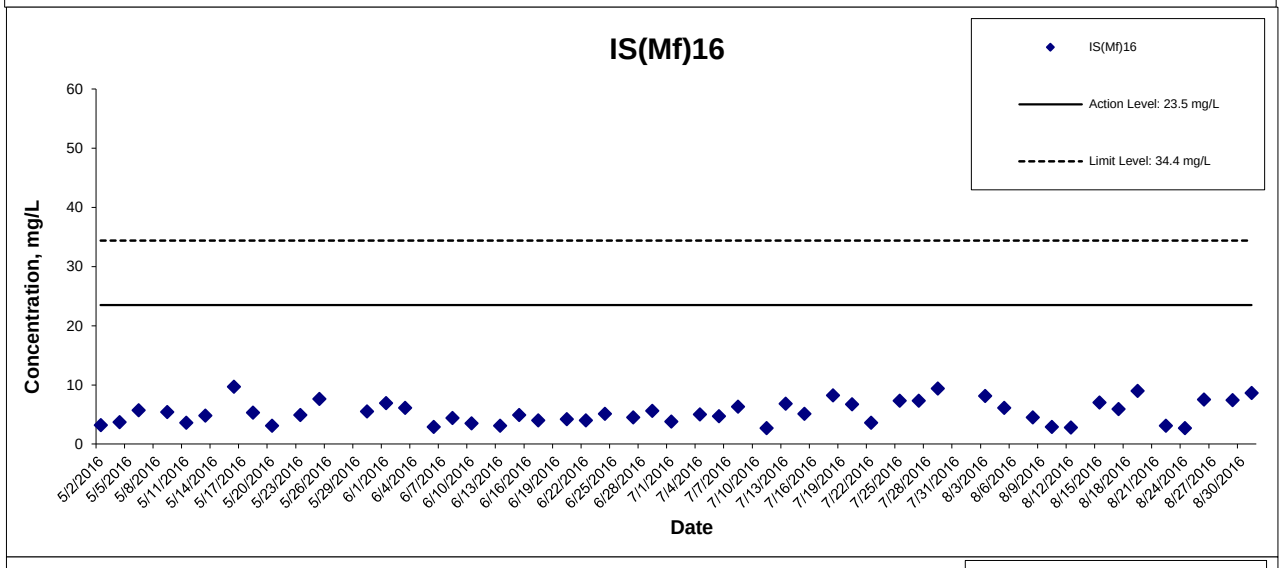
Graphical Presentation of Impact Water Quality Monitoring Results

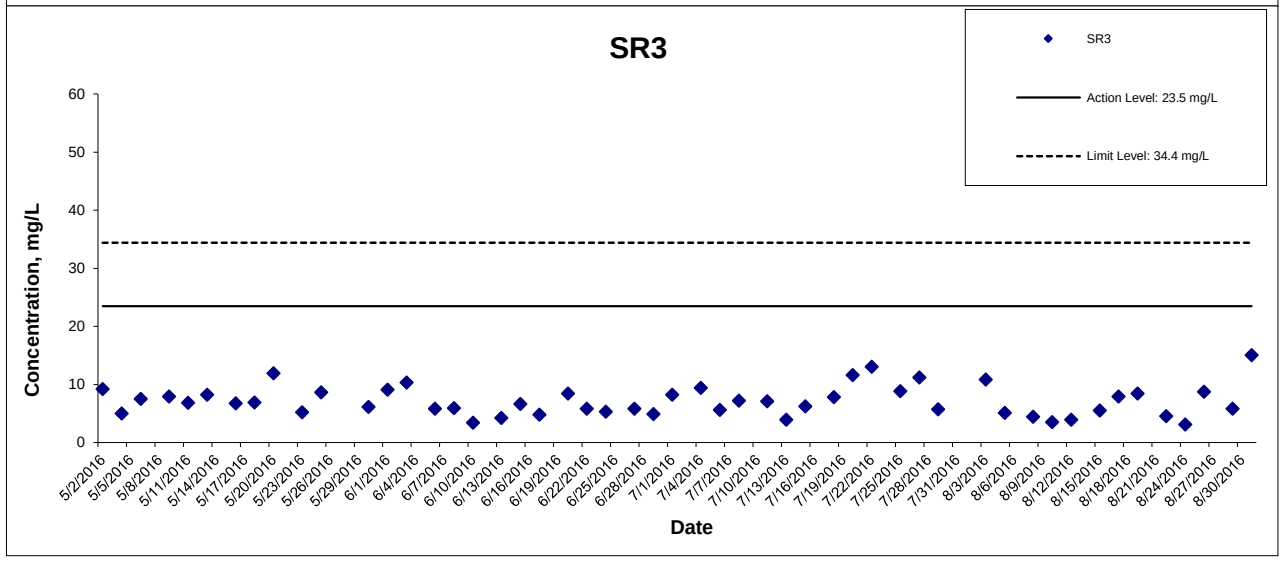
Project No.: 60249820 **Date: October 2016**

Appendix G

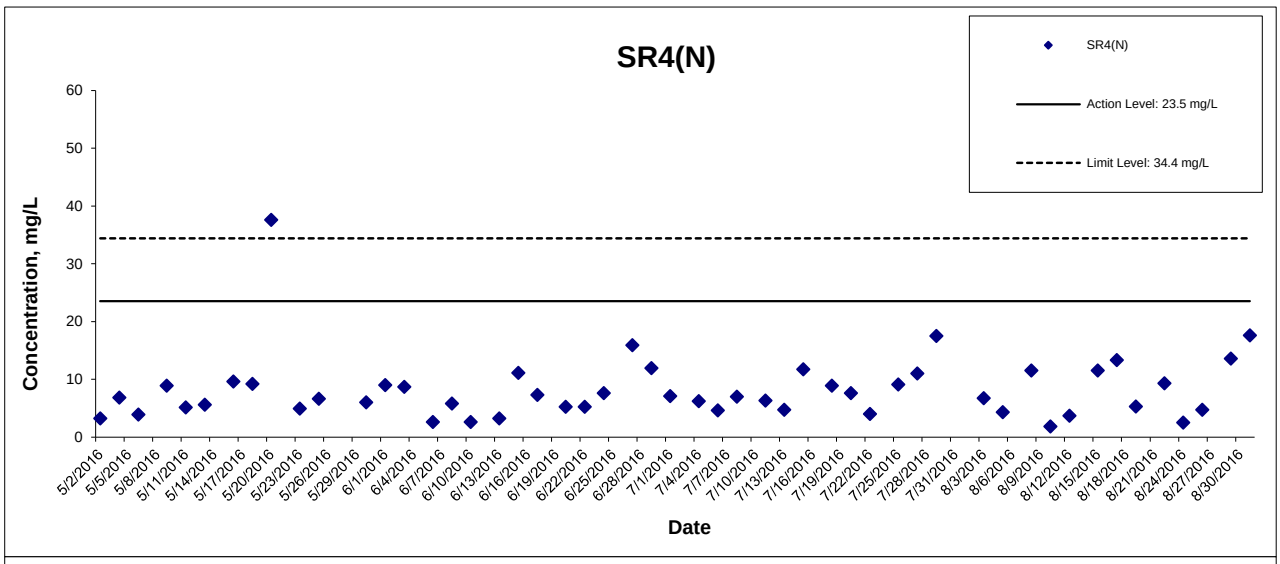
Suspended Solids at Mid-Flood Tide

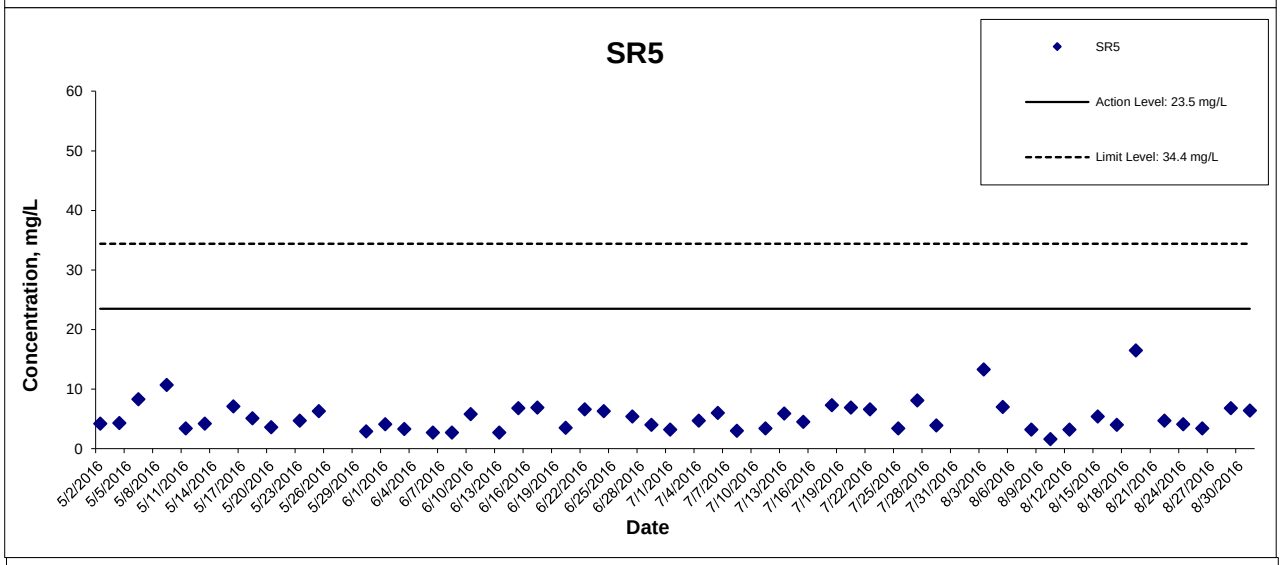


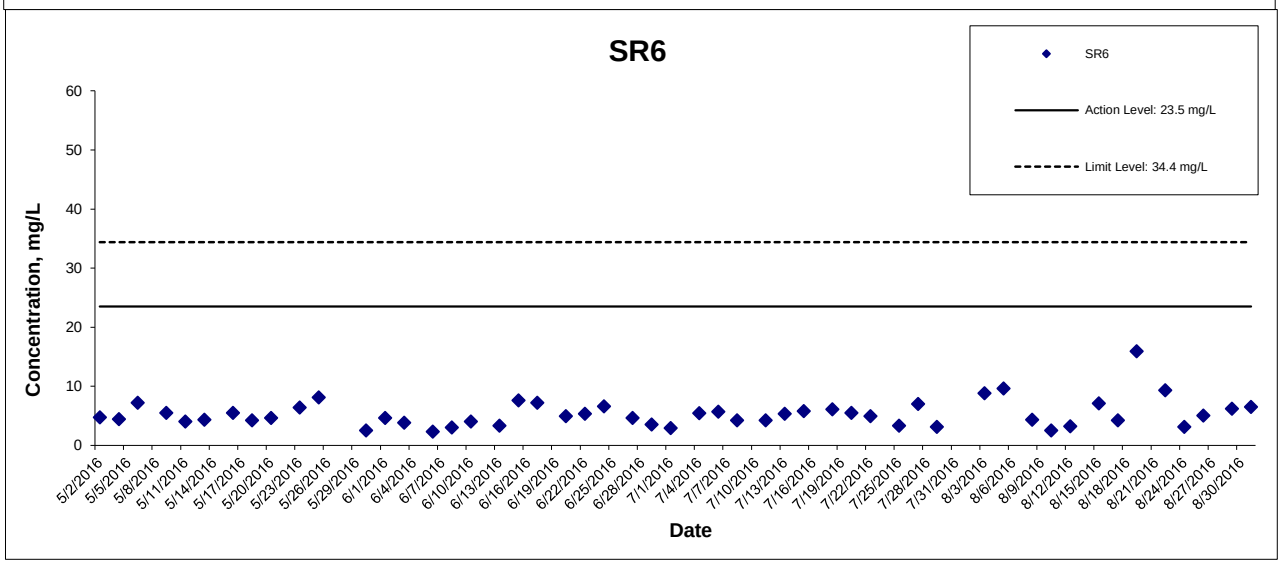




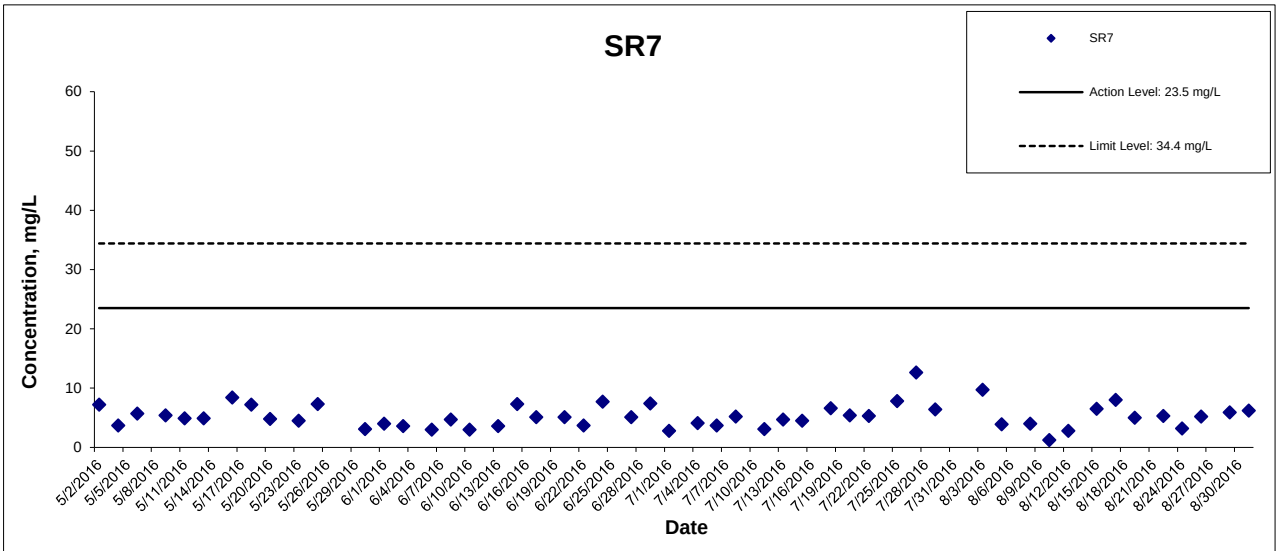
Suspended Solids at Mid-Flood Tide

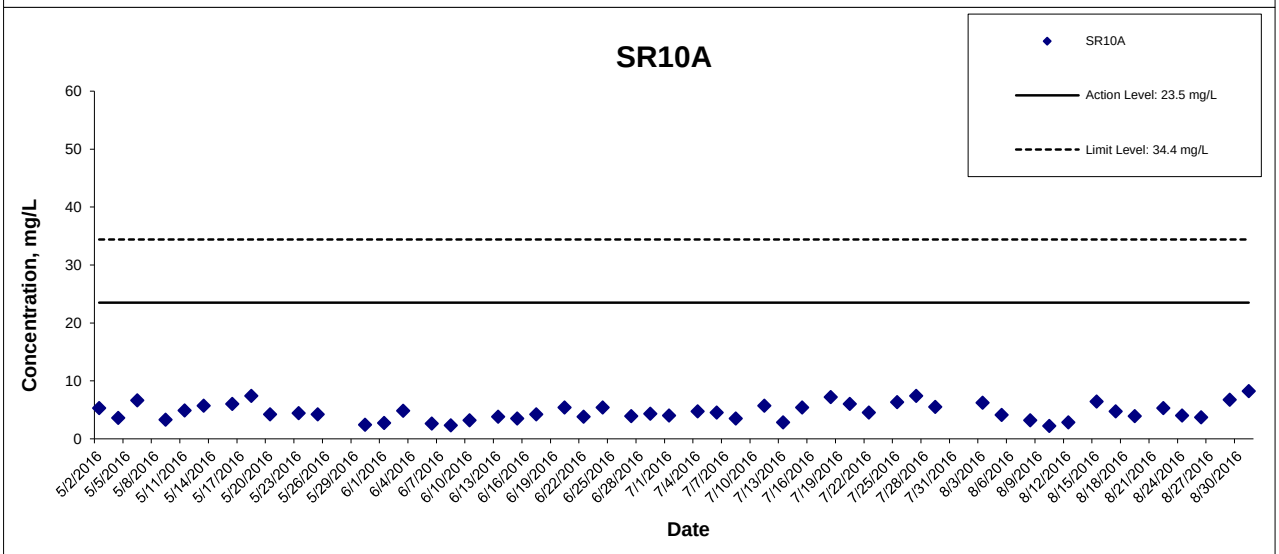


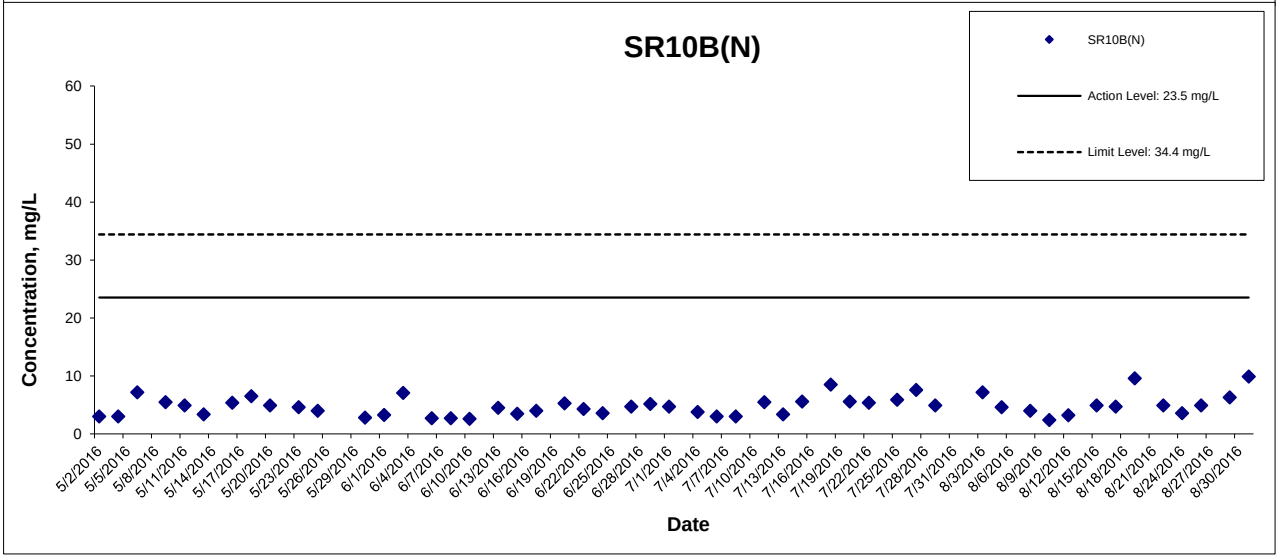




Suspended Solids at Mid-Flood Tide







Hong Kong-Zhuhai-Macao Bridge
Hong Kong Boundary Crossing Facilities-Reclamation Works

Adult Chinese white dolphin in western Hong Kong waters, July 2016

June - August 2016
Quarterly Report

Dolphin Impact Monitoring

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ANNEXES

1. Introduction

In March 2012, construction for the Hong Kong-Zhuhai-Macao Bridge (HZMB) began in Hong Kong territorial waters. In Hong Kong, the HZMB comprises three projects; the Hong Kong Boundary Crossing Facilities (HKBCF) Project; the Hong Kong Link Road (HKLR) Project and; the Tuen Mun-Chek Lap Kok Link (TM-CLKL) Project. The HKBCF, the first of the HZMB projects to commence in Hong Kong, requires the total reclamation of approximately 149 hectares (ha); which consists of 130 ha for the HKBCF artificial island and 19 ha for the TM-CLKL southern landfall (Fig. 1).

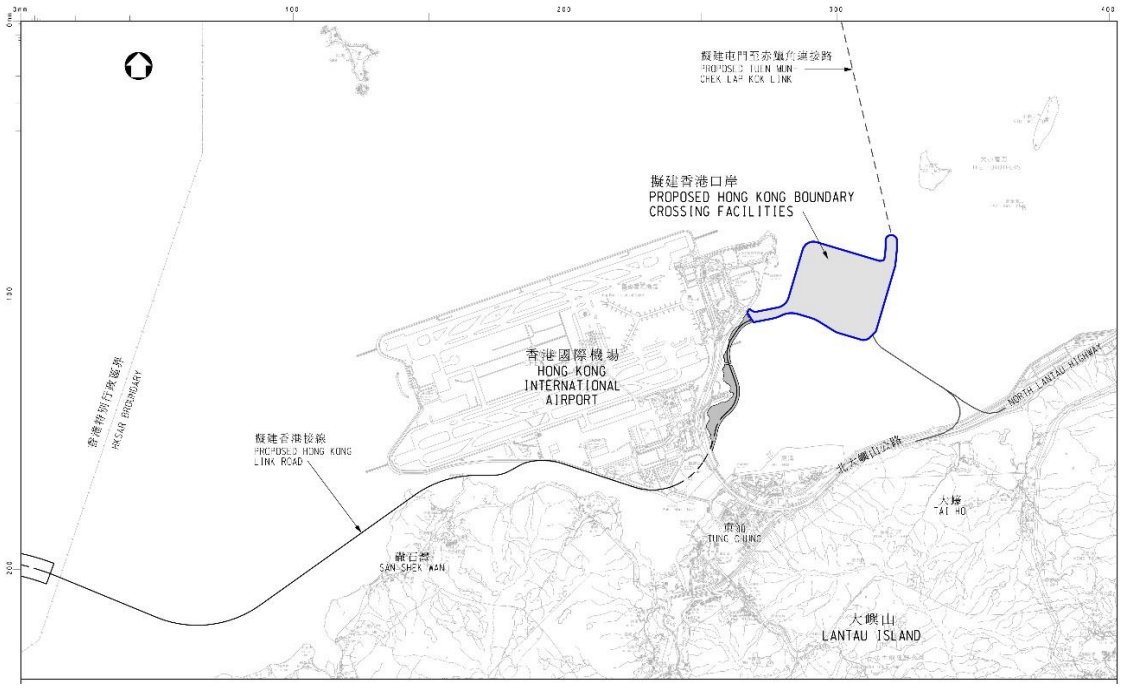

Figure 1. The Hong Kong Boundary Crossing (HKBCF) Reclamation Sites, North Lantau, Hong Kong (http://www.hzmb.hk/eng/img/overview/about_overview03_p01l.jpg**)**

The EM&A Manuals and Environmental Permits (EP) associated with all three projects have special provision for Chinese white dolphins (CWD) as they occur regularly in the waters which will be affected by the HZMB development. This report comprises the 18th quarterly (June-August 2016) summary of data associated with the impact monitoring conducted for contract HY/2010/02, HKBCF-Reclamation Works. The format of this report follows as closely as possible the outline provided for the Baseline Monitoring Report. The baseline monitoring was conducted during a different period from this quarter September to November (in 2011) and is thus not directly comparable as the there is a documented seasonal variation of habitat use and behaviour within the Hong Kong habitat. Where appropriate, information from previous reports, data provided by the Hong Kong Highways Department (HyD) and data from the Agriculture, Fisheries and Conservation Department (AFCD) Marine Mammal Annual Monitoring reports have also been incorporated[1]

[1] http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi.html

2. OBJECTIVES AND METHODOLOGY

2.1. Objectives of the Present Study

The EM&A Manual for HZMB states that "A dolphin monitoring programme at North Lantau and West Lantau waters, in particular the dolphin sighting hotspots (e.g. Brothers Islands) and areas where juveniles have been sighted (e.g. West Lantau waters), should be set up to verify the predictions of impacts and to ensure that there are no unforeseen impacts on the dolphin population during construction phase". For HKBCF the study area known as West Lantau was not included in the site specific EM&A Manual for construction phase survey work. As such, for HKBCF, vessel-based dolphin surveys to monitor impact are conducted in the areas known as Northeast Lantau (NEL) and Northwest Lantau (NWL). These surveys are conducted twice monthly and for the duration of the construction phase of HKBCF. The HZMB baseline study (incorporating HKBCF, TM-CLK and HKLR phases of the bridge development), indicates that the data gathered from these surveys are intended to monitor impacts by;

- providing ongoing assessment of the spatial and temporal distribution patterns and habitat use of CWD during the construction phase of the HKBCF project.
- identifying individual CWD by their natural marks, coloration and scars for comparison with the baseline data and to assess individual distribution patterns and habitat use.
- comparing impact survey data to that gathered during the baseline data period so that any changes deemed to be of a significant nature can be assessed and mitigated appropriately.

The baseline monitoring report includes distribution analysis, encounter rate analysis, behavioural analysis, quantitative grid analysis and ranging pattern analysis. Protocols for data interpretation and analyses methods were provided in the baseline monitoring report and are used herein solely for comparative purposes.

2.2. Line-transect Vessel Surveys

The co-ordinates for the transect lines and layout map were provided by AFCD, however, these have been modified as the construction works at HKBCF has shortened one of the transect lines. The study area now incorporates 23 transects (totalling ~108 km) which are surveyed twice per month by boat (Table 1; Figure 2). As HZMB construction works have progressed, some transect lines have been temporarily blocked either by the working vessels or the bridge structure itself. These are detailed in monthly submissions to ENPO. Extensive HZMB works in NWL have resulted in the permanent blockages of some lines. Line transect surveys should be conducted systematically (Buckland *et al* 2001). When the start of a transect line is reached, "on effort" survey begins. When the vessel is travelling between transect lines and to and from the study area, it is deemed to be "off effort". As per EM&A protocols, the boat travels at a speed of 7-8 knots (13-15 km/hr), except during some periods when tide and current flow exceeds 7 knots and thus the vessel travels at the same speed as the current. A minimum of four marine mammal observers (MMOs) are present on each survey, rotating through four positions; observers (2), data recorder (1) and rest (1). Rotations occur every 30 minutes or at the end of dolphin sightings. The data recorder enters vessel effort, observer effort, weather and sightings information directly onto the programme Logger[2] and is not part of the observer team. This is not ideal line transect survey procedure, however, the baseline study was conducted this way thus it has been requested that only two observers be used for impact surveys.

[2] Logger is purpose built software which automatically collects and stores GPS data and contains a user configurable interface for the manual entry of the data required for line transect and other cetacean research studies (Gillespie *et al* 2010).

When the boat is travelling along the transect line ("on effort"), observers search the area in front of the boat between 90° and 270° abeam (bow being 0°). When a group of dolphins is sighted, position, bearing and distance data are recorded immediately onto Logger and, after a short observation, an estimate is made of group size[3]. This is an "on effort" sighting. These input parameters are linked to the time-GPS-ships data which are automatically stored in Logger throughout the survey period. In this manner, information on heading, position, speed, weather, effort and sightings are stored in an interlinked database which can be subsequently used in a variety of analytical software packages.

Once the vessel leaves the transect line, it is deemed to be "off-effort". The dolphins are approached with the purpose of taking high resolution images. Then the vessel returns to the transect line at the point of departure and is again "on effort". If another group of dolphins is seen while travelling back to the transect line, or when with the first group of dolphins, the sightings are considered as "opportunistic" and noted accordingly.

2.2.1 Baseline Survey Data and Data from Impact Monitoring

Data from the baseline was provided by the Highways Department (January 2013). These data were extracted from the original baseline survey as the baseline survey encompassed a wider area than that stipulated in the EM&A Manual for the HKBCF Project, as such, a subset of the baseline data set was provided and appropriate rates and densities recalculated from the data provided. For impact monitoring, detailed datasets are available online via the ENPO website.

[3] Group size is defined as an aggregation of dolphins within 100m of each other involved in similar behaviour (Connor *et al* 1998).

Table 1. The Dolphin Monitoring Transect Co-Ordinates for HKBCF Monthly Monitoring

ID	X	Y	Long	Lat	ID	X	Y	Long	Lat
1	804671	815456	113.87029	22.2777	12	815542	824882	113.97565	22.3630
1	804671	831404	113.86998	22.4217	13	816506	819480	113.98507	22.3142
2	805475	815913	113.87808	22.2818	13	816506	824859	113.98501	22.3628
2	805477	826654	113.87790	22.3788	14	817537	820220	113.99507	22.3209
3	806464	819435	113.88762	22.3136	14	817537	824613	113.99502	22.3606
3	806464	822911	113.88755	22.3450	15	818568	820735	114.00507	22.3256
4	807518	819771	113.89783	22.3167	15	818568	824433	114.00503	22.3589
4	807518	829230	113.89766	22.4021	16	819532	821420	114.01442	22.3317
5	808504	820220	113.90740	22.3208	16	819532	824209	114.01439	22.3569
5	808504	828602	113.90725	22.3965	17	820451	822125	114.02333	22.3381
6	809490	820466	113.91697	22.3230	17	820451	823671	114.02332	22.3521
6	809490	825352	113.91688	22.3671	18	821504	822371	114.03356	22.3404
7	810499	820880	113.92675	22.3268	18	821504	823761	114.03354	22.3529
7	810499	824613	113.92669	22.3605	19	822513	823268	114.04334	22.3485
8	811508	821123	113.93654	22.3290	19	822513	824321	114.04333	22.3580
8	811508	824254	113.93649	22.3572	20	823477	823402	114.05270	22.3497
9	812516	821303	113.94632	22.3306	20	823477	824613	114.05269	22.3606
9	812516	824254	113.94628	22.3573	21	805476	827081	113.87788	22.3827
10	813525	820827	113.95611	22.3263	21	805476	830562	113.87781	22.4141
10	813525	824657	113.95607	22.3609	22	806464	824033	113.88752	22.3552
11	814556	818853	113.96616	22.3049	22	806464	829598	113.88742	22.4054
11	814556	820992	113.96613	22.3278	23	814559	821739	113.96614	22.3346
12	815542	818807	113.97573	22.3081	23	814559	824768	113.96610	22.3619

The total transect length for NEL and NWL combined is 108km (approved 19-08-2015)

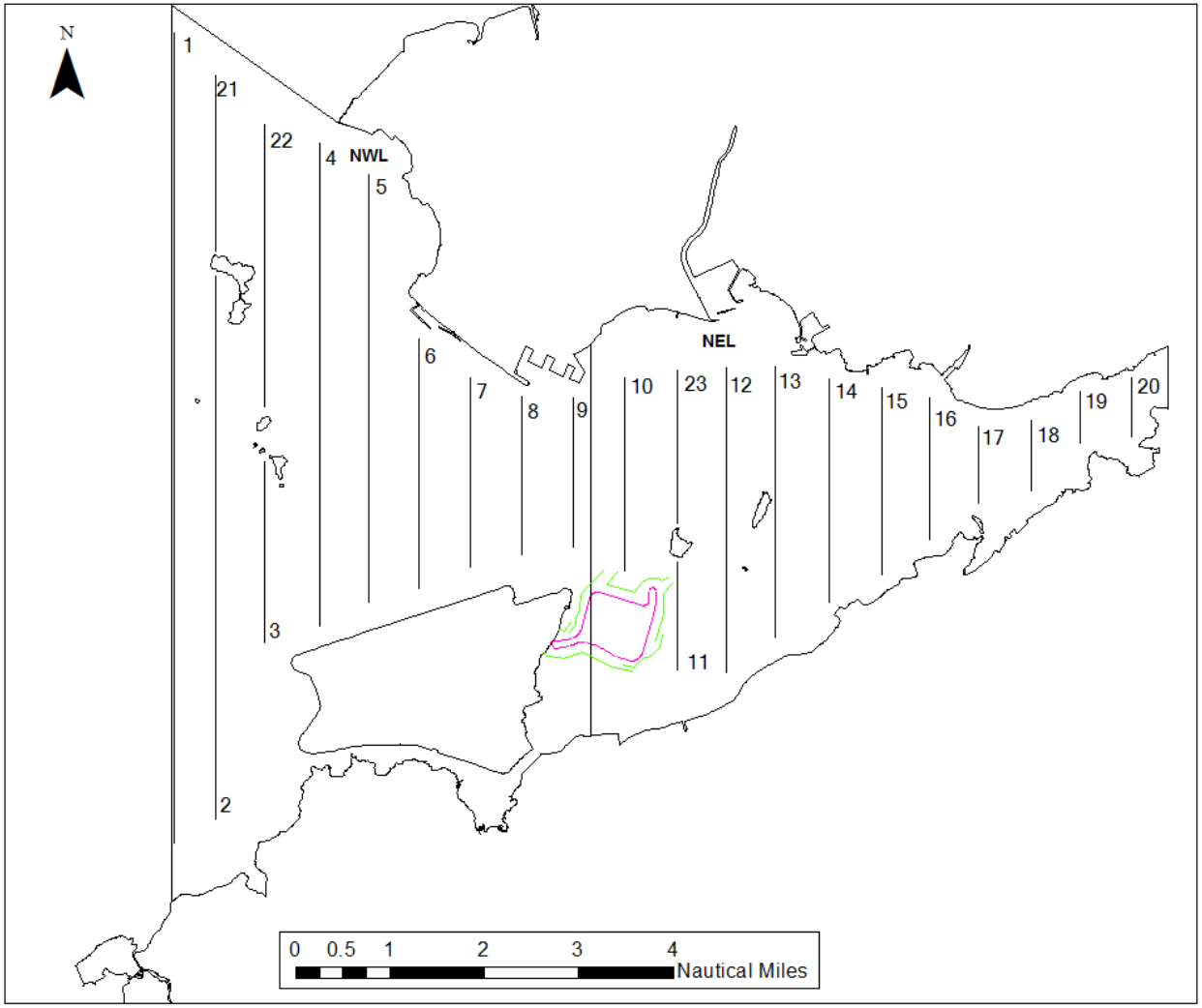

Figure 2 Location of Transect Lines for Impact Monitoring during HKBCF (modification approved 19-08-2015)

2.3. Photo-identification

When a dolphin(s) is sighted, the vessel leaves the transect line and slowly approaches the group or individual. Attempts are made to photograph every individual sighted although close approaches to mother and calf pairs are not attempted. Digital SLR cameras (Nikon D7100; D750) using long lenses (Nikor 80-400mm and fixed length 300mm) are used to obtain high resolution images. Effort is made to ensure consistency of image quality, e.g., no shadow and at an angle perpendicular to the dorsal fin. Polarising filters are used to minimise glare. In this manner, the best image clarity is achieved and image sorting and matching is more consistent. Images are sorted according to clarity and presence/absence of identifying features (nicks /cuts/deformities/injury/pigmentation). Only images deemed to be of suitable quality and as containing sufficient markings for unambiguous identification are included in the photo-identification catalogue. A recent review of photo identification techniques was referred to ensure that current protocols for this monitoring conform to internationally recognised best practises. Recommendations from this review will be considered for future analyses (Urian *et al* 2014).

2.4. Data Analyses

2.4.1. Distribution pattern analysis

Dolphin sightings data are mapped in the Geographic Information System (GIS) ArcView© 10.3.

2.4.2. Encounter rate analysis

For this report, the baseline encounter rates were re-calculated using the revised data provided rather than quoting directly from the baseline report. Calculation followed the EM&A Manuel methodology ("on-effort" sightings made during favourable weather and good visibility conditions).

2.4.3. Quantitative grid analysis of habitat use

Quantitative grid analysis is performed by mapping both sighting and dolphin densities plotted onto 1kmx1km grid squares. Only "on effort" sightings made while on a transect line and under favourable conditions should be included in grid analyses. These densities are standardised by effort by calculating survey coverage in each line transect survey to determine the number of times the grid has been surveyed. Densities are calculated using the following formulae;

SPSE and DPSE:

$$SPSE = (S/E \times 100)/SA\%$$
$$DPSE = (D/E \times 100)/SA\%$$

Where;

S= total number "on effort" sightings
D = total number dolphins from "on effort" sightings
E = total number units survey effort
SA% = percentage of sea area

2.4.4. Behavioural analysis

When dolphins are sighted during vessel surveys, their behaviour is observed. Different activities are categorised (i.e. feeding, traveling, socialising, surface active, associated with boats, unknown) and recorded in the sighting data form of Logger. The sightings form is integrated with survey effort and positional data and can be subsequently mapped to examine distribution and behavioural trends. All sightings data ("on-effort" and "opportunistic") are used in this analysis.

2.4.5. Ranging pattern analysis

In the baseline monitoring report, the program Animal Movement Analyst Extension, created by the Alaska Biological Science Centre, USGS was used in conjunction with ArcView© 3.1 and Spatial Analyst 2.0[4]. Using the fixed kernel method, kernel density estimates and kernel density plots are created using all sightings. In the baseline monitoring, data from other studies and from outside the baseline monitoring period were used to map individual ranges. It is important to maximize the number of sightings used as kernel analyses cannot be conducted unless more than 20 independent sightings are made for an individual although it is recommended that a minimum of 70 resightings are used before kernel analyses has any accuracy (Wauters *et al* 2007; Kauhala and Auttila 2010; de Faria Oshima and de Oliveira Santos, 2016.). AFCD Annual Reports use a minimum of 15 resightings for kernel analyses (AFCD 2012). For the purposes of reporting on this project, 15 or more independent resightings per individual will be used to map utilisation densities using the fixed kernel method. At the time of this report, only 13 independent resightings have been recorded for one dolphin since impact monitoring began. Home range analysis shall be conducted once 15 resightings have been recorded so that results can be compared directly to the AFCD Annual Reports.

3. RESULTS AND DISCUSSIONS

3.1. Summary of survey effort and dolphin sightings

From June – August 2016, 12 vessel surveys were conducted in the NEL and NWL survey areas. A total of 658.8 km of "on-effort" transect lines were conducted, 639.7km (97%) of which was conducted under favourable conditions (Annex I; Annex II). Only those periods of "on-effort" survey conducted under favourable conditions were included in quantitative analyses. During June – August 2016, 13 groups of dolphins, numbering 48 (min 45; max 61[5]) individuals, were sighted from the vessel surveys. Of these, nine groups were "on-effort" and the remaining four were "opportunistic" (Annex III).

Of the 13 sightings, all groups were sighted while surveying the NWL sector[6]. The baseline report, conducted during September-November 2011, notes a total of 44 groups, 34 of which occurred in NWL and 10 in NEL. This was conducted during a different season to this quarterly report. For the period June – August 2011 (advanced monitoring), a total of 37 groups were sighted, 25 of which were located in NWL and 12 in NEL. After construction had commenced, for the period June – August 2012, a total of 62 groups were sighted, 42 of which were located in NWL and 20 in NEL; for the period June – August 2013, a total of 45 groups were sighted, 38 of which were located in NWL and 7 in NEL; for the period June – August 2014, a total of 27 groups were sighted, 26 of which were located in NWL and 1 in NEL and; for the period June – August 2015, a total of 13 groups were sighted all in NWL. There are differences between the number of sightings made during baseline compared to the summer periods of this reporting quarter, however, there is known to be seasonal variation of dolphin occurrence in north Lantau, indeed within Hong Kong (AFCD 2012). When a comparison is made between June – August 2011; 2012; 2013; 2014, 2015 and the same period in 2016, the numbers of dolphin groups seen in NWL in 2012 and 2013 (both years when HKBCF was a working site) are similar. A decline is noted in the total number of NWL sightings observed in the same period for 2014 and again in 2015. The number of groups seen in 2016 is the same as that recorded in 2015. In NEL, when a comparison is made between June – August 2011; 2012; 2013, 2014, 2015 and the same period in 2016, there is a marked decline from 2013 onwards (Table 2). These data have not been corrected for effort. Maps depicting location of sightings, also not corrected for effort, are included as Figs. 3;4;5;6.

[4] In ArcGIS versions 9.2 and later, kernel range density calculation tools are integrated in the toolbox section and a separate extension is no longer required

[5] During sightings a minimum, maximum and best estimate of group size is noted; the range stated represents the minimum and maximum numbers estimated)

[6] Some sightings may have been located adjacent to the boundary of the NWL area, see maps for locations

Table 2. A Comparison of Total Sightings Recorded in NEL and NWL Areas During Sep – Nov 2011, June – August 2011; 2012; 2013, 2014, 2015 and 2016

Monitoring Period	Total Dolphin Sighting in NWL	Total Dolphin Sighting in NEL
	Number of Groups	Number of Groups
Jun – Aug 2011* (Advanced Monitoring)	25	12
Sep – Nov 2011 (Baseline Monitoring)	34	10
Jun – Aug 2012 (Impact Monitoring)	42	20
Jun – Aug 2013 (Impact Monitoring)	38	7
Jun – Aug 2014 (Impact Monitoring)	26	1
Jun – Aug 2015 (Impact Monitoring)	13	0
Jun – Aug 2016 (Impact Monitoring)	13	0

* Surveys conducted once per month

As per the EM&A manual, only "on effort" sightings can be used for some analyses therefore, the combined number of "on effort" sightings for the baseline and the months June – August 2011, 2012, 2013, 2014, 2015 and 2016 were compared. The baseline study had considerably more "on effort" sightings compared to the June – August period prior to works commencement. The period June – August during the first year of construction had more "on effort" than both the baseline and the advanced monitoring conducted in the summer of 2011. There is a decrease in absolute numbers of "on effort" groups seen between the June – August from 2014 to 2015 and a slight increase in 2016, with the period June – August 2013 having similar numbers of "on effort" sightings to the same period during advanced monitoring (Table 3). No correction for effort is made with these numbers, this is calculated in section 3.3.

Table 3. A Comparison of "On Effort" Sightings Recorded in NEL and NWL Combined During Sep – Nov 2011 and June – August 2011; 2012; 2013, 2014, 2015 and 2016.

Monitoring Period	Groups of Dolphin sighted in NEL and NWL
June – August 2011 (Advanced Monitoring)	30
Sep - Nov 2011 (Baseline Monitoring)	44
June – August 2012 (Impact Monitoring)	47
June – August 2013 (Impact Monitoring)	29
June – August 2014 (Impact Monitoring)	17
June – August 2015 (Impact Monitoring)	7
June – August 2016 (Impact Monitoring)	9

3.2. Distribution

During the baseline survey, ~77% of all "on effort" sightings were made in NWL. During the June – August periods 2011, 2012, 2013, 2014, 2015 and 2016, 63%, 64%, 86%, 94%, 100% and 100% of all sightings were made in NWL, respectively. There is a notable trend of increased use of NWL habitat when comparing the period June to August. Again, there is no correction for effort for these group sightings (Table 4). The sightings in NWL occurred at its southern edge and around the Sha Chau Lung Kwu Chau Marine Park area (SCLKCMP) (Fig 6).

Table 4. A Comparison of "On Effort" Sightings Recorded in NEL and NWL During Sep – Nov 2011, June – August 2011; 2012; 2013, 2014, 2015 and 2016.

Monitoring Period	No. of Dolphin Groups sighted in NWL	No. of Dolphin Groups sighted in NEL
June – August 2011 (Advanced Monitoring)	19	11
Sep - Nov 2011 (Baseline Monitoring)	34	10
June – August 2012 (Impact Monitoring)	30	17
June – August 2013 (Impact Monitoring)	25	4
June – August 2014 (Impact Monitoring)	16	1
June – August 2015 (Impact Monitoring)	8	0
June – August 2016 (Impact Monitoring)	9	0

3.3. Encounter rate

As some of the survey periods have different transect lengths, variation in sightings occurrence was quantified by correcting for effort (distance of transect lines surveyed, i.e., km spent "on-effort"), to obtain an encounter rate. The baseline study (Sep-Nov 2011) reports that a total of 545.6km[7] of survey effort was conducted under favourable conditions in the NEL and NWL survey areas. In NEL, a decrease in encounter rates has been documented before construction activities started at HKBCF and this has been attributed, largely, to the fast ferries which traverse this area (Marcotte *et al* 2015). Since commencement of the HKBCF, a marked decrease from baseline rates was noted in 2013. In NWL, looking only at the period June – August, 2012 and 2013 have similar encounter rates which are less than advanced monitoring, and a marked decreased in encounter rates is noted from 2014.The encounter rate in June – August 2016 is slightly increased from that noted in 2015 in NWL (Table 5).

[7] Updated data set provided April 2013

Table 5. A Comparison of Encounter Rates* in NEL and NWL Areas for Baseline Period (Sept – Nov 2011), June – August 2011; 2012; 2013, 2014, 2015 and 2016.

Monitoring Period	Encounter Rate NEL	Encounter Rate NWL
June – August 2011 (Advanced Monitoring)	7.0	11
Sept-Nov 2011 (Baseline Monitoring)	5.4	9.5
June – August 2012 (Impact Monitoring)	5.2	5.1
June – August 2013 (Impact Monitoring)	1.8	5.7
June – August 2014 (Impact Monitoring)	0.5	3.6
June – August 2015 (Impact Monitoring)	0	1.6
June – August 2016 (Impact Monitoring)	0	2.1

The AFCD Annual Reports describe variation in spatial distribution between areas and between seasons in NEL and NWL. Until 2012, it is reported that overall **annual encounter rate** for NEL varies between 1.6 and 6.2 and the **annual encounter rate** for NWL varies between 5.8 and 17.0. Both the encounter rates for NEL and NWL for this quarter (June – August 2016) are lower than the yearly average. Historically, there have been both up and down movements within **yearly** encounter rate limits, however, the general trend in yearly encounter rate for dolphins in all areas of Hong Kong is that of significant decline over the last decade, prior to new development projects in the Lantau area (AFCD 2013). The known decline in the population, in addition to the highly variable encounter rate noted historically, makes it problematic to discern any additional influence individual projects, such as HKBCF and others, may have on the dolphin population encounter rate. A marked decrease in encounter rate is recorded in NWL for the periods June-August in 2014 and 2015, when compared to the previous rate of decrease in the same period in both 2012 and 2013. A slight increase in encounter rate in NWL is noted in the June – August period 2016. A marked decrease in encounter rate in NEL, in the June-August period, has been recorded since 2013. It has been noted that in addition to HZMB activities, dredging and other new marine works have also been ongoing in both NEL and NWL. It is likely that all activities contribute to the ongoing decline in dolphin numbers from Hong Kong areas NEL and NWL.

3.4. Group size

For baseline monitoring, the NWL average group size was 4.5 and in June – August 2011; 2012; 2013, 2014, 2015 and 2016 it was 4.3, 2.8, 2.9, 3.3, 3.3 and 3.7, respectively. For baseline monitoring, the NEL average group size was 3.5 and in June – August 2011; 2012; 2013 and 2014, it was 2.8, 3.8, 2.3 and 1.0, respectively, and no sightings noted in 2015 or in 2016 (Table 6). There is a smaller group size noted during impact monitoring in NWL. There is no apparent trend in NEL, until 2014 when the numbers of groups encountered decreased. A map depicting group size distribution shows that larger groups, i.e., more than 5 individuals, occur at the southern edge of NWL and one at SCLKCMP (Fig. 7).). It has been noted previously that significantly larger groups are noted behind active fishing trawlers (Jefferson 2000). As trawlers no longer operate in Hong Kong waters, group size averages may have decreased due to this.

Table 6. A Comparison of Sightings Group Size Averages Recorded in NEL and NWL Areas During Sep – Nov 2011, June – August 2011; 2012, 2013, 2014, 2015 and 2016

Monitoring Period	Average Group Size (NWL)	Average Group Size (NEL)
June – August 2011 (Advanced Monitoring)	4.3	2.8
Sep - Nov 2011 (Baseline Monitoring)	4.5	3.5
June – to August 2012 (Impact Monitoring)	2.8	3.8
June – August 2013 (Impact Monitoring)	2.9	2.3
June – August 2014 (Impact Monitoring)	3.3	1.0
June – August 2015 (Impact Monitoring)	3.3	-
June – August 2016 (Impact Monitoring)	3.7	-

3.5. Habitat use

Quantitative grid analyses indicates that the most often frequented area in NWL is at SCLKCMP (Figs. 8; 9). When compared to the same period in 2015, the grid analyses show a shift in distribution from the east to the west of the NEL/NWL habitats with fewer cells of higher use (Fig. 10). These areas of high use have been consistent in the long term and continue to be so.

Quantitative grid analyses indicate that the most often frequented area in NWL is the northern area of SCLKCMP and one block of low use on the east of the marine park area. (Figs. 8; 9). SCLKCMP has been consistently frequented throughout dolphin impact monitoring for HZMB. The density of individual dolphins (DSPE) using the NEL and NWL habitat in 2012, the first year of HKBCF construction, shows relatively widespread use along the northeast of the airport platform, SCLKCMP, the western maritime border and Tai O as areas of use. In 2013, year two of HKBCF construction, individual dolphin density still occurred throughout the NEL and NWL habitats, however, there were fewer grids of use calculated, particularly of high use. In 2014, area usage focused almost exclusively in NWL, with only one grid of medium use in NEL. In 2015, very few grids were used with any frequency in NWL and these were located in SCLKCMP and a single grid of high use at the southern boundary of NWL. In 2016, only the SCLKCMP area was used with any frequency and to a much lesser degree than 2015 (Figure 10). For groups of dolphins (SPSE), there are obvious parallels with DSPE, however, it is noted the density of groups using the habitat of SCLKCMP and southern NWL increased between year 2012 and 2013. In 2014, all use of NEL had generally stopped, apart from one area to the east of the Brothers Islands and areas of use were noted throughout NWL. The density of group use of NWL decreased again in 2015 and was concentrated within the SCLKCMP with a single grid of high use in southern NWL. In 2016, only grids within SCLKCMP were frequented by dolphin groups (Fig. 11). In general, the dolphins' overall habitat use has decreased both spatially and in intensity of use in all areas with cessation of use of the NEL habitat since 2015.

3.6. Mother-calf pairs

One mother and calf pair was sighted during this period. During the same period in 2014 (no calves were sighted in 2015) 5.7% of dolphins sighted were calves.

3.7. Activities

Of the 13 groups sighted (using all sightings), two (15%) were engaged in feeding activities; five (38.5%) were travelling; five (38.5%) were feeding/travelling/socialising; and

one was unknown (8%). Groups engaged in multiple behaviours and travelling were the predominant activities noted during daylight hours in June to August (Fig. 11). There were no areas which showed a specific behavioural preference (Fig. 12).

3.8. Photo-identification work

The photo-identification catalogue was regularly updated and re-sightings of dolphins previously identified were recorded. The project specific photo-identification catalogue for the impact monitoring period is presented in Annex IV. All dolphins including those sighted only in the baseline are included. Not all dolphins sighted have sufficient scarring, injury or pigmentation uniqueness to be unambiguously identified. During the baseline survey, 96 individuals were noted in the NEL, NWL and WL areas. Of these, 57 were noted in the NEL and NWL area. No new dolphins have been identified in the last quarter and the catalogue stands at 123 individuals. To report date (31 August 2016), the HZMB catalogue has identified 14 dolphins that were seen in both baseline and the impact monitoring study period. Two further dolphins have been identified during impact monitoring which have been matched to the AFCD photo ID data held on the AFCD website.

There are 15 dolphins which have been sighted on six days or more during impact monitoring, nine (9) of which are known from the AFCD catalogue (HZMB 001 [WL46]; HZMB 002 [WL111]; HZMB 011 [EL01]; HZMB 041 [NL24]; HZMB 044 [NL98]; HZMB 51 [NL213]; HZMB 054 [CH34]; HZMB 083 [NL136]; HZMB 098 [NL104]) (Table 7). The highest number of re-sightings recorded during impact monitoring surveys is 13 (HZMB 022; HZMB 054), excluding multiple sightings made on the same day (Annex IV).

Table 7. Dolphins Frequently Recorded During Baseline and Impact Monitoring Surveys

HZMB ID	AFCD ID	SEEN IN BASELINE	TOTAL NUMBER OF DAYS SIGHTED **
HZMB 022	unknown	N	13
HZMB 054	CH34	Y	13
HZMB 002	WL111	Y	12
HZMB 044	NL98	Y	12
HZMB 023	unknown	*	10
HZMB 098	NL104	Y	8
HZMB 001	WL46	N	8
HZMB 083	NL136	Y	8
HZMB 051	NL213	N	7
HZMB 005	unknown	*	7
HZMB 041	NL24	Y	7
HZMB 094	unknown	*	7
HZMB 011	EL01	Y	6
HZMB 040	unknown	*	6
HZMB 064	unknown	*	6

* Cannot be determined

** The total number of days an individually identified dolphin has been sighted since the impact monitoring was initiated

4. CONCLUSION

The data from June – August 2016, shows some consistencies with the baseline data (conducted during a different season) and with the same periods in 2011, 2012, 2013, 2014 and 2015. Habitat use and behavioural trends all fall within those reported in AFCD Long Term Monitoring reports although as sightings numbers decrease, such patterns are difficult to compare (AFCD 2010; 2011; 2012; 2013; 2014; 2015). The quarterly encounter rates for both NEL and NWL is lower than that reported for **annual** rates published previously and the seasonal trend for these two areas is of a declining encounter rate with a small increase this quarter. Density distribution maps depict key areas of higher use within NWL, in particular, SCLKMP. Areas to the south of SCLKCMP and Tai O have seen diminished use since 2013 and this trend continued to 2015 with a slight increase in 2016. In general, the encounter rate, habitat use and group size information suggests that more dolphins are using the northern area of NWL and less dolphins using southern NWL. It has been some time since any dolphin was sighted in NEL. These observations are only for the period June – August, however, these trends have been apparent throughout 2016. One calf was recorded in the study area between June – August.

The overall decreases in encounter rates in both NEL and NWL are noted notwithstanding the slight increase in 2016 in NWL. HKBCF monthly reporting notes that the conditions of EM&A Manuel have been consistently upheld and that all measures stipulated to minimise disturbance to dolphins remain in place. Although it is likely that the increase in HKBCF activities is having an effect on dolphin encounter rates in NEL, it is also noted that other HZMB projects have increased activities over the last quarter throughout NEL and NWL. In addition, extensive marine works which are not part of HKBCF have been ongoing in NEL and also in parts of NWL throughout this current quarter period. Further, new projects have been initiated along the airport platform area. Some collaboration with cross border authorities has been initiated, with regards to sharing photo ID catalogues, and at recent meetings held between all environmental teams for HZMB, it was noted that some of the dolphins previously recorded in Hong Kong waters but which have been absent recently, have been recorded in adjacent waters. Therefore, the information current to this project indicates that the dolphins have shifted distribution, to the west.

At this stage, the intensity of in water marine works associated with the HKBCF is decreasing, however, the drivers behind the population decline stated in the AFCD long term monitoring programme for Hong Kong waters and independent studies for adjacent Pearl River Estuary (PRE) waters (Huang *et al* 2012) remain uncertain. Recent work indicates that habitat abandonment of NEL waters prior to HKBCF initiation was partially driven by the increase in high speed ferry traffic (Marcotte *et al* 2015) and that toxin burden may have a greater impact than initially predicted (Gui *et al.* 2014). Therefore, the HZMB Project was initiated at a time when there was already a widespread and long term reduction in the number of dolphins within what is believed to be their entire range of the PRE. The strict mitigation initiatives at HKBCF aim to minimize the localised impact of HKBCF construction, however, this in itself will not be sufficient to ameliorate the myriad of other impacts throughout the dolphins habitat.

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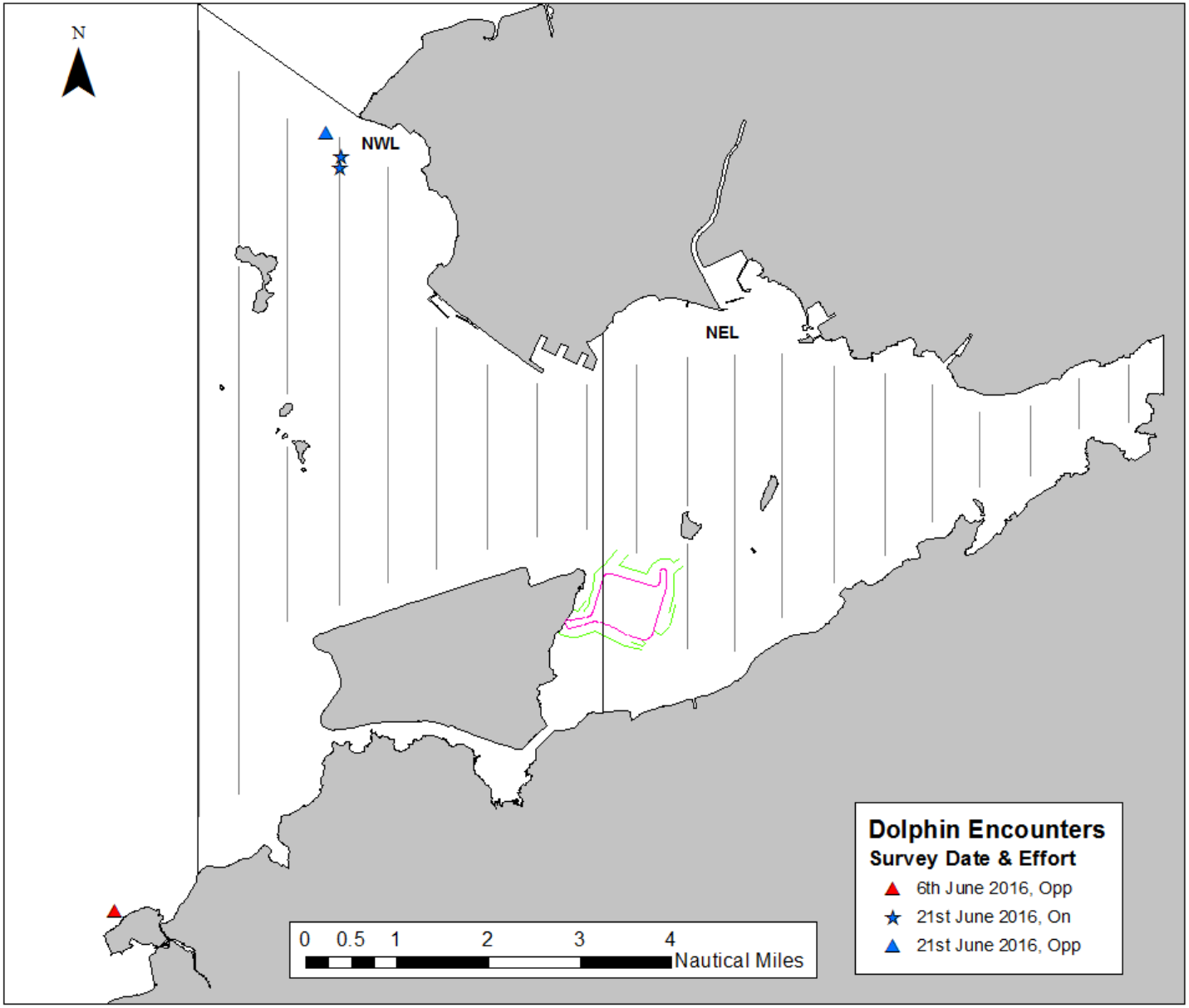

Figure 3 Distribution of Sightings Recorded During Impact Monitoring Surveys for HKBCF (June 2016)

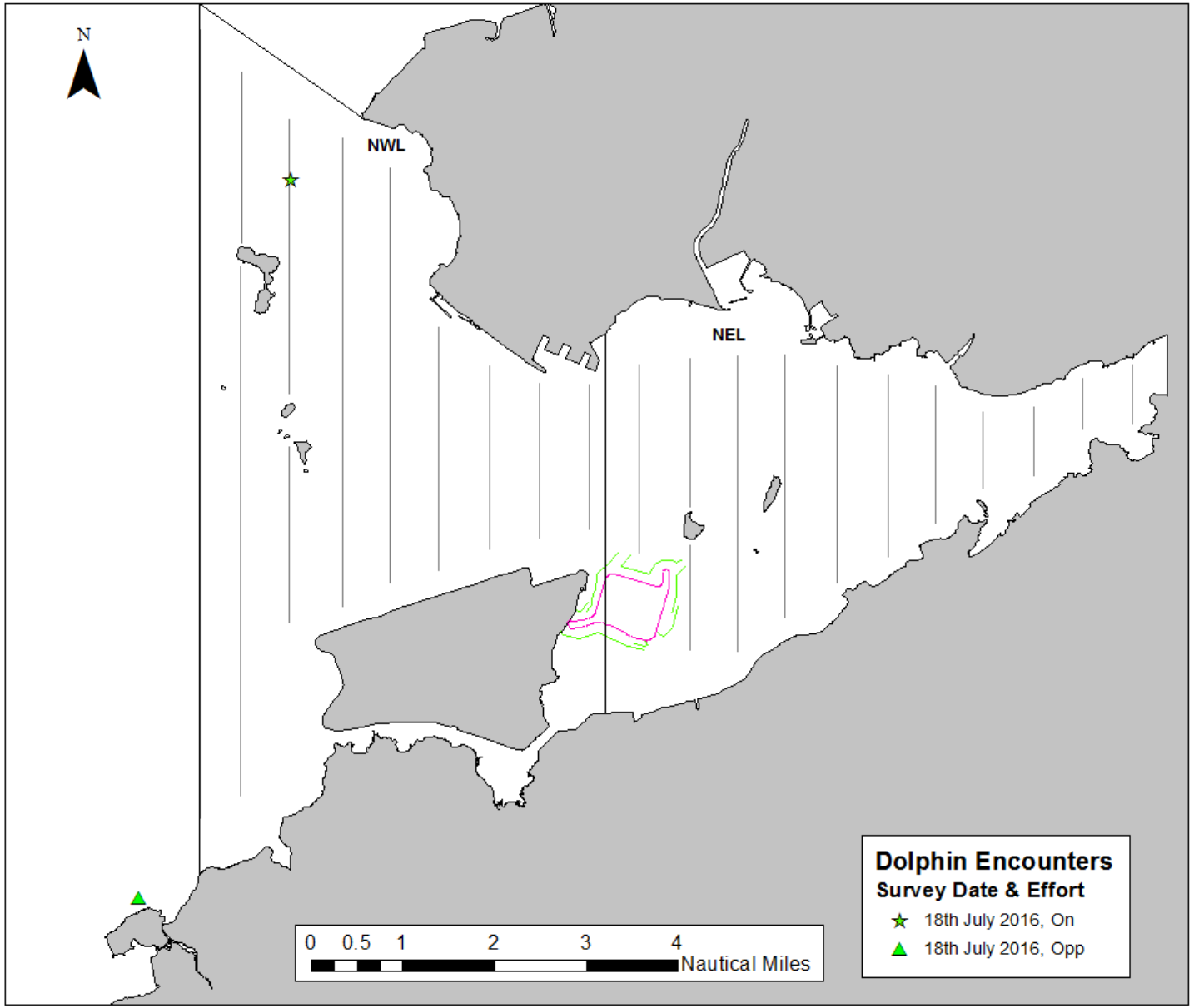

Figure 4 Distribution of Sightings Recorded During Impact Monitoring Surveys for HKBCF (July 2016)

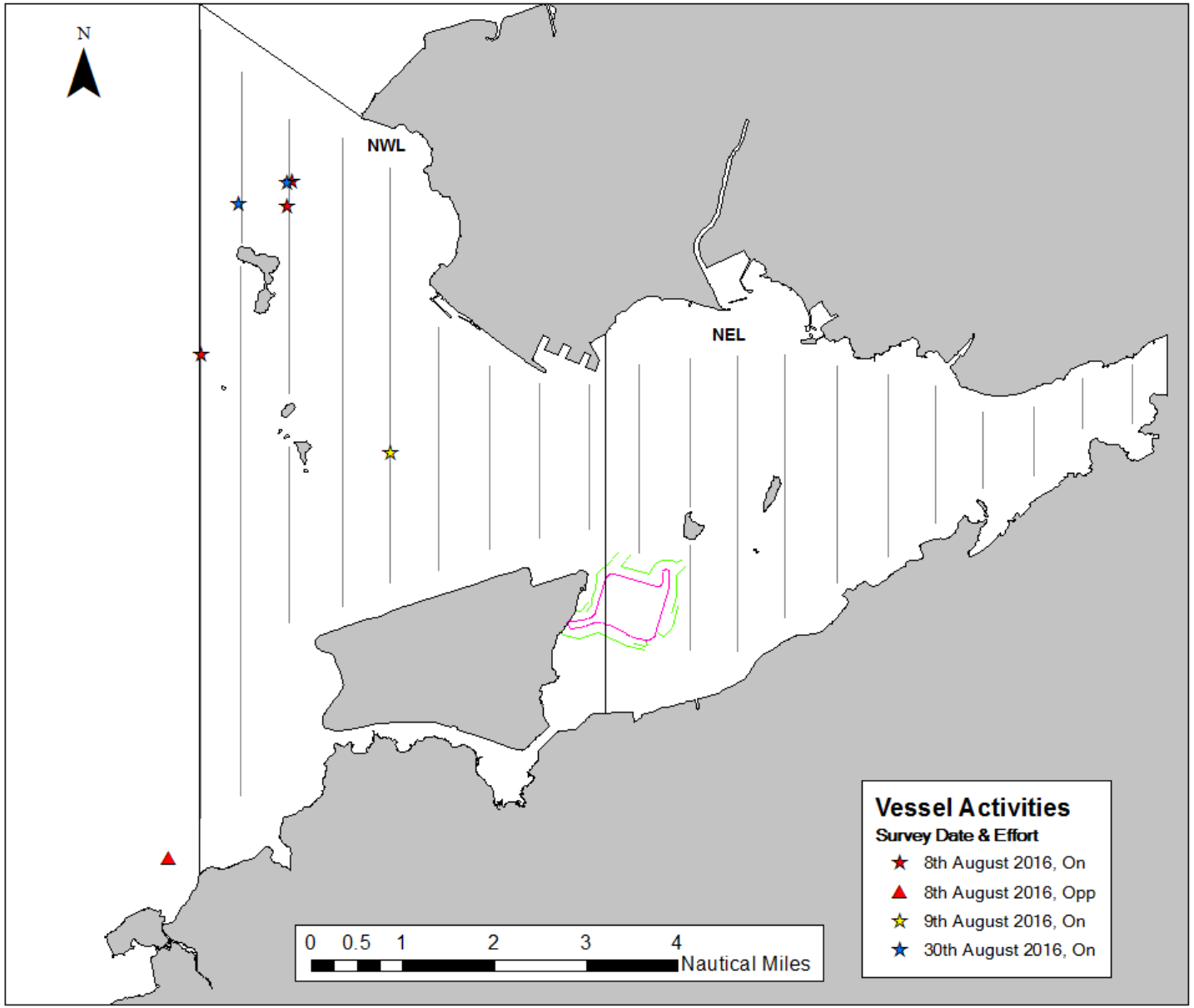

Figure 5 Distribution of Sightings Recorded During Impact Monitoring Surveys for HKBCF (August 2016)

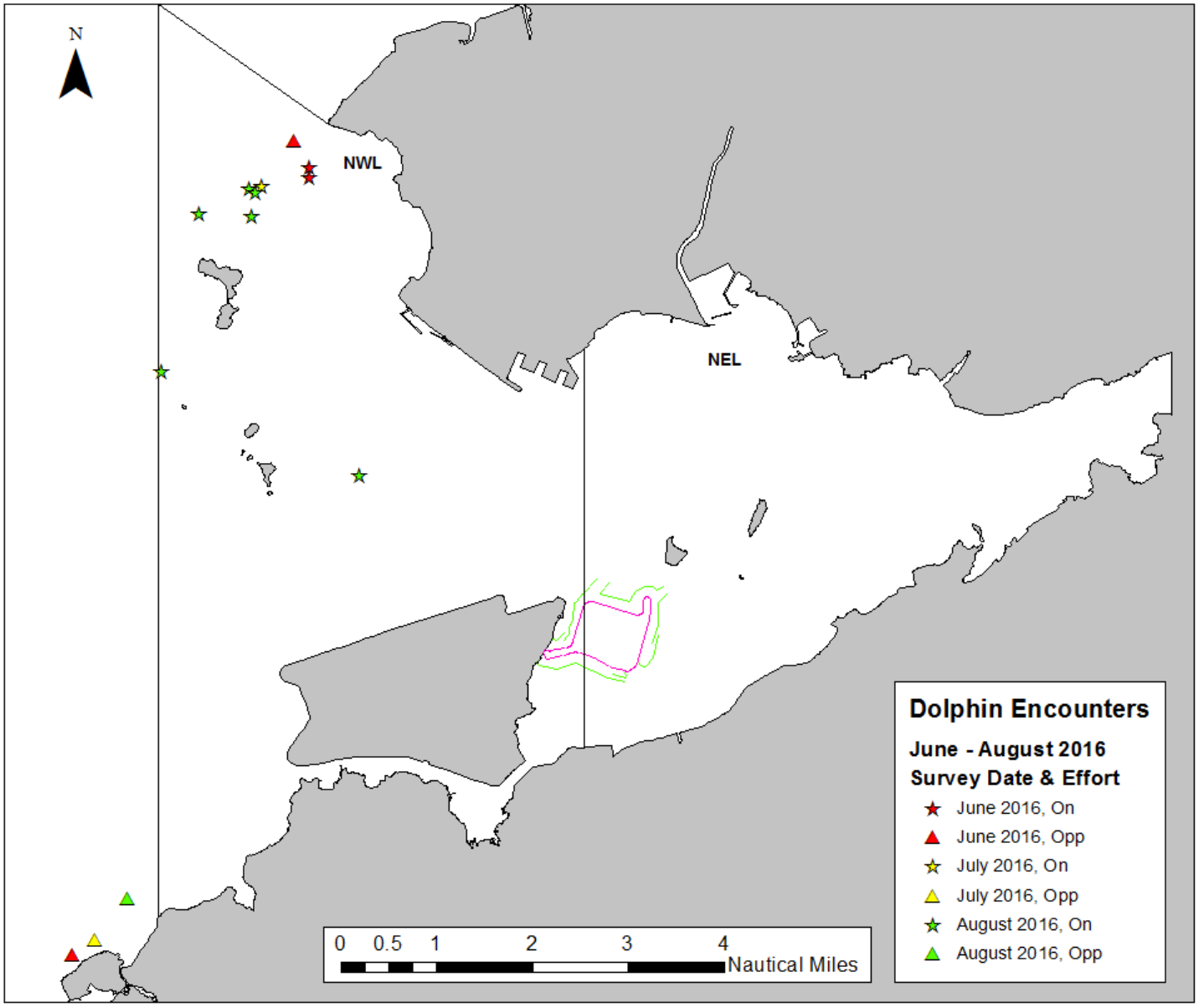

Figure 6. Distribution of Sightings Recorded During Impact Monitoring Surveys for HKBCF (June-August 2016)

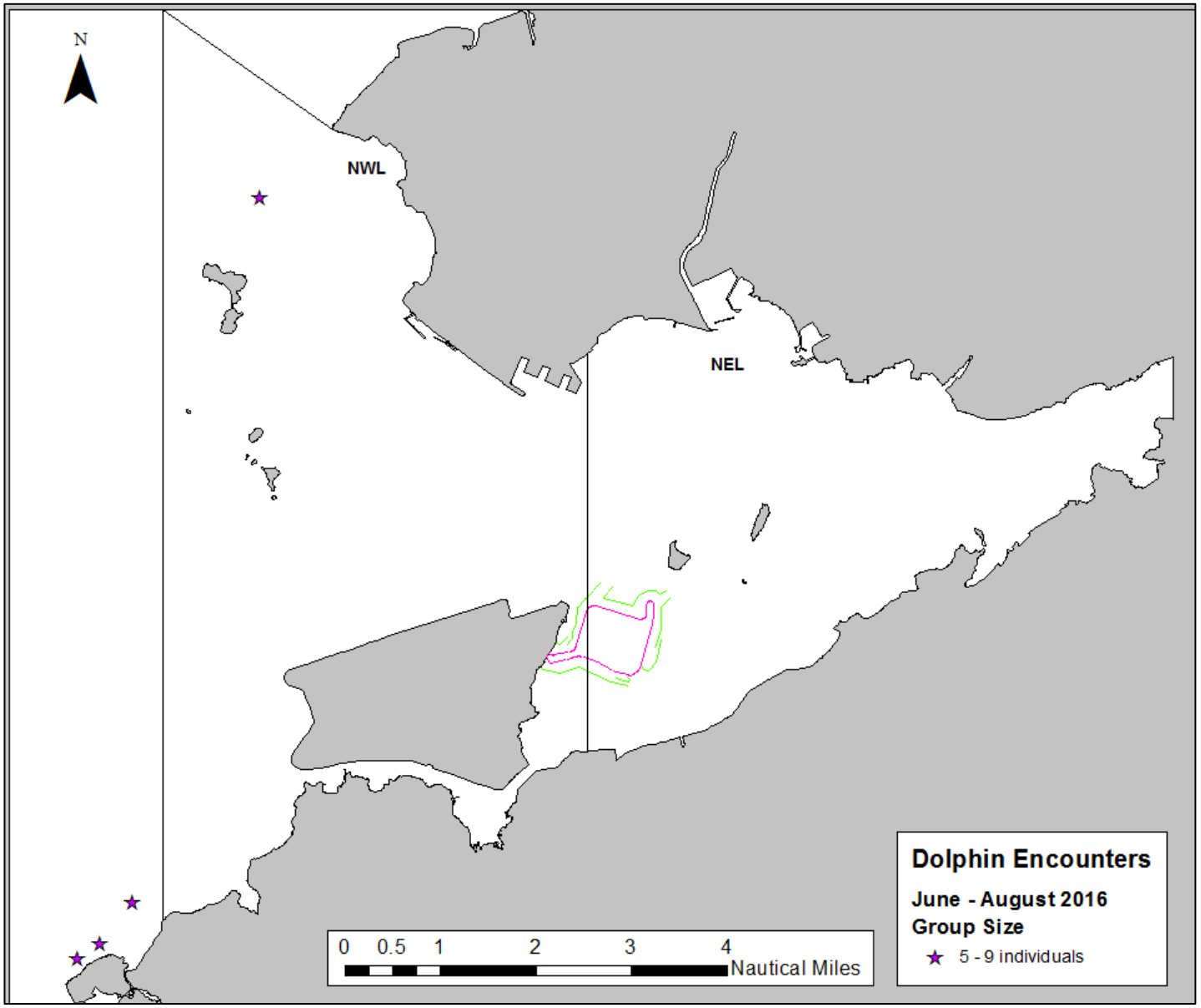

Figure 7. The Location of Dolphin Groups Numbering 5 and Above Individuals (June-August 2016)

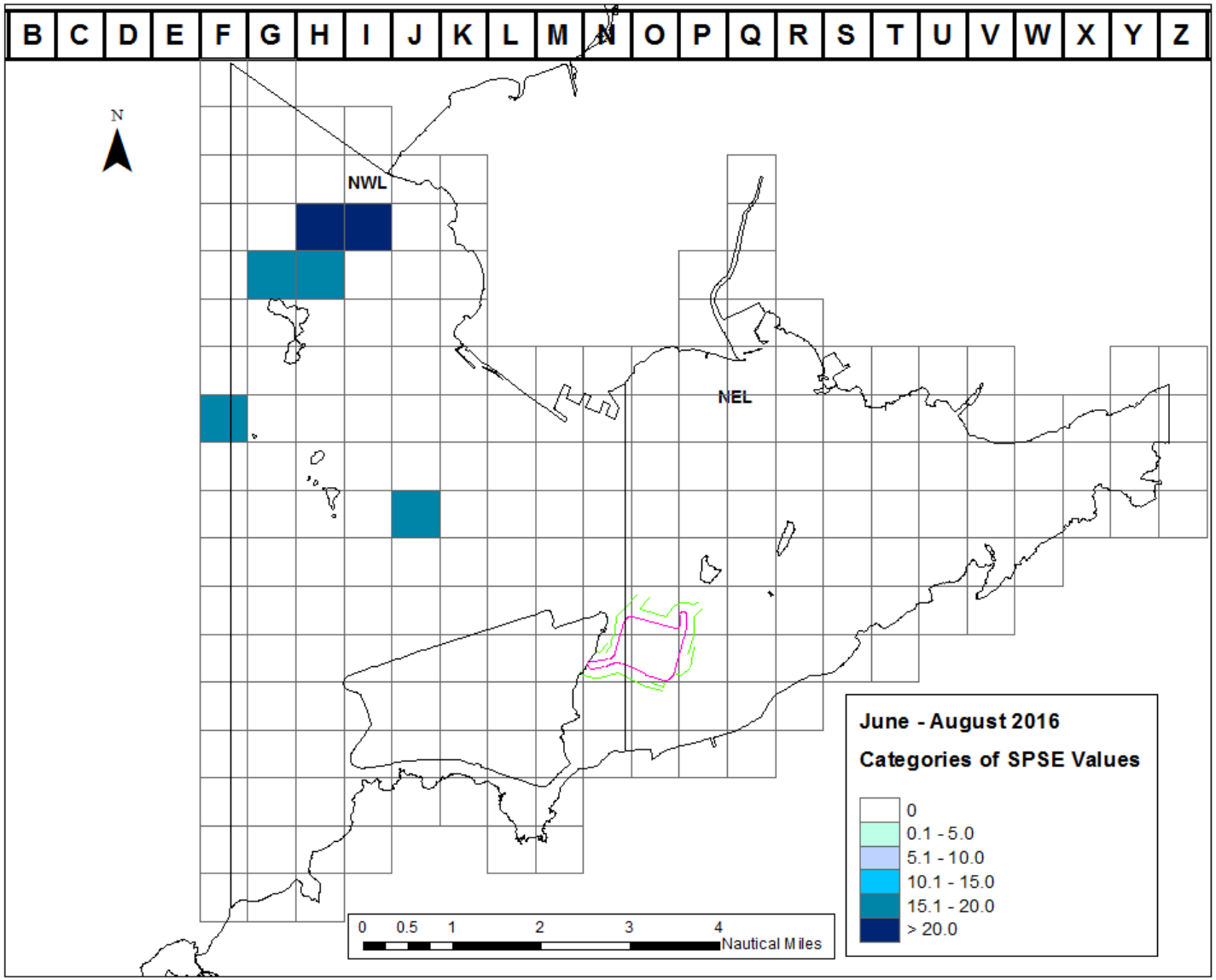

Figure 8. Sighting density SPSE (number of on-effort sightings per 100 units of survey effort) for June - August 2016.

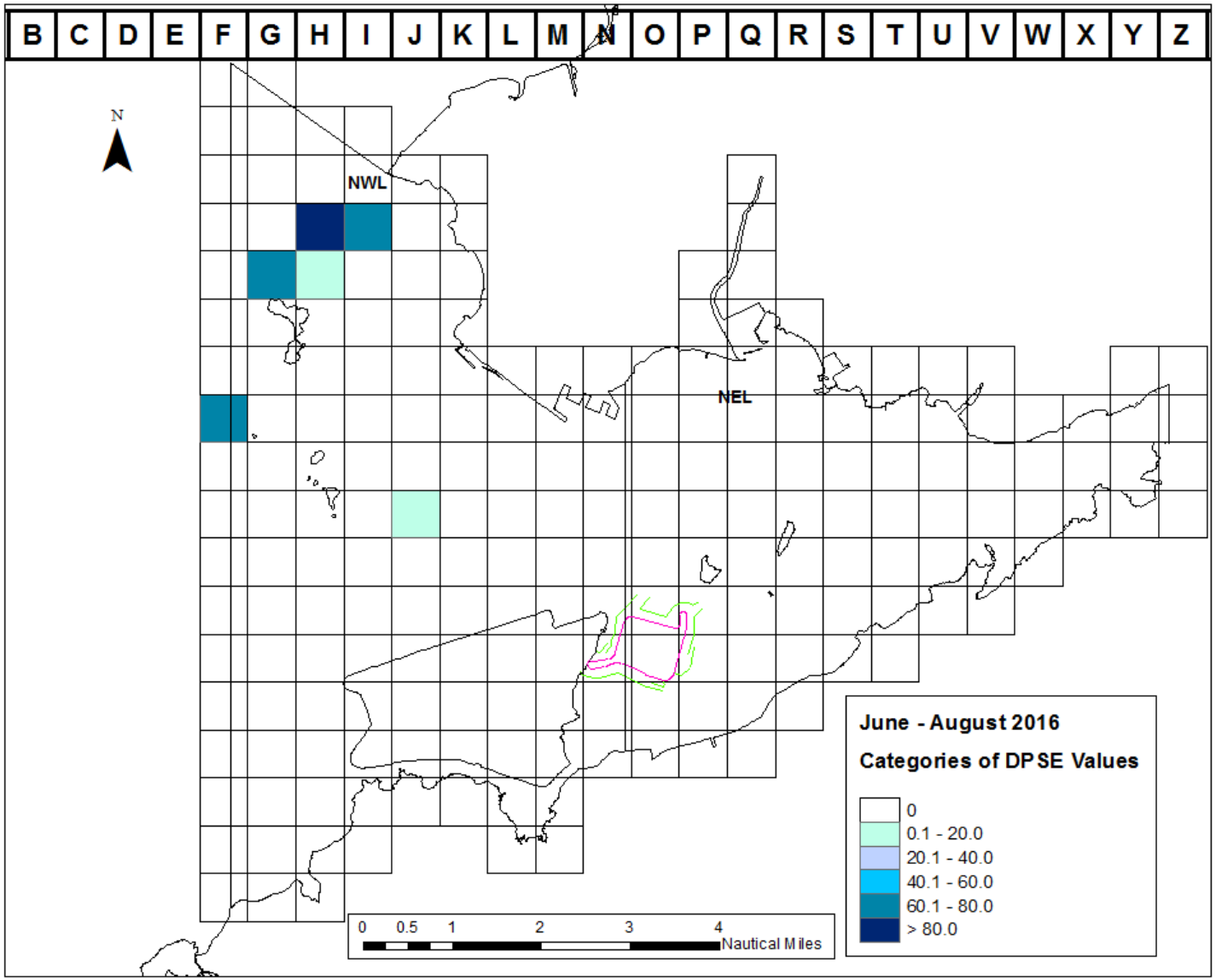

Figure 9. Dolphin density DPSE (number of dolphins per 100 units of survey effort) for June to August 2016.

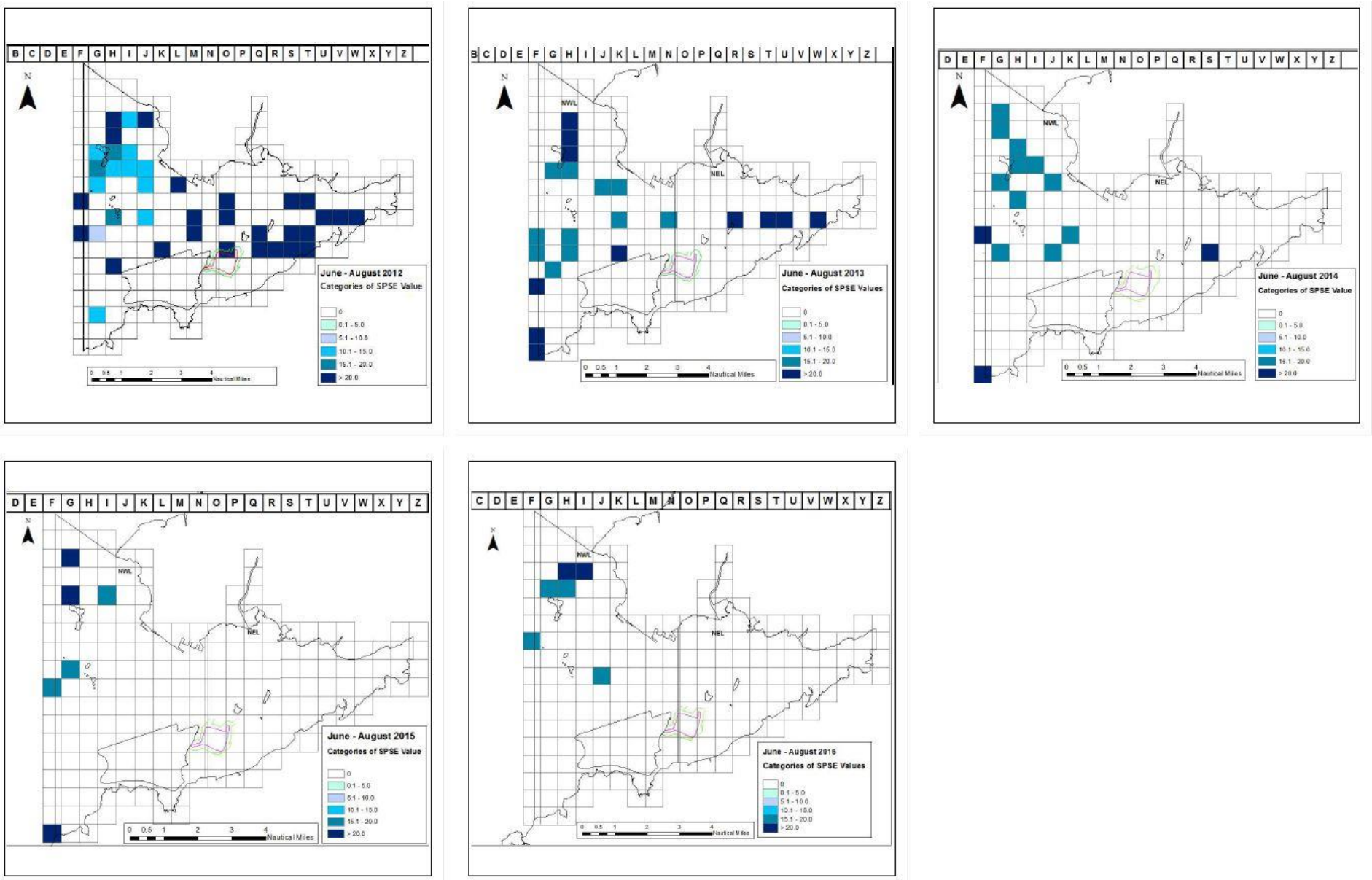

Figure 10. SPSE Grid Analysis for periods June – August 2012; 2013; 2014; 2015 and 2016

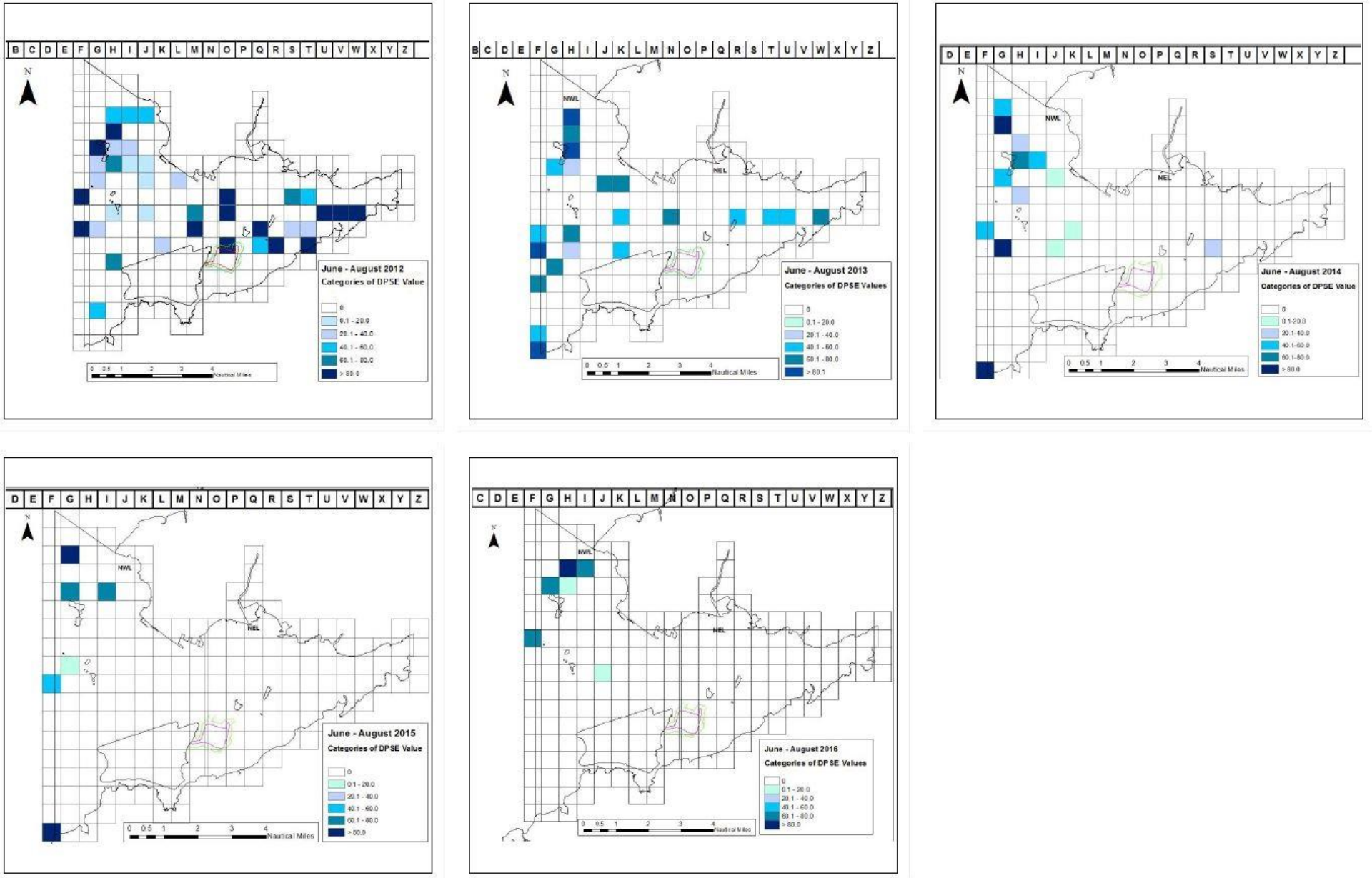

Figure 11. DPSE Grid Analysis for periods June – August 2012; 2013; 2014; 2015 and 2016

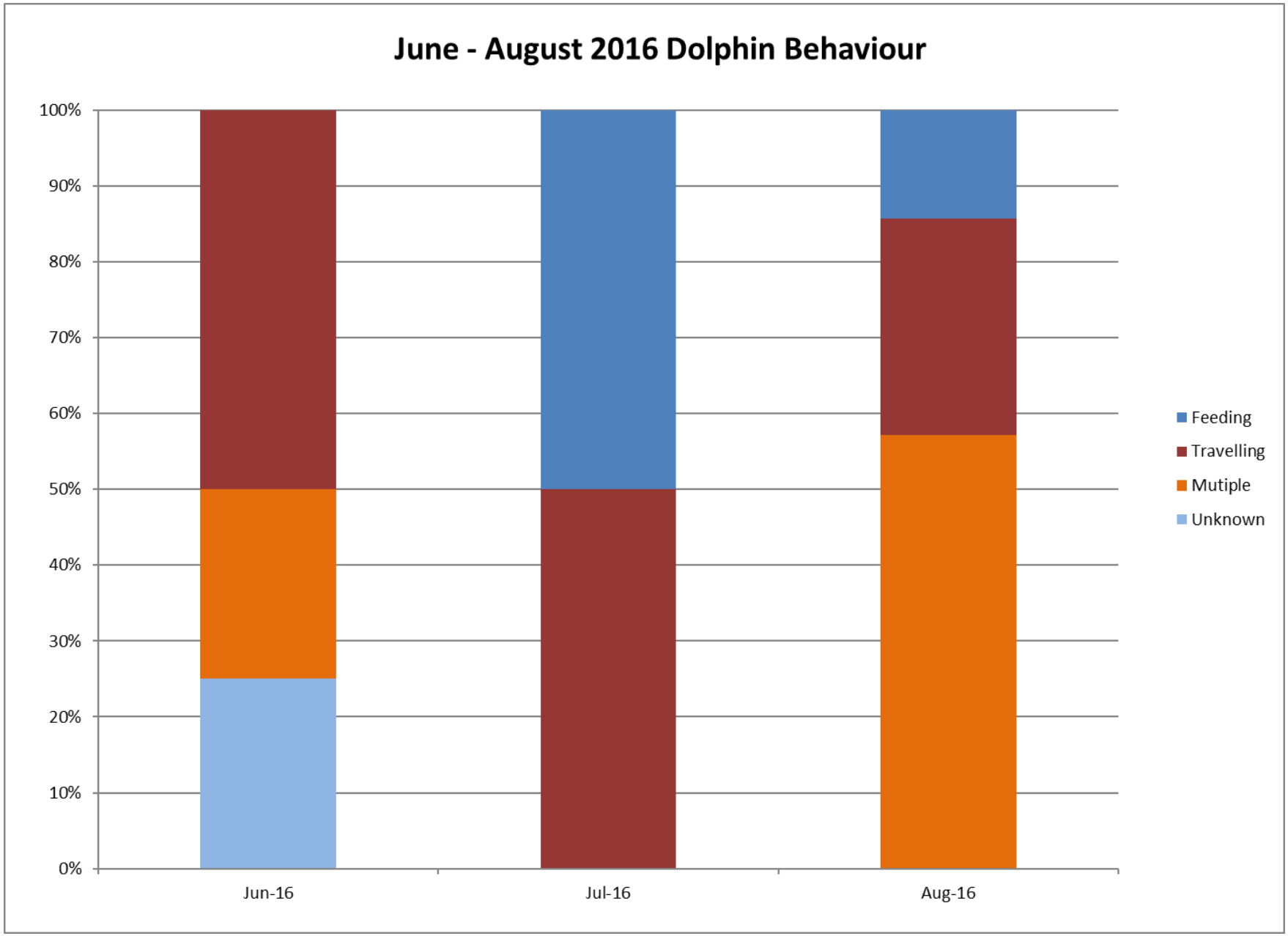

Figure 12. Activity Budget for Dolphin Behaviour June to August 2016.

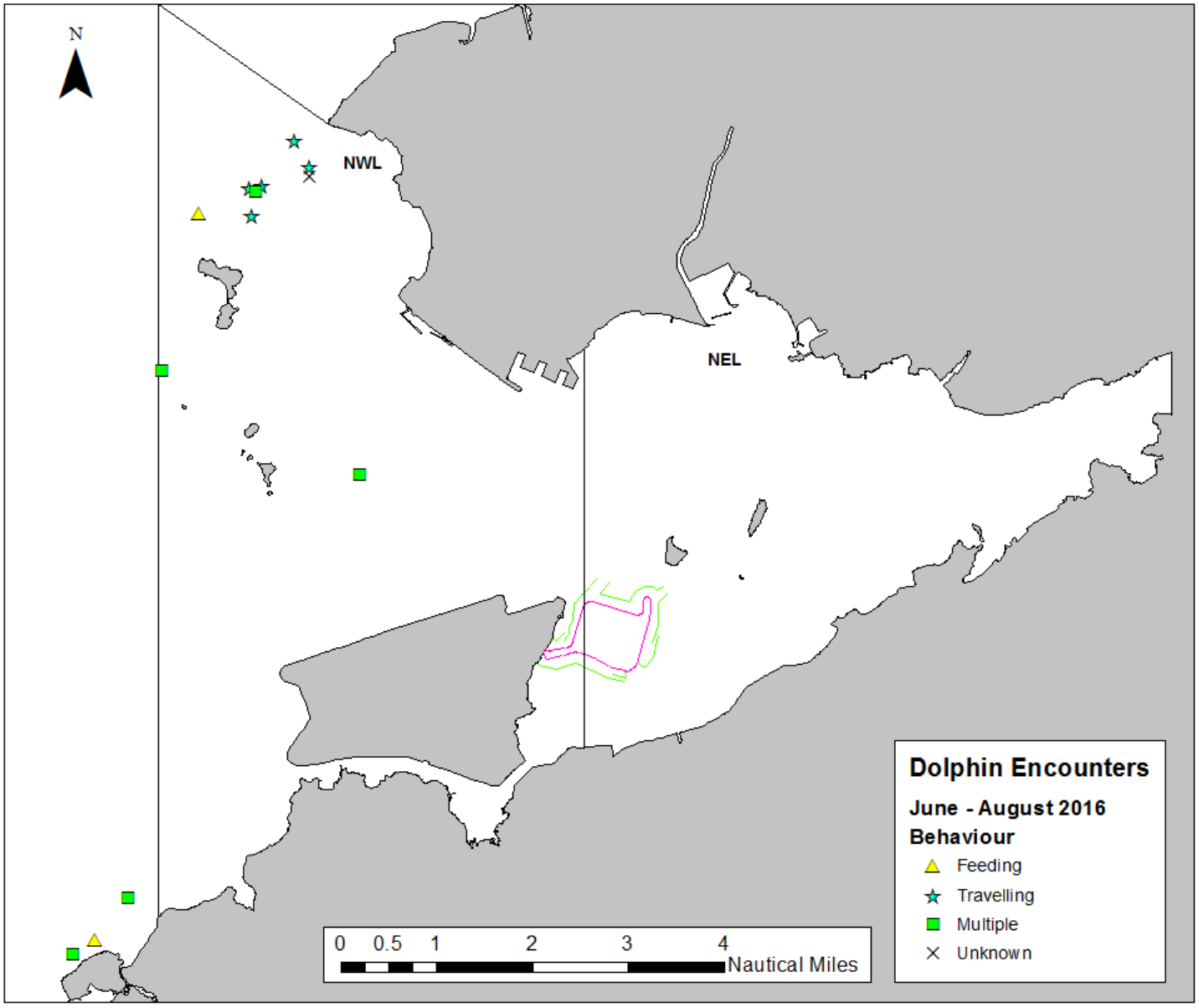

Figure 13. The Location of Different Behavioural Activities June to August 2016

Annex I. Impact Monitoring Survey Schedule and Details (June – August 2016)

Date	Location of Survey	No. Sightings ON	No. Sightings Opp	Total km ON EFFORT (favourable conditions)
06/06/2016	NWL (1-6, 21, 22)	0	1	63.6
06/07/2016	NE and NW Lantau (7-20,23)	0	0	47.3
06/20/2016	NE and NW Lantau (9-20,23)	0	0	40.3
06/21/2016	NWL (1-8, 21, 22)	2	1	70.3
07/04/2016	NWL (1-3)	0	0	34.2
07/05/2016	NE and NW Lantau (4-17,21,22)	0	0	71.0
07/06/2016	NEL (18-20)	0	0	3.6
07/18/2016	NWL (1-6, 21, 22)	1	1	62.4
07/19/2016	NE and NW Lantau (7-20,23)	0	0	46.6
08/08/2016	NWL (1-4, 21, 22)	3	1	49.9
08/09/2016	NE and NW Lantau (8-20,23)	1	0	60.6
08/29/2016	NE and NW Lantau (5-20,23)	0	0	59.8
08/30/2016	NWL (1-4, 21, 22)	2	0	49.2

Annex II. Impact Monitoring Survey Effort Summary (June – August 2016)

Date	Area	Sea State (on effort)	Effort (km)	Season	Vessel	Type
06/06/2016	NWL	1	57.2	SUMMER	HKDW	IMPACT
06/06/2016	NWL	2	6.4	SUMMER	HKDW	IMPACT
06/07/2016	NWL	1	10.2	SUMMER	HKDW	IMPACT
06/07/2016	NEL	1	34.4	SUMMER	HKDW	IMPACT
06/07/2016	NEL	2	2.7	SUMMER	HKDW	IMPACT
06/20/2016	NWL	1	3.3	SUMMER	HKDW	IMPACT
06/20/2016	NEL	1	37	SUMMER	HKDW	IMPACT
06/21/2016	NWL	1	37.5	SUMMER	HKDW	IMPACT
06/21/2016	NWL	2	8.9	SUMMER	HKDW	IMPACT
06/21/2016	NWL	3	23.9	SUMMER	HKDW	IMPACT
07/04/2016	NWL	1	0.2	SUMMER	HKDW	IMPACT
07/04/2016	NWL	2	14.7	SUMMER	HKDW	IMPACT
07/04/2016	NWL	3	16	SUMMER	HKDW	IMPACT
07/04/2016	NWL	4	3.3	SUMMER	HKDW	IMPACT
07/05/2016	NWL	2	16.5	SUMMER	HKDW	IMPACT
07/05/2016	NWL	3	21.9	SUMMER	HKDW	IMPACT
07/05/2016	NEL	1	0.8	SUMMER	HKDW	IMPACT
07/05/2016	NEL	2	16.3	SUMMER	HKDW	IMPACT
07/05/2016	NEL	3	15.5	SUMMER	HKDW	IMPACT
07/06/2016	NEL	1	3.6	SUMMER	HKDW	IMPACT
07/18/2016	NWL	1	4.5	SUMMER	HKDW	IMPACT
07/18/2016	NWL	2	31.4	SUMMER	HKDW	IMPACT
07/18/2016	NWL	3	10.7	SUMMER	HKDW	IMPACT
07/18/2016	NWL	4	15.8	SUMMER	HKDW	IMPACT
07/19/2016	NWL	2	8.1	SUMMER	HKDW	IMPACT
07/19/2016	NWL	3	1.9	SUMMER	HKDW	IMPACT
07/19/2016	NEL	1	21.2	SUMMER	HKDW	IMPACT
07/19/2016	NEL	2	11.1	SUMMER	HKDW	IMPACT
07/19/2016	NEL	3	4.3	SUMMER	HKDW	IMPACT
08/08/2016	NWL	1	33.3	SUMMER	HKDW	IMPACT
08/08/2016	NWL	2	9.5	SUMMER	HKDW	IMPACT
08/08/2016	NWL	3	7.1	SUMMER	HKDW	IMPACT
08/09/2016	NWL	1	14.2	SUMMER	HKDW	IMPACT
08/09/2016	NWL	2	9.1	SUMMER	HKDW	IMPACT
08/09/2016	NEL	1	30.1	SUMMER	HKDW	IMPACT
08/09/2016	NEL	2	7.2	SUMMER	HKDW	IMPACT
08/29/2016	NWL	1	16.9	SUMMER	HKDW	IMPACT
08/29/2016	NWL	2	6.5	SUMMER	HKDW	IMPACT
08/29/2016	NEL	1	27.5	SUMMER	HKDW	IMPACT
08/29/2016	NEL	2	8.9	SUMMER	HKDW	IMPACT
08/30/2016	NWL	1	33.6	SUMMER	HKDW	IMPACT
08/30/2016	NWL	2	15.6	SUMMER	HKDW	IMPACT

Annex III. Impact Monitoring Sighting Database (June – August 2016)

Project	Contract	Date	Sighting No.	Time	Group Size	Area	Beaufort	PSD	Effort	Type	Latitude	Longitude	Season	Boat Association
HKBCF	HY/2010/02	06-Jun-16	1261	9:30:32 AM	5	NWL	1	N/A	Opp	Impact	22.26062	113.8539	Summer	No
HKBCF	HY/2010/02	21-Jun-16	1266	11:50:57 AM	1	NWL	2	0	On	Impact	22.39666	113.8979	Summer	No
HKBCF	HY/2010/02	21-Jun-16	1267	12:04:44 PM	3	NWL	2	56	On	Impact	22.39741	113.8979	Summer	No
HKBCF	HY/2010/02	21-Jun-16	1268	12:17:29 PM	1	NWL	2	N/A	Opp	Impact	22.40294	113.8951	Summer	No
HKBCF	HY/2010/02	18-Jul-16	1276	9:18:57 AM	9	NWL	1	N/A	Opp	Impact	22.26331	113.8582	Summer	No
HKBCF	HY/2010/02	18-Jul-16	1277	1:14:48 PM	3	NWL	2	280	On	Impact	22.39455	113.8877	Summer	No
HKBCF	HY/2010/02	08-Aug-16	1283	9:45:00 AM	6	NWL	1	N/A	Opp	Impact	22.2705	113.8642	Summer	No
HKBCF	HY/2010/02	08-Aug-16	1287	10:56:20 AM	4	NWL	1	450	On	Impact	22.36256	113.8703	Summer	No
HKBCF	HY/2010/02	08-Aug-16	1288	1:59:44 PM	2	NWL	1	22	On	Impact	22.39436	113.8879	Summer	No
HKBCF	HY/2010/02	08-Aug-16	1289	2:33:36 PM	1	NWL	1	14	On	Impact	22.38967	113.8871	Summer	No
HKBCF	HY/2010/02	09-Aug-16	1291	9:32:46 AM	1	NWL	1	67	On	Impact	22.34464	113.9074	Summer	No
HKBCF	HY/2010/02	30-Aug-16	1298	12:42:29 PM	8	NWL	2	215	On	Impact	22.39416	113.8875	Summer	No
HKBCF	HY/2010/02	30-Aug-16	1299	3:06:47 PM	4	NWL	1	235	On	Impact	22.3901	113.8774	Summer	No

Annex IV

March 2012– August 2016

(and Baseline September – November 2011)

Photo Identification Information

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 134		2016/05/23	1251	NWL
HZMB 132		2016/05/23	1244	NWL
HZMB 131		2016/03/22	1215	NWL
HZMB 130		2016/02/04	1199	NWL
HZMB 129		2016/01/07	1189	NWL
		2015/10/22	1156	NWL
		2015/09/07	1143	NWL
		2015/08/25	1138	NWL
HZMB 128		2015/01/03	1056	NWL
HZMB 127		2015/01/03	1056	NWL
HZMB 126		2016/05/23	1244	NWL
		2015/02/23	1068	NWL
		2015/01/03	1054	NWL
HZMB 125		2016/05/23	1249	NWL
		2016/03/07	1208	NWL
		2014/10/13	1019	NWL
HZMB 124		2014/09/22	1005	NWL
HZMB 123		2014/08/25	998	NWL
HZMB 122		2015/10/22	1156	NWL
		2014/08/04	989	NWL
HZMB 121		2016/07/18	1276	NWL
		2014/07/14	968	NWL
HZMB 120		2014/05/31	951	NWL
HZMB 119		2014/04/19	940	NWL
HZMB 118		2014/01/06	890	NWL
HZMB 117		2014/06/17	964	NWL
		2014/01/06	888	NWL
HZMB 116		2014/08/25	999	NWL
HZMB 115		2014/07/14	972	NWL
		2014/07/14	971	NWL
		2013/12/26	879	NWL
		2013/12/26	879	NWL
HZMB 114		2016/06/06	1261	NWL
		2015/11/05	1162	NWL
		2013/10/24	827	NWL
HZMB 113		2013/10/24	827	NWL
HZMB 112		2013/10/15	815	NWL
HZMB 111		2013/10/15	815	NWL
HZMB 110		2016/01/18	1193	NWL
		2013/10/15	812	NWL
HZMB 108		2015/06/11	1118	NWL
		2013/08/30	780	NEL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 107		2015/07/28	1126	NWL
		2014/10/13	1019	NWL
		2014/05/31	951	NWL
		2013/08/21	770	NWL
HZMB 106		2013/08/21	769	NWL
HZMB 105		2014/05/31	951	NWL
		2013/07/08	711	NWL
HZMB 104		2013/07/08	711	NWL
HZMB 103		2013/07/08	711	NWL
HZMB 102		2013/07/08	706	NWL
HZMB 101		2013/07/08	706	NWL
HZMB 100		2013/07/08	706	NWL
HZMB 099		2013/06/13	681	NWL
		2013/06/13	680	NWL
HZMB 098	NL104	2015/02/23	1077	NWL
		2014/12/18	1044	NWL
		2014/08/04	992	NWL
		2014/01/06	888	NWL
		2013/11/02	849	NWL
		2013/11/02	845	NWL
		2013/10/24	831	NWL
		2013/07/08	711	NWL
		2013/05/24	659	NWL
		2011/11/07	Baseline	NWL
		2011/11/05	Baseline	NWL
		2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/10/28	Baseline	NWL
		2011/09/23	Baseline	NWL
		2011/09/16	Baseline	NWL
HZMB 097		2013/05/09	647	NWL
HZMB 096		2013/04/01	621	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 095		2013/08/30	780	NEL
		2013/06/25	697	NWL
		2013/06/13	682	NWL
		2013/04/01	621	NWL
HZMB 094		2016/08/30	1299	NWL
		2014/10/13	1019	NWL
		2014/05/31	954	NWL
		2014/02/17	910	NWL
		2013/06/26	703	NWL
		2013/06/25	698	NWL
		2013/03/18	601	NWL
HZMB 093		2013/05/24	657	NWL
		2013/02/21	587	NWL
HZMB 092		2015/04/20	1097	NWL
		2013/02/21	589	NWL
		2013/02/15	581	NWL
HZMB 091		2013/02/15	579	NWL
HZMB 090		2013/06/25	697	NWL
		2013/06/13	682	NWL
		2013/02/15	579	NWL
HZMB 089		2013/02/15	579	NWL
HZMB 088		2013/02/15	579	NWL
HZMB 087		2013/02/15	579	NWL
HZMB 086	NL242	2015/03/19	1086	NWL
		2013/05/09	642	NWL
		2013/02/15	579	NWL
		2011/10/10	Baseline	NWL
HZMB 085		2014/10/13	1019	NWL
		2014/05/31	954	NWL
HZMB 084		2013/06/26	703	NWL
		2013/02/15	579	NWL
		2013/02/14	575	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 083	NL136	2016/08/30	1298	NWL
		2015/12/01	1180	NWL
		2015/05/11	1104	NWL
		2013/12/19	863	NWL
		2013/03/28	607	NWL
		2013/02/15	579	NWL
		2013/01/28	568	NWL
		2013/01/28	564	NWL
		2012/04/19	267	NWL
		2011/10/28	Baseline	NWL
		2011/10/28	Baseline	NWL
		2011/10/10	Baseline	NEL
		2011/09/06	Baseline	NWL
HZMB 082		2014/10/20	1024	NWL
		2013/02/21	587	NWL
		2013/02/15	579	NWL
		2013/01/28	563	NWL
HZMB 081		2013/01/28	559	NWL
		2013/01/28	557	NWL
HZMB 080		2013/01/28	556	NWL
HZMB 079		2013/01/28	556	NWL
HZMB 078		2013/02/15	579	NWL
		2013/01/08	552	NWL
HZMB 077		2013/12/26	878	NWL
		2013/07/08	706	NWL
		2012/12/11	541	NWL
HZMB 076		2013/07/08	706	NWL
		2012/12/11	541	NWL
HZMB 075		2012/12/06	525	NEL
HZMB 074		2013/05/09	647	NWL
		2013/04/01	623	NWL
		2013/04/01	621	NWL
		2013/02/21	594	NEL
		2012/12/10	529	NEL
		2012/12/06	525	NEL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 073		2013/05/09	647	NWL
		2013/04/01	623	NWL
		2013/04/01	621	NWL
		2013/02/21	594	NEL
		2012/12/10	529	NEL
		2012/12/06	525	NEL
HZMB 072		2012/10/24	476	NWL
HZMB 071		2012/10/24	475	NWL
		2012/10/12	466	NWL
HZMB 070		2012/10/24	476	NWL
HZMB 069		2015/06/04	1116	NWL
		2013/08/21	774	NWL
		2013/07/08	711	NWL
		2012/10/24	476	NWL
HZMB 068		2014/10/20	1025	NWL
		2013/11/01	839	NWL
		2012/10/24	476	NWL
HZMB 067		2012/10/24	475	NWL
HZMB 066	NL93	2013/01/28	559	NWL
		2012/12/11	537	NWL
		2012/10/24	475	NWL
		2012/10/12	466	NWL
		2011/11/07	Baseline	NWL
		2011/11/05	Baseline	NWL
HZMB 064		2015/03/19	1086	NWL
		2014/06/17	964	NWL
		2013/05/09	647	NWL
		2013/01/28	561	NWL
		2012/10/24	475	NWL
		2012/10/12	466	NWL
HZMB 063		2013/05/09	647	NWL
		2012/10/12	466	NWL
HZMB 062		2012/12/06	525	NEL
		2012/10/11	457	NWL
HZMB 060		2012/09/18	447	NWL
HZMB 059		2013/02/21	591	NWL
		2012/09/18	445	NWL
HZMB 057		2012/09/18	440	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 056		2012/09/18	442	NWL
		2012/09/05	433	NEL
HZMB 055		2012/09/04	425	NWL
HZMB 054	CH34	2016/05/12	1238	NWL
		2015/12/01	1180	NWL
		2015/04/20	1097	NWL
		2015/01/15	1062	NWL
		2014/05/31	953	NWL
		2014/01/06	888	NWL
		2013/11/07	854	NWL
		2013/11/02	845	NWL
		2013/10/24	831	NWL
		2013/08/30	780	NEL
		2013/07/08	711	NWL
		2013/09/18	448	NWL
		2012/09/05	432	NEL
		2011/11/07	Baseline	NWL
		2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/11/01	Baseline	NEL
		2011/11/01	Baseline	NEL
		2011/10/28	Baseline	NWL
		2011/10/06	Baseline	NWL
HZMB 053		2012/09/04	425	NWL
HZMB 052		2012/09/04	423	NWL
HZMB 051	NL213	2015/05/11	1104	NWL
		2014/08/04	989	NWL
		2013/05/09	644	NWL
		2013/04/01	622	NWL
		2013/02/15	582	NWL
		2013/02/15	581	NWL
		2013/01/28	559	NWL
		2013/01/28	556	NWL
		2012/09/04	422	NWL
HZMB 050		2014/07/14	971	NWL
		2014/01/10	900	NWL
		2014/01/06	888	NWL
		2013/02/15	579	NWL
		2012/09/04	421	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 049		2015/10/09	1151	NWL
		2014/07/29	982	NWL
		2012/09/03	419	NWL
HZMB 048		2012/09/03	419	NWL
HZMB 047		2015/04/28	1100	NWL
		2012/09/03	412	NWL
HZMB 046		2012/09/03	412	NWL
HZMB 045		2016/05/23	1249	NWL
		2014/02/17	910	NWL
		2013/06/13	682	NWL
		2013/02/15	579	NWL
		2012/11/01	495	NWL
HZMB 044	NL98	2016/05/23	1247	NWL
		2016/01/18	1194	NWL
		2014/10/13	1019	NWL
		2014/02/17	910	NWL
		2013/12/19	864	NWL
		2013/11/02	845	NWL
		2013/11/01	842	NWL
		2013/10/15	819	NWL
		2013/05/09	648	NWL
		2013/05/09	647	NWL
		2013/04/01	623	NWL
		2013/04/01	621	NWL
		2013/02/15	579	NWL
		2012/11/01	495	NWL
		2011/11/07	Baseline	NWL
		2011/11/06	Baseline	NEL
		2011/11/01	Baseline	NEL
		2011/10/06	Baseline	NEL
HZMB 043		2012/09/03	407	NWL
HZMB 042	NL260	2015/10/22	1156	NWL
		2013/12/19	863	NWL
		2012/11/01	495	NWL
		2011/11/07	Baseline	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 041	NL24	2014/06/05	960	NEL
		2014/02/17	910	NWL
		2013/11/02	845	NWL
		2013/05/09	648	NWL
		2013/05/09	647	NWL
		2013/04/01	623	NWL
		2013/04/01	621	NWL
		2013/02/15	579	NWL
		2012/11/01	495	NWL
		2011/11/06	Baseline	NEL
		2011/11/05	Baseline	NWL
		2011/11/05	Baseline	NWL
		2011/10/10	Baseline	NWL
HZMB 040		2014/02/17	910	NWL
		2014/01/06	893	NWL
		2013/10/15	821	NWL
		2013/07/08	714	NWL
		2013/07/08	711	NWL
		2013/02/21	589	NWL
		2012/11/01	493	NWL
HZMB 038		2016/05/23	1246	NWL
		2012/11/01	490	NWL
HZMB 037		2012/11/01	490	NWL
HZMB 036		2012/09/03	407	NWL
		2012/11/01	490	NWL
HZMB 035		2013/02/15	579	NWL
		2012/11/01	490	NWL
HZMB 034		2012/11/01	493	NWL
HZMB 028		2014/11/17	1035	NWL
		2013/04/01	625	NWL
		2012/08/06	373	NWL
HZMB 027		2013/12/19	863	NWL
		2013/02/15	579	NWL
		2013/01/28	568	NWL
		2013/01/28	564	NWL
		2012/06/14	299	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 026		2014/10/13	1018	NWL
		2013/06/25	697	NWL
		2013/05/09	642	NWL
		2013/01/28	561	NWL
		2012/06/13	295	NEL
HZMB 025		2013/02/22	596	NEL
		2013/02/21	591	NWL
		2012/12/06	525	NEL
		2012/10/11	457	NWL
		2012/06/13	295	NEL
HZMB 024		2013/03/18	601	NWL
		2012/06/13	295	NEL
HZMB 023		2015/10/09	1153	NWL
		2015/10/09	1152	NWL
		2015/04/20	1097	NWL
		2014/12/18	1044	NWL
		2014/11/17	1035	NWL
		2014/01/06	888	NWL
		2013/07/08	715	NWL
		2013/07/08	711	NWL
		2013/04/01	619	NWL
		2013/02/21	589	NWL
		2013/02/15	579	NWL
		2012/07/10	330	NWL
HZMB 022		2016/04/21	1219	NWL
		2015/09/07	1143	NWL
		2015/04/20	1097	NWL
		2014/12/18	1044	NWL
		2014/11/17	1035	NWL
		2014/08/04	991	NWL
		2014/01/06	888	NWL
		2013/10/24	827	NWL
		2013/07/08	715	NWL
		2013/07/08	711	NWL
		2013/04/01	619	NWL
		2013/02/21	589	NWL
		2013/02/15	579	NWL
		2012/07/10	330	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 021	NL37	2016/03/22	1215	NWL
		2012/07/10	330	NWL
		2011/09/16	Baseline	NWL
HZMB 020		2012/07/10	330	NWL
HZMB 019		2012/07/10	330	NWL
HZMB 018		2014/02/17	910	NWL
		2013/05/09	647	NWL
		2013/02/21	594	NEL
		2012/12/10	529	NEL
		2012/07/10	330	NWL
HZMB 017		2012/07/10	330	NWL
HZMB 016		2013/07/08	706	NWL
		2012/12/11	539	NWL
		2012/09/18	446	NWL
		2012/09/04	421	NWL
		2012/07/10	330	NWL
HZMB 015		2012/07/10	330	NEL
HZMB 014	NL176	2015/08/25	1139	NWL
		2013/12/26	880	NWL
		2012/08/06	373	NWL
		2012/06/13	295	NEL
		2011/11/06	Baseline	NEL
		2011/11/01	Baseline	NEL
		2011/11/01	Baseline	NEL
HZMB 013		2012/05/28	281	NWL
HZMB 012		2012/05/28	281	NWL
HZMB 011	EL01	2013/02/22	597	NEL
		2013/02/21	592	NEL
		2013/02/14	572	NEL
		2012/11/06	517	NEL
		2012/09/19	452	NWL
		2012/03/31	261	NEL
		2011/11/02	Baseline	NWL
		2011/11/01	Baseline	NEL
HZMB 009		2015/03/19	1084	NWL
		2012/05/28	281	NWL
HZMB 008		2015/07/06	1122	NWL
		2012/05/28	281	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 007	NL246	2012/12/10	529	NEL
		2011/11/06	Baseline	NEL
		2011/09/16	Baseline	NWL
HZMB 006		2015/10/22	1158	NWL
		2013/02/21	594	NEL
		2012/12/11	539	NWL
		2012/11/01	495	NWL
		2012/03/29	250	NWL
HZMB 005		2015/02/09	1070	NWL
		2015/02/09	1069	NWL
		2013/11/09	860	NWL
		2013/11/07	858	NWL
		2013/10/15	813	NWL
		2012/12/10	532	NWL
		2012/08/06	374	NWL
		2012/05/28	287	NWL
HZMB 004		2015/07/28	1126	NWL
		2012/09/04	421	NWL
		2012/03/31	262	NWL
HZMB 003	NL179	2013/10/15	812	NWL
		2013/06/25	697	NWL
		2012/12/10	529	NEL
		2012/03/31	261	NWL
		2011/11/06	Baseline	NEL
		2011/09/16	Baseline	NWL
HZMB 002	WL111	2014/05/31	951	NWL
		2013/12/26	878	NWL
		2013/12/19	863	NWL
		2013/11/01	839	NWL
		2013/10/15	819	NWL
		2013/09/24	798	NWL
		2013/02/14	573	NWL
		2012/12/11	536	NWL
		2012/12/11	535	NWL
		2012/10/12	466	NWL
		2012/10/24	475	NWL
		2012/05/28	281	NWL
		2012/03/29	250	NWL
		2011/11/02	Baseline	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
HZMB 001	WL46	2016/07/18	1276	NWL
		2016/05/23	1251	NWL
		2014/08/25	997	NWL
		2013/08/21	771	NWL
		2013/06/13	681	NWL
		2013/04/01	617	NWL
		2013/02/14	573	NWL
		2012/03/29	250	NWL
	CH98	2011/11/02	Baseline	NWL
	NL11	2011/11/02	Baseline	NWL
		2011/11/07	Baseline	NWL
	NL12	2011/11/02	Baseline	NWL
	NL33	2011/09/23	Baseline	NWL
		2011/11/01	Baseline	NEL
		2011/11/05	Baseline	NWL
		2011/11/07	Baseline	NWL
	NL46	2011/10/28	Baseline	NWL
	CH153	2011/10/11	Baseline	NWL
	NL48	2001/11/07	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/09/16	Baseline	NWL
	NL75	2011/09/16	Baseline	NWL
		2011/09/16	Baseline	NWL
		2011/11/01	Baseline	NEL
	NL80	2011/11/02	Baseline	NWL
	NL118	2011/09/06	Baseline	NWL
	NL120	2011/11/06	Baseline	NEL
		2011/10/10	Baseline	NWL
	NL123	2011/11/06	Baseline	NEL
		2011/10/10	Baseline	NWL
		2011/10/06	Baseline	NWL
	NL139	2011/11/01	Baseline	NEL
		2011/10/10	Baseline	NEL
		2011/09/16	Baseline	NWL
	NL165	2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
	NL170	2011/10/06	Baseline	NEL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
	NL188	2011/11/07	Baseline	NWL
		2011/11/01	Baseline	NWL
		2011/10/28	Baseline	NWL
	NL191	2011/09/07	Baseline	NWL
	NL202	2011/11/07	Baseline	NWL
		2011/10/28	Baseline	NWL
	NL210	2011/11/07	Baseline	NWL
		2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/09/07	Baseline	NWL
	NL214	2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/10/28	Baseline	NWL
	NL220	2011/10/10	Baseline	NEL
	NL224	2011/10/28	Baseline	NWL
	NL226	2011/11/05	Baseline	NWL
		2011/10/17	Baseline	WL
	NL230	2011/11/02	Baseline	NWL
		2011/10/17	Baseline	WL
	NL233	2011/10/28	Baseline	NWL
		2011/10/06	Baseline	NWL
		2011/09/16	Baseline	NWL
	NL241	2011/11/07	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/09/16	Baseline	NWL
	NL244	2011/11/01	Baseline	NEL
		2011/11/01	Baseline	NWL
		2011/09/05	Baseline	WL
	NL256	2011/11/02	Baseline	NWL
	NL258	2011/09/16	Baseline	NWL
		2011/09/05	Baseline	WL
	NL259	2011/11/07	Baseline	NWL
	NL261	2011/11/01	Baseline	NEL
	NL264	2011/11/06	Baseline	NEL
		2011/10/06	Baseline	NEL
		2011/09/23	Baseline	NWL
	NL269	2011/11/02	Baseline	NWL

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
	NL272	2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/10/28	Baseline	NWL
		2011/09/16	Baseline	NWL
	NL278	2011/11/02	Baseline	NWL
	NL279	2011/11/02	Baseline	NWL
	SL42	2011/11/02	Baseline	NWL
	SL43	2011/10/28	Baseline	NWL
	WL04	2011/11/05	Baseline	NWL
		2011/11/02	Baseline	NWL
		2011/10/17	Baseline	WL
		2011/10/10	Baseline	NWL
		2011/09/16	Baseline	NWL
	WL05	2011/11/01	Baseline	NEL
		2011/11/01	Baseline	NEL
	WL11	2011/11/07	Baseline	NWL
	WL25	2011/10/17	Baseline	WL
		2011/09/23	Baseline	WL
		2011/09/16	Baseline	NWL
	WL88	2011/11/02	Baseline	WL
		2011/09/16	Baseline	NWL
	WL116	2011/09/16	Baseline	NWL
	WL124	2011/11/02	Baseline	NWL
	WL156	2011/10/28	Baseline	NWL
		2011/09/23	Baseline	WL
	WL162	2011/09/16	Baseline	NWL
	NL275	*2011/09/23*	*Baseline*	*WL*
	SL48	*2011/11/02*	*Baseline*	*WL*
		2011/10/17	*Baseline*	*WL*
		2011/09/23	*Baseline*	*WL*
	CH108	*2011/11/02*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
	CH157	*2011/11/02*	*Baseline*	*WL*
	NL206	*2011/10/07*	*Baseline*	*WL*
	WL28	*2011/09/23*	*Baseline*	*WL*
	WL42	*2011/11/02*	*Baseline*	*WL*
		2011/09/05	*Baseline*	*WL*
	WL47	*2011/10/17*	*Baseline*	*WL*

Identification Number	Baseline Identification Number	Date (YYYY-MM-DD)	Sighting Number	Area Sighted
	WL61	*2011/10/17*	*Baseline*	*WL*
		2011/09/23	*Baseline*	*WL*
	WL66	*2011/11/07*	*Baseline*	*WL*
	WL68	*2011/09/05*	*Baseline*	*WL*
		2011/09/05	*Baseline*	*WL*
	WL72	*2011/11/02*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
		2011/09/23	*Baseline*	*WL*
	WL87	*2011/09/23*	*Baseline*	*WL*
	WL88	*2011/11/02*	*Baseline*	*WL*
		2011/09/16	*Baseline*	*WL*
	WL116	*2011/09/16*	*Baseline*	*WL*
	WL118	*2011/11/02*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
	WL123	*2011/11/02*	*Baseline*	*WL*
	WL124	*2011/11/02*	*Baseline*	*WL*
	WL128	*2011/11/07*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
	WL131	*2011/11/02*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
		2011/09/23	*Baseline*	*WL*
	WL132	*2011/09/23*	*Baseline*	*WL*
	WL137	*2011/11/02*	*Baseline*	*WL*
	WL138	*2011/11/02*	*Baseline*	*WL*
	WL144	*2011/11/02*	*Baseline*	*WL*
	WL145	*2011/09/05*	*Baseline*	*WL*
	WL146	*2011/10/17*	*Baseline*	*WL*
	WL153	*2011/11/07*	*Baseline*	*WL*
	WL157	*2011/09/23*	*Baseline*	*WL*
	WL158	*2011/09/23*	*Baseline*	*WL*
	WL163	*2011/11/07*	*Baseline*	*WL*
		2011/11/02	*Baseline*	*WL*
	WL165	*2011/10/17*	*Baseline*	*WL*
	WL167	*2011/10/17*	*Baseline*	*WL*
	WL170	*2011/11/07*	*Baseline*	*WL*
	WL171	*2011/10/28*	*Baseline*	*WL*

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HZMB 001 2012-03-18_11-07-00

HZMB 002 2012-03-18_10-53-38

HZMB 002 2013-02-14_15-41-58_02

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HZMB 003 2012-12-10_11-20-34_02

HZMB 004 2012-03-18_10-54-28_01

HZMB 004 2012-09-04_09-24-54

HZMB 005 2012-03-18_10-51-26_01

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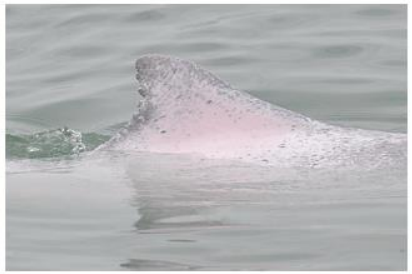

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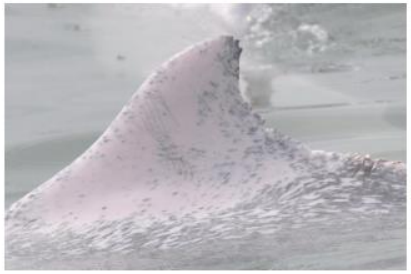

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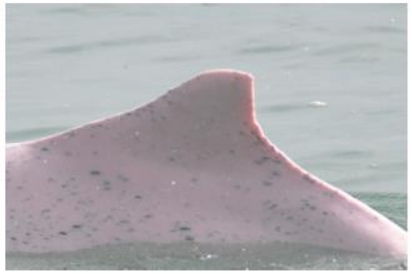

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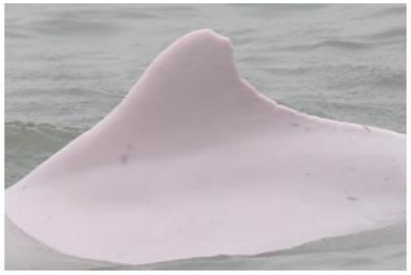

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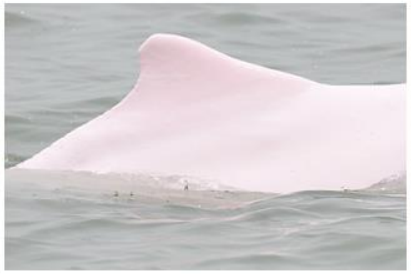

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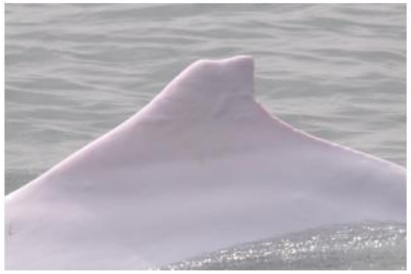

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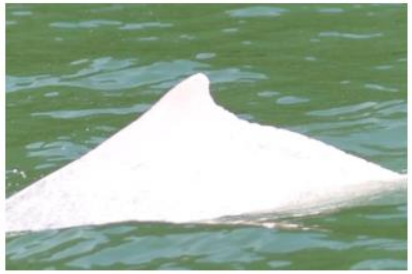

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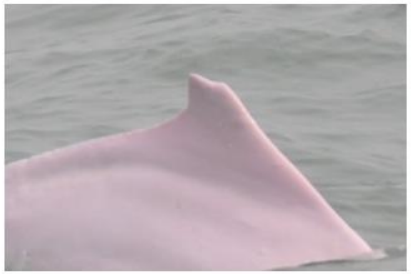

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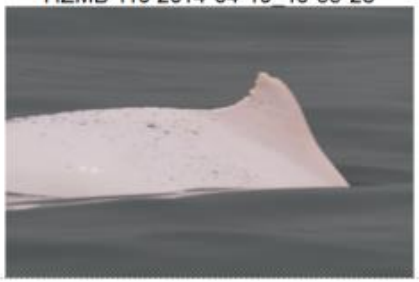

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China Harbour Engineering Company Limited

Monthly Summary Waste Flow Table for September / 2016 (year)

Project : Hong Kong – Zhuhai – Macao Bridge, Hong Kong Boundary Crossing Facilities – Reclamation Works Contract No.: HY/2010/02

Month	Actual Quantities of Inert C&D Materials Generated Monthly							Actual Quantities of C&D Wastes Generated Monthly				
	Total Quantity Generated	Hard Rock and Large Broken Concrete (see Note 1)	Reused in the Contract	Reused in other Projects (see Note 5)	Surplus Surcharge exported to Macau (see Note 5)	Disposed as Public Fill	Imported Fill	Metals	Paper/ cardboard packaging	Plastics (see Note 2)	Chemical Waste (see Note 4)	Others, e.g. general refuse (see Note 3)
	(in '000m^3)	(in '000m^3)	(in '000m^3)	(in '000m^3)	(in '000m^3)	(in '000m^3)	(in '000m^3)	(in '000 kg)	(in '000kg)	(in '000kg)	(in '000kg)	(in '000 m^3)
Jan-16	0.0000	0.0000	0.0000	3.0720	0.0000	0.0000	52.4729	0.0000	0.2520	0.0000	0.8000	0.0520
Feb-16	0.0000	0.0000	0.0000	6.3366	0.0000	0.0000	6.1333	0.0000	0.0000	6.0800	0.0000	0.0520
Mar-16	0.0000	0.0000	0.0000	56.1071	0.0000	0.0000	38.3187	0.0000	0.3080	0.0000	0.0000	0.0520
Apr-16	0.0000	0.0000	0.0000	47.2724	3.5710	0.0000	18.7380	0.0000	0.2240	0.0000	0.0000	0.3662
May-16	0.0000	0.0000	0.0000	24.8600	93.8100	0.0000	45.2723	0.0000	0.0000	0.0000	0.0000	0.0715
Jun-16	0.0000	0.1560	0.0000	29.1938	96.1830	0.0000	27.8820	0.0000	0.0000	0.0000	0.0000	0.0650
Sub-total	0.0000	0.1560	0.0000	166.8419	193.5640	0.0000	188.8172	0.0000	0.7840	6.0800	0.8000	0.6587
Jul-16	0.0000	0.0000	0.0000	35.1267	137.7494	0.0000	54.3087	0.0000	0.4200	0.0000	0.0000	0.0715
Aug-16	0.0000	0.0000	0.0000	32.4387	305.9248	0.0000	18.9587	0.0000	0.0000	0.0000	0.0000	0.0455
Sep-16												
Oct-16												
Nov-16												
Dec-16												

Notes: (1) Broken concrete for recycling into aggregates.

(2) Plastics refer to plastic bottles / containers / sheets / foam / barrier from packaging materials.

(3) Use the conversion factor : 1 full load of dumping truck being equivalent to 6.5m^3 by volume.

(4) Chemical waste refer to spent “battery” and “oil with water”.

(5) Subject to be revised.

Appendix J
Cumulative Statistics on Exceedances, Complaints, Notifications of Summons and Successful Prosecutions

Cumulative statistics on Exceedances

		Total no. recorded in this month	Total no. recorded since project commencement
1-Hour TSP	Action	-	-
	Limit	-	-
24-Hour TSP	Action	-	-
	Limit	-	-
Noise	Action	-	-
	Limit	-	-
Water Quality	Action	-	2
	Limit	-	3
Dolphin Monitoring	Action	-	-
	Limit	-	-

Remarks: Exceedances which are not project-related are not presented in this table.

Cumulative statistics on Complaints, Notifications of Summons and Successful Prosecutions

	Date Received	Subject	Status	Total no. received in this month	Total no. received since project commencement
Environmental complaints	16 July 2016	A complaint about marine litter near Tuen Mun Ferry Pier was received on 16 Jul 2016, 9:19am. The complainant complained that pollution was observed at Tuen Mun Ferry Pier and queried whether the pollutant came from the construction sites of the Lantau area or bridge construction. After investigation, it is considered the marine litter floating near the Tuen Mun Ferry Pier is	Closed	1	36

		unlikely to be related to this Contract.			
Notification of summons	-	-	-	-	2
Successful Prosecutions	-	-	-	-	2

Appendix K – Event Action Plan

Event / Action Plan for Air Quality

Event	Action			
	ET Leader	IEC	ER	Contractor
Action Level				
Exceedance for one sample	1. Identify source, investigate the causes of exceedance and propose remedial measures; 2. Inform IEC and ER; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method.	1. Notify Contractor.	1. Rectify any unacceptable practice; 2. Amend working methods if appropriate.
Exceedance for two or more consecutive samples	1. Identify source; 2. Inform IEC and ER; 3. Advise the ER on the effectiveness of the proposed remedial measures; 4. Repeat measurements to confirm findings; 5. Increase monitoring frequency to daily; 6. Discuss with IEC and Contractor on remedial actions required; 7. If exceedance continues, arrange meeting with IEC and ER; 8. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise the ER on the effectiveness of the proposed remedial measures; 5. Supervise Implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented.	1. Submit proposals for remedial to ER within 3 working days of notification; 2. Implement the agreed proposals; 3. Amend proposal if appropriate.

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Limit Level				
Exceedance for one sample	1. Identify source, investigate the causes of exceedance and propose remedial measures; 2. Inform ER, Contractor and EPD; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; 5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise the ER on the effectiveness of the proposed remedial measures; 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within 3 working days of notification; 3. Implement the agreed proposals; 4. Amend proposal if appropriate.

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Exceedance for two or more consecutive samples	1. Notify IEC, ER, Contractor and EPD; 2. Identify source; 3. Repeat measurement to confirm findings; 4. Increase monitoring frequency to daily; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Arrange meeting with IEC and ER to discuss the remedial actions to be taken; 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst ER, ET, and Contractor on the potential remedial actions; 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented; 4. Ensure remedial measures properly implemented; 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within 3 working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not under control; 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

Event / Action Plan for Construction Noise

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Action Level	1. Notify IEC and Contractor; 2. Identify source, investigate the causes of exceedance and propose remedial measures; 3. Report the results of investigation to the IEC, ER and Contractor; 4. Discuss with the Contractor and formulate remedial measures; 5. Increase monitoring frequency to check mitigation effectiveness.	1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure remedial measures are properly implemented.	1. Submit noise mitigation proposals to IEC; 2. Implement noise mitigation proposals.
Limit Level	1. Inform IEC, ER, EPD and Contractor; 2. Identify source; 3. Repeat measurements to confirm findings; 4. Increase monitoring frequency; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Inform IEC, ER and EPD the causes and actions taken for the exceedances; 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst ER, ET, and Contractor on the potential remedial actions; 2. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure remedial measures properly implemented; 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within 3 working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not under control; 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

Event / Action Plan for Water Quality

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Action level being exceeded by one sampling day	1. Repeat *in situ* measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor and ER; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Repeat measurement on next day of exceedance to confirm findings.	1. Check monitoring data submitted by ET and Contractor's working methods; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; 4. Assess the effectiveness of the implemented mitigation measures.	1. Confirm receipt of notification of non-compliance in writing; 2. Discuss with IEC on the proposed mitigation measures; 3. Make agreement on mitigation measures to be implemented; 4. Ensure mitigation measures are properly implemented.	1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Discuss with ET and IEC on possible remedial actions and propose mitigation measures to IEC and ER; 5. Implement the agreed mitigation measures. 6. Amend working methods if appropriate.

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Action level being exceeded by two or more consecutive sampling days	1. Repeat *in situ* measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, Contractor and ER; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Action level; 8. Repeat measurement on next day of exceedance to confirm findings.	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; 4. Assess the effectiveness of the implemented mitigation measures.	1. Confirm receipt of notification of non-compliance in writing; 2. Discuss with IEC on the proposed mitigation measures; 3. Make agreement on mitigation measures to be implemented; 4. Ensure mitigation measures are properly implemented; 5. Assess the effectiveness of the implemented mitigation measures.	1. Inform the Engineer and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Discuss with ET and IEC on possible remedial actions and propose mitigation measures to IEC and ER within 3 working days of notification; 5. Implement the agreed mitigation measures; 6. Amend working methods if appropriate.

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Limit level being exceeded by one sampling day	1. Repeat *in-situ* measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, Contractor, ER and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level.	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; 4. Assess the effectiveness of the implemented mitigation measures.	1. Confirm receipt of notification of failure in writing; 2. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 3. Request Contractor to critically review the working methods; 4. Ensure mitigation measures are properly implemented; 5. Assess the effectiveness of the implemented mitigation measures.	1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER; 5. Implement the agreed mitigation measures; 6. Amend working methods if appropriate.

Event	Action			
	ET Leader	**IEC**	**ER**	**Contractor**
Limit level being exceeded by two or more consecutive sampling days	1. Repeat *in-situ* measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, ER and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the Contractor's mitigation measures whenever necessary to assure their effectiveness and advise the ER accordingly.	1. Confirm receipt of notification of failure in writing; 2. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 3. Request Contractor to critically review the working methods; 4. Make agreement on the mitigation measures to be implemented; 5. Ensure mitigation measures are properly implemented; 6. Assess the effectiveness of the implemented mitigation measures; 7. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.	1. Inform the ER and confirm notification of the non-compliance in writing; 2. Take immediate action to avoid further exceedance; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER; 6. Implement the agreed mitigation measures; 7. Resubmit proposals of mitigation measures if problem still not under control; 8. As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.

Event / Action Plan for Dolphin Monitoring

Event	ET Leader	IEC	ER / SOR	Contractor
Action Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences; 3. Identify source(s) of impact; 4. Inform the IEC, ER/SOR and Contractor; 5. Check monitoring data. 6. Review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary.	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and finding with the ET and the Contractor.	1. Discuss monitoring with the IEC and any other measures proposed by the ET; 2. If ER/SOR is satisfied with the proposal of any other measures, ER/SOR to signify the agreement in writing on the measures to be implemented.	1. Inform the ER/SOR and confirm notification of the non-compliance in writing; 2. Discuss with the ET and the IEC and propose measures to the IEC and the ER/SOR; 3. Implement the agreed measures.
Limit Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences; 3. Identify source(s) of impact; 4. Inform the IEC, ER/SOR and Contractor of findings; 5. Check monitoring data;	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and findings with the ET and the Contractor; 3. Attend the meeting to discuss with ET, ER/SOR and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures. 4. Review proposals for additional monitoring and any other mitigation measures	1. Attend the meeting to discuss with ET, IEC and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures. 2. If ER/SOR is satisfied with the proposals for additional dolphin monitoring and/or any other mitigation measures submitted by ET and Contractor and verified by IEC, ER/SOR to signify the agreement in writing on such	1. Inform the ER/SOR and confirm notification of the non-compliance in writing; 2. Attend the meeting to discuss with ET, IEC and ER/SOR the necessity of additional dolphin monitoring and any other potential mitigation measures. 3. Jointly submit with ET to IEC a proposal of additional dolphin monitoring and/or any other mitigation measures when necessary. 4. Implement the agreed additional dolphin monitoring

	6. Repeat review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary. 7. If ET proves that the source of impact is caused by any of the construction activity by the works contract, ET to arrange a meeting to discuss with IEC, ER/SOR and Contractor the necessity of additional dolphin monitoring and/or any other potential mitigation measures (e.g., consider to modify the perimeter silt curtain or consider to control/temporarily stop relevant construction activity etc.) and submit to IEC a proposal of additional dolphin monitoring and/or mitigation measures where necessary.	submitted by ET and Contractor and advise ER/SOR of the results and findings accordingly. 5. Supervise / Audit the implementation of additional monitoring and/or any other mitigation measures and advise ER/SOR the results and findings accordingly.	proposals and any other mitigation measures. 3. Supervise the implementation of additional monitoring and/or any other mitigation measures.	and/or any other mitigation measures.

Report No. **D014**
Monitoring Period **June 2016 - August 2016**

The Action and Limit Levels of Chinese White Dolphin (CWD) monitoring which was extracted from the enhanced Event and Action Plan[#] are reproduced below:

	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	(STG<4.2) & (ANI<15.5)	(STG<6.9) & (ANI<31.3)
Limit Level	[(STG<2.4) & (ANI<8.9)] AND [(STG<3.9) & (ANI<17.9)]	

Quarterly Encounter Rate

	STG*	ANI**	Level Exceeded
NEL	0.0	0.0	Limit
NWL	1.4	4.6	

[#] Reference is made to the enhanced Event Action Plan for Chinese White Dolphin Monitoring accepted by EPD on 7 May 2013.
*Quarterly Encounter Rate of Number of Dolphin Sightings (STG) presents averaged encounter rates of the three monitored months in terms of groups per 100km per survey event.
**Quarterly Encounter Rate of Total Number of Dolphins (ANI) presents averaged encounter rates of the three monitored months in terms of individuals per 100km per survey event.

Investigation Results:

a) Causes of exceedance

- After review of all available and relevant data, including the raw data and analyses of other parameters included in the EM&A, no significant variation is detected in key environmental parameters.
- No direct relationship with Project construction activities can be found between either the increase or decrease of dolphin numbers in NEL but this project activities may contribute to disturbance.
- Current mitigation measures are being upheld. Dolphin Watching Plan has been implemented from the start of works of the Project.
- There has been no failure or reduction of dolphin-specific mitigation measures.
- Meetings were held on 9 December 2014, 27 April 2015, 10 July 2015, 6 October 2016, 15 January 2016, 20 April 2016, 22 July 2016 and 14 October 2016 between ENPO, project ET for this and other HZMB projects and engineer representatives, to discuss dolphin encounter rates during the period September-November 2014, December 2014-February 2015, March 2015-May 2015, June 2015-August 2015, September 2015 - November 2015, December 2015 - February 2016, March 2016 - May 2016 and June 2016 - August 2016. It was concluded that the HZMB construction work is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to individual HZMB contracts and processes cannot be separated from the other activities within the dolphins habitat.

b) Action required under the action plan
Please refer to corresponding Event and Action Plan.

c) Action taken under the action plan

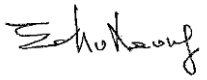
1. Statistical data analysis has been repeated to confirm findings;
2. All available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A have been reviewed;
3. Identification of souce of impact was carried out;
4. The IEC, ER and Contractor have been informed of findings;
5. Monitoring data have been checked;
6. Repeated review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary;
7. After investigation, there was no evidence that indicated that the reduced number of dolphins in NWL and NEL was related solely to Project works. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual contracts) cannot be quantified nor separate from the other stress factors. Please also refer to the attachment for full investigation result.

d) ET's conclusions and recommendations for mitigation

- Current mitigation measures for CWD are being implemented fully, and the Contractor has been reminded to consistently implement exisiting mitigation measures.
- It was considered that the current monitoring works under the EM&A programmes have already provided a high level of monitoring effort, and the joint meeting with ENPO, project ET for this and other HZMB projects and engineer representatives on 20 April 2016 concluded that additional monitoring in the three monitoring areas was not considered necessary as it may not generate additional information regarding dolphin distribution pattern in these three areas. Instead, it was considered that existing data can be reviewed and alternative analytical methods can be explored to see if it could provide new insight to the dolphin distribution pattern. On a meeting held on 6 October 2015, ENPO stated an extension of survey work into waters outside the three currently surveyed areas for this project was underway to investigated expanded habitat use of dolphins outside the project area.
- The joint meetings with ENPO, project ET for this and other HZMB projects and engineer representatives held regularly throughout the last year have discussed that efforts be made to implement additional protection measures (e.g., speed limit control) for the proposed Brothers Marine Park (BMP) be brought forward as soon as possible and to start reducing the number of Project related boats using the area. It has been noted under the Regular Marine Travel Route Plan that the contractors of HKBCF Reclamation Works have committed to reduce Project related vessel speed in BMP and also have considerabley reduced the number of vessels in the NEL and adjacent areas.

e) Contractor's actions to implement the mitigation

- The Contractor was reminded to ensure relevant mitigation measures were fully implemented.
- It was recommended that the marine works of HZMB projects should be accelerated and completed as soon as possible so as to reduce the overall duration of impacts and allow the dolphins population to recover as early as possible.
- It was also noted that as per the marine works footprint reduction (e.g., reduce the size of peripheral silt curtain) the phase plan removal of perimeter silt curtain is underway. These details ar submitted in this Projects monthy reports.
- Regular reporting of vessel movement to ENPO should continue to monitor the continued reduction of Project related vessels.



ET Leader Signature & Date: 15-Mar-17

Report No. D014
Monitoring Period June 2016 - August 2016

Investigation Report Attachment

1. Review all available and relevant data (construction activities), including raw data and analyses of other parameters (air, noise, water and underwater acoustic) covered in the EM&A, to ascertain if differences are a result of natural variation or previously observed seasonal differences.

On Friday 14 October 2016, a meeting was held between ENPO, ET for this contract and other HZMB contracts and engineer representatives following the limit level/action level exceedances for Chinese white dolphin encounter rate during the period June-August 2016. After review of the AFCD annual monitoring data, it was advised that dolphins in Hong Kong waters may have re-distributed throughout Hong Kong waters and that data from all three monitoring sections, as well as areas from outside these, should be reviewed to give a better, overall picture of current dolphin distribution patterns and to monitor individual dolphin movement. Previously, ENPO presented the preliminary findings of the HZMBA interim survey on CWD sighting and photo-identification works which provided solid evidence that some CWD that were previously more often sighted in HK waters have expanded their ranges into mainland waters and some with reduced usage in Hong Kong waters. The AFCD low abundance figure for both NEL and NWL for the period 2015-16 was also discussed. Previous data on changes in CWD ranges partially explains the decline in sightings North Lantau waters.

In the last year, there has been a consistent decrease of dolphins in the NEL and NWL areas. As stated in previous investigation reports, the HZMB works is one of the contributing factors affecting the dolphins and it was reiterated at this latest meeting that there are also concurrent works ongoing in both NEL and NWL, some of which are not part of the HZMB Project. Further, it was noted that it is extremely difficult to attribute specific impacts from any single works or activity and also, it is not possible to separate the impact caused by one part of the HZMB project from another. It was noted that there have been consistently less dolphins adjacent to HZMB construction sites as all parts of the HZMB Project have been initiated (although occasional sightings have been noted in the last quarter as part of the HKBCF Project monitoring and mitigation programme). These are in addition to the existing pressures the dolphins faced in the Lantau habitat before the HZMB development started, e.g., boat traffic, habitat degradation, pollution, competition with fisheries. All ETs noted at the meeting that mitigation across individual HZMB sites has been fully implemented. The regular checking and auditing of all mitigation works at the HKBCF reclamation works record that all dolphin mitigation measures in the form of vessel routes and speeds, etc., have been implemented and DEZ/DWP are in place. The meeting summarised that multiple factors, as listed above and including the HZMB project, have all contributed to dolphin distribution changes in Hong Kong.

For water quality monitoring, no impact water quality monitoring exceedances were recorded during this reporting quarter.

2. Identify source(s) of impacts.

There is a documented significant decline of the dolphins within Hong Kong waters in the last decade and more. In 2008, an expert panel concluded that the anthropogenic activities which occur in the Hong Kong and adjacent habitat have the potential to affect the dolphin population through pollution, infection, lowered prey availability, intense and low noise levels, collisions, behavioural changes, disturbance, entanglement in fishing gear and habitat modification by activities such as construction, dredging, sewage disposal, industrial effluent discharge, shipping, reclamation, fishing. Since this review, pro-active management by AFCD has resulted in a reduction of the negative impacts caused by non-sustainable fishing, i.e., as the trawling ban progresses, more prey should be available to dolphins, and a general reduction in fishing activities will reduce the potential for entanglement in fishing gear. It is noted that other fishing activities are ongoing in Hong Kong waters which also pose a risk of entanglement, however, data from strandings programme often cannot discern which type of fishery is (and/or net) is responsible for an individual entanglement . In other areas where coastal fisheries have been monitored by independent observers, it was noted that trawling, purse seine and gill netting have the highest bycatch incidence for bottlenose dolphins, with trawling noted as having the greatest impact (Allen *et al* 2014). Globally, trawling fisheries are of the greatest conservation concern due to their high impact on small cetaceans (Ross and Isaac 2004), and although there may still be other fisheries in operation in Hong Kong which pose an entanglement risk to dolphins, none are as intensive or as widespread as the trawl fishery was. Other identified impacts, however, are ongoing and it is noted that construction activities and the high speed ferry traffic in NEL and NWL have both increased since 2008 (AFCD Annual Monitoring Reports 2009; 2010; 2011; 2012; 2013; 2014; 2015; 2016). A recent publication incorporating data from AFCD assessed impacts known from Hong Kong between 1996 and 2013 and concluded that high speed ferries have significantly contributed to the decline in dolphins from NEL. This paper also suggests that there has been an overall decline of dolphins in the northern waters of Lantau Island (Marcotte *et al* 2015). This paper also states that caution should be exercised when interpreting these preliminary findings and further analysis is encouraged. It is noted that the high speed ferries from NEL have been re-routed since December 2015 and now travel to the east and north of Sha Chau Lung Kwu Chau Marine Park (SCLKCMP) resulting in increased high speed ferry (HSF) traffic adjacent to an area that the dolphins have traditionally used frequently. A reduction in the number of sightings in the northern SCLKCMP area has been noted since December 2015 and this observation supports the preliminary findings of Marcotte *et al* (2015) that dolphin declines may be correlated with an increase in the frequency of HSF. This was discussed during the meeting held on 20 April 2016, and all ETs agreed that there is likely a relationship between increased HSF and decreased dolphin density. Other publications (Li *et al* 2015) examine the acoustic disturbance of high speed boats[1] on Chinese white dolphins and observed that frequencies of over >100kHz dominated. This is within the dolphins communication range. The recorded boat noise raised the ambient underwater noise levels from ~5 to 47 decibels, with

[1] Boats travelling at over 15kmph

louder levels recorded at higher speeds and at closer distances. In Hong Kong, similar vessels include small fishing boats, commonly referred to as “P4s” and high speed ferries. This study notes the potential impact these elevated levels have on Chinese white dolphins in southern China and it can be assumed that similar acoustic disturbance may occur in Hong Kong waters. It is known from studies elsewhere that dredging and marine piling activities cause significant disturbance to marine mammals (David 2006; Jefferson et al. 2009; Bailey et al 2010), including vibratory piling which was conducted as part of the HZMB construction (Wang *et al* 2014; Yang *et al* 2015). Activities which are stressful to dolphins are usually associated with increased underwater noise levels and this includes vessel traffic (from all construction works in the proximity of North Lantau). It is also noted that Hong Kong and adjacent ports are the world’s busiest commercial shipping area with heavy shipping traffic. During the last quarter, there has been a marked reduction in vessel traffic associated with this Project. This reduces the impact of underwater noise levels attributable to vessels from this Project.

Other non project related works and activities around the HZMB project area may contribute to changes in dolphin distribution and include, but may not be limited to;

- Shift in distribution or change in composition of prey resources (Buchary *et al.* 2003).
- Recent publications suggest that the health status of the dolphins in Hong Kong and adjacent waters may be poor due to the long term accumulation of pollutants therefore, making them more susceptible to new stressors (Gui *et al*. 2014)
- Recent publications suggest that the health status of cetaceans in Hong Kong and adjacent waters may be compromised due to the toxic levels of perfluorinated sulfonic acids (PFSAs) recorded in the livers of *Sousa chinensis* (Lam *et al* 2016)

3. ***Repeat review to ensure all the dolphin protective measures are fully and properly***

Site inspection of the implementation of vessel speed limit, acoustic decoupling measures, spillage and runoff prevention measures on barges, training records related to regular marine travel routes for Contract’s vessels, record of implementation of dolphin watching plan and silt curtain integrity checking record were conducted during weekly site inspection. The appropriate mitigation monitoring was in place depending on site activities, i.e., DEZ/DWP for silt curtain deployment and all other Project activities, respectively.

4. Investigate whether the exceedance was caused by any of the construction activity associated with the works contract.

No single construction works associated with the HKBCF Project can be found to coincide with the observed reduction in dolphin encounter rates in NEL and NWL. As discussed at the series of meetings held, it was agreed that all HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to individual Projects cannot be quantified nor separate from the other stress factors. All mitigation measures as detailed in the EM&A are being upheld and additional measures to restrict traffic

number and routing have been proposed and, in some cases, already implemented for the HKBCF Project.

These factors were reported in D005, D006, D007, D008, D009, D010, D011, D012 and D013, and the conclusions therein are still valid, that is, there are ongoing construction works, both Project related and not, which are known to impact dolphins. At this time, the long term impacts of these works cannot be assessed although expanding the scope of monitoring areas will provide better data on impacts outside the NEL and NWL zones.

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