



**SIBELCO**  
AUSTRALIA

# 2019 Annual Environmental Management Report

## Tanilba Northern Dune



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<b>AEMR Period Completion</b>	31 <sup>st</sup> March 2019
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## 1. INTRODUCTION

### 1.1. Scope

On the 18<sup>th</sup> July 2002, Unimin Australia Limited (now trading as Sibelco Australia) was granted approval under Clause 13(1) of the *Hunter Water (Special Areas) Regulations 1997* to carry out extractive operations in the Tomago Sand Beds Catchment Area (Special Areas Approval). This relates to an area known as the Tanilba Northern Dune located near Oyster Cove in the Port Stephens Shire (the site). A copy of the Approval has been attached as APPENDIX 1.

The Special Areas Approval requires that an Environmental Management Report be submitted on the anniversary of the Date of Issue for the term of the approval. Part 3, Clause 5, subsection 4 (a)) of the licence stipulates the requirements of the report:

*“The Approval Holder must submit a report to the Director-General on each anniversary of the Date of Issue for the term of this Approval (**Environmental Management Report**), addressing:*

- (i) the performance of and compliance with the provisions of the Groundwater Management Plan by the Approval Holder;*
- (ii) the performance of and compliance with the provisions of the Rehabilitation Plans by the Approval Holder;*
- (iii) the performance of and compliance with the provisions of any other requirements of this Approval by the Approval Holder;*
- (iv) any instances in which the Approval Holder has not satisfied the requirements of the Environmental Management Plan or this Approval, indicating any reason for that non-compliance and any action that is proposed to be introduced, or has already been implemented, to prevent or remedy the non-compliance;*
- (v) identification of trends in monitoring data from the Groundwater Management Plan and Rehabilitation Plans over the life of the Extractive Operations; and*
- (vi) environmental management targets and strategies for the subsequent year.”*

This Annual Environmental Management Report (AEMR) has been prepared to report on mining activities undertaken during the past 12 month reporting period from 1<sup>st</sup> April 2018 to 31<sup>st</sup> of March 2019 at the Tanilba Northern Dune. This report addresses the site’s present compliance obligations and status, activities of the past twelve-month reporting period and the proposed activities for the following 12 months.

This AEMR will be circulated to the Hunter Water Corporation (HWC), NSW Office of Water (DPI) and Port Stephens Shire Council.

### 1.2. Background Information and Mining History

The Tanilba Northern Dune is an elevated sand dune system located on the Tilligerry Peninsula adjacent to the township of Oyster Cove in the Port Stephens Shire, New South Wales.

White silica sand has been extracted from the Tanilba Northern Dune by several companies at different locations since 1991 - the approved extraction area in relation to the regional context can be seen in Figure 1.

Prior to 2003, the western parts of the northern dune were mined by ACI Operations Ltd. Sibelco commenced operations in 2004 and areas that have been mined by Sibelco since 2005 can be seen below in Figure 2.

The Tanilba Northern Dune site is comprised of a number of approval areas managed jurisdictionally by Crown Lands, Hunter Water (x2) & Department of Planning and Environment (DPE) approvals as depicted in Figure 3. Works within these approval areas consist of four extraction zones as depicted in Figure 4.

In 2013 approval was granted by the Minister for Planning and Infrastructure to extend the approval area for quarrying activities by 9ha in an area to the north of the existing extraction operations at Zone 1. This part of the project, known as the Tanilba Northern Dune Extension Project, was declared a State Significant Project and operates under approvals issued by DPE (Project Approval MP09\_0091 issued on 8 March 2013) and HWC (BN13/5769 issued on 25<sup>th</sup> of November 2013 under clause 10 (1) of the *Hunter Water Regulation 2010*). A separate Annual Report relating to operations in the Extension area only has been prepared and provided to DPE and HWC.

### 1.3. Activities in the Reporting Period

No extractive mining activities took place on the Lots exclusive to the Special Areas Approval during this EMR reporting period. Mining activities at the site ceased in 2016. Activities undertaken during the reporting period relate primarily to management of the rehabilitated areas and ongoing monitoring requirements as described in the Environmental Management Plan (EMP) and sub-plans.

Mined areas are required to be rehabilitated in accordance with the approved Rehabilitation Plans as defined in Clauses 11 and 12 of the Special Areas Approval. Once rehabilitation is complete, the rehabilitated areas will be returned to their respective owners. Other activities undertaken during the reporting period include ongoing groundwater monitoring undertaken in accordance with the approved GMP (clause 9) as well as regular inspections of the rehabilitated areas to determine any maintenance requirements.



Figure 1: Northern Dune Regional Context Map



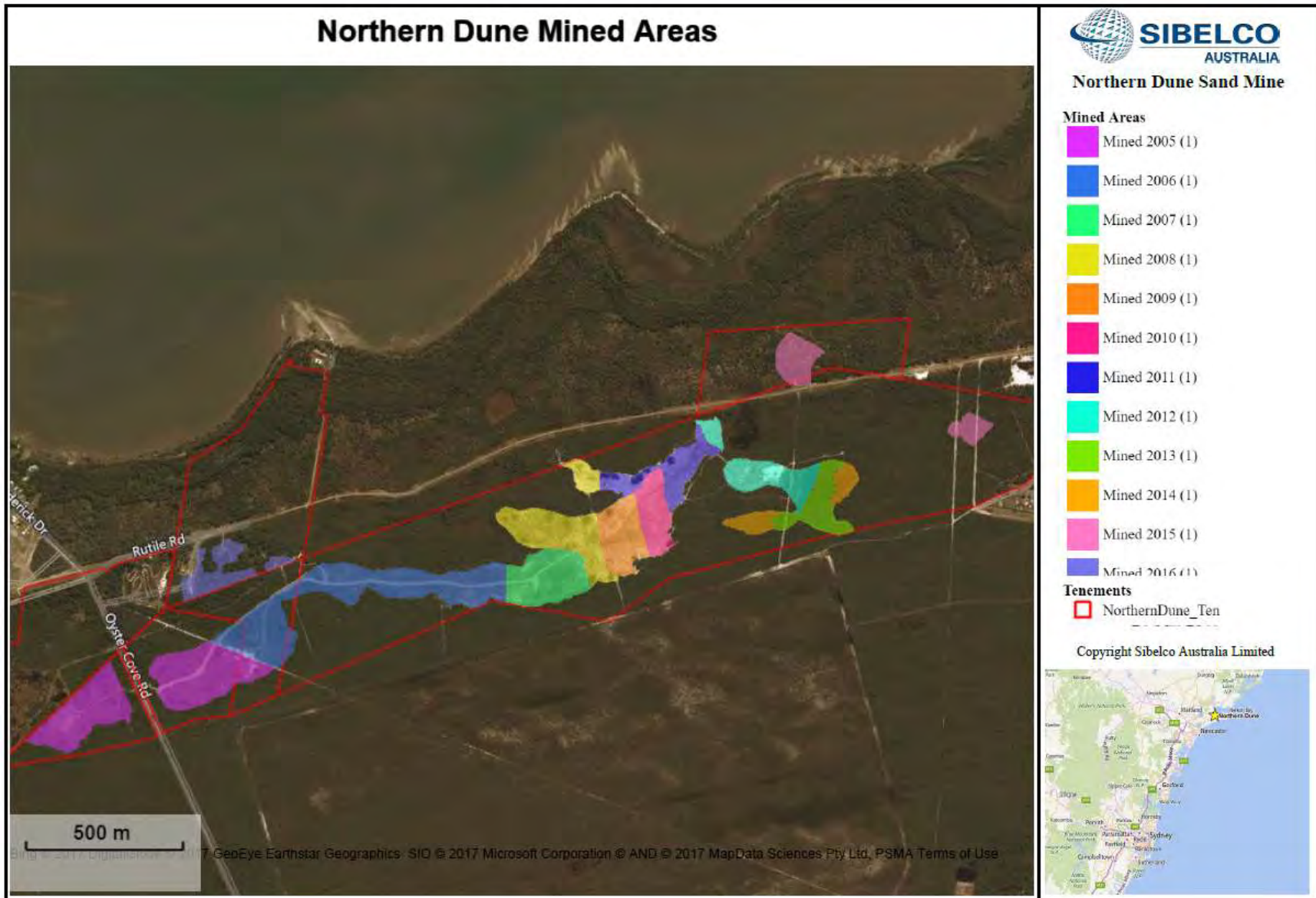


Figure 2: Northern Dune Mined Areas Since 2005



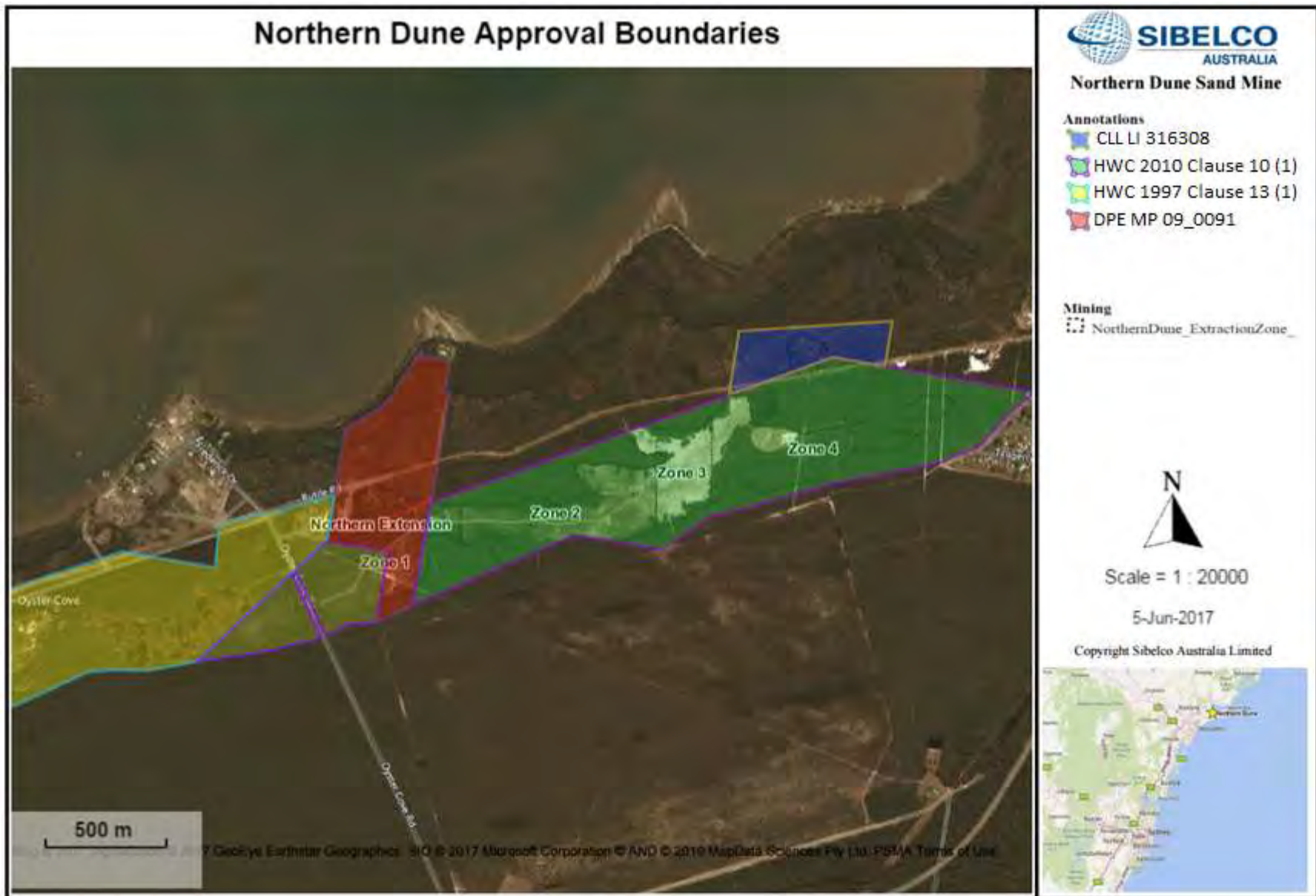


Figure 3: Northern Dune Approval Boundaries

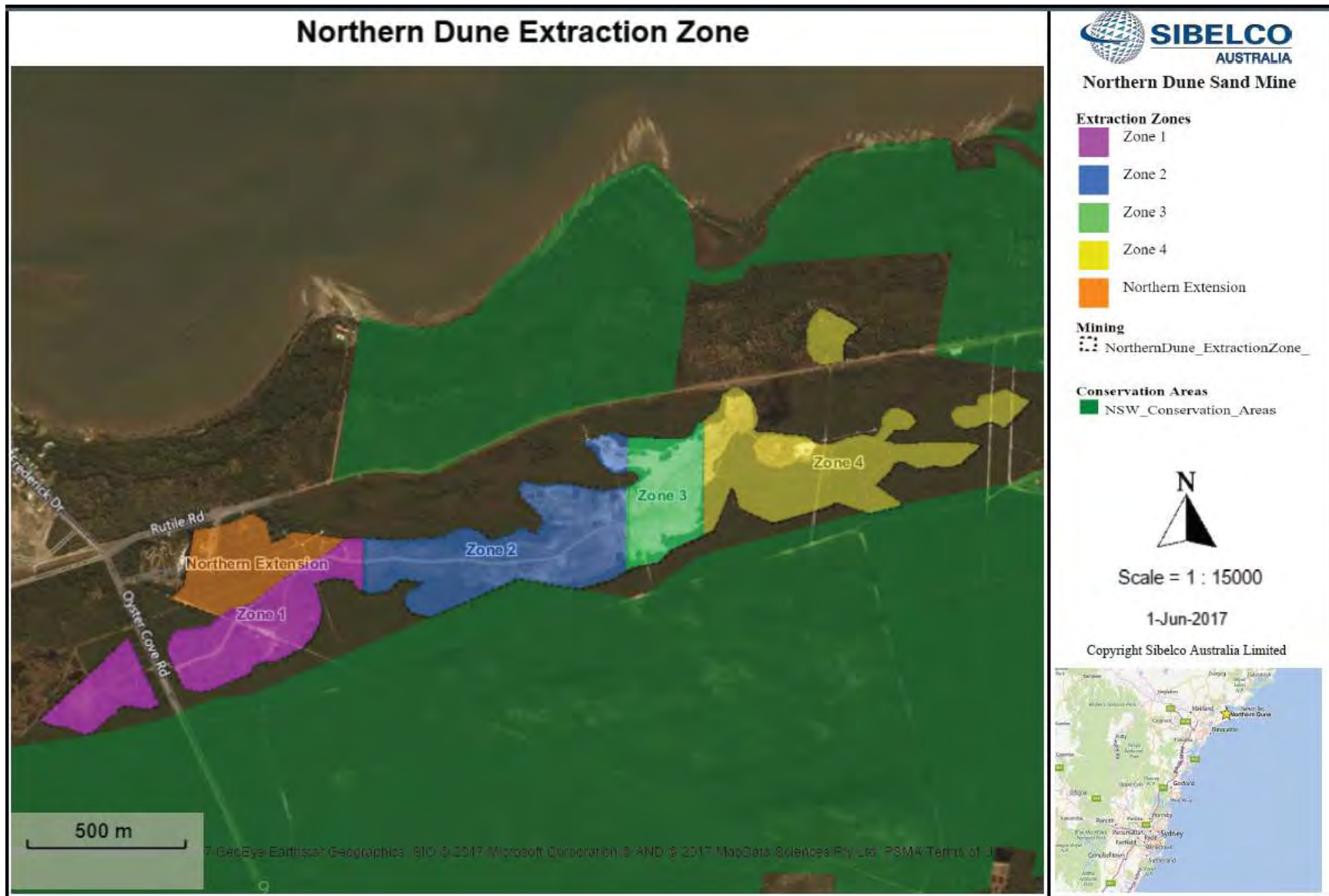


Figure 4: General Site Arrangement

### 1.3 Mine Contacts

Table 1 displays the current contact details for responsible personnel at Tanilba Northern Dune. Operations are coordinated from the Sibelco processing plant at Salt Ash.

Table 1: Key Mining Contacts

Position	Name	Contact Details	
		Mobile	Office
Regional Manager	Brian Stokes	0407 462 259	-
Quarry Manager	Peter Radziewic	0419 440 588	(02) 4982 6399
Site Manager	Shane Pont	0448 696 114	(02) 4982 6399
Sustainability Officer	Liam O'Grady	0411 819 324	(02) 9458 2968
QSE Co-ordinator	Paul Bourne	0418 625 188	(02) 4982 6399
Senior Hydrogeologist	Steve Feiss	0400 845 672	(03) 9738 8200

### 1.4 Consents, Lease, Approvals and Licences

Extractive operations in the Tanilba Northern Dune are undertaken in accordance with the various conditions outlined in the approval documents listed in Table 2 below.

Table 2: Current Approval Documents and Issuing Authorities

Approval Authority	Approval Document	Status
Hunter Water Corporation	Hunter Water (Special Areas) Regulations 1997 – Approval under Clause 13(1)	Current
Environment Protection Authority	EPL11633	Current
Environment Protection Authority	EPL21088	Current
Crown Lands Licence	LI316308	Current
Crown Lands Licence	LI190885	Current
Port Stephens Council	DA 1139/94	Current

## 2 GROUNDWATER MANAGEMENT

A Groundwater Management Plan was prepared for the project under Clause 9 of the Special Areas Approval. This section addresses compliance with the approved Groundwater Management Plan (GMP) as required by the following clauses under the Approval:

- Part 3, Clause 5, section 4 (a) (i): performance and compliance with the provisions of the Groundwater Management Plan
- Part 3, Clause 5, section 4 (a) (v): identification of trends in monitoring data from the Groundwater Management Plan over the life of the Extractive Operations.

During the reporting period, visual inspections were carried out throughout the operational and rehabilitated areas with no surface water or ponding being noted. No environmental incidents or implementations of the Emergency Response Plan (ERP) in relation to groundwater occurred.

### 2.1 Regulatory Requirements

Groundwater Management issues are managed by the regulatory approved Groundwater Management Plan (GMP). The GMP has been developed to maintain compliance with the conditions of consent and licensing requirements stipulated by the relevant regulatory authorities, during development and operation at Northern Dune. The GMP provides a formal framework for ongoing monitoring of groundwater at the site to manage the potential impact of sand extraction on groundwater level and quality.

Section 4.4 of the GMP states that the GMP will be reviewed at the completion of sand extraction in a zone and/or prior to commencement of operations in each new zone. If this review indicates a need to change programs or procedures, then a submission outlining the proposed changes and the need for them will be made to DPI-Water and HWC. In January 2019 Sibelco notified both DPI-Water and HWC that, following a review of the GMP, reporting of groundwater monitoring would be performed annually. No written response was received from either DPI-Water or HWC, but upon telephoning John Simpson from HWC he confirmed verbally that he had received the submission and would respond to Sibelco in due course. With a requirement to secure commercial contracts for a third-party to perform the groundwater quality monitoring program, Sibelco progressed with this approach. Therefore, during this AEMR period, one annual groundwater report, dated September 2018 was provided (APPENDIX 3). While reporting has been provided annually, data collection continued to occur at the same frequency as previous years. To demonstrate an annual trend throughout the AEMR period, the September 2018 groundwater report is supplemented with the further groundwater level data collected monthly, and further groundwater quality data collected 6 monthly in April 2019 as discussed in Section 2.3.1. This supplementary data is provided in APPENDIX 4.

### 2.2 Groundwater Levels

Wider groundwater monitoring was initiated at Northern Dune in 2002, prior to the commencement of sand extraction in 2003. Baseline groundwater level monitoring is undertaken within a planned zone prior to commencing sand extraction. Baseline groundwater level monitoring is used to

create a Predicted Maximum Groundwater Elevation (PMGE) which is then used for determining depth of extraction and final landform.



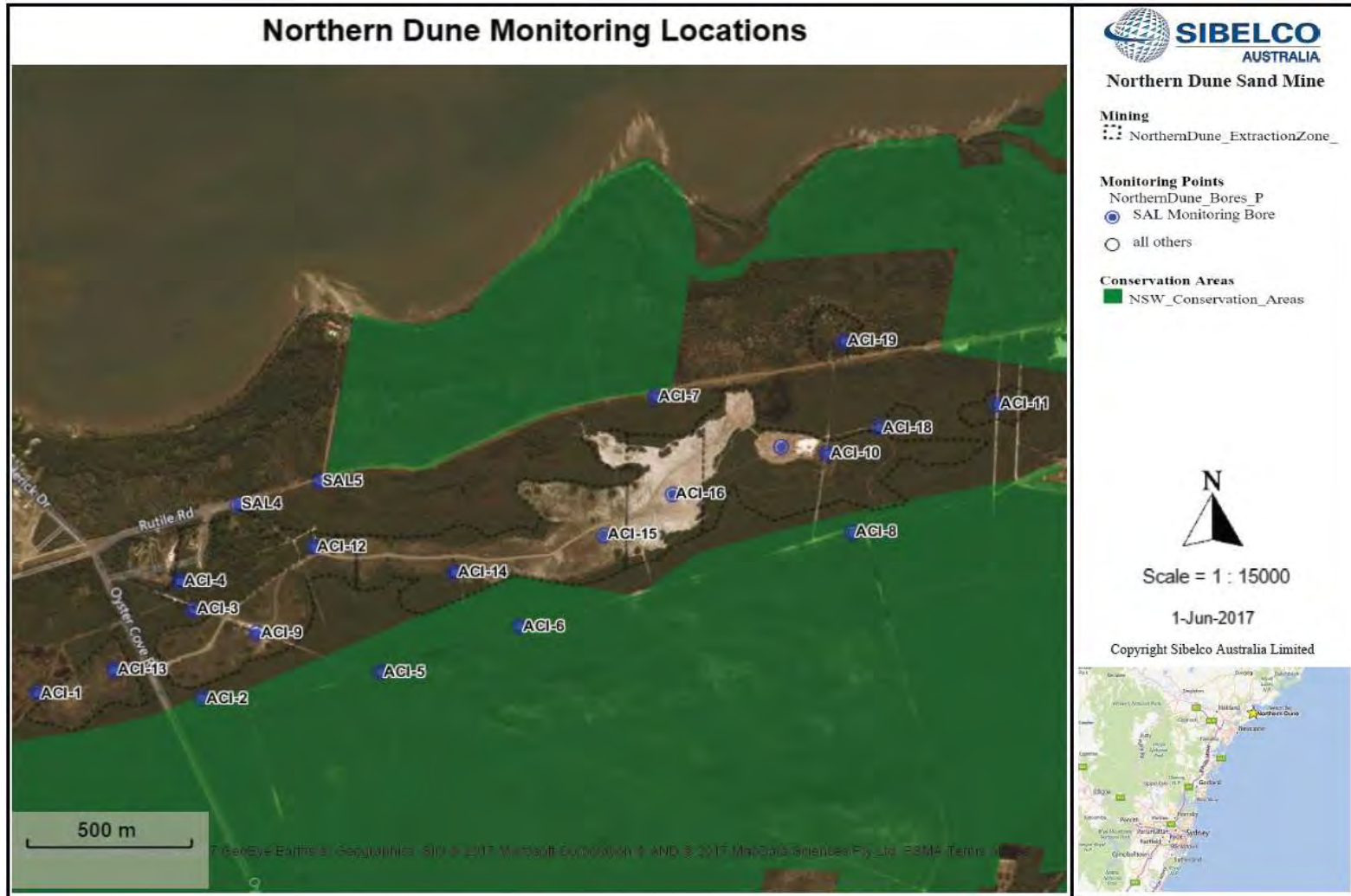


Figure 5: Piezometer Locations at Northern Dune

### 2.2.1 Groundwater Level Monitoring Network

The entire groundwater monitoring network in the surrounding area consists of 27 bores. This network covers both the Northern Dune area and the Northern Dune Extension area subject to separate approvals and reporting (for which a separate Annual Report has already been submitted). Historically the AEMR for the Northern Dune extraction area has considered this entire network. While specific bores were used to report on the Northern Dune Extension area; to demonstrate ongoing trends across the wider Northern Dunes area network, all bores continue to be provided (Appendix 3). Locations of the monitoring bores east of Oyster Cove Road can be seen in Figure 5.

### 2.2.2 Groundwater Level Monitoring Methodology

As described in the GMP, operational groundwater level monitoring is undertaken to manage compliance with the PMGE. Groundwater levels in monitoring wells are routinely measured monthly, increasing in frequency to weekly for a period of four weeks following any period when rainfall at Williamstown equals or exceeds 100 millimetres over a seven-day rolling period, or when water levels are within 100 millimetres of the maximum predicted groundwater levels. Monitoring will continue for the duration of mining, and until the release of the obligation by the regulatory authorities.

Groundwater levels are measured by suitably trained Sibelco staff members using a depth gauge with electronic indicator. If analysis of groundwater level monitoring shows anomalous levels above the PMGE then groundwater in the affected monitoring well will be retested again as soon as possible and in any case within fourteen days to confirm the results. If retesting confirms the anomaly, the regulatory authorities will be notified within fourteen days of confirmation and an investigation will be initiated.

### 2.2.3 Groundwater Level Monitoring Assessment

APPENDIX 3 and APPENDIX 4 demonstrate that all monitoring locations are compliant for the current reporting period.

Annual rain monitoring data recorded at Williamstown has been included in Figure 6 for reference. During the reporting period, the highest recorded rainfall was in June 2018 with 244.2mm being recorded. May 2018 was the lowest, with only 0.6mm falling throughout the month.

When rainfall levels exceeded more than 100mm in a seven-day period, bores are monitored weekly for a total of four weeks. This occurred once during the reporting period (October) when 108.6 mm was recorded at Williamstown RAAF over seven days from 5 to 11 October, and subsequent weekly monitoring was performed.

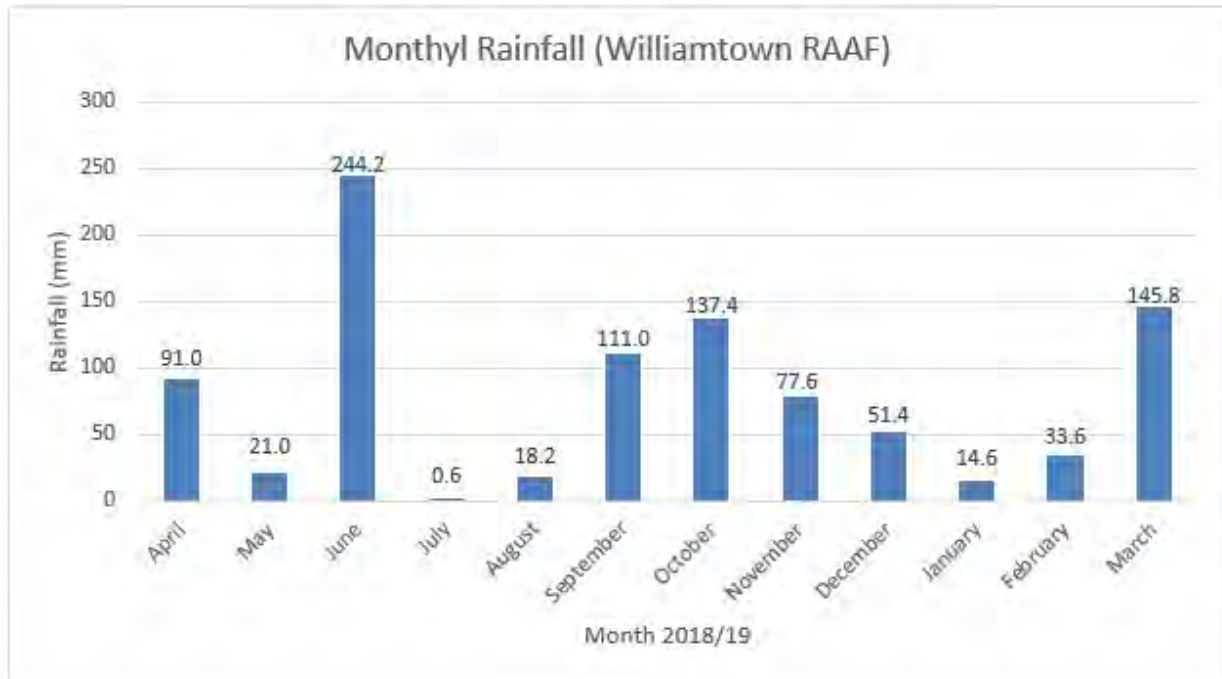


Figure 6: Monthly Rainfall Data Recorded at Williamstown RAAF

## 2.2.4 Groundwater Level Trends

During previous reporting periods, it was noted that groundwater levels fluctuate naturally in response to rainfall. During this reporting period the same trend is observed; groundwater levels rise as there is increased monthly rainfall and fall during periods of reduced rainfall. This trend is shown in the hydrographs provided in APPENDIX 3 and APPENDIX 4.

As the groundwater in the area is rain fed, and this reporting period has seen an overall reduced trend in the rainfall received annually, groundwater levels have shown a trend of falling across the monitoring network. This is evidenced by a number of bores being dry when monitoring was attempted in April 2019. Dry bores were:

- ACL-12
- ACL-13
- ACL-14
- PIEZ01
- PIEZ02

As no sample was able to be collected the quality trend analysis for these dry bores ends in September 2018 for this AEMR period.

## Groundwater Level Reporting

In accordance with the GMP, the results of groundwater level monitoring are analysed to determine whether they are anomalous and whether further sampling is required. If further sampling confirms anomalous results, then notification to the regulators is required.

During the reporting period there were no groundwater level exceedances or anomalous results at any of the monitoring points, as demonstrated by APPENDIX 3 and APPENDIX 4.

Table 3: Groundwater Level Compliance Checklist

Condition	Period					
	December 2016	March 2017	December 2017	March 2018	September 2018	June 2019
Groundwater level monitoring completed as per GMP	Yes	Yes	Yes	Yes	Yes	Yes
Survey of post-mining rehabilitation level completed as per EMP	N/A	N/A	N/A	N/A	N/A	Yes
Groundwater level is compliant (lower than the applicable PMGE)	Yes	Yes	Yes	Yes	Yes	Yes

## 2.3 Groundwater Quality

Baseline groundwater quality samples are collected prior to commencement of operations to create trigger values for comparison against sample concentrations during extraction operations and post-extraction operations to assist in detecting any changes in groundwater level and quality at the site.

Groundwater monitoring data is collected and analysed by suitably trained personnel in accordance with the Sibelco Groundwater Monitoring Guidelines.

The baselines samples for each piezometer were used to create trigger values which are then tested against at predetermined increments. Groundwater quality testing undertaken biannually and reported to the relevant regulators.

### 2.3.1 Groundwater Quality Monitoring Methodology

As described in the GMP, operational groundwater quality monitoring is carried out biannually once mining commences in a zone and will continue at a lower frequency for four years after

mining ceases or as otherwise determined by the New South Wales Office of Water and Hunter Water Corporation.

Groundwater quality is sampled and tested by an external third-party contracting company with results sent directly to Sibelco staff for analysis and reporting.

During previous AEMR periods Sibelco has provided biannual groundwater quality reports. As discussed in Section 2.1 this reporting is now provided annually. As such APPENDIX 3 provides the annual report from September 2018 and APPENDIX 4 and 5 provide supplementary data for the remaining 6 months of this AEMR period.

Extraction has ceased in the Northern Dunes area. In previous years with wider extraction occurring Sibelco have monitored locations provided in Appendix 3. Due to the low level of activity and lack of extraction at the Northern Dunes site, Sibelco initiated a program of sampling in line with the monitoring locations required by EPL 21088 P1.3 and EPL11633 P1.2. These licences require the following groundwater monitoring locations:

- EPL 21088
  - Piezo1
  - Piezo2
  - Peizo3
- EPL 11633
  - ACI-2
  - ACI-5
  - ACI-3
  - SAL-4

Therefore Appendices 4 and 5 provide groundwater quality data for these locations to supplement the data provided in September 2018 Bi-annual report (Appendix 3).

### 2.3.2 Groundwater Quality Monitoring Assessment

The September 2018 bi-annual groundwater quality assessments found exceedances of trigger values in two of the four monitoring locations (ACI-2 and SAL-4), including initial exceedances. These exceedances are discussed in the September 2018 Groundwater Monitoring report (APPENDIX 3). No exceedances were recorded for these locations in April 2019 (Appendix 4)

### 2.3.3 Groundwater Quality Trends

Analysis of groundwater quality trends over time show concentrations have naturally fluctuated in response to natural geochemical processes. This trend has been reflected in the current reporting period as indicated in the data contained in APPENDIX 3 and APPENDIX 4.

Trends available for bores, as provided in previous AEMRs and Appendix 3 and 4 are:

- ACI-2
- ACI-5
- ACI-6
- ACI-8



- ACI-11
- ACI-13
- ACI-14
- ACI-18
- SAL4
- SAL5

As discussed in Section 2.3.1 some bores have been sampled for quality for the first time during the reporting period in April 2019. These bores are:

- PIEZO1
- PIEZO2
- PIEZO3

As this AEMR period saw the initial sampling round performed on these bores, a trend analysis is not available. Therefore groundwater quality monitoring results for these bores are provided in Appendix 5.

### 2.3.4 Groundwater Quality Reporting Summary

Table 4 demonstrates groundwater quality reporting in compliance with the GMP.

Table 4: Groundwater Level Compliance Checklist

Condition	Period					
	December 2016	March 2017	December 2017	March 2018	September 2018	April 2019
Groundwater quality monitoring completed as per GMP	Yes	Yes	Yes	Yes	Yes (Appendix 3)	Yes (Appendix 3, 4 and 5)

### 2.4 Groundwater Management Plan Review

Sibelco acknowledges a need to review the GMP to identify and define the most appropriate monitoring program in line with the regulatory requirements and the current level of activity in the Northern Dunes area given the reduced level of extraction and presence of non-operational areas.

Sibelco will review and submit a revised GMP in line with the regulatory requirements (within 3 months of this AEMR).

### 3 REHABILITATION PROGRAM

The Rehabilitation Plans prepared for the project consist of the following:

- Landform Rehabilitation Plan (LRP) described in Part 3, Clause 11 of the Approval; and
- Vegetation Rehabilitation Plan (VRP) described in Part 3, Clause 12 of the Approval.

This section addresses compliance with the approved Rehabilitation Plans as required by the following clauses under the Special Areas Approval:

- Part 3, Clause 5, section 4 (a) (ii): performance and compliance with the provisions of the Rehabilitation Plans;
- Part 3, Clause 5, section 4 (a) (v): identification of trends in monitoring data from the Rehabilitation Plans over the life of the Extractive Operations.

#### 3.1 Rehabilitation Management

Rehabilitation at the Tanilba Northern Dunes area is undertaken by Sibelco staff jointly with works in areas mined as part of the approvals for the Tanilba Northern Dune Extension. For rehabilitation purposes, works across both approval areas have been subdivided into several blocks: within Tanilba Northern Dunes these are known as Blocks A to P.

Landform preparation and initial planting of all extraction areas within the former Tanilba Dunes extraction has been completed. Rehabilitation works undertaken within the Tanilba Northern Dunes during the reporting period were therefore composed predominantly of inspections to identify areas requiring weed management or maintenance. Inspection of revegetated areas forms part of monthly site inspections (refer APPENDIX 2) to identify any issues requiring management and the outcomes and observations of inspection are incorporated into the future works program together with any items or recommendations resulting from the annual performance monitoring program (refer Section 3.3).

Sibelco has implemented a regime of weed control across the whole of the Tanilba Northern Dunes mining area and maintains a continued commitment to ongoing and progressive rehabilitation. Extraction has recently ceased within the Tanilba Dunes Extension area (reported separately) and site wide weed spraying covering all parts of the Tanilba Dunes area will be undertaken following the completion of planting in the Extension area (expected to be completed in June 2019).

#### 3.2 Supplemental Monitoring

A bushfire, originating from outside the site, impacted land from Salt Ash to Tanilba Bay during August 2018. Kleinfelder Australia was engaged to undertake a survey of the whole of the Tanilba North Dunes Sand Extraction project rehabilitation area on the 28<sup>th</sup> August to assess the extent of impact of the fires upon revegetation and provide recommendations for management (APPENDIX 6). This found that:

- Blocks A2 and A1 to the west of Oyster Cove Rd were extensively burned with Block A2 particularly affected;

- Across Oyster Cove Rd, the section of Block B1 north of the haul road, extending into Block B2 and into the vegetation between the Northern Dune Extraction area and the Northern Dune Extension was also extensively burned;
- Block C appeared largely unaffected by the fire;
- Extending east to the progressively younger areas of the rehabilitation, most of the fire affected areas were south of the haul road, with the haul road appearing to act as a fire break. This resulted in Blocks D, E, F, H and I being affected while the southern section of Block L and the southernmost portion of Block M were also burned;
- Back burning to the north of the rehabilitation area resulted in small sections of Block K and J burning;
- The youngest rehabilitation – most of Block M, Blocks N, O, P and Q were unaffected by fire.

The implications for the recovery of the vegetation on the rehabilitation will largely be dependent upon the age of the rehabilitated area affected by fire and the time since it was last burned – if applicable. Conclusions and recommendations from the inspection included:

- Sibelco staff to conduct regular weed control operations in the area to help control their spread
- Monitoring to determine what species have survived and their proportions. If monitoring indicates a lack of key species, a renewed planting effort will be required to bring numbers up to target
- Block E may require substantial remedial planting and seeding to achieve rehabilitation targets
- The southern section of Block M and perhaps Block L is likely to require replanting of key species.

### 3.3 Rehabilitation Monitoring

The objective of the VRP is to progressively re-establish original vegetation community types, after extraction and landform rehabilitation has been completed, to as close as possible to that of the original vegetation. This recognises that the final landform will be lower in elevation than the original topography and provides performance measures to assess the success of the rehabilitation.

Monitoring of the progress of rehabilitation at the Tanilba Northern Dune project area was undertaken by Kleinfelder Australia Pty Ltd (Kleinfelder) in January 2019. A copy of the 2019 Annual Monitoring Report (covering both the Tanilba Northern Dune and Northern Dune Extension area) is provided in APPENDIX 7.

As extraction and subsequent rehabilitation has been progressive across the licence area, for ease of data collection, the Tanilba Northern Dunes area has been subdivided into several blocks (APPENDIX 7). Each of the blocks is at a different stage of rehabilitation:

- Rehabilitation blocks are prepared and, after 6 months of growth, surveyed biannually for a period of 3 years;

- After 3 years, blocks are monitored at a reduced frequency in accordance with the requirements of the agreed VRP.

Each of the blocks has been established at different time intervals. Blocks P and O located east of Oyster Cover Road are the last blocks to form part of the rehabilitation program under the Special Areas Approval and are currently monitored biannually as part of the Vegetation Rehabilitation program.

All other blocks forming the rehabilitation program at Northern Dunes (blocks A-N) are monitored and reported on as part of the post-3 year monitoring program. Frequency of monitoring occurs in accordance with the performance criteria outlined in the Northern Dune Environmental Management Plan (EMP) and occurs at Year 4 or 5 and again at Year 8 post rehabilitation for each respective block. This has been determined as a suitable requirement for the Sibelco mine to monitor the growth and biodiversity trends up until the release stage.

- Blocks A, B1, B2 and C have been monitored for the Year 8 stage and these results have been reported by Kleinfelder (2014b);
- Blocks D, E, F, G and H have been monitored for the Year 8 stage and results have been reported by Kleinfelder (2018);
- Blocks I, J and K Year 4-5 stage results are detailed in the Post 3-year Monitoring Survey Report (Kleinfelder 2014a, 2015 and 2016);
- Block L Year 4-5 stage survey was conducted in October 2016, with preliminary reported in 2017;
- Block M has had the initial Year 4-5 stage survey conducted, with preliminary results reported in 2017. Final Zone 4 4-5 year report is due to be reported in October 2021;
- Block N will have the initial Year 4-5 survey conducted in October 2019. Final Zone 4 4-5 year report is due to be reported in October 2021.

Results reported in this EMR therefore relate primarily to Blocks O and P. Details of each block surveyed for the 2019 annual report are provided in Table 5.

**Table 5:** Block preparation and survey details for the North Dunes Extension Rehabilitation Blocks

Block	Prepared	First Biannual Survey Conducted	Last Biannual Survey (Due)
O	January 2016	July 2016	January 2019
P	July 2016	January 2017	January 2020

The monitoring plan has been designed in accordance with principles of the EMP and will facilitate the stated aim of the EMP (Section 7.1) to re-establish stable and sustainable native vegetation cover in-line with the original vegetation community types pre-extraction, including similar structural components and species composition at similar elevations.

A total of 135 plots were surveyed for the purpose of the current annual report consisting of:

- 97 plots on Block O;

- 38 plots on Block P.

Results for each of the blocks is discussed separately below and include survey results against rehabilitation and species composition targets established in the EMP.

### 3.3.1 Block O

This survey is the sixth survey undertaken of Block O and marks three years of monitoring. Most if not all parameters would be expected to have increased, although perusal of data presented in Table 6, **Chart 1** and **Chart 2** indicates that results are mixed.

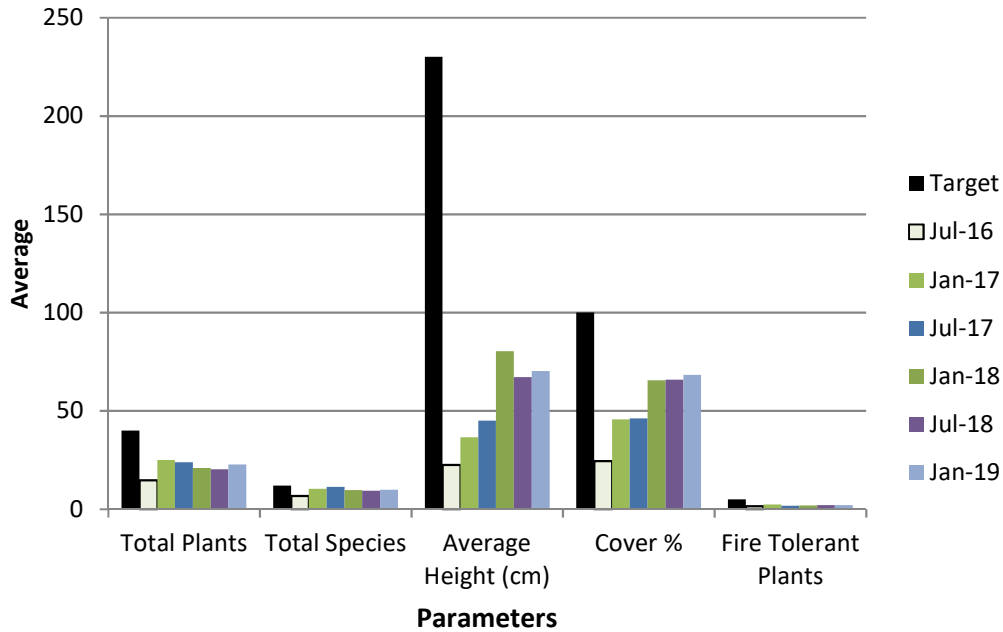
Average cover has essentially remained the same from the previous two surveys. Average plant height has recovered after an unexpected dip in the July survey but has now recovered most of the loss and is back on trajectory. Average plant density, species richness and fire tolerant species remain largely unchanged over the previous two surveys.

Vegetation structure parameters show that ground stratum species comprise 21.71% of the species present, increasing slightly from the January 2018 survey. Shrub species have continued to decline to 52.57% of species present. Midstorey and canopy species have species have increased to well above targets as a result of the deliberate planting program.

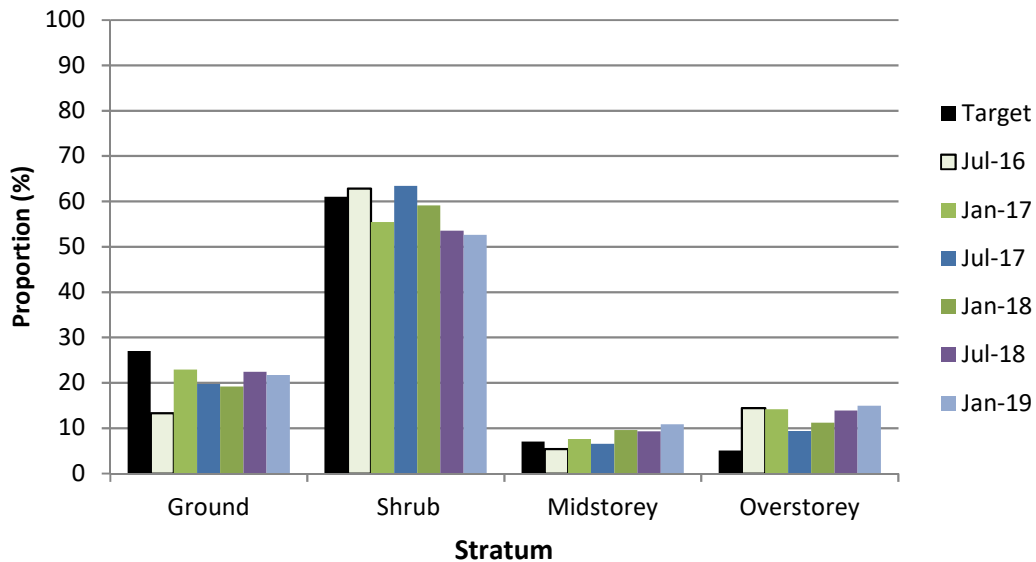
**Table 6: Progression of average monitoring parameter data and target projections for Block O over the course of the rehabilitation**

Parameter	Target	Rehab status July 2016	Rehab status Jan 2017	Rehab status July 2017	Rehab status Jan 2018	Rehab status Jul 2018	Rehab status Jan 2019	% Target Achieved Jan 2019
Average Cover (%)	100	24.53	45.57	46.14	65.57	65.77	68.20	68.20
Average height (cm)	230	22.51	36.54	45.00	80.37	67.18	70.24	30.54
Ave. No. of plants (plants/4 m <sup>2</sup> )	40	14.65	25.02	23.80	20.85	20.28	22.69	56.73
Ave. No. Fire tolerant species (plants/4 m <sup>2</sup> )	5 - 9	1.52	2.41	1.66	1.92	2.08	2.10	42.00
Ave. Species Richness (species/4 m <sup>2</sup> )	12	6.81	10.32	11.30	9.63	9.34	9.90	82.50
Ave. Ground stratum proportion (%)	27	13.28	22.87	19.70	19.15	22.36	21.71	80.41
Ave. Shrub stratum proportion (%)	61	62.84	55.46	63.43	59.12	53.49	52.57	86.18
Ave. Midstorey stratum proportion (%)	7	5.36	7.56	6.52	9.57	9.29	10.80	154.24
Ave. Overstorey stratum proportion (%)	5	14.40	14.11	9.33	11.14	13.83	14.92	298.44





**Chart 1:** The overall rehabilitation averages for Block O over the course of the biannual surveys.



**Chart 2:** The overall averages for stratum proportions for Block O over the course of the biannual surveys.

### 3.3.2 Block P

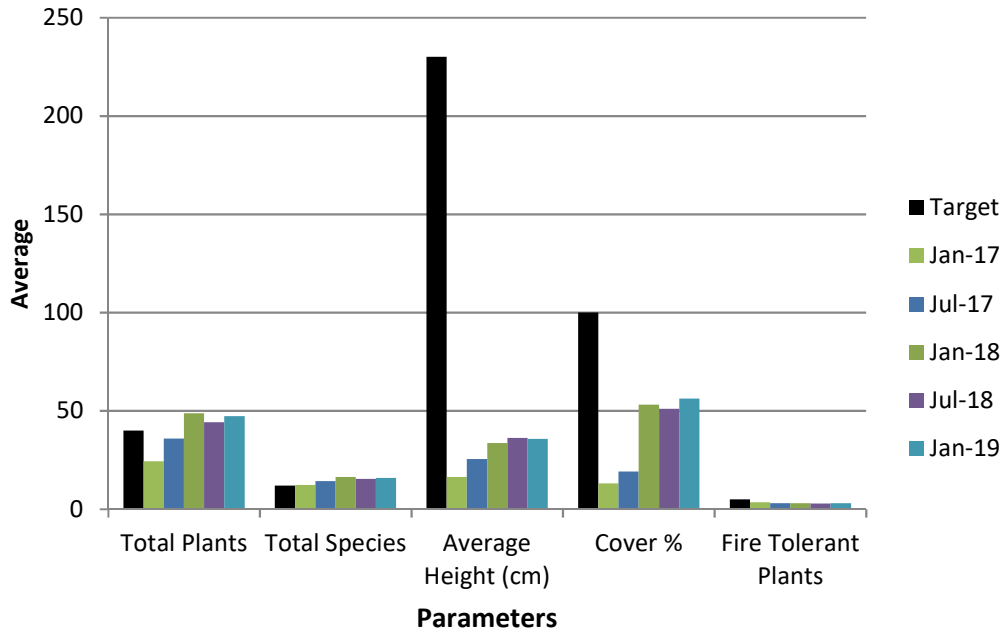
This marks the fifth survey undertaken of Block P and represents 30 months of rehabilitation (**Table 7**, **Chart 3** and **Chart 4**). This block has recorded excellent numbers as shown in **Table 7**.

Average cover has continued to increase as the plants mature and is now at 56.15%. Average height has levelled off somewhat. Plant density is still above target at 47.28 plants/4m<sup>2</sup>. The density of fire tolerant species is still below target but, at 3.08 plants/4m<sup>2</sup>, is one of the highest densities recorded on the Northern Dunes site. Average Species Richness has always been high on this block, starting at 12.31 species/4m<sup>2</sup> (right on target) and has remained relatively stable at around 15 species/4m<sup>2</sup> (currently at 15.90 species/4m<sup>2</sup>).

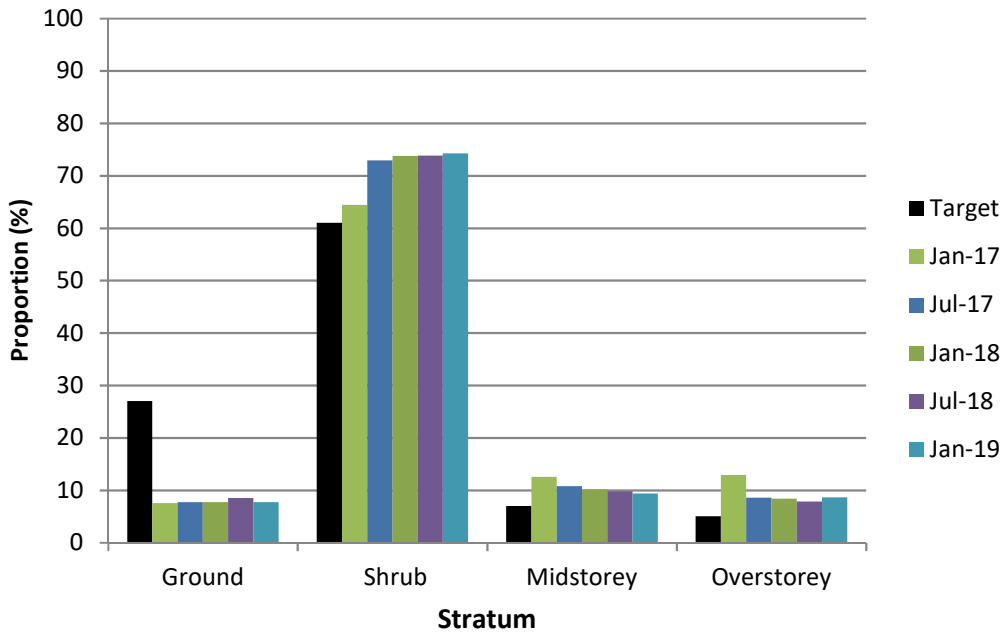
Vegetation structure has shown some minor variations with an increase in the shrub stratum in line with the increase in the number of species. The proportion of midstorey and overstorey has decreased slightly and is an artefact of the relative increase in the shrub stratum rather than a decrease in the actual number of species in these strata.

**Table 7: Progression of average monitoring parameter data and target projections for Block P over the course of the rehabilitation**

Parameter	Target	Rehab status Jan 2017	Rehab status Jul 2017	Rehab status Jan 2018	Rehab status Jul 2018	Rehab status Jan 2019	% Target Achieved Jan 2019
Average Cover (%)	<b>100</b>	13.03	19.10	53.08	51.03	56.15	56.15
Average height (cm)	<b>230</b>	16.42	25.41	33.59	36.16	35.68	15.51
Ave. No. of plants (plants/4 m <sup>2</sup> )	<b>40</b>	24.38	35.87	48.79	44.26	47.28	118.20
Ave. No. Fire resistant species (plants/4 m <sup>2</sup> )	<b>5 - 9</b>	3.51	2.95	3.00	2.87	3.08	61.60
Ave. Species Richness (species/4 m <sup>2</sup> )	<b>12</b>	12.31	14.21	16.33	15.39	15.90	132.50
Ave. Ground stratum proportion (%)	<b>27</b>	7.53	7.71	7.69	8.53	7.68	28.46
Ave. Shrub stratum proportion (%)	<b>61</b>	64.47	72.95	73.80	73.82	74.30	121.80
Ave. Midstorey stratum proportion (%)	<b>7</b>	12.56	10.75	10.13	9.80	9.39	134.10
Ave. Overstorey stratum proportion (%)	<b>5</b>	12.88	8.59	8.39	7.84	8.63	172.60



**Chart 3:** The overall rehabilitation averages for Block P over the course of the biannual surveys.



**Chart 4:** The overall averages for stratum proportions for Block P over the course of the biannual surveys.

### 3.3.3 Weeds

Sibelco has an ongoing weed management program which acts partly on direction given in the annual and midyear monitoring reports and the post 3-year reporting program.

*Eragrostis curvula* (African Lovegrass) appears to have become well established in Block O and by its continued may present a risk of spread to other areas within the block. Given the density of midstorey and canopy species, shading out will occur as the vegetation matures. However, it is likely that the proximity of this block to the powerline easement, and the amount of traffic that has been observed to use this area, will act as an ongoing source for weed species such that this block will likely never be weed free.

Block P is almost entirely weed free and is one of the best rehabilitation areas on the site.

## 3.4 Summary and Management Actions

### 3.4.1 Block O

Block O consists of Scribbly Gum/Red Bloodwood Heath-Woodland while the remaining blocks have been classified as Coastal Sand Wallum Heath-Woodland (ecobiological, 2011). While many of the species will be the same, there are different species in the seed bank and certainly different species densities. Examples include the canopy species *Angophora costata* (Smooth-Barked Apple) and twining perennial *Desmodium rhytidophyllum*, which are not present in the revegetation of the other blocks, and *Hardenbergia violacea* (Purple Coral Pea) which is very common in Block O but only rarely recorded in the other blocks.

Average Groundcover Stratum proportion at 19% is much higher than any of the other blocks, at this or any stage of rehabilitation while the Average Shrub Stratum proportion is below target at 59%. The ground stratum does have a large proportion of weedy species, while the shrub stratum is dominated by *Acacia longifolia*, an early colonising species with a prolific seed set that responds well to disturbance. The dominance of *A. longifolia* and *A. suaveolens* has also increased the average height of the vegetation as these are fast growing species. When these species start to die off, it can be expected that there will be noticeable changes to many of the vegetation parameters.

Plantings that have been undertaken in this block have been noticeably successful including many *Angophora costata* – the target for this species has been set at 175 plants for the block – as well as other canopy and midstorey species. Some species are well above target (*Corymbia gummifera*) although others are very much below target (*Leptospermum trinervium*). However, further germinations can be expected as this latter species is usually well represented in the seed bank.

Weed control was recommended earlier in the life of the rehabilitation but there is no further recommendation for weed control in this block. This is due to the geographic location of the block just to the north of, and adjacent to, the powerline easement and access road which, due to the prevalence of weeds acts as a source of, and facilitates the spread of weed species. The more advanced nature of the native species and the possibility of unintentional damage to the natives

if weed control is undertaken is also a consideration. Taken together these conditions greatly reduce the value of any weed control effort that may be undertaken by Sibelco.

No further planting is suggested for this block.

### 3.4.2 Block P

This block is nearing the end of the initial 3-year monitoring program and the development parameters are looking very promising reflecting the success of the planting program. Where this is very evident is the proportion of midstorey and canopy species which is above average for both parameters (APPENDIX 7). This may change, however, as the shrub species become established and hence increase their relative proportion as the early colonisers begin to die back.

The Total Fire-Resistant Species is the highest number recorded for any block, regardless of stage of rehabilitation. The average plant density and average number of species are also the highest for any block at this stage of rehabilitation with both being above target.

As a result of early and extensive planting in this block, five of the seven key species are above target densities with *M. nodosa* close to 82%. The only exception is *L. trinervium*, which usually comes up from the seed bank or is assisted through brush-matting (i.e. spreading of branches bearing seeds or seed capsules). The previous Annual Report (2018) recommended that further monitoring of this species occur to determine if action is required. This survey confirmed that this species will remain below target and recommended that remedial brush-matting or seeding occurs to increase numbers.

## 4 OTHER REQUIREMENTS

Clause 4 (a) (iii) of the approval granted under Clause 13(1) of the *Hunter Water (Special Areas) Regulation 1997* requires a report on the performance and compliance by Sibelco with other requirements of the Special Areas Approval not associated with the GMP or Rehabilitation Plans.

### 4.1 Part 2: Clause 3, Section 1 – Extent of Extraction Operations

*“The conduct of the Extractive Operations including the removal of vegetation and displacement of topsoil must not at any point:*

*(a) remove any material from beneath 0.7 metres above the level depicted by the Applicable Maximum Predicted Groundwater Level Plan (Extraction Buffer) for that point; or*

*(b) extend beyond the Operational Area. “*

No extraction works occurred in the areas specific to this Approval during the reporting period: extraction works ceased in 2016 and all works in the area are focused on monitoring and management of the rehabilitated areas.

### 4.2 Part 2: Clause 4 – Method of Extraction

#### 4.2.1 Laser level monitoring

*“During Extractive Operations, the Approval Holder must monitor, to the reasonable satisfaction of the Director-General, the height of land from which sand is being extracted, including by taking regular measurements using a laser level in accordance with industry standard procedure by a person, whether a surveyor, geologist or other person, trained in surveying techniques.”*

No extractive operations took place during the reporting period. Laser level monitoring was therefore not required.

#### 4.2.2 Machinery

*“The Approval Holder must remove all machinery used in the Extractive Operations from the Tomago Sandbeds Catchment Area at the end of each day’s operation”*

Machinery was not utilised in the area during the reporting period.

#### 4.2.3 Chemical storage

*“The Approval Holder must not store fuel, oil, grease and any similar potential groundwater contaminant on the Tomago Sandbeds Catchment Area”*

No chemicals were stored on the Lots exclusive to the Special Areas Approval during the reporting period

### 4.3 Part 3: Clause 5, Section 3 (a) – Notification of Incident or Event

*“The Approval Holder must notify the Director-General of any incident or event occurring in connection with the Extraction Operations that adversely affects or is likely to adversely affect the groundwater resource for use as potable supply, the groundwater ecosystem or the biophysical environment of the Tomago Sandbeds Catchment Area”*



No incidents associated with Extractive Operations that are likely to affect groundwater were recorded during the reporting period.

A bushfire, originating from outside the site, impacted land from Salt Ash to Tanilba Bay during August 2018. Kleinfelder Australia was engaged to undertake a survey of the whole of the Tanilba North Dunes Sand Extraction project rehabilitation area on the 28<sup>th</sup> August to assess the extent of impact of the fires upon revegetation and provide recommendations for management – refer to Section 3.2 of this AEMR for further information.

#### 4.4 Part 3: Clause 5, Section 4 (b) – Annual Inspection

*“The Approval Holder must arrange an annual inspection of the Extraction Area to be attended by HWC and the Department.”*

A review of the previous AEMR was held at the Salt Ash office on the 27<sup>th</sup> of July 2018, as required under Clause 4 (b) of Part 3 of the Special Areas Approval.

The meeting was attended by individuals shown in Table 8.

**Table 8: Attendees to Northern Dune AEMR Inspection**

Attendee	Representing	Presence
Paul Timmins	Sibelco	Entire Meeting
Ann Hagerthy	DPE	Entire Meeting
John Simpson	Hunter Water	Entire Meeting
Andrew Martin	Sibelco	Entire Meeting

#### 4.5 Part 3, Clause 8, Section 5 – Environmental Audits

*The Approval Holder must cause an Environmental Audit to be carried out at least once each six years for the duration of this Approval, such that the maximum period between any two consecutive Environmental Audits is six years*

An Independent Environmental Audit of the lots exclusive to the Special Areas Approval was undertaken in December 2015.

#### 4.6 Part 3, Clause 10 – Hydrocarbon Spill Procedure and Remediation of Land

*The approval Holder must develop a procedure, to the satisfaction of HWC and the Department, to be followed by the Approval Holder in responding to the event of a hydrocarbon spill in the Extraction Area with the objective of prevention or minimisation to the extent possible of any unreasonable adverse impact on the quality of groundwater in the Tomago Sandbeds Catchment Area*

A hydrocarbon spill procedure has been developed for the site and is contained within the Environmental Management Plan. This procedure is communicated through the Northern Dune Pollution Incident Response Management Plan and the Northern Dune induction as part of the emergency response plan.

There were no issues or incidents of hydrocarbon contamination at Northern Dune during the reporting period.

As required, no chemicals or mobile plant are stored overnight at Northern Dune which reduces the risk of any hydrocarbon contamination.

This is reflected in Section 5 which relates specifically to the Groundwater Management Plan and the biannual reporting.

#### **4.7 Hunter Water Regulation 2010 approval under Clause 10 (1)**

On the 25<sup>th</sup> of November 2013, a variation to the Special Areas approval was granted to Sibelco Australia under clause 10 (1) of the *Hunter Water Regulation 2010* (BN 13/5769). The approval was granted under the *Hunter Water (Special Areas) Regulation 1997* and relates to an area known as the Tanilba Northern Dune Extension Project located adjacent to, and north of, Zone 1 of the Special Areas Approval.

This area is also subject to Project Approval MP09\_0091 issued by the Department of Planning and Environment on 8 March 2013. A separate report has been prepared for activities in this area over the reporting period and a copy provided to HWC and OW in accordance with Part 3, Clause 9 of BN 13/5769.

## 5 ACTIVITIES PROPOSED IN THE NEXT EMR PERIOD

Extraction at the site ceased in 2016. There will be no further extraction from the site and all future works will focus on implementation of the rehabilitation and monitoring requirements as described in the Environmental Management Plan and sub-plans as well as implementation of recommendations made throughout the reporting period as a result of inspections or monitoring activities.

The annual rehabilitation monitoring report prepared by Kleinfelder has determined that weed management should be continued into the next reporting period. Sibelco will continue to manage rehabilitation commitments to address these actions. As progress reports are compiled throughout the reporting period any actions that arise will be managed accordingly to continue our commitment to the Rehabilitation Management Plan.

Activities proposed in the next AEMR period therefore include:

- Monitoring of groundwater in accordance with the requirement of the GMP;
- Monitoring of rehabilitated areas to assess performance against the requirements of the Rehabilitation Plans and implementation of any requirements to manage regrowth in accordance with the Plans;
- An ongoing weed management programme to reduce weed infestations.

Monitoring exceedances, if found to occur, will be reported per the approval requirements by phone and in writing within the defined approval time periods.

Any areas that are identified for improvement from the submission of this AEMR will also be a priority for Sibelco into the next reporting period.

The action program for the coming reporting period is summarised in Table 9 below.

**Table 9: Action Plan for 2019/2020 Reporting Period**

Item	Requirement	2019-2020 program	Due Date
OPERATION/ADMINISTRATION			
1	Site condition	Inspection of site for identification of maintenance requirements including condition of roadside drainage and rehabilitated areas	Monthly
2	P3, CI 5 (4)	Annual Environmental Management Report	Prepare and submit AEMR to HWC and OW on activities undertaken in the 2019-2020 reporting period
GROUNDWATER			
3	Groundwater Level Monitoring	Sibelco to monitor bores referred to in Section 2.2.1 of this AEMR, or as determined by GMP review.	Monthly (weekly for 4 weeks if >100 mm rain per 7 days)
4	Groundwater quality Monitoring	Third Party contractor to monitor bores referred to in Section 2.3.1 of this AEMR, or as determined by GMP review.	Six Monthly (September 2019 and March 2020).

5		GMP Review	The GMP will be reviewed to ensure the monitoring and reporting is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC.	Following submission of AEMR (within 3 months)
6		Reporting	Reporting frequency will be determined during the review of the GMP following consultation with DPI-Water and HWC.	Frequency determined following GMP review and consultation with DPI-Water and HWC
REHABILITATION PROGRAM				
7	P3, CI12	Weed management	Site wide weed spraying	
8		Maintenance	Follow up inspections to identify and manage regrowth across all rehabilitated areas	
9		Performance monitoring	Implement recommendations in Annual Vegetation Rehabilitation Monitoring Report (Kleinfelder 2019)	
10			Monitoring of rehabilitated areas to assess performance against the requirements of the Rehabilitation Plans	Per schedule in VRP
11			Prepare report to summarise results of rehabilitation program, identify trends and any management measures required to achieve objectives of rehabilitation program	April 2020
12		Rehabilitation Plan Review	The Rehabilitation Plans will be reviewed to ensure the monitoring and reporting is relevant to the activities being performed. The review will be performed in consultation with DPI-Water and HWC	Following submission of AEMR

## 6 REFERENCES

Kleinfelder (2014a) *Post 3-year Monitoring of the Vegetation Rehabilitation at Tanilba Northern Dune 4-5 Year Surveys of Blocks G and H, Zone 2*. Report prepared for Sibelco Australia.

Kleinfelder (2014b) *8-year Monitoring of the Vegetation Rehabilitation at Tanilba Northern Dune 8 Year Survey of Zone 1*. Report prepared for Sibelco Australia.

Kleinfelder (2015) *Initial Year 8 Surveys for Zone 2 (Block D) and Initial 4 - 5 Year Survey for Zone 3 (Blocks I and J)*. A report prepared for Sibelco Australia.

Kleinfelder (2016b) *4-5 Year Monitoring of the Vegetation at Tanilba Northern Dune, 4-5 Year Survey of Zone 3 (Blocks I, J and K)*. A report prepared for Sibelco Australia.

?? Kleinfelder (2017) *Recommended management actions for the Northern Dune Extraction Areas following the July 2017 biannual rehabilitation monitoring*. Report prepared for Sibelco Australia.

Kleinfelder (2018) *8-year Monitoring of the Vegetation Rehabilitation at Tanilba Northern Dune 8 Year Survey of Zone 2*. Report prepared for Sibelco Australia.

## 7 APPENDICES

Appendices have been attached following the order that they are referenced throughout the document.

**APPENDIX 1: Approval under Clause 13(1) of the *Hunter Water (Special Areas) Regulation 1997***

**APPENDIX 2: Inspection Records**

**APPENDIX 3: Groundwater Monitoring Biannual Report September 2018**

**APPENDIX 4: Groundwater Monitoring Supplementary Charts June 2019**

**APPENDIX 5: Groundwater Quality Results April 2019**

**APPENDIX 6: Supplemental monitoring**

**APPENDIX 7: Vegetation monitoring report**



**APPENDIX 1: Approval under Clause 13(1) of the *Hunter Water (Special Areas) Regulation 1997***



Office of the Director General

BN13/5769

Mr Ian Clark  
Sibelco Australia Limited  
PO Box 114  
TANILBA BAY NSW 2319

Dear Mr Clark

**Approval for Sibelco Australia Limited to extract sand in the Tomago Sandbeds Catchment Area**

Thank you for your letter of 29 May 2013 seeking variation to the approval by the Director General for Sibelco Australia Limited's Tanilba Northern Dune Operations in the Tomago Sandbeds Catchment Area.

I have granted an approval under clause 10(1) of the *Hunter Water Regulation 2010* for engaging in extractive industry under the Tanilba Northern Dune Extension Project. A copy of this approval is attached. The existing approval for the current operations granted under the *Hunter Water (Special Areas) Regulation 1997* remains in force.

Should you have any further enquiries about this matter, I have arranged for Mr Mitchell Isaacs, Manager, Strategic Stakeholder Liaison to assist you. Mr Isaacs may be contacted at the NSW Office of Water's Parramatta Office on telephone number (02) 8838 7529.

Yours sincerely

Mark I Paterson AO  
Director General

25.11.13

**Approval under clause 10(1) of the *Hunter Water Regulation 2010* for engaging in extractive industry in the Tomago Sandbeds Catchment Area.**

**A. Date of Issue.**

The *25<sup>th</sup>* day of *November* 2013.

**B. Approval.**

For the term of this Approval the Director General hereby permits the Approval Holder to undertake the Extractive Operations within that part of the Tomago Sandbeds Catchment Area described in this Approval, subject to the terms and conditions set out below.

**C. Term of Approval.**

This Approval shall commence on the Date of Issue.

The Extractive Industry authorised by this Approval may continue until 31 December 2020, unless revoked earlier.

**D. Approval Holder.**

Sibelco Australia Limited

**E. Extractive Industry.**

Sand Extraction.

**F. Extraction Area.**

The Approval Holder is permitted to undertake the Extractive Industry in such parts of the Land shown as "09\_0091 Extraction Area" in Figure 1 of Appendix 1.

**G. Terms and Conditions of Approval.**

The Definitions, Schedule and Appendices have effect and form part of this Approval.

**H. Approval not Transferable.**

This Approval may not be transferred or assigned by the Approval Holder (including, without limitation, assigned by way of security).



**Director General**

**Department of Trade and Investment, Regional Infrastructure and Services**

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## DEFINITIONS

In this Approval:

**Annual Review** has the same meaning as in clause 3 of Schedule 5 of the Project Approval.

**Approval Holder** has the same meaning as in clause D.

**Completion criteria** means the completion criteria for the rehabilitation and stabilisation of the site provided in the Rehabilitation Management Plan.

**Criteria for quarry closure** means the criteria for quarry closure provided in the Long Term Management Strategy.

**Director General** means the Director General, Department of Trade and Investment, Regional Infrastructure and Services and his or her authorised delegates.

**Environmental Management Plans** means the Soil and Water Management Plan, the Landscape Management Plan, the Operations Management Procedure and the Hydrocarbon Spill Procedure.

**Extraction Area** has the same meaning as in clause F.

**Extraction Buffer** has the same meaning as in clause 1(2) of the Schedule.

**Extraction Depth Limit** means the limit on the depth of extraction from the predicted maximum groundwater elevation provided in clause 10 of Schedule 3 of the Project Approval.

**Extractive Industry** has the same meaning as in clause E.

**Extractive Operations** means the operations done under this Approval or works done as part of or associated with those operations, including without limitation the clearing of land, the stripping of topsoil, road-building, undertaking the Extractive Industry, the stockpiling and storage of extracted sand, the loading of vehicles and transportation away of sand, and the rehabilitation of the landform and vegetation on the land.

**HWC** means Hunter Water Corporation (ABN 46 228 513 446) and where the context permits its servants, employees and agents.

**Hydrocarbon Spill Procedure** has the same meaning as in clause 5 of the Schedule.

**Land** means the land to which this Approval applies, described as Lots 11, 12, and 13 DP 601306, Lot 408 DP 1041934 and Lots 1 and 2 DP 408240, Oyster Cove.

**Landscape Management Plan** means the approved Landscape Management Plan for the purposes of clause 17 of Schedule 3 of the Project Approval.

**Long Term Management Strategy** means the Long Term Management Strategy prepared as part of the Landscape Management Plan for the purposes of clause 17 of Schedule 3 of the Project Approval

**Tomago Sandbeds Catchment Area** has the same meaning as in the Regulation.

**Office of Water** means the NSW Office of Water (ABN: 47 661 556 763) and where the context permits its servants, employees and agents.

**Operations Management Procedure** has the same meaning as in clause 4 of the Schedule.

**Operations Report** has the same meaning as in clause 9(3)(b) of the Schedule.

**Predicted maximum groundwater elevation** means the approved predicted maximum groundwater elevation for the purposes of conditions 10, 11 and 14 of Schedule 3 of the Project Approval.

**Project Approval** means the Project Approval for the Tanilba Northern Dune Extension Project (09\_0091) granted by the Minister for Planning and Infrastructure on 8 March 2013.

**Regulation** means the *Hunter Water Regulation 2010* (NSW).

**Rehabilitation Management Plan** means the Rehabilitation Management Plan prepared as part of the Landscape Management Plan for the purposes of clause 17 of Schedule 3 of the Project Approval.

**Soil and Water Management Plan** means the approved Soil and Water Management Plan for the purposes of clause 12 of Schedule 3 of the Project Approval.



## **SCHEDULE**

### **PART 1      EXTRACTIVE OPERATIONS**

#### **CLAUSE 1    LIMIT ON EXTRACTIVE OPERATIONS**

##### **Extraction Area**

- (1)    The Approval Holder may not undertake Extractive Operations outside of the boundary of the Extraction Area, excepting that the Approval Holder may utilise any road for the purposes of access to the Extraction Area and for associated purposes, including without limitation for the purpose of transportation away of sand from the Extraction Area, and the performance of any obligation under the Environmental Management Plans.

##### **Extraction Buffer**

- (2)    Extractive Operations including the removal of vegetation and displacement of topsoil must not remove any material from within the Extraction Depth Limit for that point (*Extraction Buffer*).

## **PART 2 ENVIRONMENTAL CONTROLS**

### **CLAUSE 2 MANNER OF PERFORMING EXTRACTIVE OPERATIONS**

To ensure that there is no adverse impact on the supply or quality of groundwater located within the Tomago Sandbeds Catchment Area, the Approval Holder must operate and manage the Extractive Operations:

- (a) in accordance with the terms and conditions of this Approval and the Environmental Management Plans; and
- (b) having regard to the importance of the groundwater and its surrounding environment for potable water supply purposes.

### **CLAUSE 3 METHOD OF EXTRACTIVE OPERATIONS**

#### **Laser level monitoring**

- (1) During Extractive Operations, the Approval Holder must monitor, to the reasonable satisfaction of the Director General, the height of the land from which sand is being extracted, including by taking regular measurements using a laser level in accordance with industry standard procedure by a person, whether a surveyor, geologist or other person, trained in surveying techniques.

#### **Machinery and Equipment**

- (2) The Approval Holder must remove all machinery used in the Extractive Operations from the Land at the end of each day's operation and park all machinery in the area specified in the Operations Management Procedure.
- (3) The Approval Holder must operate, manage and maintain all plant and equipment used in connection with the Extractive Operations in a proper and efficient condition, including any equipment used for the purposes of monitoring and rehabilitation.

#### **No storage of contaminants**

- (4) The Approval Holder must not store fuel, oil, grease or other groundwater contaminant within the Tomago Sandbeds Catchment Area.

#### **Refuelling**

- (5) The Proponent shall not undertake any refuelling or maintenance of vehicles or equipment within the Tomago Sandbeds Catchment Area, except to the extent necessary to remove vehicles or equipment from the site in the case of breakdowns.
- (6) Refuelling or maintenance necessary to remove vehicles or equipment from the site in accordance with subclause (5) is not to be undertaken unless spill control and containment equipment is available in the immediate vicinity of the refuelling or maintenance area.

### **CLAUSE 4 OPERATIONS MANAGEMENT PROCEDURE**

- (1) The Approval Holder must develop a procedure, to the satisfaction of HWC and the Office of Water, to address the management of operations at the site (*Operations Management Procedure*).

- (1) The Operations Management Procedure must:
    - (a) be submitted to HWC and the Office of Water for approval within 3 months of the Date of Issue of this Approval,
    - (b) be consistent with the requirements for the method of Extractive Operations in clause 3, and
    - (c) include, but is not limited to, procedures for the following:
      - (i) management of the plant, equipment and vehicles,
      - (ii) site operations,
      - (iii) environmental inductions, and
      - (iv) environmental training,
- in order to prevent and minimise any adverse impact on the supply or quality of groundwater within the Tomago Sandbeds Catchment Area.

#### **CLAUSE 5 HYDROCARBON SPILL PROCEDURE**

- (1) The Approval Holder must develop a procedure, to the satisfaction of HWC and the Office of Water, to manage a hydrocarbon spill on the Land (*Hydrocarbon Spill Procedure*).
- (2) The Hydrocarbon Spill Procedure must:
  - (a) be submitted to HWC and the Office of Water for approval within 3 months of the Date of Issue of this Approval,
  - (b) include, but is not limited to, a plan for the remediation of the Land in order to prevent or minimise any adverse impact on the supply or quality of groundwater within the Tomago Sandbeds Catchment Area.
- (3) The Director General may require that the Approval Holder vary any part of the Hydrocarbon Spill Procedure as a result of any incident or event which adversely impacted upon or had the potential to adversely impact upon the groundwater in the Tomago Sandbeds Catchment Area.

#### **CLAUSE 6 REHABILITATION**

##### **Requirement to rehabilitate the Land**

- (1) The Approval Holder must rehabilitate disturbed areas of the Land in accordance with the Landscape Management Plan and the Extraction Buffer.

##### **Progressive replacement of topsoil**

For the purposes of rehabilitation of the Extraction Area, topsoil must be replaced as soon as practicable after the extraction of sand has occurred to at least the minimum depth required to achieve the approved final landform elevation.

#### **CLAUSE 7 INCIDENT REPORTING**

- (1) For the purpose of clause 5 (Incident Reporting) of Schedule 5 of the Project Approval, HWC and the Office of Water are “relevant agencies” which are to be notified if there is an incident that requires reporting under those sections.
- (2) For clarification, “any incident associated with the project” in clause 5 (Incident Reporting) of Schedule 5 of the Project Approval, includes incidents which adversely impacted upon or had the potential to adversely impact upon the groundwater in the Tomago Sandbeds Catchment Area.

## **CLAUSE 8    REVOCATION OF APPROVAL**

If, in the opinion of the Director General, the groundwater located within the Tomago Sandbeds Catchment Area is becoming polluted or contaminated, or is at risk of becoming polluted or contaminated, as a result of the Extractive Operations, the Director General may revoke this Approval by notice in writing to the Approval Holder (*Revocation Notice*).

## PART 3 ENVIRONMENTAL REPORTING

### CLAUSE 9 ANNUAL ENVIRONMENTAL REPORTING

#### Annual Review

- (1) Within 1 month of the completing of the Annual Review required under clause 3 of Schedule 5 of the Project Approval the Approval Holder shall submit a copy of the review to HWC and the Office of Water.
- (2) If HWC or the Office of Water considers that the Annual Review does not adequately address the matters specified in clause 3(a)-(f) of Schedule 5 to the Project Approval, HWC or the Office of Water may require the Approval Holder to submit a supplementary report addressing the matters notified to the Approval Holder.

#### Additional Reporting

- (3) On the date on which the Annual Review is submitted in accordance with subclause (1), the Approval Holder must also submit the following to HWC and the Office of Water:
  - (a) an electronic copy of the monitoring results for groundwater levels and quality during the past year collected in accordance with the Soil and Water Management Plan, and
  - (b) a written report (*Operations Report*) addressing whether the Approval Holder has achieved compliance with:
    - (i) the requirements for the method of Extractive Operations in clause 3 of the Schedule;
    - (ii) the Operations Management Procedure;
    - (iii) the Hydrocarbon Spill Procedure; and
    - (iv) the requirement for the progressive replacement of topsoil provided in clause 6(3) of the Schedule.
- (4) The Operations Report must:
  - (a) identify any non-compliance during the previous year; and
  - (b) identify what actions were, or are being, taken to ensure compliance.
- (5) If HWC or the Office of Water considers that the Operations Report does not adequately address the matters specified in subclause (3)(b)(i)-(iv) or subclause (4), HWC or the Office of Water may require the Approval Holder to submit a supplementary report addressing the matters notified to the Approval Holder.

#### Annual inspection

- (6) Within 3 months of the date on which the Annual Review is submitted to HWC and the Office of Water, the Approval Holder must arrange an annual inspection of the Extraction Area to be attended by HWC and the Office of Water.
- (7) The Director General may direct that the Approval Holder notify other relevant agencies, including but not limited to Port Stephens Council, of the date and time of the inspection and be given the opportunity to attend. Such notice is to be provided by the Approval Holder to those agencies at least 14 days prior to the scheduled inspection date.
- (8) The Approval Holder must not arrange an annual inspection within four weeks of the date on which the Annual Review is submitted to HWC and the Office of Water.

**CLAUSE 10 INDEPENDENT ENVIRONMENTAL AUDITS**

- (1) For the purpose of clause 7 (Independent Environmental Audit) of Schedule 5 of the Project Approval, HWC and the Office of Water are “relevant agencies” to be consulted during the Independent Environmental Audit.
- (2) Within 1 month of the completion of the Independent Environmental Audit referred to in subclause (1), the Approval Holder must submit a copy of the audit report to the Office of Water and HWC, with a response to any of the recommendations in the audit report.



## PART 4 OBLIGATIONS AND RIGHTS

### CLAUSE 11 APPROVAL HOLDER'S RIGHTS AND OBLIGATIONS

#### Notification of breach

- (1) Within 3 days of becoming aware of any act by the Approval Holder that, in the opinion of the Approval Holder, may be in breach of the terms and conditions of this Approval, the Approval Holder must notify HWC and the Office of Water of the breach.

#### Investigation of performance under Approval

- (2) The Director General may require an investigation of the performance of any of the Approval Holder's obligations under this Approval during the conduct of the Extractive Operations and following the cessation of the Extractive Operations.

#### Obligations at the cessation of the Extractive Industry

- (3) Within 12 months prior to the expiry of this Approval, the Approval Holder must commission and pay the full cost of an Independent Environmental Audit of the Extractive Operations.
- (4) The Independent Environmental Audit referred to in subclause (3) must:
  - (a) be conducted by a suitably qualified, experienced, and independent team of experts whose appointment has been approved by the Director General;
  - (b) assess the environmental performance of the Extractive Operations, and its effects on the surrounding environment;
  - (c) assess whether the Approval Holder has achieved compliance with the terms and conditions of this Approval and the Environmental Management Plans; and,
  - (d) assess the Land in terms of the completion criteria and criteria for quarry closure.
- (5) The Independent Environmental Audit referred to in subclause (3) may include recommendations as to works that could be performed or additional obligations that could be imposed in order to rectify any of the matters assessed in subclause (4).
- (6) Within 1 month of the completion of the Independent Environmental Audit referred to in subclause (3), the Approval Holder must submit a copy of the audit report to the Office of Water and HWC, with a response to any of the recommendations in the audit report.
- (7) If the Approval Holder performs further work or satisfies additional obligations based on the recommendations made in the Independent Environmental Audit, the Approval Holder may cause a further Independent Environmental Audit to be carried out in relation to those further works or obligations (*Supplementary Independent Environmental Audit*).
- (8) Within 1 month of the completion of the Supplementary Independent Environmental Audit referred to in subclause (7), the Approval Holder must submit a copy of the audit report to the Office of Water and HWC.

*Note. The results of the Independent Environmental Audit and, where relevant, the Supplementary Independent Environmental Audit, may be a relevant consideration when the Director General assesses applications for further approvals or amendments to an approval.*

## **CLAUSE 12 OPERATION OF HWC**

### **Interference with HWC functions**

- (1) Nothing in this Approval allows the Approval Holder to interfere with or prevent HWC from performing its statutory functions in relation to the Tomago Sandbeds Catchment Area.

### **HWC access and infrastructure**

- (2) In carrying out Extractive Operations the Approval Holder must not, unless with written consent of HWC:
  - (a) damage or interfere with any improvements, monitoring bores, water supply infrastructure or portable operating assets of HWC situated in the Land;
  - (b) limit or impede HWC's access to any improvements, monitoring bores, water supply infrastructure or portable operating assets of HWC situated in the Land; or
  - (c) limit or impede the manner or timing of HWC in the performance of its statutory functions including installation and operation of any new improvements, monitoring bores, water supply infrastructure or portable operating assets of HWC within the Tomago Sandbeds Catchment Area.

## APPENDIX 1 EXTRACTION AREA

Note. The figure in this Appendix shows the Extraction Area, depicted as “09\_0091 Extraction Area”.

Figure 1 Extraction Area



## APPENDIX 2 CONTACT DETAILS

- (1) For the purpose of notifying the Director General under this Approval, the contact details are:
  - Mr Mark I Patterson AO
  - Director General
  - NSW Trade a& Investment
  - GPO Box 5477
  - Sydney NSW 2001
  
- (2) For the purpose of notifying HWC under this Approval, the contact details are:
  - Hunter Water Corporation
  - Attn: Manager Water Resources
  - PO Box 5171
  - HRMC NSW 2310
  
- (3) For the purpose of notifying the Office of Water under this Approval, the contact details are:
  - The NSW Office of Water
  - Attn: Manager Strategic Stakeholder Liaison
  - PO Box 3720
  - PARRAMATTA NSW 2124
  
- (4) The contact details in (1), (2) and (3) may be amended from time to time by notice in writing to the Approval Holder.

## APPENDIX 2: Inspection Records

Date: 29-8-17

Persons Inspecting: Paul Bourne

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	Satisfactory.
2	Access road is in good condition	✓	Satisfactory.
3	Haul road at extraction area is in good condition	✓	Satisfactory.
4	General condition of extraction area satisfactory	✓	Satisfactory.
5	No rubbish on site	✓	Satisfactory.
6	No signs of intruders or motorbikes/4WD	✓	Some Evidence of fire truck access.
7	No evidence of hydrocarbon spill	✓	No evidence.
8	No evidence of flood or fire damage	✓	Recent Bushfire in site. See photos.
9	Only approved Native vegetation cleared	✓	Satisfactory.
10	No relics or aboriginal artefacts	✓	Satisfactory.
11	Contractor gear in good working order Pre-starts Job Start Cards	✓	Satisfactory.
12	Safe communication with mobile plant operators?	✓	Satisfactory.
13	Water bore markers intact	X	Some markers burnt. Identification replaced.
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	✓	Satisfactory
15	Extraction in Mine Plan area?	✓	Satisfactory
16	Mining Depth (12mRL min) markers visible/intact	✓	Satisfactory
17	Mining above min depth, Operators aware of depth markers	✓	Satisfactory.
18	Working face safe	✓	Satisfactory.
19	Working face clear of debris	✓	Satisfactory.
20	Operator has mobile phone contact in case of emergency	✓	Satisfactory.
21	Operational noise satisfactory	✓	Satisfactory
22	Dust generation satisfactory	✓	Satisfactory.
23	Required signage in good condition	✓	Satisfactory.

Signed: \_\_\_\_\_

*[Handwritten Signature]*

Attach any photos below




Date: 17-9-18

Persons Inspecting: P

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	✓	
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	✓	EVIDENCE OF MOTORBIKES AT REAR OF SITE.
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	Recent fire thru site see photos.
9	Only approved Native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	✓	
12	Safe communication with mobile plant operators?	✓	
13	Water bore markers intact	✓	
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	✓	
15	Extraction in Mine Plan area?	✓	
16	Mining Depth (12mRL min) markers visible/intact	✓	
17	Mining above min depth, Operators aware of depth markers	✓	
18	Working face safe	✓	
19	Working face clear of debris	✓	
20	Operator has mobile phone contact in case of emergency	✓	
21	Operational noise satisfactory	✓	
22	Dust generation satisfactory	✓	
23	Required signage in good condition	✓	

Signed:  \_\_\_\_\_

Attach any photos below

Date: 18-10-18

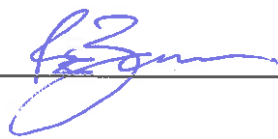
Persons Inspecting: Paul Bourne

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	Good.
2	Access road is in good condition	✓	Satisfactory.
3	Haul road at extraction area is in good condition	✓	Good.
4	General condition of extraction area satisfactory	✓	Satisfactory
5	No rubbish on site	✓	None Sighted
6	No signs of intruders or motorbikes/4WD	✓	Some evidence of motorbike activity.
7	No evidence of hydrocarbon spill	✓	None Sighted
8	No evidence of flood or fire damage	✓	Bushfire damage recovering.
9	Only approved Native vegetation cleared	✓	Small amount of weeds adjacent to roadways.
10	No relics or aboriginal artefacts	✓	None.
11	Contractor gear in good working order Pre-starts Job Start Cards	✓	Satisfactory.
12	Safe communication with mobile plant operators?	✓	Satisfactory
13	Water bore markers intact	✓	Good.
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	✓	Good.
15	Extraction in Mine Plan area?	✓	Yes.
16	Mining Depth (12mRL min) markers visible/intact	✓	Satisfactory
17	Mining above min depth, Operators aware of depth markers	✓	GPS in dozers used.
18	Working face safe	✓	Satisfactory
19	Working face clear of debris	✓	Good.
20	Operator has mobile phone contact in case of emergency	✓	Yes.
21	Operational noise satisfactory	✓	Yes.
22	Dust generation satisfactory	✓	Yes.
23	Required signage in good condition	✓	Yes.

Signed: \_\_\_\_\_



Attach any photos below

**Monthly Inspection Sheet – Northern Dune Operations**

**Sibelco Salt Ash**

Date: 28-11-18

Persons Inspecting: Paul Bourne.


Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	✓	
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	X	EVIDENCE OF MOTORBIKES.
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	
9	Only approved Native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	NA	
12	Safe communication with mobile plant operators?	NA	
13	Water bore markers intact	✓	
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	✓	
15	Extraction in Mine Plan area?	✓	
16	Mining Depth (12mRL min) markers visible/intact	NA	GPS USED ON DOZER.
17	Mining above min depth, Operators aware of depth markers	✓	
18	Working face safe	✓	
19	Working face clear of debris	✓	
20	Operator has mobile phone contact in case of emergency	N/A.	
21	Operational noise satisfactory	✓	
22	Dust generation satisfactory	✓	
23	Required signage in good condition	✓	

Signed:  \_\_\_\_\_

Attach any photos below

WEEDGROWTH NEAR EXTRACTION AREA HAS INTENSIFIED.  NEEDS SPRAYING.

Date: 12-12-18

Persons Inspecting: Paul Bourne

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	✓	
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	✓	Some signs of motorbike and 4WD activity.
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	
9	Only approved Native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	N/A	NO CONTRACTORS ON SITE.
12	Safe communication with mobile plant operators?	N/A.	NO CONTRACTORS ON SITE.
13	Water bore markers intact	✓	
Item	Observation	Result	Comment or Action



14	Extraction in approved area?	✓	
15	Extraction in Mine Plan area?	✓	
16	Mining Depth (12mRL min) markers visible/intact	✓	
17	Mining above min depth, Operators aware of depth markers	✓	
18	Working face safe	N/A	NO LONGER EXTRACTING
19	Working face clear of debris	N/A	
20	Operator has mobile phone contact in case of emergency	N/A	NO CONTRACTORS ON SITE.
21	Operational noise satisfactory	✓	
22	Dust generation satisfactory	✓	
23	Required signage in good condition	✓	

Signed: 

Attach any photos below

Monthly Inspection Sheet - Northern Dune Operations

Sibolco Salt Ash

Date: 15-1-2014

Persons inspecting: Paul Bourne

Result: ✓ - OK, meets standard; ✗ - needs improvement; NA - Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	✓	
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	✗	Signs of Motorbikes and 4WD
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	
9	Only approved native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	NA	NO CONTRACTORS INSIDE
12	Safe communication with mobile plant operators?	NA	
13	Water born markers intact	✓	
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	N/A	SEE EXTRACTOR
15	Extraction in Mine Plan area?	N/A	
16	Mining Depth (12mm min) markers visible/intact	✓	
17	Mining above min depth, Operators aware of depth markers	✓	
18	Working face safe	✓	
19	Working face clear of debris	✓	
20	Operator has mobile phone contact in case of emergency	N/A	
21	Operational noise satisfactory	✓	
22	Dust generation satisfactory	✓	
23	Required signage in good condition	✓	

Signed:  \_\_\_\_\_

Attach any photos below



*Figure 1 Northern Dune Sign*



*Figure 2 Roadway Weed Growth*





*Figure 3 Top Soil Replacement*



*Figure 4 Rehab Regrowth*

Monthly Inspection Sheet – Northern Dune Operations

Sibelco Salt Ash


Date: 28-2-2019

Persons Inspecting: Paul Bourne

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	N/A.	
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	✓	Some signs of motorbike activity.
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	
9	Only approved Native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	N/A	Extraction has stopped at Northern Dune.
12	Safe communication with mobile plant operators?	N/A	
13	Water bore markers intact	✓	
Item	Observation	Result	Comment or Action

14	Extraction in approved area?	✓	
15	Extraction in Mine Plan area?	✓	
16	Mining Depth (12mRL min) markers visible/intact	✓	
17	Mining above min depth, Operators aware of depth markers	N/A	
18	Working face safe	N/A	
19	Working face clear of debris	N/A	
20	Operator has mobile phone contact in case of emergency	N/A	
21	Operational noise satisfactory	N/A	
22	Dust generation satisfactory	✓	
23	Required signage in good condition	✓	

Signed:  \_\_\_\_\_

Attach any photos below

Monthly Inspection Sheet – Northern Dune Operations

Sibelco Salt Ash

Date: 15-3-19


Persons Inspecting: PAUL BOURNE

Result : ✓ - OK, meets standard; X – needs improvement; NA – Not applicable

Item	Observation	Result	Comment or Action
1	Access gates and locks in working order	✓	
2	Access road is in good condition	✓	
3	Haul road at extraction area is in good condition	✓	
4	General condition of extraction area satisfactory	N/A	NO LONGER EXTRACTING.
5	No rubbish on site	✓	
6	No signs of intruders or motorbikes/4WD	✓	
7	No evidence of hydrocarbon spill	✓	
8	No evidence of flood or fire damage	✓	
9	Only approved Native vegetation cleared	✓	
10	No relics or aboriginal artefacts	✓	
11	Contractor gear in good working order Pre-starts Job Start Cards	N/A	NO CONTRACTORS ON SITE.
12	Safe communication with mobile plant operators?	N/A.	
13	Water bore markers intact	✓	
Item	Observation	Result	Comment or Action



14	Extraction in approved area?	N/A	
15	Extraction in Mine Plan area?	N/A	NO EXTRACTION TAKING PLACE.
16	Mining Depth (12mRL min) markers visible/intact	✓	
17	Mining above min depth, Operators aware of depth markers	N/A	NO EXTRACTION TAKING PLACE.
18	Working face safe	N/A.	
19	Working face clear of debris	N/A.	
20	Operator has mobile phone contact in case of emergency	N/A.	
21	Operational noise satisfactory	N/A.	
22	Dust generation satisfactory	N/A.	
23	Required signage in good condition	✓	

Signed:  \_\_\_\_\_

Attach any photos below

---

### APPENDIX 3: Groundwater Monitoring Biannual Report September 2018



# **Biannual Groundwater Quality Monitoring & Quarterly Groundwater Level Monitoring**

## **Tanilba Northern Dune**

Environmental Management

Prepared by Salt Ash Operation & Mining Services

September 2018

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## Introduction

Sibelco Australia Limited (Sibelco) manage a white silica sand extraction operation at Tanilba Northern Dune on the Tilligerry Peninsula, NSW. Sand is extracted as a rolling west to east cycle in approved zones of clearing native vegetation, extracting sand, reforming a new surface and planting of native vegetation.

The aim of this report is to assess groundwater quality against the pre-determined trigger values for the biannual reporting period March 2018 – September 2018 and to assess groundwater elevations against the pre-determined maximum predicted groundwater levels for this reporting period. The report is structured as follows:

- Regulatory Requirements (Section 1)
- Groundwater Monitoring (Section 2)
- Performance against Regulatory Requirements (Section 3)
- Appendices - Groundwater Results and Analysis, Field Sheets, Laboratory Certificates including QA/QC (Section 4)

## 1. Regulatory Requirements

Environmental Management issues at the site are managed by a court approved Environmental Management Plan (EMP) supplemented by an Environmental Assessment for extraction in extension areas. Groundwater Management issues are managed by the regulatory approved Groundwater Management Plan (GMP), as stipulated in the EMP. The GMP has been developed to ensure compliance with the conditions of consent and licensing requirements stipulated by the relevant regulatory authorities, during development and operation at Northern Dune. The GMP provides a formal framework for ongoing monitoring of groundwater at the site to manage the potential impact of sand extraction on groundwater level and quality. The conditions of the EMP stipulate that:

- No excavation is to be carried out to a depth greater than 0.7m above the maximum predicted elevation of the water table;
- The land surface is to be restored, following mining, to a level at least 1m above the maximum predicted elevation of the water table; and
- If concentrations of any analyte are found to exceed the provisional trigger levels given in the GMP, that monitoring point will be re-sampled within fourteen days, with investigatory monitoring implemented should re-sampling also be in exceedance of the trigger values.
- The relevant Regulatory Authorities will be contacted if any recorded water level exceeds the benchmark maximum predicted groundwater levels.

### 1.1 GMP Groundwater Level Monitoring

#### 1.1.1 Baseline Groundwater Level Monitoring and Predicted Maximum Groundwater Elevation

Baseline groundwater level monitoring is undertaken within a planned zone prior to commencing sand extraction. Planned sand extraction is based on a predicted maximum groundwater elevation (PMGE) surface created from the PMGE of baseline groundwater levels in monitored piezometers.

#### 1.1.2 Operational Groundwater Level Monitoring

Operational groundwater level monitoring is undertaken to ensure compliance with the PMGE. Groundwater levels in monitoring wells are routinely measured monthly, increasing in frequency to weekly for a period of four weeks following any period when rainfall at Williamstown equals or exceeds 100 millimetres over a seven day rolling period, or when water levels are within 100 millimetres of the maximum predicted groundwater levels. Monitoring will continue for the duration of mining, and until the release of the obligation by the NOW and HWC. General (visual) observation of currently mined and progressively rehabilitated areas will be carried out regularly to check for the occurrence of surface water ponding or the presence of groundwater windows.

### *1.2.3 Exceedance Investigation*

If analysis of groundwater level monitoring sample shows anomalous levels above the PMGE then groundwater in the effected monitoring well will be retested again as soon as possible and in any case within fourteen days to confirm the results. If retesting confirms the anomaly, NOW and HWC will be notified immediately, by telephone and in writing, and within fourteen days of confirmation and an investigation will be initiated.

## **1.2 GMP Groundwater Quality Monitoring**

### *1.2.1 Baseline Groundwater Quality Monitoring and setting of Trigger Values*

Baseline groundwater quality samples are collected for establishing baseline hydro-geochemical conditions and to create Trigger Values for comparison against sample concentrations during and post extraction operations to assist in detecting any changes in groundwater quality at the site. Baseline groundwater quality monitoring ceases when sand extraction commences and the Operational Monitoring Plan is initiated. Trigger Values have been determined for the water quality parameters of EC, Arsenic, Manganese, Iron and TPH.

### *1.2.2 Operational Groundwater Quality Monitoring*

Operational groundwater quality monitoring will be carried out six monthly once mining commences in a zone, and will continue at a lower frequency for four years after mining ceases or as otherwise determined by the NOW and HWC. The monitoring frequency is subject to review in consultation with the NOW and HWC.

### *1.2.3 Exceedance Investigation*

If analysis of water quality monitoring sample shows anomalous concentrations of any analyte above Trigger Values, then groundwater in the effected monitoring well will be resampled and tested again as soon as possible and in any case within fourteen days to confirm the results. If resampling confirms the anomaly, NOW and HWC will be notified immediately, by telephone and in writing, and a Groundwater Assessment Plan will be prepared within twenty eight days of confirmation. The Groundwater Assessment Plan will identify the specific groundwater quality parameters; establish the spatial and temporal variability of the water quality parameters; determine whether the anomaly is natural variability (background) or potentially related to a site activity and provide an assessment of the potential impact upon the groundwater resource. If the exceedance is determined to be potentially related to a site activity then the Groundwater Assessment Plan will outline a proposed sampling plan to obtain sufficient information to prepare a Groundwater Contamination Remediation Plan if and as required.

## **2. Performance against Regulatory Requirements**

Groundwater monitoring at Northern Dune has been conducted by AECOM for Sibelco since March 2008. AECOM continues to undertake this monitoring in accordance with their QA/QC and Sibelco's Groundwater Monitoring Guidelines. Up until 2014 AECOM also undertook the reporting of groundwater but this is now undertaken by Sibelco.

### **2.1 Groundwater Monitoring Network**

The monitoring network consists of 21 Sibelco installed piezometers and 3 Government bores. Groundwater level data is routinely collected from 23 piezometers with reporting against the 22 piezometers used to create PMGE surfaces for the extraction zones. Groundwater quality is routinely collected from 10 piezometers with reporting against operational trigger levels in extraction areas.

### **2.2 Groundwater Monitoring Results and Analysis**

The results and analysis of groundwater monitoring appended to this report are as follows:

- Piezometer groundwater level with PMGE
- Piezometer groundwater level and rainfall
- Piezometer Water Quality pH, salinity (EC), iron (Fe); arsenic (As) and manganese (Mn)

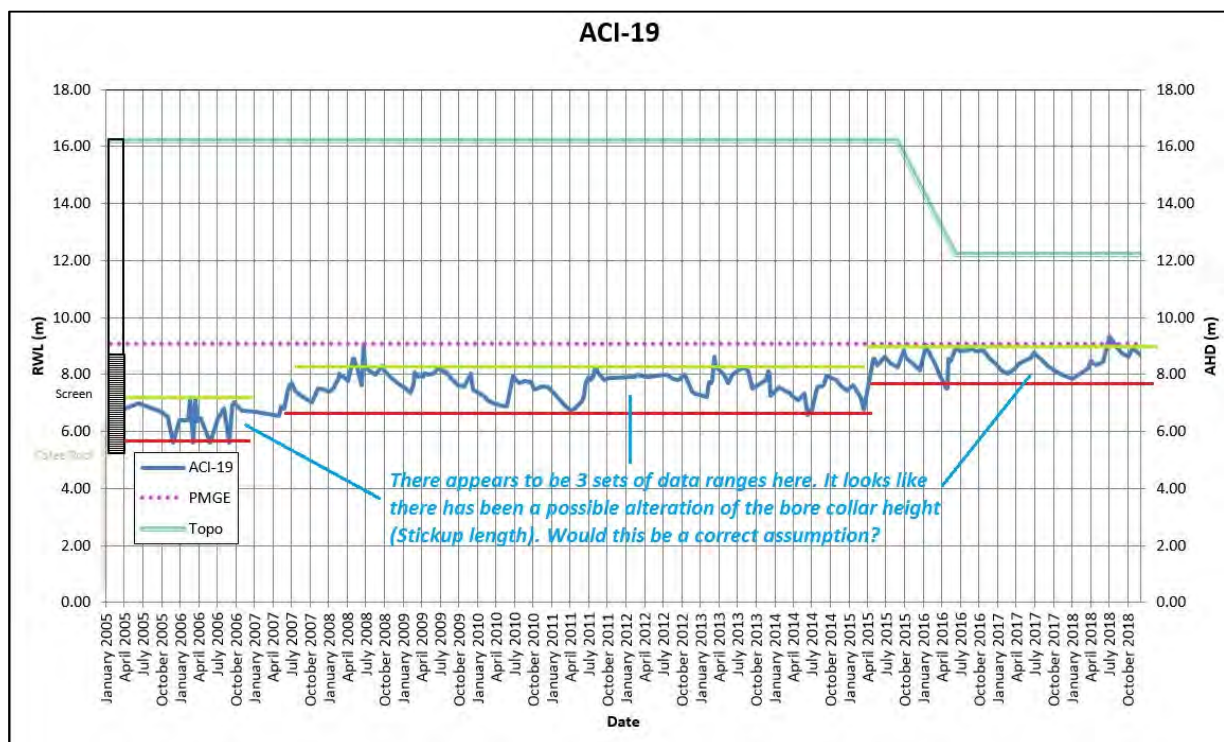
### 2.3 Groundwater Level Assessment

Groundwater level exceedances may be attributed to a number of reasons including:

1. **Aquifer compromised by sand extraction:** measurable change in local recharge due to the removal of vegetation and the reduction in thickness of the unsaturated zone
2. **False exceedances:** With sand extraction the top of the piezometer is sawn off so if the piezometer top of collar is not corrected then groundwater levels falsely appear to rise
3. **PMGE set too low because of insufficient benchmark monitoring:** Benchmarking of groundwater levels in Extraction Zones 1-4 was undertaken from monthly measurements, increasing to weekly measurements with heavy rainfall.
4. **Loss of bore integrity:** Loss of bore integrity can be due to construction related issue and/or vandalism
5. **Incorrect data:** Administrative error

There were no significant groundwater level exceedances during the reporting period.

Period	Exceedances	Likely justification	Actions for follow up
Reporting	ACI-7	As previously reported the PMGE cannot be correct since the maximum observed WL is 32cm lower than the 'approved' PMGE as determined by AECOM.	No action required
Reporting	ACI-19	Excavation work has altered bore collar elevation (reason 2 above)	Accurate survey of collar elevation.
Operation to date	ACI-1, ACI-7, ACI-10, ACI-13		



Observation for apparent water level exceedance in ACI-19

## 2.4 Groundwater Quality Assessment

Groundwater quality at Northern Dune is driven by the nature of rainfall and properties of the unsaturated zone. Rainfall entering the soil zone undergoes significant changes in chemical composition and pH by processes such as root respiration and decomposition of organic matter via chemical reactions such as sorption and redox. The chemical constituency of infiltrating water in turn modifies groundwater chemistry by processes such as leaching, dilution but not concentration (which is protected against by licence conditions limiting depth to groundwater) as well as dissolution/precipitation. The effect of multiple processes on groundwater quality parameters and therefore setting Trigger Values is that water quality data is often multiple-modal (non-normal distribution) and so simple statistical analysis using mean and standard deviation may not adequately represent processes leading to water quality change. Water quality is dependent upon the nature of rainfall (ie. timing, intensity, duration...etc) which determines whether infiltration provides a diluting effect and/or a leaching effect on ions and/or metals. Water quality can improve or deteriorate with rainfall and therefore timing of a small limited sample set strongly influences the calculated Trigger Value.

Groundwater quality trigger value exceedances may be attributed to a number of reasons including:

1. **Aquifer compromised by sand extraction:** measurable change in groundwater quality due to the removal of vegetation and the reduction in thickness of the unsaturated zone
2. **Trigger Value set too low because of insufficient benchmark monitoring:** Benchmarking should be undertaken at a frequency which would allow the likely detection of water quality maxima and minima if also required. Trigger levels for piezometers ACI-2, ACI-5, ACI-11, ACI-13, ACI-14 and ACI-16 almost certainly underestimate actual background water quality parameter levels and therefore water quality trigger level breaches will occur, particularly if sampling follows a major rainfall event
3. **Trigger Value set too low because of poor Trigger Value determination methodology:** The best method for determining trigger levels is simply observed pre-mining maxima based from targeted sampling in wet and dry conditions. Statistical methods introduce uncertainty on calculated trigger values.
4. **Loss of bore integrity:** Loss of bore integrity can be due to construction related issue and/or vandalism
5. **Incorrect data:** Administrative error

There were groundwater quality trigger value exceedances for the reporting period are summarised below.

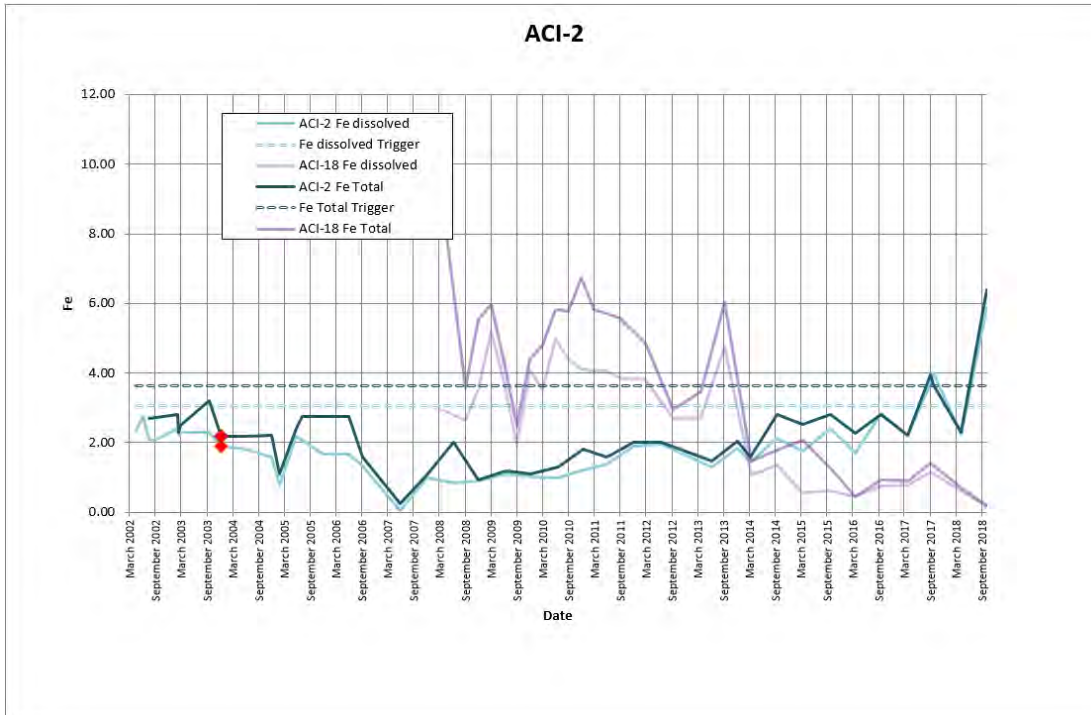
Period	Exceedances
Reporting	<b>ACI-2 (dissolved Fe, total Fe, Dissolved Mn, total Mn)</b> <b>ACI-6 (dissolved Fe)</b> <b>ACI-16 (dissolved Fe, total Fe, Dissolved Mn, total Mn)</b> <b>SAL-4 (EC, pH)</b>
Operation to date	ACI-2 (dissolved Fe, total Fe, Dissolved Mn, Total Mn) ACI-5 (Dissolved As, Total As, Dissolved Mn) ACI-6 (Dissolved Fe) ACI-13 (EC, Dissolved Fe, Total Fe, Dissolved Mn, Total Mn) ACI-14 (Dissolved Fe, Total As, Dissolved Mn, Total Mn) ACI-16 (EC, Dissolved Fe, Dissolved Mn, Total Mn, Total As)

### ACI-2

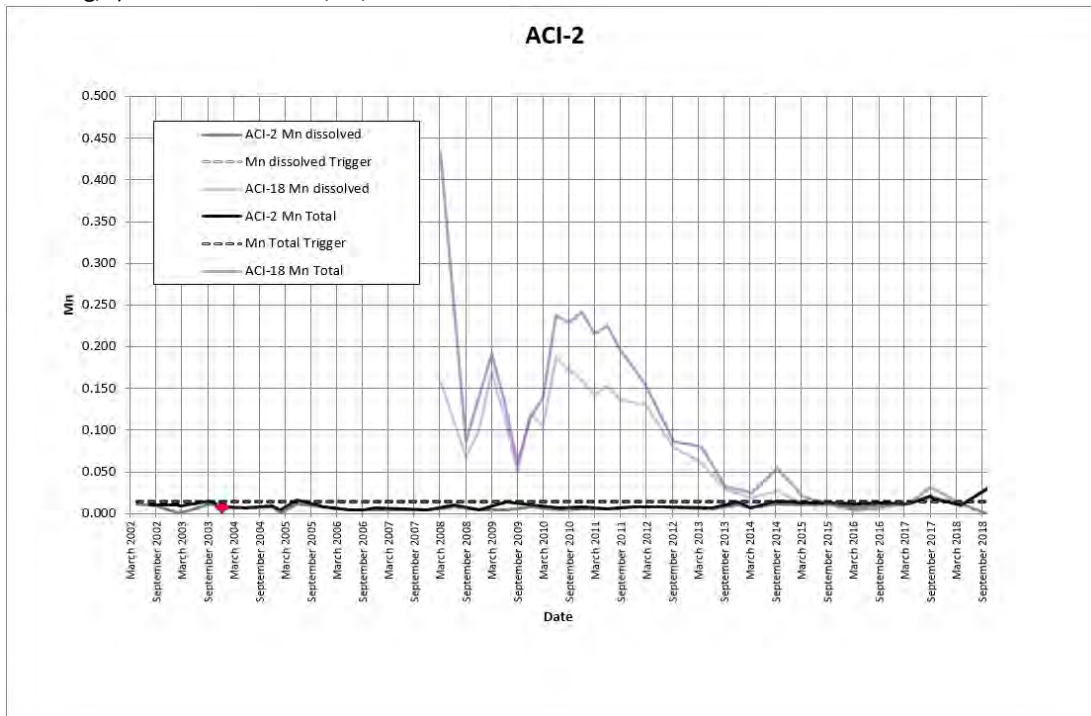
ACI-2 is located in Zone 1, mining Block B1 which was rehabilitated in May 2005.

Iron results are on a rising trend and have exceeded the assigned triggers (3.058mg/L dissolved Fe and 3.62mg/L Total Fe) on 3 out of 4 sampling events since Sept 2017. The latest dissolved Fe results were 5.87mg/L on 3/10/2018 (trigger value of 3.058mg/L) and 6.40mg/L Total Fe (trigger 3.62mg/L) on 3/10/18.





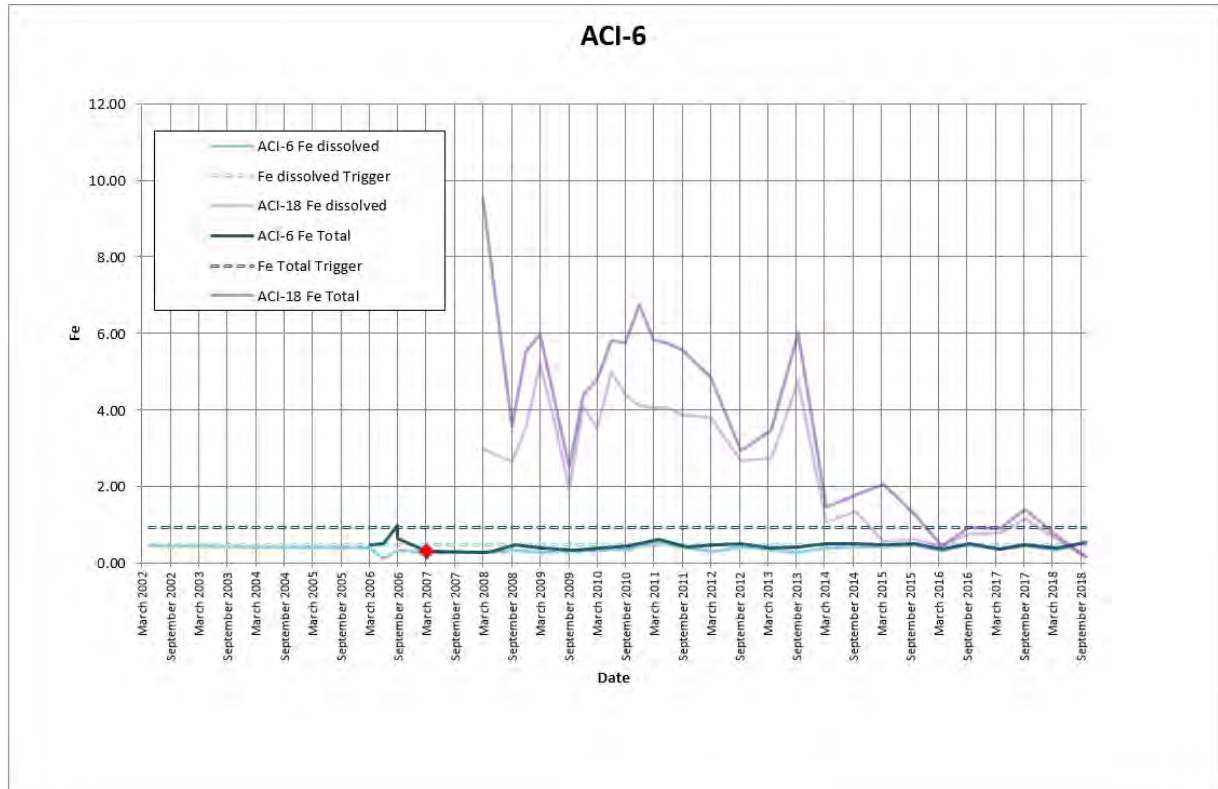
Dissolved Manganese recorded 0.03mg/L (trigger 0.015mg/L) on 3/10/18. Total Mn of 0.029mg/L (trigger 0.014mg/L) was recorded on 3/10/18.



### ACI-6

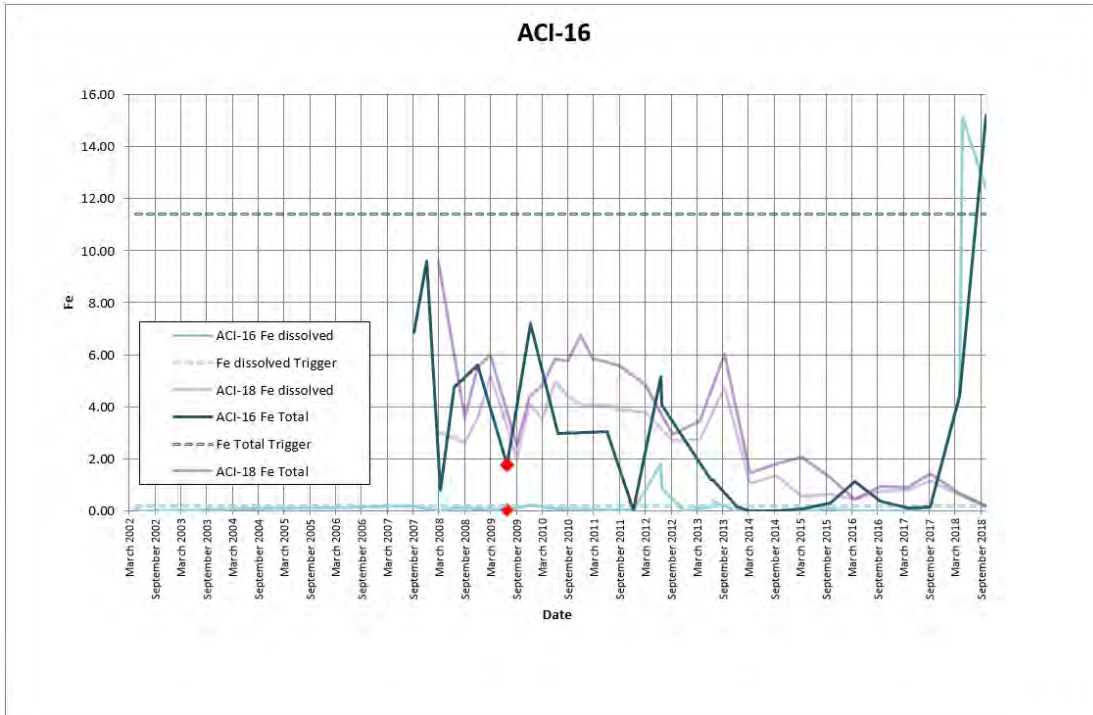
ACI-6 is located south of the mining area and closest to Mining Block E of Zone 2.

Dissolved Fe results for latest monitoring (2/10/18) returned marginally above triggers being 0.56mg/L (trigger 0.493mg/L). Total Fe of 0.54mg/L was below trigger level of 0.935mg/L.

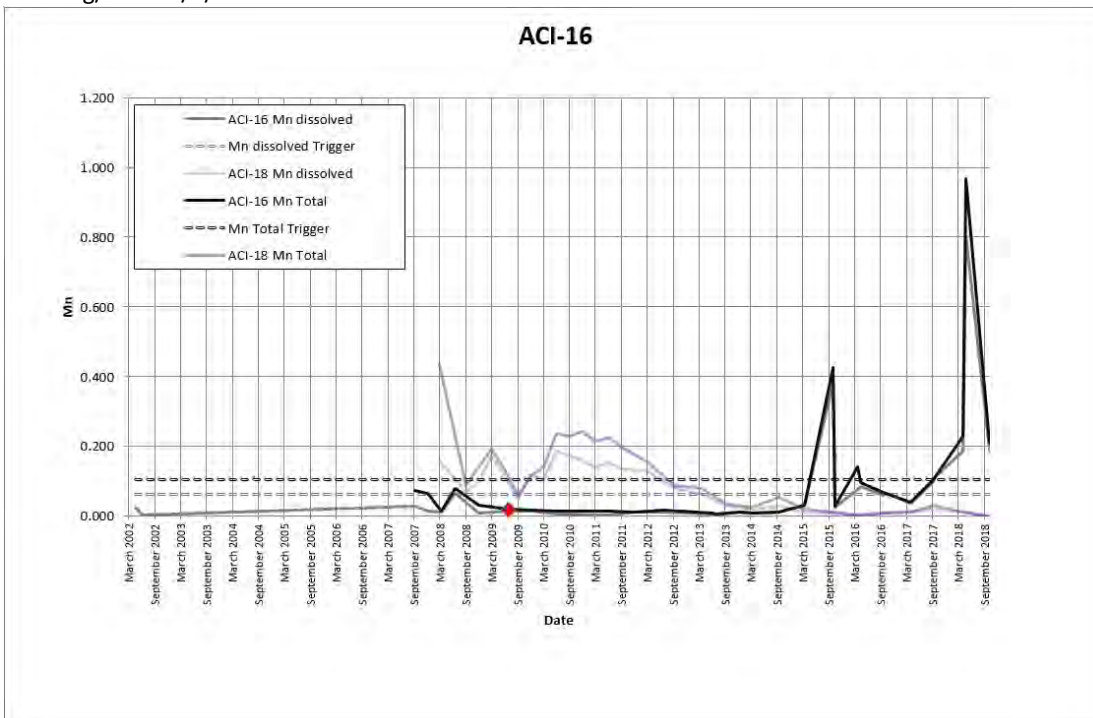


### ACI-16

ACI-16 is in an area from which sand was extracted in 2010-12. Iron results have declined in recent years but the latest sampling has shown higher levels returned for both dissolved and total iron. The latest dissolved Fe results were 12.4 mg/L on 3/10/2018 (trigger value of 0.188mg/L) and 15.2mg/l total Fe on 3/10/18. A follow up re-sample should be undertaken and will be the focus of the next round of sampling. The Fe dissolved trigger level for ACI-16 has been set too low compared to the Fe total trigger of 11.419mg/L.



Dissolved Mn results were 0.19mg/L on 3/10/2018 (trigger value of 0.061mg/L) coming off a previous high of 0.805mg/L on 23/4/2018. Total Mn results were 0.211mg/L (trigger value of 0.104mg/L) with a previous high of 0.968mg/L on 23/4/2018.



Resampling should be undertaken following a proper purging exercise of the bore.

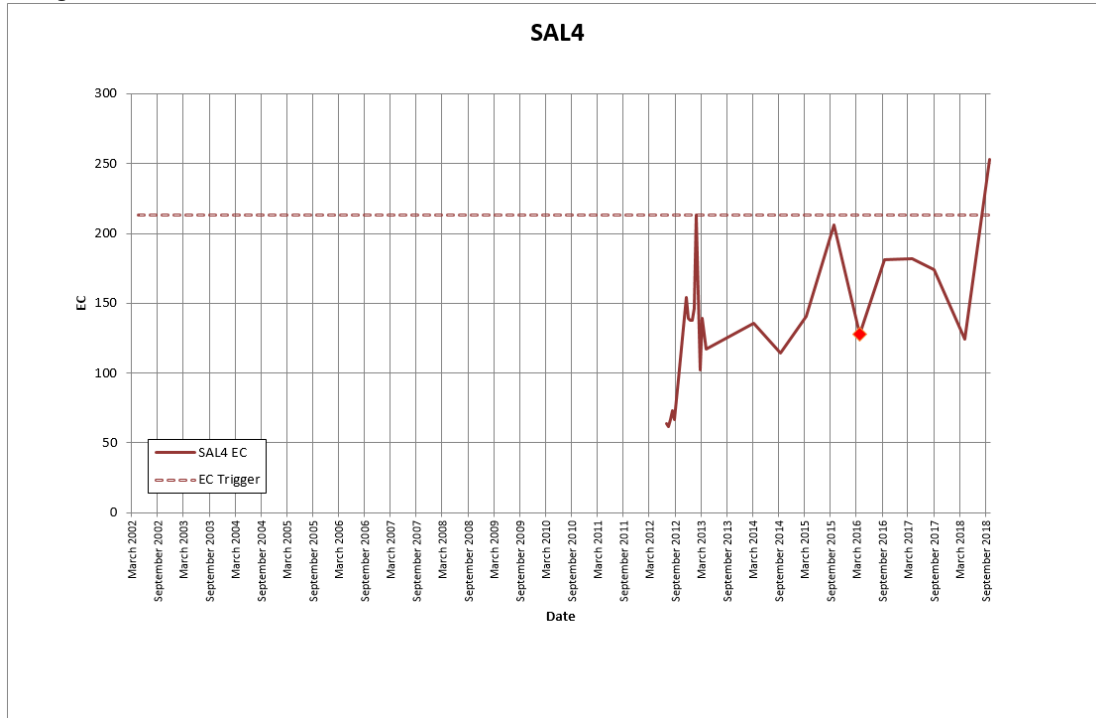
**SAL 4**

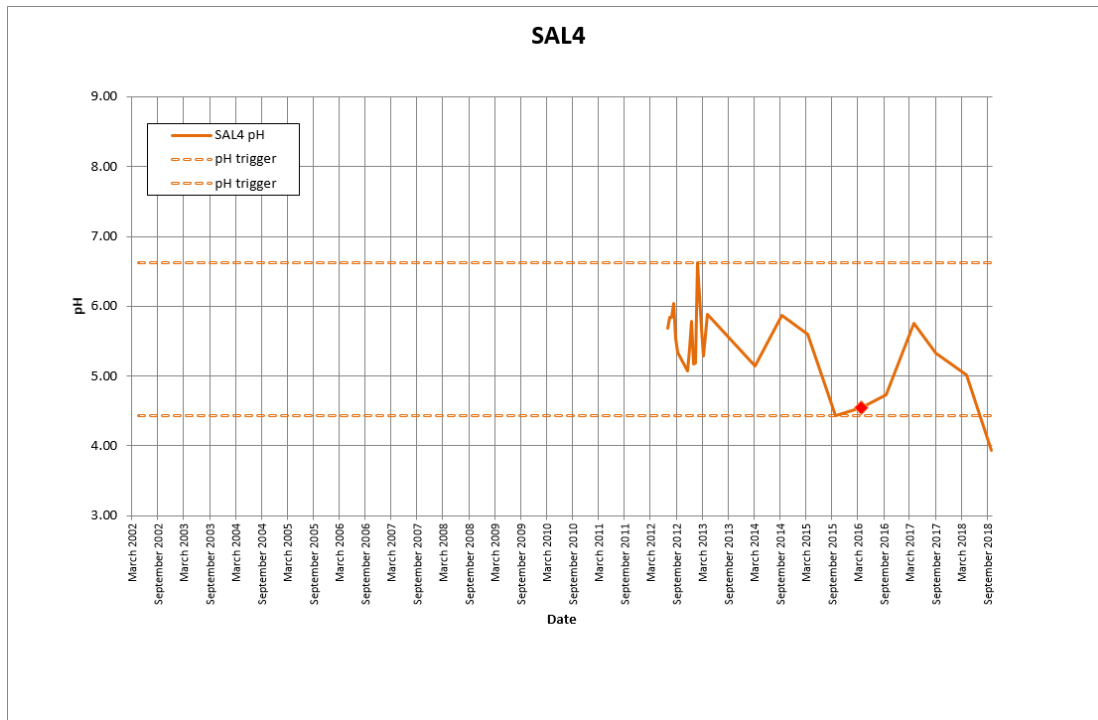
SAL 4 is located north of Mining Block Q in Mining Zone 1. Recent mining was completed in the area approximately 150m southwest of the bore.

Groundwater salinity was marginally above trigger on 2/10/18 with 253EC (trigger 213EC) and is on a rising trend. The pH of the groundwater sample on the same day was 3.94 (lower trigger = 4.44).

It is likely the collar of the bore may have surface water interaction and the influence of recent land disturbance from nearby mining has caused some changes to redox reactions which will affect the pH and also EC.

It is recommended the collar be inspected to ensure surface water has no potential to flow directly into the bore casing.





### 3. References

AECOM Groundwater Monitoring Reports

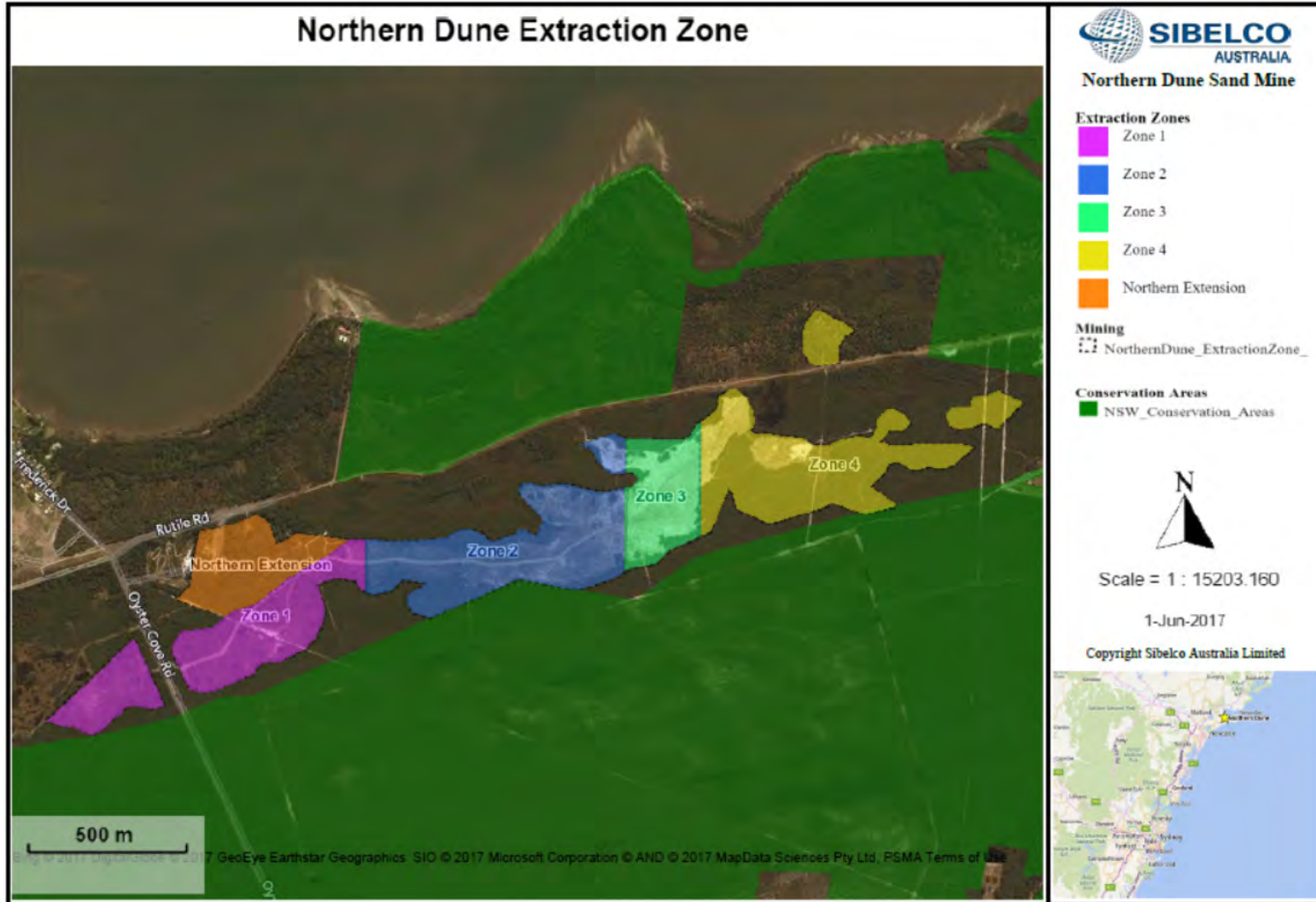
SIBELCO (2011a) Tanilba Northern Dune Groundwater Management Plan. Unpublished report

SIBELCO (2011b) Maximum groundwater elevation prediction at Tanilba Northern Dune operation. Unpublished report

SIBELCO (2012) Tanilba Northern Dune Operation Sand Extraction Extension Lots 11-13. Groundwater Level and Quality Monitoring Results May-October 2012

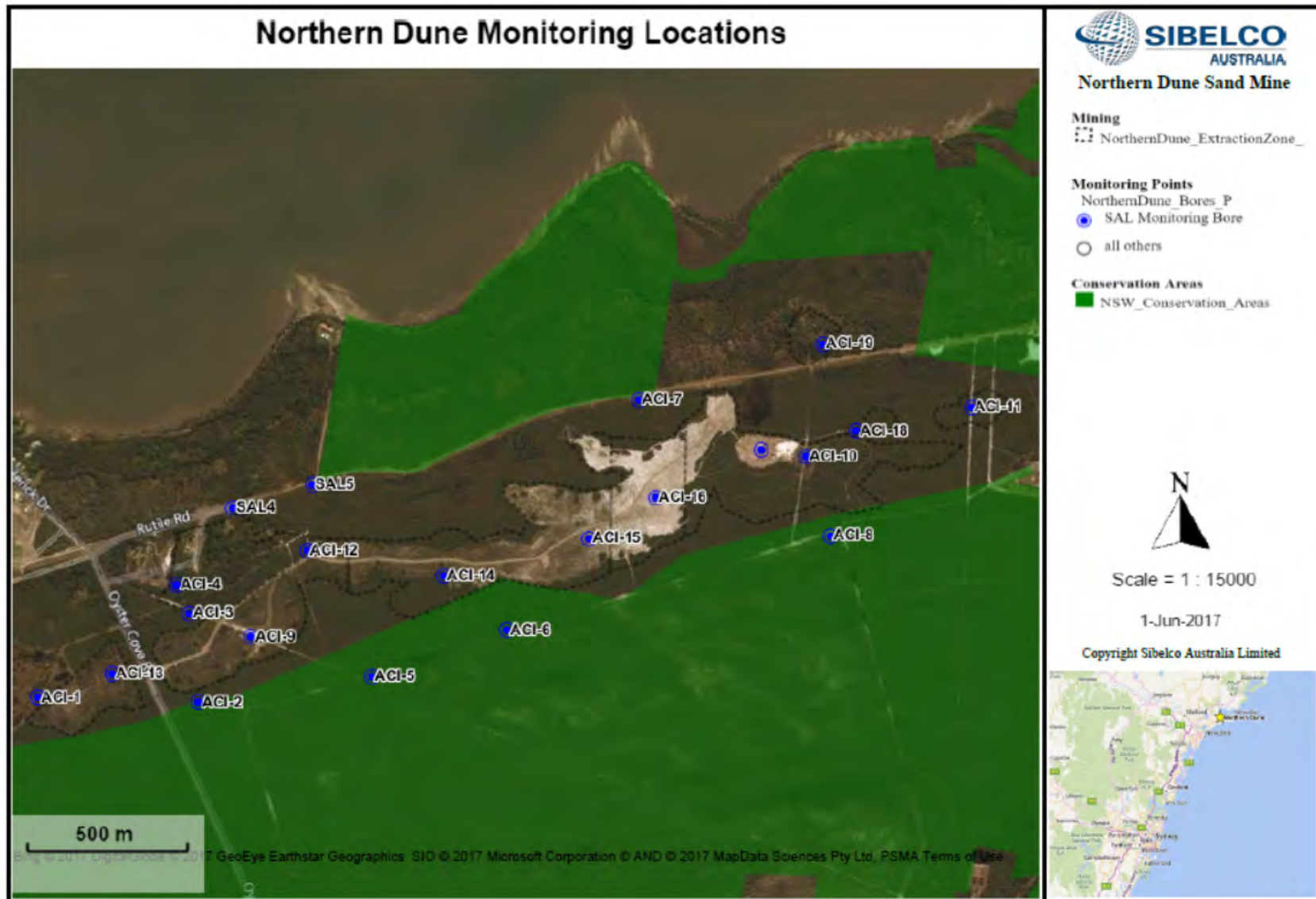
### 4. Appendices

## Northern Dune Extraction Zones

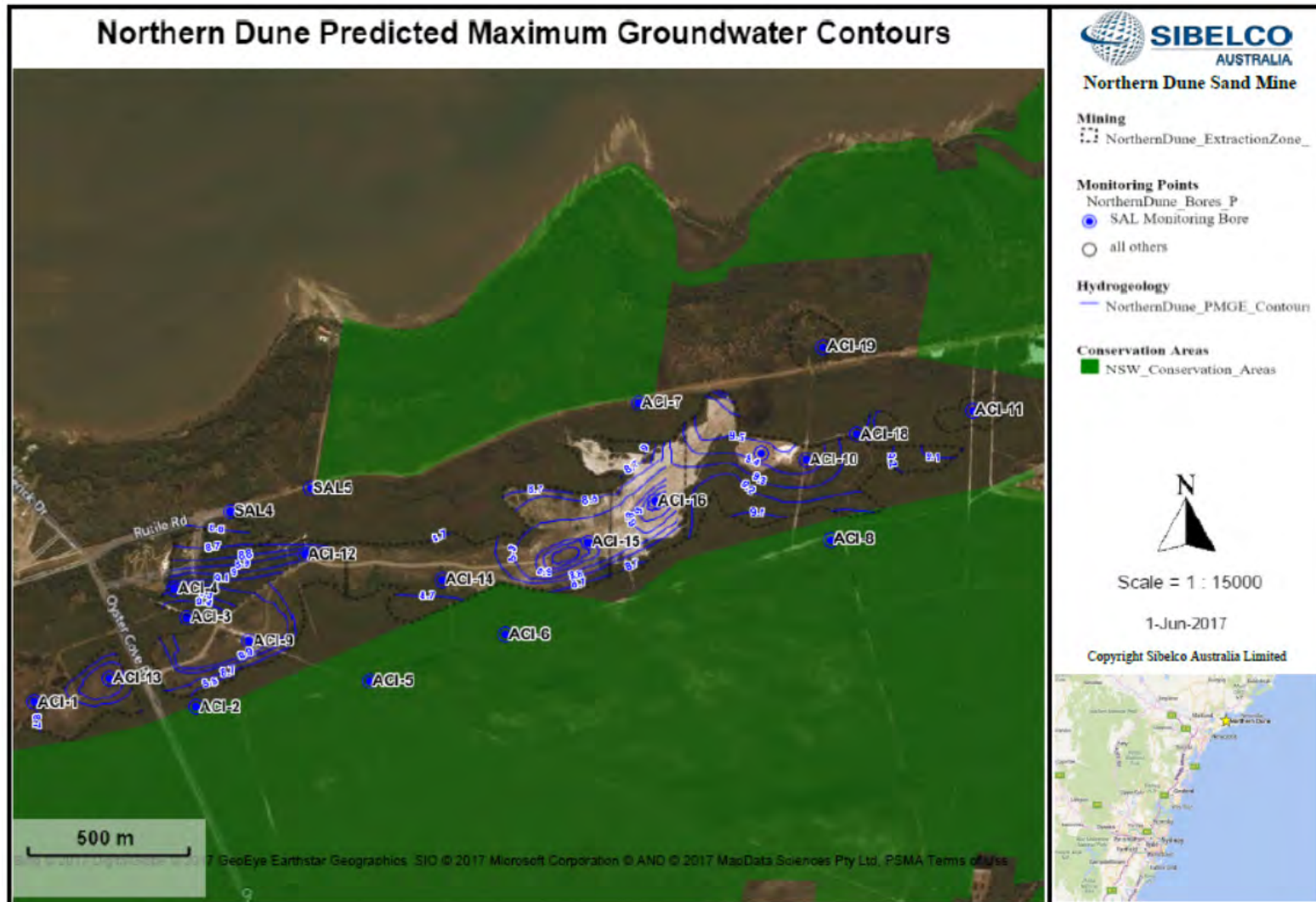




## Northern Dune Groundwater Monitoring Network



**PMGE surface and piezometer PMGE**



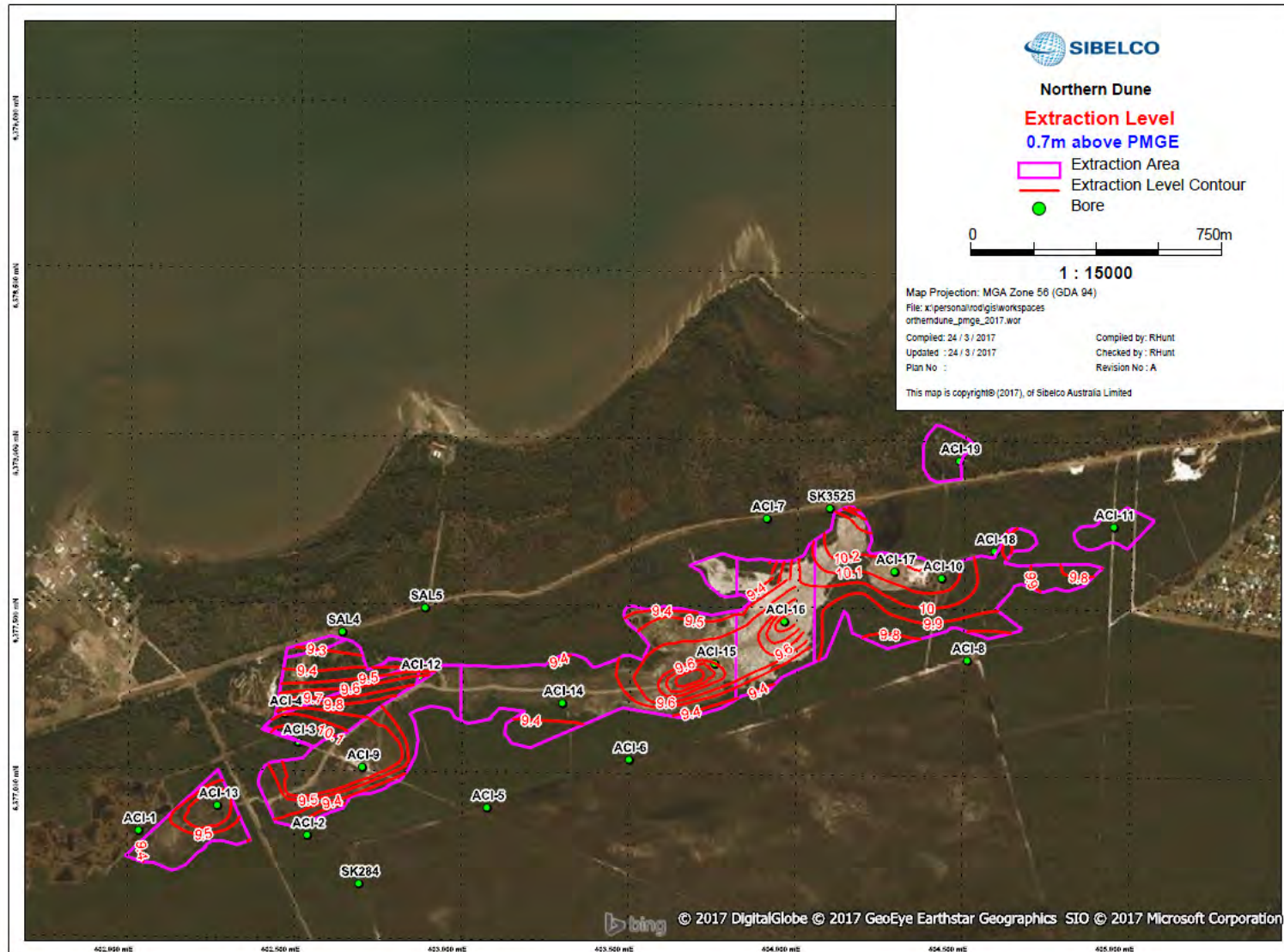


### Piezometer PMGE Groundwater Level and Groundwater Quality Trigger Values

Extraction Zone	Bore	PMGE	GROUNDWATER QUALITY TRIGGER VALUES											
			pH	EC	Iron mg/L		Arsenic mg/L		Manganese mg/L		TPH mg/L			
					Dissolved	Total	Dissolved	Total	Dissolved	Total	C6-C9	C10-C14	C15-C28	C29-C40
1	ACI-1	8.82	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-12	9.28	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-13	9.20	x	x	1.547	6.428	0.001	0.012	0.061	0.056	0.02	0.05	1.00	1.00
	ACI-2	8.44	x	x	3.058	3.623	0.001	0.010	0.015	0.014	0.02	0.05	1.00	1.00
	ACI-3	9.47	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-4	9.31	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-5	8.16	x	x	2.048	3.286	0.001	0.015	0.014	0.036	0.02	0.05	1.00	1.00
	ACI-9	9.31	x	x	x	x	x	x	x	x	x	x	x	x
2	ACI-14	9.02	x	x	1.532	2.262	0.001	0.008	0.070	0.082	0.02	0.05	1.00	1.00
	ACI-15	9.26	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-6	8.29	x	x	0.493	0.935	0.001	0.001	0.006	0.006	0.02	0.05	1.00	1.00
3	ACI-16	9.26	x	x	0.188	11.419	0.001	0.002	0.061	0.104	0.02	0.05	1.00	1.00
	ACI-7	8.92	x	x	x	x	x	x	x	x	x	x	x	x
4	ACI-10	9.49	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-17	9.47	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-8	8.86	x	x	1.108	1.410	0.002	0.002	0.006	0.006	0.02	0.05	1.00	1.00
	ACI-18	9.12	x	x	7.590	10.870	0.002	0.003	0.262	0.378	0.02	0.05	1.00	1.00
n/a	ACI-11	9.54	x	x	4.344	5.116	0.002	0.002	0.028	0.030	0.02	0.05	1.00	1.00
Lots 11-13	SAL4	8.65	4.44-6.63	213	3.210	3.640	0.001	0.002	0.093	0.116	0.02	0.05	1.00	1.00
-	ACI-19	9.06	x	x	x	x	x	x	x	x	x	x	x	x
	SAL5	x	x	x	x	x	x	x	x	x	x	x	x	x
	SK284	8.49	x	x	x	x	x	x	x	x	x	x	x	x
	SK3525	9.55	x	x	x	x	x	x	x	x	x	x	x	x
	SK3530	9.25	x	x	x	x	x	x	x	x	x	x	x	x

Trigger levels for Extraction Zones 1-4 calculated by AECOM have been retained which includes spurious data eg. ACI-13 Total Mn > Dissolved Mn and is based on a methodology. Lots 11-13 baseline data is simply maximum observed.

## Northern Dune Extraction Level Plan



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**APPENDIX 4: Groundwater Monitoring Supplementary Charts June 2019**

# Northern Dune Monitoring Locations



Northern Dune Sand Mine

**Mining**

NorthernDune\_ExtractionZone\_

**Monitoring Points**

- NorthernDune\_Bores\_P
- SAL Monitoring Bore
- all others

**Conservation Areas**

■ NSW\_Conservation\_Areas



Scale = 1 : 15000

1-Jun-2017

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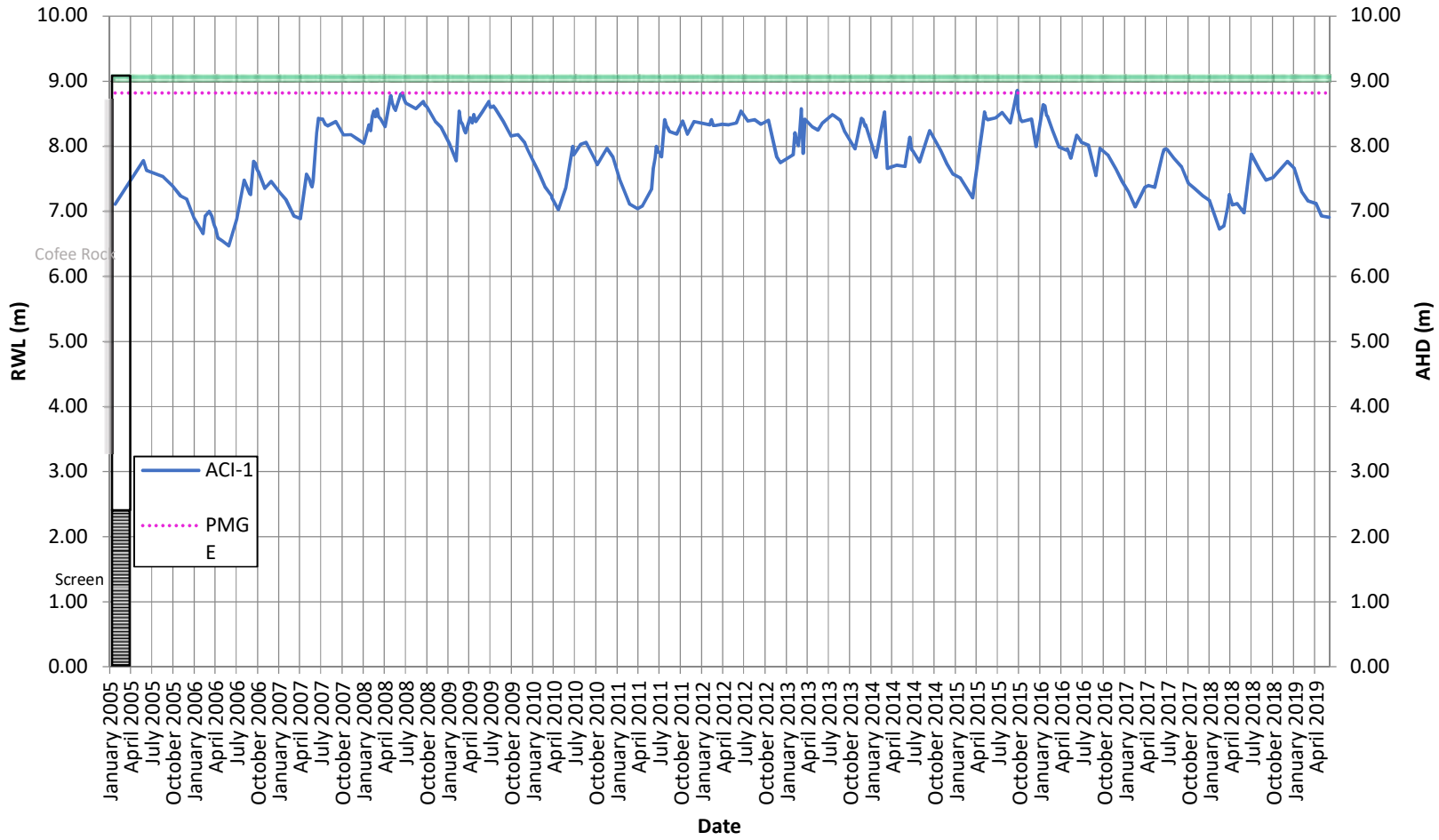
### Piezometer PMGE Groundwater Level and Groundwater Quality Trigger Values

Extraction Zone	Bore	PMGE	GROUNDWATER QUALITY TRIGGER VALUES											
			pH	EC	Iron mg/L		Arsenic mg/L		Manganese mg/L		TPH mg/L			
					Dissolved	Total	Dissolved	Total	Dissolved	Total	C6-C9	C10-C14	C15-C28	C29-C40
1	ACI-1	8.82	*	*	*	*	*	*	*	*	*	*	*	*
	ACI-12	9.28	*	*	*	*	*	*	*	*	*	*	*	*
	<b>ACI-13</b>	<b>9.20</b>	*	*	1.547	6.428	0.001	0.012	<b>0.061</b>	<b>0.056</b>	0.02	0.05	1.00	1.00
	<b>ACI-2</b>	<b>8.44</b>	*	*	3.058	3.623	0.001	0.010	0.015	0.014	0.02	0.05	1.00	1.00
	ACI-3	9.47	*	*	*	*	*	*	*	*	*	*	*	*
	ACI-4	9.31	*	*	*	*	*	*	*	*	*	*	*	*
	<b>ACI-5</b>	<b>8.16</b>	*	*	2.048	3.286	0.001	0.015	0.014	0.036	0.02	0.05	1.00	1.00
	ACI-9	9.31	*	*	*	*	*	*	*	*	*	*	*	*
2	<b>ACI-14</b>	<b>9.02</b>	*	*	1.532	2.262	0.001	0.008	0.070	0.082	0.02	0.05	1.00	1.00
	ACI-15	9.26	*	*	*	*	*	*	*	*	*	*	*	*
	<b>ACI-6</b>	<b>8.29</b>	*	*	0.493	0.935	0.001	0.001	0.006	0.006	0.02	0.05	1.00	1.00
3	<b>ACI-16</b>	<b>9.26</b>	*	*	0.188	11.419	0.001	0.002	0.061	0.104	0.02	0.05	1.00	1.00
	ACI-7	8.92	*	*	*	*	*	*	*	*	*	*	*	*
4	ACI-10	9.49	*	*	*	*	*	*	*	*	*	*	*	*
	ACI-17	9.47	*	*	*	*	*	*	*	*	*	*	*	*
	<b>ACI-8</b>	<b>8.86</b>	*	*	1.108	1.410	0.002	0.002	0.006	0.006	0.02	0.05	1.00	1.00
	<b>ACI-18</b>	<b>9.12</b>	*	*	7.590	10.870	0.002	0.003	0.262	0.378	0.02	0.05	1.00	1.00
n/a	<b>ACI-11</b>	<b>9.54</b>	*	*	4.344	5.116	0.002	0.002	0.028	0.030	0.02	0.05	1.00	1.00
Lots 11-13	<b>SAL4</b>	<b>8.65</b>	4.44-6.63	213	3.210	3.640	0.001	0.002	0.093	0.116	0.02	0.05	1.00	1.00
-	ACI-19	9.06	*	*	*	*	*	*	*	*	*	*	*	*
	SAL5	*	*	*	*	*	*	*	*	*	*	*	*	*
	SK284	8.49	*	*	*	*	*	*	*	*	*	*	*	*
	SK3525	9.55	*	*	*	*	*	*	*	*	*	*	*	*
	SK3530	9.25	*	*	*	*	*	*	*	*	*	*	*	*

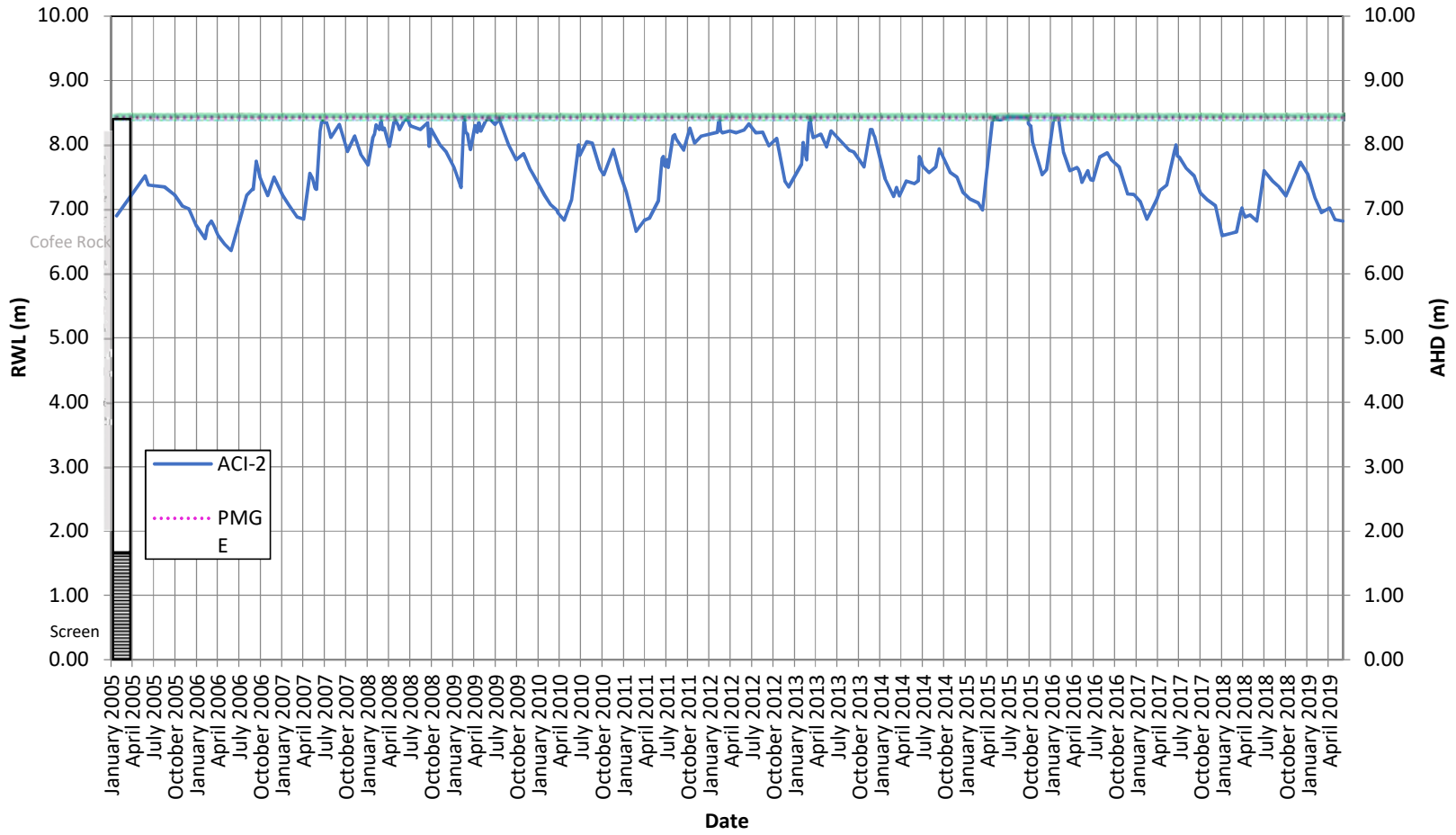
Trigger levels for Extraction Zones 1-4 calculated by AECOM have been retained which includes spurious data eg. ACI-13 Total Mn > Dissolved Mn and is based on a methodology. Lots 11-13 baseline data is simply maximum observed.



# ACI-1

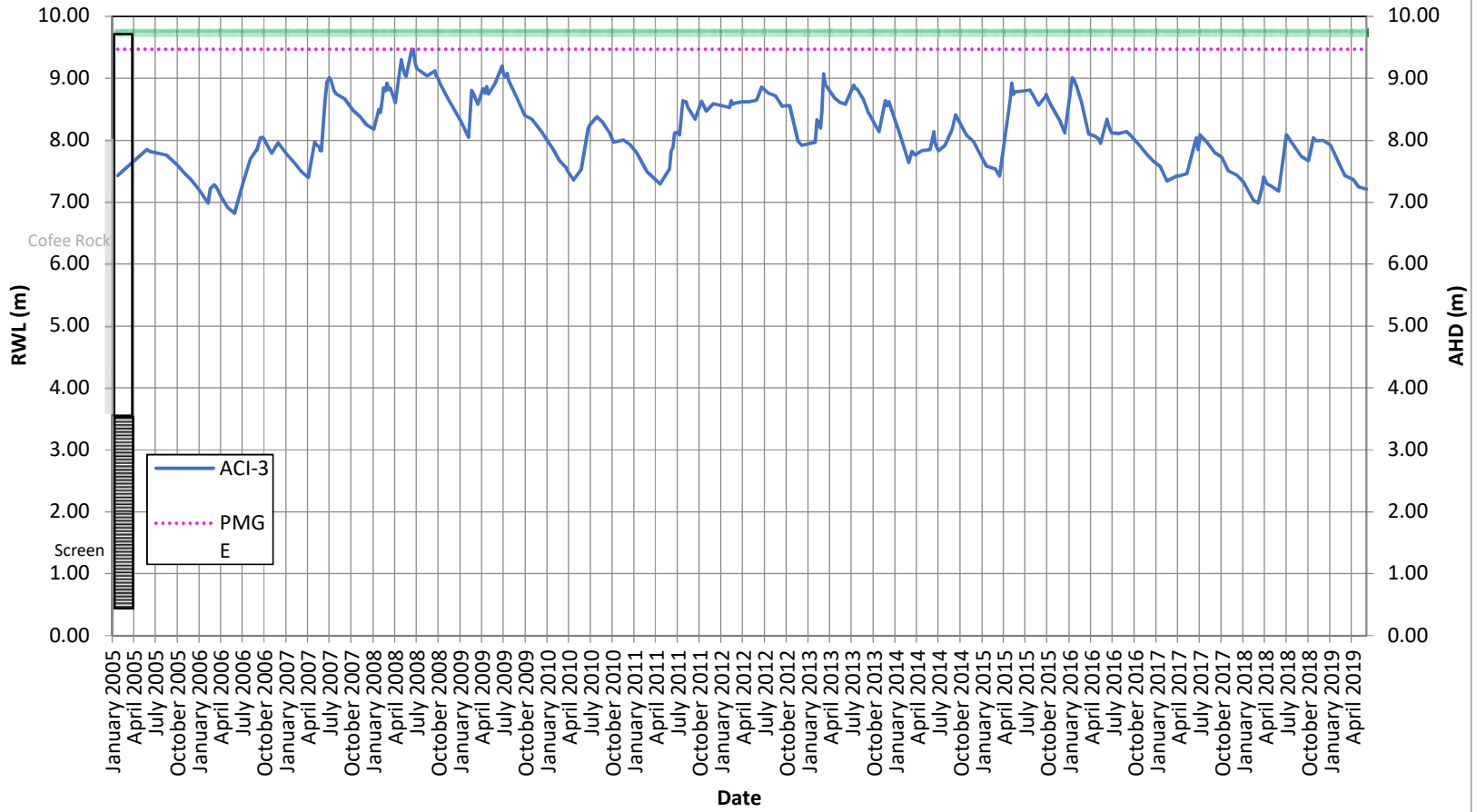


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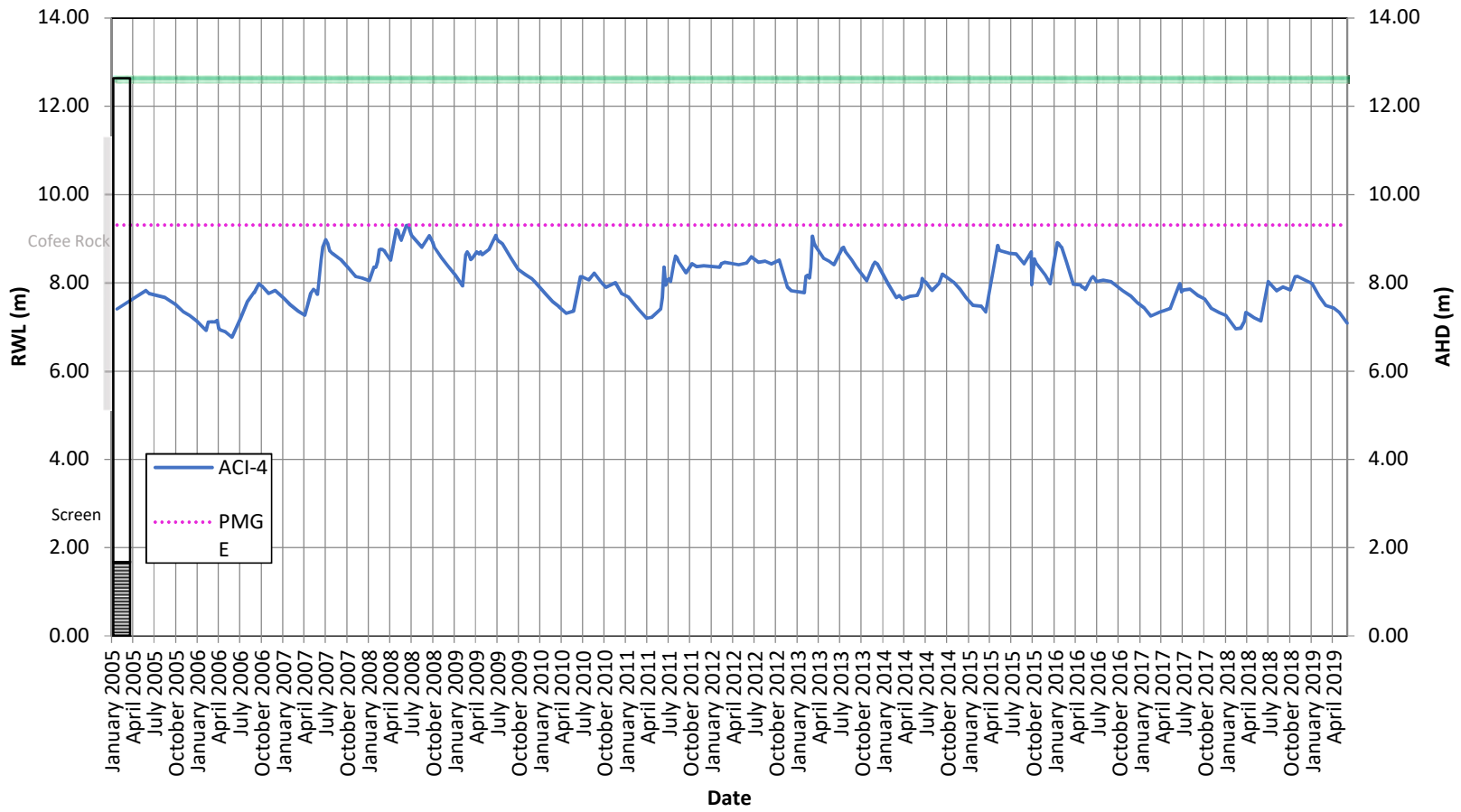




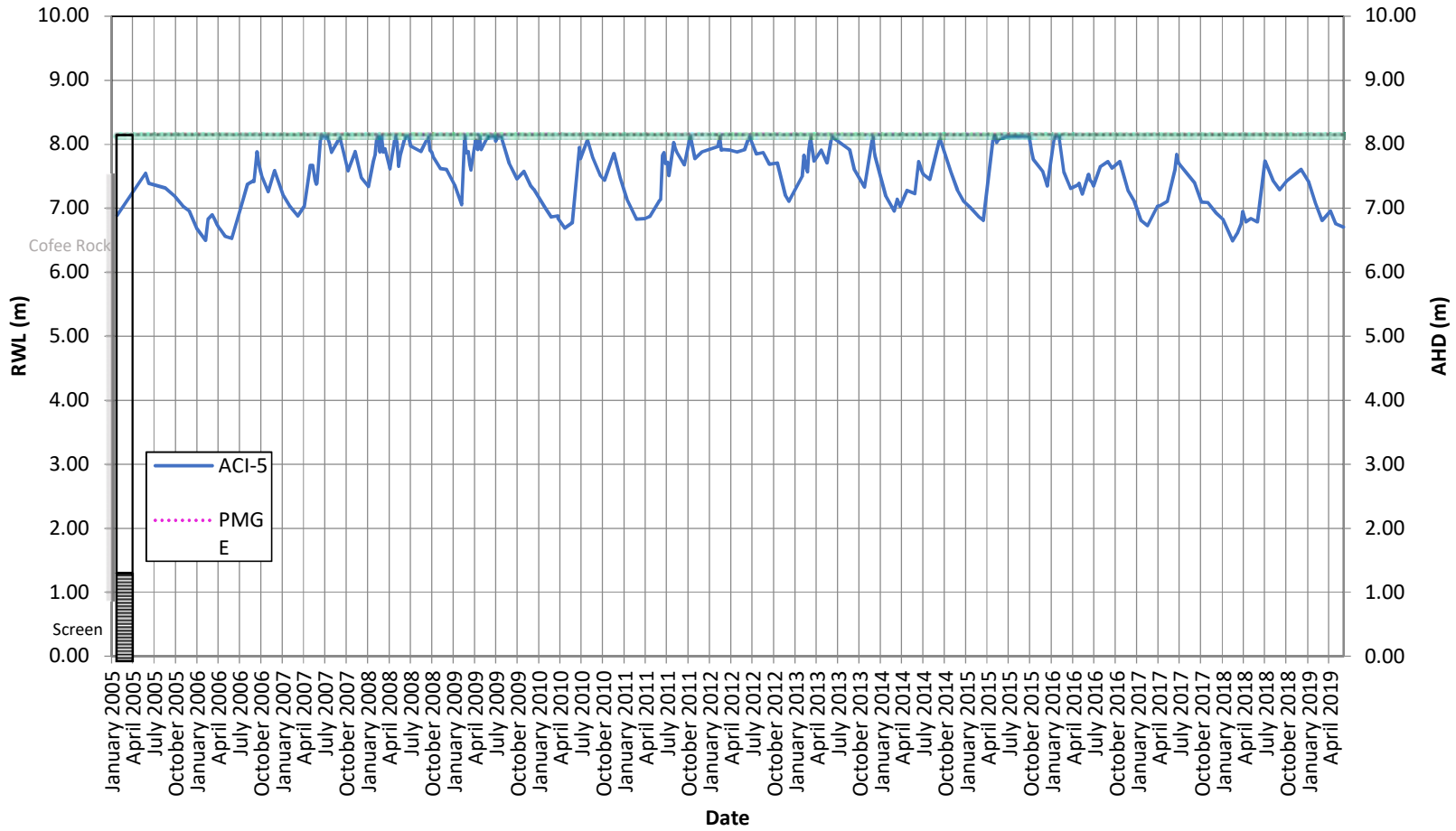
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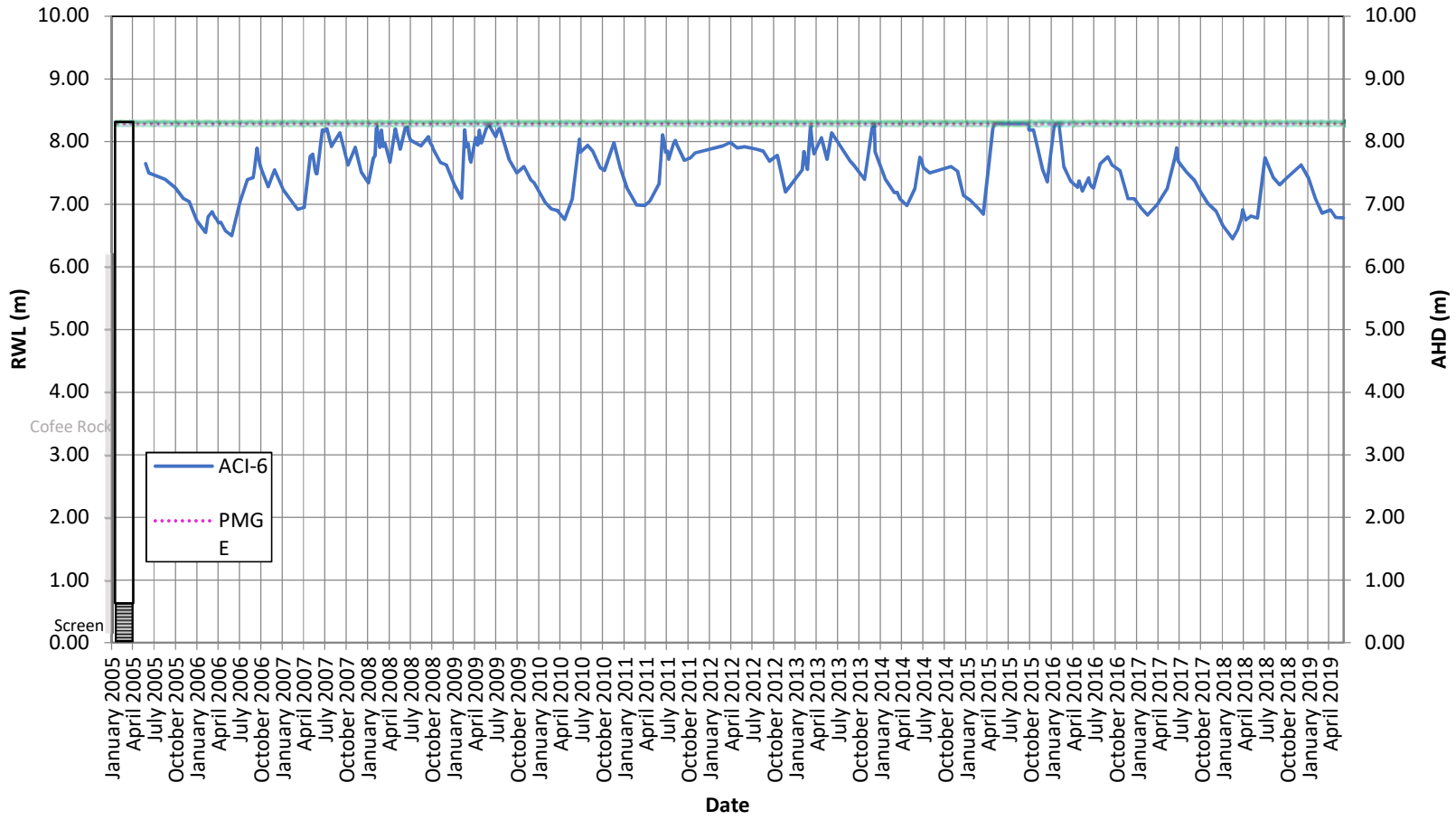
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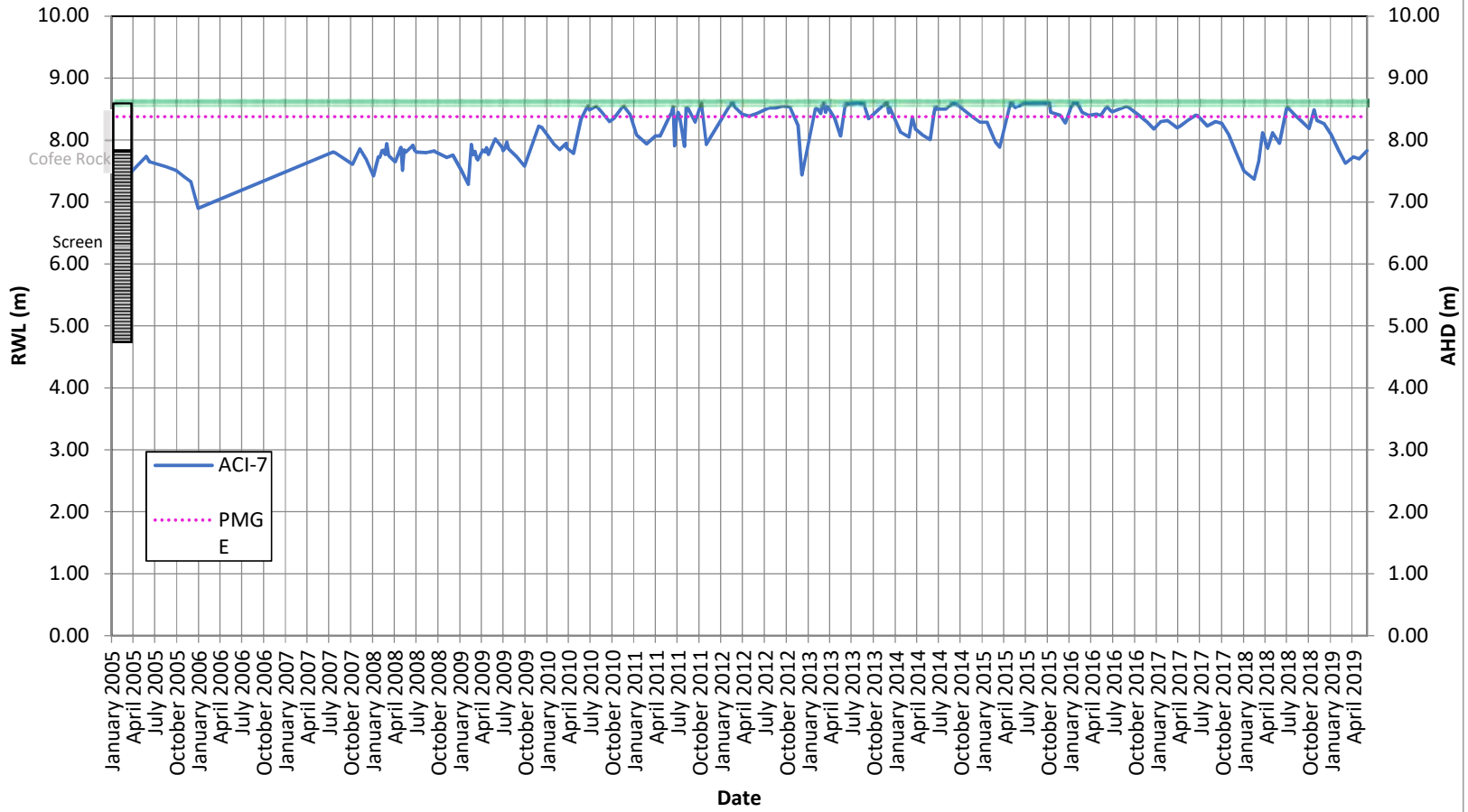
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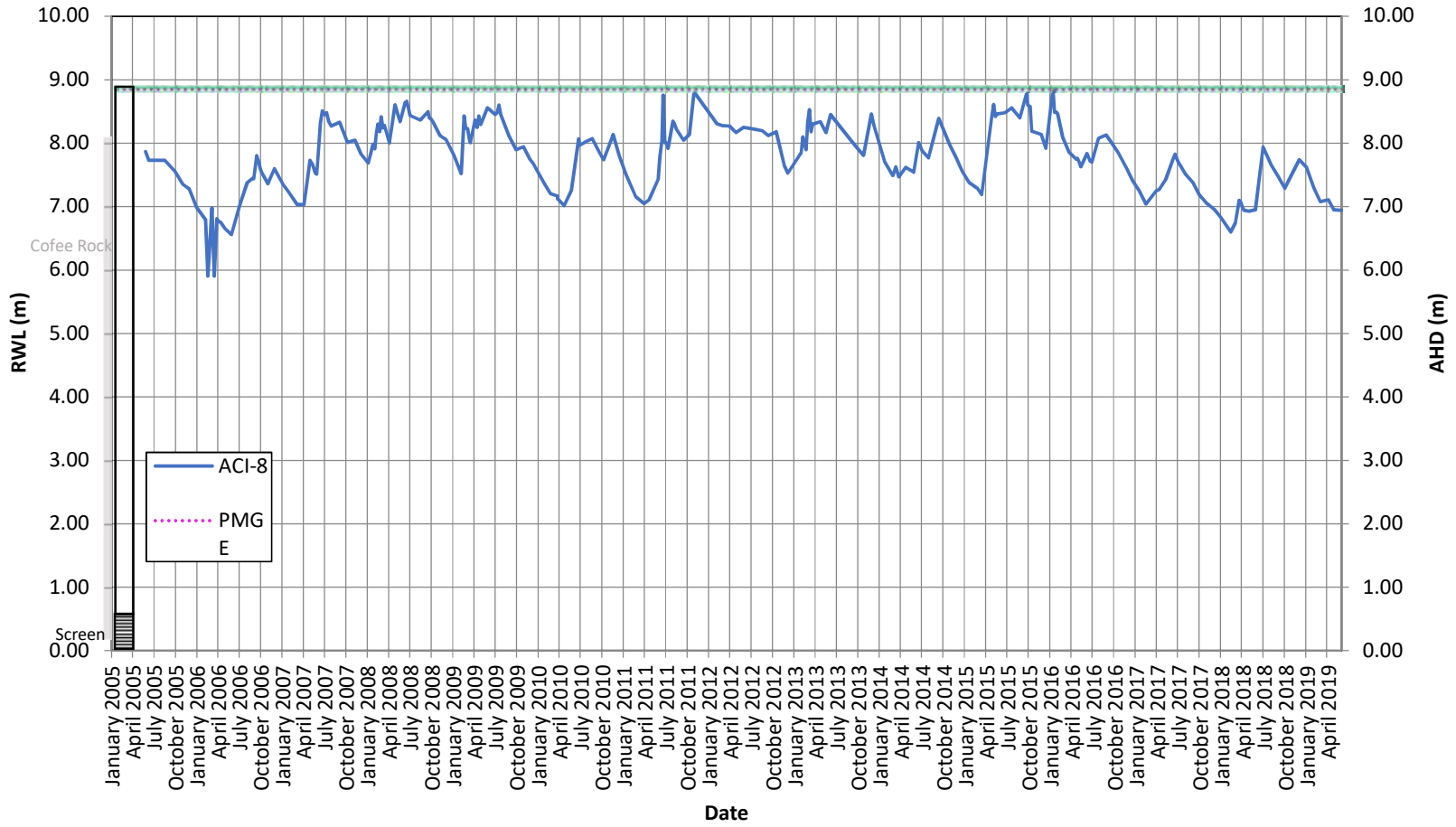
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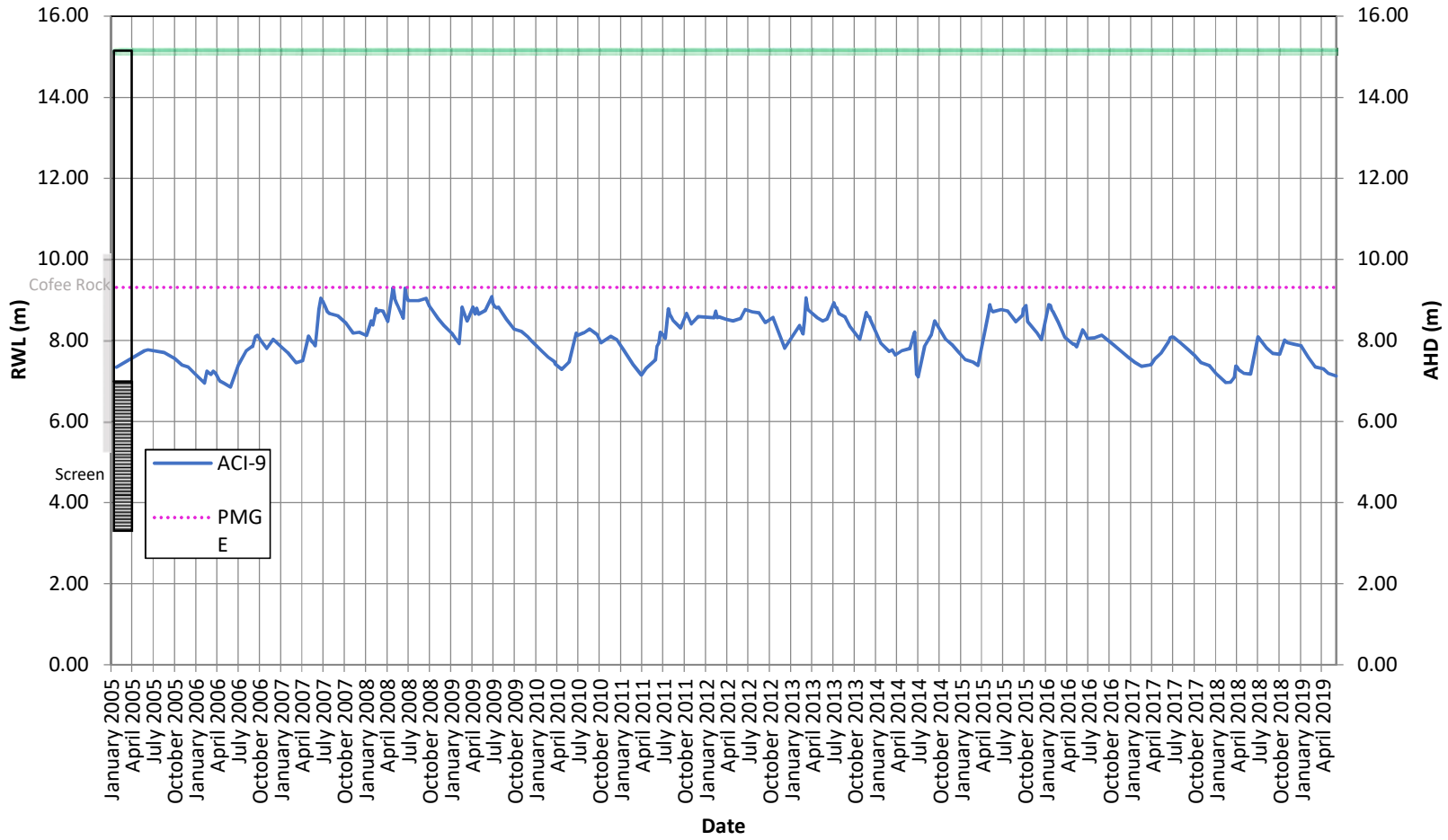
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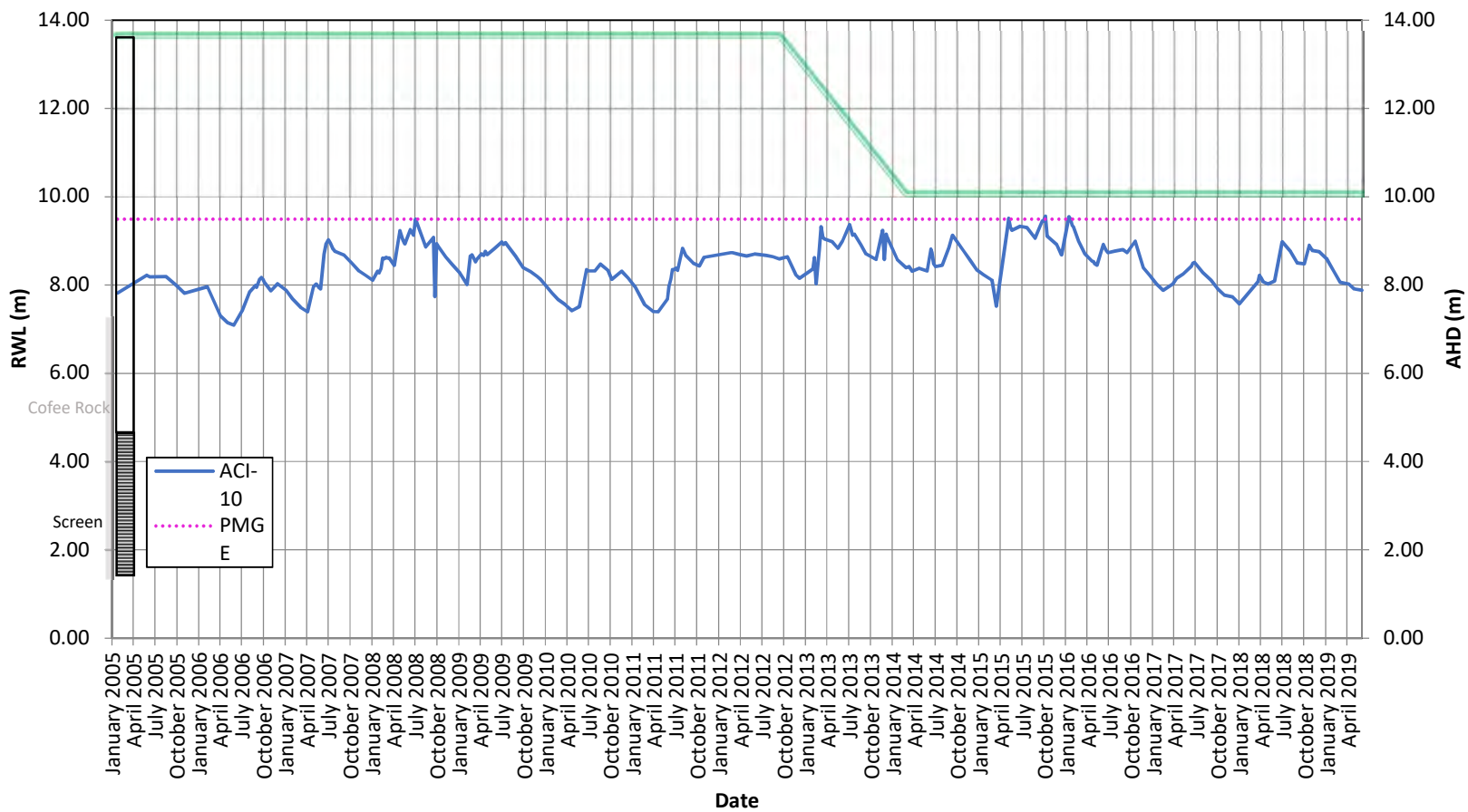
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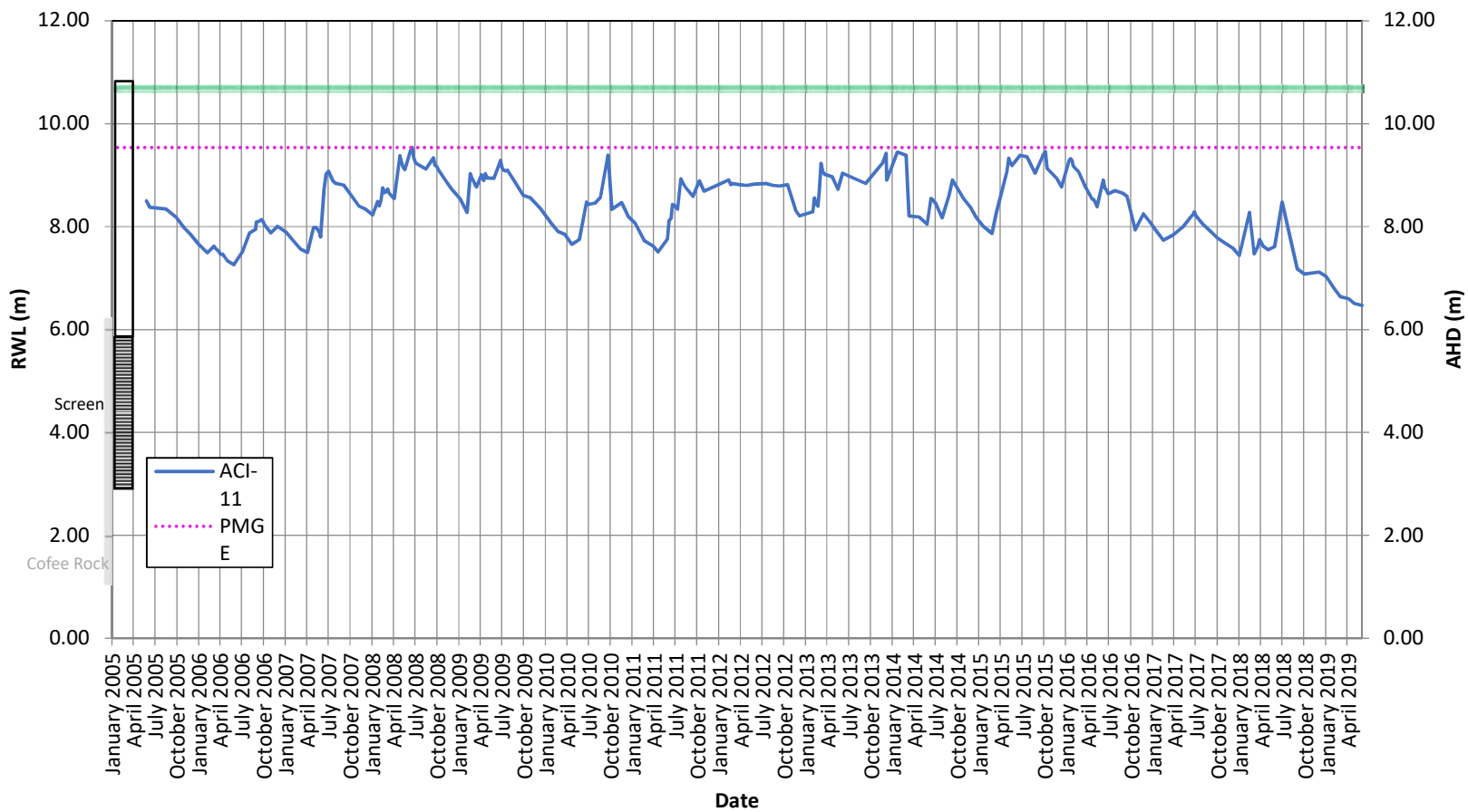


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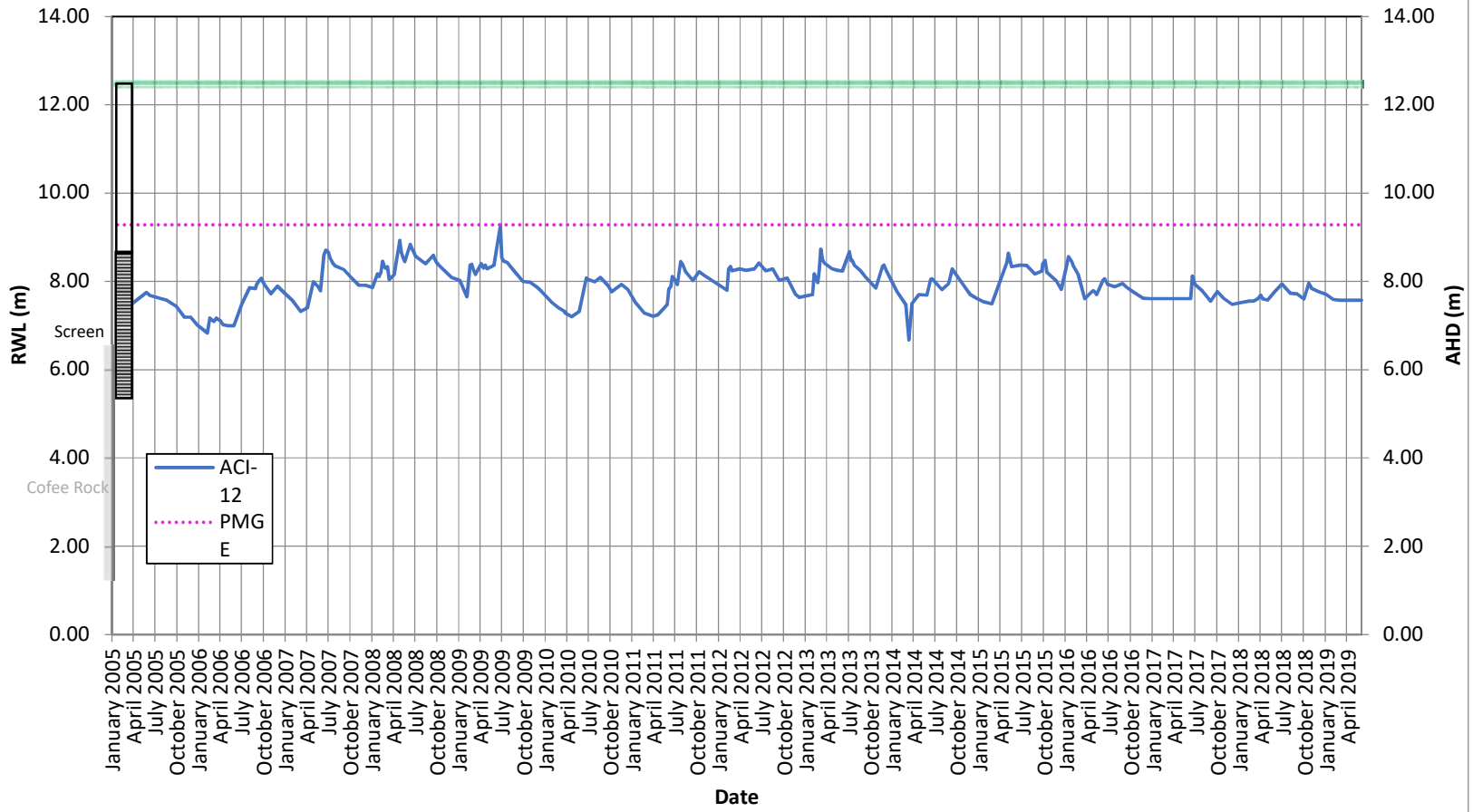




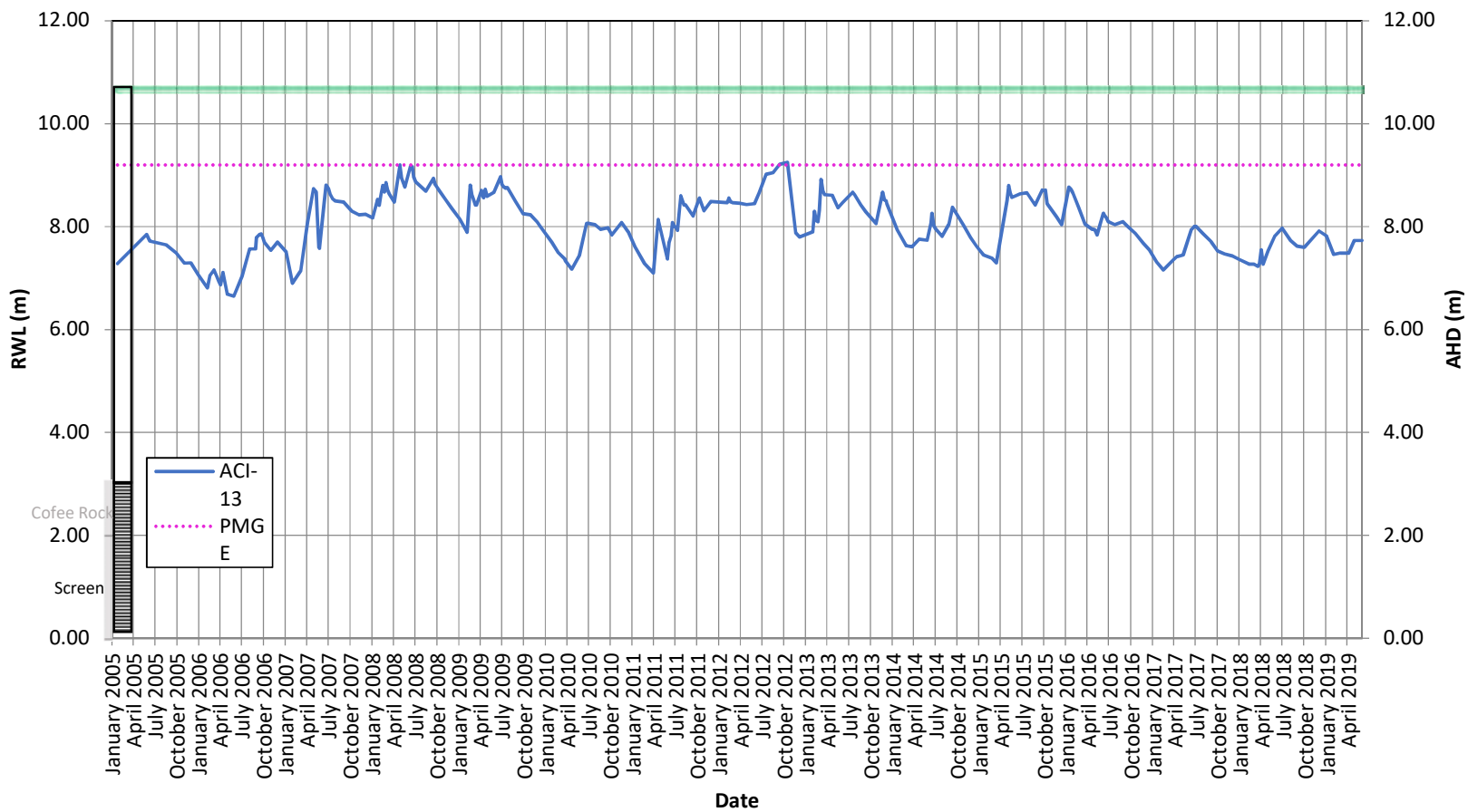
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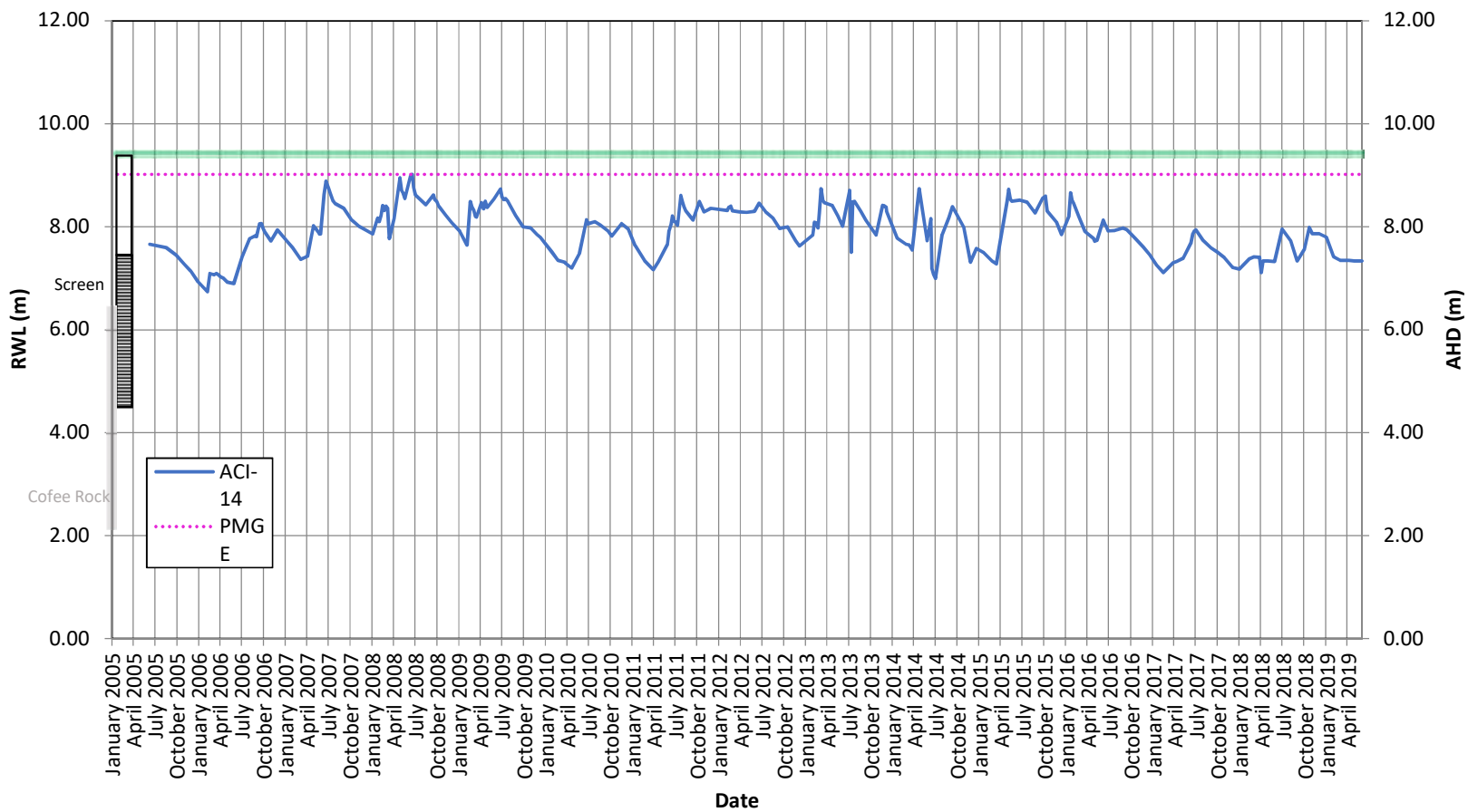
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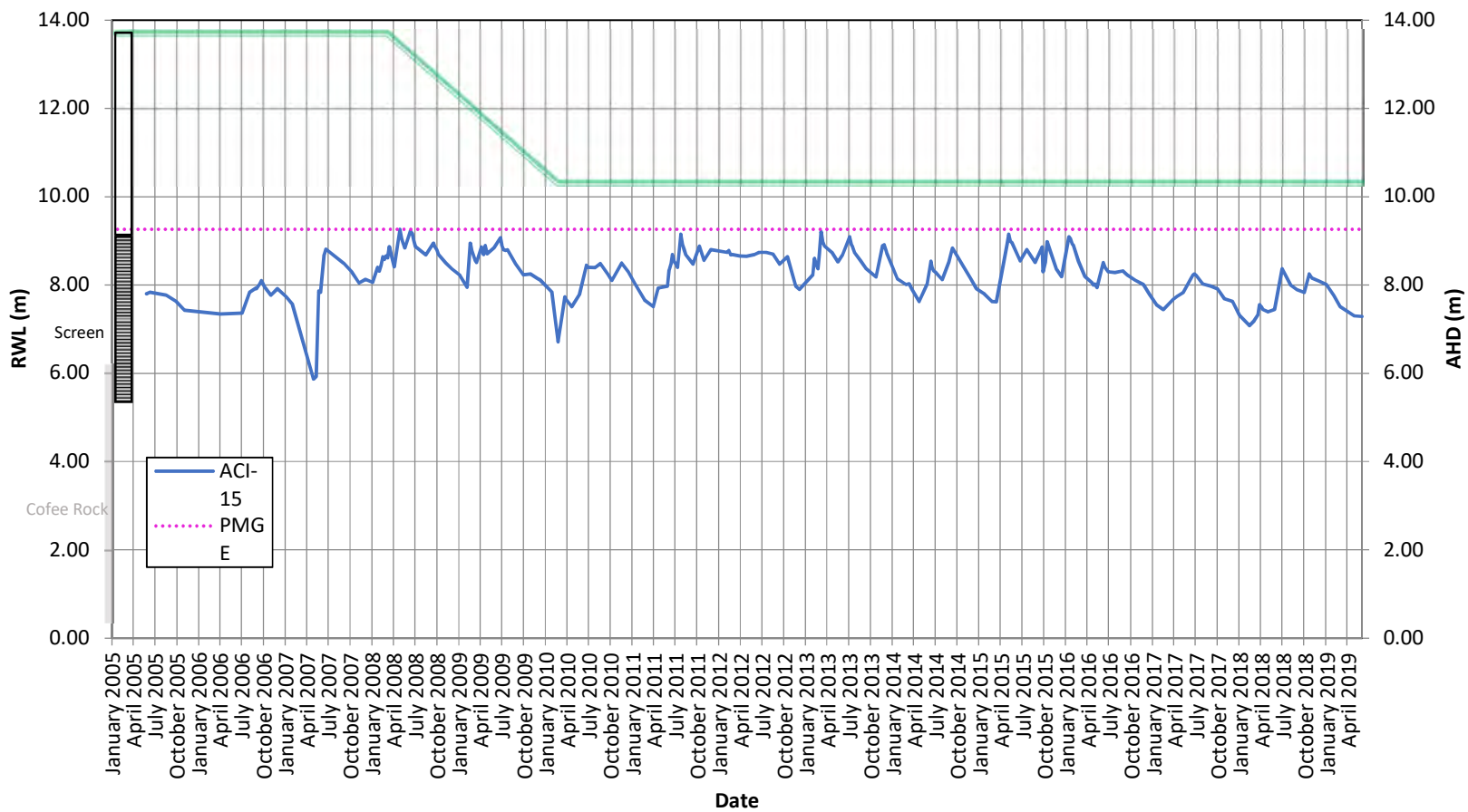
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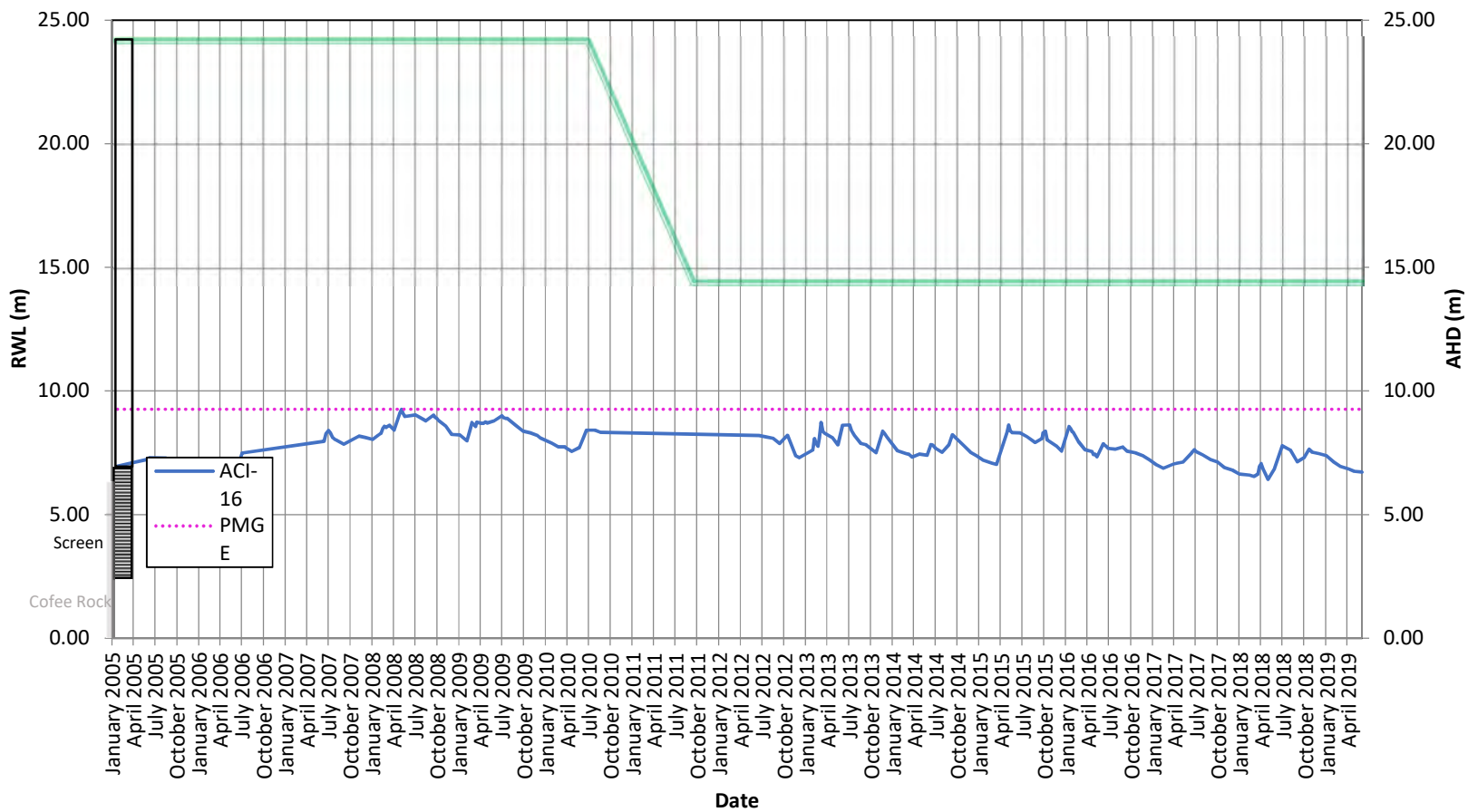
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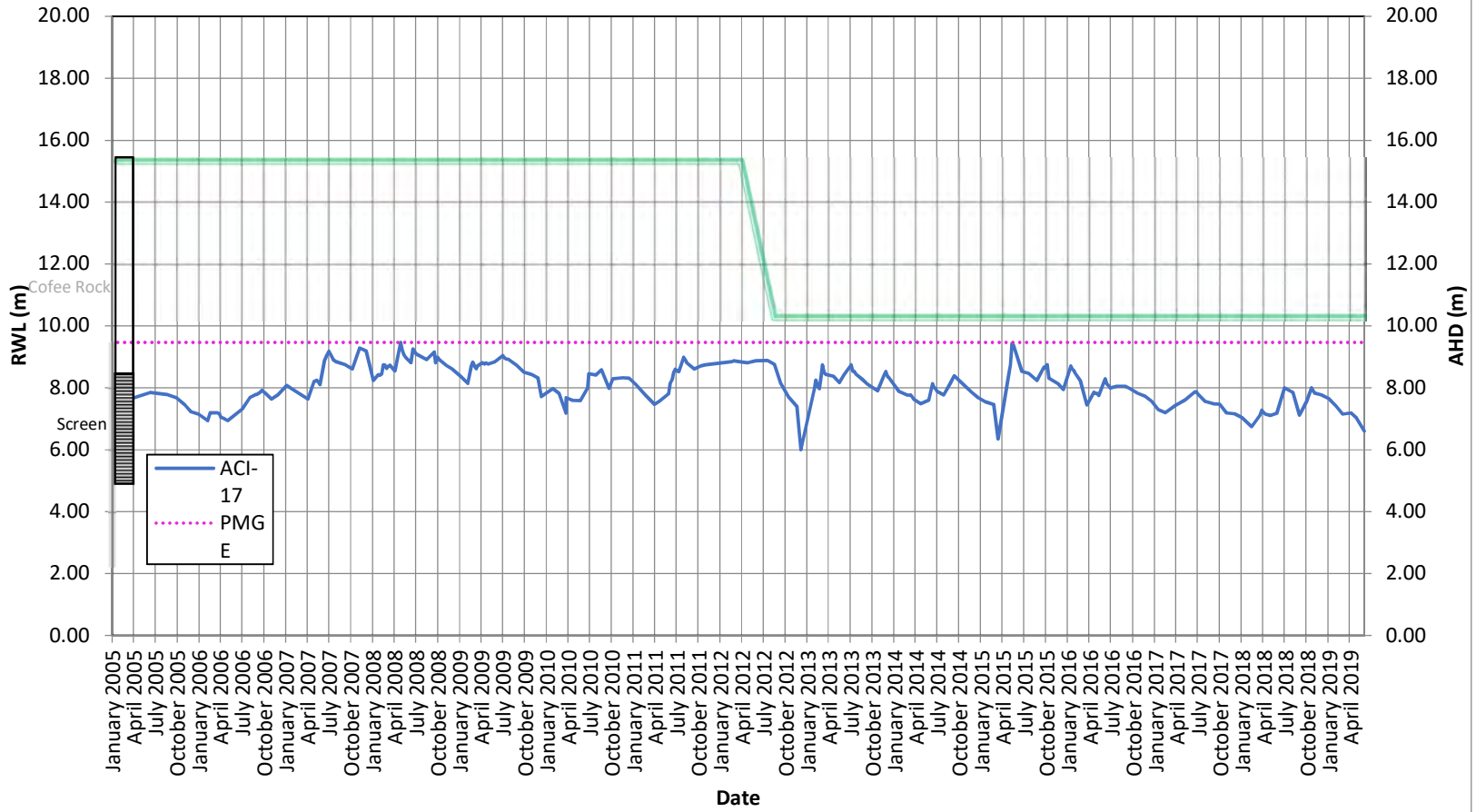
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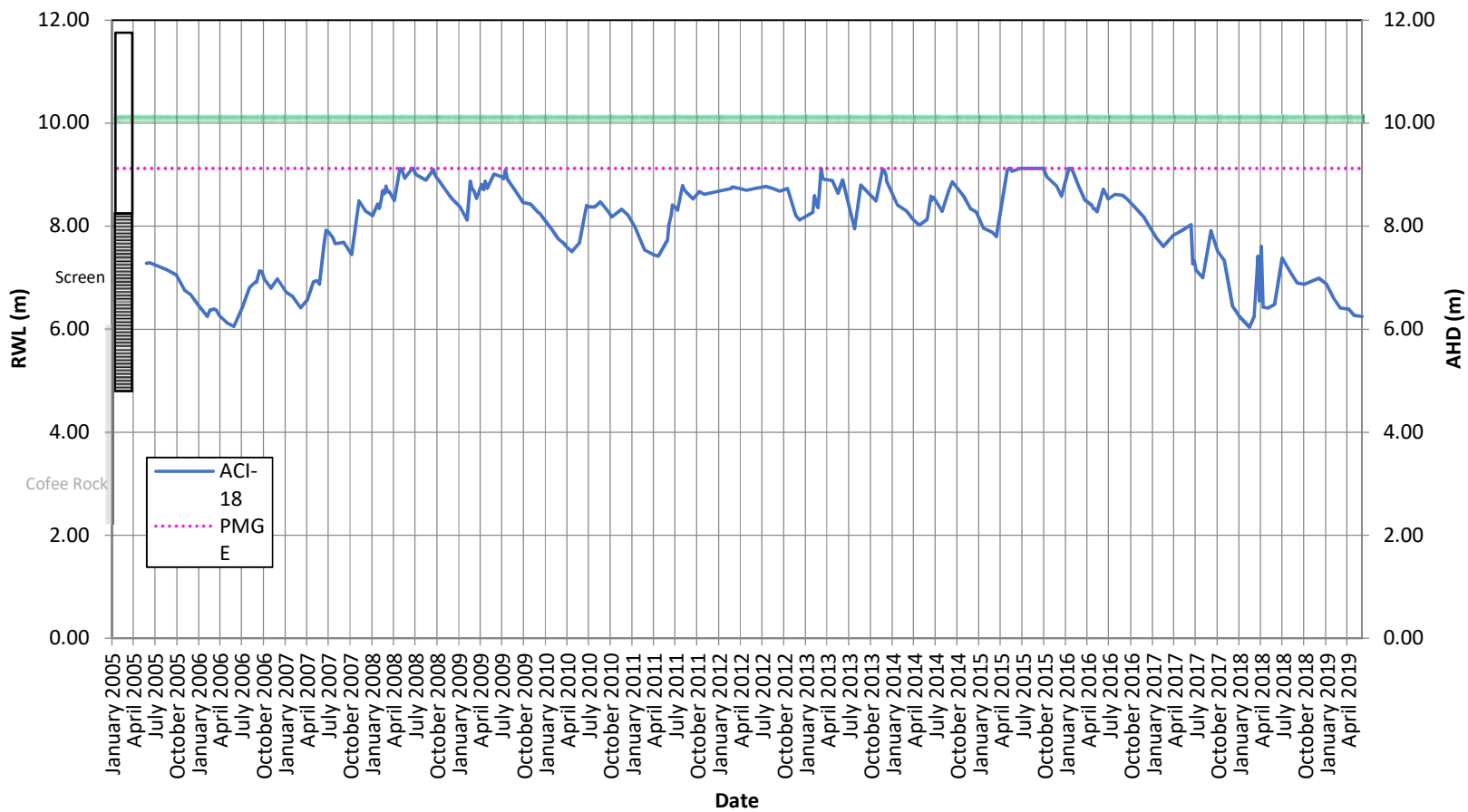
# ACI-16



# ACI-17

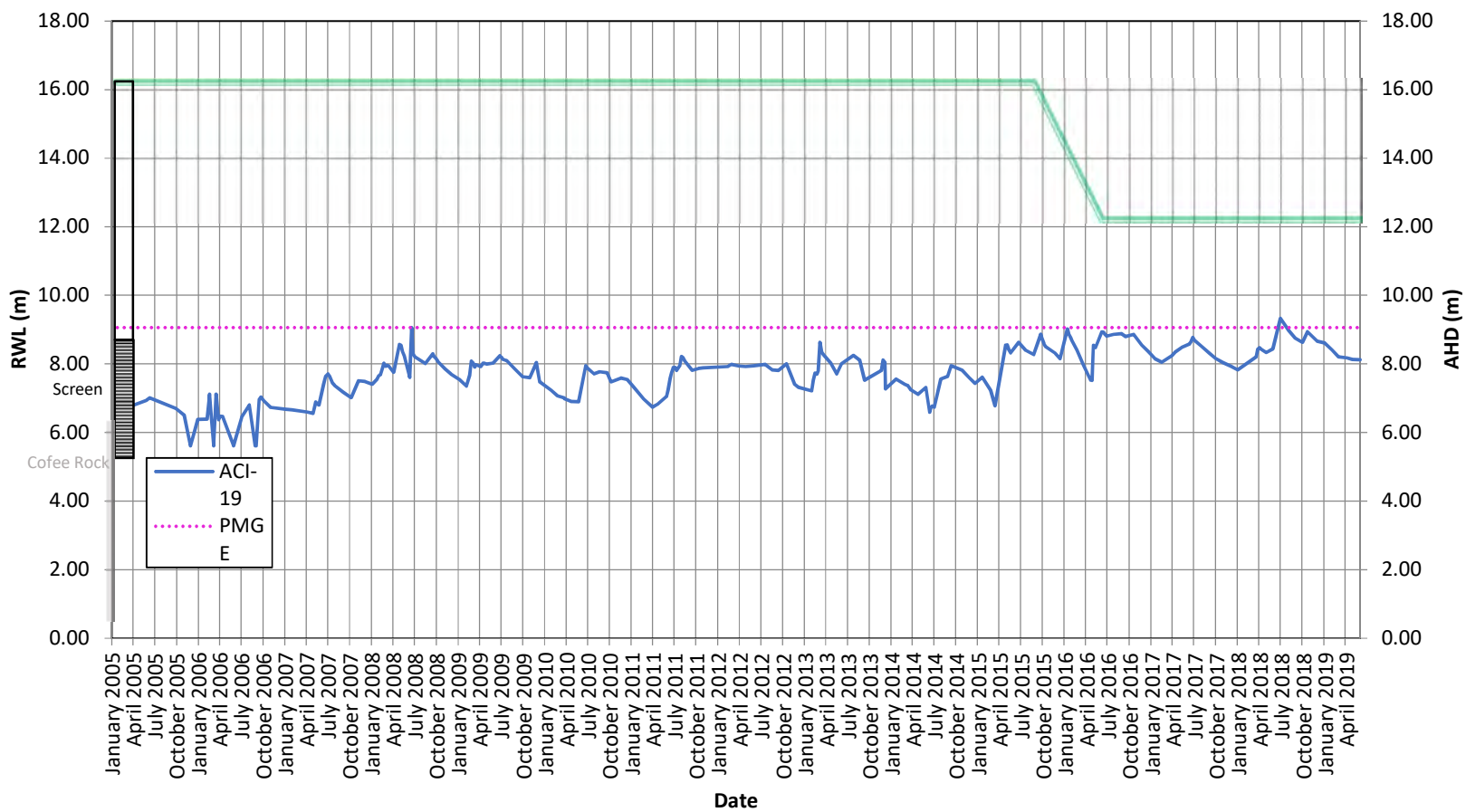


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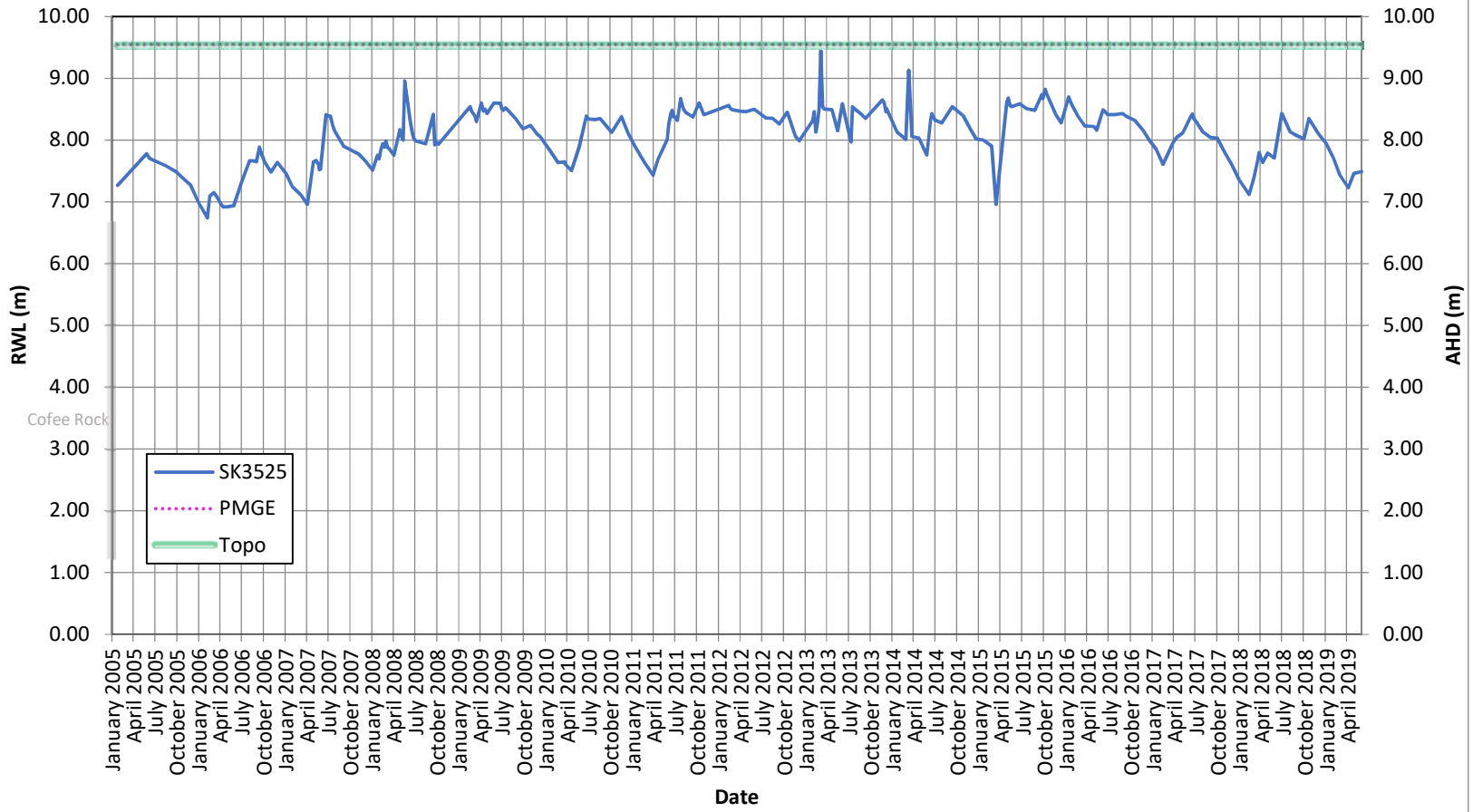




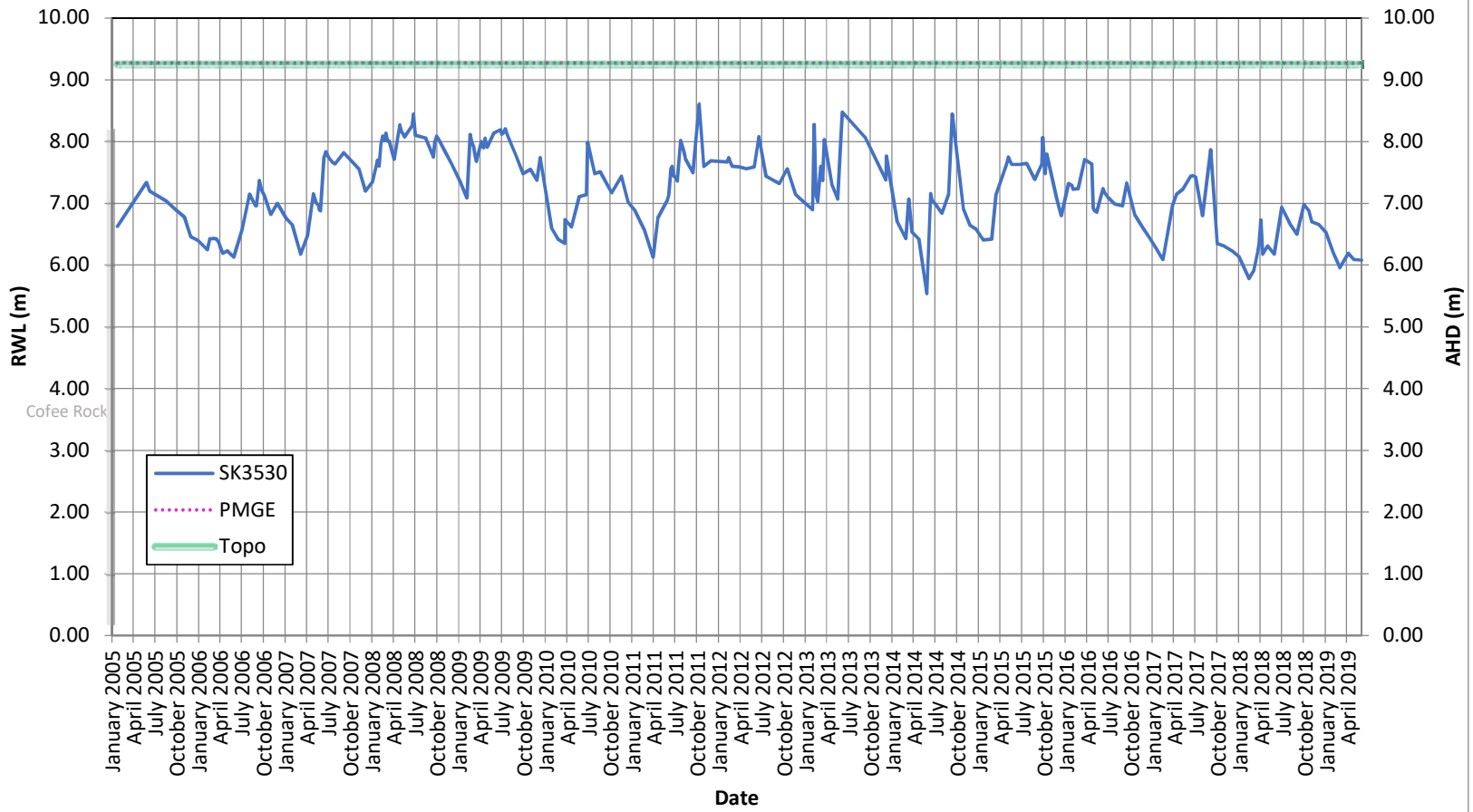
# ACI-19



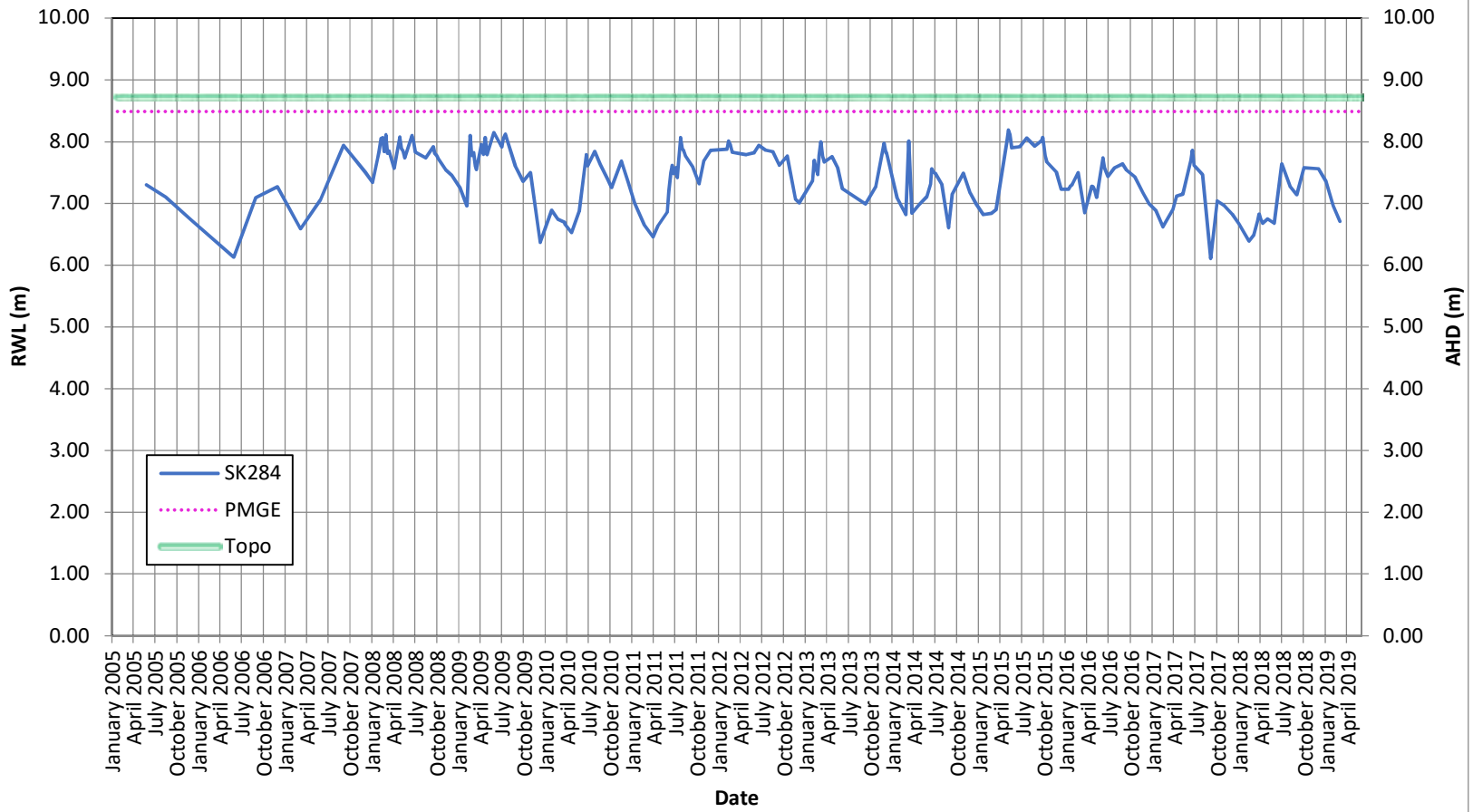
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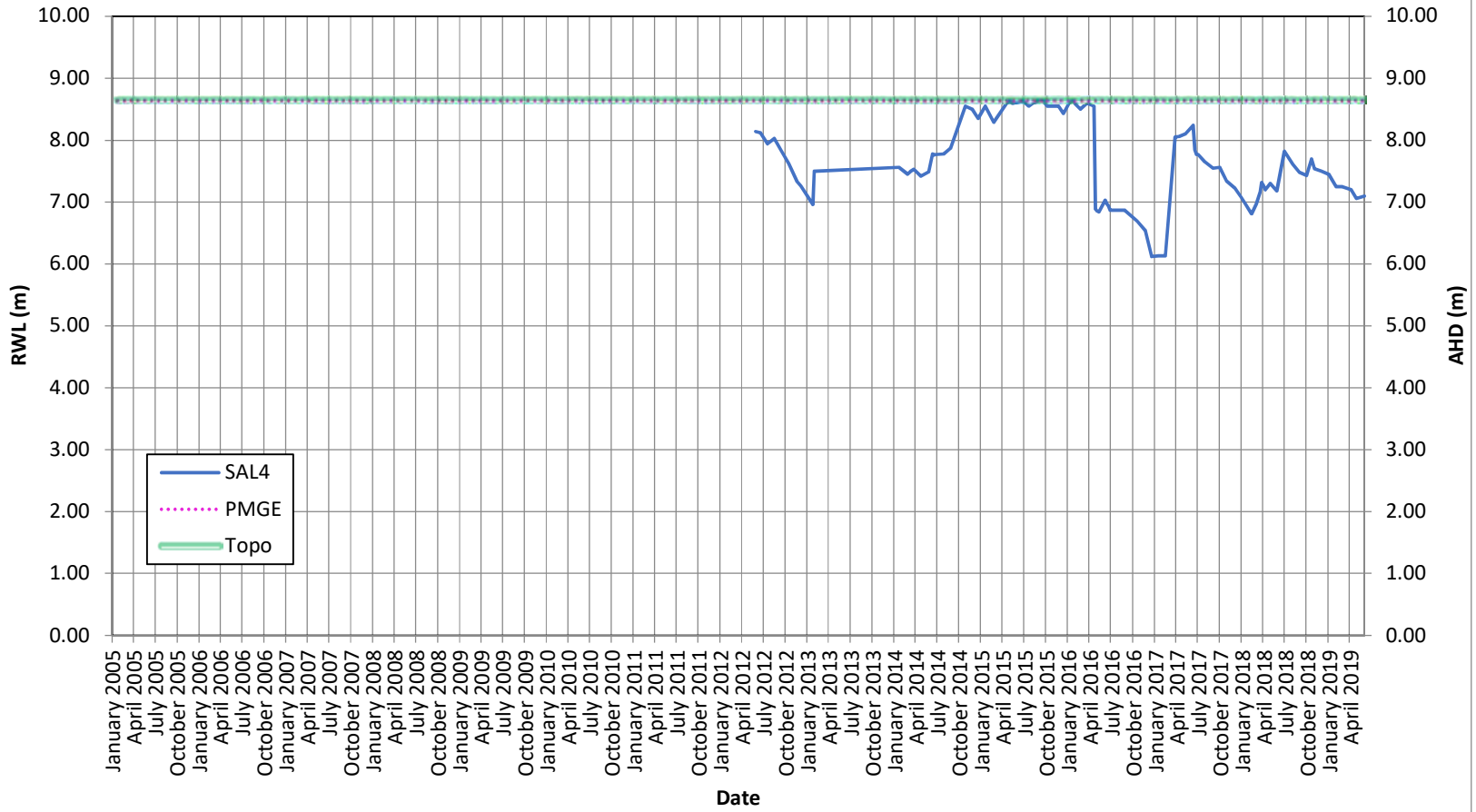
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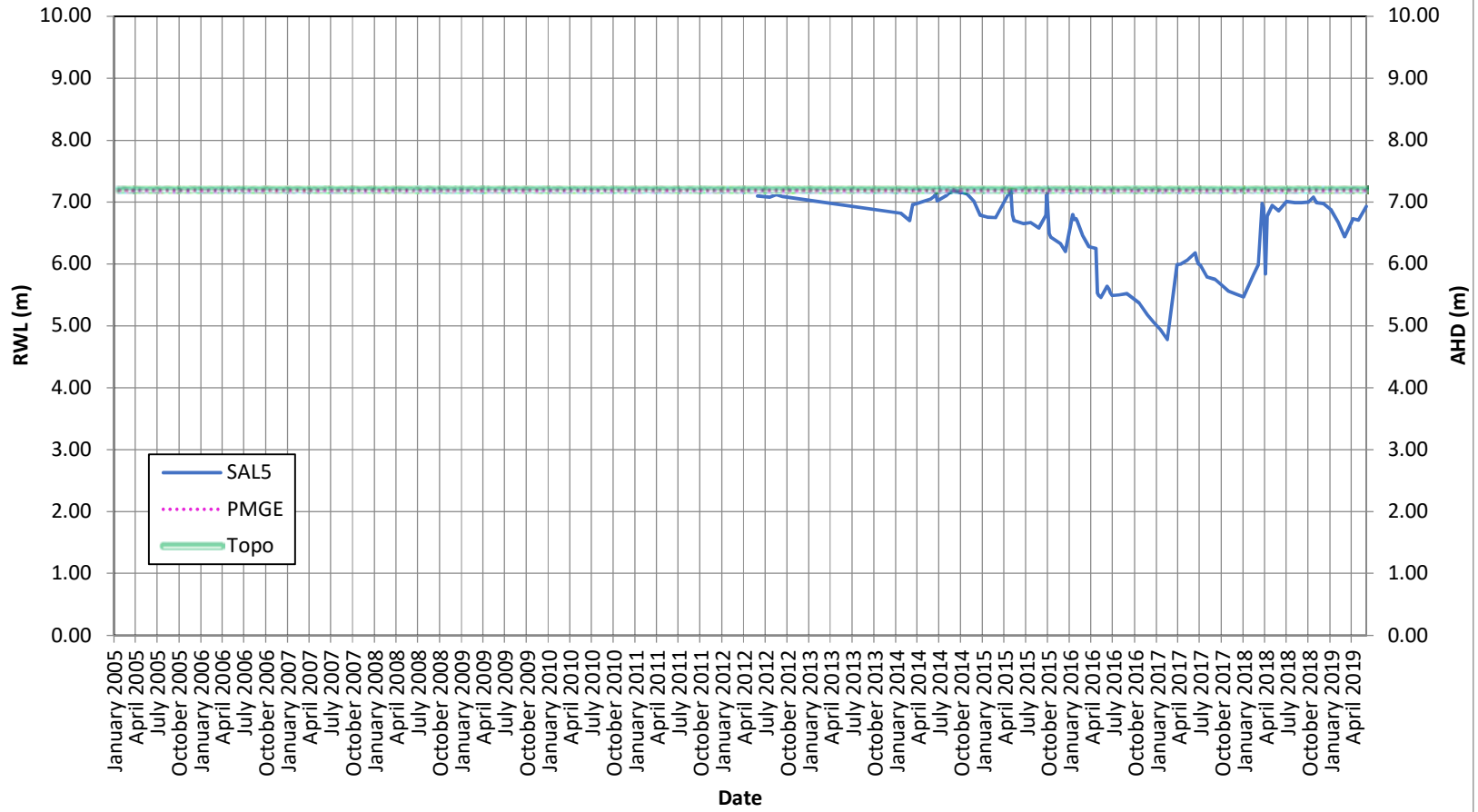
# SK284



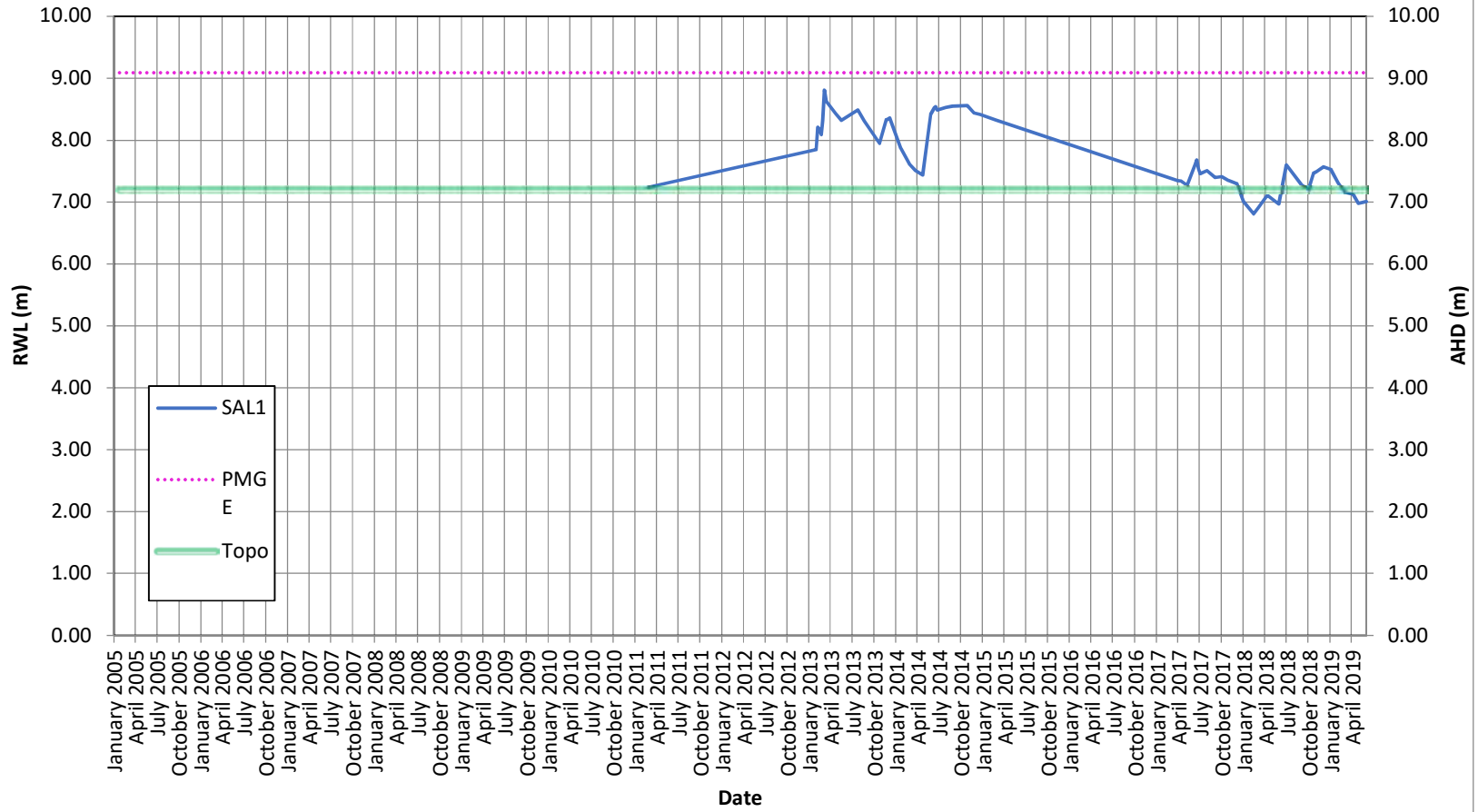
# SAL4



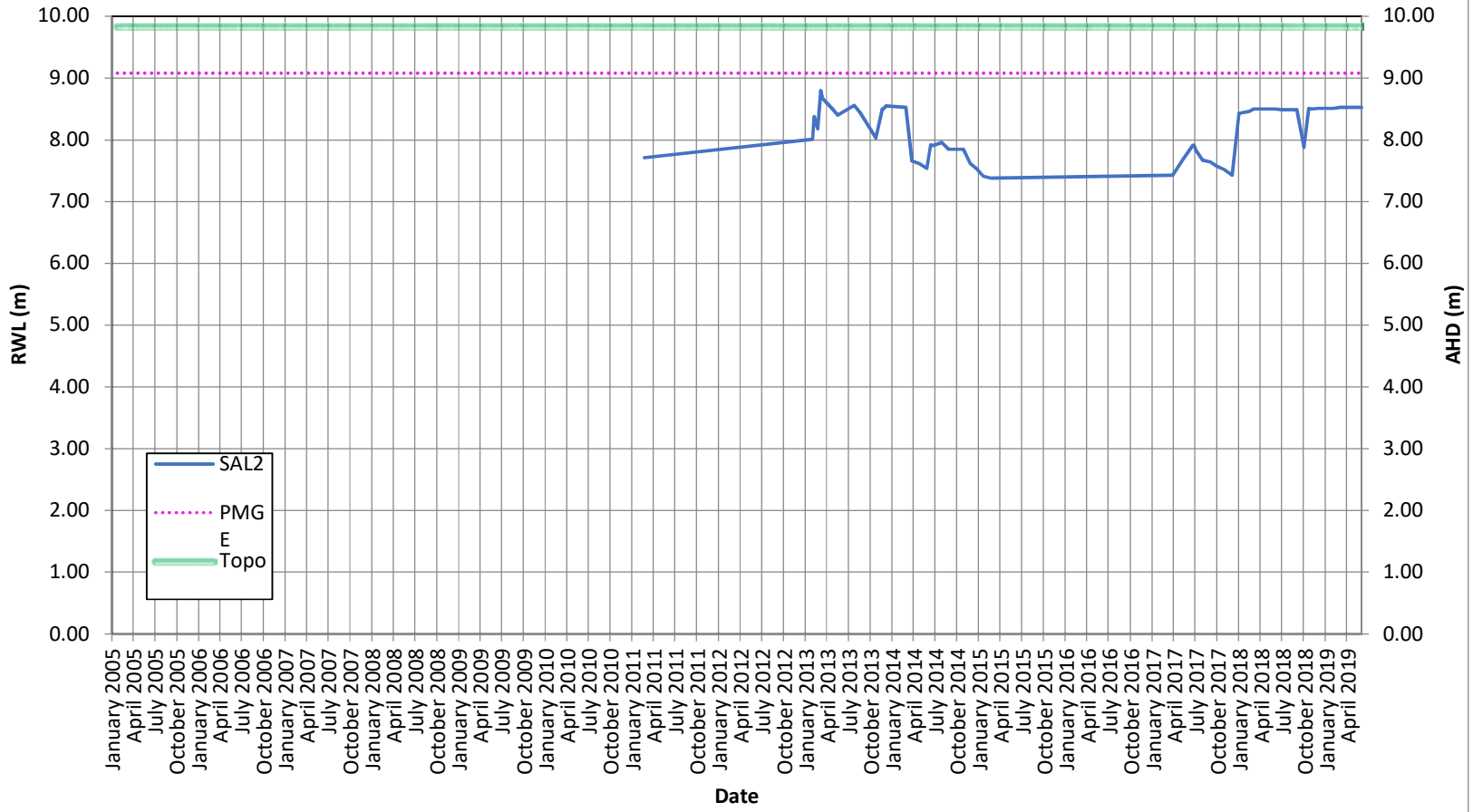
# SAL5



# SAL1

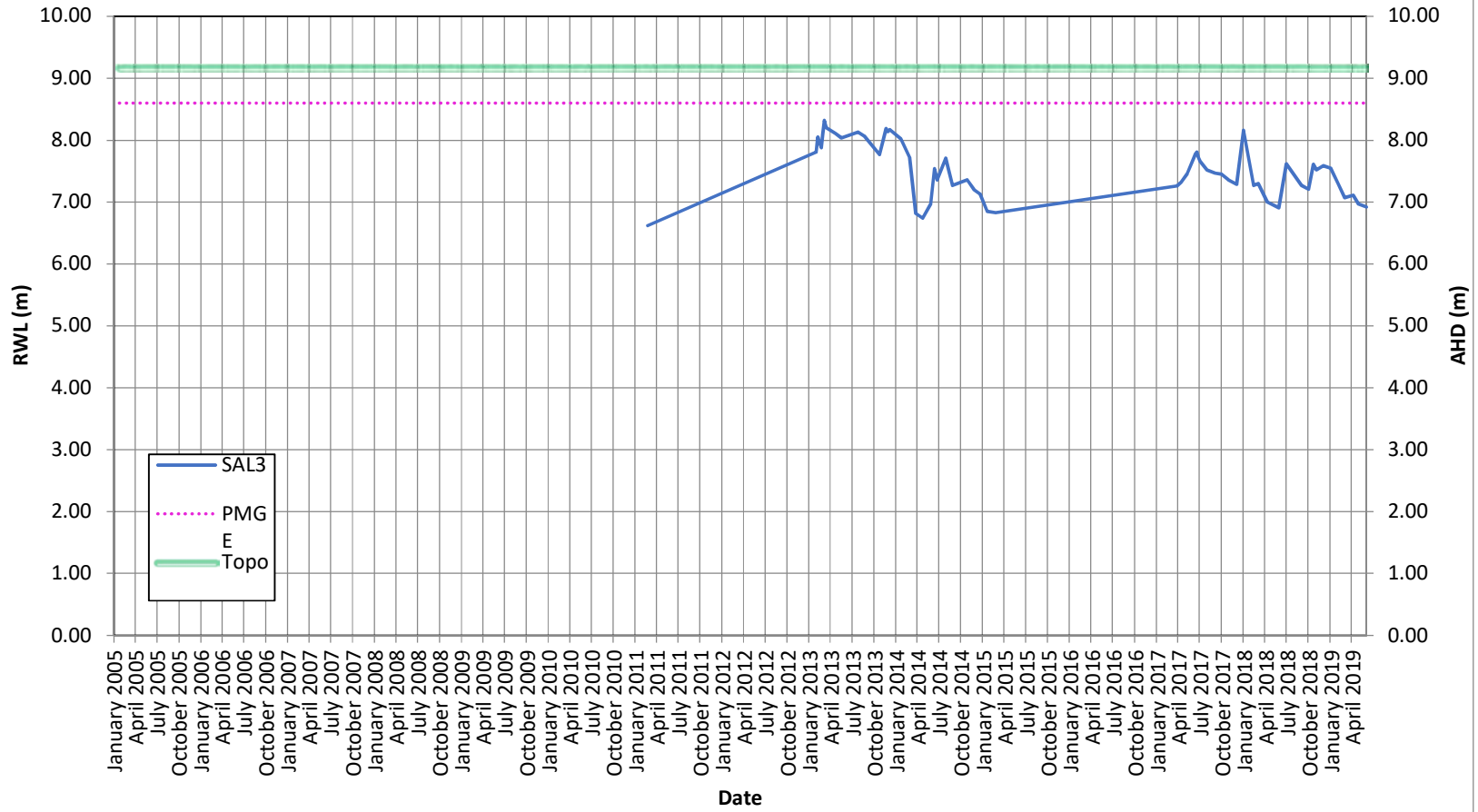


# SAL2

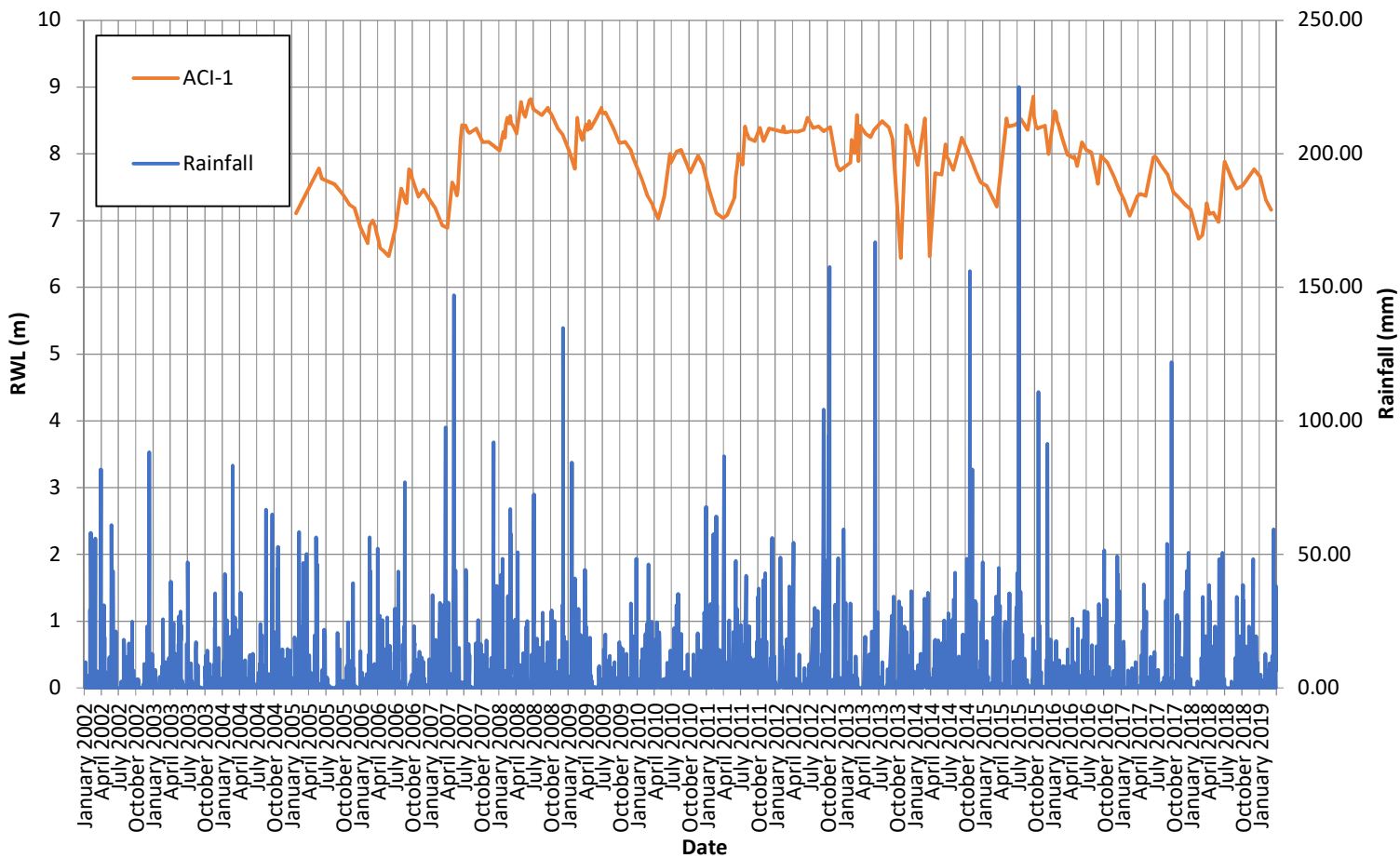




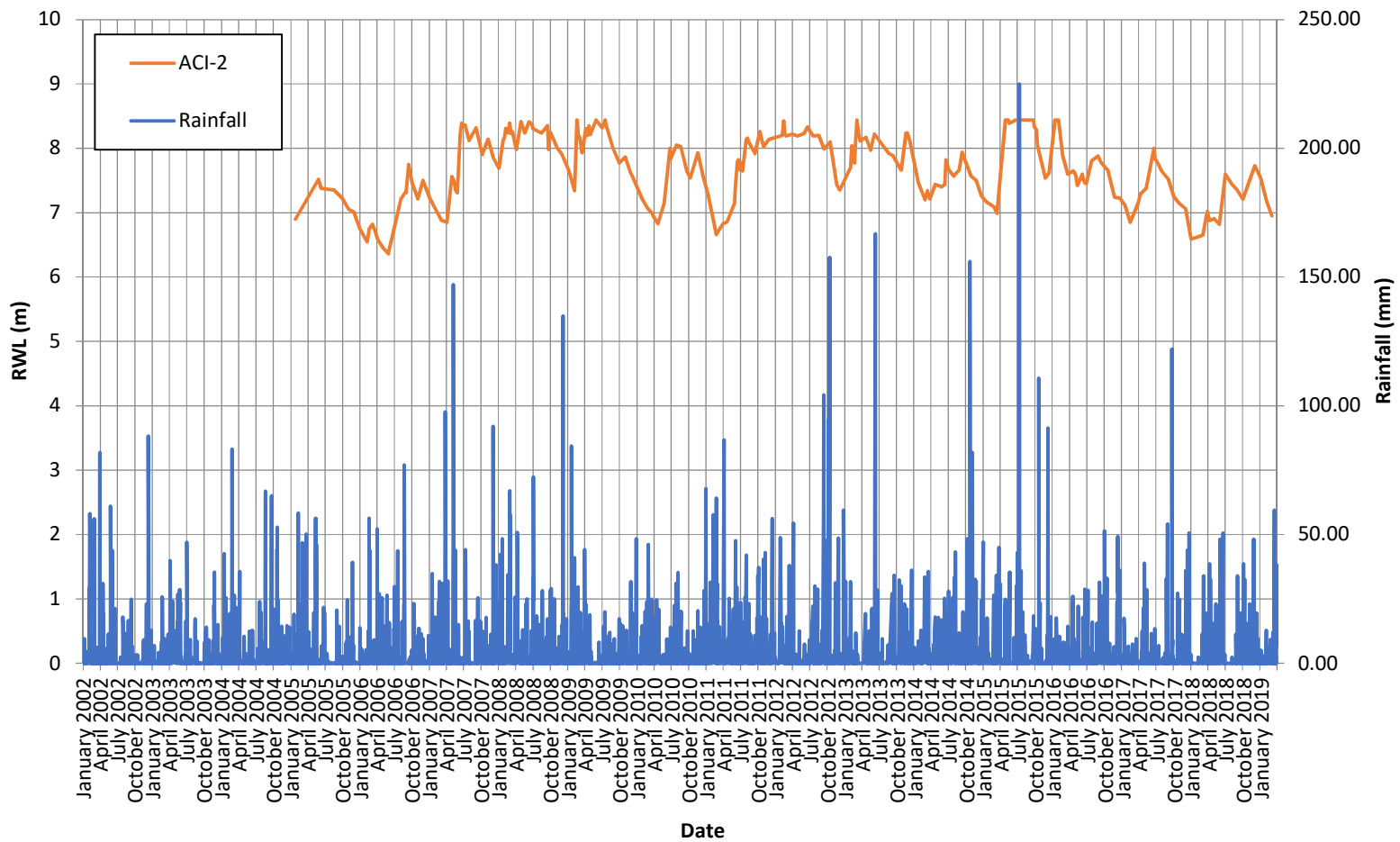
# SAL3



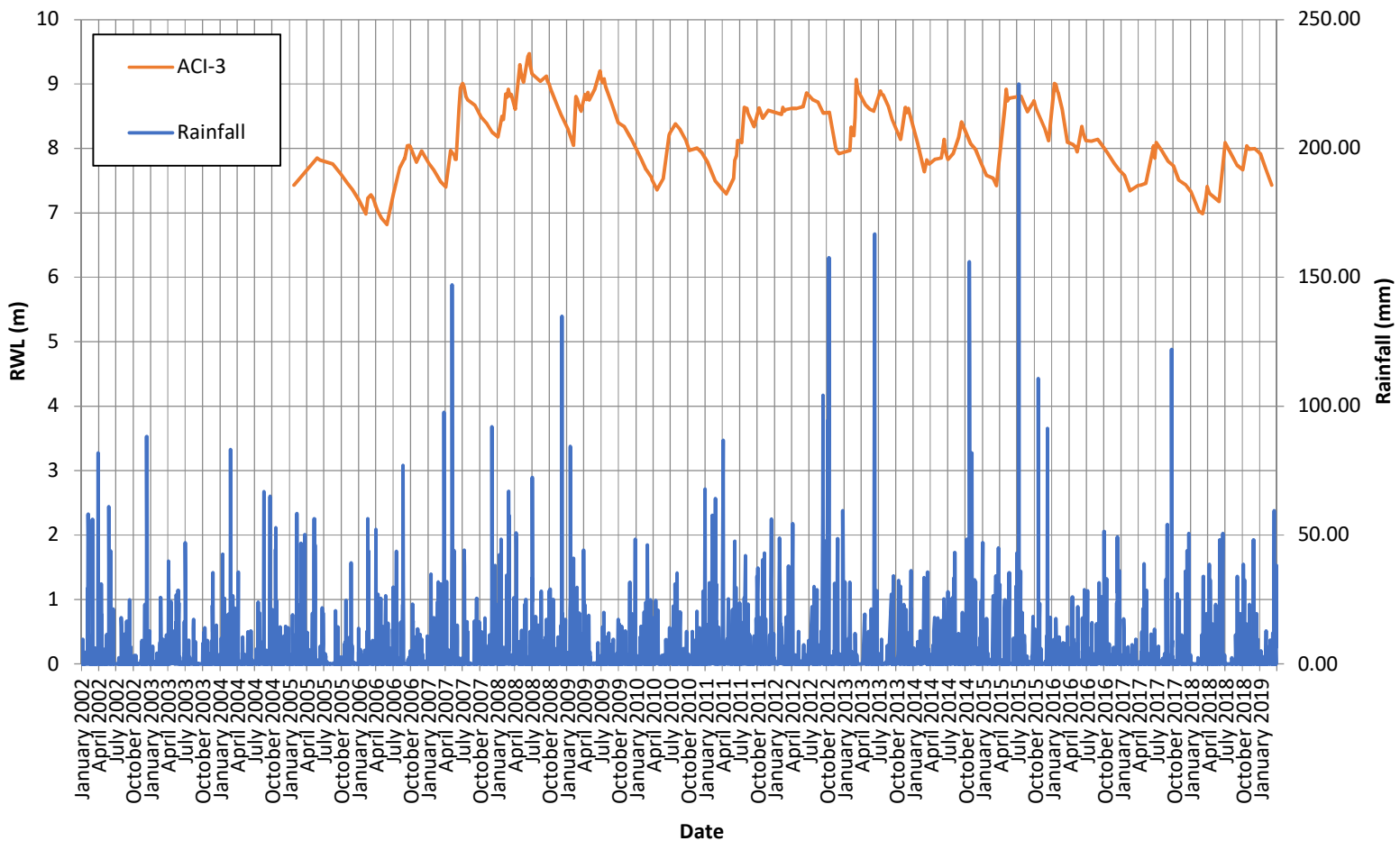
# ACI-1



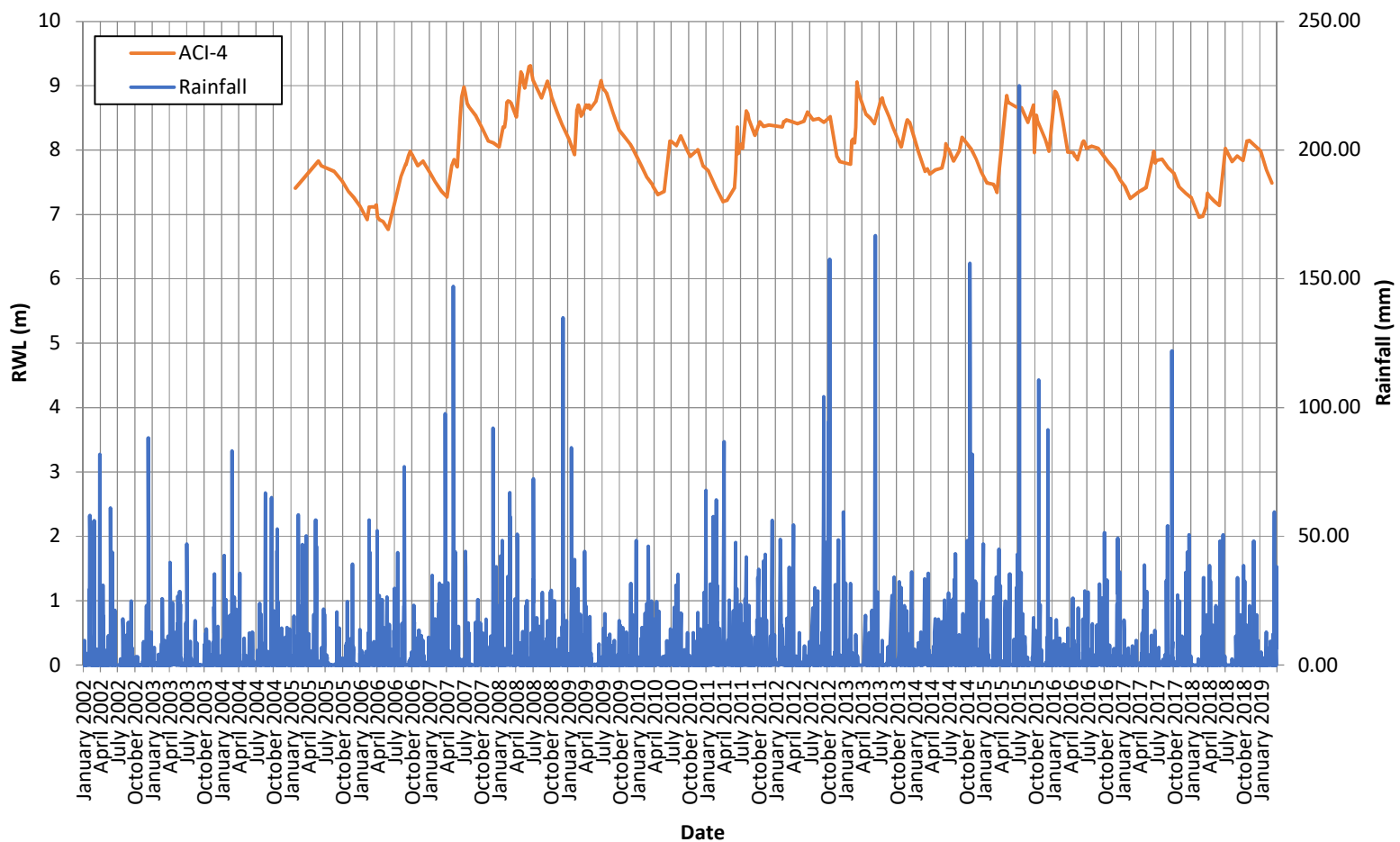
# ACI-2



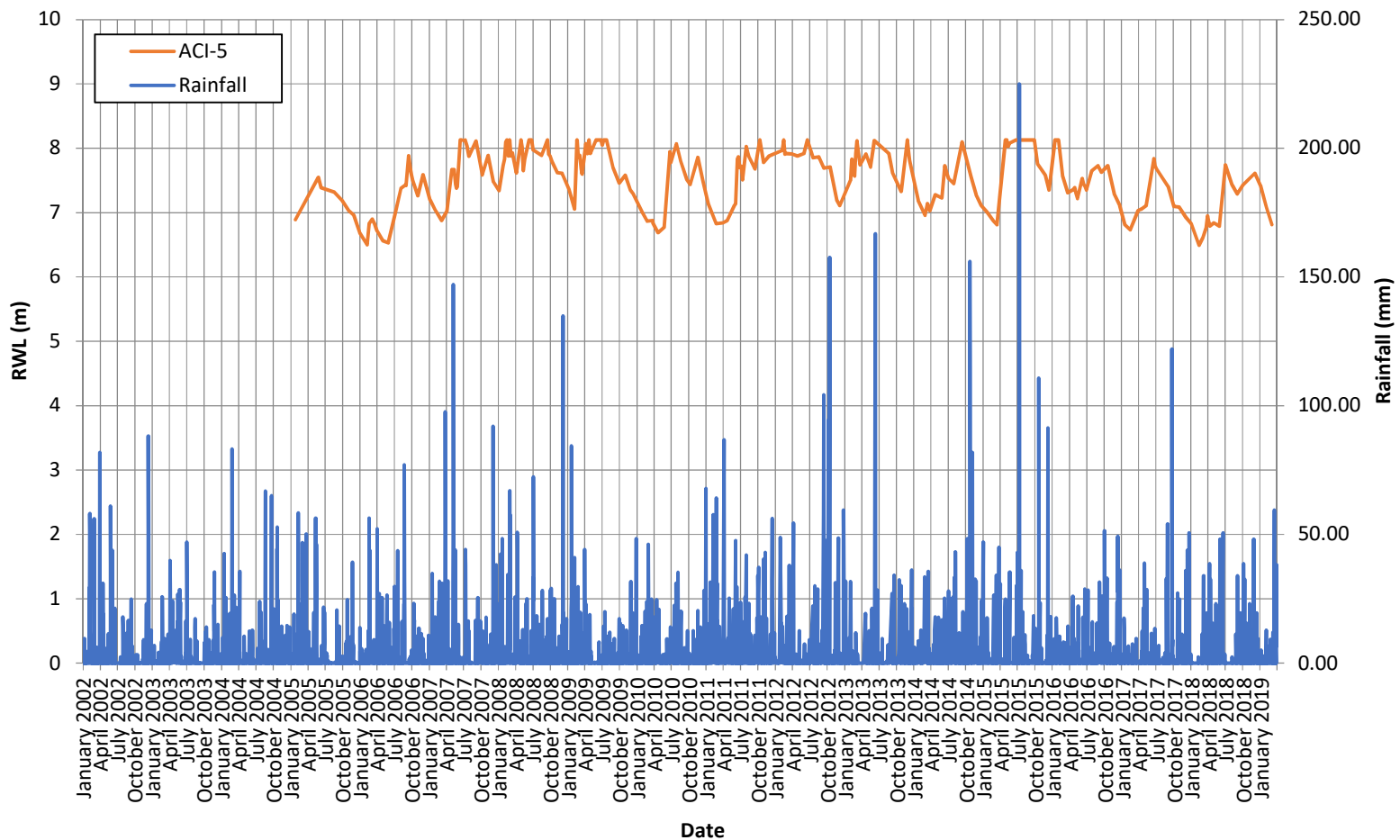
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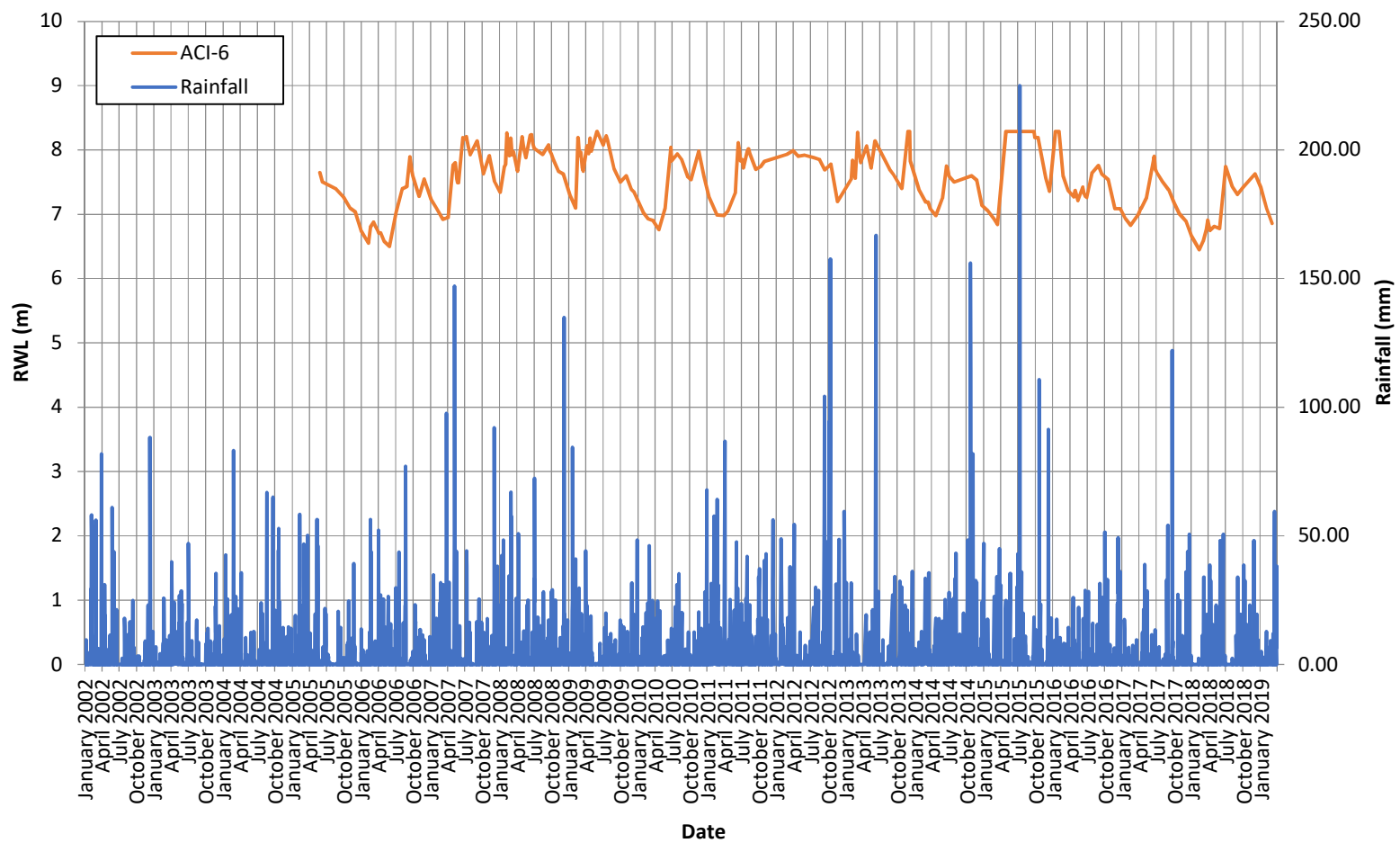
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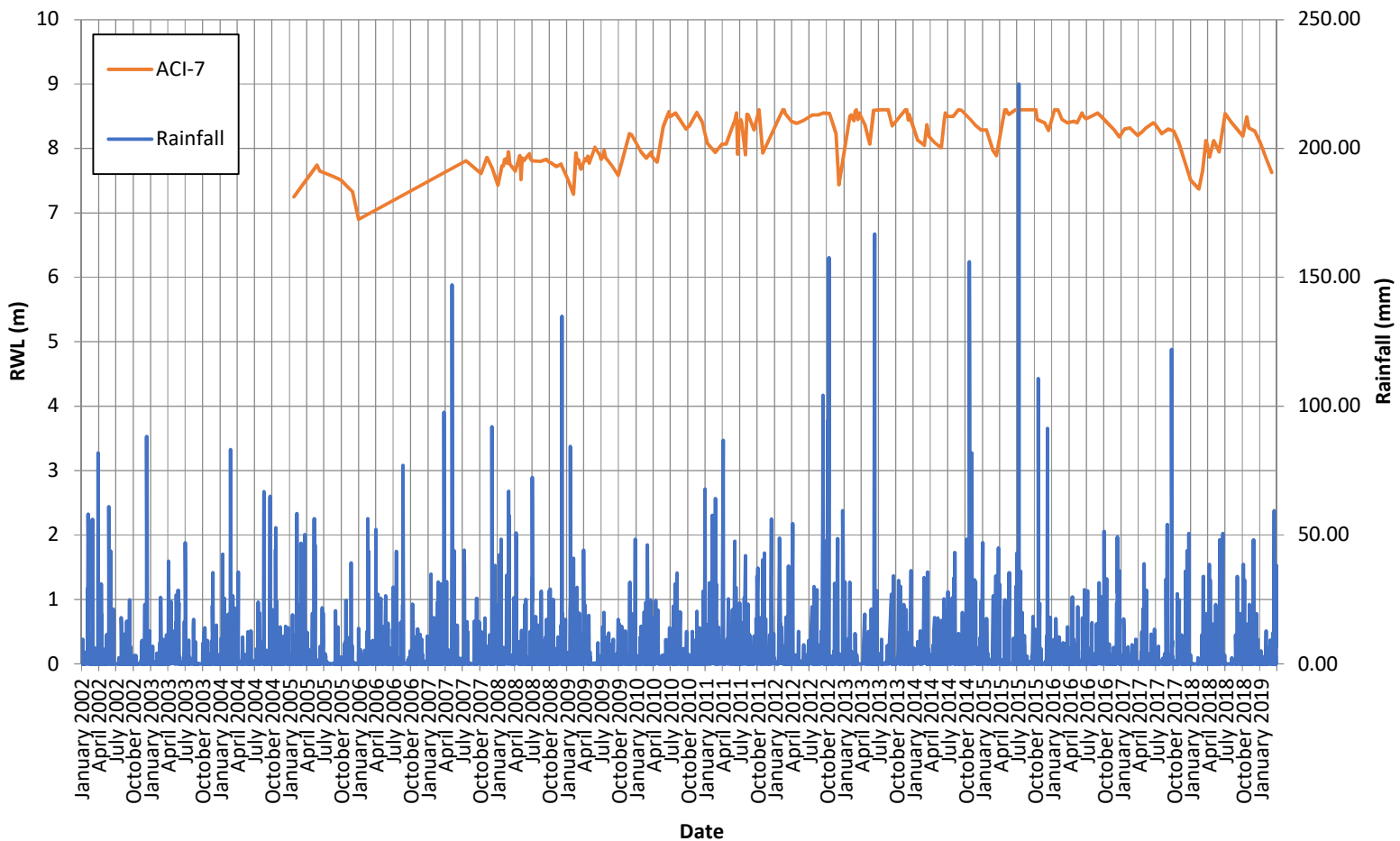
# ACI-5



# ACI-6

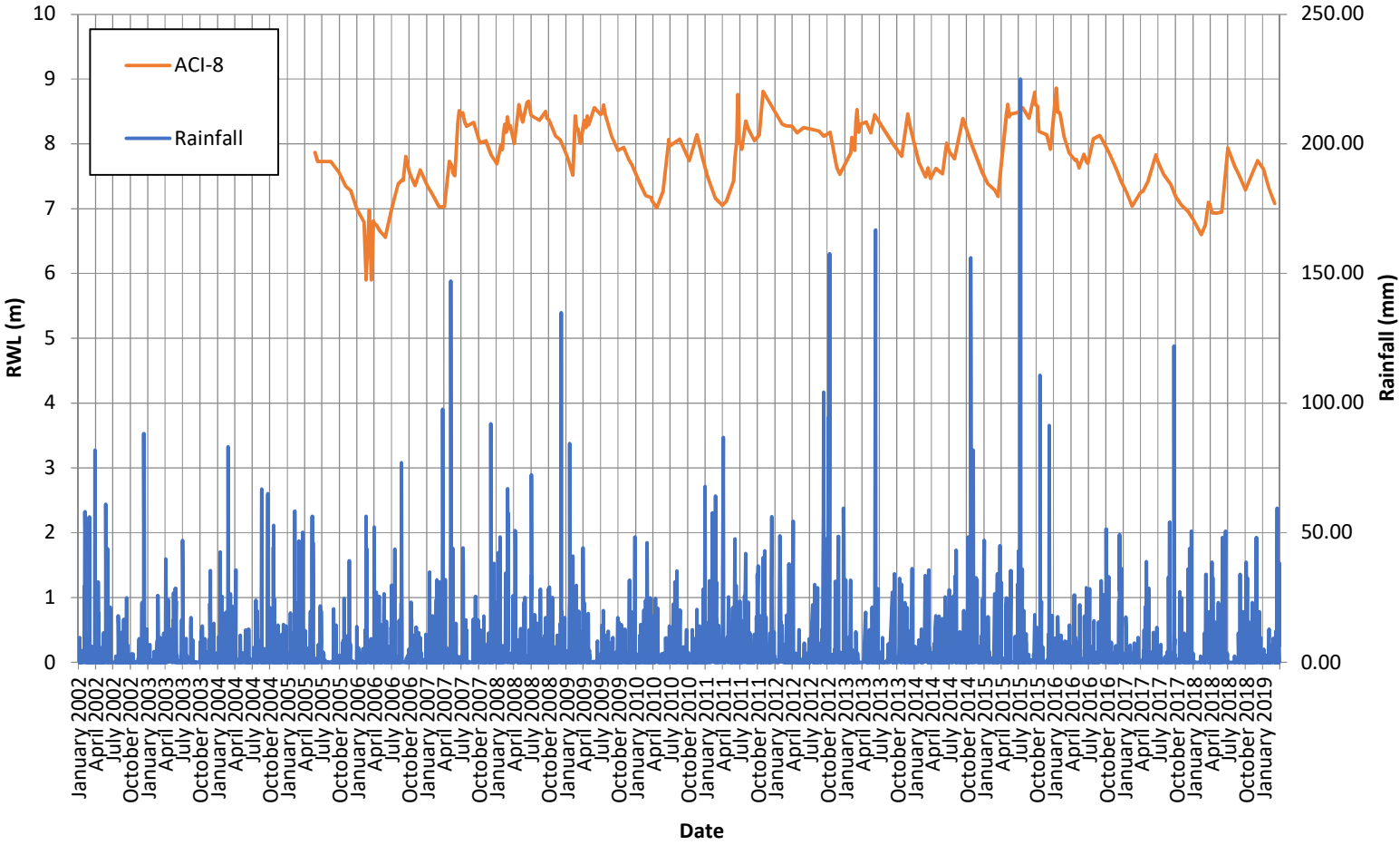


# ACI-7

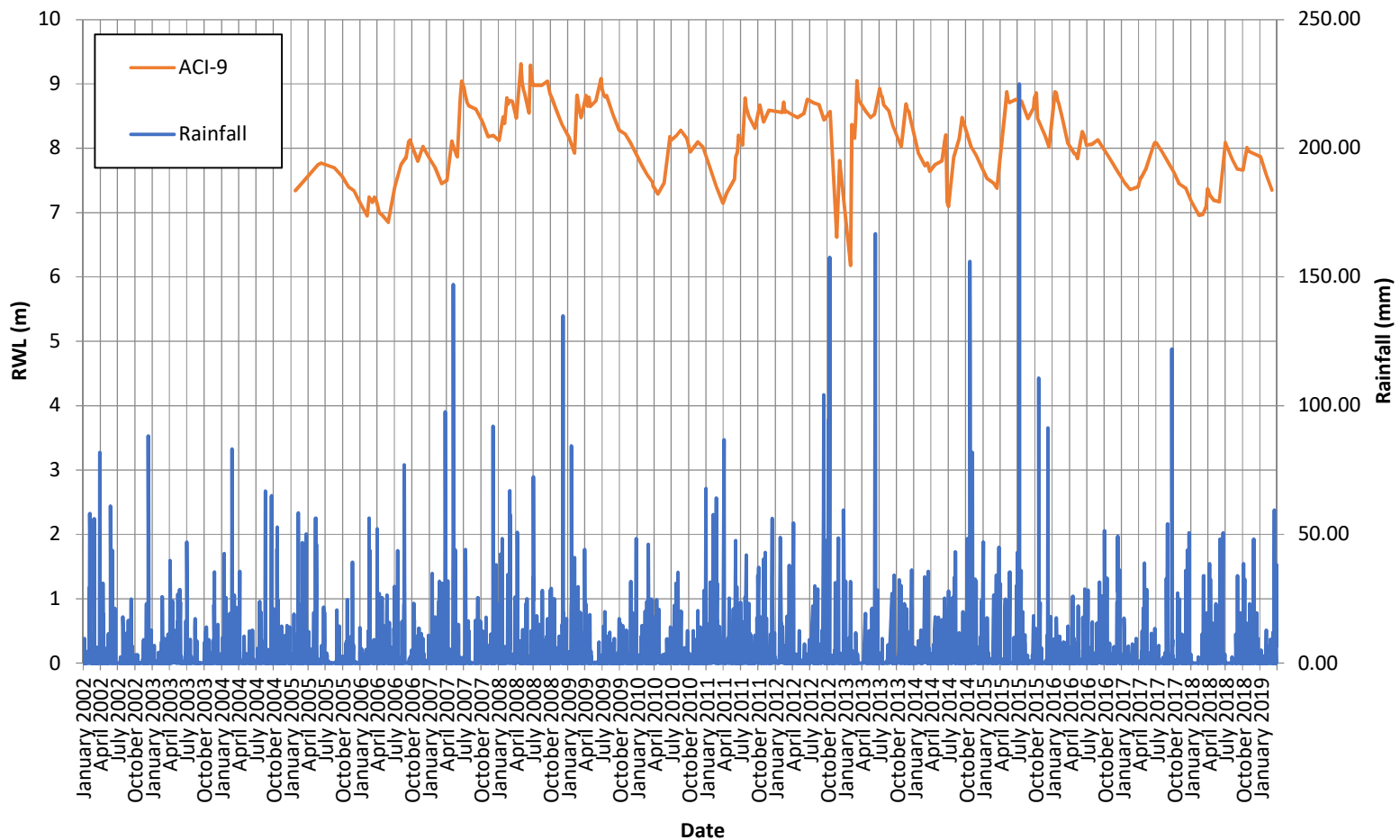




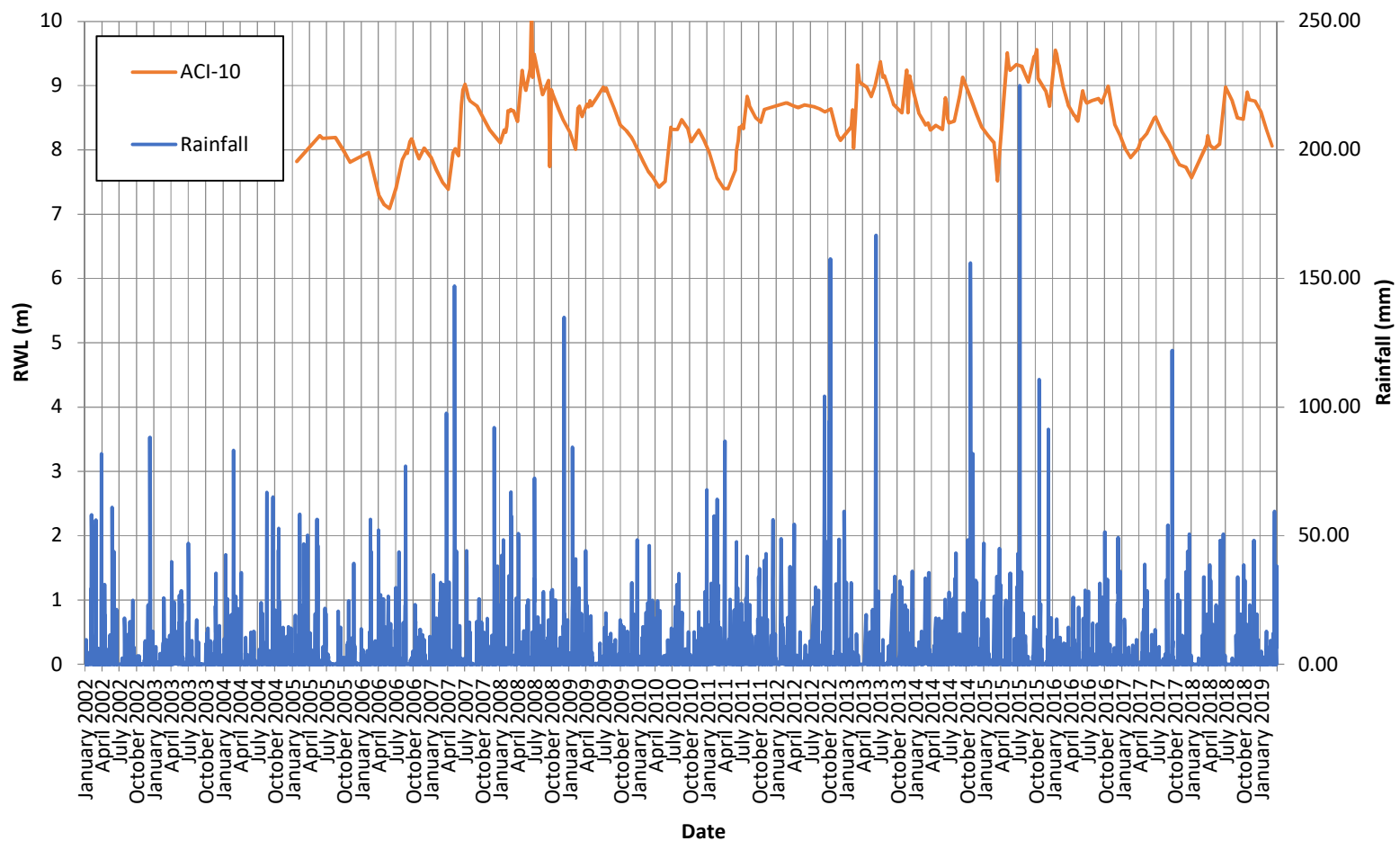
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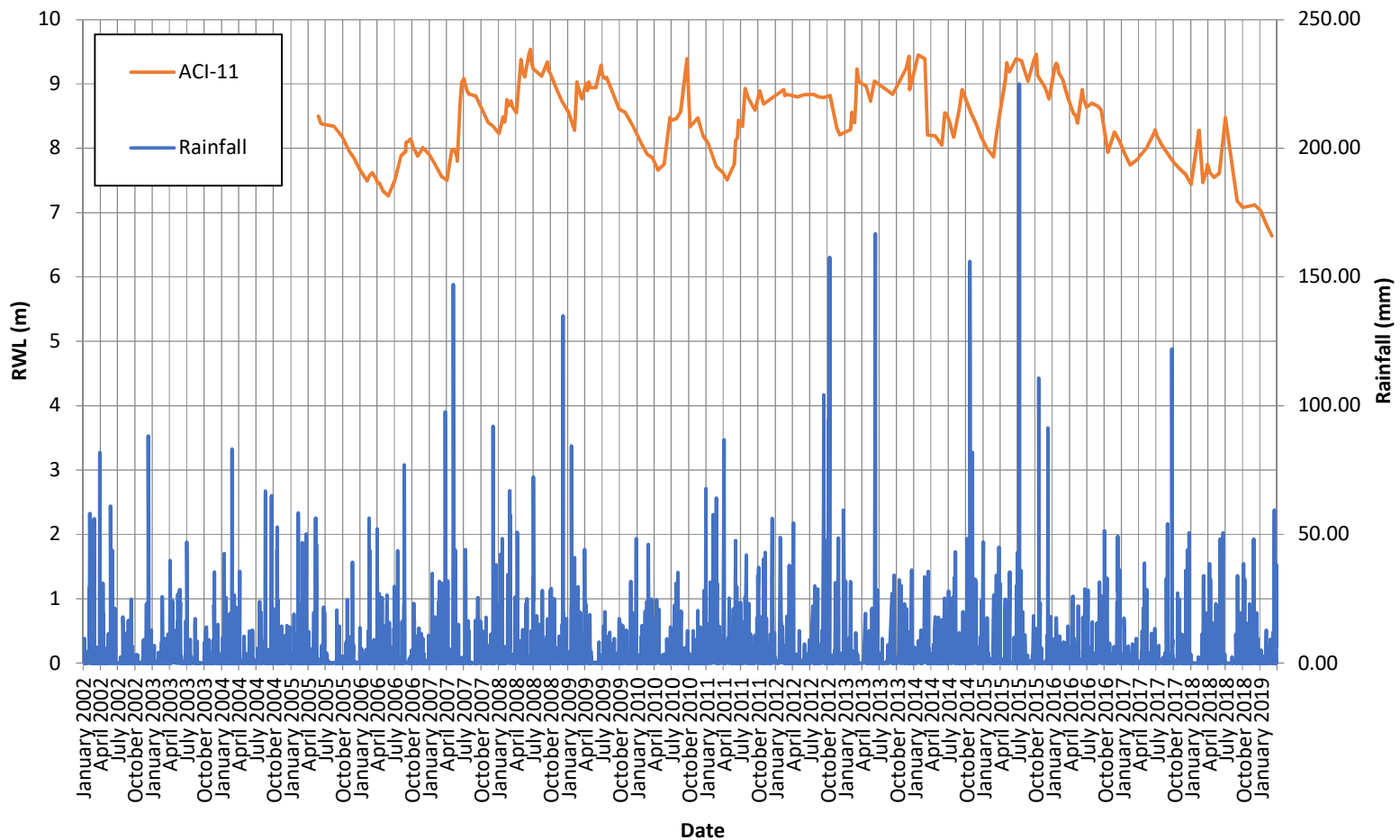
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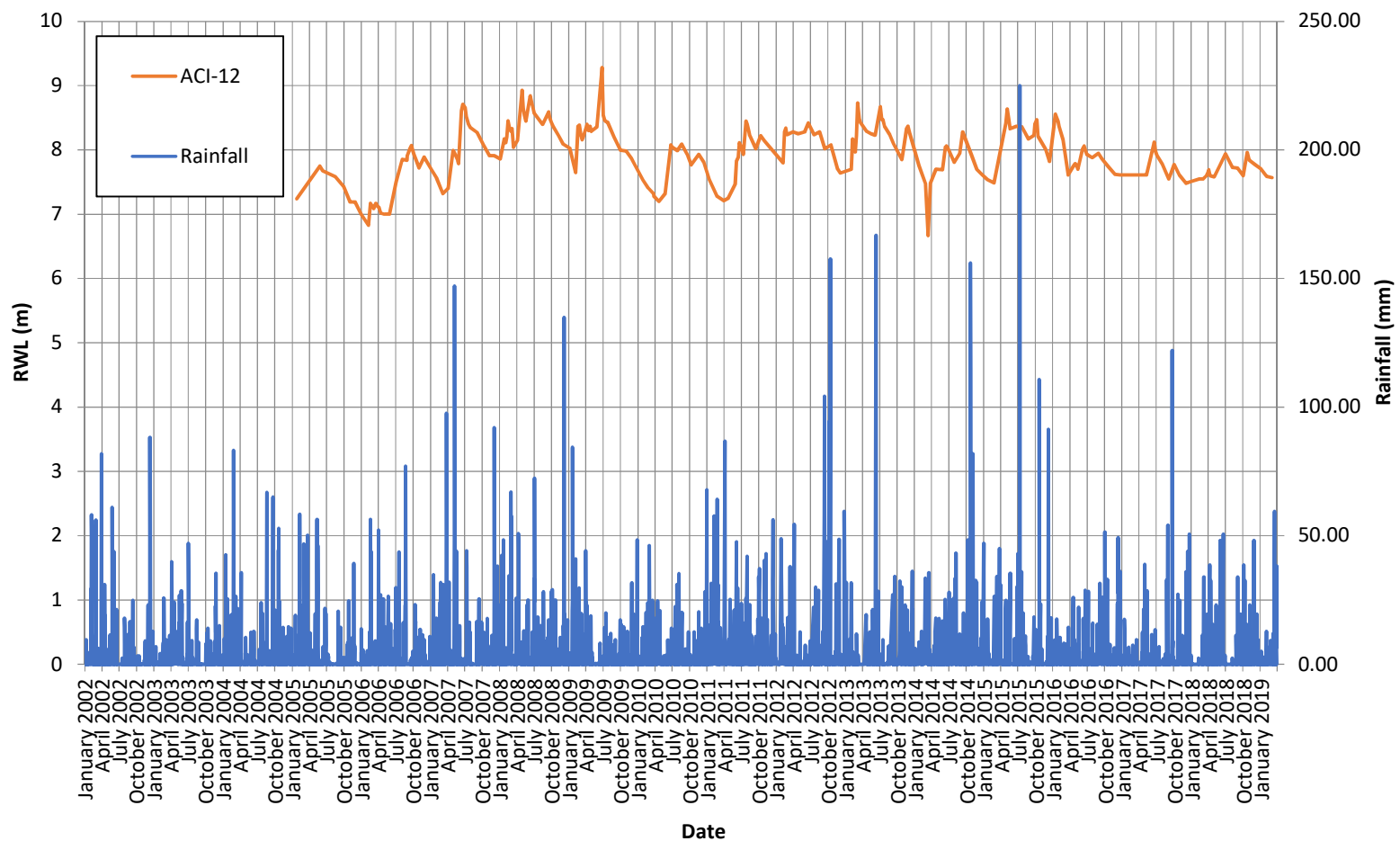
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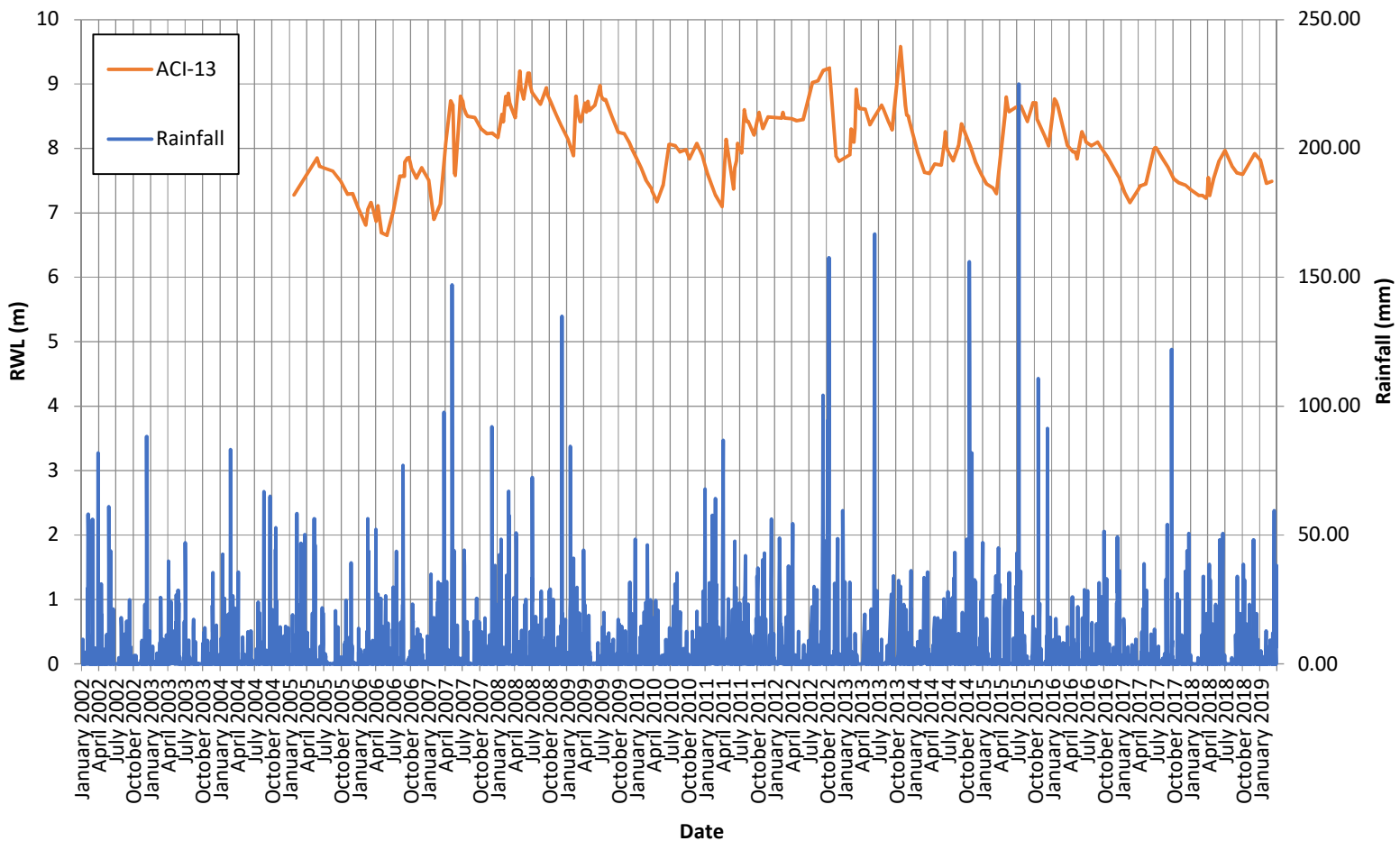
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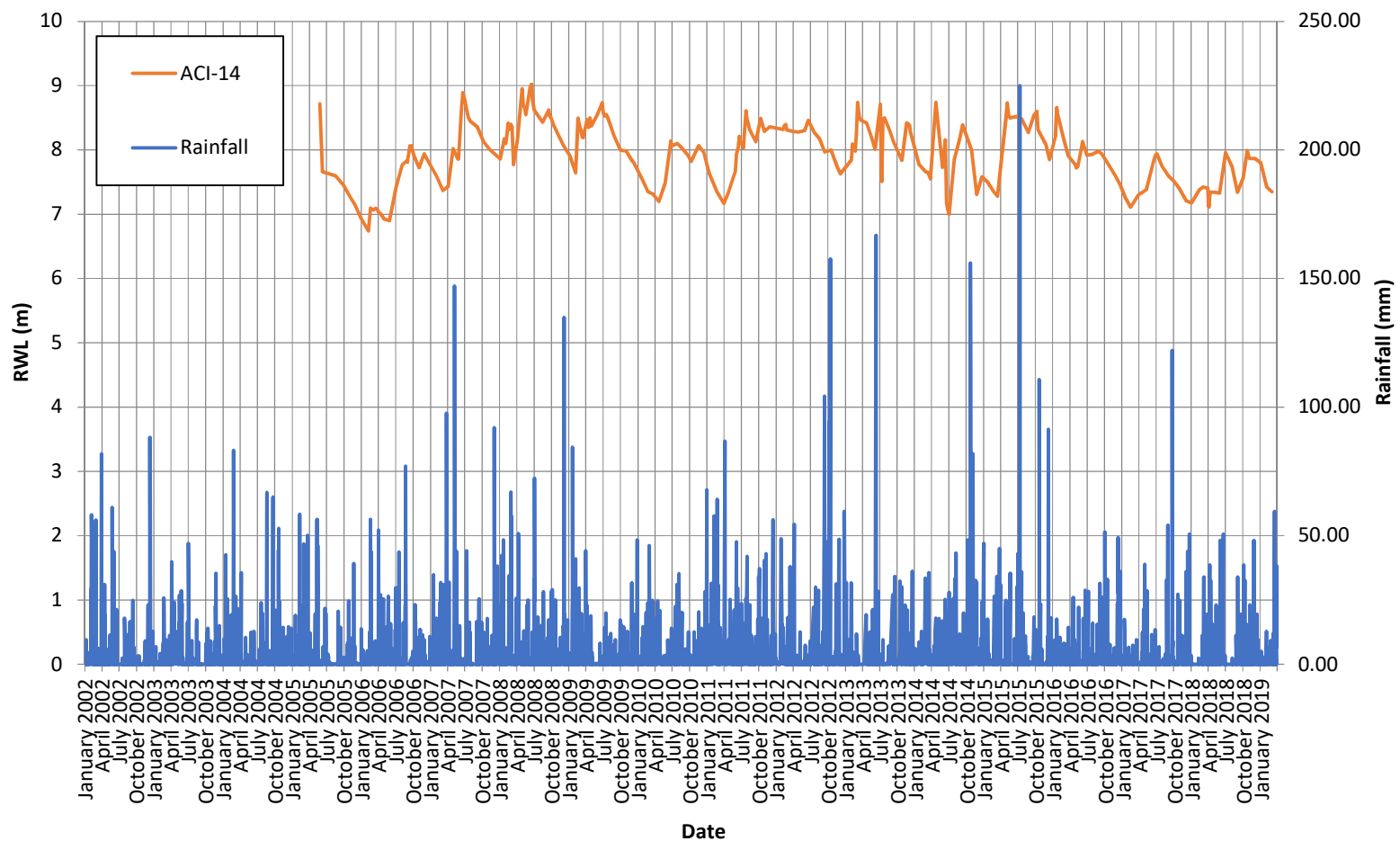
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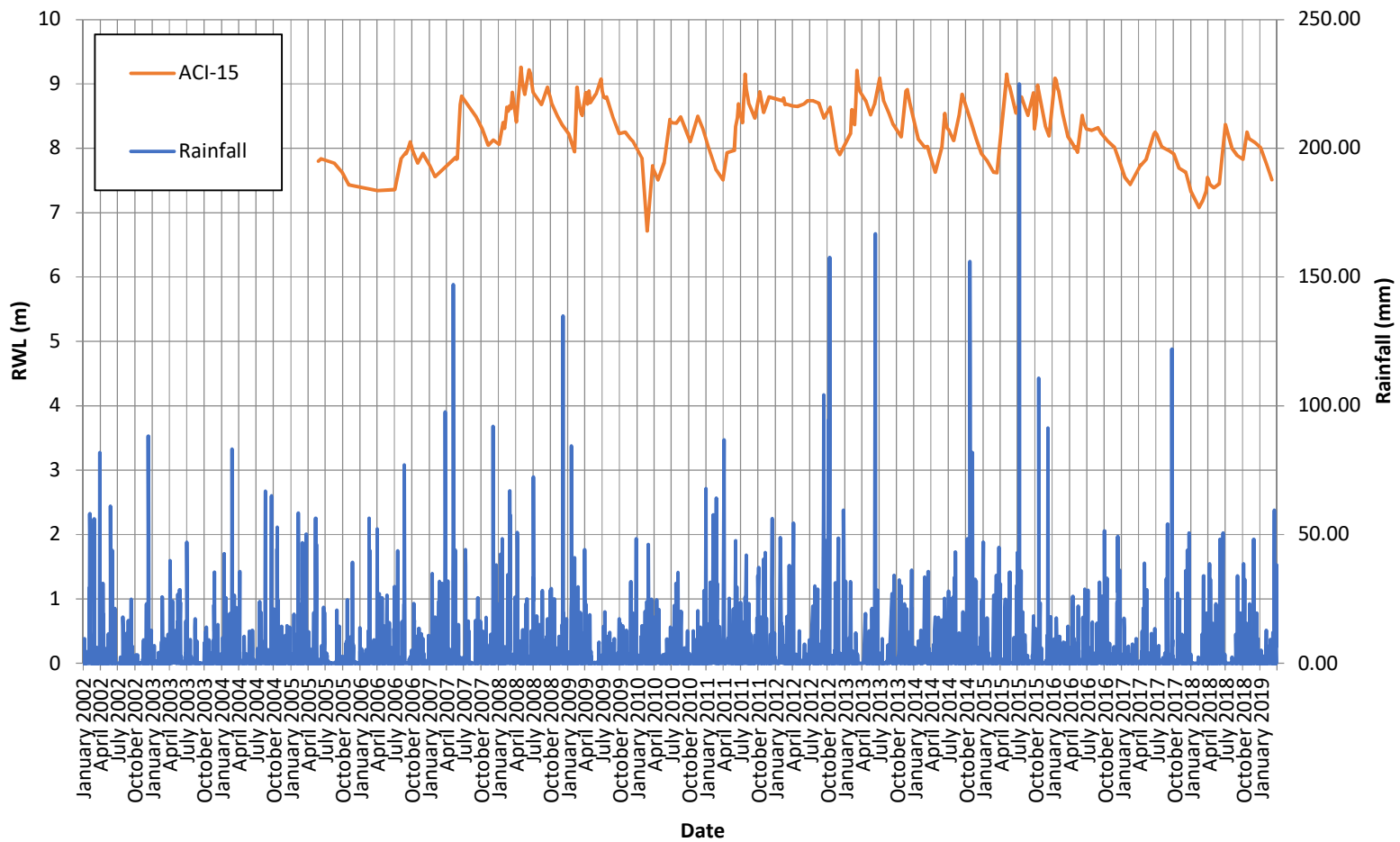
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# ACI-14

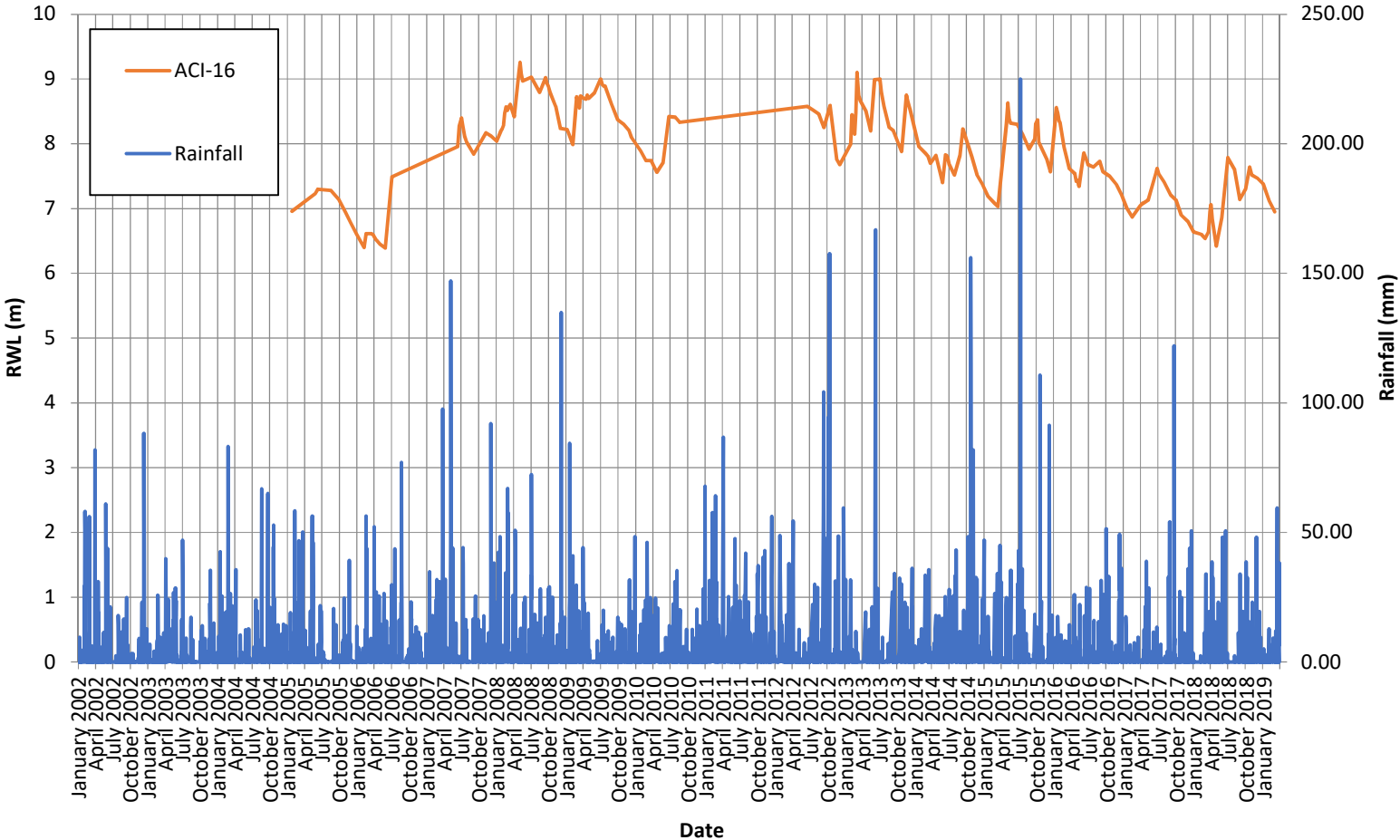


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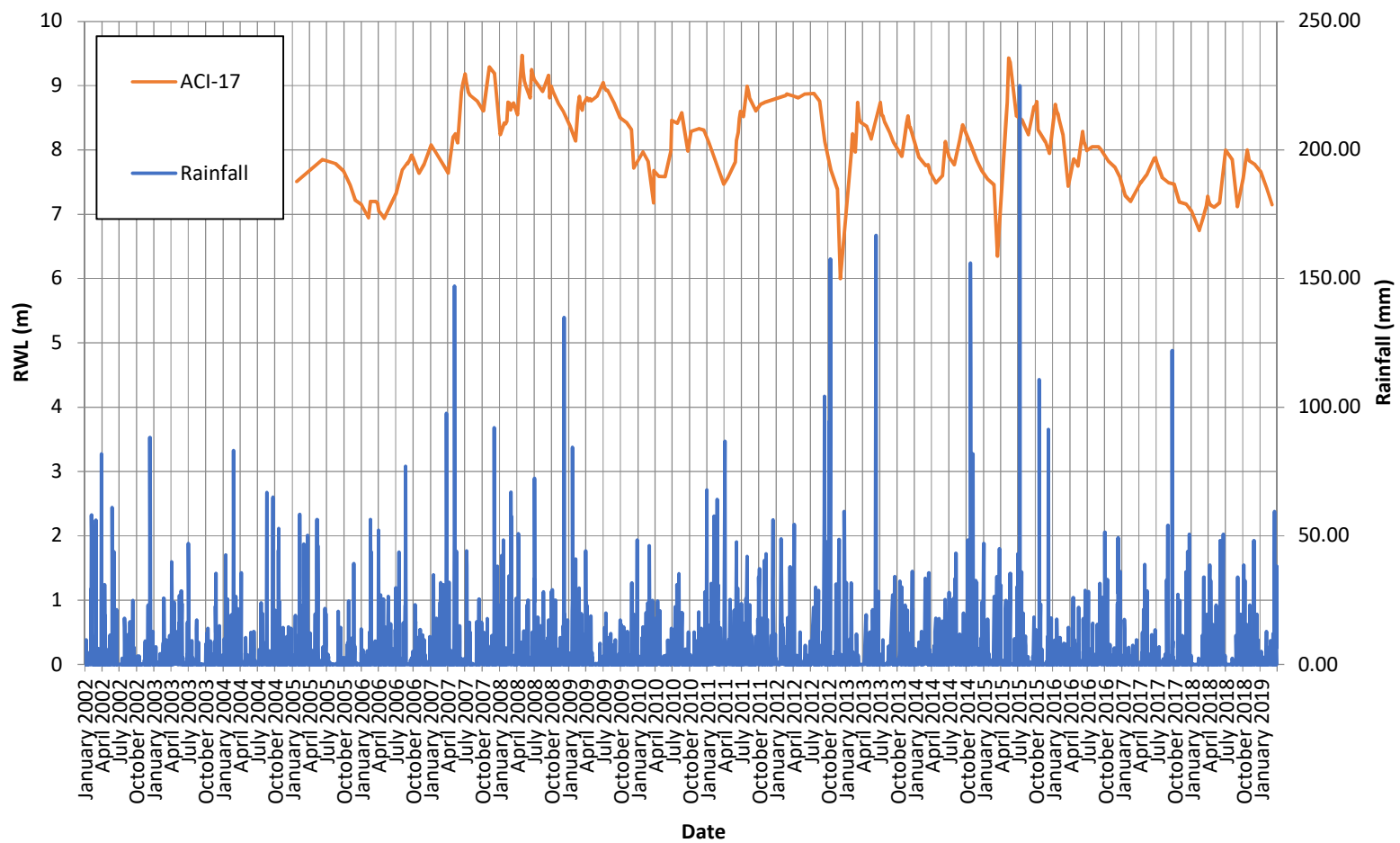




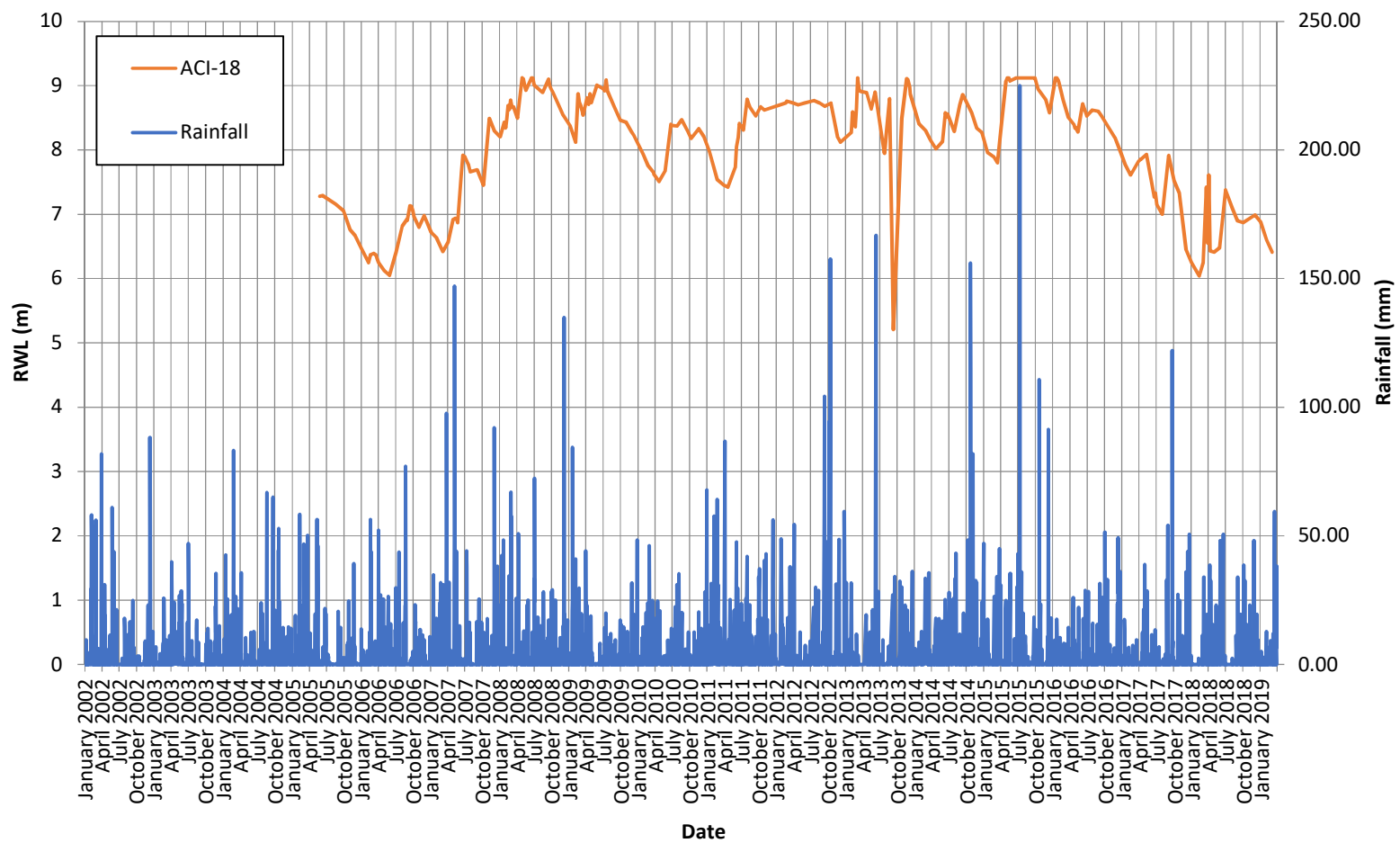
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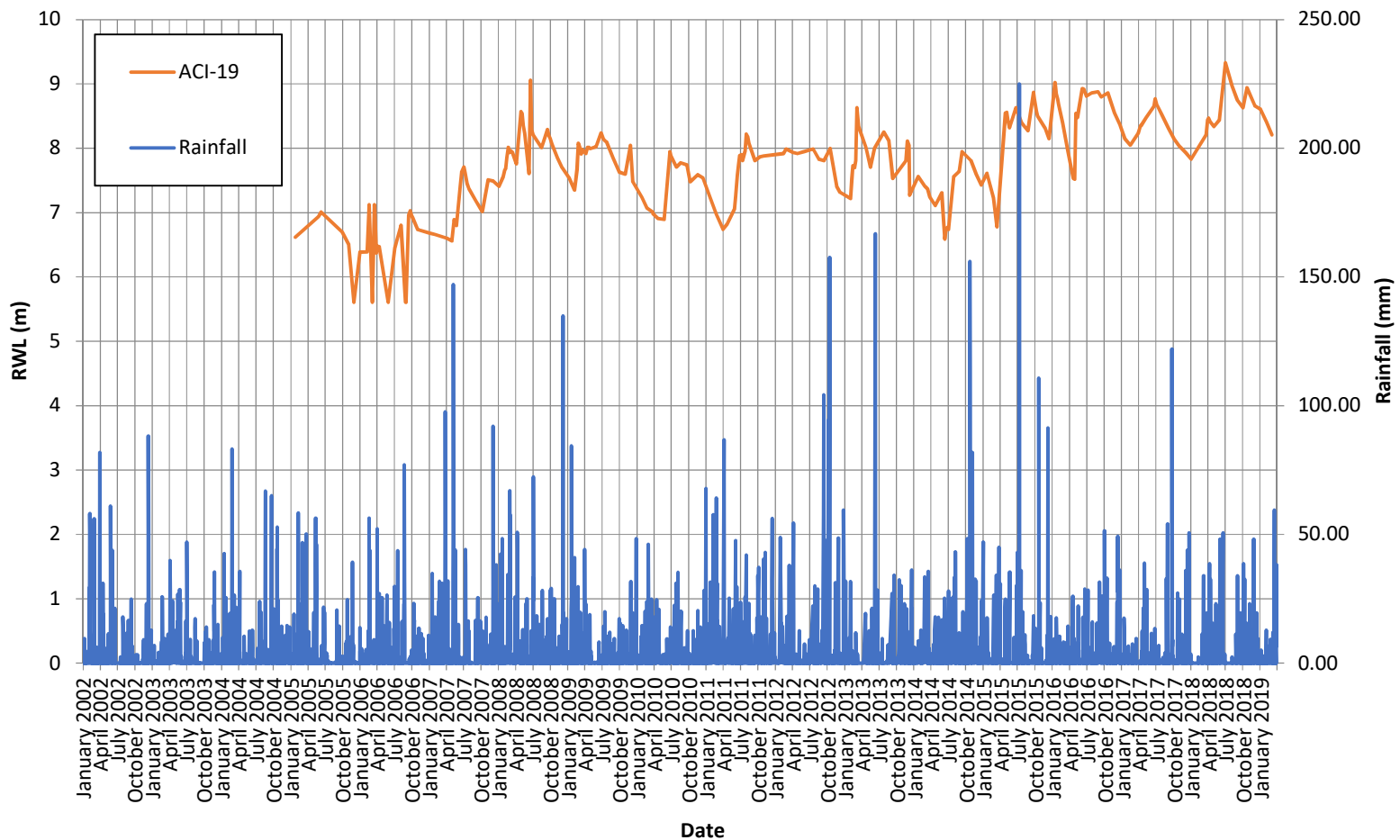
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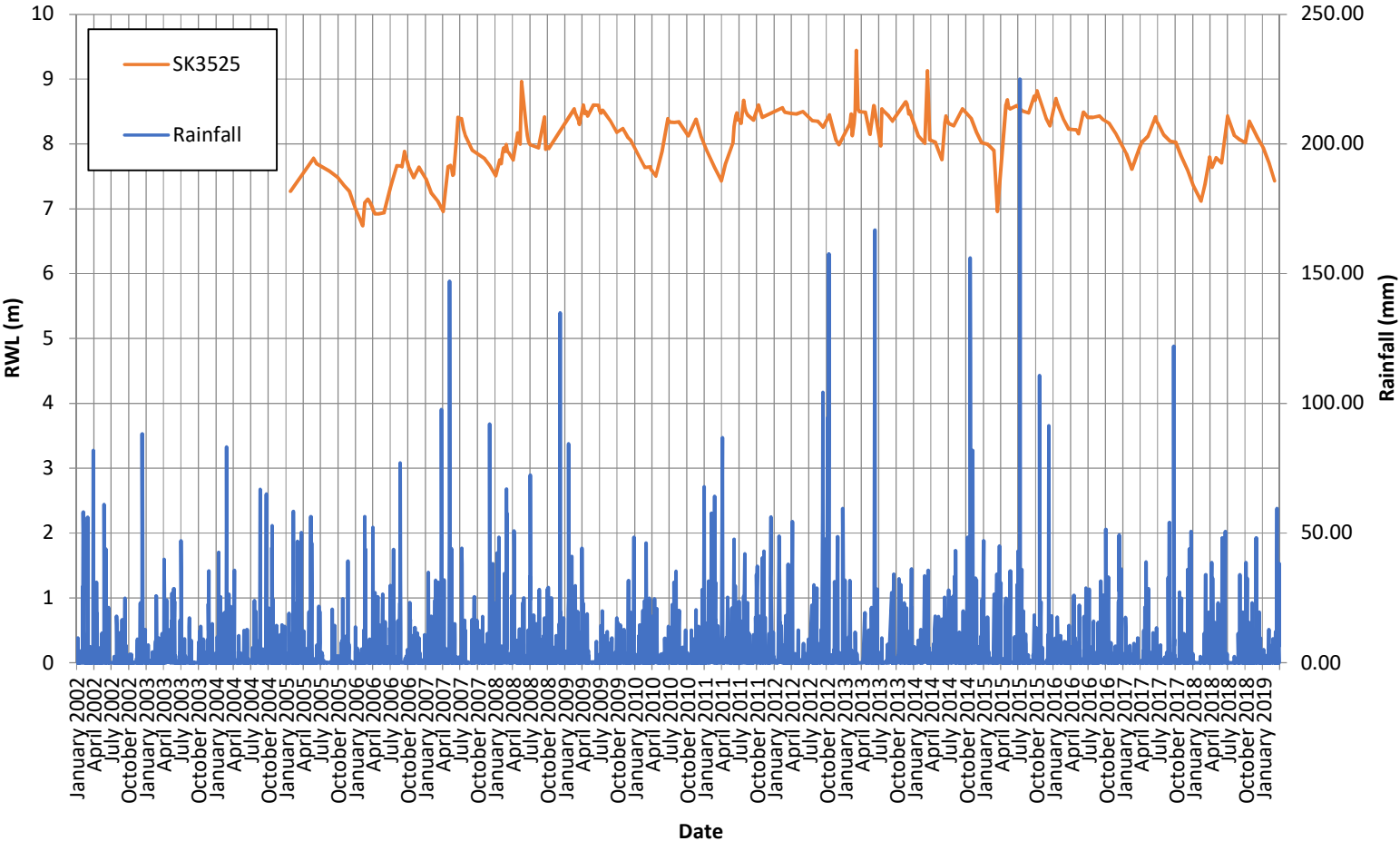
# ACI-18



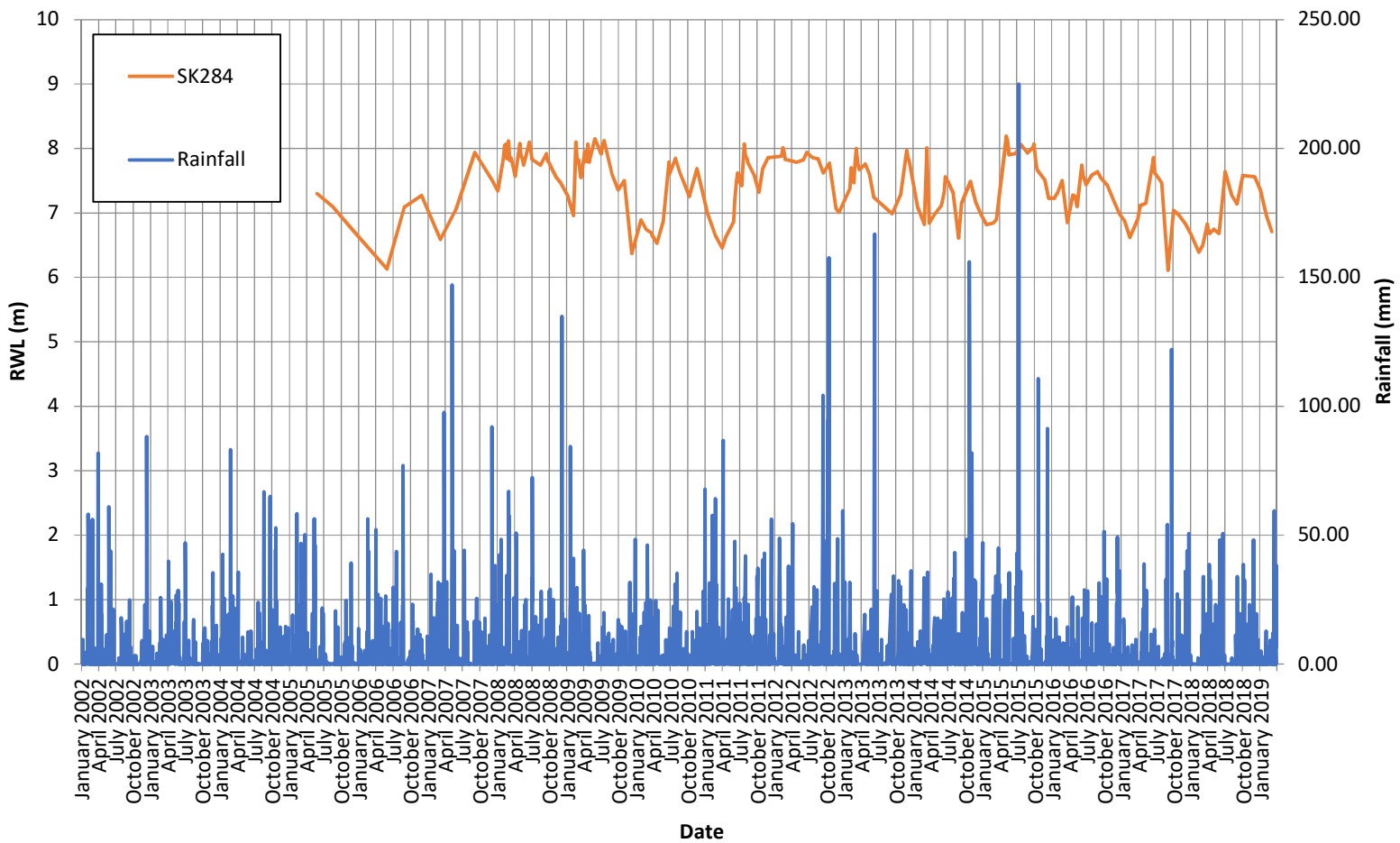
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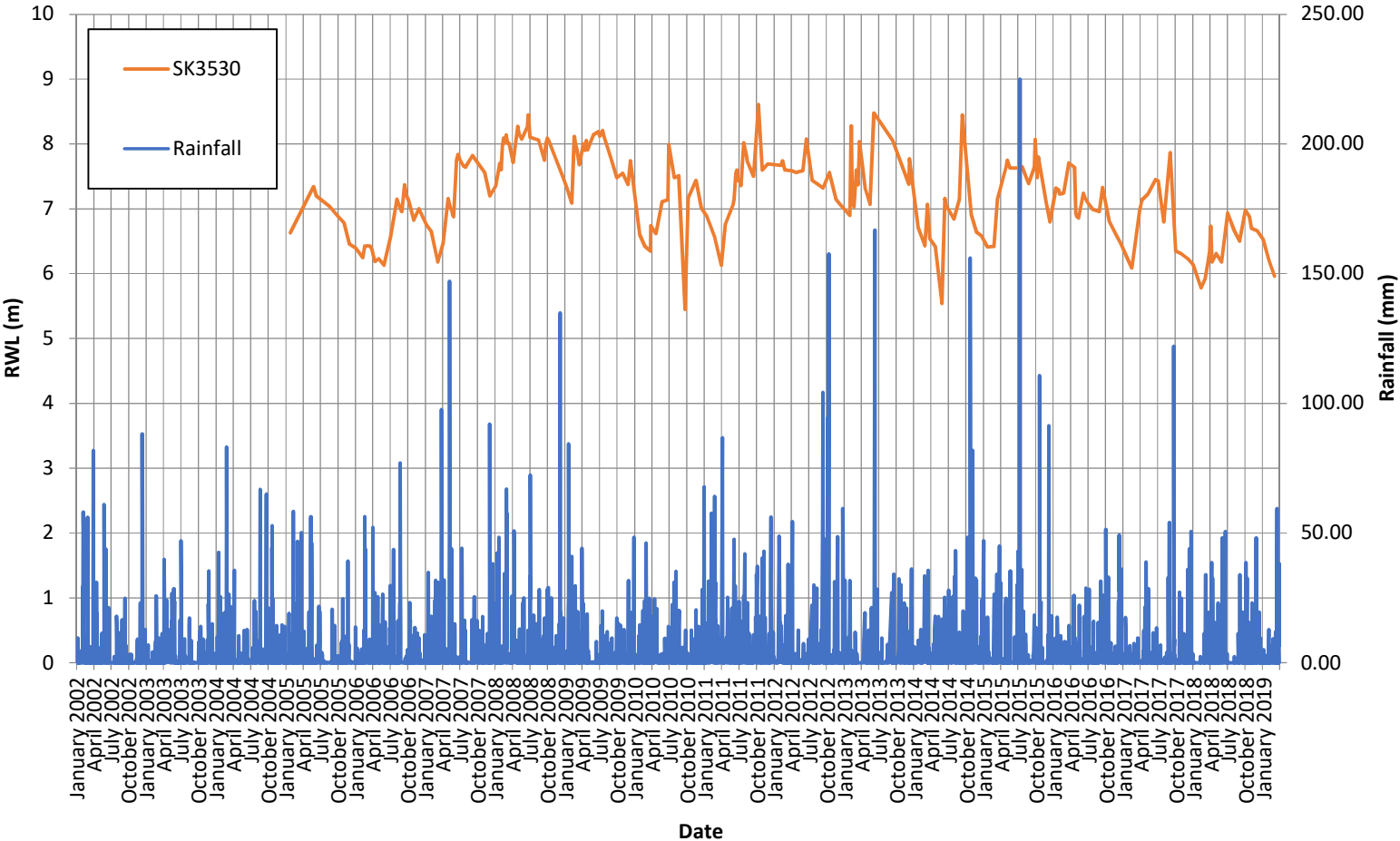
# SK3525



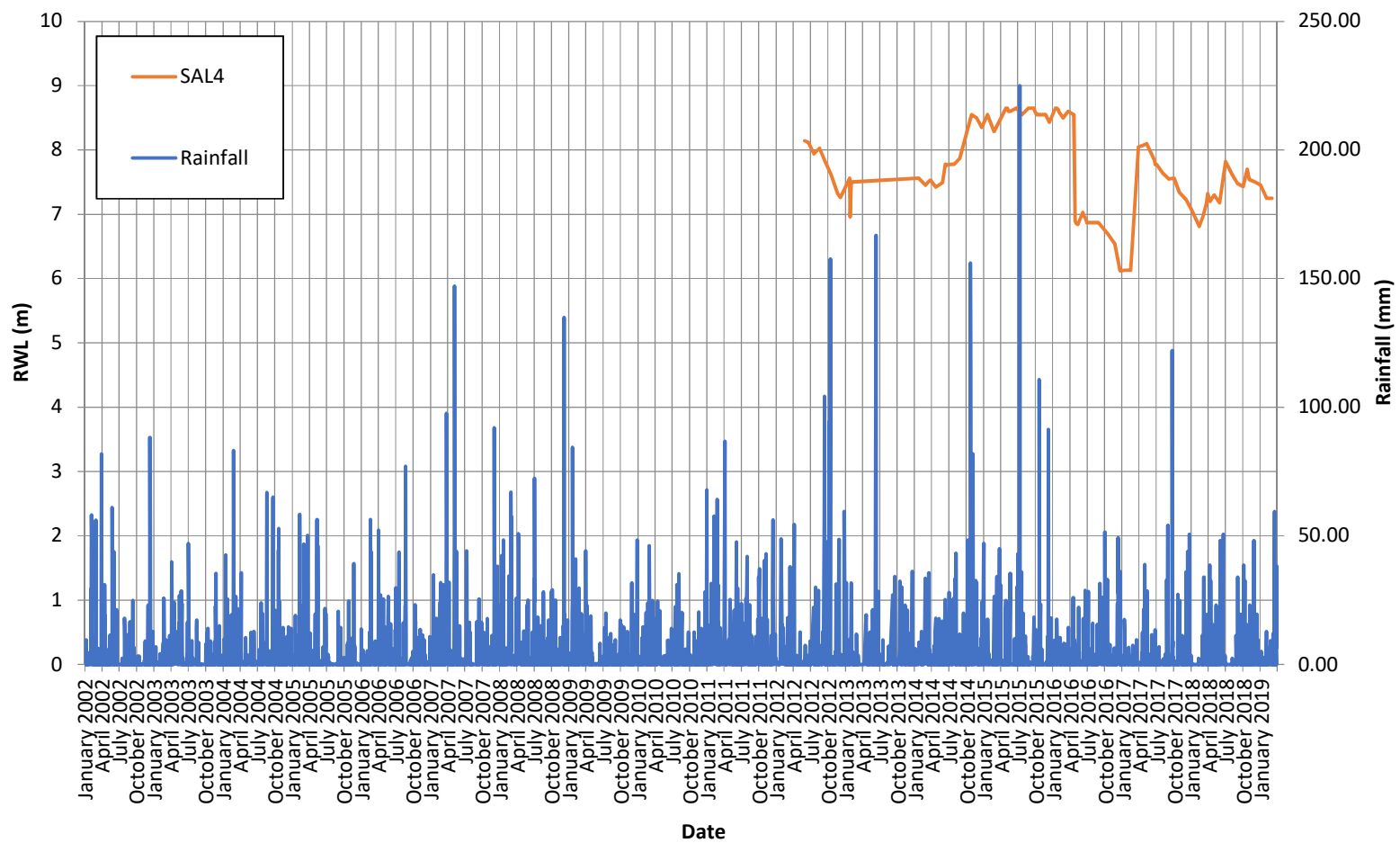
# SK284



# SK3530

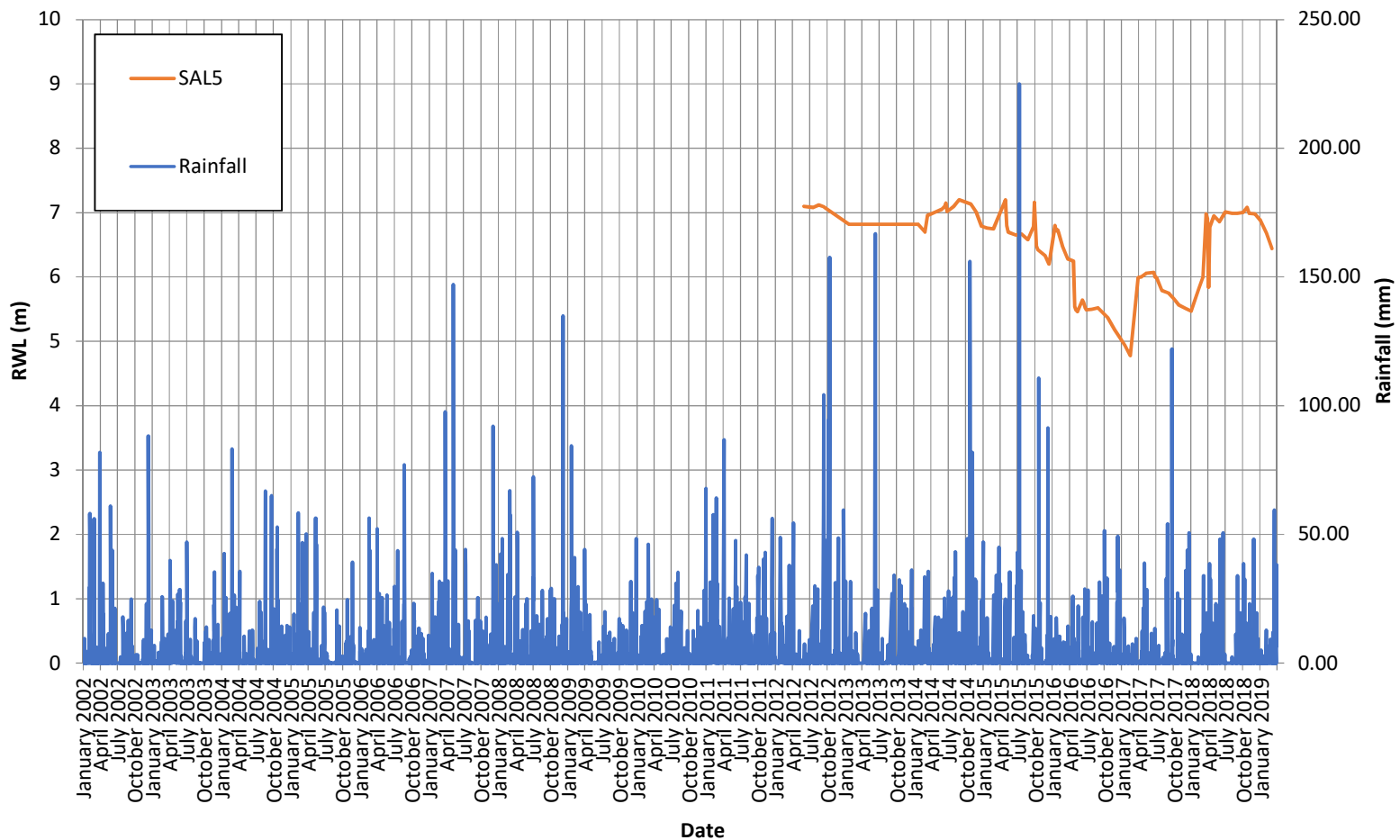


# SAL4

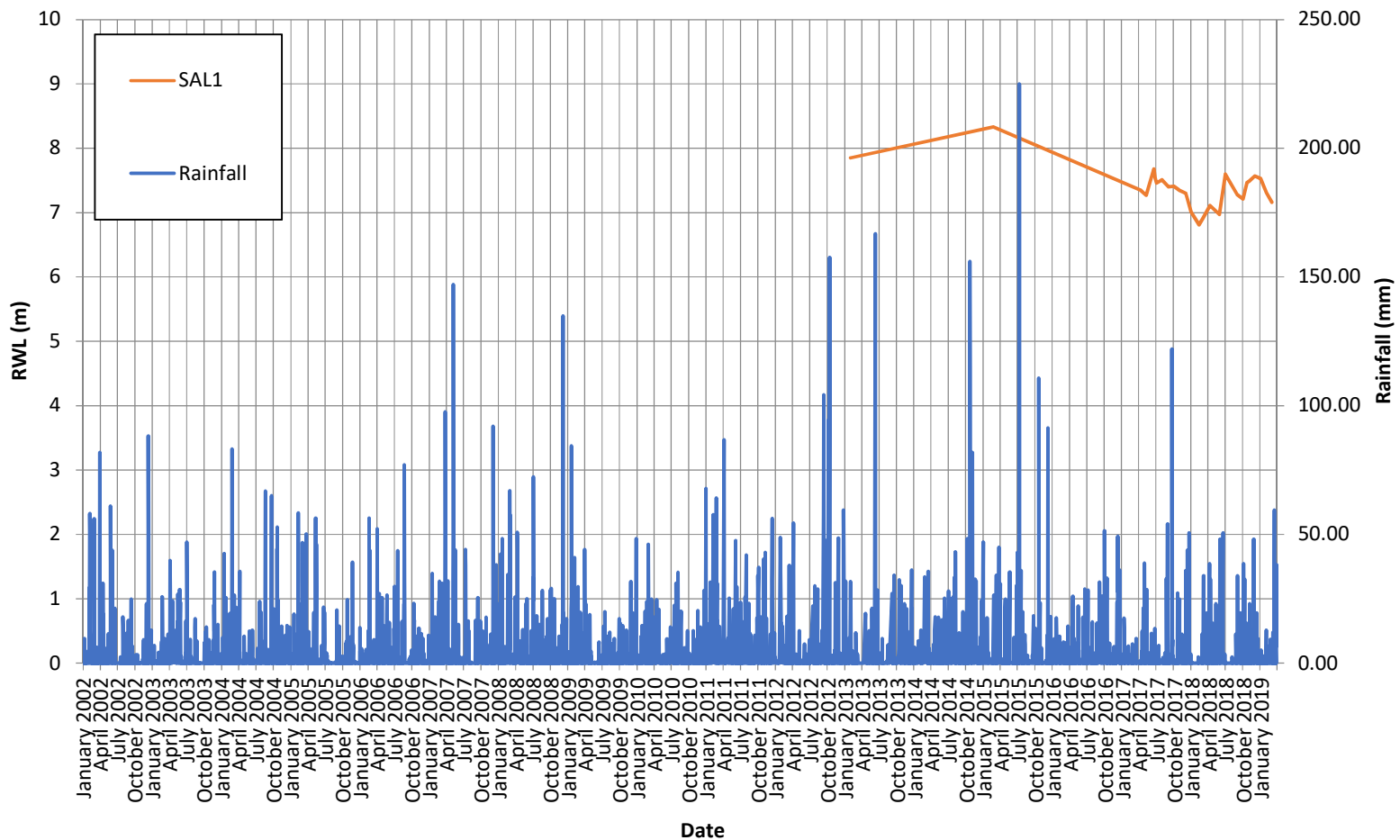




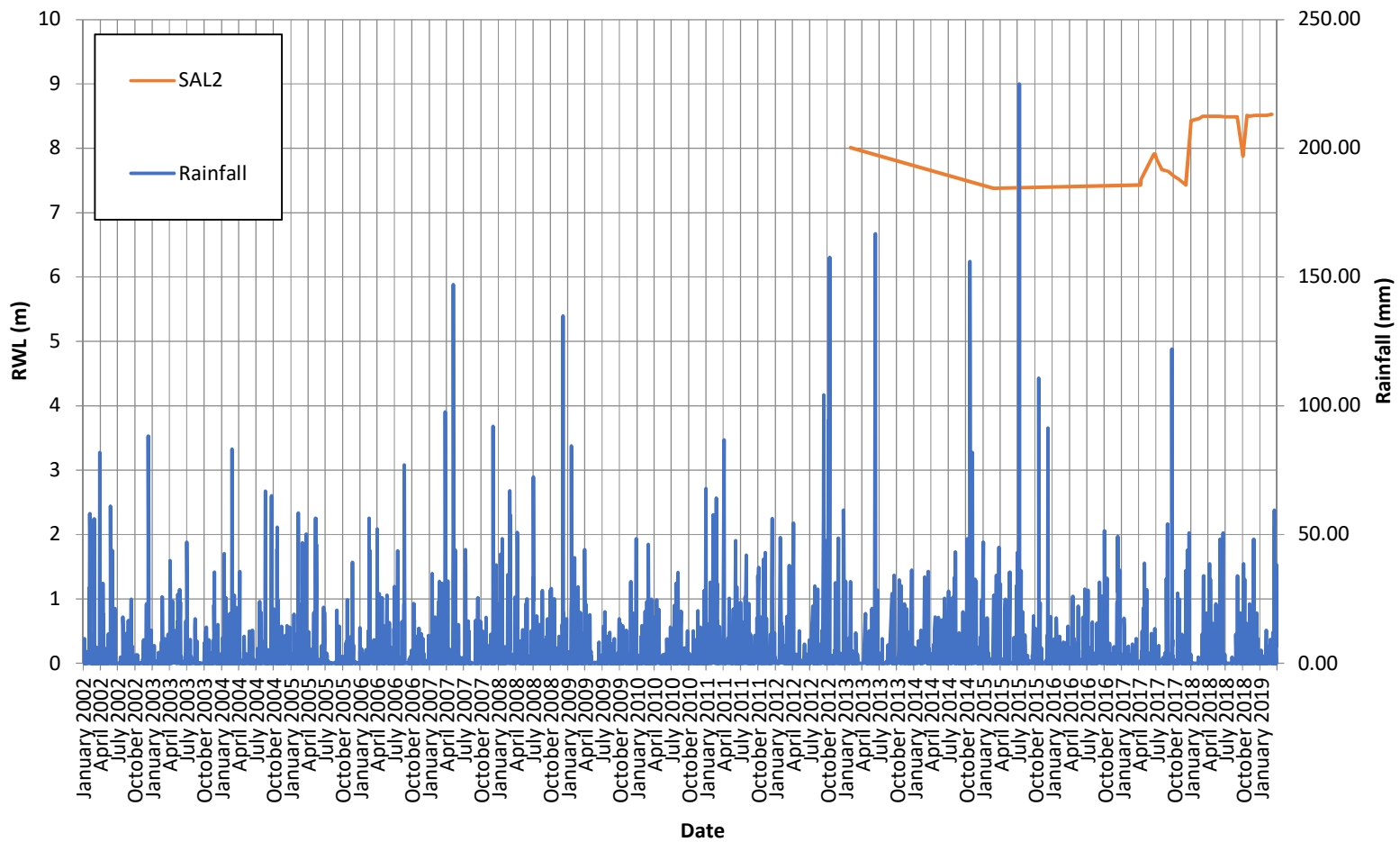
# SAL5



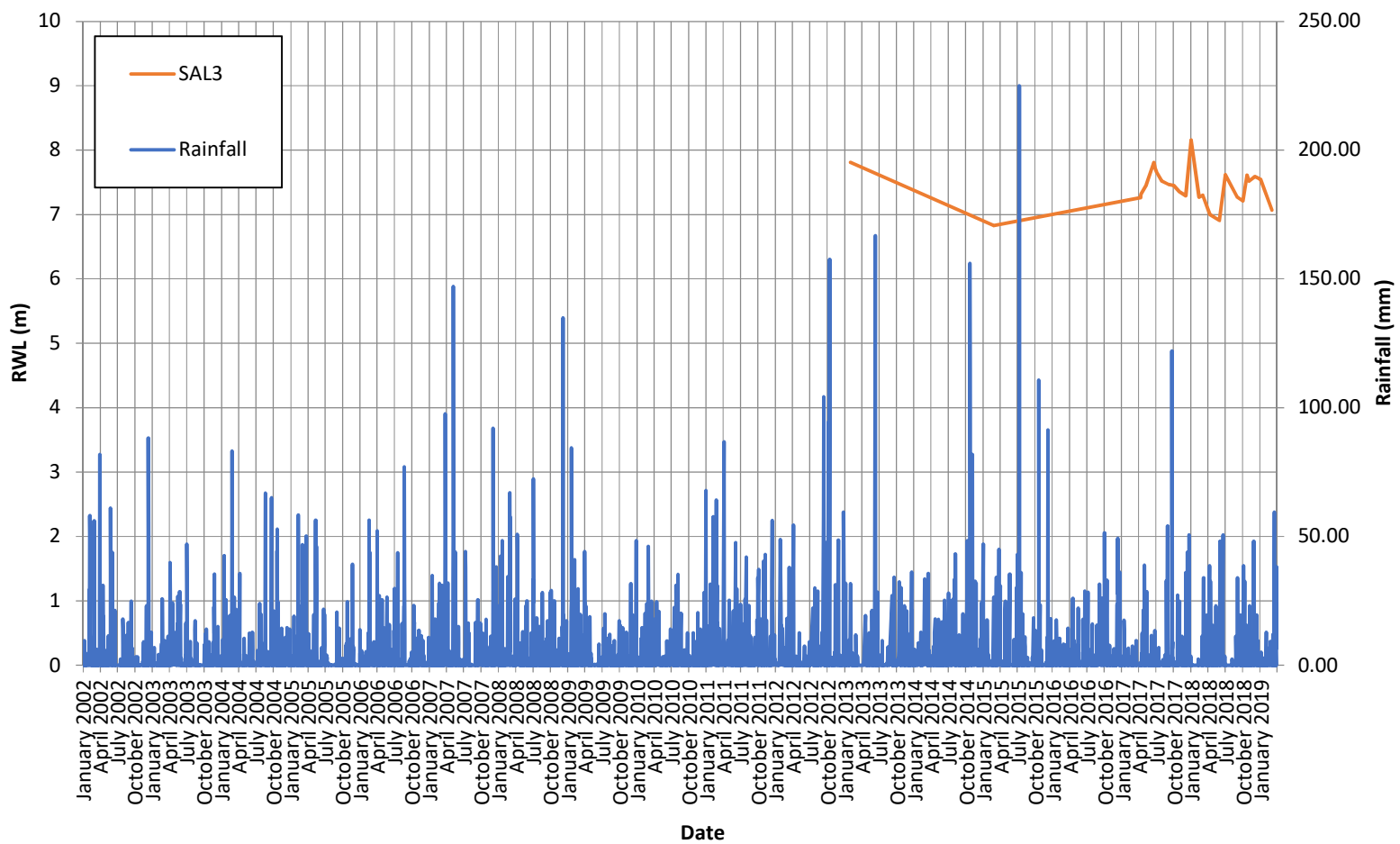
# SAL1



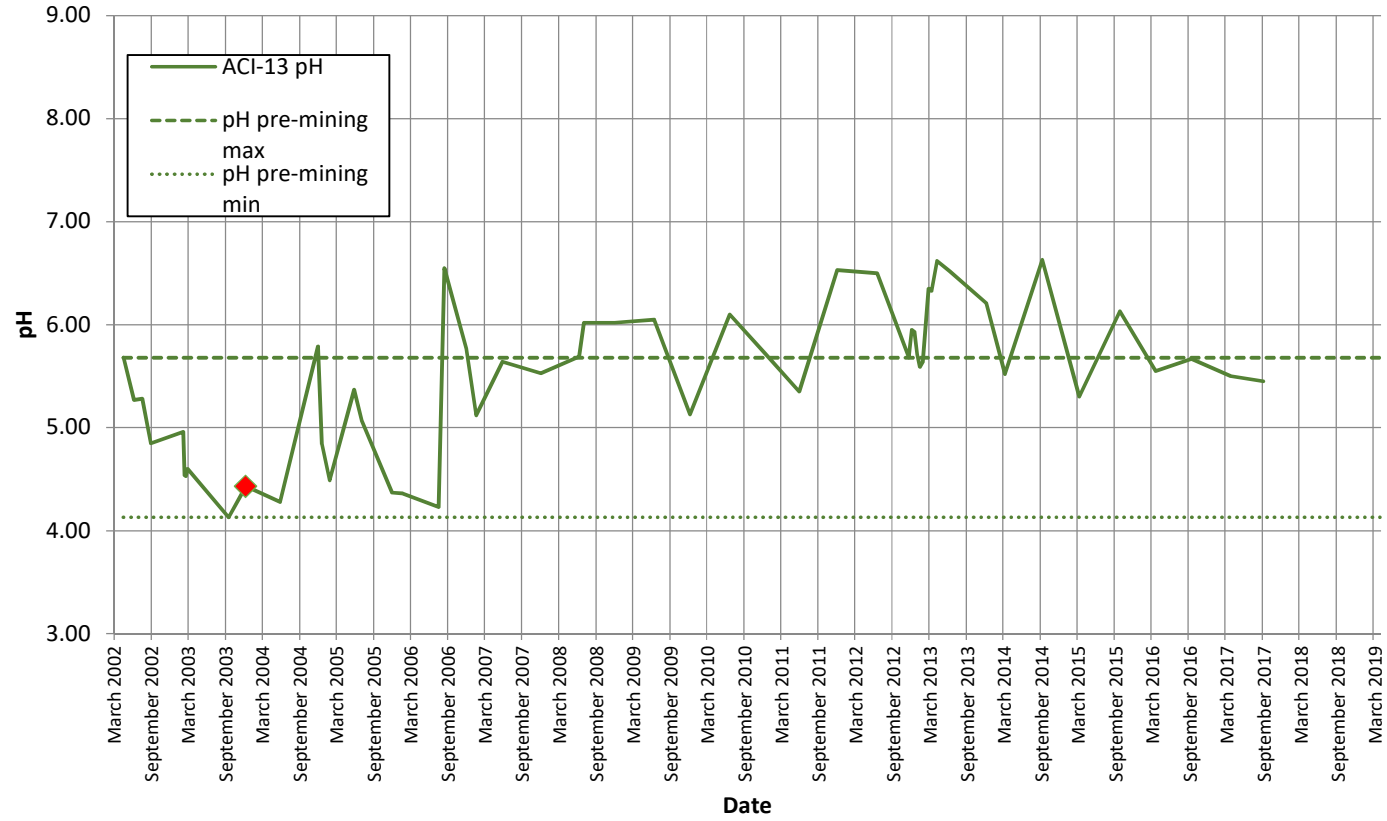
# SAL2



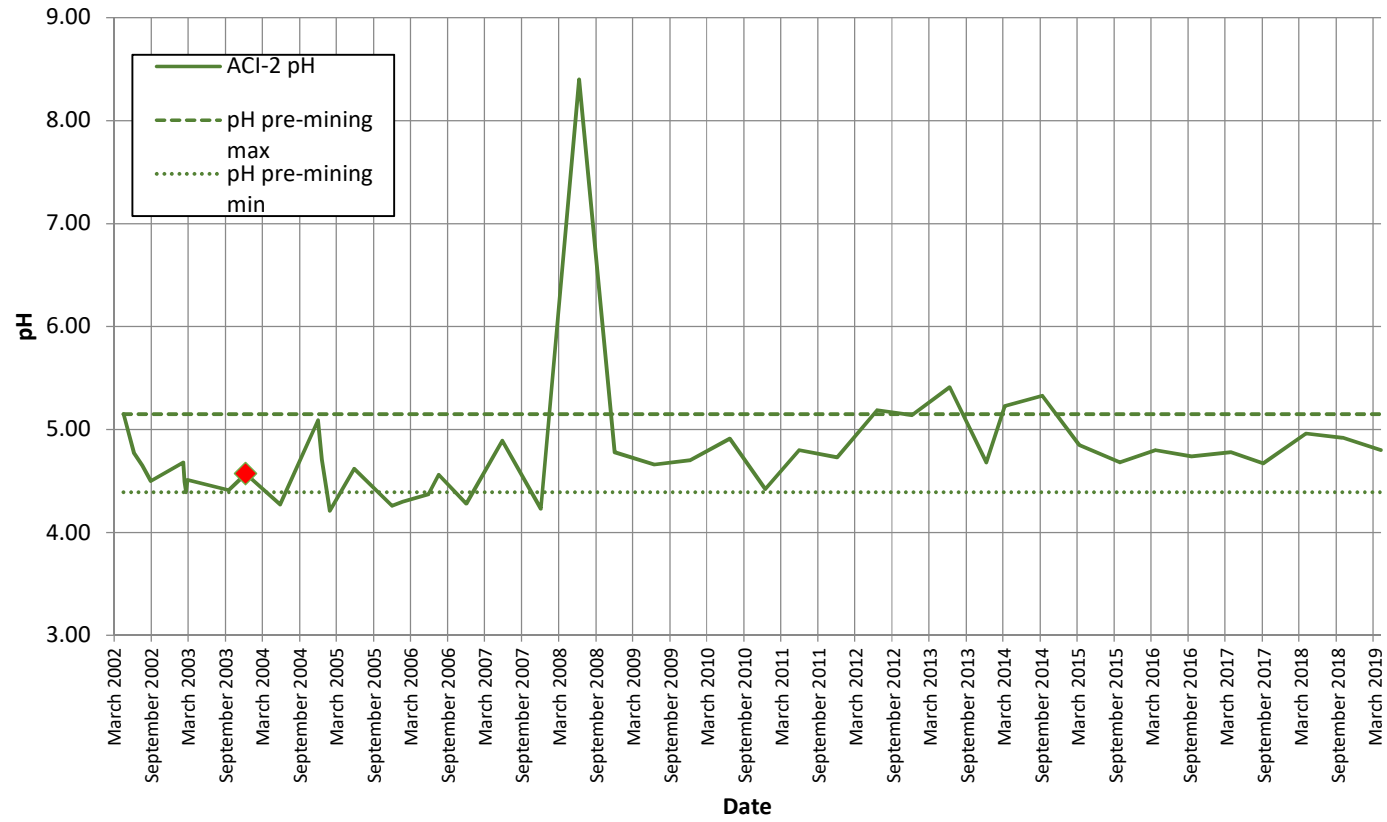
# SAL3



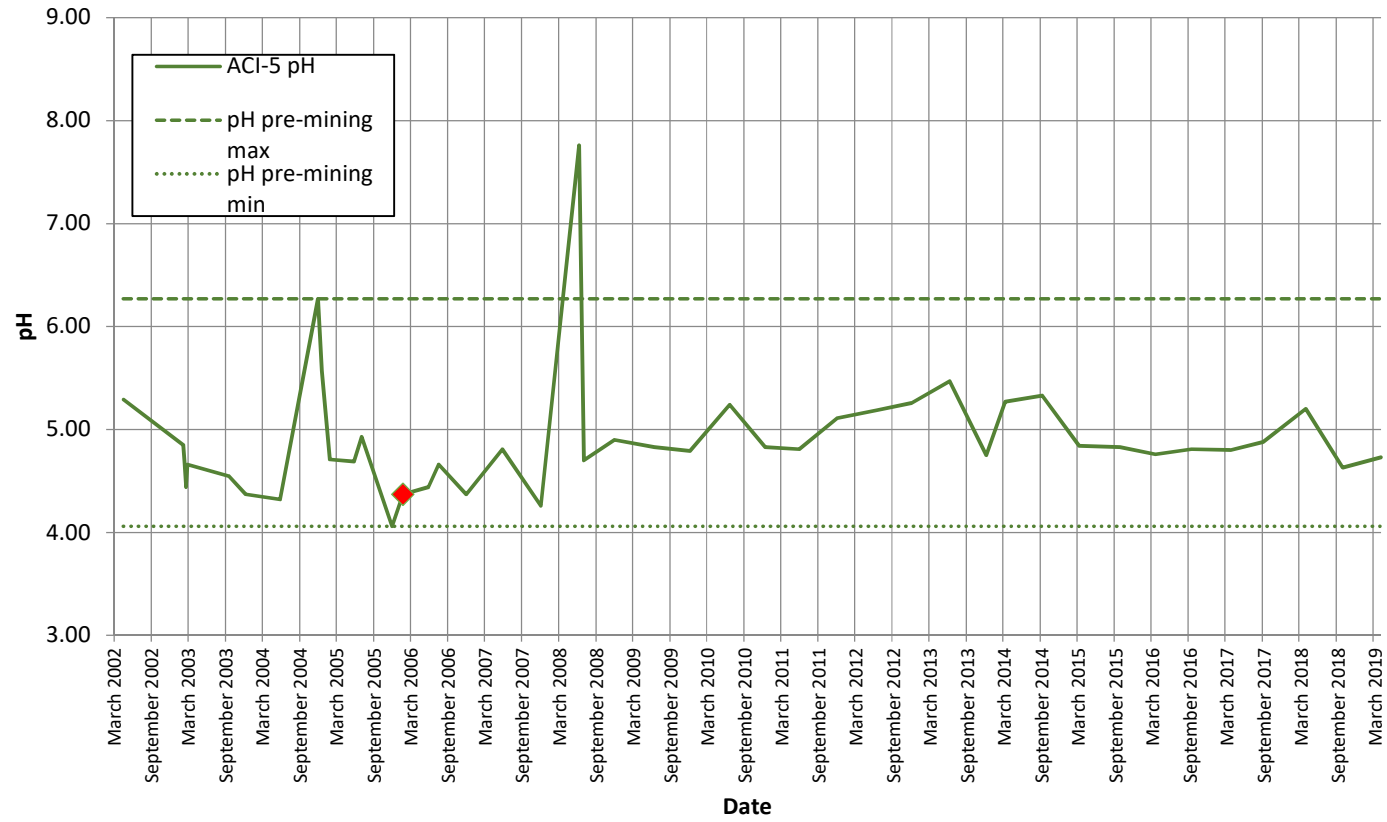
# ACI-13



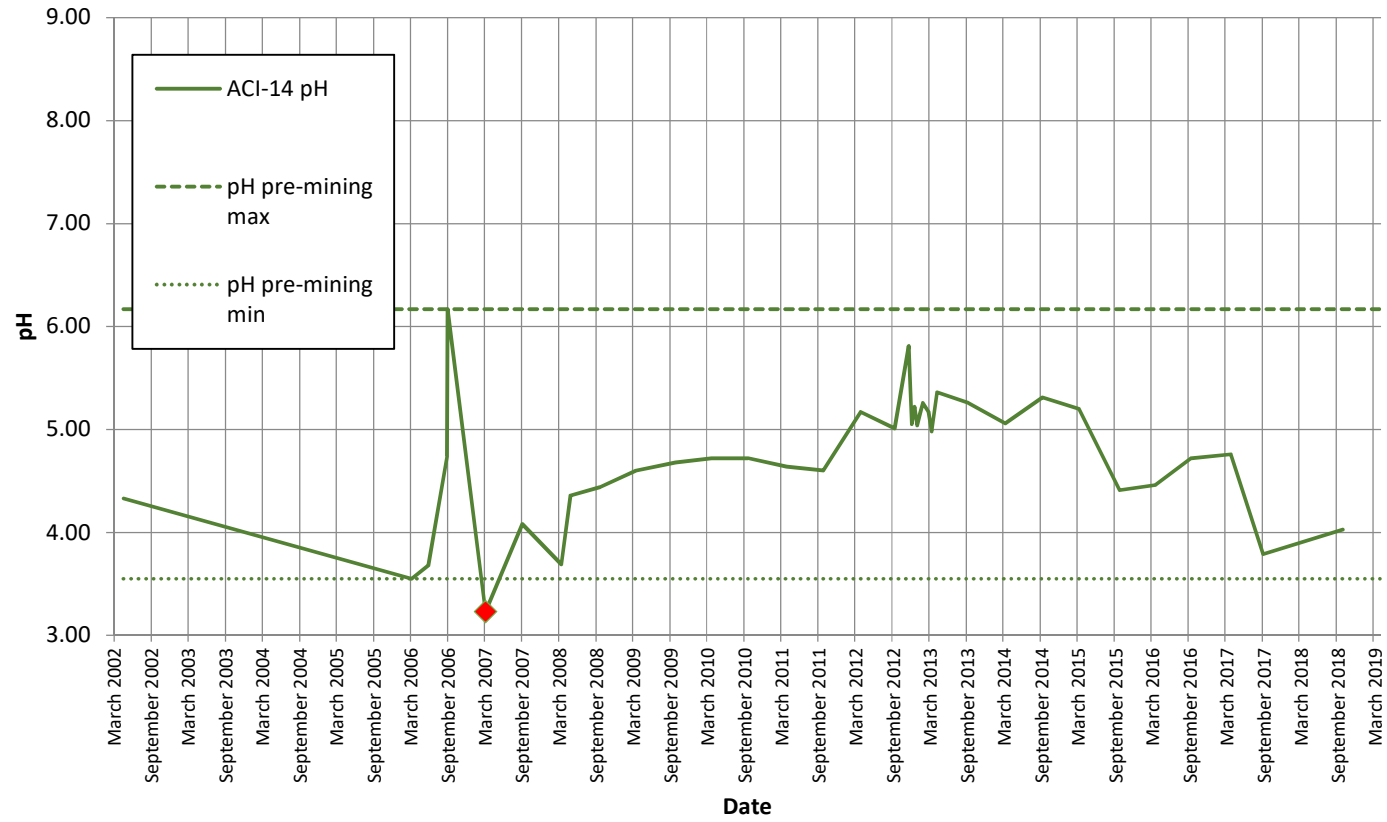
# ACI-2



# ACI-5

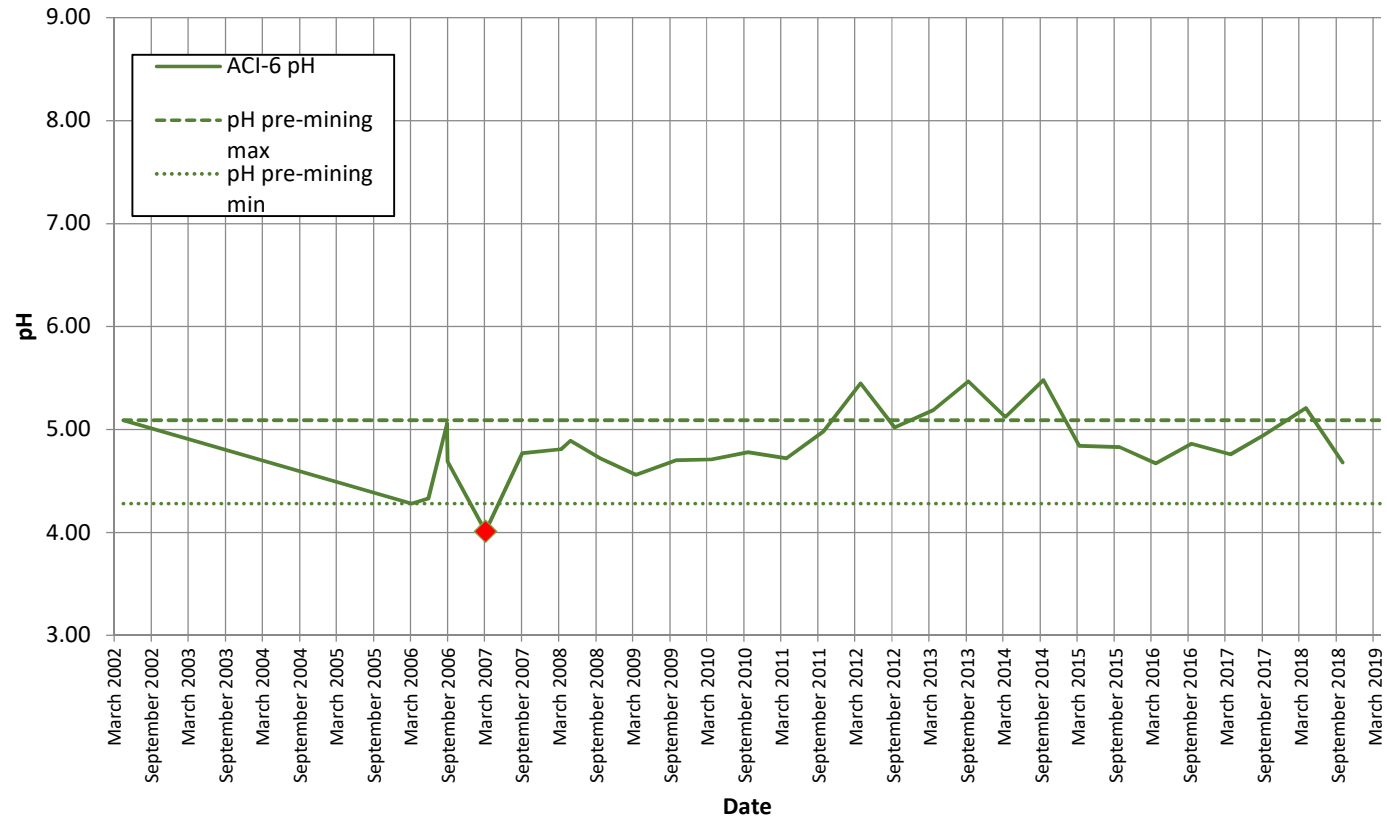


# ACI-14

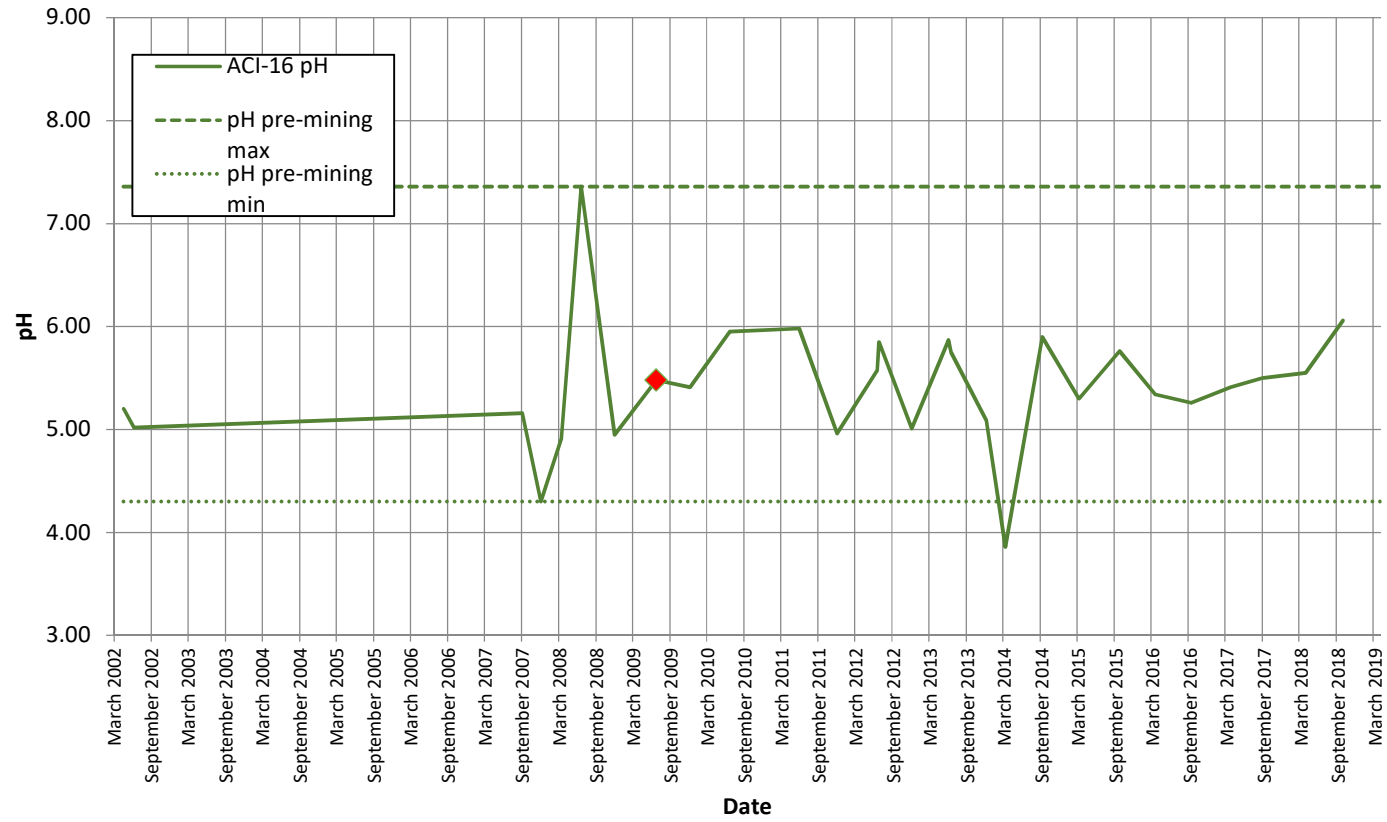




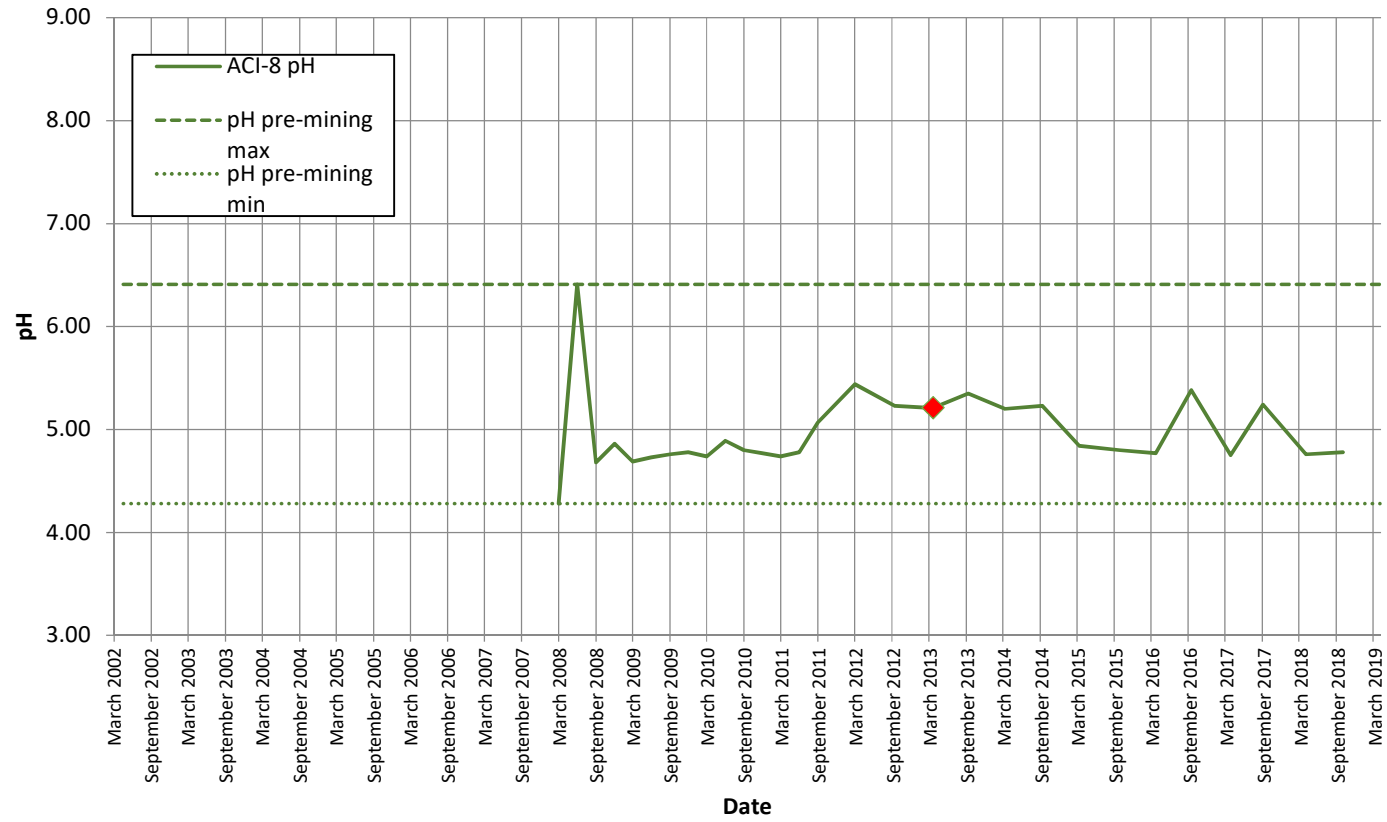
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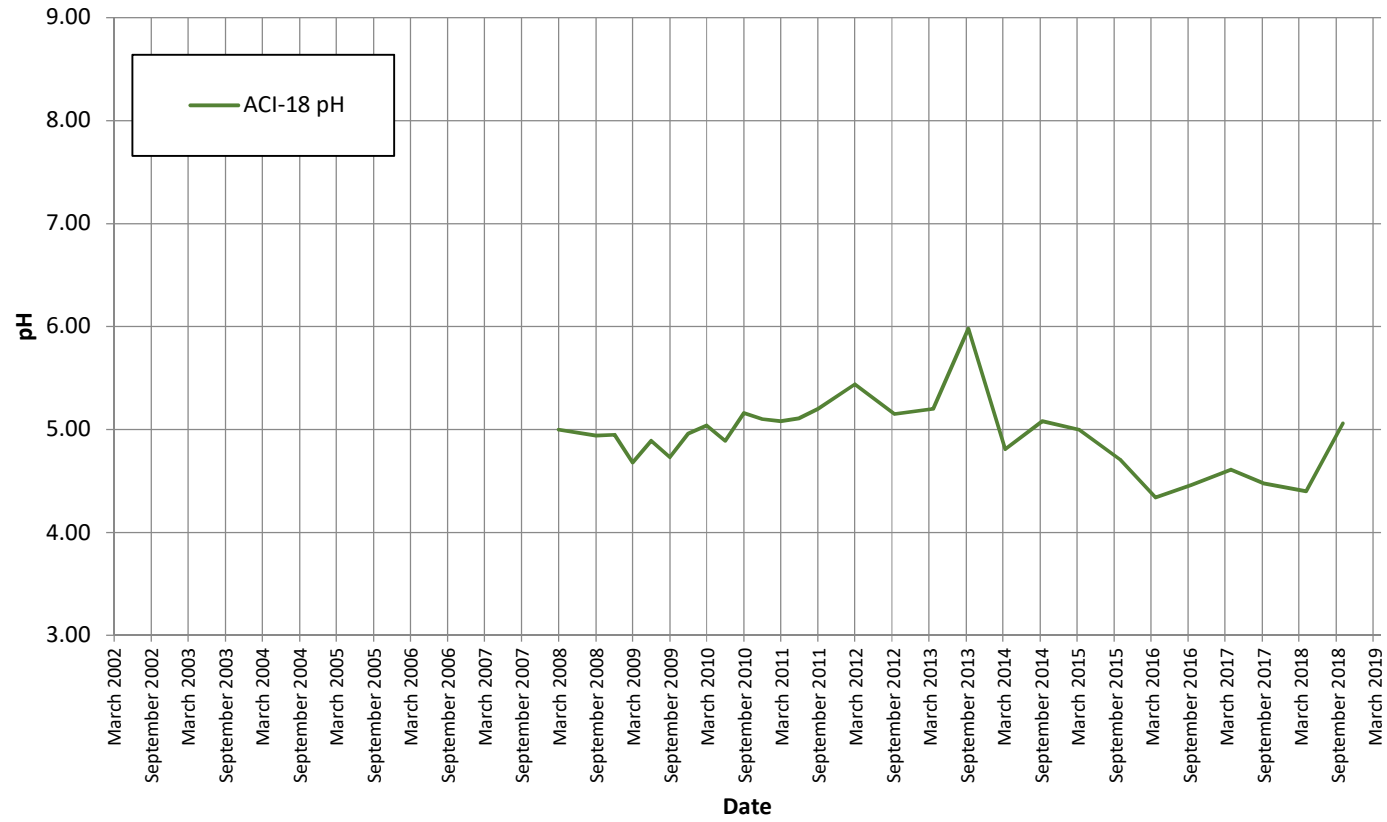
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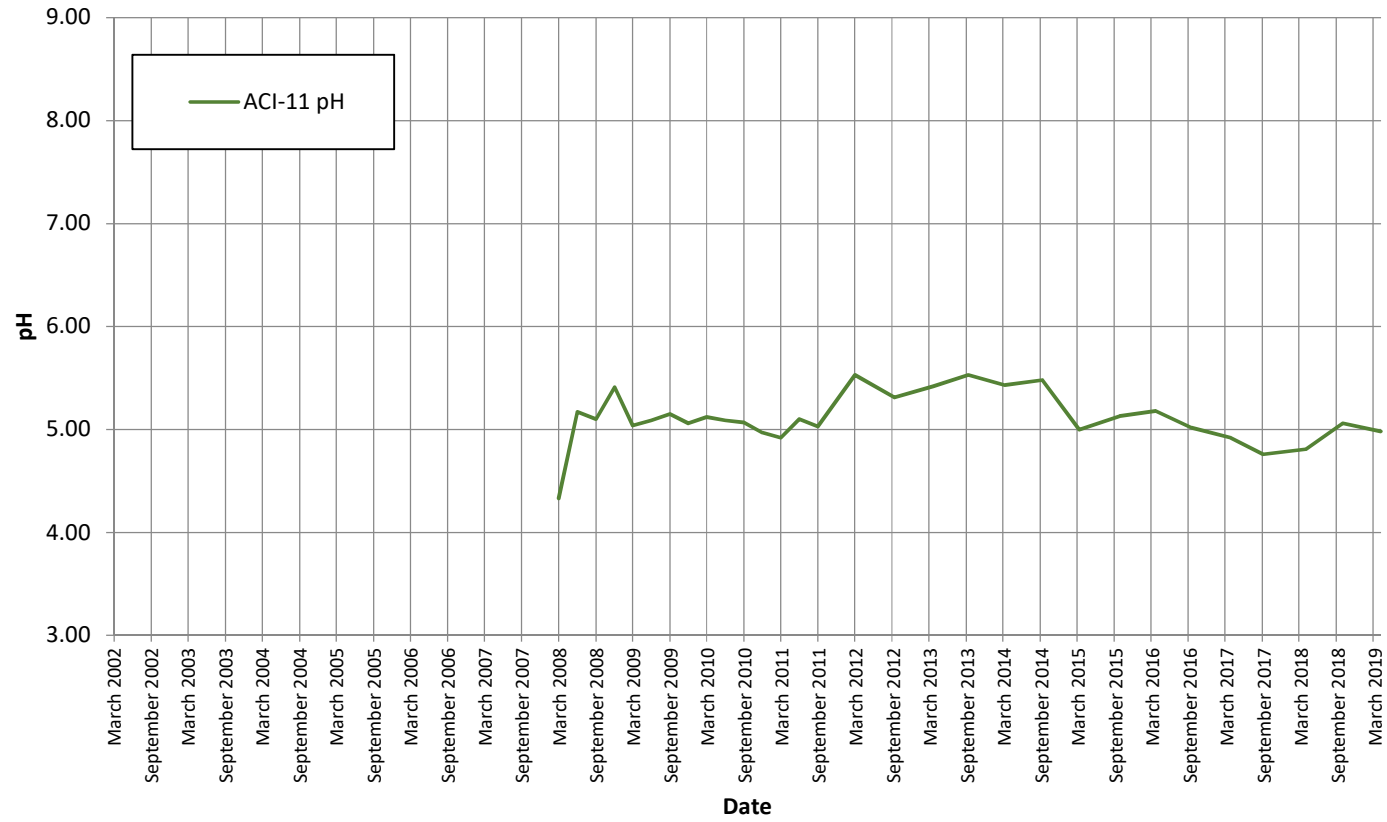
# ACI-8



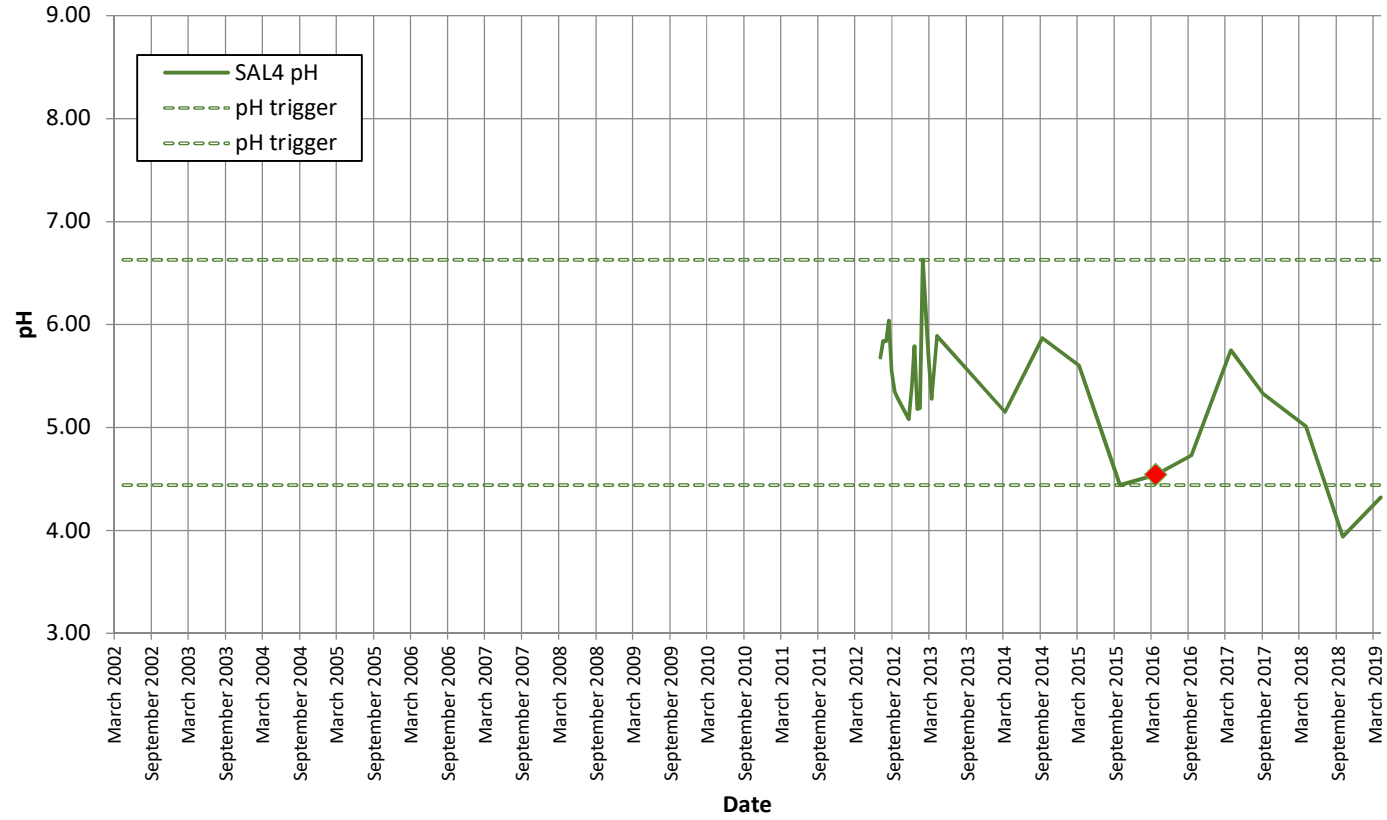
# ACI-18



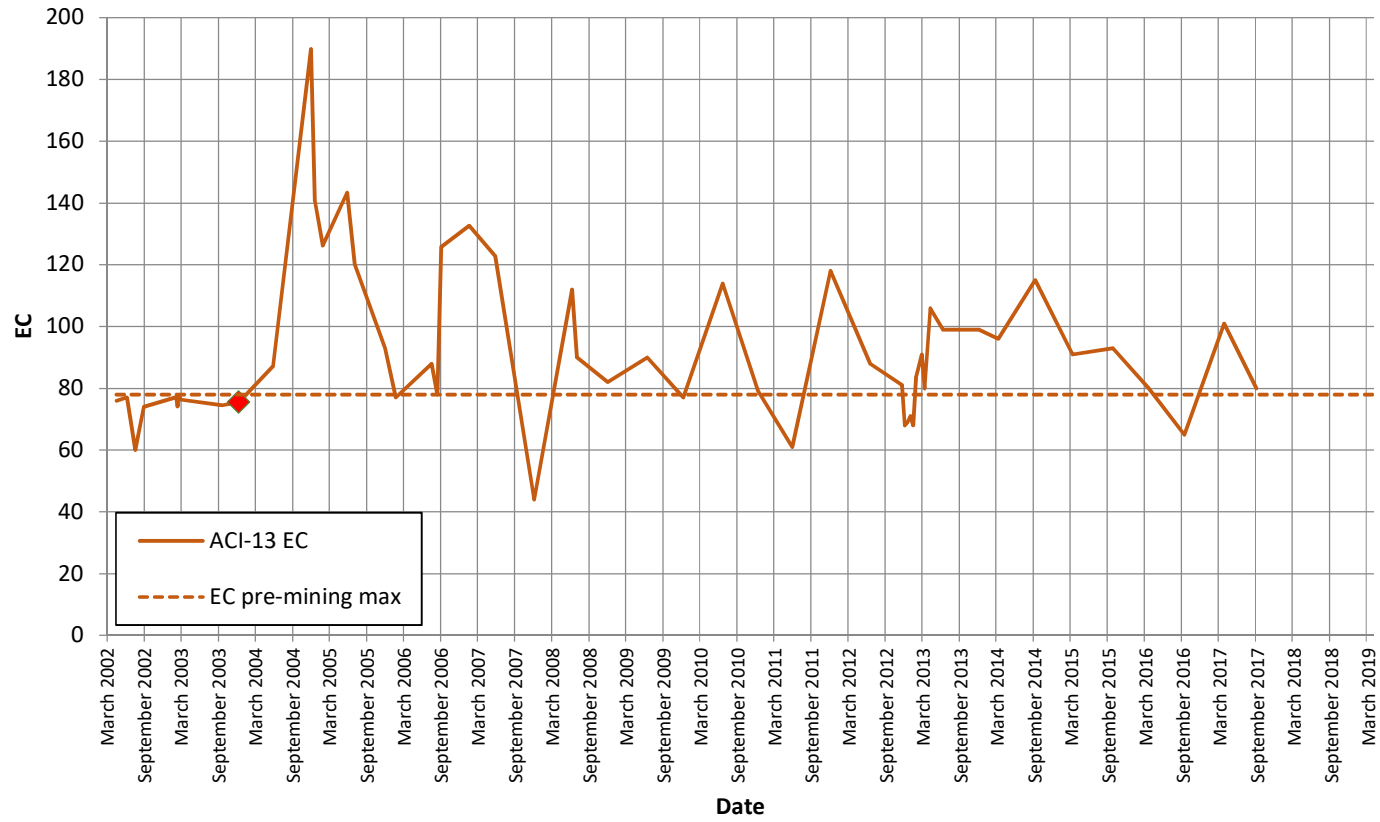
# ACI-11



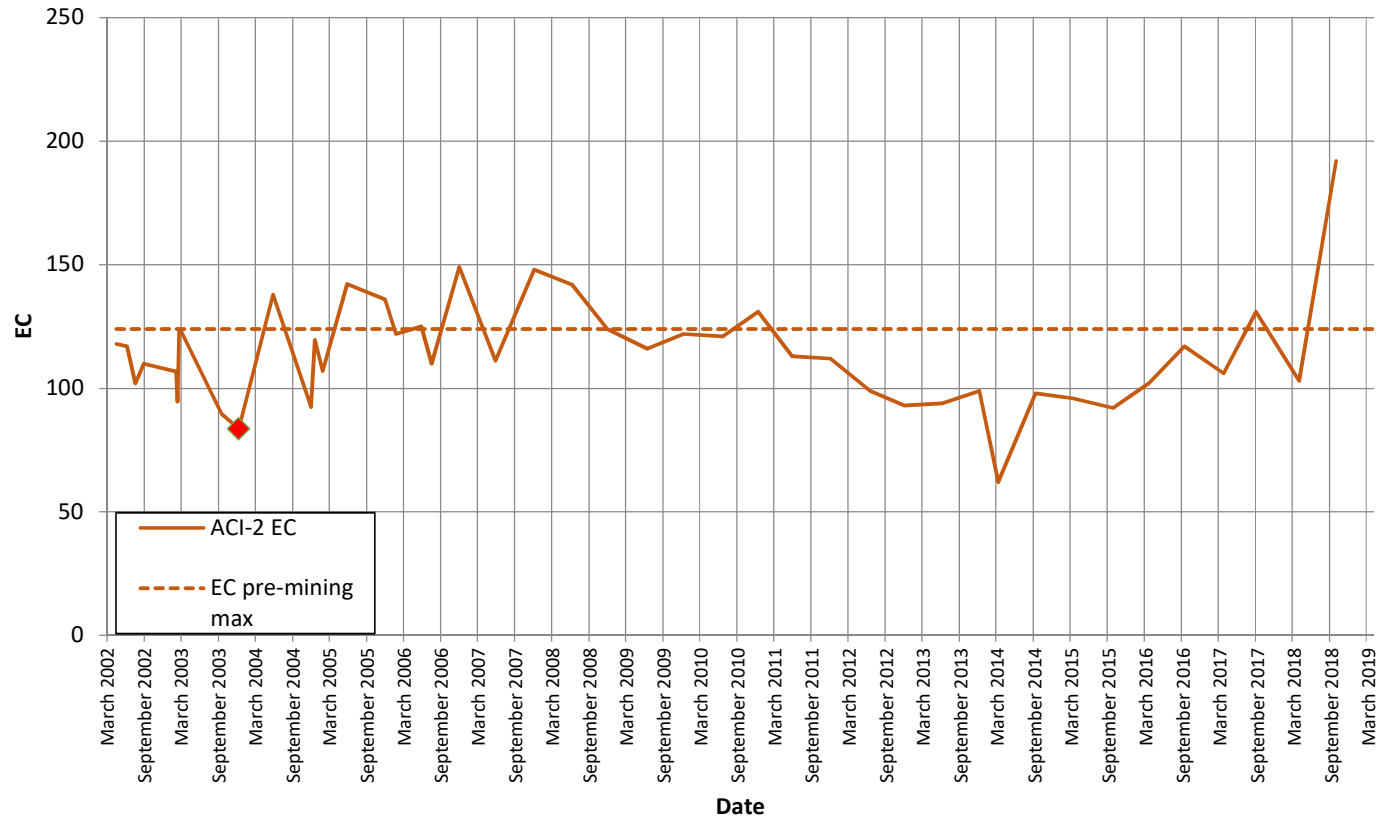
# SAL4



# ACI-13

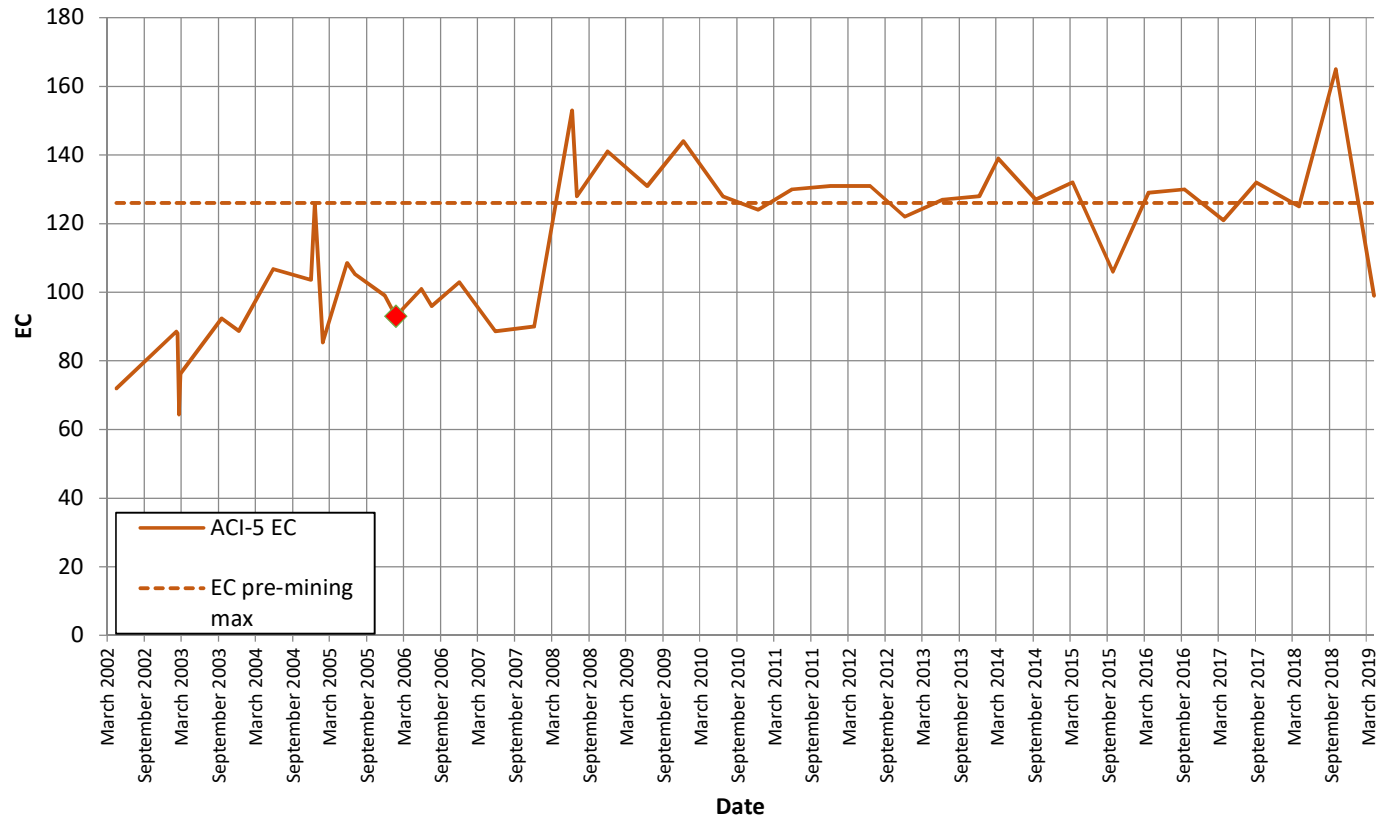


# ACI-2

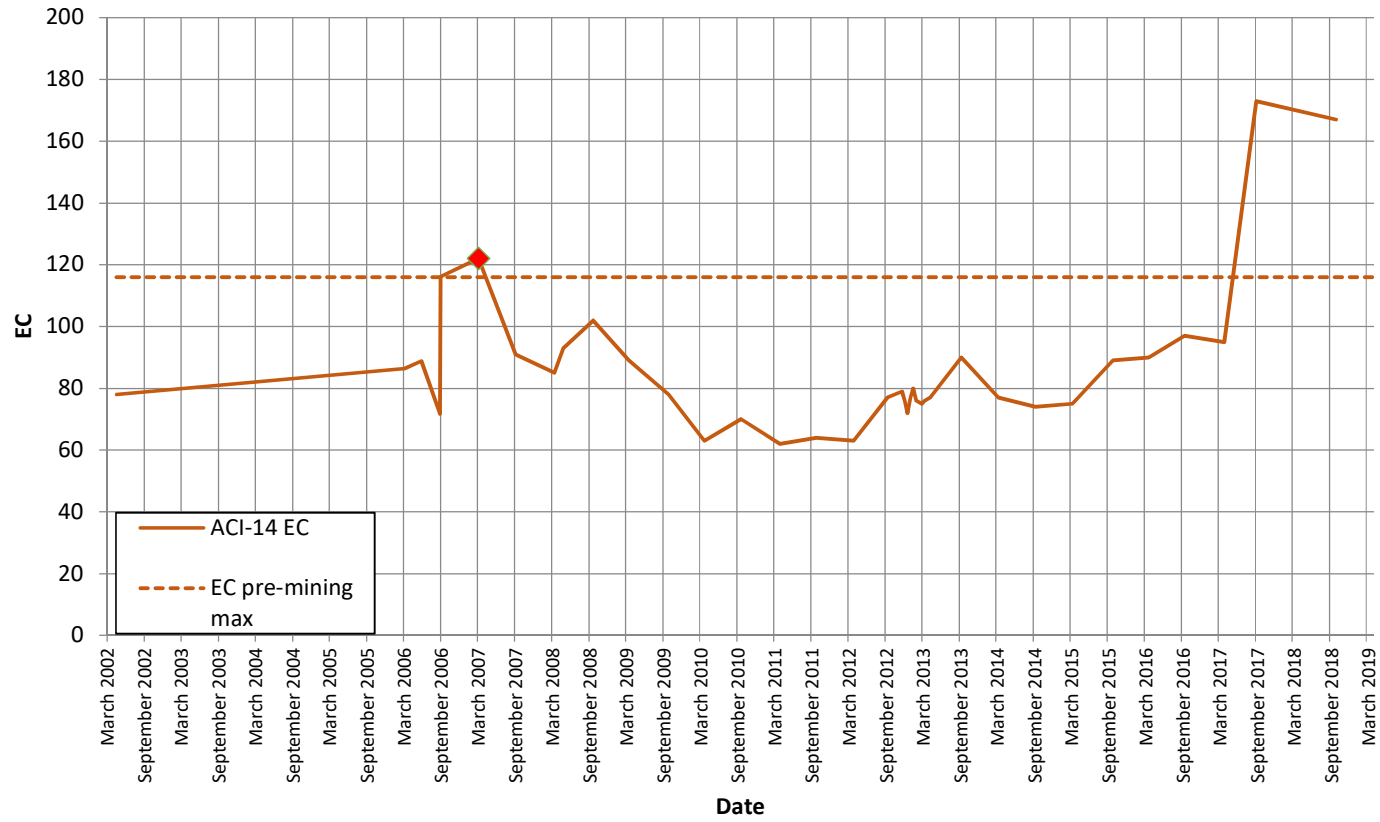




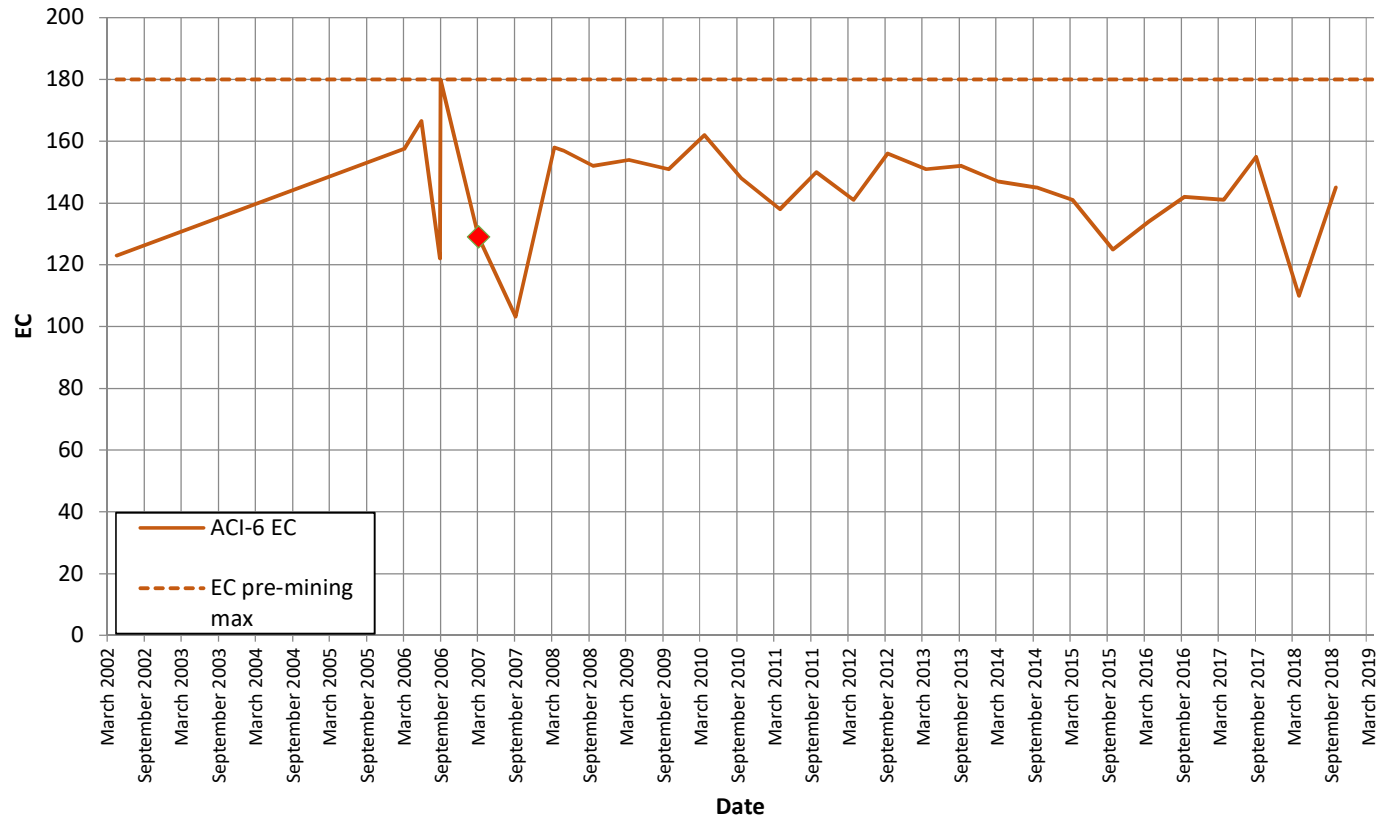
# ACI-5



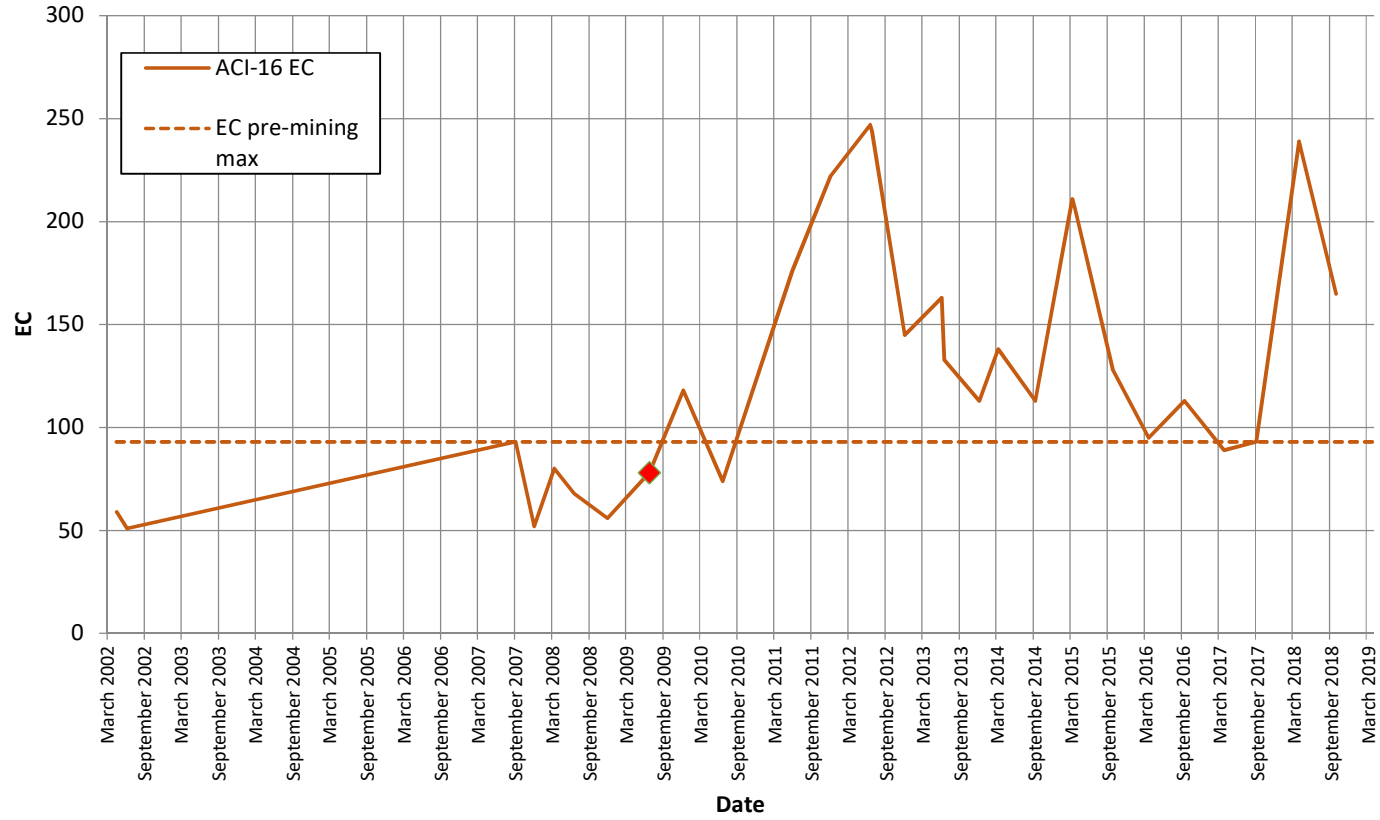
# ACI-14



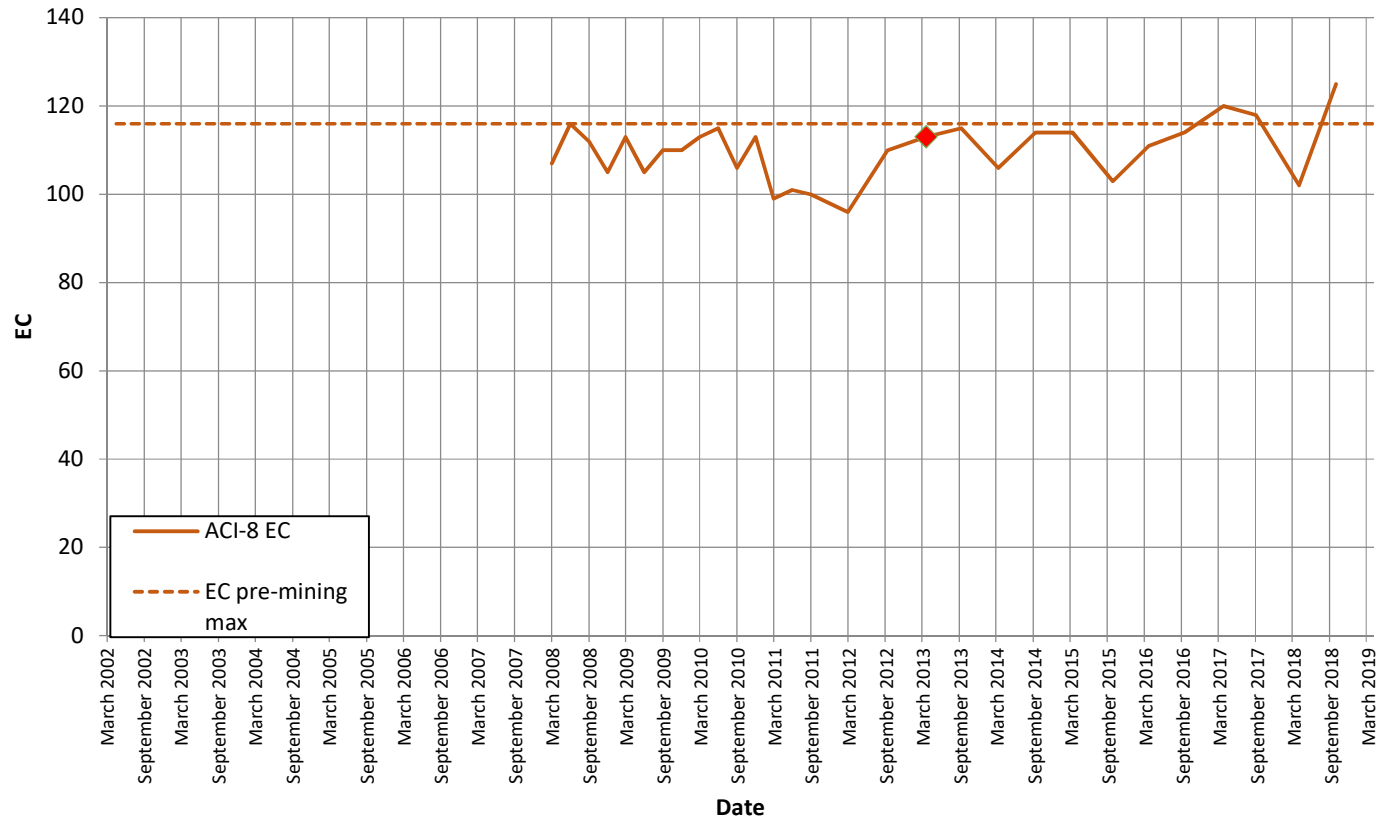
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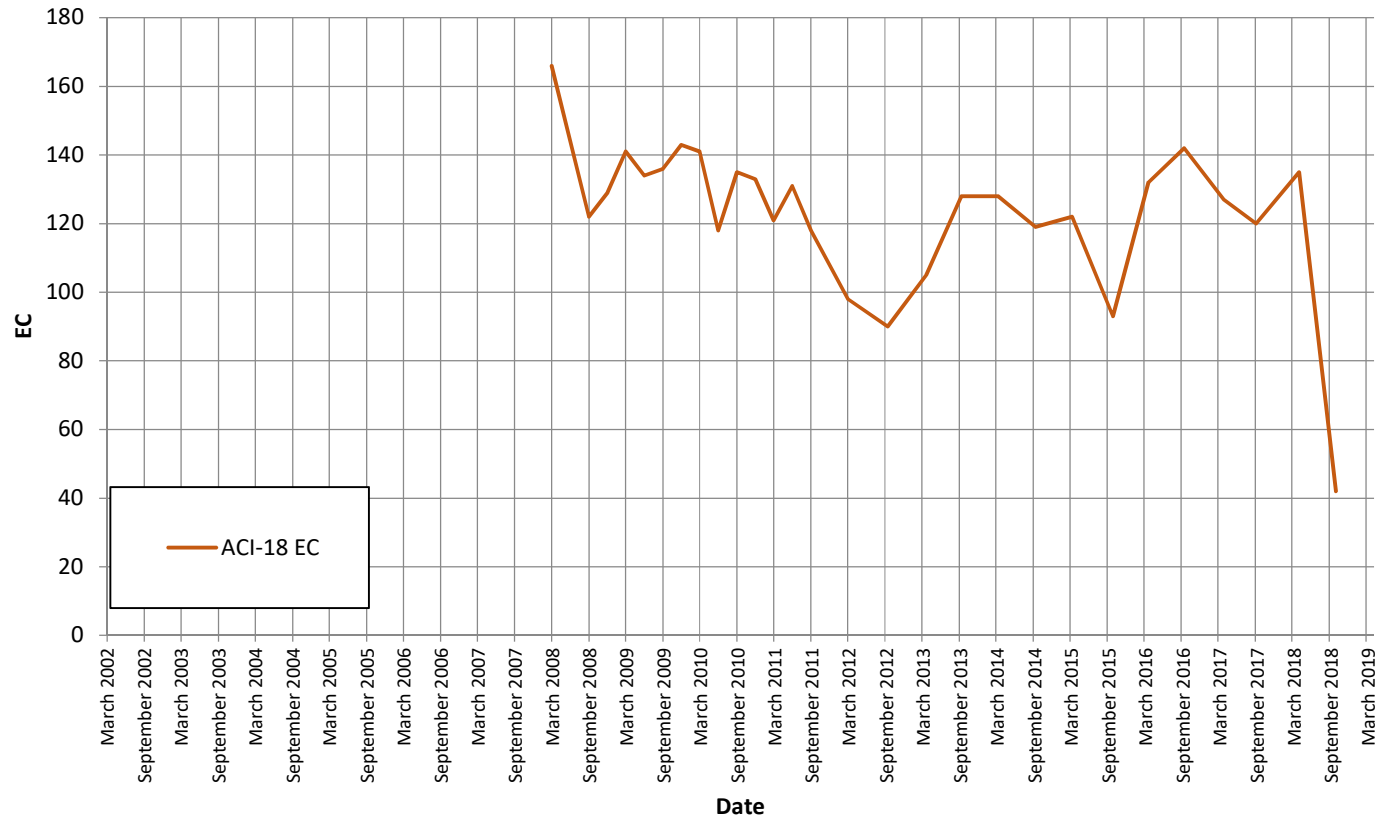
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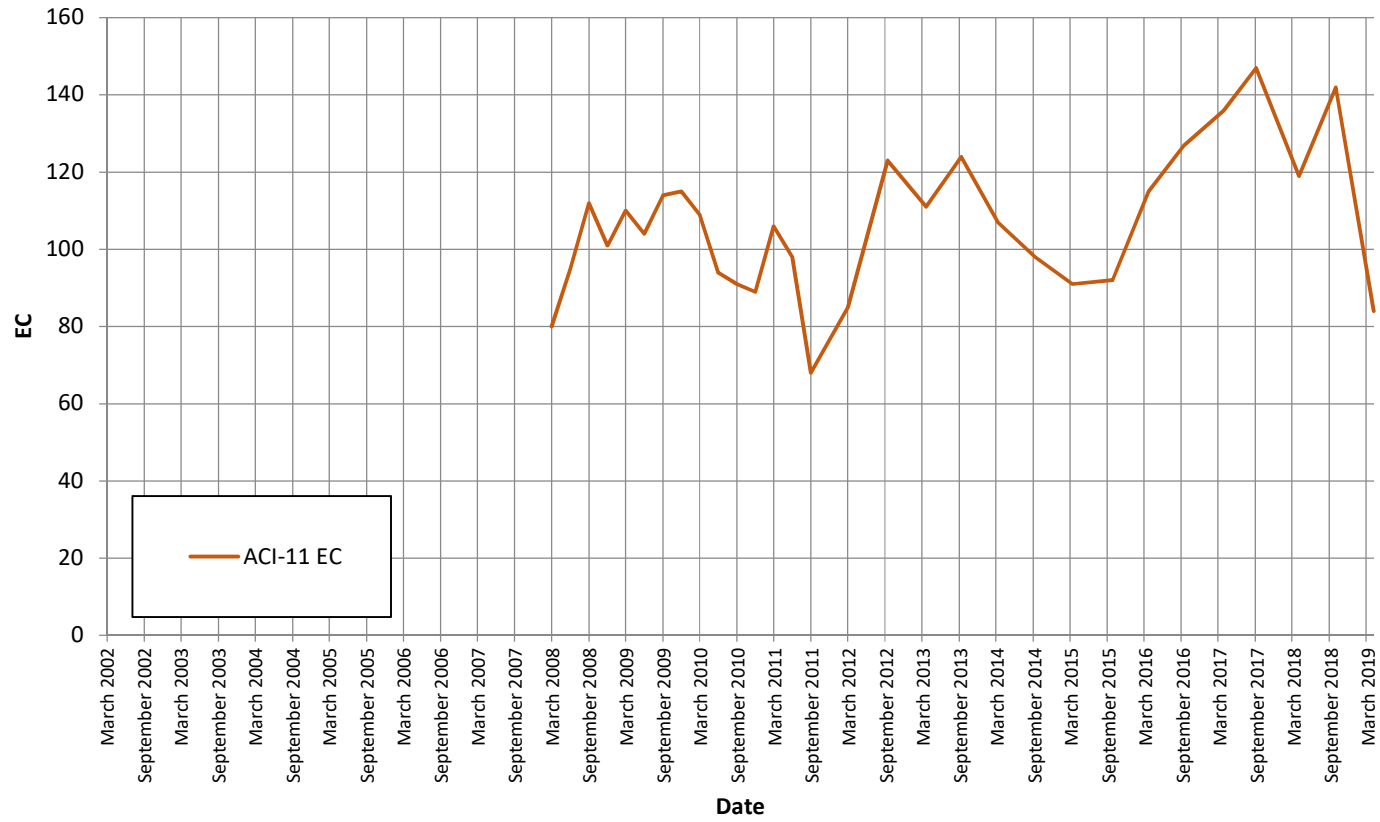
# ACI-8



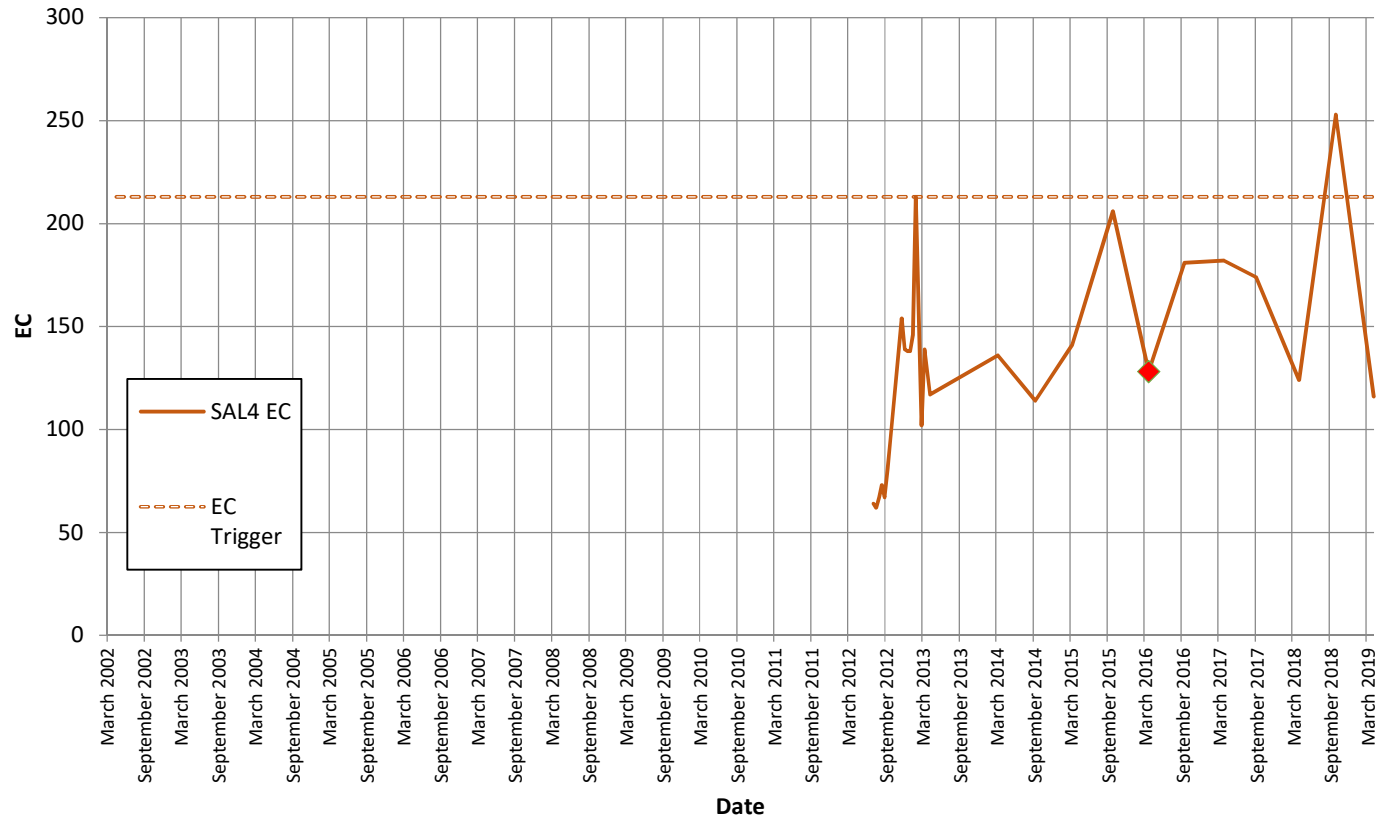
# ACI-18



# ACI-11

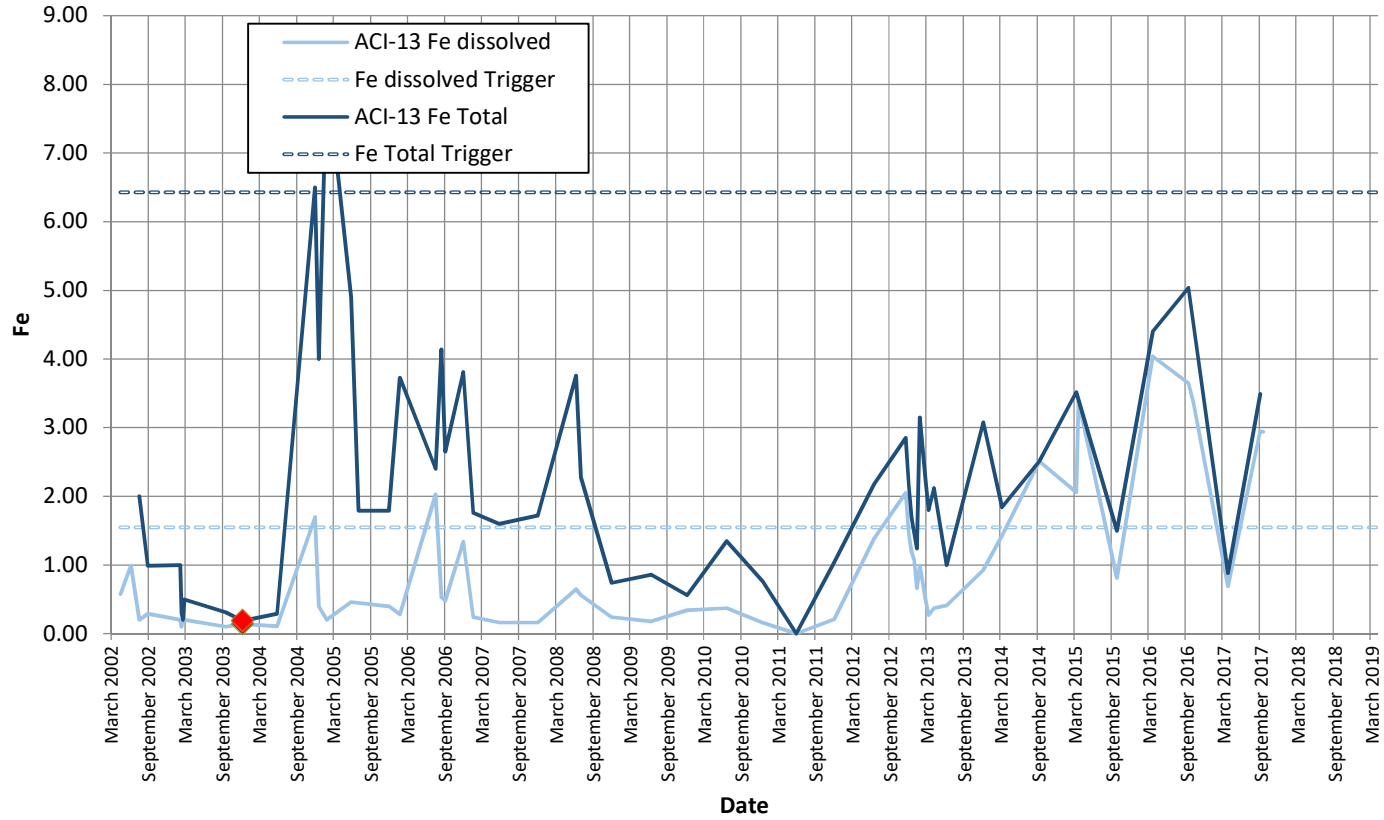


# SAL4

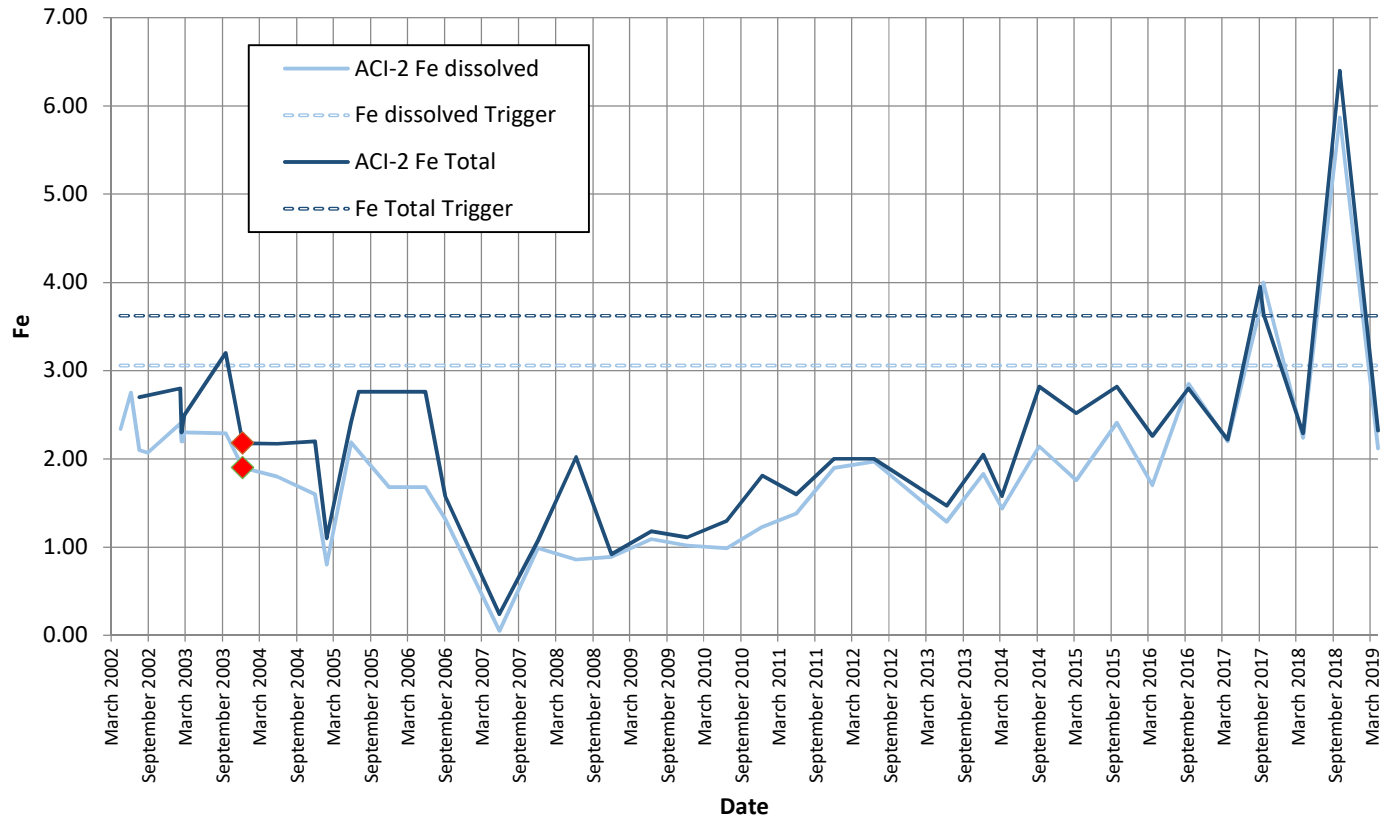




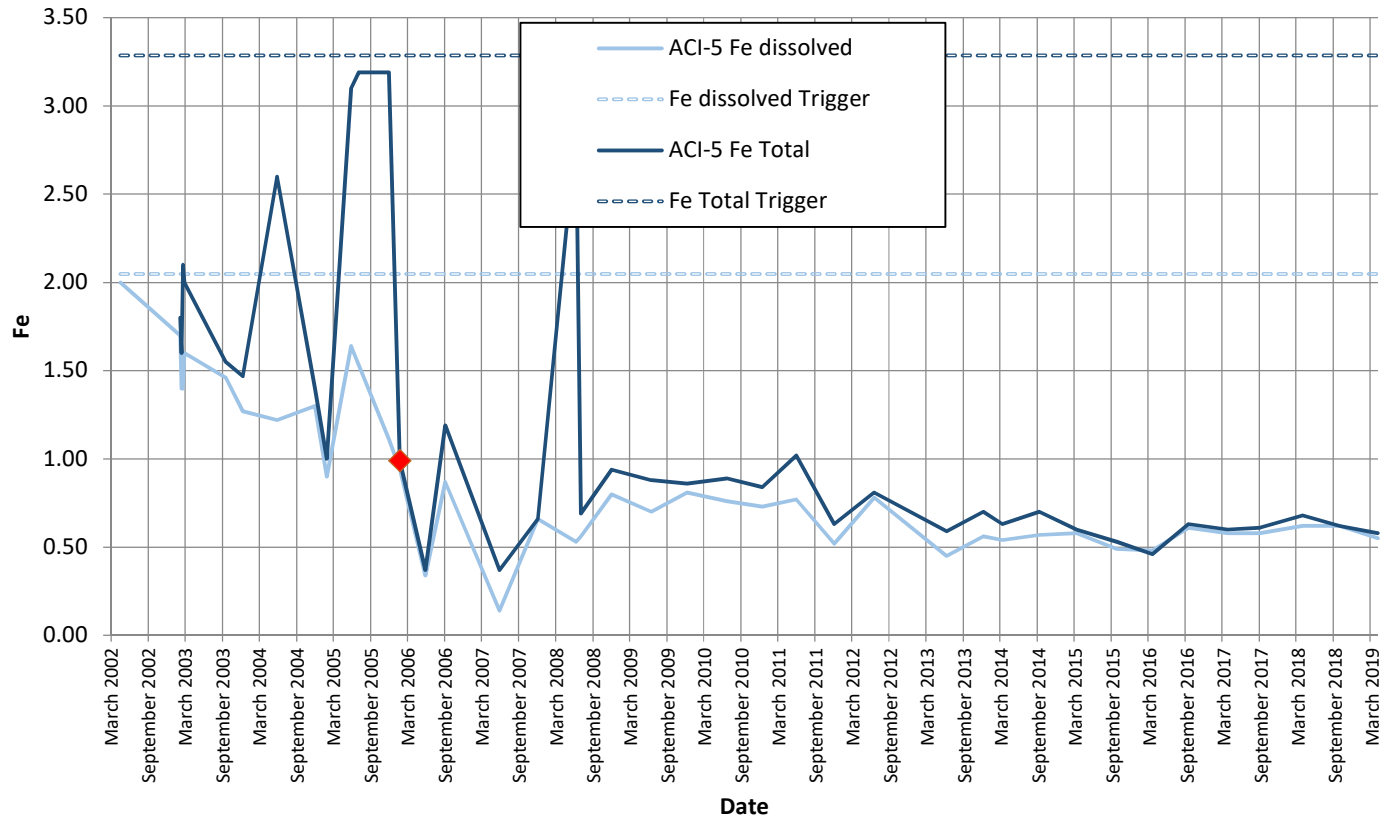
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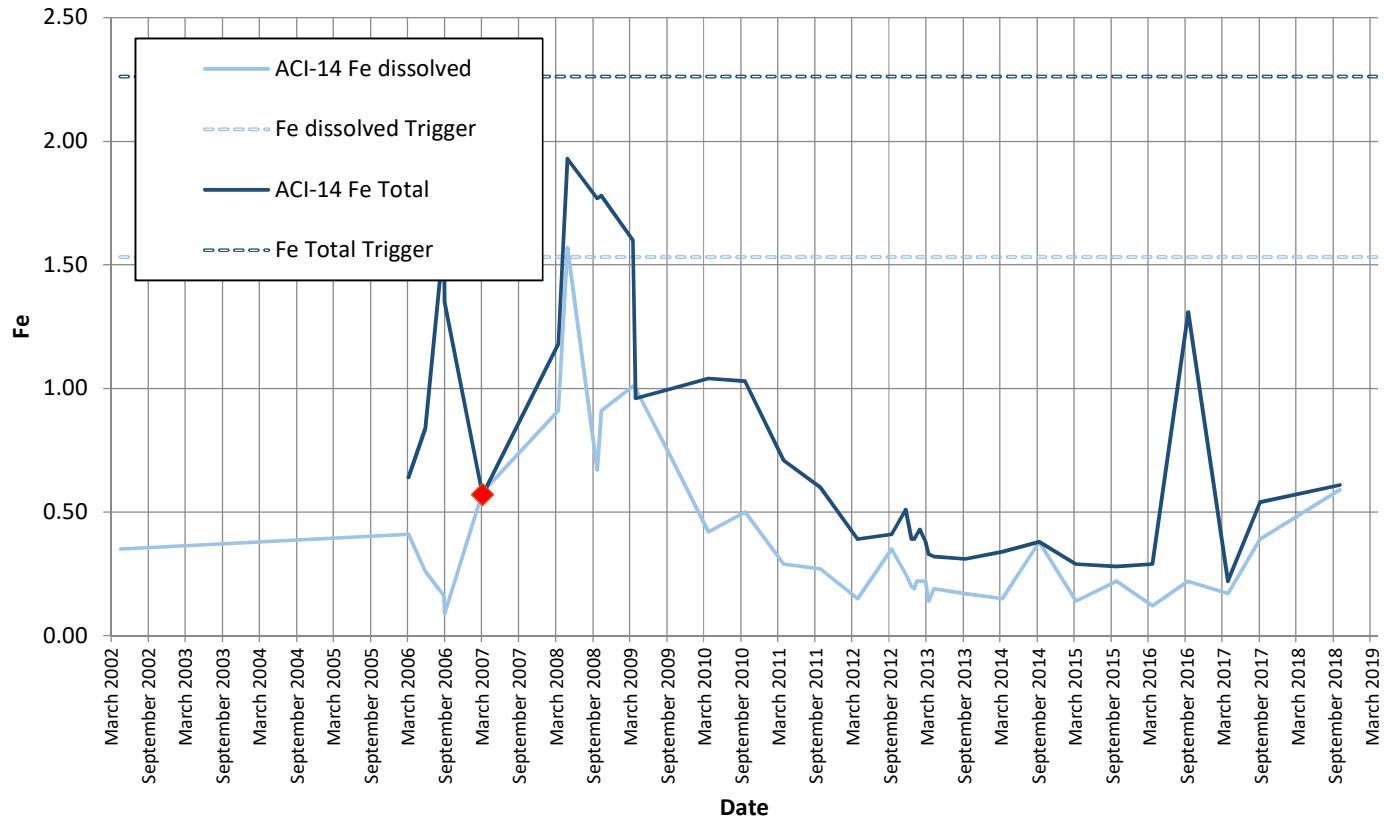
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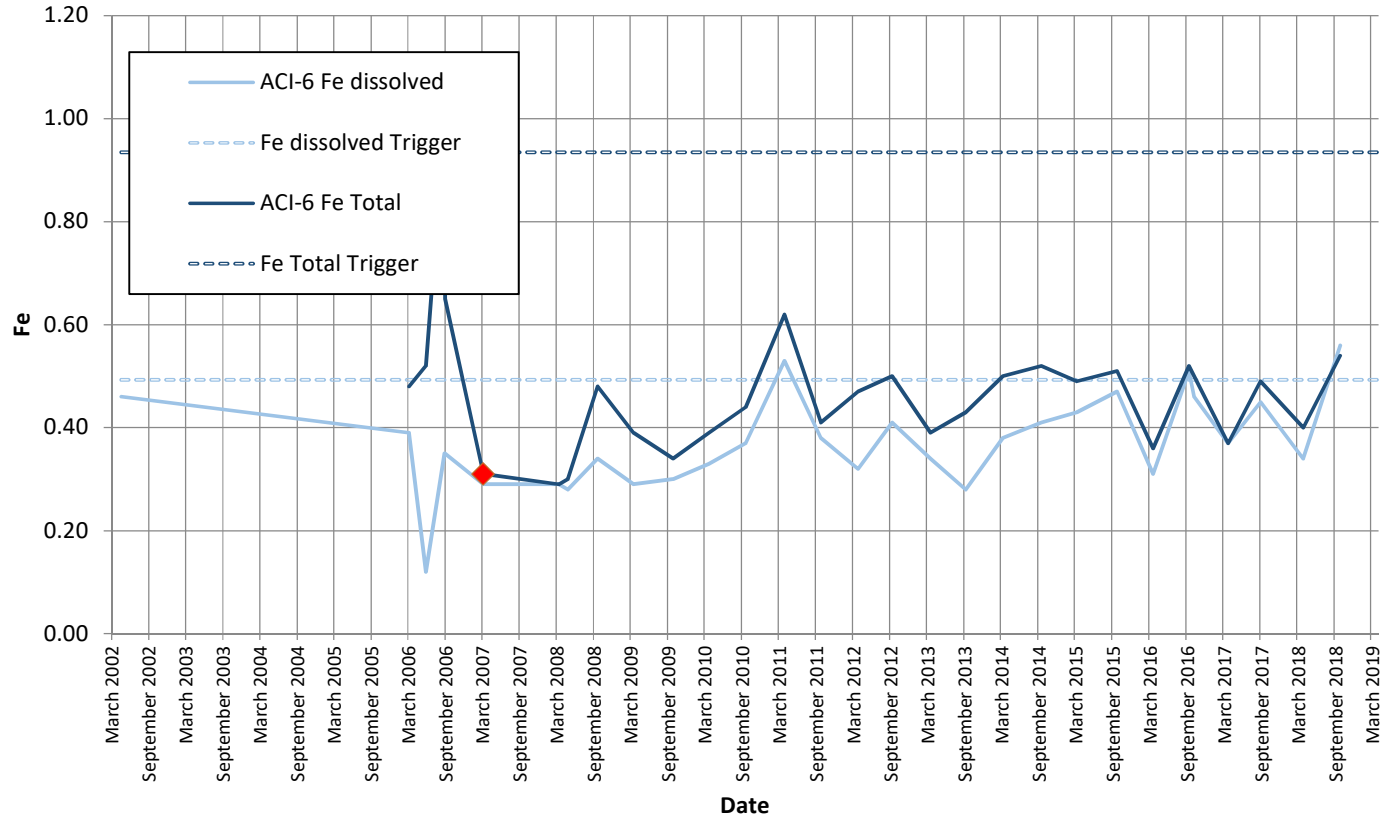
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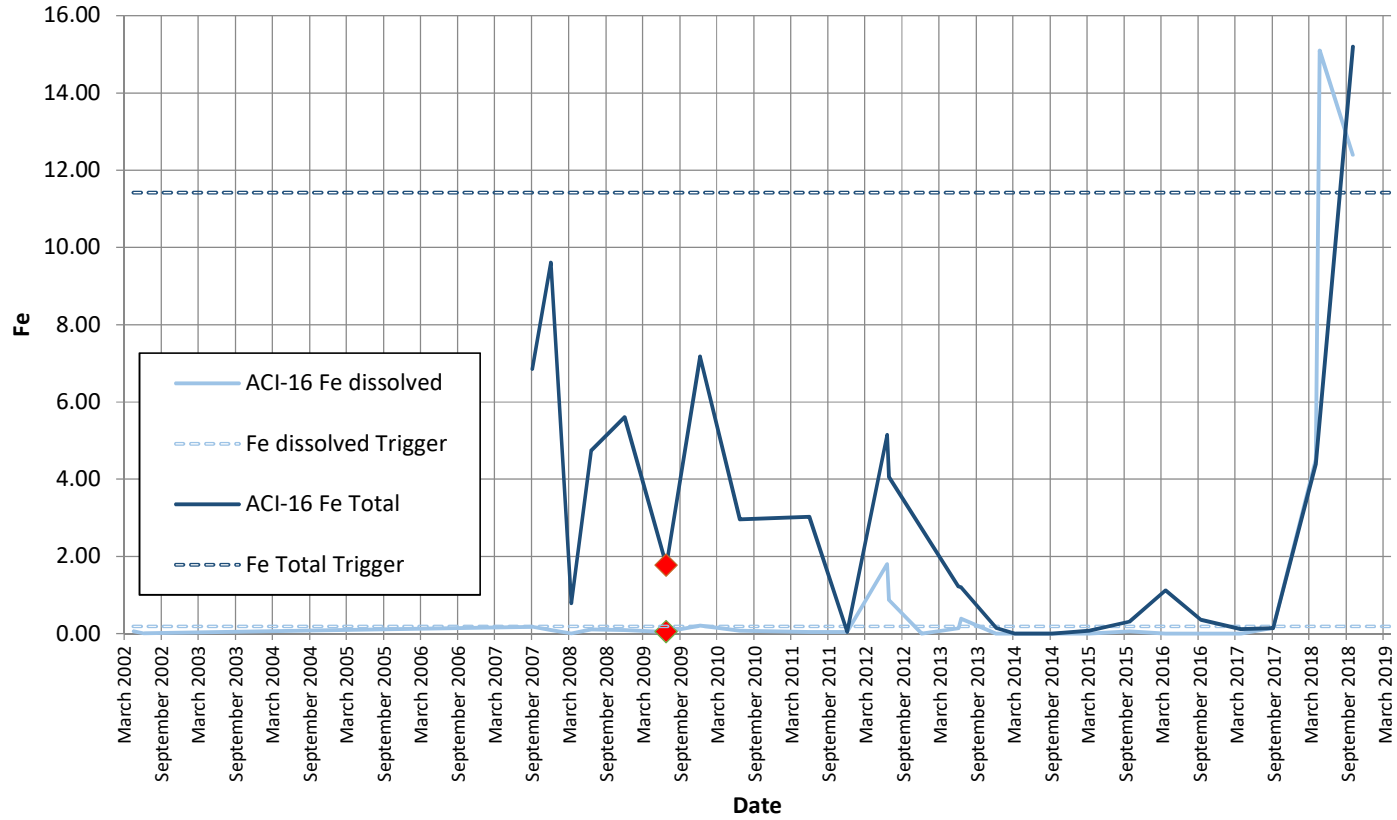
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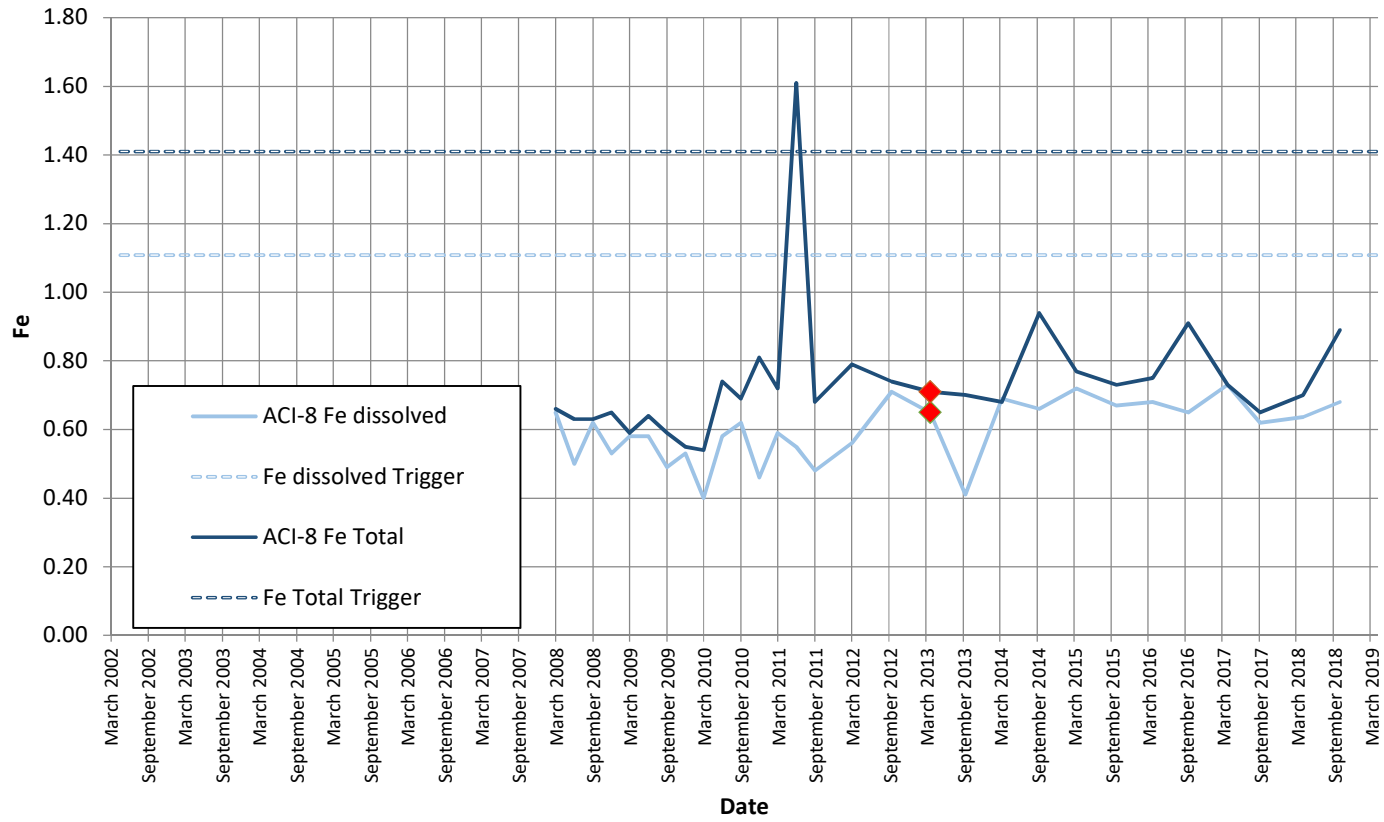
# ACI-6



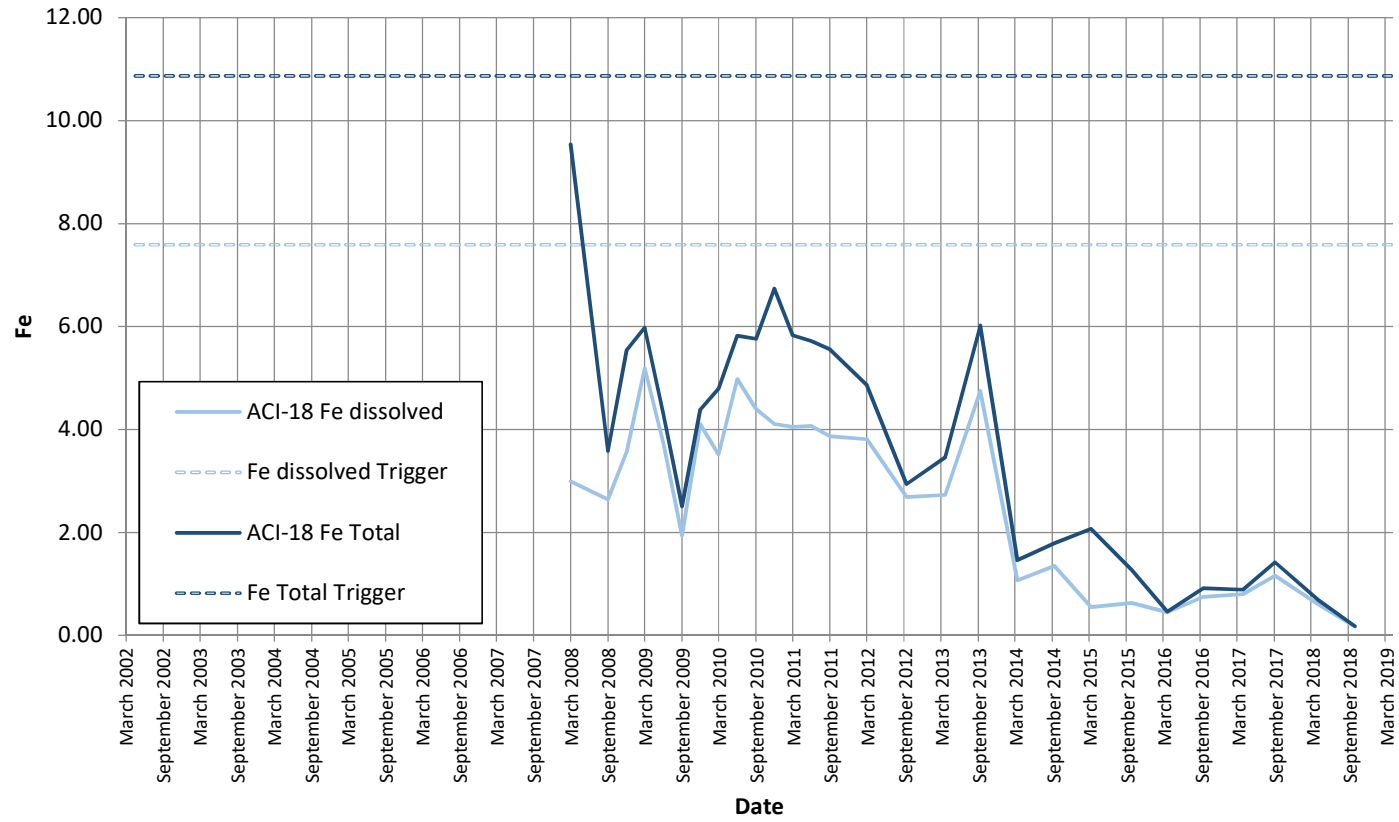
# ACI-16



# ACI-8

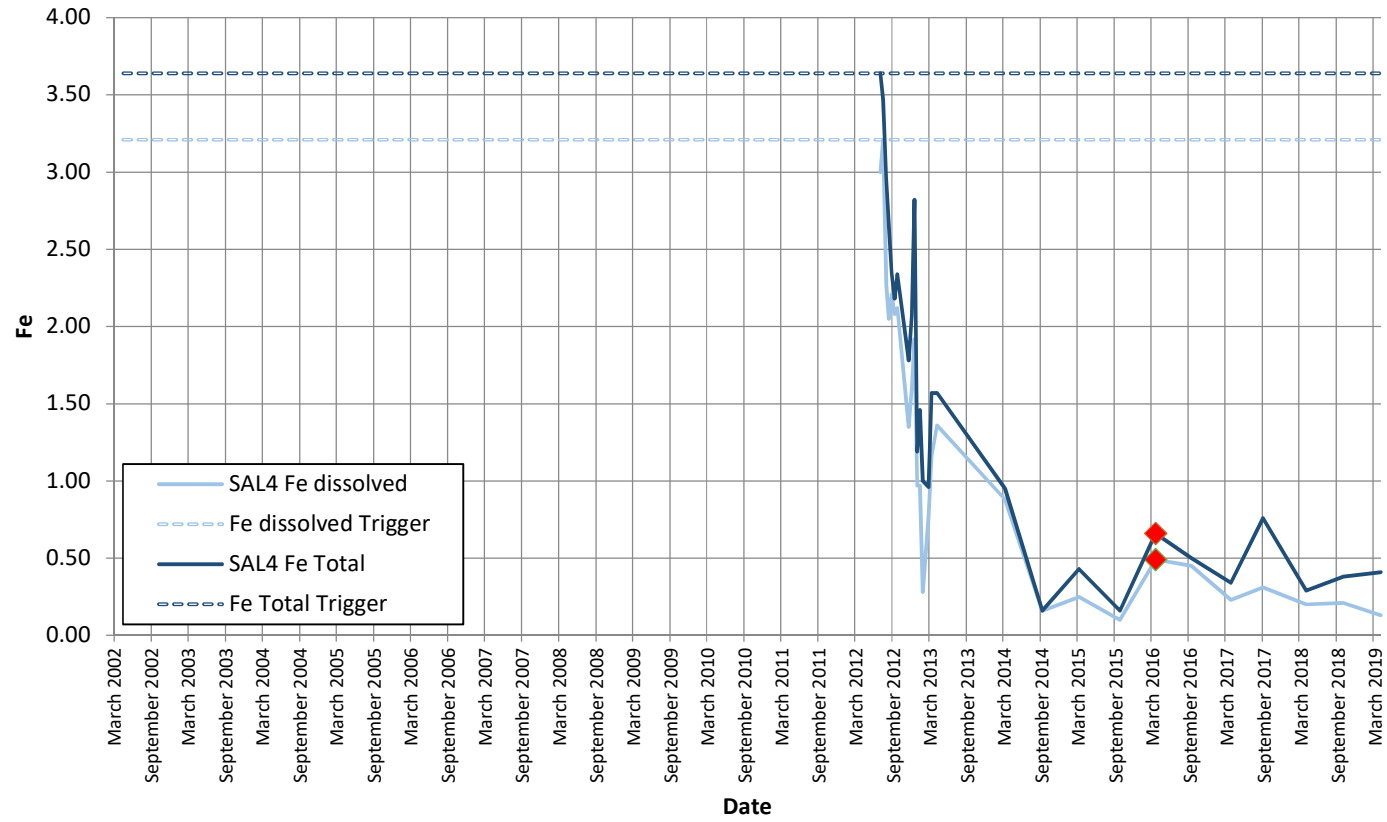


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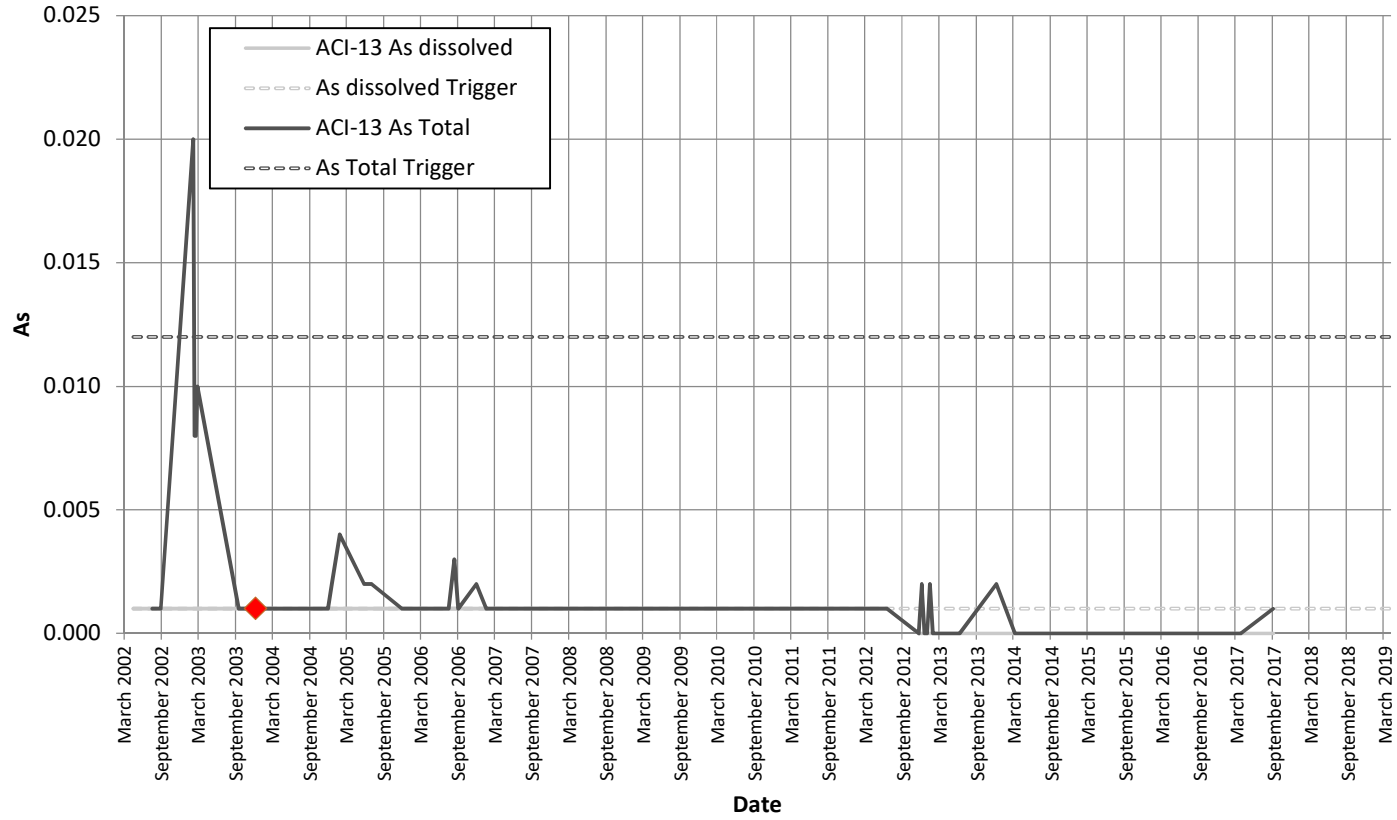




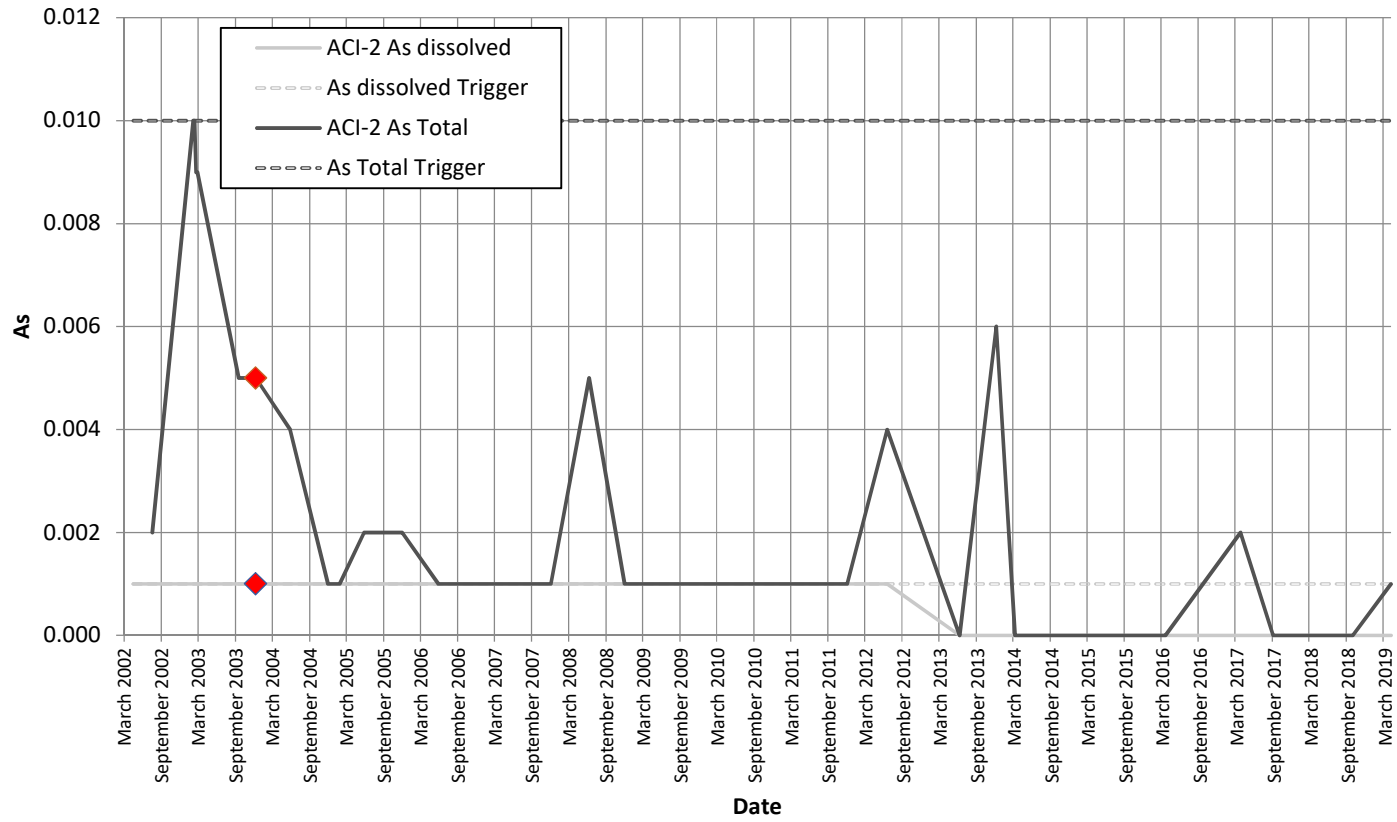
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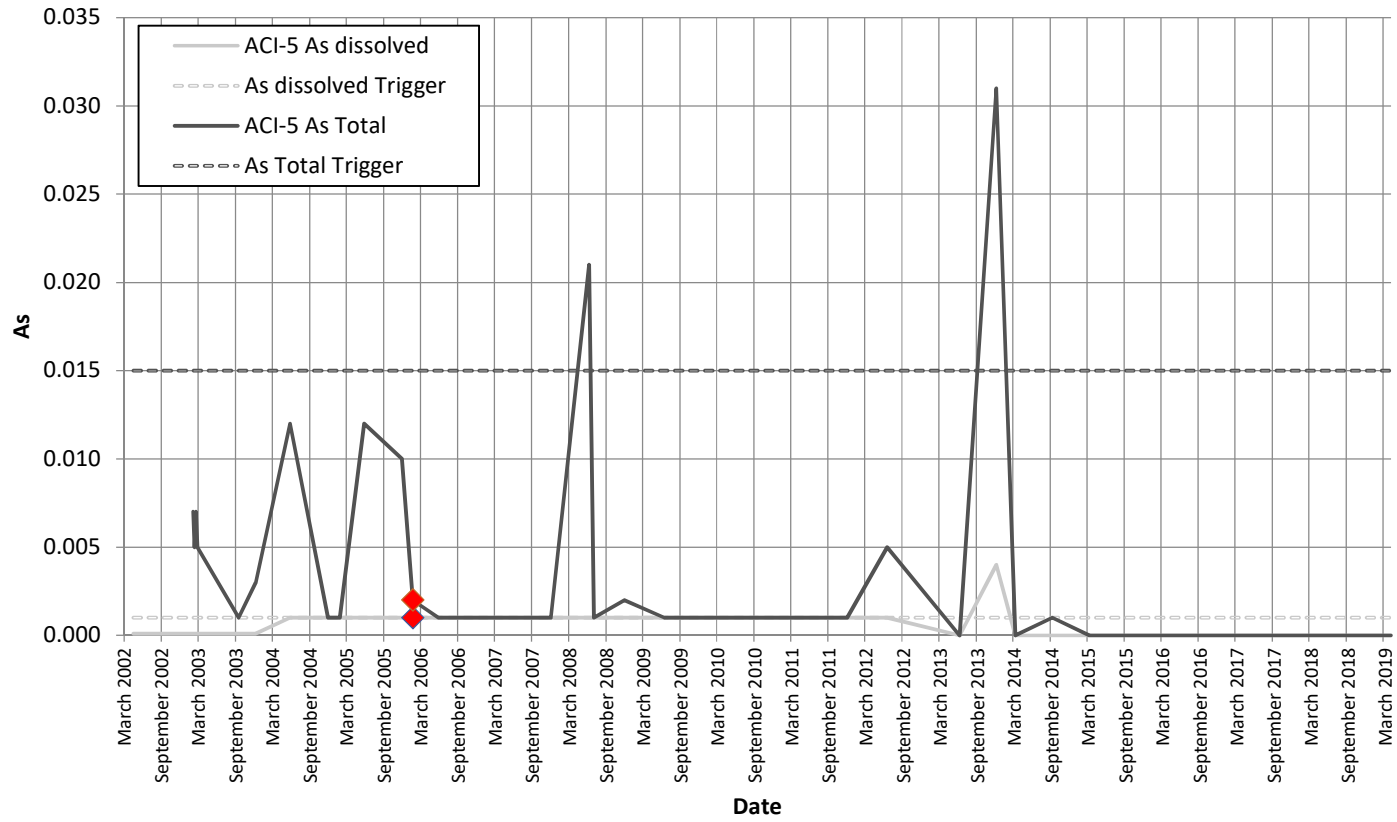
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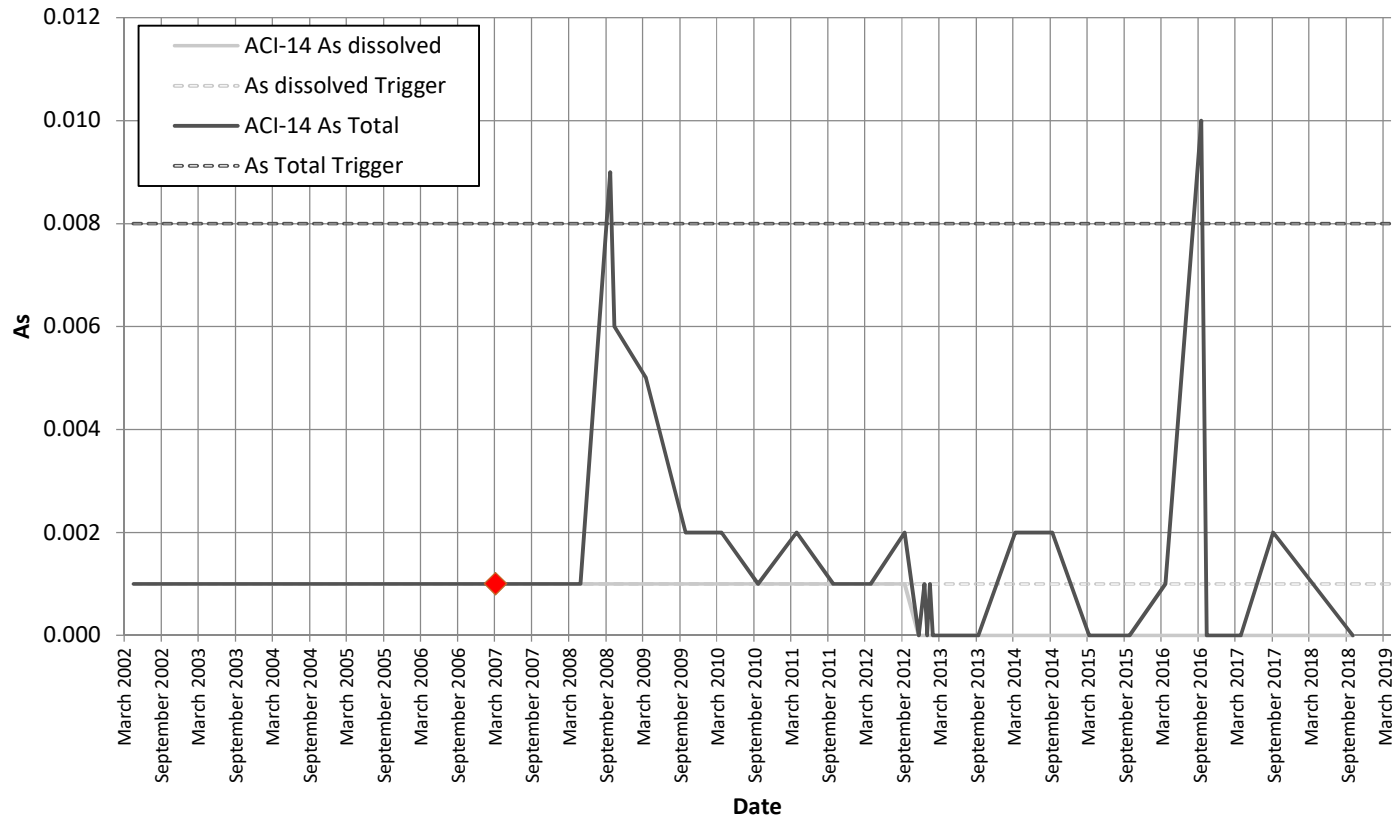
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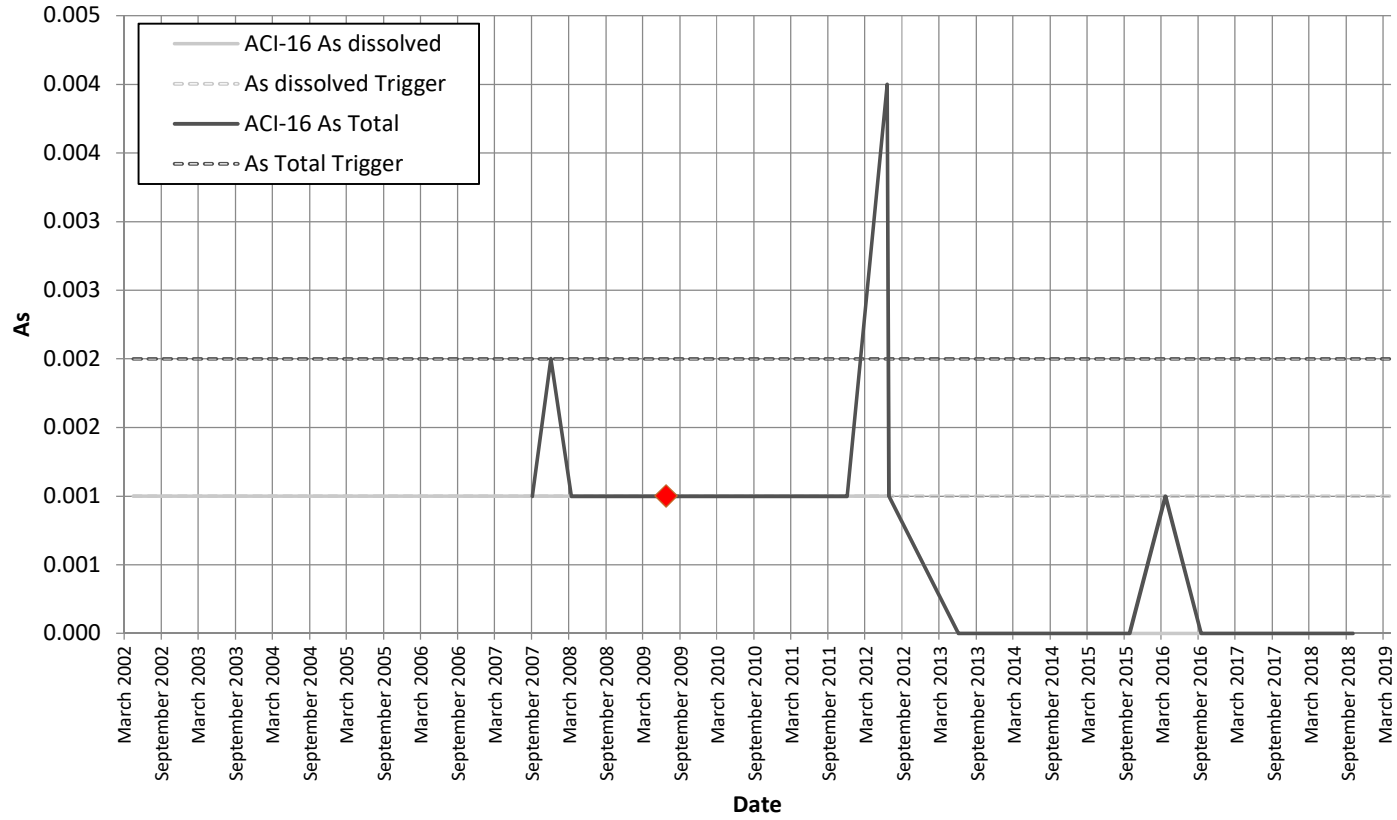
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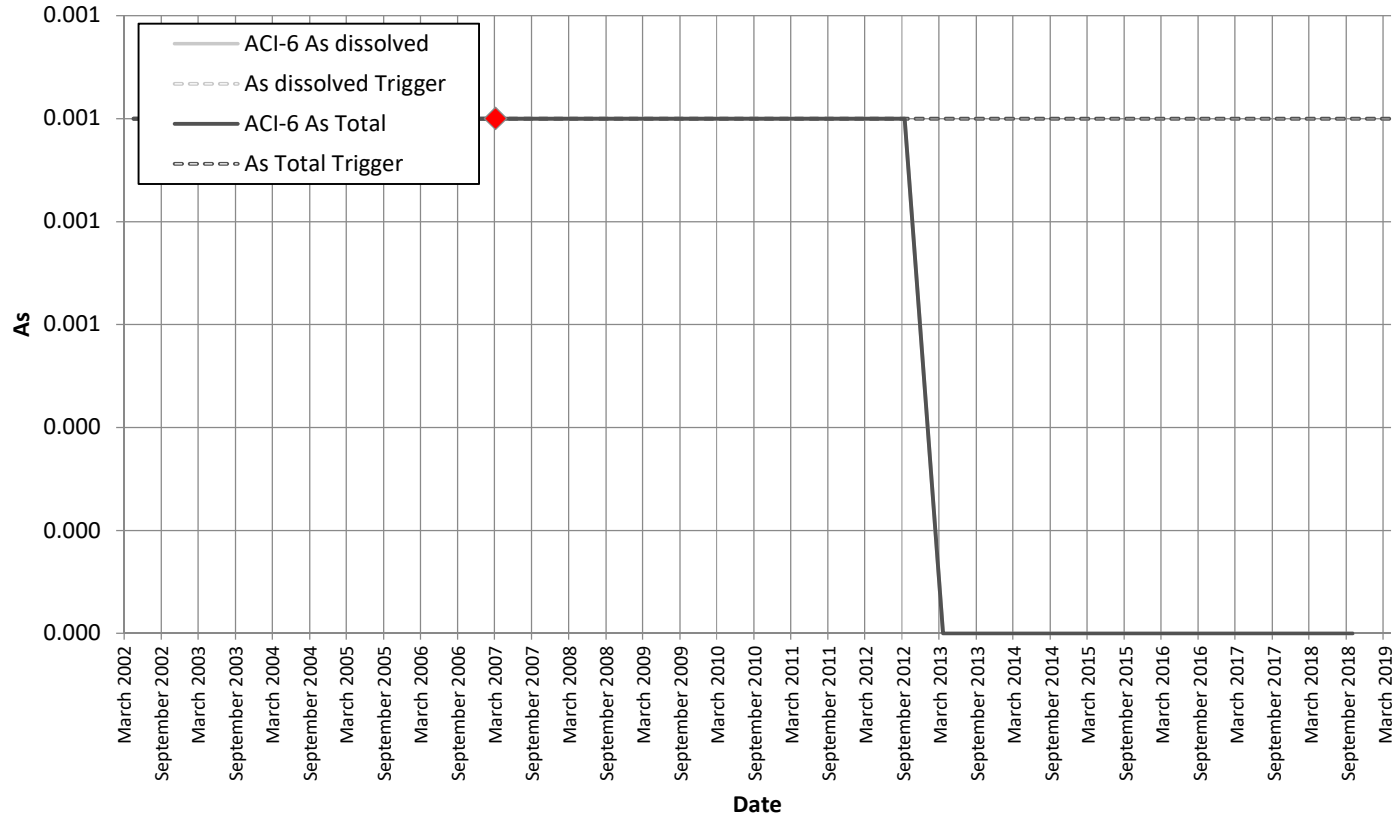
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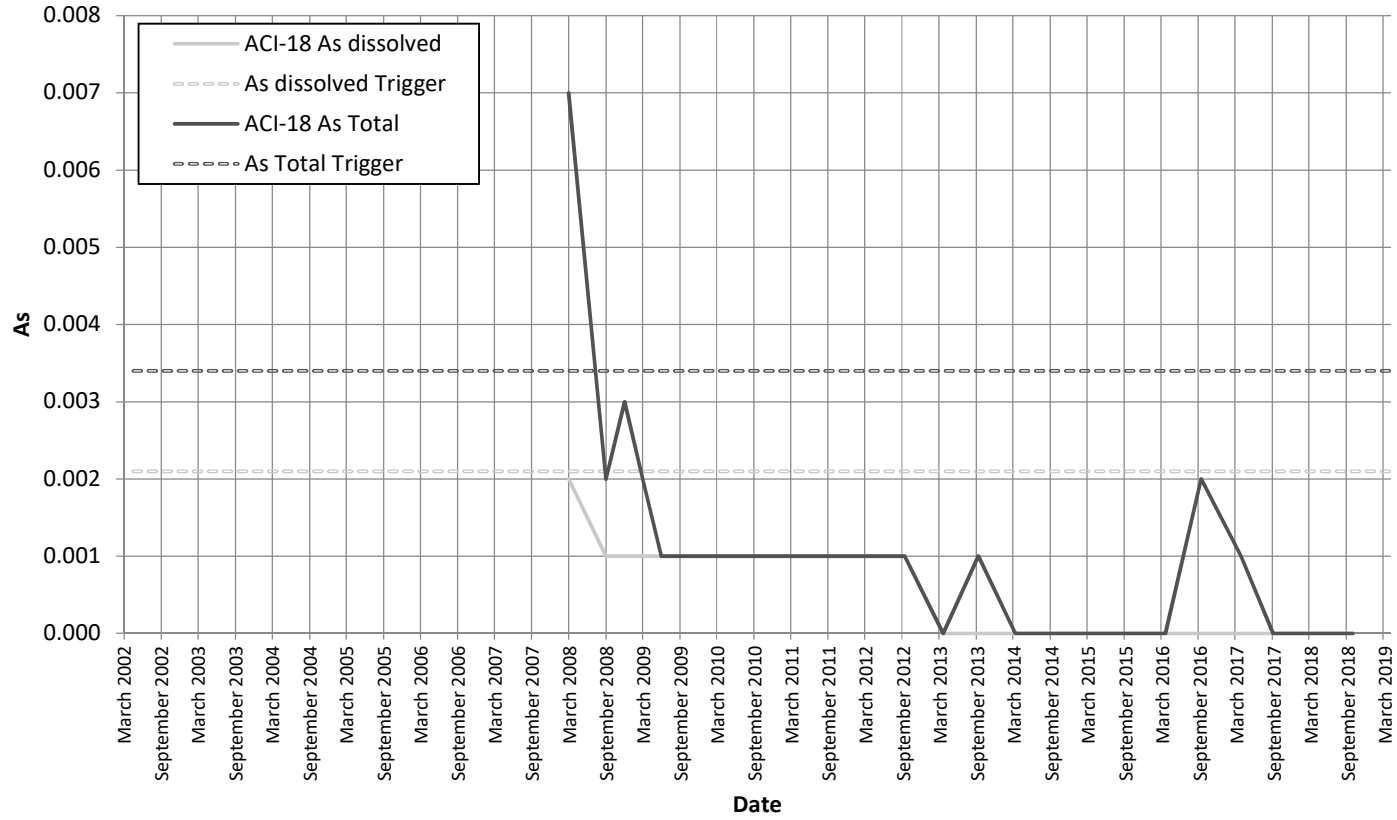
# ACI-16



# ACI-6

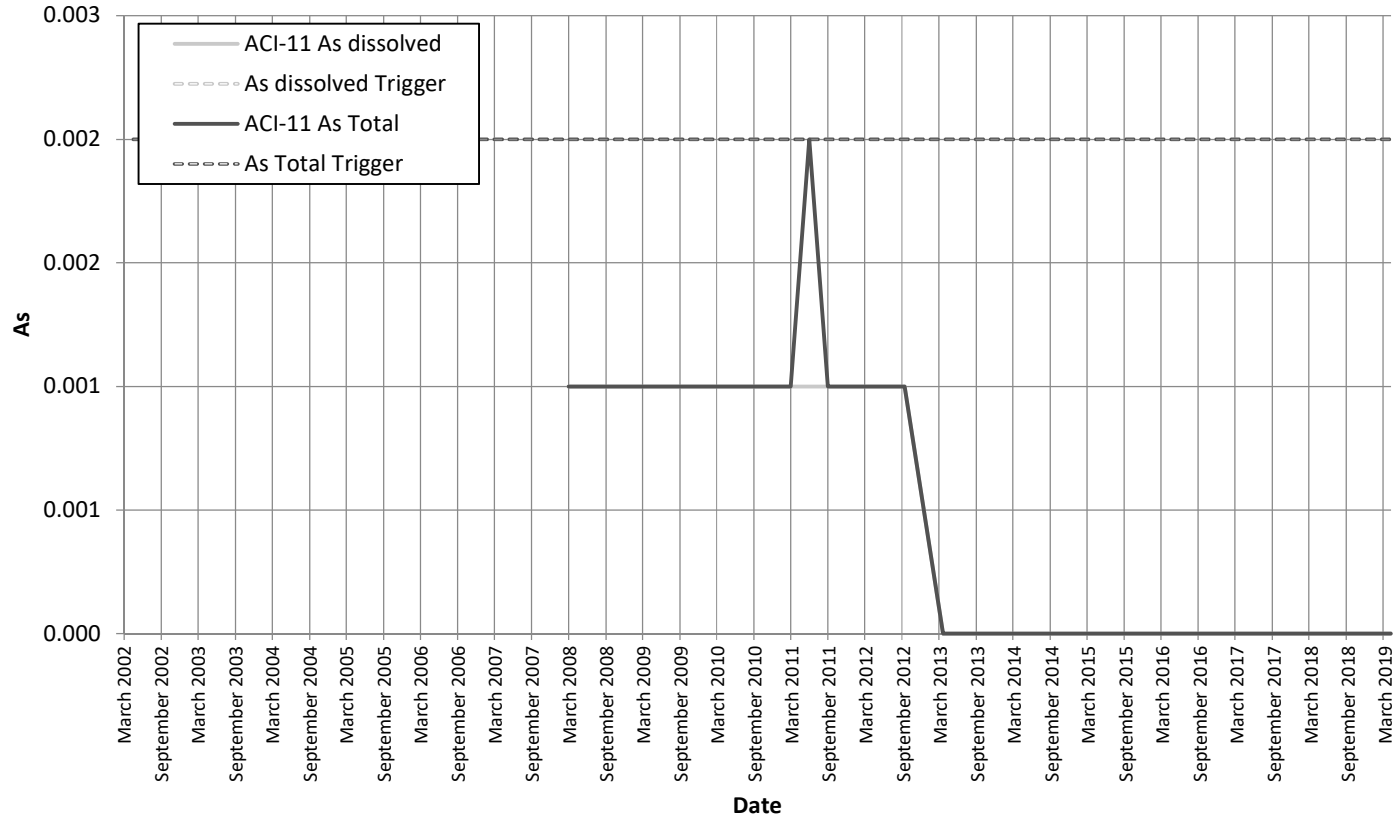


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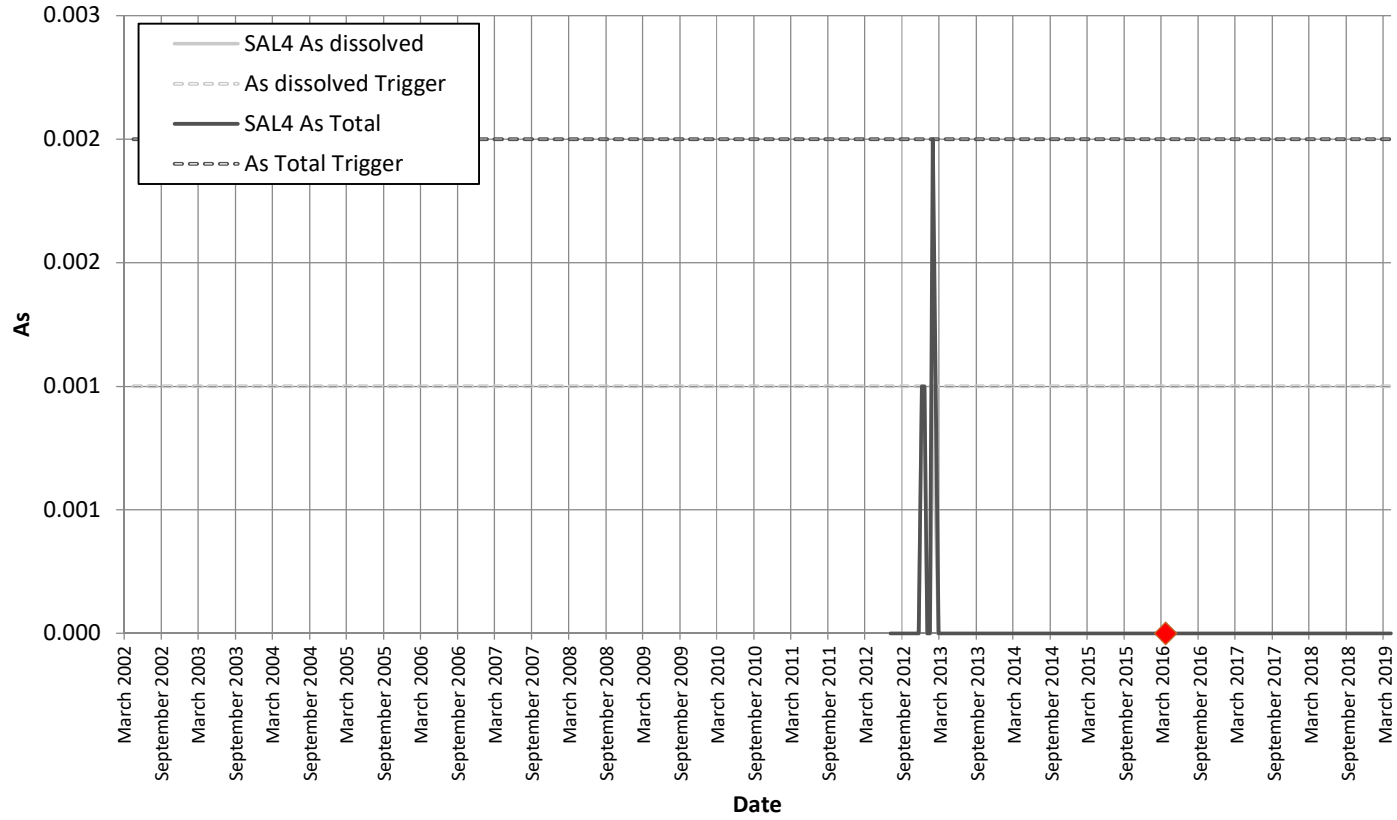




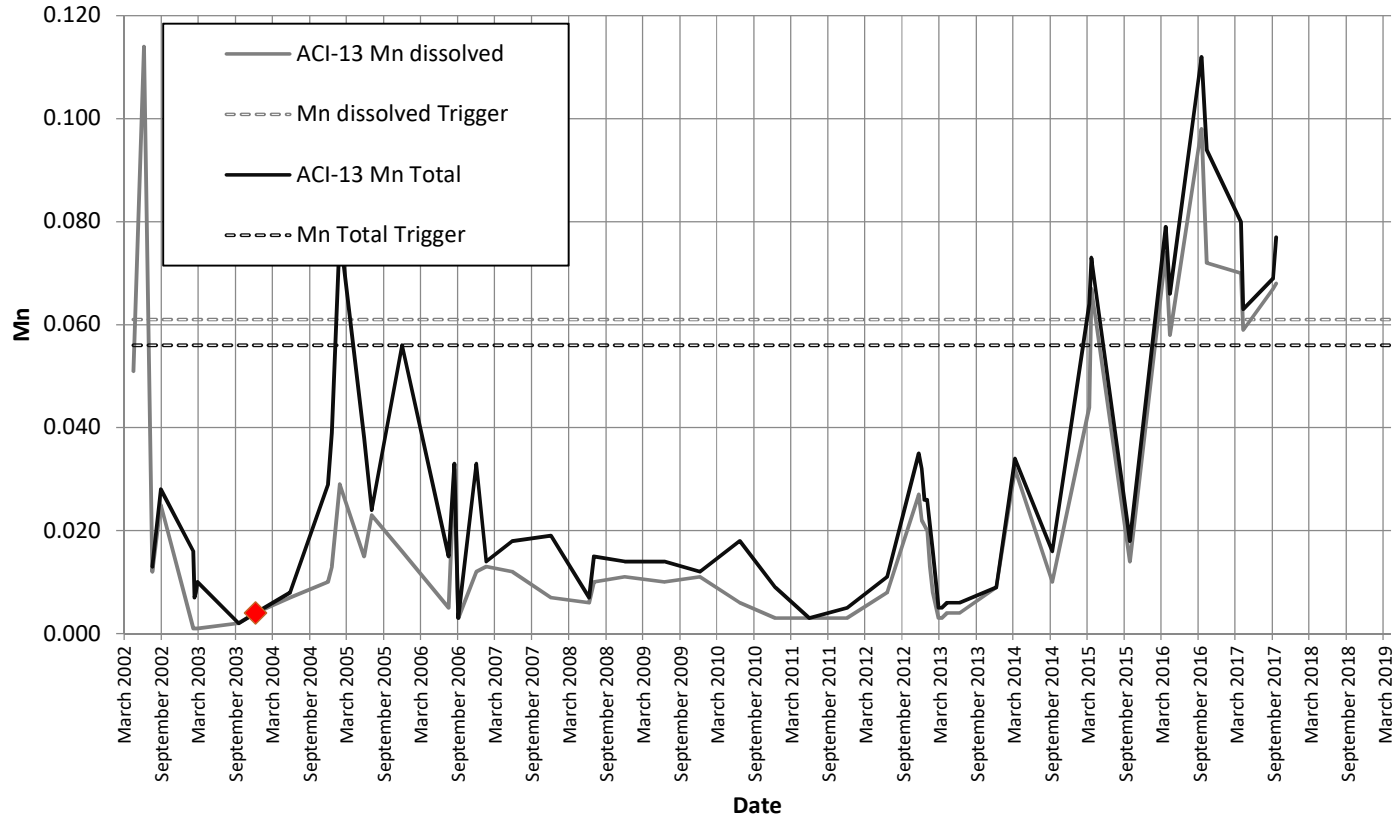
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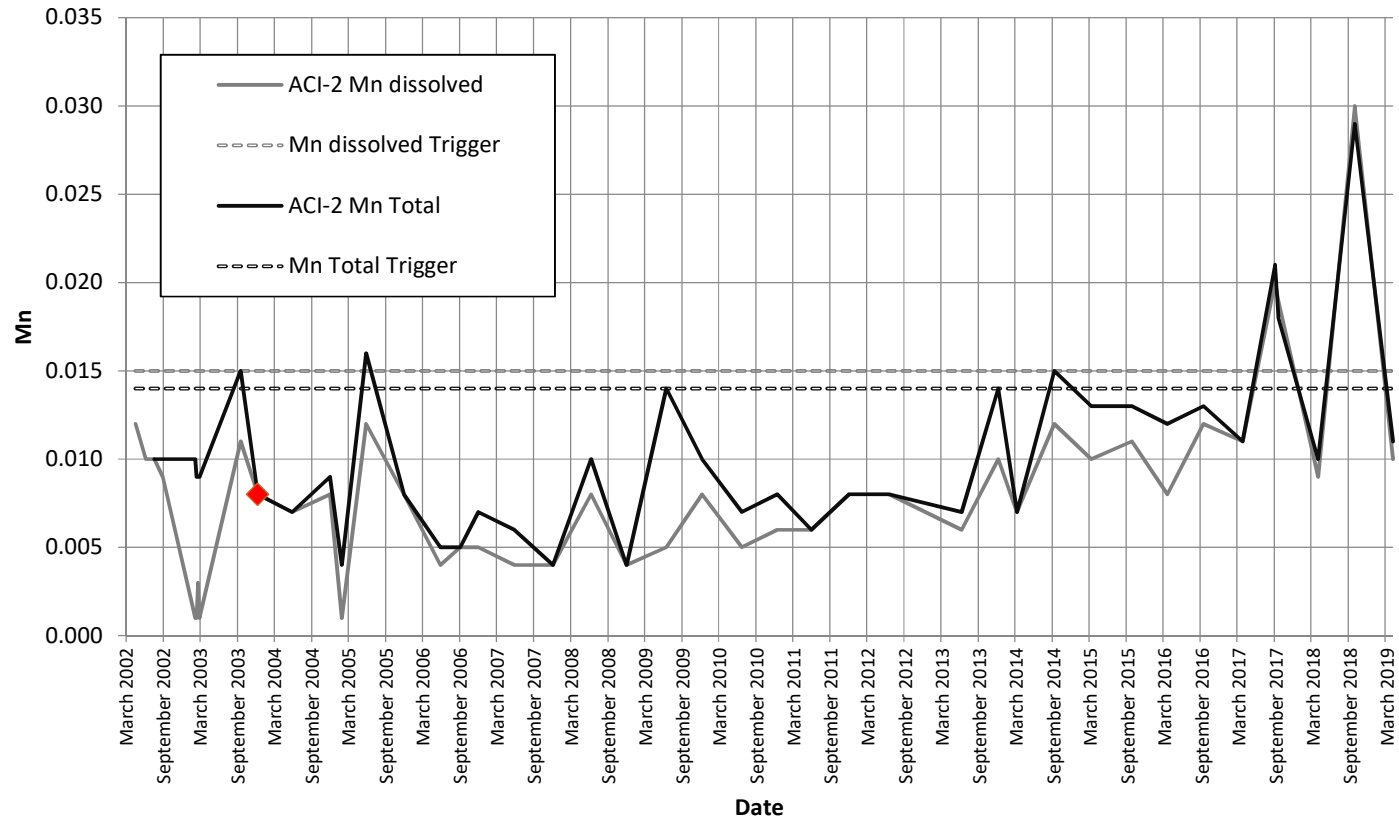
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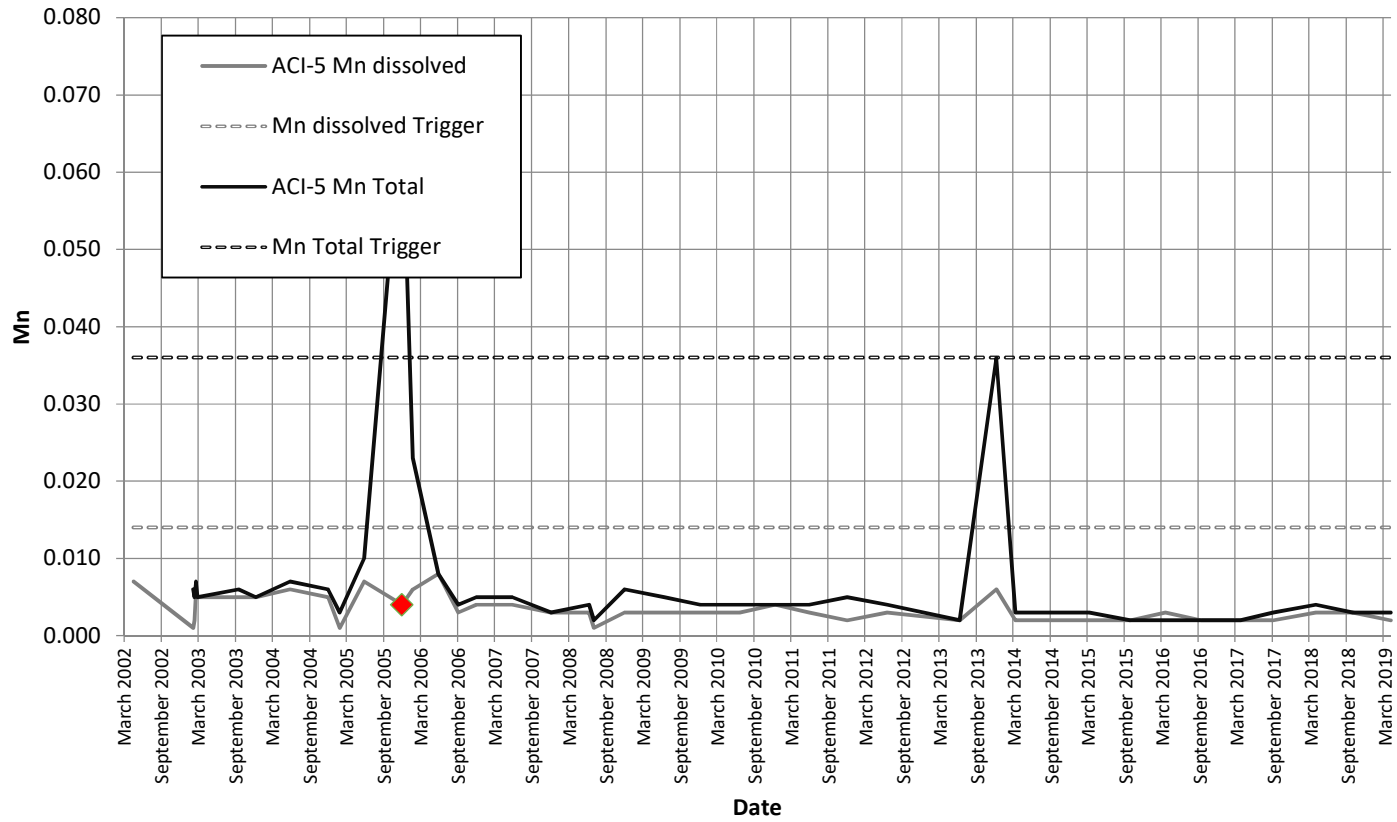
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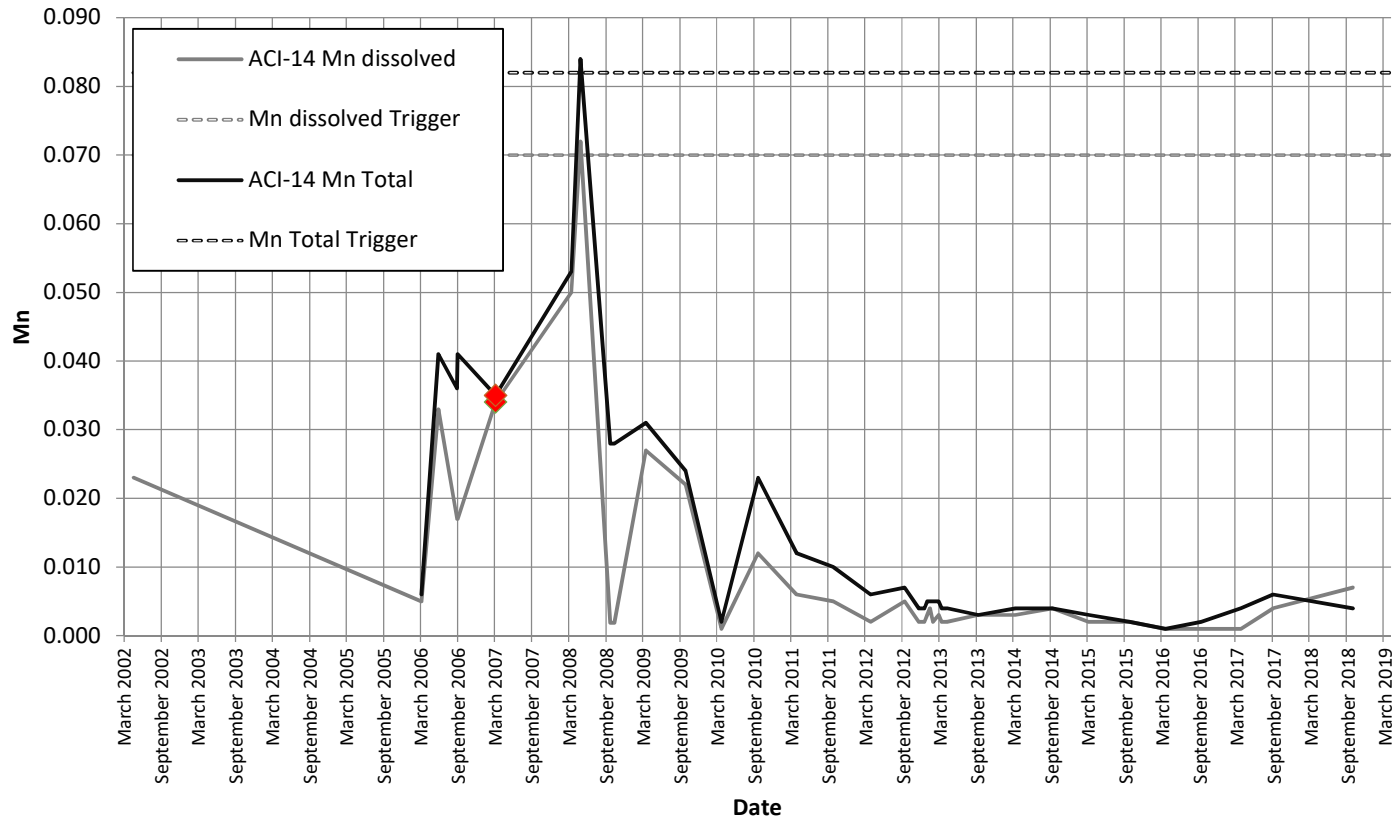
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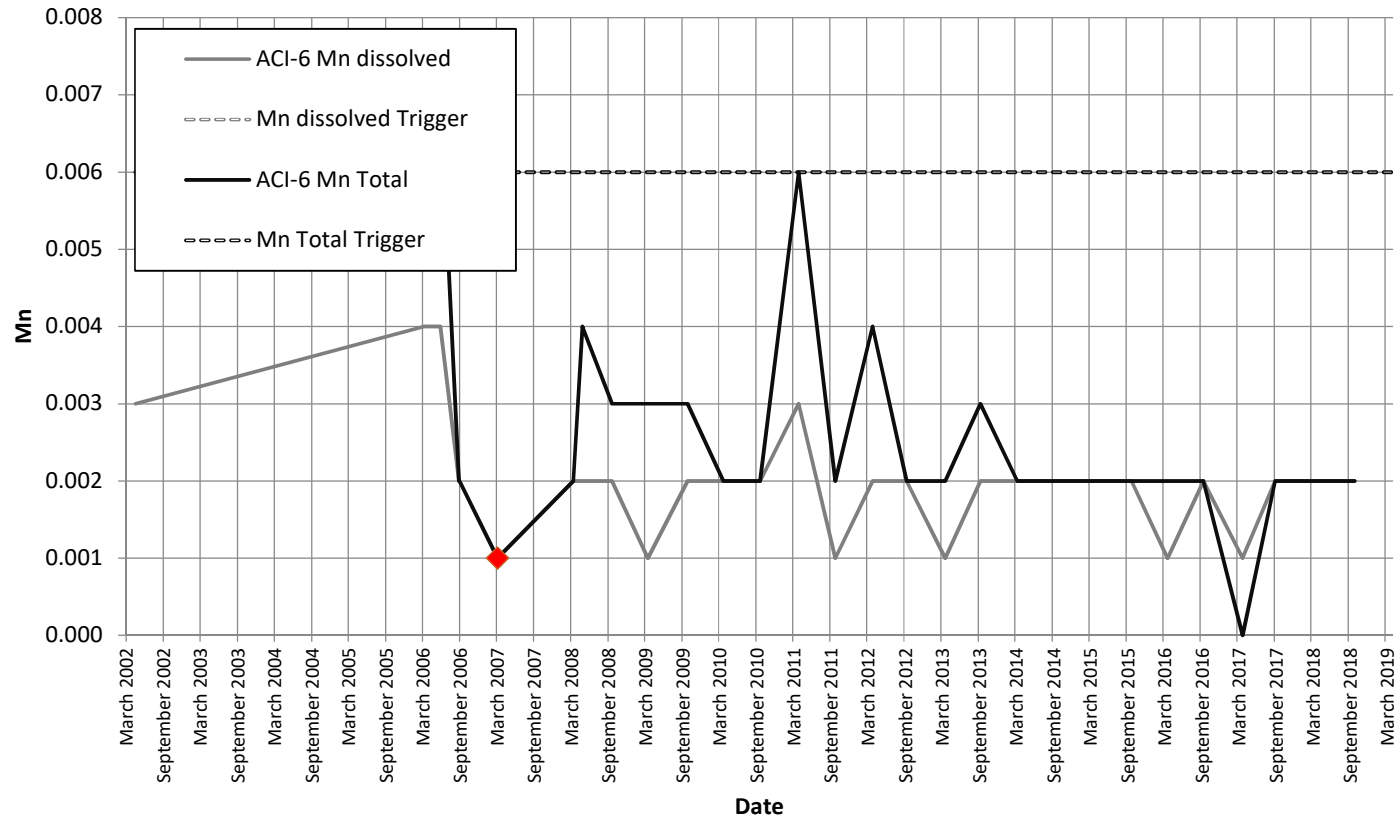
# ACI-5



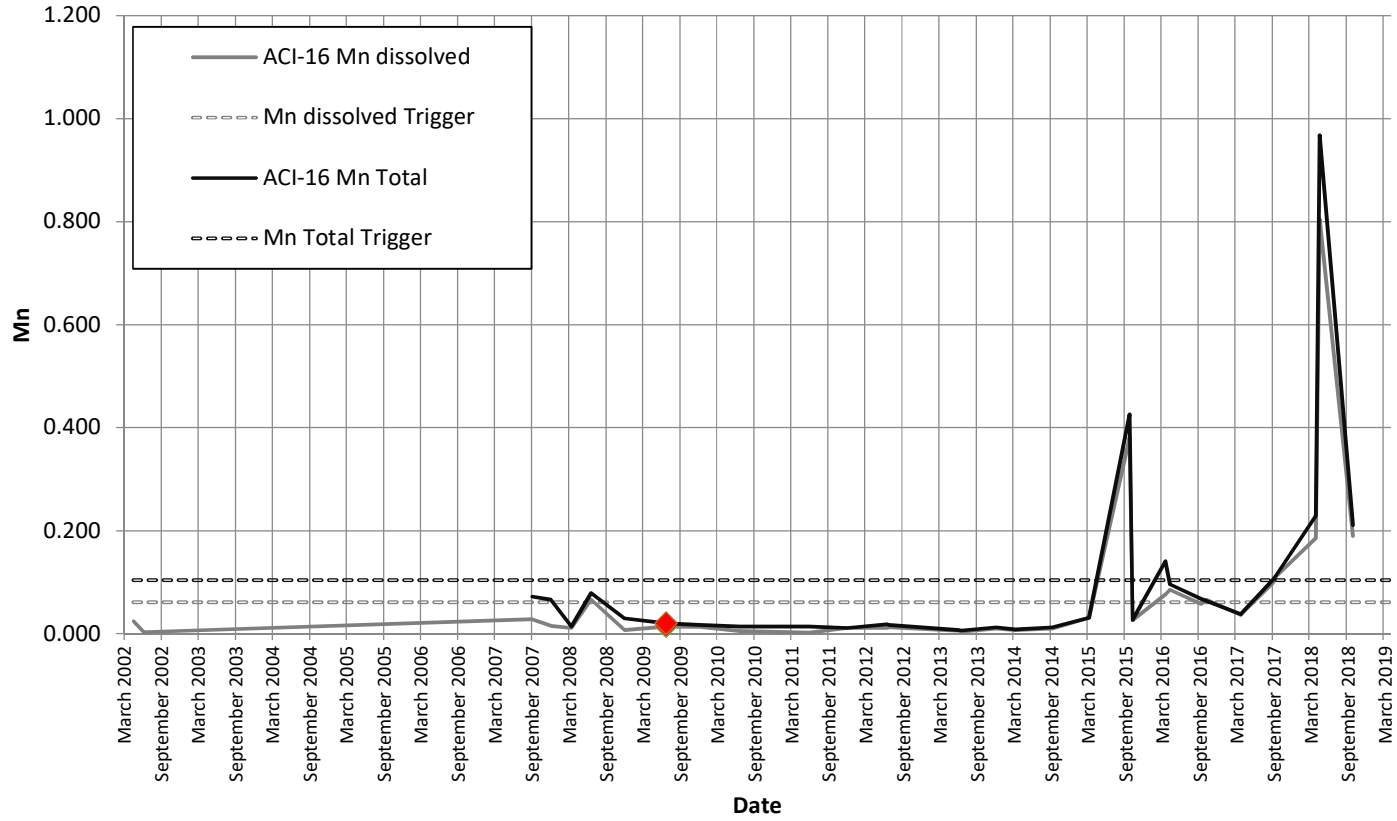
# ACI-14



# ACI-6

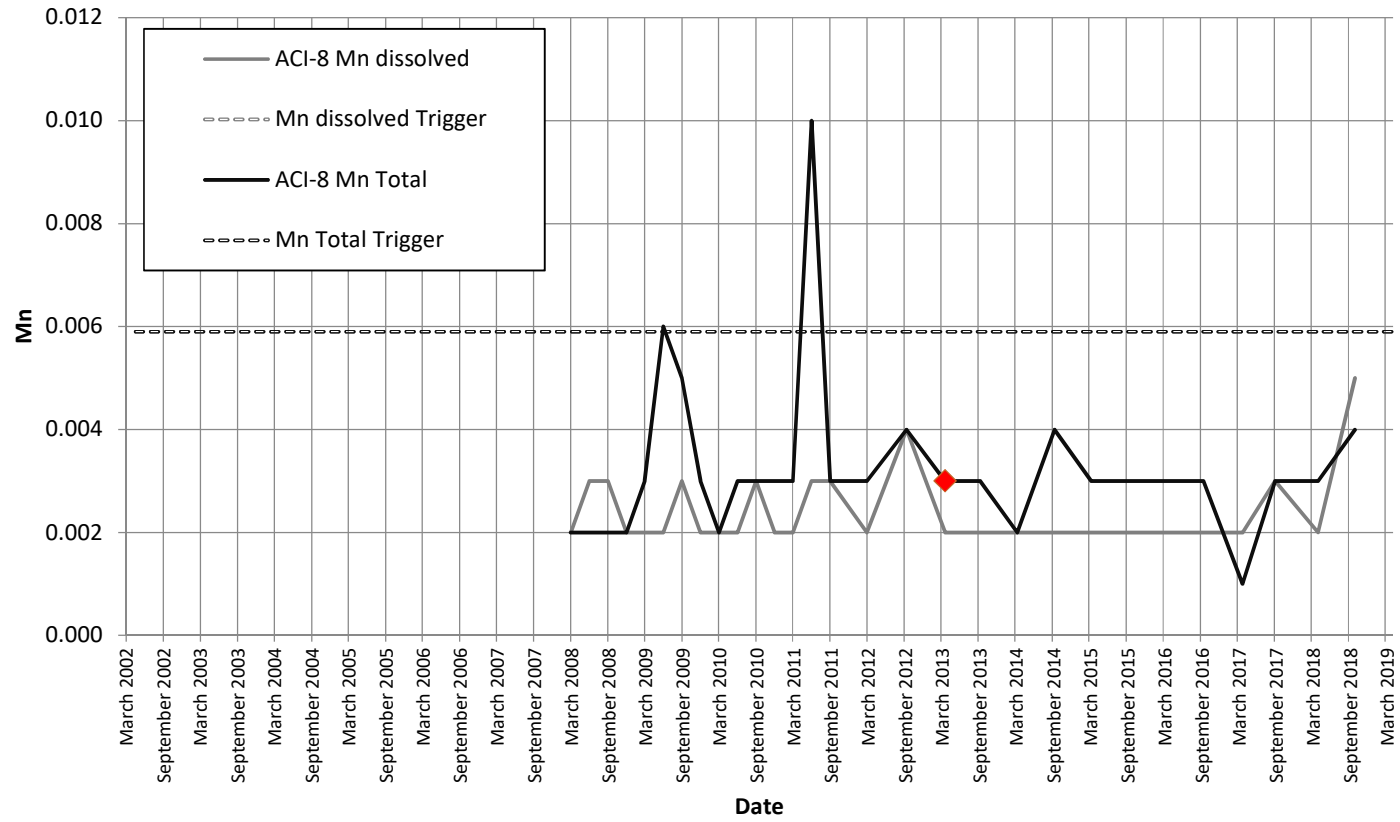


# ACI-16

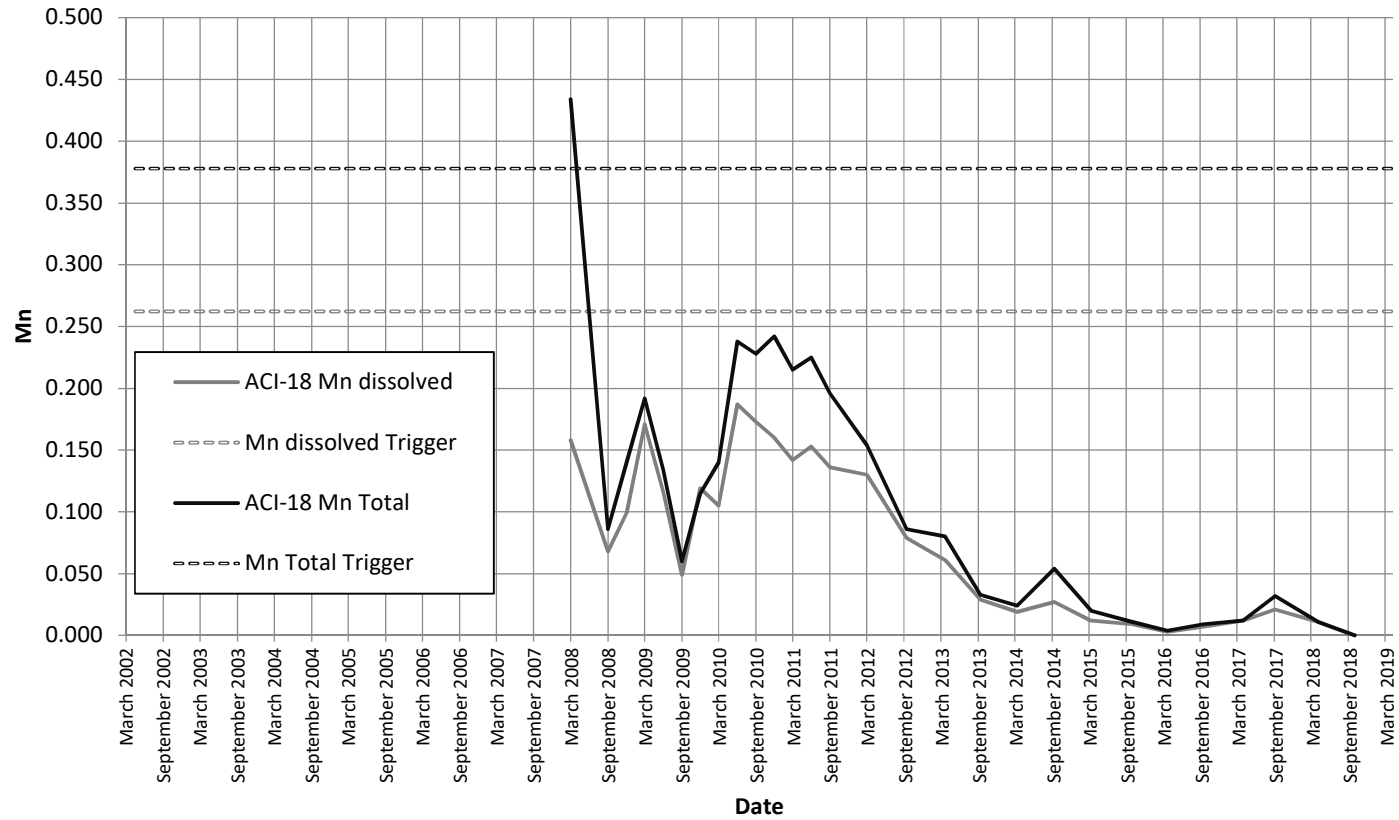




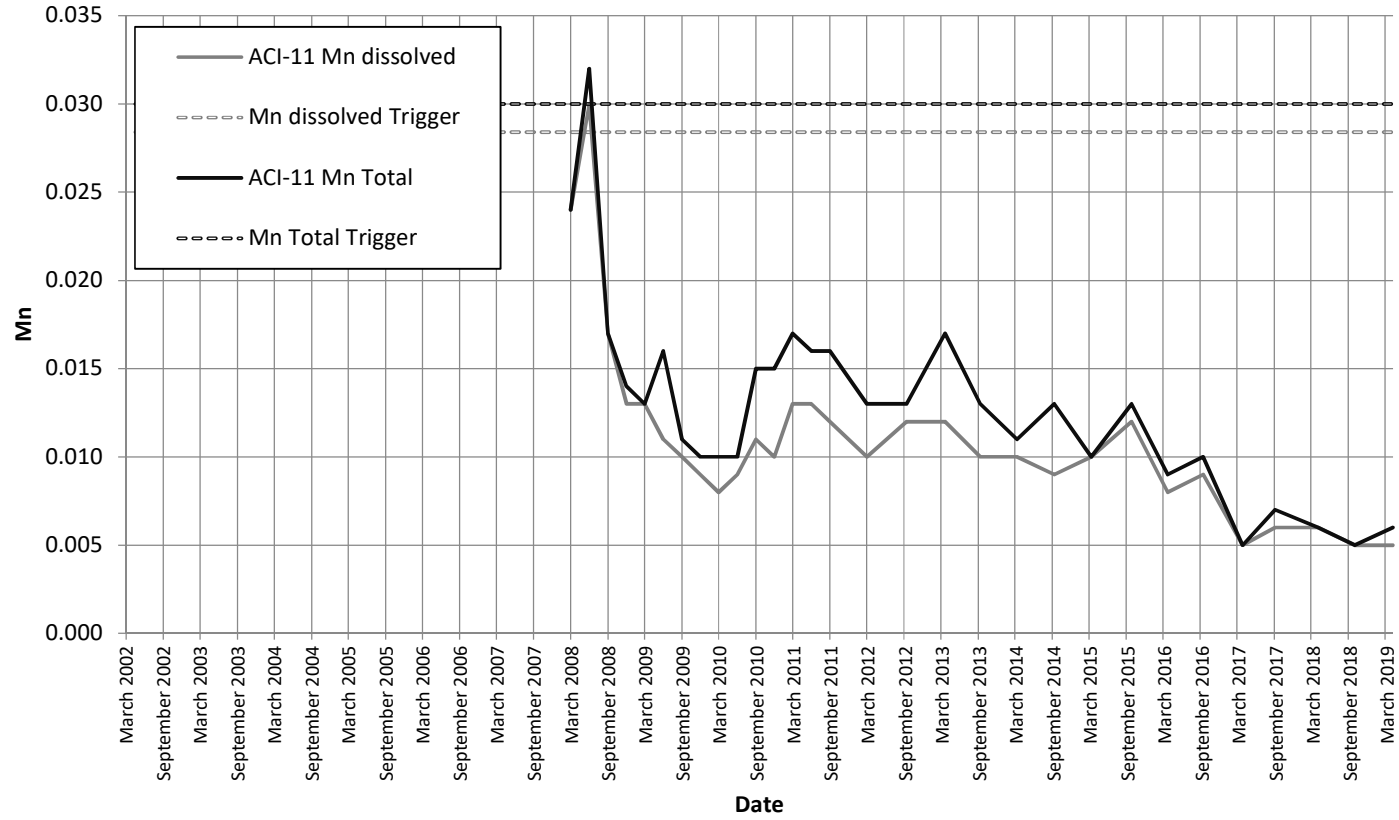
# ACI-8



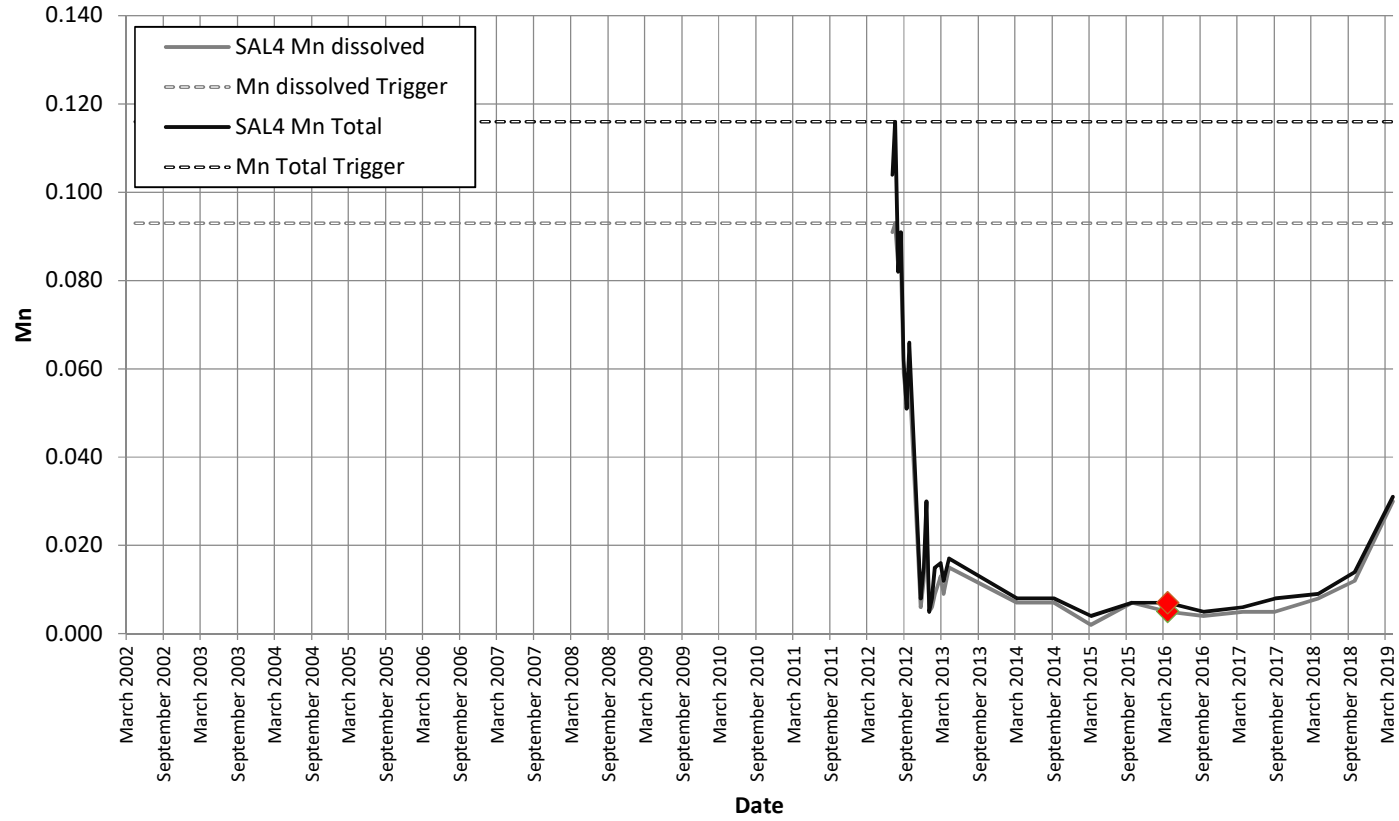
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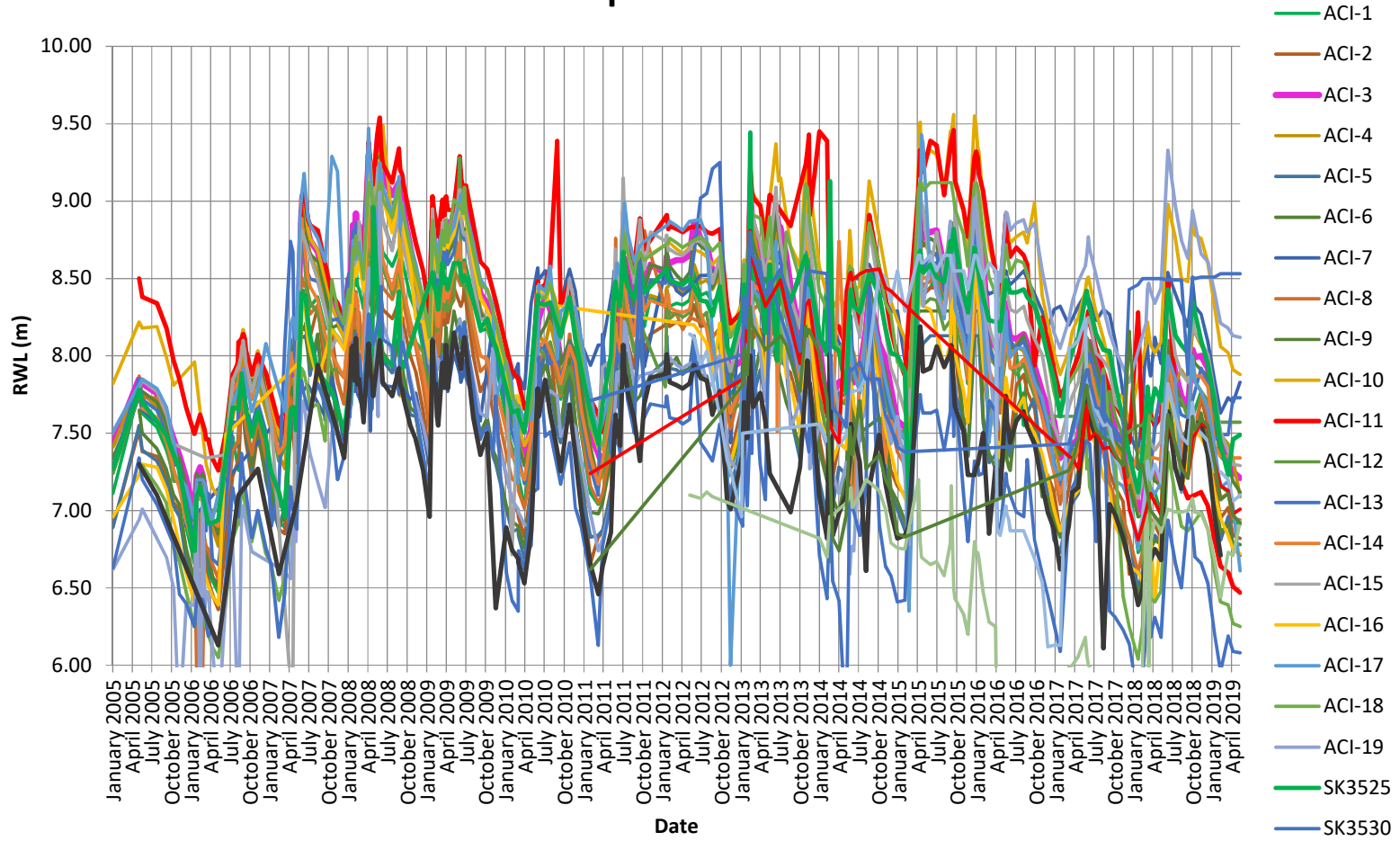
# ACI-11

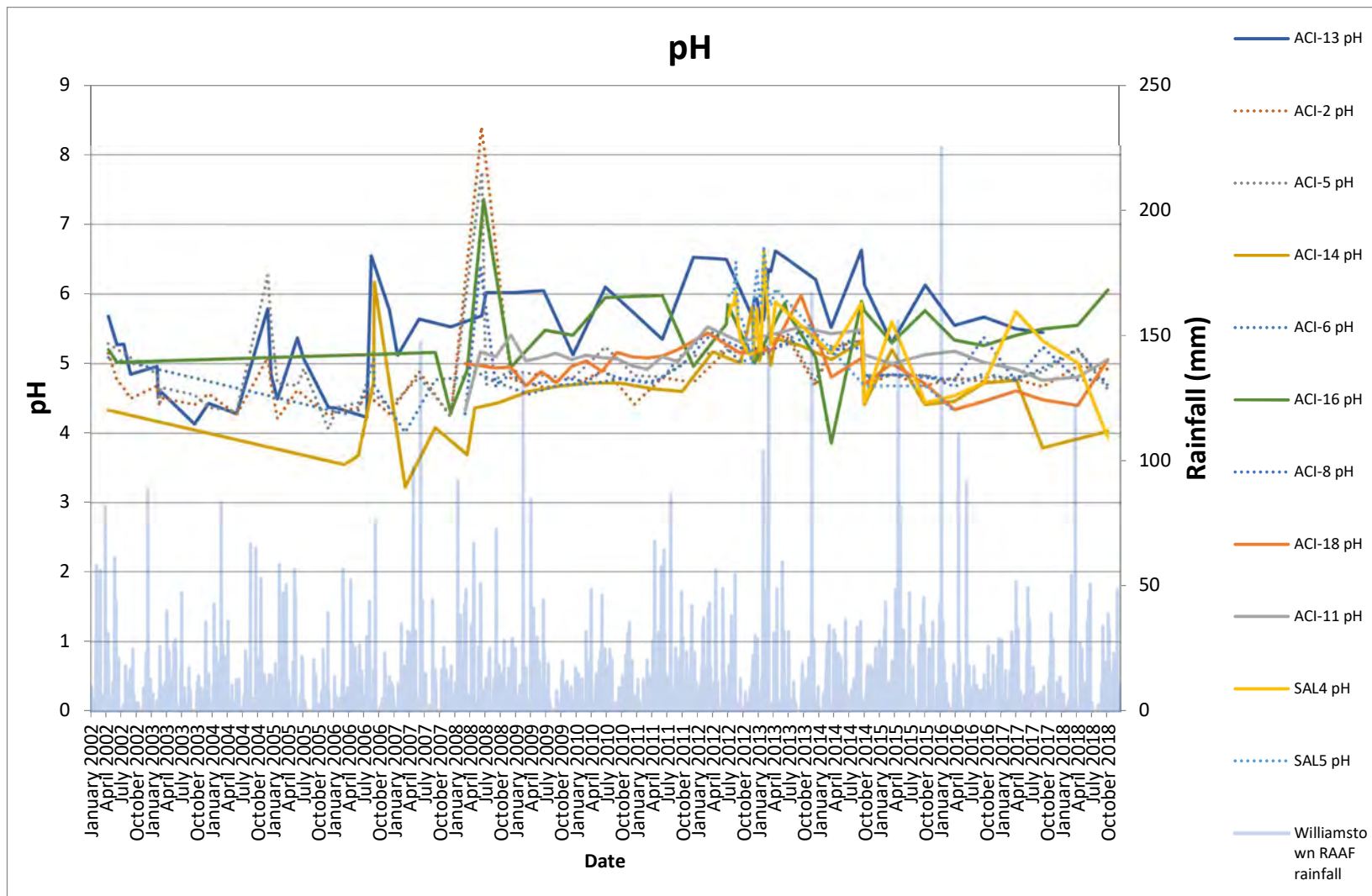


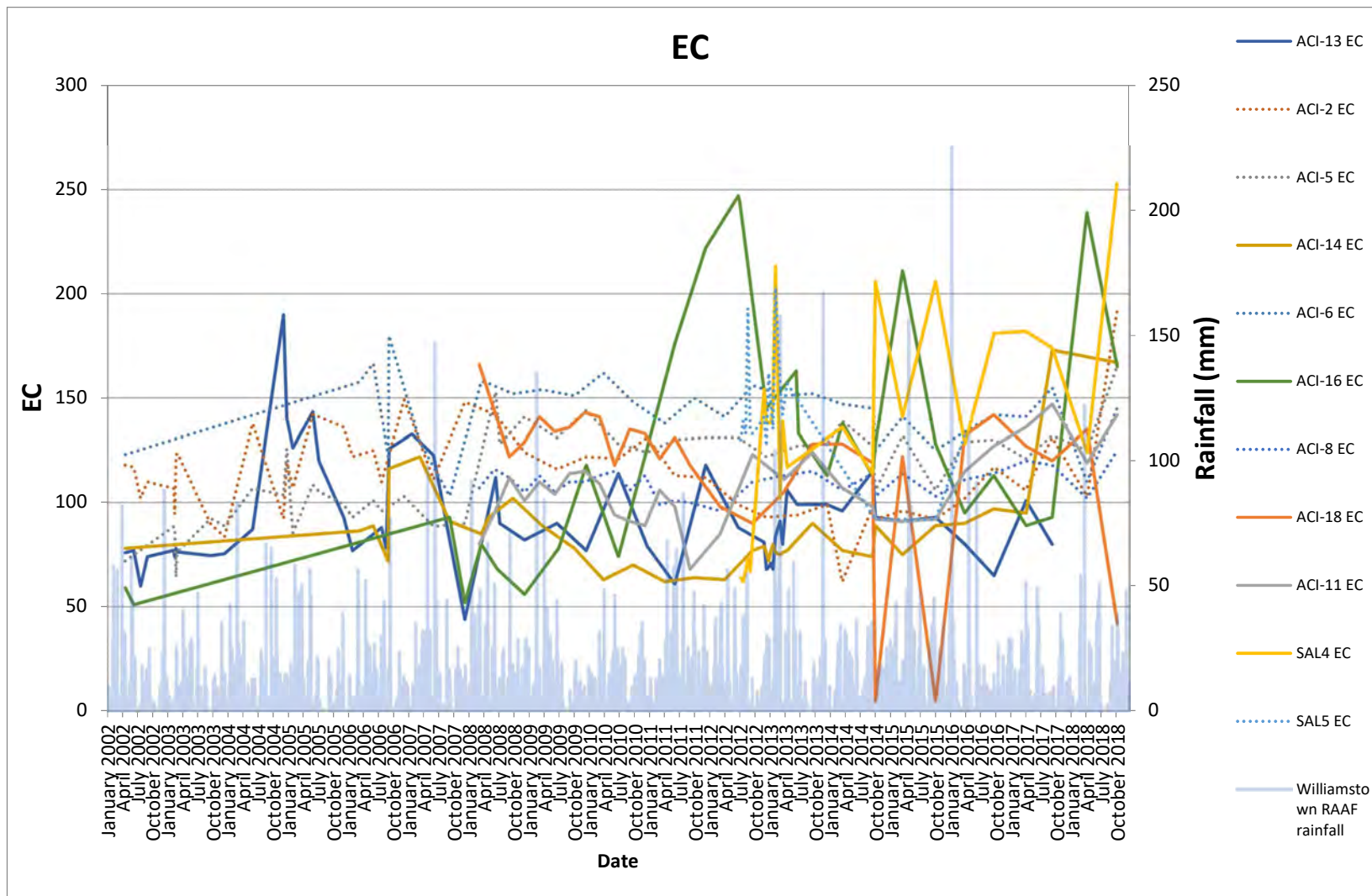
# SAL4



# All piezometers







## APPENDIX 5: Groundwater Quality Results April 2019



Monitoring Location	pH	EC	NA	K	CA	Mg	CO3	HCO3	SO4	Cl	Fe Dissolved	Fe Total	As Dissolved	As Total	Mn Dissolved	Mn Total
PIEZO1	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
PIEZO2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
PIEZO3	4.08	126	18	<1	<1	3	<1	<1	8	31	1.2	1.26	<0.001	<0.001	<0.017	<0.018

## APPENDIX 6: Supplemental monitoring



4 September 2018  
File Ref: Document1  
Document Ref: NCAP52456

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**Attention: Andrew Martin**

Delivered by email: [Andrew.Martin@sibelco.com.au](mailto:Andrew.Martin@sibelco.com.au)

**Subject: Supplemental Monitoring of the North Dunes Sand Extraction Project  
post Salt Ash fires, August 2018**

## 1. INTRODUCTION

Kleinfelder Australia was engaged to undertake a supplemental survey of the Tanilba North Dunes Sand Extraction project rehabilitation to assess the extent of the Salt Ash fires upon the revegetation. This survey was conducted by Dr. Nigel Fisher on the 28<sup>th</sup> August. Nigel is a Kleinfelder ecologist fully conversant with the revegetation on the site having conducted the rehabilitation flora monitoring on behalf of Sibelco Australia for the past five years.

This letter –

- Outlines the extent of the burn upon the rehabilitated areas;
- Proposes the long-term effects of this fire upon the rehabilitated areas; and,
- Recommendations for management actions.

## 2. EXTENT OF FIRE

To these ends the extent of the fire mapped in each rehabilitation block (**Figure 1**).

Blocks A2 and A1 to the west of Oyster Cove Rd were extensively burned, with Block A2 particularly affected. An area of vegetation that was not affected by the fires was observed on the boundary of Blocks A2 and A1 and a smaller area within Block A1 itself.

Across Oyster Cove Rd, the section of Block B1 north of the haul road, extending into Block B2 and into the vegetation between the Northern Dune Extraction area and the Northern Dune Extension was also extensively burned. At least one nest box located within this area was destroyed.

Block C appears largely unaffected by the fire.

Extending east to the progressively younger areas of the rehabilitation, most of the fire affected areas were south of the haul road, with the haul road appearing to act as a fire break. This has

resulted in Blocks D, E, F, H and I being particularly affected. The fire jumped across the haul road to burn the northern section of Block E and a small part of Block D. The boundary of the rehabilitation along Blocks J and K looks to have been used as the start of the back burn by the RFS – this appears to have limited the fire damage to only a few metres into these blocks.

The southern section of Block L and the southernmost portion of Block M were also burned.

Back burning to the north of the rehabilitation area resulted in small sections of Block K and J burning.

The youngest rehabilitation – most of Block M, Blocks N, O, P and Q were unaffected by fire.

### 3. IMPLICATIONS FOR REHABILITATION

The implications for the recovery of the vegetation on the rehabilitation will largely be dependent upon the age of the rehabilitated area affected by fire and the time since it was last burned – if applicable. The age of the various rehabilitation blocks is detailed in **Table 1**.

**Table 1: Date of rehabilitation and derived ages for each of the extraction zones in the Tanilba North Dunes Sand Extraction project.**

Block	Area	Zone	Prepared	Age of Revegetation (Years)	Affected by Fire
A1	29426	Zone 1	2004	14	Severe
A2	13988	Zone 1	Jul-05	13.5	Severe
B1	18809	Zone 1	May-05	13.5	Severe
B2	29002	Zone 1	Apr-06	12.5	Severe
C	32163	Zone 1	Nov-06	12	No
D	46773	Zone 2	Mar-07	11.5	Partial
E	24720	Zone 2	Jun-07	11.5	Partial
F	36681	Zone 2	Feb-08	10	Severe
G	25000	Zone 2	Aug-09	9	Minor
H	31900	Zone 2	Aug-09	9	Partial
I	21370	Zone 3	Jan-11	7.5	Partial
J	20107	Zone 3	Aug-11	7	Minor
K	38886	Zone 3	Jan-12	6	Minor
L	24651	Zone 4	Jul-12	6	Minor
M	33664	Zone 4	Mar-13	5.5	Minor
N	15422	Zone 4	Oct-14	4	No
O	21861	Zone 4	Jan-16	2.5	No
P	8708	Zone 4	Jul-16	2.5	No



**Figure 1:** The Tanilba North Dunes Sand Extraction Project and the rehabilitated areas by block and the extent of the August 2018 fire

As a rule, the older the rehabilitation, the more resilient to fire the vegetation will be, albeit this dependent upon the intensity of the fire. Blocks A1, A2 and B1 at 14 and 13.5 years old will have well developed seed banks with all species having had several cycles of seed set. The Eucalypts and other canopy species (*Melaleuca nodosa* and *Leptospermum polygalifolium*) were observed to have seed in the canopy. And while the intensity of the fire scorched the leaves on many of these plants they were of a size where the plants themselves and the seed should survive (**Plate 1**). The presence of the unburnt islands will act as seed sources for future revegetation (**Plate 2**). It should be stated that the vegetation community recreated on the North Dunes – Wallum Heath – is a fire adapted community with the vegetation able to respond to fire events by either re-sprouting from the base (e.g. Eucalypt species) or having seeds that require heat to germinate (e.g. *Banksia* and the legumes such as *Acacia* and *Dillwynia*).



**Plate 1:** Block A1 showing the intensity of the fire and the extent of its effect upon the vegetation (PP1)

A thin strip of unburned vegetation has remained for much of the length of the haul road stretching from Block D to parts of Block E and will also act as a seed source in the future (**Plate 3**).

Portions of Block E have now been burned twice in 3.5 years (March 2015 and August 2018) and this block was beginning to show recovery from 2015 fire. The ability of this block to revegetate to the consent requirements will now be greatly reduced.

As shown in **Plate 4**, the southern section of Blocks F, H and I were fire affected, and as rehabilitation is of a moderate age the seed bank will not be as extensive as the older rehabilitation blocks. Sibelco has conducted supplemental plantings of canopy species tube stock in these blocks after the initial seeding and planting campaigns in response to the findings of monitoring conducted by Kleinfelder (**Table 2**). These plantings – especially the

more recent plantings - may be adversely affected by the fire, and certainly most of these plants will not have sufficiently mature enough to produce large amounts of seed.

**Table 2: Summary of supplemental planting of canopy and midstory species conducted by Sibelco in Blocks F to I**

Date	Block	Species	Number
Jul 2013 to Aug 2014	F	<i>Banksia aemula</i>	1617
Aug-14		<i>Eucalyptus piperata</i>	45
Aug-14		<i>Melaleuca nodosa</i>	90
May-14	G & H	<i>Banksia aemula</i>	693
May to Aug 2014	H	<i>Banksia aemula</i>	1155
May to Aug 2014		<i>Leptospermum polygalifolium</i>	2428
Jun-14		<i>Melaleuca nodosa</i>	990
Jul-15	I & H (south side)	<i>Melaleuca nodosa</i>	675
Jun 2014 to Jul 2015	I	<i>Leptospermum polygalifolium</i>	2703
Aug 2013 to Sep 2014		<i>Melaleuca nodosa</i>	3906
Feb 2013 to Oct 2013	L	<i>Banksia aemula</i>	12, 500
Sep-13		<i>Eucalyptus camfieldii</i>	90
Nov-13		<i>Eucalyptus piperita</i>	270
Nov-13		<i>Melaleuca nodosa</i>	495

This is also a concern for the small portion of Block M that has been affected by fire (**Plate 5**). This area has only been rehabilitated for about 4 years. This is insufficient time for shrub and ground cover species to produce great quantities of seed, while the canopy species will have produced no seed. Additionally, the surrounding vegetation has been burned which will limit its ability to act as an immediate seed source – although it will recover eventually provided a sufficient period between fires occurs.





**Plate 2: BI A1 showing unburned section of vegetation which will act as seed source and increase the rate of natural revegetation (PP3)**



**Plate 3: BI D - looking south east from the haul road showing the unburned vegetation that runs parallel to the haul road with the burned areas visible in the background (PP13)**





**Plate 4: Block I - looking south showing the extent and intensity of the fire on this block (PP12)**



**Plate 5: Block M (south) looking east showing the extent of the fire damage (PP14)**



#### 4. CONCLUSIONS AND RECOMMENDATIONS

There can be no doubt that this fire event has adversely affected parts of the rehabilitation on the North Dunes. It is fortunate that the youngest areas were not greatly affected, with Block M the exception. The oldest rehabilitated blocks should recover with time – they will have built up a substantial seed bank and there were surviving areas of vegetation to act as a seed source.

The extent of the fire outside the mining lease will reduce the ability of Sibelco staff to collect seed for use in any re-seeding efforts and outside seed collections or collecting from further afield may be required.

The supplemental plantings of tube stock of the key species may also have been adversely affected with the younger plantings killed by the fire.

The extent of bare ground now exposed provides an opportunity to plant into – further canopy species for instance – and a challenge as weed species such as African Lovegrass (*Eragrostis curvula*) and Whisky Grass (*Andropogon virginicus*) will be able to colonise these areas.

Recommendations include:

1. Monitoring to determine what species have survived and their proportions – it is suggested that January will be sufficient to allow for germination and recovery. This should be conducted using the existing 20m x 20m monitoring quadrats to allow for direct comparison. The final scheduled monitoring has been conducted on Blocks in Zone 2, that is Blocks D through to H. The final scheduled monitoring for Blocks I is due in October 2019, while Blocks L and M are due in October 2020 and 2021 respectively. Any monitoring will be outside of normal monitoring requirements;
2. Block E may require substantial remedial planting and seeding to achieve rehabilitation targets;
3. Replacement of any damaged or destroyed nest boxes now – when access is relatively easy compared to when vegetation begins to recover;
4. Sibelco staff to conduct regular weed control operations in these areas to help control their spread;
5. If monitoring indicates a lack of key species, a renewed planting effort to bring numbers up to target;
6. The southern section of Block M and perhaps Block L will require replanting of key species. These areas will also require either establishment of additional 20m x 20m quadrats or utilisation of the current annual monitoring technique – 4m<sup>2</sup> quadrats every 15m.

Sincerely,

**Kleinfelder Australia Pty Ltd**

**Nigel Fisher** BSc (Hons) PhD

Restoration Ecologist

Senior Soil Microecologist

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## APPENDIX 7: Vegetation monitoring report

10 September 2018

Document No: NCA18L83922

**Attention: Andrew Martin**

Sibelco Australia

PO Box 114

Tanilba Bay NSW 2319

**Delivered by email:** [Andrew.Martin@sibelco.com.au](mailto:Andrew.Martin@sibelco.com.au)

**Subject: Recommended management actions for the Northern Dune Extraction and Northern Dune Extension Areas following the July 2018 biannual rehabilitation monitoring**

This letter provides a summary of the data and results from the July 2018 vegetation rehabilitation monitoring event, as part of the biannual monitoring of the rehabilitation on the Northern Dune Extraction and Northern Dune Extension Areas. The data collected during the July 2018 monitoring will also be included as part of the Annual Vegetation Rehabilitation Monitoring Report.

This letter provides specific management actions for each monitored rehabilitation block (i.e. blocks O and P in the North Dune Extraction Area and Block Q1 in the North Dune Extension Area) as well as general management actions for all rehabilitation areas.

Should you have any questions relating to the rehabilitation monitoring, please contact me on the details below.

If you require further information, please do not hesitate to contact me.

Kind regards

**Dr. Nigel Fisher**

Ecologist

[nfisher@kleinfelder.com](mailto:nfisher@kleinfelder.com)

Ph: 0407 657 583

## 1. MANAGEMENT ACTIONS

### Block O

This is the fourth biannual survey undertaken on this block. The rehabilitation of the key species is progressing well with three species, *A. costata*, *C. gummifera* and *L. polygalifolium* above target, while another species (*E. piperita*) has increased numbers from the previous survey (**Table 1**). Three species (*B. aemula*, *L. polygalifolium* and *M. nodosa*) have remained largely unchanged. The remaining two species (*L. trinervium* and *X. glauca*) have decreased since the last survey.

**Table 1: Summary of Block O survey results and comparison to previous surveys and targets for key species**

Species	Jul-18 Survey	Target	% of Target Achieved	% Change (from previous survey)	Jan-18 Survey	Jul-17 Survey	Jan-17 Survey
<i>Angophora costata</i>	451	175	258	59.93	282	451	2761
<i>Banksia aemula</i>	2817	5684	50	2.03	2761	2366	3155
<i>Corymbia gummifera</i>	2479	175	1418	51.71	1634	1240	563
<i>Eucalyptus piperita</i>	282	656	43	66.86	169	338	282
<i>Leptospermum polygalifolium</i>	2648	2623	101	4.46	2535	2028	2254
<i>Leptospermum trinervium</i>	507	2973	17	-60.88	1296	620	56
<i>Melaleuca nodosa</i>	4845	6121	79	0.00	4845	4564	5465
<i>Xanthorrhoea glauca</i>	225	No defined target	NA	-50.11	451	56	169

Average cover has increased substantially to approximately 66%, with continued vandalism due to illegal vehicular access having a noticeable, but localised effect on vegetation growth. A major component of the total cover is however composed of exotic grasses including *Andropogon virginicus* (Whisky Grass), *Axonopus fissifolius* (Narrow-leafed Carpet Grass), *Digitaria sanguinalis* (Summer Grass) and *Eragrostis curvula* (African Lovegrass). This last species has continued to spread from the powerline easement and was recorded in 73 plots this survey compared to 62 plots last survey. Urgent weed control efforts are now required to prevent the exotic grass species becoming totally dominant on this block.

This block is also somewhat deficient in overall diversity with any of the monitoring plots only recording planted native species or the dominant *Acacias*.

## Block P

This is the fourth survey undertaken on Block P and as such it is at the intermediate stage of rehabilitation. An extensive planting effort on this block of the key species has resulted in five of these species already achieving or near achieving targets (**Table 2**). These species are *B. aemula*, *C. gummifera*, *E. piperita*, *L. polygalifolium*, and *M. nodosa*. No *L. trinervium* individuals were recorded during the survey and none were observed incidentally.

Average cover on this block is 51%, remaining unchanged from the previous January survey when it was recorded at 53%.

This block continues to progress satisfactorily and the annual survey in January 2019 will determine what if any remedial planting is required. No weed species were observed during the survey.

**Table 2: Summary of Block P survey results and comparison to the targets for key species**

Species	Jul-18 Survey	Target	% of Target Achieved (Jul-18)	% Change (from previous survey)	Jan-18 Survey	Jul-17 Survey	Jan-17 Survey
<i>Banksia aemula</i>	2847	2264	126	13.33	2512	2456	3266
<i>Corymbia gummifera</i>	279	70	401	-28.57	391	335	115
<i>Eucalyptus piperita</i>	726	261	278	0.00	726	447	745
<i>Leptospermum polygalifolium</i>	1116	1045	107	-25.93	1507	1228	1146
<i>Leptospermum trinervium</i>	0	1184	0	-100.00	167	167	115
<i>Melaleuca nodosa</i>	1786	2438	73	0.00	1786	2177	2635
<i>Xanthorrhoea glauca</i>	502	No defined target	No defined target	-35.71	781	949	401

## Block Q1

This is the second survey conducted for this block and as such is in the early stages of revegetation. The extensive planting program has resulted in several of the key species achieving or nearly achieving target – a good result for this early in the revegetation effort. For instance, *C. gummifera* is well above target, with *B. aemula* and *B. serrata* and *L. polygalifolium* close to target. *E. piperita*, *L. trinervium* and *M. nodosa* are all below target numbers.

*C. gummifera* and the *Banksias* numbers have remained largely unchanged for the previous survey, *E. piperita* numbers have increased but were not recorded in the previous survey, while the remaining species have decreased.

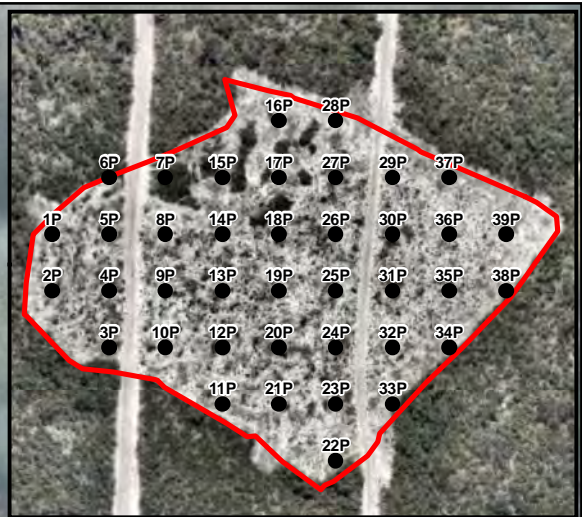
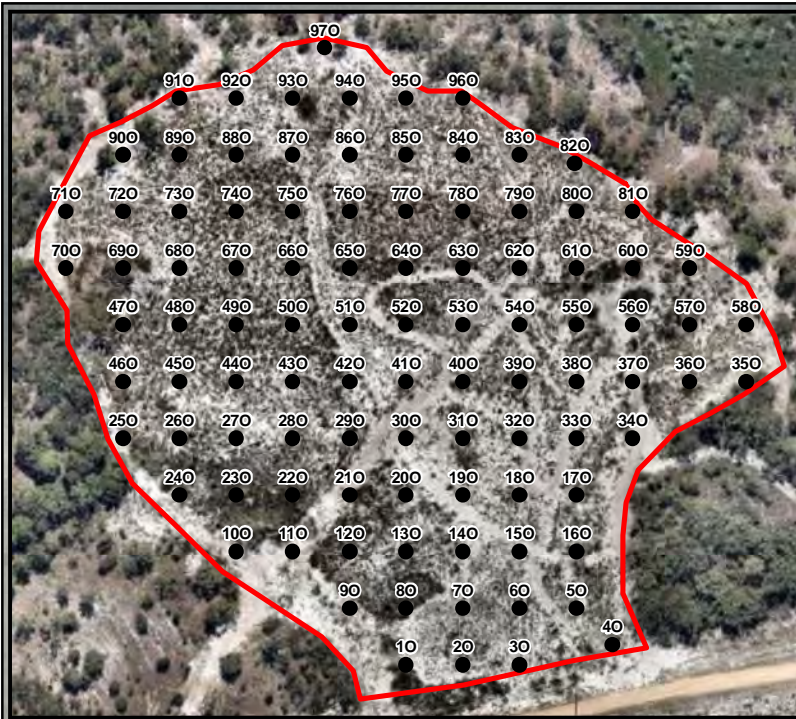
Average cover 36% has remained unchanged from the previous survey.

**Table 3: Summary of Block Q1 survey results and comparison to the targets for key species**

Species	Jul-18 Survey	Target	% of Target Achieved	Jan-18 Survey	% Change (from previous survey)
<i>Banksia aemula/serrata</i>	2750	3869	71	2588	6
<i>Corymbia gummifera</i>	1456	119	1223	1402	4
<i>Eucalyptus piperita</i>	162	446	36	0	NA
<i>Leptospermum polygalifolium</i>	1510	1786	85	1995	-24
<i>Leptospermum trinervium</i>	0	2024	0	1617	-100
<i>Melaleuca nodosa</i>	1456	4166	35	1995	-27
<i>Xanthorrhoea glauca</i>	270	No defined target	No defined target	216	25

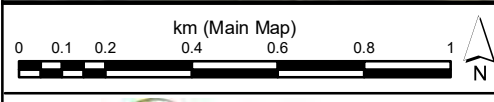
As mentioned in the Annual Monitoring Report (January 2018) for this block, revegetation is progressing very well in the eastern strip next to the haul road, while the main body of this block – between the haul road and Rutile Rd to the north – lacks diversity and is very weedy. It is acknowledged that the top soil used for the rehabilitation of this section was not of the best quality in terms of native vegetation and seed quantity which has resulted in revegetation that is deficient in diversity. Grassy weeds are present along the haul road and in the northern section mentioned above. Sibelco has undertaken some control efforts of the grasses, but a recommendation is made to increase weed control efforts to facilitate the establishment and spread of native vegetation.





**Legend**

- Block Boundaries (O, P, Q1)
- Other Block Boundaries
- Survey Point



PROJECT REFERENCE: 20191179  
 DATE DRAWN: 10/09/2018 10:53 Version 1  
 DRAWN BY: gjoyce

## Survey Point Locations

FIGURE:  
  
**1**



DATA SOURCE:  
Nearmap - 2018

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 June 2018



## Management Actions

### *Planting*

Re-vegetation has been completed on the three blocks surveyed. **Figure 2** through to **Figure 8** provide plot locations where each of the key species were recorded. For each of the species in turn:

1. *Angophora costata* (**Figure 2**) – a key species for Block O only. Many self-sown seedlings observed on the periphery of the block, and given the advanced stage of most of the vegetation any further planting would be difficult and unlikely to succeed. No further planting recommended;
2. *Banksia aemula* (**Figure 2**: Presence and absence of *Angophora costata* from the survey plots

3. Figure 3) – no further planting is required;
4. *Corymbia gummifera* (**Figure 4**) – this species is over target in all three blocks surveyed. No further planting is required;
5. *Eucalyptus piperita* (**Figure 5**) – this species has increased in recorded numbers from the previous survey. Numbers are low in Block Q1 but improving. No further planting is required;
6. *Leptospermum polygalifolium* (**Figure 6**) - this species has satisfactory abundance throughout all three surveyed blocks due to the planting program. No further planting required;
7. *Leptospermum trinervium* (**Figure 7**) – this species is seeded from brush matting and/or the seed bank. This species has decreased across all three blocks and was not recorded from Blocks P or Q1 this survey. Its disappearance is suggested to be a result of the drier than usual conditions experienced since the January 2018 surveys combined with the young age and small size of most of the plants observed at that survey. Monitoring in January 2019 will determine whether remedial planting is required;
8. *Melaleuca nodosa* (**Figure 8**) – this species is not at target in any of the surveyed blocks but is over 70% in Blocks O and P, with fairly low numbers in Block Q1. Further planting should be considered for this species in Block Q1; and,
9. *Xanthorrhoea glauca* (**Figure 9**) – a visual inspection of the blocks shows that this species is, because of the transplanting program, present throughout the revegetation area, and has been observed seeding prolifically. No further planting is recommended.

### **Weed Control**

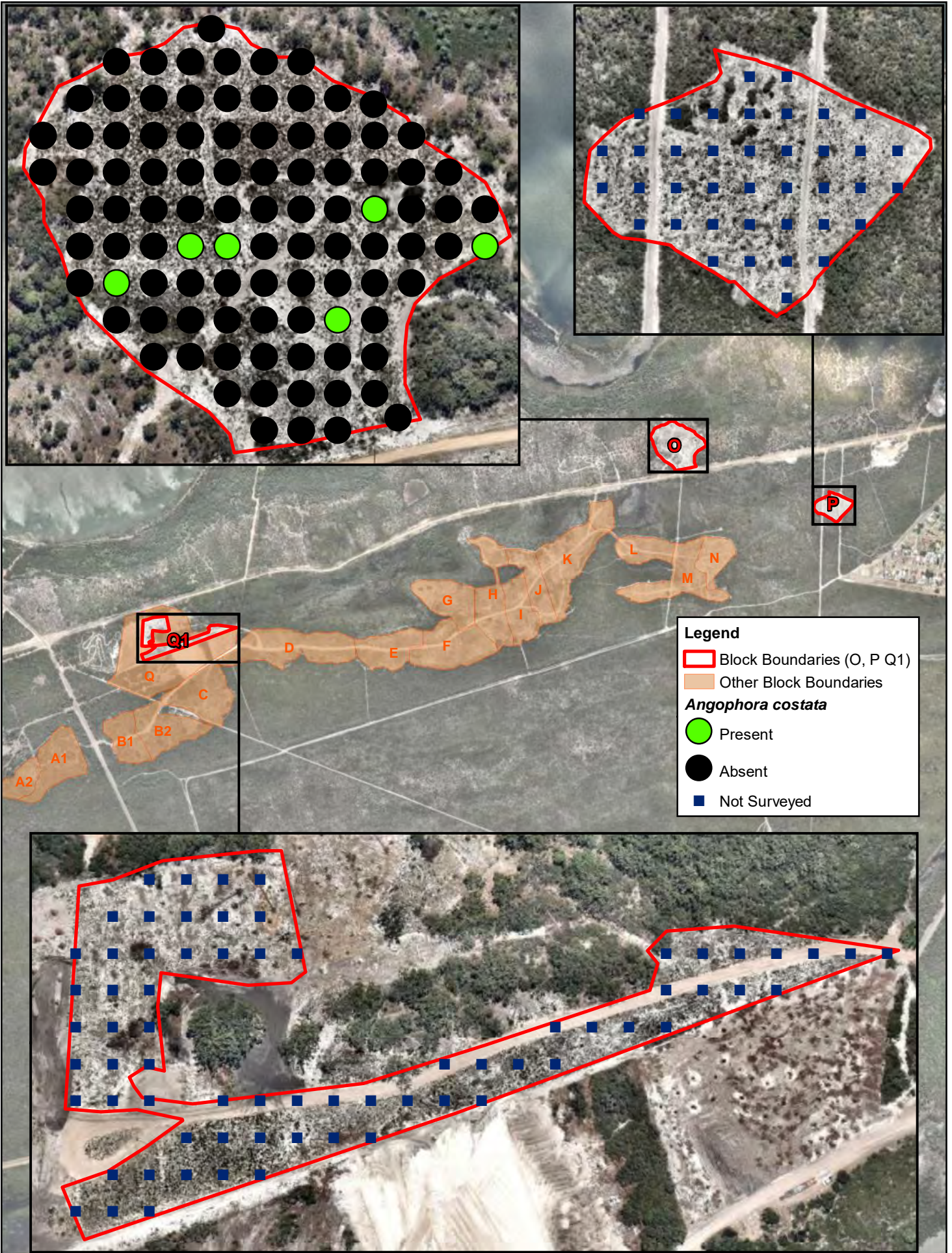
Block P does not have a weed problem, with no weed infestations recorded. Block O and Q1 as noted above, require weed control work to be conducted on the introduced grasses. This should be undertaken as soon as possible to help control the spread of these grasses into the newly revegetated areas. Rutille Road (near Blocks O and Q1) acts as a weed vector with many of the exotic grasses, lantana and other weeds present and outside of Sibelco's responsibility. This makes weed control both more of an imperative, but also increases the required frequency and cost of weed control efforts.

### **General Considerations**

Block O and the northern section of Block Q1 would benefit from increased biodiversity. However, as mentioned previously Block O is at a relatively advanced stage of revegetation and any seeding and/or planting program would need to be coordinated with a weed control program and/or disturbance such as fire. Block Q1 (north) is still at early stage of revegetation and seeding or additional planting could be undertaken.







0 0.1 0.2 0.4 0.6 0.8 1 km (Main Map)

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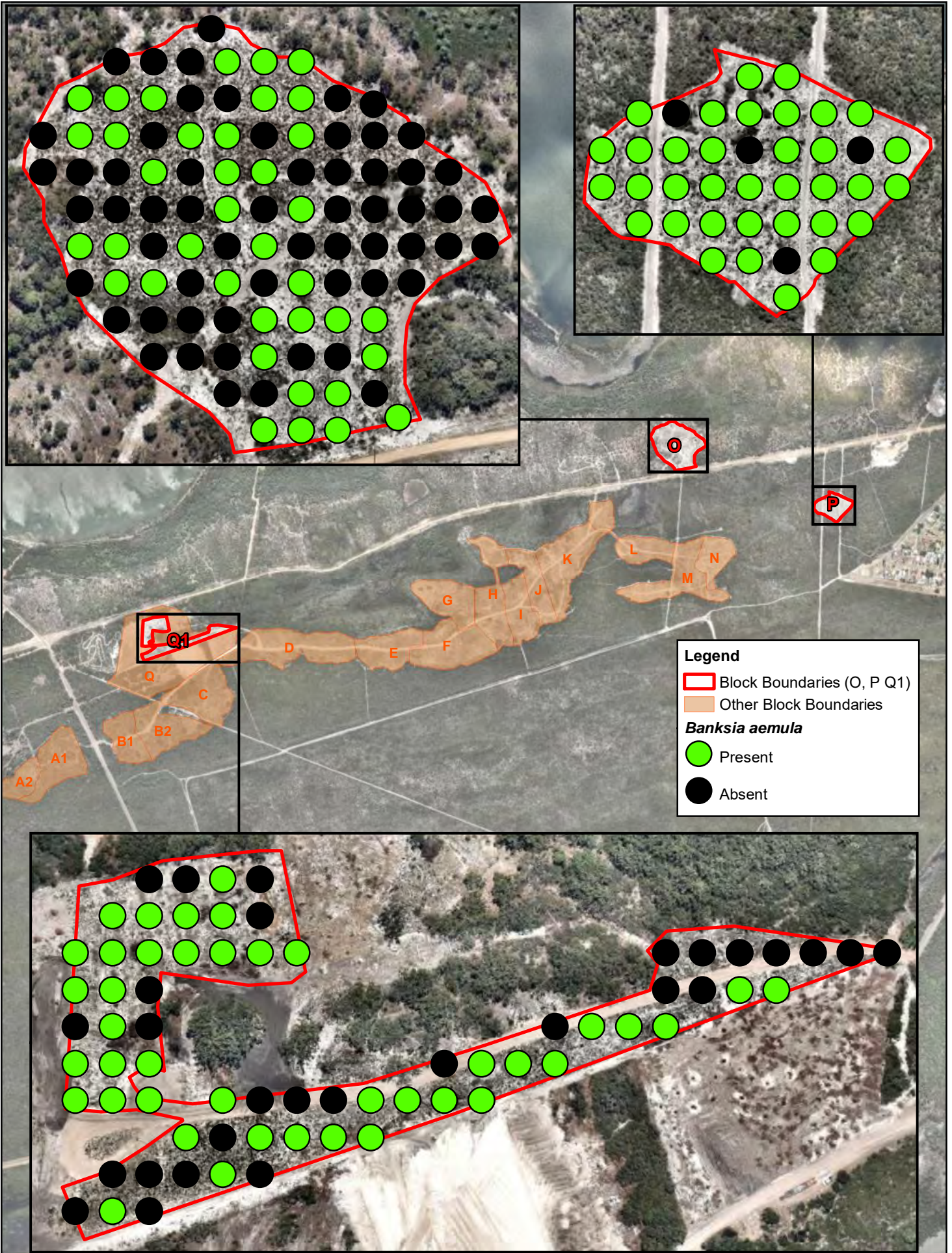
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Presence/Absence of  
*Angophora costata*

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FIGURE:  
**2**





0 0.1 0.2 0.4 0.6 0.8 1

km (Main Map)

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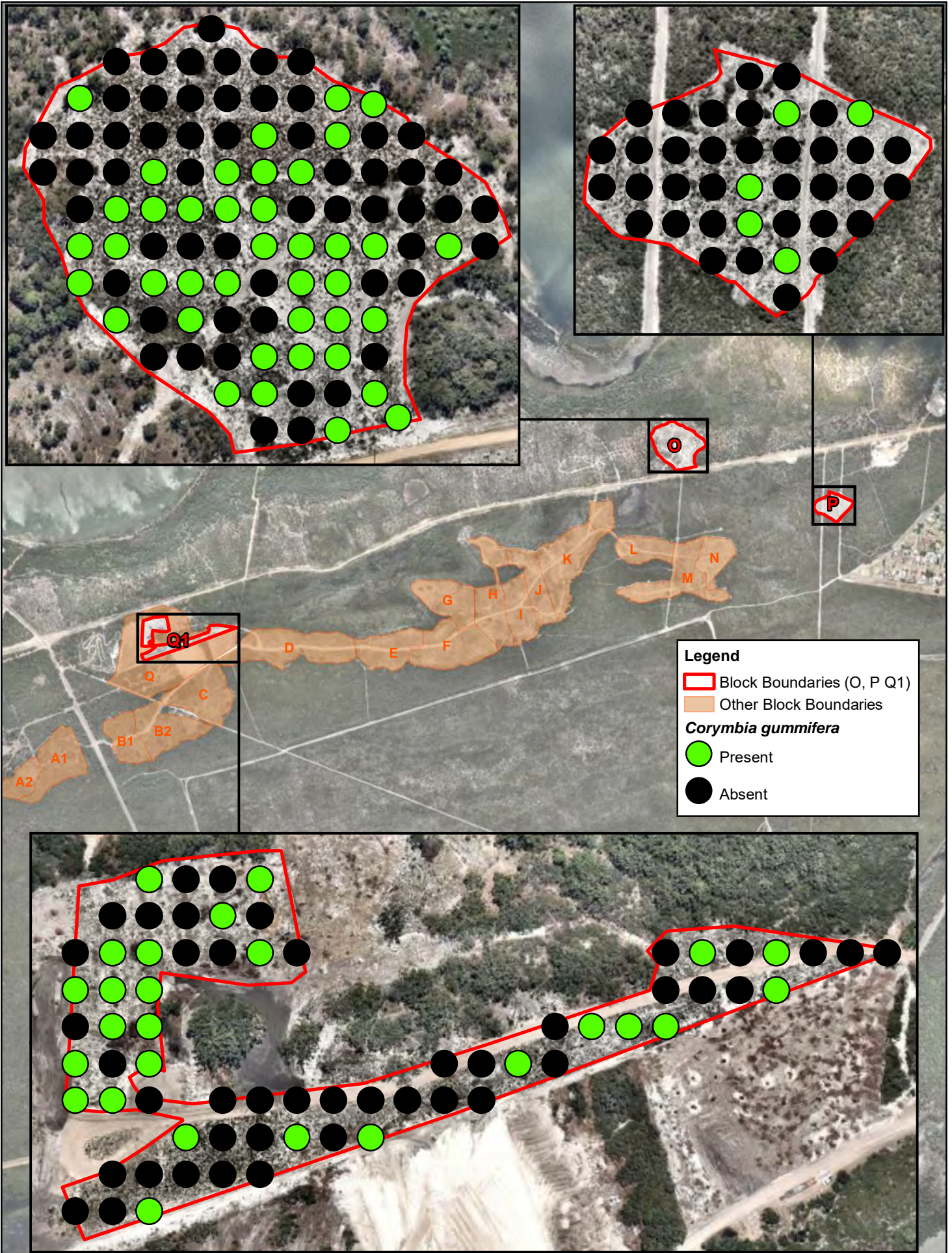
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Presence/Absence of  
*Banksia aemula*

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FIGURE:  
**3**





0 0.1 0.2 0.4 0.6 0.8 1  
km (Main Map)

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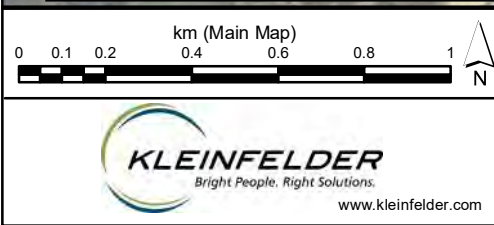
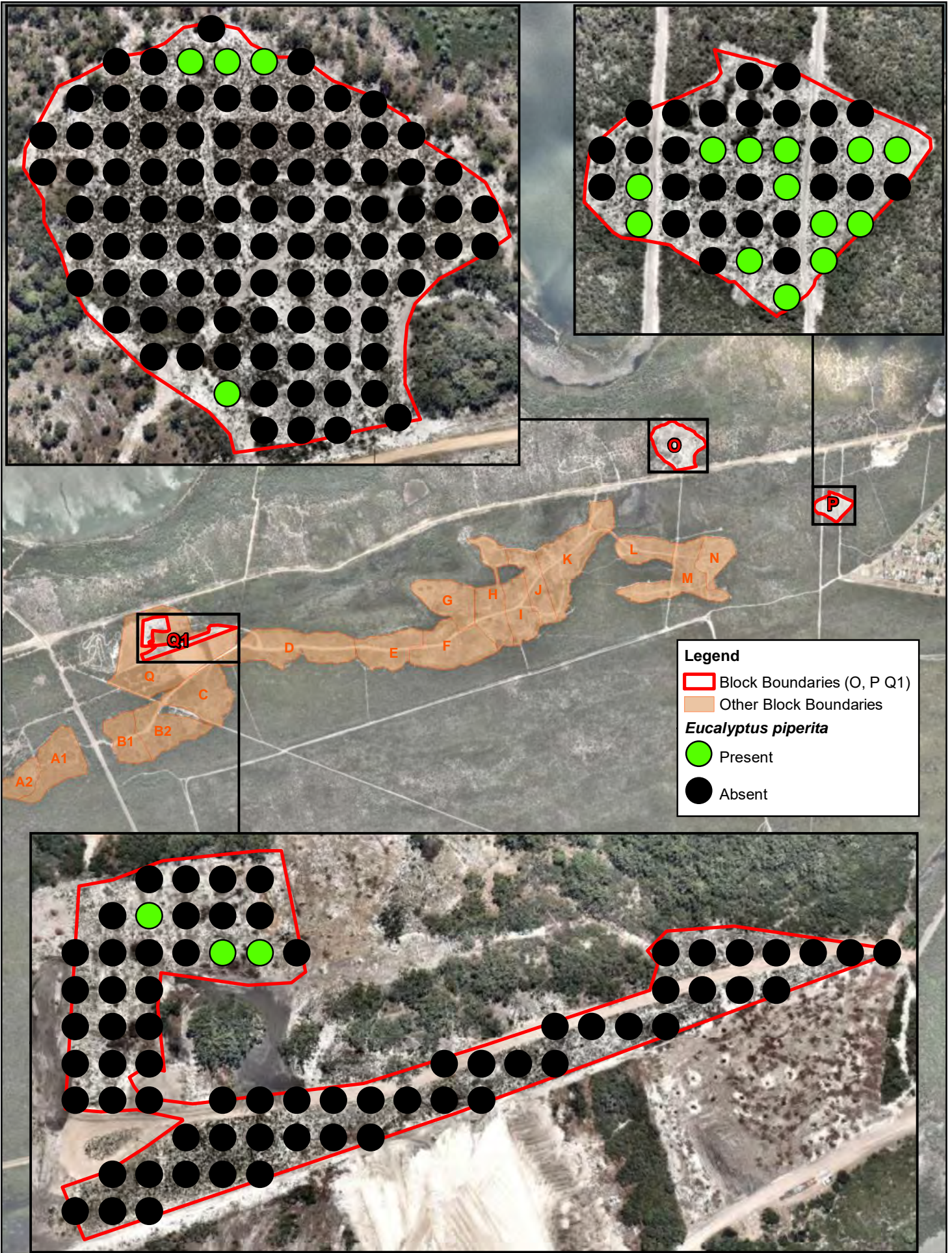
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Presence/Absence of  
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FIGURE:  
4





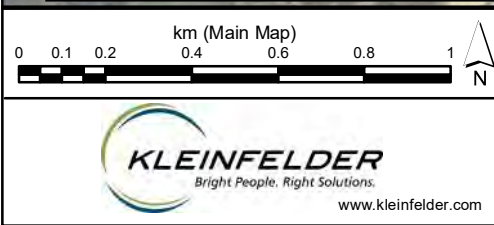
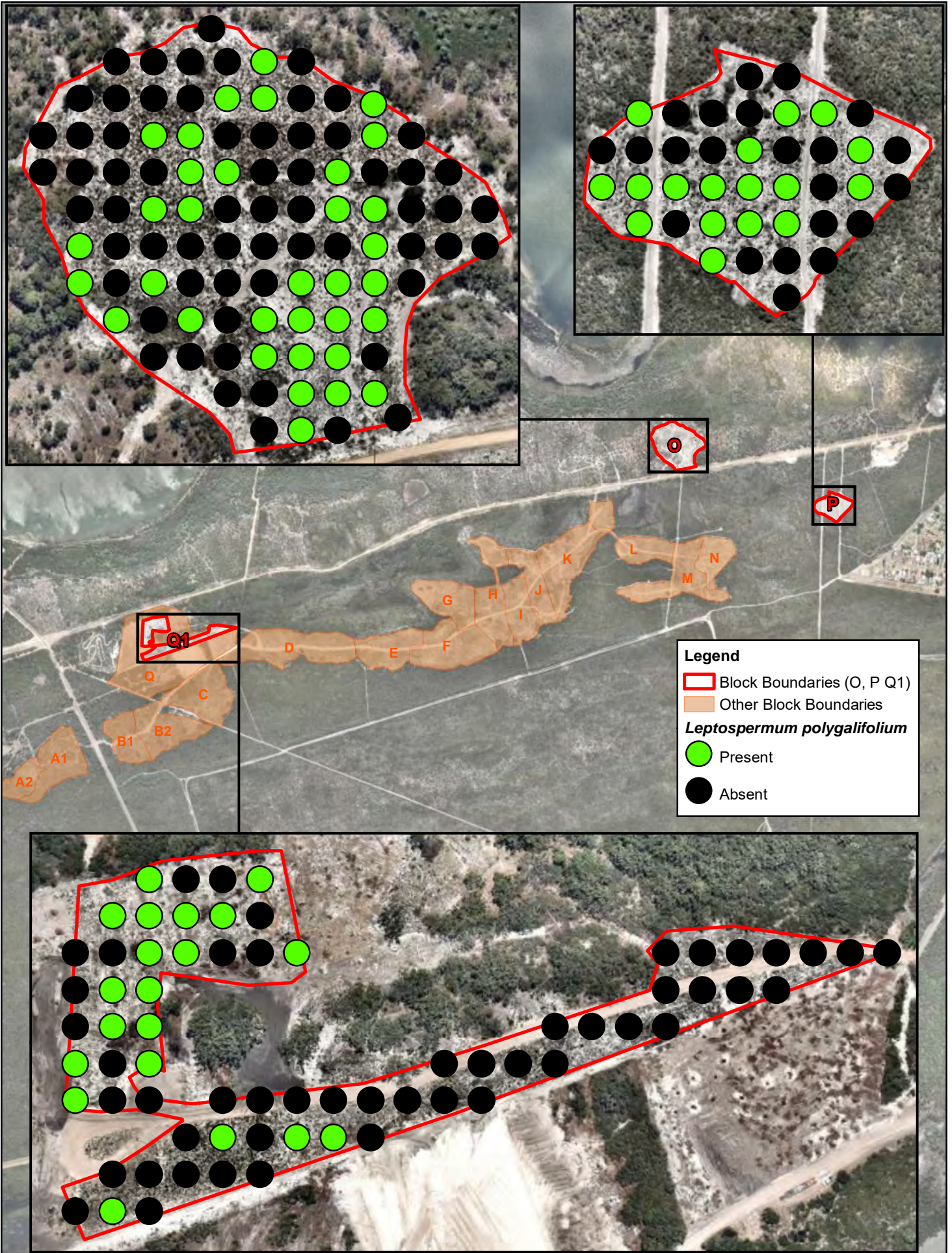
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Presence/Absence of  
*Eucalyptus piperita*

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FIGURE:  
 5





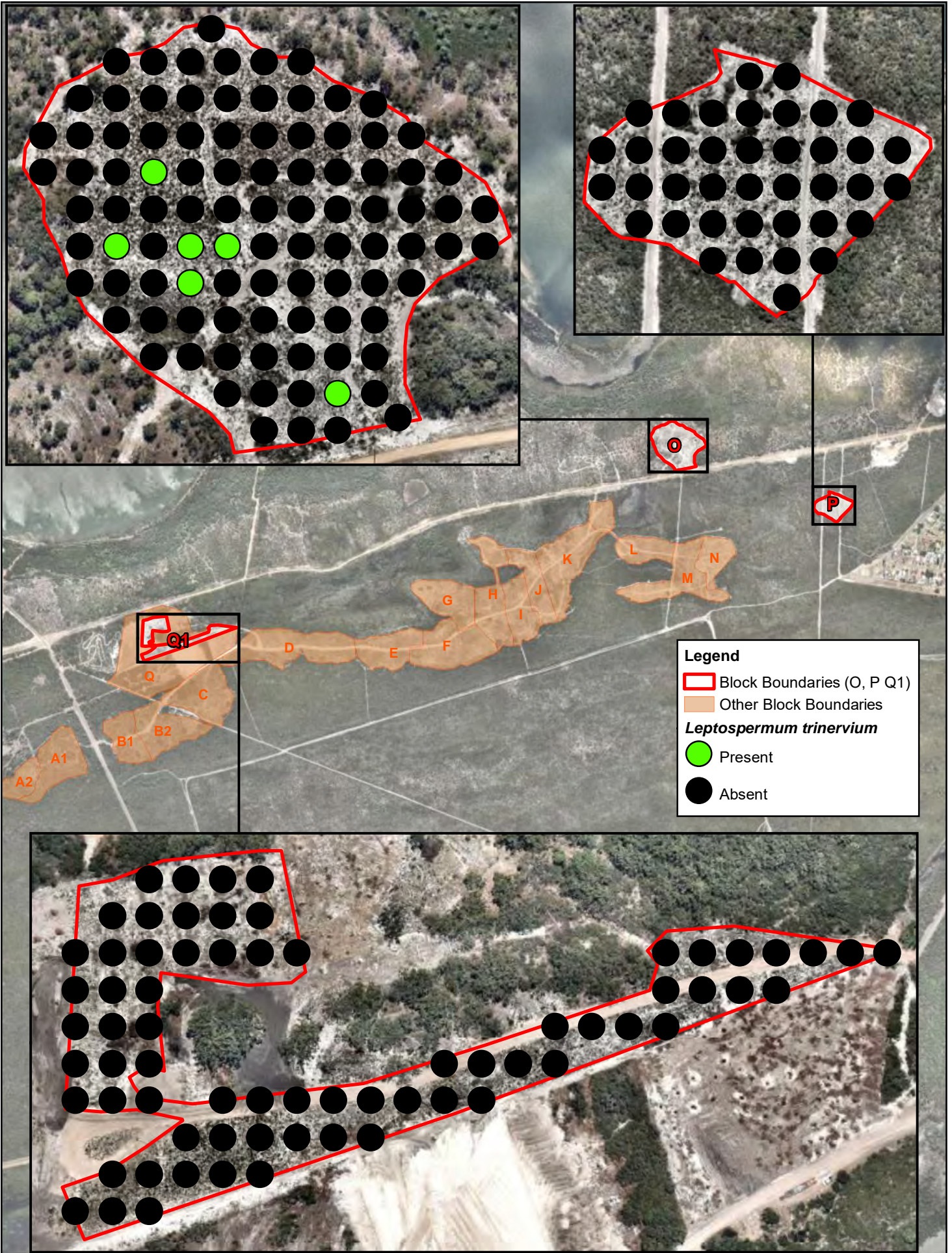
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Presence/Absence of  
*Leptospermum polygalifolium*

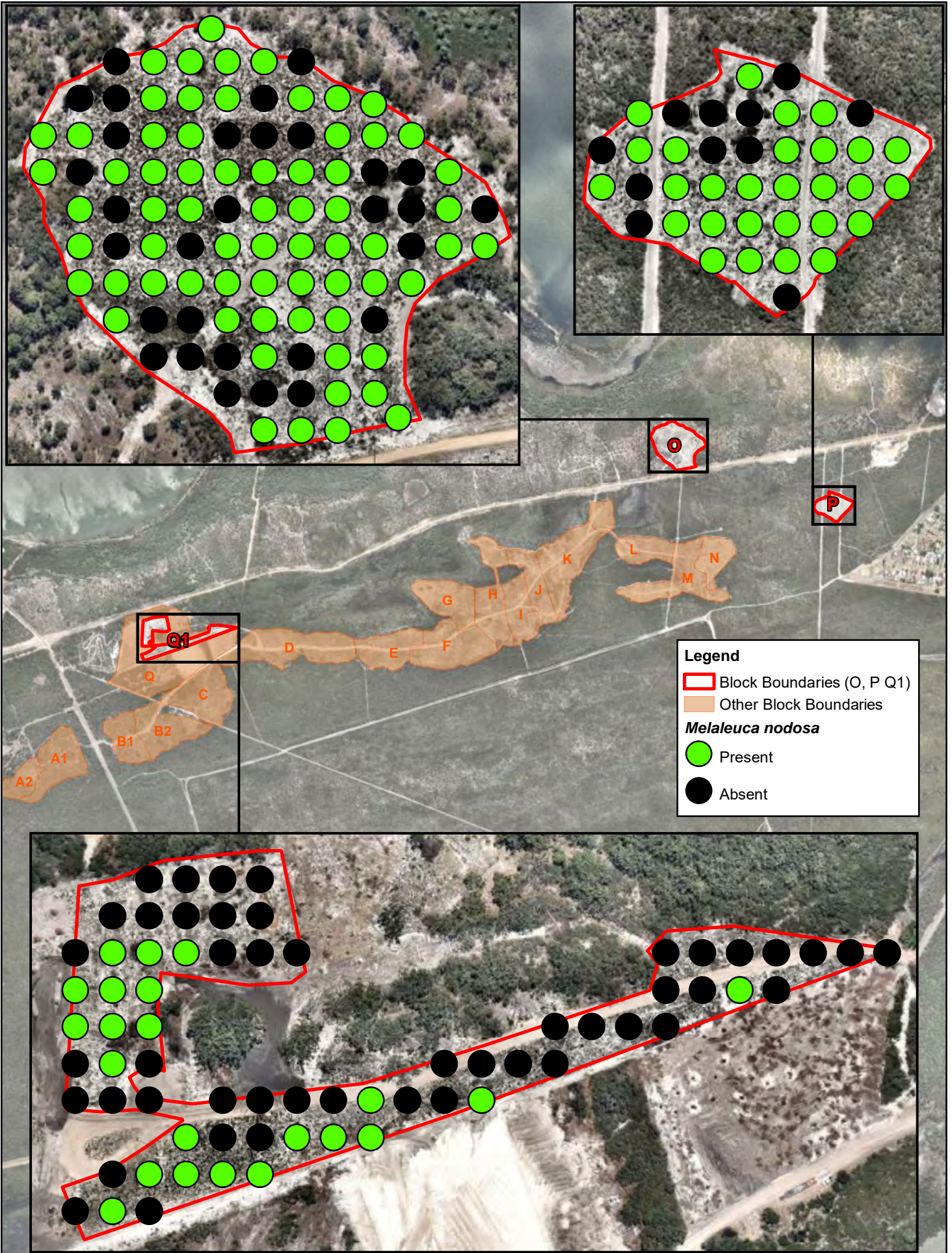
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 June 2018

FIGURE:  
 6









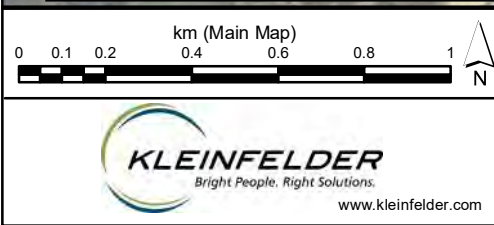
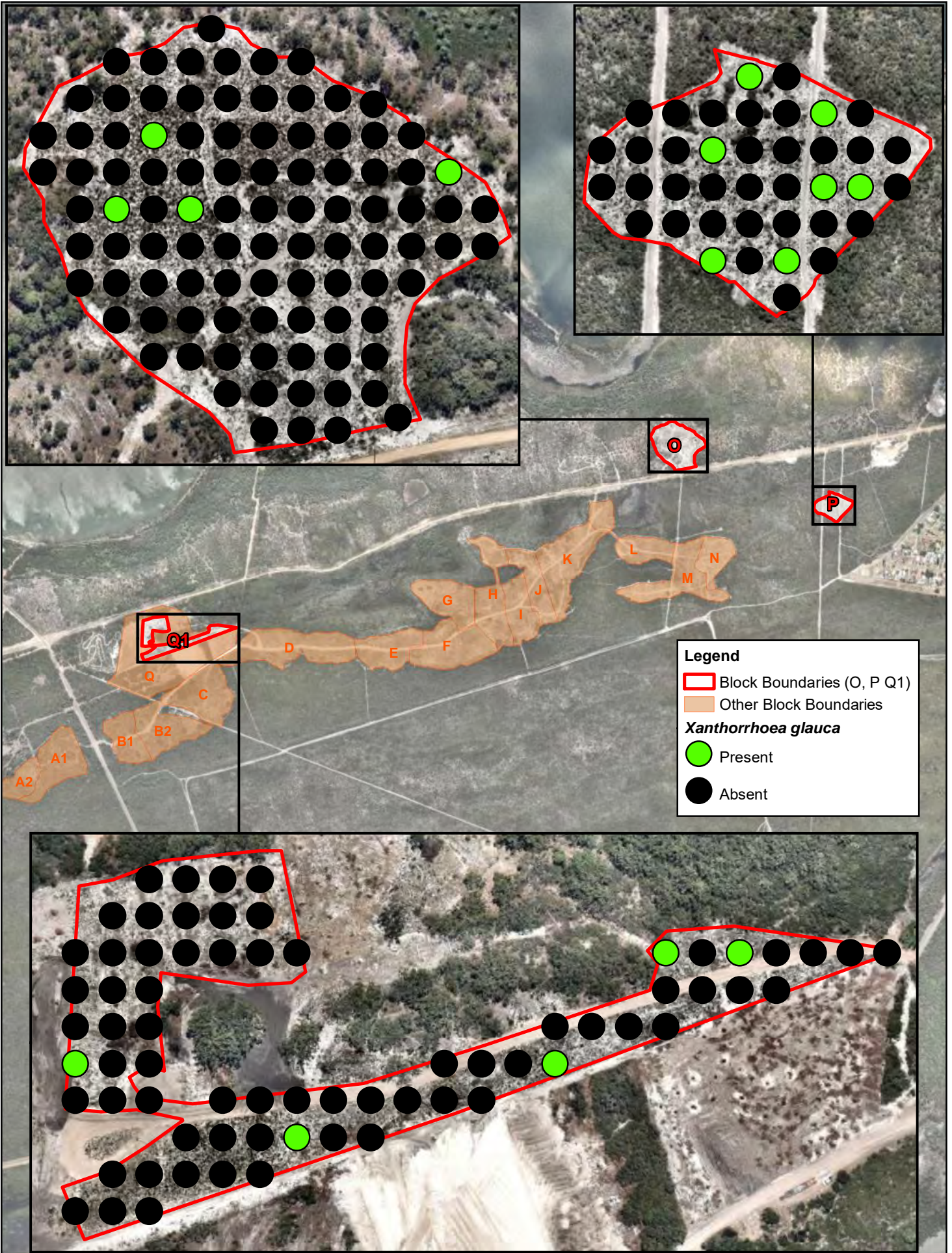
Presence/Absence of  
*Melaleuca nodosa*

FIGURE:  
8

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PROJECT REFERENCE: 20191179  
 DATE DRAWN: 10/09/2018 11:16 Version 1  
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 DATA SOURCE:  
 Nearmap - 2018

Presence/Absence of  
*Xanthorrhoea glauca*

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FIGURE:  
 9

