



## OVAM Mortsel: Bi-weekly report

Soil remediation by Electric Resistance Heating

April 26 – May 10, 2024

Former Electra Site, Statielei 111 Mortsel

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## 1 Introduction

This letter report contains a brief description of the Electrical Resistance Heating (ERH) remediation system operations performed at the former Electra Site at Statielei 105 – 113 in Mortsel. The time period addressed in this report is from April 26 to May 10, 2024. **Figure 1** contains a site map displaying the locations of the thermal treatment area, electrodes, temperature monitoring points (TMPs) and other pertinent Site features.

## 2 System Operation Activities

The weeks of the reporting period involve week 18 and 19 of 2024. During this period the site was visited 4 times.

In the reporting period the following works were performed:

- Assisted with drilling for vapor measuring point in Lindenlei and Grotenhof.
- Soil vapor measurements, together with TEC.
- Installed bleed and condense valves into soil vapor extraction system.
- Dismantled drip heat tracing Statielei 105 and 107.
- Changed drip sequence to increase drip traceability.
- General checks and equipment maintenance
  - General data collection and inspections
    - PID measurements
    - Relative humidity measurements
  - Drained the condensate in the VGAC vessels and influent hose blowers.
  - Drained cooling water from SC.
  - Blower oil change.

## 3 ERH Application Summary

The ERH system operational parameters from the current reporting period are presented in **Table 1** below.

**Table 1. ERH System Parameters**

ERH System Parameters	Estimated	Up to May 10th	Percentage of total
Operation Time (days)	137 <sup>1</sup>	171 <sup>3</sup>	125%
Cumulative Energy Applied (MWh)	3.800 <sup>2</sup>	3.022	80%

Total energy for ERH and auxiliary Equipment was ca. 3.022 MWh. ERH was completely shut off on April 17<sup>th</sup>, the electricity consumption until that point was ca. 3.010 MWh, with ca. 2.905 MWh used for ERH.

The contractual remediation target has been met on March 18: the ERH treatment time was 118 days (86% of total estimated time). The global electricity consumption up to March 18 was ca. 2.500 MWh.

## 4 Temperature Monitoring

The site average subsurface temperature decreased during this reporting period of April 26 to May 10 to 80,5 °C. The site average subsurface temperature decreased 6,1 °C. With the shutdown of ERH, temperatures appear to decrease around 0,42 °C per day.

Subsurface temperatures at different depths per TMP location and over time are presented in **Figure 2**. The highest temperature on May 10 was 99 °C in TMP E05 at 6 m bgs.

<sup>1</sup> Extra days for higher concentrations in soil not included.

<sup>2</sup> Extra energy for higher concentrations in soil not included.

<sup>3</sup> This is with regard to the days that ERH was not active.



In total 4 shallow RTD's are installed near utilities (Statielei 109 front and Statielei 113 back) to measure the temperature close to the utilities. May 10 the average temperature at the utility RTDs is 38,4 °C, the maximum temperature is 45,4 °C in RTD T1 (SL 109 front). It is observed that the temperature near the utilities is decreasing at an increased rate.

## 5 Vapor Recovery

During the reporting period the vacuum applied to the vapor recovery piping system (as measured at the condenser inlet) was maintained around 30 - 40 mbar. All pipe and field piezometer pressure measurements show negative values, indicating the system is working sufficiently to maintain negative pressure. The vapor flow rate, as measured after the vapor recovery blower, averaged circa 1.650 m<sup>3</sup>/hour.

### Vapor monitoring

During every site visit HMVT performs PID vapor measurements of the ambient air and the extracted soil vapor. The most recent PID measurement for chlorinated volatile organic compounds (CVOC) in the extracted soil vapor, collected on May 10, was 1,0 ppm. PID measurements are performed intermittently upon site visits near the electrodes that still show a high PID value.

## 6 Vapor treatment

The extracted soil vapors are treated with granular activated carbon (GAC). The emission limit, as defined in the tender document, for PCE and TCE is 100 mg/m<sup>3</sup> if total mass is higher than 2.000 g/hr. The client wants to limit the emissions to zero.

Two Mach4X vessels, containing respectively 18 and 10 m<sup>3</sup> of vapor GAC, are currently connected and functioning as vapor treatment. HMVT performs PID vapor measurements of the influent and effluent of the GAC vessels on a regular basis. During the reporting period, the PID reading of the effluent of the first GAC filter was 0,0 - 0,1 ppm. The PID reading of the effluent of the second GAC filter was 0,0 ppm. TEC will periodically take vapor samples from the influent and effluent of each vessel for analyses in the laboratory.

The activated carbon vessels had a relatively low adsorption rate. A lot of attention was spent on condensation in the VGAC vessels. Measures were taken to decrease the humidity level of the vapor stream (extra cooling and insulation of tubing). Measurements showed that relative humidity complies to the requirement as obliged, namely < 50% (at a temperature of ca. 28 - 36 °C).

HMVT also made a memo about relative humidity in the soil vapor. Condensation will probably take place on the cold vessel wall, but not in the middle of the filter. During this reporting period the activated carbon filters were drained frequently. The amount of condensate remained constant as compared to the previous period.

## 7 Condensate and water treatment

During the reporting period 16 m<sup>3</sup> of water was recovered via condensed water by the vapor recovery system. This is a 10-fold decrease as compared to the last period. The amount of condensate is decreasing because of the lower soil temperatures (not steaming anymore). A total of 2.496 m<sup>3</sup> of condensate has been produced since the start-up of the ERH system.

The condensate produced from the steam condensers is collected and treated in 2 liquid granular activated carbon vessels, before being discharged to the sewer. The discharge limit for PCE and TCE is 10 µg/l. TEC will periodically take samples from the water treatment system. From the samples of the 27<sup>th</sup> of March, no contaminants were detected in the effluent. Since then no samples were taken anymore.

## 8 Mass removal (by PID)

The mass removal calculation is based on the PID measurements in the influent of VGAC1. We use a 10,6 eV bulb, so the correction factor for PCE is 0,57. During the reporting period, the total mass removed from the subsurface was approximately 3 kg (based on PCE), 1 kg more than the previous reporting period. The total mass recovered from the subsurface since the start of the project is circa 397 kg (**Figure 3.**).

Recently it has been discovered that a significant part of the extracted soil vapor contains different compounds such as aldehydes, alcohols and ketones. The quantity (level) of these compounds fluctuates per influent measurement. For this reason the PID value on the influent side is not representative for just PCE.

When reviewing the 6 laboratory results from January 12 to March 14, the average VOCl percentage was  $66\% \pm 13\%$ . However, it also stands out that the percentage of VOCl in the total is decreasing. For comparison, it was 86% in the sample of the January 12, while having decreased to 55% on March 14. The latest analyses show that the proportion of VOCl is decreasing even more. As vapour inlet concentrations appear to decrease even further, this was not further investigated.

## 9 Health & Safety

During the reporting period no mentionable affairs regarding health and safety occurred.

### Step & Touch

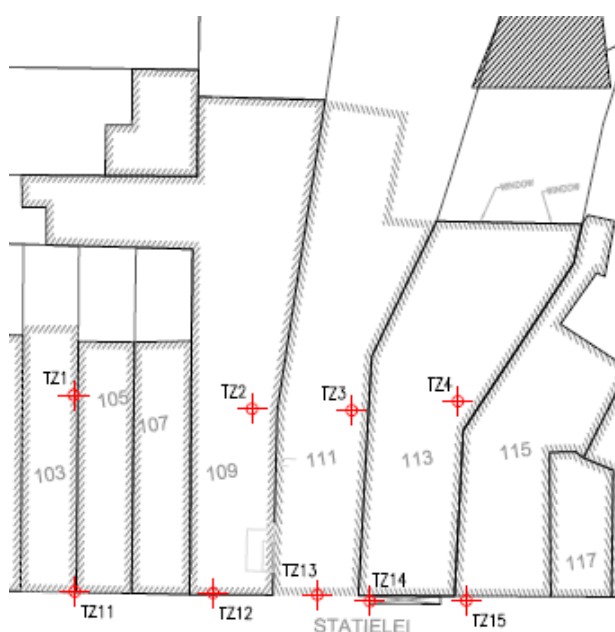
ERH was shut off, so no Step & Touch measurements were performed during this period. Step & Touch will no longer be necessary after this period.

### Ambient air monitoring

During the reporting period, no presence of CVOC in daily ambient air monitoring was measured (PID). No PPMs were measured during the reporting period. TEC will provide the measurement data from the VaporSafe.

## 10 Settlement measurements

The settlement measurements are being monitored on a weekly basis by buro Teugels. The results of the measurements can be found in table 2, displayed in meters. Settlement is expressed in mm. The measuring points can be found in the map below.



**Table 2. Results settlement measurements**

	doosier nr.:	2227978
	werf:	Wegrosen - Mortsel Statielei
	datum:	10/05/24
	Operator:	K.J. - S.B.

**ZETTINGSMETING**

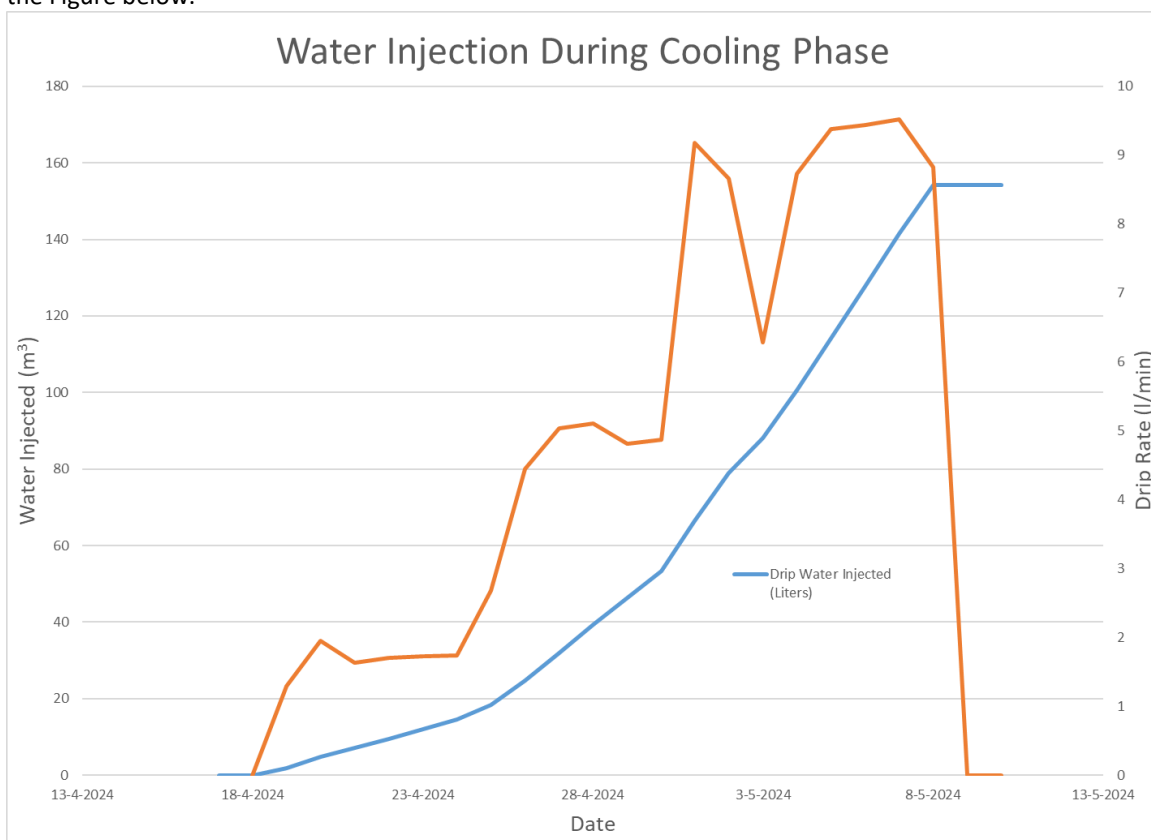
Nr. pt	19/04/23	Δ	TOT Δ	05/03/24	Δ	TOT Δ	20/03/24	Δ	TOT Δ	26/03/24	Δ	TOT Δ	03/04/24	Δ	TOT Δ	19/04/24	Δ	TOT Δ	10/05/24	Δ	TOT Δ
TZ1	5,705			5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,702	-1	-3
TZ2	8,780			8,776	-1	-4	8,776	0	-4	8,776	0	-4	8,776	0	-4	8,776	0	-4	8,774	-2	-6
TZ3	12,178			12,176	0	-2	12,176	0	-2	12,175	-1	-3	12,175	0	-3	12,175	0	-3	12,174	-1	-4
TZ4	9,256			9,255	0	-1	9,255	0	-1	9,254	-1	-2	9,254	0	-2	9,254	0	-2	9,254	0	-2
TZ11	5,211			5,210	0	-1	5,209	-1	-2	5,209	0	-2	5,209	0	-2	5,209	0	-2	5,209	0	-2
TZ12	8,150			8,146	0	-4	8,146	0	-4	8,146	0	-4	8,146	0	-4	8,146	0	-4	8,145	-1	-5
TZ13	11,095			11,096	0	1	11,095	-1	0	11,095	0	0	11,095	0	0	11,095	0	0	11,094	-1	-1
TZ14	8,922			8,924	0	2	8,924	0	2	8,924	0	2	8,924	0	2	8,923	-1	1	8,922	-1	0
TZ15	3,971			3,970	-1	-1	3,971	1	0	3,971	0	0	3,971	0	0	3,971	0	0	3,970	-1	-1

<b>OPMERKINGEN</b>	
Ref.meting:	19/04/23
Δ	: verschil t.o.v. vorige meting
TOT Δ	: verschil t.o.v. ref.meting

Limited settlements (2 – 6 mm) have been measured in buildings Statielei 103, 109 and 111. There appears to be little to no development in terms of settlement. According to stability engineer Herman Peiffer, settlements over 6 mm can pose a potential problem: it appears that this range is reached once more. Results have been transferred to Herman Peiffer, we are waiting for his advice.

## 11 Dripping

Besides cooling with vapor recovery we will additional with drip water. We started dripping tap water on April 18 (after shutdown of ERH). We slightly increase the drip water flow. The drip flow and volume are shown in the Figure below.



Drip was temporarily shut off due to sampling. It was restarted shortly after this reporting period.



## 12 Further remarks

None.

## 13 Planned Activities

Planned activities for the following two weeks (20 and 21) involve:

- Regular monitoring and maintenance activities.
- Soil vapor sampling activities for individual VR wells (together with TEC).

## Figures

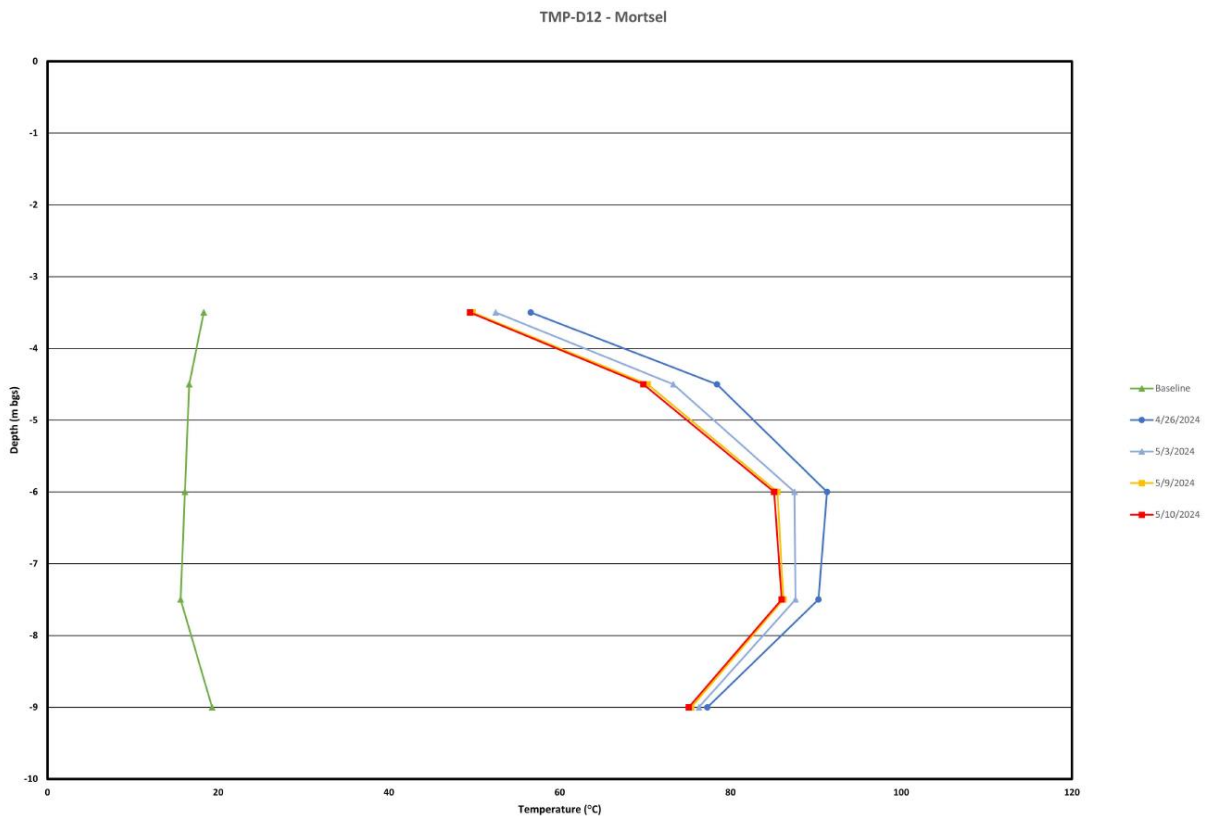
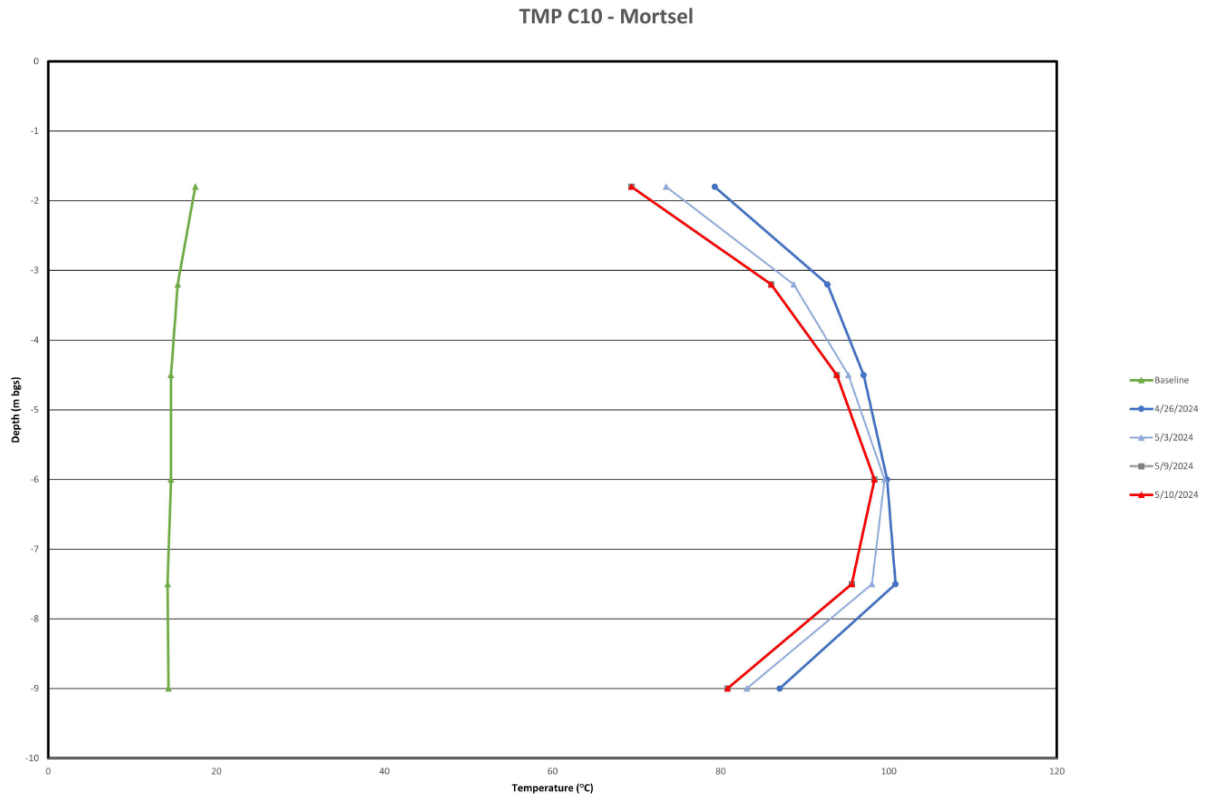
1. Site plan
2. Average Temperature vs. Time (by TMP)
3. Cumulative Mass Removed vs. Time



## Figure 1: Site plan

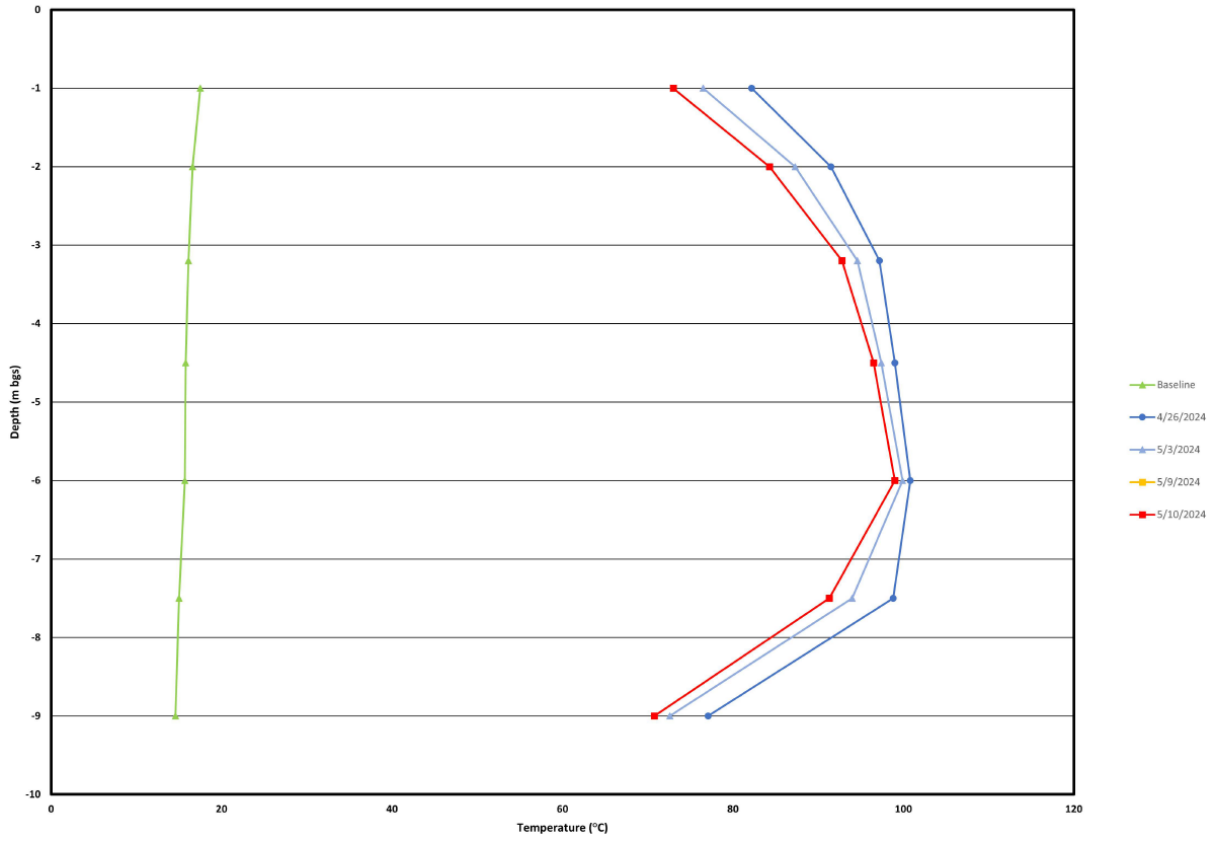
The as built site plan is attached separately

Figure 2. Average Temperature vs. Time (By TMP)

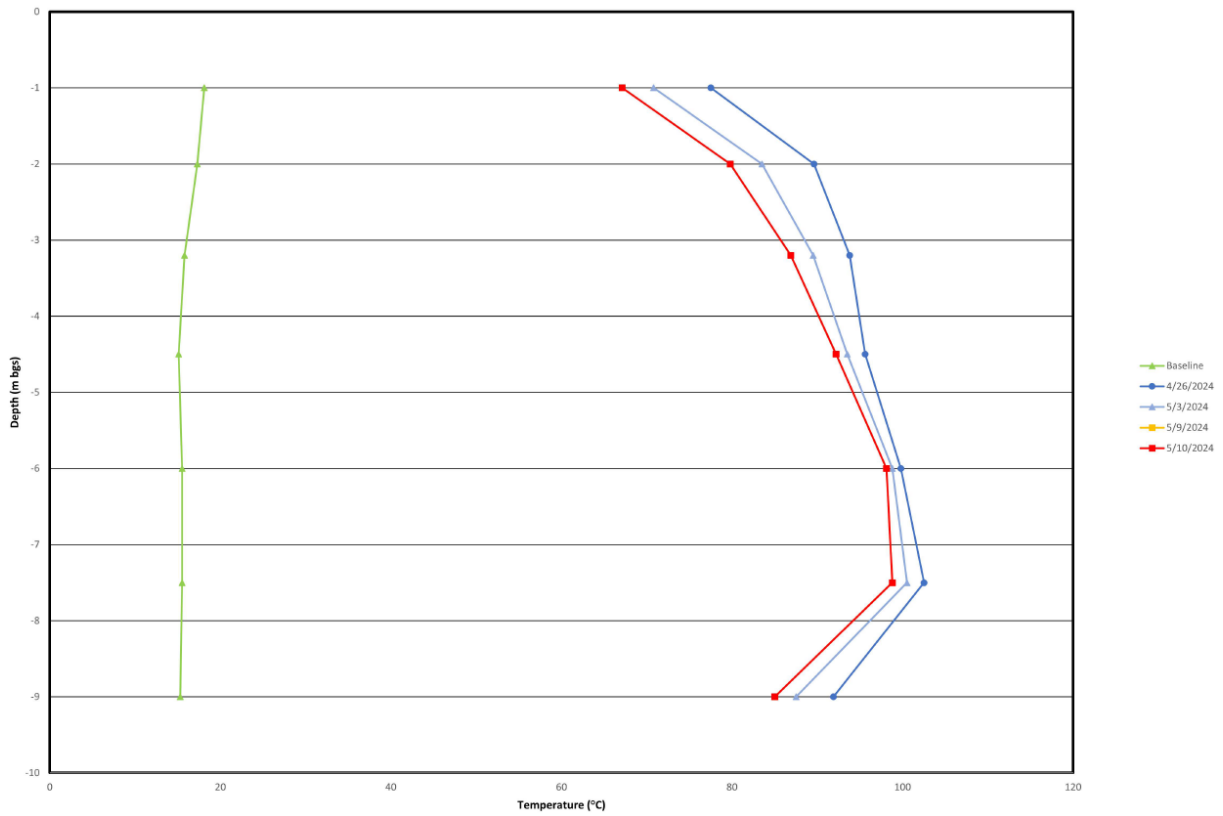




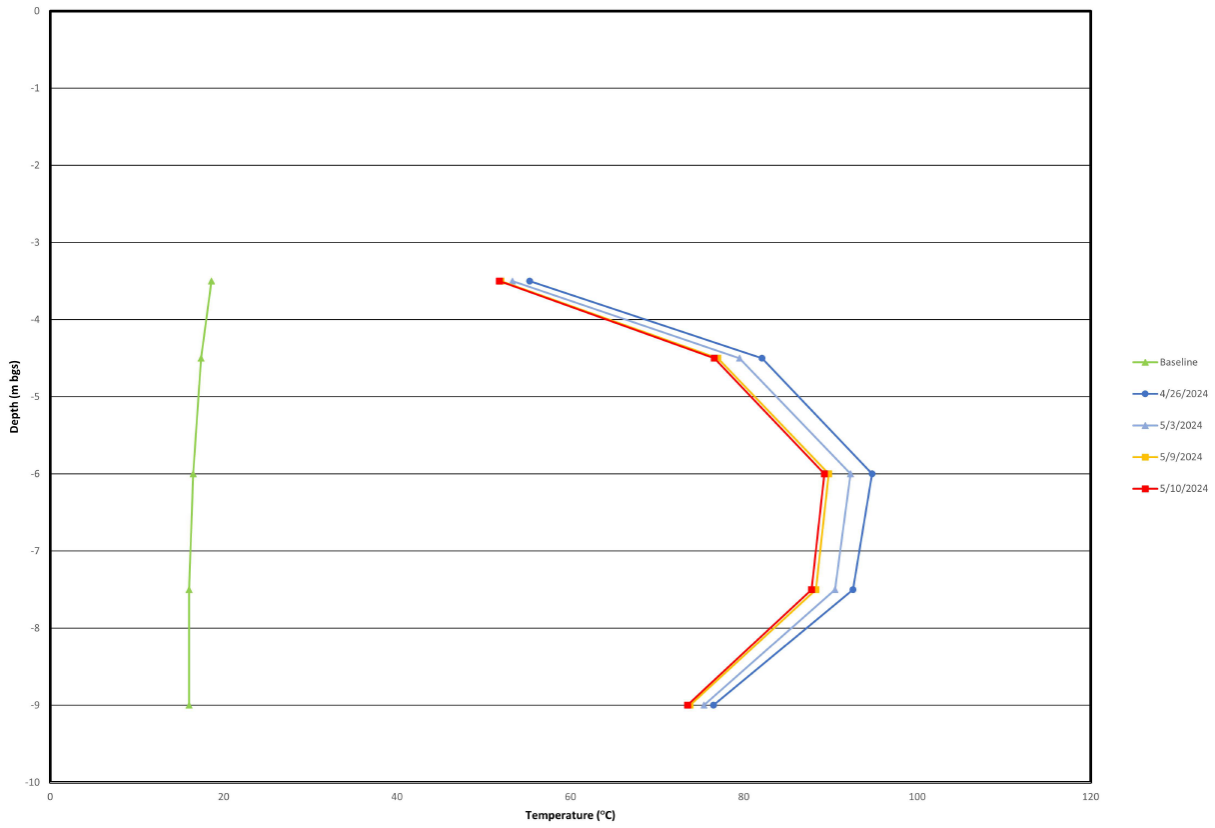
TMP-E05 - Mortsel



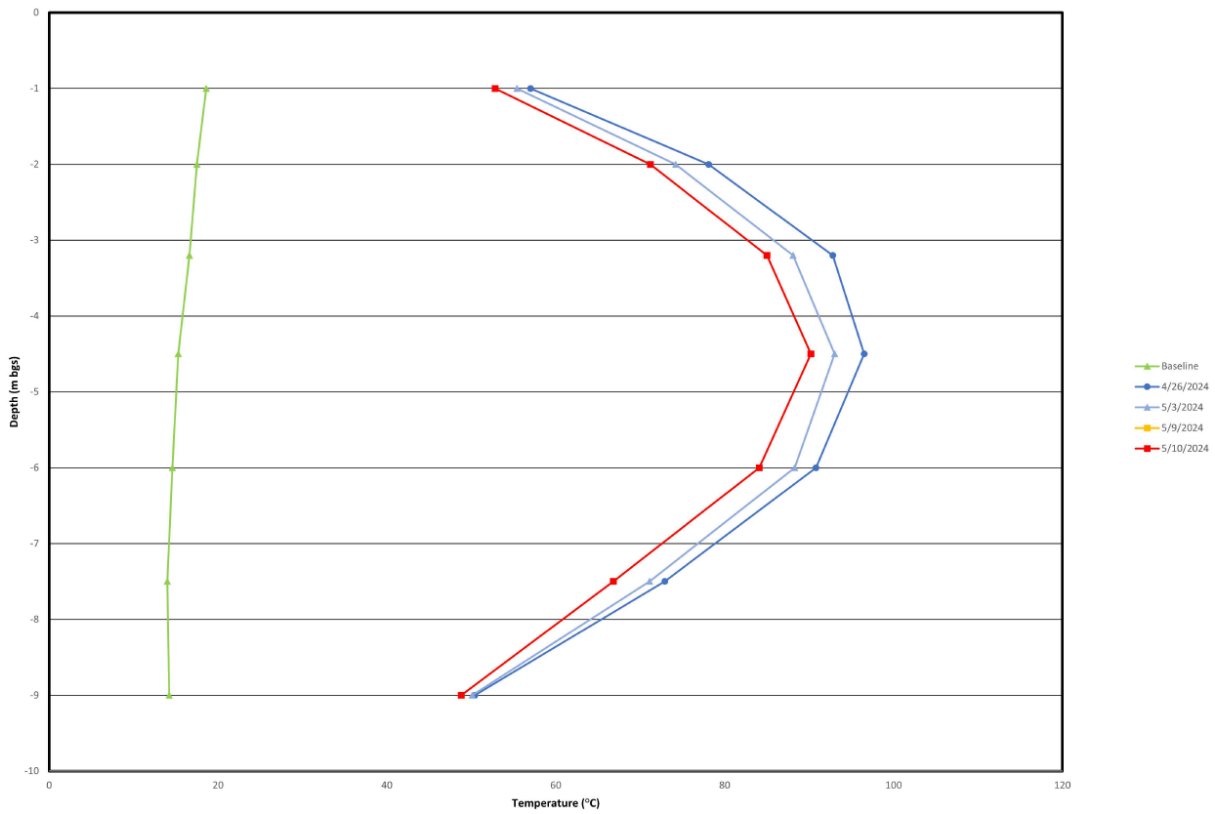
TMP F08 - Mortsel



TMP H10 - Mortsel

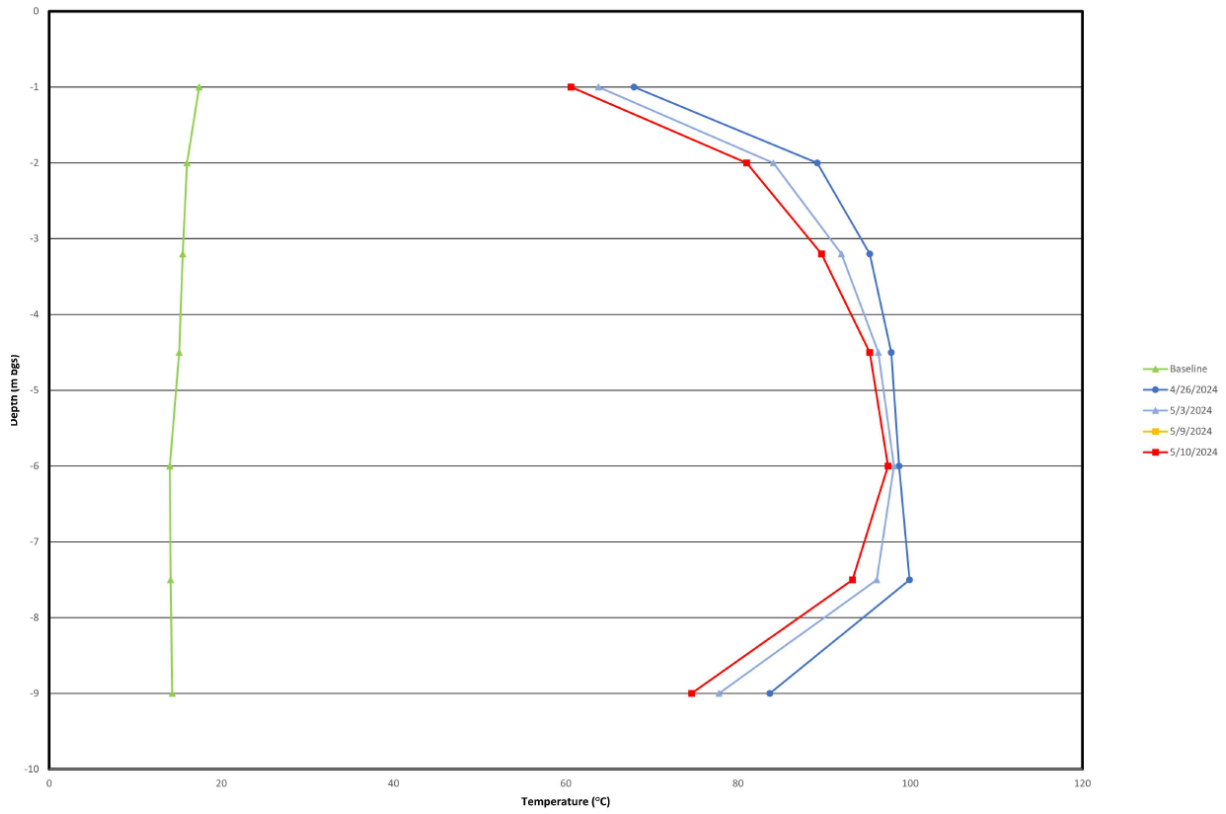


TMP J03 - Mortsel

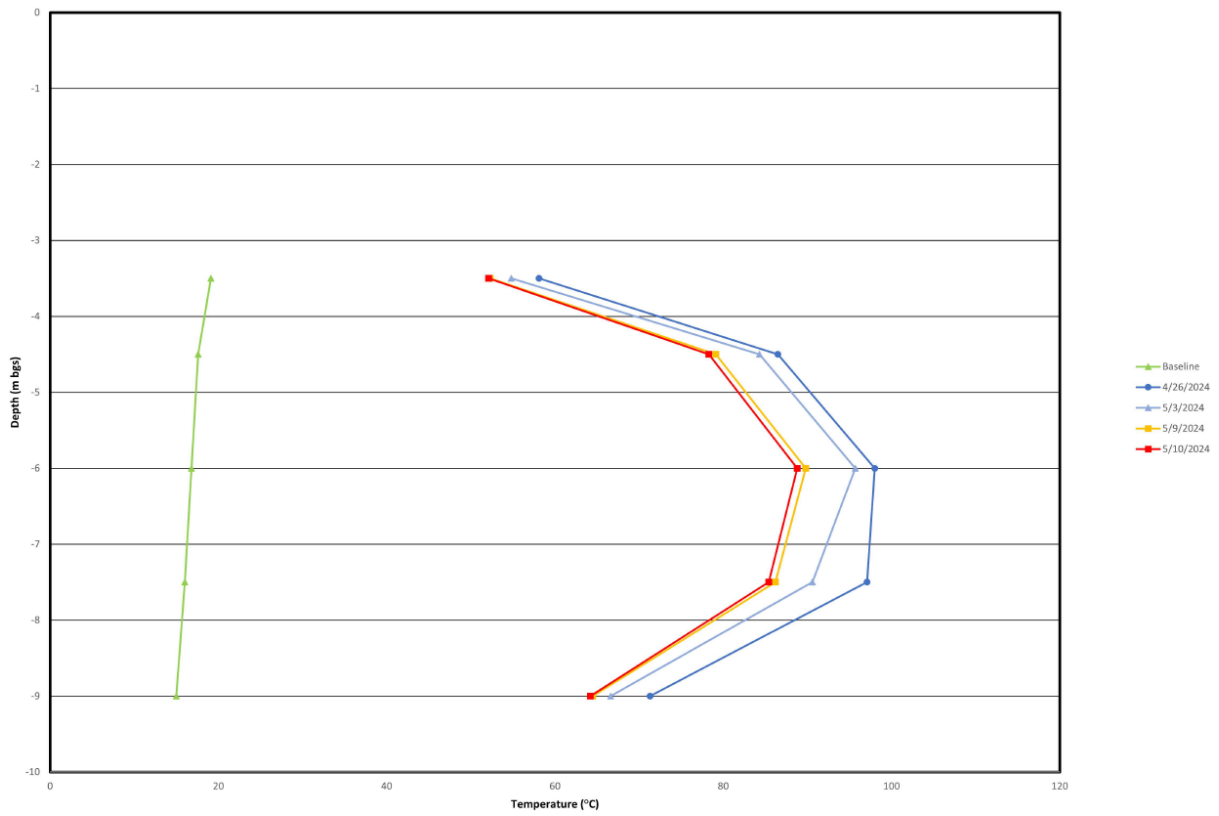




TMP K06 - Mortsel

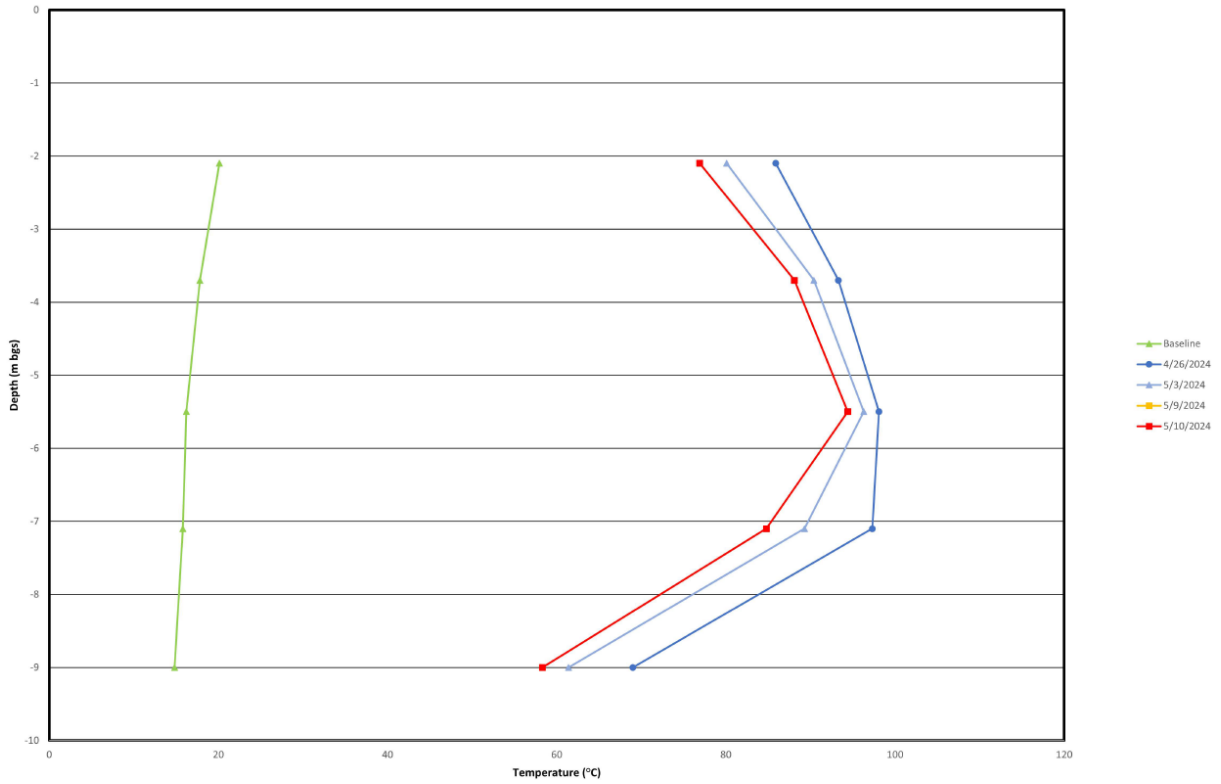


TMP K10 - Mortsel





TMP N04 - Mortsel



Mortsel TMP Average Temperature over Time

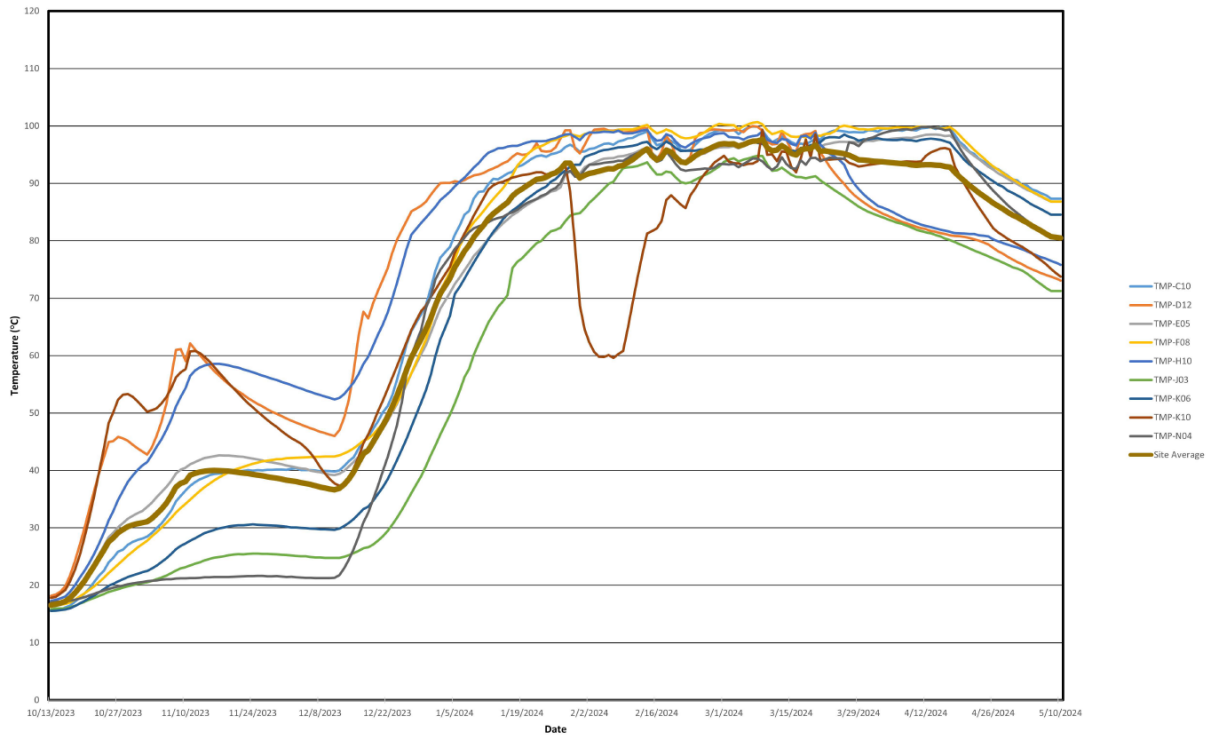




Figure 3. Cumulative Mass Removed vs. Time

