OVAM Mortsel: Bi-weekly report

Soil remediation by Electric Resistance Heating

March 29 – April 12, 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 March 29 to April 12, 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 12 and 13 of 2024. During this period the site was visited 5 times.

In the reporting period the following works were performed:

- Performed 2 times vapor measurements (together with TEC).
- Cooling for KOP was disabled as the vapor temperature is decreasing.
- Cut the fallen tree at SL105.
- Exchanged full construction waste container for empty one.
- General checks and equipment maintenance
    - General data collection and inspections
        - Amp surveys and cable change
        - PID measurements
        - Relative humidity measurements
        - Step & Touch
    - Drained the condensate in the VGAC vessels, influent hose blowers
    - Drained cooling water from SC.

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 March 29th	Percentage of total
Operation Time (days)	137[1]	143[3]	103%
Cumulative Energy Applied (MWh)	3.800[2]	2.909	77%

Total energy for ERH and auxiliary Equipment was ca. 2.909 MWh. Energy applied for ERH up to April 12th was ca. 2.809 MWh.

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 – 2.600 MWh.

4 Temperature Monitoring

During the reporting period of March 29 to April 12, 2024 the site average subsurface temperature slightly decreased (approximately 0,8 °C). This decrease is due to the disconnection of the electrodes as mentioned in Section 2, and is expected to decrease further over the following period.

The highest individual temperature measurement within the treatment volume is 105,3 ˚C at TMP K10 at 7,5 meters below ground surface (bgs). Subsurface temperatures at different depths per TMP location and over time are presented in **Figure 2**. The highest site average measured during this period was at 94,1 °C on the 29th of March.

[1] Extra days for higher concentrations in soil not included.

[2] Extra energy for higher concentrations in soil not included.

[3] This is with regard to the days that ERH was not active. Including those days would give an operation time of 140 days.

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. The average temperature at the utility RTDs is 47,7 °C, the maximum temperature is 56,3 °C in RTD T2 (SL 109 front). With the disconnection of electrodes the temperature in the RTDs will decrease.

5 Vapor Recovery

During the reporting period the vacuum applied to the vapor recovery piping system (as measured at the condenser inlet) was maintained between 65 - 85 mbar, with an average of ca. 70 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 1.400 m^3/hour. During the last three days of this reporting period, the flowrate was increased to average 1.500 m^3/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), collected on April 12th, was 3,4 ppm. The PID measurements of the extracted soil vapor are stable on a level of 3 - 4 ppm and appear to decrease slowly.

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^3 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^3 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 base. During the reporting period, the PID reading of the effluent of the first GAC filter was 0,1 - 0,3 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 overall was increasing slightly.

7 Condensate and water treatment

During the reporting period 196 m^3 of water was recovered via condensed water by the vapor recovery system. A total of 2.370 m^3 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 27th of March, no contaminants were detected in the effluent.

8 Mass removal (by PID)

The mass removal calculation is based on the PID measurements in the influent of GAC1. 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 6 kg (based on PCE), 1 kg less than the previous reporting period. The total mass recovered from the subsurface since the start of the project is circa 387 kg **(Figure 3.)**.

Recently it has been discovered that a significant part of the extracted soil vapour 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 representable for just PCE.

When reviewing the 6 laboratory result from January 12 to March 14, the average VOCl percentage was 66% ± 13%. However, it also stands out that the percentage of VOCls 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.

9 Health & Safety

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

Step & Touch

The highest measured voltage (step and touch) during the reporting period was negligible at <100 mV.

Ambient air monitoring

During the reporting period, no presence of CVOC in daily ambient air monitoring was measured (PID). 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.

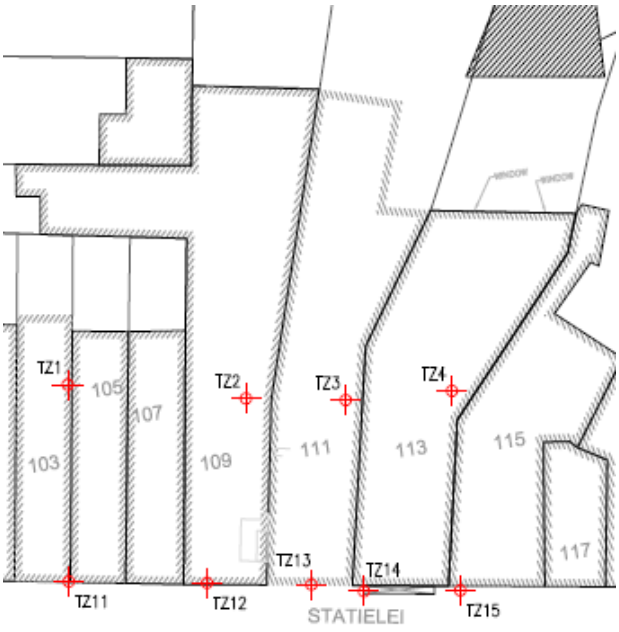


Table 2. Results settlement measurements

TEUGELS

dossier nr.:	2227978
werf:	Wegrosan - Mortsel Statielei
datum:	03/04/'24
Operator:	K.J. - S.B.

ZETTINGSMETING

Nr. pt	19/04/23	Δ	TOT Δ	20/02/24	Δ	TOT Δ	27/02/24	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
TZ1	**5,705**			5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2
TZ2	**8,780**			8,776	0	-4	8,777	1	-3	8,776	-1	-4	8,776	0	-4	8,776	0	-4	8,776	0	-4
TZ3	**12,178**			12,175	0	-3	12,176	1	-2	12,176	0	-2	12,176	0	-2	12,175	-1	-3	12,175	0	-3
TZ4	**9,256**			9,254	-1	-2	9,255	1	-1	9,255	0	-1	9,255	0	-1	9,254	-1	-2	9,254	0	-2
TZ11	**5,211**			5,209	0	-2	5,210	1	-1	5,210	0	-1	5,209	-1	-2	5,209	0	-2	5,209	0	-2
TZ12	**8,150**			8,145	0	-5	8,146	1	-4	8,146	0	-4	8,146	0	-4	8,146	0	-4	8,146	0	-4
TZ13	**11,095**			11,095	0	0	11,096	1	1	11,096	0	1	11,095	-1	0	11,095	0	0	11,095	0	0
TZ14	**8,922**			8,923	0	1	8,924	1	2	8,924	0	2	8,924	0	2	8,924	0	2	8,924	0	2
TZ15	**3,971**			3,970	0	-1	3,971	1	0	3,970	-1	-1	3,971	1	0	3,971	0	0	3,971	0	0

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

Limited settlements (2 – 4 mm) have been measured in buildings Statielei 103, 109 and 111. There appears to be little development in terms of settlement. According to stability engineer Herman Peiffer, settlements over 6 mm can pose a potential problem.

11 Further remarks

The results of the second soil and groundwater sampling round were discussed on March 18. All soil and groundwater samples meet the remediation goals. For this reason HMVT has achieved the contractual remediation targets on March 18.

However, since the soil vapour still shows significant concentrations of VOCls and other previously undiscovered compounds, OVAM has chosen to continue the remediation until further notice. Part of the thermal treatment zone has been shut off on March 20.

12 Planned Activities

Planned activities for the following two weeks (16 and 17) involve:

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

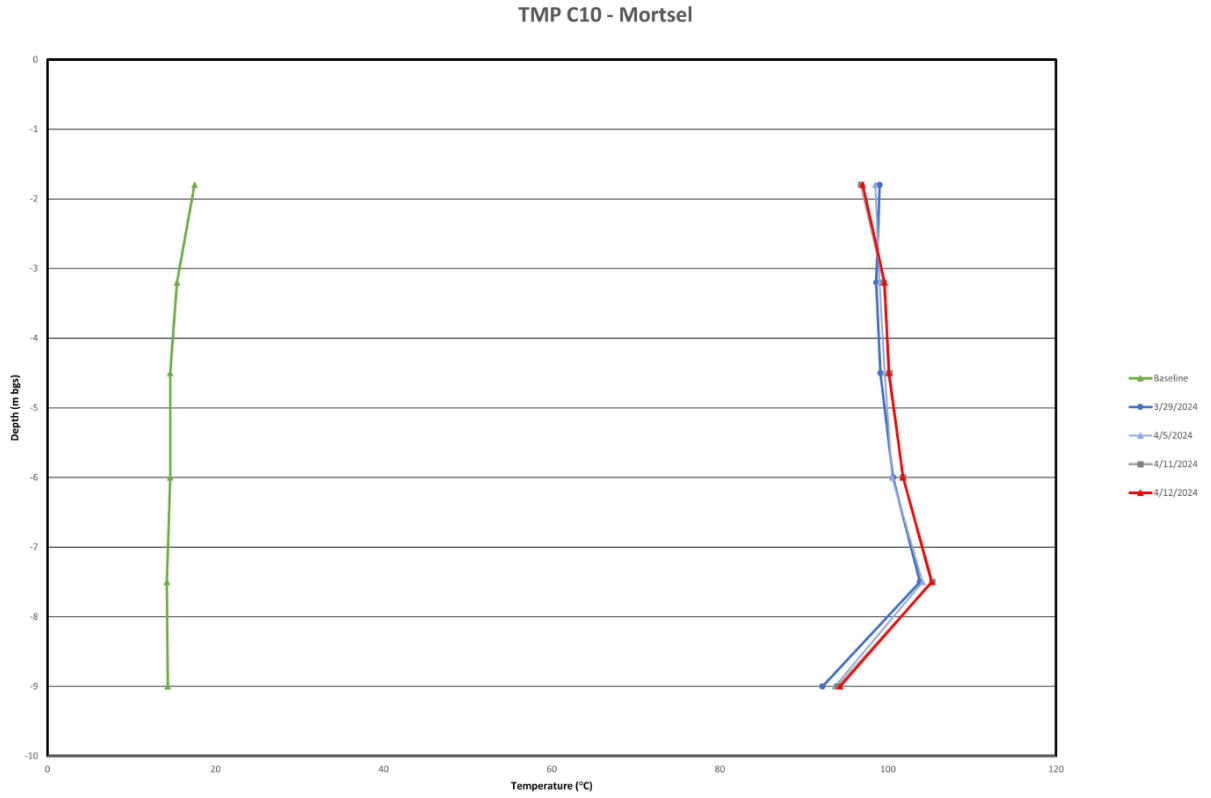
Figures

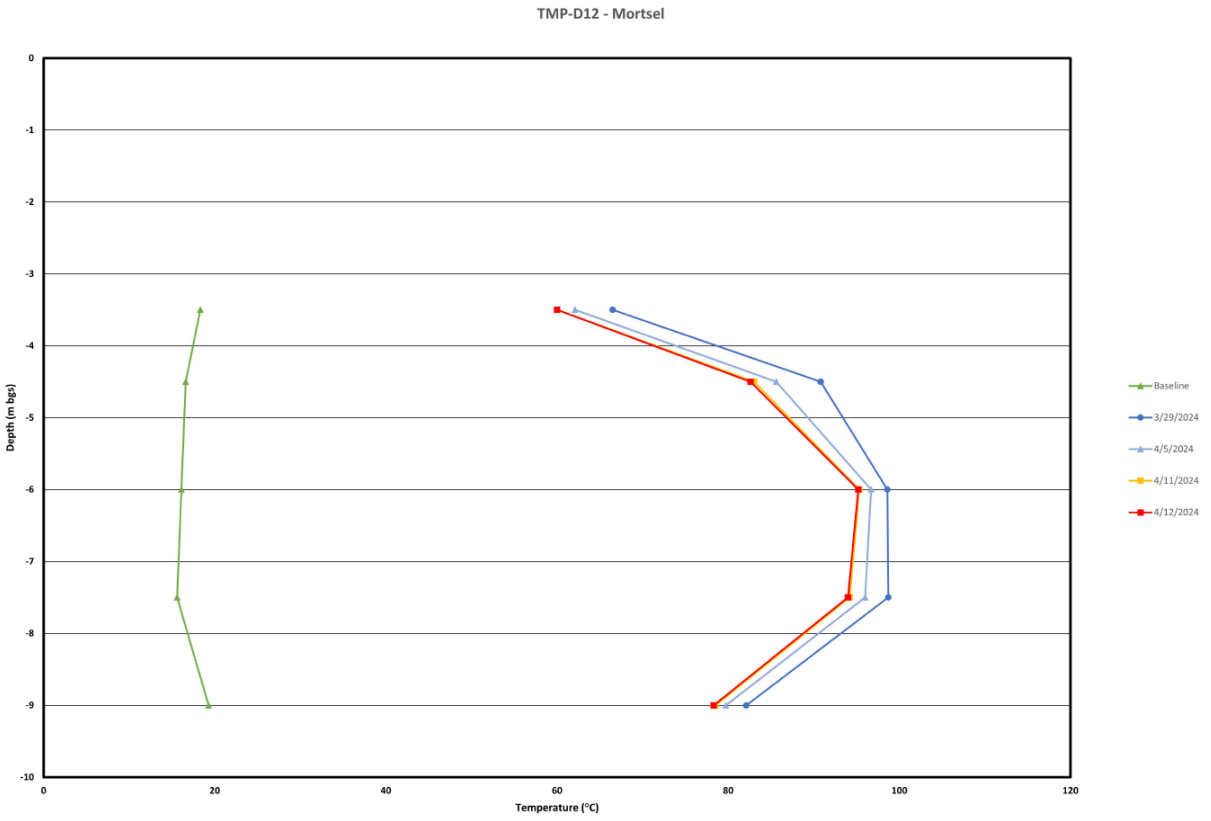
1. Site plan
2. Average Temperature vs. Time (by TMP)
3. Cumulative Mass Removed vs. Time

Figure 1: Site plan

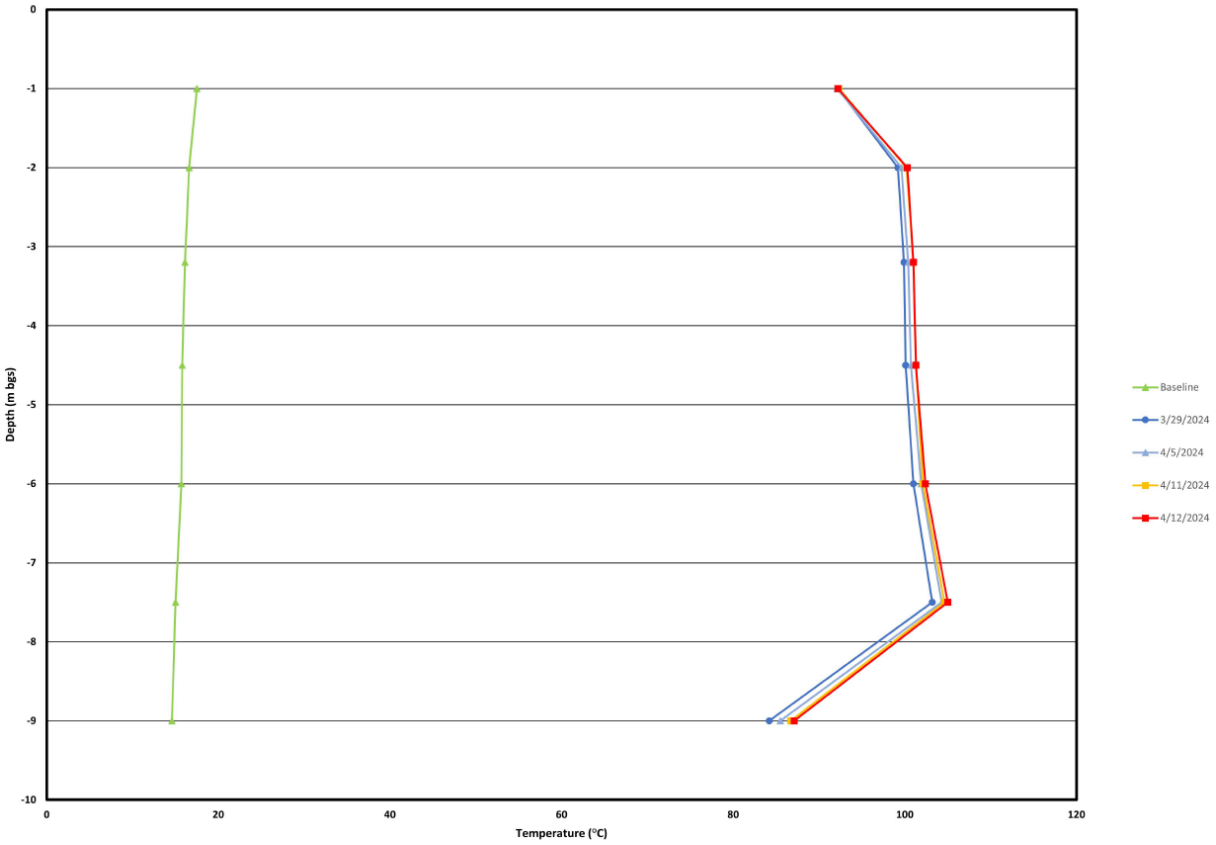
The as built site plan is attached separately

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

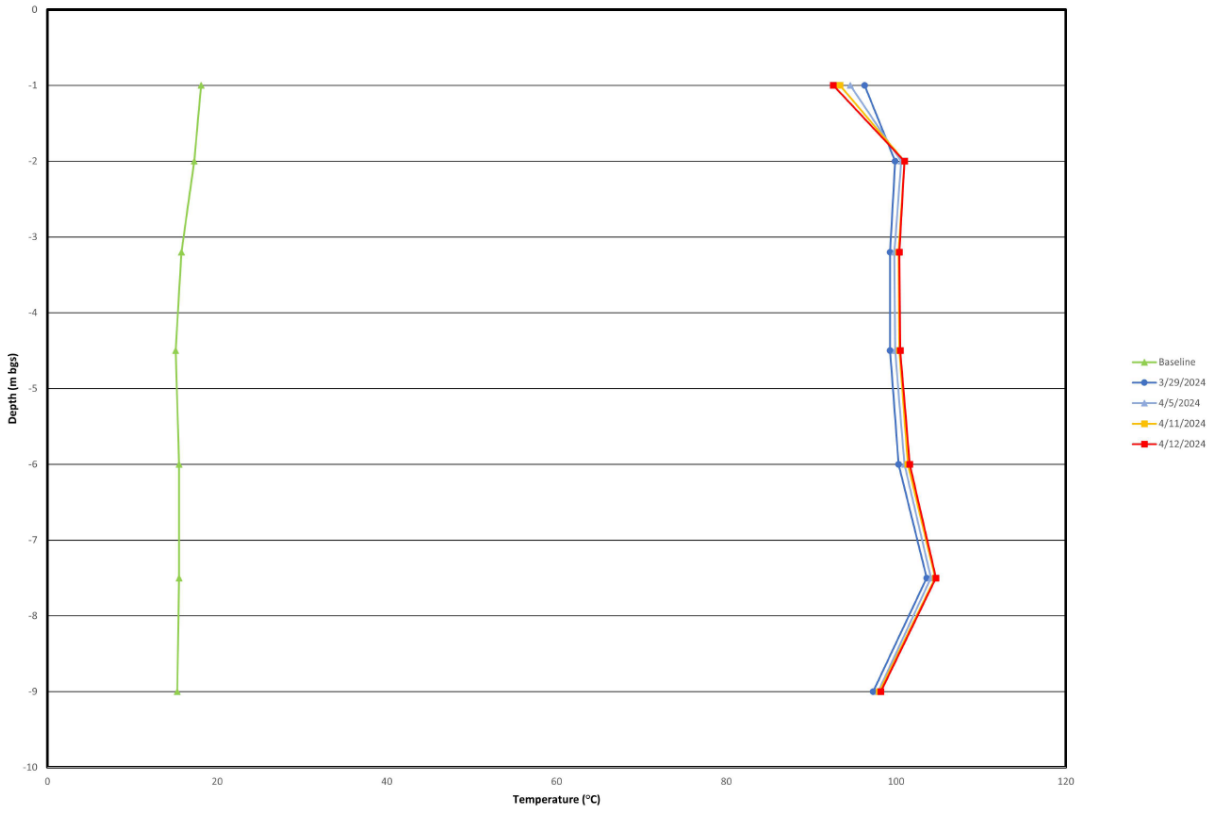




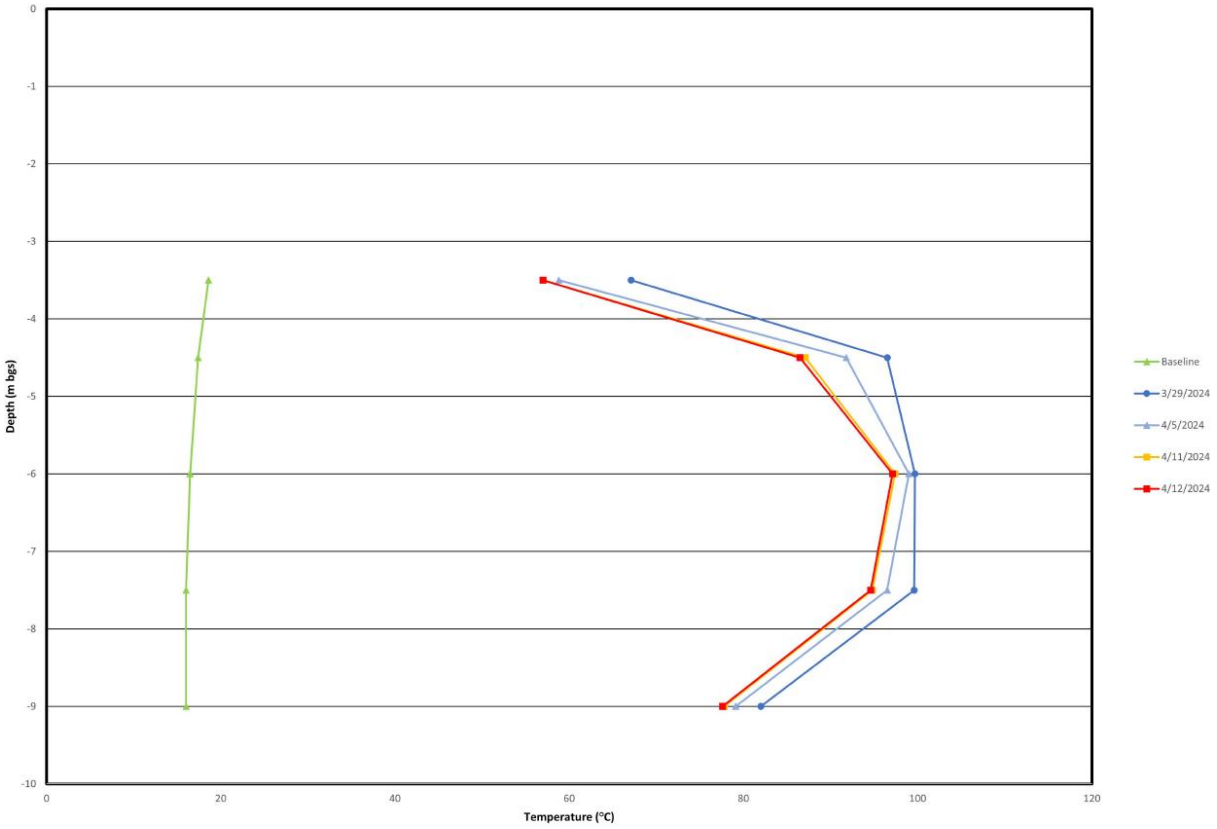
TMP-E05 - Mortsel



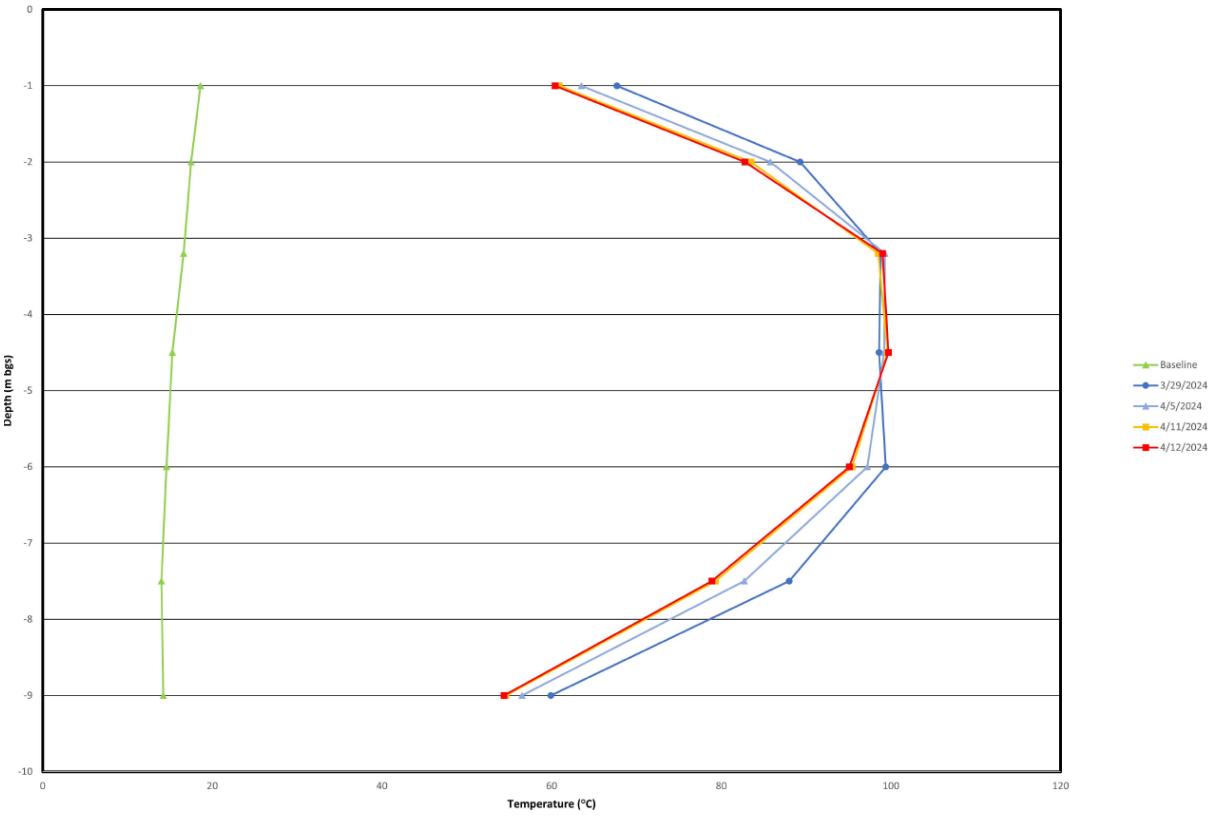
TMP F08 - Mortsel



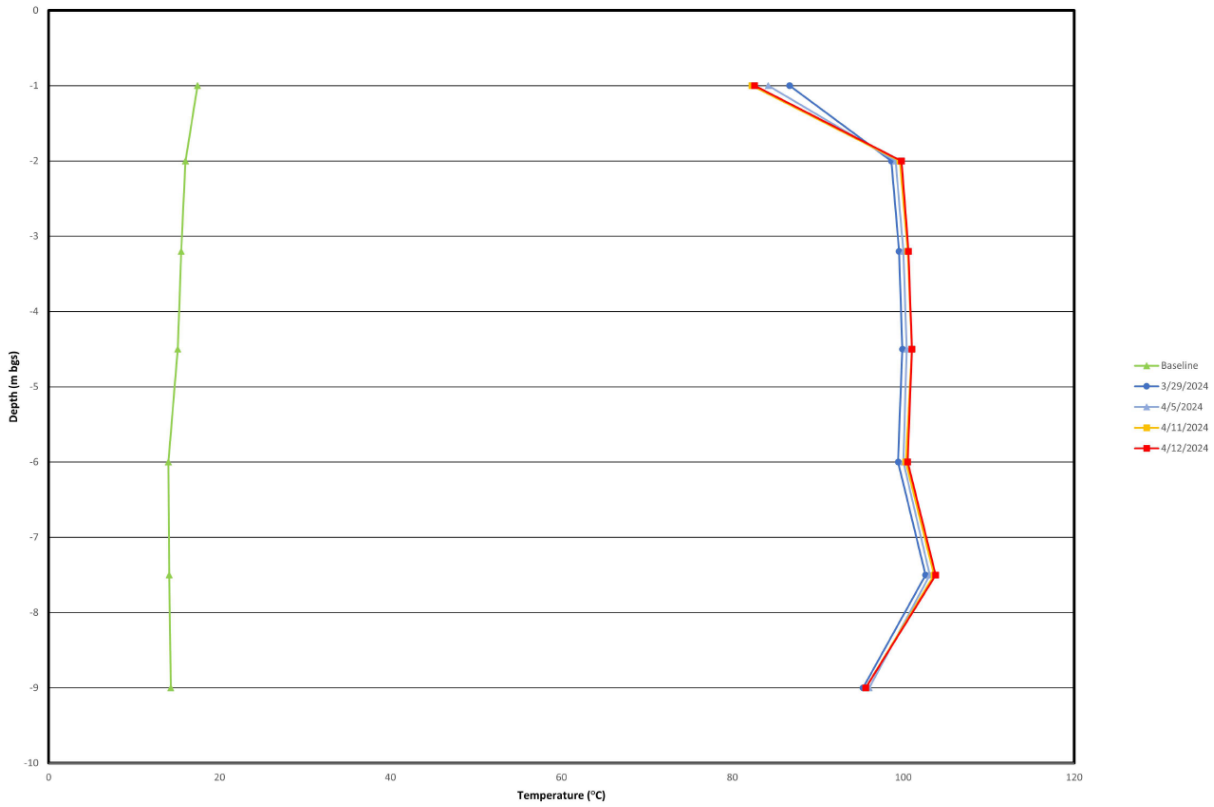
TMP H10 - Mortsel



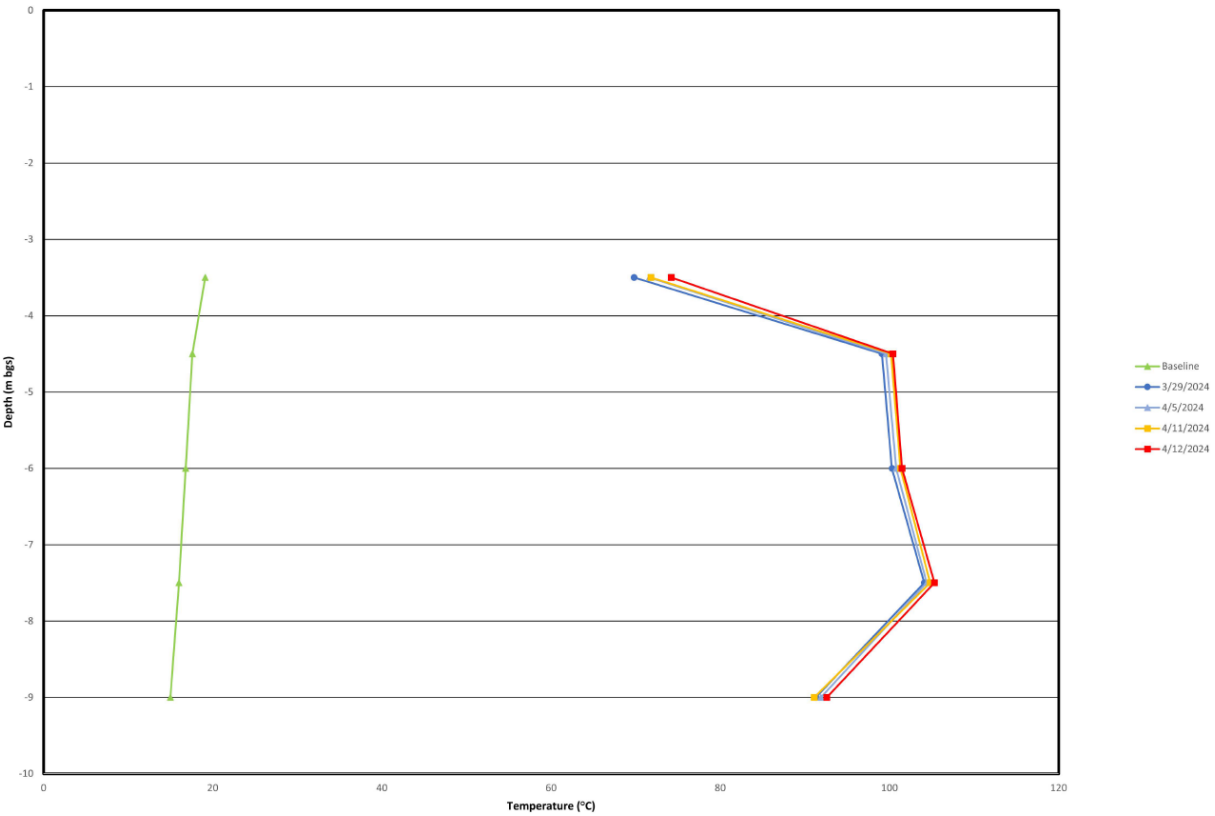
TMP J03 - Mortsel



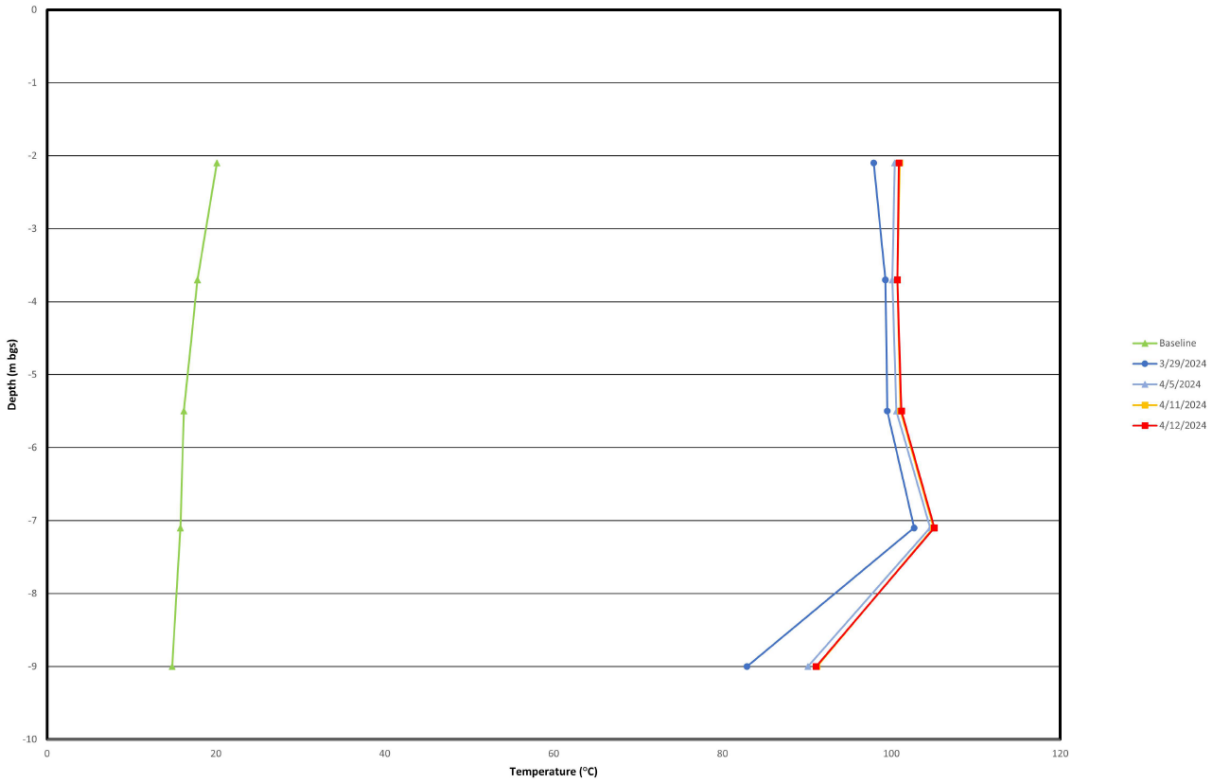
TMP K06 - Mortsel



TMP K10 - Mortsel



TMP N04 - Mortsel



Mortsel TMP Average Temperature over Time

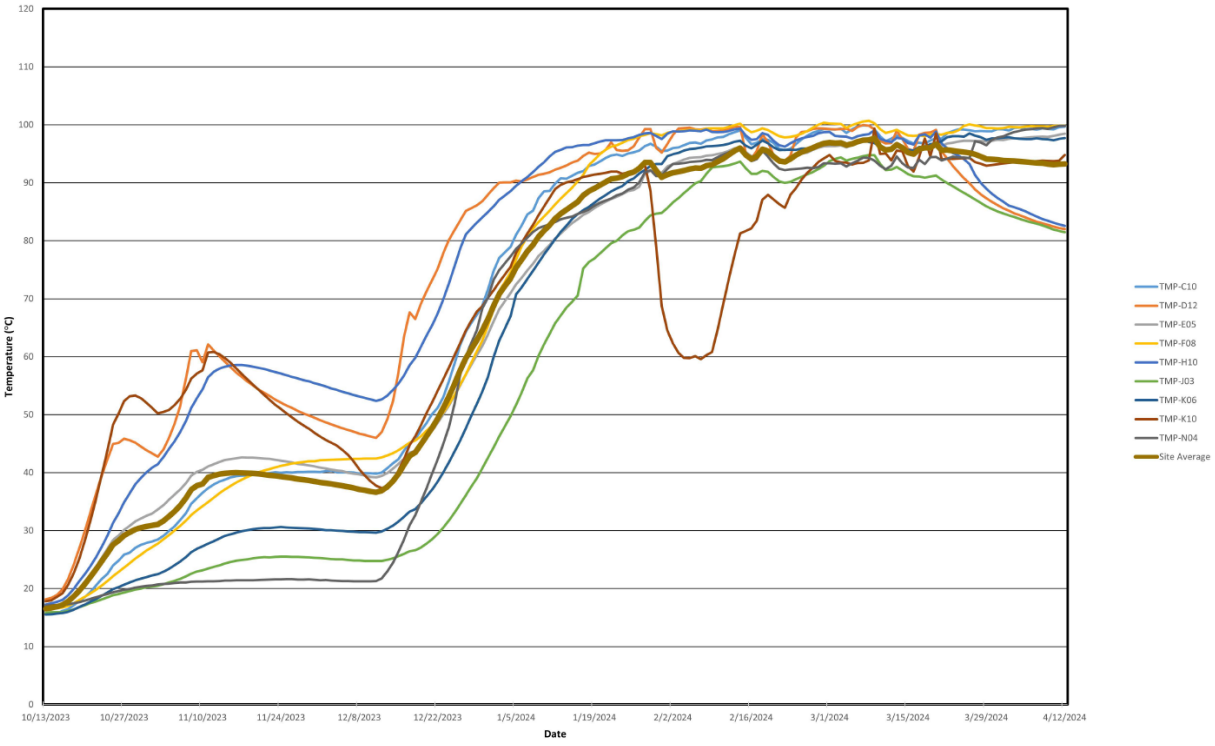


Figure 3. Cumulative Mass Removed vs. Time