

1 Executive Summary

- 1.1.1 Monitoring was undertaken across C1 throughout March 2023 in response to site construction activities. Graphs showing the monitoring data for the month are attached in Appendix A.
- 1.1.2 Monitoring at Chalfont St Peter (CSP) ventilation shaft remained at a quarterly and monthly monitoring frequency, whilst monitoring at Chalfont St Giles (CSG), Amersham (AMS), Little Missenden (LMI), and Chesham Road (CHR) ventilation shafts, along with the North Portal (NPTL) continued monthly in line with the SSMP's.
- 1.1.3 Following the January leak of the CSP Pond, all shaft attenuation ponds were drained, cleaned, and inspected by the end of February. At time of writing, no repair works were required on any pond aside from CSP. The CSP Pond has had relining works conducted on the outlet pipe. This has included a successful air leak test to BS 1610:2015 before the end of March.
- 1.1.4 Monitoring at Colne Valley Viaduct (CVV) module 1 has been changed to monthly frequency following completion of the rotary bored piling (RBP) works in January. Monitoring at Modules 4, and 2 remained at a monthly monitoring frequency. Monitoring at Module 3 was not undertaken following the completion of the RBP works within the area in November.
- 1.1.5 One trigger limit exceedance has been recorded at CVV module 1 during the month on the 21st March at borehole ML026-RO426. This is unlikely to be related to any of the current ALIGN work.
- 1.1.6 TPH was again detected in CVV Module 1 borehole ML026-RO426 on 21st March. This is believed to be related to the landfill contamination in the area. A follow up sample was collected on the 28th March which identified TPH as <LoD.
- 1.1.7 Hexavalent chromium was detected in CVV Module 1 borehole ML026-CR032 on 21st March in low levels. The presence of CrVI at this location is currently not understood and a follow up sample was collected on the 28th March with CrVI detected < LoD.
- 1.1.8 Decking activities advanced to P45, with surface water monitoring ongoing on a weekly basis for ML028-SW004 and ML028-SW003.

- 1.1.9 Additional monitoring was conducted within the CVV in response to remedial works, piling cap pours, and concrete plug pours. No impacts have been observed.
- 1.1.10 Tunnel monitoring continued at a mixed frequency of monthly, weekly, and daily. The highest frequency of monitoring is in a 150 m area upgradient and 300 m downgradient of each tunnel boring machine (TBM) as defined by the SSMP.
- 1.1.11 Cross passage (CP) monitoring continued at CP10, CP11, CP12, CP15 and CSG adit.
- 1.1.12 Monitoring across the South Portal and Western Valley Slopes areas continued at a monthly monitoring frequency, with continued surface water monitoring of the drainage systems. Pynesfield monitoring remains at a fortnightly monitoring schedule.
- 1.1.13 Following to the pH peak (above 9) recorded in February, BH2 has displayed a decrease in pH, below 9. However this is still higher than the other Pynesfield boreholes. The Pynesfield ditch has now been cleaned and inspected and some small tears have been detected. Ditch re-lining is currently being planned.
- 1.1.14 The priority monitoring round was completed, with all locations visited where possible.
- 1.1.15 Elevated volumes of rain were observed during the month at Chenies rain gauge on 25 days with a total of 134.7 mm recorded. 26 days of rainfall recorded across the South Portal site with 108.4 mm recorded.

1. Site Specific Monitoring

Overview

- 1.2 A high-level overview of the water monitoring activities and occurrences at each site is provided below for the month. The graphs showing the in-field monitoring data are attached in the appendix.

Colne Valley Viaduct (CVV)

- 1.2.1 Concrete plugs were poured at pier 11 on the 17/03. Concrete plugs have now been completed on all CVV, with pier 11 the final pour.
- 1.2.2 In March, piers 27, 28, 30 and 31 were poured.
- 1.2.3 Decking works advanced from Pier 49 to Pier 45 in March, with 42 segments installed during the month. To date, a total of 249 segments have been installed.

CVV Module 1 (Pier 12 to South Embankment)

Groundwater

- 1.2.4 There has been one trigger limit exceedance event in Module 1 in March: on 21st March at ML026-RO426 turbidity was observed at 1067 NTU, which is above the trigger limit (500 NTU); this location was revisited on the following days, showing 214 NTU on 22nd March and 54 NTU on 23rd March. A follow up visit was then undertaken on 28th March and the measured turbidity was 46 NTU. During this timeframe, all other parameters have been within their typical range, except for dissolved oxygen, which recorded a low value of 0.22 mg/l on 22nd March (the day after the turbidity spike event). On the following visits it returned to its typical range. This borehole has historically shown to be susceptible to sudden changes and spikes in turbidity compared with other CVV M1 boreholes; the reasons behind this are still unclear. However, as no intrusive activities have recently been undertaken in the area, this is unlikely to be related to current Align works.
- 1.2.5 Align believe that it is possibly associated with the mobilisation of residual polymer which was used as support fluid during the Load Test Pile 2 (LTP2). These works were undertaken between June and August 2020 within this area. It was identified at the time that polymer could remain present in the water for more than 6 months after piling activities. A detailed description and findings of the LTP2 are provided in the document no 1MC05-ALJ-EV-REP-CS01_CL01-000159.

1.2.6 It is possible that the heavy rain fall in March has somehow moved the polymer that was stored in the ground as a result of the trial done during the LTP2. However, it is unclear why this would have happened after such a long time, as 2 years and 7 months have passed since the LTP2 was carried out. Align will continue to monitor this borehole closely.

1.2.7 Table 1 compares typical borehole ranges for the area with trigger levels and any trigger level exceedances.

Table 1 CVW Module 1 borehole in-field parameter data

	pH	SPC ($\mu\text{S/cm}$)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	6.7 – 7.7	620 - 1300	1 – 25	-50 - 300	1 – 11
Trigger limit	5 – 9	1500 ¹	500	-	-
Trigger Level Exceedances	-	-	1067	-	-
Exceeding borehole	-	-	ML026-RO426 on 21/03/2023	-	-

1.2.8 Groundwater levels displayed a varied response in February, with ML026-RO430 and ML026-RO431 showing a decrease of approximately 0.4-0.5 m from early February levels, while ML026-CR032 and ML026-RO428 displayed an increase of approx. 0.2 m and 0.1 m respectively. ML026-RO426 showed a different pattern, with a decrease of nearly 0.2 m at the beginning of March, followed by an increase of approximately 0.3 m across the rest of the month

1.2.9 Groundwater levels in Module 1 have showed fluctuating trends over the last 3 months, with different boreholes displaying different patterns. Considering that intrusive works were concluded on 26th January in this area, with rotary piling in January only undertaken at Pier 11, it is unlikely that this is related with any ALIGN works. However, to get an understanding of the reasons behind such variations in the groundwater levels, more extensive monitoring is scheduled in April.

1.2.10 TPH was been detected in ML026-RO426 on 21st March, with the following values initially recorded:

¹ Due to pre-existing contamination in the Module 1 area, EC values are generally higher than anywhere else in Section C1.

TPH C12-C16 aliphatic: 58 µg/l
TPH C16-C21 aliphatic 120 µg/l

- 1.2.11 A retest of this sample confirmed the TPH presence of 160 µg/l for the C16-C21 aliphatic range, but did not confirm any C12-C16 presence.
- 1.2.12 This sample was retested due to suspected cross-contamination within the laboratory batch.
- 1.2.13 A follow up sample was collected on the 28th March which returned all TPH as below <LoD (0.1µg/L).
- 1.2.14 TPH were previously detected on 4th January, but different carbon bands were identified (C7-C10 aromatic). Discussion with S2 contractor SCS have mentioned presence of TPH in groundwater owing to historic landfill contamination within/close to their area.
- 1.2.15 Hexavalent Chromium was detected in the borehole ML026-CR032 on 21st March; a value of 5.3 µg/l was recorded. This was a part of the same batch of samples with suspected cross contamination and so was retested. The retest detected CrVI at 4.1 µg/l; another sample from this borehole was collected on 28th March with CrVI reported as < LoD (0.1 µg/l). It must be noted that ML026-CR032 was initially reported to contain TPH in the Aliphatic ranges C16-C21, with a retest detecting <0.1 µg/l. This indicates cross-contamination within the laboratory sample for the TPH analysis.
- 1.2.16 No intrusive groundworks were taking place in the vicinity or up-gradient of this borehole. This area is close to the New Years Green Bourne flood compensation pond and to the NYGB itself on the northern side. The haul road to the south of the NYGB was previously cement stabilised in December 2022. However, owing to the inferred hydraulic gradient and the works being located on the opposite side of the river, this is unlikely to be the cause.
- 1.2.17 Hexavalent Chromium was previously detected in the NYGB surface waters in early January 2023. Which was previously reported to the Environment Agency. At the time, this was recorded up-stream of the Align works, and present within surface water discharge to the river which was downgradient and downstream of the borehole. The discharge was stopped and no further chromium has been detected in the surface water ponds or discharge since.

Surface water

- 1.2.18 Surface water bodies within Module 1 include Harefield Lake No. 2 (ML026-SW002 and ML026-SW003) and New Years Green Bourne (ML026-SW005 and

ML026-SW006), as well as the new monitoring location at the outlet of NYGB into the Harefield Lake No 2 (ML026-SW007).

1.2.19 Following the elevated Electrical Conductivity displayed by the two monitoring locations (ML026-SW005 & ML026-SW006) on the NYGB in the past 2 months, in March values have decreased substantially, from approximately 5,000 and 3,600 $\mu\text{S}/\text{cm}$ respectively recorded at the beginning of the month, to approx. 800 $\mu\text{S}/\text{cm}$ recorded at the end of the month. Levels of ammoniacal nitrogen and sodium have decreased from the previous month's values, although they are still high (above 10,000 $\mu\text{g}/\text{l}$ and 100 mg/l respectively), while potassium and chloride have returned within the typical range. Exceptionally elevated values have been measured for calcium (1,500-1,700 mg/l) at the beginning of March, but levels have reduced in the second half of the month; these are displayed in Table 2.

1.2.20 The NYGB is known to be affected by contamination from the New Years Green landfill. The decreasing levels of sodium and chloride levels across March, with higher temperature recorded, show that the previous spikes were most likely related to the council road gritting undertaken in response to cold weather along Harvil Road. The causes of the high calcium levels recorded are still unclear; Align is currently investigating recent results with both onsite and off-site laboratories.

Table 2 New Years Green Bourne elevated determinand table

Location ID	Sampling date	Ammoniacal Nitrogen ($\mu\text{g}/\text{l}$)	Calcium (mg/l)	Sodium (mg/l)	Potassium (mg/l)	Chloride (mg/l)
Typical Range	03/21 – 01/23	0-500	100-500	30-200	10-50	20-100
ML026-SW005	01/03/23	19,080	1560	317	90	26
	17/03/23	12,160	667	249	38	32
ML026-SW006	01/03/23	10,760	1,660	368	64	21.5
	17/03/23	17,080	687	142	36	30

1.2.21 Table 3 compares typical surface water ranges for the area with any exceedances.

Table 3 CVV Module 1 surface water in-field parameter data

	pH	SPC ($\mu\text{S}/\text{cm}$)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	7.7 – 8.5	600 - 1200	1 – 20	0 - 300	7.5 – 13

	pH	SPC (µS/cm)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Exceedances	-	5,000, 3,600	-	-	-
Exceeding location	-	ML026-SW005, ML026-SW006	-	-	-

CVV Module 2 (Pier 28 - Pier 13)

Groundwater

- 1.2.22 Table 4 compares typical priority borehole ranges for the area with trigger levels and any trigger level exceedances.
- 1.2.23 There were no trigger limit breaches in Module 2 during the month.

Table 4 CVV Module 2 borehole in-field parameter data

	pH	SPC (µS/cm)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	7 – 8	600 - 850	1 – 25	50 - 300	2 - 8
Trigger limit	5 – 9	1000	250	-	-
Trigger Level Exceedances	-	-	-	-	-
Exceeding borehole	-	-	-	-	-

- 1.2.24 Groundwater levels remained stable across the month, with only ML027-RO062a showing a slight increase of approximately 0.1 m. This location was previously reported as briefly being artesian in January 2023, at the time of writing current results indicate a return to artesian flow. This artesian flow is anticipated to cease once Affinity Water pumping at the nearby production boreholes for Blackford pumping station are restarted.

Surface water

- 1.2.25 Surface water bodies within Module 2 include Savay Lake (ML027-SW006), and Small Pond (ML027-SW004 and SW005), as well as the Grand Union Canal (ML026-SW001).

1.2.26 Table 5 compares typical surface water ranges for the area with any exceedances.

Table 5 CVV Module 2 surface water in-field parameter data

	pH	SPC (µS/cm)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	7 – 7.7	700-850	1 – 25	0 - 250	6 – 13
Exceedances	-	-	-	-	-
Exceeding location	-	-	-	-	-

CVV Module 3 (Pier 42 – P29)

Groundwater

1.2.27 Monitoring for groundwater impacts ceased in December at module 3 in line with the SSMP following completion of intrusive piling activities.

Surface water

1.2.28 Surface water bodies within Module 3 include the River Colne, Long Pond (ML028-SW001 and ML027-SW003), and Korda Lake (ML027-SW002 and ML027-SW001).

1.2.29 Table 6 compares typical surface water ranges for the area with any exceedances.

Table 6 CVV Module 3 surface water in-field parameter data

	pH	SPC (µS/cm)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	7 –8.5	550 - 900	1 – 25	50 - 250	7- 13
Exceedances	-	-	-	-	-
Exceeding location	-	-	-	-	-

CVV Module 4 (North Embankment to Pier 43)

Groundwater

- 1.2.30 Following to the completion of CFA piling works at the North Embankment (NE) in February, the monitoring frequency at ML029-CR021 and ML029-RO431 have reverted back to monthly with no impacts observed.
- 1.2.31 Table 7 compares typical priority borehole ranges for the area with trigger levels and any trigger level exceedances.
- 1.2.32 There were no trigger limit breaches during the month in Module 4.

Table 7 CVV Module 4 borehole in-field parameter data

	pH	SPC (µS/cm)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	6.5 – 8	700 - 875	1 – 10	50 - 300	8 – 11
Trigger limit	5 – 9	1000	100 ² /250 ³ /500 ⁴	-	-
Trigger Level Exceedances	-		-	-	-
Exceeding borehole	-		-	-	-

- 1.2.33 Groundwater levels displayed a varied response during the month, with ML029-CR010 remaining stable, while ML028-CR018 and ML029-RO431 showing a decline of approximately 0.1 m l in first half of the month, followed by an increasing of nearly 0.2 m by the beginning of April.

Surface water

- 1.2.34 Surface water monitoring was completed during the month with chemical sampling and gauge board readings collected where possible. Monitoring continued both weekly and monthly. Surface water bodies within Module 4 include ML029-SW001, Denham Water-Ski Lake (ML028-SW004 and SW003) and the River Colne (ML028-SW002).
- 1.2.35 Decking activities advanced from P49 to P45 in March.

² ML029-CR010, ML029-RO431

³ ML028-CR018, ML028-CR009

⁴ ML028-CR006

1.2.36 Table 8 compares typical surface water ranges for the area with any exceedances.

Table 8 CVV Module 4 surface water in-field parameter data

	pH	SPC ($\mu\text{S}/\text{cm}$)	Turb (NTU)	REDOX (mV)	DO (mg/L)
Typical Range	7.8 – 8.5	500 – 850	1 – 25	100 – 225	9 – 13
Exceedances	-	-	-	-	-
Exceeding location	-	-	-	-	-

1.2.37 Following the high calcium levels detected in the River Colne in January, analysis undertaken by the off-site laboratory in March confirmed that that calcium has returned to typical levels (110 mg/l upstream and 120 mg/l downstream). Concurrent results from the Align on-site laboratory still displayed high levels of Calcium, with values ranging for the upstream location between 550-800 mg/l and for the downstream location between 650-900. Align’s investigation on the discrepancies in the results between the two laboratories is on-going; however, the first evidence suggest that some interferences are affecting the analysis undertaken by the on-site laboratory, which are leading to overestimated results.