



C510 – Whitechapel and Liverpool Street Station Tunnels

Instrumentation and Monitoring Close Out Report Block 04 Liverpool Street

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1 Purpose of Close out Report

Materials and Workmanship Specification - Instrumentation and Monitoring (C122-OVE-Z4-RSP-CR001-00007), section KX10.2114 specifies the requirement for a close out report prior to the decommissioning of monitoring sensors and instruments. It is therefore, the purpose of this close out report to gain acceptance to decommission identified monitoring sensors in Block 04 of Crossrail's C510 Liverpool St. Acceptance to decommission sensors will result in ceasing measurements, stopping the reporting and removing sensors.

The current document is the revision 2 of the close out report of Block 04 of Crossrail's C510 Liverpool St. presenting the decommissioning statuses of the remaining sensors of revision 1.

Appendix I of revision 2 includes the graphs and results for the crackmeters in Block 04

Appendix II of revision 2 includes a listing of the sensors' statuses, time graphs of the monitoring full history and location plans of revision 1. All the sensors that had been PROPOSED in revision 1 were accepted.

To gain approval to decommission instrumentation and monitoring, the monitoring data will be analysed to demonstrate settlement does not breach specified rates after the minimum monitoring period is complete.

N.B. Monitoring sensors refers to all monitoring points; which includes BREs, invar scales, road studs, extensometers, inclinometers, tilt meters, crack meters, water cells, retros (survey stickers) and prisms. Please note this is not an exhaustive list and does not include monitoring systems/equipment, such as communication boxes.

2 Scope of Monitoring Assessment for Close Out

Specification KX10.4103 of document C122-OVE-Z4-RSP-CR001-00007 states that to establish approval for decommissioning, the contractor is to produce a close out report which summarises the observations in correlation with the construction activities. The report is to demonstrate monitoring has reached acceptable settlement rates; whether to the specified rate, or where no rate is specified trigger values are evaluated against potential residual risks. I&M schedule C122-OVE-C2-DDJ-CR001-Z-31511 specifies the acceptable settlement rates with the requirements to monitor at different construction phases, and duration for completion. To summarise the I&M schedule states that the manual monitoring decommissioning specified rate is 2mm per year, following 16 months post construction monitoring (4 months step down and quarterly measurements for a minimum of 12 months long term monitoring). The I&M schedule does not identify the need for long term automated monitoring or specify a settlement rate requirement, it only states that monitoring must continue for 6 months post construction. At the 6 month juncture, agreement must be sought from the project manager to decommission automated monitoring programmes through a close out report or agreeing to cease the works with the project manager. In most cases decommissioning will be possible, as the residual risk will be captured through the remaining long term manual monitoring.

Contrary to the Specification for Instrumentation and Monitoring (C122-OVE-Z4-RSP-CR001-00007), the Project Managers Instruction (PMI) C510-PMI-01102 replaces long term monitoring with satellite interferometry (InSAR) for the areas agreed by the project manager. If long term monitoring responsibilities are removed from BBMV and covered by satellite interferometry, the specified settlement criteria may not be met by BBMV. If this occurs, reference to the agreement will be provided to state BBMV are no longer responsible for the sensors and consequently decommissioning acceptance will be proposed.

In some cases it may be agreed with the project manager to cease monitoring prior to meeting the specified rates. The close out report will be revised to incorporate these agreements prior to decommissioning. Due to multiple influencers and large construction monitoring zones, it may be prudent to submit successive document revisions for close out reports, where the specification is not met or the minimum post construction monitoring has not been achieved.

3 Close Out Report Block Description and Location Plan

3.1 Block 04 Location

Error! Not a valid bookmark self-reference. shows the Liverpool St general location plan, C510 tunnel construction and where Block 04 is situated. Detailed location plans can be found within the installation reports and photomontages as listed in Section 3.2. Each monitoring sensor's location is shown within the assessment plans (Section 5.4).

Numerous Thames Water critical assets surround Block 04, including:

- 9" cast iron (CI) South Side London Wall water main within London Wall;
- London Wall sewer within London Wall; and
- 12" steel (ST) water main located within South Side Finsbury Circus and Blomfield Street.

The location and details of these assets can be found in Instrumentation and Monitoring Plan: Liverpool Street Station Ground Movement and Asset Protection C122-OVE-C2-RGN-C101-50013 or the relevant C122 prepared Damage Assessment Reports.

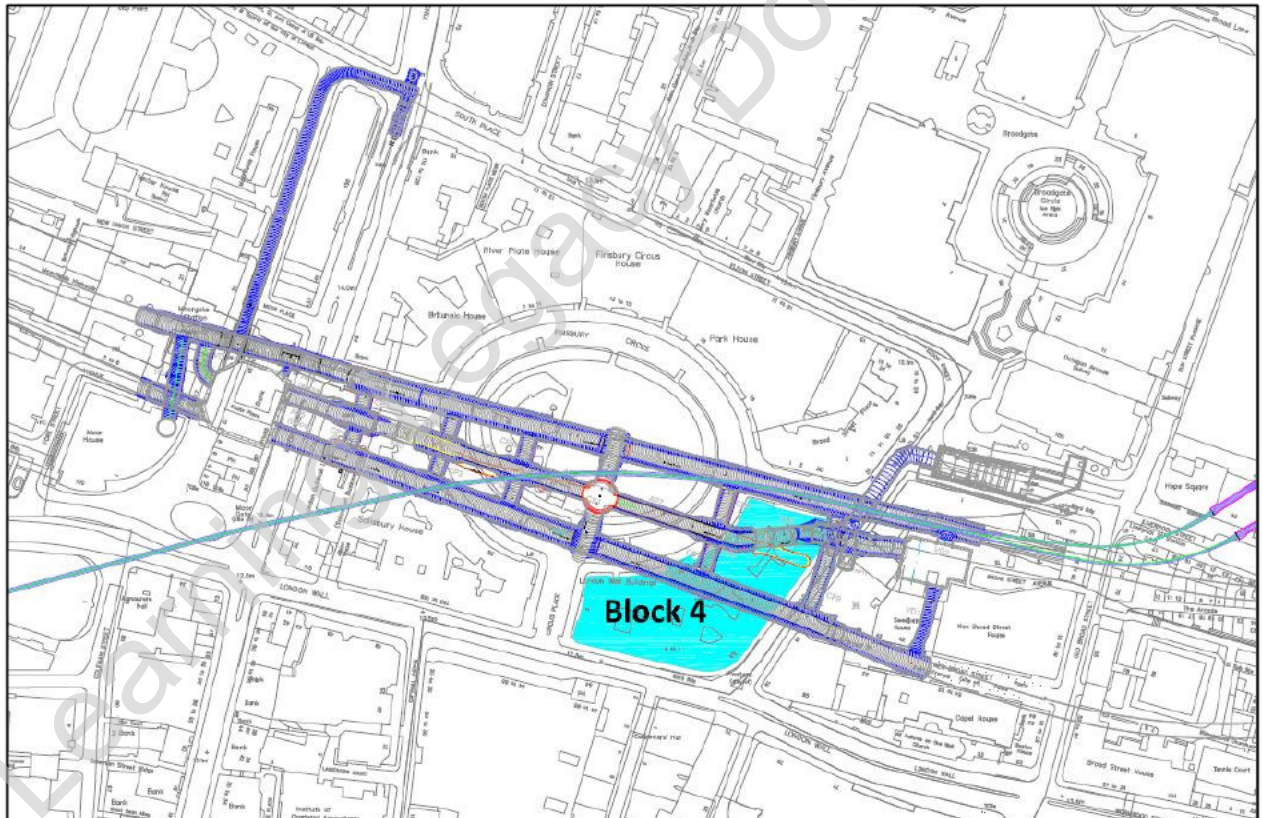


Figure 1 - Liverpool St General Location Plan - including Block 04 monitoring area

3.2 Block 04 Description

Block 04 is between London Wall, Blomfield Street and Finsbury Circus. Block 04 is located above Platform Tunnel West (PTW), Cross Passage 7 (CP7), Chamber 2 (CH2), Escalator Tunnel 2 (ES2) and Cross Passage 10 (CP10), further details of the construction programmes can be found in Section 4. Block 04 contains the following types of monitoring sensors:

- Building Levelling Studs/BREs (LB) - manual monitoring
- Invar Scales (LC) – manual monitoring
- Road Studs (LP)- manual monitoring
- Building 3D Geodetic Prism monitoring (RP) – automated monitoring
- Extensometer Rods (XR) – automated and manual monitoring
- Water Settlement Cell Electronic (SH) – automated monitoring
- Tiltmeters (TB) – automated monitoring
- Crack Monitors (CK) – manual monitoring
- Inclinometers (IM) – automated and manual monitoring

Each monitoring sensor's details are listed within the Decommissioning Status Tracker (Table 2) and further relevant information can be sourced from the following reports.

Block 04 Report References:

- Installation Report – LIV-Block 04 – London Wall Buildings
CRL Document Number: C510-BBM-C2-RGN-C101-50007
- Monitoring Installation Report LIV-Inclinometer – Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50098
- Monitoring Installation Report LIV-Extensometer – Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50112
- Monitoring Installation Report LIV-LP-04-Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50128
- Monitoring Installation Report LIV-LB-04-Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50152
- Monitoring Installation Report LIV-LB&LP-04-Liverpool Street-Internal London Wall Building
CRL Document Number: C510-BBM-C2-RGN-C101-50153
- Monitoring Installation Report LIV- All Blocks – Crack Meters – Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50224

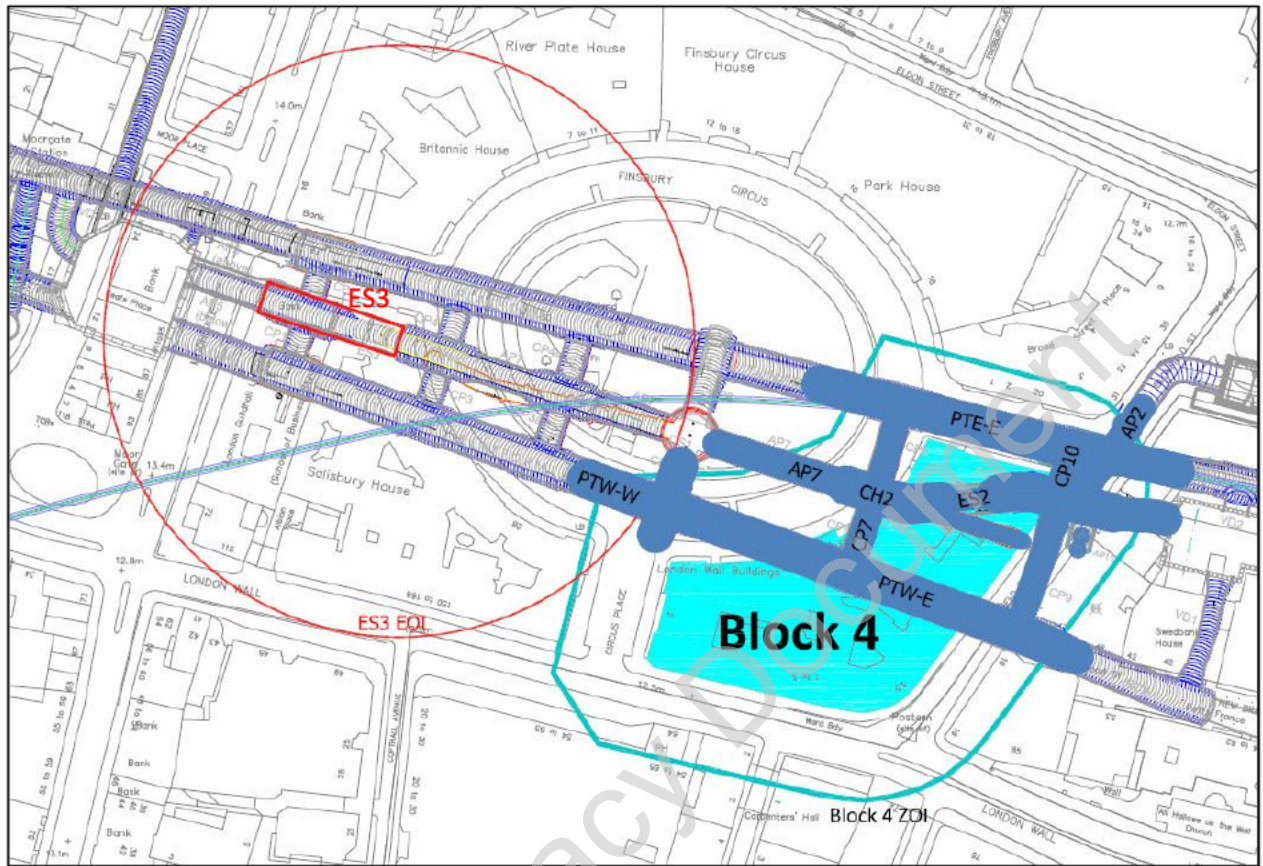
The Settlement Contour Drawing (C122-OVE-C2-DDA-CR001_Z-21313) predicts Block 04 to experience approximately 5-130mm of settlement.

4 Construction Programme Influencing Block 04

Extent of Influence (EOI) monitoring areas were established to record ground movements in relation to C510 construction. The EOI purpose is to ensure all assets and areas are adequately monitored for movement during construction, this is achieved by controlling when and how often monitoring occurs. The Asset Protection Instrument and Monitoring (I&M) Schedules (C122 –OVE-C2-DDJ-CR001_Z-31511) states the extent of influence (EOI) of an active tunnel is 2 x depth from the active tunnel face. The EOI is used to determine when monitoring sensors are no longer influenced by construction and can be considered for decommissioning.

The original specification received amendments to manual monitoring frequency within the EOI through several PMIs, with the latest PMI (C510-PMI-01103) establishing an Active ZOI (Zone of Influence) as 2 x tunnel diameter from the active tunnel face projected to the surface. The Active ZOI changed the rates of monitoring frequency, it did not replace EOI. The EOI is used to determine when a monitoring sensor is eligible for decommissioning. Whereas, active ZOI is used to analyse manual monitoring movement against construction.

To identify the tunnels that had the potential to significantly affect Block 04, a ZOI was established by giving each monitoring sensor a radius of 2.0 x tunnel diameter. This area was then used to determine all the mining advances that occurred within its boundary. Figure 2 shows the ZOI boundary (blue outline), ES3 EOI, and the tunnel constructions. Tunnel advance start and finish dates will be used in the assessment of the monitoring data.



(From General Document Template ref: BBMV-Form-S9-04 rev 5.0)

Figure 2 - Block 04 ZOI Constructions and Remaining EOI Construction Plan

Figure 2 shows the Block 04 ZOI and the tunnel advances that occurred within its boundary. The construction advances within the ZOI that have the potential to affect Block 04 are listed and summarised in Table 1. Further evidence for construction dates can be seen in Table 2, which lists the latest tunnel advance for each point.

ES3 enlargement advances were the final construction advances of the project and were completed on the 18th of March 2017. The extent of influence for this tunnel does not affect Block 04.

4.1 Tunnel Advances Affecting Block 04

The information presented in Table 1 is used in all monitoring graphs (Section 5.1), to show the ground movements in relation to construction.

TUNNEL ADVANCES START & ENDS FOR GRAPHS					
Tunnel Code	Tunnel Reference	Primary Layer Type	Start Date	End Date	Zone
ES2-Enlargement	ES2	Enlargement	28/10/2016	20/11/2016	ZOI
CH3-Enlargement	CH3	Enlargement	21/08/2016	28/08/2016	ZOI
AP11-Enlargement	AP11	Enlargement	06/08/2016	14/08/2016	ZOI
AP12-Enlargement	AP12	Enlargement	04/08/2016	04/08/2016	ZOI
AP2-Enlargement	AP2	Enlargement	13/06/2016	28/06/2016	ZOI
AP2-Pilot	AP2	Pilot	25/04/2016	18/05/2016	ZOI
ES2-Pilot	ES2	Pilot	31/10/2015	24/04/2016	ZOI
CP10-Enlargement	CP10	Enlargement	15/08/2014	17/08/2014	ZOI
CP9-Enlargement	CP9	Enlargement	08/08/2014	23/08/2014	ZOI
CP9-Pilot	CP9	Pilot	17/07/2014	23/07/2014	ZOI
CP10-Pilot	CP10	Pilot	15/07/2014	16/07/2014	ZOI
CP7-Enlargement	CP7	Enlargement	11/05/2014	06/07/2014	ZOI
CP7-Pilot	CP7	Pilot	06/05/2014	09/05/2014	ZOI
CP8-Enlargement	CP8	Enlargement	14/04/2014	26/04/2014	ZOI
RCW-Enlargement	RCW	Enlargement	14/04/2014	15/04/2014	ZOI
CP8-Pilot	CP8	Pilot	07/04/2014	12/04/2014	ZOI
RCE-Enlargement	RCE	Enlargement	31/01/2014	12/02/2014	ZOI
PTW-East-Enlargement	PTW-East	Enlargement	17/11/2013	14/04/2014	ZOI
PTE-East-Enlargement	PTE-East	Enlargement	15/11/2013	30/01/2014	ZOI
RCE-Pilot	RCE	Pilot	09/09/2013	14/09/2013	ZOI
PTW-West-Enlargement	PTW-West	Enlargement	18/08/2013	17/09/2013	ZOI
AP1a-Enlargement	AP1a	Enlargement	04/08/2013	13/08/2013	ZOI
AP1b-Enlargement	AP1b	Enlargement	13/07/2013	04/08/2013	ZOI
PTW-East-Pilot	PTW-East	Pilot	13/07/2013	17/10/2013	ZOI
PTE-East-Pilot	PTE-East	Pilot	02/07/2013	09/09/2013	ZOI
PTW-West-Pilot	PTW-West	Pilot	02/06/2013	07/06/2013	ZOI
AP1a-Pilot	AP1a	Pilot	19/05/2013	06/06/2013	ZOI
ES2-Initial-Pilot	ES2-Initial	Pilot	26/03/2013	01/05/2013	ZOI
CH2-Enlargement	CH2	Enlargement	11/04/2013	01/05/2013	ZOI
AP1b-Pilot	AP1b	Pilot	27/03/2013	18/05/2013	ZOI
AP7 East-Enlargement	AP7 East	Enlargement	02/03/2013	10/04/2013	ZOI
CH2-Pilot	CH2	Pilot	14/02/2013	18/03/2013	ZOI
CP5-Enlargement	CP5	Enlargement	08/12/2012	13/01/2013	ZOI
CP5-Pilot	CP5	Pilot	10/11/2012	16/11/2012	ZOI
AP7 East-Pilot	AP7 East	Pilot	24/10/2012	14/02/2013	ZOI
GAD2-Pilot	GAD2	Pilot	11/02/2012	09/03/2012	ZOI

Table 1 - Tunnel Advances Affecting Block 04

Heading Index:

- AP – Access Passage
- CH - Chamber
- CP - Cross Passage
- ES – Escalator
- GAD – Grout Adit
- PTE – Platform Tunnel East
- PTW – Platform Tunnel West
- RCE – Reception Chamber East
- RCW – Reception Chamber West

5 Monitoring Assessment of Block 04

Evidence for decommissioning each monitored sensor is shown through graphs, tables (decommissioning status tracker) and plans. Each element of assessment compliments the other and is used together to determine acceptance of decommissioning. The decommissioning status tracker (Table 2) highlights the monitoring sensors to be considered for decommissioning and provides the supporting evidence for the decision. In some cases supplementary evidence is required to prove stability or provide reasoning for decommissioning.

As ES3 EOI does not affect Block 4, all monitoring points within the block are considered for decommissioning.

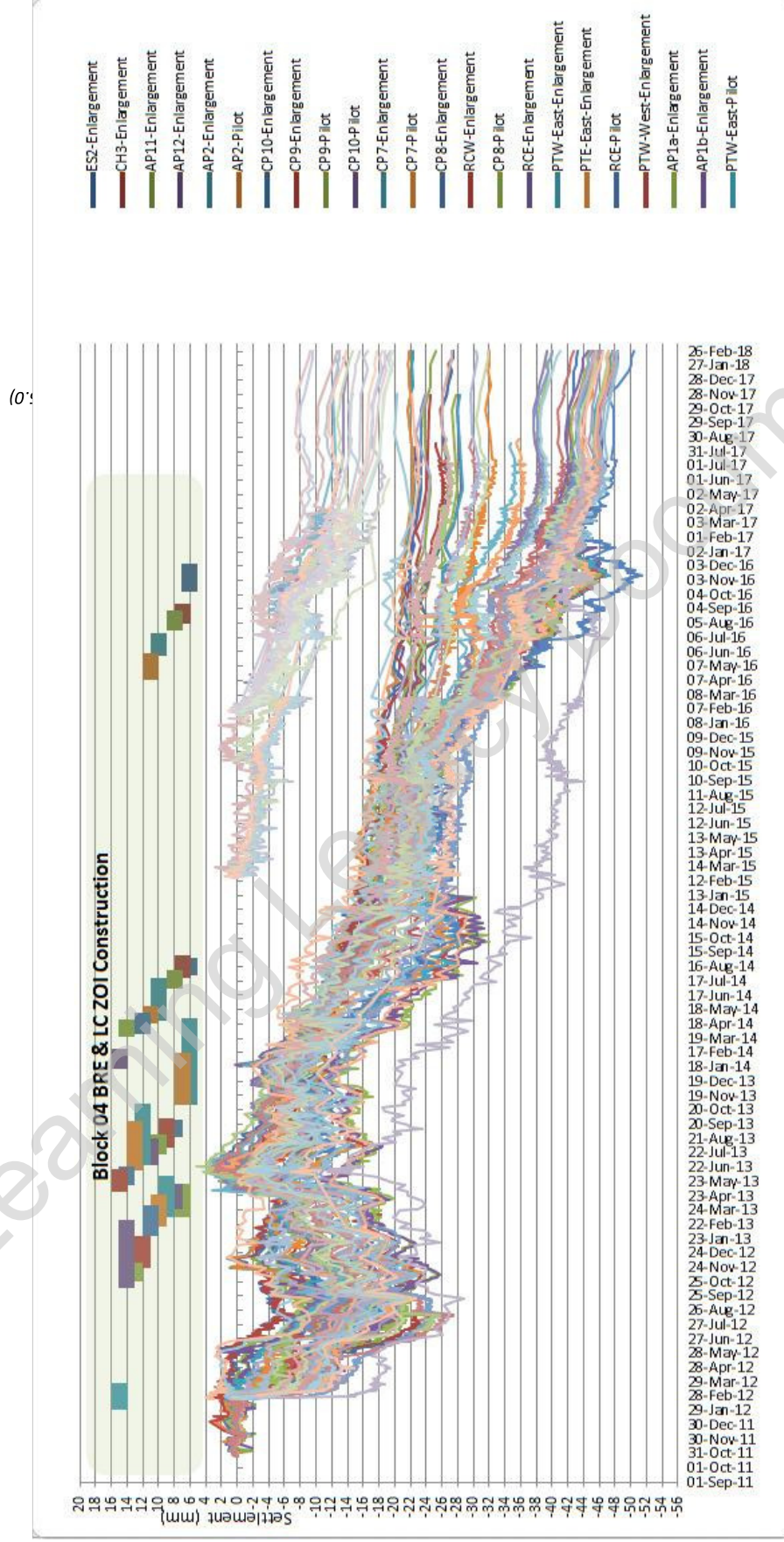
Crossrail agreed at the ERP meeting held on the 20/6/2017 to the decommissioning of grouting within the GAD2 tunnel and Blomfield Grout Box. Under Specification Section KC21.3220(c) of the Crossrail document C122-OVE-Z4-RSP-CR001-00010, it states that automatic monitoring can be decommissioned at the same time as the grouting facilities. It is therefore proposed that all automated sensors within Block 04 be removed. Precise levelling points will be maintained in place and monitored until such time that the sensors meet the settlement criteria. See graphs, tables and plans for further details on the automated sensors.

5.1 Time Graphs Monitoring Full History and Construction Durations

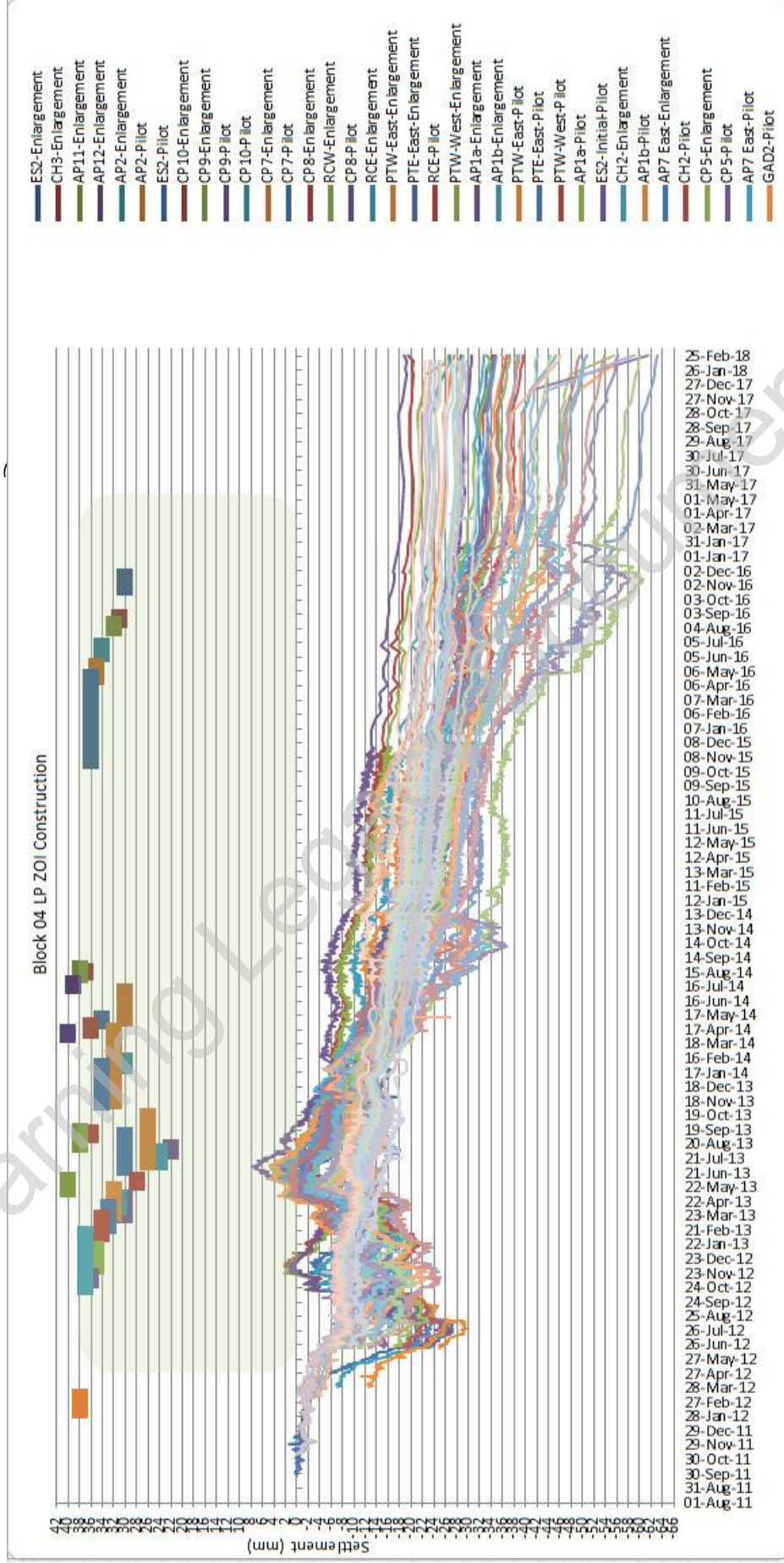
To assess the movement of Block 04 monitoring sensors; each monitoring sensor data type is displayed in a line graph, with a Gantt chart (bar) representing the construction identified in Section 4:

- Graph 1 - Block 04 Building (BRE & LC) Manual Monitoring History in Relation to Construction
- Graph 2 - Block 04 Road Studs (LP) Manual Monitoring History in Relation to Construction

Graph 1 - Block 04 Building (BRE & LC) Manual Monitoring History in Relation to Construction



Graph 2 - Block 04 Road Studs (LP) Manual Monitoring History in Relation to Construction



5.2 Block 04 Decommissioning Status Tracker

The decommissioning tracker (Table 2) identifies each monitoring sensor and provides the critical information to enable decommissioning assessment for each sensor. The initial fields shown in the tracker are descriptors of the monitoring sensor, whilst the remaining fields are the assessment for decommissioning. The purpose of the tracker is to provide Crossrail reviewers with sufficient information in conjunction with construction movement graphs and plots, to accept BBMV's proposal to decommission sensors on an individual basis.

Detailed explanation of the tracker column headers:

Tracker Column Header – Last Construction Date

To determine the last influencing construction works for each sensor, the Active ZOI parameter was used. All construction tunnelling advances within the 2 x diameter radius were listed for each sensor, from these lists the latest advance date is used as an indicator.

N.B. Each monitoring sensor's last affecting primary construction heading and advance number's completion date has been listed within the Decommissioning Status Tracker. The last construction heading listed, is not the closest to the monitoring sensor, but the last completed within the 2 x diameter radius. Not all sensors are within a distance of 2 x diameter of a tunnel advance location. If this scenario occurs the last completed heading within Block 04's ZOI is used as a reference.

Tracker Column Header – 120, 180 & 365 Days Average Settlement Trend

There are three average settlement trends, which tie into the defined monitoring time frames; 120, 180 and 365 days. The calculation used to determine the trend is the same for all three periods. It is a slope calculation (explained below) of the defined period, multiplied over one year. The trend is calculated from the latest reading and includes all readings within the defined period, which is averaged and then multiplied over 1 year. If there is no initial reading for the time frame date, the calculation will continue back to include the next available date. This is an important consideration when assessing the trend and to assist the reviewers, the time frame used within the calculation is included within the decommissioning tracker status table. Defined monitoring time frames:

- The 120 day average rate is used to show the completion of manual monitoring step down period, this is the minimum period of monitoring prior to InSAR taking monitoring responsibility.
- The 180 day average rate is the minimum monitoring period after construction for automated sensors.
- The 365 day average trend is the desired period to be used if the long term monitoring has been completed for decommissioning evidence. The specification states that if the trend is below 2mm/yr, then the sensor is eligible for decommissioning.

Slope calculation Settlement Trend:

Description – The settlement trend calculates the slope of the linear regression line through data points in known_y's and known_x's. The slope is the vertical distance divided by the horizontal distance between any two points on the line, which is the rate of change along the regression line.

Calculation

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

Example - If the calculated trend for a 6 month period is 1.5mm, it is multiplied into 365 days, to equal a projected settlement trend of 3mm over 1 year.

Tracker Column Header – ERP Ceased date

ERP and CTC meetings have identified project efficiencies, by ceasing manual monitoring programmes early, or prior to reaching 2mm/yr. InSAR may have taken responsibility of monitoring or the perceived risk may be low enough to warrant ceasing the monitoring. In these situations the cease date is provided, along with a comment explaining the reasoning. Monitoring that has been ceased still requires approval to decommission and will be identified within the decommissioning status tracker as proposed to decommission.

Tracker Column Header – Decommissioning Status

The status is the decommissioning situation for each sensor within Block 04. The different statuses are as follows:

- Outstanding - Monitoring sensor has not met the close out requirements and approval to decommission will be sought in subsequent revisions of this close out report.
- Proposed - the sensor is proposed to be decommissioned. Crossrail to accept the sensor can be decommissioned.
- Agreed – Agreed to decommission through previous revision of the close out report. No further reporting or monitoring has taken place.
- Complete - Monitoring sensor has been removed and evidence gathered during decommissioning.

N.B. When monitoring sensors have not met the requirements, it may still be appropriate to decommission. In this scenario supplementary evidence will be provided to explain the reasoning for decommissioning.

Table 2 - Block 04 Decommissioning Status Tracker BRE & LC

27/02/2018

< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm RED

AVERAGE SETTLEMENT TREND

C510 Sensor Name	Block	Section	Int/Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 Days Calculation Period	180 Days Calculation Period	180 Day Calculation Period	365 Days Calculation Period	365 Day Calculation Period	Ceased Date	General Comment	Decommissioning Status
C510-LB10487	Block 04	Spent Room	Internal	Manual	LB	BRE	Finsbury House	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	27/02/2018	#N/A	-2.6	222	-4.2	369			Outstanding
C510-LB10488	Block 04	Spent Room	Internal	Manual	LB	BRE	Finsbury House	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	27/02/2018	#N/A	-2.7	222	-4.3	369			Outstanding
C510-LB10489	Block 04	Spent Room	Internal	Manual	LB	BRE	Finsbury House	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	27/02/2018	#N/A	-3.2	222	-5.0	369			Outstanding
C510-LB10491	Block 04	Spent Room	Internal	Manual	LC	Invert Scale	Finsbury House	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	27/02/2018	#N/A	-2.2	222	-3.6	369		Stable 6 month trend	Proposed
C510-LB10471	Block 04	N/A	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	0.9	0.0	205	-6.9	372			Complete
C510-LB10472	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	0.2	-1.5	235	-5.7	372			Complete
C510-LB10473	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	0.5	-1.8	225	-6.5	372			Complete
C510-LB10474	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	0.3	-1.9	225	-6.0	372			Complete
C510-LB10476	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	1.2	-1.3	225	-6.8	372			Complete
C510-LB10477	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	1.8	-1.0	225	-7.1	372			Complete
C510-LB10481	Block 04	N/A	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	0.4	-1.7	225	-6.3	372			Complete
C510-LB10482	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	-0.1	-1.9	225	-6.1	372			Complete
C510-LB10483	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	-0.9	-2.3	225	-6.0	372			Complete
C510-LB10484	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	-0.3	-2.2	225	-5.8	372			Complete
C510-LB10485	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	-1.0	-3.7	225	-5.5	372			Complete
C510-LB10485	Block 04	S10401	Internal	Manual	LB	BRE	Finsbury House Gas	LIV_ESS_Safe_Stop_Adv+0	24/11/2016	03/11/2017	-1.0	-2.4	225	-5.2	372			Complete

Comment
Trends of LCs that were removed accidentally were generally following adjacent BRE trends



Table 2 - Block 04 Decommissioning Status Tracker CR

13/06/2017

< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm RED

AVERAGE SETTLEMENT TREND

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 Days Calculation Period	180 Days Calculation Period	365 Days Calculation Period	Ceased Date	General Comment	Decommissioning Status
C510-CK10401	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Invert_Adv-14	13/11/2016	13/03/2017	-1.3	0.0	186			Outstanding
C510-CK10402	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Invert_Adv-14	13/11/2016	13/03/2017	-1.5	0.3	186			Outstanding
C510-CK10403	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Invert_Adv-14	13/11/2016	13/03/2017	-9.7	-3.3	186			Outstanding
C510-CK10404	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/03/2017	0.1	0.2	186			Outstanding
C510-CK10405	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/03/2017	-0.1	0.7	186			Outstanding
C510-CK10406	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/03/2017	0.0	0.0	369			Outstanding
C510-CK10407	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House (Corridor)	LIV_ES2_Invert_Adv-8	07/11/2016	13/03/2017	-2.5	-2.2	229			Outstanding
C510-CK10411	Block 104	S10401	Internal	Manual	CK	Crack Monitor	23 Finsbury House (Corridor)	LIV_ES2_Invert_Adv-9	07/11/2016	13/03/2017	0.0	0.0	229			Outstanding
C510-CK10401	Block 104	S10401	Internal	Manual	CK	Crack Monitor	London Wall Building	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/03/2017	-3.1	0.9	412			Outstanding
C510-CK10402	Block 104	S10401	Internal	Manual	CK	Crack Monitor	London Wall Building	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/03/2017	0.8	0.3	412			Outstanding
C510-CK104201	Block 104	S10401	Internal	Manual	CK	Crack Monitor	London Wall Building	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/06/2017	0.0	0.0	187			Outstanding
C510-CK104601	Block 104	S10401	Internal	Manual	CK	Crack Monitor	London Wall Building	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/06/2017	-0.1	0.0	187			Outstanding
C510-CK104602	Block 104	S10401	Internal	Manual	CK	Crack Monitor	London Wall Building	LIV_ES2_Safe_Stop_Adv-10	24/11/2016	13/06/2017	-0.7	0.1	187			Outstanding

Crackmeter stable. For latest data see Appendix I. Also refer to the document "Crackmeters Block 4-Finsbury House-GAS-WATER.xlsm"

Crackmeter stable. For latest data see Appendix I. Also refer to the document "Block 4 LWB Crackmeter Graph.xlsm"



5.3 Supplementary Evidence for Decommissioning

In some cases, supplementary evidence will be provided to support the decommissioning evidence.

5.3.1 BREs

- LB10457 – The BRE was removed during works at London Wall Basement. Latest data 28/11/2017



Figure 3. London Wall Basement -

5.3.2 Roadstuds

- LP12403–Data of roadstud LP12403 probably affected by HGV parked over the studs on the pavement. Trends of points LP12404-07 might also be affected.



Figure 4. Finsbury Circus pavement, 23-25 London Wall - HGV parked over the studs



Figure 5. Finsbury Circus pavement, 23-25 London Wall - HGV parked over the studs

- LP12418-25

LP12418: Data of roadstud LP12418 affected by settlement that was caused by London Wall basement works due to HGV moving and parking over studs (Figure 6)



Figure 6. London Wall basement works

LP12419-25: Trend affected by settlement that was caused by London Wall basement works (Figure 7)



Figure 7. London Wall basement works

- LP12436-39

LP12436-37: Trend affected by settlement that was caused by recent utility works that affected LP12438-39. (Figure 8-9)

LP12438-39: Utility works lifted slabs and studs were destroyed since 13/06/2017 (Figure 9)



Figure 8. LP12437 Uneven slabs



Figure 9. Utility works lifted slabs and studs LP12438-39 were destroyed since 13/06/2017. Works also affected trends of LP12436-37.

- LP12455: Stud is damaged.



Figure 10. LP12455 Stud is damaged

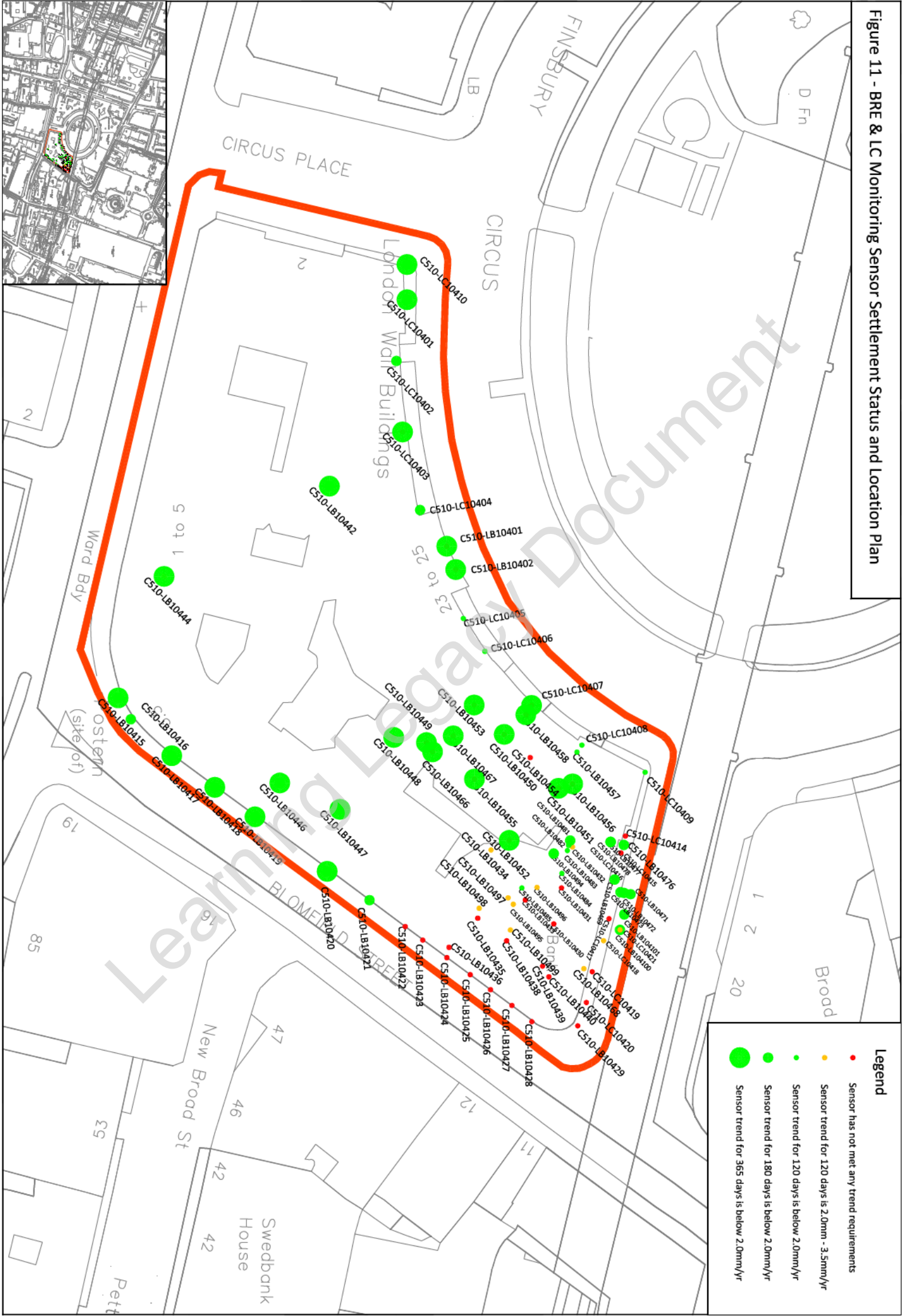
5.4 Monitoring sensor Location Plan and Decommissioning Status

The following plots provide a visual representation of all Block 04 monitoring sensors included in revision 02 with a colour circle that defines its settlement status. A green circle represents when a trend is below 2mm/yr and the larger the circle the greater the trend period. When a trend has not been met, a small red circle will represent the monitoring sensor. There are two plans for Block 04 monitoring sensors.

- Figure 11 - BRE & LC Monitoring Sensor Settlement Status and Location Plan
- Figure 12 - LP Monitoring Sensor Settlement Status and Location Plan

Learning Legacy Document

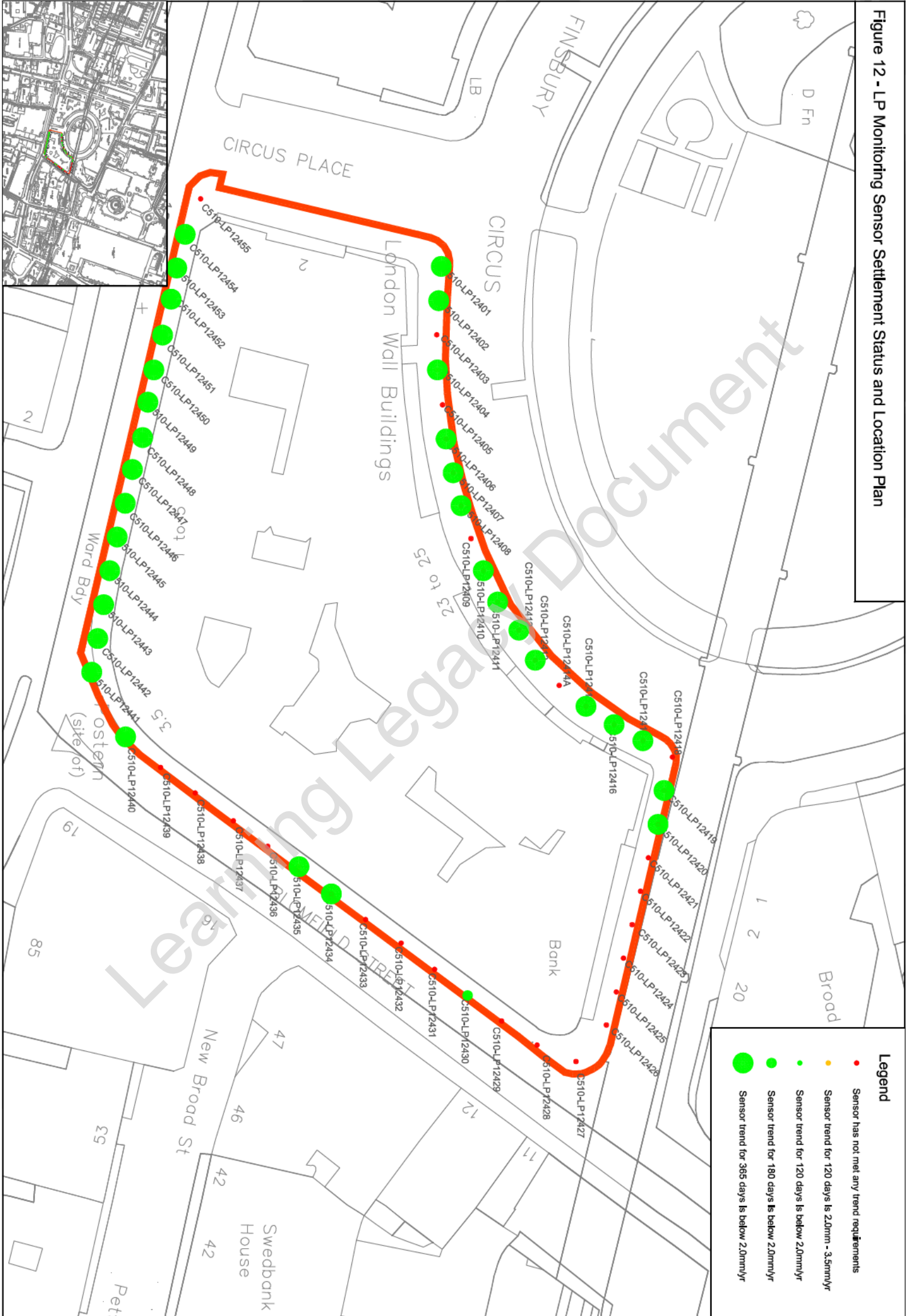
Figure 11 - BRE & LC Monitoring Sensor Settlement Status and Location Plan



Legend

- Sensor has not met any trend requirements
- Sensor trend for 120 days is 2.0mm - 3.5mm/yr
- Sensor trend for 120 days is below 2.0mm/yr
- Sensor trend for 180 days is below 2.0mm/yr
- Sensor trend for 365 days is below 2.0mm/yr

Figure 12 - LP Monitoring Sensor Settlement Status and Location Plan



Legend	
●	Sensor has not met any trend requirements
●	Sensor trend for 120 days is $\le 2.0\text{mm} - 3.5\text{mm/yr}$
●	Sensor trend for 120 days is below 2.0mm/yr
●	Sensor trend for 365 days is below 2.0mm/yr

6 Decommissioning Recommendations

Revision 2 of Block 04 close out report does not request all monitoring sensors to be decommissioned. The decommissioning status tracker (Table 2) identifies the monitoring sensors to be agreed for decommissioned. Monitoring sensors that are unable to be decommissioned will be reassessed in the future.

Summary to Continue to Monitor (“Outstanding to Decommission”):

- Road studs, BREs and invar scales that have not met the <2mm/year specification, as identified in Section 2;
- All crackmeters until adjacent monitoring sensors meet the <2mm/year specification;

Summary to Decommission (“Proposed to Decommission”):

- Sensors that have met the 2mm/year trend and proposed to be decommissioned, as per the decommissioning status tracker (Table 2).

N.B. When required, decommissioning and re-instatement evidence will be collected during the removal of monitoring sensors, which will be included within the final report.

7 **Appendix I (Crackmeters latest results)**

Learning Legacy Document

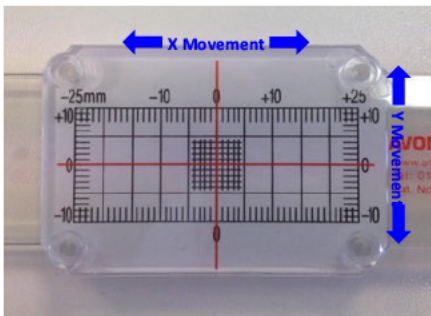
Crackmeters Results

Crackmeters Block 4 Finsbury House Gas & Water

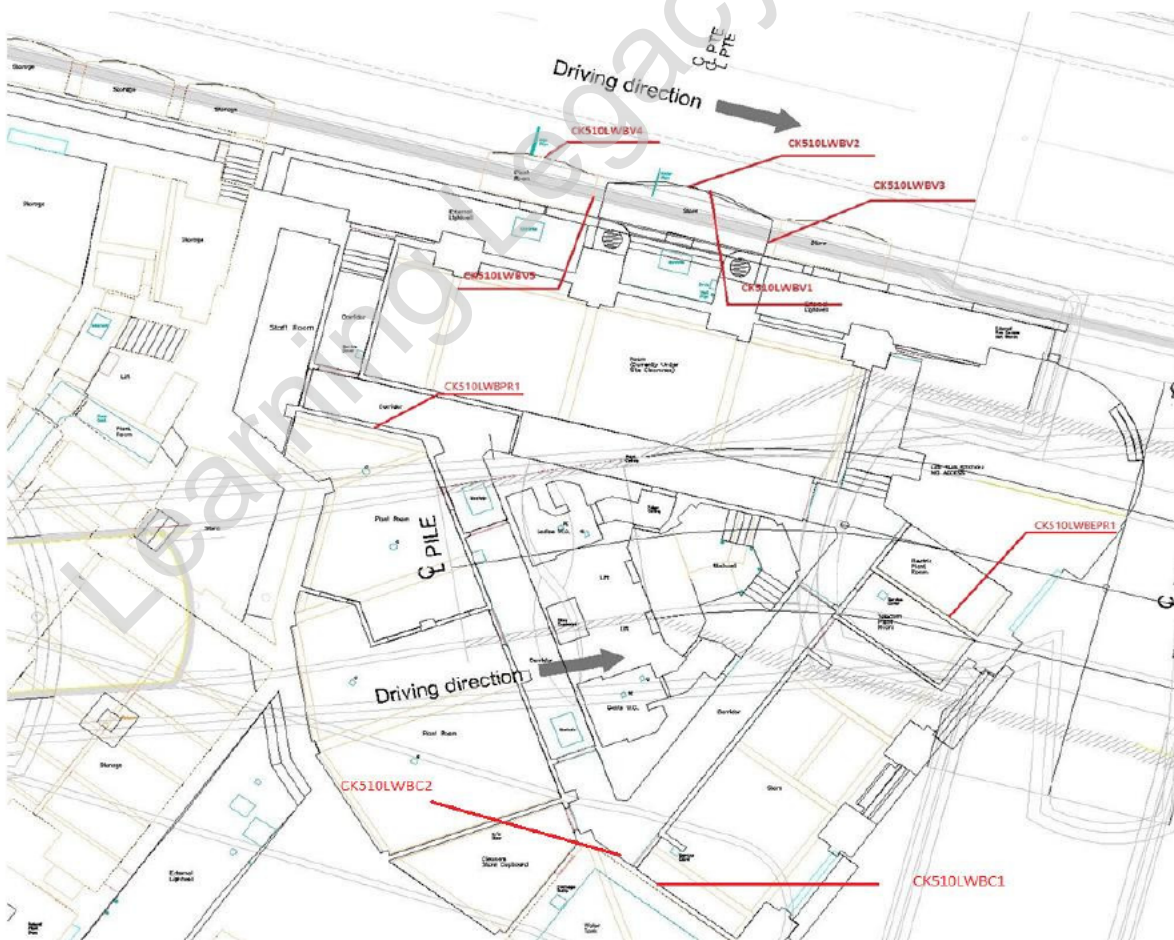


24/01/2018

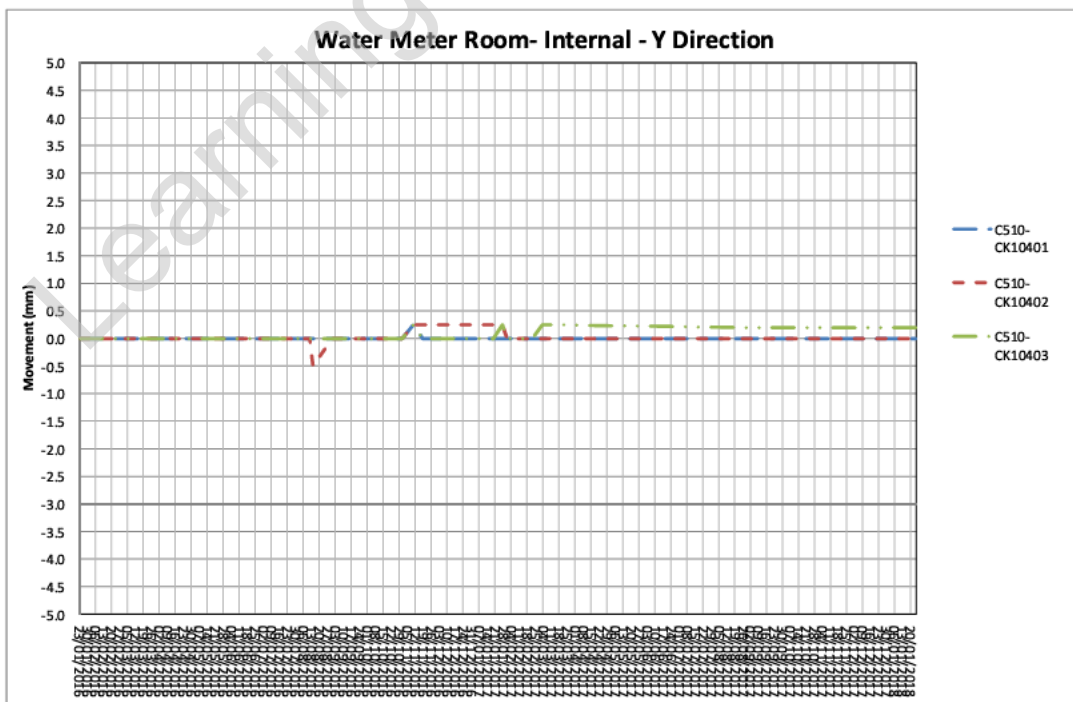
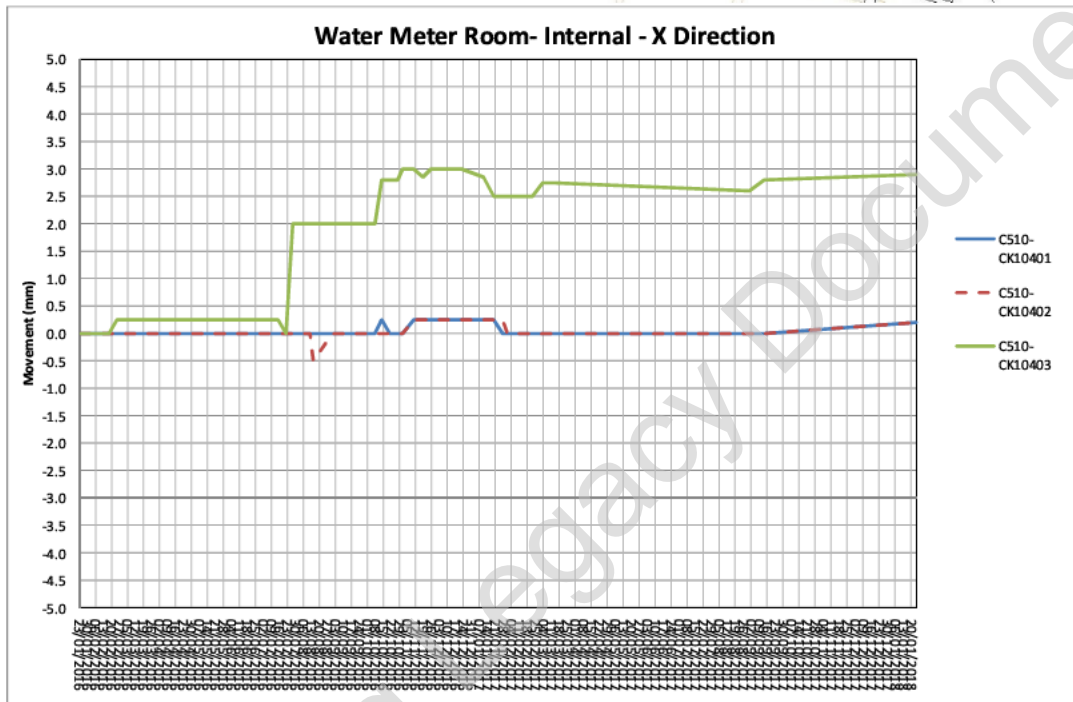
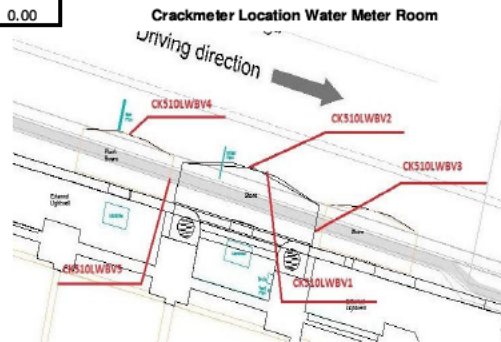
COMMENTS	
25/01/2016	CK510LWBV5 Has been destroyed
28/01/2016	CK510LWBV5 Has been reinstalled
09/03/2016	CK510LWBV4 and 5 has been destroyed, need to be reinstalled
24.03.2016	CK510LWBPR1 No access due to asbestos issue
14.07.2016	C510-CK10406
23/03/2017	CK510LWBV1-CK510LWBV2-CK510LWBV3 no access



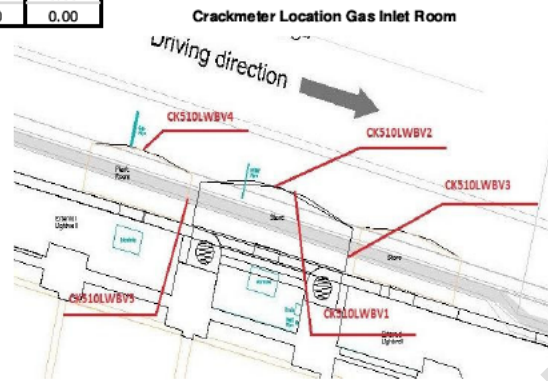
GENERAL LOCATION PLAN FOR FINSBURY HOUSE CRACKMETERS



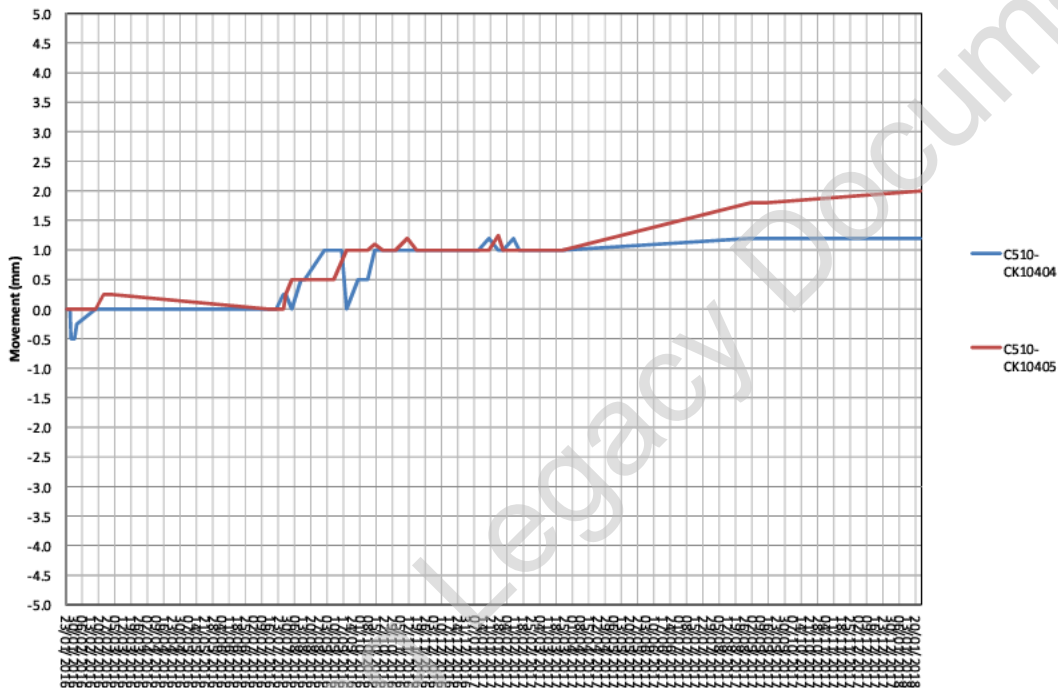
Water Meter Room					
Previous Name	UCIMS Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
				X	Y
CK510LWBV1	C510-CK10401	2.00	22/01/2016	0.00	0.00
CK510LWBV2	C510-CK10402	1.50	22/01/2016	0.00	0.00
CK510LWBV3	C510-CK10403	7.00	22/01/2016	0.00	0.00



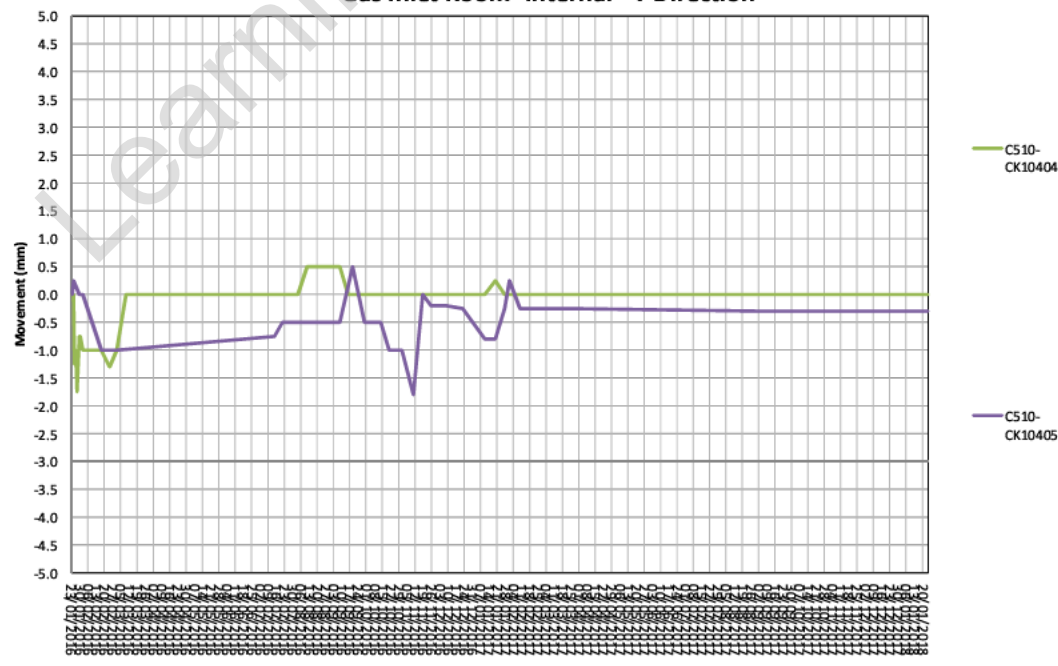
Gas Inlet Room					
Previous Name	UCIMS Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
				X	Y
CK510LWBV4	C510-CK10404	2.00	22/01/2016	0.00	0.00
CK510LWBV5	C510-CK10405	2.50	22/01/2016	0.00	0.00



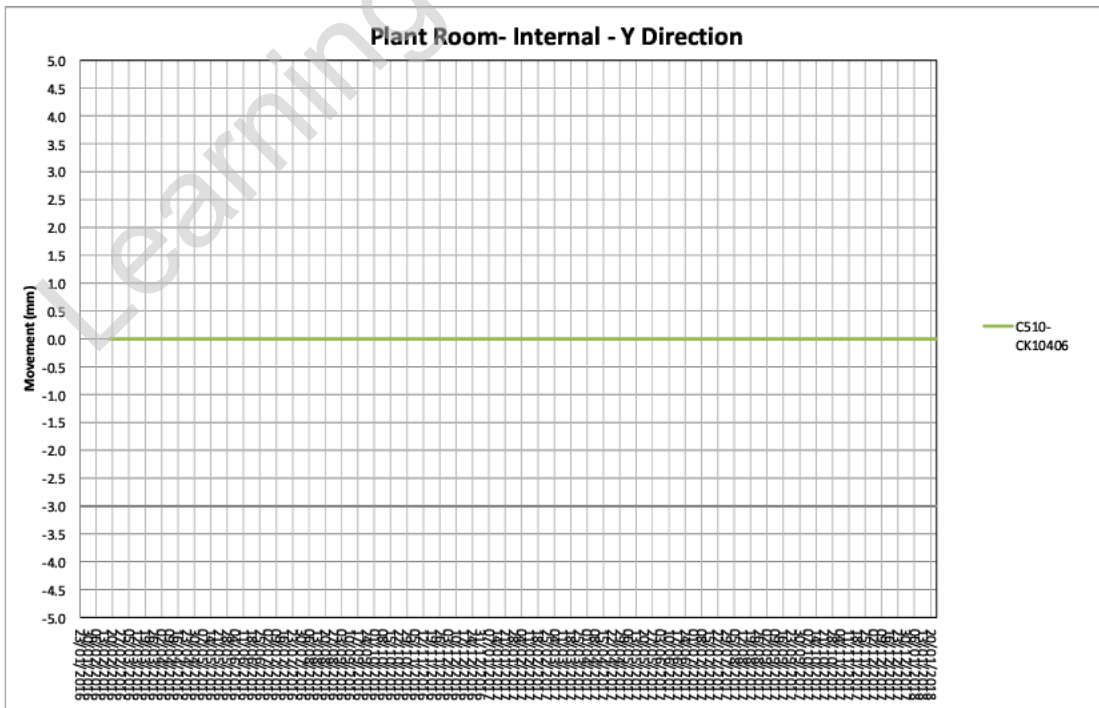
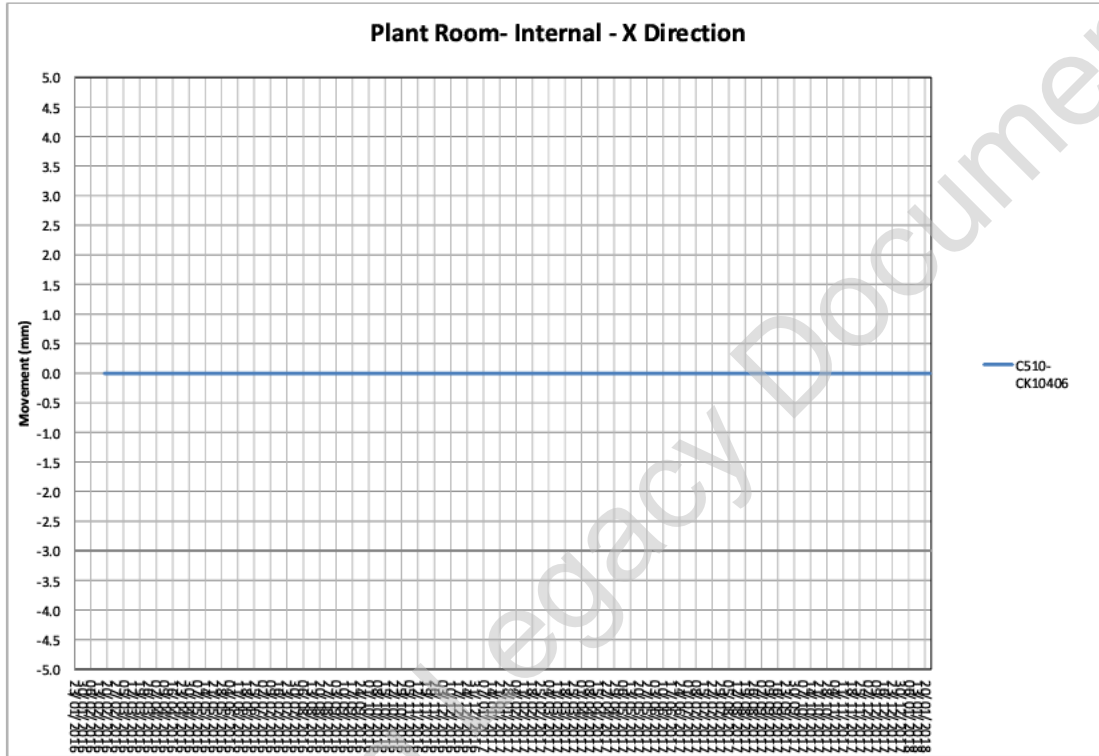
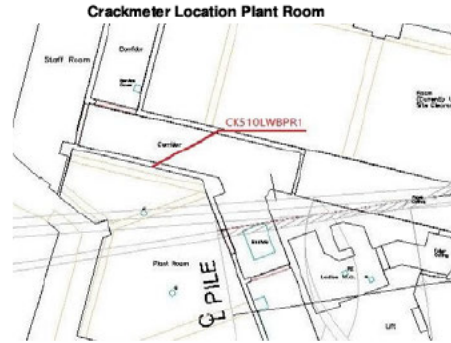
Gas Inlet Room- Internal - X Direction



Gas Inlet Room- Internal - Y Direction

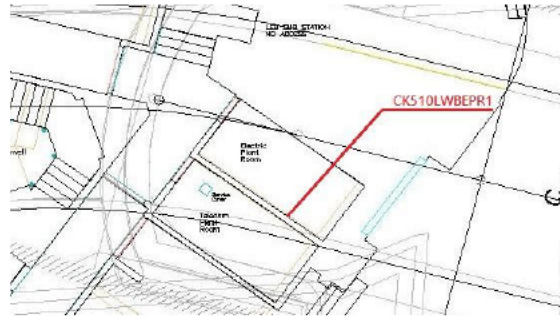


Plant Room					
Name	Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
				X	Y
CK510LWBPR1	C510-CK10406	1.50	10/02/2015	0.00	0.00

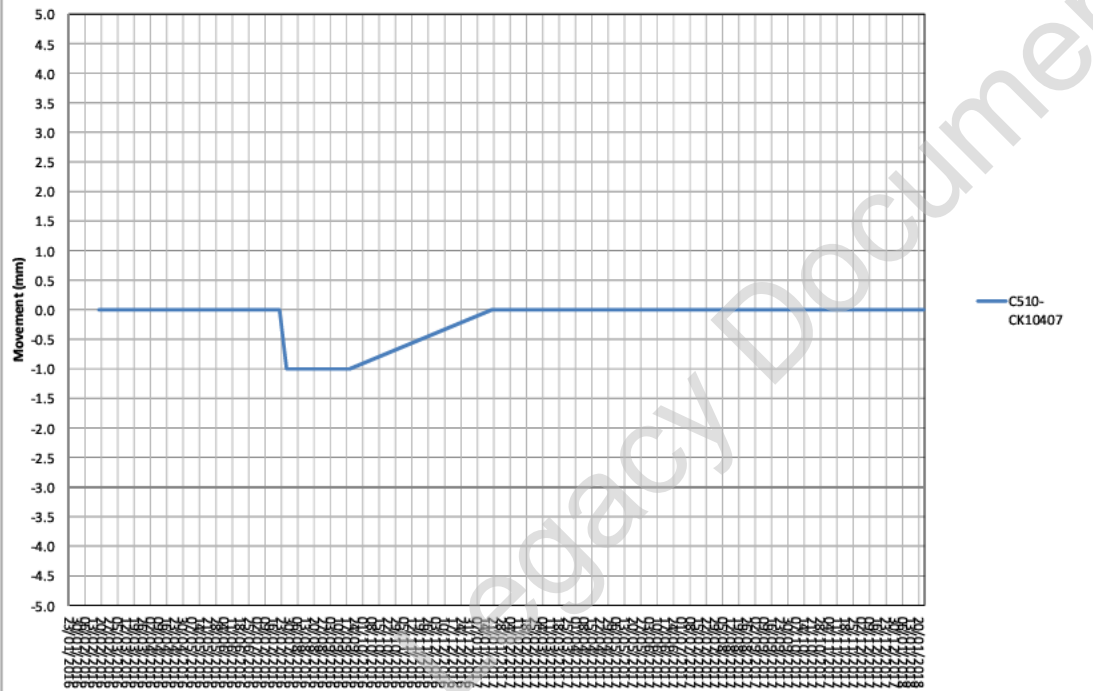


Electric Plant Room					
Previous Name	UCIMS Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
				X	Y
CK510LWBEPRI	C510-CK10407	3.00	10/02/2015	0.00	0.00

Crackmeter Location Electric Plant Room



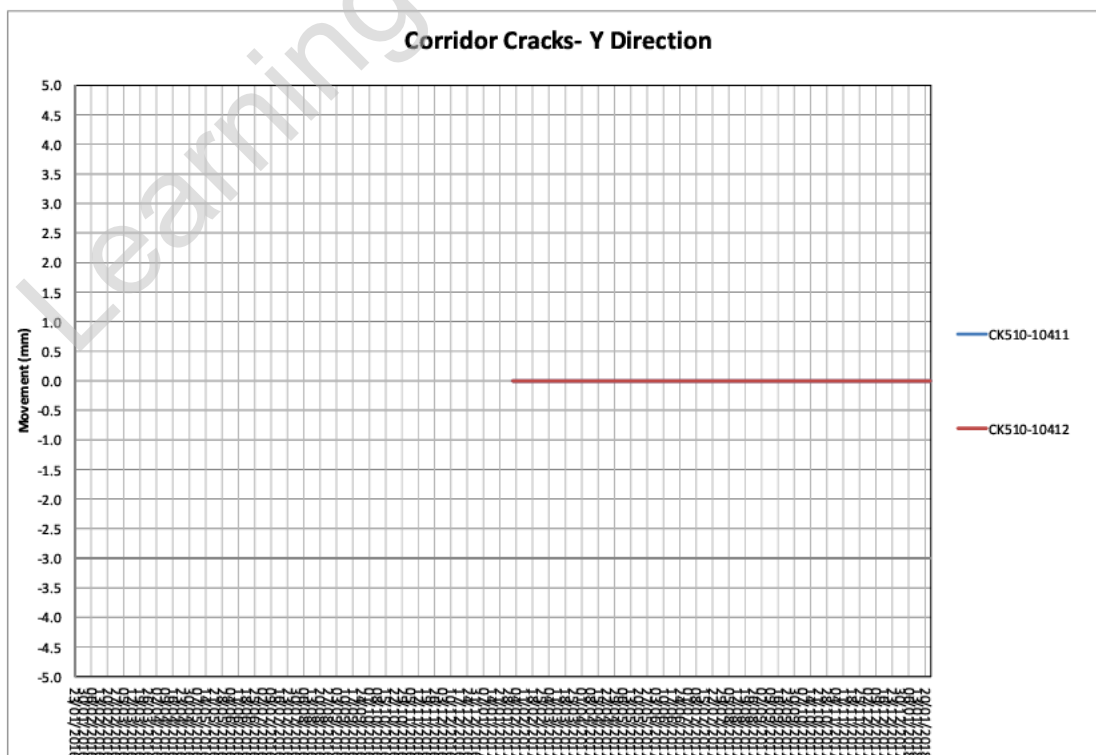
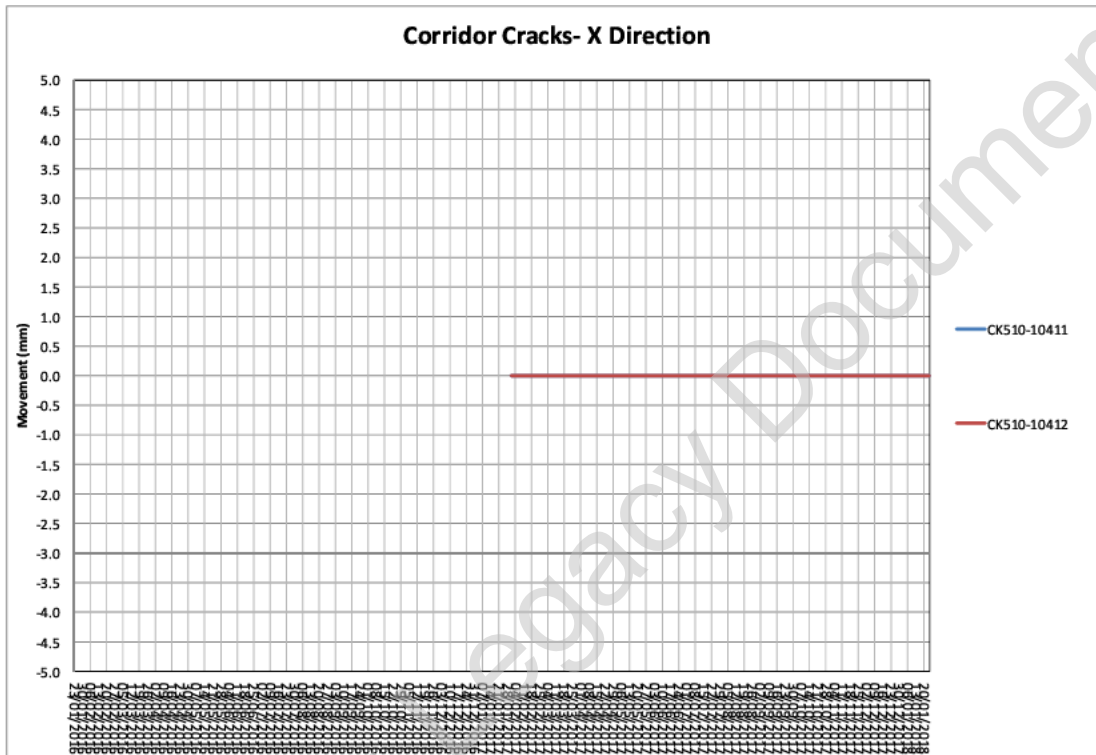
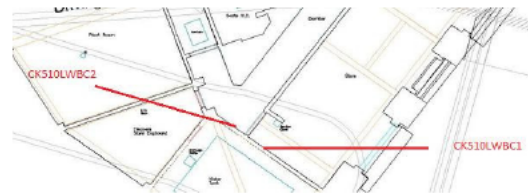
Electric Plant Room- Internal - X Direction



Electric Plant Room- Internal - Y Direction



Corridor					
Previous Name	UCIMS Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
				X	Y
CK510LWBC1	CK510-10411	0.50	03/02/2017	0.00	0.00
CK510LWBC2	CK510-10412	0.50	03/02/2017	0.00	0.00



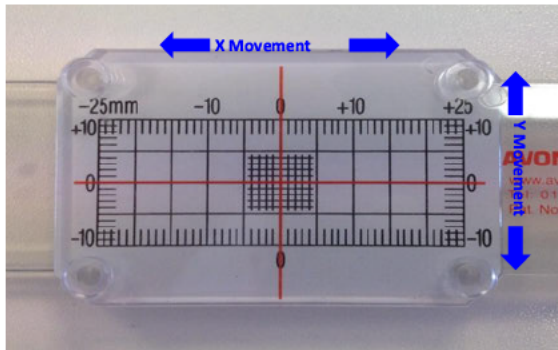
Crackmeters Results

Crackmeters Block 4 London Wall Building

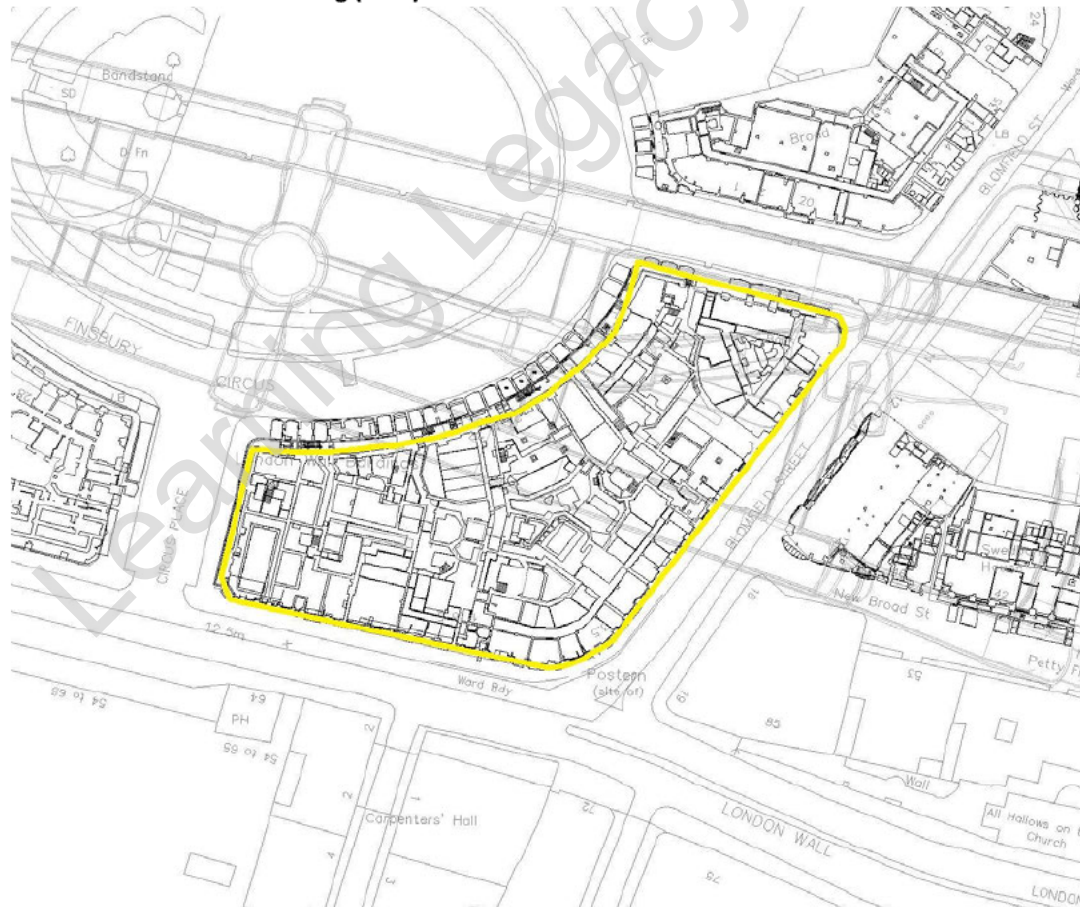


22/02/2018

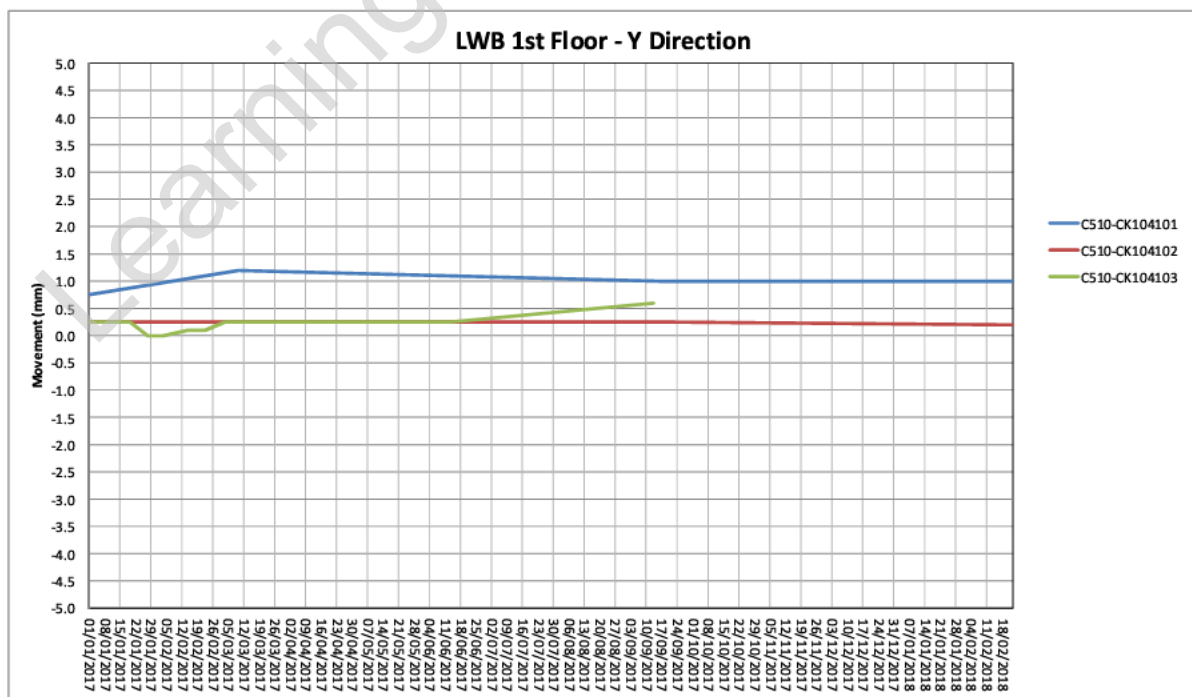
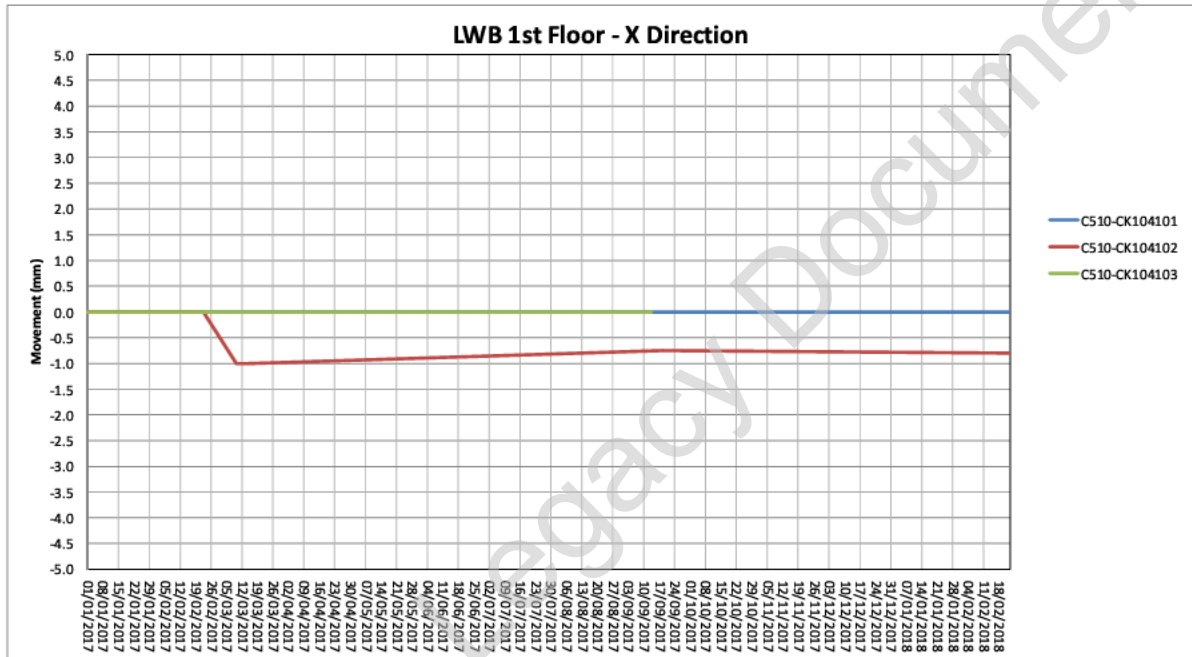
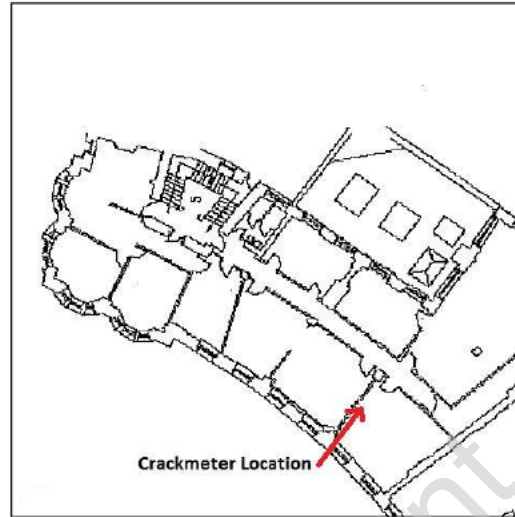
COMMENTS	
2015.12.02 No access to take readings for C510-LWB-11+12.	2016-11-25 No access to 6th floor, door will not open and no access to first floor
2016.01.07 No access to take readings for C510-LWB-11+12.	2016-12-22 No access to 6th floor due to loss of key 1st floor solicitors out for the day
2016.02.03 No access to take readings for C510-LWB-11+12.	03/03/2017 No access too first floor room, solicitors not in office.
2016.02.10 No access to take readings for C510-LWB-11+12.	27-04-2017 No access to 6th floor, door will not open and no access to first floor
2016.03.01 No access to take readings for C510-LWB-11+12.	24/05/2017 no access to CK104101-02 room locked
2016.03.09 No access to take readings for C510-LWB-11+12.	13/06/2017 no access to CK104101-02 room locked
2016.08.22 No access to take readings for C510-LWB-11+12.	
2016.10.07 No access to take readings for C510-LWB-11+12.	
2016.10.11 No access to take readings for C510-LWB-11+12.	
2016.10.21 No access to take readings for C510-LWB-11+12.	
27/10/2016 No access to take readings for C510-LWB-11+12.	
31/10/2016 No access to 6th floor, door will not open.	
2016-11-10 No access to 6th floor, door will not open and no access to first floor	



Location London Wall Building (LWB)



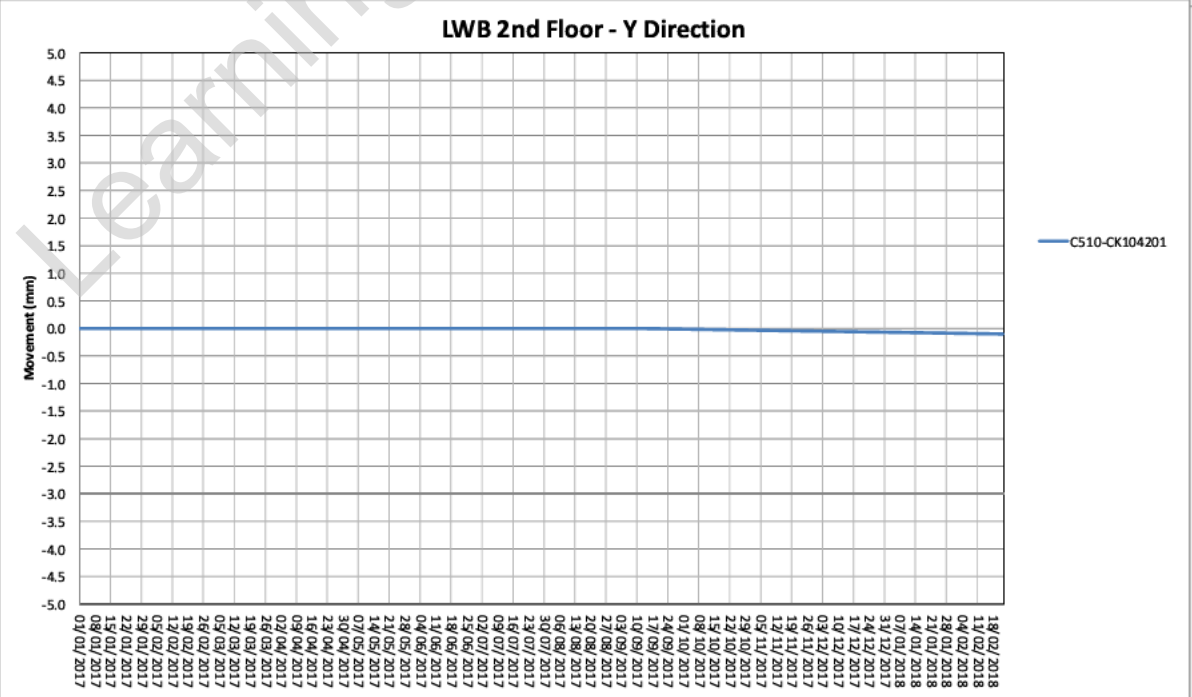
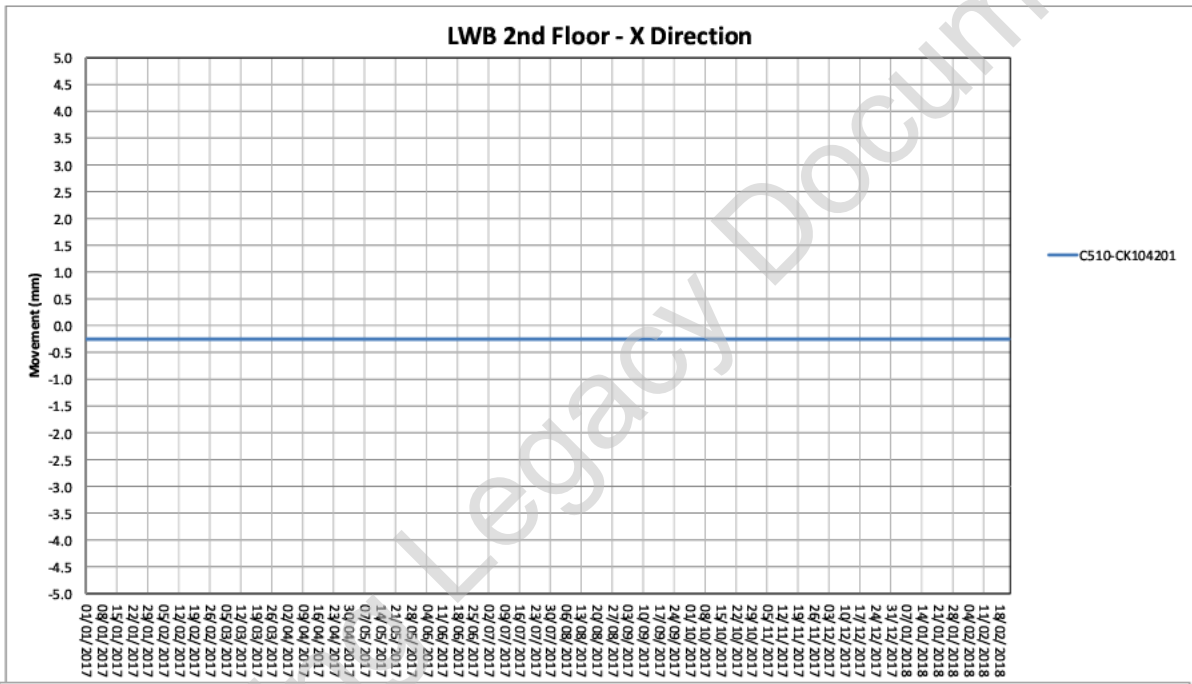
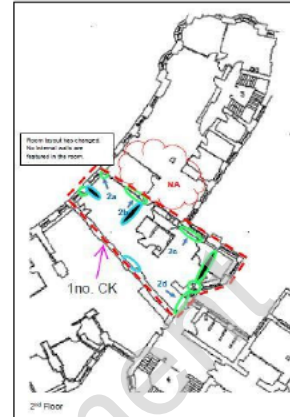
LWB 1st Floor				
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
CS10-CK104101	0.50	17/11/2015	0.00	0.00
CS10-CK104102	0.90	17/11/2015	0.00	0.00
CS10-CK104103	0.75	14/09/2016	0.00	0.00



LWB 2nd Floor				
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
CS10-CK104201	0.75	02/11/2015	-1.75	0.00

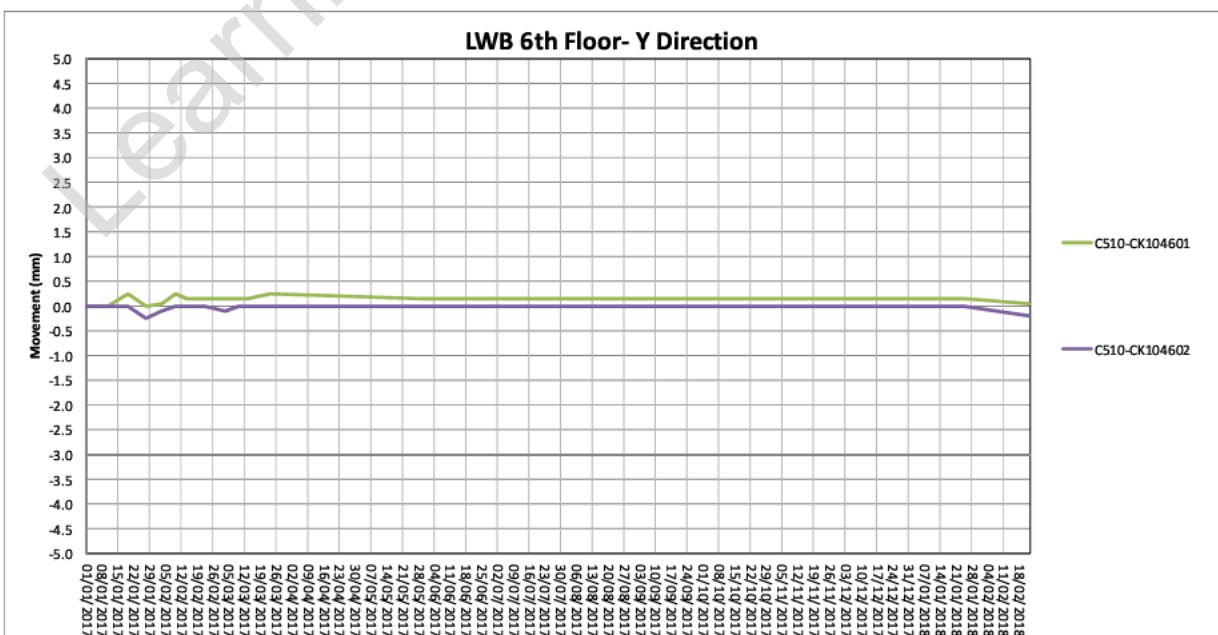
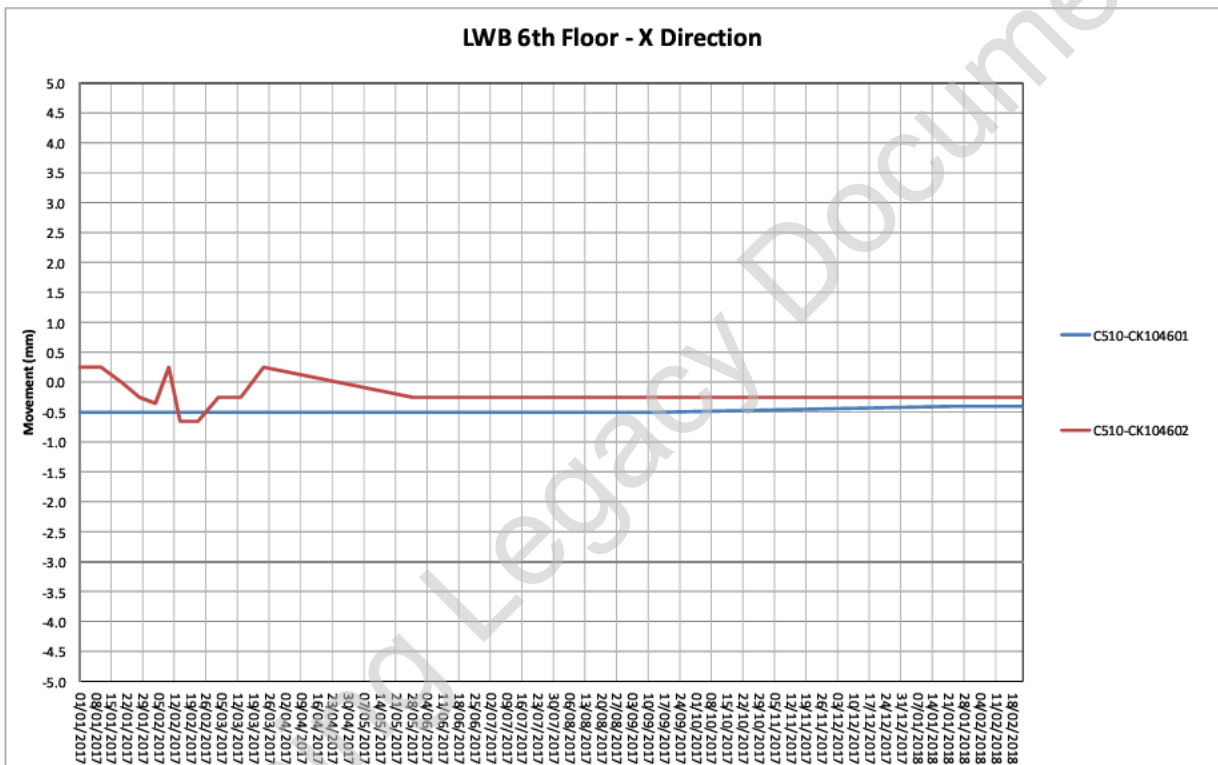
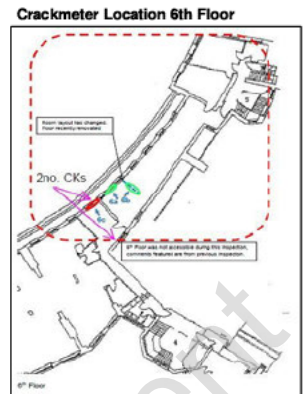
CODE 1379

Crackmeter Location 2nd Floor



LWB 6th Floor				
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK104601	0.75	02/11/2015	0.50	-0.25
C510-CK104602	2.00	02/11/2015	-0.25	0.00

KEY 112



8 Appendix II (Tables, Graphs and Figures of Rev.1)

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Table 2 - Block 04 Decommissioning Status Tracker BRE & LC

23.09.2017

< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm RED

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI/Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	AVERAGE SETTLEMENT TREND								General Comment	Decommissioning Status
											120 Days Calculation Period	180 Days Calculation Period	365 Days Calculation Period	365 Days Calculation Period	180 Days Calculation Period	365 Days Calculation Period	180 Days Calculation Period	365 Days Calculation Period		
2510-LB10438	Block 04	S1042	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-19.43	121	C	-8.13	181	C	-11.17	370		Stability
2510-LB10439	Block 04	S1042	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Invert, A&A-14	13/11/2016	05/09/2017	-19.43	121	C	-8.13	181	C	-10.20	370		Stability
2510-LB10440	Block 04	S1042	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Invert, A&A-14	13/11/2016	05/09/2017	-19.28	121	C	-4.94	181	C	-6.99	370		Stability
2510-LB10442	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV CP7 Engagement, A&A-16	05/07/2016	05/09/2017	-3.19	121	C	-5.64	181	C	-3.28	373		Stability
2510-LB10443	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV PTV East Engagement, Adv-25	30/03/2014	05/09/2017	-2.12	121	C	-1.71	191	C	-1.17	373		Proposed
2510-LB10444	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV PTV East Engagement, Adv-25	30/03/2014	05/09/2017	-8.65	121	C	-6.14	191	C	-2.92	373		Proposed
2510-LB10445	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV CP9 Engagement, Adv-32	23/08/2014	05/09/2017	-9.67	121	C	-9.76	191	C	-1.75	373		Proposed
2510-LB10447	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV CP9 Engagement, Adv-32	23/08/2014	05/09/2017	-2.72	139	C	-3.19	181	C	-3.13	461		Stability
2510-LB10448	Block 04	S1043	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.75	126	C	-6.71	181	C	-6.03	459		Stability
2510-LB10449	Block 04	S1044	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-4.35	126	C	-5.71	181	C	-5.46	459		Stability
2510-LB10450	Block 04	S1044	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.19	126	C	-6.93	181	C	-6.40	459		Stability
2510-LB10451	Block 04	S1044	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-8.68	126	C	-9.98	181	C	-1.69	459		Stability
2510-LB10452	Block 04	S1044	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.64	126	C	-9.78	181	C	-12.05	459		Stability
2510-LB10459	Block 04	S1044	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.93	126	C	-9.12	181	C	-12.82	459		Stability
2510-LB10461	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				#N/A			#N/A			#N/A			Proposed
2510-LB10462	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				#N/A			#N/A			#N/A			Proposed
2510-LB10463	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				#N/A			#N/A			#N/A			Proposed
2510-LB10464	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				#N/A			#N/A			#N/A			Proposed
2510-LB10465	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				#N/A			#N/A			#N/A			Proposed
2510-LB10466	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				-9.57	123	C	-9.59	181	C	-8.24	456		Stability
2510-LB10467	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				-5.26	123	C	-8.13	181	C	-6.96	456		Stability
2510-LB10468	Block 04	Staircase	Internal	Manual	LB	BRE	Carriar LWB				-6.73	126	C	-10.42	181	C	-9.69	456		Stability
2510-LB10453	Block 04	Shew 1	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.73	126	C	-6.91	181	C	-7.75	459		Stability
2510-LB10454	Block 04	Shew 1.2	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-2.12	123	C	-7.26	181	C	-6.49	456		Stability
2510-LB10454	Block 04	Shew 2	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-7.29	123	C	-11.19	181	C	-8.66	456		Stability
2510-LB10454	Block 04	Shew 3	Internal	Manual	LB	BRE	London Wall Building	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-6.06	123	C	-10.59	181	C	-13.59	456		Stability
2510-LB10455	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-7.66	123	C	-9.42	181	C	-9.40	456		Stability
2510-LB10410	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-8.34	121	C	-12.72	182	C	-8.82	366		Stability
2510-LB10410	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-7.55	121	C	-12.63	182	C	-7.25	366		Stability
2510-LB10412	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	27/04/2016	#N/A			#N/A			#N/A			Proposed
2510-LB10464	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-10.43	121	C	-16.29	182	C	-15.91	380		Stability
2510-LB10465	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-5.76	121	C	-10.69	182	C	-12.56	366		Stability
2510-LB10466	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-8.05	121	C	-13.04	182	C	-11.69	366		Stability
2510-LB10467	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-7.25	121	C	-11.64	182	C	-12.66	366		Stability
2510-LB10468	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-6.14	121	C	-10.18	182	C	-11.84	366		Stability
2510-LB10469	Block 04	SPaint Room	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	30/03/2017	-6.14	121	C	-10.40	182	C	-11.64	366		Stability
2510-LC10421	Block 04	SPaint Room	Internal	Manual	LC	BRE	Inver Stable				-3.87	121	F	-9.2	210	F	-10.68	366		Stability
2510-LB10468	Block 04	N/A	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Invert, A&A-8	07/11/2016	01/09/2017	-3.45	210	F	-3.45	210	F	-6.57	366		Stability
2510-LB10468	Block 04	N/A	Internal	Manual	LB	BRE	Fibrous House	LIV ES2 Safe Strip, A&A-10	24/11/2016	05/09/2017	-8.30	121	C	-5.31	184	C	-10.60	370		Stability

Never produced data due to asbestos issues. Building management to confirm whether points need to be physically decommissioned.

Trend not available as data only collected 4/3/2016 to 27/4/2016. See Supplementary Evidence ss5.3.1



Table 2 - Block 04 Decommissioning Status Tracker XR

24/08/2017

< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm RED

CS10 Sensor Name	Block	Section	Int/Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	AVERAGE SETTLEMENT TREND						General Comment	Decommissioning Status		
											120 Days	120 Days	120 Days	180 Days	180 Days	180 Days			365 Days	365 Days
C510-XR10401B-5m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	16/05/2017	120	-6.89	-8.91	-8.91	181	-2.47	376	08/02/2017	Manhole flooded and AVW200 Module broken; reported via email - Incident Report LIV 648. Agreed to cease monitoring of automated sensors in CTC/ERP meeting, dated 20/06/2017. See Supplementary Evidence ss. 5.3.3	Proposed
C510-XR10401A-5m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	16/05/2017	120	-6.73	-8.29	-8.29	181	-3.83	376	08/02/2017		
C510-XR10401E-15m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	22/03/2017	120	-12.12	-15.92	-15.92	181	-7.61	407	08/02/2017		
C510-XR10401C-20m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	16/05/2017	120	-5.98	-7.40	-7.40	181	-3.59	376	08/02/2017		
C510-XR10401E-25m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	16/05/2017	120	-5.65	-7.27	-7.27	181	-2.95	376	08/02/2017		
C510-RR10401D-23.5m	Block 104	XR10401	Inground	Automated	XR	Extensometer-Rod	Finsbury Circus	LIV ES2 Safe Stop Adv-10	24/11/2016	16/05/2017	120	-5.60	-7.08	-7.08	181	-3.45	376	08/02/2017		
C510-RR10404H-0m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.54	-2.09	-2.09	187	-6.12	370		Stable 6 month trend	Proposed
C510-RR10404G-4.5m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.79	-2.25	-2.25	187	-5.90	370			
C510-RR10404A-4.5m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.29	-0.63	-0.63	187	-3.96	370			
C510-RR10404B-4.5m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-1.83	-1.28	-1.28	187	-3.47	370			
C510-RR10404C-4m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.79	-2.16	-2.16	187	-4.76	370			
C510-RR10404E-18m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.07	-0.28	-0.28	187	-3.97	370			
C510-RR10404I-23m	Block 104	XR10404	Inground	Manual	XR	Extensometer-Rod	Bloomfield St	LIV CP9 Enlargement Adv-32	23/08/2014	26/07/2017	146	-0.29	-1.18	-1.18	187	-3.55	370			

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Table 2 - Block 04 Decommissioning Status Tracker CK

25/08/2017

< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm RED

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EO Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	AVERAGE DISPLACEMENT TREND						Ceased Date	General Comment	Decommissioning Status
											120 Days	180 Days	180 Day Calculation Period	365 Days	365 Day Calculation Period	365 Days			
C510-CK10401	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Invert Adv-14	13/11/2016	13/03/2017	-1.32	0.02	186	0.17	369			Outstanding	
C510-CK10402	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Invert Adv-14	13/11/2016	13/03/2017	-1.48	0.26	186	0.22	369			Outstanding	
C510-CK10403	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Invert Adv-14	13/11/2016	13/03/2017	-9.72	-3.29	186	0.80	369		Crackmeter stable	Outstanding	
C510-CK10404	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Step Stop Adv-10	24/11/2016	3/03/2017	0.45	0.15	186	0.44	369			Outstanding	
C510-CK10405	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Step Stop Adv-10	24/11/2016	3/03/2017	-0.09	0.73	186	1.28	377			Outstanding	
C510-CK10406	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Step Stop Adv-10	24/11/2016	3/03/2017	0.00	0.00	369	0.00	369			Outstanding	
C510-CK10407	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House	LIV ES2 Invert Adv-8	07/11/2016	13/03/2017	-2.83	-2.19	229	-0.16	369			Outstanding	
C510-CK10408	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building (Basement)	LIV ES2 Step Stop Adv-10	24/11/2016	2/10/2016	#N/A	#N/A	#N/A	#N/A	#N/A		Sensor destroyed when wall was removed	Complete	
C510-CK10409	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building (Basement)	LIV ES2 Step Stop Adv-10	24/11/2016	2/10/2016	#N/A	#N/A	#N/A	#N/A	#N/A			Complete	
C510-CK10410	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building (Basement)	LIV ES2 Step Stop Adv-10	24/11/2016	28/07/2015	#N/A	#N/A	#N/A	#N/A	#N/A		Settlement trend data to be included in next revision	Outstanding	
C510-CK10411	Block 104	S10401	Internal	Manual	OK	Crack Monitor	23 Firsbury House (Corridor)	LIV ES2 Step Stop Adv-10	24/11/2016	13/03/2017	3.10	0.90	412	0.90	412			Outstanding	
C510-CK10412	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building	LIV ES2 Step Stop Adv-10	24/11/2016	13/03/2017	0.77	0.83	412	0.93	412			Outstanding	
C510-CK10420	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building	LIV ES2 Step Stop Adv-10	24/11/2016	13/03/2017	0.00	0.00	187	-0.09	481			Outstanding	
C510-CK10421	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building	LIV ES2 Step Stop Adv-10	24/11/2016	13/03/2017	-0.42	-0.06	187	0.23	481			Outstanding	
C510-CK10462	Block 104	S10401	Internal	Manual	OK	Crack Monitor	Lofton Wall Building	LIV ES2 Step Stop Adv-10	24/11/2016	3/03/2017	-0.72	0.45	187	0.25	481			Outstanding	

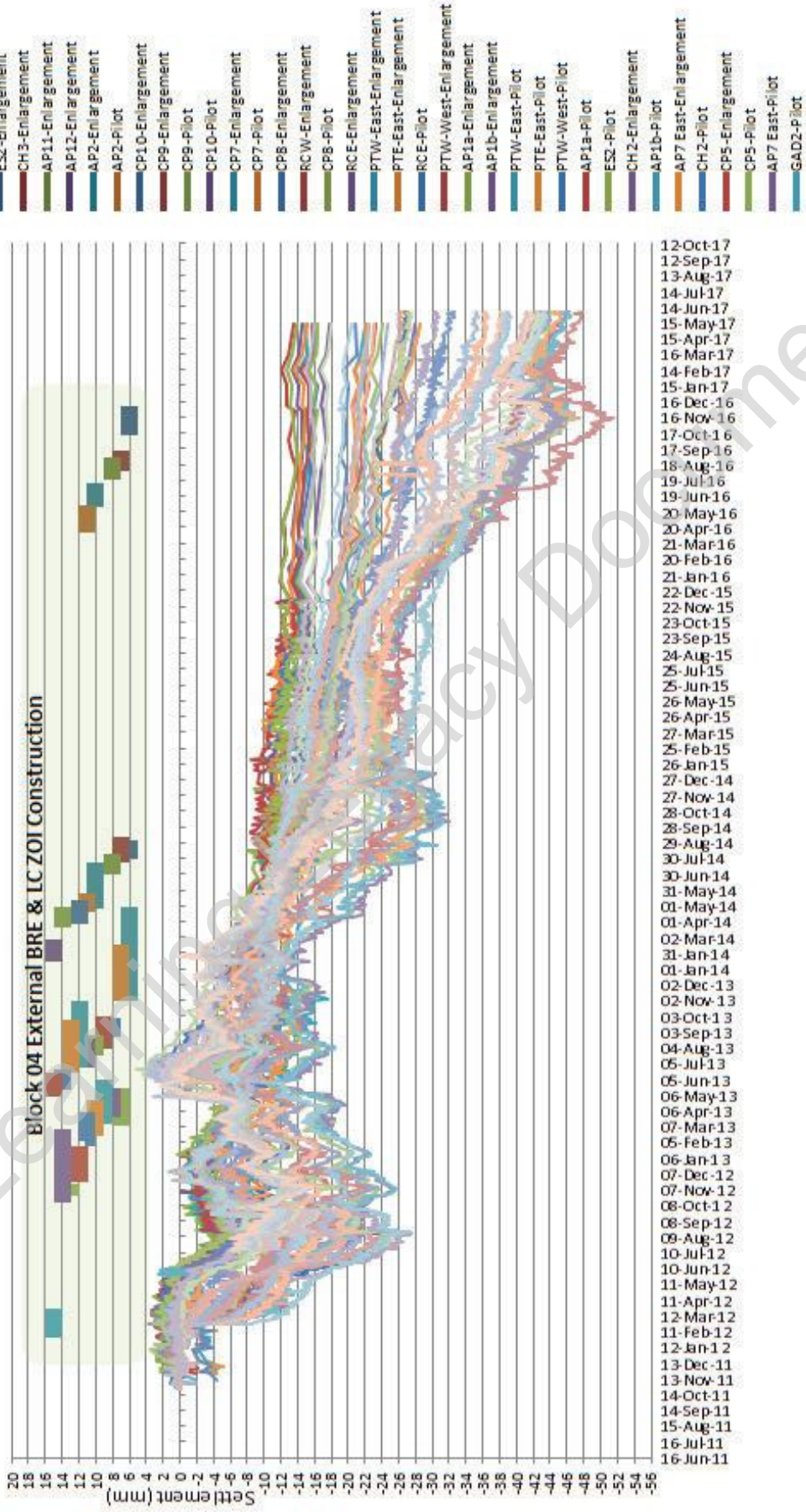
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Table 2 - Block 04 Decommissioning Status Tracker IM

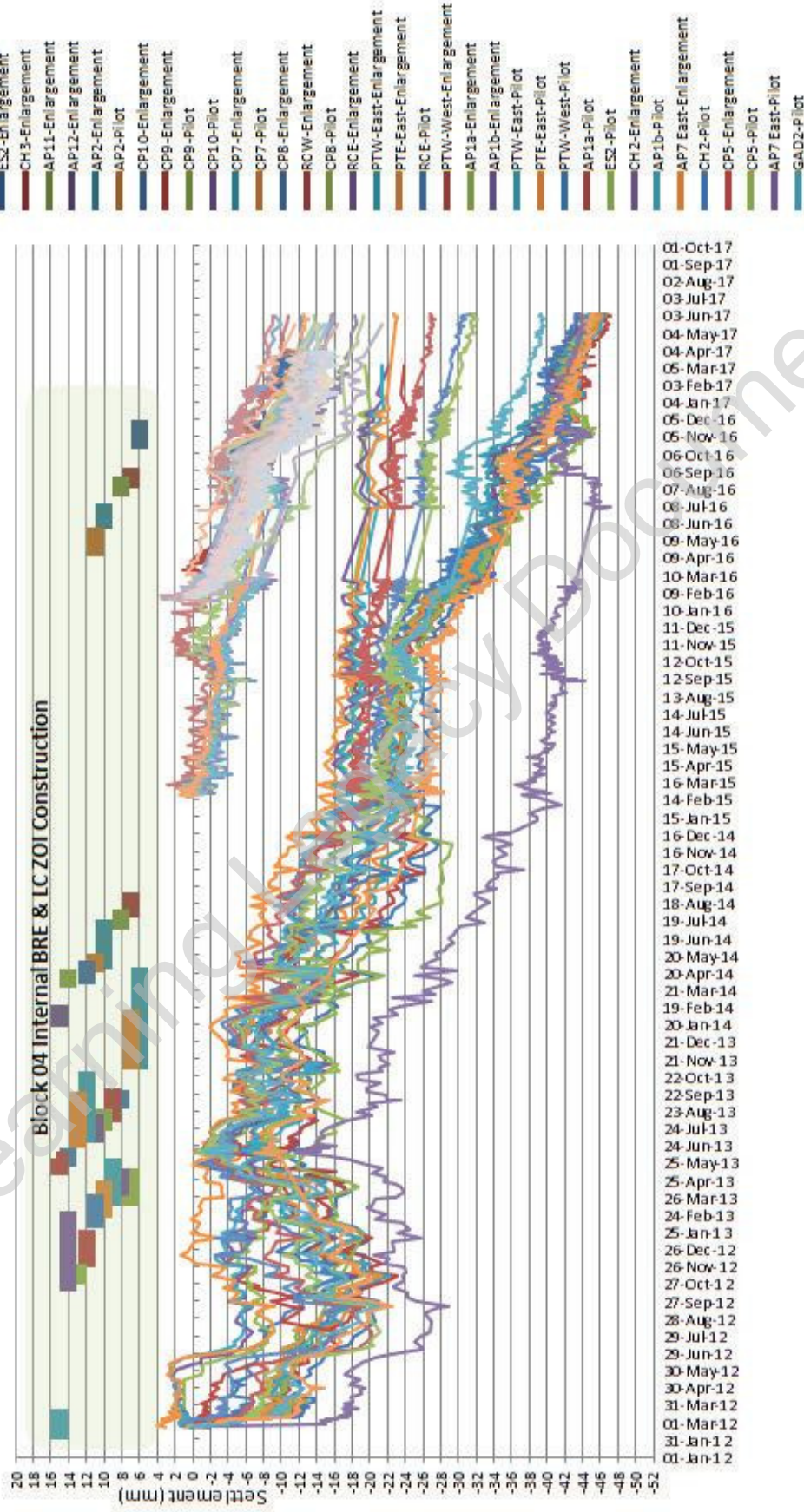
		29/06/2017		AVERAGE DISPLACEMENT TREND							RED						
				< 2.0 mm	GREEN	< 3.5 mm	AMBER	> 3.5 mm	RED								
Block	Section	Int./Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI/Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 Days	180 Days	365 Days	365 Day Calculation Period	Ceased Date	General Comment	Decommissioning Status	
C510	IM10402	Inground	Manual	IM	Inclinometer-Manual	Bloomfield St			17/11/2013	#N/A	#N/A	#N/A	#N/A	29/01/2016			Proposed
C510	IM10514	Inground	Autoread	IM	Inclinometer-Manual	Finisbury Circus			07/06/2013	#N/A	#N/A	#N/A	#N/A	29/01/2016	Ceased through C510-PMI-01083 29.01.2016		Proposed

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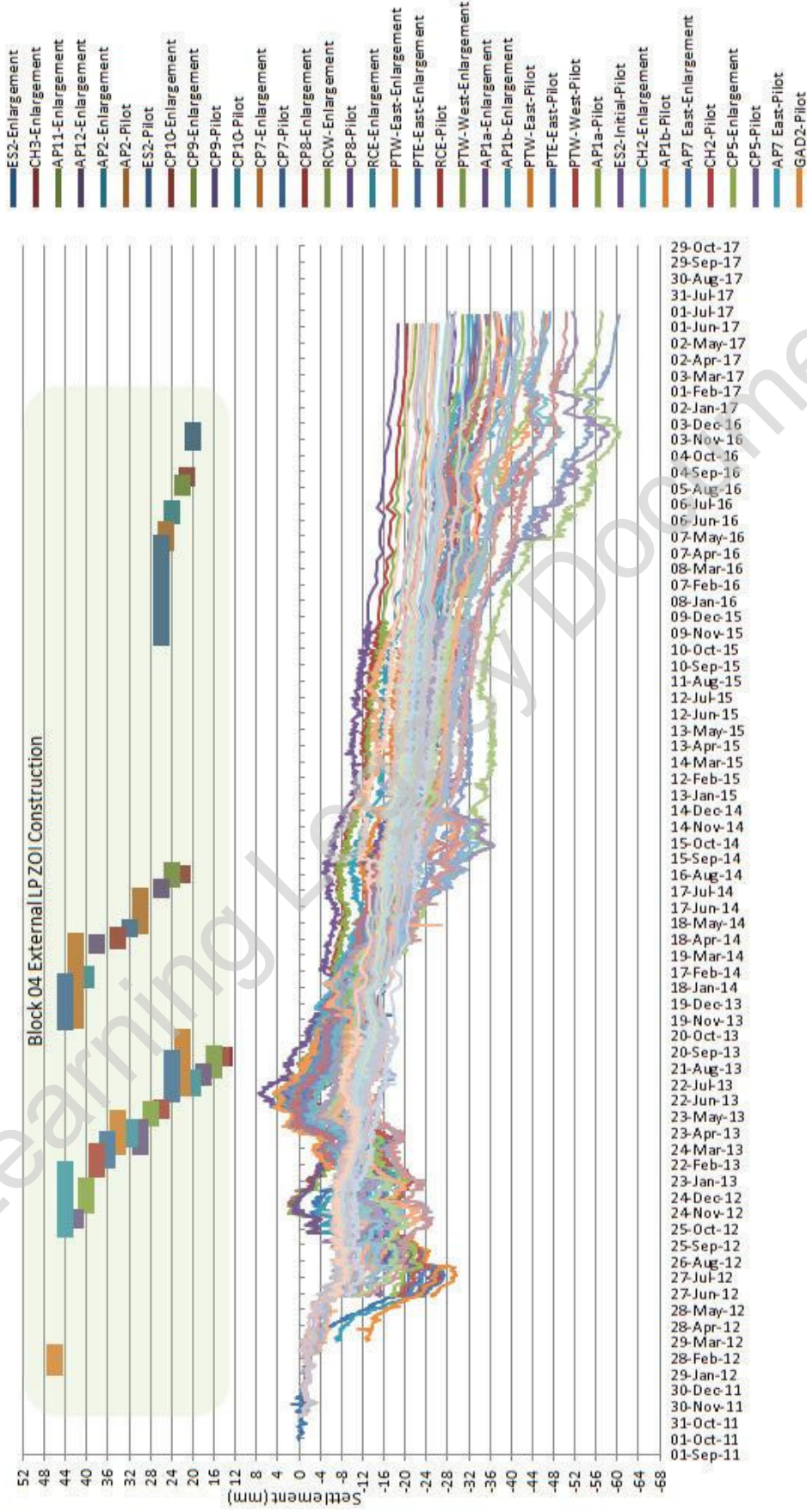
Graph 1 - Block 04 External Building (BRE & LC) Manual Monitoring History in Relation to Construction



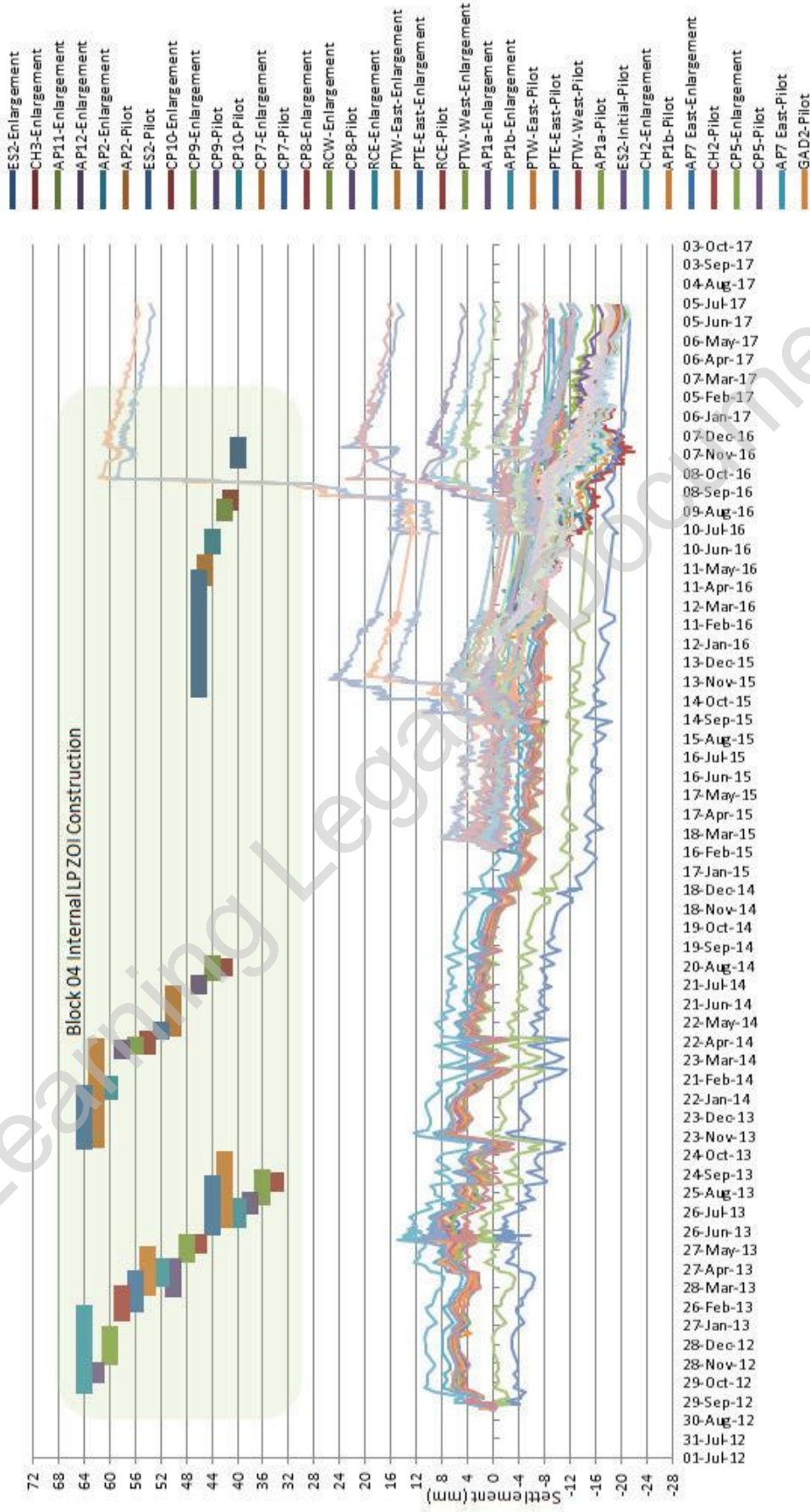
Graph 2 - Block 04 Internal Building (BRE & LC) Manual Monitoring History in Relation to Construction



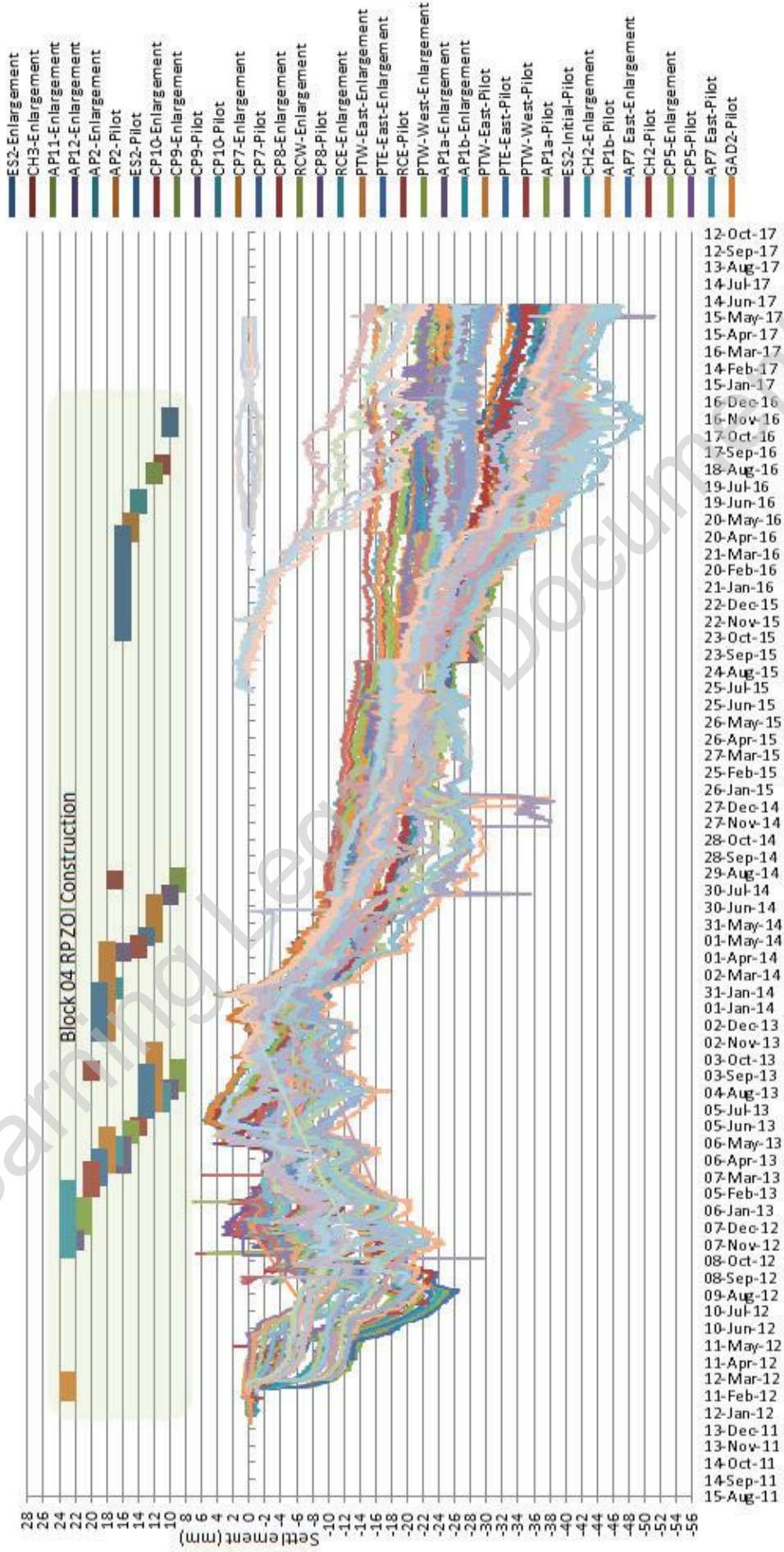
Graph 3 - Block 04 External Road Studs (LP) Manual Monitoring History in Relation to Construction



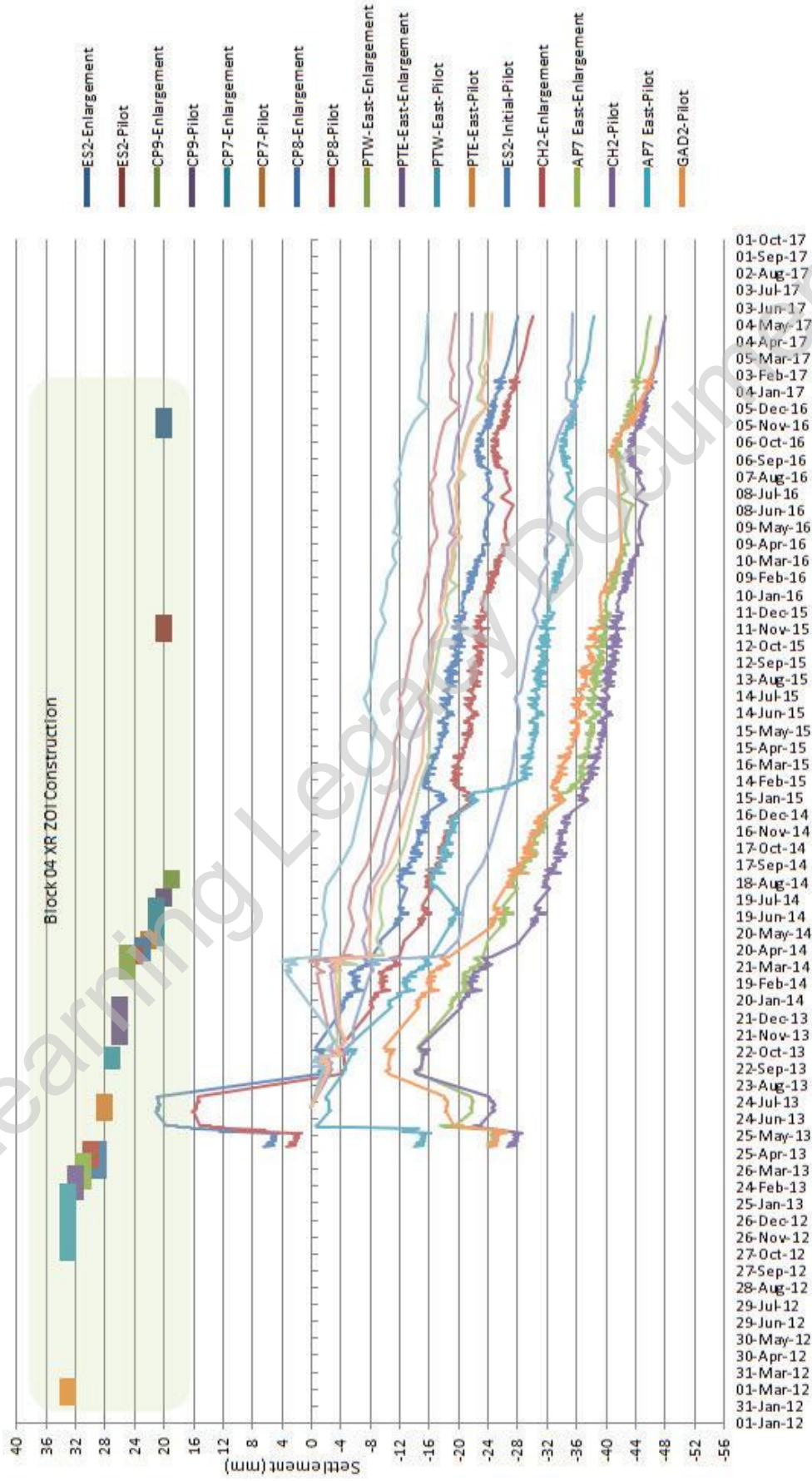
Graph 4 - Block 04 Internal Road Studs (LP) Manual Monitoring History in Relation to Construction



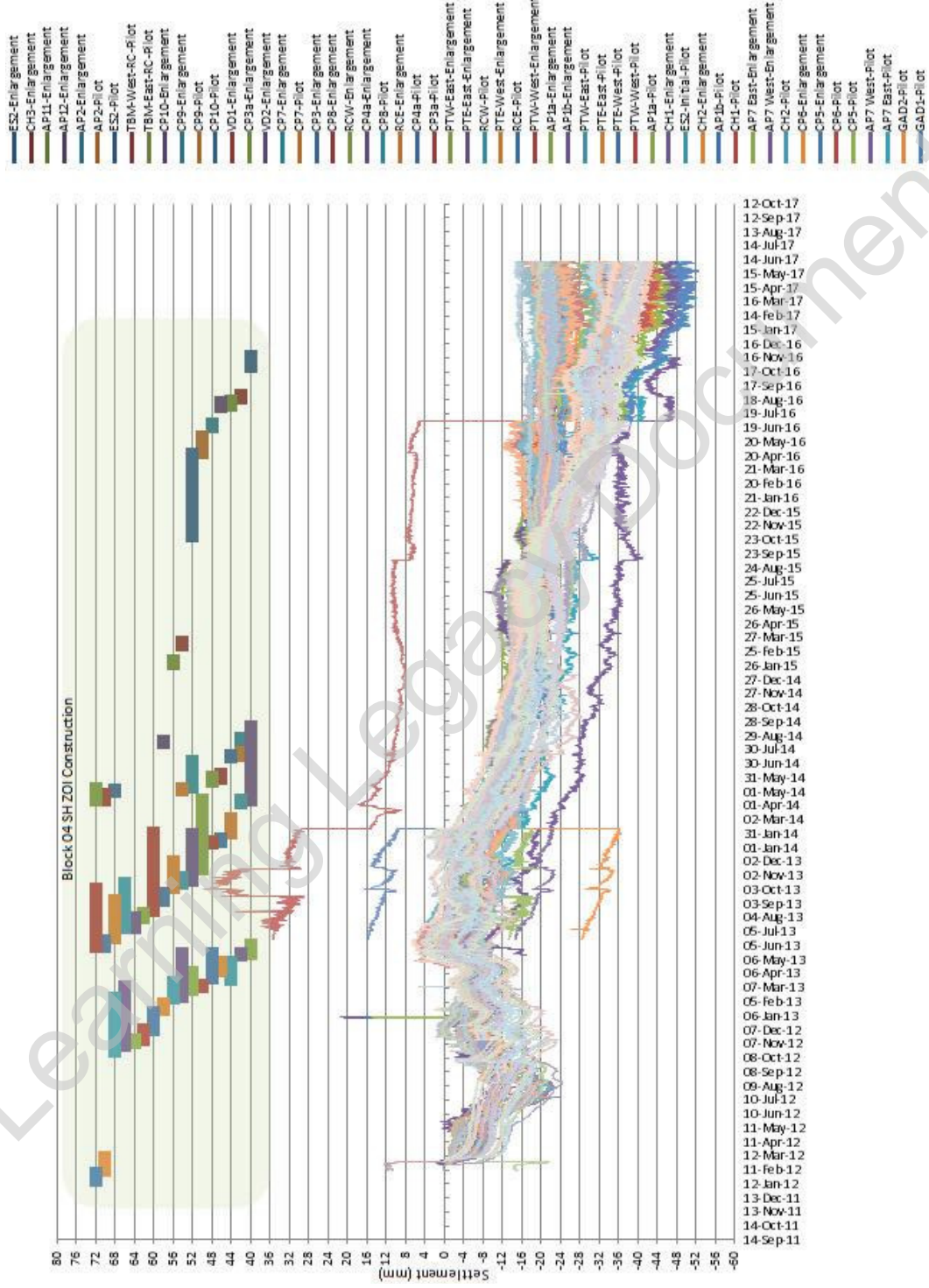
Graph 5 - All Block 04 3d Geodetic Prisms (RP) Automated Monitoring History in Relation to Construction



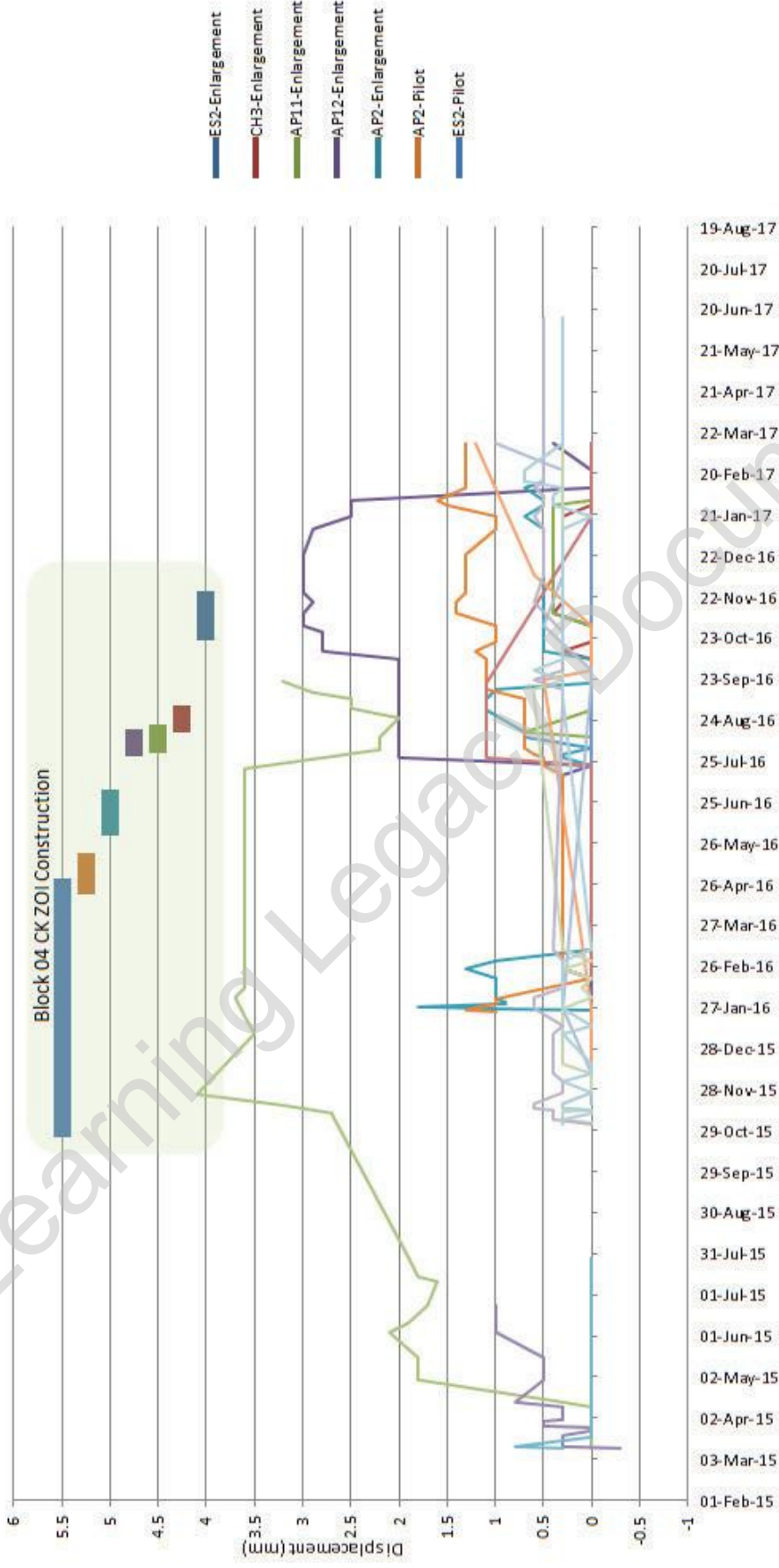
Graph 6 – All Block 04 Extensometers (XR) Automated & Manual Monitoring History in Relation to Construction



Graph 7 – All Block 04 Water Cells (SH) Automated Monitoring History in Relation to Construction

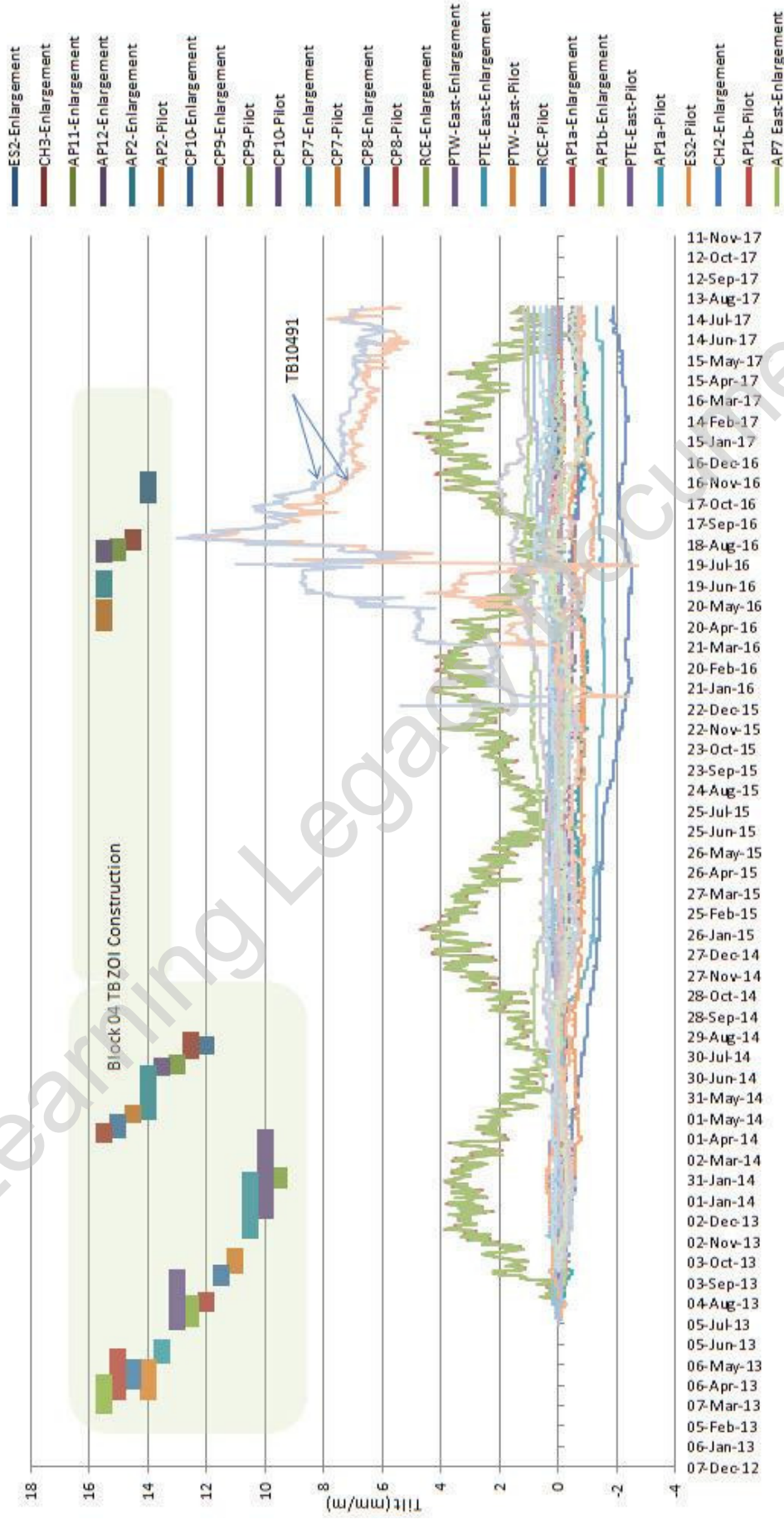


Graph 8 – All Block 04 Crack Monitors (CK) Manual Monitoring History in Relation to Construction

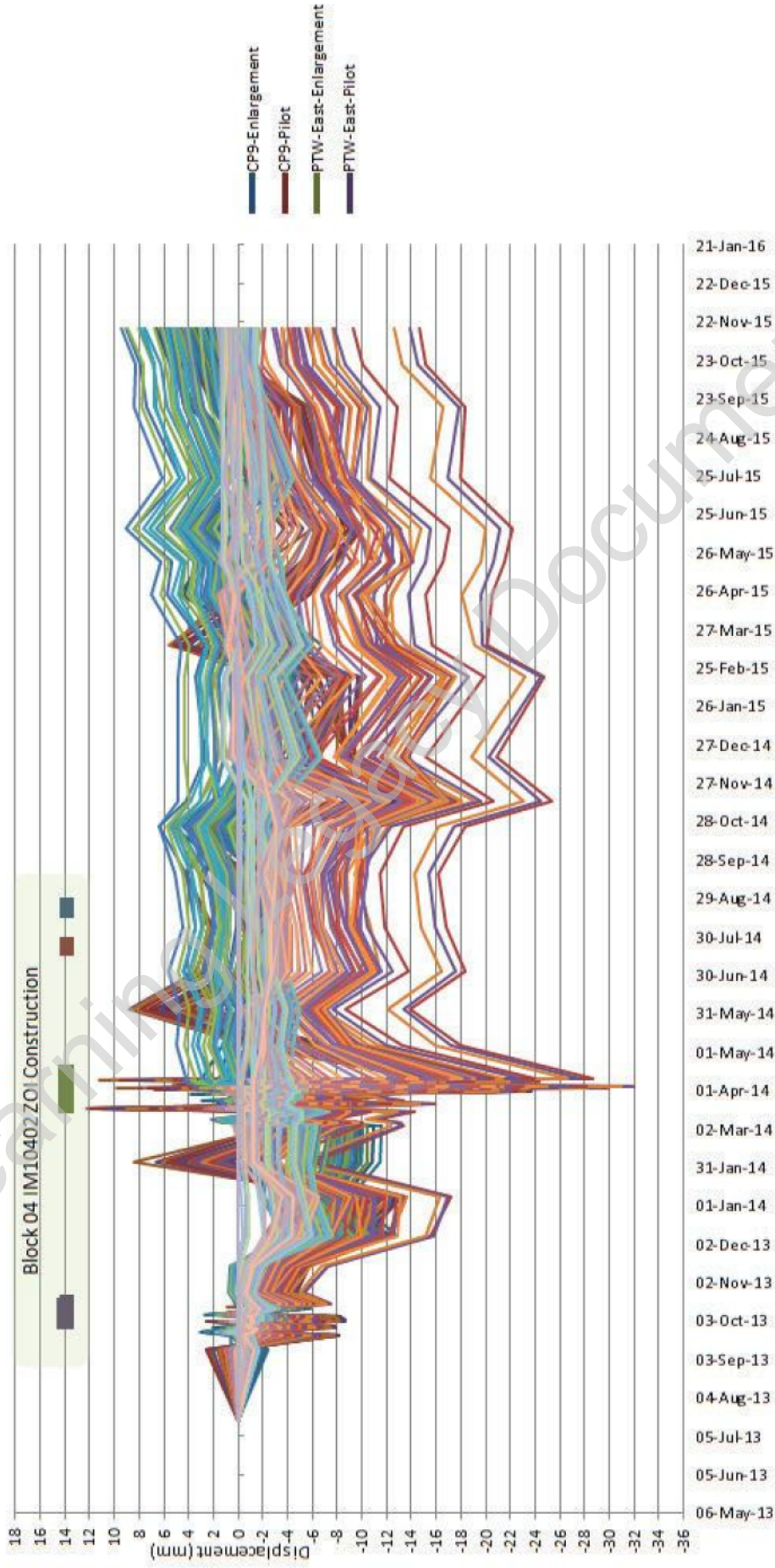


Note: Calculated crack monitor values (Z) provided are the hypotenuse of the measured X and Y movement, i.e. $Z^2 = (X^2 + Y^2)$

Graph 9 - All Block 04 Tiltmeters (TB) Automated Monitoring History in Relation to Construction



Graph 10 - Block 04 Inclinerometer (IM) IM10402 Manual Monitoring History in Relation to Construction



Graph 11 - Block 04 Inclinometer (IM) IM10514 Automated Monitoring History in Relation to Construction

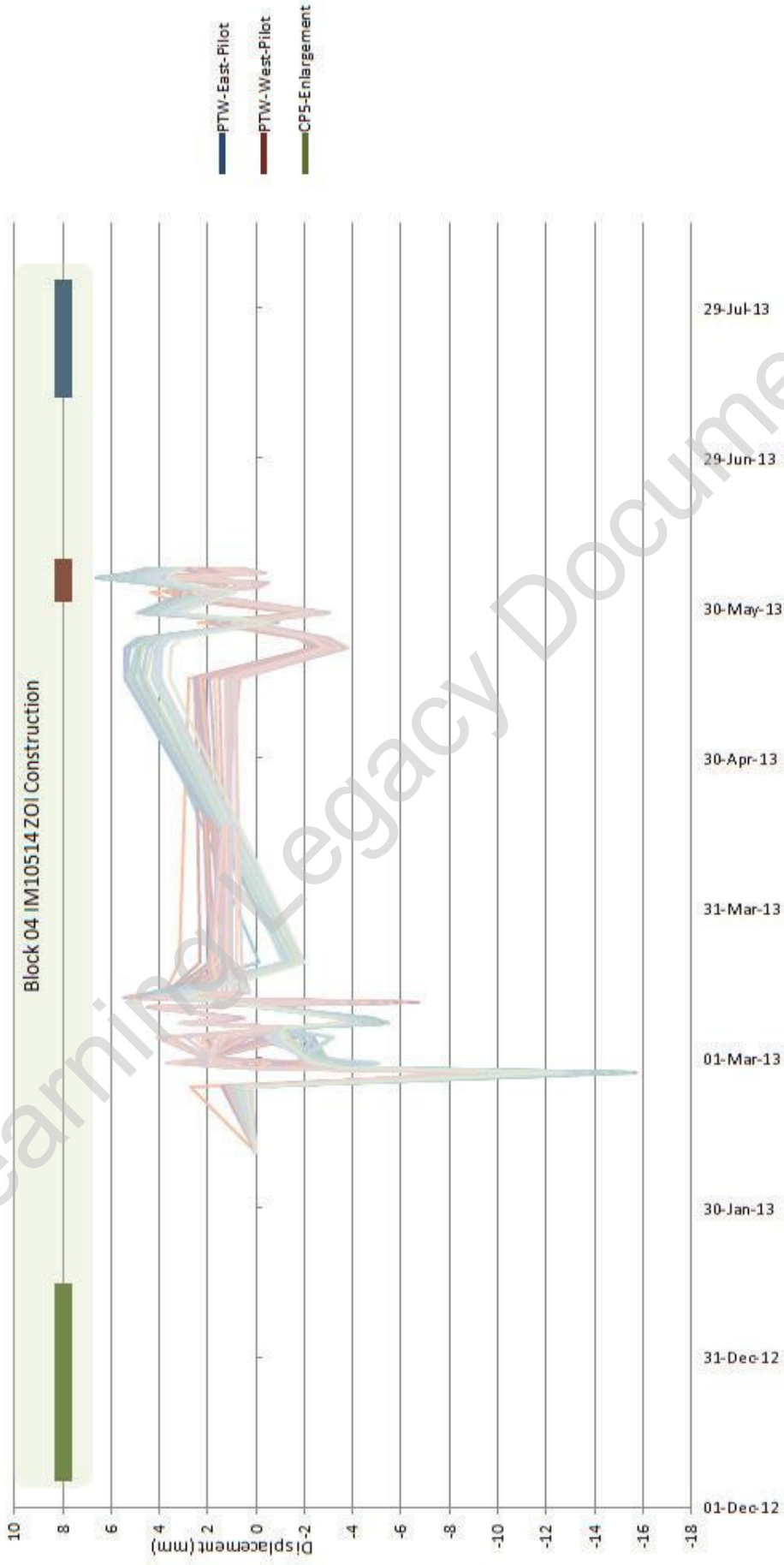
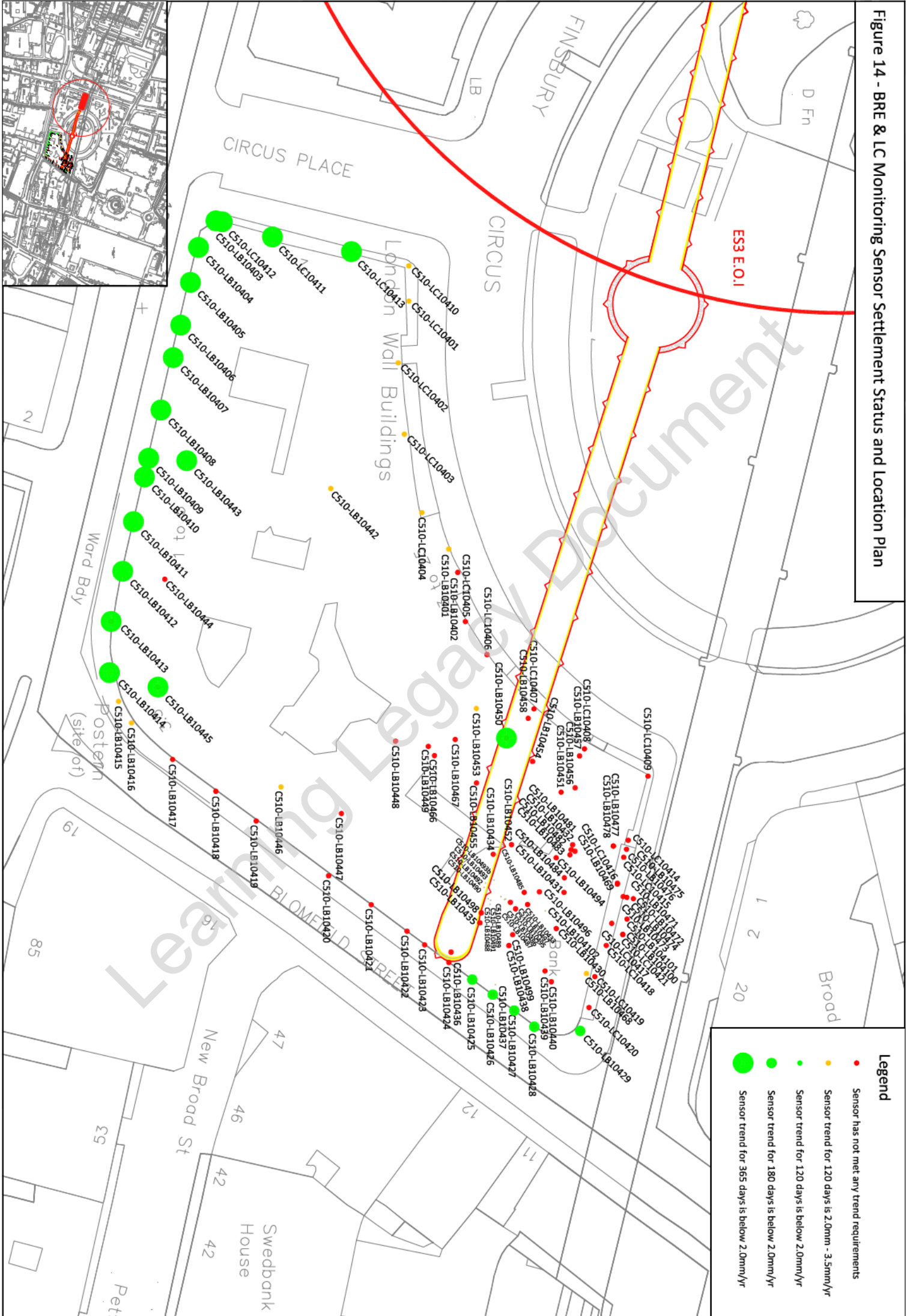


Figure 14 - BRE & LC Monitoring Sensor Settlement Status and Location Plan



Legend

- Sensor has not met any trend requirements
- Sensor trend for 120 days is 2.0mm - 3.5mm/yr
- Sensor trend for 120 days is below 2.0mm/yr
- Sensor trend for 180 days is below 2.0mm/yr
- Sensor trend for 365 days is below 2.0mm/yr

Figure 15 - LP Monitoring Sensor Settlement Status and Location Plan

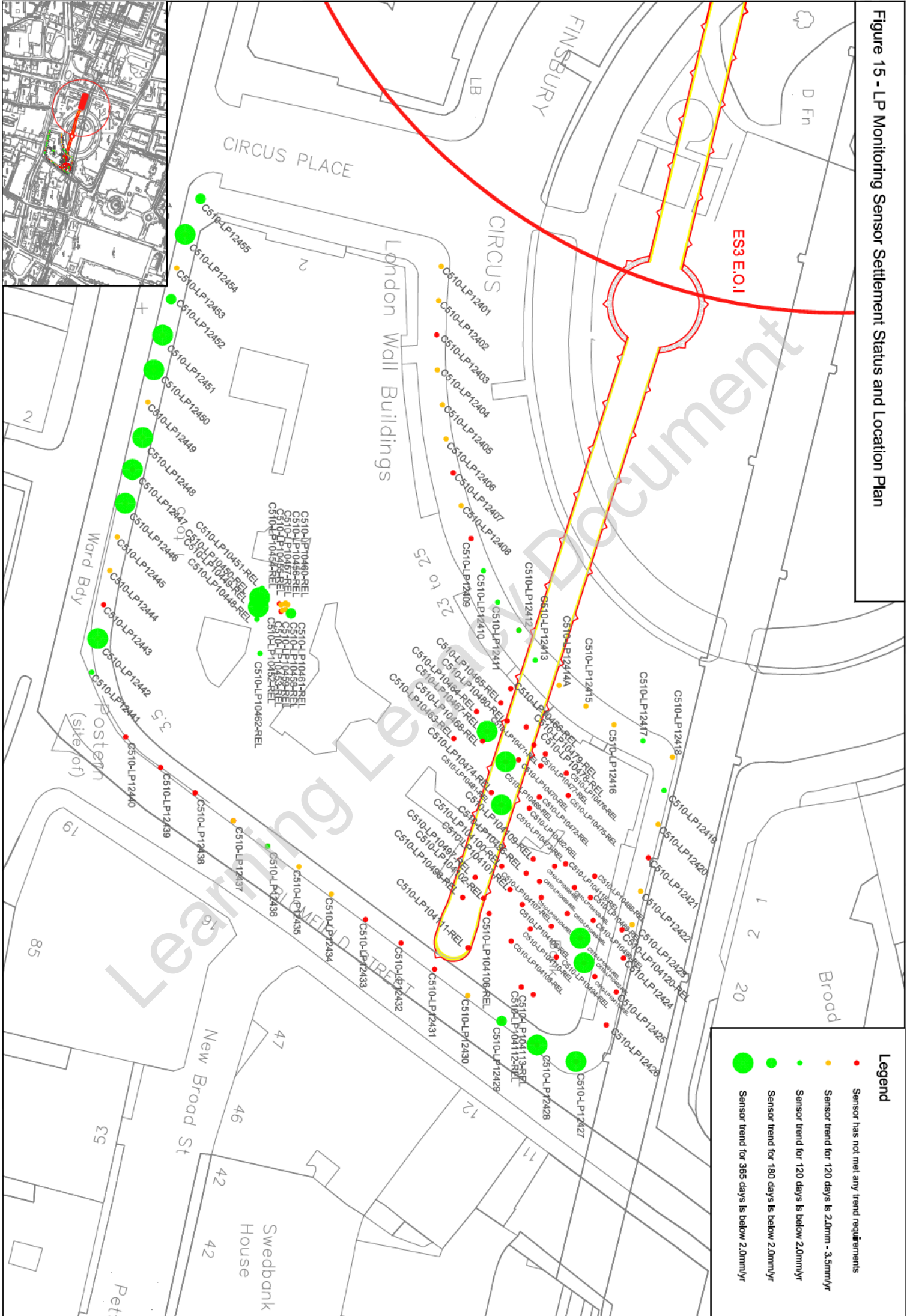


Figure 16 - RP Monitoring Sensor Settlement Status and Location Plan

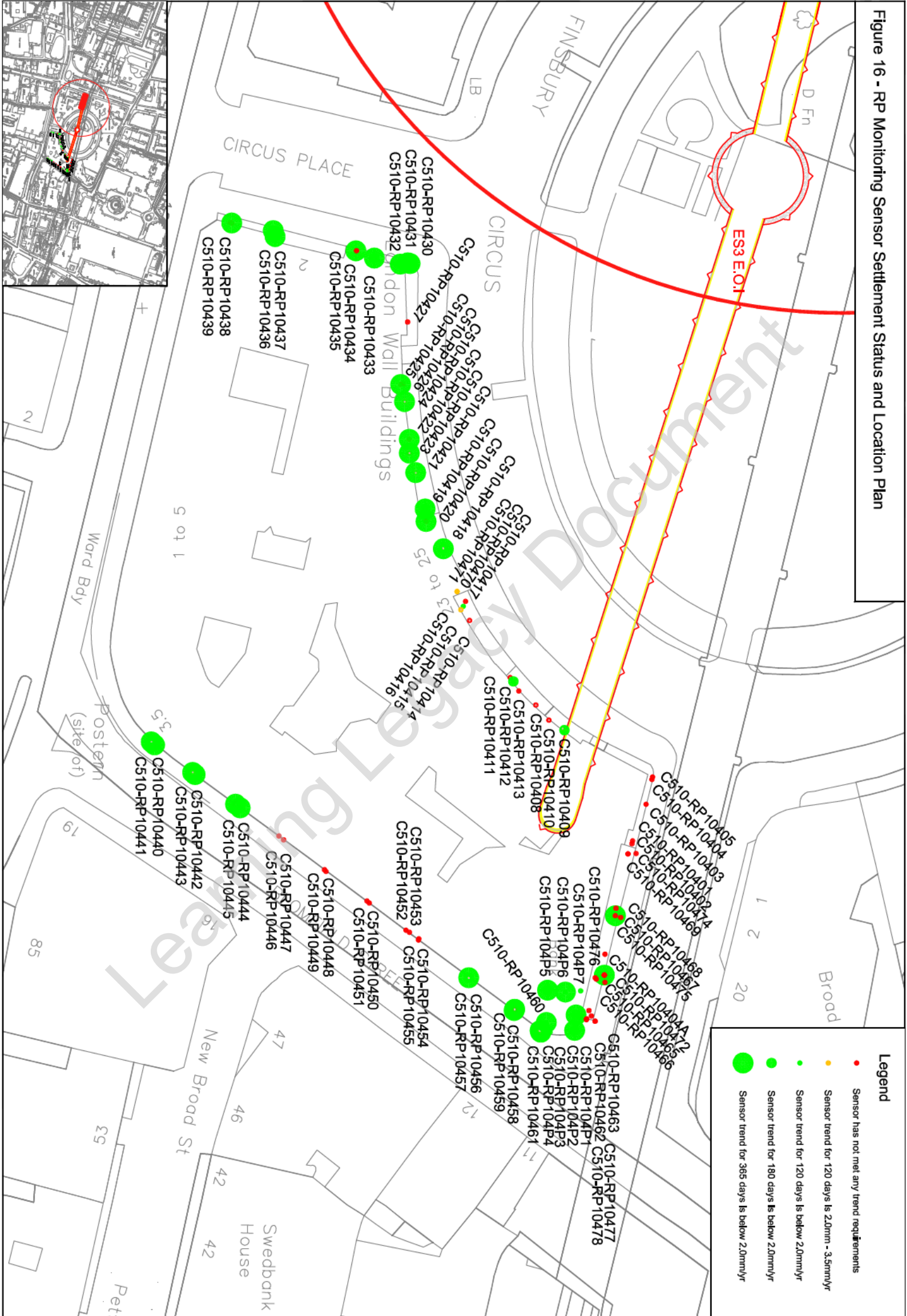


Figure 17 - XR Monitoring Sensor Settlement Status and Location Plan

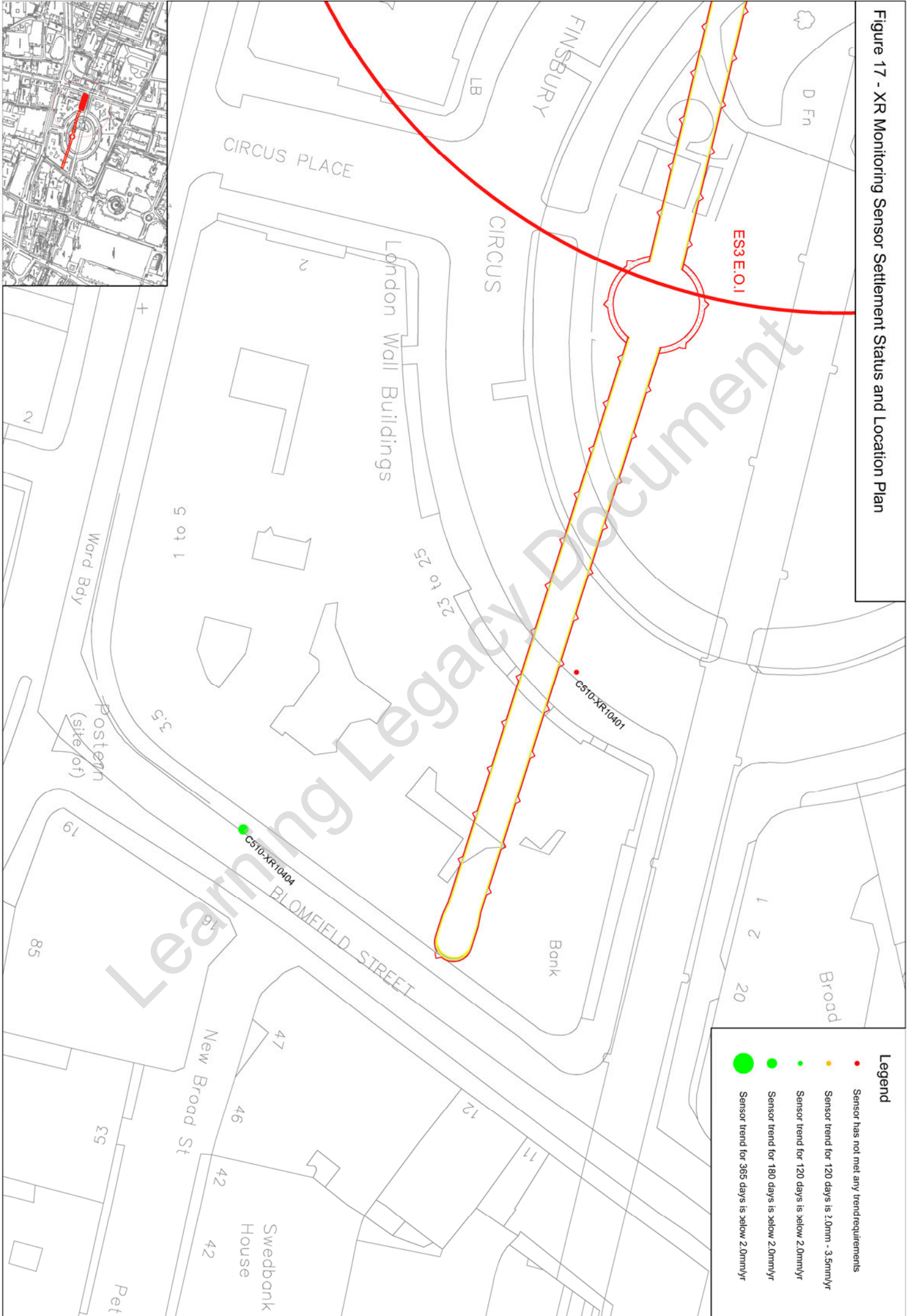


Figure 18 - SH Monitoring Sensor Settlement Status and Location Plan

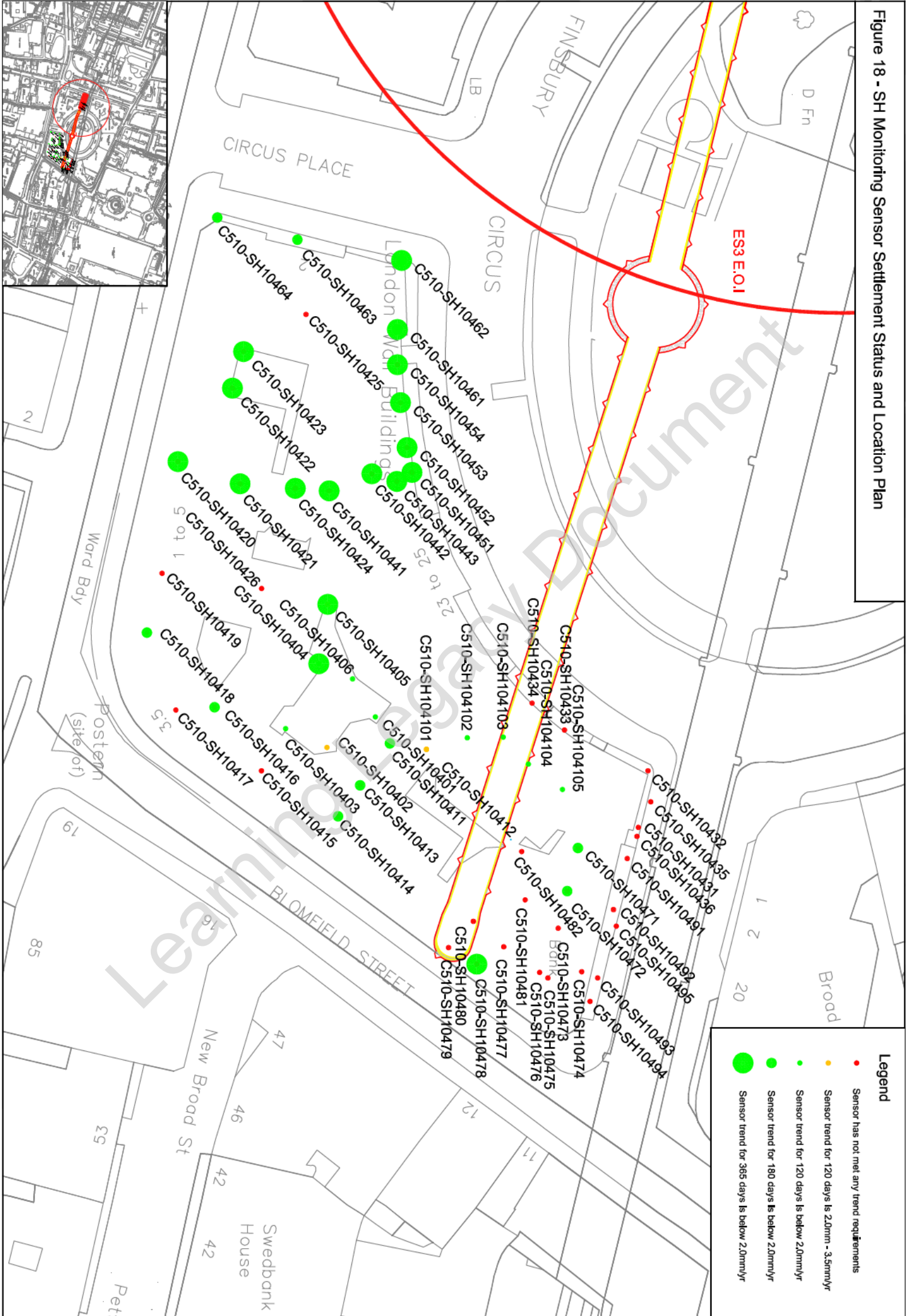
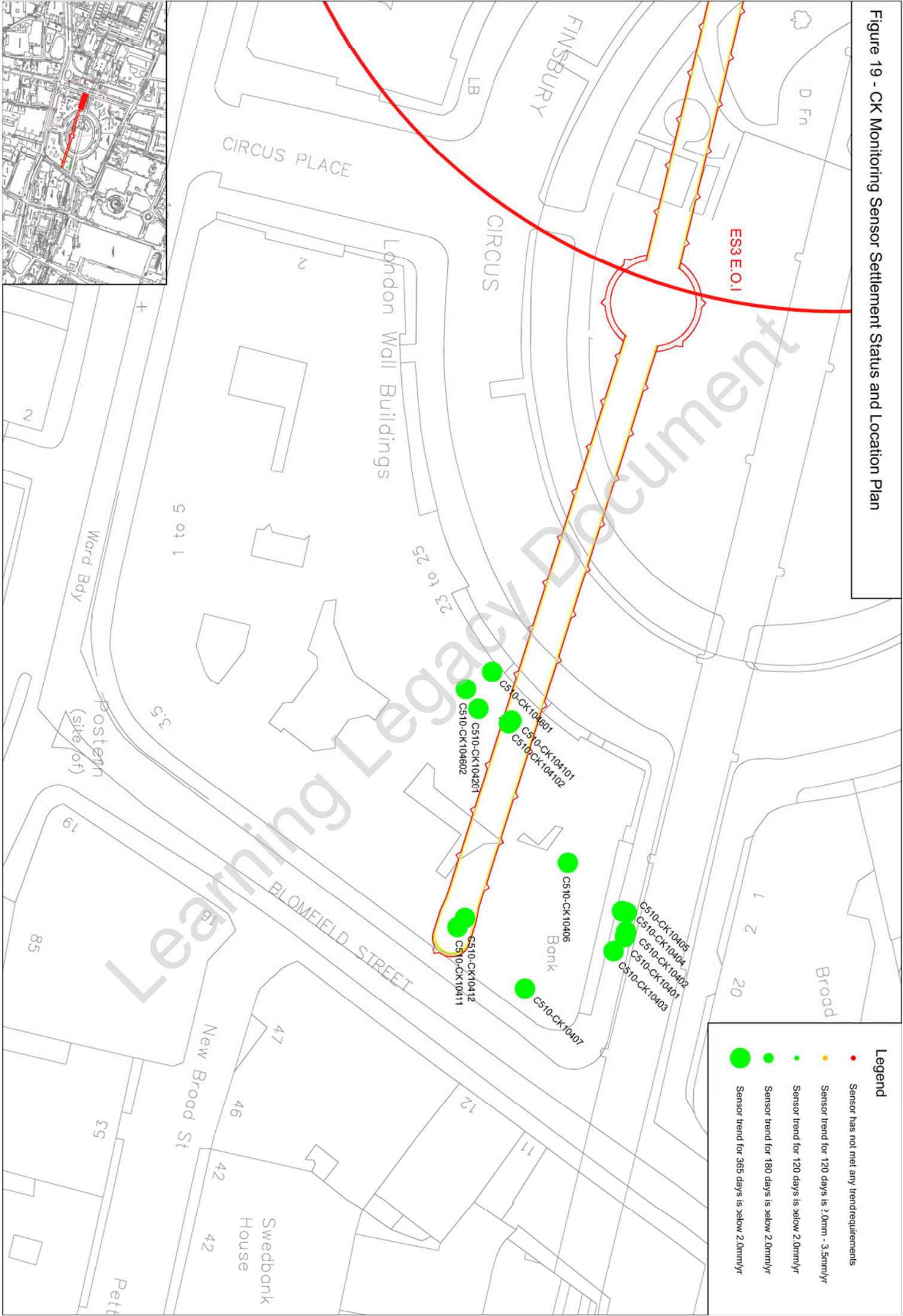


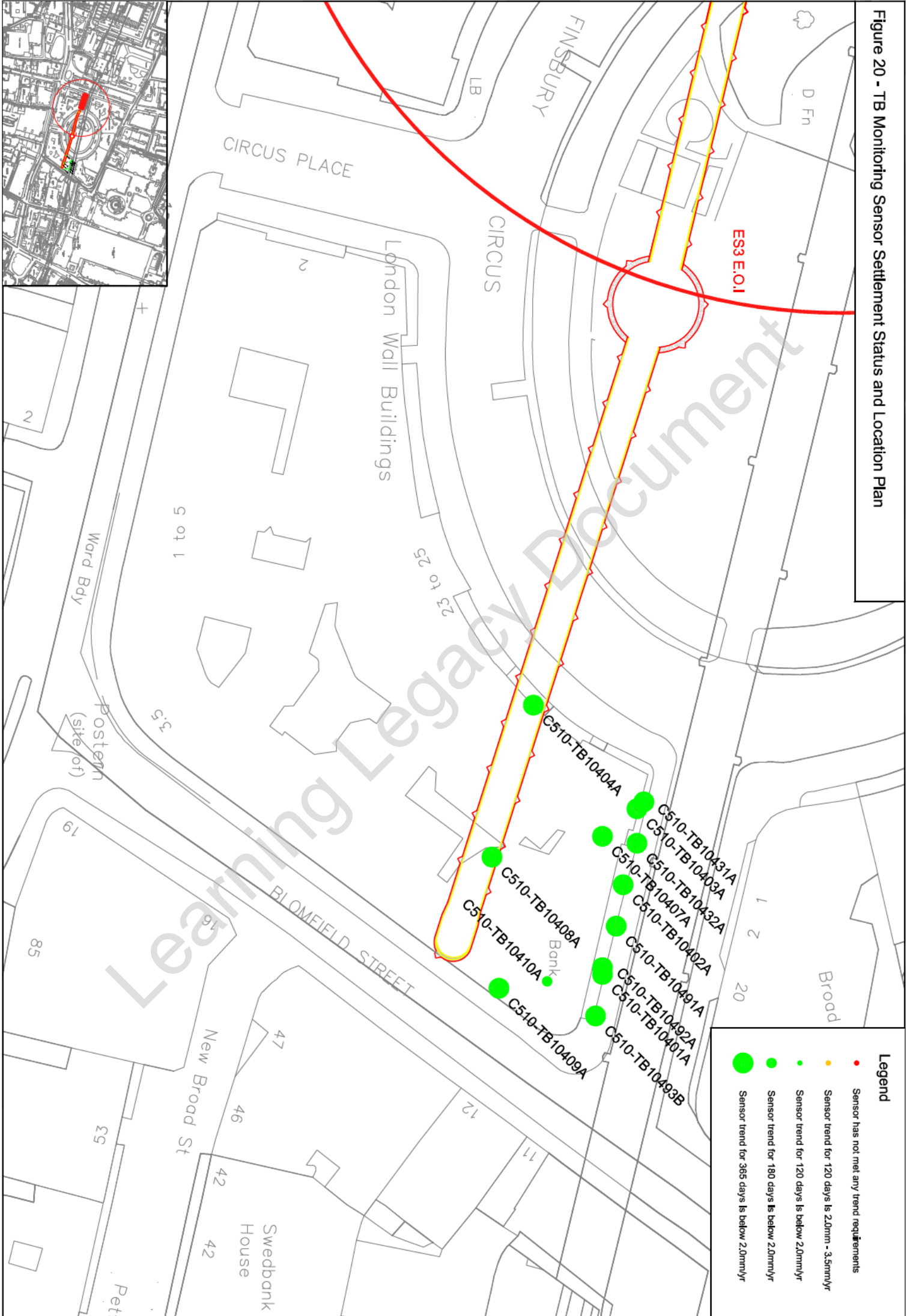
Figure 19 - CK Monitoring Sensor Settlement Status and Location Plan



Legend

- Sensor has not met any trend requirements
- Sensor trend for 120 days is $\geq 2.0\text{mm} - 3.5\text{mm/yr}$
- Sensor trend for 120 days is below 2.0mm/yr
- Sensor trend for 180 days is below 2.0mm/yr
- Sensor trend for 365 days is below 2.0mm/yr

Figure 20 - TB Monitoring Sensor Settlement Status and Location Plan



Legend

- Sensor has not met any trend requirements
- Sensor trend for 120 days is 2.0mm - 3.5mm/yr
- Sensor trend for 120 days is below 2.0mm/yr
- Sensor trend for 180 days is below 2.0mm/yr
- Sensor trend for 365 days is below 2.0mm/yr

Figure 21 - IM Monitoring Sensor Settlement Status and Location Plan

