



C510 – Whitechapel and Liverpool Street Station Tunnels

Instrumentation and Monitoring Close Out Report Block 02 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 02 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 02 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 02

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 02 Location

Figure 1 shows the Liverpool St general location plan, C510 tunnel construction and where Block 02 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 02, including:

- London Wall sewer within London Wall;
- 12" steel (ST) water main located within South Side Finsbury Circus;
- 10" & 12" cast iron (CI) West Side Moorgate (South) water main within Moorgate;
- 450mm ductile iron (DI) East Side Moorgate (South) water main within Moorgate;
- London Bridge Sewer Main Line (South) within Moorgate; and
- Goswell Street Sewer North Branch Diversion within Moorgate

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.

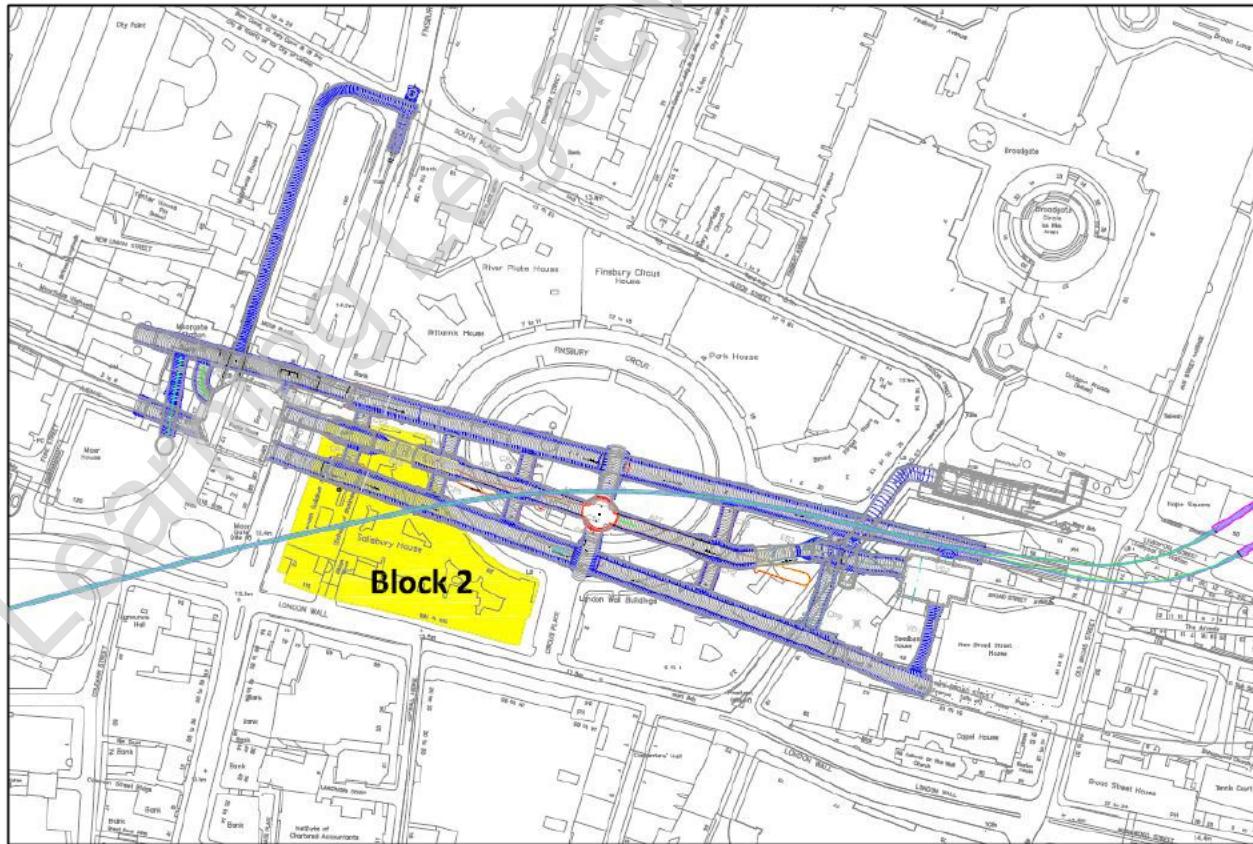


Figure 1 - Liverpool St General Location Plan - including Block 02 monitoring area

3.2 Block 02 Description

Block 02 is between London Wall, Moorgate and Finsbury Circus. Block 02 is located above Platform Tunnel West (PTW), Cross Passage 1 (CP1), Cross Passage 2 (CP2), Cross Passage 3 (CP3), Chamber 1-2 (CH1-2), Chamber 5 (CH5), Escalator Tunnel 3 (ES3), Access Passage 9 (AP9), and Launch Chamber West b (LCWb). Further details of the construction programmes can be found in Section 4. Block 02 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 and manual monitoring
- Water Settlement Cell Electronic (SH) – automated monitoring
- Tiltmeters (TB) – automated monitoring
- Crack Monitors (CK) – manual monitoring
- Extensometer Rods (XR) – automated and 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 02 Report References:

- Installation Report – LIV-Block 02 – Salisbury House & Electra House
CRL Document Number: C510-BBM-C2-RGN-C101-50005
- Monitoring Installation Report LIV-LB-02-Electra House
CRL Document Number: C510-BBM-C2-RGN-C101-50208
- Monitoring Installation Report LIV-LB-2 – Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50133
- Monitoring Installation Report LIV-LB-2 – Internal BRE's in Electra & Salisbury House
CRL Document Number: C510-BBM-C2-RGN-C101-50164
- Monitoring Installation Report LIV-Salisbury House Cellar
CRL Document Number: C510-BBM-C2-RGN-C101-50210
- Monitoring Installation Report LIV-LP-2-Finsbury Circus
CRL Document Number: C510-BBM-C2-RGN-C101-50072
- Monitoring Installation Report LIV-LP-22-Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50127
- Instrumentation C510-IM10204– Liverpool St. –Inclinometer (Redrilled)
CRL Document Number: C510-BBM-C2-RGN-C101-50095
- Instrumentation C510-IM10205– Liverpool St. –Inclinometer (Redrilled)
CRL Document Number: C510-BBM-C2-RGN-C101-50053

- Instrumentation C510-XR10207 – Liverpool St. –Extensometer
CRL Document Number: C510-BBM-C2-RGN-C101-50084
- Instrumentation C510-XR10208 – Liverpool St. –Extensometer
CRL Document Number: C510-BBM-C2-RGN-C101-50088
- Monitoring Installation Report – LIV-RP-2 – Cantilever Stairs
CRL Document Number: C510-BBM-C2-RGN-C101-50207
- Monitoring Installation Report LIV-BK-2 – Electra House Crackmeters – Liverpool Street
CRL Document Number: C510-BBM-C2-RGN-C101-50200
- 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 02 to experience approximately 1-130mm of settlement.

4 Construction Programme Influencing Block 02

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 02, 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 (yellow outline), ES3 EOI, and the tunnel constructions. Tunnel advance start and finish dates will be used in the assessment of the monitoring data.

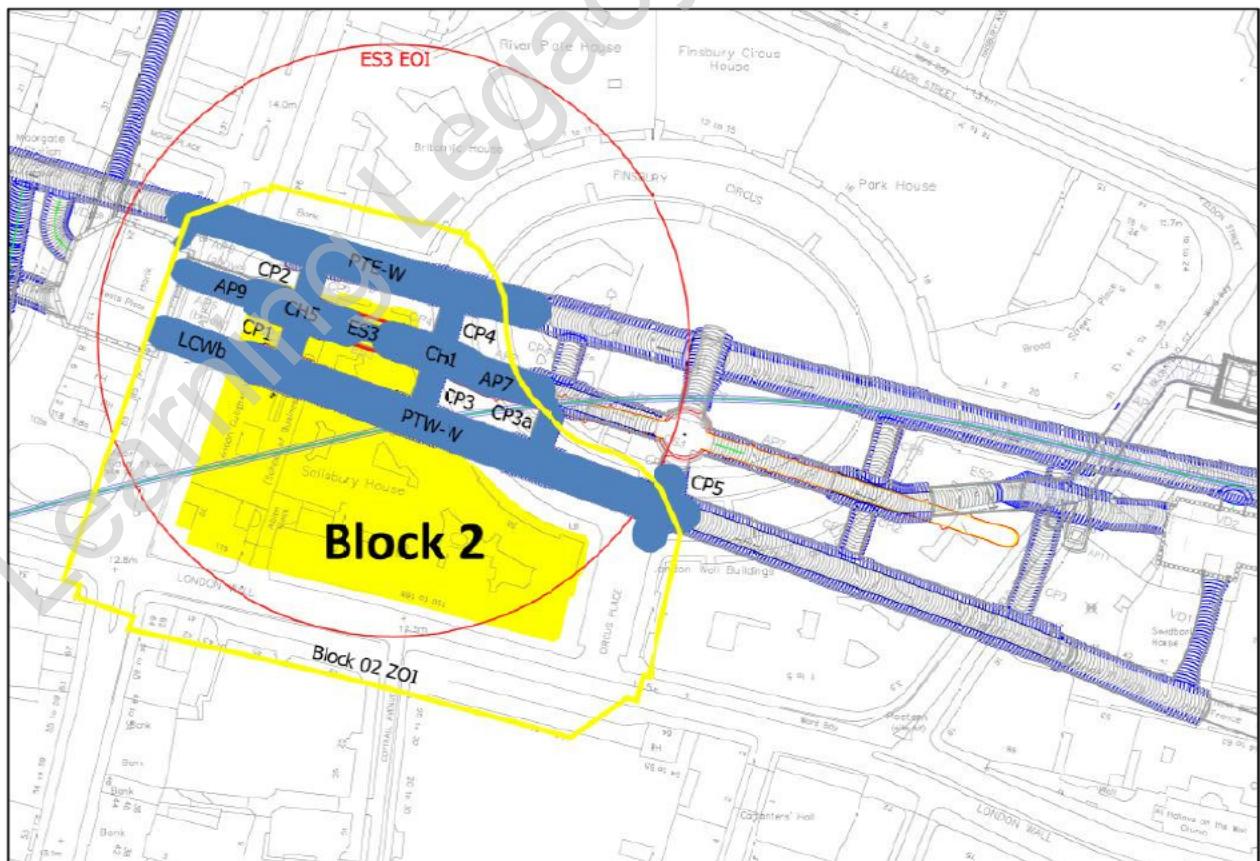


Figure 2 - Block 02 ZOI Constructors

Figure 2 shows the Block 02 ZOI and the tunnel advances that occurred within its boundary. The construction advances within the ZOI that have the potential to affect Block 02 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. Grouting within the GAD adits has been decommissioned and it is proposed that all automated sensors are to be decommissioned. Under ss. 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. Precise levelling points will be maintained in place and monitored until such time that the sensors meet the settlement criteria. Further evidence for Block 02 sensors decommissioning status can be found in the decommissioning tracker.

4.1 Tunnel Advances Affecting Block 02

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 STARTS & ENDS FOR GRAPHS					
Tunnel Code	Tunnel Reference	Primary Layer Type	Start Date	End Date	Zone
ES3-Enlargement	ES3	Enlargement	15/02/2017	18/03/2017	ZOI
CH6/ES3-Enlargement	CH6/ES3	Enlargement	11/12/2016	30/01/2017	ZOI
ES3-Pilot	ES3	Pilot	24/06/2016	15/11/2016	ZOI
AP9-Enlargement	AP9	Enlargement	30/05/2016	09/06/2016	ZOI
CP4-Enlargement	CP4	Enlargement	27/09/2014	03/10/2014	ZOI
CP2-Enlargement	CP2	Enlargement	23/08/2014	30/08/2014	ZOI
CP1-Enlargement	CP1	Enlargement	24/06/2014	30/06/2014	ZOI
CP2-Pilot	CP2	Pilot	08/06/2014	15/06/2014	ZOI
CP1-Pilot	CP1	Pilot	06/06/2014	13/06/2014	ZOI
VD7-Enlargement	VD7	Enlargement	04/06/2014	11/06/2014	ZOI
CP3a-Enlargement	CP3a	Enlargement	24/05/2014	31/05/2014	ZOI
CP4-Pilot	CP4	Pilot	07/05/2014	10/05/2014	ZOI
CP3-Enlargement	CP3	Enlargement	01/05/2014	06/05/2014	ZOI
CP3-Pilot	CP3	Pilot	29/04/2014	06/05/2014	ZOI
AP5-Enlargement	AP5	Enlargement	05/04/2014	12/04/2014	ZOI
CH5-Enlargement	CH5	Enlargement	14/03/2014	05/04/2014	ZOI
LCWb-Enlargement	LCWb	Enlargement	25/02/2014	05/03/2014	ZOI
LCE-Enlargement	LCE	Enlargement	01/02/2014	16/02/2014	ZOI
CP3a-Pilot	CP3a	Pilot	10/01/2014	14/01/2014	ZOI
PTE-West-Enlargement	PTE-West	Enlargement	29/11/2013	31/01/2014	ZOI
PTW-East-Enlargement	PTW-East	Enlargement	17/11/2013	24/11/2013	ZOI
AP5-Pilot	AP5	Pilot	30/10/2013	04/11/2013	ZOI
LCWb-Pilot	LCWb	Pilot	20/10/2013	24/10/2013	ZOI
PTW-West-Enlargement	PTW-West	Enlargement	18/08/2013	24/02/2014	ZOI
LCE-Pilot	LCE	Pilot	06/08/2013	13/08/2013	ZOI
PTW-East-Pilot	PTW-East	Pilot	13/07/2013	21/07/2013	ZOI
PTE-West-Pilot	PTE-West	Pilot	16/06/2013	06/08/2013	ZOI
PTW-West-Pilot	PTW-West	Pilot	02/06/2013	20/10/2013	ZOI
CH1-Enlargement	CH1	Enlargement	16/05/2013	26/05/2013	ZOI
CH5-Pilot	CH5	Pilot	27/04/2013	30/10/2013	ZOI
ES3/CH5-Pilot	ES3/CH5	Pilot	23/04/2013	26/04/2013	ZOI
CH1-Pilot	CH1	Pilot	09/03/2013	22/04/2013	ZOI
AP7 West-Enlargement	AP7 West	Enlargement	17/02/2013	26/05/2013	ZOI
AP7 West-Pilot	AP7 West	Pilot	11/02/2013	09/03/2013	ZOI
CP5-Enlargement	CP5	Enlargement	08/12/2012	13/01/2013	ZOI
CP5-Pilot	CP5	Pilot	11/11/2012	16/11/2012	ZOI
GAD1-Pilot	GAD1	Pilot	26/01/2012	07/02/2012	ZOI

Table 1 - Tunnel Advances Affecting Block 02

Heading Index:

AP – Access Passage

CH - Chamber

CP - Cross Passage

ES – Escalator

GAD – Grout Adit

PTE – Platform Tunnel East

PTW – Platform Tunnel West

LCE – Launch Chamber East

LCW – Launch Chamber West

VD – Ventilation Drive

5 Monitoring Assessment of Block 02

Evidence for decommissioning each monitored sensor is shown through graphs, tables (decommissioning status tracker) and plans. Each element of assessment complements 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.

ES3 was the final construction activity to affect Block 02. The final construction activity was 18/03/2017; therefore, all sensors are eligible for decommissioning from 18/09/2017 provided the specified sensor meets the <2mm/year settlement requirement. As discussed in section 4, KC21.3220(c) states, however, that all automated sensors can be decommissioned at the same time as grouting regardless of the automated sensor's settlement rate.

Crossrail agreed at the ERP meeting held on 27/07/2017 to decommission the grouting within GAD1. As such, this allowed for decommissioning of all automated sensors within the influence area. It is therefore proposed that all automated sensors within Block 02 be removed. See graphs, tables and plans for further details on the automated sensors.

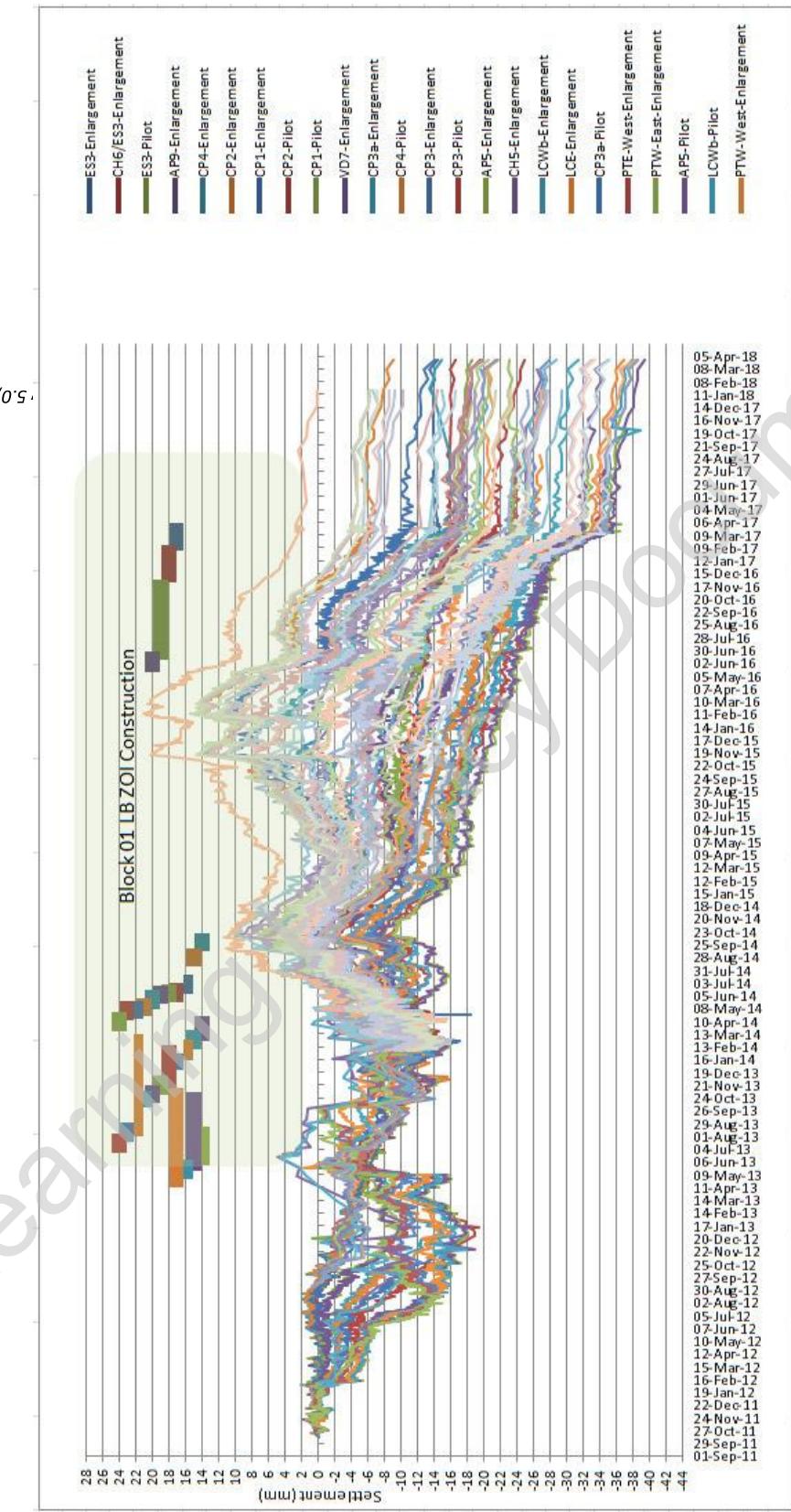
5.1 Time Graphs Monitoring Full History and Construction Durations

To assess the movement of Block 02 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:

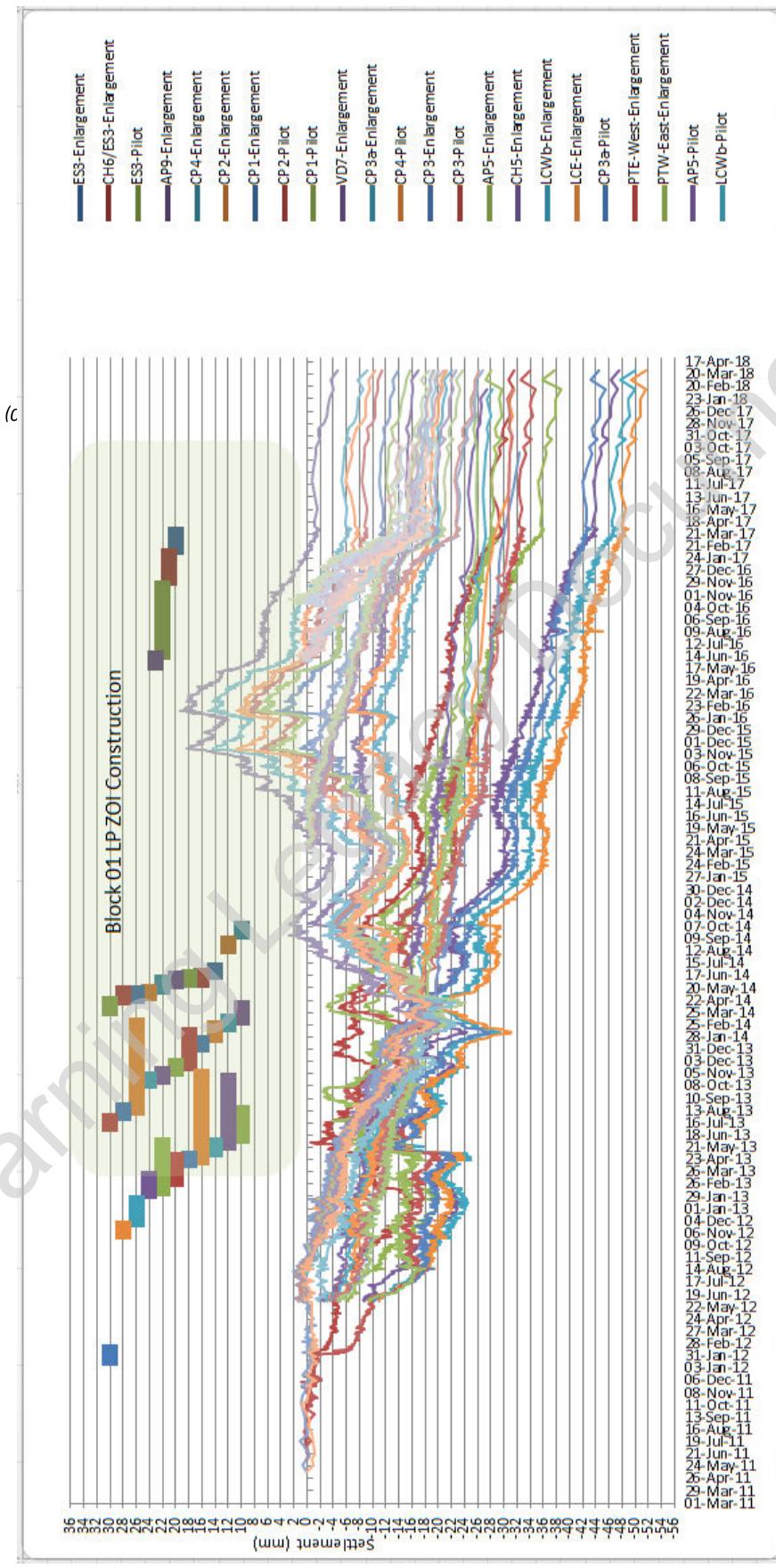
- Graph 1 - Block 02 Building (BRE & LC) Manual Monitoring History in Relation to Construction
- Graph 2 - Block 02 Road Studs (LP) Manual Monitoring History in Relation to Construction



Graph 1 - Block 02 Building (BRE & LC) Manual Monitoring History in Relation to Construction



Graph 2 - Block 02 Road Studs (LP) Manual Monitoring History in Relation to Construction



5.2 Block 02 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 02'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 02. 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 02 Decommissioning Status Tracker

28/03/2018

Table 2 - Block 02 Decommissioning Status Tracker

28/03/2018										RED					
< 2.0 mm GREEN < 3.5 mm AMBER > 3.5 mm															
C510-LP12201	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-2.5	121	-4.1	191	<2mm per year specification met
C510-LP12202	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	1.5	121	-2.0	191	<2mm per year specification met
C510-LP12203	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.6	121	-4.9	191	<2mm per year specification met
C510-LP12204	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-2.0	121	-4.6	191	<2mm per year specification met
C510-LP12205	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-1.8	121	-4.0	191	<2mm per year specification met
C510-LP12206	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	0.8	121	-2.1	191	<2mm per year specification met
C510-LP12207	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_ES1_Engagement_Uphill_Adv-8	18/03/2017	28/03/2018	-0.9	121	-0.9	191	<2mm per year specification met
C510-LP12208	Block 102	S10201	External	Manual	LP	Road Stud	Firsbury Circus	LIV_CPA_Engagement_Uphill_Adv-6	02/11/2014	28/03/2018	4.8	121	-1.3	191	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12231	Block 102	S10204	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	12/02/2018	-4.7	144	-4.2	234	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12232	Block 102	S10204	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	12/02/2018	-1.8	144	-2.0	234	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12233	Block 102	S10204	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	12/02/2018	-0.5	144	-0.7	234	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12234	Block 102	S10204	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	21/09/2017	-4.7	193	-4.7	193	Damaged - supplementary evidence to be provided
C510-LP12235	Block 102	S10204/S10205	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	12/02/2018	0.6	144	-0.2	234	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12236	Block 102	S10205	External	Manual	LP	Road Stud	London Wall	LIV_OP5_Engagement_Adv-34	18/03/2013	12/02/2018	1.1	144	0.6	234	<2mm per annum specification met. Continue to monitor until LP122334 meet trend requirements
C510-LP12237	Block 102	S10205/S10207	External	Manual	LP	Road Stud	Mongate	LIV_CPA_Engagement_Invert_Downhill_Adv-13	28/03/2014	28/03/2018	-2.9	121	-2.3	191	<2mm per year specification met
C510-LP12238	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_CPA_Engagement_Invert_Downhill_Adv-13	11/11/2016	28/03/2016	-3.6	121	-3.2	191	<2mm per year specification met
C510-LP12238	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_CPA_Engagement_Invert_Downhill_Adv-7	28/03/2017	28/03/2018	-4.1	121	-4.0	191	<2mm per year specification met
C510-LP12239	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_ES3_Engagement_Invert_Downhill_Adv-7	28/03/2017	28/03/2018	-4.6	121	-4.7	191	<2mm per year specification met
C510-LP12260	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_ES3_Engagement_Invert_Downhill_Adv-7	28/03/2017	28/03/2018	-4.1	121	-5.1	191	<2mm per year specification met
C510-LP12261	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_ES3_Engagement_Invert_Downhill_Adv-7	06/03/2017	28/03/2018	-5.9	121	-6.2	191	<2mm per year specification met
C510-LP12262	Block 102	S10207	External	Manual	LP	Road Stud	Mongate	LIV_ES3_Engagement_Invert_Downhill_Adv-7	06/03/2017	28/03/2018	-5.0	121	-6.3	191	<2mm per year specification met
C510-LP12263	Block 102	S10208	External	Manual	LP	Road Stud	Mongate	LIV_ES3_Engagement_Invert_Downhill_Adv-7	06/03/2017	28/03/2018	-5.4	121	-6.4	191	<2mm per year specification met
C510-LP12264-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-5.2	121	-6.9	191	Sensors labelled - REL due to being installed (01/04/2015) after construction commenced
C510-LP12265-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.3	121	-5.4	191	<2mm per year specification met
C510-LP12266-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.5	121	-5.4	191	<2mm per year specification met
C510-LP12267-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-3.4	121	-4.1	191	<2mm per year specification met
C510-LP12268-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.0	121	-4.6	191	<2mm per year specification met
C510-LP12269-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-3.9	121	-4.8	191	<2mm per year specification met
C510-LP12270-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.4	121	-4.9	191	<2mm per year specification met
C510-LP12271-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.4	121	-5.1	191	<2mm per year specification met
C510-LP12272-REL	Block 102	S10208	External	Manual	LP	Road Stud	West Place	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	28/03/2018	-4.8	121	-4.8	191	<2mm per year specification met
C510-LP12273	Block 102	S12204	Internal	Manual	LP	Road Stud	University	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	132	#N/A	185	#N/A
C510-LP12274	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-1.5	187	#N/A
C510-LP12275	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	132	#N/A	185	#N/A
C510-LP12276	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-2.5	187	#N/A
C510-LP12277	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-1.0	187	#N/A
C510-LP12278	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-1.5	187	#N/A
C510-LP12279	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	133	-1.5	181	#N/A
C510-LP12280	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	133	-1.1	181	#N/A
C510-LP12281	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-0.2	187	#N/A
C510-LP12282	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	133	-0.8	181	#N/A
C510-LP12283	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-0.2	187	#N/A
C510-LP12284	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-0.2	187	#N/A
C510-LP12285	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	133	-0.8	181	#N/A
C510-LP12286	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	133	-1.1	181	#N/A
C510-LP12287	Block 102	S12204	Internal	Manual	LP	Road Stud	Dental Salisbury House	LIV_ES3_Engagement_Uphill_Adv-10	18/03/2017	27/11/2017	#N/A	124	-0.2	187	#N/A

Table 2 - Block 02 Decommissioning Status Tracker RP

Table 2 - Block 02 Decommissioning Status Tracker CK

C510-CK102901	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-13	06/03/2017	02/03/2017	0.06	128	0.23	191	0.16	372	Outstanding
C510-CK102902	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-13	06/03/2017	02/03/2017	0.03	128	0.53	191	0.25	372	Outstanding
C510-CK102904	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-10	18/03/2017	02/03/2017	-0.19	128	0.07	203	0.10	372	Outstanding
C510-CK102905	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-10	18/03/2017	04/03/2017	0.06	121	-0.97	181	-0.53	374	Outstanding
C510-CK102906	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-10	16/03/2017	02/03/2017	0.91	128	0.76	191	0.97	372	Outstanding
C510-CK102907	Block-102	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Stars	LV_ESS_Ergonomics [Invest_Downhill_Adv-10	18/03/2017	04/03/2017	0.91	121	1.38	181	1.17	374	Outstanding

5.3 Supplementary Evidence for Decommissioning

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

- LP12234 - The road stud that was located in the area shown in the picture below (Figure 3) has been damaged and removed.



Figure 3. LP12234

5.4 Monitoring sensor Location Plan and Decommissioning Status

The following plots provide a visual representation of all Block 02 remaining monitoring sensors 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 three plans for Block 02 monitoring sensors:

- Figure 4 - BRE & LC Monitoring Sensor Settlement Status and Location Plan
- Figure 5 - LP Monitoring Sensor Settlement Status and Location Plan
- Figure 6 - RP Monitoring Sensor Settlement Status and Location Plan

Figure 4 - BRE & LC Monitoring Sensor Settlement Status and Location Plan

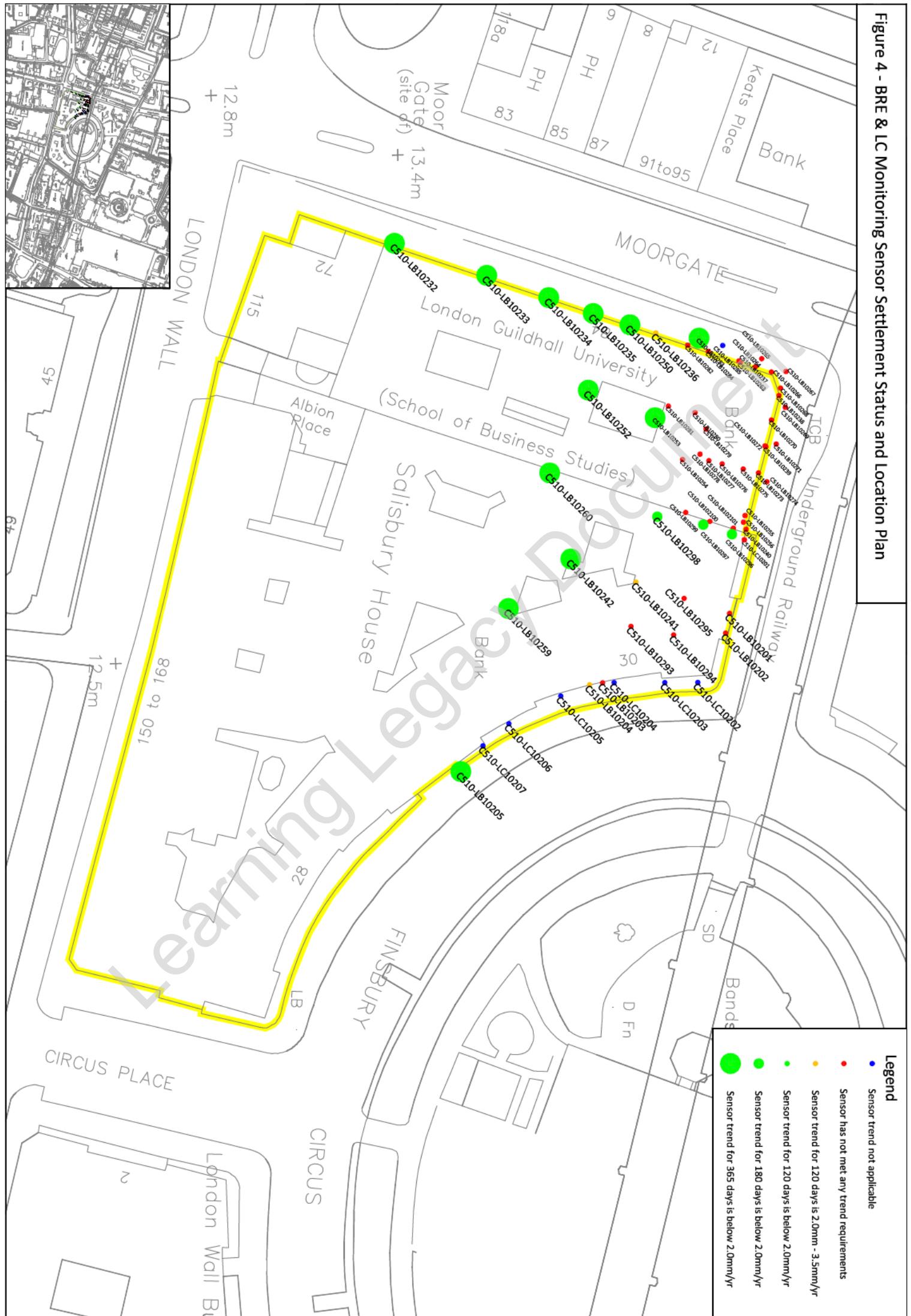


Figure 5 - LP Monitoring Sensor Settlement Status and Location Plan

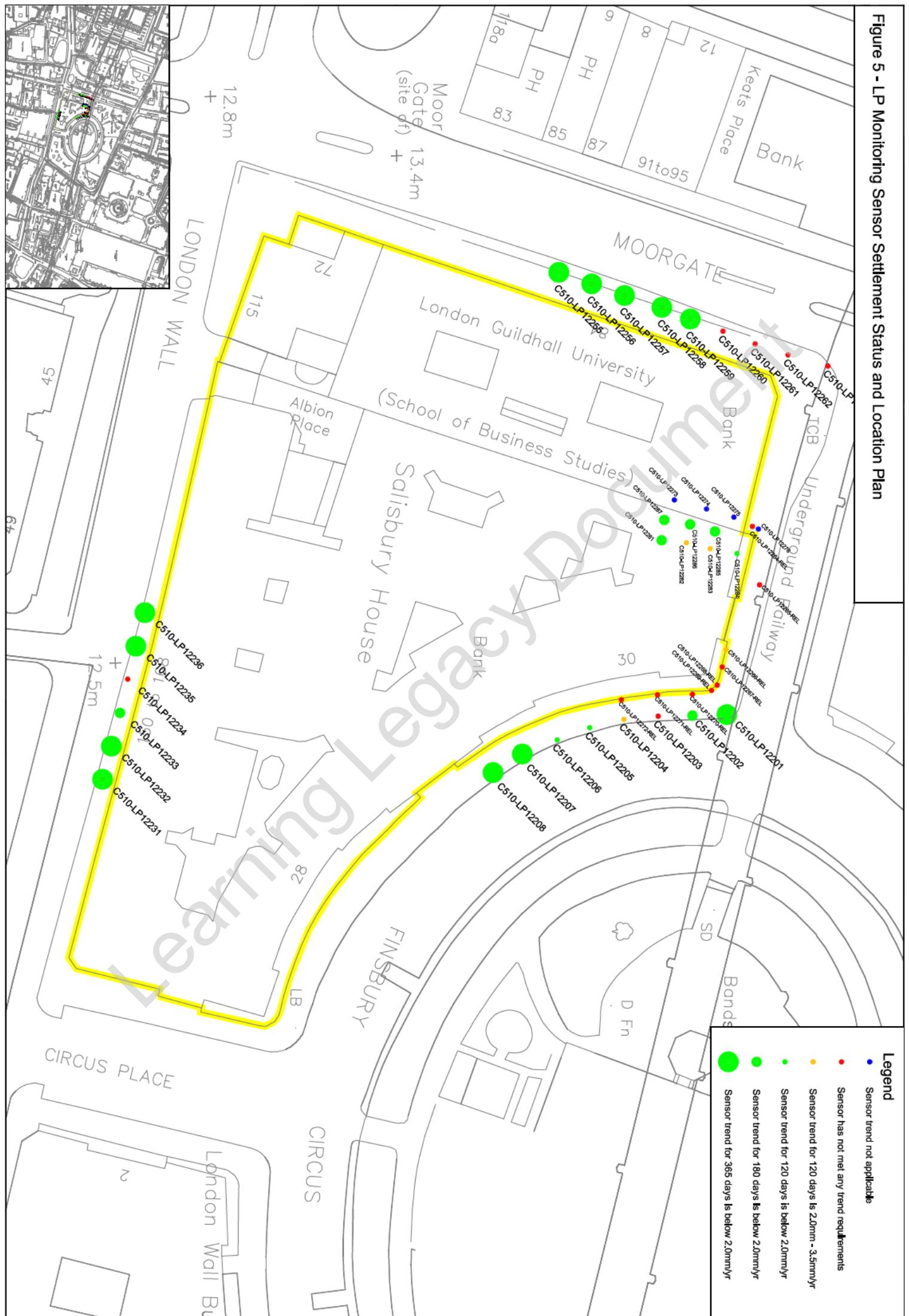
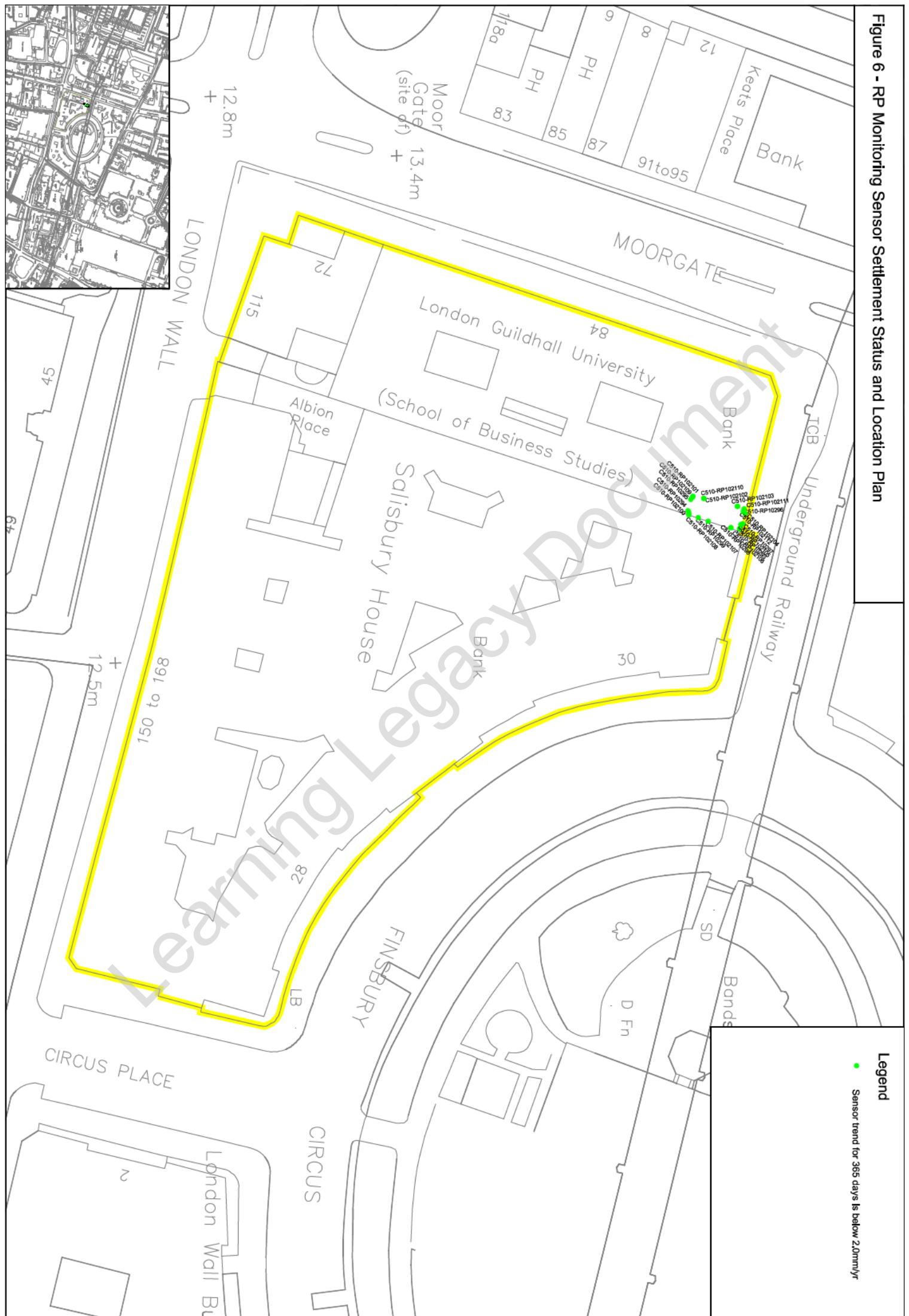


Figure 6 - RP Monitoring Sensor Settlement Status and Location Plan



6 Decommissioning Recommendations

Revision 2 of Block 02 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

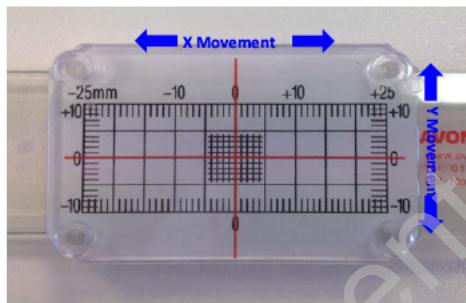
Block 2 Cantilever Stairs & University - Internal



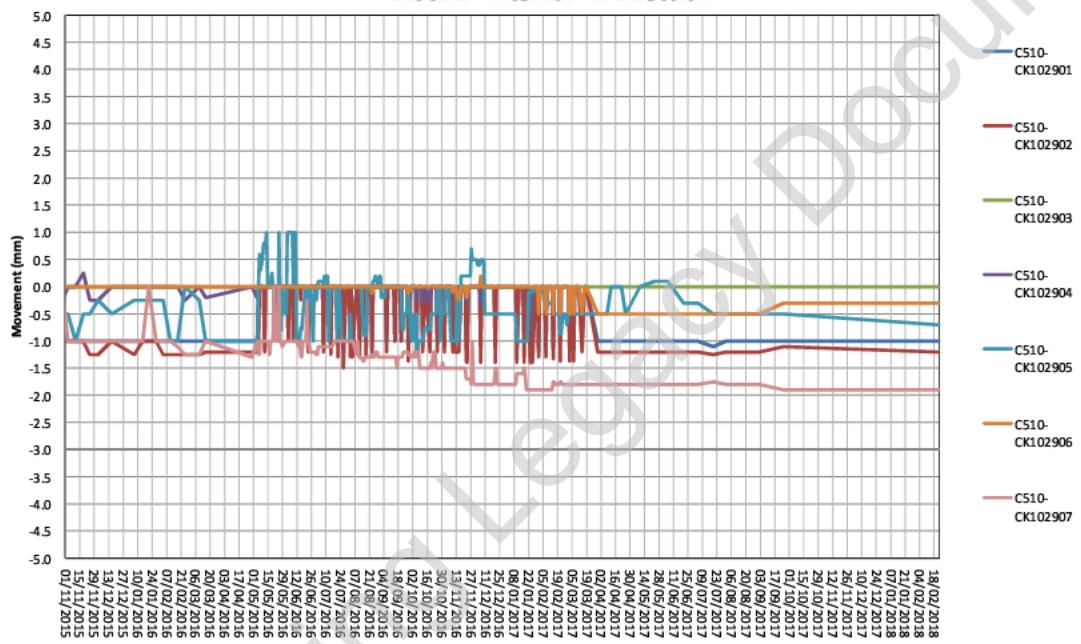
22/02/2018

	Crack Width (mm)	Date Installed	Baseline Value x	Baseline Value y
C510-CK102901	2.0	28/05/2014	0.0	0.0
C510-CK102902	1.8	28/05/2014	0.0	0.0
C510-CK102903	0.0	28/05/2014	0.0	0.0
C510-CK102904	1.0	28/05/2014	0.0	0.0
C510-CK102905	0.5	28/05/2014	0.0	0.0
C510-CK102906	1.0	28/05/2014	0.0	0.0
C510-CK102907	0.5	28/05/2014	0.0	0.0

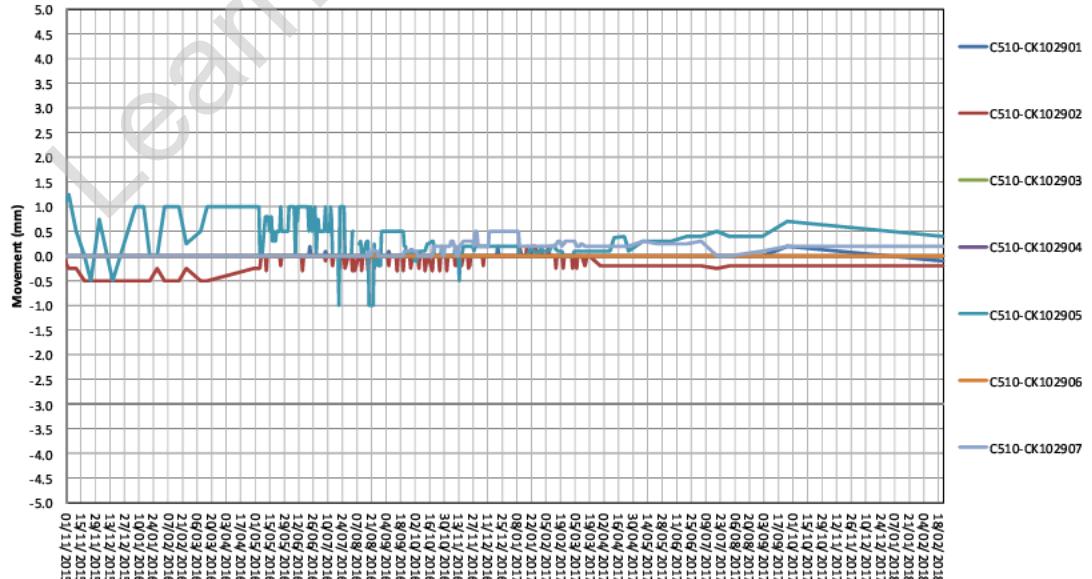
Note: C510-CK10204 Can't get acces
 23/08/2016 - No access to CK10204
 11-04-2017 - No access to CK10204
 21-04-2017 - No access to CK10204
 04-07-2017 No access TO CK10204

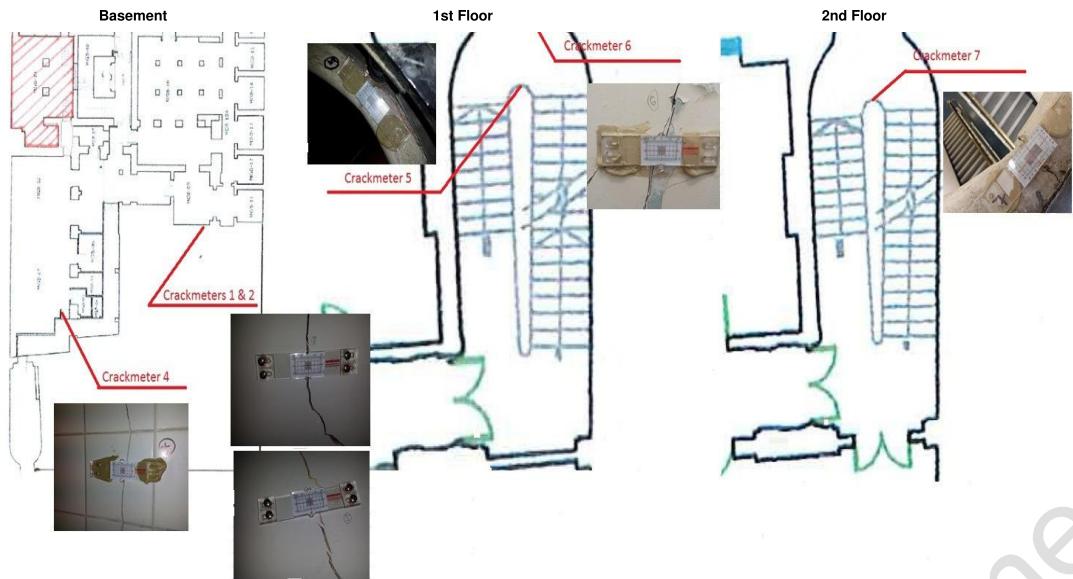


Block 2 - Internal - X Direction



Block 2 - Internal - Y Direction





Crackmeters Results

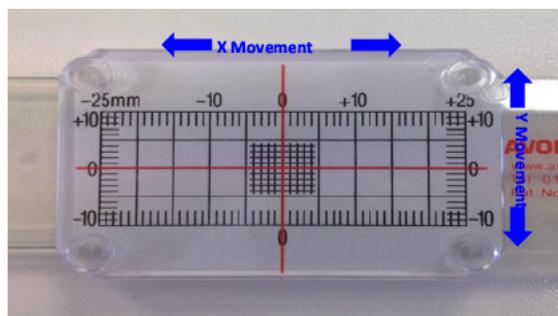
Crackmeters Block 2 University



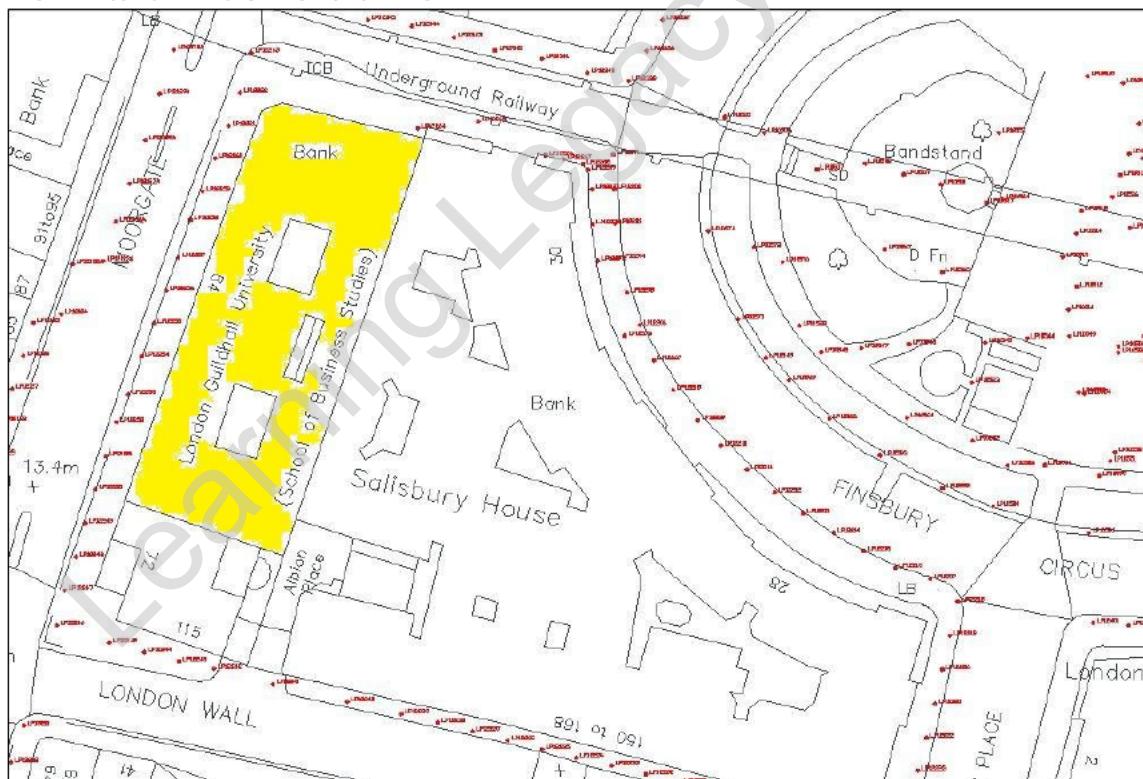
22/02/2018

COMMENTS

25/05/2016 CK102507 The crack-meter is damaged due to the wall movement and needs to be re-installed.
 27/07/2016 - CK102301-2 No access to crack meters.
 27/09/2016 - No access to C510-CK102202 & CK102203 due to class in progress.
 27/09/2016 - CK102308 showing movement, but likely due to crack meter being disturbed.
 11/10/2016 - CK102508-16 and CK102202-03 Couldn't get in a class going on
 25/10/2016 - CK102202-03 Couldn't get in a class going on
 12/12/2016-
 2017-01-17 502, 402 broken 104, 112 not visable due to lighting
 07/04/2017 - CK102305 has been knocked.
 2017-07-17 CK102104,05,14 Removed

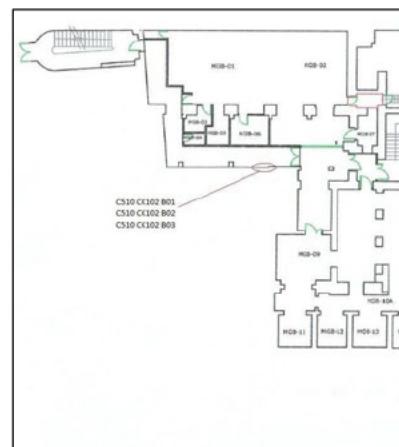


GENERAL LOCATION PLAN FOR UNIVERSITY CRACKMETERS

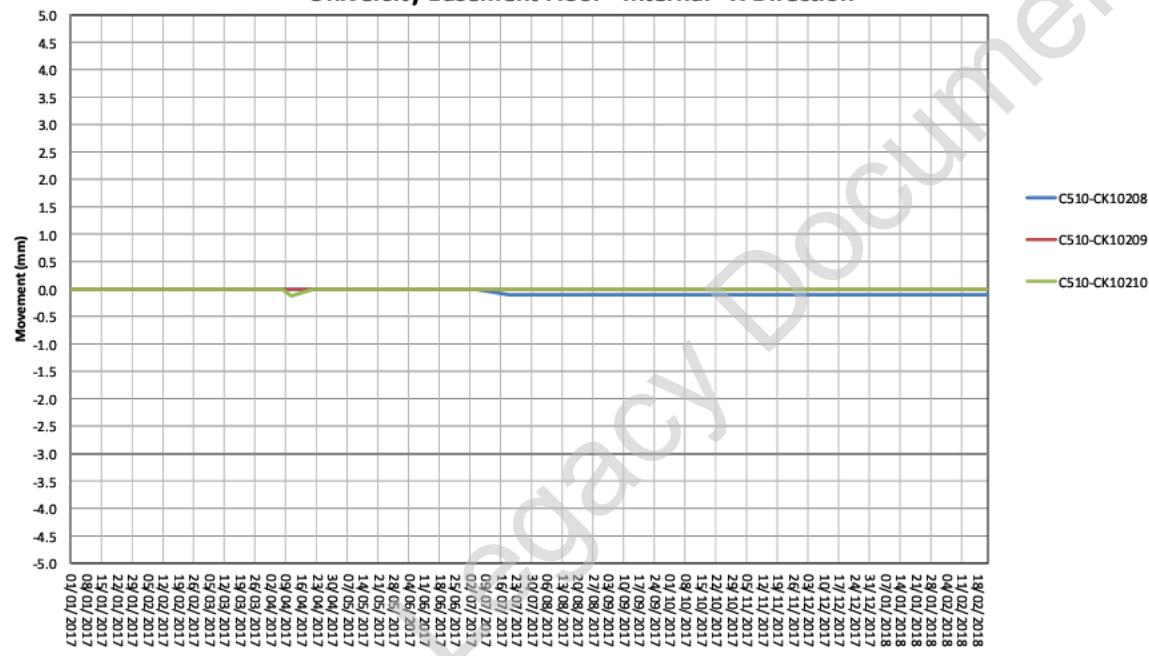


University Basement Floor					
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value		
			X	Y	Z
C510-CK10208	1.50	29/06/2015	0.00	-0.28	
C510-CK10209	0.65	30/06/2015	0.00	0.12	
C510-CK10210	1.00	04/08/2015	0.00	0.00	

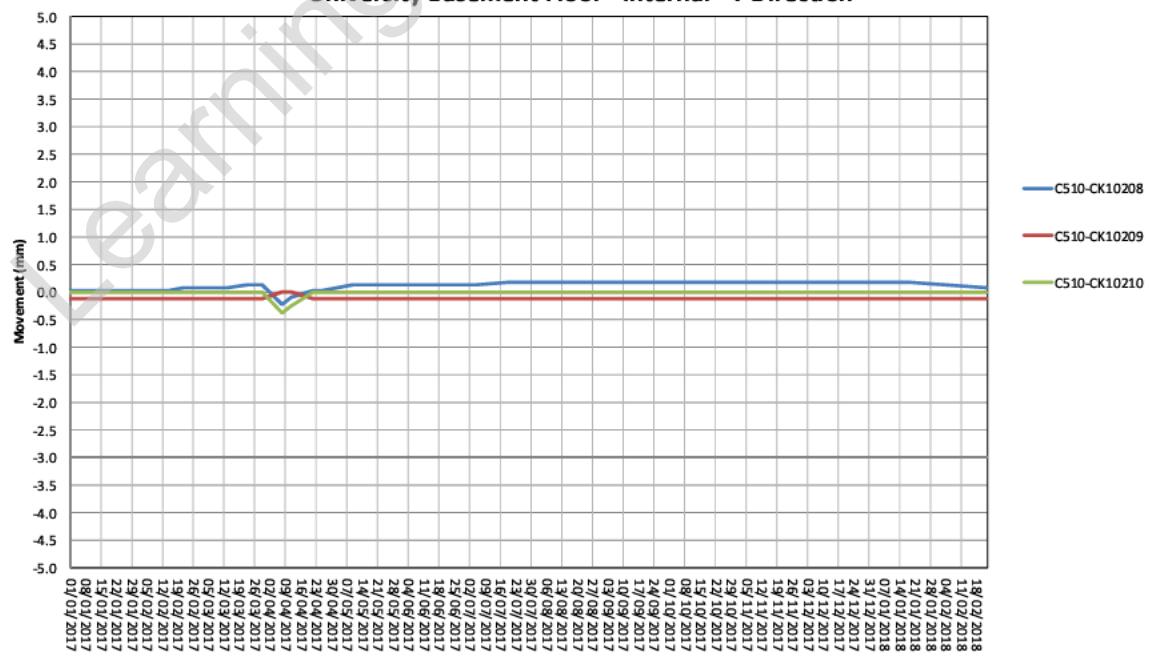
Crackmeter Location Plan Basement Floor



University Basement Floor - Internal - X Direction

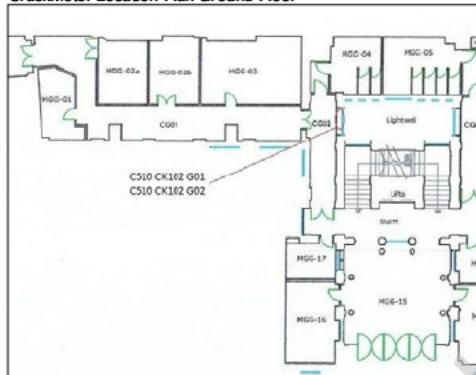


University Basement Floor - Internal - Y Direction

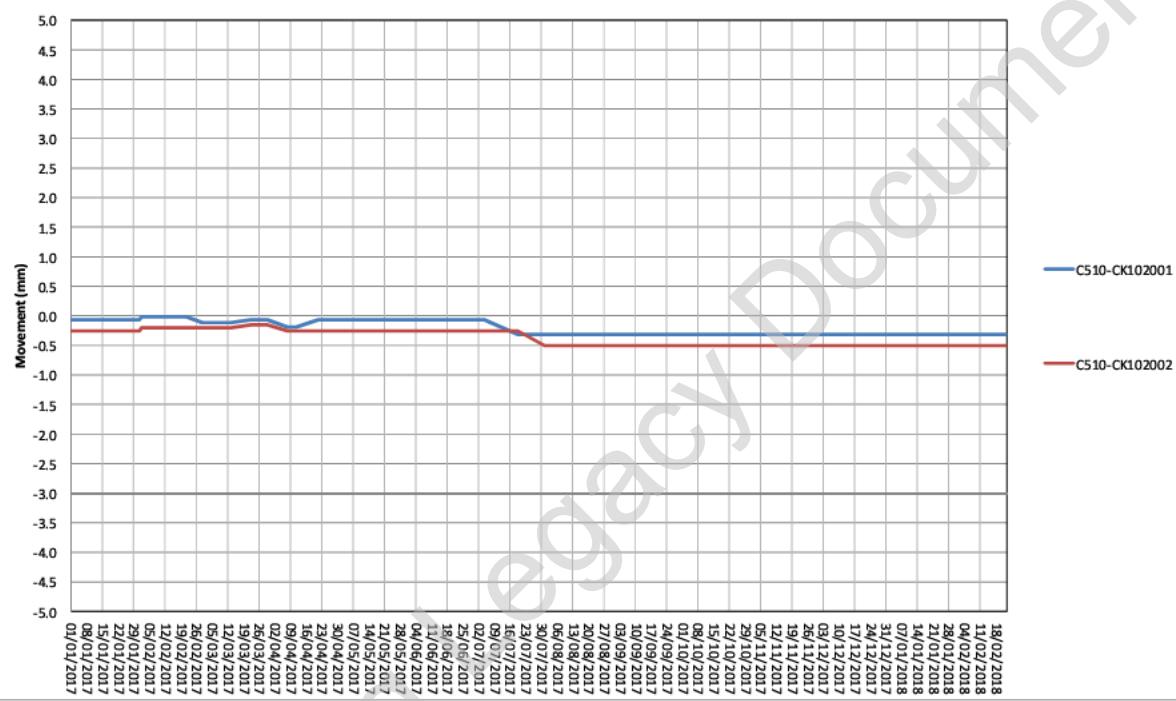


Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102001	0.65	30/06/2015	-0.19	-0.22
C510-CK102002	0.80	03/02/2015	0.00	-0.13

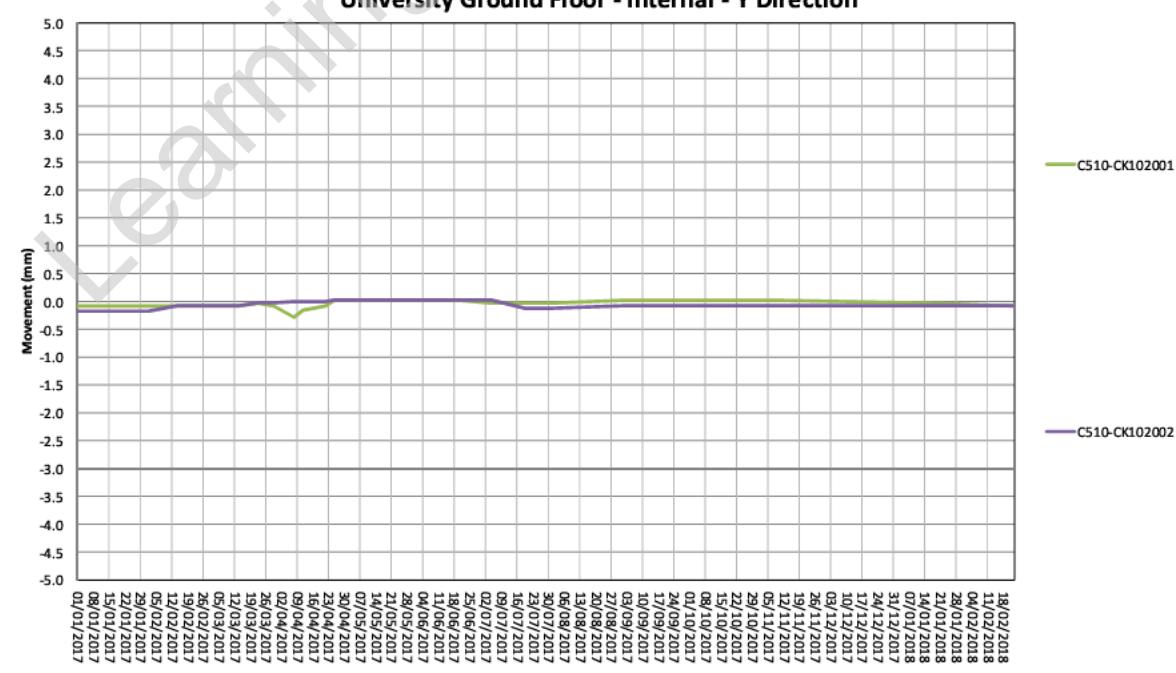
Crackmeter Location Plan Ground Floor



University Ground Floor - Internal - X Direction

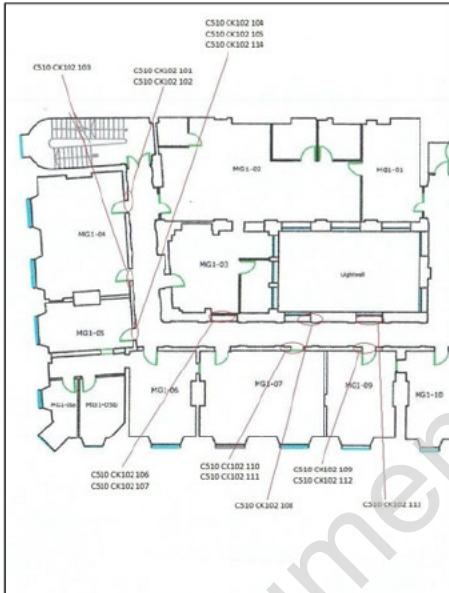


University Ground Floor - Internal - Y Direction

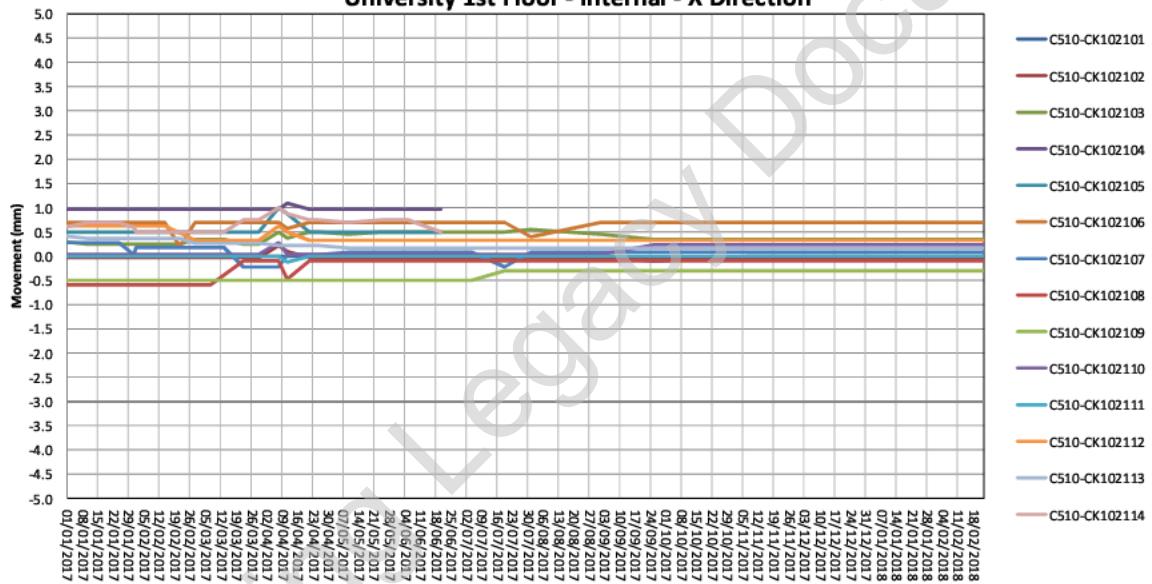


Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102101	0.10	09/07/2015	0.00	1.00
C510-CK102102	0.30	07/07/2015	0.03	-0.06
C510-CK102103	0.20	07/07/2015	0.25	0.12
C510-CK102104	1.50	15/07/2015	0.03	-1.19
C510-CK102105	1.00	15/07/2015	0.00	0.03
C510-CK102106	0.15	07/07/2015	-0.20	0.28
C510-CK102107	0.20	07/07/2015	-0.28	0.00
C510-CK102108	0.45	08/07/2015	0.59	-0.28
C510-CK102109	1.00	07/07/2015	0.00	0.00
C510-CK102110	0.55	07/07/2015	-0.03	0.48
C510-CK102111	0.75	07/07/2015	0.00	0.06
C510-CK102112	2.50	03/02/2015	-0.13	0.03
C510-CK102113	2.00	03/02/2015	0.03	0.19
C510-CK102114	0.70	15/07/2015	0.00	0.00

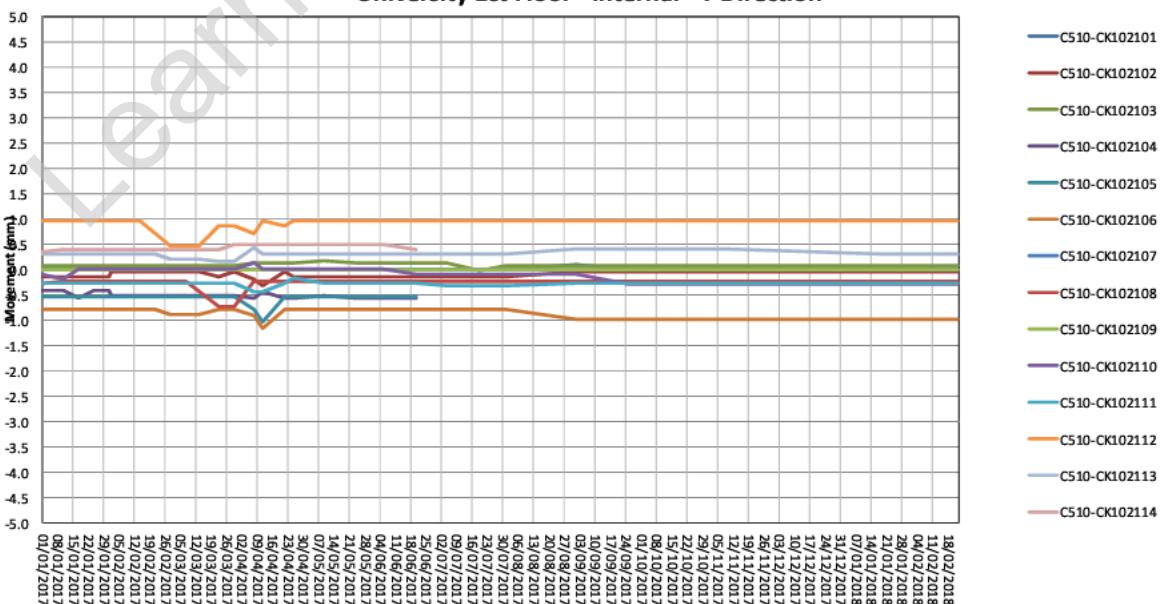
Crackmeter Location Plan 1st Floor



University 1st Floor - Internal - X Direction

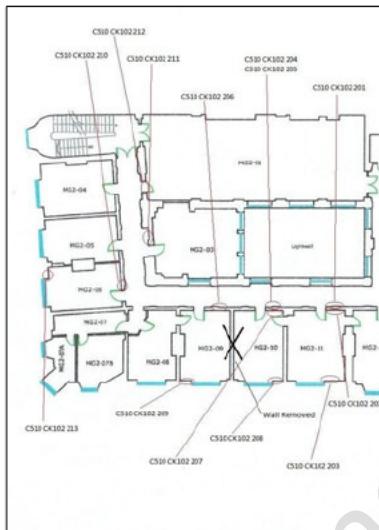


University 1st Floor - Internal - Y Direction

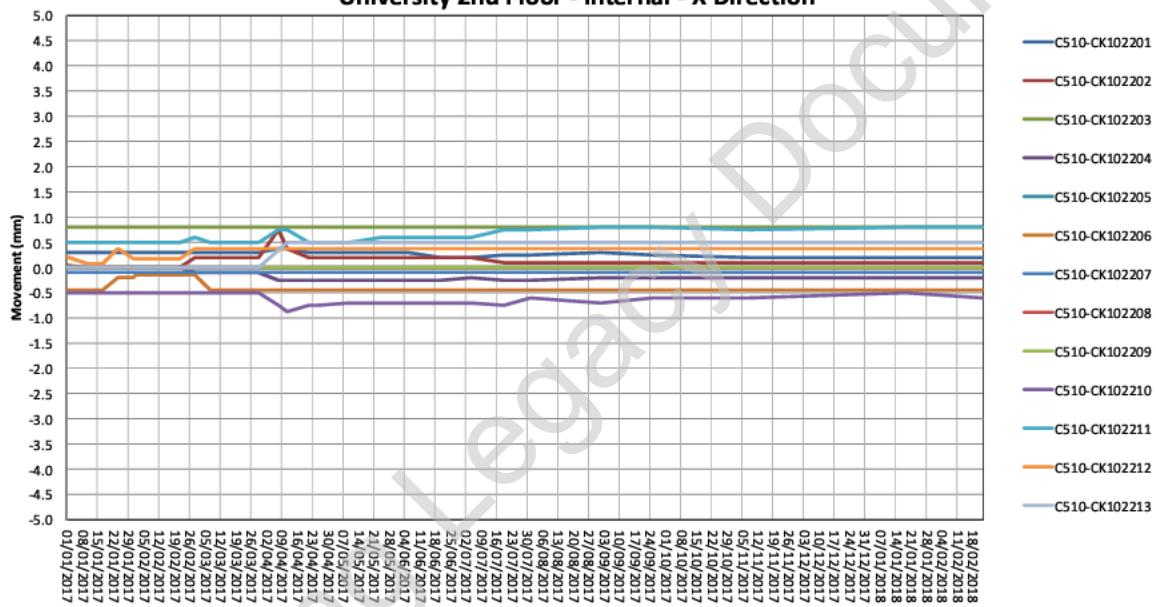


University 2nd Floor					
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value		
			X	Y	Z
C510-CK102201	1.00	29/06/2015	0.00	-0.04	
C510-CK102202	0.95	29/06/2015	0.00	-0.06	
C510-CK102203	1.25	07/07/2015	0.20	0.41	
C510-CK102204	0.40	29/06/2015	0.00	0.00	
C510-CK102205	0.80	29/06/2015	0.00	0.00	
C510-CK102206	0.15	29/06/2015	-0.06	-1.44	
C510-CK102207	0.15	01/07/2015	0.09	0.36	
C510-CK102208	0.65	08/07/2015	0.00	0.01	
C510-CK102209	0.30	08/07/2015	0.00	-1.50	
C510-CK102210	0.45	29/06/2015	-0.50	0.14	
C510-CK102211	0.60	29/06/2015	0.00	-0.04	
C510-CK102212	0.70	03/02/2015	-0.38	-0.25	
C510-CK102213	2.00	17/11/2015	0.00	0.00	

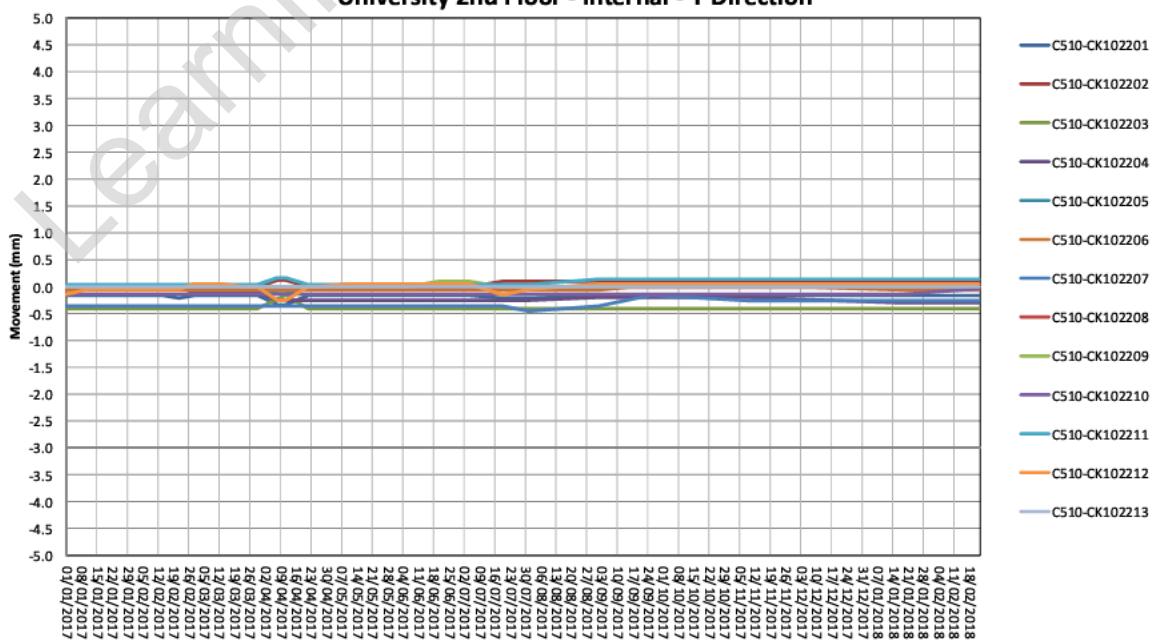
Crackmeter Location Plan 2nd Floor



University 2nd Floor - Internal - X Direction

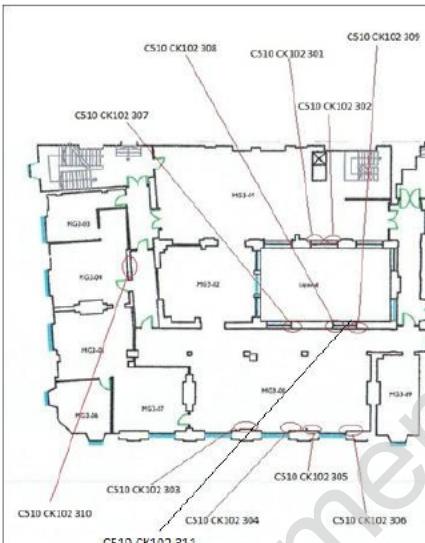


University 2nd Floor - Internal - Y Direction



Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102301	0.30	07/07/2015	0.04	-0.06
C510-CK102302	0.70	07/07/2015	-0.01	-0.04
C510-CK102303	0.40	29/06/2015	0.00	0.00
C510-CK102304	0.55	01/07/2015	0.03	0.01
C510-CK102305	0.30	29/06/2015	0.00	0.00
C510-CK102306	1.50	01/07/2015	0.00	0.04
C510-CK102307	1.00	29/06/2015	0.03	-0.07
C510-CK102308	0.65	29/06/2015	-0.03	-0.22
C510-CK102309	3.00	01/07/2015	-0.25	0.28
C510-CK102310	2.50	17/11/2015	0.00	0.00
C510-CK102311	4.00	09/06/2016	0.00	Y

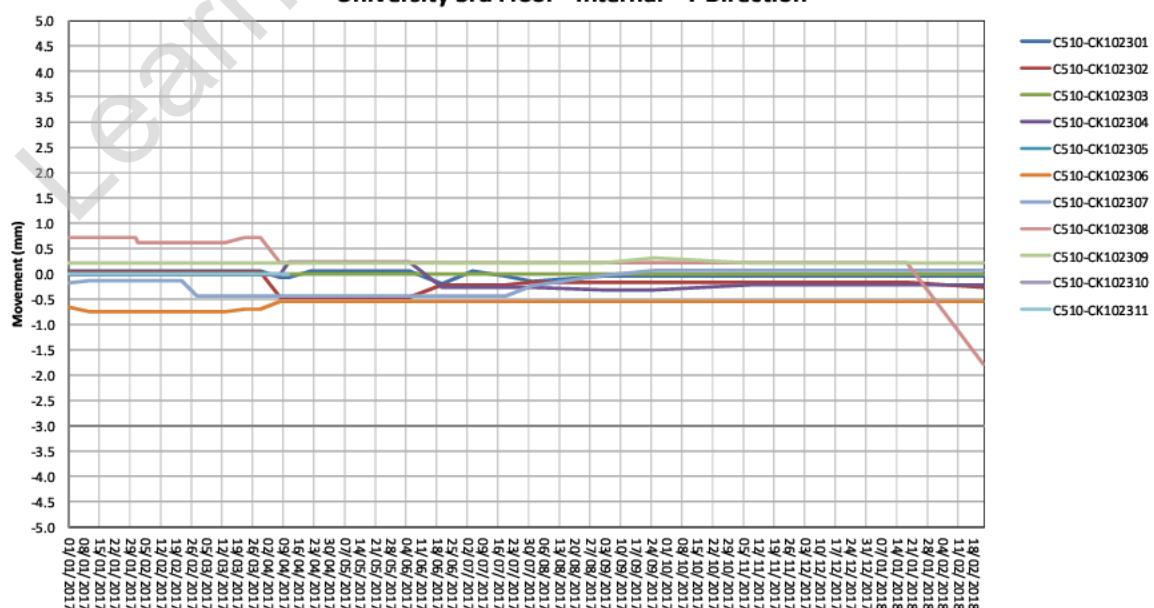
Crackmeter Location Plan 3rd Floor



University 3rd Floor - Internal - X Direction

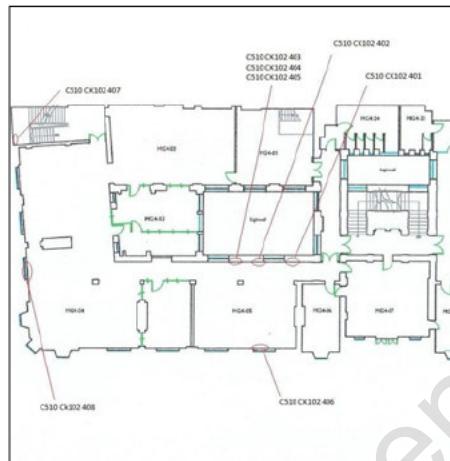


University 3rd Floor - Internal - Y Direction

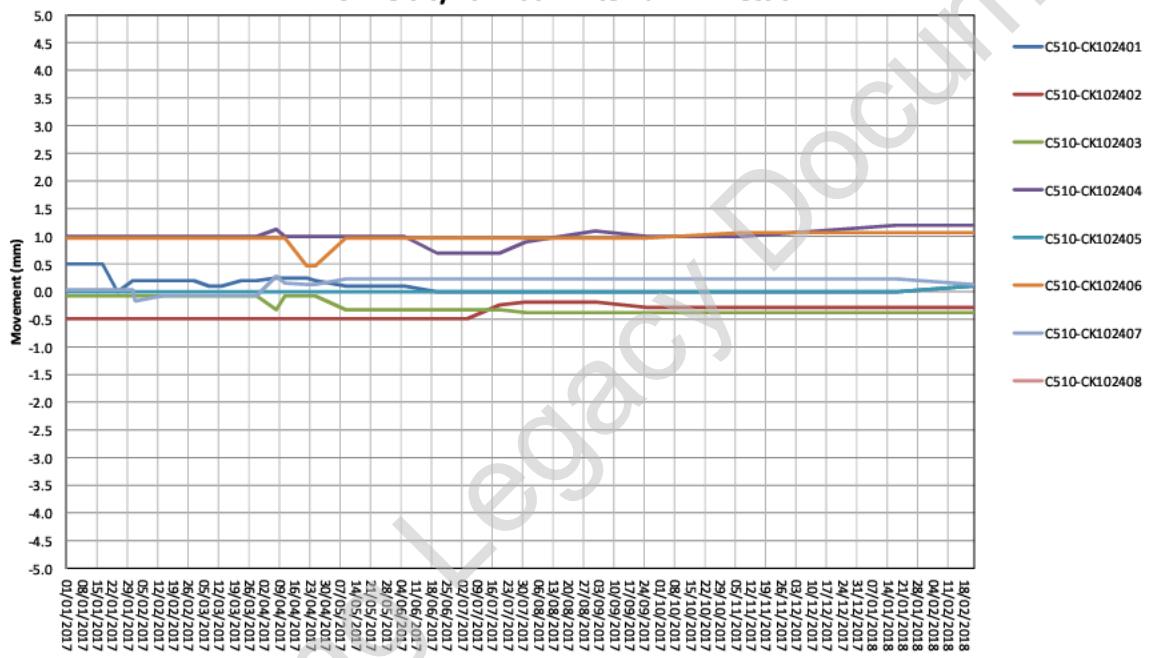


Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102401	0.55	04/08/2015	0.00	0.25
C510-CK102402	2.00	29/06/2015	-0.01	0.00
C510-CK102403	0.60	29/06/2015	0.08	0.41
C510-CK102404	0.90	03/02/2015	0.00	0.06
C510-CK102405	2.50	03/02/2015	0.00	0.03
C510-CK102406	2.00	07/07/2015	0.03	0.00
C510-CK102407	0.45	29/06/2015	-0.03	-0.06
C510-CK102408	0.50	17/11/2015	0.00	-0.25

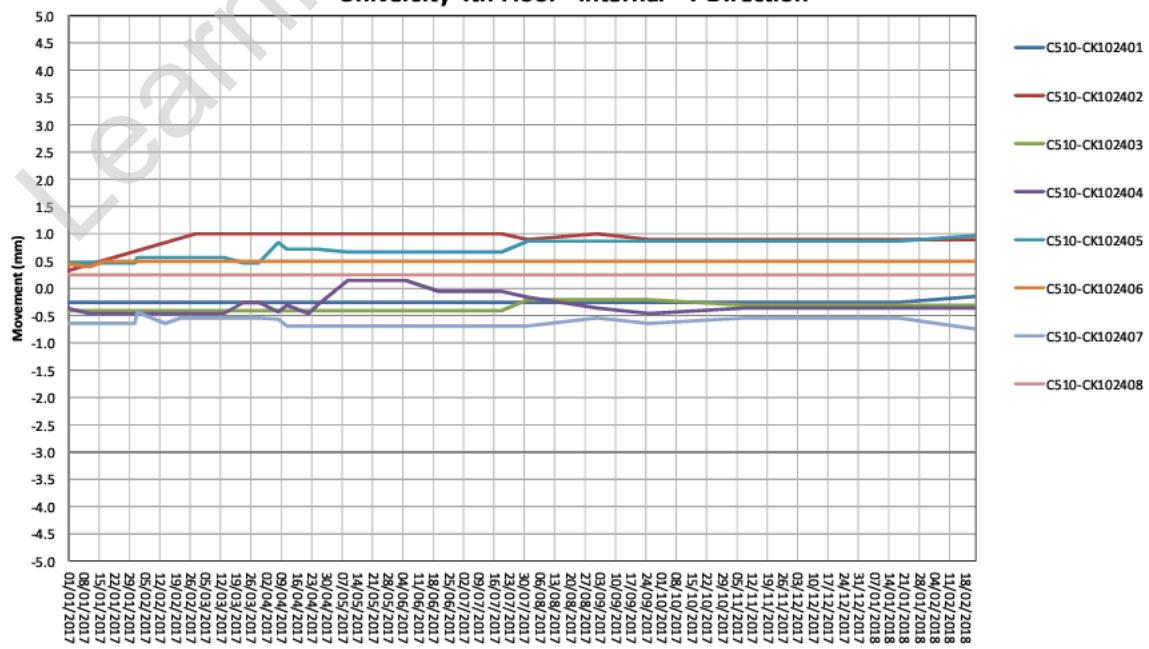
Crackmeter Location Plan 4th Floor



University 4th Floor - Internal - X Direction

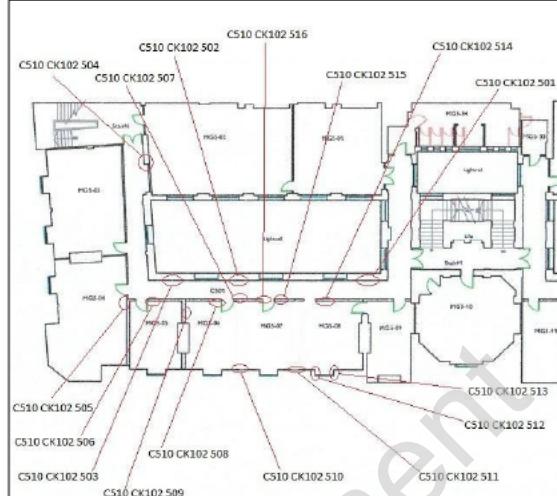


University 4th Floor - Internal - Y Direction

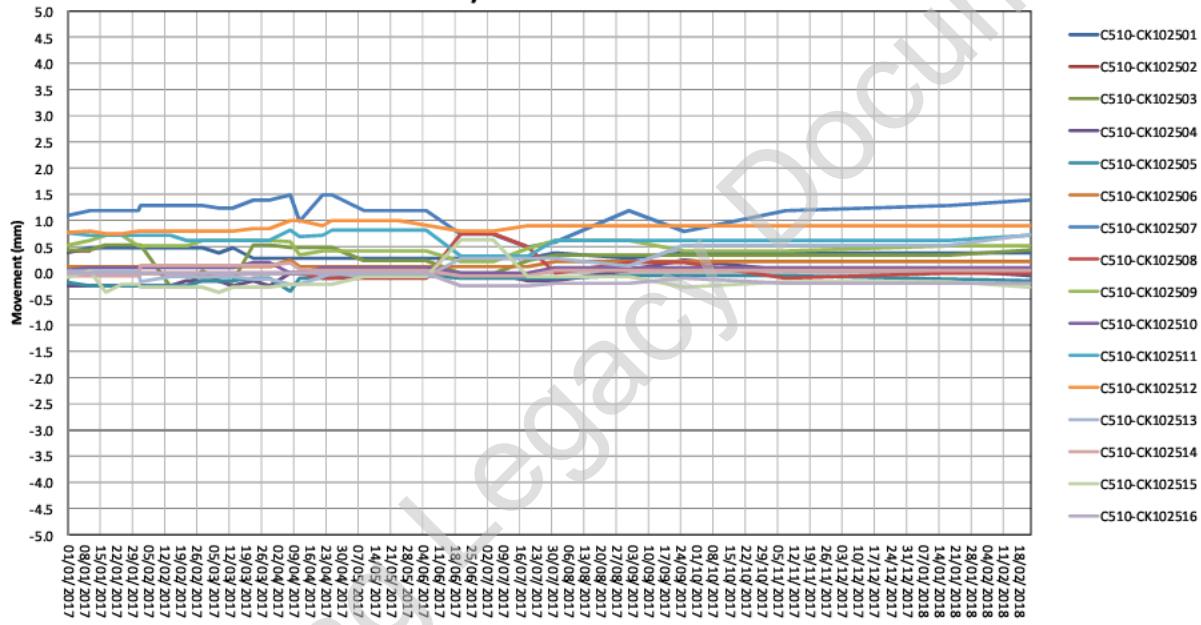


Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102501	0.25	29/06/2015	1.72	-0.38
C510-CK102502	0.45	29/06/2015	-0.22	0.00
C510-CK102503	0.10	29/06/2015	0.26	0.28
C510-CK102504	0.50	29/06/2015	-0.75	0.28
C510-CK102505	1.50	09/07/2015	-0.15	0.13
C510-CK102506	0.40	30/06/2015	-0.12	0.00
C510-CK102507	0.25	29/06/2015	1.31	-0.41
C510-CK102508	0.35	29/06/2015	0.00	0.56
C510-CK102509	0.15	29/06/2015	0.28	0.00
C510-CK102510	0.45	29/06/2015	0.00	0.00
C510-CK102511	0.55	29/06/2015	0.18	0.00
C510-CK102512	0.95	29/06/2015	0.00	0.01
C510-CK102513	0.70	29/06/2015	-0.03	-0.09
C510-CK102514	0.40	29/06/2015	0.06	0.01
C510-CK102515	0.60	29/06/2015	-0.53	-0.25
C510-CK102516	0.30	29/06/2015	0.50	-0.41

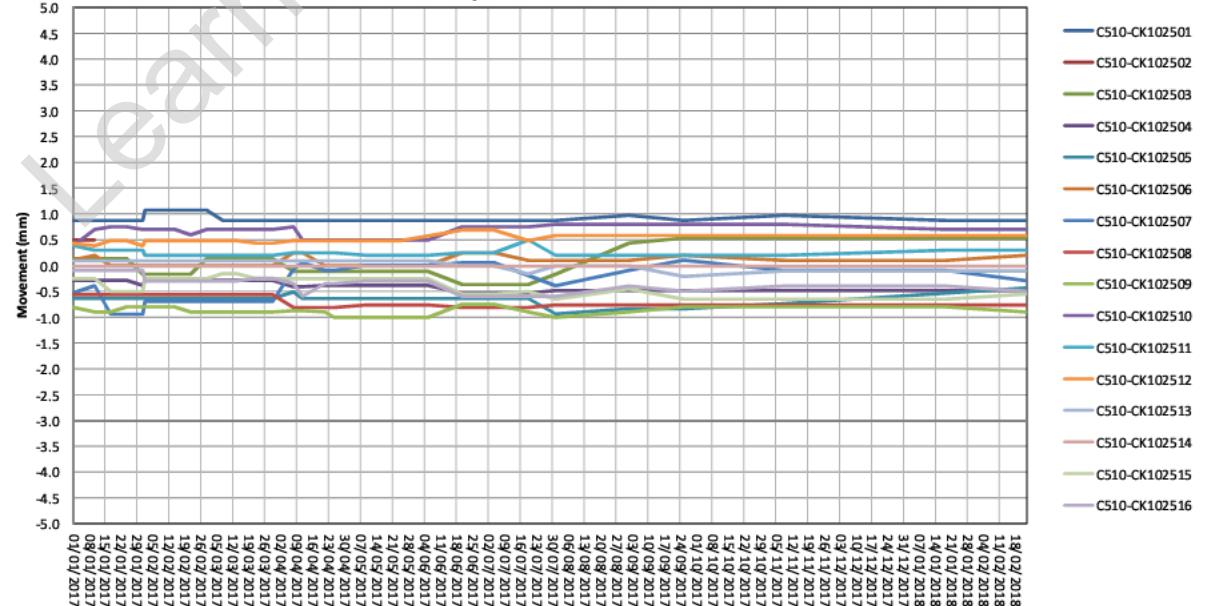
Crackmeter Location Plan 5th Floor



University 5th Floor - Internal - X Direction

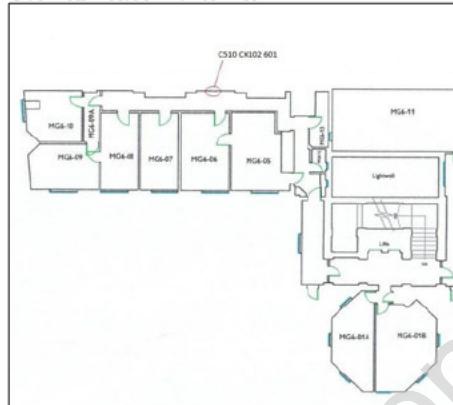


University 5th Floor - Internal - Y Direction

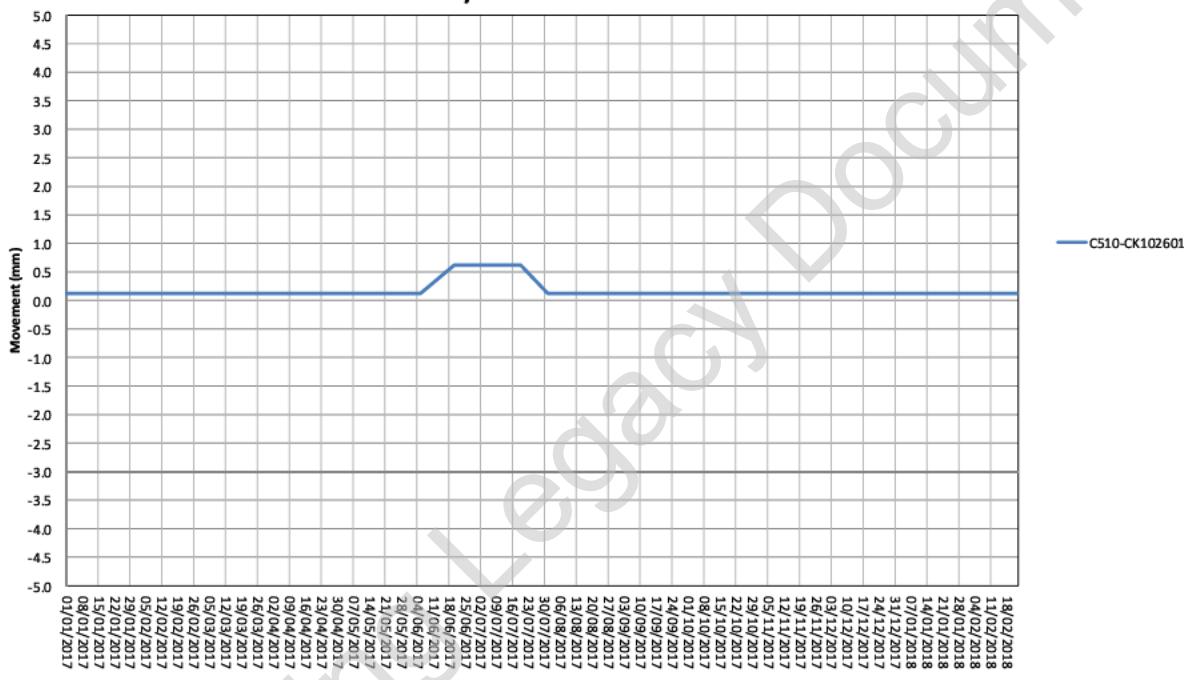


University 6th Floor				
Name	Initial Crack Width (mm)	Baseline Date	Baseline Value	
			X	Y
C510-CK102601	0.55	09/07/2015	-1.1	-0.2

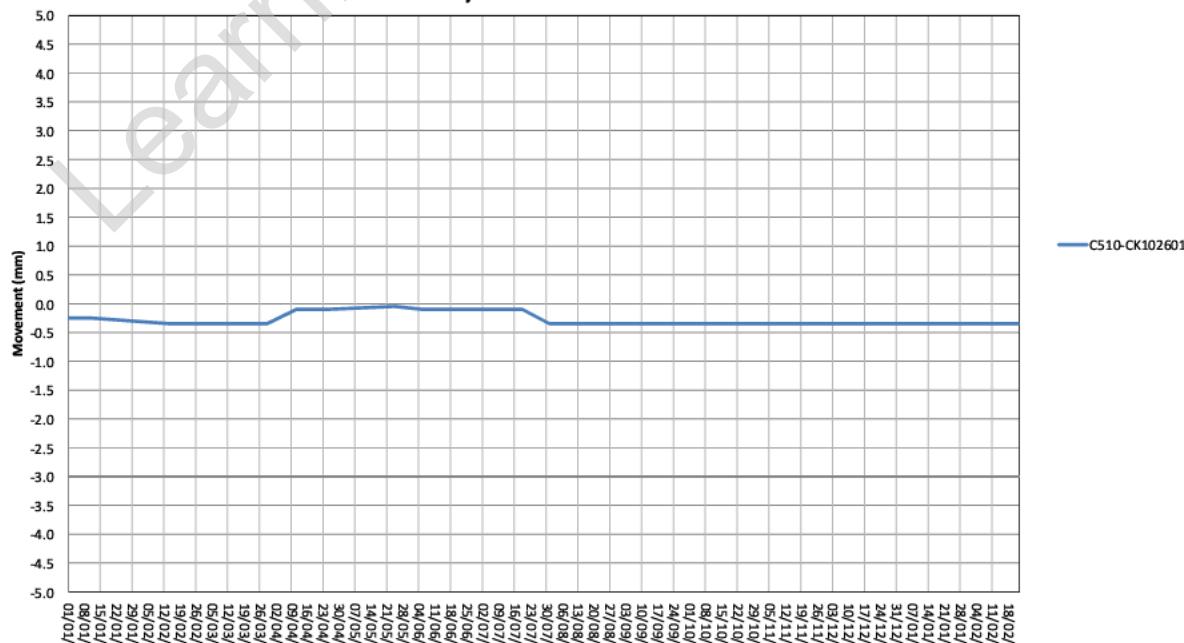
Crackmeter Location Plan 6th Floor



University 6th Floor - Internal - X Direction



University 6th Floor - Internal - Y Direction



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

Learning Legacy Document

Table 2 - Block 02 Decommissioning Status Tracker LP

CE10 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EO/Loss Primary Layer Construction		Last Construction Date	Latest Surveyed Date	AVERAGE SETTLEMENT TREND			General Comment	Decommissioning Status	
								ABP [02]	ABP [01]			120 Days	120 Day Calculation Period	180 Days	180 Day Calculation Period		
C5104-P12273	Block102	S12204	Internal	Manual	LP	Road Stud	University	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-1.60	-1.91	-0.04	-0.26	181	-19.7	366
C5104-P12274	Block102	S12204	Internal	Manual	LP	Road Stud	University	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-1.60	-1.91	-0.04	-0.26	181	-19.7	366
C5104-P12275	Block102	S12204	Internal	Manual	LP	Road Stud	University	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-2.61	-2.61	-0.34	-0.34	181	-20.05	366
C5104-P12276	Block102	S12204	Internal	Manual	LP	Road Stud	University	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-2.97	-2.97	-0.36	-0.36	181	-19.43	366
C5104-P12281	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-3.61	-3.61	-2.11	-2.11	181	-26.98	366
C5104-P12282	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-2.81	-2.81	-2.61	-2.61	181	-22.13	366
C5104-P12283	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	5.85	5.85	-4.21	-4.21	181	-22.96	366
C5104-P12284	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-1.70	-1.70	-2.32	-2.32	181	-21.68	366
C5104-P12285	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	2.46	2.46	-1.92	-1.92	181	-21.42	366
C5104-P12286	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-1.22	-1.22	-0.99	-0.99	181	-21.15	366
C5104-P12287	Block102	S12204	Internal	Manual	LP	Road Stud	DentalSalsbury_House	LIV_ESS_Engagement_Uphill_Adv-10	18/03/2017	21/09/2017	-0.84	-0.84	-1.30	-1.30	181	-19.54	366

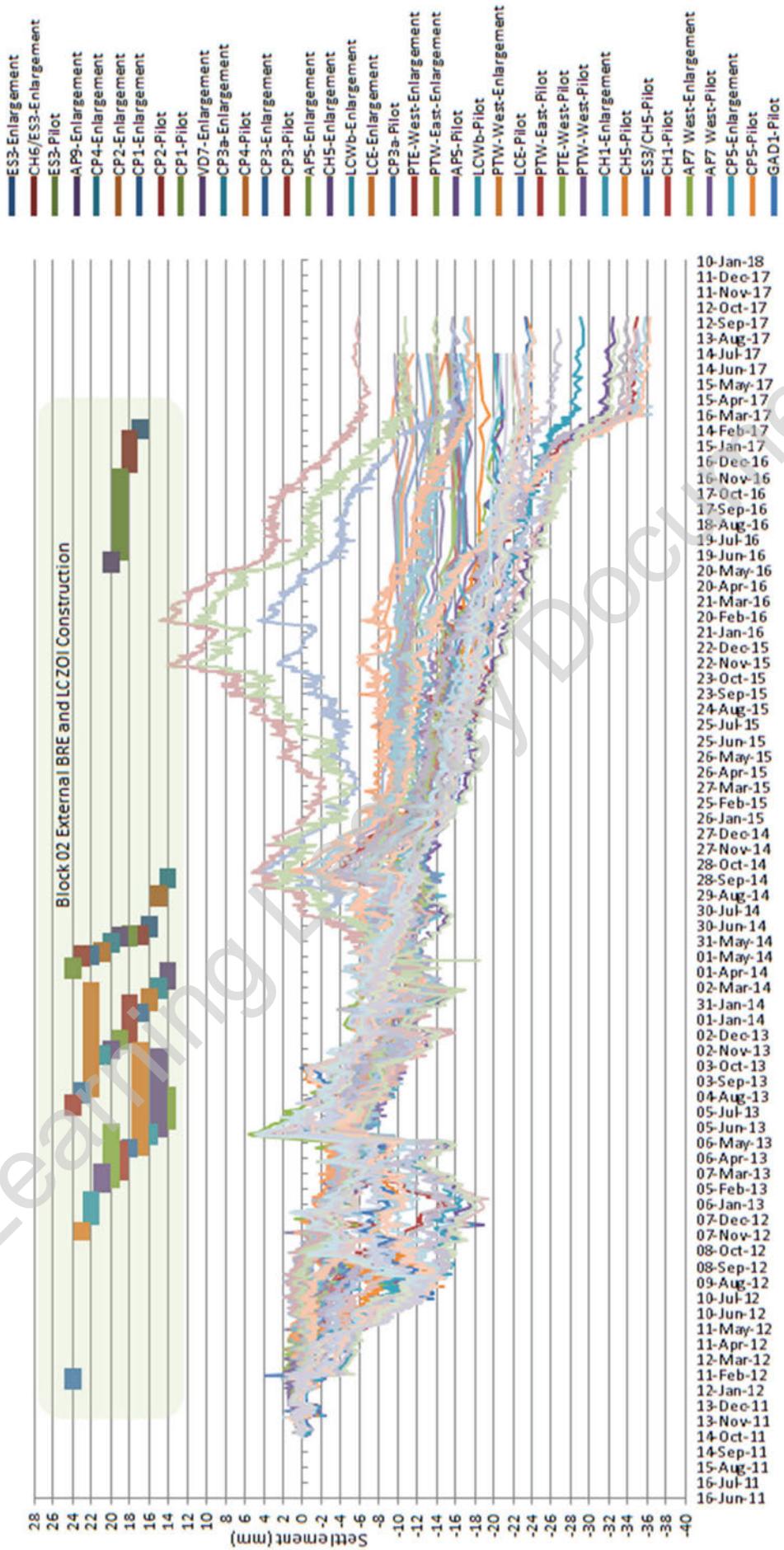
Table 2 - Block 02 Decommissioning Status Tracker XR & IM

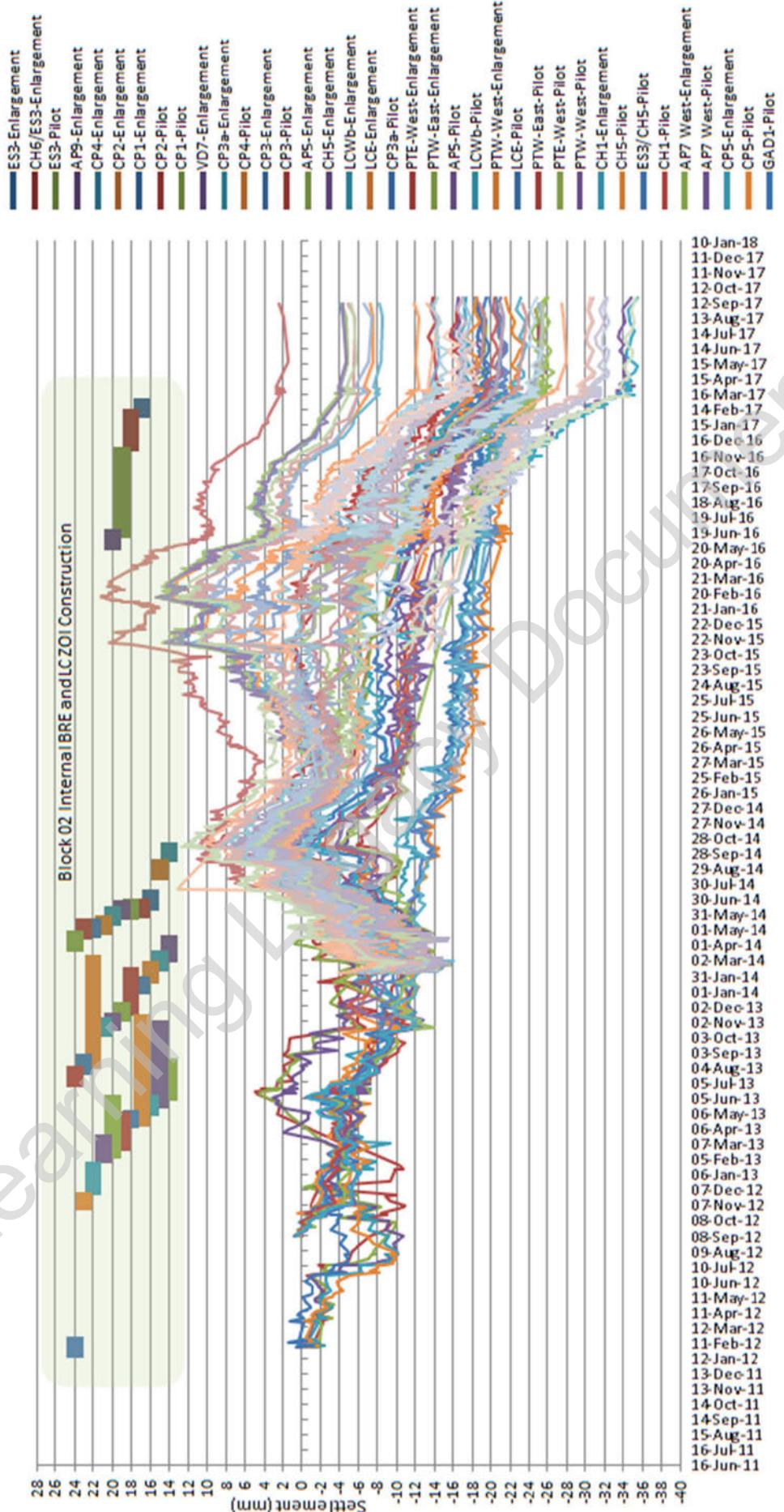
04/09/2017	AVERAGE SETTLEMENT TREND										General Comment			
	< 240 mm GREEN			< 3.5 mm AMBER			> 3.5 mm RED							
C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Description	Assit Location	EO Last Primary Layer Construction Date	Last Surveyed Date	100 Day Calculation Period	180 Day Calculation Period	365 Day Calculation Period	Closed Date	Decommissioning Status
C510-XR(202074-5cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	-496	-145	#N/A	Agreed
C510-XR(202074-5cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	-163	-145	0	Agreed
C510-XR(202076-8cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	-412	-124	189	371
C510-XR(202071-15cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	-722	-145	0	Agreed
C510-XR(202072-20cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	-64	-95	189	371
C510-XR(202073-25cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	0	-53	189	371
C510-XR(202075-29cm	Block 102	XR10207	Inground	Manual	XR	Eterslemer-Rod	Finsbury Circus	LIV-E53_Etagement_Uphr_Adv-8	15/03/2017	04/09/2017	80	-65	189	371
C510-XR(202084-0cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-54	188	370
C510-XR(202085-0cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-73	132	370
C510-XR(202085-5cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-55	132	370
C510-XR(202085-8cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-73	#N/A	Agreed
C510-XR(202085-15cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-52	132	365
C510-XR(202085-20cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-66	#N/A	Agreed
C510-XR(202085-25cm	Block 102	XR10208	Inground	Automated	XR	Eterslemer-Rod	Finsbury Circus	LIV-CP3a_Etagement_Adv-end face	12/10/2013	04/09/2017	0	-85	#N/A	Agreed
C510-M102024	M102024		Imposed	Automated	IM	Indrometer_Manual	Finsbury Circus	31/05/2014	15/08/2017	27/12/2014	#N/A	#N/A	26/01/2016	Agreed
C510-M102025	M102025		Imposed	Automated	IM	Indrometer_Manual	Finsbury Circus	31/05/2014	15/08/2017	29/01/2014	#N/A	#N/A	26/01/2016	Agreed
C510-E102024	E102024	Block 102	Inground	Automated	IE	Indromete-Automatic	Finsbury Circus	06/07/2016	#N/A	#N/A	#N/A	#N/A	29/01/2015	Agreed
C510-E102025	E102025	Block 102	Inground	Automated	IE	Indromete-Automatic	Finsbury Circus	29/01/2015	#N/A	#N/A	#N/A	#N/A	29/01/2015	Agreed

CS10-CYC02094	Block 002	S10201	Internal	Manual	OK	Crack Monitor	Cantilever Bars	UV ESS Elongation Ugh! Adv-10	18/03/2017	02/03/2017	0.19	129	0.07	203	0.10	372
CS10-CYC02095	Block 002	S10201	Internal	Manual	OK	Crack Monitor	Cantilever Bars	UV ESS Elongation Ugh! Adv-10	18/03/2017	04/03/2017	0.06	121	-0.37	181	-0.93	374
CS10-CYC02096	Block 002	S10201	Internal	Manual	OK	Crack Monitor	Cantilever Bars	UV ESS Elongation Ugh! Adv-10	18/03/2017	04/03/2017	0.91	128	0.78	191	0.67	372
CS10-CYC02097	Block 002	S10201	Internal	Manual	CK	Crack Monitor	Cantilever Bars	UV ESS Elongation Ugh! Adv-10	18/03/2017	04/03/2017	0.91	121	1.38	181	1.17	374

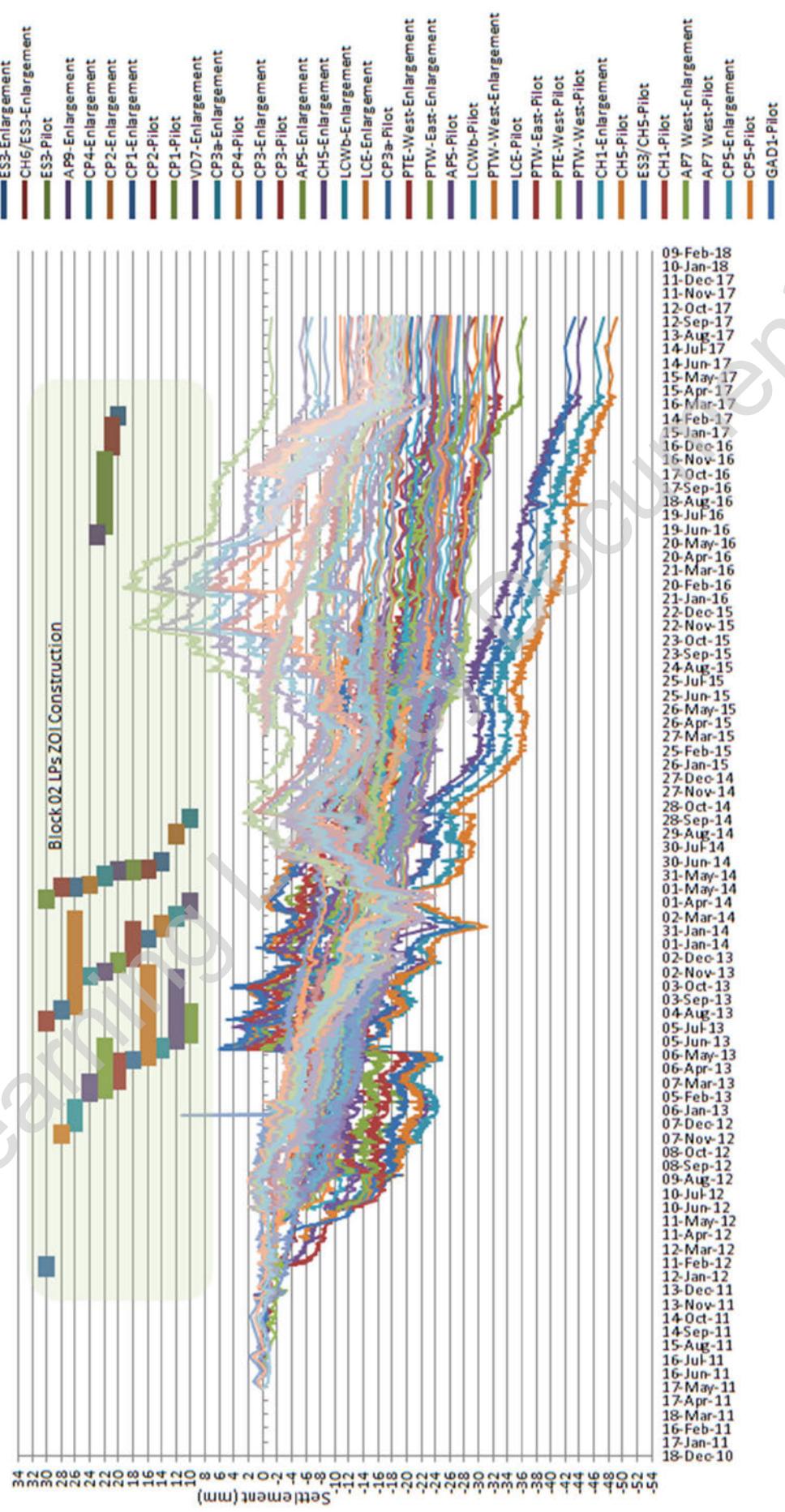
Learning Legacy Document

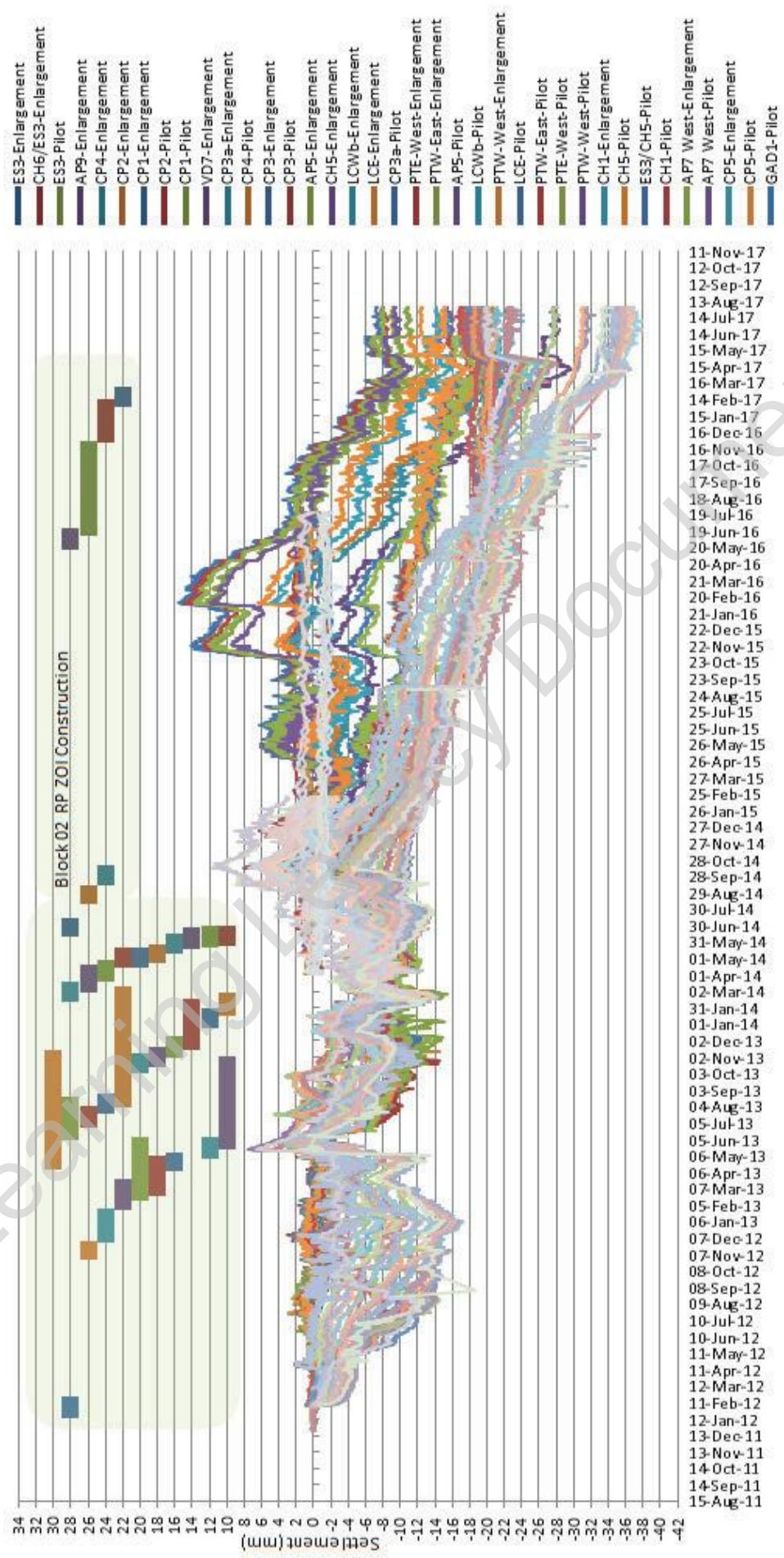
Graph 1 - Block 02 External Building (BRE & LC) Manual Monitoring History in Relation to Construction



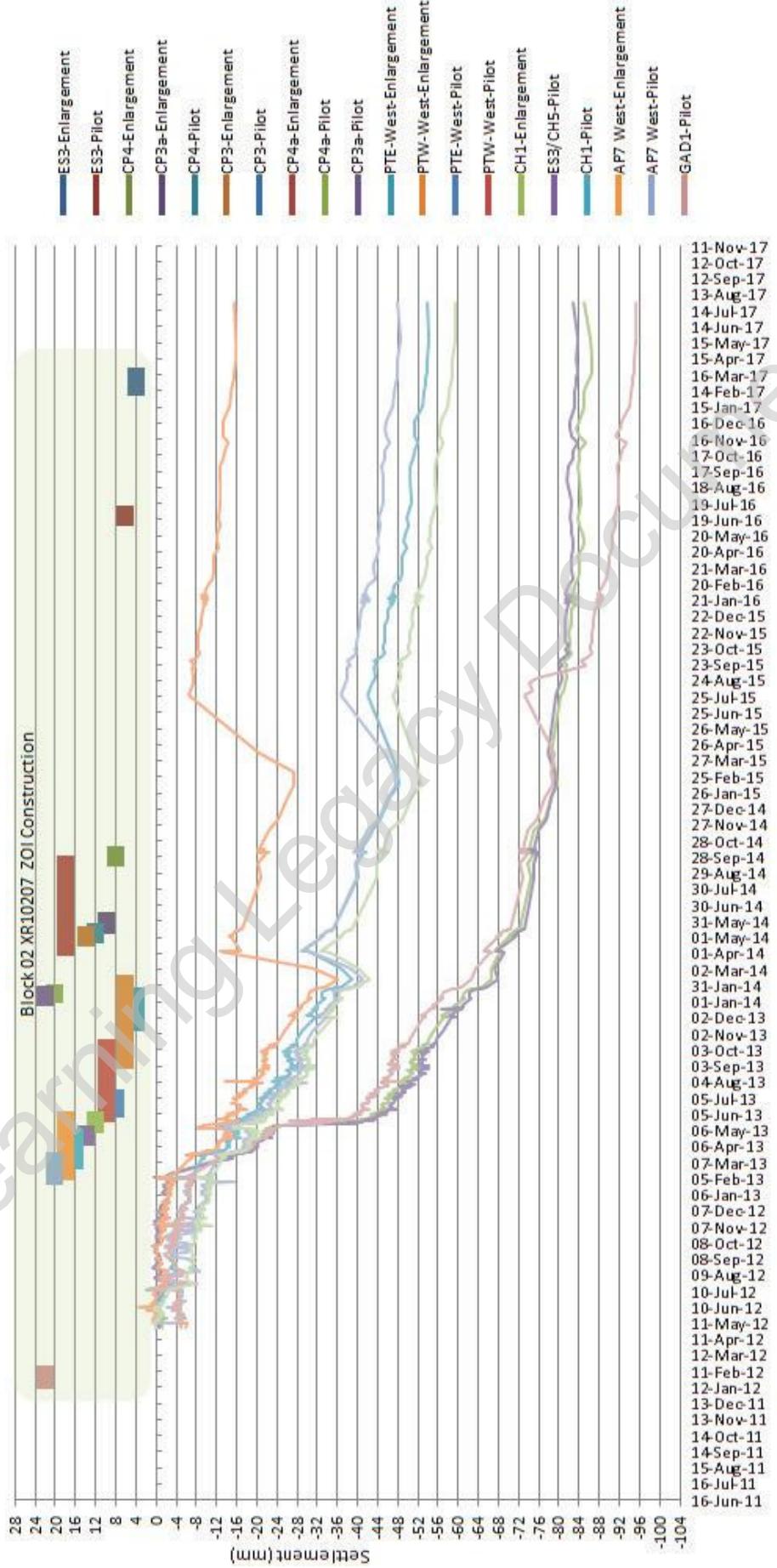
Graph 2 - Block 02 Internal Building (BRE & LC) Manual Monitoring History in Relation to Construction


Graph 3 - Block 02 All Road Studs (LP) Manual Monitoring History in Relation to Construction

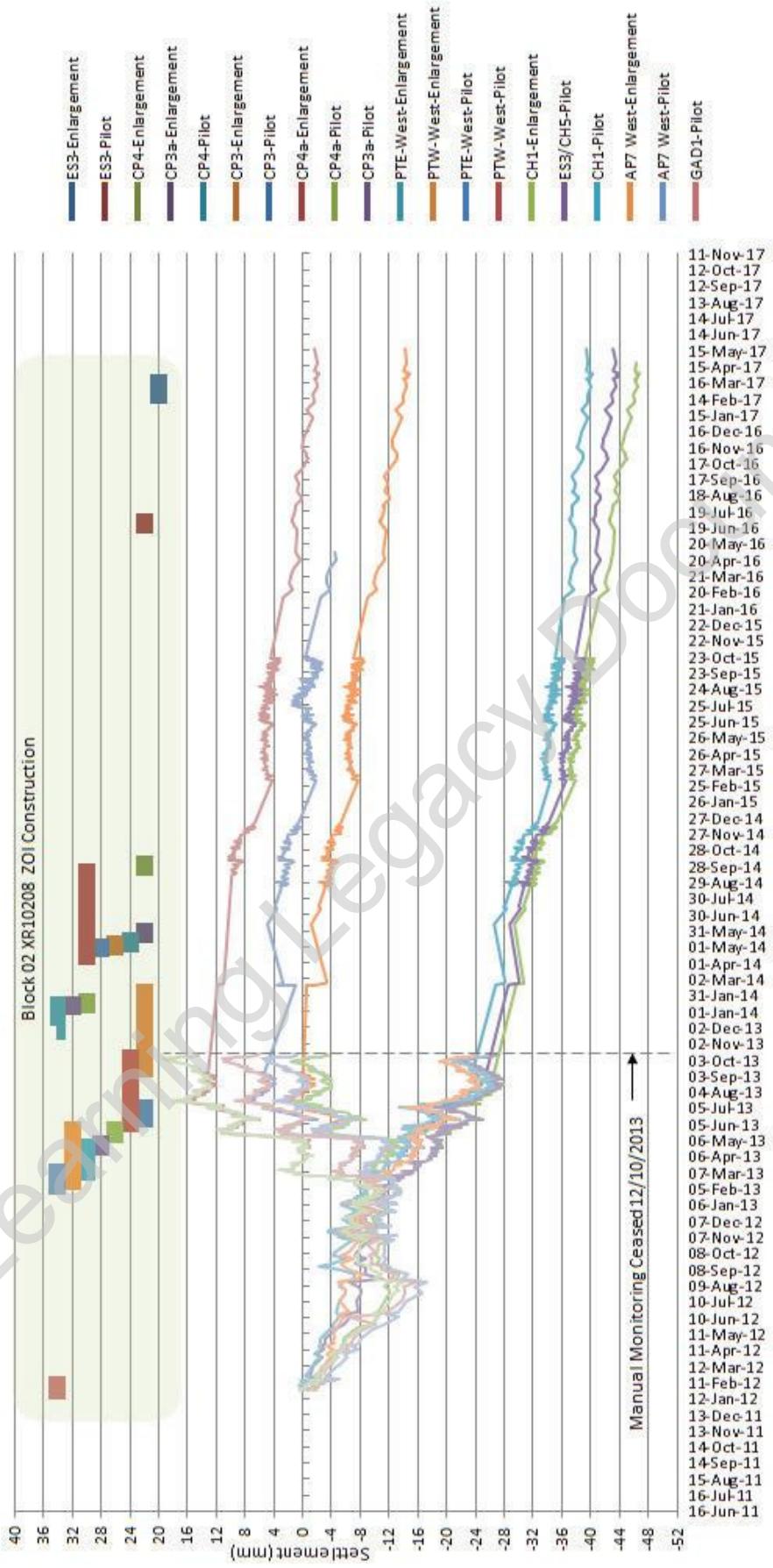


Graph 4 - All Block 02 3d Geodetic Prisms (RP) Automated Monitoring History in Relation to Construction


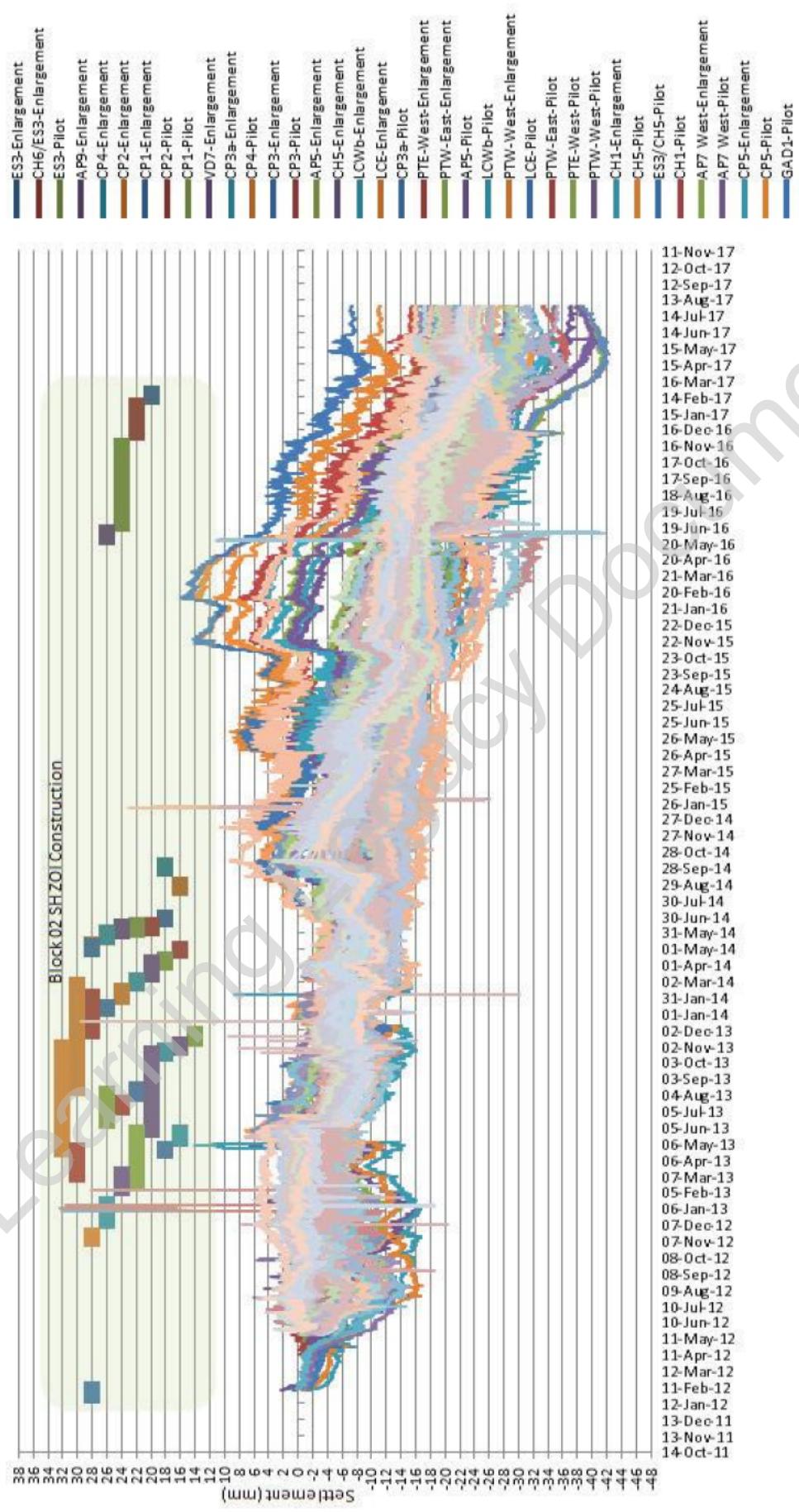
Graph 5 – Block 02 Extensometer (XR10207) Manual Monitoring History in Relation to Construction



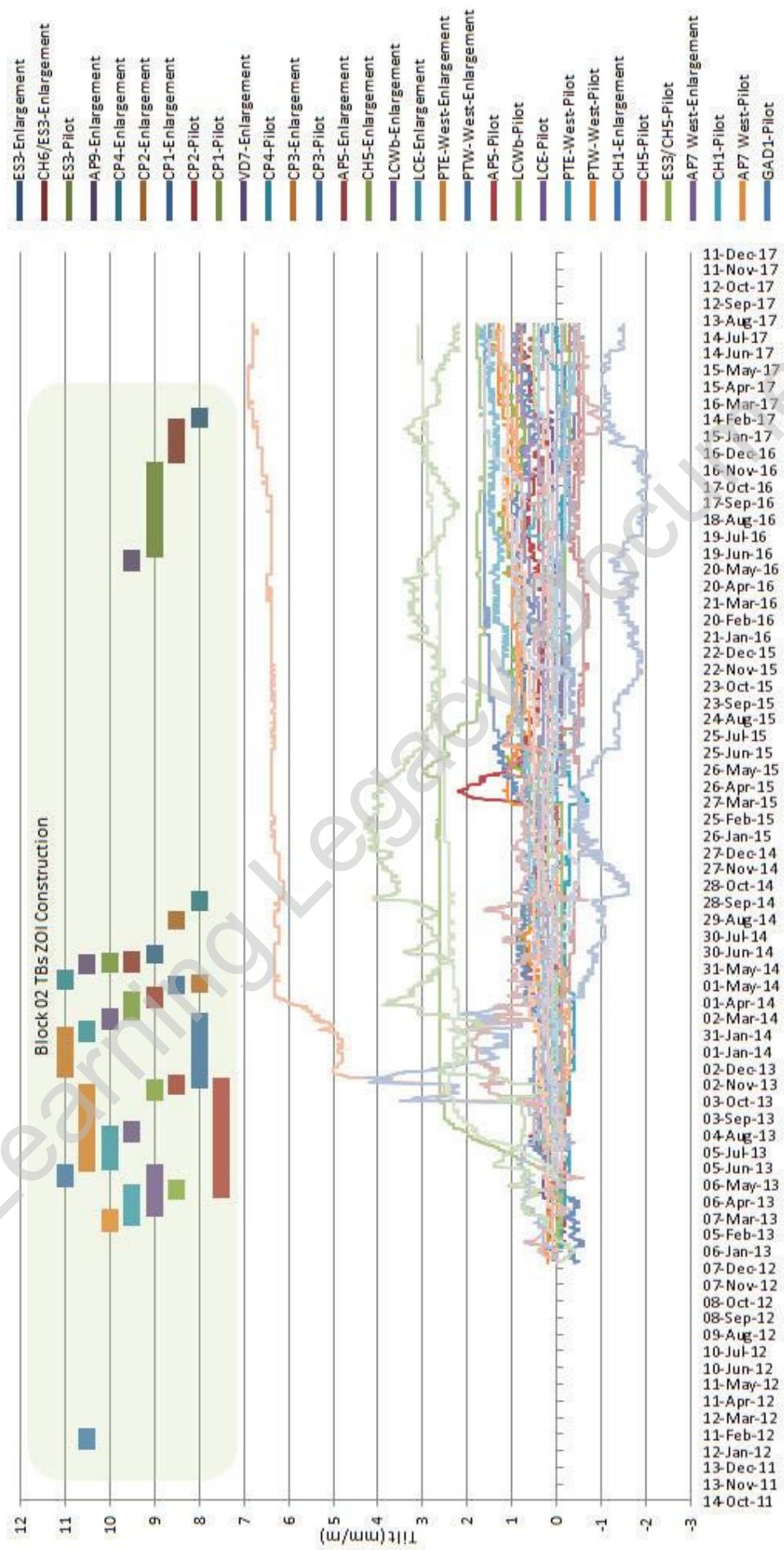
Graph 6 – Block 02 Extensometer (XR10208) Automated and Manual Monitoring History in Relation to Construction



Graph 7 – All Block 02 Water Cells (SH) Automated Monitoring History in Relation to Construction



Graph 8 - All Block 02 Tiltmeters (TB) Automated Monitoring History in Relation to Construction



Graph 9 – All Block 02 Crack Monitors (CK) Manual Monitoring History in Relation to Construction

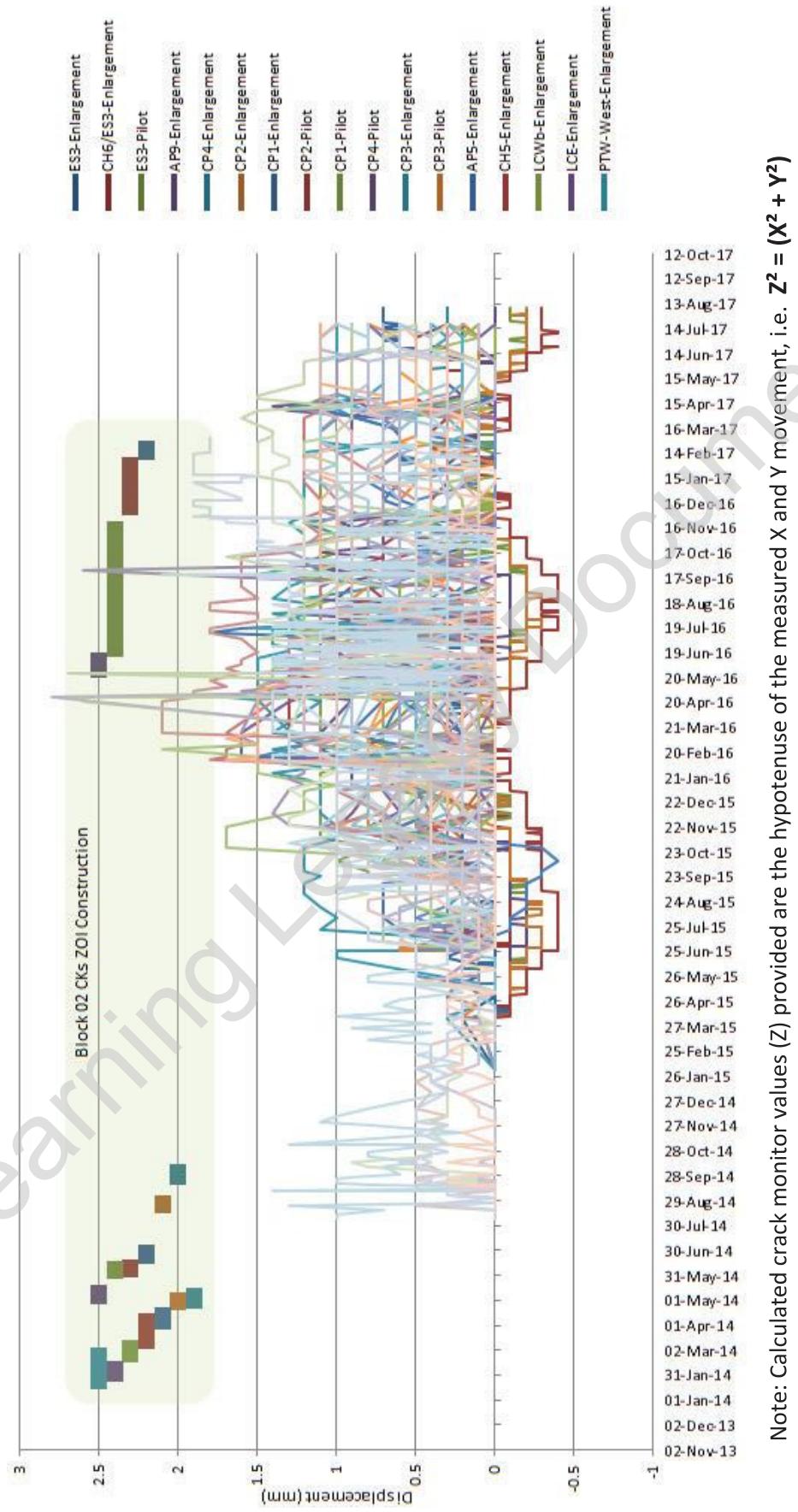


Figure 5 - BRE & LC Monitoring Sensor Settlement Status and Location Plan

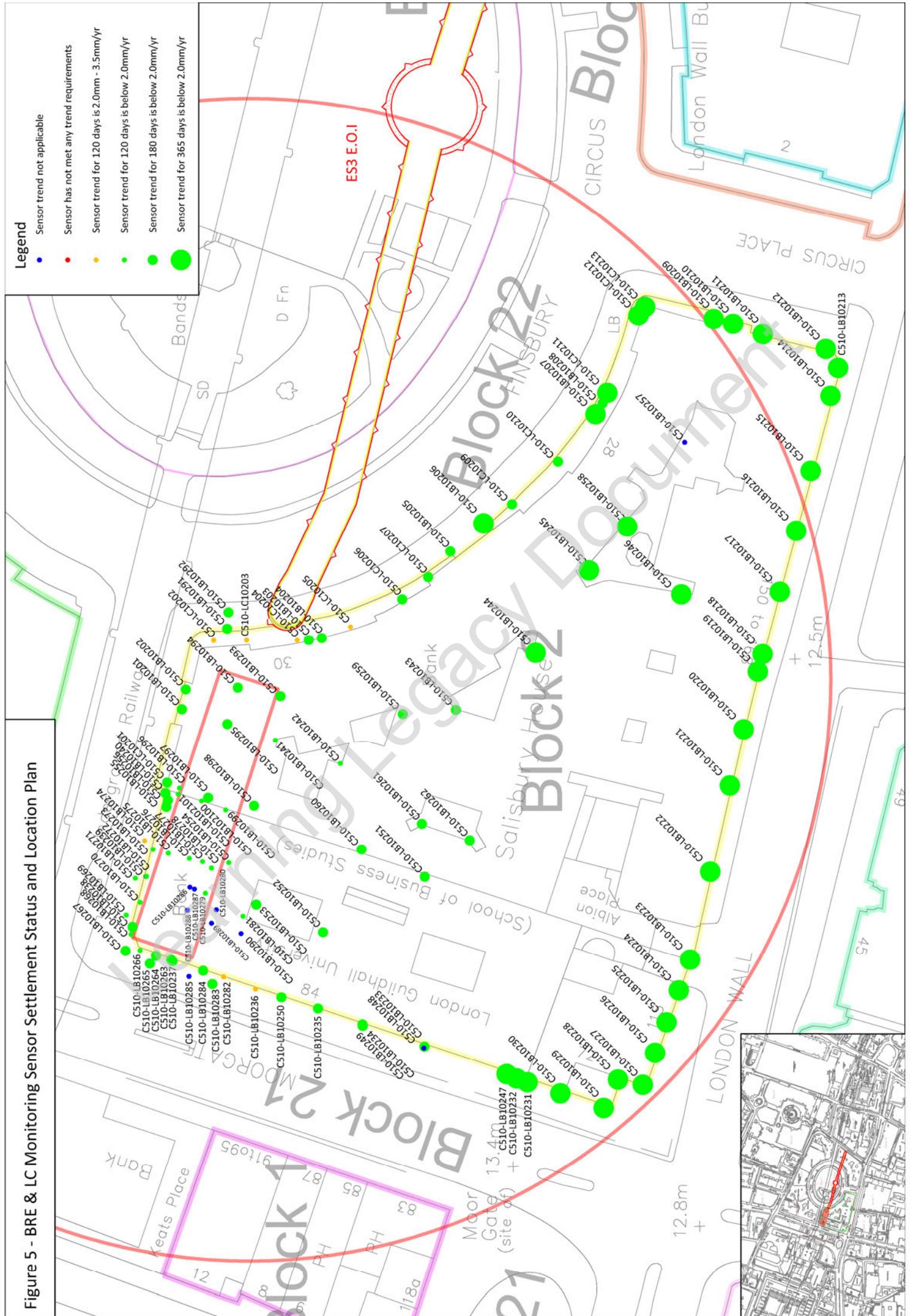


Figure 6 - LP Monitoring Sensor Settlement Status and Location Plan

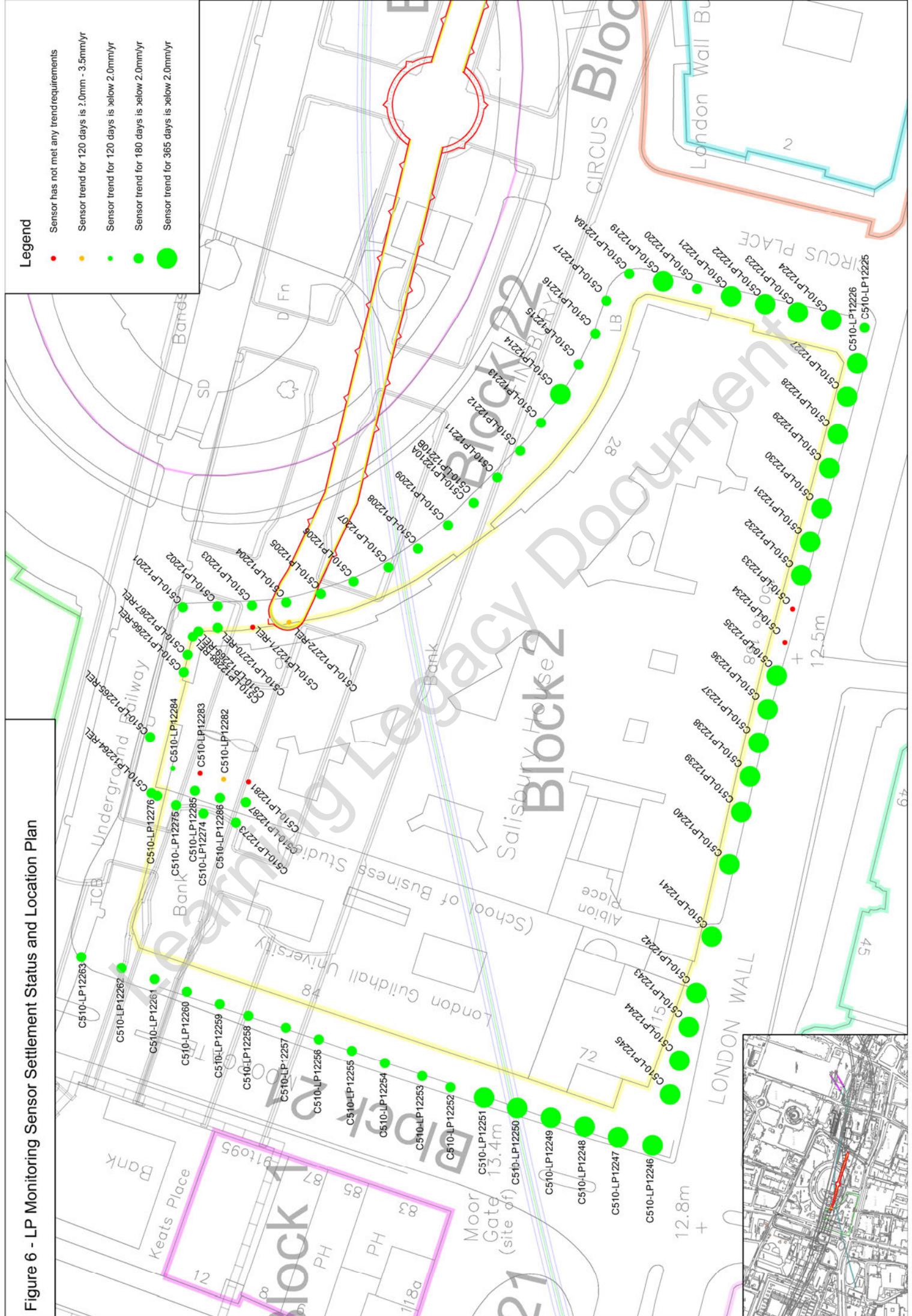


Figure 7 - RP Monitoring Sensor Settlement Status and Location Plan

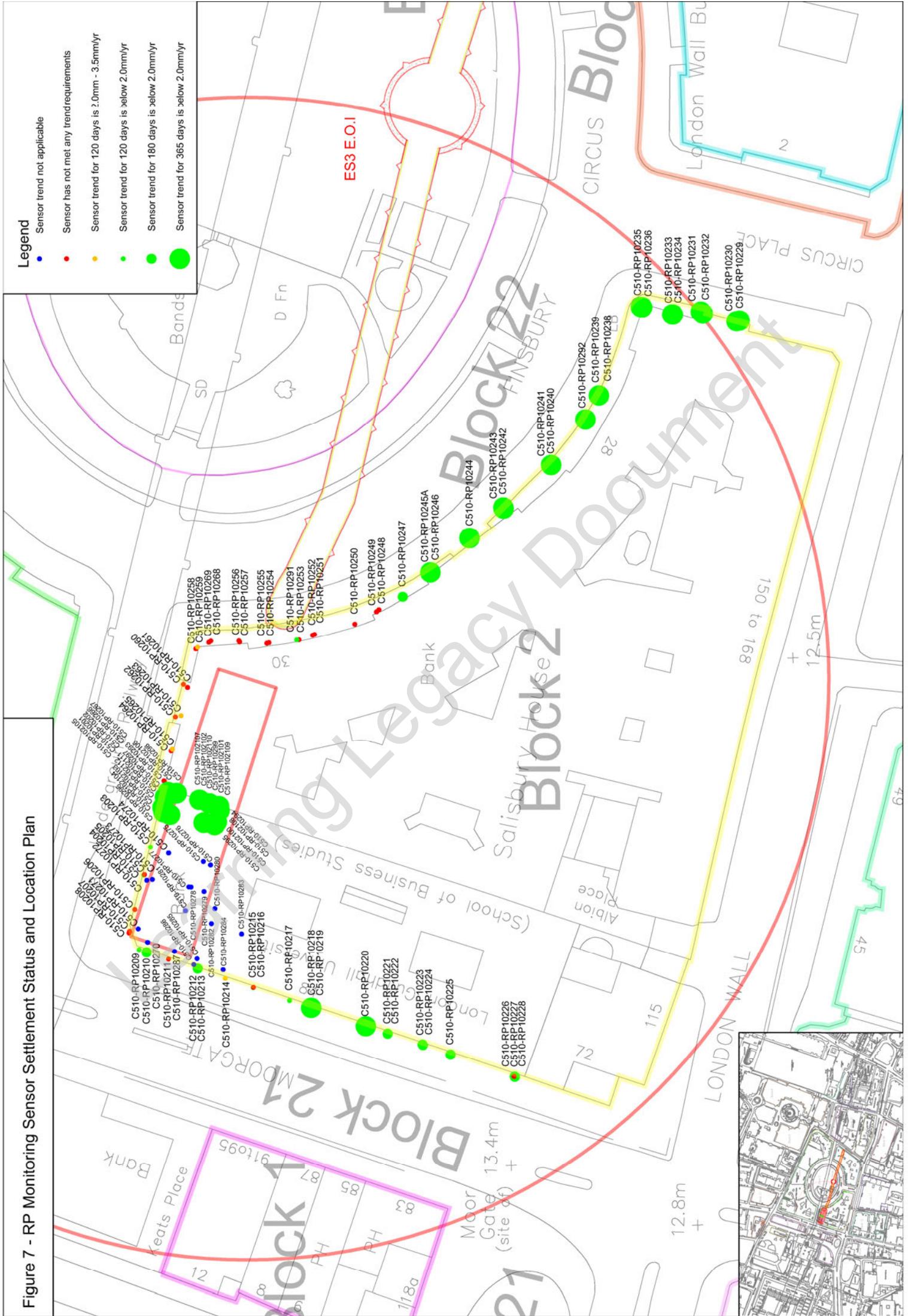


Figure 8 - XR & IM Monitoring Sensor Settlement Status and Location Plan

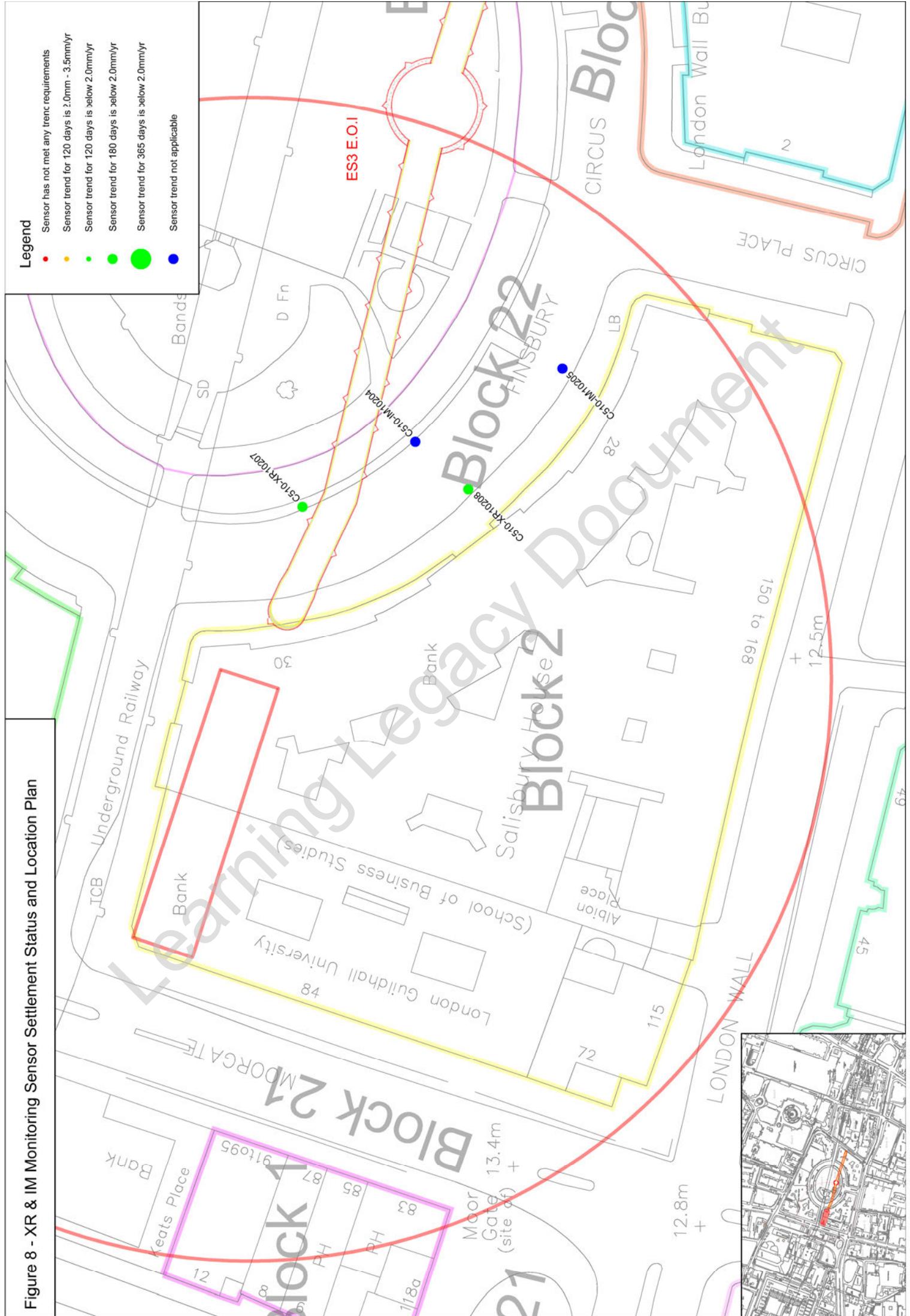


Figure 9 - SH Monitoring Sensor Settlement Status and Location Plan

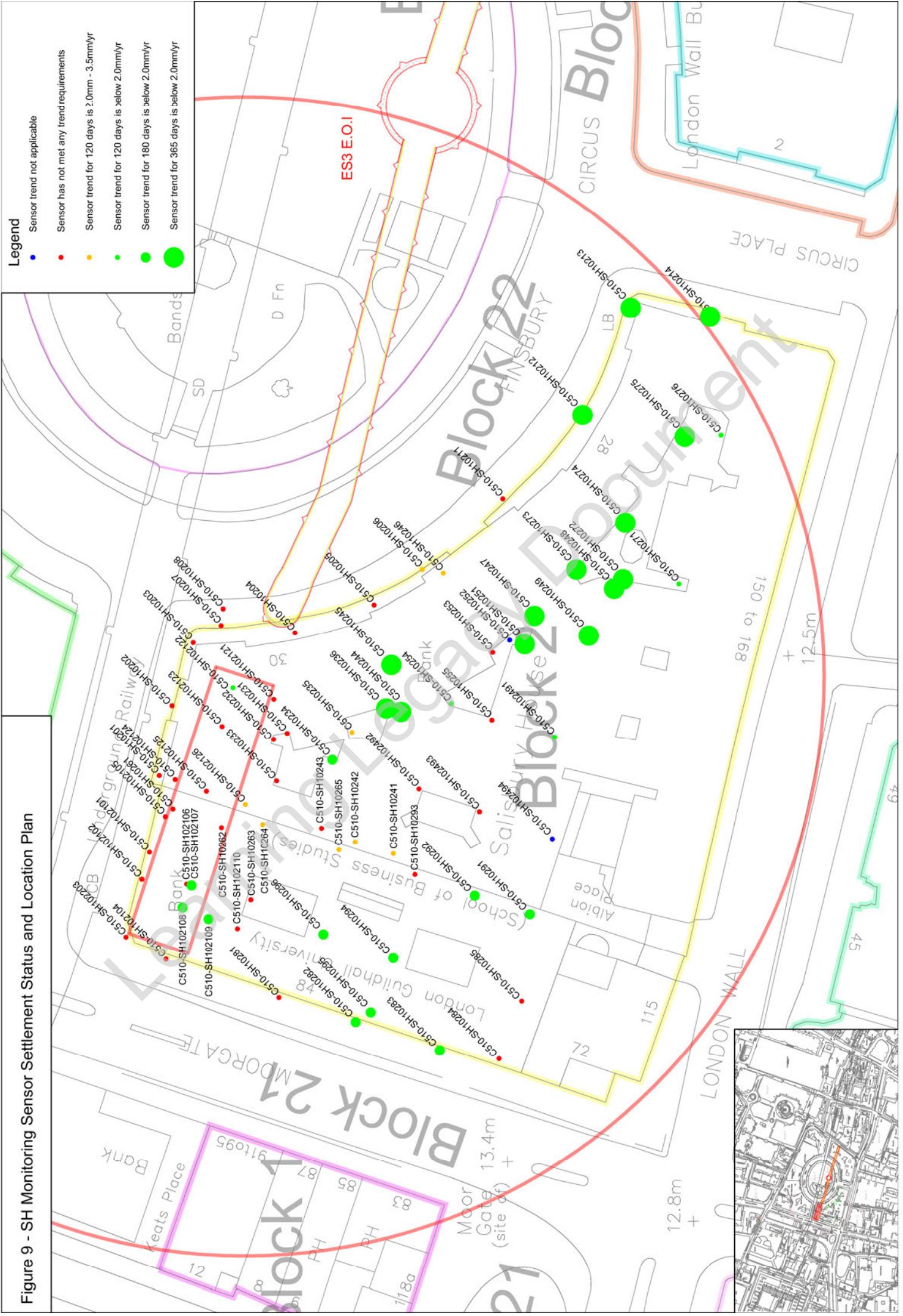


Figure 10 - CK Monitoring Sensor Settlement Status and Location Plan

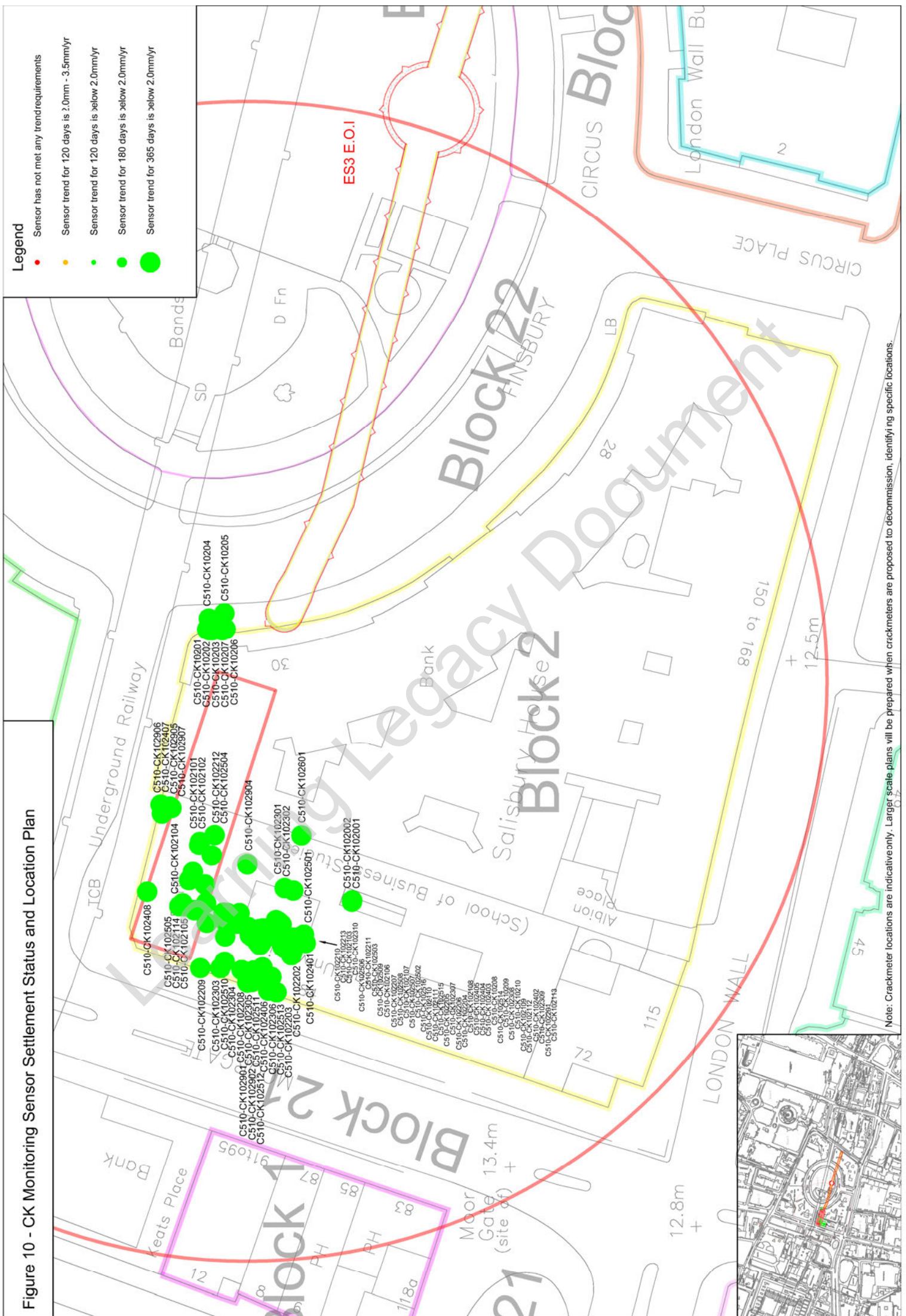


Figure 11 - TB Monitoring Sensor Settlement Status and Location Plan

