

Science Building, Highgate School London

Structural and Civil Engineering Basement Impact Assessment Report

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Contents

Page

1	Executive Summary	3
2	Scope	4
3	The Site	8
4	Ground Conditions	10
5	Site Hydrology & Hydrogeology	11
6	Proposed Structure	12
	Garner Quad Extension	
	Science Quad Extension	
7	Construction Sequence	14

Appendices:

Appendix A	Civil and Structural Drawings
Appendix B	Proposed Basement Construction Sequence Sketch
Appendix C	Blue Sky Thinking Initial Construction Report

Note:

This report has been prepared for Highgate School and their advisors, using the information available to us at the time. It should not be relied upon by anyone else or used for any other purpose. This report is confidential to our Client; it should only be shown to others with their permission. We retain copyright of this report which should only be reproduced with our permission.

1 Executive Summary

This report confirms, in accordance with Haringey Council's Development Management DPD, that the proposed subterranean extension will not cause harm to the built or natural environment and local amenity, including to the local water environment, ground conditions and biodiversity.

This Basement Impact Assessment Report (BIA) has been produced to supplement the planning application for the proposed development of the Science Block at Highgate School, located in the London Borough of Haringey.

The following report assesses the impact of the proposed basement in accordance with Haringey London Borough Council's (HLBC) 'Draft Basement Development Guidance Note'.

Price & Myers LLP are experienced in designing basements and have extensive knowledge of different types of basement construction and design, and ground conditions within London and Haringey.

A geotechnical site investigation was carried out by Lister's Geotechnical in November 2018.

2 Scope

The proposed project involves a refurbishment to the Science building, a 3-storey extension in the Garner Quad and 4-storey extension with basement in the Science Quad. The plan showing the location of each intervention can be found in Figure 1. This report will focus on the basement construction in the Science Quad to ensure that any potential disruption to the surrounding buildings and the environment are minimised.

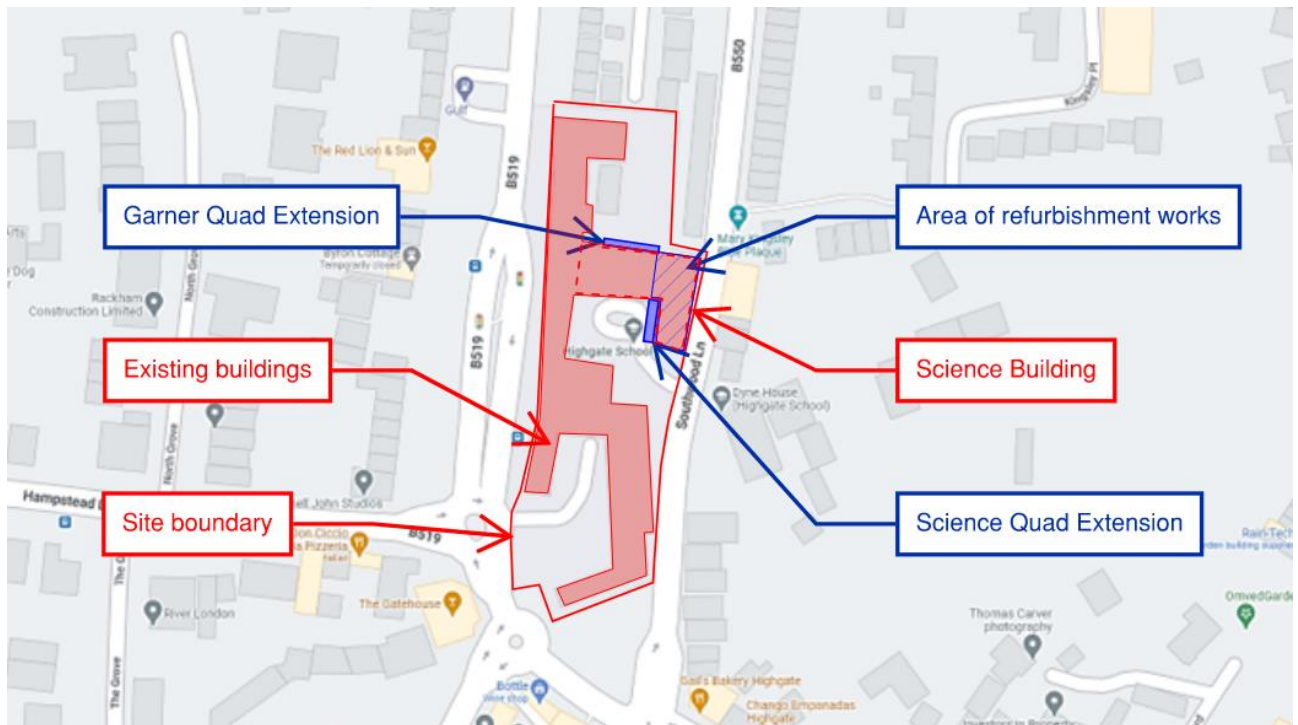


Figure 1 - Site location - Google Maps extract 2022

The following Tables 1, 2 and 3 form the screening stage of the BIA to see the effect of the basement on the surrounding area and to establish the outline of the works within this report. These tables have been prepared based on the Desk Study and Ground Investigation by Lister's Geotechnical.

Table 1 - Subterranean (ground water) screening chart

Impact Question	Answer (Yes/No)	Justification
Q1a: Is the site located directly above an aquifer?	Yes	The London Clay formation is designated as a Secondary 'A' Aquifer by the Environment Agency. The London Clay formation at this site is understood to be around 50m deep based on British Geological Survey information. Subsoils encountered in the site investigation are Made Ground upon the Bagshot Formation underlain by the Claygate Member and London Clay.

Q1b: Will the proposed basement extend beneath the water table surface?	No	The basement excavation is proposed to extend to approximately 3 to 4m below existing ground level. Investigations encountered ground water at approximately 8m below existing ground level.
Q2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	
Q3: Is the site within the catchment of the pond Chains on Hampstead Heath?	No	
Q4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No	The existing and proposed schemes share approximately the same footprint.
Q 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	The site drainage is to be designed to maintain the existing situation.
Q6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just ponds chains on Hampstead Heath) or spring line.	No	

Table 1 - Slope stability screening chart

Impact Question	Answer (Yes/No)	Justification
Q1: Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No	The site is predominantly flat
Q2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°? (approximately 1 in 8)	No	
Q3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No	
Q4: Is the site within a wider hillside setting in which the general slope is greater than 7°? (approximately 1 in 8)	Yes	The site is located in the area at the top of Highgate Hill. The landscape to the east of the site (20m away), on the other side of Southwood Lane, slopes down towards the Finsbury Park area.
Q5: Is the London Clay the shallowest strata at the site?	No	The Bagshot Formation and Claygate Member are underlain by London Clay.
Q6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree zones where trees are to be retained?	No	
Q7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Yes	The Claygate Member has moderate risk of shrink-

		swell/volume change potential. The London Clay formation is a recognised shrinkable soil. The Bagshot Formation is not a shrink/swell hazard. The basement slab will be designed to resist heave.
Q8: Is the site within 100m of a watercourse or a potential spring line?	No	
Q9: Is the site within an area of previously worked ground?	No	
Q10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	Yes	The London Clay formation is designated as a Secondary 'A' Aquifer by the Environment Agency. The basement excavation is proposed to extend to approximately 3 to 4m below existing ground level. Investigations encountered ground water at approximately 8m below existing ground level, therefore dewatering is not anticipated.
Q11: Is the site within 50m of the Hampstead Heath ponds?	No	The site is approximately 600m north of the Hampstead Heath Ponds
Q12: Is the site within 5m of a highway or pedestrian right of way?	Yes	The Site is bounded by a public road (Southwood Lane) to the East.
Q13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	The existing neighbouring structure has a lower ground floor with floor level approximately 1.6m above that of the proposed extension basement. The extension is located outside of the existing building footprint; therefore the existing foundations will be underpinned to match the level of the proposed basement.
Q14: Is the site over (or within the exclusion zone of) any tunnels e.g. railway lines?	No	The site is not above any tunnels.

Table 2 - Surface flow and flooding screening chart

Impact Question	Answer (Yes/No)	Justification
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Q1: Is the site within the catchment of the ponds on Hampstead Heath	No	The Site lies to the northeast of the Hampstead Heath Ponds catchment.
Q2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	Where possible the existing drainage will be reused.
Q3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The proposed development will occupy approximately similar areas to that of the existing.
Q4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	There will be no surface expression of the basement development, so the surface water flow regime will be unchanged.
Q5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	There will be no surface expression of the basement development, so the surface water flow regime will be unchanged.
Q6: Is the site in an area known to be at risk from Surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site has a low flooding risk from surface water, sewers, reservoirs, groundwater and fluvial/tidal watercourses.

3 The Site

The site is located within Highgate Schools' campus between North Road and Southwood Lane as shown in Figure 1. To the north of the Science Building is the Garner Quad and to the south is the Science Quad. The existing structures are late Victorian / early Edwardian Steel frames, with load bearing masonry and early age filler joist concrete floors. In 2005 Price & Myers were involved in the design of the third floor/roof extension to the Science Building.

Hampstead Heath lies to the southwest of the site. The site is not located within the Highgate Chain Catchment boundaries of the ponds, as indicated in Figure 2.

The proposed 4-storey extension with the basement is located discretely within the Science Quad. The proposed footprint of the basement is approximately 3m x 15m in plan as shown in Figure 3.



Figure 2 - Highgate Chain Catchment Boundaries (Contains Ordnance Survey data, Crown copyright and database right 2013)



Figure 3 - Location of proposed development - Google Maps extract 2022

4 Ground Conditions

A detailed geotechnical site investigation has been carried out by Listers Geotechnical Consultants Ltd (Listers), Reference 08.07.019 dated November 2018. The aim of this investigation was to determine the ground conditions and hydrogeology, to assess the extent of any contamination and to provide information for the design and construction of the proposed works.

The physical geotechnical investigation consisted of two cable percussion boreholes to 15m below ground level (BGL), two continuous tube sample boreholes, one super heavy dynamic probe, 4No hand dug foundation inspection pits and two dynamic cone penetrometer tests.

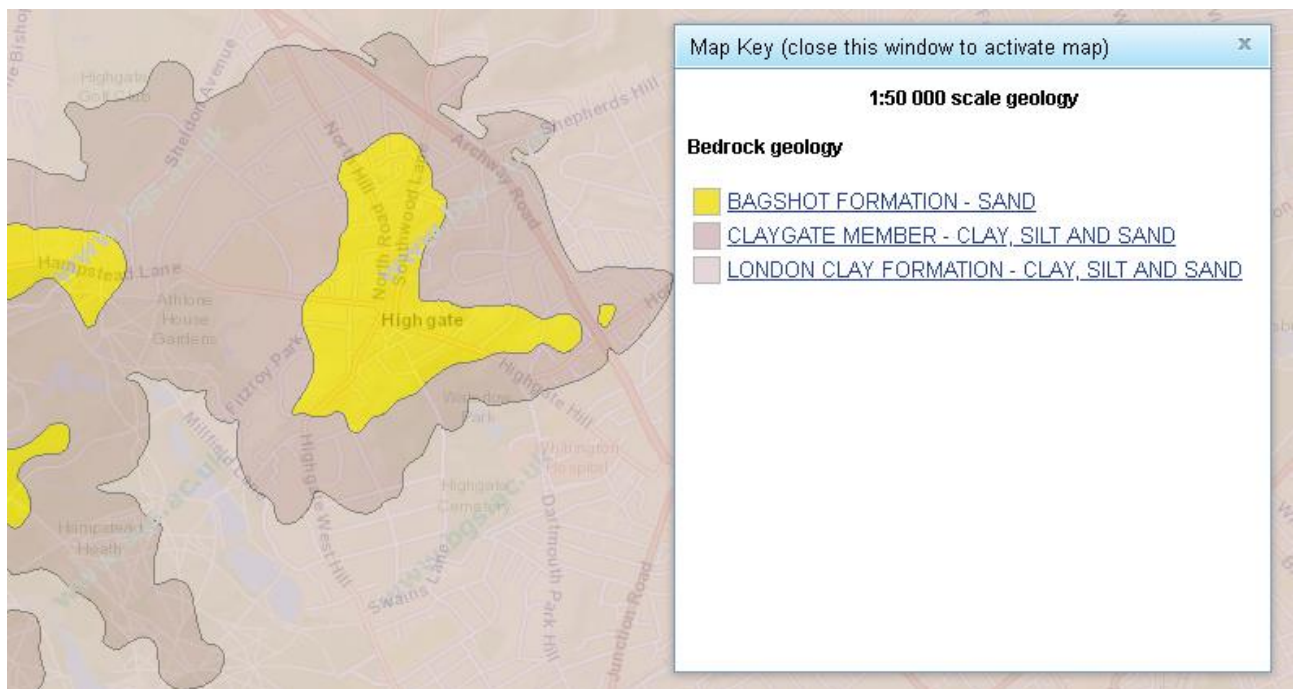


Figure 4 - Extract of geological map showing Highgate. Contains British Geological Survey materials © NERC [2019]

As shown on Figure 4, the site is underlain by a layer of Bagshot Formation sand, over the Claygate Member over London Clay.

Ground conditions were found to be broadly in line with those indicated by the Geological Survey maps. There is a layer of Made Ground approximately 0.4m deep, with Bagshot formation (CLAY/SAND) found to 11.5m BGL over the Claygate member, which was proven to 15m BGL.

Groundwater was encountered at 9 to 12.5m BGL during drilling. Subsequent monitoring of the standpipes three weeks after installation found the groundwater to be 8.6m BGL.

5 Site Hydrology & Hydrogeology

The site falls within Environment Agency Flood Zone 1 “areas with little or no potential risk of flooding” from watercourses.

The site is located within a Critical Drainage Area (CDA) (Group 4_062); however, the site is at low risk of flooding from all sources, including surface water, groundwater, public sewers or reservoirs.

Therefore, the proposed development has an acceptable flood risk within the terms and requirements of the NPPF. A detailed flood risk assessment is provided in “Flood Risk Assessment and Drainage Report”.

6 Proposed Structure

Garner Quad Extension

New Superstructure

The new three-storey extension is planned to the building in the southern side of Garner Quad. The current proposal is to demolish the existing masonry piers to create an opening for the new superstructure. This is planned as a steel frame with composite floor slabs.

The lateral stability for the superstructure is provided through ties to the existing masonry and rigid diaphragm action of the composite slabs.

New Substructure

The superstructure will be supported by two strip footings joined by a ground-bearing RC slab. The insertion of the foundation under the existing wall will require partial removal of the existing floor slab which will be made good with the new substructure.

Science Quad Extension

New Superstructure

The new four-storey extension with basement is proposed to abut the Science Building in the Science Quad. The current proposal is to form the superstructure as a steel frame with composite floor slabs. The proposed structure is independent of the existing building. The staircase within the extension will be formed in steelwork and is supported on cantilevered beams that connect to steel columns located centrally within the building.

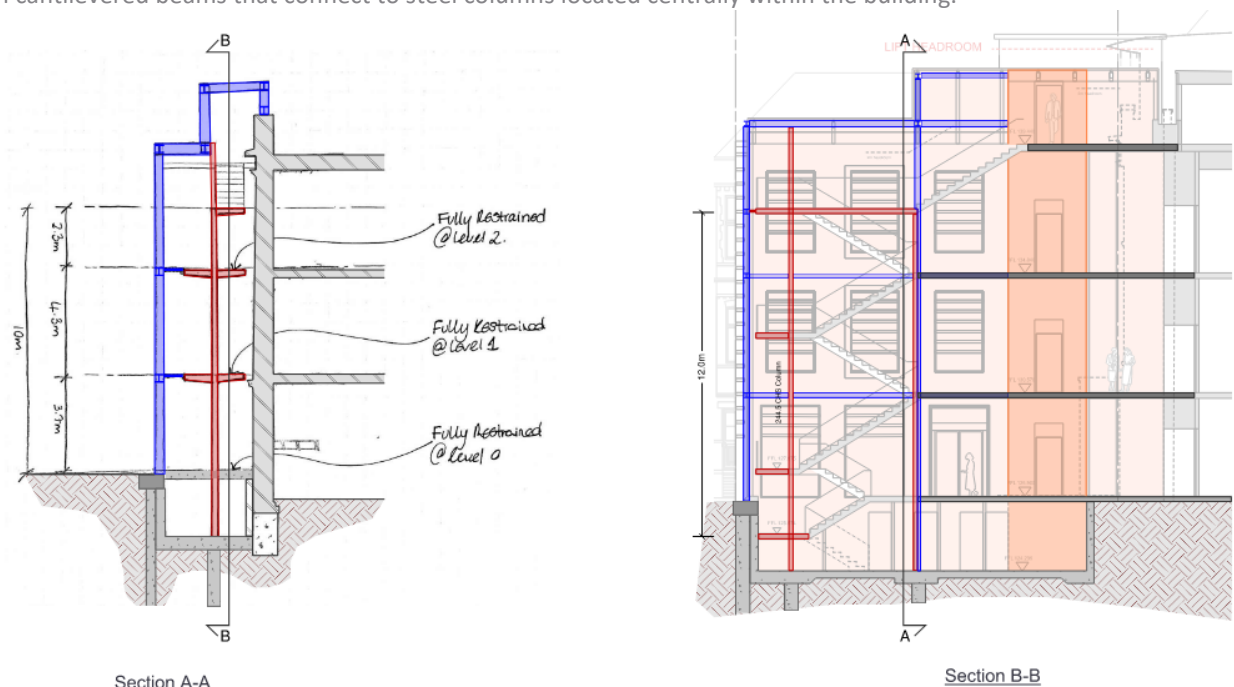


Figure 5 - Science Quad Extension structure

The lateral stability for the superstructure is provided through vertical bracing located within the proposed lift shaft and on the southern elevation.

New Substructure

The basement will be formed by installing a contiguous piled wall to the south and west elevations. The existing Science block will then be underpinned with mass concrete to the level of the proposed basement. This will allow the basement to be excavated down to formation level using temporary propping as required. A reinforced concrete (RC) waterproof box will be constructed inboard of the contiguous piles and mass concrete underpins, with the basement and ground floor slabs acting as props to laterally support the piles and perimeter retaining walls. The basement slab will be supported on a grillage of ground beams that will be supported by the contiguous piles and internal pile caps. The ground floor is supported by the perimeter retaining structure and internal RC columns and walls. This option provides a safe methodology for excavating the proposed basement and minimises the risk of damage to the existing building.

We have assumed the basement will be Grade 3 in accordance with BS8102:2022 'Code of Practice for Protection of Below Ground Structures', therefore a membrane or cavity drain system will likely be used in conjunction with the waterproof RC box.

The steel frame will be supported on the capping beam that links the contiguous piled wall and discrete concrete columns and walls within the basement.

Following the removal of the overburden pressure during the excavation of the basement, the clay will want to expand. This can cause a heave force to be exerted onto the underside of the basement slab. Given some of the heave pressure will occur in the short term, prior to the installation of the basement slab, the site investigation has recommended a design heave force of 30kN/m². The current proposal is to design the basement slab for the heave force; however, an alternative approach would be to provide heave protection, which would allow the heave force to be reduced. The heave force will be transferred through the basement slab and into the piled foundations.

The basement will be designed for an accidental water table located 1m BGL, to allow for the unlikely event of a burst water main. The contiguous piled wall will be designed to resist the lateral earth pressure in the permanent case, with the RC lining walls designed to resist the hydrostatic pressure. The overall self-weight of the building will be used to resist the uplift force due to buoyancy.

The foul water from the proposed basement sink, toilet and four showers will require pumping due to the proposed invert levels relative to the existing sewer connection. Pumping minimises the potential flood risk if the sewer was to surcharge. The sump will be formed within an in-situ RC box and a GRP pumping chamber. The sump will be sized for 24hr storage. The proposed drainage layout is included within Appendix A.

7 Construction Sequence

All of the works, particularly the sub-structure, are to be carried out in a manner, which minimises noise, dust and vibration, which could impact on the neighbouring properties and their users. The Structural Engineer will make regular site visits during the construction, to ensure the works are being generally executed in accordance with the contract documents and good engineering practice. Our outline construction sequence and assumed temporary works for the basement design as described below will be superseded by the Contractor's proposals. The Contractor will be required to submit detailed proposals, including method statements, drawings, and calculations to the Structural Engineer for review prior to the start of any works on site. The Contractor will be responsible for the design, erection, and maintenance of all temporary works in accordance with all relevant codes of practice. The Contractor is to provide adequate temporary works and supervision to ensure that the stability of the existing structure, excavations and surrounding structures are maintained at all times.

Refer to Appendix B for Price & Myers Proposed Basement Construction Sequence Sketch.

Phase 1 - Piling

- i. Install piling mat.
- ii. Install CFA piles to lift pit.
- iii. Install CFA piles to central columns.
- iv. Install CFA piles for the contiguous wall.
- v. Cast capping beams.

Phase 2 – Reduce dig

- i. Reduce level in proposed basement to bottom of existing foundation.
- ii. Cut down internal CFA piles.

Phase 3 – Underpin and prop

- i. Install mass concrete underpin in non-sequential order.
- ii. Install propping to underpins against piled wall.
- iii. Dry Pack installed to joint between existing foundation and top of underpin – Allow 48hours curing before proceeding with adjacent pins.

Phase 4 – Cast slab and wall

- i. Install dowels into contiguous piles to support basement slab and ground beams.
- ii. Reduce level in proposed basement to formation level.
- iii. Cast internal pile caps and ground beams.
- iv. Cast basement & lift pit slabs with vertical wall starter bars.
- vi. Cast RC lining walls around entire perimeter.
- vii. Cast suspended ground floor slab onto lining walls.
- viii. Remove props.

Blue Sky Thinking were commissioned to carry out a detailed Construction Review Report, which is included in Appendix C. This describes and sets out the site logistics, construction operations and the anticipated sequence of construction. The report also presents an anticipated Construction programme.

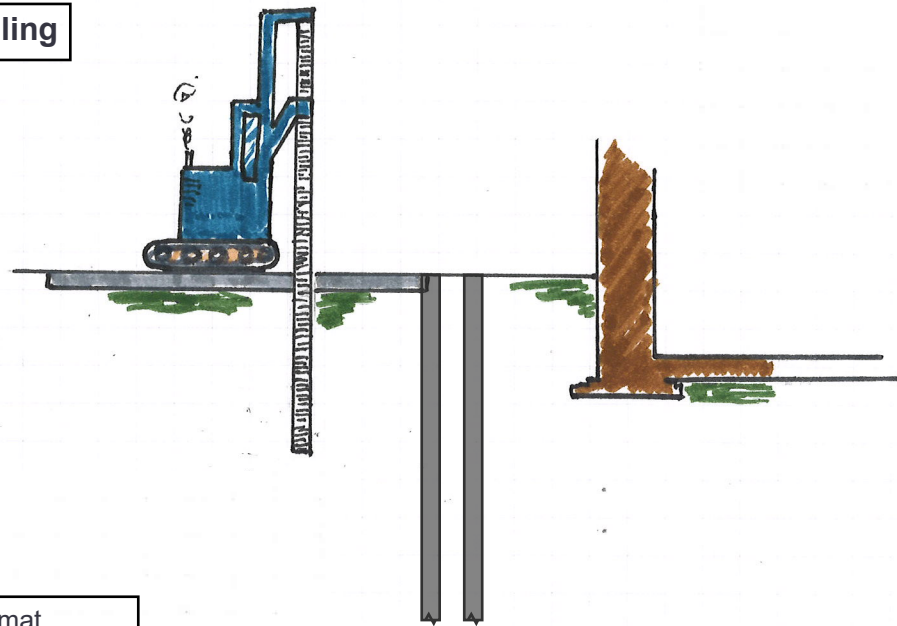
Appendix A

Civil and Structural Drawings

Appendix B

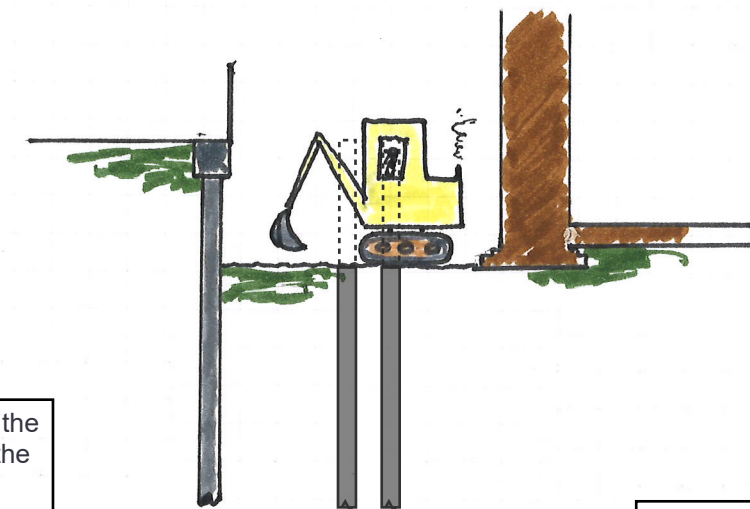
Proposed Basement Construction Sequence Sketch

Phase 1 - Piling



1. Install piling mat
2. Install CFA RC piles
3. Cast RC capping beam

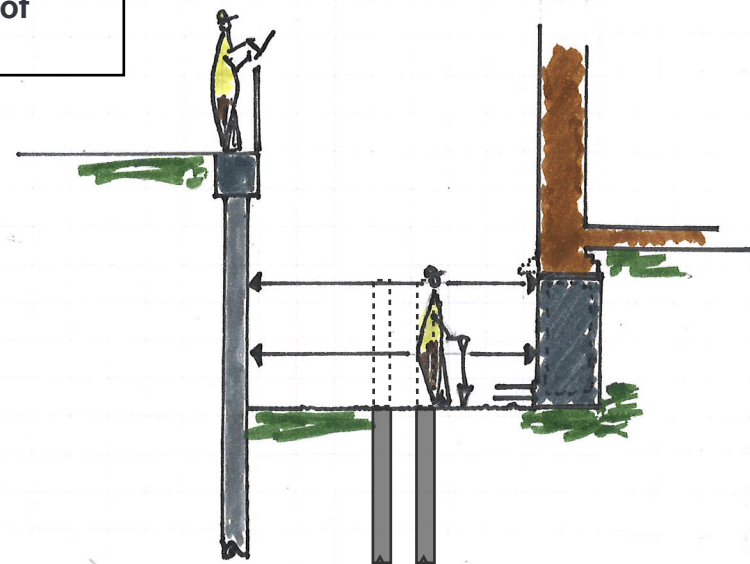
Phase 2 - Partial Reduce Level Dig



1. Reduce level within the basement footprint to the base of the existing foundation and cut down internal CFA piles.

Piles designed to cantilever in the temporary case during this phase

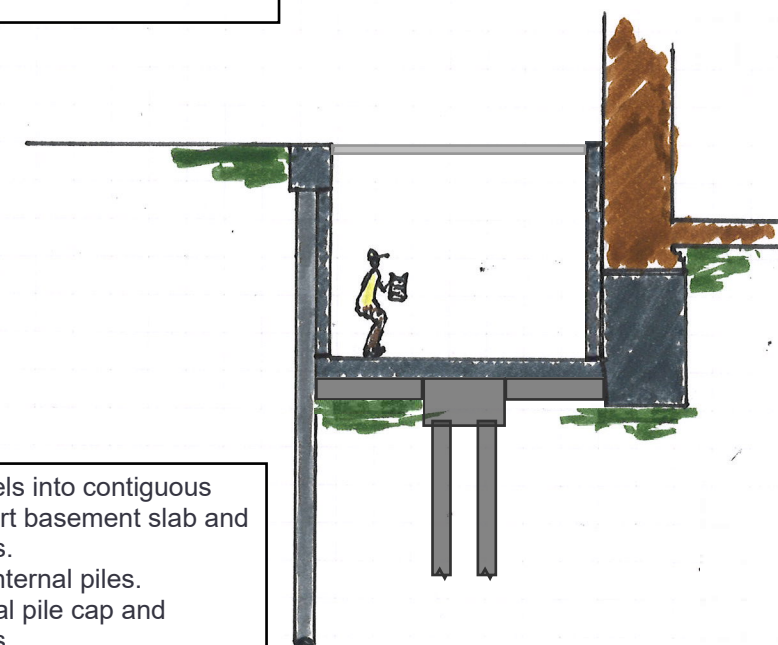
Phase 3 - Reduce Level Dig to Formation Level and Installation of Underpinning



1. Install RC underpins in a non-sequential order and provide temporary propping against the contiguous piled wall.
2. Cut down internal piles.

Allow minimum 48 hours curing time before proceeding to adjacent underpin.

Phase 4 - Cast Foundations, Basement Slab and Lining Walls



1. Install dowels into contiguous piles to support basement slab and ground beams.
2. Cut down internal piles.
3. Cast internal pile cap and ground beams.
4. Cast waterproof RC basement slab and waterproof RC lining walls.
5. Cast suspended ground floor (beyond) on formwork.

SUGGESTED CONSTRUCTION SEQUENCE FOR PROPOSED SCIENCE BLOCK BASEMENT EXTENSION

Appendix C

Blue Sky Thinking Initial Construction Report

Highgate School

INITIAL CONSTRUCTION REVIEW FOR SCIENCE BUILDING PROJECT

Rev A August 2018



CONTENTS

	page
1.0 EXECUTIVE SUMMARY	2
2.0 RISKS AND MITIGATION	
TARGET PROGRAMME CONSIDERATIONS	3
3.0 PROGRAMME ASSUMPTIONS	7
4.0 SCIENCE BLOCK	8
4.1 Programme Commentary	8
4.2 Programme	13
4.3 Logistics Drawing	14

1.0 Executive Summary

Blue Sky Building was appointed to carry out a review of the construction programme and logistics for the Extension and Refurbishment of the Science Block, on behalf of Highgate School.

This report considers the programme and logistics impact of the project. Once finalised these proposals will form the basis of a Construction Management Plan to be prepared by Blue Sky Building for inclusion in the Planning Application Submission.

The Science Block project involves the refurbishment of the existing laboratories and associated spaces, including the Link Building to the West side of the Science Quad, together with two extensions. An extension of the first and second floors into the Garner Quad to the North side of the block will allow better special use for laboratories. An extension of basement, ground, 1st and 2nd floors into the Science Quad to the south side improves entrance and circulation space, including a new lift shaft.

Improvements have been made to some elevations in recent years but not all, and the works include window replacements where required and external cleaning. Internally the majority of mechanical and electrical services will be replaced, along with building finishes.

The block will be vacated for the duration of the works to temporary classrooms in a separate location. This report does not include the temporary space.

Programme Summary

Our Outline Construction Programme (section 4.2) forecast dates are based on what we would consider a realistic delivery programme against which Highgate School might consider to add contingency in overall development planning terms, and set shorter targets when procuring the works.

As requested we have considered potential improvements by working through the critical activities and targeting earlier or shortened periods and these are shown in section 2.2 and in a Target construction programme in section 4.2. That programme shows a potential shortening of the programme of 8 weeks.

Our programme is around a month longer than the programme issued by Highgate School. Whilst it remains possible that works could be condensed to meet the one year target for decant it would be a risky strategy to follow without allowing for a contingency for not being able to move back in.

A key point will be discovery and evaluation of unknowns as they arise. Refurbishment and structural adaption of buildings carries risks of additional or prolonged works due to unexpected finds. Building structures and services should be thoroughly explored and surveyed to the fullest possible extent that can be accommodated in the live environment before conclusion of designs.

Programme Periods

Our programme periods are based on the intricate nature of the works and the limited space for materials movements and plant. There will be works that can be approached with more vigour during periods of school closure and the final programme should take benefit of those occasions as far as possible. Care should be taken however to rely too heavily on holidays, as long delays can accrue if time slots are missed.

General Deliveries

Construction access to the Science Quad from Southwood Lane is reasonable for the scale of works involved, although reversing of vehicles in or out of the gate is inevitable. Temporary removal of one of the gate piers would be useful and we understand there is precedence for this.

Access via the rear gate to Garners Quad is to be avoided, except for occasional plant deliveries. We propose that a first floor level gantry is proposed in the CMP, serving the Southwood Lane elevation. Adoption of it might be subject to Contractor's choice in the future, but showing it in the CMP could at least provide an option. The old doors onto Southwood Lane could also be used for kerbside deliveries, subject to Haringey's views on use of the pavement.

Cranage & Plant Selection

Construction of the new extensions will call for careful management and plant selection. We have offered suggestions of cranes and plant in the programme commentary but it will be essential that contractors are fully aware of the constraints at tender stage and are able to ensure that final designs are matched to methodology.

2.1 Risks & Mitigation

KEY RISKS / ISSUES	MITIGATION
Substructure	
Front extension foundation design (piles) and rig access to the site	Piling specialist input at an early stage to ensure the design is matched to a rig size and methodology that works with the limited access
Excavation plant and accessibility for excavation of rear extension	Consider methodology with design. Could be manually excavated, or min excavator from rear gate or through the existing building.
Below ground services diversions delay substructure construction	Early identification of works required with intrusive surveys undertaken as necessary.
Superstructure	
Structural interventions to the existing building (stairs, riser and plant support) could extend the programme or overload the structure	Early consideration of composite dead loadings and live construction loading & timescale.
Steel frame to Garner Quad extension currently programmed without craneage. Supply chain appreciation needed or risk of extended programme	Ensure clarity of site constraints in tender documents. Spider crane from rear gate could be substituted for our proposed method
Temporary works loadings may not work for existing structure.	Establish loading constraints with Engineer prior to tender returns. Ensure tenderers have a workable solution in their returns.
General	
Full consideration of on-site, school and public health and safety at all stages of planning and execution.	Detailed risk analysis of site operations.
A strategy to minimise disruption to the school, local environment and adjoining properties/owners.	Positive approach to neighbours – newsletters/site talks.
A methodology to secure the highest quality.	Samples/mock-ups prepared in advance and signed off.
Full consideration of both site and public health and safety at all stages of planning and execution	Detailed risk analysis of site operations
A realistic preconstruction period which provides the best input to the Client and Design Team	Ensure strategic programme and procurement route allows sufficient time to coordinate all aspects of the project
Provide above industry average facilities for the workforce	Make the site attractive to the workforce. Attract best tradesmen
Safe segregation of M&E services between site and occupied school areas	Early surveys and identification of services. Safe system of work throughout stripping out and construction phases.

KEY RISKS / ISSUES	MITIGATION
Logistics / LBH & Neighbours	
Demolition impact for noise and general disruption.	Ensure environmental monitoring is in place and a robust demolition plan is agreed with LBH and neighbours.
Delayed availability of Temporary Accommodation delays vacant possession of main works	Early alignment of VP schedule for main works with the procurement and erection of temporary classrooms. Contingency plan for late vacation.
Hours of Work conflict between LBH, neighbours and school.	Beware conflicting desires for noisy work times. Ensure pre-agreement before finalising programme.
Scaffold access over Alms house not agreed	Consider alternative access strategies and potential reduction in scope of work as a contingency plan.
Welfare location unavailable	Make a contingency plan for the project that meets programme strategy and dates
Oversailing agreements restrict mobile crane operations	Review crane positions and make early approaches to neighbours if required
School Access impacted by construction	Early agreement of delivery strategy with school and regular review with contractors
Continuity of Building Services to school and neighbouring property.	Ensure before services are terminated that all systems I are truly separated and will continue to function.
School decant programme clashes with contractors initial set up in the Science Quad	Agree vehicle slots for school use separately to contractor. Agree phased parameters of closing in hoardings with due attention to CDM requirements.

2.2 Target Programme Considerations

As requested by Highgate School we have reviewed our initial findings in order to explore potential programme savings to ensure completion of works in time for the start of Autumn term 2020.

Critical Activities

Whilst our programme is outline, limited by the current level of design the critical path can be identified as being:

- Site set up
- Preparation (stripping out and opening up unknowns)
- Structural interventions including forming risers and service routes
- Installing new services
- Commissioning and setting to work

The creation of new space in terms of the front and rear extensions is believed to be more predictable and therefore less critical, provided it is managed properly.

Potential Programme Savings

In the following table we have Identified potential improvements to critical activities to target earlier completion and to ensure term start date is met. These are categorised as:

- Discovery – de-risking of the programme by carrying out extensive and intrusive surveys of services and structure ahead of the main works
- Early Works – Things that could be brought forward along with opening up works to ensure that the start of main works is meaningful
- Main works programme periods – shortening of durations, either due to improved knowledge or as targets to achieve, plus potential contingency planning

Target Programme

We have factored the results of the table into a Target Programme which is included in section 4.2 with our first drafted programme.

This indicates a theoretical saving of 8 weeks, by using Easter and half term holidays to “get ahead” with opening up and establishing site, and shortening main works targets accordingly.

Those early works might equally be achieved in part by using evenings and week-ends, combined with the school’s regular maintenance contractors.

CRITICAL PROGRAMME ISSUE		MITIGATION			
ACTIVITY	CURRENT DURATION	SCHOOL ACTIVITY	DISCOVERY	EARLY WORKS or ENABLING PACKAGE	MAIN WORKS PROGRAMME
School Decant Space Needs to work with term and holiday periods. Risk of clash with contractor’s set up with vehicles wanting to use the same space.	6 weeks	Clear non-essential material early to shorten period Plan to use different routes when contractor starts, so contractor has the Science Quad while Removal Company has North Road and Garner Quad perhaps.			
Establish Site	2 weeks			Start works in Easter break, half term or weekends: ➤ Remove Gates & Alter Front Gate Piers ➤ Clear external furniture ➤ Probe hoarding locations and erect some posts ➤ Set up Office/ Welfare space	

ACTIVITY	CURRENT DURATION	SCHOOL ACTIVITY	DISCOVERY	EARLY WORKS or ENABLING PACCKAGE	MAIN WORKS PROGRAMME
Make Safe Services Risky item, until services are traced and identified	2 weeks		Establish early surveys and recording of all services routes out of hours. Open up ceilings and ducts and ensure there is knowledge of what feeds which area.	Use Easter Break, half term or weekends for: ➤ Intrusive surveys ➤ Identify, record and label services ➤ Remove redundant services where possible ➤ Make good fire protection to allow school use to continue	
Protect Live Services This programme item assumes that there will be live services remaining in place through the building site in order to feed live areas of school. Ideally they would be terminated or diverted, but where that is not practicable they work be securely encased and remain in position (subject to a risk assessment).	2 weeks		Early services surveys should identify which pipes and cables might need to continue to supply live areas. Subsequently a plan to divert or encase would be drawn up.	Use Easter Break, half term or weekends to: ➤ Identify services as above ➤ Install diversions if time permits ➤ Install physical enclosures and signage if time permits ➤ Complete a design of what needs to be implemented early in the main works programme	Benefits from clearer understanding of requirements at commencement of the works.
Soft strip internally	4 weeks	Early disposal of non-essential equipment and fixtures. Ensure identification and clearance of hazardous waste and chemicals from stores (Discovery of un-labelled bottles once the contractor has started cause disproportionate delays!) Identify any rooms or spaces that could be emptied and stripped a term or half a term early	Early intrusive inspections to fully understand the scope of work including asbestos removal Use empty rooms to explore and improve knowledge of the structure and services	Use Easter Break, half term or weekends to: ➤ Remove fixtures and fittings from redundant labs or rooms.	Benefits from any volume that is removed early and remaining scope is clarified from the learning accrued
Crash deck/ Break Out Floors (New Stair) Early structural interventions will be the key to opening up the building and progressing	2 weeks + 4 weeks				Shorten the period by targeting quicker start and shorter duration based on better knowledge Use the knowledge derived from

through to new structural works uninterrupted.					early opening up to progress the design of new structural elements and take surveys.
New Riser(s) As above, preparing for new services distribution is as important as building the new space (Programme not fully quantified at this stage given that more detailed design is needed to fully understand scope and difficulty)	8 weeks		Use early investigations of structure and services to better understand what's needed in the final design.		Design structural solutions that have flexibility of components, and allow details to be finalised as work progresses.
Services distribution and services second fix (Programme not fully quantified at this stage given that more detailed design is needed to fully understand scope and difficulty)	12 weeks + 12 weeks		Use early investigations of structure and services to better understand what's needed in the final design.		The earlier that services can be sized and their routes identified, the earlier components can be ordered and deliveries committed.
Services commissioning & setting to work The current, outline programme identifies commissioning as the main critical activity to completing the programme but as more detail is added the critical path will encompass all of the fitting out activities to varying degrees. (Programme not fully quantified at this stage given that more detailed design is needed to fully understand scope and difficulty)	12 weeks + 4 weeks	Consider contingency options that might be available should the programme overrun Autumn term start and what the impact might be: ➤ Can school continue to use temporary space for a half or full term? Consider the minimum time needed for decant ➤ Factor in the implications of temporary space – hire cost? Availability for next project? ➤ Would partial occupation be workable at all (if plant and commissioning can be configured to achieve it)	Use early investigations of structure and services to better understand what's needed in the final design.		Set early targets in tender and contract programme as far as possible and monitor progress tightly. Include the need for a commissioning strategy and programme to be prepared early in the construction process Request progress reporting with forward predictions of key milestones of watertight, power on, heat on and commissioning such that contingency plans can be kept under review.

3.0 Programme Assumptions

- Temporary Accommodation set up and ready to meet decant dates
- Beneficial use of permanent lift when hoist is removed.
- Progressive installation of rain water pipes and hoppers.
- New external cladding will comprise stick system curtain wall/ rendered panellised system. Inner skin assumed as Metsec or similar SFS system to allow early progress of fit out with outer skin progressing to non-critical programme.
- Logistics proposals acceptable to LBH for deliveries and cramage.
- Cladding and fit out materials selection can be procured in the time allowed.
- Fire strategy will be achievable to accommodate live school areas.
- Programme allows for removal of normal levels of asbestos expected for buildings of this age and type. Full R&D surveys to establish content and allow formal notices to be served before site start.
- No allowance for removal of contaminated spoil.
- All necessary permissions in respect to party wall agreements will be obtained to allow the programme to proceed as drafted.
- Programme is based on a working week Mon – Fri 08.00 to 18.00, Saturday 08.00 to 13.00.
- Planning & reserved matters can be dealt with within the proposed programme parameters.
- Noisy structural alteration works are allowed to be carried out in line with normal local authority timescales, i.e. minimum of four hours per day.
- Vacant possession of the site means “all of the site” and no access or constraints will need to be considered other than those which are directly associated with the works. This also means that all loose FFE will have been removed.
- Occasional access is available from the Caste Yard gate for plant delivery.
- We have assumed that the extent of service terminations/ isolations/reconnections required within the existing spaces, are restricted to those services affected by the proposed works. We have made no allowances for either the upgrading, uprating or making good which would be associated with such works.
- No allowance in the programme for any “down-time” associated with environmental matters.
- Crane licenses if necessary for the over-sailing of buildings or highways will be granted.
- Procurement route has not been assessed. Start on site dates are as advised by Highgate School.
- Full rights of access assumed from Southwood Lane and Castle Yard (occasional).
- Refurbished building to be served from existing utility supplies or, at worst new connections to mains in the immediate vicinity. No allowance for external diversions.
- Existing sewer and drain connections assumed to be adequate for the new project.
- Highway, footway and Science Quad are capable of taking the temporary vehicle and crane loading.
- All statutory service providers to deliver services to allow the programme to proceed as drafted.
- Piling (front extension) to be undertaken from ground level using a rig that can access the Quad.
- Frame is steel construction with metal deck/ concrete floors
- Roof structure to be metal deck plus traditional roof finishes.
- Stairs to be lightweight steel treads (Stairmaster or similar) with pumped concrete.
- No extensive tank construction or rainwater attenuation measures allowed for.
- No allowance for discovery and removal of munitions.
- No allowance for archaeological investigation.
- Fixed lab furniture included in contractors scope. Loose furniture and FF&E to be by school separately.

4.0 Science Block

4.1 Programme Commentary

4.1.1 Site Context

The Science Building is the central part of the Highgate School “island site”, bounded by North Road and Southwood Lane. Two enclosed quads border the building, Science Quad to the south and Garner to the north side.

The Science Building is central to school activity and, apart from housing classrooms and management offices, is a major thoroughfare for school activity. The proposal is to vacate the live classrooms and functions to temporary accommodation for the duration of the works. An access route is to be kept open for staff and pupils through the ground floor of the building, segregated into a protected route.

Vehicle access is possible into the Science Quad. Vehicle size is limited but it appears suitable for the scale of the envisaged works. One or both of the existing brick gate posts should be temporarily removed for easier access for lorries. Occasional access could be made to the Garner Quad from the rear gate from Castle Yard. The school have expressed a wish that the gate should only be used when essential, and not for general material deliveries.

The Southwood Lane elevation offers potential additional access. That elevation is to receive new windows and cleaning, for which a full scaffold will be needed. We propose that the scaffold incorporates a loading gantry at 1st floor level where vehicles can be offloaded from kerbside. We will propose that in the CMP for Planning although Haringey may want to impose time restrictions on its use. There are also two doorways onto the Southwood Lane pavement (currently sealed and unused). One or both of these could be opened up for smaller, hand carried or trolleyed goods

Adjoining Alms Houses form the boundary of Garner Quad. Works to the north elevation of the Science Building will necessitate a scaffold bridging the neighbour’s property for which oversailing agreement will be required.

The west elevation (North Road) is largely unaffected by the works and offers no usable access. Scaffolding is not needed there.

4.1.2 Logistics and Transport

Given the context of the site and the nature of the proposed works, deliveries to site and methods of materials handling will require detailed planning and consultation with the local authority and TfL, particularly for larger vehicles. Access to the science quad is limited to small vehicles only, and the design of the buildings should progress with due consideration of the limits on space, such that many components can be delivered in small, manageable loads.

Plant and craneage is also a consideration for the piling, basement and superstructure elements, where the design must be matched to methodology and plant sizing.

4.1.3 Site Establishment & Commencement

Project Commencement is targeted to make use of the summer school holidays to prepare the site for the works.

Completion of the temporary classrooms needs to be assured in advance of the break so as not to delay decant and site preparation operations. We assume that the moving of school equipment is outside the construction contract and to be managed by school staff and removal contractors. Vehicles will need to access the Science Quad for loading away of goods and waste, and the period should be carefully programmed to ensure that both removers and incoming contractors have time and space to complete their works.

Incoming contractors will need to ensure that critical works to segregate the construction site from the continued use of school are fully completed in time for the new term. This will include hoardings, services isolations and separation, and the construction of the protected access route. They will also need to establish site welfare and office accommodation, ensure temporary services are in place for the site, and that life safety systems and wayfinding are all in place for the return of the school.

As contractors take possession of the building, the external space or sections of “emptied” area it will be important to record responsibilities and control of individual areas. The Principal Contractors duties under CDM are more onerous than those on maintenance and removal companies and they must be in a position to enforce site rules on their staff and any others entering site space.

We understand that an asbestos register exists and that relatively small levels of asbestos are present in the building. If not completed beforehand a full Refurbishment and Demolition survey should be carried out as soon as the building is vacant, with licenced contractors being appointed for removal, and formal notices submitted in due time to meet the start on site dates.

At commencement the buildings need to be made safe and secure to a standard that meets CDM regulations. Remaining live services in the buildings would be made safe and temporary power and water installations installed. It appears that main incoming gas and electric supplies will remain live within the “site” area. Whilst these are away from the larger structural interventions the live routes must be thoroughly traced and physical protection added if they remain in working areas.

Redundant services must be traced, isolated and identified as safe before temporary works or stripping out get underway. Fire and smoke detection should be adapted for site conditions, and to maintain live school areas.

Hoardings and gates will be erected to the Garner and Science Quads. The protected route through the building should be designed to meet the appropriate fire standards and needs to be fully constructed before the school term starts. Each end of the tunnel should be protected by a scaffold crash deck which would best be constructed in advance of the main scaffolding.

A number of options exist for site accommodation and should be decided upon before tender. Possible locations include:

- Use space inside the buildings being refurbished. Perhaps in the link building. This has the benefit of being cheap and quick to set up but hampers fit out progress and requires one or more moves.
- Cabins in the Science Quad would be possible to meet some of the space requirement but probably not all. The space may be better left for logistics and material storage use which would be more beneficial.
- Space is believed to be available in the Tabernacle building on the opposite side of Southwood Lane. If used then it might be combined with a small cabin in the quad to ensure that site supervision is maintained in the immediate site area.

4.1.4 Early Works and Stripping Out

Hoardings outside the school property would be pre-agreed with the London Borough of Haringey and neighbours and subject to licence application in advance.

Traditional scaffolding will be required to all elevations of the Science Building and Link, except to North Road (no works there) or to the west elevation of Biology (where the front extension is to be built. Scaffolds should not be an urgent item to erect as the early priority will be on segregation and readiness for term start. External scaffold erection should be programmed to follow the initial site set up, in parallel to stripping out starting.

Scaffolds are to serve façade treatments and to provide access and environmental protection for demolition. They should be fully sheeted with Monarflex or similar sheeting which assists with preventing dust and noise escape whilst presenting a more acceptable view of the site to school and neighbours.

A small platform goods hoist will be required and should be erected in the Science Quad together with a Haki stair for operatives' access. We propose that a loading gantry be included in the scaffold to Southwood Lane, with a lifting beam to facilitate direct offloading of lorries, to reduce the extensive use of the quad.

Once the site is established and services isolations in place, the soft-strip can commence. Materials will be moved in bins to skips or lorries located in the Science Quad, or Southwood Lane.

Materials arising from upper floors would be placed into bins at source and then taken down to the quad, utilising the goods hoist, and loaded into a compactor truck or skips.

Once soft-strip is far enough advanced the hard demolition would commence as described in the following sections. Access should be sufficient to allow the use of Brokk robot machines with shear and grapple attachment or alternatively simple manual techniques. Materials would be moved to skips in the Science Quad using bins or loaded to lorries in Southwood Lane.



BROKK ROBOT

4.1.5 Garner Quad Extension

The constraints dictating the choice of plant and methodology are the enclosed site and limited access. Our methodology is based on the smallest plant, or manual alternatives. Once the building is stripped out a route through from the Science Quad to the rear could be made available, reducing the need for plant to access from the rear gate.

The proposed strip foundation for the new extension could be small enough to be excavated entirely by hand. Alternatively the mini excavator shown here retracts to under 1m wide and weighs around 1.5 tonne. It could be delivered through the building with only minor temporary works to accommodate it.



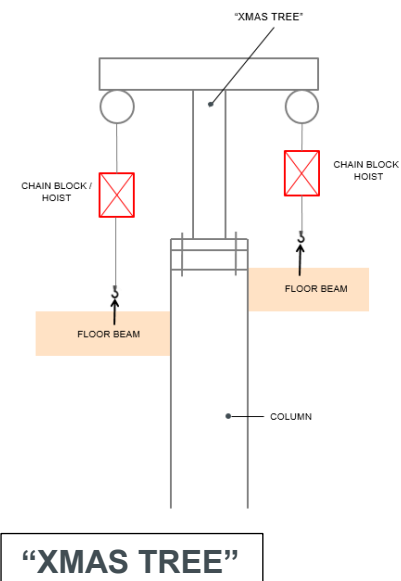
MINI-EXCAVATOR

The foundation and any associated local drain diversions can be constructed while stripping out continues inside and in advance of scaffold erection.

Once the inside is stripped and the foundation in place internal propping and external scaffold can be erected. We envisage that the external scaffold can be adapted to serve as access as well as support for temporary needles, as shown on our sequence diagram overleaf. The contractor should consider bringing in new permanent steel for the wall support *before* the propping is erected – to ensure it can be manoeuvred into place.

Once supported the old façade wall can be demolished in to the building and debris removed in bins to the front quad. New supporting steel is then lifted by block and tackle using the scaffold and temporary works for support.

Other methods of manual erection could be employed including the “Xmas Tree” system where the new permanent columns are adapted to lift the beams into place:



With the new steel placed, packed and load transferred the external scaffold is adapted to be used to pull the new extension steelwork into place. Alternatively the scaffold could be removed and a small spider crane brought in from the rear gate, although that seems an unnecessary expense for the small amount of steel to be erected. The steel itself would be delivered via the front and trolleyed through the ground floor.

Internal propping can be dismantled when no longer needed. Metal deck floors would be constructed top down, dismantling the scaffold as they complete. A new external scaffold would be erected for access to build the façade.

We assume that the façade will be small components erected manually. Ideally the inner skin would be a Metsec or similar Structural Framing System, incorporating the glazing or with temporary weatherproofing such that the fit out can proceed while the external cladding finishes continue.

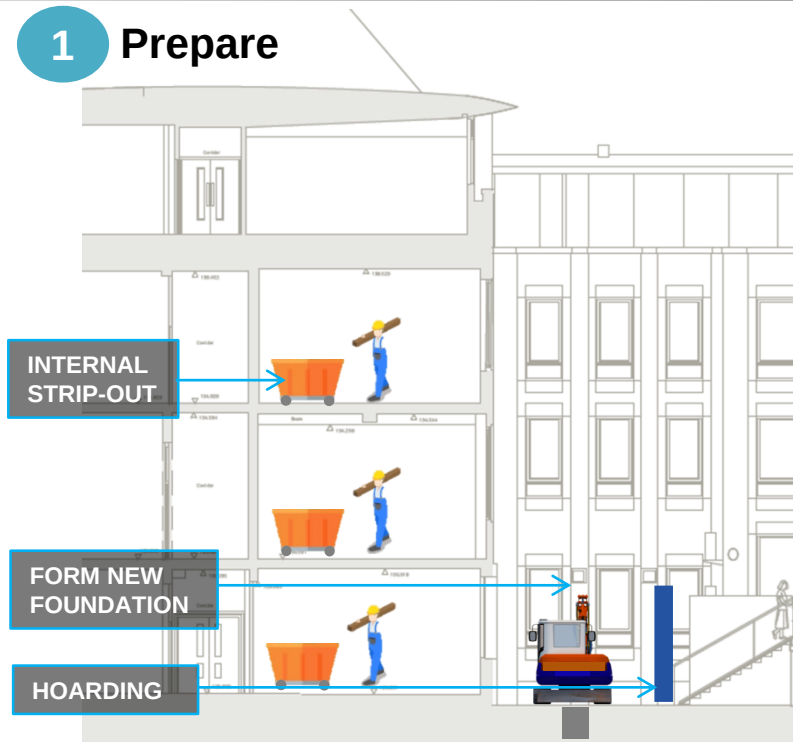
Finally the scaffold is removed and the external works completed by hand or using small machines.

SPIDER CRANE ALTERNATIVE FOR EXTENSION STEEL

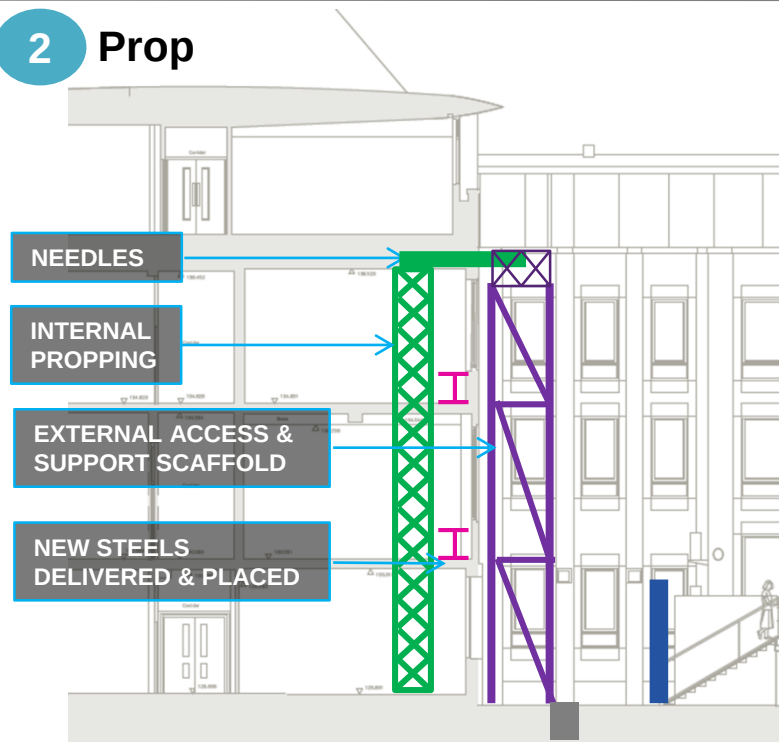


Please refer to drawing BSB-HS-002 – Rear Extension Sequence.

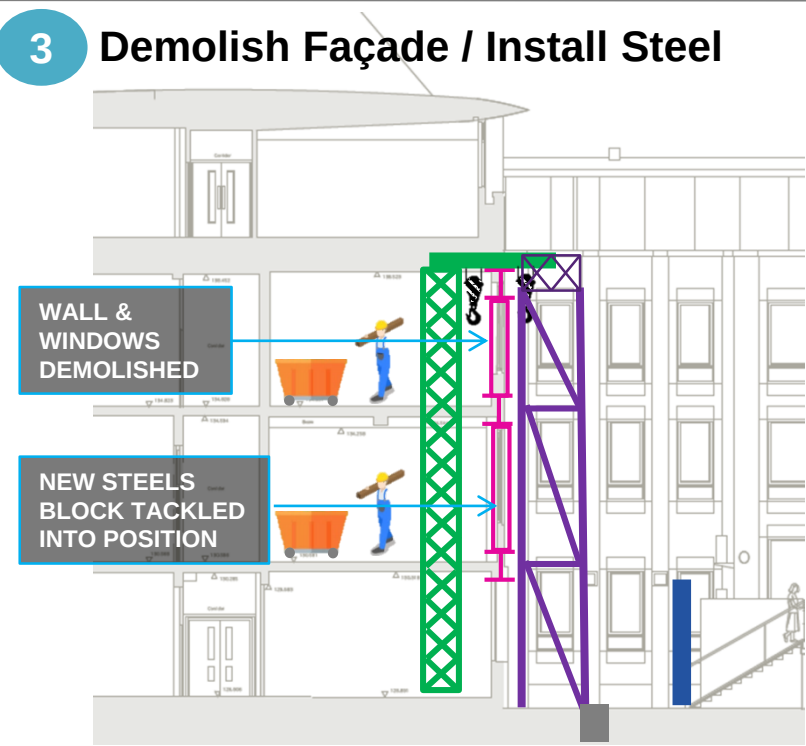
1 Prepare



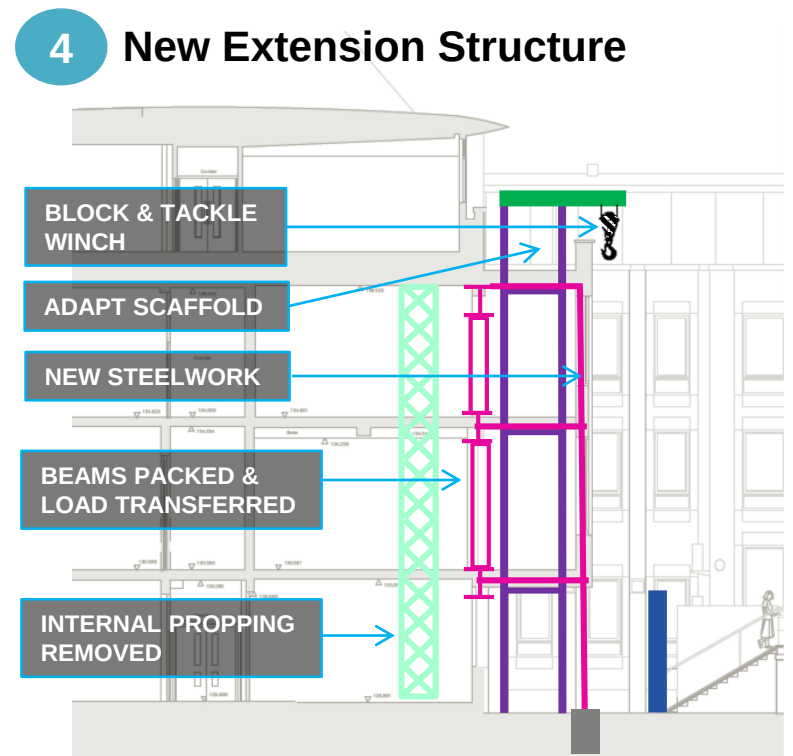
2 Prop



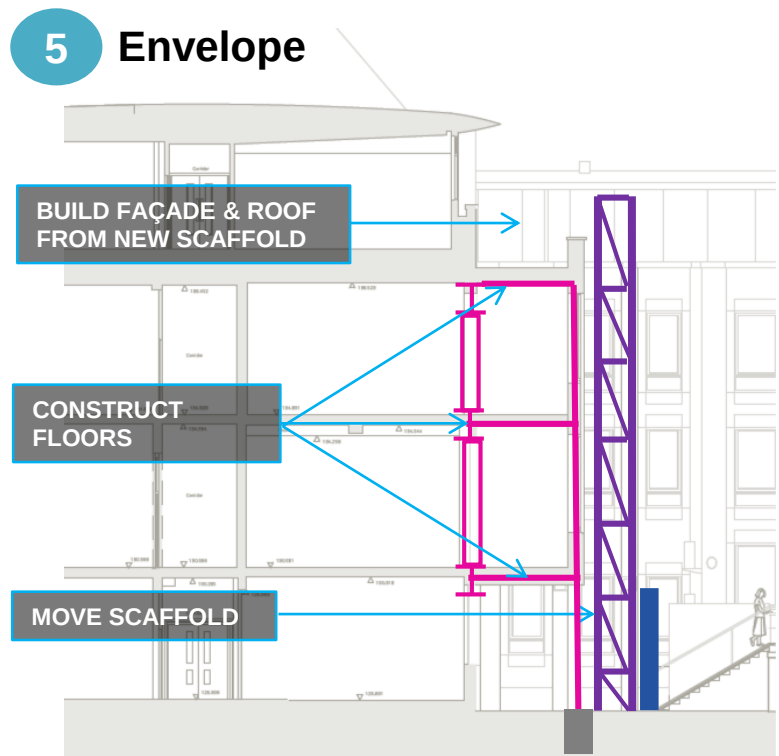
3 Demolish Façade / Install Steel



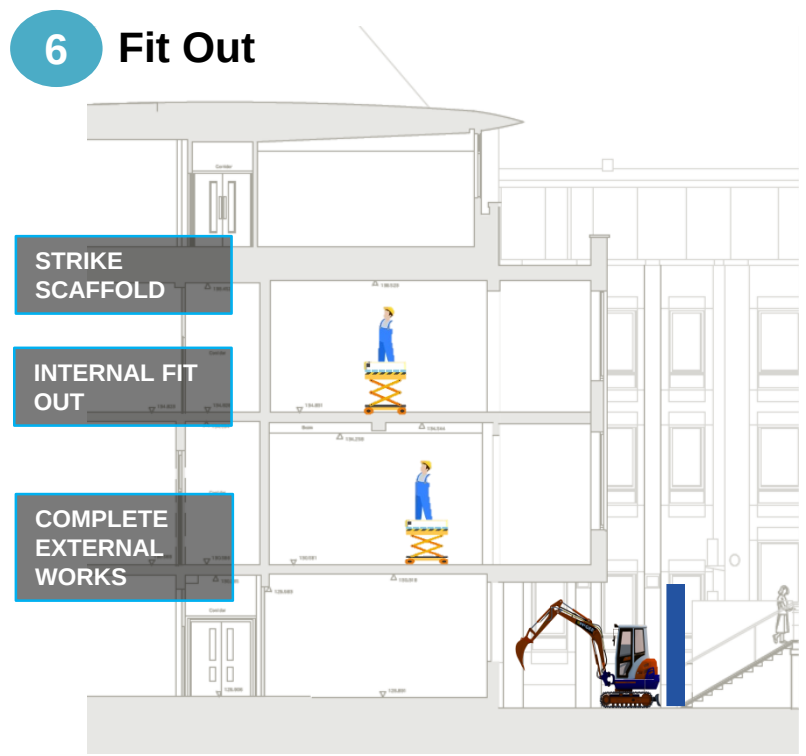
4 New Extension Structure



5 Envelope



6 Fit Out



PROJECT: Highgate School | Science Project
CLIENT: Highgate School Estate
TITLE: Rear Extension Sequence

DRAWING NO.: BSB-HS-002
REVISION NO. & DATE: Rev 0 – 11/07/2018
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4.1.6 Science Quad Extension

The Science Quad extension will be the most critical piece of the construction, as it is the largest element of work and has an effect on overall watertightness and fit out.

Internal strip out should be focused on clearing the areas of the new stair, old stair to be removed and corner wall. An external demolition scaffold should be erected in that corner in parallel to internal strip out. All of the demolition should be undertaken early in the programme to clear the way for new construction.

Underpinning the existing wall will be a slow, manual process and should be commenced as soon as possible. Works to the south end are sufficiently removed from the demolition area to get underway early. Underpinning can't be completed until the demolition completes and the corner scaffold is removed.

Piling would be undertaken from ground level using a small rig that can be driven through the entrance gate, similar to the rig in the photograph here. We estimate that 4-5 piles per day would be achievable. Arisings would be stock piled for removal by skip or lorry. Concrete deliveries would be by ready mix truck to the quad and placed directly.



**CF3 RIG,
2.2M WIDE, 11 TONNES**

Machine selection for basement excavation should be the biggest machine that can be got in. Excavation to underside of raft will proceed when piling and underpinning are clear, with temporary propping as required.



**KOMATSU EXCAVATOR,
2.4M WIDE, 8 TONNES**

We have allowed only a short period for below slab services before the raft is constructed. Large scale diversions of drainage have been suggested as possible and more time should be allowed if this transpires as necessary.

Stair trimming steel and new landings should proceed while the basement is built as the stair is most accessible before the new extension is built. The stairs should be as light as possible since the roof level is remaining in place and lifting will therefore be difficult. We envisage stair sections being delivered via the quad, lifted over the basement and pulled up through the new well from the top level. Alternative access could be possible through the first floor from the loading gantry, in which case the programme criticality between stairs and extension is reduced.

Stairs could otherwise be in-situ concrete. Slow to form but the site doesn't suit the lifting of heavy pre-cast flights.

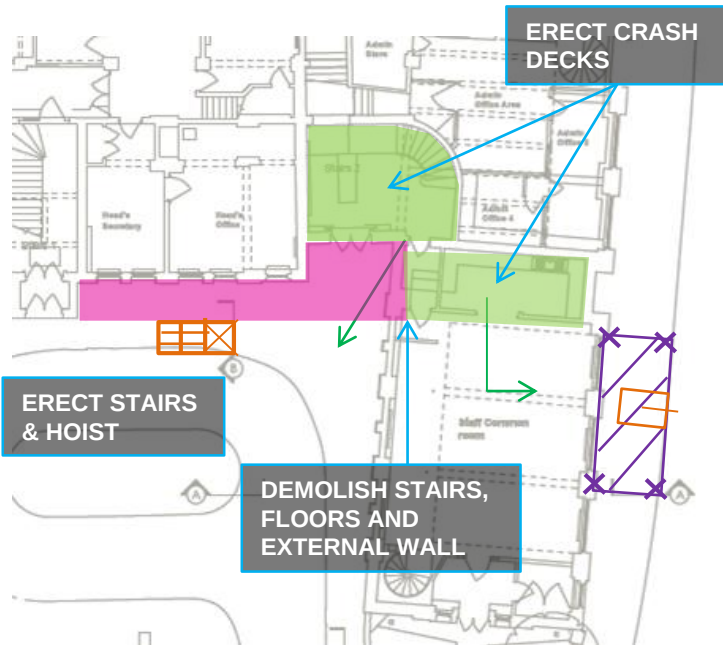
The new steelwork frame should be possible by small mobile crane operating in the front quad. Steel member should be manageable with the emphasis on crane manoeuvrability rather than capacity.

Steel for both extensions should be designed to allow small deliveries on rigid vehicles that can access the quad.

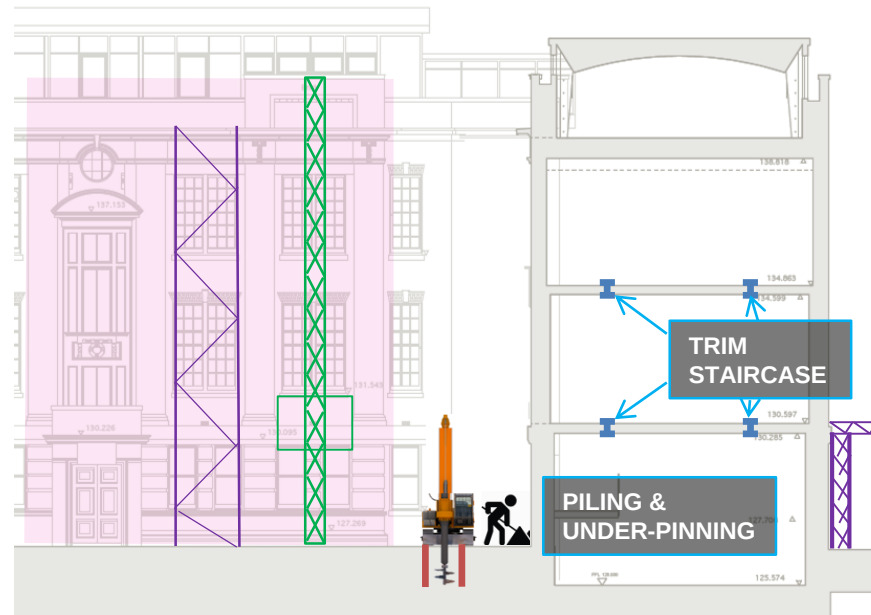
Metal deck should be placed by the mobile crane and concrete floors pumped from the quad. Then an external scaffold will provide access for erection of cladding.

Please refer to drawing BSB-HS-003 – Front Extension Sequence.

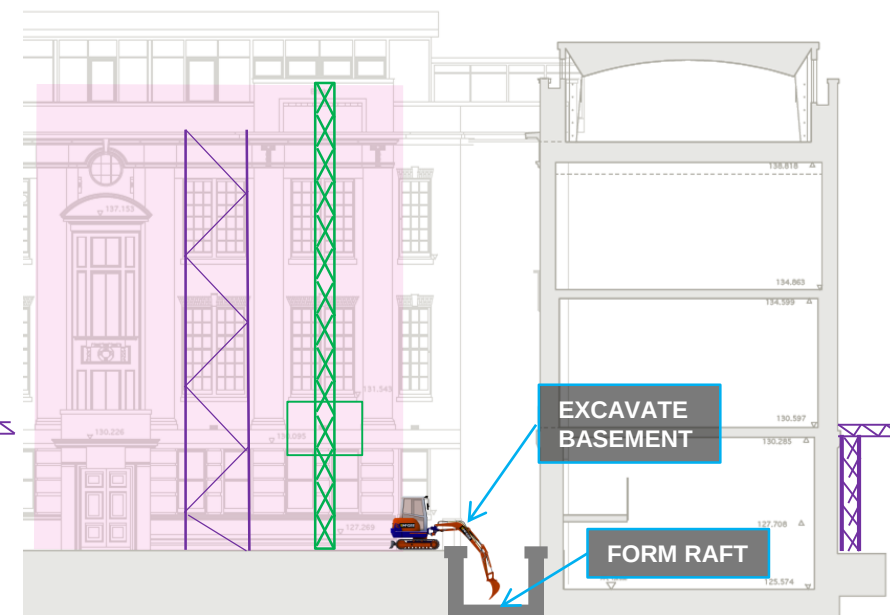
1 Demolition



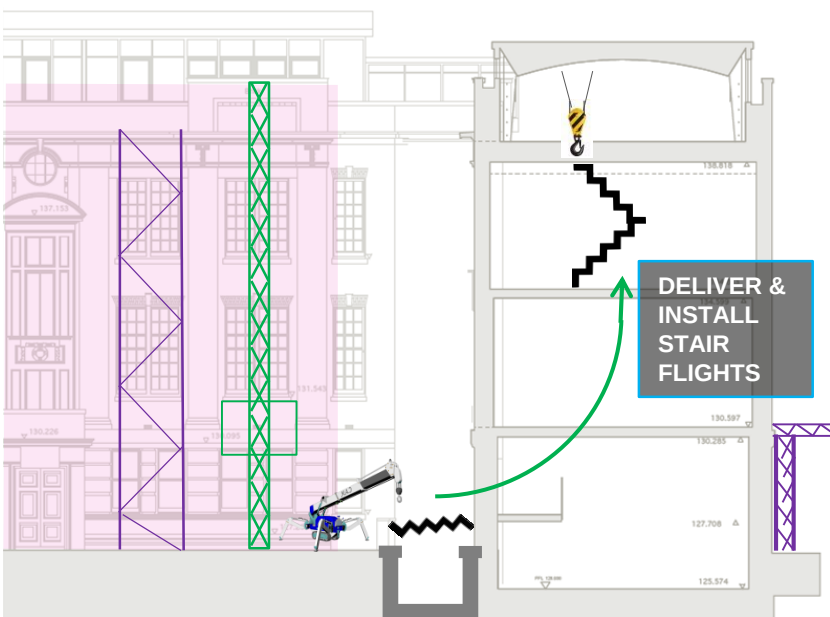
2 Foundations



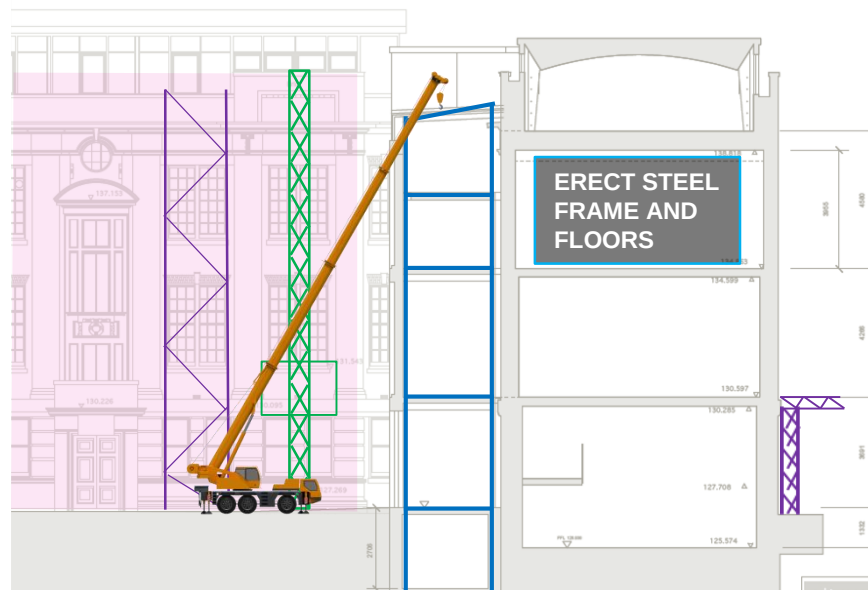
3 Basement



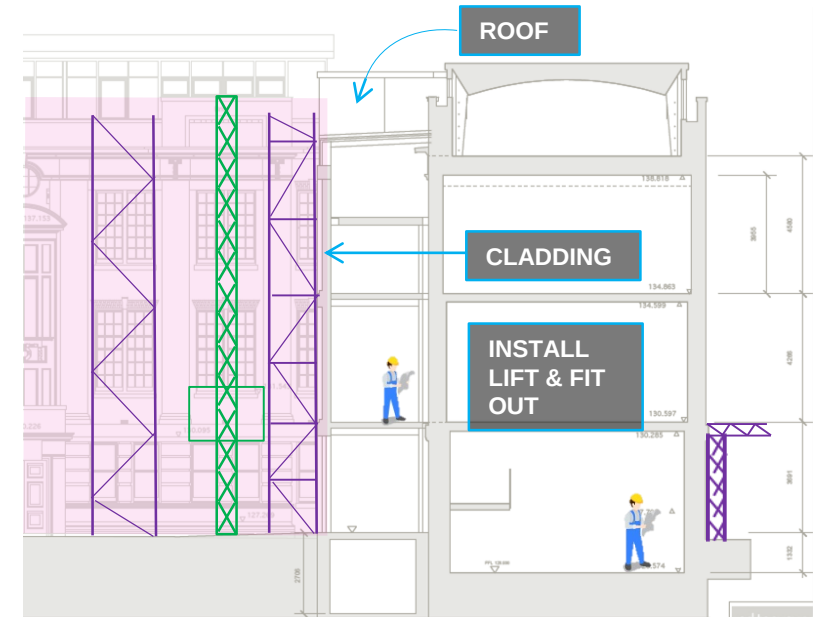
4 New Stairs



5 Frame



6 Envelope & Fit Out



NOT TO SCALE



PROJECT: Highgate School | Science Project
CLIENT: Highgate School Estate
TITLE: Front Extension Sequence

DRAWING NO.: BSB-HS-003
REVISION NO. & DATE: Rev 0 – 11/07/2018

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4.1.7 Existing Building Fabric and Envelope

We have programmed new facades on the basis of the inner skin being SFS that can be erected quickly from the new floors. Existing façade refurbishment is planned to ensure that any window replacements are similarly early such that the whole building achieves watertight in due time for the fit out. Window openings would either be fixed to the SFS or temporarily weathered to allow fitting out to start as soon as possible.

Brickwork would then follow from the external scaffold, using pre-mixed mortar delivered in tubs daily. If the inner skin was traditional blockwork there would be a programme increase, albeit not major, given the scale of work involved to achieve watertight in due time to allow services and fit out to proceed.

4.1.8 M&E Services

We understand that no significant new utility connections are required and that the new facilities are served from the existing incomers.

Key issues for the M&E sequence are to have the risers and main plant in place as soon as possible and to work away from those through the floors. With the extensions predominantly watertight (roof finishes and SFS skin in place) services distribution up the risers would take place.

Lift installation appears straightforward and we have sequenced installation to start early (subject to design and fabrication). Beneficial use of lifts should be allowed once ready to allow earliest removal of the external hoist and infill of the final windows.

4.1.9 Fit Out Works

Internal fit out is assumed to be standard school finishes incorporating hard wearing materials and detailing with the minimum of frills. That is to say, hard ceilings and exposed service spines rather than suspended ceilings for example.

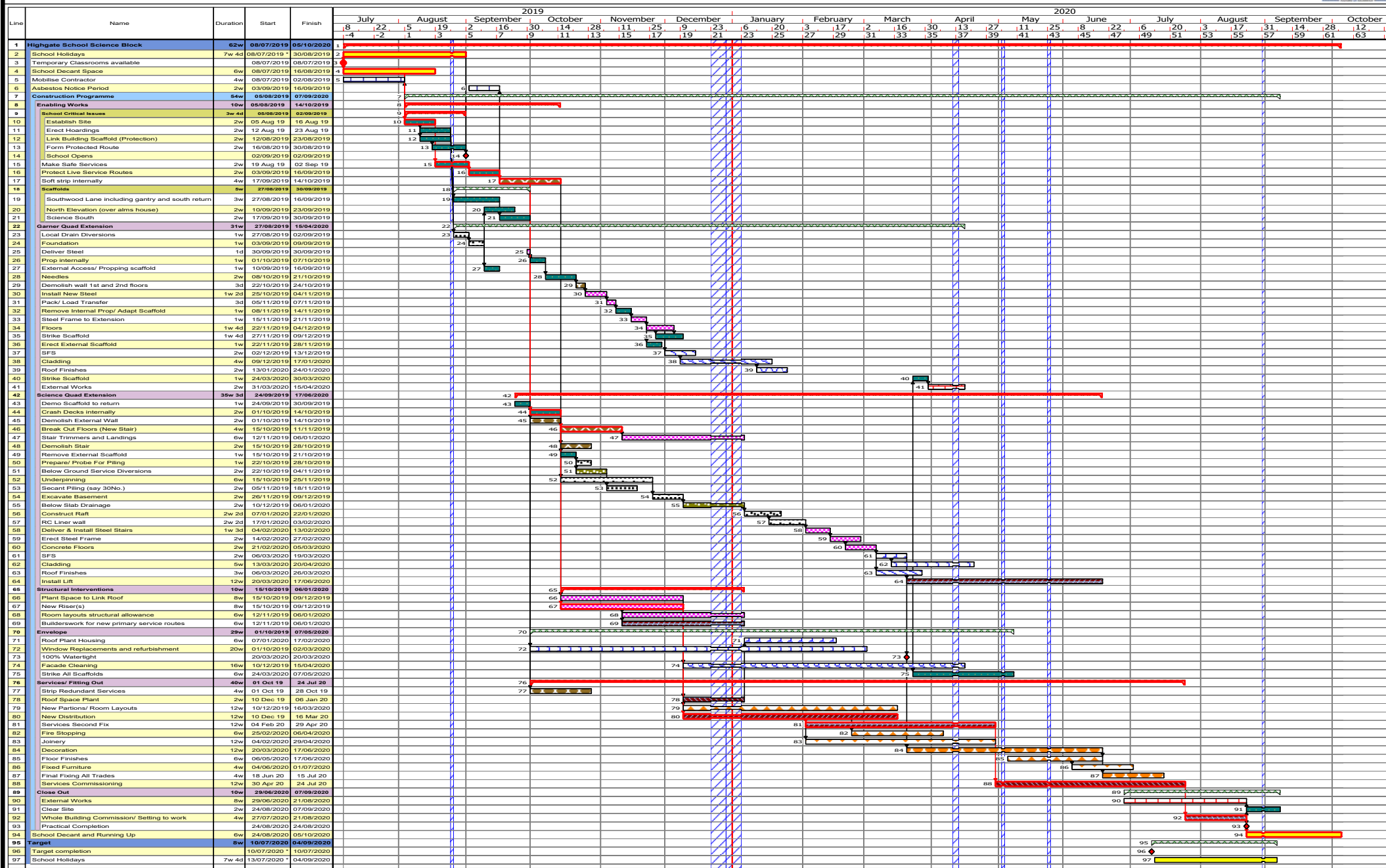
4.1.9 Finals & Handover

We have allowed for a 12 week commissioning period for individual services followed by 4 weeks of whole building testing beyond physical completion of the works to prove and complete the building. This should mean there are minimal if any defects.

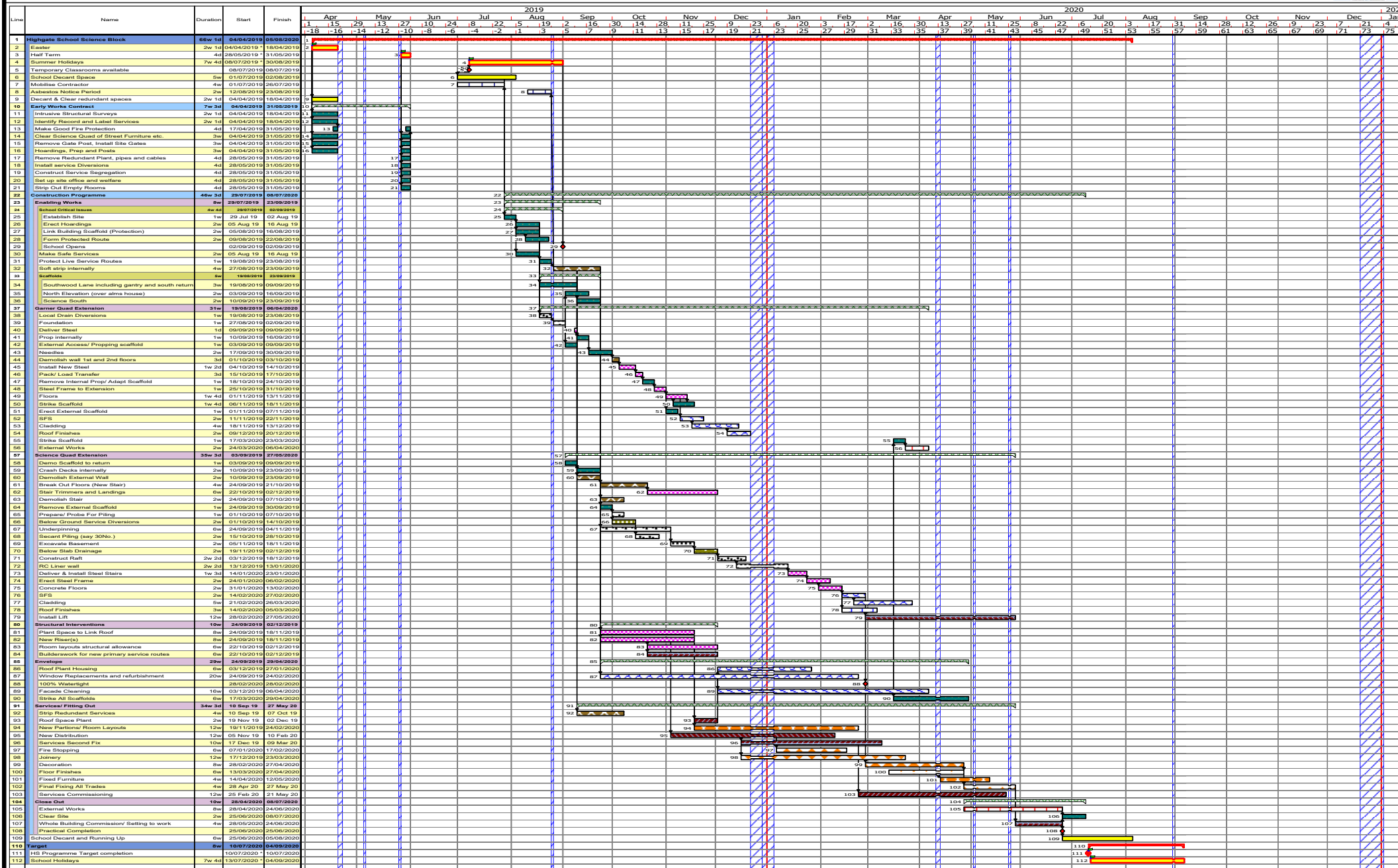
4.2 Programme

Please refer overleaf to the Outline Construction Programme and Target Construction Programme

Highgate School Science Block: Outline Construction Programme

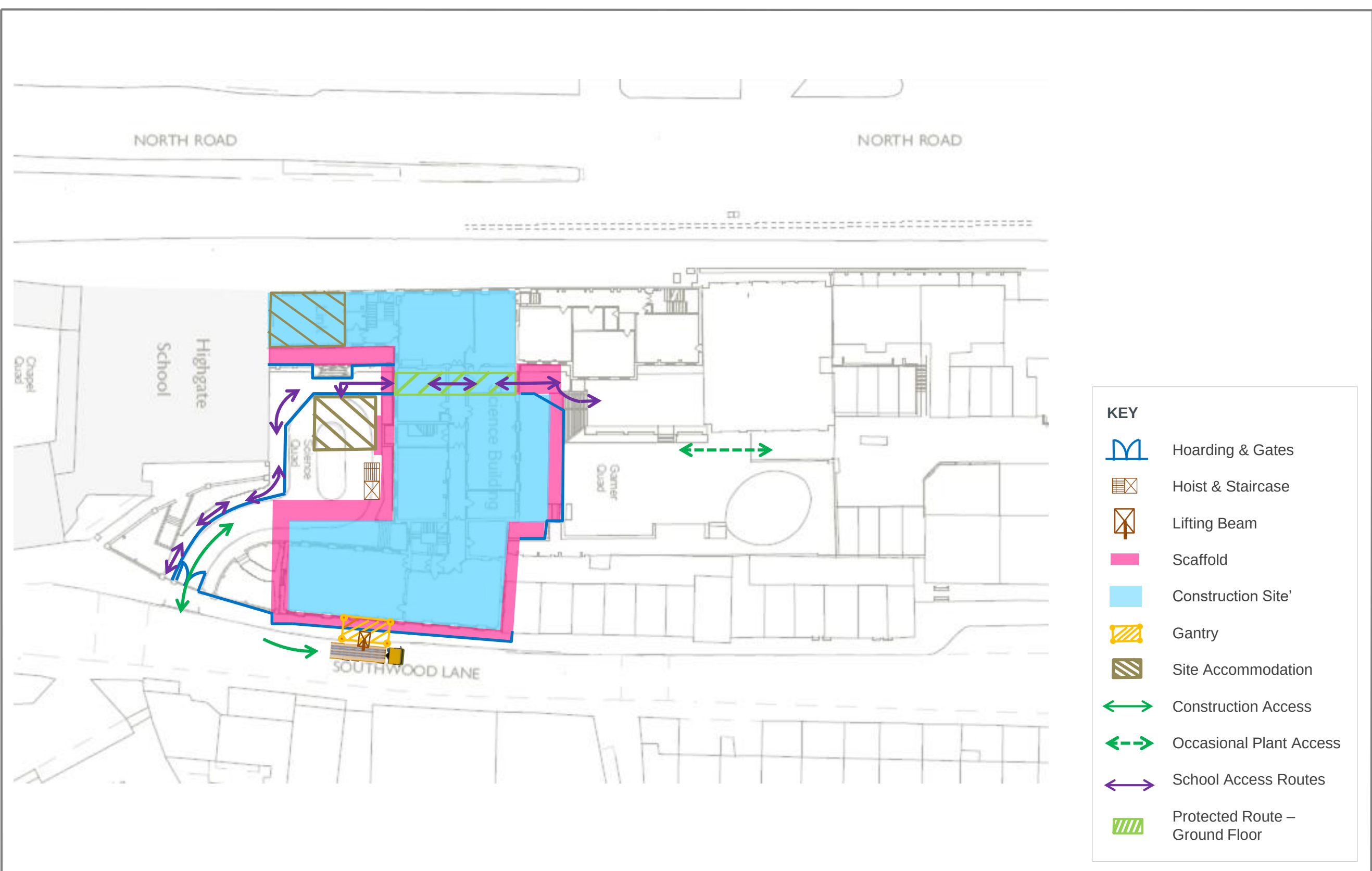


Highgate School Science Block: Target Construction Programme



4.3 Site Logistics Drawing

Please refer overleaf.



KEY

-  Hoarding & Gates
-  Hoist & Staircase
-  Lifting Beam
-  Scaffold
-  Construction Site
-  Gantry
-  Site Accommodation
-  Construction Access
-  Occasional Plant Access
-  School Access Routes
-  Protected Route – Ground Floor

 PROJECT: Highgate School Science Project CLIENT: Highgate School Estate TITLE: Logistics Plan		DRAWING NO.: REVISION NO. & DATE:	BSB-HS-001 Rev 0 – 10/07/2018 Copyright © 2018 Blue Sky Building
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