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Isleworth & Syon School for Boys Strategic Master Plan

December 2012

Contents

1. Introduction

Masterplan Process

1.1 Masterplan process

In July 2012 USP were commissioned by Isleworth and Syon School for Boys in Hounslow to carry out a strategic masterplan for the school buildings and associated grounds. The following issues have been investigated and addressed for the client:

- define a Project Brief
- scope for increasing student capacity
- identify development opportunities
- carry out condition survey on existing facilities
- map correlation between current area provision and the BB98 and recent DfE guidelines
- key influences, from site and greater context
- prepare a phased plan of works
- provide outline costing

Isleworth and Syon is a state funded non-denominational secondary school with a population of 1050 students including the sixth form and approximately 115 members of staff. In March 2012 the school became an academy.

This document presents the work carried out and includes key historical and contextual data, analysis and a design proposal for both the buildings and the public realm. The proposals are carried out in phased steps but the adopted sequence is only one possibility. The application of these proposals can take many different forms. The document is a guide for development and refurbishment with the design proposals in outline form. Further detailed design work will be necessary prior to any actual construction.

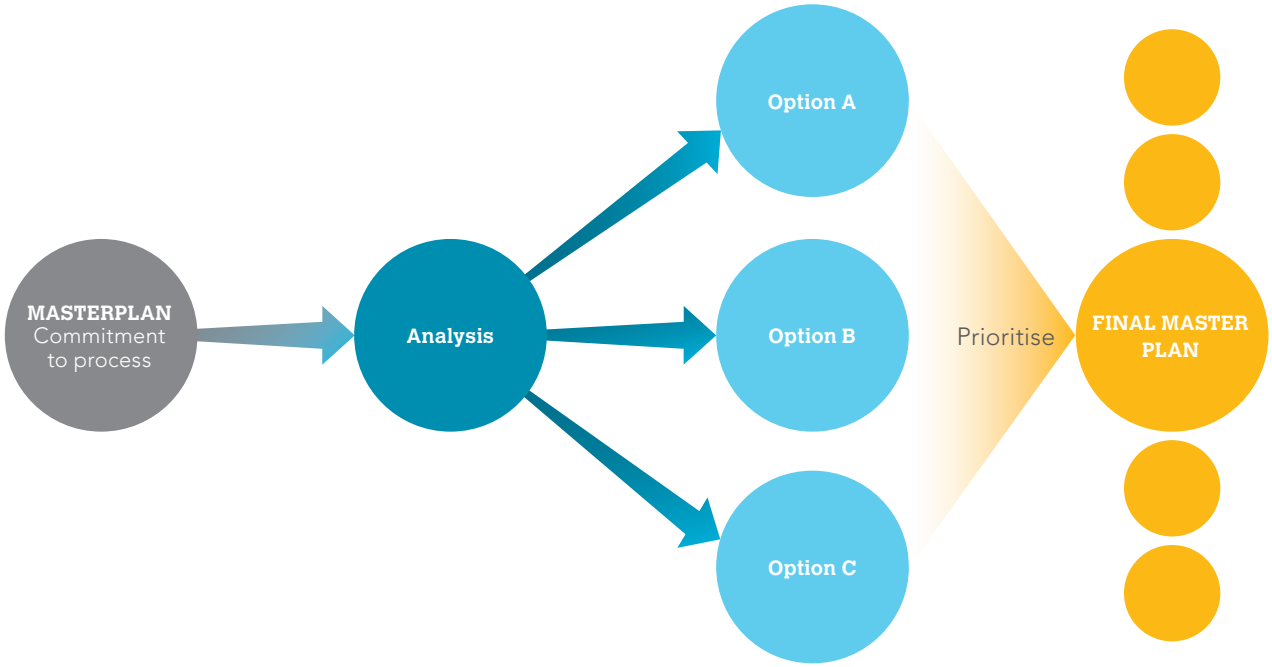
The masterplan 'product' includes both the process and proposals

- upfront strategic thinking in order to set out an approach to development over subsequent years
- clear understanding of the planning context – both in terms of local plans and government policy and planning guidance
- the clients' circumstances – masterplanning is a fluid process that goes through several stages and should be flexible and adjust to any variation in circumstances.

It is best to use the Masterplan report as a live document that informs and guides decision making in terms of development, expansion and improvements. It is specific to the local context, the school buildings and the site and not to a specific curriculum or governing mindset. This ensures that the report has a long and useful life.

The diagram below highlights the process and summarises it as follows:

- client commitment and dedication to the process
- form a clear Project Brief outlining goals and needs
- analysis by the design team
- preparation of options
- testing and review
- prioritising towards a Final Masterplan
- understanding that the final proposal is also flexible and open to interpretation and change



2. Executive Summary

Masterplan Design Proposal

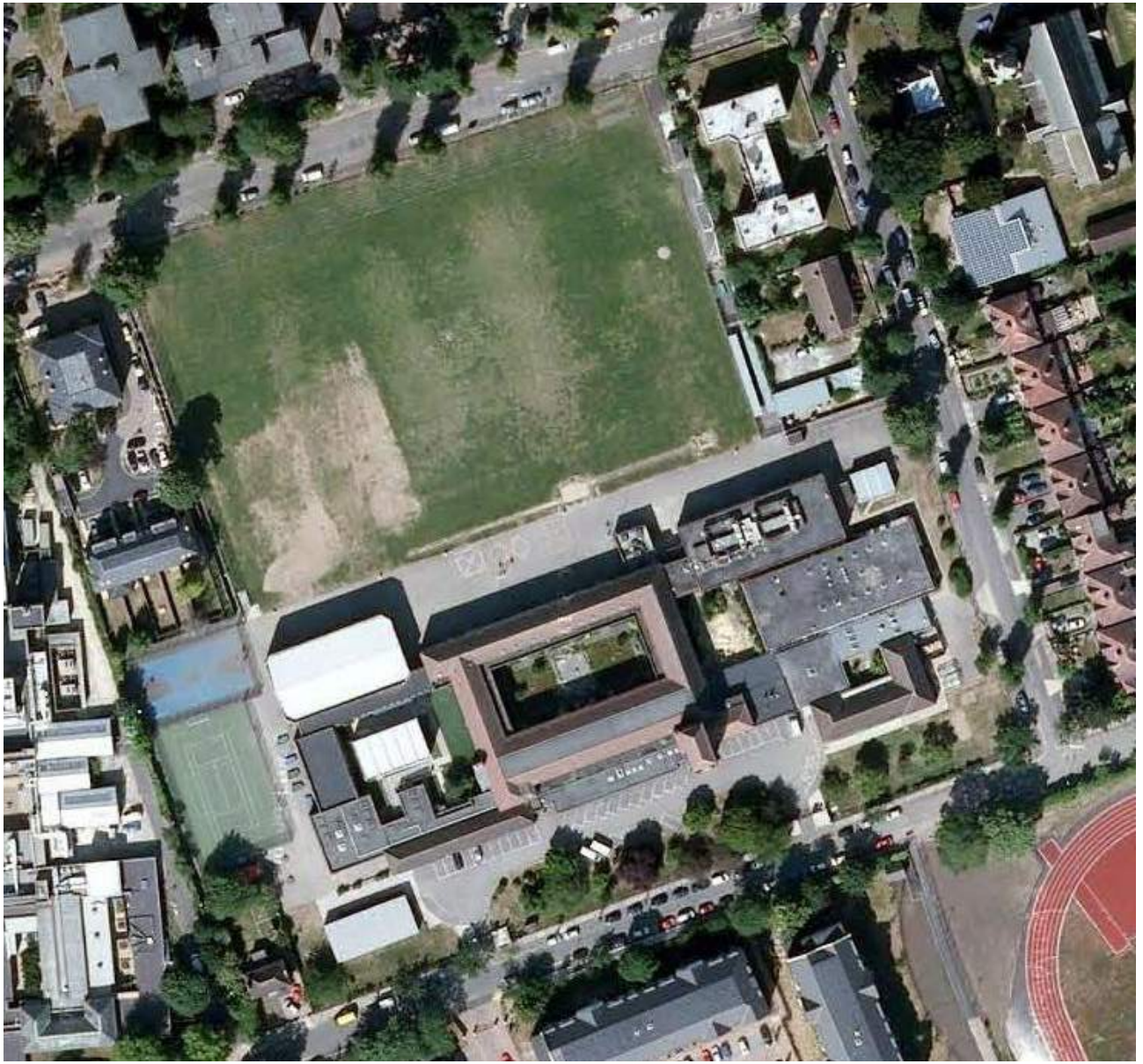
2.1 The Final Masterplan

This chapter contains a summary of the design proposal. The basis behind the proposal including research, analysis, investigation and detailed design is contained within the rest of the document.

The key themes that have informed the design proposals and the masterplan are as follows:

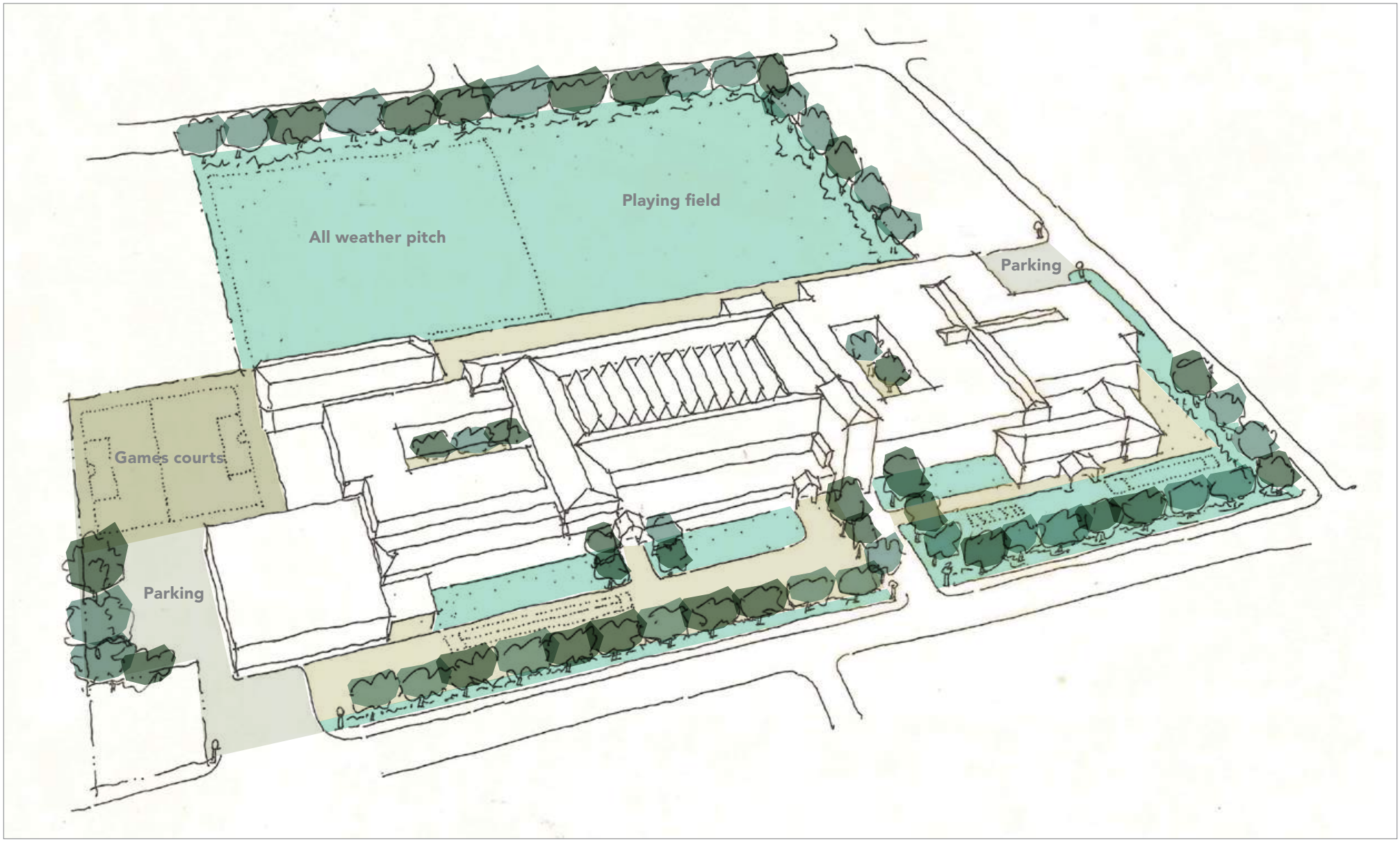
- supporting and enriching an already very successful, active and lively school
- embracing the spirit of the school which is one that balances tradition and academic performance with forward thinking and enthusiasm for the arts, science and sport
- recognising those areas of the school that have value and ensuring any development reinforces this
- respecting the historical building fabric and the contribution the landmark tower and school frontage bring to the community and the Spring Grove Conservation Area
- acknowledging that the student population is likely to grow and identifying ways for the school to expand
- but also recognising that students numbers may fluctuate over the years so ensuring a good level of flexibility in the facilities so that different uses can be accommodate over time
- recognising the schools sporting success and ensuring the correct facilities are in place to nurture this, especially in the context of the Olympic legacy and the Hounslow Statement on Sport , Health and Well Being
- reinforcing the relationship with the greater community
- being environmentally aware and responsible and adopting good sustainable practice wherever possible

On the following pages the phased development of the building improvements and expansion are mapped in a series of axonometric views. This demonstrates a possible sequence but the design work assumes a flexibility in how the masterplan may unfold as circumstances evolve and change.

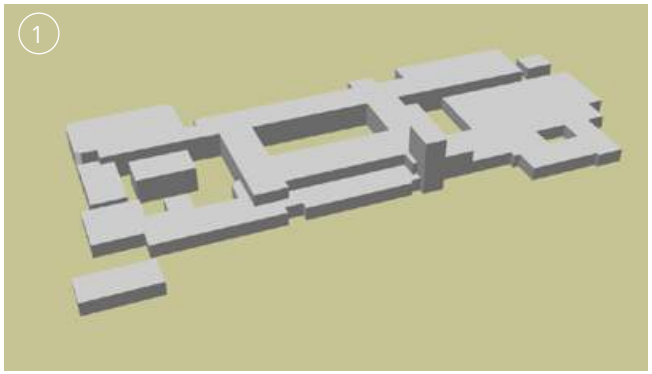


Aerial photograph of the existing condition

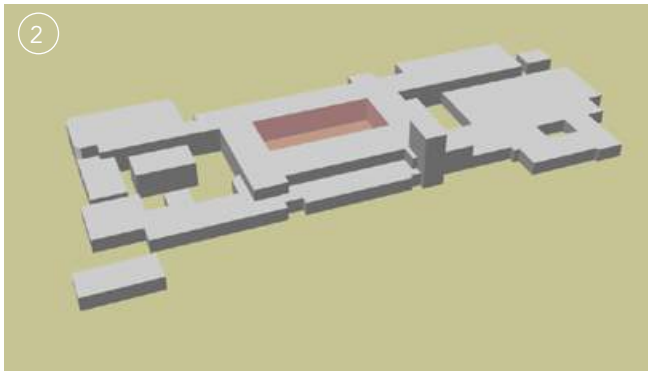
Aerial sketch view of the masterplan scheme



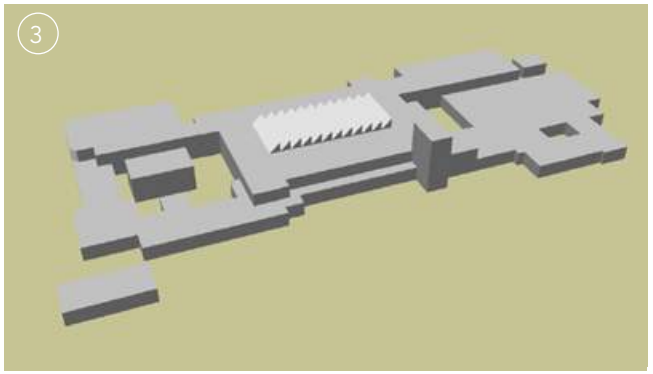
2.2 Phased design proposal



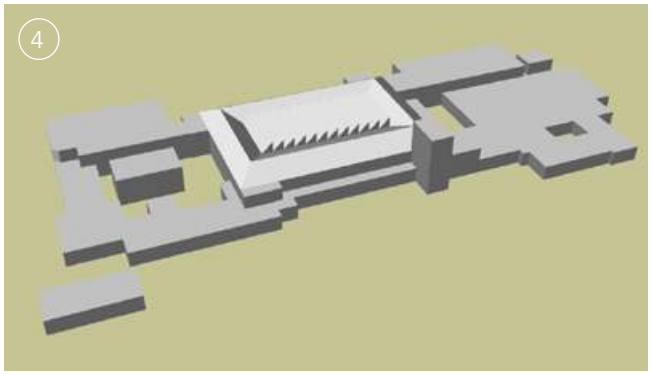
Existing condition



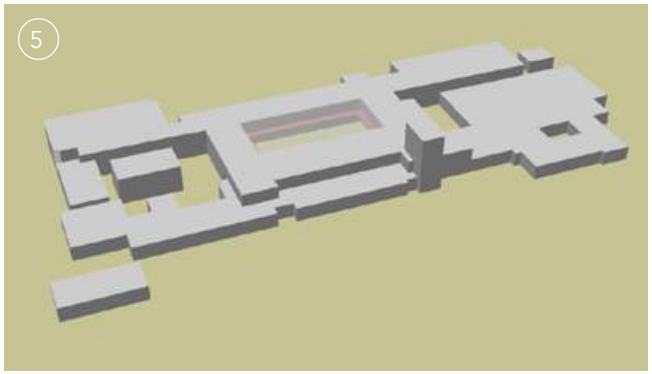
Phase A1, Enclosure for the courtyard



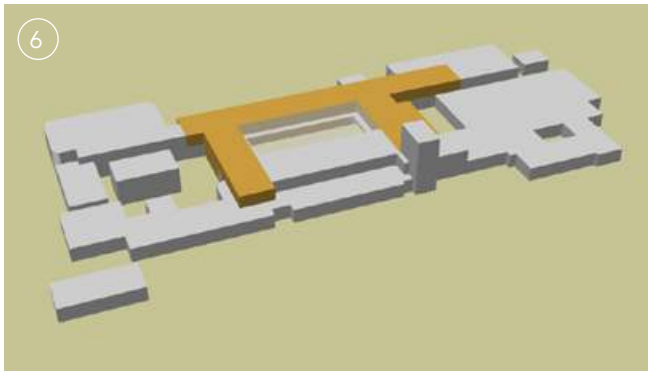
Detail design of the roof



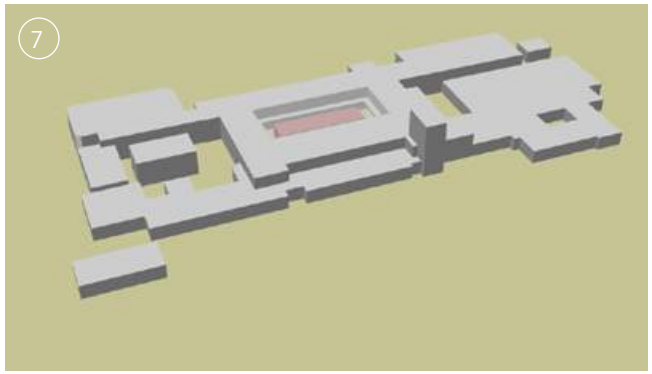
Integration with the existing roof mass



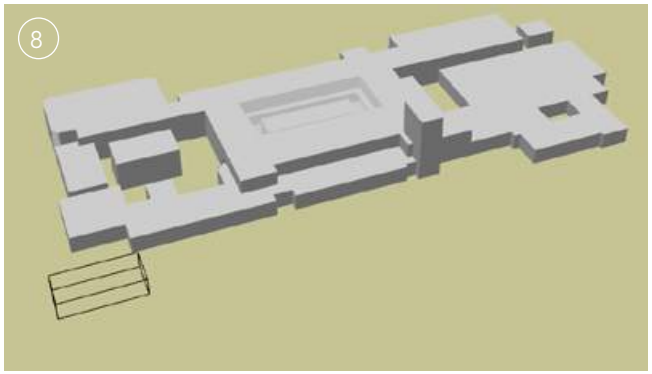
Phase A2, Shift circulation into new covered courtyard



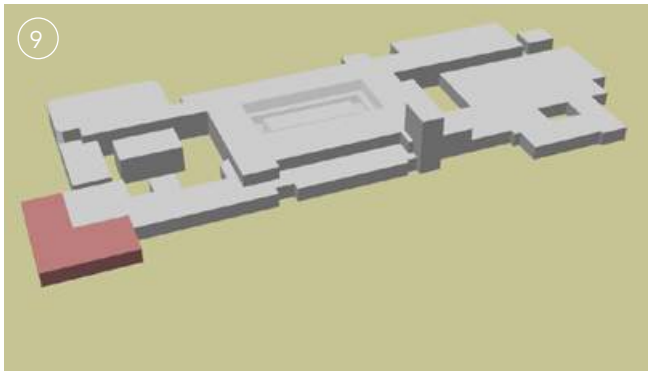
Phase A3, Refurbish adjacent classrooms and spaces to increase size



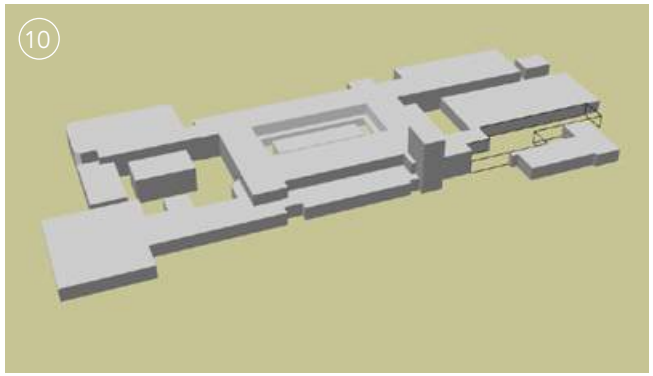
Phase A4, Build new classrooms in central void



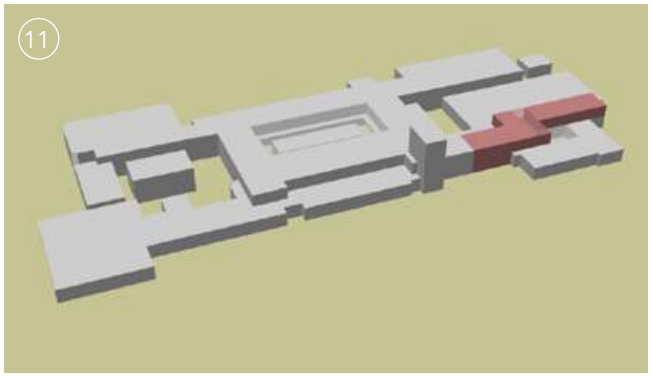
Phase B1, Demolish temporary building



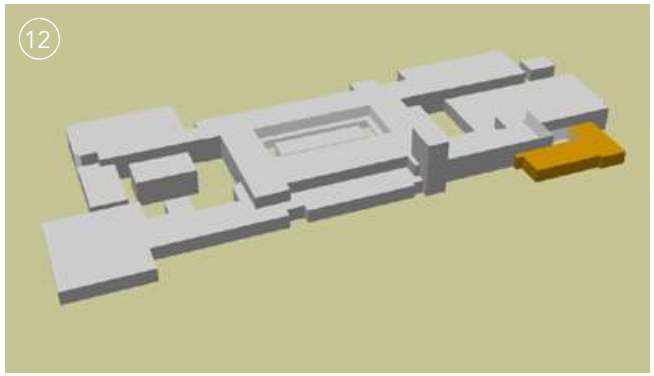
Phase B2, Construct new Dining and Catering



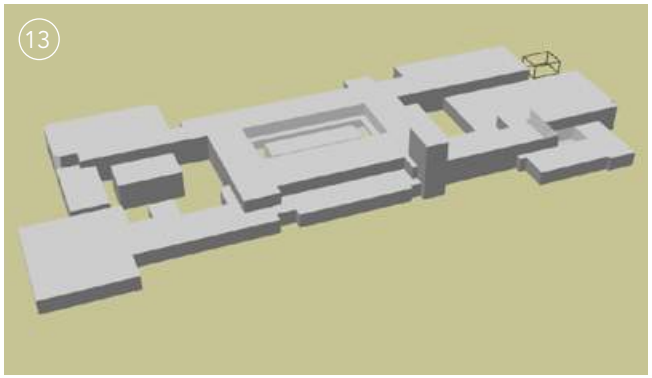
Phase C1. Demolish existing Dining and Catering



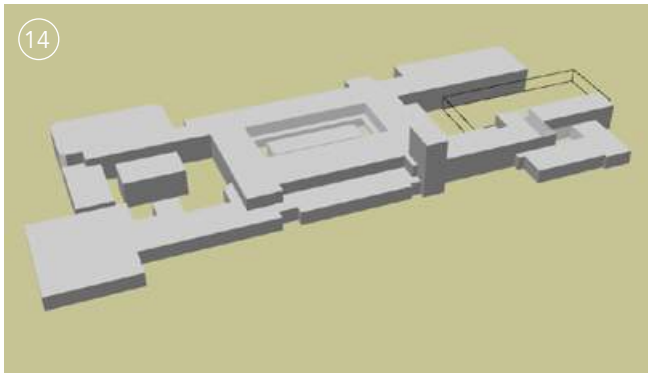
Phase C2, Construct new 2 storey wing for Performing Arts and enclose



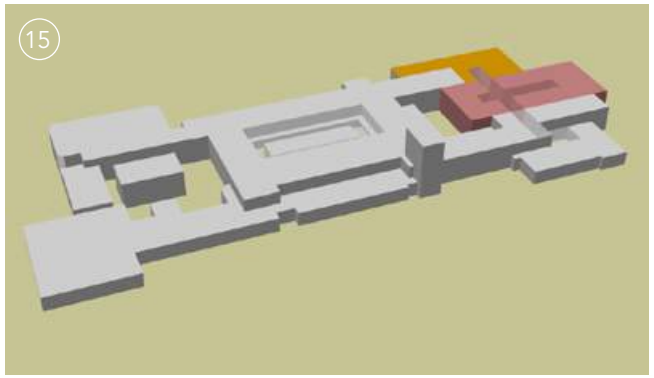
Phase C3, Refurbish existing wing



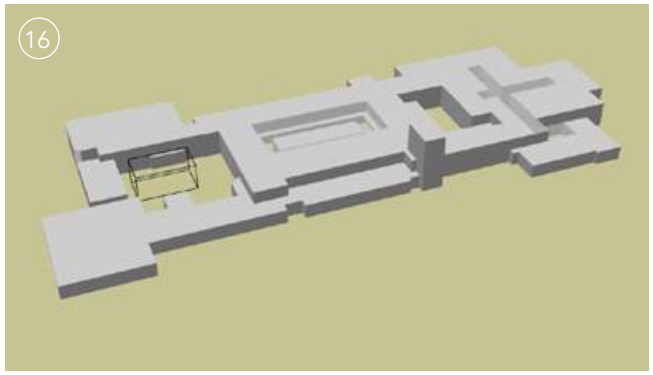
Phase D1, Demolish temporary building



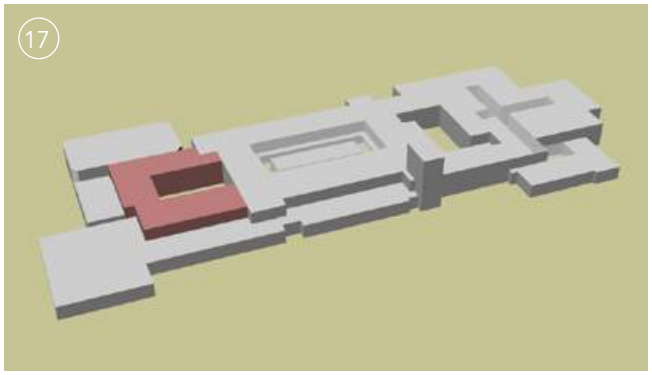
Phase D2, Demolish existing Arts and D+T



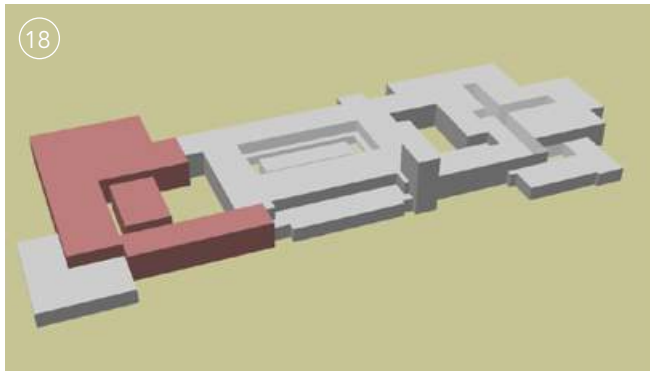
Phase D3, New 2 storey wing for Arts, D+T & classrooms. Refurbish rear wing



Phase E1, Demolish existing temporary building

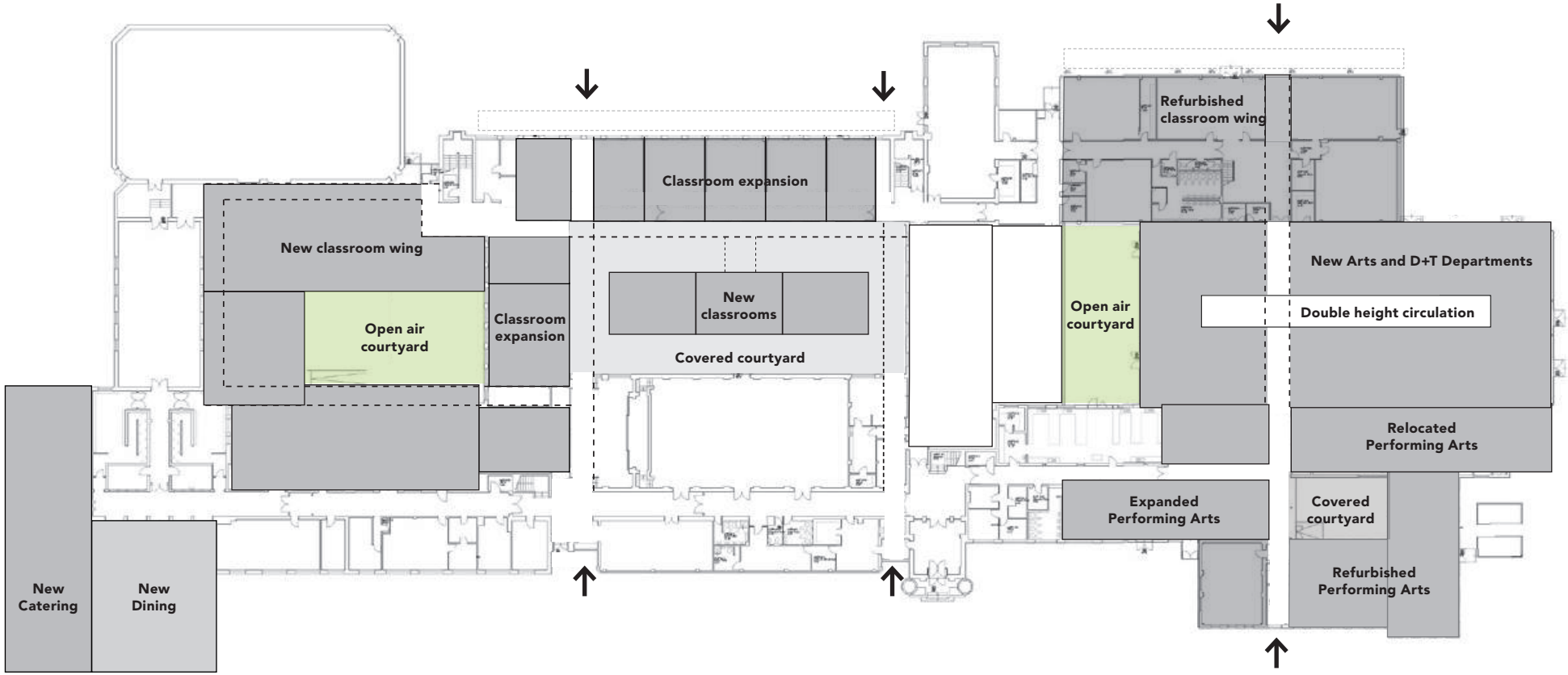


Phase E2, Construct new 2 storey wing for Sports & classrooms

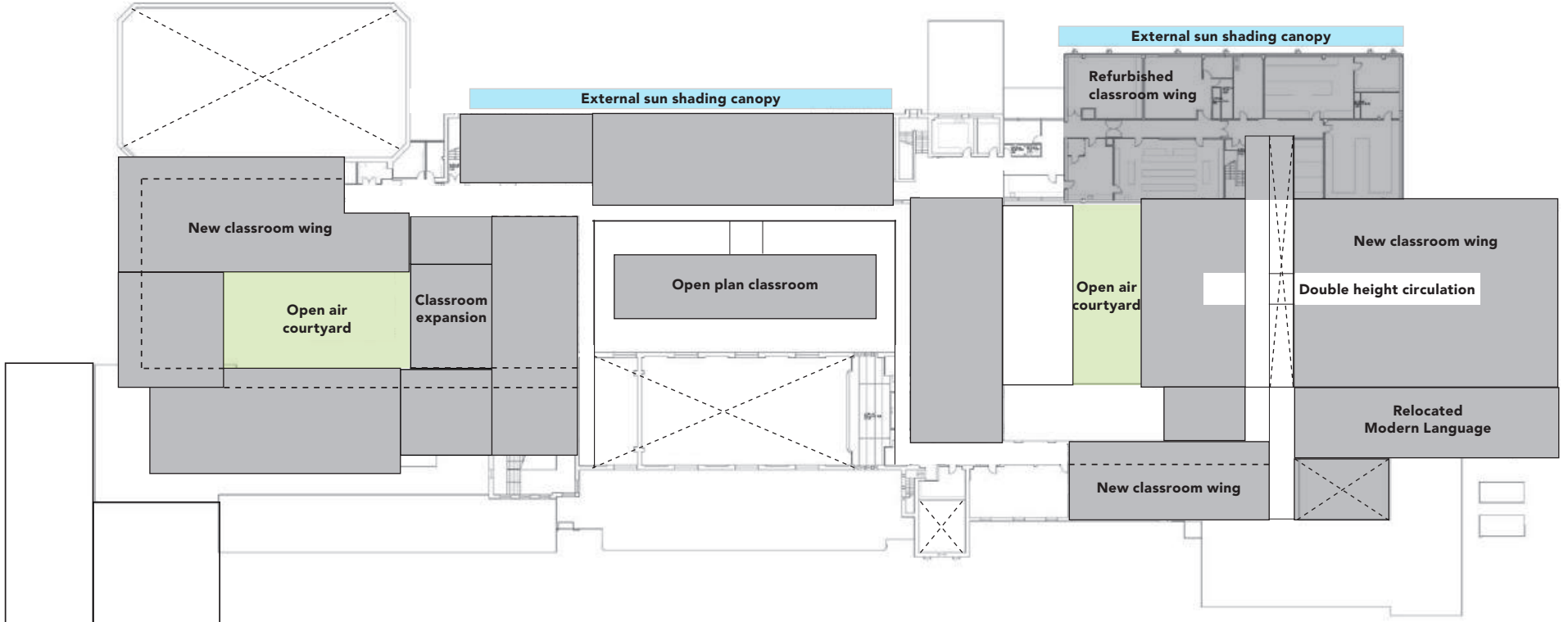


Phase E3, New 2 storey mega block for Sports Hall, PE wing and classrooms

2.3 Ground Floor, Masterplan Phase E1



First Floor, Masterplan Phase E1



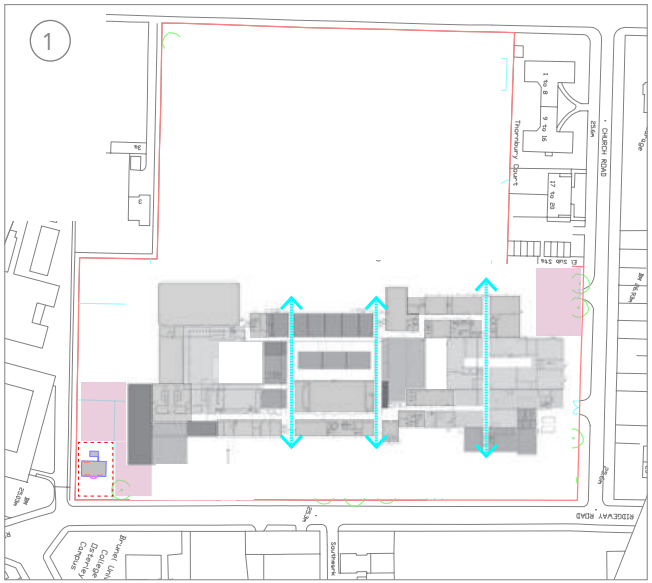
2.4 Landscape and the public realm

During the workshop with the school children it was clear that the students understood the benefits of fresh air and exercise, both on their personal well being and health but also on their ability to concentrate and perform in the classroom. The opportunities for outdoor play and 'letting off steam' were very high priorities for the students and they would take these chances whatever the weather.

This outlook is very much aligned with current government policy, DfE education approach and the local borough of Hounslow who have recently published a document highlighting the local problem.

The primary goals of the masterplan for the outdoor areas:

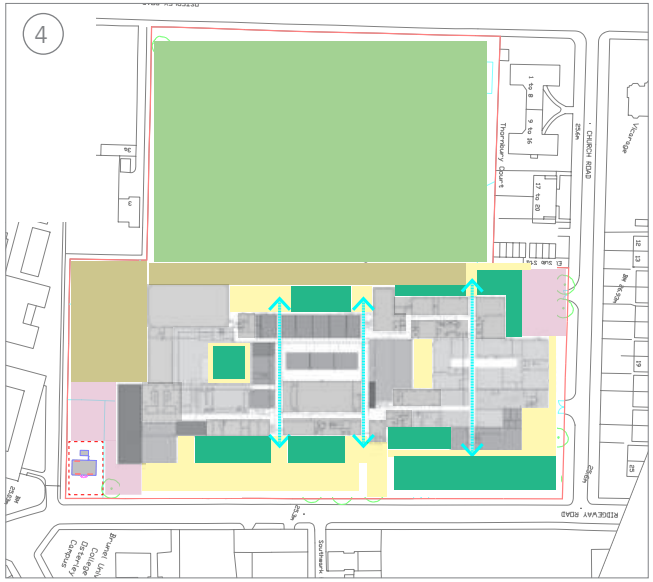
- reduce the areas for vehicle traffic and parking
- protect building fabric by shifting active ball games
- provide a wide variety of outdoor activities, from very active to calm and contemplative
- address under utilised and 'leftover' areas
- embrace environmental practices, habitat and ecology



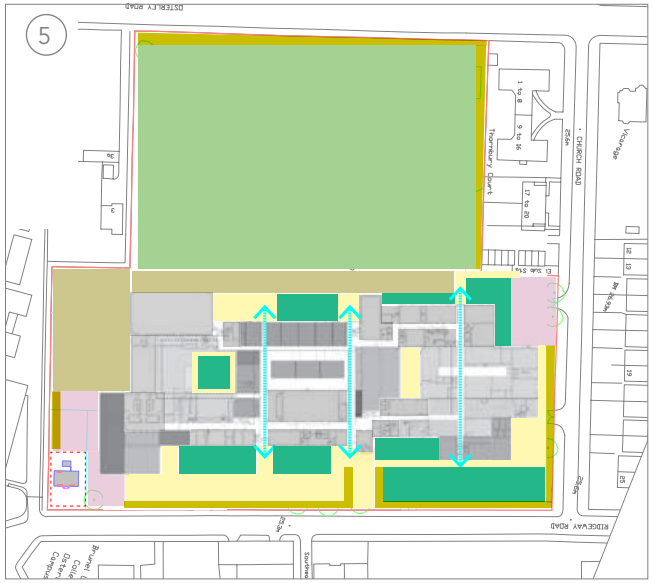
Access, parking and entrance/movement through school buildings

Playing fields

Hard and soft informal play areas

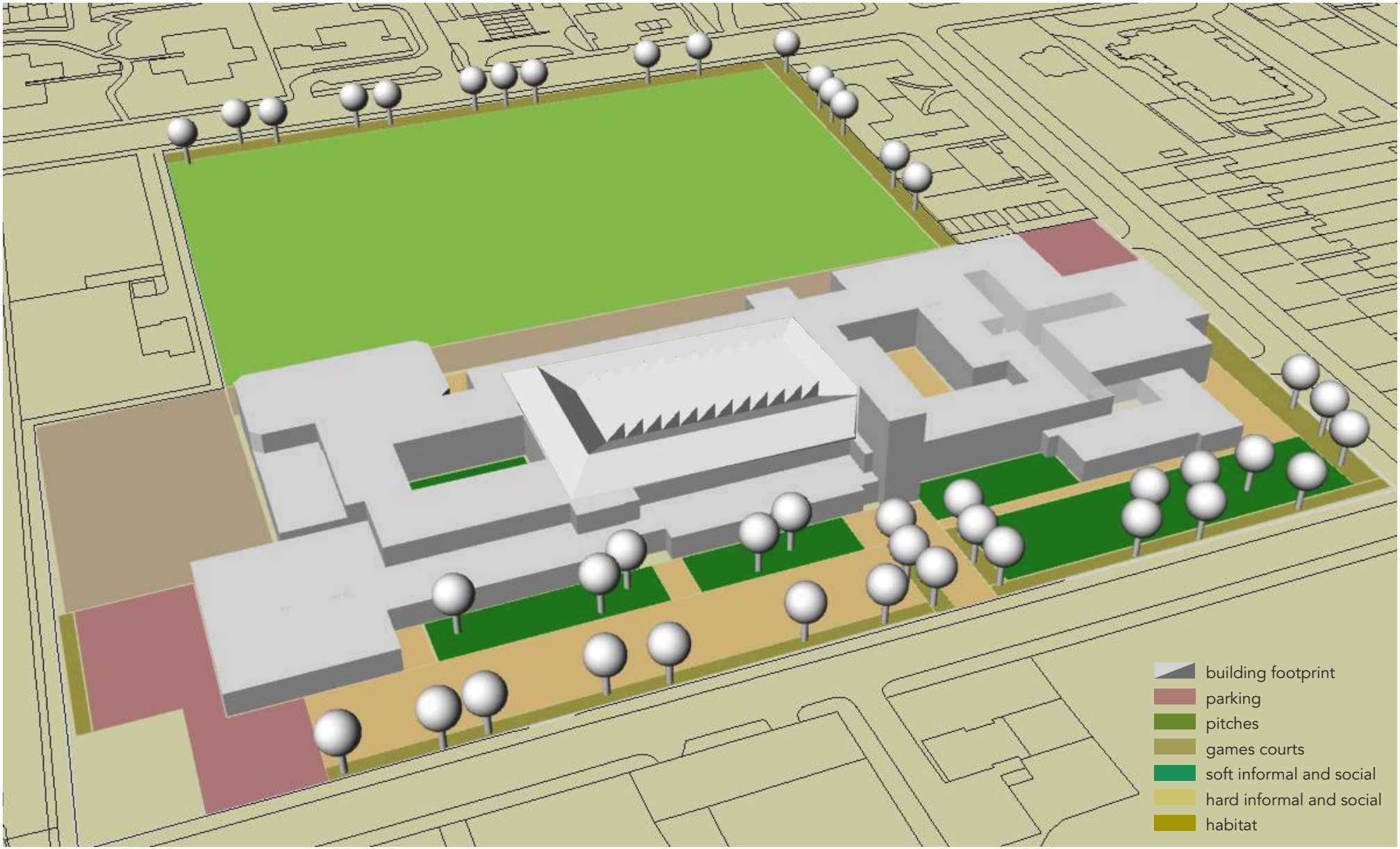


Games courts



Habitat around the perimeter

Aerial view with landscape proposal



3. Context and Setting

3.1 The site & surrounding area

Site Overview

Isleworth and Syon School is located in the London Borough of Hounslow near the A4 just south of Osterley Park. The site is located in a predominately residential area and is situated between Ridgeway Road and Osterley Road. A closely linked collection of buildings spread north to south across the site with the primary frontage and entrance onto Ridgeway Road with a large playing field and all weather pitch to the Osterley Road side of the site. Access to the school is from Ridgeway Road and the site lies within the Spring Grove Conservation Area (designated in 2002).

The main school building is a brick construction completed in 1939. An arts and technology block was added in the 1970s, and some temporary hut-type classrooms were added as recently as about 18-months ago.
The total gross internal area of the school comprises approximately 8,500m^2.

In addition to the main site there is also an off-site sports ground with changing rooms referred to as Busch Corner.

The turf area located on the western side of the site is designated as a Local Open Space in the Unitary Development Plan (UDP).

The area surrounding the site is primarily residential. A public footpath adjoins the south boundary of the school site.

Site Location

Islington & Syon School

Ridgeway Road
Isleworth
Middlesex
TW7 5LJ

Aerial view of the school

Views of the school buildings and grounds

3.2 Planning Issues

Planning and Context

The Isleworth & Syon School site is zoned for D1 Education use and is located within the Spring Grove Conservation Area, designated in April 2002.

Planning History

There are numerous planning application decision records held by The London Borough of Hounslow Council relating to the site. Details of applications received since January 1991 are available using a Planning Search facility on the Council website.
Key considerations when approaching planning consent will be the conservation area, the value of the historical buildings on the site, and consultation with neighbouring residents.

Planning Policy

The planning policy framework for the site is formed by policies at national, regional and local levels. This section provides an overview of relevant local (London Borough of Hounslow) policies for the current Isleworth and Syon School for Boys site. This mainly comprises consideration of the Council's Unitary Development Plan (UDP) with Supplementary Planning Guidance related to Conservation Area Character Appraisals.

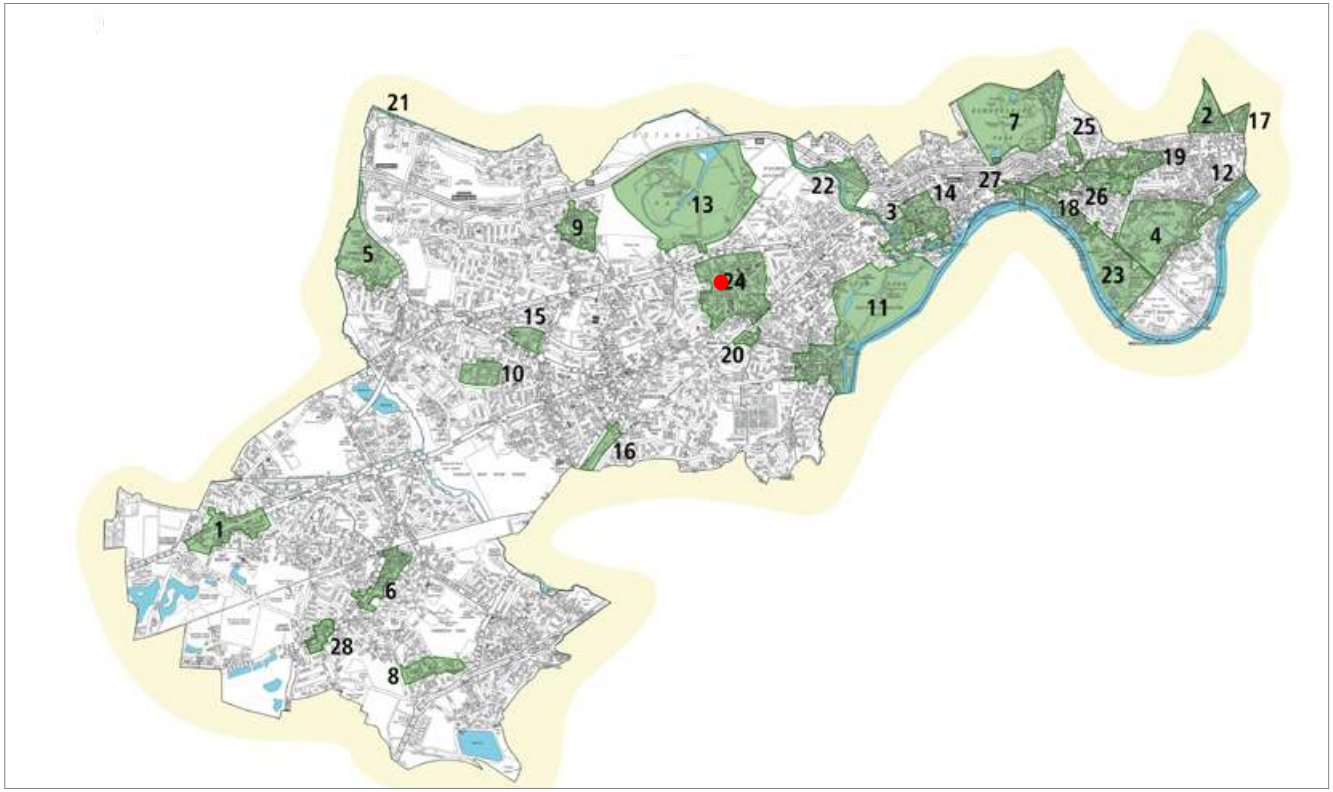
Unitary Development Plan (UDP)

The UDP for the Borough was adopted in 2003. Key planning considerations related to Policy, Transport, Development and other issues across the Council are summarised in a series of UPD maps made available by the Council.

The following comments are relevant to the school site in relation to the UPD maps:

Viewpoints and Landmarks

Viewpoints: The nearest protected viewpoint is located at a distance of approximately 1km from the site.



London Borough of Hounslow - Map of Concervation Areas

Landmarks: Landmark reference 'G' is local to the site.

Archaeological Priority Areas

The site is not located in an archaeological priority area. The nearest priority area is located over 1km away from the site.

Publicly Accessible Open Space Deficiency

The site is located within an 'Area of Publicly Accessible Open Space Deficiency'

Green Chain and Corridors

The site is not located with/along a Green Chain or Corridor.

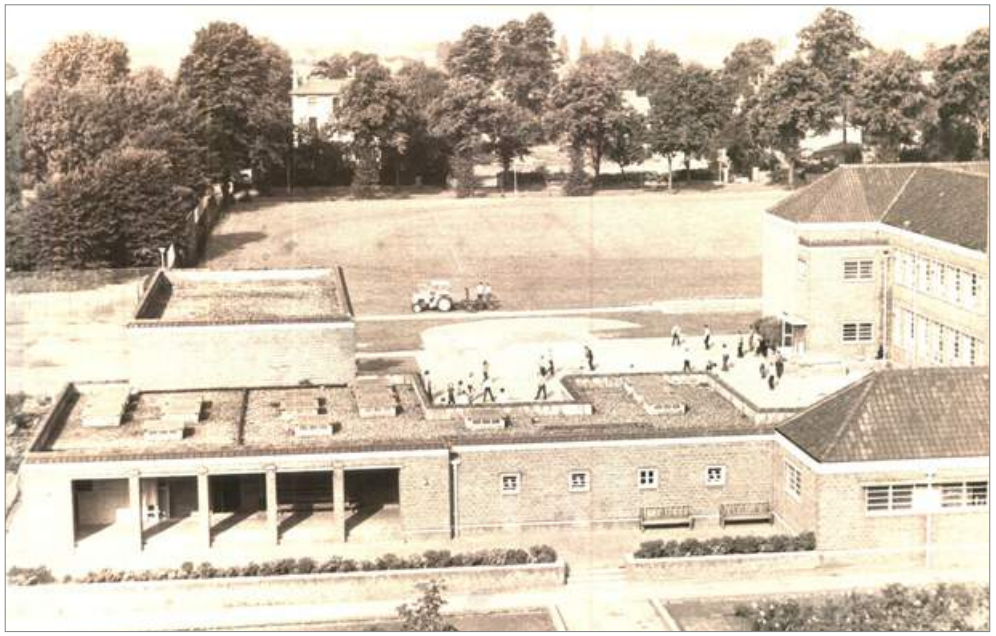
Waterways and Areas of Flooding

The site is not located in an area of flooding or near local waterways.

London Cycle Network

Church Road and Ridgeway Road adjacent to the site form part of the existing London Cycle Network.

3.3 Historical setting and the Spring Grove Conservation Area



Considerations and effects

A conservation area is described as an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.

The main effects of the designation of a Conservation Area:

1. Conservation Area Consent is required for the total or substantial demolition of all unlisted buildings (other than excepted buildings) in the area.
2. Permitted development rights under the Town and Country Planning (General Permitted Development Order 1995, are more restricted within the Conservation Area.
3. Trees within the Conservation Area are given special protection. It is an offence to cut down, lop top or uproot a tree, subject to certain exceptions, within the Conservation Area without giving at least 6 weeks' notice of intent in writing to the local planning authority.
4. Planning applications for development which would, in the opinion of the local planning authority, affect the character or appearance of the Conservation Area must be given publicity, and representations received as a result of the publicity must be taken into account in determining the application.
5. The local planning authority must in the exercise of its planning functions pay special attention to the desirability of preserving or enhancing the character or appearance of the Conservation Area.
6. It is the duty of the local planning authority from time to time to formulate and publish proposals for the reservation and enhancement of the Conservation Area.

A Residents Association exists that actually pre dates the formation of the conservation area. It is advisable that this group be consulted when considering any major development work. It is best to consult during the design process and engage the local expertise where possible.

SGRA, Spring Grove Residents Association

http://www.sgra-isleworth.org/conserv.html

Middlesex County Council constructed the Isleworth and Syon Boys' School in 1936-8. It has one and two storey ranges dominated by a powerful tower, with a more progressive tall, curved staircase window, a feature of the period and a worthy addition to the Estate.

4. The Masterplan Brief, Detail and Analysis

Workshop Data + Feedback

4.1 Workshop Input

The Client Need

The daily end users of any facility are a valuable resource for input and guidance on what works and doesn't work in a building and they can often also offer beneficial insight into the spirit and meaning of a place.

Very early on in the process the design team held a collection of workshops with the staff and students. After an initial presentation and explanation of the masterplan process three focus groups were formed. These groups were comprised of staff, year 6 and years 4 + 5.

The feedback received was translated into the Project Brief and has informed every decision made in the masterplan design proposal. Key themes and concerns are as follows:

- lack of social space
- need for fresh identity
- poor dining and catering
- congested circulation
- poor air quality and over heating in classrooms
- a passion for sport and the All Weather Pitch
- excellent understanding of the benefits of a good balance between active learning and more traditional study
- passion and belief in the school
- desire for departments to be clustered
- interest in new formats for teaching
- strong support for outdoor learning

Certainly one of the strongest messages received from the staff and students was a love of the outdoors. This was a twofold comment in that they all flourished with the benefits of exercise and fresh air but the desire for 'escape' was largely due to the high complaints about the internal climate. Stuffy, hot, overcrowded and poorly lit classrooms were a dominant concern.

Workshop with teaching staff and students, July 2012

4.2 Determining the Project Brief

Project Brief

A clear and robust project brief is key to the success of any project and design exercise. In the case of a masterplan the brief may comprise goals and themes as well as specific needs.

There have been three primary contributors to the key themes for Isleworth and Syon as follows:

- lengthy discussions with Euan Ferguson, Headteacher and the leadership team
- workshops with staff and students
- design team observations and analysis

There are very strong common themes which have enabled a clear set of goals to be established. The goals are general enough in nature that they will stand the test of time and ensure a long life and a robust guide for development.

The goals are described in more detail in the following pages and then applied and incorporated into the design proposals in Chapter 5.

4.3 An active academy

Isleworth and Syon have a long standing success rate with performance in sport but also have a strong passion for all forms of activity including dance and drama. While the benefits of an active life style are well understood in terms of health and well being, the activity at Isleworth has a direct and positive impact on academic performance as well. The students acknowledge that their concentration improves after a short break for play and that they respond better to coursework when it is varied between energetic and sedate. This may well be more applicable to boys hence an obvious characteristic at this school but in any case, the benefits are multiple:

- health and well being
- confidence and character building
- social opportunities and
- improves focus and academic performance

Spirit and identity

Dance, drama & music

State of the art facilities

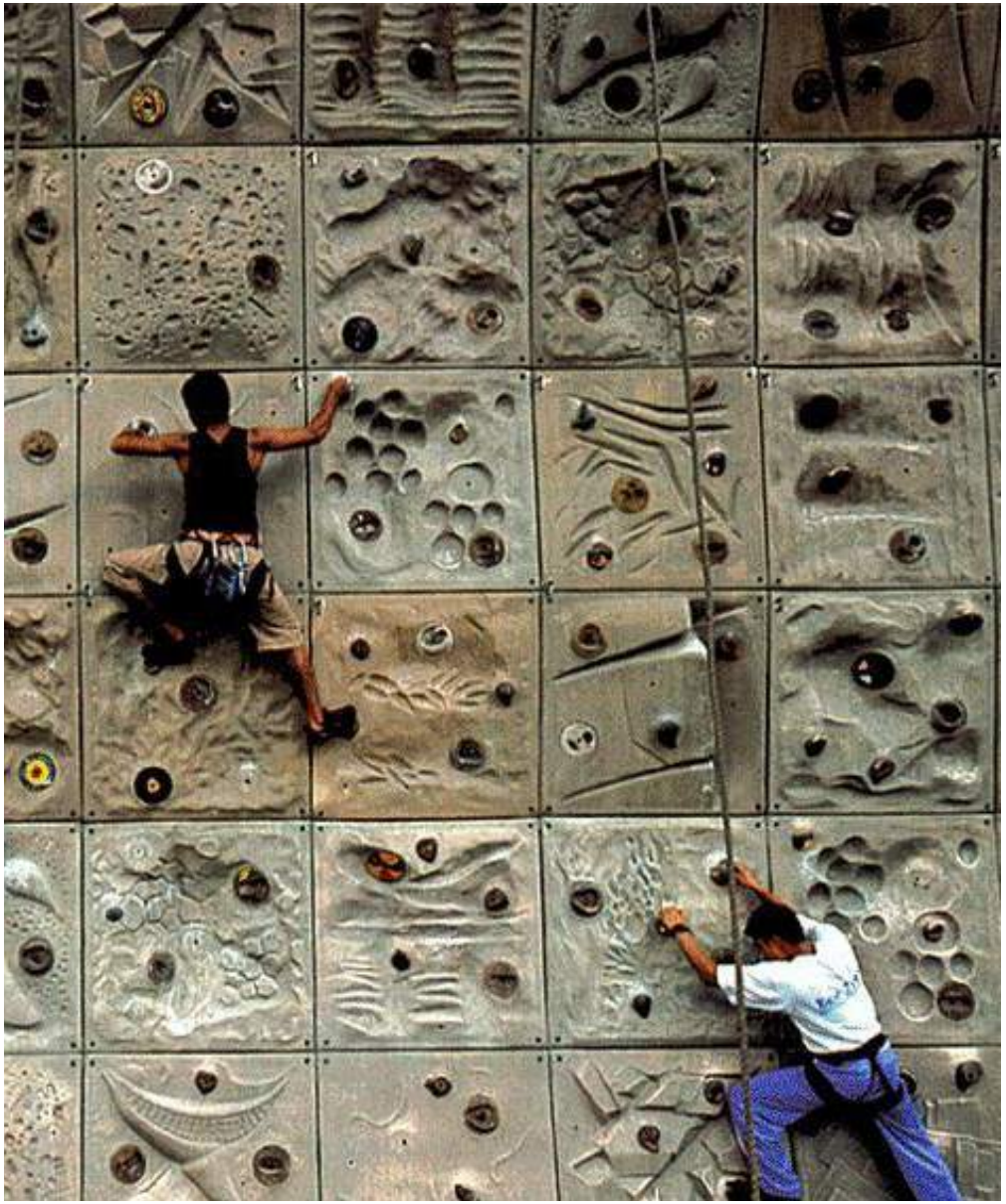
Areas to gather, perform and exhibit at the heart of the school

Opportunities for physical activity through-out

Thinking beyond traditional 'sports'

Relevant Project Themes


2



4.4 Outdoor opportunities

Building on the 'active academy' a large focus area for energetic study and schooling is in the outdoors. During break time, in almost all weathers, the full extent of the school grounds are filled with children partaking in a huge variety of activities ranging from formal games to quiet contemplation and socialising. Different types of spaces exist around the buildings and within the existing courtyards which helps define destinations for children with different needs and desires.

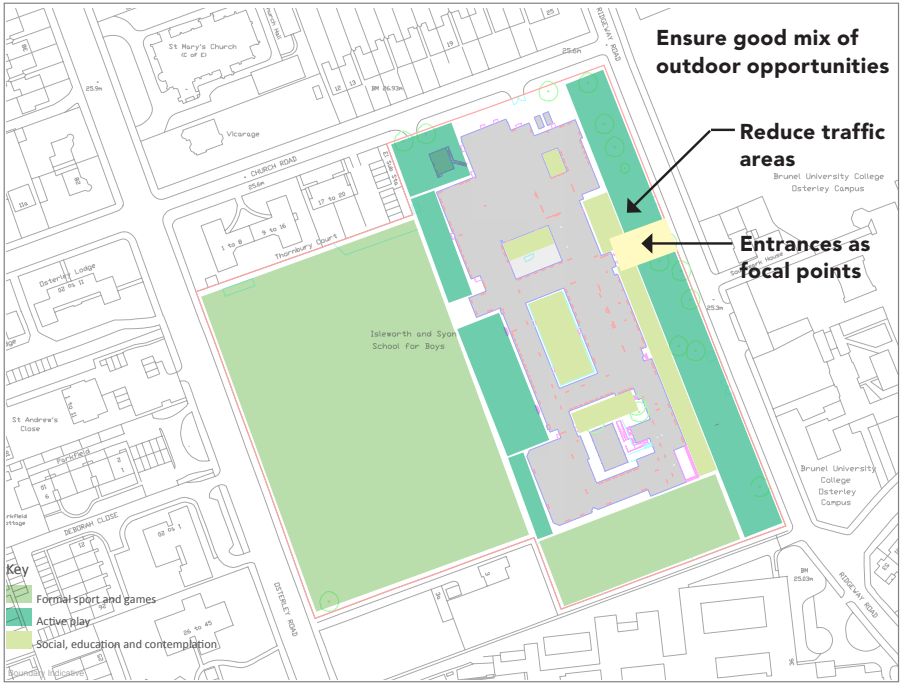
The school site benefits from a very popular All Weather Pitch and large turfed play field. This is complemented by an additional site at Busch Corner. There are fenced games courts, areas of informal hardscape and soft landscaping for socialising and informal play. This is a good range and aligns with the DfE recommendations for school grounds in terms of type.

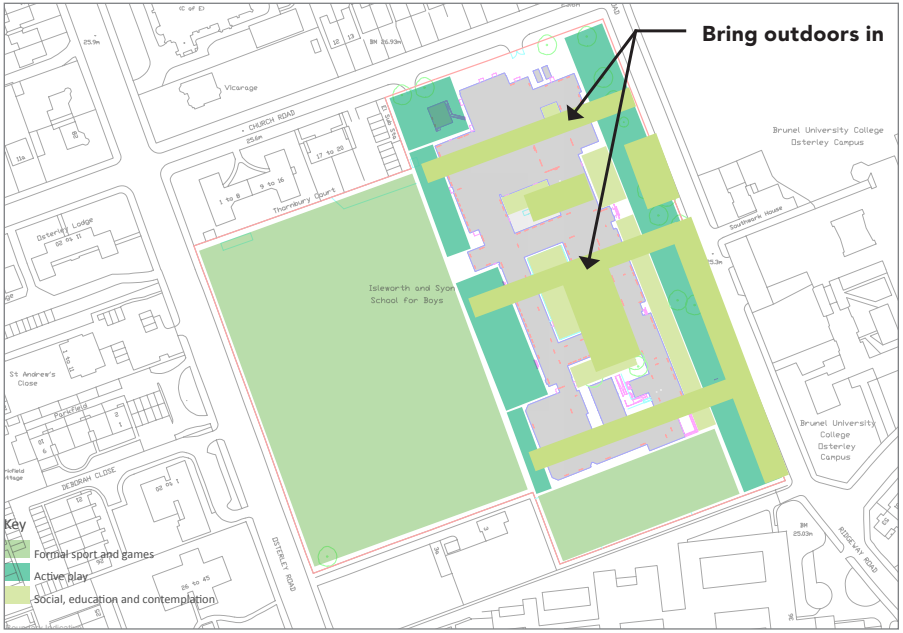
Relevant Project Themes

Traffic corridors not an ideal place for play

Create a variety of outdoor 'rooms'

Image courtesy of John McAslan + Partners Architects





Diagrams identifying key issues to address

4.5 Heritage and the Conservation Area

Key considerations

The conservation area document for Spring Grove highlights a few issues which are directly relevant to the school.

- Original building and tower
- Landscape and Trees
- Context of St Mary's Church

The document describes these issues as follows:

Trees

Some of the streets in Spring Grove were designed as tree lined avenues. These streets retain their now mature trees, which are an important feature of the estate. Mature trees within gardens and private grounds, and in spacious front gardens, are also important to the character of the area.

Relevant Project Themes

Osterley Road

This is one of the most legible and attractive areas in Spring Grove. A wide, level and treelined avenue, it retains its Victorian charm to a degree that later additions go relatively unnoticed. The school on Ridgeway Road is visible, but is an attractive thirties design, and the neat playing field acts a buffer. Part of the northern section of the road was the in the garden to Thornbury House. It would appear that the road was built to provide access from The Grove to St. Mary's Church, which may explain its design location, equidistant from both entrances to The Grove and opposite Spring Grove House.

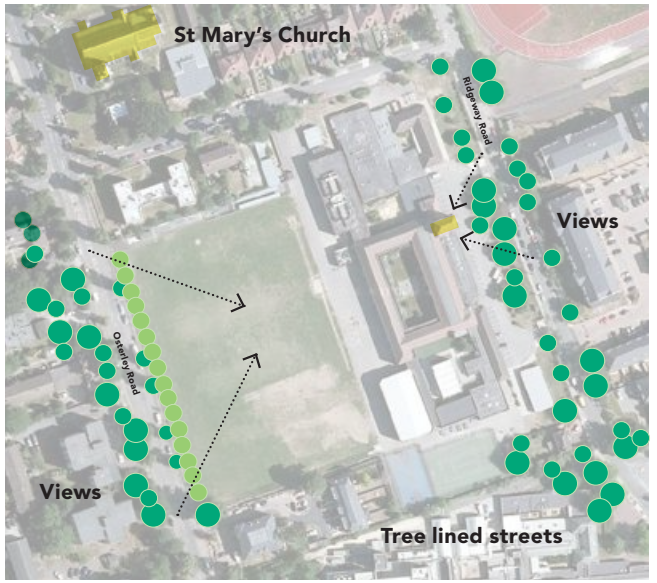
The Church of St. Mary

The church was opened in 1856 and was designed by John Taylor the younger in the decorated style, using stone facing over brick: a new form of construction invented by himself.
The church is large with a nave, chancel and vestries and was designed to take galleries when these should be needed. The two tiers of windows are for this purpose, but the galleries were never built. To the south west of the building stands a combined porch and tower surrounded by a full broad spire. Davies paid for the church and was its patron for many years. It is a landmark within the area and the spire can be seen from long distances away.

Ridgeway Road and the School

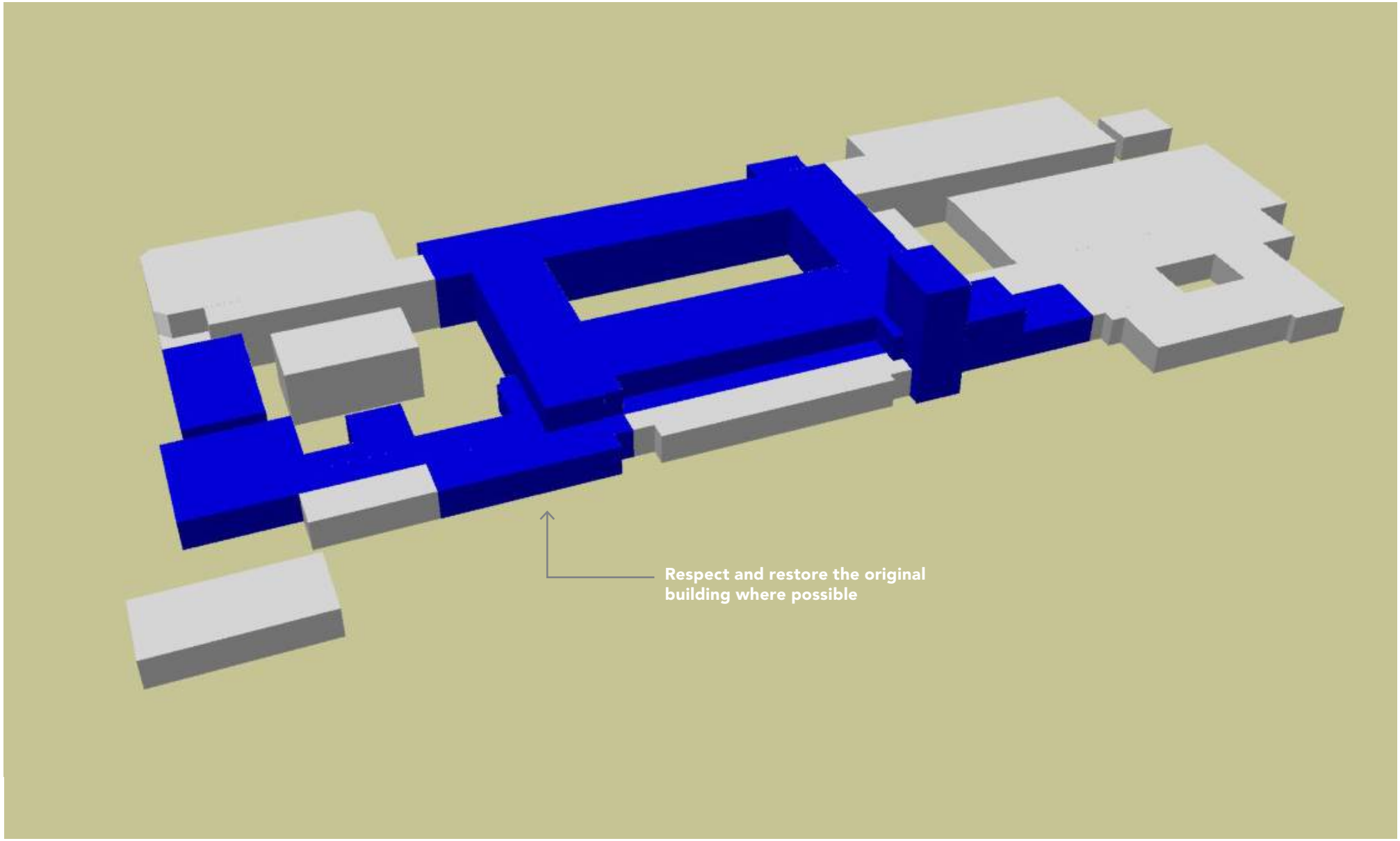
Isleworth and Syon School, and the Crown Court, replaced a large number of properties on Ridgeway Road. Middlesex County Council constructed the Isleworth and Syon Boys' School in 1936-8. It has one and two storey ranges dominated by a powerful tower, with a more progressive tall, curved staircase window, a feature of the period and a worthy addition to the Estate.

The school building built in 1936, a worthy addition to the estate.



Spring Grove Conservation Area, Relevant Issues

Main entrance at base of tower



Areas in blue highlight the form of the original building

4.6 Circulation and wayfinding

Circulation

The primary school building forms a wide and continuous frontage across the site. While entrances are located along this frontage they are not directly linked to a clear circulation pattern inside the buildings and do not make a strong connection through to the rear of the site. Therefore movement from the front of the site to the rear requires a strong know how or a long diversion around the north or south ends. This situation defines a wayfinding characteristic of the school that is less natural and intuitive and more reliant on signage and local knowledge. The masterplan should work to improve this by:

- improving permeability
- providing recognisable entrance points
- linking those entrances to a clear internal circulation pattern
- using a common theme for signage and decoration

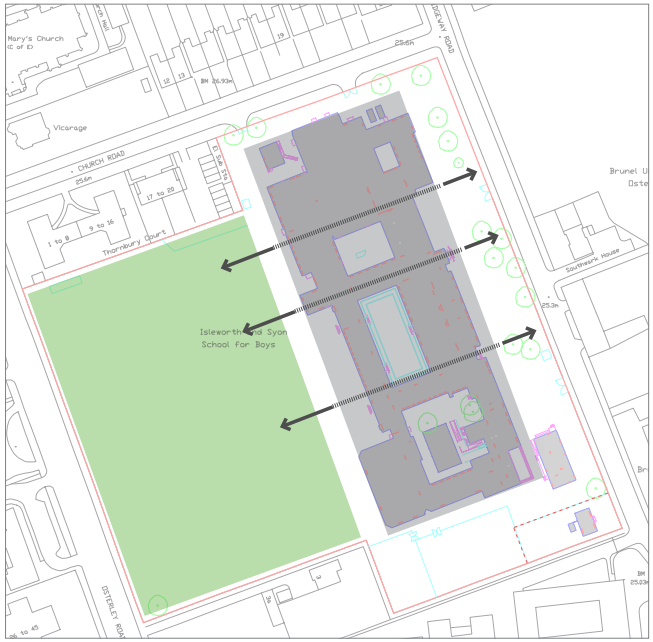
Relevant Project Themes

Access and arrival

Currently the school frontage is dominated by vehicle access and parking which compromises the setting of the school buildings and the safety of the students.

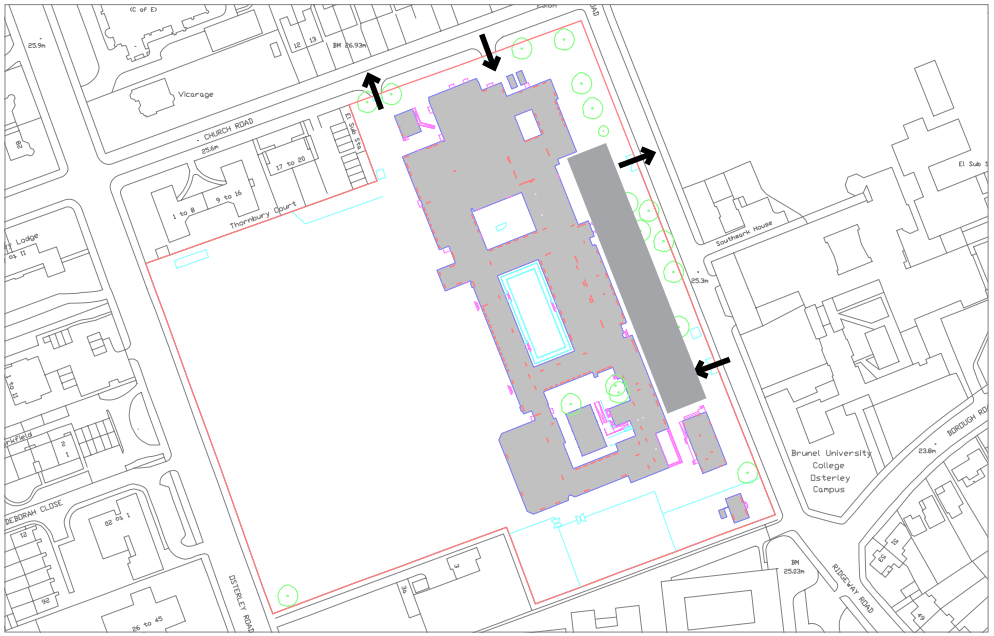
Forecasts in transport lean toward less reliance on individual car journeys therefore the masterplan should consider a future with less car parking requirements. With a long term vision in mind the school can work towards reducing the large areas of tarmac and converting this to active play and study areas for the students.

In the diagrams opposite we have researched three different possibilities for re-locating and concentrating the parking and access provision. Each of the 3 proposed options are viable but need to be considered in the greater context of the masterplan, covered in chapter 5.

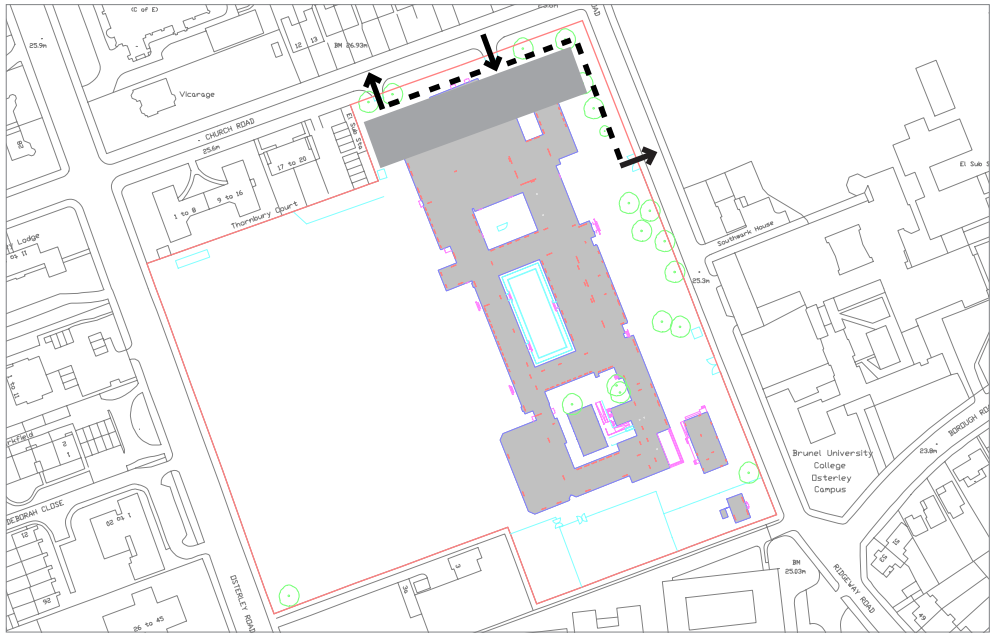


Lack of permeability through the building

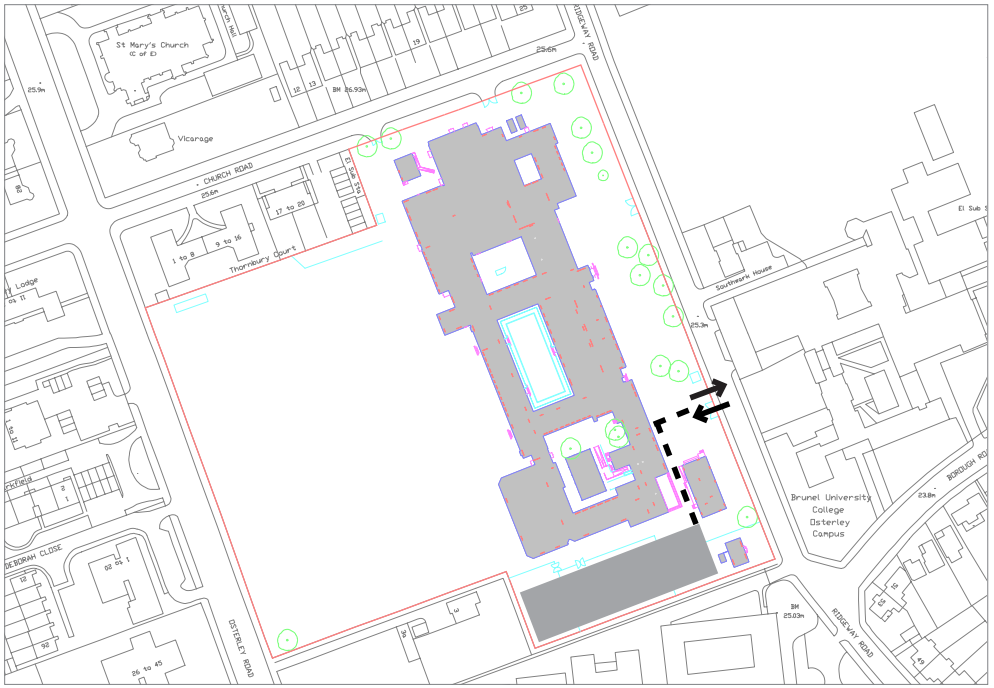
Featureless corridors running north south



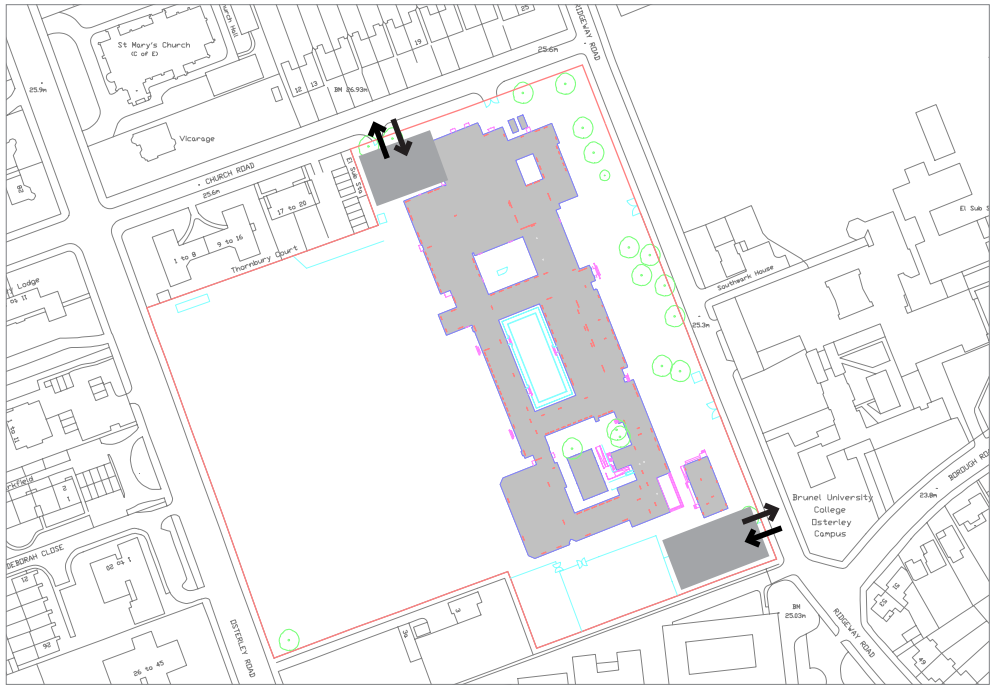
Site access and parking, existing



Site access and parking, Option 1



Site access and parking, Option 2



Site access and parking, Option 3

4.7 Development opportunities and increased capacity

Changing policy on area allowance

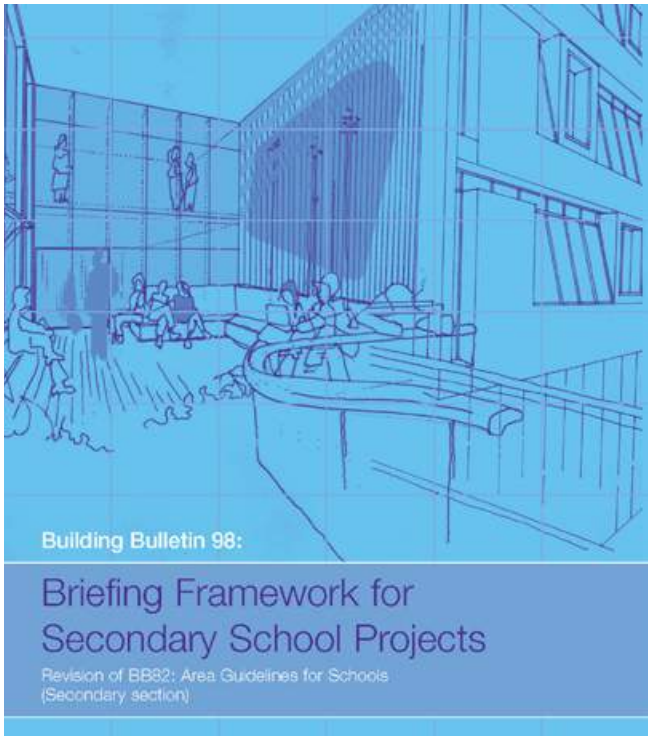
Government policy on area standards for secondary schools has recently changed from the Building Bulletin 98 to the Department for Education 2012 guidelines for development. The graph overleaf shows the current area and the comparable area standards for the different criteria. The masterplan design proposal is mapped against both of these area guides. It is important to note that the efficiency achieved in the 2012 criteria assumes a complete new build on a green field site and not an urban intervention condition like that of Isleworth & Syon.

Development opportunities

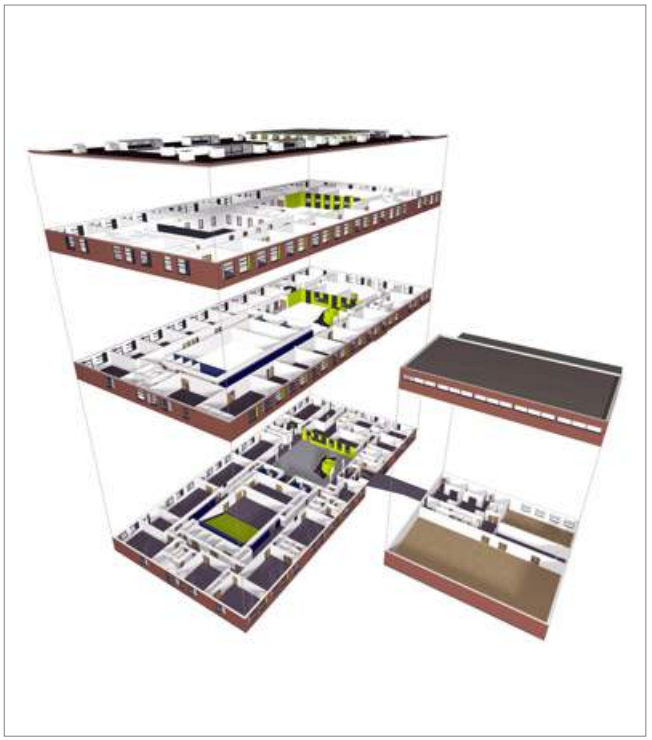
In order to consider how best to approach the existing building stock we have carried out a broad brush condition survey to determine the grade of the buildings from low to high. The central portion of the school has already been identified as having value due to the historical nature of the 1930's building.

The diagrams on the following pages show a natural focus on redevelopment at the two ends of the school, north and south. This reinforces the value of the landmark tower and central quad and begins to establish a natural heart that stems from the schools history.

Relevant Project Themes



BB98 Guidelines



Department of Education, 2012, Benchmark Secondary School for 1200

BASEMENT	219m2	GROUND FLOOR	6325m2	FIRST FLOOR	2101m2
Area	**Type**	**Area**	**Type**	**Area**	**Type**
		160 sqm	Maths		
		895 sqm	PE		
		125 sqm	Modern Language	125 sqm	Modern Language
				746 sqm	Science
		71 sqm	Drama		
		159 sqm	Music		
		409 sqm	Dining/Catering		
		257 sqm	Art		
		90 sqm	Food Tech		
		518 sqm	D+T		
				298 sqm	ICT
		843 sqm	Classroom	157 sqm	Classroom
135 sqm	Storage/Office/Lobby/Admin	881 sqm	Storage/Office/Lobby/Admin	185 sqm	Storage/Office/Lobby/Admin
		586 sqm	Common/Form Rooms	123 sqm	Common/Form Rooms
		967 sqm	Circulation/Corridor/Stairwell	465 sqm	Circulation/Corridor/Stairwell
		309 sqm	Toilet	2 sqm	Toilet
84 sqm	Plant	54 sqm	Plant		
219 sqm	Basement Total Area	**6325** sqm	Ground Floor Total Area	**2101** sqm	First Floor Total Area

8680m² Total

BB98

Area Allowance Standards

2250 + (7.0/student)

Current Area	8680m²	(934 students)
Required Area	9600m²	(1050 students)
Growth forecast	12,190m²	(1420 students)

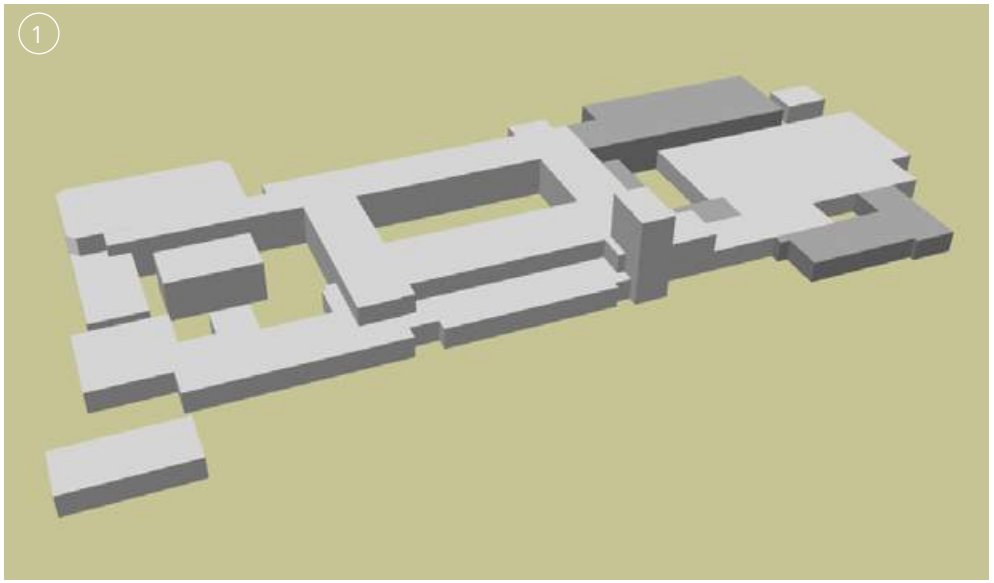
DofE 2012

Area Allowance Standards

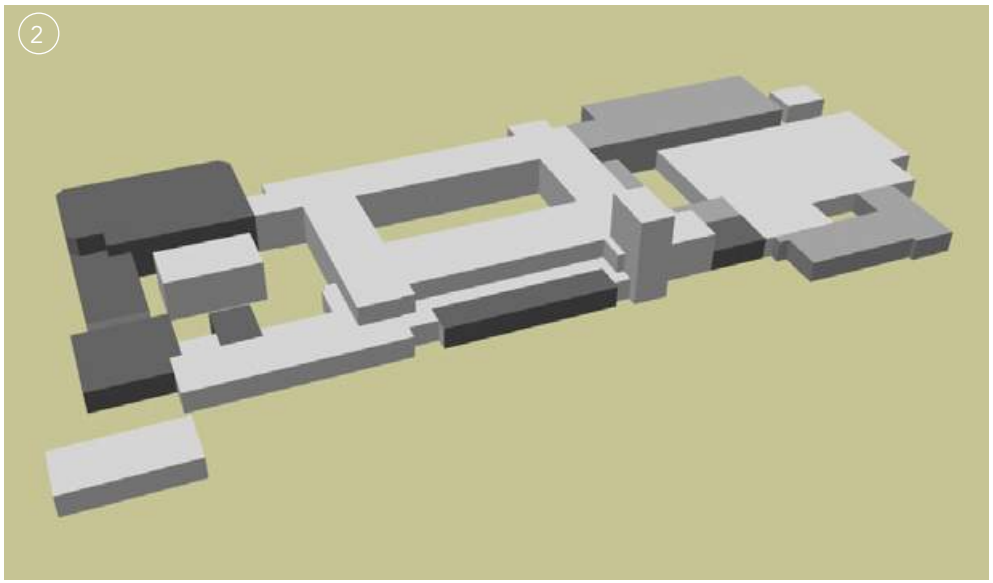
1050 + 350 + (6.3/student) + (7.0/sixth form)

Current area:	8680m²	(1137 students)
Recommended Area:	8141m²	(1050 students)
Growth forecast:	10,528m²	(1420 students)

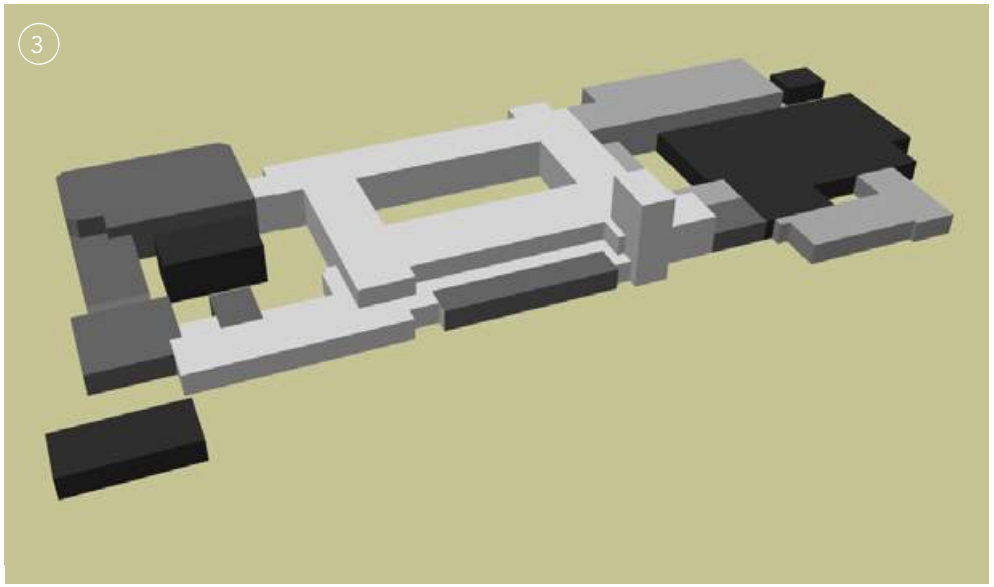
Building condition survey, high to low grade



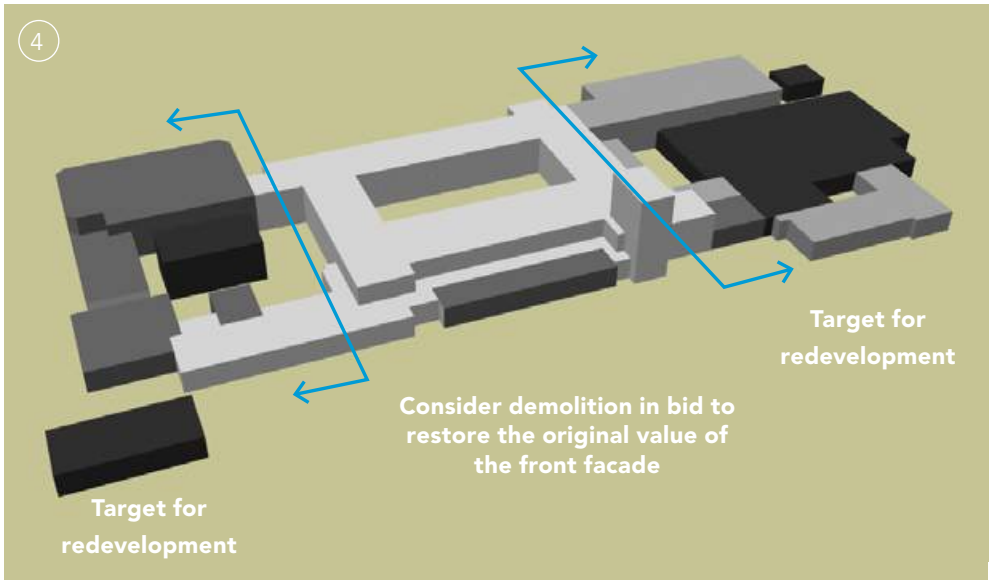
Higher grade



Higher and medium grade



HIgher, medium and low grade



Resultant areas to target for re-development

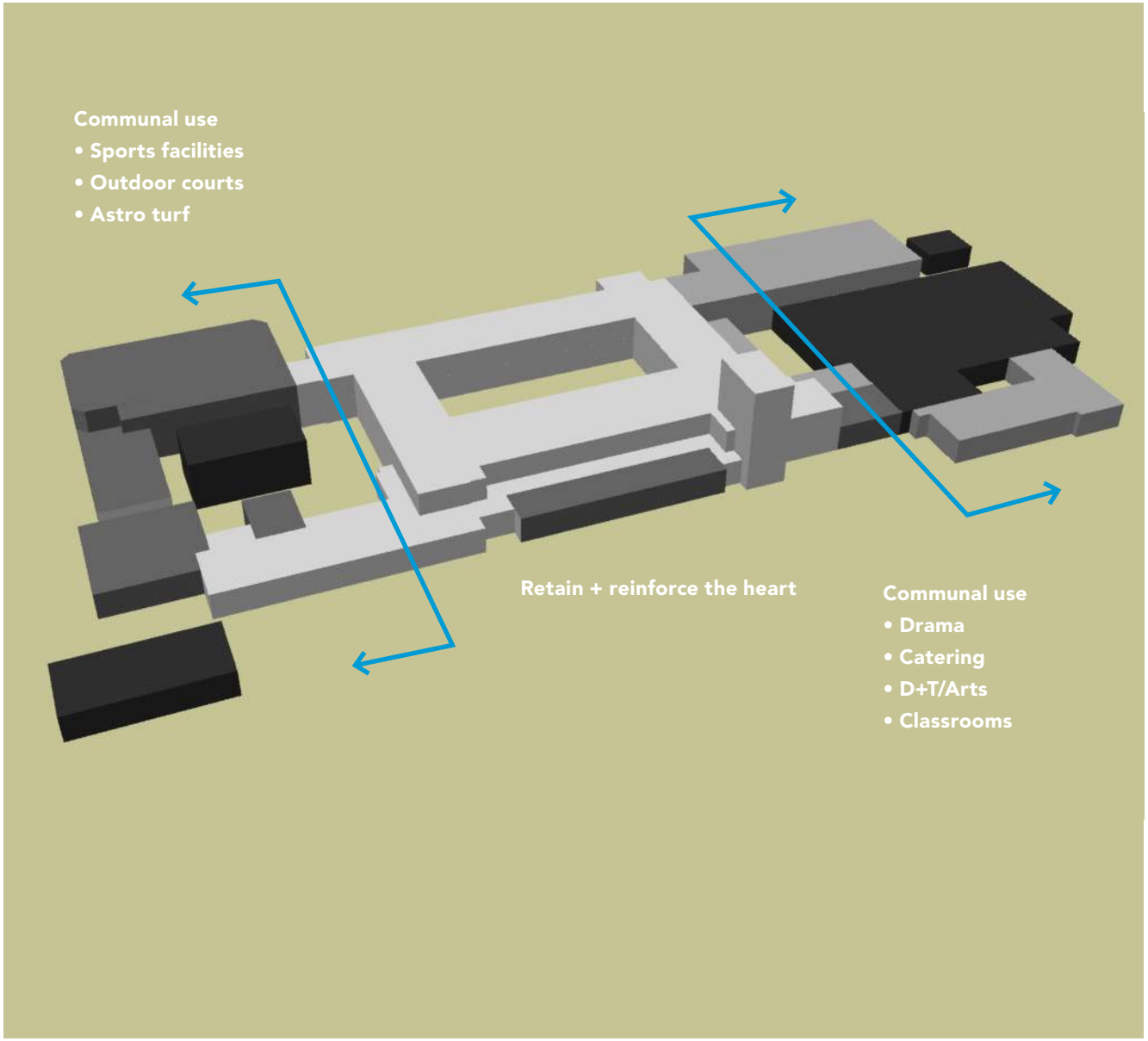
4.8 Community relations

Shared Use

Isleworth & Syon has many strong links with the greater community and currently host many outside activities within the school as well as reaching out for their own uses on other sites within Hounslow. This spirit is a feature of the school and one they would like to nurture.

The condition survey identified target areas at the north and south ends of the school for redevelopment and a focus on renovation and reinforcing of the centre and the 'heart'. This naturally suggests that any future mapping of communal use be integrated into the north and south ends. This is very beneficial as shared use will not compromise the security and identity of the heart and should the school population decline one could consider leasing a full wing that is strategically positioned to operate as a sole entity.

Relevant Project Themes



Re-development opportunities are clustered at the east and west ends of school, a natural 'bookend' position for broadening community relations

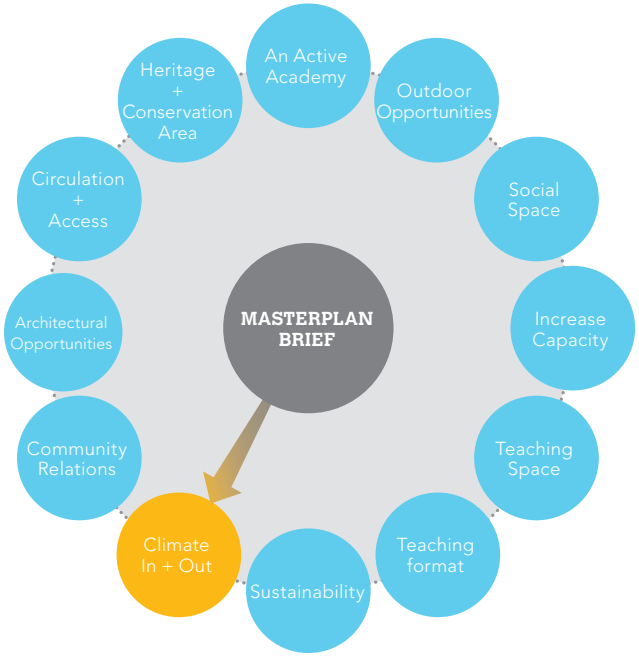
4.9 Climate, Indoors and outdoors

Climatic conditions

The school is located within the flight path for Heathrow and therefore suffers some acoustic intrusion into classrooms. To reduce the impact windows are often kept closed but this greatly compromises the air quality as any natural cross flow is prevented.

The buildings orientation presents a long facade to the west. This is beneficial for heat gain during winter months but causes significant over heating in the spring and summer. Keeping the windows shut adds to the problem as the air quality drops it also overheats especially with the added burden of heat generating equipment and IT.

Recent studies show a significant improvement in pupil performance due to the design quality of classrooms. A large part of this is associated with climatic control.



Relevant Project Themes

Year-long study finds links between performance and learning environment.

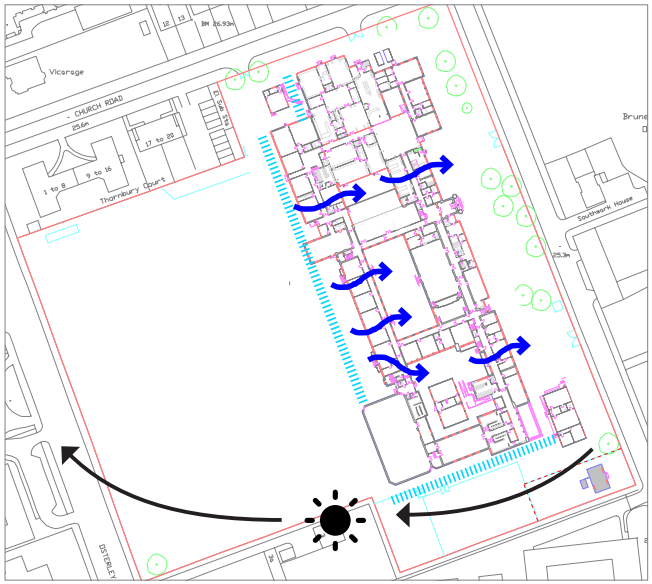
Classroom design can improve pupils' performance by as much as 25% according to a recent study. Classrooms were evaluated in terms of their

- *Orientation*
- *Natural light*
- *Noise*
- *Temperature*
- *Air quality*
- *Colour*
- *Flexibility of space*

Excerpt from Building Design, November 2012

The masterplan proposal looks are three key means to improve indoor climatic conditions:

- passive/natural air flow ventilation systems
- active mechanical ventilation with heat recovery
- shading on the western facade



External shading and cross ventilation via courtyards and streets

4.10 Teaching Space and Format

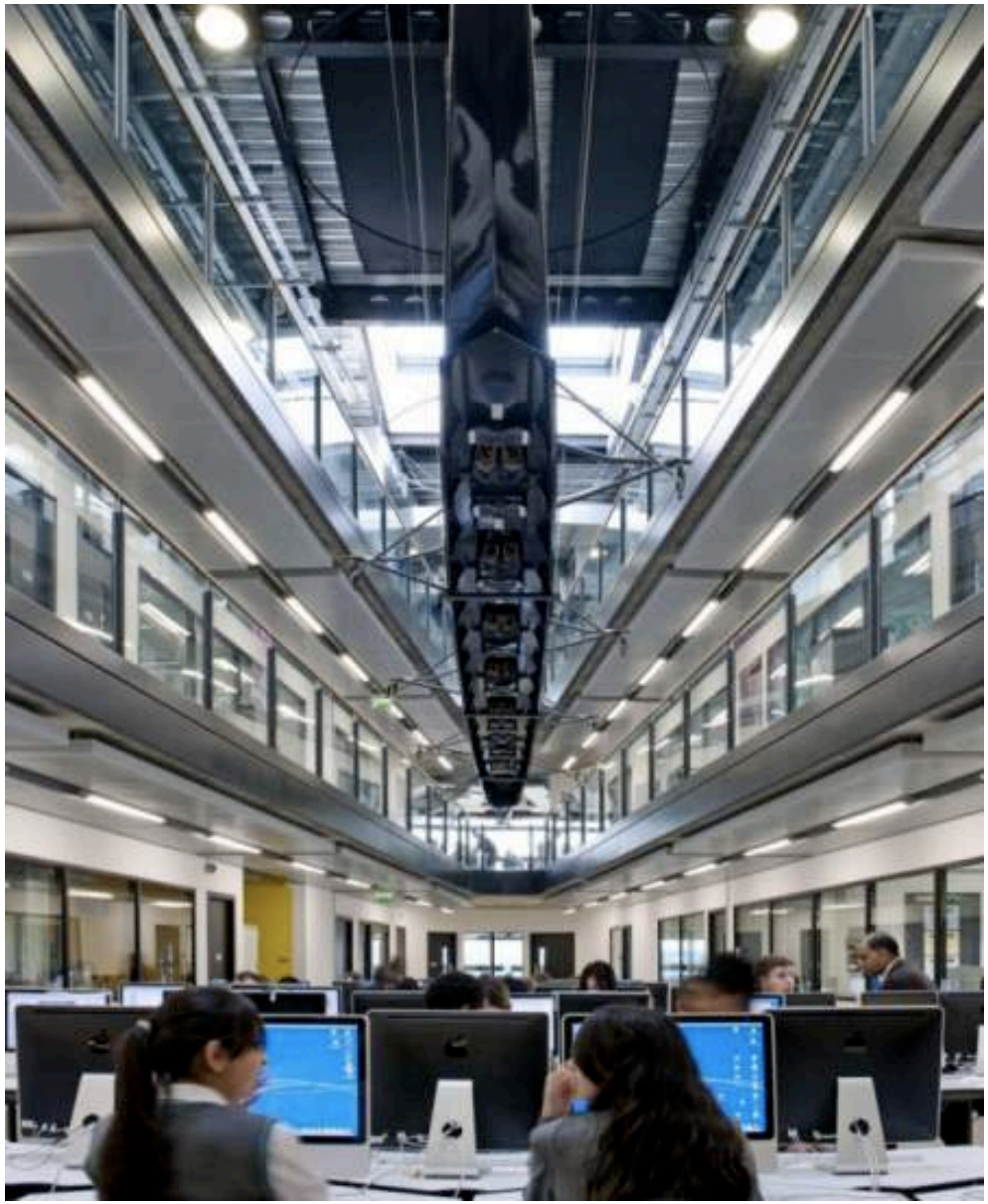
New ways of teaching and learning
Both teaching staff and students show a great interest and enthusiasm for alternate forms of teaching. Students were particularly interested as they saw these options as a treat and something to aspire to. The following ideas are embraced by the masterplan

- open plan teaching spaces
- flexible space
- seating in 'the round'
- glazed frontage and better natural surveillance
- double height spaces
- use of colour
- alternative locations, atriums, outdoors, etc

These considerations are important as many of them are flexible and dynamic enabling the systems to adapt to changing needs and environments over a time.

Relevant Project Themes

Multi purpose: areas for learning, socialising and circulation



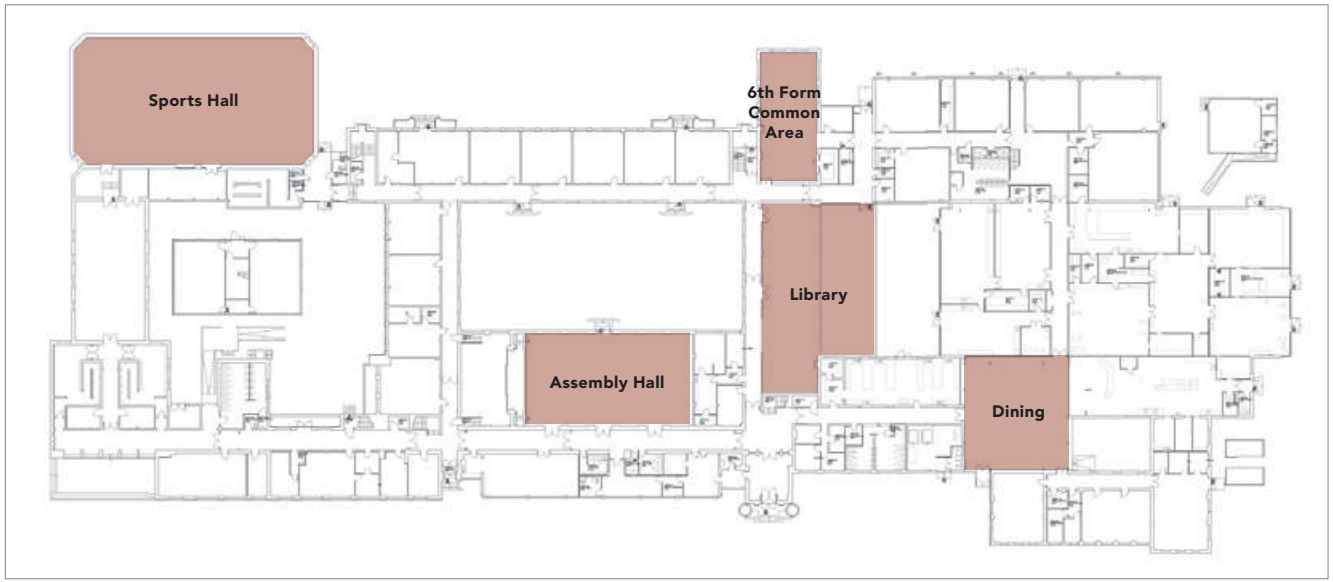
Alternative forms of learning, outdoor classrooms, open plan and glazed frontages

4.11 Social Space

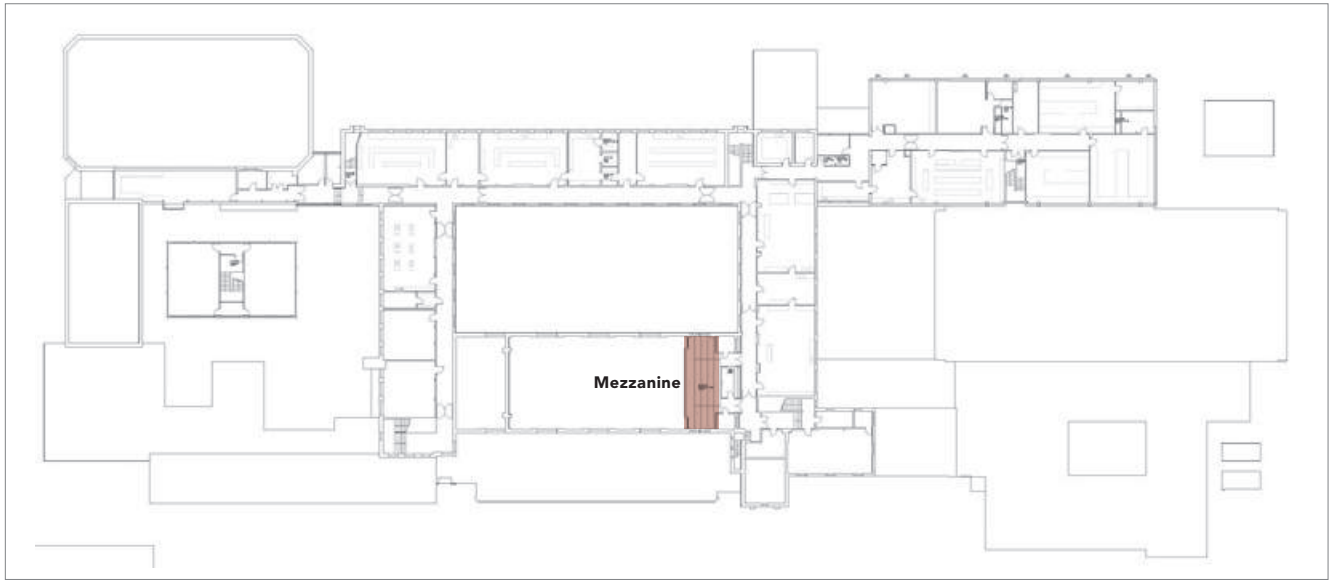
Socialising and learning
There are very few areas within the school which are currently designated for informal break-out and socialising. Given the pressures on teaching space and the curriculum this is understandable but socialising and impromptu debate are important factors in educational growth. When considering the provision of social space it is important to provide a good variety from large scale gathering to more intimate individual contemplation or small group discussion. Often these kinds of spaces can work for many purposes including exhibition, performance, flexible teaching and collective expression. The following areas should be considered moving forward:

- circulation areas
- well distributed break-out points
- primary dining as well as support cafes/snack stops
- central courtyard and heart to the school
- communication hubs, library and IT suites
- outdoor 'rooms'

Relevant Project Themes



Ground Floor Plan, Existing



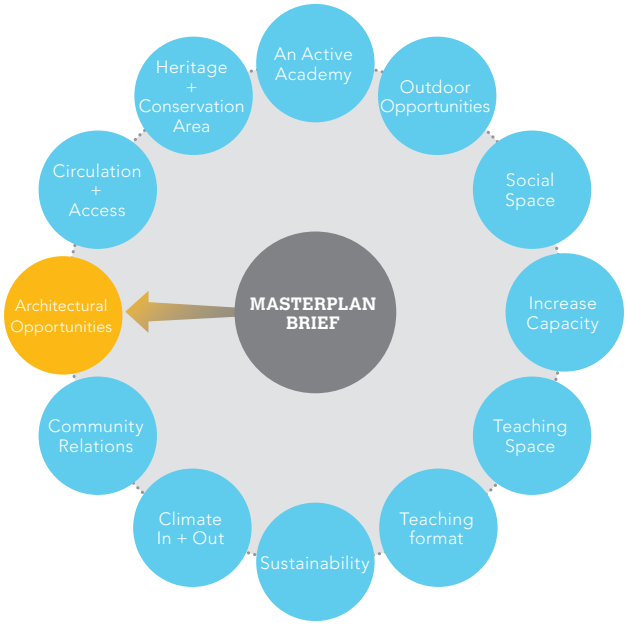
First Floor Plan, Existing

4.12 Architectural opportunities

Identity and pride of place
The masterplan process is an ideal time to reflect on the spirit of the school and how this translates into an image or impression of the place. This can be represented in many ways from the more significant building moves to the considered application of signage, imagery, interior decoration, and the use of colour.

A consistent approach creates a calm and clear setting with instinctive wayfinding and orientation, key aspects of a successful public institution.

The street frontage, school entrance and centralised shared areas are important places to start. Once the characteristics are defined they should then carry through the school and be considered when undertaking any new development or decoration.



Relevant Project Themes


Creating a fresh spirit + identity

Image courtesy of Foster and Partners Architects

5. Masterplan Design Proposals - Buildings

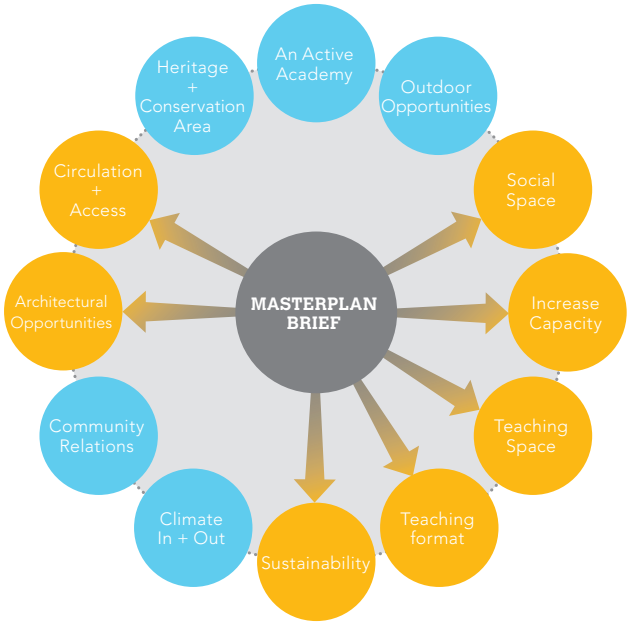
5.1 Existing department distribution, Ground Floor

Existing department distribution, First Floor

5.2 Phase A, Central Courtyard Roof & Associated Improvements

Design sequence and phasing
For the purposes of this report we have presented the masterplan design proposal in five phases, A-E but it is important to note that the sequence is flexible and can be adapted to suit changing circumstances. This is a key aspect of a successful masterplan as it ensures a long and relevant life. Another key factor is to use a sufficiently broad brush in recommendations which avoids abortive detail and too many restrictions. Flexibility and adaptation are crucial.

Department distribution
The floor plans on the previous two pages record the current distribution of departments across the school. Generally each curriculum area is fairly well concentrated with the exception of the Maths Department which is located in 3 different areas. The teaching staff highlight that a centralised location is more efficient and helps with good communication and awareness. The masterplan design proposal works to centralise departments over a series of phased moves.



Relevant Project Themes

Phase A, Central courtyard roof
The masterplan proposal begins with a recommendation to cover the central courtyard. This move alone addresses 7 of the Project Brief themes as identified in the diagram adjacent. In addition 600m2 of internal space is gained through the construction of only one external skin, the roof. This is a very efficient way to increase floor area while also reinforcing the heart of the school and creating a dynamic hub at the centre of everything. Important uses that front the courtyard include the library and the assembly hall as well as being positioned for fairly direct access to the school frontage and entrance.

The following pages cover the roof position and design proposal, the roof performance, the new internal layout and the revised department distribution.

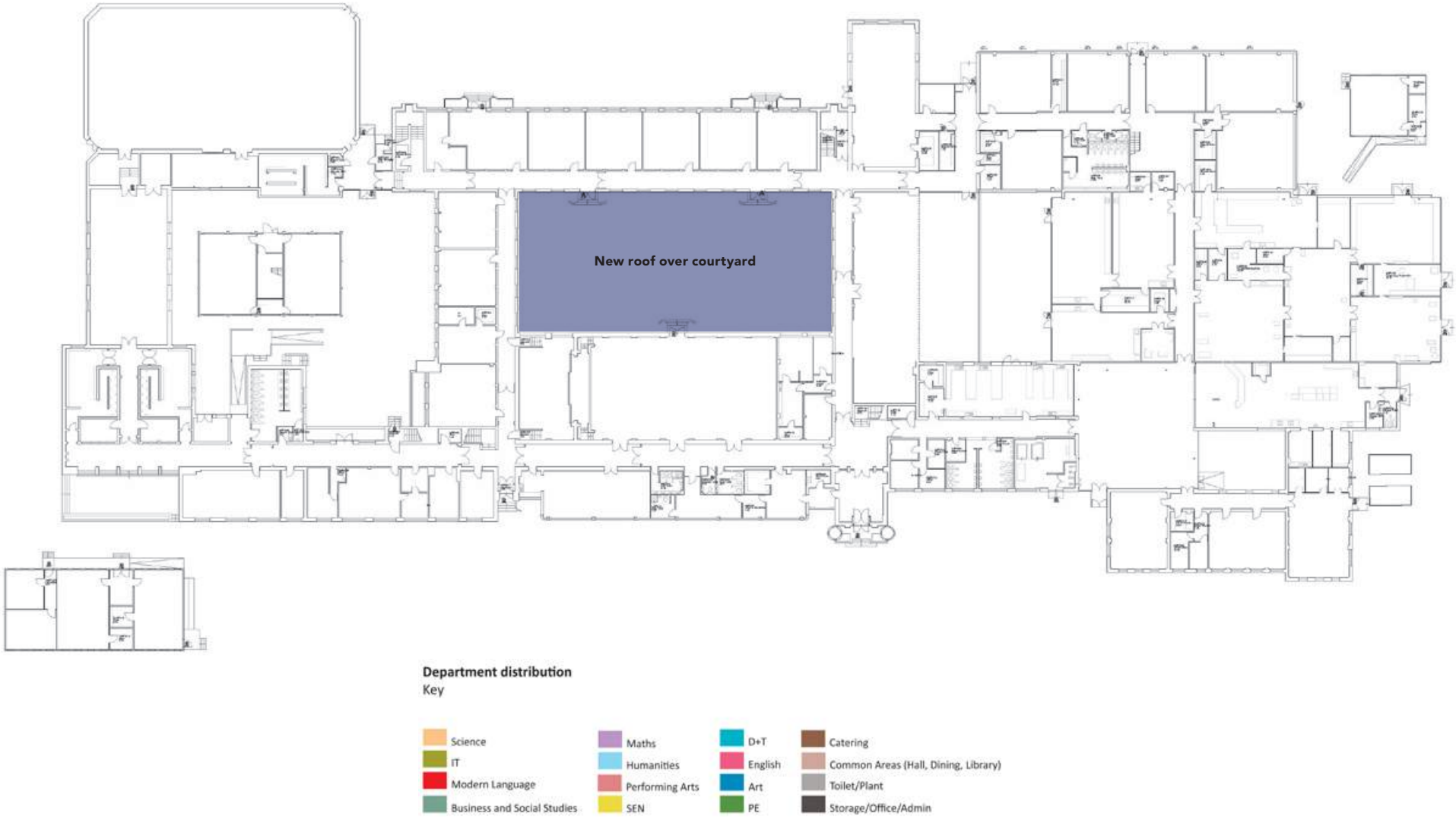
Key points for Phase A:

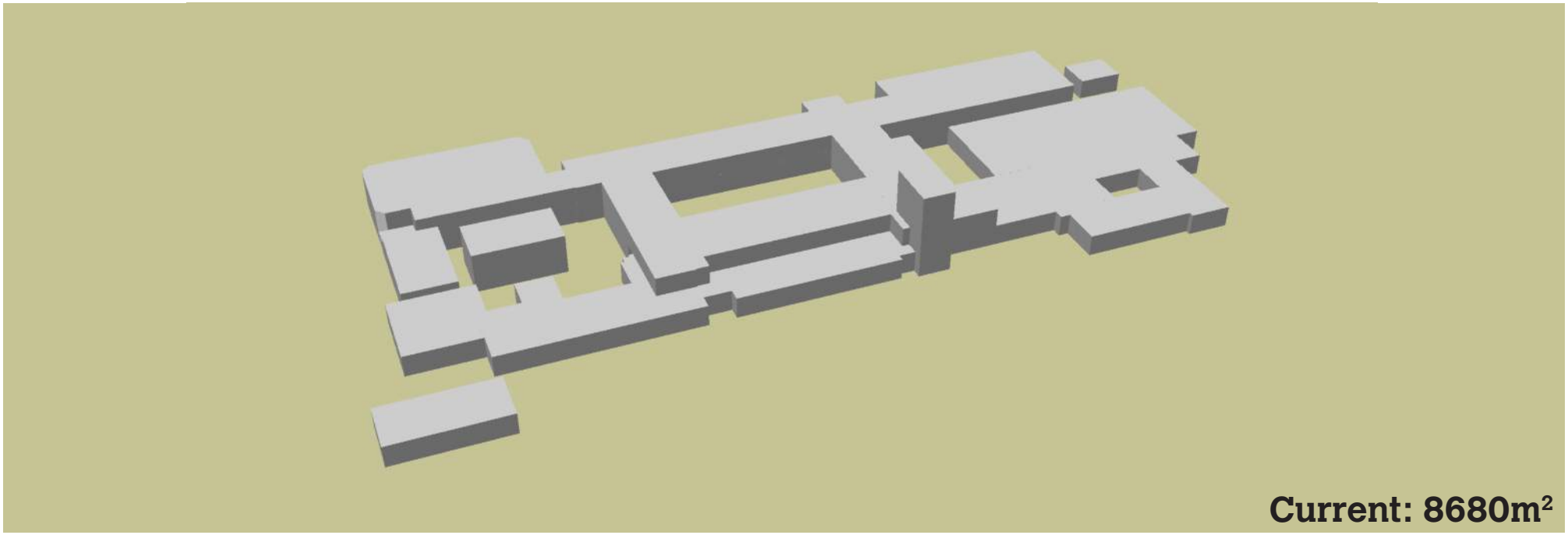
- pivotal position in school
- located within the high grade buildings
- important environmental opportunity, fresh air & energy
- enables adjacent classrooms to expand
- provides important social space
- creates a dynamic and interesting double height space
- provides opportunity for flexible teaching and group work

A vision for the future

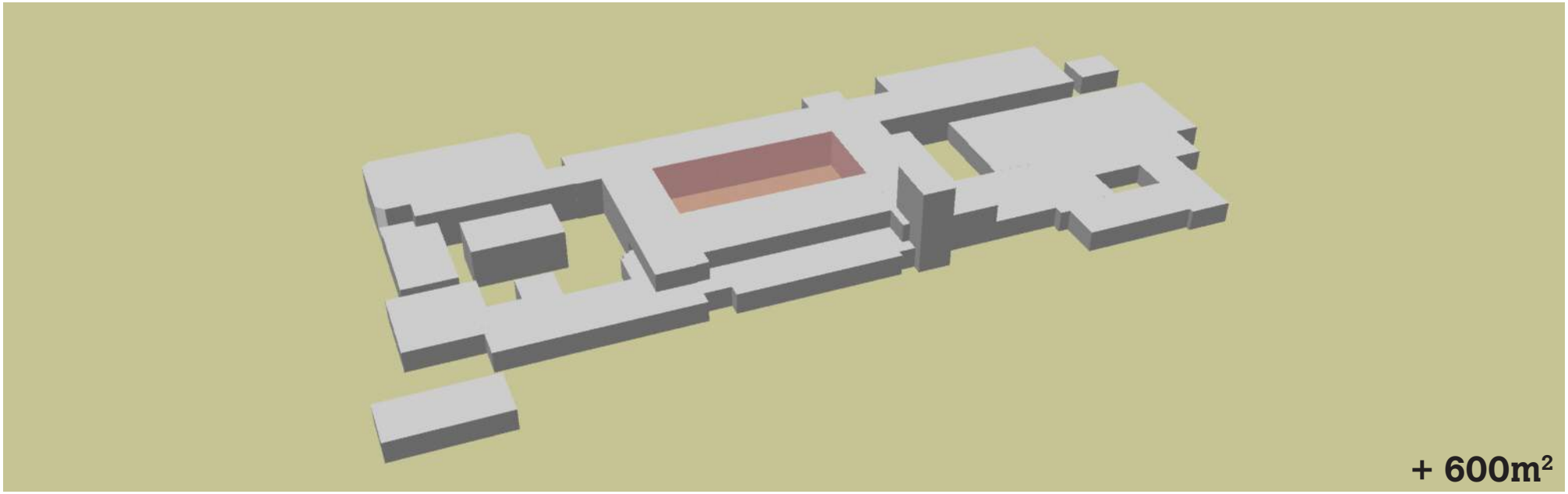
Existing open courtyard

Phase A, Enclose the central courtyard





Existing condition



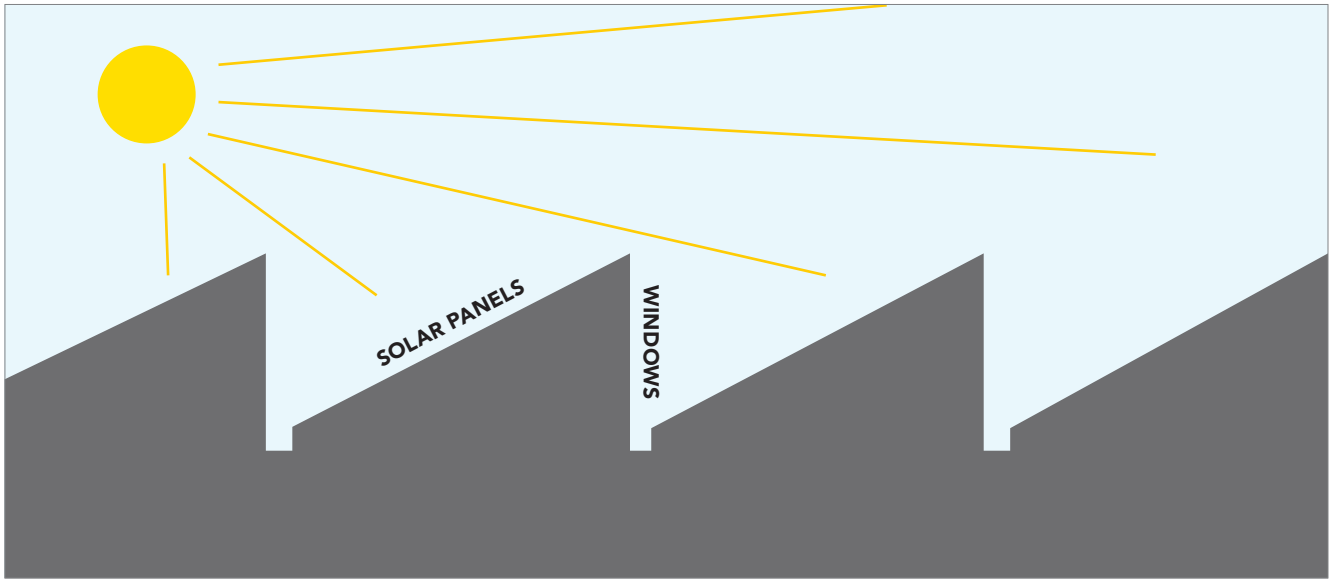
New roof, weather tight in one skin

Roof design

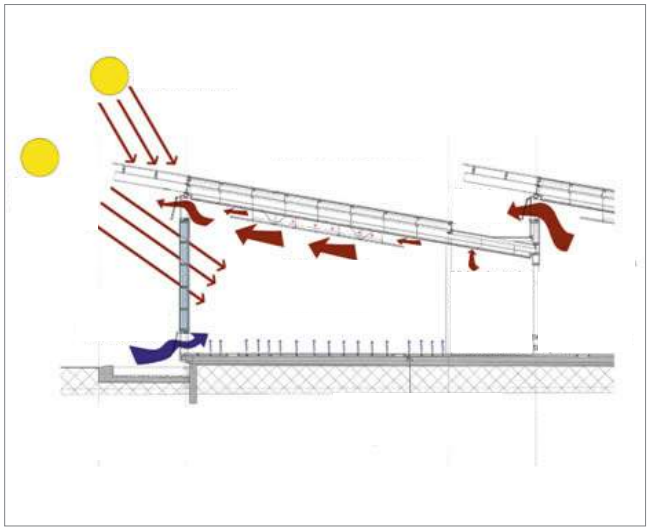
Sawtooth roof profile
There are a number of important influences on the design proposal for the roof:

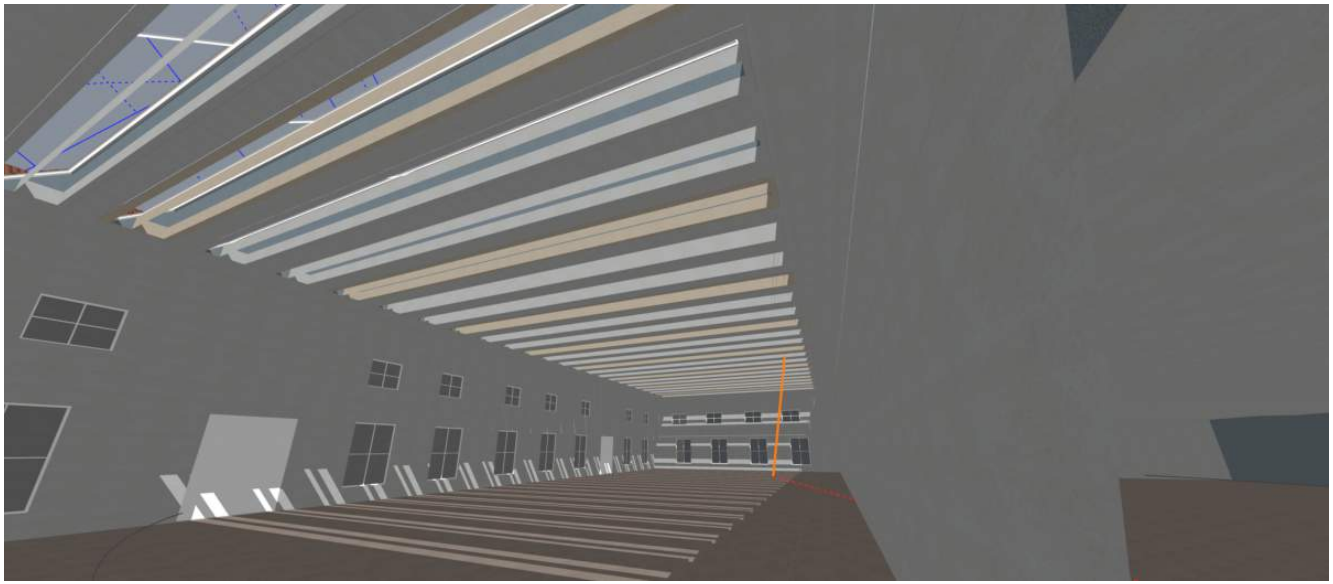
- column free space for maximum flexibility
- capturing natural daylight with out glare (northern light)
- effective cross ventilation by venting through roof
- creating an interesting and inspirational space
- defining the heart of the school

A sawtooth roof has a long and successful history in industrial buildings as it is an efficient way to create a simple long span roof structure. The courtyard orientation and a stepped profile are ideal to allow northern light in and an angled face towards the south and west for fitting solar panels and controlling heat gain during winter months. It is also possible to integrate openings at high level which assist with passive ventilation in the warmer months.

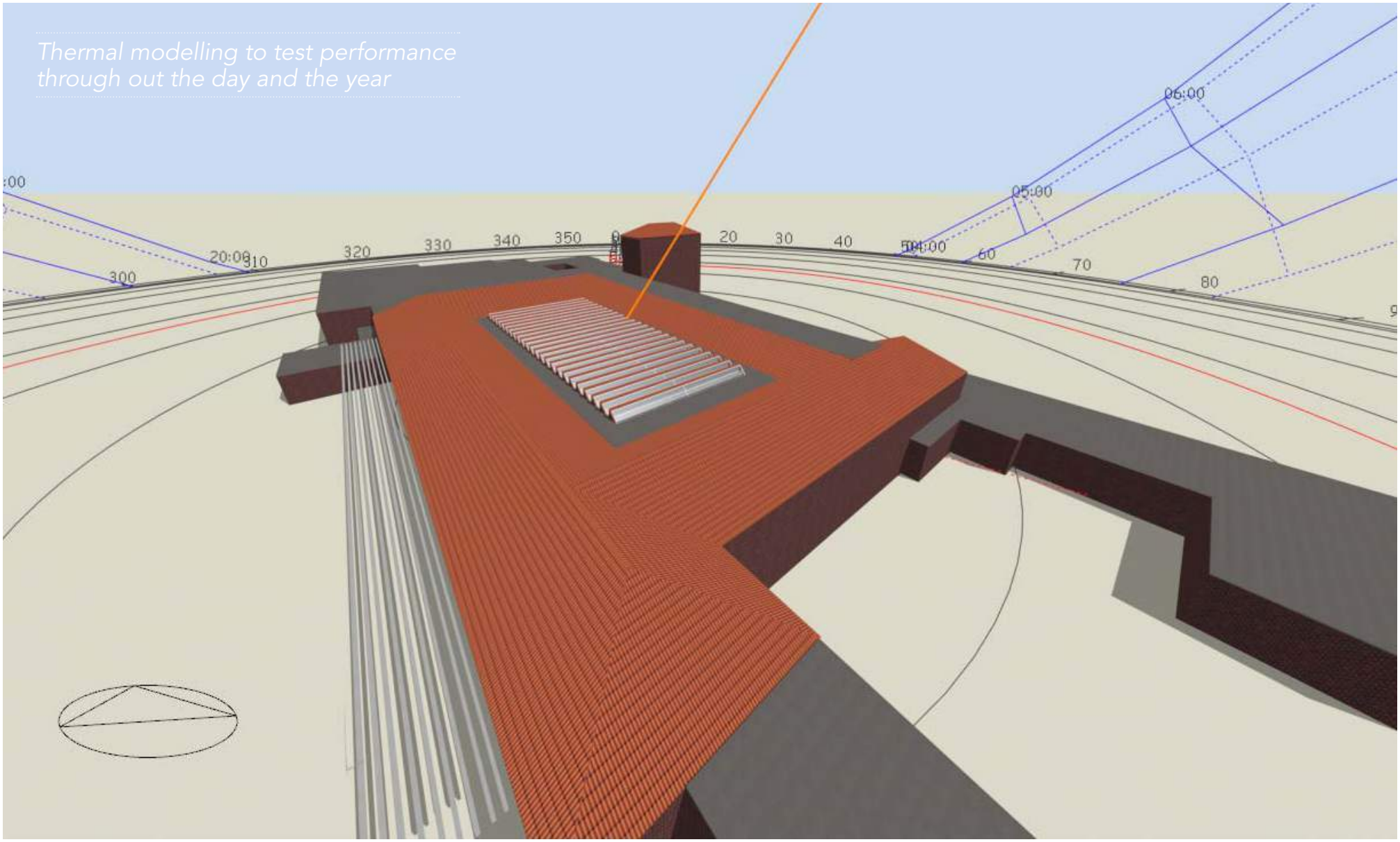


Sawtooth roof, ideal platform for solar hot water


Intelligent building form, shading overhangs, natural ventilation & thermal mass

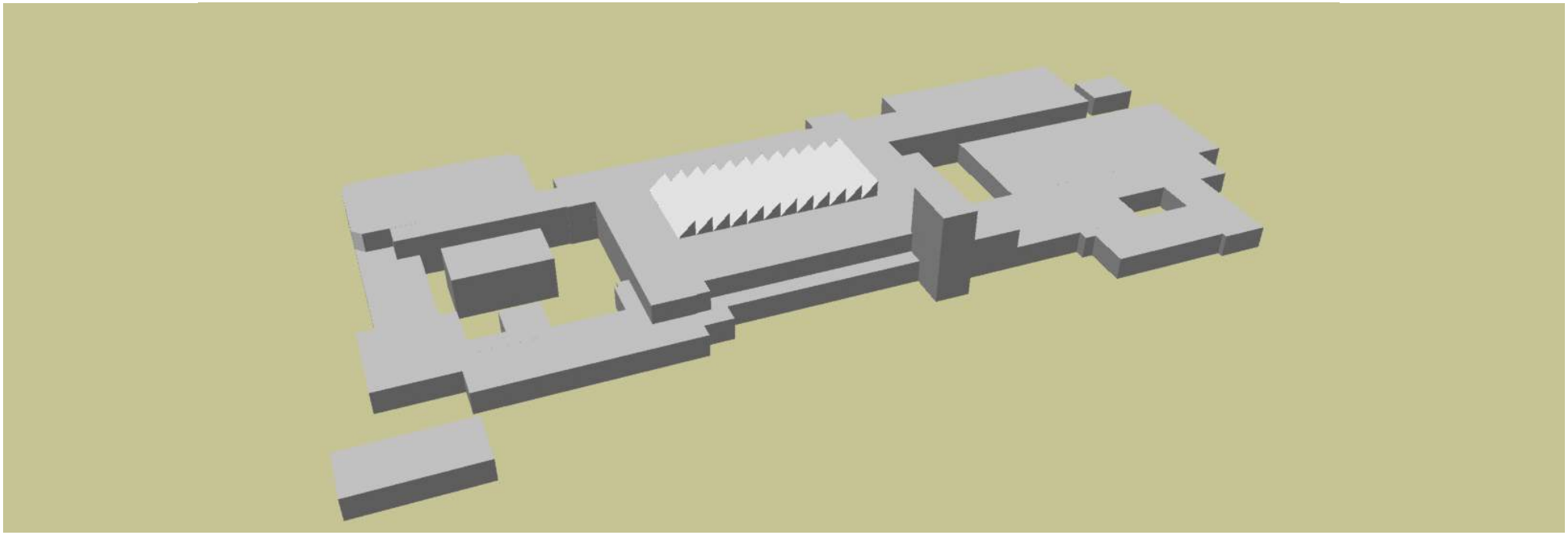

Sawtooth roof, heat gain in winter and shading in summer

Thermal modelling to test performance through out the day and the year

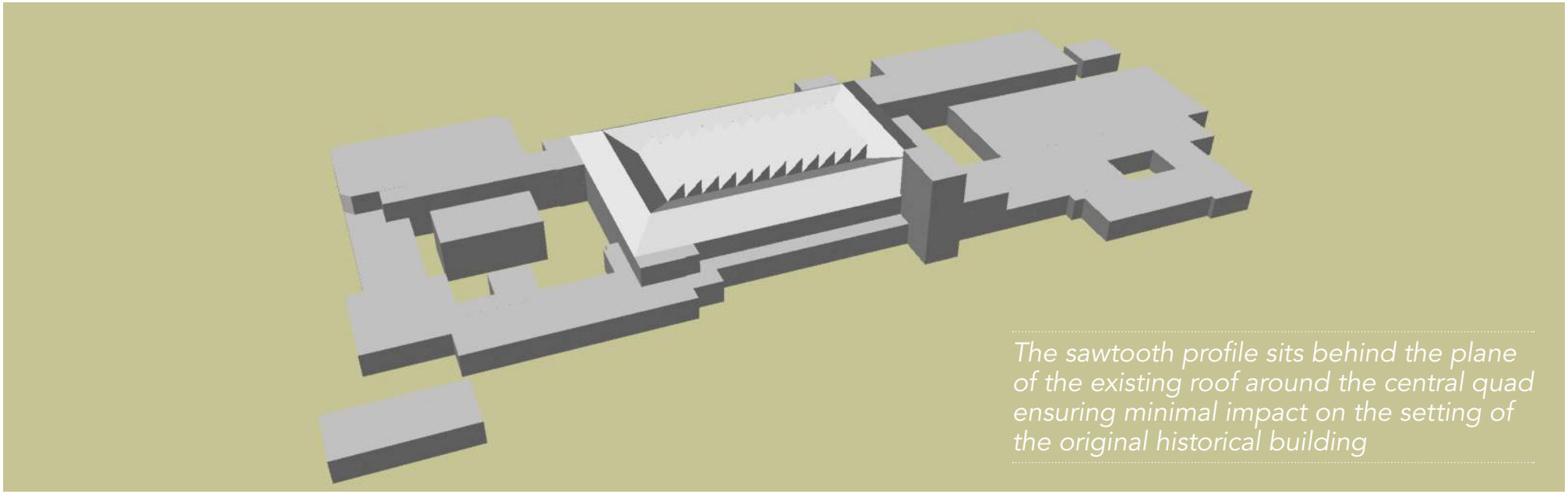


Smart roof, acting as a lung while also providing summer shade + winter warmth

Successful precedents for a sawtooth roof



Sawtooth roof in position



The sawtooth profile sits behind the plane of the existing roof around the central quad ensuring minimal impact on the setting of the original historical building

Interface with existing roof system (not visible from street level)

Increase capacity, improve permeability and circulation

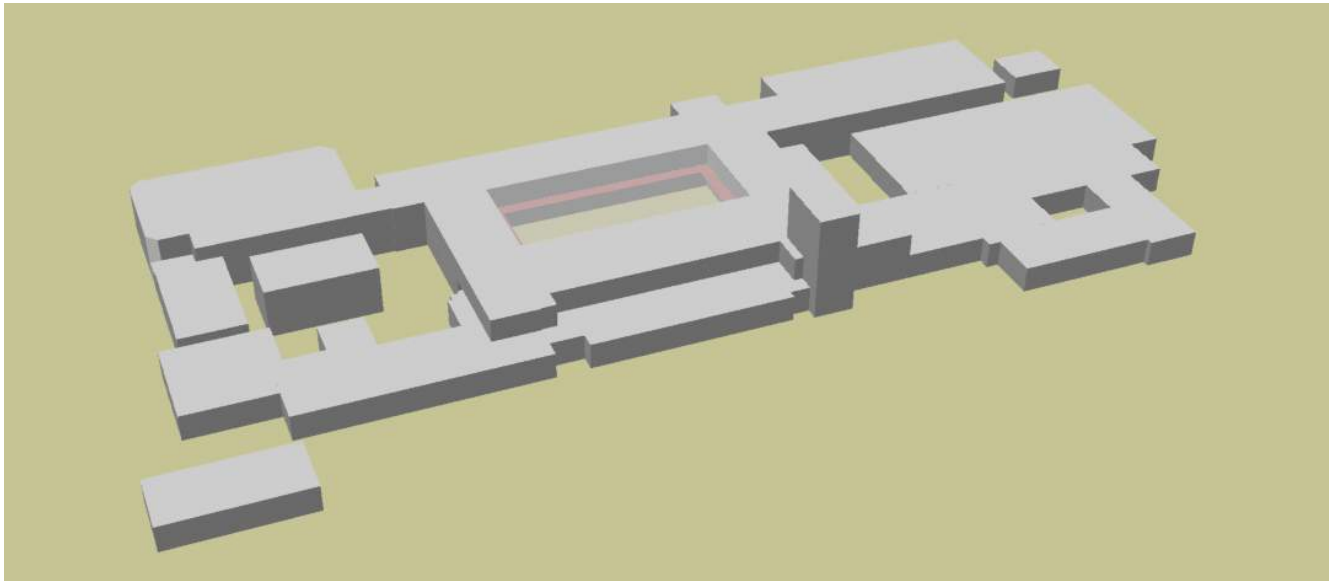
Circulation
Having created an internal space within the courtyard, circulation can shift into the shared space moving freely at ground level and on new perimeter walkways at first floor. This centralised movement and activity will provide a buzz to the courtyard and offer open views through and across the space.

Permeability
Links to the school frontage and entrance will be clear and obvious enabling natural way finding around the building. By shifting the exits at the rear of the building to be in line, direct routes can be formed, front to back, which will greatly improve permeability.

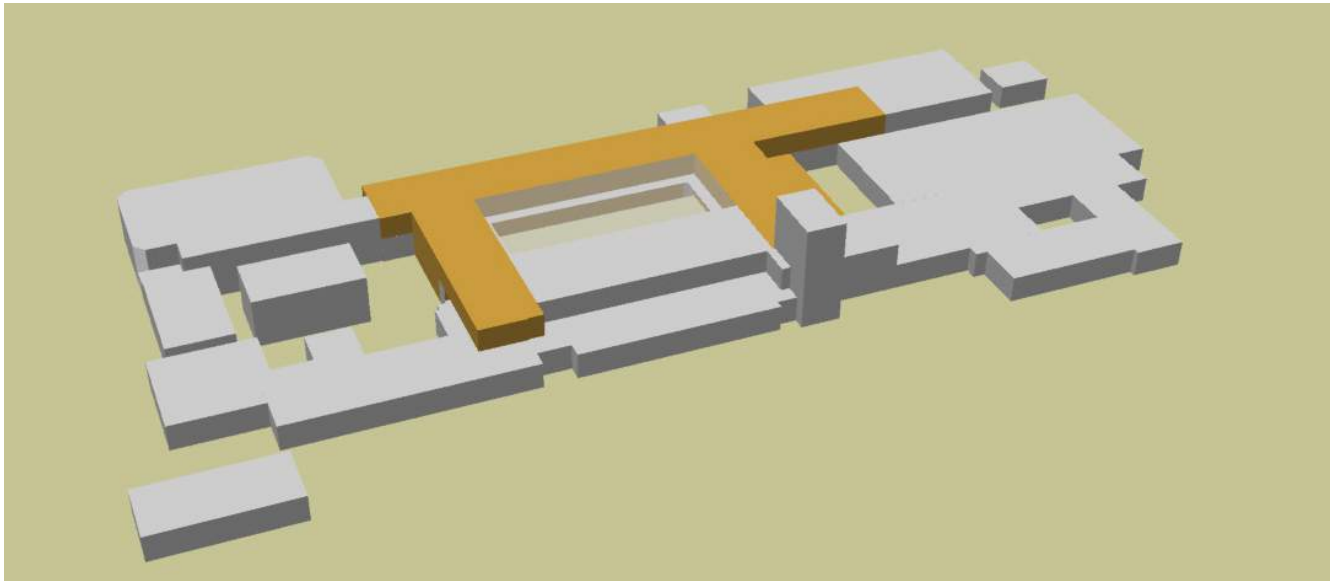
Expansion
Once circulation has shifted to the central courtyard the internal corridors that currently line 3 sides of the space on two levels can be absorbed into the adjacent classrooms and library. This move is key for the classrooms as they have all been identified as undersized which compromises teaching and student well being.

Refurbishment
While increasing classroom capacity there is an opportunity to implement the new vision for internal finishing including decoration, use of colour and signage. By incorporating this at the heart of the school the focus is defined and all future work can grow naturally out of these themes.

Capacity
Having formed an open volume with 600m^2 of floor space, there are many options for development within. In order to maintain the openness and avoid crowding the double height space, the proposal is for 3 new classrooms at ground floor to house the Maths Dept. and an open plan deck at first floor for the relocated Business & Social Studies hub. On page 59 there are 3 other options investigating different masses and densities.

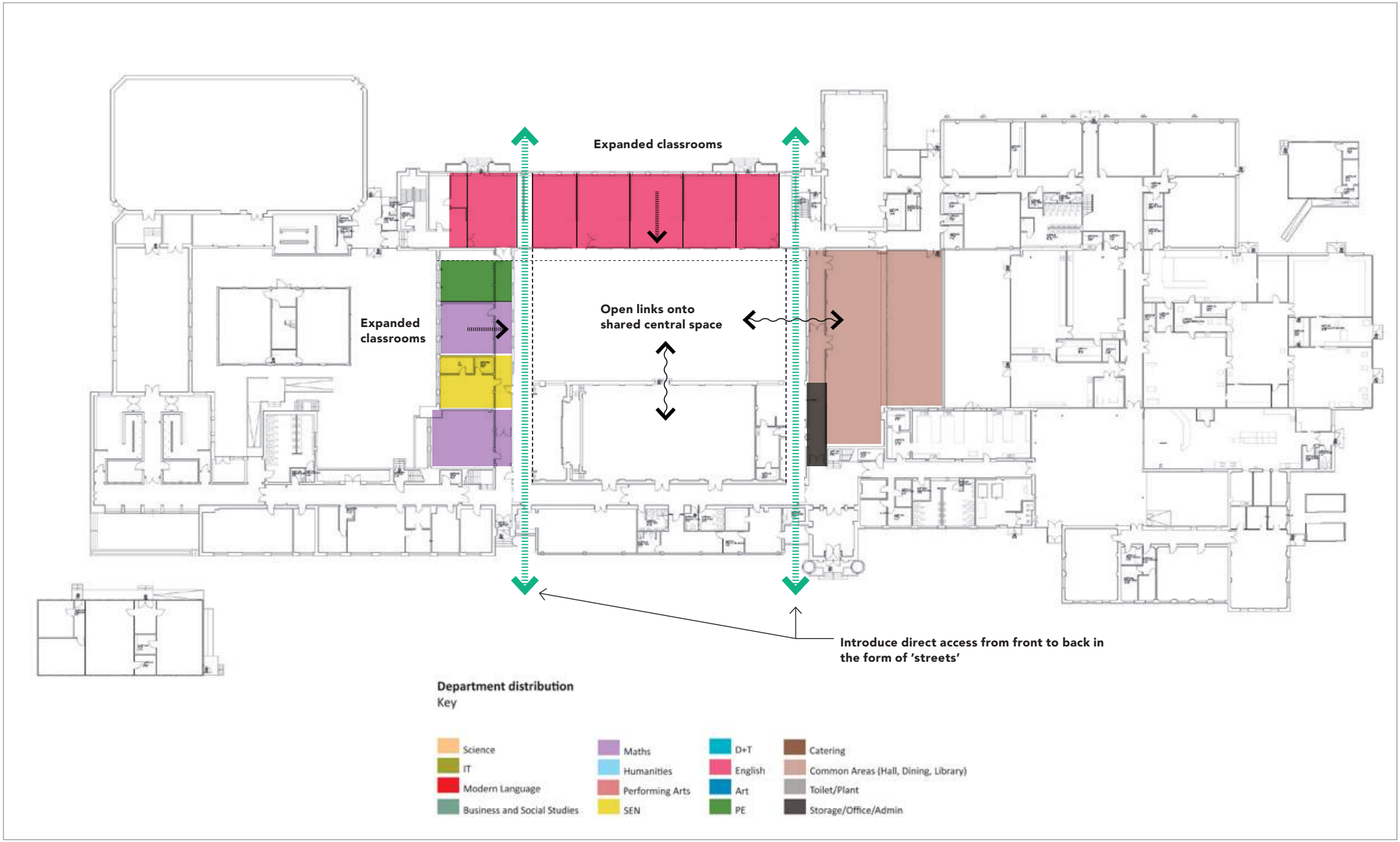


Relocate circulation within central courtyard at ground and first floor



Re-furbish adjacent rooms to absorb original circulation and increase capacity

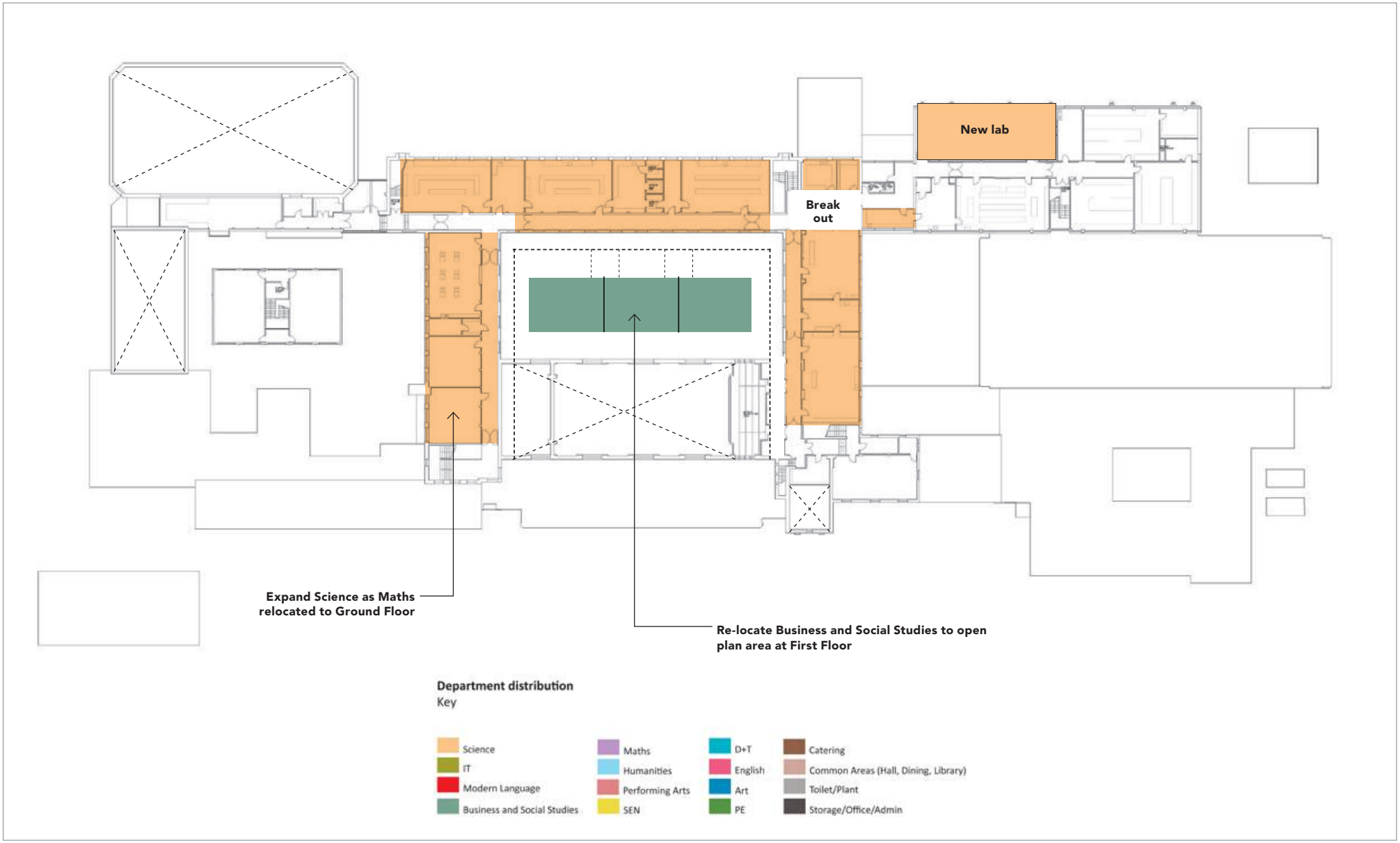
Phase A2, Circulation shifts to central courtyard enabling enlarged accommodation at perimeter

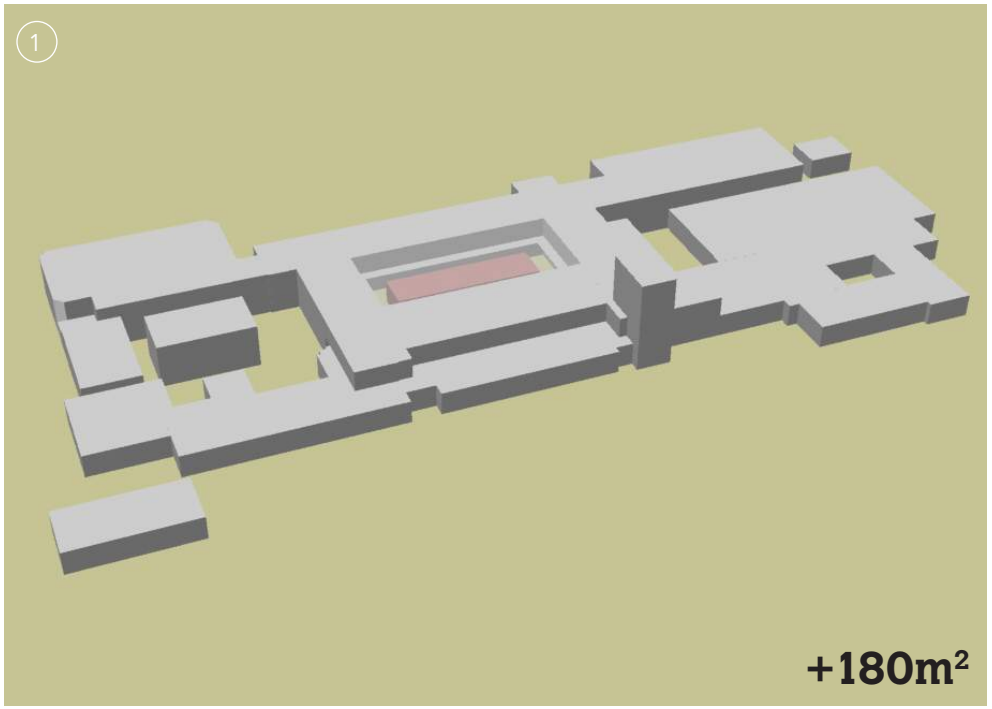


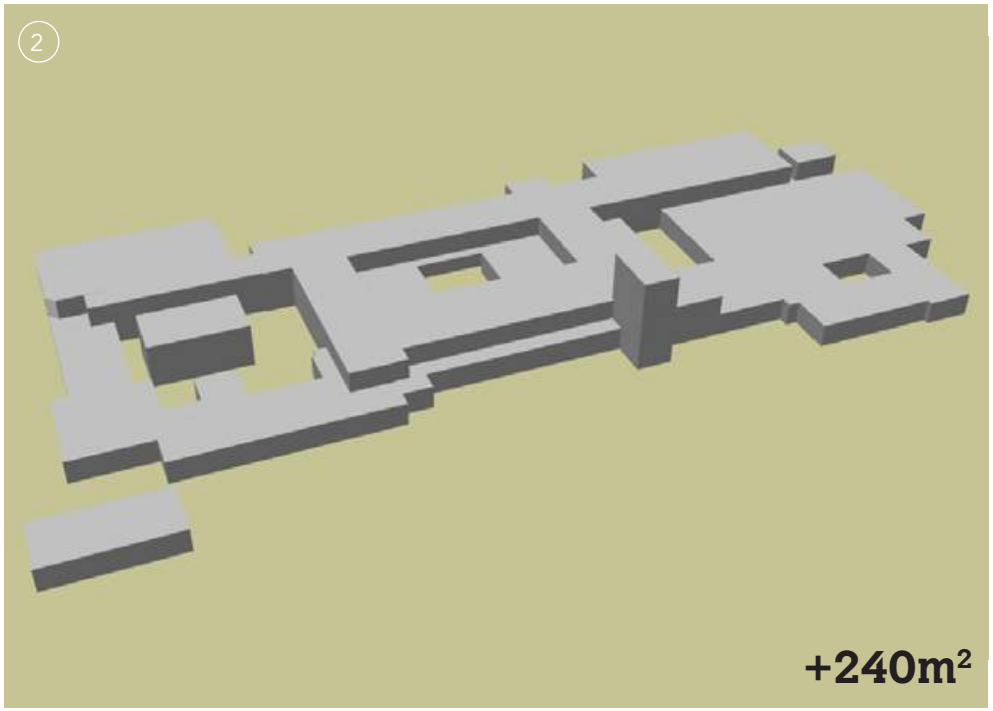
Phase A, Ground Floor

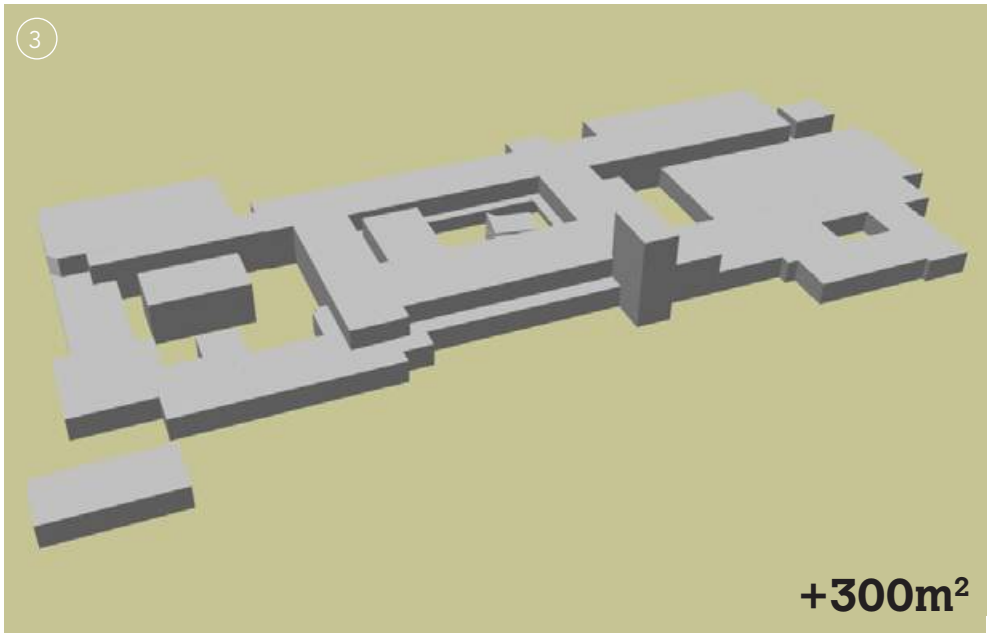
Phases A3 & 4, Increase capacity, 3 new classrooms in centre of enclosed courtyard

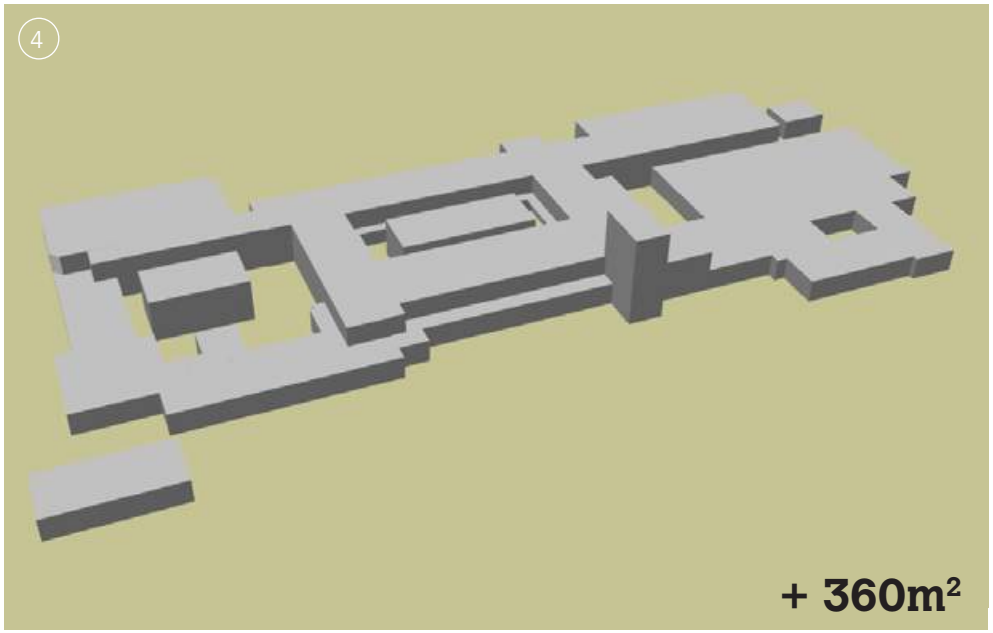
Open plan classroom @ First Floor for Business and Social Studies











Options for developing internal volume of new covered courtyard

Examples of development within large double height spaces including open decks and free standing pod type classrooms

Large gathering areas at the heart of the school

5.3 Phase B, Dining and Catering

Functional space
The school has identified, and it is clear during visits, that the current dining and catering facilities are not functioning well. The dining area must also serve as corridor access to both the Arts and D+T departments as well as the Drama and Music which implies two lines of cross traffic though a dining hall. The collision of uses greatly compromises the space and takes an already lean area provision for dining and makes it very unpleasant. The catering area is also struggling due to a difficult relationship to the dining area. The narrow frontage makes food delivery, preparation and sales all difficult. Finally both areas are housed in low grade buildings that are in poor condition and thermally very inadequate.

Relevant Project Themes

Flexible space
When considering new dining and catering facilities it is important to find a balance between the desirable area for feeding the current student population and the need to be efficient and lean with area distribution. Ideally the space has multiple functions and an ability to work in shifts so that the area is working at its maximum potential.

Community Use
As noted the school have strong links with the community and are already active in providing a venue for communal activities. The school have found that good catering facilities are an attractive feature and would be beneficial to the local context. By positioning these uses at either end of the building we will reinforce the diagram that sets potential community use at each 'book' end. Further logic is to position the dining and catering near the sports facilities for two reasons:

- the dining area can also operate within the PE curriculum
- these facilities often go hand in hand with community use of sports facilities

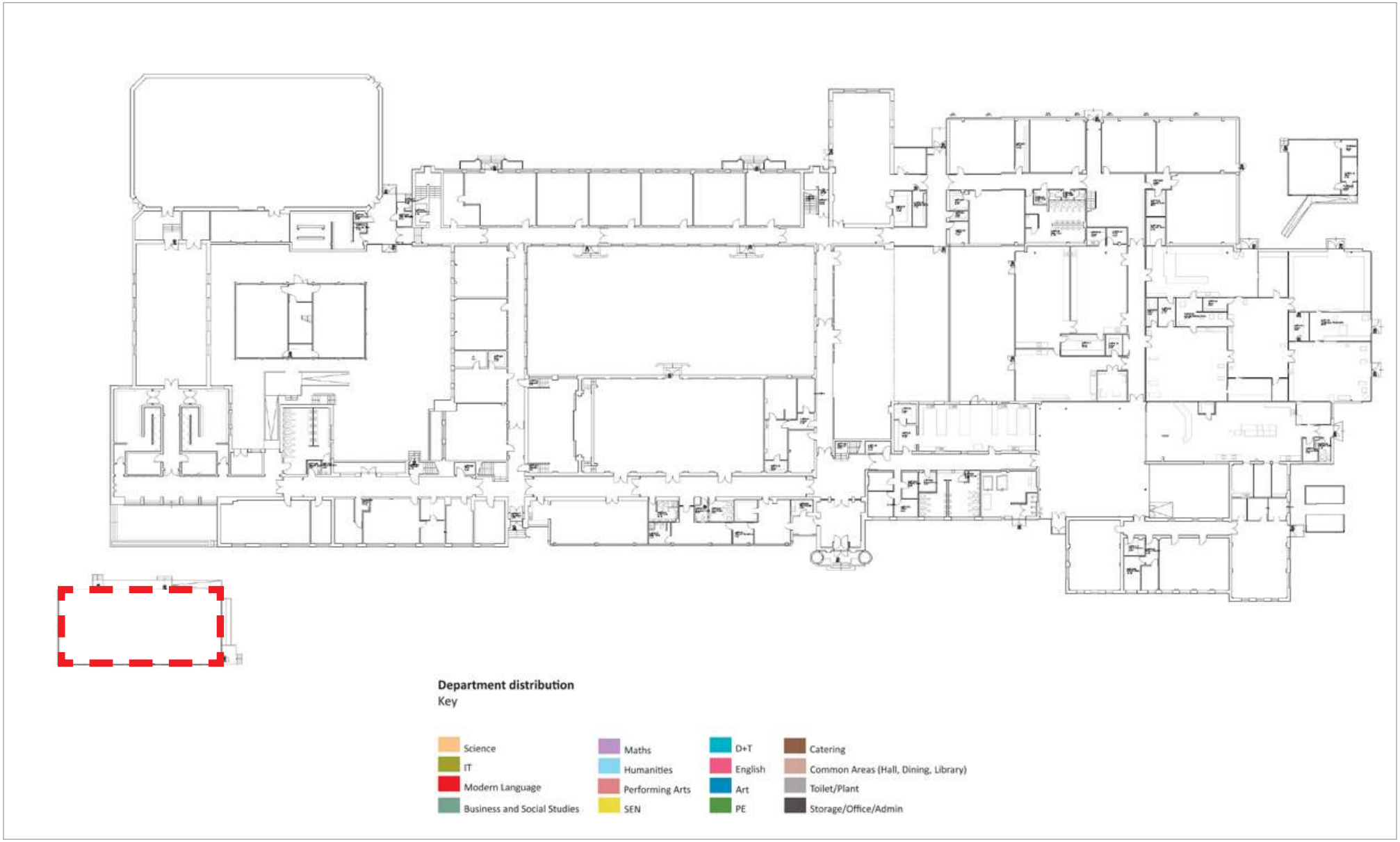
Position on site
A greater goal of the development proposals is to remove all of the temporary accommodation on site. As the Maths department was re-housed in the new central courtyard the low grade shed in the southeast corner of the site is clear for demolition. This frees up a natural area to position the new dining and catering:

- adjacent to access for deliveries
- along the school frontage as a welcome and social destination
- located in a ' book end' designated for community use
- adjacent to parking when in community use
- positioned adjacent to the current sports facilities
- ideal as single storey which may be deemed as most appropriate for this area of the site

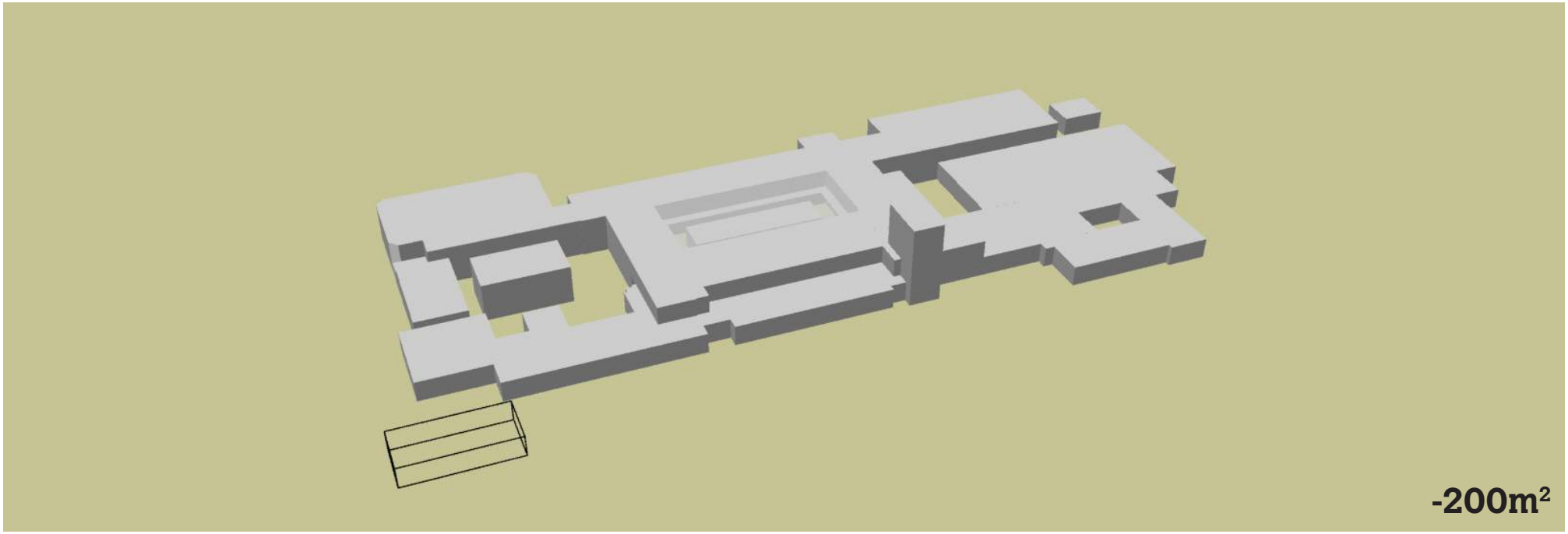


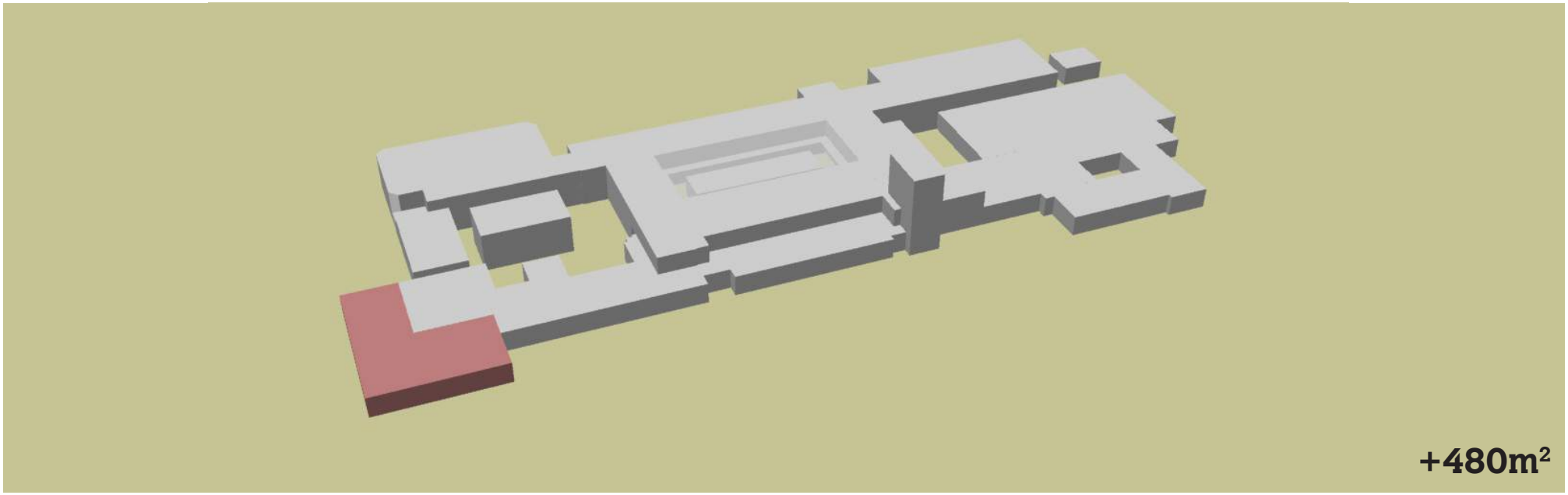
Existing dining and catering facilities

Phase B1, Demolition of the ‘poor grade’ and temporary building



Phase B2, New dining and catering positioned adjacent to PE and Sports Facilities


-200m²


+480m²

5.4 Phase C, Performing Arts Department

Removal of low grade buildings
As noted the condition of the current dining and catering buildings is poor and the thermal performance inadequate. Once these functions are re-housed this area should be earmarked for demolition.

Improving and expanding the Performing Arts
The Performing Arts Department are suffering due to the lack of a centralised space, inadequate area for the curriculum and low grade facilities for dance and drama. These shortfalls are met by using space off site but this is not ideal due to the time lost and costs associated with travel to other sites.

Relevant Project Themes

Density
When considering redevelopment the masterplan will in most cases recommend building at least 2 storeys. This is more efficient than sprawling outwards and in the case of densely populated urban areas the open ground plane should be preserved for outdoor play and recreation. This aligns with local and government policy on the protection of playing fields. Therefore the recommendation for the brown site left by the demolition of the dining and catering is for a 2 storey infill development to house an improved and centralised Performing Arts Dept. at ground floor.

Improving efficiency
In order to maximise space and establish a focus to this area of the building the design proposal is to again cover the central courtyard and shift adjacent circulation into this space. It can then provide informal break-out and impromptu dance sessions, both reinforcing the heart of this department.

Circulation and access
The redevelopment of this wing will also lead to the relocation of the current student entry point. Instead of slipping into the dining area the new entrance is positioned along an axis that leads through the building and out to the rear. This is positioned to improve permeability, circulation and to strengthen the concept of internal 'streets'.

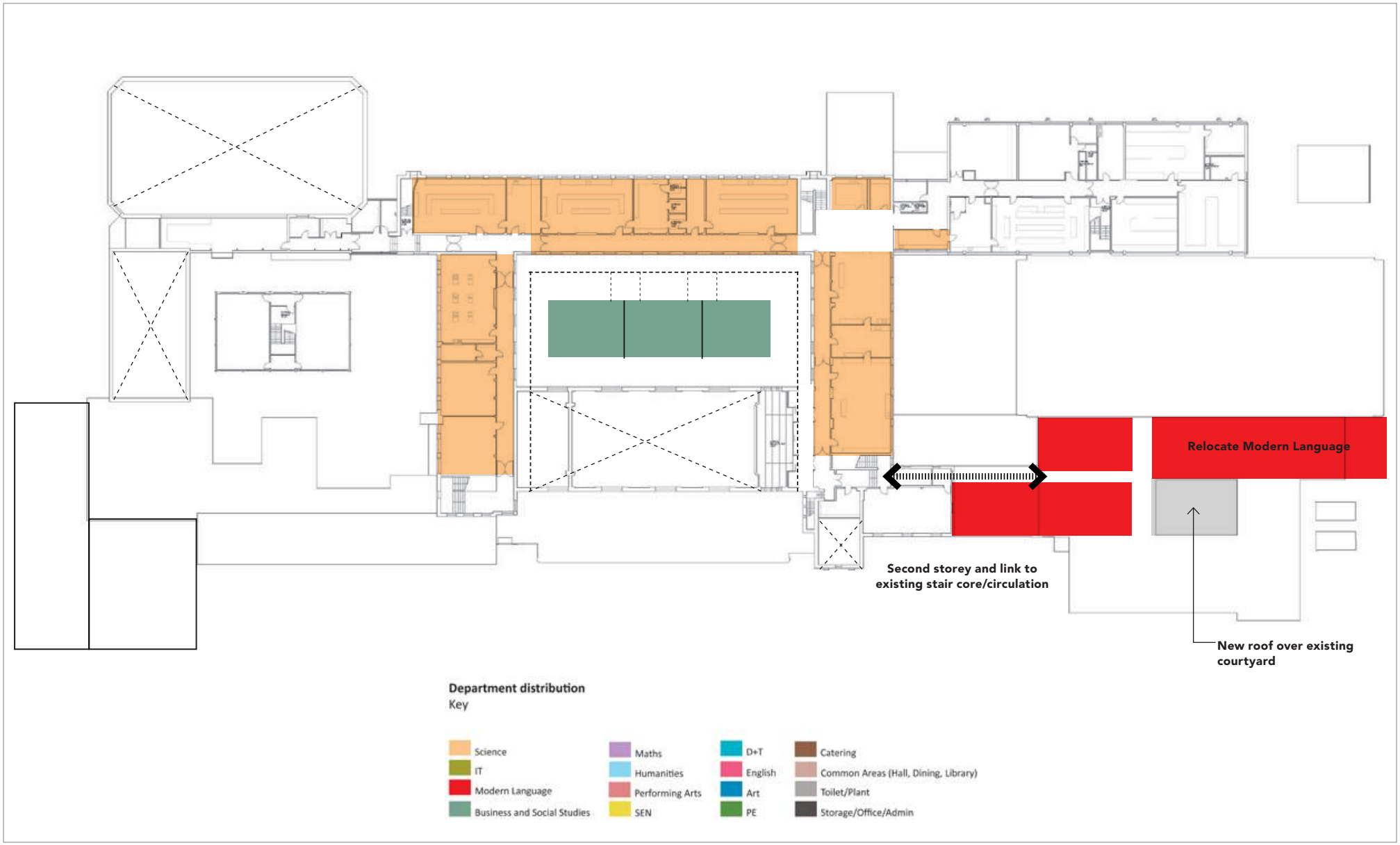
Modern Language Department
This department is currently housed in a 2 storey temporary building in the southern courtyard. By shifting it to the upper level of this new wing we are clear to demolish another low grade building.

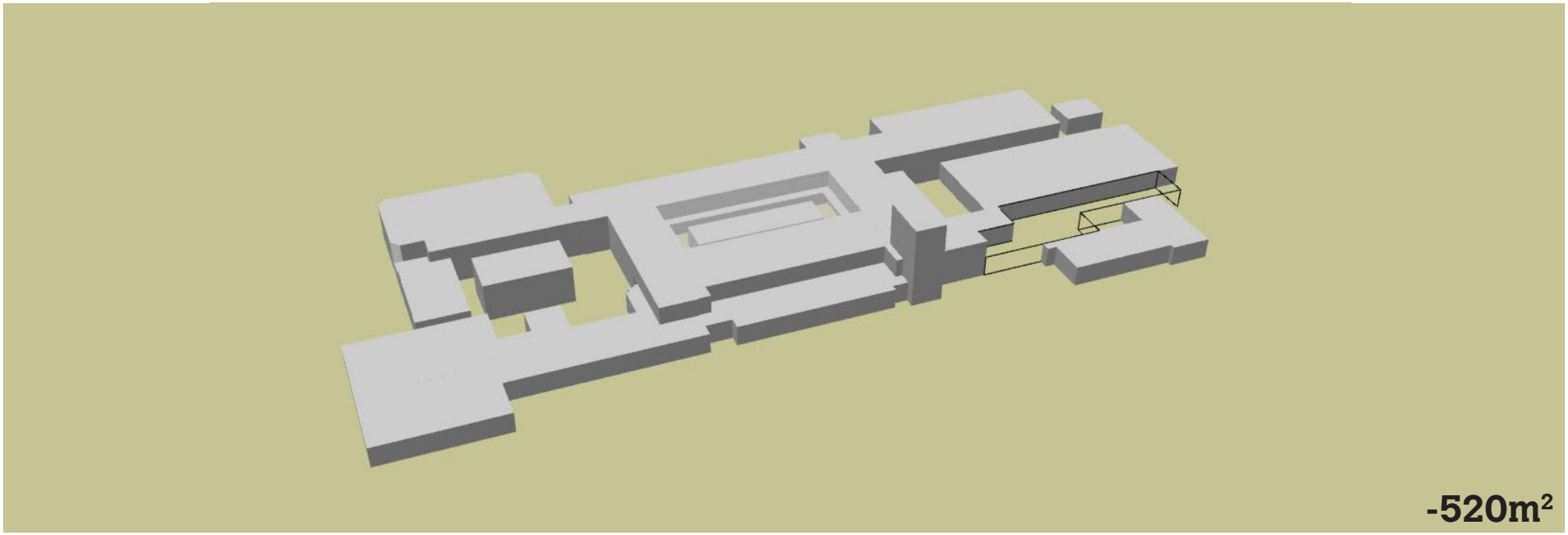
Existing drama and music area including courtyard

Phase C1, Demolition of the existing ‘poor grade’ dining, catering and boiler room areas

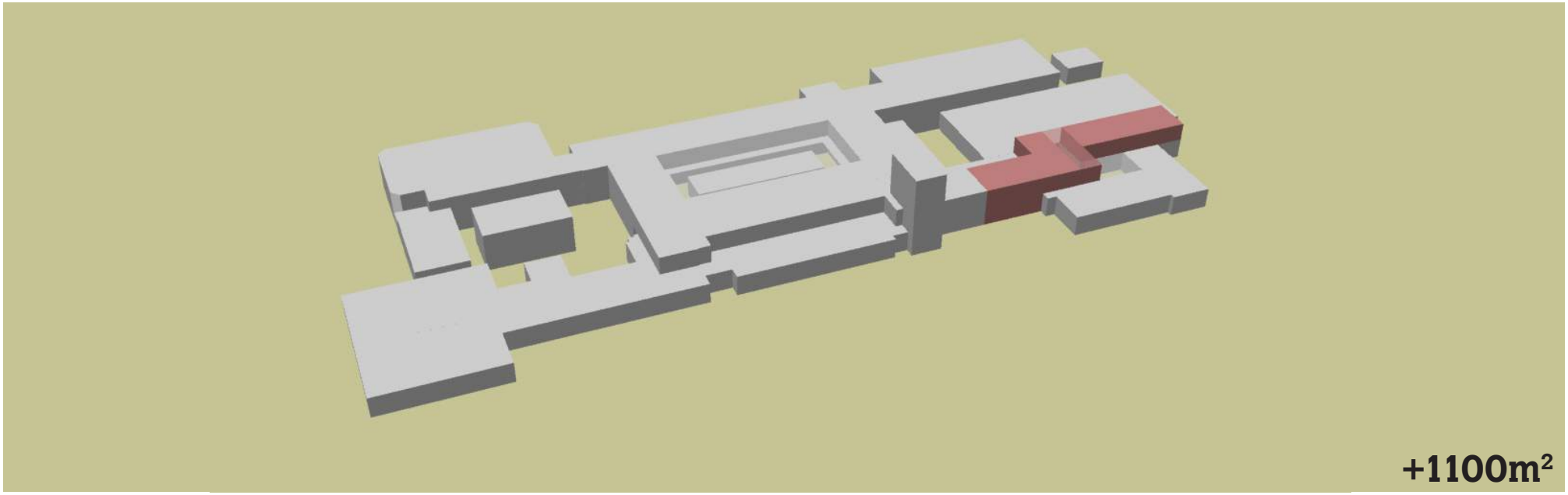
Phases C2 and C3, Redevelop this area for an improved and centralised Performing Arts

Add second storey (concentrating development) and re-house Modern Language

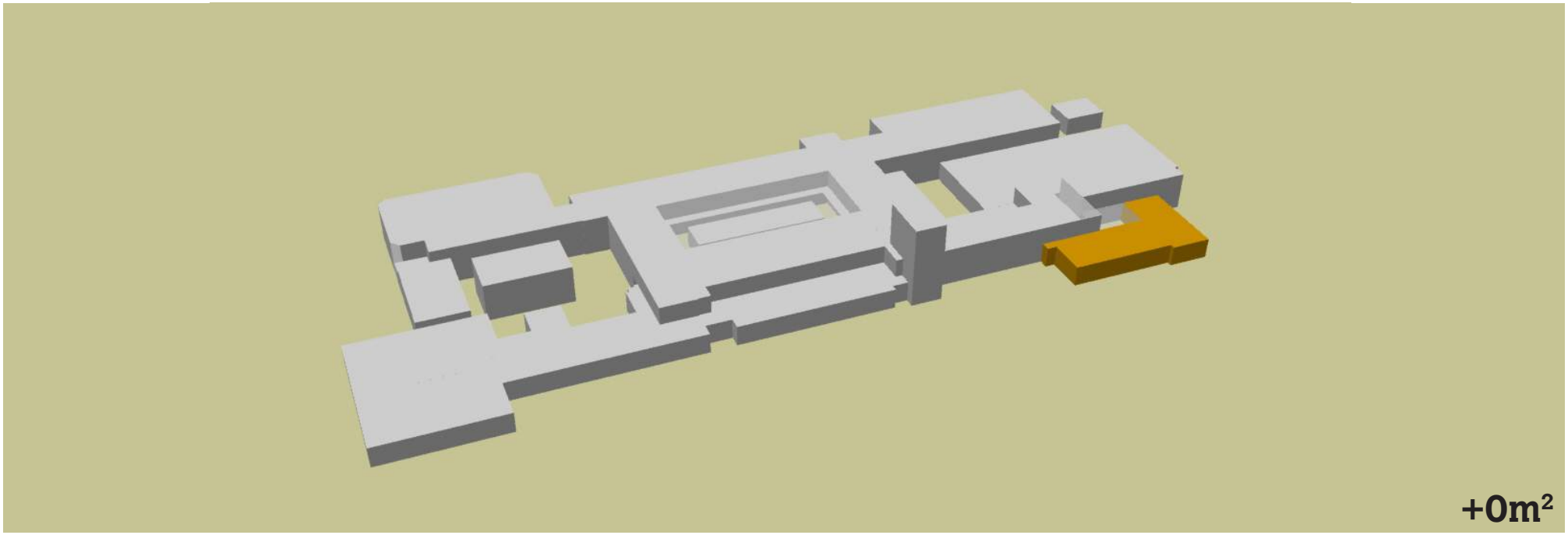




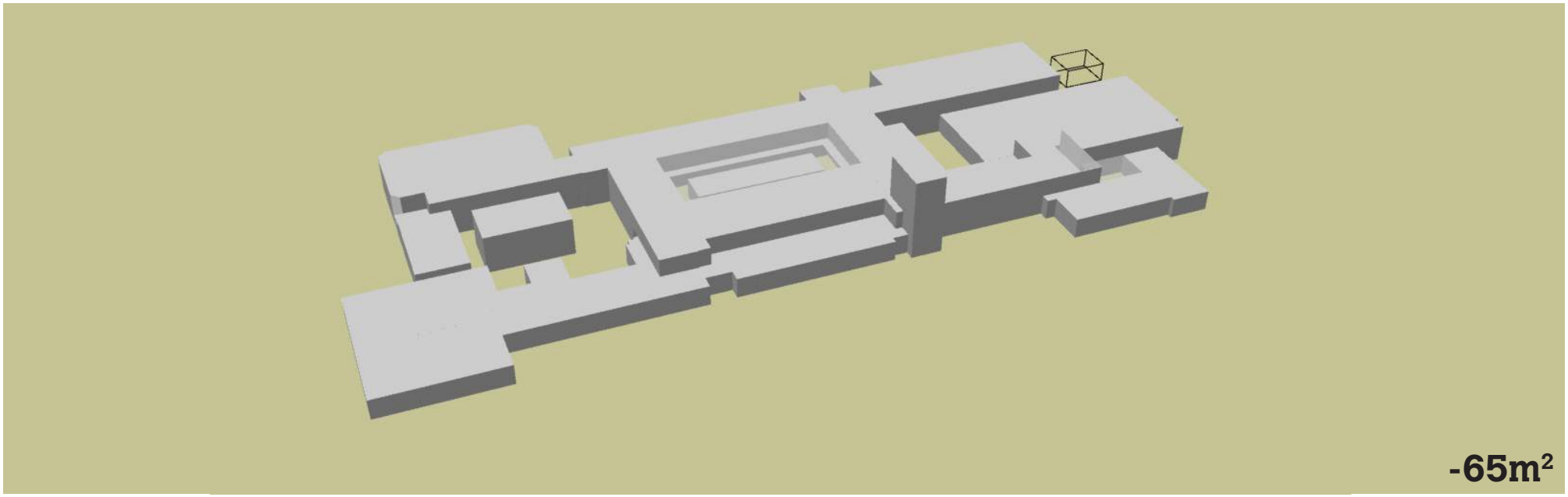
Demolish dining and catering



Build two storey classroom wing, cover courtyard at Ground Floor, make link to First Floor @ tower



Refurbish existing drama and music department, move circulation into newly covered courtyard enabling classroom area to increase



Demolish 'poor grade' and temporary classroom in northwest corner once accommodation has moved to new wing

5.5 Phase D, Arts, Design + Technology and General Teaching

Building condition survey
This area has been identified as very low grade in terms of building condition and thermal performance. The following faults are noted and this area is therefore highlighted for demolition.

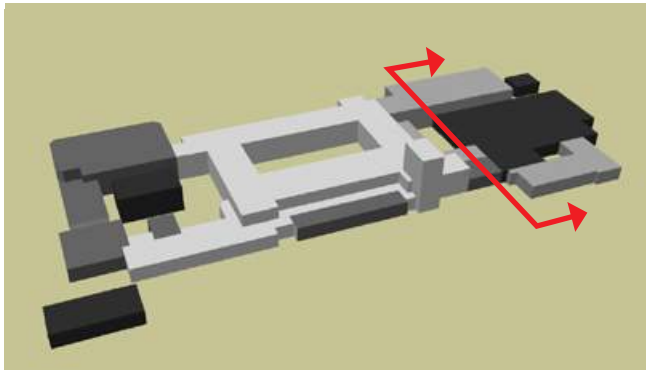
- flat and prone to leaking
- perimeter glazing causes extreme overheating in summer
- perimeter glazing causes extreme heat loss/drafts in winter
- foundation slab is cracked
- perimeter facade system is in decline

Community Use
This area of the school is earmarked as a 'bookend' for potential community use. It is adjacent to access and parking and can be isolated from the central core of the school building. Any new development should cater for this possibility and be flexible in nature.

Relevant Project Themes

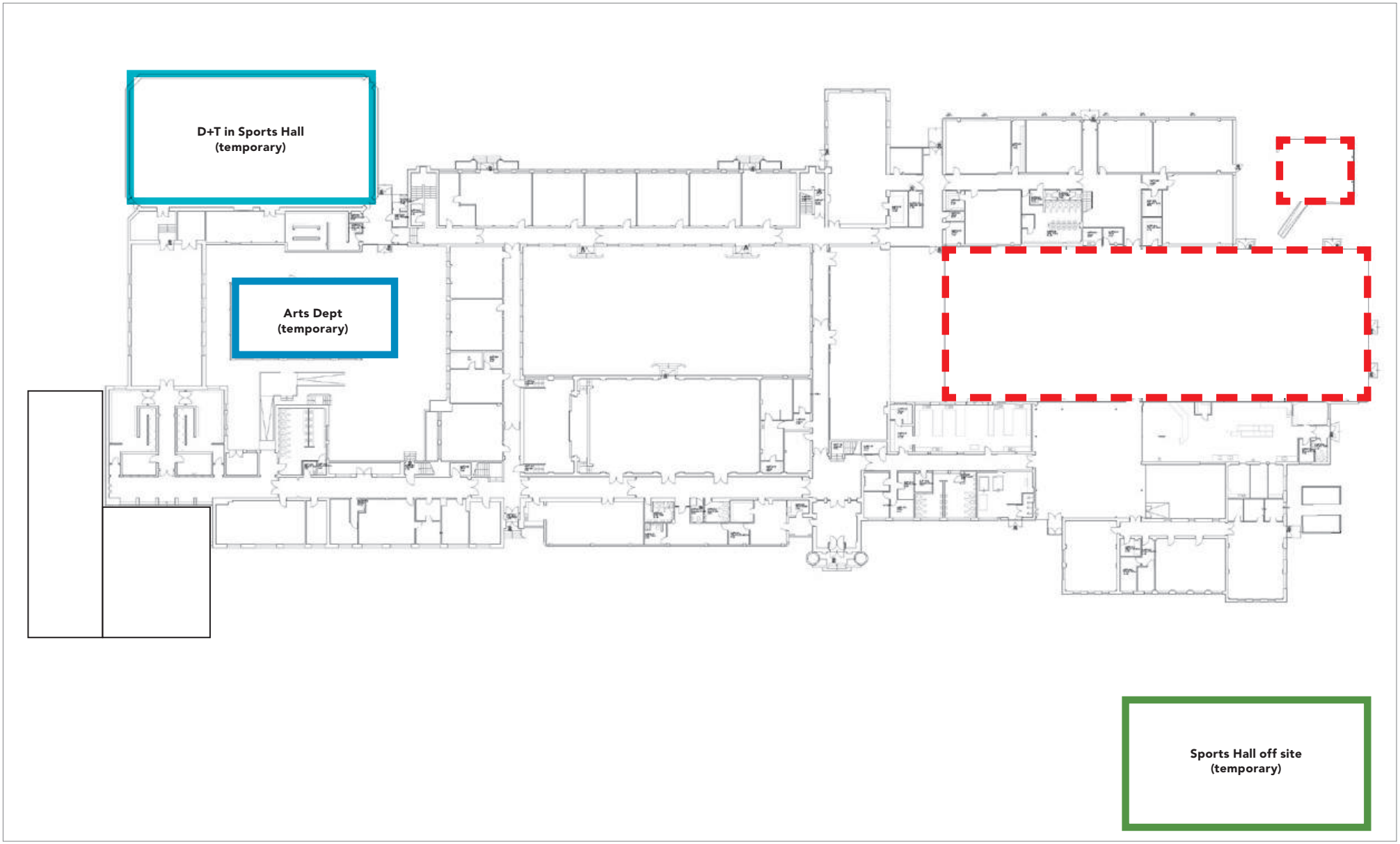
Temporary accommodation
A large part of the curriculum operates in this area of the building and will need to be housed during redevelopment. By timing the construction works with the summer break the impact can be minimised but the duration will still require accommodation elsewhere in some form. In discussion with the leadership team we understand that a sports hall can be rented off site. By shifting this use we can operate a temporary D+T department within the school sports hall and save the storage of associated equipment off site. Prior to demolishing the temporary shed in the south courtyard this building can serve as a temporary Arts Dept.

Environmental and Social Performance
The development opportunity and the clear footprint are such that quite a significant new volume and mass can be considered. The depth of the gap lends itself perfectly to the standard module of a two sided classroom wing with central circulation in a double height space. The central spines provide opportunities for break out and open plan teaching but can also be environmentally beneficial. With roof glazing along the top natural daylight can be optimised and passive ventilation also utilised with the chimney effect.


Development opportunities at north end

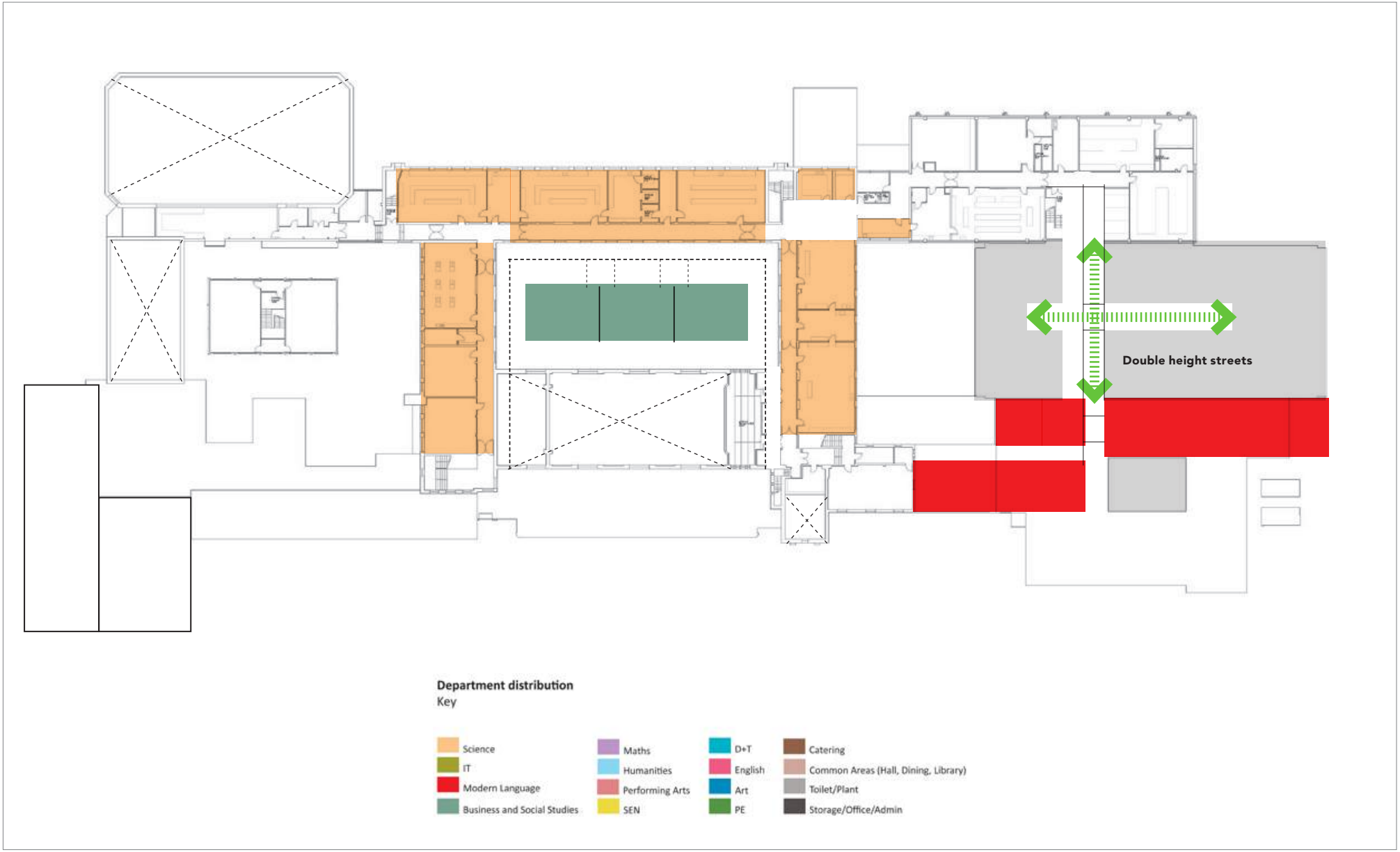

Building condition is low grade

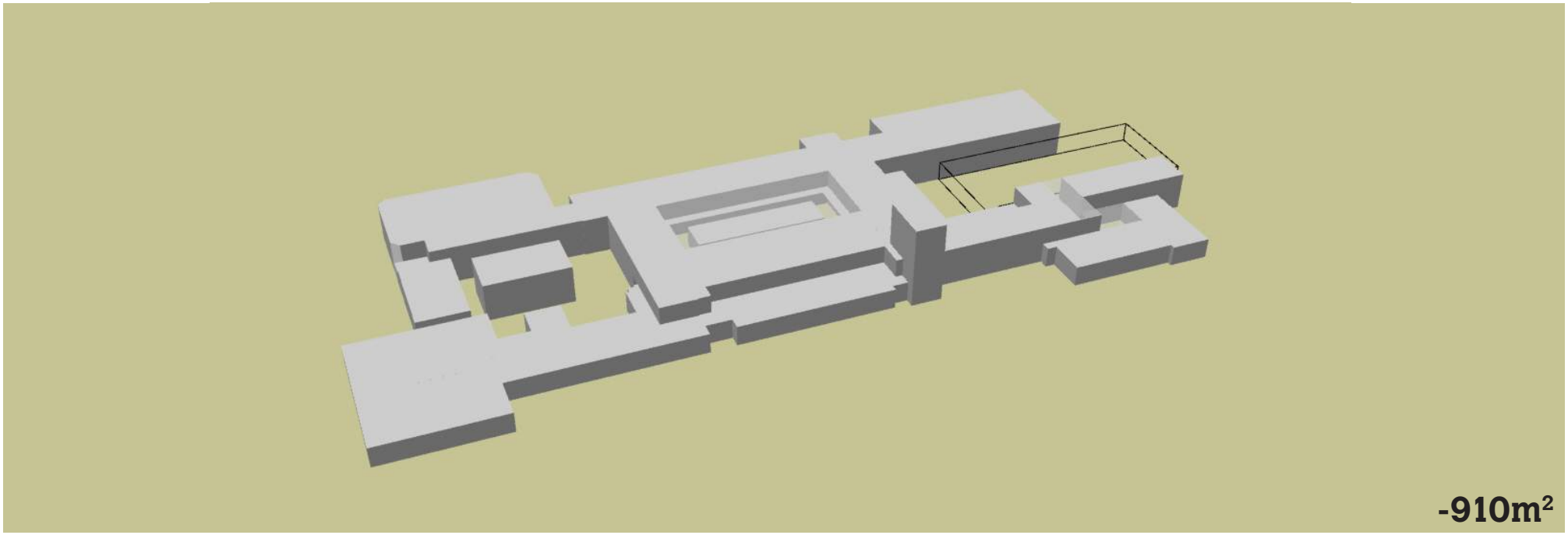
Phases D1 & 2, Arts and D+T Departments, relocation and demolition plan (low grade areas)



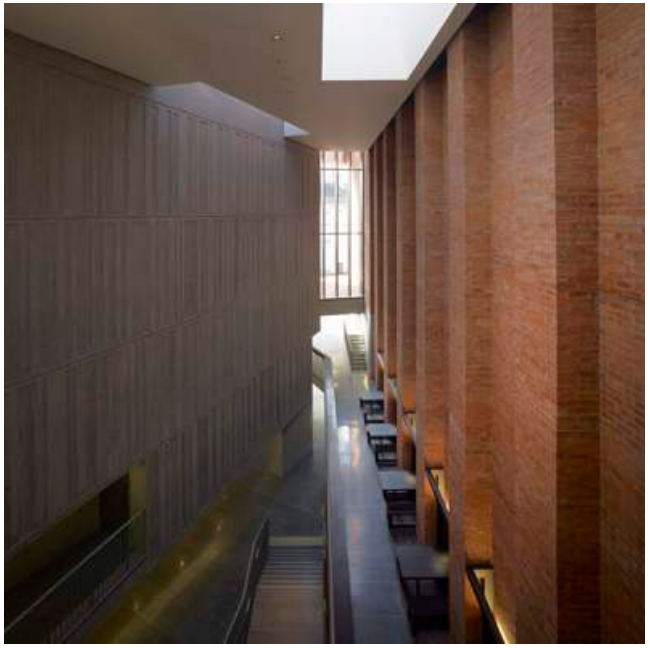
Phase D3, Redevelop Arts and D+T

First Floor, additional classrooms and increased capacity

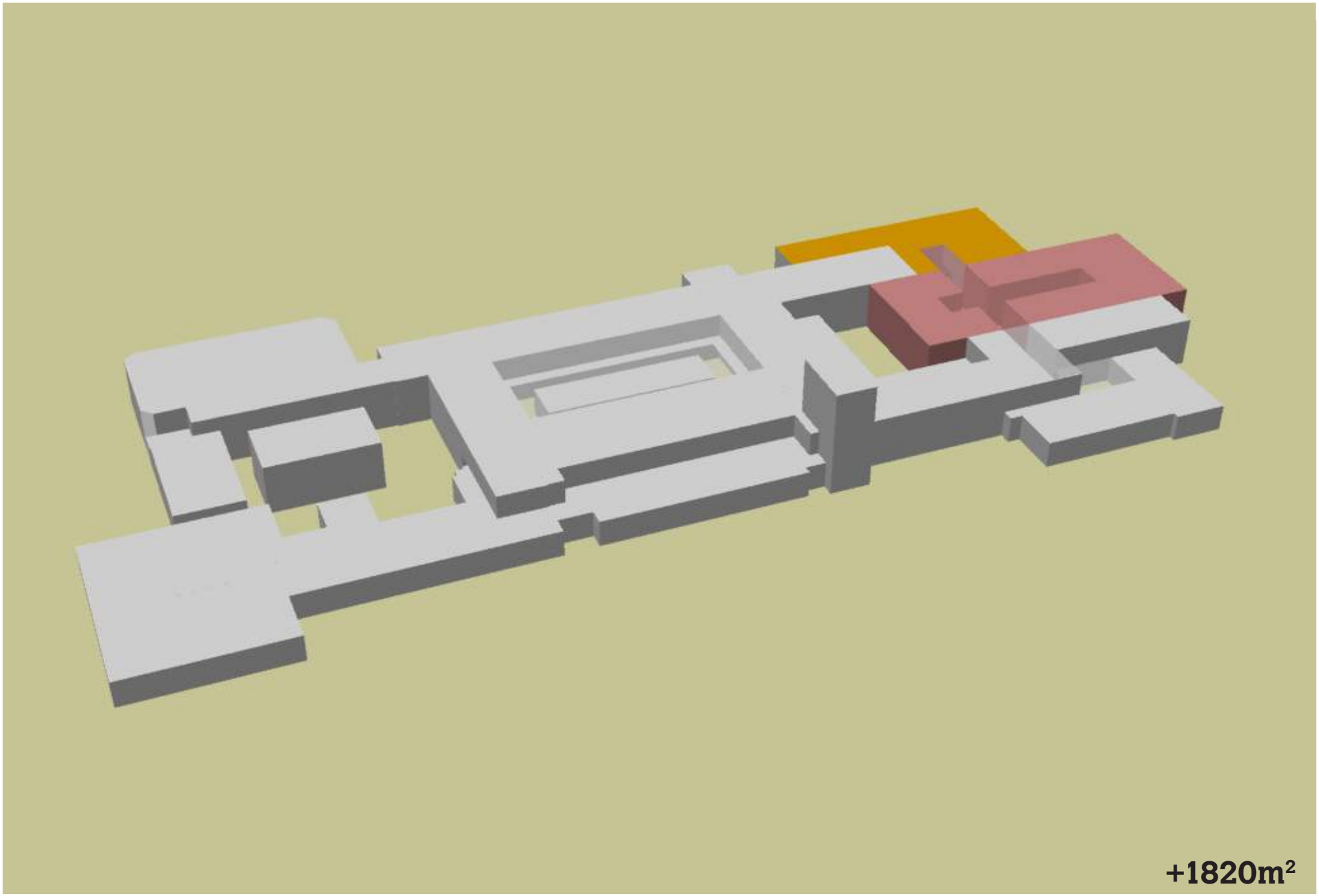




Demolition of the existing Arts and D+T Departments



Circulation streets, double height and naturally illuminated



New 2 storey infll and refurbishment

5.6 Phase E1, PE, SEN + General Teaching

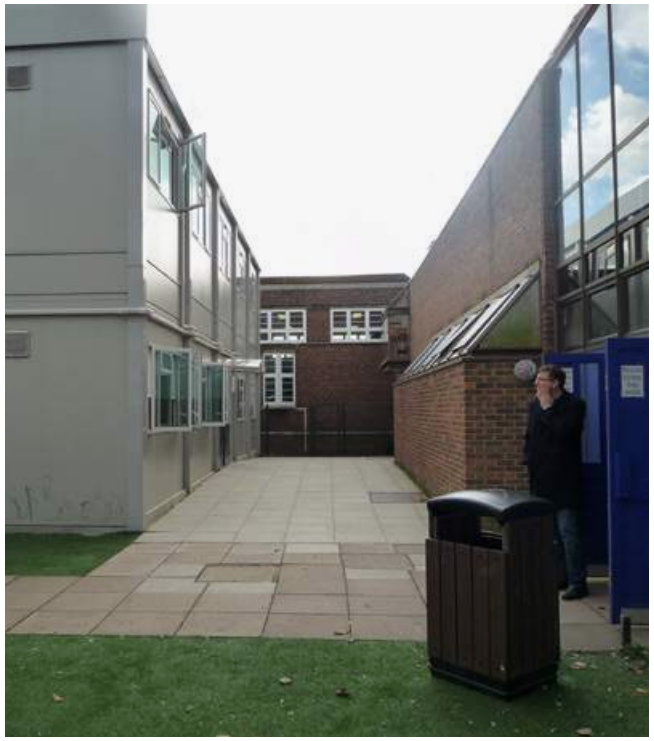
Capacity
By the end of Phase D the overall building area will have increased by 1820m2 and total 11,425m2. This may well suffice in terms of the schools expansion needs and will have removed and replaced those areas of the buildings that are currently in the worst condition.

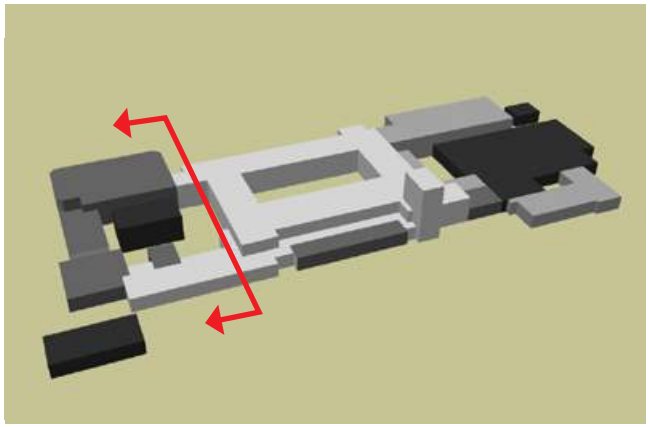
That said, it is still valuable to forecast ahead and highlight how best to address the next round especially given the changing nature of the local population and the greater debate around secondary school education. Phase E is focussed on the southern end of the building and identifies how best to expand, while maintaining the consistent themes of increasing height and protecting/ enhancing the open ground plane. There are two degrees of development, E1 a more minor infill approach that maintains the existing Sports Hall and E2 which seeks to redevelop the full PE offer including the fitness, changing and sports hall areas. Both approaches provide further typical classrooms at first floor assuming a continued increase in the general student population. Again this development is well placed for community use as it is located in a 'bookend' adjacent to access and parking.

This area of development continues the theme of working around an open courtyard but in this case the outdoor space is maintained. It serves as a private escape for the SEN department which has been able to consolidate as part of this expansion.

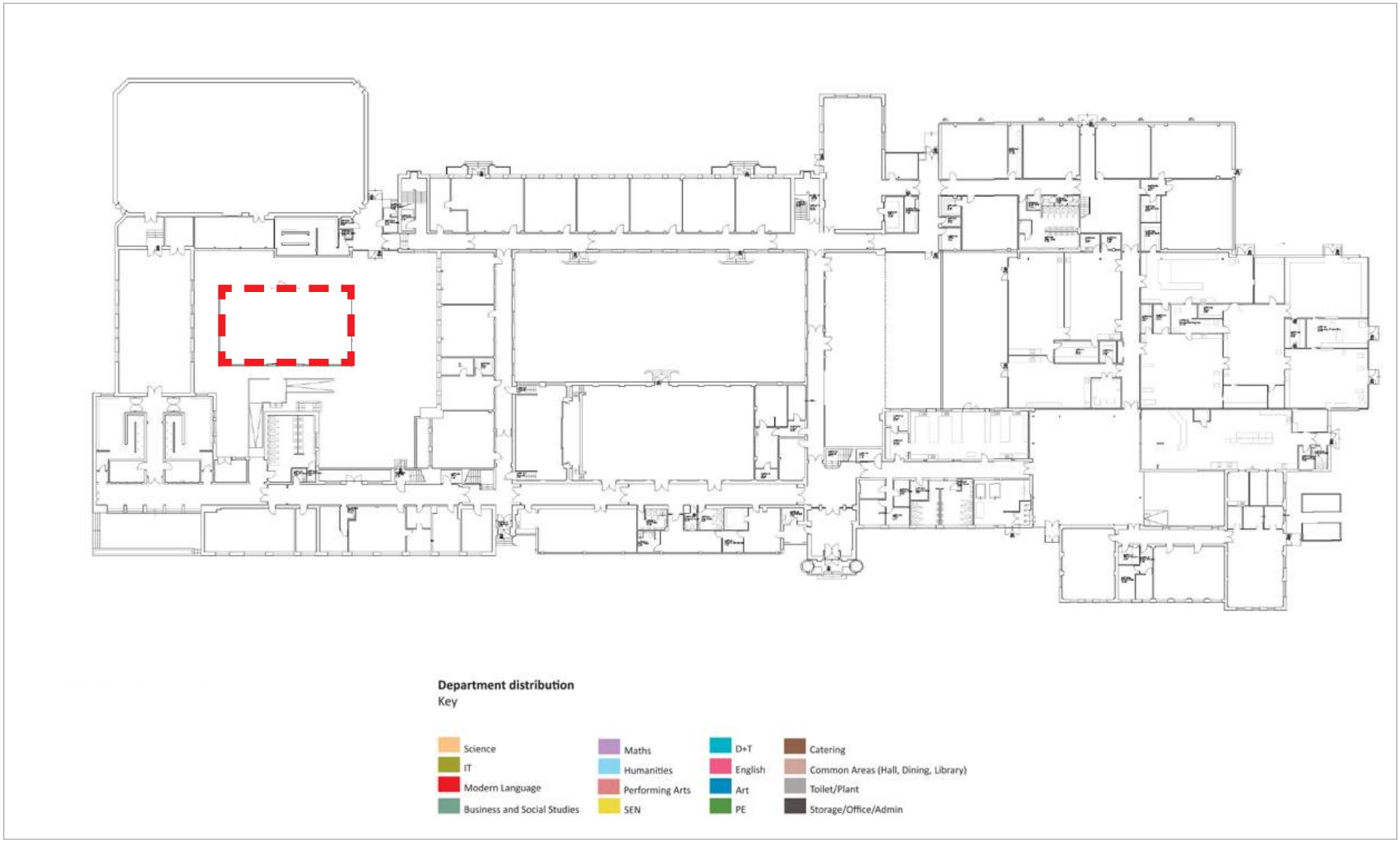
The insertion of a classroom wing into the current open courtyard assumes a re-working of the unusual spaces currently flanking the sports hall. It also provides an internal corridor which removes the need for circulating through the fitness studio.

Relevant Project Themes


Existing southern courtyard

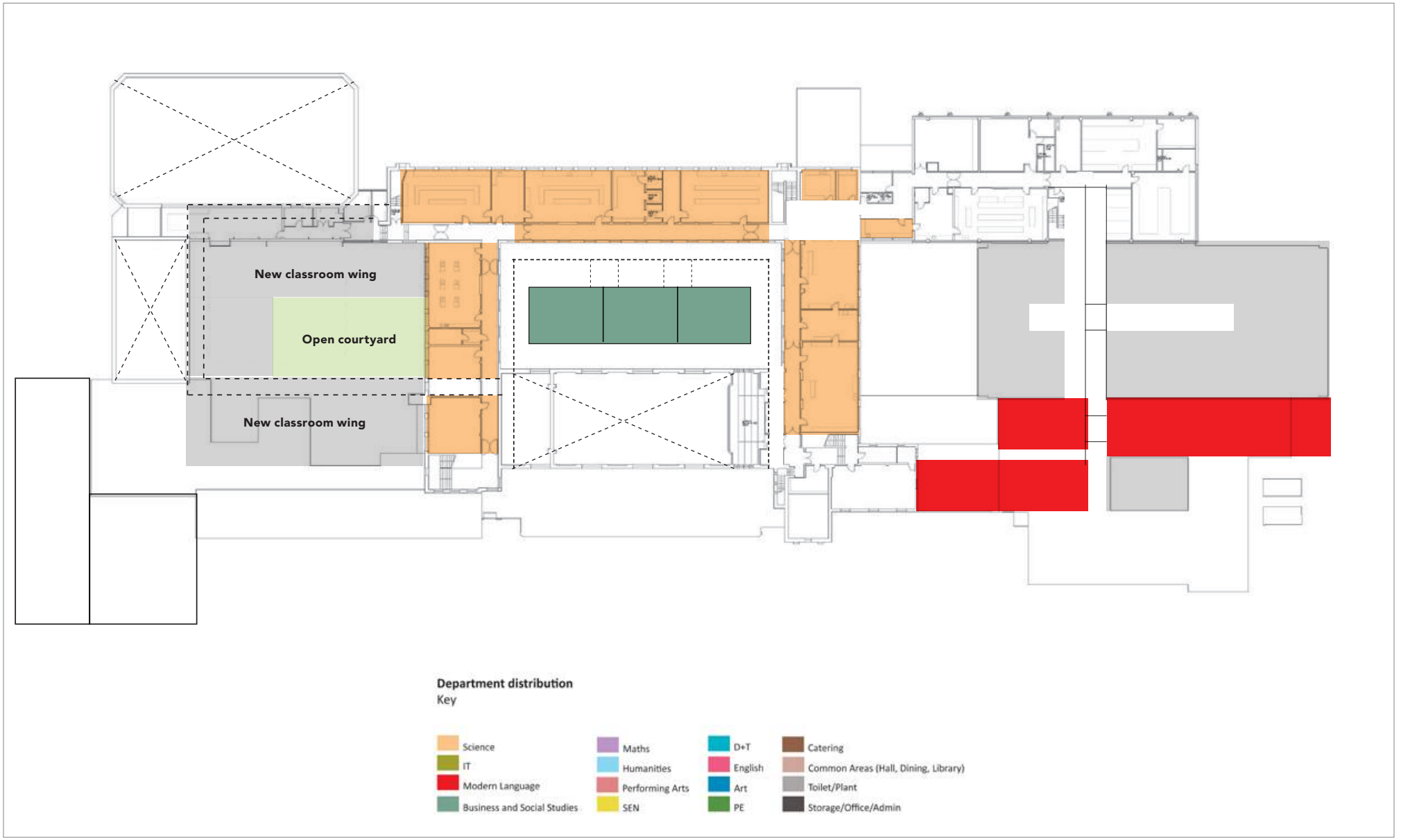

Area designated for possible community use

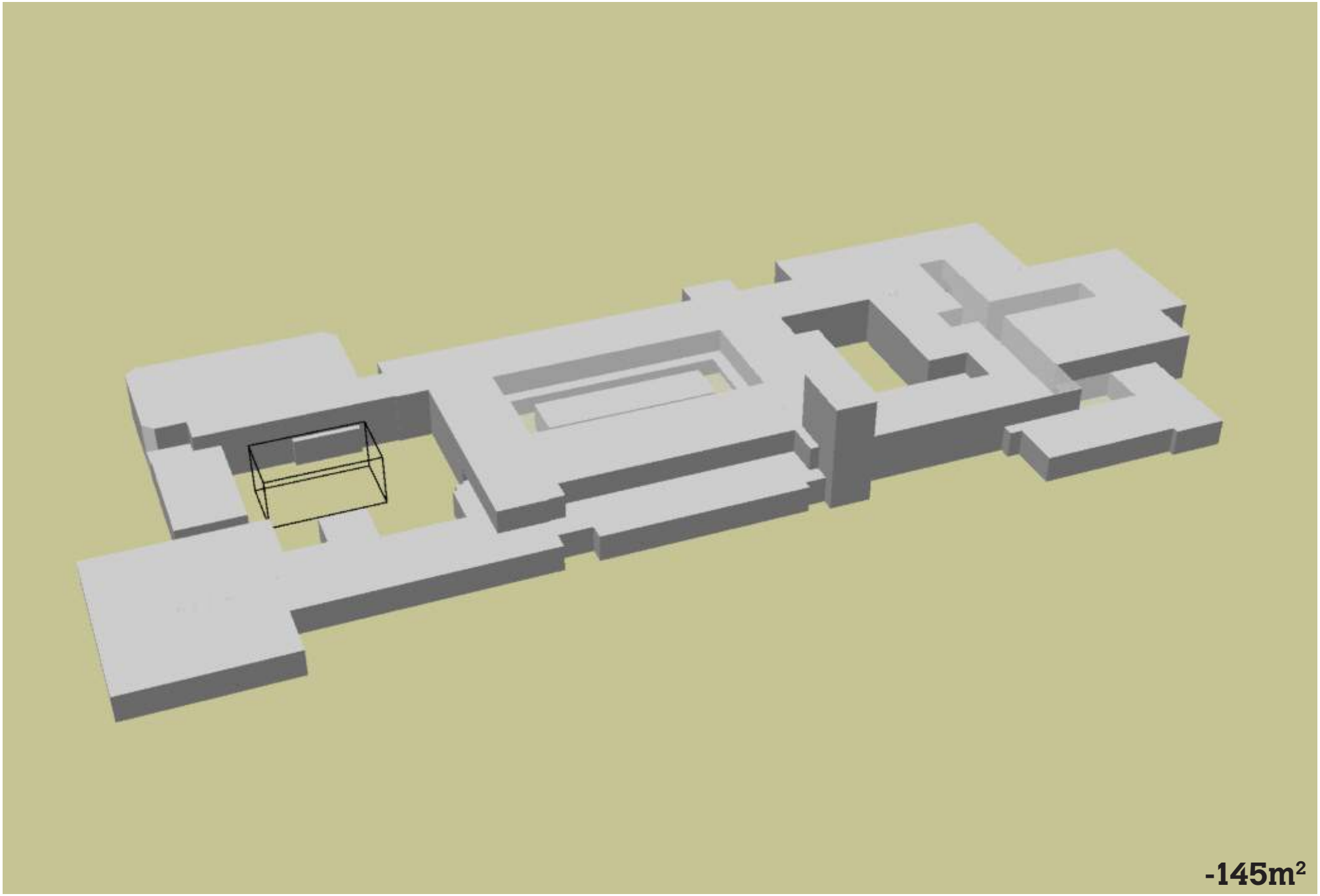
Ground floor, demolition of existing temporary building in courtyard



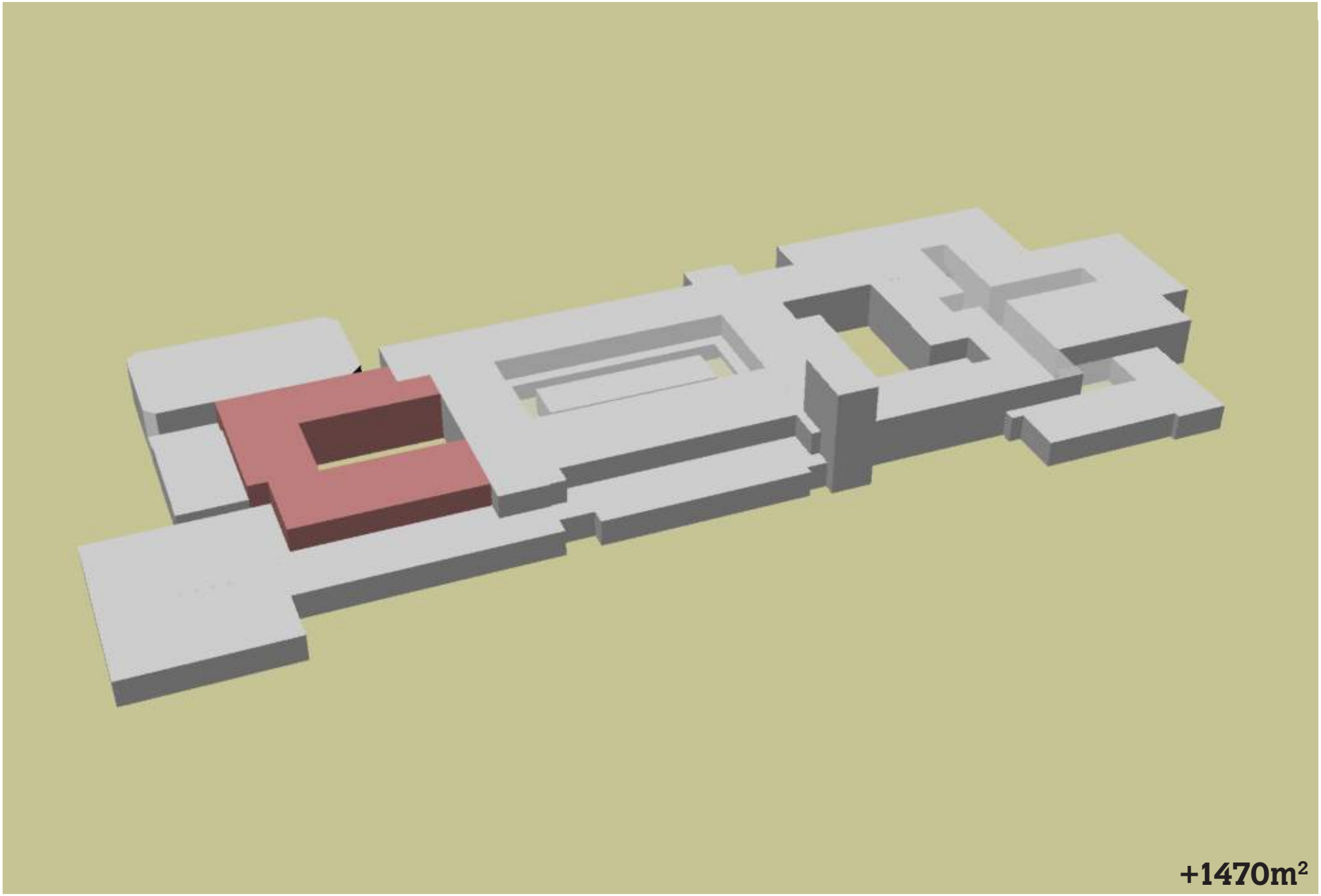
Ground Floor, new clasroom wing

First Floor, additional classrooms and increased capacity





Demolish existing 2 storey temporary building (Modern Language Department now located at first floor, above the Performing Arts)



New 2 storey classroom wing

5.7 Phase E2 Major, PE, SEN + General Teaching

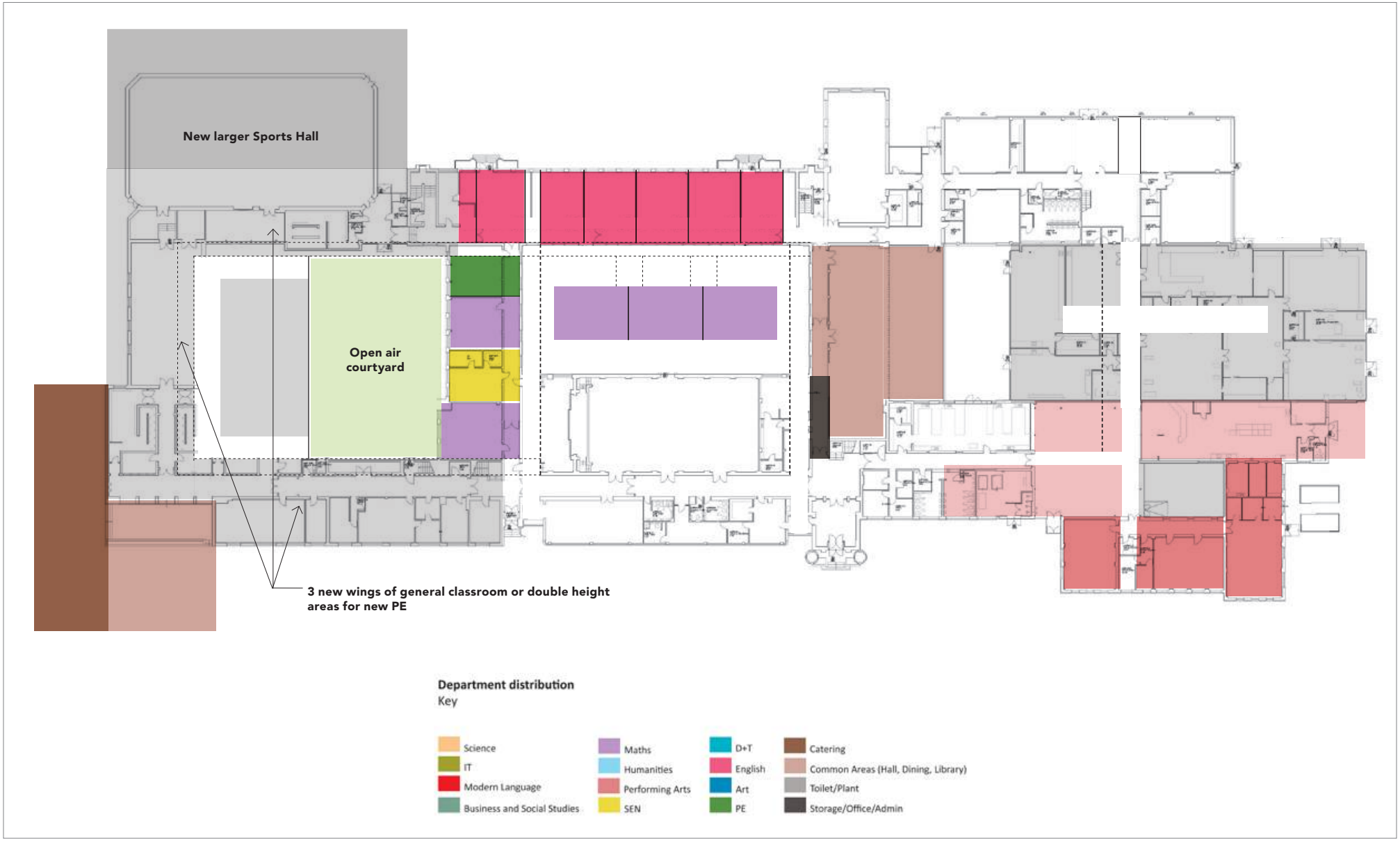
Major redevelopment proposal
This more major approach to redevelopment in the southern wing includes a complete overhaul of the PE department including the replacement of the sports hall, fitness gymnasium, changing rooms and associated administrative and classroom support.

This allows the development of a new larger sports hall and 3 new full classroom wings at two storeys. The resulting area increase is 3500m2 and a total of 12,325m2 across the site. It is interesting to note that this area equates to the BB98 criteria for a student population of 1440, near to the schools forecast for a potential increase in the student population over the coming years, but would be deemed over provision when considering the DfE 2012 criteria.

Relevant Project Themes

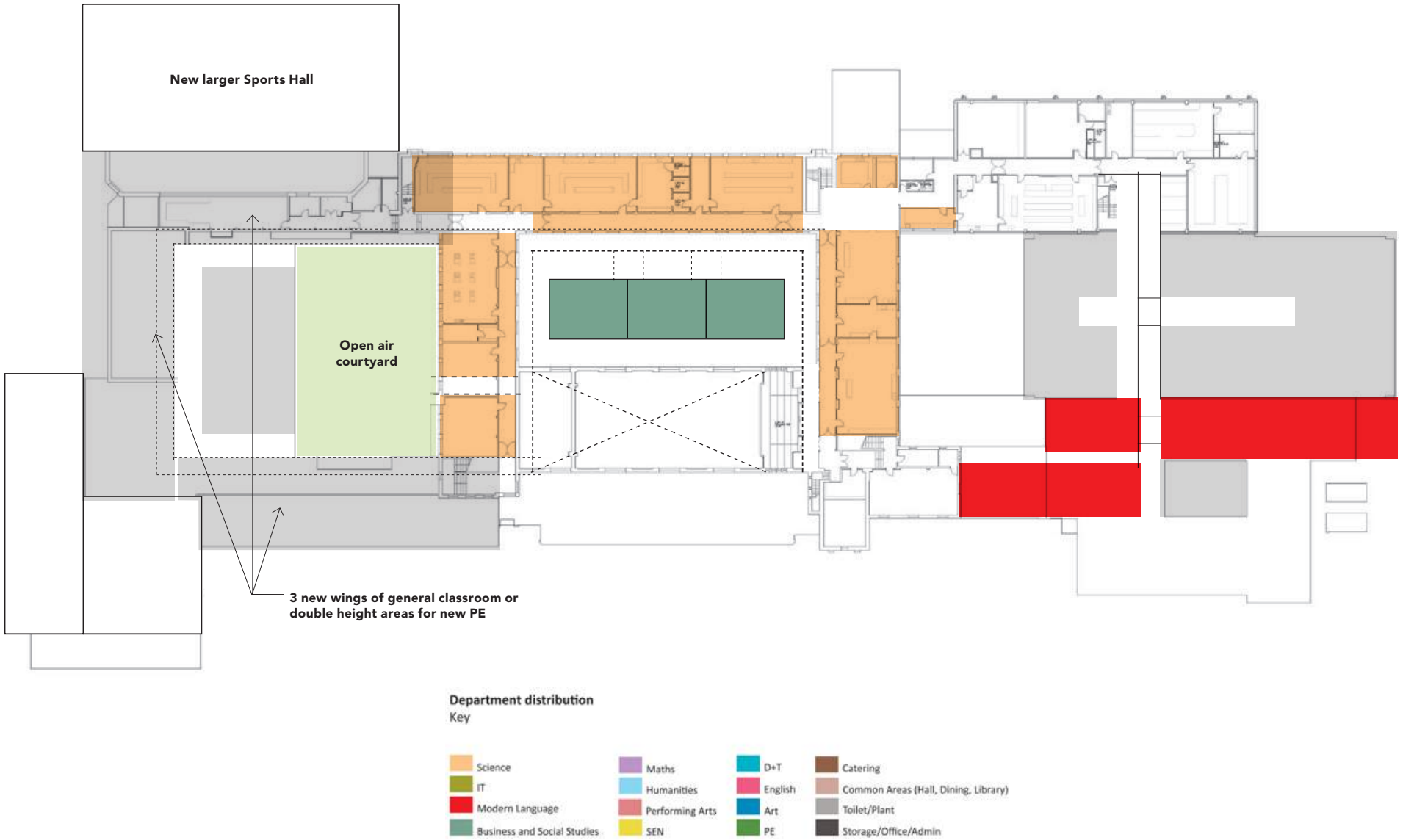
Existing Sports Hall and support facilities

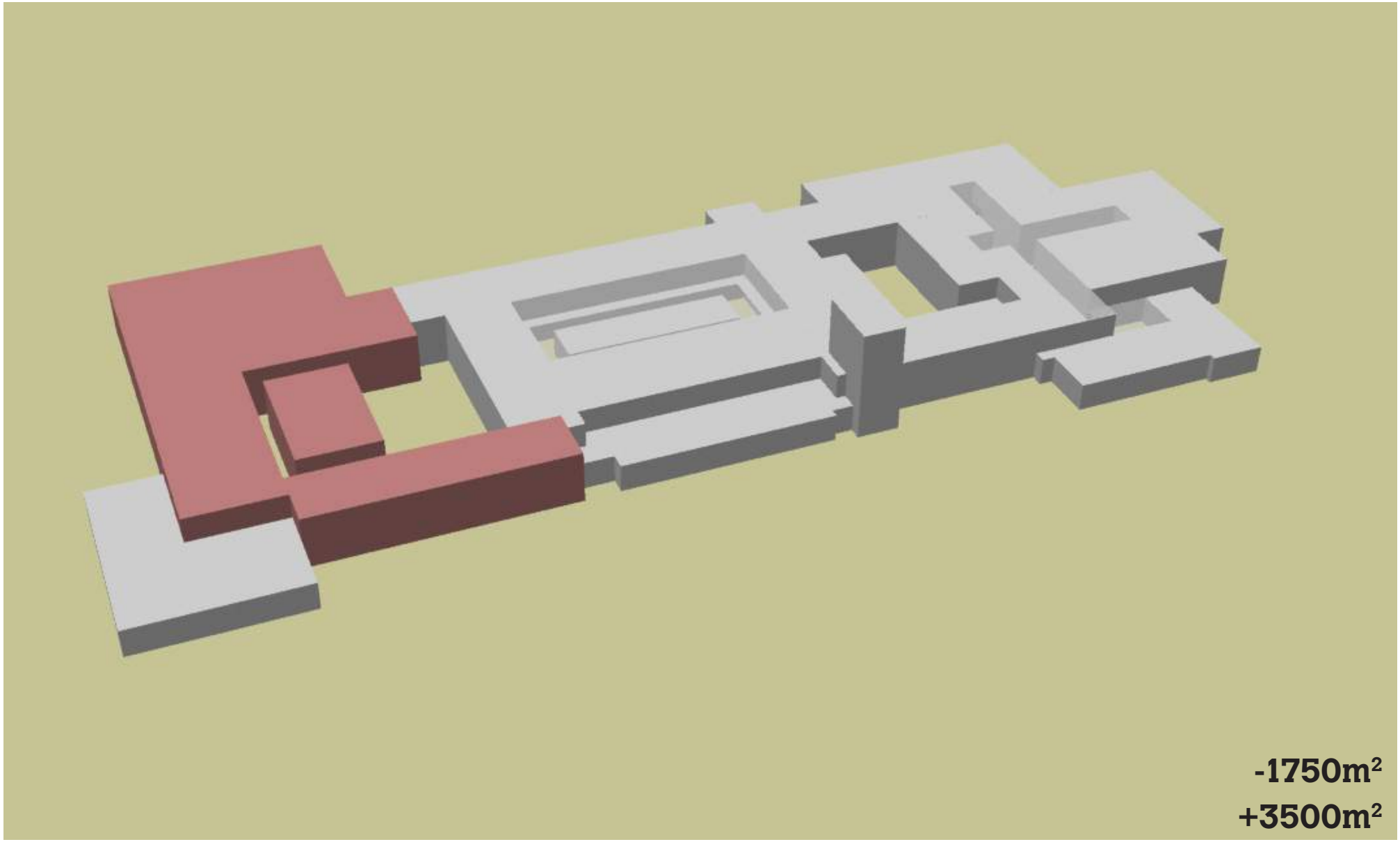
Ground Floor Plan



New 2 storey classroom wing

First Floor Plan





New 2 storey classroom wing, sports hall and associated functions

5.8 Environmental performance

Energy Audit
In November 2010 Useful Simple Projects prepared an Energy Audit for the existing building stock. The report is located in the appendix of this document. The key summary and recommendations focus on:

- Building fabric
- Space heating
- Cooling
- Domestic Hot Water
- Lighting
- Sub-metering
- Awareness and Behavior Changes

This work forms an excellent basis for addressing the existing condition and should be used to guide improvements to those parts of the buildings that have been identified as to remain.

Relevant Project Themes

During the recent masterplan work we carried out further work on the thermal performance of both the exiting building as well as testing proposals to improve the condition.

This work has highlighted two key areas; overheating in classrooms along the western facade and poor air quality due to lack of ventilation.

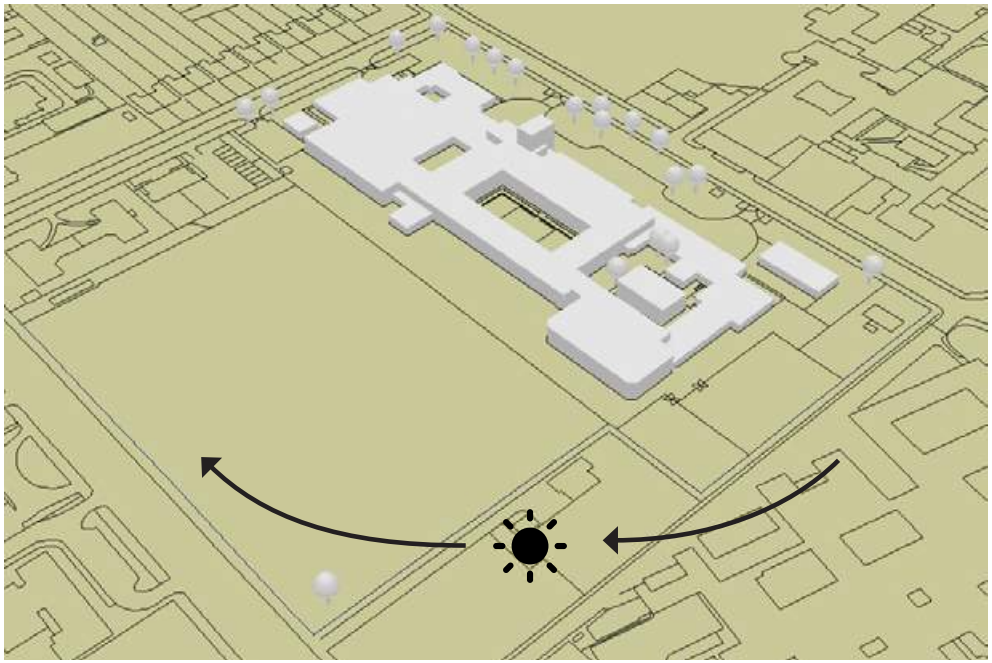
Air quality and ventilation

As discussed in the report we propose cross ventilation wherever possible by venting through the new central courtyard and the linear circulation streets. By adding a very low energy active fan into the system and a heat recovery application the air flow will maintain healthy conditions and not suffer unnecessary heat loss during winter months. The graph below demonstrates the impact on both the internal temperature and the air quality.

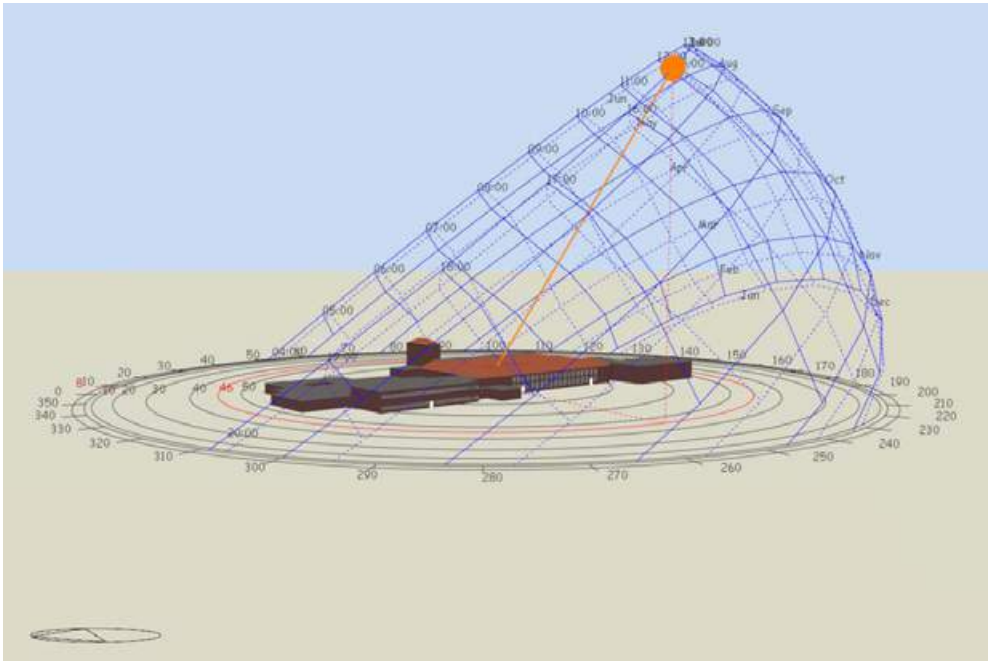
With the windows shut the proportion of the school year in which temperatures are uncomfortable is extremely high (14% for the first floor). Also the CO_2 concentrations would be extremely high (an upper limit of 1000 ppm is normal but 1800 ppm would be expected).

By providing 1000 PPM (their reasonable expectation) and the classroom is greatly improved.

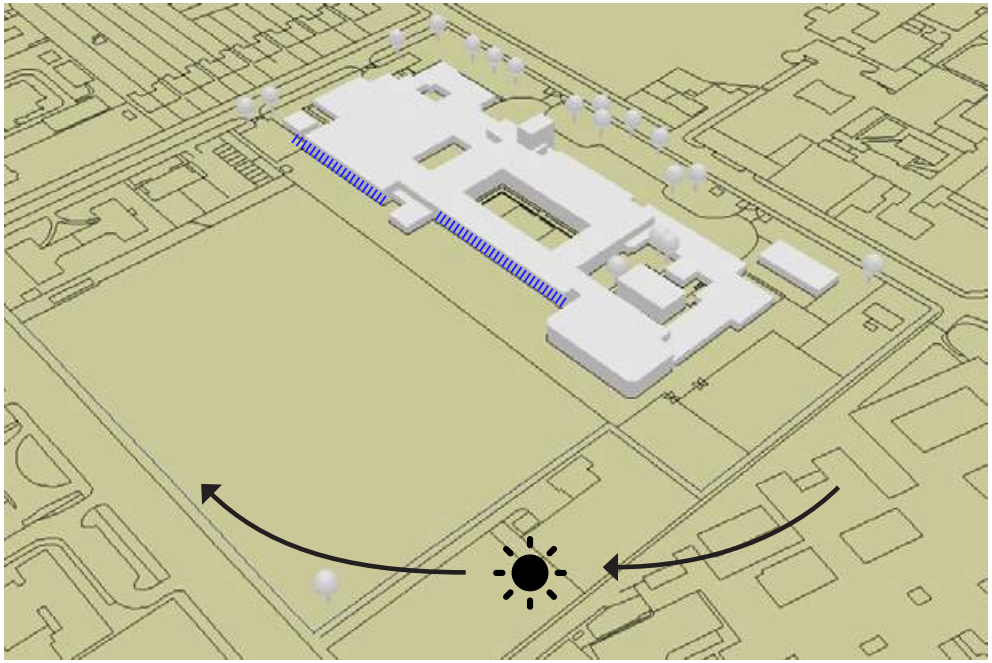
Scenario	Floor	CO_2 PPM	Max. Temp. °C	Room temperate exceeds stated temperature for hours and percent of school year						
				26 °C	27 °C	28 °C	29 °C	30 °C	31 °C	32 °C
Windows shut (0.83 ltrs/sec/pupil)	Ground	1800	37	782	610	447	333	244	158	102
				12%	10%	7%	5%	4%	2%	2%
	First		41	865	699	565	453	356	271	206
				14%	11%	9%	7%	6%	4%	3%
Mech. Vent. 8.83 ltrs/sec/pupil	Ground	900	35	171	121	82	48	33	21	14
				3%	2%	1%	1%	1%	0%	0%
	First		40	236	173	136	99	74	50	39
				4%	3%	2%	2%	1%	1%	1%



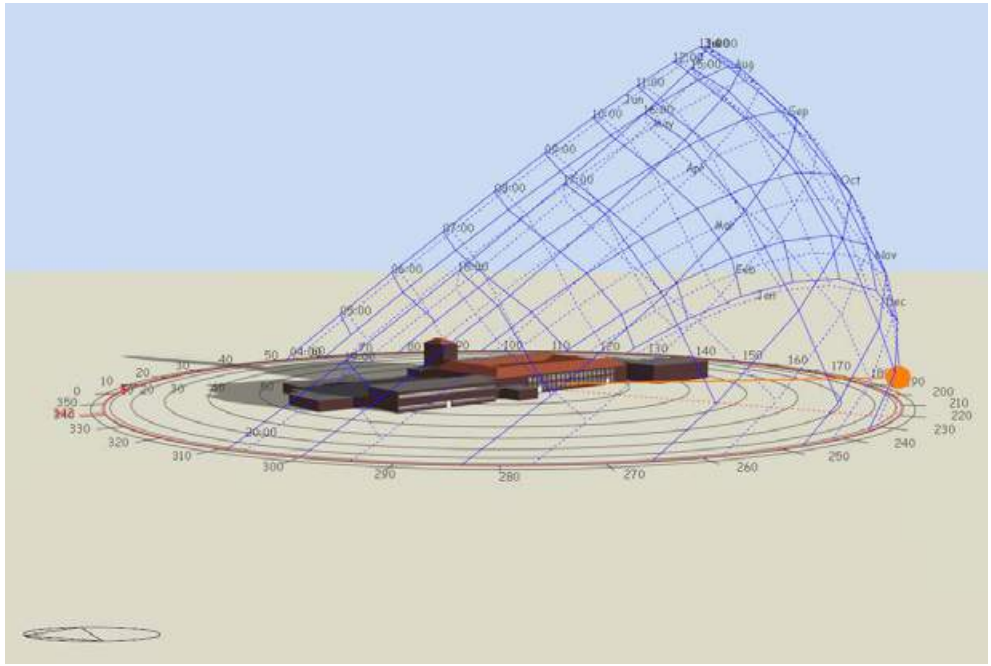
Sun path diagram



Sun path diagram, summer



Proposed position for external shading



Sun path diagram, winter

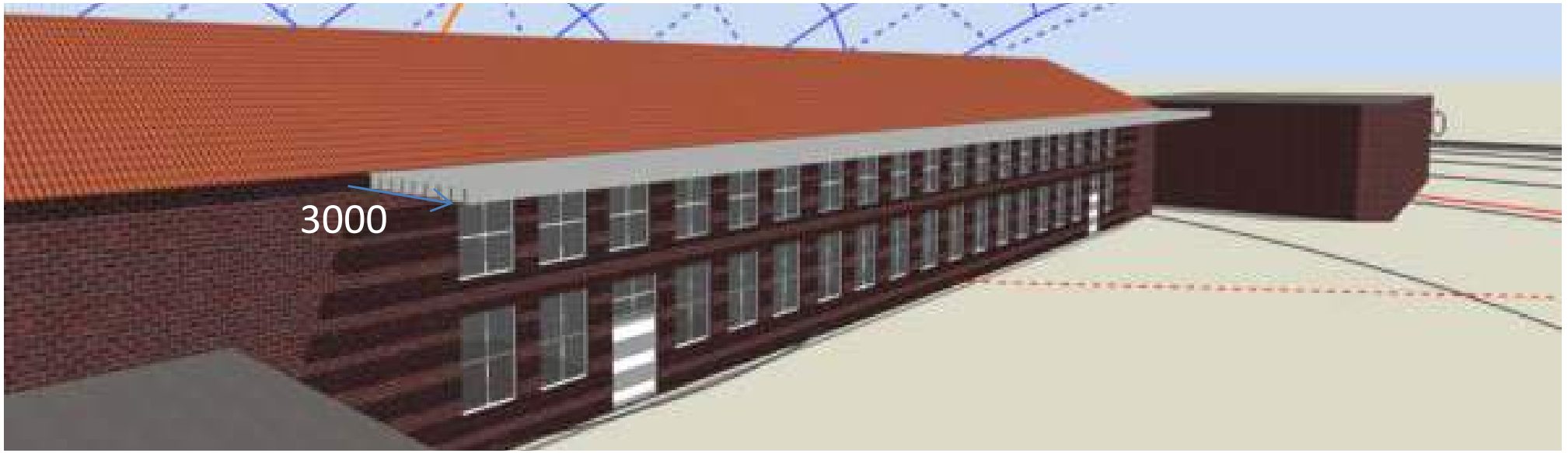
External shading, high level deep canopy

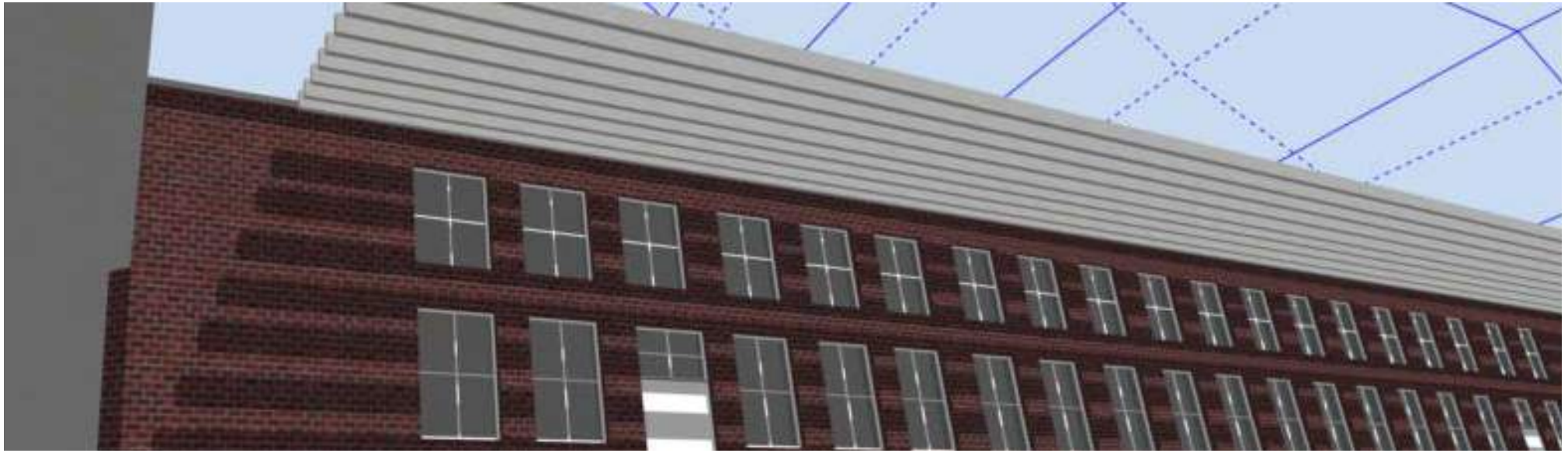
Indoor air temperatures
Our thermal modelling and data collection also indicated a problem with overheating in the classrooms at both floors along the western facade. By introducing active air flow and ventilation the temperatures will improve as highlighted in the previous graph but ideally heat gain would also be prevented from entering the building to improve conditions further.

We have investigated external shading and data shows a good improvement with significantly less hours above peak acceptable temperatures as summarised in the graph adjacent.

External Shades		Peak Temp	Hours above				
			26	27	28	29	30
Ground	None	35.6	118	96	74	54	42
	Large	32.3	87	62	46	32	18
	Local	31.1	104	76	57	43	30
First	None	32.4	118	94	68	50	35
	Large	29.8	87	58	35	9	0
	Local	33.5	109	80	55	36	17

External shading canopies, fixed at high level





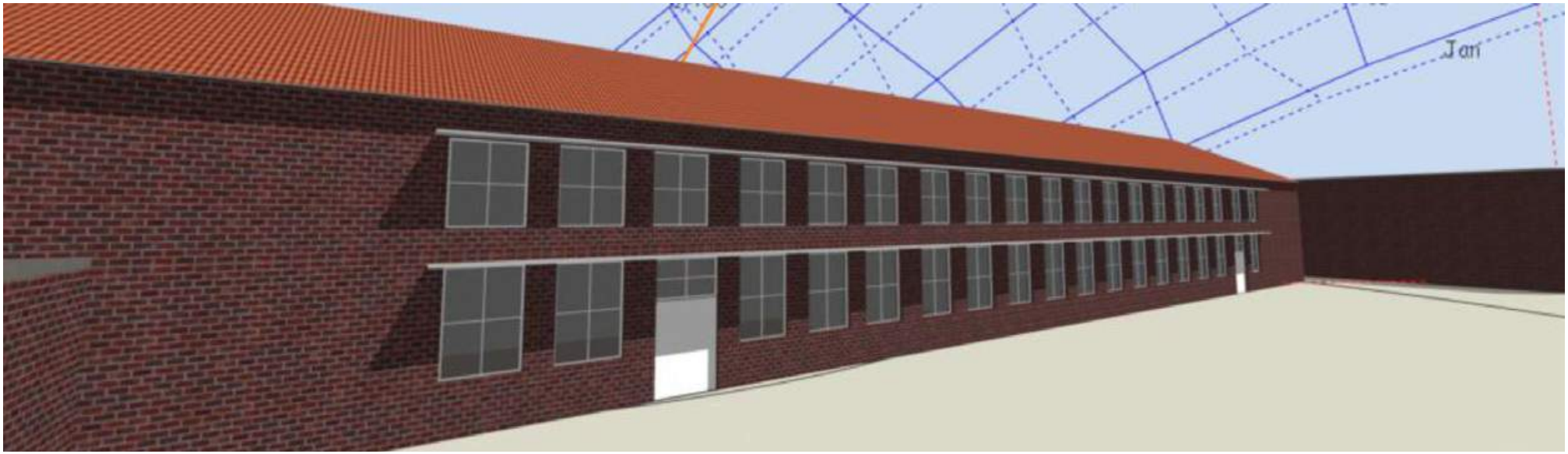
Images from the themal modelling mapping the addition of high level canopies through out the day

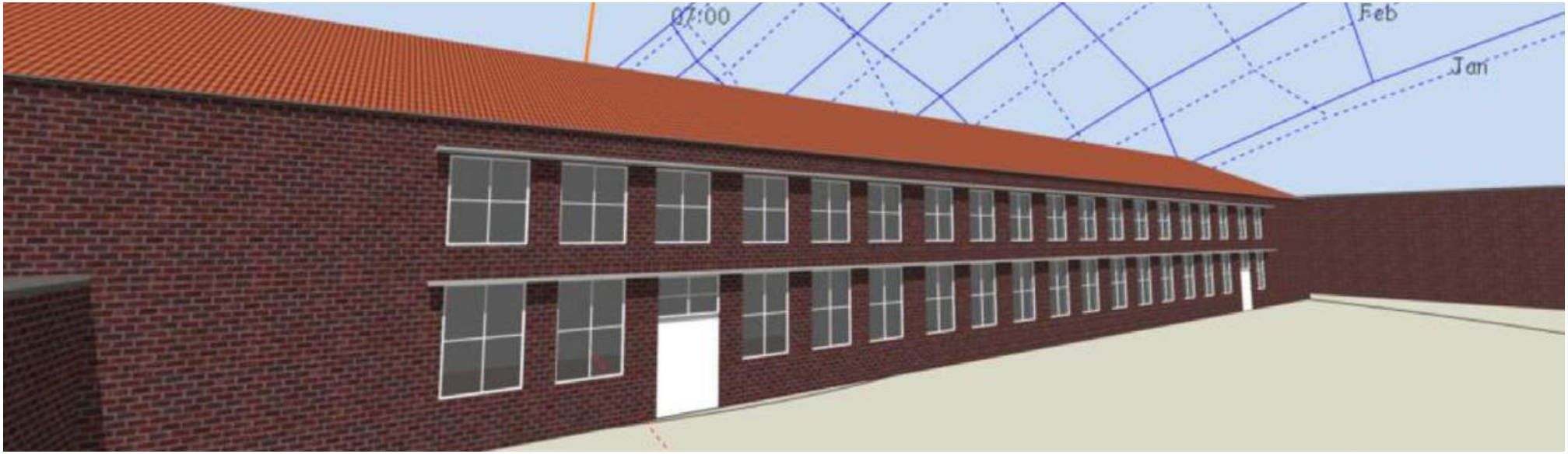
External shading, localised at each floor

There are two approaches to external shading; high level and deep canopies or localised linear strips of shallow shading. Both provide the necessary cooling and reduction of internal temperatures but the high canopy has some very beneficial dual purposes in this case. If the shading panel is solid it will also protect from the rain and provide sheltered areas along the rear facade where children can play and gain the benefits of outdoor activities during all weathers.

The canopies are also a distinct architectural move that will transform the rear facade and define outdoor rooms for gathering and teaching. Finally, this length of protected space will also serve as a buffer between the building facade and and the very active ball games along the playing field.

Examples of linear and localised shading





Images from the themal modelling mapping the addition of localised shading through out the day

6. Masterplan Design Proposals

Landscape and the Public Realm

6.1 Landscape and the Public Realm

Existing landscape

The School is fortunate in that it is located within the Spring Grove Conservation Area with tree lined streets and a general sense of green in the surrounding context.

The site itself is well equipped with formal parkland but suffers from the following:

- dominance of vehicle access, routes and parking across the frontage
- lack of permeability between building and the outdoors
- adjacency of active games areas to building facade and windows
- lack of quiet zones for contemplation
- desire for outdoor classrooms and teaching areas
- an over provision of formal parkland that feels removed from the school due to traffic routes

Relevant Project Themes

- lack of covered space for use during inclement weather
- under utilised and 'leftover' areas around perimeter
- entrance areas lack definition
- provision of hard informal play space is low

Outdoor learning

Both the students and staff are very enthusiastic about the possible opportunities for outdoor classrooms and learning, both formally and informally. Given the pressures on classrooms and internal space it would be beneficial on many fronts but rather than be too prescriptive in terms of designated areas the masterplan strives to create a good variety of outdoor 'rooms' or functions so that multiple activities can proceed in parallel. Depending on the need, a teacher may seek out a tree covered seating circle in the habitat zone or alternatively a more active hardscaped zone for drama and dance.

Department for Education

Government policy supports this approach and they are multiple reference documents to guide development plans including Building Bulletin 71, The Outdoor Classroom, 1999. This document includes advice on good qualities and features as well as design and development.

The BB98 includes a section specifically on school grounds and states the following, '...school grounds are a valuable resource and have a significant effect on the ethos of the school and the quality of education pupils receive.'

They recommend dividing the grounds into the following categories to ensure a good balance of areas and uses:

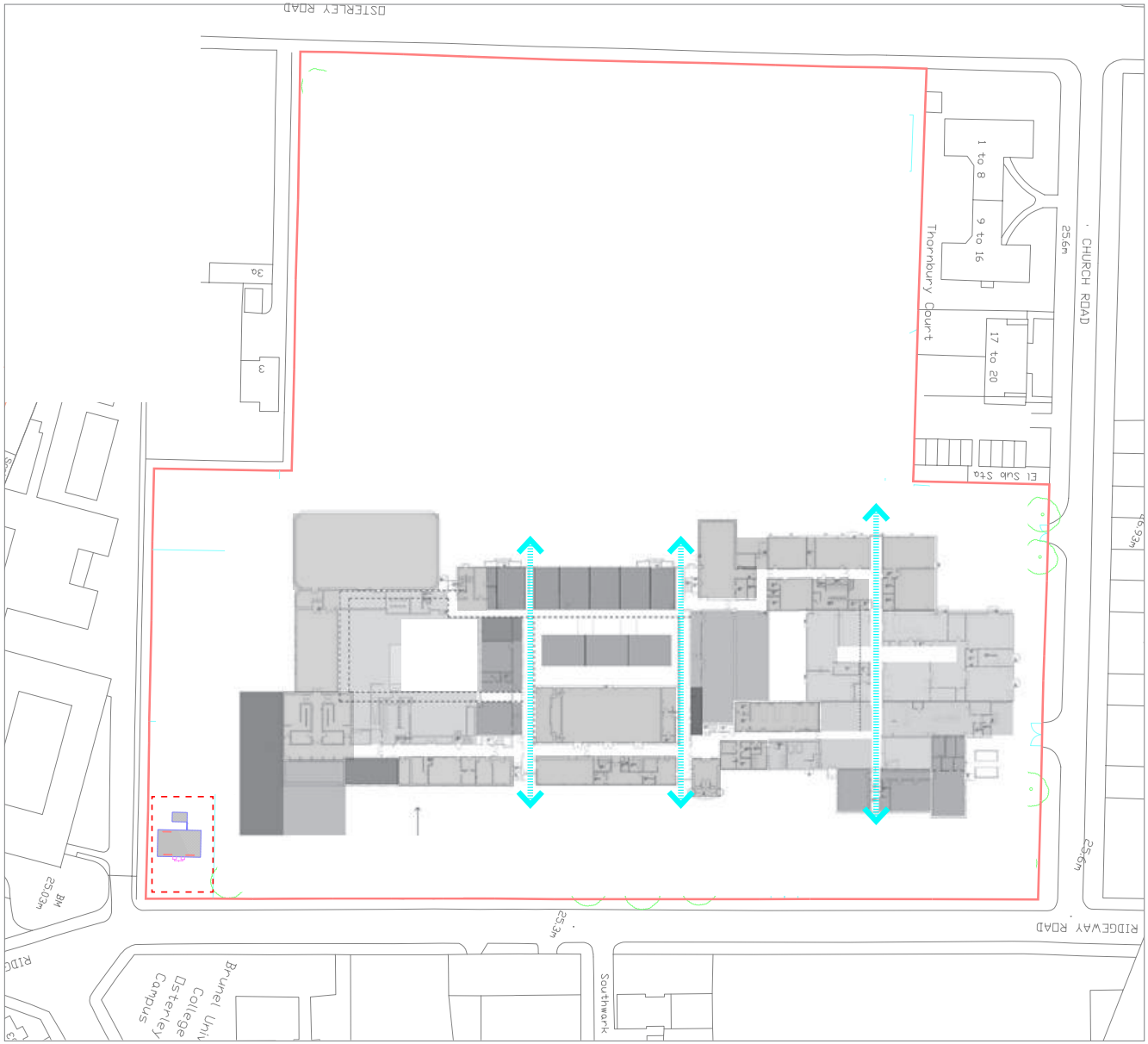
- Sports Pitches
- Games Courts
- Hard informal social areas
- Soft informal social areas
- Habitat

The following pages show the proposed distribution of the these areas around the site and at the same time address the shortfalls identified earlier.

Design philosophy

The design proposal starts with the user and their negotiation of the site and their experience of the public realm. Wayfinding and orientation are important. Entrances into the site and school should be clear and welcoming and the setting for the building working for the enhancement of the surroundings and the safety of the user.

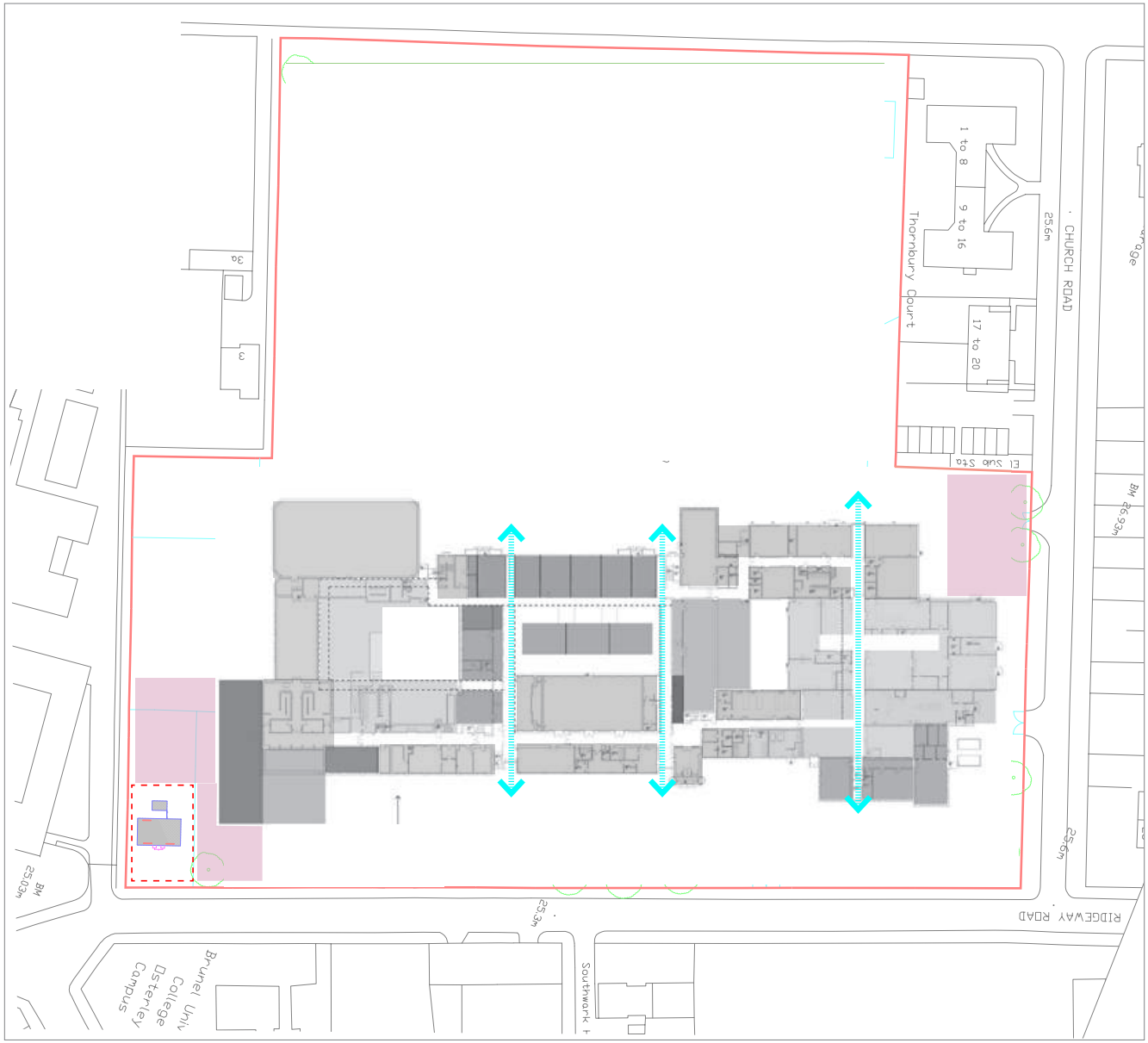
Permeability & wayfinding



- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Canopies can define entrances and improve the setting of the existing building

Access & pedestrian priority

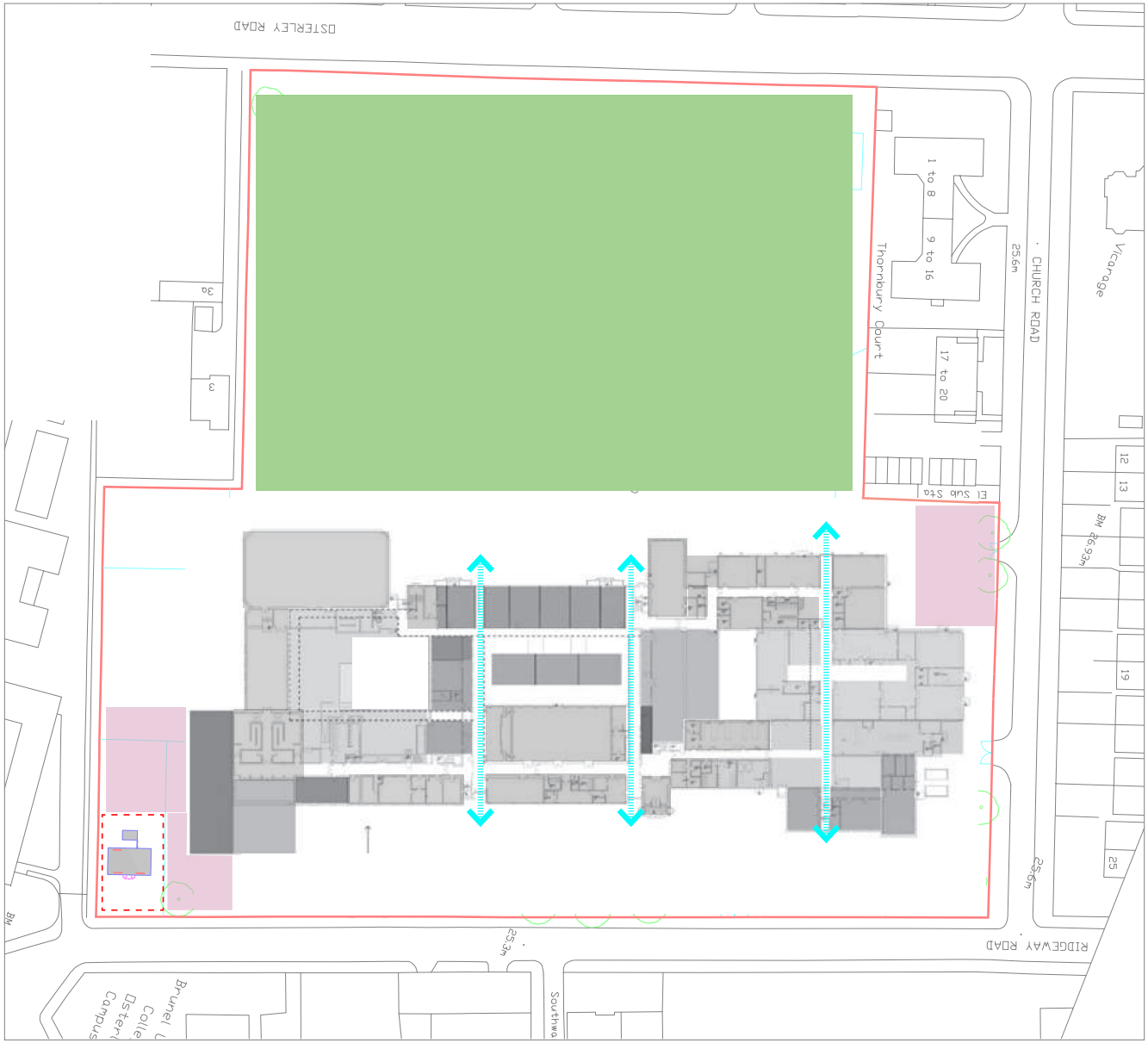


Vehicle access and parking
In line with the development plans that focus on the two ends of the building for possible community use and a desire to reinforce the quality of the centre and heart we have positioned vehicle traffic, access and parking in two isolated pockets at the east and west entrances.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Aerial phote of Busch Corner

Playing fields

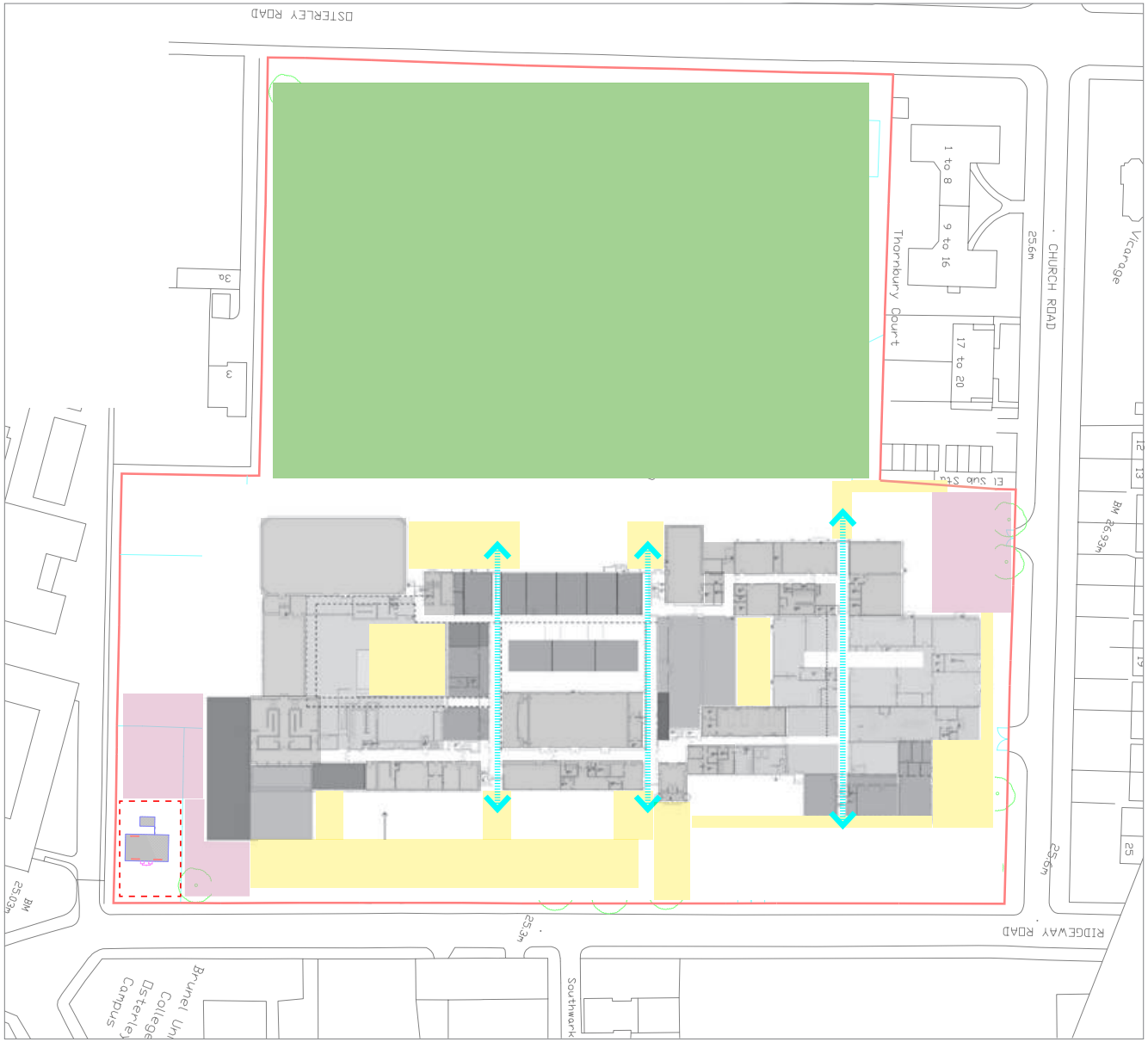


Playing fields
The school benefits from the use of Busch Corner, shown in the aerial photo overleaf as well as an all weather pitch and turfed field on the school site itself.

These areas should be protected and maintained at all costs.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Hard informal and social

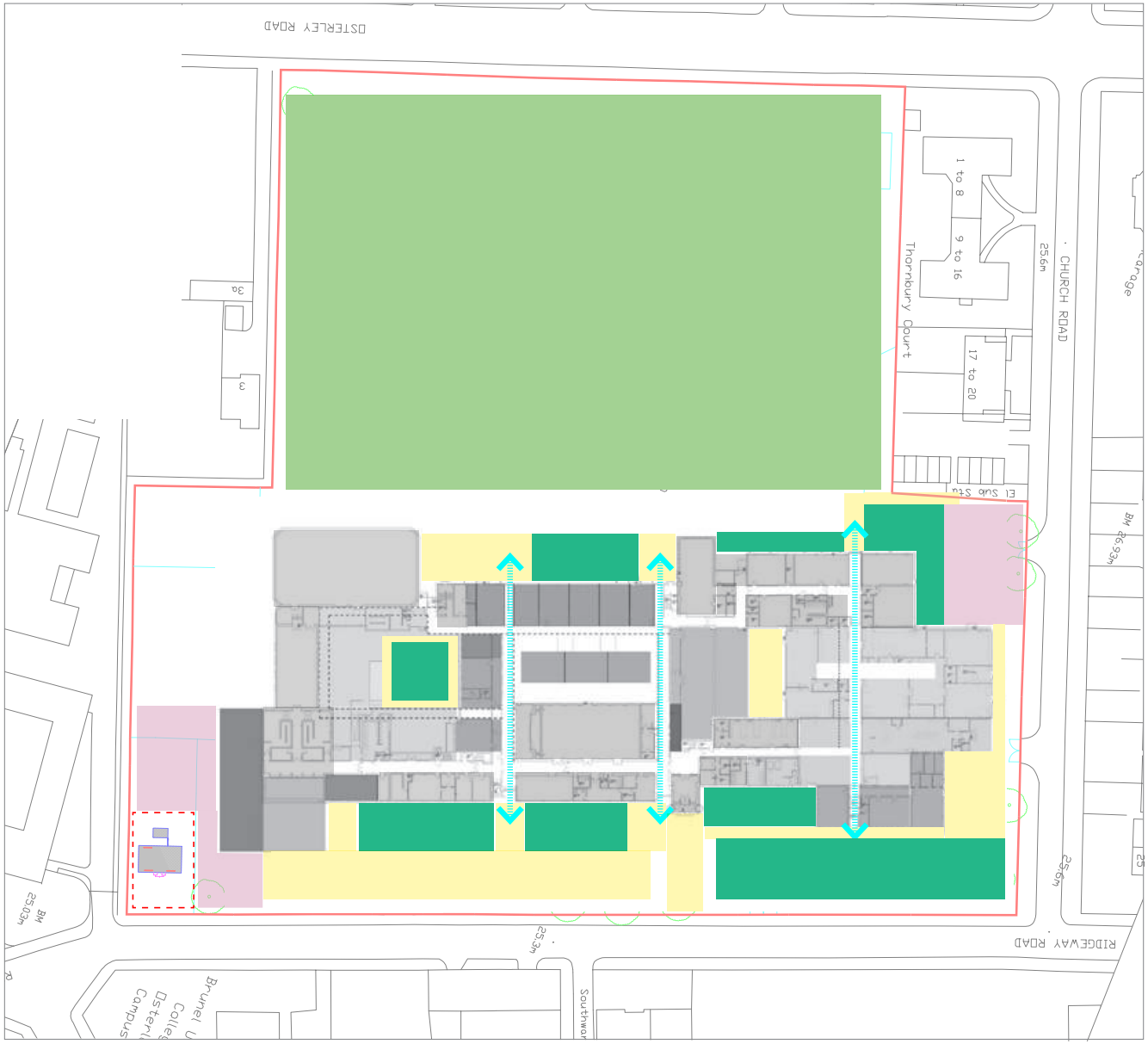


Hard informal and social areas

This type of outdoor space is generally in highest demand due to its flexibility. Assuming good drainage, it is available for use year round and can accommodate formal ball games, informal play and performances or teaching. An even distribution around the site will ensure that different groups can gather for varying purposes. We have also used these areas to define entrances and circulation routes.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Soft informal and social

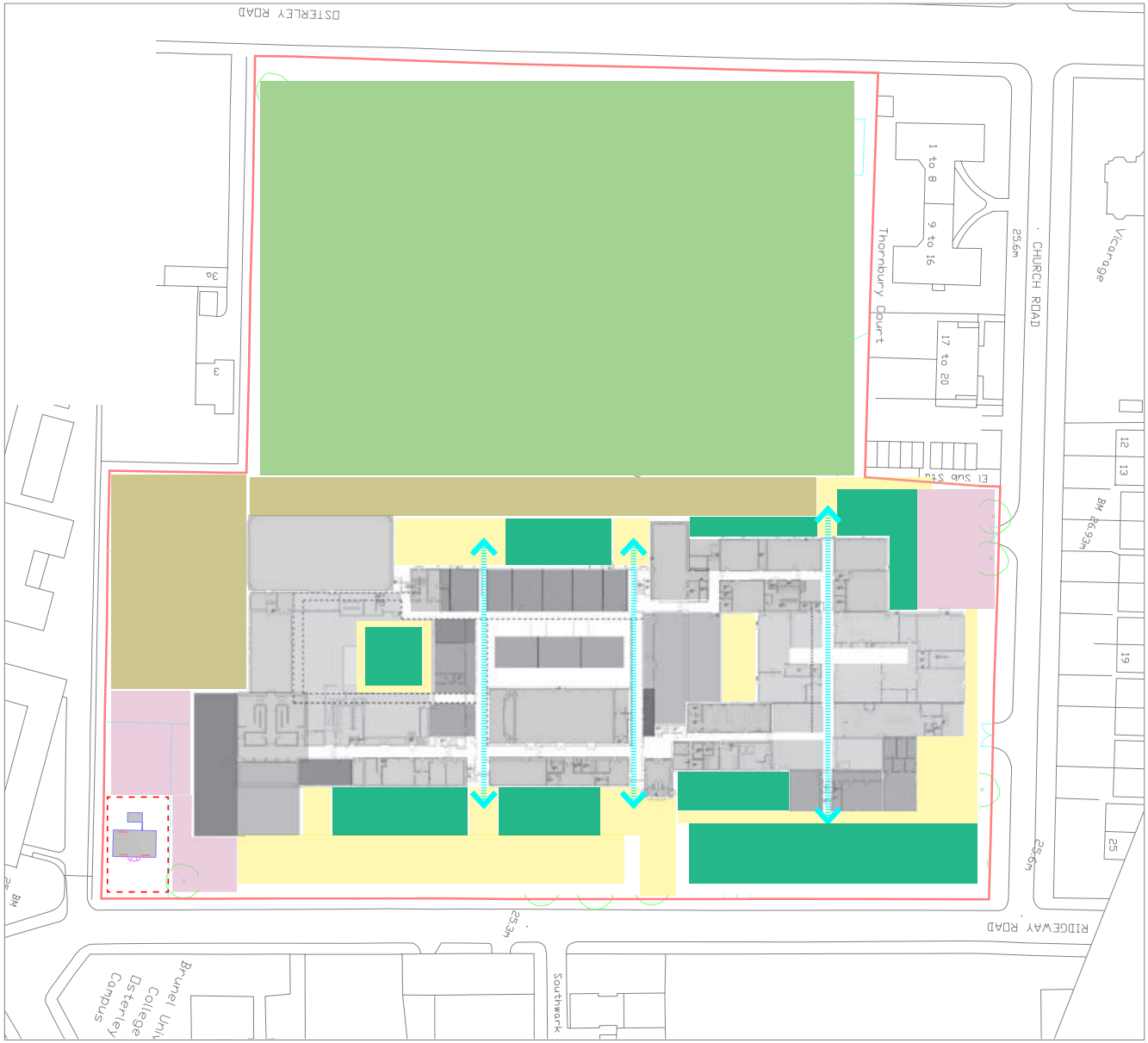


Soft informal and social areas

Areas of soft landscape will provide places to play but also soften the large areas of tarmac and hard surfaces. During hot weather grassy and tree filled areas are significantly cooler than dark expanses of tarmac and if placed adjacent to buildings can aid in keeping internal temperatures down. Again, we have provided an even distribution around the site to support a desire for destinations around the school that accommodate different age and interest groups.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Games courts

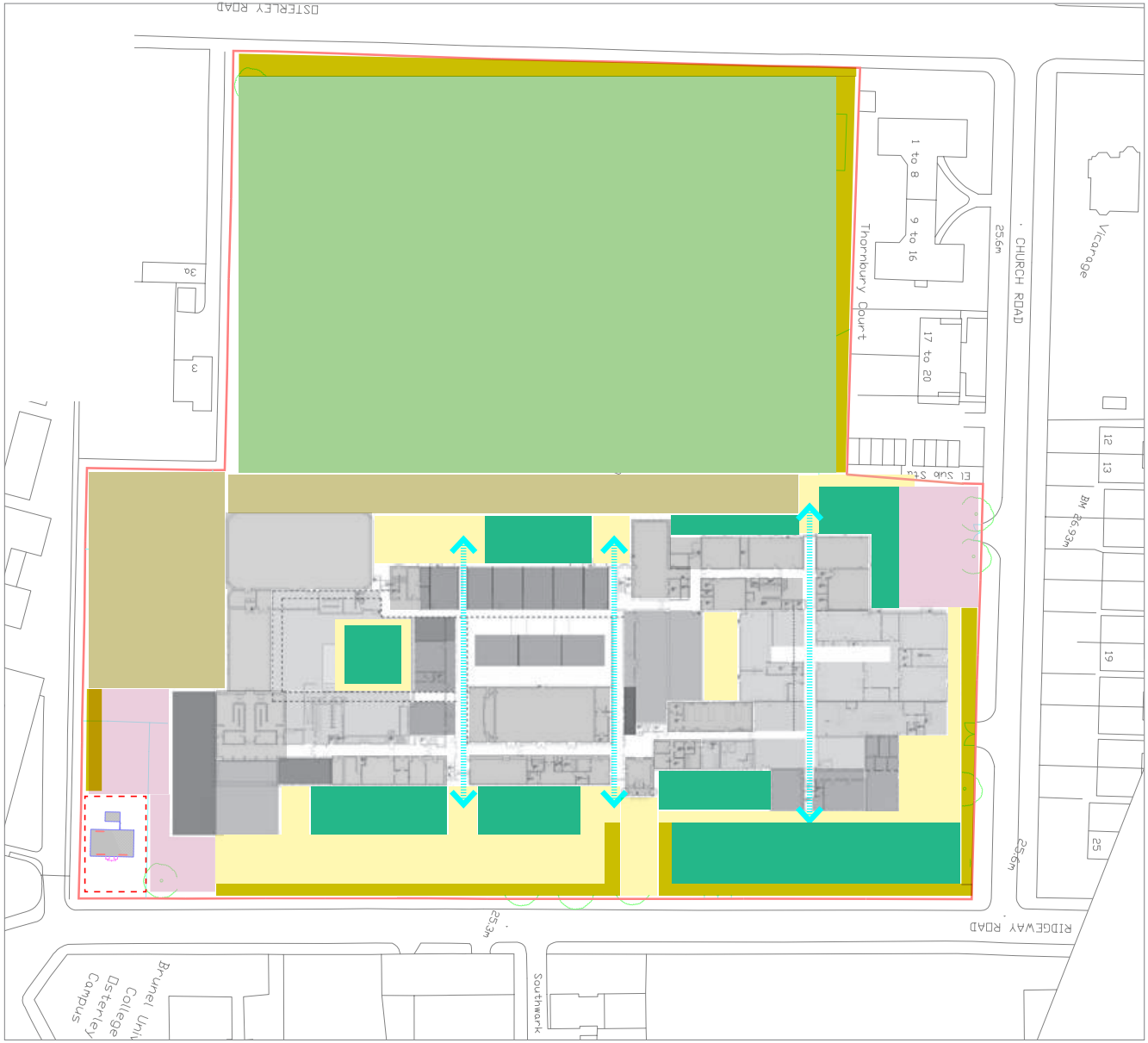


Formal games courts

Generally theas areas are fenced so they are most practical away from the building frontage. The current position on the site, at the southern end, is ideal and should be reinforced and if possible expanded depending on the demand for car parking.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

Habitat, perimeter definition



A soft boundary

Tree lined avenues are already a strong feature of the local context and valued in the conservation area. The school currently benefits from some grand trees around the perimeter and this character should be reinforced over time.

By incorporating the habitat areas into the permiter tree canopy a beautiful boundary will form around the school and add to the character. These areas can also include a range of small outdoor classroom spaces and designs to provide a valuable resource for teaching and learning across the whole curriculum. Natural growth and landscape are also considered of value to children's emotional, social and cultural development.

- building footprint
- parking
- pitches
- games courts
- soft informal and social
- hard informal and social
- habitat

7. Appendices

A. Existing Area Schedule
Ground Floor

Main Building
Block A

Room No.	Description	Area [sqm]	Ref 1	Ref 2	Ref 3
AGF0001	Office	7.28	C	51	
AGF0002	Circulation & Lobby	41.90	C	95	
AGF0003	Corridor	61.69	C	96	
AGF0004	Staff & Admin Office	24.86	G	21	
AGF0005	Reception	7.48	G	21	
AGF0006	Staff Kitchen	5.66	G	22	
AGF0007	Store	8.74	G	51	
AGF0008	Adult Toilet	9.05	G	61	
AGF0009	Disabled Toilet	3.52	G	61	
AGF0010	Heads Office	25.19	G	21	
AGF0012	Adult Toilet	10.48	G	61	
AGF0013	Staffroom	69.36	G	22	
AGF0014	Staff Kitchen	8.39	G	22	
AGF0015	Circulation	37.78	C	95	
AGF0016	Circulation	45.16	C	95	
AGF0017	Circulation	1.76	C	95	
AGF0018	Conference Room	21.74	G	22	
AGF0019	AVA Room	19.54	G	22	
AGF0020	SEN Office	8.69	D	13	20
AGF0021	Learning Support	40.36	D	13	
AGF0022	Learning Support Office	9.16	D	13	20
AGF0023	Store	1.37	D	13	50
AGF0026	Office D/H	14.84	G	21	
AGF0027	Heads of Year Office	20.51	G	21	
AGF0028	Corridor	59.27	C	96	
AGF0030	Classroom	63.04	D	1	
AGF0031	Store	12.14	D	11	50
AGF0032	Office	12.14	D	11	20
AGF0033	Corridor	6.84	C	96	
AGF0034	Circulation	27.73	C	95	
AGF0035	Changing Area	46.05	D	11	60
AGF0036	Changing Area	45.94	D	11	60
AGF0037	PE Store	11.62	D		
AGF0038	Child Toilet	45.35	G		
AGF0039	Stairwell	5.70	G		
AGF0040	Store	4.68	G		
AGF0041	Classroom	56.22	D		
AGF0042	Corridor	46.54	C		
AGF0043	SEN Resource Area	29.78	D		
AGF0044	Store	5.23	D		
AGF0045	SEN Office	8.88	D		
AGF0046	Classroom	44.99	D		
AGF0048	Classroom	44.68	D	11	
AGF0049	Cleaner Store	4.36	G	51	
AGF0050	Stairwell	37.20	C	98	
AGF0051	Adult Toilet	1.80	G	61	
AGF0052	Store	3.43	D	7	50
AGF0053	Lobby	23.17	C	97	
AGF0054	Office	7.23	D	7	20
AGF0055	Cleaner Store	2.48	G	51	
AGF0056	Changing Area	40.55	D	11	60
AGF0057	Fitness Room	40.27	D	11	
AGF0058	PE Store	13.75	D	11	50
AGF0059	Stairwell	22.10	C	98	
AGF0060	Store	5.74	D	5	50
AGF0061	Gymnasium	167.74	D	11	
AGF0062	Sports Hall	519.95	D	11	
AGF0063	Office	23.43	D	1	20
AGF0064	Classroom	57.10	D	1	
AGF0065	Classroom	45.38	D	1	
AGF0066	Classroom	45.59	D	1	
AGF0067	Classroom	45.30	D	1	
AGF0068	Classroom	45.12	D	1	
AGF0069	Classroom	48.25	D	1	
AGF0070	Circulation	116.86	C	95	
AGF0071	Store	10.98	G	51	
AGF0072	Stairwell	3.95	C	98	
AGF0073	6th Form Common Room	133.34	G	31	
AGF0074	Circulation	82.38	G	95	
AGF0075	General Store	7.42	G	51	
AGF0076	Office	10.88	G	21	
AGF0077	Office	13.53	G	21	
AGF0078	Classroom	47.48	D	7	
AGF0079	Store	6.19	D	7	50
AGF0080	Classroom	56.32	D	7	
AGF0081	Store	11.80	D	7	50
AGF0082	Adult Toilet	3.13	G	61	
AGF0083	Adult Toilet	5.83	G	61	
AGF0084	Child Toilet	41.00	G	61	
AGF0085	Classroom	48.78	D	7	
AGF0086	Stairwell	117.71	C	98	
AGF0087	Classroom	47.67	D	7	
AGF0088	Lobby	6.57	C	97	
AGF0089	Classroom	69.55	D	7	
AGF0090	Classroom	78.66	D	7	

Main Building
Block A

Room No.	Description	Area [sqm]	Ref 1	Ref 2	Ref 3
AGF0093	CDT Electronics	91.64	D	6	
AGF0095	Office	8.12	D	6	20
AGF0096	Brazing/Welding Area	18.14	D	6	
AGF0097	CDT Heavy Practical	99.38	D	6	
AGF0098	Store	5.58	D	6	50
AGF0099	CDT Resource Area	79.81	D	6	
AGF0100	Store	5.60	D	6	50
AGF0101	Metal Store	16.30	D	6	
AGF0102	Store	5.92	D	6	50
AGF0103	Multi Mat CDT Room	80.62	D	6	
AGF0104	Store	9.66	D	6	50
AGF0105	Technology Preparation	28.97	D	6	
AGF0106	Technology	81.26	D	6	
AGF0107	Resource Area	22.28	D	6	40
AGF0108	Art	82.33	D	5	
AGF0109	Store	5.28	D	5	50
AGF0110	Art	88.11	D	5	
AGF0111	Store	15.41	D	5	50
AGF0112	Art	72.24	D	5	
AGF0113	Store	5.93	D	5	50
AGF0114	Resource Area	14.58	D	5	40
AGF0115	Dining Hall	212.60	G	31	
AGF0116	Kitchen	155.94	G	35	
AGF0117	Corridor	25.81	C	96	
AGF0118	Drama Studio	60.44	D	10	
AGF0119	Music Practice	6.33	D	10	
AGF0120	Music Practice	5.88	D	10	
AGF0121	Music Office	6.75	D	10	20
AGF0122	Music	61.17	D	10	
AGF0123	Music Recital	71.10	D	10	
AGF0124	Store	5.45	D	10	50
AGF0126	Corridor	47.30	C	96	
AGF0127	Boiler Room	38.19	G	65	
AGF0131	Store	5.13	G	51	
AGF0132	Office	6.91	G	21	
AGF0133	Deputy Head Office	10.85	G	21	
AGF0134	Store	7.79	G	51	
AGF0135	Hall	286.98	G	31	
AGF0136	Teaching Store	65.90	G	22	
AGF0137	Stairwell	3.21	C	98	
AGF0138	Stairwell	3.21	C	98	
AGF0139	Assistant Head Office	10.11	G	21	
AGF0140	Attendance Office	21.31	G	21	
AGF0141	Store	17.73	G	51	
AGF0142	Corridor	54.04	C	96	
AGF0143	Library	165.90	G	31	
AGF0144	Electric	13.24	G	65	
AGF0145	Stairwell	4.72	C	98	
AGF0205	Medical Room	15.09	G	21	
AGF0223	Office	12.91	G	35	
AGF0224	Kitchen Toilet	5.12	G	35	
AGF0225	Kitchen Store	5.28	G	35	

Bike Store
Block Sa

Room No.	Description	Area [sqm]
SaGF2001	Bike Store	10.56

Bike Store
Block Sb

Room No.	Description	Area [sqm]
SbGF2002	Bike Store	10.56

Main Building
Block A

Room No.	Description	Area [sqm]	Ref 1	Ref 2	Ref 3
AGF1004	General Store	9.24	G	51	
AGF1005	General Store	8.63	G	51	
AGF1006	General Store	5.82	G	51	
AGF1007	General Store	2.00	G	51	
AGF1008	General Store	2.10	G	51	
AGF1009	Staff Changing	4.78	D	11	60
AGF1019	Corridor	72.45	C	96	
AGF1044	General Store	3.25	G	51	
AGF2000	Music Practice Room	7.42	D	10	
AGF2004	Kitchen Store	12.03	G	35	
AGF2005	Kitchen Store	9.61	G	35	
AGF2006	Kitchen Store	8.77	G	35	
AGF2007	Music Practice Room	6.95	D	10	
AGF2008	Drama Office	10.08	D	10	20
AGF2009	Boiler Room	0.61	G	65	
AGF2010	Adult Toilet	37.99	G	61	
AGF2011	Exam Store	6.96	G	51	
AGF2012	Lobby	33.33	C	97	
AGF2013	Lobby	6.08	C	97	
AGF2014	Store	4.37	G	51	
AGF2015	Male Toilet	7.77	G	61	
AGF2029	Food Technology	89.77	D	12	
AGF2030	Store	6.34	G	51	
AGF2031	Lobby	11.21	C	97	

MFL Block
Block Tf

Room No.	Description	Area [sqm]			
TfGF2019	Modern Languages	62.51	D	9	
TfGF2020	Store	5.54	D	9	50
TfGF2021	Stairwell	16.39	C	98	
TfGF2022	Lobby	6.96	C	97	
TfGF2023	Modern Languages	62.55	D	9	

Mobiles Block
Block Td

Room No.	Description	Area [sqm]			
TdGF0218	Store	6.29	D	10	50
TdGF0219	Classroom	47.55	D	10	
TdGF0220	Store	4.20	D	10	50
TdGF2003	Lobby	3.32	C	97	

New Block Te
Block Te

Room No.	Description	Area [sqm]			
TeGF1011	Classroom	57.43	D	2	
TeGF1012	Circulation	11.43	C	95	
TeGF1013	Store	6.79	D	2	50
TeGF1014	Classroom	54.61	D	2	
TeGF1015	Store	6.79	D	2	50
TeGF1016	Group Room	27.48	D	2	
TeGF1017	Group Room	20.74	D	2	
TeGF1018	Circulation	6.37	C	95	

Existing Area Schedule
First Floor

Main Building
Block A

Room No.	Description	Area [sqm]	Ref 1	Ref 2	Ref 3
A1F0146	Stairwell	21.37	C	98	
A1F0147	Office	10.50	D	7	20
A1F0148	Classroom	63.00	D	7	
A1F0149	Resource Area	15.28	G	41	
A1F0150	Circulation	19.42	C	95	
A1F0151	Balcony to Hall	57.97	G	51	
A1F0152	Server Room	6.85	G	51	
A1F0153	Circulation	49.68	C	95	
A1F0154	Science Lab	87.16	D	3	
A1F0155	Science Preparation	30.16	D	3	
A1F0156	Science Lab	89.24	D	3	
A1F0157	Stairwell	33.31	C	98	
A1F0158	Circulation	92.72	C	95	
A1F0159	Science Lab	78.16	D	3	
A1F0160	Office	15.52	D	3	20
A1F0161	Chemical Store	5.19	D	3	
A1F0162	Store	3.80	D	3	50
A1F0163	Store	5.22	D	3	50
A1F0164	Science Preparation	29.15	D	3	
A1F0165	Science Lab	77.64	D	3	
A1F0166	Science Preparation	29.10	D	3	
A1F0167	Science Lab	77.84	D	3	
A1F0168	Circulation	10.67	C	95	
A1F0169	Stairwell	5.38	C	98	
A1F0170	Office	11.72	G	21	
A1F0171	Corridor	30.80	C	96	
A1F0172	Restricted Use Room	64.95	G	22	
A1F0173	Science Lab	75.26	D	3	
A1F0174	Circulation	49.58	C	95	
A1F0175	Office	14.22	D	2	20
A1F0176	Classroom	44.92	D	2	
A1F0177	Classroom	49.38	D	2	
A1F0178	Stairwell	35.67	C	98	
A1F0179	Circulation	47.40	C	95	
A1F0180	Dark Room	18.50	D	3	
A1F0181	Office	10.03	D	3	20
A1F0182	Adult Toilet	1.76	G	61	
A1F0183	Office	10.38	D	4	20
A1F0184	Classroom	53.34	D	4	
A1F0185	Circulation	25.12	C	95	
A1F0186	Classroom	46.69	D	4	
A1F0187	Office	7.54	D	4	20
A1F0188	Store	6.68	D	4	50
A1F0189	Office	21.93	D	8	20
A1F0190	Circulation	22.93	C	95	
A1F0191	ICT	67.31	D	8	
A1F0192	Office	19.03	D	8	20
A1F0193	Store	12.33	D	8	
A1F0194	ICT	73.78	D	8	
A1F0195	ICT	56.50	D	8	
A1F0196	Science Lab	83.10	D	3	
A1F0197	Prep Room	30.38	D	3	
A1F0198	Chemical Store	3.42	D	3	
A1F0199	Greenhouse	16.59	D	3	
A1F0200	Store	5.01	D	7	50
A1F0221	Store	4.90	G	51	
A1F0222	Store	4.90	G	51	
A1F0226	Stairwell	14.37	C	98	
A1F0227	General Store	1.81	D	8	50
A1F0228	General Store	2.85	D	4	50
A1F1010	Adult Toilet	2.87	G	61	
A1F2016	Store	8.11	G	51	
A1F2017	Interview Room	9.08	G	22	
A1F2018	Office	7.98	G	21	

MFL Block
Block Tf

Room No.	Description	Area [sqm]	Ref 1	Ref 2	Ref 3
Tf1F2024	Modern Languages	62.59	D	9	
Tf1F2025	Store	5.57	D	9	50
Tf1F2026	Stairwell	16.25	C	98	
Tf1F2027	Lobby	4.78	C	97	
Tf1F2028	Modern Languages	62.53	D	9	

B. Phased Cost & Area Plan

Costing

As noted in the adjacent graph the costs/ m2 used are high level figures that align with industry standards and recently published figures for educational buildings.

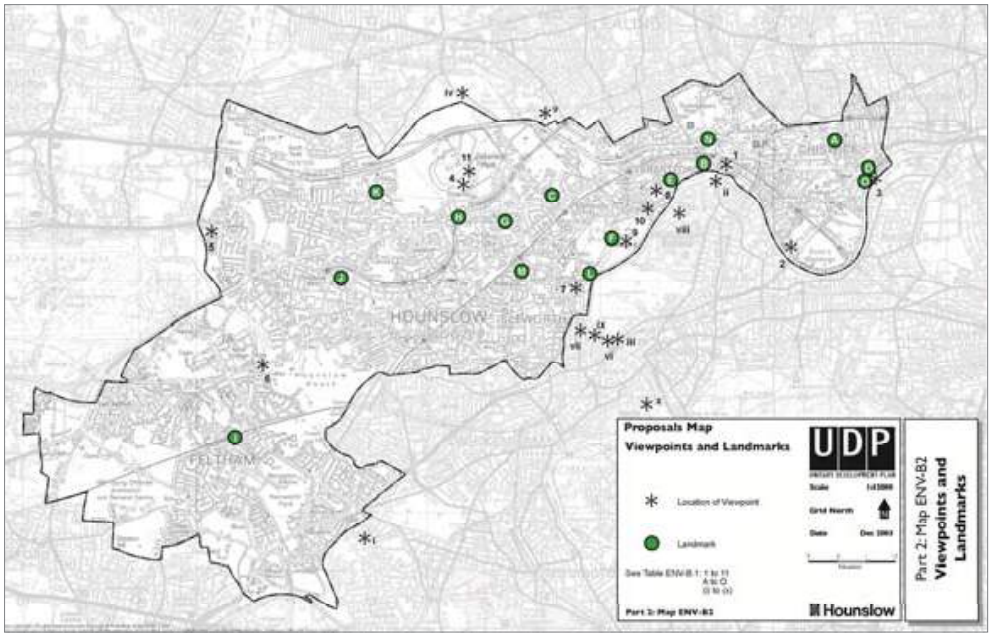
We have worked with a range of two different costs to show the variation between reported figures and the goal/ recommendations of the DfE in their recent guidelines and criteria for schools. Cleary there is a large discrepancy and it is likely that any building work at Isleworth and Syon will fall somewhere in between the two depending on complexity, timing and delivery.

		New Build Area & Cost		
Phase	**Description**	Gross area increases m2	DofE 2012, £1450/sqm	2012 industry guidance £2000/sqm
	Current Area, current population	0		
	Current Area, adjusted population for DofE 2012	0		
A	Roof in central courtyard	600	879	1200
A	New circulation at upper level	260	381	520
	Refurbish buildings adjacent to courtyard, expanding classroom area			
	Add'l classrooms in courtyard (1st floor only as ground area in roof calc)	180	264	360
	Demolish temporary maths building			
B	Add catering and dining.	480	703	960
	Demolish original catering and dining			
C	Add two storey performing arts department	1100	1612	2200
	Refurbish existing drama and music area			
	Demolish temporary drama class room			
D	Demolish single storey D+T			
	Build 2 storey D+T and general classroom block	1820	2666	3640
	Refurbish adjacent 2 storey area			
E1	Demolish changing room area and partial sports wing			
	Rebuild & redevelop sports wing and add classroom wing, 2 storey	1470	2154	2940
	Totals	5910		

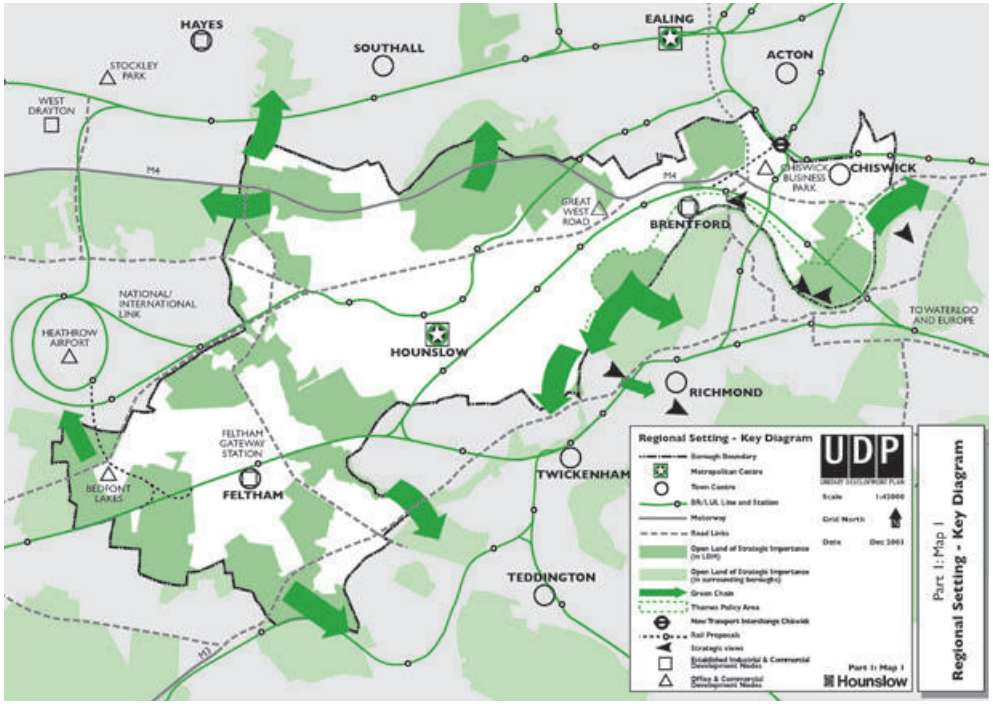
E2	Demolish existing sports wings and hall			
	Add new sports area & double classroom wing, 2 storey	3500	5128	7000
	Totals	7940		

Demolition		Refurbishment			Relocation		Total Costs			Area Tally	Students - Dof E 2012 criteria			Students -BB98
Gross areas m2	Estimated costs based on industry guidance £60/sqm	Gross areas m2	2012 industry guidance £800/sqm		Relocation - COSTS NOT INCLUDED		DofE 2012, £1450/sqm	2012 industry guidance £2000/sqm		Total Gross Area m2	Nominal number 11-16 pupils at phase	Nominal number sixth formers at phase	Total allowable number of pupils	Total allowable number of pupils
										8680				**920**
										8680	957	180	**1137**	
							879	1200		**9280**	957	180	**1137**	
		3000	2400		x									
-200	12													
							3057	3292		**9520**	1015	250	**1265**	**1030**
-520	31.2													
							734	991		**9480**	1015	250	**1265**	**1030**
		350	280		x									
-65	3.9													
							1895	2484		**10515**	1160	260	**1420**	**1180**
-910	54.6				x									
		900	720											
							3441	4415		**11425**	1305	260	**1565**	**1310**
-570	34.2				x									
							2188	2974		**12325**	1450	260	**1710**	**1440**
-2265							12194	15356		**12325**				
-1750	105				x									
							5233	7105		**13175**	1450	370	**3015**	**1580**
-3445							15239	19487		**13175**				

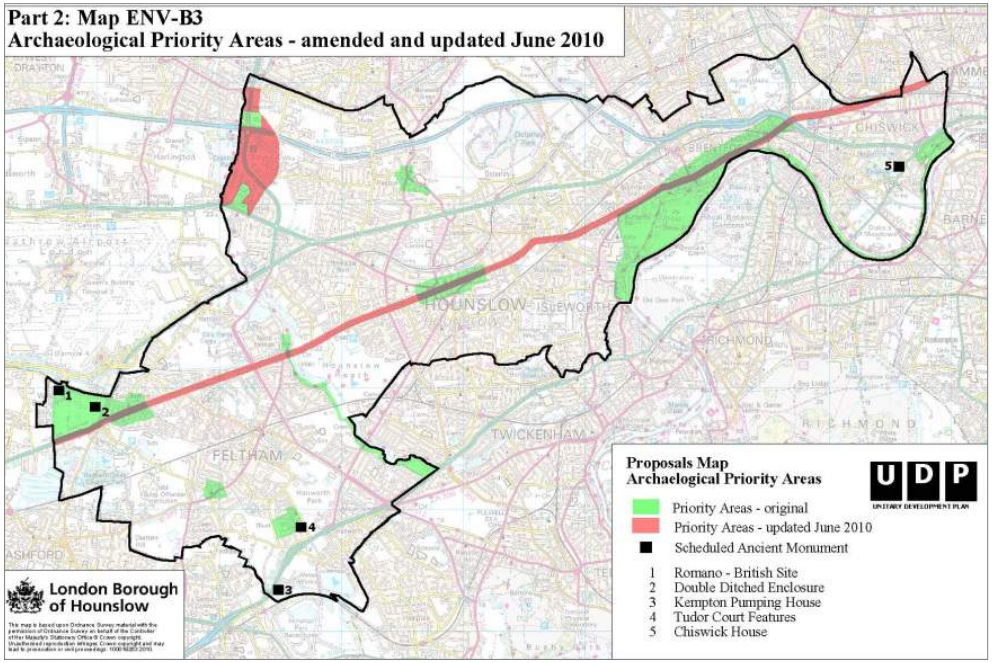
C. UDP Maps, London Borough of Hounslow



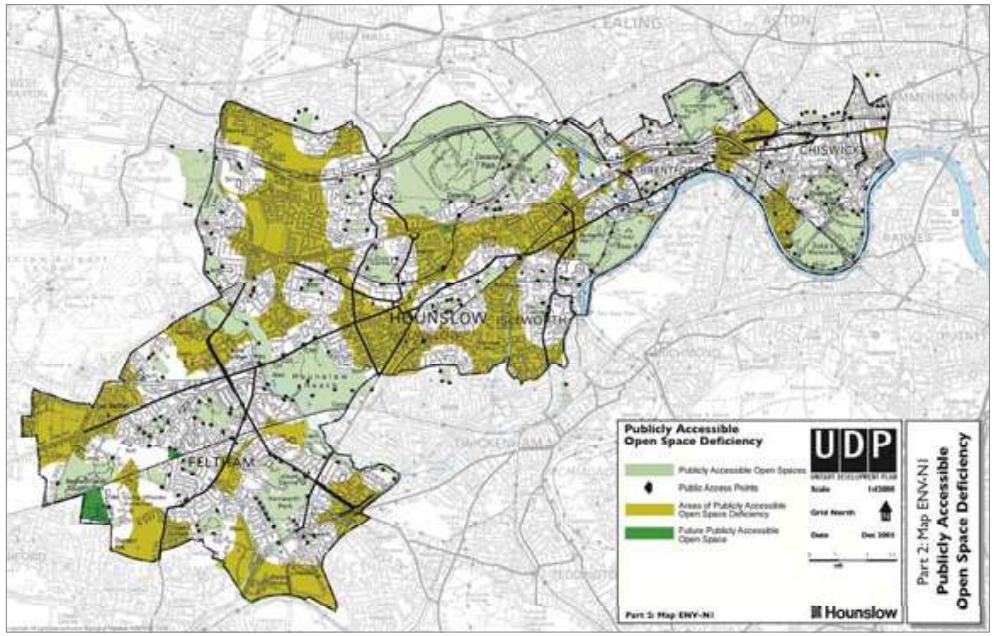
UDP Part 2: Map ENV-B2 – Viewpoints and Landmarks



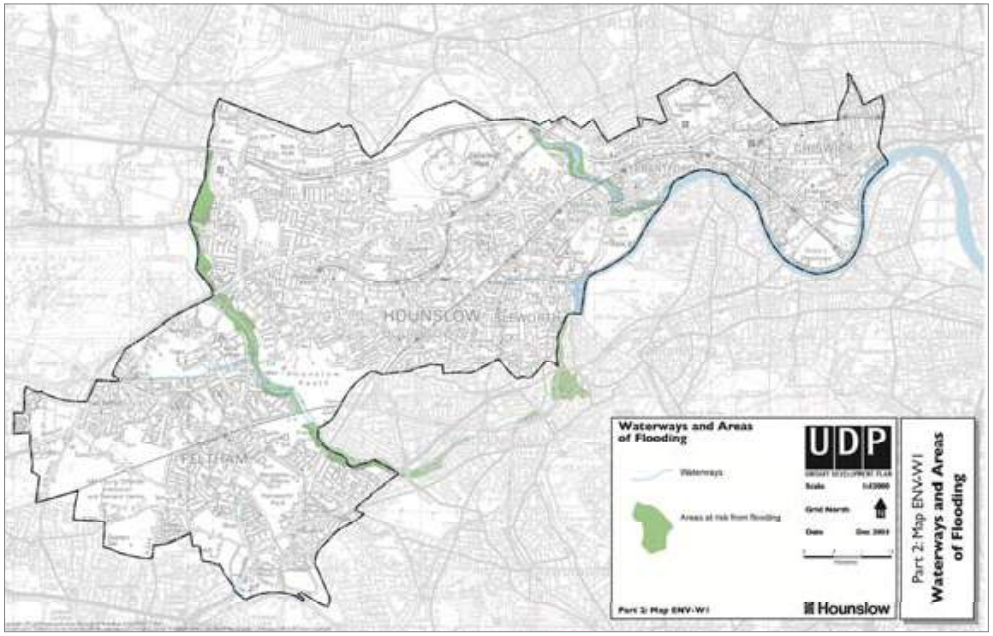
UDP Part 1: Map 1 – Regional Setting, Key Diagram



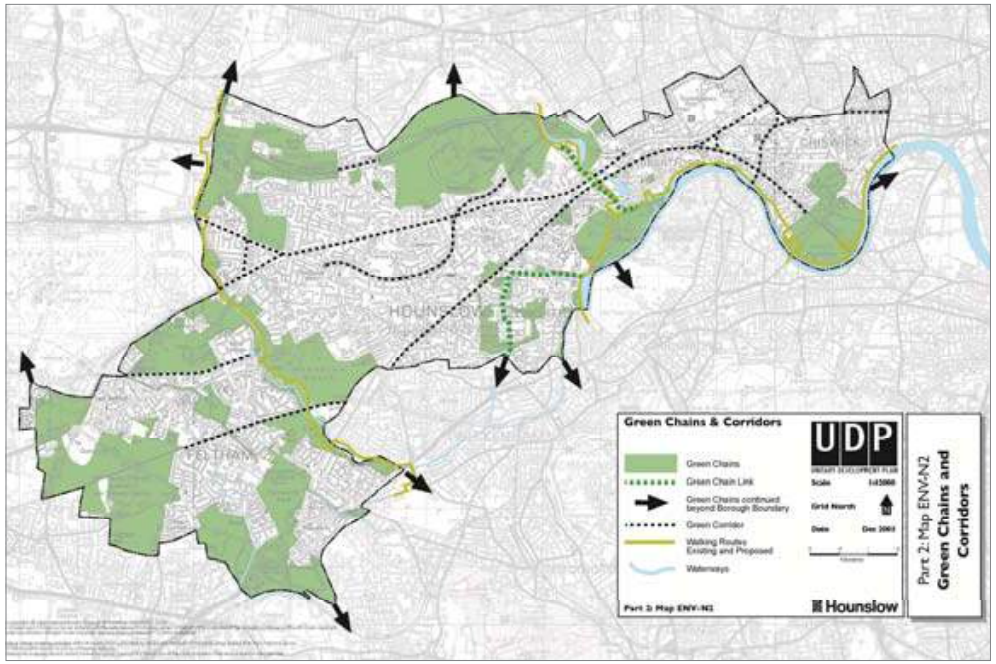
UDP Part 2: Map ENV-B3 – Archaeological Priority Areas



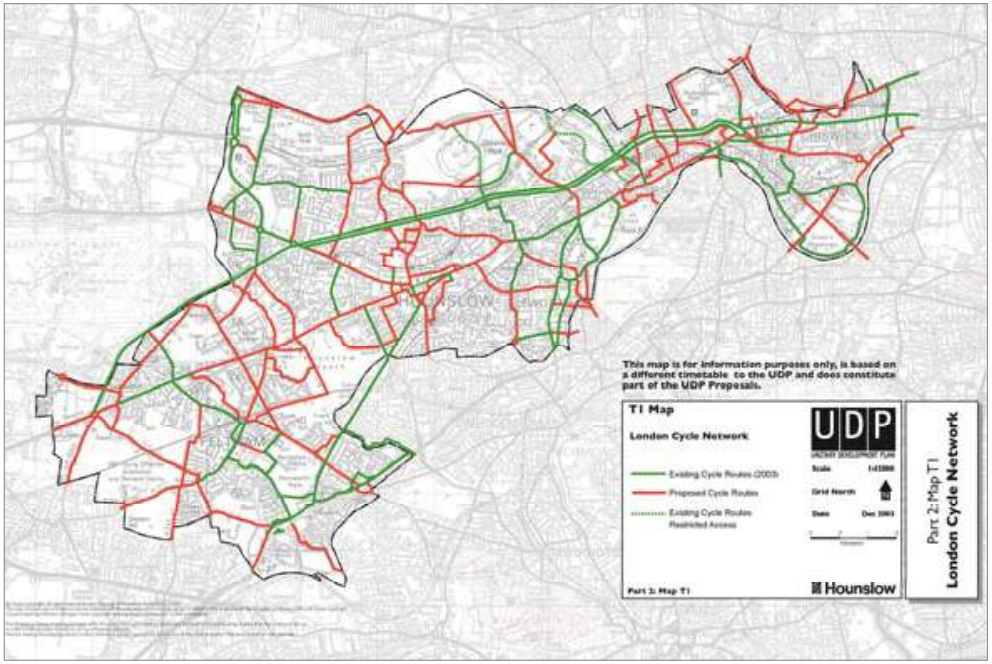
UDP Part 2: Map ENV-N1 – Publicly Accessible Open Space Deficiency



UDP Part 2: Map ENV-N1 – Waterways and Areas of Flooding



UDP Part 2: Map ENV-N2 – Green Chains and Corridors



UDP Part 2: Map ENV-N2 – Green Chains and Corridors

D. Isleworth and Syon School for Boys, Energy Audit

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Isleworth and Syon School for Boys
Energy Audit

Rev 2
21st January 2011

Contents

1. Introduction

The Isleworth and Syon School is a secondary boys school in the borough of Houslow with around 1000 pupils. The main school building is a brick construction completed in 1939. An arts and technology block was added in the 1970s, and some temporary hut-type classrooms were added as recently as about 18-months ago. In addition to the main site, there is also an off-site sports ground with changing rooms called Busch Corner.

In November 2010, Useful Simple Projects carried out an energy survey of the school, the findings of which are presented here. The basis of this survey is: drawings and historic energy data supplied by the school, a non-intrusive survey and anecdotal information received from staff.

The main report includes a discussion of the key findings of the survey and recommendations for the school to reduce its energy consumption. Specifically it sets out:

- an assessment of utility data;
- findings from the survey and recommendations for energy reduction;
- cost benefit of each recommendation; and
- advice on implementation of the recommendations.

Annual savings of approximately £33,000 have been identified with associated carbon reduction of 194 tonnes of CO_2. We estimate that the first ten interventions will have payback periods of less than 3 years and associated annual cost savings of £20,000.

The appendices include a more detailed analysis of utility data and a formal record of the non-intrusive survey.

Figure 1 - Aerial Photo of the main school looking East

2. Summary of Utility Data

Comprehensive utility records dated from 1999 were provided by the school for gas, water and electricity. These have been compared against benchmark data for schools. Analysis of this information also provides us with an idea about how much energy might be saved through improvements to the operation of the school and the building fabric as identified in section 3.

2.1 Gas

There are two meters that feed the school, the main meter and the supply to the kitchen. Analysis of the main gas data shows good correlation with weather data. A small demand in summer indicates very low consumption of gas for heating water.

The adjacent graph (figure 2.1) shows significant reductions in energy use over the past few years. This coincides with a change in boiler maintenance and improvements implemented have led to a steady reduction in gas consumption.

The kitchen gas meter also shows good correlation with weather data which suggests that it serves space heating in addition to catering and hot water loads. For good energy management it is important to establish which areas are supplied through the kitchen gas meter.

There has also been a significant reduction in gas to the kitchen gas meter.

Compared with benchmark data, gas use is below average.

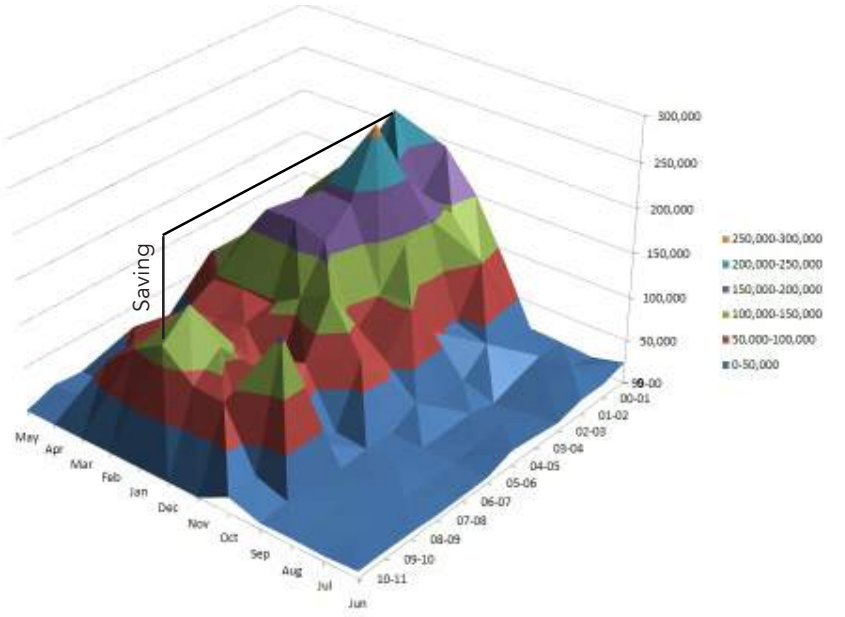

Figure 2.1 - Main Gas Consumption, kWh by Year and Month

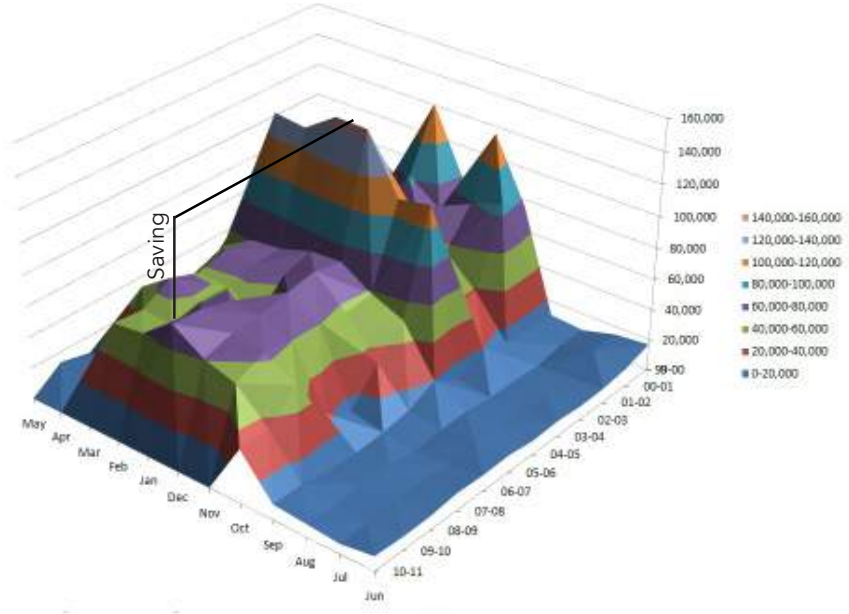

Figure 2.2 Kitchen Consumption, kWh by Year and Month

2.2 Electricity

The electricity load for the school is relatively high when compared against benchmark data. The graph adjacent shows the annual consumption over the past 10 years. Further analysis of the data over the course of the year shows that there is a relatively high base load costing about £4,300 annually. This is equivalent to the base load of 56 homes and so is not insignificant. The 'lumpy' nature of the graph shows an erratic demand.

2.3 Water use

Consumption was found to be higher than benchmark averages. It was not possible to ascertain from the survey why water consumption should be especially high and since there is no sub-metering we are unable to determine the main source of consumption. Guidance on consumption within schools identifies toilet use as the principle demand.

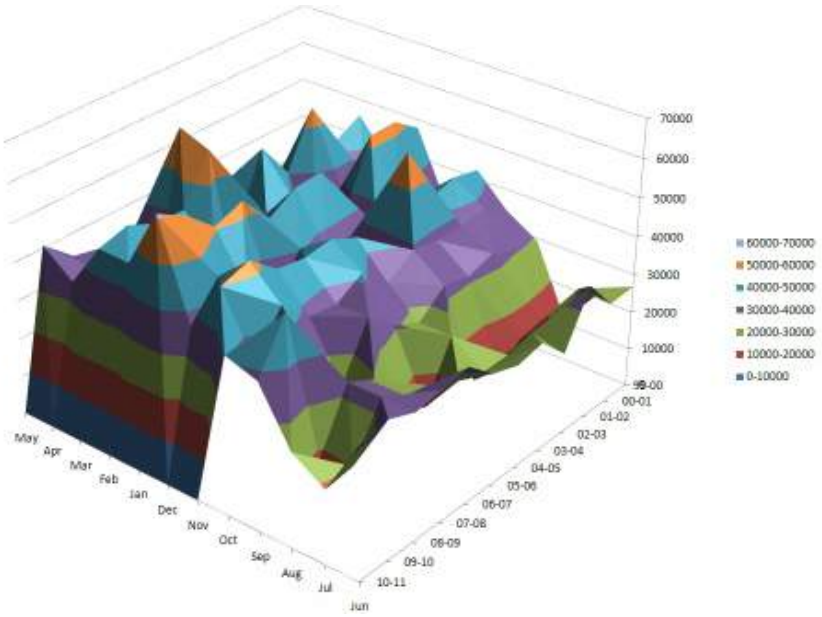

Figure 2.3 - Electricity consumption, kWh by Year and Month

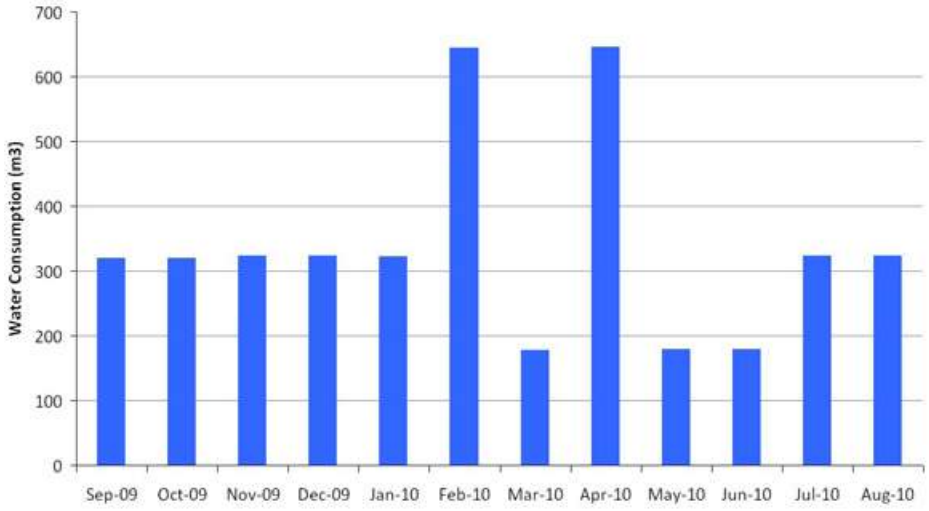

Figure 2.4 - Monthly Water Consumption

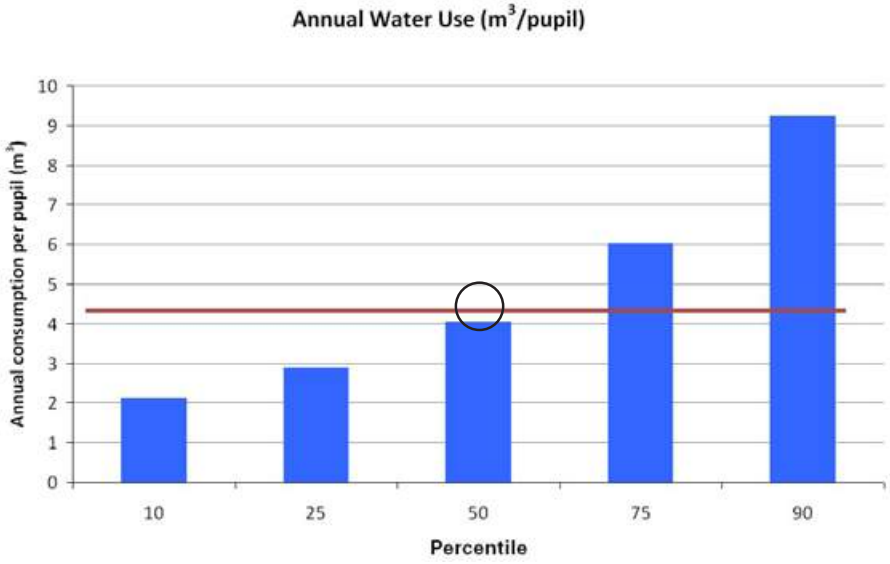

Figure 2.5 -Comparison with Benchmark Data - Consumption is above the median class

2.4 Comparison with Benchmark Data

The adjacent graphs compare consumption of electricity and gas with national benchmark data from measurements taken across a range of schools in 2003. These show that electricity consumption is higher than the average and in the upper quartile of all schools. The active management of the gas systems means the schools has a lower than average consumption in the lower 30 percentile. The combination of the slightly higher than average electricity consumption and a slightly lower than average gas consumption is that the school is in the median class in respect of carbon emissions and cost of energy per pupil.

This is good news, but the school should not be complacent in regard to its overall performance. It should be noted that this data is from 2003 and so we expect the benchmark data to improve in light of policy drivers and initiatives to reduce energy consumption. Further, given the nature of the UK school building stock, the average performance is probably quite low.

The results of the survey have identified a number of opportunities for substantial reduction in energy consumption. Continuing to report and analyse data in this way will help to drive and promote energy conservation, and as discussed in section 3.6, will allow the school to set new standards for energy consumption.

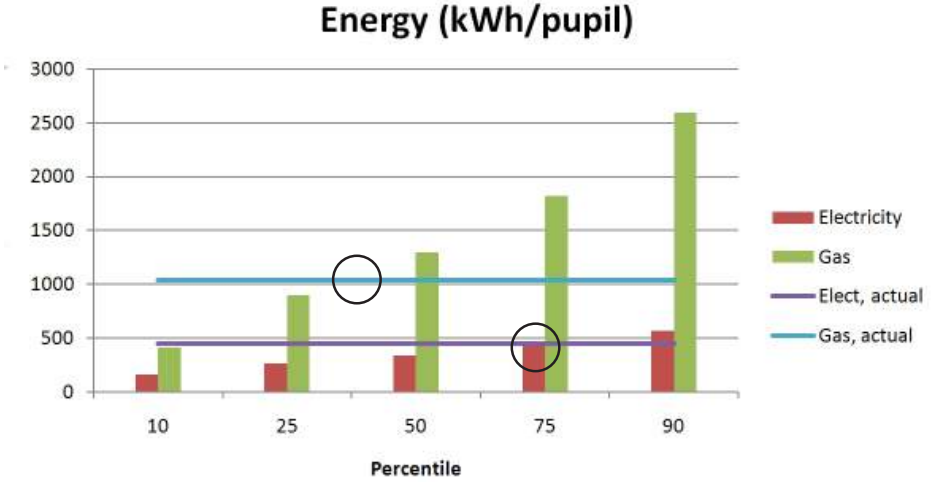

Figure 2.6 - Per pupil, electricity is at the threshold of the upper quartile and gas usage sits in between the lower quartile and the median (approximately in the best one-third of secondary schools).

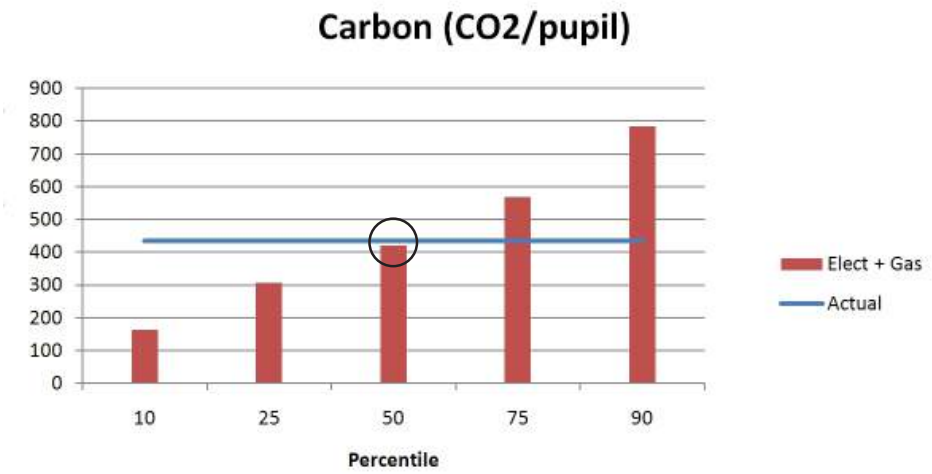

Figure 2.7 - In terms of CO2, the school is almost exactly at the median class.

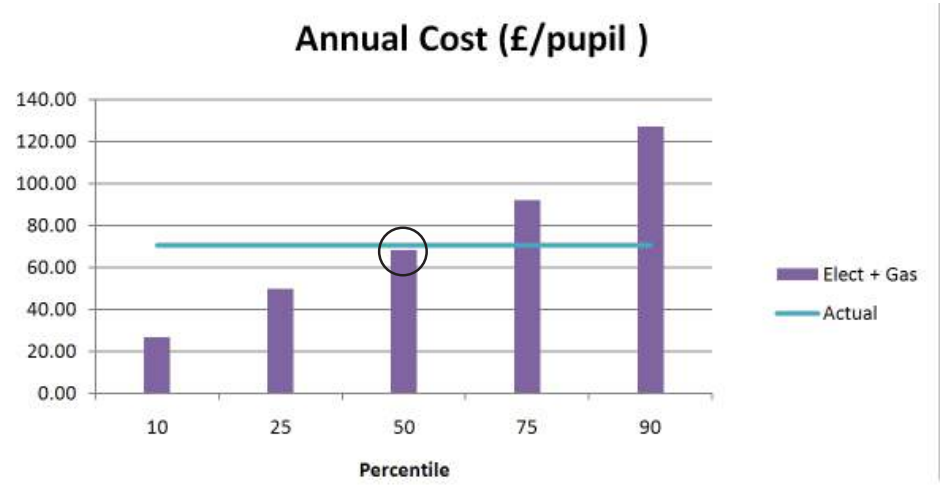

Figure 2.8 - In terms of cost, the school is almost exactly at the median class.

3. Summary and Recommendations

The following section sets out key observations from the survey and discusses recommendations for reducing energy use in the school.

3.1 Building fabric

3.1.1 Windows

Within the main school building most windows in classrooms had been fairly recently replaced with double glazing, funded by BAA. New windows, however, are hinged at the top, presumably to prevent rain ingress, but this is of little benefit in the summer when buoyant warm air is stratified at high level and has no natural 'inclination' to escape through the low-level opening.

If the windows were hinged from the bottom, they would act like chimneys allowing warm and stale air to escape through them. In the winter this could result in excess ventilation with associated energy wastage as valuable heat escapes from the classroom. However, if coupled with a policy of staff and student engagement, this could be addressed by opening the windows by a lesser extent, or by opening fewer windows. Carbon dioxide sensors with audio-visual alerts could prompt teachers to keep the air quality within a healthy range.

If rain ingress through bottom-hinged windows is thought to be a problem, then window mechanisms that allow either opening can be used.

Future window replacements should consider the quality of ventilation and the degree of control.

3.1.2 Thermal Insulation to roof areas

The art and technology block construction has a flat roof which appears to have no thermal insulation, and rainwater leaks are evident in places. Applying thermal insulation to the underside of the flat roof should provide a significant saving. Clearly water leaks should be fixed prior to installation of any thermal insulation.

When insulation is applied to the interior of the building, the exterior building element will become colder. This can result in condensation forming between the insulating layer and the building structure. In extreme cases, this condensation can freeze causing structural damage. Careful detailing of the application of insulation can avoid this, hence further work is required before proceeding with this recommendation.

Thermal insulation to pitched roofs is usually very straightforward with extremely quick repayment periods.

3.1.3 Thermal Insulation to Renovated Shower Block

At the time of the survey, the shower block was being internally lined, providing an ideal opportunity to introduce a layer of thermal insulation. There are a number of products on

Figure 3.1 - Typical replacement double-glazed window, hinged at the top)

Figure 3.2 - Exposed roof construction in the IT room (no insulation)

the market that are very slim with good thermal qualities.

3.1.4 Thermal Insulation Panels to Low Level Windows

Any glazing lower than about one metre from the floor is providing very little benefit in terms of daylighting, but contributes significantly to spatial heat losses, especially where it is behind a radiator. The adjacent figure shows this arrangement in the canteen area. In situations like this, the glazing should be insulated.

3.2 Space Heating

3.2.1 Single Pipe System

Space heating is provided by two sets of gas fired boilers. The main boilers in the plant-room near to the school hall distribute heat through an oversized Single-Pipe Heating Distribution circuit around the main school quadrant. Radiators draw hot water from this pipe in each of the teaching areas but few have individual thermostatic control. The very large pipework has been sized for gravity circulation pre-dating the use of pumps in heat systems.

This single-pipe heating distribution system is causing a very significant waste of heat. Close to the boiler room, the very large pipework is emitting vast amounts of heat, over which occupants can exert no control. As such, occupants have to open windows to maintain a comfortable teaching climate, losing heat in the process. Conversely further round the system, so much heat has been lost that occupants are using costly electric heaters in order to keep warm.

A complete replacement of the distribution system may be prohibitively expensive, but there are alternatives to this.

One option is to just replace the main distribution pipework with a highly insulated flow-and-return system, and then interface to the existing pipework through a distributed network of local heat stations. The optimum solution will depend upon a detailed network analysis.

Another option is to introduce thermostatic controls into the teaching areas. Very many rooms have no thermostatic control whatsoever, and those that do cannot control the heat being released from the large uninsulated distribution pipes.

3.2.2 Thermostatic and Manual Radiator Valves

All radiators should have, as a minimum, a manual regulating valve with a hand-wheel so that occupants can manually reduce the heat output. Alternatively, for similar cost (once labour is considered) this could be a thermostatically controlled valve which regulates the radiator output to suit the room temperature. The disadvantage with thermostatic valves is that they are much more easily damaged than a hand-wheel.

Figure 3.3 - Full-height single-glazing in the Canteen – the lower third contributes negligible daylight but suffers very high heat loss

Figure 3.4 - Typical radiator detail with no control, and very large diameter pipework for gravity circulation (loses lots of heat)

Figure 3.5 - Typical radiator detail with no control

3.2.3 Room Thermostats

Thermostatic radiator valves are not very accurate and each must be adjusted individually – this can be quite inconvenient. A much better solution is room thermostats controlling motorised valves. If the pipework is zoned on a room-by-room basis, then each room could have its own thermostat controlling a motorised valve in the pipework serving that room only. However most of the radiators are served from the main distribution pipe, in which case motorised valves are needed on each radiator individually. The motorised valve is installed in place of the traditional radiator valve, as shown in figures 3.6 and 3.8.

3.2.4 Heating Controls - Optimum Start and Stop

The heating currently comes on at 3:00 AM. If this is the right time for the heating to start on a very cold day, then it must be much too early for a mild day. Self-learning optimum start software can automatically adjust the start time to suit the prevailing weather, thereby saving hundreds of operational hours each year.

3.2.5 Insulation to pipework

The heat being lost from the over-sized pipes in the single pipe system is causing some spaces to over-heat and forcing occupants to evacuate the heat by opening windows. Insulating the pipework would reduce this heat loss. Conventional pipework insulation however is not visually attractive and is easily damaged if left unprotected. Therefore more creative measures are required.

In the arts and technology block, heating is provided through high level fan coil units. The high level pipework to the fan-coil units is especially wasteful. In accordance with normal design practice, the heating pipework to the fan-coils is not weather-compensated, meaning in this instance that the heating water circulates to the fan-coil at 75 °C irrespective of the weather.

Figure 3.6 - A wireless control system allows any number of motorised radiator valves to be linked to a wall-mounted thermostat.

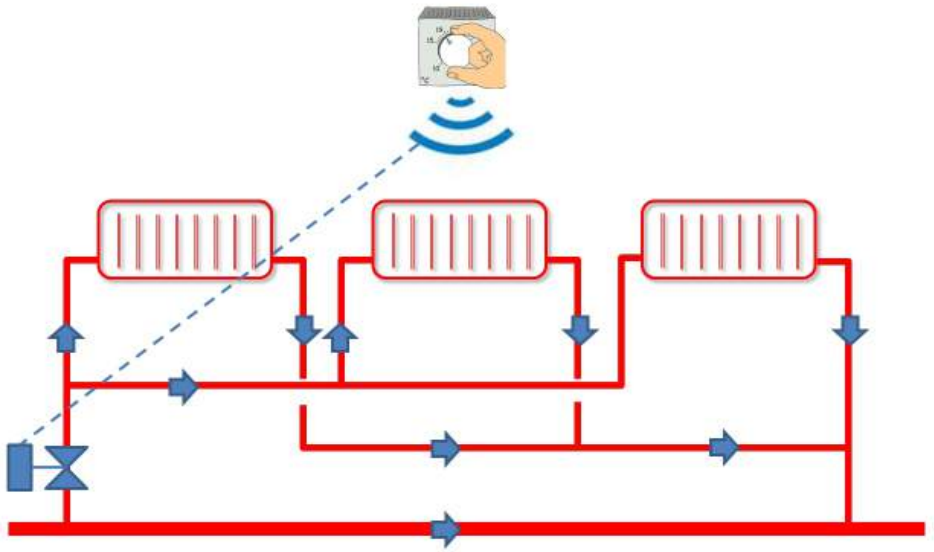

Figure 3.7 - Where pipework is zoned room-by-room, only one motorised valve is required per thermostat.

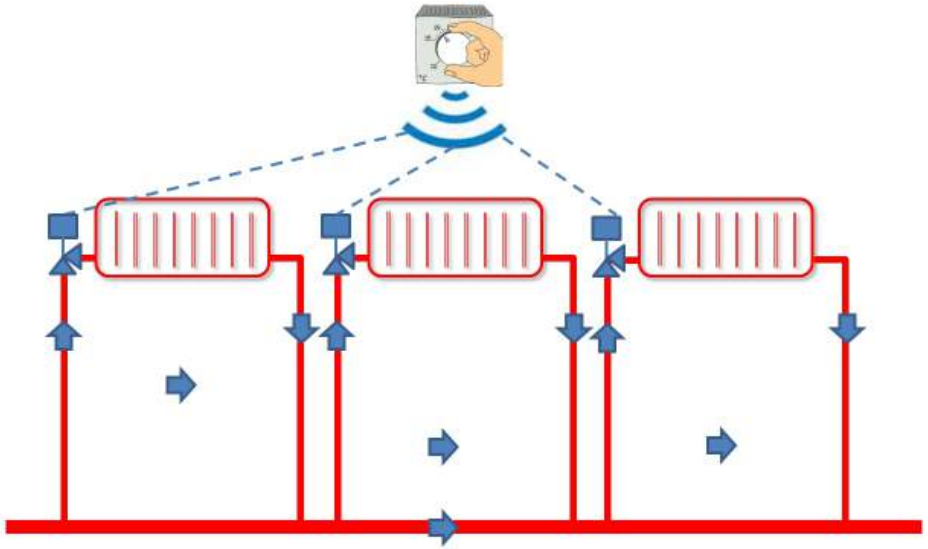

Figure 3.8 - Where radiators are served individually off the main ring main, then each radiator requires its own motorised valve.

At 75 °C, the heat transfer from the distribution pipework to the surrounding space will be very high indeed. On a mild day during the heating season, the heat transfer from the pipework to the space will exceed the room heat loss causing the space to over-heat , even if the fan-coils are off completely.

Moreover, the pipework is well above the occupied zone, so the heat loss is having little benefit on the occupants.

It is likely that the insulation was left off for aesthetic reasons at a time when energy considerations were less crucial than today.

It is recommended that both the single pipe systems and fan-coil pipes are insulated.

3.2.6 Electric Resistance Heating

Electricity is the top of the energy hierarchy, and is valued above all others. In fact, societies exchange most other energy types for electricity at "poor exchange rates" (conversion efficiencies), such is the value placed upon it. Low grade heat is at the bottom of the energy hierarchy and is frequently discarded as a waste product and ejected from buildings and processes.

Therefore using electricity to heat a building is especially wasteful. For each unit of heat derived from an electric heater, about two units of similar low grade heat is dumped to atmosphere at a power station. For this reason, electricity is typically about three-times the cost and carbon-emissions of a gas-fired heating system.

Electric heaters were found to be used as a top up heating to teaching areas at the end of the single pipe system, in the portacabin teaching areas and in the sports hall.

Improvements to the single-pipe heating system and building fabric should be implemented at least to the extent that all electric heaters in the main building can be removed.

In the teaching huts, heaters inspected did not have thermostats or time-switch controls. A very low cost measure would be to install time switches and thermostats to these electric heaters. The capital cost might even be recovered as quickly as within one heating season.

High level heat recovery techniques can be used in lofty spaces such as the Sports Hall and Main Hall. Warm air being released into the Sports Hall and Main Hall will rise under natural buoyancy and stratify at high level above the occupied zone. This effect will be especially pronounced in the Sports Hall which is heated with fan-powered convectors. Slow-moving fans can be used to direct this heat back to the occupied zone through fabric air ducts. The advantage of fabric air ducts is that they collapse on impact and then reform afterwards. This would be especially beneficial in the Sports Hall. Alternatively, the air inlets can be ducted to the top of the space.

Figure 3.9 - Exposed heating pipework, releasing heat above the occupied zone and without control

Figure 3.10 - Resistance heaters

Figure 3.11 - Heating in huts

Figure 3.12 - Resistance heaters in Sports Hall

Figure 3.13 - Sport Hall

3.3 Cooling

3.3.1 The IT Room

There is very little cooling at the school, but the IT room is one area where energy can be saved whilst improving operational resilience.

Currently, a single air-conditioning unit is used to keep the main IT room cool. If it fails, then the room will over-heat – even on a cold day. As the temperature rises, the process speed slows and eventually fails altogether.

The air-conditioning unit supplies air at about 12 °C, all year, day and night. But the annual average outside air temperature is about 11 °C. This means that electricity is often being used to "manufacturer" cool air that is warmer than outside air.

Simply opening the window is unlikely to have adequate cooling effect, but a thermostatically-controlled fan could maintain a suitable temperature for about two-thirds of the year, during which time the energy consumption would be negligible and the risk of system failure would be substantially reduced.

Not only does the fan provide a standby cooling system for about two-thirds of the year, it is much less likely to fail than an air-conditioning unit. Because the air-conditioning unit operates less often, it is less likely to fail when called upon, and if it does fail when called upon, then the fan could be used to mitigate the consequences.

3.3.2 Double Storey Huts

These have heat pump units that provide efficient heating in winter and the potential for cooling in summer. Consideration should be given to disabling the cooling function, or at least restricting the minimum cooling set-point to say 27 °C. It is not normally necessary to cool a classroom.

Figure 3.14 - Manufactured 'cold air' to the left, and unused free cold air to the right.

Figure 3.15 - Extract fan and cooling unit in the teaching huts.

3.4 Domestic Hot Water (DHW)

3.4.1 Shower Blocks

The existing showers on the main school block have a single on/off valve, which means that all showers are either on or off. Unless showering is extremely well-managed by the teachers, this is likely to result in significant wastage. Each shower should be fitted with a push-button that resets to off after about 30 seconds. It is noted that the new shower area will be fitted with individual controls.

3.4.2 Busch Corner

Water is constantly circulated between the shower area and the hot water generators at 60 °C – this is to kill any harmful bacteria. 60 °C is much to hot for showering, and so it is locally blended with cold water down to about 40 °C using a thermostatic mixing valve. All of this is common practice. However the circulation pipework is uninsulated, resulting in significant

and uncontrolled heat loss to the changing room, even in summer. This pipework should be thermally insulated.

3.5 Lighting

3.5.1 T8 Lamps

Lighting throughout the school is mainly through T8 fluorescent tubes in relatively old fittings incorporating mechanical ballasts. Mechanical ballasts produce a flicker at mains frequency, causing eye-strain. This effect is more noticeable in some people than others, and some people suffer serious headaches as a result. For those suffering with epilepsy, these older fluorescents can induce episodes. Certainly they should not be used around rotating machinery, such as in the workshops, where a strobe effect can create the illusion of rotating equipment appearing to be stationary.

Modern fittings are usually specified with low energy T5 tubes and high frequency electronic ballasts. The frequency is too high to produce any noticeable flicker or strobe effect.

A gradual replacement of light fittings in line with maintenance replacements is recommended, delivering an anticipated energy saving of around 20 percent of the total lighting load.

3.5.2 Diffusers

Various types of Perspex screens have been placed over the fluorescent tubes; this is to prevent a direct view of the lamp which in turn can cause veiling reflections on VDTs and cause glare. The Perspex has photo-degraded (yellowed) over time to the extent that the output must now be very low.

Most modern light fittings shield the lamp using the geometry of the reflector giving a much better light output ratio.

These opaque diffusers are likely to be reducing light output, and therefore increasing energy by about 20 percent. Replacement of fittings with more effective diffusers, as identified above, is recommended.

3.5.3 Switching

Light switching in many rooms is poorly zoned. For instance, one light switch for a whole room or lights switched in strips running perpendicular to the window-wall.

The daylight contribution is greatest nearest the window, and steadily falls away to nothing at a distance of about six metres. Lighting should therefore be switched in strips running parallel to the windows. Those strips nearest to the window can be off more often than those further away.

Daylight penetration is of no energy benefit if all the lights have to stay on because those parts of the room benefiting from day-light are on the same switch-circuit as other parts that do not.

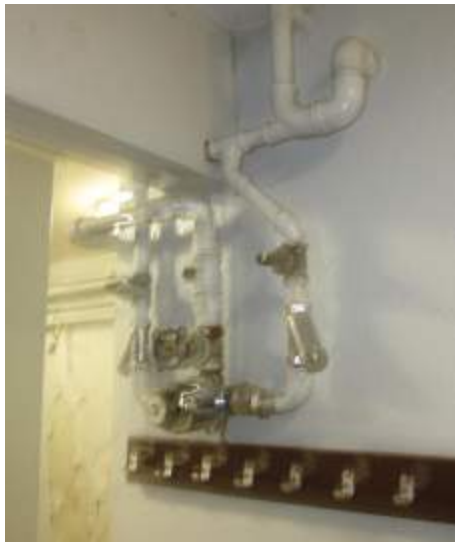

Figure 3.16 - Busch Corner changing room.

Figure 3.17 - Single Ball-o-Fix isolating valve serving all shower outlets

Figure 3.18 - Photo-degraded (yellowed) light diffuser (one of many)

Figure 3.19 - Linear fluorescents behind acrylic diffusers with poor light output (one of many)

Photocells can be used to either extinguish or continuously dim lights in response to daylight penetration. Switching is cheaper but, to avoid complaints, lights usually have to be switched off at three times the design illuminance, significantly reducing the energy saving.

Occupancy sensing using Passive Infra-Red (PIR) sensors has been installed to about 20 percent of classrooms, and this should be extended throughout the school. Health and safety considerations are paramount, and PIRs are not suitable in all spaces, such as boiler rooms and some staircases. Professional design advice should always be sought in respect to the location and installation of PIR devices to enusre an optimum solution is developed.

Further investigation into the installation of controls and zoning for lighting control is recommended.

3.6 Sub-metering, Targeting and Monitoring

3.6.1 Base electrical load

From the Benchmarking and Load Analysis it is clear that the school's electricity consumption is high (upper quartile nationally), and this is in no small part due to the high base load at night-time and weekends (c. 28 kW). However, without effective sub-metering it is only possible to speculate about the causes.

Sub-metering allows the utility bills to be itemised circuit-by-circuit. For instance, it should be possible to know how much is used by lighting and plug loads separately, and how much is used by each building.

3.6.2 Degree-day analysis

The gas consumption should obviously have a close correlation with the weather: when it is cold, more gas should be used to heat the school. In the summer the only gas used should be for Domestic Hot Water (DHW) and catering.

To help correlate gas consumption to the weather, degree-days are used. The concept of the degree-day requires first of all that a base temperature is established – this is the outside air temperature above which heating is considered unlikely. It is normal to choose 15.5 °C for this. Generally, if the outside temperature is 15.5 °C, then internally-generated heat gains and solar radiation are usually adequate to bring the space to a suitable temperature without requiring any additional heating.

One degree-day is 1.0°C below the base temperature sustained for one day. Two degree-days could be 2.0 °C below the base temperature sustained for one day, or equally it could be 1.0°C below the base temperature sustained for two days, and so on.

Usually the average daily temperature is used, so if the average temperature for a given day is 14.5°C, that day would be equal to one degree-day. However, calculations can be coarser and use monthly averages, or finer and aggregate hourly differences. Whichever method is used, degree-days is a method for estimating how cold a given month was.

Degree-day data can be downloaded on-line for a period of about three years at http://www.degreedays.net/?gclid=CPTo0sngkaUCFWr92Aod1S2lMA#generate.

There is already sufficient data to derive a relationship between degree-days and gas consumption, which could be used to set weather-corrected targets and provide early identification of prolific gas usage. The spreadsheet would make this highly automated.

3.6.3 Establish what is served off each gas meter

Currently it is not clear what is served off the kitchen gas meter. From the utility load assessment, this gas meter is clearly very sensitive to the weather, meaning that it is serving more than just catering gas. It is difficult to manage gas usage when it is not clear what is served off which meter.

3.6.4 Targeting and Monitoring

For each meter and sub-meter there should be a target. In some cases the target will vary only by the number of days in the measurement period (i.e. February lower than December), others may vary by the month (lighting meters would have lower targets in June than January), and others may vary by the prevailing weather (such as gas meters varying with degree-days). All of this information can be embedded into a spreadsheet.

Meters and sub-meters should then be read periodically (say monthly), and recorded on the spreadsheet. The spreadsheet will show alerts where measured values are out of the expected range and give advice on what action to take.

Targeting and monitoring is a very useful tool in energy management, and can quickly identify problems. Sometimes, very high energy use is indicative of even more serious problems that might otherwise go unnoticed – such as a broken window or leaking hot water pipe.

3.7 Awareness Raising and Behaviour Change

As indicated above, the achievement of significant reduction in energy consumption in the school will require the engagement of both staff and pupils on a number of fronts as described below.

3.7.1 Maintenance and Operations Staff

It is clear speaking to maintenance staff that there is ambition to reduce energy use as evidenced by reductions achieved over the past few years. Technical support to help resolve particular systematic issues described above would help to achieve ongoing reductions.

There is also an opportunity to establish a green revolving fund where savings are reinvested to improve the schools environment.

3.7.2 Pupil engagement

There is tremendous opportunity for engagement of pupils in achieving energy reductions.

Firstly through information and an awareness campaign designed to engage students both in how the school can reduce energy but also the context of why it is important to do so. This can be done through innovative workshops and presentation of the findings of this report, appropriately tailored.

Secondly by looking at opportunities to relate the curriculum to the measures being implemented in the school. For example, a really good project for a science club or as part of the curriculum would be to get the students to establish a monitoring and reporting system, investigating data to look for trends in energy reduction, the impact of particular interventions and comparison with weather data. For a media group or art class, this might include the development of a campaign and posters to support key messages about energy reduction, and reporting for the school's website.

Thirdly by using class environmental representatives and students to help the school to 'police' its energy reduction. This would be through ensuring doors and windows are used appropriately, lights are switched off when not in use, and maintenance defects are reported and further ideas for campaigns are generated.

Finally, building on the student's and school's competitive spirit, the students could develop a reporting system for all schools in the Borough with an end of year prize for the best performing school. It is likely that this sort of initiative could be funded through corporate sponsorship.

3.7.3 Teaching Staff

As a significant component of the building occupants and as the leadership of the school it is also vital that teaching staff are engaged with the process. Similar workshops and presentations focussed on the role of teachers in reduction of energy could be used. Anecdotal evidence from the survey appeared to indicate that improvements to the building operation will bring great benefits to the teaching environment.

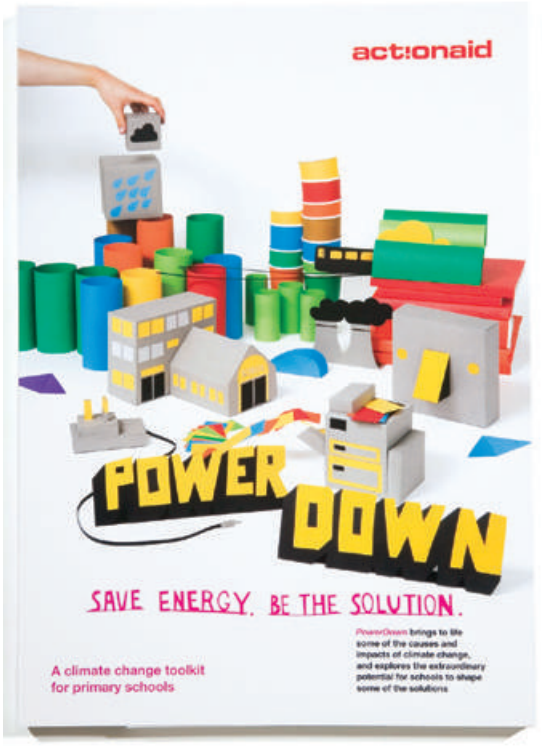

Figure 3.18 - Example of a Power Down campaign by Useful Simple.

4. Cost Benefit of Recommendations

A summary of the key recommendations is provided in Table 4.1 along with an estimate of the cost and associated pay-back period.

Not all savings are additive, one intervention to reduce heating load will reduce the opportunity for another intervention to achieve full savings. As such the total annual savings, making allowance for the diminishing returns of applying sequential improvements to the same loads, are estimated in Table 4.2.

The table only sets out changes from technical interventions. Results from behaviour change are far more difficult to assess. Rather than direct measurable interventions however, behaviour change and awareness help contribute to the successful implementation of such strategies, ensure that technologies are used correctly, and that savings are reported and celebrated.

Recommendation		Capital cost £	Annual savings						Simple repayment years
			gas £	gas kWh	elect £	elect kWh	total £	total t. CO_2	
1	Find and eliminated the base electrical load	1,000			10,089	131,470	10,089	72	0.1
2	Optimum start and stop	1,000	5,000	162,127			5,000	30	0.2
3	Prohibit or limit cooling to double-storey huts	200			1,000	10,678	1,000	6	0.2
4	Thermostats and time-switches to single storey huts.	500			1,000	0	1,000	0	0.5
5	Mechanical ventilation to IT room.	200			400	5,212	400	3	0.5
6	Insulation to shower pipework	200	200	6,485			200	1	1.0
7	Push-buttons on showers	700	500	16,213			500	3	1.4
8	Pipework thermal insulation	4,000	2,276	73,792			2,276	14	1.8
9	Local and thermostatic control to all rooms	7,500	3,000	97,276			3,000	18	2.5
10	CO_2 sensors to help teachers monitor ventilation.	5,000	2,000	64,851			2,000	12	2.5
11	High-level heat recovery from sports hall	3,000	1,000	32,425			1,000	6	3.0
12	Energy sub-metering, targeting and monitoring	10,000			3,000	39,093	3,000	21	3.3
13	More efficient heat distribution	30,000	3,251	105,417	4,936	52,708	8,187	48	3.7
14	Insulate roof areas	44,750	8,000	259,403			8,000	48	5.6
15	Insulated spandrel panel below c.1 metre	500	53	1,719			53	0.3	9.4
16	Double-glazing	100,000	10,000	324,254			10,000	60	10.0
17	Replace all old light fittings fitted with mechanical ballasts and perspex diffusers. Re-zone the lighting for affective daylight control and fit occupancy sensores throughout. (SEE NOTE 3).	223,750			12,015	128,294	12,015	70	18.6

notes:
1. Capital costs and savings are approximate and based on rules-of-thumb, simplified calculations and intuitively-derived estimates.
2. Not all savings are additive. When a number of measures are applied to the same load, diminishing returns apply.
3. Much of the lighting is quite old and is likely to need replacing over the next few years. Therefore much of this cost is not additonal, but part of the schools on-going maintenance budget. This recommendation is about using existing budgets to introduce energy savings through careful planning.

Table 4.1 - Cost benefit of principal recommendations

Estimated total annual savings

	Cost (£)	Energy (kWh)	CO_2 (tonnes)
Gas	13,000	421,530	78
Electricity	20,000	213,561	116
Total	**33,000**	**635,092**	**194**

Capital cost (£)	**431,800**
Simple repayment period (years)	**13.1** See note 3

Table 4.2 - Total estimated savings

5. Recommendations on Implementation

For a number of reasons, recommendations from energy audits are not always implemented and so it is important that the school identifies how these measures can be implemented, who will be responsible for ensuring that they are carried forward and the barriers (usually cost or time constraints) need to be overcome.

5.1 Order of implementation

In general, implementation should be in the following order:

- No cost and very low cost measures, such as behavioural changes.
- Measures for which grants are available, such as thermal insulation.
- Measures for which interest-free loans are available.
- Measures which have very short repayment periods.
- Higher cost measures with short repayment periods.
- Higher cost measures with longer repayment periods.

By generally following this hierarchy, a capital 'green' fund can be generated from quick wins to finance the more ambitious measures. As ever, there are exceptions, and the hierarchy should be used as a guide rather than followed rigidly.

5.2 Trialling interventions

Some measures are best rolled-out on a trial basis, such as modifications to the heat distribution pipework. It might be that simple insulation to key sections of pipework and adding basic thermostatic controls provides sufficient benefit that further measures cannot be justified.

Classroom CO_2 sensors is another measure that should be trialled so see how teachers respond to them, and what savings are thought to be achieved.

5.3 Developing a maintenance and replacement strategy

It is unlikely that the school will ever have c. £250,000 to improve the energy efficiency of the lighting; however the lighting will have to be replaced at some point. With thought and planning, the maintenance and replacement budget can be harnessed to bring about maximum efficiency gains. If replacement decisions are left until equipment is about to fail, or has failed, then it will usually be replaced in such a hurry that there is no time to consider any options. This leads to like-for-like replacements, so that over many replacement cycles, the building is nothing more than a new version of an old design. It is therefore useful to develop a maintenance and replacement strategy taking account of the long term desire to reduce energy consumption.

For example, on lighting, typically the fittings would be replaced with more efficient modern alternatives, but the switching and circuitry would remain the same. If however there is a long-term plan for the school lighting, then for little extra cost, each time a room is fitted with new lights, the circuits could be changed to allow for better daylight control: those near windows on different circuits to those further away. It is the school's policy to add occupancy sensors, but perhaps it could also take the opportunity to incorporate daylight sensing photocell control.

Using this approach, the additional cost of evolving the lighting into something very efficient could be marginal, say £25,000. Although it might take a number of years to implement across the whole school, the room-by-room repayment period is likely to be around two years.

5.4 Seeking grants and support for capital investment

Some grants are available for implementing measures such as insulation. The Carbon Trust also has zero interest loads available for carbon reduction interventions. Some manufacturers also support schools in the implementation of energy saving devices, although care should be taken to ensure that the technology is appropriate. Energy companies such as EON and BP have in the past provided funding for initiatives to reduce energy in schools. Some councils have also funded additional metering of schools.

A further support may be through BAA, given the local impact of the airport on schools in Hounslow.

However, grants are notoriously time consuming to obtain and paperwork-heavy so they should be sought for the most capital intensive interventions.

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