# WSU

dwp

## An Audacious Goal

An audacious sustainability goal driven by necessity, combined with new technologies and the collective will to learn, adapt and innovate, has Western Sydney University's new $24 million Science Building on track to achieve a 6 Star Green Star rating and set new Australian construction standards.

At the outset of this project, dwp's first challenge was to solve an energy problem: the University's Parramatta campus was virtually at the threshold of its high voltage supply capacity. As a result energy minimisation is a key design driver, a highly innovative design solution was developed utilizing active slabs with inslab hydronic heating and cooling.

dwp led a highly collaborative process of open discourse, lateral thinking and eight weeks of value engineering to find innovative solutions and efficiencies. Supported by the University's willingness to explore new ideas and the drive of the construction team, the team instigated innovations around construction, procurement and planning throughout the design and build.

Being the University's first 6 Star Green Star facility, the project set a very high bar. Embracing a culture of challenge and innovation, dwp constantly looked at new, better ways of doing things to achieve $1.8million in savings and created a better quality outcome for students and staff.

## Concept

Located on the historic Parramatta South campus, the Science Building is designed as a gateway to the campus centre, presenting as a bold symbol to the main campus entry. In contrast, the western facade respectfully nestles up to the heritage Vernon Lawn precinct.

The new facility with capacity for over 400 students and staff significantly expands the University's science and research programs. dwp's design carefully balances the need to create an engaging contemporary learning experience with the demands of a highly technical environment enabling sophisticated research and teaching.

The major circulation spine at the core of the building doubles as a collaborative, flexible, informal student learning precinct. Shared zones are introduced to break down traditional thinking and lower barriers between lecturers, researchers and students. This combination of circulation, workspace and breakout spaces, many with glazed internal walls, creates a highly engaging facility strongly pitched for transparency, vitality and active sharing of knowledge and research.

# Context

The University masterplan had indicated a three storey, rectilinear form for the new Science building. Drawing on dwp's previous experience with the heritage significance of this precinct, we proposed an alternative design that establishes an eastern gateway to the central hub of the campus that the masterplan had not visualised.

The resulting segmented curved form responds to the natural circulation path and fall in the site. At the western end, the built form is reduced to a single storey; here the main entry addresses the Vernon Lawn and heritage precinct. The impact of the increasing scale of the building is subtly minimised by tucking the building into the hillside.

The setting of the new Science Building in a heritage precinct points to selection of red brickwork to reference the historical character of the site. To soften the inherent heaviness of the brick, a slick metallic framework of louvres is introduced, acting as sun shields to protect the northern facade. The gantry on the southern side of the building is enclosed in a silver metallic grid reflecting the industrial nature of the functions behind the screen. The two towers housing the heavy plant for mechanical systems are enclosed in dark powder coated penthouse louvres.

# Site Constraints

Western Sydney University's Parramatta Campus occupies a site with many important heritage buildings, dating back to the beginnings of the colony of NSW. As a result, the whole site is on the State Heritage Register as well as the Register of the National Estate. The heritage and archaeological significance of the campus required a lengthy process of design reviews, archaeological testing and approvals with local authorities.

An adjacent high pressure fuel pipeline and nearby rail lines imposed strict building and excavation restrictions, challenging construction approaches. Because the scientific equipment has an extremely low tolerance to vibration and electromagnetic interference, an isolated slab is used to support the most sensitive equipment. This proved to be so effective that during testing of new equipment, the readings for vibration and interference were so low, it was at first thought that the measuring equipment was faulty.

By forming a close working relationship between all parties, the design team was able to successfully integrate seemingly contradictory goals into a final solution that successfully meets all the requirements.



Image: AW Edwards

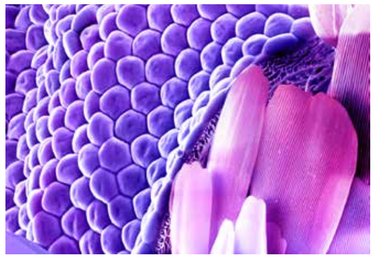
# Function

The ground level houses the teaching laboratories for physical, chemical and biological sciences. An advanced simulation laboratory allows students to engage in high level simulation and other blended learning opportunities. Located on Level 1 are the research laboratories that generate income through research grants. The research relates to non-biological sciences and employs post-graduate students. This means the University can now offer students progression from education into research.

The lower ground floor opens out to terraces that support the functions of the School of Social Sciences and Psychology, which conducts research into behavioural studies. A range of lab spaces, with sophisticated AV, are used for practical research, recording sessions and analysing outcomes. Speech therapy is conducted in very small labs. In the Art Making Space and adjacent external terrace, sketching and pottery making are used to assist in rehabilitation for psychological issues.

The Advanced Materials Characterisation Facility (AMCF) is a specialised function that houses scanning electron microscopes (SEMs) which operate at 1,000,000+ times atomic level magnification, generating extraordinary imagery. The AMCF generates income by conducting forensic work for the police and coroners court. The AMCF is located adjacent to the main building entrance, with a large window that is a literal 'window into the world of science'.





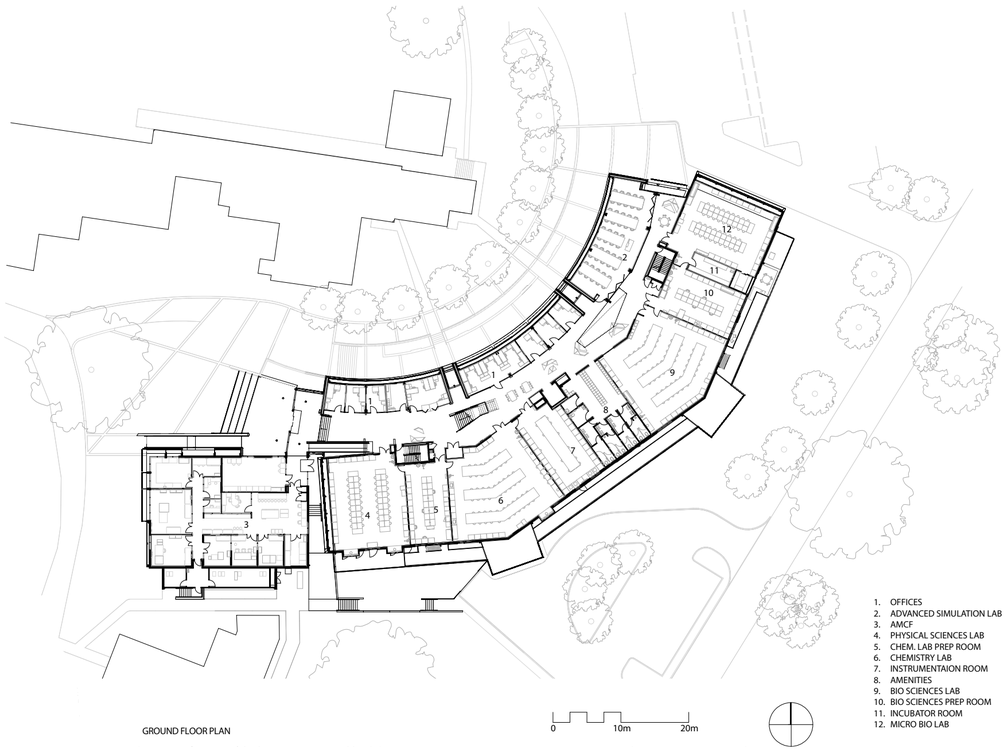
Images: UWS Advanced Materials Characterisation Facility

# Evolving the Typology

Laboratory work calls for controlled environmental conditions, typically requiring a high proportion of outside air for safe and healthy indoor environmental quality. Pumping water is vastly more efficient than pumping air and the equipment is a lot smaller. The active slabs take care of the space heating and cooling, so that only make up fresh air is circulated in fabric ducts and exhausted through the corridors.

The building's complex array of services are centralised and sequestered in a peristitial space, known as 'The Gantry'. Located externally to the labs this peristital zone is a lineal external services zone which provides easy access to the cooling, vacuum and compressed air systems, plant operations and maintenance; significantly reducing noise and disruption to nearby labs.

This ingenious solution offers direct, secure access to services; given there are 17 different gases supplied to the labs, simplifying gas maintenance is a significant economic and safety advantage. Being external to the building there is less noise and less disruption to classes and research activity.



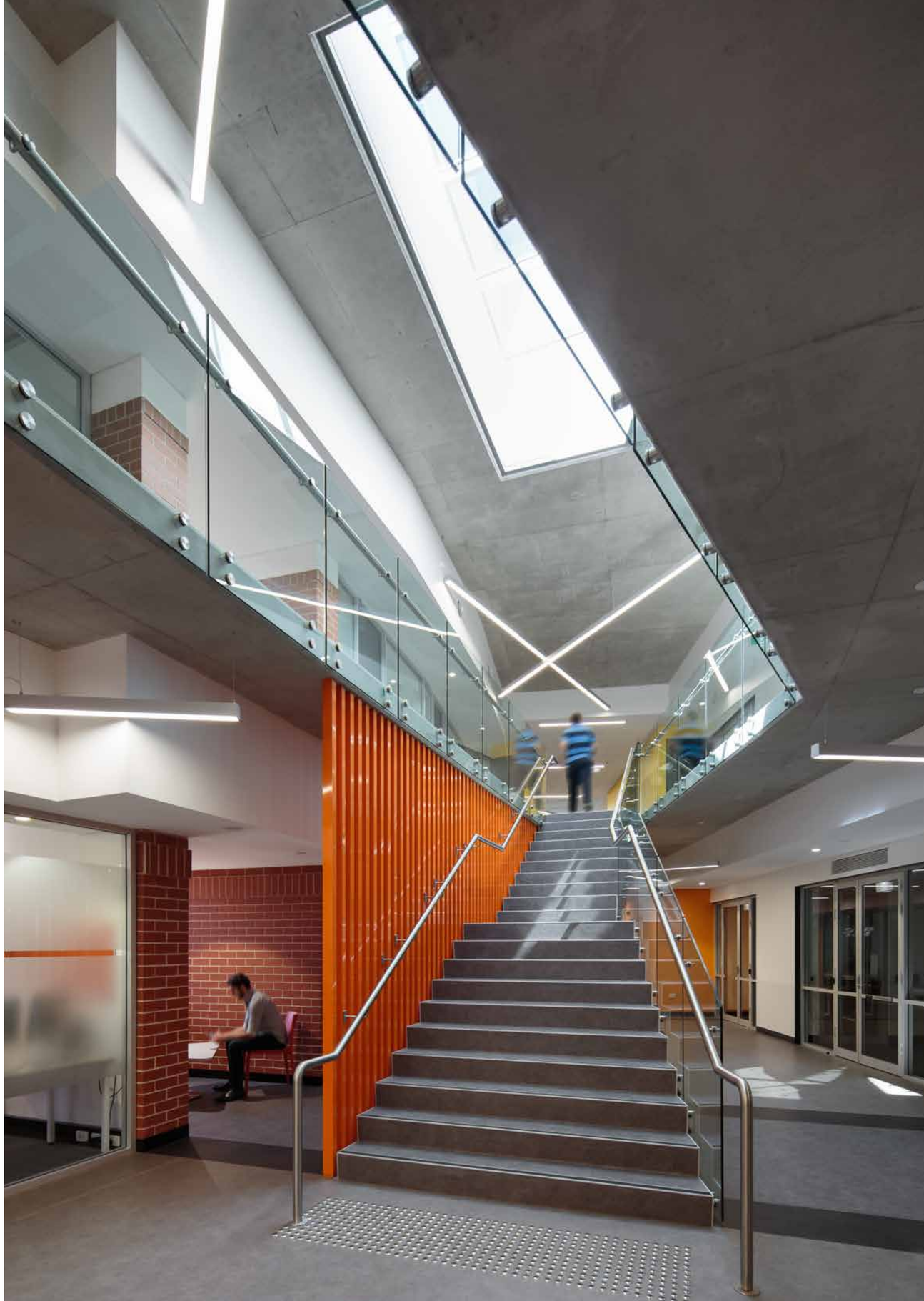

GROUND FLOOR PLAN

1. OFFICES
2. ADVANCED SIMULATION LAB
3. AMCF
4. PHYSICAL SCIENCES LAB
5. CHEM. LAB PREP ROOM
6. CHEMISTRY LAB
7. INSTRUMENTAION ROOM
8. AMENITIES
9. BIO SCIENCES LAB
10. BIO SCIENCES PREP ROOM
11. INCUBATOR ROOM
12. MICRO BIO LAB

# Planning

The internal spatial arrangement is simple. Programmed spaces are arranged either side of the main corridor; collaborative nodes are created at each inflection of the segmented curve, and voids and stairs provide physical and visual connection. Laboratories are located on the southern side. External to the laboratories is The Gantry peristitial zone where all building plant services are arranged.

Teaching and staff spaces are located on the northern side facing the major pedestrian route with views to the heritage buildings and surrounding landscape.  Offices are conveniently located close to relevant laboratories, with easy access for students. The connecting voids and stairs enhance the collaboration between researchers on Level 1 (research laboratories) and students on Ground Floor (teaching laboratories). The laboratories are as transparent as possible.



# Innovation & Collaboration

dwp led a collaborative eight week value engineering process between the contractor, engineers and University personnel, questioning every aspect of the build, reviewing construction methods and alternative systems; converting challenges into opportunities and exploring ongoing improvements. The value engineering discussions inspired the redesign and redistribution of services, as well as the revision of ceiling layouts and simplification of the construction processes and internal finishes; saving $1.8 million and creating a better quality outcome for students and staff.

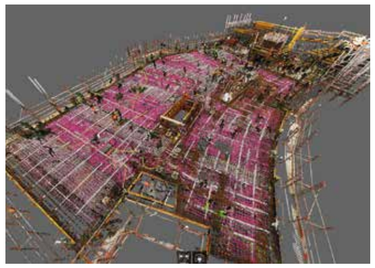
Open communication seeded innovative ideas, new ways of doing things and fast tracked problem solving. dwp's Principal Project Architect attended the site biweekly; and through discussions and sketching, resolved many small details on the spot, reducing RFIs by 80%.

# Technology

A highly accurate point cloud scan of the complex 22km hydronic pipework system was completed prior to pouring each of the slabs, creating a detailed 3D map which was then incorporated into the BIM (Building Information Model). This enriched model was crucial for clash detection, informing construction methods, tracking Green Star credits and providing better engagement with subcontractors; resulting in significant cost and material savings and a faster construction time. Knowing exactly where the post tensioning and hydronic pipes are post construction, is also critical for forming any future penetrations in slabs.

BIM powered construction saved money, materials and time. The site manager utilized the model for better communication with and training of subcontractors. In one famous moment, the site manager identified in the BIM that one critical pile had been omitted by the pile contractor, ran after the truck and called him back to drive in the missing pile.

The ground contained a very large amount of contaminated material, including asbestos sheet and vinyl. The final cost of removal and disposal of contaminated material was around $2m even after design rationalisation. The design objective was to minimise the amount of spoil generated by rationalising levels and combining services trenches where possible and to beneficially reuse material to balance cut and fill. The civil engineer had already started to develop a Triangular Irregular Network (TIN) file which the contractor developed to ensure the bulk levels were accurate. Using the TIN files, the bulk excavation and contaminated spoils were within 3% of the contractor's forecast.



Top image: AW Edwards

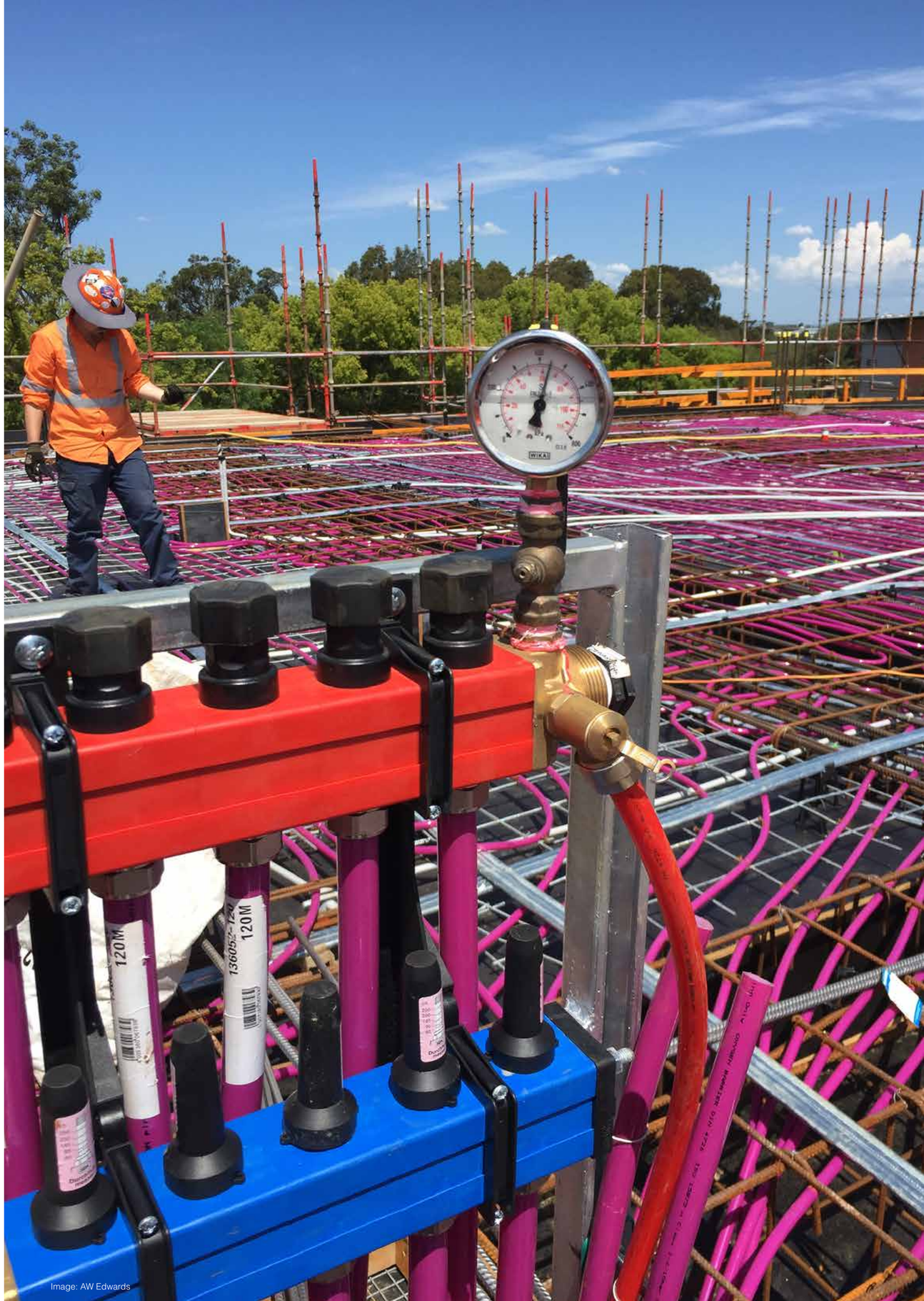



Image: AW Edwards

# Sustainability

A sustainable campus is important to the University's business model and all new buildings target 5 Star Green Stars (Education V1). With Parramatta Campus virtually at the threshold  of its high voltage supply capacity and a target of 5 Star Green Stars; dwp together with engineers, Umow Lai, designed an extremely low energy laboratory facility to deliver a 6 Star Green Star project.

Laboratory design requires 100% of the air to be conditioned for health and safety; typically a high energy demand. dwp's solution is an innovative concrete core tempering HVAC system, utilising 22km of hydronic pipework. The HVAC active thermal mass solution significantly reduces the quantity of air needing treatment, while high efficiency dehumidifying units ventilate the building with 100% fresh air. This solution, combined with a 100kw photovoltaic array, reduces energy demand significantly.

'Cupolex', a polypropylene formwork system made from recycled car batteries, is used under the ground floor slab; reducing groundworks and concrete, increasing construction speed, quality and accuracy.  Its use in this project has resulted in a new Australian Standard.

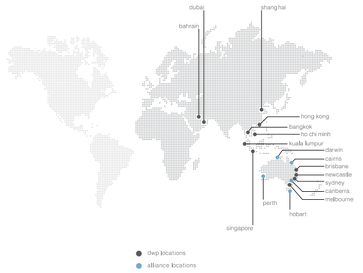
# Meeting the Brief

The new 4,600sqm building accommodates the School of Science and Health, an Advanced Materials Characterisation Facility, and the School of Social Sciences and Psychology, with capacity for over 400 students and staff. The project creates greater opportunities for Honours and research students, better industry partner engagement and promotes science to high school students.

This commission continues dwp's longstanding relationship with Western Sydney University. The brief called for accommodation for 25% more students and 50% more researchers, compliance with National construction code and functional outcomes within the constraints of heritage environments and a 5 Star Green Star rating.

dwp delivered all the above, and in terms of environmental measures, went beyond the brief with an innovative 6 Star Green Star design, all on time and $1.8 million under budget.

**We are 450 professionals who are defining a new world built on the insights of people who love the spaces we design. We are dwp - design worldwide partnership.**

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‘ This is a much anticipated new building for Parramatta, providing the very best contemporary teaching spaces and scientific research laboratories for both our undergraduate and postgraduate student population ’

**Professor Gregory Kolt**
**Dean of Science, Western Sydney University**