Appendix 12 - High Performing Buildings Study

KINESIS

PARRAMATTA CBD

HIGH PERFORMANCE BUILDING STUDY

PREPARED BY KINESIS FOR PARRAMATTA CITY COUNCIL

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Note: This report is provided subject to some important assumptions and qualifications:

The results presented in this report are modelled estimates using mathematical calculations. The data, information and scenarios presented in this report have not been separately confirmed or verified. Accordingly, the results should be considered to be estimates only and subject to such confirmation and verification.

Energy, water and greenhouse consumption estimates are based on local climate and utility data available to the consultant at the time of the report. These consumption demands are, where necessary, quantified in terms of primary energy and water consumptions using manufacturer's data and scientific principles.

Generic precinct-level cost estimates provided in this report are indicative only based on Kinesis's project experience and available data from published economic assessments. These have not been informed by specific building design or construction plans and should not be used for design and construct cost estimates.

The Kinesis software tool and results generated by it are not intended to be used as the sole or primary basis for making investment or financial decisions (including carbon credit trading decisions). Accordingly, the results set out in this report should not be relied on as the sole or primary source of information applicable to such decisions.

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INTRODUCTION

The Parramatta CBD is currently undergoing significant growth and in order to help facilitate this growth, Council is undertaking a strategic review of the Parramatta CBD planning framework. A key outcome of this review will be revised zoning and development controls for the CBD planning area.

This study is intended to be read in conjunction with a previous study undertaken by Kinesis which highlights the impact of this new development on infrastructure, affordability and environment outcomes (see *Parramatta CBD Planning Review Sustainability and Infrastructure Study*). This previous study recommended the implementation of high performance building standards to position Parramatta as a global leader in sustainable planning, attract A-Grade office development, ensure resource and infrastructure efficiency and future proof the city against emerging technologies and investment.

To deliver on this recommendation, Parramatta City Council is proposing a combination of requirements and incentives to deliver higher environmental performance outcomes in all new developments across the CBD, specifically:

- Higher environmental performance requirements for all new commercial buildings over 10,000 m2.
- Higher BASIX requirements for all new residential development, tied to a floor space bonus of 0.5:1.
- Future proofing requirements for all new development to provide dual reticulation to achieve significant potable water savings.

Kinesis have been asked by Parramatta City Council to investigate the potential for higher environmental standards for new development across the CBD. Implementing such a policy successfully will require careful consideration of procedural, environmental and financial feasibility factors. In particular Council will need to ensure:

- the environmental performance of a building above regulatory standards are cost effective;
- the development standard proposed will provide a genuine and effective environmental outcome;
- robustness in the development standard so that Council have scope to reject an application if the proponent cannot meet the test of providing an improved environmental outcome;
- the policy allows for densities which reflect principles of good planning and design;
- the policy is consistent and predictable; and
- the policy is applied in a fair and equitable manner.

The Parramatta CBD study area is outlined in Figure 1 and extends from Boundary Street to the south and, crossing the Parramatta River to Isabella Street to the north. The Parramatta CBD study area is currently estimated to include approximately 1.2 million m2 of floor space, translating to approximately 6,300 dwellings and 685,000 m2 of non-residential floor space.

PARRAMATTA CBD PLANNING REVIEW STUDY AREA

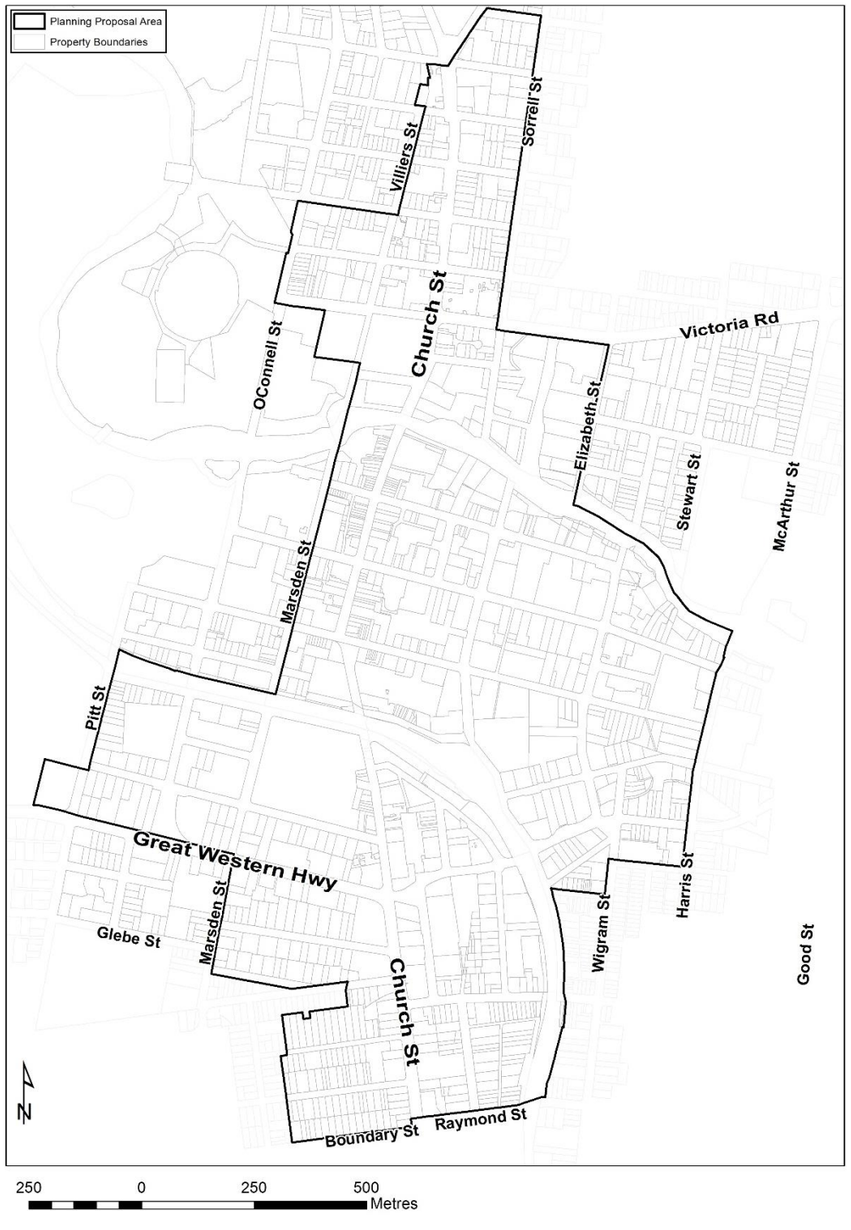

Figure 1: Parramatta CBD Planning Review Study Area boundary

OUR APPROACH

To determine an appropriate environmental standard for new development in the Parramatta CBD, Kinesis undertook the following work:

1. Review of different approaches to incentives for higher building performance

A desktop review was undertaken to determine appropriate approaches for both floor space bonuses linked to environmental performance and the methodology for how this bonus is valued and compared to the additional costs. This is discussed in *Calculating the value of the increased floor space*.

2. Understand the scale and value of FSR increase in the Parramatta CBD

Parramatta CBD floor space analysis was undertaken to understand the range and scope of development that could be subject to a floor space bonus as well as the potential value of this increased floor space. This ensured that all environmental performance analysis was undertaken using realistic building typologies and parameters.

3. Environmental performance analysis across typologies

Scenario analysis was undertaken across two building typologies to understand the impact and cost of higher environmental performance standards. Various levels of standards were analysed to provide Council with a clear understanding of the range of environmental standards and associated costs that could be delivered across the Parramatta CBD.

4. Financial outcomes analysis across typologies

The expected capital cost and (as applicable) financial return was considered and compared to the various environmental performance standard outcomes.

5. Broader benefits of higher building performance

Finally, the expected financial return was considered and compared to the various environmental performance standard outcomes to ensure any FSR bonus provides adequate incentive for developers to meet this enhanced standard.

CALCULATING THE VALUE OF THE INCREASED FLOOR SPACE

A floor space bonus is proposed for new residential development that meets higher BASIX targets. In order to determine whether the costs associated with improved development outcomes are of a magnitude that ensures the FSR bonus is taken up, the value of the floor space bonus must be determined. Several options can be used to calculate the value of a floor space bonus.

For the purpose of this analysis, the value of the increased floor space has been calculated based on a land lift calculation. Land lift calculates the additional value added to the land which is attributable to the increased floor space.

The increased floor space can be compared to creating new land and the value of this land can be calculated based on current land values. The lift in value is determined by multiplying the additional floor space by the "buildable rate". The buildable rate is the current land value divided by the floor area allowed by the current FSR.

Land Lift = ((Land Area x Land Value) / Base Floor Area) x New Additional Floor Area

Example:

- Land Area = 5,000 m2
- Base floor area under current FSR = 30,000 m2
- Current land value = $10,000 m2 of land
- Additional floor space under FSR Bonus = 3,000 m2
- Land lift = $5,000,000

Under this approach the additional financial benefit attributed to increased land value is attributed to Council and can be used to deliver improved performance outcomes while the additional financial benefit derived from the additional development (e.g. sale of apartments) flows through to the developer.

Typically, cities around the world capture between 50% and 100% of this land lift for use in the delivery of improved development, environmental or social outcomes. A local case study of where environmental performance has been linked to development incentives and increased floor space is provided below.

CASE STUDY - LINKING ENVIRONMENTAL PERFORMANCE TO DEVELOPMENT INCENTIVES

Clause 4.4A of Bankstown Local Environmental Plan (LEP) 2015 provides for Floor Space Ratio (FSR) Bonus of 0.5 on the FSRs allowed under the Local Area Plan for the Bankstown CBD on the condition that they achieve the following environmental design standards:

Residential component of a building:

- Energy target is a minimum 10-point increase in the BASIX score compared to current requirements.
- Water target is a minimum BASIX 60.

Non-Residential component of a building:

- Energy target is a maximum 135 kg of CO2/m2 per year (equivalent to a 5-star NABERS rating for commercial buildings)
- Water target is a maximum 0.47 kL/m2 per year for office (equivalent to a 4.5-star NABERS rating for commercial buildings)

As the FSR Bonus will increase the size of new buildings this will lead to increased environmental impact, in terms of increased greenhouse gas emissions from energy consumption and increased water consumption. The environmental performance standards established by Council seek to offset the impact of the increased floor space so that buildings which receive the FSR Bonus have the same environmental performance as buildings which do not.

UNDERSTANDING THE VALUE OF FSR GROWTH

Floor space data was provided by the Parramatta City Council to understand the range and scope of development that could be subject to higher environmental performance requirements or incentives. Current and Proposed zoning is shown in Figures 2 and 3. Analysis of this data highlights the following:

- Under current planning controls, the Parramatta CBD study area could deliver a total of 2.7 million m2 of floor space.
- Under the proposed planning controls, the Parramatta CBD study area could deliver a total of 4.5 million m2 of floor space, effectively increasing the potential floor space by 1.8 million m2.
- Assuming that the existing land area delivers the floor space allowable under current controls, the proposed planning controls will nearly double the equivalent land area within the CBD.
- Council is proposing a 0.5:1 floor space bonus for mixed use (residential) lots under the proposed planning controls of 10:1 or greater, (Figure 5), which would potentially deliver **32,000 m2** of additional floor space.
- Council is proposing no limit on office floor space within the CBD to attract A-Grade office space.

Based on recent acquisitions and developments, Parramatta City Council advised that a value of $10,000 per m2 of land area can be assumed. Based on a land lift calculation:

- The proposed planning controls are effectively delivering **$5.6 billion of additional land value** over and above the current planning controls.
- The floor space bonus (if taken up across all 10:1 or greater FSR lots) is effectively delivering **$53 million of additional land value**.

Note: Kinesis is aware of a number of current development applications within the study area that exceed the proposed development controls and FSRs outlined here. Kinesis is not under the assumption that the land value will remain constant as FSR and building heights increase but has used the assumption of $10,000 per m2 of land area for the purpose of this report.

CURRENT ZONING

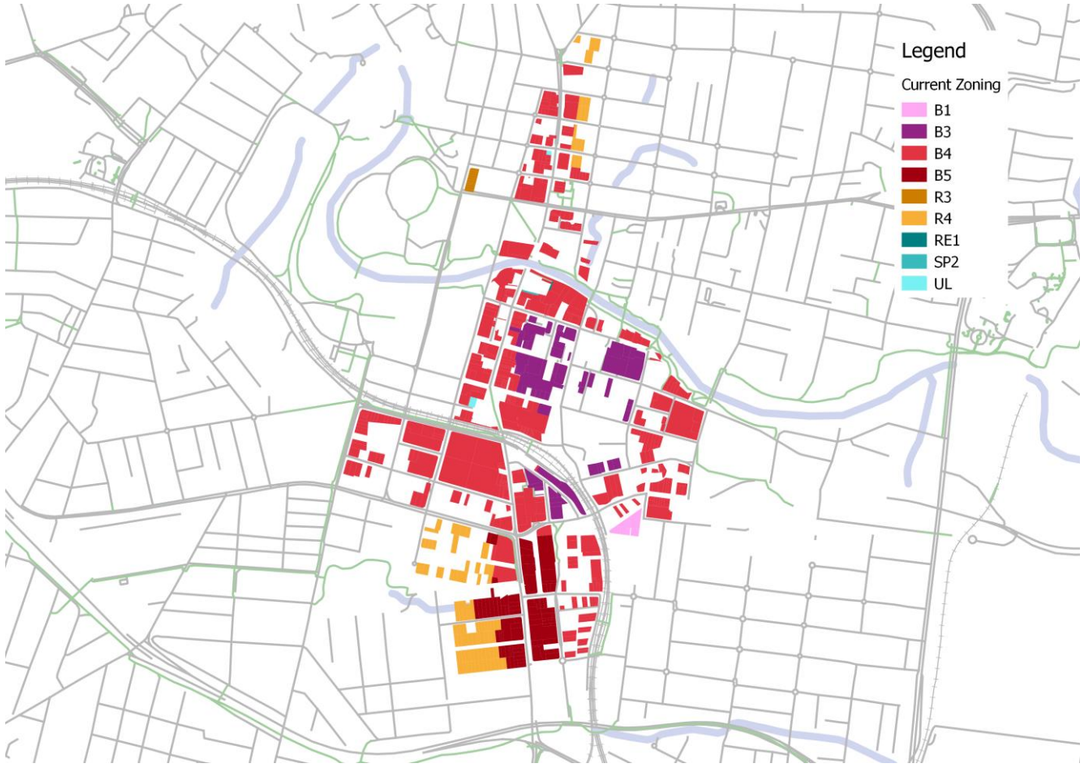

Figure 2: Zoning under the existing Parramatta City Centre LEP 2007

Notes:

Business Zones
- B3 Commercial Core
- B4 Mixed Use
- B5 Business Development

Special Purpose Zones
- SP2 Infrastructure

Recreation Zones
- RE1 Public Recreation
- RE2 Private Recreation

PROPOSED ZONING

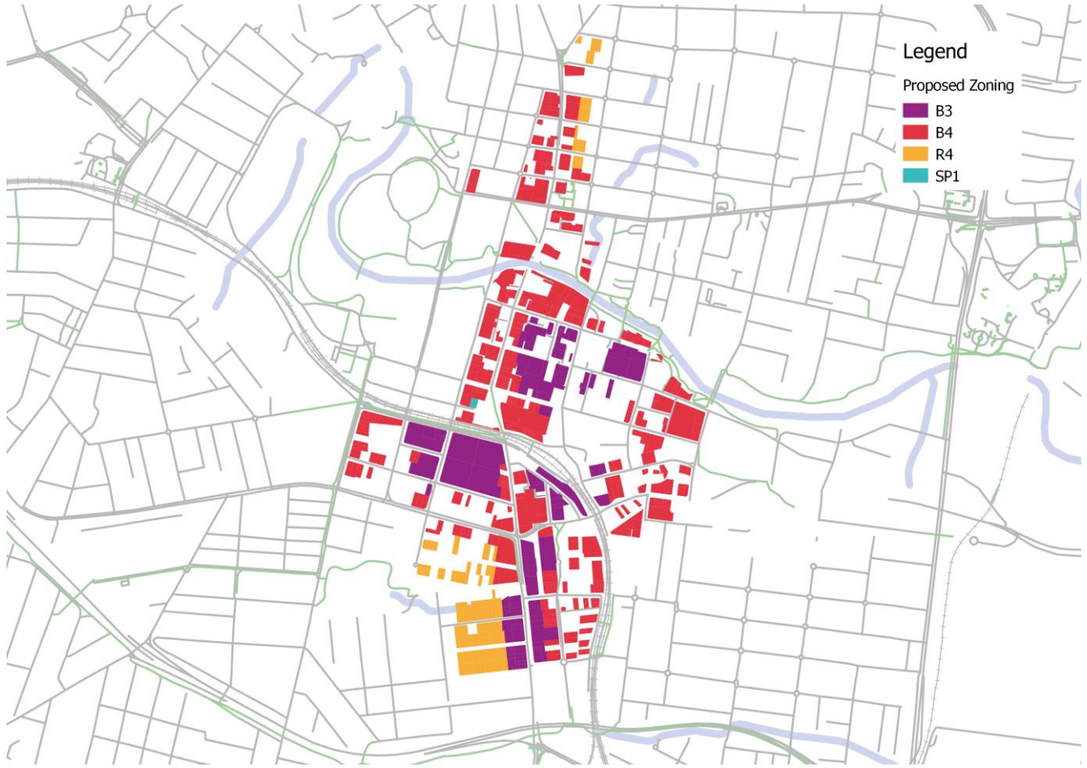

Figure 3: Zoning proposed under the CBD Planning Review

Notes:

Business Zones
- B3 Commercial Core
- B4 Mixed Use
- B5 Business Development

Special Purpose Zones
- SP2 Infrastructure

Recreation Zones
- RE1 Public Recreation
- RE2 Private Recreation

HIGH PERFORMANCE BUILDINGS POLICY - APPLICABLE LOTS

Figure 5: B4 Sites with an FSR of 10:1 or greater and B3 sites with greater than 10,000m2 allowable GFA, proposed under the CBD Planning Review

ENVIRONMENTAL PERFORMANCE ANALYSIS

To test the benefits and feasibility of improved environmental performance across new development in the Parramatta CBD, environmental performance analysis was undertaken across two site configurations:

- Commercial B3 Zoning typology
- Residential (Mixed Use) B4 Zoning typology

While the development typologies tested were fabricated, they were benchmarked and aligned to existing development applications and building designs currently proposed within the Parramatta CBD and include the following assumptions:

- Site area of 5,100 m2 under an FSR of 10:1.
- B4 Mixed Use Development Floor Space Mix
  - 92% Residential floor space
  - 8% Retail floor space
- Residential dwelling mix
  - 8% 3 bedroom
  - 64% 2 bedroom
  - 28% 1 bedroom
- B3 Commercial Core Floor Space Mix
  - 96% Commercial floor space
  - 4% Retail floor space

The development parameters used in the analysis are outlined in Tables 1 and 2. While the analysis was undertaken for a specific building type, all analysis was undertaken on a “per m2” basis to ensure the results are relevant for other development typologies (scale and size).

All scenarios were compared to a Base Case which reflects the environmental performance of a building that achieves current compliance (BASIX and building code).

The assumptions and results for each typology follow.

B4 MIXED USE DEVELOPMENT PARAMETER ASSUMPTIONS

Development Parameter	Assumptions for 10:1 FSR
Lot Area	5,100 m2
Total Floor Area (with FSR Bonus)	52,550 m2
Residential	331 dwellings
3-bedroom	40 (8%)
2-bedroom	322 (64%)
1-bedroom	141 (28%)
Retail	2,140 m2

Table 1: Development parameters assumed for an example Mixed Use (B4 Zone) typology in the Parramatta CBD

B3 COMMERCIAL CORE DEVELOPMENT PARAMETER ASSUMPTIONS

Development Parameter	Assumption 10:1 FSR
Lot Area	5,100 m2
Total Floor Area (with FSR Bonus)	52,550 m2
Commercial	51,410 m2
Retail	2,140 m2

Table 2: Development parameters assumed for an example Commercial (B3 Zone) typology in the Parramatta CBD

COMMERCIAL BUILDINGS (B3 ZONE)

For commercial buildings, it is proposed that higher environmental performance standards apply to all commercial premises with a gross floor area of 10,000 m2 or greater.

To understand the potential higher environmental performance outcomes for commercial premises in the Parramatta CBD, four environmental performance scenarios were modelled above the Base Case, each with an increased performance outcome:

- **Base Case** – achieves Building Code compliance, which is equivalent to approximately NABERS 4.5-star Energy and NABERS 3-star Water.
- **Efficient** – over complies with the Building Code and incorporates technologies and design that is approximately equivalent to a NABERS 5-star Energy and 3.5-star Water commercial building.
- **High Efficiency** – over complies with the Building Code and incorporates technologies and design that is approximately equivalent to a NABERS 5-star Energy and 4-star Water commercial building.
- **Best Practice** – in addition to High Efficiency but also incorporates local generation such as cogeneration and rainwater reuse.
- **Best Practice + Recycled Water -** over complies with the Building Code and incorporates connection to a district recycled water scheme.

The technology specifications assumed for each scenario are outlined in Table 5. The expected marginal capital costs (above the Base Case) as a cost per m2 is outlined in Table 6, highlighting that high performance targets for commercial development can be achieved for a cost of approximately $44 to $105 per m2 (depending on the performance outcome achieved).

It should be noted that the Westfield development is a unique case that may not reflect the expected building typology modelled above (over 90% commercial office floor space).

Notes on scenario analysis:

- Results are generated by CCAP Precinct, a mathematical model of sustainability performance, and reflect the specific modelled performance of a new commercial building in the climate zone containing the Parramatta CBD.
- Standard Practice reflects the consumption of the average technology in the market place, aligned to expected performance under Section J of the Building Code of Australia. Best Practice assumes approximately a 30% increase in efficiency.
- Water efficiency settings are aligned to the Sydney Water Best Practice Design Guidelines for Commercial Buildings and Shopping Centres (https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdu0/~edisp/dd_054580.pdf)
- For simplicity, cogeneration has been modelled as a low capital cost, building level scenario for use in hot water and building heating only. However, many alternative cogeneration/HVAC configurations exist or even an equivalent solution could be delivered through district energy, should they be available for the building owners to connect.

ENERGY AND WATER TECHNOLOGY ASSUMPTIONS

	Base Case	Efficient	High Efficiency	Best Practice	Best Practice + recycled water
Energy					
Lighting	Standard	Efficient	Efficient	Efficient	Efficient
Building fabric	Standard	Efficient	Efficient	Efficient	Efficient
HVAC[1]	COP 3.5	COP 5	COP 5	COP 7	COP 7
Solar	-	-	100 kW	100 kW	100 kW
Cogeneration	-	-	-	250 kW	250 kW
Water					
Efficiency	Median Practice	Economic Best Practice	High efficiency	High efficiency	High efficiency
Rainwater tank	-	-	-	20 kL	Connection to district recycled water
Water reuse	-	-	-	Toilet, irrigation	Toilet, irrigation and cooling towers

Table 5: Technology assumptions for commercial building scenario analysis

COST BENEFIT RESULTS

	Base Case	Efficient	High Efficiency	Best Practice	Best Practice + recycled water
Environmental Outcome	174 kgCO2/m2/year 0.90 kL/m2/year	142 kgCO2/m2/year 0.73 kL/m2/year	139 kgCO2/m2/year 0.65 kL/m2/year	122 kgCO2/m2/year 0.60 kL/m2/year	122 kgCO2/m2/year 0.27 kL/m2/year
Equivalent NABERS Office Outcome	4.5-star Energy 3-star Water	5-star Energy 3.5-star Water	5-star Energy 4-star Water	5-star Energy 4-star Water	5-star Energy 5-star Water
Est. energy cost/m2[1]	-	$42	$47	$85	$85
Est. water cost/m2	-	$2	$9	$11	$20
Est. total cost/m2		$44	$56	$96	$105

Table 6: Environmental outcome and estimated marginal capital cost based on scenario selections

[1] Chiller costs are estimates only, $5/m2 per 1 point in COP. This estimate assumes water cooled chillers are standard.

INDUSTRY PERFORMANCE

To benchmark the theoretical performance analysis calculated above, the results from CCAP Precinct were benchmarked against desktop research of existing best practice performance standards and benchmarks. This analysis highlights that best practice performance for commercial buildings and shopping centres is approximately equivalent to **NABERS 5-star Energy and NABERS 4-star Water** (excluding recycled water).

- Sydney Water Best Practice Guidelines for water conservation in commercial office buildings and shopping centres.
  - A very well managed commercial office building (with cooling towers, but without recycled water) is expected to use approximately 0.77 kL per m2 per year of potable water (equivalent to approximately NABERS 4-star rating). This assumes no recycled water reuse.
  - A very well managed shopping centre (without recycled water) is expected to use approximately 1.35 kL per m2 per year of potable water. This includes the whole building (not just base building).

- NABERS annual reporting statistics (2014/15)
  - In 2014/15, the average NSW NABERS Water rating for Commercial Office was 3.5-star, equivalent to approximately 0.9 kL per m2 per year.
  - In 2014/15, the average NSW NABERS Energy rating (without Green Power) for Commercial Office was 4.2-star, equivalent to approximately 138 kgCO2-e per m2 per year.
  - In 2014/15, the average NSW NABERS Water rating for Shopping Centres was 2.4-star, equivalent to approximately 1.2 kL per m2 per year (base building only).
  - In 2014/15, the average NSW NABERS Energy rating (without Green Power) for Shopping Centres was 3.8-star, equivalent to approximately 103 kgCO2-e per m2 per year (base building only).

- Recent developments and development applications in the Parramatta CBD
  - Eclipse Tower – 5-star NABERS Energy rating
  - 93 George St, Parramatta – 5-star NABERS Energy rating
  - Sydney Water headquarters – 5-star NABERS Water rating
  - 105 Phillip St – 5-Star NABERS rating
  - Parramatta Square – targeting 5-star Green Star Rating

- Property group environmental performance targets
  - Mirvac has a commitment to achieve a 5.0 Star NABERS Energy rating across its office portfolio.
  - Stockland and DEXUS have a commitment to achieve a 4.5-star NABERS Energy rating across its office portfolio.
  - The Property Council of Australia (PCA) includes NABERS Energy targets in its 'Guide to Office Building Quality' matrix. For new Premium and Grade A buildings a 5 stars NABERS Energy rating or greater is required, and 4 stars or greater for Grade B buildings.

- Other local government areas high environmental performance requirements for new commercial buildings:
  - The City of Melbourne's Environmentally Sustainable Office Buildings Policy (Melbourne Planning Scheme Clause 22.19) requires a minimum 4.5 Star Base Building Rating for office developments with a gross floor of 2,500m2 to 5,000m2.
  - Clause 4.4A of Bankstown Local Environmental Plan (LEP) 2015 provides for Floor Space Ratio (FSR) Bonus of 0.5 on the FSRs allowed under the Local Area Plan for the Bankstown CBD on the condition that they achieve the following environmental design standards:
    - Residential component of a building: Energy target is a minimum 10-point increase in the BASIX score compared to current requirements and water target is a minimum BASIX 60.
    - Non-Residential component of a building: Energy target is a maximum 135 kg of CO2/m2 per year (equivalent to a 5-star NABERS rating for commercial buildings) and water target is a maximum 0.47 kL/m2 per year for office (equivalent to a 4.5-star NABERS).

Recommended performance standards for commercial buildings (B3 Zone)

Based on the theoretical analysis by Kinesis and the NABERS benchmarking documented above, it is recommended that the High Efficiency Performance scenario established across the Parramatta CBD for new commercial development above a GFA of 10,000 m2:

- **Energy (base building and tenancy) -** 140 kgCO2-e/m2/yr (equivalent to approximately NABERS Energy 5-star)

- **Water (base building and tenancy) -** 0.65 kL/m2/yr (equivalent to approximately NABERS Water 4-star)

As a unique case, specific performance standards have been established for shopping centres - buildings with a significant amount of retail floor space. In this case, the base building only was included as tenant loads are highly variable depending on the particular retail present and are generally centrally managed with centralised HVAC and large common areas. Shopping Centre targets for the Parramatta CBD are:

- **Energy (base building only**) - 100 kgCO2-e/m2/yr (Approximately equivalent to 5-Star NABERS assuming 100,000 m2 GFA with one underground car space per 30 m2 of GFA_

- **Water (base building only)** - 0.95 kL/m2/yr (Approximately equivalent to 4-Star NABERS assuming 100,000 m2 GFA, with 1,000 food court seats, 11 cinema screens and a 1,000 m2 gymnasium)

These targets are establishing assuming the performance can be delivered without recycled water. See section *Future Proofing through Dual Reticulation*.

RESIDENTIAL MIXED USE BUILDINGS (B4 ZONE)

Environmental Performance Analysis of Residential Mixed Use (B4 Zone)

For residential mixed use (B4 Zone) buildings, an incentive-based policy is proposed to deliver higher environmental performance outcomes. This is due to:

1. BASIX SEPP allows for incentives for the adoption of measures beyond those required by BASIX.
2. Split incentives are more apparent in residential buildings where the benefits of improved environmental performance (e.g. lower operating costs) are not realised by the builder.

To understand achievable higher environmental performance outcomes for residential mixed use buildings in the Parramatta CBD, five residential environmental performance scenarios were tested for this typology (Table 2), each with an increased environmental performance outcome:

- **Base Case** – achieves BASIX compliance of Water 40 and Energy 20 as mandated through the BASIX SEPP.
- **BASIX +10** – over complies with BASIX by 10 points to achieve Water 50 and Energy 30
- **BASIX +15** – over complies with BASIX by 15 points to achieve Water 55 and Energy 35
- **BASIX +20** – over complies with BASIX by 20 points to achieve Water 60 and Energy 40
- **BASIX +20 Energy and +25 Water** – over complies with BASIX to achieve Water 65 and Energy 40.

Notes on scenario analysis:

- Results are generated by CCAP Precinct, a mathematical model of sustainability performance, and reflect the specific modelled performance of a new residential building in the Parramatta CBD climate zone.
- Standard Practice reflects the consumption of the average technology in the market place. Best Practice refers to appliances or fixtures within 1-star of the best available on the market.
- Analysis showed that, without recycled water, achieving BASIX Water 60 on high rise developments was challenging due to the low roof space available for rainwater or stormwater collection and reuse.
- Rainwater reuse could be substituted with recycled water if available to the development. This would also increase BASIX Water compliance potential to up to BASIX Water 65.
- The performance standards for this component of a mixed use building are outlined in the previous section on the Commercial Building (B3 Zone).

ENERGY AND WATER TECHNOLOGY ASSUMPTIONS

	Base Case	BASIX +10	BASIX +15	BASIX +20	BASIX +20 Energy BASIX +25 Water*
Energy					
NatHERS	6-star average	6-star average	6-star average	7-star average	7-star average
Hot Water	Centralised Gas	Centralised Gas	Centralised Gas	Centralised Gas	Centralised Gas
Space Heating	2 Star A/C	2 Star A/C	5 Star A/C	5 Star A/C	5 Star A/C
Space Cooling	2 Star A/C	2 Star A/C	5 Star A/C	5 Star A/C	5 Star A/C
Lighting	Standard Lighting	Standard Lighting	LED Lighting	LED Lighting	LED Lighting
Solar	-	-	-	150 watts/apartment	150 watts/apartment
Appliances	Standard Practice	Best Practice	Best Practice	Best Practice	Best Practice
Water					
Fixtures	Best Practice	Best Practice	Best Practice	Standard Practice	Best Practice
Appliances	Standard Practice	Best Practice	Best Practice	Standard Practice	Best Practice
Rainwater Tank	-	-	500 L/apartment	Connection to district recycled water	Connection to district recycled water
Water reuse	-	-	-	Toilet, Irrigation, Laundry	Toilet, Irrigation, Laundry
Transport					
Parking**	1 space/dwelling	1 space/dwelling	1 space/dwelling	1 space/dwelling	1 space/dwelling

Table 2: Technology assumptions for residential scenario analysis
*Includes recycled water for both internal and external uses.
**Current Parramatta CBD parking rates contained in the Parramatta LEP 2012.

A note on Transport and Parking

Parking rates have not been adjusted in order to achieve BASIX Energy 40. A 50% reduction in Parramatta CBD current parking rates tested in the scenario analysis is equivalent to approximately 5 BASIX Energy points due to the lighting and ventilation energy demands associated with underground parking. A reduction in on-site parking requirements should be considered by Council as an efficiency measure alongside broader parking considerations for the Parramatta CBD redevelopment.

Significant household cost savings can also be achieved through reduced parking requirements (see *Parramatta CBD Planning Review Sustainability and Infrastructure Study*).

Financial Analysis of Residential Mixed Use (B4 Zone)

The expected capital costs of achieving the BASIX targets are outlined in Table 3.

In order to ensure a floor space bonus is taken up by new residential development, it is important to ensure the benefits of the floor space bonus are of a magnitude that provides adequate incentive for developers to meet this enhanced standard. This was determined by comparing the land lift value to the expected capital cost of higher BASIX targets.

Land lift has been calculated based on a land value of $10,000 per m2 of land (cost estimated provided by Parramatta City Council). A comparison of land lift value and marginal cost of higher BASIX requirements is shown in Figures 7, highlighting:

- BASIX +10 scenario is expected to cost less than the land lift value for FSRs of 6:1 up to 15:1.
- BASIX +15 scenario is expected to cost less than the land lift value for FSRs of 6:1 up to 10:1.
- BASIX +20 scenario is expected to cost less than the land lift value for FSRs of 6:1 up to 9:1.

Recommended performance standards for residential mixed use buildings (B4 Zone)

Parramatta City Council have noted that additional floor space bonuses are available to mixed use residential developments in the CBD. As a result, while the floor space bonus is proposed for development sites with a base FSR greater than 10:1, the high performance building floor space bonus policy would be applied after other bonus schemes are implemented, effectively being applied to buildings primarily from 10:1up to 15:1 (the exceptions being two sites subject to planning proposals whose base FSR are proposed to be 12:1 and 19:1). Based on the land lift versus marginal capital cost (Figure 7) the following performance standards are cost effective for new residential mixed use development across the Parramatta CBD:

- BASIX Energy +10 above current compliance
- BASIX Water +10 above current compliance

At higher FSRs and building heights, the impact of solar PV and rainwater reuse becomes more and more challenging due to the lower roof area available for both solar and rainwater collection. At this scale of development, the implementation of recycled water is most effective. However, recycled water is best implemented at a precinct, rather than building by building, scale. As a result, alongside the performance standards above, it is recommended that dual reticulation is incorporated into residential buildings for both internal and external uses to enable recycled water in the future (see *Performance Standards for Future Proofing*).

COST BENEFIT RESULTS

	Base Case	BASIX +10	BASIX +15	BASIX +20	BASIX +20 Energy BASIX +25 Water*
Environmental Outcome	BASIX Energy 20 BASIX Water 40	BASIX Energy 30 BASIX Water 50	BASIX Energy 30 BASIX Water 50	BASIX Energy 40 BASIX Water 55	BASIX Energy 40 BASIX Water 65
Est. Energy Costs/m2	-	$12	$24	$39	$39
Est. Water Costs/m2	-	$10	$26	$19	$20
Est. Total Costs/m2	-	$22	$50	$58	$59

Table 3: Environmental outcome and estimated marginal capital cost based on scenario selections
*Includes recycled water for both internal and external uses.

LAND LIFT V HIGHER BASIX TARGET COSTS

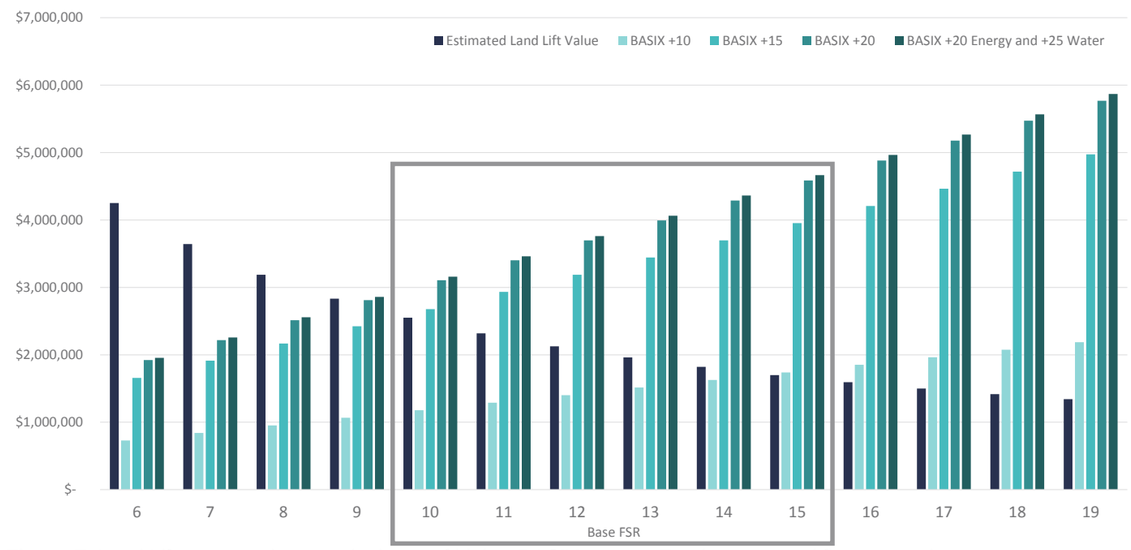

Figure 7: Land Lift compared to marginal cost of higher BASIX targets. For the proposed floor space bonus targets, the land lift is approximately equal to the marginal cost at the upper end of the applicable FSR range.

PERFORMANCE STANDARDS FOR FUTURE PROOFING

Dual Reticulation

Environmental performance targets outlined in the previous section provide a performance outcome to ensure new development contributes towards a reduction in energy consumption, greenhouse gas emissions and water consumption consistent with what is allowable under NSW planning and building controls.

This analysis has shown that:

- At high FSRs and building heights, the impact of rainwater reuse becomes more and more challenging due to the lower roof area available for rainwater collection.
- Because of this, without recycled water, achieving BASIX Water 60 on high rise developments was unachievable.

Given the 30-100 year life of new buildings, it would be considered prudent that new development is designed to accommodate future district water or energy infrastructure and emerging technologies, to future proof their owners and tenants against a rapidly changing utility services environment.

For example, a district recycled water scheme is proposed at the Parramatta Square development. It is also possible to extend the current water recycling scheme at Rosehill or alternative water recycling providers to be established within the Parramatta CBD. With these systems in place, and to ensure future buildings can connect to this opportunity, dual reticulation is required at building construction.

Dual reticulation has been estimated at $1,000 per apartment (or $10 per m2) including piping and metering requirements. Given a large part of this cost is metering, this cost is expected to be less for commercial buildings. This requirement could deliver significant future environmental performance outcomes:

- Residential buildings with recycled water for irrigation, toilet flushing and laundry would achieve a BASIX Water target 65 (+25 on current compliance).
- Commercial buildings with recycled water for irrigation, toilet flushing and cooling towers would be expected to achieve a NABERS Water rating of 5-star.

Based on this, it is recommended that all new buildings incorporate dual reticulation for recycled water for both internal and external uses. Such a requirement would significantly enhance the business case for a recycled water scheme extending through the CBD.

Other future proofing strategies

In addition to dual reticulation, Parramatta City Council should consider encouraging other future proofing strategies that respond to future technologies and address existing future challenges as the Parramatta CBD grows and develops:

- **EV Charging Bays** - Where commercial and residential parking is provided it is considered prudent to provide the infrastructure or the capacity for EV Charging Points, including appropriate charging outlets in each parking space.

- **Battery Storage Ready**- With the cost of batteries expected to decrease rapidly it is considered desirable to build the future capacity so the Parramatta CBD can have a dispersed capability of battery capacity to manage energy demands, solar PV generation and significantly reduce peak electricity demands and growing infrastructure requirements. This would be assisted by the following:

  1. Each residence being allocated a virtual 5-10 KWh battery capacity.
  2. The building infrastructure to provide sufficient plant room space and electrical services connectivity (e.g. Wiring loops to meters and switchboards) so batteries can easily be retrofitted into buildings at a later date.

- **Addressing Urban Heat Island -** with the local heat island effect being partially building induced, vegetation, green roofs, green walls and materials with a high solar reflectance index should be encouraged on at least 50% of the surfaces of all buildings, in particular western and northern building facades.

  If implemented through vegetation and green walls, it would be a requirement that the irrigation of these walls be recycled water ready, further supported the need to require dual reticulation in new development.

- **Planning for self-driving vehicles** – with the emergence of automated or self-driving vehicles, the requirement for on-site parking will be significantly reduced. Studies predict that within 25 to 30 years, automated vehicles will reduce the need for on-site parking requirements, effectively reducing the need and therefore the value of parking. In this scenario, underground parking will have limited value and developments that incorporate reduced parking or decoupled, above ground parking that can be repurposed for other commercial or residential uses in the future should be encouraged.

ENVIRONMENTAL AND COMMUNITY BENEFITS

Electricity and Peak Demand Reductions

A previous study by Kinesis *Parramatta CBD Planning Review Sustainability and Infrastructure Study* shows that under a business as usual growth scenario (assuming new development achieves building code compliance), the Parramatta CBD is expected to increase by over 100 MW (twice the existing demand). In this study, Kinesis outlines a series of strategies to reduce peak electricity demand by 55%.

Adopting the high performance building policy targets would achieve an 18% reduction in CBD peak electricity demand compared to BAU Proposed Controls (Figure 12). This peak demand reduction in largely achieved by the requirements for commercial floor space.

In short, the high performance building policy is expected to deliver approximately one third of the peak demand reductions potential outlined by Kinesis *Parramatta CBD Planning Review Sustainability and Infrastructure Study*. This reduction could be realised further if the floor space bonus applied to those sites with FSRs below 10:1 as shown in Figure 7.

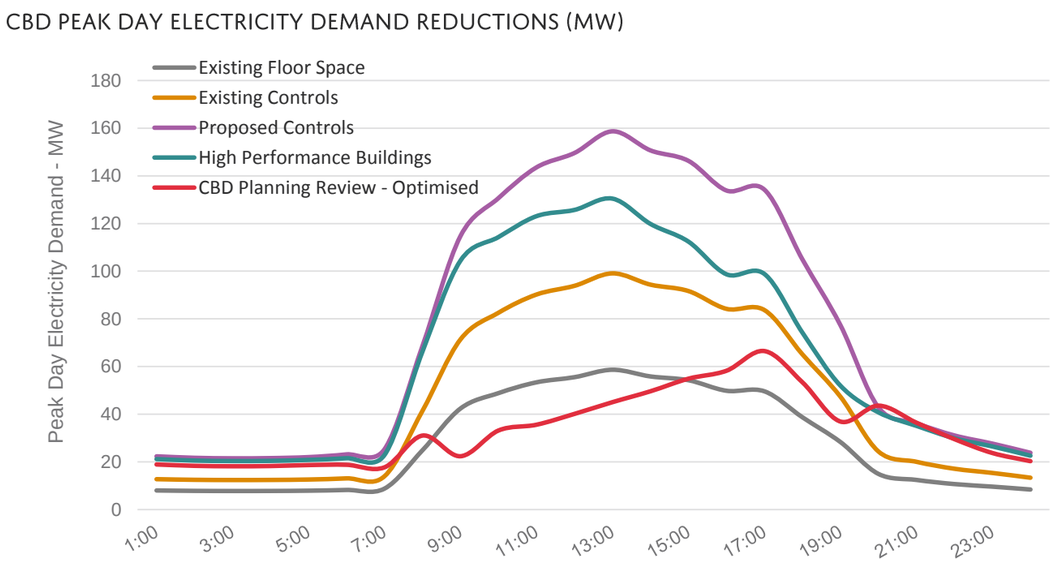

Figure 11: Study area peak electricity demand under various scenarios showing the impact of the high performance building policy.

Greenhouse Gas Emission Reductions

The *Parramatta CBD Planning Review Sustainability and Infrastructure Study* also showed that under a business as usual growth scenario (assuming new development achieves building code compliance), the Parramatta CBD is expected to nearly triple its stationary greenhouse gas emissions. In this study, Kinesis outlines a series of strategies to reduce these emissions by 42%.

Adopting the high performance building policy targets would achieve an 11% reduction in CBD stationary greenhouse gas emissions compared to BAU Proposed Controls (Figure 12).

In short, the high performance building policy is expected to deliver approximately one quarter of the emission reductions potential outlined by Kinesis *Parramatta CBD Planning Review Sustainability and Infrastructure Study*. This reduction is hindered by Council limiting the floor space bonus to a built form typology for which improved sustainability measures are expensive while higher targets would be more achievable for buildings with a lower FSR.

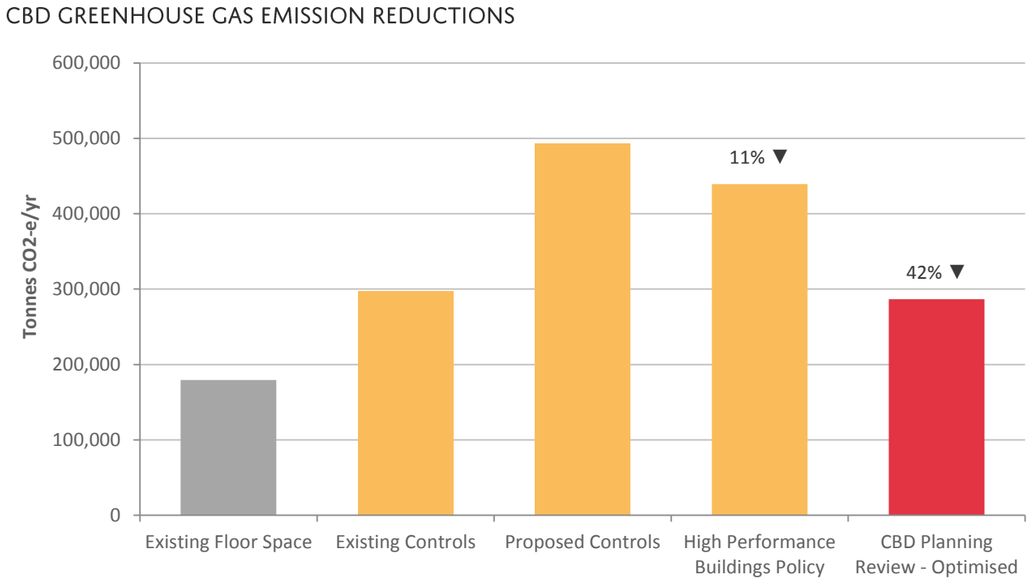

Figure 12: Study area greenhouse gas emissions under various scenarios showing the impact of the high performance building policy.

Reductions in Water Consumption

The *Parramatta CBD Planning Review Sustainability and Infrastructure Study* also outlines that under a business as usual growth scenario (assuming new development achieves building code compliance), the Parramatta CBD is expected to more than triple its water consumption. In this study, Kinesis outlines a series of strategies to reduce water consumption by 50%.

Adopting the high performance building policy targets would achieve:

- 10% reduction in CBD potable water consumption compared to BAU Proposed Controls (Figure 13)
- Increased to up to a 37% reduction once dual reticulated buildings connect to a recycled water scheme.

In short, the high performance building policy could deliver approximately one fifth of the water reduction potential outlined by Kinesis *Parramatta CBD Planning Review Sustainability and Infrastructure Study*. A district recycled water scheme would go a long way to fully realising the water reduction potential (Figure 13), and is made much more achievable by the mandating of dual reticulation for all new buildings.

CBD WATER REDUCTIONS

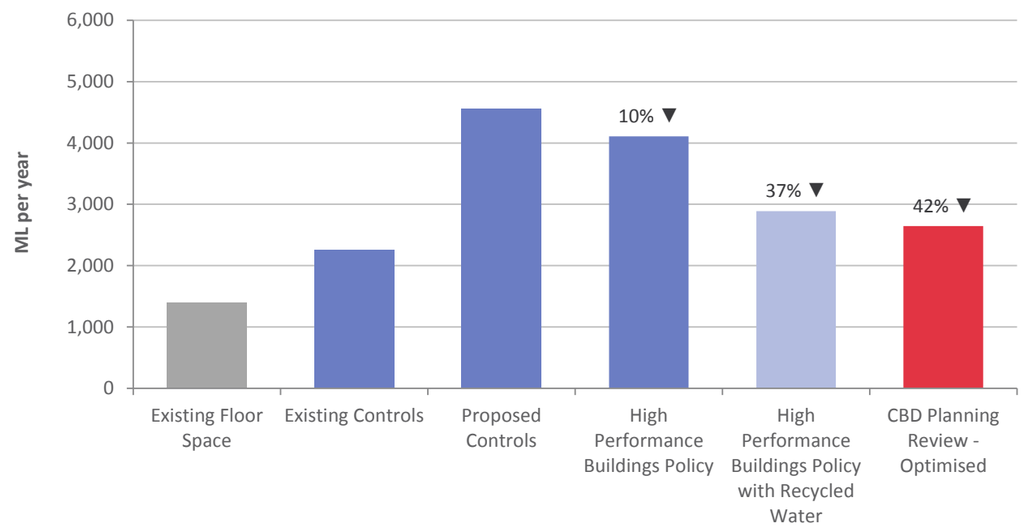

Figure 13: Study area water consumption under various scenarios showing the impact of the high performance building policy.

Residential Cost of Living

Household costs and affordability is often considered only in the context of the cost of housing. However, new development can have a significant impact on the cost of transport as well as utility costs for energy and water.

To better understand the impact of the Floor Space Bonus policy on household cost of living expenses, analysis was undertaken as follows:

- Transport costs were calculated based on projected car ownership and travel patterns (car use and public transport use) under each scenario.
- Utility costs were calculated based estimated energy and water consumption each scenario, assuming current retail tariffs.
- These results were compared to the Sydney Metropolitan average to provide a benchmark comparison.

Under the Base Case, new residents in the Parramatta CBD are expected to spend approximately $5,700 less per year due to lower car use, expected car ownership rates and BASIX requirements. Under the Floor Space Bonus policy, **residents could save up to $210 per year in utility bills** (see Figure 14 and Table 7).

If applied to lots of 10:1 or greater, the household saving equates to **$1.4 million per year** of additional disposable income reinvested into the economy. An alternative route to achieving the increased BASIX energy target is by the reduction of underground parking, foregoing the need to expend energy on car-park lighting and ventilation. This has knock-on effects on car dependency, further reducing household costs. A 50% reduction in parking would deliver an additional, annual saving of approximately $270 per household, which equates to an approximate **$1.8 million per year** of disposable income reinvested into the local economy.

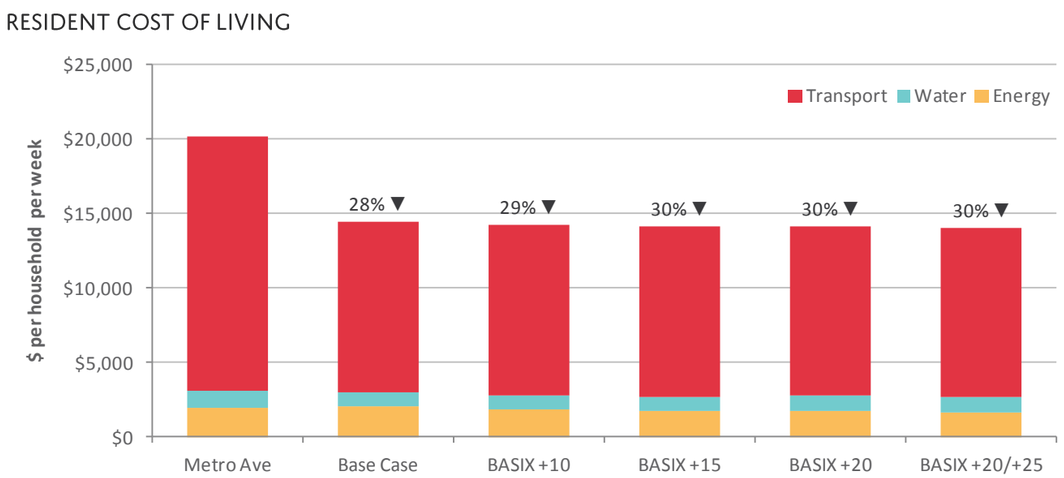

Figure 14: Estimated Household expenditure from energy, water and transport

RESIDENT COST OF LIVING

	Sydney Metropolitan Average	Base Case	BASIX +10	BASIX +15	BASIX +20	BASIX +20/+25
Energy	$1,900	$2,000	$1,840	$1,750	$1,720	$1,670
Water	$1,200	$1,030	$990	$970	$1,030	$970
Transport	$17,060	$11,440	$11,440	$11,440	$11,440	$11,440
Total	**$20,150**	**$14,470**	**$14,260**	**$14,150**	**$14,190**	**$14,080**
Savings compared to Base Case	-	-	$210	$320	$280	$400

Table 7: Estimated household savings under various floor space bonus policy residential targets

FINDINGS OF THIS STUDY

A previous study undertaken by Kinesis titled Parramatta CBD Planning Review Sustainability and Infrastructure Study, analysed the impact of the future growth of the Parramatta CBD and determined how Parramatta City Council can improve liveability, efficiency, pedestrian activity, environmental outcomes and enable private investment through the implementation of innovative and optimised development. This study has determined what proportion of these outcomes can be achieved through a high performance building policy.

The proposal from Council is a mandated efficiency targets for commercial buildings over 10,000 m2 and a floor space bonus of 0.5:1 for residential mixed use buildings zoned greater than 10:1 base FSR. This could affect more than 50% of the new floor space in the Parramatta CBD.

However, limiting the policy to apply to the highest density built form limits the ability to drive aggressive environmental performance targets and provides no incentive for improved sustainability measures on buildings for which they are more achievable. This is somewhat mitigated by the mandated targets for commercial buildings over 10,000 m2, however, an improved sustainability outcome and greater land lift value could be captured by applying a set of 'sliding-scale' type targets for all FSRs within the study area. A broader application of this policy would deliver significantly higher outcomes and provide a more equitable floor space bonus.

In summary, this study's recommendations are:

1. Environmental performance targets could deliver best practice buildings in the Parramatta CBD, attract A-Grade office development, ensure resource and infrastructure efficiency and future proof the city for emerging technologies and investment.

2. Commercial development, cost effective high performance building targets are recommended at:

    - Maximum of 140 kgCO2-e per m2 (equivalent to approximately 5-star NABERS Energy)
    - Maximum of 0.65 kL of water per m2 (equivalent to approximately 4-star NABERS Water)

3. As a unique case, specific performance standards have been established for shopping centres (large retail). In this case, the base building only was included to reflect the uncertainty of tenant loads:

    - Maximum of 100 kgCO2-e/m2/yr (equivalent to approximately 5-Star NABERS Energy)
    - Maximum of 0.95 kL/m2/year (equivalent to approximately 4-Star NABERS Water)

4. Given that over 90% of the floor area of residential mixed use (B4 zone) buildings is expected to be residential, it is recommended that environmental performance standards are applied to non-residential floor space within mixed use buildings that meets a minimum of 2,000 m2. The standards adopted should reflect a commercial use, except for large retail, which is a unique case.

5. For residential development, high performance building targets will be linked to a floor space bonus scheme. These targets are recommended at:

    - BASIX Energy +10 above current compliance requirements.
    - BASIX Water +10 above current compliance requirements.

6. The policy would deliver an 11% reduction in total greenhouse gas emissions and a 10% reduction in water consumption across the entire Parramatta CBD. This could be increased if the policy was adapted to apply to a broader range of base FSRs with a sliding scale of targets.

7. Given the 30 to 100 year life span of new development in the CBD, dual reticulation in all new development would significantly improve the business case for recycled water and further drive high performance outcomes for the city. Given that Council is limiting the policy to apply a restrictive class of buildings, this future proofing strategy is essential. Together with high performance buildings, this strategy could deliver up to 37% reduction in CBD potable water use.

8. Additional design requirement measures including, EV charging bays, battery storage capability, green walls and lower parking rates should be in place to ensure the CBD is future proofed.

NEXT STEPS

Kinesis has been made aware of additional floor space bonus policies that are being developed as part of the development of the Parramatta CBD. Given this, the findings of this study should be workshopped with key stakeholders at Parramatta City Council to further understand what Council want to achieve through across all the bonus policies and design excellence mechanisms proposed for the Parramatta CBD redevelopment.

This discussion should focus on:

1. The findings of this study and possibility of expanding it towards a broader base FSR range
2. The relationship between the various bonus policies and design excellence mechanisms
3. A mechanism to track the implementation, outcomes and benefits of the high performance building policy, given Parramatta City Council currently licences CCAP Integrated and CCAP City, smart city platforms for tracking and monitoring the performance of the CBD development.

In addition, the implementation of higher performance residential buildings outlined in this study is proposed through a floor space bonus incentives scheme. To further expand the reach and impact of high performance buildings in the Parramatta CBD, it is recommended that Council meet with the NSW Department of Planning to seek approval to increase BASIX targets for all new residential dwellings. The results of this study provide adequate evidence for the case of improved BASIX targets in the Parramatta CBD.

KEY ASSSUMPTIONS

Metropolitan Sydney average benchmarks

Electricity	2,132 kWh per person/year
Gas	3,888 MJ per person/year
Water	237.8 L per person/day
Transport	19.98 km per person/day

Tariffs and rates

Household cost savings outlined in this report are based on current tariffs outlined below:

Residential Water	**Rate**	**Unit**
Mains tariff	2.232	$/kL
Recycled water tariff	2.068	$/kL
Service charge per dwelling	765	$/yr
Recycled water service charge	0	$/yr

Residential Grid Electricity	**Rate**	**Unit**
Applied tariff	0.2514	$/kWh
Solar feed-in tariff	0.06	$/kWh
Service charge per dwelling	289.16	$/yr

Residential Gas	**Rate**	**Unit**
Gas (first 3,775 MJ per qtr/remaining)	0.041/0.023	$/MJ
Service charge per dwelling	207	$/yr

Residential Transport	**Rate**	**Unit**
Fuel	1.50	$/L
Annual capital costs (devaluation)	6,642	$/yr
Annual registration/insurance	2,172	$/yr

Floor Space Data

Floor space used in this study is based on the estimated GFA of existing, current controls and proposed controls outlined in the Kinesis *Parramatta CBD Planning Review Sustainability and Infrastructure Study.*

In addition, Parramatta Council provided floor space under the proposed controls for developable lots within the Parramatta CBD.

KEY DATA SOURCES

- ACADS-BSG Australian Climatic Data (Reference Meteorological Year, RMY) for hourly temperature, insulation and humidity.
- Bureau of Meteorology local rainfall and evaporation data
  - Data is from the representative weather station for the local climate zone
  - The RMY (Representative Meteorological Year) is synthesized from a composite of 12 typical meteorological months that best represent the historic average of the specified location using post-1986 data in addition to the earlier weather data for each of the 69 climate zones in Australia.
- Sydney Water (2009) Rouse Hill 15 minute and daily demand profiles (Kinesis request, unpublished)
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Kinesis 2014, Additional water end use breakdowns derived from first principle analysis of residential and non-residential building types.
- National Water Commission, 2011, National performance report 2009-2010: urban water utilities, National Water Commission, Canberra
- NSW Department of Planning, BASIX Residential Water Consumption Data (2010)
- Sydney Water Best Practice Guidelines for water conservation in commercial office buildings and shopping centres (2007), http://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdu0/~edisp/dd_054580.pdf
- Sydney Water Best Practice Guidelines for holistic open space turf management (2011), www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq1/~edisp/dd_045253.pdf
- Water Corporation. (2014). Mapping water use at school. from https://www.watercorporation.com.au/home/teachers/lesson-plans-and-teaching-resources/lesson-plan-search/lesson-plan/?id=%7BD9516524-4A2C-4B98-A113-3891D59F1AAA%7D
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Department of Infrastructure and Transport, 2011, Road vehicle kilometres travelled: estimations from state and territory fuel sales, Australian Government, Canberra
- Department of the Environment, 2014, National Greenhouse Accounts Factors, http://www.environment.gov.au/system/files/resources/b24f8db4-e55a-4deb-a0b3-32cf763a5dab/files/national-greenhouse-accounts-factors-2014.pdf
- Energy Use in the Australian Residential Sector, 1986 – 2020, Australian Government Department of the Environment, Water, Heritage and the Arts (DEHWA), 2008.
- Energy Efficient Strategies (2009), Appliance Energy Consumption in Australia: Equations for Appliance Star Ratings
- Building Code of Australia (2007) Energy Efficiency Requirements in Commercial Buildings
- Transport Data Centre (2006) The Development of a Sydney VKT Regression Model
- ABS (2010) 'Household Expenditure Survey, Australia: Summary of Results', catalogue number 65300DO001_200910, Australian Bureau of Statistics, Canberra.