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**RE: AUSTRALIAN TECHNOLOGY PARK
LOCOMOTIVE WORKSHOP – ATP PRECINCT
WATER REUSE STRATEGY COMPLIANCE ASSESSMENT**

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EXECUTIVE SUMMARY

The Locomotive Workshop (LW) development will consist of an internal refurbishment throughout to provide a mix use development. The building's water and sewer connect to Sydney Water infrastructure assets, with site stormwater drainage discharging to private Australian Technology Park (ATP) stormwater infrastructure. Assessment of both private and authority owned infrastructure has confirmed all assets are adequate to accommodate the proposed development.

The LW hydraulic services design incorporates industry best practice approach and is being benchmarked to standardised industry sustainability measures, measures which are designed and achieve the relevant rating in accordance with the following leading industry rating schemes:

- National Australian Built Environment Rating Scheme (NABERS)
- Green Building Council Australia Greenstar rating

The refurbishment project aspires to achieve:

- 4 NABERS water stars (in operation);
- 6 Greenstars as built.

These targets meet or exceed the current standard industry practice for newly built commercial and retail developments, notwithstanding this the Mirvac and project team has aspired to meet these targets within the existing heritage listed building with a view to deliver a development which meets the highest industry, commercial and community standards.

The water consumption strategy to be implemented as part of the LW development is designed to achieve compliance with the targets identified within '*Rainwater Harvesting and Recycled Water Reuse (RH&RWR) strategy for the ATP precinct*' dated 26th May 2017 prepared by ARUP Engineers.

The key strategy principles being:

1. Harvesting, storage and treatment of rainwater for reuse by:
 - HVAC cooling towers
 - Sanitary flushing
2. Achieving leading industry best practices water consumption solutions in line with NABERS and Greenstar schemes.
3. Non-potable water reticulation systems on site configured to facilitate retrofitting connection to new recycled effluent water main if made available to the LW site.

Rainfall Data Collection

The volume of water the roof catchment can harvest has been determined using historic rainfall data as recorded by the bureau of meteorology (BOM) for the Eveleigh area, with the closest BOM weather station being Randwick racecourse (3.8km).

Rainwater Harvesting and Reuse

The LW building will collect and harvest roof water from the equivalent of one (2) roof bays, approximately 2880m² to be stored in a 100kL rainwater tank located within Bay 15 for reuse by HVAC cooling towers and sanitary flushing on the LW site. In providing this the LW development will satisfy the first key principle of the ATP precinct strategy.

Achieving NABERS and Greenstar

The LW refurbishment includes the implementation of industry best practice environmentally sustainable design (ESD) benchmarked against both NABERS and Greenstar in line with project and precinct key principles. ESD initiatives applied which assist in achieving the second ATP precinct key principle include but are not limited to:

- integration of WELS rated fixtures throughout the retail and commercial,
- harvesting of rainwater for re-use,
- industry best practice commissioning procedures,
- monitoring of water consumption for various uses
- monitoring for identification of system non-performance or failure

Provision of Future Connection to Recycled Water Main

In addressing ATP precinct strategy key principle three it should be noted that Council has expressed their desire to provide recycled effluent water reticulation infrastructure to the ATP precinct. This is a longer-term desire and council has made no commitment on delivery, quality or mains performance.

Notwithstanding, the LW refurbishment includes the provision for future connection of recycled effluent water should it be made available. This is achieved through the installation of provisional non-potable water reticulation service comprising in ground pipework terminated at Locomotive Street (for mains connection) and reticulation pipework for future connection and supply to non-potable water system on site. In providing this reticulation the LW satisfies the third key principle within the ATP precinct water consumption strategy.

Summary

Each key principle has been addressed and satisfied as part of the LW refurbishment with the intention of being fully compliant with the key deliverables outlined with '*Rainwater Harvesting and Recycled Water Reuse (RH&RWR) strategy for the ATP precinct*'.

INTRODUCTION

The Locomotive Workshop (LW) is an existing heritage listed building located at 2 Locomotive Street, Eveleigh and along with other buildings, public domain spaces and access roads forms the Australian Technology Park (ATP) precinct.

The Locomotive Workshop building is undergoing refurbishment internally and externally whilst maintaining the heritage aesthetic and aspect throughout. External works will include provision of services as required to meet the needs of the future building use and tenant requirements, resurfacing of external hardscape areas, including interface with the public domain. Internally, Bays 1-4a will be fitted out with a retail zone over two (2) levels, Bays 5-15 will provide a mix of new & existing commercial tenancy space across two levels, back of house, plant and equipment space and end of trip facilities.

The LW is serviced by a Ø200mm potable water Sydney Water authority main in Locomotive Street, with water main connection, property service and authority water / RPZD assembly located south of Bay 08. The existing main has been assessed and found adequate to supply the LW refurbishment without need for amplification. On site sewer drains from the site to multiple sewer main connections to the south in Locomotive Street and one to the north east of the LW. Stormwater is collected from the roof and hardstand catchments and conveyed via gravity to the north and south of the building, discharging to private ATP precinct stormwater infrastructure.

Both authority and private site infrastructure is generally expected to be unaffected by the LW refurbishment project with only the travelator passing under Locomotive Street expected to require detailed assessment and coordination for construction.

LOCOMOTIVE WORKSHOP WATER CONSERVATION STRATEGY

The Locomotive Workshop refurbishment project has set out to achieve reduction in potable water consumption in line with industry best practice benchmarks through the implementation of alternative water sources, reduced consumption fixtures, water consumption monitoring and ongoing system monitoring and maintenance.

The following sustainability initiatives have been incorporated within the LW development to achieve industry benchmarked standards:

- harvesting roof rainwater for reuse
- WELS rated tapware and fixtures
- sub-metering of water consumption throughout
- system monitoring for identification of non-performance or failure

Rainwater Harvesting and Reuse

The first means of reducing the site's potable water consumption is through the implementation of rainwater harvesting for supply to HVAC cooling towers, sanitary flushing and incidental landscape irrigation.

Rainwater from the equivalent of one (2) roof bays will be collected and conveyed to a rainwater tank via a first flush device used to remove the initial pollutant laden water prior to discharging to the rainwater tank located within Bay 15.

Rainwater is stored within a 100kL rainwater tank for reuse where it passes through a pressure pump-set and 3-stage water filtration and disinfection assembly before reticulating through a dedicated non-potable water pipe network for reuse by:

- mechanical plant,
- sanitary flushing and
- landscape irrigation.

WELS Rated Tapware and Fixtures

Overall water consumption of the LW development is further improved through the inclusion of fixtures which consume less water than traditional fixtures. The following WELS ratings have been used for the selection of fixtures at the LW:

- 5-star WELS rated Taps
- 5-star WELS rated Urinals
- 4-star WELS rated WC's
- 3-star WELS rated Showers

Through the selection of fixtures which meet the above WELS rating scheme less water is consumed whilst maintaining satisfactory fixture operation.

On-site Water Consumption Sub-metering

Water consumption throughout the LW site will be monitored through a network of sub-meters used to monitor the consumption of water at various locations and processes throughout in accordance with ESD requirements. Sub-meters will be connected to the on-site building management system (BMS) which will provide facilities management teams with real time data on water consumption.

System Monitoring for Identification of Non-Performance, Failure or Misuse

Through sub-meter monitoring of equipment, plant, systems and zones within the LW, undue water consumption through system / equipment failure or negligent use can be negated by actionable information provided by the BMS to facilities management staff members.

Industry Practices and Benchmarking

From outset of the LW project Mirvac set out to achieve best industry practices for the refurbishment. Achieving this standard of performance remains a key ambition and at the forefront of the project design, construction and delivery including application of environmentally sustainable design, with this report focusing on the reduction of potable water consumption.

Design and construction teams have continued to implement measures throughout the project to achieve this by benchmarking the initiatives and design against industry standardised sustainability measures, schemes utilised for benchmark assessment include:

- National Australian Built Environment Rating System (NABERS)
- Building Council of Australia Greenstar rating

Both schemes are recognised within the Sydney and Australian building industries as the leading method for project sustainability assessment and verification.

The refurbishment project aspires to achieve:

- 4 NABERS water stars (in operation);
- 6 Greenstars as built.

These targets meet or exceed the current standard industry practice for newly built commercial and retail developments, notwithstanding this the Mirvac and project team has aspired to meet these targets within the existing heritage listed building with a view to deliver a development which meets the highest industry, commercial and community standards.

The Locomotive Workshop project with total NLA of 28,780m² achieves a reduction in potable water consumption for sanitary flushing and cooling tower water usage which exceeds comparable benchmark developments in Sydney, such as:

- 200 George Street: circa 40,000m² NLA provided a 40kL rainwater harvesting tank achieved a 7% reduction
- Wynyard Place: circa 60,000m² NLA provided a 40kL rainwater harvesting tank achieved a 7% reduction
- 33 George St: circa 15,000m² NLA provided a 30kL rainwater harvesting tank achieved a 13% reduction
- 100 Mount Street: circa 40,000m² NLA provided a 20kL rainwater harvesting tank achieved a 13% reduction
- 60 Martin Place: circa 40,000m² NLA provided a 15kL rainwater harvesting tank achieved a 12% reduction
- 50 Martin Place: circa 25,000m² NLA provided a 30kL rainwater harvesting tank achieved a 11% reduction

LOCOMOTIVE WORKSHOP WATER BALANCE

Total Roof Catchment	1440m ² (1 Roof Bay)	2880m ² (2 Roof Bays)
Total Building Non-Potable Water Demand / 50 years	364,773kL	364,773kL
Potable Water Consumed / 50 years	294,979kL	239,223kL
Potable Water Demand met from Harvested Rainwater / 50 years	69,793kL	125,549kL
% Reduction of Potable Water Consumption	19.1%	34.4%

Through increasing the harvesting area to 2880m² (2 roof bays), potable water consumption for use by sanitary flushing and cooling towers within retail and commercial bays is reduced by 34.4%, which exceeds results of both ATP Buildings 1 & 2 (19% and 21% respectively). Whilst sizing the rainwater storage at 100kL provides optimal solution to service non-potable water demands during normal rainfall events. Targeting larger storage capacity would yield only minor tangible harvesting benefits during rare large storm events which represent a small overall water volume.

ATP SITE WIDE WATER STRATEGY

'Rainwater Harvesting and Recycled Water Reuse (RH&RWR) strategy for the ATP precinct' dated 26th May 2017 prepared by ARUP provides an overview of key deliverables which are to be targeted for implementation as part of the Australian Technology Park precinct development.

The strategy is intended to be applied to Buildings 1, 2 and 3 which are all in varying stages of construction or occupation as well as the proposed Locomotive Workshop redevelopment.

ARUP report identifies buildings to be designed to achieve environmentally sustainable targets that include minimising the demand for potable water by benchmarking to standardised industry sustainability measures. The rating schemes adopted are the leading industry practice within the Sydney market, specifically;

- National Australian Built Environment Rating System (NABERS)
- Green Building Council Australia Greenstar rating

With the developments aspirations to achieve;

- 6 Greenstar as-built
- 4 NABERS water stars

ARUP report outlines a strategy in which the abovementioned rating scheme targets could be met which include the key following deliverables:

- Harvesting of roof rainwater for supply to HVAC cooling towers and sanitary flushing
- Incorporation of WELS rated fixtures for the minimisation of water consumption

The report also identifies that should a recycled effluent water main become available in line with council's long-term desire, water efficiency may be further improved by connection of each building within the ATP precinct for supply to HVAC cooling towers and sanitary flushing of fixtures. With this in mind the third strategy key principles identified is for the provision of on-site, non-potable water reticulation system to facilitate future connection should a recycled effluent water main be made available.

Incorporation of a future recycled water main connection may be addressed within the LW development through the integration of a provisional service to be installed in ground ready for connection to any future main available, continuing through to a connection point with the non-potable water system upstream of filtration and disinfection assembly to supply HVAC cooling towers, sanitary fixture flushing throughout and any incidental landscape irrigation. In doing this the LW meets all key deliverables outlined within ARUP precinct water strategy.

LOCOMOTIVE WORKSHOP HYDRAULIC DESIGN

The LW hydraulic services design incorporates the harvesting of one (2) roof bay for collection and storage within a 100kL rainwater for supply of non-potable water to HVAC cooling towers, sanitary flushing and incidental irrigation and in doing so achieve compliance with both NDY and ARUP strategies.

WELS rated fixtures have been selected and documented by the project architect and are inline with the Norman Disney & Young Environmentally Sustainable Design Specification and matrix which has been produced to meet both NABERS and Greenstar rating schemes.

Future supply by a recycled effluent water main to HVAC cooling towers and sanitary flushing can be achieved through the incorporation of a provisional supply service as part of the current development with integration to the non-potable system upstream of the filtration and disinfection assembly and terminating in ground within the Locomotive Street southern boundary facilitating a connection to a future main should one be made available.

CONCLUSION

The Locomotive Workshop development integrates with, and satisfies the key principles of the *Australian Technology Park Precinct Rainwater Harvesting and Recycled Water Reuse Strategy* prepared by ARUP by incorporating:

- Harvested rainwater used to supply HVAC cooling towers and sanitary flushing
- WELS rated fixtures selected and specified throughout
- Integration of provisional supply for connection to future recycled effluent water main

Yours faithfully,

HARRIS PAGE & ASSOCIATES PTY LIMITED

A handwritten signature in black ink, appearing to read 'KJ', with a long, sweeping horizontal line extending to the right.

KYLE JOHNSON
HYDRAULIC SERVICES CONSULTANT