DESIGNING PERMEABLE PAVEMENTS

Water Sensitive SA
27th May 2021

James Luo
Civil Engineer

CMAA
CONCRETE MASONRY ASSOCIATION OF AUSTRALIA

Design Pave

Perm Pave

WATER SENSITIVE SA

ABOUT CMAA

The Concrete Masonry Association of Australia
Peak body representing the concrete masonry manufacturers of Australia.
These include bricks, blocks, pavers and retaining walls.

CMAA
CONCRETE MASONRY ASSOCIATION OF AUSTRALIA

MANUALS, STANDARDS & CODE BOARDS

STANDARDS Australia

RESEARCH

University of South Australia

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

QUT
Queensland University of Technology

ADVOCACY & POLICY

BUILDING PRODUCTS INDUSTRY COUNCIL

safe work australia

NEPC
National Environment Protection Council

STRATEGIC VISION

CMAA
CONCRETE MASONRY ASSOCIATION OF AUSTRALIA

FREE RESOURCES AND TECHNICAL HOTLINE

CMAA
CONCRETE MASONRY ASSOCIATION OF AUSTRALIA

Please visit our website for a comprehensive catalogue of:

- technical manuals
- research papers and
- case studies.

These resources are available from our website as a free pdf download

Technical Hotline | **1300 667 617**
Website| **cmaa.com.au**

CMAA MEMBERS

CMAA
CONCRETE MASONRY ASSOCIATION OF AUSTRALIA

SPONSORING MEMBERS

Adbri Masonary
adbrimasonry.com.au

Austral Masonry
australmasonry.com.au

STATE MEMBERS

Brikmakers
brikmakers.com

Boral Masonry
boral.com.au

National Masonry
nationalmasonry.com

GENERAL MEMBERS

Baines Masonry
bainesmasonry.com.au

Cowra Concrete Products
cowraconcreteproducts.com.au

Island Block and Paving
islandblock.com.au

BCP Buliding Products
bcpbuildingproducts.com.au

Urban Stone
urbanstonecentral.com.au

ASSOCIATES

Lanxess
laxness.com.au

Bliss & Reels
blissandreels.com.au

Cathay Industries
cathayindustries.com.au

GuardIT Solutions
Guarditsolutions.com.au

SafeTec Solutions
safetecsolutions.com.au

BASF / Chemetall
chemtall.com.au

BlockAid
blockaid.com.au

Columbia Concrete Block Machine
columbiamachine.com.au

INTERNATIONAL

Besser
besser.com.au

CONTENTS

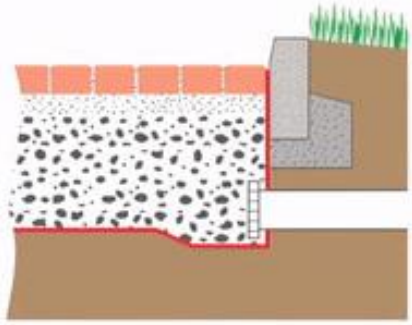
1. OVERVIEW
2. DESIGNPAVE/PERMPAVE SOFTWARE
3. RESIDENTIAL VS COMMERCIAL DETAILING
4. PROXIMITY TO STRUCTURES
5. COMMERCIAL CARPARKS
6. CASE STUDY – QUINNS BEACH CARPARK CONCEPT

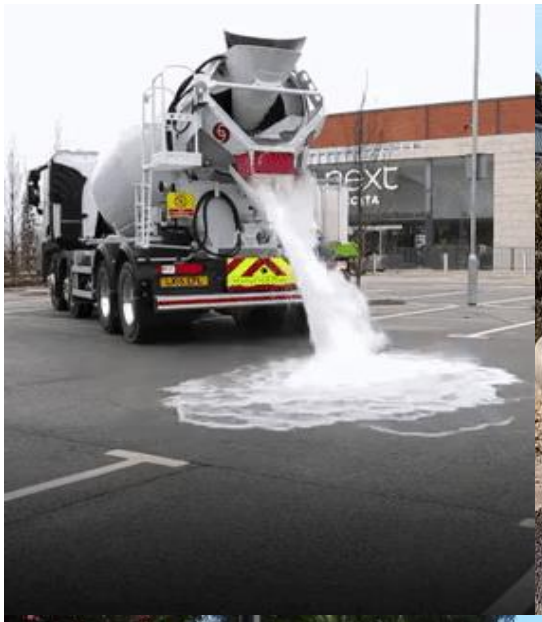
OVERVIEW

A permeable pavement system is a pavement that allows water to infiltrate the surface, where it is stored in the base course.

Trafficked permeable pavements include:

- Open-graded (Porous) Asphalt
- No-fines (Pervious) Concrete
- Permeable Interlocking Concrete Pavers



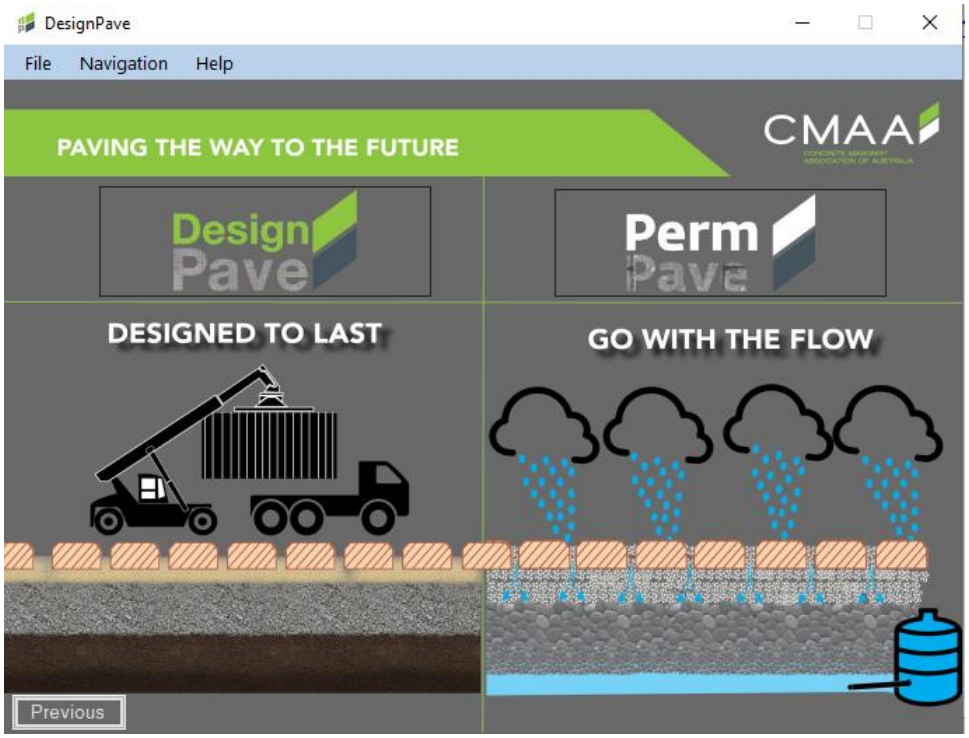


DESIGNPAVE/PERMPAVE SOFTWARE

CMAA's DesignPave can be used for designing a residential or industrial pavement from scratch, or analyse the design of your industrial pavement.

Designers are able to use the program to:

- Assess structural and traffic loads to determine the required capacity of the pavement;
- Design thickness of each layer; and
- Link with hydrological design



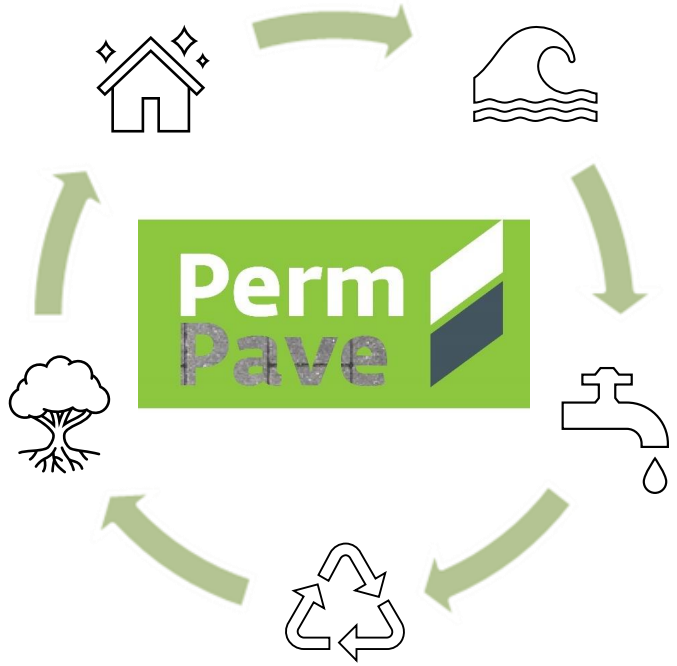
DesignPave is available free to download on CMAA's website:

http://cmaa.com.au/engineering-pavement-software

DESIGNPAVE/PERMPAVE SOFTWARE

PermPave is used for the hydrological design of your permeable pavement. It contains the following design features:

- Runoff control
- Water harvesting
- Water quality improvement



DESIGNPAVE/PERMPAVE SOFTWARE

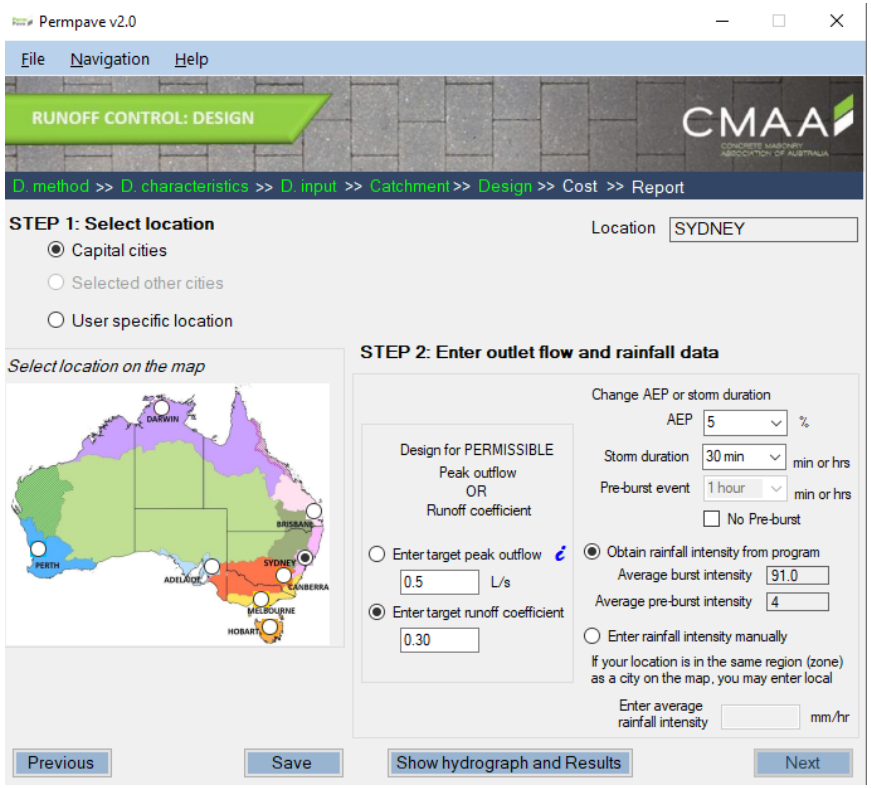
PermPave has access to both ARR 97 and ARR 2016 data. ARR IFD data was revised in December 2016 to include:

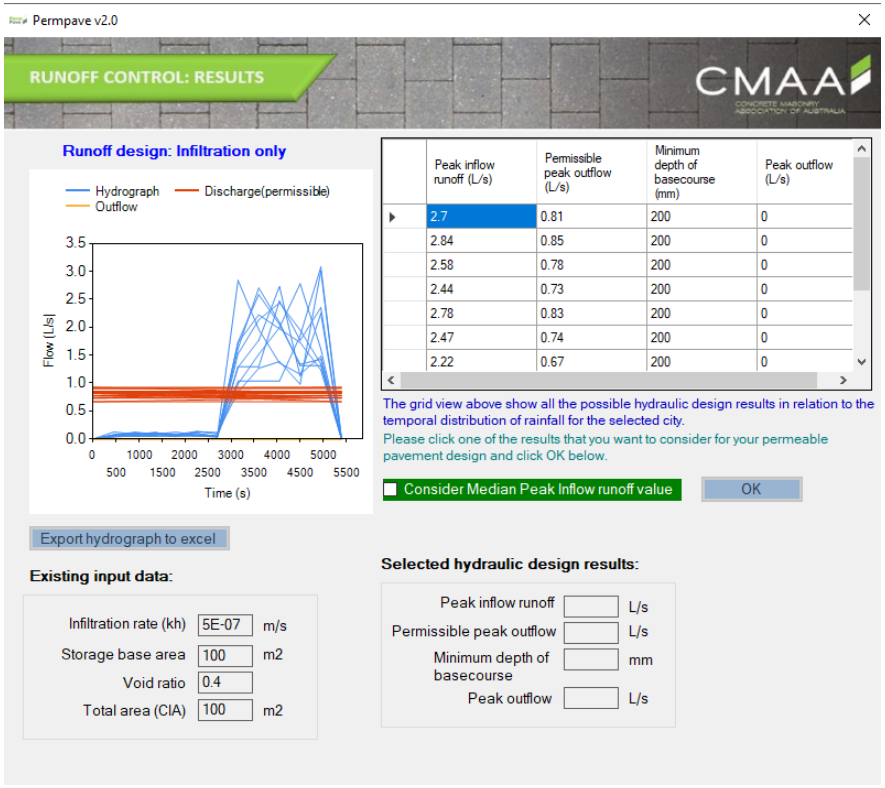
1. Up to 30 years more data available which will make **more reliable estimates**
2. Data available from other water agencies in Australia which **improves** the **spatial coverage of data**
3. Improved statistical methods for analysis of rainfall data
4. Possible impacts of climate change

FLOOD CONTROL

RUNOFF CONTROL

Users can input a location specific Intensity – Frequency – Duration (IFD) relationships to determine design storm events. A hydrograph is generated using 10 storm temporal patterns, where users can choose a storm temporal pattern. Hydraulic design results are generated once a temporal pattern is chosen.

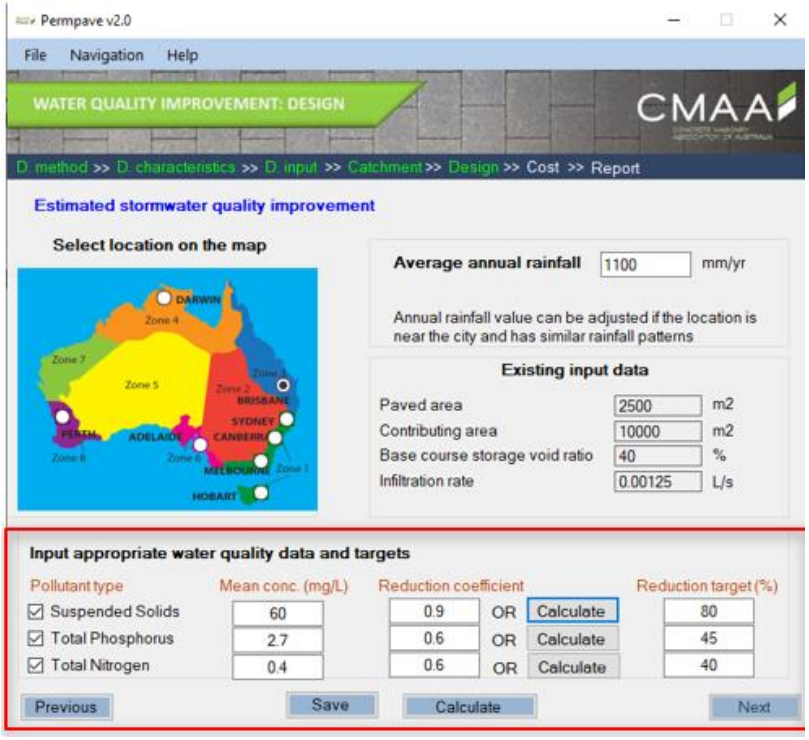


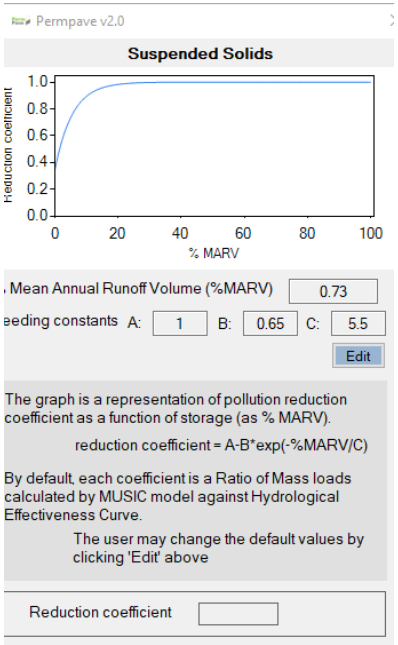


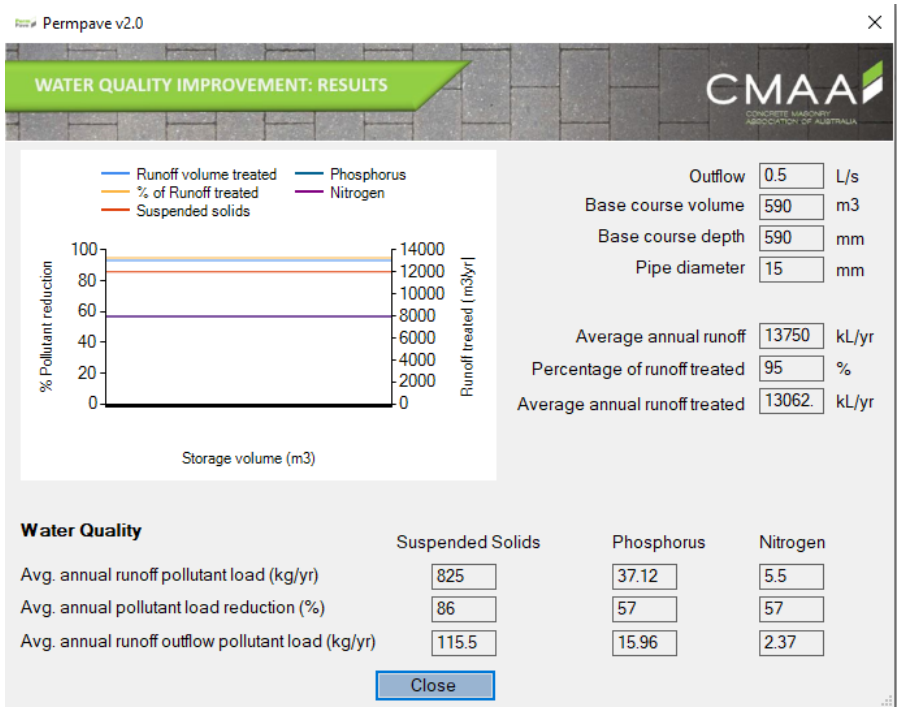
WATER QUALITY

REMOVAL OF TSS AND ANY OTHER POLLUTANTS

Users can input pollutant concentration, reduction coefficient and reduction target value
Reduction coefficient can be software default value or generated using Hydrological effectiveness curve



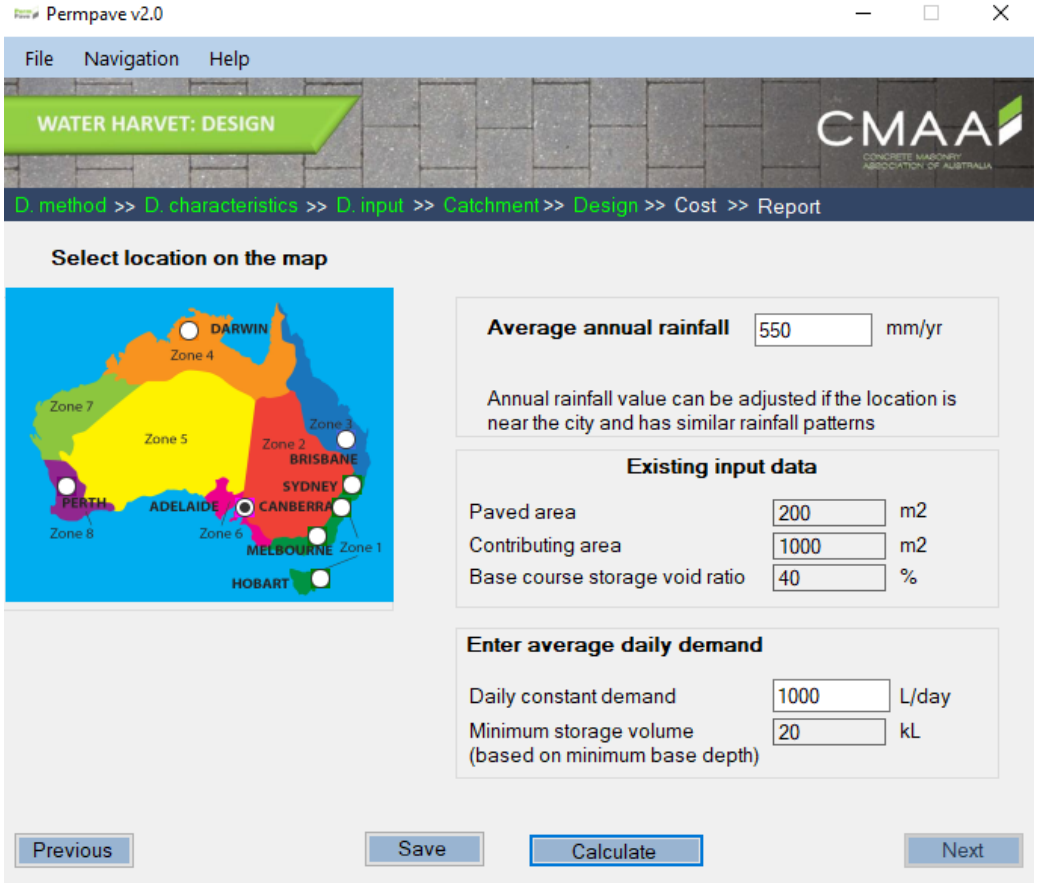


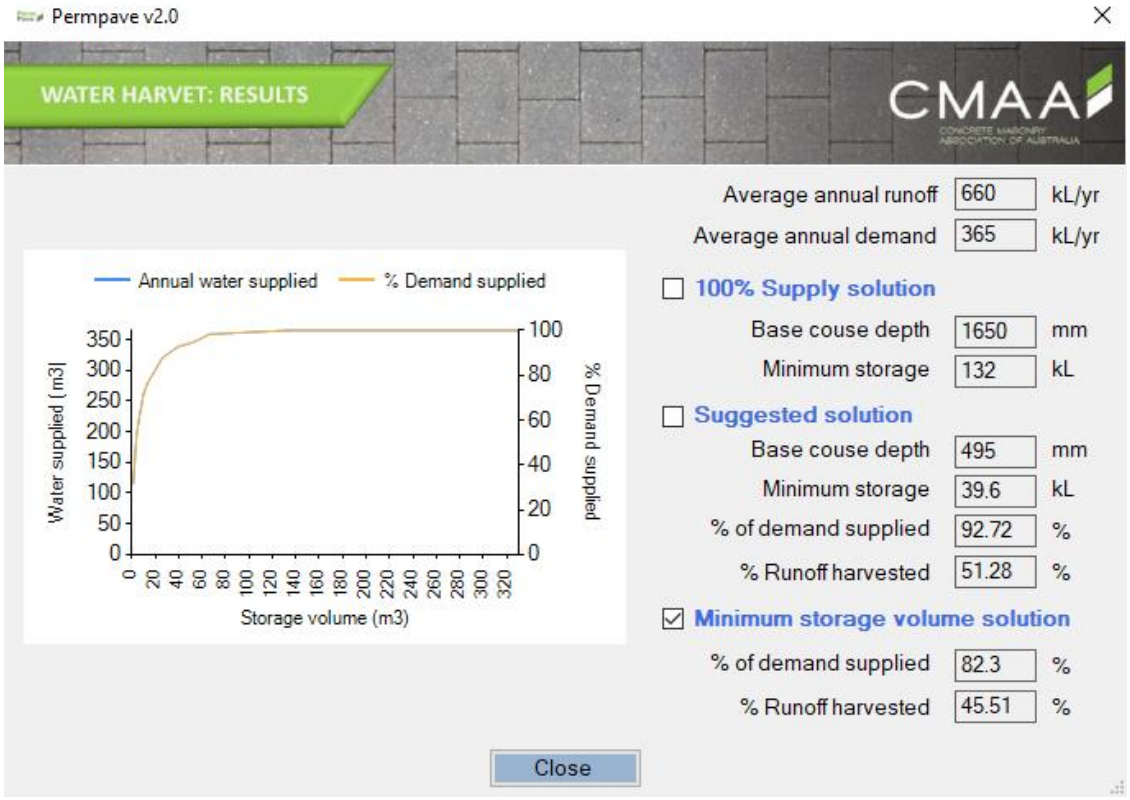


WATER STORAGE

STORAGE OF WATER FOR RE-USE

Users can input rainfall data, water storage requirement and daily constant water demand PermPave will determine the thickness of base required to achieve water storage or water demand requirements

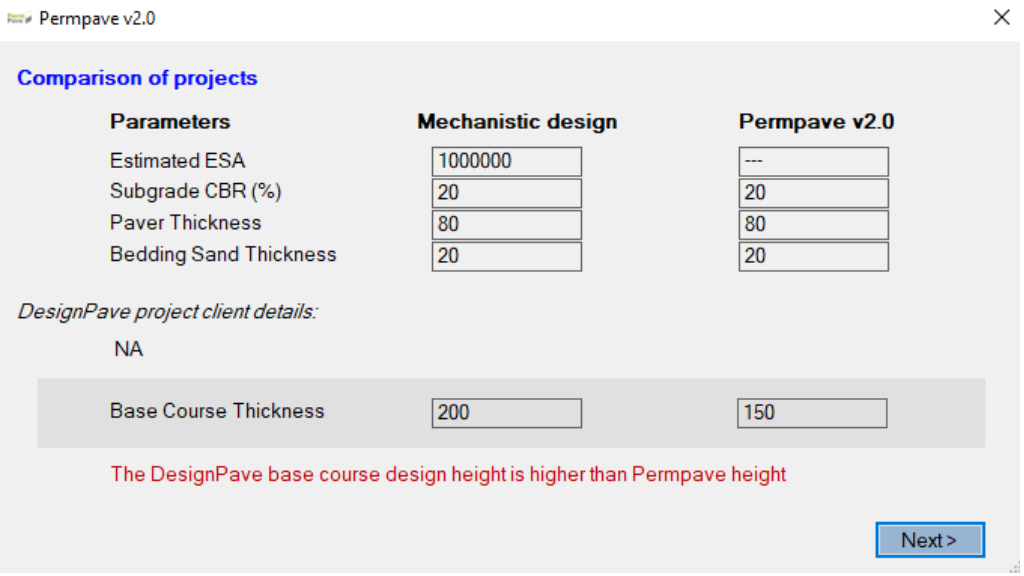


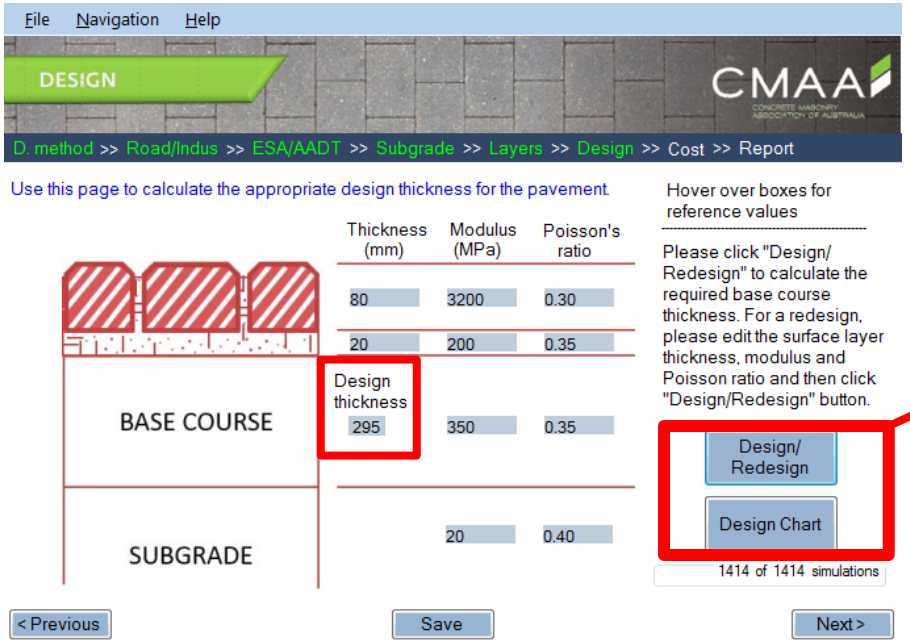


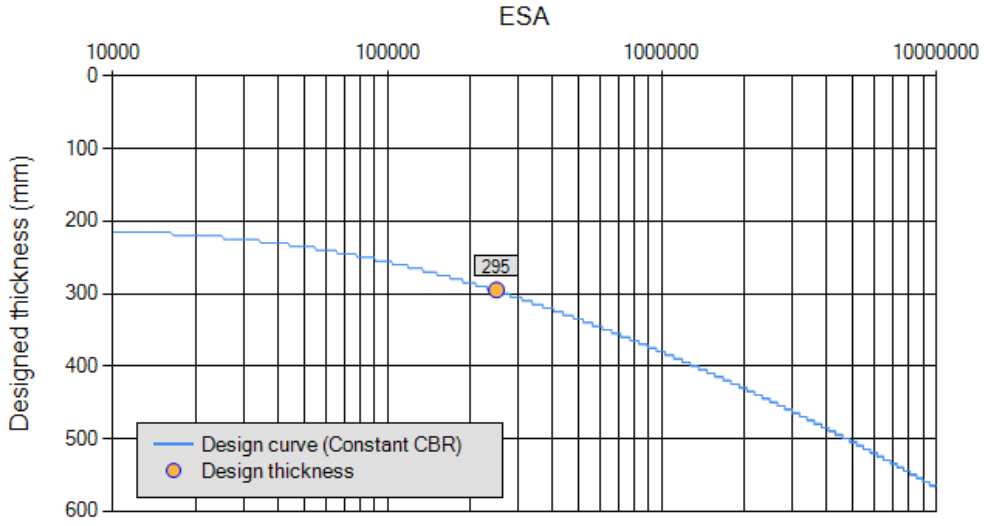
DESIGNPAVE/PERMPAVE SOFTWARE

- PermPave exists as a separate design methodology to the original structural design option in DesignPave

- When designing permeable pavements, both the hydrological and structural requirement of the pavement need to be satisfied.

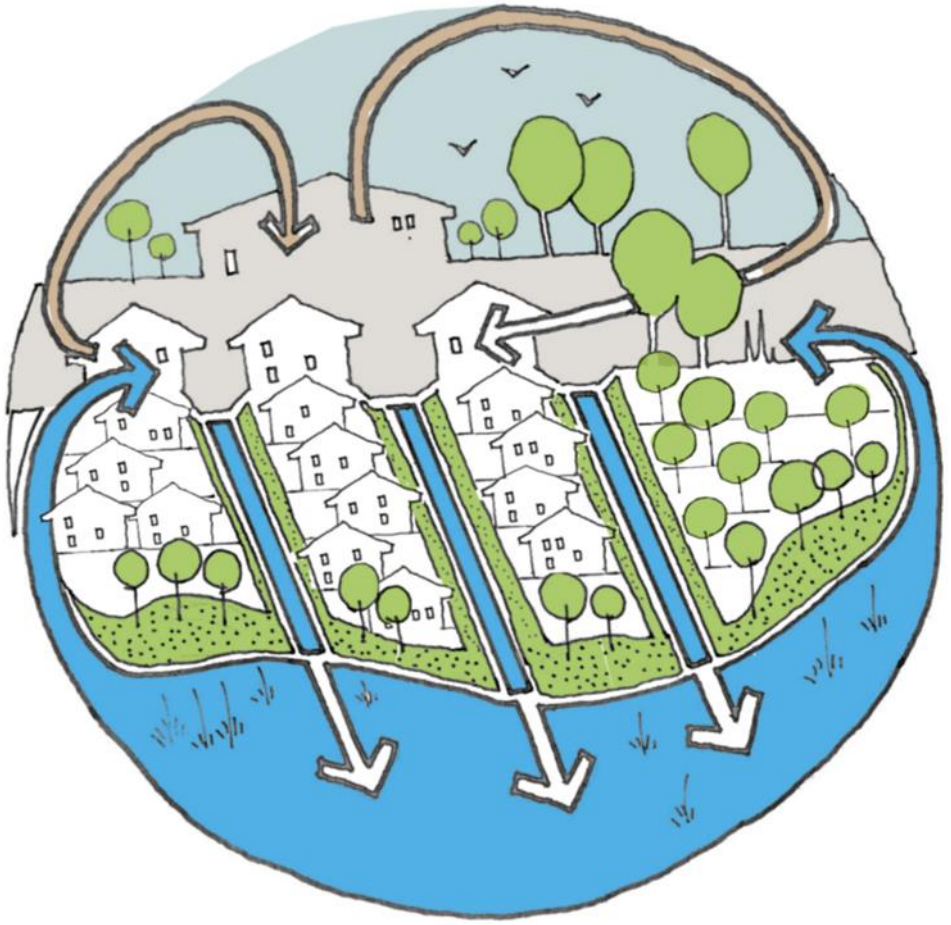






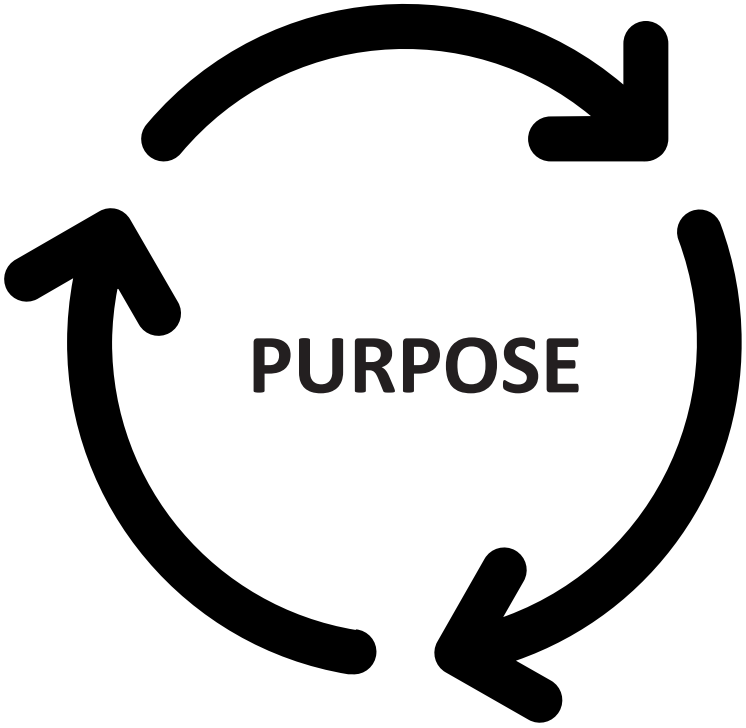
WHY PERMPAVE?

- The **only** structural and hydrological design software for the Australian climate
- Based on **data** from the **Australian Bureau of Meteorology**
- Advances Australia's permeable paving technology to be in step with the rest of the world
- Culmination of **40 years of hydrological and pavement engineering knowledge**



RESIDENTIAL VS COMMERCIAL

Loading requirements



Water demand

RESIDENTIAL VS COMMERCIAL

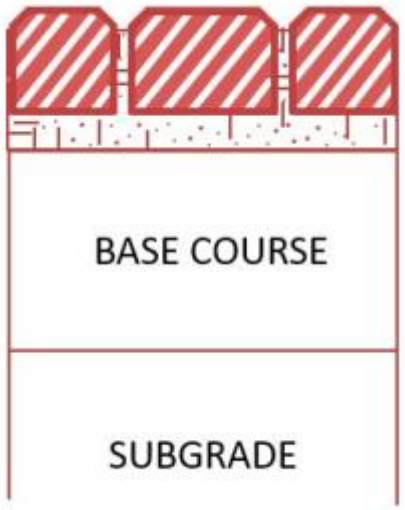
LOADING REQUIREMENTS

RESIDENTIAL	COMMERCIAL
Driveways	Carparks
Domestic parking	Local access roads
Footpaths	Public footpaths
Design: Low volume (max 10 vehicles/day) Light vehicular traffic	**Design:** High volume (max 200-500 vehicles/day) Mixed vehicular traffic

RESIDENTIAL VS COMMERCIAL

EXAMPLE – RESIDENTIAL DRIVEWAY

- Reduce water pooling
- Reduce excessive water runoff
- Allowed water to filter through the driveway surface and run into the natural water table at the lowest point of the property.



50 mm permeable paver

25 mm bedding layer

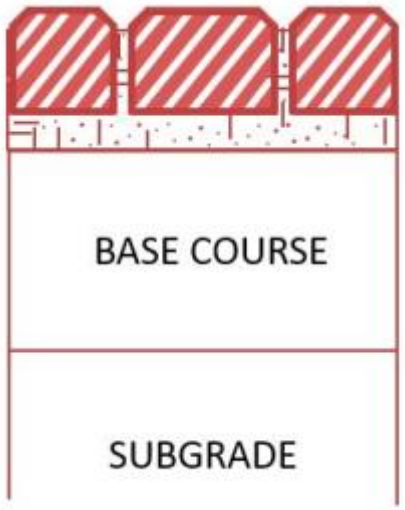
100 mm NFC basecourse layer

- Light vehicle passes (<10/day)
- Pedestrian

RESIDENTIAL VS COMMERCIAL

EXAMPLE – COMMERCIAL BUS STATION

- Reduce stormwater pits for improved pedestrian accessibility
- Provide existing tree protection and sustainability via recharge of local aquifer
- Maintained natural drainage patterns and low capacity of existing old drainage



80 mm permeable paver

25 mm bedding layer

150 mm recycled concrete basecourse layer

- Mixed vehicle passes
- Pedestrian (20,000/hour)

RESIDENTIAL VS COMMERCIAL

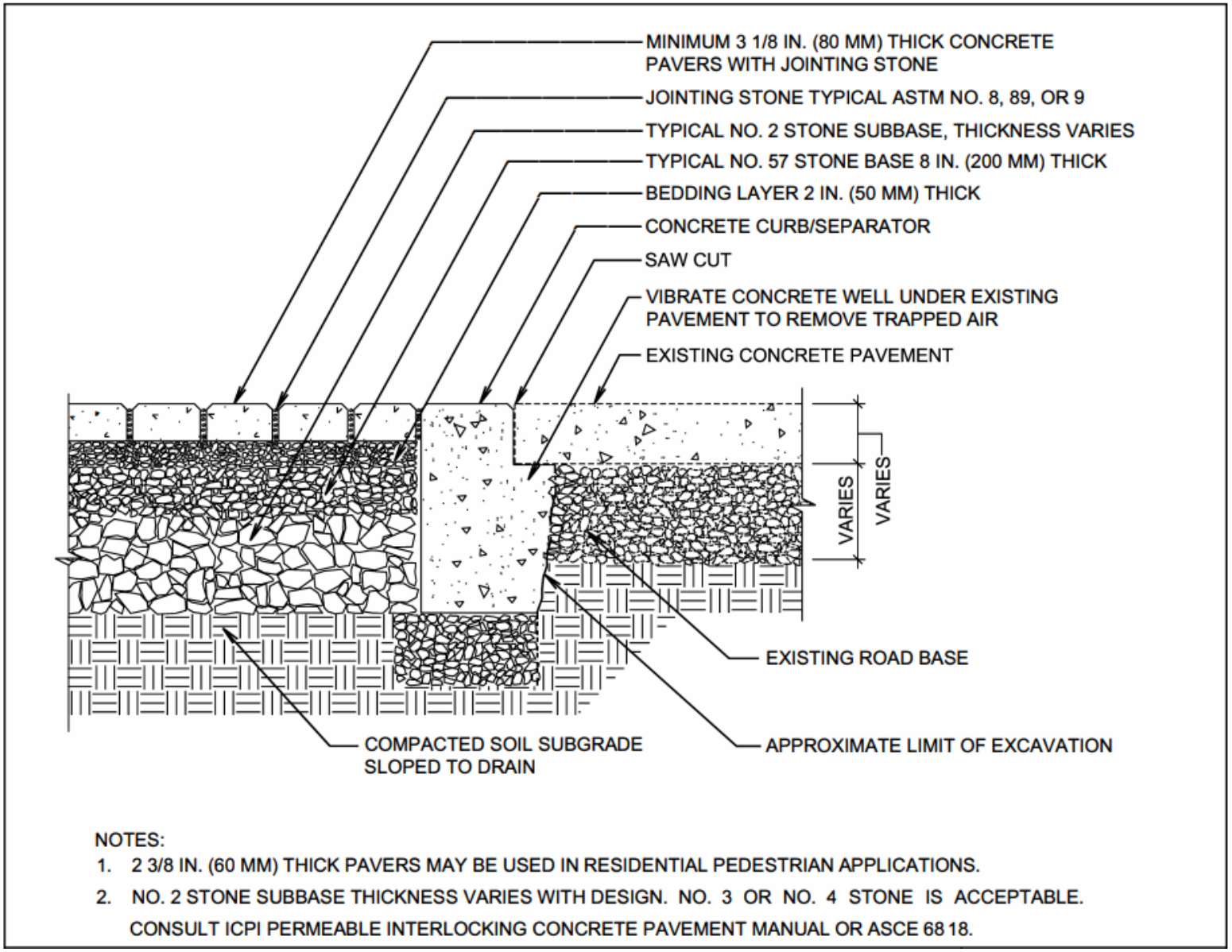
WATER DEMAND

What is the purpose of your permeable pavement?

Flood control

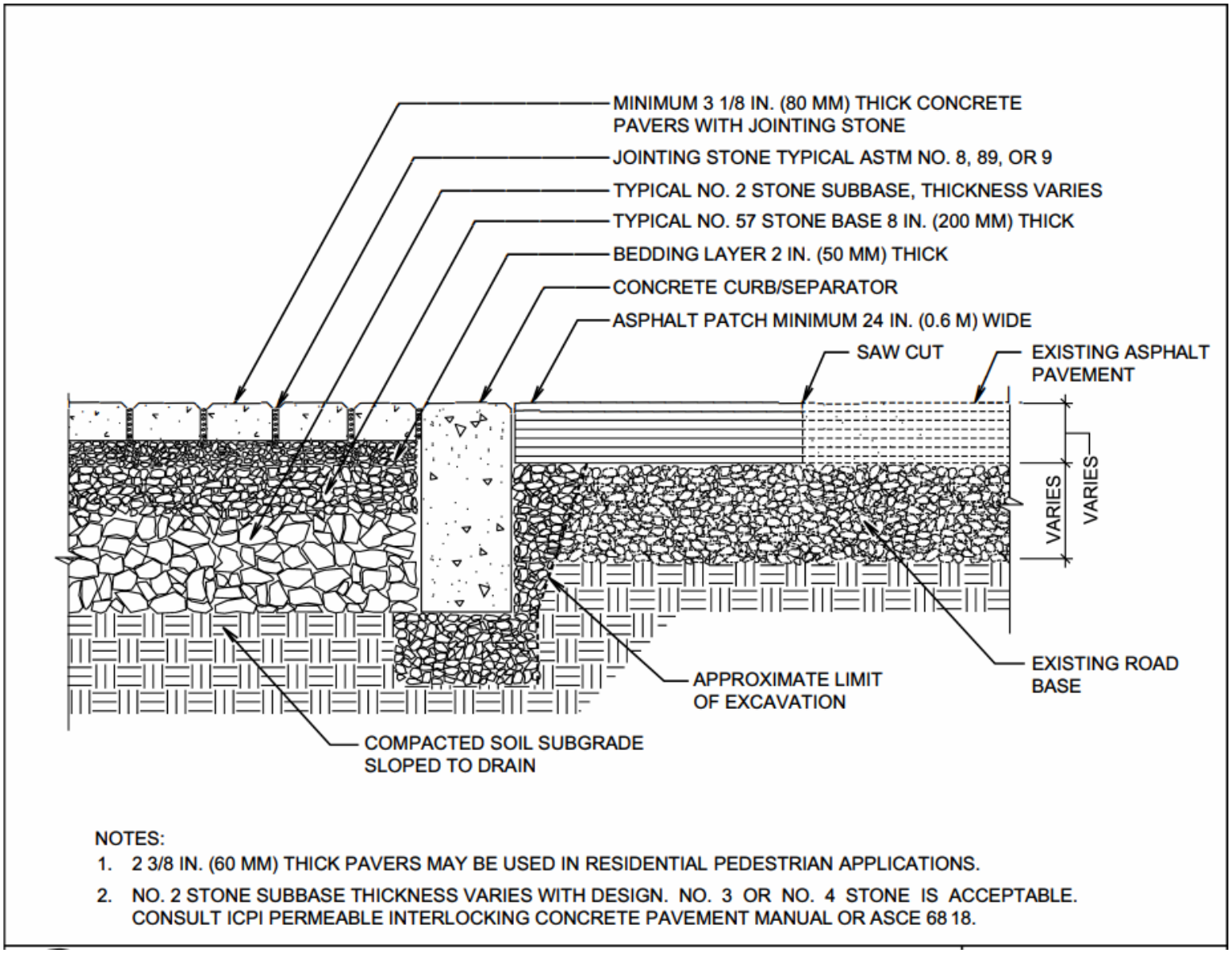
Water harvesting

PROXIMITY TO STRUCTURES/FOOTINGS



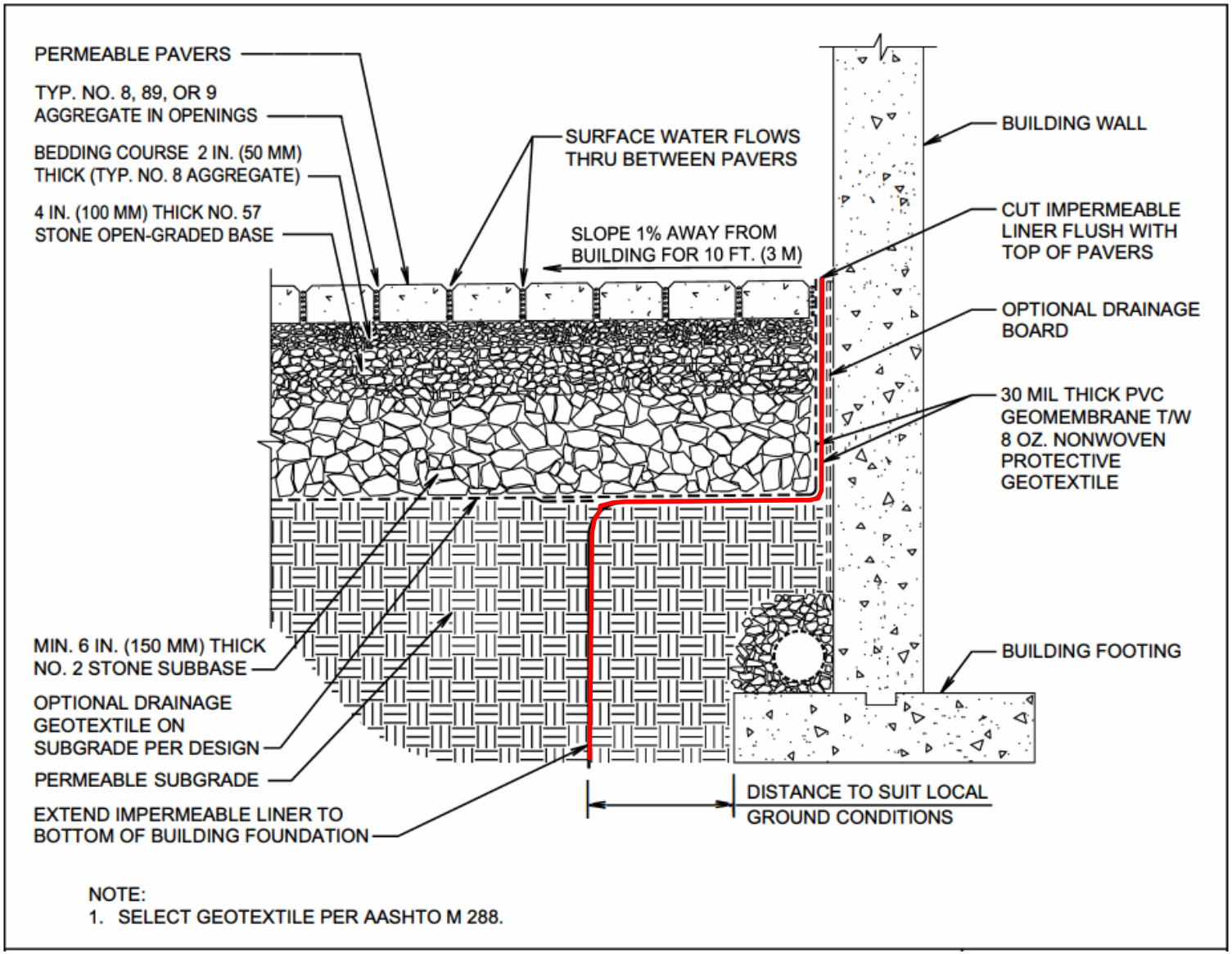
Pavement transition to concrete (ICPI, 2021)

PROXIMITY TO STRUCTURES/FOOTINGS



Pavement transition to asphalt (ICPI, 2021)

PROXIMITY TO STRUCTURES/FOOTINGS



PICP adjacent to building structure (ICPI, 2021)

COMMERCIAL CARPARKS

Many carparks experience ponding due to pavement settlement and rutting, which can cause accessibility issues after a rainfall event.

COMMERCIAL CARPARKS

It is not uncommon for PICPs to be used only in parking bays. Properly designed carparks can meet pollution reduction targets and peak flow volume targets.

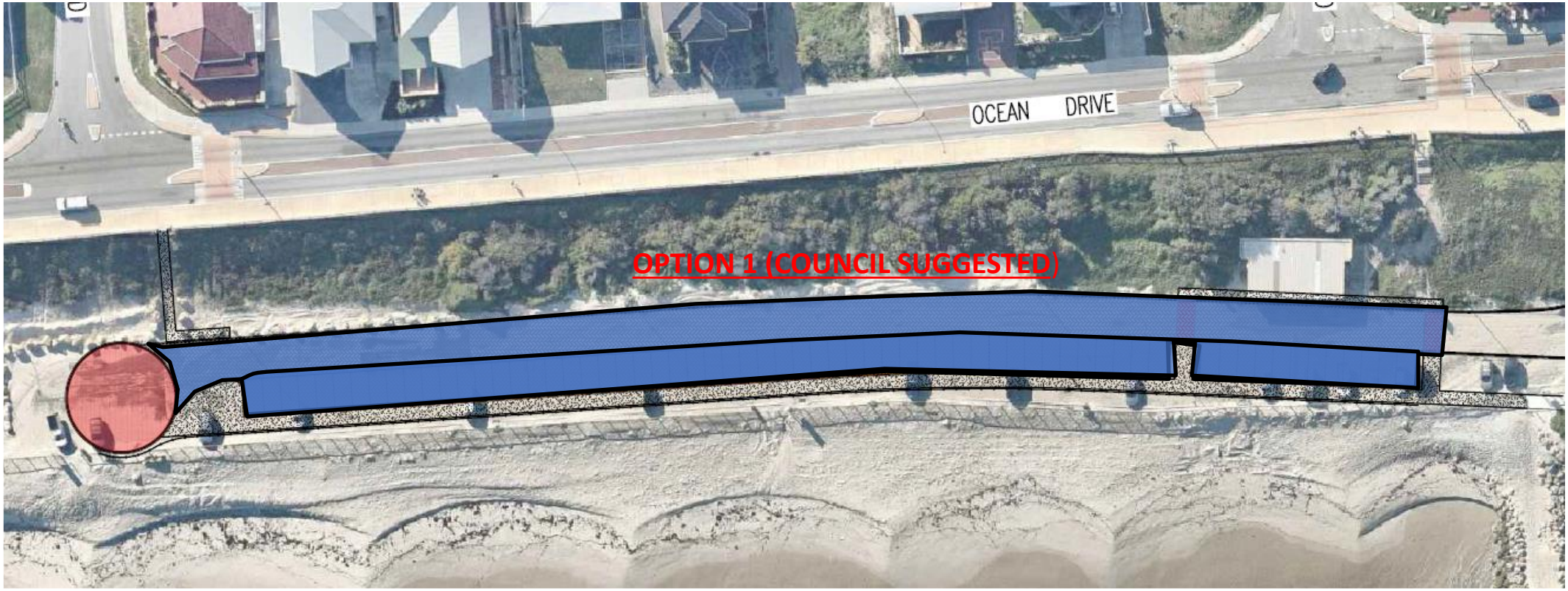
Car Parking Along Kerrabee Ave

North Haven Football Club

COMMERCIAL CARPARKS

CASE STUDY – COMMERCIAL CARPARK

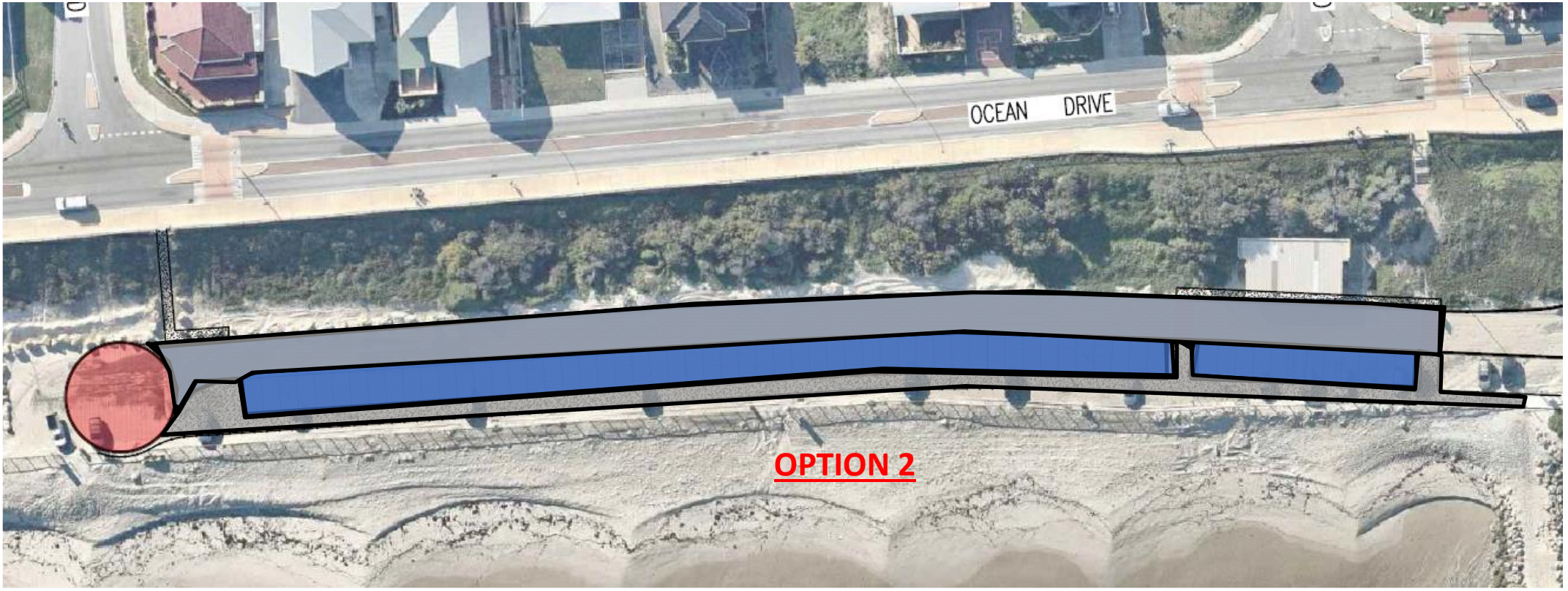
QUINNS BEACH CARPARK PROJECT CONCEPT



City of Wanneroo

CASE STUDY – COMMERCIAL CARPARK

QUINNS BEACH CARPARK PROJECT CONCEPT



City of Wanneroo

CASE STUDY – COMMERCIAL CARPARK

QUINNS BEACH CARPARK ANALYSIS

OPTION 1 (COUNCIL SUGGESTED)
Entire carpark

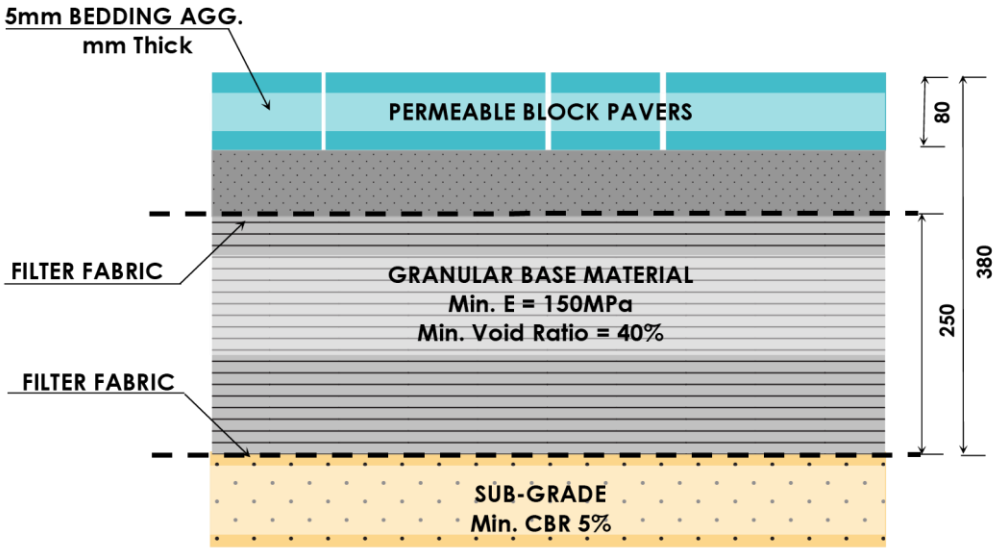


FIGURE 1: PERMEABLE PAVEMENT DESIGN SECTION
NOT FOR CONSTRUCTION

OPTION 2
Parking bays only

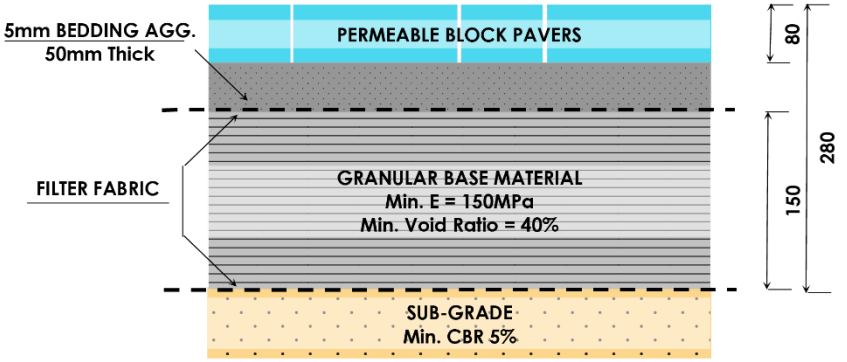


FIGURE 1: PERMEABLE PAVEMENT DESIGN SECTION
NOT FOR CONSTRUCTION

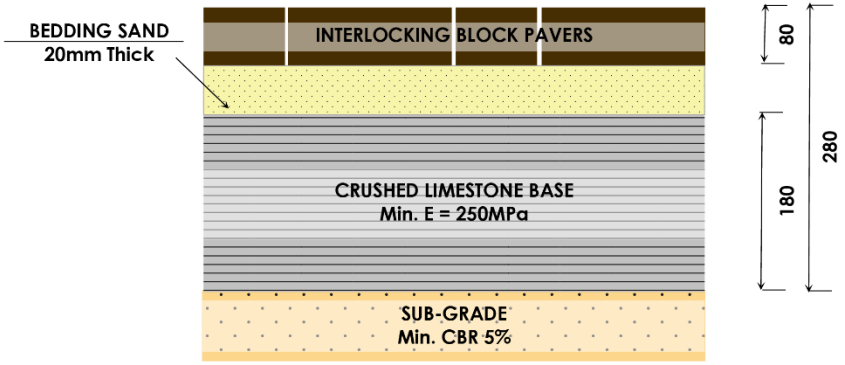


FIGURE 2: PAVEMENT DESIGN SECTION
NOT FOR CONSTRUCTION

CASE STUDY – COMMERCIAL CARPARK

QUINNS BEACH CARPARK SUMMARY

Benefit	Option 1 (Entire Carpark)	Option 2 (Parking Bays Only)
Water Outflow	0L/s	0L/s
Water Quality (TSS)	82% Reduction	62% Reduction
Water Storage	210kL	66kL
Aesthetics	✓	✓
Maintenance	✓	✓
Traffic Load	10,000ESA - GOVERNS	10,000ESA
Urban Heat Island Effect	Better	Good
Total Cost	$90/m^2	$69/m^2

APPROVED INSTALLER PROGRAM

The CMAA delivers the Approved Installer Program to councils and paver contractors to ensure pavements are being designed and installed to current industry best practice standards

We are launching the first CMAA Approved Installer Program for 2021!

Where: City of Adelaide
When: 12th August 2021

APPROVED
INSTALLER

THANK YOU

REGISTER FOR DESIGNPAVE NOW

www.cmaa.com.au/engineering-pavement-software