Armadale Access Alliance

Armadale Road to North Lake Road Bridge Project
Contract No. 237/16

Roads to Reuse Project and Recycled Materials Initiatives
Waste Strategy Roll Out

26 November 2019

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Roads to Reuse

MRWA Reported Reuse and Recycling

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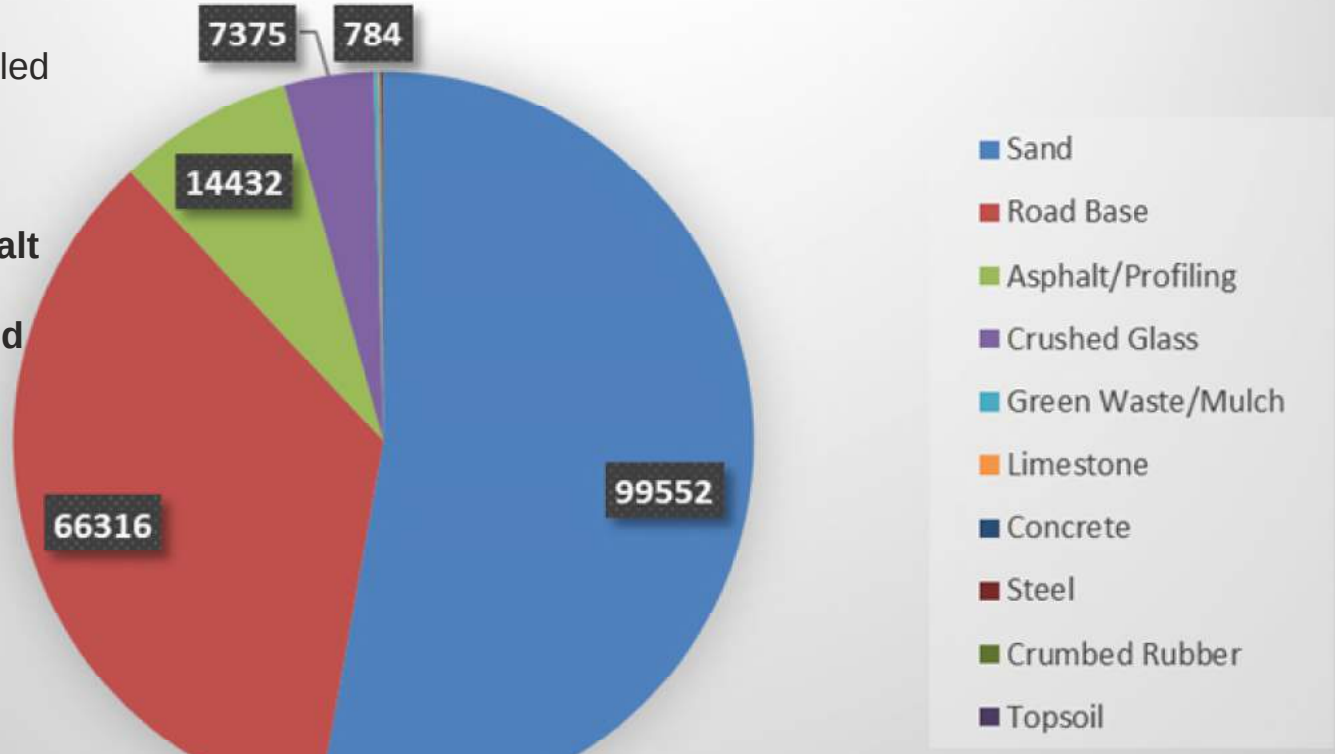
Imported Recycled Construction Materials in Tonnes

MRWA Current recycled content includes:

- **Crumbed scrap rubber**
- **Reclaimed asphalt**
- **Glass**
- **Crushed recycled concrete (CRC)**



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Roads to Reuse Pilot

- Through the Western Australia Waste Strategy 2030, Main Roads has committed to using more than 100,000t of CRC in projects during 2020, following the successful implementation of the pilot project.

- The Kwinana Freeway Northbound Widening and Murdoch Drive Connection Projects were chosen as pilot projects to utilise up to 25,000 tonnes of CRC under full-depth asphalt.

- 90% of the CRC material is coming from the Subiaco Oval demolition, which demonstrates the circular economy. Concrete recycled at recycling facilities in Kwinana and Hope Valley

Roads To Reuse – product specification

- In September 2018, the State Government released new specifications which allowed Main Roads to start using CRC road base and drainage rock on its projects.
- The specifications include a new set of testing regimes and independent audit testing to ensure recycled material is safe for its intended use.

Roads to Reuse

Main Roads Specification 501.92

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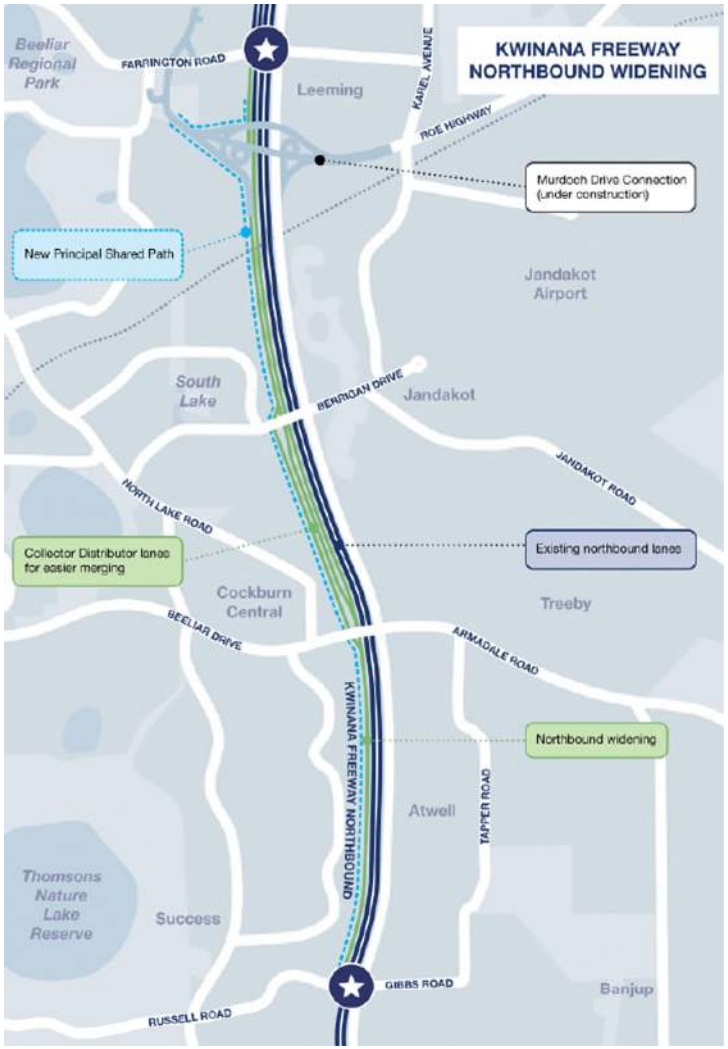

501.92 CRUSHED RECYCLED CONCRETE SUB-BASE SUPPLIED BY THE CONTRACTOR

501.92.01 GENERAL

1. The material shall consist of a uniformly blended mixture of coarse and fine aggregate resulting from the crushing of recycled concrete from construction and demolition material. This material shall be used as sub-base material under Full Depth Asphalt only. ***General***

2. Coarse aggregate (retained on 4.75mm sieve) shall consist of hard durable angular fragments and shall not break up after wetting and drying..

3. Fine aggregate (passing 4.75mm sieve) shall consist of crushed material or crushed material and sand with similar durability properties to that of the coarse aggregate.

4. Foreign material content shall be limited to the values shown in Table 501.05. ***Foreign Material***

TABLE 501.05 CRUSHED RECYCLED CONCRETE SUB-BASE LIMITS OF FOREIGN MATERIAL

Material	Maximum Limit	Sampling, Monitoring and Analytical Methods
Recycled Asphalt Pavement (RAP): % by mass retained on 4.75mm sieve	15.0%	Visual Assessment
High Density Materials (brick and tile) % by mass retained on 4.75mm sieve	15.0%	Visual Assessment
Low Density Materials (plastic, plaster, etc): % by mass retained on 4.75mm sieve	1.5%	Visual Assessment
Organic Matter (wood etc): % by mass retained on 4.75mm sieve	1.0%	Visual Assessment
Unacceptable high density materials (metals, glass and ceramics): % by mass retained on 4.75mm sieve	3.0%	Visual Assessment
Bound Asbestos (as Asbestos Containing Material): % by mass retained on 7mm sieve	0.01%	In accordance with RtR spec to be advised
Fibrous Asbestos and Asbestos Fines, and other hazardous contaminants	"No asbestos detected" or below limit	In accordance with RtR spec to be advised

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Where crushed recycled concrete be used?

Sub base under full depth asphalt

Base course under low traffic local roads

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Crushed Recycled Concrete – Implementation on site

Armadale SWTC:

- Use as sub base under Full Depth Asphalt
- Cannot be used within 100 meters of a wetland or watercourses
- Business as Usual – limestone or crushed rock sub-base
- In Final Design the use of CRC has been maximized where possible however, due to the environmental areas indented with the project, the use of CRC is limited to the southbound works on Kwinana Freeway including the ramp connections

Roads to Reuse

Crushed Recycled Concrete – Lessons Learnt MRIA Murdoch Drive Connection Project

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Lessons Learnt - Material Management:

- No stockpiling on site (direct delivery to construction lot as continuous abutting tips approximately equal to required volume per length);
- Stockpiling of the material is generally only considered where the location of the site presents potential access issues.
- Placed directly into the pavement box
- Generally reduced water use – 6-13% difference – it generally retains added water better than conventional subbase material

Roads to Reuse

Crushed Recycled Concrete – Lessons Learnt MRIA Murdoch Drive Connection Project

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Lessons Learnt - Mixing on Site:

- Less mixing required as CRC appears to be a more consistent material
- Workability is very similar when compared with conventional granular materials
- Once cured, material is durable and can withstand moderate traffic from construction traffic without further material breakdown.
- Conventional materials are more likely to breakdown under the same traffic volume.

Lessons Learnt - Trimming:

- Trimming times within the construction sequence appears to have a significant impact on the final surface finish produced. Trimming the material whilst it is still relatively green generally produces a rougher surface texture, whilst conventional trimming produces a surface that is tightly knit and relatively smooth.

- Due to the inherent nature of CRC, once the material has cured, further trimming is not feasible as the material has set up and attempted trimming is likely to further tear the material. Therefore, **the usual practice of post compaction trimming cannot be utilized** and initial construction to and within subbase surface tolerances without trimming is required.

Lessons Learnt - Risks:

- CRC also appears to retain moisture longer than conventional granular material, leading to extended construction timeframes. The use of CRC in areas of shade is not recommended as dryback will be challenging to achieve.

- **Priming**
  - Relatively tight surface requires more cutter in the cutback bitumen prime to promote prime penetration into the material;
  - Generally prime penetration of 3 to 5 mm observed;
  - C170 30:70 and C170 40:60 cutback bitumen primes were trialled for the project. Spray rates were suitably modified to match product used for priming.

Other Recycled Materials

Reclaimed Asphalt Pavement

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What is Recycled Pavement? Recycled old asphalt, Reclaimed Asphalt Pavement (RAP)

Recycled asphalt replaces the need for virgin (or new) asphalt in any project or roadway.

Granular Base (or Sub-Base) Aggregate
Recycled asphalt works to produce base or sub-base aggregate asphalt. RAP is crushed, screened, and blended with conventional granular aggregate. Blending base RAP with suitable materials is necessary to attain the required bearing strength needed for most load-bearing unbound granular applications.

What Are the Benefits of Recycled Asphalt?

The savings of **1800 tons** of **recycled asphalt** are illustrated below:

Asphalt saved from landfills	**1,820 tons**
Rock that did not need to be mined/quarried	**1700 tons**
Oil that did not need to be refined or delivered	**29,120 gallons**
Greenhouse gas emissions that were not put into the atmosphere	**70 tons**

Other Recycled Materials

Reclaimed Asphalt Pavement (RAP)

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Project Initiative:

- Project existing pavements comprise asphalt surfacing, crushed rock, bitumen stabilised limestone or gravel base course, and limestone sub-base.
- The asphalt surfacing can be potentially planed and returned to an asphalt supplier for use as Reclaimed Asphalt Pavement (RAP).
- The SWTC requires that **at least 5% of RAP** be used in the full depth asphalt intermediate courses.
- Project to develop RAP Management Plan to maximise use of RAP

Main Roads WA Initiatives:

- Main Roads standard specifications allows **10% RAP** to be included in the manufacture of structural asphalt layers, but this has not been widely adopted by industry.
- New specifications have been developed through WARRIP, in consultation with industry for high RAP content asphalt mixes.
- The NorthLink WA Central and Southern Sections both used 10% RAP in structural layers.
- Additionally, as part of the Southern Section project there was a mix design approved to increase use of RAP to 25%.
- The NorthLink WA Northern Section has a target of 17% RAP use throughout the project.
- The Armadale Road Upgrade project will be trialing a 25% RAP asphalt mix design in late 2019.

Other Recycled Materials

Glass

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Project Initiative:

- MRWA Specification 302 Earthworks, Section 302.10.1 Glass Cullet
- Project to consider use of glass cullet in embankment construction

Main Roads WA Initiatives:

- Main Roads' specifications permit the use of glass cullet in fill material, which to date, has not proven financially attractive.
- A better use of glass cullet would be to re-use it to produce new glass, as is done in Victoria and South Australia.
- The NorthLink WA Northern Section used 3150t of crushed glass to stabilize clayey materials on access tracks and 10,000t was used on embankments for the project.
- Crushed glass was also used on the Mitchell Freeway Extension to Hester Avenue (73t) and Armadale Road Upgrade Project (1000t).
- Recycled glass is used to manufacture the glass beads that are applied to road marking paint to provide better visibility at night and in wet conditions.

Other Recycled Materials

Plastic

Project Initiative:

- Currently non identified

Main Roads WA Initiatives:

- Main Roads already uses plastics in asphalt and other bituminous products, and encourages suppliers to source recycled plastics where possible. However, only a small proportion of recycled plastics are currently used due to the level of contamination in recycled plastics not meeting technical specifications.
- Since mid 2018, Main Roads has made requests to the manufacturer of Plastiphalt to collaborate for a trial to utilise recycled plastic in an asphalt mix.
- A trial is yet to be implemented as the asphalt mix is potentially more suited to low traffic local roads

Other Recycled Materials

Crumbed Scrap Rubber (rubber tyres)

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Main Roads WA Initiatives:

- Main Roads currently uses between 600 and 700 tonnes of crumbed scrap rubber annually in the **spray sealing** of roads.
- The majority of crumb rubber used in WA road applications is currently being sourced from **Victoria**.
- WA Waste Strategy 2030, Main Roads is aiming to **double** crumb rubber use in WA road infrastructure by 2021 (to make WA based facility viable)

Western Australian Road Research and Innovation Program (WARRIP), has developed new applications for incorporating crumb rubber in asphalt mixes.

• The crumb rubber asphalt trials are being run in partnership with Fulton Hogan and supported by Tyre Stewardship Australia and the Australian Asphalt Pavement Association.

• In early 2019, a crumb rubber open-graded asphalt trial was completed on multiple sections (2.3 km) of Kwinana Freeway between Russell Road and Anketell Road (**first in WA**).

• Another crumb rubber gap-graded asphalt trial is planned for late 2019 on a 1.5 km section of Marmion Avenue south of Reid Highway.

Other Recycled Materials

Crumbed Scrap Rubber (rubber tyres)

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Project Initiative:

- Project to Investigate use of Rubber in Open Graded Asphalt (currently not included in specs)
- MRWA advised that they have successfully trialed rubber in OGA on the Freeway (Fulton Hogan).
- Whilst this is demonstrating fatigue benefits, it comes at a cost premium.
- Project spec: Resurfacing – existing asphalt– sprayed seal with 5% rubber binder (crumbed rubber modified binder)
- Project Spec: Bridge Decks - 50mm thick dense graded asphalt DGA14(A15E) on 5mm rubberised binder (S45R) waterproofing seal on emulsion prime.

Main Roads WA Initiatives:

• Main Roads is also working on developing a third crumb rubber asphalt product suitable for surfacing arterial roads such as Canning Highway and Stirling Highway, which is expected to be of high interest to local government, potentially using hundreds of tonnes of scrap rubber per annum.

• The Bunbury Outer Ring Road project is expected to incorporate large amounts of crumb rubber spray sealing.

Other Recycled Materials

Blended Concrete

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Industry Innovation challenge

- **High Clinker Substitution** - Concrete (including pre-cast) used on the project has an average of 50% to 100% clinker substitutes (such as supplementary cementitious materials (SCMs) and fillers) by volume
- Clinker substitution may include fly ash, slag (all metals), metakaolin/ clay-based, volcanic rock, silica fume, waste glass, vegetable ashes (eg. bagasse ash), ground limestone etc.

Main Roads WA Initiatives:

- Main Roads plans to trial concrete mixes produced from 100% recycled aggregates in late 2019.

Project Initiative:

- Concrete Spec has S40LH mix with GP cement and ground blast furnace slag with approximate ratio 35%:65%, or mixture of GP cement and fly ash with approximate ratio 60%:40%
- Holcim assessment: S50M and S40LH are targeting a SCM of 68% and 65%. This should result in a fairly low CO2e mix.

Other Recycled Materials

Blended Concrete

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PRODUCING CEMENT USES GREAT DEAL OF ENERGY

FLY ASH - by-product of coal-burning power stations, recovered from gases and always used in conjunction with Portland Cement (our mix – 60% PC/40% fly ash)

GROUND BLAST FURNACE SLAG - by-product of the iron and steel industry. Slag floats to the top of the iron and removed, powdered. Less reactive than PC, always used in conjunction with PC (our mix - 35% Pc and 65% GGBS.)

Concrete made with GGBS cement **sets more slowly** than concrete made with ordinary Portland cement, depending on the amount of GGBS in the cement mix, but also continues to gain strength over a longer period leading to improved overall durability and life expectancy

Cement Substitutes (SCM)

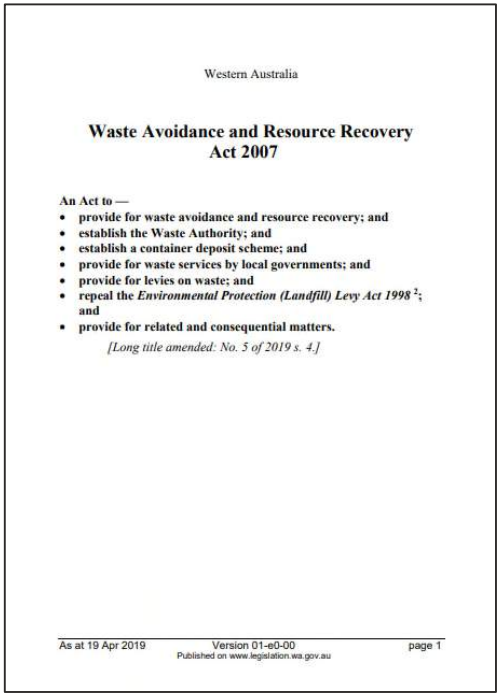
SILICA FUME - by-product from the manufacture of silicon. Due to economic considerations, the use of silica fume is generally limited to high strength concretes or concretes in aggressive environmental conditions.

LIMESTONE FINES - Limestone fines can be used as a constituent of cement to produce Portland limestone cement.

Project Waste Management Criteria and Project Start-up

Develop waste management criteria through identification of:

- **Waste objectives** – comply with contractual and legislative requirements and ensure minimal environmental impact
- **Relevant requirements and regulations** – project approval conditions, Waste Avoidance and resource Recovery Act 2007, Environmental Protection Act and Controlled Waste Regulations, National Environmental Protection Measure (NEPM)
- **Targets** - all off-site movement of waste is tracked, waste will be minimised where possible, project waste targets to be fed to procurement team and design



Western Australia

Waste Avoidance and Resource Recovery Act 2007

An Act to —

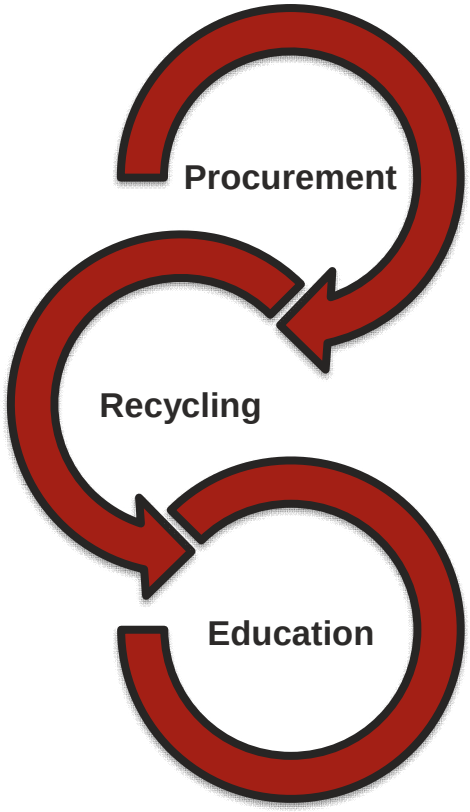
- **provide for waste avoidance and resource recovery; and**
- **establish the Waste Authority; and**
- **establish a container deposit scheme; and**
- **provide for waste services by local governments; and**
- **provide for levies on waste; and**
- **repeal the *Environmental Protection (Landfill) Levy Act 1998* [2]; and**
- **provide for related and consequential matters.**

[Long title amended: No. 5 of 2019 s. 4.]

As at 19 Apr 2019 Version 01-e0-00 page 1
Published on www.legislation.wa.gov.au

Waste Minimisation Strategies

The waste strategy must be implemented in the initial phases of the project and incorporated into design and procurement. Waste minimisation strategies include:



Must consider contractual requirements, recyclability or recyclable content of items, longevity and durability, biodegradability, sustainability endorsements

Assess viability to recycle based on logistical costs, waste contractor systems in place and availability of facilities, sale price, indirect savings

Awareness and education, signage/labels, waste information and posters, toolbox talks, emergency response and spill management

Project / Site Specific Strategies

	General waste	Recyclable waste	Hazardous waste	Procurement
Project specific strategies	• Non-recyclable office waste will be placed in the General Waste bins located at the site office compound; • Vegetation Waste will be mulched and reused onsite for Erosion and Sediment Control where practical; and • Any mixed building rubble such as bricks and plasterboard will be placed in Mixed Builders Waste bins located in the site compound waste management area and sent to a resource recovery facility for sorting and recycling.	• Office waste bins will be segregated into the following recycling streams Comingled/Paper and Cardboard/ Organics; • Recyclable construction waste including steel, concrete and timber will be segregated on site before being removed to a resource recovery facility. • Verified/classified spoil material will be collected by licenced contractor and disposed at suitably lined landfill.	• Any oily rags or used spill kit material to be placed in the oily waste bin and disposed off-site by licenced contractor; • Asbestos containing waste is only to be handled or removed by occupational hygienist or AS1/AS2 removal contractor TBA; and • Waste oil/paints will be stored in bunded drums at the allocated regulated waste section of the Waste Management area. • All hazardous waste and contaminated soil will be tracked using a Waste Tracking Register	• Identify procurement initiatives specific to the Project including packaging reduction and return, bulk loads; and • Incorporation of reusable temporary works such as proprietary formwork systems.

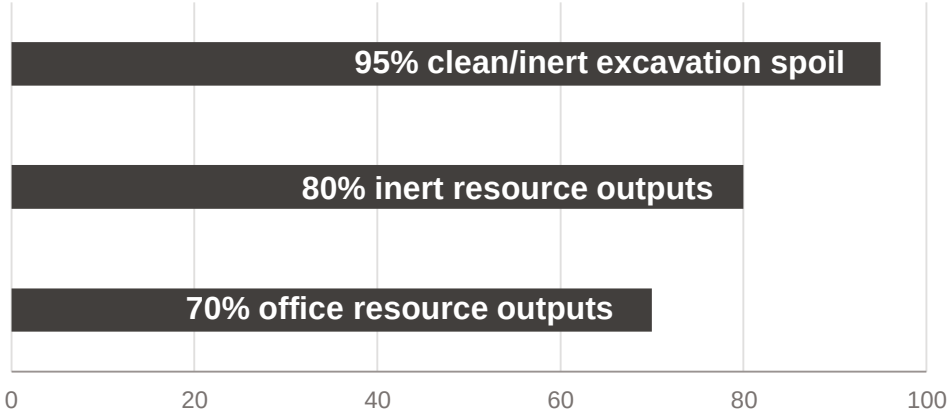
Detailed strategies relevant to construction phase to be implemented on site. These strategies are broken down by waste stream and include:

- General Waste Strategy
- Recyclable Waste Strategy
- Hazardous Waste Strategy

Procurement involvement must be maintained throughout the duration of the Project, **waste reduction starts with prevention.**

Waste Strategy

AAA Waste Targets



Project targets align with the ISCA default targets which were developed according to best practice Australian targets, based on the Australian National Waste Report 2016.

Waste Avoidance and Resource Recovery Strategy 2030 – key elements

VISION	*Western Australia will become a sustainable, low-waste, circular economy in which human health and the environment are protected from the impacts of waste.*		
OBJECTIVES	**Avoid** *Western Australians generate less waste.*	**Recover** *Western Australians recover more value and resources from waste.*	**Protect** *Western Australians protect the environment by managing waste responsibly.*
TARGETS	⊙ **2025** – 10% reduction in waste generation per capita ⊙ **2030** – 20% reduction in waste generation per capita	⊙ **2025** – Increase material recovery to 70% ⊙ **2030** – Increase material recovery to 75% ⊙ **From 2020** – Recover energy only from residual waste	⊙ **2030** – No more than 15% of waste generated in Perth and Peel regions is landfilled. ⊙ **2030** – All waste is managed and/or disposed to better practice facilities

Waste Strategy

How will we achieve our waste targets?

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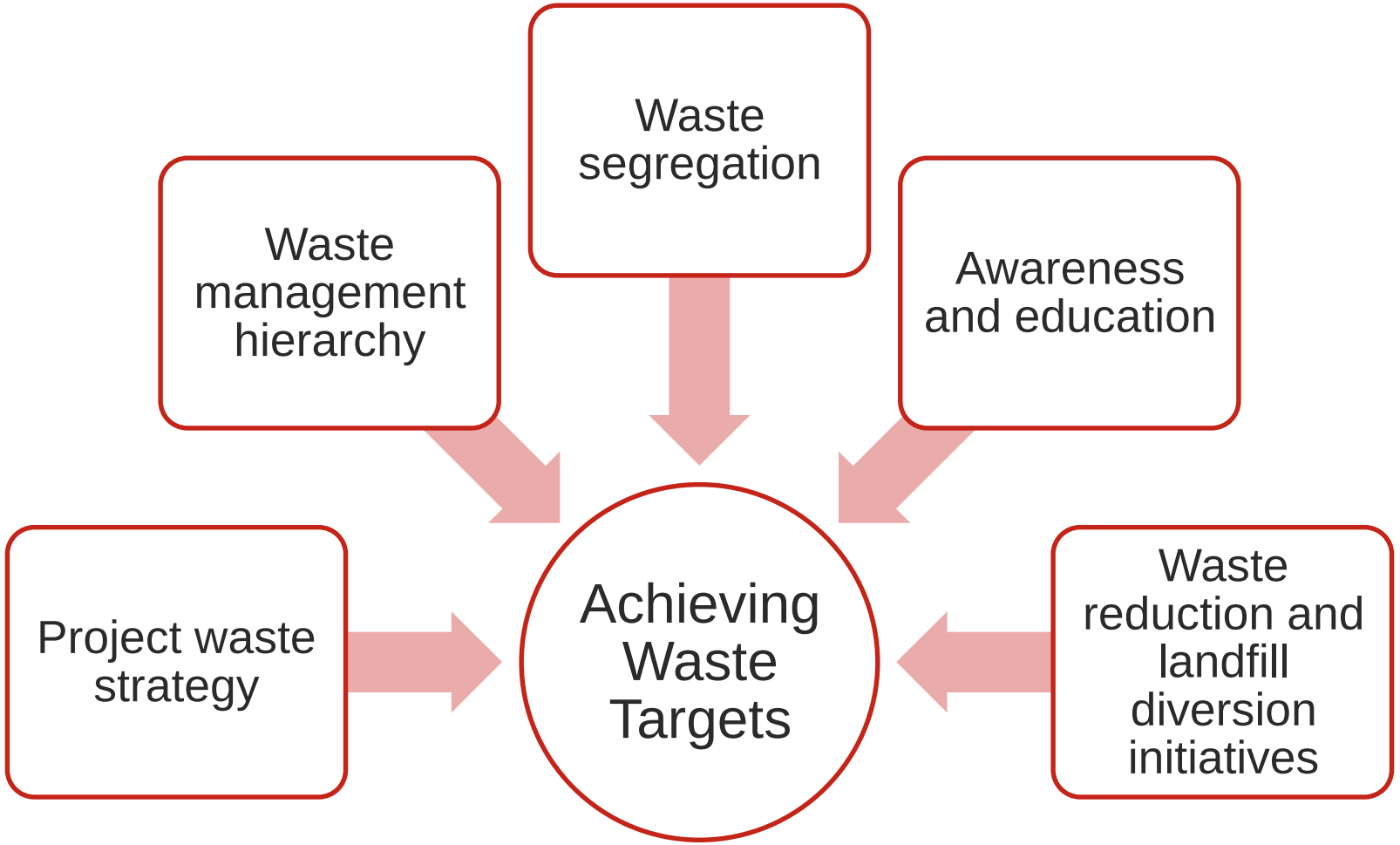

Waste Strategy

Significant Waste Streams and Segregation

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General Waste

Commingled Recycling

Construction Waste

- Steel
- Concrete
- Timber
- Mixed Builders
- Spoil
- Hazardous Waste

Waste must be segregated correctly on site to ensure optimum recycling rates and avoid refusal from recycling facilities

Waste Strategy

Waste Management Hierarchy

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1. Prevention

Minimise or avoid resource outputs through design, procurement or other processes

2. Re-use

Re-using resource outputs, especially on-site, for some other purposes

3. Recycle

Turning discarded resource outputs into some kind of useful resource by chemical transformation, typically into either energy or compost.

4. Recover

Breaking down into raw materials and reprocessing either into the same or a new product, usually offsite

5. Disposal

Landfill, where other options are unavailable or unfeasible, usually off site

Waste Strategy

Project Waste Initiatives

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- Single use plastic free
- Compost for food waste and compostable packaging
- Encourage the use of re-useable cups or provide compostable alternatives
- Consider waste impacts when planning events such as milestone BBQs
- Environment and sustainability reward and recognition program

It is predicted that we will generate 1,120kg of food and other compostable waste throughout the duration of the project. This is based on the assumption that 20L of food waste will be generated per week.

Landfill

- $11/240L
- 2,128 CO2-e (kg)
- Equivalent to 190 days electricity consumption

vs.

Compost

- $20/240L
- Prevent GHG emissions
- Help to achieve 70% landfill diversion target

Any suggestions or ideas?