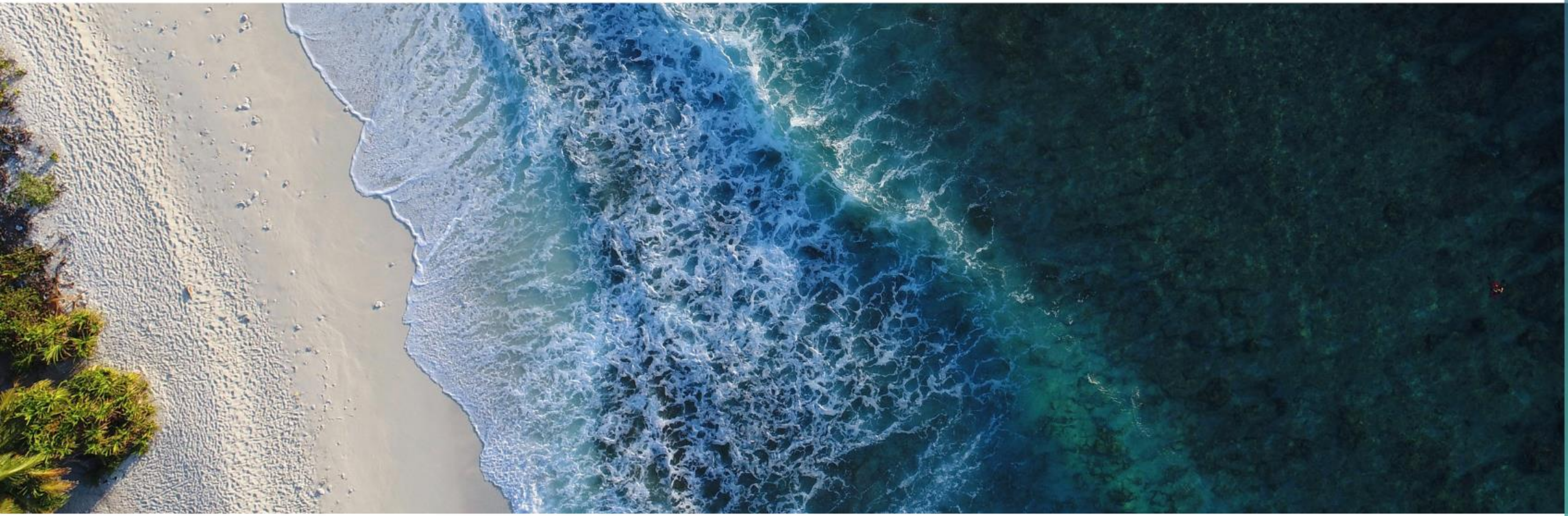
Stormwater Fundamentals Series – Gross Pollutant Traps

Presented by Peter Worth & Daniel Page
12 June 2024



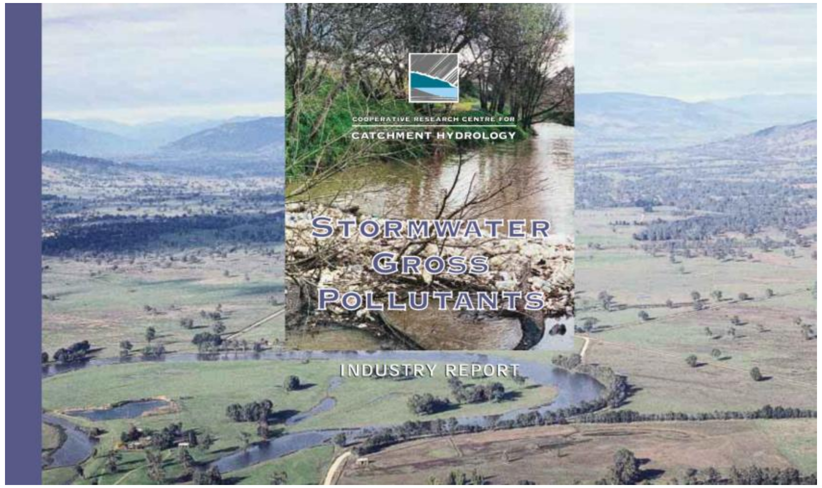
Agenda

- What is a 'gross pollutant' ?
- History of Gross Pollutant Trap's (GPTs)
- Different types of GPT's (& suitable applications)
- Key design & management considerations

What is a ‘gross pollutant’ ?

What is a ‘gross pollutant’ ?

- *“gross pollutants are defined as debris items larger than five millimetres”*
  - Source: Cooperative Research Centre for Catchment Hydrology, *Stormwater Gross Pollutants*, Industry Report, Report 97/11, December 1997



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History of GPT’s

History of GPT’s

- The first GPT to be extensively tested by a university was the CDS Technology GPT
- 1990s & early 2000s:
  - often the only treatment system able to be retrofitted

COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

Industry Report
Report 97/11
December 1997

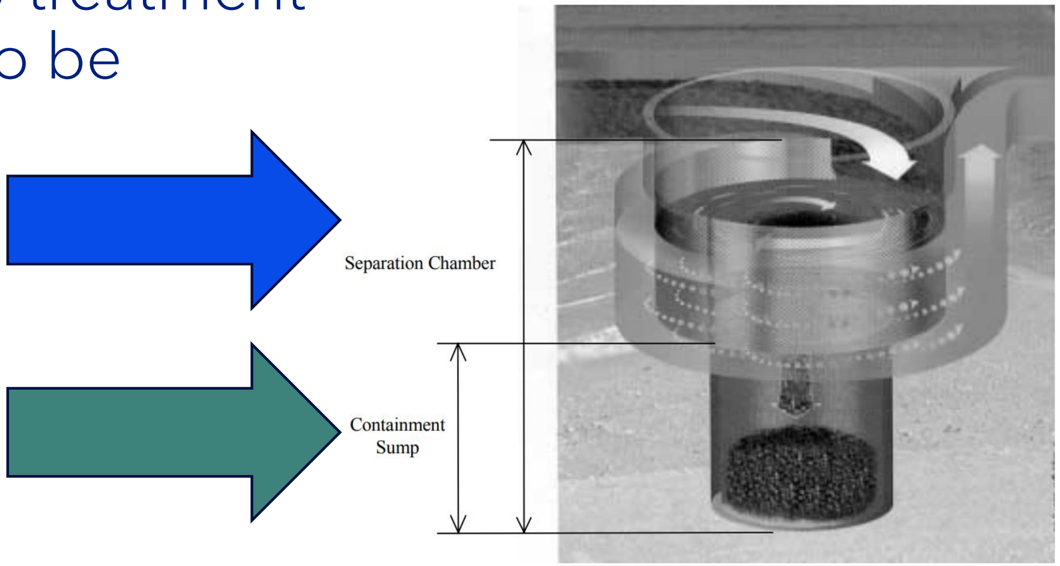
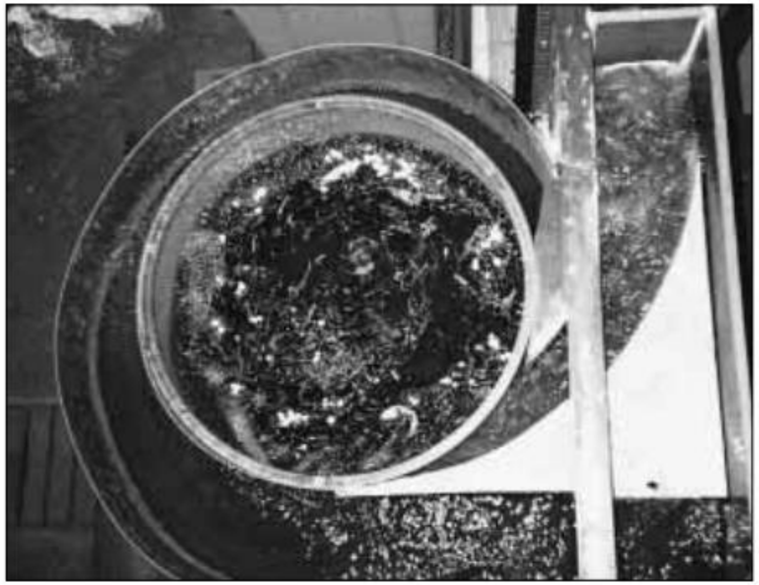


Figure 3: Isometric Representation of the CDS unit (CDS Technologies, 1998)

Continuous Deflective Separation (CDS)

The continuous deflective separation (CDS) device is installed in stormwater channels and works by diverting the incoming flow of stormwater and pollutants into a pollutant separation and containment chamber. Solids within the separation chamber are kept in continuous motion, and are prevented from ‘blocking’ the screen. Water passes through the screen and flows downstream. The non-blocking screen ensures that all gross pollutants are retained except for flows that overflow the by-pass weir during large floods. Floating objects are kept in continuous motion on the water surface, while heavier pollutants settle into a containment sump from where they can be routinely removed.



A continuous deflective separation device (CDS) in the laboratory

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History of GPT's

- Sometimes referred to as a 'primary treatment device'
- GPTs were in initially installed on 'problem sites'
  - where significant visual litter was impacting a waterway or beach

Managing Urban Stormwater: Treatment Techniques

November 1997

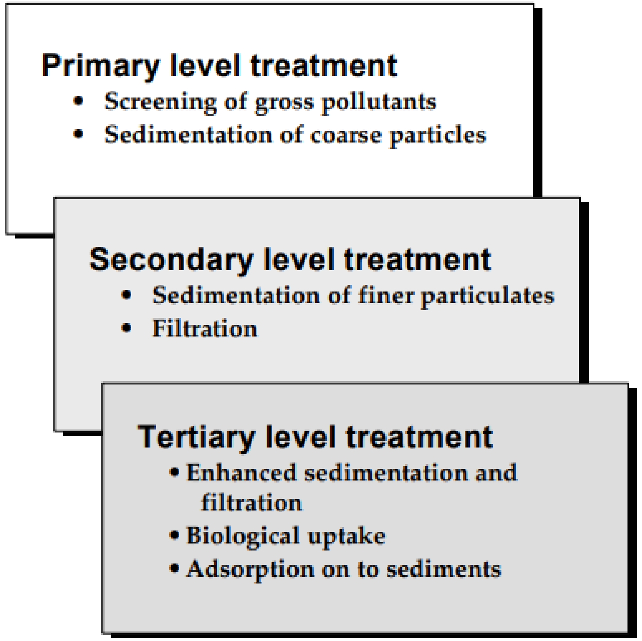

Figure 2.1 - Levels of stormwater treatment (adapted from EPAV (1996))

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History of GPT's

Figure 9.1 Gross Pollutants at the Torrens Weir

Source: Courtesy of Australian Water Environments

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History of GPT's

Gross Pollutant Material

Literature Review on Performance Testing Approaches for Gross Pollutant Traps

Luis Neumann and Ashok Sharma

Report to Stormwater Industry Association

2010

Initially, GPTs were designed to capture mainly litter and debris, but they have evolved and now are capable of not only capturing those pollutants, but also capture Suspended Sediment (SS) and hydrocarbons. As a benefit of capturing sediment, GPTs also can potentially remove particulate bound nutrients (nitrogen and phosphorus) as well as heavy metals and other pollutants that are particle bound.

Source: Murray Powell – Optima Stormwater

Different types of GPT's (& suitable applications)

GPT types

Gravity Separators

1. Difference in specific gravity traps (systems which use gravity to separate pollutants that float and that settle without the use of screens by incorporating baffles/booms in (a series of) chambers)

Direct Screens

2. Direct screening (devices that incorporate screens in various orientations to the flow and which are not self cleansing)

Hydrodynamic Separators

3. Vortex type devices (devices that direct flow to produce vortices/hydrodynamic separation, but do not have a screen)

Indirect Screens

4. Continuous deflective separation (devices that combine a vortex/hydrodynamic separation with a non-blocking screening system)

Others or Combinations

5. Others (e.g. inclined screens, devices combining different groups, etc)

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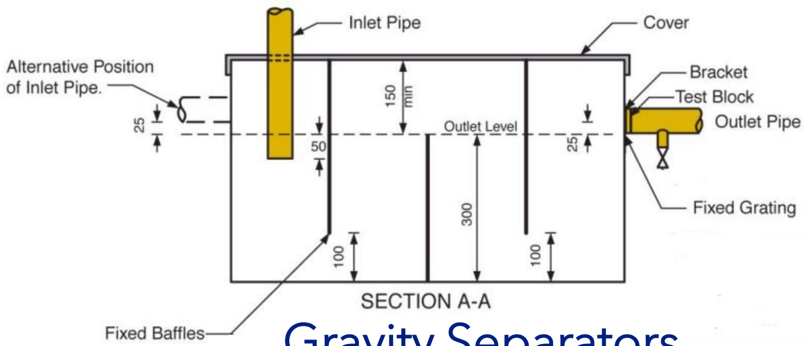
These 5 GPT groups still exist today

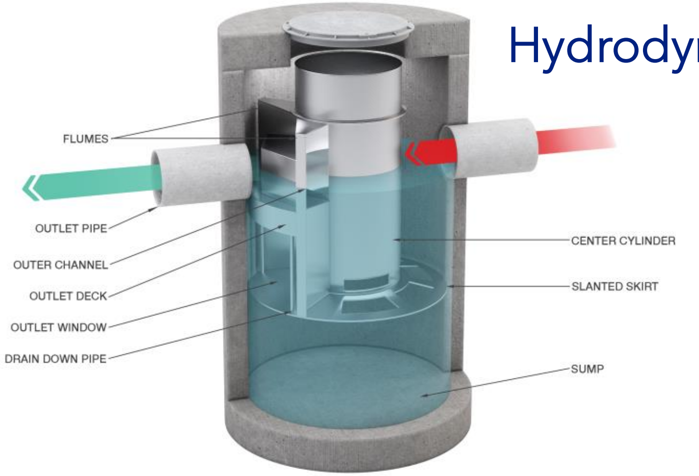
Different types of GPT's (& suitable applications)



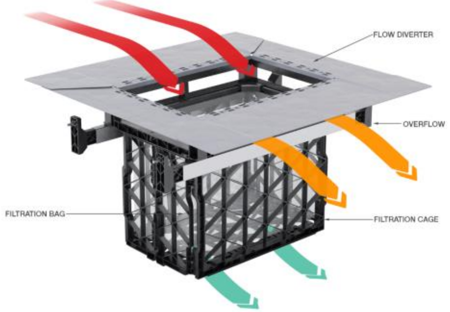
Gravity Separators

Source: Victorian Building Authority 2014

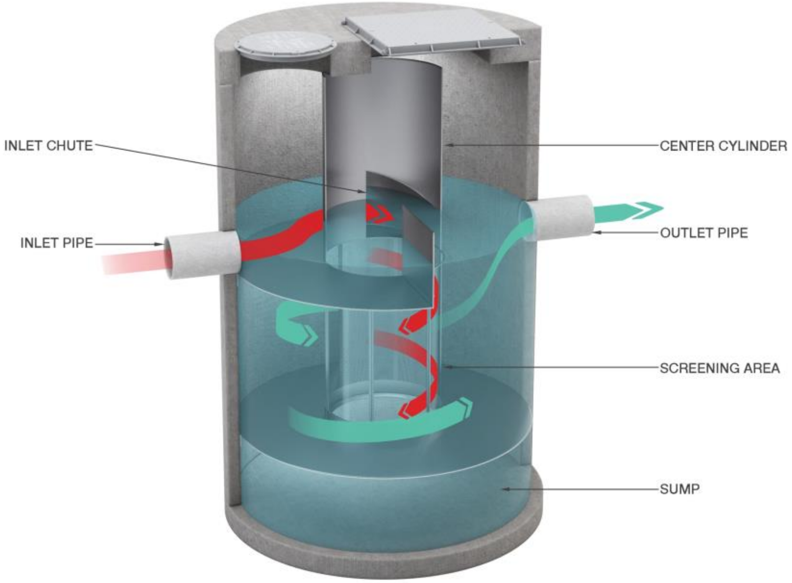
Hydrodynamic Separators



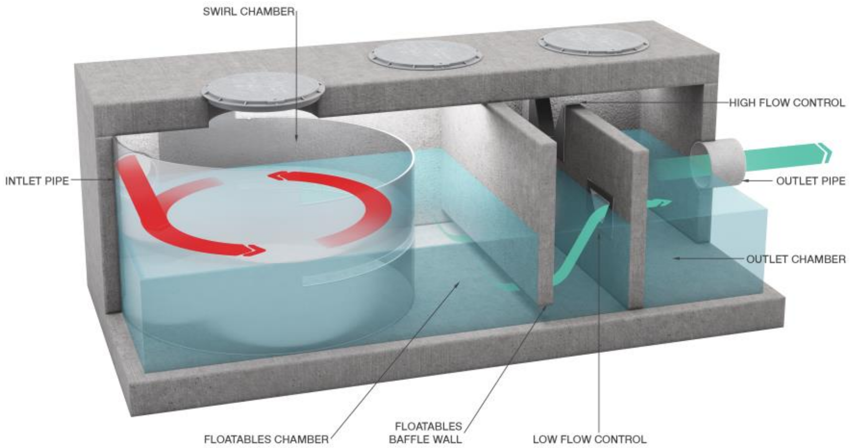
Indirect Screens



Direct Screens



Others or Combinations



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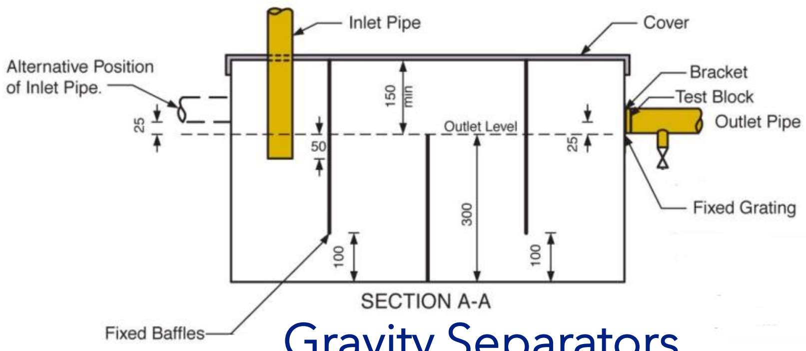
Different types of GPT's (& suitable applications)



Gravity Separators

Source: Victorian Building Authority 2014

1

- Hydrocarbons
- Metals
- Sediments

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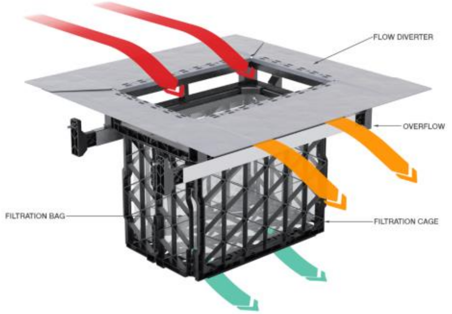
Source: Victorian Metal Traders

Different types of GPT's (& suitable applications)



Direct Screens

2

- Litter
- Sediments

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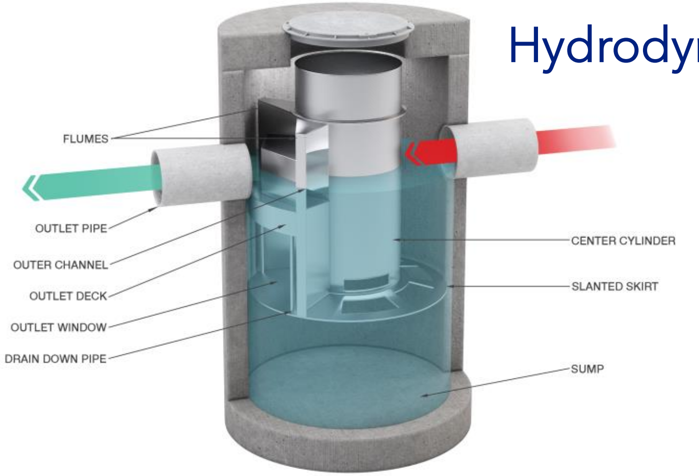
Different types of GPT's (& suitable applications)

Source: Melbourne Airport



Hydrodynamic Separators

3

- Hydrocarbons
- Sediments

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Different types of GPT’s (& suitable applications)

Source: The West Australian

- Hydrocarbons
- Course Sediments
- Fine Sediments
- Litter

4

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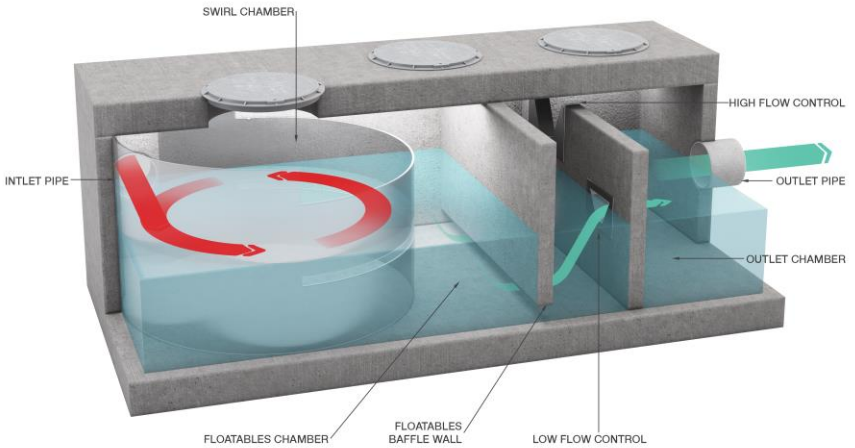
Others or Combinations



Different types of GPT's (& suitable applications)

34 OceanSave GPT's

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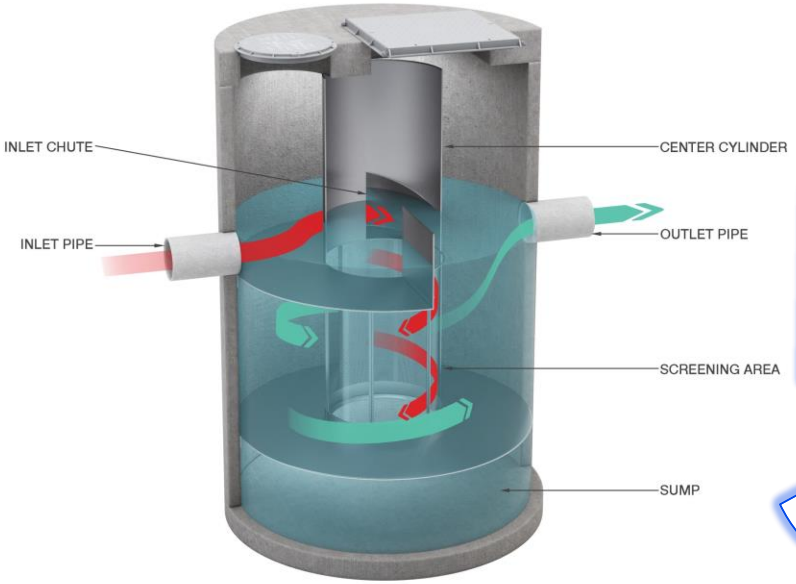
Indirect Screens



5

- Litter
- Gross pollutants
- Course sediments
- Fine sediments
- Organics
- Hydrocarbons
- Heavy metals

Source:

Shellharbour City Council | Frasers Property

Key design & management considerations

Key design & management considerations

Literature Review on Performance Testing Approaches for Gross Pollutant Traps

Luis Neumann and Ashok Sharma

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2010

The performance, operation and maintenance requirements of Gross Pollutant Traps (GPTs) are determined by individual design characteristics, catchment characteristics and stormwater composition. Design, function and the degree of sophistication of GPTs varies widely, ranging from simpler capture baskets to highly engineered models. The selection of GPTs for a particular site takes several factors in consideration, such as (Wong *et al.* 2000; Engineers Australia 2006)

5

- Location and layout
- Pollutant removal efficiency
- Design, bypass flow and operation at above design flow
- Pollutant load
- Maintenance costs and life cycle assessment

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Key design & management considerations

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1

- Location and layout

Where is the best spot for a GPT?

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Key design & management considerations

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2

- Pollutant removal efficiency

What performance do I need?

The water quality targets under Part J and principally the *Blacktown Growth Centres Development Control Plan* are noted in Table 1.

Pollutant	Post development pollutant reduction targets (percentage of post development annual average load)
Gross pollutants (GP)	90
Total suspended solids (TSS)	85
Total phosphorous (TP)	65
Total nitrogen (TN)	45
Total hydrocarbons	90

Table 1. Required percentage reductions in post development annual average load of pollutants

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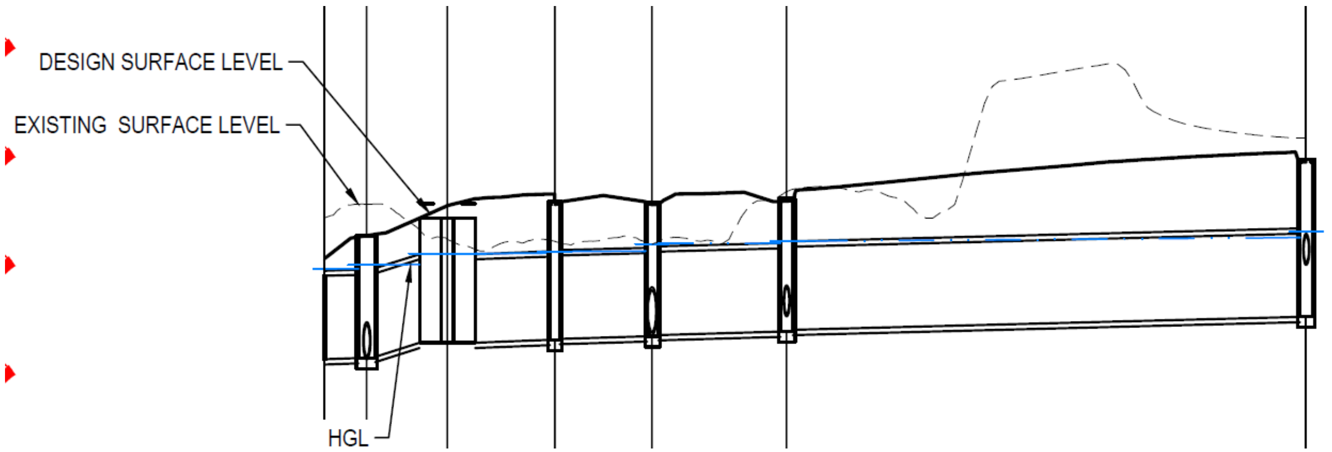
- Design, bypass flow and operation at above design flow

What is the peak flow rate?



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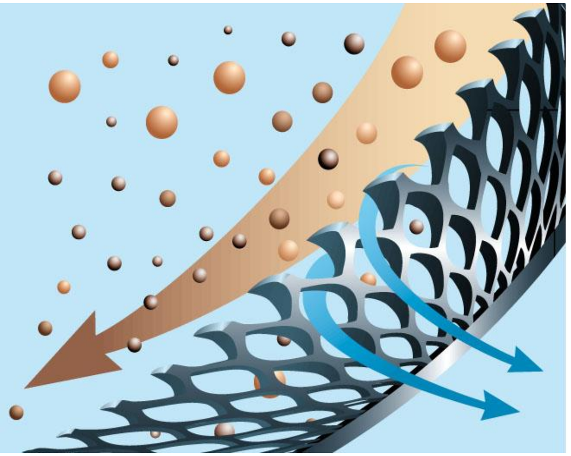
Key design & management considerations

Treatable flow rate

Vortex separation and Hydrodynamic separators devices remain fully operational for the entire storm event and therefore were able to be designed for a smaller storm event.

Pics source Rocla CDS Brochure 2008



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What is the Treatment flow rate?

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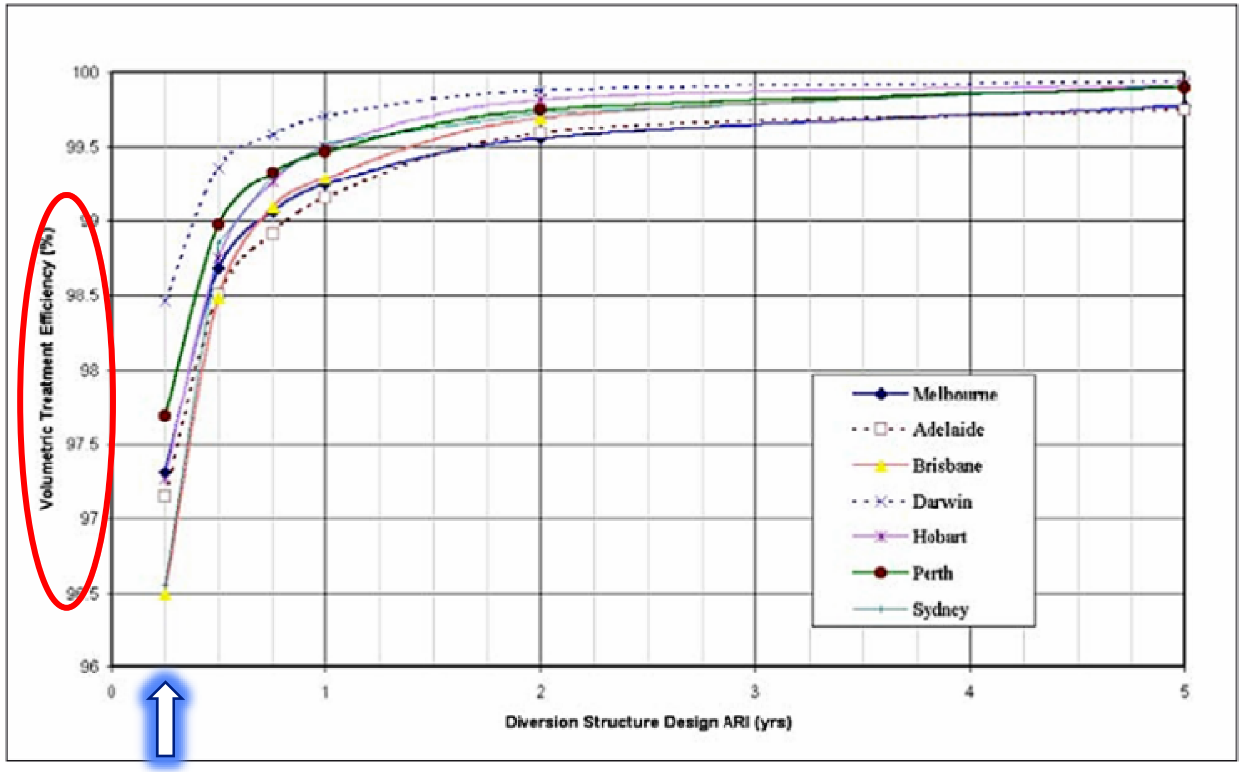

Figure 3. Treatment efficiency for various design ARIs. (Source: Wong et al. 1999.)

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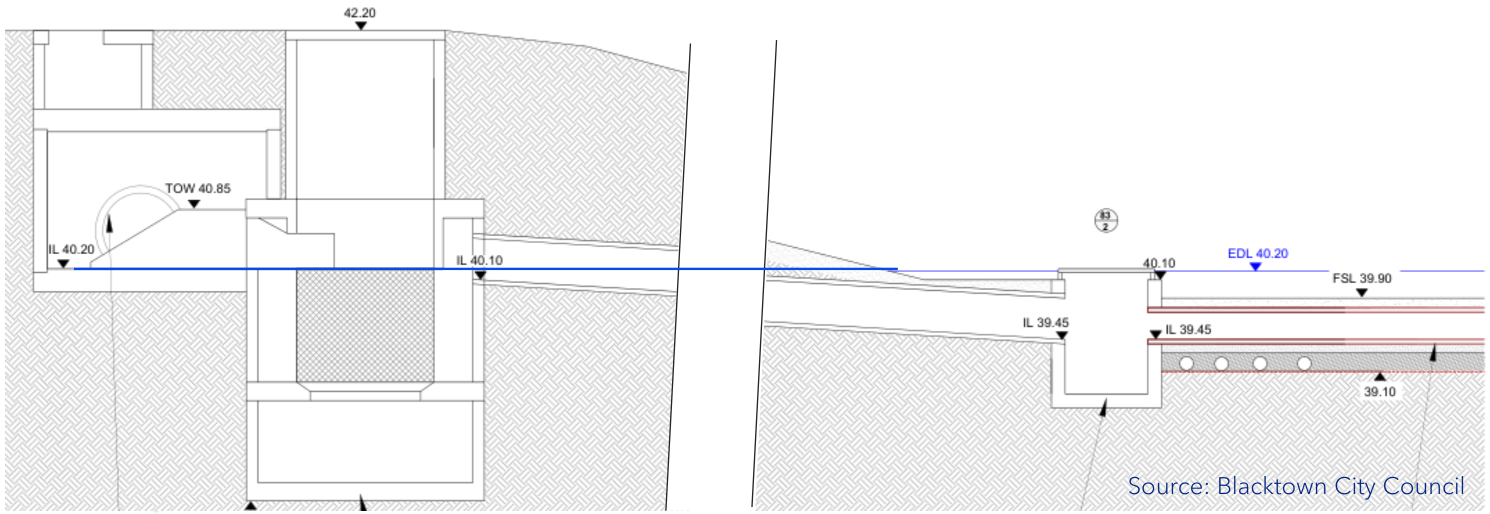
Downstream water impacts

- When GPTs are pre-treating a bio
  - Surcharge inlets
  - Extended detention depth
  - Low flow through the bio

All these can impact the GPT treatable flow rate

3



Source: Blacktown City Council

Key design & management considerations

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4

- Pollutant load

How much storage volume?

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Key design & management considerations

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5

- Maintenance costs and life cycle assessment

Is it able to be maintained?

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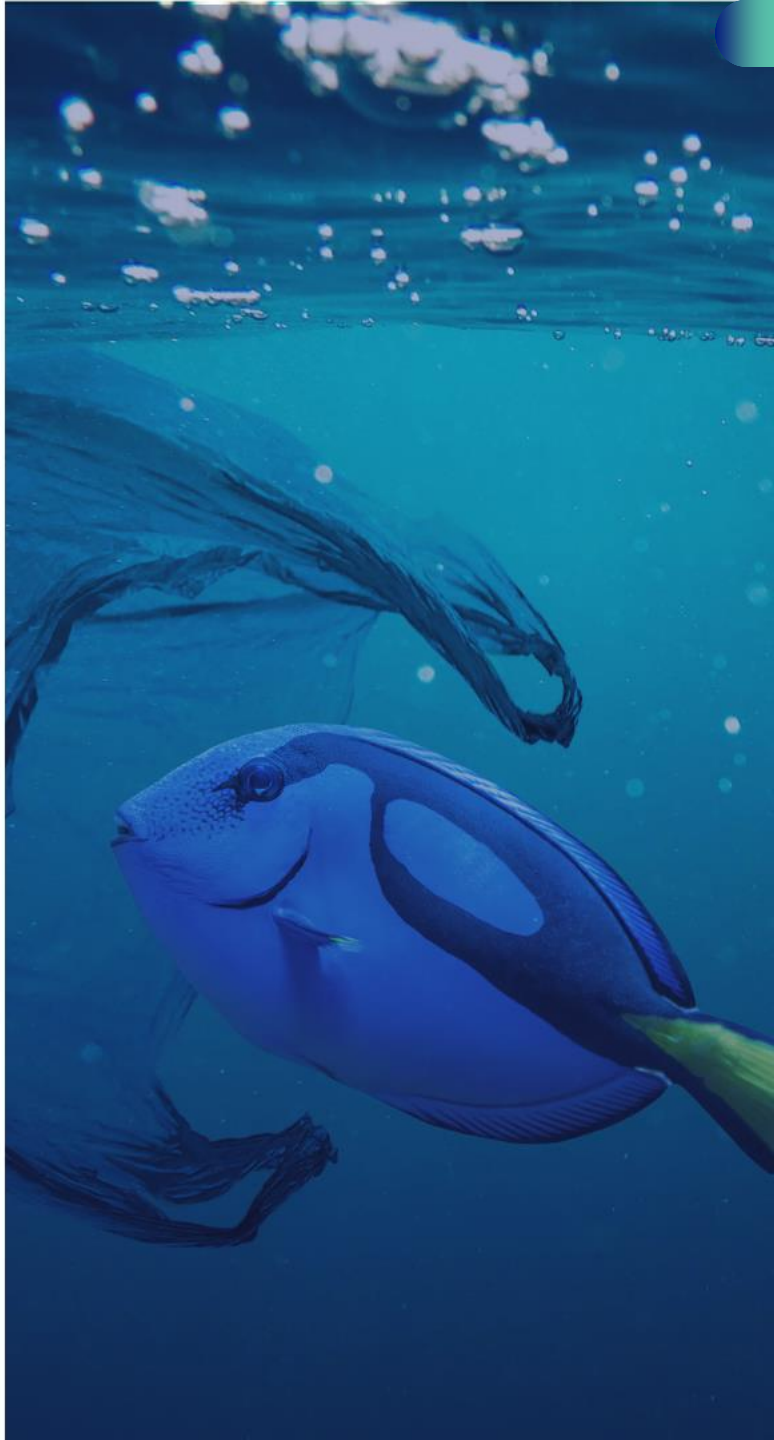

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