Role and Selection of Plants
Outline

• Role of plants and selection of species for:
  – Pollutant removal
  – Hydraulic conductivity

• Other considerations and maintenance
Effect on pollutant removal

• No significant effect for
  – TSS
  – Heavy metals

• Selection of species important for:
  – Nutrients (TP and particularly TN)
Unvegetated Media Tests: Results

- Metals: excellent in all cases
- Trapped within first 10 centimetres

<table>
<thead>
<tr>
<th>Week</th>
<th>Sand</th>
<th>Sandy Loam</th>
<th>Sandy</th>
<th>SL + hydrocell</th>
<th>SL + verm/perl</th>
<th>SL + comp/mul</th>
<th>SL/C/M on charcoal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>89</td>
<td>99</td>
<td>97</td>
<td>96</td>
<td>95</td>
</tr>
</tbody>
</table>

![Graph showing concentration vs. depth for Sandy Loam with markers for Cu, Pb, Zn]
Vegetation Trials: *Results*

1. For TSS and most metals:
   - Vegetation doesn’t matter; removal is by the soil filter

<table>
<thead>
<tr>
<th></th>
<th>Stormwater</th>
<th>Unvegetated</th>
<th>Vegetated</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS (mg l⁻¹)</td>
<td>206 ± 32</td>
<td>6 ± 4 (3%)</td>
<td>5 ± 0 (2%)</td>
</tr>
<tr>
<td>Al (mg l⁻¹)</td>
<td>5.45 ± 0.27</td>
<td>0.16 ± 0.04 (3%)</td>
<td>0.17 ± 0.02 (3%)</td>
</tr>
<tr>
<td>Cr (µg l⁻¹)</td>
<td>11 ± 1</td>
<td>1 ± 0 (12%)</td>
<td>1 ± 0 (9%)</td>
</tr>
<tr>
<td>Cu (µg l⁻¹)</td>
<td>237 ± 23</td>
<td>6 ± 2 (3%)</td>
<td>5 ± 0 (2%)</td>
</tr>
<tr>
<td>Fe (mg l⁻¹)</td>
<td>4.66 ± 0.35</td>
<td>3.11 ± 1.46 (67%)</td>
<td>5.01 ± 0.61 (107%)</td>
</tr>
<tr>
<td>Mn (µg l⁻¹)</td>
<td>47 ± 0</td>
<td>371 ± 105 (794%)</td>
<td>599 ± 62 (1283%)</td>
</tr>
<tr>
<td>Ni (µg l⁻¹)</td>
<td>10 ± 1</td>
<td>10 ± 2 (97%)</td>
<td>12 ± 1 (118%)</td>
</tr>
<tr>
<td>Pb (µg l⁻¹)</td>
<td>146 ± 3</td>
<td>&lt;1 (&lt;1%)</td>
<td>&lt;1 (&lt;1%)</td>
</tr>
<tr>
<td>Zn (mg l⁻¹)</td>
<td>1.80 ± 0.04</td>
<td>0.01 ± 0.00 (&lt;1%)</td>
<td>0.02 ± 0.01 (1%)</td>
</tr>
</tbody>
</table>
Unvegetated Media Tests: *Results*

- TSS: excellent in all cases
- Trapped at surface; release is from within media

<table>
<thead>
<tr>
<th>Media</th>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td></td>
<td>100 (0)</td>
<td>100 (0)</td>
<td>99 (0)</td>
<td>98 (1)</td>
</tr>
<tr>
<td><strong>SL</strong></td>
<td></td>
<td>91 (6)</td>
<td>92 (4)</td>
<td>88 (7)</td>
<td>87 (13)</td>
</tr>
<tr>
<td><strong>SL/H</strong></td>
<td></td>
<td>88 (4)</td>
<td>88 (7)</td>
<td>88 (6)</td>
<td>80 (16)</td>
</tr>
<tr>
<td><strong>SL/V/P</strong></td>
<td></td>
<td>90 (2)</td>
<td>91 (3)</td>
<td>85 (6)</td>
<td>86 (4)</td>
</tr>
<tr>
<td><strong>SL/C/M</strong></td>
<td></td>
<td>84 (9)</td>
<td>91 (4)</td>
<td>86 (6)</td>
<td>83 (11)</td>
</tr>
<tr>
<td><strong>SL/C/M on CH</strong></td>
<td></td>
<td>96 (2)</td>
<td>97 (0)</td>
<td>96 (2)</td>
<td>95 (2)</td>
</tr>
</tbody>
</table>

TSS: excellent in all cases
Trapped at surface; release is from within media
Unvegetated Media Tests:

**Results**

- Phosphorus: leaching
Vegetation Trials: Results

2. For nutrients:
   - Plants are important, and
   - There are significant differences between species

![Image showing a graph with species on the x-axis and total nitrogen on the y-axis. The graph indicates a statistical significance with an F value of 3.4, P < 0.001.]
Vegetation Trials: \textit{Results}

2. For nutrients:
   - Plants are important, \textit{and}
   - There are significant differences between species

![Graph showing Total Phosphorus with species comparison](image)
N removal: effect of species & time

-250%  -200%  -150%  -100%  -50%  0%  50%  100%

Sampling 1  Sampling 2  Sampling 3  Sampling 4  Sampling 5

Carex  Dianella  Microleana  Leucophyta / Non-Vegetated  Melaleuca  Non-Vegetated

Carex  Dianella  Microleana  Leucophyta / Non-Vegetated  Melaleuca  Non-Vegetated

EDA W | AECOM
FAWB Facility for Advancing Water Biofiltration
MONASH University
Selecting plants for N removal

• >50% plants made up of:
  – Carex species
  – Juncus species
  – Melaleuca species
  – Goodenia ovata

• Remainder for aesthetics / biodiversity, etc
Effect on hydraulic conductivity

- Plants essential to maintenance of hydraulic conductivity
- Differences between plants
- Change over time
Species with thick roots help…

- limit decrease in K (by creating macropores)
The effect grows with time
Other considerations & maintenance

- Selection should also consider
  - Biodiversity (Ecological Vegetation Classes, indigenous plants)
  - Diversity for robustness
  - Aesthetics
  - Suitability for climate / wet-dry regime

- Higher density
  - Less weed invasion
  - Lower maintenance