APPENDICES

1: MASTER CONCEPT PLAN   2
2: DETAILED DRAWINGS      3
3: PLANT SCHEDULE        10
4: ITEMISED COSTINGS      11
5: INTEGRATED WATER SYSTEM REPORT  20
6: USEFUL LINKS          44

This document and appendices are available at

Produced by Environment Education Victoria (EEV)

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Website: www.eev.vic.edu.au
APPENDIX 1: MASTER CONCEPT PLAN

DEER PARK NORTH PRIMARY SCHOOL

SCHOOL AS A CATCHMENT MASTER PLAN

This project was supported by a grant from the Victorian State Government

DESIGN INTENT
The project will showcase how improved liveability through creative urban greening can coexist with sustainable use of water resources.

Through a whole-of-water-cycle approach, unused areas of concrete and asphalt will be transformed into intensive and engaging learning spaces for the students, staff and local community.

A series of inter-related landscape projects will demonstrate strategies for shading, local food production, enhanced biodiversity, reduced water usage, on-site and best practice water efficiency measures.

WORKS AREAS & FEATURES LEGEND
A. PRODUCTIVE GARDEN (SEE SHEET LC-02)
- companion plants with perennial herbs
- deciduous shade trees
- drought tolerant native plants
- deciduous shade trees
- revitalised native garden beds

B. WETLAND (SEE SHEET LC-03)
- collect & treat stormwater run off from paving & irrigation:
  - gabion feature seating walls
  - native wetland plantings
  - evergreen trees to shade building

C. COMMUNITY HUB (SEE SHEET LC-04)
- collect & treat stormwater run off from paving
- revitaised native garden beds

D. RAIN GARDEN (SEE SHEET LC-05)
- rain garden to collect & treat stormwater run off from paving

E. NATIVE PLANTING (SEE SHEET LC-06)
- drought tolerant native plants
- evergreen trees to shade building

F. GRASSED COURTYARD (SEE SHEET LC-07)
- new sand pit play area
- revitalised native garden beds

G. SAND PIT (SEE SHEET LC-08)
- new sand pit play area
- revitalised native garden beds

H. COMMUNITY HUB (SEE SHEET LC-09)
- evergreen trees

I. RAIN GARDEN (SEE SHEET LC-10)
- rain garden to collect & treat stormwater run off from paving

J. NATIVE PLANTING (SEE SHEET LC-11)
- drought tolerant native plants
- evergreen trees to shade building

K. SAND PIT (SEE SHEET LC-12)
- new sand pit play area
- revitalised native garden beds

L. COMMUNITY HUB (SEE SHEET LC-13)
- evergreen trees

M. RAIN GARDEN (SEE SHEET LC-14)
- rain garden to collect & treat stormwater run off from paving

N. NATIVE PLANTING (SEE SHEET LC-15)
- drought tolerant native plants
- evergreen trees to shade building

O. SAND PIT (SEE SHEET LC-16)
- new sand pit play area
- revitalised native garden beds

P. COMMUNITY HUB (SEE SHEET LC-17)
- evergreen trees

Q. RAIN GARDEN (SEE SHEET LC-18)
- rain garden to collect & treat stormwater run off from paving

R. NATIVE PLANTING (SEE SHEET LC-19)
- drought tolerant native plants
- evergreen trees to shade building

S. SAND PIT (SEE SHEET LC-20)
- new sand pit play area
- revitalised native garden beds

T. COMMUNITY HUB (SEE SHEET LC-21)
- evergreen trees

U. RAIN GARDEN (SEE SHEET LC-22)
- rain garden to collect & treat stormwater run off from paving

V. NATIVE PLANTING (SEE SHEET LC-23)
- drought tolerant native plants
- evergreen trees to shade building

W. SAND PIT (SEE SHEET LC-24)
- new sand pit play area
- revitalised native garden beds

X. COMMUNITY HUB (SEE SHEET LC-25)
- evergreen trees

Y. RAIN GARDEN (SEE SHEET LC-26)
- rain garden to collect & treat stormwater run off from paving

Z. NATIVE PLANTING (SEE SHEET LC-27)
- drought tolerant native plants
- evergreen trees to shade building

APPENDIX 1: MASTER CONCEPT PLAN

DEER PARK NORTH PRIMARY SCHOOL

SCHOOL AS A CATCHMENT MASTER PLAN

This project was supported by a grant from the Victorian State Government

DEVELOPED BY JOSH BYRNE & ASSOCIATES PTY LTD
www.joshbyrne.com.au
16 phillimore st, fremantle wa 6160
suite 10, fremantle chamber of commerce

DESIGN INTENT
The project will showcase how improved liveability through creative urban greening can coexist with sustainable use of water resources.

Through a whole-of-water-cycle approach, unused areas of concrete and asphalt will be transformed into intensive and engaging learning spaces for the students, staff and local community.

A series of inter-related landscape projects will demonstrate strategies for shading, local food production, enhanced biodiversity, reduced water usage, on-site and best practice water efficiency measures.

WORKS AREAS & FEATURES LEGEND
A. PRODUCTIVE GARDEN (SEE SHEET LC-02)
- companion plants with perennial herbs
- deciduous shade trees
- drought tolerant native plants
- deciduous shade trees
- revitalised native garden beds

B. WETLAND (SEE SHEET LC-03)
- collect & treat stormwater run off from paving & irrigation:
  - gabion feature seating walls
  - native wetland plantings
  - evergreen trees to shade building

C. COMMUNITY HUB (SEE SHEET LC-04)
- collect & treat stormwater run off from paving
- revitalised native garden beds

D. RAIN GARDEN (SEE SHEET LC-05)
- rain garden to collect & treat stormwater run off from paving

E. NATIVE PLANTING (SEE SHEET LC-06)
- drought tolerant native plants
- evergreen trees to shade building

F. GRASSED COURTYARD (SEE SHEET LC-07)
- new sand pit play area
- revitalised native garden beds

G. SAND PIT (SEE SHEET LC-08)
- new sand pit play area
- revitalised native garden beds

H. COMMUNITY HUB (SEE SHEET LC-09)
- evergreen trees

I. RAIN GARDEN (SEE SHEET LC-10)
- rain garden to collect & treat stormwater run off from paving

J. NATIVE PLANTING (SEE SHEET LC-11)
- drought tolerant native plants
- evergreen trees to shade building

K. SAND PIT (SEE SHEET LC-12)
- new sand pit play area
- revitalised native garden beds

L. COMMUNITY HUB (SEE SHEET LC-13)
- evergreen trees

M. RAIN GARDEN (SEE SHEET LC-14)
- rain garden to collect & treat stormwater run off from paving

N. NATIVE PLANTING (SEE SHEET LC-15)
- drought tolerant native plants
- evergreen trees to shade building

O. SAND PIT (SEE SHEET LC-16)
- new sand pit play area
- revitalised native garden beds

P. COMMUNITY HUB (SEE SHEET LC-17)
- evergreen trees

Q. RAIN GARDEN (SEE SHEET LC-18)
- rain garden to collect & treat stormwater run off from paving

R. NATIVE PLANTING (SEE SHEET LC-19)
- drought tolerant native plants
- evergreen trees to shade building

S. SAND PIT (SEE SHEET LC-20)
- new sand pit play area
- revitalised native garden beds

T. COMMUNITY HUB (SEE SHEET LC-21)
- evergreen trees

U. RAIN GARDEN (SEE SHEET LC-22)
- rain garden to collect & treat stormwater run off from paving

V. NATIVE PLANTING (SEE SHEET LC-23)
- drought tolerant native plants
- evergreen trees to shade building

W. SAND PIT (SEE SHEET LC-24)
- new sand pit play area
- revitalised native garden beds

X. COMMUNITY HUB (SEE SHEET LC-25)
- evergreen trees

Y. RAIN GARDEN (SEE SHEET LC-26)
- rain garden to collect & treat stormwater run off from paving

Z. NATIVE PLANTING (SEE SHEET LC-27)
- drought tolerant native plants
- evergreen trees to shade building
DESIGN INTENT

The productive garden will provide hands-on opportunities for students, staff and local community to engage in organic food production in a dedicated and protected area for ease of management.

Key components include rotational vegetable beds for seasonal cropping, including dedicated beds for universal access, trellised fruit trees under planted with a diverse array of herbs, flowers and other companion species. Composting systems including bays, bins and worm farms for processing organic material and an outdoor teaching space for holding classes. Irrigation will be provided via a hydrozoned drip-line system fed from an existing rainwater tank, with mains water backup.
DEER PARK NORTH PRIMARY SCHOOL
WETLAND
Project No. 1427 • Issue Date September 2015 • Designed/Checked by A&H/L/JB • Drawing No. LC-03

DESIGN INTENT
Harsh, impervious concrete will be replaced with a ‘dampland depression’ type constructed wetland for capturing and filtering stormwater runoff. The area will be mass planted with native rushes, sedges and grasses, as well as a selection of trees for shade and bird habitat.

The existing 4m security fence will be reduced in height and softened with native plantings to create a welcoming arrival.

D. replace soil with free draining aggregate. Use mounds to increase the wetland flow path

E. densely planted native wetland plants & trees throughout

F. low height gabion walls to stabilise banks, provide seating & potential habitat

G. create culvert under path. Lower level of path allow water to spill over top of path in peak rain events

H. local stone formed creek bed draining towards existing stormwater side entry pit

A. overflow from existing rain water tank discharged into wetland

B. capture surface water flows in nonslip trench grate & discharge into wetland

C. use large local stone to stabilise the wetland banks throughout including the inlet zone

These project was supported by a grant from the Victorian State Government

DESIGN INTENT

The adjacent ‘community hub’ area will be enhanced with deciduous shade trees for summer shade/winter light, and tables and benches positioned to foster socialising.

The existing 4m security fence along the front boundary will be reduced in height and softened with native plantings.

A. install outdoor picnic tables with seating under shade trees
B. remove existing section of concrete, install new deciduous shade trees - see tree planting detail
C. revitalise & naturalise existing garden bed with drought tolerant native plantings
D. light coloured compacted gravel fines to soften & extend paved area
E. low height gabion walls to provide seating & potential habitat
F. local stone creek bed draining towards existing stormwater side entry pit

DEER PARK NORTH PRIMARY SCHOOL COMMUNITY HUB
Project No. 1427 • Issue Date September 2015 • Designed/Checked by A8/HL/IB • Drawing No. LC-04

This project was supported by a grant from the Victorian State Government

A. rain garden depression to store & treat rainwater from surrounding buildings, planted with dense wetland plantings

B. native wetland trees to provide shade, to east & west elevations of classrooms

C. drought tolerant native vegetation plantings outside of the rain garden

D. deciduous tree to provide shade

E. additional outdoor seating provided under central shade tree

**DESIGN INTENT**

An exposed area between two classrooms will be transformed into a shaded space with the plantings sustained by redirecting the roof runoff from two nearby buildings. This simple ‘rain garden’ will reduce stormwater runoff and improve its quality, whilst creating a comfortable gathering area for play or classes.

RAIN GARDEN LEGEND

1. rainwater is harvested from the roofs of surrounding buildings

2. rain heads to prevent debris & pests from entering the plumbing

3. grated drain below down pipe for visual inspection

4. ‘T’ piece inlet in stormwater pit with connection to slotted pipe under drainage along full length of rain garden

5. underground waterproof membrane to store water in rain garden, nutrients in water utilised by wetland plantings

6. set grated outlet height to allow excess water to bypass the rain garden with water discharging into the existing stormwater system
DESIGN INTENT
The western end of the school grounds will be planted with a row of narrow trees to provide strategic shade to the adjacent gym building. A densely planted understory of native shrubs, grasses and groundcovers will present an attractive, green arrival to the school and enhance local biodiversity. The plants will be irrigated for establishment only, fed by an existing and underutilised tank.

LARGE SHRUB PLANTING DETAIL
- Hardwood tree stakes with rubber ties to tree
- Drip irrigation with dripper at base of planting
- Mulch to base, keep mulch clear of trunk
- Top of root ball level with soil, gently tease roots if required
- Improved soil around root ball
- Loosen sub base

SMALL SHRUB PLANTING DETAIL
- Drip irrigation with dripper at base of planting
- Mulch to base, keep mulch clear of stem
- Create shallow depression around planting, gently tease roots if required
- Improved soil around root ball

SMALL SHRUB PLANTING PLAN
- Drip line at regular spacings. Spacing dependent on application
- Create shallow depression around planting
- Drip line wetting pattern for a single line shown solid grey

A. Native evergreen trees to provide shade to west elevation of recreation centre
B. Revitalise existing garden bed with new drought tolerant native plantings
C. Underutilised water tank to provide irrigation water for new plantings for establishment period only
DESIGN INTENT

Two underutilised areas near the school’s Sustainability Classroom and future Productive Garden will be retrofitted to create spaces for small group meetings and play.

The ‘Grass Courtyard’ will include mounded turf embankments for sitting/laying on and be shaded by a large deciduous tree.

The sand play space will make use of existing timber bench seating and shade sails, plus reused washed sand. The surrounds will be enhanced with sensory plantings for colour and scent.

A. evergreen trees to provide shade
B. drought tolerant, native plants on the leeward side of the turf mounds and in existing garden beds
C. turf mounds formed around central tree, to create informal classroom/gathering area
D. centrally located, deciduous tree to provide shade
E. remove existing paving and install new sand pit
F. existing shade sail
G. weather resistant, outdoor blackboard on existing garden shed wall
PRODUCTIVE GARDEN
IRRIGATION NOTES
Water for drip irrigation to be supplied from existing rainwater tank, adjacent to library building. Upgrade existing pump and install mains water backup connection to ensure water is available year round.

Apply hydrozoning principles and irrigate groups of plantings with similar water needs on separate stations. Water efficient drip irrigation installed throughout.

HYDROZONING NOTES

A Hydrozone A - Vegetables
B Hydrozone B - Trees and perennial understorey plants
C Hydrozone C - Herbs
### APPENDIX 3: PLANT SCHEDULE

**DEER PARK NORTH PRIMARY SCHOOL**

This project was supported by a grant from the Victorian State Government. Project Partners: Environmental Education Victoria, Josh Byrne & Associates, Deer Park North Primary School, V202020 Vision, Melbourne Water, City West Water, Greening the West, Brimbank City Council, NewGrow, Warners Nursery, Diggers.

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#### PRODUCTIVE GARDEN

<table>
<thead>
<tr>
<th>BOTANICAL NAME</th>
<th>COMMON NAME</th>
<th>SIZE/TYPE</th>
<th>QTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VEGETABLES:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27 beds x 4m² each</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>108m² @ 2 plants per m² = 216 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>FRUIT TREES:</strong> 9 trees</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>SHADE TREES:</strong> 3 trees</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>FRUIT TREES:</strong> 15 trees</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>SHADE TREES:</strong> 1 tree</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>COMMUNITY HUB TREES:</strong> 3 trees</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>NATIVE PLANTINGS:</strong> 232m² @ 1 plant per m² = 232 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>NATIVE PLANTINGS:</strong> 52m² @ 4 plants per m² = 208 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>NATIVE PLANTINGS:</strong> 32m² @ 2 plants per m² = 64 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>NATIVE PLANTINGS:</strong> 27m² @ 2 plants per m² = 54 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>RAIN GARDEN:</strong> 16m² @ 3 plants per m² = 48 plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>GRASSED COURTYARD:</strong></td>
</tr>
</tbody>
</table>
APPENDIX 4: ITEMISED COSTINGS

This quotation was provided at the start of the project and does not reflect the actual costs. Use these as a guide when planning your project.

<table>
<thead>
<tr>
<th>SCOPE</th>
<th>HUB</th>
<th>PRODUCTIVE GARDEN</th>
<th>WETLAND</th>
<th>RAIN GARDEN</th>
<th>WESTERN IRRIGATION</th>
<th>GRASS COURTYARD</th>
<th>SAND PIT</th>
<th>TOTAL (EXCL GST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPARATION</td>
<td>$2,734.06</td>
<td>$6,306.23</td>
<td>$10,743.22</td>
<td>$4,146.18</td>
<td>$1,025.66</td>
<td>$1,649.36</td>
<td>$1,620.77</td>
<td>$28,225.48</td>
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<tr>
<td>HARD LANDSCAPE WORKS</td>
<td>$3,391.60</td>
<td>$27,497.58</td>
<td>$15,790.46</td>
<td>$7,792.14</td>
<td>$1,529.40</td>
<td>$1,247.57</td>
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<td>$57,248.75</td>
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<tr>
<td>SOFT LANDSCAPE WORKS</td>
<td>$3,397.82</td>
<td>$11,231.32</td>
<td>$1,142.84</td>
<td>$6,560.40</td>
<td>$4,679.74</td>
<td>$3,532.66</td>
<td>$1,304.23</td>
<td>$31,849.01</td>
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<td>IRRIGATION</td>
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<td>$4,479.25</td>
<td>$1,217.56</td>
<td></td>
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<td></td>
<td>$5,696.81</td>
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<tr>
<td>NET LANDSCAPE WORKS SUB-TOTAL</td>
<td>$9,523.49</td>
<td>$49,514.36</td>
<td>$27,676.52</td>
<td>$18,498.72</td>
<td>$6,922.96</td>
<td>$6,711.42</td>
<td>$4,172.57</td>
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<tr>
<td>15% PROJECT MANAGEMENT FEES</td>
<td>$1,428.52</td>
<td>$7,427.16</td>
<td>$4,151.48</td>
<td>$2,774.81</td>
<td>$1,038.44</td>
<td>$1,006.71</td>
<td>$625.89</td>
<td>$18,463.01</td>
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<tr>
<td>TOTAL PLUS PROJECT MANAGEMENT FEES</td>
<td>$10,952.01</td>
<td>$56,941.54</td>
<td>$31,828.00</td>
<td>$21,273.53</td>
<td>$7,961.40</td>
<td>$7,718.13</td>
<td>$4,798.45</td>
<td>$141,473.05</td>
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<td>GST</td>
<td>$1,035.20</td>
<td>$5,694.15</td>
<td>$3,182.80</td>
<td>$2,127.35</td>
<td>$776.14</td>
<td>$771.81</td>
<td>$479.85</td>
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<tr>
<td>TOTAL INCLUDING GST</td>
<td>$12,047.21</td>
<td>$62,635.69</td>
<td>$35,010.79</td>
<td>$23,400.88</td>
<td>$8,757.54</td>
<td>$8,489.95</td>
<td>$5,278.30</td>
<td>$155,620.36</td>
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<tr>
<td>SPONSORSHIP ITEMS</td>
<td>$2,916.56</td>
<td>$7,261.81</td>
<td>$3,715.66</td>
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<td></td>
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<td>$13,914.04</td>
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</tbody>
</table>
**DEER PARK NORTH PRIMARY SCHOOL**

Job number: 1427

18-36 MAWSON AVE, DEER PARK VIC 3023

**ISSUED FOR APPROVAL**

Date issued: 16/04/2015

### OPINION OF PROBABLE COST - HUB

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>UNIT</th>
<th>RATE ($)</th>
<th>PRICE ($)</th>
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</thead>
<tbody>
<tr>
<td>1.00</td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.01</td>
<td>Demolition, earthworks &amp; site preparation</td>
<td>1</td>
<td>lot</td>
<td>$2,734.06</td>
<td>$2,734.06</td>
</tr>
<tr>
<td></td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION TOTAL</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2.00</td>
<td>HARD LANDSCAPE WORKS - Supply and Install</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Furniture - Relocate &amp; install timber picnic table and seating. Prepare &amp; oil timber</td>
<td>2</td>
<td>each</td>
<td>$549.00</td>
<td>$1,098.00</td>
</tr>
<tr>
<td>2.02</td>
<td>Granitic Sand - Light coloured, compacted to suit foot traffic</td>
<td>8</td>
<td>m2</td>
<td>$27.45</td>
<td>$219.60</td>
</tr>
<tr>
<td>2.03</td>
<td>Wall - Gabion wall on compacted base. Wall to finish 450mm above ground level. Local stone fill to match surrounding rocks.</td>
<td>5</td>
<td>Lm</td>
<td>$414.80</td>
<td>$2,074.00</td>
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<tr>
<td></td>
<td>HARD LANDSCAPE WORKS TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$3,391.60</td>
</tr>
<tr>
<td>3.00</td>
<td>SOFT LANDSCAPE WORKS - Supply and Install</td>
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<td></td>
</tr>
<tr>
<td>3.02</td>
<td>Soil - Blended soil mix for new deciduous trees</td>
<td>1.8</td>
<td>m3</td>
<td>$100.04</td>
<td>$180.07</td>
</tr>
<tr>
<td>3.03</td>
<td>Soil - 50mm thick soil conditioner</td>
<td>50</td>
<td>m2</td>
<td>$13.42</td>
<td>$671.00</td>
</tr>
<tr>
<td>3.04</td>
<td>Tree - 100L pot deciduous tree, including soil conditioner, fertilising, 2 of 32x32x2100 hardwood stakes with rubber ties</td>
<td>3</td>
<td>each</td>
<td>$445.30</td>
<td>$1,335.90</td>
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<tr>
<td>3.05</td>
<td>Mulch - 75mm native garden mulch</td>
<td>50</td>
<td>m2</td>
<td>$24.22</td>
<td>$1,210.85</td>
</tr>
<tr>
<td></td>
<td>SOFT LANDSCAPE WORKS TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$3,397.82</td>
</tr>
<tr>
<td>5.00</td>
<td>SPONSORSHIP ITEMS - Supply and Install</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.01</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>50</td>
<td>m2</td>
<td>$58.33</td>
<td>$2,916.56</td>
</tr>
<tr>
<td></td>
<td>SPONSORSHIP ITEMS TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$2,916.56</td>
</tr>
</tbody>
</table>

**EXCLUSIONS & QUALIFYING NOTES:**

1. Cost includes supply and installation

2. Price excludes rectification works to existing surrounding landscaping & paved areas

3. Price excludes supply of plants which are to be sought from project sponsors. See Sponsorship Items for more details

| NET LANDSCAPE WORKS SUB-TOTAL | $9,523.49 |
| 15% PROJECT MANAGEMENT FEE SUB-TOTAL | $1,428.52 |
| TOTAL PLUS PROJECT MANAGEMENT FEES | $10,952.01 |
| GST | $1,095.20 |
| TOTAL INCLUDING GST | $12,047.21 |

16/04/2015 - DPNPS - Opinion of Probable Cost - Hub
DEER PARK NORTH PRIMARY SCHOOL

Job number: 1427

18-36 MAWSON AVE, DEER PARK VIC 3023

ISSUED FOR APPROVAL

Date issued: 16/04/2015

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>UNIT</th>
<th>RATE ($)</th>
<th>PRICE ($)</th>
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</thead>
<tbody>
<tr>
<td>1.00</td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPARATION</td>
<td></td>
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</tr>
<tr>
<td>1.01</td>
<td>Demolition, earthworks &amp; site preparation</td>
<td>1</td>
<td>lot</td>
<td>$6,306.23</td>
<td>$6,306.23</td>
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</tbody>
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DEMOILITION, EARTHWORKS & SITE PREPERATION TOTAL  
$6,306.23

| 2.00 | HARD LANDSCAPE WORKS - Supply and Install                                  |     |      |          |           |
| 2.01 | Compost Bays - 3 bay timber composting bays                                | 1   | lot  | $1,525.00| $1,525.00 |
| 2.02 | Granitic Sand - Light coloured, compacted to suit foot traffic             | 80  | m2   | $27.45   | $2,196.00 |
| 2.03 | Raised Garen Bed - Raised timber garden bed, with Timber bench seat        | 30  | Lm   | $100.04  | $3,001.20 |
| 2.04 | Raised Garen Bed - Raised timber garden bed                                | 172 | Lm   | $54.90   | $9,442.80 |
| 2.05 | Raised Garen Bed - Universally accessible raised timber garden bed         | 3   | each | $1,201.70| $3,605.10 |
| 2.06 | Sand Fill - To raised garden beds                                          | 9   | m2   | $46.36   | $417.24   |
| 2.07 | Trellis - Timber fruit tree trellis                                        | 34  | Lm   | $180.56  | $6,139.04 |
| 2.08 | Worm Farm - Recycled and degassed refrigerator worm farems on concrete supports | 2  | each | $585.60  | $1,171.20 |

HARD LANDSCAPE WORKS TOTAL  
$27,497.58

| 3.00 | SOFT LANDSCAPE WORKS - Supply and Install                                  |     |      |          |           |
| 3.01 | Mulch - 75mm lupin mulch                                                   | 115 | m2   | $31.48   | $3,619.74 |
| 3.02 | Mulch - 100mm pine bark mulch                                              | 80  | m2   | $27.45   | $2,196.00 |
| 3.03 | Vegetable Soil - 300mm vegetable soil mix blend                           | 115 | m2   | $44.65   | $5,134.98 |
| 3.04 | Tree (Install only) - 100L pot deciduous tree, including soil conditioner, fertilising, staking & rubber ties | 2  | each | $140.30  | $280.60   |

SOFT LANDSCAPE WORKS TOTAL  
$11,231.32

| 4.00 | IRRIGATION - Supply and Install                                           |     |      |          |           |
| 4.01 | Irrigation controller with filter & PRV connected to library tank pumping hardware (pumping hardware upgraded by others) | 1  | lot  | $4,479.25| $4,479.25 |

IRRIGATION TOTAL  
$4,479.25

EXCLUSIONS & QUALIFYING NOTES:

1. Cost includes supply and installation

2. Price excludes rectification works to existing surrounding landscaping & paved areas

3. Price excludes supply of plants which are to be sought from project sponsors. See Sponsorship Items for more details

4. Price excludes upgrade to existing pumping hardware. JBA will seek sponsorship for the supply of pump and mains water backup valve for productive garden irrigation

5. School to arrange all plumbing work in relation to installing a mains water connection point & tap in close proximity to library tank for connection to pumping hardware

<table>
<thead>
<tr>
<th></th>
<th>NET LANDSCAPE WORKS SUB-TOTAL</th>
<th>$49,514.38</th>
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<tbody>
<tr>
<td>15% PROJECT MANAGEMENT FEE SUB-TOTAL</td>
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<td>TOTAL PLUS PROJECT MANAGEMENT FEES</td>
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<td>GST</td>
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<tr>
<td>TOTAL INCLUDING GST</td>
<td>$62,635.69</td>
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</table>

| 5.00 | SPONSORSHIP ITEMS - Supply and Install                                    |     |      |          |           |
| 5.01 | Tree (Supply only) - 100L pot deciduous tree, including soil conditioner, fertilising, staking & rubber ties | 2  | each | $305.00  | $610.00   |

16/04/2015 - DPNPS - Opinion of Probable Cost - Productive Garden  
Page 3
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>UNIT</th>
<th>RATE ($)</th>
<th>PRICE ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.02</td>
<td>Tree - 45L pot citrus tree, including soil conditioner, fertilising, staking &amp; rubber ties</td>
<td>3</td>
<td>each</td>
<td>$213.50</td>
<td>$640.50</td>
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<tr>
<td>5.03</td>
<td>Tree - 45L pot espaliered fruit tree @ 2000 cts, including soil conditioner, fertilising, initial training and pruning for espalier</td>
<td>12</td>
<td>each</td>
<td>$225.70</td>
<td>$2,708.40</td>
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<tr>
<td>5.04</td>
<td>Plantings - Passionfruit vine</td>
<td>2</td>
<td>each</td>
<td>$9.33</td>
<td>$18.67</td>
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<tr>
<td>5.05</td>
<td>Plantings - Sensory / companion herb plantings @ 500mm spacings</td>
<td>54</td>
<td>m2</td>
<td>$37.33</td>
<td>$2,015.93</td>
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<tr>
<td>5.06</td>
<td>Plantings - Vegetable seedling plantings - supply only - 1 x Advanced vegetable tray per vegetable garden bed [24 = 4 cells x 6 punnets per tray]. Plantings varies, based on nominal 400 cts.</td>
<td>12</td>
<td>per bed</td>
<td>$107.36</td>
<td>$1,288.32</td>
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**SPONSORSHIP ITEMS TOTAL**  
$7,281.81
DEER PARK NORTH PRIMARY SCHOOL

Job number: 1427

18-36 MAWSON AVE, DEER PARK VIC 3023

ISSUED FOR APPROVAL

Date issued: 16/04/2015

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<th>PRICE ($)</th>
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</thead>
<tbody>
<tr>
<td>1.00</td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION</td>
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<td>$10,743.22</td>
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<td>Demolition, earthworks &amp; site preparation</td>
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<td>lot</td>
<td>$10,743.22</td>
<td>$10,743.22</td>
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<td>2.00</td>
<td>HARD LANDSCAPE WORKS - Supply and Install</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Drainage - Pre cast box culvert under path &amp; behind gagon wall</td>
<td>1</td>
<td>item</td>
<td>$762.50</td>
<td>$762.50</td>
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<tr>
<td>2.02</td>
<td>Coarse Fill - Wetland soil / aggregate</td>
<td>30 m3</td>
<td>m3</td>
<td>$55.27</td>
<td>$1,657.98</td>
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<tr>
<td>2.03</td>
<td>Fencing - Adjust fencing to suit new works</td>
<td>1</td>
<td>item</td>
<td>$3,397.70</td>
<td>$3,397.70</td>
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<tr>
<td>2.04</td>
<td>Path - Concrete path, to match existing</td>
<td>53 m2</td>
<td>m2</td>
<td>$69.54</td>
<td>$3,685.62</td>
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<tr>
<td>2.05</td>
<td>Rockwork - Informal local stone boulders &amp; pitching</td>
<td>3 m3</td>
<td>m3</td>
<td>$263.52</td>
<td>$790.56</td>
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<tr>
<td>2.06</td>
<td>Drainage - Modular spoon drain, cut into existing paving to collect overland flows and discharge into wetland outlet zone with stone boulder stabilisation</td>
<td>1 Lm</td>
<td>Lm</td>
<td>$262.30</td>
<td>$262.30</td>
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<tr>
<td>2.07</td>
<td>Drainage - Install overflow from library tank into wetland</td>
<td>1</td>
<td>item</td>
<td>$671.00</td>
<td>$671.00</td>
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<tr>
<td>2.08</td>
<td>Wall - Gabion wall on compacted base. Wall located adjacent to path at outlet of wetland to screen debris leaving the wetland. Wall to finish 450mm above ground level, mainly embedded in ground level. Local stone fill to match surrounding rocks</td>
<td>6 Lm</td>
<td>Lm</td>
<td>$414.80</td>
<td>$2,488.80</td>
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<tr>
<td>2.09</td>
<td>Wall - Gabion wall on compacted base. Wall to finish 450mm above ground level. Local stone fill to match surrounding rocks.</td>
<td>5 Lm</td>
<td>Lm</td>
<td>$414.80</td>
<td>$2,074.00</td>
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<tr>
<td>3.00</td>
<td>SOFT LANDSCAPE WORKS - Supply and Install</td>
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<tr>
<td>3.01</td>
<td>Mulch - 75mm native garden mulch</td>
<td>35 m2</td>
<td>m2</td>
<td>$24.22</td>
<td>$847.60</td>
</tr>
<tr>
<td>3.02</td>
<td>Soil - 50mm thick soil conditioner</td>
<td>22 m2</td>
<td>m2</td>
<td>$13.42</td>
<td>$295.24</td>
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<tr>
<td>5.00</td>
<td>SPONSORSHIP ITEMS - Supply and Install</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.01</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>22 m2</td>
<td>m2</td>
<td>$58.33</td>
<td>$1,283.29</td>
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<tr>
<td>5.02</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>100 m2</td>
<td>m2</td>
<td>$7.24</td>
<td>$724.38</td>
</tr>
<tr>
<td>5.03</td>
<td>Tree - 45L pot native tree, including soil conditioner, slow release native fertiliser, staking &amp; rubber ties</td>
<td>8 each</td>
<td></td>
<td>$213.50</td>
<td>$1,708.00</td>
</tr>
</tbody>
</table>

EXCLUSIONS & QUALIFYING NOTES:
1. Cost includes supply and installation
2. Price excludes rectification works to existing surrounding landscaping & paved areas
3. Price excludes supply of plants which are to be sought from project sponsors. See Sponsorship Items for more details

**NET LANDSCAPE WORKS SUB-TOTAL**: $27,676.52

**15% PROJECT MANAGEMENT FEE SUB-TOTAL**: $4,151.48

**TOTAL PLUS PROJECT MANAGEMENT FEES**: $31,828.00

**GST**: $3,182.80

**TOTAL INCLUDING GST**: $35,010.79

SPONSORSHIP ITEMS TOTAL: $3,715.66

16/04/2015 - DPNPS - Opinion of Probable Cost - Wetland
## DEER PARK NORTH PRIMARY SCHOOL

**Job number:** 1427  
18-36 MAWSON AVE, DEER PARK VIC 3023

**ISSUED FOR APPROVAL**  
Date issued: 16/04/2015

### OPINION OF PROBABLE COST - RAIN GARDEN

<table>
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<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>UNIT</th>
<th>RATE ($)</th>
<th>PRICE ($)</th>
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<tbody>
<tr>
<td>1.00</td>
<td><strong>DEMOILITION, EARTHWORKS &amp; SITE PREPERATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.01</td>
<td>Demolition, earthworks &amp; site preparation</td>
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<td>lot</td>
<td>$4,146.18</td>
<td>$4,146.18</td>
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<td></td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION TOTAL</td>
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<td>$4,146.18</td>
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<tr>
<td>2.00</td>
<td><strong>HARD LANDSCAPE WORKS - Supply and Install</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Drainage - Direct roof drainage plumbing from 2 existing classrooms to discharge into separate Pit outlets in rain gardens, as shown on plans. The roof plumbing from one building will need to be modified to flow towards rain garden. Install an outlet pit in each rain garden to overflow back into existing stormwater drainage network.</td>
<td>1</td>
<td>lot</td>
<td>$1,769.00</td>
<td>$1,769.00</td>
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<tr>
<td>2.02</td>
<td>Drainage - Install agricultural pipe drain in 300x300mm sub surface trench wrapped in geofabric, to discharge roof rainwater in tree ring around base of new tree, refer to plans. Maintain existing stormwater drainage network to provide overflow into existing network in large storm events.</td>
<td>1</td>
<td>lot</td>
<td>$1,159.00</td>
<td>$1,159.00</td>
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<tr>
<td>2.03</td>
<td>Edging - Timber garden edging</td>
<td>19</td>
<td>Lm</td>
<td>$18.91</td>
<td>$359.29</td>
</tr>
<tr>
<td>2.04</td>
<td>Furniture - Relocate &amp; install timber picnic table and seating. Prepare &amp; oil timber</td>
<td>2</td>
<td>each</td>
<td>$549.00</td>
<td>$1,098.00</td>
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<tr>
<td>2.05</td>
<td>Granitic Sand - Light coloured, compacted to suit foot traffic</td>
<td>77</td>
<td>m2</td>
<td>$27.45</td>
<td>$2,113.65</td>
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<tr>
<td>2.06</td>
<td>Waterproof membrane - Pond liner, to base of rain garden trench</td>
<td>2</td>
<td>each</td>
<td>$646.60</td>
<td>$1,293.20</td>
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<td>HARD LANDSCAPE WORKS TOTAL</td>
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<td><strong>SOFT LANDSCAPE WORKS - Supply and Install</strong></td>
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<tr>
<td>3.01</td>
<td>Mulch - 75mm native garden mulch</td>
<td>50</td>
<td>m2</td>
<td>$24.22</td>
<td>$1,210.85</td>
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<tr>
<td>3.02</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>30</td>
<td>m2</td>
<td>$58.33</td>
<td>$1,749.94</td>
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<tr>
<td>3.03</td>
<td>Soil - Raingarden garden bed soil, free draining soil mix</td>
<td>11</td>
<td>m3</td>
<td>$147.01</td>
<td>$1,617.11</td>
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<tr>
<td>3.04</td>
<td>Soil - 50mm thick soil conditioner</td>
<td>30</td>
<td>m2</td>
<td>$13.42</td>
<td>$402.60</td>
</tr>
<tr>
<td>3.06</td>
<td>Tree - 100L pot deciduous tree, including soil conditioner, fertilising, staking &amp; rubber ties</td>
<td>1</td>
<td>each</td>
<td>$512.40</td>
<td>$512.40</td>
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<tr>
<td>3.07</td>
<td>Tree - 45L pot evergreen tree, including soil conditioner, fertilising, staking &amp; rubber ties</td>
<td>5</td>
<td>each</td>
<td>$213.50</td>
<td>$1,067.50</td>
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<td>SOFT LANDSCAPE WORKS TOTAL</td>
<td></td>
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<td>$6,560.40</td>
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### EXCLUSIONS & QUALIFYING NOTES:

1. Cost includes supply and installation  
2. Price excludes rectification works to existing surrounding landscaping & paved areas

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**NET LANDSCAPE WORKS SUB-TOTAL** $18,498.72  
**15% PROJECT MANAGEMENT FEE SUB-TOTAL** $2,774.81  
**TOTAL PLUS PROJECT MANAGEMENT FEES** $21,273.53  
**GST** $2,127.35  
**TOTAL INCLUDING GST** $23,400.88
## OPINION OF PROBABLE COST - NATIVE GARDEN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>UNIT</th>
<th>RATE ($)</th>
<th>PRICE ($)</th>
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<td>DEMOLITION, EARTHWORKS &amp; SITE PREPARATION</td>
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<td>$1,025.66</td>
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<td>Demolition, earthworks &amp; site preparation</td>
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<td>$1,025.66</td>
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<td>2.00</td>
<td>SOFT LANDSCAPE WORKS - Supply and Install</td>
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<td>2.01</td>
<td>Mulch - 75mm native garden mulch</td>
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<td>m2</td>
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<td>$871.81</td>
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<td>2.02</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>36</td>
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<td>$2,099.93</td>
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<td>2.03</td>
<td>Tree - 45L pot native tree, including soil conditioner, slow release native fertiliser, staking &amp; rubber ties</td>
<td>8</td>
<td>each</td>
<td>$213.50</td>
<td>$1,708.00</td>
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<td>3.00</td>
<td>IRRIGATION - Supply and Install</td>
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<td></td>
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<tr>
<td>3.01</td>
<td>Tap mounted battery operated irrigation controller with filter &amp; PRV connected to existing recreation centre rainwater tank and pump</td>
<td>1</td>
<td>item</td>
<td>$1,217.56</td>
<td>$1,217.56</td>
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**DEER PARK NORTH PRIMARY SCHOOL**

**Job number:** 1427

18-36 MAWSON AVE, DEER PARK VIC 3023

**ISSUED FOR APPROVAL**

Date issued: 16/04/2015

**EXCLUSIONS & QUALIFYING NOTES:**

1. Cost includes supply and installation
2. Price excludes rectification works to existing surrounding landscaping & paved areas

<table>
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<th>NET LANDSCAPE WORKS SUB-TOTAL</th>
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### DEER PARK NORTH PRIMARY SCHOOL

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<td>Demolition, earthworks &amp; site preparation</td>
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<td>HARD LANDSCAPE WORKS - Supply and Install</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Edging - Timber garden edging</td>
<td>18</td>
<td>Lm</td>
<td>$18.30</td>
<td>$329.40</td>
</tr>
<tr>
<td>2.02</td>
<td>Chalkboard - Install bespoke timber chalkboard</td>
<td>1</td>
<td>item</td>
<td>$1,200.00</td>
<td>$1,200.00</td>
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<tr>
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<tr>
<td>3.01</td>
<td>Plantings - Native plantings, including soil conditioner &amp; slow release fertiliser</td>
<td>18</td>
<td>m2</td>
<td>$58.33</td>
<td>$1,049.96</td>
</tr>
<tr>
<td>3.02</td>
<td>Tree - 100L pot deciduous tree, including soil conditioner, fertilising, staking &amp; rubber ties</td>
<td>1</td>
<td>each</td>
<td>$512.40</td>
<td>$512.40</td>
</tr>
<tr>
<td>3.03</td>
<td>Tree - 45L pot evergreen tree, including soil conditioner, fertilising, staking &amp; rubber ties</td>
<td>2</td>
<td>each</td>
<td>$213.50</td>
<td>$427.00</td>
</tr>
<tr>
<td>3.04</td>
<td>Mulch - 75mm native garden mulch</td>
<td>20</td>
<td>m2</td>
<td>$24.22</td>
<td>$484.34</td>
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<tr>
<td>3.05</td>
<td>Turf - Roll on turf, to match existing</td>
<td>54</td>
<td>m2</td>
<td>$19.52</td>
<td>$1,058.96</td>
</tr>
<tr>
<td></td>
<td>SOFT LANDSCAPE WORKS TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$3,532.66</td>
</tr>
</tbody>
</table>

**EXCLUSIONS & QUALIFYING NOTES:**

1. Cost includes supply and installation

2. Price excludes rectification works to existing surrounding landscaping & paved areas

---

**NET LANDSCAPE WORKS SUB-TOTAL**: $6,711.42

15% **PROJECT MANAGEMENT FEE SUB-TOTAL**: $1,006.61

**TOTAL PLUS PROJECT MANAGEMENT FEES**: **$7,718.13**

**GST**: **$771.81**

**TOTAL INCLUDING GST**: **$8,489.95**
## DEER PARK NORTH PRIMARY SCHOOL

**Job number:** 1427  
**18-36 MAWSON AVE, DEER PARK VIC 3023**  
**ISSUED FOR APPROVAL**  
**Date issued:** 16/04/2015

### OPINION OF PROBABLE COST - SAND PIT AREA

<table>
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<tr>
<th>ITEM</th>
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<tr>
<td>1.00</td>
<td>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION</td>
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<tr>
<td>1.01</td>
<td>Demolition, earthworks &amp; site preperation</td>
<td>1</td>
<td>lot</td>
<td>$1,620.77</td>
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<td><strong>DEMOLITION, EARTHWORKS &amp; SITE PREPERATION TOTAL</strong></td>
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<td></td>
<td></td>
<td></td>
<td>$1,620.77</td>
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<tr>
<td>2.00</td>
<td>HARD LANDSCAPE WORKS - Supply and Install</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.01</td>
<td>Edging - Timber Sand pit edging, to match existing</td>
<td>3</td>
<td>Lm</td>
<td>$54.90</td>
<td>$164.70</td>
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<td>2.02</td>
<td>Sand Pit Sand - 300mm washed white play sand on geotextile fabric</td>
<td>28</td>
<td>Lm</td>
<td>$38.67</td>
<td>$1,082.87</td>
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<td><strong>HARD LANDSCAPE WORKS TOTAL</strong></td>
<td></td>
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<tr>
<td>3.00</td>
<td>SOFT LANDSCAPE WORKS - Supply and Install</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.01</td>
<td>Mulch - 75mm native garden mulch</td>
<td>26</td>
<td>m2</td>
<td>$24.22</td>
<td>$629.64</td>
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<td>3.02</td>
<td>Plantings - Native plantings (50% infill), including soil conditioner &amp; slow release fertiliser</td>
<td>26</td>
<td>m2</td>
<td>$25.95</td>
<td>$674.59</td>
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<td><strong>SOFT LANDSCAPE WORKS TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,304.23</td>
</tr>
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</table>

### EXCLUSIONS & QUALIFYING NOTES:

1. Cost includes supply and installation  
2. Price excludes rectification works to existing surrounding landscaping & paved areas

| NET LANDSCAPE WORKS SUB-TOTAL | $4,172.57 |
| 15% PROJECT MANAGEMENT FEE SUB-TOTAL | $625.89 |
| TOTAL PLUS PROJECT MANAGEMENT FEES | $4,798.45 |
| GST | $479.85 |
| **TOTAL INCLUDING GST** | **$5,278.30** |
School as a Catchment
Integrated Water System Report
This project was supported by a grant from the Victorian State Government.

Project Partners: Environmental Education Victoria, Josh Byrne & Associates, Deer Park North Primary School, V2020 Vision, Melbourne Water, City West Water, Greening the West, Brimbank City Council, NewGrow, Warners Nursery, Diggers
SCHOOL AS A CATCHMENT

INTEGRATED WATER SYSTEM REPORT

Prepared by
JOSH BYRNE & ASSOCIATES

Prepared for
ENVIRONMENTAL EDUCATION VICTORIA (EEV),
DEER PARK NORTH PRIMARY SCHOOL (DPNPS)
& THE VICTORIAN GOVERNMENT

Project
SCHOOL AS A CATCHMENT

Date
5 MAY 2015

Josh Byrne & Associates
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PO Box 1866 Fremantle WA 6959
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**Document Status**

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Contents

1 Introduction ............................................................................................................................... 2

1.1 Target audience .................................................................................................................. 2

1.2 Deer Park North Primary School (DPNPS) ....................................................................... 2

2 Methodology .......................................................................................................................... 2

2.1 What are the opportunities? .............................................................................................. 3

2.2 What are the objectives? .................................................................................................... 3

2.3 Things to consider ............................................................................................................... 4

2.3.1 Assess the site ................................................................................................................ 4

2.3.2 Develop an ‘all water flows’ concept drawing/sketch ....................................................... 4

2.3.3 Gather input from the community ................................................................................. 4

2.3.4 Consider water-related opportunities and other desirable benefits ......................... 4

2.3.5 Crunch the numbers (quality, quantity, cost) ............................................................... 5

2.3.6 Develop a design, costs, implementation plan ............................................................ 5

2.3.7 Maintenance .................................................................................................................. 5

2.3.8 Monitor performance ..................................................................................................... 5

2.4 Quantitative performance ................................................................................................ 5

3 Water System and Design Solutions .................................................................................... 7

3.1 Water management .......................................................................................................... 7

3.1.1 School Water Efficiency Program (SWEP) ................................................................. 7

3.1.2 Water auditing ............................................................................................................. 7

3.1.3 Water leaks ................................................................................................................ 7

3.1.4 General maintenance .................................................................................................. 7

3.2 Water efficiency ............................................................................................................... 8

3.3 Rainwater.......................................................................................................................... 9

3.4 Stormwater ..................................................................................................................... 12

3.4.1 Stormwater harvesting ............................................................................................... 13

3.4.2 Water treatment ......................................................................................................... 14

(a) Raingardens .................................................................................................................. 14

(b) Constructed wetlands ................................................................................................... 15

3.4.3 Water infiltration ....................................................................................................... 16

3.5 Wastewater ..................................................................................................................... 17

3.6 Urban greening ................................................................................................................. 17

4 Summary ................................................................................................................................ 18

5 Resource List ....................................................................................................................... 19
1 Introduction
The purpose of this report is to develop an integrated water management scheme for the Deer Park North Primary School (DPNPS) to help rejuvenate key areas on the school campus. The document is also designed for use by other schools as a methodology for implementing integrated water management outcomes. It forms part of the ‘School as a Catchment’ project which will see systems designed and installed on site, student and community engagement through workshops and a host of project partners committed to disseminating the broader potential of this demonstration exemplar.

The principal objective is to increase the ‘liveability’ of the school through a holistic and integrated approach to the management of water on the school site. For example it is anticipated that substantial greening of the school can be achieved without any increase in overall water consumption. Other aspirations include the development of a productive school kitchen garden, and a more diverse and interesting use of the existing open space (often hard surfaced areas) through better management of water and increased shading, microclimates, and habitat through appropriate vegetation.

1.1 Target audience
This report is aimed at school principals and those staff involved in water and landscape management, local government staff, engineers and consultants and educational institutions more broadly. Having said that, the language is intended to be user-friendly and engaging, with the intent that it can be accessible to the general public and interested individuals.

1.2 Deer Park North Primary School (DPNPS)
Deer Park North Primary School is located on Mawson Avenue in the City of Brimbank in Melbourne’s western suburbs. The school occupies approximately 2ha and currently has some 400 students and 35 staff. The two principal sports ovals have recently been resurfaced with artificial turf which in conjunction with a large expanse of asphalt basketball courts has resulted in a relatively impervious school campus with limited natural shade or soft landscape surfaces. All stormwater currently drains to the eastern boundary and ultimately enters the Kororoit Creek catchment system. The local soil consists of relatively thin loamy topsoil overlying a heavy, impermeable clay which in turn limits the scope for the onsite infiltration of stormwater.

The school has already implemented some excellent water efficiency measures including participating in the Victorian SWEP program, installing timers for automated urinal flushing in the two toilet blocks, and four separate rainwater tank systems totaling over 60,000 litres in storage capacity for rainwater capture and reuse. The school principal is keen to ensure the school continues its progress down the path of best practice water management and to share its experience with the local community and other schools in the state.

2 Methodology
Where to start? This is the first question confronting anyone attempting to tackle their ‘water situation’ so we have developed a methodology to help structure this process. Clearly every site is unique with its own different set of issues and objectives, but nevertheless the strategy for considering each site is similar and we have tried to capture this process here.

We have broken-down this approach into the following key components and describe them in this document:

- What are the opportunities?
- What are the objectives?
- Key considerations
- Design solutions
- Quantitative performance
2.1 What are the opportunities?
The first thing we need to understand when considering an integrated water approach is to identify the opportunities for improvement and the principal water elements for investigation:

- Water efficiency
- Rainwater
- Stormwater
- Groundwater
- Wastewater (e.g. greywater)

Water efficiency is always the first key consideration as being efficient with water use in all its forms represents the ‘lowest hanging fruit’. It is invariably the quickest, easiest and most cost effective item and therefore needs to be addressed first.

Once water efficiency has been tackled it is a matter of considering both the quantity and quality of other available water sources, typically rainwater, stormwater, groundwater and wastewater. The principle behind this logic is to ask the question of whether water of lower quality can be used to achieve the same outcome. For example, can rainwater be used to flush toilets, can wastewater be used to irrigate garden beds?

This then leads to the second consideration which is that of attempting to close the water cycle, commonly referred to as ‘closing the loop’ for each water source.

An example of this would be attempting to capture, treat and use on site, all rainwater that falls on the site. This could include a mix of rainwater tanks for indoor use and perhaps irrigation, maintaining a wetland / raingarden, infiltration into the soil, and then allowing only heavy rainfall events to flow off site. The secondary outcome of this approach is that it allows the nutrient cycle to be taken into account and maximises the opportunity for closing the nutrient loop too. One example of this is where greywater is reused for irrigation supplying both water and nutrients to the garden for maximum plant growth, providing habitat, shade, general amenity benefits and reducing sewer loads.

2.2 What are the objectives?
Once we have established what the available opportunities are on the site it is necessary to decide upon some achievable objectives to utilise these opportunities. There are innumerable objectives that can be achieved however some of the most common objectives are provided below:

- Environmental
  - Reduce demand on mains water supply
  - Remove pollutants and nutrients from stormwater
  - Improved infiltration of groundwater
  - Improve flora and fauna biodiversity
- Financial
  - Reduce water costs
  - Reduce maintenance
  - Reduce costs associated with storm damage
- Social
  - Improved amenity
  - Improved health and security
  - Improved microclimate and shade
  - Create spaces for social interaction and cohesion
  - Increase availability of water for productive gardens
- Educational
  - Demonstrate environmental leadership, responsibility and resourcefulness
  - Opportunities for local food production and engaging with nature

These objectives should be considered as a guide and are clearly not exhaustive.
2.3 Things to consider
There are many issues that need consideration, some site-specific or more important according to the situation and aspirations. Some common questions to consider are:

- What are the current costs, and what cost savings are possible?
- How to consider and value other benefits and externalities such as habitat, amenity, treated stormwater, ecological values?
- Who are the ‘stakeholders’ and what are their needs?
- How do we measure performance?
- Who will maintain it/them?

Next comes the process which is the ‘doing’ stage where information (data) about the site and its systems is collated, input from the school and its community received, calculations on size and cost done, and a plan for implementation developed.

2.3.1 Assess the site
The first step is to gather as much information about the school before arriving on site – commonly called the desktop phase. Typical questions that can be answered include:

- What are the water sources?
- Where are the water meters and how many are there?
- How much water does the school use?
- Are there plans of the school, its buildings, gardens, drainage, services and any irrigation systems?
- Where does stormwater drain to?
- What is the surface area of the site?
- What is the geography, soil type, surrounding water bodies, water issues etc?
- What is the climate?

There is a wide range of information sources you can access to help answer these questions and include your local council (drainage), your water provider/utility (water meter readings, bills and locations), Bureau of Meteorology website (climate statistics) and other web tools such as Google Maps.

The next step is to walk the site. Use this opportunity to sketch or markup any plans you may have, identify any new features and confirm the information gleaned from your desktop phase (e.g, are the water meters where you thought they were and maybe take some meter readings while you are there). It may be informative to visit the site when it is raining if possible to see exactly how and where water flows. This can reveal blocked drains, overland flow paths both intentional and unintentional and areas of localised flooding.

2.3.2 Develop an ‘all water flows’ concept drawing/sketch
This is a useful way to put everything down on one page and consists of a diagram illustrating the movement of water through buildings, around the site and potentially where water is ultimately leaving the site. It can also highlight possible synergies as well as conflicts. Depending upon the level of discussion and feedback sought it can provide the ideal vehicle for this though it may be need some enhancement, even professional drafting, depending upon the likely audience.

2.3.3 Gather input from the community
There are many and various ways to gather input from your community, ranging from group presentations to workshops to surveys amongst others. The important thing is that the opportunity is made available at some stage for the community to provide input otherwise they may feel alienated and potentially hostile to any changes that are implemented. Regular project updates via newsletters or online media may also be valuable.

2.3.4 Consider water-related opportunities and other desirable benefits
This the time to consider what opportunities exist for an integrated water systems approach. For example what space is currently under-utilised and could it benefit from a raingarden or garden bed, or be a potential rainwater tank site? Is there erosion occurring on site that could be remedied with some attention to stormwater runoff? What opportunities are there to increase soft landscapes, plant new shade trees, increase plant and wildlife habitat.
2.3.6 Crunch the numbers (quality, quantity, cost)

It is important to realistically assess the numbers. This includes the volumes of water (and quality of the water where this is applicable), and the likely costs to implement possible options. Of course, this either then informs the budget or is limited by the budget. Simple payback is often used to assess and then prioritise the benefits of any intervention. For example where water efficiency measures are proposed (e.g. upgrading shower heads to water efficient models) this is commonly used to determine the ‘payback period’ which may range from months to years. The shorter the payback period the more sense it makes to implement the recommendation.

2.3.7 Maintenance

It is critically important to consider the maintenance requirements associated with all new measures. It is typically the least exciting part of any project and for this very reason is often overlooked. Indeed it is well worth considering the likely maintenance requirements, costs and human resource needs in detail prior to making any final decisions. Specifically, who will be charged with maintaining the systems?

2.3.8 Monitor performance

Once a project is complete it is important to monitor performance. It is therefore important to consider this during the planning part of the project. This is made substantially easier these days due to technologies such as data loggers, web-based dashboards and auto-alert functions, but there is invariably a need for human interaction! This can be part of the maintenance program e.g. a checklist and/or annual reporting. Monitoring performance allows trends to be identified, for example why has our water consumption increased in the last six months, and issues like leaks, to be picked up sooner rather than later. These have direct cost implications if nothing else.

2.4 Quantitative performance

While qualitative assessments of such projects are readily made, it is considered highly desirable that a range of quantitative measures be derived where feasible, in order to be able to track the performance of the various initiatives. As a result the following table has been developed which illustrates potential metrics and targets for the school to strive towards. This table can form the basis for performance monitoring and annual reporting and can readily incorporate new indicators as required. These metrics can be developed by the school and have been left as preliminary indicators for information only at this stage.

Table 1 - Quantitative performance indicators

<table>
<thead>
<tr>
<th>ITEM</th>
<th>INDICATOR</th>
<th>METRIC</th>
<th>TARGET</th>
<th>PRE-PROJECT</th>
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<th>YEAR 2</th>
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<tr>
<td>1</td>
<td>Mains water consumption</td>
<td>[L/student/school day]</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rainwater consumption</td>
<td>[L/student]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sewage discharged</td>
<td>[L/student]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Campus canopy cover</td>
<td>[% of campus, m²]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Impervious surface</td>
<td>[% of campus, m²]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Pervious surface reinstated</td>
<td>[% of campus, m²]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Productive garden bed area</td>
<td>[m²]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Amount of vegetables produced</td>
<td>[kg/year]</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Stormwater treated (estimate)</td>
<td>[kL/year]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Biodiversity/Habitat available</td>
<td>No. of species, m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>11</td>
<td>Thermal cooling per site</td>
<td>Degrees C/site</td>
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<td>OBJECTIVES</td>
<td>THINGS TO CONSIDER</td>
<td>DESIGN SOLUTIONS</td>
<td>OUTCOMES</td>
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<td>---------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>WATER EFFICIENCY</td>
<td>Reduce average per day consumption of 20.8L/student.</td>
<td>Investigate issues with existing rainwater systems and pumps.</td>
<td>Test and service pumps and improve pre-filtration of rainwater to prevent maintenance issues. Install sub meters.</td>
<td>Water savings, and improve monitoring and maintenance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAINWATER</td>
<td>Reduce water use by servicing two existing rainwater harvesting systems providing toilet flushing water.</td>
<td>What other potential water use is in close proximity that requires a short term water supply.</td>
<td>Install new drip irrigation for short term establishment of native landscaping. Install sub meter.</td>
<td>Capture more water for small constructed wetland; improve amenity, microclimate, biodiversity and provide educational benefits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STORMWATER</td>
<td>Capture a portion of stormwater leaving the site and utilise in landscape to improve amenity, microclimate and biodiversity.</td>
<td>Develop site wide plan of stormwater flows.</td>
<td>Install small constructed wetland to capture and treat a portion of storm water flows.</td>
<td>Reduce stormwater discharged from site. New areas of high impact landscaping areas and a constructed wetland entity feature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WASTEWATER</td>
<td>Utilise wastewater to reduce mains water usage and provide cost savings.</td>
<td>Consider wastewater reuse options from hand basins and cost effectiveness.</td>
<td>Potential to consider greywater reuse from hand basins in future.</td>
<td>Continue to discharge to sewer and reduce water usage through water efficiency in the short term.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>URBAN GREENING</td>
<td>Increase urban greening and liveability of school. Create areas of social cohesion. Minimise maintenance and maximise success during establishment phase.</td>
<td>Consider locations for new shade trees and landscaped areas throughout the school. Understand arrangement of existing site elements and services.</td>
<td>Include new shade trees and vegetation in high use areas and around buildings to improve shading and reduce heat loads. Install water efficient irrigation based on hydrozoning principles. Appropriate tree and plant selection. Utilise productive trees in the landscape, where possible.</td>
<td>Improve liveability, amenity and biodiversity, throughout the school. Reduce energy loads required to heat buildings. Improved success during establishment with reduced ongoing maintenance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3 Water System and Design Solutions
Here we consider the possible solutions and technologies that can be employed / retrofitted to achieve the objectives.

3.1 Water management
Understanding how water is used at your site is essential for good management and understanding where the opportunities for improvement lie. Effective water management is not a one off event - it is an ongoing process and requires someone to be responsible for this.

3.1.1 School Water Efficiency Program (SWEP)
The Schools Water Efficiency Program (SWEP) is a voluntary program that upon request will provide data loggers connected to the mains water meter for all Victorian schools to continue the education and demonstration of water efficiency in practice. Access to the up to date water consumption data collected, is available on an interactive online tool that allows for custom reporting, high level leak detection and benchmark comparison with other participating schools. The program also provides access to a tailored curriculum program for students.

SWEP is funded by the Department of Environment and Primary Industries and the Department of Education and Early Childhood Development. Refer to the section on resources for details on how to register your school.

The SWEP program provides real-time overall site usage from the mains water meter. In addition, installation of isolation valves and/or sub-meters on major water uses can provide a clearer picture of where, how and when water is being consumed within the site and allows individual areas to be isolated if repairs are required or leaks suspected. The outcomes of water saving initiatives can then be accurately assessed.

3.1.2 Water auditing
Engaging a trained water auditor to conduct a water audit and identify opportunities for water savings is valuable. Water auditors can provide technical assistance with understanding your water usage and help identify water saving opportunities. City West Water can provide assistance with this and please refer to the section on resources for further details. Many other jurisdictions have similar programs and information can be sought from the local water utility or council.

3.1.3 Water leaks
Water leaks are a clear example of water being wasted and these leaks can account for large volumes of unaccounted for water. Some leaks are easily found through regular inspection of water devices whilst other may be concealed and will require more comprehensive leak detection processes.

As part of your water management process and maintenance schedule it is recommended to test for unaccounted water loss. Water leaks can be continuous where under constant pressure or temporary in nature e.g. irrigation systems. It is relatively easy to test for continuous water leaks by recording the difference in water meter readings during long unoccupied or low occupancy periods or by reading your SWEP data logger. Continuous water use in periods of minimal use should be investigated.

3.1.4 General maintenance
A proactive approach to maintenance of your water system should be favoured over a reactive one and will help avoid water leaks and inefficiencies which can waste hundreds of dollars in water and energy costs.
3.2 Water efficiency

Once you have a clear understanding of your site, improving water efficiency is the simplest way of saving water, and energy where hot water or pumps are used. Water efficiency aims to reduce the volume of water used to perform a specific task without effecting quality of the service.

The benefits of improving water efficiency include:
- Helping to secure the water supply for future generations
- Reducing water and energy bills
- Carbon footprint reduction
- Public accountability
- Education / behaviour change opportunities

The Water Efficiency Labelling Scheme (WELS, for a link to this source refer to the resources section) helps you choose water efficient products and also sets minimum performance standards for water using devices including taps, showers, toilets, urinals and flow controllers. For new construction and refurbishments projects the selection of higher WELS rated devices is nearly always justified.

Improving water efficiency can save water, money and energy. Your water bill includes separate charges for water usage, sewage disposal and any trade waste disposal. Installing water efficient devices will reduce the volume of water used and disposed of, and provide savings on these costs. For water devices supplied with hot water it can also save significant amounts of energy and money, an example of this is water used for showers and hand basins.

Prioritising the installation of water saving technologies is important if you wish to get the best return on investment and maximise your savings. Calculating water savings is based on a number of factors, and a water auditor can assist with prioritising the most cost effective changes for your school. In addition to this South East Water has an online investment payback calculator that allows for easy analysis of water efficiency improvements including return on investment based on water and energy savings (for a link to this source refer to the resources section).
City West Water has put together some Best Practice Guidelines for Water Efficiency to help to identify water and resource saving opportunities (for a link to this source refer to the resources section). The guidelines include information about suitable water saving equipment, suggested process and procedural change, maintenance, benchmarking and a selection of case studies. The guideline covers the below major water uses:

- Amenities
- Kitchens
- Cleaning
- Cooling towers
- Fire protection systems
- Landscapes
- Swimming pools and spas

### 3.3 Rainwater

Here we consider the opportunities that are available from harvesting rainwater. We make the distinction between rainwater and stormwater due to the difference in water quality as follows: Rainwater is water which comes off roofs only (sometimes referred to as roof water) while stormwater is rainwater from all other surfaces e.g. footpaths, carparks etc.

Some of the potential uses of rainwater include water for toilet flushing and irrigation/watering of gardens. It is of course possible to use rainwater for drinking after treatment but we don’t consider this option further here as it is a costly exercise. A key benefit of using rainwater is the potential to displace mains water which is therefore a direct cost saving.

Key considerations surrounding rainwater harvesting include:

- Site characteristics
- Existing roof arrangements & plumbing elements
- Quality of roof catchment material i.e. not asbestos or lead-based paint
- Location of storage and proximity to water use
- Is the location low maintenance? i.e. overhanging trees clogging gutters
- Annual rainfall and frequency i.e. Is there sufficient regular rainfall to effectively meet demand?
- Who will be responsible maintenance? Costs associated with maintenance
- Budget estimate of costs and available budget
- Water quality e.g. Pre-filtration, leaf gutter rain heads, first flush diverters

The local climate in the western Melbourne region illustrates the relatively consistent average monthly rainfall and mild temperature profile as shown in the following table of climate data for Melbourne Airport some 15 kilometres to the north. The mean daily evaporation is also important to understand as it provides a means by which to estimate the likely plant evapotranspiration (evaporation multiplied by a crop factor) in any given month and therefore an indication of the irrigation demand. Landscape designers will consider all these factors plus average daily maximum and minimum temperatures to select suitable plant species and irrigation designs.

Table 3 - Climate statistics for Melbourne Airport (Period 1981-2010)

<table>
<thead>
<tr>
<th>STATISTIC</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEPT</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAINFALL (mm)</td>
<td>39.8</td>
<td>37.3</td>
<td>38.5</td>
<td>38.1</td>
<td>35.6</td>
<td>38.8</td>
<td>38.9</td>
<td>43.5</td>
<td>44.4</td>
<td>51.2</td>
<td>62.1</td>
<td>51.4</td>
<td>518.9</td>
</tr>
<tr>
<td>MEAN EVAPORATION DAILY (mm)</td>
<td>8.1</td>
<td>7.2</td>
<td>5.9</td>
<td>3.9</td>
<td>2.4</td>
<td>1.9</td>
<td>2.0</td>
<td>2.8</td>
<td>4.1</td>
<td>5.2</td>
<td>6.0</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>MEAN MAX. DAILY TEMP. (°C)</td>
<td>26.3</td>
<td>26.5</td>
<td>24.1</td>
<td>20.4</td>
<td>16.6</td>
<td>13.7</td>
<td>13.0</td>
<td>14.5</td>
<td>16.6</td>
<td>19.3</td>
<td>22.1</td>
<td>24.3</td>
<td></td>
</tr>
<tr>
<td>MEAN MIN DAILY TEMP. (°C)</td>
<td>13.6</td>
<td>14.1</td>
<td>12.7</td>
<td>10.1</td>
<td>8.4</td>
<td>6.3</td>
<td>5.5</td>
<td>6.0</td>
<td>7.1</td>
<td>8.5</td>
<td>10.4</td>
<td>12.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Australian Bureau of Meteorology
While this represents the total theoretical volume that could be harvested in an average year, it is the term known as ‘yield’ that is more useful to calculate. Yield is a function of the catchment area, demand and the tank size. For example in the above example, if the tank was only 5,000L capacity – depending on the type of demand e.g. irrigation, toilet flushing etc. – the tank may very well overflow at certain times of the year e.g. school holidays, and so the yield is typically somewhat less (typically 20-50%) than the theoretical maximum volume possible. It is possible to calculate different tank sizes for a given catchment area to optimise the rainwater harvesting system for any given situation. A simple spreadsheet model can be set up to do this to varying levels of sophistication as we have done here in Table 4 or alternatively there are some free on-line models that will do it for you (refer to the resources section).

Rainwater harvesting: it is possible to estimate the likely amount of rainfall that can be collected from a roof in any given month with the following ready reckoner which employs the data from above and the measured roof surface to calculate volume collected.

Table 4 - Rainwater harvesting calculator

<table>
<thead>
<tr>
<th>ASSUMPTION #1</th>
<th>Assume a runoff coefficient of 0.9 for a typical steel roof i.e it assumes 90% of all rain can be collected with only 10% lost to evaporation and infiltration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSUMPTION #2</td>
<td>Assume 100% of the roof catchment is connected to downpipes which all enter the same rainwater tank(s) then for every 1mm of rain which falls on 1m² of roof it is theoretically possible to collect 0.9L of rainwater.</td>
</tr>
</tbody>
</table>

The available catchment from the Deer Park North Primary School library roof (sloping north) is approximately 130m² however currently less than half of this is connected to the 20,000L rainwater tank. There is also an additional 300m² of potential contributing catchment on the south side of Block B. This means that it is theoretically possible to connect in excess of 430m² of roof catchment via a wet system to the rainwater tank. In order to investigate what potential yield is achievable we have modelled two potential scenarios – 150m² and 300m² of additional roof catchment with a range of rainwater tank sizes in order to demonstrate what effect this has.

We have estimated a total irrigation demand for the new school garden of 147kL/yr based on 117kL/yr for reticulated irrigation (subsurface dripline) and an allowance of a further 25% or 30kL/yr for handwatering, washing down tools and the like. This also allows an estimate of the volume of mains water top-up water that will be needed according to the tank capacity and roof catchment area.

This calculation indicates that a total catchment of 300m² connected to the existing 20kL tank can contribute over 100kL per annum in an average year. Alternatively a catchment of 150m² is only able to achieve roughly half this amount. The graph shows these relationships and demonstrates that the priority lies with connecting additional roof runoff if the maximum yield from the existing tank is to be achieved.
The rainwater harvesting systems at Deer Park Primary School are great initiatives which unfortunately are not performing at their optimum and we are aware that this is a fairly common situation. Three of the systems are plumbed into the buildings for toilet flushing purposes while the fourth is a free standing (un-plumbed) arrangement for garden watering purposes only. All four systems have pumps mounted externally to the tanks and the three used for toilet flushing have mains water back-up connections. When we conducted our site visit it was apparent that all the tanks were full, or nearly full, despite their having been no significant, recent rainfall.

This aroused our suspicions that all was not well and indeed a subsequent inspection by the school plumber confirmed that the systems were not working. There are several possible reasons for this which include design, technical and maintenance factors that should be considered prior to undertaking any repairs or retrofitting.

**Maintenance**

Systems that use externally mounted pumps will have an in-line filter/s which require regular inspection and cleaning. Once the filter/s becomes blocked the pump will either trip out or even potentially burn out. The amount of sediment and leaf litter entering the tanks - which in turn causes the clogging of the filters - is dependent on the type of first flush device and leaf diverter systems, plus overhanging trees.
3.4 Stormwater

Stormwater is the water draining off a site from rain that falls on the roof and land, and everything it carries with it. This includes the soil, organic matter, litter, fertilisers from gardens and oil residues from driveways it carries which can pollute downstream waterways.

Rainwater, as described previously refers only to the rain that falls on roofs and which is usually much cleaner than stormwater, however stormwater can still be a valuable resource depending upon how polluted it is, what treatment it receives and what the intended end use is.

Water Sensitive Urban Design (WSUD) is about integrating water cycle management into urban planning and design. WSUD looks to manage the impacts of stormwater on site with the aim of protecting and improving waterway health by mimicking the natural water cycle as closely as possible. It also provides benefits in relation to providing an alternate water supply to reduce mains water demand and provide opportunities to improve amenity, liveability and biodiversity.

We can see from the local climate data above that there is a relatively consistent rainfall average across all months of the year in this region. This is ideal for harvesting stormwater regularly for potential irrigation purposes and managing stormwater where possible through Water Sensitive Urban Design (WSUD) elements, such as raingardens and constructed wetland features.
a constructed dam or in subterranean tank. The irrigation and pump hardware to distribute the water will need to be suitable for utilising the stormwater. The stormwater harvesting system will require regular testing and maintenance to ensure water quality and performance is maintained at acceptable levels.

The storage body needs to be suitably sized to ensure sufficient water is available for irrigation year round. A mains water backup valve should also be connected and may be required to ensure a continuous supply during dry periods of weather.

### 3.4.2 Water treatment

The primary objective of the treatment of stormwater is to capture and treat stormwater on site to improve water quality, amenity, biodiversity and enhance liveability. Water treatment systems can assist with reducing loads on drainage infrastructure as they have a limited storage capacity, however they will typically require an outlet to overflow into the drainage network.

The best water treatment outcomes are achieved through design solutions that incorporate a sequence of treatment measures as opposed to a single solution, maximising water treatment potential. An example of a treatment ‘train’ is a constructed stormwater wetland which typically includes a sediment ponds basin and a wetland with a series of permanent pools and marshes.

Some typical water treatment solutions that can be used in schools include constructed wetlands and bioretention systems typically called raingardens.

#### (a) Raingardens

Bioretention systems or raingardens are specially designed vegetated areas that collect stormwater runoff and then treat the water through biological process and retain contaminants. They are flexible in design arrangement and compact in size, which makes them perfect for school sites. Raingardens are designed to reduce gross pollutants, coarse sediments, nutrients and heavy metals. They consist of a series of layers including an open water peak volume detention layer, mulch, low nutrient filter media, transition layer and in some cases a drainage layer.

Water can be collected through surface runoff or can utilise water from the school’s stormwater drainage plumbing. They typically include an overflow back into the stormwater drainage network to limit the water level in peak flow events.

Raingardens are most effective when densely planted with suitable plants and include a lined saturated zone that stores water permanently below ground level. This saturated zone supports the plant water requirements and removes or limits requirements for irrigation.

Bioretention systems incorporating trees are an example of a small type of raingarden that is typically designed to take overland flows from hardstand surfaces and support significant street trees in the landscape, providing shade and improving amenity and liveability. Below is an example of one type of raingarden design.

In situations where the water is already of a high quality, for instance where it is collected from roof catchments, there will be limited need for treatment. In this situation the raingarden can vary the requirements for a low nutrient filter media and separate transition layers and focus on storing water to support plant health. Below is a diagram of a raingarden that will be utilising a high quality water source.
(b) Constructed wetlands

Constructed wetlands are typically a series of shallow, intensively planted water bodies that reduce water velocity and treat water through sedimentation, filtration and biological processes as water flows through the system. They provide opportunities for a high level of storage and treatment and can also improve microclimate, amenity and support biodiversity. Generally wetlands will require a larger area than a rain garden and will need to be designed to ensure limited access to any open water bodies to improve safety.

The school’s existing stormwater drainage network conveys the bulk of any stormwater off site and in such situations it is possible to incorporate a wetland to intercept and treat a percentage of overland flow before discharging back into the drainage system.

Constructed wetlands typically include the following zones:
- Inlet zone – Stormwater is directed to an inlet zone typically called a sedimentation basin, to remove coarse sediments including rubbish. The sedimentation zone needs to be separate from the macrophyte zone and accessible for occasional maintenance.
- Macrophyte zone – Water then flows through a series of vegetated marshes of varying depths.
- Outlet zone – This is generally section of open water that detains water allowing for settling and sunlight to kill bacteria. It also supports aquatic life and predators that will assist with controlling mosquitoes.

The above typical sequence of treatment can be varied in larger wetland systems. The inclusion of a bypass drain to discharge water around a wetland in high flow events should also be considered. Below is an example of a typical constructed wetland design.

Figure 5. Constructed wetland typical cross-section detail

3.4.3 Water infiltration
This is the final opportunity to manage stormwater and involves infiltrating excess stormwater on site to reduce volume and frequency of stormwater entering the main stormwater drainage network. Water infiltration can partially be achieved through the water treatment methods detailed above, for example in raingardens which include a saturated zone designed to detain water to a specific water level with any remaining water collected infiltrated into the surrounding landscape. However the more typical method for infiltrating excess stormwater may be through vegetated swales, infiltration trenches and soakwells.

Swales are a landscape and engineering solution that detains and conveys water in a linear depression along a site contour. The primary principle is to infiltrate water on site and reduce / delay stormwater run-off. It also provides water treatment benefits and can support the establishment of additional landscaping.

Infiltration trenches are a depression in the landscape that has been excavated and filled with coarse free draining medium to store and infiltrate water into the soil.
3.5 Wastewater
Options for wastewater are principally treatment and reuse, and wastewater minimisation.

Wastewater reuse covers a wide range and scale of commercially available onsite wastewater treatment systems which are capable of treating wastewater to a level suitable for above ground sprinkler irrigation. In urban areas where deep sewerage is available they are unlikely to be cost effective, however in unsewered areas they can provide a realistic alternative to septic tanks and leachfields and provide a much improved environmental outcome.

Greywater reuse is also an option particularly where regular high volumes of greywater are generated, for example showers or laundries. Treating the greywater to a level fit for toilet flushing is possible but expensive, whereas greywater diversion direct to subsurface irrigation is very cost effective.

Reducing the amount of wastewater produced by reducing the amount of mains water consumed through water efficiency measures can provide an ongoing cost saving via a reduced sewage disposal charge. The sewage charge is simply the volume of water consumed multiplied by the rate multiplied by discharge factor (DF). For most schools and DPNPS the DF is 0.9.

For DPNPS the options for wastewater or greywater reuse are limited and therefore the most appropriate opportunity initially would be to maximise mains water efficiencies thereby reducing the sewage disposal charge accordingly.

There may be merit in investigating the potential for greywater reuse from the toilet block handbasins for garden irrigation in future stages.

3.6 Urban greening
Developing an integrated water management scheme provides the opportunity for schools to support environmental sustainability and community health. The management of urban water and increased community green spaces are two topical issues in Australia. Gardens and water are inherently linked - community green spaces are well recognised to play a major beneficial role in the control and improvement of urban water impacts and quality, via the improvement of
stormwater runoff reduction, flood mitigation, minimisation of soil erosion and contaminant minimisation.

A wealth of research has demonstrated the benefits of community greening, most recognisably the environmental, water and air quality improvements but also valuable social improvements such as improved aesthetics, vehicular safety, mental wellbeing and physical health. Likewise there are a number of strong arguments for improved workplace and community productivity.

Water and vegetation are both also recognised in reducing the urban heat island effect, which is where hard surfaces such as buildings, roads and concrete absorb heat causing them to be much warmer than surrounding vegetated areas. Deer Park North Primary School is located within the City of Brimbank where research has shown there is a very low amount of tree coverage and a high amount of bare ground. Integrating water management and the development of green spaces can be a highly beneficial step in addressing issues such as the urban heat island effect.

More information to provide ideas for urban green spaces and playgrounds can be found in the resources section.

4 Summary
This document is attempting to provide a holistic strategy for greening a local primary school by addressing its existing water systems in an integrated manner. It makes recommendations for retrofitting certain areas of the school in order to increase liveability. These include the development of a productive school kitchen garden, and a more diverse and interesting use of the existing space (often hard surfaced areas) through better management of water and increased shading, microclimates, and habitat through appropriate vegetation.

It is hoped that the concepts and methods outlined in this report can be readily taken up and applied by school principals and staff involved in water and landscape management, local government staff, engineers and consultants and educational institutions more broadly.
5 Resource List

Climate Data

Victorian SWEP Program

Water Auditing
City West Water:

Water Efficiency
City West Water:

South East Water (Victoria):

Water Efficiency Labelling Scheme (WELS)

Water Sensitive Urban Design (WSUD)
Melbourne Water:

CSIRO:
http://www.publish.csiro.au/pid/2190.htm

Rainwater Harvesting
Alternative technology association:
Tankulator (http://tankulator.ata.org.au/)

Urban Greening
202020 Vision:


APPENDIX 5: INTEGRATED WATER SYSTEM REPORT CONT...
## Appendix – DPNPS Integrated Water Systems Maintenance Checklist

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>WHAT DATA TO COLLECT</th>
<th>HOW OFTEN</th>
<th>WHAT MAINTENANCE TO DO</th>
<th>HOW OFTEN</th>
<th>ACTION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAINS WATER</strong></td>
<td>Read the mains water meter</td>
<td>Choose the same day of the month eg 1st day of every month</td>
<td>Use meter readings to identify any unusual consumption</td>
<td>When tabulating meter readings</td>
<td>Plot water consumption info to detect any trends</td>
<td>Compare to the SWEP data</td>
</tr>
<tr>
<td><strong>WATER EFFICIENCY</strong></td>
<td>Confirm water efficiency and check for any leaks</td>
<td>Monthly</td>
<td>Repair and/or report any leaks or issues</td>
<td>Monthly</td>
<td>Follow up to ensure any repairs have been carried out</td>
<td>See if any issues identified are supported by the meter reading trends</td>
</tr>
<tr>
<td><strong>RAINWATER:</strong></td>
<td>Review rainwater harvesting systems</td>
<td>Read all the rainwater tank meters and record depth of water in tanks</td>
<td>Use meter readings to identify any unusual consumption</td>
<td>Monthly</td>
<td>Plot water consumption to detect any trends</td>
<td>Calculate the amount of mains water being saved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose the same day of the week/month eg 1st day of every month</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STORMWATER:</strong></td>
<td>Assess plant health (wetland and raingarden) and water quality (wetland)</td>
<td>Monthly</td>
<td>Walk the sites and inspect Wetland, rain garden and drains. Remove litter, Rectify any signs of erosion and clear any blockages</td>
<td>Monthly</td>
<td>Follow up to ensure any issues have been addressed</td>
<td>Plant health is a good indicator of overall system health and function</td>
</tr>
<tr>
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</tbody>
</table>
APPENDIX 6: USEFUL LINKS

The following websites provide useful links for a school water catchment project.

- For Environment Education Victoria:
  http://www.eev.vic.edu.au

- For useful curriculum resources visit Cool Australia:
  http://www.coolaustralia.org

- For school case studies and resources visit the Sustainability Hub:
  http://sustainability.ceres.org.au

- For inspiring case studies visit Vision202020:
  http://202020vision.com.au

- For information about the Victorian ResourceSmart Schools program:
  http://www.resourcesmartschools.vic.gov.au

- For productive organic garden information visit Australian Organic Schools:
  http://www.organicschools.com.au

- For research on benefits of urban greening visit Greening the West:
  http://greeningthewest.org.au

- For resources and information on education programs visit Melbourne Water:
  http://www.melbournewater.com.au

- For gardening fact sheets visit Healthy Urban Habitat:
  http://healthyurbanhabitat.com.au