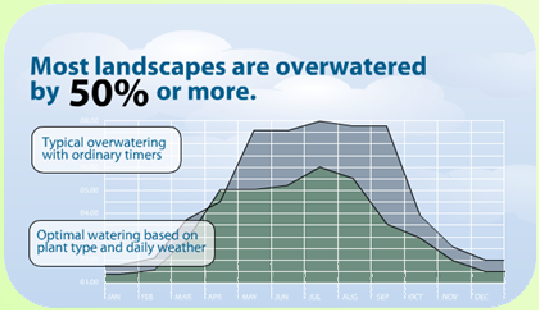
WATER CYCLE SOLUTIONS FOR IRRIGATION AT THE ESTATE SCALE

Geoff Bott

Endemic

WATER CYCLE AND IRRIGATION: INEFFICIENCIES AND SOLUTIONS



Past inefficiencies

Total Water Cycle Management

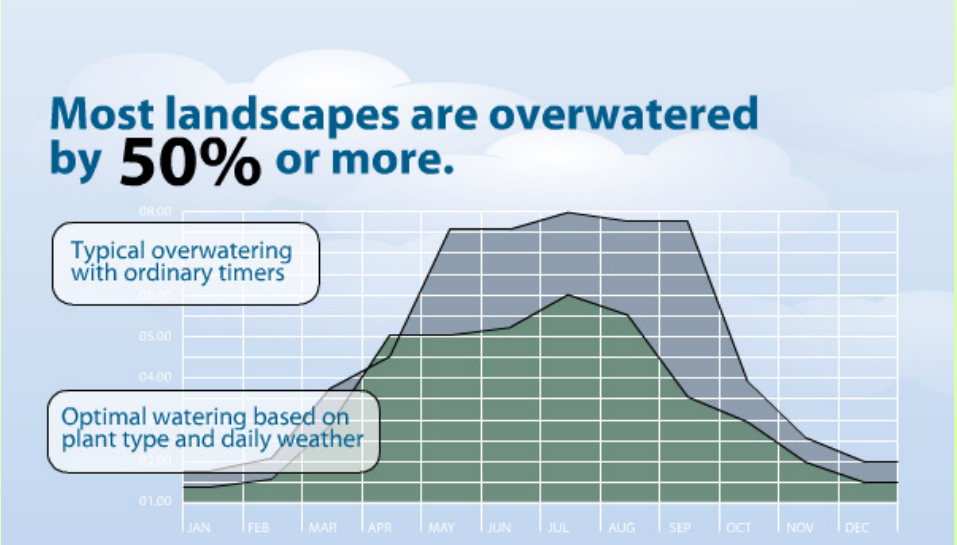
Re-use, 'smart irrigation'

Endemic

WATER MANAGEMENT INEFFICIENCIES

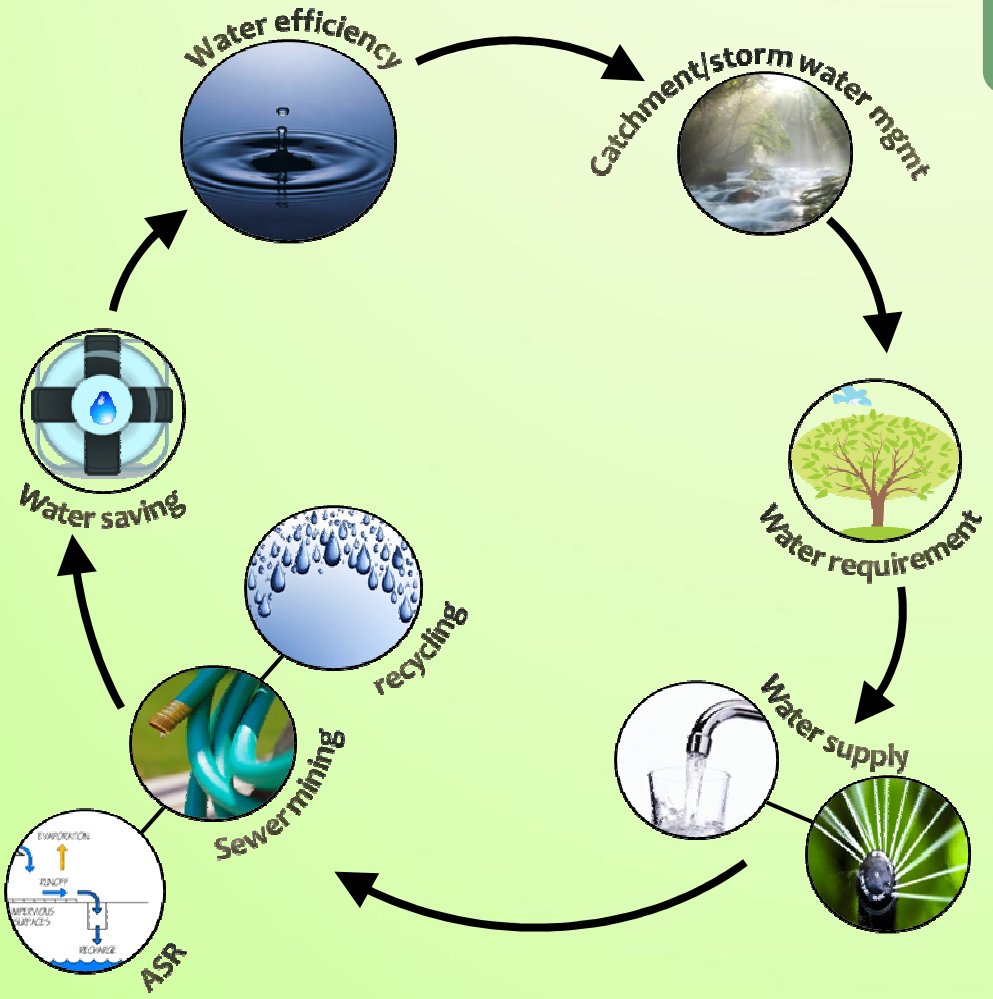
In the past...

- Lot scale water management
  - Rainwater tanks
  - Domestic bores
  - Drinking water for garden watering
- 50-70% of domestic water usage ex-house. Large lots
- Reliance on groundwater: becoming more difficult as resources becoming fully allocated
- Why not rainwater tanks??



Endemic

TOTAL WATER MANAGEMENT OPPORTUNITIES



Towards the future...

- Estate scale water management opportunity for **total-water-cycle principles**
- Integrated with Water Sensitive Urban Design
- Non-potable water sources for irrigation: sewer mining, SHARE
- Demand management initiatives. Lot size, AAAAA fixtures
- 'smart irrigation' water use efficiency

Endemic

NON-POTABLE WATER SOURCE OPTIONS

Alternatives to drinking water

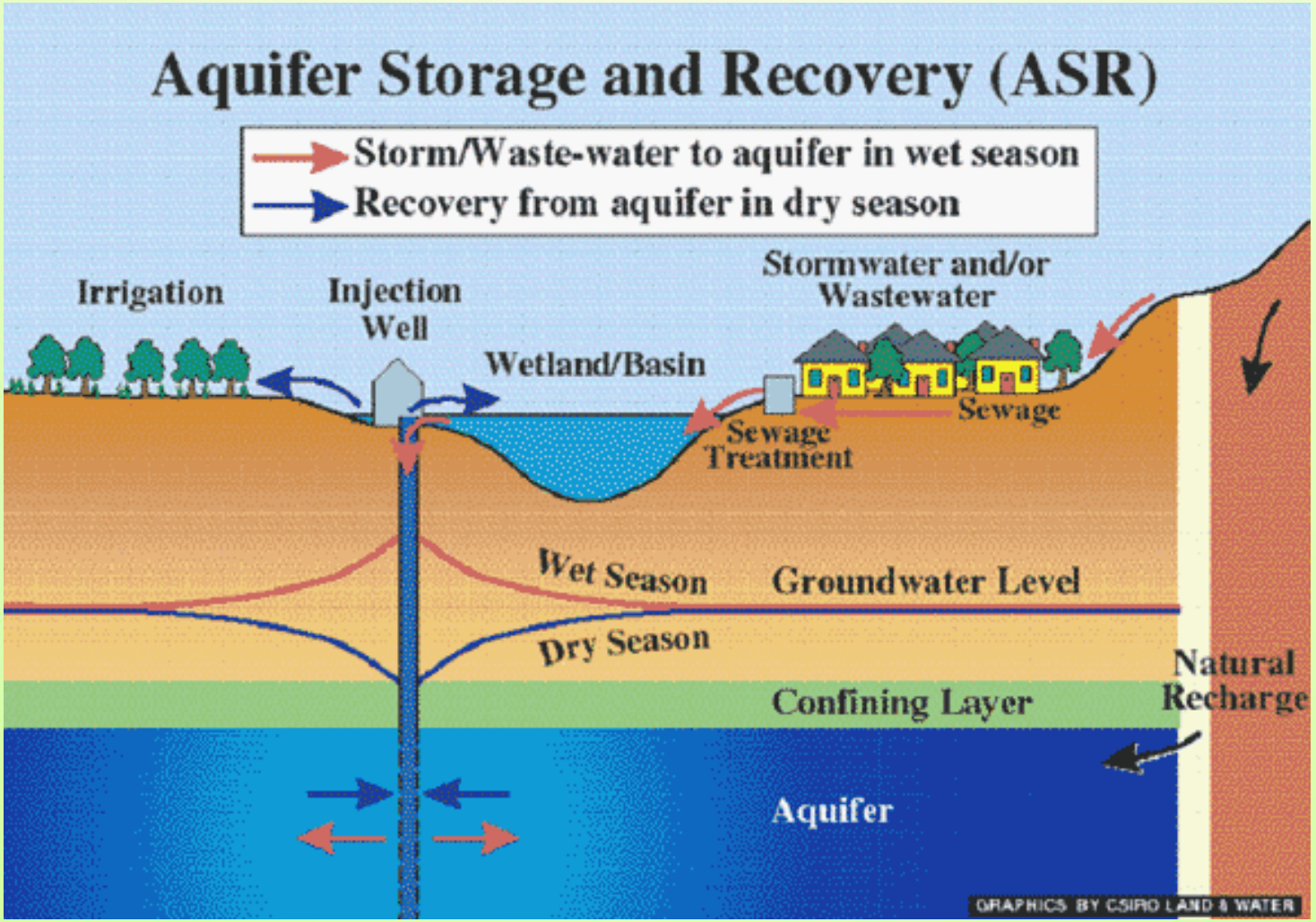
- Determined according to soil types and groundwater resource availability:
  - Aquifer Storage and Recharge.
  - Stormwater harvesting and re-use (SHARE) systems;
  - Sewer mining;

Considerations:

- Recognition of geomorphologic opportunities and constraints:
  - Guildford formation / sands;
  - Aquifer characteristics;
  - Groundwater over-allocation;
  - Lot yield and irrigation use

Endemic

CONVENTIONAL ASR: IMAGE EXAMPLE FROM CAMPBELLTOWN SOUTH AUSTRALIA

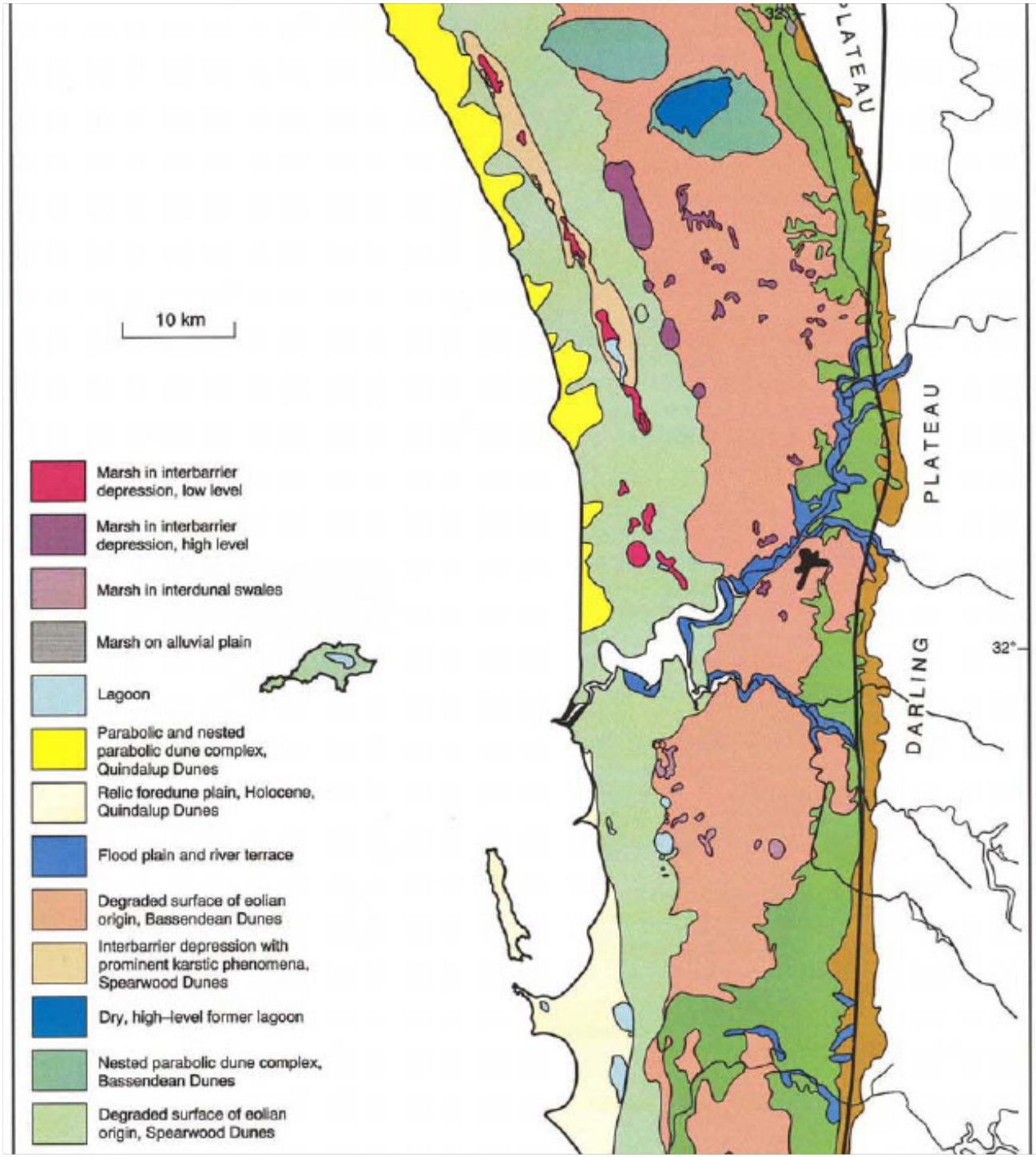


Endemic

SHARE SYSTEMS: THE CONCEPT

- A form of domestic-scale ASR already common on Swan Coastal Plain:
  - Lot-level soak-wells
  - Estate-level side entry pits / infiltration basins / swales
  - → *SHARE systems that don't employ aquifer injection or wastewater reuse*
- Estate-scale opportunities → harvest and storage of stormwater within the superficial aquifer:
  - Groundwater bores extract non-potable water from superficial aquifer
  - Water used ex-house for lot, verge and POS irrigation
  - Superficial aquifer perpetually replenished thorugh stormwater harvesting system

Endemic



Mindful of constraints:

- Wetlands
- Soil type
- Groundwater mounds
- Bush Forever
- Saline intrusion
- Aquifer over allocation
- Groundwater contamination
- Groundwater capture zone

Endemic

Aquifer Storage

- Clay soils unsuitable for SHARE
- Minimal surficial aquifer storage
- Stratigraphy complex near Scarp
- Yarragadee and Leederville over allocated

Endemic

SHARE SYSTEMS

- Passive, do not require pressurisation/injection
- No large storage need prior to injection
- Use soak wells and infiltration swales (WSUD integration)
- Suited to sandy soils, not clays
- Existing suburban areas using a form of this.....domestic bores - just not managed efficiently or integrated design

Endemic

SEWER MINING: THE CONCEPT

Sewerage wastewater extracted from local sewerage system

Transported to wastewater treatment plant

Wastewater treated; transported via recycled water network for irrigation

- For some estate-scale developments, geomorphologic constraints will not permit the use of SHARE or ASR. An alternative water source may be found in sewer mining.
  - Water treated to appropriate reuse standards;
  - Return biowaste and tailwater to the sewerage network;
  - Turned off during winter. Treatment level dictates nutrient loading
  - Pilot plants have included Flemington racecourse & workplace6 in Sydney

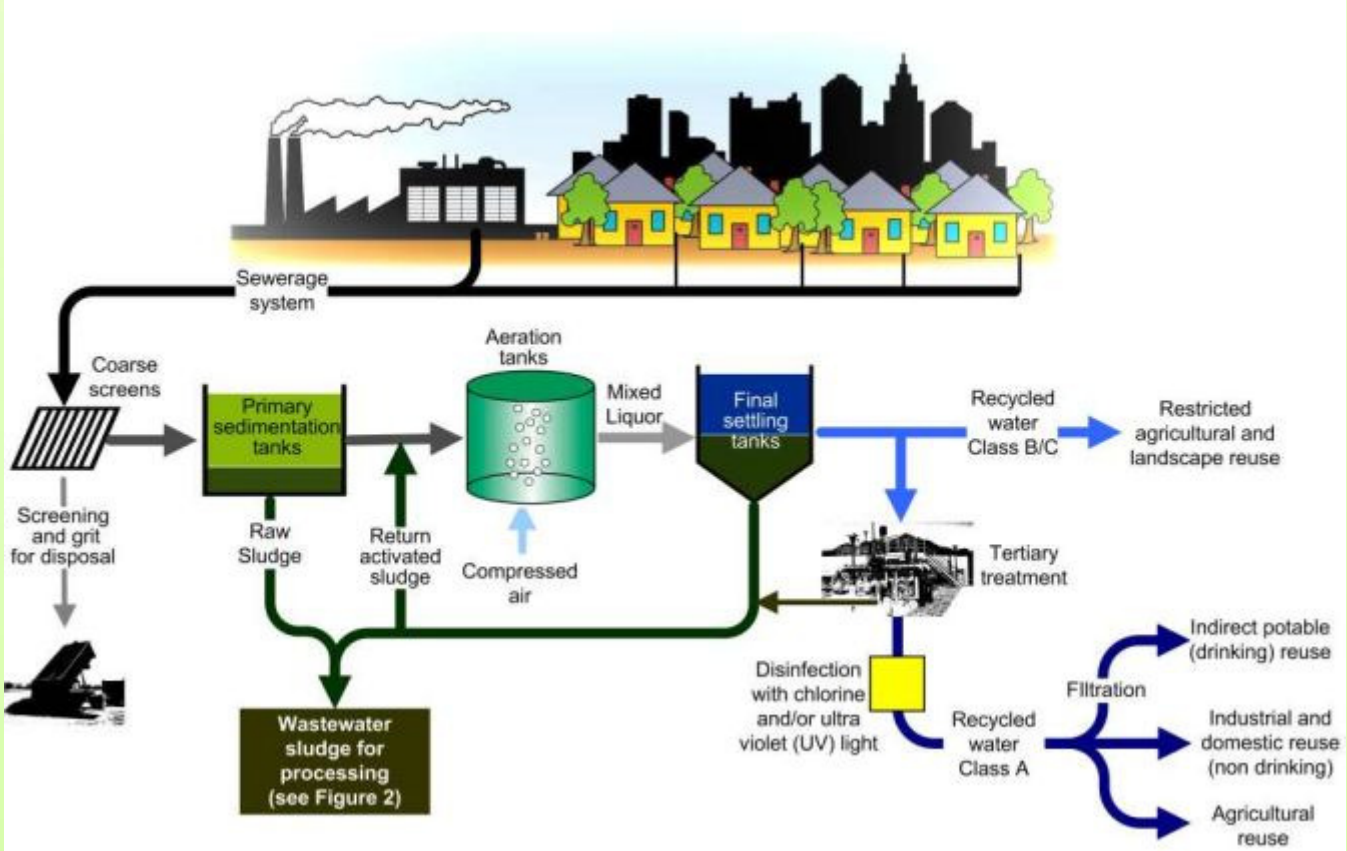
Endemic

SEWER MINING: EXAMPLES

Flemington racecourse sewerage wastewater treatment trial unit: Smart Water Fund
(http://www.smartwater.com.au/projects/Documents/CaseStudies/CS_SWF_WTA_SewerMining.pdf)

Endemic

SEWER MINING: EXAMPLES

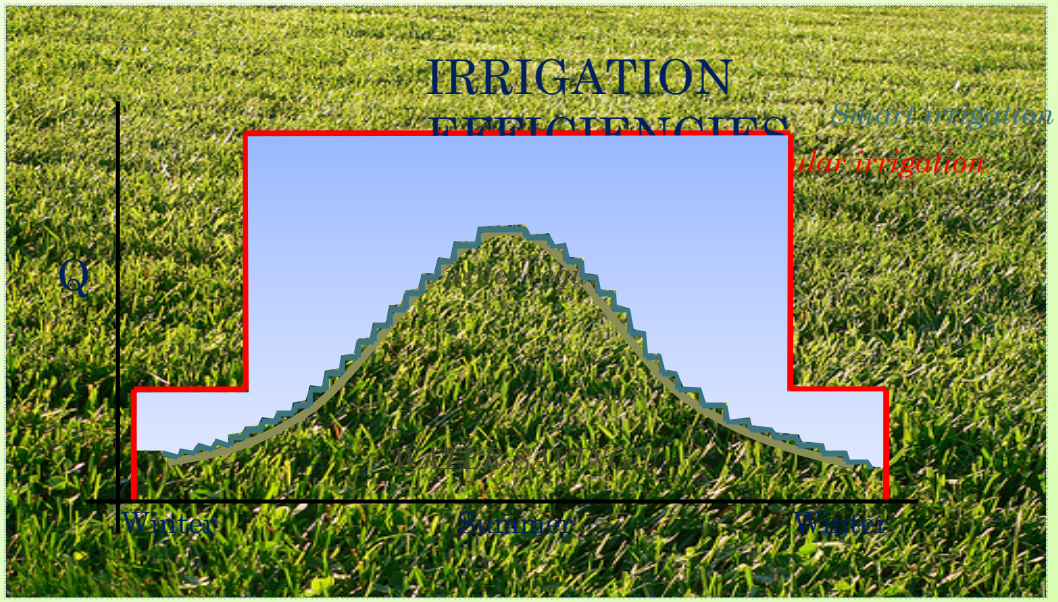


Australian & New Zealand Biosolids partnership & AWA sewer mining model.
(http://www.biosolids.com.au/images/sewage-treatment-process.jpg)

Endemic

SMART IRRIGATION: THE CONCEPT

- Household water use for garden irrigation reduced
- Water used for POS and verge irrigation reduced



- Automatically adjust irrigation run times in response to environmental changes
- A well-designed 'smart irrigation' system can be 95% efficient matching actual daily plant water requirements to realise water use savings of >40%.

Endemic

SMART IRRIGATION: ONE STEP FURTHER

- Technological advancements now permit internet upload of daily irrigation schedules to household smart irrigation controllers. Note, all new suburbs provide broadband installation to lots.

- Environmental data collected locally and irrigation schedule tailored for entire development area;

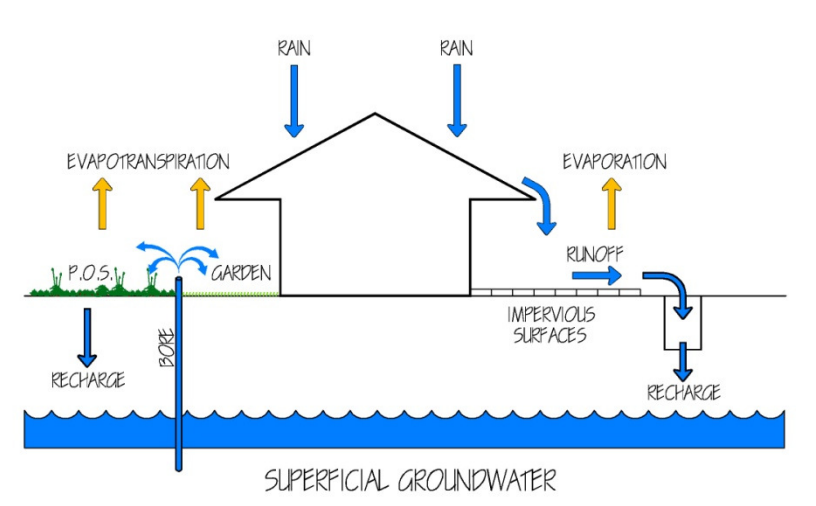
- Data can be communicated to smart control irrigators by SMS or email to switch on or switch off;
- Cheaper, more advanced system, well suited to future first home buyer residents.

Endemic

SMART IRRIGATION & SHARE: AN EXAMPLE

Banksia Grove

Banksia Grove water cycle



- Total annual water demand 695,979 kL/annum, meets <150kL target;
- Smart irrigation used non-potable water from superficial aquifer; aquifer replenished through stormwater harvesting (SHARE) system. 6 local bores supply the estate
- Estimated cost of non-potable water sourcing and smart irrigation system was $2.53 c/kL; but using less than 50% water
- Expected outcomes were:
  - No use of household drinking water supply
  - Conventional ex-house water usage reduced by 50% - Return on Investment approx. 18 mths
  - New benchmark for water use efficiency for Perth households
  - Federal Government grant recieved

Endemic

QUESTIONS

Thank you.

Geoff Bott

Geoff.bott@endemic.net.au