

DESALINATION IN AUSTRALIA

Sustainably Drought Proofing Australia

Desalination as a Drought Proof Water Supply Option

G'DAY USA

LOS ANGELES

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I Come From the Land Down-under

A Land of Plenty

A Land of Extreme -

Floods and Droughts -

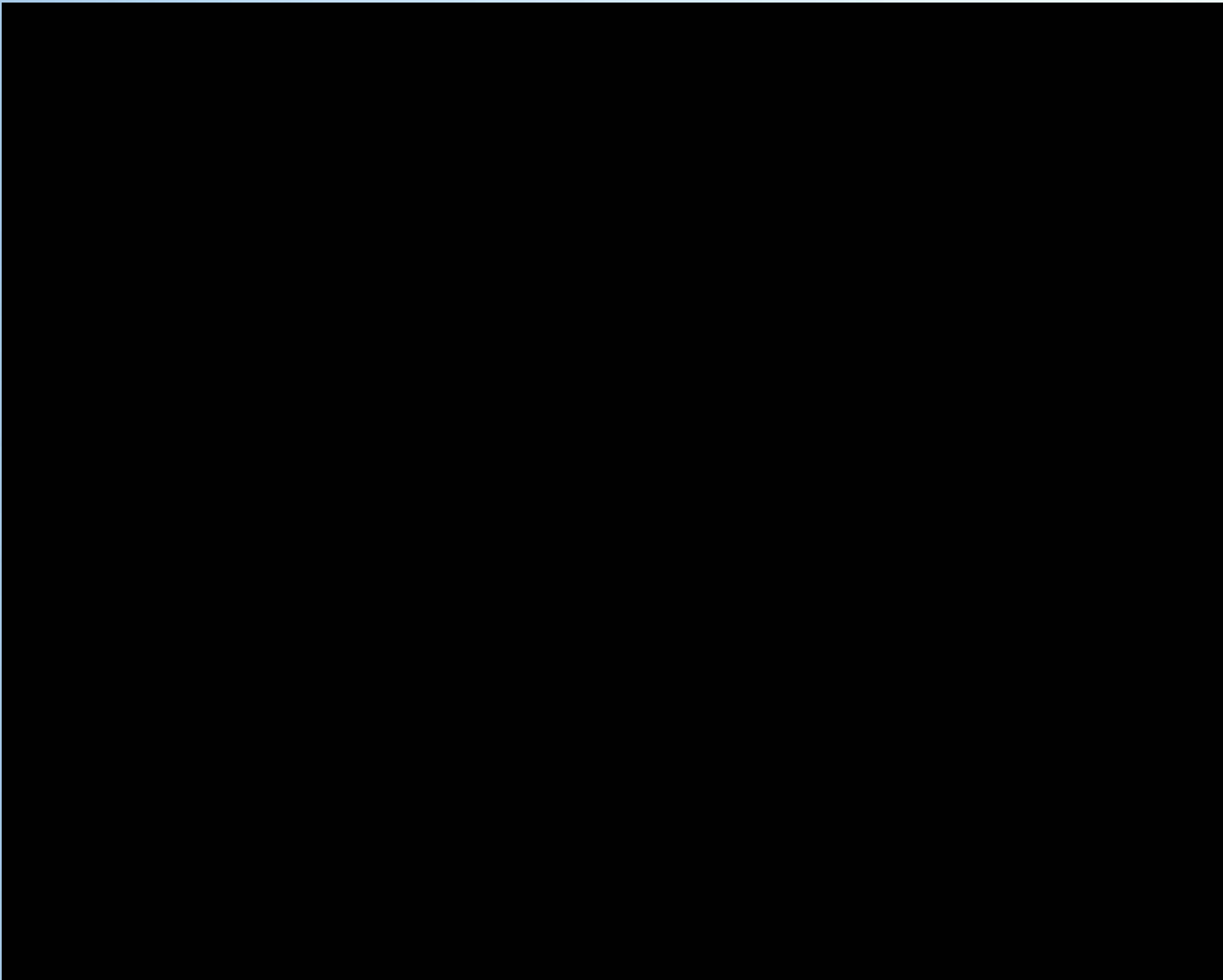
More Droughts than Floods Though

(to be sung to the Men at Work Tune – Down Under)

**I have just spent 2.5 Years Building the Worlds Most
Effective “Cloud Seeding Machine”**

**Its Called the Gold Coast Desalination Plant
But it is currently the saving water supply grace.**





Wungong Trial
Gnangara Pines
Metro Catchments



Catchment Management



Smarter use of Water

41000 gallons/y per capita
by 2012 (for Perth)



Wellington Dam
Brunswick River
Dam

Surface Water

Perth Seawater
Desalination Plant



Groundwater



Security through Diversity



SW Yarragadee
Gingin
Yanchep
Eglington

Groundwater

Water Efficiency
From Irrigation



Water Trading



Water Recycling

Kwinana Water
Reclamation Plant
20% reuse by 2012 target



The Big 6

Australia's six big desalination plants



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The Big Six – No. 1

Perth Seawater Desalination Plant (Perth I) - 38 mgd

- Client: Water Corporation
- Capacity: 38 mgd
- Plant Capital Cost: \$266 million
- Connecting System (IWSS): \$51 million
- Total Capital Cost: \$317 million
- Total Operating Cost: \$16 million/year
- Unit Cost: \$1,172/AF (AU\$1.00/m³)
- Commissioning Completion: 2007
- **GHD Involvement:** Production of Basis of Design and Basis of Construction Documents, 3rd Party Review of Designs from both Competing Consortia, Durability Reviews During Design and Construction Phase, Integration Network Concept and Detailed Design including the largest Pumping Station in the Perth Integrated System, the Nicholson Road Pumping Station (10 MW). Seaglider Oceanographic Measurements
- Configuration: Open Intake, Diffuser Outfall, Travelling Band Screens, Dual Media Pressure Filtration, 5 Micron Cartridge Filtration, 2 Pass SWRO System, Lime and CO₂ Re-mineralisation
- Seawater Feed Quality: 35000 – 38000 mg/L TDS
- Product Water Quality: < 200 mg/L
- Specific Energy Consumption (SEC): < **13.58 (13.18) kWh/kgal** - 3.59 (3.48) kWh/m³
- Technology Contractor: Degremont (France/Spain)
- Delivery Method: **Competitive Alliance - DBO**
- Awards: **GWJ Membrane Desalination Plant of Year 2006**
ERI Awarded GWJ Environmental Contribution of the Year 2006

Perth Seawater Desalination Plant



- Located in Kwinana
- 38 mgd Capacity: 40,552 AF/Y
- 24 MW Power Required

- 140 mg/L Product Water
- Commenced operation in Nov. '06
- Wind Power is used as offset

Courtesy of Water Corporation



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The Big Six – No. 2

Gold Coast Desalination Plant - 35 mgd (133 MLD)

- Client: Water Secure - Queensland
- Capacity: 36 mgd
- Plant Capital Cost: \$745 million (tunnels \$213 million)
- Connecting System (IWSS): \$198 million
- Total Capital Cost: \$943 million
- Total Operating Cost: \$32 million/year
- Unit Cost: \$2,932/AF (\$2.03/m³)
- Commissioning Completion: 2009
- **GHD Involvement:** Owners Engineer Construction and Design Review, Durability, 3rd Party Review, overall alliance project management from owners viewpoint, water quality (raw and product), instrumentation and commissioning, M&E Review, SCADA Review
- Configuration: Open Intake, Diffuser Outfall, Drum Screens, Dual Media Gravity System, Lime Filtration, 5 Micron Cartridge Filtration, 2 Pass SWRO and CO₂ Re-mineralisation
- Seawater Feed Quality: 35000 – 38000 mg/L TDS
- Product Water Quality: < 200 mg/L
- Specific Energy Consumption (SEC): < **12.38 kWh/kgal** (3.30 kWh/m³)
- Technology Contractor: Veolia (France)
- Delivery Method: **Alliance - DBO**
- Awards: **GWI Membrane Desalination Plant of Year 2008**



Gold Coast Desalination Plant



- Located in Tugin
- 36 mgd Capacity: 38,427 AF/Y
- 22 MW Power Required

- 140 mg/L Product Water
- Commenced operation in Nov. '08
- Green Energy as offset



The Big Six – No. 3

Sydney Desalination Plant - 66 mgd – Expandable to 132

- **Client:** Sydney Water – New South Wales
- **Capacity:** 66 mgd (expandable to 132 mgd)
- **Plant Capital Cost:** \$787 million (tunnels \$189 million)
- **Connecting System:** \$410 million
- **Other:** \$246 million
- **Total Capital Cost:** \$1,443 million
- **Total Operating Cost:** \$37 million/year
- **Unit Cost:** \$1,950/AF (\$1.74/m³)
- **Commissioning Completion:** 2010
- **GHD Involvement:** Feasibility Study, Preparation of Environmental Statement and Secured Approvals. Prepared Reference Design and Basis of Design and Construct, Seawater quality sampling program, All Geotechnical Investigations (on & offshore), Pilot Plant Infrastructure Design and Facilitation, Procurement Method Evaluation, Tender Documentation, Tender Evaluation (Owners Engineer), Technical Advisor – Design Review of Contractors Design, Durability, Construction Surveillance & Commissioning Support, Marine & Estuarine Monitoring Program Management, Represented Owner's Interest During Construction.
- **Configuration:** Open Intake, Diffuser Outfall, Drum Screens, Dual Media Gravity Filtration, 5 Micron Cartridge Filtration, 2 Pass SWRO System, Lime and CO₂ Re-mineralisation
- **Seawater Feed Quality:** 32000 – 41000 mg/L TDS
- **Product Water Quality:** < 140 mg/L TDS
- **Specific Energy Consumption (SEC):** < **14.76 kWh/kgal** (3.9 kWh/m³)
- **Technology Contractor:** Veolia (France)
- **Delivery Method:** **DBO**
- **Awards:** A Great Contender for 2011 GWI Award, Multiple Australian Awards



The Big Six – No. 3

Sydney Desalination Plant - 66 mgd expandable to 132



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Courtesy of Sydney Water

The Big Six – No. 4

Adelaide Desalination Plants I and II – 40 + 40 mgd (150 MLD each)

- **Client:** South Australia Water
- **Capacity:** 36 mgd + 18 mgd +18 mgd
- **Plant Capital Cost:** \$1,255 million (Estimated)
- **Connecting System (IWSS):** \$246 million (Estimated)
- **Total Capital Cost:** \$1,500 million
- **Total Operating Cost:** \$67 million/year (36mgd)
- **Unit Cost:** \$3,033/AF (\$2.70/m³) Estimated levelised cost
- **First Water:** December 2012
- **GHD Involvement:** Owners Engineer due diligence review during project development phase, Environmental Impact Statement and Development Approvals, Water Quality Integration Review and Ongoing Support.
- **Configuration:** Open Intake, Diffuser Outfall, capacity to 72 mgd 2 Pass SWRO System, initial capacity 54 mgd Lime and CO₂ Re-mineralisation
- **Seawater Feed Quality:** 35000 – 38000 mg/L TDS
- **Product Water Quality:** < 200 mg/L
- **Specific Energy Consumption (SEC):** < **18.9 (17.0) kWh/kgal** - 5 (4.5) kWh/ m³
- **Technology Contractor:** Acciona (Spain)
- **Delivery Method:** DBO
- **Awards:** Not Completed Yet

The Big Six – No. 4

Adelaide Desalination Plants I and II – 40 + 40 mgd (150 MLD each)



The Big Six – No. 5

Southern Seawater Desalination Plant (Perth II) - 40 mgd to 80 mgd

- Client: Water Corporation of Western Australia
- Capacity: 40 mgd 1st Stage, 80 mgd 2nd Stage
- Plant Capital Cost: \$640 million (Estimated with double intake/outfall)
- Connecting System (IWSS): \$98 million (Estimated)
- Total Capital Cost: \$738 million (Estimated)
- Total Operating Cost: \$29 million/year (Estimated)
- Unit Cost: \$2,042/AF (\$1.81/m³) Estimated
- Commissioning Completion: 2011
- GHD Involvement: Alliance Team / Plant Engineering/ Bid (note, out of 8 expressions of interest, which were reduced to two by the Water Corporation, the GHD – Acciona - United Utilities Team was one and did not win the Alliance Contract. It should be noted that Acciona using this design went on to win both Adelaide desalination plant projects from which GHD were excluded due to their partial owners role in this project and their Owners Engineer Role on Melbourne, for whom Acciona was also bidding, hence another set of consulting engineers was selected by the contractor). Seaglider Oceanographic Measurements
- Configuration: Open Intake, Diffuser Outfall, Travelling Band Screens, UF PVDF Pressure Filters, 5 Micron Cartridge Filtration, 2 Pass SWRO System, Lime and CO₂ Re-mineralisation
- Seawater Feed Quality: 35000 – 38000 mg/L TDS
- Product Water Quality: < 200 mg/L
- Specific Energy Consumption (SEC): < 16.04 (12.97) kWh/kgal - 4.24 (3.36) kWh/m³
- Technology Contractor: Tecnicas Reunidas, Valoriza Agua (Spain)
- Delivery Method: Competitive Alliance - DBO
- Awards: Not Completed Yet

The Big Six – No. 5

Southern Seawater Desalination Plant (Perth II)

150 MLD (40 mgd) Expandable to 300 MLD (80 mgd)



Courtesy of Water Corporation



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The Big Six – No. 6

The Victorian Desalination Project - 120 mgd

- Client: Victorian Government
- Capacity: 120 mgd 1st Stage, 160 mgd 2nd Stage
- Plant Capital Cost: \$1,840 million (Estimated)
- Connecting System (50 Mile Pipeline): \$820 million (Estimated)
- Underground power connection \$246 million (Estimated)
- Total Capital Cost: \$2,870 million
- Total Operating Cost: \$98 million/year (Estimated)
- Unit Cost: \$2,550/AF (\$2.27/m³) Estimated
- Commissioning Completion: 2011
- **GHD Involvement:** Feasibility Study, Environment Effects Statement and Approvals, Reference Design, Seawater quality sampling program, all geotechnical investigations (on & offshore), Pilot Plant facilities and support, Marine growth experiment, Management of Landowner Engagement, GIS & Mapping, Data Management, Tender Preparation and Evaluation, Design Review, Strategic Direction and Ongoing Support to Completion.
- Configuration: 4 m Dia. Undersea Inlet and Outlet Tunnels, Drum Screens, Dual Media Pressure Filtration, Cartridge Filtration, 2 Pass SWRO System, Lime and CO₂ Re-mineralisation
- Seawater Feed Quality: 35 000 – 38 000 mg/L TDS
- Product Water Quality: < 120 mg/L
- Specific Energy Consumption (SEC): < **18.17 (15.90) kWh/kgal** - 4.8 (4.2) kWh/ m³
- Technology Contractor: Degremont (France/Spain)
- Delivery Method: **PPP - BOO**
- Awards: Not Completed Yet



The Big Six – No. 6

The Victorian Desalination Project - 120 mgd then 160 mgd



Courtesy of Victorian Government



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Selected Tariffs

City	Combined Tariff	Average Domestic use (L/head/day)
Adelaide	\$3.60/m ³	605
Brisbane	\$4.85/m ³	605
Chicago	\$0.99/m ³	616
Copenhagen	\$8.00/m ³	114
Los Angeles	\$2.49/m ³	606
Melbourne	\$4.36/m ³	606
San Diego	\$4.93/m ³	616
Sydney	\$5.03/m ³	606

Costs in US\$ per cubic metre of water = Water + Wastewater fixed costs +
Water Variable costs
Wastewater variable costs
Total Sales Tax

Summary of key data from the 2010 GWI Global Water Tariff Survey

WESTERN AUSTRALIAN

\$167 Billion worth of Resources

Development
on the books

only 2 million people

3 additional large desalination plants
planned excluding the doubling of Perth II



Water Corporation Regions Supplied by Operation Development Services



Ravensthorpe TWS RO Plant



Ravensthorpe TWS RO Plant

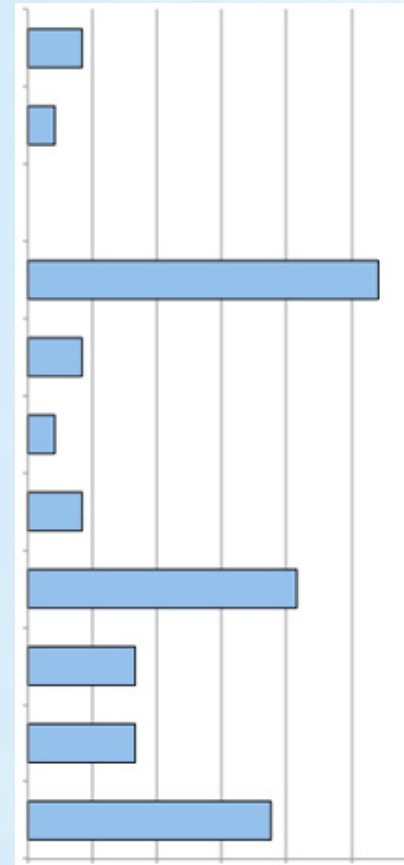


Future Californian SWRO Plants

Survey Question: Which project will be the first to make water?

WDR November 8, 2010

1. Other
2. West Basin MWD
3. Scattergood (LADWP)
4. Monterey Regional (Marina Coast)
5. City of Long Beach
6. Huntington Beach (Poseidon)
7. Dana Point (MWDOP)
8. Carlsbad (SDCWA/Poseidon)
9. Camp Pendleton (SDCWA)
10. Bay Area Regional
11. Baja California (NSC Agua)



Perth Seawater Desalination Plant

**Awarded
GWI World Membrane Desalination
Plant of the Year 2007**



**ERI Awarded GWI
Environmental
Contribution of the
Year 2007**



Courtesy of Water Corporation



Courtesy of ERI

Gold Coast Desalination Plant

Awarded GWI World Membrane Desalination Plant of the Year 2009



Courtesy of WaterSecure



Can California Do the Same in SWRO?

“Yes We Can”
“Aqua La Vista - Baby,”
“Still Awaiting Quote”





International Desalination Association

Awarded 2011 World Congress - to



Perth
Western
Australia

See You There!



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CalDesal



Californian Desalination needs your support



Questions? Thank you.

Welcome to GHD

About us

GHD is one of the world's leading

Established in 1928, GHD employs
water, energy and resources, e

Wholly-owned by its people, GHD
scientists, project managers and
Our core values of Teamwork, |

A member of the World Business
development, safety and innovation
operate.

GHD operates under a Practitioner
ISO 14001:2004 which are cer



global markets of

ts, planners,
and the community.
ional results.

ment to sustainable
vements in which we

agement System,

GHD locations

