APPENDIX H3

Comparisons with other desalination plants

H3 COMPARISONS WITH OTHER DESALINATION PLANTS

Table H3.1 provides a comparison of the pre-approval assessment undertaken for BHP Billiton's proposed Point Lowly desalination plant with other coastal reverse osmosis desalination plants in Australia.

Table H3.1: Summary of the proposed BHP Billiton desalination plant compared to other Australian desalination plants (as specified by pre-approval documentation)

Aspect of studies/ assessment	BHP Billiton (proposed)	Adelaide (construction)	Melbourne (construction)	Sydney (operating)	Gold Coast (operating)	Perth I (operating)	Perth II (construction)
Primary references	Draft EIS, Supplementary EIS	SA Water 2008, 2009	Department of Sustainability and Environment 2008	GHD Fichtner 2005; Trousdale and Henderson 2009	Gold Coast Desalination Alliance 2006; Cannesson et al. 2009	WEC 2002; Strategen 2004; Geotechnical Services 2008	Water Corporation 2008a, 2008b
General specifications							
Capacity (GL/a)	92	100	150	91 expandable to 182	45	45	50 expandable to 100
Return water discharge (ML/d)	370 (peak), 309 (average)	315	750	361 (for 182 GL/a plant)	200	180	420 (for 100GL/a plant)
Ambient salinity (g/L)	40–43	36–38	35–37	32–40	34–39	35–38	34.5–36.5; 30 during storms
Ecotoxicology							
Timing of tests with respect to approval	Before	Before	Before	After	After	After	Perth I results presented in Public Environmental Report (no new tests undertaken)
Composition of test effluent	Anti-scalant	Anti-scalants (with pH adjustment), chlorination products, backwash supernatant	Return water samples from the Perth desalination plant, including backwash supernatant	Operational plant discharge, including backwash supernatant	Operational plant discharge, including backwash supernatant	Simulated and pilot plant return water (each with anti-scalant), and later production plant discharge, including backwash supernatant	Not applicable
Number of species tested	16	8	6	5	6	5	0
Number of species used to calculate safe dilution	7 (primary dataset) 10 (secondary dataset)	6	6	5	5	5	0 (Perth I results used)
Acute/chronic data used to calculate safe dilution	Only chronic/ sub-chronic data	Two acute tests, ACR of 2.5. A second phase of testing using only chronic data was partially completed	Two acute tests, ACR of 2.5	Not determined	Only chronic/ sub-chronic data	Only chronic/ sub-chronic data	Perth I results used

Table H3.1: Summary of the proposed BHP Billiton desalination plant compared to other Australian desalination plants (as specified by pre-approval documentation) (cont'd)

Aspect of studies/ assessment	BHP Billiton (proposed)	Adelaide (construction)	Melbourne (construction)	Sydney (operating)	Gold Coast (operating)	Perth I (operating)	Perth II (construction)
Species Protection Trigger Value: dilution to protect % of species	1:70 (99%), 1:45 (95%)	1:16 (99%); 1:13 (95% – adopted), later revised to 1:20	<1:29 (99% – adopted)	<1:30 (95%)	1:10 (99%); 1:9 (95% – adopted)	1:16 (99%), 1:13 (95% – adopted) (conducted once operational)	Perth I results used
Diffuser modelling							
Outfall distance offshore (m) and construction method	900–1,100 (tunnelled)	>1,500 (tunnelled or trenched – since confirmed to be tunnelled)	Approximately 1,000 (tunnelled)	250–350 (tunnelled or trenched)	1,200 (tunnelled)	500 (trenched)	<1,100 (trenched)
Outfall diffuser system	Four rosettes spaced 67 m apart, each with five ports (although a linear diffuser is still possible)	250 m linear diffuser, 42 tee risers (84 ports)	Six rosettes spaced 50 m apart, each with five ports	Three rosettes spaced 25 m apart, each with four ports	185 m linear diffuser, eight ports	80–180 m linear diffuser (16–18 ports)	2 x 220 m linear diffusers
Near-field modelling tools	Cormix (USEPA 2010), Roberts equations (Roberts et al. 1997; Roberts & Toms 1987), Computational fluid dynamics (CFD)	Roberts equations (modified)	Visjet (Lee et al. 1990)	Roberts equations	Roberts equations	Roberts equations	Roberts equations
Predicted near-field dilutions	Roberts: 66 (first contact), 107 (at 65 m) CFD: 43 (first contact), 93 (at 100 m)	>50 (first contact)	>50 (first contact)	30 (first contact)	40–71 (at 60 m)	45 (first contact)	30 (first contact) 50 (at 100 m)
Sensitivity analysis of diffuser	Yes	Yes	Yes	No	No	No	No
Other modelling							
Coupling of diffuser and plume dispersion models	Pre-diluted insertion (based on CFD dilutions)	Direct insertion with Roberts used to determine cells for initial dispersion	Pre-diluted insertion	Multiplication of dilution factors	No plume dispersion modelling undertaken	Pre-diluted insertion (post-approval modelling)	Flux approximation

Table H3.1: Summary of the proposed BHP Billiton desalination plant compared to other Australian desalination plants (as specified by pre-approval documentation) (cont'd)

Aspect of studies/ assessment	BHP Billiton (proposed)	Adelaide (construction)	Melbourne (construction)	Sydney (operating)	Gold Coast (operating)	Perth I (operating)	Perth II (construction)
Field data collected for calibration/ validation of plume dispersion model	ADCP deployment for 2 months; a further 4 ADCPs and 6 CTDs concurrently deployed for 1–2 months; long term deployment of 1 ADCP and 3 CTDs for 15 months	Two ADCP deployments of 1–2 months; no salinity data; permanent tide gauge	Use of a suite of models previously developed for Victorian waters which has been calibrated, verified and published in the peer-reviewed scientific literature for more than 20 years	Existing regional current meter data were used, and an ADCP was deployed for one month for qualitative validation	No plume dispersion modelling undertaken	Two months of real-time temperature, salinity and meterological data (Yeates et al. 2006) (post-approval modelling)	ADCP deployment for one month; one Rhodamine dye release event
Dissolved oxygen modelling	CAEDYM	Not undertaken	Not undertaken	Not undertaken	Not undertaken	Box model, CAEDYM (after approval)	Not undertaken
Climate change modelling	Detailed consideration of changes to climatic forcing data over 70-year run	Flushing box model based on climate change forecasts; long-term runs incorporated climate change scenarios	Not undertaken	Not undertaken	Not undertaken	Not undertaken	Not undertaken
Entrainment assessment							
Intake length offshore (m) and construction method	400 (trenched)	>1,000 (tunnelled)	>800 (tunnelled)	300–400 (tunnelled or trenched)	1,400 (tunnelled)	200 (trenched)	>400 (trenched)
Depth of intake structure (m)	14	15–18	>15	20	18	Not determined	9
Height of intake off bottom (m)	2 up to 5	Above 3–4	4–5 up to 8	Up to 6	Above 4	Not determined	3.5 to 5.5
Maximum intake flow rate (m/s)	0.2	0.15 (0.01 at 10 m from intake perimeter)	0.15	0.1 (0.026 at 2 m from intake perimeter)	0.05	0.1	0.15
Plankton surveys	Seasonal larval fish surveys	Monthly surveys of larvae and plankton (partially completed)	Monthly fish larval surveys for 3 months during spring/ early summer	Not undertaken. Some fish larval data available for another NSW site from previous studies.	Not undertaken	Not undertaken. Some plankton data available from previous studies	Not undertaken
Larval entrainment modelling	Modelling of larval pathways and source of entrained larvae for entire region	Modelling of a limited number of larval input pathways	Modelling of larval pathways and source of entrained larvae for entire region	Not undertaken	Not undertaken	Not undertaken	Not undertaken

H3.1 REFERENCES

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