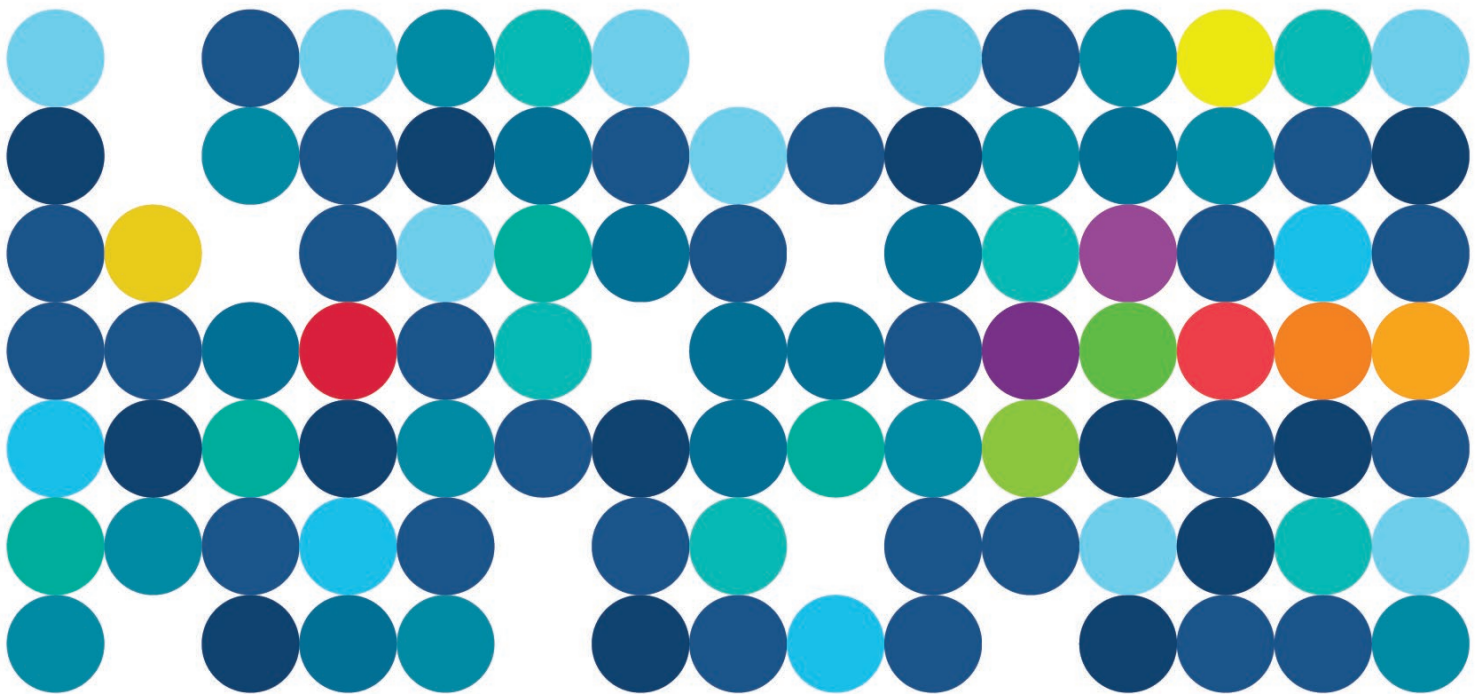


Alkimos Seawater Desalination Plant

Environmental Review Document





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Contents

Acronyms.....	i
Units	iii
Executive summary.....	i
Introduction	i
Assessment process	i
Background and context	i
Overview of Proposal	ii
Description of the Alkimos environment	vii
<i>Marine</i>	vii
<i>Terrestrial</i>	vii
Consultation	viii
Summary of potential impacts, proposed mitigation and outcomes	viii
<i>Marine environmental factors</i>	viii
Terrestrial environmental factors	xii
<i>Other environmental factors</i>	xvi
1. Introduction	1
1.1 Purpose and scope	1
1.2 Proponent	1
1.3 Environmental impact assessment process	1
1.3.1 <i>Western Australian Environmental impact assessment process</i>	2
1.3.2 <i>Western Australian standards, guidelines and policies</i>	2
1.4 Other approvals and regulation	2
1.4.1 <i>Tenure</i>	2
1.4.2 <i>Decision-Making Authorities</i>	3
1.4.3 <i>Other approvals required</i>	3
1.5 Exclusions	4
2. Background and Proposal justification.....	5
2.1 Water source planning	5
2.2 Timing for the next major water source	6
2.3 Alternatives considered	6
2.3.1 <i>Alternate water sources</i>	6
2.3.2 <i>Desalination plant location options</i>	7
2.4 Eglinton Groundwater Treatment Plant co-development	9
2.5 Integration pipeline alignment	10



3.	The Proposal.....	11
3.1	Proposal description	11
3.2	Proposal elements	11
3.2.1	<i>Development Area Footprint</i>	11
3.2.2	<i>Key Proposal characteristics</i>	15
3.3	Staging	21
3.3.1	<i>Pilot plant</i>	21
3.3.2	<i>Alkimos Seawater Desalination Plant staging</i>	21
3.4	Construction	22
3.4.1	<i>Enabling works</i>	22
3.4.2	<i>Marine infrastructure</i>	23
3.4.3	<i>ASDP infrastructure</i>	27
3.4.4	<i>Integration pipeline</i>	31
3.5	Commissioning	32
3.5.1	<i>Seawater Desalination Plant</i>	32
3.5.2	<i>Integration pipeline</i>	33
3.6	Operation	33
3.6.1	<i>Seawater Desalination Plant process overview</i>	33
3.6.2	<i>Maintenance and cleaning</i>	34
3.7	Local and regional context	37
3.7.1	<i>Physical and ecological characteristics of the terrestrial environment</i>	37
3.7.2	<i>Physical and ecological characteristics of the marine environment</i>	39
3.8	Socio-economic	43
3.8.1	<i>Alkimos Water Precinct</i>	43
3.8.2	<i>Other surrounding land uses</i>	43
4.	Stakeholder engagement	47
4.1	Key stakeholders	47
4.2	Stakeholder and community engagement process	47
5.	Environmental principles and factors	49
5.1	Identification of key factors and their significance	49
1	Key environmental factor are shown in bold.	50
5.2	Consistency with environmental principles	50
5.3	Relevant policy and guidance	52
6.	Marine Environmental Quality.....	55
6.1	EPA objective	55
6.2	Policy and guidance	55
6.3	Overview of studies	56
6.4	Receiving environment	58
6.4.1	<i>Environmental values</i>	58



6.4.2	<i>Marine environmental quality</i>	58
6.5	Potential impacts	72
6.5.1	<i>Potential construction impacts</i>	72
6.5.2	<i>Potential operational impacts</i>	73
6.6	Assessment of impacts	75
6.6.1	<i>Assessment thresholds</i>	75
6.6.2	<i>Construction impacts</i>	79
6.6.3	<i>Operational impacts</i>	83
6.6.4	<i>Cumulative impacts</i>	89
6.7	Mitigation	91
6.7.1	<i>Construction</i>	92
6.7.2	<i>Operation</i>	93
6.8	Predicted outcome	94
7.	Benthic Communities and Habitats.....	96
7.1	EPA objective	96
7.2	Policy and guidance	96
7.3	Overview of studies	96
7.4	Receiving environment	98
7.4.1	<i>Alkimos benthic communities and habitats</i>	98
7.5	Potential impacts	107
7.5.1	<i>Potential construction impacts</i>	107
7.5.2	<i>Potential operational impacts</i>	108
7.6	Assessment of impacts	110
7.6.1	<i>Local Assessment Unit</i>	110
7.6.2	<i>Construction impacts</i>	112
7.6.3	<i>Operational impacts</i>	116
7.6.4	<i>Cumulative impacts</i>	118
7.7	Mitigation	119
7.7.1	<i>Construction mitigation</i>	120
7.7.2	<i>Operations mitigation</i>	121
7.7.3	<i>Predicted outcomes</i>	122
8.	Marine Fauna	124
8.1	EPA objective	124
8.2	Policy and guidance	124
8.3	Overview of studies	124
8.4	Receiving environment	125
8.4.1	<i>Marine fauna</i>	125
8.5	Potential Impacts	131
8.5.1	<i>Potential construction impacts</i>	131
8.5.2	<i>Potential operational impacts</i>	133



8.6	Assessment of impacts	135
8.6.1	<i>Construction impacts</i>	135
8.6.2	<i>Operational impacts</i>	139
8.6.3	<i>Cumulative impacts</i>	141
8.7	Mitigation	141
8.7.1	<i>Construction mitigation strategies</i>	144
8.7.2	<i>Operation mitigation strategies</i>	146
8.8	Predicted outcome	146
9.	Flora and Vegetation	147
9.1	EPA objective	147
9.2	Policy and guidance	147
9.3	Overview of studies	148
9.4	Receiving environment	149
9.4.1	<i>Vegetation complexes</i>	149
9.5	Vegetation associations	151
9.6	Vegetation types	151
9.6.1	<i>Vegetation condition</i>	159
9.6.2	<i>Threatened Ecological Communities</i>	179
9.6.3	<i>Priority Ecological Communities</i>	179
9.6.4	<i>Flora</i>	191
9.6.5	<i>Declared pests</i>	191
9.6.6	<i>Dieback</i>	191
9.6.7	<i>Bush Forever</i>	191
9.6.8	<i>Riparian and wetland vegetation</i>	192
9.6.9	<i>Groundwater dependent ecosystems</i>	192
9.7	Potential impacts	197
9.8	Assessment of impacts	197
9.8.1	<i>ASDP site</i>	198
9.8.2	<i>Pipeline</i>	199
9.9	Mitigation	209
9.9.1	<i>Mitigation strategies</i>	210
9.10	Predicted outcome	210
10.	Terrestrial Fauna	211
10.1	EPA objectives	211
10.2	Policy and guidance	211
10.3	Overview of studies	211
10.4	Receiving environment	212
10.4.1	<i>ASDP site</i>	212
10.4.2	<i>Pipeline</i>	212
10.4.3	<i>Black cockatoo</i>	213



10.4.4	<i>Western Brush Wallaby</i>	213
10.4.5	<i>Quenda</i>	214
10.4.6	<i>Fauna habitat</i>	214
10.5	Potential impacts	225
10.6	Assessment of impacts	225
10.6.1	<i>ASDP site</i>	226
10.6.2	<i>Pipeline</i>	227
10.6.3	<i>Summary of impacts</i>	230
10.6.4	<i>Black cockatoo</i>	231
10.7	Mitigation	232
10.8	Predicted outcome	235
11.	Landforms	236
11.1	EPA objectives	236
11.2	Relevant policy and guidance	236
11.3	Overview of studies	236
11.4	Receiving environment	241
11.4.1	<i>Landform</i>	241
11.4.2	<i>Soils</i>	242
11.5	Potential impacts	242
11.6	Assessment of impacts	243
11.6.1	<i>Loss of Landform</i>	243
11.6.2	<i>Increased erosion</i>	243
11.7	Mitigation	243
11.8	Predicted outcome	245
12.	Social Surroundings	246
12.1	EPA objectives	246
12.2	Policy and guidance	246
12.3	Overview of studies	246
12.4	Receiving environment	247
12.4.1	<i>Aboriginal heritage</i>	247
12.5	Potential impacts	253
12.5.1	<i>Potential construction impacts</i>	253
12.5.2	<i>Potential operational impacts</i>	254
12.6	Assessment of impacts	254
12.6.1	<i>Construction</i>	254
12.6.2	<i>Operation</i>	256
12.7	Mitigation	257
12.7.1	<i>Construction</i>	257
12.7.2	<i>Operation</i>	259
12.8	Predicted outcome	260



13.	Other environmental factors	261
14.	Holistic impact assessment	268
15.	References.....	280

List of tables

Table 1-1: Tenure	2
Table 1-2: Decision-Making Authorities relevant to the Proposal.....	3
Table 1-3: Secondary approvals relevant to the Proposal	4
Table 3-1: Key Proposal Characteristics	15
Table 3-2: Seawater Desalination Plant estimated staging.....	22
Table 3-3: Description of construction methods	31
Table 3-4: Potential chemicals used in Seawater Desalination Plant maintenance	35
Table 3-5: Toxicants in the Seawater Desalination Plant cleaning chemicals.....	35
Table 5-1: Key environmental factors, their significance and relationship to the Proposal	49
Table 5-2: EP Act principles.....	51
Table 5-3: EPA policy and guidelines relevant to the Proposal.....	53
Table 6-1: Policies and guidelines.....	55
Table 6-2: Marine environmental quality studies	56
Table 6-3: Environmental values and environmental quality objectives	58
Table 6-4: Minimum centreline dilution at the end of the near field dilution zone as a function of ambient current speed and density difference.....	59
Table 6-5: Extent of predicted near field region (m) as a function of ambient current speed and density difference.....	59
Table 6-6: SDP modelling scenarios	64
Table 6-7: Parameters simulated with respect to the Alkimos WWTP	65
Table 6-8: Parameters simulated with respect to the SDP	66
Table 6-9: Potential construction impacts to marine environmental quality.....	73
Table 6-10: Potential operational impacts to marine environmental quality	75
Table 6-11: Levels of ecological protection linked to the environmental quality objective for maintenance of ecosystem integrity	76
Table 6-12: Indicators and trigger values applied to the assessment of construction impacts	78
Table 6-13: Indicators and trigger values applied to the assessment of operational impacts.....	78
Table 6-14: Expected salinities following the elevations predicted by modelling.....	86
Table 6-15: Published salinity tolerances for marine invertebrate species.....	86
Table 6-16: Dilutions required to achieve ecological protection derived from WET testing	89
Table 6-17: Mitigation hierarchy for potential construction and operational impacts on marine environmental quality	91
Table 6-18: Relevant environmental objectives, performance indicators and proposed measurement criteria	92
Table 6-19: Relevant environmental objectives, performance indicators and proposed measurement criteria	94
Table 7-1: Policies and guidelines.....	96
Table 7-2: Historical and contemporary benthic studies used to inform the Proposal	98



Table 7-3: Morphological groups along with representative common genera used for macroalgae monitoring at Alkimos between 2009 and 2015.....	99
Table 7-4: Classification of benthic habitats mapped at Alkimos in 2017.....	103
Table 7-5: Mean number of individuals, species and species diversity of infauna	105
Table 7-6: Potential construction impacts to benthic communities and habitats	108
Table 7-7: Potential operational impacts to benthic communities and habitats	110
Table 7-8: Escape potential for different bivalve groups for given rates of sediment burial.....	114
Table 7-9: Published salinity tolerances seagrass and macroalgal communities	116
Table 7-10: Alkimos Wastewater Treatment Plant baseline benthic communities and habitats extent (Water Corporation 2005).....	118
Table 7-11: Cumulative loss assessment of benthic communities and habitats mapped within the local assessment unit.....	119
Table 7-12: Summary of mitigation measures to ensure maintenance of ecological integrity	120
Table 7-13: Relevant environmental objectives, performance indicators and proposed measurement criteria for benthic communities and habitats.....	121
Table 7-14: Relevant environmental objectives, performance indicators and proposed measurement criteria	122
Table 8-1: Policies and guidelines.....	124
Table 8-2: Avifauna listed in the EPBC Act Protected Matters Report that may occur within 10 km of the Seawater Desalination Plant	125
Table 8-3: Marine mammals listed in the EPBC Act Protected Matters Report that may occur within 10 km of the Seawater Desalination Plant.....	127
Table 8-4: Marine reptiles listed in the EPBC Act Protected Matters Report that may occur within 10 km of the Seawater Desalination Plant.....	128
Table 8-5: Finfish listed in the EPBC Act Protected Matters Report that may occur within 10 km of the Seawater Desalination Plant area	129
Table 8-6: Potential construction impacts to marine fauna	133
Table 8-7: Potential operational phase impacts to marine fauna	135
Table 8-8: Potential noise level impacts and noise thresholds for marine fauna associated with the Proposal (McCauley et al 2010).....	137
Table 8-9: Available published salinity tolerances of key commercial fishery species in Alkimos	140
Table 8-10: Summary of mitigation measures to ensure maintenance of marine fauna.....	142
Table 8-11: Relevant environmental objectives, performance indicators and proposed measurement criteria	145
Table 9-1: Policies and guidelines.....	147
Table 9-2: Flora and vegetation studies	148
Table 9-3: Vegetation complexes.....	149
Table 9-4: Vegetation associations (Government of Western Australia 2018b).....	151
Table 9-5: Vegetation types	153
Table 9-6: Vegetation condition.....	159
Table 9-7: Threatened Ecological Communities (TEC)	180
Table 9-8: Priority Ecological Communities (PEC)	180
Table 9-9: <i>Bush Forever</i> sites in DAF	192
Table 9-10: Groundwater Dependent Ecosystems.....	193
Table 9-11: Potential impacts.....	197
Table 9-12: Clearing impacts	205
Table 9-13: Mitigation hierarchy to potential impacts on flora and vegetation	209



Table 10-1: Policies and guidelines.....	211
Table 10-2: Terrestrial fauna studies undertaken for the Proposal	211
Table 10-3: Conservation significant fauna known or likely to occur.....	212
Table 10-4: Fauna habitat types within the DAF.....	214
Table 10-5: Potential impacts.....	225
Table 10-6: Assessment against significant impact criteria	231
Table 10-7: Mitigation hierarchy to potential impacts on Terrestrial Fauna	233
Table 11-1: Policies and guidelines.....	236
Table 11-2: Landform studies.....	236
Table 11-3: Phases of Quindalup dunes	241
Table 11-4: Potential impacts.....	242
Table 11-5: Mitigation hierarchy to potential impacts on Terrestrial Fauna.....	244
Table 12-1: Policies and guidelines.....	246
Table 12-2: Social surroundings studies	246
Table 12-3: Registered Aboriginal sites close to the Proposal.....	247
Table 12-4: Aboriginal survey history	248
Table 12-5: Potential construction impacts to social surroundings	253
Table 12-6: Potential operational impacts to social surroundings.....	254
Table 12-7: Summary of construction mitigation measures to protect social surroundings.....	257
Table 12-8: Summary of operational mitigation measures to protect social surroundings.....	259
Table 13-1: Other environmental factors.....	261
Table 13-2: Wetlands intersecting the pipeline DAF.....	267
Table 13-3: Estimated power consumption and indirect greenhouse gas emissions per annum ..	267
Table 14-1: Environmental principles and predicted outcomes.....	269
Table 14-2: Summary of environmental assessment for key environmental factors	271

List of figures

Figure 3-1: Regional location	13
Figure 3-2: ASDP site	17
Figure 3-3: Alignment and dimensions of the proposed subsea tunnels.....	18
Figure 3-4: Integration pipeline.....	19
Figure 3-5: Alkimos development overview	23
Figure 3-6: Intake structure concept design	26
Figure 3-7: Rosette diffuser concept design.....	27
Figure 3-8: Model of ASDP indicative site layout (full plant capacity)	28
Figure 3-9: ASDP indicative site layout	29
Figure 3-10: Typical cross-section of pipeline construction	32
Figure 3-11: Process flow schematic.....	34
Figure 3-12: Features of the benthic environment at Alkimos.....	40
Figure 3-13: Alkimos bathymetry.....	42
Figure 3-14: Alkimos Water Precinct infrastructure	45
Figure 6-1: Historical water and sediment sampling sites at Alkimos.....	57
Figure 6-2: Unstructured mesh of regional 3D hydrodynamic model	61
Figure 6-3: Unstructured mesh of the regional 3D hydrodynamic model (Left). Detailed view indicating the instrumentation and BoM met stations (Right). The black line indicates extent of local wave and 3D hydrodynamic models	62



Figure 6-4: Unstructured mesh applied to the wave model and local 3D hydrodynamic model	63
Figure 6-5: Matrix of depth-integrated current roses for the four (AWAC sites) Gardline instruments (columns) and for different time periods (rows)	70
Figure 6-6: Distribution of sediment particle sizes	71
Figure 6-7: Cause-effect pathways associated with SDP construction and commissioning	72
Figure 6-8: Potential impacts to marine environmental quality, and flow-on effects, associated with ASDP marine operations.....	74
Figure 6-9: Conceptual framework for applying the environmental quality guidelines and standards	77
Figure 6-10: Results of the conceptual particle transport model showing the spread and depth of crushed sediments at the proposed outlet (upper) and intake (lower) drilling sites	80
Figure 6-11: Conceptual diagram showing the dilution of the brine waste stream in the near field environment.....	83
Figure 6-12: Predicted salinity elevations (50 th percentile in April) above background.....	85
Figure 6-13: Modelled areas of dissolved oxygen below the 90% high ecological protection value (orange cells) over the three-month period April to June 2017 for (a) baseline conditions (i.e. no ASDP or WWTP discharges), and (b) with ASDP and WWTP running.....	88
Figure 6-14: Vertical cross-shore section through the ASDP rosettes (annual 95 th percentile salinity elevation above background)	90
Figure 7-1: Spatial extent of historical and contemporary benthic habitat mapping studies	97
Figure 7-2: Alkimos benthic habitat classification	101
Figure 7-3: Infauna taxonomic richness	106
Figure 7-4: Potential impacts to benthic communities and habitat and flow-on effects, associated with Alkimos seawater desalination plant construction and commissioning.....	107
Figure 7-5: Potential impacts to benthic communities and habitat, and flow-on effects, associated with operation of the Alkimos seawater desalination plant.....	109
Figure 7-6: Spatial extend of the Alkimos LAU	111
Figure 7-7: Zone of historical loss together with the zone of predicted loss	113
Figure 7-8: Infauna marine sedimentation thresholds.....	115
Figure 7-9: Predicted salinity elevations (50 th percentile in April) above background overlain on marine habitats	117
Figure 8-1: Potential impacts to marine fauna associated with ASDP marine construction and commissioning activities.....	132
Figure 8-2: Potential impacts to marine fauna associated with ASDP marine operational activities	134
Figure 9-1: Vegetation types	161
Figure 9-2: Vegetation condition	170
Figure 9-3: Threatened and priority ecological communities	183
Figure 9-4: Conservation areas.....	195
Figure 10-1: Fauna habitat.....	217
Figure 11-1: Significant landforms.....	239
Figure 12-1: European heritage sites	249
Figure 12-2: Aboriginal heritage sites.....	250



List of appendices

Appendix A: Summary of stakeholder consultation

Appendix B: Alkimos Hydrodynamic Modelling: Draft Scenario Report

Appendix C: Alkimos Hydrodynamic Modelling: Calibration Report

Appendix D: Peer Review Panel Comments: Alkimos Seawater Desalination Draft Scenario Report

Appendix E: EPBC Protected Matters Report

Appendix F: Flora, Vegetation and Fauna Assessment – Spring 2017 (AECOM 2017)

Appendix G: Ecological Assessment - Alkimos SDP Pipeline Integration (AECOM 2018)

Appendix H: Alkimos Flora and Vegetation Survey – Spring 2016 (Strategen 2017)

Appendix I: CW03472 Eglinton Groundwater Investigations Flora, Vegetation, Fauna and Dieback Survey: Site 2 (Ecoscape 2018)

Appendix J: Alkimos Wastewater Treatment Plant Water Corporation Fauna Assessment (Bamford 2018)



Acronyms

Abbreviation	Definition
ABPA	Alkimos Beach Progress Association
ABSLC	Alkimos Beach Surf Lifesaving Club
AELG	Alkimos Eglinton Landowners Group
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines [for Fresh and Marine Water Quality]
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASDP	Alkimos Seawater Desalination Plant (the Proposal)
ASS	Acid sulfate soils
AST	Acoustic surface tracking
AWAC	Acoustic wave and current [profiler]
BCH	Benthic communities and habitats
BoM	Bureau of Meteorology
CCW	Conservation category wetland
CCWA	Conservation Council of Western Australia
CEB	Chemical enhanced backwash
CIP	Clean-in-place
CoW	City of Wanneroo
DBCA	Department of Biodiversity, Conservation and Attractions
DMA	Decision making authority
DO	Dissolved oxygen
DoH	Department of Health
DoTr	Department of Treasury
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EQC	Environmental Quality Criteria
EQG	Environmental Quality Guideline
EQO	Environmental Quality Objective
EQP	Environmental Quality Plan
EQS	Environmental Quality Standard
ERD	Environmental Review Document
EV	Environmental Value



Abbreviation	Definition
FSA	Fluorosilicic acid
GWTP	Groundwater treatment plant
HDD	Horizontal directional drilling
HEPA	High Ecological Protection Area
IMO	International Maritime Organisation
IMS	Introduced marine species
ISQG	Interim sediment quality guideline
IUCN	International Union for Conservation of Nature
IWSS	Integrated Water Supply Scheme
LAU	Local assessment unit
LEPA	Low Ecological Protection Area
MARPOL	The International Convention for the Prevention of Pollution from Ships
MCEMF	Marine Construction Environmental Management Framework
MCEMP	Marine Construction Environmental Management Plan
MF	Microfiltration
MRS	Metropolitan Region Scheme
MRWA	Main Roads Western Australia
MOEMP	Marine Operational Environmental Management Plan
PEC	Priority ecological community
PSDP1	Perth Seawater Desalination Plant 1
PTS	Permanent threshold shift
RMS	Root mean square
RO	Reverse osmosis
SCADA	Supervisory control and data acquisition
SEL	Sound exposure level
SDP	Seawater Desalination Plant component of the Proposal
SSDP	Southern Seawater Desalination Plant
TBM	Tunnel boring machine
TEC	Threatened ecological community
TCEMF	Terrestrial Construction Environmental Management Framework
TSS	Total suspended solids
TTS	Temporary threshold shift
TWW	Treated wastewater
UFI	Unique feature identifier
WA	Western Australia



Abbreviation	Definition
WAFIC	Western Australian Fishing Industry Council
WALGA	Western Australia Local Government Association
WET	Whole of Effluent Toxicity testing
WRLC	Western Rock Lobster Council
WWTP	Wastewater treatment plant

Units

Unit	Definition
%	Percentage
°C	Degrees Celsius
µm	Micrometre
cm	Centimetre
dB	Decibel
GL	Gigalitre
GL/a	Gigalitres per annum
ha	Hectare
kL	Kilolitres
km	Kilometre
km/hr	Kilometres per hour
kWh	Kilowatt hour
L/d	Litres per day
log ₁₀ m ⁻¹	Reciprocal metre
m	Metre
m/s	Metres per second
m ²	Square metre
m ³	Cubic metre
m ³ /s	Cubic metres per second
mg/L	Milligrams per litre
MHz	Megahertz
ML	Megalitre
ML/d	Megalitres per day
ML/km ²	Megalitres per square kilometre
mm	Millimetre
MW	Megawatt
NTU	Nephelometric Turbidity Unit
pH	Potential of Hydrogen (measure of acidity)
ppt	Parts per thousand



Executive summary

Introduction

The purpose of this Environmental Review Document (ERD) is to support the referral of a proposal by Water Corporation to build and operate a Seawater Desalination Plant (SDP) and Groundwater Treatment Plant (GWTP) at Alkimos and an associated 35 km long integration pipeline connecting the desalination plant to Wanneroo Reservoir. Collectively, these elements form the Alkimos Seawater Desalination Plant (ASDP) proposal (the Proposal) which is the subject of this referral.

Assessment process

The *Environmental Protection Act 1986* (EP Act) is the primary legislative instrument for environmental assessment in Western Australia. Under Part IV of the EP Act, the Environmental Protection Authority (EPA) is responsible for assessing significant proposals and providing advice to the Minister for Environment. This ERD has been prepared to support referral of the Proposal under the Section 38 of the EP Act and to provide sufficient information for the EPA to assess the Proposal.

The EPA lists a number of environmental factors which need to be considered in the Environmental Impact Assessment (EIA) process. The key environmental factors relevant to this Proposal are:

- Marine
 - Marine Environmental Quality
 - Benthic Communities and Habitats
 - Marine Fauna
- Terrestrial
 - Flora and Vegetation
 - Terrestrial Fauna
 - Landforms
 - Social Surroundings.

Background and context

Water source planning for Perth and the Integrated Water Supply Scheme (IWSS) have had to be adapted in response to a drying climate over the past 40 years. Perth has seen a rapid drying of climate with an even greater reduction in streamflow to metropolitan dams and recharge to aquifers.

With a trend towards a drying climate and very low streamflow reaching Perth's drinking water dams in recent years, soils in the dams' catchments have dried out to such an extent that above average rainfall is needed, year on year, to have a major difference to the levels of the dams. For this reason, Water Corporation has updated its long-term planning to reflect a



future of reduced reliance on regular dam streamflow and is looking at a range of options for the next climate-independent water source.

The main new sources under investigation for the IWSS are seawater desalination and groundwater replenishment. The content of this ERD focuses on desalination as a source; however, investigations remain ongoing by Water Corporation into groundwater replenishment alongside other solutions to ensure a number of source options are available. Alternative sources remain subject to separate independent impact assessments and, if considered viable to proceed, will be referred at the appropriate time.

A multi-criteria assessment (MCA) process was developed and applied across the water source options to evaluate them across the portfolios on a consistent basis and rank them for priority within a source development program. To ensure a comprehensive and balanced approach to option assessment, the MCA comprised the following criteria: technical and design, economic, environmental, social and approvals and land matters.

As a result of the source portfolio assessments, the water source options selected for initial priority and investigation within a source development program for the IWSS included:

- Alkimos SDP
- Perth SDP 2 (PSDP2) in Kwinana
- Eglinton GWTP.

Detailed investigations into the Alkimos and Kwinana SDP options are now complete. The investigation projects have refined numerous aspects of the project proposals, including scope, concept design and estimated cost, and brought clarity to key project delivery challenges including subsurface geology and ocean modelling, specific pipeline routes, flora and fauna considerations, and approval processes.

Approvals will be sought for both projects in parallel to maintain flexibility in the selection of a preferred option for project delivery.

Overview of Proposal

Water Corporation is proposing to construct and operate the SDP and GWTP within the Alkimos Water Precinct (Lot 1050 Marmion Avenue), marine infrastructure, and the integration pipeline required to transfer the drinking water produced to Wanneroo Reservoir and into the Integrated Water Supply Scheme (IWSS) as shown in Figure ES-1.

The SDP is proposed to be located adjacent to Water Corporation's existing Alkimos WWTP. Alkimos is located approximately 40 km northwest of the Perth CBD in the northwest corridor, north of Quinns Rock beach and south of Yanchep beach.



The SDP is proposed to be developed in four 25 GL per annum stages as per Table ES-1. It is possible that two stages may be merged to meet supply requirements. The actual timing of each stage will be based on actual growth in water demand, potential groundwater allocation reduction, actual streamflow conditions and timing of other source option development (e.g. construction of the proposed PSDP2 at Kwinana). The 6 GL/a Eglinton GWTP will be constructed during Stage 1a development to its full capacity.

Table ES-1: Seawater Desalination Plant estimated staging

Stage	Capacity	Marine works	Pipeline integration
1a	25 GL/a SDP + 6.6 GL/a GWTP	100 GL/a	50 GL to Wanneroo Reservoir
1b	50 GL/a SDP		50 GL to Wanneroo Reservoir
2a	75 GL/a SDP		100 GL to Forrestfield Reservoir
2b	100 GL/a SDP		100 GL to Forrestfield Reservoir

The key Proposal characteristics are outlined in Table ES-2. Maximum plant capacities associated with the Proposal have been provided and assumed for the purpose of the environmental impact assessment.



Table ES-2: Key Proposal characteristics

Proposal title	Alkimos Seawater Desalination Plant
Proponent name	Water Corporation
Short description	The construction and operation of a 100 GL/a seawater desalination plant co-located with the 6 GL/a Eglinton Groundwater Treatment Plant (GWTP) including a 35 km pipeline to connect the plants into the Integrated Water Supply Scheme (IWSS) at Wanneroo Reservoir
Element	Description
Treatment plants	
Total drinking water production	Nominal 100 GL per annum (4 x 25 GL stages)
SDP drinking water production ¹	Up to 160 ML/d of potable water (at 50 GL/a) and 320 ML/d (at 100 GL/a)
GWTP drinking water production	Up to 30 ML/d of potable water (For Stage 1 bores)
Power requirement ²	501,000 MWh per annum
Clearing of vegetation	24 ha of native vegetation
Seawater intake	
Intake volume ¹	360 ML/d (at 50 GL/a) up to 720 ML/d (at 100 GL/a)
Length ³ (indicative from intake Pump Station)	2.9 km
Intake structure velocity	Maximum velocity 0.15 m/sec
Outfall	
Volume ¹	210 ML/d (at 50 GL/a) up to 420 ML/d (at 100 GL/a)
Length ³ (indicative from outfall tank)	4.4 km
Salinity	Up to 75 200 mg/L
Pipeline from ASDP to Wanneroo Reservoir	
Length	35 km
Diameter	1400 mm
Clearing of vegetation	14 ha of native vegetation

¹ ASDP water production and intake/outfall volume assumes 335 operational days per year and a 40% recovery and may vary by 20% depending on membrane performance and maintenance requirements. Annual production may exceed this capacity if fewer non-productive days are utilised during the operational period.

² The energy requirement assumes plant operation for 24 hours/day producing the maximum drinking water production of the ASDP (308 ML/d) and 19.3 ML/d from the GWTP over 335 days per year. This may vary pending maintenance requirements.

³ Length of intake may be altered during final design pending water quality monitoring and modelling.



Figure ES-1: Regional Location

N

Scale 1:70,000 at A3

0

1

2

km

Coordinate System: GDA 1994 MGA Zone 50

Date: 18/03/2019

Legend

Development Area Footprint

ASDP Site

Pipeline

Integration Pipeline

Northern Route Option

Marine Tunnel

WATER

CORPORATION

strategen

ENVIRONMENTAL

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Description of the Alkimos environment

Marine

The marine environment at Alkimos is well documented following two separate rounds of mapping and approximately 15 years of monitoring undertaken as a condition of approval for an existing wastewater treatment plant. A key feature of the area is the presence of dual reef lines (inner and outer reef platforms) separated by a deep (20-23 m), sand dominated lagoon. The benthic environment varies in its rugosity from low relief to complex high relief structures, with networks of crevasses and caves. The reef structures provide habitat for a variety of reef fish and commercially important invertebrates, including western rock lobster, and the region supports numerous birds, finfish, marine mammals and reptiles of relevance.

The area is subject to a complex array of currents due to interactions between regional currents, local wind-forced currents, waves, and irregularly shaped shallow reef systems. Marine waters are generally well mixed and display minimal stratification due to the energy of the system. The broader-scale circulation in the region is dominated by the Leeuwin Current, a warm boundary current flowing southward along the edge of the continental shelf. Inshore of the Leeuwin Current, the Capes Current flows northward as a result of upwelling and northward wind stresses and is thus strongest in spring and summer months.

The area is exposed to persistently high swell conditions, despite the sheltering afforded by Rottnest Island.

Terrestrial

The Proposal is located within the Swan Coastal Plain (SCP). The SCP comprises five major geomorphologic systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf. The Proposal is located largely within the Quindalup Dune system with a portion in the north located in the Cottesloe unit of the Spearwood Dunes. The Quindalup Dune system comprises beach ridges and parabolic dunes, while the Cottesloe unit consists of shallow, yellow-brown sands and exposed limestone.

The SCP is a low-lying coastal plain covered with woodlands dominated by Banksia or Tuart on sandy soils, She-oaks on outwash plains, and Paperbark in swampy areas. The area contains a number of rare features including Holocene dunes and wetlands and a large number of rare and threatened species and ecological communities. However, extensive clearing has occurred on the SCP for urban and agricultural development, and land use is predominantly cultivation, conservation, urban and rural residential.

Most fauna in the region is widespread, with some elements confined to the northern part of the SCP. The area represents the southern limit of distribution of many species in the region, which supports a range of conservation significant fauna species, including Black Cockatoo, Western Brush Wallaby and Quenda.



Consultation

Stakeholder and community engagement for the Proposal commenced in 2017 and has been conducted in several formats, including: face to face meetings with state and local government agencies, corporations and public interest groups; participation in community events; and drop in sessions in public spaces (e.g. cafes) to promote general awareness and stimulate public feedback. An online community with feedback capabilities was established in early 2018, which provided regular updates on progress. Additionally, Water Corporation has placed advertisements in the local newspaper which were syndicated on social media.

Feedback from the community and stakeholders has been used in the design of the Proposal and further consultation is ongoing and will continue as the Proposal progresses through detailed design, approvals, construction and commissioning phases.

Summary of potential impacts, proposed mitigation and outcomes

Marine environmental factors

A key component of the marine environmental impact assessment was the development of a state-of-the-art 3D calibrated hydrodynamic and water quality model designed specifically for Alkimos conditions. (see Appendix C).

The model simulated several processes:

- the dispersion of brine and treated wastewater (TWW) from the proposed ASDP and the existing Alkimos WWTP
- the potential interaction of the brine and TWW plumes with the ASDP intake infrastructure
- the potential cumulative effects of the combined plumes on the marine environment.

Modelling provided an understanding of the behaviour of the plumes, and critically, a means of evaluating the impact of the plume (if any) on the marine environment. The model was subjected to rigorous review by a panel of industry experts (see Appendix D).

The remainder of the assessment was undertaken via a review of protected species report, scientific and technical literature, and through the development of a conceptual particle dispersion model. The outcomes of the assessments are summarised below.



Marine Environmental Quality

Marine Environmental Quality	
EPA objective	To maintain the quality of water, sediment and biota so that environmental values are protected.
Potential impacts	<p>During construction:</p> <ul style="list-style-type: none"> • reduced light (elevated sediment) • smothering / Physical damage (elevated sediment) • toxicity (grouting materials) • toxicity (cleaning and disinfection chemicals) • stressor effects (tunnel residues) • toxicity (hydrocarbon spills and waste generation). <p>During operation:</p> <ul style="list-style-type: none"> • reduction in dissolved oxygen (stratification) • stressor effects (increased salinity & temperature) • toxicity (chemicals used in maintenance processes).

A key component of this assessment was to identify the stressors related to the construction and operation of a desalination plant, and how they may affect environmental quality. These included:

- the disturbance of the benthic environment due to placement of marine infrastructure
- the discharge of return seawater (brine) to the marine environment.

Water Corporation intends to mitigate the potential effects related to these stressors by:

- installing pipelines in sub-marine tunnels excavated using a Tunnel Boring Machine (TBM)
- optimising the design of the outlet diffusers, to achieve dilutions compliant with high ecological protection criteria.

For salinity, modelling predicted that the proposed diffusers should achieve a 1 in 30 dilution within 70 m of the discharge point. A 1:30 dilution was found sufficient to reduce near field elevations to well below acceptable levels.

The use of chemicals for plant maintenance was examined in the context of frequency of use, and potential toxicity after dilution. Solids collected by the reverse osmosis media filter will be backwashed on a fortnightly basis. On completion, each filter will be rinsed and the rinsate discharged to the ocean. The rinsate is not expected to contain material concentrations of contaminants and it will be diluted both within the discharged waste (brine) stream and then further by seawater after discharge; therefore, any residual contaminants entrained within the wastestream will diminish rapidly.

The potential for dissolved oxygen (DO) drawdown following the introduction of the Proposal was examined. DO levels were maintained at >90% saturation for most of the year. These results are based on the highly conservative modelling. It is considered unlikely that the sediment oxygen demand in combination with the additional residence time caused by the brine will result in exceedances of the 90% DO criterion.



Taking the above into consideration, the Proposal is not expected to compromise the EPA's high ecological protection criteria beyond the immediate confines of the drilling site, or any further than 70 m from the outlets. Water Corporation will apply to the EPA to establish a low ecological protection area (LEPA) of a radius 100 m around the outlet diffusers.

Benthic Communities and Habitats

The EPA's *Technical Guidance Protection of Benthic Communities and Habitats* (EPA 2016e) was used to determine the potential extent and significance of direct and indirect impacts to Benthic Communities and Habitat (BCH) resulting from the Proposal. A Local Assessment Unite (LAU) of 5398 ha has been defined, which is inclusive of the zone of impact predicted for the Alkimos WWTP, to allow for a cumulative impact assessment.

Benthic Communities and Habitats	
EPA objective	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.
Potential impacts	During construction: <ul style="list-style-type: none"> • direct loss of BCH • secondary & tertiary loss of BCH (shading / smothering) • secondary loss BCH (toxicity).
	During operation: <ul style="list-style-type: none"> • tertiary effects (reduced DO) • tertiary effects (stressors) • secondary & tertiary effects (toxicity).

Planned onshore disposal of sediment material resulting from tunnelling will minimise the potential for direct and/or indirect impacts on marine quality associated with disposal of dredge spoil at sea. However, despite the adoption of the tunnelling technology, small areas of benthic communities and habitats (BCH) were considered at risk due to localised drilling activities, and flow on effects to light attenuation and dispersal of drill cuttings (sedimentation). However, the assessment concluded that the mobilisation of a small area (32 m³) of sediments over a three-week construction period was unlikely to affect local light conditions, and that the worst rates of sedimentation would be within the non-lethal range for most invertebrates.

The extent of potential habitat loss due to placement of infrastructure and the effects of sedimentation was conservatively estimated based on a cumulative impact zone of 16.7 ha. Within this impact zone, losses of reef, seagrass and macroalgal habitats were conservatively estimated at 8.3 ha, which when combined with the estimated historical losses, accounted for less than 1% of BCH in the assessment area.

Based on this, the proposed drilling and infrastructure laydown activities are not expected to contribute tangible losses of BCHs. Consideration of offsets for this environmental factor is therefore considered unnecessary.



Marine Fauna

The occurrence, frequency and distribution of marine fauna within a 10 km radius of the proposed SDP was examined via a review of the EPBC Act Protected Matters Report (Appendix E), literature and consultation with Department of Primary Industries and Regional Development (DPIRD). The EPBC Act Protected Matters Report (PMR) identified protected avifauna, marine reptiles, marine mammals and finfish species, which were subsequently considered by this review.

Marine Fauna	
EPA objective	To protect marine fauna so that biological diversity and ecological integrity are maintained.
Potential impacts	<p>During construction:</p> <ul style="list-style-type: none"> • changes in marine fauna behaviour/hearing damage (noise) • reduced light and smothering/stressor effects (elevated sediment) • injury/mortality of marine fauna (collision/entanglement) • loss of local biodiversity (introduced marine species) • toxicity effects on marine fauna (introduction of toxicants). <p>During operation:</p> <ul style="list-style-type: none"> • direct loss of marine fauna (impingement/entrainment) • stressor effects on marine fauna (reduced DO) • stressor effects on marine fauna (increased salinity) • stressor effects on marine fauna (increased temperature) • toxicity effects on marine fauna (introduction of toxicants).

By protecting the values associated with Marine Environmental Quality, it is reasonably expected that marine fauna will be protected by default. One exception, however, is the risk posed by entrapment of larger fauna on the intake screens, and/or the entrainment of larvae and plankton. The potential for both was considered in the engineering design of the intakes, which will adopt best practice technology to:

- minimise the intake velocity (0.15 m/s) to allow small fish to escape
- prevent the entry of larger fishes
- locate the intake above the seabed (~5 m) to reduce potential of demersal species to enter
- limit the intrusion of drift algae and seagrass wrack.

Remaining impacts that are not considered manageable via the key mitigation strategies, were limited to the effects of noise due to tunnelling and drilling. The marine pipelines will be tunnelled at least 10 m below the seabed and there will be no blasting or rock breaking required which is standard practice in similar environments using conventional open trench methodologies.

The effects of noise due to tunnelling and drilling were estimated based on the literature. For both, sound pressures of between 145 and 190 dB were predicted in the immediate vicinity of the activities. The assessment concluded that constant noise at these levels is not sufficient to cause injury to marine fauna but may cause behavioural responses in the form of avoidance.



In practice, this may result in a zone of avoidance of approximately 300 m radius that travels with the TBM cutting face as it advances at 0–15 m per day towards the intake and outlet locations. However, this impact will be localised and temporary and the noise generated will be substantially less than a conventional cut and cover construction methodology.

Terrestrial environmental factors

The terrestrial component of the Proposal has been subject to a number of detailed surveys, including flora and vegetation surveys, fauna surveys, desktop heritage survey, and social impact assessment.

The results of the surveys and assessments has been used in the design of the Proposal to avoid, and where that is no possible, to minimise potential impacts. Key design decisions have been made in consideration of several key terrestrial environmental factors, including the location of the ASDP infrastructure, the route of the pipeline, and the use of tunnelling to install the marine infrastructure.

The outcomes of the assessments are summarised below.

Flora and Vegetation

The terrestrial component of the Proposal covers a total area of 139 ha, of which 62 ha is native vegetation. The ASDP site is 29 ha of which 24 ha is native vegetation. The pipeline assessment corridor covers an area of 110 ha of which 38 ha is native vegetation.

Flora and Vegetation	
EPA objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Potential impacts	During construction: <ul style="list-style-type: none"> • clearing of native vegetation • disturbance or clearing of threatened and protected ecological communities • disturbance or clearing of <i>Bush Forever</i> sites • disturbance of wetlands • fragmentation of vegetation • spread of declared pest species or dieback • changes to groundwater level or flow impacting ecosystems.

ASDP infrastructure was located to minimise the clearing of native vegetation and to avoid clearing within designated conservation areas as far as reasonably practicable. Tunnelling of marine infrastructure from within the ASDP site avoids any clearing of native vegetation in the dune and coastal environment outside Water Corporation's boundary.

While the construction of the ASDP will result in the loss of 24 ha of native vegetation representative of a priority ecological community, the vegetation type is not restricted in extent given its known range. Furthermore, the ASDP site is surrounded by native vegetation which is considered to be similar in nature and condition, significant portions of which are reserved in conservation areas.



The pipeline route was selected based on minimising the clearing and fragmentation of native vegetation and avoiding sensitive ecological areas. Almost 70% of the pipeline development area footprint is within road reserve and already cleared areas. Water Corporation has selected a 30 m wide pipeline assessment corridor to allow adequate space for construction. This 30 m corridor will be further refined during final design and will be minimised where practical during construction.

Based on the route selection and use of restricted construction corridors, the construction of the pipeline is likely to impact 14 ha of native vegetation, including 6 ha of threatened ecological communities, 4 ha of priority ecological communities and 5 ha of *Bush Forever* sites. The threatened and priority ecological communities that will be impacted are known to occur across a large range and are well represented in conservation areas in the local and regional area.

Where possible, disturbed areas will be rehabilitated after construction. Indirect impacts to sensitive areas adjacent to the Proposal, such as conservation areas and wetlands, will be managed through the implementation of a Terrestrial Construction Environmental Management Framework (TCEMF).

Based on the scale and nature of impacts, the location away from sensitive areas, and the mitigation to be implemented, the Proposal is not expected to result in a significant impact on flora and vegetation, and biological diversity and ecological integrity will be maintained.

Terrestrial fauna

No conservation significant fauna species have been recorded within the ASDP site, including no observed evidence of Black Cockatoos roosting or nesting. Surveys over the pipeline assessment corridor identified 37 fauna species; six of which were identified as conservation significant species known to, or likely to, occur in the area.

Terrestrial Fauna	
EPA objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Potential impacts	During construction: <ul style="list-style-type: none"> clearing and fragmentation of habitat for Black Cockatoos, Quenda, and Brush Wallaby construction activities have potential to impact on adjacent fauna habitat through erosion, uncontrolled access, dust deposition, noise, and through the spread of weeds and dieback construction activities may result in interactions with terrestrial fauna.

The Proposal design decisions taken by Water Corporation to avoid and then minimise impacts on native vegetation also apply to terrestrial fauna.

The construction of the ASDP site will result in the loss of 26 ha of habitat potentially used as a foraging resource for the Carnaby's Black Cockatoo, and smaller areas of potential habitat for Quenda and Brush Wallaby. The Black Cockatoo habitat is not considered a significant food resource and is rated as having low and medium foraging value; and no potential breeding trees or suitable hollows were identified in the ASDP site. The site is surrounded by



conservation areas and large areas of habitat, including habitat which is likely to provide a significant foraging resource for Black Cockatoos and other bird species.

The decision to co-locate the Eglinton GWTP within the ASDP site also negates the requirement to clear the block of land originally proposed to locate the GWTP (Lot 1011). This lot contains black cockatoo habitat of very good condition which is now not required to be cleared.

The construction of the pipeline will result in the loss of 14 ha of habitat potentially used as a foraging resource for the Carnaby's Black Cockatoo. However, the area surrounding the proposal contains over 8000 ha of native vegetation in State Forest which provides habitat for Black Cockatoo.

Indirect construction impacts such as vehicle strikes and entrapment in excavations will be managed through the TCEMF.

Based on the small scale of clearing adjacent to existing cleared areas, the avoidance of high quality and critical habitat areas, the extensive areas of intact habitat in the vicinity, and the mitigation to be implemented, the Proposal is not expected to result in a significant impact on biological diversity and ecological integrity.

Landforms

The Proposal is located largely within the Quindalup Dune system with a portion in the north located in the Cottesloe unit of the Spearwood Dunes. The Quindalup Dune system comprises beach ridges and parabolic dunes, while the Cottesloe unit consists of shallow, yellow-brown sands and exposed limestone.

The Quindalup Dunes system in the area has been described as regionally significant landforms with intact vegetated parabolic dunes, supporting highly diverse upland vegetation units and habitat. These dunes are also important in providing a regional ecological linkage between coastal foreshore reserve and regional conservation areas to the east.

Landforms	
EPA objective	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.
Potential impacts	During construction: <ul style="list-style-type: none">• loss of landforms• increased aeolian erosion.

Planning for the Proposal has considered the topography and vegetation types identified in the area. The location of the ASDP has been specifically chosen for several factors including the low-lying nature of the site and the lack of conservation significant species and formations within it, and to minimise the impact to the existing conservation areas located to the north and south of the site.

Water Corporation has chosen to use tunnelling for the construction of the marine intake and outfall tunnels. This choice of construction method will be undertaken from within the ASDP site, which significantly reduces the environmental impact on the surrounding landforms.



Alternative construction methods such as pipe jacking would have resulted in disturbance to the landforms in the near shore environment.

Construction of the ASDP into the dune system will require some local dunes to be removed or re-contoured to allow for infrastructure. However, the western ASDP site boundary incorporates an earth berm with a finished top surface level of 25 mAHD. This berm effectively connects the existing southern and northern sand dunes and forms a visual barrier to the ASDP from the future western residential development.

Dust and erosion mitigation techniques will be employed during construction to reduce the effects of erosion on the surrounding area. At the completion of construction of Stage 1, erosion controls will be applied to the ASDP site to prevent further erosion of non-vegetated and un-developed areas until the construction of Stage 2 is required.

Where possible, disturbed areas will be permanently revegetated, which will be subject to ongoing monitoring and maintenance to ensure vegetation is established through the implementation of the TCEMF.

The Proposal is not expected to result in a significant impact on landforms.

Social Surroundings

Social surroundings include aesthetic, cultural, economic and social aspects that could affect or be affected by the Proposal. Residential estates occur approximately 1 km to the north and 600 m to the south of the ASDP site and a smaller concentration of residential estates and individual properties occurs at various distances from the pipeline.

Additional potential receptors surrounding the ASDP site include those identified in the Alkimos District Structure Plan, including future recreational areas of beach and parklands to the east and residential areas to the west.

The Proposal directly intersects one registered Aboriginal heritage site along the pipeline. Several other sites were identified near the Proposal.

Social Surroundings	
EPA objective	To protect social surroundings from significant harm.
Potential impacts	During construction: <ul style="list-style-type: none"> potential impacts to the amenity of residents and recreational users in the surrounding area and to heritage values from traffic noise, emissions and congestion; noise and vibration; dust; odour; and installation of the pipeline.
	During operation: <ul style="list-style-type: none"> potential impacts to the amenity of residents and recreational users in the surrounding area and to heritage values from noise, odour, traffic, and light pollution.

Traffic impacts have been avoided where possible via upgrade of the existing access road to the ASDP site and WWTP and connection with Marmion Avenue, to avoiding the local road network; and the pipeline route has been designed with specific consideration to the avoidance of private land and property.



A Traffic Management Plan will be implemented through the TCEMF to assist in traffic flow and with the arrival and departure of heavy vehicles at the ASDP site and the pipeline during construction.

The alignment of the intake and outfall tunnels and the locations of the intake and outfall risers have been chosen to avoid heritage shipwrecks, which are located at least 700 m from marine infrastructure. Where the pipeline intersects with a mythological Aboriginal registered heritage site, specific consideration and consultation will be carried to avoid any impacts to the site; including the placement of the pipe under the road at this location if required.

Water Corporation undertook noise modelling to assess the impact of noise generation from both the SDP and the WWTP at full capacity. As a result of this assessment, the following measures have been incorporated into the concept design:

- noise attenuation measures within the building including appropriate cladding, acoustic louvres and finished levels below the surrounding landscape
- a vegetated berm along the western edge of the site boundary to maintain the visual amenity and also to ensure noise regulations will be met.

Potential construction amenity impacts caused by dust, noise, vibration and odour will be managed through the TCEMF.

The risk of odour impacts from the operation of the ASDP has been removed at the design stage, by ensuring that putrescible organic waste (e.g. seaweed) removed from the seawater intake screen is macerated and returned back to the ocean rather than being dewatered and transferred to skips for disposal off site.

The ASDP has been set at levels similar to the existing WWTP, which has the effect of lowering the plant into the surrounding landscape behind the dune system; and a vegetated berm will be constructed to maintain the visual amenity of the site from the beach and from the developments planned to be located to the west of the site.

Based on the site selection, design options and mitigation measures to be implemented, the Proposal is not expected to significantly impact social surroundings. Residual impacts can be mitigated through the implementation of the TCEMF.

Other environmental factors

The following other environmental factors or matters relevant to the Proposal have been identified:

- Coastal Processes
- Subterranean Fauna
- Terrestrial Environmental Quality
- Inland Waters
- Human Health
- Air Quality (Greenhouse Gas Emissions).



Due to the predicted low level of impact, application of industry standard controls and other regulatory mechanisms, these factors are not expected to be required to be assessed in detail by the EPA.



1. Introduction

1.1 Purpose and scope

The purpose of this Environmental Review Document (ERD) is to support the referral of a proposal by Water Corporation to build and operate a Seawater Desalination Plant (SDP) and Groundwater Treatment Plant (GWTP) at Alkimos and an associated integration pipeline connecting the desalination plant to Wanneroo Reservoir. Collectively, these elements form the Alkimos Seawater Desalination Plant (ASDP) proposal (the Proposal) which is the subject of this referral.

The ERD includes a detailed description of the key components, identification of the preliminary key environmental factors and potential impacts to those factors arising from the Proposal. Specific studies and investigations have been conducted by Water Corporation in relation to the key environmental factors identified to:

- ensure that the full environmental effects of the Proposal are properly understood
- inform mitigation and optimal management controls
- enable a reliable and knowledge-based environmental impact assessment to be conducted.

1.2 Proponent

The Proponent for the Proposal is Water Corporation. Water Corporation is the principal supplier of water, wastewater and drainage services to over two million people throughout metropolitan Perth and Western Australia.

The Proponent's details are:

Water Corporation

- Address: 629 Newcastle St, Leederville WA 6000
- ABN: 28 003 434 917.

The key contact for this proposal is:

Bree Atkinson

- Telephone: (08) 9420 2893
- Email: bree.atkinson@watercorporation.com.au.

1.3 Environmental impact assessment process

Implementation of the Proposal will require compliance with Australian legislation and regulations as listed in Section 5.3. Further to these statutory requirements, a range of other guidelines, standards and policies are also relevant to the Proposal.



1.3.1 Western Australian Environmental impact assessment process

The *Environmental Protection Act 1986* (EP Act) is the primary legislative instrument for environmental assessment in Western Australia. It specifies procedures for assessment and appeal processes, including responsibilities and functions of the Western Australian Minister for the Environment and the Environmental Protection Authority (EPA). Under Part IV of the EP Act, the EPA is responsible for providing advice to the Minister for significant proposals assessed under Part IV of the EP Act.

This ERD has been prepared in accordance with the EPA's instructions on how to prepare an Environmental Review Document (EPA 2018a) to support referral of the Proposal under the Section 38 of the EP Act.

In accordance with section 3.1.3 of the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016, this ERD has been prepared to provide sufficient information for the EPA to assess the Proposal.

Consultation with Decision-Making Authorities (DMAs) has substantially commenced to support the Proposal.

1.3.2 Western Australian standards, guidelines and policies

Assessment of the environmental impacts of the Proposal is based on various Western Australian Position Statements and Guidance Statements. Standards, guidelines and policies related to specific environmental factors or individual aspects of the Proposal are identified in Section 5.3 and discussed in the individual sections relevant to the environmental factor being addressed.

1.4 Other approvals and regulation

1.4.1 Tenure

The Proposal occurs on land listed in Table 1-1.

Table 1-1: Tenure

Proposal element	Tenure
Seawater Desalination Plant (SDP) and Eglinton Groundwater Treatment Plant (GWTP)	Water Corporation - Lot 1050
Integration pipeline to Wanneroo Reservoir	Brindabella Parkway
	Department of Planning, Lands and Heritage (Lot 9602)
	Department of Planning, Lands and Heritage (Lot 2002)
	Department of Planning, Lands and Heritage (Lot 6286)
	Main Roads Western Australia (Road Reserve)
	Karborup Road Reserve & Water Corporation owned land (Lots 49, 50 & 51)
	Road Reserve
	City of Wanneroo (Road Reserve)



1.4.2 Decision-Making Authorities

The authorities listed in Table 1-2 have been identified as the key relevant Decision-Making Authorities for environmental aspects of the Proposal. Other Decision-Making Authorities may be identified by the EPA through the referral and assessment process.

Table 1-2: Decision-Making Authorities relevant to the Proposal

Decision-Making Authority	Relevant legislation
Western Australia	
Minister for the Environment	<i>Environmental Protection Act 1986 (Part IV)</i> <i>Biodiversity Conservation Act 2016</i>
Chief Executive Officer, Department of Water and Environmental Regulation (DWER)	<i>Environmental Protection Act 1986 (Part V)</i>
Department of Planning, Lands and Heritage	<i>Planning and Development Act 2005</i>
Department of Primary Industries and Regional Development (Fisheries)	<i>Fisheries Act 1905</i>
Emergency Services Commissioner, Department of Fire and Emergency Services	<i>Bush Fires Act 1954</i>
Chief Health Officer, Department of Health	<i>Health Act 1911</i>
Chief Officer, Department of Mines, Industry Regulation and Safety	<i>Dangerous Goods Safety Act 2004</i>
Commonwealth	
Department of the Environment and Energy (Commonwealth)	<i>Environment Protection and Biodiversity Conservation Act 1999</i>

1.4.3 Other approvals required

Australian Government environmental impact assessment process

While the states and territories have responsibility for environmental matters at a state and local level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to focus the Australian Government interests on protecting Matters of National Environmental Significance (MNES). The EPBC Act requires an assessment as to whether a proposed action is likely to have a significant effect on a MNES.

Several listed species and threatened ecological communities were identified within 10 km of the Proposal (refer to Appendix E) and the Proposal has the potential to impact on MNES. Therefore, the Proposal also been referred to the Australian Government for assessment under the EPBC Act.

Secondary approvals

Several other State approvals will be required to construct and operate the Proposal. The key secondary approval requirements are listed in Table 1-3. Other approvals may be identified through the referral and assessment process.



Table 1-3: Secondary approvals relevant to the Proposal

Proposal activity	Agency	Type of approval	Legislation regulating the activity
Construct prescribed premises	DWER	Works approval	<i>Environmental Protection Act 1996 (Part V)</i>
Abstraction of groundwater (for construction purposes)	DWER	Licence to take groundwater (5C)	<i>Rights in Water and Irrigation Act 1914</i>
Storage of goods classified as dangerous goods	Department of Mines, Industry Regulation and Safety	Dangerous goods licence	<i>Dangerous Goods Safety Act 2004</i>
Operate prescribed premises	DWER	Licence	<i>Environmental Protection Act 1996 (Part V)</i>
Potential impacts on conservation significant species	Department of Biodiversity, Conservation and Attractions (DBCA)	Lawful authority	<i>Biodiversity Conservation Act 2016</i>

1.5 Exclusions

The Proposal is specific to the construction and operation of the SDP, GWTP (not including the production bores and collector mains) and the associated integration pipeline to Wanneroo Reservoir.

Further pipeline upgrades may be required to integrate stages 2a and 2b into the IWSS; however, these are not anticipated to be required for at least 15 years and approvals will be sought separately.

The pipeline DAF does not include the future Nowergup Tank site which forms part of future growth planning and is not part of this referral.



2. Background and Proposal justification

2.1 Water source planning

Water source planning for Perth and the Integrated Water Supply Scheme (IWSS) have had to be adapted in response to a drying climate over the past 40 years. Perth has seen a rapid drying of climate with an even greater reduction in streamflow to metropolitan dams and recharge to aquifers.

Since 2001, Water Corporation has invested over \$2.2 billion in projects to build a more climate resilient water supply scheme for Perth.

Water Corporation developed a ten-year water supply plan, *Perth Water Forever – Whatever the Weather* (2011), which includes a number of climate independent initiatives. Water Corporation is over halfway through implementing the plan, however the climate has been drying faster than anticipated (although 2017 and 2018 provided relief from the persistent decline in water resource availability) requiring these initiatives to be accelerated:

- transferring groundwater abstraction to less sensitive locations, including the deeper aquifers, to protect groundwater dependent ecosystems
- replenishing deep aquifers with recycled water through a new groundwater replenishment scheme
- expanding seawater desalination capacity to offset impacts on the Gnangara groundwater system and the declining streamflow to dams
- continuing to make gains in water use efficiency, while preserving the Western Australian outdoor lifestyle and enabling continued growth of the city and state using wastewater recycling as a resource for industry, public open spaces and agriculture.

Increasing water use efficiency is an attractive option to keep demand low so that new water sources can be deferred. Consequently, in 2018 Water Corporation committed to achieving a new water use target of 110 kL per person per year by 2030, down from the current 125 kL per person per year. Intensive study of water use behaviour commenced in 2018 via H2OME to identify where additional water use efficiencies could be made, noting that the easiest targets for significant reductions in per capita use have already been made.

With a trend towards a drying climate and very low streamflow reaching Perth's drinking water dams in recent years, soils in the dams' catchments have dried out to such an extent that above average rainfall is needed, year on year, to have a major difference to the levels of the dams. For this reason, Water Corporation has updated its long-term planning to reflect a future of reduced reliance on regular dam streamflow and is looking at a range of options for the next climate-independent water source.

The main new sources under investigation for the IWSS are seawater desalination and groundwater replenishment. Water Corporation's first groundwater replenishment scheme is in the process of being expanded to deliver up to 28 GL per year, which is the current full capacity of the existing site (Beenyup). Water Corporation intends to obtain several years of experience with this first scheme before electing to expand groundwater replenishment to another wastewater treatment plant site. Investigation and design work required to implement further groundwater



replenishment will also take several years to complete, so the best short-term option for a new drinking water source for Perth is seawater desalination.

Seawater desalination has proved to be an exceptionally reliable water source for Perth, providing almost half of the IWSS water supply. Desalination sources are expected to become more important in the future.

2.2 Timing for the next major water source

The 2017 and 2018 streamflows, combined with maximised source production, have resulted in sufficient contingency storage levels in dams for more than the next five years. However, in a zero inflow scenario, the next source will be required sooner. The next new source is currently expected to be required in 2028 to allow for increased demand as a result of the ongoing effects of climate change in south west Australia, increasing population with the metropolitan area, and potential for a reduction in the Gngangara mound allocation.

The driver for the next source decision is based on dam storage (having sufficient contingency available) and on annual reliance on dam storage. If a groundwater allocation reduction does not eventuate or is relatively small, and if the conservative streamflow forecast (75th percentile streamflow that should be exceeded three out of four years) is consistently achieved over the next ten years, the next new source is expected to be required in 2028 to minimise reliance on dam storage. If larger streamflow volumes occur in the intervening period, it may be possible to defer the next new source.

2.3 Alternatives considered

2.3.1 Alternate water sources

In 2016, as part of Water Corporation's Dry Season Response activities, a review of water source options for the IWSS was completed which covered a range of water source portfolios:

- upgrade of existing seawater desalination plants
- new seawater desalination plants
- new groundwater schemes
- and groundwater replenishment (recycling).

A multi-criteria assessment (MCA) process was developed and applied across the water source options to evaluate them across the portfolios on a consistent basis and rank them for priority within a source development program. To ensure a comprehensive and balanced approach to option assessment, the MCA comprised the following criteria: technical and design, economic, environmental, social and approvals and land matters.

As a result of the source portfolio assessments, the water source options selected for initial priority and investigation within a source development program for the IWSS included:

- Alkimos SDP
- Perth SDP 2 (PSDP2)
- Eglinton GWTP.



While further groundwater replenishment at Woodman Point WWTP and Subiaco WWTP also scored favourably within the MCA, the timeline for investigation and delivery of these source options remains under review and presents significant risk in the event of requiring to fast-track source delivery. In addition, the first full scale GWS at Beenyup was not yet operational and it was desirable to see this scheme operating successfully before additional schemes were progressed. As a result, these options were ranked lower on the priority list of sources at the time of completing the options assessment in 2016. Water Corporation recognises that having a number of source options to consider provides greater flexibility for future source decisions and investigations into alternative source options remains ongoing at this time.

2.3.2 Desalination plant location options

Potential locations for new seawater desalination sources to the north and south of Perth have been part of Water Corporation's long-term planning and were published in the planning strategy document *Water Forever (2009)*.

Since 2008, twelve new potential desalination plant sites along the coast have been considered by the Water Corporation over three separate studies. The sites extend from Lancelin to Binningup and were compared using multiple criteria, broadly categorised as:

- cost (capital and operating)
- environmental
- social
- technical feasibility
- water quality
- integration and demand
- deliverability
- land ownership and access
- local planning
- approvals
- water source security.

The latest of the planning studies evaluating siting options for the next seawater desalination plant was completed in 2015/16, with two preferred sites emerging – one in the north and one in the south of the Perth metropolitan area. These sites are Alkimos and Kwinana, and they provide the best overall options for the next seawater desalination site.

Detailed investigations into the Alkimos and Kwinana options are now complete. The investigation projects have refined numerous aspects of the project proposals, including scope, concept design and estimated cost, and brought clarity to key project delivery challenges including subsurface geology and ocean modelling, specific pipeline routes, flora and fauna considerations, and approval processes. Approvals will be sought for both projects in parallel to maintain flexibility in the selection of a preferred option for project delivery. Ultimately, Perth may require desalination plants at both Kwinana and Alkimos.



The Alkimos SDP option was selected as one of two preferred desalination plant options as it is well located to service the growing northern suburbs and can also replace current groundwater sources that may be lost due to possible reduction in Gnangara groundwater allocation in the northern suburbs being considered by DWER.

The site for the Alkimos SDP is currently owned by Water Corporation and contains the existing Alkimos WWTP. As the land includes a generous buffer for odour management purposes, an opportunity exists to position a future seawater desalination plant within this buffer, at some distance from current residential areas and screened by vegetated dunes.

The site presents strategic advantages to co-locate water infrastructure including:

- minimising Water Corporation's footprint through co-location of assets
- minimising the need to acquire and clear other parcels of land
- improved operational efficiency
- optimising integration assets
- optimising chemical usage.

Long-term planning supports opportunities that the site offers to locate multiple water infrastructure assets as the Alkimos Water Precinct over a 20-year timeframe including:

- Alkimos WWTP (ultimate capacity is expected to reach 160 ML/day beyond 2050) - the WWTP is licensed to 160 ML/d but the present pipe and diffuser is engineered for a maximum capacity of 80 ML/d
- Alkimos SDP (ultimate capacity is expected to reach 100 GL per annum by 2050, assuming it is the next water source to be developed)
- Eglinton GWTP (capacity approximately 6 GL per annum, to be built during the first stage of Alkimos SDP, with possibly future expansion to 12 GL per annum from additional Leederville aquifer allocation)
- Alkimos Advanced Water Recycling Plant for a future groundwater replenishment scheme (ultimate capacity is expected to reach approximately 28 GL per annum beyond 2050)
- a potential educational centre where the water cycle, water sources, wastewater, recycling, reuse, and other aspects of water in Perth can be presented to the community.



To assess these plans in further detail Water Corporation undertook a multi-criteria analysis (MCA) to determine the optimal location for each asset. The following factors were considered in the MCA to inform the location of future development footprint:

- noise, light and visual impacts
- maintaining required buffers (e.g. chlorine)
- minimising impact to conservation areas and good quality vegetation
- potential for revegetation
- topography and elevation
- proximity to existing and potential residential areas
- proximity to existing underground pipelines.

2.4 Eglinton Groundwater Treatment Plant co-development

Water Corporation initially proposed a superficial groundwater scheme to meet local demand requirements including the development of seven new superficial production bores and a 30 ML/day GWTP at Lot 1011, just west of the freeway reserve. The first phase of the concept design identified potential opportunities associated with locating the GWTP within the Alkimos SDP footprint including:

- benefits to co-location of the SDP and GWTP (minimises clearing the original GWTP site, chemical and process efficiencies)
- the SDP and GWTP have different treatment requirements, which can offset each other when co-located. The SDP uses reverse osmosis which produces very soft water requiring lime addition to make it suitable for supply as drinking water, whereas groundwater from the coastal limestone aquifer has an elevated hardness concentration that requires a softening process. Blending the SDP water with groundwater reduces the amount of lime required and avoids the need for softening of the groundwater
- environmental footprint of the groundwater treatment is considerably reduced given softening is no longer required, and most of the other treatment requirements (chlorination, fluoridation, water storage tank, transfer pump station, electrical switch room, administration building, etc.) are shared with the SDP.

The co-development of Eglinton GWTP with Alkimos SDP represents another step forward in the innovative approach that Water Corporation seeks to apply for sustainable source development and best for community outcomes.

Approvals for production bores and associated infrastructure will be sought separately via DWER. For the purposes of this document, the reference to the Alkimos SDP also includes the Eglinton GWTP.



2.5 Integration pipeline alignment

Several options were considered for the pipeline route. The preferred route largely follows the corridor originally identified under the Strategic Assessment of the Perth and Peel Regions (SAPPR) due to the significant studies completed to date. The SAPPR corridor is based on a whole-of-government approach to identify a multi-use infrastructure corridor, and to minimise environmental impacts as well as infrastructure approval times.

Water Corporation then developed a limited amount of sub-options in specific areas where opportunities were apparent. The route options were assessed against the main constraints in the Proposal area including future and existing infrastructure (roads, rail, services, etc.) and developments (residential, commercial, etc.), existing services, native vegetation, and traffic (GHD 2018). Based on the assessment, a preferred route was selected.

Whilst the preferred route from the SDP site towards Carabooda Tank follows Marmion Avenue and Romeo Road, it is recognised this route remains at risk due to various developments in the area. An alternative route has also been identified, in consultation with LandCorp, where the pipeline deviates to the north from approximately the midpoint of Romeo Road (see Figure 3-4).

This route locates the pipeline within a future road reserve, referred to as 'NS2', prior to heading west along the southern side of the Alkimos City Centre commercial zone cadastral boundary. Due to the presence of various development proposals within the Alkimos City Centre zone, by several proponents including LandCorp, Metronet and MRWA, it is recognised that these developments remain subject to environmental approval assessments.

As a result, a full impact assessment for the alternative route remains to be completed by Water Corporation. Once the future timing of a proposed new water source for Perth is confirmed, the pipeline route will be reviewed, and final option selected based on the most optimised route in consultation with key stakeholders.



3. The Proposal

3.1 Proposal description

Water Corporation is proposing to construct and operate the SDP and GWTP within the Alkimos Water Precinct (Lot 1050 Marmion Avenue), marine infrastructure, and the integration pipeline required to transfer the drinking water produced to Wanneroo Reservoir and into the Integrated Water Supply Scheme (IWSS) as shown in Figure 3-1.

3.2 Proposal elements

3.2.1 Development Area Footprint

The Proposal Development Area Footprint (DAF) covers a total area of area of 155.7 ha, and comprises the following three elements:

- ASDP site –an area of approximately 29 ha within the Alkimos Water Precinct as shown on Figure 3-2. The SDP and GWTP will be located within the ASDP site
- marine infrastructure as shown in Figure 3-3 - comprising an area of 16.7 ha within a Local Assessment Unit (LAU) of 5398 ha as shown in Figure 7-6
- integration pipeline – comprising a 35 km long, 1400 mm diameter pressure main from the ASDP site Wanneroo Reservoir, with two spurs to the Carabooda Tank site and the future Nowergup Tank site.

For the purpose of the impact assessment, the pipeline DAF is based on a 30 m wide corridor, which covers a total area of 110 ha as shown in Figure 3-4. The corridor allows the final alignment to be chosen which minimises impacts on sensitive environmental features and social aspects. The actual construction corridor will be between 12 m and 16 m within the 30 m wide corridor and therefore, the actual impact footprint will be significant less than assessed.



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Figure 3-1: Regional Location

Scale 1:70,000 at A3

0 1 2 km

Coordinate System: GDA 1994 MGA Zone 50

Date: 18/03/2019

Legend

Development Area Footprint	Integration Pipeline
ASDP Site	Northern Route Option
Pipeline	Marine Tunnel



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3.2.2 Key Proposal characteristics

The key Proposal characteristics are outlined in Table 3-1. Maximum plant capacities associated with the Proposal have been provided and assumed for the purpose of the environmental impact assessment. As discussed previously, a 30 m pipeline DAF has been used and represents a conservative assessment of the extent of clearing required for the Proposal.

Table 3-1: Key Proposal Characteristics

Proposal title	Alkimos Seawater Desalination Plant
Proponent name	Water Corporation
Short description	The construction and operation of a 100 GL/a seawater desalination plant co-located with the 6 GL/a Eglinton Groundwater Treatment Plant (GWTP) including a 35 km pipeline to connect the plants into the Integrated Water Supply Scheme (IWSS) at Wanneroo Reservoir
Element	Description
Treatment plants	
Total drinking water production	Nominal 100 GL per annum (4 x 25 GL stages)
SDP drinking water production ¹	Up to 160 ML/d of potable water (at 50 GL/a) and 320 ML/d (at 100 GL/a)
GWTP drinking water production	Up to 30 ML/d of potable water (For Stage 1 bores)
Power requirement ²	501,000 MWh per annum
Clearing of vegetation	24 ha of native vegetation
Seawater intake	
Intake volume ¹	360 ML/d (at 50 GL/a) up to 720 ML/d (at 100 GL/a)
Length ³ (indicative from intake Pump Station)	2.9 km
Intake structure velocity	Maximum velocity 0.15 m/sec
Outfall	
Volume ¹	210 ML/d (at 50 GL/a) up to 420 ML/d (at 100 GL/a)
Length ³ (indicative from outfall tank)	4.4 km
Salinity	Up to 75 200 mg/L
Pipeline from ASDP to Wanneroo Reservoir	
Length	35 km
Diameter	1400 mm
Clearing of vegetation	14 ha of native vegetation

¹ ASDP water production and intake/outfall volume assumes 335 operational days per year and a 40% recovery and may vary by 20% depending on membrane performance and maintenance requirements. Annual production may exceed this capacity if fewer non-productive days are utilised during the operational period.

² The energy requirement assumes plant operation for 24 hours per day producing the maximum drinking water production of the ASDP and from the GWTP over 335 days per year. This may vary depending on maintenance requirements.

³ Length of intake may be altered during final design pending on water quality monitoring and modelling.



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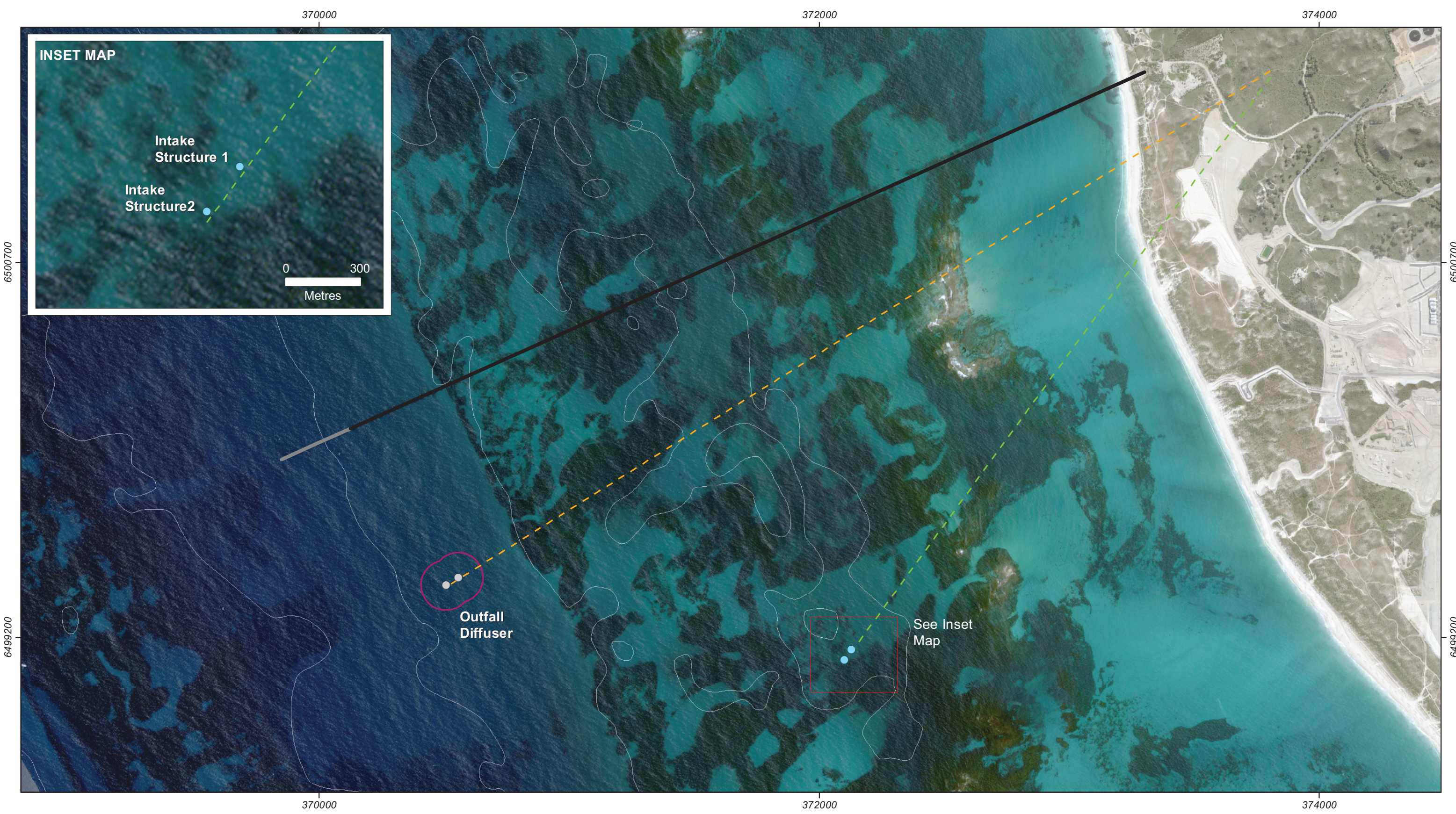


Figure 3-3: Alignment and dimensions of the proposed subsea tunnels

