

# Risk Assessment Capabilities



**HYDROSOLUTIONS**  
PTY LTD  
Hydrogeological & Environmental Consultants

Western Australia's independent groundwater & environmental consultancy, with a proven track record in groundwater, surface water, environment, risk assessment & contaminated land management. We combine reliable expertise with regulatory knowledge, delivering high-quality output on time & on budget.

## Human Health Risk Assessment (HHRA)

Our risk assessment group is experienced in qualitative, and fully quantitative (deterministic & probabilistic) human health risk assessment methodologies:

- ◆ NEPM Tier 1: Screening Risk Assessment (RA); comparison of results to generic assessment levels, e.g.:
  - ◆ HIL A: Standard Residential, with garden/ accessible soil, including childcare/ pre-&primary schools)
  - ◆ HIL B: Residential with minimal soil access, including high-rise buildings & apartments
  - ◆ HIL C: Public open space, including parks, playgrounds, playing fields, secondary schools & footpaths
  - ◆ HIL D: Commercial/ Industrial, including shops, offices, factories & industrial sites
- ◆ NEPM Tier 2: Intermediate, site-specific RA, including development of site-specific risk-based criteria (i.e. Site-specific target levels- SSTLs)
- ◆ NEPM Tier 3: Detailed, site-specific RA, including modelling of exposure pathways
- ◆ Qualitative RA: (As31000), e.g.:
  - ◆ Low/ Medium/ High risk characterisation
  - ◆ Likelihood/ Consequence matrix
- ◆ Quantitative RA, e.g.:
  - ◆ Probability tables
  - ◆ Return-period analysis
- ◆ Source-pathway-receptor analysis
- ◆ Incident/ Consequence assessment
- ◆ Issue (hazard) identification
- ◆ Exposure assessment
- ◆ Risk Communication/ Management

No. of events	1 year		10 years		20 years		50 years		100 years	
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
=0	0.999	0.971	0.99	0.748	0.981	0.56	0.952	0.235	0.907	0.655
>=1	0.001	0.029	0.01	0.252	0.019	0.44	0.048	0.765	0.093	0.345
>=2	0	0	0	0.035	0	0.115	0.001	0.425	0.004	0.285
>=3	0	0	0	0.003	0	0.021	0	0.179	0	0.554
>=4	0	0	0	0	0	0.003	0	0.06	0	0.33
>=5	0	0	0	0	0	0	0	0.016	0	0.168

## Ecological Risk Assessment (ERA)

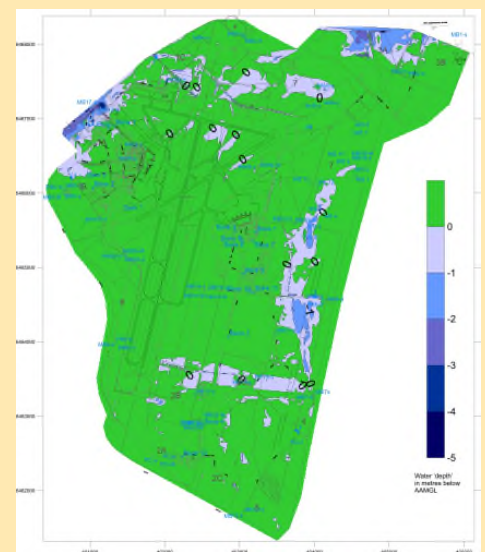
- ◆ NEPM 1999 (2013 amendment) Schedule B5B; development of site-specific EILs
- ◆ Level 1: Screening RA; comparison of results to Ecological Investigation Levels (EILs):
  - ◆ Soil EILs
  - ◆ Water: ANZECC 2000 trigger levels
- ◆ Level 2: Intermediate ERA:
  - ◆ Modify generic EILs based on site-specific factors
- ◆ Level 3: Detailed, site-specific, probabilistic ERA
- ◆ Preliminary/ Definitive ERA
- ◆ Ecotoxicological studies
- ◆ Bioavailability
- ◆ Receptor identification
- ◆ Exposure assessment
- ◆ Toxicity assessment
- ◆ Risk characterisation



## Modelling Studies

Our experienced team applies a range of modeling techniques to source-pathway-receptor analyses, the development of site-specific RA, & Monitored Natural Attention (MNA) assessments, including:

- ◆ Groundwater:
  - ◆ Analytical, including equilibrium equations/ BioPlume/MARS2D etc
  - ◆ Numerical, including MODFLOW with GwVistas/ Flowpath
  - ◆ Solute transport: with MT3D/RT3D
  - ◆ Multiphase contaminant flow & transport
  - ◆ Density (salinity) & heat-coupled models with SEAWAT
- ◆ Stochastic (climate-change)
- ◆ MNA:
  - ◆ Risk based corrective action (RBCA)
  - ◆ @Risk/ Bioplume
  - ◆ Soil Vapour Intrusion: Johnson & Ettinger
  - ◆ Et AI



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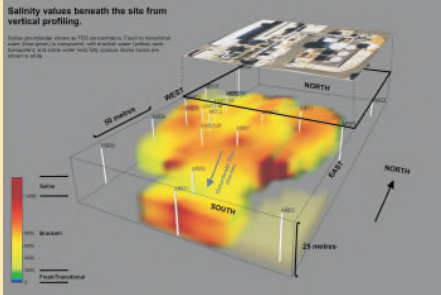




# Risk Assessment Example Projects:

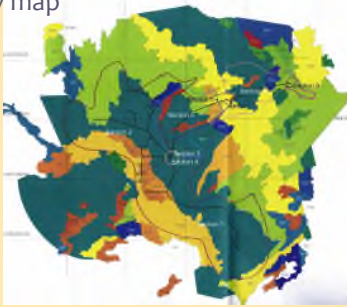
## Chlor-alkali plant, SW WA

Subregional groundwater hydraulic model, site-specific daughter model, calibrated solute transport model, density-coupled using SEAWAT. Predictive scenarios for salt recovery.



## Large nickel mine, WA Goldfields

Risk of spillages affecting land beneficial values from a pipeline & hypersaline borefield operation. Definition of a 'risk-probability map'?



## Public Water Provider

Quantitative RA, threats to a 70ML/d groundwater public water supply from hazardous goods storage & movement within the catchment area. Definition of a derogation event as a failure of potable quality supply criteria, their probability & return-interval. Comparison of risk to established engineering norms.



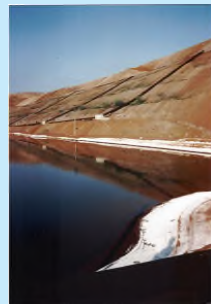
## Shell Oil

Assessment of potential environmental impact & relative sensitivity from the operation of 54 'wet' oil storage depots.



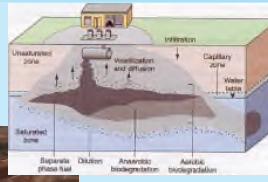
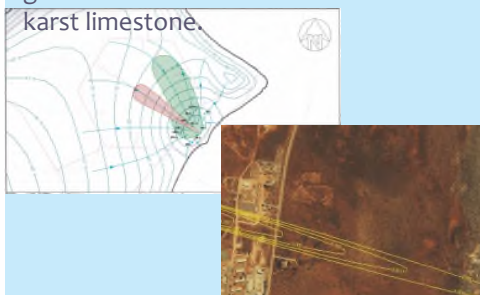
## Alcoa, Kwinana operations

Groundwater risk assessment from the leakage of highly alkaline & metal-rich leachate from residue storage areas to impact groundwater & marine water environmental values



## Department of Defence, NCS HEH

Risk assessment of potential impacts to groundwater quality from the construction of a Class IV landfill to receive contaminated soils from site-wide remedial works, including consideration of endemic Stygofauna habitat & occurrence affected by groundwater abstraction from shallow karst limestone.



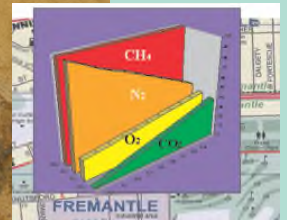
## Precious Metal Refinery; acidic & metal rich groundwater plume

Ecological risk assessment of plume impact on surface water quality within a drain discharging into the Swan River. Groundwater solute fate & transport simulation to assess pump & treat or disposal to sewer options.



## Private Developer, Health-based risk assessment, South Fremantle

Human HRA to assess existing risks from a mixed putrescible & commercial landfill, including landfill gas (explosion/asphyxiation), ingestion risk, & leachate migration in groundwater. Remedial options included active & passive LFG recovery/ ongoing monitoring, soil cover, suspended pile-foundations, & limitations on groundwater use.



## Wesfarmers CSBP, Kwinana

Assessment of risk from local & subregional groundwater contamination to affect abstracted water quality from an on-site borefield supplying process water.

