GOYDER INSTITUTE FOR WATER RESEARCH MODEL METADATA TEMPLATE

METADATA REQUIRED	DETAILS
Model Name and version	Adelaide Plains Groundwater Model 2015
Date of lodgement of Metadata. Name of Metadata Provider	August 2015 Etienne Bresciani, etienne.bresciani@flinders.edu.au
Goyder Institute Project Number and Name	**GOYDER INSTITUTE FOR WATER RESEARCH** Project No. I.1.6 Assessment of Adelaide Plains Groundwater Resources
Project Team	Project Leader: Okke Batelaan, okke.batelaan@flinders.edu.au Project Team Members: Etienne Bresciani, etienne.bresciani@flinders.edu.au Eddie Banks, eddie.banks@flinders.edu.au Steve Barnett, steve.barnett@sa.gov.au Jordi Batlle-Aguilar, jordi.batlleaguilar@flinders.edu.au Peter Cook, peter.cook@flinders.edu.au Adrian Costar, adrian.costar@sa.gov.au Roger Cranswick, roger.cranswick@flinders.edu.au John Doherty, johndoherty@ozemail.com.au Graham Green, graham.green@sa.gov.au John Kozuskanich, john.kozuskanich@flinders.edu.au Daniel Partington, daniel.partington@flinders.edu.au Maria Pool, mpoolr@gmail.com Vincent Post, vincent.post@flinders.edu.au Craig Simmons, craig.simmons@flinders.edu.au Biran Smerdon, brian.smerdon@aer.ca Stan Smith, stan.smith@csiro.au Chris Turnadge, chris.turnage@csiro.au Stephanie Villeneuve, stephanie.villeneuve@flinders.edu.au Adrian Werner, adrian.werner@flinders.edu.au Nicholas White, nicholas.white@flinders.edu.au Yueqing Xie, yueqing.xie@flinders.edu.au
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Model Location	The model, data, and all pre- and post-processing scripts are archived at the School of the Environment at Flinders University at: \\sharefiles.isd.ad.flinders.edu.au\Share\SOTEGoyderAGP\AP_model_FINAL_REPORT_VERSION Contact: Dean School of the Environment, dean.sote@flinders.edu.au. Further development is undergoing at this organisation with the same contact. The model is also planned to be archived at the DEWNR Model Warehouse. Contact: Graham Green, graham.green@sa.gov.au
IP or other permission requirements	None
Licences associated with model and/or dependencies	○ *Modelling software* - This is a MODFLOW-based model. MODFLOW and related programs are freely available for download from http://water.usgs.gov/ogw/modflow/. - Pre- and post-processing was done in Matlab (commercial product; see http://au.mathworks.com/) using the mfLab toolbox (freely available for download from https://code.google.com/p/mflab/). - Some data pre-processing was also done in Python (freely available for download from https://www.python.org/) using the ArcPy package that comes with ArcGIS (commercial product; see http://www.esri.com/software/arcgis). - Calibration and uncertainty analysis was done with PEST (freely available for download from http://www.pesthomepage.org/). - The model is also currently been implemented into the Groundwater Vistas interface (commercial product; see http://www.scisoftware.com/environmental_software/product_info.php?products_id=43). ○ *Data upon which the model depends* - Surface water features, groundwater levels and chloride data were sourced from the WaterConnect database managed by DEWNR (https://www.waterconnect.sa.gov.au/). This data can be downloaded at no cost and is licensed under a Creative Commons Attribution 3.0 Australia Licence. - Hydrogeologic units extent and elevation were sourced from DEWNR (personal communication, no licence; contact at DEWNR: Steve Barnett). - ^{14}C data was sourced from the literature and appended by new data acquired during the project (no licence). - Historical pumping and managed aquifer recharge (MAR) data were sourced from the previous modelling effort of the same area by RPS Aquaterra (Georgiou J, Stadter M, Purczel C (2011) 'Adelaide Plains groundwater flow and solute transport model'). The previous model is owned by DEWNR (contact at DEWNR: Juliette Woods). - Rainfall data was sourced from the SILO database (https://www.longpaddock.qld.gov.au/silo/) supplied under licence to

	Flinders University with a right to distribute digital products based on or containing the data, as this model. - Rainfall projection data sourced from Enviro Data SA (https://data.environment.sa.gov.au/Climate/SA-Climate-Ready/). This data can be downloaded at no cost and is licensed under a Creative Commons Attribution 4.0 International Licence. - Future MAR scheme data were provided by DEWNR (personal communication, no licence; contact at DEWNR: Graham Green).
Confidentiality agreements associated with model and/or dependencies	None
Brief outline of model	This numerical model simulates groundwater flow in steady-state (long-term historical state under pre-development conditions – no pumping) and in different transient conditions: 1900-1950 under pre-development conditions (no pumping); 1950-2013 under development conditions (pumping); 2013-2100 under different predictive scenarios (increase/decrease of pumping, climate change, increase of MAR). The model also simulates chloride and carbon-14 transport, both in steady-state (long-term historical state under pre-development conditions – no pumping).
Area/region covered	The Adelaide Plains, extending from the major faults at the foothill of the Mount Lofty Ranges in the south and east (Eden-Burnside and Para faults), up to 5 km offshore in the west, and bounded by the Light River in the north. In the vertical direction, the model extends from the land surface down to the bedrock included (model bottom fixed at -700 mAHD).
Platform and language and version	MODFLOW-NWT for groundwater flow and MT3DMS for solute transport.
Dependencies upon: i) other models and/or platforms (including version) and location ii) essential data and data sources and location	The data upon which the model depends are stored together with the model, which can therefore be run “as is”. Data sources are described above in the section on licences. The data can potentially be updated (using updated versions of the sources described above, for example) but the model would need to be updated accordingly. Updating the model with new data is relatively easy using the Matlab scripts as long as the data keep the same structure. Note that anything affecting the historical simulations implies that the model would have to be recalibrated.

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How was model used	○ *Parameterisation/Validation* The parameters were calibrated to hydraulic head data over the period 1900-2013, using the automatic calibration software PEST. Comparison of the transport results to measured concentrations was also done (but not for calibration). ○ *Scenarios and outputs from various runs* Different future scenarios were tested until 2100 for "business as usual", increase/decrease of pumping, climate change, increase of managed aquifer recharge. The outputs of the various runs are stored together with the model files. ○ *Assumptions behind model* The model consists of ten layers and uses a uniform grid size of 1,000 m in both horizontal directions. Top and bottom elevations of the layers are based on geological data from borehole information. The model is divided into 12 hydrogeological units of uniform hydraulic properties. Recharge is modelled as a portion of rainfall. More details are given in the project report. ○ *Limitations of model* On the basis of the level of misfit, errors on historical hydraulic head predictions can be expected to be on average on the order of 8.60 m. For future predictions, the accuracy also depends on probability of future stresses. Similarly, errors on Cl and ^{14}C predictions can be expected to be on average on the order of 1410 mg L^{-1} and 22 pmC, respectively. An unquantified uncertainty surrounds the predictions that are of different types than the observations used here (e.g., fluxes). The lack of intra-zone heterogeneity for hydraulic properties largely precludes reliable quantification of predictive uncertainty. ○ *Peer review process* An early version was peer-reviewed by two external reviewers in April 2015 (Glenn Harrington and Dirk Mallants). ○ *Extensibility of model (can it be run for different time periods)* Extension to different time periods would require extending rainfall or recharge data – but it is likely that the current coverage (1900-2100) will be sufficient for most purposes.
Specificity of data	Data was sourced from existing databases of the region.
Datasets/data products produced	All the data upon which the model depends are stored together with the model. Data sources are detailed in the project report.
Other Information	

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Publications (papers and technical reports)	Bresciani E., Batelaan O., Banks E.W., Barnett S.R., Batlle-Aguilar J., Cook P.G., Costar A., Cranswick R.H., Doherty J., Green G., Kozuskanich J., Partington D., Pool M., Post V.E.A., Simmons C.T., Smerdon B.D., Smith S.D., Turnadge C., Villeneuve S., Werner A.D., White N. and Xie Y. 2015, *Assessment of Adelaide Plains Groundwater Resources: Summary Report,* Goyder Institute for Water Research Technical Report Series No. 15/31, Adelaide, South Australia. Bresciani E., Batelaan O., Banks E.W., Barnett S.R., Batlle-Aguilar J., Cook P.G., Costar A., Cranswick R.H., Doherty J., Green G., Kozuskanich J., Partington D., Pool M., Post V.E.A., Simmons C.T., Smerdon B.D., Smith S.D., Turnadge C., Villeneuve S., Werner A.D., White N. and Xie Y. 2015, *Assessment of Adelaide Plains Groundwater Resources: Appendices Part I – Field and Desktop Investigations,* Goyder Institute for Water Research Technical Report Series No. 15/32, Adelaide, South Australia. Bresciani E., Batelaan O., Banks E.W., Barnett S.R., Batlle-Aguilar J., Cook P.G., Costar A., Cranswick R.H., Doherty J., Green G., Kozuskanich J., Partington D., Pool M., Post V.E.A., Simmons C.T., Smerdon B.D., Smith S.D., Turnadge C., Villeneuve S., Werner A.D., White N. and Xie Y. 2015, *Assessment of Adelaide Plains Groundwater Resources: Appendices Part II – Regional Groundwater Modelling,* Goyder Institute for Water Research Technical Report Series No. 15/33, Adelaide, South Australia.
Collaborations and acknowledgements	This project was conducted by a team of researchers of Flinders University and CSIRO during the project period 15 May 2013 – 31 May 2015 in close collaboration with the Department of Environment Water and Natural Resources (DEWNR).
Keywords	Adelaide Plains, Groundwater resources, Groundwater modelling

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