

## 2009 Atlas Update Acknowledgements

This document is an update of the 2004 Atlas; the Atlas team acknowledges the previous efforts.

**Special Acknowledgements:** Bea Lackaff (SC) created or revised Atlas maps and provided other graphics. Jim MacInnis (CoS) was responsible for project management, text writing, editing and layout. Gary Stevens (IDEQ) provided the data and source images for Human Uses (page 16) and contributed in many ways to the success of this Atlas. Special thanks to Spokane County, the City of Spokane and Idaho Department of Environmental Quality for generously supporting staff who worked on this Update. Much of the new information in this Atlas Update was published in USGS Scientific Investigations Reports 2005-5227, 2007-5041, and 2007-5044, and we gratefully acknowledge USGS and their partners: Idaho Department of Water Resources, Washington Department of Ecology, University of Idaho, and Washington State University.

**2009 Aquifer Atlas Update Team:** James D. MacInnis, P.E. (CoS), Beatrice B. Lackaff (SC), Reanette Boese (SC), Susan King (CoS), Gary Stevens (IDEQ), and Rob Lindsay (SC).

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## 2004 Atlas Update Acknowledgements

In early fall 2000 seven thousand Aquifer Atlases were printed and allocated to the participating agencies in Washington and Idaho. The Atlases were very popular, and within eighteen months most of the Atlases had been distributed to the public and to local schools. In 2003 Julia McHugh, working for the Spokane Aquifer Joint Board began efforts to reprint the Atlas. Although the original printing plates were not available, the computer files had been archived, and four of the original six Aquifer Atlas team members were available to contribute to an Atlas update. Beginning in fall 2003, a new Aquifer Atlas team, comprised of original and new members, began work on updating the 2000 Atlas with current information in preparation for a new printing.

**Special Acknowledgements:** Bea Lackaff (SC) created or revised Atlas maps and provided other graphics. Jim MacInnis (CoS) was responsible for project management, text writing, editing and layout. Special thanks to Spokane County and the City of Spokane for generously supporting Bea's and Jim's efforts on the Atlas Update.

**2004 Aquifer Atlas Update Team:** James D. MacInnis, P.E. (CoS), Beatrice B. Lackaff (SC), John P. Buchanan, Ph.D. (EWU), Reanette Boese (SC), Julia McHugh (SAJB), Geoff Harvey (IDEQ), Robert Higdeman (IDEQ), and Gary Stevens (IDEQ).

## Original 2000 Atlas Acknowledgements

Creation and publication of this Atlas was the result of faith, hard work and sweat by a small number of people, the Aquifer Atlas Team, whose names appear in the Preface (see below). However, many other people assisted the Team's efforts, and everyone's contribution added measurably to the quality and content of this document. The Aquifer Atlas Team acknowledges the following people for their contributions: Calvin Terada (EPA), Stan Miller (SC), Connie Grove (SC), Ken Lustig (PHD), John Sutherland (IDEQ), and Glen Pettit (IDEQ).

**Original 2000 Aquifer Atlas Team:** James D. MacInnis, P.E. (IDEQ), Jim Blake (SC), Brian Painter, P.G. (IDEQ), John P. Buchanan, Ph.D. (EWU), Beatrice B. Lackaff (SC), Reanette Boese (SC).

**EWU** Eastern Washington University  
**SC** Spokane County  
**CoS** City of Spokane  
**IDEQ** Idaho Depart. of Environmental Quality  
**EPA** U.S. Environmental Protection Agency  
**PHD** Panhandle Health District  
**SAJB** Spokane Aquifer Joint Board  
**USGS** United States Geologic Survey

MacInnis, J.D., Jr., Lackaff, B.B., Boese, R.M., Stevens, G., King, S., Lindsay, R.C., 2009, *The Spokane Valley-Rathdrum Prairie Aquifer Atlas 2009 Update*: Spokane, Washington, City of Spokane, 30p.

## Printing Sponsors

These organizations graciously provided funds to print this Aquifer Atlas Update.



Aquifer Protection District



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**Front Cover:** Spokane County Water Resources Program GIS, 2009.

**Page 1:** Atlas Team.

**Page 2:** Aquifer map = USGS SIR 2007-5041, Figure 1; earth photo = "The Blue Marble", NASA Visible Earth catalog; global groundwater map = United Nations Educational, Scientific and Cultural Organization and BGR (German Federal Institute for Geosciences and Natural Resources); climate change text = adapted by the Atlas Team and Stanley Miller from the *Washington Climate Change Impacts Assessment Study* Executive Summary (June 3, 2009) prepared by the University of Washington's Climate Impacts Group; Sidebar article = Spokesman-Review, May 6, 1909; text = Atlas Team.

**Page 3:** "Plante's Ferry" painting by James Madison Alden, International Boundary Survey, 1860. Courtesy of the National Archives, College Park, Maryland (thanks to Jack Nisbet.) 2004 photo = Jim MacInnis from Arbor Crest Winery; Vera photo = Vera Water and Power; Modern Electric, Broadway, and apple orchard photos = Modern Electric Water Company archives; irrigation system, wood stove, sawmill, Fort Sherman photos = Museum of North Idaho, Coeur d'Alene, ID.

**Page 4:** Background photo = Upriver Timber Dam, 1895, City of Spokane Water Department; J Harlen Bretz photo = IDEQ web site; Pardee photo = Public Broadcasting System web site; Timeline data = Archives of the Spokesman Review, the Spokane Chronicle and Atlas Team.

**Page 5:** Landsat Data: National Aeronautic & Space Administration (NASA), Washington Remote Sensing Consortium (WARSC). This image is a composite image based on two Landsat 7 ETM+ images - 6 July 2007 and 8 July 2008. The image is a 'composite' because Landsat 7 had a hardware failure, the result of which is that 22% of data is missing from each scene. A second image was used to fill in the missing

areas via computer processing techniques. The spatial resolution of the image is 30 meters. By Dr. Kerry Brooks, GIS & Simulation Laboratory, Washington State University Interdisciplinary Design Institute.

**Page 6:** Map data = Spokane County GIS, Kootenai County GIS; text = Aquifer Team.

**Page 7:** Map = USGS SIR 2005-5227, Figure 4; Pardee photo = Public Broadcasting System web site; falls photo = Jim MacInnis; text = public domain sources, Aquifer Team.

**Page 8:** J Harlen Bretz photo = IDEQ web site; Aquifer formation photo = Dr. John P. Buchanan; cataract canyon and Rathdrum Prairie-Spokane Valley photos = Jim MacInnis; paintings courtesy of Stev Ominski, used with permission; text = public domain sources, Aquifer Team.

**Page 9:** Cross sections = USGS SIR 2007-5041, Plate 2; text, graphics and key = Atlas Team.

**Page 10:** Geologic map data = adapted by Spokane County Water Quality Management Program GIS from USGS, M.L. Zientek and others, unpublished data, 2004.

**Page 11:** Graphic = Klundt & Hosmer Design, Inc. commissioned by Spokane Aquifer Joint Board.

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**Page 13:** Recharge and lakes graphs = adapted by Atlas Team from USGS SIR 2007-5041, Figure 11; precipitation map = USGS SIR 2005-

5227, Figure 3; Aquifer map = adapted from USGS SIR 2007-5041, Figure 11; meadow and Hauser Lake photos = Bea Lackaff; text and other graphics = Atlas Team.

**Page 14:** Low flow graph = adapted from USGS SIR 2007-5044, Table 6; low flow map = Spokane County Water Quality Management Program GIS; river reaches map = USGS SIR 2005-5227, Figure 8; river photo = John Patrouch; text and other graphics = Atlas Team.

**Page 15:** Discharge graph = adapted by Atlas Team from USGS SIR 2007-5041, Figure 11; Well graph = adapted by Atlas Team from USGS SIR 2007-5044, Figure 15; river photo = Bea Lackaff; Griffith springs photo = Mike Hermanson, Aug 2007; text and other graphics = Atlas Team.

**Page 16:** Graphics created through collaboration of IDEQ and Spokane County GIS; text = Atlas Team.

**Page 17 & 18:** Graphics from USGS SIR 2007-5044, Figures 1, 10, 12, 14, 17, 22, 51 and from USGS SIR 2007-5041, Figure 10; text = Atlas Team.

**Page 19:** Map from USGS SIR 2005-5227, Plate 1; text = Atlas Team.

**Page 20:** Hillyard Trough map = USGS SIR 2007-5041, Figure 7; depth to bedrock map = Oldow, J.S., Sprenke, K.F., 2006. *Gravity Acquisition and Depth to Basement Modeling of the Spokane Valley and Rathdrum Prairie Aquifer, Northeastern Washington and Northwestern Idaho*, Geological Sciences, University of Idaho, Moscow Idaho; Aquifer-river map = USGS SIR 2007-5044, Figure 18; bar graph adapted from USGS SIR 2007-5044, Figure 46; well graphs from USGS SIR 2007-5044, Figure 41; area lakes discharge table = adapted by Atlas Team from USGS SIR 2007-5041, Figure 11 (2005-estimates) and IDEQ (2007-model); text = Atlas Team.

**Page 21:** Nitrate maps = adapted by Atlas Team from nitrate concentration data collected by Spokane County Water Quality Management Program and Idaho Panhandle Health District; text = Atlas Team.

**Page 22:** Board game created by Jim MacInnis; Aqua Duck and his companions graphics courtesy of SAJB; text = Atlas Team.

**Page 23:** Tour map = Spokane County Water Resources GIS

**Page 24:** Tour information and text: Reanette Boese (SC) and Gary Stevens (IDEQ); photo credits: (A) and (B) = Bea Lackaff; (C) = Jim MacInnis; (D) = Bill Rickard; (E) = Bea Lackaff; (F) = Stan Miller; (G) = Bea Lackaff; (H), (I), (J), (K), (O) and (L) = courtesy of IDEQ; (M) = courtesy of City of Coeur d'Alene; (N) = courtesy of Panhandle Health District.

**Page 25:** Population data = U.S. Census Bureau; climate data = National Weather Service; hydrologic data = USGS; collected and compiled by Gary Stevens (IDEQ); text = Atlas Team.

**Pages 26, 27 & 28:** Text = Atlas Team; Aqua Duck and his companions graphics courtesy of SAJB.

**Back Cover:** Image Jeff Silkwood's U.S. Forest Service poster, "Glacial Lake Missoula and the Channeled Scabland" Adapted for Atlas by Spokane County GIS.

**Much of the information** included in this Atlas Update was published in USGS Scientific Investigations Reports 2005-5227, 2007-5041, and 2007-5044. A central repository for Aquifer data and interpretation has been established by the Idaho Department of Water Resources on line at <http://www.idwr.idaho.gov/WaterInformation/projects/svrp/>, and links to obtain electronic copies of the USGS report may be found at this internet site.