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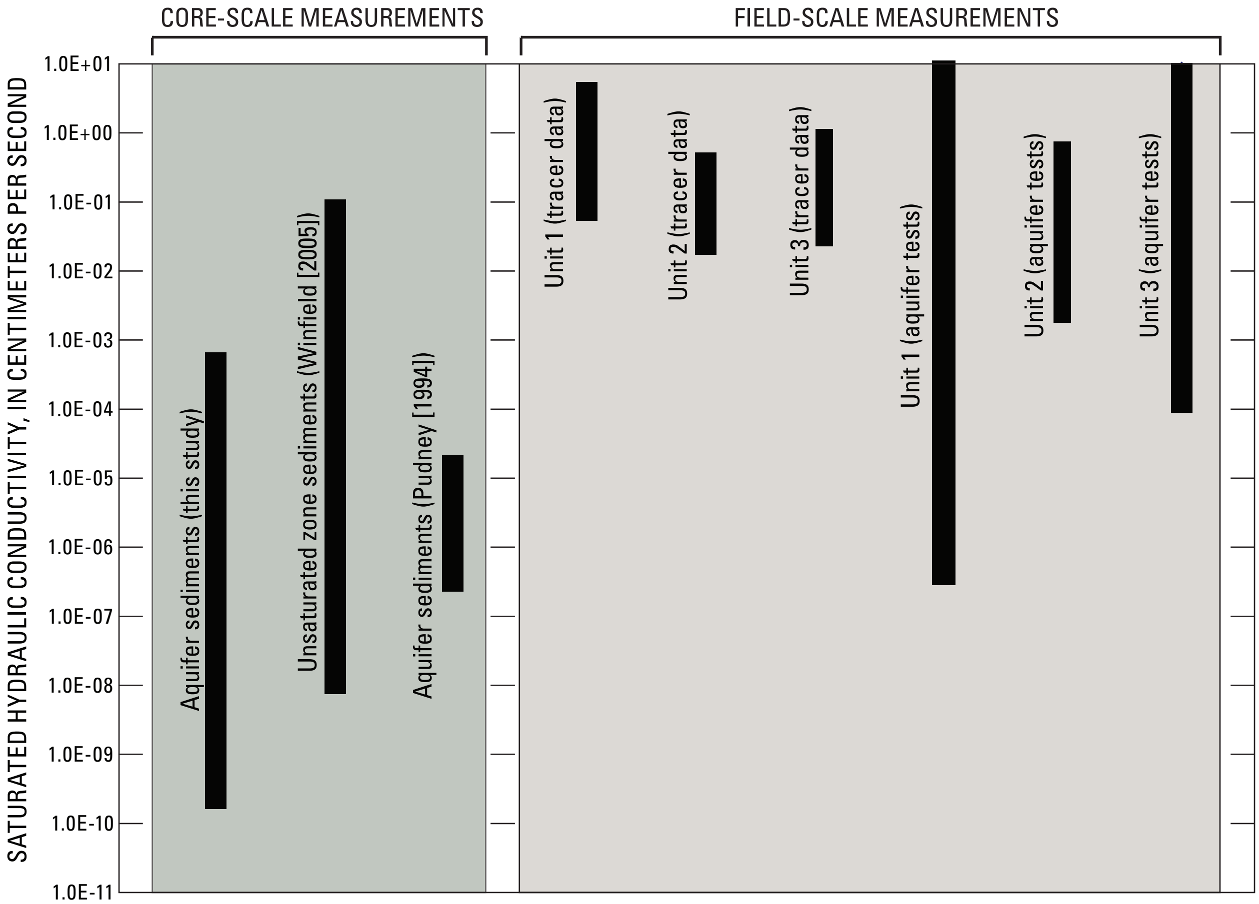
Laboratory-Measured and Property-Transfer Modeled Saturated Hydraulic Conductivity of Snake River Plain Aquifer Sediments at the Idaho National Laboratory, Idaho



Scientific Investigations Report 2008-5169

U.S. Department of the Interior
U.S. Geological Survey

Cover: Graph showing ranges in saturated hydraulic conductivity for aquifer sediments from laboratory and field measurements.

Laboratory-Measured and Property-Transfer Modeled Saturated Hydraulic Conductivity of Snake River Plain Aquifer Sediments at the Idaho National Laboratory, Idaho

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Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
centimeter of water (cm-water)	0.01419	pound per square inch (lb/in^2)
centimeter per second (cm/s)	0.03281	foot per second (ft/s)
centimeter per day (cm/d)	0.03281	foot per day (ft/d)
cubic centimeter (cm^3)	0.06102	cubic inch (in^3)
gram (g)	0.00220	pounds (lb)
gram per centimeter (g/cm)	0.00560	pound per inch (lb/in)
gram per cubic centimeter (g/cm^3)	0.03613	pounds per cubic inch (lb/in^3)
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	3.937	inch (in.)
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861	square mile (mi^2)

Datums

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Laboratory-Measured and Property-Transfer Modeled Saturated Hydraulic Conductivity of Snake River Plain Aquifer Sediments at the Idaho National Laboratory, Idaho

By Kim S. Perkins

Abstract

Sediments are believed to comprise as much as 50 percent of the Snake River Plain aquifer thickness in some locations within the Idaho National Laboratory. However, the hydraulic properties of these deep sediments have not been well characterized and they are not represented explicitly in the current conceptual model of subregional scale ground-water flow. The purpose of this study is to evaluate the nature of the sedimentary material within the aquifer and to test the applicability of a site-specific property-transfer model developed for the sedimentary interbeds of the unsaturated zone. Saturated hydraulic conductivity (K_{sat}) was measured for 10 core samples from sedimentary interbeds within the Snake River Plain aquifer and also estimated using the property-transfer model. The property-transfer model for predicting K_{sat} was previously developed using a multiple linear-regression technique with bulk physical-property measurements (bulk density [ρ_{bulk}], the median particle diameter, and the uniformity coefficient) as the explanatory variables. The model systematically underestimates K_{sat}, typically by about a factor of 10, which likely is due to higher bulk-density values for the aquifer samples compared to the samples from the unsaturated zone upon which the model was developed. Linear relations between the logarithm of K_{sat} and ρ_{bulk} also were explored for comparison.

Introduction

The subsurface at the Idaho National Laboratory (INL; fig. 1) consists of thick layers of fractured basalt interbedded with thin layers of fluvial, eolian, and lacustrine sediments. These sedimentary interbeds affect vertical and horizontal flow through the saturated and unsaturated zones, although the effect on the regional aquifer flow regime is not well understood. In the current conceptual model of the eastern Snake River Plain (ESRP) aquifer (Ackerman and others, 2006), the overall volume of sediment and basalt is treated as three composite units with effective hydraulic properties that are considered to account for the hydraulic effects of both types of material in combination within each unit. The modeling effort aims to simplify geologic and hydrologic features while retaining those features that are important to water flow and contaminant transport.

Welhan and others (2006) evaluated sediment thickness within the model domain using data from 333 boreholes in and around the INL and determined that within the Big Lost Trough (fig. 1), an area known to have the greatest sediment accumulation, sediment comprises more than 50 percent of the stratigraphic thickness at some locations. The hydrologic significance of this sediment is evident in water-table contours that indicate increased gradients in this area of high sediment accumulation (Joseph Rousseau, U.S. Geological Survey, oral commun., 2007). The hydraulic influence of these units, and hence their importance in the subregional flow model, requires an assessment of the nature of the sedimentary material that would facilitate verification of the model-simulated flow behavior. Vertical gradients observed in the field and those produced by numerical simulation could be verified using knowledge of the hydraulic properties of the sedimentary material. Sediment abundances (Welhan and others, 2006) along with the properties measured in this study provide information useful in model refinement and establish the foundation for an aquifer-specific property-transfer model.

Site Description

The INL was established in 1949 for nuclear-energy research under the U.S. Atomic Energy Commission (now the U.S. Department of Energy). The INL occupies about 2,300 km^2 of the west-central part of the ESRP (fig. 1). The site hosts several facilities of which at least four have been used to generate, store, or dispose of radioactive, organic, and inorganic wastes. The ESRP is a northeast-trending basin, about 320 km long and 80–110 km wide, that slopes gently to the southwest and is bordered by northwest-trending mountain ranges. The ESRP is underlain by interbedded volcanic and sedimentary layers that extend as much as 3,000 m below land surface. The sedimentary interbeds, which constitute about 15 percent by volume of the unsaturated zone and ESRP aquifer (Anderson and Liszewski, 1997), result from quiet intervals between volcanic eruptions and are of fluvial, eolian, and lacustrine origin. Volcanic units composed primarily of basalt flows, welded-ash flows, and rhyolite, may be vesicular to massive with either horizontal or vertical fracture patterns.

The climate of the ESRP is semiarid and the average annual precipitation is 22 cm. Parts of the ESRP aquifer underlie the INL. The depth to the water table ranges from 60 m in the northern part of the INL to about 200 m in the southern part (Barraclough and others, 1981; Liszewski and Mann, 1992). The predominant direction of ground-water flow is from northeast to southwest. Recharge to the aquifer is primarily from irrigation water diversions from streams, precipitation and snowmelt, underflow from tributary-valley streams, and seepage from surface-water bodies (Hackett and others, 1986). Within the INL boundaries, the Big Lost River (fig. 1) is an intermittent stream that flows from southwest to northeast.

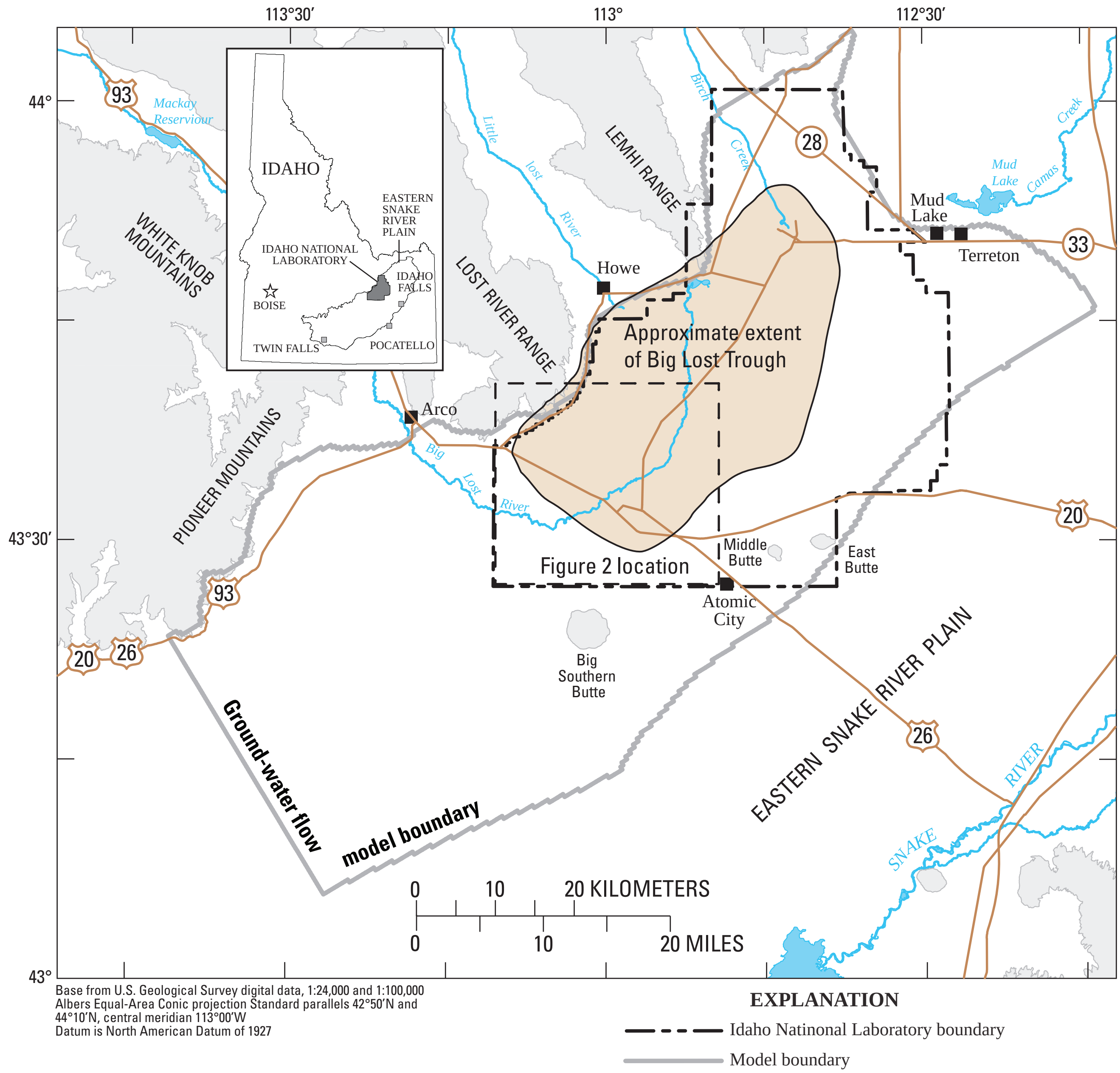

Figure 1. Location of the boundary for the subregional scale ground-water flow model, Idaho National Laboratory, Idaho.

Purpose and Scope

This report describes the nature of the sedimentary material within the ESRP aquifer, which will aid in further development of the subregional ground-water flow model. The measurements of saturated hydraulic conductivity (K_{sat}) and bulk properties on highly consolidated core samples from the ESRP aquifer and estimates of K_{sat} based on the site-specific models developed by Winfield (2005) and Pudney (1994) also are presented. In recent years, numerous deep boreholes have been drilled and core samples obtained which give an opportunity to directly measure K_{sat} and other relevant properties of sedimentary materials, such as particle-size distribution and bulk density (ρ_{bulk}). This report includes K_{sat} and bulk properties measured on 10 minimally disturbed core samples, and particle size distributions for 77 samples from 4 boreholes within the INL (fig. 2). K_{sat} also was estimated for all samples using the site-specific property-transfer model of Winfield (2005) and the simple linear relation between the logarithm of K_{sat} and ρ_{bulk} identified by Pudney (1994).

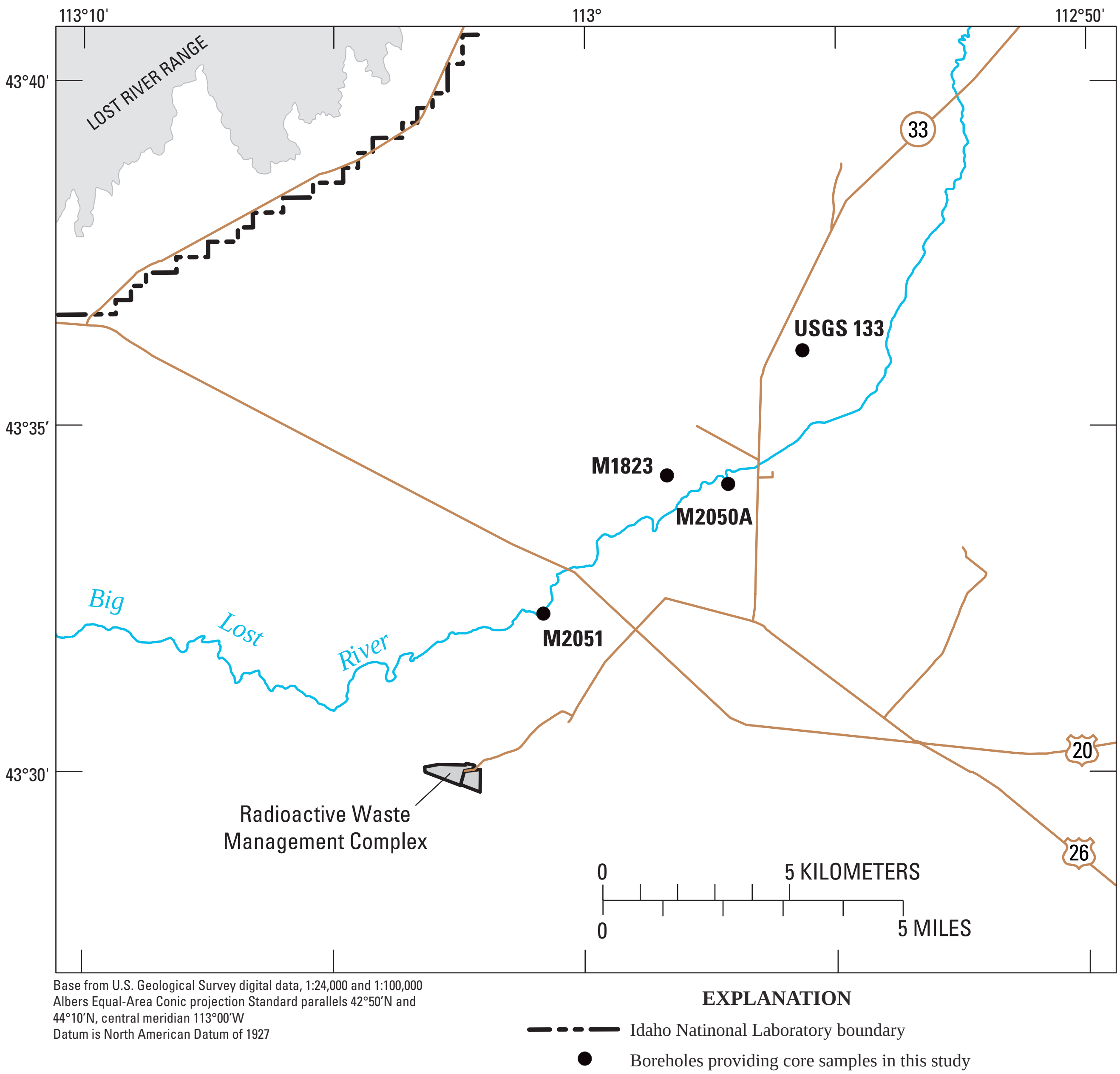

Figure 2. Locations of boreholes from which core samples were collected for this study, Idaho National Laboratory, Idaho.

The Winfield model uses bulk physical-property data, including ρ_{bulk} and particle-size statistics [median particle diameter (d_{50}) and uniformity coefficient (C_u)], to estimate K_{sat} using a multiple linear-regression equation. Winfield (2005) describes the available data, data selection and processing, multiple linear-regression assumptions and approach, and regression equations. A simple linear relation between K_{sat} and ρ_{bulk}, as identified by Pudney (1994), also was tested for comparison to the Winfield model. The Pudney (1994) data set includes samples from depths greater than 250 m; whereas, the Winfield (2005) model includes samples from depths less than 80 m.

Methods

Samples were selected primarily based on condition of the core as well as the representative nature of the material in the overall aquifer profile. Boreholes with available sediment included M1823, M2050a, M2051, and USGS133 (fig. 2). Most core samples were unlined; therefore, a technique was developed to create a liner and water-inflow reservoir as one composite unit that would prevent annular flow along the sample edge during the falling-head measurement of K_{sat} (fig. 3). The samples were first trimmed carefully using hand tools for determination of ρ_{bulk} where the sample volume must be known (ρ_{bulk} = mass of solid/total volume). High-density polyethylene liners, with a diameter several centimeters larger than the core samples, were cut to provide a 5–10 cm reservoir at the top of the sample. The core samples were placed within the prepared liners and the annular space was filled with a moderately viscous epoxy that could be poured easily, but that would minimally penetrate the sample pore spaces. Before assembly, the liners were abraded on the inner surfaces to ensure good adhesion with the epoxy. Samples used for K_{sat} measurement are listed in table 1 with a brief visual description.

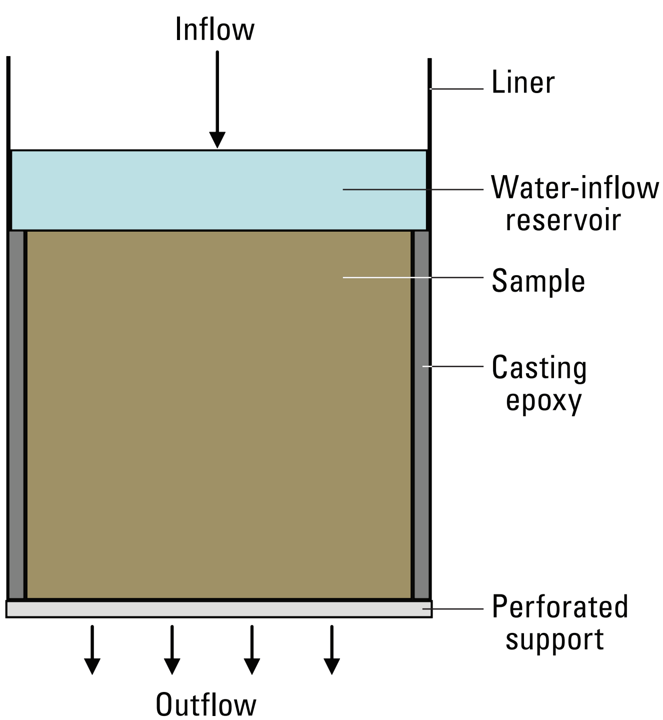

Figure 3. Experimental setup for falling-head, saturated hydraulic conductivity measurements in the laboratory.

The standard falling-head method for obtaining K_{sat} was used for most samples (Reynolds and others, 2002). For samples with low saturated conductivity, inferred a priori based on the time for the sample to saturate completely from the bottom up, a modification of the standard method was performed in a centrifuge with K_{sat} calculated using the following equation (Nimmo and Mello, 1991; Nimmo and others, 2002):

$$K_{sat} = \frac{[(-2la)/(A\rho\Delta tg)]}{\ln\ [(gz_f + \omega^2 r_b^{\,2})/(gz_i + \omega^2 r_b^{\,2})]}\ , \qquad (1)$$

where

l is sample length,
a is the cross-sectional area of the inflow reservoir,
A is the cross-sectional area of the sample,
ρ is the density of the fluid used,
t is time,
g is gravitational acceleration,
z is the height of water in the reservoir (initial and final),
r_b is the radius of rotation at the sample bottom, and
ω is angular speed.

Table 1. Samples used for measuring saturated hydraulic conductivity, Idaho National Laboratory, Idaho.

Hole	Depth (meters)	Description
M1823	221.4	brown, silty
M1823	223.7	tan with basalt flecks
M1823	284.0	orange red, crumbly
M2050a	320.3	orange red, porous
M2050a	362.7	orange red, hard
M2050a	396.2	sandy
M2050a	229.0	orange red, hard
M2051	214.5	orange red, very porous
USGS133	193.5	orange red w/basalt gravel
USGS133	240.9	brown, silty

Errors in measured K_{sat} values commonly arise from annular flow between the sample and liner (which was eliminated by casting the samples with epoxy), mechanical error, precision of the device used to measure length, and operator error. The calculated maximum error in K_{sat} due to these effects is about 10 percent (Nimmo and others, 2002).

A Coulter LS-230 Particle Size Analyzer was used to characterize particle-size distributions by optical diffraction (Gee and Or, 2002). The range of measurement for this particular device is 0.04–2,000 µm, which is divided into 116-µm size bins. Any particles greater than 2,000 µm were sieved out and later integrated into the size-distribution results. The fraction less than 2,000 µm was disaggregated carefully using a mortar and rubber-tipped pestle, and then split with a 16-compartment spinning riffler to obtain appropriate random samples for analysis. The material was sonicated in suspension for 60 seconds prior to each run; an average of two runs was calculated for each sample.

Two property-transfer models were evaluated in this study. Winfield (2005) formulated the following property-transfer equation for K_{sat} using particle-size statistics [median particle diameter (d_{50}) and uniformity coefficient (C_u)] and ρ_{bulk} as input:

$$\log(K_{sat}) = -1.7690 + 0.0794\rho_{bulk} + 1.7507\log(d_{50}) - 0.3274\log(C_u)\ . \qquad (2)$$

In an earlier study (Pudney, 1994), the following empirical relation was found between K_{sat} and ρ_{bulk}:

$$\log(K_{sat}) = -4.66\rho_{bulk} + 2.67. \qquad (3)$$

The root-mean-square error (RMSE), also referred to as the standard error of the estimate, is used in this study as a goodness-of-fit indicator between measured and estimated K_{sat} values. The RMSE is calculated as:

$$RMSE = \sqrt{\frac{\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}{n}}\ , \qquad (4)$$

where

y_j is the measured value,

$\hat{y}_j$ is the estimated value of the dependent variable, and,

n is the number of observations.

Small RMSE values indicate the estimated value is closer to the measured value of the variable. K_{sat} values span several orders of magnitude, thus, in effect, unequally weighting points in the RMSE calculation. Therefore, the K_{sat} values were transformed logarithmically prior to calculation.

The average error (*AE*) also was calculated for comparison to highlight systematic over or under prediction as follows:

$$AE = \frac{\sum(y_j - \hat{y}_j)}{n}. \qquad (5)$$

For the data analyzed here, a negative *AE* value indicates under estimation and a positive *AE* value indicates over estimation.

Results and Discussion

Samples were selected to capture as wide a variety of materials (based on visual inspection) as was practical. Hence, measured core-sample properties were highly variable (table 2). Figure 4 shows the ranges in K_{sat} values measured in this study compared with those used in the development of the Winfield (2005) property-transfer model and measured by Pudney (1994), and those from Ackerman and others (2006), where horizontal K_{sat} values for each of the three hydrolgeologic units were estimated. These estimates are from (1) average linear ground-water velocities from numerous studies of atmospheric tracers, long term monitoring of contaminant movement in the aquifer, and knowledge of hydraulic gradients and effective porosities and (2) aquifer tests.

The values determined by Ackerman and others (2006) are much higher generally than the range of values for sediments because they represent the weighted average of sediment and basalt, and reflect a much larger scale of measurement. The ground-water flow model calibration process tends to assign lower values in areas where sediment proportions are greater than 11 percent in the upper part of the aquifer (Welhan and others, 2006). Welhan and others (2006) indicated that a more sophisticated scaling process based on sediment abundance would lead to improved estimates of horizontal K_{sat} values for the hydrogeologic units. This study provides data for deep aquifer sediments that can be used in scaling the composite K_{sat} values.

Laboratory-measured K_{sat} values vary over six orders of magnitude (fig. 4) with an average value of 8.78×10^{-5} cm/s and a standard deviation of 1.45×10^{-4}. The average ρ_{bulk} was 1.64 g/cm^3 with a standard deviation of 0.28. One sample from hole M2051 at 214.5 m depth had an unusually low ρ_{bulk} value (1.02 g/cm^3) and also the highest measured K_{sat} value (4.78×10^{-4}). Excluding this anomalous sample, the average ρ_{bulk} was 1.71 g/cm^3. The sample from hole M2050a at 362.7 m depth, which had a low K_{sat} value (1.25×10^{-9} cm/s), was too consolidated to be disaggregated for particle-size analysis.

Table 2. Saturated hydraulic conductivity, bulk density, and particle size statistics for aquifer core samples, Idaho National Laboratory, Idaho.

[**Abbreviations:** m, meter; cm/s, centimeter per second; g/cm^3, gram per cubic centimeter; mm, millimeter; K_{sat}, saturated hydraulic conductivity; d_{50}, uniformity coefficient]

Hole	Depth (m)	Description	K_{sat} (cm/s)	Bulk density (g/cm^3)	Mean particle diameter (mm)	Standard deviation	Median particle diameter (d_{50}, mm)
M1823	221.4	brown, silty	1.06×10^{-4}	1.75	0.043	0.004	0.065
M1823	223.7	tan, basalt flecks	6.38×10^{-6}	1.68	0.013	0.005	0.018
M1823	284.0	oxidized, crumbly	2.54×10^{-5}	1.72	0.093	0.007	0.111
M2050a	320.3	oxidized, porous	6.48×10^{-5}	1.30	0.053	0.004	0.076
M2050a	362.7	oxidized, hard	1.25×10^{-9}	1.66	no data	no data	no data
M2050a	396.2	sandy	1.32×10^{-4}	1.66	0.088	0.005	0.160
M2050a	229.0	oxidized, hard	2.07×10^{-10}	1.77	0.032	0.004	0.052
M2051	214.5	oxidized, very porous	4.78×10^{-4}	1.02	0.052	0.004	0.063
USGS133	193.5	oxidized w/basalt gravel	6.13×10^{-5}	1.85	0.152	0.006	0.178
USGS133	240.9	brown, silty	4.68×10^{-6}	1.98	0.009	0.004	0.010

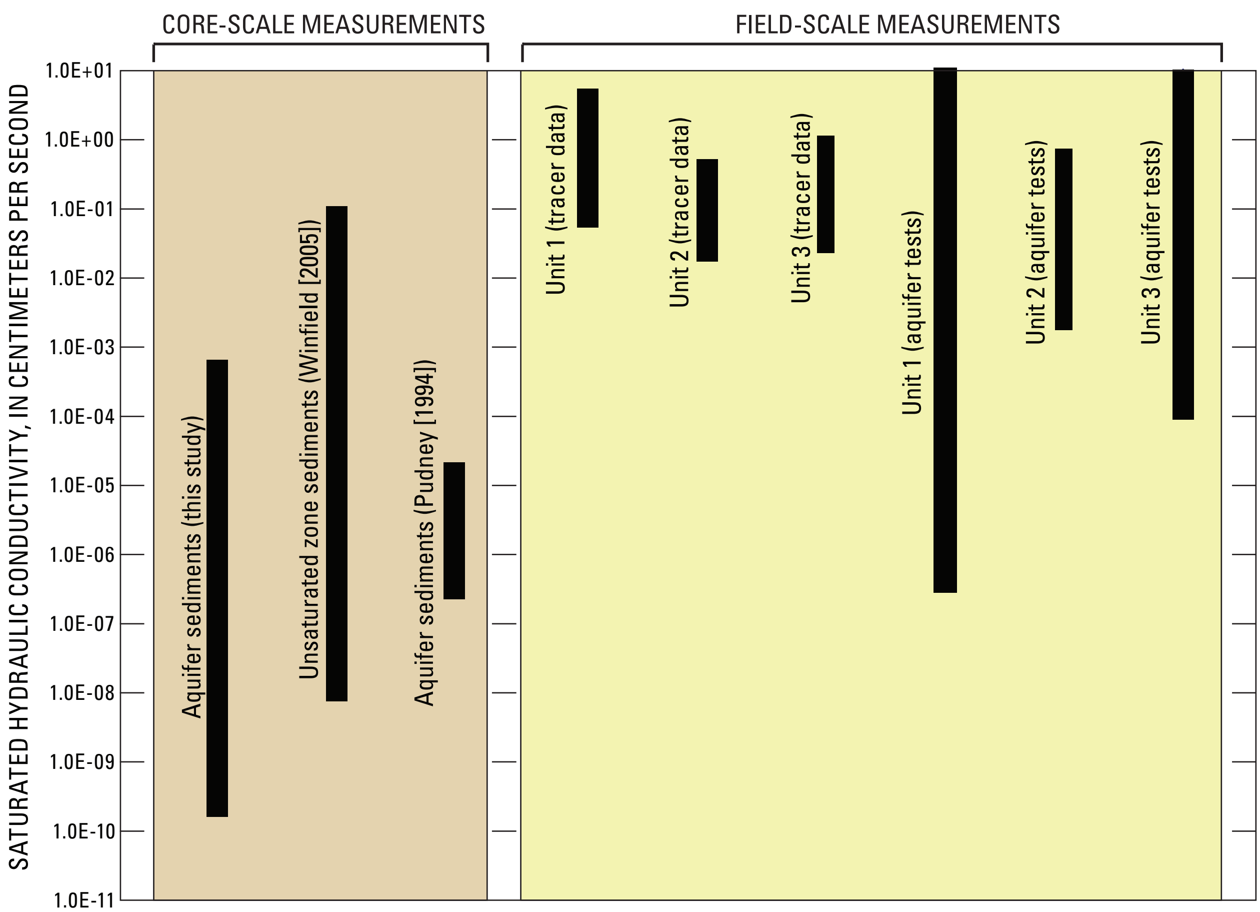

Figure 4. Ranges in saturated hydraulic conductivity measured in this study, used in the development of the Winfield (2005) property-transfer model, measured by Pudney (1994), determined based on contaminant movement for units 1–3 (Ackerman and others, 2006), and determined based on aquifer tests for units 1–3 (Ackerman and others, 2006), Idaho National Laboratory, Idaho.

Particle-size distributions for nine of the core samples are shown in figure 5. Particle-size classes are listed in table 3 for the additional 67 bulk samples.

K_{sat} values for the 78 unsaturated zone sedimentary interbed samples used by Winfield (2005) in model development ranged from 1.1×10^{-8} to 8.2×10^{-2} cm/s with an average ρ_{bulk} of 1.46 g/cm^3 (fig. 4). K_{sat} values for the seven deep samples used by Pudney (1994) ranged from 3.0×10^{-7} to 1.4×10^{-5} cm/s with an average ρ_{bulk} of 1.85 g/cm^3 (fig. 4). Generally, K_{sat} values, as well as particle size statistics, show no consistent trend with depth; however, deeper interbeds tend to have higher ρ_{bulk} values. Figure 6 shows the difference in ρ_{bulk} values for deep samples (greater than 200 m depth from this study and Pudney 1994), and shallow samples (less than 60 m depth from Perkins and Nimmo, 2000; Perkins, 2003; and Winfield, 2003). The Man-Whitney rank-sum test (Zar, 1996) was used to determine that the difference in ρ_{bulk} between the shallow and deep samples statistically is significant. The calculated test statistic (Z) was 5.488, compared with the critical two-tailed value of 1.645 with an α level of 0.05. The samples from greater than 200 m depth indicate no strong linear trends between K_{sat} and bulk properties (ρ_{bulk} and median particle diameter); however, regression trends are slightly stronger for the Pudney (1994) data set than the data set from this study (fig. 7).

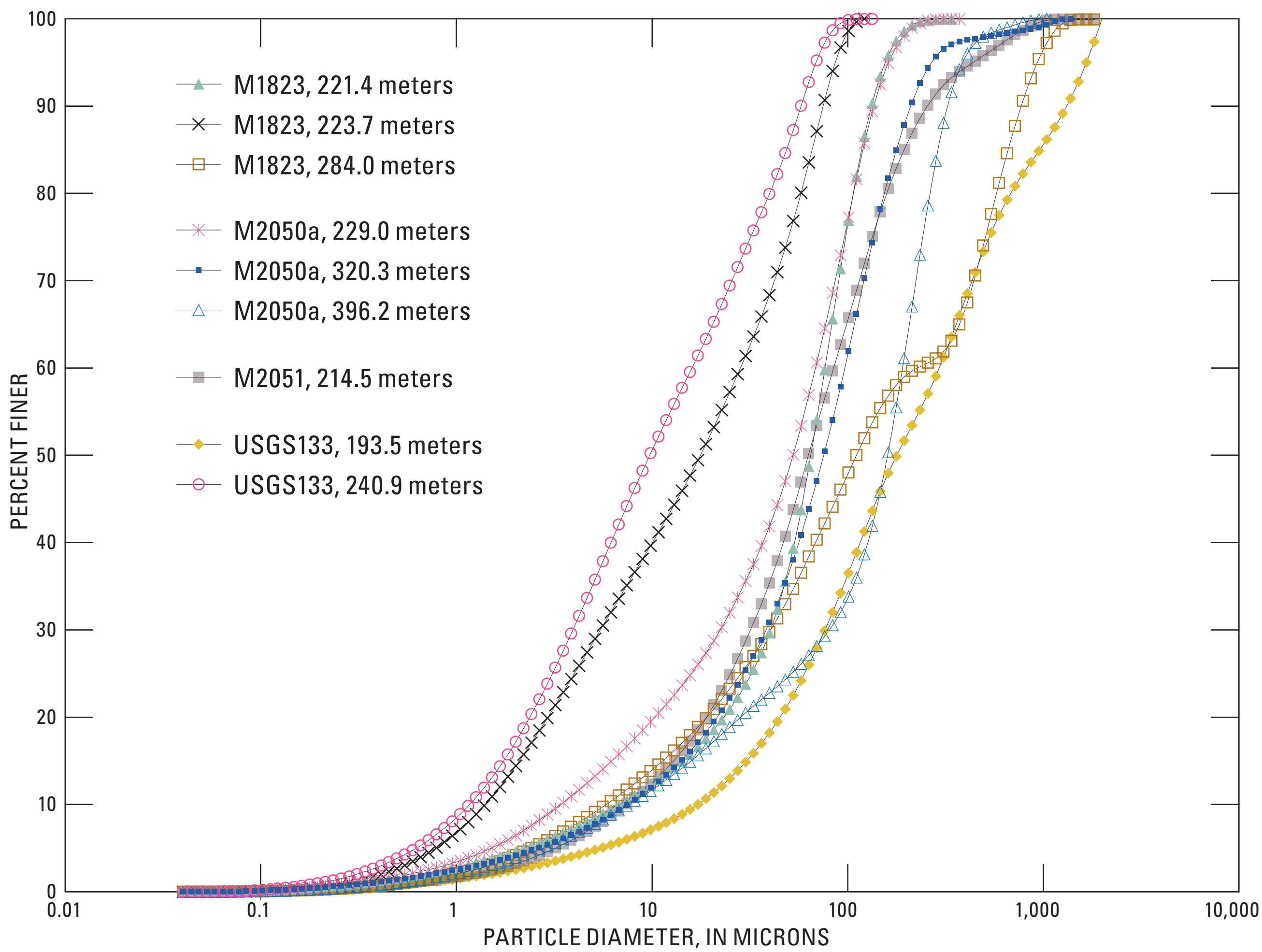

Figure 5. Particle-size distributions for 9 of the 10 core samples, Idaho National Laboratory, Idaho.

Table 3. U.S. Department of Agriculture textural size classes for 67 bulk aquifer samples, Idaho National Laboratory, Idaho.

[**Abbreviations:** m, meter; µm, micrometer; mm, millimeter. **Symbols:** <, less than; >, greater than]

Hole	Depth (m)	Clay (<2 µm)	Silt (2–50 µm)	Sand (50 µm–2 mm)	Gravel (>2 mm)
M1823	221.7	3.00	23.36	73.64	0.00
	222.5	10.40	54.22	35.38	0.00
	223.7	7.57	48.37	44.03	0.00
	223.7	10.59	60.05	29.35	0.00
	224.2	12.70	65.91	21.40	0.00
	224.5	12.76	65.72	21.53	0.00
	225.2	10.92	71.08	17.99	0.00
	276.8	2.64	20.95	75.64	0.83
	285.0	9.59	66.78	23.63	0.00
	330.3	4.29	41.56	54.21	0.00
	330.9	10.62	75.41	13.97	0.00
	332.1	3.09	20.52	76.38	0.00
	332.2	4.26	33.50	62.24	0.00
	332.4	19.10	63.58	17.30	0.00
	332.8	4.87	35.55	59.55	0.00
	333.2	14.18	56.28	29.52	0.00
	333.6	1.87	8.53	89.62	0.00
	334.1	6.00	41.04	53.00	0.00
	334.7	17.88	74.17	8.00	0.00
	335.1	7.22	45.62	47.21	0.00
	335.6	14.85	76.05	9.10	0.00
	335.9	4.85	29.57	65.33	0.24
	336.8	15.99	63.24	20.75	0.00
	337.4	2.66	17.88	79.45	0.00
	337.7	18.28	68.74	12.96	0.00
	341.1	6.99	31.50	61.44	0.00
USGS 133	192.3	1.73	10.65	83.82	3.83
	192.9	3.84	32.38	63.77	0.00
	194.4	7.43	57.88	34.68	0.00
	212.8	8.49	57.13	34.39	0.00
	238.5	2.29	19.61	78.11	0.00
	245.5	12.41	52.41	35.21	0.00
	247.5	10.96	54.00	35.05	0.00
M2051	146.0	1.76	6.41	91.80	0.00
	146.2	4.03	14.22	79.64	2.08
	146.3	8.64	34.80	52.35	4.22
	148.7	6.57	27.03	62.85	3.61
	188.1	6.08	27.54	66.32	0.00
	188.7	8.42	32.40	58.76	0.43
	189.7	14.75	60.94	23.88	0.41
	194.6	3.54	25.15	71.29	0.00
	214.3	4.65	42.60	52.74	0.00
	337.1	5.14	35.53	59.32	0.00
	337.4	10.96	53.21	35.87	0.00
	337.7	3.77	26.20	69.79	0.24
	338.0	2.50	25.91	71.44	0.11
M2050a	166.4	19.34	78.61	1.21	0.85
	226.2	4.91	52.70	42.38	0.00
	226.5	6.02	53.80	40.18	0.00
	226.5	7.89	65.68	26.41	0.00
	226.8	8.50	66.18	25.33	0.00
	228.6	5.21	39.93	54.85	0.00
	228.8	13.99	76.61	9.39	0.00
	320.7	16.98	68.42	14.61	0.00
	321.3	22.73	61.02	16.23	0.00
	321.9	15.54	54.77	29.64	0.00
	340.2	2.84	21.50	75.64	0.00
	340.5	3.52	22.79	73.70	0.00
	340.8	6.08	37.96	56.02	0.00
	390.9	13.41	79.97	6.61	0.00
	392.3	8.46	52.69	38.86	0.00
	394.7	9.20	48.26	42.48	0.00
	394.2	3.75	23.32	72.92	0.00
	397.2	7.90	36.81	55.26	0.00
	405.4	15.98	72.74	11.30	0.00
	406.0	17.39	64.10	18.58	0.00
	403.9	16.43	68.97	14.24	0.36

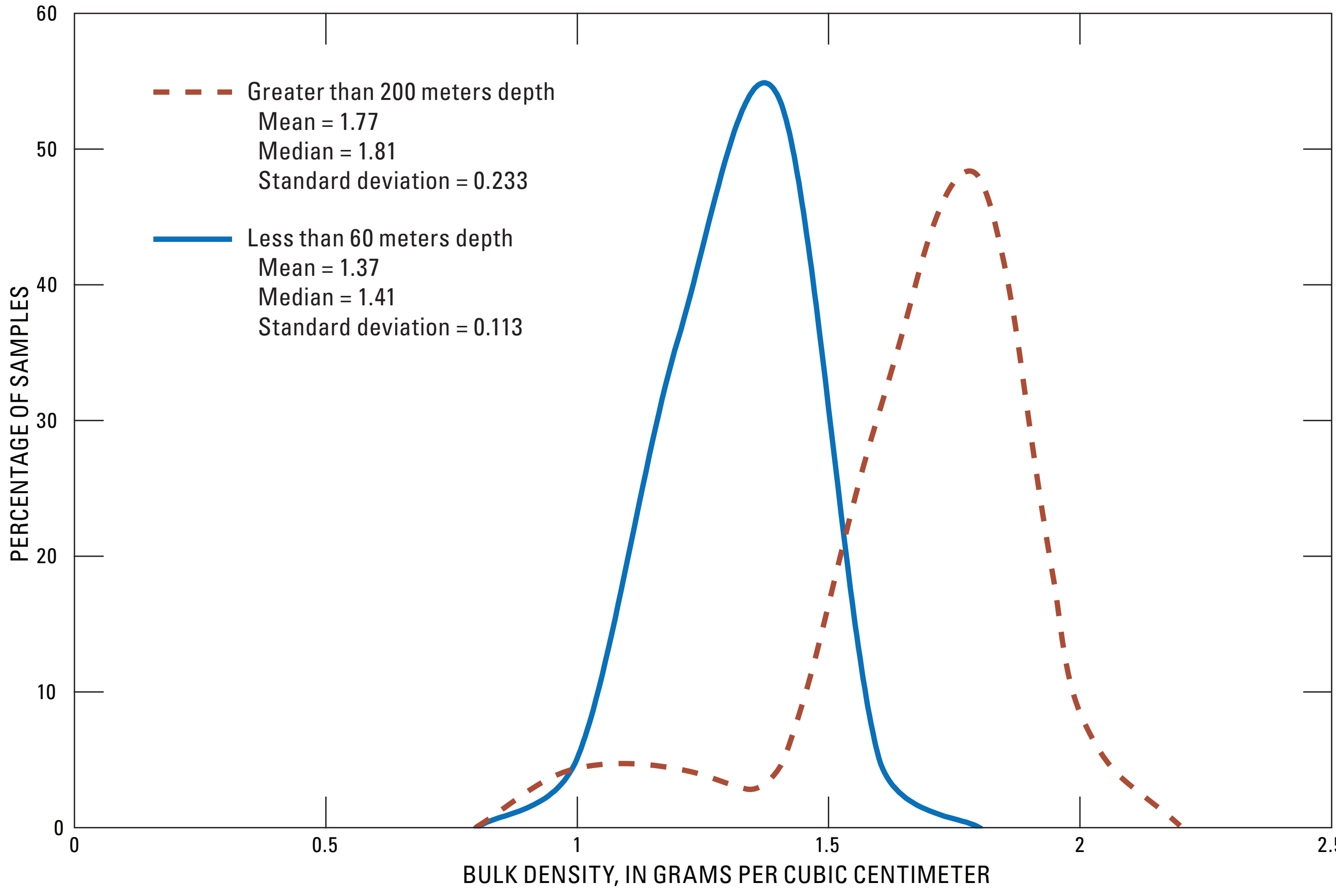

Figure 6. Bulk density values for samples from greater than 200 meters depth and less than 60 meters depth, Idaho National Laboratory, Idaho.

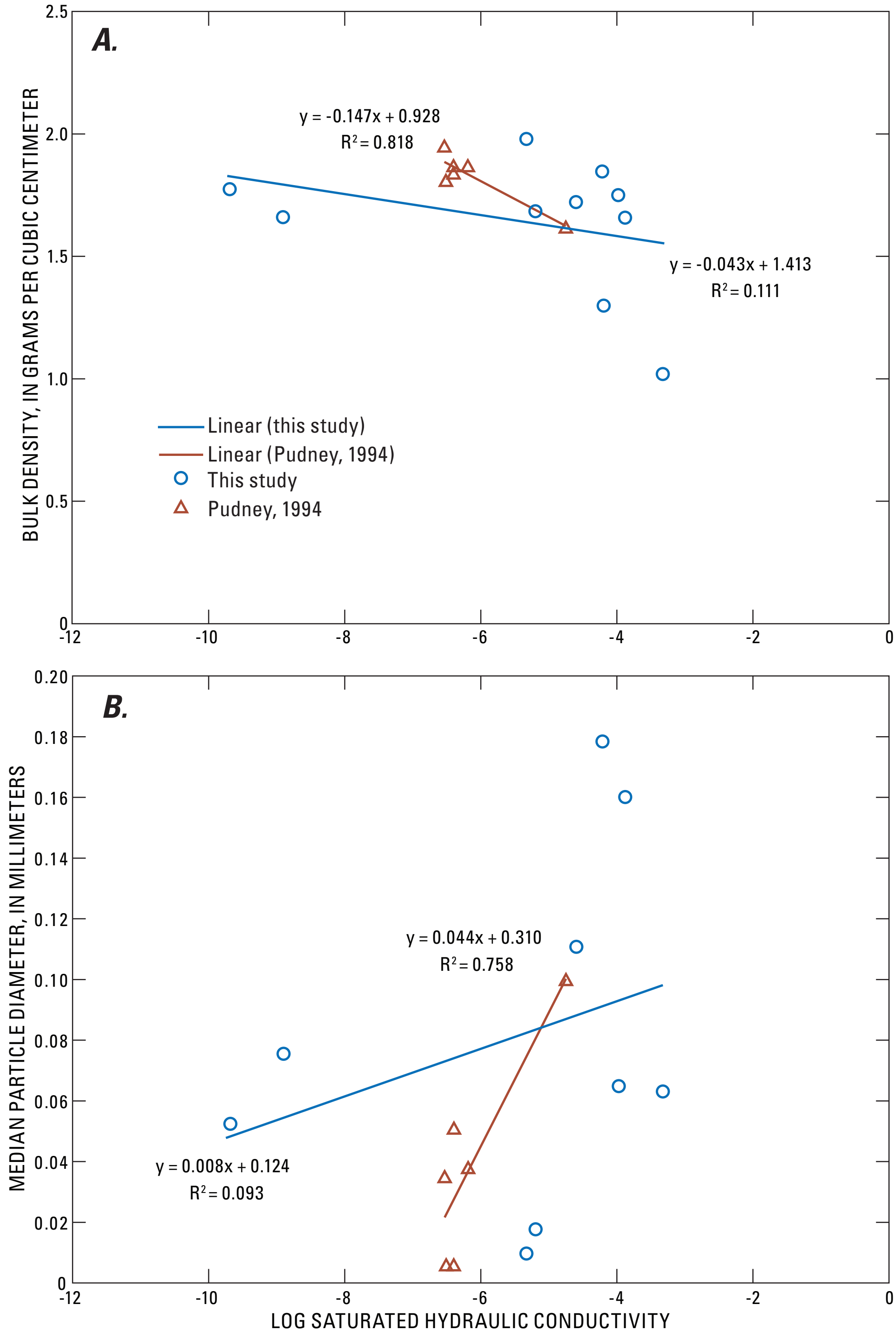

Figure 7. Trends between saturated hydraulic conductivity and (A) bulk density and (B) median particle diameter for the data from this study and Pudney (1994), Idaho National Laboratory, Idaho. Lines represent ordinary least-squares linear fits to the data.

As shown in figure 8, with the exception of the lowest measured value, the Winfield model under predicts K_{sat} (*AE* value of -0.1110). The Pudney model (based on a combination of surficial and deep samples) over and under predicts about equally (fig. 8) with slightly more under predictions (AE value of -0.0009). Also shown in figure 8 are the predictions based on a linear fit to the K_{sat} and ρ_{bulk} data for the 10 core samples used in this study (labeled linear fit 1) and a linear fit to the data from this study combined with the 7 deep samples (labeled linear fit 2) from Pudney (1994). The small measurement error associated with the K_{sat} values (about 10 percent) has no influence on the relations examined here; error bars are imperceptible on figure 8. As listed in table 4, a linear fit to all available data from greater than 200 m gives the lowest RMSE value result, slightly lower than the Winfield and Pudney models. Predictions from the linear fit to the K_{sat} and ρ_{bulk} data for the 10 core samples from this study gives the highest RMSE value. The systematic under prediction by the Winfield model indicates that an adjustment could be made for samples with higher ρ_{bulk} or other systematic differences. Because the aquifer samples are affected by different processes by virtue of being deep as well as saturated, the addition of explanatory variables that include mechanical, chemical, and mineralogical parameters might yield better predictions.

Table 4. Root-mean-square errors and average errors for the Winfield model, the Pudney model, a linear fit to the core-sample data from this study, and a linear fit to the combined data from this study and the deep core samples from Pudney, Idaho National Laboratory, Idaho.

[**Abbreviations:** RMSE, root-mean-square error; *AE*, average error; K_{sat}, saturated hydraulic conductivity]

	Winfield model (2005)	Pudney model (1994)	Linear fit 1 (10 samples)	Linear fit 2 (17 samples)
RMSE (in terms of log K_{sat})	1.99	2.06	2.86	1.96
AE (in terms of K_{sat})	-0.1110	-0.0009	-0.0034	0.0001

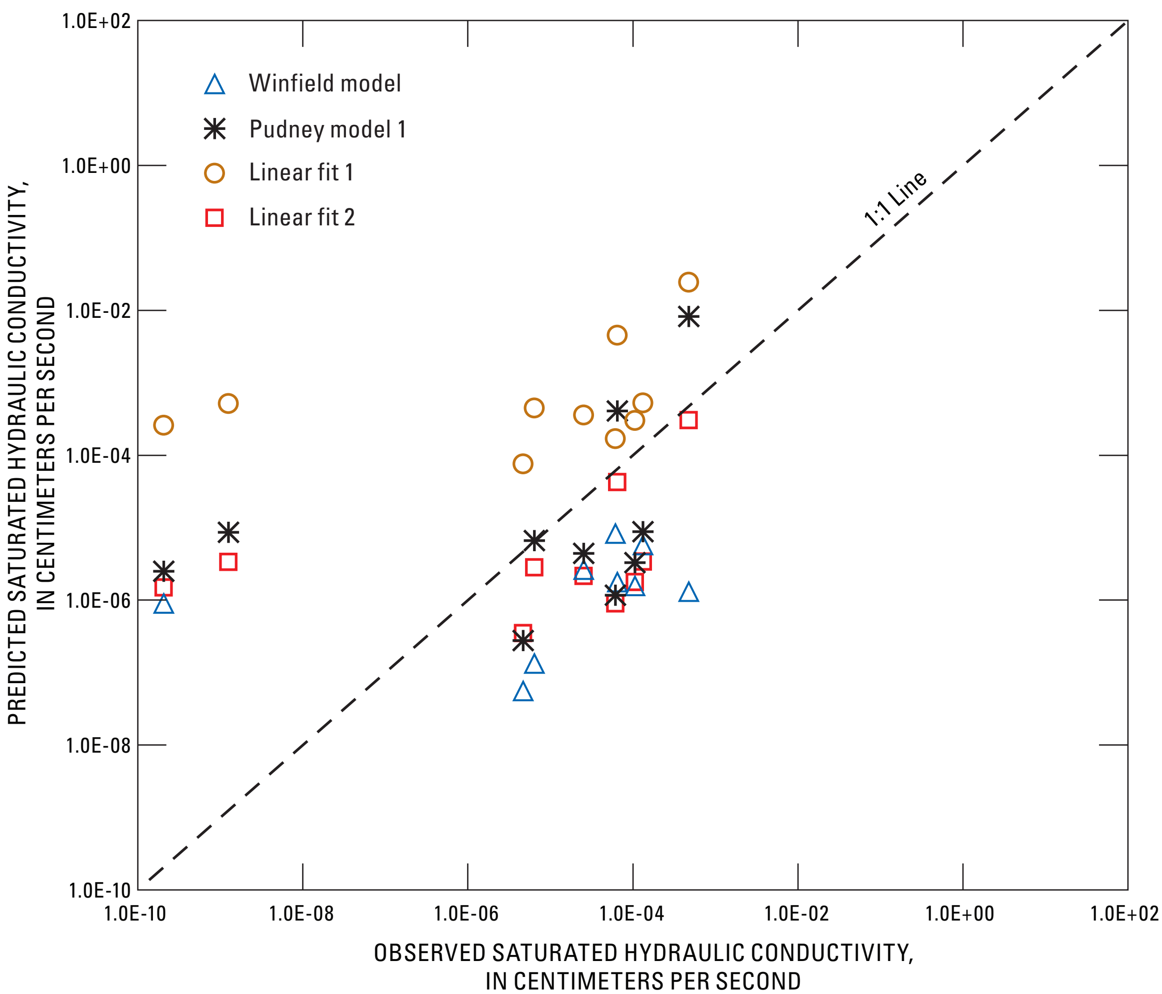

Figure 8. Relation between predicted and observed saturated hydraulic conductivity for the Winfield model, the Pudney model, a linear model fit to the data from this study (linear fit 1), and a linear model fit to the data from this study and the deep samples from Pudney (1994) (linear fit 2), Idaho National Laboratory, Idaho. The line represents a 1:1 relation.

Summary and Conclusions

Knowledge of K_{sat} and other parameters are required as input to the numerical models of saturated flow and transport which commonly are used as tools in risk assessment. K_{sat} and bulk properties were measured for 10 core samples from sedimentary interbeds within the ESRP aquifer and estimated using the Winfield site-specific property-transfer model and a simple linear relation between K_{sat} and ρ_{bulk}. The multiple linear-regression property-transfer model for estimating K_{sat} from more easily measured ρ_{bulk} and particle-size distributions originally was developed for sedimentary interbeds of the unsaturated zone at the INL. The Winfield regression model, which yielded estimates comparable to a simple linear relation between K_{sat} and ρ_{bulk}, systematically under predicted K_{sat} likely due to ρ_{bulk} values being higher for the aquifer samples than for the samples from the unsaturated zone upon which the model was developed. Because the aquifer samples are affected by different processes than those from the unsaturated zone, such as greater overburden pressure and constant saturated flow, the addition of explanatory variables that include mechanical, chemical, and mineralogical information with a multiple linear-regression approach might yield better predictions. The data presented here provide information useful in refining the hydraulic influence of sediments in the current subregional scale ground-water flow model either by scaling existing values for each of the three units in the model or by explicit incorporation of sedimentary units.

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