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FRONT COVER: **Background photograph.—**Confluence of Green and Colorado Rivers in Canyonlands National Park, Utah. **Inset photographs.—***Upper left*, Ben Nguyen, contract employee from Metropolitan State University, preparing samples for Sediment Laboratory Quality Assurance Study. *Lower left*, Control chart depicting results from interlaboratory comparison study. *Right*, Single-blind sediment reference samples, ready for distribution. Photography by John Gordon, U.S. Geological Survey.

Laboratory Performance in the Sediment Laboratory Quality-Assurance Project, 1996–98

By John D. Gordon, U.S. Geological Survey;
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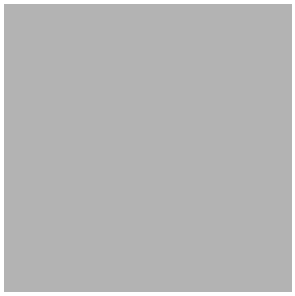

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CONVERSION FACTORS

Multiply	By	To obtain
centimeter (cm)	0.3937	inch
liter (L)	1.057	quart
milliliter (mL)	0.03381	ounce, fluid

Temperature can be converted from degree Celsius (°C) to degree Fahrenheit (°F) by using the following equation:

$$°F = 9/5\ (°C) + 32$$

The following terms and abbreviations also are used in this report:

grams (g)
micrometer (μm)
milligram (mg)
milligrams per liter (mg/L)
milliliter (mL)
maximum probability of rejecting the null hypothesis when it is true (α)

Laboratory Performance in the Sediment Laboratory Quality-Assurance Project 1996-98

By John D. Gordon, Carla A. Newland, *and* Shane T. Gagliardi

Abstract

This report describes the results of the first 3 years of an ongoing study of sediment laboratories used by the U.S. Geological Survey (USGS). The sediment laboratories currently in operation constitute the entire USGS national laboratory system for sediment analyses. As with all environmental data, physical sediment data can be expected to contain a certain amount of difference, whether the difference resulted from the collecting, transporting, or analyzing of the sample. Because it is important to know how each laboratory is performing, the USGS initiated the Sediment Laboratory Quality-Assurance (SLQA) project in August 1996. From August 1996 through June 1998, five studies were made, the results of which are the basis of this report.

The focus of the project is on quantitative analyses done on water-sediment mixtures to derive suspended-sediment concentrations, sediment-mass determinations, and sand/fine separations. For the purpose of this report, all mass determinations are net values—the tare weight of the container is excluded. The fine-size material is defined as particles sieved to a size of less than 62 micrometers (µm) and sand-size material is defined as particles sieved to a size of between 63 and 125 µm. Also, in this report, class 1 samples are defined as samples containing 50 to 100 milligrams (mg) of fine-size material, class 2 samples are defined as samples containing 101 to 300 mg of fine-size material, and class 3 samples are defined as samples containing 2,200 to 3,200 mg of fine-size material. In studies 96-1 through 98-1, the amount of sand added to each sample ranged from 9 to 28 percent of the mass of fine-size material in each sample class.

Analytical results from all sediment quality-control samples are compiled and statistically summarized by the USGS, Branch of Quality Systems, both on an intra- and interlaboratory basis. When evaluating these data, the reader needs to keep in mind that every measurement has an error component associated with it. It is premature to use the data from the first five SLQA studies to judge any of the laboratories as performing in an unacceptable manner. There were, however, some notable differences in the results for the 12 laboratories that participated in the five SLQA studies. For example, the overall median percent difference for suspended-sediment concentration on an individual laboratory basis ranged from –18.04 to –0.33 percent. Five of the 12 laboratories had an overall median percent difference for suspended-sediment concentration of –2.02 to –0.33 percent. There was less variability in the median difference for the measured fine-size material mass. The overall median percent difference for fine-size material mass ranged from –10.11 to –4.27 percent. Except for one laboratory, the median difference for fine-size material mass was within a fairly narrow range of –6.76 to –4.27 percent. The median percent difference for sand-size material mass differed among laboratories more than any other physical sediment property measured in the study. The overall median percent difference for the sand-size material mass ranged from –1.49 percent to 26.39 percent. Five of the nine laboratories that do sand/fine separa-

tions had overall median percent differences that ranged from –1.49 to 2.98 percent for sand-size material mass. Careful review of the data reveals that certain laboratories consistently produced data within statistical control limits for some or all of the physical sediment properties measured in this study, whereas other laboratories occasionally produced data that exceeded the control limits.

INTRODUCTION

The collection and analysis of fluvial sediment samples has been an integral part of hydrologic studies in the United States for over 100 years (Glysson, 1989). Sediment is one of many major pollutants in waterways of the United States and represents a concern to all aspects of the aquatic ecosystem. Understanding the importance of sediment processes in a wide range of hydrologic investigations has increased markedly in the past two decades. For example, sediment processes are critical factors in the fate and transport of toxic substances (Choi and Chen, 1976) and even low-threshold concentrations of contaminated sediment can adversely affect an ecosystem (Fairchild, 1987). As the sediment load is transported in a river, sediment processes controlling bedload transport and resuspension acutely influence the distribution and transformation of toxic materials. Sediment data also are important in computing the probable specific mass of sediment deposited in a reservoir or channel and in calculating the reservoir storage capacity or dredging requirements to keep a waterway open for navigation (Guy, 1969). The need for accurate and precise sediment analyses has increased concurrently with a greatly increased demand for sediment sample analyses. The approved methods for fluvial sediment data collection (Edwards and Glysson, 1986) and sediment analysis methods (Guy, 1969) are described in the U.S. Geological Survey Techniques for Water-Resources Investigations report series. Detailed quality-assurance guidelines are also available (Knott and others, 1992; Matthes and others, 1991). However, prior to the start of the Sediment Laboratory Quality-Assurance (SLQA) project in 1996, scant information was available on the bias and precision of sediment data produced by or for the U.S. Geological Survey (USGS). What limited information was available was not published in a citable report and was derived from a few sporadic interlaboratory comparisons—there was no ongoing assessment of laboratory bias and precision. Such a program is vital if the USGS is to achieve its goal of developing a nationally consistent and comparable database of physical sediment properties of known quality.

About 63,000 suspended-sediment concentration analyses and 16,000 sand/fine separations were performed either by or for the USGS in 1994 (Schroder and others, 1996). In 1991, the USGS Office of Surface Water (OSW) issued Technical Memorandum OSW 91.11 (U.S. Geological Survey Office of Surface Water Technical Memorandum No. 91.11, 1991) that contained a list of quality-assurance requirements for sediment laboratories that analyze samples for the USGS. One of the requirements listed in this memorandum is “successful participation in a standard reference-sample project for sediment analysis.” At the time this memorandum was issued, a standard reference-sample project for the determination of physical sediment properties did not exist. Working with the USGS Sediment Action Committee and the USGS Water Quality Service Unit in Ocala, Florida, the Branch of Quality Systems (BQS) distributed test samples as part of a pilot standard reference study in 1992 and 1994. All USGS laboratories that analyze sediment samples and one contract laboratory participated. Results of the pilot studies indicated that a standard reference-sample project was feasible and practical.

Following the 1992 and 1994 pilot studies, the BQS continued to pursue the development and testing of a standard reference-sample project for measurement of physical sediment properties. In 1996, these efforts led to an external quality-assurance project for the sediment determinations done by and for the USGS. The OSW Technical Memorandum 96.11 officially announced the formation of a quality-assurance project for sediment analyses, and the SLQA project began operation in August 1996 (U. S. Geological Survey Office of Surface Water Technical Memorandum No. 96.11, 1996).

The primary objectives of this project are to identify and eliminate systematic bias and to quantify the precision of sediment analyses. It is important to evaluate sediment analysis on an ongoing basis to monitor intra- and interlaboratory precision and to detect laboratory-specific bias in a timely manner. The quality of sediment analyses does not remain static over time given inevitable method changes and turnover in lab-oratory personnel. Sediment-analysis results from

an entire region can be biased if the laboratory servicing that region produces biased data. Laboratory bias can also be a major concern when national data assessments are completed because the comparability of results for different regions can be diminished.

This report describes the results of the first 3 years of an ongoing study of sediment laboratories used by the USGS. The USGS relies on these laboratories for all of their physical sediment data; therefore, it is important to know how each laboratory is performing. As with all environmental data, physical sediment data can be expected to contain a certain amount of error, whether the error resulted from the collecting, transporting, or analyzing of the sample. Suspended-sediment concentration data, the total sediment mass in each sample, and the results of sand/fine separations were all analyzed. For the purpose of this report, all mass determinations were net values—the tare weight of the container was excluded.

From August 1996 through June 1998, five studies were completed, the results of which are the basis of this report. The results of the individual laboratories, as well as overall summary statistics for the laboratories as a group are presented. This information will aid the reader in evaluating the overall bias and precision of physical sediment data produced by or for the USGS between 1996 and 1998 as well as gaining information on individual laboratory results during this time period.

EXPERIMENTAL DESIGN OF THE SEDIMENT LABORATORY QUALITY-ASSURANCE PROJECT

Sample Preparation

Samples were prepared gravimetrically by using two materials: AC spark-plug dust and South Dakota sand. The AC spark-plug dust is manufactured by General Motors Spark Plug Division and is a fine-grade material representative of the fine-particle fraction of sediment samples (Johnston and Swanson, 1981). The sand used in this project was obtained by sieving sediment to a size between 63 and 125 micrometers (μm) and drying at 105°C for a minimum of 24 hours. The AC spark-plug dust that was used as the fine-size material was sieved to a size less than 62 μm and also was dried at 105°C for a minimum of 24 hours.

Three amounts were chosen for each set of test samples sent to participating laboratories in a given study. These samples are identified as class 1, 2, or 3 samples. Class 1 samples are defined as samples containing 50 to 100 milligrams (mg) of fine-size material; class 2 samples are defined as samples containing 101 to 300 mg of fine-size material; and class 3 samples are defined as samples containing 2,200 to 3,200 mg of fine-size material. The target mass of fine-size material is referred to as the “base mass” of each sample. In studies 96-1 through 98-1, sand was added in amounts ranging from 9 to 28 percent of the base mass of fine-size material in each sample class (table 1).

In the first study (96-1), the three amounts of fine-size material were 50 mg, 200 mg, and 2,200 to 2,700 mg. In the second study (96-2), the library of 50-mg samples was depleted, and the decision was made to use 100-mg samples of fine size material for sample class 1. For class 2 samples in the second study (96-2), 300 mg of fine-size material was used, and for class 3 samples, 2,200 to 2,700 mg of fine-size material was used. In studies 97-1, 97-2, and 98-1, the three amounts of fine-size material were 58 mg, 116 mg, and 2,300 to 2,700 mg. Studies 96-1 and 96-2 were completed in August and September 1996, respectively. Studies 97-1 and 97-2 were completed in July and September 1997, respectively, and study 98-1 was completed in June 1998 (table 1).

Each test sample was custom made at the BQS. The sample volume varied slightly in mass, and the mass was known with an accuracy to within 0.10 mg. The sand-size material was tested for resistance to dissolution. Three samples of sand-size material were sieved, dried, and weighed. A total of 50 milliliters (mL) of deionized water was then added to the samples. After 48 hours, the samples were dried at 105°C until all of the water evaporated. The recovery of the sand-size material ranged from 99.6 to 100.3 percent, indicating that the sand-size material did not dissolve. The recovery of sand-size material that measured greater than 100 percent was attributed to a slight error in measurement.

Nine samples, three from each sample class, were sent to the laboratories in each SLQA study. Regardless of whether the participating laboratories were internal USGS laboratories or external contract laboratories, all the laboratories shown in the figures 1 through 57 (at the back of the report) analyzed sediment samples for the USGS. The laboratories were asked to determine the sediment mass and the sus-

Table 1. Sample fine-size material mass and percent sand-size material in each Sediment Laboratory Quality-Assurance study

Study number	Sample class	Range of fine-sized material mass in each sample class (milligrams)	Target mass of fine-size material (milligrams)	Percentage of sand-size material added to the mass of fine-size material
96-1	1	50 to 100	50.0	10, 15, 20
	2	101 to 300	200.0	10, 15, 20
	3	2,200 to 3,200	2,200.0	15, 20
			2,700.0	10, 15
96-2	1	50 to 100	100.0	10, 15, 20
	2	101 to 300	300.0	10, 15, 20
	3	2,200 to 3,200	2,200.0	10
			2,700.0	15, 20
97-1	1	50 to 100	58.0	11, 18, 28
	2	101 to 300	116.0	9, 15, 23
	3	2,200 to 3,200	2,300.0	17, 24
			2,700.0	12
97-2	1	50 to 100	58.0	11, 18, 28
	2	101 to 300	116.0	9, 15, 23
	3	2,200 to 3,200	2,300.0	17, 24
			2,700.0	12
98-1	1	50 to 100	58.0	12, 18, 28
	2	101 to 300	116.0	9, 15, 23
	3	2,200 to 3,200	2,300.0	17, 24
			2,700.0	12, 20

pended-sediment concentration in milligrams per liter and to perform the sand/fine separations. Throughout this report the term “sediment mass” refers to the net sediment weight of the sample as defined by Guy, 1969. The sand/fine separation results reported by the laboratories were used to calculate the reported sand-size and fine-size material mass in each sample.

As of August 31, 1998, five SLQA studies had been completed. In study number 96-1, the samples were sent to the laboratories as dry mixtures of sand-size and fine-size material, which the laboratories reconstituted to resemble a normal suspended-sediment sample by adding water. Although the laboratories were asked to keep accurate records of the volume of water added to the samples, only 6 of 11 laboratories complied with this request. Consequently, suspended-sediment concentration data for study number 96-1 are not included in this report. For study number 96-2, and all subsequent studies, the samples were shipped as sand/fine mixtures in deionized water using the same type of sand-size and fine-size material used in study number 96-1. The preparation of water-based samples eliminated some of the handling steps required by the laboratories for the first set of samples and created the opportunity to evaluate the effects of some commonly used shipping procedures on sediment determinations. The samples were prepared in glass quart-size and pint-size bottles with snap-on and threaded lids, respectively.

Beginning with study number 96-2, the suspended-sediment samples were shipped to the laboratories in specially designed plastic crates obtained from the Federal Interagency Sedimentation project. The bottles and crates used in the study and the manner in which samples were packaged were designed to replicate sediment-sample shipping procedures commonly used throughout the USGS.

Interlaboratory Comparisons

The interlaboratory comparison SLQA project was implemented in 1996 to determine if differences existed among the results of participating laboratories and to estimate any changes in overall laboratory precision. For each SLQA study, complete instructions were distributed to the laboratories. The instructions specified that the laboratories furnish the BQS with detailed suspended-sediment concentration and sand/fine separation-analysis data, including all of the requested ancillary data.

During 1996-98, the main focus of the study was to evaluate sand/fine separations and suspended-sediment concentration data. Reports that describe the performance of each laboratory were distributed at the completion of each study. Each laboratory was asked to carefully review their reported results and immediately report any discrepancies. The SLQA project staff verified all of the data used in this report.

Intralaboratory Assessments

In addition to interlaboratory comparisons, the results from each laboratory were assessed individually to determine intralaboratory precision and bias. Each participating laboratory was furnished updated estimates of their internal precision and bias, based on analysis of the full suite of reference samples that were shipped to the laboratory after each study by SLQA project personnel.

Laboratory Participation

All of the USGS laboratories that analyze physical sediment data, as well as all contract laboratories that analyze physical sediment data for the USGS, participated in the SLQA study. Tables 2 through 6 show the studies each of the laboratories participated in, and the type of data they analyzed.

Table 2. Summary of laboratory participation in the Sediment Laboratory Quality-Assurance project, study number 96-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sand/fine determinations			Sediment-mass determinations			Suspended-sediment concentration[1]		
	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3
California	x	x	x	x	x	x			
Hawaii[2,3]				x	x	x			
Iowa	x	x	x	x	x	x			
Kentucky	x	x	x	x	x	x			
Louisiana	x	x	x	x	x	x			
Missouri	x	x	x	x	x	x			
Montana	x	x	x	x	x	x			
New Mexico	x	x	x	x	x	x			
Ohio[2,4]				x	x	x			
Puerto Rico	x	x	x	x	x	x			
Washington	x	x	x	x	x	x			

[1]Suspended-sediment concentration data were not analyzed for this study.
[2]Some laboratories did not determine sand/fine separations for their customers and, thus, did not complete these analyses for the interlaboratory comparison study.
[3]Not all samples were analyzed for all constituents.
[4]Contract laboratory.

Table 3. Summary of laboratory participation in the Sediment Laboratory Quality-Assurance project, study number 96-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sand/fine determinations			Sediment-mass determinations			Suspended-sediment concentration		
	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3
California	x	x	x	x	x	x	x	x	x
Hawaii[1,2]				x	x		x	x	x
Iowa[2]				x	x	x	x	x	x
Kentucky[2]	x	x	x	x	x	x	x	x	x
Louisiana	x	x	x	x	x	x	x	x	x
Missouri[2]	x	x	x	x	x	x	x	x	x
Montana[2]	x	x	x	x	x	x	x	x	x
New Mexico	x	x	x	x	x	x	x	x	x
Ohio[1,3]				x	x	x	x	x	x
Puerto Rico	x	x	x	x	x	x	x	x	x
Washington[1]				x	x	x	x	x	x

[1]Some laboratories did not determine sand/fine separations for their customers and, thus, did not complete these analyses for the interlaboratory comparison study.
[2]Not all samples were analyzed for all constituents.
[3]Contract laboratory.

Table 4. Summary of laboratory participation in the Sediment Laboratory Quality-Assurance project, study number 97-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sand/fine determinations			Sediment-mass determinations			Suspended-sediment concentration		
	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3
California	x	x	x	x	x	x	x	x	x
Hawaii[1]				x	x	x	x	x	x
Iowa	x	x	x	x	x	x	x	x	x
Kentucky	x	x	x	x	x	x	x	x	x
Louisiana	x	x	x	x	x	x	x	x	x
Missouri[2]	x	x	x	x	x	x	x	x	x
Montana[2]	x	x	x	x	x	x	x	x	x
New Mexico	x	x	x	x	x	x	x	x	x
New York[1,2,3]							x	x	x
Ohio[1,3]				x	x	x	x	x	x
Puerto Rico	x	x	x	x	x	x	x	x	x
Washington	x	x	x	x	x	x	x	x	x

[1]Some laboratories did not determine sand/fine separations for their customers and, thus, did not complete these analyses for the interlaboratory comparison study.
[2]Not all samples were analyzed for all constituents.
[3]Contract laboratory.

Table 5. Summary of laboratory participation in the Sediment Laboratory Quality-Assurance project, study number 97-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sand/fine determinations			Sediment-mass determinations			Suspended-sediment concentration		
	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3
California	x	x	x	x	x	x	x	x	x
Hawaii[1]				x	x	x	x	x	x
Iowa	x	x	x	x	x	x	x	x	x
Kentucky	x	x	x	x	x	x	x	x	x
Louisiana	x	x	x	x	x	x	x	x	x
Missouri	x	x	x	x	x	x	x	x	x
Montana	x	x	x	x	x	x	x	x	x
New Mexico[2]	x	x	x	x	x	x	x	x	x
New York[1,3]							x	x	x
Ohio[1,3]				x	x	x	x	x	x
Puerto Rico[2]	x	x	x	x	x	x	x	x	x
Washington	x	x	x	x	x	x	x	x	x

[1]Some laboratories did not determine sand/fine separations for their customers and, thus, did not complete these analyses for the interlaboratory comparison study.
[2]Not all samples were analyzed for all constituents.
[3]Contract laboratory.

Table 6. Summary of laboratory participation in the Sediment Laboratory Quality-Assurance project, study number 98-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sand/fine determinations			Sediment-mass determinations			Suspended-sediment concentration		
	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3	Sample class 1	Sample class 2	Sample class 3
California	x	x	x	x	x	x	x	x	x
Hawaii[1]				x	x	x	x	x	x
Iowa	x	x	x	x	x	x	x	x	x
Kentucky	x	x	x	x	x	x	x	x	x
Louisiana	x	x	x	x	x	x	x	x	x
Missouri	x	x	x	x	x	x	x	x	x
Montana	x	x	x	x	x	x	x	x	x
New Mexico	x	x	x	x	x	x	x	x	x
New York[1,3]							x	x	x
Ohio[1,3]				x	x	x	x	x	x
Puerto Rico[1]				x	x	x	x	x	x
Washington	x	x	x	x	x	x	x	x	x

[1]Some laboratories did not determine sand/fine separations for their customers and, thus, did not complete these analyses for the interlaboratory comparison study.
[2]Not all samples were analyzed for all constituents.
[3]Contract laboratory.

ANALYSIS AND INTERPRETATION OF PROJECT DATA

The percent differences for the reported sediment mass, sand-size material mass, and fine-size material mass are calculated as:

$$PD = \frac{RM - KM}{KM} \times 100,$$

where:

PD is the percent difference;
RM is the reported mass, in milligrams; and
KM is the known mass determined gravimetrically by BQS, in milligrams.

All mass determinations are net values—the tare weight of the container is excluded.

The percent difference for suspended-sediment concentration is calculated by using a similar formula:

$$PD = \frac{RC - KC}{KC} \times 100,$$

where:

PD is the percent difference;
RC is the reported concentration, in milligrams per liter;
KC is the theoretical concentration, based on the known (actual) sediment mass determined gravimetrically by BQS, in milligrams, and the known volume of water used to prepare the sample, measured in liters.

The known sediment mass included the fine-size and sand-size material mass in each sample.

The overall median percent differences for each of the five separate studies completed by June 1998 are contained in tables 7 through 10. Sequential year and study numbers identify the individual studies.

The median suspended-sediment concentration percent differences were somewhat larger in the most recent studies than in the earlier studies. For example, in study number 96-2 (suspended-sediment concentration percent differences were not calculated for study number 96-1), the median suspended-sediment concentration percent difference for class 1 samples was –2.45, the median percent difference for class 2 samples was –1.57, and the median suspended-sediment concentration percent difference for class 3 samples was –0.60. In study number 98-1, the median percent difference for class 1 samples was –4.86, the median percent difference for class 2 samples was –5.48, and the median percent difference for class 3 samples was –1.27 (table 7).

The magnitude of the median percent difference for sediment mass changed slightly over the course of the five studies: In study number 96-1, the median percent difference for sediment mass was –4.92 for class 1 samples, –4.29 percent for class 2 samples, and –1.92 percent for class 3 samples. In study number 98-1, the median percent difference for sediment mass was –5.15 percent for class 1 samples, –4.82 percent for class 2 samples, and –1.70 percent for class 3 samples (table 8).

For the small and midsize samples (classes 1 and 2), the median percent differences for sand/fine separations were larger than the differences associated with sediment mass determinations. The results in tables 9 through 10 indicate that the median percent differences for sand/fine separations were consistently positive for sand-size material and remained negative for fine-size material. The median percent differences for the mass of sand-size material tended to improve substantially over time. For example, in study number 96-1, the median percent difference for class 1 samples was 23.21, the median percent difference for class 2 samples was 16.14, and the median percent difference for class 3 samples was 16.48. In study number 98-1 the median percent difference for class 1 samples was 7.08, the median percent difference was 3.48 for class 2 samples, and 0.38 percent for class 3 samples (table 9).

Median percent differences for the mass of fine-size material changed slightly over time. In study number 96-1, the median percent difference for the mass of fine-size material was –7.96 for class 1 samples, the median percent difference for class 2 samples was –6.88, and the median percent difference for class 3 samples was –4.46. In study number 98-1, the median percent difference for the mass of fine-size material was –7.81 percent for class 1 samples, –7.21 percent for class 2 samples, and –2.11 percent for class 3 samples (table 10).

Table 7. Median percent difference for suspended-sediment concentration

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class; N/A, not applicable]

Study number	Number of laboratories	Sample class	Sample base mass (milligrams)	Median percent difference
96-1	11	1	N/A	N/A
96-2	11	1	100.0	-2.45
97-1	12	1	58.0	-3.60
97-2	12	1	58.0	-2.91
98-1	12	1	58.0	-4.86
96-1	12	2	N/A	N/A
96-2	12	2	300.0	-1.57
97-1	12	2	116.0	-3.38
97-2	12	2	116.0	-3.77
98-1	12	2	116.0	-5.48
96-1	12	3	N/A	N/A
96-2	12	3	2,200.0 2,700.0	-0.60
97-1	12	3	2,300.0 2,700.0	-0.36
97-2	12	3	2,300.0 2,700.0	-0.72
98-1	12	3	2,300.0 2,700.0	-1.27

Table 8. Median percent difference for sediment mass

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Study number	Number of laboratories	Sample class	Sample base mass (milligrams)	Median percent difference
96-1	11	1	50.0	-4.92
96-2	11	1	100.0	-5.05
97-1	12	1	58.0	-3.82
97-2	12	1	58.0	-4.54
98-1	12	1	58.0	-5.15
96-1	12	2	200.0	-4.29
96-2	12	2	300.0	-4.85
97-1	12	2	116.0	-4.92
97-2	12	2	116.0	-4.77
98-1	12	2	116.0	-4.82
96-1	12	3	2,200.0 2,700.0	-1.92
96-2	12	3	2,200.0 2,700.0	-1.87
97-1	12	3	2,300.0 2,700.0	-1.36
97-2	12	3	2,300.0 2,700.0	-1.38
98-1	12	3	2,300.0 2,700.0	-1.70

Table 9. Median percent difference for sand-size material mass

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Study number	Number of laboratories	Sample class	Sample base mass (milligrams)	Median percent difference
96-1	11	1	50.0	23.21
96-2	11	1	100.0	16.70
97-1	12	1	58.0	8.28
97-2	12	1	58.0	1.82
98-1	12	1	58.0	7.08
96-1	12	2	200.0	16.14
96-2	12	2	300.0	14.69
97-1	12	2	116.0	4.54
97-2	12	2	116.0	1.46
98-1	12	2	116.0	3.48
96-1	12	3	2,200.0 2,700.0	16.48
96-2	12	3	2,200.0 2,700.0	17.70
97-1	12	3	2,300.0 2,700.0	2.25
97-2	12	3	2,300.0 2,700.0	0.72
98-1	12	3	2,300.0 2,700.0	0.38

Complete statistical summaries for each of the five SLQA studies completed between 1996 through 1998 are listed in tables 11 through 15. These tables provide information about the central tendency and variability of the data for each study. For example, the overall summary statistics for the first interlaboratory comparison study, study number 96-1, are given in table 11. The overall summary statistics for the most recent interlaboratory comparison study, study number 98-1, are given in table 15.

While the mean and the median are useful for defining the central tendency of the data, the standard error, 25^{th} percentile, 75^{th} percentile, F-pseudosigma, standard deviation, range, and the minimum and maximum are indicators of the amount of variability in the data. To calculate the F-pseudosigma, the lower quartile was subtracted from the upper quartile, and then divided by 1.349. The upper quartile is approximately equal to the 75^{th} percentile in the data distribution, while the lower quartile is approximately equal to the 25^{th} percentile in the data distribution. The smaller the F-pseudosigma, the more precise the determination was considered to be.

$$\text{F-pseudosigma} = \frac{\text{upper quartile - lower quartile}}{1.349}$$

Table 10. Median percent difference for fine-size material mass

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Study number	Number of laboratories	Sample class	Sample base mass (milligrams)	Median percent difference
96-1	11	1	50.0	-7.96
96-2	11	1	100.0	-9.09
97-1	12	1	58.0	-5.93
97-2	12	1	58.0	-6.60
98-1	12	1	58.0	-7.81
96-1	12	2	200.0	-6.88
96-2	12	2	300.0	-9.24
97-1	12	2	116.0	-6.33
97-2	12	2	116.0	-6.73
98-1	12	2	116.0	-7.21
96-1	12	3	2,200.0 2,700.0	-4.46
96-2	12	3	2,200.0 2,700.0	-5.66
97-1	12	3	2,300.0 2,700.0	-1.67
97-2	12	3	2,300.0 2,700.0	-2.00
98-1	12	3	2,300.0 2,700.0	-2.11

Tables 11-15 show that there was more variability for sand-size material mass percent difference than for any of the other measurements. For example, for study number 96-1, the F-pseudosigma calculated from sand-size material mass percent differences using class 1 samples was 17.29; for class 2 samples the F-pseudosigma was 10.45, and for class 3 samples the F-pseudosigma was 11.46. For study number 98-1, the F-pseudosigma calculated from sand-size material mass percent difference using class 1 sample was 8.81; for class 2 samples the F-pseudosigma was 7.47, and for class 3 samples the F-pseudosigma was 2.31.

The results for each laboratory participating in the SLQA project between August 1996 and June 1998 are provided in tables 16 through 27. These tables give details on a sample-by-sample basis, including the percent difference for each study for the reported suspended-sediment concentration, sediment mass, fine-size material mass, and sand-size material mass. These tables are a descriptive means to provide a comparison between different laboratories that produce physical sediment data for the USGS.

The summary statistics at the bottom of tables 16-27 are an indication of overall laboratory performance over the course of the study. Laboratories with median percent difference values closer to zero may be producing data with less bias. The 25^{th} percentile, 75^{th} percentile, F-pseudosigma, and the interquartile range values are useful for assessing the magnitude of variability in each laboratory's results.

Table 11. Statistical results summary for the Sediment Laboratory Quality-Assurance project, study number 96-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class; N/A, not applicable]

Statistic	Sample class 1				Sample class 2				Sample class 3			
	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference
Mean	-4.13	-7.92	27.94	N/A	-4.25	-7.07	19.09	N/A	-3.56	-4.24	17.10	N/A
Standard error	1.30	1.23	9.22	N/A	0.52	0.69	2.32	N/A	1.39	0.77	4.54	N/A
Median	-4.92	-7.96	23.21	N/A	-4.29	-6.88	16.14	N/A	-1.92	-4.46	16.48	N/A
25th percentile	-6.59	-10.05	11.88	N/A	-5.76	-9.11	11.71	N/A	-3.31	-6.04	10.47	N/A
75th percentile	-0.88	-6.58	35.21	N/A	-1.86	-4.47	25.81	N/A	-0.58	-2.43	25.93	N/A
F-pseudosigma	4.24	2.57	17.29	N/A	2.89	3.44	10.45	N/A	2.03	2.67	11.46	N/A
Standard deviation	7.11	6.39	47.92	N/A	2.92	3.60	12.03	N/A	7.85	4.01	23.60	N/A
Sample variance	50.62	40.80	2296.13	N/A	8.55	12.95	144.75	N/A	61.70	16.09	557.18	N/A
Kurtosis	4.02	7.29	16.93	N/A	0.60	0.31	2.17	N/A	27.18	3.11	2.49	N/A
Skewness	1.06	1.13	3.62	N/A	-0.72	-0.55	0.89	N/A	-5.05	0.85	-0.61	N/A
Range	37.69	39.85	284.67	N/A	11.64	15.25	61.16	N/A	45.41	19.98	120.57	N/A
Minimum	-17.89	-24.90	-40.69	N/A	-11.77	-15.97	-5.68	N/A	-45.05	-11.61	-50.32	N/A
Maximum	19.80	14.95	243.98	N/A	-0.13	-0.72	55.48	N/A	0.36	8.37	70.25	N/A
Count	30.00	27.00	27.00	N/A	32.00	27.00	27.00	N/A	32.00	27.00	27.00	N/A
Confidence level (95.0 percent)[1]	2.66	2.53	18.96	N/A	1.05	1.42	4.76	N/A	2.83	1.59	9.34	N/A

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is $\pm$1.96. The confidence interval is the sample mean $\pm$1.96 times the standard deviation divided by the square root of the number of data points.

Table 12. Statistical results summary for the Sediment Laboratory Quality-Assurance project, study number 96-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Statistic	Sample class 1				Sample class 2				Sample class 3			
	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference
Mean	-6.18	-9.08	18.76	0.41	-3.58	-9.47	13.54	3.36	-2.66	-6.22	20.43	1.12
Standard error	0.75	0.77	4.78	2.27	2.09	0.98	3.94	2.97	0.66	0.65	9.07	1.62
Median	-5.05	-9.09	16.70	-2.45	-4.85	-9.24	14.69	-1.57	-1.87	-5.66	17.70	-0.60
25th percentile	-8.15	-10.49	5.23	-3.95	-6.41	-10.84	0.74	-3.97	-2.61	-6.56	7.33	-1.68
75th percentile	-3.24	-7.51	24.46	0.30	-2.99	-6.33	20.71	0.12	-1.46	-4.38	34.52	0.83
F-pseudosigma	3.64	2.21	14.25	3.16	2.54	3.34	14.80	3.03	0.85	1.61	20.16	1.86
Standard deviation	4.11	3.10	19.12	12.43	11.66	4.02	16.24	16.54	3.49	2.69	37.42	9.01
Sample variance	16.93	9.59	365.52	154.45	135.93	16.18	263.68	273.73	12.20	7.23	1399.89	81.17
Kurtosis	1.60	-0.32	0.23	9.68	24.71	1.18	0.71	6.39	5.77	1.73	4.37	5.76
Skewness	-1.24	-0.20	0.60	3.11	4.65	-1.11	0.81	2.70	-1.27	-1.38	-0.28	2.18
Range	18.72	10.27	72.87	56.55	73.95	14.12	60.28	66.89	20.67	10.53	190.98	43.17
Minimum	-18.49	-14.30	-13.55	-12.25	-17.89	-18.99	-6.67	-8.08	-14.29	-13.10	-80.29	-13.14
Maximum	0.23	-4.03	59.32	44.30	56.06	-4.87	53.61	58.81	6.38	-2.57	110.69	30.03
Count	30.00	16.00	16.00	30.00	31.00	17.00	17.00	31.00	28.00	17.00	17.00	31.00
Confidence level (95.0 percent)[1]	1.54	1.65	10.19	4.64	4.28	2.07	8.35	6.07	1.35	1.38	19.24	3.30

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is $\pm$1.96. The confidence interval is the sample mean $\pm$1.96 times the standard deviation divided by the square root of the number of data points.

Table 13. Statistical results summary for the Sediment Laboratory Quality-Assurance project, study number 97-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Statistic	Sample class 1				Sample class 2				Sample class 3			
	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference
Mean	-4.64	-7.15	10.86	-5.35	-7.09	-7.43	-2.15	-5.76	-2.12	-2.44	0.73	-1.38
Standard error	0.61	0.78	2.27	1.31	1.49	0.64	4.80	1.82	0.71	0.80	2.51	1.05
Median	-3.82	-5.93	8.28	-3.60	-4.92	-6.33	4.54	-3.38	-1.36	-1.67	2.25	-0.36
25th percentile	-5.68	-8.59	2.55	-5.34	-7.63	-9.11	-6.05	-6.62	-3.10	-3.21	0.87	-3.14
75th percentile	-2.22	-4.73	16.52	-1.31	-3.80	-5.10	7.26	-1.88	-0.79	-1.10	2.81	0.37
F-pseudosigma	2.56	2.86	10.36	2.98	2.84	2.98	9.87	3.51	1.71	1.57	1.44	2.61
Standard deviation	3.50	3.89	11.37	7.85	8.54	3.22	24.01	10.92	3.89	3.98	12.57	6.19
Sample variance	12.23	15.11	129.18	61.56	73.02	10.38	576.40	119.20	15.14	15.88	158.00	38.36
Kurtosis	3.02	2.07	0.03	4.06	23.96	-0.23	10.28	7.97	4.80	8.61	5.94	4.16
Skewness	-1.51	-1.50	0.92	-1.93	-4.62	-0.87	-2.87	-2.18	-0.91	-1.48	-0.07	-0.50
Range	16.13	16.66	37.79	38.82	50.47	10.69	123.24	66.77	22.57	24.85	71.18	35.96
Minimum	-16.40	-18.45	-3.15	-31.57	-51.38	-14.27	-97.09	-50.30	-15.44	-17.01	-31.30	-19.74
Maximum	-0.27	-1.79	34.64	7.25	-0.91	-3.58	26.15	16.47	7.13	7.85	39.89	16.22
Count	33.00	25.00	25.00	36.00	33.00	25.00	25.00	36.00	30.00	25.00	25.00	35.00
Confidence level (95.0 percent)[1]	1.24	1.60	4.69	2.65	3.03	1.33	9.91	3.69	1.45	1.64	5.19	2.13

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is $\pm$1.96. The confidence interval is the sample mean $\pm$1.96 times the standard deviation divided by the square root of the number of data points.

Table 14. Statistical results summary for the Sediment Laboratory Quality-Assurance project, study number 97-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Statistic	Sample class 1				Sample class 2				Sample class 3			
	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference
Mean	-6.43	-6.43	12.62	-2.58	-5.49	-7.69	13.89	-4.47	-1.61	-2.33	2.59	0.00
Standard error	2.55	1.04	6.98	1.10	0.47	0.70	6.32	0.50	0.32	0.36	1.33	0.72
Median	-4.54	-6.60	1.82	-2.91	-4.77	-6.73	1.46	-3.77	-1.38	-2.00	0.72	-0.72
25th percentile	-6.80	-8.93	-0.67	-5.28	-7.53	-9.55	-0.02	-6.43	-2.19	-2.26	-0.32	-1.40
75th percentile	-2.98	-4.57	6.67	-1.89	-3.75	-4.74	7.03	-2.39	-1.08	-1.55	2.43	-0.16
F-pseudosigma	2.84	3.23	5.44	2.52	2.81	3.56	5.22	3.00	0.83	0.53	2.04	0.92
Standard deviation	14.67	5.22	34.90	6.62	2.72	3.52	31.60	3.00	1.79	1.82	6.67	4.25
Sample variance	215.23	27.28	1218.20	43.88	7.40	12.41	998.28	9.02	3.22	3.29	44.55	18.03
Kurtosis	27.23	8.73	6.45	2.68	-0.39	3.12	4.97	0.29	10.02	16.11	5.69	18.40
Skewness	-4.94	2.27	2.49	0.82	-0.52	-1.29	2.33	-0.77	1.64	-3.82	2.25	3.85
Range	95.22	27.48	162.32	35.81	9.91	16.81	134.82	12.77	11.83	9.53	29.72	26.42
Minimum	-84.63	-13.88	-27.00	-18.69	-11.32	-18.98	-18.54	-12.49	-6.02	-10.31	-4.87	-5.36
Maximum	10.59	13.60	135.31	17.12	-1.41	-2.17	116.28	0.28	5.81	-0.78	24.85	21.06
Count	33.00	25.00	25.00	36.00	33.00	25.00	25.00	36.00	32.00	25.00	25.00	35.00
Confidence level (95.0 percent)[1]	5.20	2.16	14.41	2.24	0.96	1.45	13.04	1.02	0.65	0.75	2.76	1.46

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is $\pm$1.96. The confidence interval is the sample mean $\pm$1.96 times the standard deviation divided by the square root of the number of data points.

Table 15. Statistical results summary for the Sediment Laboratory Quality-Assurance project, study number 98-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Statistic	Sample class 1				Sample class 2				Sample class 3			
	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference	Sediment mass percent difference	Fine-size material mass percent difference	Sand-size material mass percent difference	Suspended-sediment concentration percent difference
Mean	-5.67	-9.67	18.35	-7.34	-5.20	-7.99	15.96	-6.39	-1.30	-2.76	-1.81	-1.84
Standard error	0.52	1.55	6.03	1.20	0.50	1.17	7.14	0.93	1.87	1.10	4.84	1.72
Median	-5.15	-7.81	7.08	-4.86	-4.82	-7.21	3.48	-5.48	-1.70	-2.11	0.38	-1.27
25th percentile	-7.03	-9.79	2.29	-8.38	-6.80	-8.27	1.01	-7.75	-3.14	-4.68	-1.16	-6.80
75th percentile	-3.69	-5.49	14.18	-3.01	-3.16	-5.28	11.08	-2.34	-1.02	-1.26	1.96	-0.15
F-pseudosigma	2.47	3.19	8.81	3.98	2.70	2.22	7.47	4.01	1.57	2.54	2.31	4.92
Standard deviation	3.08	7.57	29.52	7.67	2.98	5.74	34.96	5.96	11.06	5.40	23.69	11.01
Sample variance	9.49	57.37	871.47	58.80	8.90	32.91	1221.90	35.47	122.25	29.12	561.42	121.20
Kurtosis	4.07	11.82	3.70	2.37	0.96	13.58	12.93	1.77	26.14	9.12	13.27	21.89
Skewness	-1.49	-3.20	2.04	-1.73	-0.33	-3.30	3.38	-1.38	4.70	2.22	-2.92	3.89
Range	16.08	36.28	116.16	32.33	15.30	30.53	169.46	27.20	75.93	28.03	139.89	77.54
Minimum	-16.98	-40.15	-5.71	-30.58	-13.23	-31.81	-9.86	-24.39	-17.84	-10.22	-98.90	-19.94
Maximum	-0.90	-3.87	110.45	1.75	2.07	-1.28	159.60	2.81	58.09	17.81	40.99	57.60
Count	35.00	24.00	24.00	41.00	35.00	24.00	24.00	41.00	35.00	24.00	24.00	41.00
Confidence level (95.0 percent)[1]	1.06	3.20	12.47	2.42	1.03	2.42	14.76	1.88	3.80	2.28	10.01	3.47

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is $\pm$1.96. The confidence interval is the sample mean $\pm$1.96 times the standard deviation divided by the square root of the number of data points.

Table 16. Summary results for Sediment Laboratory Quality-Assurance studies in the Salinas, California, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; **, problems with samples, therefore, numbers not used in statistics; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A180993	CA A180993	151.00	N/A	N/A	0.0500	0.0050	0.0530	0.0550	-3.55	0.0472	89.00	-5.66	0.0058	11.00	17.78	G
	B1802693	CA B1802693	157.00	N/A	N/A	0.0500	0.0078	0.0550	0.0578	-4.84	0.0473	86.00	-5.40	0.0077	14.00	-1.28	G
	C1884693	CA C1884693	159.00	N/A	N/A	0.0500	0.0097	0.0555	0.0597	-7.04	0.0461	83.00	-7.87	0.0094	17.00	-2.73	G
	A1748293	CA A1748293	620.00	N/A	N/A	0.1990	0.0202	0.2170	0.2192	-1.00	0.1931	89.00	-2.95	0.0239	11.00	18.17	G
	B17412393	CA B1741239	651.00	N/A	N/A	0.1970	0.0319	0.2279	0.2289	-0.44	0.1937	85.00	-1.67	0.0342	15.00	7.16	G
	C17416693	CA C17416693	675.00	N/A	N/A	0.2020	0.0419	0.2364	0.2439	-3.08	0.1915	81.00	-5.21	0.0449	19.00	7.20	G
	A1943393	CA A1943393	7460.00	N/A	N/A	2.1880	0.4377	2.6121	2.6257	-0.52	2.1419	82.00	-2.11	0.4702	18.00	7.42	G
	B1947893	CA B1947893	7150.00	N/A	N/A	2.1830	0.3272	2.5011	2.5102	-0.36	2.1509	86.00	-1.47	0.3502	14.00	7.02	G
	C195693	CA C195693	8440.00	N/A	N/A	2.6760	0.2674	2.9261	2.9434	-0.59	2.6042	89.00	-2.68	0.3219	11.00	20.37	G
96-2	A1902393	CA A1902393	460.00	465.00	-1.08	0.1010	0.0153	0.1128	0.1163	-2.97	0.0936	83.00	-7.30	0.0192	17.00	25.74	G
	B1903493	CA B1903493	442.00	444.40	-0.54	0.1010	0.0101	0.1070	0.1111	-3.69	0.0920	86.00	-8.89	0.0150	14.00	48.32	M
	C19011493	CA C19011493	290.00	285.35	1.63	0.0990	0.0151	0.1144	0.1141	0.23	0.0927	81.00	-6.40	0.0217	19.00	43.57	G
	A193293	CA A193293	1380.00	1380.32	-0.02	0.3000	0.0451	0.3387	0.3451	-1.85	0.2845	84.00	-5.16	0.0542	16.00	20.21	G
	B1933493	CA B1933493	1310.00	1306.80	0.24	0.2970	0.0297	0.3206	0.3267	-1.87	0.2821	88.00	-5.01	0.0385	12.00	29.54	M
	C1934993	CA C1934993	865.00	896.25	-3.49	0.2990	0.0595	0.3427	0.3585	-4.41	0.2844	83.00	-4.87	0.0583	17.00	-2.09	G
	A1947693	CA A1947693	10400.00	9640.16	7.88	2.1910	0.2190	2.5639	2.4100	6.38	2.1024	82.00	-4.04	0.4615	18.00	110.69	**
	B195993	CA B195993	10700.00	12319.12	-13.14	2.6780	0.4018	2.6398	3.0798	-14.29	2.5606	97.00	-4.38	0.0792	3.00	-80.29	**
	C1958093	CA C1958093	7960.00	8048.58	-1.10	2.6830	0.5364	3.1697	3.2194	-1.54	2.5675	81.00	-4.31	0.6022	19.00	12.27	G
97-1	CA_1_A0101	CA1A0101	247.00	252.00	-1.98	0.0575	0.0055	0.0616	0.0630	-2.22	0.0548	89.00	-4.65	0.0068	11.00	23.20	G
	CA_1_B0238	CA1B0238	266.00	270.40	-1.63	0.0577	0.0099	0.0660	0.0676	-2.37	0.0548	83.00	-5.06	0.0112	17.00	13.33	G
	CA_1_C0357	CA1C0357	181.00	188.00	-3.72	0.0590	0.0162	0.0720	0.0752	-4.26	0.0554	77.00	-6.03	0.0166	23.00	2.22	G
	CA_2_A0101	CA2A0101	496.00	506.00	-1.98	0.1164	0.0101	0.1214	0.1265	-4.03	0.1105	91.00	-5.09	0.0109	9.00	8.18	G
	CA_2_B0239	CA2B0239	512.00	525.60	-2.59	0.1148	0.0166	0.1269	0.1314	-3.42	0.1091	86.00	-4.94	0.0178	14.00	7.02	G
	CA_2_C0357	CA2C0357	343.00	356.25	-3.72	0.1159	0.0266	0.1363	0.1425	-4.35	0.1090	80.00	-5.92	0.0273	20.00	2.48	G
	CA_3_A0101	CA3A1010	10800.00	10763.20	0.34	2.3003	0.3905	2.6515	2.6908	-1.46	2.2538	85.00	-2.02	0.3977	15.00	1.85	G
	CA_3_B0239	CA3B0239	11400.00	11414.80	-0.13	2.3012	0.5525	2.8061	2.8537	-1.67	2.2449	80.00	-2.45	0.5612	20.00	1.58	M
	CA_3_C5757	CA3C5757	7420.00	7560.00	-1.85	2.7003	0.3237	2.9684	3.0240	-1.84	2.6419	89.00	-2.16	0.3265	11.00	0.87	G
97-2	CA_1_A115	CA_1_A115	246.00	252.40	-2.54	0.0565	0.0066	0.0610	0.0631	-3.33	0.0549	90.00	-2.83	0.0061	10.00	-7.58	G
	CA_1_B1233	CA_1_B1233	265.00	278.00	-4.68	0.0592	0.0103	0.0655	0.0695	-5.76	0.0550	84.00	-7.06	0.0105	16.00	1.75	G
	CA_1_C1361	CA_1_C1361	177.00	188.50	-6.10	0.0585	0.0169	0.0701	0.0754	-7.03	0.0533	76.00	-8.93	0.0168	24.00	-0.45	G
	CA_2_A115	CA_2_A115	465.00	499.20	-6.85	0.1163	0.0085	0.1154	0.1248	-7.53	0.1085	94.00	-6.73	0.0069	6.00	-18.54	G
	CA_2_B1233	CA_2_B1233	511.00	532.80	-4.09	0.1162	0.0170	0.1251	0.1332	-6.08	0.1088	87.00	-6.34	0.0163	13.00	-4.34	G
	CA_2_C1361	CA_2_C1361	343.00	356.50	-3.79	0.1147	0.0279	0.1357	0.1426	-4.84	0.1072	79.00	-6.54	0.0285	21.00	2.14	G
	CA_3_A115	CA_3_A115	10800.00	10766.00	0.32	2.3002	0.3910	2.6646	2.6915	-1.00	2.2649	85.00	-1.53	0.3997	15.00	2.14	G
	CA_3_B1233	CA_3_B1233	11500.00	11410.00	0.79	2.3001	0.5520	2.8282	2.8525	-0.85	2.2626	80.00	-1.63	0.5656	20.00	2.40	G
	CA_3_C1361	CA_3_C1361	6480.00	6565.50	-1.30	2.3014	0.3240	2.5807	2.6262	-1.73	2.2710	88.00	-1.32	0.3097	12.00	-4.65	G
98-1	CA_1_A4717	CA_1_A4717	176.00	182.86	-3.75	0.0569	0.0071	0.0612	0.0640	-4.38	0.0539	88.00	-5.35	0.0073	12.00	3.44	G
	CA_1_B4856	CA_1_B4856	162.00	167.75	-3.43	0.0580	0.0091	0.0645	0.0671	-3.87	0.0548	85.00	-5.47	0.0097	15.00	6.32	G
	CA_1_C4973	CA_1_C4973	220.00	238.67	-7.82	0.0566	0.0150	0.0654	0.0716	-8.66	0.0510	78.00	-9.87	0.0144	22.00	-4.08	G
	CA_2_A8228	CA_2_A8228	347.00	356.29	-2.61	0.1156	0.0091	0.1207	0.1247	-3.21	0.1110	92.00	-3.94	0.0097	8.00	6.11	G
	CA_2_B8145	CA_2_B8145	322.00	334.25	-3.66	0.1175	0.0162	0.1276	0.1337	-4.56	0.1110	87.00	-5.52	0.0166	13.00	2.40	G
	CA_2_C8084	CA_2_C8084	446.00	473.00	-5.71	0.1147	0.0272	0.1329	0.1419	-6.34	0.1050	79.00	-8.46	0.0279	21.00	2.61	G
	CA_3_A0617	CA_3_A0917	7600.00	7682.86	-1.08	2.2991	0.3899	2.6477	2.6890	-1.54	2.2505	85.00	-2.11	0.3972	15.00	1.86	G
	CA_3_B5756	CA_3_B	8060.00	8124.75	-0.80	2.6988	0.5511	3.2167	3.2499	-1.02	2.6699	83.00	-1.07	0.5468	17.00	-0.77	G
	CA_3_C5873	CA_3_C5873	10100.00	10078.33	0.21	2.7005	0.3230	2.9991	3.0235	-0.81	2.6692	89.00	-1.16	0.3299	11.00	2.14	G
Median					-1.98					-3.08			-5.06			2.48	
25th percentile					-3.73					-4.39			-6.19			1.23	
75th percentile					-0.60					-1.50			-2.31			10.22	
F-pseudosigma					2.32					2.14			2.88			6.67	
Interquartile range					3.13					2.89			3.88			9.00	

[1]Comments: Good (G) and marginal (M), refers to the condition of the sample upon arrival to the laboratory.

Table 17. Summary results for Sediment Laboratory Quality-Assurance studies in the Honolulu, Hawaii, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A1884293	---	---	N/A	N/A	0.0490	0.0050	---	0.0540	---	---	---	---	---	---	---	
	B1885593	---	---	N/A	N/A	0.0500	0.0080	---	0.0580	---	---	---	---	---	---	---	
	C1886393	---	---	N/A	N/A	0.0500	0.0106	---	0.0606	---	---	---	---	---	---	---	
	A1746293	---	---	N/A	N/A	0.2020	0.0209	---	0.2229	---	---	---	---	---	---	---	
	B17415893	HI B17415893	633.00	N/A	N/A	0.1970	0.0294	0.2194	0.2264	-3.10	---	---	---	---	---	---	G
	C17417693	HI C17417693	646.00	N/A	N/A	0.1970	0.0404	0.2251	0.2374	-5.18	---	---	---	---	---	---	G
	A194393	---	---	N/A	N/A	2.2040	0.4425	---	2.6465	---	---	---	---	---	---	---	
	B1947493	HI B1947493	6730.00	N/A	N/A	2.1960	0.3290	2.3330	2.5250	-7.60	---	---	---	---	---	---	G
	C1955093	HI C1955093	8410.00	N/A	N/A	2.6960	0.2673	2.9140	2.9633	-1.66	---	---	---	---	---	---	G
96-2	A1905593	HI A1905593	455.00	464.76	-2.10	0.1010	0.0152	0.1093	0.1162	-5.93	---	---	---	---	---	---	P
	B19013893	HI B19013893	450.00	439.92	2.29	0.1000	0.0100	0.1072	0.1100	-2.53	---	---	---	---	---	---	P
	C19019893	HI C19019893	291.00	303.00	-3.96	0.1010	0.0202	0.1146	0.1212	-5.45	---	---	---	---	---	---	G
	A1936993	HI A1936993	1370.00	1385.92	-1.15	0.3010	0.0455	0.3333	0.3465	-3.80	---	---	---	---	---	---	P
	B19315393	HI B1935393	1290.00	1320.48	-2.31	0.3000	0.0301	0.3128	0.3301	-5.25	---	---	---	---	---	---	P
	C19318793	HI C19318793	884.00	895.95	-1.33	0.2990	0.0594	0.3492	0.3584	-2.56	---	---	---	---	---	---	G
	A1944293	HI A1941293	9350.00	9597.44	-2.58	2.1810	0.2184	---	2.3994	---	---	---	---	---	---	---	P
	B1951893	HI B1951893	11800.00	12305.04	-4.10	2.6750	0.4013	---	3.0763	---	---	---	---	---	---	---	P
	C1956793	HI C1956793	7400.00	8100.23	-8.64	2.7000	0.5401	---	3.2401	---	---	---	---	---	---	---	G
97-1	HI_1_A0402	HI_1_A0402	244.00	255.60	-4.54	0.0584	0.0055	0.0603	0.0639	-5.63	---	---	---	---	---	---	G
	HI_1_B0538	HI_1_B0538	261.00	274.80	-5.02	0.0584	0.0103	0.0648	0.0687	-5.68	---	---	---	---	---	---	G
	HI_1_C0658	HI_1_C0658	180.00	186.50	-3.49	0.0584	0.0162	0.0693	0.0746	-7.10	---	---	---	---	---	---	G
	HI_2_A0402	HI_2_A0402	484.00	504.40	-4.04	0.1160	0.0101	0.1199	0.1261	-4.92	---	---	---	---	---	---	G
	HI_2_B0538	HI_2_B0538	514.00	528.00	-2.65	0.1152	0.0168	0.1240	0.1320	-6.06	---	---	---	---	---	---	G
	HI_2_C0658	HI_2_C0658	342.00	353.25	-3.18	0.1145	0.0268	0.1340	0.1413	-5.17	---	---	---	---	---	---	G
	HI_3_A0302	HI_3_A0302	9890.00	10764.00	-8.12	2.2999	0.3911	0.2346	2.6910	---	---	---	---	---	---	---	P
	HI_3_B0438	HI_3_B0438	11000.00	11402.40	-3.53	2.2986	0.5520	0.2767	2.8506	---	---	---	---	---	---	---	P
	HI_3_C5858	HI_3_C5858	7240.00	7560.75	-4.24	2.7007	0.3236	0.1699	3.0243	---	---	---	---	---	---	---	G
97-2	HI_1_A146	HI_1_A146	258.00	264.40	-2.42	0.0592	0.0069	0.0631	0.0661	-4.54	---	---	---	---	---	---	G
	HI_1_B1534	HI_1_B1534	261.00	268.00	-2.61	0.0565	0.0105	0.0103	0.0670	-84.63	---	---	---	---	---	---	G
	HI_1_C1662	HI_1_C1662	170.00	186.25	-8.72	0.0589	0.0156	0.0667	0.0745	-10.47	---	---	---	---	---	---	G
	HI_2_A146	none	482.00	494.80	-2.59	0.1147	0.0090	0.1182	0.1237	-4.45	---	---	---	---	---	---	G
	HI_2_B1534	HI_2_B1534	523.00	536.40	-2.50	0.1169	0.0172	0.1288	0.1341	-3.95	---	---	---	---	---	---	G
	HI_2_C1662	HI_2_C1662	346.00	356.25	-2.88	0.1164	0.0261	0.1361	0.1425	-4.49	---	---	---	---	---	---	G
	HI_3_A146	HI_3_A146	10500.00	10772.80	-2.53	2.3014	0.3910	2.5900	2.6932	-3.83	---	---	---	---	---	---	G
	HI_3_B1534	HI_3_B1534	10800.00	11411.20	-5.36	2.2999	0.5520	2.6810	2.8528	-6.02	---	---	---	---	---	---	G
	HI_3_C1662	HI_3_C1662	6280.00	6557.75	-4.24	2.2999	0.3240	2.5000	2.6231	-4.69	---	---	---	---	---	---	G
98-1	HI_1_A5018	HI_1_A5018	178.00	185.43	-4.01	0.0578	0.0071	0.0612	0.0649	-5.70	---	---	---	---	---	---	G
	HI_1_B5155	HI_1_B5155	159.00	169.25	-6.06	0.0585	0.0092	0.0630	0.0677	-6.94	---	---	---	---	---	---	G
	HI_1_C5274	HI_1_C5274	241.00	249.00	-3.21	0.0587	0.0160	0.0713	0.0747	-4.55	---	---	---	---	---	---	G
	HI_2_A7927	HI_2_A7927	352.00	355.43	-0.96	0.1145	0.0099	0.1214	0.1244	-2.41	---	---	---	---	---	---	G
	HI_2_B7846	HI_2_B7846	320.00	329.25	-2.81	0.1159	0.0158	0.1274	0.1317	-3.26	---	---	---	---	---	---	G
	HI_2_C7783	HI_2_C7783	459.00	474.33	-3.23	0.1168	0.0255	0.1359	0.1423	-4.50	---	---	---	---	---	---	G
	HI_3_A1018	HI_3_A1018	7080.00	7689.14	-7.92	2.3000	0.3912	2.4736	2.6912	-8.09	---	---	---	---	---	---	G
	HI_3_B5955	HI_3_B5955	7440.00	8128.75	-8.47	2.6997	0.5518	2.9932	3.2515	-7.94	---	---	---	---	---	---	G
	HI_3_C6074	HI_3_C6074	10000.00	10079.67	-0.79	2.7004	0.3235	2.9726	3.0239	-1.70	---	---	---	---	---	---	G
Median					-3.22					-5.04							
25th percentile					-4.32					-6.00							
75th percentile					-2.52					-3.86							
F-pseudosigma					1.33					1.58							
Interquartile range					1.79					2.14							

[1]Comments: Good (G) and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 18. Summary results for Sediment Laboratory Quality-Assurance studies in the Iowa City, Iowa, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18811893	IA A18811893	145.00	N/A	N/A	0.0490	0.0052	0.0506	0.0542	-6.64	0.0438	86.56	-10.61	0.0068	13.44	30.78	G
	B18815893	IA B18815893	155.00	N/A	N/A	0.0500	0.0081	0.0548	0.0581	-5.68	0.0452	82.48	-9.60	0.0096	17.52	18.53	G
	C18815893	IA C 18817093	161.00	N/A	N/A	0.0500	0.0099	0.0564	0.0599	-5.89	0.0453	80.32	-9.40	0.0111	19.68	11.78	G
	A17413693	IA A17413693	592.00	N/A	N/A	0.1970	0.0191	0.2080	0.2161	-3.75	0.1840	88.46	-6.60	0.0240	11.54	25.67	G
	B17416893	IA B17416893	599.00	N/A	N/A	0.1970	0.0306	0.2130	0.2276	-6.41	0.1781	83.62	-9.59	0.0349	16.38	14.02	G
	C17417393	IA C17417393	642.00	N/A	N/A	0.1970	0.0413	0.2262	0.2383	-5.08	0.1802	79.66	-8.53	0.0460	20.34	11.40	G
	A1943293	IA A1943293	7520.00	N/A	N/A	2.1810	0.4371	2.6207	2.6181	0.10	2.1338	81.42	-2.17	0.4869	18.58	11.40	G
	B1956093	IA B1956093	8820.00	N/A	N/A	2.6750	0.4018	3.0458	3.0768	-1.01	2.5862	84.91	-3.32	0.4596	15.09	14.39	G
	C1956393	IA C1956393	8460.00	N/A	N/A	2.6750	0.2675	2.9420	2.9425	-0.02	2.6166	88.94	-2.18	0.3254	11.06	21.64	G
96-2	A1903793	IA A1930793	449.30	469.32	-4.27	0.1020	0.0153	0.1104	0.1173	-5.91	---	---	---	---	---	---	G
	B19010093	IA B19010093	435.60	444.28	-1.95	0.1010	0.0101	0.1062	0.1111	-4.38	---	---	---	---	---	---	G
	C19017493	IA C19017493	294.50	302.95	-2.79	0.1010	0.0202	0.1165	0.1212	-3.86	---	---	---	---	---	---	G
	A19310493	IA A19310493	1369.40	1365.32	0.30	0.2970	0.0443	0.3351	0.3413	-1.83	---	---	---	---	---	---	G
	B19312193	IA B19312193	1315.30	1325.24	-0.75	0.3010	0.0303	0.3237	0.3313	-2.30	---	---	---	---	---	---	G
	C19314793	IA C19314793	884.20	894.40	-1.14	0.2980	0.0598	0.3496	0.3578	-2.28	---	---	---	---	---	---	G
	A1945393	IA A19545393	9695.00	9666.04	0.30	2.1970	0.2195	2.3880	2.4165	-1.18	---	---	---	---	---	---	G
	B1952793	IA B1952793	12278.80	12311.16	-0.26	2.6760	0.4018	3.0403	3.0778	-1.22	---	---	---	---	---	---	G
	C1955793	IA C1955793	8063.40	7985.90	0.97	2.6620	0.5324	3.2004	3.1944	0.19	---	---	---	---	---	---	G
97-1	IA_1_A0703	IA_2_A0703	255.00	250.40	1.84	0.0571	0.0055	0.0616	0.0626	-1.60	0.0561	91.04	-1.79	0.0055	8.96	0.35	G
	IA_1_B0837	IA_1_B0837	259.00	272.80	-5.06	0.0583	0.0099	0.0644	0.0682	-5.57	0.0539	83.70	-7.54	0.0105	16.30	6.03	G
	IA_1_C0959	IA_1_C0959	176.00	185.00	-4.86	0.0584	0.0156	0.0697	0.0740	-5.81	0.0545	78.19	-6.68	0.0152	21.81	-2.55	G
	IA_2_A0703	IA_1_A0703	437.00	501.60	-12.88	0.1150	0.0104	0.1083	0.1254	-13.64	0.0986	91.04	-14.26	0.0097	8.96	-6.70	G
	IA_2_B0837	IA_I_B0837B	497.00	534.80	-7.07	0.1172	0.0165	0.1233	0.1337	-7.78	0.1071	86.86	-8.62	0.0162	13.14	-1.81	G
	IA_2_C0959	IA_2_C0959	347.00	352.50	-1.56	0.1145	0.0265	0.1381	0.1410	-2.06	0.1104	79.94	-3.58	0.0277	20.06	4.54	G
	IA_3_A0503	IA_3_A0503	10400.00	10768.00	-3.42	2.3015	0.3905	2.5991	2.6920	-3.45	2.2134	85.16	-3.83	0.3857	14.84	-1.23	M
	IA_3_B0637	IA_3_B0637	10800.00	11402.00	-5.28	2.2988	0.5517	2.6626	2.8505	-6.59	2.2709	85.29	-1.21	0.3837	14.41	-30.45	M
	IA_3_C5959	IA_3_C5959	7560.00	7562.00	-0.03	2.7012	0.3236	3.0057	3.0248	-0.63	2.6811	89.20	-0.74	0.3246	10.80	0.31	P
97-2	IA_1_A177	IA_1_A177	250.00	256.80	-2.65	0.0571	0.0071	0.0619	0.0642	-3.58	0.0544	87.88	-4.73	0.0075	12.12	5.67	G
	IA_1_B1835	IA_1_B1835	271.00	276.80	-2.10	0.0590	0.0102	0.0669	0.0692	-3.32	0.0563	84.16	-4.57	0.0106	15.84	3.89	G
	IA_1_C1963	IA_1_C1963	178.00	184.25	-3.39	0.0590	0.0147	0.0704	0.0737	-4.48	0.0558	79.26	-5.43	0.0146	20.74	-0.67	G
	IA_2_A177	IA_2_A177	492.00	504.40	-2.46	0.1173	0.0088	0.1217	0.1261	-3.49	0.1129	92.77	-3.75	0.0088	7.23	-0.01	G
	IA_2_B1835	IA_2_B1835	522.00	533.60	-2.17	0.1167	0.0167	0.1284	0.1334	-3.75	0.1112	86.60	-4.72	0.0172	13.40	3.03	G
	IA_2_C1963	IA_2_C1963	351.00	358.25	-2.02	0.1155	0.0278	0.1388	0.1433	-3.14	0.1102	79.39	-4.59	0.0286	20.61	2.90	G
	IA_3_A177	IA_3_A177	10600.00	10762.40	-1.51	2.2990	0.3910	2.6374	2.6906	-1.98	2.2471	85.20	-2.26	0.3903	14.80	-0.32	G
	IA_3_B1835	IA_3_B1835	11300.00	11408.40	-0.95	2.3009	0.5520	2.8015	2.8521	-1.77	2.2496	80.30	-2.23	0.5519	19.70	0.13	G
	IA_3_C1963	IA_3_C1963	6530.00	6560.75	-0.47	2.3008	0.3240	2.5998	2.6243	-0.93	2.2748	87.50	-1.13	0.3250	12.50	0.46	G
98-1	IA_1_A5319	IA_1_A5319	185.00	188.57	-1.89	0.0589	0.0071	0.0645	0.0660	-2.27	0.0566	87.69	-3.97	0.0079	12.31	11.83	G
	IA_1_B5454	IA_1_B5454	147.00	147.56	-0.38	0.0568	0.0096	0.0658	0.0664	-0.90	0.0546	82.98	-3.87	0.0112	17.02	16.66	G
	IA_1_C5575	IA_1_C5575	241.00	249.00	-3.21	0.0583	0.0164	0.0719	0.0747	-3.75	0.0551	76.63	-5.49	0.0168	23.37	2.46	G
	IA_2_A7626	IA_2_A7626	354.00	360.29	-1.74	0.1175	0.0086	0.1232	0.1261	-2.30	0.1135	92.13	-3.40	0.0097	7.87	12.74	G
	IA_2_B7547	IA_2_B7547	332.00	339.50	-2.21	0.1174	0.0184	0.1319	0.1358	-2.87	0.1118	84.76	-4.77	0.0201	15.24	9.25	G
	IA_2_C7482	IA_2_C7482	459.00	473.33	-3.66	0.1149	0.0271	0.1370	0.1420	-3.52	0.1091	79.64	-5.04	0.0279	20.36	2.93	G
	IA_3_A4719	IA_3_A4719	7670.00	7693.14	-0.30	2.3010	0.3916	2.6766	2.6926	-0.59	2.2847	85.36	-0.71	0.3919	14.64	0.06	G
	IA_3_B6154	IA_3_B6154	8140.00	8124.00	0.20	2.6986	0.5510	3.2380	3.2496	-0.36	2.6853	82.93	-0.49	0.5527	17.07	0.31	G
	IA_3_C6275	IA_3_C6275	10200.00	10093.33	1.06	2.7039	0.3241	3.0002	3.0280	-0.92	2.6747	89.15	-1.08	0.3255	10.85	0.44	G
Median					-1.92					-3.14			-4.27			2.98	
25th percentile					-3.26					-4.48			-6.62			0.11	
75th percentile					-0.36					-1.22			-2.22			11.79	
F-pseudosigma					2.15					2.42			3.26			8.66	
Interquartile range					2.90					3.26			4.40			11.68	

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 19. Summary results for Sediment Laboratory Quality-Assurance studies in the Louisville, Kentucky, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18817793	KYA18817793	179.00	N/A	N/A	0.0490	0.0050	0.0540	0.0540	0.00	0.0368	68.15	-24.90	0.0172	31.85	243.98	G
	B18818793	KYB18818793	213.00	N/A	N/A	0.0490	0.0101	0.0593	0.0591	0.34	0.0456	76.90	-6.94	0.0137	23.10	35.63	G
	C18819793	KYC18819793	203.00	N/A	N/A	0.0490	0.0070	0.0546	0.0560	-2.50	0.0451	82.60	-7.96	0.0095	17.40	35.72	G
	A1741693	KY A1741693	710.00	N/A	N/A	0.1990	0.0200	0.2125	0.2190	-2.97	0.1853	87.20	-6.88	0.0272	12.80	36.00	G
	B17412693	KY B17412693	869.00	N/A	N/A	0.1970	0.0293	0.2250	0.2263	-0.57	0.1881	83.60	-4.52	0.0369	16.40	25.94	G
	C17418893	KY C17418893	911.00	N/A	N/A	0.1980	0.0408	0.2351	0.2388	-1.55	0.1860	79.12	-6.05	0.0491	20.88	20.29	G
	A1944493	KY A1944493	10700.00	N/A	N/A	2.1820	0.4361	2.5901	2.6181	-1.07	2.0959	80.92	-3.95	0.4942	19.08	13.32	G
	B1946393	KY B1946393	8890.00	N/A	N/A	2.1870	0.3276	2.4979	2.5146	-0.66	2.0895	83.65	-4.46	0.4084	16.35	24.67	G
	C1951493	KY C1951493	10300.00	N/A	N/A	2.6840	0.2683	2.9360	2.9523	-0.55	2.5643	87.34	-4.46	0.3717	12.66	38.54	G
96-2	A190493	KYA190493	480.20	455.32	5.46	0.0990	0.0148	0.1106	0.1138	-2.84	---	---	---	---	---	---	G
	B1901393	KYB1901393	442.70	444.44	-0.39	0.1010	0.0101	0.1054	0.1111	-5.14	---	---	---	---	---	---	G
	C1906993	KYC1906993	293.55	297.05	-1.18	0.0990	0.0198	0.1156	0.1188	-2.71	0.0915	79.15	-7.58	0.0241	20.85	21.61	G
	A1933193	KYA1933193	1353.90	1375.48	-1.57	0.2990	0.0449	0.3321	0.3439	-3.42	---		---	---		---	G
	B1934193	KYB1934193	1398.30	1328.96	5.22	0.3020	0.0302	0.3156	0.3322	-5.01	---		---	---		---	G
	C1939193	KYC1939193	900.00	900.05	-0.01	0.3000	0.0600	0.3513	0.3600	-2.42	0.2810	79.99	-6.33	0.0703	20.01	17.12	G
	A1946493	KYA1946493	9594.39	9605.32	-0.11	2.1830	0.2183	2.3701	2.4013	-1.30	---	---	---	---	---	---	M
	B1951693	KYB1951693	12701.79	12406.56	2.38	2.6970	0.4046	3.0434	3.1016	-1.88	---	---	---	---	---	---	P
	C1953193	KYC1953193	8123.67	8028.18	1.19	2.6760	0.5353	3.1626	3.2113	-1.52	2.5326	80.08	-5.36	0.6300	19.92	17.70	M
97-1	KY_1_A1004	KY_1_A1004	246.00	255.60	-3.76	0.0582	0.0057	0.0608	0.0639	-4.85	0.0532	87.50	-8.59	0.0076	12.50	33.33	G
	KY_1_B1136	KY_1_B1136	273.00	275.60	-0.94	0.0590	0.0099	0.0676	0.0689	-1.89	0.0554	81.95	-6.10	0.0122	18.05	23.25	G
	KY_1_C1260	KY_1_C1260	177.00	184.50	-4.07	0.0575	0.0163	0.0702	0.0738	-4.88	0.0522	74.36	-9.22	0.0180	25.64	10.43	P
	KY_2_A1004	KY_2_A1004	475.00	504.00	-5.75	0.1159	0.0101	0.1177	0.1260	-6.59	0.1054	89.55	-9.06	0.0123	10.45	21.78	G
	KY_2_B1136	KY_2_B1136	511.00	527.20	-3.07	0.1153	0.0165	0.1257	0.1318	-4.63	0.1080	85.92	-6.33	0.0177	14.08	7.26	G
	KY_2_C1260	KY_2_C1260	365.00	357.75	2.03	0.1159	0.0272	0.1398	0.1431	-2.31	0.1114	79.69	-3.88	0.0284	20.31	4.39	G
	KY_3_A0704	KY_3_A0704	10700.00	10764.00	-0.59	2.3002	0.3908	2.6413	2.6910	-1.85	2.2264	84.29	-3.21	0.4149	15.71	6.18	P
	KY_3_B0836	KY_3_B0836	11500.00	11413.20	0.76	2.3015	0.5518	2.7954	2.8533	-2.03	2.2232	79.53	-3.40	0.5722	20.47	3.70	P
	KY_3_C6060	KY_3_C6060	7340.00	7556.75	-2.87	2.6990	0.3237	2.9644	3.0227	-1.93	2.6146	88.20	-3.13	0.3498	11.80	8.06	G
97-2	KY_1_A208	KY_1_A208	253.00	258.40	-2.09	0.0581	0.0065	0.0626	0.0646	-3.10	0.0557	88.98	-4.13	0.0069	11.02	6.13	G
	KY_1_B2136	KY_1_B2136	262.00	272.00	-3.68	0.0575	0.0105	0.0650	0.0680	-4.41	0.0537	82.62	-6.60	0.0113	17.38	7.59	P
	KY_1_C2264	KY_1_C2264	182.00	186.75	-2.54	0.0595	0.0152	0.0720	0.0747	-3.61	0.0569	79.03	-4.37	0.0151	20.97	-0.67	P
	KY_2_A208	KY_2_A208	473.00	496.00	-4.64	0.1154	0.0086	0.1174	0.1240	-5.32	0.1082	92.16	-6.24	0.0092	7.84	7.03	P
	KY_2_B2136	KY_2_B2136	509.00	528.80	-3.74	0.1167	0.0155	0.1263	0.1322	-4.46	0.1113	88.12	-4.63	0.0150	11.88	-3.20	G
	KY_2_C2264	KY_2_C2264	349.00	356.00	-1.97	0.1161	0.0263	0.1380	0.1424	-3.09	0.1106	80.14	-4.74	0.0274	19.86	4.21	G
	KY_3_A208	KY_3_A208	10700.00	10764.40	-0.60	2.2990	0.3910	2.6541	2.6911	-1.37	2.2613	85.20	-1.64	0.3928	14.80	0.18	P
	KY_3_B2136	KY_3_B2136	11300.00	11403.20	-0.91	2.3002	0.5520	2.8140	2.8508	-1.29	2.2771	80.92	-1.00	0.5369	19.08	-2.49	P
	KY_3_C2264	KY_3_C2264	6630.00	6561.75	1.04	2.2999	0.3240	2.5813	2.6247	-1.65	2.2545	87.34	-1.97	0.3268	12.66	0.61	P
98-1	KY_1_A5620	KY_1_A5620	183.00	189.43	-3.39	0.0590	0.0073	0.0637	0.0663	-3.92	0.0558	87.60	-5.42	0.0079	12.40	8.20	M
	KY_1_B5753	KY_1_B5753	156.00	166.25	-6.17	0.0568	0.0097	0.0619	0.0665	-6.92	0.0518	83.68	-8.81	0.0101	16.32	4.15	G
	KY_1_C5876	KY_1_C5876	235.00	247.00	-4.86	0.0575	0.0166	0.0698	0.0741	-5.80	0.0529	75.79	-8.00	0.0169	24.21	1.80	P
	KY_2_A7325	KY_2_A7325	343.00	363.14	-5.55	0.1172	0.0099	0.1192	0.1271	-6.22	0.1090	91.44	-7.00	0.0102	8.56	3.07	P
	KY_2_B7248	KY_2_B7248	308.00	328.75	-6.31	0.1156	0.0159	0.1224	0.1315	-6.92	0.1064	86.93	-7.96	0.0160	13.07	0.61	G
	KY_2_C7181	KY_2_C7181	464.00	469.00	-1.07	0.1148	0.0259	0.1328	0.1407	-5.61	0.1059	79.74	-7.76	0.0269	20.26	3.88	M
	KY_3_A4820	KY_3_A4820	7510.00	7692.57	-2.37	2.3016	0.3908	2.6146	2.6924	-2.89	2.2449	85.86	-2.46	0.3697	14.14	-5.40	P
	KY_3_B6353	KY_3_B6353	7990.00	8138.75	-1.83	2.7037	0.5518	3.1795	3.2555	-2.33	2.6368	82.93	-2.48	0.5427	17.07	-1.64	G
	KY_3_C6476	KY_3_C6476	9340.00	10079.33	-7.34	2.6996	0.3242	2.7828	3.0238	-7.97	2.4606	88.42	-8.85	0.3222	11.58	-0.60	P
Median					-1.90					-2.84			-6.05			7.26	
25th percentile					-3.75					-4.85			-7.67			2.43	
75th percentile					-0.32					-1.65			-4.04			21.69	
F-pseudosigma					2.54					2.37			2.69			14.28	
Interquartile range					3.43					3.20			3.63			19.26	

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 20. Summary results for Sediment Laboratory Quality-Assurance studies in the Baton Rouge, Louisiana, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18816493	LA A18816493	152.00	N/A	N/A	0.0500	0.0050	0.0538	0.0550	-2.24	0.0467	86.84	-6.56	0.0071	13.16	40.76	G
	B18817693	LA B18817693	159.00	N/A	N/A	0.0490	0.0074	0.0561	0.0564	-0.53	0.0466	83.02	-4.95	0.0095	16.98	28.73	G
	C18812693	LA C18812693	161.00	N/A	N/A	0.0500	0.0100	0.0553	0.0600	-7.83	0.0440	79.50	-12.07	0.0117	21.11	16.74	G
	A17413393	LA A17413393	599.00	N/A	N/A	0.1970	0.0202	0.2099	0.2172	-3.36	0.1836	87.48	-6.79	0.0263	12.52	30.10	G
	B17415393	LA B17415393	645.00	N/A	N/A	0.1970	0.0309	0.2183	0.2279	-4.21	0.1824	83.56	-7.41	0.0359	16.44	16.14	G
	C17415993	LA C17415993	658.00	N/A	N/A	0.2010	0.0399	0.2304	0.2409	-4.36	0.1856	80.55	-7.67	0.0448	19.45	12.31	G
	A1946093	LA A1946093	7292.00	N/A	N/A	2.1820	0.4358	2.5078	2.6178	-4.20	2.0298	80.94	-6.97	0.4780	19.06	9.68	G
	B195393	LA B195393	9104.00	N/A	N/A	2.6790	0.4016	2.9742	3.0806	-3.45	2.5233	84.84	-5.81	0.4509	15.16	12.27	G
	C1956993	LA C1956993	8101.00	N/A	N/A	2.6760	0.2680	2.8798	2.9440	-2.18	2.5676	89.16	-4.05	0.3122	10.84	16.48	G
96-2	A1901293	LA A1901293	412.00	450.84	-8.62	0.0980	0.0147	0.0970	0.1127	-13.94	0.0843	86.89	-14.00	0.0127	13.11	-13.55	P
	B19010693	LA B19010693	410.00	447.20	-8.32	0.1010	0.0108	0.0975	0.1118	-12.79	0.0866	88.78	-14.30	0.0109	11.22	1.29	P
	C19017393	LA C19017393	298.00	297.05	0.32	0.0990	0.0198	0.1165	0.1188	-1.95	0.0950	81.54	-4.05	0.0215	18.46	8.51	P
	A1931893	LA A1931893	1277.00	1384.60	-7.77	0.3010	0.0452	0.2908	0.3462	-15.99	0.2484	85.43	-17.46	0.0421	14.49	-6.67	P
	B19310993	LA B19310993	1453.00	1307.08	11.16	0.2970	0.0298	0.2683	0.3268	-17.89	0.2406	89.68	-18.99	0.0279	10.39	-6.36	P
	C19317493	LA C19317493	862.00	896.58	-3.86	0.2990	0.0596	0.3403	0.3586	-5.11	0.2775	81.55	-7.19	0.0628	18.44	5.23	P
	A1942293	LA A1942293	9432.00	9619.12	-1.95	2.1860	0.2188	2.2759	2.4048	-5.36	2.0401	89.64	-6.67	0.2356	10.35	7.67	P
	B195793	LA B195793	11158.00	12333.12	-9.53	2.6810	0.4023	2.7539	3.0833	-10.68	2.3298	84.60	-13.10	0.4241	15.40	5.42	P
	C1956693	LA C1956693	8044.00	8102.35	-0.72	2.7000	0.5409	3.1743	3.2409	-2.06	2.5944	81.73	-3.91	0.5806	18.29	7.33	P
97-1	LA_1_A1305	LA_1_A1305	238.00	255.20	-6.74	0.0578	0.0060	0.0586	0.0638	-8.15	0.0524	89.50	-9.26	0.0062	10.50	2.55	G
	LA_1_B1435	LA_1_B1435	269.00	274.40	-1.97	0.0582	0.0104	0.0660	0.0686	-3.79	0.0552	83.64	-5.15	0.0108	16.35	3.76	G
	LA_1_C1561	LA_1_C1561	173.00	186.75	-7.36	0.0586	0.0161	0.0727	0.0747	-2.68	0.0559	76.88	-4.62	0.0168	23.12	4.40	G
	LA_2_A1305	LA_2_A1305	486.00	505.20	-3.80	0.1166	0.0097	0.1114	0.1263	-11.80	0.1041	93.42	-10.75	0.0073	6.58	-24.43	G
	LA_2_B1435	LA_2_B1435	532.00	533.60	-0.30	0.1169	0.0165	0.1154	0.1334	-13.49	0.1002	86.84	-14.27	0.0152	13.16	-7.96	P
	LA_2_C1561	LA_2_C1561	412.00	353.75	16.47	0.1148	0.0267	0.1307	0.1415	-7.63	0.1041	79.61	-9.36	0.0266	20.39	-0.19	P
	LA_3_A0905	LA_3_A0905	10492.00	10758.80	-2.48	2.2988	0.3909	2.5475	2.6897	-5.29	2.1682	85.11	-5.68	0.3793	14.89	-2.96	P
	LA_3_B1035	LA_3_B1305	10625.00	11404.40	-6.83	2.2995	0.5516	2.4109	2.8511	-15.44	1.9085	79.16	-17.01	0.5024	20.84	-8.91	P
	LA_3_C6161	LA_3_C6161	8786.00	7560.00	16.22	2.7006	0.3234	2.8686	3.0240	-5.14	2.5422	88.62	-5.87	0.3264	11.38	0.94	P
97-2	LA_1_A239	LA_1_A239	241.00	252.80	-4.67	0.0572	0.0060	0.0589	0.0632	-6.80	0.0526	89.30	-8.05	0.0063	10.70	5.04	G
	LA_1_B2437	LA_1_B2437	266.00	274.00	-2.92	0.0576	0.0109	0.0636	0.0685	-7.15	0.0525	82.55	-8.85	0.0111	17.45	1.82	P
	LA_1_C2565	LA_1_C2565	176.00	181.25	-2.90	0.0575	0.0150	0.0691	0.0725	-4.69	0.0539	78.00	-6.26	0.0152	22.00	1.35	G
	LA_2_A239	LA_2_A239	478.00	506.80	-5.68	0.1171	0.0096	0.1176	0.1267	-7.18	0.1081	91.92	-7.69	0.0095	8.08	-1.02	G
	LA_2_B2437	LA_2_B2437	511.00	529.60	-3.51	0.1169	0.0155	0.1214	0.1324	-8.31	0.1062	87.48	-9.15	0.0152	12.52	-1.94	P
	LA_2_C2565	LA_2_C2565	346.00	356.75	-3.01	0.1147	0.0280	0.1359	0.1427	-4.77	0.1079	79.40	-5.92	0.0280	20.60	-0.02	G
	LA_3_A239	LA_3_A239	10551.00	10759.60	-1.94	2.2989	0.3910	2.6290	2.6899	-2.26	2.2352	85.02	-2.77	0.3938	14.98	0.72	G
	LA_3_B2437	LA_3_B2437	11363.00	11406.80	-0.38	2.3008	0.5520	2.7870	2.8517	-2.27	2.2396	80.36	-2.66	0.5474	19.64	-0.64	G
	LA_3_C2565	LA_3_C2565	6475.00	6558.00	-1.27	2.2994	0.3240	2.5610	2.6232	-2.37	2.2373	87.36	-2.70	0.3237	12.64	-0.03	G
98-1	LA_1_A5921	LA_1_A5921	191.00	187.71	1.75	0.0585	0.0072	0.0643	0.0657	-2.13	0.0545	84.76	-6.84	0.0098	15.24	36.10	G
	LA_1_B6052	LA_1_B6052	166.00	167.50	-0.90	0.0580	0.0090	0.0641	0.0670	-4.33	0.0541	84.40	-6.72	0.0100	15.60	11.11	G
	LA_1_C6177	LA_1_C6177	246.00	244.67	0.54	0.0581	0.0153	0.0717	0.0734	-2.32	0.0552	76.99	-4.99	0.0165	23.01	7.83	G
	LA_2_A7024	LA_2_A7024	341.00	362.29	-5.88	0.1173	0.0095	0.1176	0.1268	-7.26	0.1086	92.35	-7.41	0.0090	7.65	-5.30	G
	LA_2_B6949	LA_2_B6949	324.00	331.75	-2.34	0.1160	0.0167	0.1263	0.1327	-4.82	0.1097	86.86	-5.43	0.0166	13.14	-0.62	G
	LA_2_C6880	LA_2_C6880	460.00	477.00	-3.56	0.1172	0.0259	0.1364	0.1431	-4.68	0.1110	81.38	-5.29	0.0254	18.62	-1.94	G
	LA_3_A4921	LA_3_A4921	7144.00	7689.71	-7.10	2.2996	0.3918	2.5048	2.6914	-6.93	2.2060	88.07	-4.07	0.2988	11.93	-23.73	G
	LA_3_B6552	LA_3_B6552	8095.00	8124.00	-0.36	2.6986	0.5510	3.1854	3.2496	-1.98	3.1793	99.81	17.81	0.0061	0.19	-98.90	G
	LA_3_C6677	LA_3_C6677	10118.00	10073.33	0.44	2.6987	0.3233	2.9676	3.0220	-1.80	2.6421	89.03	-2.10	0.3255	10.97	0.69	G
Median					-2.69					-4.77			-6.72			1.35	
25th percentile					-5.73					-7.63			-9.15			-1.94	
75th percentile					-0.38					-2.37			-4.99			8.51	
F-pseudosigma					3.97					3.90			3.09			7.74	
Interquartile range					5.35					5.26			4.16			10.45	

[1]Comments: Good (G) and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 21. Summary results for Sediment Laboratory Quality-Assurance studies in the Rolla, Missouri, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18811393	MO A18811393	315.00	N/A	N/A	0.0500	0.0051	0.0547	0.0551	-0.73	0.0464	84.83	-7.20	0.0083	15.17	62.75	G
	B18812393	MO B18812393	319.00	N/A	N/A	0.0490	0.0069	0.0528	0.0559	-5.55	0.0435	82.39	-11.22	0.0093	17.61	34.78	G
	C18816693	MO C18816693	353.00	N/A	N/A	0.0490	0.0112	0.0594	0.0602	-1.33	0.0456	76.77	-6.94	0.0138	23.23	23.21	G
	A1749393	MO A1749393	1300.00	N/A	N/A	0.2010	0.0203	0.2209	0.2213	-0.18	0.1935	87.60	-3.73	0.0274	12.40	34.93	G
	B17412293	MO B17412293	1350.00	N/A	N/A	0.1980	0.0314	0.2291	0.2294	-0.13	0.1892	82.60	-4.43	0.0399	17.40	26.95	G
	C17414893	MO C17414893	1440.00	N/A	N/A	0.1990	0.0406	0.2369	0.2396	-1.13	0.1900	80.20	-4.53	0.0469	19.80	15.53	G
	A1945993	MO A 1945993	16200.00	N/A	N/A	2.1800	0.4357	2.6167	2.6157	0.04	2.0934	80.00	-3.97	0.5265	20.12	20.84	G
	B194793	MO B194793	15100.00	N/A	N/A	2.2010	0.3301	2.5402	2.5311	0.36	2.1084	83.00	-4.21	0.4199	16.53	27.20	G
	C1954193	MO C1954193	16200.00	N/A	N/A	2.7110	0.2714	2.9748	2.9824	-0.25	2.5881	87.00	-4.53	0.3840	12.91	41.51	G
96-2	A1904293	---	---	450.92	---	0.0980	0.0147	---	0.1127	---	---	---	---	---	---	---	---
	B1908093	---	---	444.20	---	0.1010	0.0101	---	0.1111	---	---	---	---	---	---	---	---
	C19010293	MO C19010293	286.00	296.30	-3.48	0.0990	0.0195	0.1128	0.1185	-4.83	0.0898	79.61	-9.29	0.0230	20.39	17.83	G
	A1938793	---	---	1366.20	---	0.2970	0.0446	---	0.3416	---	---	---	---	---	---	---	---
	B19313493	---	---	1324.60	---	0.3010	0.0302	---	0.3312	---	---	---	---	---	---	---	---
	C19317293	MO C19317293	855.00	899.78	-4.98	0.3000	0.0599	0.3363	0.3599	-6.56	0.2719	80.85	-9.37	0.0644	19.15	7.50	G
	A1942493	---	---	9636.36	---	2.1900	0.2191	---	2.4091	---	---	---	---	---	---	---	---
	B1951293	---	---	12310.24	---	2.6760	0.4016	---	3.0776	---	---	---	---	---	---	---	---
	C1954693	MO C1954693	8000.00	8067.23	-0.83	2.6890	0.5379	3.1701	3.2269	-1.76	2.5215	79.54	-6.23	0.6486	20.46	20.58	G
97-1	MO_1_A1106	MO_1_A1606	253.00	252.40	0.24	0.0570	0.0061	0.0629	0.0631	-0.32	---	---	---	---	---	---	G
	MO_1_B1234	MO_1_B1734	258.00	271.20	-4.87	0.0574	0.0104	0.0664	0.0678	-2.06	---	---	---	---	---	---	G
	MO_1_C6262	MO_1_C1862	186.00	184.25	0.95	0.0573	0.0164	0.0735	0.0737	-0.27	0.0544	74.01	-5.07	0.0191	26.00	16.52	G
	MO_2_A1606	MO_2_A1606	498.00	502.80	-0.95	0.1155	0.0102	0.1199	0.1257	-4.61	---	---	---	---	---	---	G
	MO_2_B1734	MO_2_B1734	516.00	524.80	-1.68	0.1145	0.0167	0.1274	0.1312	-2.90	---	---	---	---	---	---	G
	MO_2_C1862	MO_2_C1862	360.00	358.75	0.35	0.1161	0.0274	0.1422	0.1435	-0.91	0.1116	78.48	-3.88	0.0306	21.52	11.68	G
	MO_3_A1106	MO_3_A1106	10771.00	10768.40	0.02	2.3012	0.3909	2.6619	2.6921	-1.12	---	---	---	---	---	---	G
	MO_3_B1234	MO_3_B1234	11201.00	11414.40	-1.87	2.3015	0.5521	2.6597	2.8536	-6.79	---	---	---	---	---	---	G
	MO_3_C6262	MO_3_C6262	7533.00	7560.00	-0.36	2.7006	0.3234	2.9954	3.0240	-0.95	---	---	-1.40	---	---	---	G
97-2	MO_1_A2610	MO_1_A2610	284.00	256.80	10.59	0.0574	0.0068	0.0690	0.0642	7.48	0.0530	76.81	-7.67	0.0160	23.19	135.31	G
	MO_1_B2738	MO_1_B2738	275.00	268.00	2.61	0.0569	0.0101	0.0680	0.0670	1.49	0.0490	72.06	-13.88	0.0190	27.94	88.11	G
	MO_1_C2866	MO_1_C2866	185.00	183.00	1.09	0.0577	0.0155	0.0730	0.0732	-0.27	0.0540	73.97	-6.42	0.0190	26.03	22.59	G
	MO_2_A2610	MO_2_A2610	502.00	503.20	-0.24	0.1169	0.0089	0.1240	0.1258	-1.43	0.1070	86.29	-8.47	0.0170	13.71	91.02	G
	MO_2_B2738	MO_2_B2738	527.00	532.40	-1.01	0.1171	0.0160	0.1310	0.1331	-1.58	0.1040	79.39	-11.19	0.0270	20.61	68.74	G
	MO_2_C2866	MO_2_C2866	356.00	355.00	0.28	0.1146	0.0274	0.1400	0.1420	-1.41	0.1050	75.00	-8.38	0.0350	25.00	27.74	G
	MO_3_A2610	MO_3_A2610	10711.00	10764.40	-0.50	2.2988	0.3910	2.6600	2.6911	-1.16	2.2480	84.51	-2.21	0.4120	15.49	5.03	G
	MO_3_B2738	MO_3_B2738	11380.00	11404.80	-0.22	2.2994	0.5520	2.8250	2.8512	-0.92	2.2329	79.04	-2.89	0.5921	20.96	7.31	G
	MO_3_C2866	MO_3_C2866	6542.00	6561.25	-0.29	2.3015	0.3240	2.5950	2.6245	-1.12	2.2501	86.71	-2.23	0.3449	13.29	6.77	G
98-1	MO_1_A6222	MO_1_A6222	183.00	186.00	-1.61	0.0583	0.0068	0.0636	0.0651	-2.30	0.0536	84.28	-8.06	0.0100	15.72	47.03	G
	MO_1_B6351	MO_1_B6351	162.00	165.50	-2.11	0.0565	0.0097	0.0644	0.0662	-2.72	0.0482	74.84	-14.70	0.0162	25.16	67.04	G
	MO_1_C6478	MO_1_C6478	244.00	249.00	-2.01	0.0578	0.0169	0.0725	0.0747	-2.95	0.0534	73.66	-7.61	0.0191	26.34	13.00	G
	MO_2_A6723	MO_2_A6723	355.00	360.29	-1.47	0.1171	0.0090	0.1230	0.1261	-2.46	0.1089	88.54	-7.00	0.0141	11.46	56.62	G
	MO_2_B6650	MO_2_B6650	348.00	338.50	2.81	0.1174	0.0180	0.1382	0.1354	2.07	0.1159	83.86	-1.28	0.0223	16.14	23.92	G
	MO_2_C6579	MO_2_C6579	471.00	471.33	-0.07	0.1158	0.0256	0.1396	0.1414	-1.27	0.1063	76.15	-8.20	0.0333	23.85	30.06	P
	MO_3_A5022	MO_3_A5022	7683.00	7694.86	-0.15	2.3022	0.3910	2.6731	2.6932	-0.75	2.2684	84.86	-1.47	0.4047	15.14	3.51	G
	MO_3_B6751	MO_3_B6751	8037.00	8102.00	-0.80	2.6892	0.5516	3.2011	3.2408	-1.23	2.6425	82.55	-1.74	0.5586	17.45	1.27	G
	MO_3_C6878	MO_3_C6878	10064.00	10058.00	0.06	2.6939	0.3235	2.9894	3.0174	-0.93	2.6555	88.83	-1.43	0.3339	11.17	3.22	G
Median					-0.33					-1.13			-6.23			23.57	
25th percentile					-1.58					-2.18			-8.20			12.67	
75th percentile					0.19					-0.30			-3.73			42.89	
F-pseudosigma					1.31					1.40			3.32			22.40	
Interquartile range					1.77					1.89			4.47			30.22	

[1]Comments: Good (G) and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 22. Summary results for Sediment Laboratory Quality-Assurance studies in the Helena, Montana, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18813393	MT A18813393	145.00	N/A	N/A	0.0490	0.0053	0.0508	0.0543	-6.45	0.0442	87.00	-9.80	0.0066	13.00	24.60	G
	B18813693	MT B18813693	156.00	N/A	N/A	0.0500	0.0082	0.0547	0.0582	-6.01	0.0449	82.00	-10.29	0.0098	18.00	20.07	G
	C18814493	MT C18814493	162.00	N/A	N/A	0.0490	0.0108	0.0566	0.0598	-5.35	0.0453	80.00	-7.59	0.0113	20.00	4.81	G
	A1742493	MT A1742493	594.00	N/A	N/A	0.2010	0.0200	0.2080	0.2210	-5.90	0.1830	88.00	-8.94	0.0250	12.00	24.55	G
	B1744993	MT B1744993	612.00	N/A	N/A	0.1990	0.0297	0.2142	0.2287	-6.34	0.1778	83.00	-10.66	0.0364	17.00	22.61	G
	C17413293	MT C17413293	638.00	N/A	N/A	0.1970	0.0397	0.2234	0.2367	-5.62	0.1787	80.00	-9.28	0.0447	20.00	12.54	G
	A1946993	MT A1946993	7360.00	N/A	N/A	2.2200	0.4445	2.5755	2.6645	-3.34	2.0862	81.00	-6.03	0.4893	19.00	10.09	G
	B1947993	MT B1947993	6950.00	N/A	N/A	2.1840	0.3279	2.4341	2.5119	-3.10	2.0446	84.00	-6.38	0.3895	16.00	18.77	G
	C1952493	MT C1952493	8170.00	N/A	N/A	2.6800	0.2679	2.8612	2.9479	-2.94	2.5179	88.00	-6.05	0.3433	12.00	28.16	G
96-2	A1904993	MT A1904993	431.00	466.20	-7.55	0.1010	0.0156	0.1064	0.1166	-8.71	0.0872	82.00	-13.62	0.0192	18.00	23.16	G
	B19018793	MT B19018793	---	794.00	---	0.1000	0.0985	---	0.1985	---	---	---	---	---	---	---	---
	C19012793	MT C19012793	283.00	293.68	-3.63	0.0980	0.0195	0.1125	0.1175	-4.23	0.0900	80.00	-8.16	0.0225	20.00	15.56	G
	A1934293	MT A1934293	1310.00	1366.68	-4.15	0.2970	0.0447	0.3226	0.3417	-5.58	0.2678	83.00	-9.85	0.0548	17.00	22.77	G
	B1938993	MT B1938993	1260.00	1324.60	-4.88	0.3010	0.0302	0.3092	0.3312	-6.63	0.2690	87.00	-10.63	0.0402	13.00	33.32	G
	C19312393	MT C19312393	866.00	899.98	-3.78	0.3000	0.0600	0.3440	0.3600	-4.44	0.2752	80.00	-8.27	0.0688	20.00	14.69	G
	A1941493	MT A1941493	9480.00	9615.12	-1.41	2.1850	0.2188	2.3467	2.4038	-2.37	2.0416	87.00	-6.56	0.3051	13.00	39.44	G
	B1951993	MT B1951993	12200.00	12345.96	-1.18	2.6840	0.4025	3.0144	3.0865	-2.34	2.5321	84.00	-5.66	0.4823	16.00	19.83	G
	C1954793	MT C1954793	8090.00	8111.45	-0.26	2.7040	0.5406	3.1884	3.2446	-1.73	2.5507	80.00	-5.67	0.6377	20.00	17.96	G
97-1	MT_1_A1907	MT_1_A1907	251.00	254.40	-1.34	0.0581	0.0055	0.0615	0.0636	-3.30	0.0554	90.00	-4.73	0.0062	10.00	11.82	P
	MT_1_B2033	MT_1_B2033	265.00	272.80	-2.86	0.0586	0.0096	0.0657	0.0682	-3.67	0.0552	84.00	-5.82	0.0105	16.00	9.50	P
	MT_1_C2163	MT_1_C2163	178.00	182.00	-2.20	0.0568	0.0160	0.0707	0.0728	-2.88	0.0530	75.00	-6.65	0.0177	25.00	10.47	G
	MT_2_A1907	MT_2_A1907	486.00	502.40	-3.26	0.1160	0.0096	0.1211	0.1256	-3.58	0.1090	90.00	-6.04	0.0121	10.00	26.15	P
	MT_2_B2033	MT_2_B2033	518.00	536.80	-3.50	0.1171	0.0171	0.1291	0.1342	-3.80	0.1110	86.00	-5.19	0.0181	14.00	5.70	P
	MT_2_C2163	MT_2_C2163	344.00	355.50	-3.23	0.1151	0.0271	0.1359	0.1422	-4.43	0.1074	79.00	-6.72	0.0285	21.00	5.31	G
	MT_3_A1307	MT_3_A1307	10900.00	10765.20	1.25	2.3004	0.3909	2.6693	2.6913	-0.82	2.2689	85.00	-1.37	0.4004	15.00	2.43	P
	MT_3_B1433	MT_3_B1433	11500.00	11412.00	0.77	2.3011	0.5519	2.8252	2.8530	-0.97	---	---	-1.78	---	---	---	P
	MT_3_C6363	MT_3_C6363	7540.00	7560.25	-0.27	2.7003	0.3238	3.0098	3.0241	-0.47	2.6787	89.00	-0.80	0.3311	11.00	2.25	G
97-2	MT_1_A2911	MT_1_A2911	246.00	264.40	-6.96	0.0588	0.0073	0.0607	0.0661	-8.17	0.0534	88.00	-9.16	0.0073	12.00	-0.22	G
	MT_1_B3039	MT_1_B3039	256.00	276.00	-7.25	0.0580	0.0110	0.0625	0.0690	-9.42	0.0519	83.00	-10.56	0.0106	17.00	-3.41	G
	MT_1_C3167	MT_1_C3167	174.00	183.75	-5.31	0.0578	0.0157	0.0685	0.0735	-6.80	0.0527	77.00	-8.75	0.0158	23.00	0.35	G
	MT_2_A2911	MT_2_A2911	484.00	512.40	-5.54	0.1173	0.0108	0.1205	0.1281	-5.93	0.1097	91.00	-6.52	0.0108	9.00	0.42	G
	MT_2_B3039	MT_2_B3039	501.00	528.80	-5.26	0.1164	0.0158	0.1217	0.1322	-7.94	0.1059	87.00	-9.04	0.0158	13.00	0.13	G
	MT_2_C3167	MT_2_C3167	334.00	358.00	-6.70	0.1171	0.0261	0.1324	0.1432	-7.54	0.1059	80.00	-9.55	0.0265	20.00	1.46	G
	MT_3_A2911	MT_3_A2911	10800.00	10760.80	0.36	2.2996	0.3910	2.6673	2.6902	-0.85	2.2672	85.00	-1.41	0.4001	15.00	2.43	G
	MT_3_B3039	MT_3_B3039	11400.00	11411.60	-0.10	2.2996	0.5520	2.8300	2.8529	-0.80	2.2640	80.00	-1.55	0.5660	20.00	2.30	G
	MT_3_C3167	MT_3_C3167	6510.00	6563.75	-0.82	2.3016	0.3240	2.5965	2.6255	-1.10	2.2590	87.00	-1.85	0.3375	13.00	4.21	G
98-1	MT_1_A6523	MT_1_A6523	184.00	189.71	-3.01	0.0593	0.0071	0.0628	0.0664	-5.42	0.0553	88.00	-6.81	0.0075	12.00	6.14	G
	MT_1_B6650	MT_1_B6650	163.00	173.25	-5.92	0.0584	0.0109	0.0643	0.0693	-7.22	0.0534	83.00	-8.61	0.0109	17.00	0.28	G
	MT_1_C6779	MT_1_C6779	229.00	246.00	-6.91	0.0584	0.0154	0.0681	0.0738	-7.72	0.0524	77.00	-10.21	0.0157	23.00	1.71	G
	MT_2_A6422	MT_2_A6422	340.00	359.71	-5.48	0.1163	0.0096	0.1179	0.1259	-6.35	0.1073	91.00	-7.75	0.0106	9.00	10.53	G
	MT_2_B6351	MT_2_B6351	313.00	333.25	-6.08	0.1149	0.0184	0.1244	0.1333	-6.68	0.1057	85.00	-7.97	0.0187	15.00	1.41	G
	MT_2_C6278	MT_2_C6278	442.00	472.67	-6.49	0.1153	0.0265	0.1318	0.1418	-7.05	0.1054	80.00	-8.55	0.0264	20.00	-0.53	G
	MT_3_A5123	MT_3_A5123	7570.00	7695.71	-1.63	2.3023	0.3912	2.6574	2.6935	-1.34	2.2588	85.00	-1.89	0.3986	15.00	1.89	G
	MT_3_B6950	MT_3_B6950	8100.00	8124.50	-0.30	2.6987	0.5511	3.2096	3.2498	-1.24	2.6640	83.00	-1.29	0.5456	17.00	-0.99	G
	MT_3_C7079	MT_3_C7079	9550.00	10082.00	-5.28	2.7003	0.3243	2.9219	3.0246	-3.40	2.6005	89.00	-3.70	0.3214	11.00	-0.89	P
Median					-3.50					-4.44			-6.76			6.14	
25th percentile					-5.51					-6.49			-9.07			1.58	
75th percentile					-1.26					-2.76			-5.54			19.30	
F-pseudosigma					3.15					2.77			2.61			13.14	
Interquartile range					4.25					3.73			3.53			17.72	

[1]Comments: Good (G) and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 23. Summary results for Sediment Laboratory Quality-Assurance studies in the Albuquerque, New Mexico, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18811493	NM A18811493	142.00	N/A	N/A	0.0490	0.0051	0.0499	0.0541	-7.76	0.0429	86.00	-12.42	0.0070	14.00	36.98	G
	B18812293	NM B18812293	162.00	N/A	N/A	0.0500	0.0082	0.0568	0.0582	-2.41	0.0460	81.00	-7.98	0.0108	19.00	31.61	G
	C18819493	NM C18819493	169.00	N/A	N/A	0.0490	0.0105	0.0591	0.0595	-0.67	0.0443	75.00	-9.54	0.0148	25.00	40.71	G
	A1745293	NM A1745293	592.00	N/A	N/A	0.1990	0.0200	0.2073	0.2190	-5.34	0.1762	85.00	-11.45	0.0311	15.00	55.48	G
	B1749893	NM B1749893	623.00	N/A	N/A	0.2010	0.0302	0.2180	0.2312	-5.71	0.1788	82.00	-11.06	0.0392	18.00	29.93	G
	C17418393	NM C17418393	623.00	N/A	N/A	0.1980	0.0402	0.2182	0.2382	-8.40	0.1702	78.00	-14.04	0.0480	22.00	19.41	G
	A194893	NM A194893	7300.00	N/A	N/A	2.1920	0.4381	2.5557	2.6301	-2.83	1.9423	76.00	-11.39	0.6134	24.00	40.01	G
	B1948093	NM B1948093	7090.00	N/A	N/A	2.2190	0.3335	2.4828	2.5525	-2.73	1.9614	79.00	-11.61	0.5214	21.00	56.34	G
	C1957793	NM C1957793	8310.00	N/A	N/A	2.7100	0.2709	2.8825	2.9809	-3.30	2.4213	84.00	-10.65	0.4612	16.00	70.25	G
96-2	A190893	NM A190893	433.00	450.72	-3.93	0.0980	0.0147	0.1071	0.1127	-4.95	0.0889	83.00	-9.29	0.0182	17.00	24.03	G
	B19011893	NM B19011893	429.00	444.56	-3.50	0.1010	0.0101	0.1077	0.1111	-3.10	0.0915	85.00	-9.36	0.0162	15.00	59.32	G
	C19015393	NM C19015393	307.00	305.98	0.33	0.1020	0.0204	0.1178	0.1224	-3.75	0.0942	80.00	-7.61	0.0236	20.00	15.55	G
	A1933993	NM A1933993	1265.00	1376.24	-8.08	0.2990	0.0451	0.3186	0.3441	-7.40	0.2644	83.00	-11.56	0.0542	17.00	20.20	G
	B19311293	NM B19311293	1252.00	1322.92	-5.36	0.3000	0.0307	0.3147	0.3307	-4.85	0.2675	85.00	-10.84	0.0472	15.00	53.61	G
	C19316193	NM C19316193	866.00	906.10	-4.43	0.3020	0.0604	0.3474	0.3624	-4.15	0.2744	79.00	-9.12	0.0730	21.00	20.70	G
	A1943693	NM A1943693	9586.00	9593.12	-0.07	2.1800	0.2183	2.3708	2.3983	-1.15	2.0389	86.00	-6.47	0.3319	14.00	52.06	G
	B1953993	NM B1953993	12134.00	12428.92	-2.37	2.7020	0.4052	3.0515	3.1072	-1.79	2.4107	79.00	-10.78	0.6408	21.00	58.14	G
	C1956593	NM C1956593	9182.00	8026.68	14.39	2.6750	0.5357	3.1329	3.2107	-2.42	2.4123	77.00	-9.82	0.7257	23.00	34.52	G
97-1	NM_1_A2208	NM_1_A2208	275.00	256.40	7.25	0.0585	0.0056	0.0580	0.0641	-9.52	0.0505	87.00	-13.74	0.0075	13.00	34.64	P
	NM_1_B2332	NM_1_B2332	271.00	270.40	0.22	0.0578	0.0098	0.0659	0.0676	-2.51	0.0554	84.00	-4.23	0.0105	16.00	7.59	G
	NM_1_C2464	NM_1_C2464	161.00	183.75	-12.38	0.0576	0.0159	0.0668	0.0735	-9.12	0.0508	76.00	-11.86	0.0160	24.00	0.83	G
	NM_2_A2208	NM A1933993	547.00	497.60	9.93	0.1146	0.0098	0.1191	0.1244	-4.26	0.1084	91.00	-5.43	0.0107	9.00	9.38	P
	NM_2_B2332	NM_2_B2332	522.00	532.40	-1.95	0.1165	0.0166	0.1262	0.1331	-5.18	0.1085	86.00	-6.84	0.0177	14.00	6.43	P
	NM_2_C2464	NM_2_C2464	326.00	356.00	-8.43	0.1159	0.0265	0.1349	0.1424	-5.27	0.1066	79.00	-8.05	0.0283	21.00	6.90	G
	NM_3_A1508	NM_3_A1508	10756.00	10759.20	-0.03	2.2990	0.3908	2.5794	2.6898	-4.10	2.1667	84.00	-5.75	0.4127	16.00	5.60	P
	NM_3_B1632	NM_3_B1632	11509.00	11404.80	0.91	2.2996	0.5516	2.8635	2.8512	0.43	2.2908	80.00	-0.38	0.5727	20.00	3.83	P
	NM_3_C6464	NM_3_C6464	7455.00	7555.00	-1.32	2.6987	0.3233	2.9986	3.0220	-0.77	2.6688	89.00	-1.11	0.3298	11.00	2.02	G
97-2	NM_1_A3212	NM_1_A3212	284.00	262.00	8.40	0.0580	0.0075	0.0637	0.0655	-2.75	0.0510	80.00	-12.14	0.0127	20.00	69.87	G
	NM_1_B3340	NM_1_B3340	254.00	274.80	-7.57	0.0581	0.0106	0.0629	0.0687	-8.44	0.0503	80.00	-13.39	0.0126	20.00	18.68	P
	NM_1_C3468	NM_1_C3468	173.00	182.00	-4.95	0.0574	0.0154	0.0683	0.0728	-6.18	0.0519	76.00	-9.57	0.0164	24.00	6.44	G
	NM_2_A3212	NM_2_A3212	453.00	505.20	-10.33	0.1173	0.0090	0.1145	0.1263	-9.34	0.0950	83.00	-18.98	0.0195	17.00	116.28	P
	NM_2_B3340	NM_2_B3340	524.00	528.40	-0.83	0.1160	0.0161	0.1245	0.1321	-5.75	0.1046	84.00	-9.84	0.0199	16.00	23.73	P
	NM_2_C3468	NM_2_C3468	325.00	352.75	-7.87	0.1153	0.0258	0.1346	0.1411	-4.61	0.1036	77.00	-10.11	0.0310	23.00	19.99	G
	NM_3_A3212	---	---	10766.80	---	2.3002	0.3910	0.0000	2.6917	---	---	---	---	---	---	---	---
	NM_3_B3340	NM_3_B3340	10942.00	11404.00	-4.05	2.3002	0.5520	2.7508	2.8510	-3.51	2.0631	75.00	-10.31	0.6877	25.00	24.85	P
	NM_3_C3468	NM_3_C3468	6483.00	6560.25	-1.18	2.2994	0.3240	2.5880	2.6241	-1.38	2.1998	85.00	-4.33	0.3882	15.00	19.56	G
98-1	NM_1_A6824	NM_1_A6824	162.00	182.86	-11.41	0.0567	0.0073	0.0577	0.0640	-9.84	0.0444	77.00	-21.64	0.0133	23.00	81.79	G
	NM_1_B6949	NM_1_B6949	142.00	172.25	-17.56	0.0583	0.0106	0.0572	0.0689	-16.98	0.0349	61.00	-40.15	0.0223	39.00	110.45	G
	NM_1_C7080	NM_1_C7080	218.00	240.33	-9.29	0.0575	0.0146	0.0662	0.0721	-8.18	0.0497	75.00	-13.65	0.0166	25.00	13.36	G
	NM_2_A6121	NM_2_A6121	330.00	357.71	-7.75	0.1155	0.0097	0.1178	0.1252	-5.91	0.1025	87.00	-11.27	0.0153	13.00	57.88	G
	NM_2_B6052	NM_2_B6052	303.00	333.50	-9.15	0.1175	0.0159	0.1214	0.1334	-9.00	0.0801	66.00	-31.81	0.0413	34.00	159.60	G
	NM_2_C5977	NM_2_C5977	448.00	469.67	-4.61	0.1154	0.0255	0.1367	0.1409	-2.98	0.1094	80.00	-5.23	0.0273	20.00	7.22	G
	NM_3_A5224	NM_3_A5224	7316.00	7690.86	-4.87	2.3017	0.3901	2.6190	2.6918	-2.70	2.0690	79.00	-10.11	0.5500	21.00	40.99	G
	NM_3_B7149	NM_3_B7149	8124.00	8131.25	-0.09	2.7010	0.5515	3.2068	3.2525	-1.41	2.5013	78.00	-7.39	0.7055	22.00	27.92	G
	NM_3_C7280	NM_3_C7280	9826.00	10076.67	-2.49	2.6988	0.3242	2.9722	3.0230	-1.68	2.6155	88.00	-3.09	0.3567	12.00	10.01	G
Median					-3.93					-4.21			-10.11			26.39	
25th percentile					-7.81					-6.49			-11.67			12.52	
75th percentile					-0.08					-2.66			-7.55			54.08	
F-pseudosigma					5.73					2.84			3.05			30.81	
Interquartile range					7.73					3.83			4.12			41.56	

[1]Comments: Good (G) and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 24. Summary results for Sediment Laboratory Quality-Assurance studies in the Ithaca, New York (contract) laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
97-1	NY_1_A3412	NY_1_A3412	189.00	256.00	-26.17	0.0579	0.0061	---	0.0640	---	---	---	---	---	---	---	G
	NY_1_B3528	NY_1_B3528	192.90	252.40	-23.57	0.0566	0.0065	---	0.0631	---	---	---	---	---	---	---	G
	NY_1_C3668	NY_1_C366?	125.40	183.25	-31.57	0.0578	0.0155	---	0.0733	---	---	---	---	---	---	---	P
	NY_2_A3412	NY_2_A3412	397.20	507.60	-21.75	0.1168	0.0101	---	0.1269	---	---	---	---	---	---	---	G
	NY_2_B3528	NY_2_B3528	396.20	499.20	-20.63	0.1149	0.0099	---	0.1248	---	---	---	---	---	---	---	G
	NY_2_C3668	NY_2_C3668	248.20	354.25	-29.94	0.1147	0.0270	---	0.1417	---	---	---	---	---	---	---	G
	NY_3_A2613	NY_3_A2613	8820.10	10762.00	-18.04	2.2991	0.3914	---	2.6905	---	---	---	---	---	---	---	G
	NY_3_B2726	NY_3_B2726	8637.30	10762.00	-19.74	2.3000	0.3905	---	2.6905	---	---	---	---	---	---	---	G
	NY_3_C6868	NY??	---	7728.75	---	2.7003	0.3912	---	3.0915	---	---	---	---	---	---	---	P
97-2	NY_1_A4416	NY_1_A4416	224.00	263.60	-15.02	0.0592	0.0067	---	0.0659	---	---	---	---	---	---	---	G
	NY_1_B4544	NY_1_B4544	228.00	280.40	-18.69	0.0590	0.0111	---	0.0701	---	---	---	---	---	---	---	G
	NY_1_C4672	NY_1_C4672	219.90	187.75	17.12	0.0583	0.0168	---	0.0751	---	---	---	---	---	---	---	P
	NY_2_A4416	NY_2_A4416	440.00	502.80	-12.49	0.1168	0.0089	---	0.1257	---	---	---	---	---	---	---	G
	NY_2_B4544	NY_2_B4544	440.00	531.60	-5.57	0.1167	0.0162	---	0.1329	---	---	---	---	---	---	---	G
	NY_2_C4672	NY_2_C4672	331.90	356.00	-6.77	0.1168	0.0256	---	0.1424	---	---	---	---	---	---	---	G
	NY_3_A4416	NY_3_A4416	10730.00	10765.20	-0.33	2.3007	0.3910	---	2.6913	---	---	---	---	---	---	---	G
	NY_3_B4544	NY_3_B4544	11362.00	11408.00	-0.40	2.2996	0.3910	---	2.8520	---	---	---	---	---	---	---	G
	NY_3_C4672	NY_3_C4672	7940.00	6558.50	21.06	2.3003	0.3240	---	2.6234	---	---	---	---	---	---	---	G
98-1	NY_1_A7125	NY_1_A7125	132.00	182.00	-27.47	0.0577	0.0060	---	0.0637	---	---	---	---	---	---	---	G
	NY_1_B7248	NY_1_B7248	136.00	169.75	-19.88	0.0574	0.0105	---	0.0679	---	---	---	---	---	---	---	M
	NY_1_C7281	NY_1_C7381	168.00	242.00	-30.58	0.0575	0.0151	---	0.0726	---	---	---	---	---	---	---	G
	NY_1_A7125	NY_1_A7125	136.00	182.00	-25.27	0.0577	0.0060	---	0.0637	---	---	---	---	---	---	---	G
	NY_1_B7248	NY_1_B7248	152.00	169.75	-10.46	0.0574	0.0105	---	0.0679	---	---	---	---	---	---	---	M
	NY_1_C7281	NY_1_C7281	188.00	242.00	-22.31	0.0575	0.0151	---	0.0726	---	---	---	---	---	---	---	G
	NY_2_A5820	WA_2_A4917	288.00	357.71	-19.49	0.1158	0.0094	---	0.1252	---	---	---	---	---	---	---	G
	NY_2_B5753	WA_2_B4856	248.00	328.00	-24.39	0.1146	0.0166	---	0.1312	---	---	---	---	---	---	---	G
	NY_2_C5676	WA_2_C4773	376.00	477.67	-21.28	0.1166	0.0267	---	0.1433	---	---	---	---	---	---	---	G
	NY_2_A5820	WA_2_A4917	312.00	357.71	-12.78	0.1158	0.0094	---	0.1252	---	---	---	---	---	---	---	G
	NY_2_B5753	WA_2_B4856	280.00	328.00	-14.63	0.1146	0.0166	---	0.1312	---	---	---	---	---	---	---	G
	NY_2_C5676	WA_2_C4773	400.00	477.67	-16.26	0.1166	0.0267	---	0.1433	---	---	---	---	---	---	---	G
	NY_3_A5325	NY_3_A5325	6160.00	7694.57	-19.94	2.3019	0.3912	---	2.6931	---	---	---	---	---	---	---	P
	NY_3_B7348	NY_3_B7348	6992.00	8132.75	-14.03	2.7013	0.5518	---	3.2531	---	---	---	---	---	---	---	M
	NY_3_C7481	NY_3_C7481	10312.00	10089.00	2.21	2.7020	0.3247	---	3.0267	---	---	---	---	---	---	---	M
	NY_3_A5325	NY_3_C5325	6708.00	7694.57	-12.82	2.3019	0.3912	---	2.6931	---	---	---	---	---	---	---	P
	NY_3_B7348	NY_3_C7348	7580.00	8132.75	-6.80	2.7013	0.5518	---	3.2531	---	---	---	---	---	---	---	M
	NY_3_C7481	NY_3_C7481	10860.00	10089.00	7.64	2.7020	0.3247	---	3.0267	---	---	---	---	---	---	---	M
Median					-18.04												
25th percentile					-22.03												
75th percentile					-8.63												
F-pseudosigma					9.94												
Interquartile range					13.41												

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 25. Summary results for Sediment Laboratory Quality-Assurance studies in the Columbus, Ohio (contract) laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18814793	OH A18814793	138.00	N/A	N/A	0.0510	0.0051	0.0484	0.0561	-13.76	---	---	---	---	---	---	G
	B18817493	OH B18817493	131.90	N/A	N/A	0.0490	0.0073	0.0462	0.0563	-17.89	---	---	---	---	---	---	G
	C18819093	OH C18819093	151.70	N/A	N/A	0.0510	0.0110	0.0532	0.0620	-14.24	---	---	---	---	---	---	G
	A1749593	OH A1749593	587.50	N/A	N/A	0.2010	0.0201	0.2055	0.2211	-7.05	---	---	---	---	---	---	G
	B17416293	OH B17416293	611.50	N/A	N/A	0.1980	0.0307	0.2142	0.2287	-6.36	---	---	---	---	---	---	G
	C17417893	OH C17417893	609.00	N/A	N/A	0.2000	0.0405	0.2136	0.2405	-11.20	---	---	---	---	---	---	G
	A1942793	OH A1942793	6877.70	N/A	N/A	2.2150	0.4439	1.4610	2.6589	-45.05	---	---	---	---	---	---	G
	B194693	OH B194693	6695.20	N/A	N/A	2.1890	0.3284	2.3340	2.5174	-7.28	---	---	---	---	---	---	G
	C1955193	OH C1955193	7892.30	N/A	N/A	2.6980	0.2703	2.7623	2.9683	-6.94	---	---	---	---	---	---	G
96-2	A1907193	OH A1907193	403.90	460.28	-12.25	0.1000	0.0151	0.0938	0.1151	-18.49	---	---	---	---	---	---	M
	B19015893	OH B19015893	406.70	431.64	-5.78	0.0980	0.0099	0.0982	0.1079	-9.03	---	---	---	---	---	---	P
	C19019693	OH C19019693	310.40	303.05	2.43	0.1010	0.0202	0.1062	0.1212	-12.39	---	---	---	---	---	---	P
	A1931293	OH A1931293	1325.70	1370.00	-3.23	0.2980	0.0445	0.3245	0.3245	-5.25	---	---	---	---	---	---	M
	B1935893	OH B1935893	1281.70	1336.12	-4.07	0.3030	0.0310	0.3897	0.3340	-7.29	---	---	---	---	---	---	P
	C19319693	OH C19319693	956.50	903.25	5.90	0.3010	0.0603	0.3387	0.3613	-6.26	---	---	---	---	---	---	G
	A1944893	OH A1944893	9588.60	9715.92	-1.31	2.2080	0.2210	2.3291	2.4290	-4.11	---	---	---	---	---	---	P
	B1953293	OH B1953293	11747.60	12305.16	-4.53	2.6750	0.4013	2.8993	3.0763	-5.75	---	---	---	---	---	---	P
	C1956493	OH C1956493	8012.10	8121.23	-1.34	2.7070	0.5415	3.1688	3.2485	-2.45	---	---	---	---	---	---	G
97-1	OH_1_A2509	OH_1_A2509	246.60	255.20	-3.37	0.0582	0.0056	0.0609	0.0638	-4.55	---	---	---	---	---	---	G
	OH_1_B2631	OH_1_B2631	260.10	277.20	-6.17	0.0588	0.0105	0.0645	0.0693	-6.93	---	---	---	---	---	---	G
	OH_1_C2765	OH_1_C2765	174.20	181.75	-4.15	0.0572	0.0155	0.0688	0.0727	-5.36	---	---	---	---	---	---	G
	OH_2_A2509	OH_2_A2509	485.90	507.60	-4.28	0.1174	0.0095	0.1205	0.1269	-5.04	---	---	---	---	---	---	G
	OH_2_B2631	OH_2_B2631	513.40	532.00	-3.50	0.1163	0.0167	0.1279	0.1330	-3.83	---	---	---	---	---	---	G
	OH_2_C2765	OH_2_C2765	345.40	359.00	-3.79	0.1165	0.0271	0.1361	0.1436	-5.22	---	---	---	---	---	---	M
	OH_3_A1709	OH_3_A1709	10682.00	10758.00	-0.71	2.2990	0.3905	2.6705	2.6895	-0.71	---	---	---	---	---	---	G
	OH_3_B1831	OH_3_B18?	11452.00	11406.40	0.40	2.2993	0.5523	2.7944	2.8516	-2.01	---	---	---	---	---	---	P
	OH_3_C6565	OH_3_C6565	7499.50	7556.75	-0.76	2.6986	0.3241	2.9848	3.0227	-1.25	---	---	---	---	---	---	M
97-2	OH_1_A3513	OH_1_A3513	249.00	262.80	-5.25	0.0589	0.0068	0.0615	0.0657	-6.39	---	---	---	---	---	---	P
	OH_1_B3641	OH_1_B3641	272.60	272.80	-0.07	0.0577	0.0105	0.0676	0.0682	-0.88	---	---	---	---	---	---	G
	OH_1_C3769	OH_1_C3769	183.10	184.50	-0.76	0.0593	0.0145	0.0724	0.0738	-1.90	---	---	---	---	---	---	G
	OH_2_A3513	OH_2_A3513	480.80	497.60	-3.38	0.1152	0.0092	0.1190	0.1244	-4.34	---	---	---	---	---	---	G
	OH_2_B3641	OH_2_B3641	499.20	537.60	-7.14	0.1161	0.0183	0.1221	0.1344	-9.15	---	---	---	---	---	---	M
	OH_2_C3769	OH_2_C3769	344.70	362.25	-4.84	0.1173	0.0276	0.1362	0.1449	-6.00	---	---	---	---	---	---	G
	OH_3_A3513	OH_3_A3513	10600.00	10760.80	-1.49	2.3002	0.3910	2.6606	2.6902	-1.10	---	---	---	---	---	---	M
	OH_3_B3641	OH_3_B3641	11263.60	11408.80	-1.27	2.3017	0.5520	2.8159	2.8522	-1.27	---	---	---	---	---	---	M
	OH_3_C3769	OH_3_C3769	6457.50	6559.50	-1.55	2.2995	0.3240	2.5750	2.6238	-1.86	---	---	---	---	---	---	M
98-1	OH_1_A7426	OH_1_A7426	173.80	184.29	-5.69	0.0580	0.0065	0.0602	0.0645	-6.67	---	---	---	---	---	---	M
	OH_1_B7547	OH_1_B7547	162.20	172.25	-5.83	0.0588	0.0101	0.0640	0.0689	-7.11	---	---	---	---	---	---	G
	OH_1_C7682	OH_1_C7682	242.00	247.67	-2.29	0.0592	0.0151	0.0716	0.0743	-3.63	---	---	---	---	---	---	G
	OH_2_A5519	OH_2_A5519	332.50	357.71	-7.05	0.1152	0.0100	0.1153	0.1252	-7.91	---	---	---	---	---	---	G
	OH_2_B5454	OH_2_B5454	287.00	328.75	-12.70	0.1149	0.0166	0.1141	0.1315	-13.23	---	---	---	---	---	---	G
	OH_2_C5375	OH_2_C5375	473.10	477.33	-0.89	0.1157	0.0275	0.1377	0.1432	-3.84	---	---	---	---	---	---	G
	OH_3_A5426	OH_3_A5426	7553.20	7694.86	-1.84	2.3019	0.3913	2.6391	2.6932	-2.01	---	---	---	---	---	---	G
	OH_3_B7547	OH_3_B8132	8041.70	8145.25	-1.27	2.7063	0.5518	3.2020	3.2581	-1.72	---	---	---	---	---	---	G
	OH_3_C7682	OH_3_C8359	10010.10	10099.67	-0.89	2.7054	0.3245	2.9830	3.0299	-1.55	---	---	---	---	---	---	M
Median					-3.30					-5.75							
25th percentile					-4.95					-7.29							
75th percentile					-1.18					-2.45							
F-pseudosigma					2.80					3.59							
Interquartile range					3.77					4.84							

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 26. Summary results for Sediment Laboratory Quality-Assurance studies in the Guaynabo, Puerto Rico, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A18812493	PR A18812493	169.20	N/A	N/A	0.0500	0.0051	0.0605	0.0551	9.80	0.0575	95.00	14.95	0.0030	5.00	-40.69	G
	B18818293	PR B18818293	165.90	N/A	N/A	0.0500	0.0080	0.0581	0.0580	0.17	0.0501	86.20	0.16	0.0080	13.80	0.22	G
	C18819393	PR C18819393	169.30	N/A	N/A	0.0490	0.0101	0.0495	0.0591	-16.24	0.0413	83.50	-15.65	0.0082	16.50	-19.13	G
	A1746393	PR A1746393	613.20	N/A	N/A	0.1990	0.0202	0.2149	0.2192	-1.96	0.1923	89.50	-3.35	0.0226	10.50	11.71	G
	B17414593	PR B17414593	648.80	N/A	N/A	0.1990	0.0313	0.2271	0.2303	-1.39	0.1976	87.00	-0.72	0.0295	13.00	-5.68	G
	C17414693	PR C17414693	671.10	N/A	N/A	0.2000	0.0408	0.2349	0.2408	-2.45	0.1912	81.40	-4.40	0.0437	18.60	7.09	G
	A1944393	PR A1944393	7400.00	N/A	N/A	2.1930	0.4387	2.5945	2.6317	-1.41	2.3766	91.60	8.37	0.2179	8.40	-50.32	G
	B1944693	PR B1944693	7084.00	N/A	N/A	2.1800	0.3276	2.4817	2.5076	-1.03	2.2087	89.00	1.32	0.2730	11.00	-16.67	G
	C1955493	PR C1955493	8275.00	N/A	N/A	2.6750	0.2685	2.8995	2.9435	-1.49	2.7081	93.40	1.24	0.1914	6.60	-28.73	G
96-2	A190293	PRA190293	664.00	460.16	44.30	0.1000	0.0150	0.1055	0.1150	-8.29	0.0897	85.00	-10.33	0.0158	15.00	5.22	P
	B1901193	PRB1901193	633.10	440.08	43.86	0.1000	0.0100	0.0989	0.1100	-10.11	0.0890	90.00	-10.99	0.0099	10.00	-1.30	P
	C1902893	PRC1902893	294.80	294.05	0.26	0.0980	0.0196	0.1147	0.1176	-2.48	0.0941	82.00	-4.03	0.0206	18.00	5.23	G
	A1934493	PRA1934493	1978.30	1393.88	41.93	0.3030	0.0455	0.3114	0.3485	-10.64	0.2678	86.00	-11.62	0.0436	14.00	-4.12	P
	B1933893	PRB1933893	2008.00	1311.32	53.13	0.2980	0.0298	0.3005	0.3278	-8.34	0.2705	90.00	-9.24	0.0301	10.00	0.74	P
	C1935293	PRC1935293	893.00	903.03	-1.11	0.3010	0.0602	0.3469	0.3612	-3.96	0.2845	82.00	-5.50	0.0624	18.00	3.71	G
	A1945293	PRA1945293	12639.00	9719.84	30.03	2.2090	0.2210	2.3323	2.4300	-4.02	2.0991	89.00	-4.98	0.2332	11.00	5.55	M
	B1951393	PRB1951393	15966.00	12304.88	29.75	2.6750	0.4012	2.9815	3.0762	-3.08	2.5343	85.00	-5.26	0.4472	15.00	11.47	P
	C1952393	PRC1952393	8403.00	8172.18	2.82	2.7240	0.5449	3.2365	3.2689	-0.99	2.6539	82.00	-2.57	0.5826	18.00	6.92	G
97-1	PR_1_A2810	PR_1_A2810	244.00	251.60	-3.02	0.0574	0.0055	0.0605	0.0629	-3.82	0.0547	90.41	-4.71	0.0058	9.59	5.49	G
	PR_1_B2930	PR_1_B2930	257.00	302.40	-15.01	0.0656	0.0100	0.0632	0.0756	-16.40	0.0535	84.65	-18.45	0.0097	15.35	-2.99	G
	PR_1_C3066	PR_1_C3066	161.00	182.00	-11.54	0.0569	0.0159	0.0639	0.0728	-12.23	0.0485	75.90	-14.76	0.0154	24.10	-3.15	P
	PR_2_A2810	PR_2_A2810	468.00	500.40	-6.47	0.1153	0.0098	0.1137	0.1251	-9.11	0.1048	92.17	-9.11	0.0089	7.83	-9.16	P
	PR_2_B2930	PR_2_B2930	487.00	527.60	-7.70	0.1153	0.0166	0.1177	0.1319	-10.77	0.1021	86.75	-11.44	0.0156	13.25	-6.05	M
	PR_2_C3066	PR_2_C3066	346.00	355.75	-2.74	0.1157	0.0266	0.1369	0.1423	-3.79	0.1107	80.86	-4.32	0.0262	19.14	-1.49	G
	PR_3_A1910	PR_3_A1910	11800.00	10760.00	9.67	2.2991	0.3909	2.8391	2.6900	5.54	2.2923	80.74	-0.30	0.5468	19.26	39.89	P
	PR_3_B2030	PR_3_B2030	10800.00	11404.80	-5.30	2.2997	0.5515	2.6533	2.8512	-6.94	2.2744	85.72	-1.10	0.3789	14.28	-31.30	P
	PR_3_C6666	PR_3_C6666	8136.00	7554.75	7.69	2.6986	0.3233	3.2374	3.0219	7.13	2.9104	89.90	7.85	0.3270	10.10	1.14	G
97-2	PR_1_A3814	PR_1_A3814	251.50	255.20	-1.45	0.0575	0.0063	0.0619	0.0638	-2.98	---	---	---	---	---	---	P
	PR_1_B3942	PR_1_B3942	253.10	267.20	-5.28	0.0574	0.0094	0.0629	0.0668	-5.84	---	---	---	---	---	---	P
	PR_1_C4070	PR_1_C4070	173.70	185.25	-6.23	0.0577	0.0164	0.0688	0.0741	-7.15	0.0568	82.60	-1.51	0.0120	17.40	-27.00	G
	PR_2_A3814	PR_2_A3814	472.80	504.80	-6.34	0.1175	0.0087	0.1121	0.1262	-11.17	0.1028	91.70	-12.51	0.0093	8.30	6.95	M
	PR_2_B3942	PR_2_B3942	512.90	529.20	-3.08	0.1160	0.0163	0.1270	0.1323	-4.01	---	0.00	---	---	0.00	---	P
	PR_2_C4070	PR_2_C4070	321.00	357.75	-10.27	0.1162	0.0269	0.1269	0.1431	-11.32	---	0.00	---	---	0.00	---	M
	PR_3_A3814	No ID Number	10900.00	10758.40	1.32	2.2985	0.3910	2.6643	2.6896	-0.94	2.2806	85.60	-0.78	0.3837	14.40	-1.90	M
	PR_3_B3942	PR_3_B3942	12000.00	11412.40	5.15	2.3003	0.5520	2.7901	2.8531	-2.21	2.2544	80.80	-2.00	0.5357	19.20	-3.09	M
	PR_3_C4070	PR_3_C4070	7000.00	6557.00	6.76	2.2996	0.3240	2.7752	2.6228	5.81	---	0.00	---	---	0.00	---	M
98-1	PR_1_A7727	PR_1_A7727	180.50	188.57	-4.28	0.0595	0.0065	0.0626	0.0660	-5.15	---	---	---	---	---	---	G
	PR_1_B7846	PR_1_B7846	157.80	175.25	-9.96	0.0594	0.0107	0.0626	0.0701	-10.70	---	---	---	---	---	---	G
	PR_1_C7983	PR_1_C7983	247.10	253.67	-2.59	0.0594	0.0167	0.0735	0.0761	-3.42	---	---	---	---	---	---	G
	PR_1_D0229	PR_1_D0229	187.40	195.71	-4.25	0.0582	0.0103	0.0652	0.0685	-4.82	---	---	---	---	---	---	G
	PR_1_E1060	PR_1_E1060	232.50	242.67	-4.19	0.0581	0.0147	0.0691	0.0728	-5.08	---	---	---	---	---	---	G
	PR_2_A5218	PR_2_A5218	339.70	357.43	-4.96	0.1164	0.0087	0.1182	0.1251	-5.52	---	---	---	---	---	---	P
	PR_2_B5155	PR_2_B5155	304.90	328.00	-7.04	0.1154	0.0158	0.1209	0.1312	-7.85	---	---	---	---	---	---	G
	PR_2_C5074	PR_2_C5074	456.30	473.00	-3.53	0.1155	0.0264	0.1357	0.1419	-4.37	---	---	---	---	---	---	G
	PR_2_D0229	PR_2_D0229	368.70	377.43	-2.31	0.1163	0.0158	0.1280	0.1321	-3.10	---	---	---	---	---	---	G
	PR_2_E1060	PR_2_E1060	473.00	473.67	-0.14	0.1146	0.0275	0.1406	0.1421	-1.06	---	---	---	---	---	---	G
	PR_3_A5527	PR_3_A5527	8200.00	7696.57	6.54	2.3023	0.3915	2.8632	2.6938	6.29	---	---	---	---	---	---	M
	PR_3_B7746	PR_3_B7746	6720.00	8126.75	-17.31	2.6990	0.5517	2.6707	3.2507	-17.84	---	---	---	---	---	---	M
	PR_3_C7883	PR_3_C7883	10000.00	10081.00	-0.80	2.7009	0.3234	2.9935	3.0243	-1.02	---	---	---	---	---	---	G
	PR_3_D0229	PR_3_D0229	7986.00	8148.00	-1.99	2.3001	0.5517	2.8023	2.8518	-1.74	---	---	---	---	---	---	G
	PR_3_E8460	PR_3_E8460	15900.00	10088.67	57.60	2.7021	0.3245	4.7847	3.0266	58.09	---	---	---	---	---	---	G
Median					-2.45					-3.82			-4.32			-1.49	
25th percentile					-5.30					-8.07			-9.78			-7.60	
75th percentile					6.19					-1.40			-0.75			5.36	
F-pseudosigma					8.52					4.94			6.70			9.61	
Interquartile range					11.49					6.67			9.04			12.96	

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Table 27. Summary results for Sediment Laboratory Quality-Assurance studies in the Vancouver, Washington, laboratory

[mg/L, milligrams per liter; g, grams; <, less than; >, greater than; ---, no data; N/A, not applicable]

Study number	Actual vial shipping-ID	Reported vial number	Reported sediment concentration (mg/L)	Actual sediment concentration (mg/L)	Suspended-sediment concentration percent difference	Actual mass of fines (g)	Actual mass of sand (g)	Reported sediment mass (g)	Actual sediment mass (g)	Sediment mass percent difference	Reported fines net mass (g)	Reported Percentage <0.062	Fine-sand material mass percent difference	Reported sand net mass (g)	Reported Percentage >0.062	Sand-size material mass percent difference	Comments[1]
96-1	A1889293	WA A1889293	140.00	N/A	N/A	0.0490	0.0050	0.0513	0.0540	-5.00	0.0446	87.00	-8.92	0.0067	13.00	33.38	G
	B1889693	WA B1889693	159.00	N/A	N/A	0.0500	0.0079	0.0556	0.0579	-3.97	0.0467	84.00	-6.59	0.0089	16.00	12.61	G
	C18810093	WA C18810093	147.00	N/A	N/A	0.0490	0.0100	0.0587	0.0490	19.80	0.0475	81.00	-2.97	0.0112	19.00	11.98	G
	A1749693	WA A1749693	599.00	N/A	N/A	0.1980	0.0217	0.2088	0.2197	-4.96	0.1837	88.00	-7.20	0.0251	12.00	15.47	G
	B17414293	WA B17414293	630.00	N/A	N/A	0.2030	0.0297	0.2212	0.2327	-4.94	0.1880	85.00	-7.38	0.0332	15.00	11.72	G
	C17416993	WA C17416993	606.00	N/A	N/A	0.1980	0.0407	0.2106	0.2387	-11.77	0.1664	79.00	-15.97	0.0442	21.00	8.66	G
	A1941393	WA A1941393	7366.00	N/A	N/A	2.1950	0.4392	2.5625	2.6342	-2.72	2.0756	81.00	-5.44	0.4869	19.00	10.85	G
	B1953793	WA B1953793	8726.00	N/A	N/A	2.7000	0.4049	3.0368	3.1049	-2.19	2.5509	84.00	-5.52	0.4859	16.00	20.00	G
	C1957093	WA C1957093	8108.00	N/A	N/A	2.6800	0.2678	2.8285	2.9478	-4.05	2.5174	89.00	-6.07	0.3111	11.00	16.18	G
96-2	A1905893	WA A1905893	449.00	464.96	-3.43	0.1010	0.0152	0.1092	0.1162	-6.06	---	---	---	---	---	---	P
	B1908393	WA B1908393	427.00	441.48	-3.28	0.1000	0.0104	0.1022	0.1104	-7.40	---	---	---	---	---	---	P
	C19012093	WA C19012093	275.00	293.95	-6.45	0.0980	0.0196	0.1085	0.1176	-7.72	---	---	---	---	---	---	G
	A19319393	WA A19319393	1339.00	1365.72	-1.96	0.2970	0.0444	0.3268	0.3414	-4.28	---	---	---	---	---	---	P
	B1939393	WA B1939393	1275.00	1315.60	-3.09	0.2990	0.0299	0.3111	0.3289	-5.41	---	---	---	---	---	---	P
	C19317093	WA C19317093	1455.00	916.18	58.81	0.3010	0.0655	0.5719	0.3665	56.06	---	---	---	---	---	---	G
	A1942693	WA A1942693	9626.00	9596.52	0.31	2.1810	0.2181	2.3433	2.3991	-2.33	---	---	---	---	---	---	P
	B195493	WA B195493	12474.00	12387.92	0.69	2.6930	0.4040	3.0412	3.0970	-1.80	---	---	---	---	---	---	P
	C1955993	WA C1955993	7993.00	8041.45	-0.60	2.6800	0.5366	3.1566	3.2166	-1.86	---	---	---	---	---	---	G
97-1	WA_1_A3111	WA_1_A3111	252.00	250.80	0.48	0.0567	0.0060	0.0620	0.0627	-1.12	0.0539	87.00	-4.87	0.0081	13.00	34.33	P
	WA_1_B3229	WA_1_B3229	269.00	272.40	-1.25	0.0582	0.0099	0.0670	0.0681	-1.62	0.0563	84.00	-3.30	0.0107	16.00	8.28	G
	WA_1_C3367	WA_1_C3367	186.00	184.25	0.95	0.0582	0.0155	0.0730	0.0737	-0.95	0.0548	75.00	-5.93	0.0183	25.00	17.74	P
	WA_2_A3111	WA_2_A3111	501.00	507.20	-1.22	0.1172	0.0096	0.1230	0.1268	-3.00	0.1119	91.00	-4.50	0.0111	9.00	15.31	P
	WA_2_B3229	WA_2_B3229	462.00	929.60	-50.30	0.1159	0.1165	0.1130	0.2324	-51.38	0.1096	97.00	-5.43	0.0034	3.00	-97.09	P
	WA_2_C3367	WA_2_C3367	328.00	357.00	-8.12	0.1162	0.0266	0.1300	0.1428	-8.96	0.1014	78.00	-12.74	0.0156	12.00	-41.35	P
	WA_3_A2111	WA_3_A2111	10766.00	10761.20	0.04	2.2998	0.3905	2.6660	2.6903	-0.90	2.2661	85.00	-1.47	0.3999	15.00	2.41	P
	WA_3_B2229	WA_3_B2229	11514.00	11403.20	0.97	2.2992	0.5516	2.8260	2.8508	-0.87	2.2608	80.00	-1.67	0.5652	20.00	2.47	P
	WA_3_C6767	WA_3_C6767	7581.00	7561.00	0.26	2.7013	0.3231	3.0040	3.0244	-0.67	2.6736	89.00	-1.03	0.3304	11.00	2.27	P
97-2	WA_1_A4115	WA_1_A4115	288.00	256.80	12.15	0.0575	0.0067	0.0710	0.0642	10.59	0.0653	92.00	13.60	0.0057	8.00	-15.22	G
	WA_1_B4243	WA_1_B4243	263.00	274.40	-4.15	0.0577	0.0109	0.0650	0.0686	-5.25	0.0553	85.00	-4.25	0.0098	15.00	-10.55	G
	WA_1_C4371	WA_1_C4371	181.00	184.75	-2.03	0.0577	0.0162	0.0720	0.0739	-2.57	0.0547	76.00	-5.16	0.0173	24.00	6.67	G
	WA_2_A4115	WA_2_A4115	458.00	501.60	-8.69	0.1163	0.0091	0.1130	0.1254	-9.89	0.1040	92.00	-10.61	0.0090	8.00	-0.66	G
	WA_2_B4243	WA_2_B4243	519.00	529.60	-2.00	0.1159	0.0165	0.1280	0.1324	-3.32	0.1114	87.00	-3.92	0.0166	13.00	0.85	G
	WA_2_C4371	WA_2_C4371	355.00	358.50	-0.98	0.1153	0.0281	0.1410	0.1434	-1.67	0.1128	80.00	-2.17	0.0282	20.00	0.36	M
	WA_3_A4115	WA_3_A4115	10696.00	10767.20	-0.72	2.3010	0.3910	2.6530	2.6918	-1.44	2.2551	85.00	-2.00	0.3980	15.00	1.83	G
	WA_3_B4243	WA_3_B4243	11317.00	11412.80	-0.84	2.3004	0.5520	2.8150	2.8532	-1.34	2.2520	80.00	-2.10	0.5630	20.00	1.85	G
	WA_3_C4371	WA_3_C4371	6460.00	6558.50	-1.50	2.2997	0.3240	2.5660	2.6234	-2.19	2.2581	88.00	-1.81	0.3079	12.00	-4.87	G
98-1	WA_1_A8028	WA_1_A8028	178.00	187.71	-5.18	0.0586	0.0071	0.0615	0.0657	-6.39	0.0547	89.00	-6.60	0.0068	11.00	-4.72	G
	WA_1_B8145	WA_1_B8145	153.00	167.00	-8.38	0.0565	0.0103	0.0607	0.0668	-9.13	0.0510	84.00	-9.76	0.0097	16.00	-5.71	G
	WA_1_C8284	WA_1_C8284	232.00	246.00	-5.69	0.0579	0.0159	0.0690	0.0738	-6.50	0.0524	76.00	-9.43	0.0166	24.00	4.15	P
	WA_2_A4917	NY_2_A5820	329.00	361.71	-9.04	0.1172	0.0094	0.1142	0.1266	-9.79	0.1039	91.00	-11.33	0.0103	9.00	9.34	G
	WA_2_B4856	NY_2_B5753	314.00	332.75	-5.63	0.1165	0.0166	0.1247	0.1331	-6.31	0.1097	88.00	-5.81	0.0150	12.00	-9.86	G
	WA_2_C4773	NY_2_C5676	432.00	480.67	-10.12	0.1175	0.0267	0.1286	0.1442	-10.82	0.1016	79.00	-13.54	0.0270	21.00	1.15	G
	WA_3_A5628	WA_3_A5628	7087.00	7684.57	-7.78	2.2986	0.3910	2.4567	2.6896	-8.66	2.0636	84.00	-10.22	0.3931	16.00	0.53	G
	WA_3_B7945	WA_3_B7945	7569.00	8140.75	-7.02	2.7041	0.5522	3.0095	3.2563	-7.58	2.4678	82.00	-8.74	0.5417	18.00	-1.90	G
	WA_3_C8084	WA_3_C8084	9566.00	10075.67	-5.06	2.6996	0.3231	2.8358	3.0227	-6.18	2.5239	89.00	-6.51	0.3119	11.00	-3.45	P
Median					-2.02					-4.05			-5.66			2.34	
25th percentile					-5.88					-6.50			-8.78			-2.29	
75th percentile					-0.44					-1.67			-3.22			11.78	
F-pseudosigma					4.03					3.58			4.13			10.43	
Interquartile range					5.44					4.83			5.57			14.07	

[1]Comments: Good (G), marginal (M), and poor (P), refers to the condition of the sample upon arrival to the laboratory.

Comparison of the 1996-98 Sediment Laboratory Quality-Assurance Results with the Results from Pilot Studies in Previous Years

Sediment interlaboratory comparison studies were made on a pilot basis in 1992 and 1994. Twenty sediment laboratories were providing data for the USGS in 1992; in 1994 the number had decreased to 18 sediment laboratories. Only 11 laboratories were providing data for the USGS in 1996 and 12 laboratories were providing data for the USGS in 1997-98. The differences associated with sand/fine separations and suspended-sediment concentrations were not tabulated in the 1992 and 1994 pilot studies. Also the samples used in the 1992 and 1994 pilot studies do not compare directly to each other or with the samples used in study numbers 96-1 through 98-1. A comparison of the sediment mass percent difference results from the 1992 and 1994 pilot (tables 28 and 29) indicates that the results from the pilot studies were similar to the results for samples with approximately the same amount of sediment mass analyzed for the SLQA project between 1996 and 1998 shown in tables 11-15.

In 1992, the median percent difference for sediment mass was –7.91 percent for samples with a known mass of 10 to 35 mg, -3.86 percent for samples with a known mass of 149 to 170 mg, and -3.41 percent for samples with a known mass of 240 to 274 mg (table 28).

One of the key findings of the 1992 pilot study was that a systematic low bias of about 1percent occurred due to material passing through the filter and common processing steps (Schroder and others, 1996). The follow-up pilot study completed in 1994 provided further information on the filtration method that was routinely used for concentration analyses, as well as a preliminary examination of particle-size analyses using the sieve-pipette method. The median percent difference for sediment mass for the 1994 pilot study for samples with a known mass of 49 to 51 mg was –4.60; there was a -4.30 percent difference for samples with a known mass of 90 to 102 mg, and -4.34 percent for samples with a known mass of 197 to 203 mg (table 29). There was an overall median percent difference between laboratories of –3.86 percent in 1992 and –5.00 percent in 1994.

Control Charts of the 1996-98 Sediment Laboratory Quality-Assurance Results

Control charts of the percent difference for each measurement made by the participating laboratories are shown in figures 1 through 57. These control charts, which were prepared according to sample base mass and analysis type within each SLQA study, give the percent difference for the reported sediment mass, fine-size material mass, sand-size material mass, and suspended-sediment concentration. The median difference for all laboratories for each analysis in each sample amount is clearly identified on the graphs. In a traditional control chart, the upper and lower control limits are typically set at $\pm$ 3 standard deviations from the mean. The median and F-pseudosigma were used in place of the mean and standard deviation. The median was used to define the central tendency. The F-pseudosigma was used as a resistant measure of data spread similar to the standard deviation.

The results for a given analysis were determined to be out of statistical control when they exceeded either the upper or lower control limit. Use of the median rather than the mean and definition of the control limits that are based on the F-pseudosigma rather than the standard deviation are appropriate because the data are not normally distributed. Furthermore, the data contained a large number of outliers—data values that fell outside the range of $\pm$3 F-pseudosigma from the median—that may have biased the mean and standard deviation.

If the median difference from all of the pooled data reported by the laboratories were zero, the median difference line for each control chart would also be zero for each type of measurement. The fact that the median difference is consistently offset from zero indicates that the data for each of the physical sediment properties are biased. The negative bias for suspended-sediment concentration (figs. 46-57) may be due to dissolution of a small amount of the fine-size material mass that is lost during filtration unless the filtrate is captured by using an evaporation dish. The median bias, for the SLQA studies that were completed in 1996-98, is consistent with the median bias in pilot studies using the AC spark-plug dust as a reference material. A significant part of this bias is attributable to common sample-processing steps and is therefore difficult to avoid. Schroder and others (1996) determined that about 1.3 percent of the known mass

Table 28. 1992 pilot study sediment mass percent difference

10 to 35 milligram samples		149 to 170 milligram samples		240 to 274 milligram samples	
Mean	-5.24	Mean	-4.12	Mean	-2.88
Standard error	4.60	Standard error	0.89	Standard error	0.50
Median	-7.91	Median	-3.86	Median	-3.41
25th percentile	-15.75	25th percentile	-5.09	25th percentile	-4.19
75th percentile	-1.42	75th percentile	-2.81	75th percentile	-2.73
F-pseudosigma	10.63	F-pseudosigma	1.69	F-pseudosigma	1.09
Standard deviation	20.59	Standard deviation	3.88	Standard deviation	2.25
Sample variance	423.77	Sample variance	15.09	Sample variance	5.04
Kurtosis	9.23	Kurtosis	5.06	Kurtosis	1.90
Skewness	2.63	Skewness	-0.90	Skewness	1.32
Range	94.39	Range	20.59	Range	9.08
Minimum	-25.00	Minimum	-15.69	Minimum	-6.09
Maximum	69.39	Maximum	4.90	Maximum	2.98
Count	20.00	Count	20.00	Count	20.00
Confidence level (95.0 percent)[1]	9.63	Confidence level (95.0 percent)[1]	1.87	Confidence level (95.0 percent)[1]	1.05

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is ±1.96. The confidence interval is the sample mean ±1.96 times the standard deviation divided by the square root of the number of data points.

Table 29. 1994 pilot study sediment mass percent difference

49 to 51 milligram samples		90 to 102 milligram samples		197 to 203 milligram samples	
Mean	-4.75	Mean	-4.12	Mean	-4.39
Standard error	0.54	Standard error	0.46	Standard error	0.30
Median	-4.60	Median	-4.30	Median	-4.34
25th percentile	-6.49	25th percentile	-5.88	25th percentile	-5.64
75th percentile	-2.42	75th percentile	-2.58	75th percentile	-2.86
F-pseudosigma	3.01	F-pseudosigma	2.45	F-pseudosigma	2.06
Standard deviation	3.72	Standard deviation	3.19	Standard deviation	2.09
Sample variance	13.80	Sample variance	10.19	Sample variance	4.36
Kurtosis	0.38	Kurtosis	5.88	Kurtosis	-0.24
Skewness	-0.30	Skewness	-0.63	Skewness	0.07
Range	16.18	Range	22.52	Range	9.65
Minimum	-13.53	Minimum	-16.96	Minimum	-9.10
Maximum	2.65	Maximum	5.56	Maximum	0.56
Count	48.00	Count	48.00	Count	48.00
Confidence level (95.0 percent)[1]	1.08	Confidence level (95.0 percent)[1]	0.93	Confidence level (95.0 percent)[1]	0.61

[1]The confidence level for specific statistics returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. Alpha is the maximum probability of rejecting the null hypothesis when it is true. If we assume alpha equals 0.05 we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is ±1.96. The confidence interval is the sample mean ±1.96 times the standard deviation divided by the square root of the number of data points.

in the sample vial is lost in the sample-transfer procedures that started with the removal of the sample from the vial and ended with the material collected in the filter. An additional 1 percent of the mass of the test sample material passes through the filter (Whatman No. 934-AH) and is lost unless the filtrate is analyzed by using an evaporation dish (Schroder and others, 1996).

The positive bias observed for sand-size material mass (figs. 31-45) and the negative bias observed for fine-size material mass (figs. 16-30) may be due to a small amount of fine-size material mass adhering to the sand-size grains, which increases the sand-size material mass and decreases the fine-size material mass.

The median line on the sand-size graphs is the measure of central tendency and this median line divides the bottom 50 percent of the data from the top 50 percent of the data. For example, the median line on the suspended-sediment concentration control charts (figs. 46-57) ranges from –4.86 to –2.45 percent for the group of samples with the lowest suspended-sediment concentration and from –1.27 to –0.36 percent for the group of samples with the highest suspended-sediment concentration.

The number of times each laboratory exceeded a control limit for each of the four analyses: (1) sediment mass, (2) fine-size material mass, (3) sand-size material mass, and (4) suspended-sediment concentration, are listed in tables 30-34. Tables 30-34 also give the percentage of reported values for a given laboratory that exceeded the $\pm$ 3 F-pseudosigma from the median control limits for each study. This is an important statistic to consider when evaluating the number of values that exceed the control limits because participation rates among laboratories varied considerably; for example, some laboratories did not perform sand/fine separations, one laboratory performed only suspended-sediment concentration analyses, and some analyses were not completed due to leakage of the sample during transportation.

The ability of a laboratory to produce data consistently within statistical control in the SLQA studies may be a useful indication of its ability to produce environmental data consistently within statistical control. Scrutiny of tables 30 through 34 reveals that there were several laboratories with high rates of participation in the SLQA studies that rarely exceeded the control limits for the various physical sediment properties. Laboratories with high rates of participation were those laboratories that completed all analyses. These laboratories usually had no, or very few, control limit exceedances in a particular SLQA study and may have been producing the most accurate environmental data during the time of that study. Some of the laboratories consistently had no, or very few, control limit exceedances in all of SLQA studies completed during 1996-98. The environmental data produced by such laboratories during 1996-98 may be of a higher level of precision than the environmental data from laboratories that did not consistently produce SLQA data within statistical control.

Analyses from samples that were reported as having leaked during transit were not considered, resulting in a smaller number of data values for laboratories reporting a large number of samples leaking during transit. The number of samples that leaked in transit for each laboratory for the five SLQA studies completed from August 1996 through June 1998 are shown in figure 58 (at the back of the report).

Scatter plots of suspended-sediment-concentration percent difference for each laboratory over time are shown in figures 59-94 at the back of the report. Figures 59-94 are broken down according to sample amount, resulting in three graphs for each of the 12 laboratories in studies 96-1 through 98-1, and are intended to show graphically any changes in laboratory performance between August 1996 and June 1998 with regard to suspended-sediment-concentration data. For example, among the 5 studies, some of the laboratories that performed the worst in study number 96-1 had the best overall performance in study number 98-1.

Table 30. Control limit exceedances (±3 F-pseudosigma) for the Sediment Laboratory Quality-Assurance project, study number 96-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sample class 1	Sample class 2	Sample class 3	Total number exceeded[1]	Total number analyzed[1]	Percent exceeded[1]
California				0	27	0.00
Hawaii				0	4	0.00
Iowa				0	27	0.00
Kentucky	S			1	27	3.70
Louisiana				0	27	0.00
Missouri	S			1	27	3.70
Montana				0	27	0.00
New Mexico		S	S,S	3	27	11.11
Ohio[2]			M	1	9	11.11
Puerto Rico	M,F,F		F,S	5	27	18.52
Washington	M			1	27	3.70

EXPLANATION

Reported values exceeded the control limit for:

M Sediment mass percent difference
F Fine-size material mass percent difference
S Sand-size material mass percent difference
C Suspended-sediment concentration percent difference

[1]Samples noted as arriving in poor or marginal condition were excluded from the analysis.
[2]This is a contract laboratory.

Table 31. Control limit exceedances (±3 F-pseudosigma) for the Sediment Laboratory Quality-Assurance project, study number 96-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sample class 1	Sample class 2	Sample class 3	Total number exceeded[1]	Total number analyzed[1]	Percent exceeded[1]
California				0	25	0.00
Hawaii			C	1	15	6.67
Iowa				0	18	0.00
Kentucky				0	24	0.00
Louisiana				0	36	0.00
Missouri				0	12	0.00
Montana				0	32	0.00
New Mexico	S	S	F,F,C	5	36	13.89
Ohio[2]				0	18	0.00
Puerto Rico				0	36	0.00
Washington		M,C		2	18	11.11

EXPLANATION

Reported values exceeded the control limit for:

M Sediment mass percent difference
F Fine-size material mass percent difference
S Sand-size material mass percent difference
C Suspended-sediment concentration percent difference

[1]Samples noted as arriving in poor or marginal condition were excluded from the analysis.
[2]This is a contract laboratory.

Table 32. Control limit exceedances (±3 F-pseudosigma) for the Sediment Laboratory Quality-Assurance project, study number 97-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sample class 1	Sample class 2	Sample class 3	Total number exceeded[1]	Total number analyzed[1]	Percent exceeded[1]
California				0	36	0.00
Hawaii				0	18	0.00
Iowa		M		1	36	2.78
Kentucky			S	1	36	2.78
Louisiana				0	36	0.00
Missouri				0	22	0.00
Montana				0	34	0.00
New Mexico				0	36	0.00
New York[2]	C,C,C	C,C,C	C,C	8	8	100.00
Ohio[2]				0	18	0.00
Puerto Rico	M,F		M,F	4	36	11.11
Washington				0	27	0.00

EXPLANATION

Reported values exceeded the control limit for:

M Sediment mass percent difference
F Fine-size material mass percent difference
S Sand-size material mass percent difference
C Suspended-sediment concentration percent difference

[1]Samples noted as arriving in poor or marginal condition were excluded from the analysis.
[2]This is a contract laboratory.

Table 33. Control limit exceedances (±3 F-pseudosigma) for the Sediment Laboratory Quality-Assurance project, study number 97-2

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sample class 1	Sample class 2	Sample class 3	Total number exceeded[1]	Total number analyzed[1]	Percent exceeded[1]
California		S		1	36	2.78
Hawaii	M		M,M,C,C	5	18	27.78
Iowa				0	36	0.00
Kentucky				0	36	0.00
Louisiana				0	36	0.00
Missouri	M,S,S,S,C	S,S,S		8	36	22.22
Montana				0	36	0.00
New Mexico	S,C	S	F,S	5	32	15.63
New York[2]	C,C		C	3	9	33.33
Ohio[2]				0	18	0.00
Puerto Rico	S			1	26	3.85
Washington	M,F,C			3	27	11.11

EXPLANATION

Reported values exceeded the control limit for:

M Sediment mass percent difference
F Fine-size material mass percent difference
S Sand-size material mass percent difference
C Suspended-sediment concentration percent difference

[1]Samples noted as arriving in poor or marginal condition were excluded from the analysis.

[2]This is a contract laboratory.

Table 34. Control limit exceedances (±3 F-pseudosigma) for the Sediment Laboratory Quality-Assurance project, study number 98-1

[Sample class 1, 50 to 100 milligrams of fine-size material; sample class 2, 101 to 300 milligrams of fine-size material; sample class 3, 2,200 to 3,200 milligrams of fine-size material; sand-size material was added in an amount ranging from 9 to 28 percent of the mass of fine-size material in each sample class]

Participating laboratory	Sample class 1	Sample class 2	Sample class 3	Total number exceeded[1]	Total number analyzed[1]	Percent exceeded[1]
California				0	36	0.00
Hawaii			M,M	2	18	11.11
Iowa				0	36	0.00
Kentucky				0	36	0.00
Louisiana	S		M,F,S,S	5	36	13.89
Missouri	S,S	S		3	36	8.33
Montana				0	36	0.00
New Mexico	M,F,F,S,S,C	F,S,S	S,S,S	12	36	33.33
New York[2]	C,C,C,C	C,C,C		7	18	38.89
Ohio[2]		M		1	18	5.56
Puerto Rico			M,C	2	30	6.67
Washington			M,M,F	3	36	8.33

EXPLANATION

Reported values exceeded the control limit for:

M Sediment mass percent difference
F Fine-size material mass percent difference
S Sand-size material mass percent difference
C Suspended-sediment concentration percent difference

[1]Samples noted as arriving in poor or marginal condition were excluded from the analysis.

[2]This is a contract laboratory.

The upper quartile, median, and lower quartile of the differences in percent between the reported and known values for three key sediment properties: suspended-sediment concentration, fine-size material mass, and sand-size material mass are shown in figure 95 at the back of the report; it is a graphical representation of the overall results for each laboratory. The difference between the upper and lower quartiles is the interquartile range for each laboratory. The interquartile range is a useful indicator of the variability associated with the measurements produced by a given laboratory. The median differences between the reported and known values can be used as an indication of laboratory bias (taking into account the previously discussed limitations—leakage, for example—of the samples used in the study). Although there was variability in the reported results, it is important to note that any changes in laboratory performance over time are not detectable in figure 95 where the results for all of the SLQA studies are pooled. It is also important to note that some laboratories with the greatest amount of variability in their results on an overall basis have been steadily improving in recent SLQA studies and have in fact produced some of the best results of any of the laboratories in recent interlaboratory comparison studies.

Results shown in figure 95 indicate there were some substantial differences among the 12 laboratories that participated in the five SLQA studies that were made from August 1996 to June 1998. All the participating laboratories performed suspended-sediment concentration analyses (fig. 95A), but only 9 of the 12 laboratories performed sand/fine separations (fig. 95B and 95C). The overall median percent difference for suspended-sediment concentration on an individual laboratory basis ranged from –18.04 to –0.33 for the 12 laboratories. Five of the 12 laboratories had an overall median percent difference for suspended-sediment concentration of –2.02 to –0.33 percent. There was less variability in the median difference for the measured fine-size material mass than for sand-size material mass (figs. 95B and 95C). The overall median percent difference for fine-size material mass varied from –10.11 to –4.27 percent. Except for one laboratory, the median percent difference for fine-size material mass was within a fairly narrow range of –6.76 to –4.27 percent (fig. 95B). The median percent difference for sand-size material mass differed among laboratories more than any other physical sediment property measured in the study. The overall median percent difference for the sand-size material mass ranged from –1.49 to 26.39 percent (fig. 95C). Five of the 9 laboratories that do sand/fine separations had overall median percent differences for sand-size material mass of –1.49 to 2.98 percent.

RECENTLY IMPLEMENTED AND PROPOSED PLANS

A double-blind reference sample project for physical sediment properties began in August 1999. The project provides the capability for submitting environmental water-sediment samples and quality-control samples that are disguised as environmental samples to participating laboratories (U.S. Geological Survey, Office of Surface Water Technical Memorandum No. 98.05, 1998). Also in 1999, participation of several additional non-USGS laboratories in the single-blind reference sample project for physical sediment properties began. The participation of sediment laboratories associated with other Federal agencies and laboratories in Canada facilitates transboundary sediment studies throughout North America. By participating in the single-blind reference sample project, these laboratories will provide an additional benchmark for assessing the performance of USGS laboratories. Another area of project expansion, which began in 1999, focuses on follow-up evaluations for laboratories that are shown to have substantial deficiencies during onsite reviews or that provide data in the SLQA studies that lie outside statistically determined data-quality boundaries (U.S. Geological Survey, Office of Surface Water Technical Memorandum No. 98.05, 1998). Finally, an ongoing, in-depth monitoring and evaluation effort of particle-size analyses, which includes particle-size analyses to be completed by sieve/pipette, Sedigraph, and bottom-withdrawal methods, is expected to begin in 2000.

SUMMARY

When evaluating the data in this report, the reader should keep in mind that every measurement has an error component associated with it. This is true for every type of data collected. Quantifying and understanding the error component are the keys to knowing the capabilities and limitations of a database. There are certain limits and constraints on every method used to collect data, and no one, no matter how careful or conscientious, can perform at a level beyond the limits of the method. The reader should also keep in mind that some sources of measurement errors are beyond the laboratory's control. Given that the Sediment Laboratory Quality-Assurance project is relatively new, it is too soon to evaluate the question of method constraints relative to correctable sources of error. It is also premature to use the data from these first few Sediment Laboratory Quality-Assurance studies to judge the performance of any of the participating laboratories. There were also some notable differences in the results for the 12 laboratories that participated in the five Sediment Laboratory Quality-Assurance studies conducted from August 1996 through June 1998. For example, the overall median percent difference for suspended-sediment concentration on an individual laboratory basis ranged from –18.04 to –0.33 for the 12 laboratories. Five of the 12 laboratories had an overall median percent difference for suspended-sediment concentration of –2.02 to –0.33 percent. There was less variability in the median percent difference for the measured fine-size material mass. The overall median percent difference for fine-size material mass varied from –10.11 to –4.27 percent. Except for one laboratory, the median percent difference for fine-size material mass was within a fairly narrow range of –6.76 to –4.27 percent. The median percent difference for sand-size material mass differed among laboratories more than any other physical sediment property measured in the study. The overall median percent difference for sand-size material mass ranged from –1.49 to 26.39 percent. Five of the nine laboratories that do sand/fine separations had overall median percent differences for sand-size material mass that ranged from –1.49 to 2.98 percent.

Careful review of the control charts reveals that certain laboratories consistently produced data within statistical control for some or all of the physical sediment properties measured in this study, but other laboratories occasionally produced data exceeding the control. The tables that summarize the incidence of control-limit exceedance and indicate there were several laboratories with high rates of participation in the Sediment Laboratory Quality-Assurance studies that had very rarely exceeded the control limits for the various physical sediment properties.

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