DRAFT
Fountain Lake Sediment and Dredging Assessment

Prepared for
Shell Rock River Watershed District

May, 2009

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BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

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1.0 Executive Summary

Sediment accumulation has occurred in Fountain Lake and can cause problems for recreational use, water quality and fisheries habitat within the lake. Because of this, the Shell Rock River Watershed District is considering dredging the accumulated sediment from the lake. As part of the preliminary stage in this process, sediment cores were collected and tested to determine possible pollutant contamination, evaluate disposal options, and estimate a potential cost range for sediment dredging and disposal.

Eleven sediment cores were collected from Fountain Lake (Edgewater, Dane, and Main Bays) in February 2009 and were determined to be high in silt. In general, the sediment collected from Fountain Lake contained low levels of pollutants and the samples analyzed were under the Minnesota Pollution Control Agency's (MPCA) Tier 1 soil reference value (SRV) criteria for most of the parameters. Tier 1 is the highest level criteria meaning the sediment is low in pollutants and can be used for all allowable reuse options. Two metals, copper and arsenic, were detected at levels higher than the Tier 1 SRV criteria in the upper sediment at three of the coring locations (Cores 5, 9 and 10). The concentrations of copper and arsenic were below Tier 2 SRV criteria at all three of these coring locations however.

Based on the analytical results, most of the dredged material may be disposed of at a permitted solid waste facility; at a permitted on-site or off-site location; or through beneficial use or reuse such as fill, road sub-base, or land application. Because some of the sample concentrations were above the Tier 1 SRV criteria, a portion of the sediments may not be appropriate for active agricultural uses or certain reuse options. However, elevated arsenic and copper were mainly detected in the area just upstream of the dam in the main bay of Fountain Lake. The dredge spoils from this area could be kept separate from spoils dredged from other areas of the lake during the operation, allowing the spoils to be reused for other purposes or disposed of in a landfill.

Based on the type of sediment to be removed, it is likely that hydraulic dredging will be the best suited technique for sediment removal from Fountain Lake. Hydraulic dredging includes the use of suction pumps and piping for removing and pumping a mixture of dredged material and water from the channel or lake bottom directly to the storage/dewatering or disposal site.

The estimated unit cost for hydraulically dredging sediment from Fountain Lake (including Bancroft, Danes, and Edgewater Bays), ranges from $4 to $6 per cubic yard for the dredging work alone. This estimated cost is based on past large scale dredging projects in the region and discussions with local contractors. Based on possible staging areas, storage locations, and disposal options for the dredged sediment, an estimated $8 to $12 per cubic yard of additional funds will be needed, bringing the total cost per cubic yard of sediment removed to $12 to $18. These are reconnaissance level unit costs to be used for planning purposes and the cost range assumes the material dredged falls under the Teir 1 SRV criteria. Based on a dredge volume estimate of 1,000,000 cubic yards, the estimated total project cost ranges from $12,000,000 to $18,000,000; however, the dredge volume can be made flexible or phased to fit the expected budget. This cost range is highly dependent upon local storage and disposal or reuse options and a more precise opinion of cost should be determined in the scoping/feasibility phase of the dredging design project. Engineering and design, permitting, construction oversight and administration are expected to be in the range of $400,000 to $600,000.

2.0 Introduction

Sediment accumulation in Fountain Lake has created problems for recreational use, water quality, and fisheries habitat. Because of these concerns, the Shell Rock River Watershed District (hereafter, the District) is considering dredging the accumulated sediment. As part of the initial phase of any large-scale sediment dredging project, the sediment to be removed must be characterized for pollutants of concern. This report focuses on the testing results for sediments collected from Dane's Bay, Edgewater Bay, and the main bay of Fountain Lake in February, 2009. Results from previous studies are summarized and preliminary estimates on dredge volumes and costs are included in this report as well.

Fountain Lake is a shallow lake of approximately 555 acres and has a tributary watershed of 62,700 acres. The lake was created by the construction of a dam (built in 1855 and rebuilt in the early 1900's) across the Shell Rock River and has three bays, Dane's, Edgewater, and Bancroft. Four creeks flow into Fountain Lake: Bancroft Creek (north), Goose Creek (northeast), Shoff Creek (southwest), and Wedge Creek (west).

Agriculture is the primary land use within the Fountain Lake watershed (based on 2001 land cover data) with minor areas of urban, upland, wetlands, and forests (Figure 1). There are several parks along the shoreline of the lake including Edgewater, Bancroft Bay, City Beach Park, and Fountain Lake Park on the south end of the main bay. The lake is used mainly for recreation and sport fishing.

The accumulation of sediment in Fountain Lake is due mainly to external inputs and various dredging projects have occurred since 1928. Between 1940 and 1942, the City of Albert Lea dredged approximately 1.8 million cubic yards of sediment from the main bay of Fountain Lake. The goal of this project was to establish minimum water depths of 5 to 7 feet for recreation purposes. Beginning in 1962, Dane's Bay and Edgewater Bay were dredged after the City purchased a hydraulic dredge.

Two sediment depth studies have been conducted in different parts of the lake since 1973. These studies indicate soft bottom sediments approximately 4 to 6 feet in depth in many areas of the lake. Based on comparison of the 1973 study and the data collected in 2006, an average of approximately 1 foot of sediment has accumulated between 1973 and 2006.

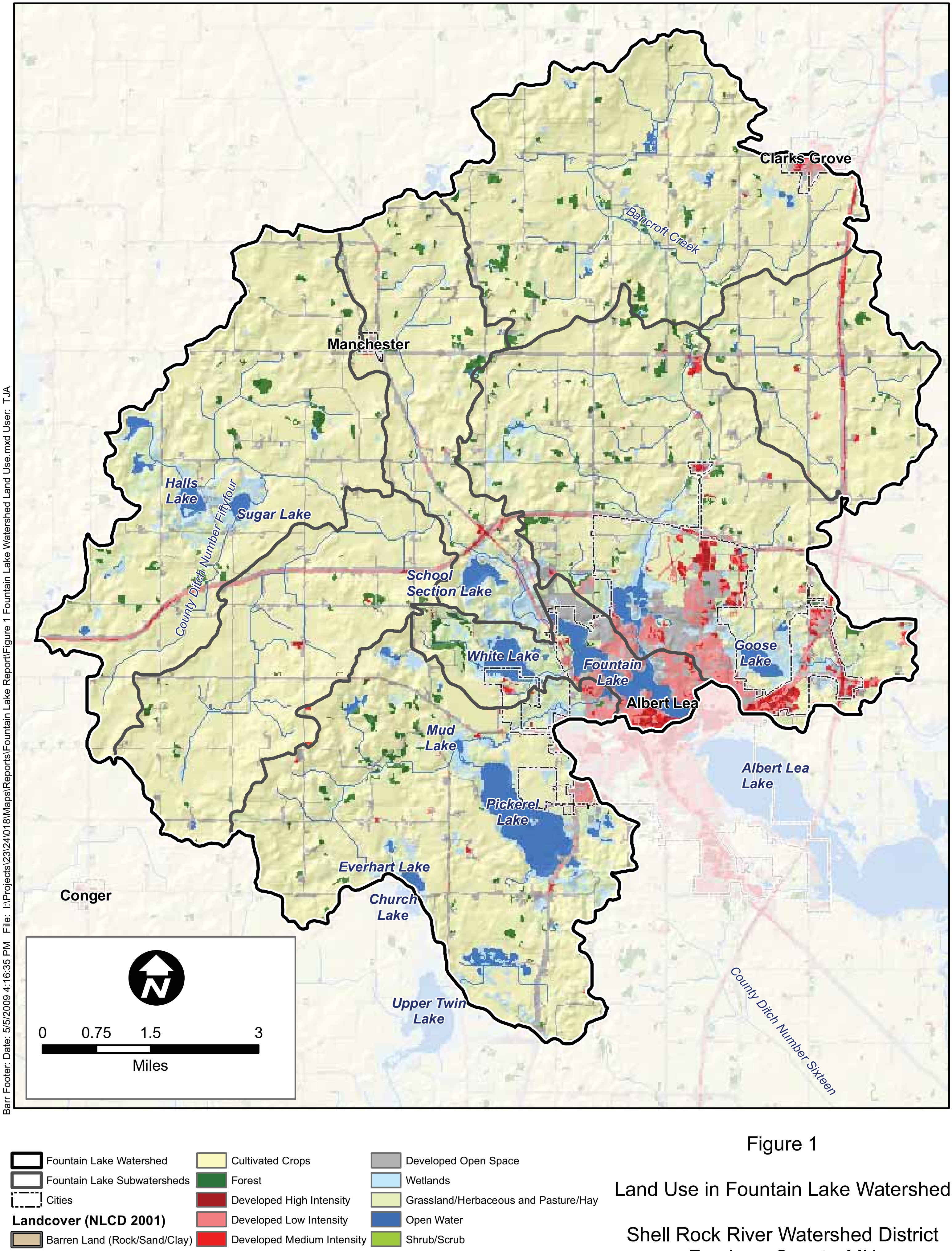


Figure 1

Land Use in Fountain Lake Watershed

Shell Rock River Watershed District
Freeborn County, MN

3.0 Site Investigation-Risk Assessment

Prior to beginning a sediment characterization study, a preliminary risk assessment must be conducted to determine the potential risk that certain pollutants will be present in the sediments. Past and present land use activities within the lake watershed are categorized and the pollutants these activities may have contributed to the sediments are then identified.

3.1 Previous Studies

Studies conducted on Fountain Lake in 1973 and Bancroft Bay in 2006 were used in the initial risk assessment for pollutant contamination in the sediment of Fountain Lake. The *Study of Albert Lea Lake Watershed* report (1973) was basic and did not include a complete testing of baseline parameters currently required by the MPCA for sediment characterization. Sediment probing was also conducted across the entire lake in 1973. The *Bancroft Bay Sediment Depth Investigation report* (2006) included additional pollutant testing but only characterized the sediment in Bancroft Bay. A summary of the 2006 work is presented below:

- 65 sediment depth probes were made in 2006 and compared to the 1973 probing data (39 points). Between 1973 and 2006, sediment accumulation was up to 0.9 feet, on average, in Edgewater, Bancroft and Main Bays of the lake.

- 10 sediment cores were collected from Bancroft Bay and analyzed for potential pollutants. Only arsenic was detected above Tier 1 SRVs in three of the sediment cores.

- Based on the findings of the 2006 study, Bancroft Bay has approximately 4 feet of silt material accumulated across the bay (on average) with the depth of accumulated sediment varying based on location.

3.2 Risk Assessment

Before sediment collection occurred in Edgewater Bay, Danes Bay, and the main bay of Fountain Lake, a risk assessment was conducted to determine the potential pollutants that may be present in the sediments collected from these area. A summary of this risk assessment, submitted to the MPCA before coring work began, is presented below.

1. **Potential contaminants based on land use in the surrounding watershed**

Current land use in the watershed tributary to Fountain Lake is dominated by agriculture (71%) with some urban (14%), upland (6%), wetland (4%), and forested (2%) areas (Figure 1). Previous reports have shown that the dominant historical land use in the watershed has been agriculture with development around the main bay of Fountain Lake and the southern portions of Edgewater and Bancroft Bays.

2. **Records of past spills or discharges**
   Groundwater monitoring at a cleanup site in Edgewater Park indicated the possibility of volatile organic compounds (VOCs) entering Edgewater Bay (Gene Olson, MPCA). The cleanup of the landfill site at Edgewater Park is expected to be completed in 2009.

3. **Current and past industrial, municipal, and stormwater outfalls**
   There are a number of storm water outfalls to Fountain Lake shown on the City of Albert Lea storm Sewer Map in Appendix A.

4. **Levels of naturally occurring or ubiquitous parameters in the watershed**
   Anthropogenic factors (factors that could impact human or animal life) associated with agricultural practices would be the primary contributor of any pollutants, primarily nutrients, pesticides and fertilizers, and biochemical oxygen demand (BOD). However, according to Freeborn County Environmental Services, none of the pesticides listed in the MPCA's Additional Sediment Parameter List are used on a regular basis, if at all. Many common pesticides have a low persistence in soils and other contaminants and other chemicals no longer in use (e.g. DDT) have likely bio-degraded to non-threat levels.

5. **Public health advisories**
   Fish consumption advisories for pregnant woman and children are listed for Fountain Lake with regard to mercury (MN DNR). No advisories for the general public for any contaminant (e.g. mercury, PCBs, etc.) are listed.

6. **Impoundment locations within the project area**
   Fountain Lake was created by the construction of a dam on the Shell Rock River at the south end of Fountain Lake in the mid-1800s. The lake then discharges to Albert Lea Lake.

7. **Treatment of surface waters with herbicides**
   Copper sulfate was commonly used from the 1950's through the 1970's to control high algal growth in area lakes. Toxaphene was used in the past to manage fish populations in Pickerel

Lake (southwest of Fountain Lake), which is within the Fountain Lake watershed. Dioxin containing substances have not been used for nearly 40 years and these substances have likely bio-degraded to levels below concern.

8. **Manufactured gas plants**

   There was one manufactured gas plant (MGP) in Albert Lea at 109 4th street SE, approximately ½ mile south of the lake.

9. **Landfills or other groundwater contamination sources**

   Landfills and other potential contamination sources were determined by using MPCA's "What's in my back yard" web application. The mapping results and a description of the sites found within the watershed are located in Appendix B.

   Two potential concerns near the lake were identified—the Albert Lea Sanitary Landfill and a non-permitted dump located within Edgewater Park. The Albert Lea Sanitary Landfill was closed in December of 1993 and, according to the MPCA, it has been classified as no threat to public health or the environment (Bancroft Bay Risk Assessment Report, 2006). The MPCA indicated there was groundwater contamination by volatile organic compounds (VOCs) but that the contamination was localized to the site and did not pose a threat to downstream sediments in Bancroft Bay. The non-permitted dump located within Edgewater Park was recently excavated and groundwater testing near the lake showed elevated VOC and arsenic concentrations in the water.

10. **Other contaminant sources**

    Because of somewhat limited boat traffic in most areas of the lake, contaminant sources from motor boat usage and/or marinas are likely low.

    Wastewater discharge from the City of Manchester, which enters at the north end of Edgewater Bay, is another potential contaminant source.

    Other potential contamination sites within the direct watershed include:

Streeter Inc.	Channel View Apartments	Albert Lea Bubbles
Albert Lea Rail Yard	Swenson Demolition	Imperial Inc.

Edgewater Restaurant	Lou-Rich Albert Lea	

Based on site history and conversations with the MPCA (Ed Olson), the potential additional contaminants (above the standard baseline analysis) include PAHs, chlorinated compounds and cyanide.

11. **Presence of Brownfield sites**
    No additional Brownfield (former waste generating) sites are located near the lake.

12. **Contaminated sites along waterways associated with the project**
    All sites listed by the MPCA are included in Appendix B.

13. **Field investigations of the proposed dredging location and disposal site investigations**
    Field investigations have shown no land uses within the possible dredge areas that would indicate a high risk of potential contamination (besides those already listed above). A disposal location has not been selected as of this time.

Based on the risk assessment described above, additional pollutants beyond the baseline parameters required by the MPCA were added to the sediment monitoring plan (Table 1). The core locations and parameters to be tested were also submitted to the MPCA for review (Brett Balavance, Duluth) and the list was determined to be adequate based on the above risk assessment. The additional parameters to be tested for will help determine the appropriate disposal methods and potential disposal locations for the dredged sediment.

Table 1. Additional parameters to characterize the sediment in Fountain Lake.

Parameter	Potential Contributor*
Cyanide	MGP/Refining
Oil and Grease	MGP/Urban areas
Organics/Pesticides	Agricultural Areas
Polyaeromatic Hydrocarbons (PAHs)	MGP/Urban areas
Volatile Organic Compounds (VOCs)	Unauthorized Dump

*Partial listing

4.0 Field Work

4.1 Sediment Coring and Probing

Sediment probing and coring was conducted by Barr Engineering on February 5-7, 2009 on Fountain Lake. Eleven cores were collected between Edgewater Bay, Danes Bay, and the main bay of Fountain Lake. Sediment depth probing (by manual push) was also conducted at the coring locations.

4.1.1 Sediment Coring

Sediment coring, sampling and testing were performed to characterize existing material to be dredged. Results are intended to identify potential limitations of a dredging project and to determine if "beneficial use" status can be applied to the dredged material, thereby reducing disposal costs.

Guidance for sediment coring was provided in Chapter 4 of the *Managing Dredged Materials in the state of MN* (MPCA guidance document, March 2008). The number and location of the sediment cores were determined based on a review of the MPCA guidance document, discussions with District staff, and review of previous sediment probing results. To reach a sufficient sediment depth, a "vibracorer" device was used over the ice. Eleven sediment cores ranging from a core retrieval of sediment depth of 2.8 to 6.5 feet were collected. Core retrieval depth did not always correspond to core push depth, mainly due to compaction of the sediment during the coring process. Figure 2 shows the sediment cores locations and the corresponding identification numbers.

Analytical samples were prepared from approximately every two foot section of the sediment core retrieved. Samples were composited in a clean bucket or metal bowl using a clean stainless steel or plastic spoon, and distributed into parameter specific sampling containers. The photos in Appendix C of this report detail some of the sampling conducted at Fountain Lake. A detailed description of each core is provided in Appendix D.

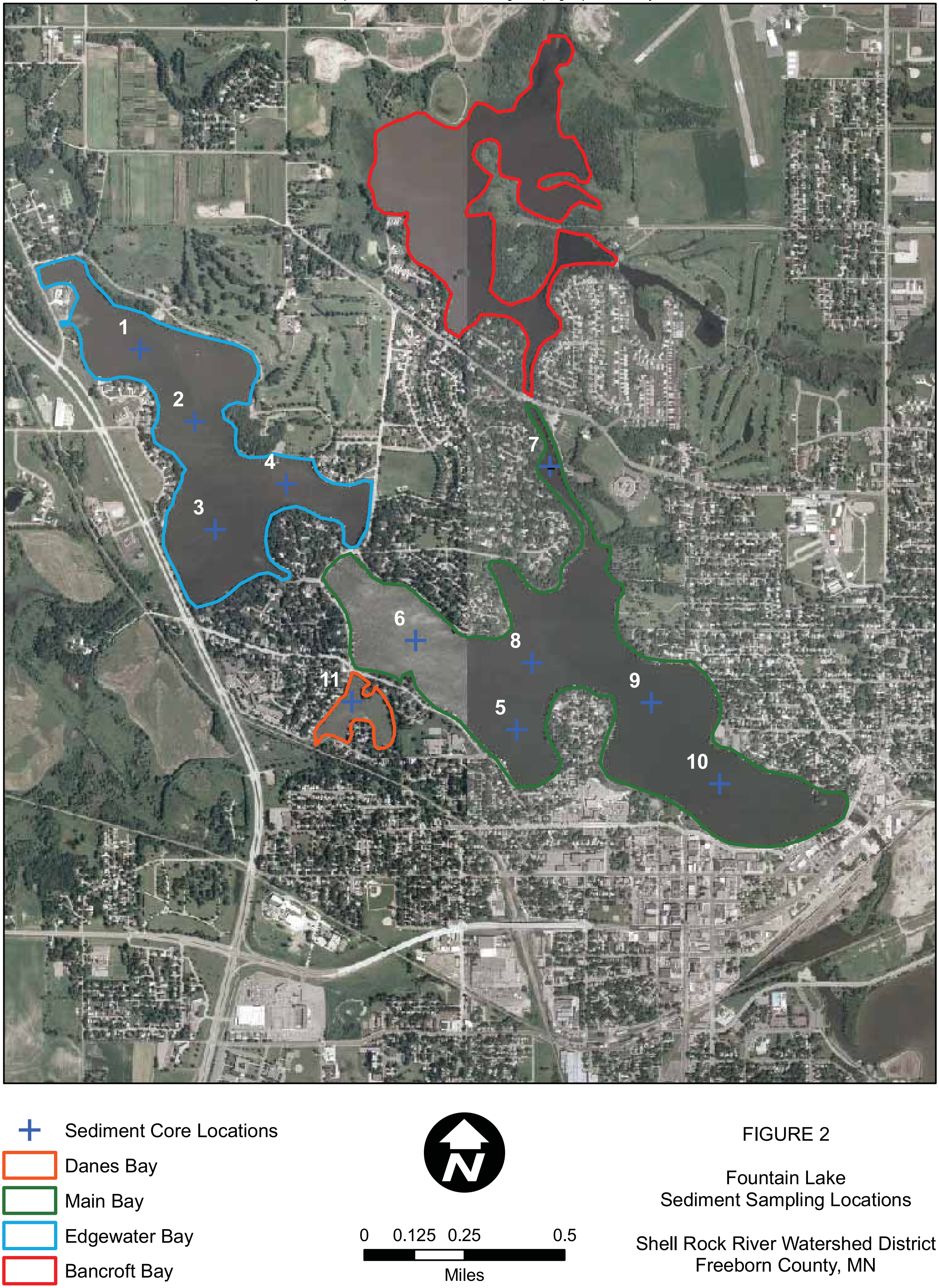


FIGURE 2

Fountain Lake
Sediment Sampling Locations

Shell Rock River Watershed District
Freeborn County, MN

Laboratory analysis of sediment cores was performed by Braun Intertec in Bloomington, MN. The following parameters were included in sediment testing of the composite samples:

- PCBs (EPA 8082, 8 arochlors)
- PAHs (EPA 8270C)
- Metals (Ar, Ba, Cd, Cr (total), Cu, Pb, Ni, Se, Ag, Zn (EPA 6010B)); Cr (VI, EPA 7199); Hg (EPA 7471A)
- Cyanide (EPA 9012B)
- Oil and Grease (EPA 9071B)
- TOC (EPA 9060)
- Total Phosphorus (EPA 365.2 M)
- TKN (EPA 351.2)
- Ammonia (EPA 350.1 M)
- Nitrate + Nitrite (EPA 353.2 M)
- Grain size characterization (ASTM D-422)
- OC Pesticides/herbicides (EPA 8081)
- Moisture Content (SM 2540G)
- Volatile organic compounds (VOCs, EPA 8260B)

4.1.2 Sediment Probing

Sediment probing was conducted at each coring site and two extra locations in Danes Bay. Generally, probing was done by driving the probe until it could no longer be pushed manually and recording the drive depth. The coring tube push depth was also recorded. Because the drive depth corresponds roughly to the depth of soft, accumulated sediment, probing provides a general idea of the potential depth of dredging. There were two locations (Cores 7 and 11) where an intermediate layer of sand was encountered. The probing (Probe Depth) and core tube depth results are shown in Table 2.

Table 2. Probe and coring depth for Fountain Lake.

Site	Probe Depth (feet)	Core Push Depth (Feet)	Number of Samples per Core	Notes
Core 1	4.4	5.4	2	Silty clay
Core 2	2.4	7.2	2	Silty clay, shells at 3’
Core 3	3.2	8.1	3	Silty clay, soil and shells at 2’
Core 4	3.5	7.5	3	Silty clay, soil and shells at 3’
Core 5	6.3	7.2	2	Clay, soil at 3’
Core 6	4	6.7	1	Very silty clay
Core 7	2.3	7.3	3	Silty clay, coarse sand layer 1.5-4.2’
Core 8	6	6.7	2	Very silty clay, sand at 2.8’
Core 9	6.2	6.2	2	Silty clay
Core 10	5.3	5.3	2	Silty clay, soil and shells at 2.7’
Core 11	5.5-6.7	9	3	Silty clay, shells at 3.2’, sandy clay at 4.2’

5.0 Analytical Results

5.1 Laboratory Analysis

Table 3 provides a summary of the analytical data and shows the Tier 1 and Tier 2 SRVs. Except for two metals (arsenic and copper), all of the testing parameters were under the Tier 1 SRVs. Copper and/or arsenic in cores 5, 9, and 10 were found above the Tier 1 SRVs (100 mg/kg for copper, and 11 mg/kg for arsenic) at sediment depths representing potential dredge material. Arsenic was also detected above the Tier 1 SRV at the estimated new sediment surface after dredging at the Core 4 location but not in the sediment expected to be removed from the lake. None of the Tier 1 SRVs were exceeded at any of the other sites.

It should be noted that an effort to revise the entire list of SRVs is underway as stated in an official memorandum by the MPCA (December 2008). Current updates by MPCA to Tier 1 and Tier 2 SRV criteria have been incorporated in this report (see Table 3), but further changes may occur during the revision process.

In general, sediment from most of the expected dredge areas falls into the Level 1 management category, meaning a wider variety of reuse options are available. In the area just upstream from the dam, dredged sediment would fall under the Level 2 management category, which eliminates options for reuse on residential or recreational properties but still allows reuse for industrial applications. Management categories are discussed in detail in Section 7 of this report.

5.2 Grain Size Analysis

Sediment grain size was determined using sieve and hydrometer analysis (ASTM D-422, Appendix E). Most samples were dominated by silt except for Cores 7, 8, and 11. One sample at site 7 (located in the channel between Bancroft Bay and the main bay) was mostly sand and gravel and contained only 4% silt and clay in the middle of the core (1.5’ to 4.2’). Core 8 was classified as clayey and silty sand. Core 11, in Danes bay, had a one-foot layer of sediment (3.2’-4.2’) that was predominantly sand with only 15% silt and clay material. Above and below that layer, the sediment was mostly silt.

Table 3. Sediment analysis results for Fountain Lake.

Location: Fountain Lake					Core 1		Core 2		Core 3			Core 4			Core 5		Core 6	Core 7			Core 8		Core 9		Core 10		Core 11		
Date: February 5-7		Detection Limt	Tier 1 SRV	Tier 2 SRV	(0-2') 2/5/2009	(2-5.4') 2/5/2009	(0-3') 2/5/2009	(3-5') 2/5/2009	(0-2') 2/5/2009	(2-5') 2/5/2009	(5-6.5') 2/5/2009	(0-2') 2/6/2009	(2-5') 2/6/2009	(5-6.3') 2/6/2009	(0-2') 2/6/2009	(2-4.8') 2/6/2009	(0-2.8') 2/6/2009	(0-1.5') 2/6/2009	(1.5-4.2') 2/6/2009	(4.2-5') 2/6/2009	(0-2.8') 2/6/2009	(2.8-5.2') 2/6/2009	(0-2') 2/7/2009	(2-3.6') 2/7/2009	(0-2') 2/7/2009	(2-4.7') 2/7/2009	(0-3.2') 2/6/2009	(3.2-4.2') 2/6/2009	(4.2-6") 2/6/2009
Inorganic Metals																													
Arsenic	mg/kg	0.28	11	20	2.6	2.1	4.1	5.2	8.7	5	3.1	9.7	7.3	**20**	**13**	4.6	5.8	7.4		2.5	3	2.4	9.2	**17**	**13**	5.1	8.9	5.5	3.2
Barium	mg/kg	0.037	1200	18000	180	180	180	290	230	310	340	270	270	250	280	230	160	210		110	140	42	280	290	270	260	190	35	110
Cadmium	mg/kg	0.016	25	200	0.39	0.37	0.43	0.25	0.48	0.27	0.25	0.65	0.27	0.36	0.73	0.49	0.41	0.52		0.14	0.35	0.099	0.59	1	1.2	0.26	0.62	0.097	0.24
Chromium (Total)	mg/kg	0.032	NA	NA	13	14	12	4.6	13	6.3	5.2	18	6.4	7.2	18	14	14	14		14	11	6	18	19	18	6.7	17	5.5	12
Copper	mg/kg	0.021	100	9000	18	15	21	7.8	50	9.1	8.5	54	9.6	10	100	16	41	26		16	17	3.7	90	**160**	**120**	14	37	3	9
Lead	mg/kg	0.12	300	700	8.6	9.6	8.3	3.2	13	4.3	4.1	18	4.1	4.7	47	13	19	16		8	9.5	5.1	46	75	60	7.4	55	9.3	5.9
Nickel	mg/kg	0.065	560	2500	12	13	16	8.8	20	9.7	8.3	21	12	14	20	14	16	16		19	11	6.3	17	18	17	8.5	15	9.9	11
Selenium	mg/kg	0.25	160	1300	0.56	0.64	ND	ND	1	ND	ND	1.5	ND	ND	1.4	1.3	0.43	0.84		0.23	0.55	0.43	1.5	3.1	3.8	2.3	ND	0.97	0.21
Silver	mg/kg	0.023	NA	NA	0.031	0.065	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.063	0.028	ND		0.086	ND	ND	ND	0.11	0.093	ND	0.044	ND	0.047
Zinc	mg/kg	0.076	8700	75000	51	64	61	26	68	29	29	86	31	37	110	57	58	77		48	41	17	98	130	110	43	100	16	40
Chromium, Hexavalent	mg/kg	0.49	87	650	0.73	0.83	1.1	0.93	2.2	1.3	1.2	1.9	1.5	1.4	1.6	1.4	1.2	1.3		0.73	1.2		1.9	1.6	2.6	1.4	1.3		0.85
Chromium, Trivalent	mg/kg	0.28	44000	100000	12	13	11	3.7	11	5	4	16	4.9	5.8	16	13	13	13		13	9.8		16	17	15	5.3	16		11
Mercury	mg/kg	0.0015	1	2	0.041	0.04	0.037	0.015	0.047	0.015	0.015	0.052	0.015	0.017	0.085	0.056	0.045	0.064		0.03	0.033	0.0081	0.065	0.094	0.073	0.027	0.067	0.0072	0.026
Cyanide	mg/kg	2	62	5000											ND	ND	ND				ND	ND	ND	ND	ND	ND		ND	
General Parameters																													
Total Kjeldahl Nitrogen	mg/kg	79			2800	2400	4800	4300	11000	5300	4900	8500	5000	7200	5200	7300	2100	4800		270	3200	240	4400	6000	4800	6100	4700	290	1100
Ammonia as N	mg/kg	0.45			51	49	61	41	140	49	43	260	94	130	210	120	110	150		6.7	82	21	370	710	220	130	320	14	5.7
Nitrate + Nitrite as N	mg/kg	0.28			1.5	2.7	2.7	3	4.2	1.8	3.2	3.6	3.9	7.2	3.6	4.2	1.9	2.9		2.9	2	ND	4.8	3.1	6	5.3	3.8	0.22	2.1
Phosphorus, Total as P	mg/kg	3.1			370	580	570	670	680	520	530	700	680	640	830	520	520	810		410	400	250	860	1000	770	760	1000	150	470
% Solids	% Wt	0.01			57	50	44	43	23	37	40	27	38	37	25	40	44	36		79	51	73	28	29	25	38	39	77	69
Oil & Grease (HEM)	mg/kg	200			850	1400	1200	1100	1700	1200	1000	980	770	840	1100	1000	450	900		ND	650	ND	980	1700	1200	510	1700	ND	ND
Total Organic Carbon	mg/kg	1000			31600	18200	76000	88800	143000	123000	122000	104000	107000	126000	91200	87800	20700	48300		ND	24500	ND	74600	75100	69800	83900	36700	ND	ND
Sieve analysis >93%					No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No
Organics/Pesticides																													
Aldrin	mg/kg	0.0052	1	2	ND	ND	0.0094	0.0097	0.014	0.0092	0.015	0.018	0.017	0.013	0.017	0.01	0.015	0.011		ND	0.013	ND	0.024	0.024	0.016	0.011	0.017	ND	0.0095
gamma-Chlordane	mg/kg	0.0028	13	74	0.0072	0.0081	0.012	0.0089	0.02	0.01	0.014	0.018	0.011	0.013	0.023	0.011	0.013	0.014		ND	0.0093	0.0046	0.019	0.02	0.021	0.012	0.016	ND	ND
alpha-Chlordane	mg/kg	0.0033	13	74	0.0049	0.0071	0.011	0.0072	0.014	0.0082	ND	0.011	0.017	ND	ND	ND	0.016	ND		ND	0.012	ND	ND	ND	ND	ND	0.017	ND	ND
Endrin	mg/kg	0.0046	8	56	ND	0.0072	0.0094	ND	0.016	ND	ND	0.011	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	mg/kg	0.0036	0.8	2	0.006	0.0086	0.011	ND	0.019	ND	ND	0.014	0.014	ND	0.024	ND	0.013	ND		ND	0.01	ND	ND	0.02	0.021	ND	0.015	ND	ND
Heptachlor	mg/kg	0.0088	2	3.5	ND	ND	ND	ND	ND	ND	ND	ND	0.014	0.015	ND	0.013	ND	ND		ND	0.01	0.0084	ND	ND	ND	0.015	ND	ND	ND
Lindane (gamma-BHC)	mg/kg	0.0041	9	15	0.008	0.0082	0.01	0.0093	0.016	0.01	0.011	0.019	0.015	0.016	ND	0.014	ND	0.015		0.0065	0.011	ND	0.019	ND	0.022	0.015	ND	ND	0.0073
4,4'-DDT	mg/kg	0.0038	15	88	0.0056	0.011	0.013	0.0079	0.022	0.0088	0.016	0.013	ND	ND	0.042	ND	0.016	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	mg/kg	0.0025	56	125	0.0082	0.016	0.018	0.01	0.036	0.012	ND	0.019	0.012	0.011	0.022	0.0093	0.01	0.011		0.0051	0.0082	0.0043	0.015	0.02	0.016	0.011	0.018	ND	0.0053
4,4'-DDE	mg/kg	0.0043	40	80	0.0088	0.014	0.02	0.011	0.031	0.014	0.015	0.024	ND	0.018	0.046	ND	0.019	ND		ND	0.013	ND	0.025	0.032	0.03	ND	0.028	ND	ND
Toxaphene	mg/kg	0.16	13	28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCBs																													
PCB 1016	mg/kg	0.042			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1221	mg/kg	0.042			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1232	mg/kg	0.042			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1242	mg/kg	0.042			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1248	mg/kg	0.042			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1254	mg/kg	0.08			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	0.17	ND	ND	0.25	ND	ND
PCB 1260	mg/kg	0.08			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1268	mg/kg	0.08			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	mg/kg	1.20	1.2	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.25	0.00	0.00
VOCs																													
Vinyl chloride	mg/kg	0.052					ND	ND	ND	ND	ND																		
Benzene	mg/kg	0.0095					ND	ND	ND	ND	ND																		
Toluene	mg/kg	0.037					ND	ND	ND	ND	ND																		
Chlorobenzene	mg/kg	0.0090					ND	ND	ND	ND	ND																		
SVOCs/PAHs																													
2-Methylnaphthalene	mg/kg	0.041	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	mg/kg	0.018	1200	5260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	mg/kg	0.012			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	mg/kg	0.018	7880	45400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22	ND	0.11	ND		ND	ND	ND	ND	0.19	ND	ND	0.14	ND	ND
Benz(a)anthracene	mg/kg	0.018	T	T	ND	ND	ND	ND	ND	0.12	ND	ND	ND	ND	0.46	ND	0.23	ND		ND	ND	ND	0.36	0.36	ND	ND	0.27	ND	ND
Benzo(a)pyrene	mg/kg	0.014	T	T	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	0.17	ND	0.058	ND		ND	ND	ND	ND	0.083	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	mg/kg	0.03	T	T	ND	ND	ND	ND	ND	0.28	ND	ND	ND	ND	0.16	ND	0.071	ND		ND	ND	ND	ND	0.087	ND	ND	0.051	ND	ND
Benzo(g,h,i)perylene	mg/kg	0.011			ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	mg/kg	0.025	T	T	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	0.18	ND	0.048	ND		ND	ND	ND	ND	0.062	ND	ND	ND	ND	ND
Carbazole	mg/kg	0.026	700	1310	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	mg/kg	0.018	T	T	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	0.15	ND	0.071	ND		ND	ND	ND	ND	0.083	ND	ND	0.072	ND	ND
Dibenz(a,h)anthracene	mg/kg	0.037	T	T	ND	ND	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	mg/kg	0.023	104	810	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	mg/kg	0.012	1080	6800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.38	ND	0.13	ND		ND	ND	ND	0.068	0.16	0.078	ND	0.12	ND	ND
Fluorene	mg/kg	0.0071	850	4120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	mg/kg	0.016	T	T	ND	ND	ND	ND	ND	0.23	ND	ND	ND	ND	0.096	ND	0.044	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	mg/kg	0.0088	10	28	ND	ND	0.15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	mg/kg	0.014			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16	ND	0.041	ND		ND	ND	ND	ND	0.062	ND	ND	0.059	ND	ND
Pyrene	mg/kg	0.018	890	5800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.34	ND	0.11	ND		ND	ND	ND	0.074	0.17	0.062	ND	0.1	ND	ND
B(a)P Equivalent[1]	mg/kg		2 T	3 T	0.0219	0.0219	0.0219	0.0219	0.0219	0.3482	0.0219	0.0219	0.0219	0.0219	0.27146	0.0219	0.10837	0.0219		0.0219	0.0219	0.0219	0.057	0.14589	0.0219	0.0219	0.05223	0.0219	0.0219

Concentrations above the Teir 1 SRV criteria are in bold and boxed

Concentrations above the Teir 2 SRV criteria are in red bold and underlined

T Value represents a criteria for the total carcinogenic PAHs as BaP. Total carcinogenic PAHs are: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, Chrysene and Indeno(1,2.3-cd)pyrene.

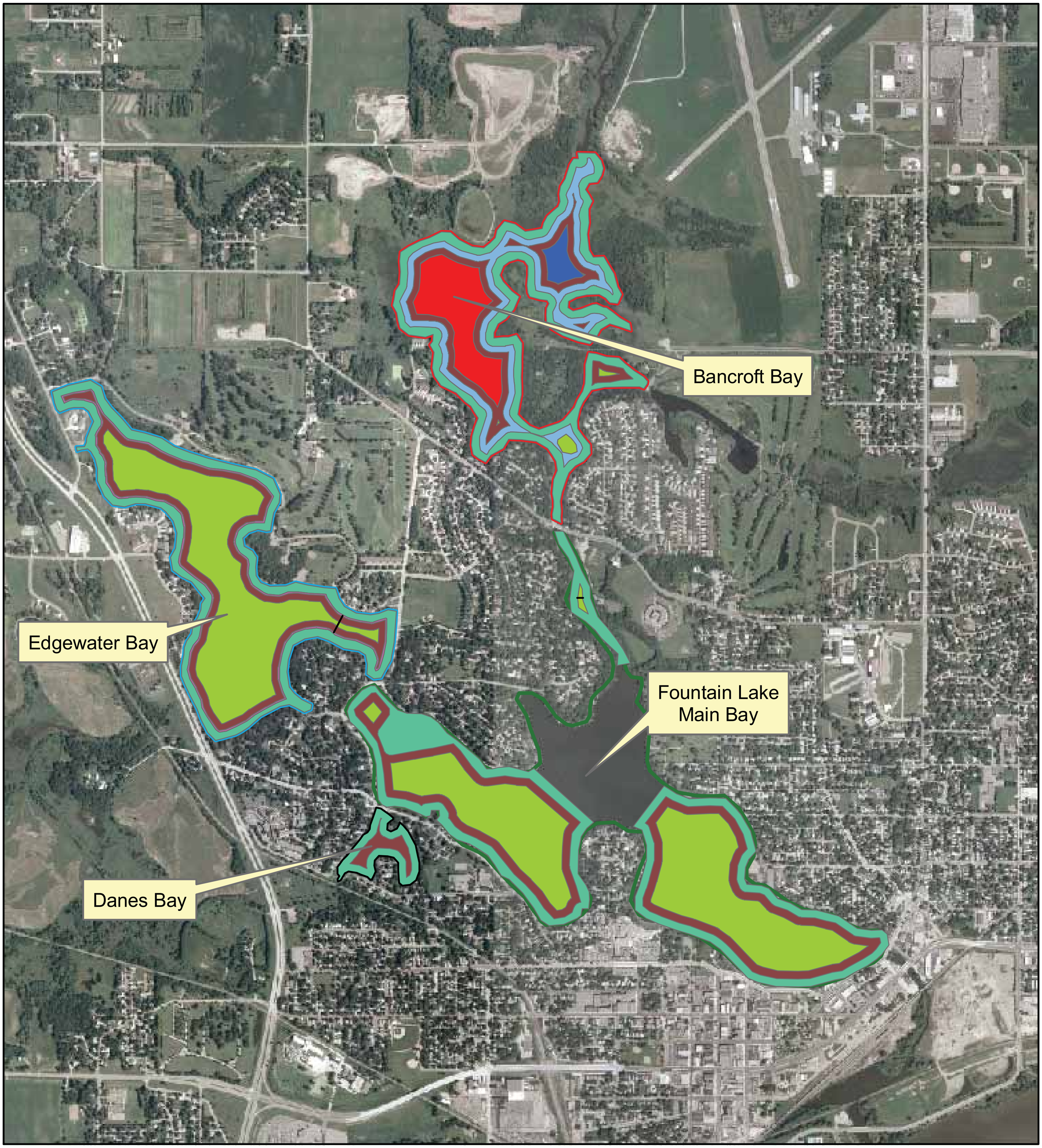
[1] Total BaP equivalents (2002) calculated using 1/2 for the detection limit on the non detected compounds.

6.0 Volume Estimate

Prior to the sediment coring, a preliminary dredging plan was developed to estimate the amount of sediment removed based on the Districts overall desires for water depth. Data from the 1973 and 2006 sediment probing studies were used to estimate the amount of sediment able to be removed, assuming dredging will not go deeper than the natural lake bottom. In most cases, sediment probing indicated silty, soft bottom sediments ranging from 4 to 6 feet in total sediment depth, with some small areas of approximately 8-10 feet and areas of less than 4 feet of soft sediment. In addition, to ensure stable sediment slopes after lake dredging, a 20:1 slope was assumed for all proposed dredging areas. In most cases, the amount of proposed sediment removal was limited by the depth of sediment accumulation (4 to 6 feet in most areas). Dredging below these depths may be possible but some potential concerns include:

- Dredging past the natural lake bottom may not be accepted once the permitting process begins
- Dredging cost may increase due to the condensed, clay-like nature of the underlying sediment
- The bottom lining of the lake may be punctured, causing accelerated drainage of the lake water

The preliminary proposed dredging plan is shown in Figure 3. District staff expressed interest in prioritizing dredging efforts toward Bancroft Bay and Edgewater Bay because higher sedimentation has historically occurred in the upstream bays where much of the sediment in the inflows settles out. Accordingly, the preliminary dredging plan maximizes potential removal in Bancroft and Edgewater Bays and presents cursory options for limited dredging in the main bay of Fountain Lake.



Proposed Dredging Areas

Sediment removal depth (feet)

- 0-2
- 2
- 4
- 5
- 6
- 5-6

0 0.2 0.4 0.8
Miles

FIGURE 3

Fountain Lake Preliminary Dredging Plan

Shell Rock River Watershed District
Freeborn County, MN

It is important to note that the proposed dredging plan shown in Figure 3 is preliminary in nature for the purposes of estimating the sediment removal totals and potential costs. The plan is subject to change based upon more accurate bathymetry, final evaluation of the potential disposal options and locations, the engineering and design of the dredging project, the funds available for the project, and input from the District staff, Board of Managers and other stakeholders. The observations and results used to develop the preliminary dredging plan are presented below for each individual portion of the lake (Edgewater Bay, Bancroft Bay, Fountain Lake main bay, and Danes Bay).

Edgewater Bay

Assumptions

- Current average water depth is 5 feet
- 20:1 slope is recommended for dredging (20 feet horizontally from shore for every vertical foot of sediment dredged)
- Average sediment accumulation thickness (from 2006 study) is 5 feet

Sediment Removal Estimate

- Approximately 695,000 CY of sediment can be removed

Bancroft Bay

Assumptions

- Current average water depth is 2-3 feet
- 20:1 slope is recommended for dredging (20 feet horizontally from shore for every vertical foot of sediment dredged)
- Average sediment accumulation thickness (from 2006 study) is 5-8 feet

Sediment Removal Estimate

- Approximately 583,100 CY of sediment can be removed

Fountain Lake (main bay)

Assumptions

- Approximate current average water depth is 5 feet (for east and west bay dredge areas); total average lake depth is approximately 6 feet
- 20:1 slope recommended for dredging (20 feet horizontally from shore for every vertical foot of sediment dredged)
- Average sediment accumulation thickness (from 2006 study) is 5 feet (East Bay) to 5.4 feet (West Bay)

Sediment Removal Estimate

- Approximately 887,400 CY of sediment can be removed from the areas indicated in the main bay
- Proposed northeast channel sediment removal (between Bancroft Bay and Fountain Lake main bay) represents an additional 5,000 CY removed

Danes Bay

Assumptions

- Approximate current average water depth is estimated to be 5 feet
- 20:1 slope recommended for dredging (20 feet horizontally from shore for every vertical foot of sediment dredged)
- Sediment accumulation thickness from the 1973 study is 4.8 feet and this study is 6.7 feet

Sediment Removal Estimate

- Approximately 33,000 CY of sediment can be removed

Table 4 shows the estimated amounts of expected dredge spoil volume from each area. This is not the total amount of silty, soft sediment present but the estimated amount that can be removed based on the constraints (e.g. maintaining a 20:1 sediment slope) for each area listed above.

Table 4. Estimated total amount of sediment that can be removed from Fountain Lake.

Location	Area (acres)	Amount (CY)
Edgewater bay	142.7	695,000
Bancroft Bay	124.2	583,100
Main Bay	239.5	892,400
Danes bay	11.8	33,000
Total	**518.2**	**2,203,500**

7.0 Disposal and Reuse

Dredged material is categorized into three management levels using the results of sediment characterization based on the pollutant concentrations found in the sediment. The three management levels, ranging from Level 1 (residential or recreational application) to Level 3 (not suitable for reuse) correspond to the Tier 1 through Tier 3 SRVs for sediment pollutant characterization and are as follows:

Level 1 Dredged Material is suitable for use or reuse on properties with a residential or recreational use category. Land application on agricultural fields may be appropriate but further analysis and permitting may be required.

Level 2 Dredged Material is suitable for use or reuse on properties with an industrial use category.

Level 3 Dredged material is not suitable for use or reuse and requires addition regulatory requirements that are not applicable to Fountain Lake sediments.

7.1 General

Dredged material may be disposed of at a permitted solid waste facility; at a permitted on-site or off-site location; or through beneficial use or reuse such as fill, road subbase, or land application. The selection of disposal options will be dependent upon several factors, including the amount of dredged sediment, the level of contamination in the dredged sediment, and the sediment composition.

Use as general fill and/or as a top soil amendment are likely reuse options for most of the expected dredge spoils. If sediments are dredged from the area upstream from the dam they would likely be considered Level 2 for management purposes and could be used as fill for industrial applications. Reuse of the dredge spoils as construction fill or road base may be an additional option; however, sediments high in silt are typically not desirable for engineered fills. With the amount of sediment expected to be removed from Fountain Lake, both land application and off-site (either local or landfill) disposal may be needed.

If the option of local disposal is selected (instead of or in combination with reuse), the MPCA Guidance Document identifies several criteria stating that the disposal facility must be:

- Above the ordinary high water table.

- Not located within a shoreland or wild and scenic river land use district (Minn. R. chapters 6105 and 6120).

- Not located within a wetland, unless federal, state and/or local approval has been obtained.

- Not located in the designated Karst Region in the Southeastern portion of Minnesota.

- At least 50 feet from the site property line.

Facilities for disposal of dredged materials are required to be designed by a professional engineer registered in the state of Minnesota. A detailed list of design, management, and closure requirements are provided in the MPCA Guidance Document beginning on page 41.

Dredge spoils may also be disposed of at a permitted solid waste facility however this is generally the most expensive option available and should only be selected if all other options are exhausted.

7.2 Dredging Methods

Different dredging methods can impact the design of a dredging project. Either mechanical or hydraulic dredging methods could be utilized for the proposed project. A brief description of each method follows.

7.2.3 Mechanical Dredging

Mechanical dredging consists of removing material by excavating or scooping sediment from the channel or lake bottom and placing the material on a barge, truck or disposal area. Mechanical dredging equipment includes clamshells, draglines, backhoes or other mechanical equipment for excavating bottom sediments. Typically, mechanical dredging equipment is mounted on a large barge and towed to the dredge site and secured with vertical anchor piling called spuds. Excavated material would then be placed and transported by shuttle barges or off-road trucks to the disposal area. Mechanical dredging at areas with difficult access would most likely require the use of barges to transport dredge spoils to off-road trucks prior to hauling to disposal areas. Mechanical dredges work best when dredging consolidated material and can be used to remove rocks, timbers, stumps and other debris that may exist at the identified sites. Mechanical dredging equipment often has difficulty retaining loose fine material which can wash out of the bucket as it is raised.

7.2.4 Hydraulic Dredging

Hydraulic dredging includes the use of pumps and piping for removing (pumping) a mixture of dredged material and water from the channel or lake bottom. A typical pipeline hydraulic dredge sucks the mixture (slurry) of sediment and water through one end and pumps the material through the discharge pipeline directly to the final disposal area. A mechanical cutting head, consisting of rotating blades, is often included at the intake pipe to agitate and loosen bottom sediments so they can be pumped through the system. Similar to mechanical dredging, hydraulic dredging equipment is typically mounted on a large barge and towed to the dredge site and secured with spuds during dredging operations. This dredging method requires a larger spoils storage and/or disposal area than mechanical dredging due to the greater volume of water that must be handled to minimize environmental impacts from return water. The dredge spoils often contain only 5% to 20% solids depending on characteristics of the sediment and whether polymers or additives have been introduced to increase the solids content of the slurry. Hydraulic pipeline dredges can be very cost efficient because they can operate continuously and pump directly to the disposal site (if the site is close to the lake). However, the presence of substantial debris at the dredging site can clog pumps and reduce efficiency.

7.3 Consideration of Techniques

There are many factors to consider when selecting a dredging method. One key consideration is the impact on the lake ecosystem. Hydraulic dredging, for example, is known to create significantly less turbidity than mechanical dredging. However, hydraulic dredging will require larger dewatering areas and result in the management of more return water. Several site parameters need to be addressed during selection and estimating the cost of a dredging method. The following is a list of the factors that should be considered when selecting a dredging technique:

- Sediment characterization and potential environmental concerns
- Depth of the lake water and depth of sediment to be dredged
- Permitting considerations
- Location, access, and distance to disposal area
- Proposed dewatering system; containment dikes, ponds, polypropylene/geotextile tubes
- Time constraints (dredge spoils consisting of silt and fine material may take well over a year to dry unless flocculants are used)
- Potential beneficial reuse of material
- Available land for dredge spoil containment, dewatering, and disposal

Because of the size of the project and the type of sediment to be removed (silty), hydraulic dredging is likely the best method for dredging in most areas. Even though hydraulic dredging will create more dredged volume and additional return water, it is likely to be less expensive and require much less time for the actual dredging process than mechanical dredging. The decision regarding dredging methodology should be addressed in further detail in the feasibility/design phase of the project, based on the factors outlined above.

7.4 Potential Storage and Disposal Sites

Potential dredge spoils dewatering, storage, or disposal areas were identified based on proximity to the proposed dredging areas and other parameters including: low use/non-residential paths from the lake to the spoils site, size of the site, current land use, available access roads, and expected cost for land rental or acquisition (Figure 4). The potential sites identified in Figure 4, which are based on local parcel data, are preliminary in nature. A more detailed investigation of potential storage and/or disposal sites should be completed in the feasibility/design phase for the project.

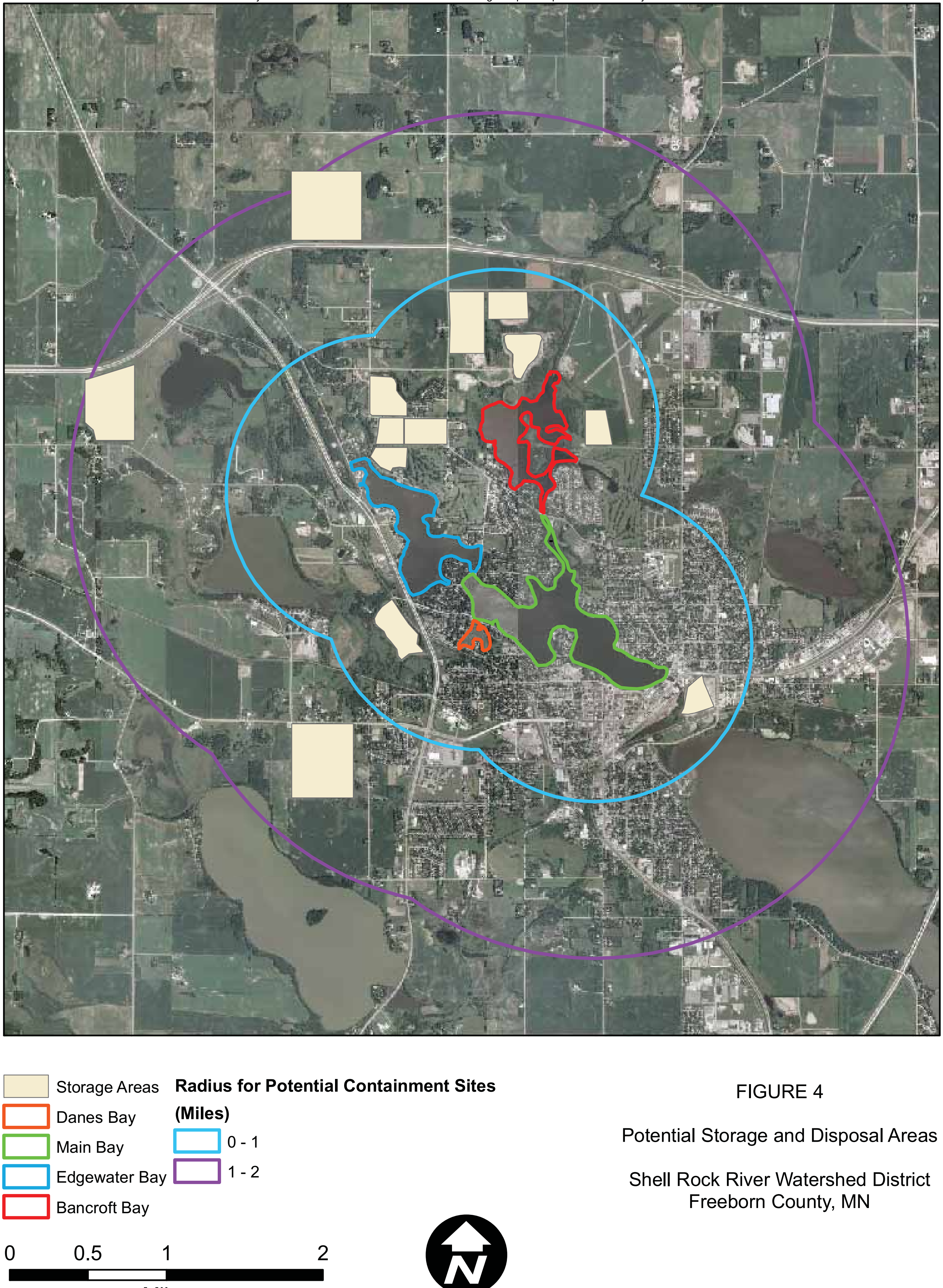


FIGURE 4

Potential Storage and Disposal Areas

Shell Rock River Watershed District
Freeborn County, MN

8.0 Permitting

Except for specific situations, a permit is required by the MPCA for the management of dredged material in the state of Minnesota. The MPCA Guidance Document provides a permit decision flow chart. The diagram indicates that for dredged materials disposed of, or stored for more than 1 year, an individual NPDES/SDS (National Pollutant Discharge Elimination System/State Disposal System) permit is needed if water discharge exists from the dredged material (e.g. ongoing dewatering). The silty nature of the sediments and the total amount expected to be removed indicates that a water discharge is likely. Return water will need to meet discharge requirements for water quality including turbidity and pollutants.

Additional permitting requirements will be dependent on the dredging methods (mechanical/hydraulic), dewatering techniques and facilities (containment dikes, ponds, polypropylene/geotextile tubes), time constraints, staging (will dewatering occur at an interim site or at its final disposal location), dredge spoils handling, long term storage and disposal, and other parameters listed in this report. As noted in Section 7.0, these factors will be addressed in further detail in the feasibility/design phase of the project.

In general, permitting will be required for:

- Dredging
- Construction of the sedimentation basin
- Dredge spoils storage and disposal
- Water discharge back to the lake

Permits from other local, state, and federal regulatory agencies are also likely to be required, including the MN DNR and the US Army Corp of Engineers. In addition, completion of an environmental assessment worksheet (EAW) and an environmental impact statement (EIS) will likely be required before dredging can begin.

9.0 Opinion of Cost

The costs included in a dredging project typically include:

- Engineering and design (including project supervision)
- Permitting
- Construction (dredging and spoils containment/disposal)
- Post construction monitoring (bathymetric survey)
- Legal/bonding costs
- Administration
- Contingencies
- Capitalized interest

Dredging costs are highly dependent on dredging techniques and disposal locations. Hydraulic dredging is the likely choice of dredging method for most areas within Fountain Lake. Based on conversations with dredging contractors, hydraulic dredging is estimated to cost between $4 - $6 dollars per cubic yard of sediment removed. The above estimate does not include costs associated with preparation, operation and restoration of disposal areas; and project costs such as land acquisition, permitting, engineering and design, construction administration, etc. Costs related to these items are further addressed below.

This unit cost for disposal is dependent upon long term storage or reuse within the surrounding area. If there are not enough beneficial reuse options available to distribute the entire amount of dredge spoils, a long term storage facility or disposal in a sanitary landfill will be required. The primary options for reuse of the dredge spoils from Fountain Lake are listed below. Note that the availability of many of these options will be dependent upon demand at the time of dredging.

- Landfill cover (Steele County Sanitary Landfill):

  Cost: Approximately $10 per cubic yard.

  Potential Disposal Amount: 40,000-50,000 cubic yards based on conversations with Steele County staff.

- Land application:

Cost: Costs associated with transportation and spreading of material which are dependent upon distance. This option is likely only cost effective within a 5-10 mile radius of the storage site.

Potential Disposal Amount: 10,000 to 100,000 cubic yards, depending on demand.

- Permanent disposal site:

  Cost: Land acquisition (approximately 100 acres) to store the material.

  Potential Disposal Amount: Up to the total amount.

- Sell as a top soil amendment:

  Cost: May be able to sell for $1 per cubic yard.

  Potential Disposal Amount: Depends on market conditions and local demand.

- Allow local contractors to use as fill for construction projects:

  Cost: May have to pay for hauling (approximately $4 per cubic yard).

  Potential Disposal Amount: At least 500,000 cubic yards.

From conversations with local contractors in and around the Albert Lea area (see Appendix F for a partial list), a large portion (500,000 cubic yards or more) of the dredge spoils could be used as low quality fill for construction projects. The spoils would have to be dewatered for use in this manner but there would be no disposal fee. A small amount (approximately 10-15%) may be used either in land application or as top soil amendment. Based on the above information, disposal costs may range from $3 to $5 per cubic yard of sediment. Again, however, this is highly dependent on demand for this type of material during the time of excavation.

A local site near the lake will be required for temporary containment and dewatering purposes. It may be necessary to lease land for temporary containment or purchase approximately 100 acres for permanent disposal. Purchase or lease of the land and construction costs for the containment facility is estimated to run between $5 and $7 per cubic yard of sediment. This includes cost for coagulants likely to be necessary to help consolidate the sediment and to reduce the amount of suspended sediment and other pollutants in the return water before discharge back to the lake. If an adequate containment site can not be secured, mechanical dewatering can be used but this option is generally more expensive.

The total estimated cost range for dredging and disposal of Fountain Lake sediment is expected to be between $12 and $18 per cubic yard of sediment removed. In addition, costs for engineering and design, permitting, and construction observation and administration are estimated to cost in the range of $400,000 to $600,000. Please note that this opinion of probable cost is made on the basis of the project related information available at this time, including conversations with contractors and probable reuse or disposal options for the dredge spoils removed from the lake. It is recommended that a detailed feasibility/design study be completed to develop a more accurate cost estimate before the project begins. The costs in this report are reconnaissance –level opinions of cost to be used for planning purposes. More precise costs may be determined when dredge technique and land disposal options are firmed up.

10.0 References

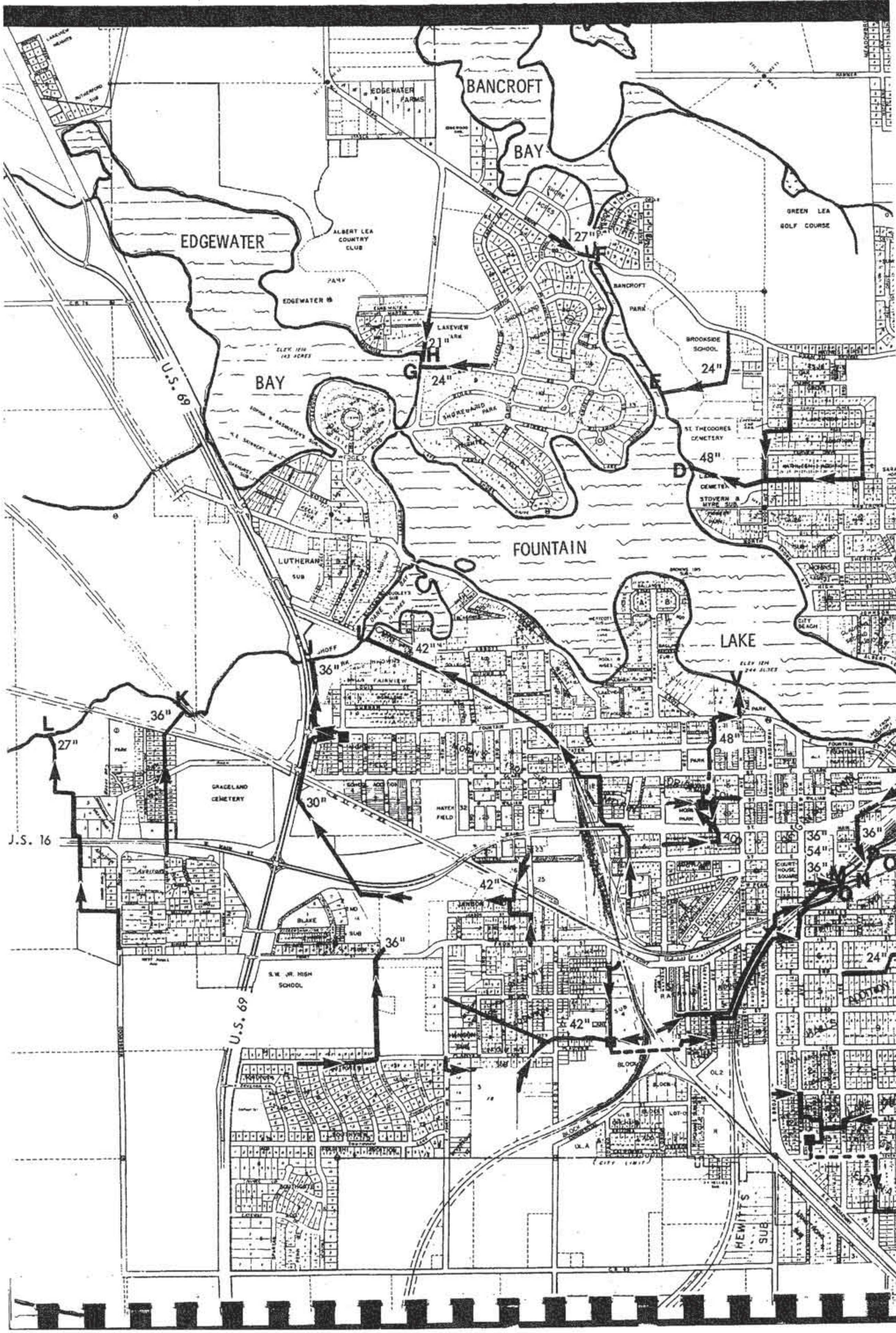
Minnesota Pollution Control Agency (MPCA). March 2008. *Managing Dredged Materials in the State of Minnesota*

A Study of Albert Lea Lake Watershed. 1973. Prepared for the City of Albert Leas and Freeborne County Commissioners.

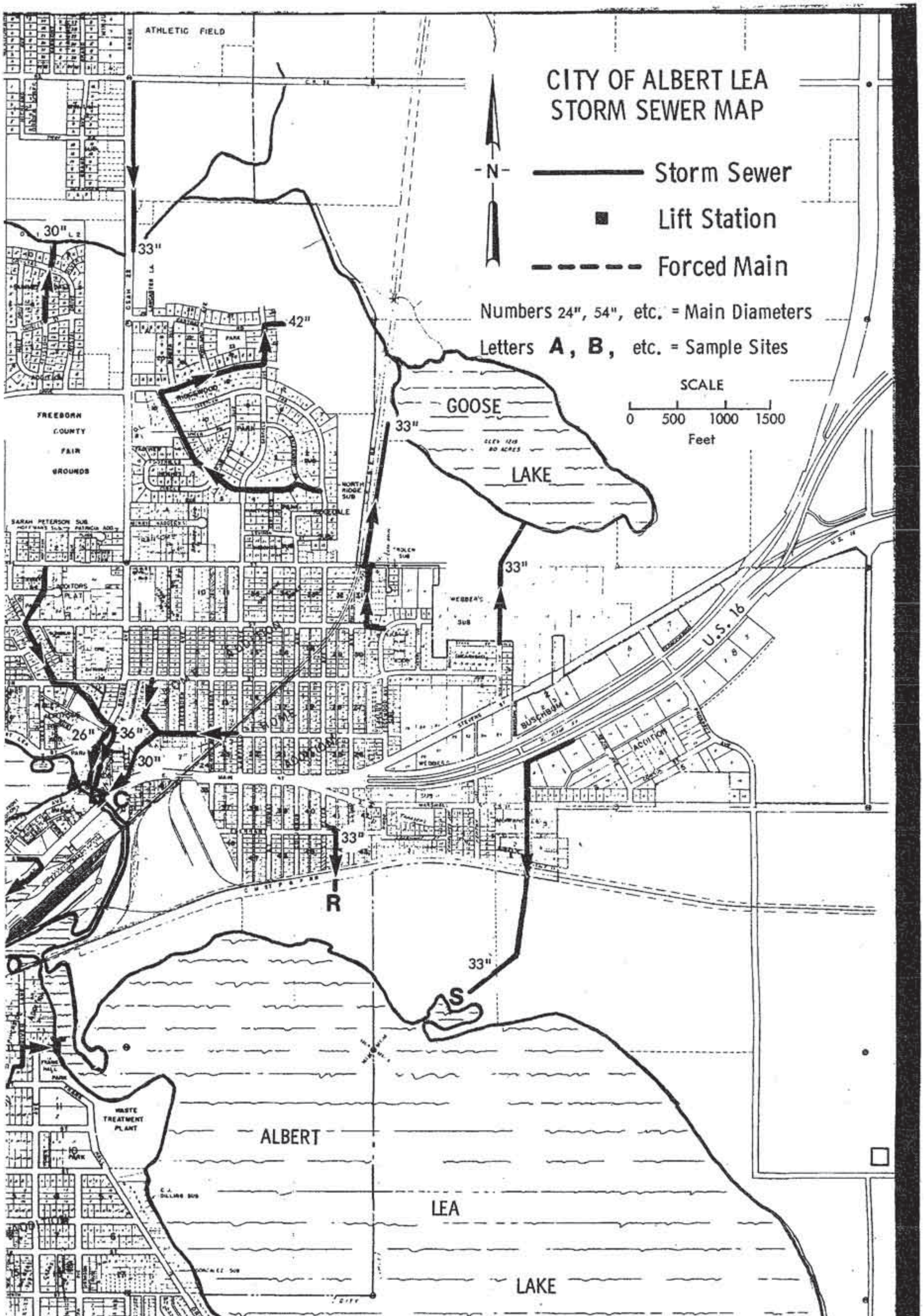
Bancroft Bay Sediment Depth Investigation and Proposed Dredging Contour Plan. 2006. Prepared for the Shell Rock River Watershed District.

Appendix A

Storm Sewer Outfalls



BANCROFT
BAY
EDGEWATER
BAY
FOUNTAIN
LAKE
U.S. 69
U.S. 16
ALBERT LEA COUNTRY CLUB
EDGEWATER PARK
LAKEVIEW PARK
BANCROFT PARK
BROOKSIDE SCHOOL
GREEN LEA GOLF COURSE
SHOREWARD PARK
ST. THEODORES CEMETERY
LUTHERAN SUB
GRACELAND CEMETERY
S.W. JR. HIGH SCHOOL
BLAKE SUB
COURT HOUSE SQUARE
CITY BEACH
HEWITTS SUB
FAIRVIEW
27"
21"
24"
24"
48"
42"
36"
36"
27"
48"
30"
42"
36"
42"
36"
54"
36"
36"
24"
A
B
C
D
E
F
G
H
I
J
K
L
N
O
P
Q



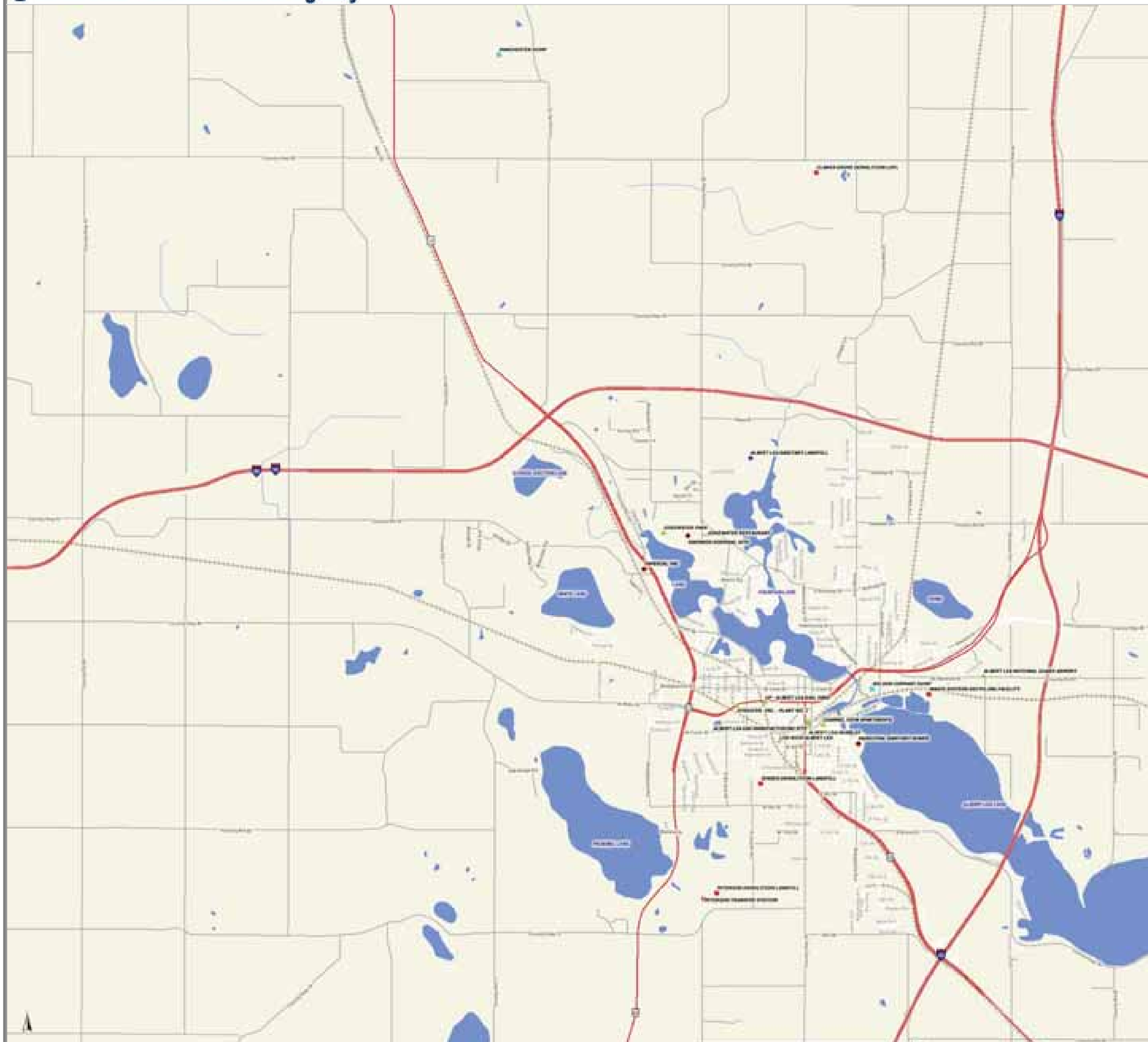
CITY OF ALBERT LEA
STORM SEWER MAP
-N-
Storm Sewer
Lift Station
Forced Main
Numbers 24", 54", etc. = Main Diameters
Letters A, B, etc. = Sample Sites
SCALE
0 500 1000 1500
Feet
ATHLETIC FIELD
GOOSE
LAKE
FREEBORN COUNTY FAIR GROUNDS
SARAH PETERSON SUB
WEBBER'S SUB
U.S. 16
BUSCHBOM
ALBERT
LEA
LAKE
WASTE TREATMENT PLANT
33"
30"
42"
36"
26"
C
R
S

Appendix B

MPCA "What's in my backyard" Maps

Fountain Lake

Minnesota Pollution Control Agency

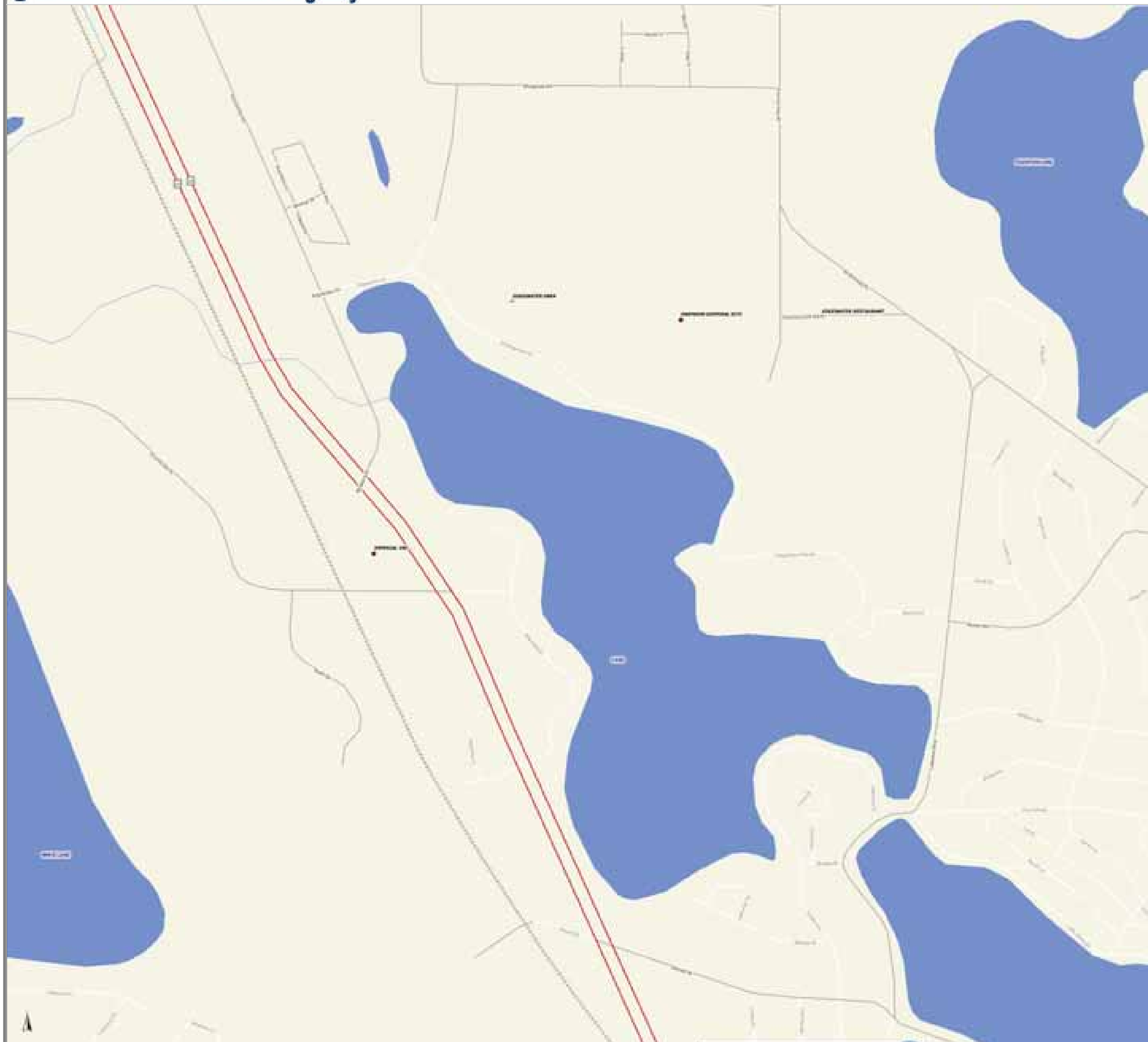


Sites

- Delisted State Superfund
- Permitted Solid Waste
- Unpermitted Dumps
- NFRAP
- State Superfund
- CERCLIS
- Federal Superfund
- State Closed Landfills
- Voluntary Investigation & Cleanup
- RCRA TSD Facilities
- RCRA Investigation & Cleanup
- State Assessment

Edgewater Bay

Minnesota Pollution Control Agency

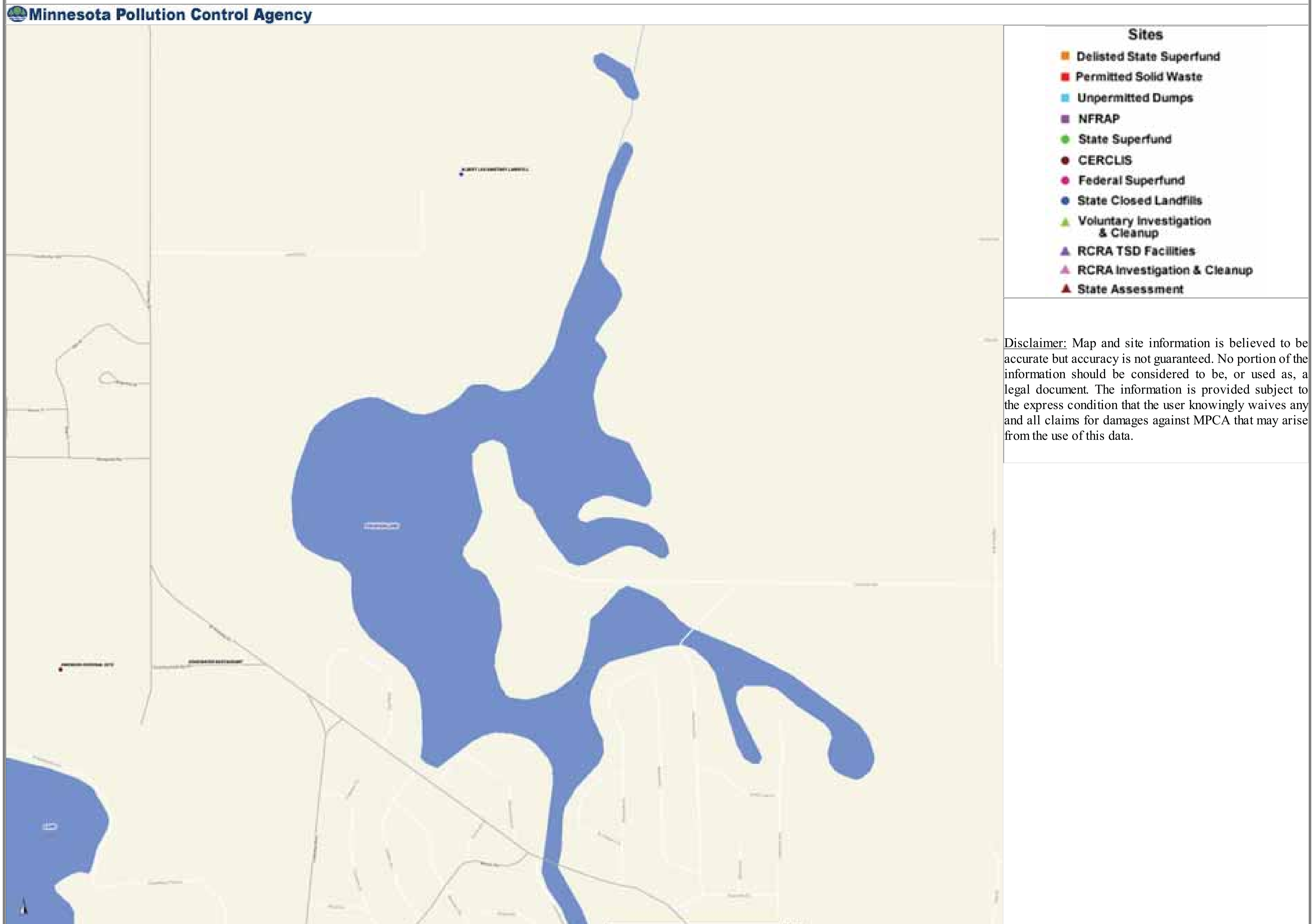


Sites

- Delisted State Superfund
- Permitted Solid Waste
- Unpermitted Dumps
- NFRAP
- State Superfund
- CERCLIS
- Federal Superfund
- State Closed Landfills
- Voluntary Investigation & Cleanup
- RCRA TSD Facilities
- RCRA Investigation & Cleanup
- State Assessment

Disclaimer: Map and site information is believed to be accurate but accuracy is not guaranteed. No portion of the information should be considered to be, or used as, a legal document. The information is provided subject to the express condition that the user knowingly waives any and all claims for damages against MPCA that may arise from the use of this data.

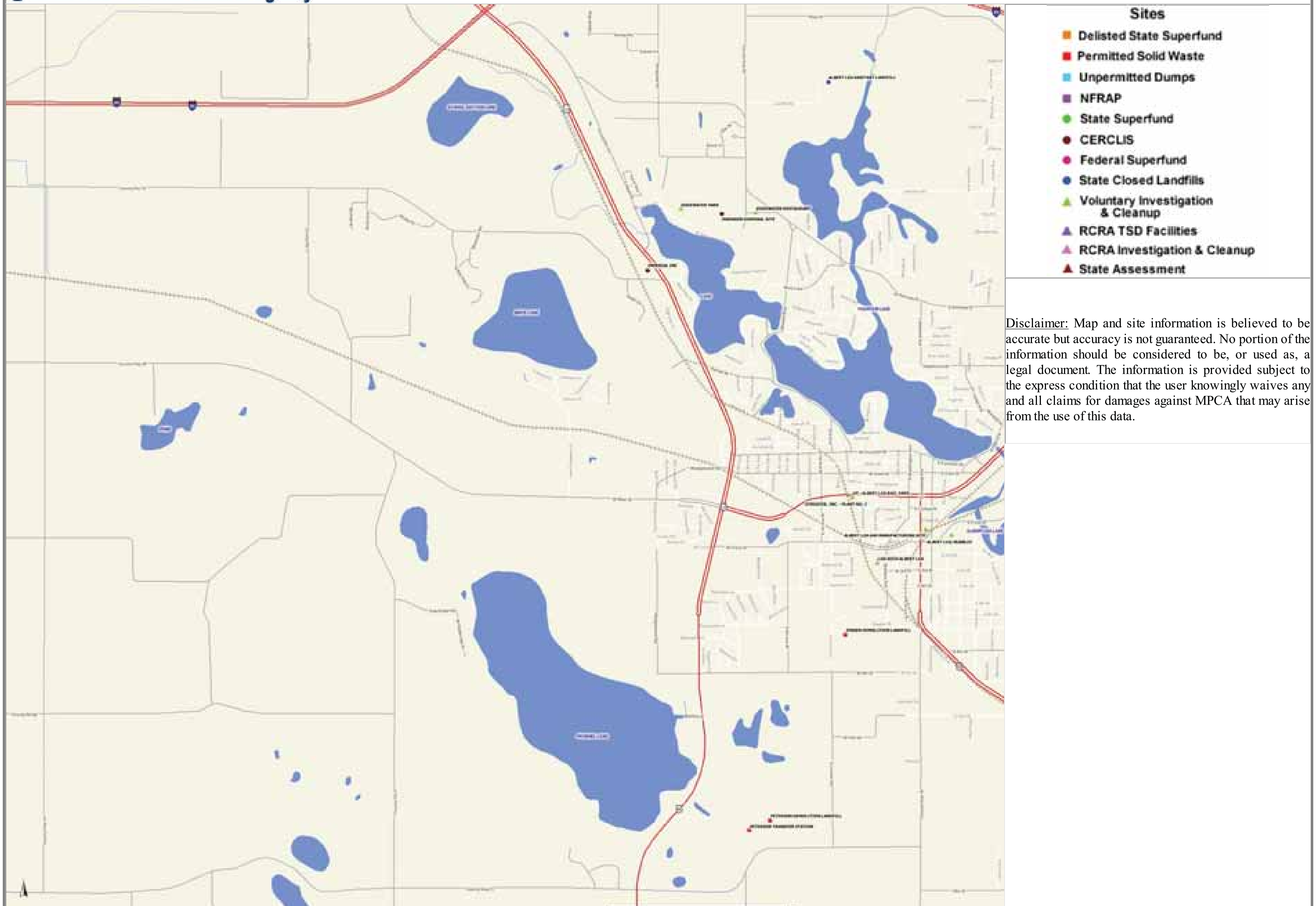
Bancroft Bay



Disclaimer: Map and site information is believed to be accurate but accuracy is not guaranteed. No portion of the information should be considered to be, or used as, a legal document. The information is provided subject to the express condition that the user knowingly waives any and all claims for damages against MPCA that may arise from the use of this data.

Fountain Lake Southwest

Minnesota Pollution Control Agency



Disclaimer: Map and site information is believed to be accurate but accuracy is not guaranteed. No portion of the information should be considered to be, or used as, a legal document. The information is provided subject to the express condition that the user knowingly waives any and all claims for damages against MPCA that may arise from the use of this data.

Appendix C

Site Photos

Photos from sampling at Fountain Lake

Site 2, Edgewater Bay. Landfill excavation in the background (north)

Site 4, Edgewater Bay. Open area in ice from aeration in the background.

Site 8, Main Bay. Top section of the sediment core.

Appendix D

Sediment Core Description

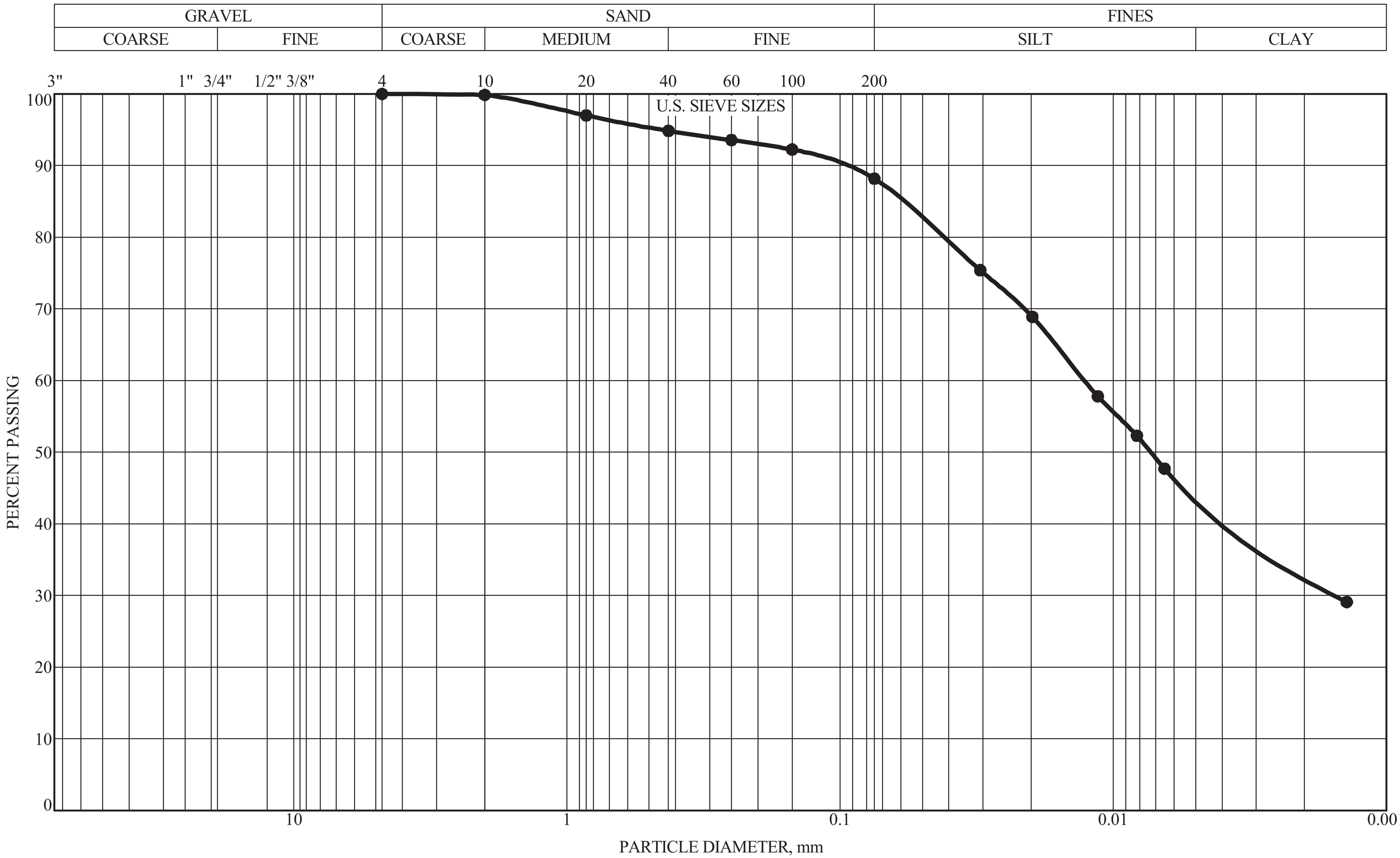
Core	Core 1		Core 2		Core 3			Core 4			Core 5		Core 6	Core 7		
Section	1	2	1	2	1	2	3	1	2	3	1	2	1	1	2	3
Date	2/5/2009		2/5/2009		2/5/2009			2/6/2009			2/6/2009		2/6/2009	2/6/2009		
Ice Depth	2.5		2.6		1.9			1.6			2		2	1.8		
Water Depth	4.8		5.6		5.9			5.5			6		6.5	2.6		
Core Push Depth	5.4		7.2		8.1			7.5			7.2		6.7	7.3		
Manual Probe Depth	4.4		2.4		3.2			3.5			6.3		4	2.3		
UTM North	4835144		4834856		4834422			4834605			4833619		4833975	4834675		
UTM East	468075		468294		468377			468662			469586		469181	469720		
Sediment Lithology																
Upper Depth	0	2	0	3	0	2	5	0	2	5	0	2	0	0	1.5	4.2
Lower Depth	2	5.4	3	5	2	5	6.5	2	5	6.3	2	4.8	2.8	1.5	4.2	5
USCS	CL	CL	CL-ML	CL-ML	CL	CL-ML	CL-ML	CL	CL-ML	CL-ML	CL	CL-ML	CL	CL,silty	GP-SP	CL
Grain Size	Fine-med	Fine-med	Fine	Med-fine	Fine	Med	Med	Fine	Fine-med	Med	Fine	Fine-med	Fine	Fine	Med-Coarse	Fine
Inclusions															15% med sand	
Moisture	Wet/moist	Moist	Wet	Moist	Wet	Moist	Moist	Wet	Moist	Moist	Wet	Moist	Wet	Wet-moist	Moist	
Color	V. Dk Bn	V. Dk Bn/Bk	V. Dk. Gy	V. Dk Gy/Bn	V. Dk Gy	Dk Bn	Dk Bn	V. Dk Gy	Gy/Dk Bn	Dk Bn	Dk Gy	V. Dk Bn/Bk	V. Dk Gy	V. Dk Gy	Gy	Gy
Comments	Silty Clay	Tighter clay/ 20% clay	Silty clay	Clumpy, less H2O, shells	Silty clay	Clumpy w/ shells, H2S	Clumpy w/ shells, H2S	Silty clay	Soil consistency, shells, H2S odor		Sticky CL	Soil consistency	Silty Clay			Tight clay, can't mix
Other Notes	Land fill removal on N. shoreline.		Aeration pump operating 700-800' SE of site										Poor recovery	Firm gravel sand layer from 1.5-4.2'		

Core	Core 8		Core 9		Core 10		Core 11		
Section	1	2	1	2	1	2	1	2	3
Date	2/6/2009		2/7/2009		2/7/2009		2/6/2009		
Ice Depth	2		2		2		1.7		
Water Depth	6.1		7.8		7.7		3.5		
Core Push Depth	6.7		6.2		5.3		9		
Manual Probe Depth	6		6.2		5.3		5.5-6.7		
UTM North	4833887		4833727		4833402		4833732		
UTM East	469648		470125		470400		468925		
Sediment Lithology									
Upper Depth	0	2.8	0	2	0	2	0	3.2	4.2
Lower Depth	2.8	5.2	2	3.6	2	4.7	3.2	4.2	6
USCS	CL	SP	CL	CL	CL	CL-ML	CL	SP	CL,S
Grain Size	Fine-med	Med	Fine-med	Fine-med	Fine	Fine-med	Fine	Med	Med
Inclusions	Tr. Sand	Tr clay						15% shells	20% SP
Moisture	Wet-moist	Moist	Moist	Moist	Wet	Moist	Wet	Moist	Moist
Color	Dk Bn/Dk Gy	Gy	V. Dk Gy	V. Dk Gy	V. Dk Gy	V. Dk Bn	Dk Gy	Gy	Bn
Comments	Runny silty clay	Clayey SP@5'	Silty Clay	Silty Clay	Silty Clay	Soil consistency, shells	Runny silty clay		Sandy Clay
Other Notes			Soft, homogenous, manual push		Soft, manual push				

Appendix E

Sediment Grain Size

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN℠ INTERTEC

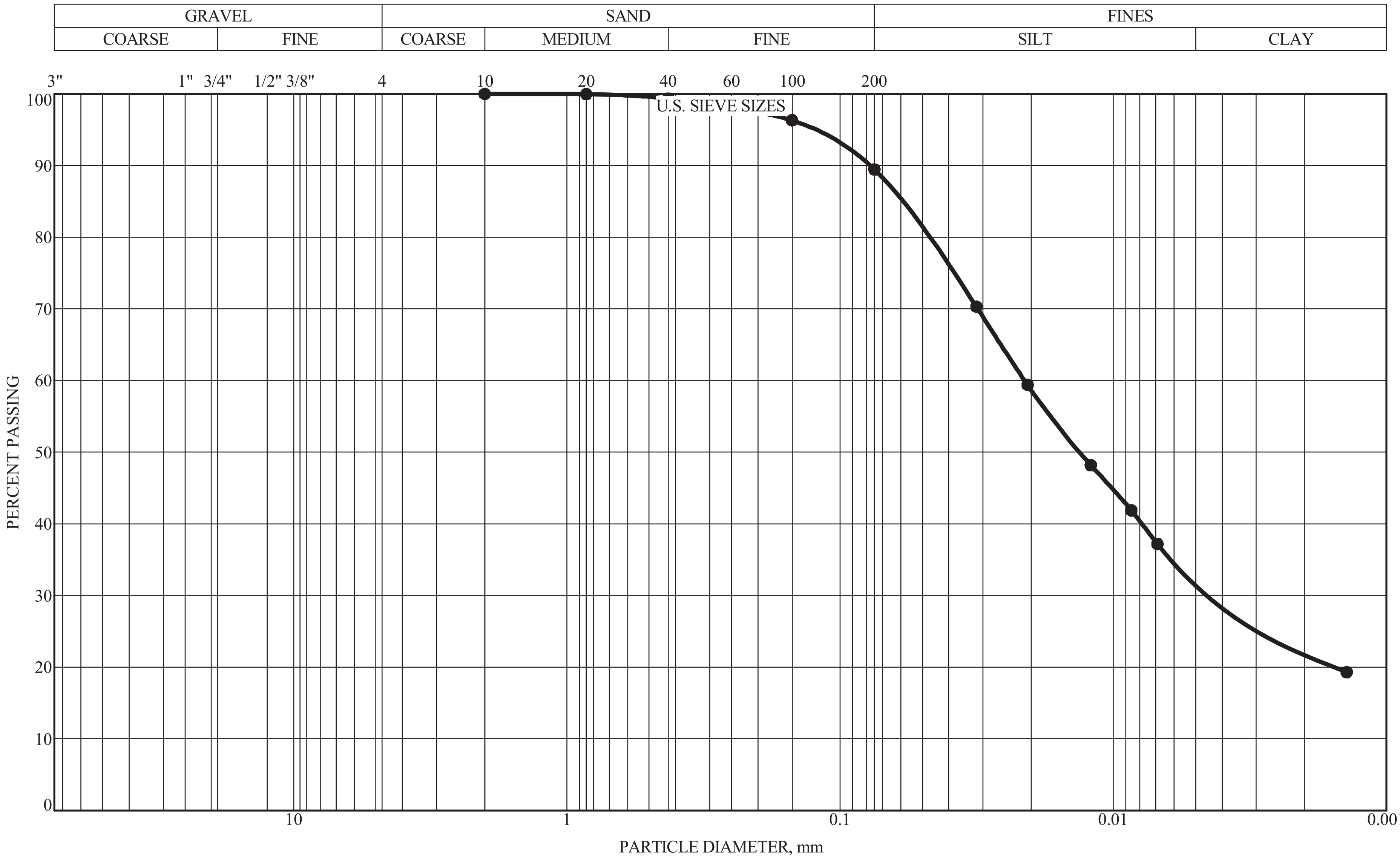
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 1 SAMPLE: 0900615-01 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	11.8%
SILT	43.7%
CLAY	44.5%
D60=0.013	Cu=
D30=0.002	Cc=
D10=	

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



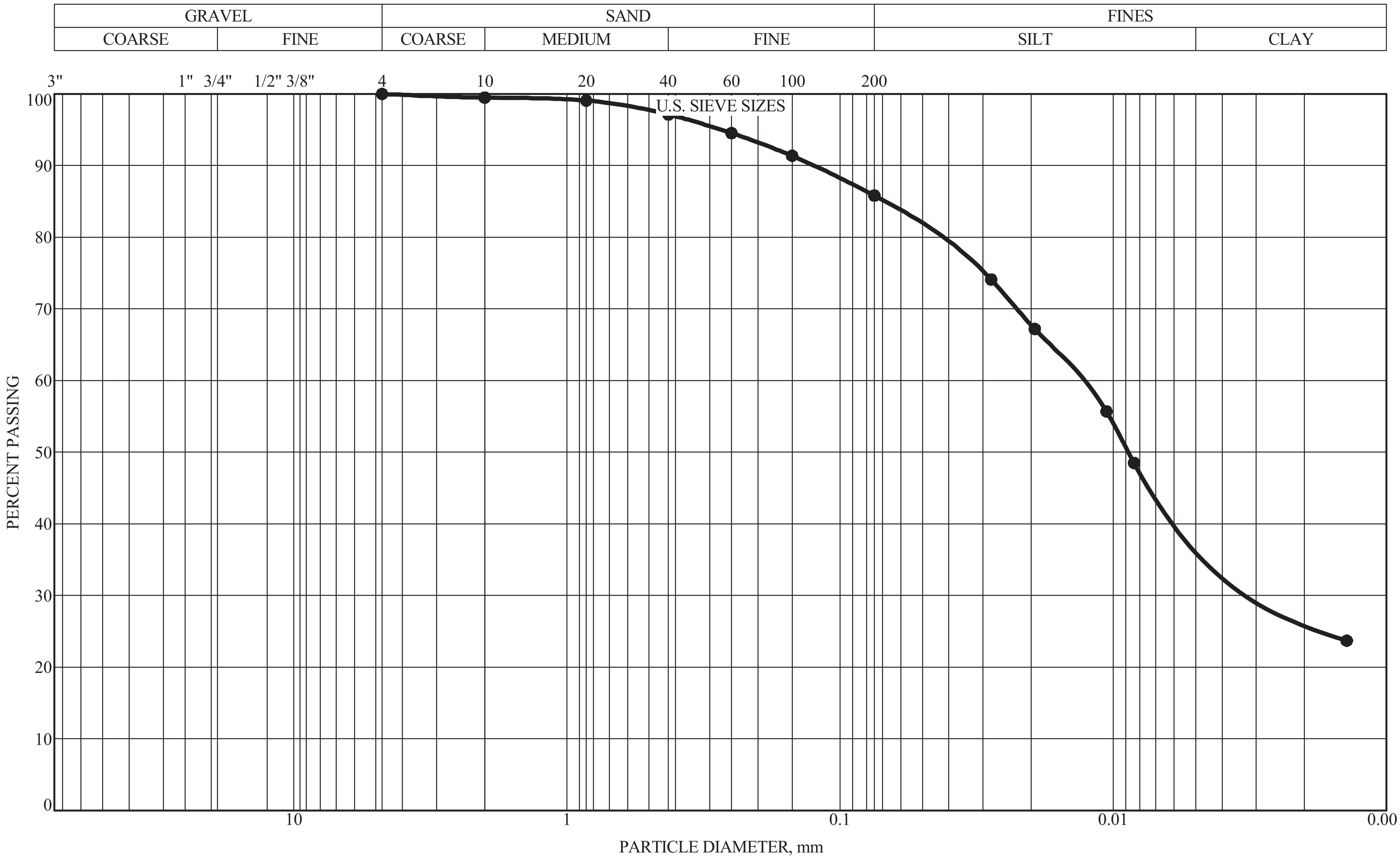
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 1 SAMPLE: 0900615-02 DEPTH: 2.0'-5.4'

GRAVEL	0.0%
SAND	10.5%
SILT	55.9%
CLAY	33.6%
D60=0.021	Cu=
D30=0.004	Cc=
D10=	

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN[SM] INTERTEC

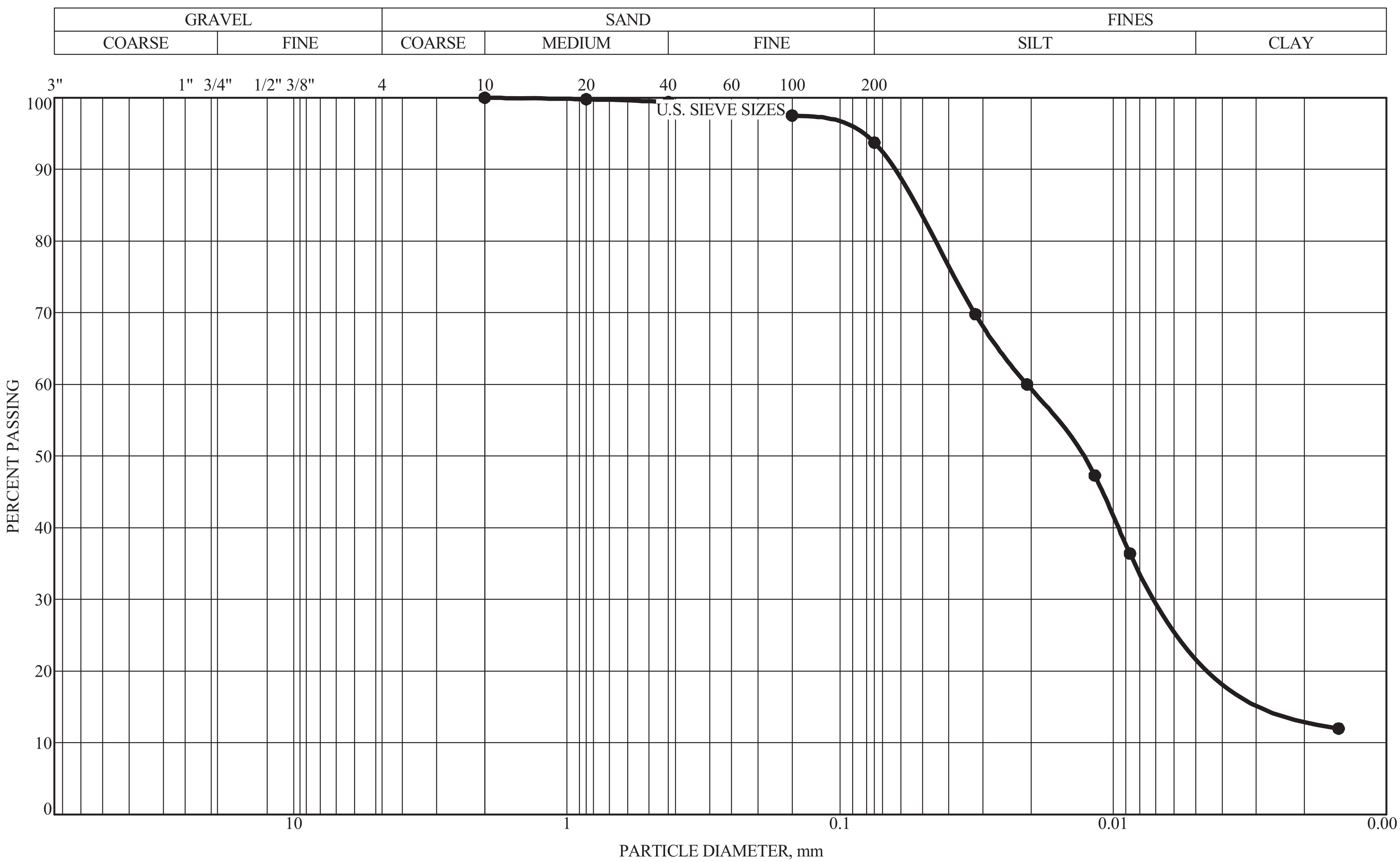
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 2 SAMPLE: 0900615-03 DEPTH: 0.0'-3.0'

GRAVEL	0.0%
SAND	14.2%
SILT	44.5%
CLAY	41.3%
D60=0.013	
D30=0.002	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

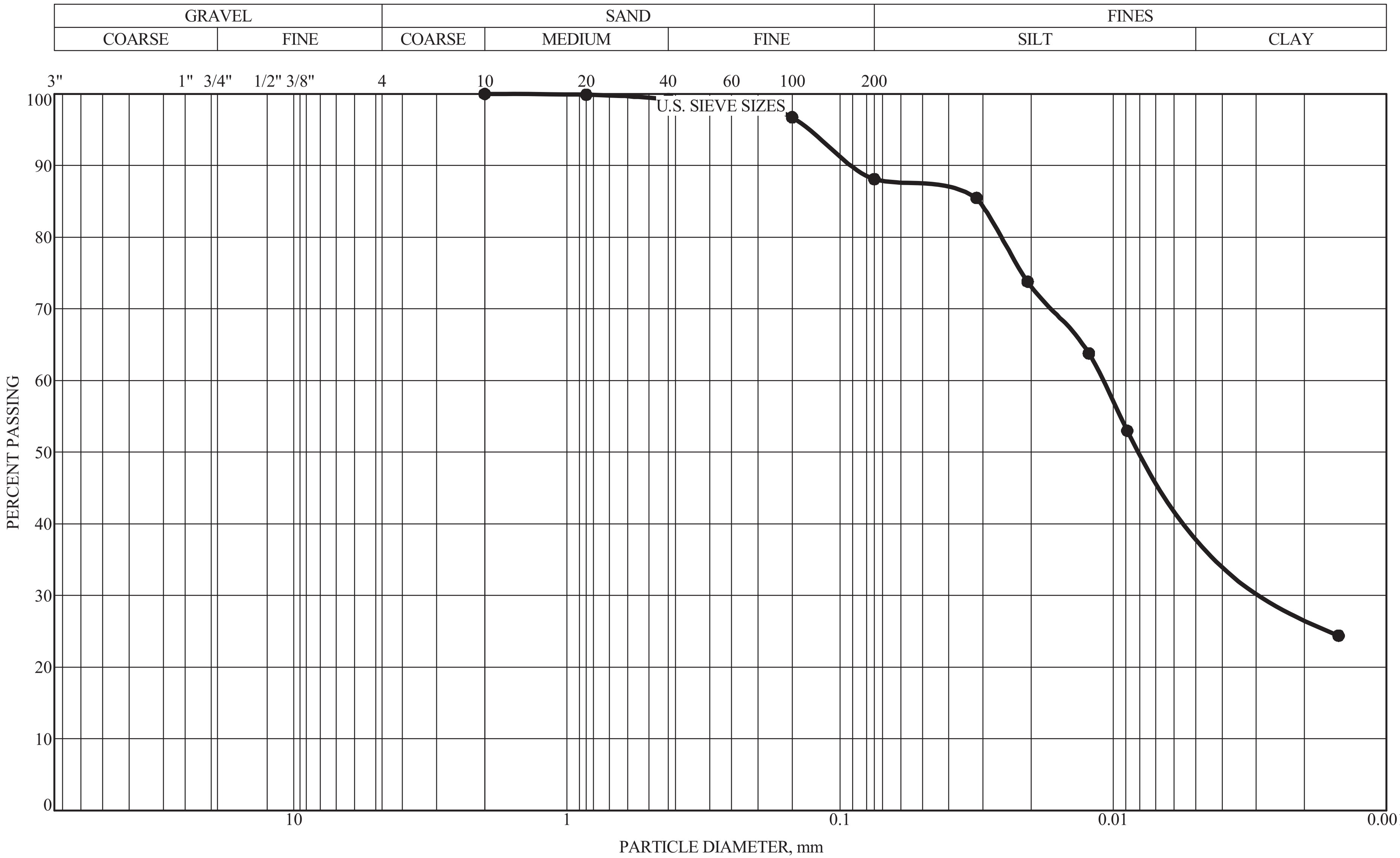
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 2 SAMPLE: 0900615-04 DEPTH: 3.0'-5.0'

GRAVEL	0.0%
SAND	6.3%
SILT	65.0%
CLAY	28.7%
D60=0.021	Cu=
D30=0.005	Cc=
D10=	

CLASSIFICATION:
ORGANIC SILT

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

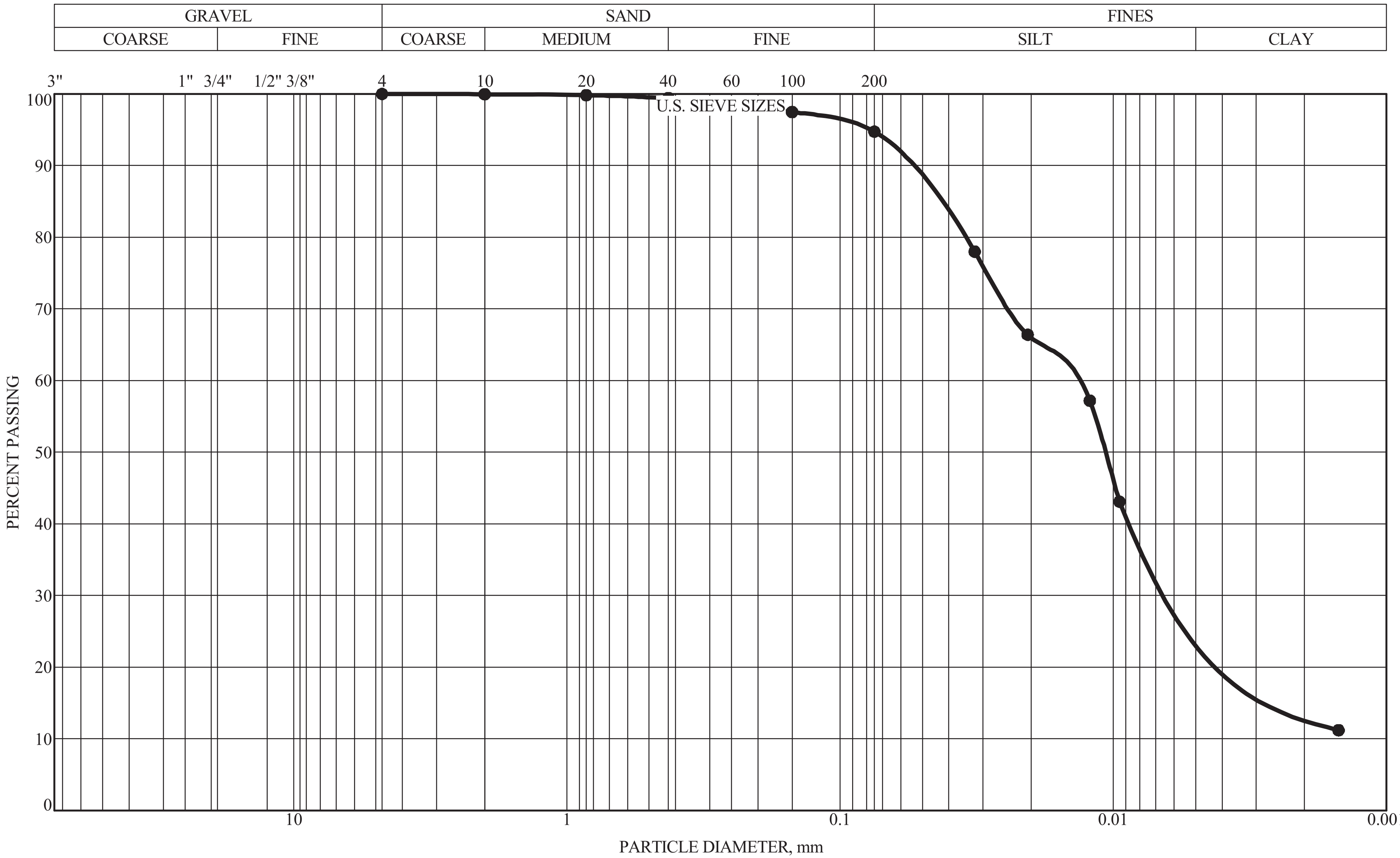
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 3 SAMPLE: 0900615-05 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	11.9%
SILT	44.4%
CLAY	43.7%
D60=0.011	
D30=0.002	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



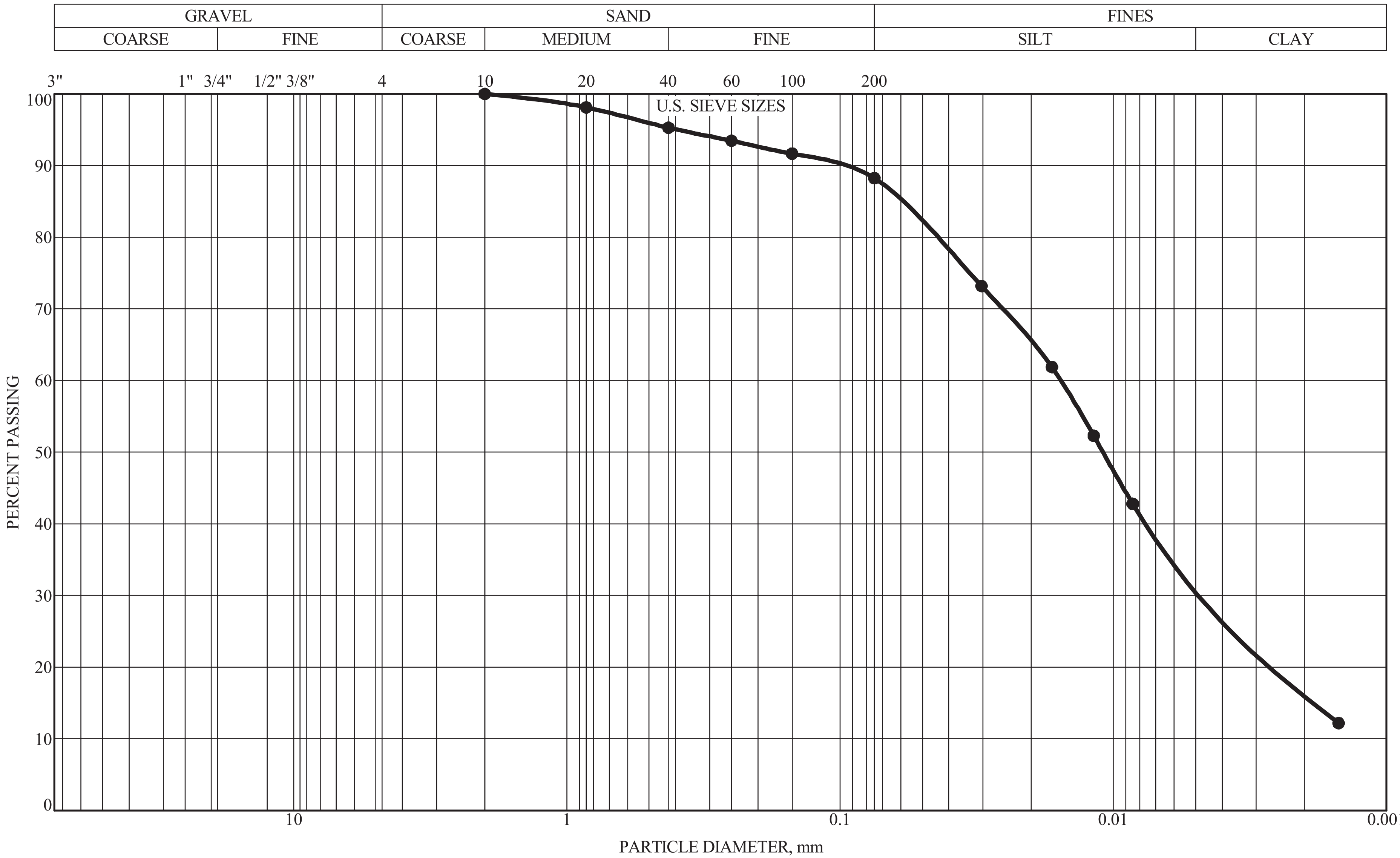
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 3 SAMPLE: 0900615-06 DEPTH: 2.0'-5.0'

GRAVEL	0.0%
SAND	5.3%
SILT	62.7%
CLAY	32.0%
D60=0.014	Cu=
D30=0.004	Cc=
D10=	

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



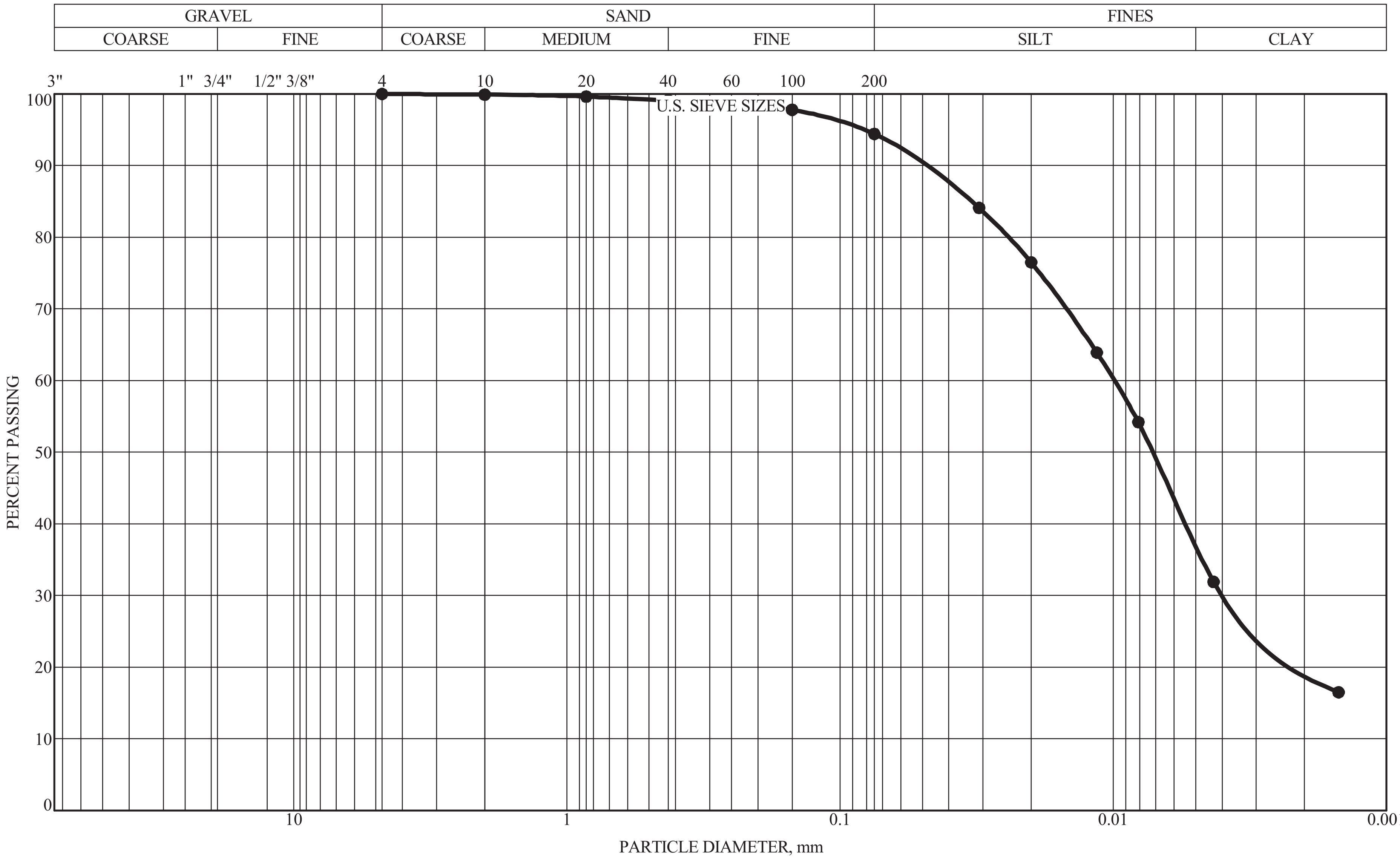
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 3 SAMPLE: 0900615-07 DEPTH: 5.0'-6.5'

GRAVEL	0.0%
SAND	11.7%
SILT	54.8%
CLAY	33.4%
D60=0.016	
D30=0.004	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 4 SAMPLE: 0900615-08 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	5.6%
SILT	57.2%
CLAY	37.2%
D60=0.010	
D30=0.004	Cu=
D10=	Cc=

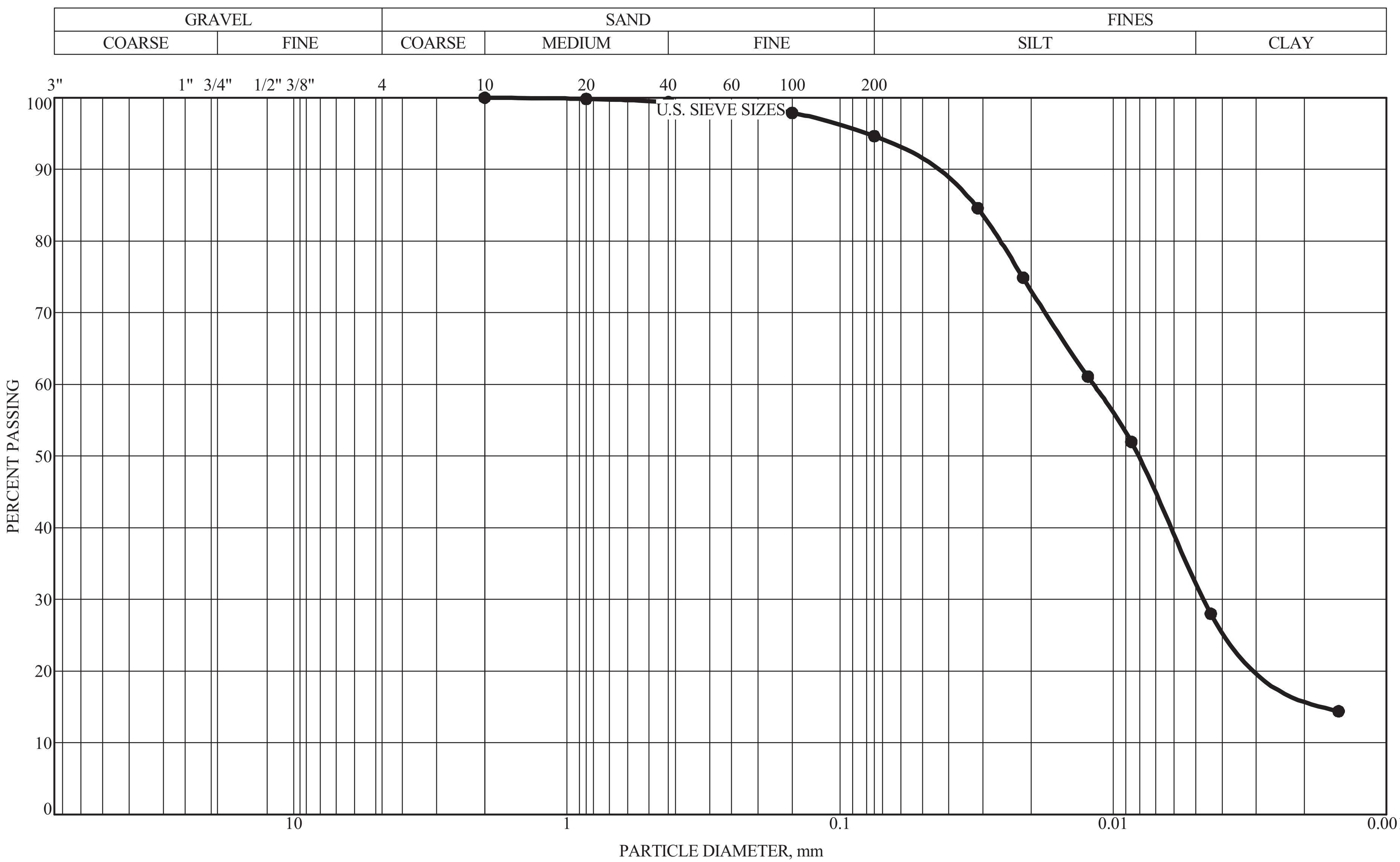
CLASSIFICATION:
ORGANIC CLAY

GS ASTM 0900615.GPJ BRAUN.GDT 2/19/09 15:47

0900615

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (ASTM)



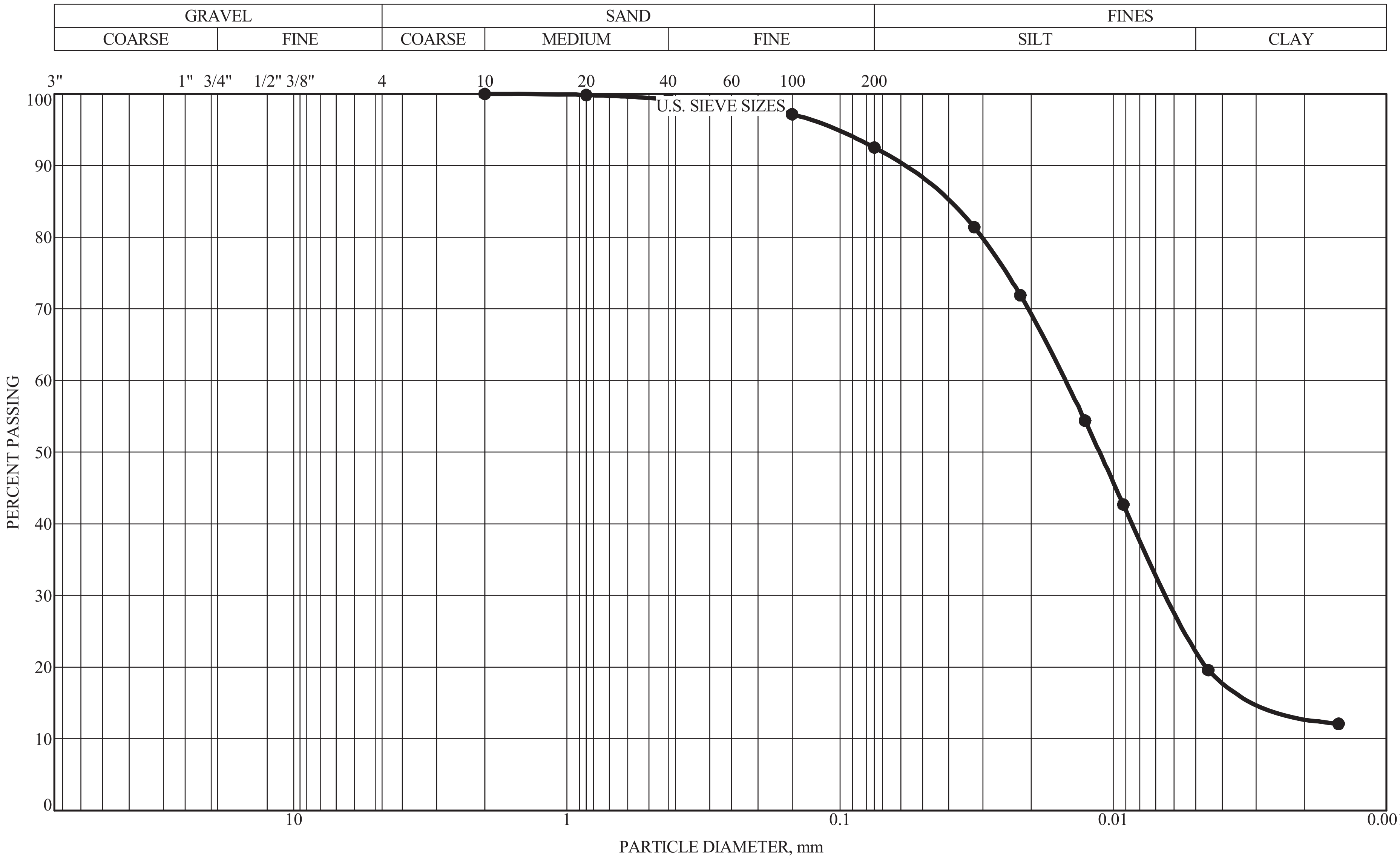
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 4 SAMPLE: 0900615-09 DEPTH: 2.0'-5.0'

GRAVEL	0.0%
SAND	5.4%
SILT	62.1%
CLAY	32.6%
D60=0.012	
D30=0.005	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 4 SAMPLE: 0900615-10 DEPTH: 5.0'-6.3'

GRAVEL	0.0%
SAND	7.5%
SILT	69.5%
CLAY	23.0%
D60=0.015	
D30=0.006	Cu=
D10=	Cc=

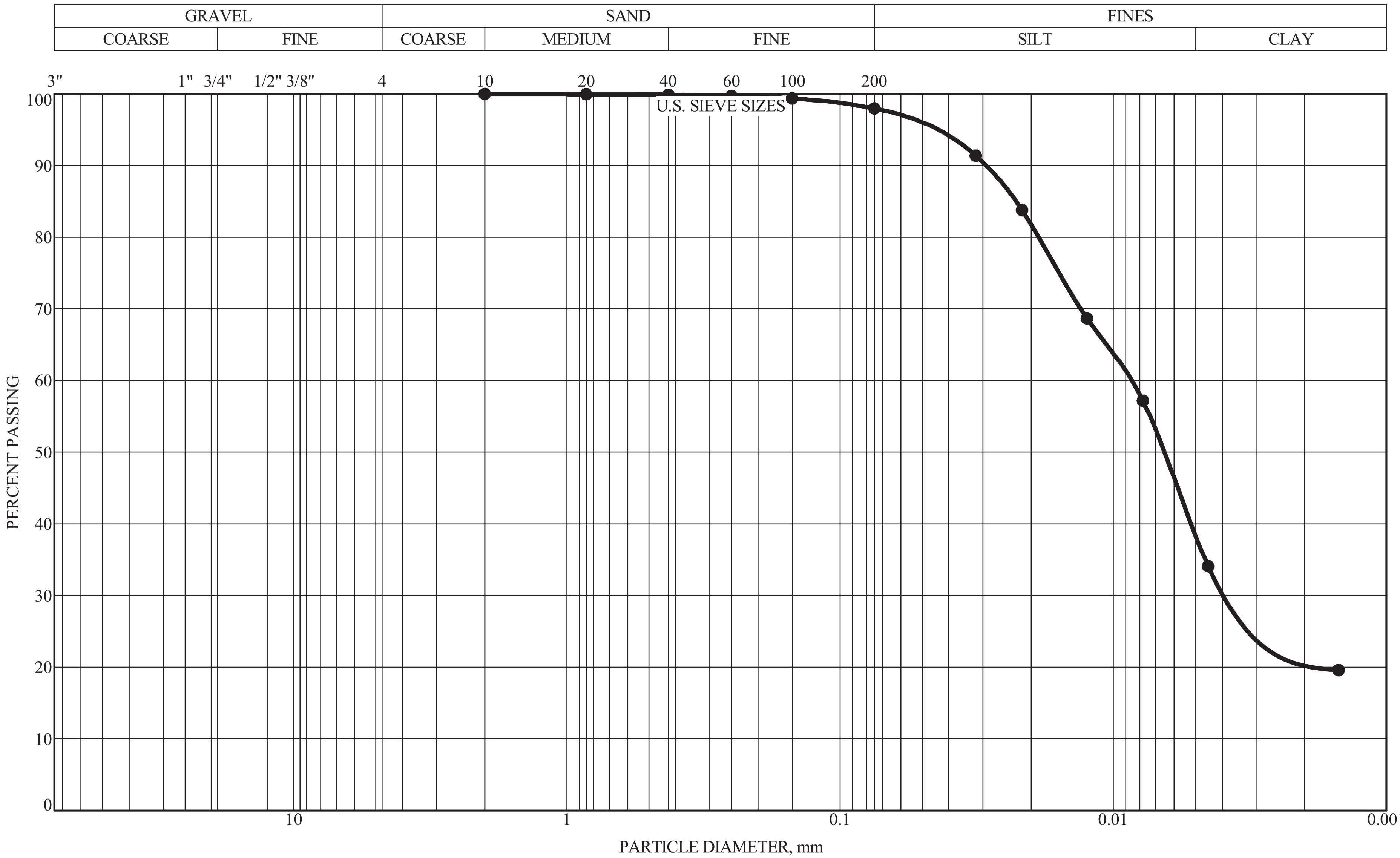
CLASSIFICATION:
ORGANIC SILT

GS ASTM 0900615.GPJ BRAUN.GDT 2/19/09 15:47

0900615

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 5 SAMPLE: 0900615-11 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	2.0%
SILT	59.5%
CLAY	38.5%
D60=0.009	
D30=0.003	Cu=
D10=	Cc=

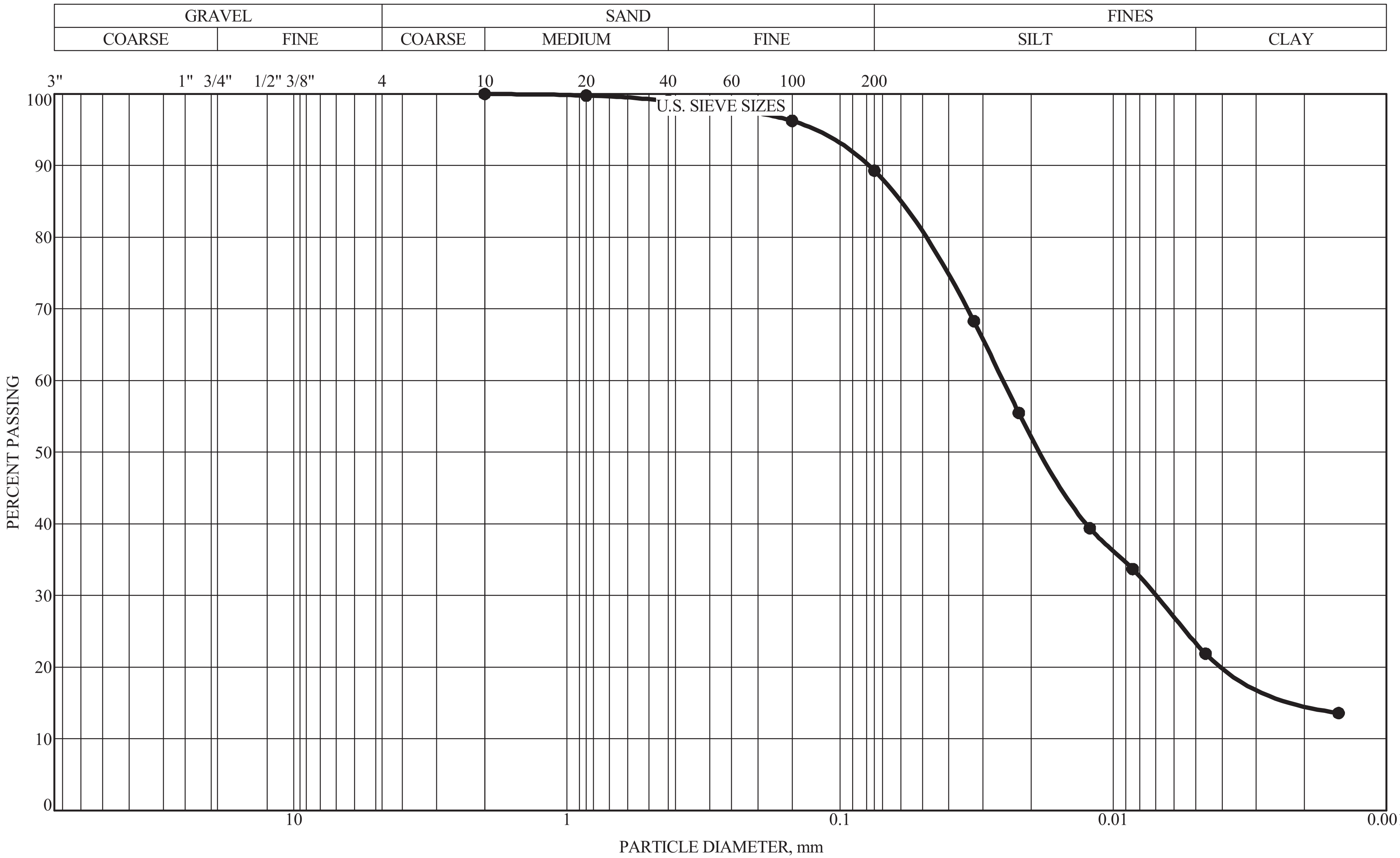
CLASSIFICATION:
ORGANIC CLAY

GS ASTM 0900615.GPJ BRAUN.GDT 2/19/09 15:47

0900615

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

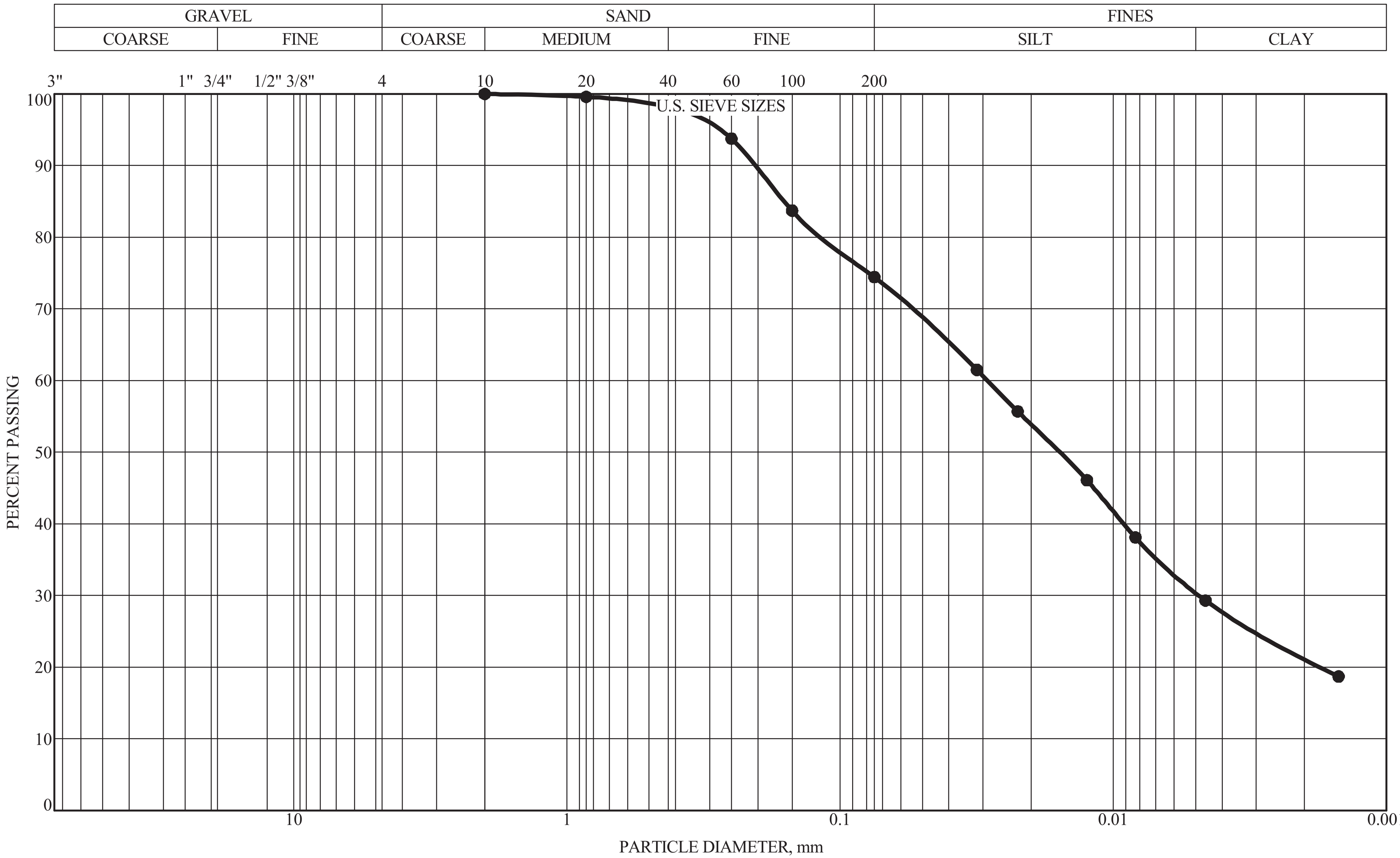
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 5 SAMPLE: 0900615-12 DEPTH: 2.0'-4.8'

GRAVEL	0.0%
SAND	10.7%
SILT	65.8%
CLAY	23.5%
D60=0.025	Cu=
D30=0.007	Cc=
D10=	

CLASSIFICATION:
ORGANIC SILT

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

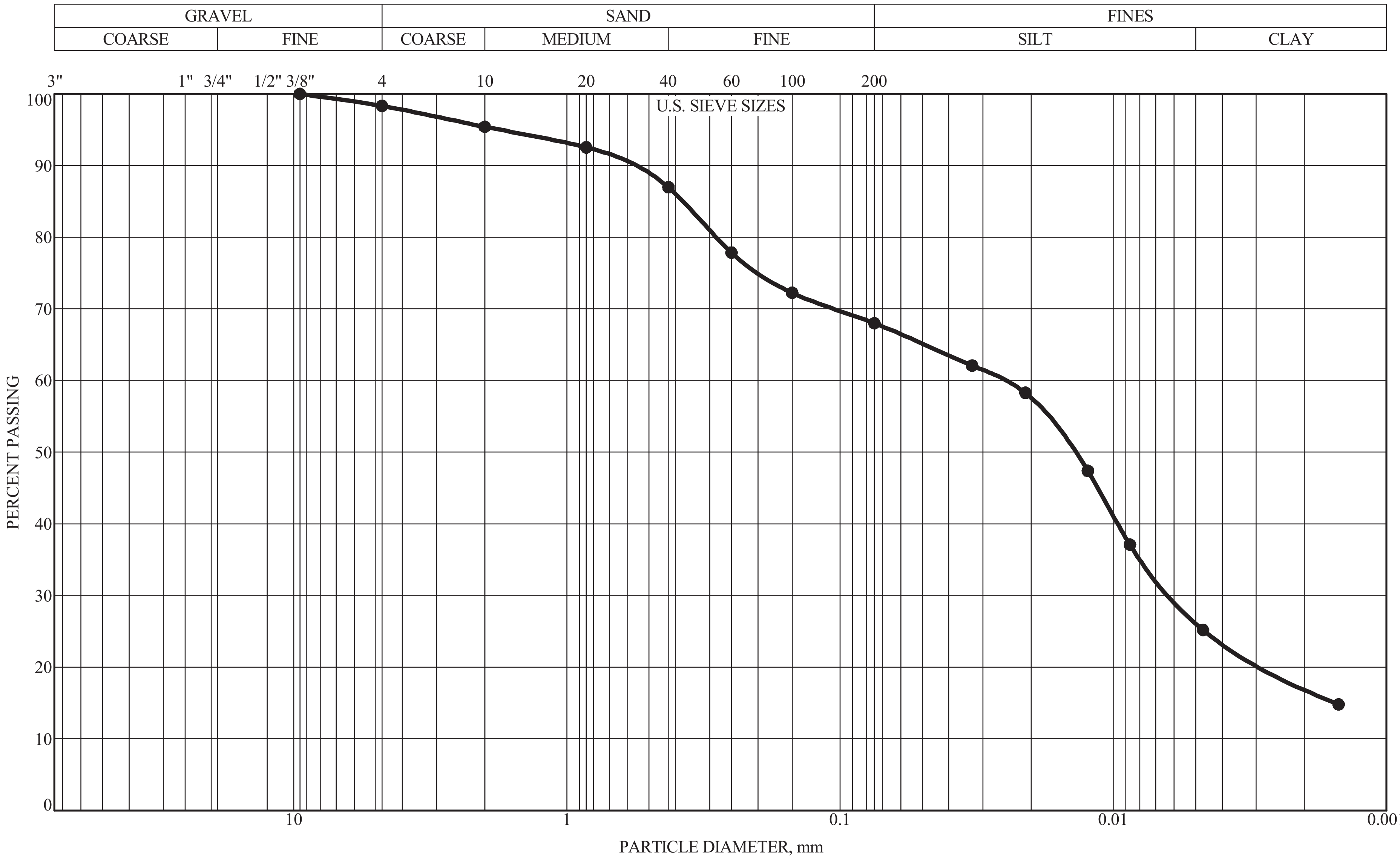
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 6 SAMPLE: 0900615-13 DEPTH: 0.0'-2.8'

GRAVEL	0.0%
SAND	25.6%
SILT	43.9%
CLAY	30.5%
D60=0.029	
D30=0.005	Cu=
D10=	Cc=

CLASSIFICATION:
LEAN CLAY with SAND

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN[SM] INTERTEC

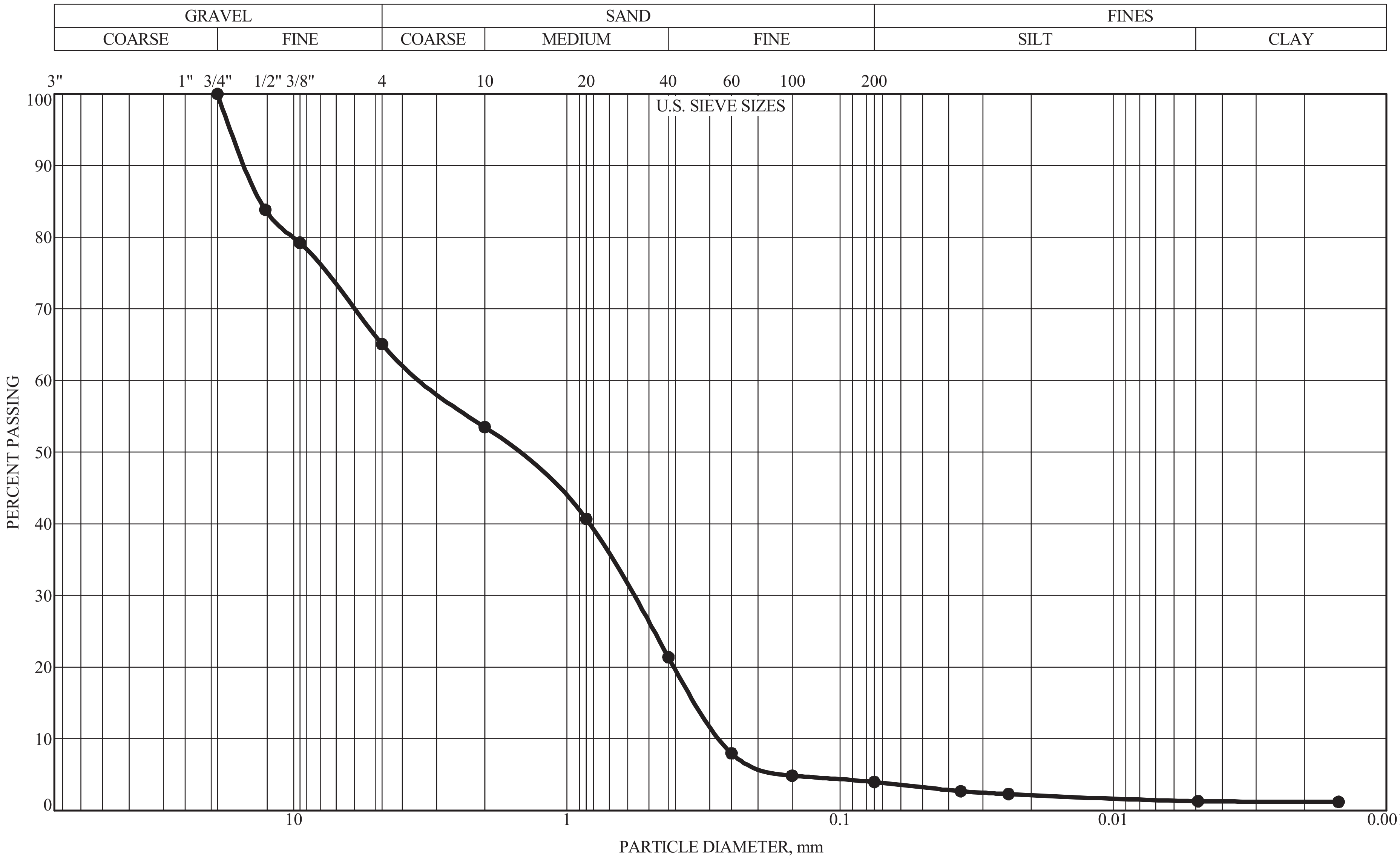
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 7 SAMPLE: 0900615-14 DEPTH: 0.0'-1.5'

GRAVEL	1.7%
SAND	30.3%
SILT	41.6%
CLAY	26.4%
D60=0.026	
D30=0.006	Cu=
D10=	Cc=

CLASSIFICATION:
SANDY ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



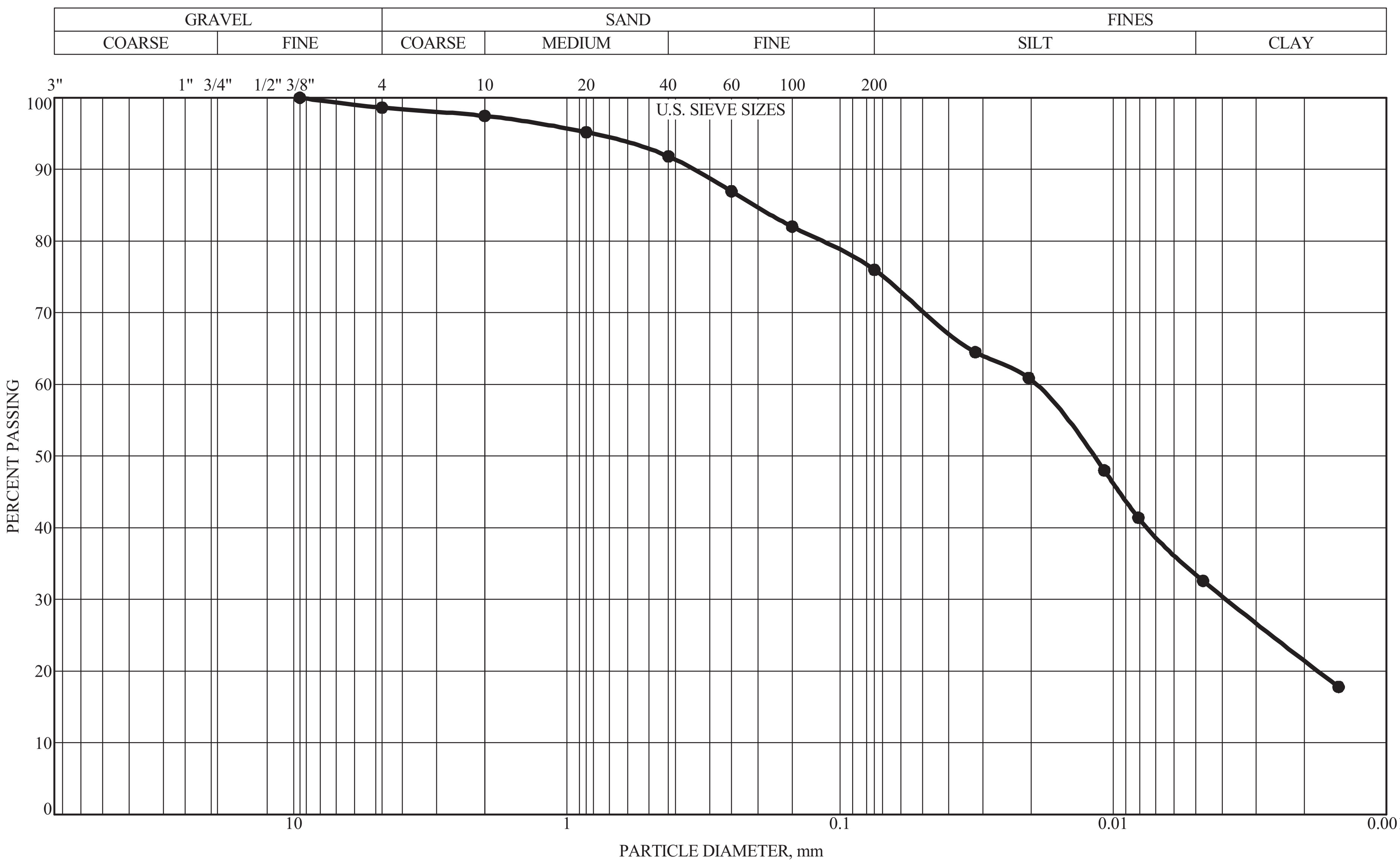
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 7 SAMPLE: 0900615-15 DEPTH: 1.5'-4.2'

GRAVEL	34.9%
SAND	61.1%
SILT	2.7%
CLAY	1.3%
D60=3.248	
D30=0.579	Cu=12.0
D10=0.271	Cc=0.4

CLASSIFICATION:
POORLY GRADED SAND with GRAVEL(SP)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



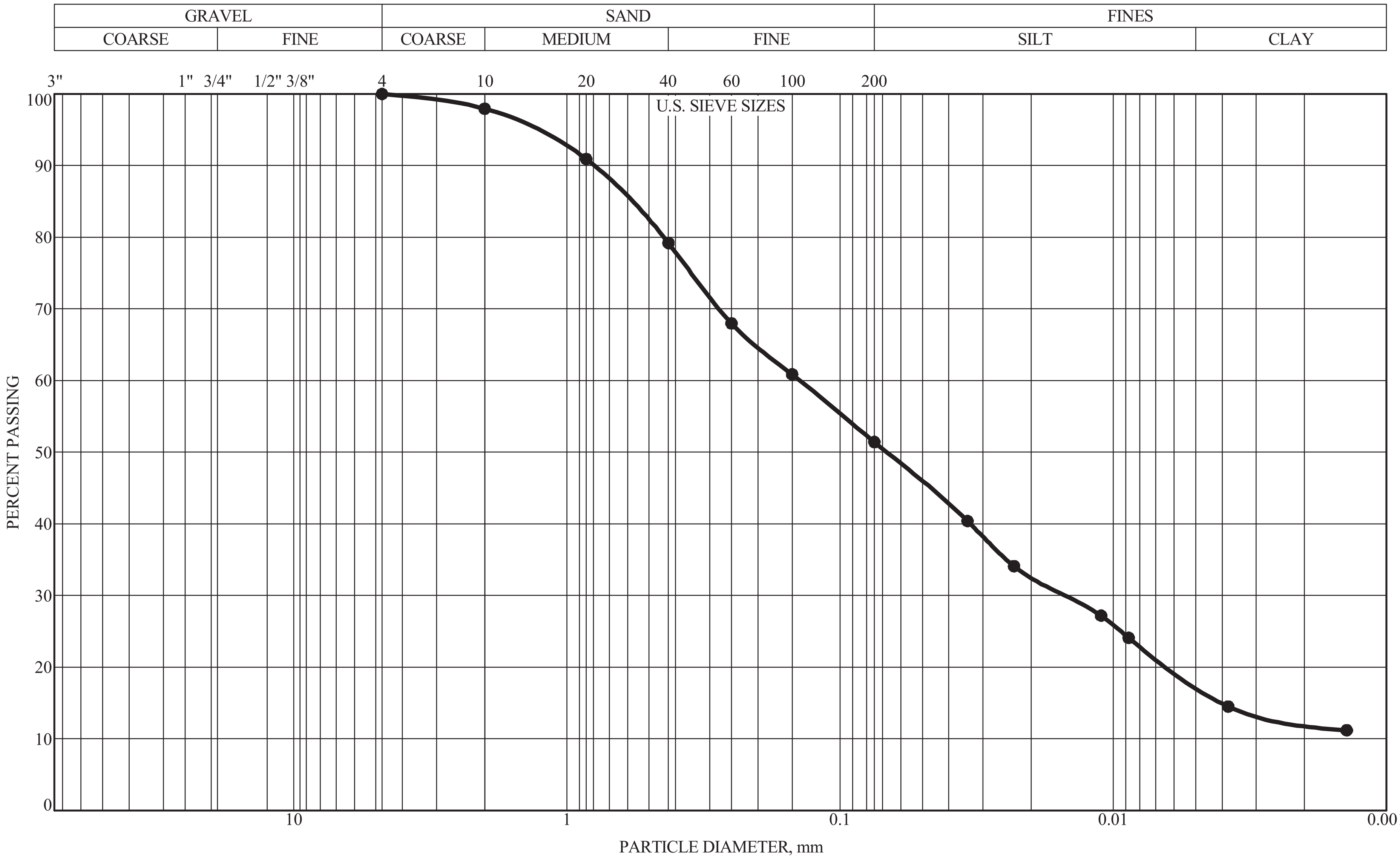
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 7 SAMPLE: 0900615-16 DEPTH: 4.2'-5.0'

GRAVEL	1.4%
SAND	22.6%
SILT	42.4%
CLAY	33.6%
D60=0.020	
D30=0.004	Cu=
D10=	Cc=

CLASSIFICATION:
LEAN CLAY with SAND

GRAIN SIZE ACCUMULATION CURVE (ASTM)



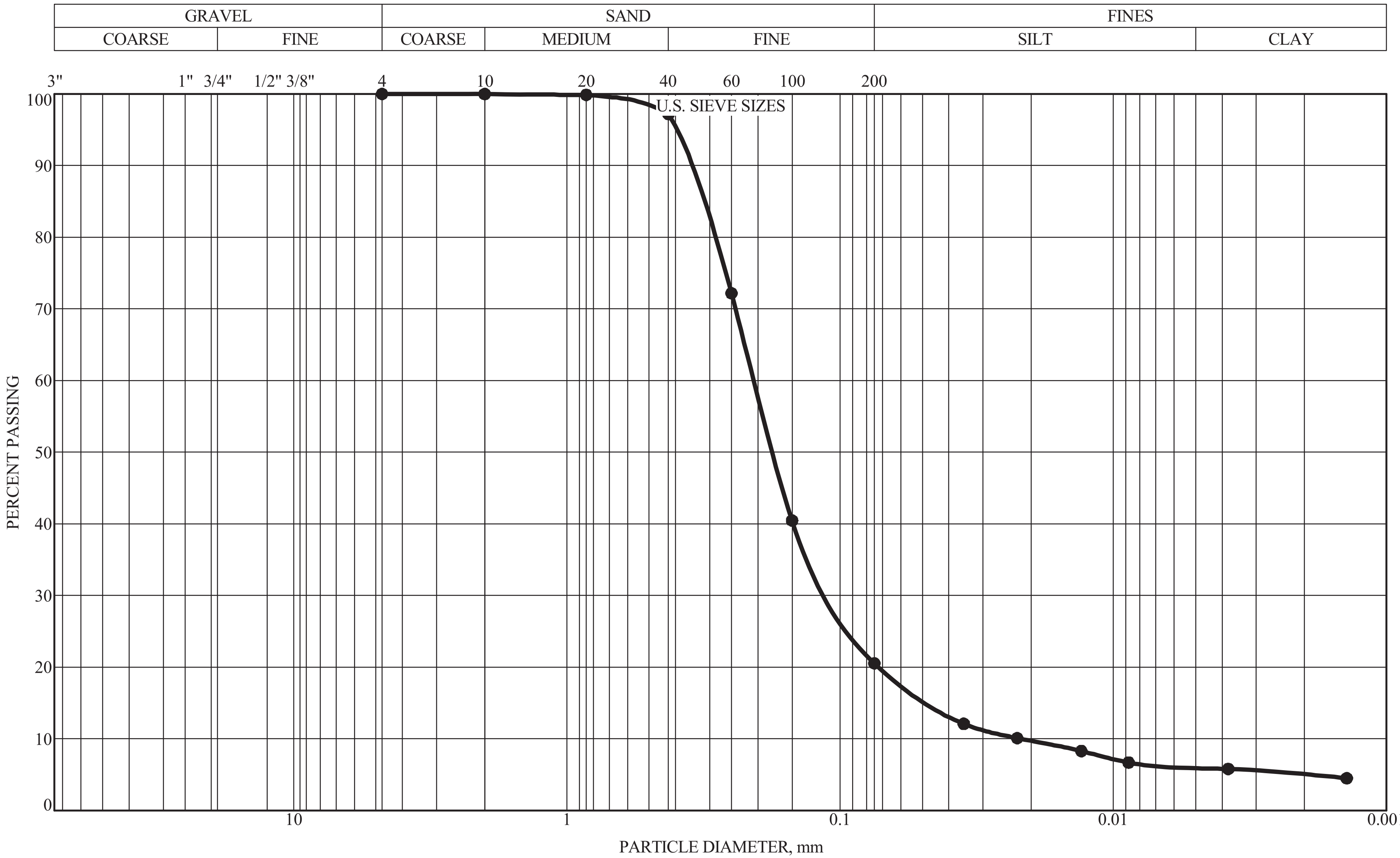
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 8 SAMPLE: 0900615-17 DEPTH: 0.0'-2.8'

GRAVEL	0.0%
SAND	48.6%
SILT	33.8%
CLAY	17.6%
D60=0.141	
D30=0.015	Cu=
D10=	Cc=

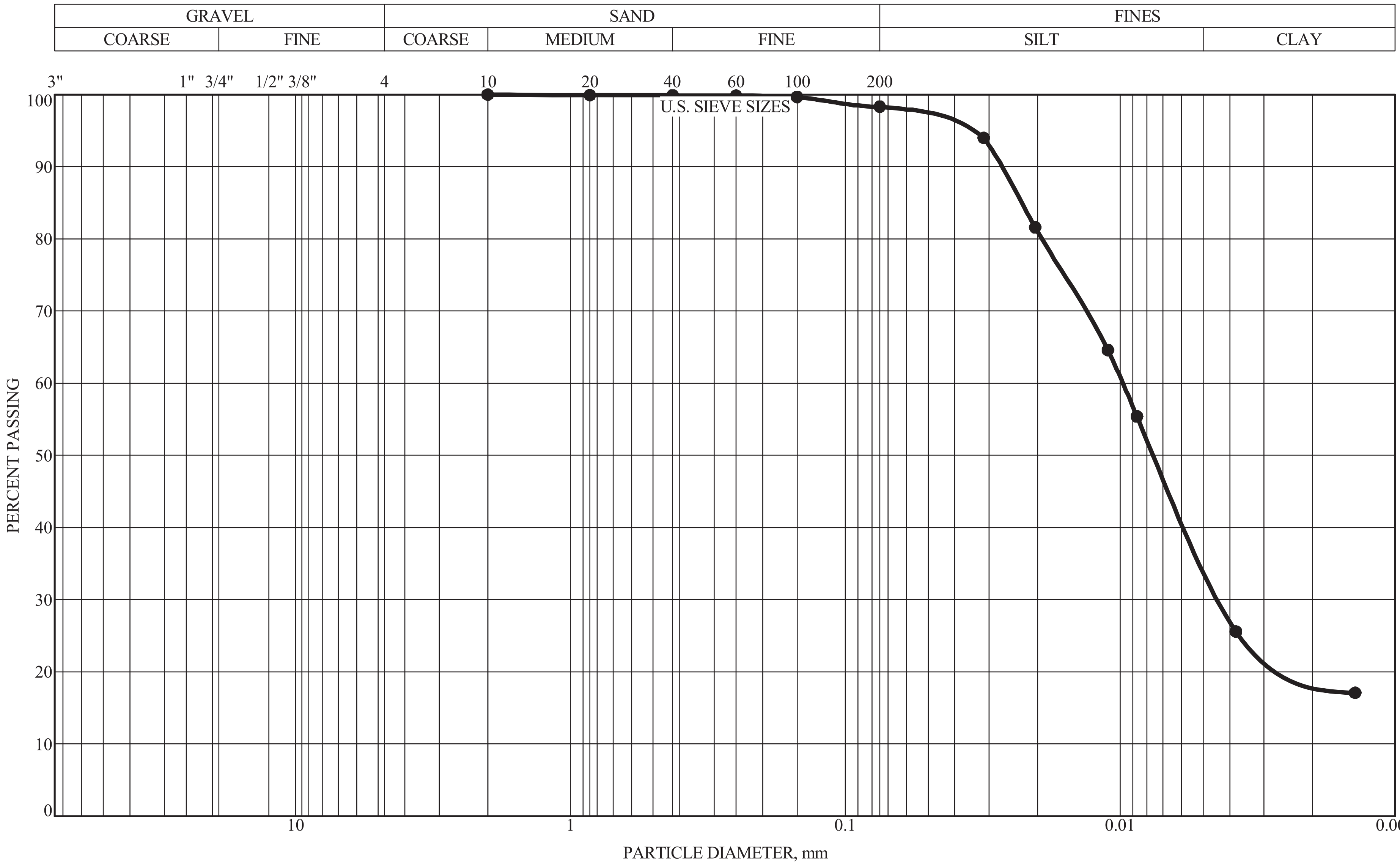
CLASSIFICATION:
CLAYEY SAND

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project 0900615 **Barr Engineering Company** **23/24-1004001002** **Fountain L. Sediment** BORING: 8 SAMPLE: 0900615-18 DEPTH: 2.8'-5.2'	GRAVEL 0.0% SAND 79.5% SILT 14.4% CLAY 6.1% D60=0.205 D30=0.104 Cu=9.4 D10=0.022 Cc=2.4	CLASSIFICATION: SILTY SAND	

GRAIN SIZE ACCUMULATION CURVE (ASTM)



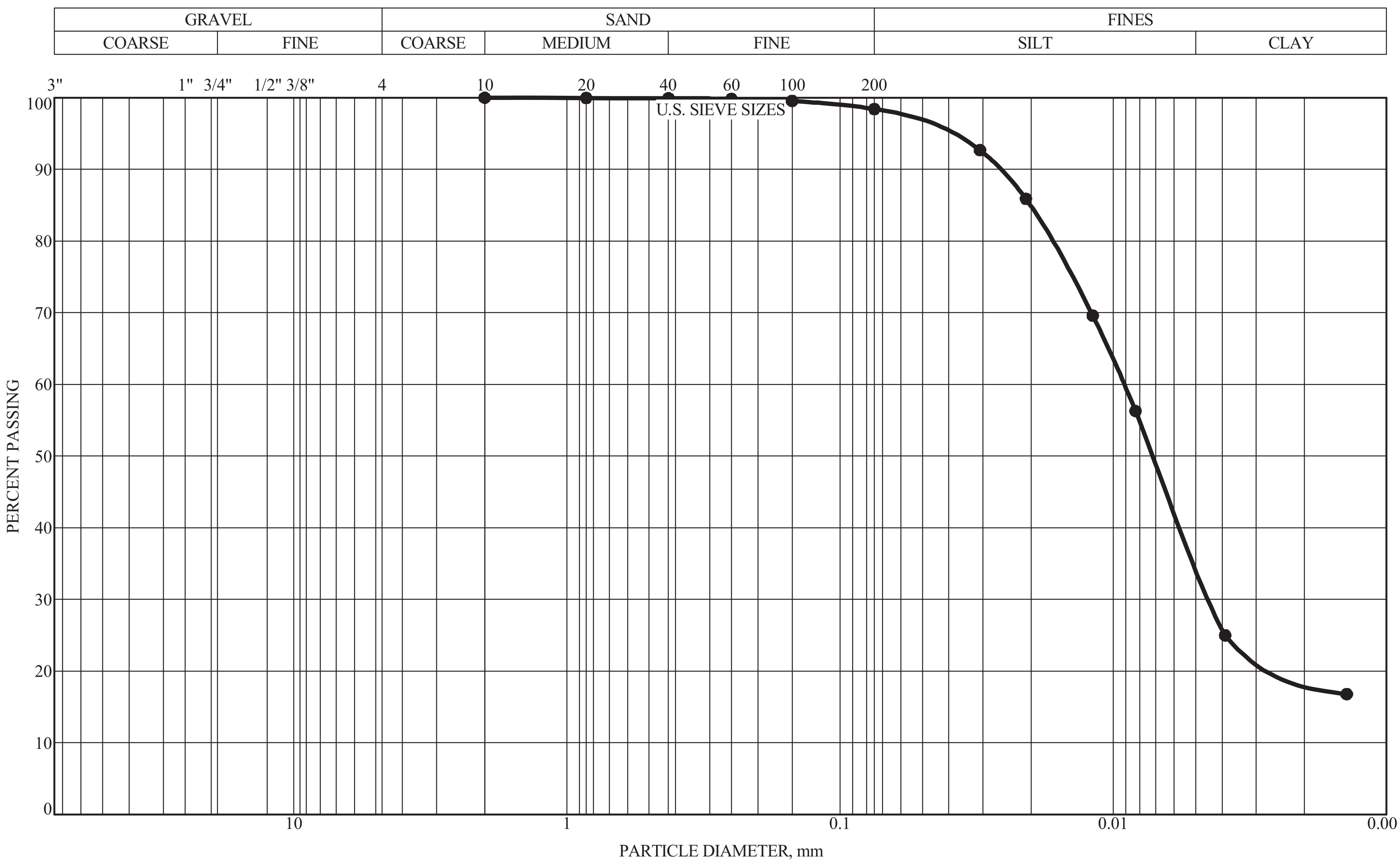
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 9 SAMPLE: 0900615-22 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	1.7%
SILT	62.9%
CLAY	35.5%
D60=0.010	Cu=
D30=0.004	Cc=
D10=	

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN[SM] INTERTEC

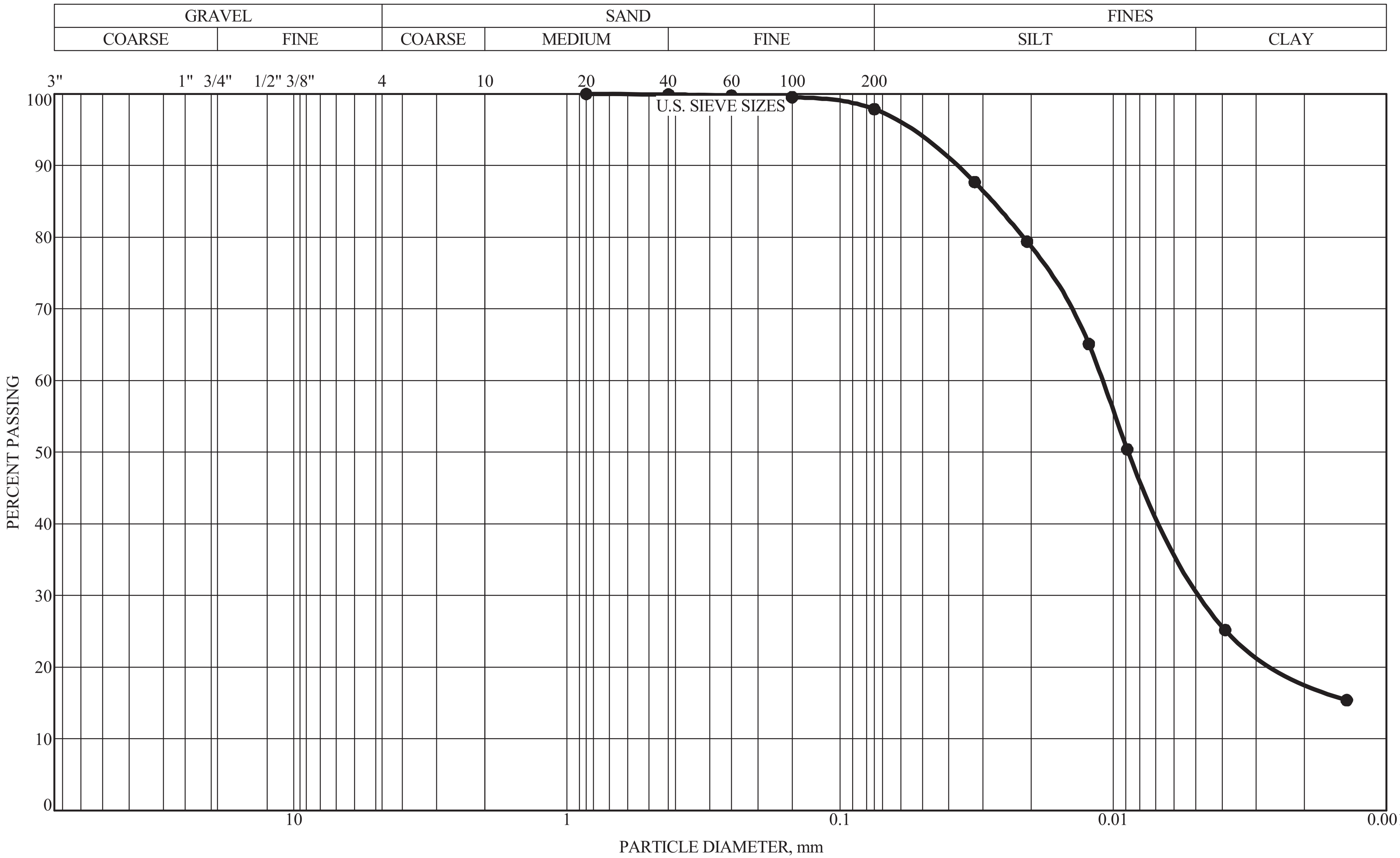
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 9 SAMPLE: 0900615-23 DEPTH: 2.0'-3.6'

GRAVEL	0.0%
SAND	1.6%
SILT	63.1%
CLAY	35.3%
D60=0.009	
D30=0.004	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



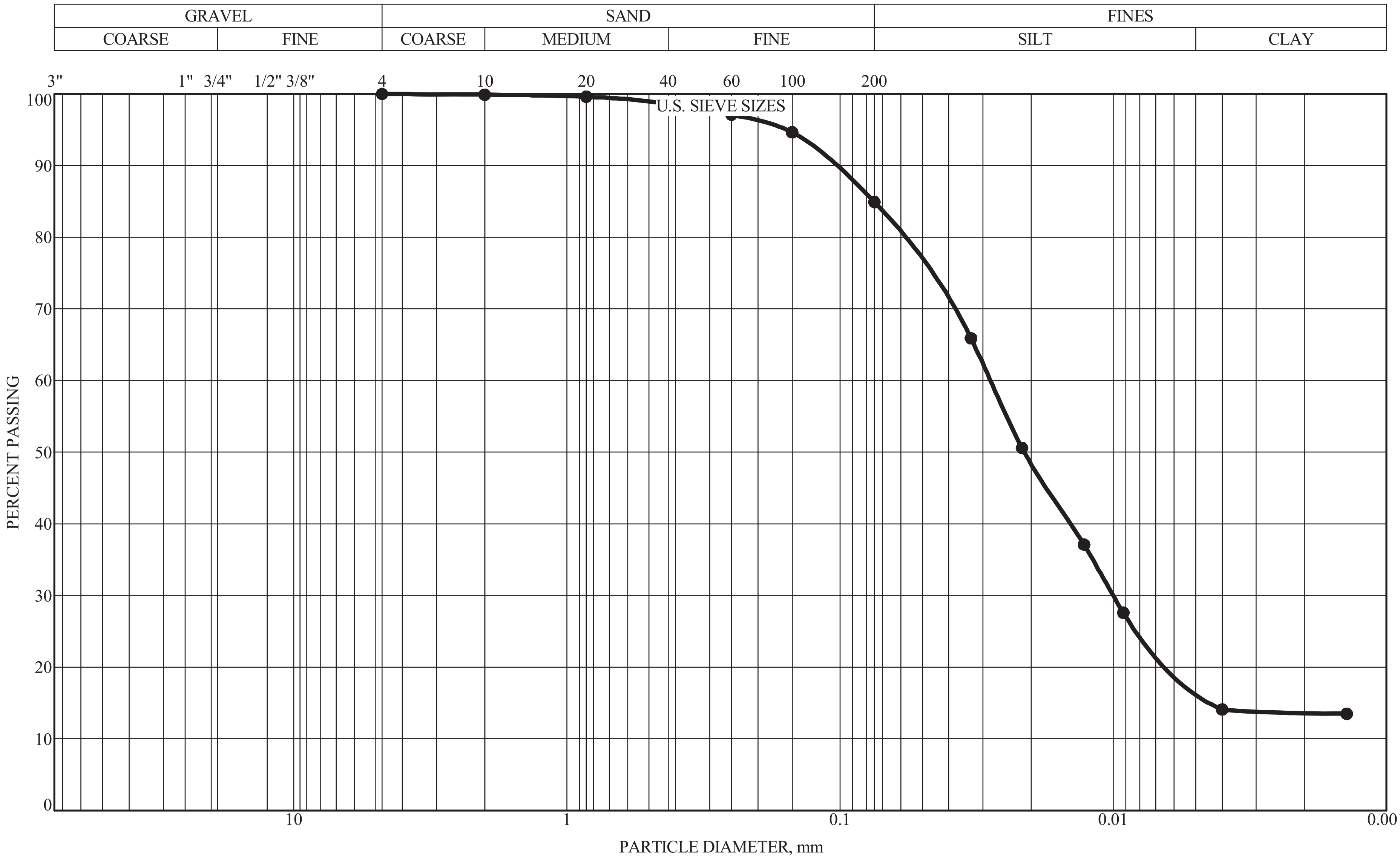
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 10 SAMPLE: 0900615-24 DEPTH: 0.0'-2.0'

GRAVEL	0.0%
SAND	2.1%
SILT	65.1%
CLAY	32.8%
D60=0.011	
D30=0.005	Cu=
D10=	Cc=

CLASSIFICATION:
ORGANIC CLAY

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

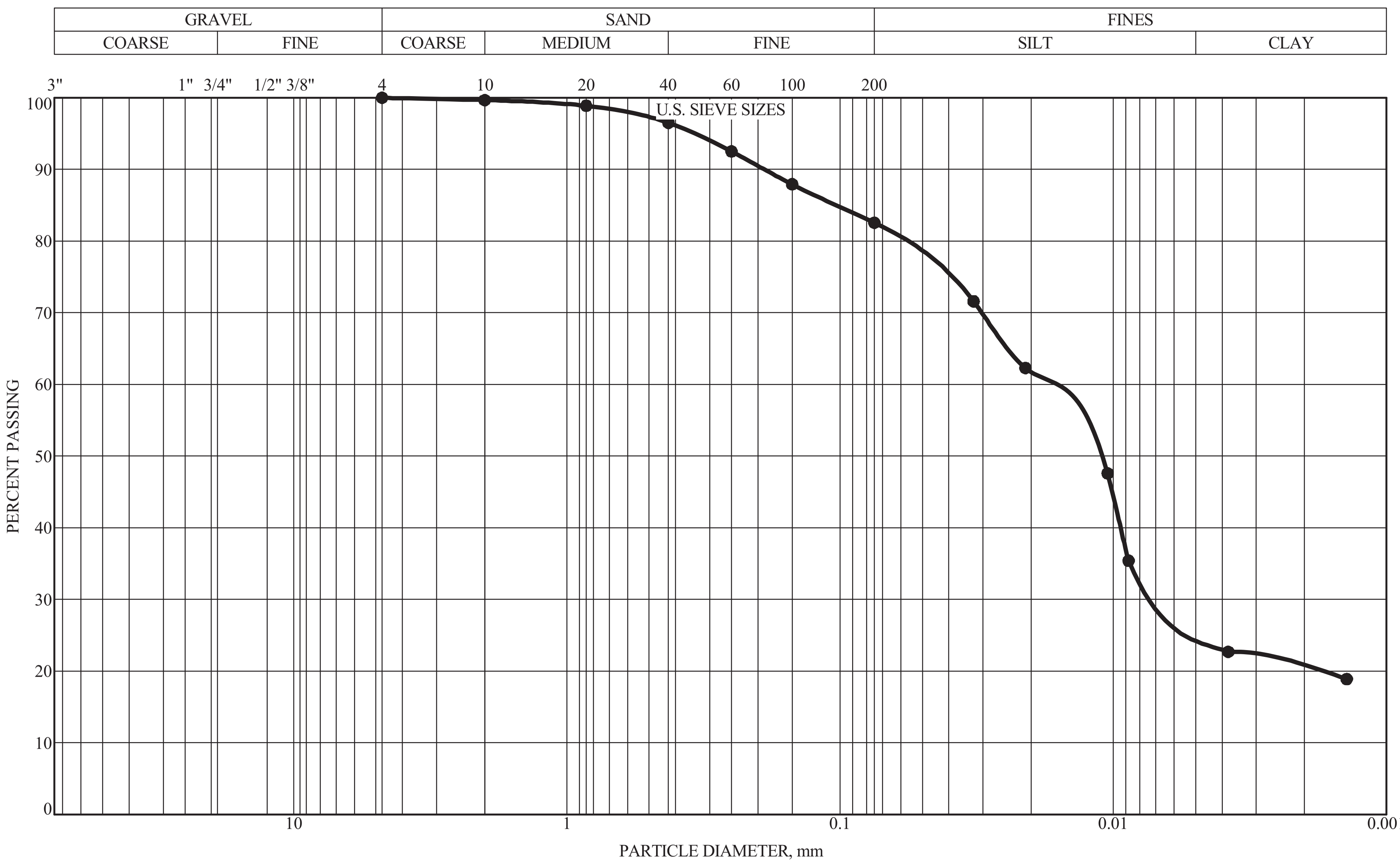
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 10 SAMPLE: 0900615-25 DEPTH: 2.0'-4.7'

GRAVEL	0.0%
SAND	15.1%
SILT	67.2%
CLAY	17.7%
D60=0.028	Cu=
D30=0.010	Cc=
D10=	

CLASSIFICATION:
SILT with SAND

GRAIN SIZE ACCUMULATION CURVE (ASTM)



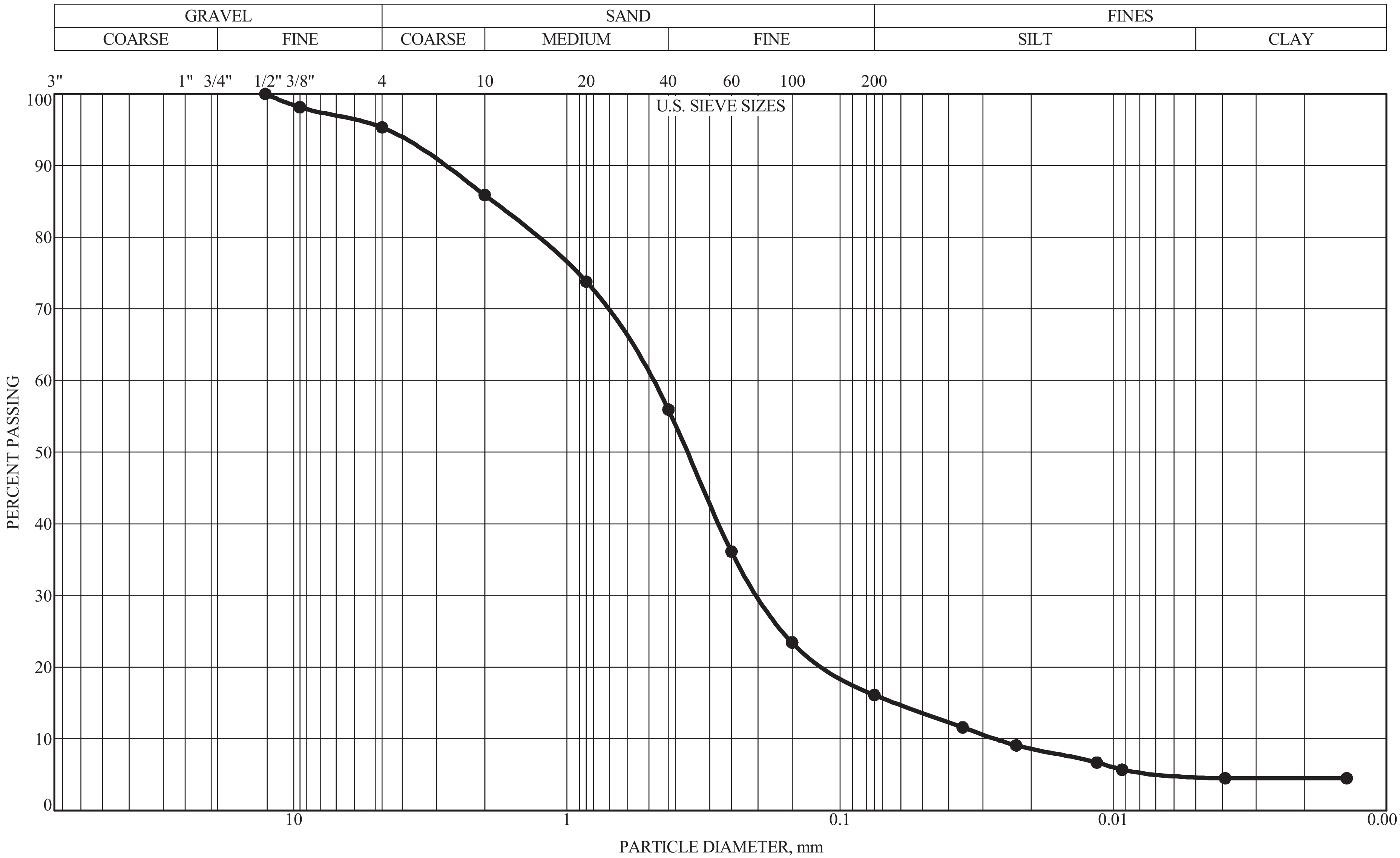
Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 11 SAMPLE: 0900615-19 DEPTH: 0.0'-3.2'

GRAVEL	0.0%
SAND	17.4%
SILT	55.7%
CLAY	26.9%
D60=0.019	Cu=
D30=0.006	Cc=
D10=	

CLASSIFICATION:
SILT with SAND

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 11 SAMPLE: 0900615-20 DEPTH: 3.2'-4.2'

GRAVEL	4.7%
SAND	79.2%
SILT	11.3%
CLAY	4.8%
D60=0.497	Cu=18.6
D30=0.195	Cc=2.9
D10=0.027	

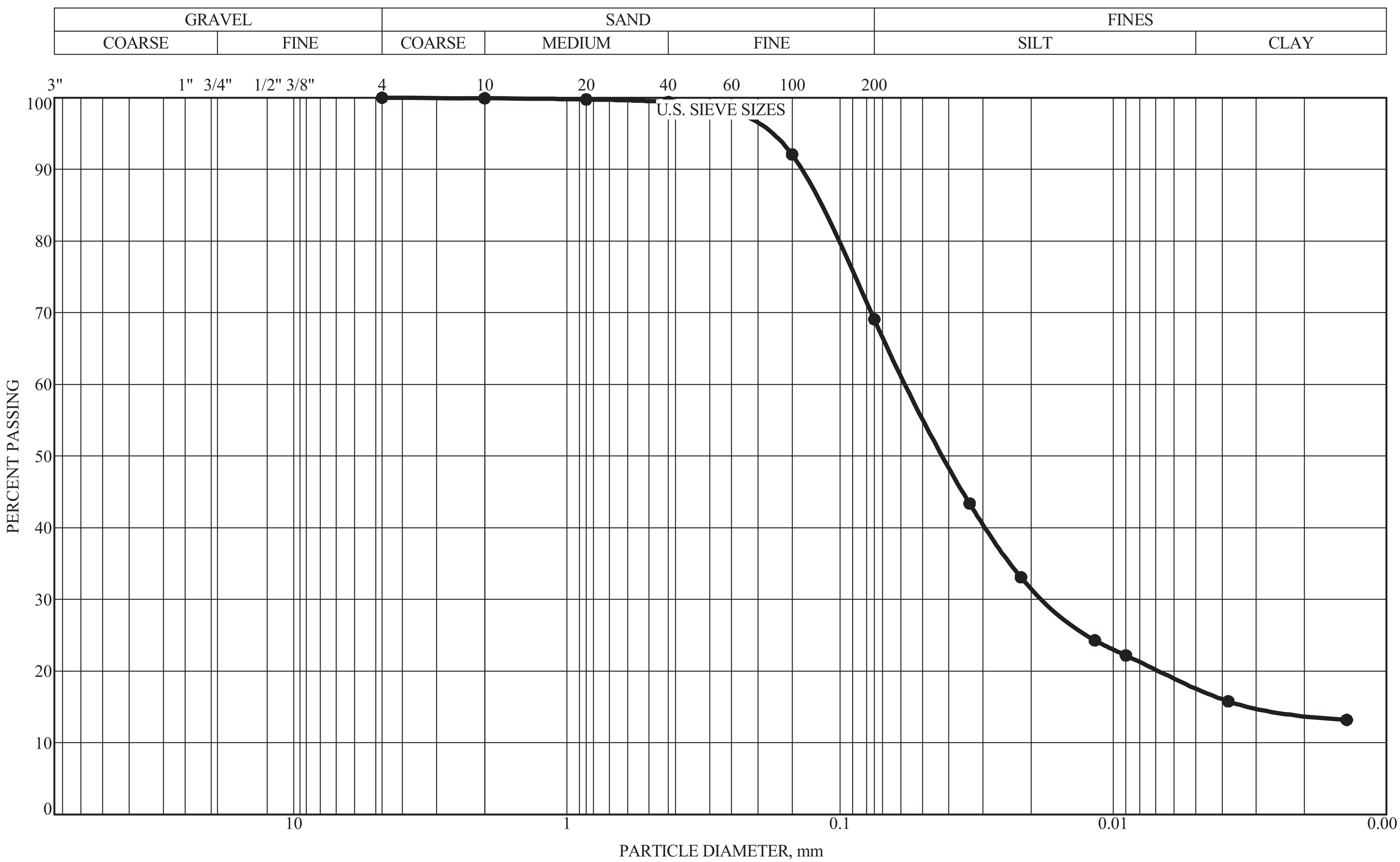
CLASSIFICATION:
SILTY SAND

GS ASTM 0900615.GPJ BRAUN.GDT 2/19/09 15:47

0900615

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project 0900615
Barr Engineering Company
23/24-1004001002
Fountain L. Sediment

BORING: 11 SAMPLE: 0900615-21 DEPTH: 4.2'-6.0'

GRAVEL	0.0%
SAND	30.9%
SILT	51.3%
CLAY	17.8%
D60=0.056	
D30=0.018	Cu=
D10=	Cc=

CLASSIFICATION:
SANDY SILT

GS ASTM 0900615.GPJ BRAUN.GDT 2/19/09 15:47

0900615

Braun Intertec Corporation

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-01	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	1 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.9
#20	(0.85mm)	97
#40	(0.425mm)	94.9
#60	(0.25mm)	93.6
#100	(0.15mm)	92.2
#200	(0.75mm)	88.2

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments 23/24-1004001002

Sample Information

Sample:	0900615-02	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	1 (2-5.4')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	100
#40	(0.425mm)	99.4
#60	(0.25mm)	98.1
#100	(0.15mm)	96.3
#200	(0.75mm)	89.5

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-03	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	2 (0-3')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.5
#20	(0.85mm)	99.1
#40	(0.425mm)	97.1
#60	(0.25mm)	94.5
#100	(0.15mm)	91.4
#200	(0.75mm)	85.8

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-04	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	2 (3-5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.8
#40	(0.425mm)	99.4
#60	(0.25mm)	98.6
#100	(0.15mm)	97.5
#200	(0.75mm)	93.7

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-05	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	3 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.9
#40	(0.425mm)	99.2
#60	(0.25mm)	98.4
#100	(0.15mm)	96.8
#200	(0.75mm)	88.1

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-06	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	3 (2-5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.8
#40	(0.425mm)	99.4
#60	(0.25mm)	98.7
#100	(0.15mm)	97.5
#200	(0.75mm)	94.7

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-07	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	3 (5-6.5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	98.1
#40	(0.425mm)	95.3
#60	(0.25mm)	93.5
#100	(0.15mm)	91.7
#200	(0.75mm)	88.3

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date:	February 19, 2009	**Project Number:**	0900615
Client:	Barr Engineering Company	**Project Description:**	Fountain L. Sediments 23/24-1004001002

Sample Information

Sample:	0900615-08	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	4 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.9
#20	(0.85mm)	99.6
#40	(0.425mm)	99.1
#60	(0.25mm)	98.7
#100	(0.15mm)	97.8
#200	(0.75mm)	94.4

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-09	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	4 (2-5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.8
#40	(0.425mm)	99.4
#60	(0.25mm)	98.8
#100	(0.15mm)	97.9
#200	(0.75mm)	94.6

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-10	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	4 (5-6.3')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.9
#40	(0.425mm)	99.2
#60	(0.25mm)	98.4
#100	(0.15mm)	97.2
#200	(0.75mm)	92.5

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-11	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	5 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	100
#40	(0.425mm)	99.9
#60	(0.25mm)	99.7
#100	(0.15mm)	99.4
#200	(0.75mm)	98.0

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-12	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	5 (2-4.8')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.8
#40	(0.425mm)	99.0
#60	(0.25mm)	97.9
#100	(0.15mm)	96.2
#200	(0.75mm)	89.3

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-13	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	6 (0-2.8')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.6
#40	(0.425mm)	98.2
#60	(0.25mm)	93.8
#100	(0.15mm)	83.7
#200	(0.75mm)	74.4

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-14	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	7 (0-1.5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	98.3
#10	(2.0mm)	95.4
#20	(0.85mm)	92.5
#40	(0.425mm)	87.0
#60	(0.25mm)	77.9
#100	(0.15mm)	72.3
#200	(0.75mm)	68.0

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-15	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	7 (1.5-4.2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	83.8
3/8"	(9.5mm)	79.2
#4	(4.75mm)	65.1
#10	(2.0mm)	53.5
#20	(0.85mm)	40.7
#40	(0.425mm)	21.4
#60	(0.25mm)	8.0
#100	(0.15mm)	4.9
#200	(0.75mm)	4.0

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-16	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	7 (4.2-5')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	98.6
#10	(2.0mm)	97.5
#20	(0.85mm)	95.2
#40	(0.425mm)	91.8
#60	(0.25mm)	87.0
#100	(0.15mm)	82.0
#200	(0.75mm)	76.0

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-17	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	8 (0-2.8')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	97.9
#20	(0.85mm)	90.9
#40	(0.425mm)	79.2
#60	(0.25mm)	68.0
#100	(0.15mm)	60.9
#200	(0.75mm)	51.4

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date:	February 19, 2009	**Project Number:**	0900615
Client:	Barr Engineering Company	**Project Description:**	Fountain L. Sediments 23/24-1004001002

Sample Information

Sample:	0900615-18	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	8 (2.8-5.2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.9
#40	(0.425mm)	97.2
#60	(0.25mm)	72.2
#100	(0.15mm)	40.5
#200	(0.75mm)	20.5

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-22	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	9 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	99.9
#40	(0.425mm)	99.9
#60	(0.25mm)	99.9
#100	(0.15mm)	99.7
#200	(0.75mm)	98.3

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-23	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	9 (2-3.6')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	100
#40	(0.425mm)	99.9
#60	(0.25mm)	99.8
#100	(0.15mm)	99.6
#200	(0.75mm)	98.4

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-24	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	10 (0-2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	100
#20	(0.85mm)	100
#40	(0.425mm)	99.9
#60	(0.25mm)	99.8
#100	(0.15mm)	99.5
#200	(0.75mm)	97.9

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-25	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	10 (2-4.7')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.9
#20	(0.85mm)	99.6
#40	(0.425mm)	98.6
#60	(0.25mm)	97.1
#100	(0.15mm)	94.7
#200	(0.75mm)	84.9

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-19	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	11 (0-3.2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.7
#20	(0.85mm)	98.9
#40	(0.425mm)	96.5
#60	(0.25mm)	92.5
#100	(0.15mm)	87.9
#200	(0.75mm)	82.6

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Client: Barr Engineering Company

Project Number: 0900615

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-20	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	11 (3.2-4.2')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	98.2
#4	(4.75mm)	95.3
#10	(2.0mm)	95.9
#20	(0.85mm)	73.8
#40	(0.425mm)	55.9
#60	(0.25mm)	36.1
#100	(0.15mm)	23.5
#200	(0.75mm)	16.1

Remarks:

Steven J. Albrecht
Project Manager

Grain Size Analysis

Date: February 19, 2009

Project Number: 0900615

Client: Barr Engineering Company

Project Description: Fountain L. Sediments
23/24-1004001002

Sample Information

Sample:	0900615-21	Date Received:	2/10/2009
Sampled By:	Client	Date Tested:	2/19/2009
Test Method:	ASTM D422	Location:	11 (4.2-6.0')

Test Results

Sieve Size		% Passing
3"	(75mm)	100
2"	(50mm)	100
1 1/2"	(37.5mm)	100
1"	(25mm)	100
3/4"	(19mm)	100
1/2"	(12.5mm)	100
3/8"	(9.5mm)	100
#4	(4.75mm)	100
#10	(2.0mm)	99.9
#20	(0.85mm)	99.8
#40	(0.425mm)	99.4
#60	(0.25mm)	98.1
#100	(0.15mm)	92.1
#200	(0.75mm)	69.1

Remarks:

Steven J. Albrecht
Project Manager

Appendix F

Partial Contractor List

Contractor Listing

Colstrup Sodding & Landscaping
1822 Brookside Drive,
Albert Lea, MN 56007
Performance Landscaping
(507)-826-3407

Performance Landscaping
17243 760th Avenue,
Albert Lea, MN 56007
(507) 373-3057

Agri Lawn
Albert Lea, MN 56007
(507)-377-0292

Stivers Nursery & Landscaping
1701 12th St SW
Austin, MN 55912
(507) 433-3503

Weis Landscaping & Design
63118 200th St
Rose Creek, MN 55970
(507) 437-4751

Nagel Sod Farm & Nursery
I-35 W Frontage
Owatonna, MN 55060
(507) 332-4020

Nagel Sod Farm
6119 Nw 66th St
Medford, MN 55049
(507) 451-9605

Dahle Sod Farm
407 4th St NW
Morristown, MN
(507) 685-2245

Wolf Landscaping
3251 Meadowview Ln
Mankato, MN
(507) 278-4455

Wilker Jason Retaining Wall & Pavers
308 10th St Nw
Byron, MN
(507) 775-7800

Mankato Landshapes Inc
55346 Hemlock Rd
Mankato, MN
(507) 625-6044

Blue Valley Sod & Landscape
1040 N River Dr
North Mankato, MN
(507) 387-1268

Ulland Brothers Excavating
2400 Myers Road
Albert Lea, MN 56007
(507) 373-1960

Sorenson Brothers
2046 Sorenson Rd
Albert Lea MN 56007
(507) 373-6122

Freeborn Construction
PO Box 56
Albert Lea, MN 56007
(507) 373-4434