Stevens, Ferrone & Bailey Engineering Company, Inc.

Geotechnical Engineering
Engineering Geology
Storm Water Management
Construction Observation & Testing Services

December 2, 2010

Mr. William Romzick
Jacobs
180 Promenade Circle, Suite 300
Sacramento, CA 95834

Re: Geotechnical Investigation
Columbarium Wall 2, Santa Fe national Cemetery, Santa Fe, New Mexico
SFB Project No.: 361-10

Mr. Romzick:

In accordance with your request, Stevens, Ferrone & Bailey Engineering Company, Inc. (SFB) has performed a geotechnical investigation of the existing Columbarium Wall 2 located at the Santa Fe National Cemetery in Santa Fe, New Mexico. The purpose of our investigation was to analyze geotechnical reasons for the observed distress to the wall and to provide geotechnical recommendations for correcting the distress.

Project Description

The Columbarium Wall 2 has undergone differential settlement that has resulted in cracking of concrete and masonry, and has also resulted in tension cracks and "pulling apart" of joints. As shown on Figure 1, the wall is approximately 350 feet in length, 6-1/2 feet in height, and retains 4 to 4-1/2 feet of fill. It is assumed that the wall is founded on a simple, shallow concrete pad. A concrete walkway exists at the front of the wall, and lawn and gravesites are located adjacent to the front and back of the wall. The lawn areas are irrigated. The results of our investigation indicate that a drainage system exists adjacent to the back of the wall, between the backfill and the wall.

Site Evaluation

On November 2, 2010, we performed a reconnaissance of the wall and surrounding area. At the time of our reconnaissance and as shown on Figure 1, the wall was bounded by lawn and gravesites to the north, a concrete walkway and lawn/gravesites to the south, and landscaping on

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the eastern and western ends. A roadway was located approximately 15 feet from the eastern end of the wall. The roadway was approximately 30 feet wide and was retained with a 12 to 14 foot high wall to the east. The wall appeared to be of segmental block and geogrid construction. A floodplain and creek existed to the east of the retaining wall. Concrete ditches bounded the road and a guard rail existed on the west side of the road. In the vicinity of Columbarium Wall 2, no distress was observed at the roadway, concrete ditches, guardrail or roadway retaining wall.

As part of our evaluation, we performed seven exploratory borings behind the wall and one exploratory boring in the roadway to the east of the wall. The borings were performed on November 2, 2010 with truck mounted drill rigs and are approximately located on the Site Plan, Figure 1. Boring SFB-1 was performed with a CME 75 drill rig equipped with hollow stem auger and an automatic hammer system to drill sampler barrels. The other borings were performed with a CME 55 equipped with 6 inch diameter solid flight auger and a standard hammer system to drive the sampler barrels. Logs of our borings and details regarding our field investigation are included in Appendix A. The results of our laboratory tests are discussed in Appendix B. It should be noted that changes in the surface and subsurface conditions can occur over time as a result of either natural processes or human activity and may affect the validity of the conclusions and recommendations in this report.

Boring SFB-1, performed in the roadway to the east of Columbarium Wall 2, encountered dense sandy fill materials below approximately 4-1/2 inches of asphalt concrete pavement. The fill materials extended to a depth of about 8 feet where medium dense native sand was encountered to a depth of about 13 feet. The medium dense sand was underlain by loose native sands that extended to the bottom of the boring, a depth of about 21-1/2 feet. The dense fill materials were likely placed during the construction of the roadway and associated retaining wall and appear to have been properly placed and compacted.

Borings SFB-2 through SFB-8 were performed behind Columbarium Wall 2. The borings encountered very loose to loose sandy fill materials extending to depths of about 4 to 10 feet below the ground surface. Below the fill materials, native sandy soils were encountered having loose to very dense consistencies which extended to the maximum depth explored of about 22-1/2 feet. The very loose to loose fill materials and the loose native soils are weak, compressible, and have a potential for consolidation due to irrigation and storm water infiltration.

Free ground water was not observed in any of the eight borings. Fluctuations in the ground water level could occur due to change in seasons, variations in rainfall, irrigation, and other factors.

Figure 2 provides a cross-section along the length of Columbarium Wall 2 showing the relationship of the wall with the fill materials and native soils encountered in our borings. Figure 2 also shows the general locations where we observed distress in the wall. As shown in Figure 2,

the observed distress correlates well with the location of the loose fills and soils, approximately located below the eastern and western third of the wall. The middle third of the wall is underlain by dense to very dense soils and shows little distress.

Our attached boring logs and related information depict location specific subsurface conditions encountered during our field investigation. The approximate locations of our borings were determined by pacing relative to stakes provided by Jacobs and should be considered accurate only to the degree implied by the method used.

Conclusions and Recommendations

Based on the results of our site reconnaissance, subsurface exploration, laboratory testing, and geotechnical engineering analyses, it is our opinion that Columbarium Wall 2 is experiencing distress where the wall is underlain by loose fill materials and loose native soils. The roadway and retaining wall to the east of Columbarium Wall 2 appear to be functioning properly and do not appear to have a negative impact on Columbarium Wall 2. Distress is observed in Columbarium Wall 2 where loose fills or soils exist below the wall (below the approximate eastern and western third of the wall), and relatively no distress is observed in Columbarium Wall 2 where the wall is underlain by dense native soils (below the approximate middle third of the wall). The loose fills and soils below the wall will continue to consolidate over time resulting in additional settlement and distress to Columbarium Wall 2.

In order to adequately support Columbarium Wall 2, we recommend compaction grouting be performed within the loose fills and soils below the wall. Figure 2 shows the approximate locations of these loose fills and soils. Compaction grouting consists of pushing grout tubes below the ground surface until moderate resistance is encountered (resistance is typically encountered at the interface between the loose fills/soils and medium dense to dense soils). At that point, cement based grout is injected into the ground at high pressures creating a grout bulb that radiates outward, densifying (compacting) the surrounding granular soils. After the initial grout bulb is created, the grout tube is raised a few feet and another grout bulb is created. This process should be continued until a sufficient number of grout bulbs are created below the wall and the underling, supporting soils are adequately densified. Once the grouting is completed, the shear strength and density of the underlying fills and soils are significantly improved, resulting in adequate support for the wall. Granular soils, such as those underlying the wall, are best suited for compaction grouting techniques. Benefits of compaction grouting include minimal disturbance to existing improvements and no need for demolition and reconstruction of the wall. In some cases, compaction grouting is able to re-level overlying improvements (such as walls).

We recommend a specialty ground modification contractor be consulted to design and perform the compaction grouting process and to advise whether or not the wall can be re-leveled using

the grouting process. The vertical extent of the compaction grouting should include all of the loose soils and fills below the wall shown on Figure 2. Laterally, the grouted zone below the wall should include the area between 1:1 (horizontal to vertical) projected planes extending downward from the outer edges of the base of the wall.

Upon completion of the grouting, we recommend a Standard Penetration Resistance value (SPT) of at least 25 be achieved in the granular soils within the grouted zone. The SPT values should be determined after grouting by drilling at least four exploratory borings (two within each grouted zone) to a depth of approximately 20 feet. SPT tests should be taken at least every 3 feet in depth. We also recommend that we review the grouting plans and specifications prior to construction to confirm that the intent of our recommendations contained in this report have been satisfied.

It is our opinion that the loose backfill behind the wall has not negatively impacted the wall. We did not observe significant overturning or sliding of the wall, and the only distress appears to be related to settlement. We do recommend, however, that the subdrain system behind the wall be inspected to make sure it is performing properly. The inspection should include the clearing of any debris or soil within the subdrain pipe, and checking the discharge point of the subdrain pipe to make sure the pipe is adequately discharging into the cemetery's storm drain system.

Conditions and Limitations

We cannot be held responsible for the validity or accuracy of information, analyses, test results, or designs provided to SFB by others. The analysis, designs, opinions, and recommendations submitted in this report are based in part upon the data obtained from our field work and upon information provided by others. Site exploration and testing characterizes subsurface conditions only at the locations where the explorations or tests are performed; actual subsurface conditions between explorations or tests may be different than those described in this report. Variations of subsurface conditions from those analyzed or characterized in this report are not uncommon and may become evident during construction. In addition, changes in the condition of the site can occur over time as a result of either natural processes (such as earthquakes, flooding, or changes in ground water levels) or human activity (such as construction adjacent to the site, dumping of fill, or excavating). If changes to the site's surface or subsurface conditions occur since the performance of the field work described in this report, or if differing subsurface conditions are encountered, we should be contacted immediately to evaluate the differing conditions to assess if the opinions, conclusions, and recommendations provided in this report are still applicable or should be amended.

We recommend that SFB be retained to provide geotechnical services during design, reviews, and construction to confirm and observe compliance with the design concepts, specifications and

recommendations presented in this report. Our presence will also allow us to modify design if unanticipated subsurface conditions are encountered or if changes to the scope of the project, as defined in this report, are made. If we are not retained to provide geotechnical or geological design modifications or observations, as necessary, prior to or during construction activities, or if other persons or entities are retained to provide such services, we cannot be held responsible for any or all claims, including but not limited to claims arising from or resulting from the performance of such services by other persons or entities, and any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

This report is a design document that has been prepared in accordance with generally accepted geological and geotechnical engineering practices for the exclusive use of Jacobs and their consultants for specific application to the Columbarium Wall 2 project in Santa Fe, New Mexico, and is intended to represent our design recommendations to Jacobs for specific application to the Columbarium Wall 2 restoration project. The conclusions and recommendations contained in this report are solely professional opinions. It is the responsibility of Jacobs to transmit the information and recommendations of this report to those designing and constructing the project. We will not be responsible for the misinterpretation of the information provided in this report.

It should be understood that advancements in the practice of geotechnical engineering and engineering geology, or discovery of differing surface or subsurface conditions, may affect the validity of this report and are not uncommon. SFB strives to perform its services in a proper and professional manner with reasonable care and competence but it is not infallible. Geological engineering and geotechnical engineering are disciplines that are far less exact than other engineering disciplines; we should be consulted if it is not completely understood what the limitations to using this report are.

In the event that there are any changes in the nature, design or location of the project, as described in this report, or if any future additions are planned, the conclusions and recommendations contained in this report shall not be considered valid unless we are contacted in writing, the project changes are reviewed by us, and the conclusions and recommendations presented in this report are modified or verified in writing. The opinions, conclusions, and recommendations contained in this report are based upon the description of the project as presented in the introduction section of this report.

This report does not necessarily represent all of the information that has been communicated by us to Jacobs and their consultants during the course of this engagement and our rendering of professional services to Jacobs. Reliance on this report by parties other than those described above must be at their own risk unless we are first consulted as to the parties' intended use of this report and only after we obtain the written consent of Jacobs to divulge information that may have been communicated to Jacobs. We cannot accept consequences for unconsulted use of

segregated portions of this report. Please refer to Appendix C for additional guidelines regarding use of this report.

If you have any questions or need additional information, please call our office.

Sincerely,

Stevens, Ferrone & Bailey
Engineering Company, Inc.

Patrick Stevens, P.E.
New Mexico Professional Civil Engineer #19868

KCF/PS:
Copies: Addressee (1 draft copy via e-mail)
Attachments: Figure 1 – Site Plan
Figure 2 – Cross-Section
Appendix A – Filed Investigation
Appendix B – Laboratory Testing

Appendix A

Field Investigation

Field Investigation

Our field investigation for the Columbarium Wall 2 consisted of a surface reconnaissance and a subsurface exploration program using a truck-mounted drill rigs equipped with continuous flight, solid and hollow stem augers. Eight 6- and 8-inch diameter exploratory borings were drilled on November 2, 2010, to a maximum depth of 22-1/2feet. The locations of the exploratory borings are shown on the Site Plan, Figure 1. Our representative continuously logged the soils encountered in the borings in the field. The soils are described in general accordance with the Unified Soil Classification System (ASTM D2487). The logs of the borings as well as a key for the classification of the soil (Figure A-1) are included as part of this appendix.

Representative samples were obtained from our exploratory borings at selected depths appropriate to the investigation. Relatively undisturbed samples were obtained using a 3-inch O.D. split barrel sampler with liners, and disturbed samples were obtained using the 2-inch O.D. split spoon sampler. All samples were transmitted to our Concord, California, office for evaluation and appropriate testing. Both sampler types are indicated in the "Sampler" column of the boring logs as designated in Figure A-1.

Resistance blow counts were obtained in our borings with the samplers by dropping a fully automatic 140-pound hammer in Boring SFB-1 and a cathead and rope 140-pound hammer in Borings SFB-2 through SFB-8; the hammers were dropped in a 30 inch free fall. The samplers were driven 18 inches, or a shorter distance where hard resistance was encountered, and the number of blows were recorded for each 6 inches of penetration. The blows per foot recorded on the boring logs represent the accumulated number of converted blows that were required to drive the last 12 inches, or the number of inches indicated where hard resistance was encountered. The blow counts recorded on the boring logs have been converted to equivalent SPT field blowcounts, but have not been corrected for overburden, silt content, or other factors.

The attached boring logs and related information show our interpretation of the subsurface conditions at the dates and locations indicated, and it is not warranted that they are representative of subsurface conditions at other locations and times.

Appendix B

Laboratory Testing

Laboratory Testing

Our laboratory testing program for the Columbarium Wall 2 restoration project was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site.

The natural water content was determined on five samples of the materials recovered from the borings. These water contents are recorded on the boring logs at the appropriate sample depths.

Dry density determinations were performed on five samples of the subsurface soils to evaluate their physical properties. The results of these tests are shown on the boring logs at the appropriate sample depths.

The percent passing the #200 sieve was determined on four samples of the subsurface soils to aid in the classification of these soils. The results of these tests are shown on the boring logs at the appropriate sample depths and on the attached Figure B-1.

Gradation tests were performed on four samples of the subsurface soils. These tests were performed to assist in the classification of the soils and to determine their grain size distribution. The results of these tests are presented on the borings logs at the appropriate sample depths and on the attached Figure B-1.

Appendix C

ASFE Report Information

DRILL RIG CME 75, Auto Hammer	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
4 1/2" AC.			0						
FILL: SAND (SM), red brown, fine- to coarse-grained, some gravel, with silt and clay, damp. Wood fragments 2'-4'.	dense				34	10	124		
			5		35	9	128		
SAND (SM), red brown, fine- to coarse-grained, trace gravel, some silt and clay at 10' (CL), damp.	medium dense		10		13				
SAND (SM), red brown, fine-grained, silty, damp.	loose		15		8				
			20		8				
Bottom of Boring = 21.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-1

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), brown, fine- to medium-grained, some gravel, with silt and clay, damp.	loose		0		4				Sieve Analysis: 5% Gravel 71%Sand 24% Silt and Clay
Moist at 5', mottled tan-brown.			5		7				
SAND (SM), brown, fine- to coarse-grained, silty, some clay, moist.	loose		10		4				
Light tan brown, mostly fine-grained at 15'.	medium dense		15		14				
Clayey at 21'.	loose		20		7				
Bottom of Boring = 21.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-2

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), brown, fine- to coarse-grained, some gravel, with silt and clay, moist.	very loose		0						Sieve Analysis: 5% Gravel 67% Sand 28% Silt and Clay
					2	15	109		
			5						
Moist, trace gravel at 8', trace organics.	loose				10				
SAND (SM), fine- to medium-grained, trace to some silt, damp.	medium dense		10						
					22	8	121		
	loose		15		7				
Fine- to coarse-grained, mottled tan orange brown.	dense		20		43				
Bottom of Boring = 21.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-3

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), red brown, fine-grained, silty, moist, trace organics.	loose		0		6				
SAND (SM), tan brown, fine-grained, silty, trace clay, damp.	medium dense		5		26				
SAND (SM), orange brown, fine- to coarse-grained, trace gravel, damp, trace to some silt.	very dense		10		83				
Mottled, fine- to medium-grained, hard layer at 16'.			15		74				
Coarse sand & trace gravel at 21'.			20		80/9.5"				
Bottom of Boring = 21 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25 30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-4

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), red brown, fine- to coarse-grained, with silt and clay, moist, trace gravel, trace organics.	very loose		0		2				
SAND (SM), tan brown, fine-grained, some silt, damp.	very dense		5		Refuseal				
Rock fragments at 12'.			10		83				
Sampler refusal at 17'.			15						
			20		88				
Bottom of Boring = 21 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-5

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), brown, fine- to coarse-grained, some gravel, with silt and clay, moist.	very loose		0		3				Sieve Analysis: 7% Gravel 64% Sand 29% Silt and Clay
Trace rock fragments at 6' geotextile fragments in samples at 6'.	medium dense		5		14				
SAND (SM), mottled brown, fine- to medium-grained, with silt and clay, trace rock fragments, damp to moist.	loose		10		5				
SAND (SM), red brown, fine-grained, trace to some silt, damp.	dense		15		46				
More well-graded, fine- to medium-grained, some coarse at 20'.	very dense		20		86				
Bottom of Boring = 22.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25 30						

EXPLORATORY BORING LOG 361-10.GPJ STEVENS FERRONE BAILEY.GDT 12/2/10

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-6

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), red brown, fine- to medium-grained, some silt and clay, moist.	very loose		0						
					2	14	103		
	loose		5		6				
Geotextile fragment at 6', mottled tan-red brown. Dark rock fragment at 6.5'.									
SAND (SM), light tan brown, mostly fine-grained, some silt and clay, damp.	loose								
			10		8				
No recovery at 15': clay in cuttings.			15		5				
Dry.	very dense		20		88/11"				
Bottom of Boring = 21.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-7

DRILL RIG CME 55	SURFACE ELEVATION ---	LOGGED BY NSK
DEPTH TO GROUND WATER Not Encountered	BORING DIAMETER 6.58-inch	DATE DRILLED 11/02/10

DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	SPT N-VALUE	WATER CONTENT (%)	DRY DENSITY (PCF)	UNC. COMP. (KSF)	OTHER TESTS
FILL: SAND (SM), reddish brown, silty, moist.	very loose		0						
FILL: SAND (SM), tan-brown, fine- to coarse-grained, trace gravel, silty and clayey.	very loose				3				Sieve Analysis: 2% Gravel 63% Sand 35% Silt and Clay
			5		2				
Moist , rock fragments at 6'.									
Trace orgainics at 10'.									
SAND (SM), red brown, fine- to medium-grained, silty, damp to moist.	medium dense		10		12				
With gravel & coarse sand, less moisture.	very dense		15		83/10"				
Gravel in shoe at 20', refusal.			20		10/0"				
Bottom of Boring = 20.5 feet Notes: Stratification is approximate, variations must be expected. Blowcounts converted to SPT N-values. See Report for additional details.									
			25						
			30						

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EXPLORATORY BORING LOG

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	BORING NO.
361-10	December 2010	SFB-8

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description
Coarse Grained Soils	Gravel Gravelly Soils		GW	Well-graded gravels or gravel sand mixtures, little or no fines
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines
			GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sand And Sandy Soils		SW	Well-graded sands or gravelly sands, little or no fines
			SP	Poorly-graded sands or gravelly sands, little or no fines
			SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, and-clay mixtures

Major Divisions		grf	ltr	Description
Soils	Silts And Clays LL < 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silt-clays of low plasticity
	Silts And Clays LL > 50		MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat and other highly organic soils

GRAIN SIZES

U.S. STANDARD SERIES SIEVE: 200, 40, 10, 4

CLEAR SQUARE SIEVE OPENINGS: 3/4", 3", 12"

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

RELATIVE DENSITY

Sands and Gravels	Blows/Foot*
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

CONSISTENCY

Silts and Clays	Blows/Foot*	Strength (tsf)**
Very Soft	0 - 2	0 - 1/4
Soft	2 - 4	1/4 - 1/2
Firm	4 - 8	1/2 - 1
Stiff	8 - 16	1 - 2
Very Stiff	16 - 32	2 - 4
Hard	Over 32	Over 4

*Number of Blows for a 140-pound hammer falling 30 inches, driving a 2-inch O.D. (1-3/8" I.D.) split spoon sampler.
**Unconfined compressive strength.

SYMBOLS & NOTES

- Standard Penetration sampler (2" OD Split Barrel)
- Modified California sampler (3" OD Split Barrel)
- California Sampler (2.5" OD Split Barrel)
- Shelby Tube
- Pitcher Barrel
- HQ Core
- Ground Water level initially encountered
- Ground Water level at end of drilling

PI = Plasticity Index
LL = Liquid Limit
R = R-Value

Increasing Visual Moisture Content

Saturated
Wet
Moist
Damp
Dry

Constituent Percentage

trace	<5%
some	5-15%
with	16-30%
-y	31-49%

Stevens, Ferrone & Bailey Engineering Company, Inc.
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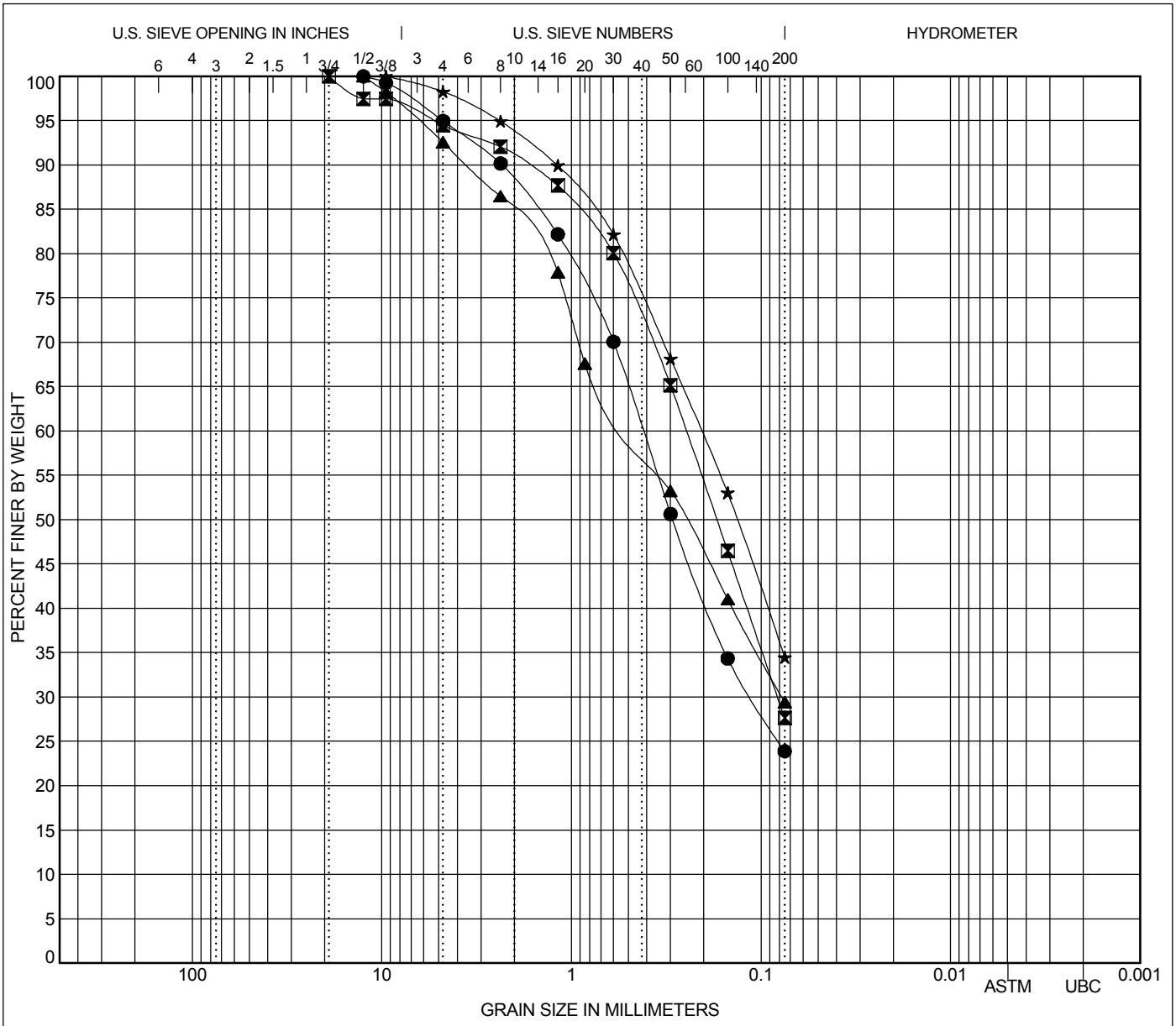
KEY TO EXPLORATORY BORING LOGS

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	FIGURE NO.
361-10	December 2010	A-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Location	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**SFB-2**	**2.0**	**Red brown SAND with silt some gravel (SM)**					
⊠	**SFB-3**	**3.0**	**salmon brown SAND with silt and clay some gravel (SM-SC)**					
▲	**SFB-6**	**3.0**	**red brown SAND with clay some silt (SC)**					
★	**SFB-8**	**6.0**	**salmon brown silt SAND some clay (SM)**					

	Location	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	ASTM %Silt	ASTM %Clay	UBC %-200<0.002mm
●	**SFB-2**	**2.0**	**12.5**	**0.419**	**0.113**		**5.0**	**71.1**	**23.9**		
⊠	**SFB-3**	**3.0**	**19**	**0.248**	**0.082**		**5.5**	**66.9**	**27.6**		
▲	**SFB-6**	**3.0**	**12.5**	**0.49**	**0.078**		**7.4**	**63.1**	**29.4**		
★	**SFB-8**	**6.0**	**9.5**	**0.206**			**1.7**	**63.8**	**34.5**		

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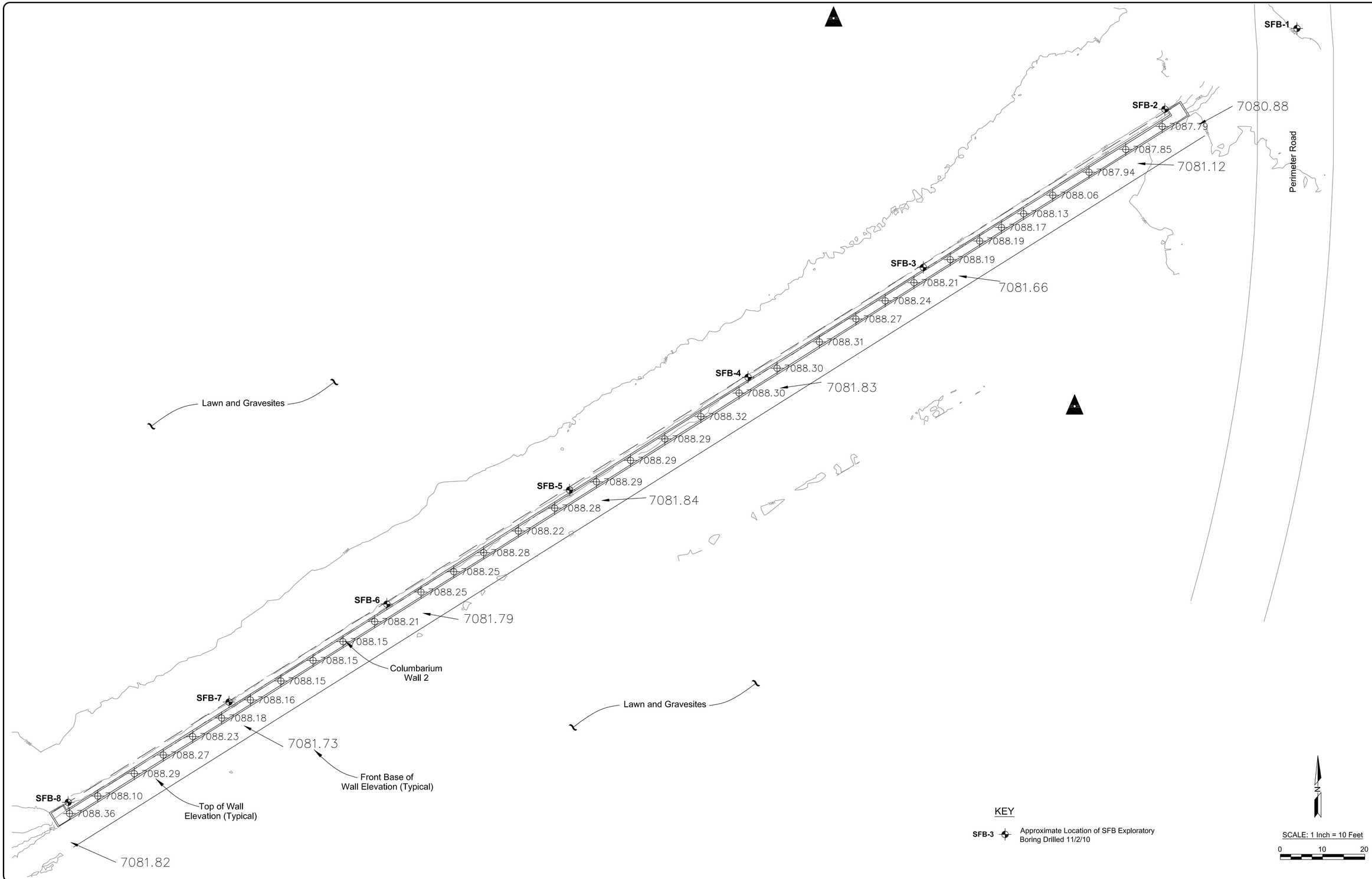
GRAIN SIZE DISTRIBUTION

SANTA FE COLUMBARIUM WALL 2
Santa Fe, NM

PROJECT NO.	DATE	FIGURE NO.
361-10	***December 2010***	***B-1***



DATE:	12/2/10
DESIGN:	NK
DRAWN:	NK
APPROVED:	KF
JOB NO:	361-10

REV. NO.	DATE	DESCRIPTION	BY

Stevens Ferrone & Bailey Engineering Company, Inc
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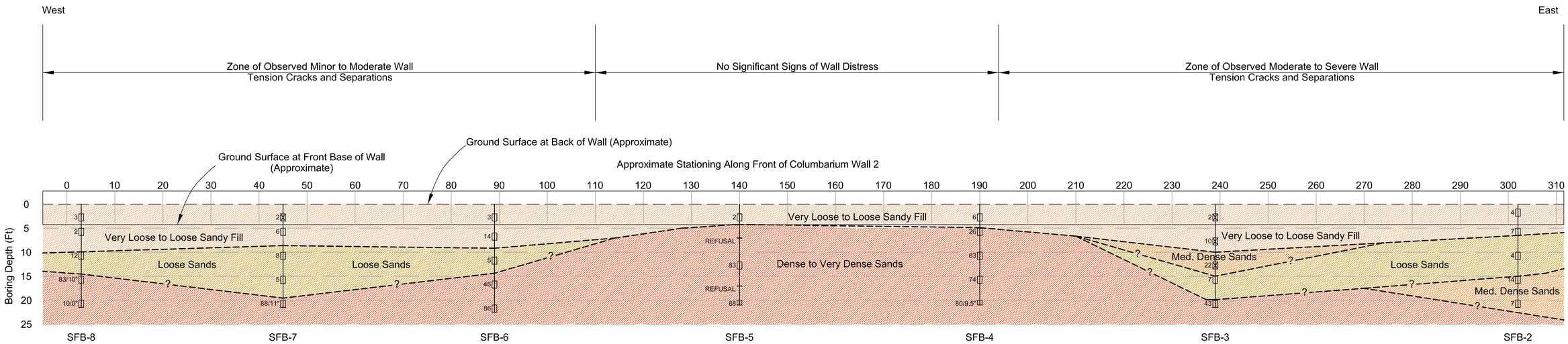
Concord, CA 94520
Tel 925.688.1001
Fax 925.688.1005
www.SFandB.com

SITE PLAN
COLUMBARIUM WALL 2

SANTA FE NATIONAL CEMETERY
Santa Fe, New Mexico

SHEET
1



KEY

22⊠	Modified California Sample (3" OD; 2.4" ID) and SPT Blowcount (Converted)
7[]	SPT(2" OD, 1-3/8" ID) Sample and Blowcount
SFB-2	Approximate Location of SFB Exploratory Boring Drilled 11/2/10
– – – – –	Approximate Stratigraphic Contact; Variations Exist and are Expected

SCALE: 1 Inch = 10 Feet

0 10 20

DATE:	12/2/10
DESIGN:	NK
DRAWN:	NK
APPROVED:	KF
JOB NO:	361-10

REV. NO.	DATE	DESCRIPTION	BY

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CROSS-SECTION
COLUMBARIUM WALL 2

SANTA FE NATIONAL CEMETERY
Santa Fe, New Mexico

SHEET
2