343

~~2-402.11~~

2-402.13

TRANSMITTAL OF GEOTECHNICAL SAMPLING AND TESTING PLAN FOR ON-SITE CLAY BORROW AREAS, OFF-SITE MATERIAL SOURCES AND OPERABLE UNIT 2 WASTE UNITS, AND ASSOCIATED CHANGE PAGES

07/16/96

DOE-1122-96
DOE-FN EPAS
30
CHANGE

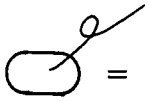
Change Pages for

Geotechnical Sampling and Testing Plan (GSTP)

for

On-Site Clay Borrow Areas, Off-Site Material Sources,

and Operable Unit 2 Waste Units, Revision 2

 = Deletions from GSTP, Revision 1

 = Additions to GSTP, Revision 1

APPENDIX

ATTACHMENT	TITLE
A	Final Geotechnical Investigation Specific Data Quality Objectives
B	SSOP-1070, "Unexpected Discovery of Cultural Resources"
C	Example Field Forms
D	Equipment List
E	Till/Fill Thickness
F	Denison Sampling
G	Schedule
H	Methodology for Using Hollow-Stem Auger as a Temporary Casing in Zones of Subsurface Uranium Contamination
I	ASTM Standards
J	OEPA Approved Policy for Management of Aqueous Investigation Derived Waste
K	Material Testing Methods
L	Waste Unit Geological Cross Sections
M	Scope for Collection and Analyses of Uranium Contaminated Perched Groundwater
N	Modal Diameter Testing
O	Interface Friction Shear Testing
P	Data Quality Objectives Addendum

TABLE 2-4
SUMMARY OF GEOTECHNICAL TESTING
(EAST FIELD BORROW SOURCE)

TEST	EWMF*	OU2 DISPOSAL FACILITY GEOTECHNICAL REPORT INCLUDING SUPPLEMENT REPORT	ON-SITE BORROW SOURCE GEOTECHNICAL INVESTIGATION (Proposed)	TOTAL
Moisture Content	33	32	115101 e	180166 e
Unit Weight	---	17	---	17
Grain Size/ Hydrometer	33	39	6454 e	136126 e
Specific Gravity	33	39	6	78
Atterberg Limits	29	37	9584 e	161150 e
Consolidation (Undisturbed)	3	3	---	6
Consolidation (Remolded)	---	---	4	4
UU Triaxial (Undisturbed)	---	---	54 e	54 e
UU Triaxial (Remolded)	---	---	7	7
CU Triaxial (Undisturbed)	3	8	32 e	1413 e
CU Triaxial (Remolded)	---	2	---	2
Hydraulic Conductivity (Undisturbed)	3	4	---	7
Hydraulic Conductivity (Remolded)	---	8	6035 e	6843 e
Standard Proctor	---	6	2321 e	2927 e
Modified Proctor	---	1	---	1
Organic Content	---	---	64	64
Modal Diameter	---	---	14	14
Sulfate	---	---	16	16
Chloride	---	---	1664 e	1664 e

* As presented in the H. C. Nutting Report (includes only sample locations either within or adjacent to the borrow source area)

TABLE 2-6
SUMMARY OF GEOTECHNICAL TESTING
(INACTIVE FLYASH PILE/SOUTH FIELD/ACTIVE FLYASH PILE)

TEST	REMEDIAL INVESTIGATION REPORT OPERABLE UNIT 2	WASTE FILL AREA INVESTIGATION (Proposed)	TOTAL
Moisture Content	41	149	190
Unit Weight	21	---	21
Grain Size/ Hydrometer	37	70	107
Specific Gravity	27	7	34
Atterberg Limits	18	69	87
Consolidation (Remolded)	---	20	20
UU Triaxial (Remolded)	---	5	5
CU Triaxial (Remolded)	---	4	4
Consolidated Drained Triaxial (Undisturbed)	1	---	1
Hydraulic Conductivity (Undisturbed)	3	---	3
Hydraulic Conductivity (Remolded)	---	1918	1918
Standard Proctor	---	18	18
Direct Shear Strength	2	---	2
Modal Diameter	---	6	6

TABLE 2-7

SUMMARY OF GEOTECHNICAL TESTING (OFF-SITE PEA GRAVEL SOURCES)

TEST	EXISTING GEOTECHNICAL DATA	OFF-SITE PEA GRAVEL MATERIAL SOURCES (Proposed)	TOTAL
Petrographic Examination*	---	TBD	TBD
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	---	18	18
Specific Gravity and Absorption of Fine Coarse Aggregate	---	18	18
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	---	18	18
Particle Size Analysis for Soils	---	18	18
Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions	---	18	18
Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions	---	18	18

* Six prescreening Petrographic Examinations will be performed at each potential off-site material source. Material identified as being of poor quality with respect to their intended use shall be eliminated from further testing. Number of Petrographic Examinations performed will be dependent on the number of off-site material sources examined; therefore, the number of petrographic examinations performed will be determined during field investigations.

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TABLE 2-8
SUMMARY OF GEOTECHNICAL TESTING
(OFF-SITE RIPRAP SOURCES)

TEST	EXISTING GEOTECHNICAL DATA	OFF-SITE RIPRAP MATERIAL SOURCES (Proposed)	NUMBER OF TESTS
Petrographic Examination*	---	TBD	TBD
Specific Gravity and Absorption of Coarse Aggregate	---	18	18
Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine	---	18	18
Rebound Number of Hardened Concrete	---	18	18
Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	---	18	18
Splitting Tensile Strength of Intact Rock Core Specimens	---	18	18
Evaluation of Rock to be Used for Erosion Control	---	18	18
Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate	---	18	18
Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions	---	18	18
Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions	---	18	18

* Six prescreening Petrographic Examinations will be performed at each potential off-site material source. Material identified as being of poor quality with respect to their intended use shall be eliminated from further testing. Number of Petrographic Examinations performed will be dependent on the number of off-site material sources examined; therefore, the number of petrographic examinations performed will be determined during field investigations.

TABLE 2-9

SUMMARY OF GEOTECHNICAL TESTING (OFF-SITE FINE AGGREGATE SOURCES)

TEST	EXISTING GEOTECHNICAL DATA	OFF-SITE FINE AGGREGATE MATERIAL SOURCES (Proposed)	NUMBER OF TESTS
Petrographic Examination*	---	TBD	TBD
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	---	18	18
Specific Gravity and Absorption of Fine Aggregate	---	18	18
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	---	18	18
Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)	---	18	18
Potential Reactivity of Aggregates (Chemical Method)	---	18	18
Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	---	18	18
Particle Size Analysis for Soils	---	18	18

* Six prescreening Petrographic Examinations will be performed at each potential off-site material source. Material identified as being of poor quality with respect to their intended use shall be eliminated from further testing. Number of Petrographic Examinations performed will be dependent on the number of off-site material sources examined; therefore, the number of petrographic examinations performed will be determined during field investigations.

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TABLE 2-10

SUMMARY OF GEOTECHNICAL TESTING (OFF-SITE COARSE AGGREGATE SOURCES)

TEST	EXISTING GEOTECHNICAL DATA	OFF-SITE FINE AGGREGATE MATERIAL SOURCES (Proposed)	NUMBER OF TESTS
Petrographic Examination*	---	TBD	TBD
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	---	18	18
Specific Gravity and Absorption of Fine Coarse Aggregate	---	18	18
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	---	18	18
Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)	---	18	18
Potential Reactivity of Aggregates (Chemical Method)	---	18	18
Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	---	18	18
Particle Size Analysis for Soils	---	18	18

* Six prescreening Petrographic Examinations will be performed at each potential off-site material source. Material identified as being of poor quality with respect to their intended use shall be eliminated from further testing. Number of Petrographic Examinations performed will be dependent on the number of off-site material sources examined; therefore, the number of petrographic examinations performed will be determined during field investigations.

The following tests shall be performed to determine the soundness, durability, and chemical reactivity of pea gravel:

- Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- Specific Gravity and Absorption of Fine Coarse Aggregate
- Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- Particle Size Analysis for Soils
- Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions

The following tests shall be performed to determine the soundness, durability, and chemical reactivity of riprap:

- Specific Gravity and Absorption of Coarse Aggregate
- Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine
- Rebound Number of Hardened Concrete
- Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)
- Splitting Tensile Strength of Intact Rock Core Specimens
- Evaluation of Rock to be Used for Erosion Control
- Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate
- Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
- Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions

Testing to determine the durability of rock to freeze and thaw conditions will be performed for exposed riprap only. Freeze/Thaw durability testing will not be performed to evaluate the durability

of riprap used in the construction of the biotic barrier, since the biotic barrier will be protected from exposure by approximately 33-inches of overburden (the vegetative and filter layers).

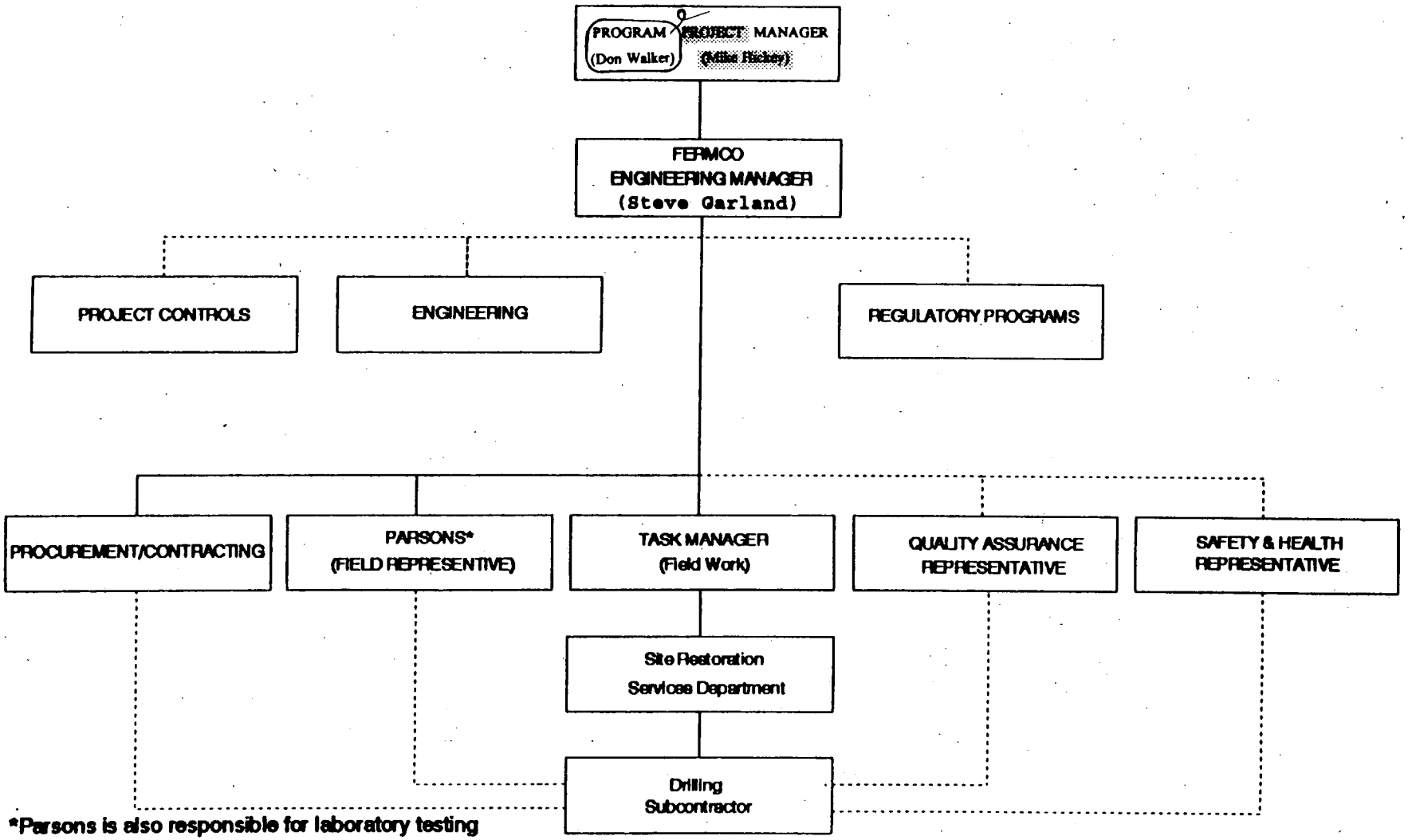
The following tests shall be performed to determine the soundness, durability, and chemical reactivity of fine and coarse portland cement aggregates (sands and gravels).

- Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- Gravity and Absorption of Fine Aggregate (Sands Only)
- Gravity and Absorption of Coarse Aggregate (Gravels Only)
- Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)
- Potential Reactivity of Aggregates (Chemical Method)
- Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)
- Particle Size Analysis for Soils

Figure E-1 (see Appendix E) indicates the total thickness of till in the East Field Borrow Source Area. Figure E-2 indicates the total thickness of till in the South Field Borrow Source Area. Figure E-3 indicates the thickness of till and Figure E-4 indicates the total thickness of fill in the Inactive Flyash Pile/South Field/Active Flyash Pile Areas. Approximate depths of till and fill have been developed from information obtained from borings, wells, lysimeters, and cone penetrometer testings that have been performed either within are adjacent to the borrow source areas and the waste fill areas (see Figures 2-1, 2-2, and 2-3).

Figures 2-4 shows the approximate depths in the Inactive Flyash, South Field, and Active Flyash Pile areas required to penetrate soils contaminated with uranium at levels above the Operable Unit 5 Proposed Final Remediation Level for non-leachable uranium from on-site soils (80 mg/kg) as reported in the November 1994 Draft Proposed Plan for Operable Unit 5. Computer modeling indicates that there are no areas within either the East Field Borrow Area or the South Field Borrow Area (after subunit waste removal) that contain total uranium concentrations exceeding 80 mg/kg.

FIGURE 3-1
FINAL GEOTECHNICAL INVESTIGATION
ORGANIZATIONAL STRUCTURE



*Parsons is also responsible for laboratory testing

TABLE 7-1

GEOTECHNICAL LABORATORY TESTING PROGRAM ON-SITE BORROW AREAS (SOIL BORINGS)

Boring Number	Planned Depth(ft)	Soil Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-148	16.5	Till	2.5-4	--	MC
		Till	5-6.5	--	GS+AL+MC
		Till	--	7.5-9.5	CU+GS+AL+MC
		Till	10-12	--	GS+AL+MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	Drill Cuttings of Gray Clay	--	SP+P_{c5}+P_{ri}+UU_{c90}+GS+AL+MC
G2-149	16.5	Till	2.5-4	--	AL+MC
		Till	5-6.5	--	MC
		Till	7.5-9.0	--	GS+AL+MC
		Till	10-12	--	MC
		Till	12.5-14	--	GS+AL+MC
		Till	15-16.5	--	AL+MC
		Till	Drill Cuttings of Gray Clay	--	SP+P_{c5}+P_{ri}+UU_{c90}+GS+AL+MC

TABLE 7-1
(Continued)

Boring Number	Planned Depth(ft)	Soil Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-150	25	Till	2.5-4	--	AL+MC
		Till	5-6.5	--	MC
		Till	7.5-9	--	GS+AL+MC+SG
		Till	--	10-12	CU+GS+AL+MC
		Till	--	13-15	P_r+GS+AL+MC
		Till		15-17	UU+GS+AL+MC
		Till	17.5-19	--	GS+MC
		Till	20-21.5	--	MC
		Till	23.5-25		MC+AL
G2-151 (MD$_3$)	20	Till	2.5-4	--	MC
		Till	5-6.5	--	GS+AL+MC
		Till	--	7.5-9.5	CU+GS+AL+MC
		Till	--	10-12	P_r+GS+AL+MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	18.5-20	--	MC
G2-152 (MD$_3$)	19	Till	2.5-4	--	AL+MC
		Till	5-6.5	--	MC
		Till	7.5-9	--	AL+MC
		Till	10-11.5	--	MC
		Till	--	12.5-14.5	P_r+GS+AL+MC+SG
		Till	15-16.5	--	MC
		Till	18.5-20	--	GS+AL+MC

TABLE 7-1
(Continued)

Boring Number	Planned Depth(ft)	Soil Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-153 (MD_2)	20	Till	2.5-4	--	MC
		Till	--	5-7	UU+GS+AL+MC
		Till	7.5-9	--	MC
		Till	10-11.5	--	GS+AL+MC
		Till	12.5-14	--	MC
		Till	15.0-16.5	--	AL+MC
		Till	18.5-20.0	18.0-20.0	P_r+UU+GS+AL+MC
G2-154	12	Till	2.5-4	--	AL+MC
		Till	5-6.5	--	MC
		Till	7.5-9	--	AL+MC
		Till	--	10-12	P_r+UU+GS+AL+MC
G2-155 (MD_2)	16	Till	2.5-4	--	AL+MC
		Till	5-6.5	--	MC
		Till	--	7.5-9.5	UU+GS+AL+MC
		Till	10-11.5	--	AL+MC
		Till	12.5-14	--	MC
		Till	14.5-16	--	GS+AL+MC
G2-156	20	Till	2.5-4	--	MC
		Till	--	5-7	P_r+GS+AL+MC
		Till	--	7.5-9.5	CU+GS+AL+MC
		Till	10-11.5	--	GS+AL+MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	18.5-20	--	MC

TABLE 7-1
(Continued)

Boring Number	Planned Depth(ft)	Soil Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-157	20	Till	2.5-4	--	MC
		Till	5-6.5	--	GS+AL+MC
		Till	--	7.5-9.5	UU+GS+AL+MC
		Till	--	10-12	P_r+GS+AL+MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	18.2-20	--	MC
G2-158 (MD,)	20	Till	2.5-4	--	GS+AL+MC
		Till	5-6.5	--	MC
		Till	--	7.5-9.5	P_r+GS+AL+MC
		Till	10-11.5	--	MC
		Till	12.5-14	--	GS+AL+MC
		Till	15-16.5	--	MC
		Till	18.5-20	--	GS+AL+MC
G2-159 (MD,)	20	Till	2.5-4	--	GS+AL+MC
		Till	5-6.5	--	MC
		Till	7.5-9	--	GS+AL+MC
		Till	10-11.5	--	MC
		Till	12.5-14	--	GS+AL+MC
		Till	15-16.5	--	MC
		Till	18.5-20	--	GS+AL+MC

Notes:

1. The definitions of the geotechnical laboratory testing* are as follows:

   MC = Moisture Content, ASTM D2216.

   GS = Grain Size/Hydrometer, ASTM D422.

TABLE 7-1
(Continued)

SG = Specific Gravity, ASTM D854.

AL = Atterberg Limits, ASTM D4318.

UU = Unconsolidated, Undrained Triaxial Compression, ASTM D2850, undisturbed sample.

P_r = Permeability, ASTM D5084, remolded sample with 95% relative compaction at moisture content wet of optimum in accordance with ASTM D698. 97% relative compaction at moisture content wet 4% above optimum with effective confining pressures of 2 psi and 5 psi in accordance with ASTM D698.

P_{r5} = Five Permeability Tests, ASTM D5084, remolded sample with effective confining pressures of 2 psi and 5 psi and with relative compactions and moisture contents in accordance with ASTM D698 as shown:

Test	Percent of Optimum Moisture Content	Percent of Standard Proctor Density
1	+0	100
2	+2	97
3	+2	99
4	+4	95
5	+4	97

MD_3 = Modal Diameter Testing (see Appendix N, Modal Diameter Testing) Collect three 1-gallon samples from drill cuttings from the following approximate depths: 2'-6', 6'-10', 10'-14'.

UU_{r90} = Unconsolidated, Undrained Triaxial Compresssion Test (ASTM D2850), remolded sample with 90% relative compaction at 4% wet of optium moisture content in accordance with ASTM D698.

SP = Standard Proctor, ASTM D698.

CU = Consolidated Undrained Triaxial Compression with pore pressure measurements, ASTM D4767, undisturbed sample. Three samples to be used at three different confining pressures. If Three samples are not available, perform an stage test on one sample.

*For the purpose each type of test, See Appendix A, (Data Quality Objectives)

TABLE 7-3

GEOTECHNICAL LABORATORY TESTING PROGRAM ON-SITE BORROW AREAS (SHALLOW BORINGS/EXCAVATIONS)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-50	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rl}+GS+AL+MC+SU+CL
		Till	5.0-10.0	SP+P_r+GS+AL+MC
G2-SB-51	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	SP+P_r+P_{rl}+GS+AL+MC
G2-SB-52	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	AL+MC
		Till	5.0-10.0	GS+AL+MC
G2-SB-53	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rs}+P_{rl}+GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-54	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC

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TABLE 7-3
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-55	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rl}+GS+AL+MC+CON_r+SG
		Till	5.0-10.0	AL+MC+SU+CL
G2-SB-56	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-57	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+GS+AL+MC+SU+CL
		Till	5.0-10.0	SP+P_r+P_{rs}+P_{rl}+GS+AL+MC
G2-SB-58	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-59	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rs}+P_{rl}+UU_{r90}+GS+AL+MC+CON_r+SG
		Till	5.0-10.0	AL+MC
G2-SB-60	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC

TABLE 7-3
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-61	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+(P_r+P_{rl})+GS+AL+MC
		Till	5.0-10.0	AL+MC+SU+CL
G2-SB-62	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	GS+MC
G2-SB-63	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-64	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+(P_r+P_{rl})+GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-65	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	AL+MC+SU+CL
G2-SB-66	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+(P_r+P_{rs}+P_{rl}+UU_{r90})+GS+AL+MC
		Till	5.0-10.0	AL+MC

TABLE 7-3
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-67	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-68	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rl}+UU_{r90}+GS+AL+MC
		Till	5.0-10.0	SP+P_r+P_{r5}+P_{rl}+GS+AL+MC
G2-SB-69	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-70	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-71	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-72	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	SP+P_r+GS+AL+MC

TABLE 7-3
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-73	6	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-6.0	SP+P_r+P_{rl}+GS+AL+MC+SU+CL
G2-SB-74	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_{r5}+P_{rl}+UU_{∞}+GS+AL+MC+CON_r+SG
		Till	5.0-10.0	AL+MC
G2-SB-75	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-76	6	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-6.0	SP+P_r+GS+AL+MC
G2-SB-77	6	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-6.0	GS+AL+MC+SU+CL
G2-SB-78	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{r5}+P_{rl}+GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-79	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC

TABLE 7-3
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-80	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rl}+GS+AL+MC
		Till	5.0-10.0	AL+MC
G2-SB-81	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+P_{rs}+P_{rl}+UU_{rm}+GS+AL+MC+CON_r +SG+SU+CL
		Till	5.0-10.0	GS+AL+MC
G2-SB-82	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	SP+P_r+GS+AL+MC+SU+CL
G2-SB-83	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC
G2-SB-84	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC
		Till	5.0-10.0	SP+P_r+GS+AL+MC+SU+CL
G2-SB-85	10	Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	GS+AL+MC+SU+CL
		Till	5.0-10.0	AL+MC

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TABLE 7-3
(Continued)

SG = Specific Gravity, ASTM D854.

AL = Atterberg Limits, ASTM D4318.

CON_r = Consolidation with time readings, ASTM D2435, remolded sample with 95% relative compaction at moisture content wet of optimum in accordance with ASTM D698.

SP = Standard Proctor, ASTM D698.

P_r = Permeability, ASTM D5084, remolded sample with 95% relative compaction at moisture content wet of optimum in accordance with ASTM D698. 97% relative compaction at moisture content wet 4% above optimum with effective confining pressures of 2 psi and 5 psi in accordance with ASTM D698.

P_{rl} = Permeability, ASTM D5084, remolded sample with 95% relative compaction at moisture content wet of optimum in accordance with ASTM D698. 97% relative compaction at moisture content wet 4% above optimum with effective confining pressures of 2 psi and 5 psi in accordance with ASTM D698. This test shall be performed with leachate provided by FERMCO.

P_{r5} = Five Permeability Tests, ASTM D5084, remolded sample with effective confining pressures of 2 psi and 5 psi and with relative compactions and moisture contents in accordance with ASTM D698 as shown:

Test	Percent of Optimum Moisture Content	Percent of Standard Proctor Density
1	+0	100
2	+2	97
3	+2	99
4	+4	95
5	+4	97

MD = Modal Diameter Testing (see Appendix N, Modal Diameter Testing)
Collect one 1-gallon sample from drill cuttings from the depth of approximate 1.5'-5.0'.

UU_{r90} = Unconsolidated, Undrained Triaxial Compresssion Test (ASTM D2850), remolded sample with 90% relative compaction at 4% wet of optium moisture content in accordance with ASTM D698.

OC = Organic Content, ASTM D2974.

SU = Sulfate (Turbidimetric) EPA Method 9038.

TABLE 7-4
(Continued)

Boring Number	Planned Depth(ft)	Soil[2] Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-164 (MD_3)	24	Fill	2.5-4	--	MC
		Till	5-6.5	--	GS+AL+MC
		Till	7.5-9	--	MC
		Till	--	10-12	P_r+GS+AL+MC
		Till	12.5-14	--	GS+AL+MC
		Till	15-16.5	--	MC
		Till	17.5-19	--	GS+AL+MC
		Till	20-21.5	--	MC
		Till	22.5-24	--	MC
G2-165	29	Fill	2.5-4	--	GS+AL+MC
		Fill	5-6.5	--	GS+AL+MC
		Fill	7.5-9	--	MC
		Fill	10-11.5	--	GS+AL+MC+CON_{r85}
		Fill	12.5-14	--	MC
		Fill	15-16.5	--	GS+AL+MC
		Fill	17.5-19	--	MC
		Fill	20-21.5	--	GS+AL+MC+CON_{r85}
		Fill	22.5-24	--	MC
		Fill	25-26.5	--	GS+AL+MC
		GMA	27.5-29	--	MC

TABLE 7-4
(Continued)

Boring Number	Planned Depth(ft)	Soil[2] Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-166	24	Fill	2.5-4	--	MC
		Fill	5-6.5	--	GS+AL+MC
		Till	7.5-9	--	MC
		Till	--	10-12	P_r+GS+AL+MC
		Till	12.5-14	--	MC
		Till	--	15-17	P_r+GS+AL+MC
		Till	17.5-19	--	MC
		Till	20-21.5	--	GS+AL+MC
		GMA	22.5-24	--	MC
G2-167	24	Fill	2.5-4	--	GS+AL+MC
		Till	5-6.5	--	MC
		Till	--	7.5-9.5	P_r+GS+AL+MC
		Till	10-11.5	--	MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	17.5-19	--	MC
		Till	20-21.5	--	MC
		GMA	22.5-24	--	MC

TABLE 7-4
(Continued)

Boring Number	Planned Depth(ft)	Soil[2] Type	SPT Depth(ft)	Shelby Depth(ft)	Geotechnical Testing
G2-168	24	Fill	0.5-2	--	MC
		Till	2.5-4	--	GS+AL+MC
		Till	5-6.5	--	MC
		Till	--	7.5-9.5	P_r+GS+AL+MC
		Till	10-11.5	--	MC
		Till	12.5-14	--	GS+AL+MC
		Till	15-16.5	--	MC
		Till	17.5-19	--	MC
		Till	20-21.5	--	MC
		GMA	22.5-24	--	MC
G2-169 (MD$_4$)	26	Fill	0.5-2	--	MC
		Till	2.5-4	--	GS+AL+MC
		Till	5-6.5	--	MC
		Till	--	7.5-9.5	P_r+GS+AL+MC
		Till	10-11.5	--	MC
		Till	12.5-14	--	MC
		Till	15-16.5	--	GS+AL+MC
		Till	17.5-19	--	MC
		Till	20-21.5	--	MC
		Till	22.5-24	--	MC
		GMA	24.5-26	--	MC

TABLE 7-4
(Continued)

Notes:

1. The definitions of the geotechnical laboratory testing* are as follows:

   MC = Moisture Content, ASTM D2216.

   GS = Grain Size/Hydrometer, ASTM D422.

   SG = Specific Gravity, ASTM D854.

   AL = Atterberg Limits, ASTM D4318.

   CON_{r85} = Consolidation with time readings, ASTM D2435, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698.

   UU_{r85} = Unconsolidated, Undrained Triaxial Compression, ASTM D2850, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698.

   CU_{r85} = Consolidated Undrained Triaxial Compression with pore pressure measurements, ASTM D4767, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698. Three samples to be used at three different confining pressures. If Three samples are not available, perform an stage test on one sample.

   SP = Standard Proctor, ASTM D698.

   P_r = Permeability, ASTM D5084, remolded sample with 95% relative compaction at moisture content wet of optimum in accordance with ASTM D698 97% relative compaction at moisture content wet 4% above optimum with effective confining pressures of 2 psi and 5 psi in accordance with ASTM D698.

   MD_3 = Modal Diameter Testing (see Appendix N, Modal Diameter Testing)
   Collect three 1-gallon samples from drill cuttings from the following approximate depths: 2'-6', 6'-10', 10'-14'.

   *For the purpose each type of test, see Appendix A, (Data Quality Objectives).

2. General soil type information are based on the available information extracted from the existing adjacent borings.

3. In order to obtain more soil material, the SPT samples may be driven for a total length of 2 feet instead of 1.5 feet if judged necessary and provided that the sampler is of adequate length.

4. In case of no sample recovery, the hole should be cleaned and new attempt should be made prior to advancing to the next sample level. Then the next sample level shall be adjusted to minimize any deviation from the above specified levels.

TABLE 7-5

GEOTECHNICAL LABORATORY TESTING PROGRAM
INACTIVE FLYASH PILE, SOUTH FIELD, ACTIVE FLYASH PILE
(SHALLOW BORINGS/EXCAVATIONS)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-91	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Flyash	1.5-10.0	SP+GS+AL+MC+CON_{r85}+SG+CU_{r85}
G2-SB-92	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Flyash	1.5-10.0	SP+GS+AL+MC+CON_{r85}+UU_{r85}+CU_{r85}
G2-SB-1493	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Fill	1.5-7.0	SP+GS+AL+MC+CON_{r85}+SG
		Till	7.0-10.0	GS+AL+MC
G2-SB-1494	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Fill	1.5-7.0	SP+GS+AL+MC+CON_{r85}+SG+UU_{r85}
		Flyash	7.0-10.0	GS+MC
G2-SB-1495	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+GS+AL+MC
		Till	5.0-10.0	GS+AL+MC

TABLE 7-5
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-1496	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-5.0	SP+P_r+GS+AL+MC
		Till	5.0-10.0	SP+P_r+GS+AL+MC
G2-SB-1497	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Fill	1.5-10.0	SP+GS+AL+MC+CON_{r85}+UU_{r85}+CU_{r85}
G2-SB-98	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-10.0	SP+P_r+GS+AL+MC
G2-SB-99	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Fill	1.5-5.0	SP+GS+AL+MC+CON_{r85}+SG+CU_{r85}
		Till	5.0-10.0	SP+P_r+GS+AL+MC
G2-SB-100	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Fill	1.5-10.0	SP+GS+AL+MC+CON_{r85}+SG+UU_{r85}

TABLE 7-5
(Continued)

Shallow Boring Number	Planned Depth(ft)	Soil Type	Sample Depth(ft)	Geotechnical Testing
G2-SB-101	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-10.0	SP+P_r+GS+AL+MC
G2-SB-102	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-10.0	SP+P_r+GS+AL+MC
G2-SB-103	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Flyash	1.5-10.0	SP+GS+AL+MC+CON_{r85}+SG+UU_{r85}
		Till	1.5-10.0	SP+P_r+GS+AL+MC
G2-SB-104	10	Topsoil	0.0-0.5	OC
		Topsoil	0.5-1.0	OC
		Topsoil	1.0-1.5	OC
		Till	1.5-10.0	SP+P_r+GS+AL+MC
G2-SB-91+ G2-SB-92+ G2-SB-93+ G2-SB-94[2]	10	Topsoil	0.0-1.5	SP+CON_{r85}
G2-SB-96+ G2-SB-99+ G2-SB-100+ G2-SB-102[2]	10	Topsoil	0.0-1.5	SP+CON_{r85}

TABLE 7-5
(Continued)

Notes:

1. The definitions of the geotechnical laboratory testing are as follows:

   MC = Moisture Content, ASTM D2216.

   GS = Grain Size/Hydrometer, ASTM D422.

   SG = Specific Gravity, ASTM D854.

   AL = Atterberg Limits, ASTM D4318.

   CON_{r85} = Consolidation with time readings, ASTM D2435, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698.

   UU_{r85} = Unconsolidated, Undrained Triaxial Compression, ASTM D2850, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698.

   CU_{r85} = Consolidated Undrained Triaxial Compression with pore pressure measurements, ASTM D4767, remolded sample with 85% relative compaction at optimum moisture content in accordance with ASTM D698. Three samples to be used at three different confining pressures. If Three samples are not available, perform an stage test on one sample.

   SP = Standard Proctor, ASTM D698.

   P_r = Permeability, ASTM D5084, remolded sample with 95% relative compaction at moisture content wet of optimum in accordacne with ASTM D698. 97% relative compaction at moisture content wet 4% above optimum with effective confining pressures of 2 psi and 5 psi in accordance with ASTM D698.

   OC = Organic Content, ASTM D2974.

   *For the purpose each type of test, see Appendix A, (Data Quality Objectives).

2. Composite sample prepared by combining samples taken from the designated locations.

For samples obtained from the Off-Site Material Source areas, Parsons geotechnical laboratory shall perform a petrographic examination (ASTM C295) of the samples before running a complete suite of laboratory tests. Potential off-site materials identified as being of poor quality with respect to their intended use shall be eliminated from further testing and alternate source locations may be provided by as a substitute. Samples judged as being of good quality shall be subject to further testing as indicated in Table 7-6, 7-7, 7-8, and 7-9. At least six tests will be performed on representative samples.

Six representative samples will be collected from each off-site test site per material type, in accordance with ASTM D-75 and D-420, and the guidelines provided in "Technical Approach Document, Revision II, UMTRA-DOE/AL 050425, dated December 1989". Sampled material will be containerized and labeled at the off-site material sources. In addition samples will be shipped directly from the off-site material sources to the testing laboratory.

TABLE 7-6

GEOTECHNICAL LABORATORY TESTING PROGRAM
FINE AGGREGATE SOURCES

ASTM METHOD	TEST	NUMBER OF TESTS
C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	18
C128	Specific Gravity and Absorption of Fine Aggregate	18
C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	18
C227	Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)	18
C289	Potential Reactivity of Aggregates (Chemical Method)	18
C586	Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	18
D422	Particle Size Analysis for Soils	18

TABLE 7-7

GEOTECHNICAL LABORATORY TESTING PROGRAM
COARSE AGGREGATE SOURCES

ASTM METHOD	TEST	NUMBER OF TESTS
C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	18
C127	Specific Gravity and Absorption of Fine Coarse Aggregate	18
C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	18
C227	Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar Bar Method)	18
C289	Potential Reactivity of Aggregates (Chemical Method)	18
C586	Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	18
D422	Particle Size Analysis for Soils	18

TABLE 7-8

GEOTECHNICAL LABORATORY TESTING PROGRAM
PEA GRAVEL SOURCES

ASTM METHOD	TEST	NUMBER OF TESTS
C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	18
C127	Specific Gravity and Absorption of Fine Coarse Aggregate	18
C131	Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	18
D422	Particle Size Analysis for Soils	18
D5313	Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions	18

TABLE 7-9

GEOTECHNICAL LABORATORY TESTING PROGRAM
RIPRAP SOURCES

ASTM METHOD	TEST	NUMBER OF TESTS
C127	Specific Gravity and Absorption of Coarse Aggregate	18
C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine	18
C805	Rebound Number of Hardened Concrete	18
C586	Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)	18
D3967	Splitting Tensile Strength of Intact Rock Core Specimens	18
D4992	Evaluation of Rock to be Used for Erosion Control	18
D5240	Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate	18
D5312	Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions	18
D5313	Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions	18

During the sampling visit, the size and limit of the off-site material area shall be confirmed and each material source will be photographed.

The following are examples of Off-Site Material Sources identified for potential sample collection (see Figure 7-5 for approximate location of these material vendors).

Fine Concrete Aggregates (Sand) Sites

- Welch Sand and Gravel
- New Point
- Avis
- Schweitzer - The Gravel Company