EVALUATION RESEARCH CORPORATION

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COMANCHE PEAK RESPONSE TEAM

QUALITY INSTRUCTION FOR ISSUE-SPECIFIC ACTION PLAN VII.c

INSTRUCTION NO.: QI-057

REVISION: 6

ISSUE DATE: 06/27/86

DOCUMENTATION REVIEW OF FILL AND BACKFILL PLACEMENT

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1.0 PURPOSE

This Quality Instruction (QI) presents the attributes and accept/reject criteria for the performance of a documentation review for fill and backfill placement.

2.0 APPLICABILITY

This QI applies to the performance of an independent review of the documentation for the safety-significant attributes for all safety-related soil/rock fill and backfill placement in Unit 1, Unit 2, and common areas. It applies to the samples selected from the population described in the Population Description for Fill and Backfill Placement.

3.0 REFERENCES

3.1 CPP-009, "Performance of Reinspections and Documentation Reviews".

3.2 QA/QC-RT-497, "Description Memorandum for Document Review of Fill and Backfill Placement".

4.0 GENERAL

Documentation reviews are performed and documented in accordance with established CPRT procedures. Reference 3.1 addresses the method to perform and document the reviews. Reference 3.2 contains: a list of the source documents for each attribute, a list of attributes which have been excluded from the documentation review, a justification for each exclusion, and a list of any alternate accept/reject criteria.

4.1 Responsibilities

4.1.1 QA/QC Discipline Engineers

The QA/QC Discipline Engineers prepare the QI delineating review attributes and accept/reject criteria.

4.1.2 QA/QC Inspectors

QA/QC Inspectors perform documentation review in accordance with reference 3.1 and this QI and record results and deviations.

4.2 Policy

Activities performed under this procedure shall conform to the policies contained in the latest Comanche Peak Response Team Program Plan and Issue-Specific Action Plan VII.c.

5.0 INSTRUCTION

Using the information below, perform the documentation reviews on the sample items listed for this population and document the results on the applicable checklist (Attachment 6.1 for SSI Dam, otherwise Attachment 6.2).

Documentation to be reviewed is located as follows:

- Inspection reports and related laboratory test results are located in the TUGCO Vault.
- Personnel certification records are located in the TUGCO Vault/PPRV.

Note: For the checklist attributes which follow, specific notation of each attribute is preferable. However, notation of a more general nature, such as by reference to specification section, may be acceptable. Consult population engineer for advice in such cases.

A. SSI Dam Fill

A.1 General

Review the Inspector's Daily Report to verify notation that:

a. No construction was noted as being not in accordance with contract plans and/or specifications.

b. The zones of the embankment and outer slopes were delineated at approximately 100' intervals at least every 5' in elevation.

c. The hauling equipment did not cause horizontal shears or slickensides, rutting, quaking, heaving, cracking, or excessive deformation of embankment.

d. Materials were secured from approved borrow sources.

e. The foundation against which the embankment was placed was prepared as required.

A.2 Impervious Material Placement

Review the Inspector's Daily Report to verify notation that:

a. The combined excavation, placing and spreading operation was done in such a manner to obtain a blend of material prior to compacting.

5.0 INSTRUCTION (Cont'd)

A. SSI Dam Fill (Cont'd)

b. The material was spread in approximately horizontal layers not more than 8" thick before compacting.

c. The surface of the embankment was roughened and loosened prior to placing the succeeding layer.

d. The hauling equipment was routed over the surface of the embankment to distribute compactive effort.

e. The center portion was crowned so that the fill would drain freely.

f. All roots and debris and all stones greater than 6" were removed prior to compaction.

A.3 Rock Fill Placement

Review the Inspector's Daily Report to verify notation that:

a. The rock fill was spread in approximately horizontal layers not more than 24" thick prior to compaction.

b. Roots and debris if present were removed from the fill prior to compaction.

A.4 Filter Placement

Review the Inspector's Daily Report to verify notation that:

a. The material was placed in lifts not exceeding 12" loose and loose lift thickness was noted.

b. Care was taken to avoid contamination.

c. The material was placed by equipment that does not induce segregation.

d. Contamination by adjacent material, roots, or other debris was avoided.

A.5 Moisture Control

Review the Inspector's Daily Report to verify notation that:

5.0 INSTRUCTION (Cont'd)

A. SSI Dam Fill (Cont'd)

a. The filter zones were wet sufficiently to avoid segregation at time of placement and compaction.

b. The impervious fill borrow pits were irrigated as required.

A.6 Processing of Impervious Fill

Review the Inspector's Daily Report to verify notation that:

a. The moisture content was uniformly distributed throughout the layer of soil prior to compaction.

b. The surface of the previously compacted layer was moist prior to placing the succeeding layer.

c. Over wet layers were allowed to dry to proper moisture content (if necessary) prior to compacting.

A.7 Processing Rock Fill Material

Review the Inspector's Daily Report to verify notation that:

a. Each layer was placed to produce a well graded mass with minimum practical percentage of voids.

b. Large stones were well distributed in the entire mass of stone.

c. The fill was placed in conjunction with the central core and filter system.

A.8 Compaction Equipment

Review the Inspector's Daily Report to verify notation that the compacting equipment conforms to requirements.

A.9 Impervious Fill Compaction

Review the Inspector's Daily Report to verify notation that:

5.0 INSTRUCTION (Cont'd)

A. SSI Dam Fill (Cont'd)

a. Each lift was given eight (8) passes with tamping roller or a combination of four (4) passes with tamping roller followed by four (4) passes with a pneumatic roller as required or by eight (8) passes of pneumatic roller as directed.

b. The rolling sequence or pattern followed for each lift was per requirements.

c. The test sample was taken below the indention of the sheep's foot roller, or below six inches (6") whichever is the greater depth.

A.10 Filter Compaction

Review the Inspector's Daily Report to verify notation that the material was placed with a spreader box that does not induce segregation.

A.11 Rock Fill Compaction

Review the Inspector's Daily Report to verify notation that:

a. Each lift received a minimum of four (4) passes with vibratory roller as required.

b. The number of additional passes required were noted on the Inspector's Daily Report.

A.12 Testing

a. Review the Inspector's Daily Report to verify that referenced testing is consistent with frequency of testing requirements for fill (see Attachment 6.3).

b. Review the Inspector's Daily Report to verify that locations for all referenced tests are clearly noted.

c. Review all referenced test results to verify that location description is consistent with the Inspector's Daily Report location description.

5.0 INSTRUCTION (Cont'd)

A. SSI Dam Fill (Cont'd)

d. Review in-place density test results (excluding rapid compaction results) listed on the Inspector's Daily Report to verify that minimum acceptable in-place density requirements, as summarized on Attachment 6.4, are met.

e. Review any relative density or maximum dry density test referenced on the in-place density test form to verify that the applicable (i.e., most up-to-date) test is referenced.

f. Review relative density or maximum dry density test results to verify consistency with the values reported on the in-place density test form.

g. Review any rapid compaction test results to verify that minimum acceptable in-place density requirements for impervious fill, as summarized on Attachment 6.4, were met.

h. Review any material test results (i.e., gradation, Atterberg limit, soundness, or flatness and elongation test results) referenced on the Inspector's Daily Report to verify that requirements, as summarized on Attachment 6.4 are met.

A.13 Inspection and Test Personnel Certification

Verify that Inspection and Test personnel were certified to perform the inspections and tests at the time they were performed.

B. Fill and Backfill (except for SSI Dam)

B.1 Extent of Backfill

Review the Inspection Report to verify that the extent of backfill covered by the report is clearly identified either on the lead sheet or on attached sketch.

B.2 Soil Backfill Placement Signature Card

a. Review the Inspection Report to verify notation(*) that a Soil Backfill Placement Signature Card was completed which would cover the topic backfill.

5.0 INSTRUCTION (Cont'd)

B. Fill and Backfill (Cont'd)

b. Review the applicable soil backfill placement signature card to verify that it was signed and dated to indicate satisfactory completion of pertinent discipline requirements or lack thereof.

B.3 Stockpiles

Review the Inspection Report to verify notation(*) that:

a. Stockpiles were constructed to prevent contamination and segregation.

b. Stockpiles were properly identified.

B.4 Preparation of Working Surface

Review the Inspection Report to verify notation(*) that working surface was free of foreign material.

B.5 Placement of Backfill

Review the Inspection Report to verify notation(*) that:

a. Backfill was placed in horizontal lifts not thicker than 8" loose.

b. Moisture content of the material was controlled in obtaining the required density.

B.6 Testing

a. Review the Inspection Report to verify that referenced testing is consistent with frequency of testing requirements (See Attachment 6.5).

Note: In case evaluation of this attribute is not possible due to attribute B.1 having been marked "reject", this attribute should be marked neither "accept" nor "reject". Instead, an explanatory remark should be added on the checklist (e.g., "evaluation not possible...due to rejection of B.1")

5.0 INSTRUCTION (Cont'd)

B. Fill and Backfill (Cont'd)

b. Verify that locations for all referenced tests are clearly noted either on the Inspection Report itself, on an attached sketch, or on the reference tests.

c. Review all referenced test results to verify that location description is not inconsistent with the Inspection Report location description.

Note: Notations of location may not be as specific as on the Inspection Report, but should be identifiable to the same location.

d. Review in-place density test results listed on the Inspection Report to verify that the density acceptance criteria, as summarized on Attachment 6.6, are met.

e. Review the in-place density test form to verify that the applicable (i.e., most up-to-date) reference values for relative density (or maximum dry density) have been used for the relative density (or percent maximum dry density) determination shown on the in-place density test form.

f. (intentionally left blank)

g. Review gradation test results listed on the Inspection Report to verify that the gradation acceptance criteria, as summarized on Attachment 6.6, are met.

B.7 Preparation of Trenches for Buried Pipe and Electrical Duct Banks

Review the Inspection Report to verify notation(*) that:

a. Trench was excavated to required width and depth.

b. Claystone was removed to the required depth when encountered.

5.0 INSTRUCTION (Cont'd)

B.8 Backfill/Bedding Placement for Buried Pipe and Electrical Duct Banks

Review the Inspection Report to verify notation(*) that:

a. Any bedding material placed was placed in horizontal lifts not thicker than 6" loose.

b. Moisture content of the material was controlled in obtaining the required density.

c. Any bedding material placed for pipe was shaped to fit curvature of pipe for a width of at least 60% of pipe diameter.

d. Applicable pipe spacing was maintained during backfill operation.

e. Any bedding material placed was hand-tamped around any cable, conduit or duct bank for a minimum distance of 12".

* Note: In lieu of specific notations for each of the following lettered items, a general notation which covers several of the items along with the notation "Inspection completed, all applicable items satisfactory" and a clear reference to "QI-QP-11.0-9" is acceptable.

B.9 Inspection and Test Personnel Certification

Verify that the Inspection Report and any test results reviewed under B.6 were signed/initialed by personnel who were certified to perform the inspections and tests at the time of performance. Basis for verification is the TUGCO "Inspection Certification" form. Form should show certification to appropriate TUGCO procedure for task performed.

EXCEPTION TO THE ABOVE: For Inspection Reports written prior to July 12, 1978:

For Test Personnel:

Verify that any test results reviewed under B.6 were signed/initialed by personnel who were certified to perform the tests at the time of performance. Basis for certification is the R. W. Hunt Company certificate which should show certification to applicable R. W. Hunt method for tests performed.

5.0 INSTRUCTION (Cont'd)

B. Fill and Backfill (Cont'd)

For Inspection Personnel:

Verify that the Inspection Report was signed by personnel who were certified to perform the inspection at the time of performance. Basis for verification is the Brown & Root Certification Summary Record.

If this attribute is rejected:

1) Record the person(s) name on the Deviation Report (DR).

2) Record on the DR whether the person was ever appropriately certified and note any pertinent dates.

6.0 Attachments

6.1 Checklist: Fill and Backfill Placement (SSI DAM) (2 pages)

6.2 Checklist: Fill and Backfill Placement (Except for SSI Dam) (2 Pages)

6.3 CPSES SSI Dam Test Program (3 pages)

6.4 Summary: Acceptance Criteria for SSI Dam Fill

6.5 Minimum Frequency of Testing Requirements: Backfill and Bedding

6.6 Summary: Acceptance Criteria for Fill and Backfill (Except for SSI Dam)

COMANCHE PEAK RESPONSE TEAM CHECKLIST		Attachment 6.1 QI-057 Rev. 6
POPULATION DESC Fill & Backfill Placement (SSI Dam)	VERIFICATION PKG NO. R-S-FILL-	PAGE 1 OF 2
QUALITY INSTRUCTION QI-057	☐ REINSPECTION	☐ UNIT 1
EQUIPMENT MARK/TAG NO. Inspector's Daily Report No.	☒ DOCUMENTATION REVIEW	☐ UNIT 2 ☒ COMMON

ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
A SSI DAM	———	———	———	
A.1 General	———	———	———	
a. Plans & Specifications				
b. Zone Delineation				
c. Damage due to hauling Equipment				
d. Borrow Sources				
e. Foundation Requirements				
A.2 Impervious Material Placement	———	———	———	
a. Material Blend				
b. Layer Thickness				
c. Surface Roughening				
d. Distribution of Compactive Effort				
e. Crowning				
f. Debris Removal				
A.3 Rock Fill Placement	———	———	———	
a. Layer Thickness				
b. Debris Removal				
A.4 Filter Placement	———	———	———	
a. Layer Thickness				
b. Avoid Contamination				
c. Avoid Segregation				
d. Contamination Avoided				
A.5 Moisture Control	———	———	———	
a. Filter Zone Wetting				
b. Borrow Pit Irrigation				
A.6 Processing Impervious Fill	———	———	———	
a. Moisture				

PREPARED BY:	APPROVED BY:
DISCIPLINE ENGR. DATE	LEAD DISCIPLINE ENGR. DATE
INSPECTED BY:	APPROVED BY:
INSPECTOR DATE	LEAD INSPECTOR DATE

COMANCHE PEAK RESPONSE TEAM CHECKLIST				Attachment 6.1 OI-057 Rev. 6
POPULATION DESC Fill & Backfill Placement (SSI Dam)	VERIFICATION PKG NO. R-S-FILL-			PAGE 2 OF 2
ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
b. Surface Moistening				
c. Over wet Layers				
A.7. Processing Rockfill	———	———	———	
a. Layer Placement				
b. Stones Distribution				
c. Placement Coordination				
A.8 Compaction Equipment				
A.9 Impervious Fill Compaction	———	———	———	
a. Number of Passes				
b. Rolling Pattern				
c. Test Sampling				
A.10. Filter Compaction				
A.11 Rock Fill Compaction	———	———	———	
a. Number of Passes				
b. Additional Passes				
A.12 Testing	———	———	———	
a. Frequency of Testing				
b. IDR Test Location				
c. Test Results Test Location				
d. Density Criteria Met				
e. Reference Applicability				
f. Reference Consistency				
g. Rapid Compaction				
h. Material Testing				
A.13 Personnel Certification				

COMANCHE PEAK RESPONSE TEAM CHECKLIST		Attachment 6.2 QI-057 Rev. 6
POPULATION DESC Fill & Backfill Placement (Except for SSI Dam)	VERIFICATION PKG NO. R-S-FILL-	PAGE 1 OF 2
QUALITY INSTRUCTION QI-057	☐ REINSPECTION	☐ UNIT 1
EQUIPMENT MARK/TAG NO.	☒ DOCUMENTATION REVIEW	☐ UNIT 2 ☒ COMMON

ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
B Fill and Backfill (Except For SSI DAM)	———	———	———	
B.1 Extent of Backfill				
B.2 Soil Backfill Placement Signature Card	———	———	———	
a. IR Notation				
b. Signed and Dated				
B.3 Stockpiles	———	———	———	
a. Construction				
b. Identification				
B.4 Preparation of Working Surface				
B.5 Placement of Backfill	———	———	———	
a. Lift Thickness				
b. Moisture Control				

PREPARED BY:	APPROVED BY:
DISCIPLINE ENGR. DATE	LEAD DISCIPLINE ENGR. DATE
INSPECTED BY:	APPROVED BY:
INSPECTOR DATE	LEAD INSPECTOR DATE

COMANCHE PEAK RESPONSE TEAM CHECKLIST				Attachment 6.2 OI-057 Rev. 6
POPULATION DESC Fill & Backfill Placement (Except for SSI Dam)	VERIFICATION PKG NO. R-S-FILL-			PAGE 2 OF 2
ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
B.6 Testing	———	———	———	
a. Frequency of Testing				
b. Inspection Report Test Location				
c. Test Results Test Location				
d. Density Criteria Met				
e. Reference Applicability				
f. Reference Consistency				
g. Gradation Testing				
B.7 Preparation of Trenches	———	———	———	
a. Trench Excavation				
b. Claystone Removal				
B.8 Backfill/Bedding Placement	———	———	———	
a. Lift Thickness				
b. Moisture Control				
c. Shaped Bedding				
d. Pipe Spacing				
e. Hand-Tamping				
B.9 Personnel Certification				

COMANCHE PEAK STEAM ELECTRIC STATION
SAFE SHUTDOWN IMPOUNDMENT DAM TEST PROGRAM

Quality Control Test	Procedures Reference	Location	Frequency of Testing**	Acceptance Criteria	Specification Reference
Dental Concrete					
Cement	ASTM C150-73a	Mfg.	Ea. Source	See Specifications	101.4.2.3A
Fine Aggregate	ASTM C33-71a	Supplier	Ea. Source	See Specifications	101.4.2.3
Coarse Aggregate	ASTM C33-71a	Supplier	Ea. Source	See Specifications	101.4.2.4
Water	U. S. Public Health Standards (1962 Rev.)	Supply	Ea. Source	See Specifications	101.4.2.5
Mixed On Site Concrete	ASTM C94-73a	Supplier	Ea. Source	See Specifications	101.4.2.9
Curing Compound	ASTM C309-73	Supplier	Ea. Source	See Specifications	101.4.2.15
Tests-Compression	ASTM C39-72	Work Site	Not less than 2 tests of 2 cyl/day nor less than 2 tests of 2 cyl/100 C.Y.		
Pneumatically Placed Concrete					
Cement	ASTM C150-73a	Mfg.	Ea. Source	ASTM C150	101.4.3.2.1
Fine Aggregate					
Organic Impurities	ASTM C40-73	Stockpile	Ea. Source	See Specifications	101.4.3.2.2
Deleterious Substances	ASTM C33-71a	Stockpile	Ea. Source	See Specifications	101.4.3.2.2
Fineness Modulus	ASTM C33-71a	Stockpile	Ea. Source	See Specifications	101.4.3.2.2
Grading	ASTM C136-71	Stockpile	Ea. Source	See Specifications	101.4.3.2.2
Moisture	ASTM D2216-71	Stockpile	1 Per Day	See Specifications	101.4.3.2.2
Tests-Compression	ASTM C39-72	Work Site	2 Tests of 2 Cyl. Cyl. per day	See Specifications	101.4.3.5
Compacted Fill					
Rock Fill					
Gradation	PSAR	In Place	1 per 60,000 C.Y.	See Specifications	101.5.4.3
Soundness	ASTM C88-73	In Quarry and/or Stockpile	1 per 60,000 C.Y.	See Specifications	101.5.2.3
Specific Gravity	ASTM C127-73	In Place	1 per 60,000 C.Y.	N/A	N/A
Density	PSAR	In Place	1 per 60,000 C.Y.	N/A	N/A
Filter					
Gradation	M-J	In Place	1 per 3,000 C.Y.	See Specifications	101.5.4.4
Soundness	ASTM C88-73	In Place	1 per 30,000 C.Y.	See Specifications	101.5.4.4
Density	ASTM D1556-64 or	In Place	1 per shift or	See Specifications	101.5.9.2
	ASTM D2167-66	In Place	1 per lift	See Specifications	101.5.9.2
Relative Density	ASTM D2049-69	In Place	1 per 3,000 C.Y.	See Specifications	101.5.9.2

Sheet 1 of 3

FREESE AND NICHOLS
CONSULTING ENGINEERS

Procedure No.	Revision	Issue Date	Page
Appendix J	#1, 5-1-75	12-20-74	9 of 20

Attachment J-1

Attachment 6.3
QI-057
Rev. 6
Page 1 of 3

COMANCHE PEAK STEAM ELECTRIC STATION (Continued)
SAFE SHUTDOWN IMPOUNDMENT DAM TEST PROGRAM

Quality Control Test	Procedures Reference	Location	Frequency of Testing**	Acceptance Criteria	Specifications Reference
Impervious Fill					
Acceptance Test					
Moisture	USBR Monograph #26	In Place	Min. 1/Lift or Min. 1/Shift	See Specifications	101.5.7.1
Density	USBR Monograph #26	In Place	Min. 1/Lift or Min. 1/Shift	See Specifications	101.5.9.1
Liquid Limit	ASTM D423-66 1 Pt. Method	Borrow Pit	Min. 1 per 4,000 C.Y or Suspected Chg. in Materials	See Specifications	101.5.4.2
Plastic Limit	ASTM D424-59	Borrow Pit	Min. 1 per 4,000 C.Y. or Suspected Chg. in Materials	See Specifications	101.5.4.2
Record Test					
Moisture	ASTM D2216-71	In Place	Min. 1 per 3,000 C.Y.	See Specifications	101.5.7.1
Density	ASTM D2167-66 or D1556-64 or D2937-71	In Place	Min. 1 per 3,000 C.Y.	See Specifications	101.5.9.1
O-M Relationship	AASHO-T99-70	In Place	Each Significant Change of Material	N/A	N/A
Liquid Limit	ASTM D423-66	In Place	Min. 1 per 3,000 C.Y.	See Specifications	101.5.4.2
Plastic Limit	ASTM D424-59	In Place	Min. 1 per 3,000 C.Y.	See Specifications	101.5.4.2
Information Test					
Moisture	ASTM D3017-72	In Place	As Necessary	See Specifications	101.5.7.1
Density	ASTM D2922-71	In Place	To verify Inspector's Judgment	See Specifications	101.5.9.1
Liquid Limit	M-J	In Place	As Necessary	See Specifications	101.5.4.2
Plastic Limit	M-J	In Place	To verify Inspector's Judgment	See Specifications	101.5.4.2
Gravel Roadway					
Gradation	M-J	Work Site	1 per 10,000 C.Y.	See Specifications	101.6.2
Liquid Limit	ASTM D423-66	Work Site	1 per 10,000 C.Y.	See Specifications	101.6.2
Plasticity Index	ASTM D424-59	Work Site	1 per 10,000 C.Y.	See Specifications	101.6.2
Bar Shrinkage	THD Method 107-E Rev. 1 Jan. 72	Work Site	1 per 10,000 C.Y.	See Specifications	101.6.2
Foundation Inspection*	M-J	Foundation	Upon Completion of Excavation	See Specifications	101.4.4

Sheet 2 of 3

FREESE AND NICHOLS
CONSULTING ENGINEERS

Procedure No.	Revision	Issue Date	Page
Appendix J	#1, 5-1-75	12-20-74	10 of 20

Attachment J-1

Attachment 6.3
QI-057
Rev. 6

COMANCHE PEAK STEAM ELECTRIC STATION (Continued)
SAFE SHUTDOWN IMPOUNDMENT DAM TEST PROGRAM

Quality Control Test	Procedures Reference	Location	Frequency of Testing**	Acceptance Criteria	Specifications Reference
Coring Test*	U.S.A.C.E.	In Place	At 50% and 100% completion of Core	M-J Stability Analysis of Embankment	N/A
Concrete	Constructor will identify tests and conduct Quality Assurance				
Reinforcing Steel	Constructor will identify tests and conduct Quality Assurance				

*Hold Point
**Tests required on a per shift or per day basis are not required unless the constructor is placing material.

Attachment J-1

Sheet 3 of 3

FREESE AND NICHOLS
CONSULTING ENGINEERS

Procedure No.	Revision	Issue Date	Page
Appendix J	#1, 5-1-75	12-20-74	11 of 20

Attachment 6.3
QI-057
Rev. 6

3

SUMMARY: ACCEPTANCE CRITERIA FOR SSI DAM FILL

MATERIAL TYPE	GRADATION OR CLASSIFICATION	SOUNDNESS	FLAT AND ELONGATED PARTICLES	MAXIMUM LOOSE LIFT THICKNESS	MINIMUM ACCEPTABLE IN-PLACE DENSITY
IMPERVIOUS FILL ("CORE")	CH or CL with liquid limit > 30%	N/A	N/A	8"*	95% of maximum density with a moisture content within 1% dry to 3% wet of optimum per AASHO Test T99
FILTER "A"	SIEVE SIZE / PERCENT PASSING: 1/2" 100; #4 78-100; #10 50-85; #40 33-60; #100 8-27; #200 0-10	Maximum loss 25% weighted average at 5 cycles in Magnesium Sulphate per ASTM C88	The quantity of flat and elongated particles in separate groups as defined and determined by CRD-C-119 shall not exceed 25% in any size group.	12"	80% relative density per ASTM D2049
FILTER "B"	SIEVE SIZE / PERCENT PASSING: 6" 100; 3" 88-100; 3/4" 60-78; #4 32-45; #10 15-26; #40 0-10				
ROCK FILL	SIEVE SIZE / PERCENT PASSING: 30" 100; 12" 75-95; 4" 25-70; 1" 0-26; 1/4" 0-8	Maximum loss 35% weighted average at 5 cycles in Magnesium Sulphate per ASTM C88	Not more than 25% or rock particles (by number) passing the 24" sieve and retained on the 4" sieve shall have a breadth or thickness of less than one-third (1/3) of its length.	24"	N/A

* Except: if material cannot be compacted by roller equipment because of inadequate clearances, material shall be spread in 4" layers and compacted with power tampers.

NOTE: Summary is based on the following sections from Freese and Nichols Specification FNSSI-1, Rev. 12:

Material Type	FNSSI-1 Sections
Impervious Fill	101.5.4.2, 101.5.5, 101.5.6.1, 101.5.7.1, and 101.5.9.1
Filter "A" & "B"	101.5.4.4, 101.5.6.3, and 101.5.9.2
Rock Fill	101.5.4.3 and 101.5.6.2

ATTACHMENT TO DC/DDA-154

I. BACKFILL

Test		Location	Minimum Frequency
1) Maximum dry density and optimum moisture	AASHTO Designation T-99 Method D	In Place	One test per 2000 cu. yds or suspected change in material.
2) Density in place	ASTM D2922/ASTM 2216 ASTM D2167 or ASTM D1556	In Place	One test per 3 lifts or 500 cu. yds. which is greater or as otherwise directed by the Engineer.
3) Gradation	ASTM C-136	In Place	One test per 3 lifts or 300 cu. yds. which is greater or as otherwise directed by the Engineer.

II. BEDDING

Test		Location	Minimum Frequency
1) Relative Density	ASTM D2049	In Place	One test per 2000 cu. yds. or suspected change in material.
2) Density in place	ASTM D2922/ASTM 2216 ASTM D2167 or ASTM D1556	In Place	One test per 3 lifts or 500 cu. yds which is greater or as otherwise directed by the Engineer.
3) Gradation	ASTM C-136	In Place	One test per 3 lifts or 500 cu. yds. which is greater or as otherwise directed by the Engineer.

Please note that these are minimum testing frequencies and additional test should be taken as determined necessary by the contractor and/or testing agency.

SUMMARY: ACCEPTANCE CRITERIA FOR FILL AND BACKFILL
(Except for SSI Dam)

MATERIAL TYPE	GRADATION		MAXIMUM LOOSE LAYER THICKNESS	DENSITY REQUIREMENTS
	SIEVE SIZE (U.S. STD.)	% PASSING BY WEIGHT		
Soil Backfill Backfill material surrounding and above pipes other than bedding	2"	100	8"	95% of maximum dry density per AASHTO Designation T99, Method D
	1"	50-85		
	1/2"	25-65		
	No. 4	15-50		
	No. 10	5-40		
	No. 40	0-20		
	No. 100	0-10		
Pipe bedding and material replacing claystone		Gradation Alternatives	6"	80 % relative density per ASTM D2049
	3/8"	100 / 100		
	No. 4	80-100 / 95-100		
	No. 8	65-90 / 80-100		
	No. 16	50-75 / 50-85		
	No. 30	40-60 / 25-60		
	No. 50	30-45 / 10-30		
	No. 100	15-25 / 2-10		
	No. 200	0-10 / -		

Note: Summary is based on the following:
Gibbs & Hill Specification 2323-SS-6, Rev. 2, Sec. 5.0
Gibbs & Hill Specification 2323-SS-8, Rev. 3, Secs. 8.0 & 9.0
CPSES DC/DDA 259, 9-20-77
CPSES DC/DDA 461, 10-28-77