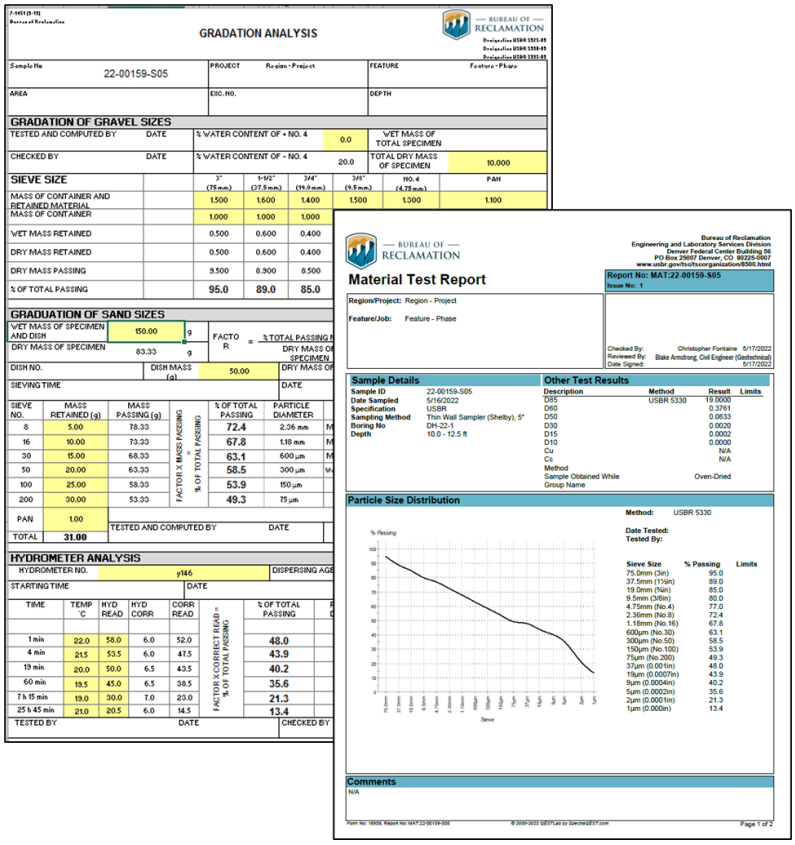
BUREAU OF RECLAMATION

Implementation of a Laboratory Information Management System for Reclamation Infrastructure

Science and Technology Program
Research and Development Office
Final Report No. ST-2023-21079-01



GRADATION ANALYSIS

Sample No 22-00159-S05 | PROJECT Region - Project | FEATURE Feature - Phase

AREA | EXC. NO. | DEPTH

GRADATION OF GRAVEL SIZES

TESTED AND COMPUTED BY | DATE | % WATER CONTENT OF + NO. 4 0.0 | WET MASS OF TOTAL SPECIMEN

CHECKED BY | DATE | % WATER CONTENT OF - NO. 4 20.0 | TOTAL DRY MASS OF SPECIMEN 10.000

SIEVE SIZE		3" (75 mm)	1-1/2" (37.5 mm)	3/4" (19.0 mm)	3/8" (9.5 mm)	NO. 4 (4.75 mm)	PAN
MASS OF CONTAINER AND RETAINED MATERIAL		1.500	1.600	1.400	1.500	1.300	1.100
MASS OF CONTAINER		1.000	1.000	1.000			
WET MASS RETAINED		0.500	0.600	0.400			
DRY MASS RETAINED		0.500	0.600	0.400			
DRY MASS PASSING		9.500	8.300	8.500			
% OF TOTAL PASSING		95.0	89.0	85.0			

GRADUATION OF SAND SIZES

WET MASS OF SPECIMEN AND DISH 150.00 g | FACTOR = % TOTAL PASSING / DRY MASS OF SPECIMEN

DRY MASS OF SPECIMEN 83.33 g

DISH NO. | DISH MASS (g) 50.00 | DRY MASS OF

SIEVING TIME | DATE

SIEVE NO.	MASS RETAINED (g)	MASS PASSING (g)	FACTOR X MASS PASSING = % OF TOTAL PASSING	% OF TOTAL PASSING	PARTICLE DIAMETER
8	5.00	78.33		72.4	2.36 mm
16	10.00	73.33		67.8	1.18 mm
30	15.00	68.33		63.1	600 µm
50	20.00	63.33		58.5	300 µm
100	25.00	58.33		53.9	150 µm
200	30.00	53.33		49.3	75 µm
PAN	1.00	TESTED AND COMPUTED BY		DATE	
TOTAL	31.00				

HYDROMETER ANALYSIS

HYDROMETER NO. y146 | DISPERSING AGE

STARTING TIME | DATE

TIME	TEMP °C	HYD READ	HYD CORR	CORR READ	FACTOR X CORRECT READ = % OF TOTAL PASSING	% OF TOTAL PASSING
1 min	22.0	58.0	6.0	52.0		48.0
4 min	21.5	53.5	6.0	47.5		43.9
15 min	20.0	50.0	6.5	43.5		40.2
60 min	19.5	45.0	6.5	38.5		35.6
7 h 15 min	19.0	30.0	7.0	23.0		21.3
25 h 45 min	21.0	20.5	6.0	14.5		13.4

TESTED BY | DATE | CHECKED BY

BUREAU OF RECLAMATION

Bureau of Reclamation
Engineering and Laboratory Services Division
Denver Federal Center Building 56
PO Box 25007 Denver, CO 80225-0007
www.usbr.gov/tsc/tscorganization/8300.html

Material Test Report

Report No: MAT:22-00159-S05
Issue No: 1

Region/Project: Region - Project
Feature/Job: Feature - Phase

Checked By: Christopher Fontaine 5/17/2022
Reviewed By: Blake Armstrong, Civil Engineer (Geotechnical)
Date Signed: 5/17/2022

Sample Details

Sample ID	22-00159-S05
Date Sampled	5/16/2022
Specification	USBR
Sampling Method	Thin Wall Sampler (Shelby), 5"
Boring No	DH-22-1
Depth	10.0 - 12.5 ft

Other Test Results

Description	Method	Result	Limits
D85	USBR 5330	19.0000	
D60		0.3761	
D50		0.0833	
D30		0.0020	
D15		0.0002	
D10		0.0000	
Cu		N/A	
Cc		N/A	
Method			
Sample Obtained While Group Name		Oven-Dried	

Particle Size Distribution

Method: USBR 5330
Date Tested:
Tested By:

Sieve Size	% Passing	Limits
75.0mm (3in)	95.0	
37.5mm (1½in)	89.0	
19.0mm (¾in)	85.0	
9.5mm (⅜in)	80.0	
4.75mm (No.4)	77.0	
2.36mm (No.8)	72.4	
1.18mm (No.16)	67.8	
600µm (No.30)	63.1	
300µm (No.50)	58.5	
150µm (No.100)	53.9	
75µm (No.200)	49.3	
37µm (0.001in)	48.0	
19µm (0.0007in)	43.9	
9µm (0.0004in)	40.2	
5µm (0.0002in)	35.6	
2µm (0.0001in)	21.3	
1µm (0.00in)	13.4	

Comments
N/A

Form No: 18928, Report No: MAT:22-00159-S05 © 2000-2022 GEOTest by SpectreGEO.com Page 1 of 2

U.S. Department of the Interior

November 2023

REPORT DOCUMENTATION PAGE

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Civil Engineer

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14. ABSTRACT

The concrete and geotechnical laboratories at the Technical Service Center (TSC) have acquired a new Lab Information Management System (LIMS) to aid in tracking samples and documenting test results. QESTLab by SpectraQEST, is used to log concrete cylinders and cores, slurry, rock, masonry, and soil samples, create datasheets, analyze raw testing data, track testing due dates, store testing results, and produce reports for clients. Personnel from Reclamation's regional laboratories have expressed interest in implementing QESTLab to better manage their respective labs. The TSC can assist with implementation to ensure continuity throughout Reclamation. This robust database will replace several paper-based sample and test tracking methods which will ensure quality and security of all data. There are many options for customization to fit Reclamation's needs which are summarized in this report. In addition to implementing for all future laboratory testing and field testing during construction, historical core data or construction QA/QC data could be archived.

15. SUBJECT TERMS
concrete field testing, concrete laboratory testing, geotechnical laboratory testing, laboratory information management system,

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**THIS PAGE**			Catherine Lucero
U	U	U			**19b. TELEPHONE NUMBER** *(Include area code)* **303-445-2343**

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Implementation of a Laboratory Information Management System for Reclamation Infrastructure

Final Report No. ST-2023-21079-01 (8530-2023-32)

prepared by

Technical Service Center
Catherine Lucero, P.E., Civil Engineer

Peer Review

Bureau of Reclamation
Research and Development Office
Science and Technology Program

Final Report No. ST-2023-21079-01 (8530-2023-32)

Implementation of a Laboratory Information Management System for Reclamation Infrastructure

CATHERINE LUCERO Digitally signed by CATHERINE LUCERO
Date: 2023.11.17 09:05:15 -07'00'

Prepared by: Catherine Lucero, P.E.
Civil Engineer, Concrete and Structural Laboratory

Digitally signed by BLAKE ARMSTRONG
Date: 2023.11.17 09:08:11 -07'00'

Peer Review by: Blake Armstrong
Civil Engineer, Geotechnical Laboratory and Field Support

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Acronyms and Abbreviations

AASHTO	American Association of Highway and Transportation Officials
ASTM	American Society for Testing and Materials
CSL	Concrete and Structural Laboratory
GLFS	Geotechnical Laboratory and Field Services
Reclamation	Bureau of Reclamation
TSC	Technical Service Center

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Executive Summary

The goal of this project is to establish a common Laboratory Information Management System (LIMS) used throughout Reclamation. The selected software QESTLab, by SpectraQEST, was selected due to its large scope of materials and equipment management. The software is also customizable, which is needed for Reclamation's testing that deviates from standard ASTM or AASHTO methods.

Historically, a DOS based programs PCQAS and PCEARTH were used to generate monthly documentation and evaluation of tests performed by Reclamation staff. This information is crucial for final construction reports (Reclamation Report type L-29) which maintain a record for future evaluations. The PCQAS/EARTH software was custom built but antiquated. Regional labs have been unable to use it for at least 15 years as computer operating systems are not compatible.

The QESTLab software has been used by the Regional Laboratories beginning in 2022. Custom test screens, dynamic worksheets, and reports were created to meet Reclamation needs. The software is more intuitive than the previous DOS based systems and queries of data are easy to perform. In addition to testing results, the LIMS assists with tracking equipment maintenance and calibration events which is crucial in obtaining and maintaining laboratory accreditation.

Organization

The Reclamation laboratories are considered separate laboratories with their own people, equipment, and Work Orders within QESTLab. Users can view information for other labs, but do not have permission to make changes.

For continuity throughout all Reclamation reports, the Client and Project lists are Global and are shared by all labs.

- Client → [Region] – [Project] ex. Region 7 UCB – Navajo-Gallup Water Supply Project
- Project → [Feature] – [Program] ex. Reach 14 – Final Design

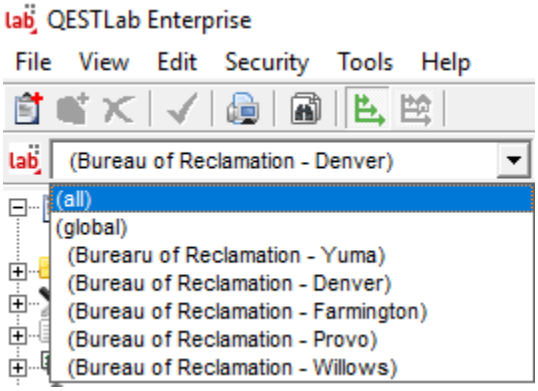

Figure 1. Laboratories included in QESTLab. The environment can be switched to Global to access Reclamation-wide lists.

Document Organization

QESTLab is structured through a hierarchy of documents, or elements of the QESTLab tree, shown in Figure 2. The tree contains various nodes.

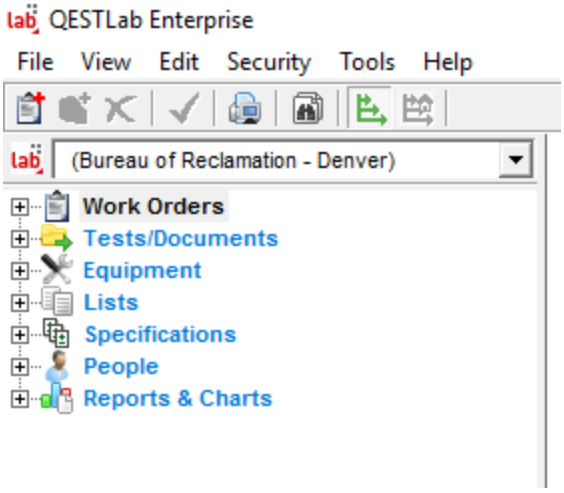

Figure 2. QESTLab Tree

Work Orders

Work Orders are grouped samples, tests, and reports under the same Client and Project. They can be grouped in any logical way. The TSC and Regional Laboratories function differently, so there is not one specified way to group tests in a Work Order. For Quality Assurance testing during construction, a work order can contain all testing for a given project on a given day. For geotechnical purposes, it is common to group by drill hole, test pit, material source etc.

Work Orders can contain multiple Samples (soil sample, concrete sample, etc.) and each Sample can have multiple Test Screens associated with them.

Test Screens

Test screens are analogous to paper worksheets and captures test data from laboratory and field tests. The test screens perform calculations and report test results per the test standard. Native test screens used by Reclamation include:

- Concrete (ASTM Tests)
  - C 39 Compressive Strength of Cylindrical Concrete Specimens
  - C 42 Drilled Cores and Sawed Beams of Concrete
  - C 78 Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
  - C 109 Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
  - C 138 Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
  - C 143 Slump of Hydraulic-Cement Concrete
  - C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
  - C 496 Splitting Tensile Strength of Cylindrical Concrete Specimens
  - C 1064 Temperature of Freshly Mixed Hydraulic-Cement Concrete
- Aggregate and Soils (ASTM and USBR Tests)
  - C 40 Organic Impurities in Fine Aggregates for Concrete
  - C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
  - C 117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

  - C 123 Lightweight Particles in Aggregate
  - C 127 Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
  - C 128 Relative Density (Specific Gravity) and Absorption of Fine Aggregate
  - C 131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - C 136 Sieve Analysis of Fine and Coarse Aggregates
  - C 142 Clay Lumps and Friable Particles
  - D 422 Particle Size Analysis of Soils – Sieve & Hydrometer
  - D 558 Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures
  - D 559 Wetting and Drying Compacted Soil-Cement Mixtures
  - D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (Proctor) (Imperial and Metric)
  - D 854 Specific Gravity of Soil Solids by Water Pycnometer
  - D 1556 Density and Unit Weight of Soil in Place by Sand-Cone Method
  - D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (Proctor) (Imperial and Metric)D 1633 Compressive Strength of Molded Soil-Cement Cylinders
  - D 2166 Unconfined Compressive Strength of Cohesive Soil
  - D 2216 Laboratory Determination of Water (Moisture) Content of Soil and Rock by MassD 2434 Permeability of Granular Soils (Constant Head)
  - D 2487 Unified Soil Classification System
  - D 2488 Visual-Manual Identification of Soils
  - D 2937 Density by Drive-Cylinder
  - D 2974 Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
  - D 4254 Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
  - D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
  - D 5084 Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method C)
- Other Materials (ASTM Tests)
  - A 370 Mechanical Testing of Steel Products

Minor customizations have been made to the native test screens to meet Reclamation testing requirements.

User Documents

User Documents are used to extend QESTLab's capabilities by allowing the support of other test standards not currently in QESTLab. These are used by Reclamation to incorporate USBR test methods per the Earth Manual or Concrete Manual. Excel worksheets can be incorporated and pushed back to QESTLab to store the result in the database. The advantage to using a User Document with an Excel worksheet is that Reclamation users are already familiar with the format of the Excel worksheet. An example is shown in Figure 3.

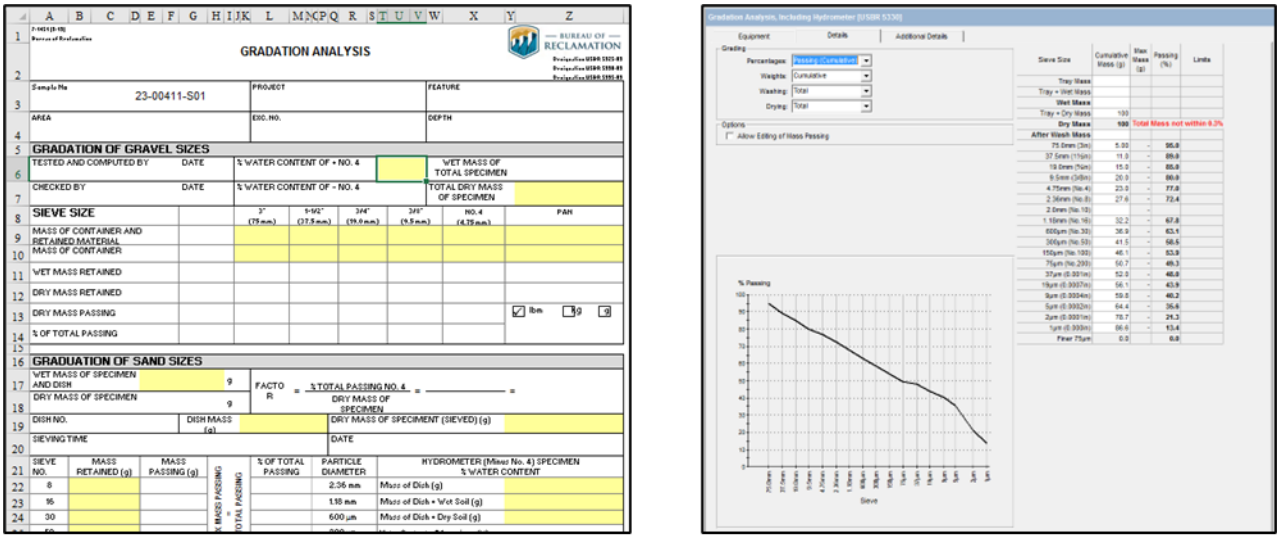

Figure 3. (a) Example of a Reclamation form as an Excel sheet connected to QESTLab to perform calculations and (b) test screen including imported data.

Test methods with User Documents associated with them include:

- ASTM D 6572 Crumb Dispersion Test
- ASTM C 469 Elastic Modulus and Poisson's Ratio of Concrete
- ASTM D 1587 In-Place Density with Thin-Walled Tube (Shelby Tube) Sampling
- ASTM D 7263 Density (Unit Weight) of Soil Specimens
- ASTM D 5030 In-Place Density by Water Replacement (Metal Ring)
- ASTM D 4253 Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- ASTM D 4643 Moisture Content of Soil by Microwave Oven Heating
- ASTM D 4914 In-Place Density by Sand Replacement (Metal Ring)
- ASTM D 4959 Moisture Content of Soil By Direct Heating
- ASTM D 5080 Rapid Determination of Percent Compaction
- ASTM D7382 Compaction of Granular Soils Using a Vibratory Hammer
- USBR 5330 Gradation Analysis, Including Hydrometer
- USBR 5410 Pinhole Dispersion Test
- USBR 7240 Rapid Method Proctor Compaction
- USBR (In-house Procedure) Mica and Friable Particle Count
- X-ray Diffraction (Contract Lab Procedure)

Test Reports

A final Test Report can be created for a given Sample summarizing results from multiple tests run on the sample. An example Material Test Report is in Appendix A. The types of Test Reports used by Reclamation include:

- Concrete Test Report (for fresh concrete placed in the field)
- Concrete Core Test Report (for hardened cores collected from the field)
- Material Test Report (for soil, aggregate, or soil cement)
- Soil Compaction Test Report
- Unconfined Compression Strength Test Report (for soil, soil cement, or concrete)
- Other Test Report (for rebar)

Attachments can be added to a Test Report including photos of samples or any figures created from external data collection systems such as stress-strain curves. Test reports can be signed within QESTLab prior to exporting and distributing to clients.

The heading of the Test Reports reflect the laboratory where the testing was performed. For example, tests completed at the Farmington Laboratory will have the name and address of the Farmington Office.

Equipment

Laboratory equipment is stored in QESTLab. There are predefined types of equipment (i.e. Slump Cones or Hydrometers), other equipment can be categorized as "General Equipment".

Each piece of equipment can have an arbitrary number of calibrations, checks and maintenance tasks. Before a record is added to a piece of equipment, the activity associated with the record needs to be created. The activity task allows you to set the schedule of when the task occurs and a reminder window.

When a new task is created, the most important fields to complete are the Last Performed Date and the Schedule. A Type can be selected from the list and a Description added if desired. Calibration records, such as worksheets recording calibration results, can be uploaded to a task as they are completed.

Users are notified of upcoming calibration or maintenance activities in a pop-up upon login. Only equipment associated with the user's lab will show. Comprehensive lists of upcoming calibration or maintenance actives can be generated with a Management Report.

Specific equipment used to complete a test method can be selected on a Test Screen. The user will be notified if the piece of equipment is out of calibration.

Specifications

Specifications are used to set limits to tested values. The specification limits are shown next to the test results in Test Reports. Results out of compliance with a specification are highlighted in red. A specification does not need to be associated with a given Specimen in order to have test data saved.

Concrete specifications (03 30 00) were entered for projects currently in construction:

- Fresh concrete temperature
- Slump
- Air Content
- Compressive Strength

Aggregate specifications (03 30 00) for acceptance for use in concrete were entered for projects currently in construction:

- ASTM C33 physical properties

An example of a Concrete Specification showing next to test results is shown in Figure 4.

Specification: Bluestone Class 491

		Measured	Specified
Slump (in):	ASTM C 143	3.5	2 - 5
Slump w/ Plasticizer (in):			
Air Temp (°F):		N/A	
Concrete Temp (°F):	ASTM C 1064	72	
Air Content (%)	ASTM C 138	5.80	4.5 - 7.5
Unit Weight (pcf):	ASTM C 138	142.4	

Figure 4. Example of a concrete specification as shown in a Concrete Test Report

For geotechnical purposes (specifically for older test screens), specifications are used to set sieve (or particle) sizes. Logic can also be applied to flag values that are not meeting specifications. An example of ASTM C 136 gradation results with the specifications is available in Figure 5. Values that are out of specification are flagged with asterisks.

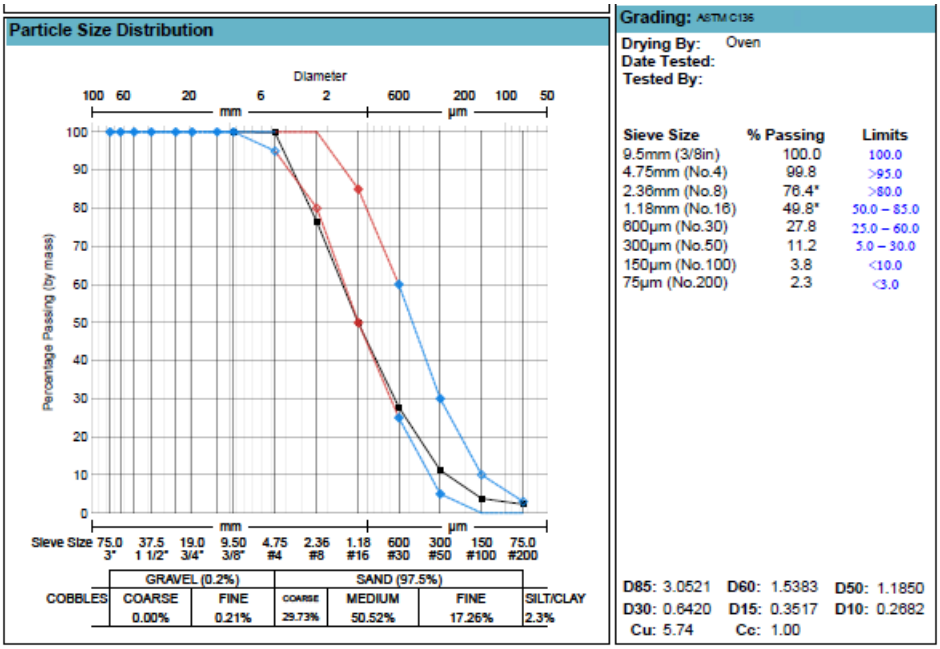

Figure 5. Example of a concrete specification as shown in a Concrete Test Report

Reports and Charts

Management Reports are used to query and filter the QESTLab database to create summary reports of multiple Samples. Reports made by TSC personnel are in Appendix B and C. In addition to summarizing Sample test results, Management Reports can also query Equipment information. An example of an equipment inventory list pulled from QESTLab is in Appendix D.

Field Lab Training

TSC personnel hosted training and feedback sessions for field labs virtually and on-site during FY22 through FY23.

- Yuma Area Office (Virtual)
- Farmington Area Office (On-Site)
- Provo Area Office (On-Site)
- Willows Laboratory (Virtual and On-Site)

Feedback from the laboratories was used to prioritize creating new User Documents and Management Reports not native to QESTLab. For example, simplified concrete cylinder break sheets were created for field use. An example is shown in Appendix E.

Summary and Next Steps

All Regional Labs have QESTLab licenses and have received at least introductory training on the software. The TSC has generated several custom User Documents, Dynamic Worksheets, and templates for Management Reports to meet the needs of Reclamation testing labs. The templates and guidance established allows uniformity of reporting throughout Reclamation.

There are other products available from SpectraQEST including QESTField which is intended for inspection on site. This application will be further explored in future years. The Regional Labs and TSC will remain in close collaboration to fully utilize QESTLab for preconstruction and quality assurance testing.

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Appendix A – Example Test Reports

Bureau of Reclamation
Engineering and Laboratory Services Division
Denver Federal Center Building 56
PO Box 25007 Denver, CO 80225-0007
www.usbr.gov/tsc/tscorganization/8500.html

Material Test Report

Report No: MAT:22-00159-S05
Issue No: 1

Region/Project: Region - Project

Feature/Job: Feature - Phase

Checked By: Christopher Fontaine 5/17/2022
Reviewed By: Blake Armstrong, Civil Engineer (Geotechnical)
Date Signed: 5/17/2022

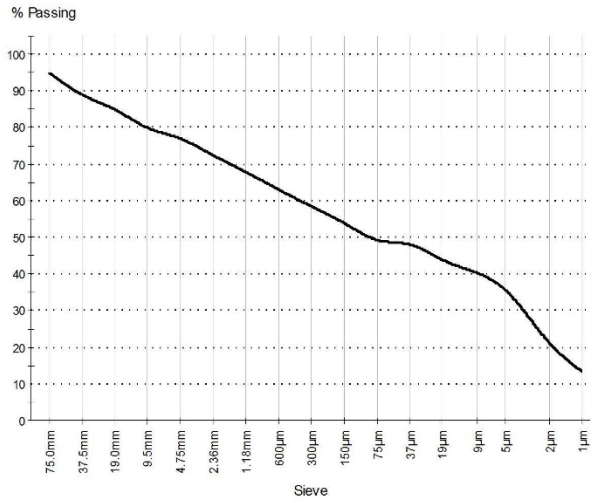
Sample Details

Sample ID	22-00159-S05
Date Sampled	5/16/2022
Specification	USBR
Sampling Method	Thin Wall Sampler (Shelby), 5"
Boring No	DH-22-1
Depth	10.0 - 12.5 ft

Other Test Results

Description	Method	Result	Limits
D85	USBR 5330	19.0000	
D60		0.3761	
D50		0.0833	
D30		0.0020	
D15		0.0002	
D10		0.0000	
Cu		N/A	
Cc		N/A	
Method			
Sample Obtained While		Oven-Dried	
Group Name			

Particle Size Distribution



Method: USBR 5330

Date Tested:
Tested By:

Sieve Size	% Passing	Limits
75.0mm (3in)	95.0	
37.5mm (1½in)	89.0	
19.0mm (¾in)	85.0	
9.5mm (3/8in)	80.0	
4.75mm (No.4)	77.0	
2.36mm (No.8)	72.4	
1.18mm (No.16)	67.8	
600µm (No.30)	63.1	
300µm (No.50)	58.5	
150µm (No.100)	53.9	
75µm (No.200)	49.3	
37µm (0.001in)	48.0	
19µm (0.0007in)	43.9	
9µm (0.0004in)	40.2	
5µm (0.0002in)	35.6	
2µm (0.0001in)	21.3	
1µm (0.000in)	13.4	

Comments

N/A

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Engineering and Laboratory Services Division
Denver Federal Center Building 56
PO Box 25007 Denver, CO 80225-0007
www.usbr.gov/tsc/tscorganization/8500.html

Material Test Report

Report No: MAT:22-00159-S05
Issue No: 1

Region/Project: Region - Project

Feature/Job: Feature - Phase

Checked By: Christopher Fontaine 5/17/2022
Reviewed By: Blake Armstrong, Civil Engineer (Geotechnical)
Date Signed: 5/17/2022

Other Test Results

Description	Method	Result	Limits
Group Symbol			
Composite Sieving Used		No	
Dispersion Method		Dispersant by hand	
Prior Testing			

Comments

N/A

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RECLAMATION

Bureau of Reclamation
Engineering and Laboratory Services Division
Denver Federal Center Building 56
PO Box 25007 Denver, CO 80225-0007
www.usbr.gov/tsc/tscorganization/8500.html

Concrete Test Report

Report No: CTR:21-0077-C01
Issue No: 1

Region/Project: CCRL/AMRL

Feature/Job: 8530 - Proficiency Sample Program

Catherine Lucero, P.E.

Checked By: Barbara Aguilera 5/21/2021
Reviewed By: Catherine Lucero, Civil Engineer
Date Signed: 5/21/2021

Mix Data

Mix Submitted By:
Supplier:
Plant:
Mix Identification: Sample 197 ODD
Specified Design Strength (psi):
Design Unit Weight (pcf):
Water Cement Ratio (lb/lb):

Material	Source	Amount	Moisture

Sample Details

Date Sampled: 05/13/21
Date Received:
Sample Location:
Curing Method: Laboratory Cure
Field Sample No.:
Field Cure Temp (°F) High:
Low:
Contractor:
Ticket no.:
Truck No.:
Sampled By:
Submitted By:
Weather:
Est. Wind (mph):
Est. Rh (%):

Specification:

		Measured	Specified
Slump (in):	ASTM C 143	2.25	
Slump w/ Plasticizer (in):			
Air Temp (°F):		72	
Concrete Temp (°F):	ASTM C 1064	79	
Air Content (%)	ASTM C 231	2.2	
Unit Weight (pcf):	ASTM C 138	155.0	
Volume of Density Measure (ft³):		N/A	

Batch Size (yd³):
Yd³ Placed:
Water Added (gal) Before:
After:
Time Batched:
Time Sampled:
Time Placed:
Time in Truck (mins):

Compressive Strength of Concrete Cylinders — ASTM C 39

Specimen ID	Date Tested	Age (Days)	Diameter (in)	Length (in)	Area (in²)	Type of Cap	Maximum Load (lbf)	Type of Fracture	Compressive Strength (psi)	Remarks	Density (pcf)
21-0077-C01\1	05/20/21	7	3.99	8.06	12.50	U	56887	5	4550		156.8
21-0077-C01\2	05/20/21	7	3.98	8.06	12.44	U	58840	5	4730		156.5
21-0077-C01\3	05/20/21	7	3.99	8.07	12.50	U	65230	5	5220		156.1
								Average 7 Day Compressive Strength (psi)	4830		
								Required Strength (psi)			

Notes

1. Sampling to ASTM C 172
2. Specimen(s) prepared to ASTM C 31
3. Capping: B = Bonded ASTM C 617,U = Unbonded ASTM C 1231

Remarks

Fracture Type: 5 = Semi-Conical Break

Bureau of Reclamation
Engineering and Laboratory Services Division
Denver Federal Center Building 56
PO Box 25007 Denver, CO 80225-0007
www.usbr.gov/tsc/tscorganization/8500.html

Material Test Report

Report No: MAT:20-0077-S04
Issue No: 1

Region/Project: [redacted]

Feature/Job: [redacted]

Catherine Lucero, P.E.

Checked By:
Reviewed By: Catherine Lucero, Civil Engineer
Date Signed: 1/4/2021

Sample Details

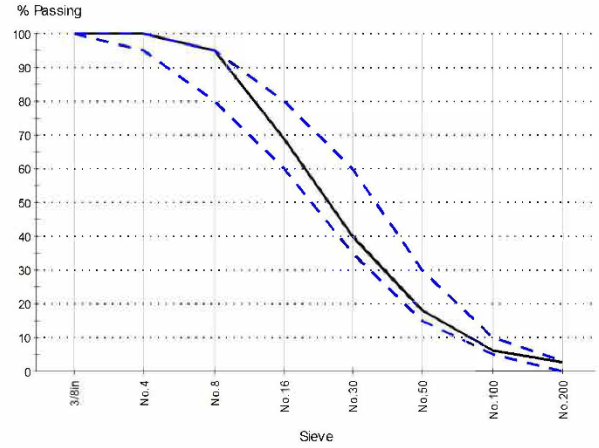
Sample ID 20-0077-S04
Source [redacted]
Material Manufactured Concrete Sand
Specification [redacted] Fine Aggregate

Other Test Results

Description	Method	Result	Limits
Test Type	AASHTO T 104	Fine	
Preparation		Freshly Prepared	
Solution Type		Magnesium	
Minus Number 4 (%)		100	
Total Weighted Fine Loss (%)		8	<18

Particle Size Distribution

ASTM C 136, ASTM C 117



Drying by: Oven
Date Tested: 4/7/2020
Tested By: Frank Valdez

Sieve Size	% Passing	Limits
9.5mm (3/8in)	100	100
4.75mm (No.4)	100	95 – 100
2.36mm (No.8)	95	80 – 95
1.18mm (No.16)	69	60 – 80
600µm (No.30)	40	35 – 60
300µm (No.50)	18	15 – 30
150µm (No.100)	6	5 – 10
75µm (No.200)	2.7	0 – 3

Comments

* = Result does not meet the specification

Bureau of Reclamation
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Material Test Report

Report No: MAT:20-0077-S04
Issue No: 1

Region/Project: [redacted]

Feature/Job: [redacted]

Catherine Lucero, P.E.

Checked By:
Reviewed By: Catherine Lucero, Civil Engineer
Date Signed: 1/4/2021

Other Test Results

Description	Method	Result	Limits
Specific Gravity (OD)	ASTM C 128	2.64	
Specific Gravity (SSD)		2.66	≥2.6
Apparent Specific Gravity		2.71	
Absorption (%)		1.0	≤2
Additional Notes			
Fineness Modulus	ASTM C 136, ASTM C 117	2.72	
Clay lumps & friable particles - fine (%)	ASTM C 142	0.0	
Clay lumps & friable particles - coarse (%)		0.00	
Clay lumps & friable particles (%)		0.00	≤1.2
Procedure	ASTM C 40	Glass color standard	
Organic plate No.		< 1	<3

Comments

* = Result does not meet the specification

Appendix B – Example Concrete Field Testing Summary Report

EXAMPLE
Concrete Summary

Concrete Supplier	Concrete Mix ID	LocationDescription	Date Batched	Ambient Temp (F)	Concrete Temp (F)	Slump (in)	Air (%)	Age (d)	Density (pcf)	Strength (psi)	Acceptance Age (d)	Design Strength (psi)
Supplier #1	4C-8 Concrete	Concrete Pipe Collar 8315+60	3/30/2021	57	60	4.25	6.1	7	141.0	4088	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8315+60	3/30/2021	57	60	4.25	6.1	7	141.0	4139	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8315+60	3/30/2021	57	60	4.25	6.1	28	141.0	5376	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8315+60	3/30/2021	57	60	4.25	6.1	28	141.0	5112	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8061+00	4/13/2021	63	68	3.50	5.8	7	143.0	3924	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8061+00	4/13/2021	63	68	3.50	5.8	7	143.0	3912	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8061+00	4/13/2021	63	68	3.50	5.8	28	143.0	4933	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8061+00	4/13/2021	63	68	3.50	5.8	28	143.0	5018	28	4500
	4C-8 Concrete	Concret Pipe Collar 8414+00	4/19/2021	66	62	4.00	4.1	7	144.8	4838	28	4500
	4C-8 Concrete	Concret Pipe Collar 8414+00	4/19/2021	66	62	4.00	4.1	7	144.8	4810	28	4500
	4C-8 Concrete	Concret Pipe Collar 8414+00	4/19/2021	66	62	4.00	4.1	28	144.8	5717	28	4500
	4C-8 Concrete	Concret Pipe Collar 8414+00	4/19/2021	66	62	4.00	4.1	28	144.8	5712	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8260+00	4/28/2021	63	62	4.50	5.0	7	142.8	4725	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8260+00	4/28/2021	63	62	4.50	5.0	7	142.8	4704	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8260+00	4/28/2021	63	62	4.50	5.0	28	142.8	5808	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8260+00	4/28/2021	63	62	4.50	5.0	28	142.8	5968	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8211+00	5/5/2021	68	69	5.75	6.9	7	139.5	4455	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8211+00	5/5/2021	68	69	5.75	6.9	7	139.5	4399	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8211+00	5/5/2021	68	69	5.75	6.9	28	139.5	5467	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8211+00	5/5/2021	68	69	5.75	6.9	28	139.5	5443	28	4500
	4C-8 Concrete	Concrete Taper Collar 8006+00	5/10/2021	66	71	4.75	6.0	7	141.7	4476	28	4500
	4C-8 Concrete	Concrete Taper Collar 8006+00	5/10/2021	66	71	4.75	6.0	7	141.7	4622	28	4500
	4C-8 Concrete	Concrete Taper Collar 8006+00	5/10/2021	66	71	4.75	6.0	28	141.7	5658	28	4500
	4C-8 Concrete	Concrete Taper Collar 8006+00	5/10/2021	66	71	4.75	6.0	28	141.7	5708	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8132+00	5/17/2021	64	69	4.00	5.2	7	143.2	4943	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8132+00	5/17/2021	64	69	4.00	5.2	7	143.2	5044	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8132+00	5/17/2021	64	69	4.00	5.2	28	143.2	5959	28	4500
	4C-8 Concrete	Concrete Pipe Collar 8132+00	5/17/2021	64	69	4.00	5.2	28	143.2	5883	28	4500
	4C-8 Concrete	Concrete Anchor Block 8002+03	5/18/2021	62	67	3.00	5.1		143.5		28	4500
	4C-8 Concrete	Concrete Pipe Collar 7394+50	5/21/2021		66	3.00	6.0				28	4500
	4C-8 Concrete	Concrete Pipe Collar 7312+20	5/24/2021	62	68	2.00	4.5		145.4		28	4500
	4C-8 Concrete	Concrete Pipe Collar 7277+00	5/26/2021	60	74	3.75	6.0	7	143.1	4499	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7277+00	5/26/2021	60	74	3.75	6.0	7	143.1	4622	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7277+00	5/26/2021	60	74	3.75	6.0	28	143.1	5870	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7277+00	5/26/2021	60	74	3.75	6.0	28	143.1	5811	28	4500
	4C-8 Concrete	Cocrete Pipe Collar 6459+50	6/3/2021	60	75	4.00	5.9	7	141.5	3829	28	4500
	4C-8 Concrete	Cocrete Pipe Collar 6459+50	6/3/2021	60	75	4.00	5.9	7	141.5	3666	28	4500
	4C-8 Concrete	Cocrete Pipe Collar 6459+50	6/3/2021	60	75	4.00	5.9	28	141.5	4904	28	4500
	4C-8 Concrete	Cocrete Pipe Collar 6459+50	6/3/2021	60	75	4.00	5.9	28	141.5	4984	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7213+50	6/7/2021	86	84	4.00	4.0	7	144.8	4328	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7213+50	6/7/2021	86	84	4.00	4.0	7	144.8	4219	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7213+50	6/7/2021	86	84	4.00	4.0	28	144.8	5338	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7213+50	6/7/2021	86	84	4.00	4.0	28	144.8	5215	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7148+00	6/10/2021	76	77	3.50	5.9		141.4		28	4500
	4C-8 Concrete	Concrete Pipe Collar 7071+50	6/14/2021	74	77	4.00	6.0	7	142.3	4664	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7071+50	6/14/2021	74	77	4.00	6.0	7	142.3	4670	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7071+50	6/14/2021	74	77	4.00	6.0	28	142.3	5683	28	4500
	4C-8 Concrete	Concrete Pipe Collar 7071+50	6/14/2021	74	77	4.00	6.0	28	142.3	5737	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6399+00	6/23/2021								28	4500
	4C-8 Concrete	Concrete Pipe Colllar 6324+40	6/24/2021	72	81	3.00	5.3	7	141.8	4704	28	4500
	4C-8 Concrete	Concrete Pipe Colllar 6324+40	6/24/2021	72	81	3.00	5.3	7	141.8	4641	28	4500
	4C-8 Concrete	Concrete Pipe Colllar 6324+40	6/24/2021	72	81	3.00	5.3	28	141.8	5331	28	4500
	4C-8 Concrete	Concrete Pipe Colllar 6324+40	6/24/2021	72	81	3.00	5.3	28	141.8	5932	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6202+30	7/6/2021	81	84	3.25	4.7		141.7		28	4500
	4C-8 Concrete	Concrete Pipe Collar 6251+20	7/7/2021	96	85	3.25	7.4	7	139.6	4380	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6251+20	7/7/2021	96	85	3.25	7.4	7	139.6	4410	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6251+20	7/7/2021	96	85	3.25	7.4	28	139.6	5471	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6251+20	7/7/2021	96	85	3.25	7.4	28	139.6	5414	28	4500
	4C-8 Concrete	Concrete Pipe Collar	7/14/2021	71	79	4.25	7.0		140.1		28	4500
	4C-8 Concrete	Concrete Pipe Collar 6061+00	7/16/2021	73	79	4.25	7.4	7	139.3	3653	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6061+00	7/16/2021	73	79	4.25	7.4	7	139.3	4080	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6061+00	7/16/2021	73	79	4.25	7.4	28	139.3	4676	28	4500
	4C-8 Concrete	Concrete Pipe Collar 6061+00	7/16/2021	73	79	4.25	7.4	28	139.3	4750	28	4500
	4C-8 Concrete	Pipe Collar 42181+84	7/26/2021	72	77	3.75	6.0		141.6		28	4500
	4C-8 Concrete	Pipe Collar 42080+00	7/30/2021	67	76	5.00	7.0		138.1		28	4500
	4C-8 Concrete	Pipe Collar 6532+00	8/5/2021	95	88	4.25	5.6	7	142.1	4595	28	4500
	4C-8 Concrete	Pipe Collar 6532+00	8/5/2021	95	88	4.25	5.6	7	142.1	4827	28	4500
	4C-8 Concrete	Pipe Collar 6532+00	8/5/2021	95	88	4.25	5.6	28	142.1	5493	28	4500
	4C-8 Concrete	Pipe Collar 6532+00	8/5/2021	95	88	4.25	5.6	28	142.1	5614	28	4500
	4C-8 Concrete	Pipe Collar 42029+00	8/11/2021	77	76	4.50	4.0		144.0		28	4500
	4C-8 Concrete	Concrete Bollards at 7312+20	8/30/2022								28	4500
	4C-8 Concrete	Concrete Thrust Block at 6532+41		61	75	2.75	5.5		144.7		28	4500
	4C-8 Concrete	Concrete thrust block 42181+84		61	75	5.00	3.7				28	4500
	4C-8 Concrete	Concrete bollards 8414+00, 7312+20, 7277+00, 7213+50, 7148+00									28	4500
	4C-8 Concrete	Concrete Bollards 7213+50, 7071+50, 6399+00, 6324+40									28	4500
	4C-8 Concrete	Concrete Bollards 6459+40, 6324+40, 6300+60, 6289+70, 6251+20, 6202+30									28	4500
	4C-8 Concrete	Concrete Bollards 6117+00									28	4500
	4C-8 Concrete	Concrete Bollards 6061+00 and 4281+85									28	4500
	4C-8 Concrete	Concrete Bollards 42080+00, 42029+00									28	4500
	4C-8 Concrete	Concrete Bollards 2.0 yds at 8001+06 and 40 yds at 7394+50									28	4500
	4C-8 Concrete	Concrete bollards 7023+84,6532+76, and 42136+9(									28	4500
								Average 7 Day Strength (psi)	**4220**			
								Average 28 Day Strength (psi)	**5610**			

Example - Controlled Low Strength Material Summary

CLSM Supplier	CLSM Mix ID	Location Description	Date Batched	Ambient Temp (F)	CLSM Temp (F)	Slump (in)	Age (d)	Strength (psi)
Supplier #1	12.1/12.2 CLSM	Pipe Encasement 121021+25 to 121020+83	10/28/2022		78	4	7	660
	12.1/12.2 CLSM	Pipe Encasement 121021+25 to 121020+83	10/28/2022		78	4	7	613
	12.1/12.2 CLSM	Pipe Encasement 121020+83 to 121021+24	10/29/2022		80	4	7	252
	12.1/12.2 CLSM	Pipe Encasement 121020+83 to 121021+24	10/29/2022		80	4	7	229
	12.1/12.2 CLSM	Pipe Encasement 121021+38 to 121021+69	10/31/2022		77	5	7	258
	12.1/12.2 CLSM	Pipe Encasement 121021+38 to 121021+69	10/31/2022		77	5	7	252
	12.1/12.2 CLSM	Pipe Encasement 121021+69 to 121024+22	11/1/2022		73	4	7	417
	12.1/12.2 CLSM	Pipe Encasement 121021+69 to 121024+22	11/1/2022		73	4	7	422
	12.1/12.2 CLSM	Pipe Encasement 121021+69 to 121024+22	11/1/2022		73	4	7	195
	12.1/12.2 CLSM	Pipe Encasement 121021+69 to 121024+22	11/1/2022		73	4	7	213
	12.1/12.2 CLSM	Pipe encasement 121023+74 to 121024+23	11/7/2022		76	5.5	7	383
	12.1/12.2 CLSM	Pipe encasement 121023+74 to 121024+23	11/7/2022		76	5.5	7	359
	12.1/12.2 CLSM	Pipe encasement 121024+23 to 121025+03	11/8/2022		86	5.75	7	364
	12.1/12.2 CLSM	Pipe encasement 121024+23 to 121025+03	11/8/2022		86	5.75	7	358
	12.1/12.2 CLSM	121025+03 to 121026+08 pipe embedment	11/9/2022	76		5.5	7	357
	12.1/12.2 CLSM	121025+03 to 121026+08 pipe embedment	11/9/2022	76		5.5	7	320
	12.1/12.2 CLSM	121026+08 to 121027+46 Pipe embedment	11/11/2022		63	7.25	7	135
	12.1/12.2 CLSM	121026+08 to 121027+46 Pipe embedment	11/11/2022		63	7.25	7	134
	12.1/12.2 CLSM	121027+46 to 121028+46 pipe embedment	11/12/2022		70	6.25	7	165
	12.1/12.2 CLSM	121027+46 to 121028+46 pipe embedment	11/12/2022		70	6.25	7	165
	12.1/12.2 CLSM	121028+46 to 121029+80 pipe embedment	11/14/2022		71	5	7	127
	12.1/12.2 CLSM	121028+46 to 121029+80 pipe embedment	11/14/2022		71	5	7	133
	12.1/12.2 CLSM	121038+50 to 121039+48 pipe embedment	11/18/2022		70	6		
	12.1/12.2 CLSM	121038+50 to 121041+48 pipe embedment	11/21/2022		68	5.5		
	12.1/12.2 CLSM	121041+48 to 121043+47	11/22/2022		61	7.25		
	12.1/12.2 CLSM	Pipe Embedment 121043+45 to 121046+45	11/28/2022		63	6.5	7	165
	12.1/12.2 CLSM	Pipe Embedment 121043+45 to 121046+45	11/28/2022		63	6.5	7	150
	12.1/12.2 CLSM	Pipe Embedment 121043+45 to 121046+45	11/28/2022		63	6.5	7	154
	12.1/12.2 CLSM	Pipe Embedment 121043+45 to 121046+45	11/28/2022		63	6.5	7	140
	12.1/12.2 CLSM	Pipe Embedment 121046+46 to 121047+88	11/29/2022		64	7.25	7	154
	12.1/12.2 CLSM	Pipe Embedment 121046+46 to 121047+88	11/29/2022		64	7.25	7	152
	12.1/12.2 CLSM	121047+88 to 121047+97 for pipe embedment	11/30/2022		77	6	7	161
	12.1/12.2 CLSM	121047+88 to 121047+97 for pipe embedment	11/30/2022		77	6	7	151
	12.1/12.2 CLSM	Pipe Embedment 121047+97 to 121050+52	12/2/2022		76	6	7	106
	12.1/12.2 CLSM	Pipe Embedment 121047+97 to 121050+52	12/2/2022		76	6	7	105
	12.1/12.2 CLSM	Pipe Embedment 121050+52 to 121053+47	12/5/2022		70	6.25	7	180
	12.1/12.2 CLSM	Pipe Embedment 121050+52 to 121053+47	12/5/2022		70	6.25	7	169
	12.1/12.2 CLSM	Pipe Embedment 121050+52 to 121053+47	12/5/2022		70	6.25	7	152
	12.1/12.2 CLSM	Pipe Embedment 121050+52 to 121053+47	12/5/2022		70	6.25	7	145
	12.1/12.2 CLSM	Pipe embedment 121053+47 to 121056+45	12/6/2022		67	6	7	179
	12.1/12.2 CLSM	Pipe embedment 121053+47 to 121056+45	12/6/2022		67	6	7	171
	12.1/12.2 CLSM	Pipe embedment 121053+47 to 121056+45	12/6/2022		67	6	7	162
	12.1/12.2 CLSM	Pipe embedment 121053+47 to 121056+45	12/6/2022		67	6	7	167
	12.1/12.2 CLSM	Pipe Embedment 121056+45 to 121059+38	12/7/2022		73	7	7	176
	12.1/12.2 CLSM	Pipe Embedment 121056+45 to 121059+38	12/7/2022		73	7	7	153
	12.1/12.2 CLSM	Pipe Embedment 121059+38 to 121061+23	12/8/2022		73	6.25	7	207
	12.1/12.2 CLSM	Pipe Embedment 121059+38 to 121061+23	12/8/2022		73	6.25	7	221
	12.1/12.2 CLSM	Pipe Embedment 121063+94 to 121065+23	12/9/2022		74	6.25	7	192
	12.1/12.2 CLSM	Pipe Embedment 121063+94 to 121065+23	12/9/2022		74	6.25	7	203
	12.1/12.2 CLSM	Pipe Embedment 121062+83 to 121063+94	12/10/2022		73	6.25		
	12.1/12.2 CLSM	Pipe Embedment 121063+94 to 121065+46	12/14/2022		66	6	7	162
	12.1/12.2 CLSM	Pipe Embedment 121063+94 to 121065+46	12/14/2022		66	6	7	170
	12.1/12.2 CLSM	Pipe Embedment 121065+46 to 121066+80	12/15/2022		62	7.5	7	151
	12.1/12.2 CLSM	Pipe Embedment 121065+46 to 121066+80	12/15/2022		62	7.5	7	155
	12.1/12.2 CLSM	Pipe Embedment 121066+80 to 121067+80	12/17/2022		73	5.5		
	12.1/12.2 CLSM	Pipe Embedment 121069+22 to 121070+50	12/19/2022		68	6		
	12.1/12.2 CLSM	Pipe Embedment in 3 places 121067+92 to 121068+12, 121069+06 to 121069+36, and 121070+39 to 121072+53	12/20/2022		68	6.25	7	149
	12.1/12.2 CLSM	Pipe Embedment in 3 places 121067+92 to 121068+12, 121069+06 to 121069+36, and 121070+39 to 121072+53	12/20/2022		68	6.25	7	164
	12.1/12.2 CLSM	Pipe Embedment in 3 places 121067+92 to 121068+12, 121069+06 to 121069+36, and 121070+39 to 121072+53	12/20/2022		68	6.25	7	118
	12.1/12.2 CLSM	Pipe Embedment in 3 places 121067+92 to 121068+12, 121069+06 to 121069+36, and 121070+39 to 121072+53	12/20/2022		68	6.25	7	124
	12.1/12.2 CLSM	Pipe Encasement 121072+71 to 121073+68	1/19/2023		69	5	7	181
	12.1/12.2 CLSM	Pipe Encasement 121072+71 to 121073+68	1/19/2023		69	5	7	166
	12.1/12.2 CLSM	Pipe Encasement 121073+05 to 121074+70	1/21/2023		70	5	7	198
	12.1/12.2 CLSM	Pipe Encasement 121073+05 to 121074+70	1/21/2023		70	5	7	183
	12.1/12.2 CLSM	Pipe Enbedment 121074+83 to 121076+10	1/22/2023		65	6		
	12.1/12.2 CLSM	Pipe Embedment 121076+96 to 121079+05	1/23/2023		60	4.25	7	170
	12.1/12.2 CLSM	Pipe Embedment 121076+96 to 121079+05	1/23/2023		60	4.25	7	166
	12.1/12.2 CLSM	Pipe Embedment 121079+05 to 121080+06	1/24/2023		65	5.5	7	132
	12.1/12.2 CLSM	Pipe Embedment 121079+05 to 121080+06	1/24/2023		65	5.5	7	144
	12.1/12.2 CLSM	Pipe Encasement 121080+06 to 121082+03	1/25/2023		60	6.25	7	113
	12.1/12.2 CLSM	Pipe Encasement 121080+06 to 121082+03	1/25/2023		60	6.25	7	118
	12.1/12.2 CLSM	Pipe Embedment 121082+03 to 121084+00	1/26/2023		70	5.25	7	132
	12.1/12.2 CLSM	Pipe Embedment 121082+03 to 121084+00	1/26/2023		70	5.25	7	138
	12.1/12.2 CLSM	Pipe Embedment 121084+00 to 121085+07	1/27/2023		70	6.5	7	117
	12.1/12.2 CLSM	Pipe Embedment 121084+00 to 121085+07	1/27/2023		70	6.5	7	119
	12.1/12.2 CLSM	Pipe Encasement 121085+08 to 121085+95	1/30/2023		68	7	7	70
	12.1/12.2 CLSM	Pipe Encasement 121085+08 to 121085+95	1/30/2023		68	7	7	75
	12.1/12.2 CLSM	Pipe Embedment 121085+95 to 121087+92	1/31/2023		62	7	7	70
	12.1/12.2 CLSM	Pipe Embedment 121085+95 to 121087+92	1/31/2023		62	7	7	80

	12.1/12.2 CLSM	Pipe Embedment 121087+92 to 121088+92 and 121086+32 to 121085+95	2/1/2023		72	6	7	126
	12.1/12.2 CLSM	Pipe Embedment 121087+92 to 121088+92 and 121086+32 to 121085+95	2/1/2023		72	6	7	127
	12.1/12.2 CLSM	Pipe Embedment 121088+92 to 121090+50	2/2/2023		64	7	7	109
	12.1/12.2 CLSM	Pipe Embedment 121088+92 to 121090+50	2/2/2023		64	7	7	97
	12.1/12.2 CLSM	Pipe Embedment 121090+50 to 121092+95	2/3/2023		69	6.25	7	99
	12.1/12.2 CLSM	Pipe Embedment 121090+50 to 121092+95	2/3/2023		69	6.25	7	99
	12.1/12.2 CLSM	Pipe Encasement 121092+95 to 121095+80	2/7/2023		73	5		
	12.1/12.2 CLSM	Pipe Encasement 121095+80 to 121099+30	2/9/2023		65	5.5	7	93
	12.1/12.2 CLSM	Pipe Encasement 121095+80 to 121099+30	2/9/2023		65	5.5	7	94
	12.1/12.2 CLSM	Pipe Enbedment 121099+30 to 121101+34	2/10/2023		68	5.25	7	110
	12.1/12.2 CLSM	Pipe Enbedment 121099+30 to 121101+34	2/10/2023		68	5.25	7	116
	12.1/12.2 CLSM	Pipe embedment 121101+34 to 121104+14	2/13/2023		68	6.25	7	110
	12.1/12.2 CLSM	Pipe embedment 121101+34 to 121104+14	2/13/2023		68	6.25	7	114
	12.1/12.2 CLSM	Pipe Embedment 121104+14 to 121105+59	2/14/2023	25	62	6.75	7	103
	12.1/12.2 CLSM	Pipe Embedment 121104+14 to 121105+59	2/14/2023	25	62	6.75	7	104
	12.1/12.2 CLSM	Pipe Embedment 121105+59 to 121108+09	2/20/2023	45	60	7.5	7	
	12.1/12.2 CLSM	Pipe Embedment 121105+59 to 121108+09	2/20/2023	45	60	7.5	7	
							Average	**180**
Supplier #2	12.1/12.2 CLSM Michele\	121033+18 to 121035+48 pipe embedment	11/17/2022		80	8.5		
	12.1/12.2 CLSM Michele\	121029+80 to 121030+85 pipe embedment	11/15/2022		58	10	7	71
	12.1/12.2 CLSM Michele\	121029+80 to 121030+85 pipe embedment	11/15/2022		58	10	7	55
	12.1/12.2 CLSM Michele\	121030+85 to 121033+18 pipe embedment	11/16/2022		78	9	7	49
	12.1/12.2 CLSM Michele\	121030+85 to 121033+18 pipe embedment	11/16/2022		78	9	7	83
							Average	**65**

Appendix C – Example Soil Field Testing Summary Report

EXAMPLE
Density Summary

Field Sample ID	Date Sampled	Type	Station	Offset	Elevation	D-Value	Max Dry Density (lb/ft^3)	Optimum Moisture Content (%)
	2/21/2023							
	11/9/2022	Wash Crossing	121024+ 24	1	6638.0'	87.1	104.5	18.8
11-10-A1R	11/10/2022	Wash Crossing	121025+14	0	6641.0'	89.9	96	18.5
1-22-A1R	1/22/2023	Road Crossing	121073+30	5	6619.0'	97.5	112.8	14.8
1111-A1X		Wash crossing	121025+14	0	6641.0'	95.8	109.8	16.5
01-31-A1R	1/31/2023		121085+21	2	6620.0'	93.8	114.9	14.2
02-04-A1R	2/4/2023		121092+13	1.2	6648.0'	95.4	113.8	14
1112-A1R	11/12/2022	Wash Crossing	121026+31	0		94.2	103.7	18.8
02-06-A1R	2/6/2023		121086+80	1	6627.0'	98.8	113.7	13.8
127A1R	12/7/2022	Wash Crossing	121054+70	0		96.7	111.2	15.8
02-06-A1X	2/6/2023		121092+13	1.3	6647.0'	95.1	114.3	13.4
1221A1R	12/21/2022	Road Crossing	121072+18	0		95.6	112.1	15.7
02-06-A2X	2/6/2023		121092+13	1.3	6647.0'	100.2	113.7	14.6
02-07-A1X	2/7/2023		121085+35	0	6621.0'	99.7	114.3	14.7
02-11-A1R	2/11/2023		121099+53	0	6598.0'	104.4	113.1	14.7

Appendix D – Equipment Inventory List from Management Report

Type	Code	Make and Model	Reclamation PCN or Serial No.	Date In Service
Airmeter	MR-1	Forney LA-0316		NOT IN SERVICE
	MR-2	Forney LA-0316		6/24/2019
	MR-3	Forney LA-0316		6/25/2020
Balance	AGG-1	Toledo 8140	SN4292780-4QT	
	AGG-2	GSE/Weightronix 450	415029	
	AGG-3	Mettler PC16	PCN0017286/SN-A88016	
	AGG-6	OHAUS C11P9	0601995JHT	
	AGLAB-1	Mettler PM11	PCN0139655/SN-G75780	
	FORK-2	Toledo 2881	PNC0021904/SN-541820	
	FORK-3	Cascade iForks5.0	10341FC00130	
	MIX-1	Mettler WS60LVR0000	00199356DM	
	MIX-2	Mettler WW500VR000	00078936BM	
	MIX-3	ADAM GKB130A	AE950329	
	STRAIN-2	Lebow/Hardy 3397	8788	
	STRAIN-3	Lebow/Hardy 3160-108	5717	
	THERM-1	ADAM GFK330ah	AE82628	
	THERM-2	Mettler 1502E	B151568927	
	THERM-3	Sartorius PRACTUM513-IS	634730100	
	AGG-5	Toledo AJ2200-NT	160199004	
	MIX-4	ADAM ABK130a	AE9BK85	
Bulk Density Measure	1.0CF			NOT IN SERVICE
	1.5CF			NOT IN SERVICE
	0.25CF-MR-1			11/1/2019
	0.25CF#2MR-2			6/24/2019
	0.25CF#3MR-3			6/25/2020
	0.5CF#2			NOT IN SERVICE
	0.5CF#3			
Caliper	FOWLER24"CAL	Fowler 54-100-024-1	646795135017	
	WESTWARD12"CAL.	2ZA59, AZA61		6/1/2018
	MITUTOYO6"	Mitutoyo Corperation CD-6"ASX	A1729529	7/1/2015
Compression Machine	UTM120K	Satec	C472265	1/1/2010
	UTM600K	598-81-E3-F4-G2	5598Q9266	7/9/2008
	UTM5000K	Stancil	472265	1/1/1998
Conical Mould	SPGCONE#1	Specific Gravity Cone		
	SPGCONE#2	Specific Gravity Cone		
	SPGCONE#3	Specific Gravity Cone		
Flask	SPGFLASK#1	Jar #1	#1	
	SPGFLASK#2	Jar #2	#2	
General Equipment	STRAIGHTEDGE#1	Gilson HMA-368		1/6/2022
	STRAIGHTEDGE#2	Gilson HMA-368		1/6/2022
	FEELERGAUGE#1	Starrett Model 172AS		1/22/2022
	FEELERGAUGE#2			
	UTM120K-TOP	Top Bearing Block - UTM120K		
	9-INCH BOTTOM	9-inch Bottom Bearing Block		
	UTM600K-TOP	Top Bearing Block - UTM600K		
	12-INCH BOTTOM	12-inch Bottom Bearing Block		
	RING-6-1	Gilson HM-180		7/10/2022
	RING-6-2	Gilson HM-180		7/10/2022
	RING-4-1	Gilson HM-181		5/22/2018
	RING-4-2	Gilson HM-181		5/22/2018
	VIBRA-TAK	Vibra-Tak Reed Tachometer		3/1/2022
Hydrometer	HYDROMETER#2	Gilson MA-169 (Magnesium)		7/15/2020
	HYDROMETER#1	Gilson/MA-168 (Sodium)		7/20/2020
L.A. Machine	LAABRASION#1	Gilson HM-70A	LA-506	7/1/2020
Load Cell	R0018988	Cell Load Eaton: Dynascan / 3644-103-2000k	92	12/18/2019
	R0145635	Ld Cell,Comp,Strain Gage:HoustonScil/3500-Lh-100	5544-001	12/18/2019
	R0018919	Dynascan Model 3644-103-1000k	PCNR0018919/SN-R90	12/18/2019
	RAS1	Loadstar Sensors Model RAS1-050S-S	F220533161	2/3/2022
Microwave Oven	MICROWAVE#1	Sharp R-510 AK	255803	
	MICROWAVE#2	Kenmore Elite405.74229310	261831000000	

Mixing Equipment	CHEMGROUTPUMP	Graco Chemical Grout Pump	PCNR1035802	12/21/2011
	AUTOMORTARMIX	ToniTechnik Automated Mortar Mixer	PCNR1079920	3/15/2017
	CONCRESININJECT	Lily CD-15 Concrete Resin Injector	PCNR1079547	11/19/2010
	GROUTMIXER	ChemGrout Grout Mixer	PCNR1018192	7/15/1993
Oven	AGGOVEN#1	VWR Scientific 1370 FM		
	AGGOVEN#2	Russels Technical Products	PCN0101255	3/1/1986
Proportional Calliper	CALIPERS#1	Gilson		
Rebound Hammer	SCHMIDT	Schmidt Hammer Concrete Tester	PCNR0145550	9/14/1992
Sieve Set	12"FINE-SET	Gilson 12" Standard Fine Stack		8/24/2020
	12"COARSE-SET	Gilson 12" Standard (1" NMSA) Coarse Stack		8/24/2020
	8"FINE-SET	8" Standard Fine Sieve Stack		12/18/2019
	8"COARSE-SET	8" Standard Coarse (1" NMSA) Sieve Stack		12/18/2019
	14X22COARSE-SET	Gilson 14x22" Gilson Tray (2" NMSA) Sieve Stack		8/31/2020
Sieve Shaker	MARY-ANNSHAKER	Mary Ann Sieve Sifter 6" or 8" Sieves	9103 USBR*0007	
	GILSON#1	Left Gilson: TS-1	9103	12/18/2019
	GILSON#2	Right Gilson: TS-1	8639 USBR*R0134329	12/18/2019
	ROWATAP	6" Sieve Shaker	8	NOT IN SERVICE
Slump Cone	SLUMPCONE#2	Forney 12" Slump Cone		
	SLUMPCONE#3	Forney 12" Slump Cone		
	SLUMPCONE#4	Forney 12" Slump Cone		
Tamper	TAMPER#1	Fine SPG Tamper		1/22/2021
Temperature Controller	SPGTEMPCONTROL1	HG-802/HG-8021		11/25/2020
	TEMPCONTROL2	Poly Science (MX-CA11B) (Soundness)	1804-01123	2/4/2021
	TEMPCONTROL3	Poly Science(MX-CA11B) (Soundness)	510-768	10/14/2021
Thermometer	THERMOMETER#1	Traceable / 4049	200021164	7/15/2020
	CONCRETETHERM#1	Taylor 9878E		2/10/2021
	CONCRETETHERM#2	Gilson MA-201		1/6/2022
	SULFURTHERM#1	McMaster Model 38305K33 50 to 300 °F		1/22/2022
	SULFURTHERM#2	McMaster Model 38305K33 50 to 300 °F		1/22/2022
	THERMOMETER#4	Control Company / 6427	200184010	7/15/2020
	THERMOMETER#3	Control Company / 647	200184007	7/15/2020
Water Bath	FINESPGWB1	TA200H		6/7/2021
	CYLINDERWB2			6/7/2021

Appendix E – Simplified Concrete Break Card

Daily Concrete Break Sheet

6/17/2021 11:42:30 AM

Simplified concrete break sheet (ASTM C39); no density required.

Tested By: _____
Search: Test Date Between Jun-17-21 And Jun-17-21

Client ID	Specimen ID	Test Date	Age (d)	Diameter (in)	Diameter (in)	Peak Load (lb)	Strength (psi)
TEST-1	21-00110-C01\8	6/17/2021	351				
TEST-2	21-00110-C01\9	6/17/2021	351				
TEST-3	21-00110-C01\10	6/17/2021	351				