Appendix A

Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah

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LMS/HAT/S14765

Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report
Mexican Hat, Utah

January 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

CFR	*Code of Federal Regulations*
DBM	Design Basis Memoranda
DOE	U.S. Department of Energy
GHE	Gas Hills East
LiDAR	light imaging, detection, and ranging
LM	Office of Legacy Management
LMS	Legacy Management Support
LTSP	Long-Term Surveillance Plan
NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Nuclear Regulatory Commission
$pCi/m^2/s$	picocuries per square meter per second
PMP	probable maximum precipitation
RCT	radiological control technician
RRM	residual radioactive materials
SME	subject matter expert
SOARS	System Operation and Analysis at Remote Sites
T_c	time of concentration
UMETCO	UMETCO Minerals Corporation
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act

Executive Summary

In 2016, multiple subtle depressions were identified in the rock cover along the toe and lower portions of the northeast side slope of the Mexican Hat Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I disposal cell. Due to concerns regarding the potential impacts of the cover depressions related to disposal cell performance and erosion resistance, evaluations of the depressions and information related to the cell cover design were performed. The evaluations included visual observations of the depressions, and limited small-area manual removals of the rock cover components to scan for radioactivity, to evaluate for conformance with the disposal cell design specifications, and to observe any apparent erosion on the surface of the radon barrier material. Reviews of disposal cell as-built drawings and supporting design calculations for the rock cover components were also included in the evaluations. This report provides the results of the evaluations and identifies a recommended path forward.

Based on multiple field observations and a series of radiological surveys confirming the absence of elevated radiological readings, no evidence of a breach through the disposal cell cover has been identified, and the site remains protective of human health and the environment.

The Mexican Hat disposal cell is located on the Navajo Reservation in southeast Utah. Construction of the 68-acre Mexican Hat disposal cell was completed in 1995. The disposal cell was designed to encapsulate radioactive tailings and other residual radioactive materials (RRM) in a way that minimizes the need for active maintenance and limits radon gas emanation in accordance with UMTRCA. UMTRCA also requires that disposal areas for the control of RRM and their listed constituents be designed to be effective for up to 1000 years to the extent reasonably achievable, and in any case, for at least 200 years.

The Mexican Hat disposal cell cover was constructed with a 2% top slope that transitions to 20% side slopes; runoff from the disposal cell cover flows into a perimeter drainage channel that ultimately discharges into three engineered toe drains along the northern and eastern perimeters of the disposal cell. The disposal cell side slope cover consists of multiple components: a 24-inch-thick low-permeability radon barrier, a 6-inch-thick sandy gravel bedding layer that overlies the radon barrier, and a 12-inch-thick rock riprap surface layer over the bedding layer. The radon barrier was designed to limit radon gas emanation and meteoric water infiltration. The riprap and bedding layers were designed to protect the radon barrier from erosion and to minimize the need for active maintenance of the disposal cell.

The depressions in the Mexican Hat disposal cell cover were initially observed during the 2016 annual site inspection on March 17, 2016. Subsequent site visits between April and August 2016 included the collection of topographic survey data and additional visual observations of the depression areas, radon gas monitoring, and limited hand removal of the riprap and bedding layers to observe the condition of the underlying radon barrier surface. Additional evaluation efforts included a review of as-built drawings to understand the relationship between the protective cover and the underlying tailings material, a review of the original design calculations that were prepared to determine the probable maximum precipitation (PMP) event, and a review of the original design calculations prepared to determine the gradation sizes and thicknesses of the bedding and riprap layers needed to protect the radon barrier from erosion during a PMP event. Calculations were also performed to confirm that the specified bedding materials were properly sized to serve as a filter between the riprap and the radon barrier layers. All calculations are presented in the appendixes.

A variety of site visits were performed in 2017 to further evaluate the depression features:

- An observational site visit in March 2017 and the annual site inspection in April 2017 confirmed previous visual observations from 2016. Observations of the depressions during varying lighting conditions (i.e., varying sun angles) indicated that some previously identified areas of cover depressions along the northeast side slope may be more extensive than previously considered.
- Gamma radiation scans were performed on the riprap surface throughout the northeast side slope in September 2017. No elevated radiological readings were observed at the depression features relative to visually-determined unaffected areas on upper portions of the northeast side slope.
- Additional visual observations of the northeast, north, and west side slopes during various lighting conditions were made during a site visit in October 2017. Surface depressions on the northeast side slope appeared to be similar to those observed in April 2016. What appeared to be minor construction-related surface imperfections were observed on the west side slope, with no similarities to the surface depressions observed on the northeast side slope. No surface depressions were observed on the north side slope.
- A small void extending into the apparent base of the bedding layer and upper portion of the radon barrier was identified near the toe of the northeast side slope within a previously observed depression in December 2017. A follow-up inspection with a radiological control technician confirmed that radiological readings at the void and other depression feature locations were consistent with background levels.

Two subsequent site investigations were conducted in January 2018 to gain knowledge of subsurface conditions beneath observed surface depressions and beneath areas where no surface depressions were visually apparent. Additional surface depressions were observed and investigated on the north, east, and west side slopes. Small test pits were manually excavated by removing the rock cover components to the top of the radon barrier surface. Surface depressions features located on the north, east, and west side slopes were much more subtle compared to those previously observed on the northeast side slope. The majority of test pits located within areas of observed surface depressions on the north and northeast side slopes revealed incisements and voids extending into the radon barrier; no breach through the cover was evident. Test pits located in areas where no surface depressions were visually apparent did not reveal signs of radon barrier degradation. Additionally, the majority of bedding material observed along the lower portions of the north and northeast side slopes did not appear to meet the gradation specifications for the disposal cell; the bedding material in these areas appeared to be highly segregated with only larger gravel aggregate present and little to no fines. Bedding materials observed in other areas of the disposal cell appeared to have the appropriate proportions of fines and coarse-grained materials, but were noted to possibly be overconcentrated in fines. Samples were not collected to perform gradation analyses of these materials. Cementitious material in the top 1–6 inches of the radon barrier was also observed in test pits located near the toe of the north and northeast side slopes. The origin of the cementitious material was not determined. Radiological gamma scans were conducted at all test pit locations, and no elevated readings relative to ambient conditions were observed.

An engineering review of information associated with the Gas Hills East, Wyoming, Disposal Site, an UMTRCA Title II disposal cell, where rill-type erosion occurred at the radon barrier and riprap layer interface, was also performed as part of this evaluation. The initial design of the Gas Hills East disposal cell did not include a bedding layer between the riprap and the radon barrier layers. This configuration was determined to be the root cause of the observed radon barrier erosion. Corrective actions implemented to address radon barrier erosion at the Gas Hills East site included the installation of a bedding layer between the riprap and radon barrier layers. Because the Mexican Hat disposal cell cover design already includes a bedding layer between the riprap and the radon barrier layers, the radon barrier erosion and the associated repairs that occurred at the Gas Hills East site have limited application for evaluating the depression features and radon barrier erosion at the Mexican Hat site.

Review of the original design calculations for the Mexican Hat disposal cell indicates that the specified riprap and bedding layers were properly sized for the PMP event. Test pit observations of the riprap and bedding layers have provided visual confirmation that the installed material thicknesses were installed as identified on the as-built drawings. However, observed segregated bedding materials in some of the test pits do not appear to meet the specified gradations.

Based on the characteristics of the observed voids, piping, and incisements, including their locations towards the lower portions of the north and northeast side slopes, and the lack of fines in the bedding/filter material in these areas (which would allow for higher runoff velocities in the bedding/filter material), it can be reasonably assumed that these features are the result of precipitation-induced erosion. No evidence of subsidence in these areas has been identified.

Further investigation and evaluation of the depression features, including materials sampling and testing in areas within and beyond the areas of depression features, is recommended to determine the cause(s) of distress, and to develop appropriate corrective actions. Materials sampling and testing will be conducted to determine where in situ side slope cell cover components (i.e., riprap, bedding layer, and the radon barrier) conform, or do not conform, with the engineering design and construction specifications. The investigation will focus on bedding layer gradation as well as the spatial distribution of cementitious material that has been observed immediately below the base of the bedding layer in test pits with observed radon barrier degradation; determining if the radon barrier is subject to degradation due to cation exchange, dispersive soils, or both; determining the lateral extent of RRM that was placed beneath the radon barrier near the toe of the northeast and north side slopes and under the drainage apron adjacent to the northeast side slope; and identifying potential sources and impacts of windblown material on the riprap rock surfaces and the sediment deposits in the northeast drainage apron.

Additional recommendations include ground-based light imaging, detection, and ranging (LiDAR) topographical surveys focused on the northeast side slope, aerial LiDAR topographical surveys of the entire disposal cell, aerial thermal surveys of the entire disposal cell, semiannual collection of horizontal and vertical survey data at the existing settlement plates located on the cell cover, procurement of a geotechnical engineering subject matter expert (SME) and a geomorphology SME to provide peer review during the design and future investigations, and performing interim radon barrier protection with suitable fill materials in areas with observed radon barrier degradation. This recommendation also includes the preparation and submittal of survey monitoring status reports subsequent to each combined LiDAR and settlement plate survey event. Survey monitoring status reports would include documentation and analysis of LiDAR and settlement plate survey data, identification of any observed changes in empirical survey data, and a compilation and review of data associated with onsite weather monitoring equipment.

The installation of a System Operation and Analysis at Remote Sites (SOARS)-based weather monitoring station that is equipped with a camera and capable of measuring precipitation totals and intensities has been completed to collect site-specific meteorological data. Data from the SOARS meteorological station are reviewed on a routine basis for rainfall events that have intensities greater than or equal to 0.16 inch in a 5-minute interval for the purpose of triggering an episode-based LiDAR survey to determine if additional materials have been removed as a result of the episodic rainfall event, causing the depressions to deepen or enlarge. Additionally, the SOARS equipment sends notifications when certain precipitation parameters are exceeded.

The Long-Term Surveillance Plan (LTSP) for the Mexican Hat disposal site provides criteria for maintenance and emergency measures at the site. Minor erosion or undesirable changes in riprap integrity on the disposal cell are considered to constitute a Priority 5 condition and should be addressed by conducting an evaluation to assess the associated potential impact(s) followed by the implementation of an appropriate response to address the problem(s). The cover depression features that are the subject of this evaluation were first identified during the annual site inspection in March 2016 and constitute a Priority 5 condition. The recommendation provided is consistent with the response actions for a Priority 5 condition. Based on the language in the LTSP, a breach of the disposal cell is interpreted as a breach of the entire cover (including the radon barrier), which would result in the exposure of RRM. No evidence of a breach has been identified throughout the compilation of this report and associated field activities. However, if there is evidence that erosion is continuing to deepen or enlarge the depression features to the extent that the release of tailings is imminent (Priority 2) or the cover is breached (Priority 1), emergency response actions would be initiated at the U.S. Department of Energy’s request to repair the cover.

1.0 Introduction

In 2016, multiple subtle depressions were identified in the rock cover along the toe and lower portions of the northeast side slope of the Mexican Hat Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I disposal cell. Due to concerns regarding the potential impacts of the cell cover depressions related to cell performance and erosion resistance, evaluations of the depressions and information related to the cell cover design were performed. This report provides the results of the evaluations and identifies a recommended path forward.

1.1 Purpose and Scope

The purpose of this evaluation is to assess the depression features and design documentation associated with the Mexican Hat disposal cell in an effort to determine the impacts related to cell cover performance and to identify needs for follow-up actions. The scope of the evaluation included conducting visual observations of the depressions, and limited small-area manual removals of the rock cover components to scan for radioactivity, to evaluate for conformance with the disposal cell design specifications, and to observe any apparent erosion on the surface of the radon barrier material. Reviews of disposal cell as-built drawings and supporting design calculations for the rock cover components were also included in the evaluations. In addition, circumstances that were considered to be similar at the Gas Hills East, Wyoming, UMTRCA Title II Disposal Site were reviewed to ascertain applicability to the Mexican Hat disposal cell cover depression features.

1.2 Site Description

1.2.1 Ownership and Location

The Mexican Hat disposal cell is located on the Navajo Reservation in southeast Utah. The 68-acre disposal cell is located on the approximately 119-acre disposal site. The site is held in trust by the United States of America for the Bureau of Indian Affairs; the Navajo Nation retains title to the land.

The site is located in San Juan County, Utah, in Sections 13 and 24, Township 42 South, Range 18 East, and in Sections 18 and 19, Township 42 South, Range 19 East, Salt Lake Principal Meridian. The disposal site is located approximately 1.5 miles southwest of the town of Mexican Hat, Utah, and 1 mile south of the San Juan River (see Figure 1 and Figure 2). The small Navajo community of Halchita is approximately 0.5 mile southwest of the site.

1.2.2 History

Texas-Zinc Minerals Corporation constructed the Mexican Hat Mill on land leased from the Navajo Nation and operated the facility from 1957 to 1963. In 1963, Atlas Corporation purchased the mill and operated it until it closed in 1965. A sulfuric acid manufacturing plant operated at the site from 1957 to 1970; Atlas continued operating the sulfuric acid manufacturing plant at the site until the lease expired in 1970 and control of the site reverted to the Navajo Nation.

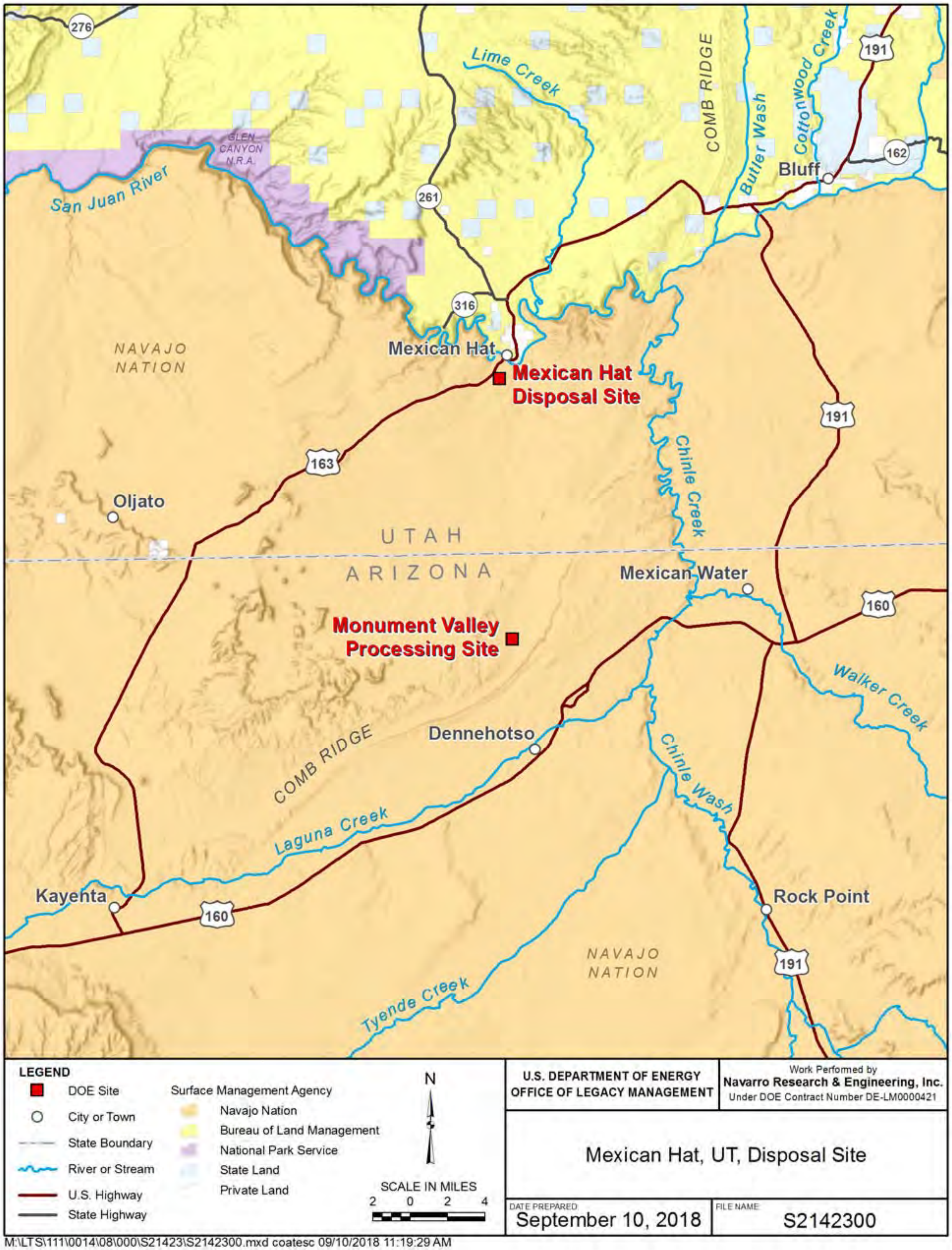

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Figure 1. General Location Map of the Mexican Hat, Utah, Disposal Site

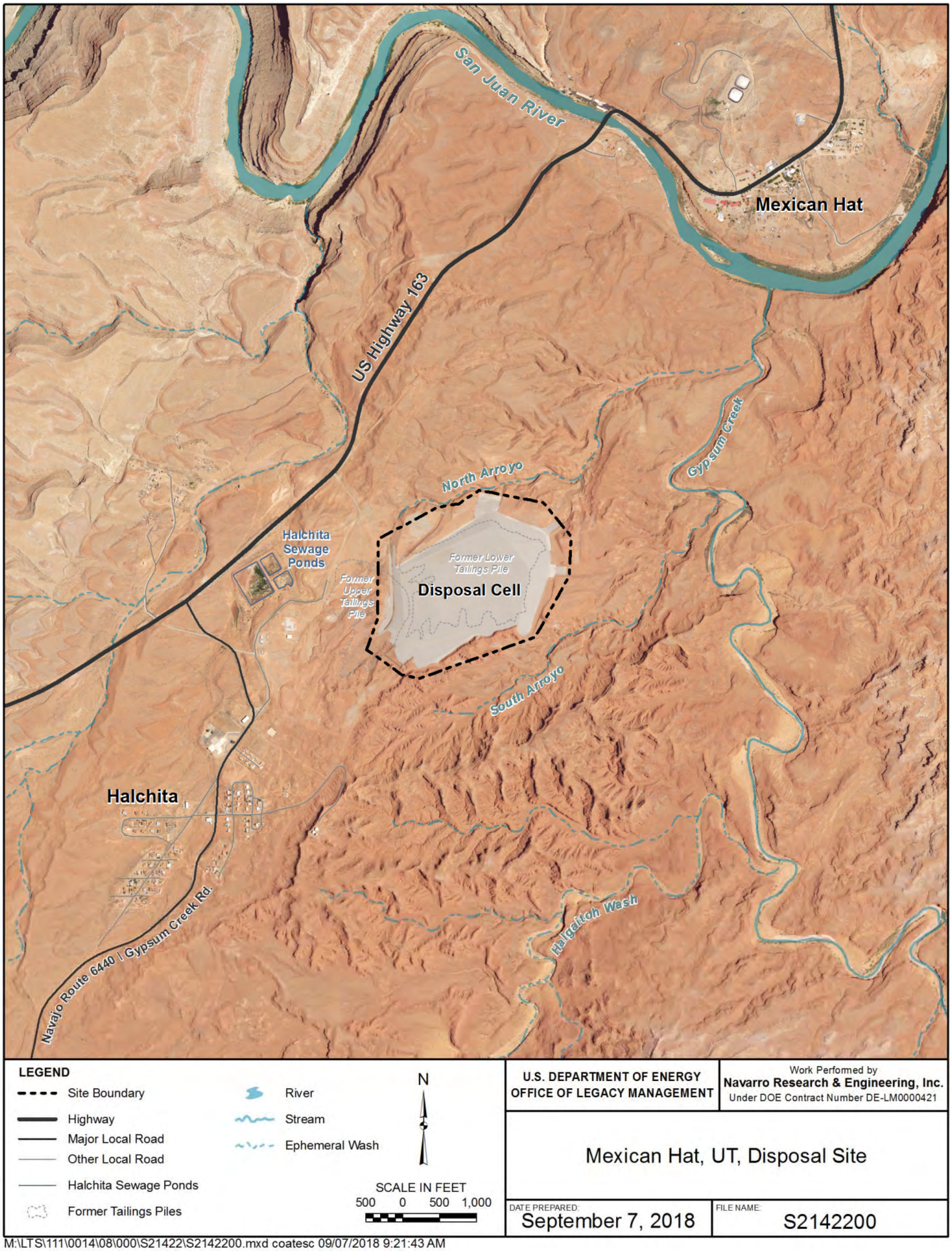

Figure 2. Mexican Hat, Utah, Disposal Site Vicinity Map

Ore brought to the mill contained a considerable amount of copper sulfide and other sulfide minerals and was processed to recover both copper and uranium. The milling process produced radioactive tailings, a predominantly sandy material. Spent tailings were mixed with process water and pumped through a pipeline to two onsite tailings piles: the former lower tailings pile and the former upper tailings pile (see Figure 2).

1.2.3 Mill Tailings Disposal and Cell Construction

The U.S. Department of Energy (DOE) remediated the site under the Uranium Mill Tailings Remedial Action (UMTRA) Project. Surface remediation and construction of the disposal cell was completed at the site in 1995. The pentagonal-shaped disposal cell was constructed at the location of the preexisting former lower tailings pile (see Figure 2). Radioactive materials from the former upper tailings pile, demolished mill structures, and 11 vicinity properties were relocated and placed on top of the preexisting tailings at the location of the former lower tailings pile. An additional 983,000 cubic yards (1.3 million dry tons) of tailings and associated wastes were subsequently hauled from the Monument Valley, Arizona, UMTRCA Title I Processing Site (located approximately 15 miles south of the site) and placed on top of the contaminated materials from the Mexican Hat site. A total of approximately 3.6 million cubic yards (4.4 million dry tons) of radioactive tailings and other residual radioactive materials (RRM) were ultimately encapsulated in the Mexican Hat UMTRCA Title I disposal cell.

The Mexican Hat disposal cell abuts a rock outcrop on its south side and rises approximately 50 feet above the surrounding terrain to the north, east, and west. The disposal cell was designed to encapsulate radioactive tailings and other RRM in a way that minimizes the need for active maintenance and limits radon gas emanation in accordance with UMTRCA. The cell was constructed with a 2% top slope transitioning to 20% side slopes (Figure 3), which drain into a surrounding rock perimeter channel. The perimeter channel discharges to three engineered toe drains (Figure 4) that drain into existing arroyos to the north and east of the cell.

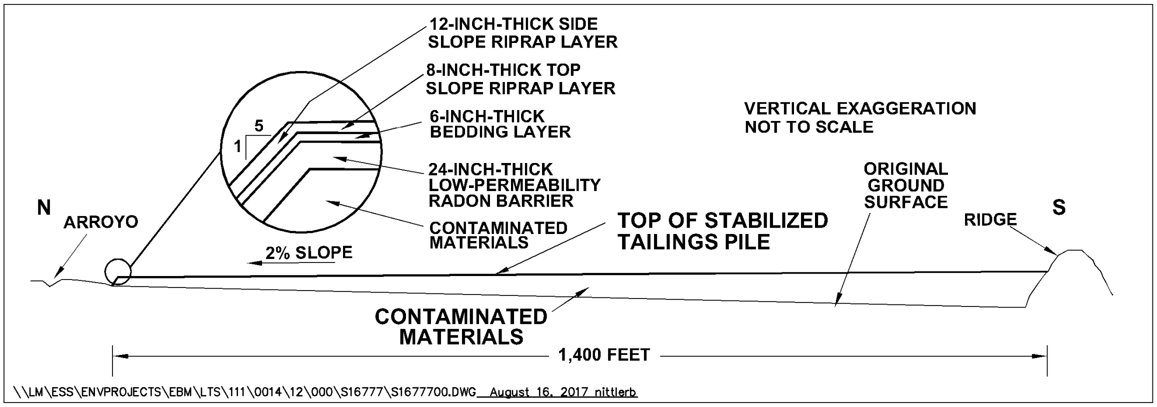

Figure 3. Typical North-South Cross Section of the Mexican Hat Disposal Cell

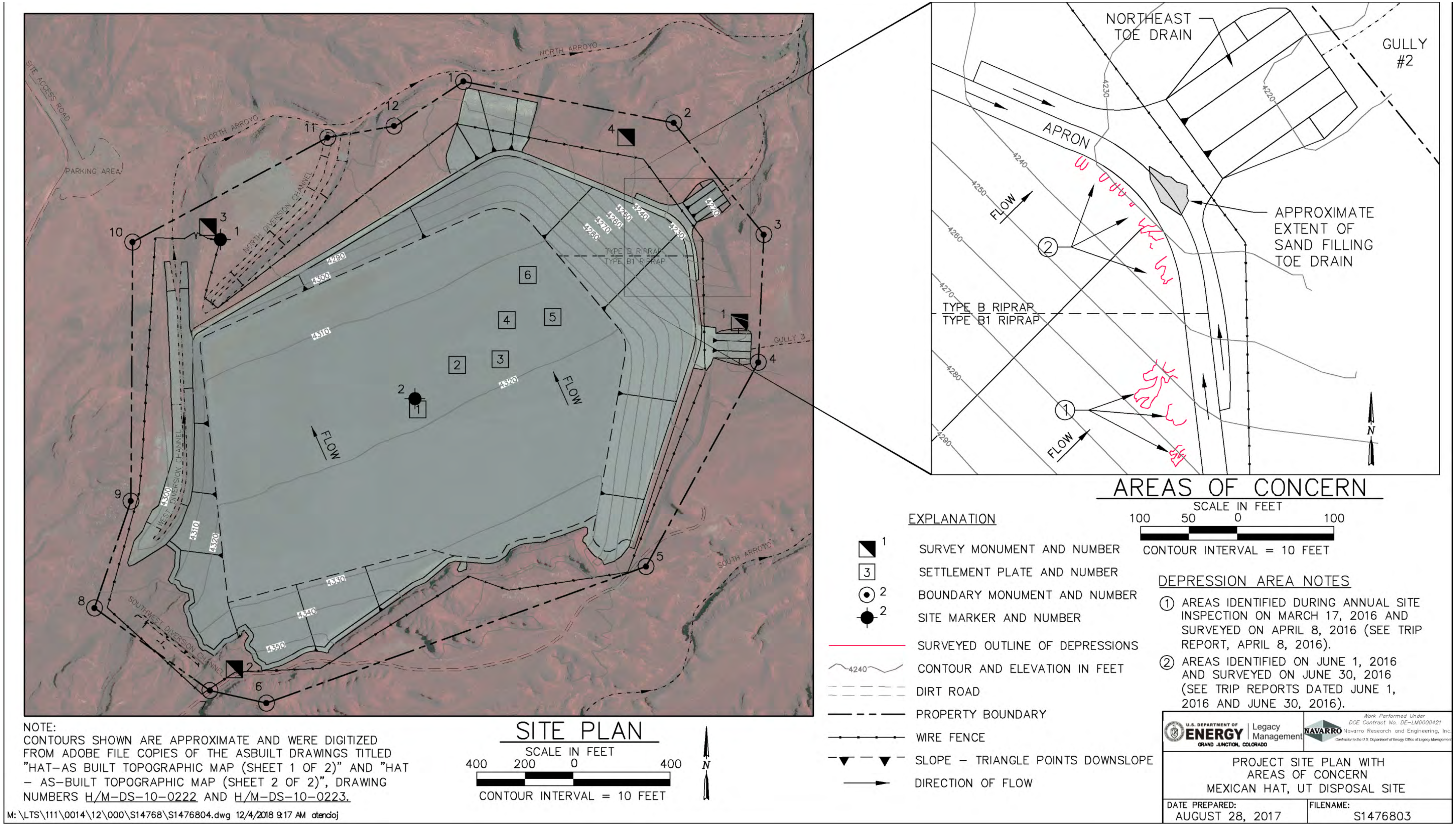

Figure 4. Project Site Plan with Areas of Concern

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The northeast side slope is the longest side slope on the Mexican Hat disposal cell. The longest distance from the top to the bottom of the northeast side slope (draining into the northeast toe drain) is approximately 460 feet. The northeast side slope constitutes an approximate surface area of 7 acres. Since the 2% top slope was contoured to direct runoff in a north to northwesterly direction, only a minor portion of runoff originating from the top slope of the disposal cell ends up on the northeast side slope; run-on to the northeast side slope from the 2% top slope of the disposal cell constitutes approximately 2.7 acres, or 6% of the 46.4-acre top slope. Thus, the combined watershed of the northeast side slope is approximately 10 acres (Figure 4).

1.2.4 Uranium Mill Tailings Radiation Control Act of 1978

UMTRCA was promulgated to protect human health and the environment from the hazards associated with uranium milling waste, and it established requirements for the safe and environmentally sound disposal, long-term stabilization, and control of uranium mill tailings and other RRM for the purposes of minimizing or eliminating radiation health hazards to the public. Title I of UMTRCA addresses processing sites that were no longer in operation when the law was passed. Most or all of the uranium produced at UMTRCA sites was sold to the federal government prior to 1971 (42 USC 7901 et seq.).

UMTRCA Title I sites were remediated by DOE under the UMTRA Project. In accordance with Title 40 *Code of Federal Regulations* Section 192 (40 CFR 192), waste disposal sites that are constructed for the control of uranium mill tailings and other RRM are designed to be effective for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years. Disposal sites are also designed and stabilized in a manner that minimizes the need for future maintenance and limits the release of radon-222 to the atmosphere to an average of no more than 20 picocuries per square meter per second ($pCi/m^2/s$).

The Mexican Hat disposal cell was designed and constructed in accordance with the *control standards* defined in 40 CFR 192. Surface remediation at the site was completed in 1995 to meet the *cleanup standards* defined in 40 CFR 192. When the depression features were identified along the northeast side slope in 2016, the disposal cell was approximately 20 years old, or 1/10th of its minimum design life mandated under UMTRCA.

1.2.5 Long-Term Surveillance Plan

LM manages the site in accordance with the 2007 site-specific Long-Term Surveillance Plan (LTSP) to ensure that the disposal cell and related infrastructure continues to function as designed. The LTSP describes how DOE will fulfill the general license requirements of 10 CFR 40.27 as the long-term custodian of the Mexican Hat UMTRCA Title I disposal site. LM and the Legacy Management Support (LMS) contractor conduct annual site inspections in accordance with the site-specific LTSP to verify the integrity of the disposal cell and its surface features, monitor and evaluate site infrastructure, surveillance, and security features, and perform minor site maintenance as necessary.

Table 3-2 of the 2007 Mexican Hat LTSP (Table 1) provides criteria for maintenance and emergency measures at the site. Based on this table, minor erosion or undesirable changes in riprap integrity on the disposal cell are considered to constitute a Priority 5 condition and should be addressed by conducting an evaluation to assess the associated impact(s) followed by the implementation of an appropriate response to address the problem(s). The cover depression features that are the subject of this evaluation were first identified during the annual site inspection in March 2016 and constitute a Priority 5 condition. Based on the language in the LTSP, a breach of the disposal cell is interpreted as a breach of the entire cover (including the radon barrier), which would result in the exposure of RRM. No evidence of a breach has been identified throughout the compilation of this report and associated field activities. DOE notified the U.S. Nuclear Regulatory Commission (NRC) and the Navajo Nation of the depression features in a letter dated May 5, 2016.

Table 1. DOE Criteria for Maintenance and Emergency Measures

Priority	Description[a]	Example	Response
1	Breach of disposal cells with dispersal of radioactive material.	Seismic event that exceeds design basis and causes massive discontinuity in cover.	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to prevent further dispersal, recover radioactive materials, and repair breach.
2	Breach without dispersal of radioactive material.	Partial or threatened exposure of radioactive materials.	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to repair the breach.
3	Breach of site security.	Human intrusion, vandalism.	Restore security; urgency based on assessment of risk.
4	Maintenance of specific site surveillance features.	Deterioration of signs, markers.	Repair at first opportunity.
5	Minor erosion or undesirable changes in riprap integrity or vegetation.	Erosion not immediately affecting disposal cell, change in riprap protection layer thickness.	Evaluate, assess impact, respond as appropriate to address problem.

Note:
[a] Other changes or conditions will be evaluated and treated similarly on the basis of perceived risk.

Observations and materials sampling and testing results from future site visits will continue to be used to evaluate the prioritization conditions established in Table 3-2 of the 2007 Mexican Hat LTSP (Table 1).

2.0 Components of the Mexican Hat Disposal Cell Cover

This section consists of a review and discussion of the Mexican Hat disposal cell cover component as-builts, and a review of the design calculations and the basis of design supporting the cover system. Photographs of the disposal cell during construction and the placement of cover component materials are also provided to illustrate how the disposal cell was constructed.

2.1 Cover Component As-Builts

The components of the protective cover materials placed over the compacted tailings on the side slopes of the Mexican Hat disposal cell include a radon barrier layer, a bedding/filter layer, and a rock riprap erosion-protection layer as shown in Figure 5. The disposal cell cover system, which includes top slope and side slope configurations and associated drainage structures on the cell apron area, was designed to promote sheet flow runoff during precipitation and snowmelt events and to prevent erosion of the radon barrier. Material descriptions and construction as-builts were obtained from Volume 2 of the Final Completion Report for the Mexican Hat and Monument Valley UMTRCA Title I sites[1]. Review of the final construction as-built drawings (see Appendix C3 pp. 65–84) indicate that contaminated materials (i.e., radioactive tailings and other RRM) may directly underlie the areas where the depression features have been observed. In particular, drawing number H/M-DS-10-0216, Sections C0219 and D0219 (Appendix C3, p. 74), depicts contaminated materials extending all the way to the base of the 20% side slope; section D0219 depicts contaminated materials extending beneath the transition zone from the northeast side slope to a portion of the 4% apron consisting of riprap Type C manufactured limestone that directs runoff to the northeast toe drain.

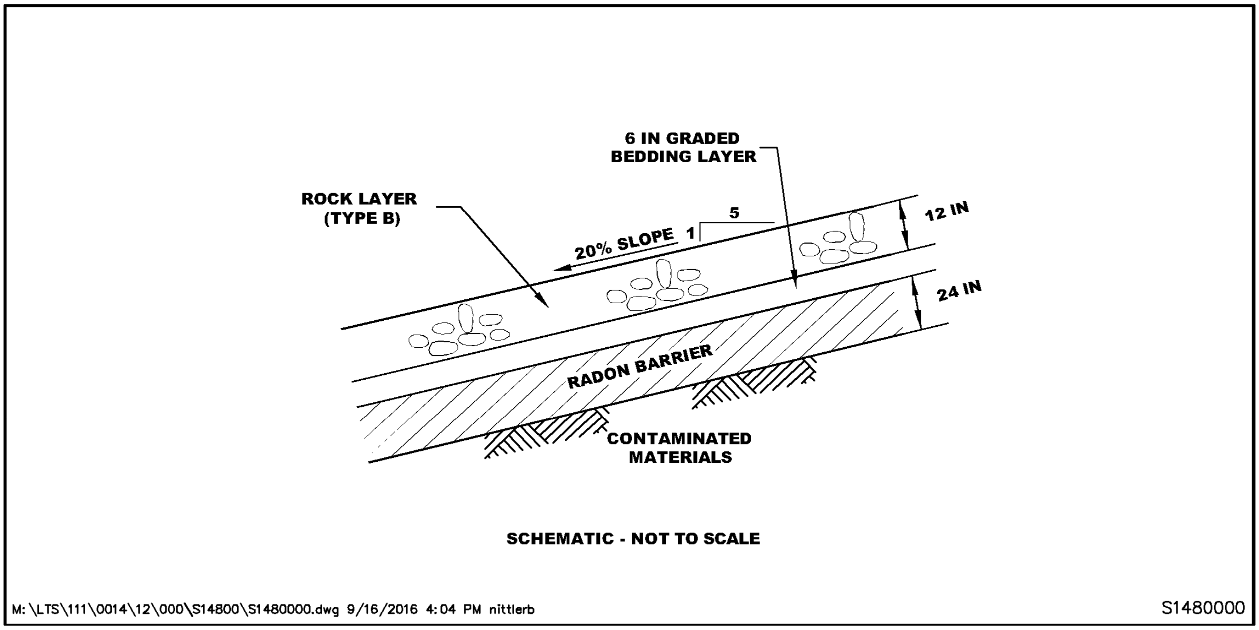

Figure 5. Mexican Hat, Utah, Disposal Cell Cover Components

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[1] MK-F (MK-Ferguson Company), 1997. *Mexican Hat, Utah, Monument Valley Arizona, Completion Report*, prepared by MK-Ferguson Company for the U.S. Department of Energy, UMTRA Project Team, Environmental Restoration Division, Albuquerque, New Mexico.

2.1.1 Radon Barrier

The low-permeability radon barrier directly overlies the compacted tailings. It consists of native fine-grained borrow material amended with 10% bentonite. The sources of the borrow material were located approximately 5 miles south of the site, called RB-4 and RB-7. The bentonite was amended to the borrow source material using a pug mill.

The radon barrier was designed to retard the emanation of radon gas from the tailings embankment into the atmosphere in accordance with UMTRCA and to minimize meteoric water infiltration. The radon barrier material is a 24-inch-thick layer that was placed in approximately three equal lifts and compacted to 100% of a reference density determined by the ASTM D698 method. The radon barrier materials were specified to conform to the following gradation limits listed in Table 2[2].

Table 2. Radon Barrier Gradation Specifications for the Mexican Hat, Utah, Disposal Site

U.S. Standard Sieve Size (square openings)	Percent Passing (by weight)
4 inch	100
3/4 inch	70–100
No. 4	50–100
No. 60	15–100
No. 200	5–100

2.1.2 Bedding Layer

The 6-inch-thick bedding/filter layer consists of manufactured materials that were sourced from the Bluff gravel quarry located approximately 30 miles northeast of the site near Bluff, Utah. The bedding layer materials were placed over the radon barrier to act as a construction bedding layer and as a graded filter material prior to placement of the overlying riprap rock layer. The smaller-sized bedding filter material was designed to protect the underlying radon barrier material from particle removal via interstitial flows through the overlying larger riprap material during precipitation and associated runoff events. The bedding layer material is classified as a sandy gravel with few fines (GC or GM), and was specified to conform to the following gradation limits listed in Table 3[3].

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[2] Ibid.

[3] Ibid.

Table 3. Bedding Layer Gradation Specifications for the Mexican Hat, Utah, Disposal Site

U.S. Standard Sieve Size (square openings)	Percent Passing (by weight)
3 inch	100
1-1/2 inch	50–100
1 inch	35–70
No. 4	10–30
No. 30	0–10 (0-5)[a]
No. 100	0–5 (0)[a]

Note:
[a] The bedding gradation limits were revised prior to placement by deleting the No. 100 sieve size and modifying the No. 30 sieve size to 0-5 percent passing by weight. (Morrison-Knudsen design calculations 09-418-05-01, page 18 (see Appendix B)

2.1.3 Rock Layer Materials

The riprap rock layer materials are the largest and uppermost components of the disposal cell erosion-protection cover system and directly overlie the bedding layer. The riprap is a screened, river-run material that was sourced from the Bluff gravel quarry located approximately 30 miles northeast of the site near Bluff, Utah. The gradation sizes of the riprap materials vary and were determined based on the slope grades and the final cell geometry. Three types of riprap were used for the finish grade of the disposal cell. Type A riprap was used on the flat (2%) top slopes, and Types B1 and B were used on the 20% side slopes where the surface depressions on the cover have been observed. The 12-inch-thick Types B and B1 riprap materials were specified to conform to the following limits listed in Table 4 and Table 5, respectively[4].

Table 4. Type B Riprap Gradation Specifications for the Mexican Hat, Utah, Disposal Site

U.S. Standard Sieve Size (square openings)	Percent Passing (by weight)
8 inch	100
6 inch	25–100
5 inch	0–100
4 inch	0–25
1 inch	0–5

Table 5. Type B1 Riprap Gradation Specifications for the Mexican Hat, Utah, Disposal Site

U.S. Standard Sieve Size (square openings)	Percent Passing (by weight)
5 inch	100
4 inch	0–100
3 inch	0–50
2 inch	0–25
No. 4	0–5

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[4] Ibid.

Figure 4 shows the general layout of the site, including security and surveillance features, engineered drainages and diversion channels, runoff directions, and the observed locations of the depressions in relation to the dividing line between the Type B and Type B1 riprap on the northeast side slope.

2.2 Review of the Design Calculations and Basis of Design

A uranium mill tailings disposal cell is designed and constructed to effectively contain stabilized mill tailings and other RRM for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years (40 CFR 192.02). Additional control standards defined in 40 CFR 192.02 include, among other things, providing reasonable assurance that releases of radon-222 to the atmosphere from uranium mill tailings and other RRM will not exceed an average release rate of 20 $pCi/m^2/s$.

The configuration and composition of a multicomponent UMTRCA disposal cell cover is designed to adhere to the UMTRCA control standards. Radon barriers are designed to limit radon gas emanation and meteoric water infiltration. The overlying riprap and bedding layers are designed to protect the radon barrier from erosion and to minimize the need for active maintenance of the disposal cell.

In the case of the Mexican Hat disposal cell, the radon barrier is composed of local silty sands with a 10% bentonite amendment. The bentonite amendment was added to reduce the permeability of the silty sands that were used for the radon barrier. The erosion-protection cover components at the site (i.e., a sandy gravel bedding/filter layer and an overlying rock riprap layer) were constructed over the radon barrier to protect the radon barrier from wind and water erosion.

The design basis of an UMTRCA disposal cell begins with a review of meteorological data and determination of a probable maximum precipitation (PMP) event. The PMP event is used as a basis for determining the appropriate size(s) and thickness(es) of the erosion-protection cover components. The gradation sizes of the bedding/filter material are determined using accepted procedures to prevent “piping” of soils as discussed in Cedergren (1989)[5] and as specified in the Bureau of Reclamation *Earth Manual* (1980)[6].

The LMS contractor conducted a review of the original design calculations that were used to determine the basis of design for the Mexican Hat Title I disposal cell. The review concluded that both the hydrology and cover design calculations were correct and followed current acceptable standards.

2.2.1 Hydrology Design Calculations Review and Summary

Based on the hydrology design calculations (No. 09-223-01-02, see Appendix A) prepared by Morrison-Knudsen (the remedial action contractor that built the cell), the design storm event used to determine the rainfall intensity and unit discharge sheet flow rates for the Mexican Hat

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[5] Cedergren, H.R., 1989. *Seepage, Drainage and Flow Nets*, 3rd ed., John Wiley and Sons, New York.

[6] U.S. Department of Interior, 1980. *Earth Manual*, 2nd ed. Bureau of Reclamation, U.S. Government Printing Office, Washington, D.C.

disposal cell was the probable maximum precipitation (PMP) 1-hour storm. At the Mexican Hat site, a PMP 1-hour storm of 8.1 inches was determined following the procedures provided in Hydrometeorological Report 49 of the National Weather Service. On the basis of procedures outlined in NRC document NUREG-4620[7], the PMP and a calculated time of concentration (T_c) were used to calculate the rainfall intensity. The duration T_c is the time required for a drop of water to flow the longest distance across the disposal cell. The T_c value for the Mexican Hat cell was calculated to be 2.5 minutes; incorporating this T_c value results in a calculated rainfall intensity of 53.5 inches per hour. The 53.5 inches per hour rainfall intensity was then used to calculate the flow velocities that the erosion-protection materials need to resist when developing the design parameters of the Mexican Hat disposal cell.

Review of the hydrology computations indicates that the design rainfall intensities were accurately determined at the time the cell was designed and adhere to current acceptable standards. The design flows generated from these hydrology calculations were used to size the riprap cover materials. Although NRC NUREG-4620 has been superseded by NRC NUREG-1623[8] since the Mexican Hat disposal cell was designed and built, NUREG-1623 provides the same procedure as NUREG-4620 for computing the intensity duration storm event.

2.2.2 Cover Design Calculations Review and Summary

The Mexican Hat cover design calculations prepared by Morrison-Knudsen were obtained from the historical records and reviewed. Sizing calculations for the Types B and B1 rock riprap layers are included in Morrison-Knudsen design calculations No. 09-418-14-00 and No. 09-418-05-01 (see Appendix B, p. 1, and Appendix B, p. 19). These calculations followed the procedures outlined in NUREG-4620 and were the basis for the design criterion for sizing the riprap on preventing erosion under PMP conditions.

Review of the riprap sizing computations indicates that the rock was properly sized following acceptable procedures outlined in the updated NUREG-1623; the calculated sizing was properly reflected in the riprap specifications for both the top slope and side slope materials to accommodate the design PMP event. The updated NUREG-1623 procedure was used to review the calculations, since the superseded NUREG-4620 procedure lacked quantitative criteria for assessing material displacement based on a range of interstitial velocities; NUREG-1623 provides the same procedures for design purposes and provides quantitative criteria.

Calculations supporting the sizing of the bedding/filter layer materials were found in Morrison-Knudsen design calculations 09-418-05-01 (see Appendix B) and were determined to be correct. However, a new calculation check of the filter criteria between the Type B and Type B1 riprap erosion-protection layers and the bedding layer was conducted, confirming that the radon barrier would be adequately protected by the overlying specified bedding and riprap layers based on the disposal cell design specifications (see Section 5.0). Furthermore, a variation between the proposed design gradation in the Morrison-Knudsen calculation and the specified gradation in the project specifications exists at the Nos. 30 and 100 sieve sizes. The original calculation proposed 0–5% passing the No. 30 sieve size, whereas the specified gradation

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[7] Nelson, J.D. et al., 1986, *Methodologies for Evaluating Long-Term Stabilization Designs of Uranium Tailings Impoundments*, U.S. Nuclear Regulatory Commission, NUREG/CR-4620.

[8] U.S. Nuclear Regulatory Commission, 2002. *Design of Erosion Protection for Long-Term Stabilization*, NUREG-1623.

allowed for 0–10% passing the No. 30 sieve size. An additional criterion of 0–5% passing the No. 100 sieve size was also added to the specified gradation (see Section 2.1.2). Based on the provided calculations, neither of these sieve size design variations would negatively affect the performance of the bedding/filter layer.

2.3 Construction Material Placement and Quality Control Requirements

2.3.1 Relocation and Placement of RRM and Other Contaminated Material

The Completion Report for the site discusses a work stoppage during the construction of the cell. There is no reason for the stoppage listed, but it does indicate there was no work conducted on the cell from November 1990 until March 1993, a period of approximately 27 months. The report states that at the time of stoppage, RRM and other contaminated materials from the Monument Valley site were still being placed on the cell. Prior to demobilizing from the site during the work stoppage, the exposed contaminated fill surface was treated with a soil sealer. No radon barrier material was placed prior to the work stoppage demobilization. When work began on the cell again in March 1993, the Completion Report states that prior to the placement of any additional materials, the site was recompacted, and compaction was reverified. The Completion Report does not state whether additional contaminated fill was added at that time.

According to the Completion Report, as contaminated material was placed, it was monitored to verify that it was free of excessive organic material and large debris. It was placed in 12-inch loose lifts and then compacted. The compaction criteria were 90% compaction for the interior of the cell and 95% compaction for the top 3 feet of the cell. A total of 2961 compaction tests were administered during the construction of the cell. Of the 2961 tests taken, 180 compaction tests did not pass, and these areas were recompacted and retested until passing results were obtained[9].

2.3.2 Demolition Debris and Bulk Material Placement

The Completion Report does not specify the exact location of the demolition debris or bulk material within the disposal cell. However, the Completion Report states that the demolished mill facilities, including debris and asbestos-containing materials, were placed in the lower lifts of the disposal cell. This is consistent with design specifications that required the larger and more contaminated material to be placed first, in the lower portions of the disposal cell. There is no evidence of larger contaminated material placed near the edges of the side slopes; primarily windblown material was placed on the side slopes (see photographs in Section 2.4 from 1989 construction). Based on information and pictures contained in the Completion Report, it appears that the placement of the contaminated materials adhered to the design and specification requirements.

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[9] MK-F (MK-Ferguson Company), 1997. *Mexican Hat, Utah, Monument Valley Arizona, Completion Report*, prepared by MK-Ferguson Company for the U.S. Department of Energy, UMTRA Project Team, Environmental Restoration Division, Albuquerque, New Mexico.

The Completion Report discusses the design criteria that required NRC, DOE, and Navajo Nation approval and the Design Basis Memoranda (DBM) that assured the design criteria were met (see Appendix F2). The DBM established for the decontamination and the demolition of structures specified the following:

> Foundation and rubble piles be broken up in specific sizes to facilitate their disposal. Debris to be placed in layers, and tailings compacted within and around the individual pieces of debris in order to eliminate voids and nesting, and thereby minimize differential settlement. Organic materials such as wooden demolition debris and grubbed vegetation be evenly distributed throughout the lower portion of the disposal embankment so as not to exceed 5 percent by volume in any lift. Alternately, large volumes of organic materials be buried elsewhere on the site (away from the tailings) where differential settlement is of less concern or be removed from the site if monitored and found safe.

The DBM established for tailings materials excavation and final embankment, contained in Appendix F2, specified the following:

> The relocated contaminated materials placed above the existing lower tailings piles will be densified by compaction or some other means to reduce the potential for long-term differential settlement.
>
> The embankment construction will be sequenced to place lesser contaminated materials over more highly contaminated materials to reduce radon exhalation. The embankment will be comprised as follows, in order from bottom to top:
>
> a. In-situ tailing piles.
>
> b. Relocated materials from the mill area and the ore storage area at Monument Valley; rubble pieces will be placed on the top of the existing tailings embankment and surrounded with compacted relocated soils.
>
> c. Heap leach pad area at Monument Valley.
>
> d. Monument Valley tailings.
>
> e. Relocated, contaminated materials from the windblown and waterborne deposit areas.
>
> f. Contaminated materials from temporary facilities.

The project specification for demolition (02050, page 4), contained in Appendix F1, required the following in regard to the larger pieces of contaminated materials:

> Demolished materials, consisting of steel, concrete, wood, masonry and other man-made materials, rubble, debris and boulders shall be reduced in size to pieces to be no greater than 3 feet in any dimension and no more than 27 cubic feet in volume.
>
> Metal objects with voids shall be crushed to sizes no greater than 27 cubic feet in volume, with the least dimension not exceeding 6 inches.
>
> Any pipe, conduit and ducts shall be cut to sizes no greater than 10 feet in length.

In the Completion Report Appendix E, "Materials Testing Summary Report," the Contaminated Fill Material section (see Appendix F3 of this report) states:

> All contaminated material and debris resulting from demolition of the old Halchita/Mexican Hat Mill foundation, and associated structures, and from off-site vicinity properties during Phase I, were cut or broken into sizes meeting specified requirements before placement in the cell embankment.
>
> Where contaminated fill material contained individual pieces larger than the 12 inch loose lift thickness, the lift thickness was verified as minimum constructible thickness and materials were spread to ensure a void free mass and provide adequate compaction between larger particles.
>
> During placement of contaminated fill material, continuous visual inspection was performed to ensure that organic materials did not constitute more than five percent of the placed volume. Also, demolition debris and organics were evenly distributed throughout the fill to avoid concentrations. Individual linear pieces of wood, steel and plastic were cut or broken into pieces not greater than 10 feet in length; similarly, pieces of concrete, rock, masonry and steel was sized down to be less than 3 feet in any dimension and/or less than 27 cubic feet in volume[10].

Based on the design specifications and review of information contained in the Completion Report, there is no indication that demolition debris or bulk materials were placed in any fashion that would promote subsidence along the side slopes of the disposal cell.

2.3.3 Radon Barrier

The radon barrier material is a 24-inch-thick layer that was placed in 10-inch loose lifts and then compacted to 100% dry density of a reference density determined by the ASTM D698 method. There were 642 compaction tests administered during the construction of the cell. According to the Completion Report, of the 642 tests taken, 102 compaction tests did not pass, and these areas were recompacted and retested until passing results were obtained[11].

2.3.4 Bedding Layer

Photo documentation in the Completion Report indicates that at least some of the bedding material was placed and spread on the side slopes from the top of the slope and pushed to the toe of the slope with a dozer. There is no indication as to how much of the bedding material was placed in this manner, and the Completion Report does not specify how the bedding materials were placed.

Gradation testing was required of the bedding material at a frequency of one test for each 10,000 cubic yards of bedding material placed. There was 59,992 cubic yards of bedding material placed, providing an average test frequency of one gradation test for every 3333 cubic yards of bedding material placed. There were 18 gradation tests taken, with no failing tests. The

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[10] Ibid.

[11] Ibid.

Completion Report does not state where the gradation tests were taken, whether at the gravel pit, onsite, or before or after placement.

The specifications for the project required that the erosion-protection materials be handled, loaded, transported, stockpiled, and placed in a manner that avoided nonconformance with specifications due to segregation and degradation, including materials moved to and from stockpiles. The bedding material was moved twice prior to being placed, according to the Completion Report. It was first moved to a stockpile at the gravel pit using a front-end loader. From the stockpile it was moved with a front-end loader to load double-belly tractor trailer trucks. The trucks then transported the bedding material to the cell, which was subsequently placed directly on the final grade of the radon barrier using a motor grader and a dozer.

Once the bedding material was placed, a dozer was required to make two passes over the placed material as a performance specification. No numerical compaction was specified. The specified depth of the bedding layer was 0.5 foot plus or minus 0.1 foot, for an allowable thickness ranging from 0.4 to 0.6 foot. The depth of the material was tested 156 times, a minimum of one test per 200 foot × 200 foot area, with three depth tests not passing. The areas where the depth did not pass were reworked and retested until passing results were obtained. The average thickness of the bedding material was 0.56 foot, with a low of 0.38 foot and a high of 0.69 foot, according to the Completion Report for the project[12].

2.3.5 Rock Layer Materials

Gradation testing was required as follows: an initial test of the Type B riprap during the early stages of the placement, one test each when approximately one-third and two-thirds of the total volume of material had been placed, and a final test near completion of the placement, for a total of four tests. According to the Completion Report, 20,760 cubic yards of Type B riprap was placed on the disposal cell. A total of eight tests were taken, providing an average test frequency of one gradation test for every 2595 cubic yards of Type B riprap placed. There were no failing tests. The thickness of the Type B riprap was specified to be a minimum depth of 1 foot and a maximum thickness of 135% of the minimum, or 1.35 feet. There were 26 thickness tests taken with an average thickness of 1.11 feet, a low depth of 1.02 feet, and a high depth of 1.29 feet meeting the specification.

According to the Completion Report, the same manner of gradation testing required for the Type B riprap was also required for the Type B1 riprap, for a total of four tests. According to the Completion Report, 25,704 cubic yards of Type B1 riprap was placed on the disposal cell. A total of four tests were taken, providing an average test frequency of one gradation test for every 6426 cubic yards of Type B1 riprap placed. There were no failing tests. The thickness of the Type B1 riprap was specified to be a minimum depth of 1 foot and a maximum thickness of 135% of the minimum, or 1.35 feet. There were 26 thickness tests taken with an average thickness of 1.09 feet, a low depth of 1.04 feet, and a high depth of 1.20 feet, meeting the specification[13].

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[12] Ibid.

[13] Ibid.

2.4 Historical Construction Photographs of Cell Construction/Placement of Bedding and Riprap Materials

The following photographs were taken during the construction of the Mexican Hat disposal cell cover. The equipment and materials shown provide a quick view of the means and methods employed to place the cover component materials. Each photograph is date-stamped and includes a brief description of the activity being performed. Based on the compilation of the available records associated with the disposal cell Completion Report, not all photographs included within the following pages are relevant for the purposes of this evaluation report.

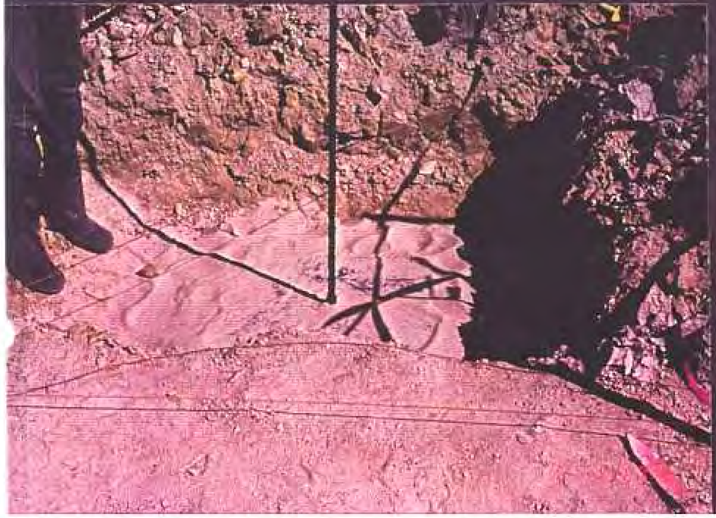
Cell: QC monitoring, loose lift thickness retest after surface was cut by Cat 14G grader — Passed.

5-14 03/02/89

QC-Hat Site-06

Cell, northeast corner: Subgrade surface.

6-1 03/13/89



Cell, Displacement monument: Prior to placing tailings over foundation base.

6-3 03/13/89

Cell, Displacement monument: Contaminated tailings placed over foundation base — Compaction effort.

6-5 03/13/89

Cell, Displacement monument: After compaction of tailings placed over foundation base — QC monitoring, sandcone density test.

6-6 03/13/89

Cell, 5:1 slope area: Cat 631 scraper, delivering and spreading contaminated windblown material.

6-15 03/21/89

Cell, 5:1 slope area: QC verifying contaminated windblown material compaction, sandcone density test.

6-17 03/23/89

QC-Hat Site-07

Hat Site: Health Physics personnel, verification of contaminated windblown material cleanup.

7-6 03/28/89

QC-Hat Site-08

Cell: Cat 65 challenger tractor / 5x5 tag-a-long sheep's-foot roller, compaction effort — Contaminated windblown material. Note excavations for sandcone density testing (visible in distance).

8-13 04/06/89

QC-Hat Site-09

Cell: QC monitoring, loose lift thickness test — Contaminated tailings fill material.

9-14 04/18/89

Cell: QC monitoring, sandcone density test.

9-16 04/19/89

QC-Hat Site-10

Cell, 5:1 slope area: Cat 65 challenger tractor / 5x5 tag-a-long sheep's-foot roller, compaction effort — Contaminated windblown material.

10-5 04/25/89

QC-Hat Site-11

Cell, 5:1 slope area: Cat 65 challenger tractor / 5x5 tag-a-long sheep's-foot roller, compaction & Cat 10,000 gallon water-wagon, moisture conditioning efforts — Contaminated windblown material.

11-14 05/15/89

Cell, 5:1 slope area: Cat 631B scraper, delivering and spreading contaminated windblown material.

11-17 05/16/89

Hat Site, Mill-Site: Cat 416 backhoe / hydraulic impact hammer, demolishing contaminated concrete structures.

11-25 05/17/89

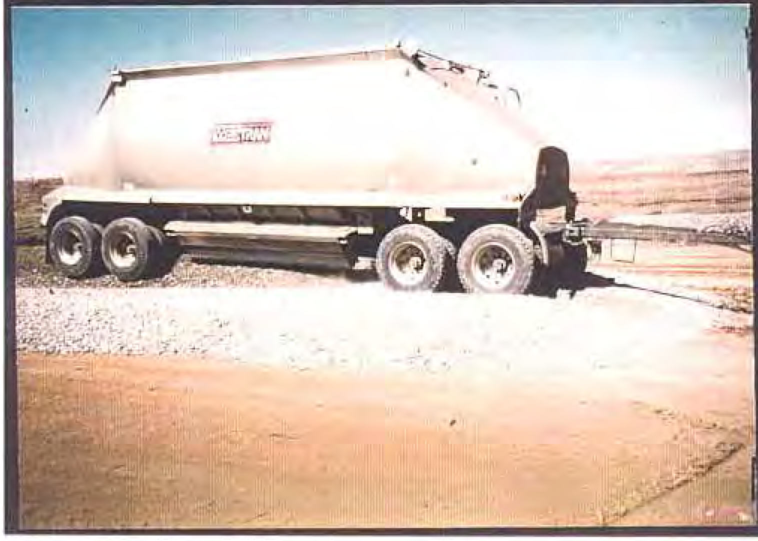
QC-Hat Site-79

Hat Site, QC laboratory trailer yard: MK QC personnel, gradation analysis test type C erosion protection material (hand separation via sieving grids).

79-4 05/03/94

Cell: Radon gas flux point #99.

79-19 05/10/94



QC-Hat Site-80

Cell, 2% slope area: Semi-trailer-pup belly-dump, delivering bedding material over approved radon barrier material surface.

80-22 05/19/94

Cell, overview of 2% slope area: Semi-trailer-pup belly-dump, delivering bedding material over approved radon barrier material surface.

80-23 05/19/94

Cell: QC verification, third (final) lift of radon barrier material — Loose lift thickness check.

80-25 05/20/94

QC-Hat Site-81

Cell, north 5:1 slope area: QC person, sandcone density test with type C erosion protection material stockpile in background.

81-3 05/21/94

Hat Site, type C erosion protection material stockpile area: Dimensional analysis — Evaluation of type C erosion protection material.

81-8 05/25/94

QC-Hat Site (RICOH) 02

Cell, 2% slope area: Dozer, trackwalking compaction efforts on bedding material — Prior to final grade, depth and gradation checks.

(RICOH) 02-3 06/10/94

Cell, test pad area: Dozer, cutting type A erosion protection material to thickness.

(RICOH) 02-5 06/15/94

Cell, 2% slope area: Volvo end-dump articulated rock truck, delivering type A erosion protection material over approved bedding material surface.

(PENTAX) 02-16 06/14/94

QC-Hat Site-83

Cell, displacement monument area: Excavation preparations for installation.

83-18 01/12/94

Cell, displacement monument area: sandcone density test.

83-21 01/13/94

Cell, overview of northeast 5:1 slope radius area: Bedding material application activities over approved radon barrier material surface.

(PENTAX) 05-24 07/09/94

QC-Hat Site-84

Cell, north 5:1 slope area: Cat water-wagon, moisture conditioning radon barrier material.

84-3 07/18/94

Cell, 2% slope area: Dozer / weighted pipe, final grading of type A erosion protection material surface.

84-7 07/19/94

Cell, south perimeter: Excavation of surface to in-situ bedrock at grade.

87-11 08/27/94

Hat Site, gully 3: Visibly non-testable (according to ASTM standards, >30% retained on ¾" sieve) common fill material.

87-20 08/31/94

QC-Hat Site-88

Hat Site, overview of west ditch: Dozer, trackwalking effort (two passes observed), bedding material placement activities - Approved subgrade surface.

88-9 09/07/94

QC-Hat Site-75

Hat Site, overview Pug Mill: Setting up and stockpiling material for radon barrier material production.

75-4 03/01/94

Hat Site, Pug mill: Production and load out of radon barrier material into scraper, for delivery to cell.

75-22 04/15/94

Cell, west side at 2% — 5:1 slope transition: Finished grade — Before radon barrier material application.

75-23 03/15/94

QC-Hat Site-76

Cell, west 2% slope area: Finished grade — Before radon barrier material application.

76-3 03/16/94

Cell, 2% slope area: QC monitoring, loose lift thickness test — Radon barrier material.

76-4 03/17/94

Cell, 2% slope area: Cat 825 Sheep's-foot roller, compaction effort — Radon barrier material, first of three lifts.

76-5 03/18/94

Hat Site, north side - toe of 5:1 slope: QC personnel, verification of competent in-situ rock — Drilling to refusal with auger drill.

76-14 03/23/94

QC-Hat Site-77

Cell, west 2% slope area: Cat 631 scraper, delivering radon barrier material.

77-19 04/07/94

Cell, west 2% slope area: QC testing — Sandcone density test on second of three lifts of radon barrier material.

77-24 04/12/94

3.0 Existing Mexican Hat Disposal Cell Cover Conditions

This section describes the current conditions of the Mexican Hat disposal cell cover. The current knowledge of existing Mexican Hat disposal cell cover conditions has been gained through annual site inspections and subsequent follow-up site visits to further investigate the cover depression features. Additionally, available precipitation data for the area are summarized in this section.

3.1 Site Inspections and Visits

3.1.1 2016 Annual Inspection, March 17, 2016

The 2016 annual site inspection was conducted on March 17, 2016. This was the first time the depression features were observed on the northeast side slope (see Area 1 on Figure 4). The 2016 Annual Site Inspection Report is included in Appendix C1.

3.1.2 Site Visit Report (Follow-Up to Annual Inspection) April 8, 2016

A follow-up site visit to focus attention on the area where depressions were first observed was made on April 8, 2016 (See Site Visit Report in Appendix C2 and Area 1 on Figure 4). The inspection team identified an area 80 feet × 100 feet to obtain topographic survey information of the observed depressions features. The mapped depression features in Area 1 were approximately 10–50 feet in length.

Radiological scanning for radon gas and gamma radiation was also conducted during this site visit. An Alpha Nuclear model 597-PX3 radon gas monitor was used to determine radon levels at a background location outside the site fence and at the depression areas. Radon readings at the depression areas were consistent with background readings. Similarly, a Mount Sopris model SC-132/EL-0047 crutch scintillometer was used to determine if elevated gamma radiation levels were present at the depression areas. Gamma scans were performed at a range of background locations outside the site fence and then compared with scans conducted at the depression areas. The gamma scans performed at the depression areas did not exhibit differences compared to those observed at the background locations. Based on the radiological scanning performed during this site visit, RRM has not been exposed at the depression areas.

The inspection team also removed the riprap and bedding cover materials by hand to expose a portion of the top of the radon barrier in one location during this follow-up site visit. The top of the radon barrier was exposed in a small area of approximately 10 inches in diameter. The last photograph of the Site Visit Report shown in Appendix C2 (p. 8) appears to show that the bedding layer material is extremely segregated with little fines. In addition, a small erosion channel 6 inches wide × 4–5 inches deep in the radon barrier was observed running parallel to the side slope. However, the overall size of the exposed area was too small to conclude whether or not interstitial velocities are eroding the radon barrier below the bedding layer. The inspection team suggested that additional follow-up site visits were needed.

3.1.3 Engineering Site Visit Trip Report June 1, 2016

Further examination of the cover depression features was performed on June 1, 2016 (see Trip Report in Appendix C3). Similar to the previous site visit, engineering staff manually removed small sections of riprap and bedding materials to view the underlying layers in several depression feature areas. The areas of radon barrier exposed were too small to ascertain whether or not the radon barrier surface was experiencing erosional forces. Photos 7–11 of Appendix C3 (p. 4) show the cover material removal areas. The conclusions of the site visit were that depressions indeed are occurring in the areas originally found and that a larger cover removal area would be required to determine if the cause of the depressions is erosional. A closer look at photos 7–11 in Appendix C3 (p. 4) indicates a red coating of what may be windblown material coating the 12-inch-thick riprap layer. This material is similar in color and composition to the radon barrier material and may be contributing to the collection of fines observed at the low point of the perimeter drainage channel adjacent to gully 2 (Figure 4).

Several additional cover depression features were identified to the north of the depression areas initially observed during the March 2016 annual site inspection (see Area 2 on Figure 4). These areas appeared to be less extensive than the areas identified in March 2016 and were identified for a later survey. No subsurface investigation of these areas was performed during this site visit.

3.1.4 Site Visit Report, June 30, 2016

A site visit was made to locate the additional depression features observed during the previous site visit dated June 1, 2016 (see Appendix C4). Survey-grade equipment was used to map these additional depression feature locations as shown in Area 2 of Figure 4. The mapped depression features in Area 2 were approximately 10–20 feet in length.

3.1.5 Site Visit Report, August 18 and 19, 2016

A site visit was made to both the Monument Valley and Mexican Hat sites to assess potential site damage after a flash flood event occurred in the area (see Appendix C5). According to the National Weather Service Climatological Data for Mexican Hat, Utah, the event occurred on August 6, 2016. The offsite weather station recorded a total precipitation of 0.53 inch for the day. Information that relates to the storm duration or storm intensity was not available. No changes in the cover depression features from this rainfall event were evident.

3.1.6 Observational Site Visit, March 2, 2017

An observational site visit was conducted at the site on March 2, 2017. The purpose of this visit was to familiarize a new LMS staff member to the site and the depression features observed along the northeast side slope. Based on the time of day, this observational site visit provided unique lighting conditions (i.e., angle of the sun) that indicated that some previously identified areas of cover depressions along the northeast side slope may be more extensive than previously considered. Due to the nature of this observational site visit, a site visit report was not prepared.

3.1.7 2017 Annual Inspection, April 11, 2017

The 2017 annual site inspection was conducted on April 11, 2017 (See Appendix C6). No major changes to the areas of observed depression were visually evident during the annual inspection relative to previous visual observations.

3.1.8 Site Visit Trip Report, Radiological Survey, September 21, 2017

A radiological survey was performed by a qualified radiological control technician (RCT) along the northeast side slope utilizing a handheld 2 inch × 2 inch sodium iodide crutch scintillometer to verify the absence of elevated radiological readings in areas of concern (i.e., depression features). Ambient radiological conditions were determined based on an average of readings collected at three areas upslope of depression features on the northeast side slope. Once ambient conditions were determined, the majority of visually identified depression features were surveyed utilizing the scintillometer. Readings were collected at the top of the riprap surface. Overall, the results showed no elevated radiological readings relative to visually determined nondistressed areas located upslope of depression features on the northeast side slope and further support the determination that RRM has not been exposed at the depression areas (see Appendix C7).

3.1.9 Engineering Site Visit Trip Report, October 23–25, 2017

An observational site visit was conducted at the site on October 24–25, 2017. The purpose of this visit was to introduce and familiarize a geotechnical subject matter expert (SME) to the site and the depression features observed along the northeast side slope. The appearance of the depressions on the northeast side slope did not appear to have changed compared to previous visual observations. The other side slopes of the disposal cell were observed, but no depressions similar to the ones seen on the northeast side slope were noted. There was also no apparent accumulation of sediment in the north toe drain, as was observed in the northeast toe drain. Following the site visit to the disposal cell, a site visit was taken to the radon barrier borrow area several miles south of Halchita, Utah (see Appendix C8).

3.1.10 Site Visit Trip Report, December 14, 2017

During this site visit on December 14, 2017, personnel from the Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department manually removed small portions of the riprap and bedding layer cover components to facilitate the inspection of linear depressions observed near the toe of the northeast side slope. At one of the locations, near the toe of the northeast side slope, a small void was observed at the apparent base of the bedding layer and upper portion of the radon barrier. The approximate dimensions of the void were 8 inches deep × 12 inches wide. The length of the void was unknown, but it appeared to extend downslope along the interface of the bedding layer and radon barrier. An approximately 6-inch-thick, red cemented layer was observed at the top of the void immediately below the base of the bedding layer. There was no indication that the radon barrier had been breached; hand removal of cover components did not extend into the radon barrier. The bedding layer consisted of almost all coarse gravel materials; fine sand materials were absent. The rock riprap and gravel/bedding materials that were removed were ultimately placed back in the void, and the exposed area was restored. The restored area was marked by wedging a wooden stake between the rock riprap materials, and an orange ribbon was tied to the top of the stake (see Appendix C9).

3.1.11 Site Visit Trip Report, Radiological Survey, December 27, 2017

To obtain ambient radiological condition data to compare to areas of concern on the northeast side slope of the disposal cell, a series of radiological surveys were performed by a qualified RCT. An Alpha Nuclear model 597-PX3 radon monitor was utilized to collect 30-minute continuous samples for radon gas, and a handheld 2 inch × 2 inch sodium iodide crutch scintillometer was utilized to collect gamma radiological readings at a total of seven radiological survey locations throughout the site.

Two upwind locations, one downwind location, and the area of the site marker on the top slope of the disposal cell were surveyed to assess ambient radiological conditions. Three additional locations were surveyed in areas of concern along the northeast side slope of the disposal cell, one of which included the area of the recently discovered void. A series of three separate surveys were performed at the location of the void, and it was reexposed to provide a thorough assessment of radiological conditions at this location.

Overall, the results at all surveyed locations showed no elevated radiological readings relative to ambient radiological conditions. Radiological survey results were below all applicable exposure-based and radon emanation standards, further supporting the determination that RRM has not been exposed at the depression areas (see Appendix C10).

3.1.12 Engineering Site Visit Trip Report, January 9 and 10, 2018

This site visit was made as a follow-up visit to assess the area of the cell where a small void was recently discovered near the toe of the northeast side slope and to assess other areas where the 5:1 rock cover is and is not showing visual signs of depressions on the disposal cell side slopes. Over the 2-day period, a total of six small test pits were hand excavated to expose the bedding material and top of the radon barrier.

All test pit locations were intermittently screened for gamma radiation by an RCT utilizing a handheld 2 inch × 2 inch sodium iodide crutch scintillometer. Test pits were screened before, during, and after disturbance, and no elevated radiological readings relative to ambient conditions were observed throughout the 2 days of field work. No breach through the radon barrier was evident throughout this field work.

Windblown sediment accumulation was present below the immediate riprap surface at all test pit locations. Riprap and bedding layer thicknesses appeared to meet specifications at test pit locations. Cemented material (presumably radon barrier) was observed along the interface of the bedding layer and radon barrier towards the lower portions of the northeast side slope. The cemented material appeared to be thicker towards the toe of the side slope and was not present at upgradient test pits located near the crest of the side slope. Fine aggregates in the bedding layer appeared to be absent towards lower portions of northeast side slope and were possibly overconcentrated near the crest of the northeast side slope. Voids and erosion were observed within the radon barrier material in two of the test pits located near the lower portion of the northeast side slope (see Appendix C11).

3.1.13 Engineering Site Visit Trip Report, January 23–25, 2018

Additional surface depressions observed on the north side slope during the January 9 and 10, 2018, site visit were investigated during this site visit. Other areas of concern where the 5:1 rock cover is showing visual signs of depressions on the north, west, and east side slopes of the disposal cell as well as a discolored area on the top slope of the disposal cell cover were also investigated. A total of seven small test pits were hand excavated to expose the bedding material and the top of the radon barrier over the 2-day period.

All test pit locations were intermittently screened for gamma radiation by an RCT utilizing a handheld 2 inch × 2 inch sodium iodide crutch scintillometer or equivalent radiological screening device. Test pits were screened before, during, and after disturbance, and no elevated radiological readings relative to ambient conditions were observed throughout the 2 days of field work. No breach through the radon barrier was evident throughout this field work, and no elevated radiological readings were observed.

Riprap and bedding layer thicknesses appeared to meet specifications at test pit locations. Windblown sediment accumulation was present below the immediate riprap surface at all test pit locations. Some test pits on the north and east side slopes exhibited radon barrier degradation showing potentially collapsed voids, incisements, and cementation. Signs of incipient radon barrier degradation were observed at one location of the east side slope, but were not as evident as radon barrier degradation observed on the north and northeast side slopes. Aggregate fines in the bedding layer appeared to be absent towards lower portions of north and east side slopes (see Appendix C12).

3.2 Site Visit Observations Summary

Listed below is a summary of observations from the multiple site visits and investigations that have been completed since the depressions on the northeast side slope were first observed:

- No elevated gamma radiation or radon gas readings relative to ambient background conditions were observed during any of the site visits or investigations.
- No breach through the full thickness of the radon barrier is evident.
- Sediment of undetermined origin has accumulated in the northeast toe drain, but sediment has not been observed in the other two toe drains.
- Voids, piping, and incisements in the radon barrier have been observed near the toes of the northeast and north side slopes of the disposal cell. Based on the characteristics observed at these features, including their locations towards the lower portions of the north and northeast side slopes, and the lack of fines in the bedding/filter materials in these areas (which would allow for higher runoff velocities in the bedding/filter material), it can be reasonably assumed that these features are the result of precipitation-induced erosion. No evidence of subsidence in these areas has been identified.
- Windblown sediment accumulation has been observed approximately 6 inches below the immediate riprap surface at all investigation locations.
- Riprap and bedding layer thicknesses appear to meet the original construction specifications at investigation locations.

- Cemented material was observed along the interface of the bedding layer and radon barrier towards the lower portions of the northeast and north side slopes.
- The cemented material appears to be thicker towards the toe of the side slopes and not present at upgradient control points.
- Fine aggregates in the bedding layer appear to be absent towards lower portions of northeast and north side slopes and are possibly overconcentrated at upper portions of the northeast and north side slopes.

The following table provides a synopsis of characteristics that were observed at specific test pit locations that were investigated in January 2018 (Table 6). See Figure 6 for the test pit locations.

3.3 Post-Construction Hydrology Review and Summary

Monthly historical precipitation data from the Western Regional Climate Center Cooperative Climatological Data Summaries for Utah were reviewed for the Mexican Hat, Utah, station (Station ID: 42-5582) to assess the amount of precipitation the local area has been subjected to relative to the disposal cell design PMP event. The Mexican Hat weather station is located about 1 mile north of the disposal site. Daily total precipitation is collected by an observer at this station. According to the available data, the historical average annual precipitation for the area near Mexican Hat, Utah, is 6.58 inches during the 70-year period of record from July 1, 1946, to February 9, 2017. For the 50-year period between 1946 and 1995, the average annual precipitation was 6.14 inches. In the 21 years that followed between 1996 and 2016 (last full year of data), the average annual precipitation increased to 6.74 inches (see Appendix D, p. 1).

Construction of the Mexican Hat disposal cell was completed in 1995. The annual rainfall for 2015 is notably the greatest annual rainfall on record since the onset of data collection in 1946 (see Appendix D, p. 1). Cumulative monthly amounts of greater than 1 inch of precipitation occurred in 5 months throughout calendar year 2015 (i.e., monthly sums of precipitation). Additionally, 5 months of above 1-inch cumulative precipitation totals occurred between the 2015 annual inspection that was performed in early April 2015 and the subsequent March 2016 annual inspection when the depression features were first identified (see Appendix D, p. 2). It is also notable that the greatest annual rainfall accumulations of record were recorded after the disposal cell construction was completed in 1995 (11.50 inches in 2005, 10.56 inches in 2010, and 13.86 inches in 2015) (see Appendix D, p. 1). However, despite indications that annual precipitation amounts have increased since the completion of the Mexican Hat disposal cell, a comparison to determine whether the design PMP event has been exceeded cannot be performed without site-specific rainfall intensity data.

Table 6. January 2018 Disposal Cell Cover Test Pit Observations

Disposal Cell Section	Northeast Side Slope						North Side Slope			West Side Slope	East Side Slope		Top Slope
Test Pit (TP) Identifier	TP1	TP2	TP3	TP4	TP5	TP8	TP6	TP7	TP10	TP11	TP12	TP13	TP9
Elevated Radiological Readings[a]													
Visible Surface Anomalies[b]	✓	✓					✓	✓	✓	✓	✓	✓	
Out of Spec Rip Rap Thickness[c]													
Out of Spec Bedding Thickness[d]													
Fines Absent in Bedding Layer[e]	✓	✓				✓	✓	✓			✓		
Cementation at Base of Bedding Layer[f]	✓	✓				✓	✓	✓					
Radon Barrier Degradation[g]	✓	✓					✓	✓			✓		
Other Cover Deformation[h]													✓

Notes:

[a] All test pits were scanned with a sodium iodide scintillometer or equivalent radiological detection instrument by a qualified radiological control technician (RCT).

[b] Surface depression or rill-like features in riprap surface.

[c] Riprap tolerance on side slope is 1.0–1.35 feet.

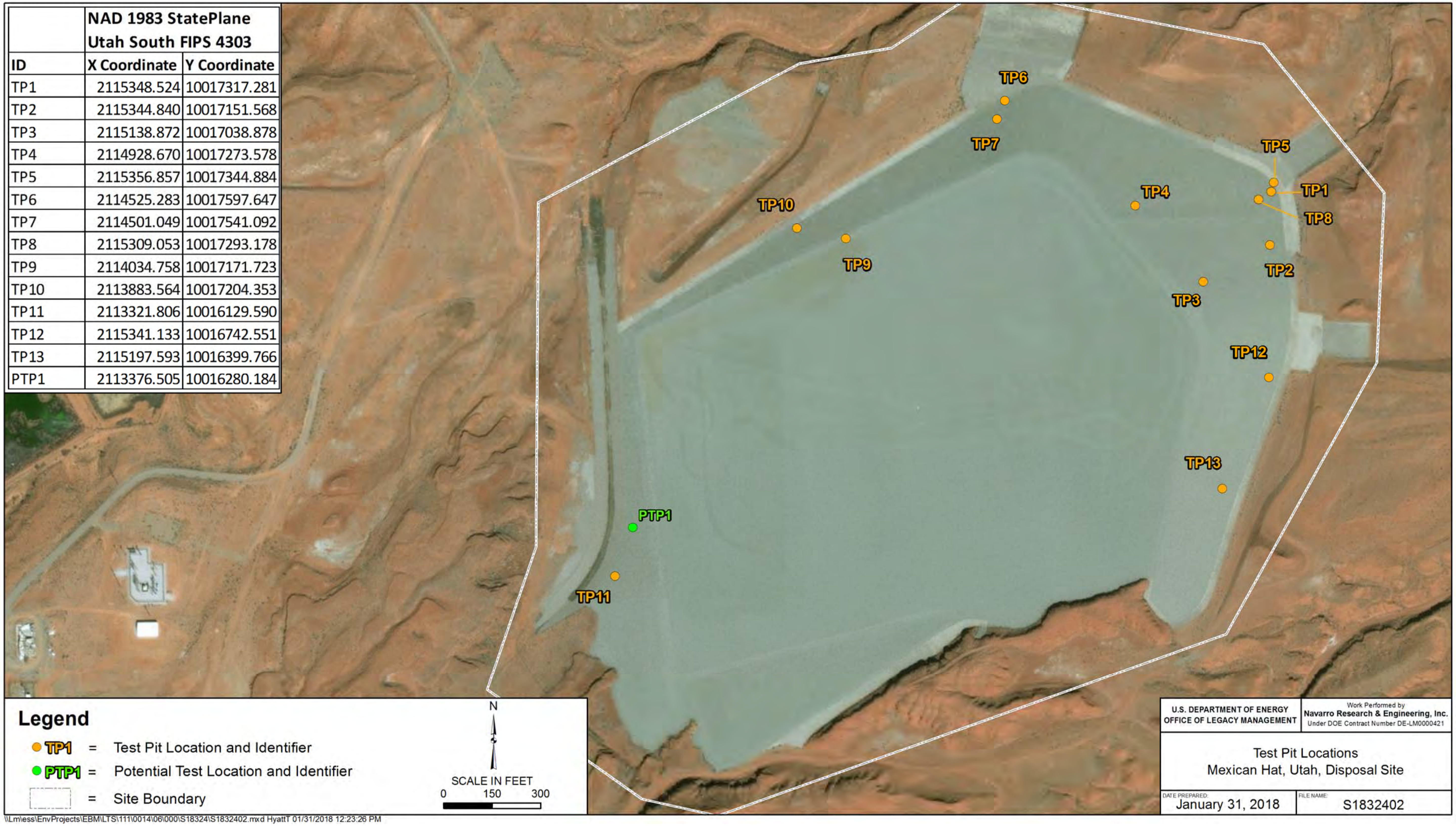
[d] Bedding layer tolerance is 0.5 foot ± 0.1 foot (0.4–0.6 foot).

[e] Based on visual observation; indicates only coarse-grained materials were observed. The bedding layer specifications required a sandy gravel gradation.

[f] Cementation varies from well-cemented to weakly cemented. Cementation reacts to hydrochloric acid.

[g] Indicates radon barrier incisement, piping, or collapsed voids.

[h] TP9 was uncovered in an area of red staining on the riprap. Hand excavations in this area revealed differential surface grading on the radon barrier surface.



	NAD 1983 StatePlane Utah South FIPS 4303	
ID	**X Coordinate**	**Y Coordinate**
TP1	2115348.524	10017317.281
TP2	2115344.840	10017151.568
TP3	2115138.872	10017038.878
TP4	2114928.670	10017273.578
TP5	2115356.857	10017344.884
TP6	2114525.283	10017597.647
TP7	2114501.049	10017541.092
TP8	2115309.053	10017293.178
TP9	2114034.758	10017171.723
TP10	2113883.564	10017204.353
TP11	2113321.806	10016129.590
TP12	2115341.133	10016742.551
TP13	2115197.593	10016399.766
PTP1	2113376.505	10016280.184

\\Lm\ess\EnvProjects\EBM\LTS\111\0014\06\000\S18324\S1832402.mxd HyattT 01/31/2018 12:23:26 PM

Figure 6. January 2018 Test Pit Locations at the Mexican Hat, Utah, Disposal Site

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4.0 Comparison of Observations with Design

The Mexican Hat disposal cell design requirements were compared with the actual field observations to verify that the cell was constructed in accordance with the design criteria. Precipitation data since the disposal cell was constructed were compared to precipitation data that were used to support the design. The types and thicknesses of the cover materials specified in the disposal cell design requirements were also compared with actual field observations and visually verified.

4.1 Hydrology

The disposal cell was designed to withstand the PMP, which is a 1-hour storm event of 8.1 inches. Since the construction of the disposal cell was completed in 1995, all monthly measurements from the nearby weather station have been consistently less than 4 cumulative inches of precipitation, with the majority of months experiencing less than 1 cumulative inch of precipitation (see Appendix D, p. 2, Monthly Sum of Precipitation (Inches) Post-Cover Completion). Based on this information, past exceedance of the PMP is highly unlikely. However, rainfall intensity data from the Mexican Hat disposal site are needed to determine actual precipitation conditions at the site. The intensity of a storm, or how quickly the cell is exposed to the total amount of precipitation, is what can potentially cause damage to the cover materials.

4.2 Cover Materials

The Type B and Type B1 riprap cover materials observed during recent visits to the site appear to be consistent with the original design specification as stated in Section 2.1.3 of this report. This material, as reported previously, was coated with fines, possibly windblown material across the entire cross section of the areas of investigation. It is likely that these fines collect on the rock surfaces between rainfall events and are subsequently washed out and deposited in low areas of the perimeter channel portion of the cell during precipitation events. However, because the material collecting at the low point of the perimeter drainage channel adjacent to the northeast toe drain (Figure 4) exhibits the same general color and composition as the disposal cell radon barrier material, the origin of this material is not conclusive.

The 6-inch bedding layer material thicknesses were observed to be consistent with the original design specification as provided in Section 2.1.2. However, there were locations near the toes of the northeast and north side slopes where segregation of the fine and coarse materials within the bedding layer had occurred. Segregation within the bedding layer could have occurred during the original material placement, depending on the placement method used, but it also could have occurred from interstitial flow velocities associated with high-intensity precipitation events. On the basis of the hydrology discussion in Section 4.1, it is more likely the segregation occurred during the original placement of the bedding layer material.

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5.0 Supplemental Filter Design Analysis

A supplemental rock riprap–bedding layer filter criteria calculation (Calculation No. S14794, Appendix E) was performed as a supplement to the original Morrison-Knudsen design calculation to confirm that the specified gradations were adequate to protect the radon barrier material from erosion. The results of the additional calculation confirm that both types of riprap were adequately designed to filter the bedding layer from internal erosion and piping, and that the bedding layer was adequately designed to filter the radon barrier from internal erosion and piping due to hydrostatic forces in accordance with design criteria outlined in NUREG-4620. Neither of the two riprap types acts as a filter unto itself; however, this is not a concern due to the fact that the riprap layer is sized to provide erosion protection against wind and the PMP and was not originally designed to serve as a filter.

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6.0 Gas Hills East Cover Rehabilitation Review

The Gas Hills East, Wyoming, Disposal Site (GHE) is an UMTRCA Title II transition site located between Riverton and Casper, Wyoming. The GHE disposal cell was completed in 2006. In 2011, the cover underwent major repairs to correct erosion of the radon barrier that was occurring beneath the rock cover. The GHE circumstances were reviewed to determine if there were any similarities with the Mexican Hat disposal cell depressions and whether there were any lessons learned from the GHE cover failure that would be applicable for the Mexican Hat disposal cell. The differences between the GHE cover design that failed and the Mexican Hat cover design are summarized below.

6.1 Gas Hills East Design Differences

The design and construction of the Gas Hills East disposal cell is regulated under Title II of UMTRCA. The GHE disposal cell was originally constructed as an above-ground tailings impoundment. A cover referred to as the A-9 Repository Erosion Protection cover was installed over the tailings impoundment. Review of the A-9 cover design report (UMETCO Minerals Corporation 2010[14]) indicated that a bedding/filter layer was not necessary to handle interstitial flow velocities in accordance with the accepted procedure established in NRC NUREG/CR-4620[7]. The guidance available at the time of the GHE design in NUREG-4620 provided guidance on the calculation of interstitial velocities, indicating that velocities of up to 2.5 feet per second would not require a bedding/filter layer.

Since the original design interstitial velocities for the GHE disposal cell were calculated to be between 0.6 and 0.8 foot per second, a bedding/filter layer was not installed between the radon barrier and the riprap layers. However, the original design assumptions proved to be inadequate, and in 2011, radon barrier soil erosion was repaired and a bedding/filter layer was installed beneath the rock cover where Type C erosion protection was installed. During the repair activity, erosion gullies were observed within the radon barrier, measuring approximately 1–2 feet wide × 1–2 feet deep.

The GHE cover repair design used the NRC NUREG-1623[2] draft guidance to determine if bedding/filter material was required to accommodate the calculated interstitial velocities (Draft Guidance, February 1999). The NUREG-1623 guidance supersedes NUREG-4620, and states that interstitial velocities of 0.5 foot per second or less may not require a bedding/filter layer. When interstitial velocities are between 0.5 and 1.0 feet per second, the need for a filter layer is dependent on the soil material at the riprap–radon barrier interface. Finally, NUREG-1623 suggests that a filter layer should be provided when interstitial velocities are 1.0 feet per second or greater. It is noted here that one area within the Type C erosion protection had a slope that approached 20%, which was also the steepest slope on the GHE cover. During the original GHE disposal cell construction, a field decision was made to place a 3-inch-thick layer of bedding/filter material beneath the riprap rock in this area. Inspections of this area showed no signs of subgrade erosion, which supports the need for a filter material as determined during the cover redesign.

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[14] UMETCO Minerals Corporation, 2010. *Gas Hills Reclamation Project Above Grade Tailings Impoundment and A-9 Repository Erosion Protection Enhancement Design Report*, December 20.

The Mexican Hat disposal cell is regulated under Title I of UMTRCA. At the time the disposal cell was designed, NUREG-4620 provided the recommended methods to determine interstitial velocities but did not provide standard velocity criteria to be used for filter design purposes. The Mexican Hat design calculations estimated that the maximum interstitial velocity would be 0.5 foot per second. Based on the available guidance at the time (NUREG-4620), interstitial velocities less than or equal to 2.5 feet per second may not require a bedding/filter layer. However, despite this the Mexican Hat cell design incorporated a bedding layer.

6.2 GHE Contractor Staff Interview

On July 20, 2016, Navarro personnel and LM representatives met with Mr. Tom Gieck of UMETCO Minerals Corporation (UMETCO) to gain insight into the issue the GHE project experienced with erosion below the riprap layer of the A-9 Repository Cover. According to UMETCO, interstitial surface water flow within the Type C riprap layer caused rill-type erosion at the radon barrier and riprap layer interface. UMETCO faults the lack of a bedding/filter layer as the cause of the erosion, which is supported with the field findings that erosion of the radon barrier was not observed in the area where bedding/filter material was installed during the original GHE disposal cell construction.

6.3 Summary of GHE Findings

Because the Mexican Hat disposal cell cover design already includes a bedding layer between the riprap and the radon barrier layers, the radon barrier erosion and the associated repairs that occurred at the Gas Hills East site have limited application for evaluating the depression features and radon barrier erosion at the Mexican Hat disposal cell. It is interesting to note, however, that no signs of radon barrier erosion were evident where bedding/filter material was placed during the original GHE disposal cell construction, as opposed to the Type C zones where no bedding was used and radon barrier erosion was identified.

7.0 Assessment Summary and Recommended Future Actions

Review of the original design calculations for the Mexican Hat disposal cell indicate that the design specifications for the riprap and bedding layers were properly sized for the PMP event. Field observations (see Section 3.1, Site Inspections and Visits) of the riprap and bedding layers provided visual confirmation that the installed materials would likely meet the required construction specification material thicknesses, but the required gradations for the bedding/filter layer as installed likely do not meet the construction specifications. The fine aggregate material of the specified bedding layer appears to be lacking in the lower portions of the northeast and north side slopes and is possibly overconcentrated near the top of these side slopes.

Voids, piping, and incisements in the radon barrier have been observed near the toes of the northeast and north side slopes of the disposal cell. Based on the characteristics of the observed features, including their locations towards the lower portions of the north and northeast side slopes, and the lack of fines in the bedding/filter materials in these areas (which would allow for higher runoff velocities in the bedding/filter material), it can be reasonably assumed that these features are the result of precipitation-induced erosion. No evidence of subsidence in these areas has been identified. As-built construction drawings of the disposal cell indicate that contaminated materials directly underlie the cell cover components in these areas. However, based on multiple field observations and a series of radiological surveys confirming the absence of elevated radiological readings, no evidence of a breach through the disposal cell cover has been identified, and the site remains protective of human health and the environment.

Actions that have been implemented since the first observation of the cover depressions in 2016 include:

1. Installation of a System Operation and Analysis at Remote Sites (SOARS)-based weather monitoring station that provides real-time 5-minute rainfall intensities to be measured.
2. Installation of a SOARS-based camera that provides real-time observation of the northeast side slope.
3. Initiation of semiannual ground-based light imaging, detection, and ranging (LiDAR) topographic surveys of the northeast side slope.
4. Initiation of aerial LiDAR topographic and other aerial surveys of the entire disposal cell.
5. Initiation of semiannual horizontal and vertical surveys using survey-grade GPS instrumentation of the six settlement plates located on the cell cover to assess if settlement of the cell is occurring.
6. Future preparation of survey monitoring status reports subsequent to each combined LiDAR and settlement plate survey event. Survey monitoring status reports would include documentation and analysis of LiDAR and settlement plate survey data, identification of any observed changes in empirical survey data, and a compilation and review of data associated with the onsite weather monitoring equipment.
7. Initiation of continuous radiological monitoring through the installation of paired radon monitoring cups and thermoluminescent dosimeters at locations inside and outside of the site boundary to develop a suitable data set that provides objective evidence that the disposal cell remains protective of human health and the environment.

Additional actions that have taken place since the 2016 observation of the cover depressions include:

1. Engagement of a geotechnical engineering SME, Mr. Ron Rager, who was the lead geotechnical engineer for the UMTRA program and who was involved with the engineering design of the Mexican Hat disposal cell.
2. Engagement of a geotechnical engineer from the University of Virginia, Dr. Craig Benson, Dean of the School of Engineering and Applied Science, who has extensive experience in the design and long-term performance of disposal cell covers.
3. Collaboration with engineers and scientists from the Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department and the Desert Research Institute.

7.1 Precipitation Driver for Episode-Based LiDAR Surveys

Monthly and daily rainfall data collected since the completion of the cell were examined and compared to National Oceanic and Atmospheric Administration (NOAA) Atlas 14-point precipitation frequency estimates for the Mexican Hat weather station to estimate the recurrence interval of rainfall amounts at the disposal cell under various time intervals. Evaluation of rainfall during the monsoon months of July through September since the disposal cell was constructed (see Appendix D, p. 2) indicates a 95% confidence interval that monthly rainfalls during those monsoon months will be between 0.64 and 0.90 inch, which correlates well with the NOAA 90% probability 30-day point precipitation frequency estimate recurrence interval of something less than 1 year. The associated 5-minute rainfall amount for a 1-year recurrence interval is 0.124 inch (see Appendix D, p.3). The highest monthly rainfall measured in February 2015, the wettest year since completion of the cell (see Appendix D, p. 2), was 3.55 inches, which matches up to the NOAA point precipitation frequency estimate recurrence interval of 25–50 years and translates to a 5-minute rainfall amount of 0.342–0.407 inch. The highest daily rainfall during February 2015 was 1.45 inches, suggesting a recurrence interval of 25 years with an associated 5-minute rainfall of 0.342 inch. It is unknown what level of rainfall intensity has actually caused the radon barrier erosion that has been observed to date, but to be conservative, it is recommended that a recurrence interval of 2 years be used as the trigger to initiate an episodic LiDAR survey. The 5-minute rainfall amount for a 2-year storm with a 90% probability of occurrence is 0.16 inch (see Appendix D, p. 3).

Based on this information combined with the original design rainfall intensity of 53.5 inches per hour relating to a 2.5-minute T_c value, as discussed in Section 2.2.1, it is recommended that a site-specific precipitation event of 0.16 inch or more per 5-minute interval, determined by real-time data acquisition via the onsite SOARs meteorological station, be used as the trigger value for initiating episode-based LiDAR surveys.

7.2 Recommendations

Based on the reviews, investigations, and observations documented in this report and to mitigate the potential for erosion-related release of tailings or other RRM, the following actions are recommended.

1. Continue visual and radiological monitoring of the disposal cell with a focus on the north and northeast side slopes to ensure that the site remains protective of human health and the environment.
2. Continue monitoring the disposal cell via the terrestrial or aerial surveys and weather station actions that have been implemented at the site to date.
3. Perform interim radon barrier protection with suitable fill materials in areas with observed radon barrier degradation.
4. Conduct materials sampling and testing at targeted cover depression and non-depression locations on the east, northeast, north, and west side slopes of the disposal cell to determine how in-place materials conform with the original disposal cell construction specifications and determine if there are other material properties that may be contributing to the ongoing radon barrier erosion. Materials sampling and testing will be conducted to determine where in situ cell cover components (i.e., riprap, bedding layer, and the radon barrier) conform, or do not conform, with the engineering design and construction specifications. The investigation will focus on bedding layer gradation as well as the spatial distribution of cementitious material that has been observed immediately below the base of the bedding layer in test pits with observed radon barrier degradation; determining if the radon barrier is subject to degradation due to cation exchange, dispersive soils, or both; determining the lateral extent of RRM that was placed beneath the radon barrier near the toe of the northeast and north side slopes and under the drainage apron adjacent to the northeast side slope; and identifying potential sources and impacts of windblown material on the riprap rock surfaces and the sediment deposits in the northeast drainage apron.
5. Using information from the multiple site visits that have been conducted along with the information collected from the materials sampling and testing, determine the cause(s) of the depression features and identify possible corrective actions and how they would be implemented.
6. Prepare documentation of future materials sampling and testing field activities and results and any analyses associated with developing possible corrective actions.
7. Protect areas with substantial depressions on the northeast side slope as an interim measure while the cause(s) of the depression features are identified and a long-term remedy is developed.
8. Identify and engage a geomorphology SME to assist with the evaluation and development of erosion solutions.
9. Conduct an episodic LiDAR survey if precipitation intensities equal or exceed 0.16 inch per 5-minute interval, and compare episodic survey data to previous survey data to determine if additional materials have been removed as a result of the episodic rainfall event, causing the depressions to deepen or enlarge.

10. In accordance with the LTSP, if there is evidence that erosion is continuing to deepen or enlarge the depression features to the extent that the release of tailings is imminent or the cover is breached, the LMS contractor would, at DOE’s request, initiate emergency response actions to repair the cover.

Implementation of the above recommendations is necessary to (1) obtain quantitative topographic information of the cell cover to track potential changes over time as they relate to meteorological events, (2) determine where in situ cell cover components conform, or do not conform, with the engineering design and construction specifications, (3) obtain qualitative and quantitative information to support the identification of the cause(s) of the cover depression features and associated radon barrier erosion, (4) mitigate the potential of a breach through the disposal cell cover that would result in the exposure or dispersal of RRM, (5) document the activities and findings of the recommended actions, (6) develop a path forward to develop a long-term remedy for the disposal cell erosion protection system, and (7) ensure ongoing protection of human health and the environment.

Appendix A

Hydrology Design Calculation

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MKE Document No. 5025-HAT-C-01-01141-02

Calculation Cover Sheet

REVIEWED FOR
QUALITY REQUIREMENTS
BY C. Ricketts
QA ENTRY NO.

Contract No. 5025-02 **Discipline** ESCUP **Calc. No.** ~~9-223-01~~ 02
No. of Sheets ~~33~~ 34

Project
UMTRA-HAT/MON

Feature
SITE HYDROLOGY at HAT

Item
—

Sources of Data
—

Sources of Formulae & References

SEE SHEET 25

Preliminary Calc. ☒ **Final Calc.** ☒ **Supersedes Calc. No.** ______

02	SUPERSEDED RAINFALL DISTRIBUTION CALC.	S.E.	5/9/88	AB	5/9/88		5/9/88
01	Time-Intensity Curve Revised Sheets 23-23A	R.F. Claire	5/7/87	HM	June 10/87		6/10/87
0	—	P.O. GREGORY	6-6-86	HM	8/20/86		8/25/86
Rev. No.	**Revision**	**Calculation By**	**Date**	**Checked By**	**Date**	**Approved By**	**Date**

IECO Form 42-110

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY

Project UMTRA-HAT
Feature SITE HYDROLOGY
Item —
Contract No. 5025-02
Designed PDG
Checked HM
Sheet i
File No.
Date 5-21-86
Date [illegible]

TABLE OF CONTENTS

3. HYDROLOGY FOR PERMANENT DRAINAGE

~~4. SUMMARY~~

Project UMTRA-HAT	Contract No. 5025-02	Sheet 1
Feature SITE HYDROLOGY	Designed POG	File No.
Item —	Checked HM	Date 5-21-86
		Date 8/15/86

1. PURPOSE

This calculation presents the hydrologic parameters required for the design of both temporary and permanent site drainage features. Storm intensities and distributions are developed for the following design storms:

10-year	1-hour storm
25-year	1-hour storm
10 year	24-hour storm
pmp	

2. HYDROLOGY FOR TEMPORARY DRAINAGE

a. Requirements

For the design of temporary drainage structures (including all ditches and retention basins) the following design storms are required (DOE 1986, pp. 62-63)

10-year	1-hour storm
25-year	1-hour storm
10-year	24-hour storm

All of the storms can be evaluated using the NOAA Precipitation Frequency Atlas of the U.S. Volume 6, Utah (DOC, 1973).

Project UMTRA-HAT	Contract No. 5025-02	Sheet 2	File No.
Feature SITE HYDROLOGY	Designed POG	Date 5-22-86	
Item —	Checked HM	Date 8/15/86	

b. <u>10-year, 1-hour storm</u>

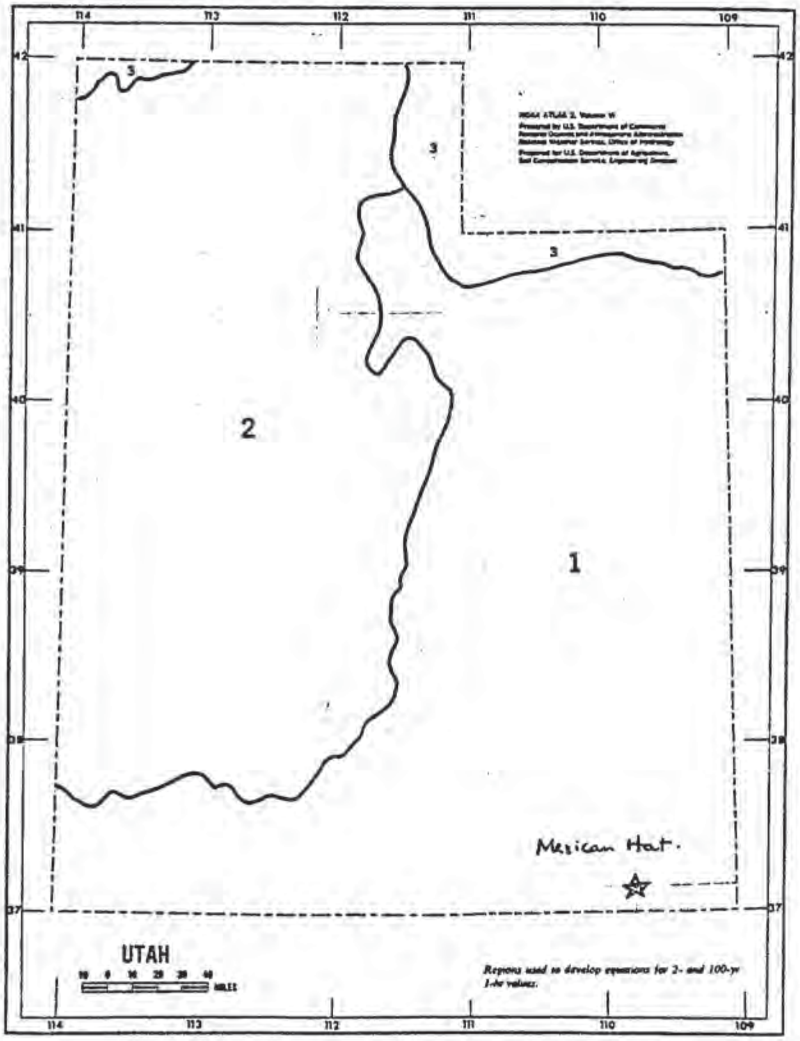
The storms are developed based on the maps and methods given in the Atlas (DOC, 1973).

1) Location of site

From dRAP (DOE, 1986, Appendix D, page D-1)

37° 09' N POG 8-20-86
109° 53' W

2) Select appropriate region – from Fig. 18 (DOC, 1973) use region 1. (see next below)



Regions used to develop equations for 2- and 100-yr 1-hr values.

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Project UMTRA-HAT
Feature SITE HYDROLOGY
Item –
Contract No. 5025-02
Designed POG
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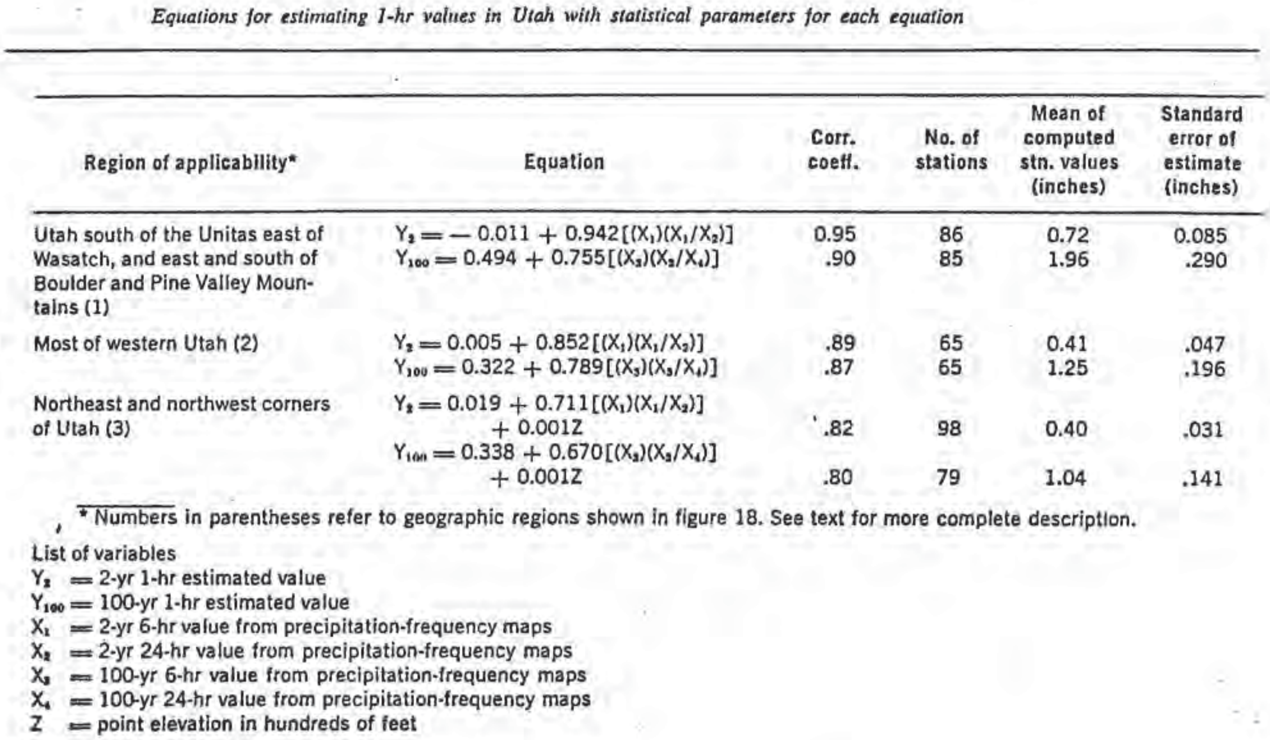
Sheet 3
File No.
Date 5-22-86
Date [illegible] 15/86

3) For region 1, the following equations are used:

$$Y_2 = -0.011 + 0.942\left[(X_1)(X_1/X_2)\right] \checkmark$$

$$Y_{100} = 0.494 + 0.755\left[(X_3)(X_3/X_4)\right] \checkmark$$

These equations are taken from Table 11 (DOC, 1973): which is reproduced below:



Equations for estimating 1-hr values in Utah with statistical parameters for each equation

Region of applicability*	Equation	Corr. coeff.	No. of stations	Mean of computed stn. values (inches)	Standard error of estimate (inches)
Utah south of the Unitas east of Wasatch, and east and south of Boulder and Pine Valley Mountains (1)	$Y_2 = -0.011 + 0.942[(X_1)(X_1/X_2)]$	0.95	86	0.72	0.085
	$Y_{100} = 0.494 + 0.755[(X_3)(X_3/X_4)]$	.90	85	1.96	.290
Most of western Utah (2)	$Y_2 = 0.005 + 0.852[(X_1)(X_1/X_2)]$	.89	65	0.41	.047
	$Y_{100} = 0.322 + 0.789[(X_3)(X_3/X_4)]$	.87	65	1.25	.196
Northeast and northwest corners of Utah (3)	$Y_2 = 0.019 + 0.711[(X_1)(X_1/X_2)] + 0.001Z$	.82	98	0.40	.031
	$Y_{100} = 0.338 + 0.670[(X_3)(X_3/X_4)] + 0.001Z$	.80	79	1.04	.141

* Numbers in parentheses refer to geographic regions shown in figure 18. See text for more complete description.

List of variables
Y_2 = 2-yr 1-hr estimated value
Y_{100} = 100-yr 1-hr estimated value
X_1 = 2-yr 6-hr value from precipitation-frequency maps
X_2 = 2-yr 24-hr value from precipitation-frequency maps
X_3 = 100-yr 6-hr value from precipitation-frequency maps
X_4 = 100-yr 24-hr value from precipitation-frequency maps
Z = point elevation in hundreds of feet

The values of X_1, X_2, X_3, and X_4 are determined from Figs. 19, 25, 24, & 30, respectively (DOC, 1973). The figures are reproduced on the following four sheets. The resulting X-values are given below:

X_1 = 0.8 in (see sht. 4)
X_2 = 1.0 in ✓ (see sht. 5)
X_3 = 2.0 in ✓ (see sht. 6)
X_4 = 2.6 in (see sht 7)

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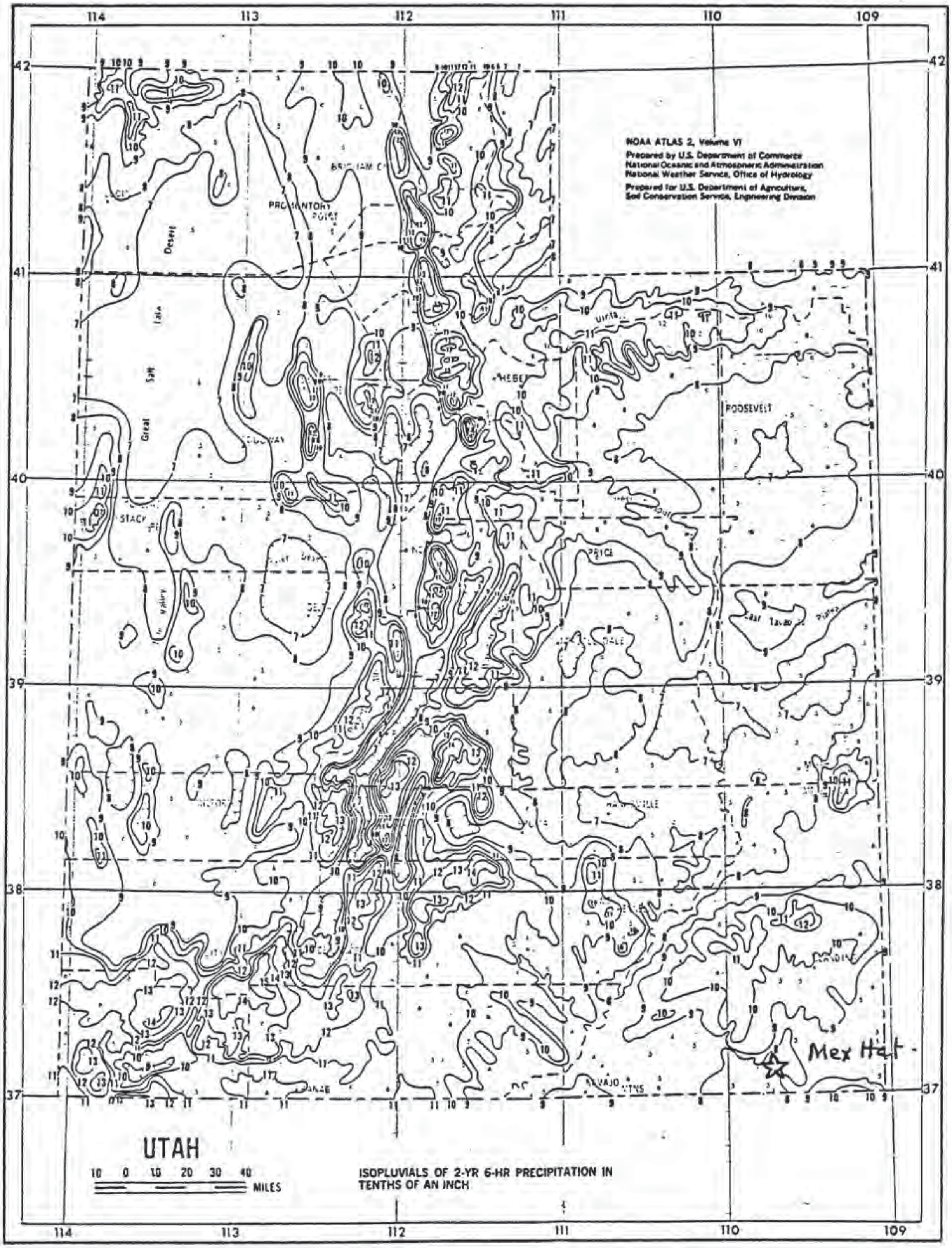
Sheet 4
Project UMTRA - HAT
Contract No. 5025-02
File No.
Feature SITE HYDROLOGY
Designed POG
Date 5-22-86
Item —
Checked HM
Date 9/15/86



MAP FOR DETERMINATION OF X_1 – Fig. 19 (DOC, 1973)

$X_1 = 0.8$ in

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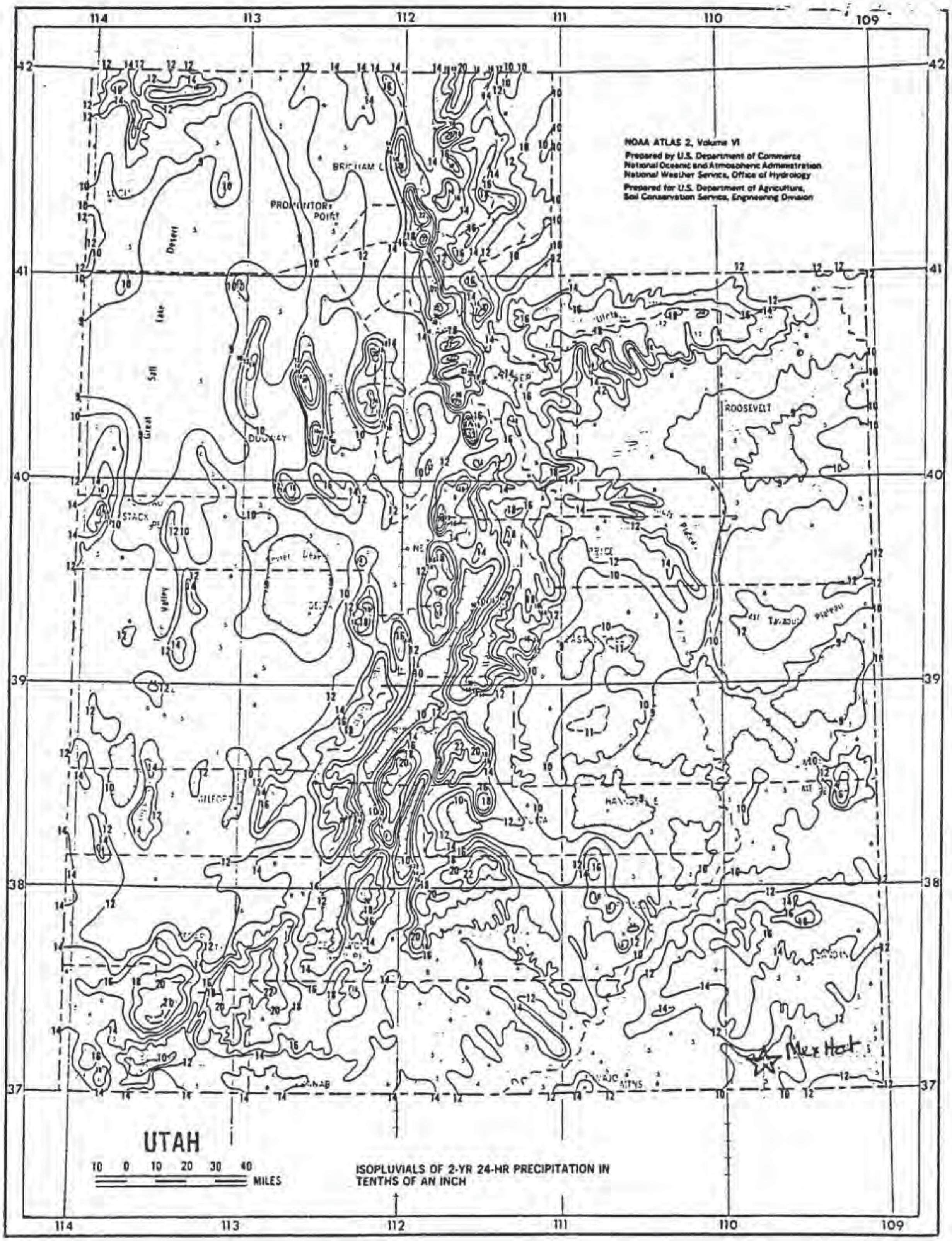
Sheet 5
File No.
Date 5-22-86
Date 8/15/86



NOAA ATLAS 2, Volume VI
Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

ISOPLUVIALS OF 2-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

MAP FOR DETERMINATION OF X_2 - Fig. 25 (DOC, 1973)

$X_2 = 1.0$ in

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Designed POG
Date 5-22-86
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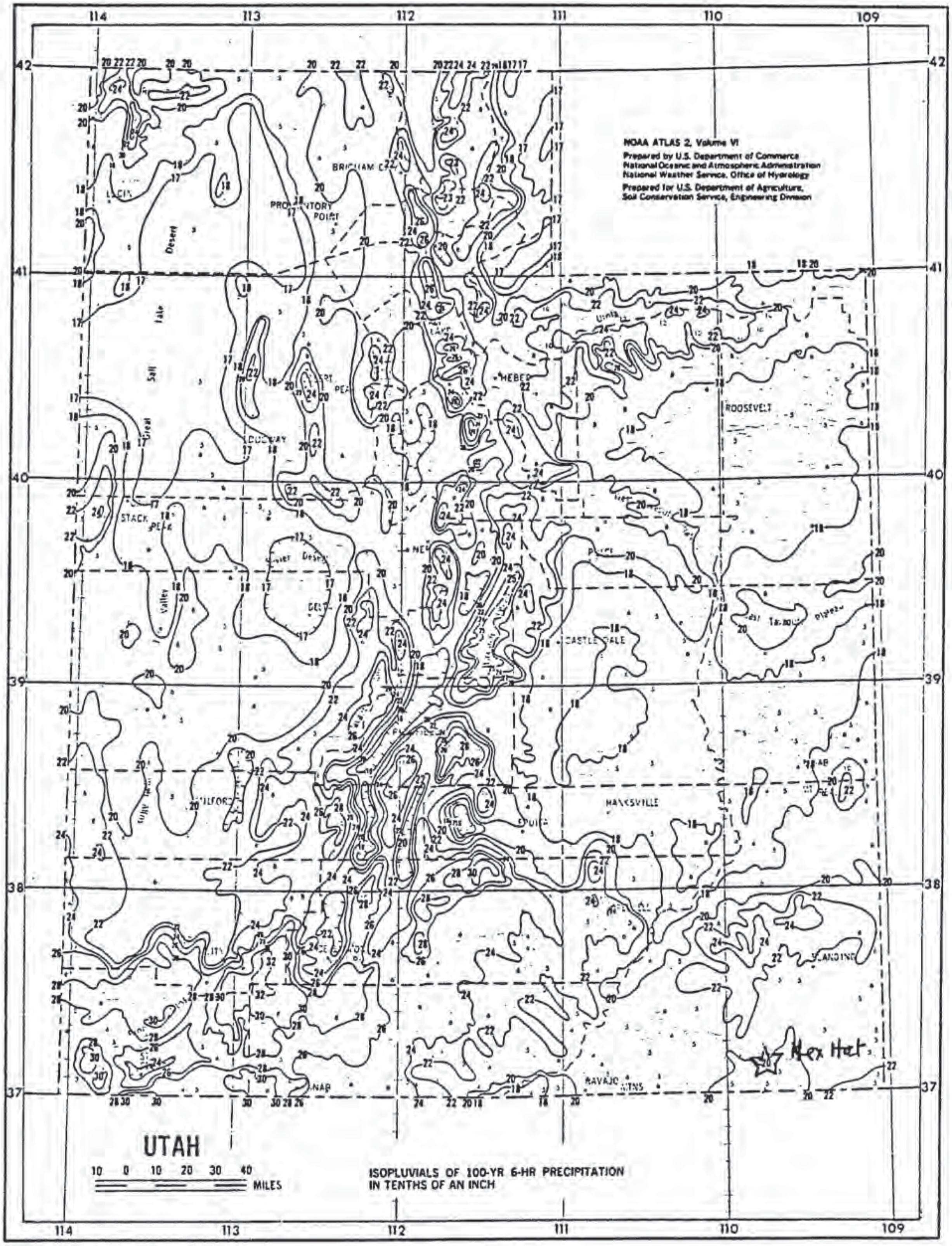
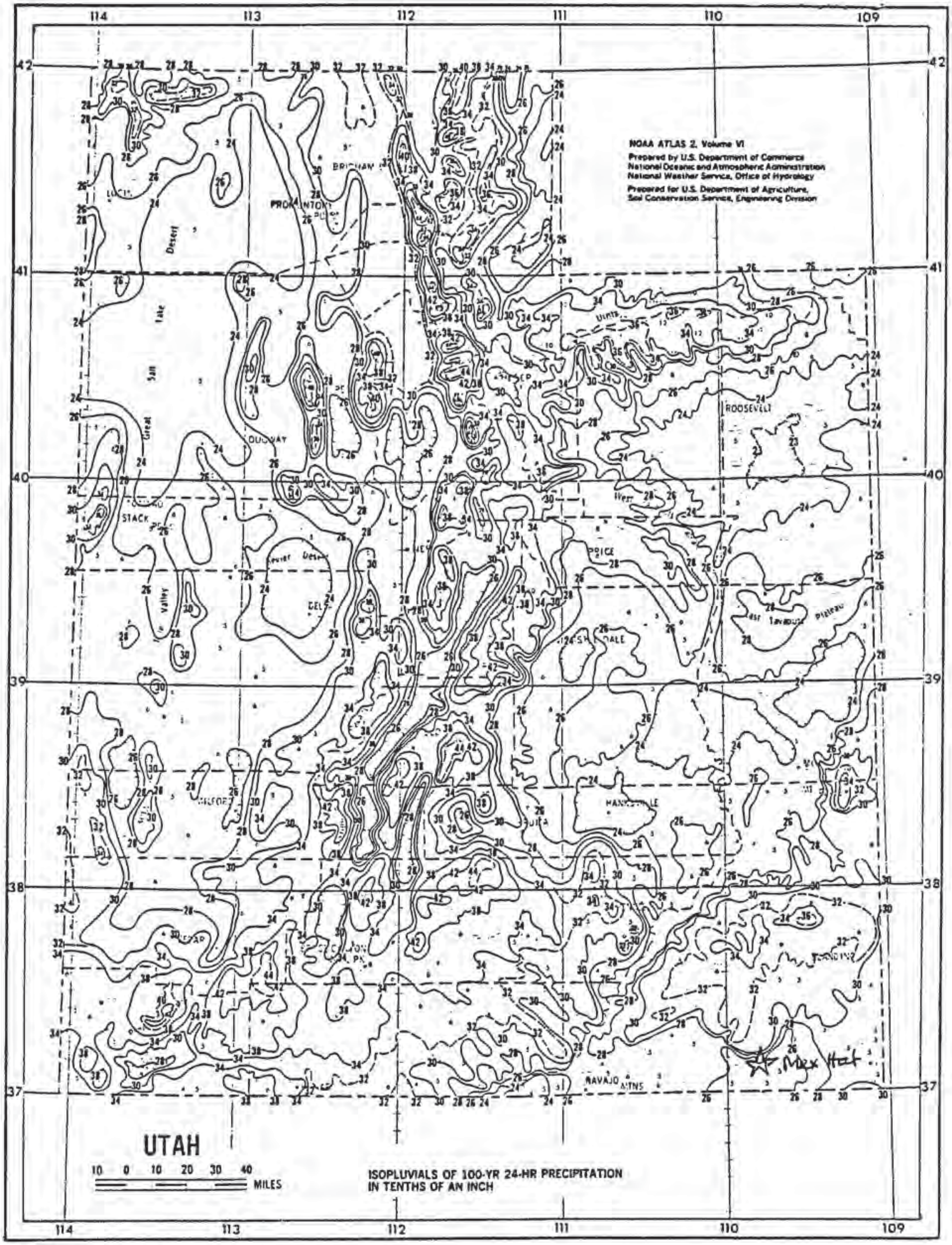


MAP FOR DETERMINATION OF X_3 - Fig. 24 (DOC, 1973)

X_3 = 20 inches

Project UMTRA - HAT		Contract No. 5025-02	Sheet 7
			File No.
Feature SITE HYDROLOGY		Designed POG	Date 5-22-86
Item —		Checked HM	Date 8/15/86



MAP FOR DETERMINATION OF X_4 - Fig. 30 (DOC, 1973)

$X_4 = 2.6$ in

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Designed POG
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$$\therefore \quad Y_2 = -0.011 + 0.942\left(\frac{0.8 \times 0.8}{1.0}\right) = 0.59 \text{ in} \checkmark$$

$$Y_{100} = 0.494 + 0.755\left(\frac{2.0 \times 2.0}{2.6}\right) = 1.66 \text{ in} \checkmark$$

These values are input into Fig. 17A (DOC, 1973) ✓ for determination of the 10-year, 1-hour storm as shown below:

Illustration of use of precipitation-frequency diagrams using values from precipitation-frequency maps and relations at Blanding, Utah.

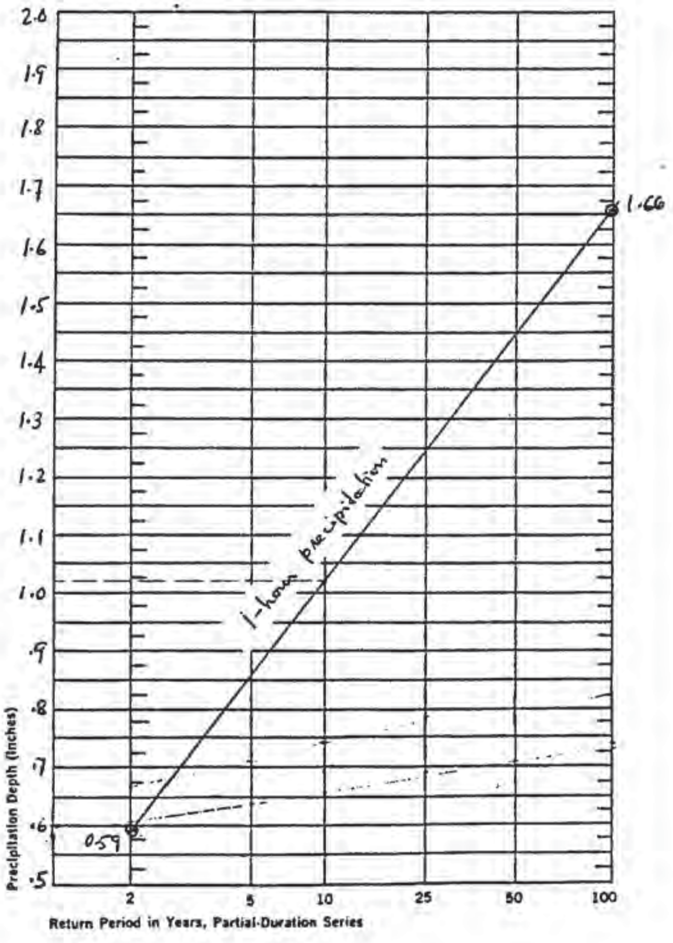

Figure 17A (DOC, 1973) ✓

The 10-year, 1-hr intensity is found to be <u>1.02</u> in. ✓
The intensity-duration curve for periods less than 1-hour are developed using Table 12 (DOC, 1973) which is shown on sht. 9. ✓

Sheet 9
Project UMTRA - HAT
Contract No. 5025-02
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Feature SITE HYDROLOGY
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Date 5-22-86
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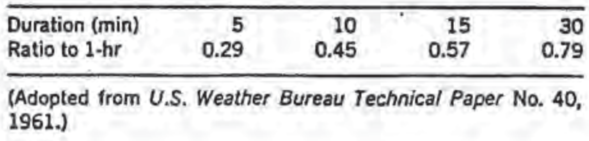
Date 8/15/86



Duration (min)	5	10	15	30
Ratio to 1-hr	0.29	0.45	0.57	0.79

(Adopted from *U.S. Weather Bureau Technical Paper* No. 40, 1961.)

Table 12. *Adjustment factors to obtain n-min estimates from 1-hr values*

The corresponding values for a 1-hour rainfall of 1.02 in is

Duration	5 min	10 min	15 min	30 min	60 min
Rainfall	0.30"	0.46"	0.58"	0.81"	1.02"
Intensity*	3.6"/hr ✓	2.8"/hr ✓	2.3"/hr ✓	1.6"/hr	1.02"/hr

$$* \text{ Intensity is equal to } \frac{(\text{Rainfall}) \times (60 \text{ min})}{(\text{Duration})}$$

The intensity duration curve for the 10-year 1-hour storm is plotted on sht. 10.

4) The storm distribution, or hyetograph of the 10-year, 1-hour storm is required for input into the reservoir routing models used in design of the temporary drainage features. The hyetograph is developed based upon those presented by Huff (1967). A second quartile, 50% probability storm distribution is used as these were found to be the most storm typic. The hyetograph for a 1-hour storm is presented in terms of percent total rainfall on sheet 11.

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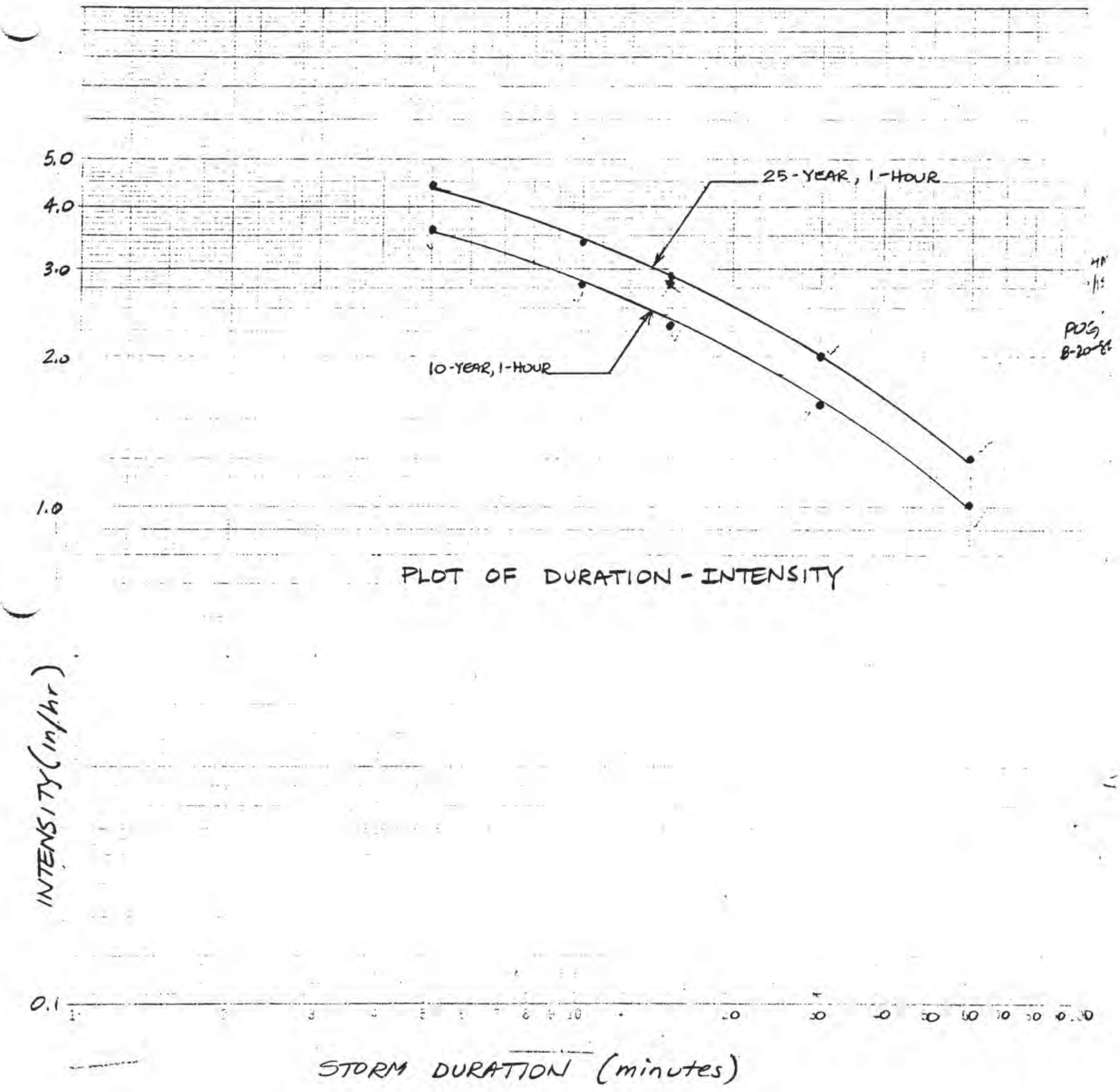
Project	UMTRA-HAT	Contract No. 5025-02	Sheet 10
Feature	SITE HYDROLOGY		File No.
		Designed POG	Date 5-22-86
Item	—	Checked HM	Date 8/15/86



PLOT OF DURATION - INTENSITY

HM
8/15

POG
8-20-86

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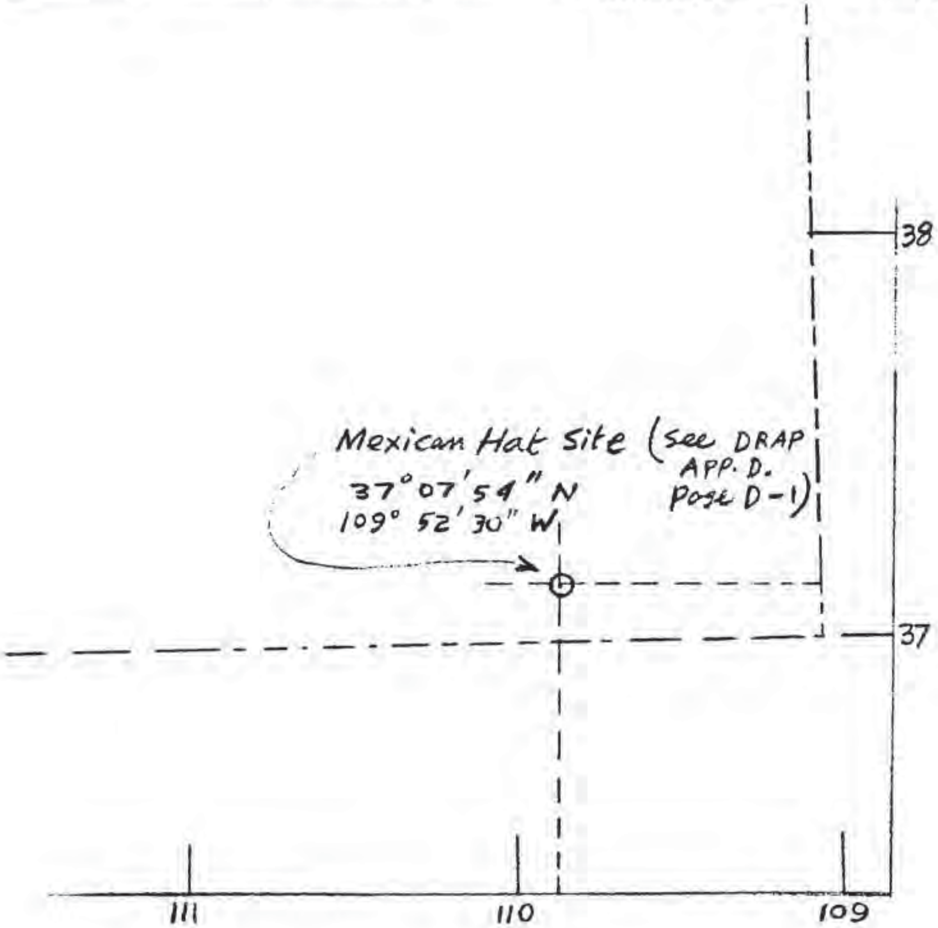
Project UMTRA/HAT
Contract No. 5025-02
Sheet 10A/
File No.
Feature HYDROLOGY - MEXICAN HAT SITE
Designed HM
Date 8/15/86
Item —
Checked PO GREGORY
Date 8-20-86



Recurrence Interval (Year)	Rainfall Depths (Inches)	
	6 HOUR	24 HOURS
2	0.8" ✓	1.0"
5	1.1" ✓	1.4"
10	1.3" ✓	1.7" ✓
25	1.6" ✓	2.0" ✓
50	1.8" ✓	2.3" ✓
100	2.0" ✓	2.6" ✓

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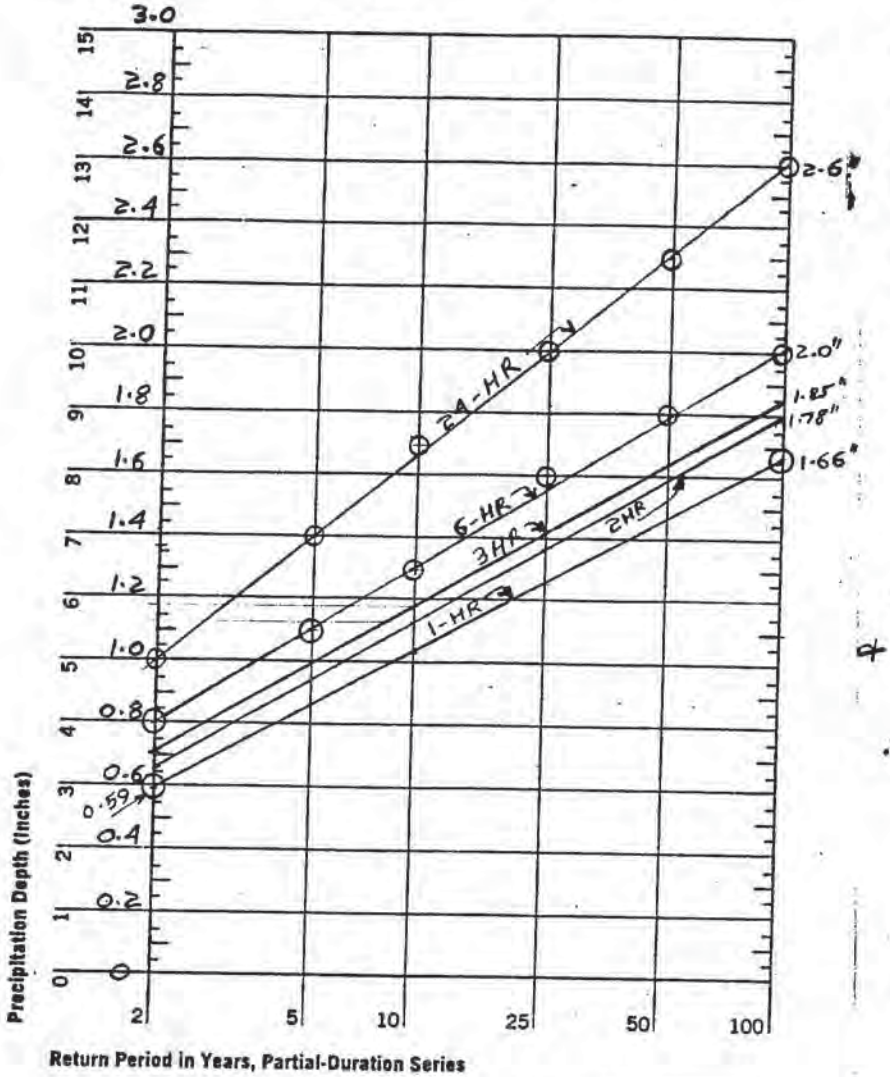
Sheet 10 B/
Project UMTRA/HAT
Contract No. 5025-02 File No. /
Feature Hydrology – Mexican Hat Site
Designed HM Date 8/20/86
Item —
Checked PO GREGORY Date 8-20-86



The 6-Hr and 24-Hr rainfall depths at various recurrence intervals (as tabulated on Sheet 10A) and also the 1-Hr rainfall depths from Sheet 8 are plotted on the Figure on this sheet.

To estimate 2-Hr and 3-Hr precip values, the following equations are used (DOC, 1973, page 16):

2-Hr = 0.341(6-Hr) + 0.659 (1-Hr)
& 3-Hr = 0.569(6-Hr) + 0.431(1-Hr)

∴ 2-Yr 2-Hr
= 0.341 (6-Hr 2-Yr) + 0.659 (1-Hr 2-Yr)
= 0.341(0.8) + 0.659(0.59)
= 0.66"

2-Yr 3-Hr
= 0.569 (6-Hr 2-Yr) + 0.431 (1-Hr 2-Yr)
= 0.569(0.8) + 0.431(0.59)
= 0.71"

Similary 100-Yr, 2-Hr = 0.341(2.0) + 0.659(1.66)
= 1.78"

and, 100-Yr, 3-Hr = 0.569(2.0) + 0.431(1.66)
= 1.85"

The 2-Hr and 3-Hr values are also plotted on the Figure on this page.

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Project UMTRA - Mexican Hat
Feature Site Hydrology [illegible]
Item —
Contract No. 5025
Designed ABH
Checked ~~AS~~ HM
Sheet 10C/
File No.
Date 1/2/86
Date 1/10/86 8/20/86

Using NOAA Atlas 2, Vol 6 (Ref. 1), Figs 19, 24, 25 & 30, ✓

at Mexican Hat Site (37° ~~09'~~ 08' N & 109°53' W)

X_1 : 2-yr, 6-hr precip = 0.8 inch ✓

X_2 : 2-yr, 24-hr precip = 1.0 inch ✓

X_3 : 100-yr, 6-hr precip = 2.0 inch. ✓

X_4 : 100-yr, 24-hr precip = 2.6 inch ✓

Then using Table 11 (Ref. 1), 1-hr precip. values are obtained for the SE region as follows:

Y_2 : 2-yr, 1-hr precip

$$= -0.011 + 0.942\left[X_1\,(X_1/X_2)\right] \checkmark$$

$$= -0.011 + 0.942\left(\frac{0.8 \times 0.8}{1.0}\right) = 0.59 \text{ inches} \checkmark$$

Y_{100} : 100-yr, 1-hr precip

$$= 0.494 + 0.755\left[X_3\,(X_3/X_4)\right]$$

$$= 0.494 + 0.755\left(\frac{2.0 \times 2.0}{2.6}\right) = 1.66 \text{ inches} \checkmark$$

Then using Fig 17A (Ref. 1) for plotting position, the partial-duration precipitation for return periods between 2- and 100-yrs are obtained. Adjustment factors for n-minute estimates from Table 12 (Ref 1) are then used to calculate fractional-hour precipitations.

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Project UMTRA - HAT
Feature SITE HYDROLOGY
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File No.
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8/20/86

Return Period, Years		Precipitation, inches Duration, 1-hour	30-min.	15-min	10-min	5-min.	
			x.79	x.57	x.45	x.29	← (Ref 1, Table 12)
2	→	0.59	0.47	0.34	0.27	0.17	
5	Using Ref 1, Fig 17A	0.86	0.68	0.49	0.39	0.25	
10		1.02	0.81	0.58	0.46	0.30	
25		1.25	0.99	0.71	0.56	0.36	
50		1.45	1.15	0.83	0.65	0.42	
100	→	1.66	1.31	0.95	0.75	0.48	

Alternatively, the precipitation can be expressed as intensity, by dividing by time duration, as follows:

Return Period, Years	Intensity, inches/hour Duration 1-hour	30-min	15-min.	10-min.	5-min
2	0.59	0.94	1.36	1.62	2.04
5	0.86	1.36	1.96	2.34	3.00
10	1.02	1.62	2.32	2.76	3.60
25	1.25	1.98	2.84	3.36	4.32
50	1.45	2.30	3.32	3.90	5.04
100	1.66	2.62	3.80	4.50	5.76

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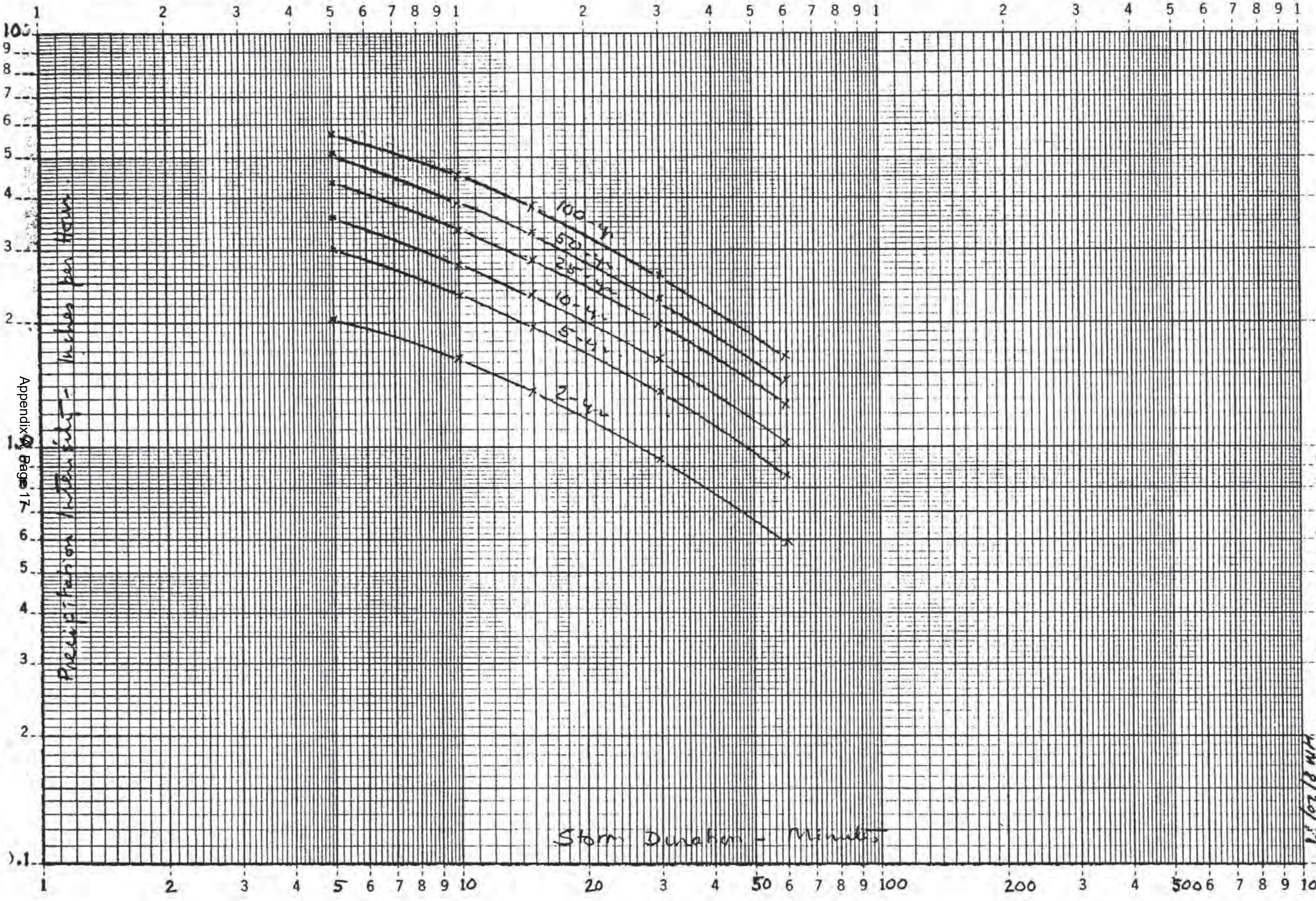

UMTRA / HAT CONTRACT # 5325-02

AEH 1-6-86
AS 1-10-86
HM 8/20/87

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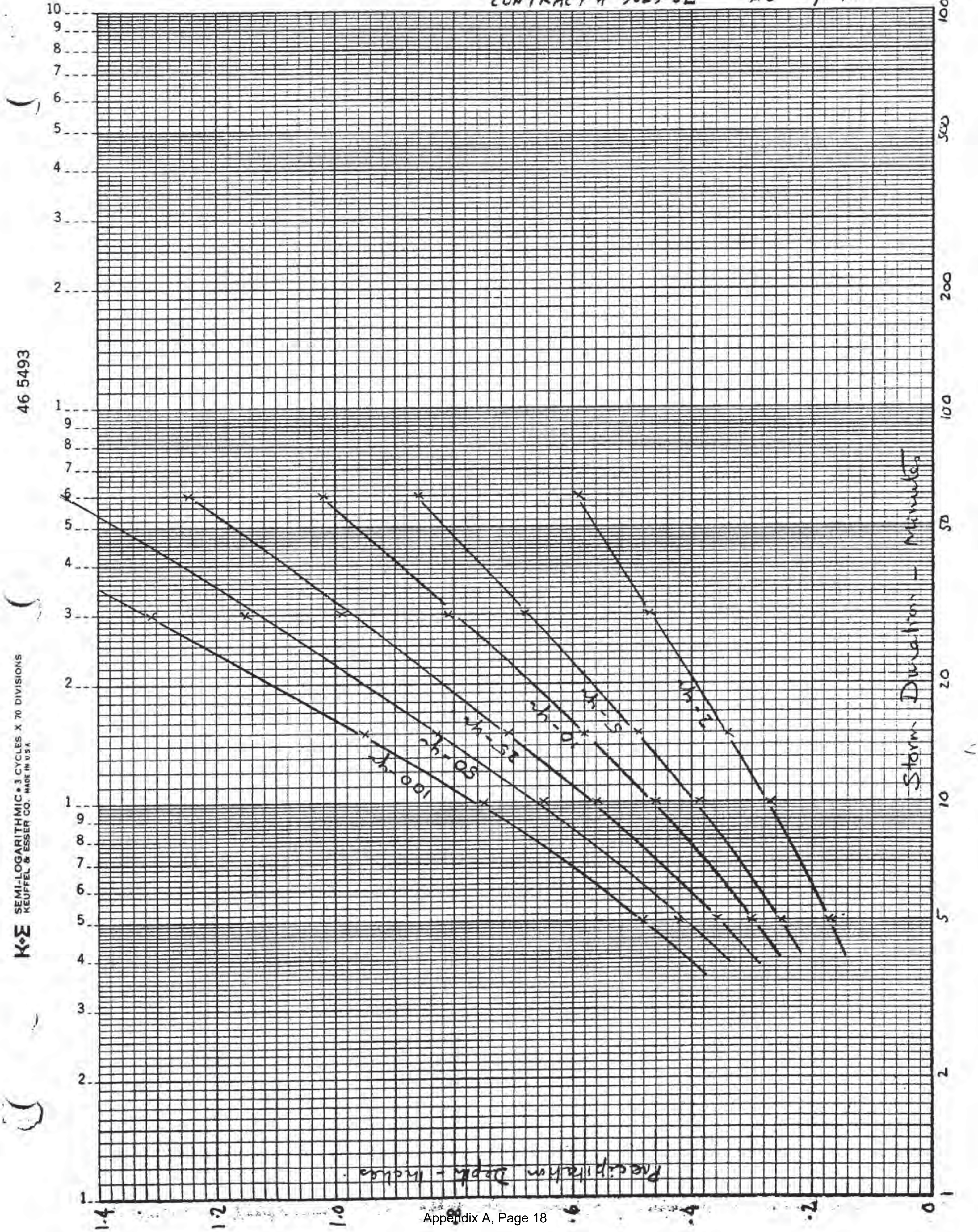
UMTRA/HAT
CONTRACT # 5025-02

ABH/1-6-86
AS 1/10/86

1 OF 1



Sheet 11
Project UMTRA - HAT
Contract No. 5025 - 02
File No.
Feature Site Hydrology
Designed POG
Date 6-3-86
Item —
Checked HM
Date 8/19/86

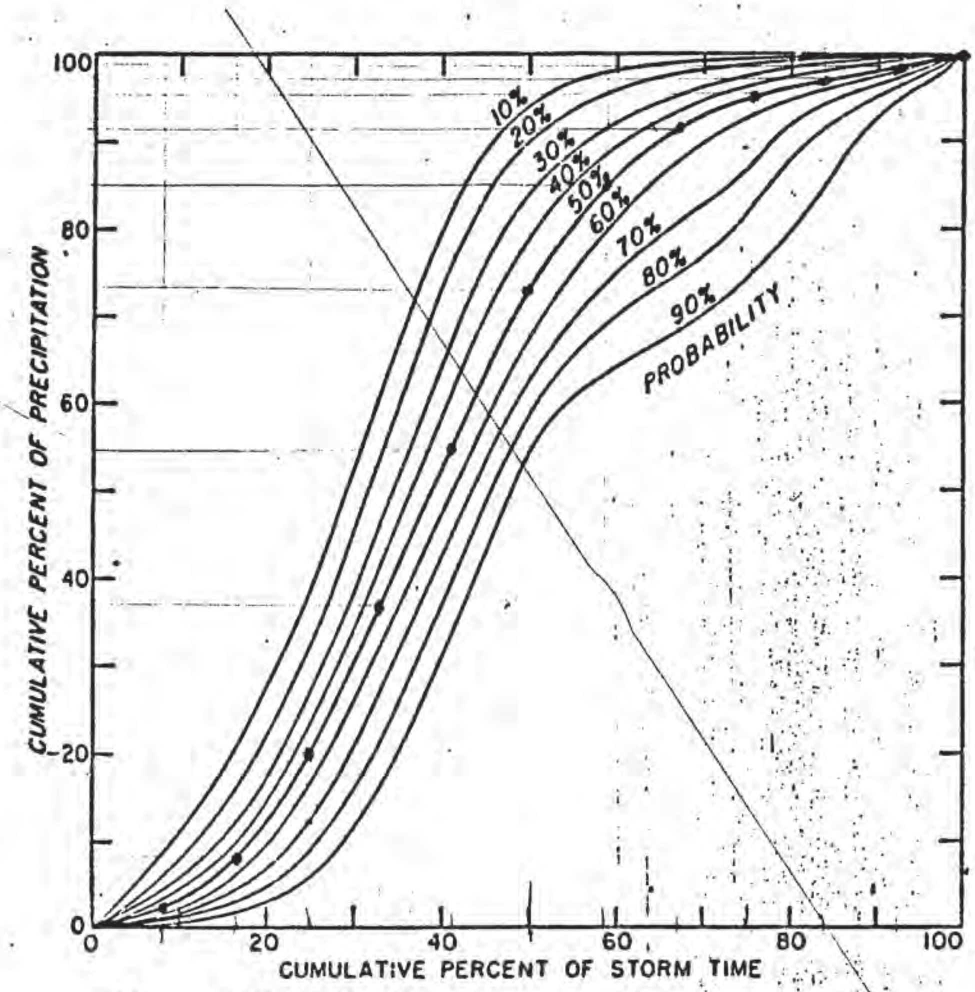


Fig. 4. Time distribution of second-quartile storms.

(from Huff (1967) p. 1010)

TIME	% TOTAL RAINFALL
0	
5min	3
10	5
15	12
20	17
25	19
30	18
35	12
40	7
45	4
50	2
55	1
60	1

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9-230-01
SHEETS 23 AND 24
SLB 5-9-88

Project UMTRA-HAT
Feature SITE HYDROLOGY
Item –
Sheet 12
Contract No. 5025-05
File No.
Designed POG
Date 5-23-86
Checked HM
Date 8/15/86

c) 25-year, 1-hour storm

The 25-year, 1-hour storm intensity is determined from Fig. 17A (DOC, 1977) as given on sheet 8 and is found to be 1.25 in.

The corresponding values for a 1-hour rainfall of 1.25in are found using Table 12 on sheet 9:

Duration	5min	10min	15min	30min	60min
Rainfall	0.36"	0.56"	0.71"	0.99"	1.25"
Intensity*	4.4"/hr	3.4"/hr	~~2.8"/hr~~	2.0"/hr	1.25"/hr

POG
8-20-86

The intensity-duration curve for the 25-year, 1-hour storm is plotted on sheet 10. ✓

d) 10-year, 24-hour storm

1) The 10-year, 24-hour precipitation is 1.7 inches (DOE, 1986, p. D-2~~7~~44) POG 8-20-86

2) The rainfall distribution (hyetograph) for this storm is developed using the figure on sheet 11 and is given below.

SUPERSEDED
SHB 5-9-88

TIME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
% TOTAL RAINFALL	1	1	2	~~3~~	4	8	8	9	~~9~~	9	10	8	7	5	~~4~~	2	2	2	~~2~~	1	1	1	1	1
				4	5				1		3								1					

45

= [illegible]
= 100%

→ (see sheet 26)

* Intensity is equal to $\frac{(\text{Rainfall}) \times (60\ \text{min})}{(\text{Duration})}$

POG
8-20-86

Project	UMTRA-HAT	Contract No. 5025-02	Sheet 13
			File No.
Feature	SITE HYDROLOGY	Designed POG	Date 6-3-86
Item	—	Checked HM	Date 5/18/8?

3. HYDROLOGY FOR PERMANENT DRAINAGE

a. Requirements

For the design of permanent drainage features, including all permanent drainage ditches and erosion protection, the duration-intensity relationship for the probable maximum precipitation (PMP) is needed. The PMP can be calculated for either (1) a general storm or (2) a local storm (DOC, 1977). Both the general and local PMP need to be determined and compared in order to find the worst case precipitation. ✓

b. General-Storm PMP

The general-storm PMP is calculated using the methods presented in Section 6.2 of Hydromet 49 (DOC, 1977). The worksheets for determining the general-storm PMP (Table 6. of Hydromet 49) are included on the following 6 sheets. The resulting monthly general-storm PMP ~~intensities~~ values are tabulated below:

HM
3/14/87

MONTH	6 HOUR	12	18	24	48	72
J	3.3 in	4.9	6.0	6.8	9.0	10.2 ✓
F	3.3	4.9	6.0	6.8	9.0	10.2 ✓
M	3.4	5.0	6.0	6.8	9.0	10.0 ✓
A	3.6	5.2	6.3	7.1	9.3	10.4 ✓
M	3.7	5.3	6.4	7.2	9.4	10.4 ✓
J	4.1	5.7	6.7	7.5	9.6	10.6 ✓
J	4.9	6.7	7.7	8.6	10.9	11.9 ✓
A	~~6.5~~ 5.5 HM 3/14/87	7.4	8.5	9.4	11.9	12.9
S	5.5 POG 8-20-86	7.4	8.5	9.4	11.9	12.9 ✓
O	5.1	6.9	8.1	9.0	11.5	12.6 ✓
N	~~4.1~~ 4.0	~~5.9~~ 5.8	~~7.1~~ 7.0	~~8.1~~ 7.9	~~10.7~~ 10.4	~~12.0~~ 11.7
D	3.6	~~5.3~~ 5.0	~~6.4~~ 6.1	~~7.4~~ 7.0	~~9.9~~ 9.7	~~11.2~~ 10.5

HM 5/18/8?
POG 8-20-86

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Project UMTRA - HAT Sheet 14
Feature SITE HYDROLOGY Contract No. 5025-02 File No.
Item 1 Designed PDG Date 6-3-86
Checked 11M Date 2/10/86

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area ______ mi^2 (km^2)
Latitude 37°09'N, Longitude 109°53'W of basin center

Month JAN

Step PDG 9-20-85

Duration (hrs) 6 12 18 24 48 72

A. Convergence PMP

1. Drainage average value from one of figures 2.5 to 2.16 8.4 in. (mm)
2. Reduction for barrier-elevation [fig. 2.18] 51 %
3. Barrier-elevation reduced PMP [step 1 X step 2] 4.3 in. (mm)
4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. 59 80 92 100 121 134 %
5. Convergence PMP for indicated durations [steps 3 X 4] 2.5 3.4 4.0 4.3 5.2 5.8 in. (mm)
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5] 2.5 0.9 0.6 0.3 0.9 0.6 in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29] __ __ __ __ __ __ %
8. Areally reduced PMP [step 6 X step 7] 2.5 0.9 0.6 0.3 0.9 0.6 in. (mm)
9. Drainage average PMP [accumulated values of step 8] 2.5 3.4 4.0 4.3 5.2 5.8 in. (mm)

B. Orographic PMP

1. Drainage average orographic index from figure 3.11a to d. (Revised) 3 in. (mm)
2. Areal reduction [figure 3.20] 100 %
3. Adjustment for month [one of figs. 3.12 to 3.17] 83 %
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.5 in. (mm)
5. Durational variation [table ~~3.6~~ 3.9] 32 59 81 100 152 177 %
6. Orographic PMP for given durations [steps 4 X 5] 0.8 1.5 2.0 2.5 3.8 4.4 in. (mm)

C. Total PMP

1. Add steps A9 and B6 3.3 4.9 6.0 6.8 9.0 10.2 in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area < 1.0 mi^2 ~~(km^2)~~
Latitude 37°09'N, Longitude 109°53'W of basin center

Month FEB

Step

Duration (hrs) 6 12 18 24 48 72

A. Convergence PMP

1. Drainage average value from one of figures 2.5 to 2.16 8.4 in. (mm)
2. Reduction for barrier-elevation [fig. 2.18] 51 %
3. Barrier-elevation reduced PMP [step 1 X step 2] 4.3 in. (mm)
4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. 59 80 92 100 121 134 %
5. Convergence PMP for indicated durations [steps 3 X 4] 2.5 3.4 4.0 4.3 5.2 5.8 in. (mm)
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5] 2.5 0.9 0.6 0.3 0.9 0.6 in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29] __ __ __ __ __ __ %
8. Areally reduced PMP [step 6 X step 7] 2.5 0.9 0.6 0.3 0.9 0.6 in. (mm)
9. Drainage average PMP [accumulated values of step 8] 2.5 3.4 4.0 4.3 5.2 5.8 in. (mm)

B. Orographic PMP

1. Drainage average orographic index from figure 3.11a to d. (Revised) 3 in. (mm)
2. Areal reduction [figure 3.20] 100 %
3. Adjustment for month [one of figs. 3.12 to 3.17] 82 %
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.5 in. (mm)
5. Durational variation [table ~~3.6~~ 3.9] 32 59 81 100 152 177 %
6. Orographic PMP for given durations [steps 4 X 5] 0.8 1.5 2.0 2.5 3.8 4.4 in. (mm)

C. Total PMP

1. Add steps A9 and B6 3.3 4.9 6.0 6.8 9.0 10.2 in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT
Area ________ mi² (km²)
Latitude 37°09'N, Longitude 109°53'W of basin center

Month MAR

Step		6	12	18	24	48	72	
A.	Convergence PMP							
1.	Drainage average value from one of figures 2.5 to 2.16: 8.4 in. (mm)							
2.	Reduction for barrier-elevation [fig. 2.18]: 51 %							
3.	Barrier-elevation reduced PMP [step 1 X step 2]: 4.3 in. (mm)							
4.	Durational variation [figs. 2.25 to 2.27 and table 2.7].	61	81	92	100	120	131	%
5.	Convergence PMP for indicated durations [steps 3 X 4]	2.6	3.5	4.0	4.3	5.2	5.6	in. (mm)
6.	Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	2.6	0.9	0.5	0.3	0.9	0.4	in. (mm)
7.	Areal reduction [select from figs. 2.28 and 2.29]	-	-	-	-	-	-	%
8.	Areally reduced PMP [step 6 X step 7]	2.6	0.9	0.5	0.3	0.9	0.4	in. (mm)
9.	Drainage average PMP [accumulated values of step 8]	2.6	3.5	4.0	4.3	5.2	5.6	in. (mm)
B.	Orographic PMP							
1.	Drainage average orographic index from figure 3.11a to d. (Revised): 3 in. (mm)							
2.	Areal reduction [figure 3.20]: 100 %							
3.	Adjustment for month [one of figs. 3.12 to 3.17]: 84 %							
4.	Areally and seasonally adjusted PMP [steps 1 X 2 X 3]: 2.5 in. (mm)							
5.	Durational variation [table 3.~~8~~ 9]	32	59	81	100	152	177	%
6.	Orographic PMP for given durations [steps 4 X 5]	0.8	1.5	2.0	2.5	3.8	4.4	in. (mm)
C.	Total PMP							
1.	Add steps A9 and B6	3.4	5.0	6.0	6.8	9.0	10.0	in. (mm)
2.	PMP for other durations from smooth curve fitted to plot of computed data.							
3.	Comparison with local-storm PMP (see sec. 6.3).							

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM
Area <1.0 mi² ~~(km²)~~
HM
POG
8-20-86
Latitude 37°09'N, Longitude 109°53'W of basin center

Month APR

Step		6	12	18	24	48	72	
A.	Convergence PMP							
1.	Drainage average value from one of figures 2.5 to 2.16: 8.8 in. (mm)							
2.	Reduction for barrier-elevation [fig. 2.18]: 51 %							
3.	Barrier-elevation reduced PMP [step 1 X step 2]: 4.5 in. (mm)							
4.	Durational variation [figs. 2.25 to 2.27 and table 2.7].	63	82	93	100	118	128	%
5.	Convergence PMP for indicated durations [steps 3 X 4]	2.8	3.7	4.2	4.5	5.3	5.8	in. (mm)
6.	Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	2.8	0.9	0.5	0.3	0.8	0.5	in. (mm)
7.	Areal reduction [select from figs. 2.28 and 2.29]							%
8.	Areally reduced PMP [step 6 X step 7]	2.8	0.9	0.5	0.3	0.8	0.5	in. (mm)
9.	Drainage average PMP [accumulated values of step 8]	2.8	3.7	4.2	4.5	5.3	5.8	in. (mm)
B.	Orographic PMP							
1.	Drainage average orographic index from figure 3.11a to d. (Revised): 3 in. (mm)							
2.	Areal reduction [figure 3.20]: 100 %							
3.	Adjustment for month [one of figs. 3.12 to 3.17]: 85 %							
4.	Areally and seasonally adjusted PMP [steps 1 X 2 X 3]: 2.6 in. (mm)							
5.	Durational variation [table 3.~~8~~ 9]	32	59	81	100	152	177	%
6.	Orographic PMP for given durations [steps 4 X 5]	0.8	1.5	2.1	2.6	4.0	4.6	in. (mm)
C.	Total PMP							
1.	Add steps A9 and B6	3.6	5.2	6.3	7.1	9.3	10.4	in. (mm)
2.	PMP for other durations from smooth curve fitted to plot of computed data.							
3.	Comparison with local-storm PMP (see sec. 6.3).							

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Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM
Area ______ mi^2 (km^2)
Latitude 37° 09'N, Longitude 109°53'W of basin center

Month MAY

Step	6	12	18	24	48	72	
	Duration (hrs)						
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 9.0 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 4.6 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	64	83	93	100	117	126	%
5. Convergence PMP for indicated durations [steps 3 X 4]	2.9	3.8	4.3	4.6	5.4	5.8	in. (mm)
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5]	2.9	0.9	0.5	0.3	0.8	0.4	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]							%
8. Areally reduced PMP [step 6 X step 7]	2.9	0.9	0.5	0.3	0.8	0.4	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	2.9	3.8	4.3	4.6	5.4	5.8	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 85 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.6 in. (mm)							
5. Durational variation [table 3.~~6~~ 9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5]	0.8	1.5	2.1	2.6	4.0	4.6	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	3.7	5.3	6.4	7.2	9.4	10.4	in. (mm)

2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Table 6.1.—General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM
Area < 1.0 mi^2 ~~(km^2)~~ HM
Latitude 37°09'N, Longitude 109°53'W of basin center

Month JUNE

Step	6	12	18	24	48	72	
	Duration (hrs)						
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 9.7 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 4.9 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	68	85	94	100	115	122	%
5. Convergence PMP for indicated durations [steps 3 X 4]	3.3	4.2	4.6	4.9	5.6	6.0	in. (mm)
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5]	3.3	0.9	0.4	0.3	0.7	0.4	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]							%
8. Areally reduced PMP [step 6 X step 7]	3.3	0.9	0.4	0.3	0.7	0.4	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	3.3	4.2	4.6	4.9	5.6	6.0	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 85 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.6 in. (mm)							
5. Durational variation [table 3.~~6~~ 9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5]	0.8	1.5	2.1	2.6	4.0	4.6	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	4.1	5.7	6.7	7.5	9.6	10.6	in. (mm)

2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

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Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area ______ mi² (km²)
Latitude 37°09'N, Longitude 109°52'W of basin center
Month JULY

Step	6	12	18	24	48	72	
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 11.2 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 5.7 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	71	87	95	100	114	119	%
5. Convergence PMP for indicated durations [steps 3 X 4]	4.0	5.0	5.4	5.7	6.5	6.8	in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	4.0	1.0	0.4	0.3	0.8	0.3	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]							%
8. Areally reduced PMP [step 6 X step 7]	4.0	1.0	0.4	0.3	0.8	0.3	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	4.0	5.0	5.4	5.7	6.5	6.3	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 96 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.9 in. (mm)							
5. Durational variation [table 3.~~6~~9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5]	0.9	1.7	2.3	2.9	4.4	5.1	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	4.9	6.7	7.7	8.6	10.9	11.9	in. (mm)

2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area < 1.0 mi² (km²) HM
Latitude 37°09'N, Longitude 109°53'W of basin center
Month AUG

Step	6	12	18	24	48	72	
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 12.5 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 6.4 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	71	87	95	100	114	119	%
5. Convergence PMP for indicated durations [steps 3 X 4]	4.5	5.6	6.1	6.4	7.3	7.6	in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	4.5	1.1	0.5	0.3	0.9	0.3	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]	100%						%
8. Areally reduced PMP [step 6 X step 7]	4.5	1.1	0.5	0.3	0.9	0.3	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	4.5	5.6	6.1	6.4	7.3	7.6	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 100 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 3 in. (mm)							
5. Durational variation [table 3.~~6~~9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5] P.X 3-20-86	1.0	1.8	2.4	3.0	4.6	5.3	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	6.3	7.4	8.5	9.4	11.9	12.9	in. (mm)

2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

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Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area ______ mi² (km²)
Latitude 37°09'N, Longitude 109°53'W of basin center

Month SEP

Step	6	12	18	24	48	72	
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 12.5 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 6.4 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	71	87	95	100	114	119	%
5. Convergence PMP for indicated durations [steps 3 X 4]	4.5	5.6	6.1	6.4	7.3	7.6	in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	4.5	1.1	0.5	0.3	0.9	0.3	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]							%
8. Areally reduced PMP [step 6 X step 7]	4.5	1.1	0.5	0.3	0.9	0.3	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	4.5	5.6	6.1	6.4	7.3	7.6	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 100 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 3 in. (mm)							
5. Durational variation [table 3.~~8~~ 9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5]	1.0	1.8	2.4	3.0	4.6	5.3	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	5.5	7.4	8.5	9.4	11.9	12.9	in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.							
3. Comparison with local-storm PMP (see sec. 6.3).							

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area <1.0 mi² ~~(km²)~~ H.M.
Latitude 37°09'N, Longitude 109°53'W of basin center

Month OCT

Step	6	12	18	24	48	72	
A. Convergence PMP							
1. Drainage average value from one of figures 2.5 to 2.16 11.8 in. (mm)							
2. Reduction for barrier-elevation [fig. 2.18] 51 %							
3. Barrier-elevation reduced PMP [step 1 X step 2] 6.0 in. (mm)							
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	68	85	94	100	115	122	%
5. Convergence PMP for indicated durations [steps 3 X 4]	4.1	5.1	5.7	6.0	6.9	7.3	in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5]	4.1	1.0	0.6	0.3	0.6	0.4	in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]							%
8. Areally reduced PMP [step 6 X step 7]	4.1	1.0	0.6	0.3	0.6	0.4	in. (mm)
9. Drainage average PMP [accumulated values of step 8]	4.1	5.1	5.7	6.0	6.9	7.3	in. (mm)
B. Orographic PMP							
1. Drainage average orographic index from figure 3.11a to (Revised) d. 3 in. (mm)							
2. Areal reduction [figure 3.20] 100 %							
3. Adjustment for month [one of figs. 3.12 to 3.17] 99 %							
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 3 in. (mm)							
5. Durational variation [table 3.~~8~~ 9]	32	59	81	100	152	177	%
6. Orographic PMP for given durations [steps 4 X 5]	1.0	1.8	2.4	3.0	4.6	5.3	in. (mm)
C. Total PMP							
1. Add steps A9 and B6	5.1	6.9	8.1	9.0	11.5	12.6	in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.							
3. Comparison with local-storm PMP (see sec. 6.3).							

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Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area ____ mi² (km²)
Latitude 37° 09'N, Longitude 109°53'W of basin center

Month NOV

Step Duration (hrs) 6 12 18 24 48 72

A. Convergence PMP
1. Drainage average value from one of figures 2.5 to 2.16 10.0 in. (mm)
2. Reduction for barrier-elevation [fig. 2.18] 51 %
3. Barrier-elevation reduced PMP [step 1 X step 2] 5.1 in. (mm)
4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. 61 81 92 100 120 131 %
5. Convergence PMP for indicated durations [steps 3 X 4] 3.1 4.1 4.7 5.1 6.1 6.7 in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5] 3.1 1.0 0.6 0.4 1.0 0.6 in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29] ___ %
8. Areally reduced PMP [step 6 X step 7] 3.1 1.0 0.6 0.4 1.0 0.6 in. (mm)
9. Drainage average PMP [accumulated values of step 8] 3.1 4.1 4.7 5.1 6.1 6.7 in. (mm)

B. Orographic PMP
1. Drainage average orographic index from figure 3.11a to d. (Revised) 3 in. (mm)
2. Areal reduction [figure 3.20] 100 %
3. Adjustment for month [one of figs. 3.12 to 3.17] 92 %
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.8 in. (mm)
5. Durational variation [table 3.~~8~~ 9] 32 59 81 100 152 177 %
6. Orographic PMP for given durations [steps 4 X 5] 0.9 1.7 [illegible] [illegible] [illegible] 5.[illegible]
~~1.0~~ 1.8 2.4 3.0 ~~4.6~~ 5.3 in. (mm) HM 8/15/86 POG 8-20-86

C. Total PMP
1. Add steps A9 and B6 7.[illegible] [illegible] [illegible] 11.[illegible]
4.0 5.9 ~~7.1~~ ~~8.1~~ ~~10.7~~ 12.0 in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage MEXICAN HAT, NM Area < 1.0 mi² (~~km²~~)
Latitude 37° 09'N, Longitude 109° 53'W of basin center

Month DEC

Step Duration (hrs) 6 12 18 24 48 72

A. Convergence PMP
1. Drainage average value from one of figures 2.5 to 2.16 8.6 in. (mm) 7
2. Reduction for barrier-elevation [fig. 2.18] 51 %
3. Barrier-elevation reduced PMP [step 1 X step 2] 4.4 in. (mm)
4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. 58 80 92 100 121 134 5 % POG 8-20-86
5. Convergence PMP for indicated durations [steps 3 X 4] 2.6 3.5 4.0 4.4 5.3 5.9 in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5] 2.6 0.9 0.5 0.4 0.9 0.6 in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29] ___ %
8. Areally reduced PMP [step 6 X step 7] 2.6 0.9 0.5 0.4 0.9 0.6 in. (mm)
9. Drainage average PMP [accumulated values of step 8] 2.6 3.5 4.0 4.4 5.3 5.9 in. (mm)

B. Orographic PMP
1. Drainage average orographic index from figure 3.11a to d. (Revised) 3 in. (mm)
2. Areal reduction [figure 3.20] 100 %
3. Adjustment for month [one of figs. 3.12 to 3.17] 88 %
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 2.6 in. (mm)
5. Durational variation [table 3.~~8~~ 9] 32 59 81 100 152 177 % ✓
6. Orographic PMP for given durations [steps 4 X 5] 0.83 1.5 2.1 2.6 4.0 4.6
~~1.0~~ ~~1.8~~ ~~2.4~~ ~~3.0~~ ~~4.6~~ ~~5.5~~ in. (mm) HM 8/15/86 POG 8-20-86

C. Total PMP
1. Add steps A9 and B6 3.4 5.0 6.1 7.0 9.3 10.5
~~3.6~~ 5.3 ~~6.4~~ ~~7.4~~ ~~9.9~~ ~~11.2~~ in. (mm)
2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

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C. Local - Storm PMP

The local-storm PMP is calculated using the methods presented in Section 6.3 of Hydromet 49 (DOC, 1977). The worksheets for determining the local-storm PMP (Tables 6.3A & 6.3B of Hydromet. 49) are included on the following two sheets.

The 1-hour, 1-sq. mile local-storm PMP is found to be 8.1 inches.

The durational variation in precipitation for the local-storm durations between 15-min and 6-hour are tabulated below:

Duration	Precipitation	Intensity*
15 min	6.0 in	24.0 in/hr
30 min	7.2	14.4
45 min	7.7	10.3
60 min	8.1	8.1
2 hr	8.9	4.5
3 hr	9.3	3.1
4 hr	9.6	2.4
5 hr	9.6	1.9
6 hr	9.7	1.6

To determine the intensity variation for times less than 15-minutes, the intensity-duration values tabulated above are plotted on sheet 23. The curve is mathematically modeled by the following equation:

$$i = 10^{[G + H(\log t)^{Z}]}$$ (See MKE, 1986)

This equation can be used to determine intensities for times less than 15 minutes once the G, H, and Z parameters are determined through extrapolation of the curve drawn on sheet 23

$$* \text{ Intensity} = \left(\frac{\text{Precipitation}}{\text{Duration}}\right) \times 60 \text{ min/hr}$$

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Table 6.3A.—Local-storm PMP computation, Colorado River, Great Basin and California drainages. For drainage average depth PMP. Go to table 6.3B if areal variation is required.

Drainage MEXICAN HAT Aréa <1.5 mi^2 (~~km^2~~) HM
Latitude 37°09'N Longitude 109°52'W Minimum Elevation ~~4250~~ ft (m)
41 – [illegible]

Steps correspond to those in sec. 6.3A.

1. Average 1-hr 1-mi^2 (2.6-km^2) PMP for drainage [fig. 4.5]. 8.1 in. (mm)

2. a. Reduction for elevation. [No adjustment for elevations up to 5,000 feet (1,524 m): 5% decrease per 1,000 feet (305 m) above 5,000 feet (1,524 m)]. 100 %

   b. Multiply step 1 by step 2a. 8.1 in. (mm)

3. Average 6/1-hr ratio for drainage [fig. 4.7]. 1.20

	Duration (hr)									
	1/4	1/2	3/4	1	2	3	4	5	6	
4. Durational variation for 6/1-hr ratio of step 3 [table 4.4].	74	89	95	100	110	115	118	119	120	%
5. 1-mi^2 (2.6-km^2) PMP for indicated durations [step 2b X step 4].	6.0	7.2	7.7	8.1	8.9	9.3	9.6	9.6	9.7	in. (mm)
6. Areal reduction [fig. 4.9].	100%									%
7. Areal reduced PMP [steps 5 X 6].	6.0	7.2	7.7	8.1	8.9	9.3	9.6	9.6	9.7	in. (mm)
8. Incremental PMP [successive subtraction in step 7].				8.1	0.8	0.4	0.3	0.0	0.1	in. (mm)
	6.0	1.2	0.5	0.4	} 15-min. increments					

9. Time sequence of incremental PMP according to: HMR No.5

   Hourly increments [table 4.7]. 0.4 0.3 0.8 0.1 8.1 0.0 in. (mm)

   Four largest 15-min. increments [table 4.8]. 6.0 1.2 0.5 0.4 ✓ in. (mm)

POG
8-20-86

MORRISON-KNUDSEN ENGINEERS, INC.
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Sheet 22
Project UMTRA - HAT
Contract No. 5025-02
File No.
Feature SITE HYDROLOGY
Designed POG
Date
Item —
Checked HM
Date 8/21/85

Table 6.3B.--Local-storm PMP computation, Colorado River and Great Basin, and California drainages. (Giving areal distribution of PMP).

Steps correspond to those in sec. 6.3B.

1. Place idealized isohyetal pattern [fig. 4.10] over drainage adjusted to 1:500,000 scale to obtain most critical placement.
2. Note the isohyets within drainage.
3. Average 1-hr 1-mi^2 (2.6-km^2) PMP for drainage [fig. 4.5]. 8.1 in. (mm)
4. a. Reduction for elevation. [No adjustment for elevations up to 5,000 feet (1,524 m), 5% decrease per 1,000 feet (305 m) above 5,000 feet (1,524 m)]. 100 %

   b. Multiply step 3 by step 4a. 8.1 in. (mm)
5. Average 6/1-hr ratio for drainage [fig. 4.7]. 1.2
6. Obtain isohetal labels for 15-min incremental and the highest PMP from table 4.5 corresponding 6/1-hr ratio of step 5.

	Isohyet										
PMP Increment	A	B	C	D	E	F	G	H	I	J	
AREA (sq. mi	1	5	25	55	95	150	220	300	385	500	
Highest 1-hr	100	82	58	44	32	23	16	13	12	11	
Highest 15-min.	74	56	32	21	14	8	7	6	5	4	
2nd "	15	15	15	12	9	6	4	3	3	3	
3rd "	6	6	6	6	5	5	3	2	2	2	in %
4th "	5	5	5	5	4	4	2	2	2	2	

7. Obtain isohyetal labels in % of 1-hr PMP for 2nd to 6th highest hourly incremental PMP values from table 4.6 using 6/1-hr ratio of step 5.

2nd Highest 1-hr PMP	11	11	11	11	10	8	7	5	5	5	
3rd "	4	4	4	4	4	4	4	4	4	4	
4th "	3	3	3	3	3	3	3	3	3	3	in %
5th "	2	2	2	2	2	2	2	2	2	2	
6th "	1	1	1	1	1	1	1	1	1	1	

8. Multiply steps 6 and 7 by step 4b to get incremental isohyetal labels of PMP.

Highest 15-min.	6.0	4.5	2.6	1.7	1.1	0.6	0.6	0.5	0.4	0.3	
2nd "	1.2	1.2	1.2	1.0	0.7	0.5	0.3	0.2	0.2	0.2	
3rd "	0.5	0.5	0.5	0.5	0.4	0.4	0.2	0.2	0.2	0.2	
4th "	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	
Highest 1-hr	8.1	6.6	4.5	3.6	2.6	1.9	1.3	1.1	1.0	0.9	in in. (mm)
2nd "	0.9	0.9	0.9	0.9	0.8	0.6	0.6	0.4	0.4	0.4	
3rd "	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
4th "	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
5th "	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
6th "	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	

9. Arrange values of step 8 in time sequence [tables 4.7 and 4.8].

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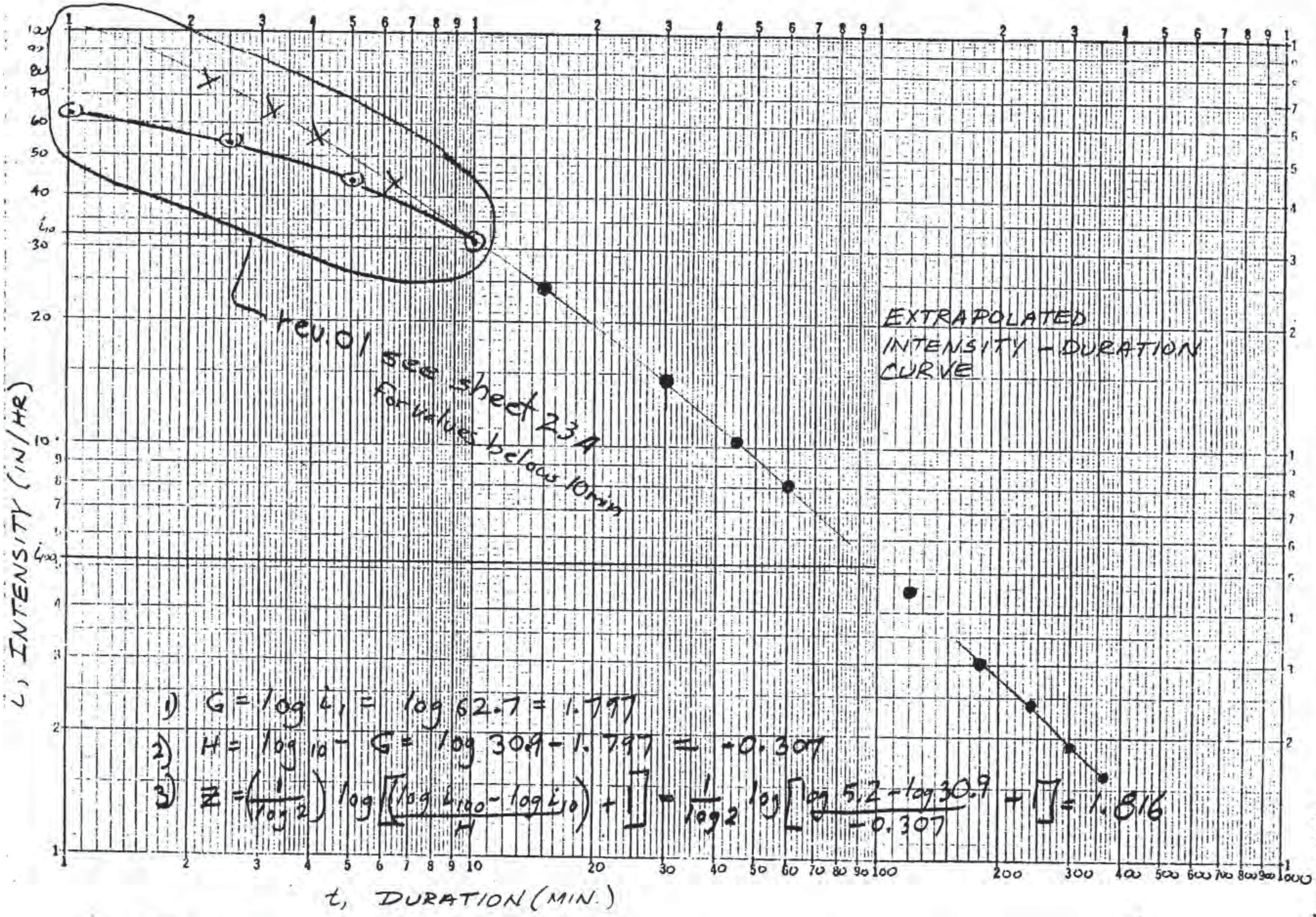
Project: UMTRA - HAT
Contract No. 5025-02
Sheet: 23
File No.:
Feature: SITE HYDROLOGY
Designed: POG
Date: 6-5-86
Item: —
Checked: HM
Date: 5/2[illegible]/[illegible]

Rev.01 RFC 5/7/87
HM June 10/87



1) $G = \log i_1 = \log 62.7 = 1.797$

2) $H = \log i_{10} - G = \log 30.9 - 1.797 = -0.307$

3) $Z = \left(\frac{1}{\log 2}\right) \log \left[\left(\frac{\log i_{100} - \log i_{10}}{H}\right) + 1\right] = \frac{1}{\log 2} \log \left[\frac{\log 5.2 - \log 30.9}{-0.307} + 1\right] = 1.816$

~~(1) G = log i_1 = log 101 = 2.004~~ = log 62.7 = 1.797 ✓

~~(2) H = log i_{10} - G - log 32 - 2.004 = -0.499~~ ✓ = log 32 - 1.797 = -0.292

~~(3) Z = $\left(\frac{1}{\log 2}\right) \log \left[\left(\frac{\log i_{100} - \log i_{10}}{H}\right) + 1\right] = \left(\frac{1}{\log 2}\right) \log \left[\frac{\log 5.2 - \log 3.2}{-0.499} + 1\right] = 1.661$~~

Deleted Rev 01

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Project	UMTRA - HAT	Contract No. 5025-02	Sheet 23A
Feature	SITE HYDROLOGY	Designed Rev.01 RFC	File No.
Item	Intensity Duration Curve.	Checked Rev.01 HM	Date 6/7/86
			Date June 10/87

This Sheet is a new sheet and is part of <u>revision 01.</u>

From TAD (Table 3.1 page 29)

Table 3.1 Incremental rainfall duration percentages

Rainfall duration (min) (RD)	Percentage of 1-hr PMP (%)
2.5	27.5
5	45
15	74
30	89
45	95
60	100

% of 1-hr PMP = RD/(0.0089 x RD + 0.0686) R^2 = 0.9998

for 1.0 min % = 1/(0.0089 x 1.0 + 0.0686) = 12.9%

From sheet 20 - 60 min PMP intensity = 8.1"/hr.

From above & Formula 7 (TAD, Page 31)

$$I = PMP_{(t_c)} \times \frac{60}{t_c} \text{ inches/hour. . . . . . .(7)}$$

where $PMP_{(t_c)}$ = the incremental rainfall amount for the time of concentration.

t_c = time of concentration.

(RD)	% of 1-hr PMP	$I = \% \times 8.1" \times \frac{60}{T_c}$	
1.0 min	12.9	0.129 × 8.1" × 60/1 =	62.7"/hr.
2.5	27.5	0.275 × 8.1" × 60/2.5 =	53.5"/hr.
5	45	0.45 × 8.1" × 60/5 =	43.7"/hr
15	74	0.74 × 8.1 × 60/15 =	24.0"/hr
10	63.5	0.635 × 8.1 × 60/10 =	30.9"/hr

HM June 1/87
RFC 6/10/87

From sheet 23 Intensity including of below 10 min is changed

G = 1.797 changed this revision
H = -0.307 " " "
Z = 1.816 " " "

Note: No change in itensities above 10 min. duration ; minor change from 6 to 10 min duration.

Project UMTRA - HAT	Contract No. 5025-02	Sheet 24
Feature SITE HYDROLOGY	Designed POG	File No.
Item —	Checked HM	Date 6-6-86
		Date 8/21/86

d. Design PMP

After developing both the general-storm and local-storm PMP's for the Mexican Hat site, it is clear that the local-storm PMP represents the worst-case. Therefore, the local storm parameters and intensity-duration characteristics developed in the preceding three sheets will be used in the design of permanent erosion protection.

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Project UMTRA - HAT
Feature SITE HYDROLOGY
Item —
Contract No. 4005-05
Designed POG
Checked HM
Sheet 25
File No.
Date
Date 8/2[illegible]/85

Rev.01 RFC. 1/7/87
HM June 10/87

5. REFERENCES

DOE (U.S. Department of Energy), 1986, Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings Site at Mexican Hat, Utah – Text, Appendices A, B, & C. – Draft, Albuquerque, N.M.

DOC (U.S. Department of Commerce), 1973, Precipitation Frequency Atlas for The U.S. – Volume 6 Utah, National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Md.

Huff, F.A., 1967, "Time Distribution of Rainfall in Heavy Storms," Water Resources Research, Vol. 3, No. 4, pp. 1007 – 1019.

MKE, (Morrison-Knudsen Engineers, Inc.), 1986, "Procedure for Determining Curve Parameters for Design Precipitation Intensity," unpublished report prepared for UMTRA project, MKE Document No. 4005-GEN-R-01-02622-00.

[TAD (U.S. Department of Energy), May 1986 "Technical Approach Document" for UMTRA project. MKE Doc. No. 4005-GEN-R-04-02239-01] Rev.01

Appendix B

Riprap and Filter Design Calculation

Calculation Cover Sheet

QUALITY REQUIREMENTS
BY C Ricketts
QA ENTRY NO.

MKO

Contract No. 3885-51 **Discipline** MKES **Calc. No.** 9-418-05-~~00~~ 01
No. of Sheets ~~16~~ ~~17~~ 18

Project
UMTRA - HAT/MON

Feature
EROSION PROTECTION

Item
OVERSIZING, GRADATION, & THICKNESS

Sources of Data
—

Sources of Formulae & References
(see sheet ii)

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No.** —

01	(see sheet iv.)	Jason C. Kuo	2-18-92		2/19/92		2/19/92
00	—	Jason C. Kuo	5-16-91	Belinda Wong	5-20-91		5/29/91
Rev. No.	**Revision**	**Calculation By**	**Date**	**Checked By**	**Date**	**Approved By**	**Date**

Form 42-110

MORRISON-KNUDSEN ENGINEERS, INC.
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Project UMTRA - H/M
Feature Erosion Protection
Item Oversizing, Gradation, Thickness
Contract No. 3885-58
Designed JCK
Checked BYW
Sheet i
File No.
Date 5-16-91.
Date 5-28-91

Summary :

1. Riprap Type A. B. C :

. Design gradation limits are shown on sheet 3.

- Design gradation curves are shown on sheets 4, 5, 6.

- Design layer thicknesses are shown on sheet 12.

2. Bedding material :

- Design gradation limit is shown on sheet 10.

- Design gradation curve is shown on sheet 11

- Design layer thickness is shown on sheet 12.

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Project UMTRA MAT/MON	Contract No. 3885-58	Sheet ii	
Feature Erosion Protection	Designed JCK	Date 5-14-91	
Item Oversizing, gradation, thickness	Checked BYW	Date 5-28-91	
	△01 jck	2-18-92	
	FHW	2/19/92	

CONTENTS

MORRISON-KNUDSEN ENGINEERS, INC.
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Project UMTRA-HAT/MON	Contract No. 3885-58	Sheet iii	
		File No.	
Feature Erosion Protection	Designed JCK	Date 5-14-91	
Item Oversizing, Gradation, & Thickness	Checked BYW	Date 5-28-91	

01 JCK 2-18-92
FHW 3/19/92

REFERENCES:

1. "UMTRA-Mexican Hat: Erosion Protection – Rock Quality Evaluation at Bluff", Cal. # 9-259-05-00, 5/88.

2. MKES, "UMTRA-HAT/MON: Erosion Protection – Riprap Design" MKES Cal. # 9-418-01-~~00~~01, ~~5/91~~ 2/92 01

3. MKE, "UMTRA Design Procedures", Rev. 7, ch 5, 1/89

4. DOE, "Use of Coarse Material in the Bedding Layer on UMTRA Sites", MKE DOC. # 5025-HAT-C-03-01853-00, 11/89

5. J.L. Sherard, et al, "Basic Properties of Sand and Gravel Filters", Journal of Geot. Eng., Vol. 110, No. 6, 6/84

6. T.W. Lambe & R.V. Whitman, "Soil Mechanics", 1978

7. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, 1959

8. NAVFAC, DM-7.1, "Soil Mechanics", 1982

9. MKES, "UMTRA HAT/MON: Erosion Protection – Rock Quality Sugarloaf and Lime Ridge". Cal. # 9-418-04-00, 5/91

MK-ENVIRONMENTAL SERVICES
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Project UMTRA - HAT/MON	Contract No. 38858	Sheet iV	File No. -
Feature Erosion Protection	Designed Jclk	Date 2-18-92	
Item Oversizing, Gradation, & Thickness	Checked FHW	Date 2/19/92	

(This entire sheet is added for Rev. 01)

- Purpose of Rev. 01

To include the rounded rock (such as Bluff) as an alternative rock source for the Riprap Type C.

- Summary :

1. sheets revised : ii, iii, 1, 3, 9, 12
   sheets added : iV,
   sheet superseded : 2, 5.

ENG 375/89 (ENV.) #4242/89

MORRISON-KNUDSEN ENGINEERS, INC.
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Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet 1.	File No.
Feature Erosion Protection	Designed JCK	Date 5-14-91	
Item Oversizing, Gradation, & Thickness	Checked BYW	Date 5-28-91	

01 JCK 2-18-92
ENAS 2/19/92

1. Introduction:

Currently, the riprap materials for erosion protection at the UMTRA Mexican Hat site, Utah are proposed to be obtained from (1) Bluff quarry and (2) Sugarloaf quarry, Utah. The materials from Bluff quarry are round river cobbles with rock quality scores (RQS) greater than 80% (sheet 1 of Ref 1). 01 These materials will be used as riprap type A, B, C and bedding material. The materials from Sugarloaf quarry are composed of crushed limestone with RQS > 80% and crushed sandstone with RQS ≥ 65% (sheet 1 of Ref 9). This material can be used for Riprap Type A, B, and C.

The purpose of this calculation set is to determine

1. gradation requirements and layer thicknesses for riprap materials from both borrow sources:
   (1) rounded rock (Bluff quarry): with RQS > 80%.
   (2). angular rock (Sugarloaf quarry): a conservative RQS = 65% was assumed (sheet 1, Ref 9)
2. Gradation requirements and layer thickness for bedding material.

2. Method:

The required riprap $D_{50,min}$ sizes were determined elsewhere (Ref 2). For riprap material with RQS < 80%, the $D_{50,min}$ need to be oversized as described in Ref. 3. Ref. 3 was also used to determine the gradation requirements and layer thickness. To have a better drainage within the bedding layer, the method used in determining gradation requirements was described on sheet 7.

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Sheet 2
Project UMTRA - HAT/MON
Contract No. 3885-58
File No. –
Feature Erosion Protection
Designed JCK
Date 2-18-92.
Item Oversizing, Gradation, Thickness
Checked THW
Date 2/19/92

– (This sheet is part of Rev. 0/)

3. Gradation Requirement for Riprap :

3.1 Required Oversizing : (Ref. 3)

- RQS < 80% : oversizing factor (OF) = (80 - RQS) %.
- RQS ⩾ 80% : OF = 0 %.

⇒ oversized D_{50} : $D^*_{50,min} = (1 + OF) \times D_{50,min}$.

3.2 Calculating $D^*_{50,min}$:

Riprap type	Rock Source (1)	$D_{50,min}$ (2) (in)	RQS (%)	OF (%)	$D^*_{50,min}$ (in)	Selected $D^*_{50,min}$ (in)
A	rounded	1.5	≥80	0	1.5	1.7
	angular	1.5	65	15	1.7	
B	rounded	4.4	≥80	0	4.4	4.4
	angular	3.4	65	15	3.9	
C	rounded	6.6	≥80	0	6.6	6.9
	angular	6.0	65	15	6.9	

Remarks: (1) Rounded rock from Bluff source.
angular rock from Sugarloaf source
(2) data from Ref 2.

3.3 Calculating $D_{100,min}$, $D_{100,max}$, $D_{25,min}$

from Ref. 3 : $D_{100,min} = 1.26 \times D^*_{50,min}$

$D_{100,max} = 1.71 \times D^*_{50,min}$

$D_{25,min} = 0.68 \times D^*_{50,min}$

Therefore,

Riprap Type	$D_{100,min}$ (in)	$D_{100,max}$ (in)	$D_{25,min}$ (in)
A	2.1	2.9	1.2
B	5.5	7.5	3.0
C	8.7	11.8	4.7

Project	UMTRA - HAT MON	Contract No.	3885-58	Sheet	3
Feature	Erosion Protection	Designed	JCK	File No.	
				Date	5-16-91
Item	Oversizing, Gradation & Thickness	Checked	BYW	Date	5-28-91

3. Gradation Calculation for Riprap : (cont'd) Rev. 01 JCK 2-18-92
FNW 2/19/92

(B) Summary of Gradation Limits :

1. Riprap Type A :

U.S. Standard Sieve opening (in)	percentage finer by weight (%)
3	100
2	0 - 100
$1\frac{1}{2}$	0 - 40
1	0 - 10
$\frac{1}{2}$	0 - 5

2. Riprap Type B :

U.S. Standard Sieve opening (in)		percentage finer by weight (%)
8		100
~~5~~ 6	Rev 01	25 ~~0~~ - 100
~~4~~ 5		0 - ~~40~~ 100
~~3~~ 4		0 - 25
1		0 - 5

3. Riprap Type C :

U.S. Standard Sieve opening (in)	percentage finer by weight (%)
12	100
9	0 - 100
7	0 - 50
5	0 - 25
2	0 - 5

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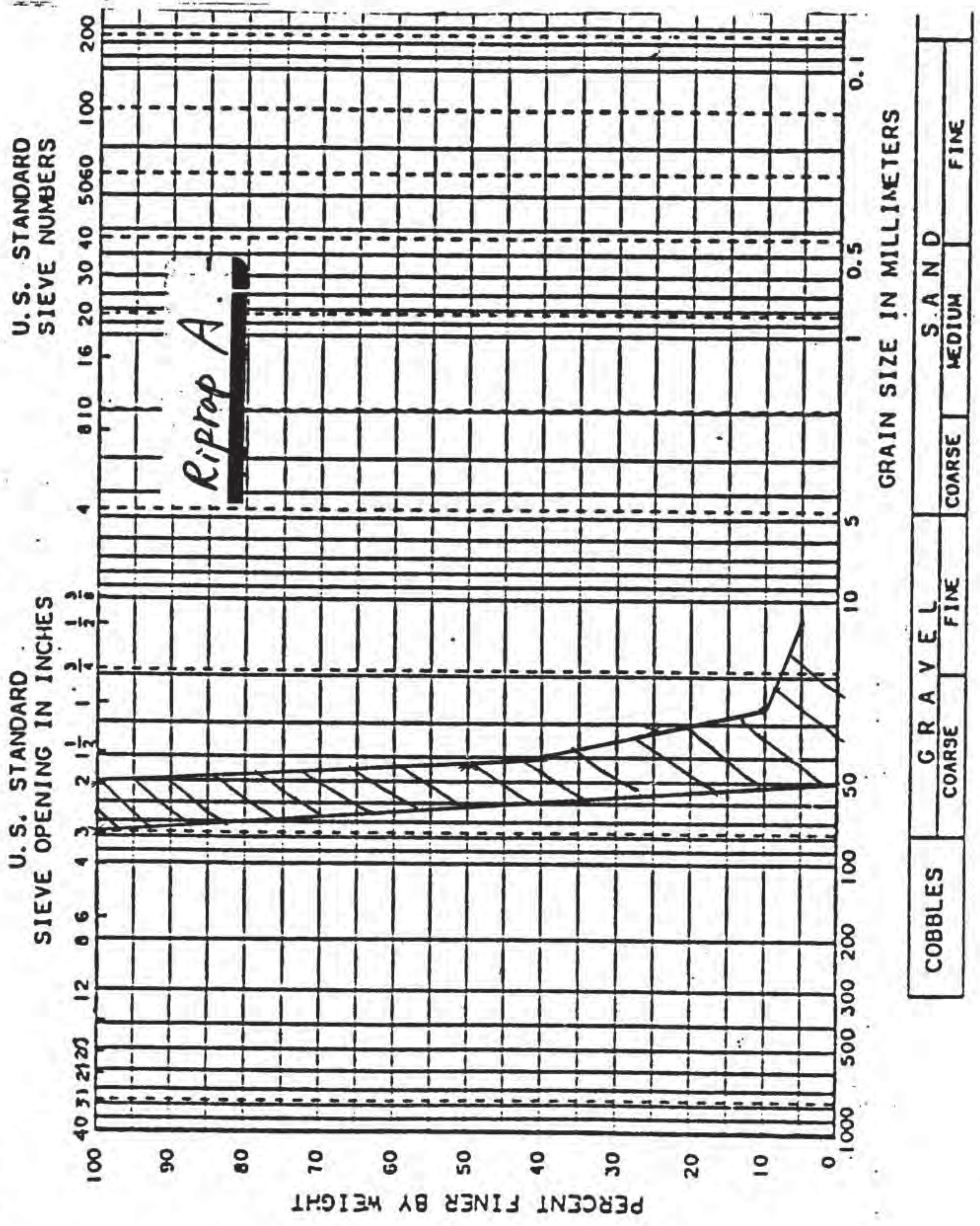
Project UMTRA · HAT/MON	Contract No. 3885-58	Sheet 4
Feature Erosion Protection	Designed Jck	File No.
Item Oversizing, gradation, & Thickness	Checked BJW	Date 5-16-91
		Date 5-28-91

3. Gradation Calculation for Riprap : (cont'd)

(c) gradation Curves :



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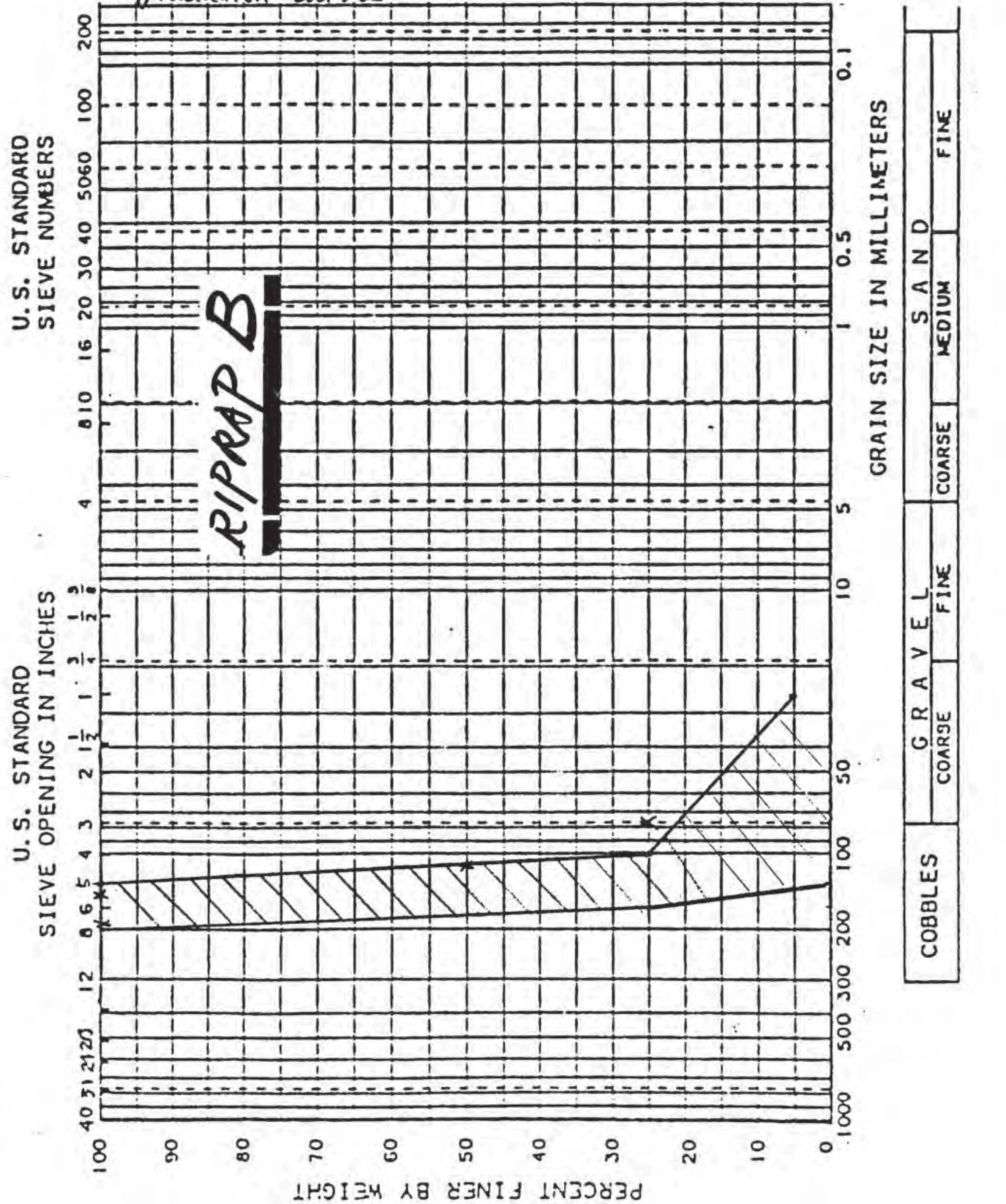
Project	UMTRA - HAT/MON	Contract No. 3885-58	Sheet 5
			File No.
Feature	Erosion Protection	Designed JCK	Date 2-18-92
Item	Oversizing, gradation & thickness	Checked ZHW	Date 2/19/92

(This sheet is for Rev. 01)

3. Gradation Calculations for Riprap (cont'd)

(c) Gradation Curves



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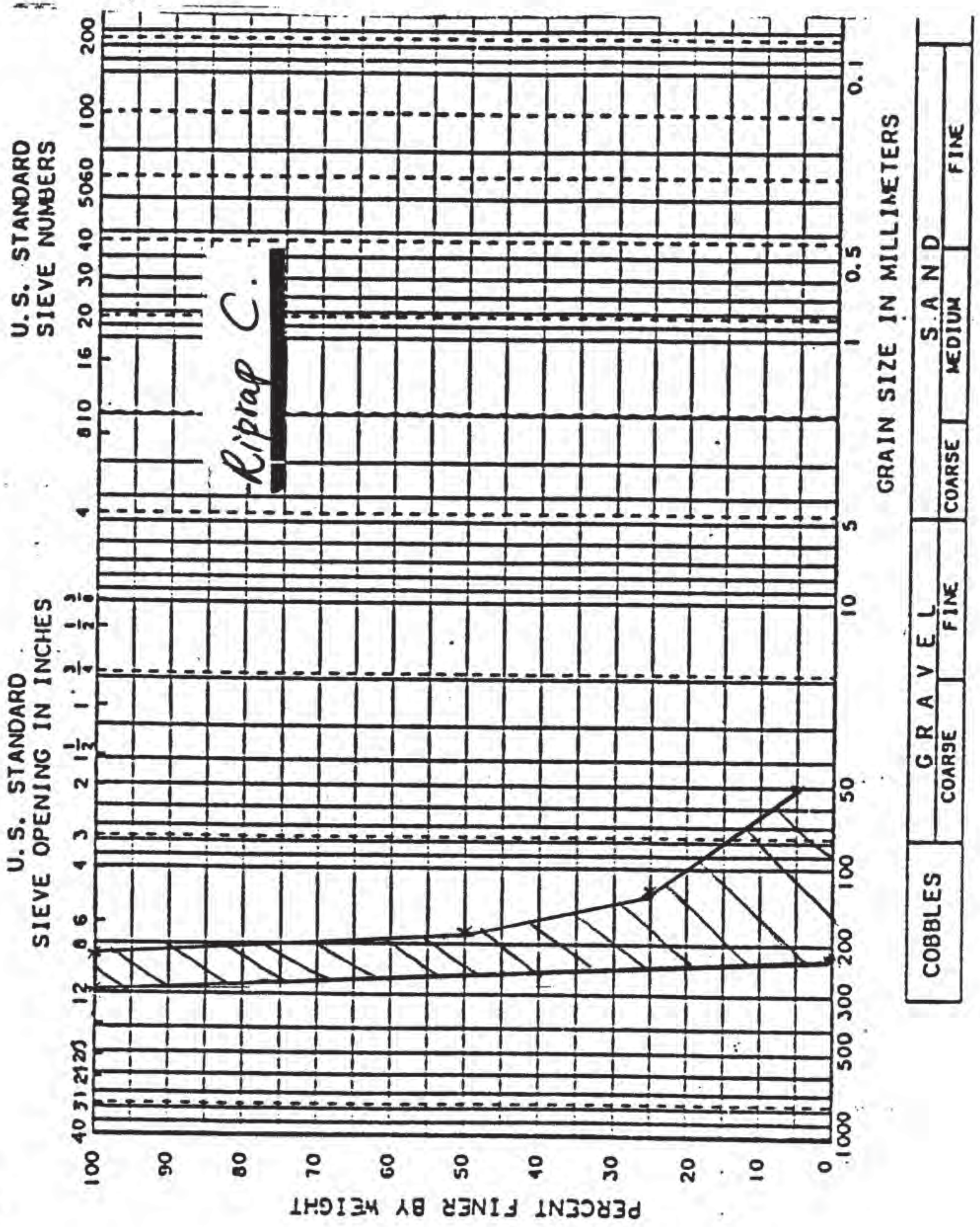
Project	UMTRA HAT/MON	Contract No.	3885-58	Sheet	6
				File No.	
Feature	Erosion Protection	Designed	JCK	Date	5-16-91
Item	Oversizing, Gradation, & Thickness	Checked	BJW	Date	5-28-91

3. Gradation Calculations for Riprap : (cont'd)

(c) Gradation Curve :



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Project UMTRA - H/M Contract No. 3885-58 Sheet 7 File No.
Feature Erosion Protection Designed JCK Date 5-16-91
Item Oversizing, Gradation, Thickness Checked BJW Date 5-28-91

4. Gradation Calculation for Bedding Material:

A) grain Size Requirements for Better Drainage:

as indicated on sheet 13: "The DOE agrees with the TAC recommendation to coarsen the bedding layer at the Mexican Hat Site". (Ref. 4). The following approach was taken to permit better drainage in the bedding layer.

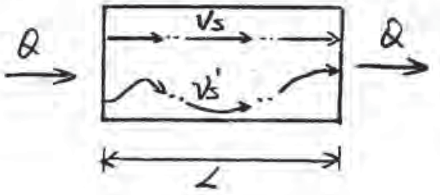
1. method:

① By assuming Darcy's Law, the seepage velocity

$$V_s = \frac{K \cdot i}{n} \qquad \text{(p252 of Ref. 6)}$$

where
V_s - seepage velocity, assumed a straight flow path (cm/sec)
K - permeability (cm/sec)
i - gradient
n - porosity, assume 0.3

② Actual seepage velocity:



V_s is a fictitious velocity: The actual seepage velocity V_s' is that the water travels along an irregular path with a greater distance L'.

$$T = L'/L \approx 1.5 \qquad \text{(p694 of Ref. 5)}$$

$$\text{Since } \frac{L}{V_s} = \frac{L'}{V_s'} \Rightarrow V_s' = V_s \cdot \frac{L'}{L} = V_s T$$

$$\therefore V_s' = \frac{K \cdot i}{n} \cdot T$$ where T: tortuosity factor.

③ $K = 0.35 \cdot (D_{15})^2$ (eq 2. of Ref 5)

where D_{15}: grain size which 15% of the total soil particles are small (cm)

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Project UMTRA MAT/MON	Contract No. 3885-58	Sheet 8	File No.
Feature Erosion Protection	Designed JCK	Date 5-18-91	
Item Oversizing, Gradation, Thickness	Checked BJW	Date 5-28-91	

4. Gradation Calculations for Bedding Material : (cont'd)

(A) Grain Size Requirements for Better Drainage : (cont'd)

2. Calculations.

A. D_{15} upperbound :

- The maximum seepage velocity That will not cause erosion for very fine material in Ref. 7 is 0.5 ft/sec (Ref. 7 Fig 7-3) assuming subgrade soil is non-dispersive.
- The max. slope of riprapped areas for Mexican Hat Site is 20%

From $V_s = \frac{K i}{n} \cdot T \Rightarrow K = \frac{V_s \cdot n}{i \cdot T} = \frac{0.5 \cdot 0.3}{0.2 \cdot 1.5}$

$= 0.5$ ft/sec

$= 15.2$ cm/sec

From $K = 0.35 (D_{15})^2 \Rightarrow D_{15} = \sqrt{K/0.35} = \sqrt{15.2/0.35} = 6.6$ mm

use $\boxed{D_{15} \leq 6.6 \text{ mm } (0.26'')}$

B. D_{15} lowerbound :

From p7.1-275 of Ref. 8 : "Mixtures of about equal parts gravel with medium to coarse sand have a permeability of approximately 1 fpm" for the drainage materials.

$\Longrightarrow K = 1$ fpm $= 0.51$ cm/sec

for $D_{15} = \sqrt{0.51/0.35} = 1.2$ mm

Oversized by 15% for rock quality

$\therefore D_{15} = 1.2 \times 1.15 = 1.4$ mm

use $\boxed{D_{15} \geq 1.4 \text{ mm } (0.06'')}$

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Project UMTRA - MAT/MON
Feature Erosion Protection
Item Oversizing, Gradation, Thickness
Contract No. 3885-58
Designed JCK
Checked BYW
Sheet 9
File No.
Date 5-16-91
Date 5-28-91

4 Gradation Calculation for Bedding Material : (cont'd)

(B) Use "filter criteria with Riprap"

Only one kind of bedding material was proposed to be used for Mexican Hat site.

A. From Ref 3, p5-14 : $\frac{D_{15})_f}{D_{85})_b} \leq 7.5$

("f" denotes riprap layer and "b" denotes bedding layer)

therefor : $D_{85})_b \geq \frac{D_{15})_f}{7.5}$

Riprap Type	A	B △1	C
Max. $D_{15})_f$ (1)	2.1"	~~5.5~~" 5.9	9.1"
min. $D_{85})_b$ (2)	0.28"	~~0.73~~" 0.79	1.21

Rev. 01
JCK 2-18-92.
FHW 2/19/92

remarks: (1) obtained from sheets 4 to 6
(2) min. $D_{85})_b$ = max. $D_{15})_f / 7.5$

∴ the governing min $D_{85})_b$ from above table is 1.21"

$\Rightarrow$ Say $\boxed{D_{85} \geq 1.2''}$

B. From Ref 3. P5-14. $\boxed{D_{100})_{max} \leq 3''}$

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Project	UMTRA HAT/MON	Contract No. 3885-58	Sheet 10
			File No.
Feature	Erosion Protection	Designed JCK	Date 5-16-91
Item	Oversizing, Gradation, Thickness	Checked BYW	Date 5-28-91

4. Gradation Calculations for Bedding Material : (cont'd)

(C) Summary of Gradation Limits :

A. Calculated grain sizes :

$1.4\,mm\,(0.06") \le D_{15} \le 6.6\,mm\,(0.26")$ (from sheet 8)

$1.2" \le D_{85}$ (from sheet 9)

$D_{100} \le 3"$ (from sheet 9)

B. Proposed gradation Requirements :

U.S. standard sieve		% passing by weight
No.	Size	
	3"	100
	1 1/2"	50 - 100
	1"	35 - 70
4		10 - 30
30		0 - 5

gradation limits shown on sheet 11.

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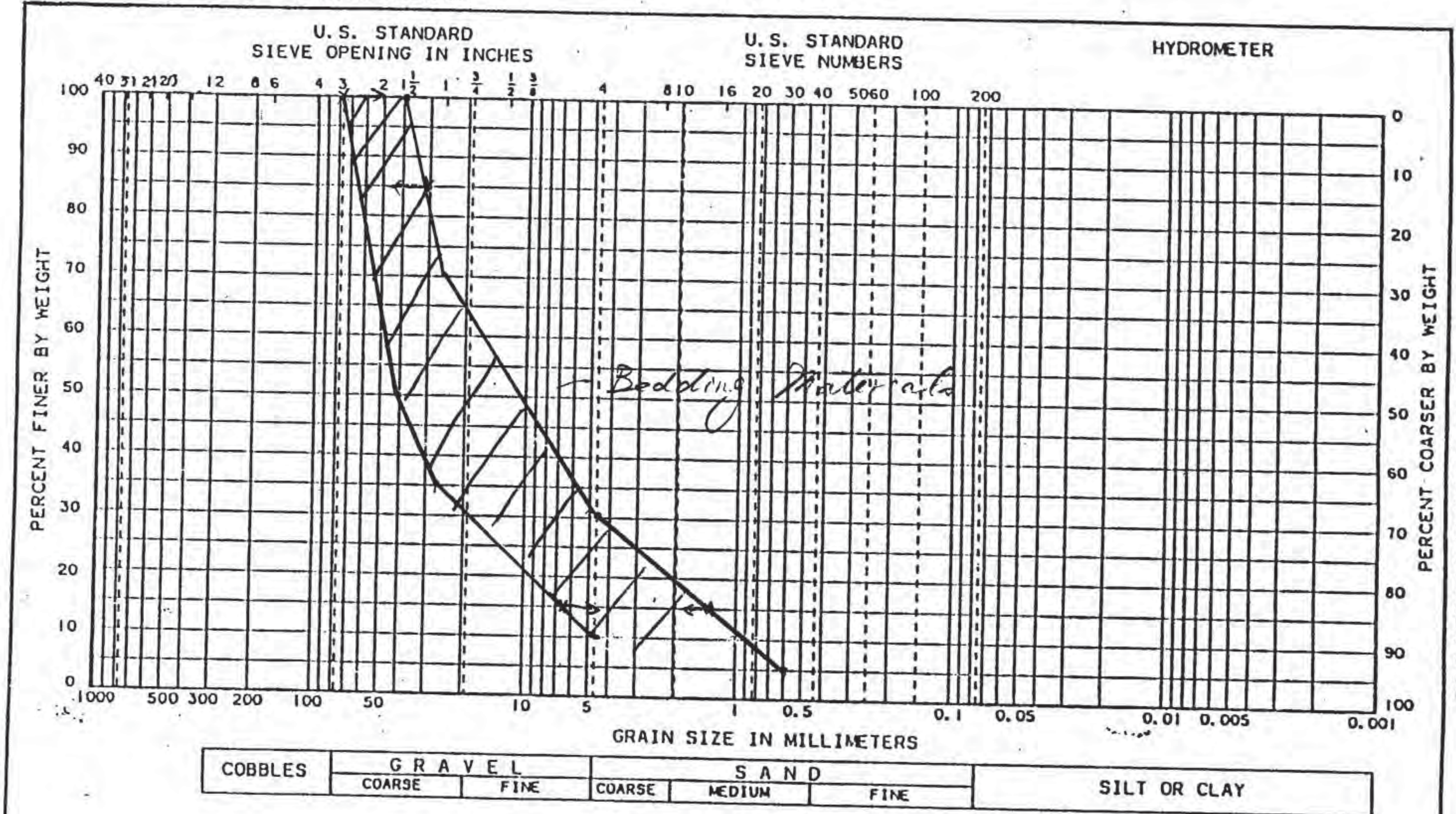
GRAIN SIZE ANALYSIS

UMTRA HAT/MON



PROJECT	UMTRA - HAT/MON
JOB NO.	3885-58
AREA	Bedding material
HOLE NO.	
DATE	

Sheet # 11
Jck 5-16-91
BMN 5-28-91

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY

Project	UMTRA - HAT/MON	Contract No. 3885-58	Sheet 12
Feature	Erosion Protection	Designed JCK	File No.
Item	Oversizing, Gradation, Thickness	Checked BZW	Date 5-16-91
			Date 5-28-91

5. Thickness for Erosion Protection Layer:

A. Thickness for Riprap layer

(1) Design Criteria : (Ref. 3, P5-13)

a. $T_{min} \geq 1.9 \cdot D_{50})_{min}$

b. $T_{min} \geq 1.5\ D_{50})_{max}$.

c. $T_{min} \geq 12$ inch

(2) Calculation

Riprap Type	A	B	C
min. D50 (1)	~~1.6"~~ 1.7"	~~4.1~~ 4.4"	7.0"
Max D50 (1)	~~2.3"~~ 2.4"	~~6.0"~~ 6.7"	10.0"
Tmin ≥ 1.9 D50)min	~~3.0"~~ 3.2"	~~7.8~~ 8.4"	13.3"
Tmin ≥ 1.5 D50)max	~~3.5~~ 3.6"	~~9.0"~~ 10.1"	15"
Tmin ≥ 12 in	12"	12"	12"
Required Tmin	12"	12"	15"

Rev. 01
JCK 2-18-92
MW 2/19/92

remarks: (1) - data was obtained from sheets 4, 5, 6.

B. Bedding layer:

(1) Design Criteria : (P5-15, Ref. 3)

a. $T_{min} \geq 1.1 \times D_{100})_{max}$.

b. $T_{min} \geq 6''$

(2) Calculation

$D_{100})_{max} = 3'' \Rightarrow T_{min} \geq 1.1 \times 3 = 3.3'' \leq 6''$

use $\underline{\underline{T_{min} = 6''}}$

Sheet 13

MKE DOC. 5025-HAT-L-03_01853-00

3050-89-1356

JCK 5-16-91
BJW 5-28-91

Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

MK-FERGUSON CO.
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NOV 2 1989

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NOV 10 1989
UMTRA - S.F.

Mr. James G. Oldham
Project Director
MK-Ferguson Company
P.O. Box 9136
Albuquerque, NM 87119

Dear Jim,

Over the last year there has been several discussions held and correspondence prepared between the DOE, TAC, and RAC regarding the use of coarse material in the bedding layer on UMTRA sites and specifically of Mexican Hat, to reduce the amount of water infiltrating into the contaminated materials and reduce the potential for vegetation germination and growth.

Enclosed is a letter and report from the TAC on this subject transmitted to the Project Office on October 27, 1989.

The DOE agrees with the TAC recommendation to coarsen the bedding layer at the Mexican Hat site. Please revise the specification as necessary and submit to the Project Office for review.

If you have any questions or require any additional information please contact Elizabeth Damler of my staff at 846-1224.

Sincerely,

Steve Hamp fr

Mark L. Matthews
Acting Project Manager
Uranium Mill Tailings Project Office

Enclosure

cc w/o enclosure:
K. Agogino, JEG
J. Caldwell, MK-F

DIST	INFO	SEP	DIST	INFO
PDC			JGO	✓
HAV/H				
RAP			REC	✓
MFP			JEH/GRJ	✓
FJF/MKE	✓		CDV	
GG/PD			JEH	
JEJ			JJD	
TBS	✓		MDT	
DEW			JGP	
JWS			DPB	
WAZ			SJS/DC	✓
RSW				

ORIG. FILE 1C-1
WORK FILE HAT

MKES Doc. No. 3885-H/M-C-01-02863-00

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

UMTRA PROJECT
CALCULATION COVER SHEET
CALC. NO. 9-418-14-00

QA check
5/10/95
CR

Contract No. 3885-58 Discipline CIVIL No. of Sheets 56
(includes cover sheet)

Project

UMTRA - MEXICAN HAT / MONUMENT VALLEY

Feature

EROSION PROTECTION

Item

TAILINGS EMBANKMENT AND SOUTH-EDGE AREAS

Sources of Data

(see references on sheet ii)

Sources of Formulae & References

(see references on sheet ii)

Preliminary Calc. ☐ Final Calc. ☒ Supersedes Calc. No. 9-418-13-00

				Checking criteria listed in the MKES UMTRA Project Procedures Manual were used during the checking of all revisions of this calculation.			
00	–	Belinda J. Wong	11/29/93	Fang Hong Wei	12/8/93	James Kim	12-10-93
Rev. No.	Revision	Calculation By	Date	Checked By	Date	Approved By	Date

F:\UMTRA\GEN\CALCCOVR.SHT 02/93

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

				Sheet	i
Project	UMTRA - HAT/MON	**Contract No.**	3885-58	**File No.**	–
Feature	EROSION PROTECTION	**Designed**	BYW	**Date**	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	**Checked**	FHW	**Date**	11-30-93

Table of Contents

Sheet No.

Appendices

F:\BYW\HAT\TEXT\PID20

				Sheet	ii
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

References

1. MKES Cal. No. 09-418-08-00, "UMTRA-HAT/MON, Erosion Protection, Embankment Toe Apron," August 1992.

2. MKES Cal. No. 09-418-05-01, "UMTRA-HAT/MON, Erosion Protection, Oversizing,Gradation and Thickness," Feb. 1992.

3. U.S. Department of Energy (DOE), UMTRA-DOE-AL-050425.0002, "Technical Approach Document," Rev. 11, Dec 1989, Figure 4.1, pp. 71.

4. MKES "RPRP/SFST- A Computer Program for Designing Riprap Protection for Sheet Flow using Factor of Safety or Stephenson's Method," Sept. 1987, MKES Document No. 4005-Gen-0-01-03409-00.

5. M.A. Stevens, D.B. Simons & G.L. Lewis, "Safety Factors for Riprap Protection," ASCE Journal of Hydraulics, Vol. 102, HY5, May 1976, pp. 637-655.

6. D. Stephenson,"Rockfill in Hydraulic Engineering", Elsevier Scientific Publication, N.Y., 1979.

7. MKES UMTRA Design Procedures, Chapter 5, "Erosion Protection," Rev. 7, Jan. 1989.

8. Chow, V. T., "Handbook of Applied Hydrology," McGraw-Hill Book Co. Inc., N.Y., 1964.

9. U.S. Army Corps of Engineers (COE), "Hydraulic Design of Spillways," EM1110-2-1603,March 1965, reprint with change 1.

10. Chow, V.T., "Open Channel Hydraulics," McGraw-Hill Book Co. Inc., N.Y., 1959.

11. NRC,NUREG/CR-4651, "Development of Riprap Design Criteria by Riprap Testing in Flumes, Phase I," May 1987, pp. 60.

12. MKES Cal. No. 09-223-01-02, "UMTRA-HAT/MON, Site Hydrology," May 1988.

13. MKES Cal. No. 09-418-06-00, "UMTRA-HAT/MON, Erosion Protection - Rock Quality, Bluff Source(New Areas)," June 1991.

14. MKES Cal. No. 09-418-04-00, "UMTRA-HAT/MON, Erosion Protection - Rock Quality Evaluation at Sugarloaf and Lime Ridge," May 1991.

15. MKES UMTRA-HAT/MON, "Engineering Geology Report for the Mexican Hat Site," August 1992.

16. U.S. Department of Transportation (DOT), "Hydraulic Design of Energy Dissipitators for Culverts and Channels," Hydraulic Engineering Circular No. 14, Dec. 1975.

17. Davis and Sorensen, "Handbook of Applied Hydraulics," 3rd Ed., McGraw-Hill Book Co., N.Y., 1969

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project	UMTRA - HAT/MON	**Contract No.**	3885-58	**Sheet**	1
Feature	EROSION PROTECTION	**Designed**	BYW	**File No.**	–
Item	EMBANKMENT AND SOUTH-EDGE AREAS	**Checked**	FHW	**Date**	11-29-93
				Date	11-30-93

1.0 Introduction and Purpose

Based on the actual quantities of contaminated materials removed at the Monument Valley processing site to date and the estimated remaining quantities, the final disposal embankment (cell) topslope elevation at UMTRA - Mexican Hat site is anticipated to be about 11 feet lower than the current design elevation . Hence the cell configuration has been changed accordingly as shown on sheet 4. This calculation is to perform the erosion protection design for this latest cell configuration. In addition, there is a concern that the approved Bluff borrow source may not have sufficient quantity of material available to meet all the project needs for riprap Type B. Therefore a new Type B1 riprap will be introduced to reduce the wastage and to optimize the volume of raw material to be processed in the Bluff source.

The scope of work in this calculation will include the following:

- Evaluate the stability of Type A (D_{50} = 1.7") riprap to be placed on the 2% cell top slopes.
- Evaluate the stability and the extent of Type B1 (D_{50} = 3.0") and Type B (D_{50} = 4.4") ripraps to be placed on the 20% or flatter embankment side slopes.
- Design the erosion protection along the south edge of the cell. Areas where Type B1, Type B, or Type C (D_{50} = 6.9") ripraps shall be placed will be determined.

The latest cell configuration is anticipated to have no or insignificant adverse effect on the following previously submitted calculations in erosion protection design:

- Calculation No. 9-418-08-00 : erosion protection design along the cell sideslope toe apron (Ref. 1).
- Calculation No. 9-418-05-01 : oversizing, gradation, and thickness for different types of erosion protection materials (Ref. 2).

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ENVIRONMENTAL SERVICES GROUP

				Sheet	2
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

2.0 Results

- 2 Percent Top Slope

The required min. D_{50} for the top slope is 0.8 inches (see sheet 12) based on the longest critical flow length of 1420 feet. Type A rock, a round river cobble from the Bluff source (Ref. 13), with a min. D_{50} of 1.7 inches (Ref. 2), will be used for the top slope. The average rock quality scores from the Bluff source is greater than 80% and no oversizing is required (Ref. 13).

- Side Slope

Both Type B1 ($D_{50(min)}$ = 3") and Type B ($D_{50(min)}$ = 4.4") rocks will be placed on the side slope. The smaller Type B1 rock with a layer thickness of 12 inches can be placed on the southern portions of the embankment side slopes which have shorter flow lengths (see sheet 4). The gradation requirements were included in Appendix B. The Type B rock should be placed on the northern parts of the embankment side slopes which have longer flow lengths (see sheet 4). Both Type B1 and Type B rocks will also come from the Bluff source, and no oversizing is required.

- South-Edge Upslope Area

1) Type B1 rock will be placed on the slope areas with a slope no steeper than 7(h):1(v) along the western portion of the south-edge upslope area (between points "A" and "B" as shown on sheet 4). A 10-foot wide transition area of about 5.3 % slope with Type B1 rock will be provided between the approximately 7:1 slope area and the 2% top slope. The layer thickness on the upstream apron of the approx. 7:1 slope area should be at least 1 foot deep to protect from local scouring when the existing haul road does not lie on the erosion resistant rock. Otherwise, the upstream portion of the approx. 7:1 rock cover shall tie-in to the erosion resistant rock of the roadway.

2) Type B rock or larger shall be placed along the upstream side of the existing haul road between points "H" and "C" to resist the impact of flow from the short steep upslope ridge (see sheet 4). This area will be graded to drain the runoff across the roadway.

3) A min. 10-foot wide apron consisting of Type B rock connecting the natural ground below the roadway and the 2 % top slope will be placed between points "B" and "C" (see sheet 4). The slope of the apron will be about 5.3 % and the apron will be 12 inches thick at the upstream end.

4) Either Type B rock on a 2.5(h):1(v) slope or Type C rock on a 2(h):1(v) slope should be provided to backfill an existing gully between points "C" and "D" (see sheet 4). The angular Type C rock shall be from the potential borrow source at Sugar Loaf quarry. The $D_{50(min)}$ of the Type C rock is 6.9 inches with a 15% oversizing factor.

5) A min. 10-foot wide apron consisting of Type B rock connecting the short steep south ridge and the 2% top slope will be placed between points "D" and "E" (see sheet 4). The slope of the apron is about 5.3 % and the apron shall be at least 12 inches thick at the upstream end.

6) The erosion protection plan and typical sections revised to incorporate the changes due to a predicted 11-foot lower embankment are shown on sheet 5.

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9-418-14-00

Sheet 4

NOTES:

1. THE EROSION PROTECTION WILL BE PROVIDED EITHER BY TYPE C RIPRAP ON A 2(H):1(V) SLOPE OR TYPE B RIPRAP ON A 2.5(H):1(V) SLOPE.
2. BACKFILLS EXISTING GULLIES WITH ROCKFILL SELECTED BY THE CONTRACTOR.
3. SLOPE VARIES 7(MIN):1.

BYW 11/29/93
FHW 11/30/93

UMTRA/HAT-MON
Embankment and South-Edge Areas
Erosion Protection

Type B1 rock for apron along u/s edge of 7:1/8:1 slope area.

Type B or larger rocks to pack-fill for grading to drain across roadway.

Type B rock for apron at intersection of 2% top slope and natural slope.

100 0 100 200
SCALE FEET

QA MK-F	NO.	DATE	REVISION	BY	CK	CHKT MGR	CHKT ENG	QA MGR	DOE APP.
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	△								

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED | DRAWN
CHECKED
INSPECTED
RECOMMENDED

MEXICAN HAT SITE
MEXICAN HAT, UTAH
3885-58

SITE PLAN

APPROVED | DATE | DOE PROJECT ENGINEER | DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT

PROJECT NO.
DE-AC04-83AL18796

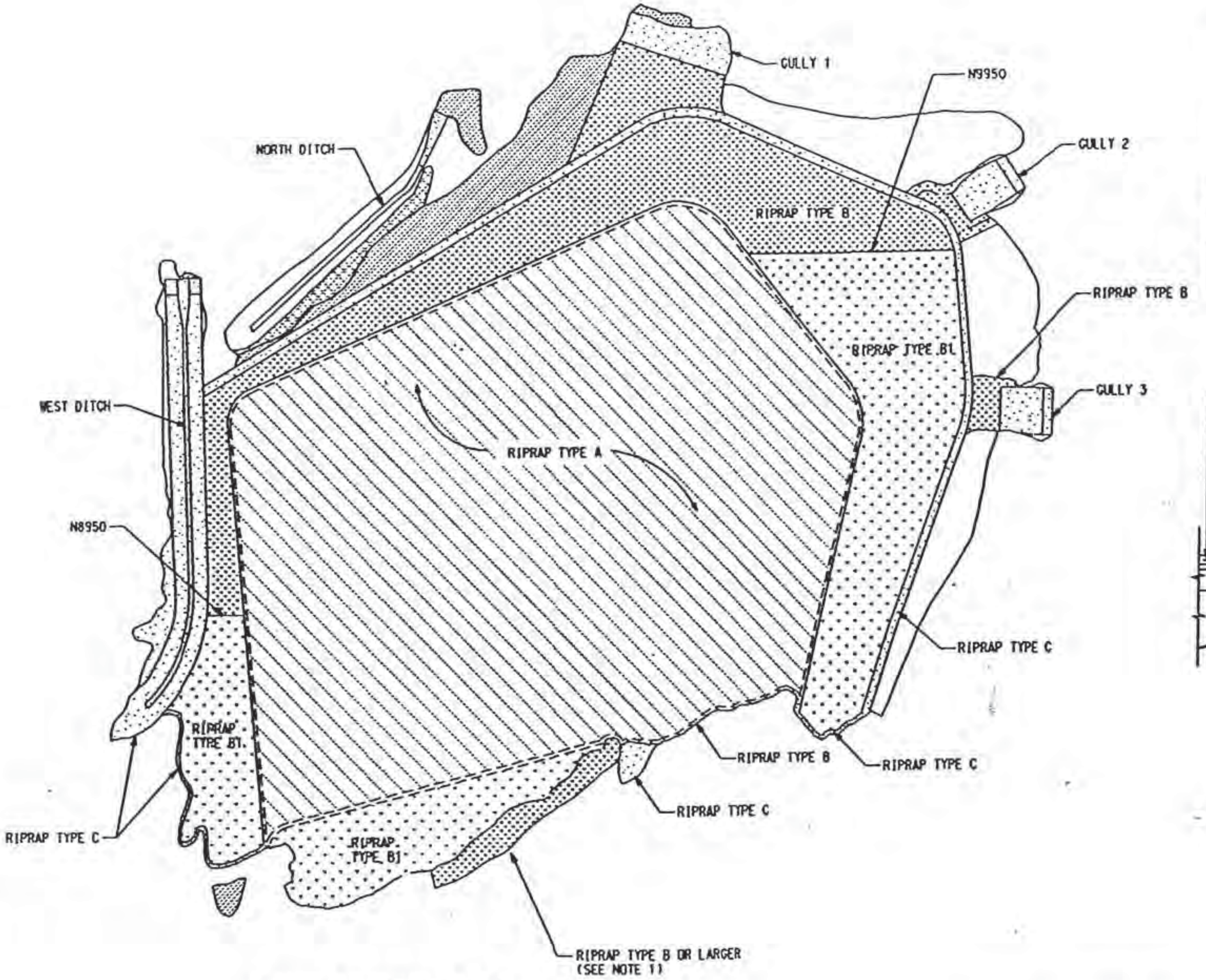
DRAWING NO.
REV.

DATE 10/11/83

FILENAME -TOPMAT.DGN

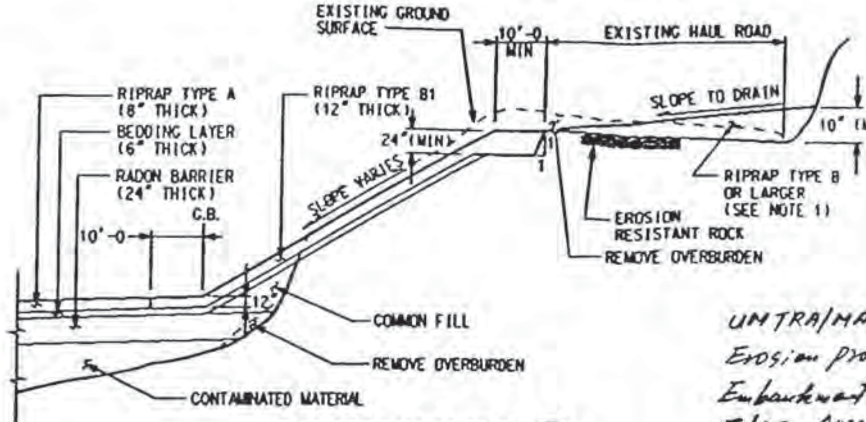
9-418-14-00

Sheet 5



EROSION PROTECTION PLAN

NOT TO SCALE



TYP. SECTION IN CUT (B)

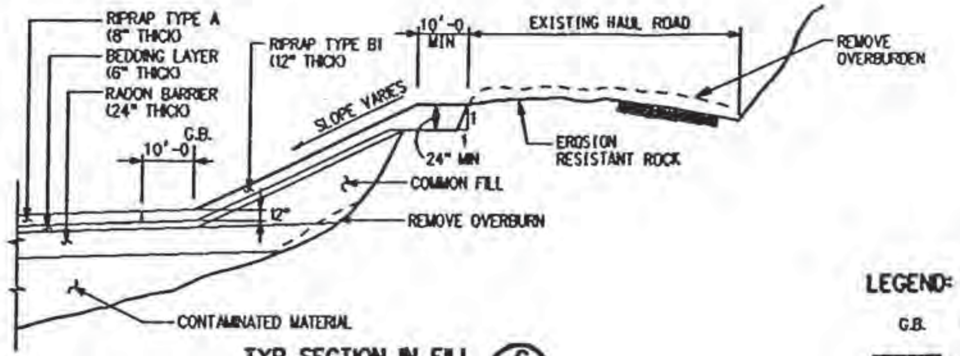
NOT TO SCALE

NOTES:

1. EXACT LOCATION AND SLOPE OF RIPRAP TO BE PLACED ON EXISTING HAUL ROAD SHALL BE AS DIRECTED BY THE CONTRACTOR.

UMTRA/MAY
Erosion Protection
Embankment and South
Edge Areas

BYW 11/29/93
FHW 11/30/93



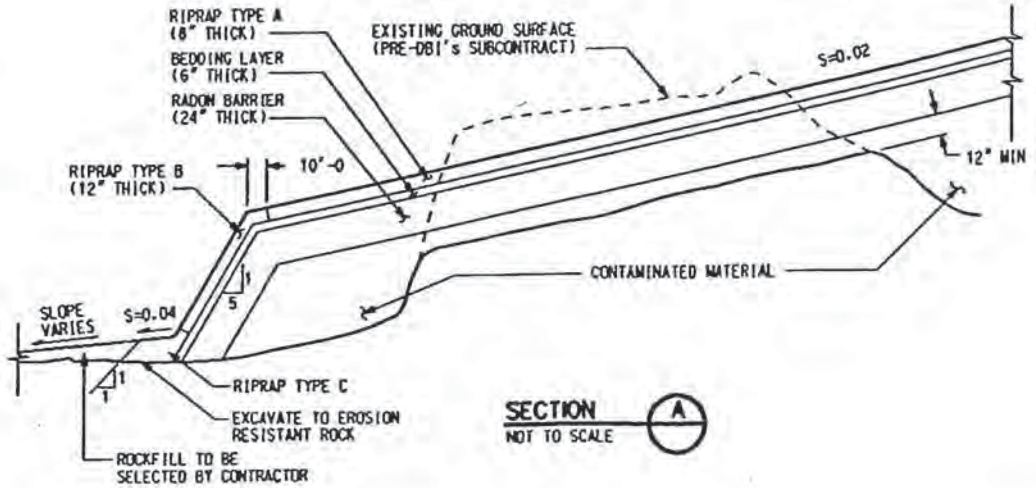
TYP. SECTION IN FILL (C)

NOT TO SCALE

LEGEND:

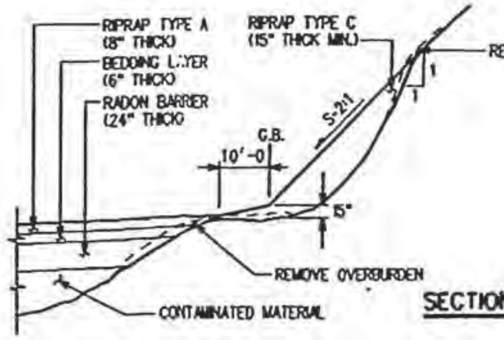
G.B. GRADE BREAK

▩	ROCK TO BE CHIPPED
▧	RIPRAP TYPE A
░	RIPRAP TYPE B1
▦	RIPRAP TYPE B
░	RIPRAP TYPE C
▩	ROCKFILL TO BE SELECTED BY THE CONTRACTOR



SECTION (A)

NOT TO SCALE



SECTION (D)

NOT TO SCALE

DRAFT

DATE 10/18/93
FILENAME - TEMPHAT2.DGN

QA MK-F	NO.	DATE	REVISION	BY	CK	CHKT SUB.	CHKT DISC.	QA APR.	DOE APP.
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U.S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT SITE
MEXICAN HAT, UTAH

EROSION PROTECTION PLAN AND SECTIONS

DESIGNED DRAWN
CHECKED
INSPECTED
RECOMMENDED
APPROVED DATE
DOE PROJECT ENGINEER DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO.
REV.

3.0 Methods

All the riprap sizing on the upslope toe/apron area in this calculation are based on sheet flow conditions under PMP storms. Thus, measures shall be provided to assure that sheet flow conditions can be achieved for surface flow onto the embankment top slope.

3.1 Top And Side Slopes

The required min. D_{50} will be determined using the computer program "RPRP/SFST" developed by MKES (Ref. 4).

The Safety Factor method (Ref. 5) is used for the slope less than 10 % (Ref. 7), and Stephenson's Method (Ref. 6) is used for the slope greater than or equal to 10 % (Ref. 7).

- Safety Factor Method (Ref. 5)

On a plane slope, the equation is as follows:

$$D_{50} = \frac{21\tau}{\left[(G_s-1)\ \gamma_w\ \cos\theta\left[\frac{1}{S.F.}-\frac{\tan\theta}{\tan\phi}\right]\right]}$$

where:
S.F.= safety factor = 1.0 for PMP condition
ϕ = angle of repose (in degree) of rock
θ = angle of the plane slope
τ = shear stress (psf)
γ_w = 62.4 pcf
G_s = specific gravity

- Stephenson's Method (Ref. 6)

$$D_{50} = \left[\frac{q\ (\tan\theta)^{\frac{7}{6}}\ (p)^{\frac{1}{6}}}{C\ g^{\frac{1}{2}}[(1-p)\ (G_s-1)\ \cos\theta\ (\tan\phi-\tan\theta)]^{\frac{5}{3}}}\right]^{\frac{2}{3}}$$

where:
p = porosity ≐ 0.33
C = empirical factor
= 0.22 for rounded rock
= 0.27 for angular rock
other parameters are previously defined.

3.2 South-Edge Upslope Area

The critical peak PMP discharge at each different locations along the south-edge area will be estimated from the Rational Formula, Q = C I A (Ref. 8). For a sheet flow condition, the length of the slope will be used to represent the area (i.e. A = length x 1 foot strip.) The longest slope length will be chosen for the design peak discharge.

Stable rock size, D_{50}(min), on the upslope apron will be estimated by the appropriate methods such as the U.S. Army Corps of Engineer's Stilling Basin Method (Ref. 9), Stephenson's Method (Ref. 6), and the Safety Factor Method (Ref. 5). The equations and criteria are described below:

3.2.1 Flow Characteristics (Manning's and other equations)

Based on Manning's Formula and a sheet flow conditions, the flow characteristics (i.e. flow depth, flow velocity, etc ...) are computed with:

$$q = \frac{1.486}{n} y^{\frac{5}{3}} s^{\frac{1}{2}}, \quad \text{or} \quad y = \left[\frac{n\, q}{1.486\, s^{\frac{1}{2}}} \right]^{0.6} \qquad \text{(Ref. 10)}$$

$$v = \frac{q}{y}, \quad Fr = \frac{v}{\sqrt{g\, y \cos\theta}}, \quad \tau = \gamma_w\, y\, s \qquad \text{(Ref. 10)}$$

$n = 0.0456\ (D_{50}\ s)^{0.159}$ for slopes > 10% and D_{50} in inches (Ref.11),

or

$$n = \frac{y^{1/6}}{(23.85 + 21.95 \log(y/D_{50}))}$$ for slopes ≤ 10% and D_{50} in feet (Ref.7)

where, q = flow per unit width (cfs/ft)
y = flow depth (ft)

v = flow velocity (fps)
s = energy slope (approximated as side slope)
n = Manning's roughness coeff.
D_{50} = Median diameter of riprap
Fr = Froude number
$\theta = \tan^{-1}(s)$ = slope angle
g = acceleration of gravity (ft/sec^2)

3.2.2 Riprap Sizing for Erosion Protection

The Safety Factor Method and Stephenson Method are the same as described in Sec. 3.1 above. The U.S. Army Corps of Engineers Stilling Basin Method (Ref. 9) is presented below:

$$D_{50} = \frac{v^2}{\left[E^2\ 2\ g\ (G_s-1)(\cos\theta-\sin\theta)\right]}$$

where:
v = minimum velocity to move the D_{50} rock
(The velocity on the steeper slope will be used.)
E = Empirical constant
= 0.86 for high turbulence
= 1.20 for low turbulence
θ = slope of the apron
G_s = Specific gravity of the rock

4.0 Calculations

4.1 Top and Side Slopes

The calculations were either performed using the computer program "RPRP/SFST" (Ref. 4) or by hand computation. The various assumptions and input parameters used are presented below:

1) PMP rainfall intensity-duration regression equation (Ref. 12 and see sheet A-1) constants are:

$$I = 10^{G - H(\log T)^{Z}}$$

G=1.797; H=0.307; and Z=1.816

2) Specific gravities of the rocks are 2.64 for rounded rock from Bluff source (Ref. 13) and 2.70 for angular rock from Sugar Loaf source

3) Coefficient in Stephenson's equation C = 0.22 for rounded rock and 0.27 for angular rock.

4) Factor of Safety =1.0

5) No flow through the rock pores is considered (a conservative assumption)

6) Porosity of the rock = 0.30 (assumed)

7) Rock friction angle- estimated from sheet A-2 (Ref. 3)

The rock source for Type A, B, and B1 rocks will be from Bluff source. These rocks will consist of rounded river cobbles with rock quality scores greater than 80%. Therefore no oversizing is required (Ref. 3).

4.1.1 Top Slope

The longest/critical flow length was determined to be line T-T (at point c_1) as shown on sheet 4.

$L_1 = 150'$ $s_1 = 0.4$
$L_2 = 1270'$ $s_2 = 0.02$

Total $L = L_1 + L_2 = 1420'$

Based on computer output (see sheets 11 and 12) and using the round rocks, the required $D_{50(min)}$ is 0.8 inches.

Hence Type A rock is stable on the 2% top slope.

At point "c_1",

$I_{PMP} = 28.3$ in/hr, $q = 0.92$ cfs/ft,
$y = 0.18'$, $v = 4.3$ fps, $n = 0.026$ (see sheet 13)

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet 11
		File No. –
Feature EROSION PROTECTION	Designed BYW	Date 11-18-93
Item EMBANKMENT AND SOUTH-EDGE AREAS	Checked FHW	Date 11-19-93

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HATSP8.OUT                 11/12/93                  Page 1

**INPUT FILE PRINTOUT**
              TOP SLOPE
UMTRA/M/H - ~~SIDE~~ SLOPE,ZERO PORE FLOW (FILE:HATSP8.OUT)

HAT   FHW   11-12 1993
  1.797  .307 1.816 2.640  .220       1  .002 1.0
   2    0
   0    0
   3   25
  UPS      150.0  40.0    .30  35.0  ST
  TOP      *****   2.0    .30  37.0  FS
  .5000    1.0    .00065
  .0250    1.0    .00065

* * * * * * * * * * * END INPUT DATA * * * * * * * * * * *



UMTRA/M/H - SIDE SLOPE,ZERO PORE FLOW (FILE:HATSP8.OUT)

UMTRA/HAT      RUN I.D.=FHW      DATE=11-12 1993

***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***

* * * * * * * * * * * INPUT DATA * * * * * * * * * * * * *


COEFFICIENTS FOR INTENSITY DURATION CURVE -
         IPMP=10**(G-H*(LOGT)**Z):

         G= 1.797  H= .307  Z=1.816

RIPRAP STONE SP.GRAVITY= 2.64    C IN STEPHENSONS EQN=  .22

               - - - EMBANKMENT - - -
  AREA
(LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
IN PLAN)            (FT)    (%)             ANGLE
                                            (DEG)
  1        UPS      150.     40.     .30    35.  STEPHENSONS
  1        TOP      1270.    2.      .30    37.  SAFETY FACTOR

* * * * * * * * * * * END INPUT DATA * * * * * * * * * * *
```

Note: Input data here on this sheet are for output on sheet 12

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet 12
Feature EROSION PROTECTION	Designed BYW	File No. –
Item EMBANKMENT AND SOUTH-EDGE AREAS	Checked FHW	Date 11-18-93
		Date 11-19-93

```
                    HATSP8.OUT              11/12/93              Page 2
          TOP SLOPE        DETAILED CALC TABLE WITH FINAL ROCK SIZE

                  SEGMENT=TOP     LENGTH=1270. FT.   SLOPE=  2.%

                        ASSUMED D50=  .0673FT. AT D/S END OF SEGMENT
                  CORRESPONDING Q=   .998CFS/FT AT SEGMENT END BY FS METHOD

                  SLOPED      *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
                  DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
                  FROM  TO                                              INT. TOTAL
                  (FT)  (FT)
                     0.  50.     .035    .000   .035    .62   .06   .203  1.34  1.34
                    50. 100.     .070    .000   .070   1.05   .07   .137   .79  2.13
                   100. 150.     .105    .000   .105   1.42   .07   .115   .59  2.72
                     0.  51.     .141    .000   .141   1.62   .09   .025   .52  3.24
                    51. 102.     .177    .000   .177   1.80   .10   .025   .47  3.71
                   102. 152.     .212    .000   .212   1.96   .11   .024   .43  4.14
                   152. 203.     .248    .000   .248   2.11   .12   .024   .40  4.54
                   203. 254.     .284    .000   .284   2.24   .13   .024   .38  4.92
                   254. 305.     .319    .000   .319   2.36   .14   .023   .36  5.28
                   305. 356.     .355    .000   .355   2.47   .14   .023   .34  5.62
                   356. 406.     .391    .000   .391   2.58   .15   .023   .33  5.95
                   406. 457.     .427    .000   .427   2.68   .16   .023   .32  6.26
                   457. 508.     .462    .000   .462   2.78   .17   .023   .30  6.57
                   508. 559.     .498    .000   .498   2.87   .17   .023   .29  6.86
                   559. 610.     .534    .000   .534   2.96   .18   .023   .29  7.15
                   610. 660.     .569    .000   .569   3.05   .19   .023   .28  7.43
                   660. 711.     .605    .000   .605   3.13   .19   .022   .27  7.70
                   711. 762.     .641    .000   .641   3.21   .20   .022   .26  7.96
                   762. 813.     .676    .000   .676   3.29   .21   .022   .26  8.22
                   813. 864.     .712    .000   .712   3.37   .21   .022   .25  8.47
                   864. 914.     .748    .000   .748   3.44   .22   .022   .25  8.72
                   914. 965.     .783    .000   .783   3.51   .22   .022   .24  8.96
                   965.1016.     .819    .000   .819   3.58   .23   .022   .24  9.19
                  1016.1067.     .855    .000   .855   3.65   .23   .022   .23  9.43
                  1067.1118.     .890    .000   .890   3.71   .24   .022   .23  9.65
                  1118.1168.     .926    .000   .926   3.77   .25   .022   .22  9.88
                  1168.1219.     .962    .000   .962   3.84   .25   .022   .22 10.10
                  1219.1270.     .998    .000   .998   3.90   .26   .022   .22 10.32

                      RAINFALL INTENSITY            RAINFALL INTENSITY
                      THAT ASSUMED D50           BASED ON CALCULATED
                      CAN WITHSTAND BASED           TIME OF CONC.AND USING
                      ON THE EQN I=Q/CA=            INTERPOLATING FUNCTION
                 (43560*Q)/L                     I=10**(G-H*((LOGT)**Z))

                          (INCH/HR)                         (INCH/HR)
                           30.60                             30.37

                           *******RESULTS SUMMARY******* AREA=1

                 SEGMENT  LENGTH  SLOPE  D50     Q AT      TC      STARTING  METHOD OF
                           (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                                (CFS/FT)            (INCH)
                 UPS       150.   40.0   6.0     .235       2.5      6.00   STEPHENSON
                 TOP      1270.    2.0    .8     .998      10.3       .30   SAFETY FACTOR
```

↑ D_{50} (min) required

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON	**Contract No.** 3885-58	**Sheet** 13
Feature EROSION PROTECTION	**Designed** BYW	**File No.** –
Item EMBANKMENT AND SOUTH-EDGE AREAS	**Checked** FHW	**Date** 11-18-93
		Date 11-19-93

```
 SLOPED     *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
 DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
 FROM  TO                                               INT. TOTAL
 (FT)  (FT)
   0.   50.   .032   .000   .032    .58   .06   .209  1.43  1.43
  50.  100.   .065   .000   .065   1.00   .06   .145   .83  2.26
 100.  150.   .097   .000   .097   1.34   .07   .118   .62  2.89
   0.   51.   .130   .000   .130   1.38   .09   .032   .61  3.50
  51.  102.   .163   .000   .163   1.54   .11   .031   .55  4.05
 102.  152.   .196   .000   .196   1.68   .12   .030   .50  4.55
 152.  203.   .229   .000   .229   1.80   .13   .030   .47  5.02
 203.  254.   .262   .000   .262   1.92   .14   .029   .44  5.46
 254.  305.   .295   .000   .295   2.03   .15   .029   .42  5.88
 305.  356.   .328   .000   .328   2.13   .15   .028   .40  6.28
 356.  406.   .361   .000   .361   2.22   .16   .028   .38  6.66
 406.  457.   .394   .000   .394   2.32   .17   .028   .36  7.02
 457.  508.   .427   .000   .427   2.41   .18   .028   .35  7.38
 508.  559.   .460   .000   .460   2.49   .18   .027   .34  7.72
 559.  610.   .493   .000   .493   2.57   .19   .027   .33  8.04
 610.  660.   .526   .000   .526   2.65   .20   .027   .32  8.36
 660.  711.   .559   .000   .559   2.72   .21   .027   .31  8.67
 711.  762.   .592   .000   .592   2.80   .21   .027   .30  8.98
 762.  813.   .625   .000   .625   2.86   .22   .027   .30  9.27
 813.  864.   .658   .000   .658   2.93   .22   .026   .29  9.56
 864.  914.   .691   .000   .691   3.00   .23   .026   .28  9.84
 914.  965.   .724   .000   .724   3.06   .24   .026   .28 10.12
 965. 1016.   .757   .000   .757   3.12   .24   .026   .27 10.39
1016. 1067.   .790   .000   .790   3.18   .25   .026   .27 10.66
1067. 1118.   .823   .000   .823   3.24   .25   .026   .26 10.92
1118. 1168.   .856   .000   .856   3.30   .26   .026   .26 11.18
1168. 1219.   .889   .000   .889   3.36   .27   .026   .25 11.43
1219. 1270.   .922   .000   .922   3.41   .27   .026   .25 11.68
   0.    1.   .922   .000   .922   5.07   .18   .042   .00 11.68
   1.    1.   .923   .000   .923   5.07   .18   .042   .00 11.68

     RAINFALL INTENSITY              RAINFALL INTENSITY
     THAT ASSUMED D50              BASED ON CALCULATED
     CAN WITHSTAND BASED             TIME OF CONC.AND USING
     ON THE EQN I=Q/CA=              INTERPOLATING FUNCTION
 (43560*Q)/L                     I=10**(G-H*((LOGT)**Z))

        (INCH/HR)                          (INCH/HR)
         28.29                              28.27

          *******RESULTS SUMMARY******* AREA=1

 SEGMENT  LENGTH  SLOPE  D50     Q AT      TC     STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END (MINUTES) ROCK D50  CALC.
                                (CFS/FT)           (INCH)
  UPS      150.    40.0   6.0     .235      2.5     6.00   STEPHENSON
  TOP     1270.     2.0   1.5    2.524*1    7.0     1.50   SAFETY FACTOR
  HYPO*2     1.    20.0   4.2     .923     11.7      .30   STEPHENSON
```

← Actual flow condition at end of top slope for D_{50} = 1.5" for a total length of 150 + 1270 = 1420 ft.

Note: Input data not included, but similar to input data on sheet 11 except assigning D_{50} = 1.5" on top slope input and adding a hypothetical segment.

Remark: #1 This Q is the largest flow that Type A rock D_{50} = 1.5" can sustain. Actual flow rate is 0.92 cfs/ft as shown on above table (underlined)

#2 This very short hypothetical segment is added in order to have the actual flow condition computed as shown on above table (underlined)

4.1.2 Side Slope

Required rock sizes on the embankment side slopes at different locations were evaluated to determine the areas where Type B1 rock can be used to sustain the PMP flow condition and to check the stability of Type B rock at the remainder of the side slope areas.

1) Between "a" and "b" (see sheet 4)

There is no flow contribution from the top slope. Flow is only from the 5:1 side slope itself.

The longest flow length is at "b" with $L = 350'$.

By Kirpich equation (Ref. 8),

T_c (time of concentration) $= 0.0078\ L^{0.77} / s^{0.385} = 1.3$ min, for $s=0.20$

use minimum $T_c = 2.5$ min., hence $I_{PMP} = 53.5$ in/hr. (see sheet A-1)

$q = C\ I\ L / 43560 = 1.0\ (53.5)\ (350) / 43560 = 0.43$ cfs/ft

By Stephenson Method:

θ = side slope = 11.31°
For rounded rock, use $\phi \doteq 37°$ (see sheet A-2)

Then $D_{50} = (0.22049\ q)^{2/3} = 0.21' = 2.5''$

This required rock size is less than 3 inches, so <u>use Type B1 rock</u>.

The critical q and longest flow length that the type B1 rock can sustain the PMP flow on the 5:1 side slope alone can be determined as follows:

$q_c = D_{50}^{1.5} / 0.22049$

For $D_{50} = 3''$, $q_c =$ <u>0.57 cfs/ft</u>.

$q_c = C\ I\ L_c / 43560$

Assume $T_c = 2.5$ min., $I_{PMP} = 53.5$ in/hr. (see sheet A-1)

Hence, $L_c = 43560\ (0.57)\ /\ 53.5 = \underline{465\text{ ft}}$.

Check $T_c = 0.0078\ L^{0.77}\ /\ s^{0.385} = 1.6\text{ min} < 2.5\text{ min}$ O.K.

2) Between "b" and "c" (see sheet 4)

This area will have combined flows from 2% top slope and 5:1 side slope. Flow length combination of top and side slopes that will have stable rock size of Type B1 (D_{50} = 3") under PMP sheet flow condition are as follows:

Top Slope	600'	550'	500'	420'	330'	180'	100'
Side Slope	20'	50'	100'	150'	200'	350'	400'
Total Length	620'	600'	600'	570'	530'	530'	500'

Based on these results, the approximate boundary, where Type B1 rock (D_{50} = 3") is stable on the 5:1 side slope between points "b" and "c" under PMP conditions, is shown on sheet 4.

Output for the "RPRP/SFST" computer runs are presented in Appendix C.

3) Between "c", "c_1 " and "d" (see sheet 4)

This is the area where Type B rock is required on the 5:1 side slope. A check is made to see if Type B rock is stable on the 5:1 side slope under PMP conditions. Several combined top slope and side slope flow lengths were tested, and the most critical condition is at point "c_2. (flow line T-T):

L_1 = 150' s = 0.4
L_2 = 1270' s = 0.02
L_3 = 100' s = 0.2
Total length = 1520'

The required rock size (D_{50}) is 4.3". Hence Type B rock, D_{50} = 4.4" is stable. Output from the "RPRP/SFST" computer runs are presented on sheets 16 to 18.

At point "c_2",
I_{PMP} = 27.6 in/hr, q = 0.96 cfs/ft, n=0.043
y = 0.19', v = 5.1 fps (see sheet 18)

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project	UMTRA - HAT/MON	Contract No.	3885-58	Sheet	16
Feature	EROSION PROTECTION	Designed	BYW	File No.	–
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-18-93
				Date	11-19-93

For Side slope :

```
HATSP7.OUT                 11/12/93                Page 1

 **INPUT FILE PRINTOUT**

 UMTRA/M/H - SIDE SLOPE,ZERO PORE FLOW (FILE:HATSP.OUT)

 HAT   FHW    11-12 1993
   1.797  .307 1.816 2.640  .220      1  .002 1.0
    3    0
    0    0    0
    3   25    2
  UPS      150.0  40.0   .30  35.0  ST
  TOP      *****   2.0   .30  37.0  FS
  SIDE     100.0  20.0   .30  37.0  ST
   .5000   1.0   .00065
   .1250   1.0   .00065
   .0250   1.0   .00065

 * * * * * * * * * * * * END INPUT DATA * * * * * * * * * * * *



 UMTRA/M/H - SIDE SLOPE,ZERO PORE FLOW (FILE:HATSP.OUT)

  UMTRA/HAT       RUN I.D.=FHW      DATE=11-12 1993

 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***


 * * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *


  COEFFICIENTS FOR INTENSITY DURATION CURVE -
            IPMP=10**(G-H*(LOGT)**Z):

            G= 1.797  H= .307  Z=1.816

   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22

                - - - EMBANKMENT - - -
    AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
 IN PLAN)             (FT)    (%)             ANGLE
                                              (DEG)
     1        UPS      150.    40.     .30    35.  STEPHENSONS
     1        TOP     1270.     2.     .30    37.  SAFETY FACTOR
     1        SIDE     100.    20.     .30    37.  STEPHENSONS

 * * * * * * * * * * * * END INPUT DATA * * * * * * * * * * * *
```

Note: Input data on this sheet are for output on sheet 17.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet 17	
Feature EROSION PROTECTION	Designed BYW	File No. –	
Item EMBANKMENT AND SOUTH-EDGE AREAS	Checked FHW	Date 11-18-93	
		Date 11-19-93	

For side slope:

```
SLOPED        *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
DISTANCE      ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
FROM  TO                                                  INT. TOTAL
(FT)  (FT)

   0.   50.    .032    .000    .032    .57   .06    .211   1.46  1.46
  50.  100.    .063    .000    .063    .99   .06    .147    .85  2.31
 100.  150.    .095    .000    .095   1.32   .07    .119    .63  2.94
   0.   51.    .127    .000    .127   1.37   .09    .032    .62  3.56
  51.  102.    .160    .000    .160   1.52   .10    .031    .56  4.12
 102.  152.    .192    .000    .192   1.67   .12    .030    .51  4.63
 152.  203.    .224    .000    .224   1.78   .13    .030    .47  5.10
 203.  254.    .256    .000    .256   1.90   .13    .029    .45  5.55
 254.  305.    .289    .000    .289   2.01   .14    .029    .42  5.97
 305.  356.    .321    .000    .321   2.11   .15    .028    .40  6.37
 356.  406.    .353    .000    .353   2.20   .16    .028    .38  6.76
 406.  457.    .385    .000    .385   2.30   .17    .028    .37  7.12
 457.  508.    .418    .000    .418   2.38   .18    .028    .36  7.48
 508.  559.    .450    .000    .450   2.47   .18    .027    .34  7.82
 559.  610.    .482    .000    .482   2.55   .19    .027    .33  8.15
 610.  660.    .514    .000    .514   2.62   .20    .027    .32  8.48
 660.  711.    .547    .000    .547   2.70   .20    .027    .31  8.79
 711.  762.    .579    .000    .579   2.77   .21    .027    .31  9.10
 762.  813.    .611    .000    .611   2.84   .22    .027    .30  9.40
 813.  864.    .643    .000    .643   2.90   .22    .027    .29  9.69
 864.  914.    .676    .000    .676   2.97   .23    .026    .29  9.97
 914.  965.    .708    .000    .708   3.03   .23    .026    .28 10.25
 965. 1016.    .740    .000    .740   3.09   .24    .026    .27 10.53
1016. 1067.    .772    .000    .772   3.15   .25    .026    .27 10.80
1067. 1118.    .805    .000    .805   3.21   .25    .026    .26 11.06
1118. 1168.    .837    .000    .837   3.27   .26    .026    .26 11.32
1168. 1219.    .869    .000    .869   3.32   .26    .026    .25 11.57
1219. 1270.    .901    .000    .901   3.38   .27    .026    .25 11.82
   0.   50.    .933    .000    .933   5.06   .18    .043    .16 11.99
  50.  100.    .965    .000    .965   5.14   .19    .043    .16 12.15

     RAINFALL INTENSITY              RAINFALL INTENSITY
     THAT ASSUMED D50             BASED ON CALCULATED
     CAN WITHSTAND BASED             TIME OF CONC.AND USING
     ON THE EQN I=Q/CA=              INTERPOLATING FUNCTION
  (43560*Q)/L                   I=10**(G-H*((LOGT)**2))

         (INCH/HR)                       (INCH/HR)

           27.65                           27.62


              *******RESULTS SUMMARY******* AREA=1


 SEGMENT  LENGTH  SLOPE  D50      Q AT        TC      STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END   (MINUTES)  ROCK D50   CALC.
                                (CFS/FT)              (INCH)

  UPS      150.    40.0   6.0     .235        2.5       6.00   STEPHENSON
  TOP     1270.     2.0   1.5 *  2.524        7.0       1.50   SAFETY FACTOR
  SIDE     100.    20.0   4.3     .965       12.2        .30   STEPHENSON
```

* D_{50} (min) required

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON
Feature EROSION PROTECTION
Item EMBANKMENT AND SOUTH-EDGE AREAS
Contract No. 3885-58
Designed BYW
Checked FHW
Sheet 18
File No. –
Date 11-18-93
Date 11-19-93

For side slope:

```
SLOPED       *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
DISTANCE     ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
FROM  TO                                                  INT. TOTAL
(FT)  (FT)
   0.   50.    .032    .000    .032    .57   .06   .211  1.46  1.46
  50.  100.    .063    .000    .063    .98   .06   .147   .85  2.31
 100.  150.    .095    .000    .095   1.32   .07   .119   .63  2.94
   0.   51.    .127    .000    .127   1.37   .09   .032   .62  3.56
  51.  102.    .160    .000    .160   1.52   .10   .031   .56  4.12
 102.  152.    .192    .000    .192   1.66   .12   .030   .51  4.63
 152.  203.    .224    .000    .224   1.78   .13   .030   .47  5.10
 203.  254.    .256    .000    .256   1.90   .13   .029   .45  5.55
 254.  305.    .288    .000    .288   2.01   .14   .029   .42  5.97
 305.  356.    .321    .000    .321   2.11   .15   .028   .40  6.37
 356.  406.    .353    .000    .353   2.20   .16   .028   .38  6.76
 406.  457.    .385    .000    .385   2.30   .17   .028   .37  7.13
 457.  508.    .417    .000    .417   2.38   .18   .028   .36  7.48
 508.  559.    .450    .000    .450   2.47   .18   .027   .34  7.83
 559.  610.    .482    .000    .482   2.55   .19   .027   .33  8.16
 610.  660.    .514    .000    .514   2.62   .20   .027   .32  8.48
 660.  711.    .546    .000    .546   2.69   .20   .027   .31  8.79
 711.  762.    .579    .000    .579   2.77   .21   .027   .31  9.10
 762.  813.    .611    .000    .611   2.83   .22   .027   .30  9.40
 813.  864.    .643    .000    .643   2.90   .22   .027   .29  9.69
 864.  914.    .675    .000    .675   2.97   .23   .026   .29  9.98
 914.  965.    .707    .000    .707   3.03   .23   .026   .28 10.26
 965. 1016.    .740    .000    .740   3.09   .24   .026   .27 10.53
1016. 1067.    .772    .000    .772   3.15   .25   .026   .27 10.80
1067. 1118.    .804    .000    .804   3.21   .25   .026   .26 11.06
1118. 1168.    .836    .000    .836   3.26   .26   .026   .26 11.32
1168. 1219.    .869    .000    .869   3.32   .26   .026   .26 11.58
1219. 1270.    .901    .000    .901   3.37   .27   .026   .25 11.83
   0.   50.    .932    .000    .932   5.02   .19   .043   .17 11.99
  50.  100.    .964    .000    .964   5.10   .19   .043   .16 12.16
-----------------------------------------------------------------
   0.    1.    .965    .000    .965   5.14   .19   .043   .00 12.16
```

← Actual flow condition at end of 5:1 slope (point C_2 on sheet 4). for a total flow length of 1521 ft.

```
   RAINFALL INTENSITY            RAINFALL INTENSITY
   THAT ASSUMED D50           BASED ON CALCULATED
   CAN WITHSTAND BASED           TIME OF CONC.AND USING
   ON THE EQN I=Q/CA*            INTERPOLATING FUNCTION
(43560*Q)/L                  I=10**(G-H*((LOGT)**Z))

       (INCH/HR)                      (INCH/HR)
        27.63                          27.60
```

Note: Input data not included, but similar to input data on sheet 16 except assigning D_{50} = 1.5" & 4.4" on Top + side slope, and also adding a hypothetical segment

```
            *******RESULTS SUMMARY******* AREA=1

SEGMENT  LENGTH  SLOPE  D50     Q AT       TC     STARTING  METHOD OF
          (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                               (CFS/FT)            (INCH)
UPS       150.   40.0   6.0     .235       2.5      6.00   STEPHENSON
TOP      1270.    2.0   1.5    2.524       7.0      1.50   SAFETY FACTOR
SIDE      100.   20.0   4.4    1.007*1    11.9      4.40   STEPHENSON
HYPO*2      1.   20.0   4.3     .965      12.2       .30   STEPHENSON
```

Note: *1 This is the largest Q, D_{50} = 4.4" can sustain. Actual flow rate = 0.944 cfs/ft as shown on above table (underlined)
*2 hypothetical segment is added in order to have actual flow condition computed as shown on above table.

4) Between "d" and "e"

At point "d", where Type B1 rock becomes stable on the side slope, was determined by trial-and-error computation.

At point "d_1",

$L_1 = 100 \quad \Delta h = 4410-4360 = 50 \qquad s_1 = 50/100 = 0.5$
$L_2 = 50 \quad \Delta h = 10 \qquad s_2 = 0.1$
$L_3 = 230 \qquad s_3 = 1/7 = 0.14286$
$L_4 = 480 \qquad s_4 = 0.02$
$L_5 = 115(\ 6.2(h):1(v)$ side slope$) \qquad s_5 = 18.5/115 = 1/6.2 = 0.1613$

Let part of the length, L_5 of the 6.2(h):1(v) side slope which Type B1 rock can sustain the PMP flow be: $L_a = 60'$.

Therefore Total length = 100+50+230+480+60 = 930

$$T_c = 0.0078\ (\ 100^{0.77} / 0.5^{0.385} + 50^{0.77} / 0.1^{0.385} + 230^{0.77} / 0.14286^{0.385} + 480^{0.77} / 0.02^{0.385} + 60^{0.77} / 0.1613^{0.385}) = 6.3 \text{ min}$$

(note: assumed T_c is approximately the sum of T_c from each flow length segments using Kirpich equation)

Using $T_c = 6.3$, $I_{PMP} = 39.5$ in/hr.

$q = 1.0\ (39.5)\ (930) / 43560 = 0.84$ cfs/ft

By Stephenson Method:
Use $\phi = 37°$, $\theta = \tan^{-1}(1/6.2) = 9.16°$, $p = 0.3$, $C = 0.22$, $G_s = 2.64$

Then $D_{50} = (0.15156\ q)^{2/3} = \underline{3.0''}$ (Type B1 rock)

At point "d_2",

$L_1 = 100 \quad s_1 = 0.5$
$L_2 = 50 \quad s_2 = 0.1$
$L_3 = 230 \quad s_3 = 0.14286$
$L_4 = 460 \quad s_4 = 0.02$
$L_5 = 125 \qquad s_5 = 1:6.5 = 0.15385$ (side slope)

Therefore Total length = 100+50+230+460+125 = 965

T_c = 6.3 min, I_{PMP} = 39.5 in/hr.

$q = 1.0\ (39.5)\ (965)\ /\ 43560 = 0.88$ cfs/ft

By Stephenson Method:

Use $\phi = 37°$, $\theta = \tan^{-1}(1/6.5) = 8.75°$, $p = 0.3$, $C = 0.22$, $G_s = 2.64$

Then $D_{50} = (0.1402\ q)^{2/3} = \underline{3.0''}$ (use Type B1 rock)

Based on these computations, the approximate boundary of Type B1 rock for side slope on the west side of the embankment is shown on sheet 4.

4.2 South-Edge Upslope Area

4.2.1 Area below haul road between points "A" and "B" with approx.7:1 slope (see sheet 4)

This is the area where 2% top slope will not extend to the existing roadway. A rock cover with slope no steeper than 7(h):1(v) will be provided as transition between the 2% top slope and the roadway.

Based on field investigations and the geology report (Ref. 15), the roadway in this area lies on an erosion resistant rock which can sustain and resist the erosive force of flow from the steep upland area. Thus the roadway can serve as an energy dissipator and disperse the flow downstream; this approximately creates a sheet flow condition downstream of the roadway. Additionally, most of the runoff from the upland in this area will be drained along the upstream side of the roadway and diverted through an open cut area (east of point "H", see sheet 4) toward south-east away from the disposal cell.

Since gullies currently exist below the roadway, the apron area between the 2% top slope and the roadway will be graded with a maximum slope of about 7:1 and armored with Type B1 riprap (if feasible) to further promote evenly distributed flow.

1) Peak discharge

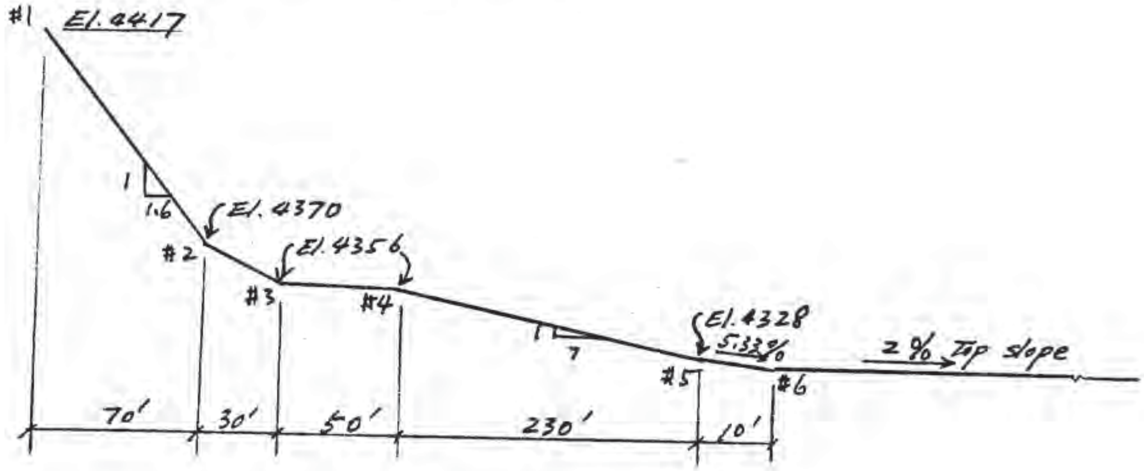
The longest and most critical flow length is selected as the critical condition for the designed peak discharge. The following is a summary table of the condition along this flow path. A profile is also shown on sheet 21.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

				Sheet	21
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

location#	Elev.	L	ΔL	ΔH	$\Delta H/\Delta L$	slope	T_c (min)	I (in/hr)	q (cfs/ft)
1	4415	0							
2	4370	70	70	45	0.643	1.6:1	0.24		
3	4356	100	30	14	0.47	2.1:1	0.40	53.5**	0.12
4	4356	150	50	0	0		*		
5	4328	380	230	28	0.145+	7:1	1.50	53.5**	0.47
6***	4327.47	390	10	0.53	0.0533	18.75:1	1.70	53.5**	0.48

* To be conservative, neglect the T_c for this section.
** Use a minimum T_c = 2.5 minutes.
*** Slope downstream of location #6 is 2% (embankment top slope).
\+ Actual slope is milder, but use 7:1 slope.
\# See flow-path K-K on sheet 4.



2) <u>Flow characteristics at different slope locations</u>

- <u>At location #3 - upstream side of roadway</u>

q = 0.12 cfs/ft (see table above)
s = 0.47 (approximate upstream slope), θ = 25.2°
let n = 0.05 for jagged and irregular rock cut condition (Ref. 10)

$$y = \left[\frac{n\,q}{1.486\ s^{\frac{1}{2}}}\right]^{0.6} = 0.046'$$

$$v = \frac{q}{y} = 2.6 \text{ fps}, \qquad Fr = \frac{v}{\sqrt{gy\cos\theta}} = 2.3$$

Hydraulic jump occurs at point no. 3

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2}-1\right) = 2.7, \text{ (Ref. 10)} \qquad y_2 = 0.13'$$

$$v_2 = \frac{q}{y_2} = 0.96 \text{ fps}$$

Length of jump $\doteq 5\ y_2 = 0.7'$ (Ref. 10)

Hence, the 25 to 35 feet wide roadway is long enough to spread the flow from the upland slope.

- <u>At location #5 - upstream end of 5.33% transition slope</u>

q = 0.47 cfs/ft (see sheet 21)

<u>On upstream 7:1 slope</u>
$s = 0.1429$ and $\theta = 8.13°$
$n = 0.0456\ (D_{50}\ s)^{0.159} = 0.04$ for $D_{50} = 3.0''$

then, $y_1 = 0.13'$, $v = 3.6$ fps and $Fr = 1.8$
$\tau = \gamma_w\ y\ s = 0.96\ \text{lb/ft}^2$

<u>On 5.33% slope</u>
$s = 0.053$, $\theta = 3.05°$; use $n = 0.037$

then, $y_2 = 0.17'$, $v = 2.8$ fps and $Fr = 1.20$
$\tau = \gamma_w\ y\ s = 0.56\ \text{lb/ft}^2$

$$\text{check } n = \frac{y^{1/6}}{\left[23.85 + 21.95 * \log(\frac{y}{D_{50}})\right]} = 0.037 \qquad \text{O.K.}$$

Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet 23
Feature EROSION PROTECTION	Designed BYW	File No. –
Item EMBANKMENT AND SOUTH-EDGE AREAS	Checked FHW	Date 11-29-93
		Date 11-30-93

- At location #6 - upstream end of 2% top slope

q = 0.48 cfs/ft (see sheet 21)

On upstream 5.33% slope

s = 0.0533 ($\theta = 3.05°$)
use n = 0.037

then, y = 0.17′, v = 2.8 fps, Fr = 1.2
$\tau = \gamma_w \, y \, s = 0.57$ psf

$$\text{check } n = \frac{y^{1/6}}{\left[23.85 + 21.95 * \log(\frac{y}{D_{50}})\right]} = 0.037 \quad \text{O.K.} \quad (D_{50} = 3.0 \text{ in.})$$

On 2% slope

s = 0.02 ($\theta = 1.146°$)
use n = 0.035

then, y = 0.22′, v = 2.2 fps, Fr = 0.82
$\tau = \gamma_w \, y \, s = 0.27$ psf

$$\text{check } n = \frac{y^{1/6}}{\left[23.85 + 21.95 * \log(\frac{y}{D_{50}})\right]} = 0.035 \quad \text{O.K.}$$

So, hydraulic jump occurs on the 2% slope :

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2} - 1\right) = 1.27$$

$y_2 = 1.27\, y_1 = 1.27\,(0.17) = \underline{\underline{0.22'}}$

Length of jump = 5 y_2 = 5 (0.22) = 1 ft (insignificant).

3) <u>Required riprap sizing</u>

a) At Location #4: upstream of 7:1 slope (see sheet 21).

- Required Rock Size:

$l = 150'$, use $T_c = 2.5$ min, $I_{PMP} = 53.5$ in/hr

$q = 1.0\ (53.5)\ (150)\ /\ 43560 = 0.184$ cfs/ft

Assume no erosion resistant rock exists at this location.
Assume flow concentration factor (FCF) = 3.0.

Then, $q = 3\ (0.184) = 0.55$ cfs/ft

Using a slope of $s = 0.04$ across the roadway,

$y = [n\ q\ /\ (1.486\ s^{0.5})\ ]^{0.6}$, use $n = 0.04$

Then, $y = 0.21'$, $v = 2.6$ fps, $\tau = 0.52$ lb/ft^2

Required rock size on 7:1 slope (By Stephenson's Method):

using $q = 0.55$ cfs and slope of 7:1, $\theta = 8.13°$

$G_s = 2.64$, $\phi = 37°$ (see sheet A-2), $C = 0.22$ for round rock

$D_{50} = (0.12443\ q)^{0.667} = \underline{\underline{2.0''}}$ (Type B1 rock is O.K.)

- Estimate of local scour depth at location #4: (Assuming no erosion resistant rock exists at this location):

Depth of apron upstream of 7:1 slope at location #4 will be at least equal to the local scour due to the PMP. Local scour was estimated below:

<u>Using the DOT empirical equation for scour below culvert outlet (Ref 16):</u>

$$D_s = \alpha\ y_e^{\gamma} \left[\frac{Q}{y_e^{2.5}}\right]^{\beta} (t)^{\theta},$$ where

D_s = depth of scour in feet
y_e = flow depth or equivalent flow depth in feet
Q = peak flow rate in cfs (for sheet flows, Q=q in cfs per unit width)
t = duration in min with peak flow rate, use 30 min.
α, γ, β, and θ are empirical parameters, and the following values are used:
$\alpha = 0.82$, $\beta = 0.375$, $\theta = 0.1$ and $\gamma = 1.0$ (Ref. 10)

Hence for $y_e = 0.21'$, $Q = q = 0.55$ cfs/ft

$$D_s = 0.82\ (0.21)^{1.0} \left[\frac{0.55}{(0.21)^{2.5}}\right]^{0.375} (30)^{0.1} = 0.84\text{ft.}$$

Using Lacey's regime equation (Ref. 17)

$$R = 0.9 \left[\frac{q^2}{f}\right]^{\frac{1}{3}},\quad q = 0.55\ \ (FCF = 3),\qquad \text{where}$$

R = hydraulic radius in feet,
q = cfs/ft
f = Lacey's silt factor $= 1.76 \sqrt{D_{50}(\text{min})}$

Assume for very fine sand, $D_{50}(\text{min}) \doteq 1.0$ mm, then $f = 1.76$

$$R = 0.9 \left[\frac{0.55^2}{1.76}\right]^{\frac{1}{3}} = 0.5 \text{ ft}$$

Depth of scour below water surface $= \chi R = 2.25\ (0.5) = 1.13$ ft
(χ = 1.75 to 2.25, to be conservative use $\chi = 2.25$)

$\therefore$ Depth of scour below apron = 1.13 - 0.21 = 0.9 ft.

Using the Tractive Force Method (Ref. 10)

It is conservatively assumed that the road surface has the equivalent soil condition as firm loam; thus the critical tractive force is 0.075 lb/ft^2 (Ref. 10). Under the existing slope of 0.04, with n = 0.04, q = 0.55 (FCF = 3) $\tau = 0.52$ lb/ft^2 (see sheet 24) > 0.075

Thus, local scour will reduce the slope until the shear stress is less than 0.075 lb/ft^2:

$$\text{at } s = 0.002,\quad y = \left[\frac{0.04 \times 0.55}{1.486\ (0.002)^{0.5}}\right]^{0.6} = 0.52 \text{ ft}$$

$$\tau = 0.064 \ \text{lb/ft}^2 < 0.075 \quad \text{ok}$$

Therefore, instantaneous local scour = 0.52 - 0.21 = <u>0.31 ft.</u>

Based on the above estimate, local scour upstream of the 7:1 slope is within 1 foot, and the upstream apron for the 7:1 slope rock cover will be set at 1 foot.

b) At Location #5: downstream of 7:1 slope and upstream of the transition slope (5.33%) where the shear stress is most critical (see sheet 21).

<u>Based on the COE Stilling Basin Equation</u> (Ref. 9):

$$D_{50} = \frac{v^2}{E^2\ 2\ g\ (G_s-1)\ (\cos\theta - \sin\theta)}$$

use velocity from the 7:1 slope; $v = 3.6$ fps (see sheet 22)
$E = 0.86$ (high turbulence) (Ref. 9)
To be conservative, use 7:1 slope, $\theta = \tan^{-1}(1/7) = 8.13°$
$G_s = 2.64$ for round rock (Ref. 10), then
$D_{50} = 0.015\ v^2 = 0.20' = \underline{\underline{2.3''}}$

<u>Based on Stephenson's equation</u>

$$D_{50} = \left[\frac{q\ (\tan\theta)^{\frac{7}{6}}\ (p)^{\frac{1}{6}}}{C\ g^{\frac{1}{2}}\ [(1-p)\ (G_s-1)\ \cos\theta\ (\tan\phi - \tan\theta)]^{\frac{5}{3}}}\right]^{\frac{2}{3}}$$

use upland slope of 7:1, $\theta = 8.13°$
$p \doteq 0.3$, $q = 0.47$ cfs (see sheet 21)
$G_s = 2.64$, $\phi = 37°$ (see sheet A-2), $C = 0.22$
$D_{50} = (0.12443\ q)^{0.667} = 0.15' = \underline{\underline{1.8''}}$

Therefore, Type B1 riprap, D_{50}(min) = 3.0″ shall be used for area below the roadway and above the 2% top slope (i.e. between points #4 and #6 as shown on sheet 21)

4) Check stability of Type A rock at upstream end of 2% top slope

- Safety Factor Method on a plan slope

$$D_{50} = \frac{21\tau}{\left[(G_s-1)\ \gamma_w\ \cos\theta\ \left[\dfrac{1}{S.F.} - \dfrac{\tan\theta}{\tan\phi}\right]\right]}$$

use τ = 0.57 psf from the upstream 5.33% slope (see sheet 23)

On the 2% slope, $\theta = \tan^{-1}(0.02) = 1.146°$

$\phi = 35°$ (see sheet A-2)
$G_s = 2.64$ (rounded rock, Ref. 13)
S.F. = 1.0

then $D_{50} = 0.2113\ \tau = 0.12' = 1.5''$ (D_{50} for Type A rock) O.K.

5) Check required rock size between points "H" and "C" on upstream side of Roadway. The most critical location is at point "G" or point 3 (see sheet 4):

Point	Location EL.	ΔL	$\Sigma\ \Delta l$	$\Delta h / \Delta l$
1	4391.6			
2	4370.0	75	75	0.288
3	4340.0	30	105	1.000

At point 3 (see sheet 4),

Use T_c = 2.5 min, I_{PMP} = 53.5 in/hr, l = 75+30 = 105'

q = (53.5) (105) / 43560 = 0.129 cfs/ft

use FCF = 3.0, q = 0.129 x 3 = 0.39 cfs/ft

use n = 0.05, s = 1.0, and assume Manning Formula can be applied:

$y = [\ n\ q\ /\ (1.486\ s^{0.5})\ ]^{0.6} = 0.074'$

therefore, v = 5.2 fps

Using COE Stilling Basin Method

$$D_{50} = \frac{v^2}{E^2\,2\,g\,(G_s-1)\,(\cos\theta - \sin\theta)}$$

where $\theta = 2.29°$ ($s = 0.04$) , $G_s = 2.64$, and $v = 5.2$ fps

$D_{50} = 0.01335\ v^2 = 0.37' = 4.4''$

Thus, use at least Type B rock with $D_{50} = 4.4''$ or any larger rock size along this area.

4.2.2 Area between points B & C

In this area, the 2% top slope will intercept the existing ground below the haul road (about 8 % slope) with a 10-foot long, 5.33 % slope transition apron. The stable rock size for erosion protection will be estimated based on the most critical flow length as shown on sheet 4.

Required riprap at the most critical location(i.e. at the upstream end of the 5.33% transition slope) will be sized as below:

1) Peak discharge and flow characteristics

Longest flow length at upstream end of 5.3 % slope is 210 feet.
From Kirpich's equation:

$T_c = 1.4$ min, use $T_c = 2.5$ min, and $I = 53.5$ in/hr.

$q = 53.5\ (210)\ /\ 43560 = 0.26$ cfs/ft

use FCF = 3, then $q = 3\ (.26) = 0.78$ cfs/ft,
use $n = 0.04$, and use upstream slope $S = 0.08$, then

$y = [\ (0.04 \times 0.78)\ /\ (1.486 \times 0.08^{0.5})\ ]^{0.6} = 0.21'$
$v = 3.7$ fps, $\tau = \gamma_w\ y\ s = 1.05\ \text{lb/ft}^2$

2) Required riprap sizing

Using the Safety Factor Method for a Plane Slope

Use τ = 1.05 lb/ft^2 from the upstream 8 % slope to act on the 5.33% slope.

θ = 3.05° (5.33% slope)
For rounded rock, G_s = 2.64, use ϕ = 38° (see sheet A-2)

$D_{50} = 0.221\ \tau = 0.23' = 2.8''$

Therefore, the use of Type B riprap, D_{50} = 4.4", will be stable on the 10-foot long transition zone between the natural ground and the upstream end of the 2% top slope.

- Estimate of local scour depth at upstream end of 5.3 % slope:

Using the DOT empirical equation for scour below culvert outlet (Ref 16):

$$D_s = \alpha\, y_e^{\gamma} \left[\frac{Q}{y_e^{2.5}}\right]^{\beta} (t)^{\theta},$$ where

D_s = depth of scour in feet
y_e = flow depth or equivalent flow depth in feet
Q = peak flow rate in cfs (for sheet flows, Q=q in cfs per unit width)
t = duration in min with peak flow rate, use 30 min.
α, γ, β, and θ are empirical parameters, and the following values are used:
$\alpha = 0.82$, $\beta = 0.375$, $\theta = 0.1$ and $\gamma = 1.0$ (Ref. 10)

Hence for y_e = 0.21', Q = q = 0.78 cfs/ft (use FCF = 3)

$$D_s = 0.82\ (0.21)^{1.0} \left[\frac{0.78}{(0.21)^{2.5}}\right]^{0.375} (30)^{0.1} = 0.84\text{ft.}$$

Using Lacey's regime equation (Ref. 17)

$R = 0.9\left[\frac{q^2}{f}\right]^{\frac{1}{3}}$, $q = 0.78$ (FCF = 3), where

R = hydraulic radius in feet,
q = cfs/ft
f = Lacey's silt factor $= 1.76\sqrt{D_{50}(\text{min})}$

Assume for very fine sand, $D_{50}(\text{min}) \doteq 1.0$ mm, then $f = 1.76$

$$R = 0.9\left[\frac{0.78^2}{1.76}\right]^{\frac{1}{3}} = 0.63 \text{ ft}$$

Depth of scour below water surface $= \chi R = 2.25\ (0.63) = 1.42$ ft
($\chi = 1.75$ to 2.25, to be conservative use $\chi = 2.25$)

∴ Depth of scour below apron = 1.42 - 0.21 = 1.2 ft.

Using the Tractive Force Method (Ref. 10)

It is assumed that the natural ground surface has the equivalent soil condition as firm loam; thus the critical tractive force is 0.075 lb/ft^2 (Ref. 10). Under the existing slope of 0.08, with $n = 0.04$, $q = 0.78$ (FCF = 3) $\tau = 1.05\ \text{lb/ft}^2$ (see sheet 29) > 0.075

Thus, local scour will reduce the slope until the shear stress is less than 0.075 lb/ft^2:

Try $s = 0.0015$, then $y = 0.69'$, $\tau = 0.065\ \text{lb/ft}^2 < 0.075$
Depth of scour = 0.69 - 0.21 = 0.48'

Hence local scour depth upstream of the 5.3 % slope is about 1 foot, and the upstream apron for the 5.3 % transition slope rock cover will be set at 1 foot.

				Sheet	31
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

3) Check Stability of Type A rock at Upstream End of 2 % Slope

- Flow characteristics at end of 5.33 % transition zone

$L = 210 + 10 = 220'$
$q = C\,I\,L / 43560 = 1.0\,(53.5)\,(220) / 43560 = 0.27$ cfs/ft
$s = 0.0533$
use $n = 0.049$

then, $y = 0.142'$, $v = 1.9$ fps, and $Fr = 0.89$
$\tau = \gamma_w\, y\, s = 0.47$ psf

$$\text{check } n = \frac{y^{1/6}}{\left[23.85 + 21.95 * \log\left(\frac{y}{D_{50}}\right)\right]} = 0.049 \quad \text{O.K.} \quad (D_{50} = 4.4 \text{ in.})$$

- Rock size required on 2% top slope

Use Safety Factor Method (see sheet 6 for equation)

$\tau = 0.47$ psf from the 5.33% transition slope
$\theta = \tan^{-1}(0.02) = 1.146°$, $G_s = 2.64$ (Ref. 13), $\phi = 35°$ (see sheet A-2)

then $D_{50} = 0.211\,\tau = 0.099' = 1.2'' <$ Type A rock, $D_{50} = 1.5''$ O.K.

4.2.3 Area between points C & D

The upslope area between C and D (see sheet 5) will be regraded in 2.5:1 slope ($s = 0.4$) or 2:1 ($S=0.5$) slope and backfilled with riprap in order to promote sheet flow. The 2.5:1/2:1 slope will intercept the 2% embankment top slope with a 10-foot long transition apron. The stable rock size for erosion protection will be estimated based on the most critical flow length as shown on sheet 4.

Required riprap at the most critical location (i.e at the downstream end of 2.5:1 slope and at the upstream end of the 5.33% transition slope) will be sized as below:

1) Peak Discharge

Longest flow length on the 2.5/2.0 :1 slopes is 150 feet.
From Kirpich's equation:

$$T_c = \frac{0.0078\ (150)^{0.77}}{(0.4)^{0.385}} = 0.5\ \text{min}$$

Since $T_c < 2.5$ min, use $T_c = 2.5$ min, and $I = 53.5$ in/hr.

$q = 53.5\ (150)\ /\ 43560 = 0.18$ cfs/ft

2) Riprap sizing for 2.5:1 slope

- Flow Characteristics:

For $s = 0.4$ ($\theta = 21.8°$),
$n = 0.0456\ (D_{50}\ s)^{0.159} = 0.05$ for slopes > 10%
and $D_{50} = 4.4''$ for Type B rock
$y = [\ (0.05 \times 0.18)\ /\ (1.486 \times 0.4^{0.5})\ ]^{0.6} = 0.06'$
$v = 2.9$ fps, and $Fr = 2.1$
$\tau = \gamma_w\ y\ s = 1.50\ \text{lb/ft}^2$

The hydraulic jump occurs at the 5.33% transition slope apron:

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2}-1\right) = 2.5, \qquad y_2 = 0.15'$$

Therefore, transition length required $= 5\ y_2 = 1$ ft.
Use 10 feet, to be conservative.

- Riprap Sizing:

The critical location is at junction of 2.5:1 slope and 5.33% transition slope

Rounded rock with the following parameters will be used:
$G_s = 2.64$, $c = 0.22$, $p \doteq 0.3$, $\phi = 38°$, $\theta = 21.8°$ ($s = 0.4$ or 2.5:1 slope)

Using Stephenson's Method

$D_{50} = (1.009\ q)^{0.667} = 3.8''$ for $q = 0.18$ cfs/ft

Using the COE Stilling Basin Method

$E = 0.86$ (high turbulence)
$G_s = 2.64$, $\theta = 21.8°$

$D_{50} = 0.0230\ v^2 = 2.3''$ for $v = 2.9$ fps

Using the Safety Factor Method for a Plane Slope

Use $\tau = 1.50$ lb/ft^2 from 2.5:1 slope to act on the 5.33% slope.

$\theta = 3.05°$ (5.33% slope)
For rounded rock, $G_s = 2.64$, use $\phi = 38°$ (see sheet A-2)

$D_{50} = 0.221\ \tau = 0.33' = 4.0''$

Therefore, Type B riprap, $D_{50} = 4.4''$, shall be used on the 2.5:1 slope and on the 10-foot long transition zone at the upstream end of the 2% top slope.

3) Riprap sizing for 2:1 slope

- Flow characteristics:

$q = 0.18$ cfs/ft (see sheet 32)

For $s = 0.5$ ($\theta = 26.57°$)
$n = 0.0456\ (D_{50}\ s)^{0.159} = 0.054$ for $D_{50} = 6''$ (Type C rock)

$y = [n\ q\ /\ (1.486\ s^{0.5})\ ]^{0.6} = 0.06'$, $v = 3.0$ fps
$\tau = \gamma\ y\ s = 1.87$ lb/ft^2
$Fr = 2.3$

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2}-1\right) = 2.77, \qquad y_2 = 0.166'$$

Length of the hydraulic jump = $5\ y_2 = 1'$.

Use a transition length of 10 feet, to be conservative.

- Riprap Sizing:

Critical location is at junction of 2:1 slope and 5.33% transition zone

Using Stephenson Method (for angular rock - Type C)

G_s = 2.7 (Ref. 14), C = 0.27, p = 0.3, ϕ = 40° (see sheet A-2),
and θ = 26.57° (2:1 slope)

then, $D_{50} = (1.30\ q)^{0.667}$ = 4.6" for q = 0.18 cfs/ft

$D_{50,\text{required}}$ = 4.6 x 1.15 = 5.2" with 15 % oversizing factor (Ref. 14).

Using the Safety Factor Method

τ = 1.87 lb/ft² from the 2:1 slope to act on the 5.33% transition slope.

θ = 3.05° (5.33% slope)

For angular rock, G_s = 2.7, use ϕ = 40°.

$D_{50} = 0.2117\ \tau$ = 0.4' = 4.8"

$D_{50,\text{required}}$ = 4.8 x 1.15 = 5.5" with 15 % oversizing factor.

Using the COE Stilling Basin Method

E = 0.86 (high turbulence), G_s = 2.7, θ = 26.57 (2:1)
v = 3 fps from 2:1 slope

$D_{50} = 0.0276\ v^2$ = 0.249' = 3"

$D_{50,\text{required}}$ = 3.0 x 1.15 = 3.4" with 15 % oversizing factor.

Hence use Type C rock, D_{50} = 6" (before oversizing)
= 6.9" (with 15% oversizing factor).

4) Check stability of Type A rock at upstream end of 2% top slope

Flow characteristics on 5.33% transition zone

$L = 150 + 10 = 160'$
$q = C\,I\,L / 43560 = 1.0\,(53.5)\,(160) / 43560 = 0.20$ cfs/ft
$s = 0.0533$
use $n = 0.053$

then, $y = 0.124'$, $v = 1.6$ fps, and $Fr = 0.81$
$\tau = \gamma_w\, y\, s = 0.41$ psf
assume Type B rock, $D_{50} = 4.4$ in.

$$\text{check } n = \frac{y^{1/6}}{\left[23.85 + 21.95 * \log\left(\frac{y}{D_{50}}\right)\right]} = 0.053 \qquad \text{O.K.}$$

Rock size required on 2% top slope

Use Safety Factor Method (see sheet 3 for equation)

$\tau = 0.41$ psf from the 5.33% transition slope
$\theta = \tan^{-1}(0.02) = 1.146°$, $G_s = 2.64$ (Ref. 13), $\phi = 35°$ (see sheet A-2)

then $D_{50} = 0.211\,\tau = 0.09' = 1.0'' <$ Type A rock, $D_{50} = 1.5''$ O.K.

4.2.4 Typical transition to 2% slope between points D and E

As shown on sheet 4, the areas near the east part of the upslopes will not be regraded, and the 2% slope will intercept the existing ground with a 10-foot long 5.33% transition apron. Rock size for this transition apron is determined below.

1) Required transition length

The most critical flow length is, $L = 50'$ at location F (see sheet 4).
The existing slope is about 48% ($\Delta H/L = 0.48$, $\theta = 25.6°$).

$T_c = 0.21$ min < 2.5 min, so use $I = 53.5$ in/hr

$\therefore q = C\,I\,L / 43560 = 1.0\,(53.5)\,(50) / 43560 = 0.06$ cfs/ft

By Mannings Formula,
$n = 0.05$ for jagged and irregular rock cut condition (Ref. 10)
$y = 0.03'$, $v = 2.0$ fps, $Fr = 2.1$
$\tau = \gamma\, y\, s = 0.90\ \text{lb/ft}^2$

The hydraulic jump occurs on the 5.33% slope:

$$\frac{y_2}{0.03} = \frac{1}{2}\left(\sqrt{1+8(2.1)^2}-1\right) = 2.56, \qquad y_2 = 0.08'$$

Therefore, transition length required = 5 y_2 = 0.4 ft; and using a transition length of 10 feet is conservative.

2) <u>Riprap sizing at intersection of 48% (existing) and 5.33% slope</u>

- Stephenson's Method

Based on the 48% slope, $\theta = 25.64°$, $q = 0.06$ cfs/ft
For rounded rock, $C = 0.22$, $G_s = 2.64$, and $\phi = 38°$ (Type B riprap), $p \doteq 0.3$

then $D_{50} = (1.94\ q\,)^{0.667} = 0.24' = 2.9''$

Use Type B rock, $D_{50} = 4.4''$

The critical q for $D_{50} = 4.4''$ to remain stable would be:

$4.4'' / 12 = (1.94\ q_c)^{0.667}$, $\therefore\ q_c = 0.115$ cfs/ft

This is equivalent to a flow concentration factor, FCF, of q_c / q = <u>1.9</u>

- Safety Factor Method

Assume shear stress acting on the 48% slope will act on the 5.33% transition slope.

$\tau = 0.90\ \text{lb/ft}^2$, $\theta = 3.05°$ ($s = 0.0533$), $\phi = 38°$
$G_s = 2.64$

Then, $D_{50} = 0.220\ \tau = 0.2' = 2.4''$

For Type B rock, $\tau_c = D_{50} / 0.22 = 1.67$
$y_c = \tau_c / \gamma\ s = 1.67 / (62.4 \times 0.48) = 0.0556$
$q_c = 1.486 / 0.05\ (0.0556)^{5/3}\ (0.48)^{1/2} = 0.167$ cfs/ft

$FCF = q_c / q = \underline{\underline{2.8}}$

- COE Stilling Basin Method

$G_s = 2.64$, θ = slope of apron = 3.05° (s = 0.0533)
E = 0.86 (high turbulence)

then, $D_{50} = 0.01354\ v^2$
for q = 0.06 cfs/ft, v = 2.0 fps, D_{50} = 0.7"

For D_{50} = 4.4" (Type B rock),
$v_c = [\ (4.4/12) / 0.01354\ ]^{0.5}$ = <u>5.2 fps</u>, $v_c = 1.486/n * y^{2/3} * s^{1/2}$,
Hence, $y_c = (n\ v_c / 1.486\ s^{1/2})^{1.5} = 0.127$, $q_c = v_c\ y_c = 0.66$, $FCF = q_c/q = 11$

Hence, the use of Type B rock can sustain a flow concentration factor of 2 to 11.

3) <u>Estimate local scour depth</u>

Assume FCF = 3.0, q = 0.06 x 3 = 0.18 cfs/ft, s = 0.48
use n = 0.05, $y = [n\ q / (1.486\ s^{0.5})\ ]^{0.6} = 0.06'$
v = 3.1 fps, $\tau = \gamma\ y\ s = 1.24\ \text{lb/ft}^2$

- Using the DOT empirical equation (Ref. 16)

$$D_s = \alpha\ y_c^{\gamma} \left[\frac{Q}{y_c^{2.5}} \right]^{\beta} (t)^{\theta}, \quad \text{where}$$

For $y_c = 0.06'$, Q = q = 0.18 cfs/ft

$$D_s = 0.82\ (0.06)^{1.0} \left[\frac{0.18}{(0.06)^{2.5}} \right]^{0.375} (30)^{0.1} = 0.51\text{ft.}$$

- Using the Tractive Force Method (Ref. 10)

Use critical shear, $\tau_c = 0.075 \text{ lb/ft}^2$

$q = 0.18$ cfs/ft (FCF = 3), $n = 0.05$

Try $s = 0.004$, then $y = 0.24$, $\tau = 0.061 < \tau_c = 0.075$ O.K.

$D_s = 0.24 - 0.06 = 0.2'$

- Using the Lacey's Regime Equation

Assume for very fine sand, $D_{50}(\text{min}) \doteq 1.0$ mm, then $f = 1.76$

$$R = 0.9 \left[\frac{0.18^2}{1.76} \right]^{\frac{1}{3}} = 0.24 \text{ ft}$$

$$D_s = y R - y_o = 2.25 \, (0.24) - 0.06 = \underline{\underline{0.5'}}$$

Hence scour depth is approximately 0.5 ft, use a depth of at least 1 ft for the rock cover along the edge of the apron.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

				Sheet	A-0
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

APPENDIX A

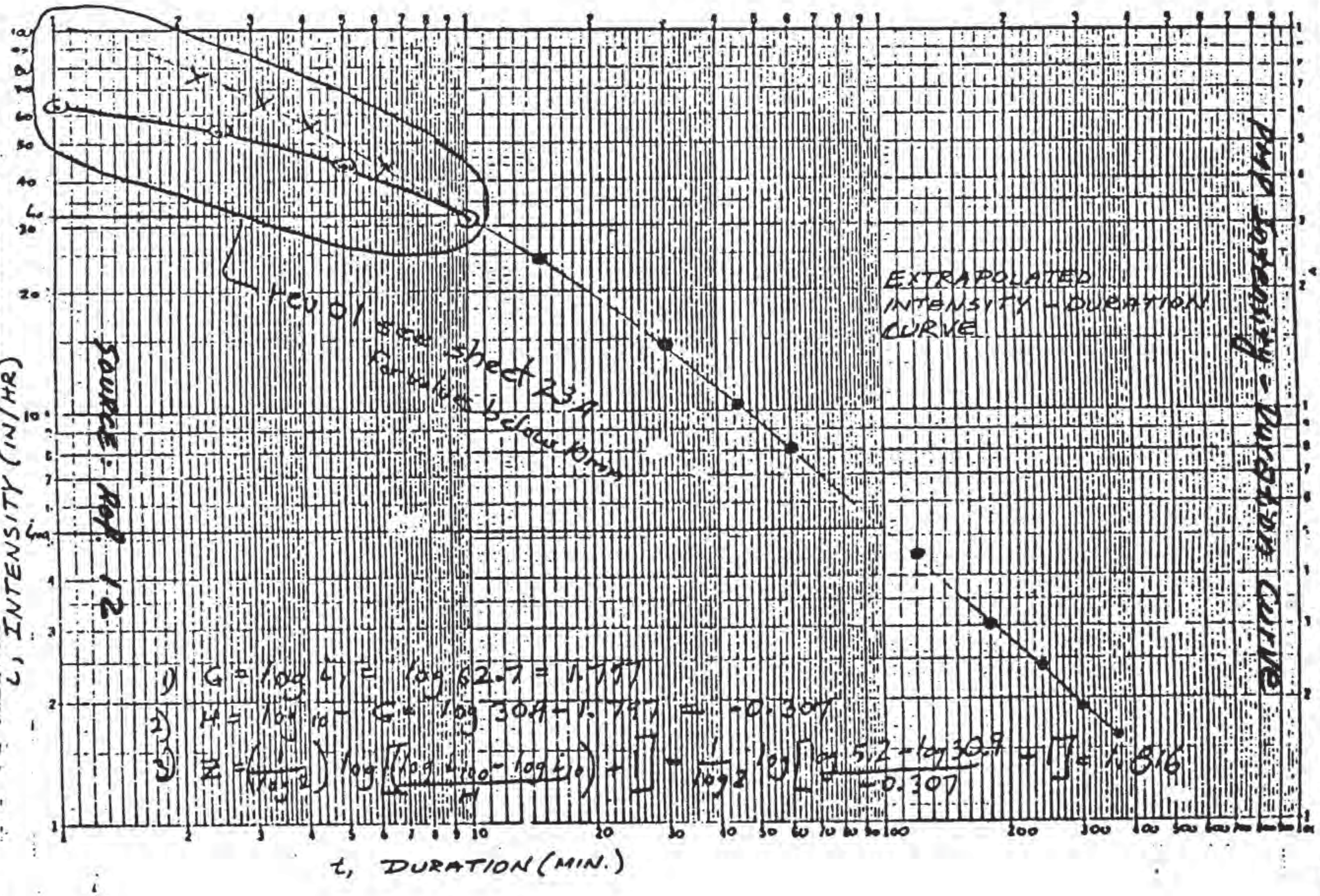
REFERENCE CHARTS

F:\BYW\HAT\TEXT\PID20

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON
Feature EROSION PROTECTION
Item EMBANKMENT AND SOUTH-EDGE AREAS
Contract No. 3885-58
Designed BYW
Checked FHW
Sheet A-1
File No. –
Date 11-29-93
Date 11-30-93

PMP Intensity - Duration Curve



1) $G = \log i_1 = \log 62.7 = 1.797$

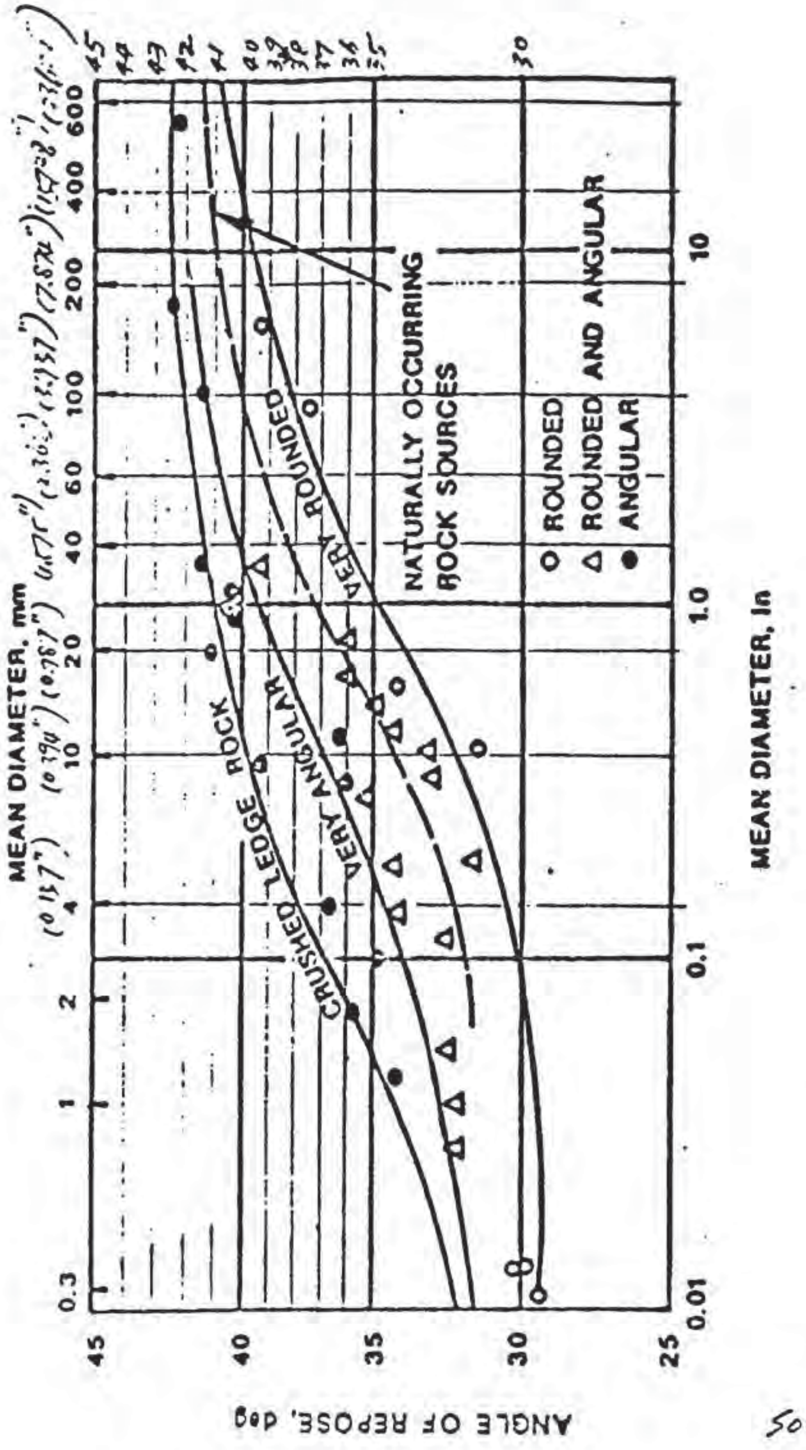
2) $H = \log i_{10} - G = \log 30.9 - 1.797 = -0.307$

3) $J = \left(\frac{1}{\log 2}\right)\log\left[\left(\frac{\log i_{100} - \log i_{10}}{H}\right) + 1\right] = \frac{1}{\log 2}\log\left[\frac{\log 5.2 - \log 30.9}{-0.307} + 1\right] = 1.816$

SOURCE: Ref. 12

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

				Sheet	A-2
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93



Source: Ref. 3

ANGLE OF REPOSE FOR ROCK OF VARIOUS DIAMETERS

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project	UMTRA - HAT/MON	Contract No.	3885-58	Sheet	B-0
Feature	EROSION PROTECTION	Designed	BYW	File No.	–
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-29-93
				Date	11-30-93

APPENDIX B

GRADATION OF TYPE B1 ROCK

F:\BYW\HAT\TEXT\PID20

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

				Sheet	B-1
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

Appendix B -Type B1 Riprap Gradation

1.0 Gradation Requirements:

$D_{50}(min) = 3"$ (Bluff source with round rock, and no oversizing required, (Ref.13))

$D_{100}(max) = 1.71 * D_{50}(min) = 5.1" = 5.0"$ (Ref. 7)

$D_{100}(min) = 1.26 * D_{50}(min) = 3.8" = 4.0"$ (Ref. 7)

$D_{25}(min) = 0.68 * D_{50}(min) = 2.0"$ (Ref. 7)

Based on above values, the upper and lower bounds of gradation curves for the Type B1 rock are developed as shown on sheet B2.

The gradation limits are given below:

U.S. Standard Sieve Opening	% Passing By Weight
5 "	100
4 "	0 - 100
3 "	0 - 50
2 "	0 - 25
#4	0 - 5

2.0 Layer Thickness:

a. $T\ (min) \geq 1.9 * D_{50}(min) = 5.7"$ (Ref. 7)

b. $T\ (min) \geq 1.5 * D_{50}(max) = 1.5*4.5 = 7"$ (Ref. 7)

c. $T\ (min) \geq 12"$ (Ref. 7)

Thus use the layer thickness = 12 ".

3.0 Bedding Layer:

Bedding materials determined in Ref. 2 for all Type A, Type B, Type C rocks can also be used for Type B1 rock since Type B1 rock size is between Type A and Type B rocks.

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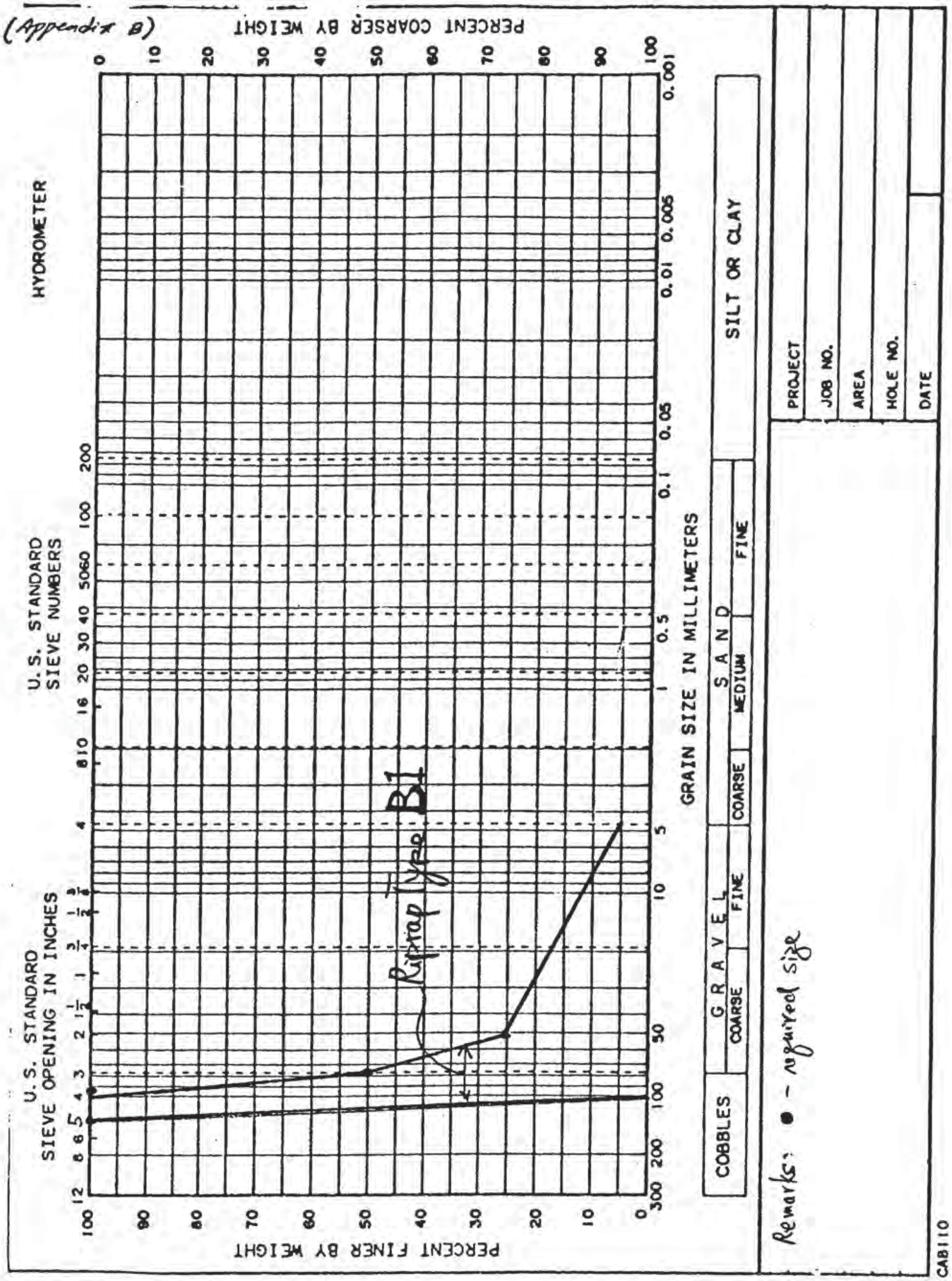
Project	UMTRA - HAT/MON	Contract No.	3885-58	Sheet	B-2
Feature	EROSION PROTECTION	Designed	BYW	File No.	–
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-29-93
				Date	11-30-93

GRAIN SIZE ANALYSIS

(Appendix B)



Remarks: ● - required size

MORRISON KNUDSEN CORPORATION
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Project UMTRA - HAT/MON
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Date 11-30-93

APPENDIX C

COMPUTER OUTPUT FROM RPRP/SFST FOR TYPE B1 ROCK EVALUATION ON THE EAST SIDE OF THE EMBANKMENT

F:\BYW\HAT\TEXT\PID20

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Sheet C-1
Project UMTRA - HAT/MON
Contract No. 3885-58
File No. –
Feature EROSION PROTECTION
Designed BYW
Date 11-29-93
Item EMBANKMENT AND SOUTH-EDGE AREAS
Checked FHW
Date 11-30-93

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HATSP1.OUT                11/11/93                 Page 1
 UMTRA/M/H - SIDE SLOPE,ZERO PORE FLOW (FILE:HATSP.OUT)
 UMTRA/HAT      RUN I.D.=FHW      DATE=11-11 1993

 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***
 * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * *

  COEFFICIENTS FOR INTENSITY DURATION CURVE -
          IPMP=10**(G-H*(LOGT)**Z):
          G= 1.797  H= .307  Z=1.816

   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22
             - - - EMBANKMENT - - -
   AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
 IN PLAN)            (FT)    (%)             ANGLE
                                              (DEG)
    1        TOP      600.      2.     .30     35.  SAFETY FACTOR
    1        SIDE      20.     20.     .30     37.  STEPHENSONS
    1        HYPO       1.     20.     .30     37.  STEPHENSONS
 * * * * * * * * * * * END INPUT DATA * * * * * * * * * * *

          DETAILED CALC TABLE WITH FINAL ROCK SIZE
   SEGMENT=HYPO    LENGTH=   1. FT.  SLOPE= 20.%

           ASSUMED D50=  .2535FT. AT D/S END OF SEGMENT
 CORRESPONDING Q=    .579CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

 SLOPED     *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
 DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
 FROM  TO                                              INT. TOTAL
 (FT)  (FT)
    0.  50.    .047   .000   .047    .83   .06   .038  1.00  1.00
   50. 100.    .093   .000   .093   1.17   .08   .034   .71  1.71
  100. 150.    .140   .000   .140   1.43   .10   .032   .58  2.30
  150. 200.    .186   .000   .186   1.64   .11   .030   .51  2.81
  200. 250.    .233   .000   .233   1.82   .13   .029   .46  3.27
  250. 300.    .280   .000   .280   1.98   .14   .029   .42  3.69
  300. 350.    .326   .000   .326   2.12   .15   .028   .39  4.08
  350. 400.    .373   .000   .373   2.26   .16   .028   .37  4.45
  400. 450.    .419   .000   .419   2.39   .18   .028   .35  4.80
  450. 500.    .466   .000   .466   2.51   .19   .027   .33  5.13
  500. 550.    .513   .000   .513   2.62   .20   .027   .32  5.45
  550. 600.    .559   .000   .559   2.72   .21   .027   .31  5.75
    0.  20.    .578   .000   .578   4.33   .13   .040   .08  5.83
    0.   1.    .579   .000   .579   4.34   .13   .040   .00  5.84

     RAINFALL INTENSITY            RAINFALL INTENSITY
     THAT ASSUMED D50          BASED ON CALCULATED
     CAN WITHSTAND BASED           TIME OF CONC.AND USING
     ON THE EQN I=Q/CA=            INTERPOLATING FUNCTION
 (43560*Q)/L                   I=10**(G-H*((LOGT)**Z))

          (INCH/HR)                        (INCH/HR)
           40.60                            40.53

              *******RESULTS SUMMARY******* AREA=1

 SEGMENT  LENGTH  SLOPE  D50     Q AT       TC     STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                (CFS/FT)            (INCH)
  TOP      600.    2.0    1.5   2.515       2.9      1.50  SAFETY FACTOR
  SIDE      20.   20.0    3.0    .578       5.8      1.50  STEPHENSON
  HYPO       1.   20.0    3.0    .579       5.8       .30  STEPHENSON
```

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON
Feature EROSION PROTECTION
Item EMBANKMENT AND SOUTH-EDGE AREAS
Contract No. 3885-58
Designed BYW
Checked FHW
Sheet C-2
File No. –
Date 11-29-93
Date 11-30-93

Evaluation of Type B rock

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MATR10.OUT                8/4/93              Page 1

MEXICAN HAT - TOP AND SIDE SLOPES,ZERO PORE FLOW, ROUNDED RO 3885-58
UMTRA/HAT        RUN I.D.=FHW       DATE=07/28 1993
***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***

* * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *
 COEFFICIENTS FOR INTENSITY DURATION CURVE -
          IPMP=10**(G-H*(LOGT)**Z):
          G= 1.797  H= .307  Z=1.816
  RIPRAP STONE SP.GRAVITY= 2.64    C IN STEPHENSONS EQN=  .22

             - - - EMBANKMENT - - -
   AREA
(LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
IN PLAN)             (FT)    (%)             ANGLE
                                             (DEG)
    1        TOP     550.     2.      .30     35.  SAFETY FACTOR
    1        SIDE     50.    20.      .30     37.  STEPHENSONS
    1        SIDE    350.    20.      .30     38.  STEPHENSONS

         DETAILED CALC TABLE WITH FINAL ROCK SIZE
  SEGMENT=SIDE     LENGTH= 350. FT.   SLOPE= 20.%

         ASSUMED D50=  .2978FT. AT D/S END OF SEGMENT
CORRESPONDING Q=   .799CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

SLOPED      *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N      CONC(MIN)
FROM  TO                                                INT. TOTAL
(FT)  (FT)
   0.  50.   .042   .000   .042    .79   .05   .039   1.06  1.06
  50. 100.   .084   .000   .084   1.12   .08   .034    .75  1.81
 100. 150.   .126   .000   .126   1.36   .09   .032    .61  2.42
 150. 200.   .168   .000   .168   1.56   .11   .031    .53  2.95
 200. 250.   .210   .000   .210   1.73   .12   .030    .48  3.43
 250. 300.   .252   .000   .252   1.88   .13   .029    .44  3.88
 300. 350.   .295   .000   .295   2.03   .15   .029    .41  4.29
 350. 400.   .337   .000   .337   2.15   .16   .028    .39  4.67
 400. 450.   .379   .000   .379   2.28   .17   .028    .37  5.04
 450. 500.   .421   .000   .421   2.39   .18   .028    .35  5.39
 500. 550.   .463   .000   .463   2.50   .19   .027    .33  5.72
   0.  50.   .505   .000   .505   4.06   .12   .041    .21  5.93
   0.  50.   .547   .000   .547   4.04   .14   .044    .21  6.13
  50. 100.   .589   .000   .589   4.19   .14   .043    .20  6.33
 100. 150.   .631   .000   .631   4.34   .15   .043    .19  6.52
 150. 200.   .673   .000   .673   4.49   .15   .042    .19  6.71
 200. 250.   .715   .000   .715   4.63   .15   .042    .18  6.89
 250. 300.   .757   .000   .757   4.77   .16   .041    .17  7.07
 300. 350.   .799   .000   .799   4.90   .16   .041    .17  7.24

    RAINFALL INTENSITY               RAINFALL INTENSITY
    THAT ASSUMED D50               BASED ON CALCULATED
    CAN WITHSTAND BASED               TIME OF CONC.AND USING
    ON THE EQN I=Q/CA=                INTERPOLATING FUNCTION
(43560*Q)/L                        I=10**(G-H*((LOGT)**Z))
          (INCH/HR)                           (INCH/HR)
            36.66                               36.63

            *******RESULTS SUMMARY******* AREA=1
SEGMENT  LENGTH  SLOPE  D50     Q AT       TC      STARTING  METHOD OF
          (FT)    (%)  (INCH)  D/S END  (MINUTES)  ROCK D50   CALC.
                               (CFS/FT)            (INCH)
 TOP      550.    2.0   1.5    2.515       2.6       1.50   SAFETY FACTOR
 SIDE      50.   20.0   3.0     .570       5.6        .30   STEPHENSON
 SIDE     350.   20.0   3.6     .799       7.2        .30   STEPHENSON
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MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON	Contract No. 3885-58	Sheet C-3
Feature EROSION PROTECTION	Designed BYW	File No. –
Item EMBANKMENT AND SOUTH-EDGE AREAS	Checked FHW	Date 11-29-93
		Date 11-30-93

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HATR12.OUT                 8/4/93          Page 1
 MEXICAN HAT - TOP AND SIDE SLOPES,ZERO PORE FLOW, ROUNDED RO
 UMTRA/HAT       RUN I.D.=FHW      DATE=07/28 1993
 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***
```

3185-58

Evaluation of Type B1 rock

```
 * * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *
  COEFFICIENTS FOR INTENSITY DURATION CURVE -
          IPMP=10**(G-H*(LOGT)**Z):
          G= 1.797  H= .307  Z=1.816
   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22
             - - - EMBANKMENT - - -
    AREA
  (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
  IN PLAN)            (FT)    (%)             ANGLE
     1        TOP     500.      2.     .30     35.  SAFETY FACTOR
     1        SIDE    100.     20.     .30     37.  STEPHENSONS
     1        SIDE    460.     20.     .30     38.  STEPHENSONS

            DETAILED CALC TABLE WITH FINAL ROCK SIZE
    SEGMENT=SIDE    LENGTH= 460. FT.  SLOPE= 20.%

            ASSUMED D50=  .3153FT. AT D/S END OF SEGMENT
  CORRESPONDING Q=   .871CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

  SLOPED     *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
  DISTANCE  ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
  FROM  TO                                              INT. TOTAL
  (FT)  (FT)
    0.  50.   .041   .000   .041    .78   .05   .039  1.07  1.07
   50. 100.   .082   .000   .082   1.10   .07   .034   .76  1.83
  100. 150.   .123   .000   .123   1.34   .09   .032   .62  2.45
  150. 200.   .164   .000   .164   1.54   .11   .031   .54  2.99
  200. 250.   .205   .000   .205   1.72   .12   .030   .49  3.47
  250. 300.   .247   .000   .247   1.86   .13   .029   .45  3.92
  300. 350.   .288   .000   .288   2.00   .14   .029   .42  4.34
  350. 400.   .329   .000   .329   2.13   .15   .028   .39  4.73
  400. 450.   .370   .000   .370   2.25   .16   .028   .37  5.10
  450. 500.   .411   .000   .411   2.37   .17   .028   .35  5.45
    0.  50.   .452   .000   .452   3.82   .12   .042   .22  5.67
   50. 100.   .493   .000   .493   4.00   .12   .041   .21  5.88
    0.  46.   .531   .000   .531   3.91   .14   .045   .20  6.07
   46.  92.   .569   .000   .569   4.05   .14   .045   .19  6.26
   92. 138.   .607   .000   .607   4.19   .14   .044   .18  6.44
  138. 184.   .644   .000   .644   4.32   .15   .044   .18  6.62
  184. 230.   .682   .000   .682   4.45   .15   .043   .17  6.79
  230. 276.   .720   .000   .720   4.58   .16   .043   .17  6.96
  276. 322.   .758   .000   .758   4.70   .16   .042   .16  7.12
  322. 368.   .796   .000   .796   4.81   .17   .042   .16  7.28
  368. 414.   .833   .000   .833   4.93   .17   .042   .16  7.44
  414. 460.   .871   .000   .871   5.04   .17   .041   .15  7.59

      RAINFALL INTENSITY           RAINFALL INTENSITY
      THAT ASSUMED D50           BASED ON CALCULATED
      CAN WITHSTAND BASED           TIME OF CONC.AND USING
      ON THE EQN I=Q/CA=            INTERPOLATING FUNCTION
 (43560*Q)/L                  I=10**(G-H*((LOGT)**Z))
           (INCH/HR)                    (INCH/HR)
            35.81                        35.76
              *******RESULTS SUMMARY******* AREA=1
 SEGMENT  LENGTH  SLOPE  D50     Q AT      TC     STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                (CFS/FT)            (INCH)
  TOP      500.     2.0    1.5   2.515      2.5      1.50  SAFETY FACTOR
  SIDE     100.    20.0    3.0    .577      5.4       .30  STEPHENSON
  SIDE     460.    20.0    3.8    .871      7.6       .30  STEPHENSON
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MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project	UMTRA - HAT/MON	Contract No.	3885-58	Sheet	C-4
Feature	EROSION PROTECTION	Designed	BYW	File No.	–
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-29-93
				Date	11-30-93

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HATR14.OUT               8/4/93           Page 1
 MEXICAN HAT - TOP AND SIDE SLOPES,ZERO PORE FLOW, ROUNDED RO
 UMTRA/HAT      RUN I.D.=FHW       DATE=07/28 1993
 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***
```

Evaluation of Type B rock

```
 * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *
  COEFFICIENTS FOR INTENSITY DURATION CURVE -
            IPMP=10**(G-H*(LOGT)**Z):
            G= 1.797  H= .307  Z=1.816
   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22
             - - - EMBANKMENT - - -
    AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
  IN PLAN)     *      (FT)    (%)             ANGLE
                                              (DEG)
    1        TOP     420.     2.     .30     35.  SAFETY FACTOR
    1        SIDE    150.    20.     .30     37.  STEPHENSONS
    1        SIDE    370.    20.     .30     38.  STEPHENSONS

           DETAILED CALC TABLE WITH FINAL ROCK SIZE
    SEGMENT=SIDE      LENGTH= 370. FT.   SLOPE= 20.%
              ASSUMED D50=  .3010FT. AT D/S END OF SEGMENT
  CORRESPONDING Q=   .813CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

  SLOPED      *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
  DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N      CONC(MIN)
  FROM  TO                                                INT. TOTAL
  (FT)  (FT)
     0.  47.    .040   .000   .040    .77   .05    .039  1.01  1.01
    47.  93.    .081   .000   .081   1.09   .07    .034   .71  1.72
    93. 140.    .121   .000   .121   1.33   .09    .032   .58  2.31
   140. 187.    .161   .000   .161   1.53   .11    .031   .51  2.81
   187. 233.    .202   .000   .202   1.70   .12    .030   .46  3.27
   233. 280.    .242   .000   .242   1.85   .13    .029   .42  3.69
   280. 327.    .282   .000   .282   1.99   .14    .029   .39  4.08
   327. 373.    .323   .000   .323   2.11   .15    .028   .37  4.45
   373. 420.    .363   .000   .363   2.23   .16    .028   .35  4.80
     0.  50.    .406   .000   .406   3.64   .11    .043   .23  5.03
    50. 100.    .450   .000   .450   3.83   .12    .042   .22  5.25
   100. 150.    .493   .000   .493   4.01   .12    .041   .21  5.46
     0.  62.    .546   .000   .546   4.02   .14    .044   .26  5.71
    62. 123.    .599   .000   .599   4.22   .14    .043   .24  5.95
   123. 185.    .653   .000   .653   4.41   .15    .043   .23  6.19
   185. 247.    .706   .000   .706   4.59   .15    .042   .22  6.41
   247. 308.    .759   .000   .759   4.76   .16    .041   .22  6.63
   308. 370.    .813   .000   .813   4.92   .17    .041   .21  6.84

      RAINFALL INTENSITY              RAINFALL INTENSITY
      THAT ASSUMED D50             BASED ON CALCULATED
      CAN WITHSTAND BASED             TIME OF CONC.AND USING
      ON THE EQN I=Q/CA=              INTERPOLATING FUNCTION
 (43560*Q)/L                   I=10**(G-H*((LOGT)**Z))
             (INCH/HR)                      (INCH/HR)
              37.66                          37.65

              *******RESULTS SUMMARY******* AREA=1
 SEGMENT  LENGTH  SLOPE  D50     Q AT      TC     STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                (CFS/FT)           (INCH)
  TOP      420.    2.0    1.5    2.515     2.5      1.50   SAFETY FACTOR
  SIDE     150.   20.0    3.0     .563     5.1       .30   STEPHENSON
  SIDE     370.   20.0    3.6     .813     6.8       .30   STEPHENSON
```

				Sheet	C-5
Project	UMTRA - HAT/MON	Contract No.	3885-58	File No.	–
Feature	EROSION PROTECTION	Designed	BYW	Date	11-29-93
Item	EMBANKMENT AND SOUTH-EDGE AREAS	Checked	FHW	Date	11-30-93

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HATR16.OUT                8/4/93            Page 1
 MEXICAN HAT - TOP AND SIDE SLOPES,ZERO PORE FLOW, ROUNDED RO
 UMTRA/HAT      RUN I.D.=FHW       DATE=07/28 1993
 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***
Evaluation of Type B1 rock
 * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *
  COEFFICIENTS FOR INTENSITY DURATION CURVE -
          IPMP=10**(G-H*(LOGT)**Z):
          G= 1.797  H= .307  Z=1.816
   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22

            - - - EMBANKMENT - - -
   AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
 IN PLAN)            (FT)    (%)             ANGLE
                                              (DEG)
    1        TOP      330.     2.      .30     35.  SAFETY FACTOR
    1        SIDE     200.    20.      .30     37.  STEPHENSONS
    1        SIDE     300.    20.      .30     38.  STEPHENSONS


          DETAILED CALC TABLE WITH FINAL ROCK SIZE
   SEGMENT=SIDE    LENGTH= 300. FT.  SLOPE= 20.%
           ASSUMED D50=  .2900FT. AT D/S END OF SEGMENT
  CORRESPONDING Q=   .768CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

  SLOPED     *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
  DISTANCE  ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
  FROM  TO                                             INT. TOTAL
  (FT)  (FT)
     0.  55.    .051    .000   .051    .87   .06   .037  1.06  1.06
    55. 110.    .102    .000   .102   1.23   .08   .033   .75  1.80
   110. 165.    .153    .000   .153   1.49   .10   .031   .62  2.42
   165. 220.    .204    .000   .204   1.71   .12   .030   .54  2.96
   220. 275.    .255    .000   .255   1.89   .13   .029   .48  3.44
   275. 330.    .305    .000   .305   2.06   .15   .029   .45  3.89
     0.  50.    .352    .000   .352   3.39   .10   .044   .25  4.13
    50. 100.    .398    .000   .398   3.61   .11   .043   .23  4.36
   100. 150.    .444    .000   .444   3.82   .12   .042   .22  4.58
   150. 200.    .491    .000   .491   4.02   .12   .041   .21  4.79
     0.  50.    .537    .000   .537   4.03   .13   .043   .21  4.99
    50. 100.    .583    .000   .583   4.20   .14   .043   .20  5.19
   100. 150.    .629    .000   .629   4.37   .14   .042   .19  5.38
   150. 200.    .676    .000   .676   4.53   .15   .042   .18  5.57
   200. 250.    .722    .000   .722   4.68   .15   .041   .18  5.75
   250. 300.    .768    .000   .768   4.83   .16   .041   .17  5.92

     RAINFALL INTENSITY          RAINFALL INTENSITY
     THAT ASSUMED D50          BASED ON CALCULATED
     CAN WITHSTAND BASED          TIME OF CONC.AND USING
     ON THE EQN I=Q/CA=           INTERPOLATING FUNCTION
 (43560*Q)/L                 I=10**(G-H*((LOGT)**Z))
           (INCH/HR)                   (INCH/HR)
             40.32                       40.27


             *******RESULTS SUMMARY******* AREA=1
  SEGMENT  LENGTH  SLOPE  D50     Q AT       TC     STARTING  METHOD OF
           (FT)    (%)   (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                 (CFS/FT)            (INCH)
  TOP      330.     2.0   1.5    2.515      2.5      1.50  SAFETY FACTOR
  SIDE     200.    20.0   2.9     .550      4.5       .30  STEPHENSON
  SIDE     300.    20.0   3.5     .768      5.9       .30  STEPHENSON
```

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON
Feature EROSION PROTECTION
Item EMBANKMENT AND SOUTH-EDGE AREAS
Contract No. 3885-58
Designed BYW /
Checked FHW
Sheet C-6
File No. –
Date 11-29-93
Date 11-30-93

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HATR17.OUT                 8/4/93              Page 1
MEXICAN HAT - TOP AND SIDE SLOPES,ZERO PORE FLOW, ROUNDED RO
UMTRA/HAT       RUN I.D.=FHW       DATE=07/28 1993
***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***
```

Evaluation of Type B1 rock

```
* * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *

  COEFFICIENTS FOR INTENSITY DURATION CURVE -
            IPMP=10**(G-H*(LOGT)**Z):
            G= 1.797  H= .307  Z=1.816
   RIPRAP STONE SP.GRAVITY= 2.64   C IN STEPHENSONS EQN=  .22

               - - - EMBANKMENT - - -
   AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
 IN PLAN)            (FT)    (%)             ANGLE
                                              (DEG)
    1         TOP     180.     2.      .30     35.  SAFETY FACTOR
    1         SIDE    350.    20.      .30     37.  STEPHENSONS
    1         SIDE     70.    20.      .30     38.  STEPHENSONS
 * *-* * * * * * * * * * END INPUT DATA * * * * * * * * * * *

           DETAILED CALC TABLE WITH FINAL ROCK SIZE
   SEGMENT=SIDE    LENGTH=  70. FT.  SLOPE= 20.%

           ASSUMED D50=  .2529FT. AT D/S END OF SEGMENT
  CORRESPONDING Q=   .626CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

  SLOPED      *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
  DISTANCE    ALLOC.    PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
  FROM  TO                                                 INT. TOTAL
  (FT)  (FT)
     0.  45.    .047    .000   .047    .83   .06    .038    .90   .90
    45.  90.    .094    .000   .094   1.18   .08    .034    .64  1.54
    90. 135.    .141    .000   .141   1.43   .10    .032    .52  2.06
   135. 180.    .188    .000   .188   1.64   .11    .030    .46  2.52
     0.  50.    .240    .000   .240   2.74   .09    .048    .30  2.82
    50. 100.    .292    .000   .292   3.05   .10    .046    .27  3.10
   100. 150.    .344    .000   .344   3.33   .10    .044    .25  3.35
   150. 200.    .396    .000   .396   3.58   .11    .043    .23  3.58
   200. 250.    .448    .000   .448   3.82   .12    .042    .22  3.80
   250. 300.    .500    .000   .500   4.04   .12    .041    .21  4.00
   300. 350.    .553    .000   .553   4.25   .13    .040    .20  4.20
     0.  70.    .626    .000   .626   4.51   .14    .040    .26  4.46

      RAINFALL INTENSITY           RAINFALL INTENSITY
      THAT ASSUMED D50          BASED ON CALCULATED
      CAN WITHSTAND BASED           TIME OF CONC.AND USING
      ON THE EQN I=Q/CA=            INTERPOLATING FUNCTION
(43560*Q)/L                  I=10**(G-H*((LOGT)**Z))
          (INCH/HR)                     (INCH/HR)
            45.42                         45.39


                ******RESULTS SUMMARY******* AREA=1


SEGMENT  LENGTH  SLOPE  D50     Q AT      TC      STARTING  METHOD OF
          (FT)    (%)  (INCH)  D/S END (MINUTES) ROCK D50  CALC.
                               (CFS/FT)            (INCH)

 TOP      180.    2.0    1.5    2.515     2.5       1.50  SAFETY FACTOR
 SIDE     350.   20.0    3.0     .570     4.1        .30  STEPHENSON
 SIDE      70.   20.0    3.0     .626     4.5        .30  STEPHENSON
```

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

Project UMTRA - HAT/MON
Feature EROSION PROTECTION
Item EMBANKMENT AND SOUTH-EDGE AREAS
Contract No. 3885-58
Designed BYW
Checked FHW
Sheet C-7
File No. –
Date 11-29-93
Date 11-30-93

```
HATSP.OUT                 11/11/93                 Page 1
 UMTRA/M/H - SIDE SLOPE,ZERO PORE FLOW (FILE:HATSP.OUT)
  UMTRA/HAT      RUN I.D.=FHW      DATE=11-11 1993

 ***SAFETY FACTOR/STEPHENSON METHOD FOR EMBANKMENT EROSION PROTECTION***

 * * * * * * * * * * * * INPUT DATA * * * * * * * * * * * * * *

  COEFFICIENTS FOR INTENSITY DURATION CURVE -
            IPMP=10**(G-H*(LOGT)**Z):

            G= 1.797  H= .307  Z=1.816

   RIPRAP STONE SP.GRAVITY= 2.64    C IN STEPHENSONS EQN=  .22

                - - - EMBANKMENT - - -
    AREA
 (LOCATION  SEGMENT  LENGTH  SLOPE POROSITY  FRICTION
 IN PLAN)            (FT)    (%)             ANGLE
                                              (DEG)
     1        TOP     100.     2.     .30     35.  SAFETY FACTOR
     1        SIDE    400.    20.     .30     37.  STEPHENSONS
     1        HYPO      1.    20.     .30     37.  STEPHENSONS
 * * * * * * * * * * * * END INPUT DATA * * * * * * * * * * * *

           DETAILED CALC TABLE WITH FINAL ROCK SIZE
    SEGMENT=HYPO    LENGTH=   1. FT.   SLOPE= 20.%

            ASSUMED D50=  .2496FT. AT D/S END OF SEGMENT
  CORRESPONDING Q=   .566CFS/FT AT SEGMENT END-BY STEPHENSONS METHOD

  SLOPED     *****FLOWS(CFS/FT)**** VEL.  DEPTH  MANNING  TIME OF
  DISTANCE   ALLOC.   PORES   ROCK  (FPS)  (FT)     N     CONC(MIN)
  FROM  TO                                                INT. TOTAL
  (FT)  (FT)
     0.  50.   .056   .000   .056    .91   .06   .037   .91   .91
    50. 100.   .113   .000   .113   1.29   .09   .033   .65  1.56
     0.  50.   .169   .000   .169   2.27   .07   .053   .37  1.93
    50. 100.   .226   .000   .226   2.66   .08   .049   .31  2.24
   100. 150.   .282   .000   .282   3.00   .09   .046   .28  2.52
   150. 200.   .339   .000   .339   3.30   .10   .044   .25  2.77
   200. 250.   .395   .000   .395   3.58   .11   .043   .23  3.00
   250. 300.   .452   .000   .452   3.84   .12   .042   .22  3.22
   300. 350.   .508   .000   .508   4.08 - .12   .041   .20  3.42
   350. 400.   .564   .000   .564   4.30   .13   .040   .19  3.62
     0.   1.   .566   .000   .566   4.30   .13   .040   .00  3.62

       RAINFALL INTENSITY            RAINFALL INTENSITY
       THAT ASSUMED D50           BASED ON CALCULATED
       CAN WITHSTAND BASED           TIME OF CONC.AND USING
       ON THE EQN I=Q/CA=            INTERPOLATING FUNCTION
 (43560*Q)/L                   I=10**(G-H*((LOGT)**Z))

           (INCH/HR)                     (INCH/HR)
            49.17                          49.01

             *******RESULTS SUMMARY******* AREA=1
 SEGMENT  LENGTH  SLOPE  D50      Q AT       TC     STARTING  METHOD OF
           (FT)    (%)  (INCH)  D/S END  (MINUTES) ROCK D50  CALC.
                                (CFS/FT)            (INCH)
 TOP       100.    2.0    1.5    2.515      2.5      1.50   SAFETY FACTOR
 SIDE      400.   20.0    3.0     .565      3.6      1.50   STEPHENSON
 HYPO        1.   20.0    3.0     .566      3.6       .30   STEPHENSON
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Appendix C

Site Annual Inspections and Site Visits

Appendix C1

2016 Annual Inspection of the Mexican Hat, Utah, Disposal Site

12.0 Mexican Hat, Utah, Disposal Site

12.1 Compliance Summary

The Mexican Hat, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on March 17, 2016. Linear shallow depressions were observed on the northeast side slope near the toe of the disposal cell. All-terrain vehicle (ATV) tracks were also observed on the top slope of the disposal cell near the West Diversion Channel. The tire tracks were created during vegetation control activities in September 2015 and were repaired during a later visit. Several perimeter signs were missing, and were replaced during a later visit.

A required annual assessment of six designated seeps was conducted during the inspection. Seep 0251 and Seep 0264 had moist conditions. Recent rains left evaporites and pooled water within the North Arroyo, and presumably caused the observed moist conditions. Seep 0248 was dripping; the seep and adjacent Gypsum Creek were sampled on March 15, 2016, and on October 3, 2016. Evaluation of the sample results will be provided in the 2017 compliance report. Groundwater monitoring is not required, and no monitoring wells are present at the site.

The U.S. Department of Energy (DOE) and DOE Legacy Management Support (LMS) contractor personnel conducted a follow-up inspection on April 8, 2016, to further evaluate the depressions identified on the northeast side slope of the disposal cell. A surface radiation survey and land survey of the area were completed. The rock cover was pulled back from one of the deeper depressions revealing small erosion channels in the 6-inch bedding layer of the disposal cell cover. A report summarizing the follow-up inspection with recommendations to address the depressions is being completed and will be transmitted to the U.S. Nuclear Regulatory Commission (NRC) and the Navajo Nation.

12.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2007) and in procedures DOE established to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 12-1 lists these requirements.

Table 12-1. License Requirements for the Mexican Hat Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 12.4
Follow-Up Inspections	Section 3.5	Section 12.5
Maintenance	Section 3.6	Section 12.6
Emergency Measures	Section 3.6	Section 12.7
Environmental Monitoring	Section 3.7	Section 12.8

12.3 Institutional Controls

The 119-acre disposal site, identified by the property boundary shown in Figure 12-1, is held in trust by the United States for the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation to perform remedial actions at the former uranium processing sites. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site.

The site was accepted under the NRC general license (10 CFR 40.27) in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and the following physical ICs that are inspected annually: the disposal cell, the entrance gate and sign, perimeter warning signs, a security fence, site markers, and survey and boundary monuments.

12.4 Inspection Results

The site, south of Mexican Hat, Utah, was inspected on March 17, 2016. The inspection was conducted by J. Gillespie of the LMS contractor. A. Denny (DOE site manager) and J. Nofchissey and C. Corley (Navajo Nation Abandoned Mine Lands Program) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring.

12.4.1 Site Surveillance Features

Figure 12-1 shows the locations of site surveillance features. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 12-1 by photograph location (PL) numbers.

12.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is via a short unmarked dirt road off U.S. Highway 163 that ends at a graded parking area. Erosion continues to occur along the dirt road, but the site continues to be accessible. DOE is not responsible for maintenance of the access road.

The entrance gate consists of a double-leaf swing gate at the northwest corner of the site. The gate was locked and functional. The entrance sign is attached to the gate (PL-1). No maintenance needs were identified.

12.4.1.2 Perimeter Signs and Security Fence

There are 43 perimeter signs, attached to steel posts set in concrete, positioned along the site boundary (PL-2). Each perimeter sign location has a pair of signs: an upper property ownership/no-trespassing sign and a lower sign identifying the site as a radioactive materials disposal site. Several signs have bullet damage but remain legible. One or both of the perimeter signs were missing for perimeter signs P16, P17, P18, P39, P40, P41, and P43; they were replaced during a later visit. No other maintenance needs were identified.

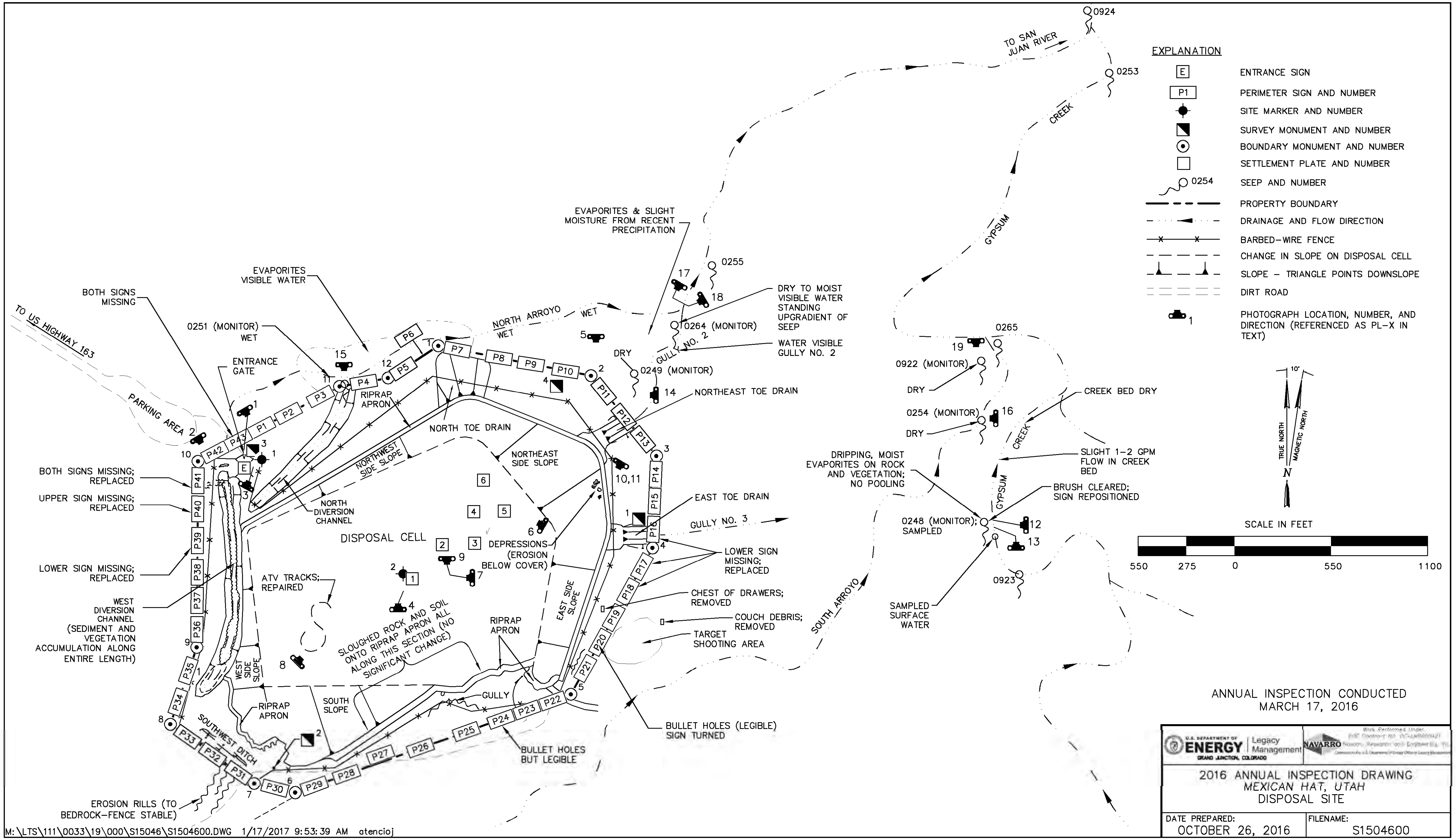

Figure 12-1. 2016 Annual Inspection Drawing for the Mexican Hat Disposal Site

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A barbed-wire fence inside the site boundary encloses the disposal cell. Periodically, the fence is damaged by livestock, erosion, or vandalism and requires repair. No maintenance needs were identified.

12.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the security fence near the entrance gate (PL-3). Its concrete base has several minor cracks, but repairs are not necessary at this time. Site marker SMK-2 is on the disposal cell top slope (PL-4). No maintenance needs were identified.

12.4.1.4 Survey and Boundary Monuments

There are four survey monuments that were installed for survey control during disposal cell construction. Twelve boundary monuments mark the site boundary (PL-5). No maintenance needs were identified.

12.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas (referred to as “transects” in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell; (2) the toe drains and diversion channels; (3) the balance of the site and the site perimeter; and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site’s integrity, protectiveness, or long-term performance.

12.4.2.1 Disposal Cell

The disposal cell, completed in 1994, occupies 68 acres. The rock-covered top slope of the disposal cell is functioning as designed (PL-6 and PL-7). There was no evidence of erosion, settling, slumping, or other modifying processes on the top of the disposal cell. ATV tracks on the top of the disposal cell near the West Diversion Channel were observed (PL-8). These were created during vegetation control activities in September 2015. The tracks were less than 6 inches deep and were repaired during a later visit. After observing these tracks, the DOE site manager directed that no driving be conducted on the disposal cell.

There was no noticeable increase of sloughed red country rock and soil along the south apron (PL-9). Because the apron in this area is immediately adjacent to the base of the steep, rocky cliff face along the southern edge of the disposal cell cover, it is expected that sediment and unstable rock from the cliff face will continue to fall onto the apron. The accumulated material is not impacting the function of the apron but this area will continue to be monitored.

Linear shallow depressions were observed at the toe of the northeast side slope near the east toe drain (PL-10 and PL-11). A follow-up inspection was performed on April 8, 2016, to further evaluate these depressions. The NRC site manager (D. Orlando) and the Navajo Nation representative (M. Roanhorse) were notified of the observation. No other maintenance needs were identified.

12.4.2.2 Toe Drains and Diversion Channels

The disposal cell toe drains and diversion channels were functioning as designed. Offsite areas to the west of the site continue to erode and transport sediment onto the site and into the west diversion channel. The sediment accumulation has promoted the growth of vegetation in the channel, including perennial grasses and annual weeds; however, the sediment and vegetation are not affecting the performance of the diversion channel. No maintenance needs were identified.

12.4.2.3 Balance of the Site and Site Perimeter

Minor erosion continues to occur in upgradient areas along the west and southwest portions of the site. This is an expected natural process and a result of the site coming to equilibrium with the outlying areas. Inspectors will continue to monitor erosion in these areas, but it is not a concern unless it damages the security fence or impacts the performance of the west diversion channel.

Trespassing occurs just inside the site boundary (outside the security fence) as evidenced by vehicle and ATV tracks and trash accumulation. Vandalism continues, as indicated by new bullet holes in several perimeter signs. This is expected to be an ongoing problem at the site because access to these areas cannot be restricted. Damaged perimeter signs are replaced when they become illegible. No evidence of trespassing has been observed beyond the security fence surrounding the disposal cell. No other maintenance needs were identified.

12.4.2.4 Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed.

12.5 Follow-Up Inspections

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition, or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.

DOE and LMS contractor personnel conducted a follow-up inspection on April 8, 2016, to further evaluate the depressions identified on the northeast side slope of the disposal cell. A surface radiation survey and land survey of the area was completed; radiation measurements were within background levels. The rock cover was pulled back from one of the deeper depressions to reveal a shallow erosion channel in the radon barrier of the disposal cell cover. The disposal cell radon barrier is constructed of 24 inches of compacted clay that is protected by a 6-inch bedding layer of small-diameter crushed rock on top of the clay barrier and 12 inches of rounded river rock on top of the bedding layer (Figure 12-2).

A report summarizing the follow-up inspection with recommendations to address the depressions is being completed and will be transmitted to NRC and the Navajo Nation.

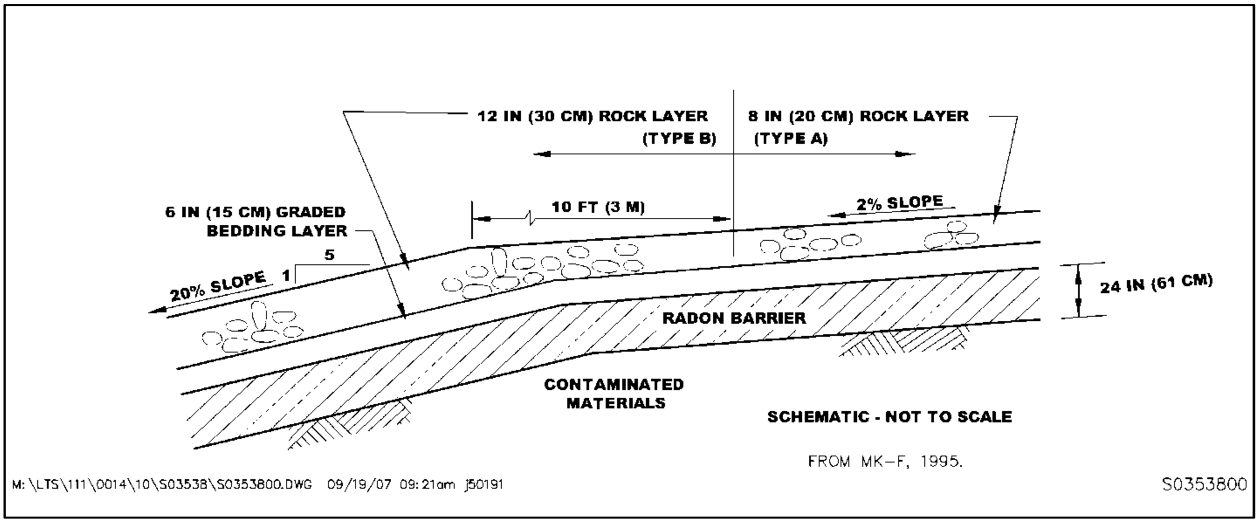


Figure 12-2. Generalized Cross Section of Disposal Cell Cover, Mexican Hat Disposal Site

12.6 Maintenance

One or both of the perimeter signs were missing for perimeter signs P16, P17, P18, P39, P40, P41, and P43, and were replaced during a later visit on August 17, 2016. A couch and parts of a chest of drawers in the vicinity of the offsite informal target shooting area were disposed of during a later visit on August 16, 2016, as a best management practice. Overgrown vegetation at Seep 0248 was removed to provide access for sampling, and the sign was repositioned to face Gypsum Creek. No other maintenance needs were identified.

12.7 Emergency Measures

In accordance with the LTSP, emergency measures are the actions that DOE will take in response to “unusual damage or disruption” that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40, Appendix A, Criterion 12. The disposal cell side-slope depressions were determined to not require an emergency action at this time; therefore, no need for emergency measures was identified.

12.8 Environmental Monitoring

12.8.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required at this site because the uppermost aquifer is hydrogeologically isolated from contamination in the overlying formation. No groundwater monitoring wells remain at the site.

12.8.2 Seep Monitoring

An annual assessment of six designated seeps was conducted during the inspection in accordance with Section 3.7.2 of the LTSP and an approved monitoring plan (DOE 2006). The seeps locations appear in Figure 12-3. Signs warning against drinking the water are posted at five of the seep locations. Seep 0249 in Gully No. 2 does not have a sign but has historically been dry and is covered by riprap material.

In accordance with the LTSP, seep flow rates are required to be monitored annually through observation through 2016, at which time an evaluation will be conducted to determine whether to continue or discontinue seep monitoring. A seep monitoring evaluation report will be prepared in 2017.

Since 2010, seep flow has been observed only at upgradient (background) Seep 0248. Water was observed dripping from the adjacent evaporites at Seep 0248 at an increased rate from previous years. Seeps 0251 and 0264, hydraulically downgradient of the site, were observed to be moist; in previous years both had been dry. Recent rains left evaporites and pooled water within the North Arroyo, and presumably caused the observed moist conditions and evaporites. Gypsum Creek had evidence of major flash flooding from recent rains. Seeps 0249, 0254, and 0922, also hydraulically downgradient of the site, were dry, which is the same as the previous year. Table 12-2 provides observations and qualitative descriptions of seep flows, along with a reference to photographic documentation.

In 2015 the Navajo Nation requested sampling of Seep 0248 due to increased precipitation in the area. To address this request, Seep 0248 was sampled during August and September 2015. Surface water samples were collected at Seep 0248 and one location in Gypsum Creek upgradient of Seep 0248 on March 15, 2016 (PL-12 and PL-13), and October 3, 2016. Evaluation of the sample results will be provided in the 2017 seep monitoring evaluation report.

Table 12-2. Observations of Seeps near the Mexican Hat Disposal Site

Seep Location Number	Drainage	Photo Location Numbers	Observed Seep Conditions
0248	Gypsum Creek	PL-12, PL-13	Seep was dripping and a pool collected at the base of the cliff. Sample collected from seep and from upgradient location in Gypsum Creek on March 15, 2016.
0249	Gully No. 2	PL-14	Dry conditions (no change from previous year).
0251	North Arroyo	PL-15	Moist conditions with evaporites presumably from recent rains.
0254	South Arroyo	PL-16	Dry conditions (no change from previous year). Location is not posted due to seasonal flash flood conditions in the drainage.
0264	North Arroyo	PL-17, PL-18	Moist conditions with ponding west of the location and evaporites presumably from recent rains.
0922	South Arroyo	PL-19	Dry conditions (no change from previous year). Evidence observed that Gypsum creek experienced flash flooding from recent rains.

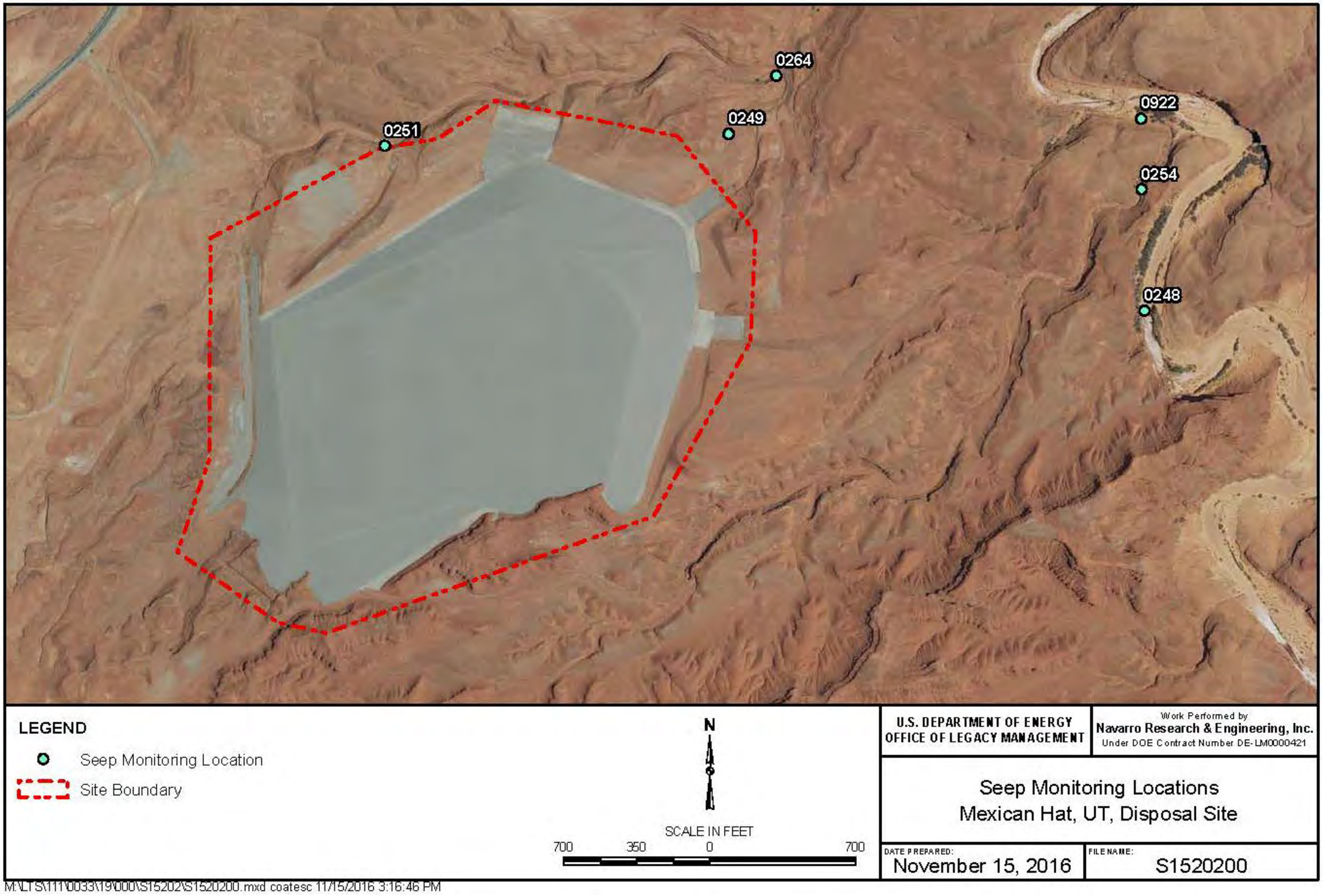


Figure 12-3. Mexican Hat Disposal Site Seep Monitoring Locations

12.8.3 Vegetation Monitoring

In accordance with the LTSP, vegetation conditions are observed during annual inspections to ensure that undesirable plant species, including deep-rooted plants on the disposal cell cover and noxious weeds, do not proliferate at the site. Natural plant community succession will not adversely impact the performance of the disposal cell features. No vegetation management was required in 2016.

12.9 References

DOE (U.S. Department of Energy), 2006. *Resolution of Seep and Ground Water Monitoring at the Mexican Hat, Utah, UMTRCA Title I Disposal Site*, DOE-LM/GJ1139-2006, March.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site, San Juan County, Utah*, DOE-LM/1530-2007, Rev. 3, October.

12.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	150	Entrance Gate
PL-2	150	Perimeter Sign P42 Near Boundary Monument BM-10
PL-3	30	Site Marker SMK-1
PL-4	36	Site Marker SMK-2
PL-5	180	Boundary Monument BM-2
PL-6	300	View Northwest Across Disposal Cell Top Slope
PL-7	270	View West Across Disposal Cell Top Slope With Site Marker SMK-2
PL-8	45	View Northeast of ATV Tracks Around Dead Four-Wing Saltbush Shrub
PL-9	180	Sloughed Rock Area Along South Edge of Disposal Cell
PL-10	210	Depressions on Northeast Side Slope Near the Toe of Disposal Cell
PL-11	210	Depressions on Northeast Side Slope Near the Toe of Disposal Cell
PL-12	270	Access to Seep 0248
PL-13	0	Surface Water Sampling Location at Gypsum Creek Upgradient of Seep 0248
PL-14	270	Seep 0249 in Gully No. 2 (Dry)
PL-15	180	Seep 0251 (Moist)
PL-16	180	Seep 0254 (Dry)
PL-17	210	Seep 0264 (Moist)
PL-18	240	Ponded Water West of Seep 0264
PL-19	0	Seep 0922 (Dry)

PL-1. Entrance Gate

PL-2. Perimeter Sign P42 Near Boundary Monument BM-10

PL-3. Site Marker SMK-1

PL-4. Site Marker SMK-2

PL-5. Boundary Monument BM-2

PL-6. View Northwest Across Disposal Cell Top Slope

PL-7. View West Across Disposal Cell Top Slope With Site Marker SMK-2

PL-8. View Northeast of ATV Tracks Around Dead Four-Wing Saltbush Shrub

PL-9. Sloughed Rock Area Along South Edge of Disposal Cell

PL-10. Depressions on Northeast Side Slope Near the Toe of Disposal Cell

PL-11. Depressions on Northeast Side Slope Near the Toe of Disposal Cell

PL-12. Access to Seep 0248

PL-13. Surface Water Sampling Location at Gypsum Creek Upgradient of Seep 0248

PL-14. Seep 0249 in Gully No. 2 (Dry)

PL-15. Seep 0251 (Moist)

PL-16. Seep 0254 (Dry)

PL-17. Seep 0264 (Moist)

PL-18. Ponded Water West of Seep 0264

PL-19. Seep 0922 (Dry)

Appendix C2

Site Visit Report, April 8, 2016

Site Visit Report

Refer to the Quality Assurance Manual *Section 1.5.3.4 for a description of this process.*

Assessment Title *(short title describing process or area examined)*: Follow up to March 17, 2016 Annual Site Inspection Observations and Radiological Scan of Observations on North East Slope.	**Site** *(include name of building if applicable)*: Mexican Hat Disposal Cell, Utah

Date(s) Performed: 4/8/2016

Site Manager or Lead: Joey Gillespie

Issued By: Anthony Martinez/ Joey Gillespie **Date Issued:** 4/14/2016

Summary *(brief summary of results including what was examined and what was observed)*:

- Subject Matter Experts on Title I / II cell inspections visited the site on April 8 to view the depressions occurring along the toe of the northeast side slope. Several depressions were noted and surveyed in by Navarro GIS personnel during the site visit. The 80 X 100 feet area surveyed contained approximately rill areas or depressions.
- Anthony Martinez set up a radon monitor in a background area to establish background radon outside of the cell fence and then placed the instrument in one of the observed cell depressions. Results of the instrument scan were negligible difference between the background location and the cell.
- Gamma scan was also performed at a background location around the Mexican Hat disposal cell and in the depressions on the disposal cell. The areas of concern were compared and the results show no difference between the two. The results were provided to the LMS site lead who requested the scan.
- SMEs removed cover material from one of the depressions or rills. Base of the cover material showed the cause of the depressions on the surface to be .caused by erosion of either the 6 inch bedding layer or the very top portion of the 24 inch radon barrier. A small trough of approximately 6 inches wide by 4-5 inches deep was observed by the SMEs after pulling back the rip rap erosional cover.

Purpose and Scope *(reason for site visit assessment and scope of area examined)*:

- Visit by Navarro personnel (SMEs) to observe several slight depressions noted during the March 17th Annual Site Inspection. Depressions were noted along the toe of the northeast slope of the Mexican Hat disposal cell
- Radiological gamma survey of depressions to be performed to determine if radon barrier had been compromised.

Report detail *(detailed description of processes and areas examined. Describe problem areas as well as positive practices. Include action items that were completed during site visit)*:

Setup radon monitors in a background area in the morning and on one of the depressions on the Mexican Hat Disposal cell in the afternoon to collect data for a radon study, results included as attachment.

Gamma scan was done in background around the Mexican Hat disposal cell and scan were done on the indention on the disposal cell the areas of concern and compared, the results show no difference between the two. Information was passed on to site lead who requested the scan.

Travel back from Mexican Hat, UT to the LM Office at Grand Junction, CO on Saturday.

Observations *(examples: Consider repainting door when weather permits. Housekeeping is exceptionally good)*:

See attached photos of the areas .

Action Items *(follow-up with site manager or lead on action items listed. Consider including action items on the Site Problem/Issue Report Log (form LMS 1019) implemented by LMS Project and Programs Manual, Appendix A, "Problem/Issue Reporting.)*:

It was determined that the depressions would need an additional follow up inspection by Navarro

Site Visit Report (continued)

Assessment Title *(short title describing process or area examined)*: Follow up to March 17, 2016 Annual Site Inspection Observations and Radiological Scan of Observations on North East Slope.	**Site** *(include name of building if applicable)*: Mexican Hat Disposal Cell, Utah

construction/engineering personnel in order to generate an evaluation summary report to be submitted to DOE LM and then to be submitted to NRC.

Documents/Procedures Reviewed *(reference information or required documents used to prepare for and conduct the site visit)*:

Annual Site Inspection Report Mexican Hat Utah dated March 17, 2016

Job Safety Analysis

Plan of the Day

N/A

Persons Contacted:

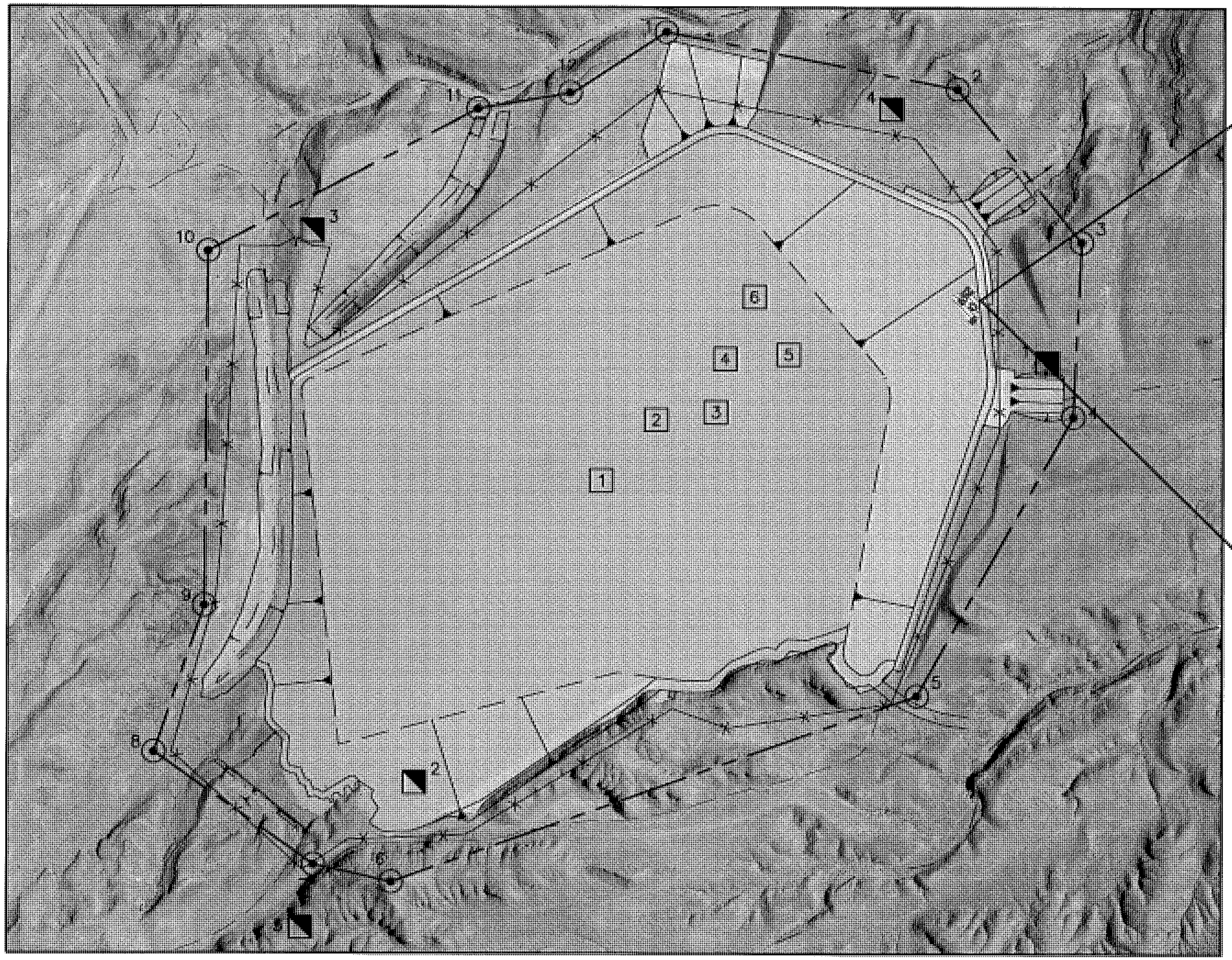
Joey Gillespie / Anthony Martinez, Brendan Nittler, Dick Johnson, Mike Widdop, Steve Hall,(Navarro); Angelita Denny (DOE LM).

Email Distribution *(include site manager or lead, responsible management, affected individuals and CorrectiveAction@lm.doe.gov)*:

Joey Gillespie, Jeff Carman, Sam Marutzky, Beverly Cook, Shelly Gutierrez, CorrectiveAction@lm.doe.gov

See the following attachments:

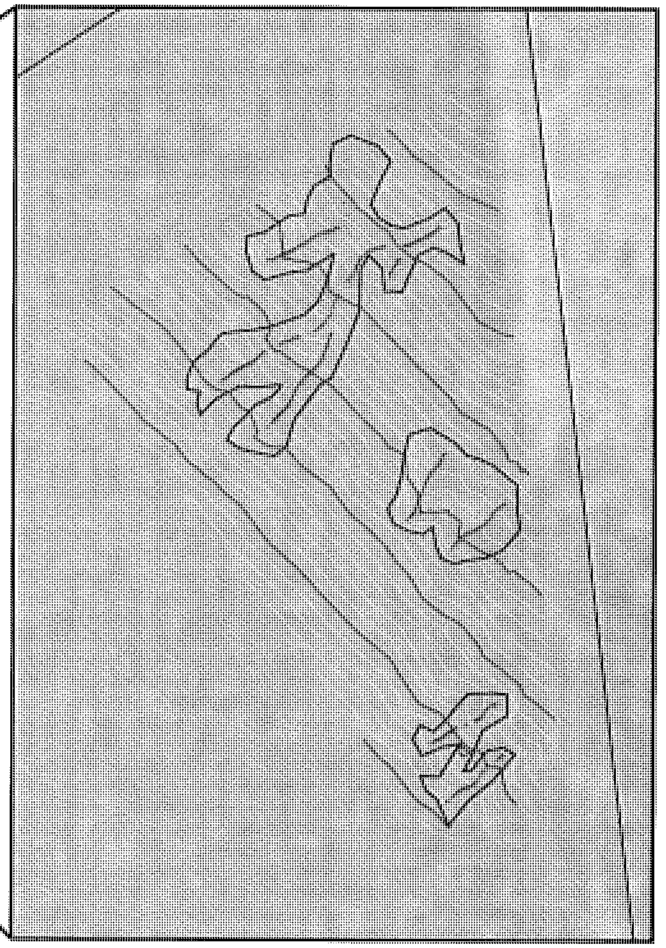
Site Location Figure
Photos
Radon and Gamma Results



SITE PLAN

SCALE IN FEET

400 200 0 400 800 1200



AREA OF CONCERN

SCALE IN FEET

30 15 0 30 60 90

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

NAVARRO
Work Performed Under
DOE Contract No. DE-LM0000421
Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

Figure 1

AREA OF CONCERN
MEXICAN HAT, UT
DISPOSAL SITE

DATE PREPARED:
APRIL 12, 2016

FILENAME:
SXXXXXXX

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alphaNUCLEAR


LEGENDARY
WHITETAILS
ERTON
COLORADO

Appendix C3

Engineering Site Visit Trip Report, June 1, 2016

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U.S. Department of Energy Office of Legacy Management

Engineering Site Visit Trip Report

Site Mexican Hat Disposal Site **Project** Rock Cover Inspection

Individuals making trip Dan Nordeen and Dan Brennecke from Engineering, Doug Collet from Construction

Purpose:

Evaluate areas of concern where 5:1 rock cover is showing signs of depression and make recommendations to address potential erosion issues.

Basic Itinerary:
(including dates, to and from, travel method, lodging location

06/01/16: Round trip travel from Grand Junction, CO to Mexican Hat, UT in GSA vehicle.

Summary:

- Depressions were subtle and somewhat difficult to identify along the surface of rock as evidenced in some of the photos. Previous personnel site visit on March 17th identified at least 4 areas of concern marked out with rebar embedded into the rock and capped with an orange protective cap. After locating several depressions we inspected 3 of the areas in more detail. The areas are located along the 5:1 northeast side slope roughly between the drainage outlets called Gully's 2 and 3. See attached sketch of the plan view, inset of enlarged area of concern.
- The surface rock designated as Type B1 Riprap was removed first by hand to expose the bedding layer material below and subsequently the radon barrier. Approximate depths can be seen in the photographs. The Type B1 Riprap appeared to be consistent with the specified gradation (5" to No. 4) with a thickness that seemed consistent with the specified tolerance of 0% to +35% (12" to a maximum of 16.2"). (see attached construction specifications for radon barrier and erosion protection) The bedding layer material appeared to be inconsistent with the specified depth of 6" and consisted of segregated material that did not have the specified fines within the bedding material matrix.
- The small areas of radon barrier material exposed in the investigation area did not allow determination of depth variations between the depression area and the adjacent non-depressed area. The radon barrier material exposed was a fine grained material and appeared to be consistent with the specified grading requirements which are very broad and allow material as large as 4 inches.
- Investigated areas were backfilled by hand and left in a slightly depressed condition relative to the adjacent surfaces. Stone mounds which last longer than flagging were made near the center of each location for future location of the areas that were investigated. Measurements were made between the perimeter marked with rebar and the investigated areas so that the investigated areas could be plotted on the map upon return to the office. However, it is recommended that a topographical survey be performed to locate the investigation areas.
- Identified several new areas of depression just above the drainage outlet structure called Gully 2. The riprap material at this location is Type B, a larger graded rock than the Type B1 previously discussed. Type B material can be as large as 8" as opposed to a maximum size of 5" for Type B1 Riprap. These areas were not investigated for subsurface conditions at the time of the investigation.
- Photographs also indicate the identification of a buildup of fine grained material within the type C Riprap where the slope is the lowest just after transition from the Type B1 to the Type C Riprap at Gully 2. (See figure 1 for the approximate location of new areas of concern north of the areas identified in March).

Discussion:

- The June 1st inspection of the riprap surface indicated that there may be erosion of the radon barrier fine grained material that may be causing depressions in the overlying riprap layers, however, there is no assurance that this is the case given the small riprap areas that were removed for subsurface inspection. In order to better inspect the validity of radon barrier fine grained soil loss due to subsurface erosion, a larger area of riprap/bedding material would need to be removed to allow inspection of the radon barrier surface within the areas of concern and the adjacent new areas to determine whether or not a variation in the bedding layer and or radon barrier surface is present. This would involve the use of larger sized, track-hoe style equipment with a skilled operator to carefully remove each layer to the top surface of the radon barrier material. This action carries additional risk of further disturbance to the surface rock each time the track equipment needs to reposition. With proper care, the damage would be easily repaired as the equipment moves off the pile, smoothing and compacting with the bucket along the way.

- Alternatively, other options that can be discussed are:
    - No action – monitor disturbed areas over time to allow more time to evaluate the cause and affectand provide for planning of the work.
    - Regrade the existing riprap surface in the disturbed areas to match adjacent surfaces and then monitor over time to see if the depressions reoccur.
    - Backfill the depressions with new riprap material to match adjacent grades and then monitor over time to see if the depressions reoccur

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Included Items:

- The following documents are attached to this Report:
    1. Mexican Hat As-Built drawings
    2. Construction Specification Section 02200 “Earthwork”
    3. Construction Specification Section 02228 “Radon Barrier”
    4. Construction Specification Section 02278 “Erosion Protection”
    5. Figure 1 Sketch over Enlarged Area of Concern map.
    6. Site Photos

Action Items:

- Discuss observances with LMS and LM Site Managers to determine if additional investigation/corrective action is warranted.

Cc:			
	Dan Brennecke	Dick Johnson	Joey Gillespie
	Troy Thomson	Doug Collet	Sam Campbell

Photo 1. View upslope of NE sideslope red outlines areas of concern (approx. 100ft x100ft)

Photo 2. Mid-point along NE side slope of area of concern bounded in red

Photo 3. Across the NE slope west of areas of concern bounded in red (approx. 100ftx100ft area)

Photo 4. Upslope and view west of the NE slope of areas of concern bounded in red

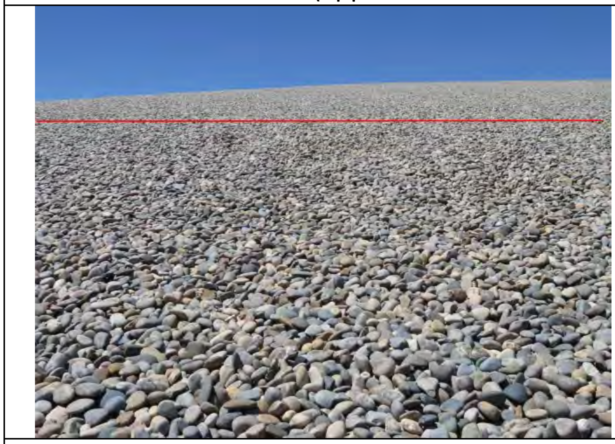


Photo 5.Upslope east view of the NE slope of areas of concern bounded in red

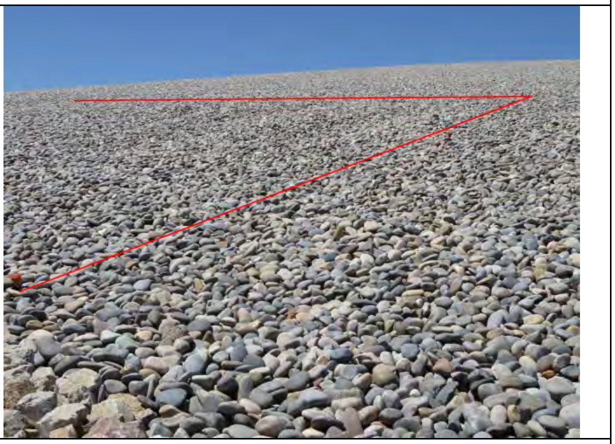


Photo 6. Upslope of west side NE slope of areas of concern bounded in Red (approx. 100ft x 100ft)

Photo 7 - Test Pit 1

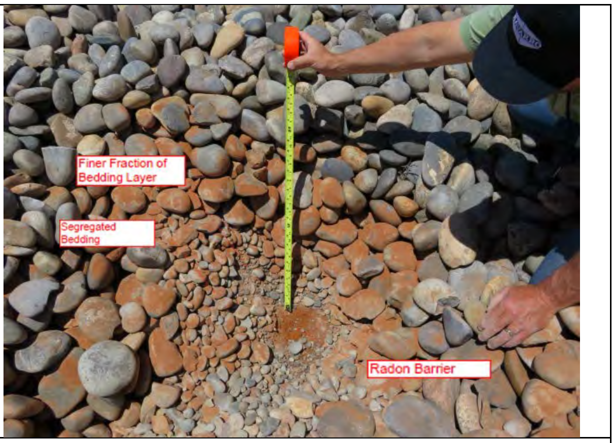


Photo 8 – Test Pit 2

Photo 9 – Test Pit 2

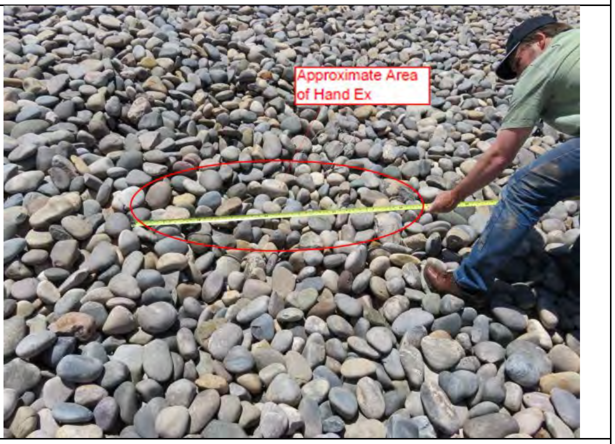


Photo 10 – Test Pit 1 Backfilled

Photo 11 – Test Pit 3

Photo 12 – Rock Mon @ TP1

Photo 13 – Rock Mon at TP 2

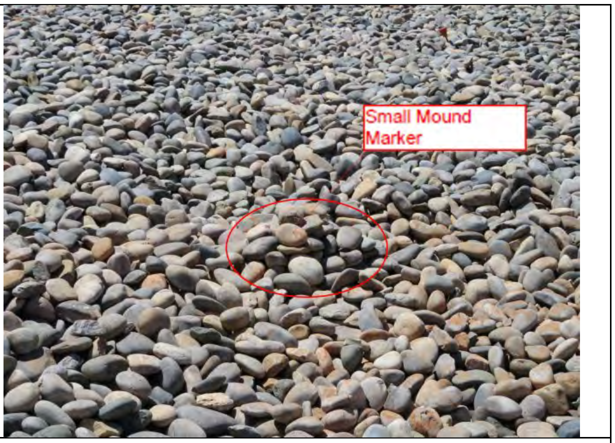


Photo 14 – Rock Mon @ TP 3

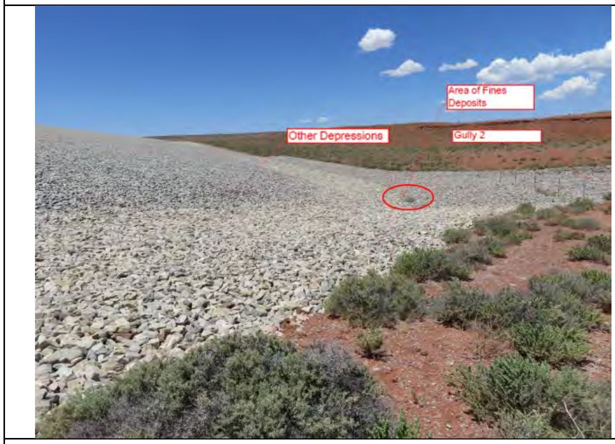


Photo 15 - Rock Drain Low Point

Photo 16 – Rock Drain Low Point

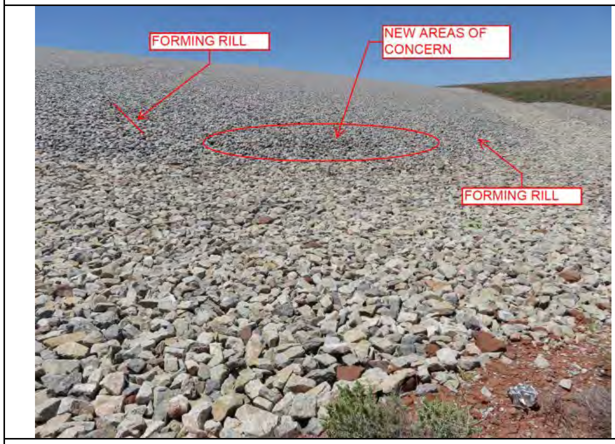
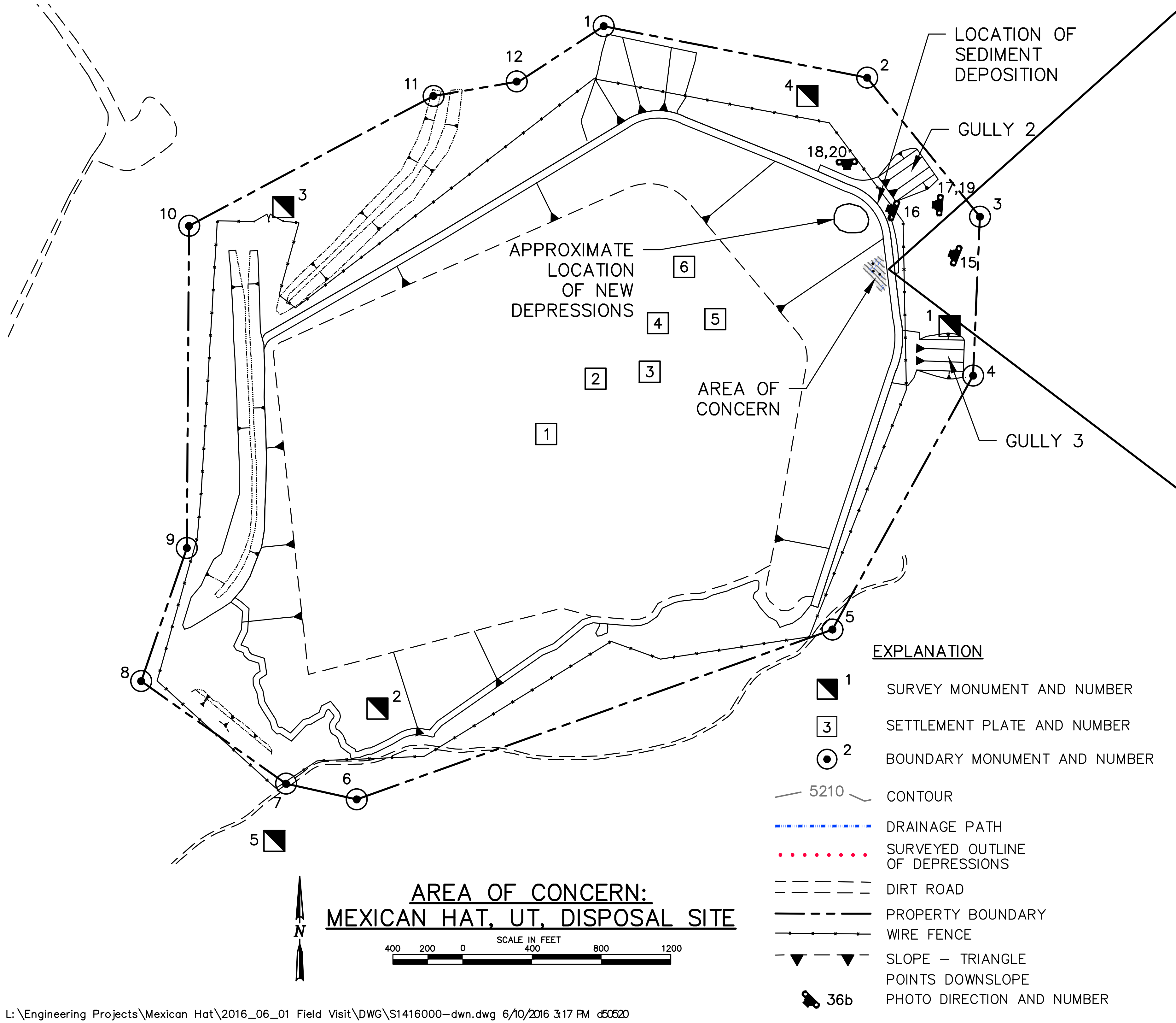


Photo 17 - NEW DEPRESSIONS

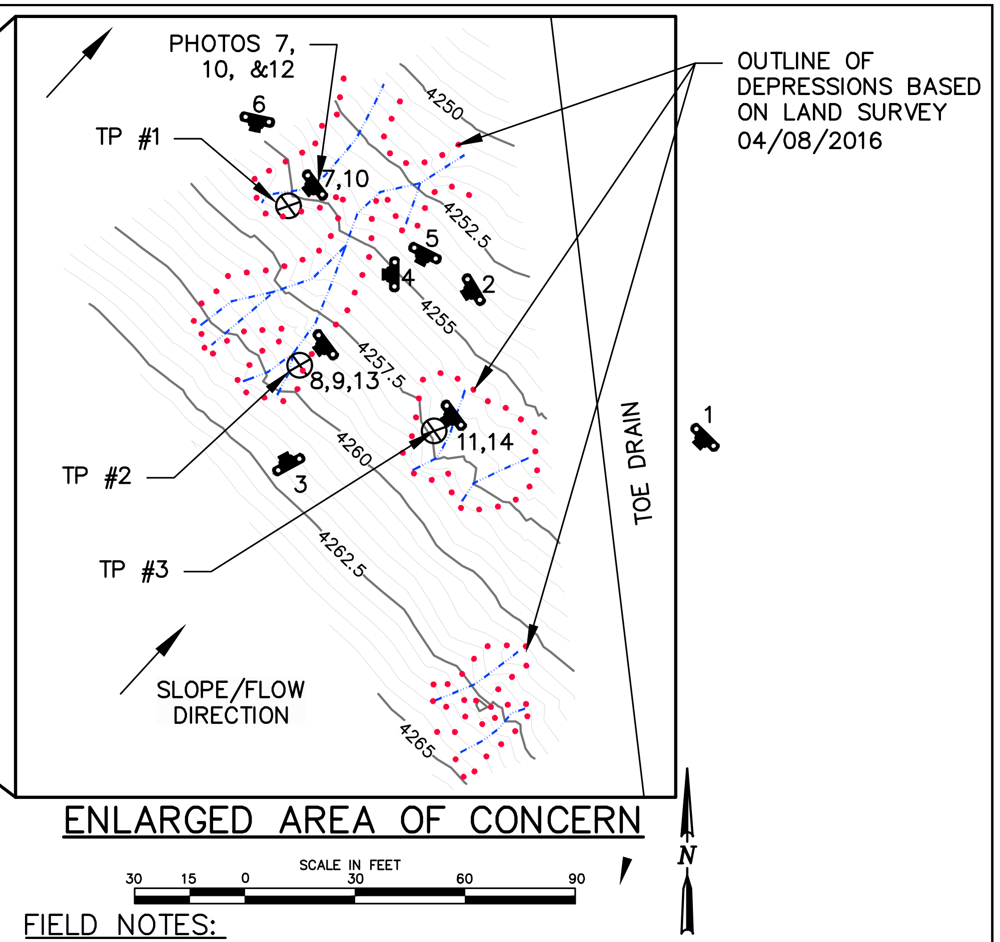
Photo 18 – NEW DEPRESSIONS

Photo 19 – NEW DEPRESSIONS

Photo 20 - NEW DEPRESSIONS



AREA OF CONCERN: MEXICAN HAT, UT, DISPOSAL SITE



ENLARGED AREA OF CONCERN

FIELD NOTES:

TP #1:
- DUG PIT TO RADON BARRIER
- NOT WIDE ENOUGH TO SEE ANY VARIATION IN BEDDING OR RADON LAYER.
- BEDDING LAYER APPROXIMATELY 4" THICK.

TP #2
- DUG TO RADON BARRIER
- FILTER LAYER APPROXIMATELY 1" LOWER THAN ADJACENT
- FILTER APPROXIMATELY 4" THICK @ LOW SPOT
- NOT WIDE ENOUGH TO SEE ANY VARIATION IN BEDDING OR RADON LAYER.

TP #3
- DUG TO TOP OF FILTER ONLY

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE–LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

Figure 1

AREA OF CONCERN
MEXICAN HAT, UT
DISPOSAL SITE

DATE PREPARED: JUNE 6, 2016

FILENAME: S1416000–dwn

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SCOPE

A. This Specification Section covers earthwork for the following:

1. Excavation of contaminated materials from the Mexican Hat and Monument Valley sites.
2. Transportation of contaminated materials from Monument Valley to Mexican Hat.
3. Excavation of uncontaminated common materials.
4. Excavation of uncontaminated rock materials.
5. Construction of the tailings embankment excluding radon barrier and erosion protection which includes disposal of (contaminated and uncontaminated). demolished materials and debris and other contaminated materials including the following in the construction of the tailings embankment:
   a. Existing stockpiles of demolished materials, debris and rubble.
   b. Demolished materials and debris resulting from work specified in Section 02050.
   c. Contaminated cleared vegetation resulting from site clearing specified in Section 02110.
   d. Contaminated sediments from retention basins, dikes and ditches specified in Section 02141.
   e. Stockpiled contaminated vicinity property materials.
6. Construction of permanent drainage ditches.
7. Finish grading of the site, including restoration and regrading of areas occupied by existing temporary drainage ditches, existing wastewater retention basins

and dikes, existing contaminated water recirculation pond, sumps, and temporary facilities areas.

8. Placement of selected rockfill from on-site stockpiles.

9. Furnishing and installing new displacement monuments and extend existing displacement monument as shown on the Subcontract Drawings.

1.2 WORK NOT INCLUDED

A. Earthwork related to the construction of offsite construction facilities specified in Section 01500 is not included in this Section.

B. Earthwork for pipe trenches is not included in this Section.

C. Construction of protective cover of the tailings embankment and for permanent ditches and gullies. Protective cover includes (1) radon barrier materials, (2) bedding materials, and (3) erosion protection materials.

D. Delivery and stockpiling of contaminated vicinity property materials in the tailings embankment by others.

[Text Deleted]*

1.3 RELATED WORK

A. Section 00800 - Special Conditions

B. Section 01300 - Submittals

C. Section 01500 - Construction Facilities

D. Section 01560 - Temporary Controls

E. Section 02050 - Demolition

F. Section 02110 - Site Clearing

G. Section 02141 - Dewatering and Drainage

H. Section 02228 - Radon Barrier

I. Section 02278 - Erosion Protection

1.4 DEFINITIONS

A. Contaminated materials and uncontaminated materials are defined in Article SC-1 of the Special Conditions.

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B. Excavation: Excavation shall include excavation of all materials including silt, clay, sand, gravel, talus, soft or disintegrated rock, boulders or detached pieces of solid rock and rippable rocks (see definition) but shall exclude rocks requiring drilling and blasting operations or grinding and planing. Excavation shall be classified into the following categories:

1. **Contaminated Materials Excavation.**

2. **Uncontaminated Materials Excavation.**

C. Contaminated Materials Excavation: Contaminated materials excavation shall include excavation of contaminated materials regardless of the nature (soil or rock) of the materials from the tailings piles, existing and heap leach pads area at Monument Valley, windblown and waterborne areas, the wastewater retention basins, and the dikes.

D. Uncontaminated Materials Excavation: Uncontaminated materials excavation shall include excavations of uncontaminated materials from the various areas of the site including, but not limited to, excavations for permanent drainage ditches and for finish grading. Uncontaminated materials excavation shall be classified into common excavation and rock excavation in accordance with the following designations and classifications:

1. Rock Excavation: Rock excavation shall include excavation by drilling and blasting or by grinding and planing of material classified as rock and shall include the satisfactory removal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; and conglomerate deposits that are so firmly cemented as to possess the characteristics of solid rock that is impossible to remove without systematic drilling and blasting. The Subcontractor shall not proceed with the excavation of this material until the Contractor has classified the materials as common excavation or rock excavation and cross-sections are taken as required. Failure on the part of the Subcontractor to uncover such material, notify the Contractor, and allow ample time for classification and cross-sectioning of the undisturbed surface of such material will cause the forfeiture of the Subcontractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contractor for the areas of work in which such deposit occurs.

2. Common Excavation: Common excavation shall include the satisfactory removal of all such materials including rippable rocks (see definition below), not materials classified as rock excavation defined above.

E. Overexcavation: Overexcavation is defined as (1) excavation carried out beyond the lines and grades indicated on the Subcontract Drawings or in the Subcontract Specifications or (2) excavation not authorized by the Contractor.

F. Slimes: Slimes are the fraction of the tailings consisting of silty clay, clay and clayey silt, generally defined as containing 70 percent or more of minus No. 200 sieve material.

G. Percent Maximum Density: Percent maximum density is the field dry density expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698, as applicable.

H. Tailings Embankment: Tailings embankment shall consist of in situ tailings pile materials, contaminated windblown/ waterborne materials from the Mexican Hat site, relocated tailings from Monument Valley and other areas of the site, including contaminated materials from windblown and waterborne areas, heap leach pads area, wastewater retention basins, contaminated water recirculation pond, demolished materials and debris, vicinity property materials and the protective cover materials.

I. Subgrade Preparation: Preparation of surfaces of excavations including permanent drainage ditches, backfills, apron, and embankments upon which bedding materials, riprap, or other features are to be constructed. Such surface preparation shall include mixing and manipulation, fine grading, and compaction of materials.

J. Cover: Cover shall consist of the layers of following fill materials placed over the relocated contaminated materials in the tailings embankment as shown on the Subcontract Drawings:

1. Bedding and riprap materials.

2. Radon barrier material.

K. Demolished Materials and Debris:

1. Demolished materials and debris resulting from the demolition work specified under this Subcontract.

2. Stockpiles of Demolished Materials, Debris and Rubble: Existing stockpiles consist of pieces of ore, rock, wood, concrete, steel and debris from demolished work specified under this Subcontract.

L. Finish grading of the site shall include excavation, fill and backfill of the various areas of the site including removal of retention basin dikes (existing), backfilling of temporary drainage ditches (existing), wastewater retention basin (existing), contaminated water recirculation ponds (existing), and temporary facilities (existing) areas as shown on the Subcontract Drawings.

M. Temporary Drainage Ditches: Temporary drainage ditches shall include temporary diversion, collection and interceptor ditches as required by the Subcontractor or as shown on the Subcontract Drawings.

N. Rippable Rock: Rippable rock is defined as mineral matter in place and of such hardness and texture that it can be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler-type tractor Caterpillar Model D10N or equal, operating in low gear; or in areas where the use of the ripper described above is impracticable, rippable rock is defined as mineral material of such hardness and texture that it can be loosened or broken down by a 6-pound drifting pick. The drifting pick shall be Class D, Federal Specification GGG-H-506D, with handle not less than 34 inches in length.

O. Disposal of Demolished Materials and Debris: Disposal shall include loading and transporting demolished materials and debris from existing stockpiles or from demolition operations performed under the Subcontract, and unloading, placing and compacting in the final placement location as indicated on the Subcontract Drawings.

P. Frozen Material or Subgrade or Foundation: Material on subgrade or foundation that has a temperature at or below 32°F and/or generally contains a visible amount of water in the form of ice.

Q. Rockfill Selected by the Contractor: Rockfill from existing stockpiles or required rock excavation which is selected by the Contractor. Selected rockfill generally consists of larger size pieces of sound limestone or sandstone which are of a better quality than most of the on-site rock.

1.5 APPLICABLE PUBLICATIONS

A. The Publications listed below form a part of this Specification to the extent referenced. The Publications are referred to in the text by the basic designation only:

1. American Society for Testing and Materials (ASTM):

D422-63	Test Method for Particle-Size Analysis of Soils Including Percent Passing No. 200 Sieve (and excluding hydrometer analysis)
D698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49-kg) Rammer and 12-in. (305-mm) Drop
D1556-90	Test Method for Density of Soil in Place by the Sand-Cone Method
D2167-84	Test Method for Density and Unit Weight of Soil In-Place by the Rubber-Balloon Method
D2216-90	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
D2487-90	Test Method for Classification of Soils for Engineering Purposes
D2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D3017-88	Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D4643-87	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

2. Blasting practices shall generally be in accordance with the "Blasters Handbook" - 16th Edition by E. I. du Pont de Nemours and Co. (INC) of Wilmington, Delaware 19898.

3. U.S. Federal Specifications (FS):

GGG-H-506D Int AMD 1	Hoe, Mattock and Pick

1.6 PERMITS AND APPLICABLE LAWS

A. All required Federal, State, and local permits for blasting and explosives shall be obtained and paid for by the Subcontractor. Copies of such permits shall be furnished to the Contractor before any blasting operations are started.

B. All blasters and blasting foremen shall be properly qualified and licensed in accordance with the applicable laws and regulations of Federal, State, and local governments.

C. All transportation and storage of explosives shall be in accordance with the applicable laws and regulations of Federal, State and local governments.

1.7 QUALITY ASSURANCE

A. The Contractor will take soil samples and perform moisture-density, gradation and other tests to ascertain that the work is being performed in compliance with these Specifications. Samples may be taken at the place of excavation, stockpiles, or in the fill itself. The Contractor will conduct the density and other tests on the fill and related laboratory testing as frequently as the Contractor considers necessary. The Subcontractor shall remove surface material and render assistance as necessary to enable sampling and testing to be carried out.

B. Methods of Sampling and Testing:

1. In-Place Density: ASTM D1556, D2167, or D2922
2. Particle Size Analysis: ASTM D422
3. Moisture Content: ASTM D2216
4. Laboratory Moisture-Density Relations: ASTM D698
5. Soil Classification: ASTM D2487
6. In-Place Moisture Content: ASTM D3017, or ASTM D4643

C. Suitability of Materials: The suitability of all materials for foundations and backfill will be determined by the Contractor. Fill material will be approved material from borrow areas or required excavations.

D. The Subcontractor shall make his own determination of any processing that may be required and shall perform testing as required to ensure that the materials meet the Specification requirements.

E. The Contractor may direct that inspection trenches or test pits be cut into fills to determine that the Specifications have been met. Such trenches or pits will be of limited depth and size, and shall be backfilled with the material excavated therefrom, or other fill material meeting the requirements for the zones cut into. Backfill shall be compacted to a density at least equal to that of the contiguous fill.

F. When the Contractor directs inspection trenches or test pits to be excavated into fills and backfills and materials are found to meet all Specification requirements, the excavation and refilling shall be paid for as additional work pursuant to the applicable provisions of the General Conditions. Inspection trenches or test pits, and the refilling of the same, shall be at the Subcontractor's expense when it is found that the materials do not meet the Specification requirements.

G. Tolerances: See Specification Section 01052, Article 1.8.

1.8 SUBMITTALS

A. General submittal requirements are specified in Section 01300.

B. At least 90 days before opening borrow areas, the Subcontractor shall submit a mining plan for each separate borrow area. The plan shall include method of stripping and processing of materials, excavation plan, and a site restoration plan.

C. At least 30 days before commencing blasting operations, the Subcontractor shall submit to the Contractor for review a detailed blasting plan covering the area to be blasted. The blasting plan shall contain complete hole layouts, proposed loading, delays and all information required by this Specification. The Contractor may require changes in the blasting plan if the results of blasting do not meet Subcontract requirements.

D. All changes in the blasting plan shall be submitted for approval at least 48 hours prior to the time of the proposed changes.

E. At least 48 hours before blasting within one-quarter mile of a stream course, the Subcontractor shall submit for approval a plan showing all details of his proposed blasting operation and the scheduled time for the blast.

F. The Contractor's review of the Subcontractor's proposed blasting procedures shall not be construed to relieve the Subcontractor of his responsibility to protect existing facilities not to be demolished. Any damage done by the Subcontractor's operations shall be repaired at Subcontractor's expense.

[1.9 SAFETY PROVISIONS FOR BLASTING]*

A. The Subcontractor shall provide and operate at all times an instrument for the detection of approaching electrical storms, including an automatic alarm such as a Litton TSM/C.

B. Electrical Storms: No explosive material shall be handled, transported or in any way made use of during any period of electrical storm or lighting or other electrical phenomenon. In the event that any such condition should appear imminent or occur, or if some known leakage of electricity should occur in the neighborhood of, or in, the work, while the transport, handling, making-up or charging or other use of explosives is being effected, then the work shall be evacuated and abandoned completely until at least thirty minutes after the condition has ceased or the leakage stopped.

C. Detonating Explosive Charges:

1. Only approved exploding devices shall be used for detonating charges. Under no circumstances are lighting and power cables to be used for detonating. All pipes, ducts, track, and other metal shall be properly grounded.
2. An adequate warning system shall be provided by the Subcontractor to ensure that all personnel, staff, visitors and anyone else are at a safe distance before blasting takes place.
3. No radio transmitter shall be operated within 75 feet of the area where electric blasting operations are in progress.
4. No naked lights or sparks are allowed anywhere in the vicinity of blasting operations on the surface.
5. Where detonating is carried out electrically the Subcontractor shall take every precaution necessary to prevent premature explosions and misfires. Before

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* P.I.D. 09-S-15

connection of the detonating wires to the detonating cable the round shall be tested for electrical continuity in an approved manner with an approved testing device or meter. In the event that this testing should show a lack of continuity then the round shall be retested leaving out one detonator at a time until the fault is identified. Should this procedure identify a faulty detonator then stemming shall be carefully removed from the hole and an additional primer inserted and wired into the circuit in place of the defective one. No attempt shall be made to draw a defective detonator or primer. On satisfactory completion of the circuit all workers other than those immediately necessary shall be withdrawn to a safe distance before detonating wires are connected to the detonating cable, and the connection of the detonating cable to the detonator shall be the last operation:

6. Where detonating is carried out by electricity, following a blast, before any person returns to the work place affected by the operation,

   a. The detonating cables shall be withdrawn from the battery, blasting machine or other source of electricity and shall be short circuited.

   b. The blasting switch shall be locked in the open position.

7. Blasting cables and wires shall be clearly distinguishable from other cables and wires and shall only be used for blasting.

D. Misfires of Explosive Charges:

1. Should a misfire occur, then the Subcontractor shall warn all persons affected, and no persons other than those required shall enter the workings until the charge has exploded or, in the case of electrical detonating, an interval of at least twenty minutes has elapsed after operation of the exploder.

2. A misfired detonator may only be removed from the face by means of approved apparatus which permits such an operation to be carried out with absolute safety. Under no circumstance shall charges which have misfired be otherwise tampered with. Should it prove impossible to extract the charge with safety, then the Contractor may authorize the Subcontractor to explode the charge by sympathetic detonation, the greatest care being taken to ensure that no new hole is drilled to intersect an old

one or that the unexploded charge is in any other way affected. After the second shot is detonated, the search shall be made for the unexploded charge.

1.10 PROTECTION

A. The Subcontractor shall preserve and protect the following:

1. Trees, shrubs and other features remaining as a portion of final grading.
2. Bench marks and monuments, existing structures, fences, walks, pavings, curbs, etc. from equipment and vehicular traffic.
3. Utilities not specified for removal.
4. Excavations from cave-in by shoring, bracing, sheet-piling, underpinning or by other methods.
5. Bottoms of excavations and soil adjacent to and beneath foundations from frost.
6. Perimeter of excavation to prevent surface water runoff into excavation.
7. Monitor wells to be saved.
8. Finished work.
9. Existing features not part of this Subcontract, e.g., existing roads or existing wells.
10. Archaeological areas identified by the Contractor or encountered during the work.
11. Displacement monuments.

1.11 EXISTING CONDITIONS

The Subcontractor shall not disturb the existing asbestos-containing materials burial area shown on the Subcontract Drawings.

PART 2 - PRODUCTS

2.1 EXPLOSIVES

A. A record shall be maintained by the Subcontractor for storage and withdrawal of explosive stocks and detonators. The inventory record shall be subject to inspection at all times. The Subcontractor shall provide such reasonable and adequate protective facilities as may be necessary to prevent loss and theft of explosives and to minimize hazards of subversive action or sabotage. Loss or theft of explosives shall be reported to the Contractor immediately. Overnight storage of explosives and detonators outside of the magazine will not be permitted. Only qualified personnel shall be permitted to handle explosives.

2.2 UNCONTAMINATED FILL MATERIALS

A. General:

1. Fill materials shall be obtained from required excavations and from borrow areas shown on the Subcontract Drawings or from other approved borrow areas selected by the Subcontractor and approved by the Contractor.

2. The Subcontractor shall be responsible for obtaining required permits and approvals for Subcontractor-selected borrow areas in accordance with the provisions of Article SC-11 of the Special Conditions. Designation of a borrow area does not indicate that all material within that area meets the Specification requirements specified herein.

   a. The Subcontractor shall make his own determination of any processing or selective excavation that may be required, and shall perform testing as required to meet the Specifications for the various construction materials.

   b. Submittals to the Contractor for approval of sources proposed for use by the Subcontractor shall include boring logs, borrow area maps and supporting laboratory test data. The Subcontractor also shall provide evidence of availability, right of access to private property including access by the Contractor for sampling and testing, and his plan for hauling the materials to the site. Submittals for approval of sources for uncontaminated fill materials shall be received by the Contractor at least 30 days (60 days for radon barrier materials) before use of the material at the site. The Contractor may perform additional tests to determine if the materials meet the requirements specified herein.

c. Approval will be based on evidence of compliance with the requirements specified herein and on verification by the Subcontractor that the volume of materials available is sufficient for construction requirements.

3. Gradations: Gradations specified shall be as determined after delivery to the site, except where normal compaction operations reduce materials to acceptable sizes, in which case in-place gradations shall be acceptable.

B. Uncontaminated Common/General Fill Materials: Uncontaminated common/general fill materials for general fill shall conform to the following requirements. All references to "uncontaminated fill" or "uncontaminated fill materials" shall mean "uncontaminated common/general fill" or "uncontaminated common/general fill materials".

1. Uncontaminated fill materials shall not contain more than 5 percent, by volume, of organic material or other deleterious substances.

2. Maximum particle size shall not be greater than the compacted lift thickness in any dimension, except as noted hereinafter. Individual large stones shall be distributed within the fill materials to provide visual void-free mass, and be able to meet the requirements of Article 3.8. For fill areas under pavement locations, maximum stone dimension allowed in the upper 6 inches of the fill shall be 4 inches. Larger stones may be utilized in initial backfill in the lower layers of finish grading of the site.

2.3 CONTAMINATED FILL MATERIALS

Contaminated materials as defined in Article SC-1 of the Special Conditions resulting from the clearing, stripping and excavation operations in contaminated areas. These materials shall include materials excavated from tailings piles, windblown and waterborne areas, contaminated sediments from drainage ditches and wastewater retention basins, recirculation pond, and any other areas designated by the

Contractor including vicinity properties and demolished materials and debris.

2.4 DEMOLISHED MATERIALS AND DEBRIS

A. The demolished materials and debris shall include the following:

1. Existing stockpiles of contaminated and uncontaminated demolished materials and debris.
2. Contaminated and uncontaminated demolished materials and debris resulting from work specified under Sections 02050 and 02110.
3. Rubble and debris located within the site boundary.

B. For disposal purposes all demolished materials and debris shall be considered as contaminated materials.

2.5 VICINITY PROPERTY MATERIALS

Excavated contaminated materials resulting from cleanup of vicinity properties will be hauled to the site and stockpiled on the tailings embankment by others. The Subcontractor shall make provisions in his schedule and work plan for placement and compaction of vicinity properties materials stockpiled in the tailings embankment by others. The Subcontractor shall make allowances for decontamination of vicinity property subcontractor vehicles.

2.6 ROCKFILL SELECTED BY THE CONTRACTOR

Rockfill selected by the Contractor shall come from either existing stockpiles as designated by the Contractor or from required rock excavations as selected by the Contractor.

PART 3 - EXECUTION

3.1 PROTECTION OF EXPOSED SURFACES

A. During seasonal shutdowns and during other periods of prolonged exposure (more than six weeks) of excavated or filled areas, the Subcontractor shall provide labor, materials and equipment, as required by the Contractor, to maintain and protect exposed surfaces of uncontaminated and contaminated materials against wind erosion and excessive stormwater erosion. Prior to the application of protective erosion control measures, the exposed surfaces shall be sloped to drain and compacted with a smooth drum roller to eliminate ruts and ridges formed by construction equipment. Unless otherwise approved by the Contractor, acceptable methods of erosion protection are as follows:

[1. Spraying with Water containing Chemical Additives: Acceptable chemical additives are CPB-12 as manufactured by Wen-Don Corporation, 206 West 2nd South, Price, Utah 84501; "Soil Seal Concentrate" as manufactured by Soil Stabilization Products Company of Merced, California; "Soil-Sement" as manufactured by Midwest Industrial Supply, Inc. of Canton, Ohio; or approved equal. Mixing and application shall be in accordance with the manufacturer's recommendations.]*

2. Covering exposed surfaces with geotextile fabric such as "Supac" as manufactured by Phillips Fibers Corporation of Sacramento, California, or approved equal. Handling and installation shall be as recommended by the manufacturer of the product.

[B. After removal of contaminated materials and completion of finish grading, the Subcontractor shall provide labor, materials and equipment as required by the Contractor to protect exposed surfaces against erosion. This shall be achieved by spraying with water containing chemical additives such as CPB-12 as manufactured by Wen-Don Corporation, 206 West 2nd South, Price, Utah 84501; "Soil Seal Concentrate", as manufactured by Soil Stabilization Products Company of Merced, California; "Soil-Sement" as manufactured by Midwest Industrial Supply, Inc. of Canton, Ohio; or approved equal. Mixing and application shall be in accordance with the manufacturer's recommendations. Exposed rock surfaces do not require treatment. The soil sealant shall only be applied to areas that are backfilled or where uncontaminated soils remain.]*

[C. Following a seasonal shutdown or period of prolonged exposure of more than six (6) weeks, the Contractor will verify by density test, that the last lift of material placed has been maintained at the applicable minimum specified density. Verification by density test will be performed prior to placing any additional materials on the surface and at frequencies described in Article 3.7. Material failing to meet the specified density requirements shall be removed or reworked to satisfy the minimum specified density requirements.]*

* P.I.D. 09-S-15

3.2 EARTHWORK - GENERAL

A. Preparation:

1. Clearing and stripping shall be as specified in Section 02110.

2. Required lines, levels, contours and datum shall be identified before the start of earthwork operations.

3. The Subcontractor shall verify the existing above-ground and underground utilities, identify them, and notify the Contractor immediately of his finding, if any, for appropriate action.

B. Dewatering and Drainage: Prior to commencement of earthwork operations, the Subcontractor shall verify that the dewatering and drainage facilities are constructed and operational in accordance with the requirements of Section 02141.

C. In order to avoid cross-contamination of uncontaminated material, the contaminated and uncontaminated materials shall be kept separated during earthwork operations. Stockpiles of contaminated materials shall be placed on contaminated areas and the drainage collected in the retention basin.

D. Earthwork shall conform to lines and grades indicated on the Subcontract Drawings or specified in this Section.

E. The excavated uncontaminated common materials, where practicable, shall be used as fill in various areas of the sites including general fill, roadway fill, structure fill, backfill, fill for the final grading of the site and for the construction of the tailings embankment, as required.

F. The excavated uncontaminated rock materials shall be placed in the spoil area indicated on the Subcontract Drawings. The Contractor may direct the Subcontractor to place selected excavated uncontaminated rock materials in stockpiles. Rockfill selected by the Contractor shall come from existing or new stockpiles of selected, excavated, uncontaminated rock.

3.3 EXCAVATION

A. General:

1. Excavation shall be carried out to reach the lines and grades indicated on the Subcontract Drawings or specified

herein, or, in the case of contaminated materials, as required by the Contractor's Health Physics Personnel.

2. At all times, the Subcontractor shall conduct his operations in such a manner as to prevent free standing water and contamination of uncontaminated materials. The Subcontractor shall, as a minimum, take the following measures to safeguard against such problems:

   a. Water leaving a contaminated excavation area or contaminated area otherwise disturbed by construction activities shall be routed into the retention basin as specified in Section 02141.

   b. Exposed surfaces of contaminated and uncontaminated materials excavations shall be protected from erosion as specified in Article 3.1 above.

3. The Subcontractor shall remove all excavated material from the excavation site and dispose of it in fills required at the site or use it for other purposes, as approved.

4. Unsuitable or low density subgrade material not readily capable of in-place compaction shall be excavated as directed by the Contractor and disposed of as specified in Article 3.4.

[5. Adequate working space for safety of personnel shall be provided within the limits of the excavation. Extra precautions shall be taken to protect workers when excavating near steep rock faces. Boulders or loose rock on the rock face shall be removed as they become exposed.]*

6. Except as otherwise noted, care shall be exercised to preserve the material below and beyond the lines of all excavation. Where excavation is carried below grade, the Subcontractor shall backfill to the required grade or to indicated invert grade, as specified, and recompact the backfill to meet the existing conditions.

7. Excavation for the convenience of the Subcontractor shall conform to the limits approved by the Contractor and shall be at no additional expense to the Contractor.

8. Excavated material shall be placed at sufficient distance from edge of excavations to prevent cave-ins or bank slides. Slopes of excavated cuts and stockpiles shall

* P.I.D. 09-S-15

not be steeper than 2(H) to 1(V) unless indicated otherwise on the Subcontract Drawings.

9. Where practicable, suitable materials removed from excavation shall be used as fill or backfill.

B. Contaminated Materials Excavation:

1. Contaminated materials excavation shall include excavation of (a) contaminated materials from the tailings piles at the Monument Valley site, (b) windblown and waterborne off-pile areas including wet slimes and rippable rock, at both sites, and (c) existing retention basins and dikes and heap leach pads area. The Subcontractor shall minimize the open excavation area of contaminated materials at any time during excavation work. The Subcontractor shall operate from one or two sides at one time, progressing uniformly to opposite sides for completion, unless directed otherwise by the Site Manager. Contaminated materials shall be excavated to the depths indicated on the Subcontract Drawings, or as required by the Contractor, and placed in the proper part of the tailings embankment. Contaminated materials will be excavated generally in priority of its placement in the tailings embankment to minimize rehandling and stockpiling. Excavation shall be carried out to the limits and grades required by the Contractor. Rock requiring drilling and blasting operations shall not be included in this excavation.

[2. The Subcontractor shall remove contaminated material from rippable rock surface to acceptable finish. Examples of an acceptable rock finish are available at each site. The locations of areas with an acceptable rock finish are shown on the Subcontract Drawings. The Subcontractor shall employ whatever equipment methods are necessary in order to achieve an acceptable rock finish, and remove windblown/waterborne contamination from within rock crevices.]*

3. During excavation operation, tests will be performed by the Contractor to determine radioactive contamination of the material to be excavated.

C. Uncontaminated Materials Excavation:

1. General: Uncontaminated materials excavation shall include excavations of uncontaminated materials from the

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various areas of the site. The excavated materials shall be used as fill in various areas of the sites including construction of berms, dikes, general fill, roadway fill, structure fill, backfill, and fill for final grading of site, as required. Uncontaminated excavated material may be stockpiled for later use.

2. Rock Excavation:

   a. The Subcontractor shall perform required rock excavation to the limits shown on the Subcontract Drawings or as directed by the Contractor.

   b. Care shall be exercised to avoid excessive overbreak beyond or below grade lines of excavation.

   c. Blasting methods and procedures shall be such that, upon completion of the excavation, all rock surfaces will be sound and relatively uniform. Explosives shall be of such quantity and power and shall be used in a manner that will minimize opening of seams and disturbing of rock outside the prescribed limits of excavation. As the excavation approaches its final limits, the depths of holes for blasting and the quantity of explosives used for each hole shall be reduced so that the rock underlying or adjacent to the final limits is not shattered or otherwise disturbed.

   d. The Subcontractor shall remove all shattered material and debris from excavation.

   e. Excavated rock materials shall be used as fill, where required, or may be stockpiled in approved locations for later placement as fill.

   f. Where shown on the Subcontract Drawings, rock shall be chipped or ground to final grade. Blasting or ripping of rock within this area will not be permitted.

3. Permanent Drainage Ditches Excavation:

   a. Ditches shall be excavated true to line and grade. Any erosion which occurs to ditch excavation before placing erosion protection materials shall be repaired with compacted backfill. All such repairs shall be at Subcontractor's expense and shall not be included in pay quantities, unless otherwise shown on the Subcontract Drawings.

b. Where the subgrade consists of common fill, the subgrade shall be compacted as specified in Article 3.8 below. After compaction has been completed, finish grading shall be done in such a manner that the sideslopes and bottom are rendered smooth surfaces. All loose rocks, brush, roots, large clods, and other objects shall be removed before placement of the bedding material and the riprap material.

4. Borrow Area Excavation:

a. General:

1) Borrow areas for general fill are indicated on the Subcontract Drawings.

2) Borrow areas shall meet all permit and negotiated requirements as required by the Contractor.

3) Necessary clearing, grubbing, and disposal of debris shall be performed by the Subcontractor as incidental operations to the borrow excavation.

4) After borrow excavations are completed, borrow areas shall be graded to drain. Natural drainage patterns shall be maintained.

5) Where general fill materials are not available in sufficient quantity from the required excavations, such materials shall be obtained from approved offsite borrow areas.

b. The Subcontractor shall notify the Contractor at least 30 days in advance of opening any borrow area so that adequate time will be allowed for testing the material.

3.4 DISPOSAL OF EXCAVATED MATERIALS

A. Contaminated Materials: All contaminated materials excavated from the Mon tailings piles, retention basins, heap leach pads, windblown, and other areas of the site shall be used in the construction of the tailings embankment as specified herein. Contaminated material will be placed in the tailings embankment by priority generally as indicated Article 3.5.B.5. Radiological monitoring of contaminated materials or construction expediency may change this priority, as directed by the Contractor.

B. Uncontaminated Materials:

1. Materials excavated from the sites, including excavations for drainage ditches which do not classify as contaminated materials, shall be used as uncontaminated material fill for construction of various features, or stockpiled for later use for site grading as specified in this Section and as required by the Contractor.

2. Where used in fills, such material shall be transported directly from the excavation and placed in its final position in such fills whenever possible. If required by the Subcontractor's schedule, the material may be placed temporarily in stockpiles at approved locations. Material in stockpile shall be protected from contamination of any kind that would render it unsuitable for use in fills.

3. Clean, sound, unweathered rock, of suitable material, from the required excavation may be incorporated into fills, after processing as necessary, provided it meets the appropriate specifications and as approved by the Contractor.

4. Uncontaminated Common and Rock Materials: See Article 3.2, Paragraphs E and F.

5. Garbage, refuse, debris, oil, and any waste material which is harmful to the environment shall be removed from the job site and disposed of offsite in a manner approved by the authority having jurisdiction over the offsite disposal facility.

6. Excess uncontaminated materials shall be disposed of on site or in the spoil area shown on the Subcontract Drawings as approved by the Contractor.

C. Disposal of Demolished Materials and Debris:

1. Existing stockpiles of demolished materials and debris, and demolished materials and debris resulting from demolition work specified in Section 02050 shall be disposed of in the tailings embankment conforming to the applicable provisions of this Section and as required by the Contractor.

2. During construction of the tailings embankment, provision shall be made to leave required space at proper location

in the embankment for the placement of the demolished materials and debris resulting from the demolition work specified in Section 02050.

3.5 FILL CONSTRUCTION

A. General Requirements:

1. Clearing and stripping shall be as specified in Section 02110.

2. Fill materials shall be placed and compacted to the lines and grades shown on the Subcontract Drawings or as required by the Contractor.

3. Prior to placing of uncontaminated fill materials, the subgrade will be radiologically surveyed by the Contractor to confirm that EPA standards have been met. These radiological surveys may cause delays to backfill operations of up to seven working days. The Subcontractor shall plan his work accordingly.

4. If any portion of the materials placed as fill does not meet the specified requirements, the Subcontractor shall remove such material and replace it with fill materials meeting the specification at no additional cost to the Contractor.

5. Constructed fills shall be maintained to meet the requirements of this Specification until final completion and acceptance of the Work. This shall include all measures to prevent erosion or contamination during construction, including contamination by radioactive material. During seasonal or other extended shutdowns, all exposed surfaces shall be protected with special treatments specified in Article 3.1 above.

B. Placing Requirements:

1. Prior to placement of materials, the in-place density of the subgrade shall be as specified in Article 3.9. Subgrade preparation, where required, shall be as specified in Article 3.8.

2. No material shall be placed on any portion of the subgrade or against or upon any structure until consent to place such fill has been obtained from the Contractor.

3. Fill materials may require moisture conditioning (wetting or drying) prior to compaction. Some tailings slimes particularly will require spreading and extended drying time prior to compaction.

4. Fill materials shall be placed in continuous and approximately horizontal lifts for their full length and width unless otherwise specified or specifically permitted by the Contractor.

5. The following sequence shall be followed in placing materials in the tailings embankment:

   [a. Materials from the heap leach pad area and the old pile area at Monument Valley including demolished materials, boulders, ore and debris.]*

   b. Tailings materials from the new pile area at Monument Valley.

   c. Contaminated materials from windblown, waterborne and off pile areas.

   d. Vicinity property material as delivered to the site and as directed by the Contractor.

   e. Excess uncontaminated materials from required excavations, including retention basin dikes.

   f. Radon barrier material: The entire thickness shall be amended with 10 percent bentonite.

   g. Bedding material.

   h. Riprap protection.

6. Method of dumping and spreading the materials shall ensure uniform distribution of the material.

[7. The loose thickness of each layer shall not be greater than that required to achieve the specified compaction. For material containing particles having a maximum dimension of less than 10 inches the loose lift thickness shall not exceed 12 inches. For material containing particles greater than 10 inches, the loose lift shall be kept to the minimum constructible thickness, as approved by the Contractor. Oversize material shall be placed in

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accordance with Article 3.5.B.10 and graded to avoid ponding of surface water. Oversize material shall be compacted in accordance with Article 3.5.C.8. Rubble and boulders from Monument Valley shall be broken to a maximum rock size of 36 inches before placing in the tailings embankment.]*

8. Unless otherwise indicated, fill materials shall be placed to a grade no flatter than 2 percent to facilitate drainage of water. In areas where ponding cannot be prevented or ponding has occurred and fill is required to be placed, placing shall begin only after the area is dewatered and permission to place is obtained from the Contractor.

9. Materials shall not be placed on frozen subgrade or frozen fill, nor shall frozen material be used as fill.

10. Bulky (demolished materials and debris) materials shall be disposed of in the lower portion of the tailings embankment fill. The materials shall be placed evenly in each lift to minimize the volume of voids created in the disposal mass and to avoid nesting. Organic matter shall be distributed to provide a concentration of not more than five percent in any area of the embankment.

11. When no longer needed for control of contamination, as determined by the Contractor, the retention basins, recirculation pond, and the like shall be removed and the area restored.

C. Compaction Requirements:

1. Each lift of fill materials shall be compacted to a minimum density specified in Article 3.9.

2. During compaction, the moisture content of fill material shall be maintained to achieve specified density. Uniform moisture distribution shall be obtained by disking, blading, or other methods approved by the Contractor prior to compaction of a lift.

3. If the surface of the prepared foundation or the rolled surface of any lift of fill is too dry or too smooth to bond properly with the lift of material to be placed thereon, it shall be scarified and moistened by sprinkling to the acceptable moisture content prior to placement of the next lift of fill.

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4. If the rolled surface of any lift of the fill in place is too wet for proper compaction of the lift of fill material to be placed thereon, it shall be removed, allowed to dry or worked with harrow, scarifier, or other suitable equipment to reduce the water content to the required amount, and then re-compacted before the next succeeding lift of fill is placed.

5. Fill placed at densities lower than the specified minimum density or at moisture contents that make compaction difficult shall be reworked to meet the density and moisture requirements or removed and replaced by acceptable fill compacted to meet these requirements.

6. Uncontaminated fill material in the stockpile areas shall be placed by spreading with a bulldozer and track walking. Lift thickness before compaction shall not exceed one foot. Compaction shall be accomplished by routing of hauling and spreading equipment units.

7. Unfavorable Weather: Placing, spreading, rolling or compacting fill material that is frozen or thawing, or during unfavorable weather conditions shall not be permitted.

8. Compaction of fill with more than 30 percent retained on a 3/4-inch standard sieve:

   a. Prior to compaction, materials shall be moisture conditioned as approved by the Contractor. If required, moisture addition shall be limited to the amount of water required to lubricate rock particles. When adding moisture, care shall be taken not to increase the moisture content of underlying soils.

   b. Compaction shall be accomplished by any of the following combinations of passes and equipment, or approved equal combination:

Equipment	Minimum No. of Passes for 90% Compaction	Minimum No. of Passes for 95% Compaction
BOMAG Vibratory Roller Model 213D	2	4
CAT CS 553 Vibratory Roller	2	4
CAT Compactor Model 825C	2	4
Raygo Vibratory Roller Model 400A	2	4
Track-Type Tractor with Ground Pressure of at Least 9.8 psi	3	5
Towed 5x5 Sheepsfoot, Fully Ballasted	3	4

c. Depending on soil conditions, the Subcontractor may be required to change the compaction equipment or increase the number of passes to achieve the desired compaction. Approval of a combination of equipment and number of passes suitable for certain soil types and conditions may not apply to different soil conditions.

d. Materials shall not be subject to requirements of Article 3.8.A.

3.6 ROCKFILL PLACEMENT

A. Selected rockfill shall be placed as shown on the Subcontract Drawings or as directed by the Contractor. Rockfill shall be placed by end dumping and may be spread by bulldozers or other suitable equipment.

B. Rockfill shall be placed so that larger stones are well distributed throughout the mesh. Rearranging of individual stones will be required to the extent necessary to obtain a reasonably well graded distribution of stone sizes.

C. Excavated rock other than rockfill selected by the Contractor shall be placed on the designated spoil area or in other areas within the site as designated by the Contractor. Spoiled rockfill shall be compacted by routing tracted construction equipment over the surface.

3.7 FIELD QUALITY CONTROL

A. General: The Contractor will take samples and perform tests throughout the construction period, and the Subcontractor shall cooperate in providing access for the Contractor to areas where testing is to be performed and shall schedule his placing to avoid interference with the testing operations.

B. Tests: The Contractor will perform the following tests on a regular basis.

1. In-place density and moisture content tests where density is specified will be as follows:

   a. A minimum of one test per 1000 cubic yards of contaminated and uncontaminated materials placed excluding radon barrier material. At least two tests shall be performed for each day of material placement in excess of 150 cubic yards.

   b. Foundation and Subgrade: Prior to placing the first layer of material on the foundation, the subgrade will be inspected to assure that it has no sign of deterioration due to frost action, erosion due to rainwater, rutting, areas of subsidence, or drying out of the surface. The inspection shall verify that the foundation surface has been moistened, but there is no standing water on the surface and that the foundation surface of cohesive soils has been scarified or penetrated to ensure proper bonding of overlying material. Unacceptable surface material shall be either removed or excavated and recompacted to Specification requirements.

   [c. A minimum of one test per 30,000 sq.ft. on the surface of previously placed materials after a seasonal shutdown or period of prolonged exposure and prior to placing additional materials.]*

2. The placing and compaction of temporary stockpiles will be subject to the approval of the Contractor.

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3.8 SUBGRADE PREPARATION

A. Subgrade Preparation: Subgrade preparation includes fine grading and compaction of excavations, backfills, embankments (including stockpiles) upon which pavement, surfacing, base, subbase, and riprap or other structures are constructed.

B. The entire surface of the subgrade shall be plowed, harrowed, and mixed to a depth of at least 6 inches. Compaction shall be carried out for the full area below finished subgrade to at least the density specified in Article 3.9 below.

3.9 COMPACTION DENSITIES

A. Subgrade of permanent drainage ditches and embankments, and each layer of embankment and backfill shall be compacted to at least the following percentage of maximum dry density, as determined by ASTM D698 test method:

1.	Subgrade Preparation:	90 percent
2.	Subgrade Preparation for Permanent Drainage Ditches	95 percent
3.	Tailings Embankment Fill Except Top 3 feet	90 percent
4.	Tailings Embankment Fill Top 3 feet Immediately Below the Bottom of Radon Barrier	95 percent
5.	Trench Backfill and Common Fill	95 percent
6.	Site Restoration	90 percent

3.10 DISPLACEMENT MONUMENTS

Displacement monuments shall be furnished and installed by the Subcontractor as shown on the Subcontract Drawings. The Subcontractor shall take precautions not to damage the existing monument or new monuments once they are installed. Damaged monuments shall be replaced by the Subcontractor at no additional cost to the Contractor. The Subcontractor shall add extension rods to existing monuments as the fill is being placed. All displacement monuments shall be permanently protected as shown in the Subcontract Documents.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement for payment for the following items of earthwork will be by the cubic yards of material excavated and placed in the disposal cell. The quantities for payment will be computed by average end area method from surveys conducted before and after fill operations. Separate measurement for payment will not be made for excavation of the materials in their original locations. A survey of the existing tailings embankment will be required by the Subcontractor prior to placement of any materials on the embankment.

1. Placement in the Tailings Embankment of all Contaminated and Other Materials Including Demolished Materials, Debris, Rubble and Vicinity Property Materials (Bid Schedule Item 401)

B. Measurement for payment for the following items of excavation will be by the cubic yards of materials excavated. The quantities for payment will be computed by average end area method from surveys conducted before and after excavation operations:

1. Rock Excavation for Finish Grading of the Mexican Hat Site Including Ditches and Gullies and Grinding or Planing of Rock Adjacent to the North Ditch (Bid Schedule Item 801)

C. Measurement for payment for the following items of fills will be by the cubic yards of materials placed. The quantities for payment will be computed by average end area method from surveys conducted before and after placement:

1. Uncontaminated Material Fill for Finish Grading of the Mexican Hat and Monument Valley Sites (Bid Schedule Item 802)

2. Rockfill Selected by Contractor for Finish Grading of the Mexican Hat Site (Bid Schedule Item 803)

D. Measurement for payment for the following items of work will be by the acre measured in the horizontal plane from surveys conducted before and after the work as shown on the Subcontract Drawings, or by the methods determined by the Contractor:

1. Fine Grading of Existing Side Slopes of the Tailings Embankment (Bid Schedule Item 402)

2. Cleanup of Rock Surfaces at the Mexican Hat and Monument Valley Sites (Bid Schedule Item 403)

E. Separate measurement for payment will not be made for the following items, and such work will be considered incidental to the related items of work:

1. Subgrade preparation.

2. Stockpiling of excavated materials.

3. Required rehandling of materials.

4. Blasting.

5. Borrow area excavation, restoration, reseeding and incidental activities.

6. Protection of exposed surfaces during shutdown.

F. Overexcavation: Overexcavation for the Subcontractor's convenience or due to error or lack of control by the Subcontractor will not be measured for payment. At the discretion of the Contractor, overexcavation shall be backfilled with compacted uncontaminated fill, as required, at the Subcontractor's expense.

G. Separate measurement for payment will not be made for any other excavations or fills specified in this Section.

H. Measurement for payment for furnishing and installing displacement monuments will be by the number of new monuments installed. The price shall include extending and protecting the existing displacement monuments. (Bid Schedule Item 404)

4.2 PAYMENT

A. Payment for the item of Article 4.1.A above will be by the applicable unit price per cubic yard quoted therefor in the Bid Schedule. The price quoted shall include full compensation for excavating, loading, hauling, unloading, and placing the excavated materials in their final locations including all clearing, stripping, grading, shaping, preparing subgrade, compacting, temporary stockpiling and required rehandling.

B. Payment for the items of Article 4.1.B above will be by their applicable unit prices per cubic yard quoted therefor in the Bid Schedule. The prices quoted shall include full compensation for excavating, hauling, and placing the excavated materials in temporary stockpiles, or in spoil areas if excess or unsuitable for use as fill, as required, including all clearing, stripping, shaping, and compacting such stockpiles or areas as specified.

C. Payment for the items of Article 4.1.C above will be by their applicable unit prices per cubic yard quoted therefor in the Bid Schedule. The prices quoted shall include full compensation for hauling the materials from excavated areas or retrieving the materials from temporary stockpiles, and placing and compacting the materials in their final locations including all clearing, stripping, grading, shaping, preparing subgrade, and compacting. The prices quoted shall also include full compensation for furnishing imported uncontaminated materials from the Subcontractor's own sources. No separate payment will be made for temporary stockpiles and rehandling or for moisture/dust controls which are considered included in the Subcontract unit prices.

D. Payment for the items of Article 4.1.D above will be by their applicable unit prices per acre quoted therefor in the Bid Schedule. The prices quoted shall include full compensation for removing the materials from the required areas, as required, and placing the excavated materials in their final locations including all grading, shaping, preparing subgrade, and compacting, as required.

E. Separate payment will not be made for the items mentioned in Article 4.1.E above. All costs for such work will be considered to be included in the prices quoted for the applicable related items of work.

F. Separate payment will not be made for any other excavations or fills specified in this Section. All costs for excavations or for furnishing and placing such fills will be considered to be included in the related items of excavation.

G. Payment for furnishing and installing new displacement monuments will be by the unit price per each quoted therefor in the Bid Schedule.

END OF SECTION 02200

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SECTION 02228

RADON BARRIER

PART 1 - GENERAL

1.1 SCOPE

A. This Specification Section covers the following:

1. Production of radon barrier materials by mixing bentonite with uncontaminated soil from borrow areas RB-4 and RB-7.

2. Placement of the radon barrier layer in the construction of the cover for the tailings embankment.

1.2 RELATED WORK

A Section 00800 - Special Conditions

B. Section 01052 - Layout of Work and Surveys

C. Section 01300 - Submittals

D. Section 01500 - Construction Facilities

E. Section 01560 - Temporary Controls

F. Section 02200 - Earthwork

1.3 DEFINITIONS

A. Radon Barrier - The layer constructed on top of the contaminated materials in the tailings embankment consisting of bentonite amended soils from borrow areas RB-4 and RB-7. The purpose of this layer is to retard the emanation of radon gas from the tailings embankment into the atmosphere and to reduce infiltration of incident precipitation into the tailings embankment.

B. Cover - See Section 02200.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Society for Testing and Materials (ASTM):

D422-63	Method for Particle-Size Analysis of Soils (R1972)
D698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49-kg) Rammer and 12-in. (305-mm) Drop
D1140-54	Test Method for Amount of Material in Soils Finer than the No. 200 (75-um) Sieve (R1971)
D1556-90	Test Method for Density of Soil in Place by the Sand-Cone Method
D2167-84	Standard Test Method for Density and Unit Weight of Soil In-Place by the Rubber-Balloon Method
D2216-90	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
D2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D4643-87	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

2. American Petroleum Institute (API):

   Specification 13A, Section 4, Specification for Oil Well Drilling-Fluid Materials

1.5 QUALITY ASSURANCE

[A. The Contractor will take soil samples and perform moisture, density, gradation and other tests to ascertain that the work is being performed in compliance with these Specifications. Samples will be taken during excavation and on the fill itself. The Contractor will conduct the density and other tests on the fill and related laboratory testing at frequencies described in Article 3.5. The Subcontractor shall remove surface material and render assistance as necessary to enable sampling and testing.]*

B. Methods of Sampling and Testing:

1. Particle Size Analysis including Percentage Passing No. 200 Sieve (and excluding hydrometer analysis): ASTM D422

2. In-Place Density: ASTM D1556, D2167, or D2922

3. Moisture Content: ASTM D2216 or D4643

4. Laboratory Moisture-Density Relations: ASTM D698

C. Suitability of Materials: The suitability of materials for radon barrier will be determined by the Contractor. The materials shall be approved material meeting the requirements of this Specification and obtained from Contractor-approved borrow sources.

D. The Contractor may direct that inspection trenches or test pits be cut into the radon barrier to determine that the Specification requirements have been met. Such trenches or pits will be of limited depth and size, and shall be backfilled with the material excavated therefrom, or other material meeting the requirements for the radon barrier. Backfill shall be compacted to a density at least equal to that specified for radon barrier.

E. When the Contractor directs inspection trenches or test pits to be excavated into compacted radon barrier and materials are found to meet all Specification requirements, the excavation and refilling shall be paid for as additional work pursuant to the applicable provisions of the General Conditions. Inspection trenches or test pits, and the refilling of the same, shall be at the Subcontractor's expense when it is found that the materials do not meet the Specification requirements.

F. Tolerances: See Specification Section 01052, Article 1.8.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Radon barrier materials shall be a mixture of radon barrier soils and bentonite.

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B. Radon Barrier Soils: Radon barrier soils shall be produced by selective excavation of material from borrow areas RB-4 and RB-7. Materials unsuitable for use as radon barrier material which are produced due to over-excavation or removal of overburden shall be stockpiled at the borrow site in areas selected by the Subcontractor and subject to Contractor's approval. Stockpiled materials shall be used later for site grading or borrow area reclamation. The radon barrier soils shall meet the following criteria:

1. Radon barrier soil shall meet the following gradation limits prior to mixing with bentonite:

Sieve Size	% Passing by Weight
4-inch	100
3/4-inch	70-100
No. 4	50-100
No. 60	15-100
No. 200	5-100

2. Radon barrier soil shall not contain more than 5 percent by volume of organic material, roots more than 1/4 inch in diameter or other deleterious substances.

3. The Subcontractor shall perform testing as required to ensure that the materials meet the specification requirements.

4. Clod sizes in radon barrier materials shall be 1 inch or smaller. The Subcontractor shall screen or otherwise process materials as required.

C. Bentonite:

1. Bentonite shall be high swelling, unaltered, sodium montmorilonitic clay. High swelling is defined as the ability of two grams of bentonite, mechanically reduced to 100 mesh, to swell in water to an apparent volume of 10.0 cubic centimeters or more when added a little at a time, to 100 cubic centimeters of distilled water in a graduated cylinder.

2. Colloid content of the base bentonite, mechanically reduced to 100 mesh, shall exceed 33 percent as measured by evaporating the suspended portion of a 2 percent solution after 24 hours of sedimentation in a beaker.

3. Bentonite shall have the following physical properties determined in accordance with the requirements of A.P.I. Specification 13A, Section 4:

Grit Content (plus 200 Mesh wet sieve analysis)	55% maximum
Viscosity (600 RPM)	6 cps minimum
Filtrate (30 minutes)	30 mils maximum
Moisture Content	10% maximum

4. Dry fines of the bentonite shall be:

   100% passing Number 4 sieve by weight

   15% maximum passing Number 200 sieve by weight

5. Bentonite shall be protected from the weather during shipping and storage.

6. A certified material test report (CMTR) or Certificate of Compliance (C of C) shall be furnished with each lot number of bentonite delivered to the site. If a CMTR or C of C is not furnished, testing shall be performed by the Subcontractor to demonstrate that all physical properties required by API and the specifications have been met. All CMTR's, C of C's and/or test results shall verify that each lot of bentonite meets the specified requirements or the material shall be rejected. No bentonite material shall be mixed or placed prior to this verification.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection of exposed surfaces shall be as specified in Article 3.1 of Section 02200.

B. Dust control measures shall be as specified in Section 01560.

C. Clearing and stripping shall conform to Section 02110.

3.2 BORROW AREA EXCAVATION

A. Only portions of the area within the designated borrow area contain material suitable for mixing with bentonite to produce radon barrier material. The material shall meet the requirements specified in Article 2.1.B. Subcontractor shall identify the areas that contain material suitable for radon barrier material prior to the excavation.

B. Excavations shall not be within 50 feet of the shoulders of the existing Navajo Nation road that separates the borrow areas.

C. Excavations for radon barrier soils to be used for mixing with bentonite to produce radon barrier materials shall be carried out in the presence of a qualified technician employed by the Subcontractor.

D. Materials excavated for mixing with bentonite to produce radon barrier shall not be used for other purposes except as approved by the Contractor.

3.3 MIXING OF RADON BARRIER

A. The radon barrier soil shall be thoroughly mixed with bentonite. The bentonite content shall not be less than 10 percent by weight. The percentage shall be determined by dividing the dry weight of bentonite by the dry weight of soil without bentonite.

[B. Mixer: The mixer for mixing bentonite with the radon barrier material shall be capable of thoroughly mixing and controlling the percentage, by weight, of bentonite, soil and water. The mixer shall be the following, or approved equal:]*

1. Pug-mill, Pioneer Model 425P stabilizer plant.

[Text Deleted]*

C. Submittals: Sixty days after award of Subcontract, the Subcontractor shall submit, for approval, a narrative on how the radon barrier material will be mixed, placed and compacted. The narrative shall include the following:

1. Description of equipment used, including manufacturer's specifications.
2. Narrative of mixing operations, including how the bentonite, soil and water will be mixed; how quantities will be determined; and the duration of mixing.

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3. Procedures for calibrating the mixing equipment to show the proper mix is obtained and procedures for verifying calibration during operations. The plant shall be calibrated just before start of operation as well as during operation.

D. If stationary plant is used to mix the radon barrier material, the Subcontractor shall locate the plant so as not to interfere with other operations. At the end of the work, foundations shall be removed and disposed of by the Subcontractor, and the site restored as approved by the Contractor.

E. The Contractor may visually inspect the mixture for uniformity and consistency. Adjustments to mixing or procedures may be required by the Contractor to provide a uniform mix.

3.4 PLACEMENT AND COMPACTION OF RADON BARRIER

A. The radon barrier material shall be laid down in controlled lifts as specified in this Section.

B. Unless otherwise specified or indicated herein or elsewhere in the Subcontract Drawings, placement and compaction of the radon barrier material shall conform to the applicable provisions of Section 02200.

C. Unfavorable Weather: Placing, spreading, rolling or compacting fill material that is frozen or thawing, or during unfavorable weather conditions will not be permitted. If the work of placement of radon barrier material is interrupted by heavy rain or other unfavorable weather, such work shall not be resumed until ascertaining that the moisture content and density of the previously placed soil are acceptable to the Contractor.

D. The Subcontractor shall only work on an area that can be completed in one working day. Completion shall be defined as soil moisture adjustment, spreading of the bentonite, the mixing of the soil with the bentonite, and compaction of the soil bentonite layer.

E. Prior to placing radon barrier material, the final grade of the underlying contaminated materials shall be as shown in the Subcontract Drawings and specified in Section 02200.

F. In placing and working the first layer of radon barrier, care shall be taken to avoid mixing in any of the underlying radiologically contaminated soil.

G. Twenty-four inch thick radon barrier shall be placed in three lifts. The lifts shall be placed in a loose lift of approximately 10 inches to give a compacted thickness of 8 inches. The Subcontractor shall provide survey stakes verifying each 8-inch compacted lift.

H. Compaction of radon barrier shall be accomplished using tamping foot rollers.

I. The radon barrier material shall be compacted to at least 100 percent of maximum dry density as determined by ASTM D698. During compaction of radon barrier materials, moisture content shall be maintained between the optimum moisture content and plus three percent as determined by ASTM D698. The moisture content of the preceeding in-place radon barrier lift, with the exception of the top 2 inches shall be maintained at not less than optimum minus one percent moisture content until the succeeding lift of radon barrier or bedding material is placed.

J. Once minimum specified density is achieved for radon barrier, additional compaction shall not be performed.

K. Moisture added to the radon barrier materials shall be applied in a manner that prevents runoff onto contaminated materials.

L. The top surface of the underlying compacted radon barrier shall be scarified to a depth of 1 inch to 2 inches just prior to placement of the overlying loose lift. Scarification shall be accomplished by suitable equipment capable of accurate depth control.

M. If shrinkage cracks occur on top of each lift prior to placing the next lift, the surface should be scarified to the depths of the crack, moisture conditioned, and recompacted.

N. The top surface of the final layer of radon barrier shall be compacted with a tamping foot roller, then bladed and finished with a grader and a smooth drum roller. The top surface of the final layer of radon barrier shall be free of ruts, depressions, or low areas in which water can accumulate.

O. Upon completion of radon barrier placement and prior to the placement of bedding material, the Contractor will perform required radiological measurements. These measurements generally can be accomplished in 30 hours but may vary depending on atmospheric conditions. Measurements will be taken at approximately 100 evenly spaced locations as determined by the Contractor.

3.5 FIELD QUALITY CONTROL

A. The Contractor will perform the following tests on a regular basis. These tests are a minimum requirement:

1. In-Place Density and Moisture Content Tests: A minimum of one test will be performed per 500 cubic yards of the material placed. At least two tests will be performed for each day of material placement in excess of 150 cubic yards.

[2. Gradation Test: A minimum of one test per 1,000 cubic yards of material placed and a minimum of one test each day of material placement. The gradation tests will be performed on borrow material from RB-4 and RB-7 prior to mixing with bentonite. The Contractor may also do gradation testing on radon barrier materials after being mixed with bentonite.]*

3. Procedures and frequency for calibration of the mixing equipment shall be in accordance with the Contractor-approved plan.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement for payment for furnishing and placement of radon barrier material in the embankment cover will be by the cubic yards of compacted material in place. The quantities for payment will be computed by the average end area method from surveys conducted before and after placement and from lines and dimensions as shown on the Subcontract Drawings. (Bid Schedule Item 501)

B. Measurement for payment for furnishing bentonite will be by the ton delivered to the site and used in the radon barrier. (Bid Schedule Item 502)

C. Separate measurement for payment will not be made for the following items, and such work will be considered incidental to the related items of work:

* P.I.D. 09-S-15

1. Dust control.
2. Stripping.
3. Temporary stockpiling of excavated materials.
4. Required rehandling of materials.
5. Borrow area grading for restoration.
6. Erosion protection of exposed surfaces.
7. Temporary storage of bentonite.

4.2 PAYMENT

A. Payment for the excavation and placement of radon barrier material in the embankment cover will be by the unit price per cubic yard quoted therefor in the Bid Schedule. The price quoted shall include full compensation for excavation of the radon barrier material from the specified borrow source and processing, mixing, placement and compaction of the material in its final location.

B. Payment for furnishing bentonite will be by the unit price per ton, delivered to the site and used in the radon barrier, quoted therefor in the Bid Schedule.

C. Separate payment will not be made for the items mentioned in Article 4.1.C above. All costs for such work will be considered to be included in the prices quoted for the applicable related items of Work specified in this Subcontract.

END OF SECTION 02228

SECTION 02278

EROSION PROTECTION

PART 1 - GENERAL

1.1 SCOPE

This Specification Section describes the requirements for furnishing and placing riprap and bedding materials for tailings embankment cover, drainage ditches, apron and gullies.

1.2 WORK NOT INCLUDED

Erosion protection related to the construction facilities specified in Section 01500 is not included in the scope of work of this Specification.

1.3 RELATED WORK

A. Section 01300 - Submittals

B. Section 02200 - Earthwork

C. Section 02228 - Radon Barrier

1.4 APPLICABLE PUBLICATIONS

A. The Publications listed below form a part of this Specification to the extent referenced. The Publications are referred to in the text by the basic designation only:

1. American Society for Testing and Materials (ASTM):

C88-90	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C117-90	Test Method for Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
C127-88	Test Method for Specific Gravity and Absorption of Coarse Aggregate
C131-89	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

C136-84	Standard Method for Sieve Analysis of Fine and Coarse Aggregates, Rev. A
C295-90	Standard Guide for Petrographic Examination of Aggregates for Concrete
D75-87	Standard Practice for Sampling Aggregates

2. International Society for Rock Mechanics (ISRM), 1981

Rock Characterization Testing and Monitoring, ISRM Suggested Methods, E.T. Brown, Editor, Pergamon Press, New York:

Suggested Method for Determining Indirect Tensile Strength by the Brazil Test, pp. 120-121

Suggested Method for Determination of the Schmidt Rebound Hardness, PP. 101-102

1.5 PERMITS

The Contractor will provide permits for the use of borrow areas shown on the Subcontract Drawings as specified in Article SC-11 of Special Conditions. If the Subcontractor uses other sources for erosion protection materials, he shall be responsible for obtaining all required permits.

1.6 SUBMITTALS

A. During production of riprap and bedding materials, the Subcontractor shall submit gradation test results, in triplicate, in accordance with Article 2.1 below. For riprap and bedding materials, quality and gradation tests for each type material shall be performed a minimum of four times during production. An initial sample shall be obtained and tested during the early stages of production activities. Additional samples shall be obtained and tested when approximately one-third and two thirds of the total volume of material has been produced, and a final sample shall be obtained and tested near completion of the production activities. If the total volume of material for each riprap type or bedding material is greater than 30,000 cubic yards, quality and gradations tests shall be performed for each additional 10,000 cubic yards, or fraction thereof produced. The frequency for performing the quality and gradation tests shall be when approximately 10,000 cubic yards of material has been produced and near completion of production activities.

B. The Subcontractor shall submit, in writing, the name and qualifications of his proposed testing laboratory to the Contractor for approval.

C. The technical submittal covering the production of erosion protection materials shall include, but not be limited to, the following:

   1. Narrative acknowledging permit stipulations for each rock borrow source.
   2. Mining plan.
   3. Use, handling and storage of explosives.
   4. Expected quarry breakage or pit analysis.
   5. Required combined product gradation.
   6. Production analysis.
   7. Flow diagram of production plant showing all products and wastage in tons per hour.
   8. Plant layout showing individual pieces of equipment.
   9. Complete list of equipment with manufacturers' models, capacities, horsepower and expected production curves.
   10. Schedule.
   11. Manpower required.
   12. Handling of finished products.
   13. Safety.
   14. Maintenance of public and on site haul roads.
   15. Dust control.
   16. Protection of archaeological sites.
   17. Quality control.

D. If the Subcontractor determines to use other sources for erosion protection materials, a site inspection report containing the information specified in Article 2.3 below shall be submitted, in triplicate, to the Contractor for review and approval of the source, in accordance with the requirements of Section 01300.

1.7 QUALITY ASSURANCE

Test Section: [For placement control purposes, one test section for each of Riprap Types A, B1, and B shall be constructed.]* The test sections shall be not less than 30 feet wide by 50 feet long in size, and shall be constructed either on or away from the embankment. Riprap material fully meeting the specified gradations shall be placed in the test sections by the same methods that will be used for production placement. The finished test sections, after testing to ensure that the in-place gradation requirements have been met, shall be used as a visual sample for comparison of production work. After completion of riprap installation, the test sections, if constructed away from the pile, shall be blended into the final grading contours, as approved by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material Sources: Erosion protection materials including riprap and bedding materials shall be obtained from sources approved by the Contractor. [The approved source for Type A, B1, and B erosion protection and bedding materials is the Bluff Gravel Quarry near Bluff, Utah, located approximately 30 miles northeast of the tailings site.]*

B. Subcontractor may propose other sources of materials. The basis for approval of the Subcontractor-proposed sources shall be as specified in Article 2.3. The materials shall meet the requirements of this Specification.

C. Approval of source as a borrow area does not mean that all materials excavated will meet the requirements of this Specification. Processing or selective quarrying may be necessary to meet the quality requirements of this Section. The basis for approval of other sources proposed by the Subcontractor is specified in Article 2.3 below. The Subcontractor shall be responsible for providing the laboratory test results.

D. The materials shall be below the background radioactive level and free from other contamination.

E. Material shall be dense, sound, resistant to abrasion, and shall be free from cracks, seams, and other defects as shown during field inspection as per Article 3.3 below.

* P.I.D. 09-S-20

F. The shape of at least 75 percent of the material, by weight, shall be such that the minimum dimension is not less than one third of the maximum dimension.

G. Quality and Gradation Tests: For record purposes the following tests will be performed by the Contractor:

Test	Designation
Gradation	ASTM C117 ASTM C136
Specific Gravity (Saturated Surface Dry Basis)	ASTM C127
Absorption	ASTM C127
Sodium Sulfate Soundness Soundness (5 Cycles)	ASTM C88 Coarse Aggregate
Abrasion (Los Angeles Machine) (100 Cycles)	ASTM C131
Schmidt Hammer	ISRM Method
Splitting Tensile Strength (Modified-Loading rate shall cause failure in 1 to 3 minutes)	ISRM Method

The frequency of tests shall be in accordance with Article 1.6.A for the total amount produced at each quarry irregardless of number of types of materials produced.

2.2 QUALITY REQUIREMENTS

A. All riprap and bedding materials used shall meet the following requirements:

1. Results of the tests specified in Table 02278-A on samples of each material shall be used to obtain rock quality scores using the criteria given in the table. The frequency of quality testing shall be as specified for gradation testing in Article 1.6.A. The score for each test is determined by multiplying the appropriate weighting factor by the score (0 to 10) based on the specific test result. The final score for each sample is the ratio of the sum of the individual test scores (six tests) to the maximum possible score, expressed as a

percentage. To be acceptable, the minimum final score shall be as follows:

65% for Bedding material and for Riprap Type A.

80% for Riprap Type B1 and Type B material from the Bluff quarry or if the material is rounded. 65% for Riprap Type B1 and Type B material if the material is angular.

65% for Riprap Type C material if the material is angular and 80% if the material is rounded.

The Schmidt Hammer Test and Splitting Tensile Strength Test will not be required on the bedding material or on Type A, Type B1 and Type B Riprap. The scoring of bedding material and Type A, Type B1 and Type B Riprap will be based on the four remaining tests.

2.3 SUBCONTRACTOR-PROPOSED SOURCES

A. The basis for approval of sources proposed by the Subcontractor shall be as follows:

1. A site inspection report by an engineering geologist which will include, as a minimum, an evaluation of soundness, hardness, and durability for three samples representative of the proposed source. The evaluation of durability shall be based in part on petrographic examination of rock types available from the source. The petrographic examination shall be in accordance with ASTM C295. In addition, the material shall meet the quality requirements of Article 2.2 above. Representativeness of samples shall be determined by the Contractor, based on precise location and source of sample taken in relation to the whole borrow area. The site inspection report shall include locations of all samples and methods of sampling.

2. If available, examples of successful uses of the material including riprap that has been in place on other project sites for more than 20 years, rock that has functioned satisfactorily as foundation stone or building facing for 50 years or more, and abandoned quarry faces which have maintained their integrity after not being worked for approximately 50 years or more. Durability shall be indicated by lack of significant weathering or loss of volume and strength over decades of exposure to natural weathering elements.

3. The Subcontractor shall have a qualified laboratory perform the six (6) types of tests listed in Table 02278-A on each sample (minimum of 6 samples) from the proposed source unless existing particle sizes are inadequate to perform Schmidt Hammer or Tensile Strength tests as specified. Special attention shall be given to ensure that the samples are representative of the proposed rock materials. Test samples shall be obtained from within the precise locations of rock deposits from which materials will be produced. To be approved as a source, the final score for each sample shall be obtained and evaluated as specified in Article 2.2.A.1.

4. If selected by the Subcontractor, the Sugarloaf riprap material shall consist of limestone and shall contain no more than 10 percent sandstone by weight.

2.4 GRADATION

A. Riprap materials shall be reasonably well graded within the following limits, and the Contractor reserves the right of inspection while the samples are taken:

U.S. Standard Sieve Size (Square Openings)	Percent Passing (by weight)
Type A	
3-inch	100
2-inch	0-100
1-1/2-inch	0-40
1-inch	0-10
1/2-inch	0-5
Type B1	
5-inch	100
4-inch	0-100
3-inch	0-50
2-inch	0-25
No. 4	0-5
Type B	
8-inch	100
6-inch	25-100
5-inch	0-100
4-inch	0-25
1-inch	0-5

Type C	
12-inch	100
9-inch	25-100
7-inch	5-50
5-inch	0-25
2-inch	0-5

B. **Bedding Materials:**

1. **Bedding materials shall be obtained from the Bluff quarry or other sources as approved by the Contractor. Rock for the bedding material shall meet the quality requirements for riprap materials in Articles 2.1 and 2.2. The Subcontractor shall process the materials to conform with the gradation requirements specified below.**

2. Gradation: Bedding materials shall be reasonably well graded within the following limits:

U.S. Standard Sieve Size (Square Openings)	Percent Passing (by weight)
3-inch	100
1-1/2-inch	50-100
1-inch	35-70
No. 4	10-30
No. 30	0-10
No. 100	0-5

2.5 SOURCE QUALITY CONTROL

The Subcontractor shall have a qualified, experienced person present at the quarry during production of rock materials to ensure that only suitable quality rock is processed. The materials may be inspected and tested by the Contractor at the borrow area prior to mining operations to ensure that they meet all requirements of this Specification with the exception of the gradation requirement. The Subcontractor shall assist the Contractor in obtaining samples. Gradation requirements will be tested at the placement location.

PART 3 - EXECUTION

3.1 PLACEMENT AND COMPACTION

A. General: Erosion protection materials shall be handled, loaded, transported, stockpiled and placed in a manner which avoids nonconformance with specifications due to segregation and degradation, including materials moved to and from stockpiles.

B. Subgrade preparation for apron, ditches and gullies shall conform to Specification Section 02200.

   1. Prior to placement of bedding materials, the Contractor will take radiological measurements as described in Specification Section 02228.

C. Where the required bedding material thickness is 6 inches, the bedding material shall be spread and compacted in one layer.

D. Each layer of bedding material shall be track-walked with two passes of a D6 bulldozer or equivalent operating up and down the slope, over the entire area of placement.

E. Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the drainage material. The larger stones shall be well distributed throughout the mass. The finished riprap shall be free from pockets of small stones and clusters of larger stones. Placing stone in layers will not be permitted. Placing stone by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well graded distribution of stone sizes as specified above.

F. Riprap material may be placed by end-dumping and may be spread by bulldozers or other suitable equipment.

G. Riprap layers placed upon bedding material shall be placed in such a manner which minimizes horizontal displacement of the bedding material.

H. Construction equipment carrying contaminated materials shall not be allowed to move over placed riprap and bedding layers except at equipment crossovers as designated by the Contractor. Each crossover shall be cleaned of all contaminating materials as approved by the Contractor before additional materials are placed in those areas. Other construction equipment may move over placed riprap and bedding layers. The Contractor may restrict such traffic to minimize damage to completed layers. Areas of riprap and bedding layers damaged by construction equipment shall be restored to meet the requirements of the Specifications.

3.2 TOLERANCES

A. The material layers shall be placed generally to the limits and thicknesses shown on the Subcontract Drawings within the following tolerances:

1. The top of the radon barrier or bedding subgrade shall be within ± 0.1 foot of the design grades shown on the Subcontract Drawings.

2. Bedding material shall be within ±0.1 foot of the design grades shown on the Subcontract Drawings.

3. The minimum in-place thickness of riprap material shall not be less than the minimum thickness shown.

4. The maximum in-place thickness of riprap material shall not be more than 135 percent of the thickness shown.

5. Local irregularities not exceeding the limits of Paragraphs 3 and 4 above will be permitted provided that such irregularities do not form noticeable mounds, ridges, swales or depressions which in the opinion of the Contractor could cause concentrations of surface runoff or form ponds or gullies.

3.3 FIELD QUALITY CONTROL

A. The placement of the materials will be inspected and tested by the Contractor during and after placement to ensure that the following requirements are met:

1. Material of the correct type and quality is being placed. Individual pieces or pockets of material greater than or equal to 8 inches in diameter not meeting the requirements noted in Article 2.1.E shall be removed per Paragraph D below. Individual pieces or pockets of

material less than 8 inches in diameter not meeting the requirements of Article 2.1.E may be left in place provided that concentrations of such pieces do not exist as determined by the Contractor.

2. The material being placed is clean and free of unsuitable material.

3. The material is being stockpiled, loaded, transported and placed in a manner which minimizes segregation and degradation.

4. The material is being placed to line and grade within the tolerances and limits designated in Article 3.2 above.

5. The material placed meets the gradation requirements specified.

B. Materials segregated or not placed according to the above requirements shall be regraded or adjusted, using appropriate equipment, to conform with the tolerances and limits given above, at no additional cost to the Contractor.

C. The Subcontractor may place erosion protection material only at his own risk, if durability test results are not available and approved by the Contractor.

D. Materials not meeting the requirements of this Section shall be removed and replaced with specified materials at no additional cost to the Contractor. Rejected materials shall be disposed of offsite as Subcontractor's property at no additional cost to the Contractor. Materials not meeting the grading requirements shall be reprocessed or discarded. The Contractor may require modification of the processing and grading operations to ensure that the specified grading requirements are met.

E. During placement of Type A, B1, B and C riprap materials and bedding materials, the Contractor will perform a minimum of four gradation tests in accordance with Article 2.4 above. An initial sample shall be obtained and tested during the early stages of placement activities. Additional samples shall be obtained and tested when approximately one-third and two-thirds of the total volume of material has been placed, and a final sample shall be obtained and tested near completion of placement activities. If the total volume of material placed for Type A, Type B1 and Type B Riprap and Bedding materials is greater than 30,000 cubic yards, a gradation test shall be performed for each additional 10,000 cubic yards, or fraction thereof placed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement for payment for furnishing and placing the following materials will be by the cubic yards of material placed:

1. Riprap Material, Type A
2. Riprap Material, Type B
3. Riprap Material, Type C
4. Bedding Material

B. The quantities will be calculated from the lines and dimensions shown on the Subcontract Drawings and/or by using average end area methods from surveys conducted before and after placement for the areal extent of the placement.

4.2 PAYMENT

Payment for the items of Article 4.1.A above, will be by their applicable unit prices per cubic yard quoted therefor in the Bid Schedule. The prices quoted shall include full compensation for furnishing labor, materials, tools, equipment and incidentals and for performing specified work including development of the source (where applicable), obtaining required permits (where applicable), clearing, stripping and excavating; processing the materials; testing and evaluating the materials; transporting to placement locations; placing; compacting and consolidating complete in place.

END OF SECTION 02278

TABLE 78-A
ROCK QUALITY SCORING CRITERIA

	Weighting Factor			Score										
	Lime-stone	Sand-stone	Igne-ous	10	9	8	7	6	5	4	3	2	1	0
Specific Gravity	12	5	9	2.75	2.70	2.65	2.60	2.55	2.50	2.45	2.40	2.35	2.30	< 2.3
Absorp-tion (%)	13	5	2	0.1	0.3	0.5	0.67	0.83	1.0	1.5	2.0	2.5	3.0	> 3.0
Sodium Sulfate (%)*	4	3	11	1	3	5	6.7	8.3	10	12.5	15	20	25	> 25
Abrasion (%)**	1	8	1	1	3	5	6.7	8.3	10	12.5	15	20	25	> 25
Schmidt Hammer	11	13	3	70	65	60	54	47	40	32	24	16	8	< 8
Tensile Strength(psi)	5	4	10	1400	1200	1000	833	666	500	400	300	200	100	< 100

1. Scores derived from Tables 6.2 and 6.7 of Ref. 1.

2. Any rock to be used must be qualitatively rated at least "fair" in a petrographic examination conducted by a geologist experienced in petrographic analysis.

3. Weighting Factors derived from Table 7 of Ref. 2, based on inverse of ranking of test methods for each rock type.

4. Test methods should be standardized (ASTM, e.g.) and should be those used in Ref. 2.

Ref. 1 Lindsey, C.G., Long, L.W., and Begej, C.W. (1982), Long-Term Survivability of Riprap for Armoring Uranium Mill Tailings and Covers: A Literature Review, U.S. Nuclear Regulatory Commission, NUREG/CR-2642.

Ref. 2 De Puy, G.W., "Petrographic Investigations of Rock Durability and Comparisons of Various Test Procedures," Engineering Geology, Vol. 2, No. 2, July 1965.

* 5 Cycles
** 100 Revolutions

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UNITED STATES
DEPARTMENT OF ENERGY

UMTRAP
URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT

AS-BUILT DRAWINGS

MEXICAN HAT, UTAH
AND
MONUMENT VALLEY, ARIZONA

QA REVIEWED FOR
QUALITY REQUIREMENTS
BY Steven Notz
02/03/92

PATRICK H. GRIFFIN
31 Jan 92

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
	△								
	△								
—	△	5/9/95	AS-BUILT	JKK	NC	MJ	DB	CR	—
3 Dn 6/31/92	△	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED CLW
DRAWN RBC
CHECKED EHR
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

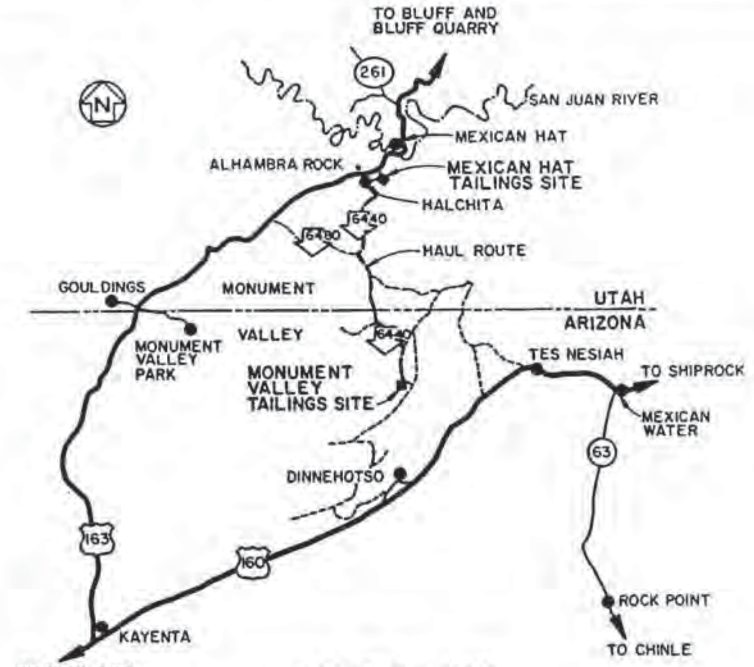
TITLE SHEET

DOE PROJECT ENGINEER
DATE 2/

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-GE-10-0201

B50251100003800/UMTRAD



LOCATION MAP

5 0 5 10
SCALE MILES

SITE LOCATION MAP

LEGEND:

163	U.S. HIGHWAY
261	STATE HIGHWAY
6440	INDIAN SERVICE ROUTE
63	COUNTY ROAD

NOTES:

1. FOR MEXICAN HAT SITE:
   - A. HORIZONTAL AND VERTICAL CONTROL POINTS ESTABLISHED BY WESTERN DESIGN CONSULTANTS OF SALT LAKE, UTAH. CONTOURS BASED ON AERIAL PHOTOGRAPHY TAKEN JULY 1990, UNLESS OTHERWISE NOTED.
   - B. COORDINATES SHOWN ARE THE PROJECT COORDINATES. PROJECT COORDINATES FOR STA. 4 ARE N 8,000 AND E 9,600. STATE COORDINATES FOR STA. 4 ARE X=2,473,150.34 AND Y=172,750.12, SURVEYED BY SAN JUAN ENGINEERS OF FARMINGTON N.M., JUNE 1987.
2. FOR MONUMENT VALLEY SITE:
   - A. ALL INFORMATION SHOWN IS BASED ON "PLANT" COORDINATES UNLESS OTHERWISE NOTED WITH AN ASTERISK (*) WHICH IS BASED ON ARIZONA STATE PLANE COORDINATES.
   - B. THE DIFFERENCE BETWEEN THE TWO COORDINATE SYSTEM IS:

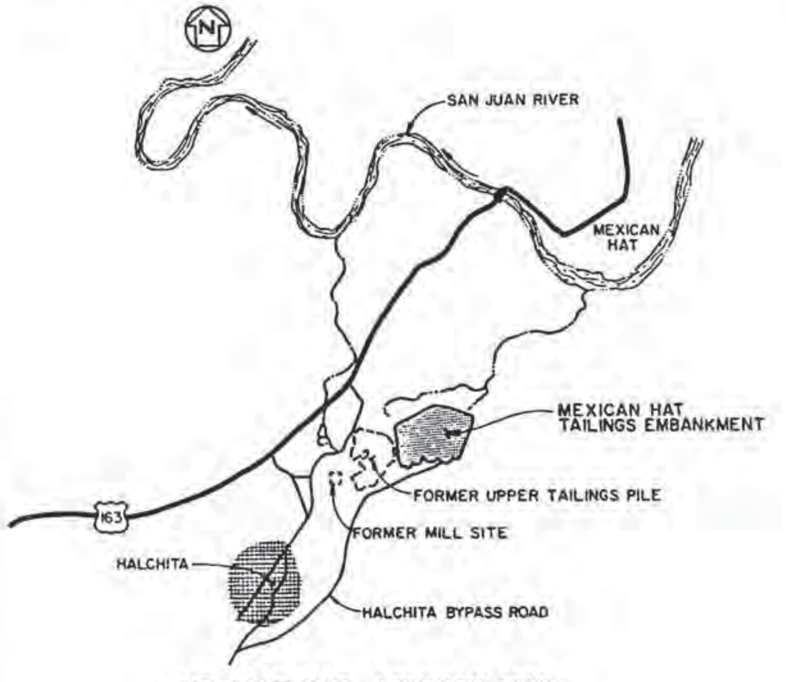
     ARIZONA STATE PLANE COORDINATE SYSTEM NORTH — "PLANT" NORTH — 0°12'32"
   - C. TOPOGRAPHIC FEATURES AND GRID SYSTEM ARE TAKEN FROM THE RECORD OF SURVEY FURNISHED BY JACOBS ENGINEERING GROUP, INC. IN MAR. 1984.

LIST OF DRAWINGS

	DRAWING NO.	DRAWING TITLE
GENERAL	H/M-GE-10-0201	TITLE SHEET
	H/M-GE-10-0202	VICINITY MAPS, LOCATION MAP AND LIST OF DRAWINGS
	** ~~H/M-GE-10-0203~~	~~HAUL ROAD CORRIDOR AND BORROW AREA LOCATIONS~~
	** ~~H/M-GE-10-0204~~	~~RIPRAP BORROW AREAS~~
	** ~~H/M-GE-10-0205~~	~~RADON BARRIER MATERIAL BORROW AREAS AND GYPSUM WASH CROSSING~~
MEXICAN HAT	** ~~H/M-DS-10-0210~~	~~HAT SITE PLAN~~
	HAT-PS-10-0955	UPPER TAILINGS PILE EXCAVATION PLAN
	HAT-PS-10-0956	WINDBLOWN MATERIALS EXCAVATION PLAN
	H/M-DS-10-0211	HAT-CONTAMINATED MATERIAL EXCAVATION PLAN
	* H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
	* H/M-DS-10-0213	TAILINGS EMBANKMENT PLAN AND DITCH SECTIONS AND DETAILS
	* H/M-DS-10-0214	HAT-FINAL SITE GRADING PLAN
	H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)
	H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)
	H/M-DS-10-0217	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 1 OF 2)
	H/M-DS-10-0218	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 2 OF 2)
	H/M-DS-10-0219	HAT-EROSION PROTECTION PLAN AND SECTIONS
	H/M-DS-10-0220	HAT-GULLY DETAILS
	** ~~H/M-DS-10-0221~~	~~HAT-BORING LOCATION PLAN~~
	H/M-DS-10-0222	HAT-AS BUILT TOPOGRAPHIC MAP (SHEET 1 OF 2)
	H/M-DS-10-0223	HAT-AS BUILT TOPOGRAPHIC MAP (SHEET 2 OF 2)
	H/M-DS-10-0240	LOCATION OF MONUMENTS, MARKERS AND SIGNS
MONUMENT VALLEY	** ~~H/M-PS-10-0230~~	~~MON-SITE PLAN~~
	** ~~H/M-PS-10-0231~~	~~MON-CONSTRUCTION FACILITIES AND SITE DRAINAGE~~
	* H/M-PS-10-0232	MON-CONTAMINATED MATERIAL EXCAVATION PLAN (SHEET 1 OF 2)
	* H/M-PS-10-0233	MON-CONTAMINATED MATERIAL EXCAVATION PLAN (SHEET 2 OF 2)
	** ~~H/M-PS-10-0234~~	~~MON-FINAL SITE GRADING AND DRAINAGE (SHEET 1 OF 2)~~
	** ~~H/M-PS-10-0235~~	~~MON-FINAL SITE GRADING AND DRAINAGE (SHEET 2 OF 2)~~
	** ~~H/M-PS-10-0236~~	~~MON-BORINGS, TEST PITS AND MONITORING WELLS LOCATION PLAN~~
	H/M-PS-10-0237	MON-AS BUILT TOPOGRAPHIC MAP

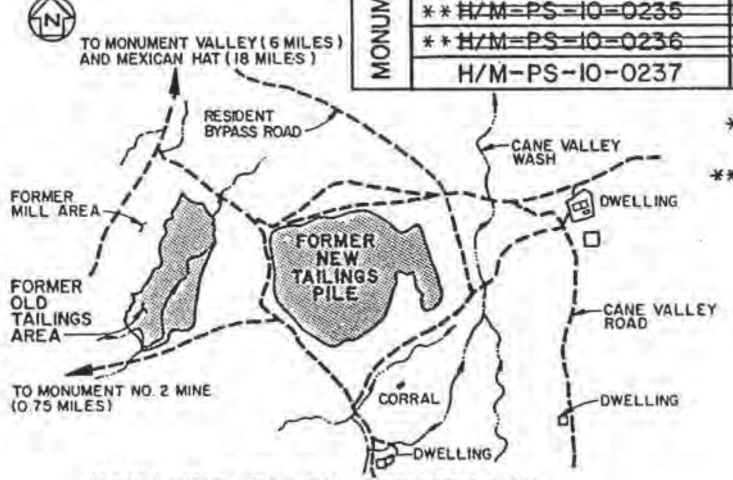
* FOR AS-BUILT TOPOGRAPHY AT HAT DISPOSAL SITE REFER TO DWG. NOS. H/M-DS-10-0222 & 0223. AND AT MON PROCESSING SITE REFER TO DWG. NO. H/M-PS-10-0237.

** FOR CONSTRUCTING PURPOSE ONLY, DRAWINGS ARE NOT INCLUDED.



MEXICAN HAT - VICINITY MAP

0 1/2 1
SCALE MILE



MONUMENT VALLEY - VICINITY MAP

600 0 600 1200
SCALE FEET

QA REVIEWED FOR QUALITY REQUIREMENTS BY
02/03/92

PATRICK R. GRIFFIN
STATE OF UTAH

	NO.	DATE	REVISIONS	BY	CK	ESD MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
	△								
—	△	5-9-95	AS-BUILT						—
	△	3-3-92	REVISED AS PER P.I.D. NO. 09-S-15						
	△	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

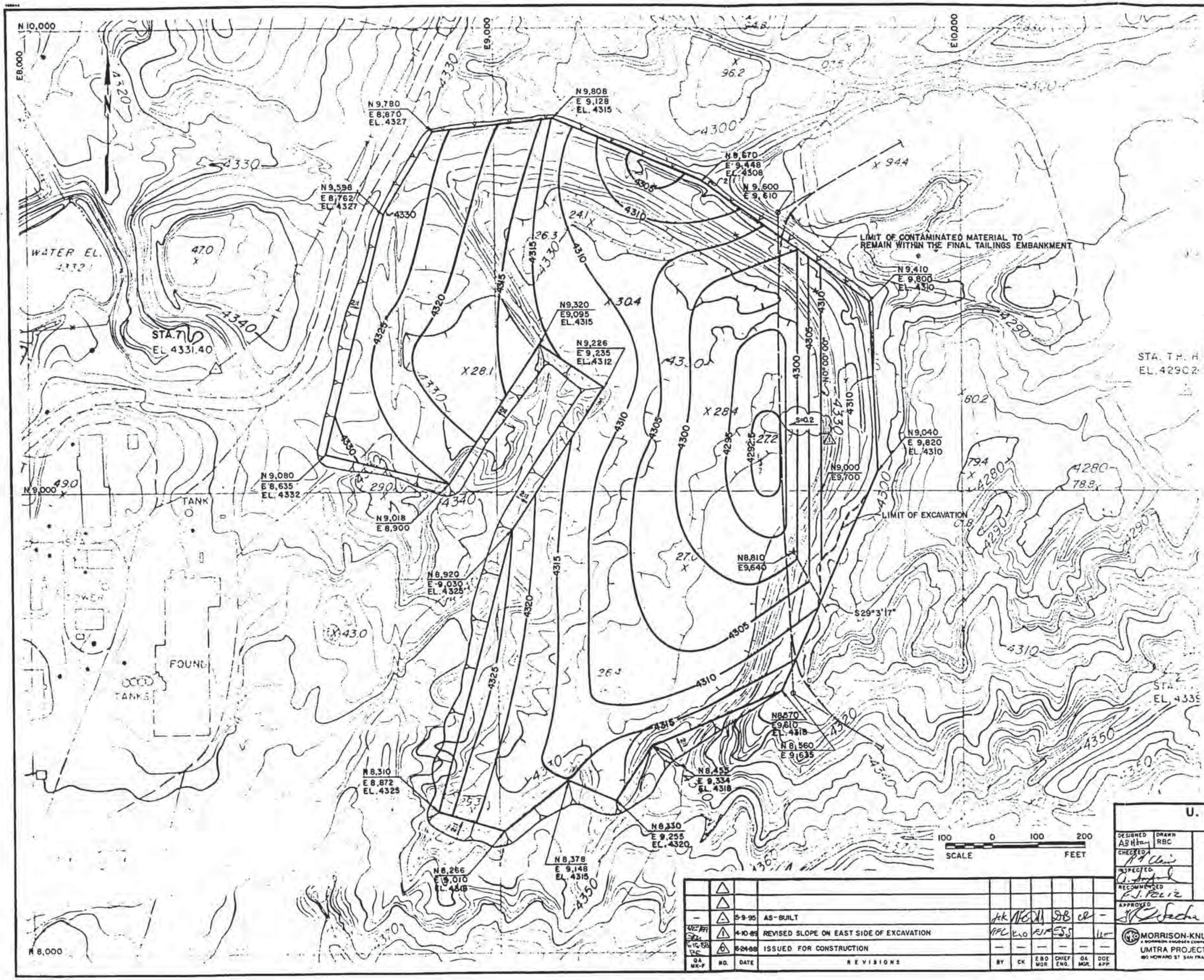
DESIGNED | DRAWN AOM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92
DOE PROJECT ENGINEER
DATE 2/3/92

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

VICINITY MAPS, LOCATION MAP AND LIST OF DRAWINGS

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-GE-10-0202
REV. —



NOTES:

1. ALL EXCAVATED CUT SLOPES WERE 2(H):1(V) MAXIMUM.
2. EXCAVATION PLAN SHOWN IS APPROXIMATE. ACTUAL DEPTHS AND EXTENT OF EXCAVATION WERE DETERMINED IN THE FIELD BY THE CONTRACTOR BASED ON RADIOLOGICAL SURVEYS.
3. CONTAMINATED MATERIAL WITHIN THE FINAL TAILINGS EMBANKMENT WAS EXCAVATED TO THE LIMITS SHOWN. LIMITS ARE APPROXIMATE.
4. TOPOGRAPHIC SURVEY CONDUCTED BY WESTERN DESIGN CONSULTANTS ON AUG. 11, 1982. ELEVATIONS ARE TWO FEET INTERVALS AND ARE TIED TO DATUM POINT NORTHEAST CORNER SECT. 7, T42S, R19E, SALT LAKE BASE AND MERIDIAN.

REFERENCE DRAWINGS:

HAT-PS-10-0960	FINAL SITE GRADING AND DRAINAGE PLAN
HAT-PS-10-0957	TAILINGS EMBANKMENT PLAN

LEGEND:

Y Y Y	LIMIT OF CUT

QA REVIEWED FOR QUALITY REQUIREMENTS
BY Bill Conn[illegible]
6-16-88

NO. 4719
EDWIN S. SMITH

E.S. Smith.

QA MK-F	NO.	DATE	REVISIONS	BY	CK	EBO MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
	△								
–	△	5-9-95	AS-BUILT	jck	NFC	[illegible]	DB	ch	–
[illegible]	△	4-10-89	REVISED SLOPE ON EAST SIDE OF EXCAVATION	RFC	Eco	FJF	ESS		[illegible]
6-16-88 RC	0	6-24-88	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT SITE
MEXICAN HAT, UTAH
PHASE II CONSTRUCTION

UPPER TAILINGS PILE EXCAVATION PLAN

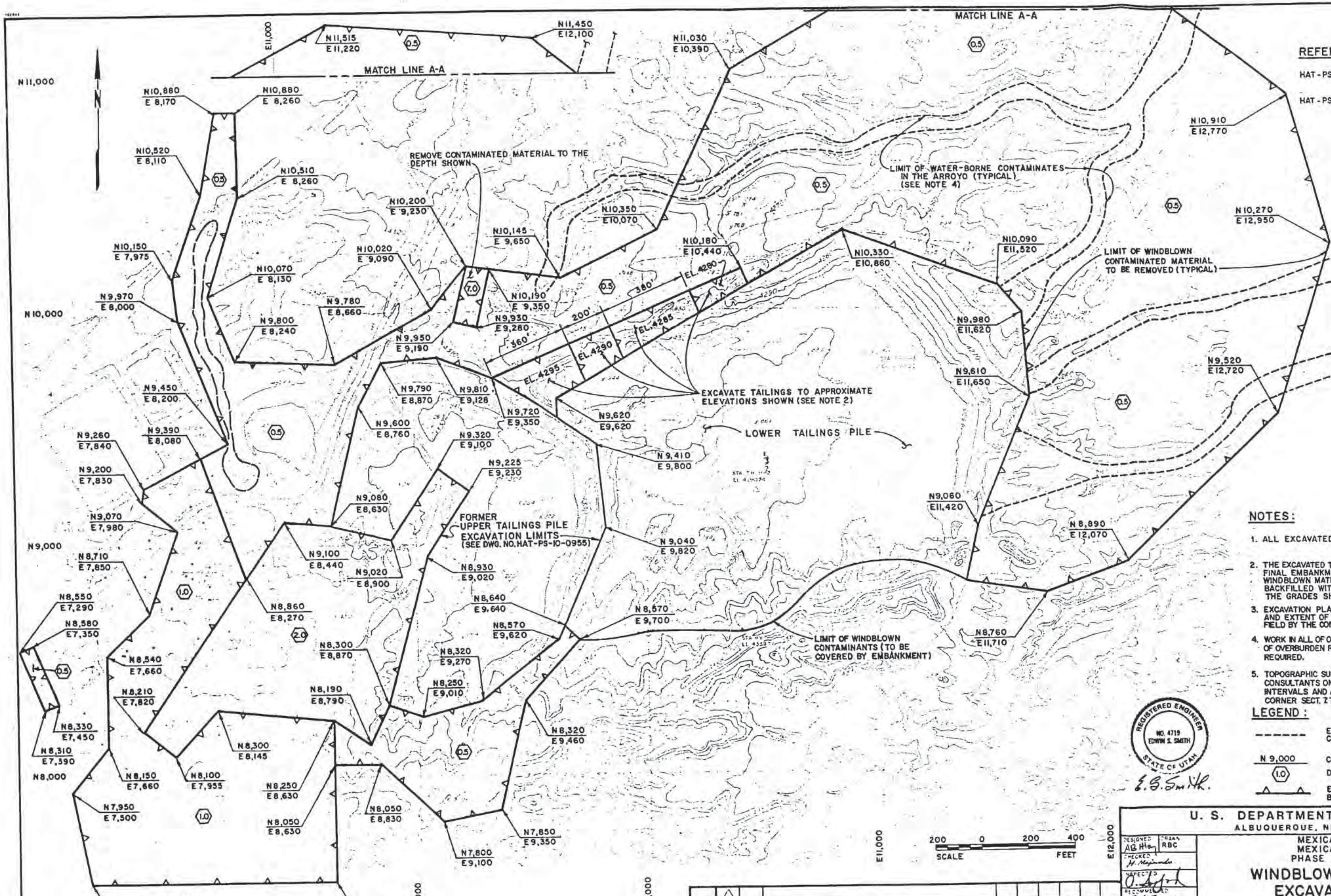
DESIGNED	AB H[illegible]
DRAWN	RBC
CHECKED	R. [illegible]
INSPECTED	[illegible]
RECOMMENDED	F.J. Feliz
APPROVED	[illegible]
DATE	6-15-88
	E.S. Smith. / C. [illegible] 6/15/88
DOE PROJECT ENGINEER	John L. D[illegible]
DATE	6/ /88

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796

DRAWING NO. HAT-PS-10-0955

REV. —



REFERENCE DRAWINGS:

HAT-PS-10-0955	UPPER TAILINGS PILE EXCAVATION PLAN.
HAT-PS-10-0960	FINAL SITE GRADING AND DRAINAGE PLAN.

NOTES:

1. ALL EXCAVATED CUT SLOPES WERE 2(H):1(V) MAXIMUM.
2. THE EXCAVATED TAILINGS WERE PLACED ON THE FINAL EMBANKMENT PRIOR TO THE PLACEMENT OF WINDBLOWN MATERIAL. EXCAVATED AREAS WERE BACKFILLED WITH UNCONTAMINATED MATERIAL TO THE GRADES SHOWN ON DWG. NO. HAT-PS-10-0960.
3. EXCAVATION PLAN SHOWN IS APPROXIMATE. ACTUAL DEPTHS AND EXTENT OF EXCAVATION WERE DETERMINED IN THE FIELD BY THE CONTRACTOR BASED ON RADIOLOGICAL SURVEYS.
4. WORK IN ALL OF OR PORTIONS OF THE ARROYO CONSISTED OF OVERBURDEN REMOVAL. NO ROCK EXCAVATIONS WERE REQUIRED.
5. TOPOGRAPHIC SURVEY CONDUCTED BY WESTERN DESIGN CONSULTANTS ON AUG. 11, 1982. ELEVATIONS ARE TWO FEET INTERVALS AND ARE TIED TO DATUM POINT NORTHEAST CORNER SECT. 7 T42S, R19E, SALT LAKE BASE AND MERIDIAN.

LEGEND:

- - - - - -	ESTIMATED LIMITS OF WATER-BORNE CONTAMINATES
N 9,000	CONSTRUCTION GRID COORDINATES
(1.0)	DEPTH OF EXCAVATION IN FEET
△ △	ESTIMATED LIMITS OF WATER-BORNE CONTAMINANTS

NO. 4719
EDWIN S. SMITH
E.S. Smith.

[illegible] QUALITY OF [illegible],
BY Bill [illegible]
6-16-88

QA MK-F	NO	DATE	REVISIONS	BY	CK	ENG MGR	CHIEF ENG	QA MGR	DOE APP
	△								
	△								
—	2	5-9-95	AS-BUILT	jck	RFC	DN	SB	[illegible]	—
1-8-88 RC	1	9-9-88	REVISED NOTE 4 (PID NO. 09-S-03).	[illegible]	SAS	KJ	ESS		[illegible]
6-14-88 EC	0	6-24-88	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

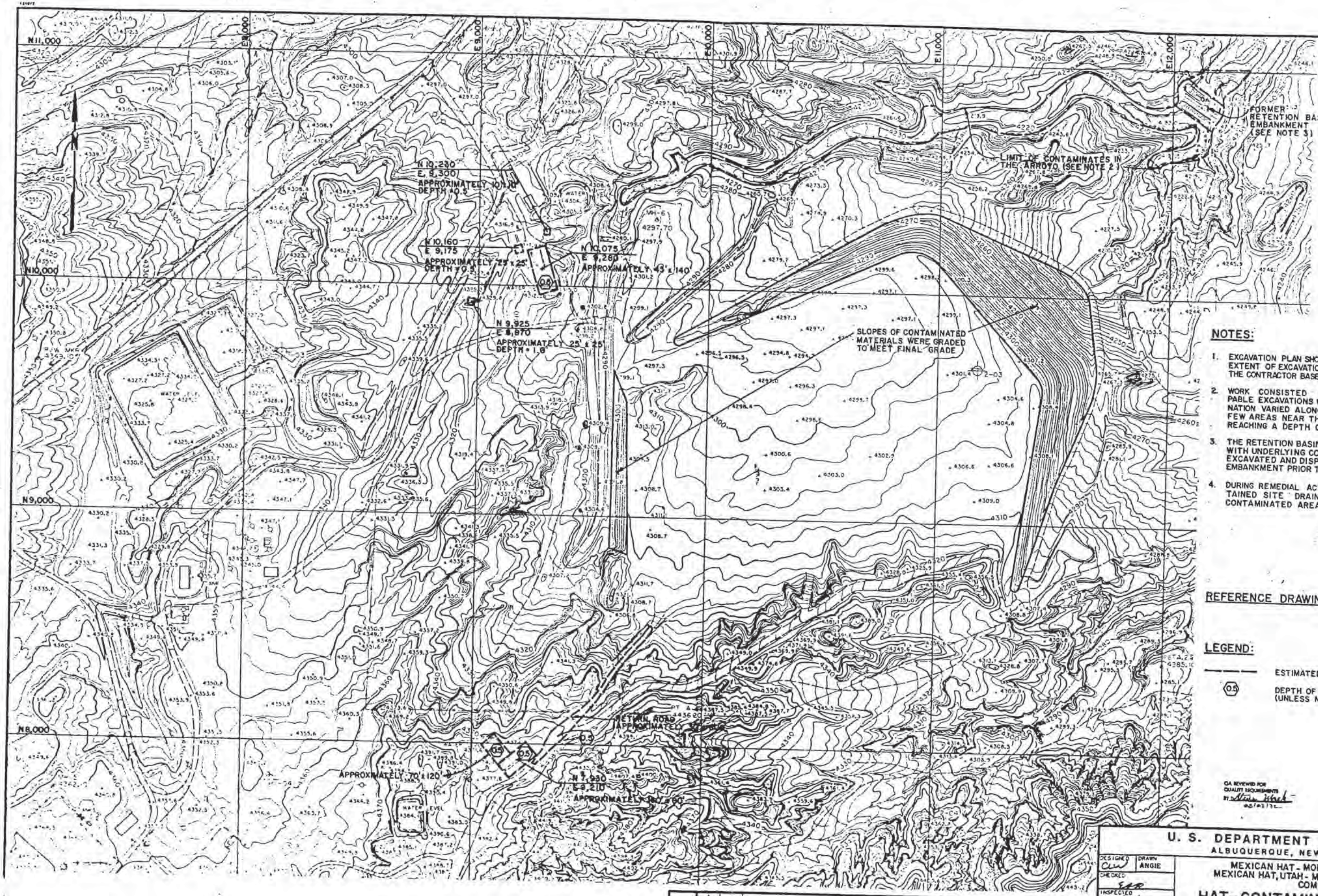
MEXICAN HAT SITE
MEXICAN HAT, UTAH
PHASE II CONSTRUCTION

WINDBLOWN MATERIALS EXCAVATION PLAN

DESIGNED AB Hi[illegible] DRAWN RBC
CHECKED H. Majumdar
INSPECTED O. Asford
RECOMMENDED F. J. Fazio
APPROVED [illegible]
DATE 6-15-88 E.S. Smith. / [illegible] 6/15/88
DOE PROJECT ENGINEER John R [illegible] DATE 6/8/88

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT

PROJECT NO DE-AC04-83AL18796
DRAWING NO HAT-PS-10-0956 REV —



NOTES:

1. EXCAVATION PLAN SHOWN IS APPROXIMATE. ACTUAL DEPTHS AND EXTENT OF EXCAVATION WERE DETERMINED IN THE FIELD BY THE CONTRACTOR BASED ON RADIOLOGICAL SURVEYS.
2. WORK CONSISTED OF OVERBURDEN REMOVAL. NO RIPPABLE EXCAVATIONS WERE REQ'D. THE DEPTH OF CONTAMINATION VARIED ALONG THE ARROYO FROM 2'-0 WITH A FEW AREAS NEAR THE RETENTION BASIN EMBANKMENT REACHING A DEPTH OF 3'-0.
3. THE RETENTION BASIN EMBANKMENT MATERIAL ALONG WITH UNDERLYING CONTAMINATED MATERIAL WAS EXCAVATED AND DISPOSED OF IN THE TAILINGS EMBANKMENT PRIOR TO PLACEMENT OF THE RADON BARRIER.
4. DURING REMEDIAL ACTION THE SUBCONTRACTOR MAINTAINED SITE DRAINAGE TO PREVENT RUNOFF FROM CONTAMINATED AREAS FROM LEAVING THE SITE.

REFERENCE DRAWINGS:

LEGEND:

— — —	ESTIMATED LIMITS OF OFF-PILE CONTAMINATES
⬡ 05	DEPTH OF EXCAVATION IN FEET (UNLESS NOTED OTHERWISE)

QA REVIEWED FOR QUALITY REQUIREMENTS
BY Steve Hrck
02/03/92

STATE OF UTAH

QA MK-F	NO.	DATE	REVISIONS	BY	CK	ENG	CHIEF	QA	DOE
	△								
	△								
	△								
—	△	5/5/95	AS-BUILT	jck	NFC	JAJ	JB	el	—
JPM 2/03/92	△	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

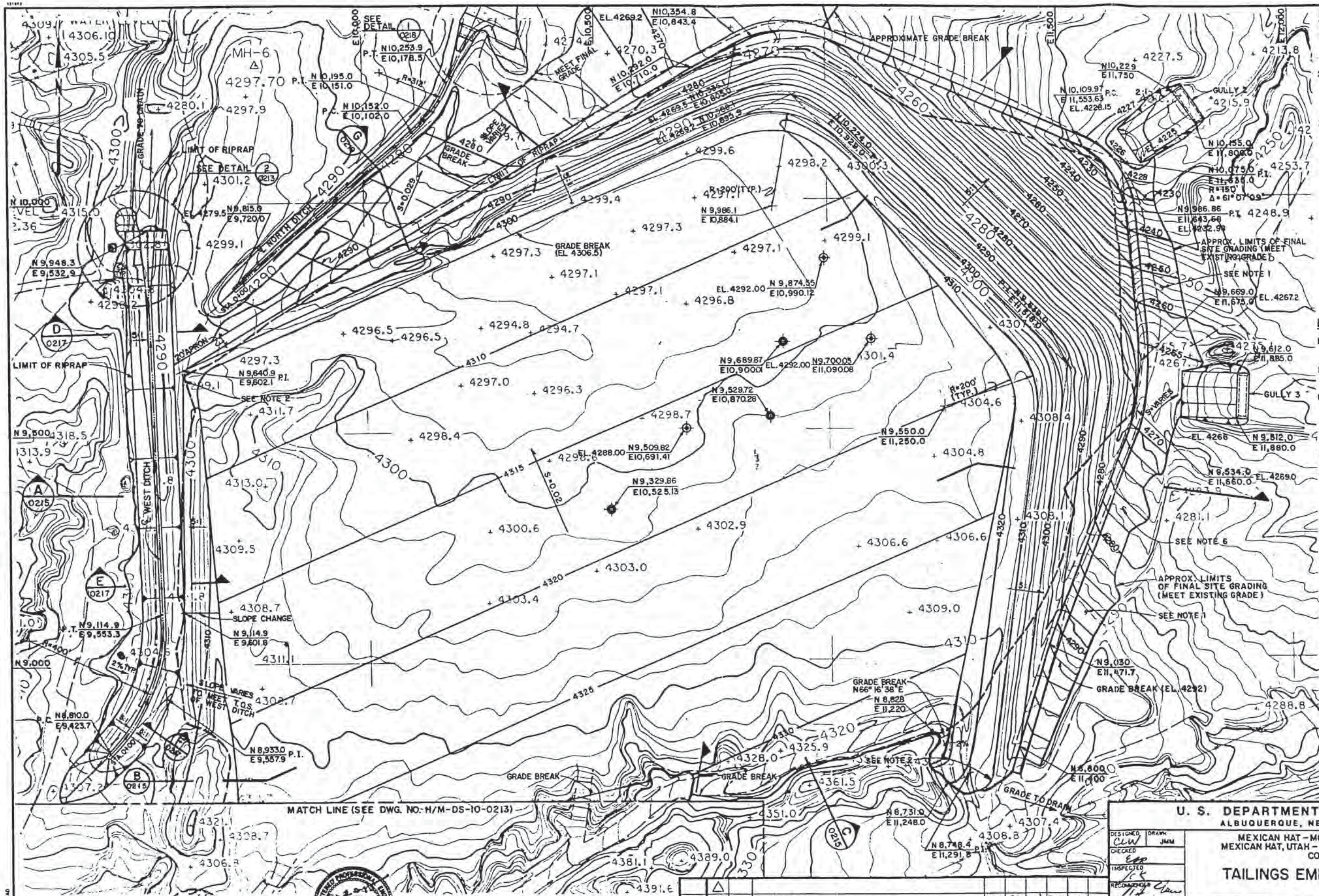
HAT-CONTAMINATED MATERIAL EXCAVATION PLAN

DESIGNED CLW
DRAWN ANGIE
CHECKED EAR
INSPECTED J-K
RECOMMENDED N.H. Claire
APPROVED J.R. Smith
DATE 1/31/92
Pat Griffin Marton
DOE PROJECT ENGINEER Steve Hoag
DATE 2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT

PROJECT NO.
DE-AC04-83AL18796

DRAWING NO.



NOTES:

1. GRADED APRON AREA TO ELIMINATE HIGH SPOTS AND PREVENT FLOW CONCENTRATIONS.
2. CORNER CONTOURS ON THE TAILINGS EMBANKMENT WERE ROUNDED WITH A 50' RADIUS IN THE PLAN VIEW UNLESS NOTED OTHERWISE.
3. FINAL GRADES SHOWN ARE APPROXIMATE.

REFERENCE DRAWINGS:

H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)
H/M-DS-10-0217	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0218	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 2 OF 2)
H/M-DS-10-0219	HAT-EROSION PROTECTION PLAN AND SECTIONS
H/M-DS-10-0213	TAILINGS EMBANKMENT PLAN AND DITCH SECTIONS AND DETAILS

LEGEND:

4300	EXISTING CONTOURS
4320	FINAL CONTOURS
——·——	DRAINAGE DITCH
N10,000	CONSTRUCTION GRID COORDINATE
┬┬┬	TOP OF CUT
┳┳┳	TOP OF FILL
— — —	LIMIT OF CONTAMINATED MATERIAL
⊕	DISPLACEMENT MONUMENT LOCATION SIT AT THE BOTTOM OF RADON BARRIER
⊕	DISPLACEMENT MONUMENT LOCATION & ELEVATION OF BASE PLATE AS OF MARCH 1989

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
—	△	5-9-95	AS-BUILT						—
	2	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20						
	1	6-18-93	REVISED AS PER P.I.D. NO. 09-S-17						
	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

TAILINGS EMBANKMENT PLAN

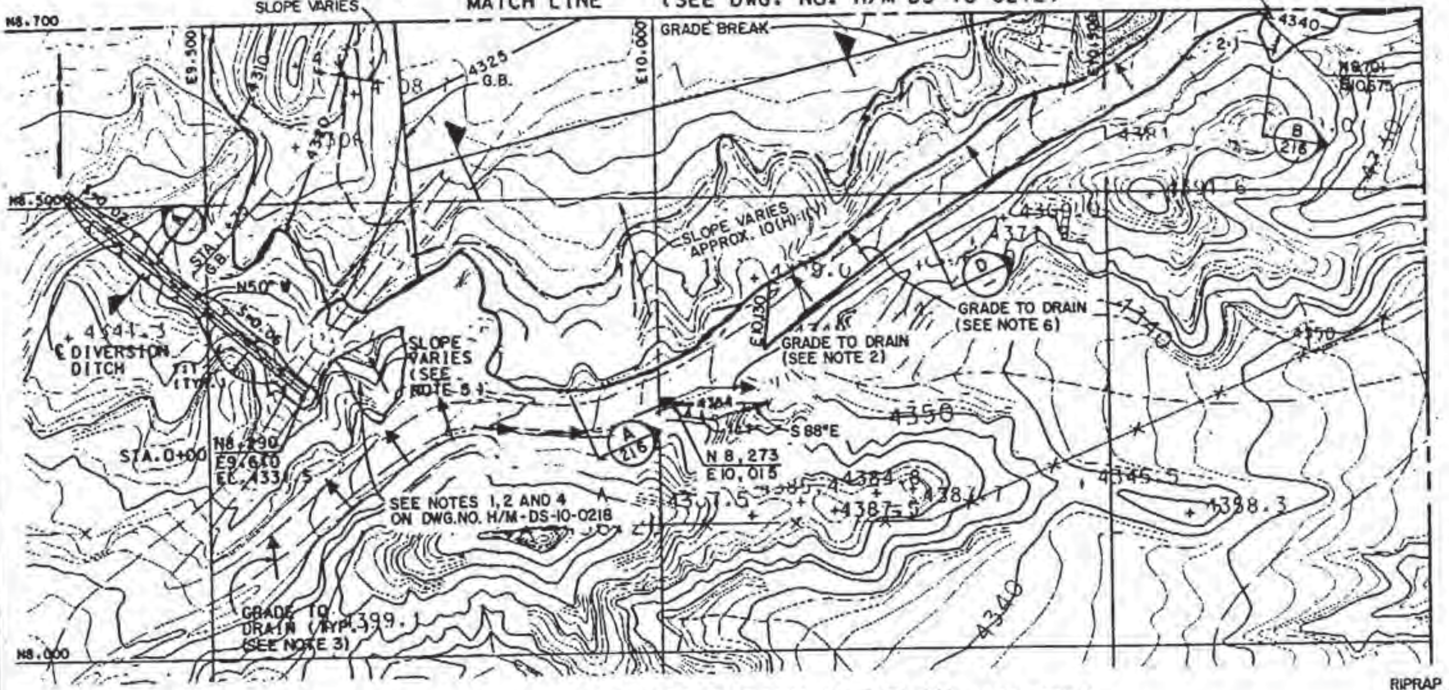
DESIGNED	CLW
DRAWN	JMM
CHECKED	
INSPECTED	
RECOMMENDED	
APPROVED	
DATE	1/1/92
DOE PROJECT ENGINEER	
DATE	2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796

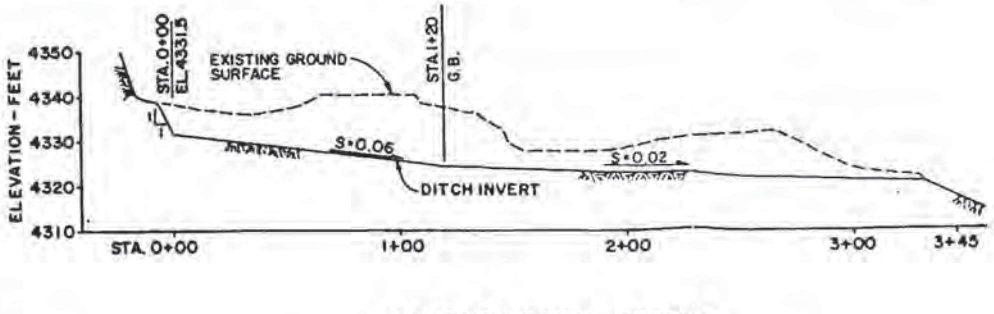
DRAWING NO. H/M-DS-10-0212

REV. —

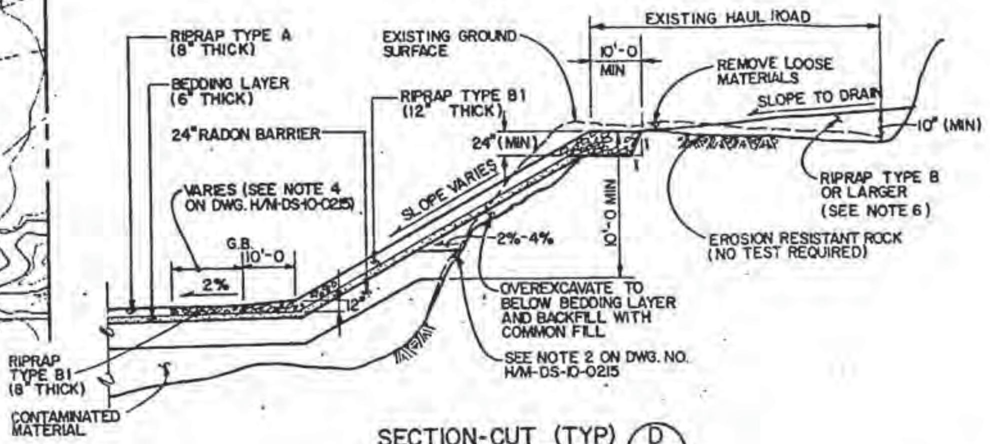


TAILINGS EMBANKMENT PLAN (SEE NOTE 1)

100 0 100 200
SCALE FEET

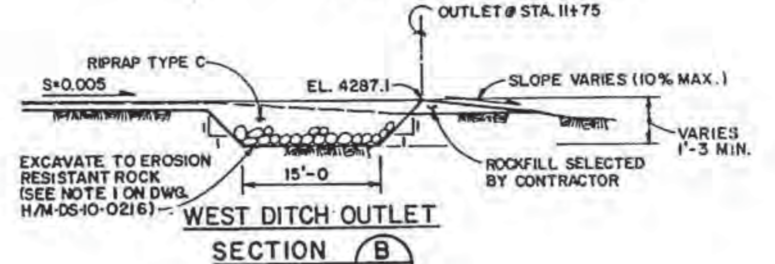


DIVERSION DITCH - PROFILE



SECTION-CUT (TYP) D

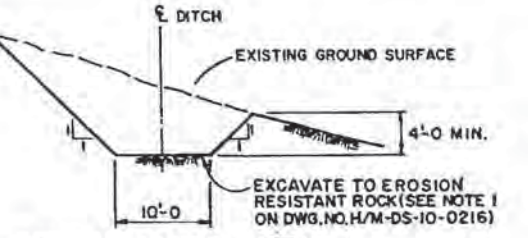
NOT TO SCALE



WEST DITCH OUTLET

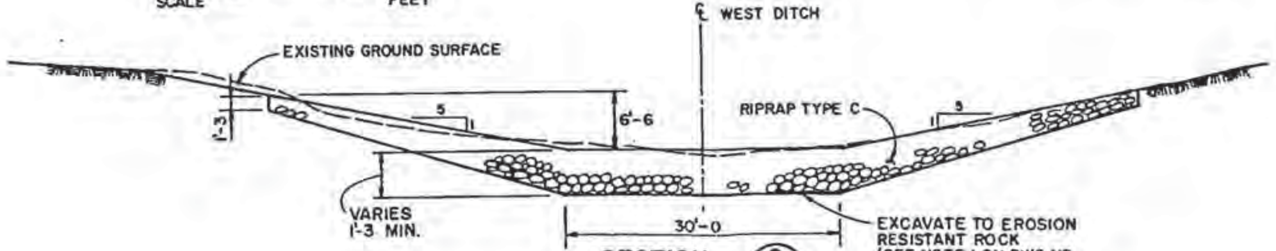
SECTION B

10 0 10 20
SCALE FEET



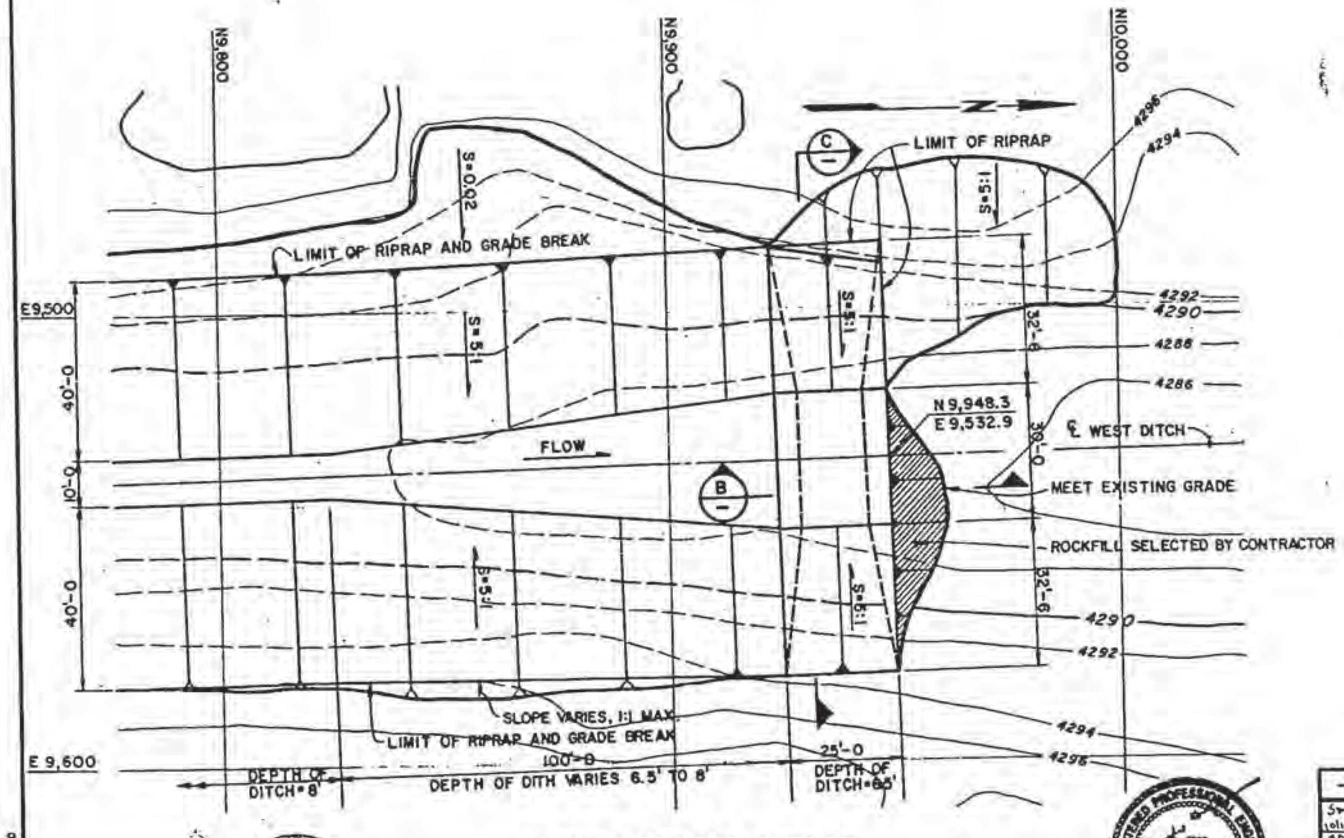
TYPICAL SECTION A

NOT TO SCALE



SECTION C

10 0 10 20
SCALE FEET



WEST DITCH TOE OUTLET DETAIL 2 0212

20 0 20 40
SCALE FEET

NOTES:

1. SEE DWG. H/M-DS-10-0212 FOR ADDITIONAL NOTES AND LEGEND.
2. GRADED EXISTING TERRAIN SOUTH OF PILE AS DIRECTED BY THE CONTRACTOR TO AVOID FLOW CONCENTRATIONS ONTO THE PILE.
3. GRADED EXISTING TERRAIN SOUTHWEST OF PILE.
4. (NOT USED)
5. BACKFILLED EXISTING GULLIES WITH ROCKFILL SELECTED BY CONTRACTOR.
6. GRADED EXISTING HAUL ROAD EAST OF E10,130 TO DRAIN WITH RIPRAP TYPE B.

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)
H/M-DS-10-0218	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 2 OF 2)

LEGEND:

⩘⩘⩘	TOP OF ROCK
▨	LIMITS OF ROCKFILL SELECTED BY THE CONTRACTOR
G.B.	GRADE BREAK

QA REVIEWED FOR QUALITY REQUIREMENTS
02/03/93

QA MK-F	NO.	DATE	REVISIONS	BY	CK	ENG MGR.	CHIEF ENG.	QA MGR.	DOE APP.
—	△	5-9-95	AS-BUILT	JCK	APC	DM	DB	cl	—
Sm 10/14/94	4	10-5-94	REVISED AS PER P.I.D. NO. 09-S-24	BW	JCK	DMJ	DB	CAP	RAE
Sm 4/19/94	3	4-6-94	REVISED AS PER P.I.D. NO. 09-S-22	BW	JCK	DMJ	SFN	CAP	RCE
Sm 3/24/94	2	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20	CW	JCK	APC	BRT	CAP	RAE
Sm 6/21/93	1	6-18-93	REVISED AS PER P.I.D. NO. 09-S-17	JCK	APC	DMJ	BRT	HV	RWE
Sm 2/03/93	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

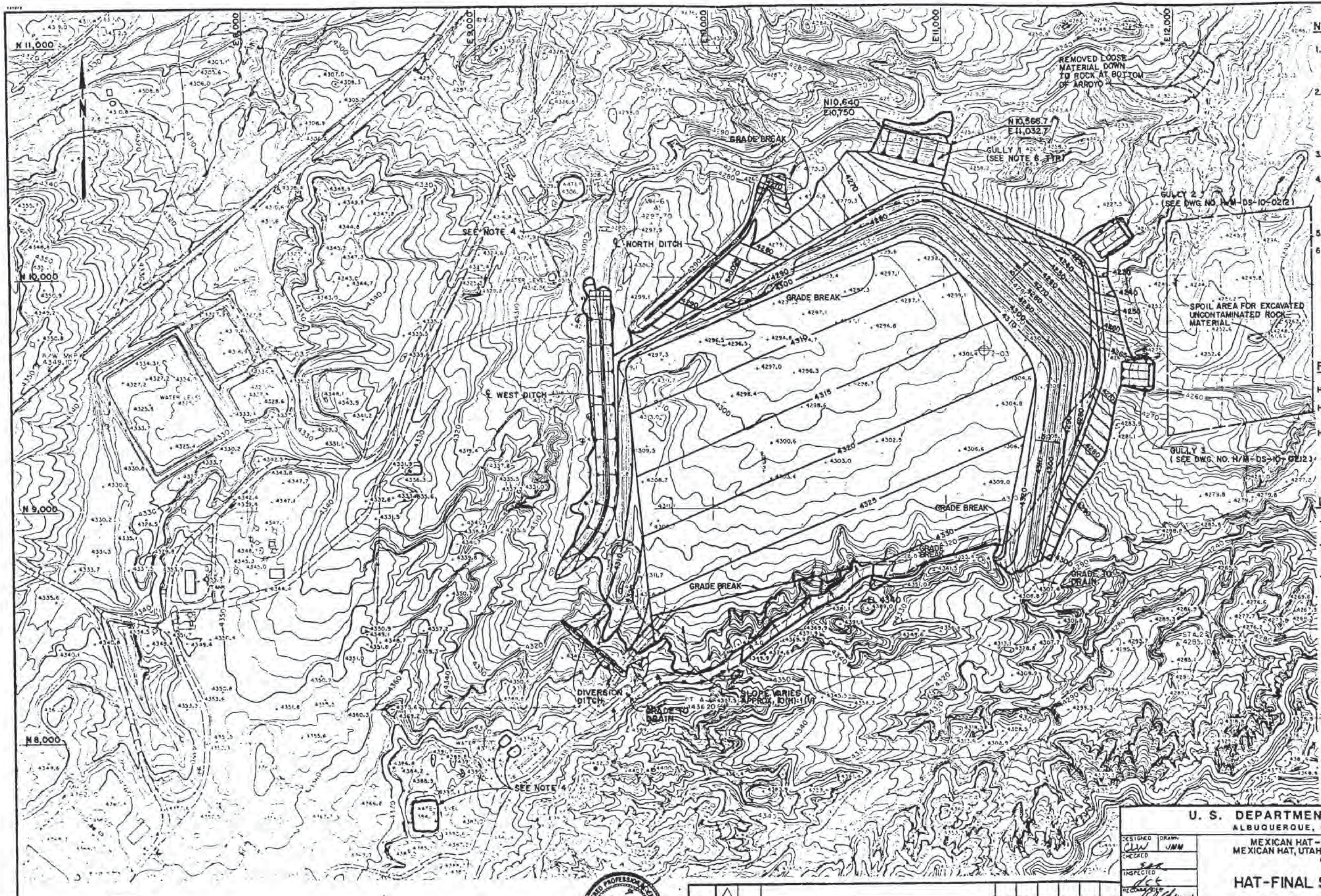
DESIGNED CLW
DRAWN JMM
CHECKED
INSPECTED JCK
RECOMMENDED
APPROVED
DATE 1/21/92
DOE PROJECT ENGINEER
DATE 2/3/92

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

TAILINGS EMBANKMENT PLAN AND DITCH SECTIONS AND DETAILS

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0213
REV. –



NOTES:

1. SEE DWG. NO. H/M-DS-10-0212 AND H/M-DS-10-0213 FOR FINAL SITE GRADING REQUIREMENTS AROUND DISPOSAL CELL.
2. FINAL GRADES SHOWN ARE APPROXIMATE.
3. (NOT USED)
4. ALL DEPRESSIONS AND LOW SPOTS INCLUDING WATER PONDS WERE BACKFILLED WITH COMMON FILL AND SLOPED TO DRAIN AS DIRECTED BY THE CONTRACTOR.
5. FOR LEGEND, SEE DWG. NO. H/M-DS-10-0212
6. FOR GULLY DETAILS, SEE DWG. NO. H/M-DS-10-0220.

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0213	TAILINGS EMBANKMENT PLAN AND DITCH SECTIONS AND DETAILS
H/M-DS-10-0220	HAT - GULLY DETAILS

LEGEND:

┬┬┬	TOP OF CUT
┬┬┬	TOP OF FILL
——→	FLOWPATH

QA REVIEWED FOR QUALITY REQUIREMENTS BY 2/05/92

200 0 200 400
SCALE FEET

QA	NO.	DATE	REVISIONS	BY	CK	ESD MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
—	△	5-9-95	AS-BUILT						—
	2	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20						
	1	8-16-93	REVISED AS PER P.I.D. NO. 09-S-17						
	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA
COMPLETION

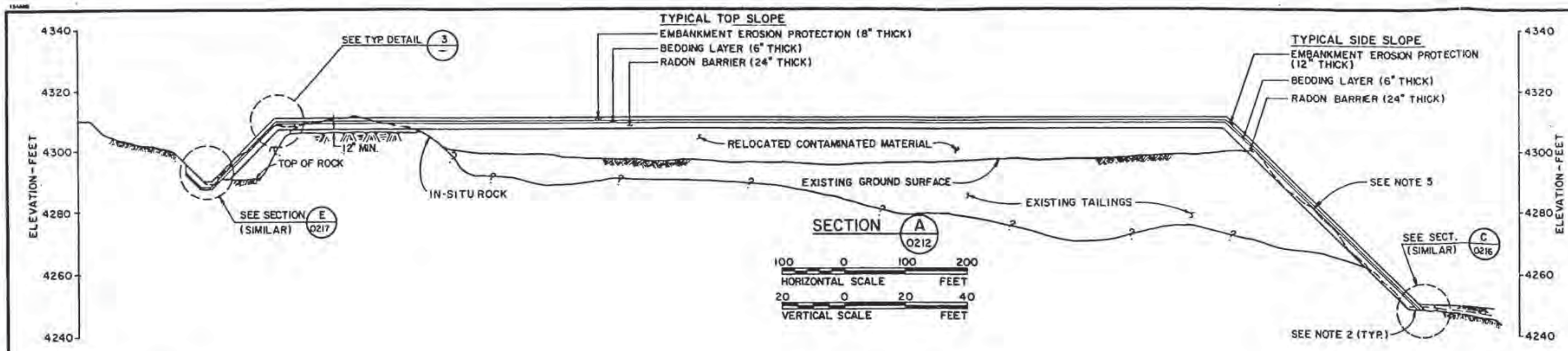
HAT-FINAL SITE GRADING PLAN

DESIGNED CLW
DRAWN JMM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92
DOE PROJECT ENGINEER Steve Hamp
DATE 2/1/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0214
REV. —

PATRICK R. GRIFFIN
29265



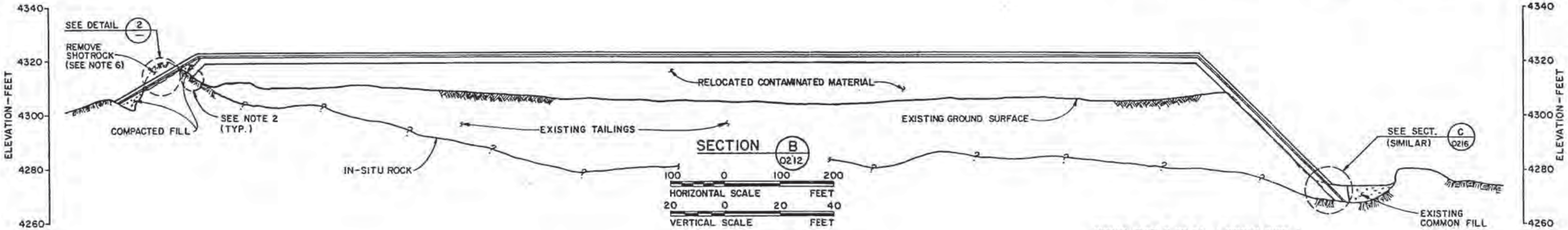
SECTION A 0212

NOTES:

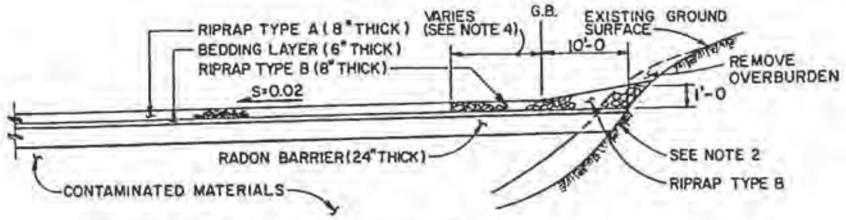
1. (NOT USED)
2. EXTENDED RADON BARRIER AND EROSION PROTECTION TO INTO UNCONTAMINATED COMPETENT IN-SITU ROCK. ALL OVERBURDEN AND LOOSE ROCK WERE REMOVED PRIOR TO PLACING RADON BARRIER AND EROSION PROTECTION.
3. SEE EROSION PROTECTION PLAN ON DWG. NO. H/M-DS-10-0219 FOR LOCATION OF RIPRAP TYPE B AND TYPE B1.
4. WIDTH OF ADDITIONAL RIPRAP TYPE B AND B1 WERE UNIFORM (C AT EACH SIDE ALONG THE TOPSLOPE AS DIRECTED BY CONTRACTOR.
5. REGRADED EXISTING SLOPE TO MATCH FINAL GRADE OF CONTAMINATED MATERIALS.
6. SHOTROCK IS ROCK PREVIOUSLY BLASTED BY OTHERS BUT NOT EXCAVATED.

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)
H/M-DS-10-0217	HAT-SITE DRAINAGE SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0219	HAT-EROSION PROTECTION PLAN AND SECTIONS

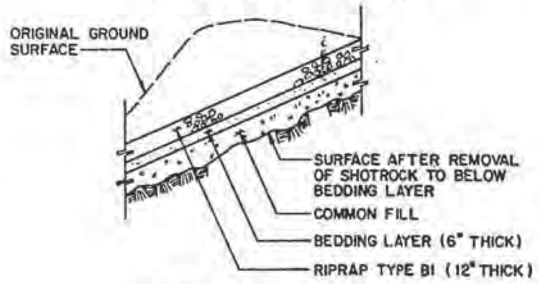


SECTION B 0212

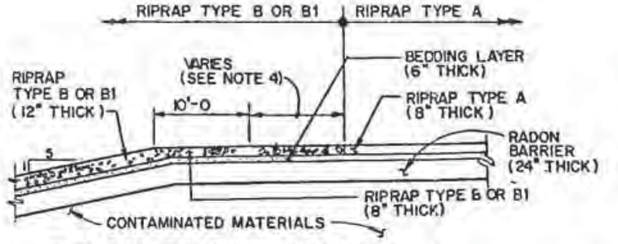


TYPICAL KEY FOR SOUTH TOE

DETAIL 1
NOT TO SCALE



DETAIL 2
NOT TO SCALE

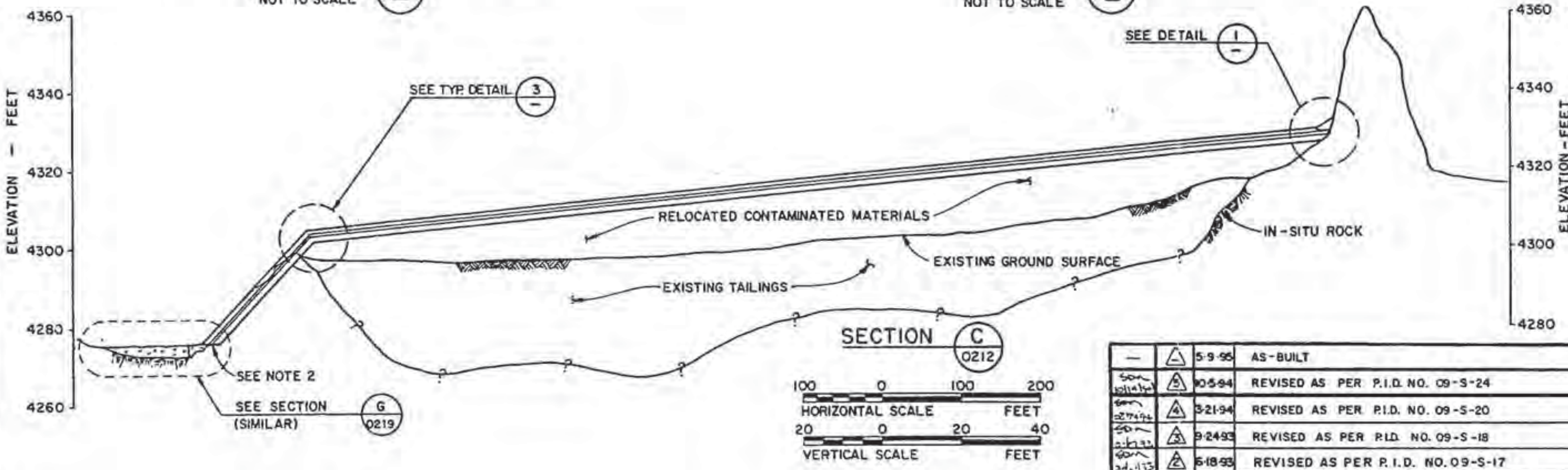


TYPICAL TRANSITION FROM RIPRAP TYPE A TO TYPE B OR B1 (SEE NOTE 3)

TYP. DETAIL 3
NOT TO SCALE

LEGEND:

▨	TOP OF ROCK



SECTION C 0212

QA REVIEWED FOR QUALITY REQUIREMENTS
BY [illegible]

PATRICK R. GRIFFIN

QA MK-F	NO.	DATE	REVISIONS	BY	CK	ENG. MGR.	CHIEF ENG.	QA MGR.	DOE APP.
—	△	5-9-95	AS-BUILT	JKK	RFC	DM	DB	CR	—
SDM	5	10-5-94	REVISED AS PER P.I.D. NO. 09-S-24	[illegible]	JKK	DM	DB	[illegible]	RSE
SDM	4	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20	[illegible]	JKK	[illegible]	[illegible]	[illegible]	RSE
SDM	3	9-24-93	REVISED AS PER P.I.D. NO. 09-S-18	[illegible]	JKK	DM	DB	[illegible]	[illegible]
SDM	2	6-18-93	REVISED AS PER P.I.D. NO. 09-S-17	JKK	RFC	DM	DRS	[illegible]	RSE
SDM	1	8-3-92	REVISED AS PER P.I.D. NO. 09-S-15	JKK	RFC	DM	[illegible]	[illegible]	[illegible]
[illegible]	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

TAILINGS EMBANKMENT SECTIONS AND DETAILS
(SHEET 1 OF 2)

DESIGNED CLW
DRAWN VMM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92
DOE PROJECT ENGINEER Steve Hoop
DATE

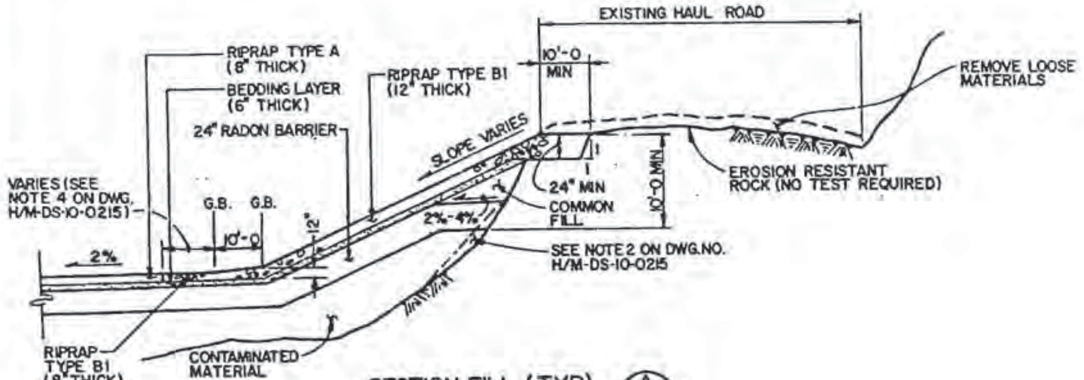
MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796

DRAWING NO. H/M-DS-10-0215

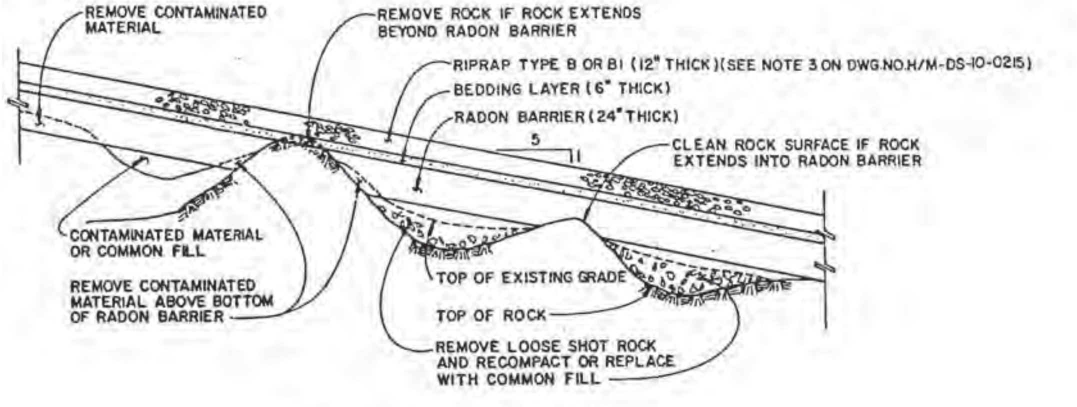
8502511200038000/SMTRAD

10



SECTION-FILL (TYP) Ⓐ 213

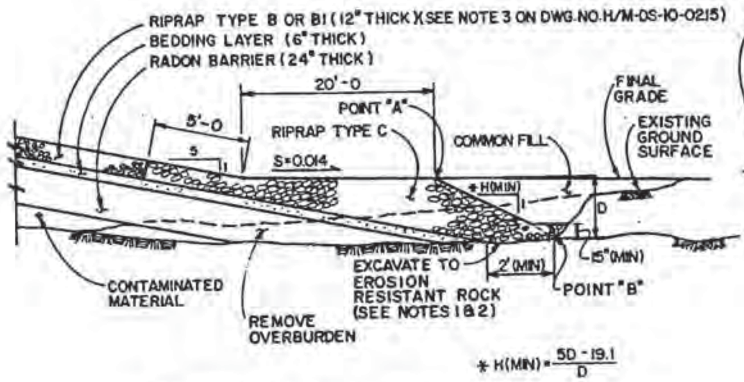
NOT TO SCALE



SIDESLOPE GRADING DETAIL

(SEE NOTE 10)

5 0 5 10
SCALE FEET

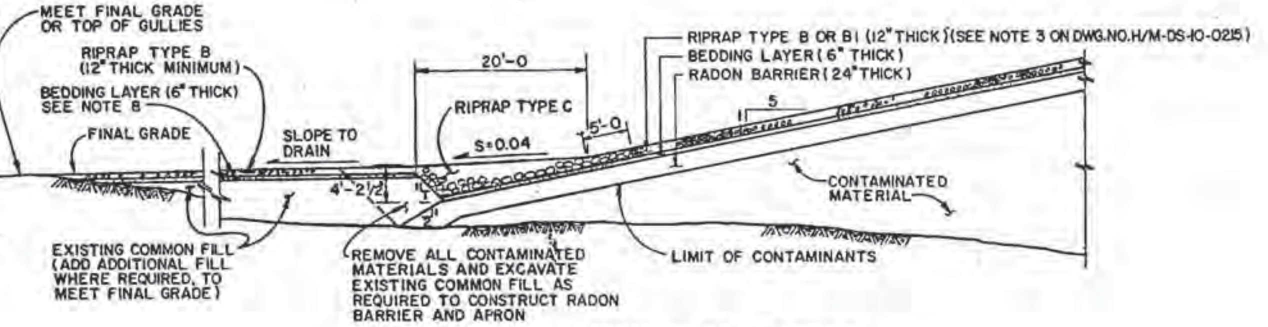


TYPICAL APRON IN FILL AREAS

(SEE NOTE 9)

SECTION Ⓒ

NOT TO SCALE 0215/0219

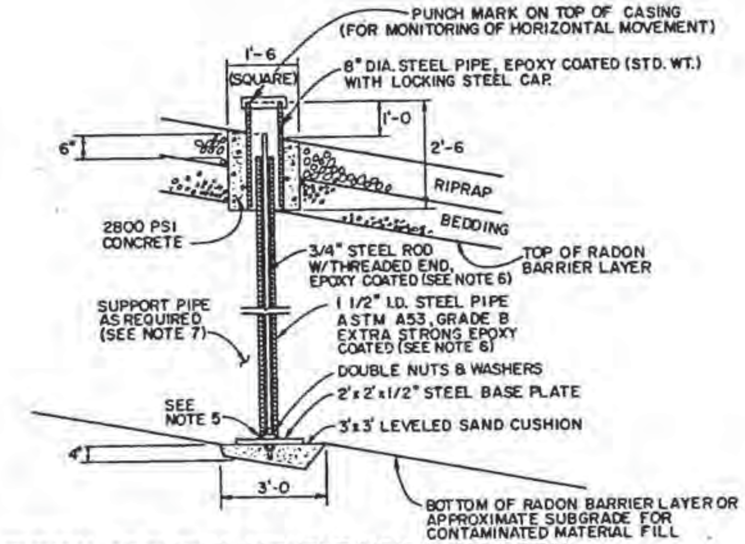


TYPICAL APRON IN FILL AREAS WITH RIPRAP PROTECTION BEYOND 20' APRON

SECTION Ⓓ 0219

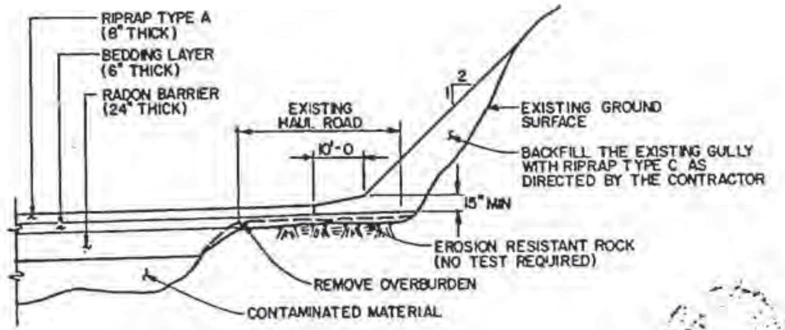
(SEE NOTE 11)

10 0 10 20
SCALE FEET



TYPICAL NEW DISPLACEMENT MONUMENT DETAIL

NOT TO SCALE (H/M-DS-10-0212)



SECTION Ⓑ 213

NOT TO SCALE

NOTES:

1. IN THE KEYTRENCH AREA, EROSION RESISTANT ROCK WAS DETERMINED BY REFUSAL OF A POWER AUGER, DRILLING VERTICALLY, USING AN AUGER BIT. TRENCH BOTTOMS WERE TESTED ON MAXIMUM OF 20 FOOT CENTERS. GENERALLY EROSION RESISTANT ROCK IS NATURAL, UNDISTURBED, INTACT ROCK WHICH CANNOT BE READILY RIPPED OR LOOSENED OR BROKEN BY A BACKHOE DURING NORMAL EXCAVATION AND RINGS WHEN STRUCK WITH A GEOLOGIST'S ROCK HAMMER

2. WHERE EXCAVATIONS WERE TO GO TO EROSION RESISTANT ROCK, THE SUBCONTRACTOR EXPOSED THE EROSION RESISTANT ROCK FOR INSPECTION AND LOGGED BY THE CONTRACTOR'S GEOLOGIST. ALL LOOSE MATERIAL WAS REMOVED AND THE ROCK SURFACE CLEANED TO THE ACCEPTABLE ROCK CLEANUP SURFACE. BACKFILL WAS NOT PLACED UNTIL CONTRACTOR APPROVED THE ROCK SURFACE AT THE BOTTOM OF THE EXCAVATION.

3. FOR APRON AREAS REQUIRING RIPRAP PROTECTION SEE DWG. NO. H/M-DS-10-0219.

4. LENGTH OF PIPE AND ROD OF EXISTING DISPLACEMENT MONUMENT VARIED ACCORDING TO ELEVATION OF BASE PLATE AS SHOWN ON DWG. NO. H/M-DS-10-0212.

5. WHERE THE BASE PLATE WAS LOCATED AT THE TOP OF THE RELOCATED TAILINGS (UNDERNEATH THE RADON BARRIER) THE PIPE WAS PLACED DIRECTLY ON THE PLATE. PIPES WERE NOT ATTACHED TO PLATES OR RODS.

6. PIPES AND RODS WITH TOTAL LENGTH GREATER THAN FOUR FEET WERE INSTALLED IN 4-FOOT SECTIONS AS FILL CONSTRUCTION PROGRESSES. RODS WERE SECURELY FLUSH-COUPLED AS REQUIRED. PIPES WERE SECURELY COUPLED SUCH THAT INSIDE DIAMETER IS NOT LESS THAN 1 1/2" AT ANY POINT. SUBCONTRACTOR MADE ELEVATION MEASUREMENTS OF TOP OF ROD IMMEDIATELY BEFORE AND AFTER ADDITION OF EACH ROD SECTION. PIPES WERE CAPPED AT ALL TIMES TO PREVENT ENTRANCE OF FOREIGN MATTER.

7. PIPES WERE SUPPORTED BY FILL COMPACTED BY LIGHT WEIGHT TAMPERS WITHIN FIVE FEET OF PIPES TO MEET SAME COMPACTION REQUIREMENTS AS FOR ADJACENT FILL. CARE WAS TAKEN TO ENSURE THAT PIPES REMAIN NOMINALLY CENTERED AROUND RODS.

8. BEYOND THE EMBANKMENT APRON, BEDDING LAYER WAS NOT REQUIRED IF RIPRAP WAS IN CONTACT WITH IN-SITU BEDROCK.

9. THE DEPTH TO EROSION RESISTANT ROCK BELOW POINT "A" VARIED. THE MINIMUM DEPTH WAS 15 INCHES BELOW FINAL GRADE. THE LOCATION OF POINT "A" WAS FIXED. THE SLOPE OF RIPRAP TYPE C EXTENDED TO TOP OF THE EROSION RESISTANT ROCK. LOCATION OF POINT "B" WAS VARIED.

10. SIDE SLOPE DETAIL APPLIED TO AREAS OF EXISTING SIDE SLOPE WHERE ROCK IS AT OR NEAR THE SURFACE.

11. SECTION D - APPLIED BETWEEN THE GULLIES AND THE EMBANKMENT AND OTHER AREAS WHERE DEPTH TO COMPETENT ROCK BELOW FINAL GRADE IS GREATER THAN 4'-2 1/2".

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0213	TAILINGS EMBANKMENT PLAN AND DITCH SECTIONS AND DETAILS
H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0219	HAT-EROSION PROTECTION PLAN AND SECTIONS

QA REVIEWED FOR QUALITY REQUIREMENTS BY

PATRICK B. GRIFFIN
No. 7346

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	6	10-5-94	REVISED AS PER P.I.D. NO. 09-S-24						
	5	4-6-94	REVISED AS PER P.I.D. NO. 09-S-22						
	4	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20						
	3	9-24-93	REVISED AS PER P.I.D. NO. 09-S-18						
	2	5-18-93	REVISED AS PER P.I.D. NO. 09-S-17						
	1	8-3-92	REVISED AS PER P.I.D. NO. 09-S-15						
	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
—	7	5-9-95	AS-BUILT						—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

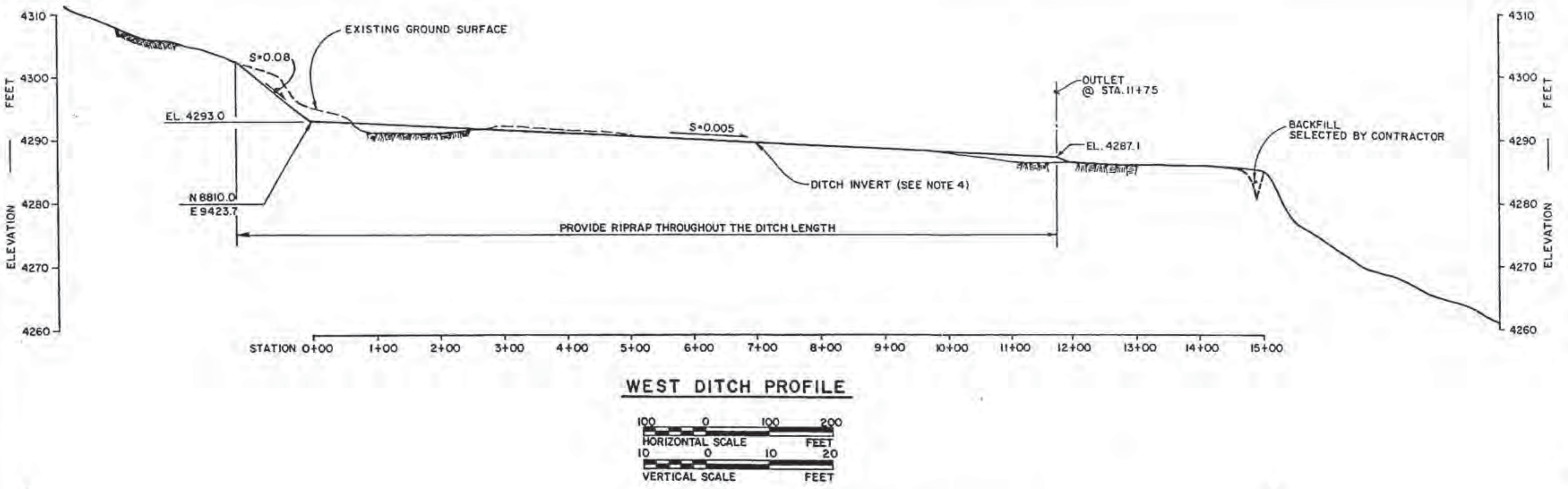
DESIGNED CJW
DRAWN JMM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/4/92
DOE PROJECT ENGINEER
DATE 7/3/92

MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA
COMPLETION

TAILINGS EMBANKMENT SECTIONS AND DETAILS
(SHEET 2 OF 2)

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0216
REV. —



WEST DITCH PROFILE

NOTES:

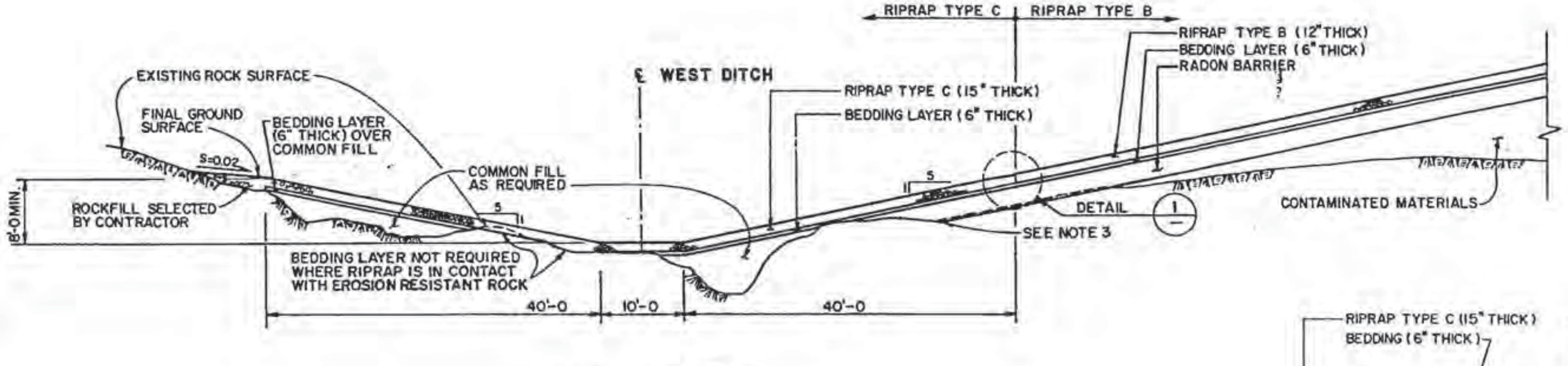
1. SECTION E APPLIED BETWEEN STATION 0+00 AND STATION 9+75, SECTION D APPLIED DOWNSTREAM OF STATION 9+75.
2. SEE DWG. NO. H/M-DS-10-0212 FOR PLAN OF WEST DITCH.
3. EXTENDED RADON BARRIER BEYOND LIMITS OF CONTAMINATED MATERIAL TO ROCK.
4. DITCH INVERT SHOWN WAS TOP OF RIPRAP.

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)

LEGEND:

▨ TOP OF ROCK



SECTION E
0212/0215

REF. MKE DOC.
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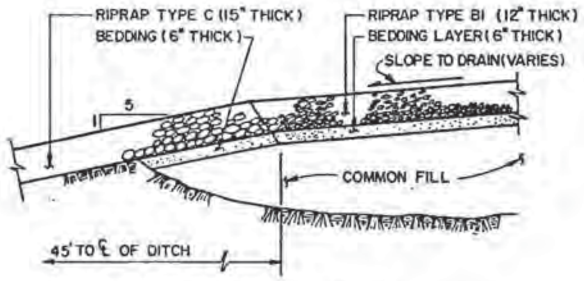
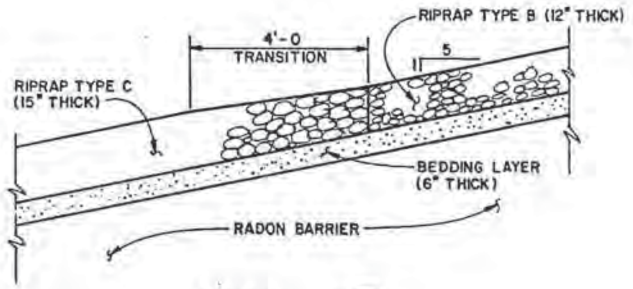
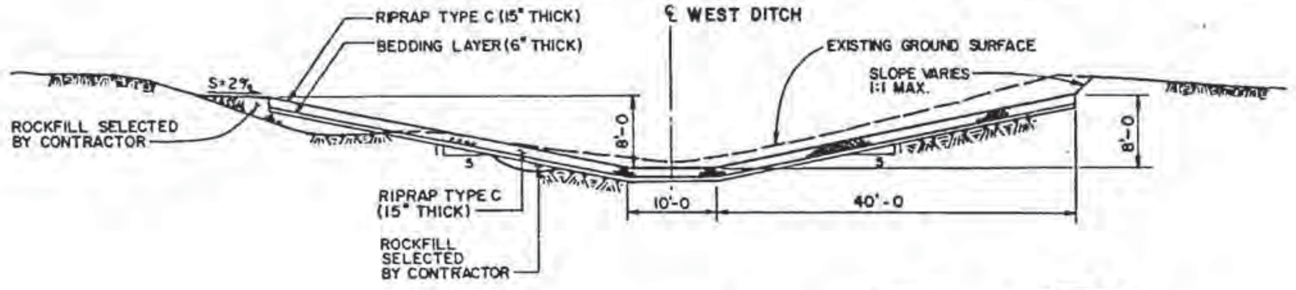


SECTION F
NOT TO SCALE 0212



DETAIL 1
NOT TO SCALE



SECTION D
0212

10 0 10 20
SCALE FEET

QA REVIEWED FOR QUALITY REQUIREMENTS
BY
10/03/92

QA MK-F	NO.	DATE	REVISIONS	BY	CK	ENG MGR.	CHIEF ENG.	QA MGR.	DOE APP.
—	△	5-9-95	AS-BUILT				ZB		—
	3	9-24-93	REVISED AS PER P. I.D. NO. 09-S-18						
	2	6-18-93	REVISED AS PER P. I.D. NO. 09-S-17						
	1	8-3-92	REVISED AS PER P. I.D. NO. 09-S-15						
	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

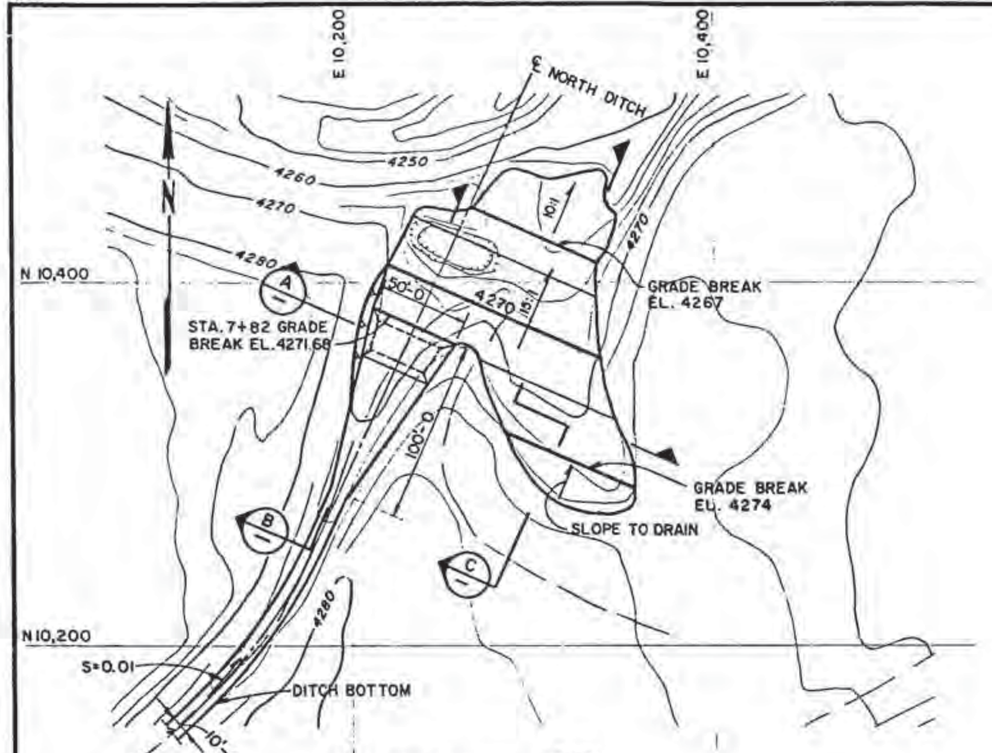
HAT-SITE DRAINAGE SECTIONS AND DETAILS
(SHEET 1 OF 2)

DESIGNED CLW
DRAWN JMM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/1/92
DOE PROJECT ENGINEER
DATE 2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

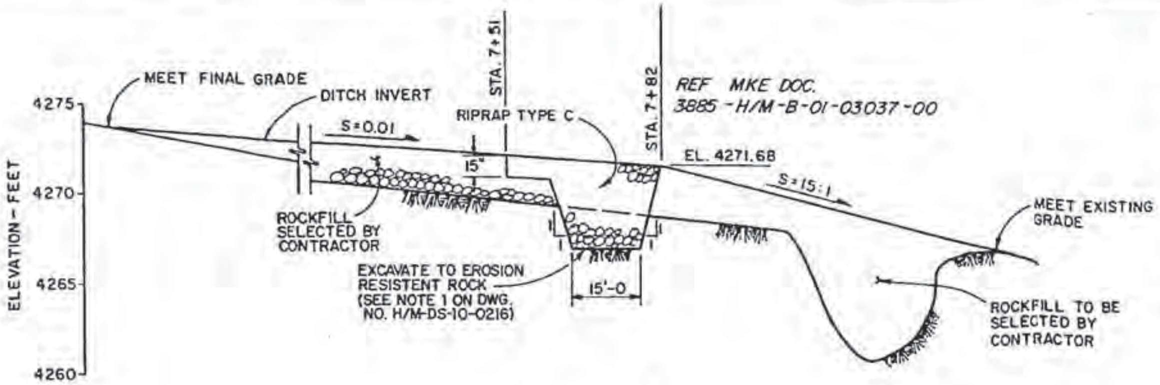
PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0217
REV. —

12



DETAIL ① 0212

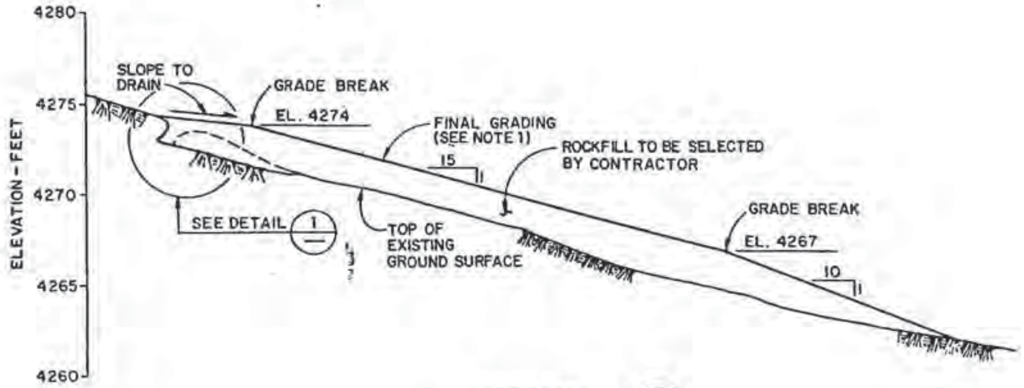
SCALE 50 0 50 100 FEET



SECTION (B)

HORIZONTAL SCALE 20 0 20 40 FEET

VERTICAL SCALE 5 0 5 10 FEET



SECTION (C)

HORIZONTAL SCALE 20 0 20 40 FEET

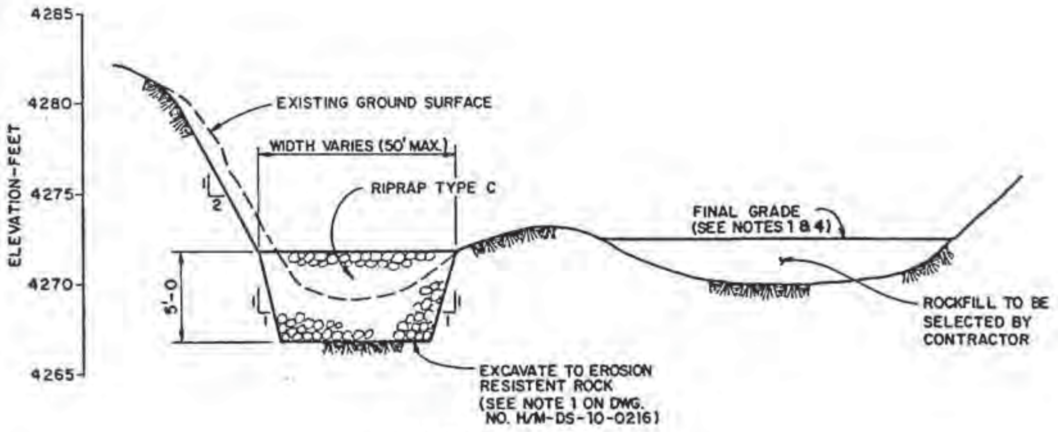
VERTICAL SCALE 5 0 5 10 FEET

NOTES:

1. FINAL SURFACE OF ROCKFILL TO BE SELECTED BY CONTRACTOR WAS GRADED TO PROMOTE SHEET FLOW. THE SURFACE HAD NO NOTICABLE MOUNDS, RIDGES, SWALES OR DEPRESSIONS AS DETERMINED BY THE CONTRACTOR.
2. ROCKFILL SIZES WERE SELECTED TO FILL ALL SPACES AND TO AVOID NESTING. ROCKFILL SMALLER THAN 1' PIECES WERE PLACED AND COMPACTED ACCORDING TO PROCEDURES APPROVED BY THE CONTRACTOR. ROCKFILL LARGER THAN 1' WERE INDIVIDUALLY PLACED.
3. LARGER PIECES OF ROCKFILL WERE PLACED NEAR THE SURFACE.
4. ROCKFILL WERE PLACED TO MEET EXISTING GRADE AND AVOID FLOW CONCENTRATIONS BETWEEN ROCKFILL SURFACE AND EXISTING TERRAIN.

REFERENCE DRAWINGS:

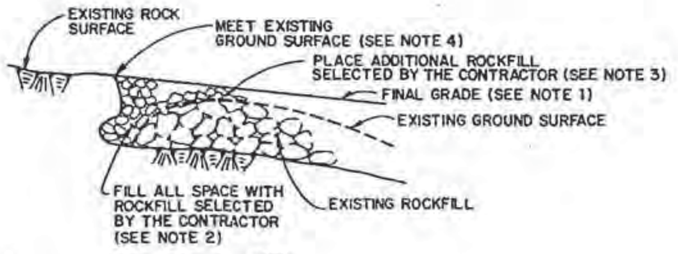
H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)



SECTION (A)

HORIZONTAL SCALE 20 0 20 40 FEET

VERTICAL SCALE 5 0 5 10 FEET



DETAIL (I)
NOT TO SCALE

QA REVIEWED FOR QUALITY REQUIREMENTS
BY [illegible]
05/03/92

RA Clum

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
	△								
–	△	5-9-95	AS-BUILT	JK					–
	△	5-18-93	REVISED AS PER P.I.D. NO. 09-S-17	JK					
	△	1/31/92	ISSUED FOR CONSTRUCTION	–	–	–	–	–	–

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

HAT-SITE DRAINAGE SECTIONS AND DETAILS
(SHEET 2 OF 2)

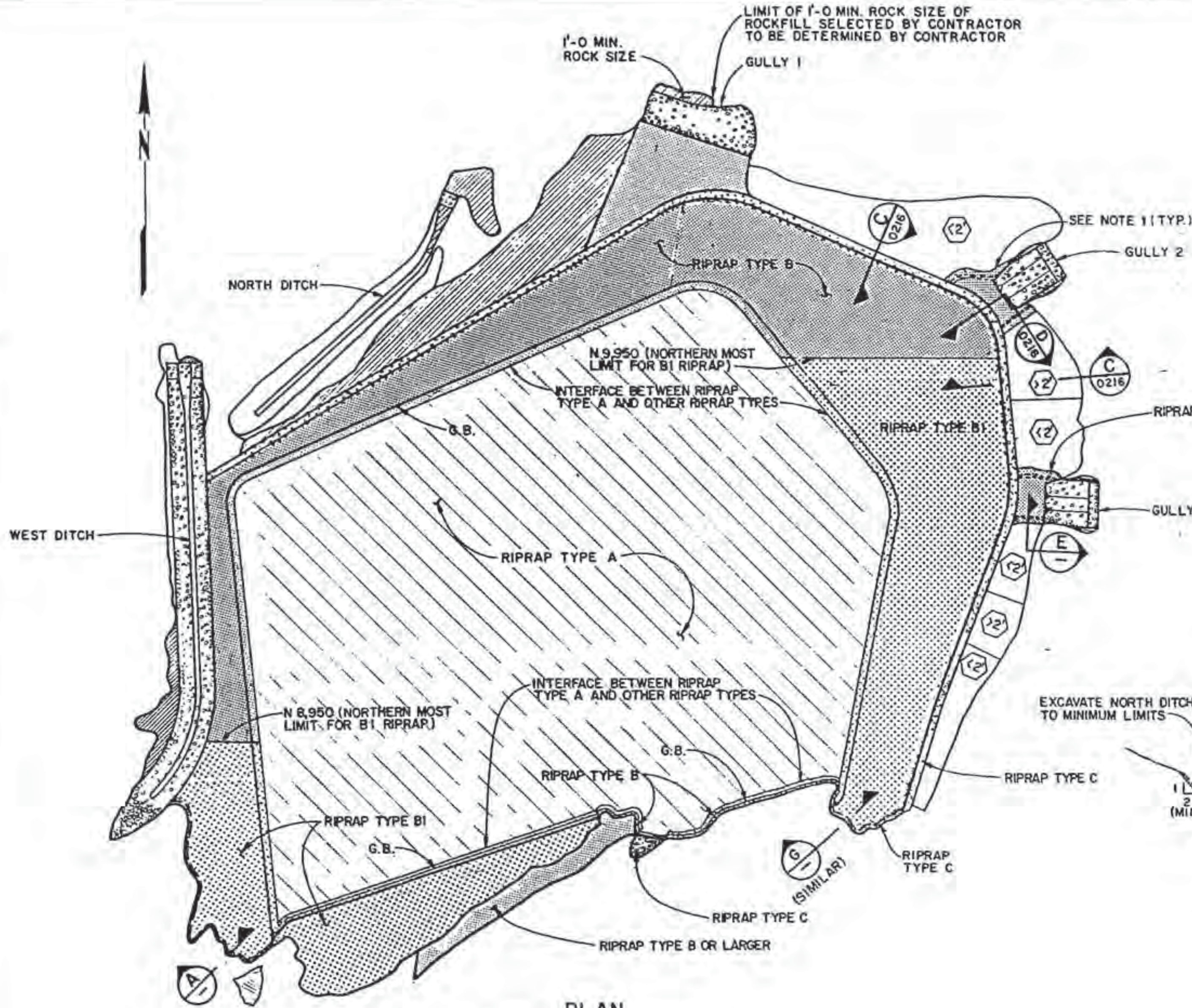
DESIGNED CLW
DRAWN JHM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/1/92
DOE PROJECT ENGINEER
DATE 2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

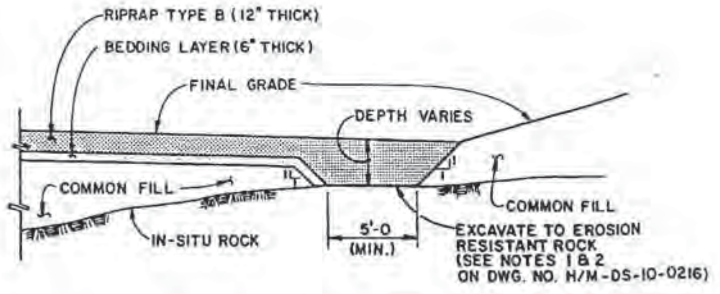
PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0218
REV. —

8502511G0003500/UMTR.

13

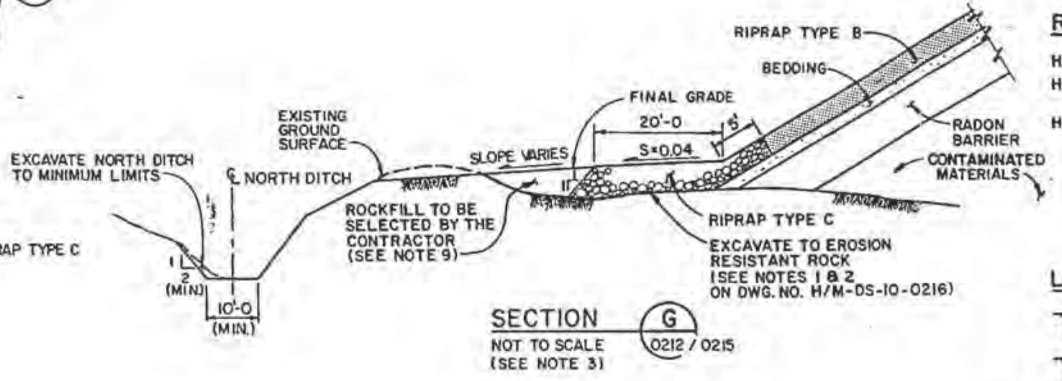


PLAN
EROSION PROTECTION



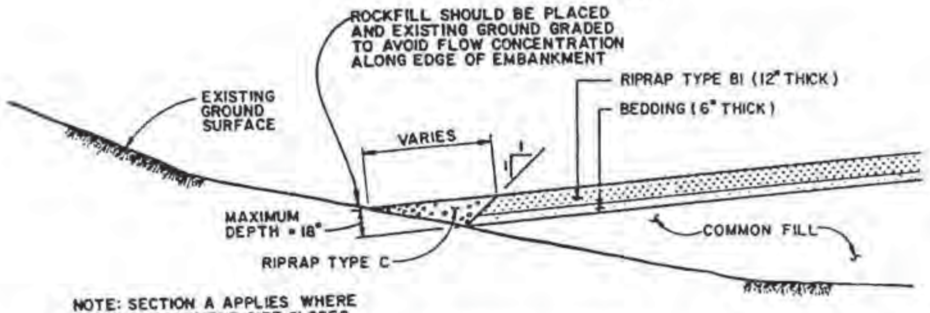
TYPICAL SECTION E

NOT TO SCALE
SEE NOTE 5



SECTION G 0212 / 0215

NOT TO SCALE
(SEE NOTE 3)



NOTE: SECTION A APPLIES WHERE EMBANKMENT SIDE SLOPES MEET EXISTING GRADE BETWEEN TOP SLOPE AND TOE OF SIDE SLOPE

SECTION A

SEE NOTE 4

NOTES:

1. THE OUTER LIMIT OF RIPRAP COVER SHOWN IS APPROXIMATE.
2. (NOT USED)
3. SECTION G APPLIED WHERE DEPTH TO ROCK BELOW FINAL GRADE IS 3 FEET OR LESS OR AS DIRECTED BY THE CONTRACTOR.
4. SECTION A APPLIED WHERE THE EMBANKMENT SIDE SLOPE COMES IN CONTACT WITH GROUND SURFACE. DETAIL 1 ON DWG. H/M-DS-10-0215 APPLIED WHERE THE EMBANKMENT TOP SLOPE CAME IN CONTACT WITH GROUND SURFACE.
5. SECTION E APPLIED WHEREVER THERE WAS A TRANSITION BETWEEN EROSION PROTECTION AND COMMON FILL BETWEEN THE EMBANKMENT APRON AND THE GULLIES
6. TOP OF RIPRAP TYPE C WAS GRADED TO PROVIDE SMOOTH TRANSITION TO TOP OF RIPRAP TYPE A.
7. (NOT USED)
8. (NOT USED)
9. ROCKFILL WAS PLACED IN 1 FOOT LIFTS AND COMPACTED BY TRACK WALKING.

REFERENCE DRAWINGS:

H/M-DS-10-0212	TAILINGS EMBANKMENT PLAN
H/M-DS-10-0215	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 1 OF 2)
H/M-DS-10-0216	TAILINGS EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)

LEGEND:

╥╥╥	TOP OF CUT
╤╤╤	TOP OF FILL
▨	TOP OF ROCK
▧	RIPRAP TYPE A
░	RIPRAP TYPE B1
▒	RIPRAP TYPE B
▓	RIPRAP TYPE C
▨	ROCKFILL TO BE SELECTED BY CONTRACTOR
>2'	APPROXIMATE DEPTH OF EXISTING FILL IN APRON IS LESS THAN 4' BUT GREATER THAN 2'
<2'	APPROXIMATE DEPTH OF EXISTING FILL IN APRON IS LESS THAN 2'

QA REVIEWED FOR QUALITY REQUIREMENTS,
BY

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOC APP.
—	△	5-9-95	AS-BUILT						—
	4	10-5-94	REVISED AS PER P.I.D. NO. 09-S-24						
	3	3-21-94	REVISED AS PER P.I.D. NO. 09-S-20						
	2	12-4-93	REVISED AS PER P.I.D. NO. 09-S-18						
	1	6/18/93	REVISED AS PER P.I.D. NO. 09-S-17						
	0	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED CLW
DRAWN JMM
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92

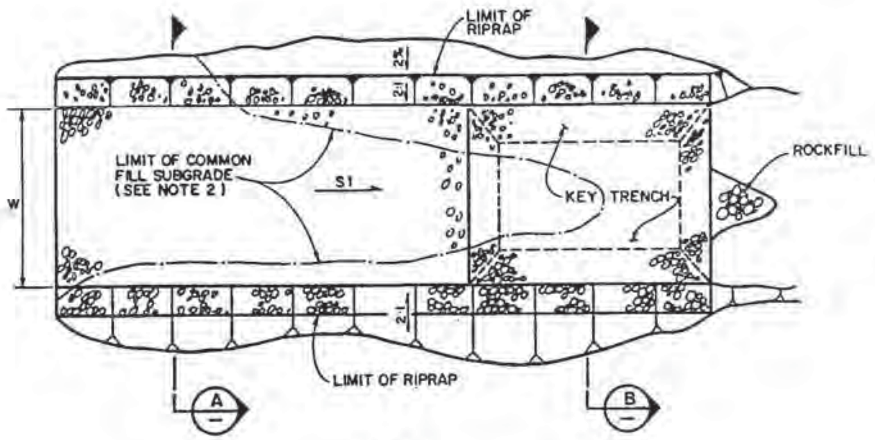
MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA
COMPLETION

HAT-EROSION PROTECTION PLAN AND SECTIONS

DOE PROJECT ENGINEER Steve Hamp
DATE 2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

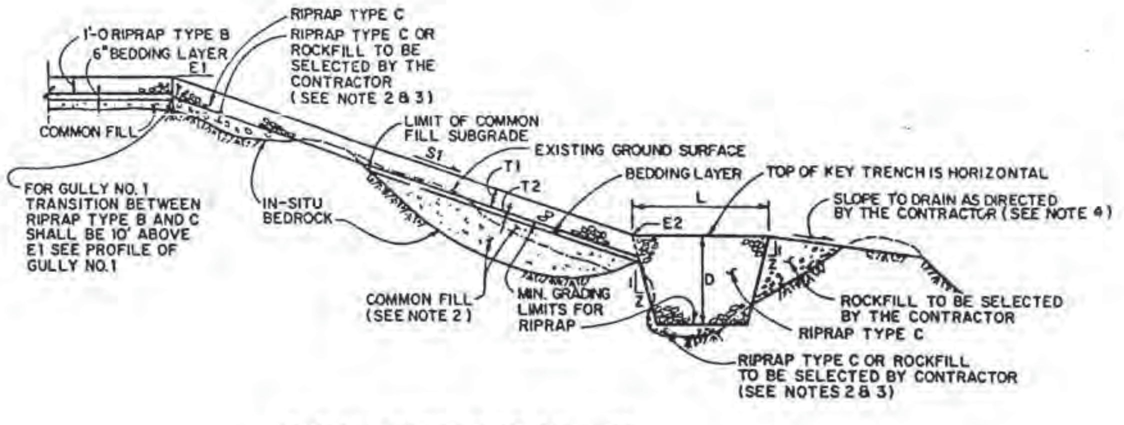
PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0219
REV. —



PLAN

TYPICAL EROSION PROTECTION AT GULLIES

(H/M-DS-10-0219)
NOT TO SCALE



TYPICAL PROFILE AT GULLIES

(SEE TABLE 1 FOR DIMENSIONS)
NOT TO SCALE

TABLE 1–SETTINGS AND DIMENSIONS OF GULLIES

GULLY	GULLIES						KEY TRENCH			SIDE-SLOPE DEPTH (FT)
	WIDTH (FT)	ELEVATION (FT.)		SLOPE	THICKNESS (FT.)		LENGTH (FT)	THICKNESS (FT)	SIDE-SLOPE	
	W(MIN.) *	E1	E2	S1	T1(MIN)	T2	L	D(MIN) **	Z (MIN)	H
1	292	4262	4245I	0.141	1.25	0.5	VARIES	1.25	1	2
2	90	4225	4218	0.049	1.25	0.5	25	1.25	1	2
3	100	4266	4253	0.108	1.25	0.5	25	1.25	1	2

* WIDTH MAY BE WIDER IF EXPOSED SIDE SLOPE EXCAVATIONS WERE ON EROSION RESISTANT ROCK.

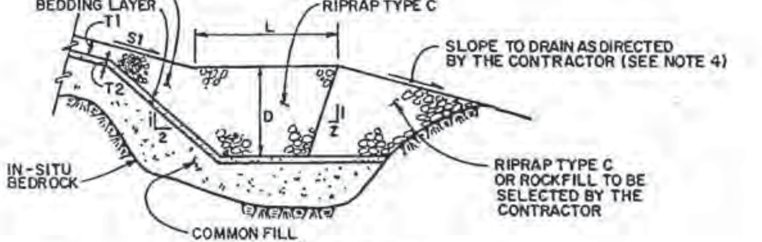
** KEY TRENCH WAS EXTENDED DOWN TO EROSION RESISTANT ROCK

NOTES:

1. THE OUTER LIMIT OF RIPRAP COVER SHOWN WAS APPROXIMATE. FINAL LIMIT WAS DETERMINED BY THE CONTRACTOR IN THE FIELD DURING CONSTRUCTION.
2. WHERE EXISTING SUBGRADE CONSISTED OF COMMON FILL A BEDDING LAYER WAS PLACED BETWEEN THE RIPRAP AND THE FILL. WHERE EXISTING SUBGRADE CONSISTED OF IN-SITU ROCK OR ROCKFILL SELECTED BY THE CONTRACTOR, NO BEDDING LAYER WAS REQUIRED.
3. IN AREAS WHERE EXISTING GRADE WAS ABOVE THE MINIMUM GRADING LIMIT, THE AREA WAS EXCAVATED TO OR BELOW THE MINIMUM LIMIT. WHERE EXISTING GRADE WAS BELOW THE MINIMUM LIMIT, THE AREA WAS BACKFILLED WITH TYPE C RIPRAP OR ROCKFILL TO BE SELECTED BY THE CONTRACTOR AS SHOWN.
4. SLOPE WAS 10% MAX.
5. ALONG GULLY BOTTOM AND SIDESLOPES SURFACES, THERE WAS NO TRANSITION BETWEEN RIPRAP AND INSITU ROCK.
6. ROCKFILL SELECTED BY CONTRACTOR PLACED BELOW GULLY NO. 1 WAS 1' MINIMUM ROCK SIZE. ROCK PIECES WAS PLACED INDIVIDUALLY TO MINIMIZE VOIDS. IRREGULARITIES IN THE FINISHED SURFACE, CONSISTANT WITH THE ROCK SIZES, WAS ALLOWED.

REFERENCE DRAWINGS:

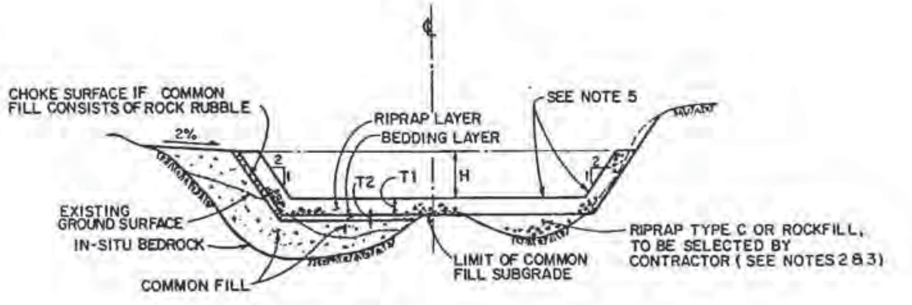
H/M-DS-10-0216	TAILING EMBANKMENT SECTIONS AND DETAILS (SHEET 2 OF 2)
H/M-DS-10-0219	HAT-EROSION PROTECTION PLAN AND SECTIONS.



TYPICAL KEY TRENCH DETAIL IN COMMON FILL

(SEE TABLE 1 FOR DIMENSIONS)
NOT TO SCALE

REF. MKE DOC.
3885-H/M-B-01-03037-00



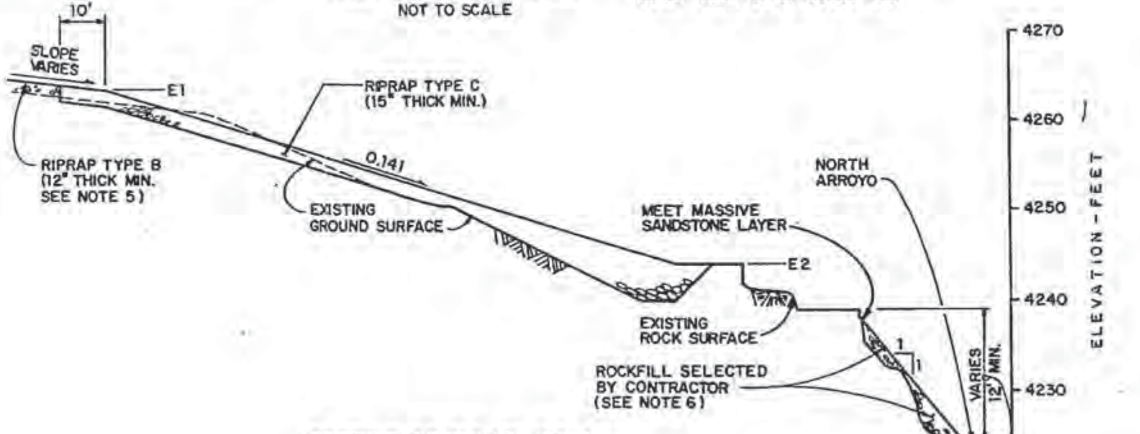
TYPICAL GULLIES SECTION (A)

(SEE NOTE 2)
NOT TO SCALE

LEGEND:

⊤ ⊤	TOP OF CUT
⊤ ⊤	TOP OF FILL
▨	TOP OF ROCK

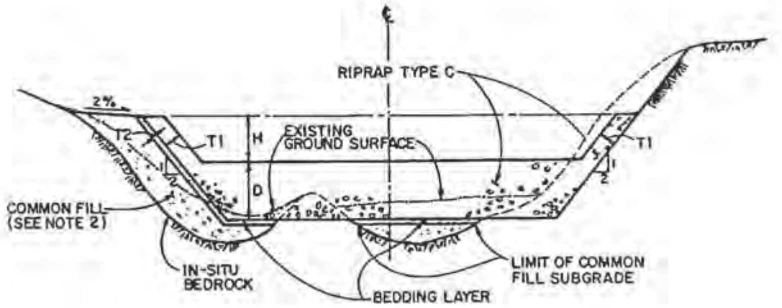
QA REVIEWED FOR QUALITY REQUIREMENTS BY



PROFILE OF GULLY NO. 1

(H/M-DS-10-0219)

20 0 20 40
HORIZONTAL SCALE FEET
10 0 10 20
VERTICAL SCALE FEET



TYPICAL KEY TRENCH SECTION (B)

(SEE NOTE 2 AND TABLE 1 FOR DIMENSIONS)
NOT TO SCALE

No. 7340
PATRICK R. GRIFFITH

QA MK-F	NO.	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.
	△								
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—	△	5-9-95	AS-BUILT						—
	△	6-18-93	REVISED AS PER P.I.D. NO. 09-S-17						
	△	1/31/92	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

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RECOMMENDED
APPROVED
DATE 1/1/12

MEXICAN HAT–MONUMENT VALLEY SITES
MEXICAN HAT, UTAH–MONUMENT VALLEY, ARIZONA
COMPLETION

HAT- GULLY DETAILS

DOE PROJECT ENGINEER
DATE

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST., SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0220
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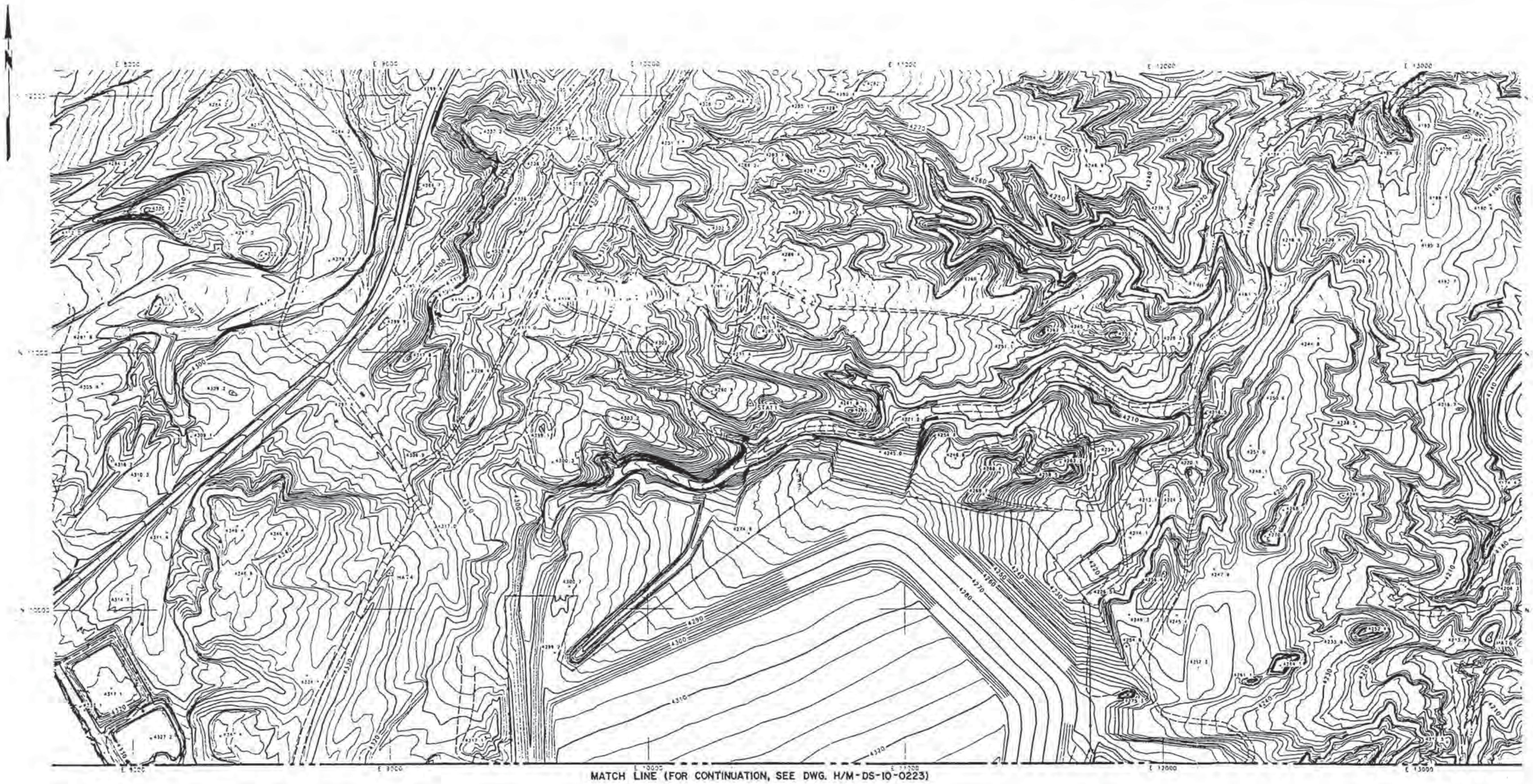

MATCH LINE (FOR CONTINUATION, SEE DWG. H/M-DS-10-0223)

NOTE:

1. TOPOGRAPHY IS PROVIDED BY AERO-GRAPHICS INC., SALT LAKE CITY, UTAH BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 23, 1995.

LEGEND:

—•—•—	FENCE	△AUX2	SURVEY CONTROL POINT
═ ═ ═	UNIMPROVED ROAD	●	UTILITY POLE
—…—	FLOWPATH		

REFERENCE DRAWINGS:

H/M-DS-10-0223 HAT AS-BUILT TOPOGRAPHIC MAP (SHEET 2 OF 2)

200 0 200 400
SCALE FEET

QA MK-F	NO	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP
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U. S. DEPARTMENT OF ENERGY
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MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA

HAT - AS BUILT
TOPOGRAPHIC MAP
(SHEET 1 OF 2)

DESIGNED —
DRAWN —
CHECKED —
INSPECTED —
RECOMMENDED —
APPROVED —
DATE —
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DOE PROJECT ENGINEER —
DATE —

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO.
DE-AC04-83AL18796

DRAWING NO.
H/M-DS-10-0222

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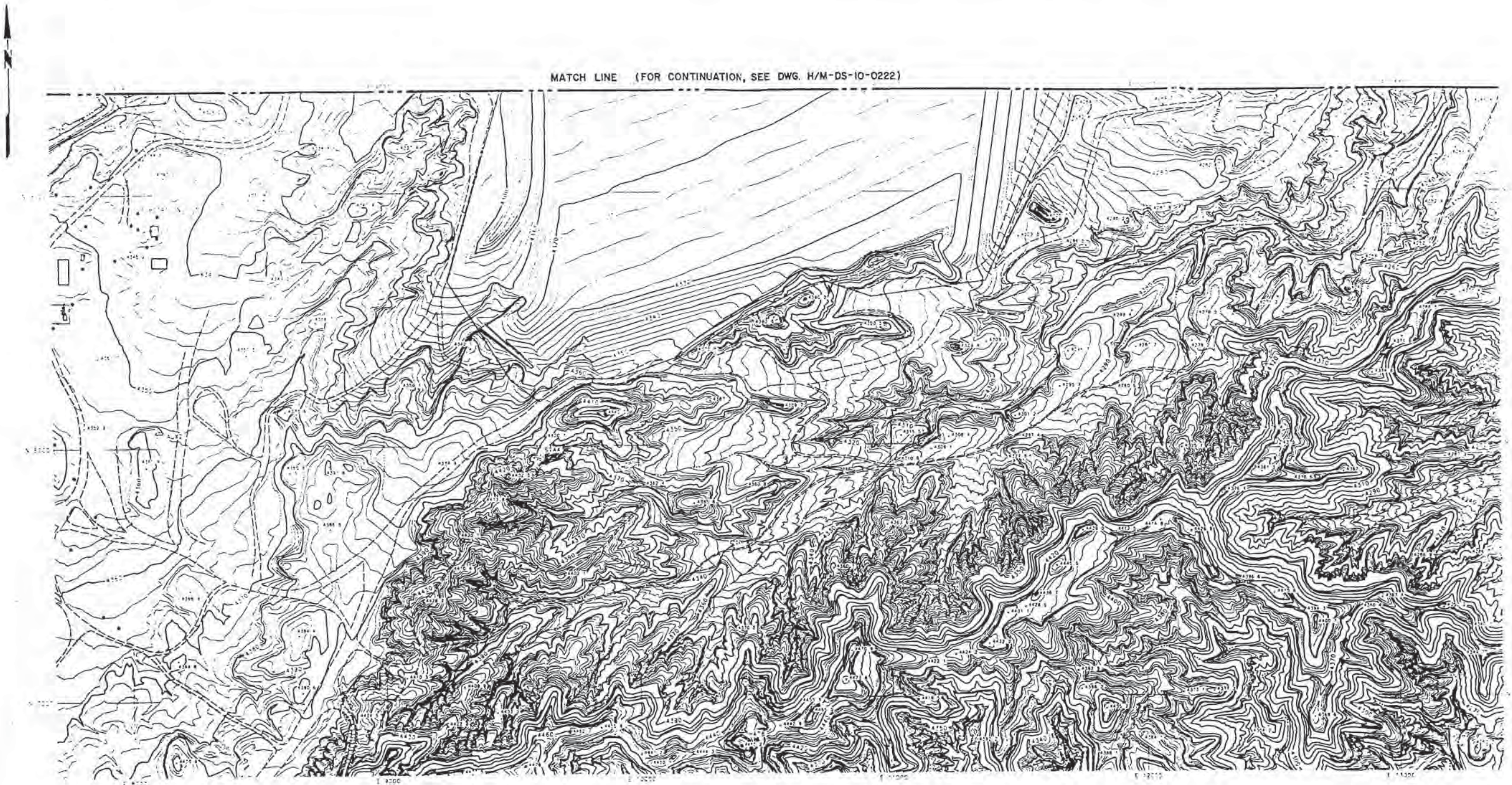

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SCALE FEET

NOTE:

1. TOPOGRAPHY IS PROVIDED BY AERO-GRAPHICS INC., SALT LAKE CITY, UTAH BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 23, 1995.

LEGEND:

—•—•—	FENCE
═ ═ ═	UNIMPROVED ROAD
—…—	FLOWPATH
△ AUX2	SURVEY CONTROL POINT
●	UTILITY POLE

REFERENCE DRAWINGS:

H/M-DS-10-0222 HAT AS-BUILT TOPOGRAPHIC MAP (SHEET 1 OF 2)

QA MK-F	NO	DATE	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP
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U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED — DRAWN —
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INSPECTED —
RECOMMENDED —
APPROVED — DATE — — DOE PROJECT ENGINEER — DATE —

MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA

HAT - AS BUILT TOPOGRAPHIC MAP
(SHEET 2 OF 2)

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-DS-10-0223
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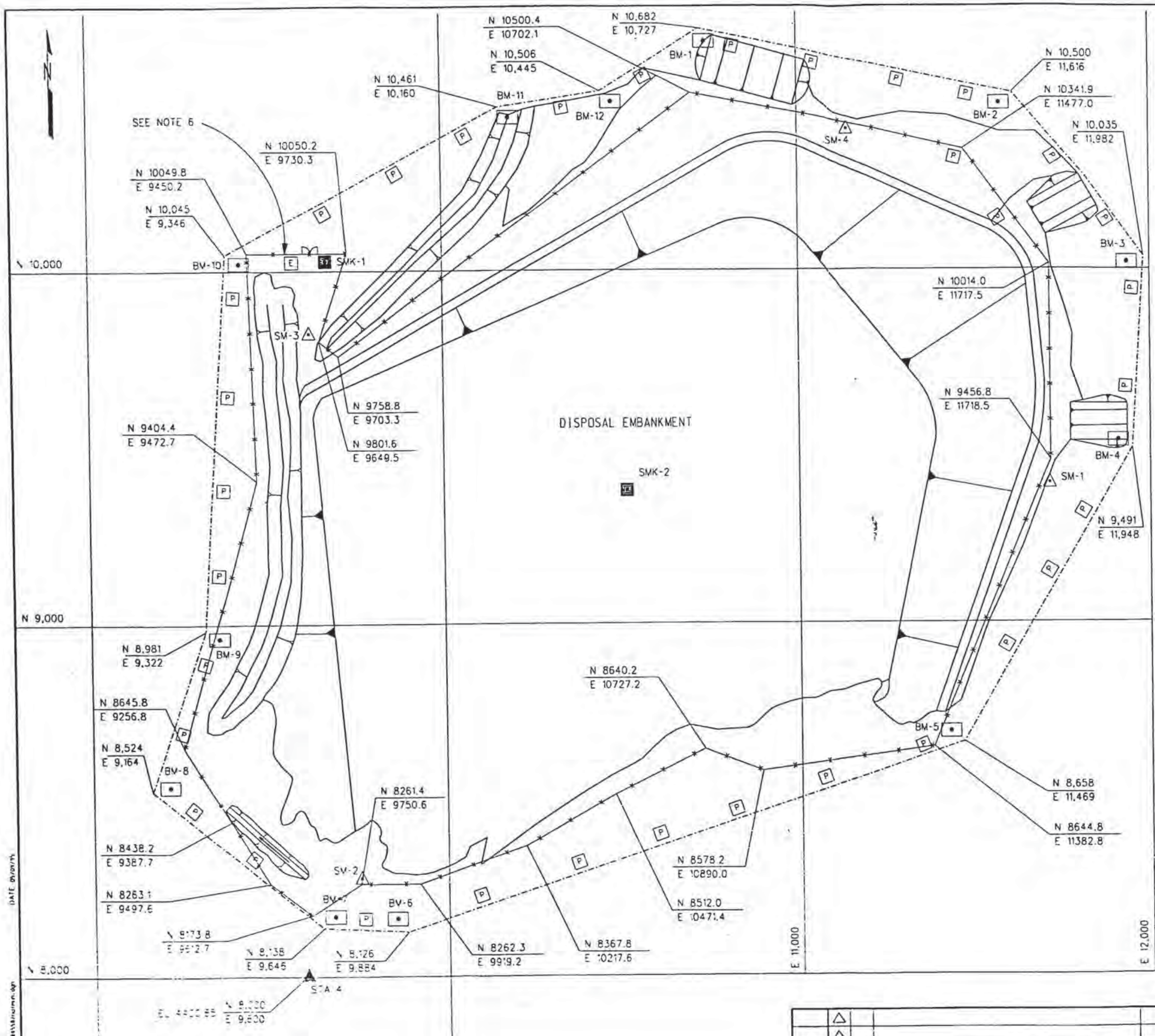

NOTES:

1. SURFACE FEATURES SHOWN ARE APPROXIMATE.
2. FOR DISPLACEMENT MONUMENT LOCATION, SEE DWG. NO. H/M-DS-10-0212.
3. THE BOUNDARY MONUMENTS WERE OFFSET 10 FEET ALONG THE NORTHERLY AND EASTERLY AXIS FROM THE SITE BOUNDARY CORNERS INSIDE THE LEGAL SITE BOUNDARIES.
4. PERIMETER SIGNS WERE LOCATED 5 FEET INSIDE THE DISPOSAL SITE BOUNDARY. THE ENTRANCE SIGN SHALL BE LOCATED IMMEDIATELY ADJACENT TO THE ENTRANCE GATE 5 FEET INSIDE THE FENCE.
5. GRANITE SITE MARKER SMK-1 WERE SET ADJACENT TO THE ENTRANCE AT A DISTANCE OF 10 FEET INSIDE THE FENCE LINE SUCH THAT IT DOES NOT RESTRICT VEHICULAR TRAFFIC.
6. WHERE CROSSING THE WEST DITCH, THE FENCE WERE CONSTRUCTED SUCH THAT POSTS AND WIRES DO NOT OBSTRUCT DITCH FLOW, AS DIRECTED BY THE CONTRACTOR.

LEGEND:

△ SM-1	PERMANENT SURVEY MONUMENT
▲ STA 4	EXISTING SURVEY MONUMENT
⊡ BM-2	PERMANENT BOUNDARY MONUMENT (SEE NOTE 3)
■ SMK-2	GRANITE SITE MARKER
P	PERIMETER SIGN (SEE NOTE 4)
E	ENTRANCE SIGN (SEE NOTE 4)
⊓⊓	CHAIN LINK FENCE AND 40' WIDE DOUBLE LEAF SWING GATE
—×—	BARBED WIRE FENCE
⊤⊤	EMBANKMENT
—·—·—	SITE BOUNDARY

REFERENCE DRAWINGS:

H/M-DS-10-0212 TAILINGS EMBANKMENT PLAN

LOCATION OF MONUMENTS

DESCRIPTION	NORTHING	EASTING	ELEVATION
BM-1	10,672.0	10,737.2	4238.86
BM-2	10,490.1	11,606.0	4240.18
BM-3	10,025.1	11,972.0	4252.01
BM-4	9,501.0	11,938.1	4254.65
BM-5	8,668.1	11,459.1	4301.40
BM-6	8,131.2	9,879.2	4437.75
BM-7	8,188.1	9,646.0	4366.98
BM-8	8,534.2	9,174.1	4315.51
BM-9	8,971.4	9,332.4	4303.84
BM-10	10,035.1	9,356.0	4309.36
BM-11	10,451.0	10,170.0	4270.26
BM-12	10,496.1	10,455.0	7275.18
SMK-1	10,038.8	9,719.6	4300.54
SMK-2	9,376.3	10,514 7	4319.08
SM-1	9,664.5	11,862.4	4274.57
SM-2	8,275.0	9,749.4	4363.84
SM-3	10,072.5	9,717.4	4299.68
SM-4	10,435.1	11,313.0	4269.03

0ft 150 300 450ft
SCALE

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U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED DRW
DRAWN RGS
CHECKED J. C. KUO
INSPECTED W. LIN
RECOMMENDED R. F. CLARE
APPROVED D.R. SANDERS
DATE 6/29/94
D. BOLTON 6/29/94
C. RICKETS 6/29/94
DOE PROJECT ENGINEER R EDGE
DATE 7/11/94

MEXICAN HAT AND MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, AZ
LONG-TERM SURVEILLANCE PLAN - PART 1

LOCATION OF MONUMENTS, MARKERS AND SIGNS

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO DE-AC04-83AL18796
DRAWING NO H/M-DS-10-0240
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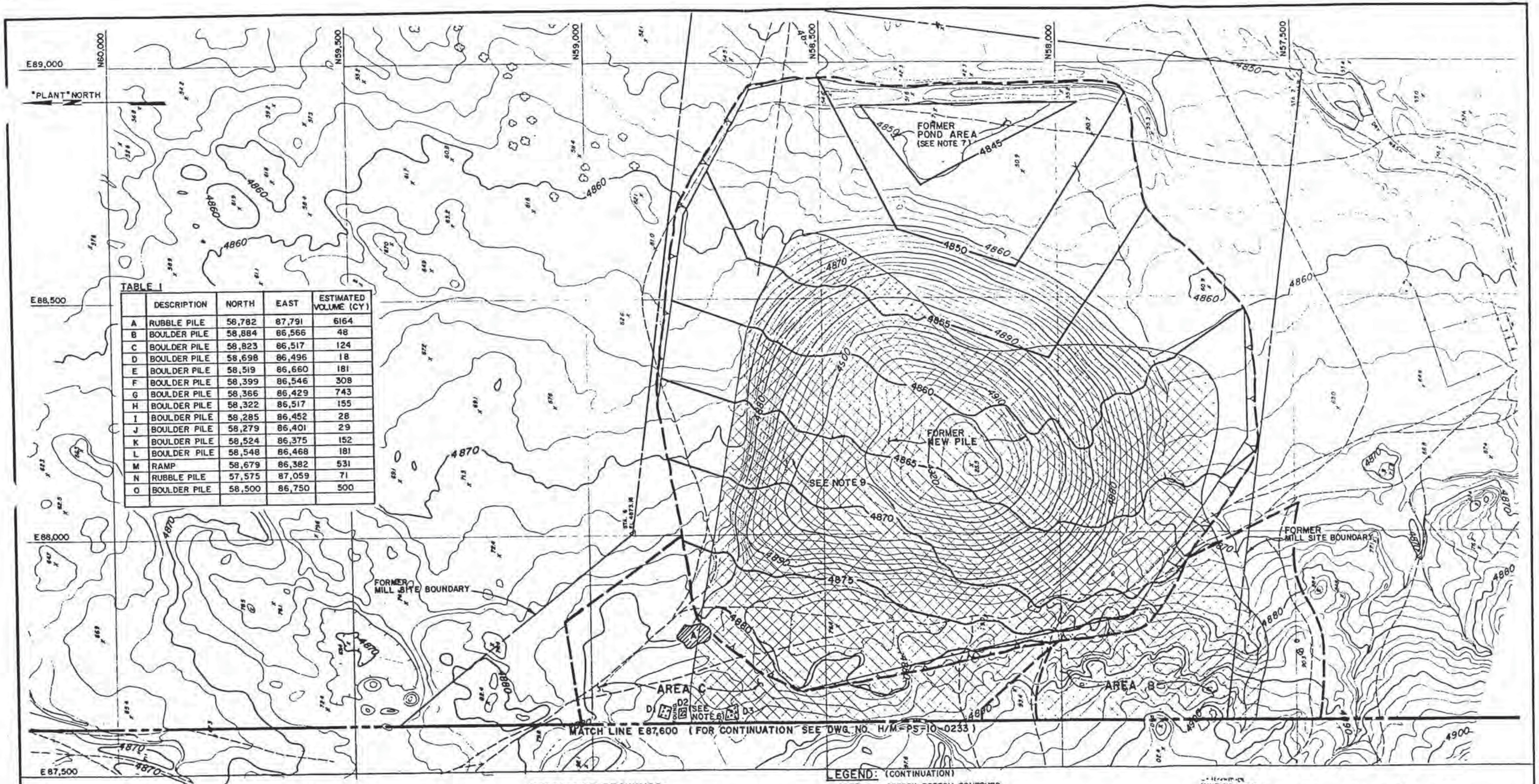

TABLE I

	DESCRIPTION	NORTH	EAST	ESTIMATED VOLUME (CY)
A	RUBBLE PILE	58,782	87,791	6164
B	BOULDER PILE	58,884	86,566	48
C	BOULDER PILE	58,823	86,517	124
D	BOULDER PILE	58,698	86,496	18
E	BOULDER PILE	58,519	86,660	181
F	BOULDER PILE	58,399	86,546	308
G	BOULDER PILE	58,366	86,429	743
H	BOULDER PILE	58,322	86,517	155
I	BOULDER PILE	58,285	86,452	28
J	BOULDER PILE	58,279	86,401	29
K	BOULDER PILE	58,524	86,375	152
L	BOULDER PILE	58,548	86,468	181
M	RAMP	58,679	86,382	531
N	RUBBLE PILE	57,575	87,059	71
O	BOULDER PILE	58,500	86,750	500

NOTES:

1. EXCAVATION OF CONTAMINATED MATERIAL IN AREAS A, B, C, E AND THE OLD PILE WERE AT THE DIRECTION OF THE CONTRACTOR IN THE FIELD. DEPTHS OF CONTAMINATION IN AREAS C, E AND THE OLD PILE AVERAGED 1 FOOT, HOWEVER THE ROCKY TERRAIN PROHIBITED LEVEL EXCAVATION.
2. EXCAVATION PLAN SHOWN IS APPROXIMATE. ACTUAL DEPTHS AND EXTENT OF EXCAVATION WERE DETERMINED IN THE FIELD BY THE CONTRACTOR BASED ON RADIOLOGICAL SURVEYS.
3. EXCAVATED SLOPES WERE NOT EXCEED 2 (H): 1 (V) FOR CUTS IN SOIL. ROCK SLOPES WERE AS DIRECTED BY THE CONTRACTOR.
4. THE AREAS SHOWN WERE BASED ON THE BENDIX REPORT WHICH IS INCLUDED IN THE INFORMATION FOR BIDDERS.
5. LOCATIONS AND QUANTITIES FOR RUBBLE AND BOULDER PILES (SEE TABLE I) SUPERCEDED THE VALUES GIVEN IN THE BENDIX REPORT.
6. LOCATION OF FACILITIES DEMOLISHED WERE APPROXIMATE.
7. THE POND LINER AND ANY UNDERLYING CONTAMINATED MATERIAL WERE REMOVED AFTER ALL OTHER CONTAMINATED MATERIALS AT THE MONUMENT VALLEY SITE HAVE BEEN REMOVED.
8. ALL COORDINATES SHOWN ARE "PLANT" COORDINATES UNLESS NOTED OTHERWISE.
9. SURFACE AND CONDITION OF ROCK UNDER CONTAMINATED MATERIALS WERE IRREGULAR AND VARIED WIDELY.

19

REFERENCE DRAWINGS:

H/M-PS-10-0233 MON-CONTAMINATED MATERIAL EXCAVATION PLAN (SHEET 2 OF 2)

LEGEND:

⊤⊤	TOP OF CUT

LEGEND: (CONTINUATION)

—4870—	APPROX. BOTTOM CONTOURS OF EXCAVATIONS
— — —	LIMIT OF CONTAMINATED AREA
—·—·—	MILL SITE BOUNDARY
▨ A	NOT TO SCALE RUBBLE OR BOULDER PILE (SEE NOTE 5 AND TABLE 1)
⛶ D1	FACILITY TO BE DEMOLISHED AND ID NUMBERS SEE INFORMATION FOR BIDDERS FOR DETAILS
⊠	AREA OF ROCK CLEANUP

PATRICK E. GRIFFIN
31 Jan 92
STATE OF UTAH

QUALITY REQUIREMENTS
Steven Mantz
07/03/92

100 0 100 200
SCALE FEET

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U. S. DEPARTMENT OF ENERGY
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MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

MON-CONTAMINATED MATERIAL EXCAVATION PLAN
(SHEET 1 OF 2)

DESIGNED CM
DRAWN RBC
CHECKED
INSPECTED
RECOMMENDED
APPROVED
DATE 1/31/92
DOE PROJECT ENGINEER Steve Hamp
DATE 2/3/92

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-PS-10-0232
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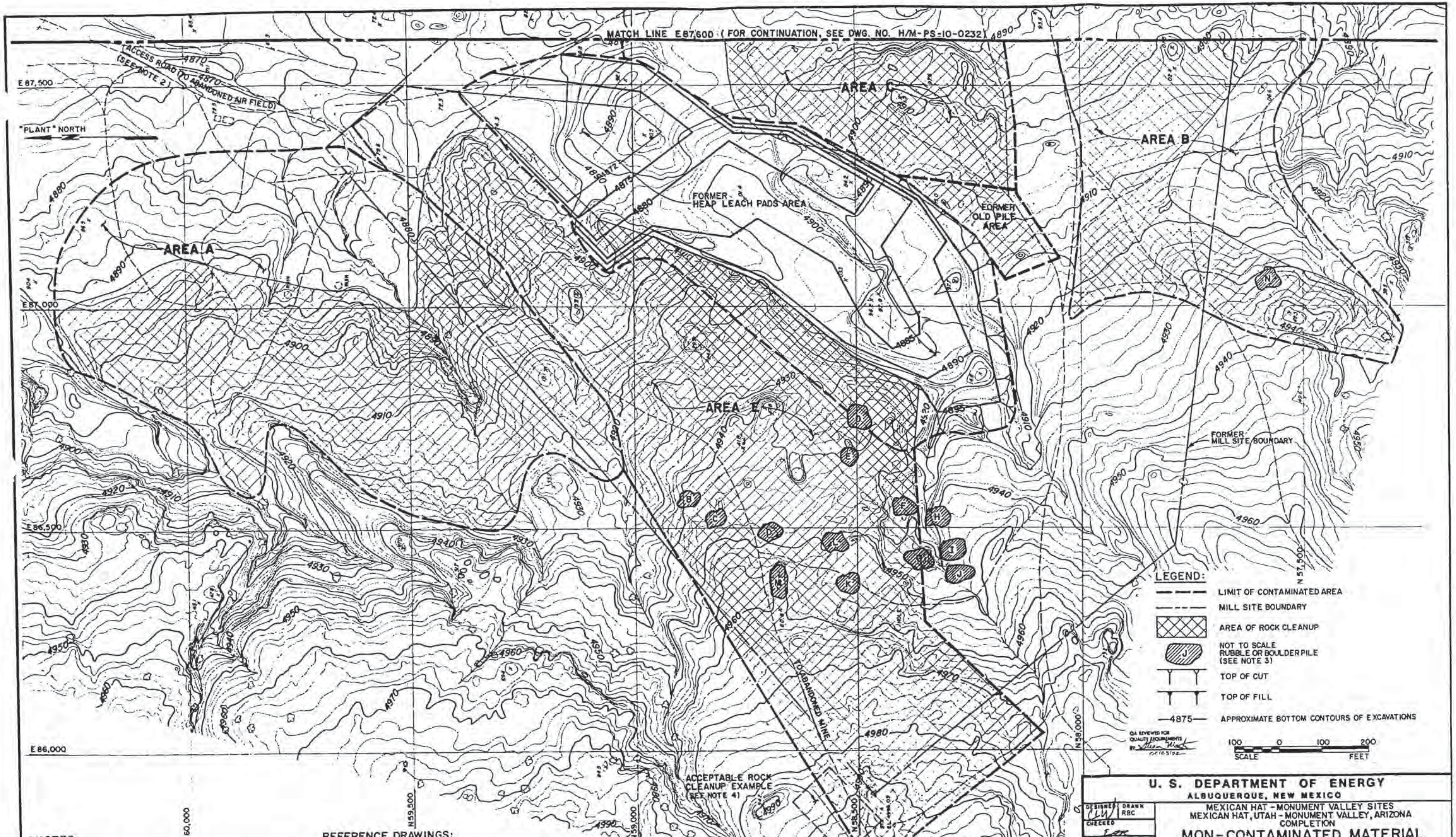

QA REVIEWED FOR QUALITY REQUIREMENTS BY Steven Mack 06/03/92

NOTES:

1. FOR ADDITIONAL NOTES SEE DRAWING NO. H/M-PS-10-0232.
2. CONTAMINATED MATERIALS WERE REMOVED WITHIN 100' FROM THE CENTERLINE OF THE ACCESS ROAD TO THE ABANDONED AIRFIELD TO NORTHING 63,400.
3. SEE TABLE 1 ON DWG. NO. H/M-PS-10-0232 FOR THE COORDINATES AND VOLUMES OF THE RUBBLE AND BOULDER PILES.
4. THE FINAL ROCK SURFACE OF OFF-PILE CLEANUP WAS SIMILAR TO THE ACCEPTABLE ROCK CLEANUP EXAMPLE AREA OR AS APPROVED BY THE CONTRACTOR.
5. EXCAVATION PLAN SHOWN IS APPROXIMATE. ACTUAL DEPTHS AND EXTENT OF EXCAVATION WERE DETERMINED IN THE FIELD BY THE CONTRACTOR BASED ON RADIOLOGICAL SURVEYS.

REFERENCE DRAWINGS:

H/M-PS-10-0232	CONTAMINATED MATERIAL EXCAVATION PLAN (SHEET 1 OF 2)

x

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APPROVED
DATE 1/31/92
DOE PROJECT ENGINEER
DATE -/3/92

MEXICAN HAT - MONUMENT VALLEY SITES
MEXICAN HAT, UTAH - MONUMENT VALLEY, ARIZONA
COMPLETION

MON-CONTAMINATED MATERIAL EXCAVATION PLAN
(SHEET 2 OF 2)

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT
180 HOWARD ST SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO. H/M-PS-10-0233
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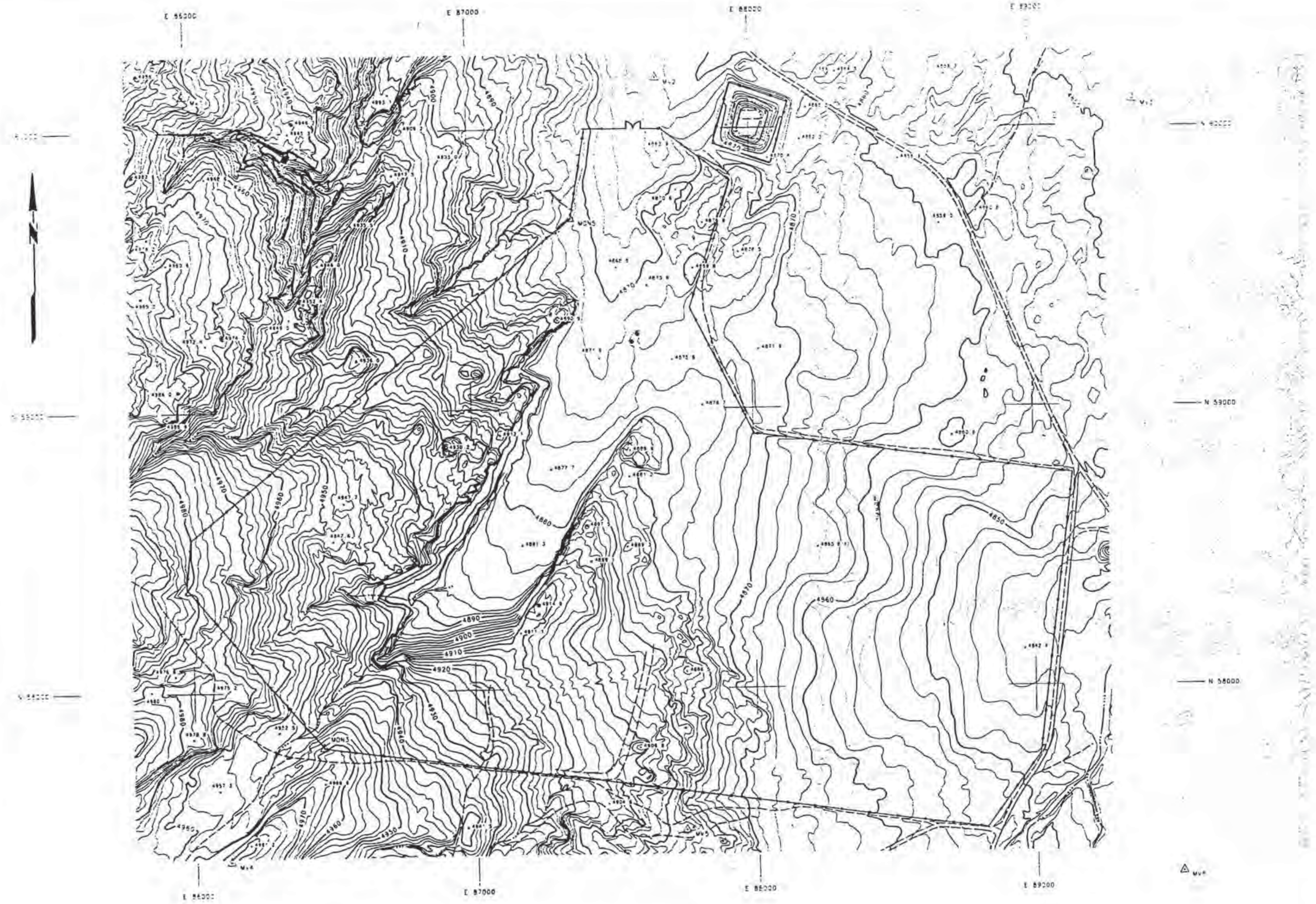
NOTE:

1. TOPOGRAPHY IS PROVIDED BY AERO-GRAPHICS INC., SALT LAKE CITY, UTAH BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 23, 1995.



LEGEND:

———	FENCE
═══	UNIMPROVED ROAD
—…—	FLOWPATH
△MV2	SURVEY CONTROL POINT
●	UTILITY POLE

200 0 200 400
SCALE FEET

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U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

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DOE PROJECT ENGINEER — DATE —

MEXICAN HAT-MONUMENT VALLEY SITES
MEXICAN HAT, UTAH-MONUMENT VALLEY, ARIZONA

MON-AS BUILT TOPOGRAPHIC MAP

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
UMTRA PROJECT
180 HOWARD ST. SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796
DRAWING NO H/M-PS-10-0237
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Appendix C4

Site Visit Report, June 30, 2016

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U.S. Department of Energy Office of Legacy Management

Site Visit Report

Refer to the Quality Assurance Manual *Section 1.5.3.4 for a description of this process.*

Assessment Title *(Site Visit of NE Slope and Areas east of cell)***:** Land Survey of additional depressions and meet with Cassandra Bloedel of the NN EPA about areas of concern	**Site** *(Mexican Hat Site Mexican Hat UT)***:** Mexican Hat, UT, Site Mexican Hat

Date(s) Performed: June 30 2016

Site Manager or Lead: Joey Gillespie

Issued By: Joey Gillespie **Date Issued:** 7/21/2016

Purpose and Scope *(reason for site visit assessment and scope of area examined)***:**

- Meet Navarro land survey crews at the Mexican Hat Disposal cell north east slope to identify and survey in additional depressions at the base of the slope.
- Meet with Navajo Nation EPA Cassandra Bloedel and Frederic Sherman. About areas of elevated radiation readings in the area of the former mill site. Area was previously investigated and deemed clean in 2011

Summary and Results *(brief summary of results including what was examined and what was observed)***:**

08:30-09:58 brief crews and NN EPA to the Plan of the Day and JSA

09:58 -11:00 discuss finding of mill balls in 2011;size and shape.;NN EPA points out old haul road as one of the areas of concern also what appears to be stained soil and rock and pushed up dirt against the former haul road edges. NN EPA also mentions that ore could have been spilled from the haul trucks

11:00 -11:16 Branden and Trisha (Navarro Land Surveyors)on site; brief to the JSA and POD and begin setting up for the survey. NN AML Jonie and DOE LM Angelita off site to visit the Monument Valley site. J Gillespie stays with the surveyors. NN EPA off site back to their office.

11:00 – 13:00 Surveyors setting up instruments.

13;00-1530 Surveyors work to tie in the existing and additional cell cover depressions

14:00 all crews off site for the day and headed back to Grand Juncition

---

Conclusions *(detailed description of processes and areas examined. Describe problem areas as well as positive practices. Include action items that were completed during site visit)***:**

Nothing to conclude at this time

Action Items *(follow-up with site manager or lead on action items listed)***:**

- Angelita to coordinate with AML and NN EPA for radiation survey of the areas of concern.
- Surveyors to return if necessary to complete land survey of areas of concern
- Review old photographs and drawings to determine location of former haul roads and potential origin of mill balls
- NN EPA to provide photos of the mill balls to Angelita
- Keep Jonie of NN AML informed of site visits and dates of the rad survey.
- Send Construction Completion Reports for Mexican Hat to Jonie at AML:
- Send Gas Hills East reports to Gilbert of NN AML

Observations *(examples: Consider repainting door when weather permits. Housekeeping is exceptionally good)***:**

- Dark staining is partially moisture on the top of sediments. Dark staining on the former haul road near the old mill site is attributed to baking by ash and lava during the activity from Mount Ahambra.
- Some former T posts were flagged that potentially outline the former staging area for the surveyors to locate
- No Mill balls or other mill related materials were noted during the walkover

Assessment Title *(Site Visit of NE Slope and Areas east of cell)***:**	**Site** *(Mexican Hat Site Mexican Hat UT)***:**
Land Survey of additional depressions and meet with Cassandra Bloedel of the NN EPA about areas of concern	Mexican Hat, UT, Site Mexican Hat

-

Documents/Procedures Reviewed *(reference information or required documents used to prepare for and conduct the site visit)***:**

- Mexican Hat Construction Completion reports
- Prior Areas of Concern Trip Report performed in 2011

Persons Contacted:

Casandra Bloedel NN EPA
Joni Nofchissey NN AML

E-Mail Distribution *(include site manager or lead, responsible manager, program manager and their administrative assistant, Corrective Action, and affected individuals)***:**

Angelita.Denny@lm.doe .gov
Joey.gillespie@lm.doe.gove
Gj.rc@lm.doe.gov

	
Photo 1 South over Area of Concern	Photo 2. South and East over Area of Concern
	
Photo 3. Former Mill buildings near Area of Concern	Photo 4 NN EPA Personnel pointing out elevated areas
	
Photo 5. Former Road Bed East of Disposal cell	Photo 6 View East of Access Road and Area of Concern

	
Photo 7 NN EPA Walking over Darker Soils	Photo 8 Dark staining of soils within Area of Concern
	
Photo 9. Darker soils near possible haul road east of the cell	Photo 10 Soil accretion within Area of Concern
	
Photo 11. Stained Soil at the end of a possible haul road East of the site	Photo 12. Mexican Hat Disposal cell east of the Area of Concern in foreground

Photo 13. View southeast of Area of Concern Disposal Cell to the Left of Photo

Photo 14. View southeast of area of concern with Halchita water tank in background

Photo 15. Remnant of steel T post

Photo 16. East of Area of Concern with Disposal cell in background

Photo 17. Area of Concern with Disposal Cell in background

Photo 18. Area of Concern along access road east of the Disposal Cell

Photo 19. Surveyors gathering data on existing depressions on the northeast side slope of the Mexican Hat Disposal Cell

Photo 20. Surveyors gathering data on existing depressions on the northeast side slope of the Mexican Hat Disposal Cell

Photo 21 Red outlines of depressions near the toe of northeast slope and Gully #2

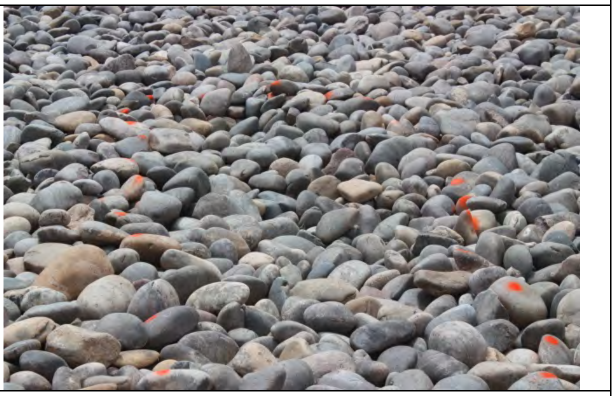

Photo 22 Red outlines of depressions near the toe of northeast slope and Gully #2

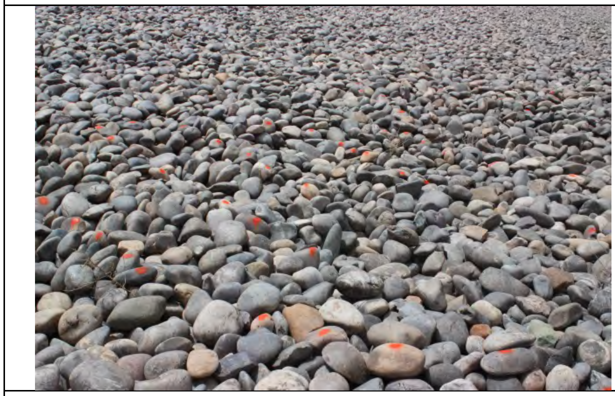

Photo 23 Red outlines of depressions near the toe of northeast slope and Gully #2

Photo 24 Red outlines of depressions near the toe of northeast slope and Gully #2

	
Photo 25. Sediment filling erosion channel at base of north east slope	Photo 26. Sediment filling erosion channel at base of north east slope
	
Photo 27 Surveyors working on collection of coordinates for depressions above RipRap	Photo 28 Red outlined depressions at contact with erosional channel Rip Rap

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Appendix C5

Site Visit Report, August 18 and 19, 2016

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U.S. Department of Energy Office of Legacy Management

Site Visit Report

Refer to the Quality Assurance Manual *Section 1.5.3.4 for a description of this process.*

Assessment Title *(Site Visit after Flash Flood event)*: Visit Monument Valley Flooding damage to Fence and then to Mexican Hat to review depressions on north east cell cover	**Site** *(Mexican Hat Site Mexican Hat UT/ Monument Valley AZ)*: Click here to enter text.

Date(s) Performed: August 18 and 19 2016

Site Manager or Lead: Joey Gillespie DOE LM Manager Angelita Denny

Issued By: Joey Gillespie **Date Issued:** 8/29/2016

Purpose and Scope *(reason for site visit assessment and scope of area examined)*:

- Visit the two sites to observe and document damage from recent precipitation event in early August

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Summary and Results *(brief summary of results including what was examined and what was observed)*:

08:30-13:30 Drive with Angelita Denny to Monument Valley Site brief Angelita to the Plan of the Day and JSA

13:30 -15:30 Delineate former evaporative pond area with yellow rope and t-posts with signs requiring a Rad Worker Permit to enter or do work in the former evap pond area. Need additional cord to outline the entire evap pond area

15:30 – 16:30 Review the wash area for flash flood damage at the north end fence crossings. Ben Stanley did what repairs he could but the flash flood areas will need an engineered solution in the future

16:30 off site to Monument Valley Grocery for additional rope.

<u>8/19/2016 Friday</u>

09:00 – 10:00return to Monument Valley in order to meet with Ben Stanley ; Brief to the POD and JSA then visit the south drainage wash area and look at the amount of debri against the fence.

- Ben needs a First Aid Kit and gloves
- Perimeter signs around the perimeter
- Gate or site entrance signs
- Need additional rope to outline the Former Evap Pond Area

10:00-11;50 drive to Mexican Hat and review disposal cell depressions. No real change to the depressions caused by the precipitation event. Install signs below the perimeter signs where they were missing and drive down to Gypsum Creek to view flood damage. It was noted that significant sediment was transported and placed over the Seep location # 0922. Seep is no longer visible and the sign had been washed away. Denny and Gillespie did not hike up the drainage to ck on Seep 0248 due to time constraints.

<u>Mexican Hat</u>

- Seep #0248 is scheduled to be sampled September 26 but this may change
- Ruts were scheduled to be repaired August 25th
- Sign needs to be replaced at Seep # 0922
- Additional debri needs to be carried to the landfill from surrounding the cell
- Entrance road has some erosion occurring that may need attention in the future

11:50-19:00 Drive back to Grand Junction from Mexican Hat.

Conclusions *(detailed description of processes and areas examined. Describe problem areas as well as positive practices. Include action items that were completed during site visit)*:

Assessment Title *(Site Visit after Flash Flood event)*: Visit Monument Valley Flooding damage to Fence and then to Mexican Hat to review depressions on north east cell cover	**Site** *(Mexican Hat Site Mexican Hat UT/ Monument Valley AZ)*: Click here to enter text.

Nothing to conclude at this time

Action Items *(follow-up with site manager or lead on action items listed)*:

- Replace the sign at Seep 0922
- Place rock in erosional channel along entrance road at sign P-22

Observations *(examples: Consider repainting door when weather permits. Housekeeping is exceptionally good)*:

- Access to Monument Valley site had significant washouts and culvert damage
- No Change to depressions on the cell cover at Mexican hat(north east side slope) after recent heavy precipitation
- Significant sediment buildup in Gypsum Creek covering Seep # 0922 and removing the sign

Documents/Procedures Reviewed *(reference information or required documents used to prepare for and conduct the site visit)*:

- Job Safety Analysis and Plan of the Day

Persons Contacted:

Ben Stanley at the Monument Valley Site

E-Mail Distribution *(include site manager or lead, responsible manager, program manager and their administrative assistant, Corrective Action, and affected individuals)*:

Angelita.Denny@lm.doe .gov
Joey.gillespie@lm.doe.gove
Gj.rc@lm.doe.gov

Photo 1 Northeast slope depressions in foreground

Photo 2 Northeast slope depressions in foreground

Photo 3 Overview of the northeast toe and Gully #2

Photo 4 Change in riprap size diagonally across northeast slope

Photo 5 Change in rip rap size diagonally across northeast slope

Photo 6 Gypsum creek deposits over seep location 0922

Photo 7. Gypsum creek sedment deposition from recent precip event

Photo 8. Gypsum creek sedment deposition from recent precip event

Photo 1. Delineation of the Former Evap Pond at Monument Valley site

Photo 2. Delineation of the Former Evap Pond at Monument Valley site

Photo 3. Delineation of the Former Evap Pond at Monument Valley site

Photo 4. Main drainage sheet flow damage to northern fence crossing

Photo 5 Southern fence crossing of main wash

Photo 6 Southern fence crossing of main wash

	
Photo 7 Southern fence crossing of main wash	Photo 8 Southern fence crossing of main wash
	
Photo 9 Southern fence crossing of main wash	Photo 10 Southern fence crossing of main wash
	
Photo 11. Main wash erosional feature	Photo 12. Erosional outwash overlook of northern fence crossing

Appendix C6

2017 Annual Inspection of the Mexican Hat, Utah, Disposal Site

12.0 Mexican Hat, Utah, Disposal Site

12.1 Compliance Summary

The Mexican Hat, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on April 11, 2017. Subtle depressions in the riprap cover continue to be observed along the toe and lower portions of the northeast side slope of the disposal cell. Visual observations of the depressions indicate the potential for erosion of the underlying sandy gravel bedding layer, the radon barrier, or both. A report that evaluates the depression features and provides a set of options and a recommended path forward is in development. Inspectors identified several routine maintenance needs but found no cause for a follow-up inspection during the annual inspection.

During a site visit on December 14, 2017, a small void in the disposal cell cover was identified near the toe of the northeast side slope near the previously observed depressions. The small void extended to the apparent base of the bedding layer and upper portion of the radon barrier. A follow-up inspection with a radiation control technician was conducted on December 27, 2017. The follow-up inspection confirmed that radiological readings at the void were consistent with background levels.

The U.S. Department of Energy (DOE) conducted annual observational monitoring (i.e., photographic documentation and observational description) of seven designated seeps during the annual inspection. Seep 0248 was dripping and was the only seep with wet conditions; the remaining seeps were dry. Ephemeral drainages along the perimeter of the site were dry; however, the presence of evaporites in these drainage areas provided evidence of recent surface water. Gypsum Creek had several areas of flowing surface water and contained significant areas of evaporites throughout dry areas within and leading to its flow path. Groundwater monitoring is not required.

12.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2007) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 12-1 lists these requirements.

Table 12-1. License Requirements for the Mexican Hat, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 12.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 12.5	(b)(4)
Maintenance	Section 3.6	Section 12.6	(b)(5)
Emergency Measures	Section 3.6	Section 12.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 12.8	(b)(2)

12.3 Institutional Controls

The 119-acre disposal site, identified by the property boundary shown in Figure 12-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation to perform remedial actions at the former uranium processing sites. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site.

The site was accepted under the general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, fence, perimeter signs, site markers, and survey and boundary monuments.

12.4 Inspection Results

The site, 1.5 miles south of the town of Mexican Hat, Utah, was inspected on April 11, 2017. The inspection was conducted by E. Tyrrell and S. Hall of the DOE Legacy Management Support (LMS) contractor. A. Denny (DOE site manager) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

12.4.1 Site Surveillance Features

Figure 12-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 12-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 12.10.

12.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from a short unmarked dirt road off U.S. Highway 163 that ends at a graded parking area. Minor erosion continues to occur along the dirt access road, but the site remains accessible. Entrance to the site is through a locked steel entrance gate at the northwest corner of the site (PL-1). The entrance gate was locked and functional. The entrance sign is affixed to a steel post immediately behind the entrance gate (PL-2). The entrance sign listed outdated DOE and Navajo Nation contact information and was replaced during a later site visit; no other maintenance needs were identified.

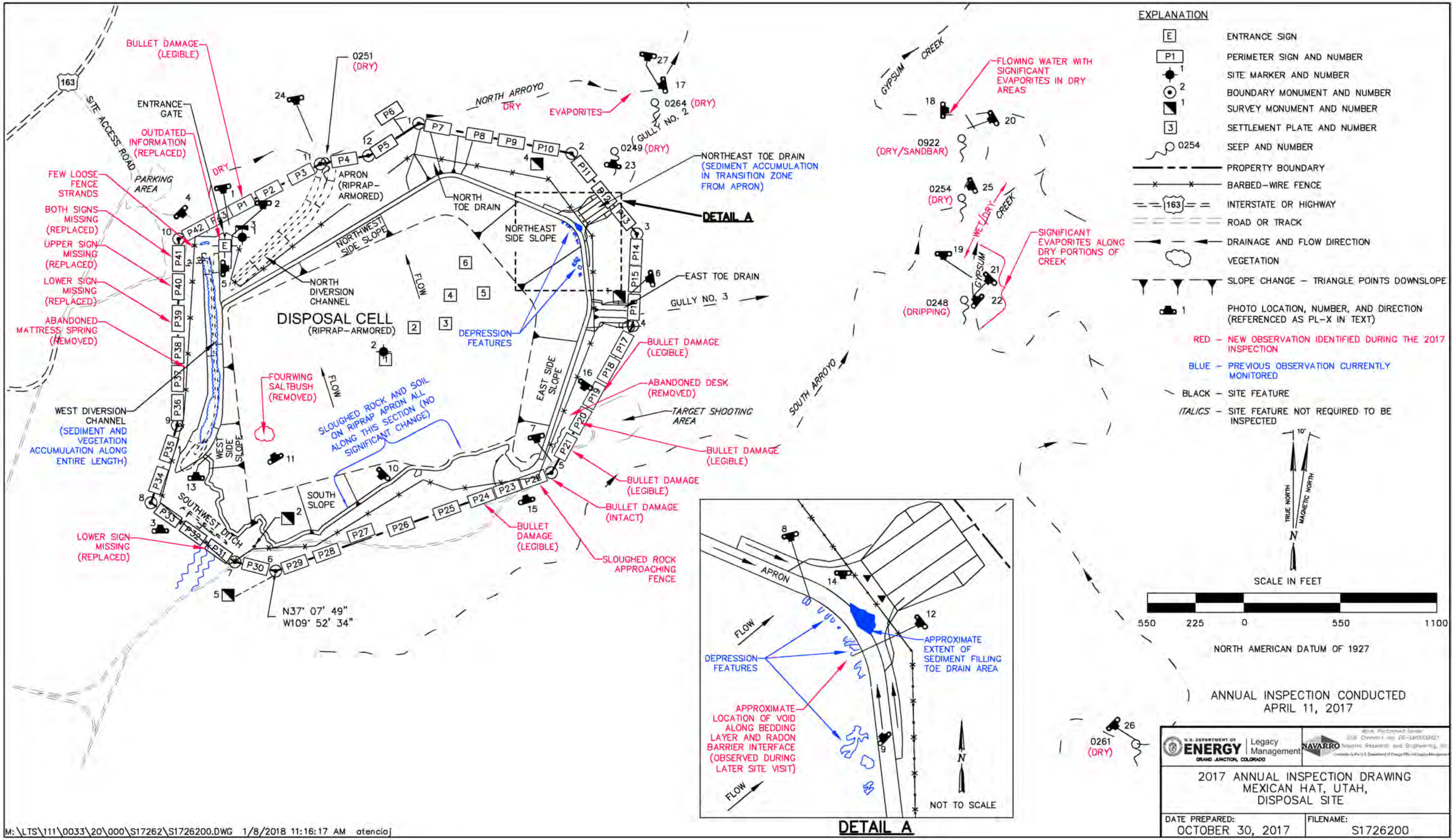

Figure 12-1. 2017 Annual Inspection Drawing for the Mexican Hat, Utah, Disposal Site

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12.4.1.2 Fence and Perimeter Signs

A barbed-wire fence encloses the disposal cell (PL-3). Periodically, the fence is damaged by livestock, erosion, or vandalism and requires repair. Loose fence strands were identified at a few locations across the site, but did not warrant maintenance.

There are 43 pairs of perimeter signs, designated P1 through P43 (each pair consisting of an upper property ownership/no-trespassing sign and a lower sign identifying the site as a radioactive materials disposal site), positioned along the property boundary. Each paired perimeter sign is attached to a single steel post set in concrete. Perimeter signs are typically located outside the fence that encloses the disposal cell (PL-4), but some are affixed directly to the fence or immediately inside the fence. Several perimeter signs (P19, P20, P21, and P24) have bullet damage but remain legible. Additionally, several perimeter signs are bent (presumably due to animal contact) but did not require maintenance during the annual inspection. One or both of the paired perimeter signs were missing during the inspection at perimeter sign locations P31, P39, P40, and P41 and were replaced during a later site visit from May 8–10, 2017; no other maintenance needs were identified.

12.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the fence near the entrance gate (PL-5); its concrete base has several minor cracks, but they do not compromise the integrity of the base and repairs are not necessary at this time. Site marker SMK-2 is on the top slope of the disposal cell. No immediate maintenance needs were identified.

12.4.1.4 Survey and Boundary Monuments

Four survey monuments were installed at the site during construction of the disposal cell for survey control. SM-1 was not located during the inspection but was identified on top of a large mound during a later site visit (PL-6). Twelve boundary monuments delineate the property boundary. Bullet damage was identified at BM-5 (PL-7), but repairs are not necessary at this time as the boundary monument remains legible and intact. No immediate maintenance needs were identified.

12.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas (referred to as “transects” in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the toe drains and diversion channels, (3) the balance of the site and the site perimeter, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of settlement, erosion, or other modifying processes that might affect the site’s conformance with LTSP requirements.

12.4.2.1 Disposal Cell

The disposal cell, completed in 1994, occupies 68 acres. The disposal cell is armored with riprap to control erosion. No evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell were present on the top slope of the disposal cell.

Subtle depressions in the riprap cover along the toe and lower portions of the northeast side slope of the disposal cell were identified during the 2016 annual inspection and a subsequent follow-up inspection on April 8, 2016. Additional site visits to further characterize the depression features were completed in 2016. The additional site visits were not identified in the *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2016) but are detailed in an upcoming northeast slope cover depressions evaluation report. Based on visual observations, no major changes to the depression features were evident during the 2017 annual inspection relative to previous visual observations in 2016 (PL-8 and PL-9).

Evaluations of the depression features as they relate to long-term performance of the disposal cell are ongoing. A radiological survey performed on the northeast side slope in September 2017 did not identify any elevated gamma radiation readings in the areas of observed depressions relative to visually determined unaffected areas of the disposal cell located topographically upgradient of the depression features on the northeast side slope. DOE has initiated supplemental monitoring and evaluation activities related to the depression features, including the installation of an onsite meteorological weather station; performing semiannual ground-based light imaging, detection, and ranging (LiDAR) topographic surveys along the northeast side slope (the first event was performed in October 2017); and semiannual collection of horizontal and vertical GPS grade survey data at the existing settlement plates on the top slope of the disposal cell. A report that provides an evaluation of the depression features as well as a set of options and a recommended path forward is in development and will be distributed to NRC and stakeholders upon completion.

There was no noticeable increase of sloughed red rock and soil along the south apron of the disposal cell (PL-10). Because the apron in this area is immediately adjacent to the base of the steep rocky cliff face along the southern edge of the disposal cell cover, it is expected that sediment and unstable rock from the cliff face will continue to fall onto the apron. The accumulated material is not currently impacting the function of the apron, and this area will continue to be monitored.

A single fourwing saltbush (a deep-rooted plant) was identified growing on the southwest portion of the disposal cell top slope (PL-11) during the inspection. This plant was removed at its base with cutting shears, and the remaining plant and root materials were subsequently treated with herbicide during a later site visit; no other maintenance needs were identified during the 2017 annual inspection.

During a site visit on December 14, 2017, with representatives from the Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department, a small portion of the riprap and bedding layer cover components were removed by hand to facilitate inspection of linear depressions observed near the toe of the northeast side slope. At one of the locations, a small void was observed at the apparent base of the bedding layer and upper portion of the radon barrier (PL-12), where a 5 to 6 inch cemented layer was present. The approximate dimensions of the void were 8 inches deep × 12 inches wide. The length of the void was unknown, but it appeared to extend downslope along the interface of the bedding layer and radon barrier. Associated linear depressions observed on the cover in this area are suspected to be associated with this feature and may represent collapsed portions of prior openings with similar conditions. A follow-up inspection was conducted with a radiation control technician on

December 27, 2017, to assess radon and gamma radiation readings at multiple locations across the site, including the area of the observed void. An alphaNUCLEAR Model 597-PX3 radon monitor was used to collect 30-minute continuous samples for radon gas, and a hand-held sodium iodide scintillometer was used to collect gamma radiological readings. All radiological readings were consistent with background levels; no elevated radiological readings were observed. Additional site visits to further evaluate the observed void and to assess the potential for additional areas with similar features are planned for early 2018. NRC was notified of these observations and planned follow-up visits in early January 2018. Subsequent meetings were held with the Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department to discuss the findings. Findings from additional site visits and additional information regarding the void will be included in the depression features evaluation report.

12.4.2.2 Toe Drains and Diversion Channels

Upgradient offsite areas continue to undergo erosion, resulting in the transport of sediment onto the site and into the west diversion channel. The sediment accumulation has promoted the growth of vegetation, including perennial grasses and annual weeds, in the west diversion channel (PL-13). However sediment accumulation and associated vegetation have not adversely affected the performance of the west diversion channel.

Sediment accumulation has also been observed along the transition zone from the apron to the northeast toe drain (PL-14). The origin of this material has not been determined. Windblown sediment that settles on the disposal cell cover may be washed out in this area, which is not of concern. However, if the material is related to the observed depression features on the northeast side slope, it would indicate cover erosion, which would be a concern. Minor vegetation has begun to establish in this area, but that does not currently affect the performance of the northeast toe drain. Inspectors will continue to monitor this area concurrent with the observed depression features on the northeast side slope. No maintenance needs were identified.

12.4.2.3 Balance of the Site and Site Perimeter

Minor erosion continues in upgradient areas along the southwest portions of the site. This is an expected natural process as the exposed geology at the site is brittle and subject to weathering. Inspectors will continue to monitor erosion in these areas, but erosion is not a concern unless it damages the fence or impacts the performance of site drainage and diversion features such as the west diversion channel.

Sloughed rock from an overhanging shelf was observed along the southern perimeter of the site. Although this material currently appears to be stable, this rock is approaching the fence between perimeter signs P22 and P23 and will likely need to be removed or secured to protect the fence from damage or a potential breach (PL-15).

Scattered trash (broken glass, bottles, cans, cardboard, and paper containers) continues to accumulate in the more accessible areas of the site where vehicle access is available. The most noticeable accumulations of trash are located along the access road and in the parking area, the areas on the site outside of the fence between perimeter signs P31 and P42, and the southern portion of the site between perimeter signs P22 and P27. Trespassing just inside the site boundary (outside the fence), as evidenced by vehicle and all-terrain vehicle tracks, occurs in the same areas where trash accumulations are present. However, some trash is likely being transported onto the site via wind from nearby locations.

As in previous years, bulk abandoned items were discovered during the inspection. An abandoned wooden desk was identified outside of the fence but within the site boundary near perimeter sign P20 (PL-16). In addition, an abandoned mattress spring was identified outside the fence but within the site boundary between perimeter signs P37 and P38. These bulk abandoned items were removed from the site and properly disposed of during a later site visit.

Vandalism continues to occur at the site, as indicated by new bullet damage in several perimeter signs and on boundary monument BM-5. This is expected to be an ongoing problem due to the remote location of the site and the fact that access to these areas cannot be restricted. Damaged perimeter signs are replaced when they become illegible. No other maintenance needs were identified.

12.4.2.4 Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were identified.

12.5 Follow-Up Inspections

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site have substantially changed. DOE conducted a follow-up inspection in response to an observed void identified during a site visit after the 2017 annual inspection. The follow-up inspection was conducted with a radiation control technician on December 27, 2017, to assess radon and gamma radiation readings at multiple locations across the site, including the area of the observed void. All radiological readings were consistent with background levels; no elevated radiological readings were observed. Additional site visits to further evaluate the observed void and to assess the potential for additional areas with similar features are planned for early 2018. NRC was notified of these observations and planned follow-up visits in early January 2018.

12.6 Maintenance

The LMS contractor performed maintenance at the site on May 8–10, 2017. The perimeter signs (P31, P39, P40, and P41) that were missing during the inspection were replaced during this maintenance trip. Breakaway bolts were used to affix the perimeter signs that were replaced to the preexisting metal poles set in concrete in an attempt to prevent future theft. Adhesive labels displaying updated contact information and the Office of Legacy Management website address were affixed to the remaining perimeter signs that were readily accessible during this maintenance trip. The fourwing saltbush that was identified on the top slope of the disposal cell was removed at its base with cutting shears; the remaining plant and root materials were subsequently treated with herbicide. The bulk abandoned items (the wooden desk and mattress spring) that were identified during the annual inspection were removed from the site and disposed of properly. In addition, a significant amount of windblown debris and litter was also removed from within and around the site perimeter. Areas of focus included the entire southern portion of the site along the access road leading to the target shooting area and Gypsum Creek overlook, the southwest ditch, the west diversion channel, and the site access road and parking area leading to the entrance gate. Solid waste from the maintenance trip was transported to the San Juan County Landfill south of Blanding, Utah for disposal. Outdated contact information was identified on the site's entrance sign during the annual inspection, and the sign was replaced at a later date. The warning sign near seep 0248 is partially buried and will be repositioned at a later date; no other maintenance needs were identified.

12.7 Emergency Measures

Emergency measures are the actions that DOE will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. The depression features identified along the disposal cell's northeast side slope do not meet the criteria for constituting the need for an emergency action; therefore, no need for emergency measures was identified.

12.8 Environmental Monitoring

12.8.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required because the uppermost aquifer is hydrogeologically isolated from contamination in the overlying formation.

12.8.2 Seep Monitoring

In accordance with Section 3.7.2 of the LTSP, DOE conducts observational monitoring of seven designated seeps during annual inspections as specified in an approved monitoring plan (DOE 2006). Observational monitoring consists of visual observations and photographic documentation of the seven seep locations that are specified in the LTSP. The observed seep locations, shown in Figure 12-2, are primarily the result of the infiltration of precipitation into the surrounding formation or perched water that leaked from the former processing site tailings pond. The majority of seeps have exhibited dry conditions over the past 10 years of observational monitoring.

Since 2010, groundwater discharge from seeps has only been observed at cross-gradient seep 0248, which typically exhibits dripping conditions. During the inspection, water was observed dripping from seep 0248. Since the seep was only dripping and did not exhibit steady flow, an estimated flow rate was not determined. The remaining seeps on the annual monitoring plan exhibited dry conditions during the inspection. Table 12-2 documents the conditions of each monitored seep that was observed during the inspection, including the respective drainage in which each seep occurs and a reference to photographic documentation.

The North Arroyo near the base of seep 0264 was slightly moist with visible evaporites extending to topographically upgradient areas of the ephemeral wash (PL-17). The remainder of the North Arroyo was dry during the inspection.

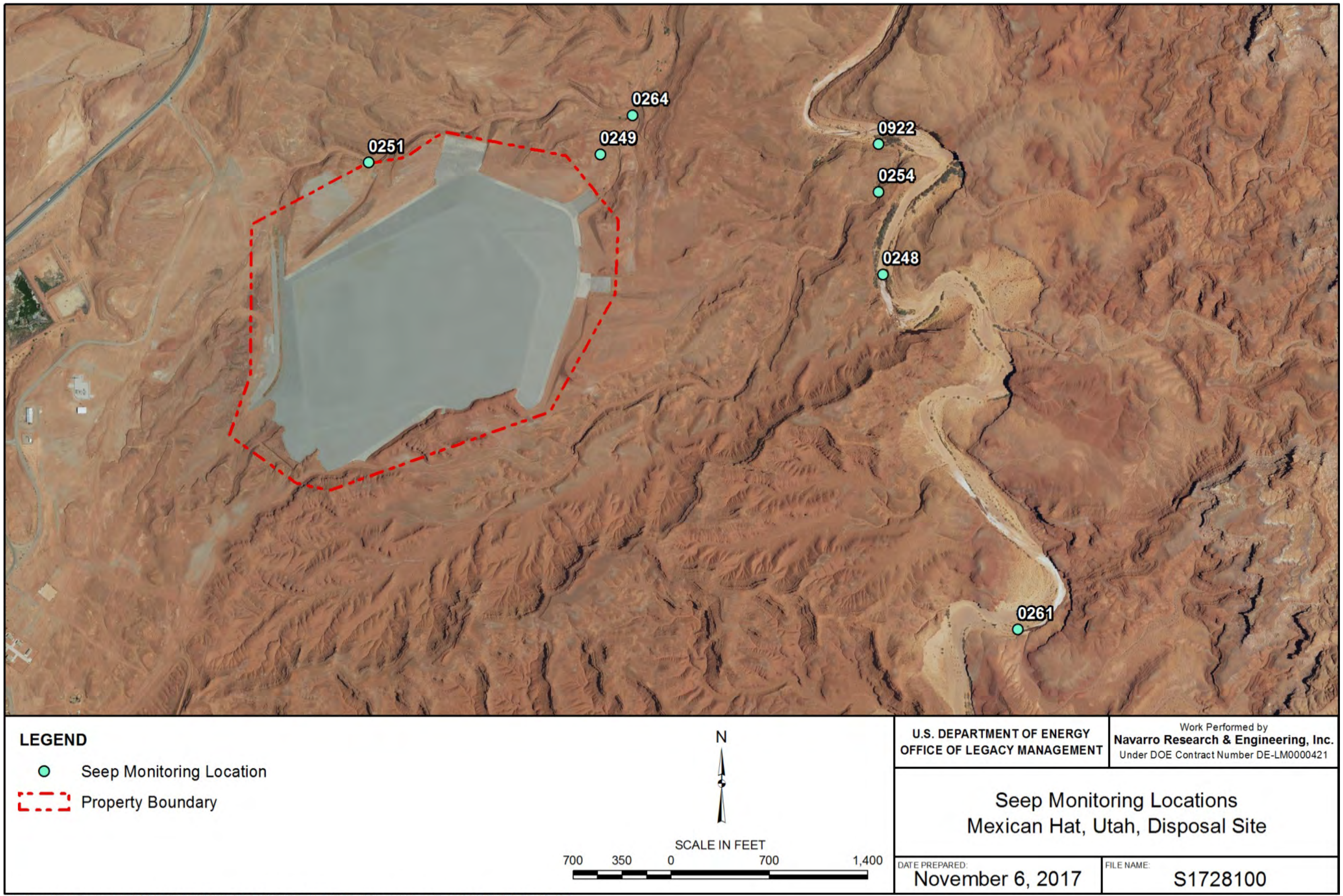

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Figure 12-2. Seep Monitoring Locations at the Mexican Hat, Utah, Disposal Site

Table 12-2. Observations of Seeps near the Mexican Hat, Utah, Disposal Site

Seep Location Number	Drainage	Photo Location Numbers	Observed Seep Conditions
0248	Gypsum Creek	PL-21 and PL-22	Seep was dripping and a small pool of water had collected at the base of the cliff (no flow rate measured). Warning sign is partially buried under sediment and will be repositioned at a later date.
0249	Gully No. 2	PL-23	Dry conditions (no evaporites present); seep area is covered with gray limestone, presumably extra riprap apron material from disposal cell construction. Warning sign not posted at this location since this seep has never been documented to be discharging water.
0251	North Arroyo	PL-24	Dry conditions (no evaporites present).
0254	South Arroyo	PL-25	Dry conditions (no evaporites present). Warning sign not posted at this location due to seasonal flash flood conditions in the ephemeral drainage.
0261	Gypsum Creek	PL-26	Dry conditions. This seep is located next to Gypsum Creek, which was flowing at the time of the inspection. Since this seep is considered a background location, no warning sign is posted at this location.
0264	North Arroyo	PL-27	Dry conditions. Ephemeral wash near seep location was moist with intermittent evidence of evaporites, presumably from recent precipitation.
0922	Gypsum Creek	PL-20	Dry conditions (no evaporites present in immediate area). Seep is located along the south side of Gypsum Creek, which had evidence of significant water (more than 10 feet) from an unknown period. Seep location is now covered entirely by a sandbar that has formed along this section of Gypsum Creek.

Gypsum Creek had several areas of flowing surface water during the inspection. Significant amounts of evaporites were also observed throughout Gypsum Creek (PL-18 and PL-19). Gypsum Creek also had evidence of significant flash flooding from an indeterminate period; there was debris more than 10 feet above the ground surface in some areas of the creek. This flood event presumably created the sandbar that is currently covering seep 0922 (PL-20).

In accordance with the LTSP, annual visual observations of the seeps was only required through 2016, at which time the LTSP directed an evaluation to be conducted to determine whether to continue or discontinue observational seep monitoring. A seep monitoring evaluation report is currently in development. Qualitative seep monitoring was continued during the 2017 annual inspection as a best management practice to support the seep monitoring evaluation report.

In accordance with the LTSP, the need to collect water quality samples at the seeps will be evaluated if observed seep flows significantly increase compared to historical seep flow rates. The Navajo Nation requested sampling of seep 0248 in 2015 due to increased precipitation in the area. To address this request, seep 0248 was sampled in September 2015. Water quality samples were collected at seep 0248 and one location in Gypsum Creek upstream of seep 0248 on March 15, 2016. Seep 0248 and Gypsum Creek were sampled again on October 3, 2016. Evaluation of the sample results will be provided in the pending seep monitoring evaluation report.

12.8.3 Vegetation Monitoring

In accordance with the LTSP, vegetation conditions are observed during annual inspections to ensure that undesirable plant species, including deep-rooted plants on the disposal cell cover and noxious weeds, do not proliferate at the site. With the exception of deep-rooted vegetation, natural plant community succession is expected and will not adversely impact the performance of the disposal cell. A single fourwing saltbush plant (a deep-rooted plant) was identified on the top slope of the disposal cell during the inspection and subsequently removed during a later trip. Vegetation growth in the west diversion channel will continue to be monitored during annual inspections to ensure that it does not negatively affect the performance of this surface water diversion structure. No other maintenance needs were identified.

12.9 References

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, “Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content,” *Code of Federal Regulations.*

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2006. *Resolution of Seep and Ground Water Monitoring at the Mexican Hat, Utah, UMTRCA Title I Disposal Site,* DOE-LM/GJ1139-2006, March.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site, San Juan County, Utah,* DOE-LM/1530-2007, Rev. 3, October.

DOE (U.S. Department of Energy), 2016. *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S15036, March.

12.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	170	Entrance Gate
PL-2	180	Entrance Sign with Outdated Contact Information (Replaced)
PL-3	0	Fence Enclosing Southwest Portion of Disposal Cell
PL-4	135	Perimeter Sign P42 and Fence
PL-5	90	Site Marker SMK-1
PL-6	260	Approximate Location of Survey Monument SM-1
PL-7	170	Boundary Monument BM-5 with Bullet Damage
PL-8	165	Depression Features near Toe of Northeast Side Slope (Black Backpack for Scale)
PL-9	315	Depression Features near Toe of Northeast Side Slope (Black Backpack for Scale)
PL-10	225	Sloughed Rock on Riprap Apron near South Slope of Disposal Cell
PL-11	330	Fourwing Saltbush on Top Slope of Disposal Cell (Removed)
PL-12	230	Void Along Bedding Layer and Radon Barrier Interface (Observed During December 14, 2017, Site Visit)
PL-13	0	West Diversion Channel with Vegetation Along Low Points of Drainage
PL-14	180	Sediment Accumulation Along Transition Zone from Apron to Northeast Toe Drain
PL-15	345	Sloughed Rock Approaching Fence
PL-16	215	Abandoned Wooden Desk (Removed)
PL-17	260	North Arroyo (Dry) with Visible Evaporites
PL-18	90	Gypsum Creek (Flowing) with Visible Evaporites
PL-19	180	Gypsum Creek on Approach to Seep 0248 with Significant Evaporites
PL-20	240	Seep 0922 Covered in Sandbar
PL-21	225	Seep 0248 (Dripping) with Partially Buried Warning Sign
PL-22	310	Seep 0248 (Dripping) with Pooled Water at Base of Cliffside
PL-23	10	Seep 0249 (Dry) Covered in Gray Limestone Rock
PL-24	170	Seep 0251 (Dry) with Minor Evaporites Present in North Arroyo
PL-25	245	Seep 0254 (Dry)
PL-26	135	Location of Seep 0261 Based on GPS Data with Evaporites
PL-27	190	Seep 0264 (Dry) with Moist Floor in Adjacent North Arroyo

PL-1. Entrance Gate

PL-2. Entrance Sign with Outdated Contact Information (Replaced)

PL-3. Fence Enclosing Southwest Portion of Disposal Cell

PL-4. Perimeter Sign P42 and Fence

PL-5. Site Marker SMK-1

PL-6. Approximate Location of Survey Monument SM-1

PL-7. Boundary Monument BM-5 with Bullet Damage

PL-8. Depression Features near Toe of Northeast Side Slope (Black Backpack for Scale)

PL-9. Depression Features near Toe of Northeast Side Slope (Black Backpack for Scale)

PL-10. Sloughed Rock on Riprap Apron near South Slope of Disposal Cell

PL-11. Fourwing Saltbush on Top Slope of Disposal Cell (Removed)

PL-12. Void Along Bedding Layer and Radon Barrier Interface (Observed During December 14, 2017 Site Visit)

PL-13. West Diversion Channel with Vegetation Along Low Points of Drainage

PL-14. Sediment Accumulation Along Transition Zone from Apron to Northeast Toe Drain; View to the South

PL-15. Sloughed Rock Approaching Fence

PL-16. Abandoned Wooden Desk (Removed)

PL-17. North Arroyo (Dry) with Visible Evaporites

PL-18. Gypsum Creek (Flowing) with Visible Evaporites

PL-19. Gypsum Creek on Approach to Seep 0248 with Significant Evaporites

PL-20. Seep 0922 Covered in Sandbar

PL-21. Seep 0248 (Dripping) with Partially Buried Warning Sign

PL-22. Seep 0248 (Dripping) with Pooled Water at Base of Cliffside

PL-23. Seep 0249 (Dry) Covered in Gray Limestone Rock

PL-24. Seep 0251 (Dry) with Minor Evaporites Present in North Arroyo

PL-25. Seep 0254 (Dry)

PL-26. Location of Seep 0261 Based on GPS Data with Evaporites

PL-27. Seep 0264 (Dry) with Moist Floor in Adjacent North Arroyo

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Appendix C7

Site Visit Trip Report, September 21, 2017

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Site Visit Trip Report

Site	Mexican Hat, Utah, Disposal Site	**Project**	NE Slope Cover Depressions Evaluation
Individuals making trip	Evan Tyrrell, CHMM (Navarro) & Bill Cary, Radiological Control Technician (RCT) (Navarro)		
Date(s) of Site Visit	September 21, 2017		

Purpose:

Perform radiological survey along the northeast side slope to verify the absence of elevated radiological readings.

Summary:

A radiological survey was performed by a qualified radiological control technician (RCT) along the northeast side slope utilizing a handheld 2”x2” sodium iodide crutch scintillometer to verify the absence of elevated radiological readings in areas of concern (i.e., depression features). Ambient radiological conditions were determined to be 150 counts per second (cps) and were based on an average of readings collected at three areas upslope of depression features that have been identified on the northeast side slope. Once ambient conditions were determined, the majority of visually-identified depression features were surveyed utilizing the scintillometer. Readings were collected at the top of the rip rap surface.

Overall, the results showed no elevated radiological readings relative to visually-determined non-distressed areas located upslope of depression features on the northeast side slope.

Included Items:

- The following documents are attached to this Report:
  1. Radiological survey map (raw data)

Cc:			
	Dan Brennecke	Dan Nordeen	Jeff Carman
	John Manée	Michael McDonald	Bill Cary
	Fred Smith		

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NAVARRO
Contractor to the U.S. Department of Energy Office of Legacy Management

Radiological Survey Map

Page 1 **of** 2

Radiological Work Permit No.: N/A
Purpose: Radiological survey of areas of possible erosion to cell
Time: 0945
Site Name: Mexican Hat Site
Location: Slope above Northeast Toe Drain
Technician: Bill Cary
Date: 9/21/2017
Reviewer: Scott A. Newsom Scott A. Newsom 2018.01.03 11:43:13 -07'00'
Date:

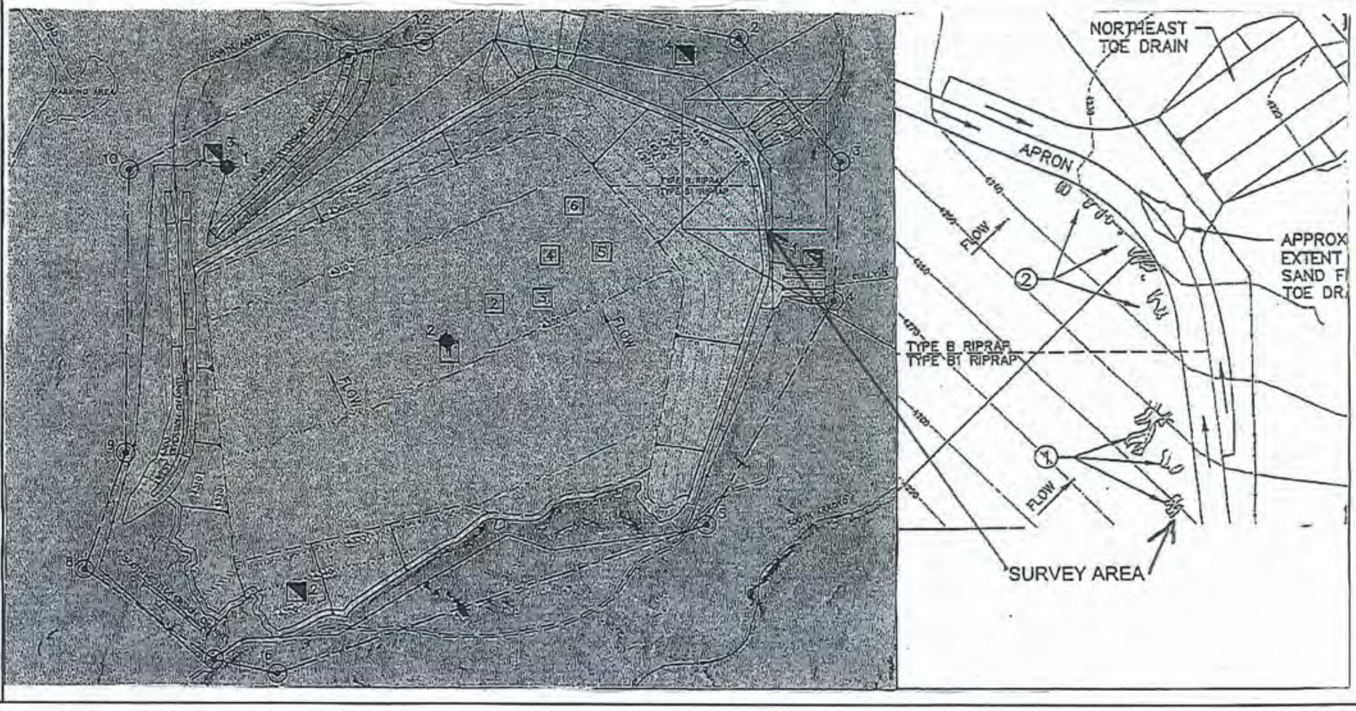
Instrument 1		**Instrument 2**		**Instrument 3**	
Instrument/Probe Model	N/A	Instrument/Probe Model	N/A	Instrument Model	SC-133
Instrument Serial No.		Instrument Serial No.		Instrument Serial No.	13012
Probe Serial No.		Probe Serial No.		Probe Serial No.	13012
Calibration Due		Calibration Due		Calibration Due	7/31/18
Efficiency α β		Efficiency α β		Background	150 cps
BKGD (cpm): α β		BKGD (cpm): α β			
Area Probe Correction Factor		Area Probe Correction Factor			

Standarized Symbols for Surveys

⊡	=	Tape press (4"x4") (no. inside)
○	=	Smears (no. inside)
○	=	Large area smears
△	=	Air samples (no. inside)
▭	=	Neutron readings in mrem/hr unless otherwise noted
—	=	Gamma readings in μrem/hr unless otherwise noted (beta readings also)
*	=	Contact readings (dose rate)
HS	=	Hot spot
SOP	=	Step-off pad
K	=	Reading at knee level (when sources from overhead)
H	=	Reading at head level (when sources from overhead)
-----	=	Contaminated area
XXXXX	=	Radiation area
-x-x-x-	=	Contaminated/radiation area
RM	=	Radioactive material area
⊗	=	Floor drain
ccpm or ncpm	=	Corrected or net cpm (gross back-ground) for direct frisk, alpha or beta/gamma specified
#	=	Direct frisk

Highest Dose Rates
General Area 10.8 μR/hr
Contact N/A

Highest Contamination Level
Fixed N/A
Loose 156 cps



File Index No.:

Radiological Survey Map (continued)

Page 2 of 2

JC 9/21/17

Item Surveyed	Location Surveyed	Direct Survey						Smear Survey						Inst. No. Used
		Gross Counts		Net Counts[a]		Activity[b]		Gross Counts		Net Counts[a]		Activity[b]		
		Beta/Gamma ~~cpm~~	Alpha cpm	Beta/Gamma ~~cpm~~	Alpha cpm	Beta/Gamma dpm/100 cm²	Alpha dpm/100 cm²	Beta/Gamma cpm	Alpha cpm	Beta/Gamma cpm	Alpha cpm	Beta/Gamma dpm/100 cm²	Alpha dpm/100 cm²	
Cell Slope	F. East #1 Depr.	154 cps		4 cps										3
	East #2 w/cairn	153 cps		3 cps										
	East #3 w/cairn	152 cps		2 cps										
	East #4 Rivulet	156 cps		6 cps										
	Center #5 w/cairn	155 cps		5 cps										
	Center #6 w/cairn	128 cps		-22 cps										
	Center #7 Depr.	124 cps		-26 cps										
	Center #8 Depr.	123 cps	N/A	-27 cps										
	West #9 Depr.	123 cps		-27 cps		N/A				N/A				
	West #10 Depr.	123 cps		-27 cps										
	West #11 Depr.	119 cps		-31 cps										
	West #12 Depr.	124 cps		-26 cps										
	West #13 Depr.	119 cps		-31 cps										
	West #14 Rivulet	120 cps		-30 cps										
	West #15 Depr.	124 cps		-26 cps										
	West #16 Rivulet	122 cps		-28 cps										
Cell Slope	Toe Drain #17	122 cps		-28 cps										3
	N/A			N/A										N/A

Applicable Limits (check one for alpha and one for beta)
Alpha (removable/total): ☐ 1000/5000 ☐ 200/1000 ☐ 20/500
Beta (removable/total): ☐ 1000/5000 ☐ 200/1000

[a]Activity Equation
Gross count minus BKGD count = Net count
Net count/Eff = dpm
Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm²

APCF
44-9 = 6.5
FHZ 732 (GM) = 6.5
43-10-1 = 1

Remarks: Daily Instrument Response completed before instrument use. Standard Deviation= 14.92 Backround is average of 3 locations. Survey was performed to determine if there was any elevated radiation in depressions that were discovered in the cell slope. No elevated radioactivity areas were found.

Released To: N/A

Release: ☐ **Unrestricted** ☐ **Restricted** ☒ **Other** (see remarks)

[b]See Table 2–2 of Site Radiological Control Manual I (LMS/POL/S04322).

Appendix C8

Engineering Site Visit Trip Report, October 23–25, 2017

U.S. Department of Energy Office of Legacy Management

Engineering Site Visit Trip Report

Site	Mexican Hat Disposal Site	**Project**	Cell Depressions Evaluation

Engineer(s) making trip Dan Nordeen, Dan Brennecke, Scott DenBaars, Ron Rager. Also in attendance from Navarro was the site lead, Evan Tyrrell. Working separately on the site weather station controls were Ben Potter, Chris Holmes, and Jaron Ragsdale from the AST group of Navarro.

Purpose:

The intent of this site visit was to introduce and familiarize Mr. Rager to the current cell cover depression features that are presently under evaluation at the Mexican Hat Disposal Site.

Basic Itinerary: (including dates, to and from, travel method, lodging location

Monday, October 23, 2017 meeting with Ron Rager at the GJO site.

Tuesday, October 24, 2017, traveled from Grand Junction to Mexican Hat via GSA vehicle, checked in at the San Juan Motel, Mexican Hat, conducted site visit in afternoon.

Wednesday, October 25, 2017, completed site visit in morning and visited the radon barrier borrow area that was used in the original construction of the disposal cell, left Mexican Hat and returned to Grand Junction in the afternoon.

Individuals Met With (Name and Company):

Ron Rager (subcontract engineering consultant).

Souder-Miller surveyors Gene Reininger and Schuyler Arensberg were on-site performing a follow–up; second LiDAR scan using advanced technology Trimble TX10 scanning equipment due to problems with overlap and registry that occurred using the older model Trimble TX8 in September 2017.

Summary:

The group met at the San Juan Inn restaurant at noon on October 24th and then traveled to the disposal site from there for Ron's initial overview. The first stop was to do a closer look at the cell cover depressions on the northeast side slope. The surveyors were scanning the side slope of interest so we lagged back until they were done before walking to the depressions areas. We also walked the cover topslope at the northeast corner. While waiting for the surveyors we were able to show Ron the weather station nearby that will be used for collecting precipitation data in close proximity to the disposal cell. We were able to observe the northeast corner sideslope during the changing afternoon lighting conditions to see how the appearance of the depressions changed with the variable lighting. The depressions on the northeast side slope did not appear to have changed from those observed in April 2016 when Engineering (Dan Nordeen and Dan Brennecke) first observed the depressions. The sediment accumulating in the transition zone from the apron to the northeast toe drain was also observed.

The following day, October 25th, the group walked the west side slope mid-morning and observed the north side slope from a distance looking for additional evidence of distress. What appeared to be minor construction related surface imperfections were observed on the west side slope along the entire length. None of these imperfections appeared to be similar to the depression features observed on the northeast side slope. No depressions were observed on the north side slope and no accumulation of sediment was apparent in the north toe drain. The visit ended after touring the location of the radon barrier borrow area several miles south of Halchita.

Discussion:

Overall, Ron Rager thought the cell cover was performing very well. Discussions with Ron Rager were wide ranging and included possible causes for the depression features on the northeast side slopes including the possibility that erosion is occurring below the bedding layer causing radon barrier material to be transported to the toe of slope. Another potential cause discussed was the method of placement by construction equipment implying the depressions may have been a result of the equipment methods used to place the cover components

Telephone/Meeting/Conference Record (continued)

along the northeast side slope. Additional discussions can be found on the attached trip report from Ron Rager.

Action Items:

Several items for follow-up:

1. Review QA/QC data available in completion reports with respect to anomalies during construction. Also look for possible non-conformance issues if available.
2. Ron Rager will try contacting the TAC engineer who worked on the site during final design phases. His name is John MacBee.
3. Ron Rager will look for references to special studies prepared in the 1988-1990 years.
4. Dan Nordeen will provide access to the LM EFT site for transferring large files back and forth.

Cc:			
	Dan Brennecke	Scott DenBaars	Evan Tyrrell
	Jeff Carman	David Miller	

MEMORANDUM

TO: Navarro Research and Engineering, Inc.

FROM: Ron Rager – Consultant to Navarro Research and Engineering, Inc.

SUBJECT: Mexican Hat Site Visit Trip Report—October 23-26, 2017

DATE: December 1, 2017

From 10/23 to 10/26 of 2017 Ron Rager met with a group from Navarro (Contractor to DOE LM) met to discuss and visit the Mexican Hat disposal cell site including:

Dan Nordeen
Dan Brennecke
Scott DenBaars
Evan Tyrrell

The purpose of the trip was to familiarize Ron with the depression features that have been identified in the rock cover at the toe of the northeast side slope and adjacent to the rock apron/ditch of the disposal cell. The LM contractor has written a draft report dated September 2017, which is currently in review by DOE and details the locations and characteristics of the depression features. The draft report also outlines three potential paths forward for further evaluating the depression features. These pathways include: a) continued monitoring of the situation, including deposition of fine grained material in the riprap apron in order to evaluate potential further cover degradation in the impacted areas, b) regrade the cover and monitor the subject area, and c) a targeted cover investigation to inspect selected areas of the depression features down to the top of the radon barrier, including the potential for erosion of the bedding layer and the radon barrier; these cover components cannot be observed at this time because of the riprap covering.

An initial meeting was held at the Grand Junction Navarro office on the afternoon of 10/23 in order to familiarize Ron Rager with the site conditions and to discuss the draft evaluation report. Evan Tyrrell presented a draft color mosaic aerial image of the northeast portion of the disposal cell that was provided by a subcontract survey company and explained that a terrestrial LiDAR survey was being conducted in order to provide a detailed topographic map of the affected areas and the surrounding surfaces.

The potential for rilling (erosion) of the radon barrier and/or bedding layer was discussed along with observations made when a small hand excavation was made in one of the depressed areas. Deposits of fine grained material in the voids of the rip rap below the depressions were also discussed.

A letter from DOE dated 11/2/1989 (Appendix, B Riprap and Filter Design Calculation (from 1991 and 1992)) contained in the original design calculation for the erosion barrier instructing the

Remedial Action Contractor (RAC) to coarsen the bedding layer of the Mexican Hat site was discussed. Ron indicated that the Technical Assistance Contractor (TAC) had performed flume studies at Colorado State University to this effect. These studies were done in relation to a set of "Special Studies" involving such items as sodium bentonite amendment of radon barrier materials, freeze-thaw evaluations of cover materials, and the aforementioned study.

The radon barrier material bentonite amendment was also discussed.

Numerous documents are available from the design period and should indicate how the design was approached and the rational supporting the design criteria.

Following the Grand Junction meeting, Dan Nordeen and Ron visited Greg Smith, a Navarro geotechnical engineering consultant familiar with UMTRA cell designs, to see if he had any of the Special Studies discussed in the meeting. He did not, but indicated that he had checked the bedding gradation as designed by the RAC and found them in compliance with the American Society of Civil Engineers (ASCE) gradation requirements for filters in manmade dams.

The site was inspected on 10/24 and 10/25 to observe existing conditions of the disposal cell with a focus on the northeast side slope where the depression features have been identified. The scope of this trip was limited to visual observations of the disposal cell and area surrounding the cell as well as the original borrow source area for radon barrier material. Weather conditions were excellent, being sunny and warm.

The northeast side slope was inspected during all light conditions from early morning to late afternoon (low to high angle lighting conditions). Several depressions were observed as previously discussed in the draft evaluation report. Conditions appeared to be unchanged from those inspections. Some of the tan fine grained soil coating the stones comprising the riprap was also observed. Limited visual observations confirmed that there is no apparent cause for the formation of the depressions.

In-filling of voids in the riprap-lined drainage located at the transition to the toe outlet apron was inspected. The fine grained material has the appearance of wind blown material and is also similar to that of the radon barrier borrow source. This very fine grained sand and silt is present in drainages and dune formations located to the southeast of the cell.

Other slopes were also inspected for surface depressions. These slopes are of shorter length but receive the runoff from the entire top slope of the cell. Although minor irregularities in the slopes are apparent, none are of the size and depth of those located along the northeast side slope.

During the inspection several possible reasons for the surface depressions were discussed including the possibility that the amended radon barrier was constructed of dispersive soils (some fine grained soils found in the American Southwest exhibit this "colloidal dispersivity" where the finest portion of the soil is eroded by moving water at low gradients). Another possibility is settlement within the disposal cell fill as a result of unintended construction practices such as the positioning of ramps, etc. which might show latent and exaggerated settlement compared to the rest of the pile. Other possible causes may be developed as a result of the proposed targeted investigation of the cover.

The borrow area used for the radon barrier was inspected. The borrow area is located approximately eight miles south of Halchita along the road leading to the former Monument Valley mill site. The material used for the radon barrier appears to be lighter in color than the surrounding red color of the foundation material of the Mexican Hat disposal cell site. Although alluvial in origin, the material looks similar to wind blown deposits present on the adjacent ground surface around the borrow area.

A LiDAR topographic survey was being conducted at the same time this site visit occurred. Maintenance of a rainfall monitoring station was also being conducted.

No firm conclusions were reached and none were sought at this time.

Several action items were discussed:

- Ron Rager will seek to contact John MacBee, the TAC civil/geotechnical engineer who worked on this site during the final design by the RAC. He is in Albuquerque, New Mexico.
- Ron Rager will look for reference to special studies in the RAP and other reports prepared in the 1988-1999 time frame.
- Dan Nordeen will provide access to the LM ftp site and upload the RAP and Completion Report.
- Dan Nordeen will obtain and review the construction quality control reports for any anomalies which might help to explain the depressions.

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Appendix C9

Site Visit Trip Report, December 14, 2017

Site Visit Trip Report

Site	Mexican Hat, Utah, Disposal Site	**Project**	NE Slope Cover Depressions Evaluation

Individuals making trip Evan Tyrrell, Navarro; Angelita Denny, DOE-LM; Gilbert Dayzie & Joni Tallbull, NNUMTRA/AML

Date(s) of Site Visit December 14, 2017

Purpose:

Perform visual observations of depression features on the northeast side slope of the disposal cell

Summary:

The Department of Energy Office of Legacy Management (DOE-LM) Site Manager coordinated a site visit with Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department (NNUMTRA/AML) personnel to observe depression features that had been previously identified along the toe and lower portions of the northeast side slope of the disposal cell. NNUMTRA/AML had received the draft *Mexican Hat UMTRCA Disposal Cell Northeast Slope Cover Depressions Evaluation Report* for review and were interested in viewing the depression features. NNUMTRA/AML representatives arrived onsite prior to the arrival of representation from DOE-LM, and manually removed small portions of the riprap and bedding layer cover components to facilitate inspection of the depressions observed near the toe of the northeast side slope. At one of the locations, near the toe of the northeast side slope, a small void was observed at the apparent base of the bedding layer and upper portion of the radon barrier.

At the time DOE-LM representation arrived at the site, the presence of a small void beneath the rock riprap material was evident in the area where cover components had been removed by NNUMTRA/AML personnel. There was no indication that the radon barrier was breached; manual removal of cover materials did not extend into the radon barrier.

NNUMTRA/AML cleared additional material that had sloughed into the evident void. Repositioning the materials that had sloughed into the opening confirmed the presence of a small void (approximately 8 inches deep × 12 inches wide) that appeared to be present at the apparent base of the bedding layer and upper portion of the radon barrier. The length of the void was unknown, but it appeared to extend downslope along the interface of the bedding layer and radon barrier. An approximately 6-inch-thick, red cemented layer was observed at the top of the void immediately below the base of the bedding layer. The bedding layer consisted of almost all coarse-grained materials; fine-grained materials were absent.

The rock riprap and gravel/bedding materials that were removed were ultimately placed back in the void and the exposed area was restored. The location was marked using a wooden stake with orange flagging. NNUMTRA/AML personnel verbally communicated that an additional area towards the toe of the longest extent of the northeast side slope had been exposed by manually removing cover components and was subsequently restored prior to the arrival of DOE-LM representation. It was also communicated that this additional area did not exhibit the same features (i.e., a void) compared to the area with the small void described above. No additional hand removal of material on the cell occurred that day and no indication of a breach of the radon barrier was evident. However, radiological surveys were not taken during this work as there was no Radiological Control Technician onsite and the work that was performed by NNUMTRA/AML personnel was neither planned nor authorized.

DOE-LM notified the Nuclear Regulatory Commission (NRC) of these events and findings in an email dated January 8, 2018 and NRC issued a response to DOE-LM via email on January 22, 2018. Email correspondence is accessible on the ADAMS NRC website located at http://www.nrc.gov/reading-rm/adams.html.

Included Items:

- The following documents are attached to this Report:
  1. Trip Photos

Cc:	Dan Brennecke	David Miller	Jeff Carman
	John Manée		

Void near toe of northeast side slope

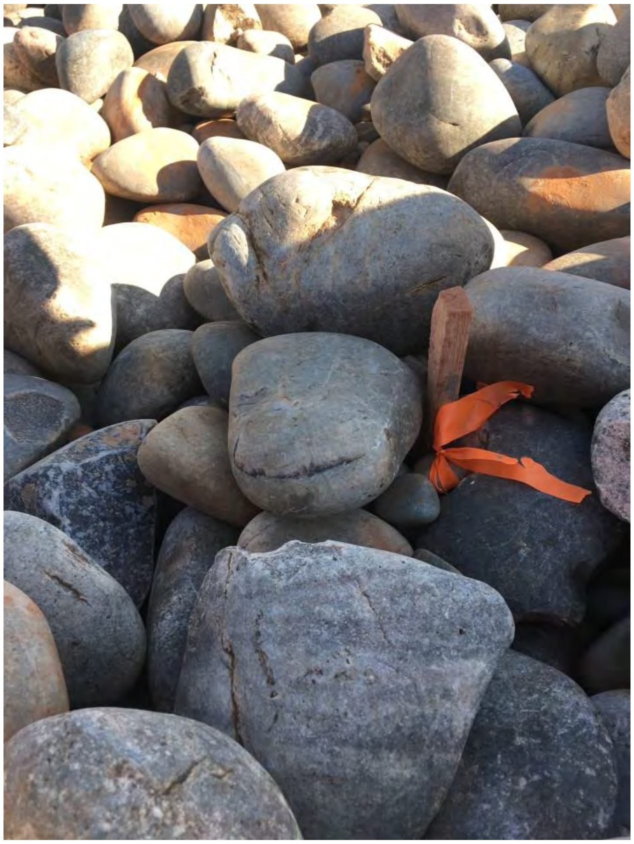
[redacted]

Location of void relative to toe of northeast side slope

[redacted]

Relative location of void beneath small area of hand removed rip rap and bedding material

Void near toe of northeast side slope



Restored void area marked with wooden stake for future evaluations

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Appendix C10

Site Visit Trip Report, December 27, 2017

Site Visit Trip Report

Site	Mexican Hat, Utah, Disposal Site	**Project**	NE Slope Cover Depressions Evaluation
Individuals making trip	Evan Tyrrell, CHMM (Navarro) & Bill Cary, Radiological Control Technician (RCT) (Navarro)		
Date(s) of Site Visit	December 27, 2017		

Purpose:

Perform radiological surveys throughout the site to compare to radiological readings at depression features and within the previously discovered void near the toe of the northeast side slope.

Summary:

A series of radiological surveys were performed by a qualified radiological control technician (RCT) in order to obtain ambient radiological conditions to compare to areas of concern on the northeast side slope of the disposal cell. An alphaNUCLEAR Model 597-PX3 radon monitor was utilized to collect 30-minute continuous samples for radon gas and a handheld 2”x2” sodium iodide “crutch” scintillometer was utilized to collect gamma radiological readings at a total of seven (7) radiological survey locations (RSL) throughout the site (RSL-1 through RSL-7). A handheld GPS device was used to collect location data for each radiological survey location. Radiological survey locations are depicted on an enclosed figure.

Two upwind locations were surveyed (RSL-1 and RSL-2). RSL-3 was collected on the top slope of the disposal cell next to site marker SMK-1. RSL-4 through RSL-6 were collected in areas of concern along the northeast side slope of the disposal cell. RSL-4 was located at the area of the recently discovered void and a series of three surveys were performed at this location (RSL-4a [before disturbance]; RSL-4b [after re-exposure of void]; and RSL-4c [after restoring the void]). Finally, RSL-7 was collected at a downwind location to the northeast of the disposal cell. At the end of the day, RSL-1 was resurveyed (RSL-1R) for radon to assess for any potential changes in ambient radon concentrations that may have occurred due to changes in meteorological conditions (i.e., barometric pressure, temperature).

Overall, the results showed no elevated radiological readings relative to ambient radiological conditions. In addition, RSL-4a, RSL-4b, and RSL-4c did not show any significant changes based on pre-exposure, re-exposure, and post-restoration activities at the recently discovered void near the toe of the northeast side slope. Finally, radiological survey results were below all applicable exposure-based and radon emanation standards.

Included Items:

- The following documents are attached to this Report:
  1. Trip Photos
  2. Radiological survey locations map
  3. Radiological survey results table (tabulated data)
  4. Radiological survey results (raw data)

Cc:	Dan Brennecke	Dan Nordeen	Jeff Carman
	John Manée	Michael McDonald	Bill Cary
	Fred Smith		

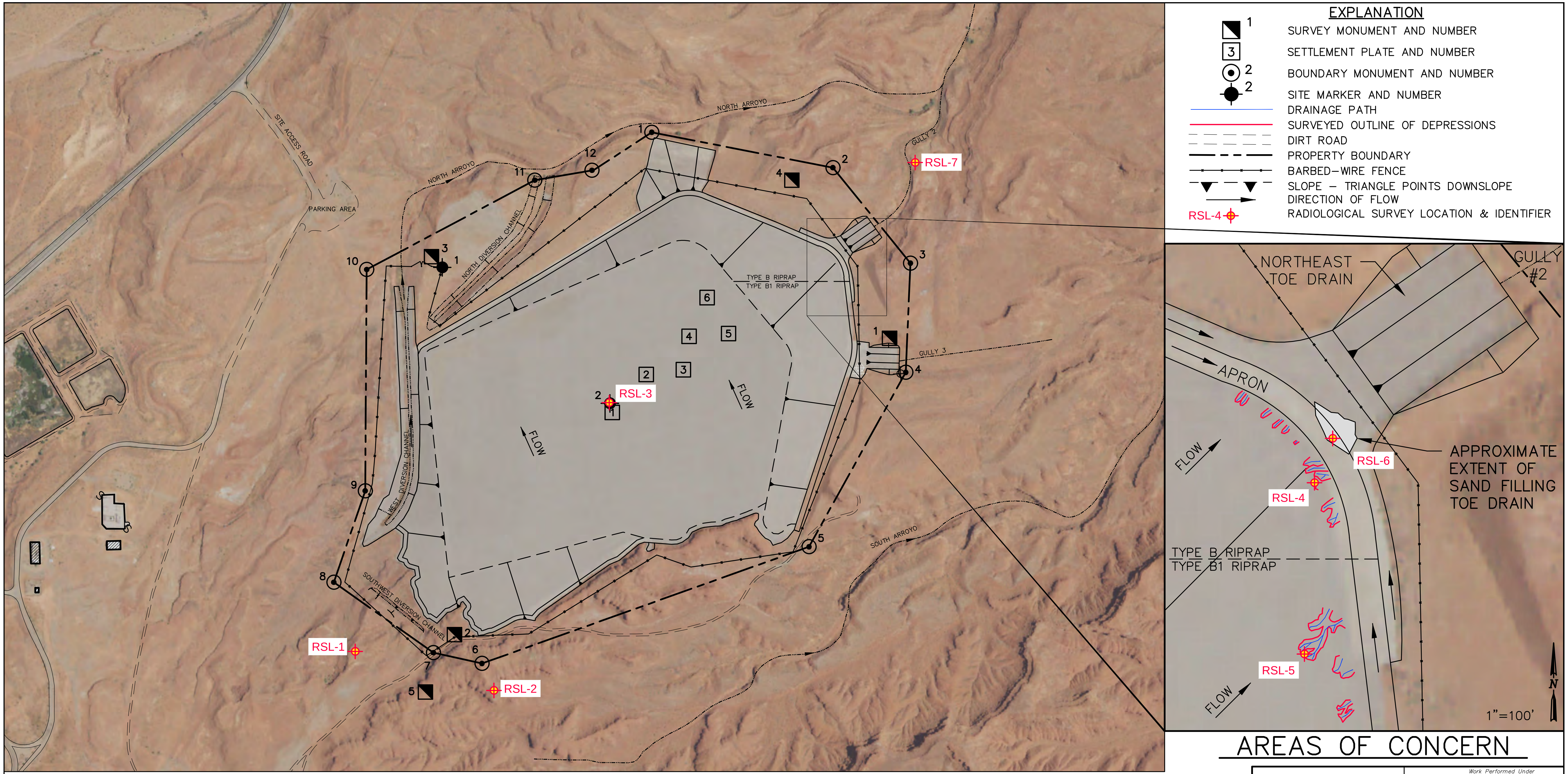
Radiological survey location RSL-1 (upwind)

Ongoing collection of radon data at radiological survey location RSL-2 (upwind) using alphaNUCLEAR Model 597-PX3 radon monitor

Radiological survey location RSL-4b (re-exposed void) using handheld 2”x2” sodium iodide crutch scintillometer

Radiological survey location RSL-4b (re-exposed void) using alphaNUCLEAR Model 597-PX3 radon monitor

Radiological survey location RSL-7 (downwind)



AREAS OF CONCERN

NOTE:
- RSL–4 is located in the area of the recently discovered void.
- Radiological Survey performed on December 27, 2017.

SITE PLAN

SCALE IN FEET
500 250 0 500

N

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE–LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

PROJECT SITE PLAN WITH AREAS OF CONCERN
AND DECEMBER 2017 RAD. SURVEY LOCATIONS
MEXICAN HAT, UT DISPOSAL SITE

DATE PREPARED: January 16, 2018

FILENAME: S1817900

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Radiological Survey Results
December 27, 2017
Mexican Hat, Utah, Disposal Site

Date	Radiological Survey Location (RSL) Identifier	Location Description	Radon (Rn)		Gamma			
			Bq/m^3 Average[1]	Rn-222 Working Level (WL) Average[1,2]	Counts per Second (cps)	Counts per Second (cps)	µR/hr	µR/hr
					BACKGROUND	DIRECT	BACKGROUND	DIRECT
12/27/2017	RSL-1	Upwind of Disposal Cell (background)	35	0.0033	213	NA	12.6	NA
12/27/2017	RSL-1R	Replicate of RSL-1	42	0.01	NA	NA	NA	NA
12/27/2017	RSL-2	Upwind of Disposal Cell (background)	13	0.0033	241	NA	13.5	NA
12/27/2017	RSL-3	Top Slope of Disposal Cell near Site Marker (background)	68	0.01	226	NA	13.5	NA
12/27/2017	RSL-4a	Northeast Side Slope at Void Location (before disturbance)	28	0.0067	162	161	11.0	11.0
12/27/2017	RSL-4b	Northeast Side Slope at Void Location (after re-exposure)	28	0.0033	162	181	11.0	11.6
12/27/2017	RSL-4c	Northeast Side Slope at Void Location (after restoration)	0	0.0	162	165	11.0	11.1
12/27/2017	RSL-5	Northeast Side Slope at Depression Feature	44	0.1	195	180	12.0	11.6
12/27/2017	RSL-6	Northeast Toe Drain Area in Area of Sediment Accumulation	69	0.1	155	133	10.8	10.1
12/27/2017	RSL-7	Downwind of Disposal Cell (background)	74	0.15	181	185	11.6	11.7

Notes

[1] = Average radon values determined by averaging the 10-minute sample intervals at each RSL collected over a 30-minute duration

[2] = UMTRCA Standard of 20 pCi/m^2/s is equivalent to a WL of 1.8

NA = Not Applicable

Radon-222 WL Values for Mexican Hat Tailing Pile and surrounding areas

Sample ID	Location (see map)	Radon – WL (RN-222) Average	Location Type
RSL-1	Upwind of cell, (Hill south of cell)	.0033	Background
RSL-2	Upwind of cell, (Tall hill Southeast of cell)	.0033	Background
RSL-3	Site Monument, (Site monument in center of the cell	.01	Background
RSL-7	Downwind of cell, (Toe drain on small hill)	.01	Background
RSL-1R	Upwind of cell, (2nd sample at 1st location later in the day)	.01	Background
RSL-4a	Cell void, (before disturbance)	.0067	Area of concern on cell
RSL-4b	Cell void, (after exposing void)	.0033	Area of concern on cell
RSL-4c	Cell void, (after covering void)	0.0	Area of concern on cell
RSL-5	Eastern Cairn, (above eastern cairn in a small depression)	.01	Area of concern on cell
RSL-6	In toe drain of cell slope, (approx. center of toe drain of cell north of cell)	.01	Near area of concern

1. Radon survey was completed on Mexican Hat tailings pile to try and determine if Rn-222 release rate is exceeding the 20 pCi/m2/s Limit for (inactive UMTRA Title I) sites.
2. The average WL was determined by averaging the 10 minute sample intervals at each location.
3. Th(Bq/m3) values were excluded in average calculation due to Rn-220 being part of the Th-234 decay chain conceder NORM.
4. 20 pCi/m2/s Limit from (Regulatory Guide 3.64 (Task WM 503-4) for (inactive UMTRA Title I) sites.
   20 pCi/m2/s = 1.8 WL/m2
5. The results above in the table were determined from three 10 minute sample intervals, these are results for that given day when measurement were performed. This method is just a **very small** snap shot in time, many variables that can effect sample results (wind, barometric pressure, etc.). I would recommend placing radon cup long term, in background areas and areas of concern(depressions) to get a better understanding of radon emissions.

Conclusion: Survey results indicate that WL (working level) radon emission from the area of concern (voids or depressions) are at background levels.

Radon Concentration Data Log Sheet

Site ID Mexican Hat Site

Instrument ID 2144

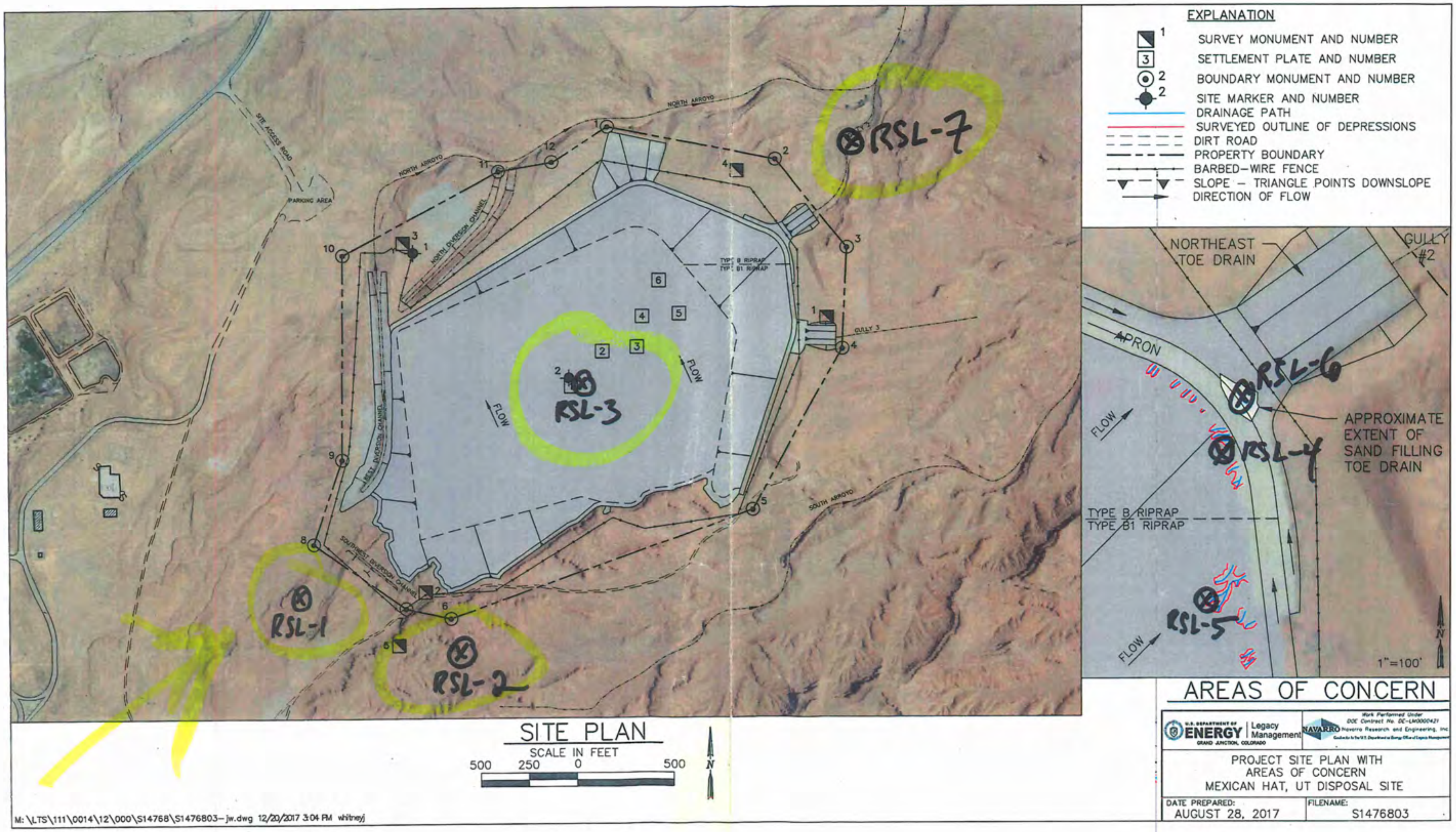
Date 12/27/17

	Run Time (HHMM)					
	Start	Stop	Location	Sub-location	Feature Type	Comments/Notes
1	0900	0930	RSL-1	Upwind of Cell		Hill South of cell
2	0945	1015	RSL-2	Upwind of Cell		Tall Hill Southeast of cell
3	1040	1110	RSL-3	Site Monument		Site Monument in center of the cell
4	1140	1210	RSL-4a	Void		Before disturbance
5	1230	1300	RSL-4b	Void		After exposing Void
6	1310	1340	RSL-4c	Void		After covering Void
7	1350	1420	RSL-5	Eastern Cairn		Above Eastern Cairn in a small depression
8	1425	1455	RSL-6	In Tow Drain of Cell Slope		Approx. Center of Tow Drain of Cell, North of Cell
9	1525	1555	RSL-7	Down wind of Cell.		Downwind of Cell Toe Drain on Small Hill
10	1615	1645	RSL-1R	Upwind of Cell		2nd sample at 1st location, Hill South of Cell

Additional Comments

Anthony Martinez / Anthony Martinez
Reviewer

1/2/18
Date



AREAS OF CONCERN

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

NAVARRO
Work Performed Under
DOE Contract No. DE-LM0000421
Navarro Research and Engineering, Inc
Contractor to the U.S. Department of Energy Office of Legacy Management

PROJECT SITE PLAN WITH
AREAS OF CONCERN
MEXICAN HAT, UT DISPOSAL SITE

DATE PREPARED:
AUGUST 28, 2017

FILENAME:
S1476803

RSL - 1 up wind of cell (Hill South of cell)

Date: 2017-12-27 08:57:55
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 9:07	1	1	0	46	0	0.01	0	488	62678	86
12/27/2017 9:17	1	0	0	38	0	0	0	475	65067	89
12/27/2017 9:27	0	5	0	21	0	0	0	468	59606	90

RSL-2 upwind of cell (Tall hill Southeast of cell)

Date: 2017-12-27 09:43:52
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 9:53	0	1	0	0	0	0	0	463	58477	91
12/27/2017 10:03	1	4	0	18	0	0	0	451	55617	93
12/27/2017 10:13	1	2	0	21	0	0.01	0	444	63450	95

RSL - 3 Site Monument (in center of the cell)

Date: 2017-12-27 10:38:25
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 10:48	2	4	0	94	0	0.01	0	448	60035	94
12/27/2017 10:58	1	5	0	55	0	0.01	0	436	62358	96
12/27/2017 11:08	2	3	0	54	0	0.01	0	428	65344	98

RSL-4a Before disturbance (void)

Date: 2017-12-27 11:38:56
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 11:48	0	1	0	0	0	0	0	443	63450	95
12/27/2017 11:58	2	2	0	36	0	0.01	0	428	55075	98
12/27/2017 12:08	3	4	1	49	111	*0.04	0	419	55832	99

0.01

Not used
due to RN-220

RSL-4b After exposing (void)

Date: 2017-12-27 12:28:48
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 12:38	1	1	0	46	0	0.01	0	440	64532	95
12/27/2017 12:48	0	1	0	17	0	0	0	430	64584	98
12/27/2017 12:58	1	4	0	21	0	0	0	428	63185	98

RSL-4c After Covering (Void)

Date: 2017-12-27 13:10:36
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 13:20	0	4	0	0	0	0	0	440	61172	96
12/27/2017 13:30	0	4	0	0	0	0	0	425	56957	99

RSL-5 Eastern Cairn (Above eastern cairn in small depression)

Date: 2017-12-27 13:48:03
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 13:58	1	2	0	47	0	0.01	0	434	56700	97
12/27/2017 14:08	2	2	0	54	0	0.01	0	418	58737	99
12/27/2017 14:18	0	4	0	32	0	0.01	0	419	57059	99

RSL-6 IN tow Drain of cell slope (Approx. center of Tow Drain of cell, North of cell)

Date: 2017-12-27 14:25:17
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 14:35	1	1	0	46	0	0.01	0	426	57327	98
12/27/2017 14:45	4	5	0	91	0	0.01	0	422	60490	99

RSL-7 Down wind of cell (Downwind of cell Tow Drain on small hill)

Date: 2017-12-27 15:24:09
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 15:34	2	2	0	92	0	0.02	0	433	64249	97
12/27/2017 15:44	1	1	0	55	0	0.01	0	424	62139	99

RSL-1R up wind of cell (2nd sample at 1st location Hill South of cell)

Date: 2017-12-27 16:13:49
Run Type: Default Run
Efficiency: 0.0558
Flow Rate: 250.00
mBinsRun: 3
RaA Background Counts: 0
RaC Background Counts: 0
ThC Background Counts: 0

Time	1.8->6.5 MeV Counts	6.5->8.2 MeV Counts	8.2->9.0 MeV Counts	Rn (Bq/m^3)	Th (Bq/m^3)	WL	Status	Pump Duty Cycle Number	Air Flow Period	Filter Level
12/27/2017 16:23	1	1	0	46	0	0.01	0	432	55741	97
12/27/2017 16:33	1	4	0	35	0	0.01	0	424	63341	99
12/27/2017 16:43	2	1	0	44	0	0.01	0	424	62426	99

Data was saved using Vista Data Vision
Saved: 2017-12-28 17:07:02

Time Period: 2017-12-27 00:00:00 - 2017-12-29 00:00:00

Time	Mexican Hat Met - Hourly: Met_AirTemp_C[°C]	Mexican Hat Met - Hourly: Met_Bar_mmHg_WS700[mm Hg]
12/27/2017 0:00	0.1874403	771.9655
12/27/2017 1:00	-0.6419345	772.5656
12/27/2017 2:00	-1.855468	773.3157
12/27/2017 3:00	-2.808112	773.9908
12/27/2017 4:00	-3.677588	774.7408
12/27/2017 5:00	-4.223851	774.8908
12/27/2017 6:00	-4.397686	775.0409
12/27/2017 7:00	-4.440899	775.6409
12/27/2017 8:00	-4.812047	776.166
12/27/2017 9:00	-5.676641	776.4659
12/27/2017 10:00	-4.208169	776.3159
12/27/2017 11:00	-2.120177	775.0409
12/27/2017 12:00	0.4333776	773.3907
12/27/2017 13:00	3.516268	771.2905
12/27/2017 14:00	6.262809	769.1904
12/27/2017 15:00	7.863207	767.4652
12/27/2017 16:00	9.388597	766.4901
12/27/2017 17:00	10.49793	766.1901
12/27/2017 18:00	10.35917	766.3401
12/27/2017 19:00	8.508809	767.3902
12/27/2017 20:00	5.879426	769.2653
12/27/2017 21:00	3.125354	770.2405
12/27/2017 22:00	1.550704	770.9155
12/27/2017 23:00	0.2653733	771.5155
12/28/2017 0:00	-0.6555852	772.4156
12/28/2017 1:00	-1.530612	772.7156
12/28/2017 2:00	-2.16002	772.8657
12/28/2017 3:00	-2.536813	773.6157
12/28/2017 4:00	-3.264441	774.0657
12/28/2017 5:00	-4.107949	774.5157
12/28/2017 6:00	-4.467507	775.1909
12/28/2017 7:00	-4.794944	775.7159
12/28/2017 8:00	-5.500718	776.3909
12/28/2017 9:00	-6.045571	777.366
12/28/2017 10:00	-4.562256	776.3159

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Radiological Survey Map

Page 1 **of** ~~2~~ 4 1-4-18

Radiological Work Permit No.: N/A **Purpose:** Radiological Investigation Survey **Time:** Various

Site Name: Mexican Hat **Location:** Various locations at the Mexican Hat Disposal Cell.

Technician: Bill Cary / Bill Cary **Date:** 12/27/2017 **Reviewer:** **Date:** 1-4-18

Instrument 1			**Instrument 2**			**Instrument 3**	
Instrument/Probe Model	N/A		Instrument/Probe Model	N/A		Instrument Model	SC-133
Instrument Serial No.			Instrument Serial No.			Instrument Serial No.	13012
Probe Serial No.			Probe Serial No.			Probe Serial No.	13012
Calibration Due			Calibration Due			Calibration Due	7/31/18
Efficiency	α	β	Efficiency	α	β	Background	Backrounds were taken at various locations; see remarks
BKGD (cpm):	α	β	BKGD (cpm):	α	β		
Area Probe Correction Factor			Area Probe Correction Factor				

Standarized Symbols for Surveys

□	= Tape press (4"x4") (no. inside)
○	= Smears (no. inside)
○	= Large area smears
△	= Air samples (no. inside)
▭	= Neutron readings in mrem/hr unless otherwise noted
—	= Gamma readings in µrem/hr unless otherwise noted (beta readings also)
*	= Contact readings (dose rate)
HS	= Hot spot
SOP	= Step-off pad
K	= Reading at knee level (when sources from overhead)
H	= Reading at head level (when sources from overhead)
-----	= Contaminated area
XXXXX	= Radiation area
-x-x-x-	= Contaminated/radiation area
RM	= Radioactive material area
⊗	= Floor drain
ccpm or ncpm	= Corrected or net cpm (gross back-ground) for direct frisk, alpha or beta/gamma specified
#	= Direct frisk

Highest Dose Rates

General Area 13.5 µR/hr

Contact N/A

Highest Contamination Level

Fixed N/A

Loose

N/A see attached map

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Radiological Survey Map (continued)

Page 2 of ~~2~~ 4 BL 1-4-18

BL 12/27/17

Item Surveyed	Location Surveyed	Direct Survey Gross Counts Beta/Gamma ~~cpm~~	Direct Survey Gross Counts Alpha cpm	Direct Survey Net Counts[a] Beta/Gamma ~~cpm~~	Direct Survey Net Counts[a] Alpha cpm	Direct Survey Activity[b] Beta/Gamma dpm/100 cm²	Direct Survey Activity[b] Alpha dpm/100 cm²	Smear Survey Gross Counts Beta/Gamma cpm	Smear Survey Gross Counts Alpha cpm	Smear Survey Net Counts[a] Beta/Gamma cpm	Smear Survey Net Counts[a] Alpha cpm	Smear Survey Activity[b] Beta/Gamma dpm/100 cm²	Smear Survey Activity[b] Alpha dpm/100 cm²	Inst. No. Used
RSL-1	Hill south of cell	213cps		N/A										3
RSL-2	Tall hill southeast of cell	241cps		N/A										3
RSL-3	Monument,center of cell	226cps	N/A	N/A										3
RSL-4a	Void before open	161cps		-1cps										3
RSL-4b	Void after open.	181cps		19cps										3
RSL-4c	Void after close	165cps		3cps										3
RSL-5	Depression	180cps		-15cps										3
RSL-6	Toe drain area	133cps		-22cps						N/A				3
RSL-7	Hill north of cell	185cps		4cps		N/A								3
	N/A													N/A

Applicable Limits (check one for alpha and one for beta)

Alpha (removable/total): ☐ 1000/5000 ☐ 200/1000 ☐ 20/500

Beta (removable/total): ☒ 1000/5000 ☐ 200/1000

[a]Activity Equation

Gross count minus BKGD count = Net count

Net count/Eff = dpm

Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm²

APCF

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks: Daily Instrument Response completed before instrument use. First 3 locations were backround only. Other backrounds taken adjacent to survey areas. RSL-4 backround 11.0 uR/hr, 162 cps, RSL-5 12.0 uR/hr, 195 cps, RSL-6 10.8 uR/hr, 155 cps, RSL-7 11.6 uR/hr, 181 cps.

Released To: N/A

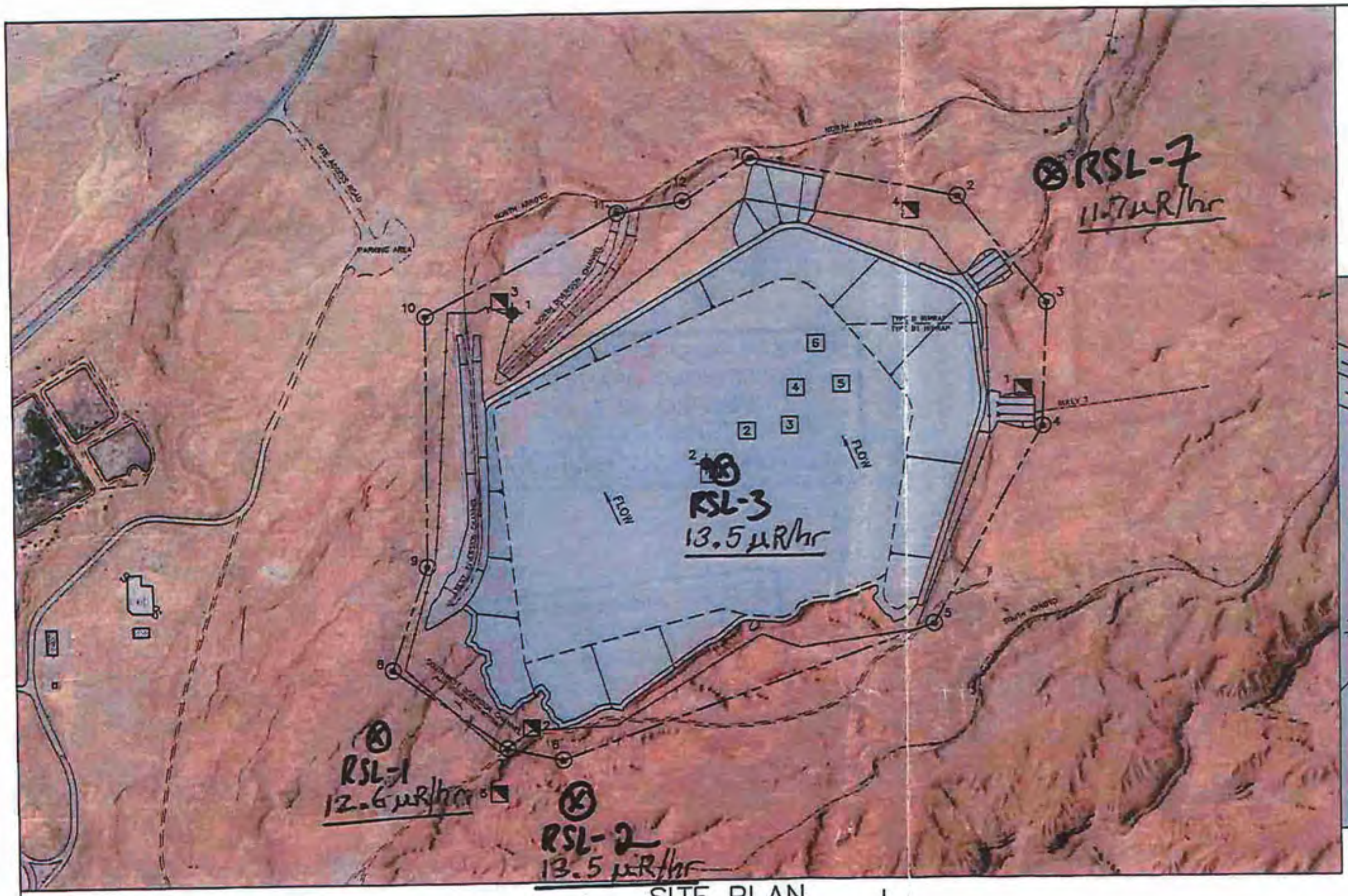
Pg 3 of 4

Radiological Survey Map (continued)

Release: ☐ **Unrestricted** ☐ **Restricted** ☒ **Other** (see remarks)

[b] See Table 2–2 of Site Radiological Control Manual I (LMS/POL/S04322).

Pg 4 of 4

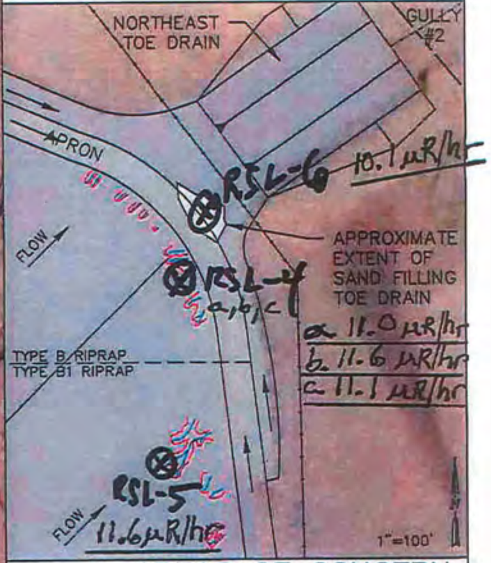


SITE PLAN

SCALE IN FEET
500 250 0 500
N

EXPLANATION

◩ 1	SURVEY MONUMENT AND NUMBER
☐3	SETTLEMENT PLATE AND NUMBER
⊙ 2	BOUNDARY MONUMENT AND NUMBER
⯁ 2	SITE MARKER AND NUMBER
━	DRAINAGE PATH
━	SURVEYED OUTLINE OF DEPRESSIONS
- - - - -	DIRT ROAD
—— - ——	PROPERTY BOUNDARY
—+—+—	BARBED-WIRE FENCE
-▼- -▼-	SLOPE – TRIANGLE POINTS DOWNSLOPE
→	DIRECTION OF FLOW



AREAS OF CONCERN

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under DOE Contract No. DE-LM0000421
Navarro Research and Engineering, Inc.

PROJECT SITE PLAN WITH
AREAS OF CONCERN
MEXICAN HAT, UT DISPOSAL SITE

DATE PREPARED:	FILENAME:
AUGUST 28. 2017	S1476803

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Appendix C11

Engineering Site Visit Trip Report, January 9 and 10, 2018

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Engineering Site Visit Trip Report

Site	Mexican Hat, Utah, Disposal Site	**Project**	NE Side Slope Inspection, January 8-10, 2018

Individuals making trip
Dan Brennecke, Dan Nordeen, John Manée, Jeff Carman, Evan Tyrrell, Nick Kiusalaas, Ryan Hernandez, Treyton Nusbaum-Davis, Curtis Hales, Milton Bluehouse, Chrissy Largo, and Yolanda Harrison from LMS. In attendance from DOE LM for observation were Angelita Denny and Bill Frazier. In attendance from NNUMTRA/AML for observation were Gilbert Dayzie, Joni Tallbull, and Cortasha Upshaw.

Purpose:

Follow-up visit to assess the area of the cell where a small void was recently discovered near the toe of the northeast side slope, and to assess other areas of concern and areas of no concern (control) where 5:1 rock cover is, and is not, showing visual signs of depressions on the northeast side slope of the disposal cell.

Basic Itinerary:
(including dates, to and from, travel method, lodging location

01/08/18: Travel from Grand Junction, CO to Mexican Hat, UT in GSA vehicle, check in at the San Juan Motel in Mexican Hat, UT.

01/09/18: Evaluate at least four (4) areas 4’ x 6’ in dimension, at least two showing depressions on the NE slope, and one slightly inside the apron drainage area where sediment accumulation has been observed at the toe of slope.

01/10/18: Complete trip evaluation by opening up one additional area upslope from TP1, travel back to Grand Junction, CO.

Summary:

- Met at the site at 0800 and reviewed all applicable safety and health paperwork and other LMS procedural documentation (e.g., Plan of the Week, JSA, Pre-Job Brief, PPE requirements).
- A total of 6 small test pits (TP1 through TP5, and TP8) were hand excavated to expose the bedding material and top of the radon barrier over the two-day period. All manually-removed materials were placed on tarps to maintain segregation of the riprap rock and bedding layer cover components. Two areas on the north side slope (TP6 and TP7) were flagged as potential test pit follow-up locations. Locations of each test pit were logged with a handheld GPS unit and are shown on the attached test pit locations map. Location specific test pit information is detailed below.
- All disturbed test pits were restored by replacing the removed bedding and riprap materials consistent with the as built conditions encountered during removal. Restored test pit locations were marked in the center of the restored area with a labeled pin flag, and the perimeter of the riprap that was removed at each location was painted with survey marker paint.
- All test pit locations were intermittently screened for gamma radiation by a Radiological Control Technician (RCT) utilizing a handheld 2”x2” sodium iodide “crutch” scintillometer. Test pits were screened before, during, and after disturbance, and no elevated radiological readings relative to ambient conditions were observed throughout the two days of field work.
- <u>TP1 (location of recently discovered void near toe of northeast side slope)</u>: The location was exposed by manually removing Type B riprap to expose the underlying bedding layer material in an area approximately 6’ by 4’ in size. Windblown material was observed on the riprap layer at approximately 5-inches below the surface. The riprap layer was roughly 12 inches thick. Approximately 4-inches of bedding material was encountered below the riprap materials, which contained little to no fine grained materials and did not appear to meet the gradation specifications in accordance with the cell completion report. An approximately 6-inch-thick, red cemented layer was observed immediately below the base of the bedding layer, where an open void was present. The cemented layer contained limited amounts of bedding material. The void was approximately 8 inches deep by 12 inches wide and appeared to extend through the cemented material, presumably into the radon barrier. The void extended under the cemented layer from 6-inches to 1-foot in all directions. Upon completing the removal of material from the TP1 area, an additional void located downslope from the initial void was discovered, which appeared to be connected to the initial void. The cemented material effervesced in the presence of hydrochloric acid (HCl) (10%) at both locations indicating the

presence of calcium carbonate. The exposed radon barrier below the cemented layer had limited reaction with HCl indicating limited amounts of calcium carbonate. The exposed cemented layer at this location was painted with survey marker paint for future reference. TP1 was restored by first placing large riprap in the voids and subsequently replacing the bedding and riprap materials consistent with the as built conditions encountered during removal.

- TP2 (visually distressed area exhibiting rill-like depressions on riprap surface): The surface rock designated as Type B1 Riprap was removed first by hand to expose the bedding layer material below in an area approximately 6' by 4'. Windblown material was noted approximately 6-inches below the surface. The riprap layer was approximately 16-inches thick. The gradation at the top of the exposed bedding material appeared to be 1-1/2" to 2" diameter washed rounded gravel with little to no fine-grained material. An apparent depressed area (potentially a collapsed void) was observed in the southeast corner of the exposed bedding layer. The bedding layer was removed, and was approximately 4-inches thick and consisted of segregated material with finer ¼-inch gravel at the base of the bedding layer. No fine-grained sand material was observed and the bedding material did not appear to meet the gradation specifications in accordance with the cell completion report. The SE depressed/void area appeared to be a void that had collapsed on itself with bigger rock mixed in with fines. The void was approximately 12-inches deep from the bottom of the bedding layer. The beginning of a linear erosion rill was observed in the radon barrier in the NE corner of the excavation and progressed from 0 to 6 inches deep on the surface of the radon barrier when first exposed. Digging into the rill area exposed moist material with some aggregate mixed in suggesting that maybe the rill was deeper at some previous time. It extended from the upper to lower portion of the exposed radon barrier, indicating it continued downslope of the test pit. Poorly cemented to non-cementitious material was noted at the surface of the radon barrier. Materials at this location effervesced in the presence of 10% HCl, indicating the presence of calcium carbonate (the reaction to HCl was not as strong as at TP1, suggesting the material is less strongly cemented). The exposed radon barrier at this location was painted with survey marker paint for future reference. TP2 was restored by first placing large riprap in the collapsed void and subsequently replacing the bedding and riprap materials consistent with the as built conditions encountered during removal.
- TP3 (control area with no apparent surface depressions in the riprap surface): Similar removal procedures were followed at this location with removal of Type B1 riprap material by hand in a 5' by 7' area, followed by removal of a small portion of the bedding layer below to investigate the bedding layer and expose the radon barrier.. Windblown material was observed at 6-inches below the top of the riprap surface. The riprap layer was approximately 1-foot thick. The bedding layer was approximately 7-inches thick, with substantially more sandy fines compared to TP1 and TP2. No disturbance was noted in the surface of the exposed bedding material at TP3. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP4 (control area with no apparent surface depressions in the riprap surface): Type B riprap material was removed by hand in an 8' by 3' area, followed by removal of a small portion of the bedding layer to investigate the bedding layer and expose the radon barrier. The riprap layer was 12-inches thick, and bedding layer was 6-inches thick with substantially more sandy fines compared to TP1 and TP2. No disturbance was noted in the surface of the exposed bedding material. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP5 (limestone riprap apron near transition from northeast side slope where sediment accumulation has been observed): A small area of type C angular limestone riprap was removed from this location, which was located approximately 75-feet downslope and slightly cross gradient from TP1. As riprap was removed, the space between the angular riprap was heavily in-filled with red silty sand that did not display clay-like properties. The physical properties of this material indicated that it appears to be accumulated windblown sediment. Riprap thickness appeared to be approximately 24-inches thick, but the excavation area was too small to properly evaluate. At the 24-inch depth, smaller rounded gravel resembling bedding material was observed but was not confirmed to be bedding material. No signs of cell performance issues were identified at this small excavation area. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP6 (near the toe of the north side slope in a small observed depression): A very small area of riprap was removed, but a full excavation was not completed at this location. The riprap appeared to be more than 12-inches thick and indicated the potential presence of a collapsed area. Further excavation will be required to evaluate this location. The observed depression in this location was not as evident compared to surface depressions that have been visually identified on the northeast side slope. Restoration of the exposed area proceeded with cover material replacement consistent with the as built conditions encountered during removal.

- TP7 (north side slope): A slight depressed area upslope and slightly west of TP6 was observed, but an excavation was not performed. Again, the observed depression in this location was not as evident compared to surface depressions that have been visually identified on the northeast side slope. This area was denoted TP7 as a potential test pit follow-up location.
- TP8 (located approximately 50-feet upslope of TP1 in an area where a surface depression was not visually evident): This area was excavated similarly to the other test pits, in an 8' by 4' area. The riprap layer was 12-inches thick, with windblown material 6-inches below the surface. The bedding layer was approximately 8-inches thick, with some ¼-inch gravel and no visible fines at the bottom (did not appear to meet gradation specifications). There was 2-inches of cementitious material on the surface of the radon barrier with gravel/sand fines up to ¼-inch diameter mixed in. No degradation of the exposed bedding layer was observed at this location. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during excavation.

Key Findings:

- No breach through the radon barrier was evident throughout this field work and no elevated radiological readings were observed.
- Riprap and bedding layer *thicknesses* appeared to meet specifications at test pit locations.
- Windblown sediment accumulation was present below the immediate riprap surface at all test pit locations.
- Cemented material (presumably radon barrier) was observed along the interface of the bedding layer and radon barrier towards the lower portions of the northeast side slope at TP1, TP2, and TP8. The cemented material appeared to be thicker towards the toe of the side slope and was not present at upgradient control points (i.e., TP3 and TP4).
- Northeast side slope exhibiting radon barrier degradation (piping/voids, incisement, and/or cementation) at TP1 and TP2; cementation was present at TP8.
- Bedding Material
  - Fines appear to be absent towards lower portions of northeast side slope (TP1, TP2, and TP8).
  - Fines could be over-concentrated at upper portions of northeast side slope (TP3 and TP4).

Included Items:

- The following documents are attached to this Report:

1. Trip Photos
2. Test Pit Location Map

Cc:			
	Dan Brennecke	Dan Nordeen	Jeff Carman
	David Miller	Evan Tyrrell	Nick Kiusalaas


TP1 – Bedding Layer/Voids


TP1 - Voids


TP1 – Voids


TP2 – Bedding Layer


TP2 – Bedding Layer


TP2 – Rill after digging out with rock hammer

TP2 – Voids

TP2 - Voids

TP3 – Bedding Layer

TP3 – Bedding Layer Bottom

TP3 – Top of Radon Barrier

TP4 – Top of Radon Barrier

TP5 – Gamma scan of excavation

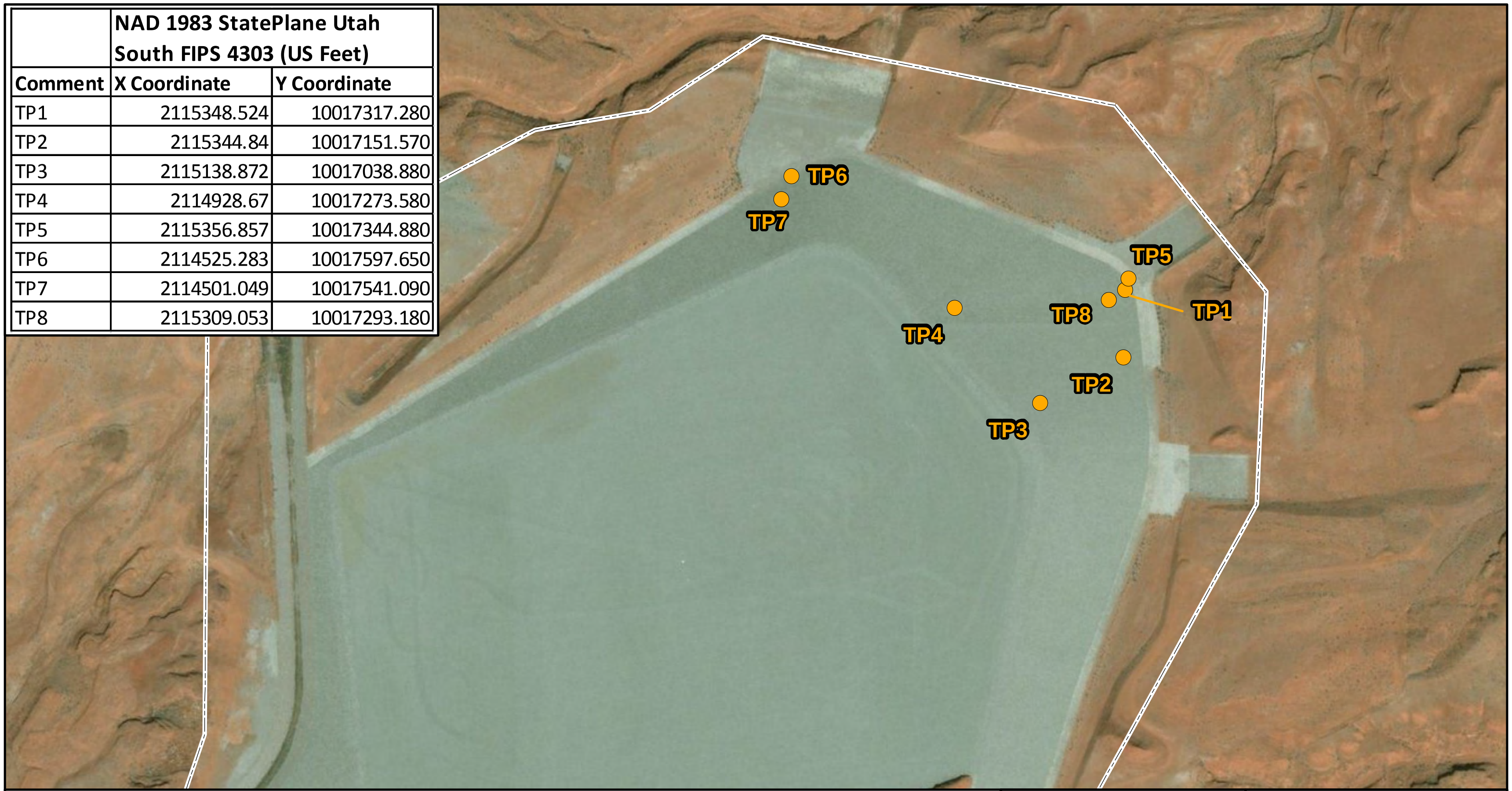
TP5 – Estimated Bottom of Angular Rip Rap

TP8 – Top of Bedding Layer

TP8 – Top of Radon Barrier

TP8 – Bedding Layer and Top of Radon Barrier

TP8 – Top of Radon Barrier



	NAD 1983 StatePlane Utah South FIPS 4303 (US Feet)	
Comment	X Coordinate	Y Coordinate
TP1	2115348.524	10017317.280
TP2	2115344.84	10017151.570
TP3	2115138.872	10017038.880
TP4	2114928.67	10017273.580
TP5	2115356.857	10017344.880
TP6	2114525.283	10017597.650
TP7	2114501.049	10017541.090
TP8	2115309.053	10017293.180

Legend

● **TP1** = Test Pit Location and Identifier

▭ = Site Boundary

NOTE: TP6 and TP7 flagged as potential test pit follow-up locations

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U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Test Pit Locations
Mexican Hat, Utah, Disposal Site

DATE PREPARED:
January 19, 2018

FILE NAME:
S1832400

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Appendix C12

Engineering Site Visit Trip Report, January 23–25, 2018

Engineering Site Visit Trip Report

Site	Mexican Hat, Utah, Disposal Site	**Project**	Limited Cover Evaluation, January 23-25, 2018
Individuals making trip	John Manée, Jeff Carman, Evan Tyrrell, Ryan Hernandez, Travis Thoele, Curtis Hales from LMS. In attendance from NNUMTRA/AML for observation was Gilbert Dayzie.		

Purpose:

Follow-up visit to assess the area of the cell where depressions were recently observed and marked near the toe of the north side slope, and to assess other areas of concern where 5:1 rock cover is showing visual signs of depressions on the north, west, and east side slopes of the disposal cell, as well as a discolored area on the top of the disposal cell cover.

Basic Itinerary:
(including dates, to and from, travel method, lodging location

01/23/18: Travel from Grand Junction, CO to Mexican Hat, UT in GSA vehicle, check in at the San Juan Motel in Mexican Hat, UT, walk south, north, west and top slopes to identify potential test pit locations.

01/24/18: Evaluate at least six (6) areas 4' x 6' in dimension showing depressions on the north, west, east, and top slopes of the disposal cell.

01/25/18: Complete limited cover evaluation by evaluating two additional areas on the east side slope, travel back to Grand Junction, CO.

Summary (1/23/2018):

- John Manée and Jeff Carman arrived at the site on 1/23/18 at 1600 and reviewed all applicable safety and health paperwork and other LMS procedural documentation (e.g., Plan of the Week, JSA, Pre-Job Brief, PPE requirements).
- Walked the south, west, north and top slopes to identify areas for possible test pits.
- Left the site at 1745.

Summary (1/24/2018):

- John Manée, Jeff Carman, Evan Tyrrell, Ryan Hernandez, Travis Thoele, and Curtis Hales arrived at the site on 1/24/18 at 0800 and on 1/25/18 at 0730 and reviewed all applicable safety and health paperwork and other LMS procedural documentation (e.g., Plan of the Week, JSA, Pre-Job Brief, PPE requirements). Gilbert Dayzie arrived at about 1600 and was provided a safety and health briefing upon arrival.
- A total of 7 small test pits (TP6, TP7, and TP9 through TP13) were manually excavated to expose the bedding material and the top of the radon barrier over the two-day period. All manually-removed materials were placed on tarps to maintain segregation of the riprap rock and bedding layer cover components. One area on the west side slope (PTP1) was flagged as a potential test pit follow-up location. Locations of each test pit were logged with a handheld GPS unit and are shown on the attached test pit locations map. Location specific test pit information is detailed below.
- All disturbed test pits were restored by replacing the removed bedding and riprap materials consistent with the as built conditions encountered during removal. Restored test pit locations were marked in the center of the restored area with a labeled pin flag, and the perimeter of the riprap that was removed at each location was painted with survey marker paint.
- All test pit locations were intermittently screened for gamma radiation by a Radiological Control Technician (RCT) utilizing a handheld 2"x2" sodium iodide "crutch" scintillometer or equivalent radiological screening device. Test pits were screened before, during, and after disturbance, and no elevated radiological readings relative to ambient conditions were observed throughout the two days of field work.

- TP7 (location of previously marked depression on the north side slope): This location was exposed by manually removing Type B riprap to expose the underlying bedding layer material below in an area approximately 6’ by 4’ in size. Windblown material was observed on the riprap layer at approximately 6-inches below the surface. The riprap layer was roughly 15-inches thick. Approximately 8-inches of bedding material was encountered below the riprap materials, which contained little to no fine grained materials and did not appear to meet the gradation specifications in accordance with the cell completion report. There was riprap material into the bedding layer on the west side of the pit. An approximate 2-inch-thick, red, weakly-cemented layer was observed immediately below the base of the bedding layer. There appeared to be erosion into the radon barrier in a seam that could be the start of piping. The exposed cemented layer and radon barrier at this location were painted with survey marker paint for future reference. TP7 was restored by replacing the bedding and riprap materials consistent with the as built conditions encountered during removal.
- TP9 (location on northern extent of top slope near the transition to the north side slope within an area of red discoloration): The surface rock designated as Type A riprap was removed by hand to expose the bedding layer material below in an area approximately 6’ by 4’. Windblown material was noted approximately 3-inches below the surface. The riprap layer was approximately 8-inches thick, meeting the riprap thickness specifications for the top slope. The surface gradation of the bedding material appeared to be ¼” to 2” diameter washed rounded gravel with fine grained material and appeared to meet the gradation specifications in accordance with the cell completion report. A slight, linear, vertically elevated feature was observed in the north end of the exposed bedding layer. The bedding layer was removed, and was approximately 6-inches thick and consisted of segregated material with finer ¼-inch gravel at the bottom of the layer. The slight, linear, vertically elevated feature had an approximate 2-inch vertical elevation increase in the radon barrier leading towards the north side slope and appeared to continue laterally along the transition area from the top slope to the north side slope. The exposed radon barrier did not show signs of cementation and, with the exception of the slight, linear, vertically elevated feature, appeared to be in good condition. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP10 (area with minor surface depression on the north side slope): Removed Type B riprap material by hand to expose the underlying bedding material in a 6’ by 4’ area. Windblown material was observed on the riprap layer at 6-inches below surface. The riprap layer was roughly 8-inches thick on the uphill side and 12-inches thick on the downhill side. An approximate 7-inch-thick layer of bedding material was encountered below the riprap materials, with sandy fines the last 2-inches above the radon barrier, which appeared to meet the gradation specifications in accordance with the cell completion report. The top of the radon barrier appeared to be in good condition, and there was no apparent reason for the surface depression observed on the riprap surface at this test pit location. The exposed radon barrier and bedding layer were painted with survey marker paint for future reference. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP11 (area with minor surface depression on the west side slope): This location was exposed by manually removing the type B riprap material, followed by manual removal of the bedding layer until the radon barrier was exposed in a 6’ by 4’ area. Windblown material was noted on the riprap layer approximately 10-inches below the surface. The riprap layer was roughly 16-inches thick, and the bedding layer was approximately 6-inches thick, with sandy, fine-grained material at the bottom of the bedding layer, which appeared to meet the gradation specifications in accordance with the cell completion report. There was no depression noted below the riprap layer, and the bedding material appeared to be uniform in appearance below the riprap layer. There was no apparent reason for the depression noted at the top of the riprap layer and the underlying cover components (i.e., bedding layer and top of the radon barrier) appeared to be in good condition. The exposed radon barrier and bedding layer were painted with survey marker paint for future reference. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- PTP1 (possible test pit location on the west side slope): A slight surface depression was observed at this location, with 1-1/2” to 2” round river rock observed near the top of the riprap layer, but an excavation was not performed. The area was denoted as PTP1 as a potential test pit follow-up location. The location was GPS located for possible future excavation.
- TP6 (near the toe of the north side slope in a small observed depression): This location was exposed by manually removing the Type B riprap material to expose the underlying bedding layer material in an approximately 6’ by 4’ area. The riprap layer was roughly 14-inches thick. Windblown material was observed on the riprap layer at approximately 6-inches below the surface. The top of the bedding layer showed a depression in the bedding material of about 8-inches. An approximate 8-inch-thick layer of bedding material

was encountered below the riprap materials, which contained little to no fine grained materials and did not appear to meet the gradation specifications in accordance with the cell completion report. An approximate 2-inch-thick, red, weakly-cemented layer was observed immediately below the base of the bedding layer. Below the red cemented layer, very soft radon barrier material was noted, with evidence of radon barrier incisement in one area that was easily penetrated with hand tools to over 6-inches in depth. Also noted was a void that extended 3-inches under the cemented layer. The area of depression was about 12-inches wide by 24-inches long. The exposed radon barrier and bedding layer were painted with survey marker paint for future reference. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.

- Completed the test pits at 1630 on 1/24/18. Walked the south, west, and top slopes of the site to review the test pit locations with NNUMTRA/AML personnel. Left the site at 1745.

Summary (1/25/2018):

- John Manée, Jeff Carman, Evan Tyrrell, Ryan Hernandez, Travis Thoele, and Curtis Hales arrived at the site on 1/25/18 at 0715. Gilbert Dayzie arrived at about 0800.
- The intent of the morning was to observe the east side slope as the sun came up, and proceed to the west slope as it continued to rise. The sun was only clearly visible on the top of the east slope for a few minutes, before it became obscured by cloud cover. Cloud cover persisted for the remainder of the morning.
- TP12 (area with minor surface depression on the east side slope): This area was exposed by manually removing the Type B1 riprap material to expose the underlying bedding layer material in an approximately 6’ by 4’ area. The riprap layer was roughly 12-inches thick. Windblown material was observed on the riprap layer at approximately 5-inches below the surface. An approximate 4-inch-thick layer of bedding material was encountered below the riprap materials, which contained little to no fine grained materials and did not appear to meet the gradation specifications in accordance with the cell completion report. There was a noted depression at the bedding layer that continued into the radon barrier. This depression was noted to be 2-inches lower on the north side of the test pit compared to the south side. The radon barrier was dry, very soft, and showing beginning signs of possible erosion. No cementation was observed. The exposed radon barrier and bedding layer were painted with survey marker paint for future reference. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.
- TP 13 (south and upslope of TP12): This area was exposed by manually removing the Type B1 riprap material to expose the underlying bedding layer material in an approximately 3’ by 3’ area. The riprap layer was roughly 13-inches thick. Windblown material was observed on the riprap layer at approximately 6-inches below the surface. An approximate 6-inch thick layer of bedding material was encountered below the riprap materials. The bedding layer exhibited 1-1/2 to 2-inch material at the top of the layer, with ¼” to ½” material at the lower portion of the layer, showing more fines than most previous locations, and appeared to meet the gradation specifications in accordance with the cell completion report. The fines extended ¾” to 1” from the top of the radon barrier and the top of the radon barrier appeared to be in good condition. Restoration of the test pit proceeded with cover material replacement consistent with the as built conditions encountered during removal.

Key Findings:

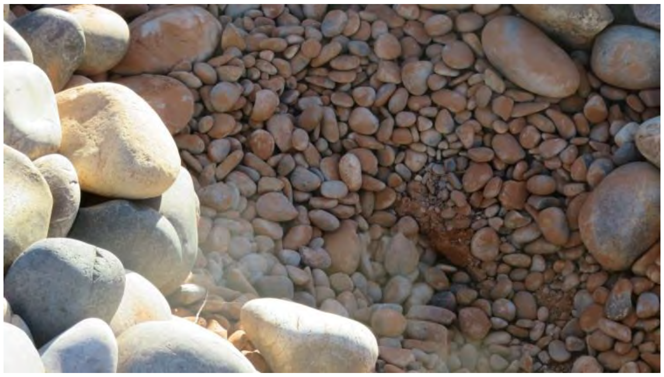
- No breach through the radon barrier was evident throughout this field work and no elevated radiological readings were observed.
- Riprap and bedding layer *thicknesses* appeared to meet specifications at test pit locations.
- Windblown sediment accumulation was present below the immediate riprap surface at all test pit locations.
- North and east side slopes exhibiting radon barrier degradation (piping/voids, incisement, and/or cementation) at TP6, TP7, and TP12 with weak-cementation present at TP6 and TP7. Signs of incipient radon barrier degradation were observed at one location of the east side slope (TP12), but were not as evident as radon barrier degradation observed at TP6 and TP7 on the north side slope.
- Bedding Material
    - Fines appear to be absent towards lower portions of north and east side slopes (TP6, TP7, and TP12).

Included Items:

- The following documents are attached to this Report:
    1. Trip Photos
    2. Test Pit Locations Map

Cc:	Dan Brennecke	Dan Nordeen	Jeff Carman
	Evan Tyrrell	David Miller	


TP6 – Bedding Layer/Depression


TP6 - Bedding Layer/Depression


TP6 – Void


TP6 – Void


TP6 – Depth of Void


TP7 – Bedding Layer


TP7 – Depression


TP7 - Void

TP7 – Voids

TP9 – Top Slope Riprap

TP9 – Bedding Layer

TP9 – Elevated Feature in Bedding Layer

TP9 – Depth to Radon Barrier

TP10 – Top of Bedding Layer

TP10 – Bedding Layer

TP10 – Top of Radon Barrier

TP11 – Bedding Layer

TP11 – Bedding Layer

TP11 – Top of Radon Barrier

TP12 – Top of Bedding Layer

TP12 – Top of Radon Barrier

TP13 – Top of Bedding Layer

TP13 – Top of Radon Barrier

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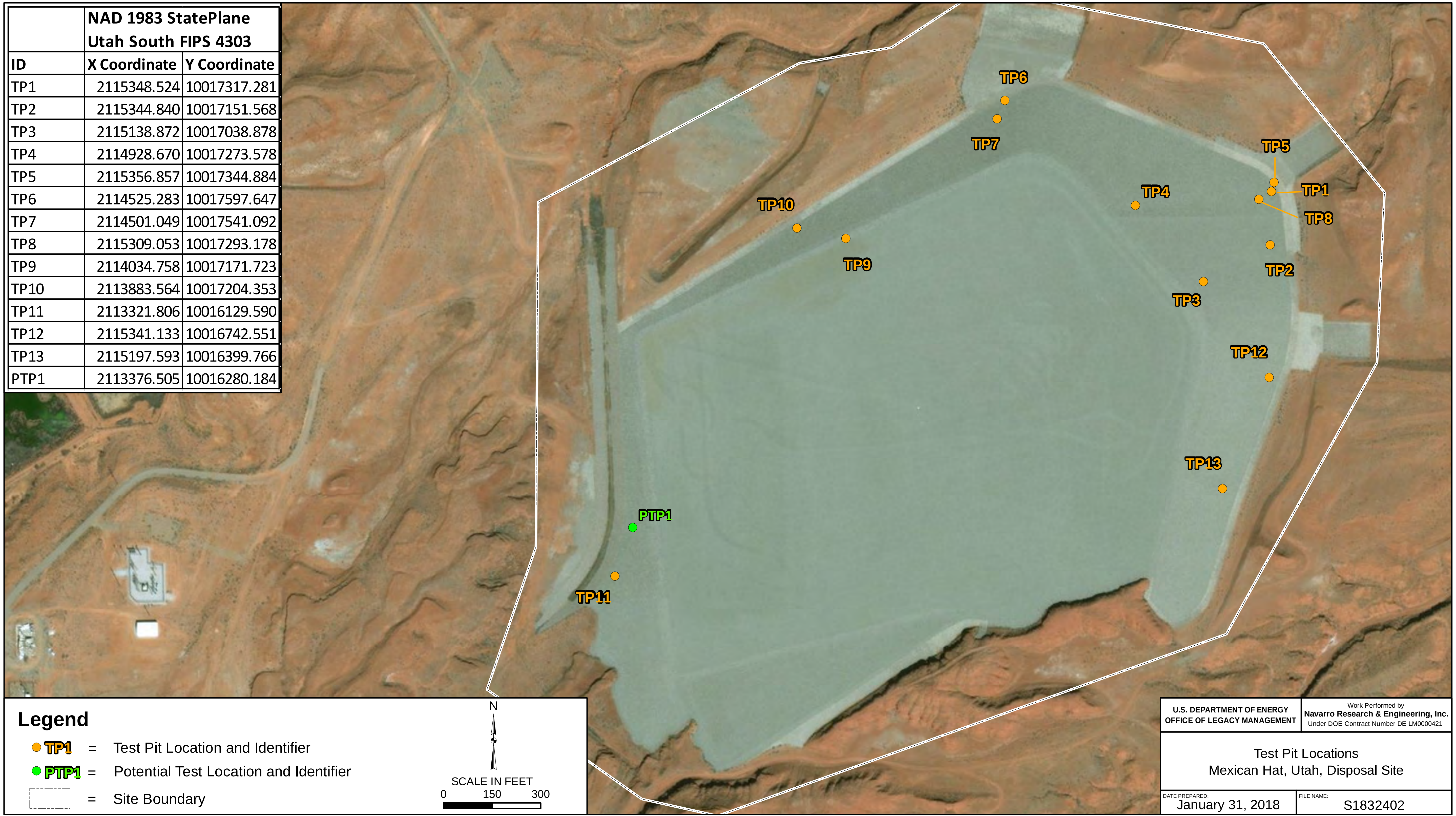

	NAD 1983 StatePlane Utah South FIPS 4303	
ID	X Coordinate	Y Coordinate
TP1	2115348.524	10017317.281
TP2	2115344.840	10017151.568
TP3	2115138.872	10017038.878
TP4	2114928.670	10017273.578
TP5	2115356.857	10017344.884
TP6	2114525.283	10017597.647
TP7	2114501.049	10017541.092
TP8	2115309.053	10017293.178
TP9	2114034.758	10017171.723
TP10	2113883.564	10017204.353
TP11	2113321.806	10016129.590
TP12	2115341.133	10016742.551
TP13	2115197.593	10016399.766
PTP1	2113376.505	10016280.184

Legend

● **TP1** = Test Pit Location and Identifier

● **PTP1** = Potential Test Location and Identifier

⬚ = Site Boundary

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U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Test Pit Locations
Mexican Hat, Utah, Disposal Site

DATE PREPARED: January 31, 2018

FILE NAME: S1832402

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Appendix D

Precipitation Data

Hydrology Review Data

Mexican Hat Average Annual Rainfall

Prior to Cover Compele

	Year	Ann Rain (in.)
1	1946	4.58
2	1947	7.32
3	1948	7.26
4	1949	8.39
5	1950	1.74
6	1951	2.72
7	1952	8.30
8	1953	4.45
9	1954	4.23
10	1955	2.63
11	1956	3.98
12	1957	9.57
13	1958	3.96
14	1959	4.57
15	1960	5.78
16	1961	6.54
17	1962	4.59
18	1963	3.82
19	1964	3.34
20	1965	9.25
21	1966	7.44
22	1967	4.84
23	1968	6.16
24	1969	4.92
25	1970	6.36
26	1971	5.76
27	1972	9.93
28	1973	6.93
29	1974	5.49
30	1975	4.95
31	1976	4.31
32	1977	3.04
33	1978	9.63
34	1979	7.08
35	1980	7.89
36	1981	7.54
37	1982	8.21
38	1983	9.19
39	1984	6.70
40	1985	7.82
41	1986	7.20
42	1987	8.45
43	1988	5.99
44	1989	3.70
45	1990	6.46
46	1991	4.90
47	1992	9.51
48	1993	8.76
49	1994	4.64
50	1995	6.42
	Average	6.14

After Cover Compele

	Year	Ann Rain (in.)
1	1996	5.43
2	1997	6.54
3	1998	4.99
4	1999	5.03
5	2000	7.11
6	2001	5.11
7	2002	6.56
8	2003	5.75
9	2004	6.67
10	2005	11.50
11	2006	5.75
12	2007	7.60
13	2008	5.93
14	2009	5.80
15	2010	10.56
16	2011	4.70
17	2012	3.77
18	2013	6.73
19	2014	4.08
20	2015	13.86
21	2016	8.07
	Average	6.74

Monthly Sum of Precipitation (Inches) Post Cover Completion

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1995	1.12	0.15	1.50	0.55	1.76	0.17	0.09	0.57	0.27	0.00	0.11	0.13	6.42
1996	0.29	0.14	0.11	0.06	0.66	0.31	0.24	0.10	1.10	0.81	1.41	0.20	5.43
1997	0.82	0.25	0.01	1.25	0.36	0.04	0.23	1.20	1.18	0.85	0.27	0.08	6.54
1998	0.25	1.12	0.65	0.28	0.14	0.00	0.37	0.07	0.55	1.23	0.31	0.02	4.99
1999	0.13	0.03	0.00	0.79	0.53	0.15	1.55	1.25	0.45	0.00	0.01	0.14	5.03
2000	0.42	0.20	1.55	0.13	0.10	0.10	0.85	0.70	0.65	1.99	0.26	0.16	7.11
2001	0.80	0.52	0.65	0.25	0.15	1.15	0.13	0.42	0.16	0.01	0.28	0.59	5.11
2002	0.14	0.00	0.22	0.15	0.01	0.00	0.10	0.41	3.73	1.22	0.36	0.22	6.56
2003	0.22	1.15	0.76	0.02	0.07	0.11	0.22	0.50	1.26	0.37	0.84	0.23	5.75
2004	0.43	1.01	0.02	1.00 f	0.00	0.01	0.64	0.18	2.12	0.22	1.34	0.70	6.67 a
2005	1.60	2.03 c	0.38	0.44	0.13	0.45	0.64	2.80	2.25	0.65	0.10	0.03	11.5
2006	0.48	0.10	1.00	0.02	0.11	0.15	0.87	0.33	0.14	2.11	0.08	0.36	5.75
2007	0.30	0.65	0.24	0.36	0.91	0.20	1.18	1.76	0.36	0.34	0.63	0.67	7.6
2008	1.19	1.31	0.00	0.10	0.37	0.06	0.02	0.25	0.16	0.60	0.76	1.11 a	5.93
2009	0.30	0.15	0.00	0.26	1.63	0.68	0.10	0.11	0.23	0.31	0.31	1.72 a	5.8
2010	1.64	1.16	0.88	0.08	0.78	0.18	0.60	2.20	1.11	1.07	0.07	0.79	10.56
2011	0.00	0.13	0.07	0.43	0.20	0.02	1.36	0.15	0.84	0.53	0.28	0.69	4.7
2012	0.47	0.34	0.10	0.05	0.00	0.00	0.63	0.95	0.43	0.35	0.00	0.45	3.77
2013	1.15	0.12	0.25	0.06	0.40	0.00	0.93	0.63	1.59	0.12	1.31	0.17 a	6.73
2014	0.00	0.28	0.10	0.10	0.29	0.00	0.21	1.01	1.23	0.34	0.11	0.41	4.08
2015	0.82	3.55 a	0.49	0.15	0.48	1.52	2.24	1.12	0.12	2.43	0.63	0.31	13.86
2016	2.70 a	0.47	0.19	0.43	0.32	0.02	0.41	1.30	0.71	0.05	0.55	0.92	8.07

🟨 Represents the highest rainfall for a given month since cover construction completed.
🟧 Added to show that for 5-months of a single year (2015) the rainfall was greater than one inch.

MEXICAN HAT, UT

Monthly Sum of Precipitation (Inches) 1946 to Present

File last updated on February 09, 2017
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

Note: Data listed in this table represents historical statistics based on measurements that were collected from the beginning (1946) to date.

Period of Record Statistics (1946 to Present)

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
MEAN	0.58	0.54	0.42	0.33	0.40	0.23	0.65	0.77	0.70	0.81	0.49	0.51	6.58
S.D.	0.60	0.61	0.42	0.33	0.44	0.35	0.58	0.67	0.65	0.90	0.39	0.46	2.14
SKEW	1.46	2.51	1.18	1.22	1.64	2.05	0.97	1.77	1.83	3.34	0.86	0.87	0.76
MAX	2.70	3.55	1.74	1.36	1.76	1.52	2.33	3.74	3.73	6.20	1.62	1.72	13.86
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.63
YRS	71	70	71	70	71	71	69	70	70	69	69	69	64

Western Regional Climate Center
(https://wrcc.dri.edu)

NOAA Atlas 14, Volume 1, Version 5 MEXICAN HAT
Station ID: 42-5582
Location name: Mexican Hat, Utah, USA*
Latitude: 37.1447°, Longitude: -109.8683°
Elevation:
Elevation (station metadata): 4130 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin,
Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao,
Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.124 (0.107-0.144)	0.160 (0.139-0.187)	0.216 (0.187-0.253)	0.266 (0.230-0.312)	0.342 (0.291-0.403)	0.407 (0.343-0.480)	0.480 (0.398-0.572)	0.563 (0.459-0.679)	0.687 (0.544-0.844)	0.795 (0.617-0.994)
10-min	0.189 (0.163-0.220)	0.243 (0.211-0.285)	0.329 (0.285-0.385)	0.405 (0.349-0.475)	0.520 (0.443-0.613)	0.619 (0.521-0.731)	0.730 (0.606-0.870)	0.857 (0.699-1.03)	1.05 (0.829-1.28)	1.21 (0.939-1.51)
15-min	0.234 (0.202-0.273)	0.301 (0.262-0.352)	0.408 (0.353-0.477)	0.502 (0.433-0.589)	0.644 (0.550-0.760)	0.768 (0.646-0.906)	0.905 (0.752-1.08)	1.06 (0.866-1.28)	1.30 (1.03-1.59)	1.50 (1.16-1.88)
30-min	0.315 (0.272-0.367)	0.405 (0.353-0.475)	0.549 (0.476-0.643)	0.676 (0.584-0.793)	0.868 (0.740-1.02)	1.03 (0.870-1.22)	1.22 (1.01-1.45)	1.43 (1.17-1.72)	1.75 (1.38-2.14)	2.02 (1.57-2.53)
60-min	0.390 (0.336-0.455)	0.502 (0.436-0.587)	0.680 (0.589-0.795)	0.837 (0.722-0.982)	1.07 (0.916-1.27)	1.28 (1.08-1.51)	1.51 (1.25-1.80)	1.77 (1.44-2.13)	2.16 (1.71-2.65)	2.50 (1.94-3.13)
2-hr	0.464 (0.407-0.539)	0.589 (0.516-0.683)	0.792 (0.691-0.915)	0.968 (0.839-1.11)	1.24 (1.06-1.43)	1.48 (1.24-1.71)	1.75 (1.44-2.04)	2.06 (1.66-2.42)	2.54 (1.98-3.02)	2.97 (2.24-3.56)
3-hr	0.509 (0.452-0.581)	0.641 (0.567-0.735)	0.841 (0.743-0.959)	1.01 (0.889-1.15)	1.28 (1.11-1.45)	1.51 (1.29-1.72)	1.78 (1.49-2.05)	2.09 (1.72-2.44)	2.56 (2.05-3.05)	2.98 (2.32-3.60)
6-hr	0.602 (0.545-0.674)	0.749 (0.676-0.839)	0.953 (0.858-1.07)	1.13 (1.01-1.26)	1.39 (1.23-1.56)	1.61 (1.41-1.81)	1.87 (1.61-2.11)	2.18 (1.84-2.47)	2.65 (2.18-3.05)	3.06 (2.46-3.63)
12-hr	0.702 (0.639-0.777)	0.875 (0.798-0.970)	1.09 (0.995-1.21)	1.27 (1.15-1.40)	1.52 (1.37-1.68)	1.72 (1.54-1.90)	1.93 (1.71-2.15)	2.19 (1.90-2.50)	2.67 (2.21-3.08)	3.09 (2.48-3.67)
24-hr	0.709 (0.648-0.785)	0.880 (0.813-0.980)	1.12 (1.03-1.22)	1.31 (1.21-1.41)	1.57 (1.44-1.70)	1.79 (1.63-1.93)	2.01 (1.82-2.17)	2.24 (2.01-2.52)	2.70 (2.28-3.11)	3.12 (2.49-3.71)
2-day	0.769 (0.706-0.833)	0.966 (0.887-1.05)	1.21 (1.12-1.31)	1.40 (1.29-1.52)	1.67 (1.53-1.80)	1.88 (1.72-2.03)	2.09 (1.90-2.26)	2.31 (2.09-2.55)	2.73 (2.35-3.14)	3.15 (2.53-3.74)
3-day	0.823 (0.759-0.892)	1.03 (0.952-1.12)	1.28 (1.19-1.39)	1.49 (1.37-1.61)	1.76 (1.62-1.91)	1.98 (1.80-2.14)	2.19 (1.99-2.38)	2.42 (2.19-2.64)	2.77 (2.44-3.16)	3.17 (2.62-3.76)
4-day	0.877 (0.812-0.952)	1.10 (1.02-1.19)	1.36 (1.25-1.48)	1.57 (1.45-1.70)	1.86 (1.71-2.02)	2.07 (1.89-2.25)	2.30 (2.09-2.49)	2.52 (2.28-2.74)	2.82 (2.53-3.17)	3.19 (2.71-3.78)
7-day	1.01 (0.922-1.10)	1.26 (1.15-1.37)	1.55 (1.43-1.69)	1.79 (1.66-1.94)	2.10 (1.93-2.27)	2.34 (2.15-2.53)	2.57 (2.35-2.78)	2.81 (2.56-3.04)	3.12 (2.82-3.38)	3.35 (3.02-3.82)
10-day	1.12 (1.03-1.22)	1.39 (1.28-1.51)	1.72 (1.58-1.86)	1.98 (1.83-2.14)	2.31 (2.13-2.50)	2.56 (2.35-2.77)	2.81 (2.56-3.03)	3.04 (2.77-3.30)	3.36 (3.04-3.64)	3.59 (3.23-3.89)
20-day	1.39 (1.25-1.54)	1.74 (1.58-1.93)	2.16 (1.95-2.39)	2.48 (2.24-2.75)	2.91 (2.62-3.22)	3.23 (2.89-3.57)	3.55 (3.16-3.92)	3.87 (3.44-4.28)	4.29 (3.78-4.74)	4.60 (4.02-5.10)
30-day	1.63 (1.49-1.80)	2.05 (1.88-2.25)	2.53 (2.31-2.79)	2.90 (2.63-3.18)	3.37 (3.06-3.70)	3.71 (3.36-4.07)	4.05 (3.65-4.45)	4.39 (3.94-4.82)	4.81 (4.29-5.28)	5.12 (4.54-5.63)
45-day	1.93 (1.76-2.11)	2.42 (2.21-2.66)	2.97 (2.73-3.26)	3.39 (3.10-3.72)	3.92 (3.58-4.29)	4.29 (3.92-4.71)	4.67 (4.24-5.12)	5.01 (4.54-5.49)	5.45 (4.92-5.97)	5.76 (5.19-6.32)
60-day	2.20 (2.03-2.38)	2.74 (2.52-2.96)	3.36 (3.10-3.63)	3.81 (3.53-4.13)	4.39 (4.06-4.74)	4.80 (4.43-5.18)	5.19 (4.78-5.61)	5.56 (5.10-6.01)	6.02 (5.50-6.51)	6.33 (5.77-6.87)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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Appendix E

Revised Filter Criteria Between Type B Riprap and Bedding Calculations

Calculation No.:

Technical Task Cover Sheet

Discipline geotechnical/hydrological **Number of Sheets** ____

Project:
Legacy Management

Site:
Mexican Hat, UT

Subject:
Filter Criteria between Type B riprap and Bedding Layer

Sources of Data:

MK Calculation, “UMTRA HAT/MON, Erosion Protection, Oversizing, Gradation & Thickness”, No. 9-418-05-01

Calculated by	Date	Checked by	Date
G. Smith	9/12/2016		

Geo Smith ENGINEERING, LLC

Problem Statement:

Check filter criteria between Type B (&B1) riprap erosion protection and the bedding layer.

Method of Solution

Use open graded filter criteria to check filter compatibility between the two materials.

Assumptions:

As-built materials meet design specifications

Sources of Formulas and References:

Cedergren, Harry, R., 1988. *Seepage, Drainage, and Flow Nets,* 3rd edition, John Wiley and Sons, New York, NY.

Pit Slope Manual, Chapter 9 Waste Embankments, 1979. Mining Research Program, Mining Research Laboratories, CANMET Report 77-01.

Computer Source:

NA

Calculation:

Gradation of the Bedding Layer and Type B and B1 riprap are presented below and shown graphically on Figure No. 1 (ref: MK Calculation HAT/MON, Erosion Protection, Oversizing, Gradation & Thickness", No. 9-418-05-01).

Bedding Layer

Sieve Size (square opening)	% passing (by weight)
3-inch	100
1.5-inch	50-100
1-inch	35-70
No. 4	10-30
No. 30	0-10
No. 100	0-5

Type B Riprap Layer

Sieve Size (square opening)	% passing (by weight)
8-inch	100
6-inch	25-100
5-inch	0-100
4-inch	0-25
1-inch	0-5

Type B1 Riprap Layer

Sieve Size (square opening)	% passing (by weight)
5-inch	100
4-inch	0-100
3-inch	0-50
2-inch	0-25
No. 4	0-5

Open graded filters are required to prevent internal erosion of fine protection material. To be effective the filter must be more permeable than the protected material and its gradation must be that voids are sufficiently small to prevent passage of fine material from the protected material.

Filter criteria has 5 rules as follows (15 and 85 represent effective diameters of magnitude % passing, F is filter material and B represents the protected material) :

Rule #1
$D_{15\ F}/D_{85\ B} < 5$ *piping ratio,*

Rule #2
$D_{15\ F}/D_{15\ B} > 5$ and < 20 *guarantees sufficient permeability and to eliminate hydrostatic forces in filters,*

Rule #3
$D_{50F}/D_{50B} < 25$ *prevents movement of particles through filters,*

Rule #4
$D_{85F}/D_{15F} > 5$ *filter should filter itself and filter should be graded smoothly,*

Rule #5
Filters should not contain more than 5% passing No. 200 sieve.

In this analysis the bedding material is the protected material and Type B and B1 ripraps are the filters.

The following effective diameters for bedding and riprap material are evident from Figure No. 1.

Effective diameters for Material Layers

Material/Effective dia.	D_{15} (mm)	D_{50} (mm)	D_{85} (mm)
Bedding Layer	6 - 1	53 – 9.5	60 - 30
Type B riprap	150 - 50	177 - 108	195 - 122
Type B1 riprap	101 - 35	110 - 76	130 - 95

Type B/Bedding Layer
Rule #1 ; 146/30 = 4.9 < 5 ok
Rule #2 ; 50/6 = 8.33 > 5, <20 ok
Rule #3 ; 177/9.5 = 18.6 < 25 ok
Rule #4 ; 200/50 = 4 ng
Rule #5 ; 0% passing #200 ok

Type B1/Bedding Layer
Rule #1 ; 101/30 = 3.4 < 5 ok
Rule #2 ; 35/6 = 5.8 > 5, <20 ok
Rule #3 ; 110/9.5 = 11.6 < 25 ok
Rule #4 ; 130/35 = 3.7 ng
Rule #5 ; 0% passing #200 ok

Discussion:

Both types of riprap will prevent piping of the bedding layer and are permeable enough to prevent buildup of hydrostatic forces within the riprap. Both riprap material will prevent erosion of the bedding layer through the riprap layers. However, both ripraps do not filter themselves but are free of excessive fines. Both riprap gradations do not contain enough finer rock to be smoothly graded to provide a filter for itself, however the gradations are correctly designed as a uniform rock materials to provide erosion protection.

Conclusion and Recommendations:

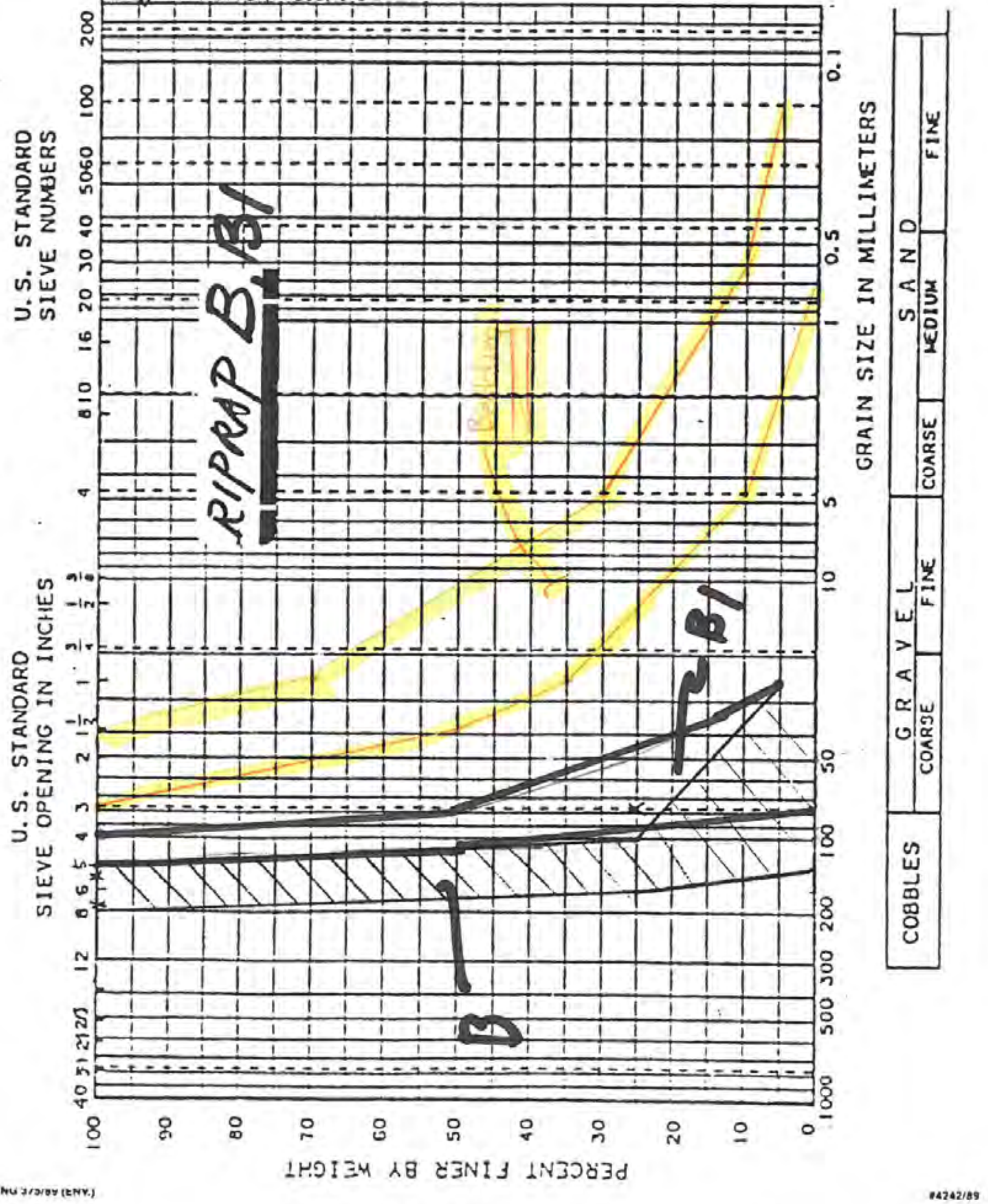
Both types of riprap adequately filter the bedding layer from internal erosion and piping. However neither riprap filters itself. This is not a concern due to the fact that the riprap layers are designed to provide erosion protection against wind and water erosion and were not designed as filters. Also the hydraulics to cause removal of riprap material will not arise.

MK-ENVIRONMENTAL SERVICES
A DIVISION OF MK-FERGUSON

Project UMTRA – HAT/MON	Contract No. 3885-58	Sheet 5	File No.
Feature Erosion Protection	Designed JCK	Date 2-18-92	
Item Oversizing, gradation & thickness	Checked ZHW	Date 2/19/92	

(This sheet is for Rev. 01)

3. Gradation Calculations for Riprap cont'd)
(c) Gradation Curves



ENG 3/3/89 (ENV.)

#4242/89

Figure No. 1

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Appendix F

Demolition and Contaminated Material Placement

Appendix F1

Demolition Specification

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 SCOPE

A. This Specification Section describes the requirements for the demolition and disposal of the following facilities:

1. Existing Structures and Facilities:

   a. Concrete structures at the Monument Valley Site.

   b. Steel debris at the Monument Valley Site.

   c. Rubble, boulder and ore piles at Monument Valley Site. The piles are scattered throughout the site in the south, west and northwest areas of the site.

   d. Decontamination pad.

   e. Membrane liners from ditches, retention basins, spillways, collection sumps, recirculation ponds and water supply ponds.

   f. Existing chain link and woven wire fences.

   [g. Miscellaneous debris scattered throughout the site or included in the contaminated material.]*

2. Structures installed/constructed under this Subcontract including Washwater recirculation system including piping, tanks, and new pond liners.

B. Approximate descriptions and data of these facilities are listed in attached Table 02050-A and identified on the Subcontract Documents. Additional details are included in the Information for Bidders.

C. The structures and facilities installed/constructed under this Subcontract are specified under various Specification Sections of this Subcontract and are shown on the Subcontract Drawings. Although these structures are not listed in Table 02050-A, all temporary structures and facilities built at the sites shall be demolished and disposed of.

* P.I.D. 09-S-15

1.2 WORK NOT INCLUDED

Removal and disposal of existing stockpiles of demolished materials and debris is not included in the Scope of Work of this Section. Disposal of demolished materials and debris is specified in Section 02200.

1.3 RELATED WORK

A. Section 00800 - Special Conditions: Articles SC-7 and SC-8

B. Section 01300 - Submittals

C. Section 01500 - Construction Facilities

D. Section 01560 - Temporary Controls

E. Section 02200 - Earthwork: Disposal of demolished materials and debris.

1.4 DEFINITIONS

A. Demolition includes complete dismantling, cutting and breaking up of structures, including all solid contents and associated services and utility lines including their foundations and below grade slabs and footings.

[B. Removal and Disposal of Rubble: This shall consist of the removal of demolition debris, rubble containing wood, concrete, steel and boulders, breaking into specified sizes, loading, transporting to Mexican Hat site, unloading and placing in the tailings embankment as specified in Section 02200. The size and location of rubble piles is described in the Information for Bidders. The location of the rubble piles is also shown on the Subcontract Drawings.]*

[Text Deleted]*

1.5 SUBMITTALS

A. General submittal requirements are specified in Section 01300.

B. Ten days prior to the start of Work, the Subcontractor shall submit to the Contractor, for review, a demolition plan including the following:

* P.I.D. 09-S-15

1. Methods of demolition to be used.
2. Schedule showing dates and structures to be demolished.
3. List of equipment to be used.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 DEMOLITION

A. During the execution of this Subcontract, if unidentified waste material is suspected or encountered, the Site Manager shall be immediately notified for identification and subsequent disposition.

B. Locations of structures to be demolished are shown on the Subcontract Drawings and listed in attached Table 02050-A; however, the Subcontract Drawings do not show the locations of all foundations, rubble and debris, concrete pads, and the like, all of which are required to be demolished and removed within the boundaries of the project sites.

C. Pollution Controls:

   1. Water sprinkling, temporary enclosures, and other Contractor-approved methods shall be used to limit the amount of airborne dust and dirt to the lowest practical level. Demolition work shall comply with governing regulations pertaining to environmental protection.

   2. Water shall not be used if it is likely to create hazardous or objectionable conditions such as ice, flooding, or pollution. An approved water-based biodegradable wetting agent (surfactant), such as Dupont "Duponol WAQ" or equal, may be used to reduce the quantity of water required.

D. Demolition work shall be carried out using equipment compatible to the structures to be demolished and by methods required to complete the Work in accordance with governing regulations. The structures shall be demolished, and the materials and debris disposed of as specified in Section 02200.

E. After the completion of the construction phase, the synthetic membranes shall be removed, decontaminated and disposed of as required by the Contractor. If the membrane cannot be decontaminated by practical means, it shall be disposed of by cutting into strips, shredding and placing in the tailings embankment in a manner that would not induce settlement, inhibit water migration, or exceed the 5 percent limit on organic material by volume.

[F. Demolished materials, consisting of steel, concrete, wood, masonry and other man-made materials, rubble, debris and boulders shall be reduced in size to pieces to be no greater than 3 feet in any dimension and no more than 27 cubic feet in volume.]*

G. Metal objects with voids shall be crushed to sizes no greater than 27 cubic feet in volume, with the least dimension not exceeding 6 inches.

H. Grading shall be performed, as required by the Contractor, to restore existing grades to near natural conditions and as specified in Section 02200.

I. Fences and gates shall be removed and disposed of as Subcontractor's property. Concrete footings shall be disposed of in the tailings embankment or as directed by the Contractor.

J. Any pipe, conduit and ducts shall be cut to sizes no greater than 10 feet in length.

3.2 DISPOSAL OF DEMOLISHED MATERIALS AND DEBRIS

[A. Demolished materials, consisting of steel, concrete, wood, masonry and other man-made materials, rubble, debris and boulders shall be transported to the Mexican Hat site and disposed of in the tailings embankment, as specified in Section 02200 and as shown on the Subcontract Drawings.]*

B. Burning of materials resulting from demolition operations will not be permitted.

C. Uncontaminated materials such as fencing, piping membranes, wooden platforms, and stairs for trailers and other materials shall be removed as Subcontractor's property as directed by the Contractor.

D. Water supply facilities designated by the Contractor shall remain in place.

* P.I.D. 09-S-15

[Text Deleted]*

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement for payment for demolition and disposal of structures specified in this Section will be on a lump sum basis.

B. Measurement for payment for removal and disposal of rubble specified in this Section will be on a lump sum basis.

[Text Deleted]*

4.2 PAYMENT

[A. Payment for demolition and disposal of structures, removal and disposal of rubble, debris and boulders specified in this Section will be by the respective lump sum prices quoted therefor in the Bid Schedule. The prices quoted shall include full compensation for furnishing all labor, materials, equipment, incidentals, and for performing all work specified including, but not limited to, transportation and placement of demolished materials, debris and boulders in the tailings embankment.]*

B. Separate payment will not be made for any other work specified in this Section. Full compensation for such work will be considered incidental to the applicable related items of work.

END OF SECTION 02050

* P.I.D. 09-S-15

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Appendix F2

Design Basis Memoranda

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UMTRA PROJECT - HAT/MON
DESIGN BASIS MEMORANDUM NO. 09-232-01
DECONTAMINATION AND DEMOLITION OF STRUCTURES

CONTENTS

1. PURPOSE

The purpose of this memorandum is to provide the basic information and set the guidelines for preparation of drawings and specifications for decontamination and demolition at the Mexican Hat and Monument Valley sites (Refs. 1 and 4).

2. SCOPE

This memorandum will establish the criteria for demolishing the foundations and rubble piles at the Monument Valley site.

It will also describe measures required for the demolition of the temporary fencing, retention basins, and the decontamination facilities for both sites.

3. DECONTAMINATION

Specifications for decontamination shall be written to require that:

A. Decontamination be performed by experienced crews supplied with adequate protective equipment (coveralls, respirators, gloves, boots and eye protection).

B. Contaminated water from washdown activities be used as a dust suppressant or monitored and disposed of in the retention basin.

C. Upon completion of remedial action work, other contaminated sediments, sludges and other materials from the bottoms, sides and ditches of the retention basin will be excavated and incorporated into the embankment. The shutdown and clean-up of the retention basin will be guided by applicable sections of 30 CFR Part 816 (Ref. 5).

D. Strict maintenance of the HEPA filter and proper disposal of contents and filters be required where decontamination is performed using nuclear grade industrial vacuum cleaners.

E. Application of contamination fixants prior to demolition be done under the supervision of health physicists, who will specify protective clothing and equipment.

4. DEMOLITION

Specifications for demolition shall require that:

A. Foundations and rubble piles shall be broken up in specified sizes to facilitate their disposal.

B. Protective equipment for personnel be required during the use of cutting torches, jack hammers or other equipment for demolition. Appropriate engineering controls be used to prevent dispersion of contaminated dust during demolition.

C. Open burning not be permitted.

5. PROTECTION AND SAFETY

All work shall be conducted in accordance with the UMTRA Project health and safety program, Reference 3.

6. DISPOSAL OF MATERIAL

Specifications for disposal of material shall require that:

A. Organic materials such as wooden demolition debris and grubbed vegetation be evenly distributed throughout the embankment; alternatively, large volumes of organic materials be buried elsewhere on the site (away from the tailings) where differential settlement is of less concern or be removed from the site if monitored and found safe (Ref. 2, Sec. 2.2.2d).

B. Rubble pieces be placed on the top of the existing pile and surrounded with compacted contaminated materials. Debris not be nested but instead placed in layers and tailings compacted within and around the individual pieces of debris in order to eliminate voids and, thereby, minimize differential settlement (Ref. 2, Sec. 2.2.2d).

C. No salvage of uncontaminated materials by the Subcontractor be allowed unless approved by the RAC.

D. Uncontaminated excavated material from the retention basin shall be stockpiled for restoration purposes. After final removal of contaminated sediments, the retention basin and the disturbed adjacent areas shall be filled, contoured for drainage, or restored to original ground contours, and revegetated.

7. REFERENCES

1. U.S. Department of Energy, "Remedial Action Plan and Conceptual Site Design for the Stabilization of the Inactive Uranium Mill Tailings Site at Mexican Hat, Utah, Draft February 1986, UMTRA-DOE/AL 050509.0000.

2. U.S. Department of Energy, "Design Criteria for Stabilization of Inactive Uranium Mill Tailings Sites", June 1984, UMTRA-DOE/AL-050424.0049.

3. U.S. Department of Energy, UMTRA Project Health and Safety Plan, June 1983, DOE/AL-6.

4. U.S. Department of Energy, "Remedial Action Plan and Conceptual Site Design for the Stabilization of the Inactive Uranium Mill Tailings Site at Monument Valley, Arizona, Draft February 1986, UMTRA-DOE/AL 050519.0000.

5. U.S. Department of Interior, "Code of Federal Regulation, CFR 30, Part 816, Chapter VII, Subchapter K: Permanent Program Performance Standards - Surface Mining Activities, Federal Register, Office of Surface Mining, July 1985.

UMTRA PROJECT - HAT/MON
DESIGN BASIS MEMORANDUM NO. 09-239-01
TAILINGS MATERIALS EXCAVATION AND FINAL EMBANKMENT

CONTENTS

1. PURPOSE

This Design Basis Memorandum presents the basis for design of the tailings materials excavation and the final embankment design for the Mexican Hat and Monument Valley sites.

2. SCOPE

The embankment will be designed to contain all contaminated materials from the Mexican Hat and Monument Valley Sites, including the adjacent areas, to provide long-term stability and radon control. Contaminated materials from the areas to be excavated and relocated to the tailings embankment include: the Monument Valley tailings piles and the heap leach pad areas, the windblown and water-borne deposit areas, spot wind-blown contaminated areas dispersed around the processing site and demolition materials.

3. DESIGN CRITERIA AND GUIDELINES

A. Excavation of Contaminated Materials

Contaminated materials outside of the proposed embankment area will be excavated to levels of contamination which do not exceed 5 picocuries of Ra-226 per gram above background in the top 15 centimeters of soil, and do not exceed 15 picocuries per gram above background averaged in any 15-cm layer below that depth (Ref. 2, Sec. 1.3.f). Excavation limits and depths will be defined on the construction plans based on the available most recent radiological survey data. Final excavation limits will be based on field radiological surveys during construction. The excavated areas will be regraded and revegetated for good drainage.

B. Final Embankment

1. The embankment area and layout will be consistent with the requirement that stabilization controls will be effective for up to 1,000 years, to the extent reasonably achievable, and in any case for at least 200 years (Ref. 2, Sec. 1.3.b).

2. The embankment will contain contaminated materials from existing

tailings piles, and the contaminated materials excavated from mill area, heap leach pad areas, ore storage area at Monument Valley and windblown and waterborne deposit areas at both sites in the vicinity, and any other contaminated materials such as wood, organic debris or demolition debris (Ref. 2, Sec. 2.2.2).

3. The estimated quantity of materials to be placed in the final embankment, as well as its area, will be determined consistent with good engineering practice, the estimated quantity of contaminated materials, economics of construction, and availability of land. The embankment system shall not extend into areas outside the designated site, onto floodplains, or into other areas which will reduce the performance of the remedial action, without prior written approval from the UMTRA Project office of the Department of Energy (Ref. 2, Sec. 2.2.2b).

4. The contaminated materials placed above the existing tailings will be densified by compaction or some other means to reduce the potential for long-term differential settlement.

5. A layer of uncontaminated earthen material designed to provide reasonable assurance that releases of radon-222 from the tailings embankment will not exceed an average release of 20 picocuries per square meter per second will be installed as a cover over the embankment to serve as a radon barrier (Ref. 3, Sec. 2.3).

6. The cover will be protected by a layer of rock, against erosion of the soil cover from the Probable Maximum Precipitation (Ref. 2, Sec. 2.2.2f). One or more filter layers will be required between the radon barrier and rock cover protection (Ref. 4, Ch. 5, Sec. 5.1.7).

7. If practical, embankment side slopes will be 1 vertical to 5 horizontal. The design of embankment sideslope shall be based on detailed analysis of tailings properties, slope stability, and erosion protection requirements (Ref. 3, Sec. 3.1.5). The minimum top slope shall be sufficient to promote drainage and prevent ponding (Ref. 2, Sec. 2.2.2c).

8. If wood or other organic debris is placed within the tailings embankment, it shall be chipped or otherwise reduced in size. It shall then be distributed throughout the lower portion of the tailings so as not to exceed 5 percent by volume in any lift or layer, and thus minimize differential settlement (Ref. 2, Sec. 2.2.2d).

9. The embankment will be designed to withstand the design earthquake.

10. The embankment construction will be sequenced to place lesser contaminated materials over more highly contaminated materials to reduce radon exhalation. The embankment will be comprised as follows, in order from bottom to top:

a. In-situ tailings piles.

b. Relocated materials from the mill area and the ore storage area at Monument Valley; rubble pieces will be placed on the top of the existing tailings embankment and surrounded with compacted relocated soils.

c. Heap leach pad area at Monument Valley.

d. Monument Valley tailings.

e. Relocated, contaminated materials from the windblown and waterborne deposit areas.

f. Contaminated material from temporary facilities.

g. Radon barrier.

h. Filter zone or zones.

i. Rock cover.

4. REFERENCES

1. U.S. Department of Energy, "Remedial Action Plan and Site Conceptual Design for the Stabilization of the Inactive Uranium Mine Tailings Site at Mexican Hat, Utah, Draft", UMTRA-DOE/AL-050509.0000, February 1986.

2. U.S. Department of Energy, "Design Criteria for Stabilization of Inactive Uranium Mill Tailings Sites", UMTRA-DOE/AL-050424.0049, June 1984.

3. U.S. Department of Energy, "Plan for Implementing EPA Standards for UMTRA Sites", January 1984, UMTRA-DOE/AL-163.

4. Morrison-Knudsen Engineers, "UMTRA Design Procedures Manual".

5. U.S. Department of Energy, "Remedial Action Plan and Conceptual Site Design for Stabilization of the Inactive Uranium Mine Tailings Site at Monument Valley, Arizona", UMTRA-DOE/AL-050519.0000, February 1986.

Appendix F3

Completion Report

CONTAMINATED FILL MATERIAL

- Prior to placement of contaminated fill material the entire contaminated subgrade (existing grade of the tailings embankment) was plowed, harrowed and mixed to a depth of at least six inches, as verified by visual inspection.

- Prior to placement of the first lift, the entire contaminated subgrade surface of the tailings embankment area was compacted by either a Caterpillar 65 Challenger tractor towing a 5x5 sheepfoot compactor, or a Caterpillar 825 sheepfoot compactor. Preparation of the contaminated subgrade surface was inspected and approved in accordance with the Design Specifications.

- All contaminated material and debris resulting from demolition of the old Halchita/Mexican Hat Mill foundation, and associated structures, and from off-site vicinity properties during Phase I, were cut or broken into sizes meeting specified requirements before placement in the cell embankment.

- Contaminated fill materials requiring encapsulation were located and compacted in the cell embankment using the following equipment:

  <u>Phase I</u>

  Excavation: Caterpillar 235 excavator, Caterpillar 988 front end loader, and Caterpillar 631 and 633 scrapers.

Haulage:	Caterpillar 631 and 633 scrapers, and 769 off-highway end dump trucks.
Compaction:	Caterpillar D8N and D9N dozers, 14G and 140G motor grader, 65 Challenger tractor towing a 5x5 sheepfoot compactor and BG land leveler.

Phase II

Excavation:	Caterpillar 235 excavator, 988 front end loader, and Caterpillar 631 and 633 scrapers, and Komatsu WA500 and WA600 front end loaders.
Haulage:	Caterpillar 631 and 633 scrapers, 25 ton articulated end dump trucks, Volvo 25 ton and 30 ton articulated rock trucks, International semi-trucks pulling end dump or belly dump trailers or trailer pup units.
Material Placement:	Caterpillar 14G and 16G motor graders, and Caterpillar 633 scraper.

Compaction: Caterpillar D8N and D9N dozers, 825 sheepfoot compactor, 65 Challenger tractor towing a 5x5 sheepfoot compactor, vibratory smooth-drum compactor, 825C sheepfoot compactor, Caterpillar D8N dozer, Caterpillar 613 and 633 waterwagons, and international 5,000 gallon waterwagon and trucks.

- Contaminated fill material was placed and verified to not exceed a 12 inch loose lift thickness. Where contaminated fill material contained individual pieces larger than the 12 inch loose lift thickness, the lift thickness was verified as minimum constructable thickness and materials were spread to ensure a void free mass and provide adequate compaction between larger particles.

- During placement of contaminated fill material, continuous visual inspection was performed to ensure that organic materials did not constitute more than five percent of the placed volume. Also, demolition debris and organics were evenly distributed throughout the fill to avoid concentrations. Individual linear pieces of wood, steel and plastic were cut or broken into pieces not greater than 10 feet in length; similarly, pieces of concrete, rock, masonry and steel was sized down to be less than 3 feet in any dimension and/or less than 27 cubic feet in volume.

- There was a total of 2,072,039 cubic yards of contaminated material placed in the cell embankment. Of the total 2,072,039 cubic yards, 185,040 cubic yards (i.e., 10 percent) was concrete, debris material, or large rocky contaminated material that could not be tested in accordance with ASTM D-698. Gradation testing was performed in accordance with ASTM D-698 to determine the testable status of the contaminated material. Materials exceeding 30 percent retatined on the 3/4 inch screen were considered non-testable.

- The contaminated fill material was required to be compacted with a minimum number of passes of an approved piece of equipment. Placement and compaction of the contaminated fill material was verified by visual QC inspections, as required.

- The test frequency for performing gradation testing of non-testable contaminated fill material was not specified in the Design Specifications.

- There were 72 gradation tests performed for the 185,040 cubic yards of non-testable contaminated fill material placed. This provides an average test frequency of one gradation test for each 2,570 cubic yards of material placed.

- The required test frequency for performing maximum dry density determination testing (i.e., ASTM D-698), was prior to placement of material and supplemental testing at a frequency of one test for each 10 to 15 in-place field density tests.

- There were 432 maximum dry density determination tests performed in accordance with ASTM D-698. With a total of 2,961 in-place field density tests performed, the average test frequency was one maximum dry density determination test for each 6.9 in-place density tests performed.

- The required test frequency for performing the one-point proctor check was a minimum of one, one-point proctor check for each five in-place density tests performed.

- There were 901 one-point proctor checks performed to ensure that the correct maximum dry density value was utilized when analyzing in-place field density tests. With 2,961 in-place density tests performed, the average test frequency was one, one-point proctor check for each 3.3 in-place field density tests performed.

- Compaction verification was accomplished by in-place field density testing in accordance with ASTM D-1556.

- Required compaction for contaminated fill material was either 90 percent or 95% percent of maximum dry density determination (as measured per maximum density testing, ASTM D-698). The top/outside three feet of contaminated material under the radon barrier cover material required 95% percent compaction. The interior material required 90% percent compaction.

- The test frequency for performing in-place field density testing was a minimum of one in-place field density test for each 1,000 cubic yards of material placed. In addition, a minimum of two in-place moisture/density tests were required to be performed each day of placement in excess of a 150 cubic yards of testable material placed, and at least one in-place moisture/density test for each lift of material placed and for each full shift of compaction operations.

- There was a total 2,961 in-place density tests performed. Of the 2,961 density tests performed, 715 tests were in areas where 95% of the maximum dry density compaction was required. Average compaction for all in-place density tests were 97.6%. With 1,886,999 cubic yards of testable contaminated fill material placed, the average test frequency was one in-place field density test for each 637.3 cubic yards of contaminated fill material placed. All of the in-place field density test results were in accordance with the Design Specifications. Reference Moisture/Density Test Frequency Charts at end of this section.

- There were 180 failing in-place density tests within the embankment perimeter. Areas represented by these tests were reworked, retested and passed in accordance with the Design Specifications.

- Contaminated fill materials were moisture-conditioned at the excavation site or in stockpiles to aid in compaction efforts. This was accomplished by either addition of water or by allowing the material to dry after scarification. Water was not applied to contaminated fill material on the cell embankment, except for environmental dust control purposes, as necessary.

- Moisture content verification was accomplished by in-place moisture tests in accordance with ASTM D-4643 and ASTM D-2216.

- For initial control, it was required that a minimum of ten consecutive moisture correlation tests between the conventional oven and the microwave oven be performed. The initial control was performed on contaminated material prior to utilizing the microwave oven method. Thereafter and during placement of uncontaminated material, the required test frequency for performing moisture correlation testing was a minimum of one moisture correlation test by conventional oven dried method for every 10 microwave oven tests performed. The moisture correlation test results were required to be within plus or minus one percent.

- There were 3,240 microwave oven-dried moisture tests performed, with 774 conventional oven-dried moisture correlation tests. This provides an average test frequency of one conventional oven-dried moisture correlation test for each 4.2 microwave oven-dried moisture tests performed. All correlation test results were within one percent (+/- 1%) of the microwave oven-dried test result.

- Prior to placement of radon barrier material, the contaminated fill material finish grade was verified to be graded uniform and smooth through visual inspection and survey verification.

- In addition, there were a minimum of two in-place moisture density tests performed each day of placement in excess of a 150 cubic yards of testable material placed and at least one in-place moisture density test for each lift of material placed and for each full shift of compaction operations. The bulk density of sand-cone density sand was determined twice a day and for each new bag of sand.

- During seasonal shutdowns and other periods of prolonged exposure (lasting six weeks or longer) of any contaminated cell surface area, the exposed contaminated fill surface was protected against erosion with periodic application of water containing a soil sealer. Prior to placement of any additional materials, surface layer compaction in all such areas was reverified by in-place density tests at a minimum of one test per 30,000 square feet. When work was interrupted for seasonal shutdown and during the contract suspension, all exposed surfaces of tailings material were stabilized by application of a tackifier compound to prevent off-site spread of contaminated material by erosion. Surveillance and monitoring of off-site areas verified that dispersement of contaminated material had not occurred.

- All measuring and testing equipment used during remedial action was calibrated against equipment having a known valid relationship to National Institute of Standards & Technology (NIST). Calibrated testing equipment included: scales, proctor molds and hammers, sand-cone funnels and plates, NIST-traceable test weights, calipers and thermometers. All other test equipment was maintained and functionally checked as per the specifications.

- Test frequencies referenced herein were derived from total final material quantity, divided by total number of tests taken for that material. It should be noted that during remedial action activities material quantities were not continuously surveyed during production, placement, and/or compaction. To determine quantities, surveys were completed at various milestones, e.g., completion of first lift, for pay quantities, to verify survey coordinates. Therefore, daily material quantities were estimated by load counts rates until final or cross section surveys were obtained. Reference the Moisture/Density Test Frequency Test Charts at the end of the written text.

- With various design slopes associated with the cell and staggered lift placements, it is feasible to test each lift and, thereby, have certain horizontal elevations void of in-place field density and moisture tests.

- The comparison chart at the end of this section, addresses the governing requirements in this section.

- Tests and inspections were performed in accordance with all specified requirements.

- The following data has been provided identifying each contaminated fill material moisture/density test location:

Appendix B

Geotechnical Sampling and Materials Testing Work Plan for the Mexican Hat, Utah, UMTRCA Title I Disposal Site

LMS/HAT/S20483, Rev-1

Geotechnical Sampling and Materials Testing Work Plan for the Mexican Hat, Utah, UMTRCA Title I Disposal Site

January 2019

NOT FOR PUBLIC RELEASE

Work performed under DOE contract number DE-LM0000421
for the U.S. Department of Energy Office of Legacy Management.

Contents

Appendixes

Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
AED	automated external defibrillator
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASTM	ASTM International
CFR	*Code of Federal Regulations*
CXE	Categorical Exclusion Evaluations
DOE	U.S. Department of Energy
DQO	Data Quality Objective
ECPOC	environmental compliance point of contact
HASP	*LMS Health and Safety Plan*
IRBP	interim radon barrier protection
ISMS	Integrated Safety Management System
IWCP	Integrated Work Control Process
JSA	Job Safety Analysis
LM	Office of Legacy Management
LMS	Legacy Management Support
$\mu g/m^3$	micrograms per cubic meter
NEPA	National Environmental Policy Act
PAE	Project or Activity Evaluation
PBZ	personal breathing zone
PPE	personal protective equipment
RCT	Radiological Control Technician
RRM	residual radioactive material
RWP	Radiological Work Permit
S&H	Safety and Health
SDS	Safety Data Sheet
UMTRCA	Uranium Mill Tailings Radiation Control Act
UTV	utility task vehicle
XRD	X-ray diffraction

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1.0 Introduction

This work plan presents the field workflow for the implementation of cell cover geotechnical sampling and materials testing at the Mexican Hat, Utah, Disposal Site (site). In 2016, multiple subtle depressions were identified in the rock cover along the toe and lower portions of the northeast side slope of the Mexican Hat Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I disposal cell. Due to concerns regarding the potential impacts of the cell cover depressions related to cell performance and erosion resistance, evaluations of the cover depressions and the cell cover design were performed. The evaluations included visual observations of the depressions and limited small area manual removals (test pits) of the rock cover components to scan for radioactivity, evaluate for conformance with the disposal cell design specifications, and observe the condition of the upper radon barrier surface. Reviews of disposal cell as-built drawings and supporting design calculations for the rock cover components were also included in the evaluations.

As a result of limited field investigations, voids, cavities, and incisements were discovered within the radon barrier along the lower portions of the north and northeast side slopes of the disposal cell. Similar degradation has not been observed in test pits excavated at other locations on the cell cover. Surface discoloration observed on the northwest portion of the disposal cell top slope indicates an area where potential ponding has occurred, and a small test pit within this area identified a slight offset at the plane of lateral contact between the top slope and side slope radon barrier components (the elevation of the side slope radon barrier appeared to be higher than the top slope elevation by a few centimeters). This offset may be a construction artifact, or the result of post construction settling, and may inhibit surface drainage onto the north side slope; however, this feature appears to be separate from the degradation features observed on the northeast and north side slopes, and the data collection activities described in this plan are not directed at further evaluation of this feature.

A series of alpha and gamma radiological surveys have been performed at the site to assess the potential for release of residual radiological materials or ineffective radon mitigation by the cell cover. Elevated radiological readings (readings that exceed ambient values, based on background values) have not been identified. Based on multiple field observations and the results of radiological surveys, no evidence of a breach through the disposal cell cover has been identified and the site remains protective of human health and the environment. In addition to describing sampling of cell cover components, this plan also describes how additional gamma radiological surveys will be performed utilizing a handheld sodium iodide scintillometer during test pit excavations and sampling activities.

This work plan describes the approach for additional cover investigations, specifically materials sampling and testing of the disposal cell side slope cover components, sample collection, and geotechnical and chemical analyses. Data obtained as of result of implementing this work plan will be used to identify possible causes for the cover degradation features that have been observed at the site and to determine long-term performance implications on the east, northeast, north, and west side slopes of the disposal cell. Appendix A, “Sampling and Location Maps,” of this work plan presents maps of potential test pit locations and offsite aeolian source materials to be sampled, with adjustments to be made in the field utilizing an iterative approach.

A Legacy Management Support (LMS) contractor team was formed to prepare this work plan, the *Project or Activity Evaluation (PAE)* (LMS 1005), the *Job Safety Analysis (JSA)* (LMS 1748), and other documents as required under the *Integrated Work Control Process* (LMS/POL/S11763). All work will be performed in accordance with approved administrative and engineering safety and health controls (e.g., JSA), applicable personal protective equipment (PPE), U.S. Department of Energy (DOE) directives, and Office of Legacy Management (LM) and LMS contractor policies and procedures.

The LMS contractor team consists of the following members:

- Dan Brennecke, Engineering Manager
- Jeff Carman, Task 103 Manager
- David Dander, Hydrogeologist
- Nicholas Kiusalaas, Applied Studies and Technology Manager
- Don Lambert, Construction Manager
- John Manée, Project Engineer
- Anthony Martinez, Safety and Health Engineer
- Mike McDonald, Radiological Control Manager
- Linda Tegelman, Quality and Performance Assurance
- Joe Trnka, Environmental Compliance
- Evan Tyrrell, Site Lead

The site is located on the Navajo Reservation. The equipment, operator(s), and laborers to implement this work plan will be subcontracted on a time and materials basis, via procurement in accordance with the Navajo Preference in Employment Act. A separate statement of work will be prepared for subcontractor procurement.

2.0 Data Quality Objectives

The proposed geotechnical sampling approach for the site was developed using the Data Quality Objectives (DQO) process developed by the U.S. Environmental Protection Agency (EPA 2006). The DQO process is a systematic planning tool for developing technically sound data collection plans. The DQO process provides a rigorous technical framework for developing the type, quantity, and quality of information needed to support the acquisition of geotechnical sampling data at the site.

Components of the DQO process are as follows:

Step 1. Develop Problem Statement: Observed cover degradation and verification of radon barrier erosion along the lower portions of the north and northeast side slopes through limited manual excavations performed in 2018 demonstrates that the disposal cell erosion protection system is not performing as designed. The extent of erosional features has not been fully characterized at this time and it is unknown if other side slopes of the disposal cell are subject to similar performance issues.

Visual observations at test pits indicate that the bedding/filter material may be highly segregated. Fines in the bedding/filter layer appear to be limited or completely absent toward the lower portions of side slopes and could be over-concentrated at the upper portions of side slopes, affecting flow velocities generated during precipitation and associated runoff events. Lack of fines in the bedding layer would allow for higher runoff velocities due to larger void spaces in the interstices of the bedding/filter material. Quantitative geotechnical analytical data are needed to verify spatial conformance or nonconformance of the bedding material gradations in comparison to the engineering design construction specifications of the disposal cell to ascertain the causes of observed cover degradation and to identify potential future performance issues on the disposal cell side slopes. Records associated with the original gradation tests for the bedding/filter material do not state whether the tests were taken at the gravel pit, onsite, or before or after placement.

Weak to strongly cemented material (either windblown silt or upper radon barrier material) has been observed immediately below the base of the bedding layer in test pits with observed radon barrier degradation. The cemented material is considered to be a post-construction soil development of unknown origin, presumably caused by an undetermined source of calcium or calcium carbonate, leading to the development of a hardened caliche layer on the top of the radon barrier. The cemented material could negatively affect the performance of the radon barrier through the development of berms, desiccation cracking, or both, resulting in preferential flow pathways during precipitation and associated runoff events, and resulting in erosion of the radon barrier. Cation exchange has been identified as a potential mechanism resulting in the development of the cemented material through the replacement of sodium ($2Na^{1+}$) contained in the radon barrier (amended with sodium bentonite) with calcium (Ca^{2+}). Soil dispersion has also been identified as a potential contributor to degradation of the radon barrier.

Sediment accumulation has also been observed along the interface of the apron and northeast toe drain of the disposal cell. The origin of this material is unknown, but could be deposited Aeolian dust, washed-out fines from the bedding material, eroded radon barrier material, or a combination thereof. Red, aeolian dust has been observed immediately below the riprap surface at every test pit that has been uncovered thus far at the site. Due to the similar color and composition of the radon barrier and native soils at the site, it is not possible to determine the source of the accumulated sediment material solely based on visual observations.

Step 2. Identify the Goals and Objectives of the Study: Geotechnical sampling is needed to quantitatively verify spatial conformance or nonconformance with the disposal cell design specifications through a series of test pits, sample collection, and geotechnical and chemical analyses along the side slopes of the disposal cell, and to determine the lateral extent of residual radioactive material (RRM) into the northeast drainage apron.

The primary goals and objectives are as follows:

- Determine the spatial distribution where in situ cell cover components (i.e., riprap, bedding layer, and the radon barrier) are in conformance and nonconformance with the engineering design and construction specifications along the side slopes of the disposal cell
- Determine the spatial distribution where cemented material is present or not present in the top surface of the radon barrier along the side slopes of the disposal cell
- Identify potential contributors of the cemented material that has been observed immediately below the base of the bedding layer in test pits with observed radon barrier degradation
- Determine the capacity of the radon barrier that may be subject to degradation due to cation exchange, dispersive soils, or both
- Determine the lateral extent of RRM that was placed beneath the radon barrier near the toe of the northeast and north side slopes and under the drainage apron adjacent to the northeast side slope during the construction of the disposal cell
- Determine whether windblown material on the riprap rock surfaces has similar chemical and physical properties compared to the sediment deposits in the northeast drainage apron
- Determine if the sediment deposits in the northeast drainage apron have similar chemical and physical properties compared to the in situ radon barrier and windblown material on the riprap rock surfaces
- Continually verify the absence of elevated radiological measurements at test pits locations and ensure that RRM is not collected during the sampling efforts through radiological screening
- Visit off-site locations southwest of the site that represent possible sources of aeolian material that has deposited on the site. Determine the chemical and physical properties of the source material for comparison with the chemical properties of on-site windblown deposits, radon barrier material, and sediment deposits

Step 3. Identify Information and Inputs: Relevant information and inputs that were used to develop this work plan include the following parameters:

- A series of visual observations of the depressions, and limited small area manual excavations (test pits) of the rock cover components to observe the conditions of the underlying cover materials
- The performance of a series of radiological surveys that did not identify elevated radiological readings in comparison to natural background conditions in the vicinity of the site
- A comprehensive review of the available documentation related to the engineering design and construction of the disposal cell, including, but not limited to, the Final Completion Report for the site
- Reviews of disposal cell as-built drawings and supporting design calculations for the rock cover components
- Review and evaluation of the available quality assurance records; however, a significant amount of records are not available due to limited records retention periods
- An examination of terrestrial- and aerial-based historical photographs of the site

- Interviews with the DOE site manager and equipment operators who were involved with the construction of the disposal cell
- An evaluation of the construction methods and techniques that were used during the construction of the disposal cell, including transportation, stockpiling, and material placement
- Collaboration with engineers and scientists from the Navajo Nation Uranium Mill Tailings Remedial Action/Abandoned Mine Lands Department and the Desert Research Institute
- Consultation with internal and external subject matter experts, including the geotechnical engineering design manager for the DOE Technical Assistance Contractor at the time of disposal cell design and construction
- An examination of regional meteorological records before and after construction of the disposal cell, and the establishment of a System Operation and Analysis at Remote Sites (SOARS)–based weather monitoring station at the site in July 2017 that is equipped with a camera and capable of measuring precipitation totals and intensities
- Implementation and review of data associated with ground-based light imaging, detection and ranging (lidar) topographical surveys focused on the northeast side slope, aerial photogrammetry of the entire disposal cell footprint, and collection of horizontal and vertical survey data at the existing settlement plates located on the top slope of the disposal cell
- Review and evaluation of the available information of other UMTRCA disposal cells for design and performance comparison
- Preliminary literature review of information related to surface impoundments, dispersive soils, cation exchange, slope stability, and erosion control

Step 4. Define the Boundaries of the Study: With the exception of potential off-site aeolian source material that will be collected, the boundaries of the study area will include the footprint of the disposal cell, site hydrologic catchment areas, and associated drainage basins. The primary focus for this work plan is on the side slopes of the cell. This work plan has not been developed to address any potential top slope drainage issues.

Step 5. Develop the Analytic Approach: The analytic approach to achieve the primary goals and objectives of this work plan is mainly the continued use of test pits in a systematic and iterative process using a defined logic (see Section 3.2, “Identification of Sample Area Location,” and Test Pit and Sample Collection Locations Map in Appendix A, page A-1) to identify sample locations and collect samples for geotechnical and chemical analyses (see Appendix B, “Sample Collection and Testing Table”). Additionally, one 3-foot-wide test pit exposing the radon barrier surface from the crest of the northeast side slope to the toe of the northeast side slope will be excavated. This long test pit will be excavated perpendicular to the side slope contours to facilitate a thorough analysis of the bedding layer material and radon barrier surface along the entire length of the side slope. All excavations will be intermittently screened with a handheld sodium iodide scintillometer to verify the absence of elevated radiological readings. Radiological screening is described throughout Section 3.0 “Field Workflow” and radiological monitoring and controls are discussed in Section 5.9.

The LMS contractor team will determine the following aspects of the windblown material on the riprap:

- The presence of windblown deposits on the riprap
- Gradation of the windblown material
- Chemical and physical characteristics and minerology of the windblown material

Additionally, the LMS contractor team will determine the above aspects of off-site soils for comparison with windblown material on the riprap.

The LMS contractor team will determine the following aspects of the bedding layer:

- Gradation of the bedding layer at representative test pit locations along each testing line on the sideslopes
- Moisture content of the bedding layer at representative test pit locations along each testing line on the side slopes
- Carbonate content of the bedding layer at select test pit locations
- Minerology of the bedding material at select, field-determined locations
- Where the gradation of the bedding layer on all side slopes transitions from specified material to material that is out of specification based on comparison to the original disposal cell construction specifications

The LMS contractor team will determine the following aspects of the radon barrier:

- Thickness of the radon barrier
- In situ bulk density at the surface (top 6 inches) of the radon barrier
- In situ moisture content of the surface, midpoint, and lower portion of the radon barrier
- Gradation of the surface, midpoint, and lower portion of the radon barrier
- Chemical and physical characteristics, carbonate content, and minerology of the surface, midpoint, and lower portion of the radon barrier
- Dispersive characteristics of the surface, midpoint, and lower portion of the radon barrier
- Cation exchange capacity of the surface, midpoint, and lower portion of the radon barrier
- The presence and thickness of cemented material and whether the cemented material is part of the original radon barrier thickness
- Gradation of the cemented material
- Bulk density of the cemented material
- Chemical characteristics, carbonate content, and minerology of the cemented material

The LMS contractor team will determine the following aspects of the potential windblown material sources southwest of the site:

- Chemical and physical characteristics, carbonate content, and minerology of the source material at the surface of the material
- Gradation of the source material at the surface of the material

Aeolian source material sample locations were identified via aerial imagery and will be collected in areas that will be representative of localized geologic formations that are exposed in the area. Based on the predominant wind direction in the region and aeolian deposition patterns observed in aerial imagery, planned aeolian source material sample locations are located to the southwest of the site as shown in the Borrow and Aeolian Offsite Sampling Areas map contained in Appendix A, page A-3.

Step 6. Specify Performance and Acceptance Criteria: The following performance and acceptance criteria will be implemented before, during, and after field activities associated with this work plan:

- Documentation of field activities executed at each test pit and sampling location, including photographs and written field notes.
- Development of an as-built test pit and sample locations map.
- Documentation of deviations that take place in the field as compared to the work flow contained in this work plan (see Section 3.0, “Field Workflow”).
- All geotechnical samples will be sent to, and tests will be performed by, subcontracted materials testing laboratories that will have the American Association of State Highway and Transportation Officials (AASHTO) accreditation in accordance with AASHTO R 18, “Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories,” and meet the requirements of ASTM International (ASTM) D3740, “Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.”
- All chemical samples will be sent to and tested by a chemical testing laboratory capable of and qualified to perform the desired chemical tests.
- Minerology of select, field-determined samples will be determined via X-ray diffraction (XRD) and sent to Colorado Mesa University for analysis.
- Verification that subcontracted laboratories conform with, and are capable of, performing the analytical methods as specified in Appendix B.

Step 7. Plan for Obtaining Data: Two methods will be used to obtain the data. The first method for obtaining data under this work plan will be to remove the riprap layer and the bedding layer from the crest of the northeast side slope to the toe of the northeast side slope perpendicular to the side slope contours, exposing the radon barrier surface in a 3-foot wide test pit (see Section 3.2, “Identification of Sample Area Location,” and line 5 in Test Pit and Sample Collection Locations Map in Appendix A, page A-1) to collect samples for geotechnical and chemical analyses (see Appendix B).

The second method for obtaining data under this work plan is through the continued use of test pits in a systematic and iterative process using a defined logic (see Section 3.2, "Identification of Sample Area Location," and Test Pit and Sample Collection Locations Map in Appendix A, page A-1) to identify sample locations and collect samples for geotechnical and chemical analyses (see Appendix B). Field work flow is described below in Section 3.0.

3.0 Field Workflow

The LMS contractor team will implement the field workflow activities listed below, which are listed in sequential order and further detailed in the following subsections:

- Procurement of Required Equipment, Materials, and Subcontractors
- Identification of Sample Area Location
- Predisturbance Radiation Screening
- Removal of Riprap at Sample Areas
- Bedding Layer Surface Radiation Screening
- Documentation and Measurement of the Exposed Bedding Layer Area
- Sampling of the Bedding Layer
- Removal of the Bedding Layer
- Radon Barrier Surface Radiation Screening
- Documentation and Measurement of the Exposed Radon Barrier Area
- Coring and Sample Collection of the Radon Barrier
- Radon Barrier Auger Core Radiation Screening
- Replacement of Radon Barrier Core Material
- Replacement of Eroded Radon Barrier Discovered During Sampling
- Restoration and Documentation of Sample Area

3.1 Procurement of Required Equipment, Materials, and Subcontractors

Prior to the performance of the work described in the Work Plan, the following equipment, materials, and subcontractors will be procured and available at the site:

<u>LMS contractor provided</u>

- Stakes, pin flags, markers, index cards, handheld GPS unit, and paint to mark investigation area boundaries
- Shade tents
- Cooling vests, if necessary
- Hand-held radios for communication
- Camera for documentation of investigation areas

- Inspection camera for viewing any concealed voids
- Sodium iodide scintillometer for gamma radiation screening
- Tarps, plastic sheeting, or geotextile material to temporarily place and retain segregation of the removed materials
- Plastic sheeting for radon barrier auger/core material segregation
- Shovels, brushes, hammers, rock hammers, chisels, or other hand tools to remove, sample, and replace cover materials
- 500-foot and 25-foot measuring tapes, carpenter's ruler, yard stick, or other measuring equipment for documentation and field measurements
- Utility task vehicle (UTV) for transporting samples and replacement material
- 2-inch-diameter and 4-inch-diameter hand augers for coring the radon barrier
- Shelby tubes for collection of radon barrier material
- Flashlights
- Sampling containers (2- to 8-ounce bottles with lids, Ziploc-type bags)
- 5-gallon buckets with lids and handles for transporting samples and hauling bedding material to and from the UTV
- Adhesive labels for marking sample containers
- 1-inch, No. 4, No. 30, and No. 100 sieve screens for removing fines from stockpiled replacement bedding material
- PPE as identified in the JSA, including first aid kit and automated external defibrillator (AED)
- Other materials as defined in the *Interim Radon Barrier Protection Work Plan for Areas with Observed Radon Barrier Degradation at the Mexican Hat, Utah, UMTRCA Title I Disposal Site Interim Radon Barrier Protection Work Plan for Areas with Observed Radon Barrier Degradation at the Mexican Hat, Utah, UMTRCA Title I Disposal Site* (IRBP Work Plan) (see Appendix D, "Interim Radon Barrier Protection Work Plan")

Construction subcontractor provided

- Rubber track-mounted excavator to remove and replace cover materials
- Rubber track-mounted skidsteer with bucket for transporting samples and replacement bedding material
- Field laborers
- Shovels and other hand tools to remove and replace cover materials
- Portable sanitary facility and handwashing station
- PPE as identified in the Statement of Work and JSA
- Other equipment as defined in the IRBP Work Plan (see Appendix D)

A geotechnical materials testing laboratory and a chemical testing laboratory for sample analysis will also be subcontracted by the LMS contractor. XRD samples will be sent to Colorado Mesa University for testing.

3.2 Identification of Sample Area Location

- Locate sample areas as shown on the sample points map in Appendix A, page A-1 based on mapped GPS coordinates using a handheld GPS unit. The initial sample area for each line of sample areas shown on the map will always be close to the toe of the slope, either in an observed depression area or within 15 to 30 feet upslope of the apron (Type C angular rock). The sample locations will be determined in the field using an iterative approach for the primary purpose of delineating the areas of the disposal cell where the bedding layer gradation is in conformance and nonconformance with the engineering design and construction specifications. The iterative approach will also be used to determine where the cemented material is or is not present on the side slopes. Additional sample parameters will be collected at each test pit location in accordance with the sample collection and analysis testing table contained in Appendix B.
- Mark a 3-foot by 3-foot perimeter with survey marker paint of the sample area to be either manually or mechanically exposed. If the sample area location is within a visible depression feature, demarcate the initial excavation perimeter using engineering judgement.
- Take photographs to document conditions of the predisturbed area
- Additional sample areas will be as follows:
    - The second sample area for each line of sample areas will always be 10 to 30 feet downslope from the crest (top) of the slope and perpendicular to the contours of the slope.
    - If the first sample area of a line of sample areas does exhibit cemented material or does not exhibit specified fines but the second sample area does not exhibit cemented material or does exhibit specified fines, based on engineering judgement in the field, a third sample area for that line of sample areas will be half the distance between the first and second sample areas in order to delineate the areas out of specification. If the first and second sample areas of a line do not exhibit cemented material and do exhibit specified fines, based on engineering judgement, no more sample areas will be needed in that line of sample areas.
    - If the third sample area of a line of sample areas does exhibit cemented material or does not exhibit specified fines, based on engineering judgement, a fourth sample area for that line of sample areas will be half the distance between the second and third sample areas (upslope). If the third sample area of a line did not exhibit cemented material or did exhibit specified fines, based on engineering judgement, a fourth sample area for that line of sample areas will be half the distance between the first and third sample areas (downslope).
    - The process of iterative sampling by going half the distance between sample areas upslope upon observing cemented material or non-specified fines and downslope half the distance between sample areas upon observing no cemented material or specified fines will continue until, based on engineering judgement, the bedding material appears to meet the construction specification for fines in the bedding sample and there is no cemented material present.

  - Based upon the distance from the crest of the slope where the bedding material appears to meet the construction specification and there is no cemented material present on two lines of sample areas on a slope, a sample area will, based on engineering judgement, be investigated horizontally half the distance between the two lines of samples at the same distance from the crest of the slope to determine if specified bedding material also exists and no cemented material is present between the two adjacent sample lines.

- Locate line 5 as shown on the sample points map in Appendix A, page A-1 based on mapped GPS coordinates using a handheld GPS unit. Expose the radon barrier along line 5 from the crest of the slope to the toe of the slope and into the angular rock apron area exposing a 3-foot width of radon barrier surface. The long test pit will expose the top of the radon barrier along the entire length of the side slope perpendicular to the contours to determine the location(s) of gradation variations in the bedding material, where cemented material begins, where rilling begins, and where voids are present. Sample parameters will be collected in the apron, near the bottom and top of the exposed area, and at locations within the exposed area using engineering judgement in accordance with the sample collection and analysis parameters contained in Appendix B. The work flow associated with the removal and stockpiling of materials, sample collection, and restoration from the test pits is described below.
- The LMS contractor team will take samples of off-site soils according to the sample mass requirements contained in the testing table in Appendix B for the required tests in the table for comparison with windblown material on the riprap. Samples taken will correspond to the sample areas as shown on the Borrow and Aeolian Offsite Sampling Areas map contained in Appendix A, page A-3.

3.3 Predisturbance Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the undisturbed surface of the sample area. All radiation screening will be performed by a radiological control technician (RCT).
- Document all radiation screening readings done by the RCT on the *Radiological Survey Map* (LMS 1553) for future reference. Documentation will include the investigation area identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

3.4 Removal of Riprap at Sample Areas

- Safe work practices tailored to the site conditions and planned work will be developed for the use of mechanized excavation equipment and will be specifically assessed by LMS Safety and Health subject matter experts prior to the initiation of work. At this time, plans call for a rubber track-mounted excavator to be used to remove riprap on the 5H:1V side slope. A sample area near the lower portion of the northeast side slope has been identified to initially demonstrate safe work practices for the use of this equipment prior to use at other locations. The configuration and use of the excavator will be approved by the construction site supervisor and the Safety and Health representative prior to the initiation of work.
- For test pit locations, first position the excavator cross slope of the sample area to remove riprap and place it adjacent to the sample area so that it is not directly downgradient of

the sample area to allow for extending the sample area downslope if necessary. If this positioning does not conform with safe work practices based on site conditions or other considerations, reposition the excavator downslope of the sample area to remove riprap and place it on the cross slope side of the sample area. The excavator will be positioned to conform to safe work practices based on site conditions. Anticipated equipment maneuverability requirements and limitations on the disposal cell cover are described in Section 6.6.

- If safe work practices cannot be established for excavator use on side slopes, the excavator will not be used in these locations. However, it is anticipated that safe work practices can be established for excavator use on the relatively flat portion of the apron at minimum.
- If manual excavation is required, riprap will be removed along the extent of the sample area and placed on an adjacent tarp to maintain material segregation. If manual removal of riprap becomes necessary, the proposed long test pit on line 5 will be divided into smaller test pits similar to those proposed in other areas of the cell cover.
- For the long test pit location on line 5, excavate a 5-foot-wide area beginning with removal of the riprap at the crest, continuing perpendicular to the slope contours to the toe, and ending into the apron area of the northeast side slope, exposing, but not removing, any of the bedding layer. Place all of the riprap to one side of the opened area to segregate the removed riprap from undisturbed riprap. Once the riprap has been removed, position the excavator on the opposite side of the opened area from the removed riprap and pull the bedding material to the side of the opened area closest to the excavator, exposing a 3-foot-wide area of radon barrier along the entire length of the slope.
- During removal of the riprap layer, take samples of windblown deposited material in the riprap layer according to the sample mass requirements contained in the testing table in Appendix B for the required tests in the table.
- Brush samples of the windblown deposited material from the riprap into Ziploc-type bags. Windblown deposited material from multiple sample locations may be composited or combined into a single Ziploc-type bag until the required sample quantity is collected.
- Label samples with an appropriate marker by line number, sample area number, type of material, and number of the sample, as shown on the sample points map in Appendix A, page A-1 (e.g., the windblown deposited material samples taken at the first sample area on the first line of samples would be labeled L1-01W). Seal samples in Ziploc-type bags or 2- to 8-ounce jars as required by the table in Appendix B.
- Transport the windblown deposited material sample from the cell cover to an onsite vehicle for eventual transportation to a materials testing lab.
- Suspend removal of riprap materials at the top of the bedding layer surface.
- Document the depth of the riprap layer and the conditions of the bedding layer surface in a field book and collect photographic documentation.

3.5 Bedding Layer Surface Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the upper surface of the exposed bedding layer. All radiation screening will be performed by an RCT.
- Document all radiation screening readings done by the RCT on the *Radiological Survey Map* for future reference. Documentation will include the investigation area identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

3.6 Documentation and Measurement of the Exposed Bedding Layer Area

- Measure the exposed bedding layer for area and depth of material.
- Document the exposed bedding layer, both written and pictorially, in a field log book.

3.7 Sampling of the Bedding Layer

- Not every test pit will be sampled for bedding gradation. At a minimum, samples of the bedding layer will be taken on each line with multiple test pits near the crest of each slope, near the toe of each slope, and at a location in between these two testing locations where the fines, based upon engineering judgement, appear to meet the design specification. Lines with single test pits will be sampled to confirm where the bedding material appears to meet the construction specification and there is no cemented material present between two lines of sample areas on a slope.
- Take samples of the bedding layer according to the sample mass requirements contained in the testing table in Appendix B for the required tests in the table.
- Take samples of the bedding layer using shovels to fill three 5-gallon buckets with lids.
- Label samples with an appropriate marker by line number, sample area number, type of material, and number of the sample, as shown on the sample points map in Appendix A, page A-1 (e.g., the bedding material sample taken at the first sample area on the first line of samples would be labeled L1-01B.) Seal samples in Ziploc-type bags, 2- to 8-ounce jars, or 5-gallon buckets as required by the table in Appendix B.
- Record the sample on the sample log sheet (see Appendix C, “Sample Log Sheet”). Transport samples using a skidsteer or UTV with tracks to an onsite vehicle for eventual transportation to a materials testing lab.

3.8 Removal of the Bedding Layer

- Remove the remaining bedding layer with the excavator by using the excavator bucket to push or pull the remaining material to the edges of the sample area. Manual removal of the bedding material may be required by the use of hand tools to mitigate disturbance of the underlying radon barrier.
- If it is necessary to manually remove the remaining bedding layer with hand tools, place the removed bedding material on a separate tarp from the riprap to maintain material segregation, or move the remaining material to the edges of the sample area with hand tools.
- Suspend removal of bedding layer materials at the top of the radon barrier surface.

- The only area that is expected to be extended beyond an initial 3-foot by 3-foot designated area is the long sample pit on line 5, as described in Sections 3.2 and 3.4 above. This opened area will be extended downslope of the initial location into the apron area (Type C angular riprap) to determine the underlying conditions of the apron area, and for testing through the radon barrier. If degradation of the radon barrier is discovered in any other sampling area, the radon barrier will be protected as described in Section 3.15 of this Work Plan, but not extended to protect degradation beyond the sample area.
- Document the thickness of the bedding layer and the conditions of the radon barrier surface in a field book, and collect photographic documentation.

3.9 Radon Barrier Surface Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the upper surface of the exposed radon barrier. All radiation screening will be performed by an RCT.
- Document all radiation screening readings done by the RCT on the *Radiological Survey Map* for future reference. Documentation will include the sample area identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

3.10 Documentation and Measurement of the Exposed Radon Barrier Area

- Measure the exposed radon barrier for area, including the depths and widths of any void, cavity, and incisement areas that may be present.
- Document the exposed radon barrier, both written and pictorially, in a field log book.

3.11 Coring and Sample Collection of the Radon Barrier

- If present below the bedding layer, collect samples of cemented material according to the sample mass requirements for the required tests as listed in Appendix B and seal them in Ziploc-type bags as required by the table in Appendix B. Cemented material sample identifiers will have a designation of “C,” such as L1-01C.
- Use Shelby tubes to collect samples in the top 6-inches of the radon barrier material by pushing or driving the Shelby tubes into the radon barrier with hammers or the excavator bucket. Take samples of the mid and lower portions of the radon barrier using the 4-inch-diameter hand auger. Use the 4-inch-diameter hand auger to determine the thickness of the radon barrier, and whether any RRM is present below the radon barrier, as determined by a radiological scan and visual observations. Place all removed radon barrier material on plastic sheeting to ensure that RRM is contained and does not contaminate adjacent materials. RRM will be identified based on visual observations and material exhibiting radiological instrument readings greater than two times background, as determined by the RCT and scintillometer. If RRM is present, measure the depth to RRM below the in situ surface of the radon barrier.
- Take samples with the Shelby tubes and 4-inch-diameter auger according to the sample mass requirements B for the required tests in the table in Appendix B and seal them in Ziploc-type bags or 2- to 8-ounce jars as required by the table in Appendix B. No RRM samples will be taken.

- Label samples with an appropriate marker by line number, sample area number, type of material, depth of the sample (top (T), middle (M) or bottom (B)), and number of the sample, as shown on the sample points map in Appendix A, page A-1 (e.g., the radon barrier core sample taken at the first sample area on the first line of samples in the middle of the radon barrier would be labeled L1-01RM).
- Record the sample on the sample log sheet (see Appendix C).
- Transport samples of the radon barrier material to an onsite vehicle for eventual transportation to a materials testing lab.
- Take photographs of the removed core and the core hole in the radon barrier.

3.12 Radon Barrier Auger Core Radiation Screening

- Perform radiation screening on the material taken from the core with a sodium iodide scintillometer as it is placed on the plastic sheeting, and on the bottom of the auger core after it has been removed from the radon barrier. All radiation screening will be performed by an RCT.
- Document all radiation screening readings done by the RCT on the *Radiological Survey Map* for future reference. Documentation will include the sample area identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

3.13 Replacement of Radon Barrier Core Material

- Carefully place any RRM directly into the bottom of the auger hole using the plastic sheeting to direct the placement and inhibit cross-contamination.
- Place any of the removed radon barrier material not taken for testing directly above the replaced RRM and compact by hand with hand compaction tools.
- Prepare replacement radon barrier material according to Section 2.9 of the IRBP Work Plan (Appendix D).
- Transport the prepared radon barrier replacement material to the sample area using a skidsteer or UTV.
- Place the prepared radon barrier replacement material where radon barrier was removed with the hand auger and Shelby tubes. Compact the replacement material with hand compaction tools until flush with the adjacent, undisturbed radon barrier surfaces.

3.14 Replacement of Eroded Radon Barrier Discovered During Sampling

Should voids, cavities, or incisements of the radon barrier be observed, follow the procedures in Sections 2.9 through 2.11 of the IRBP Work Plan (Appendix D) to protect the radon barrier from further degradation.

3.15 Restoration and Documentation of Sample Area

- Take a photograph of the restored radon barrier.
- Using engineering judgement, sift replacement bedding layer material through 1-inch, No. 4, No. 30, and No. 100 sieve screens as necessary to match as closely as possible the bedding material removed for sampling.
- Transport the screened replacement bedding material to the sample area using a skidsteer or UTV.
- Place and evenly spread the bedding material across the extent of the excavated area.
- Manually place, if necessary, and evenly spread the bedding material with hand tools across the extent of the excavated area.
- Take a photograph of the restored bedding layer.
- Place and evenly spread the previously removed riprap using an excavator across the extent of the excavated area.
- Manually place, if necessary, and evenly spread the previously removed riprap across the extent of the excavated area.
- Place a labeled pin flag in the center of the restored area, with the date and sample area identifier marked on the flag.
- Paint the entire perimeter of the restored area with survey marker paint.
- Take a photograph of the restored area.
- If the sample area was not a pre-mapped location, collect coordinates of the sample area with a handheld GPS unit and label the coordinates using the respective sample area identifier.

4.0 Testing Laboratories

All geotechnical samples will be sent to, and tests will be performed by, a subcontracted geotechnical materials testing laboratory that will have AASHTO accreditation in accordance with AASHTO R 18, “Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories,” and meets the requirements of ASTM D3740, “Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.”

All chemical samples will be sent to and tested by a chemical testing laboratory capable of and qualified to perform the desired chemical tests. XRD samples will be sent to Colorado Mesa University for testing.

5.0 Safety and Health

This section provides a discussion of the safety and health policies and requirements associated with the planning and implementation phases of this work. All work will be conducted in accordance with DOE regulations and LMS procedures that are contained or referenced in the *LMS Health and Safety Plan* (HASP; LMS/POL/S20043). The HASP defines the safety and health requirements for all work performed by the LMS contractor at sites administered by LM.

The requirements for the HASP are identified in the following:

- Title 10 *Code of Federal Regulations* Part 835 (10 CFR 835), “Occupational Radiation Protection”
- 10 CFR 851, “Worker Safety and Health Program”
- 29 CFR 1910, “Occupational Safety and Health Standards”
- 29 CFR 1926, “Safety and Health Regulations for Construction”

The HASP incorporates the requirements outlined in the *Integrated Safety Management System Description* (LMS/POL/S14463) and *Worker Safety and Health Program (10 Code of Federal Regulations 851 Implementation)* (LMS/POL/S14697). Additionally, all work will be performed in accordance with the *Integrated Work Control Process* (LMS/POL/S11763).

The following subsections provide an overview of the integrated safety management system (ISMS), integrated work control process (IWCP), training, first aid, CPR, fit for duty, JSA, and PPE requirements and provide a discussion on select hazards, controls, pause/stop work policy, and radiological monitoring and controls.

5.1 Integrated Safety Management System

The objective of the ISMS is to systematically integrate safety into management and work practices at all levels so that objectives are accomplished while protecting workers, the public, and the environment. To achieve this objective, DOE Policy 450.4A, *Integrated Safety Management Policy*, established DOE’s expectations for integrated safety management implementation through guiding principles and core safety management functions. The objective, guiding principles, and core functions of safety management are consistent with those used in implementing safety management throughout the DOE complex. The mechanisms, responsibilities, and implementation components that are unique to the LM sites are established according to the type of work and hazards associated with that work. Additional information is provided in the *Integrated Safety Management System Description*.

5.2 Integrated Work Control Process

Complete and efficient planning and control of work activities is fundamental to safe, environmentally protective work execution. The *Integrated Work Control Process* is applicable to all work activities managed and performed by the LMS contractor and subcontractors and describes the policies, procedures, and requirements for planning, initiating, authorizing, performing, and conducting work at LM sites and facilities. The IWCP utilizes processes and tools established in the *Integrated Safety Management System Description*, HASP, and

Environmental Management System Description (LMS/POL/S04346) as well as in other LMS procedures and manuals.

The IWCP defines LMS work types, provides guidance for determining when each work type is applicable, and defines the work planning and control requirements for each work type. The work described in this work plan constitutes a Type 4 work activity: work planned using a PAE form. Type 4 work activities are planned using a PAE form and consist of activities that:

- Are complex or involve higher risk.
- Require significant work planning to ensure safe and efficient performance.
- Require significant subject matter expert input and review to ensure a comprehensive operational envelope.
- Are planned to involve multiple related activities.

IWCP requirements for Type 4 work include, but are not limited, to the following:

- **Project or Activity Evaluation**: The PAE form is used as a planning tool, and completion of the form is an iterative workflow process that culminates in a project or activity that is ready to be authorized by site leads. Key elements of the PAE workflow process are work scope definition, work planning, hazard identification and mitigation, environmental compliance planning, work authorization, performance of work, and project closeout.
- **Readiness Review**: A Readiness Review is a systematic and documented review prior to the start of work or an activity ensuring that planning is complete and that people, equipment, and procedures are available and adequate. Additionally, Readiness Reviews are conducted to provide objective evidence that appropriate planning has taken place to allow the project, task, or operation to proceed safely and effectively. The level of rigor and formality of review varies depending on the complexity and risk of the work. Before the start of work on a task assignment, project, or other significant activity, the LMS project lead determines the level of review and associated documentation needed to ensure that planning is complete. During the readiness review, the PAE form for the planned work will be provided and a *Readiness Review Checklist* (LMS template) will be completed. The *Readiness Review Checklist* is used as a tool to identify pre- and post-start items and hold points that need to be addressed to adequately perform the planned work in accordance with the IWCP. Participation and input by relevant LMS contractor core team members and applicable approvals are required prior to initiating Type 4 work activities. Additional information on Readiness Reviews is contained in the *Quality Assurance Manual* (LMS/POL/S04320).
- **Plan of the Day/Plan of the Week**: The *Plan of the Day/Plan of the Week* form (LMS 2130) is an IWCP tool that is used to define and authorize planned work at LM sites and facilities. The form is used to indicate the date(s) the work is authorized, work type, activity description or work control reference, applicable JSA(s), and person in charge and is signed by the LMS site lead to formally authorize the work. Authorized work containing different work types (e.g., Skill-Based Activity, PAE) is listed on separate rows of the form with a corresponding reference to the applicable JSA(s) by name or identifier. Requirements for incorporating emergent work (i.e., any work not covered in the activity description or work control reference section) are identified in Section 4 of the *Plan of the Day/Plan of the Week* form.

- **Initial Prejob Briefing:** All field personnel will attend an initial prejob briefing conducted by the LMS line supervisor on the first day of work before conducting any fieldwork. The JSA and other field forms will be covered and signed at this time. If circumstances require the use of personnel who did not attend the initial site briefing, these personnel will receive briefings from the LMS line supervisor before they may begin fieldwork.
- **Prejob Brief/Safety Meetings:** At the beginning of each day's work and before specific tasks with significant or modified safety considerations, the LMS contractor team will conduct an operations safety and health meeting for all onsite personnel. Work authorized by the LMS site lead through the *Plan of the Day/Plan of the Week* form will be reviewed, and the hazards associated with those activities will be identified along with the safety implications and controls to mitigate the hazards as identified in the applicable JSA. Relevant safety documentation associated with the upcoming work will be reviewed. In addition, issues or concerns noted from the previous days' activities will be discussed. This briefing will be documented with a required sign-in sheet (i.e., *Pre-Job Brief/Safety Meeting Attendance Record* [LMS 1554]) to identify the topics discussed and the personnel in attendance. A separate briefing with sign-in on the *Pre-Job Brief/Safety Meeting Attendance Record* will be conducted for any worker(s) who requests to be onsite and cannot attend the daily meeting. All personnel are required to participate and sign in or they will not be allowed to participate in activities at the site.

5.3 Training Requirements

All personnel who conduct work on the behalf of LM or the LMS contractor have the responsibility to maintain and provide documentation on the appropriate level of training and qualifications to perform activities associated with their position. Employees are encouraged to work with management to schedule appropriate training in a timely manner, which means before work and before the expiration of qualifications. Minimum training requirements for LMS contractor and subcontractor personnel (depending upon the work being performed) may include the following:

- Silica Awareness (HS763)
- Heat Stress (HS418)
- Hearing Conservation (MD105)
- Ladder Safety (HS420)
- UTV Safety (HS344)
- Trailer Towing Safety (HS276)
- General Employee Radiological Training (HS109)

Note

As field conditions warrant, silica awareness, hearing conservation, heat stress, and ladder safety, training may be conducted in the field. UTV safety and trailer towing safety training is only required for LMS contractor personnel operating a UTV or towing a trailer, respectively.

Additional training information is available within the *Training Program Description* (LMS/POL/S04323) and the *Training Department Procedures Manual* (LMS/POL/S15034).

5.4 First Aid, CPR, and Fitness for Duty

The LMS contractor team will provide a person who is certified in first aid and CPR to be onsite at all times while work is being performed. The LMS contractor team will ensure that a first aid kit and AED unit are onsite at all times when personnel are present.

All personnel performing field work (including subcontractors) will be required to complete a *10 CFR 851, Fit For Duty Evaluation (Employee/Subcontractor)* (LMS 2115), have a subsequent medical physical, and be cleared by the LMS Occupational Medicine Provider to perform work at this site.

5.5 Job Safety Analysis

All personnel present will read, sign, and adhere to the hazard controls specified in the approved JSA. Personnel will not perform any work not addressed by the JSA. In accordance with the *Job Safety Analysis* procedure (LMS/PRO/S16030), if hazards are encountered that are not addressed in the JSA, the designated contractor line supervisor can modify the JSA to reflect changed conditions or equipment as needed or as requested by a worker as a field change.

5.6 Personal Protective Equipment Within the Work Zone

The requirement for specific PPE, including when to wear it, will be determined in the JSA for the project by the LMS contractor team. The LMS contractor team reserves the right to adjust PPE requirements to protect personnel from hazards. Depending on the work being performed, PPE requirements may include the following:

- Hard hats: Hard hats meeting the specifications of American National Standards Institute (ANSI) Standard Z89.1, “American National Standard for Industrial Head Protection,” for Class G (general) helmets (tested at 2200 volts) will be worn consistently in areas where overhead hazards are present or anticipated, in work areas and as specified by a JSA, *Radiological Work Permit* (RWP; LMS 1588), or other safety and health (S&H) procedure.
- Eye and face protection: Eye protection and face protection (if applicable) meeting the specifications of ANSI Standard Z87.1, “American National Standard for Occupational and Educational Eye and Face Protection Devices,” will be worn consistently whenever personnel run a reasonable probability of eye or face injury resulting from work being performed and as specified by a JSA, RWP, or other S&H procedure. Personnel must use appropriate eye or face protection when exposed to hazards from flying particles, liquid chemicals, acids or caustics, chemical gases or vapors, or potentially injurious light radiation.
- High-visibility outerwear: For daytime work, the shirt, jacket, or coveralls will be orange, yellow, strong yellow-green, or fluorescent versions of these colors. High-visibility outerwear will be worn consistently in work areas and when specified by a JSA, RWP, or other S&H procedure.
- Safety toed footwear: Safety shoes meeting the specifications of ANSI Standard Z41, “American National Standard for Personal Protection - Protective Footwear” ASTM Standard 2412, “Standard Test Methods for Foot Protection”; or ASTM Standard 2413, “Standard Specification for Performance Requirements for Protective

(Safety) Toe Cap Footwear," will be worn consistently in work areas and when specified by a JSA, RWP, or other S&H procedure.

- Coats, gloves, and hats as ambient weather conditions warrant.
- Work gloves when handling rock cover components, when using tools, and during material mixing and sieving operations that provide ample protection for the task being performed.
- Knee pads when moving rocks or kneeling on hard, uneven surfaces.
- Hearing protection, as warranted, with a noise reduction rating of at least 31 decibels for earmuffs and 33 decibels for ear plugs.

Note *Site personnel and visitors are not required to wear safety toed footwear unless they may be exposed to a foot crush hazard, but site personnel and visitors will consistently wear closed toe, substantial footwear when they are onsite.*

PPE requirements for each task will be addressed in the JSA. Respiratory protection, although not anticipated, is required when activities are known or suspected to result in airborne contamination hazards in excess of occupational exposure limits. Determination of the need for respiratory protection will be made by the industrial hygiene group and implemented in accordance with the *Respiratory Protection Program* (LMS/POL/S16042).

5.7 Thermal Stress

Personnel could potentially be exposed to heat and cold stress conditions when working on an LMS contractor project. Heat stress evaluation and monitoring is required when ambient temperatures are expected to exceed 80 °F and work will be performed outdoors for more than 15 minutes. The preferred approach to heat stress monitoring is to use physiological monitoring (i.e., heart rate). Environmental monitoring may be performed as an alternative option. Average high temperatures in Mexican Hat, Utah, typically exceed 80 ˚F from May through September, and heat stress monitoring and mitigation will be implemented when performing work during this time of the year. LMS personnel are issued physiological monitoring equipment (Polar A370 wrist monitor) to monitor their pulse rate; subcontractor personnel will be manually monitored using a pulse oximeter. Refer to the *Heat Stress Evaluation and Monitoring Procedure* (LMS/POL/S15935) for additional information related to heat stress.

Cold stress conditions exist when the ambient temperature is below 60 ˚F. Cold stress is monitored by measuring environmental conditions. When the temperature is below 40 ˚F, a windbreak garment should be worn during windy conditions and water repellant gear worn if a worker may become wet while performing work. Air temperature and wind speed should be monitored every 4 hours when temperatures are below 30 ˚F to ensure appropriate controls are utilized, and heated warming areas (such as a vehicle with a functioning heater) will be available to take breaks as necessary.

5.8 Silica Exposure Monitoring, Awareness, and Mitigation

The potential for exposure to respirable crystalline silica and dust exists when personnel are sieving bedding material, preparing radon barrier replacement material, and during mechanical excavation of the cell cover components. Travel along unpaved roads may also create airborne dust.

General area and personal breathing zone (PBZ) monitoring will be conducted while the abovementioned activities are being performed. PBZ monitoring will be performed in accordance with the National Institute for Occupational Safety and Health Method 7400, “Silica, Crystalline, by XRD.” Monitoring will be performed to ensure the controls identified in the JSA are sufficient in maintaining silica levels below the American Conference of Governmental Industrial Hygienists threshold limit value of 25 micrograms per cubic meter for an 8-hour work shift. PBZ monitoring will be focused on personnel sieving bedding material, mixing supplemental radon barrier materials, and operating heavy equipment. Additionally, general area monitoring may be performed to determine the silica content of dust in the area. General area monitoring will be performed using co-located traditional air monitoring devices with real-time respirable dust monitors (TSI SidePak AM520).

Respirable crystalline silica and dust awareness and mitigation will consist of the following, but not limited to:

- In addition to the silica awareness training, hazards, controls, and best management practices will be discussed prior to beginning work each day during safety tailgate meetings.
- Personnel will be advised to work upwind of areas where airborne particulates are being generated, as applicable. Flagging will be used to determine changes in wind direction.
- Work will be paused if excessive wind speeds generate a substantial volume of visible airborne particulates and personnel will be directed to an appropriate standby location.
- Water will be utilized as a dust suppressant on dirt roadways and equipment routes. The subcontractor will supply a water truck that will be used to apply water in areas where dust generation is anticipated.
- Speed limitations will be established and implemented for vehicles, UTVs, and equipment on dirt roadways and within work areas to minimize dust generation.
- Water misting will be utilized between materials mixing/sieving operations and personnel who are mixing/sieving materials.
- Personnel involved in materials mixing/sieving operations will be advised to carefully pour, mix, and sieve materials to minimize the generation of airborne particulates.
- Additional engineering controls will be established and implemented as determined during the execution of the work described in this plan

5.9 Pause/Stop Work Policy

All personnel working on LM sites or performing activities on behalf of LM or the LMS contractor, regardless of employer, have the responsibility and authority to stop work immediately, without fear of reprisal, when the employee believes the following:

- Conditions exist that pose a danger to the health and safety of workers or the public
- Conditions exist that, if allowed to continue, could adversely affect the safe operation of or could cause serious damage to a facility
- Conditions exist that, if allowed to continue, could result in the release from the facility to the environment of radiological or chemical contaminants that exceed applicable regulatory requirements or approvals

Employees have the authority and responsibility to stop dangerous work in accordance with the *Pause/Stop Work Procedures* (LMS/PRO/S20037). Personnel are responsible for identifying safety concerns, potential hazards, or unsafe conditions and immediately notifying line management. Everyone has the right, responsibility, and authority to report unsafe or environmentally unsound conditions or practices and to pause or stop work activities without fear of reprisal. All onsite personnel are required to immediately report to the line supervisor any unsafe activities, changed conditions, and safety and health incidents.

5.10 Sanitation

The subcontractor will provide a chemical toilet and handwashing station at the worksite.

5.11 Drinking Water

Bottled drinking water will be provided and made available to all personnel by the LMS contractor team. Proper hydration will be a focus during daily tailgate safety meetings.

5.12 Safety Data Sheets

A copy of the Safety Data Sheet (SDS) is required for each chemical used on the jobsite (e.g., survey marking paint). A copy of each SDS will be kept on the jobsite and placed in a designated location for all personnel to access.

5.13 Radiological Monitoring and Controls

Based on recent cell cover work (over multiple recent years and at several different sites), it has been determined that there are no radiological exposures anticipated or associated with this work activity or scope. However, the planned work will be radiologically monitored and controlled so that personnel radiation exposures are maintained as low as reasonably achievable (ALARA). The LMS contractor will implement necessary radiological work controls and monitoring for the work being conducted throughout the execution of this work plan. Daily safety briefings will include discussions on radiological awareness and ALARA principles, including time, distance, and shielding.

5.13.1 Radiological Monitoring

When excavations on the cell cover are performed, radiological monitoring will be implemented. Radiological monitoring will be performed by a qualified RCT and may include collecting information for determining the following:

- Radiation dose rates
- Radon gas concentrations
- Surface contamination measurements

Specific radiological monitoring during the implementation of this work plan is contained in Section 3.0, “Field Workflow.”

5.13.2 Radiological Controls

Hand auguring through the radon barrier material will be conducted to collect samples and determine the thickness of the radon barrier, which may expose minimal amounts of the underlying RRM. Samples of RRM will not be collected. Any RRM encountered during hand auguring will be returned to the sample location.

Based on the planned work, no radiological exposures are expected. A 4-inch-diameter hand auger is the only tool that will be used to penetrate through the full thickness of the radon barrier, which will result in de minimis exposure of RRM contained within the disposal cell. Shelby tubes will only be used on the top surfaces of the radon barrier that do not exhibit degradation features and will only penetrate to a depth of 6 inches; the as-built radon barrier thickness is 2-feet-thick across the entire cell footprint. Nonetheless, the following radiological work controls will be implemented and used to ensure that workers’ exposures remain ALARA.

As necessary, occupational radiation worker controls will be implemented during work periods, in accordance with the *Radiation Protection Program Plan* (LMS/POL/S04373) and the *Radiological Control Manual* (LMS/POL/S04322). These radiological controls will be implemented by the project’s RCT providing job coverage for the work being performed at the site. The project’s RWP will be implemented when radiological conditions meet implementation trigger levels, as determined by the RCT covering the work. If the RCT declares designates an area as a radiological contamination area, then workers entering the contamination area will be Radiological Worker II qualified or will be escorted into the contamination area by personnel with Radiological Worker II qualifications. Workers without current Radiological Worker II training qualifications will be required to take General Employee Radiological Training (HS109), which will provide the level of awareness necessary to identify radiological exposure risks.

Gamma radiation level and radon concentration limits are presented in 10 CFR 835, “Occupational Radiation Protection Program,” and in DOE Order 458.1, *Radiation Protection of the Public and the Environment*, respectively. These rules establish the dose limits for members of the public while onsite during access to a controlled area (10 CFR 835.208) and for members of the public while offsite (DOE Order 458.1.4.b(1)(a)). Limits for occupational workers are several orders of magnitude higher, and are also identified in 10 CFR 835.

6.0 Environmental Management System

In accordance with the LMS contractor's Environment, Safety, Health, and Quality Assurance policies and the Environmental Management System, all LMS contractor personnel performing work for LM will follow safe and environmentally sound work practices. Work will be conducted in a manner that protects personnel and the public; complies with DOE directives; and complies with applicable federal, state, and local requirements, agreements, and permits under the LM contract. In addition, work will be conducted in a manner that prevents pollution, minimizes wastes, and conserves natural and cultural resources to the extent that such activities are technically and economically feasible. Additionally, the approach used for implementing the work plan and all personnel involved will strive to minimize land disturbances caused at this site as a result of conducting all work described in this document.

- All onsite personnel are responsible for immediately informing the line supervisor of any unsafe or environmentally unsound conditions and have the authority to pause or stop work without fear of reprisal, if warranted. A post activity trip report will be developed documenting site activities performed under this work plan.
- The work identified in this work plan has been assessed in two National Environmental Policy Act (NEPA) Categorical Exclusion Evaluations (CXEs). The first CXE, LM 04-18, evaluated the environmental impacts associated with routine maintenance of the existing site infrastructure. The second CXE, LM 07-18, evaluated the construction of permanent aerial survey monument markers, expanded upon the road repair activity, and provided for the construction of a new vehicle gate in the perimeter fence. Proposed activities fit within the following categories: B1.3, Routine Maintenance; B1.13, Pathways, short access roads, and rail lines; B3.1, Site characterization and environmental monitoring; and B3.8, outdoor terrestrial ecological and environmental research. Through these two CXE documents, LM has demonstrated that these actions do not individually or cumulatively have a significant effect on the human environment, thereby supporting justification for classification of this action as a Categorical Exclusion under DOE NEPA regulations in 10 CFR 1021.410.

6.1 Cultural Resources

Work described in this document taking place on the engineered cover of the disposal cell, and the associated materials, work equipment, and vehicles, will be staged in areas that have been surveyed in the past and found to lack important cultural resources. The National Historic Preservation Act Section 106 review process for the proposed work was initiated by mailing consultation materials with a finding of "no historic property subject to effect [36 CFR 00.4(d)(i)]" to the Navajo Nation Tribal Historic Preservation Department on January 9, 2018. A response from the Tribal Historic Preservation Officer was received on April 11, 2018, with the finding that no historic properties will be affected based on the proposed undertakings within the limits of the 1983 cultural resource survey at the site, and notification to proceed was recommended.

Two offsite aeolian soil samples will be collected by hand for comparison to windblown material observed on the disposal cell. Due to the minor nature of this undertaking, which lacks the potential to have an effect on historic property, no Section 106 consultation is required for the proposed hand collection of offsite aeolian samples.

6.2 Migratory Bird Treaty Act

Personnel will not work in or travel in areas outside of the approved work areas or access routes without approval. Personnel will not harass or otherwise disturb or move active bird nests, eggs, or young birds, or "take" a migratory bird in any way. If an active nest or eggs are discovered in the work area, personnel will notify the environmental compliance point of contact (ECPOC) and resolve any Migratory Bird Treaty Act (Title 16 *United States Code* Sections 703–712) concerns before work can continue.

6.3 Endangered Species Act

No threatened or endangered species or their designated critical habitat is known to exist at the site. All of the invasive work will take place on the engineered cover of the cell. The cover is a modern engineered feature.

6.4 Waste Management

Personnel will properly manage all waste generated by project activities. No hazardous or radioactive waste materials are expected to be generated during field activities. The site will be kept clean and orderly. Personnel will clean up debris and waste material from the site daily. Construction debris and nonhazardous waste material are expected to be very minimal and will be disposed of in approved receptacles or dropped off by the team at nearby trash receptacles. Personnel will immediately notify the line supervisor if any hazardous waste is suspected or generated outside the scope of the project and follow the ECPOC's directions to manage the waste.

6.4.1 Waste Reduction and Recycling

Work will be performed in an environmentally responsible manner consistent with the LMS *Environmental Management System Teams Manual* (LMS/POL/S11374) waste reduction and recycling targets. In working toward these targets, all personnel are encouraged to minimize the waste generated and maximize the amount of material that is reused, salvaged, and recycled.

6.5 Spills

If spills of any fluids from equipment operations or maintenance (e.g., fuel, hydraulic fluids, coolant, lubricants, cleaning solvents, used oil) occur, personnel will immediately notify the line supervisor, Safety and Health, and ECPOC and follow their directions to clean up the spill. All spills will be managed in accordance with the *Environmental Instructions Manual* (LMS/POL/S04338). Equipment leaks and other types of spills will be diapered, contained, absorbed, or otherwise blocked to prevent ground surface contamination until the leak is repaired or the equipment is replaced. Personnel will clean up and subsequently manage spilled materials and associated wastes (e.g., contaminated soils), including proper storage, until the ECPOC can arrange for offsite disposal of the material.

6.6 Driving on the Disposal Cell Cover

Driving on the disposal cell cover with a track-mounted excavator, a track-mounted skidsteer, or a track-mounted UTV will be required to remove cover materials, transport material to and from the sample areas, and replace cover materials. During cell cover access, the track-mounted equipment will be required to drive up the side slope perpendicular to the side slope contours to access the sample areas. The equipment will egress from the sample areas by backing down the slope without turning the equipment around. If multiple trips to a single sample area are required, the equipment will be required to split the tracks from the previous trip so that the equipment is not tracking in the exact same path for each trip. All individual sample areas will be accessed from the toe of the slope upslope to the respective sample area. The equipment will not travel from sample area to sample area via cross-slope travel. Equipment operators will be identified daily during tailgate meetings.

7.0 References

10 CFR 835. “Occupational Radiation Protection Program,” *Code of Federal Regulations*.

10 CFR 851, “Worker Safety and Health Program,” *Code of Federal Regulations*.

10 CFR 1021. “National Environmental Policy Act Implementing Procedures,” *Code of Federal Regulations*.

29 CFR 1910, “Occupational Safety and Health Standards,” *Code of Federal Regulations*.

29 CFR 1926, “Safety and Health Regulations for Construction,” *Code of Federal Regulations*.

36 CFR 800. “Protection of Historic Properties,” *Code of Federal Regulations*.

16 USC 703–712. “Migratory Bird Treaty Act,” *United States Code*.

AASHTO (American Association of State Highway and Transportation Officials), 2018. AASHTO R 18, “Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.”

American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) Standard Z87.1. “Occupational and Educational Personal Eye and Face Protection Devices.”

ASTM (ASTM International), D3740. “Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction,” ASTM International, West Conshohocken, Pennsylvania, 2018.

DOE Order 458.1, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, February 11, 2011.

DOE Policy 450.4A Chg 1 (MinChg), *Integrated Safety Management Policy*, U.S. Department of Energy, January 18, 2018.

Environmental Instructions Manual, LMS/POL/S04338, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Environmental Management System Description, LMS/POL/S04346, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Environmental Management System Teams Manual, LMS/POL/S11374, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

EPA (U.S. Environmental Protection Agency), 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA/240/B-06/001, Office of Environmental Information, February.

Heat Stress Evaluation and Monitoring Procedure, LMS/POL/S15935, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Integrated Safety Management System Description, LMS/POL/S14463, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Integrated Work Control Process, LMS/POL/S11763, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Job Safety Analysis, LMS/PRO/S16030, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

LMS Health and Safety Plan, LMS/POL/S20043, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

MK-F (MK-Ferguson Company), 1997. *Mexican Hat, Utah, Monument Valley Arizona, Completion Report*, prepared by MK-Ferguson Company for the U.S. Department of Energy, UMTRA Project Team, Environmental Restoration Division, Albuquerque, New Mexico.

Pause/Stop Work Procedures, LMS/PRO/S20037, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Quality Assurance Manual, LMS/POL/S04320, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Radiation Protection Program Plan, LMS/POL/S04373, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Radiological Control Manual, LMS/POL/S04322, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Respiratory Protection Program, LMS/POL/S16042, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Training Department Procedures Manual, LMS/POL/S15034, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Training Program Description, LMS/POL/S04323, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Worker Safety and Health Program (10 Code of Federal Regulations 851 Implementation), LMS/POL/S14697, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

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Appendix A

Sampling Location Maps

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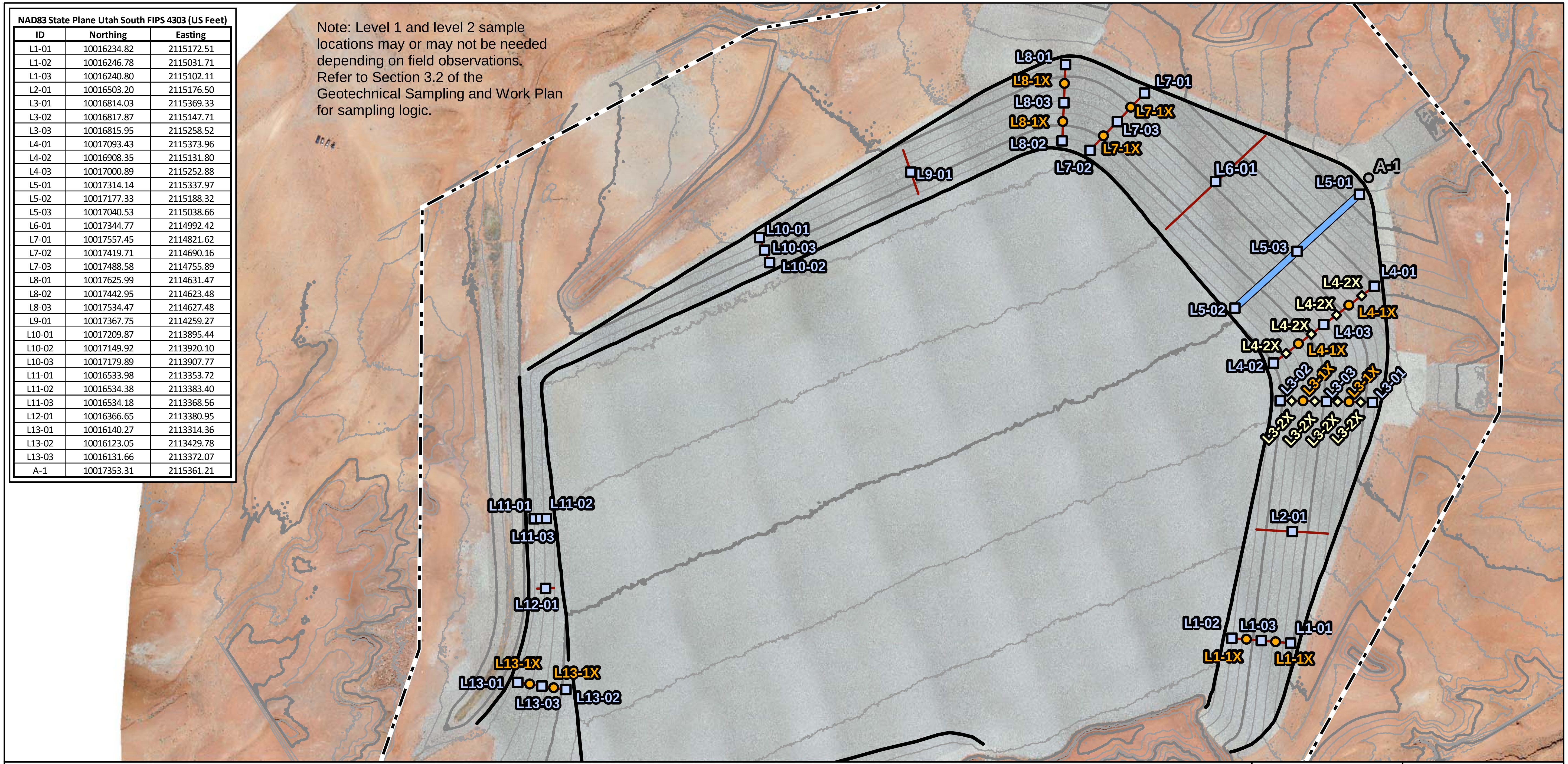
NAD83 State Plane Utah South FIPS 4303 (US Feet)

ID	Northing	Easting
L1-01	10016234.82	2115172.51
L1-02	10016246.78	2115031.71
L1-03	10016240.80	2115102.11
L2-01	10016503.20	2115176.50
L3-01	10016814.03	2115369.33
L3-02	10016817.87	2115147.71
L3-03	10016815.95	2115258.52
L4-01	10017093.43	2115373.96
L4-02	10016908.35	2115131.80
L4-03	10017000.89	2115252.88
L5-01	10017314.14	2115337.97
L5-02	10017177.33	2115188.32
L5-03	10017040.53	2115038.66
L6-01	10017344.77	2114992.42
L7-01	10017557.45	2114821.62
L7-02	10017419.71	2114690.16
L7-03	10017488.58	2114755.89
L8-01	10017625.99	2114631.47
L8-02	10017442.95	2114623.48
L8-03	10017534.47	2114627.48
L9-01	10017367.75	2114259.27
L10-01	10017209.87	2113895.44
L10-02	10017149.92	2113920.10
L10-03	10017179.89	2113907.77
L11-01	10016533.98	2113353.72
L11-02	10016534.38	2113383.40
L11-03	10016534.18	2113368.56
L12-01	10016366.65	2113380.95
L13-01	10016140.27	2113314.36
L13-02	10016123.05	2113429.78
L13-03	10016131.66	2113372.07
A-1	10017353.31	2115361.21

Note: Level 1 and level 2 sample locations may or may not be needed depending on field observations. Refer to Section 3.2 of the Geotechnical Sampling and Work Plan for sampling logic.



▭	Site Boundary	
🟦	Long Test Pit	*A 3 foot wide test pit running the length of the side slope that exposes the radon barrier*
—	Sample Lines	*Endpoints are 20' offset from the Breaklines Digitized perpendicular to contours*
—	Breaklines	*Digitized from a 2017 digital elevation model*

Sample Locations

Level 0
□ L1-01 *Top, bottom, and middle of sample line*

Level 1
● L1-1X *Midpoint between two Level 0 locations if necessary*

Level 2
◇ L1-2X *Midpoint between two Level 1 locations if necessary*

Apron
○ A-1

Level Number
L7-21
Line Number *Sample Number*

N

SCALE IN FEET
200 100 0 200

Contour interval: 5 foot

U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Test Pit and Sample Collection Locations
Mexican Hat, UT, Disposal Site

DATE PREPARED: September 26, 2018

FILE NAME: S2021305

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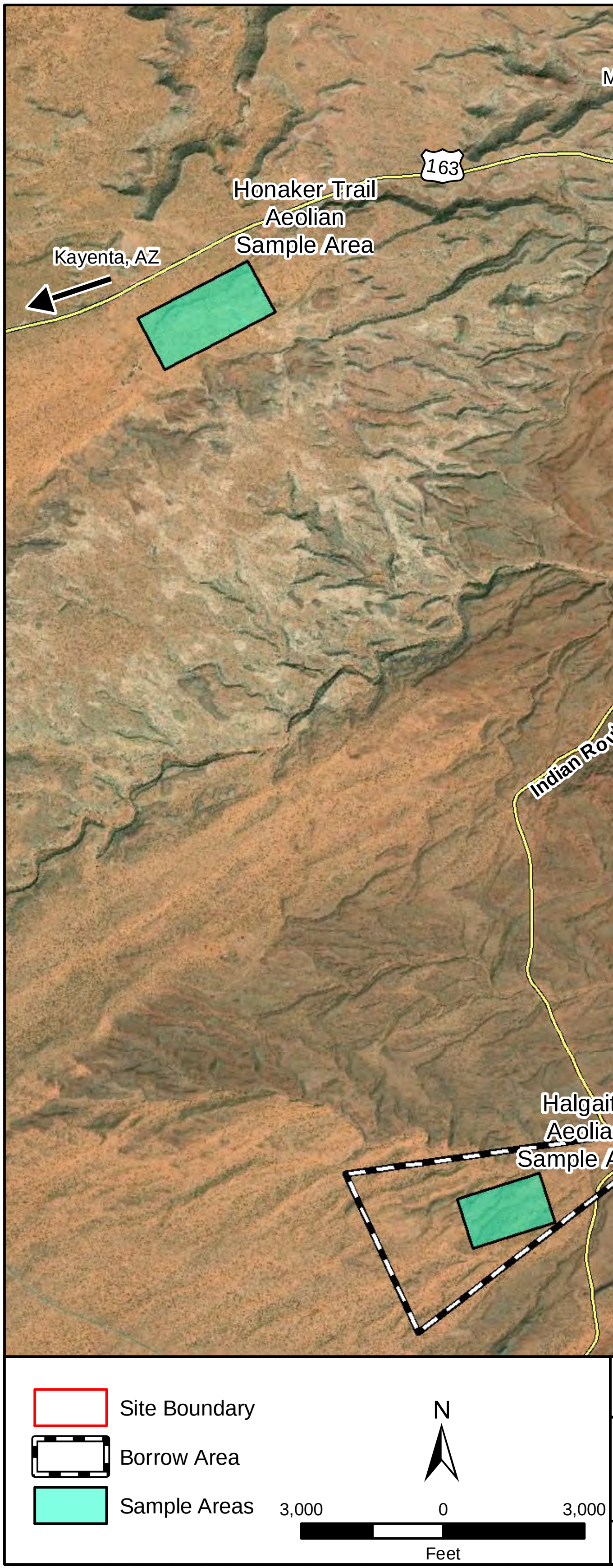

U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Borrow and Aeolian
Offsite Sampling Areas
Mexican Hat, Utah, Disposal Site

DATE PREPARED:
October 10, 2018

FILE NAME:
S2188501

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Appendix B

Sample Collection and Testing Table

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Sample Collection and Testing Table

Test Method		Material and Collection Containers							
Method	Description	Bedding	Top Radon Barrier	Middle Radon Barrier	Bottom Radon Barrier	Cemented Material	Aeolian Dust	Aeolian Source Material	Slope Toe Fines
ASTM D6913	Sieve	B (3)	S	Z	Z	Z	Z	Z	Z
ASTM D7928	Hydrometer	Z				Z	Z	Z	Z
ASTM D4221	Double Hydrometer[2]		S	Z	Z				
ASTM D7263	Moisture Content and Density		S			Z			
ASTM D2216	Moisture Content by Mass	J		J	J				J
ASTM D4318	Plasticity Index		S	Z	Z	Z	Z	Z	Z
ASTM D4373	Carbonate Content	Z	S	Z	Z	Z	Z	Z	Z
ASTM D7503-18	Exchange Complex and Cation Exchange Capacity of Inorganic Fine-Grained Soils[3]	Z	Z	Z	Z	Z	Z	Z	Z
ASTM D4972	pH		Z	Z	Z	Z	Z	Z	Z
ASTM G187	Resistivity		Z	Z	Z	Z	Z	Z	Z
NA	Xray Diffraction[3]	Z	Z	Z	Z	Z	Z	Z	Z

B= 5-Gallon Bucket
S= Shelby Tube
Z= Ziploc Bag
J= Jar
NA= Not Applicable

Test Method		Sample Mass Requirements (grams)							
ASTM Method	Description	Bedding	Top Radon Barrier	Middle Radon Barrier	Bottom Radon Barrier	Cemented Material	Aeolian Dust	Aeolian Source Material	Slope Toe Fines
D6913	Sieve	75,000	75	75	75	1,300	75	75	75
D7928	Hydrometer	50				50	50	50	50
D4221	Double Hydrometer[2]		100	100	100				
ASTM D7263	Moisture Content and Density		Note 1			250			
ASTM D2216	Moisture Content by Mass	20		20	20				20
D4318	Plasticity Index		200	200	200	200	200	200	200
D4373	Carbonate Content	10	10	10	10	10	10	10	10
D7503-18	Exchange Complex and Cation Exchange Capacity of Inorganic Fine-Grained Soils[3]	250	250	250	250	250	250	250	250
ASTM D4972	pH		40	40	40	40	40	40	40
ASTM G187	Resistivity		500	500	500	500	500	500	500
NA	Xray Diffraction[3]	50	50	50	50	50	50	50	50
Total (grams)		75,380	1225	1245	1245	2650	1175	1175	1195
Total (lbs)		**166.2**	**2.7**	**2.7**	**2.7**	**5.8**	**2.6**	**2.6**	**2.6**

Note 1: ASTM D7263 only performed on shelby tube sample.
2 Dispersive Characteristics
3 To be collected in a single container

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Appendix C

Sample Log Sheet

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FIELD SAMPLE LOG

Sampled By: ______________________ **Signature:** ______________________

Project: Mexican Hat Materials Sampling and Testing **Page** ________ **of** ________

					Analysis to be Performed (Check for Each Sample)										
Sample Date	**Time**	**Sample ID**	**Container Type**	**# of Containers**	**Sieve**	**Hydrometer**	**Double Hydrometer**	**Moisture by Mass**	**Plasticity Index**	**Carbonate Content**	**Cation Exchange**	**Moisture and Density**	**pH**	**Resistivity**	**XRD**

B= 5-Gallon Bucket
S= Shelby Tube
Z= Ziploc Bag (Quart)
J= 2-Ounce Jar

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NOT FOR PUBLIC RELEASE

Appendix D

Interim Radon Barrier Protection Work Plan

NOT FOR PUBLIC RELEASE

LMS/HAT/S19326, Rev-1

Interim Radon Barrier Protection Work Plan for Areas with Observed Radon Barrier Degradation at the Mexican Hat, Utah, UMTRCA Title I Disposal Site

July 2018

Work performed under DOE contract number DE-LM0000421
for the U.S. Department of Energy Office of Legacy Management.

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Contents

Abbreviations

AED	automated external defibrillator
CXE	Categorical Exclusion Evaluation
DOE	U.S. Department of Energy
ECPOC	environmental compliance point of contact
GPS	global positioning system
IRBP	interim radon barrier protection
JSA	Job Safety Analysis
LM	Office of Legacy Management
LMS	Legacy Management Support
LTSP	*Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site San Juan County, Utah*
NEPA	National Environmental Policy Act
PPE	personal protective equipment
RCT	radiological control technician
SDS	Safety Data Sheet
UMTRCA	Uranium Mill Tailings Radiation Control Act
UTV	utility task vehicle (track mounted)

1.0 Introduction

This work plan presents the field workflow for the implementation of interim radon barrier protection (IRBP) at the Mexican Hat, Utah, Disposal Site (site). In 2016, multiple subtle depressions were identified in the rock cover along the toe and lower portions of the northeast side slope of the Mexican Hat Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I disposal cell. Due to concerns regarding the potential impacts of the cell cover depressions related to cell performance and erosion resistance, an evaluation of the depressions was performed. The evaluation included visual observations of the depressions, limited manual removal of the rock cover components to expose the top of the radon barrier surface, review of disposal cell as-built drawings, and review of supporting design calculations for the rock cover components.

As a result of limited field investigations, voids and incisements were discovered within the radon barrier on the north and northeast side slopes of the disposal cell. It is suspected that as little as 25% (6 inches) of the radon barrier remains in some areas of known radon barrier degradation, and additional precipitation events may lead to a Priority 1 or 2 condition as defined in Table 3-2 of the *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site San Juan County, Utah* (LTSP) (DOE 2007).

This work plan will be used to implement IRBP in areas where radon barrier degradation is visually confirmed through forensic field activities. IRBP will serve as an interim measure to reduce the potential for a Priority 1 or 2 condition at the site until corrective measures are identified, approved, and implemented to effectively address long-term cell performance. Initial, and potentially subsequent, implementation of this work plan will be accompanied by a map of locations to be protected or investigated for potential protection.

Prior to the development of this work plan, an evaluation of media that could be used to implement IRBP was performed. Media that were considered included bentonite amended granular radon barrier material, permeable fill, sodium bentonite, original radon barrier material, cement grout, and expansive foam. Based on the evaluation, bentonite amended granular radon barrier material meeting the radon barrier layer specifications for the site was identified as the most appropriate media for providing interim protection of the radon barrier in areas with observed voids and incisements. The use of this media is based on a number of factors, including availability, controlling radon emanation, preventing precipitation infiltration, mitigating future erosion, and providing a distinction between the material and the radon barrier to determine the thickness of the radon barrier at a later date.

A Legacy Management Support (LMS) contractor team was formed to prepare this work plan, the *Project or Activity Evaluation* (LMS 1005), the *Job Safety Analysis (JSA)* (LMS 1748), and other documents as required under the LMS *Integrated Work Control Process* (LMS/POL/S11763). All work shall be performed in accordance with approved administrative and engineering safety and health controls (e.g., JSA), applicable personal protective equipment (PPE), U.S. Department of Energy (DOE) directives, and Office of Legacy Management (LM) and LMS contractor policies and procedures.

The LMS contractor team consists of the following members:

Jeff Carman, Task 103 Manager

Dan Brennecke, Engineering Manager

John Manée, Engineering

Joe Trnka, Environmental Compliance

Nate Bailey, Safety and Health Manager

Mike McDonald, Safety and Health (Radiological Control Manager)

Evan Tyrrell, Site Lead

Linda Tegelman, Quality Assurance

Gary Baur, Construction Manager

2.0 Field Workflow

The LMS contractor team will have responsibility for the field workflow activities listed below, which are further detailed in the following subsections:

- Procurement of Required Equipment and Materials
- Identification of IRBP Area Location
- Predisturbance Radiation Screening
- Removal of Riprap at IRBP Areas
- Bedding Layer Surface Radiation Screening
- Removal of the Bedding Layer
- Radon Barrier Surface Radiation Screening
- Documentation and Measurement of the Exposed IRBP Area
- Preparation of IRBP Materials for the Degraded Radon Barrier Area
- Installation of IRBP Materials
- Restoration and Documentation of IRBP Area

2.1 Procurement of Required Equipment and Materials

Prior to the performance of the work described in the work plan, the following equipment and materials will be procured and available at the site:

- Stakes, pin flags, markers, handheld global position system (GPS) unit, and paint to mark IRBP area boundaries
- Shade tent
- Camera for documentation of IRBP areas
- Inspection camera for viewing concealed voids

- Tarps to temporarily place and retain segregation of the removed materials
- Shovels or other hand tools to remove and replace cover materials
- Sodium iodide scintillometer for gamma radiation screening
- Tape measure, carpenter’s ruler, or other measuring equipment for documentation
- Radon barrier material meeting the original design gradation specifications for the radon barrier material
- Sodium bentonite (granular) to mix in with radon barrier fill material
- 250 gallon portable water containers (minimum size) for moisture conditioning IRBP material
- Water to moisture condition IRBP material
- Electric barrel mixer to mix and moisture condition IRBP material
- Generator (gas-powered) for operating mixer
- Pressurized pump sprayers (2 minimum) for moisture conditioning IRBP material in mixer and for moistening top of radon barrier prior to placement of IRBP material
- Hoes, rakes, and shovels for mixing radon barrier material and sodium bentonite
- Utility task vehicle (UTV) for transporting IRBP material
- 5-gallon buckets with handles to haul IRBP material to and from UTV
- Motorized compaction machine (jumping jack) for compacting IRBP material
- Leveling tools to match IRBP material with top of adjacent radon barrier surfaces
- Geotextile fabric to mitigate erosion of IRBP areas
- Scissors for cutting geotextile fabric
- PPE as identified in the JSA, including first aid kit and automated external defibrillator (AED)

2.2 Identification of IRBP Area Location

- Locate the IRBP area based on previously collected GPS coordinates collected from the respective test pit area using a handheld GPS unit, or identify test pit area based on visual observations and collect coordinates using a handheld GPS unit.
- Determine the initial extent of the IRBP area to be manually exposed, and paint a perimeter with survey marker paint.
- Take a photograph to document conditions of the predisturbed IRBP area.

2.3 Predisturbance Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the undisturbed surface of the IRBP area. All radiation screening shall be performed by a radiation control technician (RCT).
- All radiation screening readings shall be documented by the RCT in a log book for future reference. Documentation shall identify the IRBP area identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

2.4 Removal of Riprap at IRBP Areas

- Place tarps cross-gradient and adjacent to the outer extent of the IRBP area.
- Manually remove riprap along the extent of the IRBP area, and place removed riprap on adjacent tarp to maintain material segregation.
- Visually determine if the IRBP area needs to be extended beyond the initial designated area, and modify the IRBP area accordingly.
- Suspend removal of riprap materials at the top of the bedding layer surface.
- Document the conditions of the bedding layer surface in a field book, and collect photographic documentation.

2.5 Bedding Layer Surface Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the upper surface of the exposed bedding layer. All radiation screening shall be performed by an RCT.
- All radiation screening readings shall be documented by the RCT in a log book for future reference. Documentation shall identify the IRBP identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

2.6 Removal of the Bedding Layer

- Manually remove the bedding layer with hand tools, placing the removed bedding material on a separate tarp from the riprap to maintain material segregation.
- Manually clean out any remaining bedding materials within the IRBP area.
- Visually determine if the IRBP area needs to be extended beyond the initial designated area, and modify the IRBP area accordingly to expose the entire extent of degraded radon barrier.
- Suspend manual removal of bedding layer materials at the top of the radon barrier surface.
- Document the conditions of the radon barrier surface in a field book, and collect photographic documentation.

2.7 Radon Barrier Surface Radiation Screening

- Perform radiation screening with a sodium iodide scintillometer on the upper surface of the exposed radon barrier. All radiation screening shall be performed by an RCT.
- All radiation screening readings shall be documented by the RCT in a log book for future reference. Documentation shall identify the IRBP identifier, date, time, and description of the materials being screened.
- Elevated radiation levels identified during screening activities will be assessed by the RCT to determine the need to evaluate radiological work controls.

2.8 Documentation and Measurement of the Exposed IRBP Area

Collect measurements both laterally and vertically of the degraded radon barrier area, and document the conditions in a field book and via photographic documentation.

2.9 Preparation of IRBP Materials for the Degraded Radon Barrier Area

- Mix the granular bentonite and the radon barrier material in an electric barrel mixer using a 1-gallon container by volume; mix 9 gallons of radon barrier material with 1 gallon of granular bentonite to create the mixed IRBP material. Mixing shall be performed with the electric barrel mixer until granular bentonite is sufficiently mixed with the radon barrier material.
- Moisture condition the mixed IRBP material using water from a portable container or pressurized pump sprayer until visually moistened for sufficient compaction, being careful not to over moisten or saturate the mixed material.
- Transport the mixed IRBP material to the IRBP area using a UTV, remaining off the cell for the maximum amount possible (refer to Section 4.6 for UTV requirements).

2.10 Installation of IRBP Materials

- Scarify any exposed smooth surfaces within the IRBP area to a 1-inch depth to provide a roughened contact surface for the IRBP materials.
- Moisten the exposed area as necessary with a pressurized pump sprayer.
- Place moisture conditioned IRBP material in radon barrier degregated area in 4-inch maximum loose lifts after attempting to fill in as much downgradient void space as possible.
- Manually compact placed lift with a motorized compaction machine (jumping jack) until material no longer shows indentations indicating that the lift is still being compressed.
- Repeat placement and compaction steps until the IRBP material is level with the top of the adjacent radon barrier surface.
- Use hand tools to level the IRBP material flush with the adjacent radon barrier surface.
- Document the measurements of the finished IRBP surface area, and take a photograph of the finished IRBP material surface.

- Place geotextile fabric over the leveled IRBP material, extending laterally at least 1 foot (where possible) beyond the placed IRBP material in all directions, or to the edge of the exposed radon barrier if less than 1 foot.
- Take a photograph of the installed geotextile fabric, and collect GPS measurements of the IRBP area utilizing a handheld GPS unit.

2.11 Restoration and Documentation of IRBP Area

- Gently hand place 2 to 3 inches of the previously removed bedding material with a shovel on the edges and seams of the geotextile fabric first, prior to placing on the remaining fabric, to hold the edges and seams of the geotextile fabric while placing the remaining bedding material, ensuring that the geotextile fabric remains undisturbed and intact with the IRBP surface.
- Manually place and evenly spread the remaining bedding material with hand tools across the extent of the IRBP area, taking care not to displace the geotextile fabric.
- Take a photograph of the replace bedding material layer.
- Manually place and evenly spread the previously removed riprap across the extent of the IRBP area.
- Place a labeled pin flag in the center of the IRBP restored area.
- Paint the entire perimeter of the restored area with survey marker paint.
- Take a photograph of the restored area.

3.0 Safety and Health

This section describes the project safety and health requirements. All work shall be conducted in accordance with safety regulations promulgated by federal, state, and local agencies and DOE regulations that are contained in the LMS *Safety and Health Manual* (LMS/POL/S04321).

Workers are responsible for identifying safety concerns, potential hazards, or unsafe conditions and immediately notifying line management. Each worker has the right, responsibility, and authority to report unsafe or environmentally unsound conditions or practices and to pause or stop work activities without fear of reprisal. All onsite personnel are required to immediately report to the line supervisor any unsafe activities, changed conditions, and safety and health incidents. Good housekeeping shall be maintained at all times to mitigate slip, trip and fall hazards posed by the staging of materials, tools and equipment at location subject to IRBP. Additionally the buddy system, or radio communication, will be used when individuals are working outside of line-of-sight.

3.1 Job Safety Analysis

All personnel present shall read, sign, and adhere to the hazard controls specified in the approved JSA. Workers shall not perform any work not covered by the JSA or for which the JSA does not provide adequate protection. The designated contractor line supervisor can modify the JSA to reflect changed conditions or equipment as needed or as requested by a worker as a field change.

3.2 Training Requirements

Workers are responsible for performing tasks in accordance with relevant associated LMS training and may not perform tasks for which they have not been adequately trained. Minimum training requirements include the following:

- Initial Site Briefing: All field personnel shall attend an initial site briefing conducted by the LMS contractor line supervisor on the first day of work before conducting any fieldwork. The JSA and other field forms will be covered and signed at this time. If circumstances require the use of personnel who did not attend the initial site briefing, these personnel will receive individual briefings from the LMS contractor line supervisor before they may begin fieldwork.
- Tailgate Safety Meetings: At the beginning of each day’s work and before specific tasks with significant or modified safety considerations, the LMS contractor team will conduct an operations safety and health meeting for all onsite personnel. The scope of the upcoming day’s operations and activities will be reviewed, and hazards associated with those activities will be identified along with the safety implications and procedures to mitigate the hazards. Relevant safety documentation associated with the upcoming work will be reviewed. In addition, issues or concerns noted from the previous days’ activities will be discussed. This briefing will be documented with a required sign-in sheet (i.e., *Pre-Job Brief/Safety Meeting Attendance Record* [LMS 1554]) to identify the topics discussed and the personnel in attendance. A separate briefing with sign-in on the *Pre-Job Brief/Safety Meeting Attendance Record* will be conducted for any worker(s) who requests to be onsite and cannot attend the daily meeting. All workers are required to participate and sign in, or they will not be allowed to participate in activities at the site.

3.3 First Aid, CPR, and Fitness for Duty

The LMS contractor team will provide a person who is trained in first aid and CPR to be onsite at all times while work is being performed. The LMS contractor team will ensure that a first aid kit and AED unit are onsite at all times when workers are present. All team members performing fieldwork will be required to complete a *10 CFR 851, Fit For Duty Evaluation (Employee/Subcontractor)* [LMS 2115] and to receive a subsequent medical physical.

3.4 Personal Protective Equipment Within the Work Zone

The requirement for specific PPE, including when to wear it, will be determined in the JSA for the project by the LMS contractor team. The LMS contractor team reserves the right to adjust PPE requirements to protect personnel from hazards.

- All personnel shall wear safety glasses with side shields or lens wraps and that are stamped on the frame as meeting ANSI/ISEA Z87.1, "Occupational and Educational Personal Eye and Face Protection Devices."
- All personnel shall wear coats, gloves, and hats, as conditions warrant.
- Work gloves are required during handling of all rock cover components.
- Personnel moving rocks shall wear hard hats appended with approved metal mesh face shields.
- Personnel moving rocks or kneeling on the cell shall wear knee pads.
- All workers shall wear shoes with ankle protection.

3.5 Drinking Water

Bottled drinking water will be provided to the field crew by the LMS contractor team, and proper hydration will be encouraged throughout the duration of work activities at the site.

3.6 Safety Data Sheets

A copy of the Safety Data Sheet (SDS) is required for each chemical used on the jobsite (e.g., survey marking paint). A copy of each SDS shall be kept on the job site and placed in a convenient location for all personnel to access.

3.7 Radiation Exposure Monitoring

- The LMS contractor will implement practical radiological controls including using PPE appropriate for the work being conducted.
- Exposure-based monitoring is not necessary, as there have not been any identified areas exhibiting elevated radiation above ambient conditions at this site.
- However, a radiological work permit (LMS HAT-18-001A) will be on hand if necessary to implement additional work controls, and a qualified LMS contractor RCT shall be onsite at all times when work is being performed.

4.0 Environmental Management System

In accordance with the LMS contractor's Environment, Safety, Health, and Quality Assurance policies and the Environmental Management System, all LMS contractor personnel performing work for LM shall follow safe and environmentally sound work practices. Work shall be conducted in a manner that protects workers and the public; complies with DOE directives; and complies with applicable federal, state, and local requirements, agreements, and permits under the LM contract. In addition, work shall be conducted in a manner that prevents pollution, minimizes wastes, and conserves natural and cultural resources to the extent that such activities are technically and economically feasible. Additionally, the approach used for implementing the work plan and all personnel will strive to minimize land disturbances caused at this site as a result of conducting all work described in this document.

- All onsite personnel are responsible for immediately informing the line supervisor of any unsafe or environmentally unsound conditions and have the authority to pause or stop work without fear of reprisal, if warranted. A postactivity trip report will be developed documenting site activities performed under this work plan.
- The work identified in this work plan has been assessed in two National Environmental Policy Act (NEPA) Categorical Exclusion Evaluations (CXEs). The first CXE, LM 04-18, evaluated the environmental impacts associated with routine maintenance of the existing disposal site infrastructure. The second CXE, LM 07-18, evaluated the construction of permanent aerial survey monument markers, expanded upon the road repair activity, and provided for the construction of a new vehicle gate in the perimeter fence. Proposed activities fit within the following categories: B1.3, Routine Maintenance; B1.13, Pathways, short access roads, and rail lines; B3.1, Site characterization and environmental monitoring; and B3.8, Outdoor terrestrial ecological and environmental research. Through these two CXE documents, LM has demonstrated that these actions do not individually or cumulatively have a significant effect on the human environment, thereby supporting justification for classification of this action as a Categorical Exclusions under DOE NEPA regulations in Title 10 *Code of Federal Regulations* Section 1021.410 (10 CFR 1021.410).

4.1 Cultural Resources

All of the work described in this document will take place on the engineered cover of the disposal site. IRBP materials, associated work equipment, and vehicles will be staged in areas that have been surveyed in the past and found to lack important cultural resources. The Section 106 process for the proposed work was initiated by mailing consultation materials with a finding of “no historic property subject to effect [36 CFR 800.4(d)(i)]” to the Navajo Nation Tribal Historic Preservation Department on January 9, 2018. No objection from the Navajo Nation Historic Preservation Department was received within 60 days of their receipt of this finding. This lack of formal objection allows LM to complete its Section 106 responsibilities in accordance with 36 CFR 800.4(d)(1)(i).

4.2 Migratory Bird Treaty Act

Personnel shall not work in or travel in areas outside of the approved work areas or access routes without approval. Personnel shall not harass or otherwise disturb or move active bird nests, eggs, or young birds or “taking” a migratory bird in any way. If an active nest or eggs are discovered in the work area, personnel shall notify the environmental compliance point of contact (ECPOC) and resolve any Migratory Bird Treaty Act (Title 16 *United States Code* Sections 703–712 [16 USC 703–712]) concerns before work can continue.

4.3 Endangered Species Act

No threatened or endangered species or their designated critical habitat is known to exist at the site. All of the work will take place on the engineered cover of the disposal site. The cover is a modern engineered feature.

4.4 Waste Management

Personnel shall properly manage all waste generated by project activities. No hazardous or radioactive waste materials are expected to be generated during field activities. The site shall be kept clean and orderly. Personnel shall clean up debris and waste material from the site daily. Construction debris and nonhazardous waste material are expected to be very minimal and shall be disposed of in approved receptacles or dropped off by the team at nearby trash receptacles. Personnel shall immediately notify the project lead if any hazardous waste is suspected or generated outside the scope of the project and follow the ECPOC’s directions to manage the waste.

4.4.1 Waste Reduction and Recycling

Work will be performed in an environmentally responsible manner consistent with the LMS *Environmental Management System Sustainability Teams Manual* (LMS/POL/S11374) waste reduction and recycling targets. In working toward these targets, all personnel are encouraged to minimize the waste generated and maximize the amount of material that is reused, salvaged, and recycled.

4.5 Spills

If spills of any fluids from equipment operations or maintenance (e.g., fuel, hydraulic fluids, coolant, lubricants, cleaning solvents, used oil) occur, personnel shall immediately notify the line supervisor, Safety and Health, and ECPOC and follow their directions to clean up the spill. All spills will be managed in accordance with the *Environmental Instructions Manual* (LMS/POL/S04338). Equipment leaks and other types of spills shall be diapered, contained, absorbed, or otherwise blocked to prevent ground surface contamination until the leak is repaired or the equipment is replaced. Personnel shall clean up and subsequently manage spilled materials and associated wastes (e.g., contaminated soils), including proper storage, until the ECPOC can arrange for offsite disposal of the material.

4.6 Driving on the Disposal Cell Cover

Driving on the disposal cell cover with a track mounted UTV will be required to transport IRBP material to the IRBP area. During cell cover access, the UTV will be required to drive up the side slope perpendicular to the side slope contours to access the IRBP area. The UTV will egress from the IRBP area by backing down the slope without turning the UTV around. If multiple UTV trips to a single IRBP area are required, the UTV will be required to split the tracks from the previous trip so that the UTV is not tracking in the exact same path for each trip. Individual IRBP areas will all be accessed from the toe of slope upslope to the respective IRBP area. The UTV will not travel from IRBP area to IRBP area via cross slope travel. UTV drivers will be identified daily during tailgate meetings.

5.0 References

10 CFR 1021. “National Environmental Policy Act Implementing Procedures,” *Code of Federal Regulations*.

36 CFR 800. “Protection of Historic Properties,” *Code of Federal Regulations*.

16 USC 703–712. “Migratory Bird Treaty Act,” *United States Code*.

ANSI/ISEA Z87.1. “Occupational and Educational Personal Eye and Face Protection Devices,” American National Standards Institute.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site San Juan County, Utah*, DOE-LM/1530, Office of Legacy Management, October.

Environmental Instructions Manual, LMS/POL/S04338, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Environmental Management System Sustainability Teams Manual, LMS/POL/S11374, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Integrated Work Control Process, LMS/POL/S11763, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Safety and Health Manual, LMS/POL/S04321, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

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Appendix C

Geotechnical Laboratory Report

Appendix C-1: Initial Properties
Appendix C-2: Particle Size Analysis
Appendix C-3: Percent Dispersion by Double Hydrometer
Appendix C-4: Atterberg Limits/Identification of Fines
Appendix C-5: Direct Shear Consolidated Drained
Appendix C-6: Collapse Potential
Appendix C-7: Carbonate Content, pH, and Resistivity
Appendix C-8: Final Gradations

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Final Laboratory Report for
Navarro Research and Engineering, Inc.

Mexican Hat, Geotechnical Materials Testing

Contract # DE-LM0000421 , PO# LMCP6198

THOMAS A. GOLDEN
NEW MEXICO
22750
11/22/19
PROFESSIONAL ENGINEER

November 22, 2019

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

November 22, 2019

John Manée
Navarro Research and Engineering, Inc.
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503
(970) 248-6242

Re: DBS&A Laboratory Report for the Navarro Research and Engineering, Inc., Mexican Hat, Geotechnical Materials Testing, Contract # DE-LM0000421 , PO# LMCP6198

Dear Mr. Manée:

Enclosed is the report for the Navarro Research and Engineering, Inc. Mexican Hat, Geotechnical Materials Testing samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Navarro Research and Engineering, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Joleen Hines
Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Notes

Sample Receipt:
A total of one hundred and seven samples were hand delivered on April 24, 2019. Each sample was delivered in three full 5-gallon buckets, a resealable plastic bag, a 250 mL HDPE bottle, and/or in 4” x 5” stainless steel sleeves (tubes) sealed with end caps. All samples were received in good order.

Sample Preparation and Testing Notes:
Each of the thirty five bucket samples, one of the bag samples, and each of the fifty seven bottle samples were subjected to initial gravimetric moisture content determination. In order to differentiate the bucket and bottle moisture content results, the sample ID’s for the bucket samples are appended with “(BM)”, indicating ‘Bucket Moisture’.

Seventeen of the tube samples were subjected to initial gravimetric and volumetric moisture content, dry bulk density, and calculated total porosity determinations. Porosity calculations are based on the use of an assumed specific gravity value of 2.65.

Each of the thirty five bucket samples, forty one of the bag samples, and sixteen of the tube samples were subjected to particle size analysis. For the bucket samples, the hydrometer portion of the analysis was obtained either from the bucket material or from the corresponding bag material. One bucket sample did not have a sufficient amount of fines to perform the hydrometer portion of the analysis. Particle diameter calculations in the hydrometer portion of the particle size analysis are based on the use of an assumed specific gravity value of 2.65. The percent passing results are reported to 0.1%, rather than 1% as specified in the test method.

Thirty eight of the bag samples and sixteen of the tube samples were subjected to secondary hydrometer analysis in order to determine dispersion characteristics by double hydrometer analysis. This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the “A” line, and more than 12% of the soil fraction is finer than 2-µm when dispersant is used. In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100. Particle diameter calculations in the hydrometer portion of the analysis are based on the use of an assumed specific gravity value of 2.65. The percent passing results are reported to 0.1%, rather than 1% as specified in the test method.

Forty one of the bag samples and sixteen of the tube samples were subjected to Atterberg limits testing. If the material was determined to be non-plastic, the fines were classified by the visual-manual method.

Nine of the tube sample were subjected to consolidated drained direct shear testing. Four samples received 3-point direct shear in which normal loads of 100, 200, and 400 psf (0.69, 1.39, 2.78 psi) were used. Five samples received 1-point direct shear in which a normal load of 400 psf (2.78 psi) was used. The estimated cohesion and friction angle provided represent one possible interpretation of the test results. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application. The initial dry bulk density (in g/cc) and the actual normal load applied (in psf), are included in each sub-sample ID.

One of the tube samples was subjected to collapse potential testing. The initial dry bulk density (in g/cc) and the specified inundation load (1044 psf (7.25 psi)) are included in the sub-sample ID.

Seventy three of the bag samples and sixteen of the tube samples were subjected to carbonate content testing, and fifty four of the bag samples were subjected to pH and electrical resistivity testing. This testing was performed by GeoTesting Express in Acton, MA.

Summaries

Project Information and Sample List

Client Project Information

Facility Name:	Mexican Hat Disposal Site
Project Number:	1.103.1.02.112.7.20
Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-077	A-1	04/16/2019 1330	1
HAT01-11.1904001-074	A-2	04/16/2019 1335	1
HAT01-11.1904001-062	A-3	04/16/2019 1350	1
HAT01-11.1904001-078	ASM-1	04/16/2019 830	1
HAT01-11.1904001-079	ASM-2	04/16/2019 915	1
HAT01-11.1904001-002	L1-02B	04/10/2019 850	5
HAT01-11.1904001-003	L1-03B	04/10/2019 900	5
HAT01-11.1904001-001	L1-11B	04/10/2019 1045	5
HAT01-11.1904001-004	L2-01B	04/10/2019 1130	4
HAT01-11.1904001-065	L3-01RB	04/09/2019 1440	2
HAT01-11.1904001-053	L3-01RM	04/09/2019 1450	2
HAT01-11.1904001-038	L3-01RT	04/09/2019 1500	1
HAT01-11.1904001-006	L3-02B	04/09/2019 930	5
HAT01-11.1904001-066	L3-02RB	04/09/2019 1100	2
HAT01-11.1904001-054	L3-02RM	04/09/2019 1045	2
HAT01-11.1904001-039	L3-02RT	04/09/2019 1000	1
HAT01-11.1904001-007	L3-03B	04/09/2019 1155	5
HAT01-11.1904001-067	L3-03RB	04/09/2019 1330	2
HAT01-11.1904001-055	L3-03RM	04/09/2019 1400	2

Project Information and Sample List (Continued)

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Facility Name:	Mexican Hat Disposal Site
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PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-040	L3-03RT	04/09/2019 1345	1
HAT01-11.1904001-005	L3-11B	04/09/2019 1525	5
HAT01-11.1904001-008	L4-01B	04/17/2019 1045	3
HAT01-11.1904001-009	L4-02B	04/17/2019 1145	4
HAT01-11.1904001-010	L4-03B	04/17/2019 1340	4
HAT01-11.1904001-024	L4-11B	04/17/2019 1500	4
HAT01-11.1904001-011	L5-01B	04/17/2019 1700	3
HAT01-11.1904001-034	L5-01C	04/17/2019 1620	1
HAT01-11.1904001-068	L5-01RB	04/18/2019 740	2
HAT01-11.1904001-056	L5-01RM	04/18/2019 750	2
HAT01-11.1904001-041	L5-01RT	04/18/2019 800	2
HAT01-11.1904001-082	L5-01UNKNOWN	04/18/2019 950	1
HAT01-11.1904001-012	L5-02B	04/18/2019 1230	5
HAT01-11.1904001-069	L5-02RB	04/18/2019 1240	2
HAT01-11.1904001-057	L5-02RM	04/18/2019 1235	2
HAT01-11.1904001-042	L5-02RT	04/18/2019 1235	2
HAT01-11.1904001-013	L5-03B	04/18/2019 1015	5
HAT01-11.1904001-070	L5-03RB	04/18/2019 1020	2
HAT01-11.1904001-058	L5-03RM	04/18/2019 1020	2

Project Information and Sample List (Continued)

Client Project Information

Facility Name:	Mexican Hat Disposal Site
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Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-043	L5-03RT	04/18/2019 1020	2
HAT01-11.1904001-107	L5-11B	04/18/2019 1150	5
HAT01-11.1904001-108	L5-11RB	04/18/2019 1155	2
HAT01-11.1904001-109	L5-11RM	04/18/2019 1150	2
HAT01-11.1904001-110	L5-11RT	04/18/2019 1200	2
HAT01-11.1904001-103	L5-21B	04/18/2019 1125	5
HAT01-11.1904001-104	L5-21RB	04/18/2019 1120	2
HAT01-11.1904001-105	L5-21RM	04/18/2019 1125	2
HAT01-11.1904001-106	L5-21RT	04/18/2019 1120	2
HAT01-11.1904001-027	L5-31B	04/18/2019 1045	5
HAT01-11.1904001-100	L5-31RB	04/18/2019 1045	2
HAT01-11.1904001-101	L5-31RM	04/18/2019 1045	2
HAT01-11.1904001-102	L5-31RT	04/18/2019 1045	2
HAT01-11.1904001-095	L5-41B	04/18/2019 940	4
HAT01-11.1904001-096	L5-41RB	04/18/2019 945	2
HAT01-11.1904001-097	L5-41RM	04/18/2019 945	2
HAT01-11.1904001-098	L5-41RT	04/18/2019 945	2
HAT01-11.1904001-091	L5-51B	04/18/2019 900	3
HAT01-11.1904001-092	L5-51RB	04/18/2019 915	2

Project Information and Sample List (Continued)

Client Project Information

Facility Name: Mexican Hat Disposal Site
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Project Name: Mexican Hat Disposal Site (Soil Testing)
PO Number: LMCP6198
COC ID: HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code: HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-093	L5-51RM	04/18/2019 915	2
HAT01-11.1904001-094	L5-51RT	04/18/2019 915	2
HAT01-11.1904001-087	L5-61B	04/18/2019 815	3
HAT01-11.1904001-088	L5-61RB	04/18/2019 830	2
HAT01-11.1904001-089	L5-61RM	04/18/2019 830	2
HAT01-11.1904001-090	L5-61RT	04/18/2019 830	2
HAT01-11.1904001-085	L5-01A-RB	04/17/2019 1650	2
HAT01-11.1904001-086	L5-01A-RU	04/17/2019 1655	2
HAT01-11.1904001-014	L6-01B	04/17/2019 1000	4
HAT01-11.1904001-015	L7-01B	04/16/2017 1520	5
HAT01-11.1904001-044	L7-01RT	04/16/2019 1610	1
HAT01-11.1904001-016	L7-02B	04/16/2019 1630	5
HAT01-11.1904001-045	L7-02RT	04/11/2019 1655	1
HAT01-11.1904001-017	L7-03B	04/16/2019 1705	5
HAT01-11.1904001-046	L7-03RT	04/16/2019 1700	1
HAT01-11.1904001-018	L7-11B	04/17/2019 825	5
HAT01-11.1904001-050	L7-11RT	04/17/2019 850	1
HAT01-11.1904001-071	L8-01RB	04/10/2019 1515	2
HAT01-11.1904001-059	L8-01RM	04/11/2019 1530	2

Project Information and Sample List (Continued)

Client Project Information

Facility Name:	Mexican Hat Disposal Site
Project Number:	1.103.1.02.112.7.20
Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-047	L8-01RT	04/10/2019 1545	1
HAT01-11.1904001-019	L8-02B	04/10/2019 1600	5
HAT01-11.1904001-072	L8-02RB	04/10/2019 1620	2
HAT01-11.1904001-060	L8-02RM	04/10/2019 1625	2
HAT01-11.1904001-048	L8-02RT	04/10/2019 1615	1
HAT01-11.1904001-020	L8-03B	04/11/2019 840	5
HAT01-11.1904001-073	L8-03RB	04/11/2019 855	2
HAT01-11.1904001-061	L8-03RM	04/10/2019 900	2
HAT01-11.1904001-049	L8-03RT	04/11/2019 915	1
HAT01-11.1904001-021	L9-01B	04/11/2019 1350	4
HAT01-11.1904001-022	L10-01B	04/11/2019 1030	5
HAT01-11.1904001-023	L10-02B	04/11/2019 1130	5
HAT01-11.1904001-025	L11-01B	04/11/2019 1510	5
HAT01-11.1904001-026	L11-02B	04/11/2019 1545	5
HAT01-11.1904001-028	L12-01B	04/12/2019 940	4
HAT01-11.1904001-029	L13-01B	04/11/2019 1700	5
HAT01-11.1904001-030	L13-02B	04/12/2019 830	5
HAT01-11.1904001-075	L13-02RB	04/12/2019 835	2
HAT01-11.1904001-063	L13-02RM	04/12/2019 850	2

Project Information and Sample List (Continued)

Client Project Information

Facility Name:	Mexican Hat Disposal Site
Project Number:	1.103.1.02.112.7.20
Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Lab ID	Sample Number (Location)	Date and Time Sampled	No. of Containers
HAT01-11.1904001-051	L13-02RT	04/12/2019 900	1
HAT01-11.1904001-080	L-compW	04/16/2019 1050	1
HAT01-11.1904002-006	L4-01R	04/17/2019 1100	1
HAT01-11.1904002-005	L4-01RT	04/17/2019 1100	1
HAT01-11.1904002-008	L4-02R	04/17/2019 1300	1
HAT01-11.1904002-007	L4-02RT	04/17/2019 1300	1
HAT01-11.1904002-010	L4-03R	04/17/2019 1415	1
HAT01-11.1904002-009	L4-03RT	04/17/2019 1415	1
HAT01-11.1904002-004	L4-11R	04/17/2019 1540	1
HAT01-11.1904002-003	L4-11RT	04/17/2019 1540	1
HAT01-11.1904002-002	L5-01R	04/17/2019 1655	1
HAT01-11.1904002-001	L5-01RT	04/17/2019 1655	1

Summary of Tests Performed

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
A-1	HAT01-11.1904001-077															X	X			X			X	X	X
A-2	HAT01-11.1904001-074															X	X			X			X	X	X
A-3	HAT01-11.1904001-062															X	X			X			X	X	X
ASM-1	HAT01-11.1904001-078															X	X			X			X	X	X
ASM-2	HAT01-11.1904001-079															X	X			X			X	X	X
L1-02B	HAT01-11.1904001-002	X	X													X	X						X		
L1-03B	HAT01-11.1904001-003	X	X													X	X						X		
L1-11B	HAT01-11.1904001-001	X	X													X	X						X		
L2-01B	HAT01-11.1904001-004		X													X	X						X		
L3-01RB	HAT01-11.1904001-065	X													X	X	X			X			X	X	X
L3-01RM	HAT01-11.1904001-053	X													X	X	X			X			X	X	X
L3-01RT	HAT01-11.1904001-038	X		X											X	X	X			X			X		
L3-02B	HAT01-11.1904001-006	X	X													X	X						X		
L3-02RB	HAT01-11.1904001-066	X													X	X	X			X			X	X	X
L3-02RM	HAT01-11.1904001-054	X													X	X	X			X			X	X	X
L3-02RT	HAT01-11.1904001-039	X		X											X	X	X			X			X		

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DH = Double Hydrometer, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L3-03B	HAT01-11.1904001-007	X	X													X	X						X		
L3-03RB	HAT01-11.1904001-067	X													X	X	X			X			X	X	X
L3-03RM	HAT01-11.1904001-055	X													X	X	X			X			X	X	X
L3-03RT	HAT01-11.1904001-040	X		X											X	X	X			X			X		
L3-11B	HAT01-11.1904001-005	X	X													X	X						X		
L4-01B	HAT01-11.1904001-008		X													X	X								
L4-02B	HAT01-11.1904001-009		X													X	X						X		
L4-03B	HAT01-11.1904001-010		X													X	X						X		
L4-11B	HAT01-11.1904001-024		X													X	X						X		
L5-01B	HAT01-11.1904001-011		X													X	X								
L5-01C	HAT01-11.1904001-034															X	X			X			X	X	X
L5-01RB	HAT01-11.1904001-068	X													X	X	X			X			X	X	X
L5-01RM	HAT01-11.1904001-056	X													X	X	X			X			X	X	X
L5-01RT	HAT01-11.1904001-041	X		X											X	X	X			X			X	X	X
L5-01UNKNOWN	HAT01-11.1904001-082																						X		
L5-02B	HAT01-11.1904001-012	X	X													X	X						X		

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Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L5-02RB	HAT01-11.1904001-069	X													X	X	X			X			X	X	X
L5-02RM	HAT01-11.1904001-057	X													X	X	X			X			X	X	X
L5-02RT	HAT01-11.1904001-042	X		X											X	X	X			X			X	X	X
L5-03B	HAT01-11.1904001-013	X	X													X	X						X		
L5-03RB	HAT01-11.1904001-070	X													X	X	X			X			X	X	X
L5-03RM	HAT01-11.1904001-058	X													X	X	X			X			X	X	X
L5-03RT	HAT01-11.1904001-043	X		X											X	X	X			X			X	X	X
L5-11B	HAT01-11.1904001-107	X	X													X	X						X		
L5-11RB	HAT01-11.1904001-108	X													X	X	X			X			X	X	X
L5-11RM	HAT01-11.1904001-109	X													X	X	X			X			X	X	X
L5-11RT	HAT01-11.1904001-110	X		X											X	X	X			X			X	X	X
L5-21B	HAT01-11.1904001-103	X	X													X	X						X		
L5-21RB	HAT01-11.1904001-104	X													X	X	X			X			X	X	X
L5-21RM	HAT01-11.1904001-105	X													X	X	X			X			X	X	X
L5-21RT	HAT01-11.1904001-106	X		X											X	X	X			X			X	X	X
L5-31B	HAT01-11.1904001-027	X	X													X	X						X		

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Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L5-31RB	HAT01-11.1904001-100	X													X	X	X			X			X	X	X
L5-31RM	HAT01-11.1904001-101	X													X	X	X			X			X	X	X
L5-31RT	HAT01-11.1904001-102	X		X											X	X	X			X			X	X	X
L5-41B	HAT01-11.1904001-095		X													X	X						X		
L5-41RB	HAT01-11.1904001-096	X													X	X	X			X			X	X	X
L5-41RM	HAT01-11.1904001-097	X													X	X	X			X			X	X	X
L5-41RT	HAT01-11.1904001-098	X		X											X	X	X			X			X	X	X
L5-51B	HAT01-11.1904001-091		X													X	X								
L5-51RB	HAT01-11.1904001-092	X													X	X	X			X			X	X	X
L5-51RM	HAT01-11.1904001-093	X													X	X	X			X			X	X	X
L5-51RT	HAT01-11.1904001-094	X		X											X	X	X			X			X	X	X
L5-61B	HAT01-11.1904001-087		X													X									
L5-61RB	HAT01-11.1904001-088	X													X	X	X			X			X	X	X
L5-61RM	HAT01-11.1904001-089	X													X	X	X			X			X	X	X
L5-61RT	HAT01-11.1904001-090	X		X											X	X	X			X			X	X	X
L5-01A-RB	HAT01-11.1904001-085	X													X	X	X			X			X	X	X

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Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L5-01A-RU	HAT01-11.1904001-086	X													X	X	X			X			X	X	X
L6-01B	HAT01-11.1904001-014		X													X	X						X		
L7-01B	HAT01-11.1904001-015	X	X													X	X						X		
L7-01RT	HAT01-11.1904001-044																							X	X
L7-02B	HAT01-11.1904001-016	X	X													X	X						X		
L7-02RT	HAT01-11.1904001-045																							X	X
L7-03B	HAT01-11.1904001-017	X	X													X	X						X		
L7-03RT	HAT01-11.1904001-046																							X	X
L7-11B	HAT01-11.1904001-018	X	X													X	X						X		
L7-11RT	HAT01-11.1904001-050																							X	X
L8-01RB	HAT01-11.1904001-071	X													X	X	X			X			X	X	X
L8-01RM	HAT01-11.1904001-059	X													X	X	X			X			X	X	X
L8-01RT	HAT01-11.1904001-047	X		X											X	X	X			X			X		
L8-02B	HAT01-11.1904001-019	X	X													X	X						X		
L8-02RB	HAT01-11.1904001-072	X													X	X	X			X			X	X	X
L8-02RM	HAT01-11.1904001-060	X													X	X	X			X			X	X	X

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DH = Double Hydrometer, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L8-02RT	HAT01-11.1904001-048	X		X											X	X	X			X			X		
L8-03B	HAT01-11.1904001-020	X	X													X	X						X		
L8-03RB	HAT01-11.1904001-073	X													X	X	X			X			X	X	X
L8-03RM	HAT01-11.1904001-061	X													X	X	X			X			X	X	X
L8-03RT	HAT01-11.1904001-049	X		X											X	X	X			X			X		
L9-01B	HAT01-11.1904001-021		X													X	X						X		
L10-01B	HAT01-11.1904001-022	X	X													X	X						X		
L10-02B	HAT01-11.1904001-023	X	X													X	X						X		
L11-01B	HAT01-11.1904001-025	X	X													X	X						X		
L11-02B	HAT01-11.1904001-026	X	X													X	X						X		
L12-01B	HAT01-11.1904001-028		X													X	X						X		
L13-01B	HAT01-11.1904001-029	X	X													X	X						X		
L13-02B	HAT01-11.1904001-030	X	X													X	X						X		
L13-02RB	HAT01-11.1904001-075	X													X	X	X			X			X	X	X
L13-02RM	HAT01-11.1904001-063	X													X	X	X			X			X	X	X
L13-02RT	HAT01-11.1904001-051	X		X											X	X	X			X			X		

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method

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[3] HC = Hanging Column, PP = Pressure Plate, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DH = Double Hydrometer, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Tests Performed (Continued)

Sample Number	Lab ID	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]							Particle Size[4]			Specific Gravity[5]		Atterberg Limits	Direct Shear	Collapse Potential	Carbonate Content	pH	Resistivity
		G	BM	VM	CH	FH	FW	HC	PP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C						
L-compW	HAT01-11.1904001-080															X	X			X			X	X	X
L4-01R	HAT01-11.1904002-006	X	X																		X	X			
L4-01RT	HAT01-11.1904002-005	X	X																		X				
L4-02R	HAT01-11.1904002-008	X	X																		X				
L4-02RT	HAT01-11.1904002-007	X	X																		X				
L4-03R	HAT01-11.1904002-010	X	X																		X				
L4-03RT	HAT01-11.1904002-009	X	X																		X				
L4-11R	HAT01-11.1904002-004																								
L4-11RT	HAT01-11.1904002-003	X	X																		X				
L5-01R	HAT01-11.1904002-002	X	X																		X				
L5-01RT	HAT01-11.1904002-001	X	X																		X				

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DH = Double Hydrometer, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity

Sample Number	Lab ID	Moisture Content As Received Gravimetric (%, g/g)	 As Received Volumetric (%, cm^3/cm^3)	 Remolded Gravimetric (%, g/g)	 Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L1-02B	HAT01-11.1904001-002	4.9	NA	---	---	NA	NA	NA
L1-02B (BM)	HAT01-11.1904001-002 (BM)	2.7	NA	---	---	NA	NA	NA
L1-03B	HAT01-11.1904001-003	2.7	NA	---	---	NA	NA	NA
L1-03B (BM)	HAT01-11.1904001-003 (BM)	1.7	NA	---	---	NA	NA	NA
L1-11B	HAT01-11.1904001-001	4.7	NA	---	---	NA	NA	NA
L1-11B (BM)	HAT01-11.1904001-001 (BM)	1.7	NA	---	---	NA	NA	NA
L2-01B (BM)	HAT01-11.1904001-004 (BM)	0.9	NA	---	---	NA	NA	NA
L3-01RB	HAT01-11.1904001-065	8.5	NA	---	---	NA	NA	NA
L3-01RM	HAT01-11.1904001-053	12.8	NA	---	---	NA	NA	NA
L3-01RT	HAT01-11.1904001-038	13.3	23.9	---	---	1.81	2.04	31.9
L3-02B	HAT01-11.1904001-006	7.0	NA	---	---	NA	NA	NA
L3-02B (BM)	HAT01-11.1904001-006 (BM)	2.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L3-02RB	HAT01-11.1904001-066	8.4	NA	---	---	NA	NA	NA
L3-02RM	HAT01-11.1904001-054	15.4	NA	---	---	NA	NA	NA
L3-02RT	HAT01-11.1904001-039	10.2	18.5	---	---	1.81	1.99	31.8
L3-03B	HAT01-11.1904001-007	5.6	NA	---	---	NA	NA	NA
L3-03B (BM)	HAT01-11.1904001-007 (BM)	3.4	NA	---	---	NA	NA	NA
L3-03RB	HAT01-11.1904001-067	12.4	NA	---	---	NA	NA	NA
L3-03RM	HAT01-11.1904001-055	14.6	NA	---	---	NA	NA	NA
L3-03RT	HAT01-11.1904001-040	11.7	20.9	---	---	1.78	1.99	32.7
L3-11B	HAT01-11.1904001-005	8.5	NA	---	---	NA	NA	NA
L3-11B (BM)	HAT01-11.1904001-005 (BM)	1.2	NA	---	---	NA	NA	NA
L4-01B (BM)	HAT01-11.1904001-008 (BM)	0.6	NA	---	---	NA	NA	NA
L4-02B (BM)	HAT01-11.1904001-009 (BM)	3.5	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L4-03B (BM)	HAT01-11.1904001-010 (BM)	3.1	NA	---	---	NA	NA	NA
L4-11B (BM)	HAT01-11.1904001-024 (BM)	1.7	NA	---	---	NA	NA	NA
L5-01B (BM)	HAT01-11.1904001-011 (BM)	0.3	NA	---	---	NA	NA	NA
L5-01RB	HAT01-11.1904001-068	10.1	NA	---	---	NA	NA	NA
L5-01RM	HAT01-11.1904001-056	12.4	NA	---	---	NA	NA	NA
L5-01RT	HAT01-11.1904001-041	9.2	15.3	---	---	1.66	1.82	37.2
L5-02B	HAT01-11.1904001-012	3.8	NA	---	---	NA	NA	NA
L5-02B (BM)	HAT01-11.1904001-012 (BM)	2.2	NA	---	---	NA	NA	NA
L5-02RB	HAT01-11.1904001-069	12.4	NA	---	---	NA	NA	NA
L5-02RM	HAT01-11.1904001-057	12.0	NA	---	---	NA	NA	NA
L5-02RT	HAT01-11.1904001-042	13.3	23.0	---	---	1.72	1.95	35.0
L5-03B	HAT01-11.1904001-013	4.0	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-03B (BM)	HAT01-11.1904001-013 (BM)	2.3	NA	---	---	NA	NA	NA
L5-03RB	HAT01-11.1904001-070	10.6	NA	---	---	NA	NA	NA
L5-03RM	HAT01-11.1904001-058	9.6	NA	---	---	NA	NA	NA
L5-03RT	HAT01-11.1904001-043	11.9	21.1	---	---	1.77	1.99	33.1
L5-11B	HAT01-11.1904001-107	4.5	NA	---	---	NA	NA	NA
L5-11B (BM)	HAT01-11.1904001-107 (BM)	2.8	NA	---	---	NA	NA	NA
L5-11RB	HAT01-11.1904001-108	13.0	NA	---	---	NA	NA	NA
L5-11RM	HAT01-11.1904001-109	13.8	NA	---	---	NA	NA	NA
L5-11RT	HAT01-11.1904001-110	12.1	20.1	---	---	1.66	1.86	37.3
L5-21B	HAT01-11.1904001-103	4.3	NA	---	---	NA	NA	NA
L5-21B (BM)	HAT01-11.1904001-103 (BM)	2.4	NA	---	---	NA	NA	NA
L5-21RB	HAT01-11.1904001-104	12.7	NA	---	---	NA	NA	NA

NA = Not analyzed
--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-21RM	HAT01-11.1904001-105	12.6	NA	---	---	NA	NA	NA
L5-21RT	HAT01-11.1904001-106	11.9	21.2	---	---	1.78	2.00	32.7
L5-31B	HAT01-11.1904001-027	3.9	NA	---	---	NA	NA	NA
L5-31B (BM)	HAT01-11.1904001-027 (BM)	2.3	NA	---	---	NA	NA	NA
L5-31RB	HAT01-11.1904001-100	12.8	NA	---	---	NA	NA	NA
L5-31RM	HAT01-11.1904001-101	13.6	NA	---	---	NA	NA	NA
L5-31RT	HAT01-11.1904001-102	12.8	23.0	---	---	1.80	2.03	32.2
L5-41B (BM)	HAT01-11.1904001-095 (BM)	0.4	NA	---	---	NA	NA	NA
L5-41RB	HAT01-11.1904001-096	12.7	NA	---	---	NA	NA	NA
L5-41RM	HAT01-11.1904001-097	10.5	NA	---	---	NA	NA	NA
L5-41RT	HAT01-11.1904001-098	8.8	16.0	---	---	1.81	1.97	31.6
L5-51B (BM)	HAT01-11.1904001-091 (BM)	0.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-51RB	HAT01-11.1904001-092	10.8	NA	---	---	NA	NA	NA
L5-51RM	HAT01-11.1904001-093	9.4	NA	---	---	NA	NA	NA
L5-51RT	HAT01-11.1904001-094	9.2	16.1	---	---	1.76	1.92	33.6
L5-61B (BM)	HAT01-11.1904001-087 (BM)	0.3	NA	---	---	NA	NA	NA
L5-61RB	HAT01-11.1904001-088	10.9	NA	---	---	NA	NA	NA
L5-61RM	HAT01-11.1904001-089	11.4	NA	---	---	NA	NA	NA
L5-61RT	HAT01-11.1904001-090	11.3	17.2	---	---	1.52	1.69	42.7
L5-01A-RB	HAT01-11.1904001-085	14.2	NA	---	---	NA	NA	NA
L5-01A-RU	HAT01-11.1904001-086	13.3	NA	---	---	NA	NA	NA
L6-01B (BM)	HAT01-11.1904001-014 (BM)	3.3	NA	---	---	NA	NA	NA
L7-01B	HAT01-11.1904001-015	2.6	NA	---	---	NA	NA	NA
L7-01B (BM)	HAT01-11.1904001-015 (BM)	0.9	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L7-02B	HAT01-11.1904001-016	4.9	NA	---	---	NA	NA	NA
L7-02B (BM)	HAT01-11.1904001-016 (BM)	2.8	NA	---	---	NA	NA	NA
L7-03B	HAT01-11.1904001-017	5.7	NA	---	---	NA	NA	NA
L7-03B (BM)	HAT01-11.1904001-017 (BM)	2.6	NA	---	---	NA	NA	NA
L7-11B	HAT01-11.1904001-018	6.7	NA	---	---	NA	NA	NA
L7-11B (BM)	HAT01-11.1904001-018 (BM)	2.7	NA	---	---	NA	NA	NA
L8-01RB	HAT01-11.1904001-071	7.9	NA	---	---	NA	NA	NA
L8-01RM	HAT01-11.1904001-059	12.1	NA	---	---	NA	NA	NA
L8-01RT	HAT01-11.1904001-047	12.4	19.5	---	---	1.58	1.77	40.5
L8-02B	HAT01-11.1904001-019	4.9	NA	---	---	NA	NA	NA
L8-02B (BM)	HAT01-11.1904001-019 (BM)	2.1	NA	---	---	NA	NA	NA
L8-02RB	HAT01-11.1904001-072	11.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L8-02RM	HAT01-11.1904001-060	7.7	NA	---	---	NA	NA	NA
L8-02RT	HAT01-11.1904001-048	11.6	19.0	---	---	1.65	1.84	37.8
L8-03B	HAT01-11.1904001-020	4.4	NA	---	---	NA	NA	NA
L8-03B (BM)	HAT01-11.1904001-020 (BM)	1.9	NA	---	---	NA	NA	NA
L8-03RB	HAT01-11.1904001-073	10.7	NA	---	---	NA	NA	NA
L8-03RM	HAT01-11.1904001-061	10.8	NA	---	---	NA	NA	NA
L8-03RT	HAT01-11.1904001-049	13.5	21.5	---	---	1.59	1.81	40.0
L9-01B (BM)	HAT01-11.1904001-021 (BM)	2.1	NA	---	---	NA	NA	NA
L10-01B	HAT01-11.1904001-022	4.6	NA	---	---	NA	NA	NA
L10-01B (BM)	HAT01-11.1904001-022 (BM)	2.1	NA	---	---	NA	NA	NA
L10-02B	HAT01-11.1904001-023	3.9	NA	---	---	NA	NA	NA
L10-02B (BM)	HAT01-11.1904001-023 (BM)	2.6	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L11-01B	HAT01-11.1904001-025	4.7	NA	---	---	NA	NA	NA
L11-01B (BM)	HAT01-11.1904001-025 (BM)	2.0	NA	---	---	NA	NA	NA
L11-02B	HAT01-11.1904001-026	4.4	NA	---	---	NA	NA	NA
L11-02B (BM)	HAT01-11.1904001-026 (BM)	1.4	NA	---	---	NA	NA	NA
L12-01B (BM)	HAT01-11.1904001-028 (BM)	2.1	NA	---	---	NA	NA	NA
L13-01B	HAT01-11.1904001-029	4.4	NA	---	---	NA	NA	NA
L13-01B (BM)	HAT01-11.1904001-029 (BM)	1.9	NA	---	---	NA	NA	NA
L13-02B	HAT01-11.1904001-030	6.4	NA	---	---	NA	NA	NA
L13-02B (BM)	HAT01-11.1904001-030 (BM)	3.3	NA	---	---	NA	NA	NA
L13-02RB	HAT01-11.1904001-075	10.2	NA	---	---	NA	NA	NA
L13-02RM	HAT01-11.1904001-063	11.8	NA	---	---	NA	NA	NA
L13-02RT	HAT01-11.1904001-051	10.6	20.0	---	---	1.88	2.08	28.9

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L4-01R (1.74 g/cc) (97 psf)	HAT01-11.1904002-006 (1.74 g/cc) (97 psf)	12.9	22.5	---	---	1.74	1.97	34.2
L4-01R (1.75 g/cc) (222 psf)	HAT01-11.1904002-006 (1.75 g/cc) (222 psf)	12.9	22.5	---	---	1.75	1.97	34.1
L4-01R (1.80 g/cc) (417 psf)	HAT01-11.1904002-006 (1.80 g/cc) (417 psf)	12.7	23.0	---	---	1.80	2.03	32.0
L4-01R (1.79 g/cc) (1,044 psf)	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)	12.0	21.4	---	---	1.79	2.00	32.6
L4-01RT (1.82 g/cc) (409 psf)	HAT01-11.1904002-005 (1.82 g/cc) (409 psf)	12.7	23.2	---	---	1.82	2.06	31.2
L4-02R (1.78 g/cc) (102 psf)	HAT01-11.1904002-008 (1.78 g/cc) (102 psf)	12.2	21.8	---	---	1.78	2.00	32.9
L4-02R (1.73 g/cc) (202 psf)	HAT01-11.1904002-008 (1.73 g/cc) (202 psf)	12.3	21.3	---	---	1.73	1.95	34.6

NA = Not analyzed
--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Density (g/cm^3)	Density (g/cm^3)	Porosity (%)
L4-02R (1.72 g/cc) (398 psf)	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)	14.3	24.5	---	---	1.72	1.97	35.0
L4-02RT (1.77 g/cc) (363 psf)	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)	9.1	16.2	---	---	1.77	1.94	33.0
L4-03R (1.73 g/cc) (100 psf)	HAT01-11.1904002-010 (1.73 g/cc) (100 psf)	13.3	22.9	---	---	1.73	1.96	34.8
L4-03R (1.74 g/cc) (207 psf)	HAT01-11.1904002-010 (1.74 g/cc) (207 psf)	13.3	23.2	---	---	1.74	1.97	34.3
L4-03R (1.74 g/cc) (413 psf)	HAT01-11.1904002-010 (1.74 g/cc) (413 psf)	12.9	22.6	---	---	1.74	1.97	34.2
L4-03RT (1.77 g/cc) (399 psf)	HAT01-11.1904002-009 (1.77 g/cc) (399 psf)	10.6	18.7	---	---	1.77	1.96	33.1
L4-11RT (1.75 g/cc) (416 psf)	HAT01-11.1904002-003 (1.75 g/cc) (416 psf)	10.2	17.8	---	---	1.75	1.93	34.0

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-01R (1.76 g/cc) (107 psf)	HAT01-11.1904002-002 (1.76 g/cc) (107 psf)	13.5	23.7	---	---	1.76	2.00	33.6
L5-01R (1.74 g/cc) (211 psf)	HAT01-11.1904002-002 (1.74 g/cc) (211 psf)	13.2	22.9	---	---	1.74	1.97	34.3
L5-01R (1.76 g/cc) (398 psf)	HAT01-11.1904002-002 (1.76 g/cc) (398 psf)	13.7	24.1	---	---	1.76	2.00	33.5
L5-01RT (1.70 g/cc) (399 psf)	HAT01-11.1904002-001 (1.70 g/cc) (399 psf)	12.7	21.6	---	---	1.70	1.91	36.0

NA = Not analyzed
--- = This sample was not remolded

Summary of Particle Size Characteristics

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	USCS Classification
A-1	HAT01-11.1904001-077	0.066	0.13	0.15	2.3	1.2	WS/H	Silty sand (SM)
A-2	HAT01-11.1904001-074	0.070	0.14	0.15	2.1	1.2	WS/H	Poorly-graded sand with silt (SP-SM)
A-3	HAT01-11.1904001-062	0.039	0.13	0.15	3.8	1.4	WS/H	Silty sand (SM)
ASM-1	HAT01-11.1904001-078	0.068	0.12	0.12	1.8	1.1	WS/H	Silty sand (SM)
ASM-2	HAT01-11.1904001-079	0.080	0.13	0.14	1.8	1.1	WS/H	Poorly-graded sand with silt (SP-SM)
L1-02B	HAT01-11.1904001-002	0.33	16	20	61	9.0	WS/H	Poorly-graded gravel with sand (GP)s
L1-03B	HAT01-11.1904001-003	5.1	16	20	3.9	1.2	WS/H	Poorly-graded gravel (GP)
L1-11B	HAT01-11.1904001-001	5.0	20	25	5.0	1.4	WS/H	Well-graded gravel (GW)
L2-01B	HAT01-11.1904001-004	12	24	27	2.3	1.2	WS/H	Poorly-graded gravel (GP)
L3-01RB	HAT01-11.1904001-065	0.0040	0.12	0.14	35	8.3	WS/H	Silty sand (SM)
L3-01RM	HAT01-11.1904001-053	0.018	0.13	0.16	8.9	2.9	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L3-01RT	HAT01-11.1904001-038	0.0064	0.13	0.15	23	7.4	WS/H	Silty sand (SM)
L3-02B	HAT01-11.1904001-006	1.2	25	28	23	9.6	WS/H	Poorly-graded gravel (GP)
L3-02RB	HAT01-11.1904001-066	0.043	0.13	0.16	3.7	1.4	WS/H	Silty sand (SM)
L3-02RM	HAT01-11.1904001-054	0.027	0.12	0.14	5.2	2.0	WS/H	Silty sand (SM)
L3-02RT	HAT01-11.1904001-039	0.012	0.12	0.14	12	3.7	WS/H	Silty sand (SM)
L3-03B	HAT01-11.1904001-007	0.15	13	17	113	15	WS/H	Classification by ASTM 2487 requires Atterberg test
L3-03RB	HAT01-11.1904001-067	0.015	0.13	0.15	10	3.6	WS/H	Silty sand (SM)
L3-03RM	HAT01-11.1904001-055	0.027	0.12	0.14	5.2	2.0	WS/H	Silty sand (SM)
L3-03RT	HAT01-11.1904001-040	0.013	0.12	0.14	11	3.9	WS/H	Silty sand (SM)
L3-11B	HAT01-11.1904001-005	7.8	18	20	2.6	1.1	WS/H	Poorly-graded gravel (GP)
L4-01B	HAT01-11.1904001-008	16	31	34	2.1	1.2	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L4-02B	HAT01-11.1904001-009	0.10	8.8	14	140	5.2	WS/H	Classification by ASTM 2487 requires Atterberg test
L4-03B	HAT01-11.1904001-010	0.13	13	20	154	8.9	WS/H	Classification by ASTM 2487 requires Atterberg test
L4-11B	HAT01-11.1904001-024	4.9	23	26	5.3	1.8	WS/H	Well-graded gravel (GW)
L5-01B	HAT01-11.1904001-011	13	27	30	2.3	1.1	WS/H	Poorly-graded gravel (GP)
L5-01C	HAT01-11.1904001-034	0.073	17	22	301	0.036	WS/H	Poorly-graded gravel with silt and sand (GP-GM)s
L5-01RB	HAT01-11.1904001-068	0.011	0.12	0.16	15	2.4	WS/H	Silty sand (SM)
L5-01RM	HAT01-11.1904001-056	0.018	0.12	0.14	7.8	2.5	WS/H	Silty sand (SM)
L5-01RT	HAT01-11.1904001-041	0.014	0.11	0.13	9.3	3.3	WS/H	Silty sand (SM)
L5-02B	HAT01-11.1904001-012	0.30	14	19	63	8.1	WS/H	Poorly-graded gravel with sand (GP)s
L5-02RB	HAT01-11.1904001-069	0.014	0.12	0.14	10	3.1	WS/H	Silty sand (SM)
L5-02RM	HAT01-11.1904001-057	0.0069	0.12	0.14	20	6.3	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-02RT	HAT01-11.1904001-042	0.014	0.11	0.13	9.3	3.3	WS/H	Silty sand (SM)
L5-03B	HAT01-11.1904001-013	0.55	17	22	40	6.3	WS/H	Poorly-graded gravel (GP)
L5-03RB	HAT01-11.1904001-070	0.0062	0.11	0.14	23	6.1	WS/H	Silty sand (SM)
L5-03RM	HAT01-11.1904001-058	0.025	0.12	0.14	5.6	2.3	WS/H	Silty sand (SM)
L5-03RT	HAT01-11.1904001-043	0.016	0.12	0.14	8.8	2.9	WS/H	Silty sand (SM)
L5-11B	HAT01-11.1904001-107	0.13	11	16	123	6.6	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-11RB	HAT01-11.1904001-108	0.0046	0.12	0.14	30	7.6	WS/H	Silty sand (SM)
L5-11RM	HAT01-11.1904001-109	0.012	0.12	0.14	12	4.2	WS/H	Silty sand (SM)
L5-11RT	HAT01-11.1904001-110	0.018	0.11	0.13	7.2	2.6	WS/H	Silty sand (SM)
L5-21B	HAT01-11.1904001-103	0.14	12	17	121	11	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-21RB	HAT01-11.1904001-104	0.0050	0.11	0.13	26	6.9	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-21RM	HAT01-11.1904001-105	0.013	0.12	0.14	11	3.7	WS/H	Silty sand (SM)
L5-21RT	HAT01-11.1904001-106	0.021	0.11	0.13	6.2	2.2	WS/H	Silty sand (SM)
L5-31B	HAT01-11.1904001-027	0.24	16	21	88	10	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-31RB	HAT01-11.1904001-100	0.0049	0.12	0.14	29	8.4	WS/H	Silty sand (SM)
L5-31RM	HAT01-11.1904001-101	0.0090	0.12	0.14	16	5.0	WS/H	Silty sand (SM)
L5-31RT	HAT01-11.1904001-102	0.0096	0.11	0.13	14	4.9	WS/H	Silty sand (SM)
L5-41B	HAT01-11.1904001-095	8.1	23	27	3.3	1.0	WS/H	Poorly-graded gravel (GP)
L5-41RB	HAT01-11.1904001-096	0.0053	0.12	0.14	26	8.0	WS/H	Silty sand (SM)
L5-41RM	HAT01-11.1904001-097	0.015	0.12	0.14	9.3	3.5	WS/H	Silty sand (SM)
L5-41RT	HAT01-11.1904001-098	0.013	0.12	0.14	11	3.7	WS/H	Silty sand (SM)
L5-51B	HAT01-11.1904001-091	7.6	23	27	3.6	1.1	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-51RB	HAT01-11.1904001-092	0.011	0.12	0.14	13	4.2	WS/H	Silty sand (SM)
L5-51RM	HAT01-11.1904001-093	0.025	0.12	0.14	5.6	2.4	WS/H	Silty sand (SM)
L5-51RT	HAT01-11.1904001-094	0.015	0.12	0.14	9.3	3.0	WS/H	Silty sand (SM)
L5-61B	HAT01-11.1904001-087	13	24	27	2.1	1.1	WS	Poorly-graded gravel (GP)
L5-61RB	HAT01-11.1904001-088	0.019	0.12	0.14	7.4	2.4	WS/H	Silty sand (SM)
L5-61RM	HAT01-11.1904001-089	0.037	0.12	0.14	3.8	1.6	WS/H	Silty sand (SM)
L5-61RT	HAT01-11.1904001-090	0.025	0.11	0.13	5.2	1.9	WS/H	Silty sand (SM)
L5-01A-RB	HAT01-11.1904001-085	0.037	0.12	0.14	3.8	1.4	WS/H	Silty sand (SM)
L5-01A-RU	HAT01-11.1904001-086	0.012	0.12	0.14	12	3.7	WS/H	Silty sand (SM)
L6-01B	HAT01-11.1904001-014	0.23	13	18	78	11	WS/H	Classification by ASTM 2487 requires Atterberg test
L7-01B	HAT01-11.1904001-015	9.9	21	24	2.4	0.95	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L7-02B	HAT01-11.1904001-016	0.24	14	18	75	14	WS/H	Poorly-graded gravel with sand (GP)s
L7-03B	HAT01-11.1904001-017	0.41	17	21	51	9.6	WS/H	Poorly-graded gravel (GP)
L7-11B	HAT01-11.1904001-018	0.25	18	21	84	16	WS/H	Poorly-graded gravel (GP)
L8-01RB	HAT01-11.1904001-071	0.0061	0.11	0.14	23	3.9	WS/H	Silty sand (SM)
L8-01RM	HAT01-11.1904001-059	0.011	0.12	0.14	13	4.7	WS/H	Silty sand (SM)
L8-01RT	HAT01-11.1904001-047	0.0084	0.12	0.14	17	5.0	WS/H	Silty sand (SM)
L8-02B	HAT01-11.1904001-019	2.5	17	20	8.0	2.4	WS/H	Well-graded gravel (GW)
L8-02RB	HAT01-11.1904001-072	0.0082	0.12	0.14	17	4.5	WS/H	Silty sand (SM)
L8-02RM	HAT01-11.1904001-060	0.020	0.13	0.14	7.0	2.6	WS/H	Silty sand (SM)
L8-02RT	HAT01-11.1904001-048	0.0059	0.12	0.14	24	7.0	WS/H	Silty sand (SM)
L8-03B	HAT01-11.1904001-020	5.2	24	27	5.2	1.6	WS/H	Well-graded gravel (GW)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L8-03RB	HAT01-11.1904001-073	0.0078	0.12	0.14	18	4.7	WS/H	Silty sand (SM)
L8-03RM	HAT01-11.1904001-061	0.0073	0.13	0.15	21	6.1	WS/H	Silty sand (SM)
L8-03RT	HAT01-11.1904001-049	0.020	0.13	0.14	7.0	2.9	WS/H	Silty sand (SM)
L9-01B	HAT01-11.1904001-021	0.41	14	19	46	8.2	WS/H	Poorly-graded gravel (GP)
L10-01B	HAT01-11.1904001-022	4.5	19	22	4.9	1.5	WS/H	Well-graded gravel (GW)
L10-02B	HAT01-11.1904001-023	0.74	18	22	30	5.9	WS/H	Poorly-graded gravel (GP)
L11-01B	HAT01-11.1904001-025	3.1	19	23	7.4	1.7	WS/H	Well-graded gravel (GW)
L11-02B	HAT01-11.1904001-026	6.3	23	26	4.1	1.6	WS/H	Well-graded gravel (GW)
L12-01B	HAT01-11.1904001-028	7.7	23	26	3.4	1.6	WS/H	Classification by ASTM 2487 requires Atterberg test
L13-01B	HAT01-11.1904001-029	3.4	22	26	7.6	1.9	WS/H	Well-graded gravel (GW)
L13-02B	HAT01-11.1904001-030	0.19	16	22	116	8.6	WS/H	Classification by ASTM 2487 requires Atterberg test

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L13-02RB	HAT01-11.1904001-075	0.0033	0.061	0.10	30	2.4	WS/H	Sandy silt s(ML)
L13-02RM	HAT01-11.1904001-063	0.0036	0.066	0.11	31	2.3	WS/H	Sandy silt with gravel s(ML)g
L13-02RT	HAT01-11.1904001-051	0.0035	0.079	0.15	43	2.2	WS/H	Silty sand with gravel (SM)g
L-compW	HAT01-11.1904001-080	0.013	0.048	0.056	4.3	1.7	WS/H	Silt with sand (ML)s

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d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Percent Gravel, Sand, Silt and Clay*

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
A-1	HAT01-11.1904001-077	0.0	87.3	12.0	0.7
A-2	HAT01-11.1904001-074	0.5	88.3	9.5	1.7
A-3	HAT01-11.1904001-062	10.2	66.7	19.9	3.2
ASM-1	HAT01-11.1904001-078	0.0	87.0	11.0	2.0
ASM-2	HAT01-11.1904001-079	0.0	92.7	6.2	1.2
L1-02B	HAT01-11.1904001-002	79.2	16.4	3.4	1.1
L1-03B	HAT01-11.1904001-003	91.8	5.6	2.2	0.3
L1-11B	HAT01-11.1904001-001	90.7	6.1	2.6	0.6
L2-01B	HAT01-11.1904001-004	99.0	0.5	0.4	0.1
L3-01RB	HAT01-11.1904001-065	2.5	65.4	23.7	8.4
L3-01RM	HAT01-11.1904001-053	1.9	74.8	16.0	7.3
L3-01RT	HAT01-11.1904001-038	1.0	73.3	17.7	8.0
L3-02B	HAT01-11.1904001-006	87.4	8.9	3.0	0.7
L3-02RB	HAT01-11.1904001-066	2.0	78.5	13.5	6.0
L3-02RM	HAT01-11.1904001-054	1.0	76.3	15.5	7.2
L3-02RT	HAT01-11.1904001-039	1.3	71.3	20.3	7.1

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L3-03B	HAT01-11.1904001-007	75.4	18.3	5.2	1.1
L3-03RB	HAT01-11.1904001-067	1.6	75.0	16.8	6.6
L3-03RM	HAT01-11.1904001-055	0.7	75.9	16.1	7.3
L3-03RT	HAT01-11.1904001-040	1.5	73.4	17.9	7.2
L3-11B	HAT01-11.1904001-005	95.8	2.8	1.1	0.2
L4-01B	HAT01-11.1904001-008	98.9	0.7	0.4	0.1
L4-02B	HAT01-11.1904001-009	62.8	29.6	5.9	1.7
L4-03B	HAT01-11.1904001-010	70.3	23.1	4.8	1.8
L4-11B	HAT01-11.1904001-024	90.2	7.1	2.2	0.5
L5-01B	HAT01-11.1904001-011	98.3	1.2	0.4	0.1
L5-01C	HAT01-11.1904001-034	66.2	23.5	7.8	2.4
L5-01RB	HAT01-11.1904001-068	5.4	60.5	28.2	5.9
L5-01RM	HAT01-11.1904001-056	3.6	69.4	19.9	7.1
L5-01RT	HAT01-11.1904001-041	0.6	70.8	21.7	6.9
L5-02B	HAT01-11.1904001-012	77.7	17.7	3.6	0.9
L5-02RB	HAT01-11.1904001-069	0.7	71.1	20.7	7.4

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-02RM	HAT01-11.1904001-057	0.8	70.9	20.1	8.1
L5-02RT	HAT01-11.1904001-042	0.1	71.1	21.2	7.7
L5-03B	HAT01-11.1904001-013	81.2	14.5	3.4	0.9
L5-03RB	HAT01-11.1904001-070	2.0	67.5	22.8	7.7
L5-03RM	HAT01-11.1904001-058	0.5	76.8	15.3	7.4
L5-03RT	HAT01-11.1904001-043	0.4	72.8	19.6	7.2
L5-11B	HAT01-11.1904001-107	67.3	26.1	5.1	1.5
L5-11RB	HAT01-11.1904001-108	0.8	67.5	23.1	8.6
L5-11RM	HAT01-11.1904001-109	0.4	74.6	17.6	7.4
L5-11RT	HAT01-11.1904001-110	0.0	71.9	20.9	7.3
L5-21B	HAT01-11.1904001-103	71.6	22.3	4.8	1.2
L5-21RB	HAT01-11.1904001-104	0.7	65.8	24.8	8.6
L5-21RM	HAT01-11.1904001-105	0.7	73.4	18.0	7.9
L5-21RT	HAT01-11.1904001-106	0.4	71.4	21.4	6.9
L5-31B	HAT01-11.1904001-027	78.3	16.2	4.2	1.2
L5-31RB	HAT01-11.1904001-100	1.2	69.1	21.4	8.2

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-31RM	HAT01-11.1904001-101	0.6	72.0	19.3	8.0
L5-31RT	HAT01-11.1904001-102	0.5	71.7	20.2	7.6
L5-41B	HAT01-11.1904001-095	95.0	3.5	1.2	0.3
L5-41RB	HAT01-11.1904001-096	0.9	70.0	20.9	8.2
L5-41RM	HAT01-11.1904001-097	0.2	76.2	16.1	7.4
L5-41RT	HAT01-11.1904001-098	0.0	73.7	19.0	7.3
L5-51B	HAT01-11.1904001-091	94.7	4.0	1.0	0.3
L5-51RB	HAT01-11.1904001-092	0.5	72.5	19.3	7.7
L5-51RM	HAT01-11.1904001-093	0.0	79.5	13.3	7.1
L5-51RT	HAT01-11.1904001-094	0.5	72.6	19.7	7.1
L5-61B	HAT01-11.1904001-087	100.0	0.0	0.0	0.0
L5-61RB	HAT01-11.1904001-088	0.6	72.1	20.3	6.9
L5-61RM	HAT01-11.1904001-089	0.1	79.5	14.0	6.4
L5-61RT	HAT01-11.1904001-090	0.3	72.6	20.1	7.1
L5-01A-RB	HAT01-11.1904001-085	0.4	76.5	15.9	7.2
L5-01A-RU	HAT01-11.1904001-086	8.9	63.3	20.5	7.3

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L6-01B	HAT01-11.1904001-014	77.1	17.4	4.4	1.1
L7-01B	HAT01-11.1904001-015	97.1	1.9	0.8	0.2
L7-02B	HAT01-11.1904001-016	78.0	17.4	3.6	1.1
L7-03B	HAT01-11.1904001-017	81.7	14.6	3.0	0.7
L7-11B	HAT01-11.1904001-018	82.0	13.4	3.6	0.9
L8-01RB	HAT01-11.1904001-071	9.6	52.4	30.8	7.2
L8-01RM	HAT01-11.1904001-059	1.9	72.3	17.8	7.9
L8-01RT	HAT01-11.1904001-047	1.6	69.7	20.9	7.8
L8-02B	HAT01-11.1904001-019	87.4	9.8	2.3	0.5
L8-02RB	HAT01-11.1904001-072	3.1	65.8	23.5	7.6
L8-02RM	HAT01-11.1904001-060	1.7	73.3	19.0	6.1
L8-02RT	HAT01-11.1904001-048	0.9	69.6	21.0	8.4
L8-03B	HAT01-11.1904001-020	91.1	6.7	1.9	0.3
L8-03RB	HAT01-11.1904001-073	1.2	67.9	23.4	7.5
L8-03RM	HAT01-11.1904001-061	3.5	70.0	18.7	7.9
L8-03RT	HAT01-11.1904001-049	0.4	76.0	17.0	6.5

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L9-01B	HAT01-11.1904001-021	81.8	13.3	4.1	0.8
L10-01B	HAT01-11.1904001-022	89.8	7.5	2.3	0.4
L10-02B	HAT01-11.1904001-023	82.8	13.3	3.2	0.6
L11-01B	HAT01-11.1904001-025	87.9	9.3	2.4	0.5
L11-02B	HAT01-11.1904001-026	92.5	6.0	1.0	0.4
L12-01B	HAT01-11.1904001-028	91.9	3.0	4.3	0.8
L13-01B	HAT01-11.1904001-029	88.5	8.2	2.7	0.5
L13-02B	HAT01-11.1904001-030	73.9	20.5	4.5	1.1
L13-02RB	HAT01-11.1904001-075	12.9	31.7	47.6	7.8
L13-02RM	HAT01-11.1904001-063	16.9	29.7	45.3	8.1
L13-02RT	HAT01-11.1904001-051	24.3	26.4	41.6	7.7
L-compW	HAT01-11.1904001-080	0.2	18.5	75.0	6.3

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*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Summary of Percent Dispersion by Double Hydrometer

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L3-01RB	HAT01-11.1904001-065	5.4	8.3	65	No	Dispersive
L3-01RM	HAT01-11.1904001-053	8.2	7.3	100	No	Dispersive
L3-01RT	HAT01-11.1904001-038	8.0	8.0	100	No	Dispersive
L3-02RB	HAT01-11.1904001-066	3.4	6.0	57	No	Dispersive
L3-02RM	HAT01-11.1904001-054	7.1	7.2	100	No	Dispersive
L3-02RT	HAT01-11.1904001-039	7.0	7.1	100	No	Dispersive
L3-03RB	HAT01-11.1904001-067	4.8	6.6	73	No	Dispersive
L3-03RM	HAT01-11.1904001-055	7.5	7.2	100	No	Dispersive
L3-03RT	HAT01-11.1904001-040	6.6	7.2	100	No	Dispersive
L5-01RB	HAT01-11.1904001-068	1.4	5.9	24	No	Nondispersive
L5-01RM	HAT01-11.1904001-056	6.0	7.0	100	No	Dispersive
L5-01RT	HAT01-11.1904001-041	5.7	6.9	100	No	Dispersive
L5-02RB	HAT01-11.1904001-069	4.7	7.4	64	No	Dispersive
L5-02RM	HAT01-11.1904001-057	7.8	8.1	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer than 2-µm when dispersant is used.

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-μm, Not Dispersed	Percent Finer Than 2-μm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L5-02RT	HAT01-11.1904001-042	7.4	7.7	100	No	Dispersive
L5-03RB	HAT01-11.1904001-070	8.7	7.7	100	No	Dispersive
L5-03RM	HAT01-11.1904001-058	5.8	7.4	78	No	Dispersive
L5-03RT	HAT01-11.1904001-043	7.7	7.2	100	No	Dispersive
L5-11RB	HAT01-11.1904001-108	7.6	8.6	100	No	Dispersive
L5-11RM	HAT01-11.1904001-109	7.0	7.3	100	No	Dispersive
L5-11RT	HAT01-11.1904001-110	6.4	7.2	100	No	Dispersive
L5-21RB	HAT01-11.1904001-104	7.4	8.6	100	No	Dispersive
L5-21RM	HAT01-11.1904001-105	7.3	7.9	100	No	Dispersive
L5-21RT	HAT01-11.1904001-106	6.8	6.9	100	No	Dispersive
L5-31RB	HAT01-11.1904001-100	8.1	8.2	100	No	Dispersive
L5-31RM	HAT01-11.1904001-101	7.9	8.0	100	No	Dispersive
L5-31RT	HAT01-11.1904001-102	6.5	7.5	100	No	Dispersive
L5-41RB	HAT01-11.1904001-096	7.8	8.1	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer

[*] In cases where the difference between the percent finer than 2-μm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the “A” Line[1]	Dispersiveness Classification
L5-41RM	HAT01-11.1904001-097	7.2	7.4	100	No	Dispersive
L5-41RT	HAT01-11.1904001-098	6.4	7.3	100	No	Dispersive
L5-51RB	HAT01-11.1904001-092	6.3	7.6	100	No	Dispersive
L5-51RM	HAT01-11.1904001-093	6.6	7.1	100	No	Dispersive
L5-51RT	HAT01-11.1904001-094	6.1	7.1	100	No	Dispersive
L5-61RB	HAT01-11.1904001-088	7.1	6.9	100	No	Dispersive
L5-61RM	HAT01-11.1904001-089	6.4	6.4	100	No	Dispersive
L5-61RT	HAT01-11.1904001-090	6.2	7.1	100	No	Dispersive
L5-01A-RB	HAT01-11.1904001-085	7.4	7.2	100	No	Dispersive
L5-01A-RU	HAT01-11.1904001-086	7.4	7.2	100	No	Dispersive
L8-01RB	HAT01-11.1904001-071	7.5	7.2	100	No	Dispersive
L8-01RM	HAT01-11.1904001-059	7.0	7.9	100	No	Dispersive
L8-01RT	HAT01-11.1904001-047	8.4	7.8	100	No	Dispersive
L8-02RB	HAT01-11.1904001-072	8.9	7.6	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the “A” line, and more than 12% of the soil fraction is finer

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-μm, Not Dispersed	Percent Finer Than 2-μm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L8-02RM	HAT01-11.1904001-060	5.8	6.1	100	No	Dispersive
L8-02RT	HAT01-11.1904001-048	8.2	8.4	100	No	Dispersive
L8-03RB	HAT01-11.1904001-073	8.2	7.5	100	No	Dispersive
L8-03RM	HAT01-11.1904001-061	7.3	7.9	100	No	Dispersive
L8-03RT	HAT01-11.1904001-049	7.5	6.5	100	No	Dispersive
L13-02RB	HAT01-11.1904001-075	6.2	7.8	79	No	Dispersive
L13-02RM	HAT01-11.1904001-063	6.2	8.0	78	No	Dispersive
L13-02RT	HAT01-11.1904001-051	5.2	7.6	68	No	Dispersive

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[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer

[*] In cases where the difference between the percent finer than 2-μm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Atterberg Tests

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
A-1	HAT01-11.1904001-077	---	---	---	ML
A-2	HAT01-11.1904001-074	---	---	---	ML
A-3	HAT01-11.1904001-062	---	---	---	ML
ASM-1	HAT01-11.1904001-078	---	---	---	ML
ASM-2	HAT01-11.1904001-079	---	---	---	ML
L3-01RB	HAT01-11.1904001-065	---	---	---	ML
L3-01RM	HAT01-11.1904001-053	---	---	---	ML
L3-01RT	HAT01-11.1904001-038	---	---	---	ML
L3-02RB	HAT01-11.1904001-066	---	---	---	ML
L3-02RM	HAT01-11.1904001-054	---	---	---	ML
L3-02RT	HAT01-11.1904001-039	---	---	---	ML
L3-03RB	HAT01-11.1904001-067	---	---	---	ML
L3-03RM	HAT01-11.1904001-055	---	---	---	ML
L3-03RT	HAT01-11.1904001-040	---	---	---	ML
L5-01C	HAT01-11.1904001-034	---	---	---	ML
L5-01RB	HAT01-11.1904001-068	---	---	---	ML
L5-01RM	HAT01-11.1904001-056	---	---	---	ML
L5-01RT	HAT01-11.1904001-041	---	---	---	ML
L5-02RB	HAT01-11.1904001-069	---	---	---	ML
L5-02RM	HAT01-11.1904001-057	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Atterberg Tests (Continued)

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
L5-02RT	HAT01-11.1904001-042	---	---	---	ML
L5-03RB	HAT01-11.1904001-070	---	---	---	ML
L5-03RM	HAT01-11.1904001-058	---	---	---	ML
L5-03RT	HAT01-11.1904001-043	---	---	---	ML
L5-11RB	HAT01-11.1904001-108	---	---	---	ML
L5-11RM	HAT01-11.1904001-109	---	---	---	ML
L5-11RT	HAT01-11.1904001-110	---	---	---	ML
L5-21RB	HAT01-11.1904001-104	---	---	---	ML
L5-21RM	HAT01-11.1904001-105	---	---	---	ML
L5-21RT	HAT01-11.1904001-106	---	---	---	ML
L5-31RB	HAT01-11.1904001-100	---	---	---	ML
L5-31RM	HAT01-11.1904001-101	---	---	---	ML
L5-31RT	HAT01-11.1904001-102	---	---	---	ML
L5-41RB	HAT01-11.1904001-096	---	---	---	ML
L5-41RM	HAT01-11.1904001-097	---	---	---	ML
L5-41RT	HAT01-11.1904001-098	---	---	---	ML
L5-51RB	HAT01-11.1904001-092	---	---	---	ML
L5-51RM	HAT01-11.1904001-093	---	---	---	ML
L5-51RT	HAT01-11.1904001-094	---	---	---	ML
L5-61RB	HAT01-11.1904001-088	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Atterberg Tests (Continued)

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
L5-61RM	HAT01-11.1904001-089	---	---	---	ML
L5-61RT	HAT01-11.1904001-090	---	---	---	ML
L5-01A-RB	HAT01-11.1904001-085	---	---	---	ML
L5-01A-RU	HAT01-11.1904001-086	---	---	---	ML
L8-01RB	HAT01-11.1904001-071	---	---	---	ML
L8-01RM	HAT01-11.1904001-059	---	---	---	ML
L8-01RT	HAT01-11.1904001-047	---	---	---	ML
L8-02RB	HAT01-11.1904001-072	---	---	---	ML
L8-02RM	HAT01-11.1904001-060	---	---	---	ML
L8-02RT	HAT01-11.1904001-048	---	---	---	ML
L8-03RB	HAT01-11.1904001-073	---	---	---	ML
L8-03RM	HAT01-11.1904001-061	---	---	---	ML
L8-03RT	HAT01-11.1904001-049	---	---	---	ML
L13-02RB	HAT01-11.1904001-075	---	---	---	ML
L13-02RM	HAT01-11.1904001-063	---	---	---	ML
L13-02RT	HAT01-11.1904001-051	---	---	---	ML
L-compW	HAT01-11.1904001-080	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Consolidated Drained Direct Shear Estimated Friction Angle and Cohesion

Sample Number	Lab ID	c Cohesion (psf)	φ Friction Angle (°)
L4-01R	HAT01-11.1904002-006	115	31
L4-02R	HAT01-11.1904002-008	490	36
L4-03R	HAT01-11.1904002-010	503	33
L5-01R	HAT01-11.1904002-002	300	37

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[1] The cohesion and friction angle provided represent one possible interpretation of a test results. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Summary of Consolidated Drained Direct Shear Peak Stress and Lateral Displacement

Sample Number	Lab ID	Peak Nominal Normal Stress (psf)	Peak Nominal Shear Stress (psf)	Peak Relative Lateral Displacement (%)
L4-01R (1.74 g/cc) (97 psf)	HAT01-11.1904002-006 (1.74 g/cc) (97 psf)	123	159	3.38
L4-01R (1.75 g/cc) (222 psf)	HAT01-11.1904002-006 (1.75 g/cc) (222 psf)	217	286	6.20
L4-01R (1.80 g/cc) (417 psf)	HAT01-11.1904002-006 (1.80 g/cc) (417 psf)	468	384	2.23
L4-01RT (1.82 g/cc) (409 psf)	HAT01-11.1904002-005 (1.82 g/cc) (409 psf)	426	942	4.88
L4-02R (1.78 g/cc) (102 psf)	HAT01-11.1904002-008 (1.78 g/cc) (102 psf)	101	554	2.29
L4-02R (1.73 g/cc) (202 psf)	HAT01-11.1904002-008 (1.73 g/cc) (202 psf)	202	635	2.40
L4-02R (1.72 g/cc) (398 psf)	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)	404	762	3.67
L4-02RT (1.77 g/cc) (363 psf)	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)	387	643	5.36
L4-03R (1.73 g/cc) (100 psf)	HAT01-11.1904002-010 (1.73 g/cc) (100 psf)	104	583	1.63
L4-03R (1.74 g/cc) (207 psf)	HAT01-11.1904002-010 (1.74 g/cc) (207 psf)	226	618	1.93
L4-03R (1.74 g/cc) (413 psf)	HAT01-11.1904002-010 (1.74 g/cc) (413 psf)	423	773	2.17
L4-03RT (1.77 g/cc) (399 psf)	HAT01-11.1904002-009 (1.77 g/cc) (399 psf)	400	1049	4.27
L4-11RT (1.75 g/cc) (416 psf)	HAT01-11.1904002-003 (1.75 g/cc) (416 psf)	424	657	2.53
L5-01R (1.76 g/cc) (107 psf)	HAT01-11.1904002-002 (1.76 g/cc) (107 psf)	108	361	3.37
L5-01R (1.74 g/cc) (211 psf)	HAT01-11.1904002-002 (1.74 g/cc) (211 psf)	232	493	4.04
L5-01R (1.76 g/cc) (398 psf)	HAT01-11.1904002-002 (1.76 g/cc) (398 psf)	408	576	3.32
L5-01RT (1.70 g/cc) (399 psf)	HAT01-11.1904002-001 (1.70 g/cc) (399 psf)	403	637	6.80

Summary of Collapse Potential Testing

Sample Number	Lab ID	Pressure at Inundation (psf)	Collapse Potential (I_c) (%)
L4-01R (1.79 g/cc) (1,044 psf)	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)	1,044	0.02

Summary of Carbonate Content, pH, and Resistivity

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
A-1	HAT01-11.1904001-077	6	9.5	8.1	4,704
A-2	HAT01-11.1904001-074	4	9.4	8.0	7,021
A-3	HAT01-11.1904001-062	5	9.3	8.0	4,493
ASM-1	HAT01-11.1904001-078	4	7.9	7.3	13,339
ASM-2	HAT01-11.1904001-079	3	7.5	6.9	18,254
L1-02B	HAT01-11.1904001-002	6			
L1-03B	HAT01-11.1904001-003	7			
L1-11B	HAT01-11.1904001-001	8			
L2-01B	HAT01-11.1904001-004	6			
L3-01RB	HAT01-11.1904001-065	6	8.9	8.2	1,123
L3-01RM	HAT01-11.1904001-053	5	9.3	8.5	913
L3-01RT	HAT01-11.1904001-038	7			
L3-02B	HAT01-11.1904001-006	5			
L3-02RB	HAT01-11.1904001-066	5	9.5	8.1	1,615
L3-02RM	HAT01-11.1904001-054	5	9.5	8.4	1,194
L3-02RT	HAT01-11.1904001-039	6			
L3-03B	HAT01-11.1904001-007	6			
L3-03RB	HAT01-11.1904001-067	6	9.3	8.4	1,264
L3-03RM	HAT01-11.1904001-055	4	9.5	8.5	1,334
L3-03RT	HAT01-11.1904001-040	7			
L3-11B	HAT01-11.1904001-005	4			
L4-02B	HAT01-11.1904001-009	6			
L4-03B	HAT01-11.1904001-010	6			
L4-11B	HAT01-11.1904001-024	9			

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[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L5-01C	HAT01-11.1904001-034	5	9.5	8.6	1,123
L5-01RB	HAT01-11.1904001-068	9	8.1	7.9	1,053
L5-01RM	HAT01-11.1904001-056	4	9.7	8.5	1,755
L5-01RT	HAT01-11.1904001-041	6	9.5	8.6	1,053
L5-01UNKNOWN	HAT01-11.1904001-082	4			
L5-02B	HAT01-11.1904001-012	7			
L5-02RB	HAT01-11.1904001-069	5	9.5	8.6	1,194
L5-02RM	HAT01-11.1904001-057	5	9.8	8.7	1,264
L5-02RT	HAT01-11.1904001-042	5	9.6	8.5	1,474
L5-03B	HAT01-11.1904001-013	9			
L5-03RB	HAT01-11.1904001-070	8	9.5	8.6	1,194
L5-03RM	HAT01-11.1904001-058	4	9.8	8.6	1,404
L5-03RT	HAT01-11.1904001-043	6	9.7	8.5	1,966
L5-11B	HAT01-11.1904001-107	9			
L5-11RB	HAT01-11.1904001-108	6	9.2	8.4	1,194
L5-11RM	HAT01-11.1904001-109	6	9.4	8.4	1,123
L5-11RT	HAT01-11.1904001-110	5	9.6	8.6	1,615
L5-21B	HAT01-11.1904001-103	9			
L5-21RB	HAT01-11.1904001-104	8	9.2	8.2	1,194
L5-21RM	HAT01-11.1904001-105	4	9.4	8.3	1,053
L5-21RT	HAT01-11.1904001-106	5	9.6	8.6	1,755
L5-31B	HAT01-11.1904001-027	11			
L5-31RB	HAT01-11.1904001-100	6	9.4	8.4	913
L5-31RM	HAT01-11.1904001-101	5	9.4	8.5	1,123

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[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L5-31RT	HAT01-11.1904001-102	5	9.6	8.4	1,825
L5-41B	HAT01-11.1904001-095	7			
L5-41RB	HAT01-11.1904001-096	6	9.2	8.4	983
L5-41RM	HAT01-11.1904001-097	4	9.4	8.4	18,254
L5-41RT	HAT01-11.1904001-098	6	9.8	8.6	1,825
L5-51RB	HAT01-11.1904001-092	6	9.1	8.3	1,123
L5-51RM	HAT01-11.1904001-093	6	9.4	8.5	1,404
L5-51RT	HAT01-11.1904001-094	5	9.7	8.4	2,036
L5-61RB	HAT01-11.1904001-088	5	9.0	8.2	1,053
L5-61RM	HAT01-11.1904001-089	4	9.3	8.6	1,194
L5-61RT	HAT01-11.1904001-090	6	9.6	8.4	1,615
L5-01A-RB	HAT01-11.1904001-085	4	9.3	8.5	1,123
L5-01A-RU	HAT01-11.1904001-086	5	9.4	8.5	1,194
L6-01B	HAT01-11.1904001-014	12			
L7-01B	HAT01-11.1904001-015	9			
L7-01RT	HAT01-11.1904001-044		9.7	8.5	1,966
L7-02B	HAT01-11.1904001-016	8			
L7-02RT	HAT01-11.1904001-045		9.4	8.2	1,825
L7-03B	HAT01-11.1904001-017	8			
L7-03RT	HAT01-11.1904001-046		9.7	8.4	2,106
L7-11B	HAT01-11.1904001-018	7			
L7-11RT	HAT01-11.1904001-050		9.5	8.4	2,036
L8-01RB	HAT01-11.1904001-071	10	9.0	8.2	1,264
L8-01RM	HAT01-11.1904001-059	4	9.6	8.4	1,615

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[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L8-01RT	HAT01-11.1904001-047	5			
L8-02B	HAT01-11.1904001-019	11			
L8-02RB	HAT01-11.1904001-072	7	9.4	8.3	1,194
L8-02RM	HAT01-11.1904001-060	5	9.4	8.0	2,176
L8-02RT	HAT01-11.1904001-048	6			
L8-03B	HAT01-11.1904001-020	7			
L8-03RB	HAT01-11.1904001-073	7	9.5	8.3	1,755
L8-03RM	HAT01-11.1904001-061	6	9.6	8.3	2,036
L8-03RT	HAT01-11.1904001-049	4			
L9-01B	HAT01-11.1904001-021	8			
L10-01B	HAT01-11.1904001-022	8			
L10-02B	HAT01-11.1904001-023	7			
L11-01B	HAT01-11.1904001-025	6			
L11-02B	HAT01-11.1904001-026	7			
L12-01B	HAT01-11.1904001-028	24			
L13-01B	HAT01-11.1904001-029	9			
L13-02B	HAT01-11.1904001-030	8			
L13-02RB	HAT01-11.1904001-075	18	8.4	7.9	2,317
L13-02RM	HAT01-11.1904001-063	18	8.6	7.8	4,072
L13-02RT	HAT01-11.1904001-051	19			
L-compW	HAT01-11.1904001-080	9	7.8	7.5	913

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[1] Calcium Carbonate content precise to +/- 1.5%

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Particle Size Analysis:	ASTM D7928, ASTM D6913
Double Hydrometer:	ASTM D4221
USCS (ASTM) Classification:	ASTM D6913, ASTM D4318, ASTM D2487
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488
Direct Shear Consolidated Drained:	ASTM D3080
Collapse Potential of Soils:	ASTM D5333
Carbonate Content:	ASTM D4373
pH:	ASTM D4972
Resistivity:	ASTM G187

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L1-02B	HAT01-11.1904001-002	4.9	NA	---	---	NA	NA	NA
L1-02B (BM)	HAT01-11.1904001-002 (BM)	2.7	NA	---	---	NA	NA	NA
L1-03B	HAT01-11.1904001-003	2.7	NA	---	---	NA	NA	NA
L1-03B (BM)	HAT01-11.1904001-003 (BM)	1.7	NA	---	---	NA	NA	NA
L1-11B	HAT01-11.1904001-001	4.7	NA	---	---	NA	NA	NA
L1-11B (BM)	HAT01-11.1904001-001 (BM)	1.7	NA	---	---	NA	NA	NA
L2-01B (BM)	HAT01-11.1904001-004 (BM)	0.9	NA	---	---	NA	NA	NA
L3-01RB	HAT01-11.1904001-065	8.5	NA	---	---	NA	NA	NA
L3-01RM	HAT01-11.1904001-053	12.8	NA	---	---	NA	NA	NA
L3-01RT	HAT01-11.1904001-038	13.3	23.9	---	---	1.81	2.04	31.9
L3-02B	HAT01-11.1904001-006	7.0	NA	---	---	NA	NA	NA
L3-02B (BM)	HAT01-11.1904001-006 (BM)	2.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L3-02RB	HAT01-11.1904001-066	8.4	NA	---	---	NA	NA	NA
L3-02RM	HAT01-11.1904001-054	15.4	NA	---	---	NA	NA	NA
L3-02RT	HAT01-11.1904001-039	10.2	18.5	---	---	1.81	1.99	31.8
L3-03B	HAT01-11.1904001-007	5.6	NA	---	---	NA	NA	NA
L3-03B (BM)	HAT01-11.1904001-007 (BM)	3.4	NA	---	---	NA	NA	NA
L3-03RB	HAT01-11.1904001-067	12.4	NA	---	---	NA	NA	NA
L3-03RM	HAT01-11.1904001-055	14.6	NA	---	---	NA	NA	NA
L3-03RT	HAT01-11.1904001-040	11.7	20.9	---	---	1.78	1.99	32.7
L3-11B	HAT01-11.1904001-005	8.5	NA	---	---	NA	NA	NA
L3-11B (BM)	HAT01-11.1904001-005 (BM)	1.2	NA	---	---	NA	NA	NA
L4-01B (BM)	HAT01-11.1904001-008 (BM)	0.6	NA	---	---	NA	NA	NA
L4-02B (BM)	HAT01-11.1904001-009 (BM)	3.5	NA	---	---	NA	NA	NA

NA = Not analyzed
--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Density (g/cm^3)	Density (g/cm^3)	Porosity (%)
L4-03B (BM)	HAT01-11.1904001-010 (BM)	3.1	NA	---	---	NA	NA	NA
L4-11B (BM)	HAT01-11.1904001-024 (BM)	1.7	NA	---	---	NA	NA	NA
L5-01B (BM)	HAT01-11.1904001-011 (BM)	0.3	NA	---	---	NA	NA	NA
L5-01RB	HAT01-11.1904001-068	10.1	NA	---	---	NA	NA	NA
L5-01RM	HAT01-11.1904001-056	12.4	NA	---	---	NA	NA	NA
L5-01RT	HAT01-11.1904001-041	9.2	15.3	---	---	1.66	1.82	37.2
L5-02B	HAT01-11.1904001-012	3.8	NA	---	---	NA	NA	NA
L5-02B (BM)	HAT01-11.1904001-012 (BM)	2.2	NA	---	---	NA	NA	NA
L5-02RB	HAT01-11.1904001-069	12.4	NA	---	---	NA	NA	NA
L5-02RM	HAT01-11.1904001-057	12.0	NA	---	---	NA	NA	NA
L5-02RT	HAT01-11.1904001-042	13.3	23.0	---	---	1.72	1.95	35.0
L5-03B	HAT01-11.1904001-013	4.0	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-03B (BM)	HAT01-11.1904001-013 (BM)	2.3	NA	---	---	NA	NA	NA
L5-03RB	HAT01-11.1904001-070	10.6	NA	---	---	NA	NA	NA
L5-03RM	HAT01-11.1904001-058	9.6	NA	---	---	NA	NA	NA
L5-03RT	HAT01-11.1904001-043	11.9	21.1	---	---	1.77	1.99	33.1
L5-11B	HAT01-11.1904001-107	4.5	NA	---	---	NA	NA	NA
L5-11B (BM)	HAT01-11.1904001-107 (BM)	2.8	NA	---	---	NA	NA	NA
L5-11RB	HAT01-11.1904001-108	13.0	NA	---	---	NA	NA	NA
L5-11RM	HAT01-11.1904001-109	13.8	NA	---	---	NA	NA	NA
L5-11RT	HAT01-11.1904001-110	12.1	20.1	---	---	1.66	1.86	37.3
L5-21B	HAT01-11.1904001-103	4.3	NA	---	---	NA	NA	NA
L5-21B (BM)	HAT01-11.1904001-103 (BM)	2.4	NA	---	---	NA	NA	NA
L5-21RB	HAT01-11.1904001-104	12.7	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-21RM	HAT01-11.1904001-105	12.6	NA	---	---	NA	NA	NA
L5-21RT	HAT01-11.1904001-106	11.9	21.2	---	---	1.78	2.00	32.7
L5-31B	HAT01-11.1904001-027	3.9	NA	---	---	NA	NA	NA
L5-31B (BM)	HAT01-11.1904001-027 (BM)	2.3	NA	---	---	NA	NA	NA
L5-31RB	HAT01-11.1904001-100	12.8	NA	---	---	NA	NA	NA
L5-31RM	HAT01-11.1904001-101	13.6	NA	---	---	NA	NA	NA
L5-31RT	HAT01-11.1904001-102	12.8	23.0	---	---	1.80	2.03	32.2
L5-41B (BM)	HAT01-11.1904001-095 (BM)	0.4	NA	---	---	NA	NA	NA
L5-41RB	HAT01-11.1904001-096	12.7	NA	---	---	NA	NA	NA
L5-41RM	HAT01-11.1904001-097	10.5	NA	---	---	NA	NA	NA
L5-41RT	HAT01-11.1904001-098	8.8	16.0	---	---	1.81	1.97	31.6
L5-51B (BM)	HAT01-11.1904001-091 (BM)	0.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Density (g/cm^3)	Density (g/cm^3)	Porosity (%)
L5-51RB	HAT01-11.1904001-092	10.8	NA	---	---	NA	NA	NA
L5-51RM	HAT01-11.1904001-093	9.4	NA	---	---	NA	NA	NA
L5-51RT	HAT01-11.1904001-094	9.2	16.1	---	---	1.76	1.92	33.6
L5-61B (BM)	HAT01-11.1904001-087 (BM)	0.3	NA	---	---	NA	NA	NA
L5-61RB	HAT01-11.1904001-088	10.9	NA	---	---	NA	NA	NA
L5-61RM	HAT01-11.1904001-089	11.4	NA	---	---	NA	NA	NA
L5-61RT	HAT01-11.1904001-090	11.3	17.2	---	---	1.52	1.69	42.7
L5-01A-RB	HAT01-11.1904001-085	14.2	NA	---	---	NA	NA	NA
L5-01A-RU	HAT01-11.1904001-086	13.3	NA	---	---	NA	NA	NA
L6-01B (BM)	HAT01-11.1904001-014 (BM)	3.3	NA	---	---	NA	NA	NA
L7-01B	HAT01-11.1904001-015	2.6	NA	---	---	NA	NA	NA
L7-01B (BM)	HAT01-11.1904001-015 (BM)	0.9	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L7-02B	HAT01-11.1904001-016	4.9	NA	---	---	NA	NA	NA
L7-02B (BM)	HAT01-11.1904001-016 (BM)	2.8	NA	---	---	NA	NA	NA
L7-03B	HAT01-11.1904001-017	5.7	NA	---	---	NA	NA	NA
L7-03B (BM)	HAT01-11.1904001-017 (BM)	2.6	NA	---	---	NA	NA	NA
L7-11B	HAT01-11.1904001-018	6.7	NA	---	---	NA	NA	NA
L7-11B (BM)	HAT01-11.1904001-018 (BM)	2.7	NA	---	---	NA	NA	NA
L8-01RB	HAT01-11.1904001-071	7.9	NA	---	---	NA	NA	NA
L8-01RM	HAT01-11.1904001-059	12.1	NA	---	---	NA	NA	NA
L8-01RT	HAT01-11.1904001-047	12.4	19.5	---	---	1.58	1.77	40.5
L8-02B	HAT01-11.1904001-019	4.9	NA	---	---	NA	NA	NA
L8-02B (BM)	HAT01-11.1904001-019 (BM)	2.1	NA	---	---	NA	NA	NA
L8-02RB	HAT01-11.1904001-072	11.3	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Density (g/cm^3)	Density (g/cm^3)	Porosity (%)
L8-02RM	HAT01-11.1904001-060	7.7	NA	---	---	NA	NA	NA
L8-02RT	HAT01-11.1904001-048	11.6	19.0	---	---	1.65	1.84	37.8
L8-03B	HAT01-11.1904001-020	4.4	NA	---	---	NA	NA	NA
L8-03B (BM)	HAT01-11.1904001-020 (BM)	1.9	NA	---	---	NA	NA	NA
L8-03RB	HAT01-11.1904001-073	10.7	NA	---	---	NA	NA	NA
L8-03RM	HAT01-11.1904001-061	10.8	NA	---	---	NA	NA	NA
L8-03RT	HAT01-11.1904001-049	13.5	21.5	---	---	1.59	1.81	40.0
L9-01B (BM)	HAT01-11.1904001-021 (BM)	2.1	NA	---	---	NA	NA	NA
L10-01B	HAT01-11.1904001-022	4.6	NA	---	---	NA	NA	NA
L10-01B (BM)	HAT01-11.1904001-022 (BM)	2.1	NA	---	---	NA	NA	NA
L10-02B	HAT01-11.1904001-023	3.9	NA	---	---	NA	NA	NA
L10-02B (BM)	HAT01-11.1904001-023 (BM)	2.6	NA	---	---	NA	NA	NA

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L11-01B	HAT01-11.1904001-025	4.7	NA	---	---	NA	NA	NA
L11-01B (BM)	HAT01-11.1904001-025 (BM)	2.0	NA	---	---	NA	NA	NA
L11-02B	HAT01-11.1904001-026	4.4	NA	---	---	NA	NA	NA
L11-02B (BM)	HAT01-11.1904001-026 (BM)	1.4	NA	---	---	NA	NA	NA
L12-01B (BM)	HAT01-11.1904001-028 (BM)	2.1	NA	---	---	NA	NA	NA
L13-01B	HAT01-11.1904001-029	4.4	NA	---	---	NA	NA	NA
L13-01B (BM)	HAT01-11.1904001-029 (BM)	1.9	NA	---	---	NA	NA	NA
L13-02B	HAT01-11.1904001-030	6.4	NA	---	---	NA	NA	NA
L13-02B (BM)	HAT01-11.1904001-030 (BM)	3.3	NA	---	---	NA	NA	NA
L13-02RB	HAT01-11.1904001-075	10.2	NA	---	---	NA	NA	NA
L13-02RM	HAT01-11.1904001-063	11.8	NA	---	---	NA	NA	NA
L13-02RT	HAT01-11.1904001-051	10.6	20.0	---	---	1.88	2.08	28.9

NA = Not analyzed
--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L4-01R (1.74 g/cc) (97 psf)	HAT01-11.1904002-006 (1.74 g/cc) (97 psf)	12.9	22.5	---	---	1.74	1.97	34.2
L4-01R (1.75 g/cc) (222 psf)	HAT01-11.1904002-006 (1.75 g/cc) (222 psf)	12.9	22.5	---	---	1.75	1.97	34.1
L4-01R (1.80 g/cc) (417 psf)	HAT01-11.1904002-006 (1.80 g/cc) (417 psf)	12.7	23.0	---	---	1.80	2.03	32.0
L4-01R (1.79 g/cc) (1,044 psf)	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)	12.0	21.4	---	---	1.79	2.00	32.6
L4-01RT (1.82 g/cc) (409 psf)	HAT01-11.1904002-005 (1.82 g/cc) (409 psf)	12.7	23.2	---	---	1.82	2.06	31.2
L4-02R (1.78 g/cc) (102 psf)	HAT01-11.1904002-008 (1.78 g/cc) (102 psf)	12.2	21.8	---	---	1.78	2.00	32.9
L4-02R (1.73 g/cc) (202 psf)	HAT01-11.1904002-008 (1.73 g/cc) (202 psf)	12.3	21.3	---	---	1.73	1.95	34.6

NA = Not analyzed

--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L4-02R (1.72 g/cc) (398 psf)	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)	14.3	24.5	---	---	1.72	1.97	35.0
L4-02RT (1.77 g/cc) (363 psf)	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)	9.1	16.2	---	---	1.77	1.94	33.0
L4-03R (1.73 g/cc) (100 psf)	HAT01-11.1904002-010 (1.73 g/cc) (100 psf)	13.3	22.9	---	---	1.73	1.96	34.8
L4-03R (1.74 g/cc) (207 psf)	HAT01-11.1904002-010 (1.74 g/cc) (207 psf)	13.3	23.2	---	---	1.74	1.97	34.3
L4-03R (1.74 g/cc) (413 psf)	HAT01-11.1904002-010 (1.74 g/cc) (413 psf)	12.9	22.6	---	---	1.74	1.97	34.2
L4-03RT (1.77 g/cc) (399 psf)	HAT01-11.1904002-009 (1.77 g/cc) (399 psf)	10.6	18.7	---	---	1.77	1.96	33.1
L4-11RT (1.75 g/cc) (416 psf)	HAT01-11.1904002-003 (1.75 g/cc) (416 psf)	10.2	17.8	---	---	1.75	1.93	34.0

NA = Not analyzed
--- = This sample was not remolded

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity (Continued)

		Moisture Content						
		As Received		Remolded				
Sample Number	Lab ID	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
L5-01R (1.76 g/cc) (107 psf)	HAT01-11.1904002-002 (1.76 g/cc) (107 psf)	13.5	23.7	---	---	1.76	2.00	33.6
L5-01R (1.74 g/cc) (211 psf)	HAT01-11.1904002-002 (1.74 g/cc) (211 psf)	13.2	22.9	---	---	1.74	1.97	34.3
L5-01R (1.76 g/cc) (398 psf)	HAT01-11.1904002-002 (1.76 g/cc) (398 psf)	13.7	24.1	---	---	1.76	2.00	33.5
L5-01RT (1.70 g/cc) (399 psf)	HAT01-11.1904002-001 (1.70 g/cc) (399 psf)	12.7	21.6	---	---	1.70	1.91	36.0

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L1-02B
Lab ID:	HAT01-11.1904001-002
Date/Time sampled:	04/10/2019 850

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	171.22	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.54	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	157.06	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-02B (BM)
Lab ID: HAT01-11.1904001-002 (BM)
Date/Time sampled: 04/10/2019 850

	As Received	Remolded
Test Date:	8-May-19	---
Field weight of sample* (g):	5387.55	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	507.36	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4753.96	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-03B
Lab ID: HAT01-11.1904001-003
Date/Time sampled: 04/10/2019 900

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	180.17	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	169.12	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L1-03B (BM)
Lab ID:	HAT01-11.1904001-003 (BM)
Date/Time sampled:	04/10/2019 900

	As Received	Remolded
Test Date:	9-May-19	---
Field weight of sample* (g):	5114.72	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	527.11	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4511.09	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	J. Hines/J. Newcomer
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L1-11B
Lab ID:	HAT01-11.1904001-001
Date/Time sampled:	04/10/2019 1045

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	66.53	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	57.36	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-11B (BM)
Lab ID: HAT01-11.1904001-001 (BM)
Date/Time sampled: 04/10/2019 1045

	As Received	Remolded
Test Date:	8-May-19	---
Field weight of sample* (g):	5511.53	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	524.54	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4902.75	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L2-01B (BM)
Lab ID:	HAT01-11.1904001-004 (BM)
Date/Time sampled:	04/10/2019 1130

	As Received	Remolded
Test Date:	10-May-19	---
Field weight of sample* (g):	7335.50	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	540.12	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	6734.55	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	J. Hines/J. Newcomer
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RB
Lab ID: HAT01-11.1904001-065
Date/Time sampled: 04/09/2019 1440

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	59.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.46	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	48.43	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	8.5	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-01RM
Lab ID:	HAT01-11.1904001-053
Date/Time sampled:	04/09/2019 1450

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	51.63	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	40.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RT
Lab ID: HAT01-11.1904001-038
Date/Time sampled: 04/09/2019 1500

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2336.40	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	389.34	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1719.16	
Sample volume (cm^3):	952.16	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.3	
Volumetric Moisture Content (% vol):	23.9	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	2.04	
Calculated Porosity (% vol):	31.9	
Percent Saturation:	75.1	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02B
Lab ID: HAT01-11.1904001-006
Date/Time sampled: 04/09/2019 930

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	195.81	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	176.93	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	7.0	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02B (BM)
Lab ID:	HAT01-11.1904001-006 (BM)
Date/Time sampled:	04/09/2019 930

	As Received	Remolded
Test Date:	9-May-19	---
Field weight of sample* (g):	6699.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	539.33	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	6021.07	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Sacks/J. Newcomer
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RB
Lab ID: HAT01-11.1904001-066
Date/Time sampled: 04/09/2019 1100

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	84.76	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.43	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	72.25	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	8.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RM
Lab ID:	HAT01-11.1904001-054
Date/Time sampled:	04/09/2019 1045

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	61.54	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	47.72	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	15.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RT
Lab ID: HAT01-11.1904001-039
Date/Time sampled: 04/09/2019 1000

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2300.20	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	389.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1733.41	
Sample volume (cm^3):	959.80	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.2	
Volumetric Moisture Content (% vol):	18.5	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	31.8	
Percent Saturation:	58.0	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03B
Lab ID:	HAT01-11.1904001-007
Date/Time sampled:	04/09/2019 1155

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	203.92	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	187.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	5.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03B (BM)
Lab ID:	HAT01-11.1904001-007 (BM)
Date/Time sampled:	04/09/2019 1155

	As Received	Remolded
Test Date:	10-May-19	---
Field weight of sample* (g):	5189.40	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	537.01	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4499.34	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	J. Hines/J. Newcomer
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03RB
Lab ID:	HAT01-11.1904001-067
Date/Time sampled:	04/09/2019 1330

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	55.38	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.45	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	43.52	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RM
Lab ID: HAT01-11.1904001-055
Date/Time sampled: 04/09/2019 1400

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	57.15	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	44.22	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	14.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RT
Lab ID: HAT01-11.1904001-040
Date/Time sampled: 04/09/2019 1345

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2316.40	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	409.60	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1706.60	
Sample volume (cm^3):	957.57	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.7	
Volumetric Moisture Content (% vol):	20.9	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	32.7	
Percent Saturation:	63.8	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-11B
Lab ID: HAT01-11.1904001-005
Date/Time sampled: 04/09/2019 1525

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	125.05	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.46	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	109.33	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	8.5	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L3-11B (BM)	
Lab ID:	HAT01-11.1904001-005 (BM)	
Date/Time sampled:	04/09/2019 1525	
	As Received	Remolded
Test Date:	9-May-19	---
Field weight of sample* (g):	4924.09	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	531.63	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4338.30	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.2	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01B (BM)
Lab ID: HAT01-11.1904001-008 (BM)
Date/Time sampled: 04/17/2019 1045

	As Received	Remolded
Test Date:	9-May-19	---
Field weight of sample* (g):	7771.57	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	515.65	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	7211.60	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Sacks/J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02B (BM)
Lab ID: HAT01-11.1904001-009 (BM)
Date/Time sampled: 04/17/2019 1145

	As Received	Remolded
Test Date:	10-May-19	---
Field weight of sample* (g):	4907.19	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	525.28	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4233.51	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.5	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03B (BM)
Lab ID: HAT01-11.1904001-010 (BM)
Date/Time sampled: 04/17/2019 1340

	As Received	Remolded
Test Date:	10-May-19	---
Field weight of sample* (g):	5215.83	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	539.24	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4534.14	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11B (BM)
Lab ID: HAT01-11.1904001-024 (BM)
Date/Time sampled: 04/17/2019 1500

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	6009.82	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	531.02	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5387.99	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01B (BM)
Lab ID: HAT01-11.1904001-011 (BM)
Date/Time sampled: 04/17/2019 1700

	As Received	Remolded
Test Date:	11-May-19	---
Field weight of sample* (g):	6006.50	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	546.13	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5445.16	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Sacks/J. Hines
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RB
Lab ID: HAT01-11.1904001-068
Date/Time sampled: 04/18/2019 740

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	198.20	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.46	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	174.15	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01RM
Lab ID:	HAT01-11.1904001-056
Date/Time sampled:	04/18/2019 750

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	126.12	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	106.41	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01RT
Lab ID:	HAT01-11.1904001-041
Date/Time sampled:	04/18/2019 800

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2132.60	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	391.06	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1594.84	
Sample volume (cm^3):	958.69	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	9.2	
Volumetric Moisture Content (% vol):	15.3	
Dry bulk density (g/cm^3):	1.66	
Wet bulk density (g/cm^3):	1.82	
Calculated Porosity (% vol):	37.2	
Percent Saturation:	41.1	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-02B
Lab ID:	HAT01-11.1904001-012
Date/Time sampled:	04/18/2019 1230

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	150.98	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.46	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	139.27	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02B (BM)
Lab ID: HAT01-11.1904001-012 (BM)
Date/Time sampled: 04/18/2019 1230

	As Received	Remolded
Test Date:	11-May-19	---
Field weight of sample* (g):	4899.34	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	545.94	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4258.71	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.2	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RB
Lab ID: HAT01-11.1904001-069
Date/Time sampled: 04/18/2019 1240

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	169.61	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	145.18	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-02RM
Lab ID:	HAT01-11.1904001-057
Date/Time sampled:	04/18/2019 1235

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	206.73	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	178.75	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.0	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RT
Lab ID: HAT01-11.1904001-042
Date/Time sampled: 04/18/2019 1235

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2272.80	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	408.30	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1645.30	
Sample volume (cm^3):	954.67	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.3	
Volumetric Moisture Content (% vol):	23.0	
Dry bulk density (g/cm^3):	1.72	
Wet bulk density (g/cm^3):	1.95	
Calculated Porosity (% vol):	35.0	
Percent Saturation:	65.7	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03B
Lab ID: HAT01-11.1904001-013
Date/Time sampled: 04/18/2019 1015

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	194.61	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	180.98	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.0	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03B (BM)
Lab ID: HAT01-11.1904001-013 (BM)
Date/Time sampled: 04/18/2019 1015

	As Received	Remolded
Test Date:	11-May-19	---
Field weight of sample* (g):	5398.35	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	512.27	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4774.36	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RB
Lab ID: HAT01-11.1904001-070
Date/Time sampled: 04/18/2019 1020

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	169.07	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	147.07	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L5-03RM	
Lab ID:	HAT01-11.1904001-058	
Date/Time sampled:	04/18/2019 1020	
	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	109.48	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	93.99	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	9.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RT
Lab ID: HAT01-11.1904001-043
Date/Time sampled: 04/18/2019 1020

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2223.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	409.40	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1620.60	
Sample volume (cm^3):	913.49	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.9	
Volumetric Moisture Content (% vol):	21.1	
Dry bulk density (g/cm^3):	1.77	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	33.1	
Percent Saturation:	63.9	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11B
Lab ID: HAT01-11.1904001-107
Date/Time sampled: 04/18/2019 1150

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	163.64	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.61	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	150.28	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.5	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11B (BM)
Lab ID: HAT01-11.1904001-107 (BM)
Date/Time sampled: 04/18/2019 1150

	As Received	Remolded
Test Date:	22-May-19	---
Field weight of sample* (g):	5384.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	504.15	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4748.29	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Bland/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RB
Lab ID: HAT01-11.1904001-108
Date/Time sampled: 04/18/2019 1155

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	174.96	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	149.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.0	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-11RM
Lab ID:	HAT01-11.1904001-109
Date/Time sampled:	04/18/2019 1150

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	125.54	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.54	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	104.53	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RT
Lab ID: HAT01-11.1904001-110
Date/Time sampled: 04/18/2019 1200

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2170.90	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	389.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1588.99	
Sample volume (cm^3):	956.39	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.1	
Volumetric Moisture Content (% vol):	20.1	
Dry bulk density (g/cm^3):	1.66	
Wet bulk density (g/cm^3):	1.86	
Calculated Porosity (% vol):	37.3	
Percent Saturation:	53.9	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21B
Lab ID: HAT01-11.1904001-103
Date/Time sampled: 04/18/2019 1125

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	140.12	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	128.12	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21B (BM)
Lab ID: HAT01-11.1904001-103 (BM)
Date/Time sampled: 04/18/2019 1125

	As Received	Remolded
Test Date:	22-May-19	---
Field weight of sample* (g):	5003.15	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	511.63	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4385.18	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Bland/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RB
Lab ID:	HAT01-11.1904001-104
Date/Time sampled:	04/18/2019 1120

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	179.82	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	153.79	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RM
Lab ID:	HAT01-11.1904001-105
Date/Time sampled:	04/18/2019 1125

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	121.34	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	102.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RT
Lab ID: HAT01-11.1904001-106
Date/Time sampled: 04/18/2019 1120

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2258.70	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	408.90	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1653.50	
Sample volume (cm^3):	926.98	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.9	
Volumetric Moisture Content (% vol):	21.2	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	32.7	
Percent Saturation:	64.8	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31B
Lab ID: HAT01-11.1904001-027
Date/Time sampled: 04/18/2019 1045

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	210.71	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	196.49	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31B (BM)
Lab ID: HAT01-11.1904001-027 (BM)
Date/Time sampled: 04/18/2019 1045

	As Received	Remolded
Test Date:	17-May-19	---
Field weight of sample* (g):	5135.11	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	519.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4513.19	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB
Lab ID: HAT01-11.1904001-100
Date/Time sampled: 04/18/2019 1045

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	159.98	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	136.04	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RM
Lab ID: HAT01-11.1904001-101
Date/Time sampled: 04/18/2019 1045

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	120.66	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	100.48	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RT
Lab ID: HAT01-11.1904001-102
Date/Time sampled: 04/18/2019 1045

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2171.10	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	409.30	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1561.90	
Sample volume (cm^3):	869.49	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.8	
Volumetric Moisture Content (% vol):	23.0	
Dry bulk density (g/cm^3):	1.80	
Wet bulk density (g/cm^3):	2.03	
Calculated Porosity (% vol):	32.2	
Percent Saturation:	71.4	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41B (BM)
Lab ID: HAT01-11.1904001-095 (BM)
Date/Time sampled: 04/18/2019 940

	As Received	Remolded
Test Date:	21-May-19	---
Field weight of sample* (g):	5336.15	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	531.63	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4785.05	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Bland/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RB
Lab ID: HAT01-11.1904001-096
Date/Time sampled: 04/18/2019 945

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	177.38	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	151.63	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RM
Lab ID: HAT01-11.1904001-097
Date/Time sampled: 04/18/2019 945

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	169.09	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	147.10	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.5	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-41RT
Lab ID:	HAT01-11.1904001-098
Date/Time sampled:	04/18/2019 945

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2296.50	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	411.40	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1732.20	
Sample volume (cm^3):	956.21	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	8.8	
Volumetric Moisture Content (% vol):	16.0	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	31.6	
Percent Saturation:	50.5	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-51B (BM)
Lab ID:	HAT01-11.1904001-091 (BM)
Date/Time sampled:	04/18/2019 900

	As Received	Remolded
Test Date:	21-May-19	---
Field weight of sample* (g):	5816.16	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	515.65	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5285.08	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RB
Lab ID: HAT01-11.1904001-092
Date/Time sampled: 04/18/2019 915

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	189.72	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.53	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	165.35	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RM
Lab ID: HAT01-11.1904001-093
Date/Time sampled: 04/18/2019 915

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	151.01	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	132.06	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	9.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RT
Lab ID: HAT01-11.1904001-094
Date/Time sampled: 04/18/2019 915

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2249.20	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	407.70	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1686.80	
Sample volume (cm^3):	958.87	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	9.2	
Volumetric Moisture Content (% vol):	16.1	
Dry bulk density (g/cm^3):	1.76	
Wet bulk density (g/cm^3):	1.92	
Calculated Porosity (% vol):	33.6	
Percent Saturation:	48.0	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61B (BM)
Lab ID: HAT01-11.1904001-087 (BM)
Date/Time sampled: 04/18/2019 815

	As Received	Remolded
Test Date:	17-May-19	---
Field weight of sample* (g):	5721.01	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	527.11	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5179.51	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Bland/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RB
Lab ID: HAT01-11.1904001-088
Date/Time sampled: 04/18/2019 830

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	177.10	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	153.90	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RM
Lab ID: HAT01-11.1904001-089
Date/Time sampled: 04/18/2019 830

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	152.76	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.46	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	131.34	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT
Lab ID: HAT01-11.1904001-090
Date/Time sampled: 04/18/2019 830

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2028.20	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	409.60	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1454.20	
Sample volume (cm^3):	958.17	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.3	
Volumetric Moisture Content (% vol):	17.2	
Dry bulk density (g/cm^3):	1.52	
Wet bulk density (g/cm^3):	1.69	
Calculated Porosity (% vol):	42.7	
Percent Saturation:	40.2	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RB
Lab ID: HAT01-11.1904001-085
Date/Time sampled: 04/17/2019 1650

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	103.64	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	85.07	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	14.2	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RU
Lab ID: HAT01-11.1904001-086
Date/Time sampled: 04/17/2019 1655

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	111.96	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	93.06	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L6-01B (BM)	
Lab ID:	HAT01-11.1904001-014 (BM)	
Date/Time sampled:	04/17/2019 1000	
	As Received	Remolded
Test Date:	11-May-19	---
Field weight of sample* (g):	5441.61	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	528.99	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4755.54	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-01B
Lab ID: HAT01-11.1904001-015
Date/Time sampled: 04/16/2017 1520

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	198.26	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.41	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	186.93	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-01B (BM)
Lab ID: HAT01-11.1904001-015 (BM)
Date/Time sampled: 04/16/2017 1520

	As Received	Remolded
Test Date:	13-May-19	---
Field weight of sample* (g):	6197.48	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	531.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5615.84	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	0.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-02B
Lab ID: HAT01-11.1904001-016
Date/Time sampled: 04/16/2019 1630

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	112.11	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	100.68	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-02B (BM)
Lab ID: HAT01-11.1904001-016 (BM)
Date/Time sampled: 04/16/2019 1630

	As Received	Remolded
Test Date:	13-May-19	---
Field weight of sample* (g):	4725.62	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	500.71	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4108.46	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L7-03B	
Lab ID:	HAT01-11.1904001-017	
Date/Time sampled:	04/16/2019 1705	
	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	111.03	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	98.87	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	5.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-03B (BM)
Lab ID: HAT01-11.1904001-017 (BM)
Date/Time sampled: 04/16/2019 1705

	As Received	Remolded
Test Date:	13-May-19	---
Field weight of sample* (g):	5356.19	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	531.60	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4703.06	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L7-11B
Lab ID:	HAT01-11.1904001-018
Date/Time sampled:	04/17/2019 825

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	161.03	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	144.84	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	6.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-11B (BM)
Lab ID: HAT01-11.1904001-018 (BM)
Date/Time sampled: 04/17/2019 825

	As Received	Remolded
Test Date:	13-May-19	---
Field weight of sample* (g):	5708.33	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	530.20	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5040.29	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RB
Lab ID: HAT01-11.1904001-071
Date/Time sampled: 04/10/2019 1515

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	81.55	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	69.57	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	7.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RM
Lab ID: HAT01-11.1904001-059
Date/Time sampled: 04/11/2019 1530

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	81.62	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	67.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-01RT
Lab ID:	HAT01-11.1904001-047
Date/Time sampled:	04/10/2019 1545

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2086.60	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	388.30	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1511.50	
Sample volume (cm^3):	958.24	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.4	
Volumetric Moisture Content (% vol):	19.5	
Dry bulk density (g/cm^3):	1.58	
Wet bulk density (g/cm^3):	1.77	
Calculated Porosity (% vol):	40.5	
Percent Saturation:	48.2	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02B
Lab ID: HAT01-11.1904001-019
Date/Time sampled: 04/10/2019 1600

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	107.25	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	96.09	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02B (BM)
Lab ID: HAT01-11.1904001-019 (BM)
Date/Time sampled: 04/10/2019 1600

	As Received	Remolded
Test Date:	14-May-19	---
Field weight of sample* (g):	5472.56	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	798.03	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4576.24	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-02RB
Lab ID:	HAT01-11.1904001-072
Date/Time sampled:	04/10/2019 1620

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	80.56	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	66.55	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RM
Lab ID: HAT01-11.1904001-060
Date/Time sampled: 04/10/2019 1625

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	78.66	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	67.00	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	7.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-02RT
Lab ID:	HAT01-11.1904001-048
Date/Time sampled:	04/10/2019 1615

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2155.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	388.57	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1583.53	
Sample volume (cm^3):	960.39	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.6	
Volumetric Moisture Content (% vol):	19.0	
Dry bulk density (g/cm^3):	1.65	
Wet bulk density (g/cm^3):	1.84	
Calculated Porosity (% vol):	37.8	
Percent Saturation:	50.4	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-03B
Lab ID:	HAT01-11.1904001-020
Date/Time sampled:	04/11/2019 840

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	176.75	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	163.10	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03B (BM)
Lab ID: HAT01-11.1904001-020 (BM)
Date/Time sampled: 04/11/2019 840

	As Received	Remolded
Test Date:	14-May-19	---
Field weight of sample* (g):	7059.09	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	528.12	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	6411.01	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L8-03RB	
Lab ID:	HAT01-11.1904001-073	
Date/Time sampled:	04/11/2019 855	
	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	142.75	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	123.04	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RM
Lab ID: HAT01-11.1904001-061
Date/Time sampled: 04/10/2019 900

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	38.35	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	28.78	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L8-03RT	
Lab ID:	HAT01-11.1904001-049	
Date/Time sampled:	04/11/2019 915	
	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2141.60	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	408.40	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1526.50	
Sample volume (cm^3):	959.40	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.5	
Volumetric Moisture Content (% vol):	21.5	
Dry bulk density (g/cm^3):	1.59	
Wet bulk density (g/cm^3):	1.81	
Calculated Porosity (% vol):	40.0	
Percent Saturation:	53.9	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L9-01B (BM)
Lab ID: HAT01-11.1904001-021 (BM)
Date/Time sampled: 04/11/2019 1350

	As Received	Remolded
Test Date:	14-May-19	---
Field weight of sample* (g):	5228.85	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	865.71	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4271.47	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L10-01B
Lab ID: HAT01-11.1904001-022
Date/Time sampled: 04/11/2019 1030

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	146.08	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	133.43	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L10-01B (BM)
Lab ID: HAT01-11.1904001-022 (BM)
Date/Time sampled: 04/11/2019 1030

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	6363.65	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	827.10	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5420.41	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro	
Job Number:	DB19.1089.00	
Sample Number:	L10-02B	
Lab ID:	HAT01-11.1904001-023	
Date/Time sampled:	04/11/2019 1130	
	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	171.16	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	158.52	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L10-02B (BM)
Lab ID:	HAT01-11.1904001-023 (BM)
Date/Time sampled:	04/11/2019 1130

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	5577.61	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	532.02	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4919.28	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.6	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	J. Hines/ J. Newcomer
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-01B
Lab ID: HAT01-11.1904001-025
Date/Time sampled: 04/11/2019 1510

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	109.71	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	98.60	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.7	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-01B (BM)
Lab ID: HAT01-11.1904001-025 (BM)
Date/Time sampled: 04/11/2019 1510

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	6086.12	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	572.91	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5406.88	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.0	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-02B
Lab ID: HAT01-11.1904001-026
Date/Time sampled: 04/11/2019 1545

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	105.67	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.54	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	94.98	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-02B (BM)
Lab ID: HAT01-11.1904001-026 (BM)
Date/Time sampled: 04/11/2019 1545

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	5890.74	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	517.51	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	5299.73	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L12-01B (BM)
Lab ID: HAT01-11.1904001-028 (BM)
Date/Time sampled: 04/12/2019 940

	As Received	Remolded
Test Date:	17-May-19	---
Field weight of sample* (g):	5349.88	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	528.67	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4722.80	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	2.1	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L13-01B
Lab ID:	HAT01-11.1904001-029
Date/Time sampled:	04/11/2019 1700

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	106.30	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.49	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	95.60	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	4.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by:	A. Baldridge
Data entered by:	A. Baldridge
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-01B (BM)
Lab ID: HAT01-11.1904001-029 (BM)
Date/Time sampled: 04/11/2019 1700

	As Received	Remolded
Test Date:	17-May-19	---
Field weight of sample* (g):	5464.13	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	525.30	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4846.47	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	1.9	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02B
Lab ID: HAT01-11.1904001-030
Date/Time sampled: 04/12/2019 830

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	72.47	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.47	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	62.02	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	6.4	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02B (BM)
Lab ID: HAT01-11.1904001-030 (BM)
Date/Time sampled: 04/12/2019 830

	As Received	Remolded
Test Date:	17-May-19	---
Field weight of sample* (g):	5327.24	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	524.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	4647.11	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	3.3	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: J. Hines/ A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L13-02RB
Lab ID:	HAT01-11.1904001-075
Date/Time sampled:	04/12/2019 835

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	168.13	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	146.65	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.2	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RM
Lab ID: HAT01-11.1904001-063
Date/Time sampled: 04/12/2019 850

	As Received	Remolded
Test Date:	31-May-19	---
Field weight of sample* (g):	210.29	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.48	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	182.38	
Sample volume (cm^3):	NA	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	11.8	
Volumetric Moisture Content (% vol):	NA	
Dry bulk density (g/cm^3):	NA	
Wet bulk density (g/cm^3):	NA	
Calculated Porosity (% vol):	NA	
Percent Saturation:	NA	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RT
Lab ID: HAT01-11.1904001-051
Date/Time sampled: 04/12/2019 900

	As Received	Remolded
Test Date:	15-May-19	---
Field weight of sample* (g):	2382.60	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	389.27	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	1801.93	
Sample volume (cm^3):	956.60	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.6	
Volumetric Moisture Content (% vol):	20.0	
Dry bulk density (g/cm^3):	1.88	
Wet bulk density (g/cm^3):	2.08	
Calculated Porosity (% vol):	28.9	
Percent Saturation:	69.2	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.74 g/cc) (97 psf)
Lab ID: HAT01-11.1904002-006 (1.74 g/cc) (97 psf)
Date/Time sampled: 04/17/2019 1100

	As Received	Remolded
Test Date:	29-May-19	---
Field weight of sample* (g):	158.26	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	140.17	
Sample volume (cm^3):	80.38	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.9	
Volumetric Moisture Content (% vol):	22.5	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	34.2	
Percent Saturation:	65.8	

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.75 g/cc) (222 psf)
Lab ID:	HAT01-11.1904002-006 (1.75 g/cc) (222 psf)
Date/Time sampled:	04/17/2019 1100

	As Received	Remolded
Test Date:	29-May-19	---
Field weight of sample* (g):	158.30	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	140.23	
Sample volume (cm^3):	80.26	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.9	
Volumetric Moisture Content (% vol):	22.5	
Dry bulk density (g/cm^3):	1.75	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	34.1	
Percent Saturation:	66.1	

Laboratory analysis by:	D. O'Dowd
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.80 g/cc) (417 psf)
Lab ID: HAT01-11.1904002-006 (1.80 g/cc) (417 psf)
Date/Time sampled: 04/17/2019 1100

	As Received	Remolded
Test Date:	29-May-19	---
Field weight of sample* (g):	161.99	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	143.68	
Sample volume (cm^3):	79.71	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.7	
Volumetric Moisture Content (% vol):	23.0	
Dry bulk density (g/cm^3):	1.80	
Wet bulk density (g/cm^3):	2.03	
Calculated Porosity (% vol):	32.0	
Percent Saturation:	71.8	

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.79 g/cc) (1,044 psf)
Lab ID:	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)
Date/Time sampled:	04/17/2019 1100

	As Received	Remolded
Test Date:	14-Jun-19	---
Field weight of sample* (g):	160.71	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	143.52	
Sample volume (cm^3):	80.38	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.0	
Volumetric Moisture Content (% vol):	21.4	
Dry bulk density (g/cm^3):	1.79	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	32.6	
Percent Saturation:	65.5	

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01RT (1.82 g/cc) (409 psf)
Lab ID:	HAT01-11.1904002-005 (1.82 g/cc) (409 psf)
Date/Time sampled:	04/17/2019 1100

	As Received	Remolded
Test Date:	13-Aug-19	---
Field weight of sample* (g):	165.04	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	146.43	
Sample volume (cm^3):	80.29	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.7	
Volumetric Moisture Content (% vol):	23.2	
Dry bulk density (g/cm^3):	1.82	
Wet bulk density (g/cm^3):	2.06	
Calculated Porosity (% vol):	31.2	
Percent Saturation:	74.3	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02R (1.72 g/cc) (398 psf)
Lab ID: HAT01-11.1904002-008 (1.72 g/cc) (398 psf)
Date/Time sampled: 04/17/2019 1300

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	157.74	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	138.06	
Sample volume (cm^3):	80.19	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	14.3	
Volumetric Moisture Content (% vol):	24.5	
Dry bulk density (g/cm^3):	1.72	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	35.0	
Percent Saturation:	70.0	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02R (1.73 g/cc) (202 psf)
Lab ID:	HAT01-11.1904002-008 (1.73 g/cc) (202 psf)
Date/Time sampled:	04/17/2019 1300

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	160.63	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	143.07	
Sample volume (cm^3):	82.54	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.3	
Volumetric Moisture Content (% vol):	21.3	
Dry bulk density (g/cm^3):	1.73	
Wet bulk density (g/cm^3):	1.95	
Calculated Porosity (% vol):	34.6	
Percent Saturation:	61.5	

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Albay-Yenney
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02R (1.78 g/cc) (102 psf)
Lab ID: HAT01-11.1904002-008 (1.78 g/cc) (102 psf)
Date/Time sampled: 04/17/2019 1300

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	160.06	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	142.61	
Sample volume (cm^3):	80.15	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.2	
Volumetric Moisture Content (% vol):	21.8	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	32.9	
Percent Saturation:	66.3	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02RT (1.77 g/cc) (363 psf)
Lab ID:	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)
Date/Time sampled:	04/17/2019 1300

	As Received	Remolded
Test Date:	15-Aug-19	---
Field weight of sample* (g):	155.37	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	142.40	
Sample volume (cm^3):	80.24	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	9.1	
Volumetric Moisture Content (% vol):	16.2	
Dry bulk density (g/cm^3):	1.77	
Wet bulk density (g/cm^3):	1.94	
Calculated Porosity (% vol):	33.0	
Percent Saturation:	48.9	

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Albay-Yenney
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.74 g/cc) (413 psf)
Lab ID: HAT01-11.1904002-010 (1.74 g/cc) (413 psf)
Date/Time sampled: 04/17/2019 1415

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	157.98	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	139.87	
Sample volume (cm^3):	80.25	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.9	
Volumetric Moisture Content (% vol):	22.6	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	34.2	
Percent Saturation:	65.9	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.74 g/cc) (207 psf)
Lab ID: HAT01-11.1904002-010 (1.74 g/cc) (207 psf)
Date/Time sampled: 04/17/2019 1415

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	158.27	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	139.67	
Sample volume (cm^3):	80.28	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.3	
Volumetric Moisture Content (% vol):	23.2	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	34.3	
Percent Saturation:	67.5	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.73 g/cc) (100 psf)
Lab ID: HAT01-11.1904002-010 (1.73 g/cc) (100 psf)
Date/Time sampled: 04/17/2019 1415

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	156.93	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	138.55	
Sample volume (cm^3):	80.16	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.3	
Volumetric Moisture Content (% vol):	22.9	
Dry bulk density (g/cm^3):	1.73	
Wet bulk density (g/cm^3):	1.96	
Calculated Porosity (% vol):	34.8	
Percent Saturation:	65.9	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03RT (1.77 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-009 (1.77 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1415

	As Received	Remolded
Test Date:	14-Aug-19	---
Field weight of sample* (g):	157.31	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	142.28	
Sample volume (cm^3):	80.27	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.6	
Volumetric Moisture Content (% vol):	18.7	
Dry bulk density (g/cm^3):	1.77	
Wet bulk density (g/cm^3):	1.96	
Calculated Porosity (% vol):	33.1	
Percent Saturation:	56.5	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11RT (1.75 g/cc) (416 psf)
Lab ID: HAT01-11.1904002-003 (1.75 g/cc) (416 psf)
Date/Time sampled: 04/17/2019 1540

	As Received	Remolded
Test Date:	15-Aug-19	---
Field weight of sample* (g):	154.67	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	140.38	
Sample volume (cm^3):	80.27	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	10.2	
Volumetric Moisture Content (% vol):	17.8	
Dry bulk density (g/cm^3):	1.75	
Wet bulk density (g/cm^3):	1.93	
Calculated Porosity (% vol):	34.0	
Percent Saturation:	52.4	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (398 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (398 psf)
Date/Time sampled: 04/17/2019 1655

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	160.84	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	141.50	
Sample volume (cm^3):	80.28	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.7	
Volumetric Moisture Content (% vol):	24.1	
Dry bulk density (g/cm^3):	1.76	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	33.5	
Percent Saturation:	72.0	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01R (1.74 g/cc) (211 psf)
Lab ID:	HAT01-11.1904002-002 (1.74 g/cc) (211 psf)
Date/Time sampled:	04/17/2019 1655

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	158.06	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	139.67	
Sample volume (cm^3):	80.22	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.2	
Volumetric Moisture Content (% vol):	22.9	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	1.97	
Calculated Porosity (% vol):	34.3	
Percent Saturation:	66.8	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (107 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (107 psf)
Date/Time sampled: 04/17/2019 1655

	As Received	Remolded
Test Date:	22-Aug-19	---
Field weight of sample* (g):	160.38	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	141.31	
Sample volume (cm^3):	80.36	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	13.5	
Volumetric Moisture Content (% vol):	23.7	
Dry bulk density (g/cm^3):	1.76	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	33.6	
Percent Saturation:	70.5	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT (1.70 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-001 (1.70 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1655

	As Received	Remolded
Test Date:	13-Aug-19	---
Field weight of sample* (g):	153.50	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	136.20	
Sample volume (cm^3):	80.25	
Assumed particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	12.7	
Volumetric Moisture Content (% vol):	21.6	
Dry bulk density (g/cm^3):	1.70	
Wet bulk density (g/cm^3):	1.91	
Calculated Porosity (% vol):	36.0	
Percent Saturation:	60.0	

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	USCS Classification
A-1	HAT01-11.1904001-077	0.066	0.13	0.15	2.3	1.2	WS/H	Silty sand (SM)
A-2	HAT01-11.1904001-074	0.070	0.14	0.15	2.1	1.2	WS/H	Poorly-graded sand with silt (SP-SM)
A-3	HAT01-11.1904001-062	0.039	0.13	0.15	3.8	1.4	WS/H	Silty sand (SM)
ASM-1	HAT01-11.1904001-078	0.068	0.12	0.12	1.8	1.1	WS/H	Silty sand (SM)
ASM-2	HAT01-11.1904001-079	0.080	0.13	0.14	1.8	1.1	WS/H	Poorly-graded sand with silt (SP-SM)
L1-02B	HAT01-11.1904001-002	0.33	16	20	61	9.0	WS/H	Poorly-graded gravel with sand (GP)s
L1-03B	HAT01-11.1904001-003	5.1	16	20	3.9	1.2	WS/H	Poorly-graded gravel (GP)
L1-11B	HAT01-11.1904001-001	5.0	20	25	5.0	1.4	WS/H	Well-graded gravel (GW)
L2-01B	HAT01-11.1904001-004	12	24	27	2.3	1.2	WS/H	Poorly-graded gravel (GP)
L3-01RB	HAT01-11.1904001-065	0.0040	0.12	0.14	35	8.3	WS/H	Silty sand (SM)
L3-01RM	HAT01-11.1904001-053	0.018	0.13	0.16	8.9	2.9	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L3-01RT	HAT01-11.1904001-038	0.0064	0.13	0.15	23	7.4	WS/H	Silty sand (SM)
L3-02B	HAT01-11.1904001-006	1.2	25	28	23	9.6	WS/H	Poorly-graded gravel (GP)
L3-02RB	HAT01-11.1904001-066	0.043	0.13	0.16	3.7	1.4	WS/H	Silty sand (SM)
L3-02RM	HAT01-11.1904001-054	0.027	0.12	0.14	5.2	2.0	WS/H	Silty sand (SM)
L3-02RT	HAT01-11.1904001-039	0.012	0.12	0.14	12	3.7	WS/H	Silty sand (SM)
L3-03B	HAT01-11.1904001-007	0.15	13	17	113	15	WS/H	Classification by ASTM 2487 requires Atterberg test
L3-03RB	HAT01-11.1904001-067	0.015	0.13	0.15	10	3.6	WS/H	Silty sand (SM)
L3-03RM	HAT01-11.1904001-055	0.027	0.12	0.14	5.2	2.0	WS/H	Silty sand (SM)
L3-03RT	HAT01-11.1904001-040	0.013	0.12	0.14	11	3.9	WS/H	Silty sand (SM)
L3-11B	HAT01-11.1904001-005	7.8	18	20	2.6	1.1	WS/H	Poorly-graded gravel (GP)
L4-01B	HAT01-11.1904001-008	16	31	34	2.1	1.2	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L4-02B	HAT01-11.1904001-009	0.10	8.8	14	140	5.2	WS/H	Classification by ASTM 2487 requires Atterberg test
L4-03B	HAT01-11.1904001-010	0.13	13	20	154	8.9	WS/H	Classification by ASTM 2487 requires Atterberg test
L4-11B	HAT01-11.1904001-024	4.9	23	26	5.3	1.8	WS/H	Well-graded gravel (GW)
L5-01B	HAT01-11.1904001-011	13	27	30	2.3	1.1	WS/H	Poorly-graded gravel (GP)
L5-01C	HAT01-11.1904001-034	0.073	17	22	301	0.036	WS/H	Poorly-graded gravel with silt and sand (GP-GM)s
L5-01RB	HAT01-11.1904001-068	0.011	0.12	0.16	15	2.4	WS/H	Silty sand (SM)
L5-01RM	HAT01-11.1904001-056	0.018	0.12	0.14	7.8	2.5	WS/H	Silty sand (SM)
L5-01RT	HAT01-11.1904001-041	0.014	0.11	0.13	9.3	3.3	WS/H	Silty sand (SM)
L5-02B	HAT01-11.1904001-012	0.30	14	19	63	8.1	WS/H	Poorly-graded gravel with sand (GP)s
L5-02RB	HAT01-11.1904001-069	0.014	0.12	0.14	10	3.1	WS/H	Silty sand (SM)
L5-02RM	HAT01-11.1904001-057	0.0069	0.12	0.14	20	6.3	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-02RT	HAT01-11.1904001-042	0.014	0.11	0.13	9.3	3.3	WS/H	Silty sand (SM)
L5-03B	HAT01-11.1904001-013	0.55	17	22	40	6.3	WS/H	Poorly-graded gravel (GP)
L5-03RB	HAT01-11.1904001-070	0.0062	0.11	0.14	23	6.1	WS/H	Silty sand (SM)
L5-03RM	HAT01-11.1904001-058	0.025	0.12	0.14	5.6	2.3	WS/H	Silty sand (SM)
L5-03RT	HAT01-11.1904001-043	0.016	0.12	0.14	8.8	2.9	WS/H	Silty sand (SM)
L5-11B	HAT01-11.1904001-107	0.13	11	16	123	6.6	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-11RB	HAT01-11.1904001-108	0.0046	0.12	0.14	30	7.6	WS/H	Silty sand (SM)
L5-11RM	HAT01-11.1904001-109	0.012	0.12	0.14	12	4.2	WS/H	Silty sand (SM)
L5-11RT	HAT01-11.1904001-110	0.018	0.11	0.13	7.2	2.6	WS/H	Silty sand (SM)
L5-21B	HAT01-11.1904001-103	0.14	12	17	121	11	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-21RB	HAT01-11.1904001-104	0.0050	0.11	0.13	26	6.9	WS/H	Silty sand (SM)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-21RM	HAT01-11.1904001-105	0.013	0.12	0.14	11	3.7	WS/H	Silty sand (SM)
L5-21RT	HAT01-11.1904001-106	0.021	0.11	0.13	6.2	2.2	WS/H	Silty sand (SM)
L5-31B	HAT01-11.1904001-027	0.24	16	21	88	10	WS/H	Classification by ASTM 2487 requires Atterberg test
L5-31RB	HAT01-11.1904001-100	0.0049	0.12	0.14	29	8.4	WS/H	Silty sand (SM)
L5-31RM	HAT01-11.1904001-101	0.0090	0.12	0.14	16	5.0	WS/H	Silty sand (SM)
L5-31RT	HAT01-11.1904001-102	0.0096	0.11	0.13	14	4.9	WS/H	Silty sand (SM)
L5-41B	HAT01-11.1904001-095	8.1	23	27	3.3	1.0	WS/H	Poorly-graded gravel (GP)
L5-41RB	HAT01-11.1904001-096	0.0053	0.12	0.14	26	8.0	WS/H	Silty sand (SM)
L5-41RM	HAT01-11.1904001-097	0.015	0.12	0.14	9.3	3.5	WS/H	Silty sand (SM)
L5-41RT	HAT01-11.1904001-098	0.013	0.12	0.14	11	3.7	WS/H	Silty sand (SM)
L5-51B	HAT01-11.1904001-091	7.6	23	27	3.6	1.1	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L5-51RB	HAT01-11.1904001-092	0.011	0.12	0.14	13	4.2	WS/H	Silty sand (SM)
L5-51RM	HAT01-11.1904001-093	0.025	0.12	0.14	5.6	2.4	WS/H	Silty sand (SM)
L5-51RT	HAT01-11.1904001-094	0.015	0.12	0.14	9.3	3.0	WS/H	Silty sand (SM)
L5-61B	HAT01-11.1904001-087	13	24	27	2.1	1.1	WS	Poorly-graded gravel (GP)
L5-61RB	HAT01-11.1904001-088	0.019	0.12	0.14	7.4	2.4	WS/H	Silty sand (SM)
L5-61RM	HAT01-11.1904001-089	0.037	0.12	0.14	3.8	1.6	WS/H	Silty sand (SM)
L5-61RT	HAT01-11.1904001-090	0.025	0.11	0.13	5.2	1.9	WS/H	Silty sand (SM)
L5-01A-RB	HAT01-11.1904001-085	0.037	0.12	0.14	3.8	1.4	WS/H	Silty sand (SM)
L5-01A-RU	HAT01-11.1904001-086	0.012	0.12	0.14	12	3.7	WS/H	Silty sand (SM)
L6-01B	HAT01-11.1904001-014	0.23	13	18	78	11	WS/H	Classification by ASTM 2487 requires Atterberg test
L7-01B	HAT01-11.1904001-015	9.9	21	24	2.4	0.95	WS/H	Poorly-graded gravel (GP)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L7-02B	HAT01-11.1904001-016	0.24	14	18	75	14	WS/H	Poorly-graded gravel with sand (GP)s
L7-03B	HAT01-11.1904001-017	0.41	17	21	51	9.6	WS/H	Poorly-graded gravel (GP)
L7-11B	HAT01-11.1904001-018	0.25	18	21	84	16	WS/H	Poorly-graded gravel (GP)
L8-01RB	HAT01-11.1904001-071	0.0061	0.11	0.14	23	3.9	WS/H	Silty sand (SM)
L8-01RM	HAT01-11.1904001-059	0.011	0.12	0.14	13	4.7	WS/H	Silty sand (SM)
L8-01RT	HAT01-11.1904001-047	0.0084	0.12	0.14	17	5.0	WS/H	Silty sand (SM)
L8-02B	HAT01-11.1904001-019	2.5	17	20	8.0	2.4	WS/H	Well-graded gravel (GW)
L8-02RB	HAT01-11.1904001-072	0.0082	0.12	0.14	17	4.5	WS/H	Silty sand (SM)
L8-02RM	HAT01-11.1904001-060	0.020	0.13	0.14	7.0	2.6	WS/H	Silty sand (SM)
L8-02RT	HAT01-11.1904001-048	0.0059	0.12	0.14	24	7.0	WS/H	Silty sand (SM)
L8-03B	HAT01-11.1904001-020	5.2	24	27	5.2	1.6	WS/H	Well-graded gravel (GW)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L8-03RB	HAT01-11.1904001-073	0.0078	0.12	0.14	18	4.7	WS/H	Silty sand (SM)
L8-03RM	HAT01-11.1904001-061	0.0073	0.13	0.15	21	6.1	WS/H	Silty sand (SM)
L8-03RT	HAT01-11.1904001-049	0.020	0.13	0.14	7.0	2.9	WS/H	Silty sand (SM)
L9-01B	HAT01-11.1904001-021	0.41	14	19	46	8.2	WS/H	Poorly-graded gravel (GP)
L10-01B	HAT01-11.1904001-022	4.5	19	22	4.9	1.5	WS/H	Well-graded gravel (GW)
L10-02B	HAT01-11.1904001-023	0.74	18	22	30	5.9	WS/H	Poorly-graded gravel (GP)
L11-01B	HAT01-11.1904001-025	3.1	19	23	7.4	1.7	WS/H	Well-graded gravel (GW)
L11-02B	HAT01-11.1904001-026	6.3	23	26	4.1	1.6	WS/H	Well-graded gravel (GW)
L12-01B	HAT01-11.1904001-028	7.7	23	26	3.4	1.6	WS/H	Classification by ASTM 2487 requires Atterberg test
L13-01B	HAT01-11.1904001-029	3.4	22	26	7.6	1.9	WS/H	Well-graded gravel (GW)
L13-02B	HAT01-11.1904001-030	0.19	16	22	116	8.6	WS/H	Classification by ASTM 2487 requires Atterberg test

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Summary of Particle Size Characteristics (Continued)

Sample Number	Lab ID	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification
L13-02RB	HAT01-11.1904001-075	0.0033	0.061	0.10	30	2.4	WS/H	Sandy silt s(ML)
L13-02RM	HAT01-11.1904001-063	0.0036	0.066	0.11	31	2.3	WS/H	Sandy silt with gravel s(ML)g
L13-02RT	HAT01-11.1904001-051	0.0035	0.079	0.15	43	2.2	WS/H	Silty sand with gravel (SM)g
L-compW	HAT01-11.1904001-080	0.013	0.048	0.056	4.3	1.7	WS/H	Silt with sand (ML)s

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d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Percent Gravel, Sand, Silt and Clay*

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
A-1	HAT01-11.1904001-077	0.0	87.3	12.0	0.7
A-2	HAT01-11.1904001-074	0.5	88.3	9.5	1.7
A-3	HAT01-11.1904001-062	10.2	66.7	19.9	3.2
ASM-1	HAT01-11.1904001-078	0.0	87.0	11.0	2.0
ASM-2	HAT01-11.1904001-079	0.0	92.7	6.2	1.2
L1-02B	HAT01-11.1904001-002	79.2	16.4	3.4	1.1
L1-03B	HAT01-11.1904001-003	91.8	5.6	2.2	0.3
L1-11B	HAT01-11.1904001-001	90.7	6.1	2.6	0.6
L2-01B	HAT01-11.1904001-004	99.0	0.5	0.4	0.1
L3-01RB	HAT01-11.1904001-065	2.5	65.4	23.7	8.4
L3-01RM	HAT01-11.1904001-053	1.9	74.8	16.0	7.3
L3-01RT	HAT01-11.1904001-038	1.0	73.3	17.7	8.0
L3-02B	HAT01-11.1904001-006	87.4	8.9	3.0	0.7
L3-02RB	HAT01-11.1904001-066	2.0	78.5	13.5	6.0
L3-02RM	HAT01-11.1904001-054	1.0	76.3	15.5	7.2
L3-02RT	HAT01-11.1904001-039	1.3	71.3	20.3	7.1

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L3-03B	HAT01-11.1904001-007	75.4	18.3	5.2	1.1
L3-03RB	HAT01-11.1904001-067	1.6	75.0	16.8	6.6
L3-03RM	HAT01-11.1904001-055	0.7	75.9	16.1	7.3
L3-03RT	HAT01-11.1904001-040	1.5	73.4	17.9	7.2
L3-11B	HAT01-11.1904001-005	95.8	2.8	1.1	0.2
L4-01B	HAT01-11.1904001-008	98.9	0.7	0.4	0.1
L4-02B	HAT01-11.1904001-009	62.8	29.6	5.9	1.7
L4-03B	HAT01-11.1904001-010	70.3	23.1	4.8	1.8
L4-11B	HAT01-11.1904001-024	90.2	7.1	2.2	0.5
L5-01B	HAT01-11.1904001-011	98.3	1.2	0.4	0.1
L5-01C	HAT01-11.1904001-034	66.2	23.5	7.8	2.4
L5-01RB	HAT01-11.1904001-068	5.4	60.5	28.2	5.9
L5-01RM	HAT01-11.1904001-056	3.6	69.4	19.9	7.1
L5-01RT	HAT01-11.1904001-041	0.6	70.8	21.7	6.9
L5-02B	HAT01-11.1904001-012	77.7	17.7	3.6	0.9
L5-02RB	HAT01-11.1904001-069	0.7	71.1	20.7	7.4

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-02RM	HAT01-11.1904001-057	0.8	70.9	20.1	8.1
L5-02RT	HAT01-11.1904001-042	0.1	71.1	21.2	7.7
L5-03B	HAT01-11.1904001-013	81.2	14.5	3.4	0.9
L5-03RB	HAT01-11.1904001-070	2.0	67.5	22.8	7.7
L5-03RM	HAT01-11.1904001-058	0.5	76.8	15.3	7.4
L5-03RT	HAT01-11.1904001-043	0.4	72.8	19.6	7.2
L5-11B	HAT01-11.1904001-107	67.3	26.1	5.1	1.5
L5-11RB	HAT01-11.1904001-108	0.8	67.5	23.1	8.6
L5-11RM	HAT01-11.1904001-109	0.4	74.6	17.6	7.4
L5-11RT	HAT01-11.1904001-110	0.0	71.9	20.9	7.3
L5-21B	HAT01-11.1904001-103	71.6	22.3	4.8	1.2
L5-21RB	HAT01-11.1904001-104	0.7	65.8	24.8	8.6
L5-21RM	HAT01-11.1904001-105	0.7	73.4	18.0	7.9
L5-21RT	HAT01-11.1904001-106	0.4	71.4	21.4	6.9
L5-31B	HAT01-11.1904001-027	78.3	16.2	4.2	1.2
L5-31RB	HAT01-11.1904001-100	1.2	69.1	21.4	8.2

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-31RM	HAT01-11.1904001-101	0.6	72.0	19.3	8.0
L5-31RT	HAT01-11.1904001-102	0.5	71.7	20.2	7.6
L5-41B	HAT01-11.1904001-095	95.0	3.5	1.2	0.3
L5-41RB	HAT01-11.1904001-096	0.9	70.0	20.9	8.2
L5-41RM	HAT01-11.1904001-097	0.2	76.2	16.1	7.4
L5-41RT	HAT01-11.1904001-098	0.0	73.7	19.0	7.3
L5-51B	HAT01-11.1904001-091	94.7	4.0	1.0	0.3
L5-51RB	HAT01-11.1904001-092	0.5	72.5	19.3	7.7
L5-51RM	HAT01-11.1904001-093	0.0	79.5	13.3	7.1
L5-51RT	HAT01-11.1904001-094	0.5	72.6	19.7	7.1
L5-61B	HAT01-11.1904001-087	100.0	0.0	0.0	0.0
L5-61RB	HAT01-11.1904001-088	0.6	72.1	20.3	6.9
L5-61RM	HAT01-11.1904001-089	0.1	79.5	14.0	6.4
L5-61RT	HAT01-11.1904001-090	0.3	72.6	20.1	7.1
L5-01A-RB	HAT01-11.1904001-085	0.4	76.5	15.9	7.2
L5-01A-RU	HAT01-11.1904001-086	8.9	63.3	20.5	7.3

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L6-01B	HAT01-11.1904001-014	77.1	17.4	4.4	1.1
L7-01B	HAT01-11.1904001-015	97.1	1.9	0.8	0.2
L7-02B	HAT01-11.1904001-016	78.0	17.4	3.6	1.1
L7-03B	HAT01-11.1904001-017	81.7	14.6	3.0	0.7
L7-11B	HAT01-11.1904001-018	82.0	13.4	3.6	0.9
L8-01RB	HAT01-11.1904001-071	9.6	52.4	30.8	7.2
L8-01RM	HAT01-11.1904001-059	1.9	72.3	17.8	7.9
L8-01RT	HAT01-11.1904001-047	1.6	69.7	20.9	7.8
L8-02B	HAT01-11.1904001-019	87.4	9.8	2.3	0.5
L8-02RB	HAT01-11.1904001-072	3.1	65.8	23.5	7.6
L8-02RM	HAT01-11.1904001-060	1.7	73.3	19.0	6.1
L8-02RT	HAT01-11.1904001-048	0.9	69.6	21.0	8.4
L8-03B	HAT01-11.1904001-020	91.1	6.7	1.9	0.3
L8-03RB	HAT01-11.1904001-073	1.2	67.9	23.4	7.5
L8-03RM	HAT01-11.1904001-061	3.5	70.0	18.7	7.9
L8-03RT	HAT01-11.1904001-049	0.4	76.0	17.0	6.5

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Percent Gravel, Sand, Silt and Clay* (Continued)

Sample Number	Lab ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L9-01B	HAT01-11.1904001-021	81.8	13.3	4.1	0.8
L10-01B	HAT01-11.1904001-022	89.8	7.5	2.3	0.4
L10-02B	HAT01-11.1904001-023	82.8	13.3	3.2	0.6
L11-01B	HAT01-11.1904001-025	87.9	9.3	2.4	0.5
L11-02B	HAT01-11.1904001-026	92.5	6.0	1.0	0.4
L12-01B	HAT01-11.1904001-028	91.9	3.0	4.3	0.8
L13-01B	HAT01-11.1904001-029	88.5	8.2	2.7	0.5
L13-02B	HAT01-11.1904001-030	73.9	20.5	4.5	1.1
L13-02RB	HAT01-11.1904001-075	12.9	31.7	47.6	7.8
L13-02RM	HAT01-11.1904001-063	16.9	29.7	45.3	8.1
L13-02RT	HAT01-11.1904001-051	24.3	26.4	41.6	7.7
L-compW	HAT01-11.1904001-080	0.2	18.5	75.0	6.3

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*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-1
Lab ID: HAT01-11.1904001-077
Date/Time sampled: 04/16/2019 1330

Test Date: 31-May-19

Initial Dry Weight of Sample (g): 2175.48
Weight Passing #10 (g): 2174.90
Weight Retained #10 (g): 0.58
Weight of Hydrometer Sample (g): 105.58
Calculated Weight of Sieve Sample (g): 105.61

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	2175.48	100.00
	2"	50	0.00	0.00	2175.48	100.00
	1.5"	38.1	0.00	0.00	2175.48	100.00
	1"	25	0.00	0.00	2175.48	100.00
	3/4"	19.0	0.00	0.00	2175.48	100.00
	3/8"	9.5	0.00	0.00	2175.48	100.00
	4	4.75	0.58	0.58	2174.90	99.97
	10	2.00	0.00	0.58	2174.90	99.97
-10			(Based on calculated sieve wt.)			
	20	0.85	0.10	0.13	105.48	99.88
	40	0.425	0.36	0.49	105.12	99.54
	60	0.250	5.05	5.54	100.07	94.76
	100	0.150	35.47	41.01	64.60	61.17
	140	0.106	33.25	74.26	31.35	29.69
	200	0.075	17.92	92.18	13.43	12.72
	dry pan		4.76	96.94	8.67	
	wet pan			8.67	0.00	

d_{10} (mm): 0.066
d_{16} (mm): 0.080
d_{30} (mm): 0.11

d_{50} (mm): 0.13
d_{60} (mm): 0.15
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2.3
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-1
Lab ID: HAT01-11.1904001-077
Date/Time sampled: 04/16/2019 1330

Test Date: 29-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

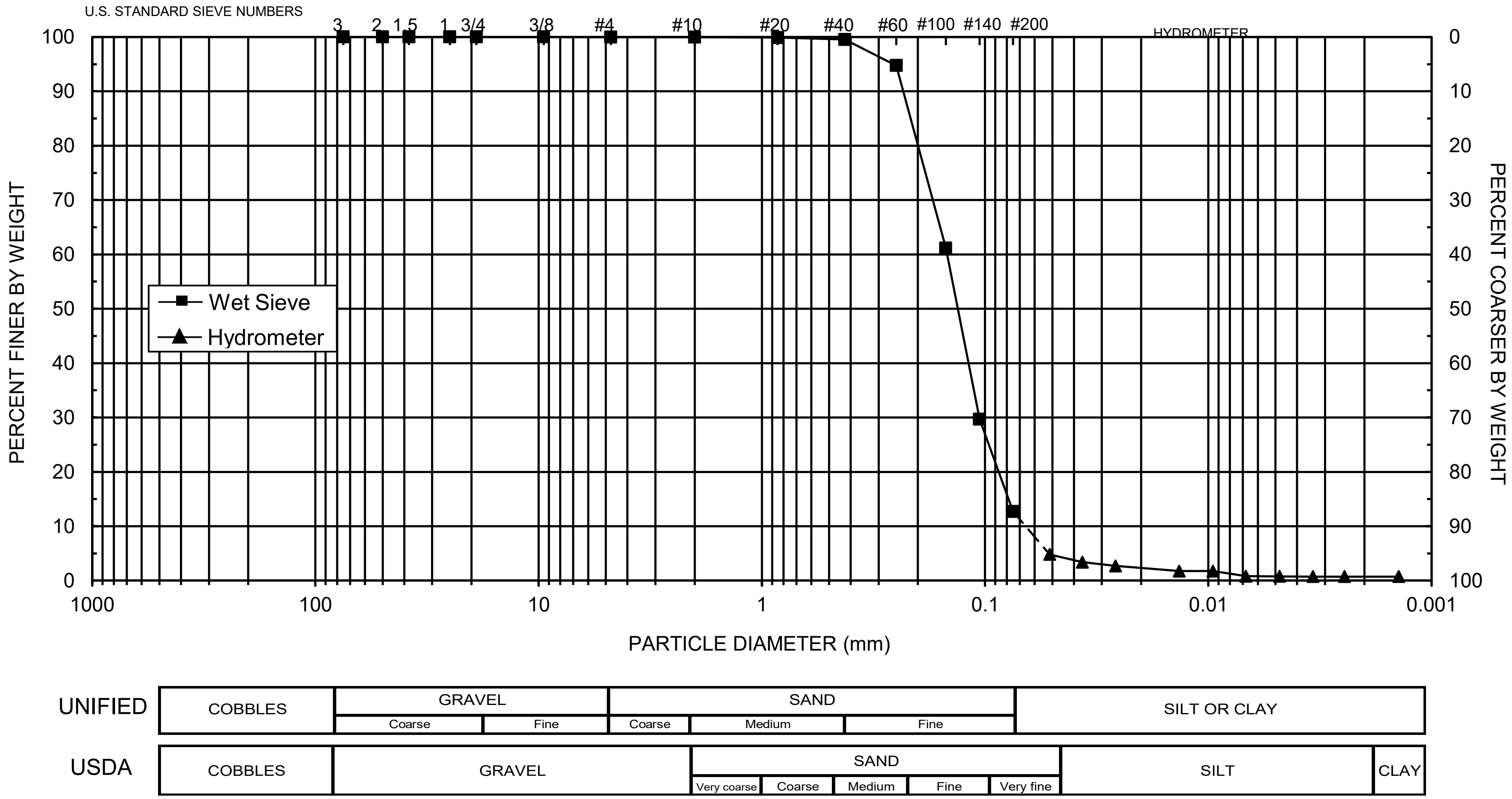
Initial Wt. (g): 105.58
Total Sample Wt. (g): 2175.48
Wt. Passing #10 (g): 2174.90

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	10.25	5.15	5.1	14	0.0513	5	4.8
	2	21.8	8.75	5.15	3.6	14	0.0366	3	3.4
	4	21.8	8.00	5.15	2.9	15	0.0260	3	2.7
	15	21.8	7.00	5.15	1.9	15	0.0135	2	1.7
	30	21.8	7.00	5.15	1.9	15	0.0095	2	1.7
	60	21.8	6.00	5.15	0.9	15	0.0068	1	0.8
	120	21.7	6.00	5.19	0.8	15	0.0048	1	0.8
	240	21.6	6.00	5.22	0.8	15	0.0034	1	0.7
	460	21.6	6.00	5.22	0.8	15	0.0025	1	0.7
30-May-19	1408	21.6	6.00	5.22	0.8	15	0.0014	1	0.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.066**	d_{30} = **0.11**	d_{50} = **0.13**	d_{60} = **0.15**	C_u = **2.3**	C_c = **1.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
A-1	**04/16/2019 1330**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-2
Lab ID: HAT01-11.1904001-074
Date/Time sampled: 04/16/2019 1335

Test Date: 30-May-19

Initial Dry Weight of Sample (g): 1984.74
Weight Passing #10 (g): 1971.70
Weight Retained #10 (g): 13.04
Weight of Hydrometer Sample (g): 107.54
Calculated Weight of Sieve Sample (g): 108.25

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1984.74	100.00
	2"	50	0.00	0.00	1984.74	100.00
	1.5"	38.1	0.00	0.00	1984.74	100.00
	1"	25	0.00	0.00	1984.74	100.00
	3/4"	19.0	0.00	0.00	1984.74	100.00
	3/8"	9.5	4.65	4.65	1980.09	99.77
	4	4.75	5.24	9.89	1974.85	99.50
	10	2.00	3.15	13.04	1971.70	99.34
-10			(Based on calculated sieve wt.)			
	20	0.85	0.12	0.83	107.42	99.23
	40	0.425	0.76	1.59	106.66	98.53
	60	0.250	6.19	7.78	100.47	92.81
	100	0.150	37.36	45.14	63.11	58.30
	140	0.106	33.78	78.92	29.33	27.09
	200	0.075	17.23	96.15	12.10	11.18
	dry pan		4.29	100.44	7.81	
	wet pan			7.81	0.00	

d_{10} (mm): 0.070
d_{16} (mm): 0.083
d_{30} (mm): 0.11
d_{50} (mm): 0.14
d_{60} (mm): 0.15
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.14
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2.1
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.15

Classification of fines (visual method): ML

USCS Soil Classification: Poorly-graded sand with silt (SP-SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

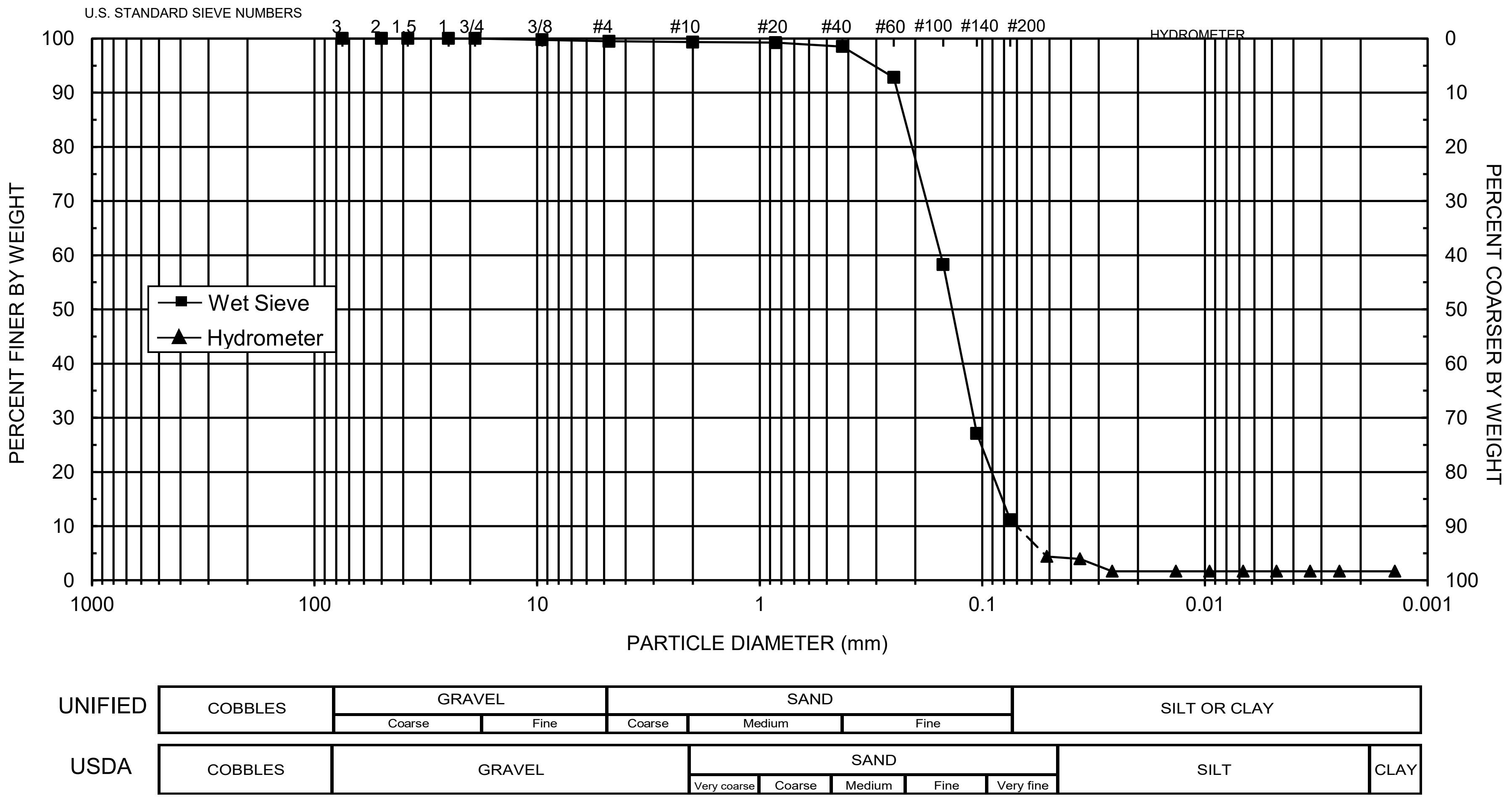
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	A-2	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-074	*Assumed particle density:*	2.65
Date/Time sampled:	04/16/2019 1335	*Initial Wt. (g):*	107.54
Test Date:	28-May-19	*Total Sample Wt. (g):*	1984.74
Start Time:	9:48	*Wt. Passing #10 (g):*	1971.70

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	10.00	5.22	4.8	14	0.0513	4	4.4
	2	21.6	9.50	5.22	4.3	14	0.0364	4	4.0
	4	21.7	7.00	5.19	1.8	15	0.0261	2	1.7
	15	21.7	7.00	5.19	1.8	15	0.0135	2	1.7
	30	21.7	7.00	5.19	1.8	15	0.0095	2	1.7
	60	21.7	7.00	5.19	1.8	15	0.0067	2	1.7
	120	21.7	7.00	5.19	1.8	15	0.0048	2	1.7
	240	21.7	7.00	5.19	1.8	15	0.0034	2	1.7
	440	21.7	7.00	5.19	1.8	15	0.0025	2	1.7
29-May-19	1388	21.7	7.00	5.19	1.8	15	0.0014	2	1.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.070**	d_{30} = **0.11**	d_{50} = **0.14**	d_{60} = **0.15**	C_u = **2.1**	C_c = **1.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
A-2	**04/16/2019 1335**	**Poorly-graded sand with silt (SP-SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-3
Lab ID: HAT01-11.1904001-062
Date/Time sampled: 04/16/2019 1350

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1949.20
Weight Passing #10 (g): 1727.02
Weight Retained #10 (g): 222.18
Weight of Hydrometer Sample (g): 89.50
Calculated Weight of Sieve Sample (g): 101.01

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1949.20	100.00
	2"	50	0.00	0.00	1949.20	100.00
	1.5"	38.1	98.24	98.24	1850.96	94.96
	1"	25	42.41	140.65	1808.55	92.78
	3/4"	19.0	0.00	140.65	1808.55	92.78
	3/8"	9.5	31.07	171.72	1777.48	91.19
	4	4.75	26.94	198.66	1750.54	89.81
	10	2.00	23.52	222.18	1727.02	88.60
-10			(Based on calculated sieve wt.)			
	20	0.85	0.72	12.23	88.78	87.89
	40	0.425	1.25	13.48	87.53	86.65
	60	0.250	4.30	17.78	83.23	82.39
	100	0.150	23.45	41.23	59.78	59.18
	140	0.106	22.90	64.13	36.88	36.51
	200	0.075	13.54	77.67	23.34	23.11
	dry pan		1.97	79.64	21.37	
	wet pan			21.37	0.00	

d_{10} (mm): 0.039
d_{16} (mm): 0.056
d_{30} (mm): 0.090
d_{50} (mm): 0.13
d_{60} (mm): 0.15
d_{84} (mm): 0.31

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.17

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-3
Lab ID: HAT01-11.1904001-062
Date/Time sampled: 04/16/2019 1350

Test Date: 17-May-19
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

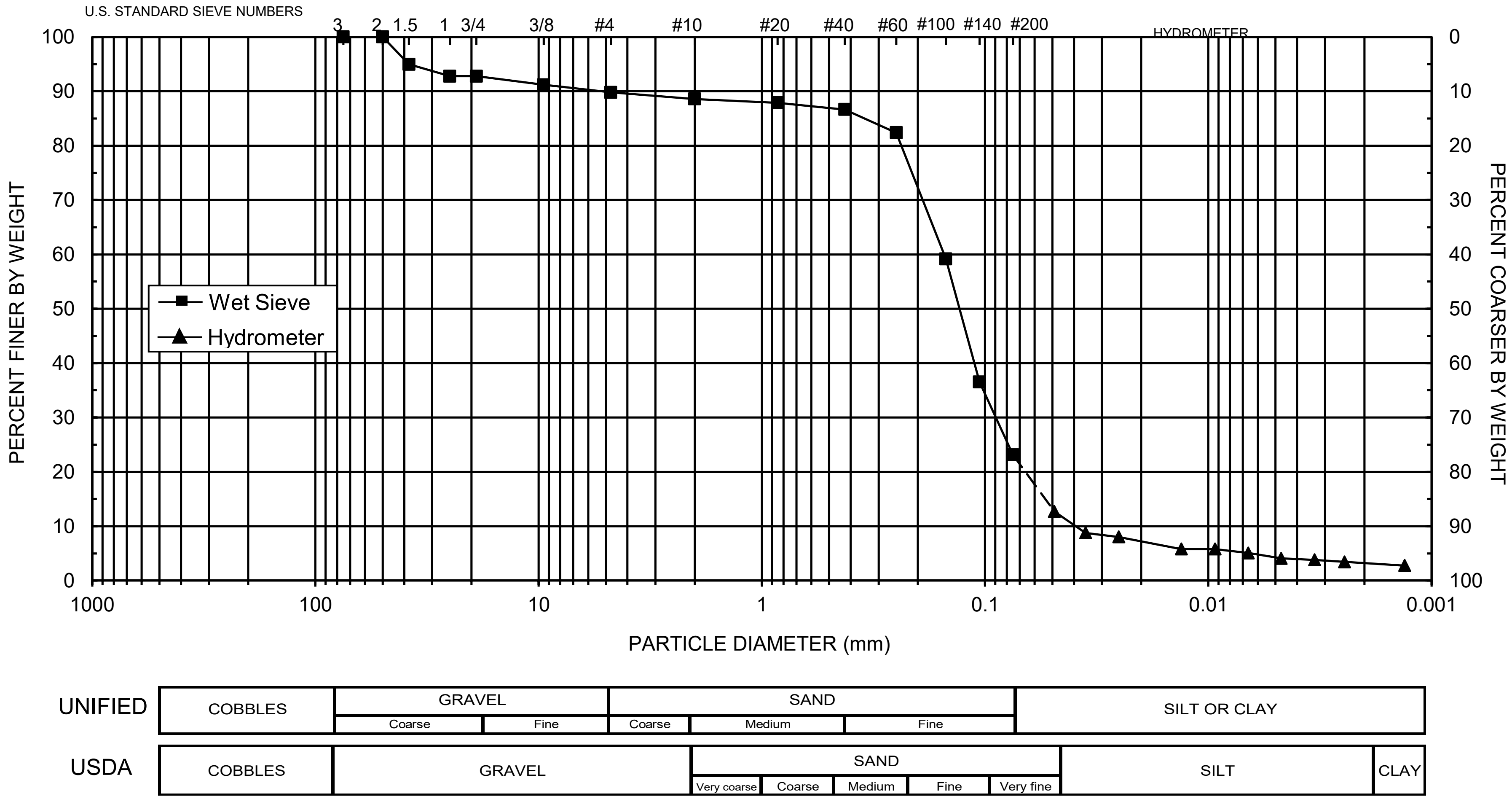
Initial Wt. (g)*:* 89.50
Total Sample Wt. (g)*:* 1949.20
Wt. Passing #10 (g)*:* 1727.02

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
17-May-19	1	21.9	18.00	5.11	12.9	13	0.0489	14	12.7
	2	21.9	14.00	5.11	8.9	14	0.0355	10	8.8
	4	21.9	13.25	5.11	8.1	14	0.0252	9	8.0
	15	21.9	11.00	5.11	5.9	14	0.0132	7	5.8
	30	21.9	11.00	5.11	5.9	14	0.0093	7	5.8
	60	21.9	10.25	5.11	5.1	14	0.0066	6	5.1
	120	21.9	9.25	5.11	4.1	14	0.0047	5	4.1
	240	21.8	9.00	5.15	3.9	14	0.0033	4	3.8
	446	21.5	8.75	5.26	3.5	14	0.0024	4	3.4
18-May-19	1551	21.7	8.00	5.19	2.8	15	0.0013	3	2.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.039**	d_{30} = **0.090**	d_{50} = **0.13**	d_{60} = **0.15**	C_u = **3.8**	C_c = **1.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
A-3	**04/16/2019 1350**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-1
Lab ID: HAT01-11.1904001-078
Date/Time sampled: 04/16/2019 830
Test Date: 30-May-19

Initial Dry Weight of Sample (g): 1133.35
Weight Passing #10 (g): 1133.24
Weight Retained #10 (g): 0.11
Weight of Hydrometer Sample (g): 89.29
Calculated Weight of Sieve Sample (g): 89.30

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1133.35	100.00
	2"	50	0.00	0.00	1133.35	100.00
	1.5"	38.1	0.00	0.00	1133.35	100.00
	1"	25	0.00	0.00	1133.35	100.00
	3/4"	19.0	0.00	0.00	1133.35	100.00
	3/8"	9.5	0.00	0.00	1133.35	100.00
	4	4.75	0.11	0.11	1133.24	99.99
	10	2.00	0.00	0.11	1133.24	99.99
-10			(Based on calculated sieve wt.)			
	20	0.85	0.03	0.04	89.26	99.96
	40	0.425	0.02	0.06	89.24	99.93
	60	0.250	0.26	0.32	88.98	99.64
	100	0.150	12.65	12.97	76.33	85.48
	140	0.106	42.95	55.92	33.38	37.38
	200	0.075	21.77	77.69	11.61	13.00
	dry pan		5.03	82.72	6.58	
	wet pan			6.58	0.00	

d_{10} (mm): 0.068
d_{16} (mm): 0.078
d_{30} (mm): 0.095
d_{50} (mm): 0.12
d_{60} (mm): 0.12
d_{84} (mm): 0.15

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 1.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.1
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

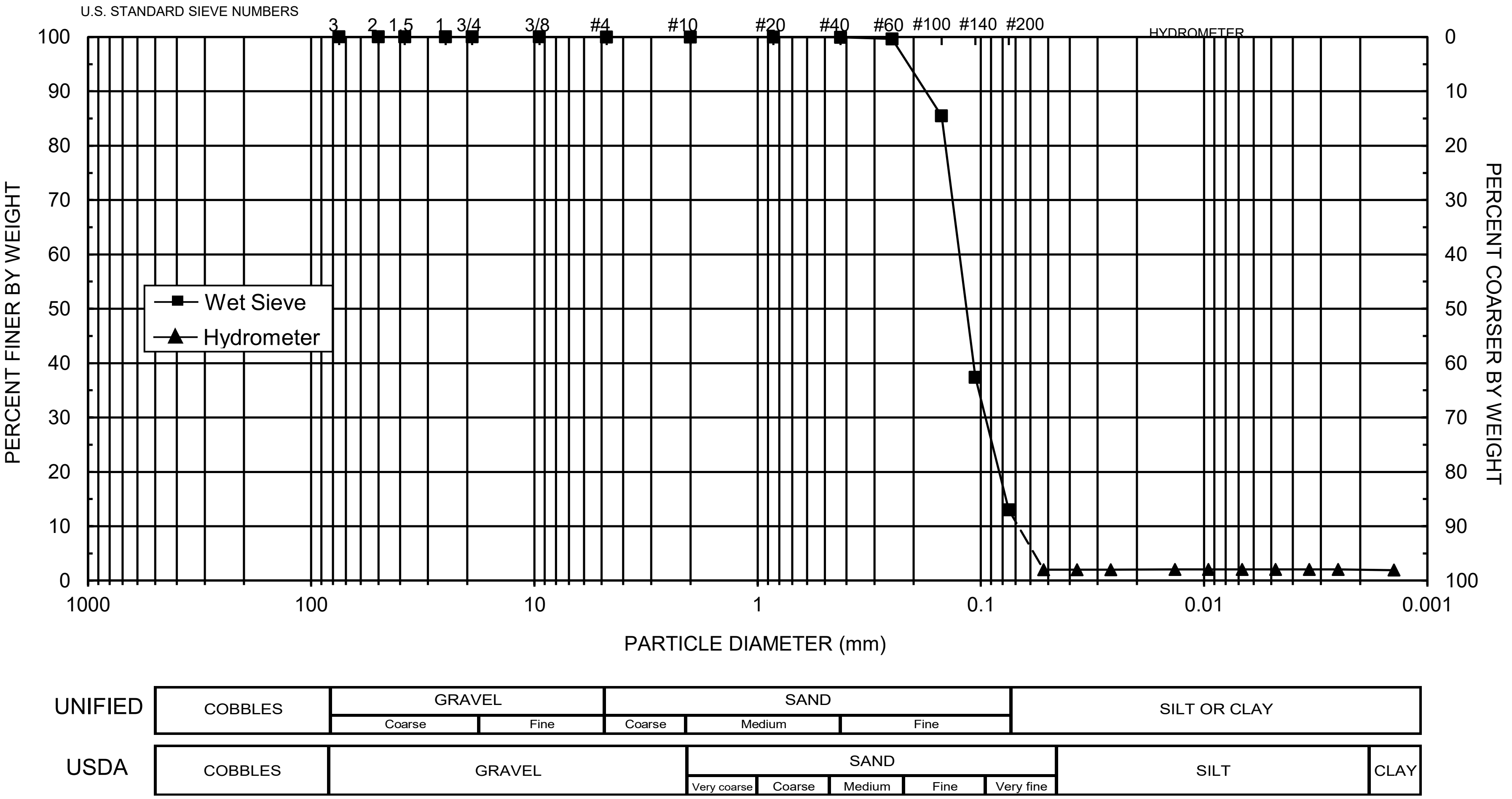
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	ASM-1	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-078	*Assumed particle density:*	2.65
Date/Time sampled:	04/16/2019 830	*Initial Wt. (g):*	89.29
Test Date:	28-May-19	*Total Sample Wt. (g):*	1133.35
Start Time:	9:54	*Wt. Passing #10 (g):*	1133.24

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	7.00	5.22	1.8	15	0.0523	2	2.0
	2	21.6	7.00	5.22	1.8	15	0.0370	2	2.0
	4	21.6	7.00	5.22	1.8	15	0.0262	2	2.0
	15	21.7	7.00	5.19	1.8	15	0.0135	2	2.0
	30	21.7	7.00	5.19	1.8	15	0.0096	2	2.0
	60	21.7	7.00	5.19	1.8	15	0.0068	2	2.0
	120	21.7	7.00	5.19	1.8	15	0.0048	2	2.0
	240	21.7	7.00	5.19	1.8	15	0.0034	2	2.0
	435	21.7	7.00	5.19	1.8	15	0.0025	2	2.0
29-May-19	1383	21.7	6.90	5.19	1.7	15	0.0014	2	1.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.068**	d_{30} = **0.095**	d_{50} = **0.12**	d_{60} = **0.12**	C_u = **1.8**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
ASM-1	**04/16/2019 830**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-2
Lab ID: HAT01-11.1904001-079
Date/Time sampled: 04/16/2019 915

Test Date: 31-May-19

Initial Dry Weight of Sample (g): 1594.61
Weight Passing #10 (g): 1594.61
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 101.16
Calculated Weight of Sieve Sample (g): 101.16

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1594.61	100.00
	2"	50	0.00	0.00	1594.61	100.00
	1.5"	38.1	0.00	0.00	1594.61	100.00
	1"	25	0.00	0.00	1594.61	100.00
	3/4"	19.0	0.00	0.00	1594.61	100.00
	3/8"	9.5	0.00	0.00	1594.61	100.00
	4	4.75	0.00	0.00	1594.61	100.00
	10	2.00	0.00	0.00	1594.61	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	0.00	101.16	100.00
	40	0.425	0.00	0.00	101.16	100.00
	60	0.250	0.15	0.15	101.01	99.85
	100	0.150	30.17	30.32	70.84	70.03
	140	0.106	48.55	78.87	22.29	22.03
	200	0.075	14.86	93.73	7.43	7.34
	dry pan		2.89	96.62	4.54	
	wet pan			4.54	0.00	

d_{10} (mm): 0.080
d_{16} (mm): 0.092
d_{30} (mm): 0.11

d_{50} (mm): 0.13
d_{60} (mm): 0.14
d_{84} (mm): 0.19

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 1.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.1
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Poorly-graded sand with silt (SP-SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-2
Lab ID: HAT01-11.1904001-079
Date/Time sampled: 04/16/2019 915

Test Date: 29-May-19
Start Time: 9:30

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

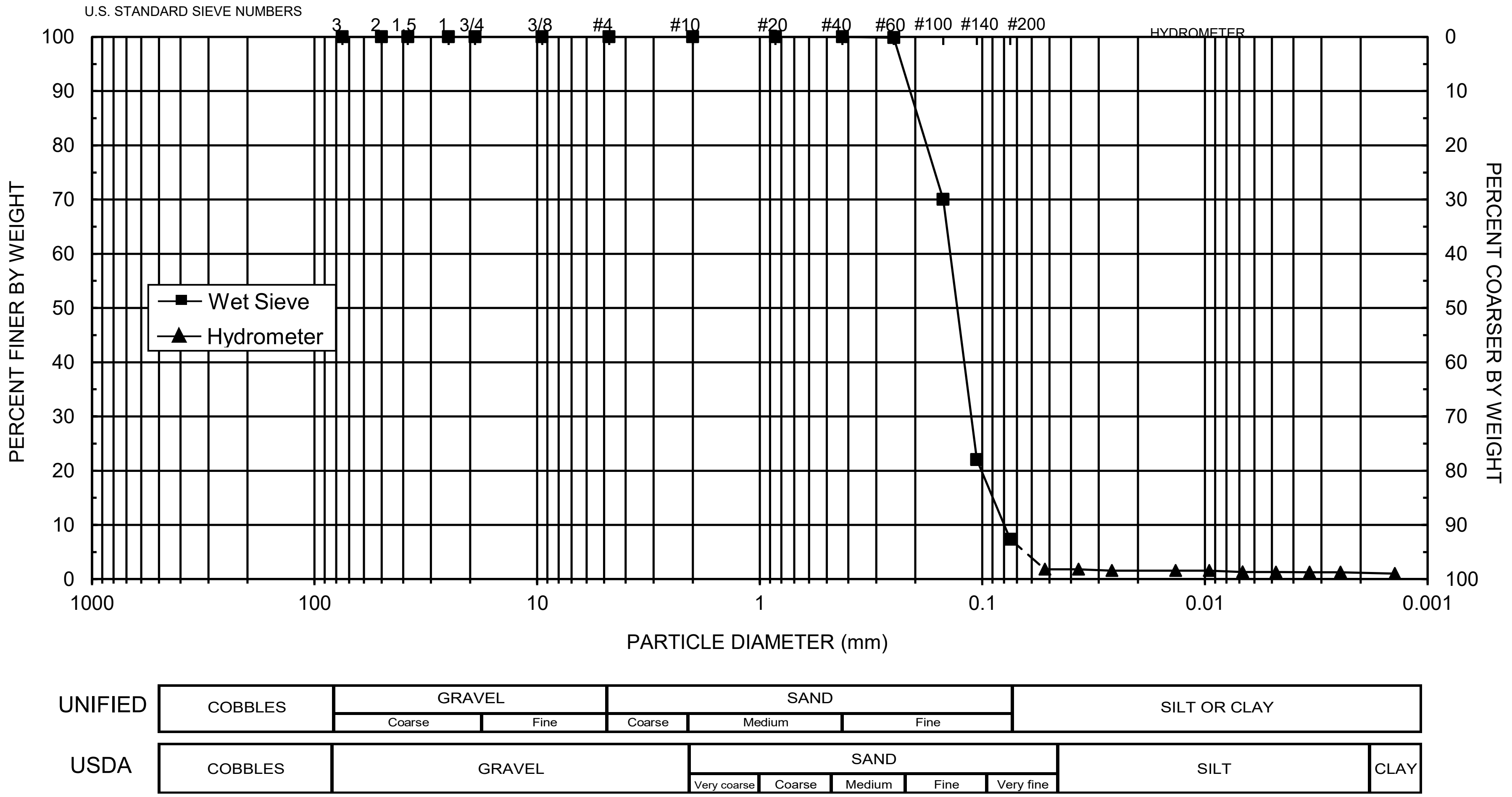
Initial Wt. (g)*:* 101.16
Total Sample Wt. (g)*:* 1594.61
Wt. Passing #10 (g)*:* 1594.61

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	7.00	5.15	1.9	15	0.0523	2	1.8
	2	21.8	7.00	5.15	1.9	15	0.0370	2	1.8
	4	21.8	6.75	5.15	1.6	15	0.0262	2	1.6
	15	21.8	6.75	5.15	1.6	15	0.0135	2	1.6
	30	21.8	6.75	5.15	1.6	15	0.0096	2	1.6
	60	21.8	6.50	5.15	1.4	15	0.0068	1	1.3
	120	21.7	6.50	5.19	1.3	15	0.0048	1	1.3
	240	21.6	6.50	5.22	1.3	15	0.0034	1	1.3
	455	21.6	6.50	5.22	1.3	15	0.0025	1	1.3
30-May-19	1403	21.6	6.25	5.22	1.0	15	0.0014	1	1.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.080**	d_{30} = **0.11**	d_{50} = **0.13**	d_{60} = **0.14**	C_u = **1.8**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
ASM-2	**04/16/2019 915**	**Poorly-graded sand with silt (SP-SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	79760.40
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	11334.76
Sample Number:	L1-02B	*Weight Retained #10 (g):*	68425.65
Lab ID:	HAT01-11.1904001-002	*Weight of Hydrometer Sample (g):*	74.55
Date/Time sampled:	04/10/2019 850	*Calculated Weight of Sieve Sample (g):*	524.59
Test Date:	15-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	79760.40	100.00
	2"	50	2375.86	2375.86	77384.54	97.02
	1.5"	38.1	5380.23	7756.09	72004.31	90.28
	1"	25	14912.10	22668.19	57092.21	71.58
	3/4"	19.0	12075.68	34743.87	45016.53	56.44
	3/8"	9.5	17845.20	52589.07	27171.34	34.07
	4	4.75	10562.94	63152.01	16608.39	20.82
	10	2.00	5273.64	68425.65	11334.76	14.21
-10			(Based on calculated sieve wt.)			
	20	0.85	7.23	457.27	67.32	12.83
	40	0.425	10.00	467.27	57.32	10.93
	60	0.250	10.19	477.46	47.13	8.98
	100	0.150	8.15	485.61	38.98	7.43
	140	0.106	8.87	494.48	30.11	5.74
	200	0.075	6.71	501.19	23.40	4.46
	dry pan		0.54	501.73	22.86	
	wet pan			22.86	0.00	

d_{10} (mm):	0.33	d_{50} (mm):	16
d_{16} (mm):	2.5	d_{60} (mm):	20
d_{30} (mm):	7.7	d_{84} (mm):	33

Median Particle Diameter --d_{50} (mm): 16

Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 61

Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 9.0

Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 17

USCS Soil Classification: Poorly-graded gravel with sand (GP)

Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

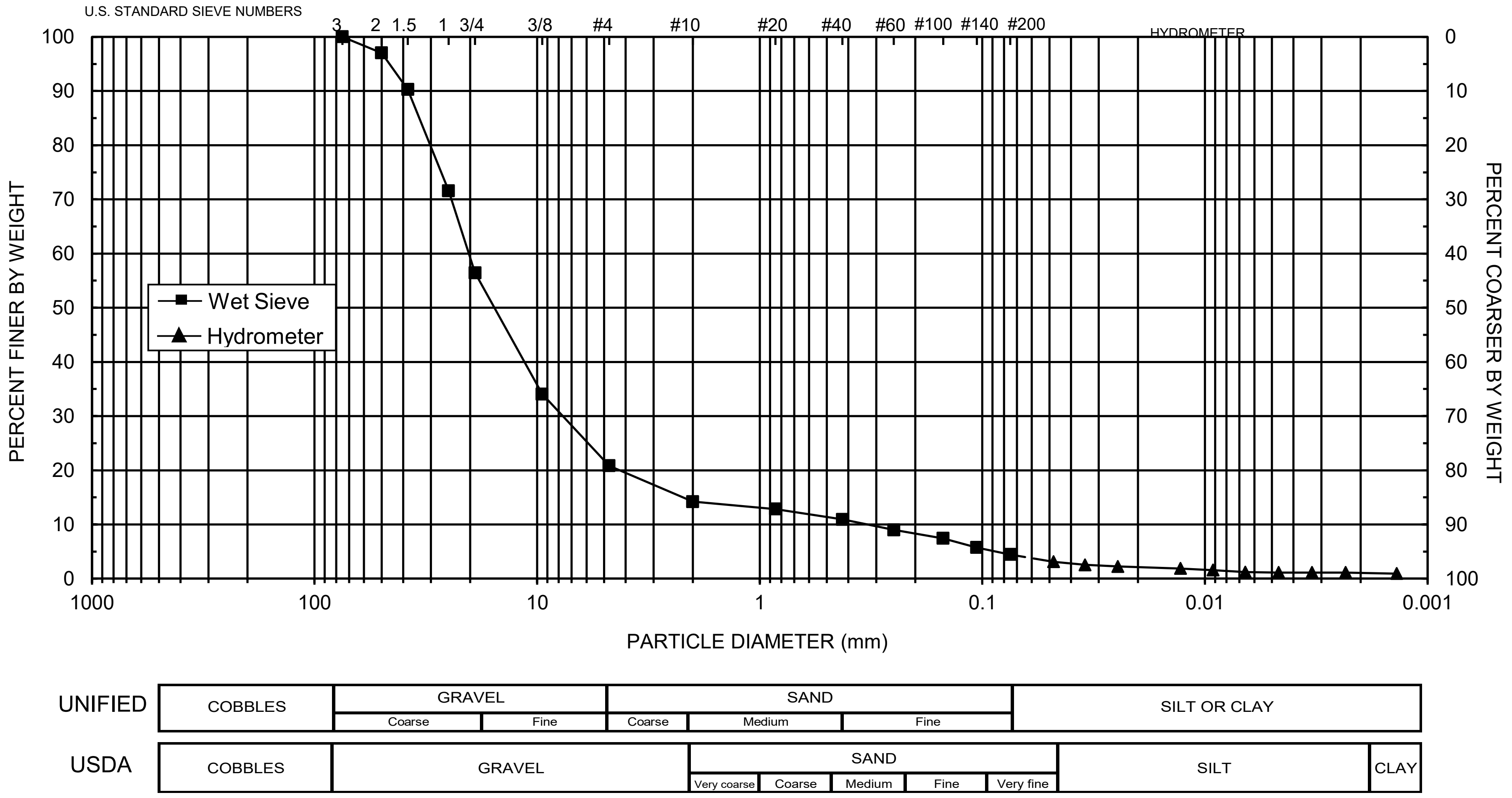
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L1-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-002	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 850	*Initial Wt. (g):*	74.55
Test Date:	13-May-19	*Total Sample Wt. (g):*	79760.40
Start Time:	9:00	*Wt. Passing #10 (g):*	11334.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	21.50	5.19	16.3	12	0.0478	22	3.1
	2	21.7	18.50	5.19	13.3	13	0.0345	18	2.5
	4	21.7	17.00	5.19	11.8	13	0.0246	16	2.3
	15	21.7	15.00	5.19	9.8	13	0.0129	13	1.9
	30	21.7	13.50	5.19	8.3	14	0.0092	11	1.6
	60	21.7	11.50	5.19	6.3	14	0.0066	8	1.2
	120	21.9	11.00	5.11	5.9	14	0.0047	8	1.1
	240	21.9	11.00	5.11	5.9	14	0.0033	8	1.1
	480	21.9	11.00	5.11	5.9	14	0.0023	8	1.1
14-May-19	1402	21.9	10.00	5.11	4.9	14	0.0014	7	0.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.33**	d_{30} = **7.7**	d_{50} = **16**	d_{60} = **20**	C_u = **61**	C_c = **9.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L1-02B	**04/10/2019 850**	**Poorly-graded gravel with sand (GP)s**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-03B
Lab ID: HAT01-11.1904001-003
Date/Time sampled: 04/10/2019 900

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 73310.22
Weight Passing #10 (g): 3812.35
Weight Retained #10 (g): 69497.87
Weight of Hydrometer Sample (g): 98.58
Calculated Weight of Sieve Sample (g): 1895.66

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	73310.22	100.00
	2"	50	0.00	0.00	73310.22	100.00
	1.5"	38.1	4610.49	4610.49	68699.73	93.71
	1"	25	17726.50	22336.99	50973.23	69.53
	3/4"	19.0	8368.67	30705.66	42604.56	58.12
	3/8"	9.5	24983.95	55689.61	17620.61	24.04
	4	4.75	11645.01	67334.61	5975.60	8.15
	10	2.00	2163.25	69497.87	3812.35	5.20
-10			(Based on calculated sieve wt.)			
	20	0.85	7.84	1804.92	90.74	4.79
	40	0.425	6.91	1811.83	83.83	4.42
	60	0.250	8.12	1819.95	75.71	3.99
	100	0.150	8.35	1828.30	67.36	3.55
	140	0.106	9.65	1837.95	57.71	3.04
	200	0.075	9.79	1847.74	47.92	2.53
	dry pan		2.08	1849.82	45.84	
	wet pan			45.84	0.00	

d_{10} (mm): 5.1
d_{16} (mm): 6.7
d_{30} (mm): 11
d_{50} (mm): 16
d_{60} (mm): 20
d_{84} (mm): 32

Median Particle Diameter --d_{50} (mm): 16
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 3.9
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.2
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 18

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-03B
Lab ID: HAT01-11.1904001-003
Date/Time sampled: 04/10/2019 900

Test Date: 14-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

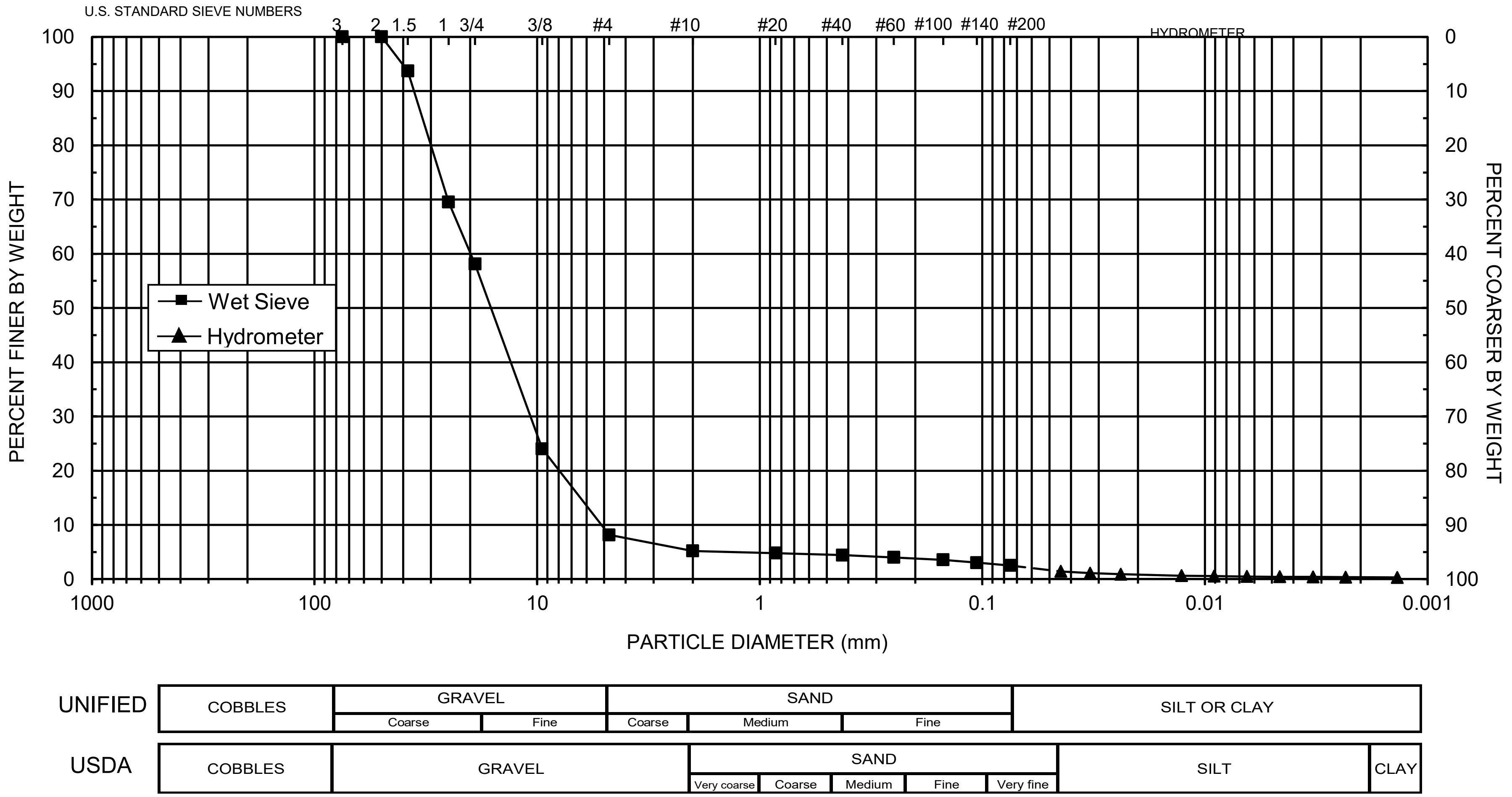
Initial Wt. (g)*:* 98.58
Total Sample Wt. (g)*:* 73310.22
Wt. Passing #10 (g)*:* 3812.35

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	32.00	5.08	26.9	11	0.0443	27	1.4
	2	22.0	26.00	5.08	20.9	12	0.0328	21	1.1
	4	22.0	22.00	5.08	16.9	12	0.0238	17	0.9
	15	22.0	17.00	5.08	11.9	13	0.0127	12	0.6
	30	22.0	15.50	5.08	10.4	13	0.0091	11	0.5
	60	21.9	14.00	5.11	8.9	14	0.0065	9	0.5
	120	21.8	13.25	5.15	8.1	14	0.0046	8	0.4
	240	21.6	13.00	5.22	7.8	14	0.0033	8	0.4
	476	21.6	12.00	5.22	6.8	14	0.0023	7	0.4
15-May-19	1396	21.8	11.00	5.15	5.9	14	0.0014	6	0.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **5.1**	d_{30} = **11**	d_{50} = **16**	d_{60} = **20**	C_u = **3.9**	C_c = **1.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L1-03B	**04/10/2019 900**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L1-11B
Lab ID:	HAT01-11.1904001-001
Date/Time sampled:	04/10/2019 1045
Test Date:	16-May-19

Initial Dry Weight of Sample (g):	78275.61
Weight Passing #10 (g):	5692.71
Weight Retained #10 (g):	72582.90
Weight of Hydrometer Sample (g):	85.23
Calculated Weight of Sieve Sample (g):	1171.93
Shape:	Rounded
Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	78275.61	100.00
	2"	50	0.00	0.00	78275.61	100.00
	1.5"	38.1	7703.49	7703.49	70572.12	90.16
	1"	25	23616.76	31320.25	46955.36	59.99
	3/4"	19.0	10486.99	41807.24	36468.37	46.59
	3/8"	9.5	22754.78	64562.02	13713.59	17.52
	4	4.75	6423.79	70985.81	7289.80	9.31
	10	2.00	1597.09	72582.90	5692.71	7.27
-10			(Based on calculated sieve wt.)			
	20	0.85	4.23	1090.93	81.00	6.91
	40	0.425	5.28	1096.21	75.72	6.46
	60	0.250	8.43	1104.64	67.29	5.74
	100	0.150	10.92	1115.56	56.37	4.81
	140	0.106	10.32	1125.88	46.05	3.93
	200	0.075	8.95	1134.83	37.10	3.17
	dry pan		1.08	1135.91	36.02	
	wet pan			36.02	0.00	

d_{10} (mm):	5.0	d_{50} (mm):	20
d_{16} (mm):	8.4	d_{60} (mm):	25
d_{30} (mm):	13	d_{84} (mm):	35

Median Particle Diameter --d_{50} (mm):	20
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm):	5.0
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm):	1.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm):	21

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L1-11B
Lab ID: HAT01-11.1904001-001
Date/Time sampled: 04/10/2019 1045

Test Date: 14-May-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

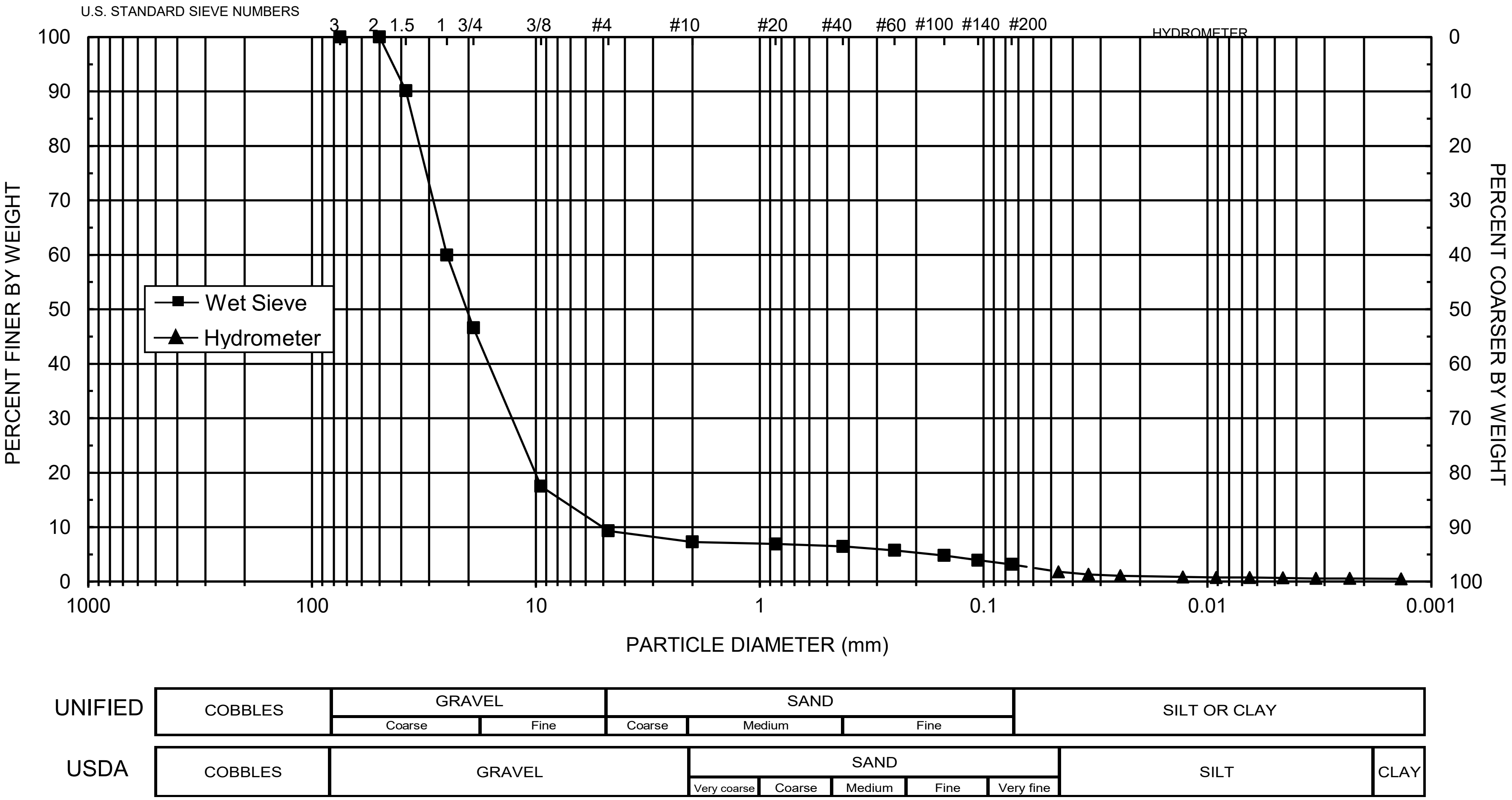
Initial Wt. (g)*:* 85.23
Total Sample Wt. (g)*:* 78275.61
Wt. Passing #10 (g)*:* 5692.71

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	26.00	5.08	20.9	12	0.0463	25	1.8
	2	22.0	20.50	5.08	15.4	12	0.0340	18	1.3
	4	22.0	17.75	5.08	12.7	13	0.0245	15	1.1
	15	22.0	15.00	5.08	9.9	13	0.0129	12	0.8
	30	21.9	14.00	5.11	8.9	14	0.0091	10	0.8
	60	21.9	14.00	5.11	8.9	14	0.0065	10	0.8
	120	21.8	13.00	5.15	7.9	14	0.0046	9	0.7
	240	21.6	12.00	5.22	6.8	14	0.0033	8	0.6
	480	21.6	12.00	5.22	6.8	14	0.0023	8	0.6
15-May-19	1402	21.8	11.00	5.15	5.9	14	0.0014	7	0.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **5.0**	d_{30} = **13**	d_{50} = **20**	d_{60} = **25**	C_u = **5.0**	C_c = **1.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L1-11B	**04/10/2019 1045**	**Well-graded gravel (GW)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L2-01B
Lab ID: HAT01-11.1904001-004
Date/Time sampled: 04/10/2019 1130

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 71259.95
Weight Passing #10 (g): 641.41
Weight Retained #10 (g): 70618.54
Weight of Hydrometer Sample (g): 52.32
Calculated Weight of Sieve Sample (g): 5812.65

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	71259.95	100.00
	2"	50	240.80	240.80	71019.15	99.66
	1.5"	38.1	9151.27	9392.07	61867.88	86.82
	1"	25	24400.00	33792.07	37467.88	52.58
	3/4"	19.0	21414.92	55206.99	16052.96	22.53
	3/8"	9.5	14046.42	69253.41	2006.54	2.82
	4	4.75	1291.56	70544.97	714.98	1.00
	10	2.00	73.57	70618.54	641.41	0.90
-10			(Based on calculated sieve wt.)			
	20	0.85	0.92	5761.25	51.40	0.88
	40	0.425	0.94	5762.19	50.46	0.87
	60	0.250	2.04	5764.23	48.42	0.83
	100	0.150	4.92	5769.15	43.50	0.75
	140	0.106	5.69	5774.84	37.81	0.65
	200	0.075	6.32	5781.16	31.49	0.54
	dry pan		0.81	5781.97	30.68	
	wet pan			30.68	0.00	

d_{10} (mm): 12
d_{16} (mm): 15
d_{30} (mm): 20
d_{50} (mm): 24
d_{60} (mm): 27
d_{84} (mm): 37

Median Particle Diameter --d_{50} (mm): 24
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 2.3
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.2
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 25

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L2-01B
Lab ID: HAT01-11.1904001-004
Date/Time sampled: 04/10/2019 1130

Test Date: 14-May-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

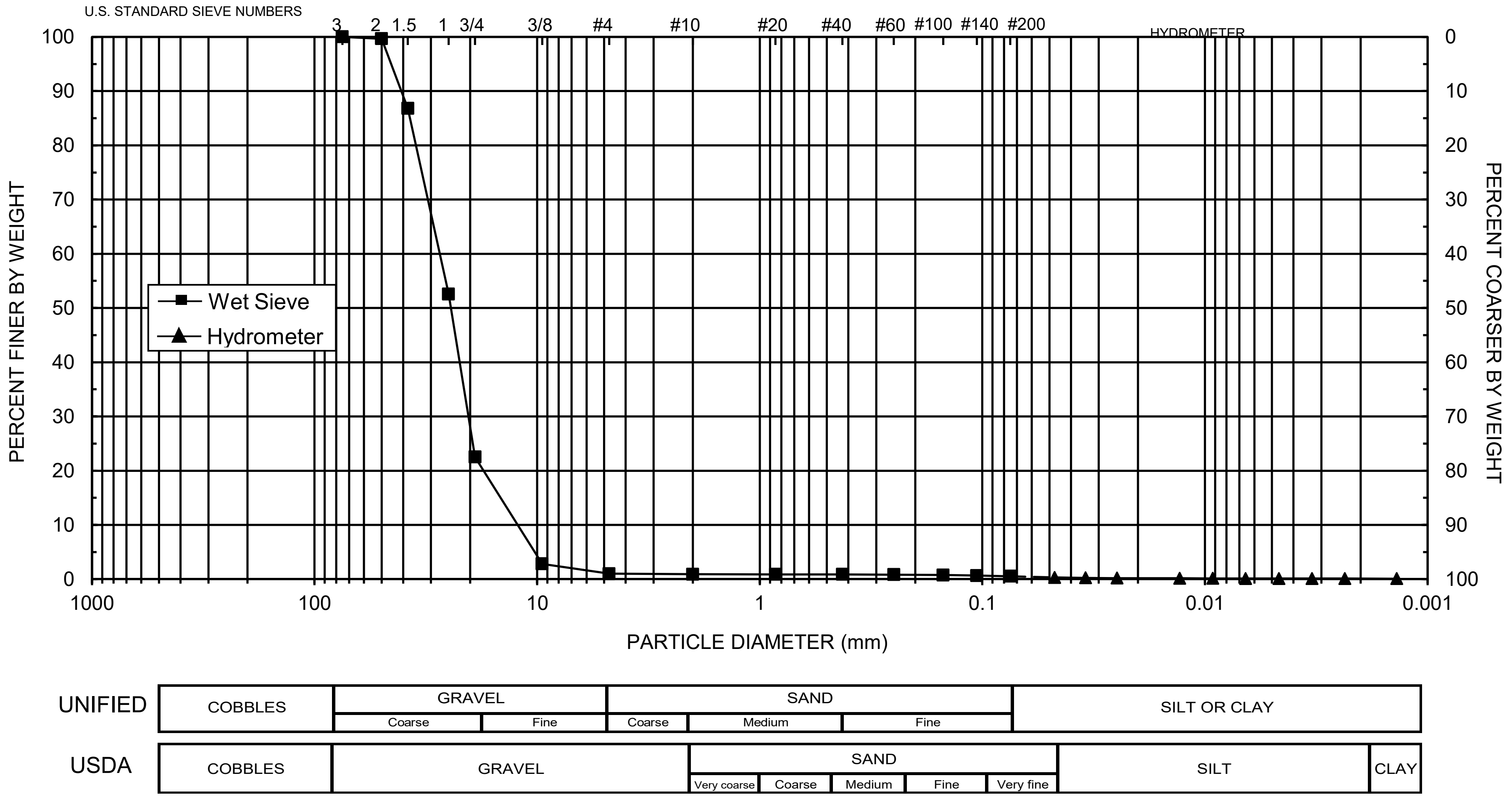
Initial Wt. (g)*:* 52.32
Total Sample Wt. (g)*:* 71259.95
Wt. Passing #10 (g)*:* 641.41

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	23.00	5.08	17.9	12	0.0473	34	0.3
	2	22.0	19.00	5.08	13.9	13	0.0344	27	0.2
	4	22.0	16.00	5.08	10.9	13	0.0248	21	0.2
	15	22.0	14.00	5.08	8.9	14	0.0130	17	0.2
	30	21.9	13.00	5.11	7.9	14	0.0092	15	0.1
	60	21.9	12.00	5.11	6.9	14	0.0066	13	0.1
	120	21.8	11.75	5.15	6.6	14	0.0046	13	0.1
	240	21.6	11.00	5.22	5.8	14	0.0033	11	0.1
	472	21.6	11.00	5.22	5.8	14	0.0024	11	0.1
15-May-19	1391	21.8	10.50	5.15	5.4	14	0.0014	10	0.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **12**	d_{30} = **20**	d_{50} = **24**	d_{60} = **27**	C_u = **2.3**	C_c = **1.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L2-01B	**04/10/2019 1130**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RB
Lab ID: HAT01-11.1904001-065
Date/Time sampled: 04/09/2019 1440

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 1447.10
Weight Passing #10 (g): 1394.30
Weight Retained #10 (g): 52.80
Weight of Hydrometer Sample (g): 101.78
Calculated Weight of Sieve Sample (g): 105.63

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1447.10	100.00
	2"	50	0.00	0.00	1447.10	100.00
	1.5"	38.1	0.00	0.00	1447.10	100.00
	1"	25	0.00	0.00	1447.10	100.00
	3/4"	19.0	0.00	0.00	1447.10	100.00
	3/8"	9.5	25.83	25.83	1421.27	98.22
	4	4.75	10.30	36.13	1410.97	97.50
	10	2.00	16.67	52.80	1394.30	96.35
-10			(Based on calculated sieve wt.)			
	20	0.85	0.87	4.72	100.91	95.53
	40	0.425	1.17	5.89	99.74	94.42
	60	0.250	6.28	12.17	93.46	88.47
	100	0.150	25.21	37.38	68.25	64.61
	140	0.106	21.83	59.21	46.42	43.94
	200	0.075	12.48	71.69	33.94	32.13
	dry pan		2.02	73.71	31.92	
	wet pan			31.92	0.00	

d_{10} (mm): 0.0040
d_{16} (mm): 0.024
d_{30} (mm): 0.068
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 35
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 8.3
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RB
Lab ID: HAT01-11.1904001-065
Date/Time sampled: 04/09/2019 1440

Test Date: 24-May-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

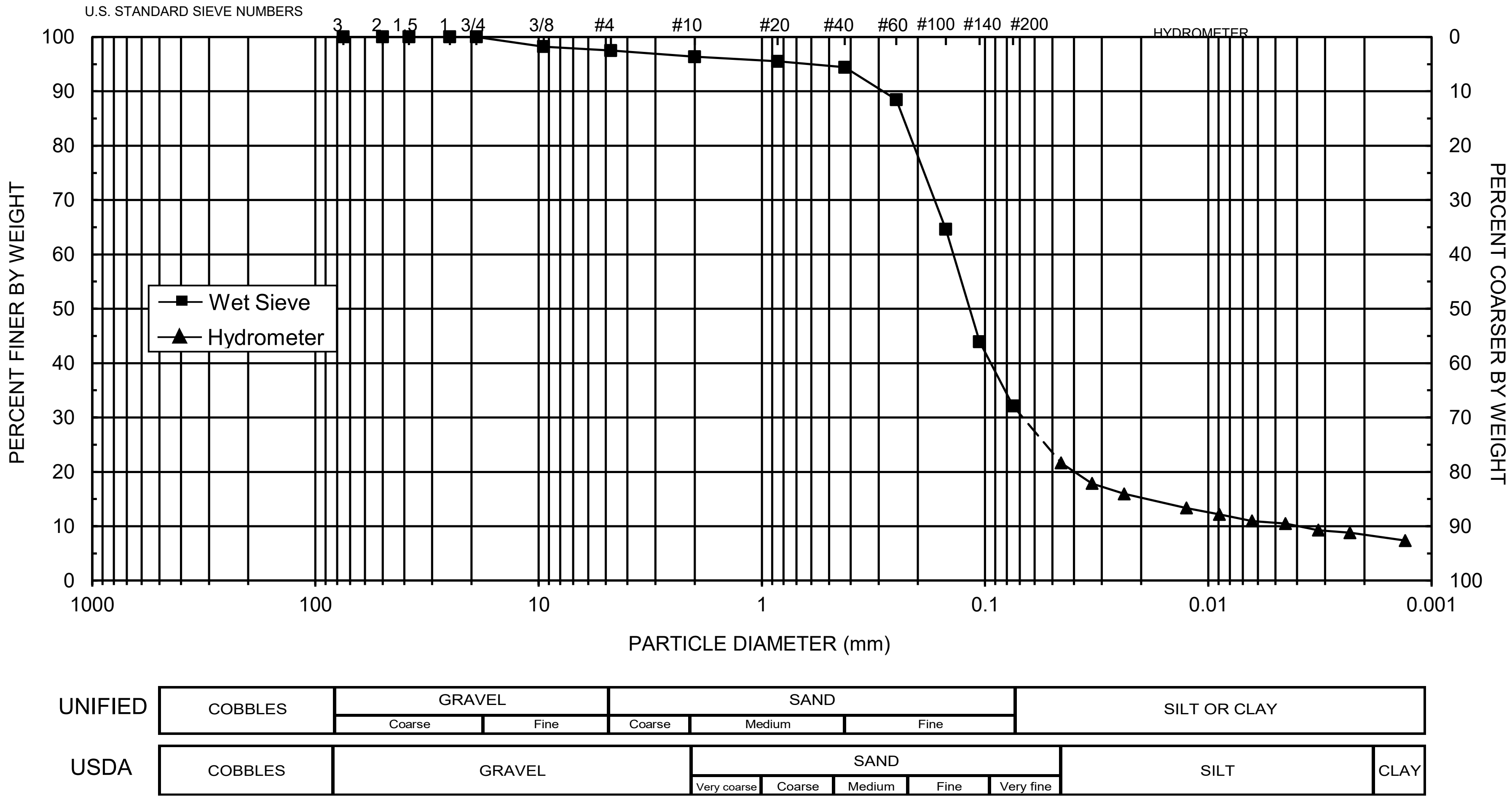
Initial Wt. *(g):* 101.78
Total Sample Wt. *(g):* 1447.10
Wt. Passing #10 *(g):* 1394.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	28.00	5.15	22.9	11	0.0456	22	21.6
	2	21.8	24.00	5.15	18.9	12	0.0332	19	17.8
	4	21.8	22.00	5.15	16.9	12	0.0238	17	16.0
	15	21.8	19.25	5.15	14.1	13	0.0125	14	13.3
	30	21.8	18.00	5.15	12.9	13	0.0089	13	12.2
	60	21.7	16.75	5.19	11.6	13	0.0064	11	10.9
	120	21.7	16.25	5.19	11.1	13	0.0045	11	10.5
	240	21.6	15.00	5.22	9.8	13	0.0032	10	9.3
	465	21.6	14.50	5.22	9.3	13	0.0023	9	8.8
25-May-19	1478	21.6	13.00	5.22	7.8	14	0.0013	8	7.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0040**	d_{30} = **0.068**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **35**	C_c = **8.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-01RB	**04/09/2019 1440**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RM
Lab ID: HAT01-11.1904001-053
Date/Time sampled: 04/09/2019 1450

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1394.63
Weight Passing #10 (g): 1359.55
Weight Retained #10 (g): 35.08
Weight of Hydrometer Sample (g): 97.03
Calculated Weight of Sieve Sample (g): 99.53

Shape: Rounded
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1394.63	100.00
	2"	50	0.00	0.00	1394.63	100.00
	1.5"	38.1	0.00	0.00	1394.63	100.00
	1"	25	0.00	0.00	1394.63	100.00
	3/4"	19.0	0.00	0.00	1394.63	100.00
	3/8"	9.5	12.21	12.21	1382.42	99.12
	4	4.75	13.83	26.04	1368.59	98.13
	10	2.00	9.04	35.08	1359.55	97.48
-10			(Based on calculated sieve wt.)			
	20	0.85	0.40	2.90	96.63	97.08
	40	0.425	0.77	3.67	95.86	96.31
	60	0.250	8.61	12.28	87.25	87.66
	100	0.150	30.28	42.56	56.97	57.24
	140	0.106	21.90	64.46	35.07	35.23
	200	0.075	11.89	76.35	23.18	23.29
	dry pan		2.33	78.68	20.85	
	wet pan			20.85	0.00	

d_{10} (mm): 0.018
d_{16} (mm): 0.055
d_{30} (mm): 0.091
d_{50} (mm): 0.13
d_{60} (mm): 0.16
d_{84} (mm): 0.24

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 8.9
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RM
Lab ID: HAT01-11.1904001-053
Date/Time sampled: 04/09/2019 1450

Test Date: 7-Jun-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

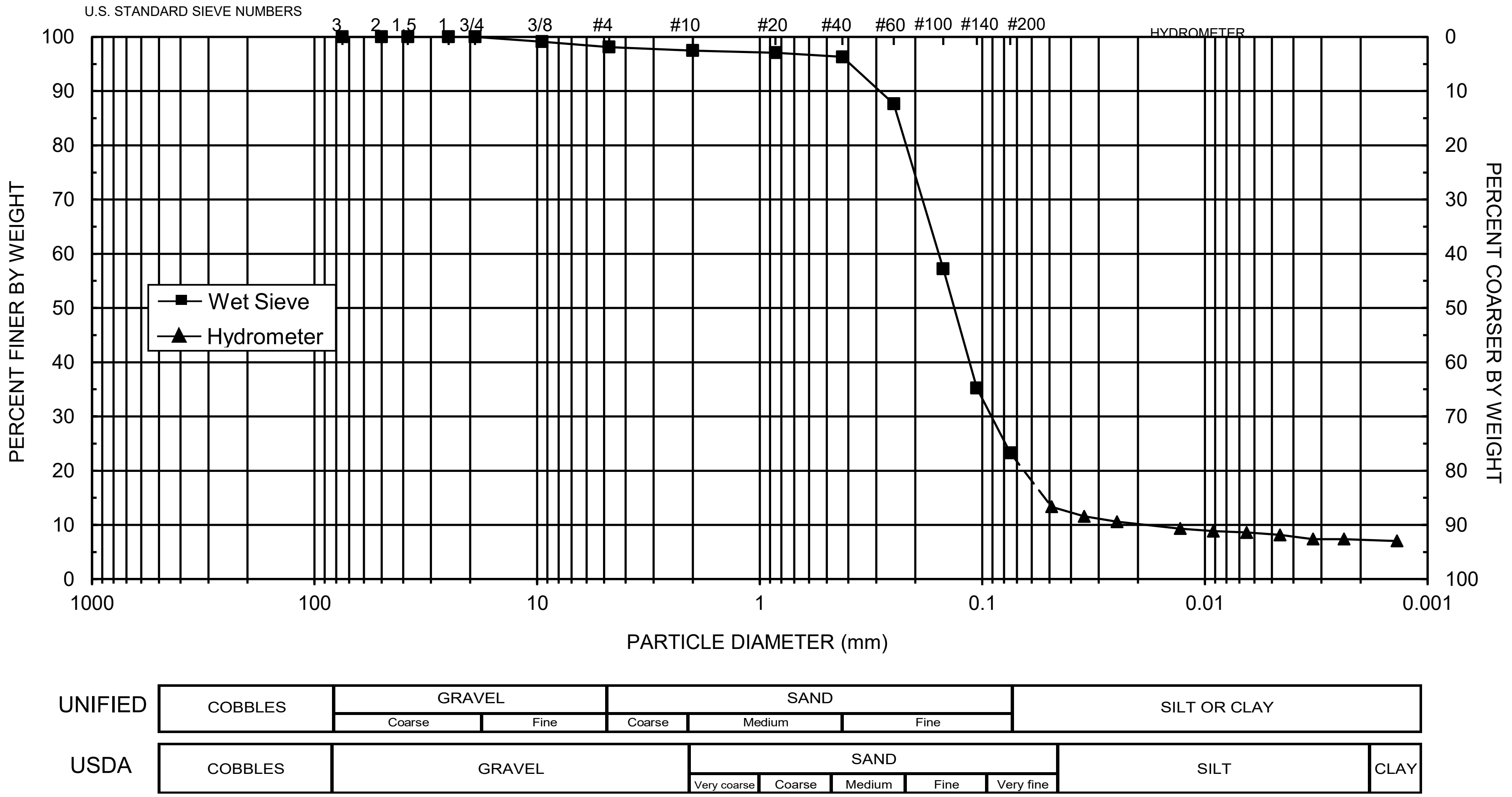
Initial Wt. (g)*:* 97.03
Total Sample Wt. (g)*:* 1394.63
Wt. Passing #10 (g)*:* 1359.55

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.6	18.50	5.22	13.3	13	0.0488	14	13.3
	2	21.6	16.75	5.22	11.5	13	0.0349	12	11.6
	4	21.6	15.75	5.22	10.5	13	0.0248	11	10.6
	15	21.6	14.50	5.22	9.3	13	0.0129	10	9.3
	30	21.7	14.00	5.19	8.8	14	0.0092	9	8.9
	60	21.7	13.75	5.19	8.6	14	0.0065	9	8.6
	120	21.8	13.25	5.15	8.1	14	0.0046	8	8.1
	240	21.8	12.50	5.15	7.4	14	0.0033	8	7.4
	456	21.8	12.50	5.15	7.4	14	0.0024	8	7.4
8-Jun-19	1370	21.5	12.25	5.26	7.0	14	0.0014	7	7.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.018**	d_{30} = **0.091**	d_{50} = **0.13**	d_{60} = **0.16**	C_u = **8.9**	C_c = **2.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-01RM	**04/09/2019 1450**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RT
Lab ID: HAT01-11.1904001-038
Date/Time sampled: 04/09/2019 1500

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1719.16
Weight Passing #10 (g): 1694.67
Weight Retained #10 (g): 24.49
Weight of Hydrometer Sample (g): 101.46
Calculated Weight of Sieve Sample (g): 102.93

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1719.16	100.00
	2"	50	0.00	0.00	1719.16	100.00
	1.5"	38.1	0.00	0.00	1719.16	100.00
	1"	25	0.00	0.00	1719.16	100.00
	3/4"	19.0	0.00	0.00	1719.16	100.00
	3/8"	9.5	11.00	11.00	1708.16	99.36
	4	4.75	6.28	17.28	1701.88	98.99
	10	2.00	7.21	24.49	1694.67	98.58
-10			(Based on calculated sieve wt.)			
	20	0.85	1.28	2.75	100.18	97.33
	40	0.425	1.15	3.90	99.03	96.21
	60	0.250	8.30	12.20	90.73	88.15
	100	0.150	29.39	41.59	61.34	59.60
	140	0.106	21.71	63.30	39.63	38.50
	200	0.075	13.22	76.52	26.41	25.66
	dry pan		2.05	78.57	24.36	
	wet pan			24.36	0.00	

d_{10} (mm): 0.0064
d_{16} (mm): 0.049
d_{30} (mm): 0.084
d_{50} (mm): 0.13
d_{60} (mm): 0.15
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 23
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 7.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RT
Lab ID: HAT01-11.1904001-038
Date/Time sampled: 04/09/2019 1500

Test Date: 5-Jun-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

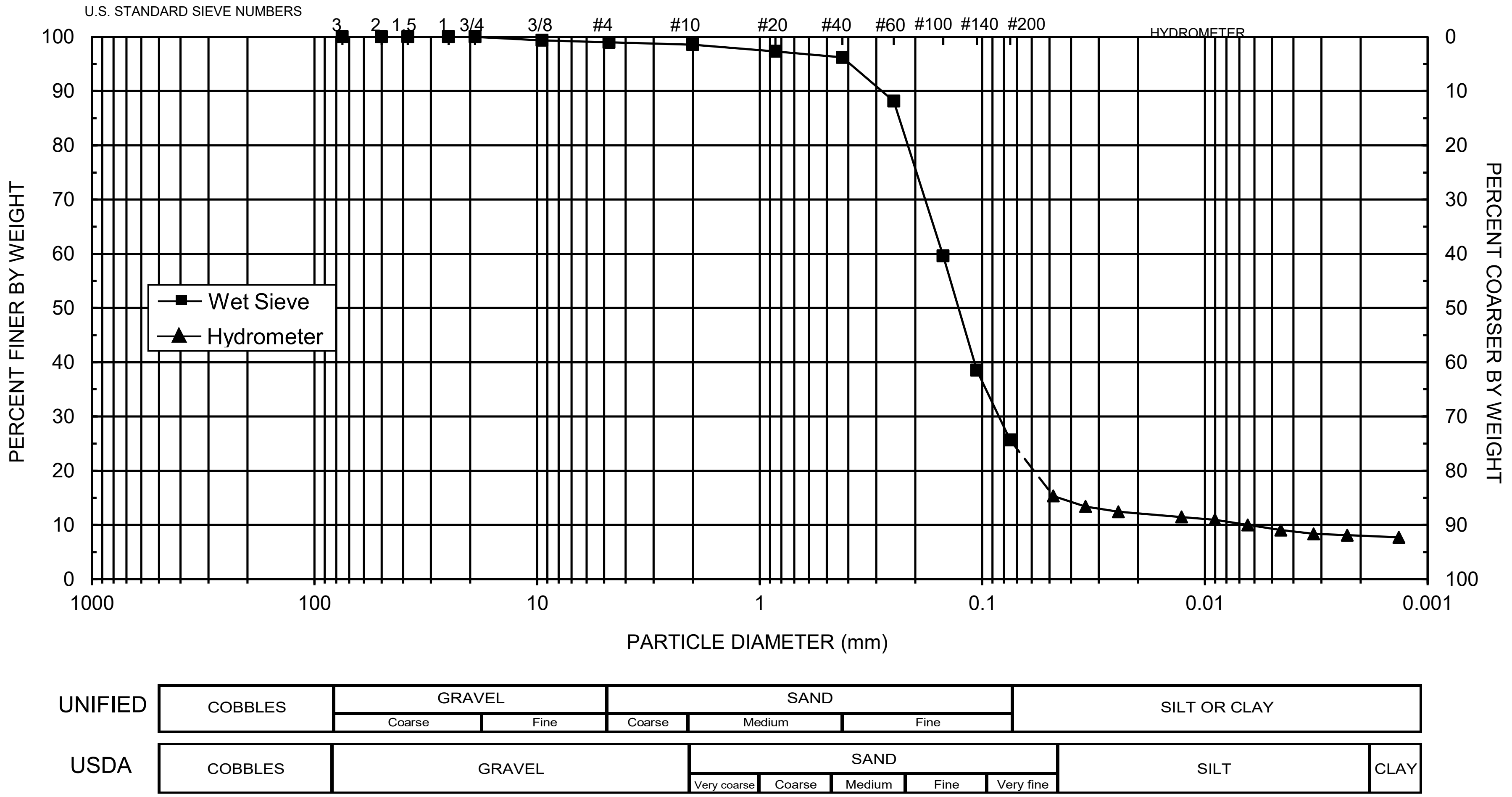
Initial Wt. (g): 101.46
Total Sample Wt. (g): 1719.16
Wt. Passing #10 (g): 1694.67

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	21.00	5.22	15.8	12	0.0479	16	15.3
	2	21.6	19.00	5.22	13.8	13	0.0344	14	13.4
	4	21.6	18.00	5.22	12.8	13	0.0245	13	12.4
	15	21.6	17.00	5.22	11.8	13	0.0127	12	11.4
	30	21.6	16.50	5.22	11.3	13	0.0090	11	11.0
	60	21.6	15.50	5.22	10.3	13	0.0064	10	10.0
	120	21.7	14.50	5.19	9.3	13	0.0046	9	9.0
	240	21.8	13.75	5.15	8.6	14	0.0032	8	8.4
	481	21.8	13.50	5.15	8.4	14	0.0023	8	8.1
6-Jun-19	1402	21.3	13.25	5.33	7.9	14	0.0013	8	7.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: J. Hines
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0064**	d_{30} = **0.084**	d_{50} = **0.13**	d_{60} = **0.15**	C_u = **23**	C_c = **7.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-01RT	**04/09/2019 1500**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02B
Lab ID: HAT01-11.1904001-006
Date/Time sampled: 04/09/2019 930

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 82773.29
Weight Passing #10 (g): 8626.86
Weight Retained #10 (g): 74146.43
Weight of Hydrometer Sample (g): 80.61
Calculated Weight of Sieve Sample (g): 773.44

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	82773.29	100.00
	2"	50	0.00	0.00	82773.29	100.00
	1.5"	38.1	9384.26	9384.26	73389.03	88.66
	1"	25	31788.00	41172.26	41601.03	50.26
	3/4"	19.0	16307.03	57479.29	25294.00	30.56
	3/8"	9.5	10855.19	68334.47	14438.82	17.44
	4	4.75	3984.28	72318.75	10454.54	12.63
	10	2.00	1827.68	74146.43	8626.86	10.42
-10			(Based on calculated sieve wt.)			
	20	0.85	5.55	698.38	75.06	9.70
	40	0.425	7.70	706.08	67.36	8.71
	60	0.250	8.82	714.90	58.54	7.57
	100	0.150	11.10	726.00	47.44	6.13
	140	0.106	10.34	736.34	37.10	4.80
	200	0.075	8.24	744.58	28.86	3.73
	dry pan		1.14	745.72	27.72	
	wet pan			27.72	0.00	

d_{10} (mm): 1.2
d_{16} (mm): 7.7
d_{30} (mm): 18

d_{50} (mm): 25
d_{60} (mm): 28
d_{84} (mm): 36

Median Particle Diameter --d_{50} (mm): 25
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 23
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 9.6
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 23

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

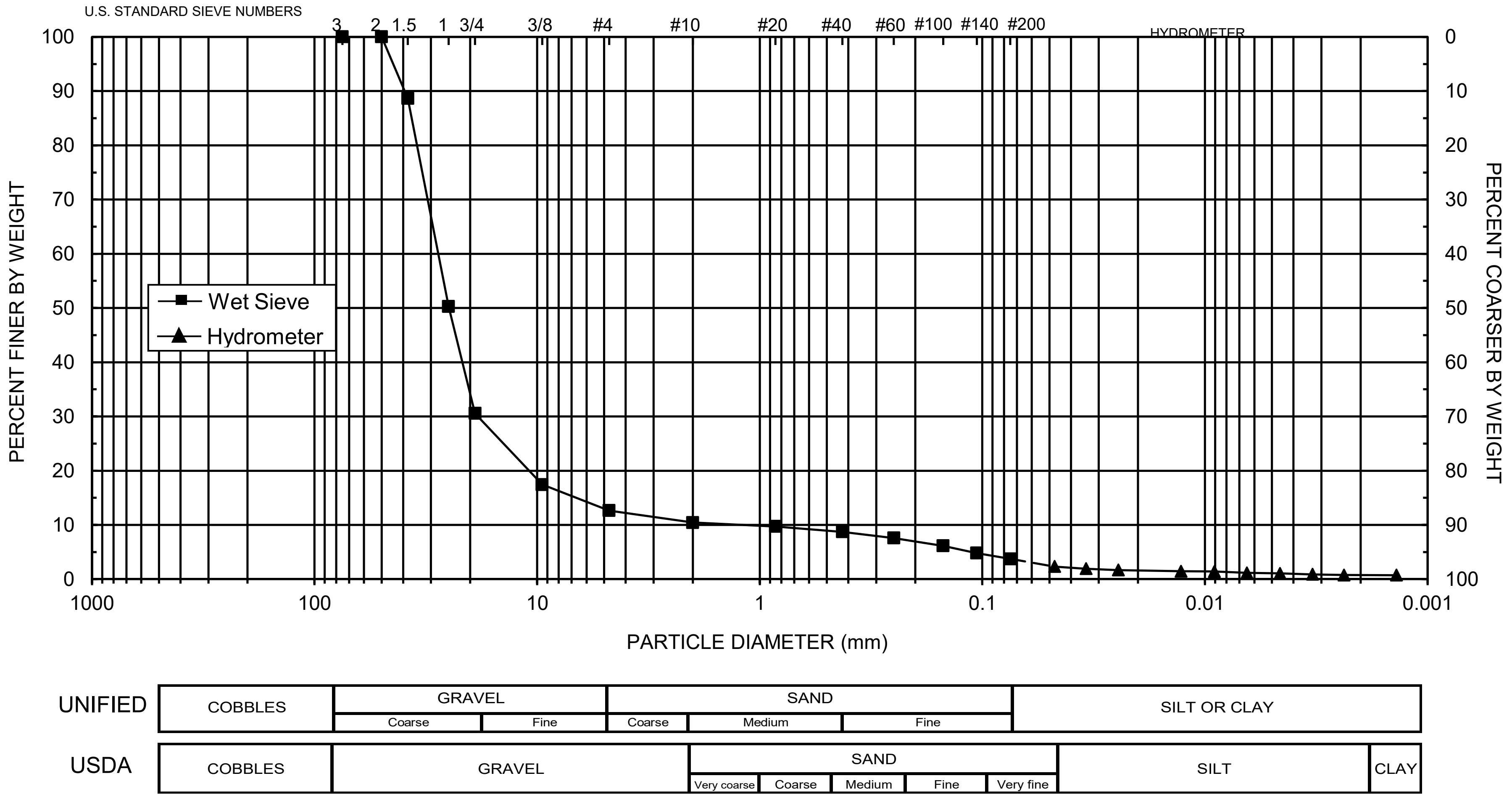
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-006	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 930	*Initial Wt.* (g)*:*	80.61
Test Date:	14-May-19	*Total Sample Wt.* (g)*:*	82773.29
Start Time:	9:24	*Wt. Passing #10* (g)*:*	8626.86

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	23.00	5.08	17.9	12	0.0473	22	2.3
	2	22.0	20.00	5.08	14.9	13	0.0342	19	1.9
	4	22.0	18.00	5.08	12.9	13	0.0245	16	1.7
	15	22.0	16.25	5.08	11.2	13	0.0128	14	1.4
	30	21.9	16.00	5.11	10.9	13	0.0091	14	1.4
	60	21.8	14.00	5.15	8.9	14	0.0065	11	1.1
	120	21.8	13.25	5.15	8.1	14	0.0046	10	1.0
	240	21.6	12.00	5.22	6.8	14	0.0033	8	0.9
	464	21.6	11.00	5.22	5.8	14	0.0024	7	0.7
15-May-19	1382	21.8	10.75	5.15	5.6	14	0.0014	7	0.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **1.2**	d_{30} = **18**	d_{50} = **25**	d_{60} = **28**	C_u = **23**	C_c = **9.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-02B	**04/09/2019 930**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RB
Lab ID: HAT01-11.1904001-066
Date/Time sampled: 04/09/2019 1100

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 1935.23
Weight Passing #10 (g): 1881.17
Weight Retained #10 (g): 54.06
Weight of Hydrometer Sample (g): 104.72
Calculated Weight of Sieve Sample (g): 107.73

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1935.23	100.00
	2"	50	0.00	0.00	1935.23	100.00
	1.5"	38.1	0.00	0.00	1935.23	100.00
	1"	25	0.00	0.00	1935.23	100.00
	3/4"	19.0	0.00	0.00	1935.23	100.00
	3/8"	9.5	27.81	27.81	1907.42	98.56
	4	4.75	10.04	37.85	1897.38	98.04
	10	2.00	16.21	54.06	1881.17	97.21
-10			(Based on calculated sieve wt.)			
	20	0.85	1.44	4.45	103.28	95.87
	40	0.425	4.91	9.36	98.37	91.31
	60	0.250	11.39	20.75	86.98	80.74
	100	0.150	25.08	45.83	61.90	57.46
	140	0.106	26.19	72.02	35.71	33.15
	200	0.075	14.63	86.65	21.08	19.57
	dry pan		2.51	89.16	18.57	
	wet pan			18.57	0.00	

d_{10} (mm): 0.043
d_{16} (mm): 0.064
d_{30} (mm): 0.098
d_{50} (mm): 0.13
d_{60} (mm): 0.16
d_{84} (mm): 0.29

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 3.7
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.4
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.16

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

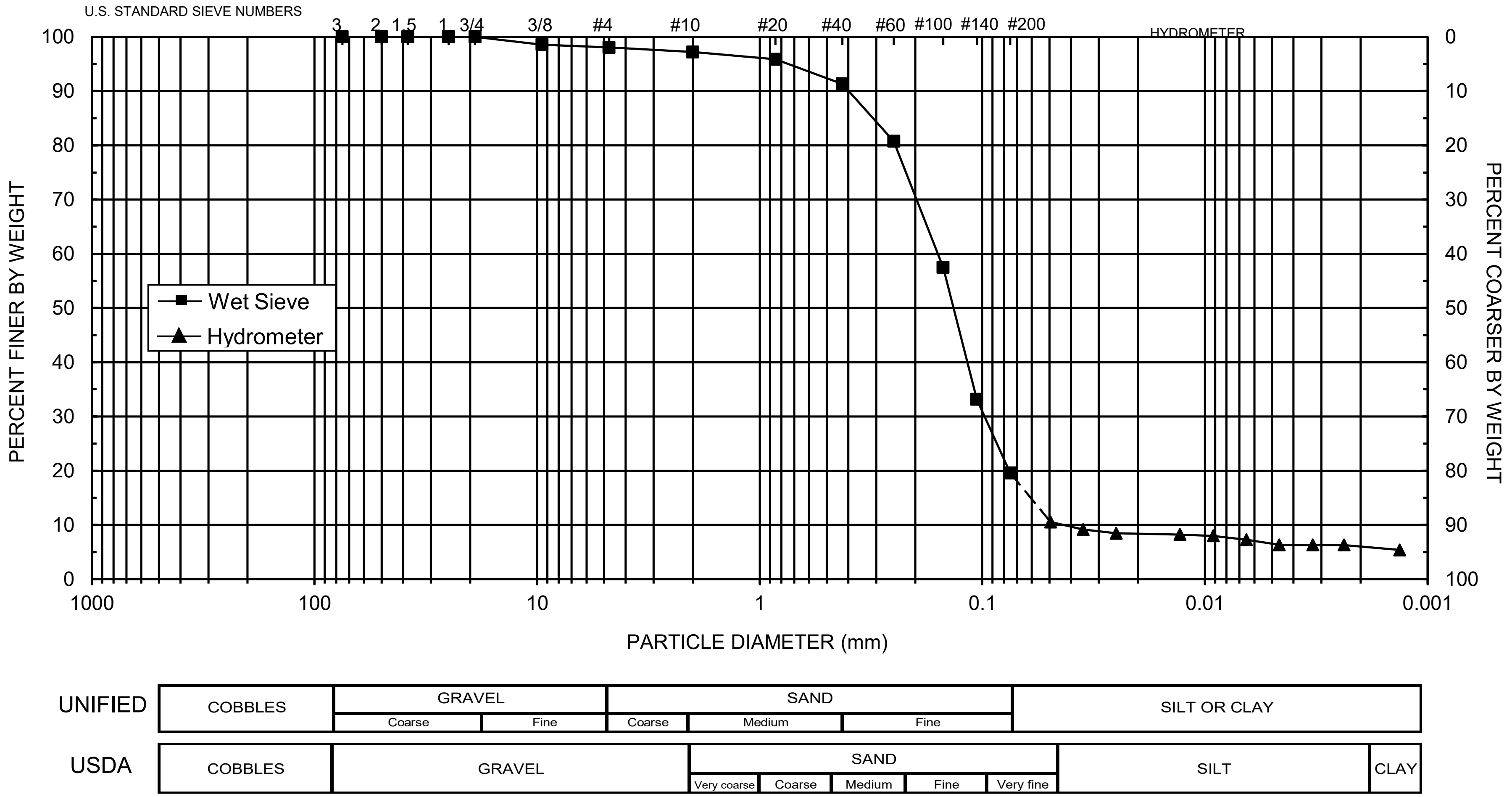
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-02RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-066	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1100	*Initial Wt. (g):*	104.72
Test Date:	24-May-19	*Total Sample Wt. (g):*	1935.23
Start Time:	9:12	*Wt. Passing #10 (g):*	1881.17

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	16.50	5.15	11.4	13	0.0494	11	10.5
	2	21.8	15.00	5.15	9.9	13	0.0352	9	9.1
	4	21.8	14.25	5.15	9.1	13	0.0250	9	8.4
	15	21.8	14.00	5.15	8.9	14	0.0129	8	8.2
	30	21.8	13.75	5.15	8.6	14	0.0092	8	8.0
	60	21.7	13.00	5.19	7.8	14	0.0065	7	7.3
	120	21.7	12.00	5.19	6.8	14	0.0046	7	6.3
	240	21.6	12.00	5.22	6.8	14	0.0033	6	6.3
	458	21.6	12.00	5.22	6.8	14	0.0024	6	6.3
25-May-19	1469	21.6	11.00	5.22	5.8	14	0.0013	6	5.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.043**	d_{30} = **0.098**	d_{50} = **0.13**	d_{60} = **0.16**	C_u = **3.7**	C_c = **1.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-02RB	**04/09/2019 1100**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RM
Lab ID: HAT01-11.1904001-054
Date/Time sampled: 04/09/2019 1045

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1716.95
Weight Passing #10 (g): 1690.28
Weight Retained #10 (g): 26.67
Weight of Hydrometer Sample (g): 89.06
Calculated Weight of Sieve Sample (g): 90.47

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1716.95	100.00
	2"	50	0.00	0.00	1716.95	100.00
	1.5"	38.1	0.00	0.00	1716.95	100.00
	1"	25	0.00	0.00	1716.95	100.00
	3/4"	19.0	0.00	0.00	1716.95	100.00
	3/8"	9.5	9.14	9.14	1707.81	99.47
	4	4.75	8.39	17.53	1699.42	98.98
	10	2.00	9.14	26.67	1690.28	98.45
-10			(Based on calculated sieve wt.)			
	20	0.85	0.26	1.67	88.80	98.16
	40	0.425	0.88	2.55	87.92	97.19
	60	0.250	7.74	10.29	80.18	88.63
	100	0.150	23.69	33.98	56.49	62.44
	140	0.106	21.38	55.36	35.11	38.81
	200	0.075	14.58	69.94	20.53	22.69
	dry pan		4.41	74.35	16.12	
	wet pan			16.12	0.00	

d_{10} (mm): 0.027
d_{16} (mm): 0.055
d_{30} (mm): 0.088

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 5.2
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.0
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

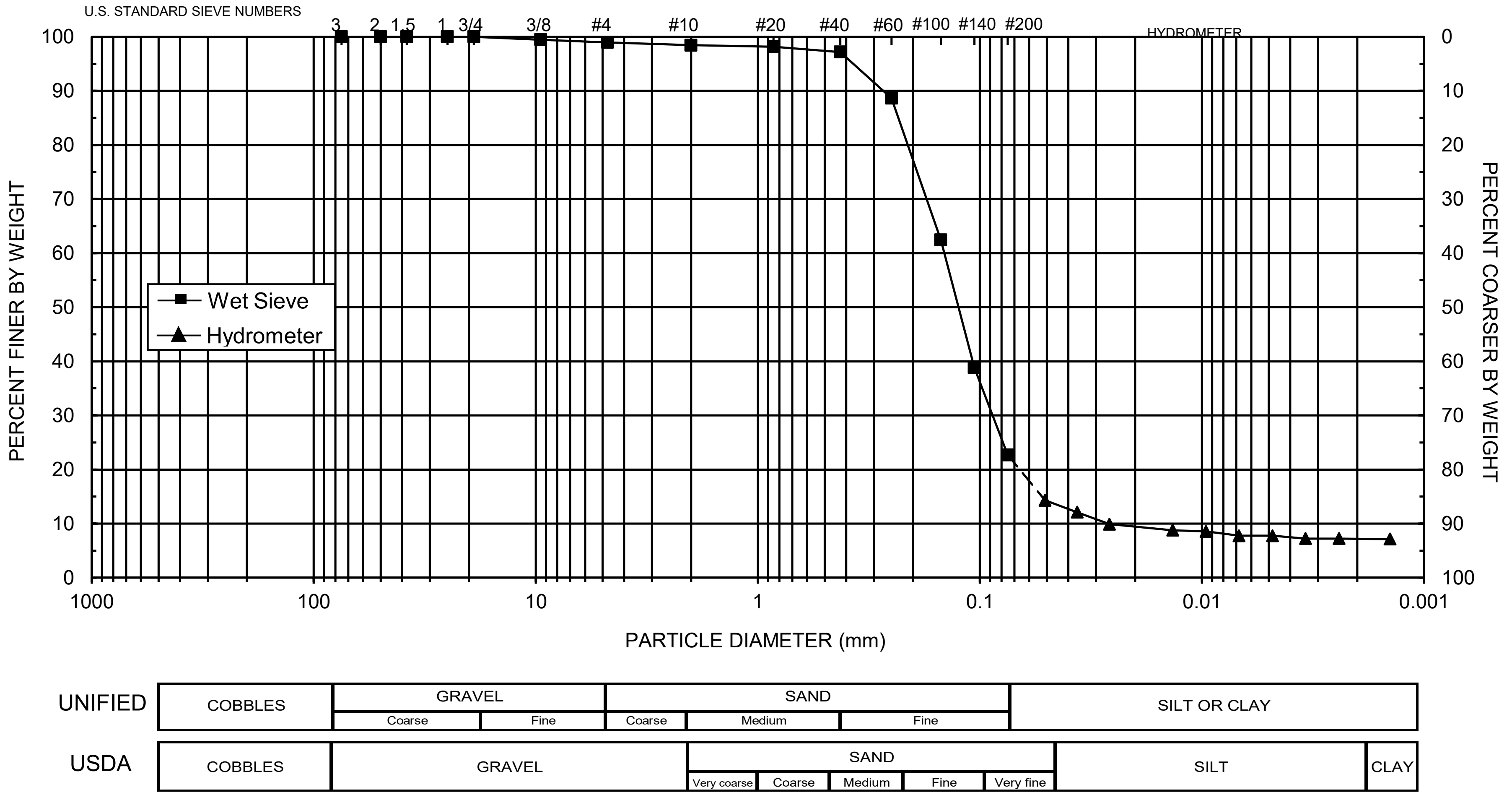
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L3-02RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-054	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1045	*Initial Wt.* (g):	89.06
Test Date:	7-Jun-19	*Total Sample Wt.* (g):	1716.95
Start Time:	9:00	*Wt. Passing #10* (g):	1690.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.5	19.00	6.06	12.9	14	0.0509	15	14.3
	2	21.5	17.00	6.06	10.9	14	0.0364	12	12.1
	4	21.5	15.00	6.06	8.9	15	0.0261	10	9.9
	15	21.5	14.00	6.06	7.9	15	0.0135	9	8.8
	30	21.6	13.75	6.02	7.7	15	0.0096	9	8.5
	60	21.7	13.00	5.99	7.0	15	0.0068	8	7.8
	120	21.7	13.00	5.99	7.0	15	0.0048	8	7.8
	240	21.8	12.50	5.95	6.6	15	0.0034	7	7.2
	480	21.8	12.50	5.95	6.6	15	0.0024	7	7.2
8-Jun-19	1382	21.5	12.50	6.06	6.4	15	0.0014	7	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.027**	d_{30} = **0.088**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **5.2**	C_c = **2.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-02RM	**04/09/2019 1045**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RT
Lab ID: HAT01-11.1904001-039
Date/Time sampled: 04/09/2019 1000

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1733.41
Weight Passing #10 (g): 1693.95
Weight Retained #10 (g): 39.46
Weight of Hydrometer Sample (g): 89.88
Calculated Weight of Sieve Sample (g): 91.97

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1733.41	100.00
	2"	50	0.00	0.00	1733.41	100.00
	1.5"	38.1	0.00	0.00	1733.41	100.00
	1"	25	0.00	0.00	1733.41	100.00
	3/4"	19.0	0.00	0.00	1733.41	100.00
	3/8"	9.5	12.34	12.34	1721.07	99.29
	4	4.75	9.67	22.01	1711.40	98.73
	10	2.00	17.45	39.46	1693.95	97.72
-10			(Based on calculated sieve wt.)			
	20	0.85	1.04	3.13	88.84	96.59
	40	0.425	0.92	4.05	87.92	95.59
	60	0.250	5.77	9.82	82.15	89.32
	100	0.150	20.94	30.76	61.21	66.55
	140	0.106	21.03	51.79	40.18	43.69
	200	0.075	14.94	66.73	25.24	27.44
	dry pan		2.84	69.57	22.40	
	wet pan			22.40	0.00	

d_{10} (mm): 0.012
d_{16} (mm): 0.050
d_{30} (mm): 0.079
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 12
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

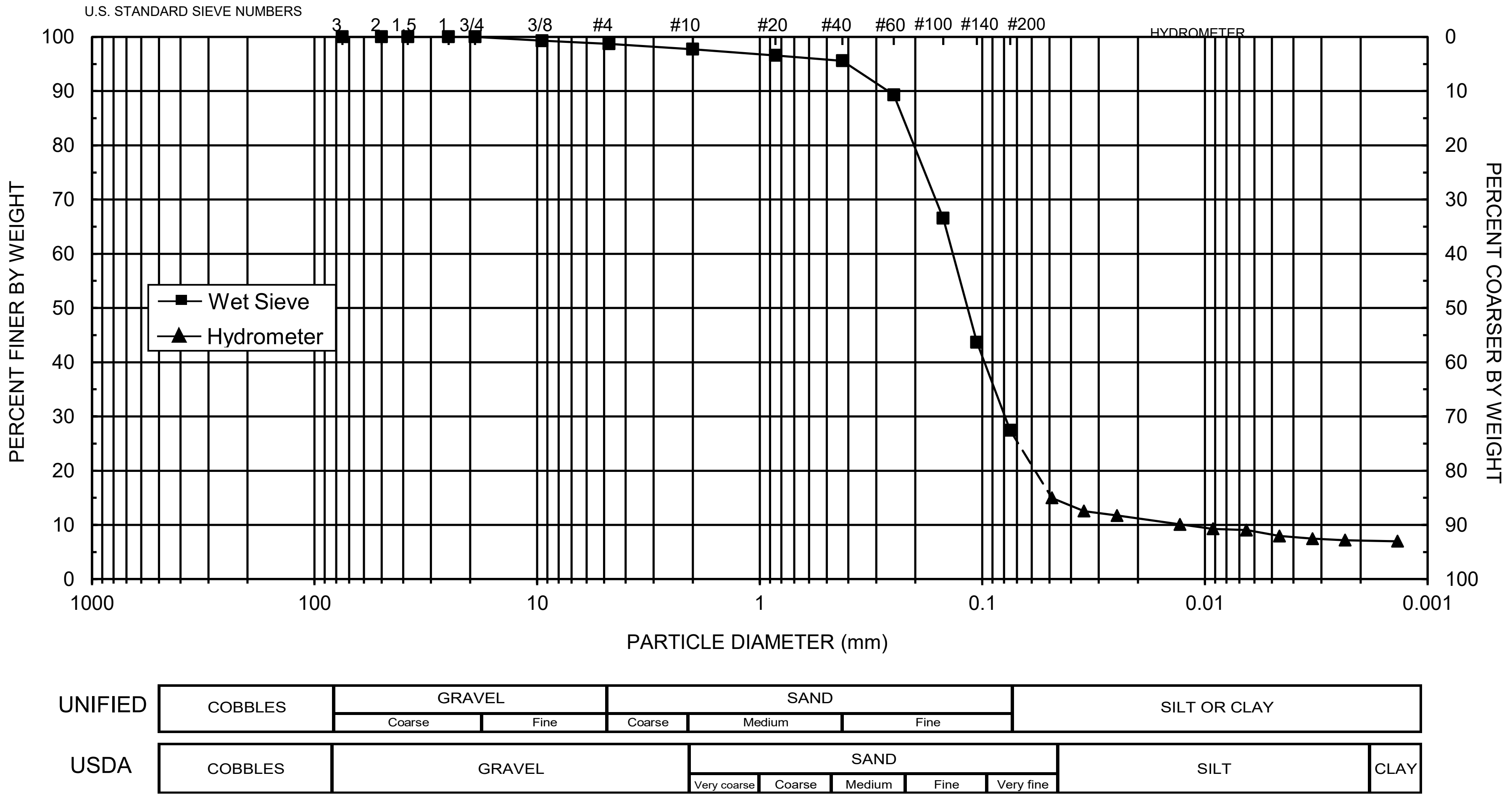
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-02RT	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-039	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1000	*Initial Wt.* *(g):*	89.88
Test Date:	5-Jun-19	*Total Sample Wt.* *(g):*	1733.41
Start Time:	9:12	*Wt. Passing #10* *(g):*	1693.95

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	19.00	5.22	13.8	13	0.0487	15	15.0
	2	21.6	16.75	5.22	11.5	13	0.0349	13	12.5
	4	21.6	16.00	5.22	10.8	13	0.0248	12	11.7
	15	21.6	14.50	5.22	9.3	13	0.0129	10	10.1
	30	21.6	13.75	5.22	8.5	14	0.0092	9	9.3
	60	21.7	13.50	5.19	8.3	14	0.0065	9	9.0
	120	21.7	12.50	5.19	7.3	14	0.0046	8	8.0
	240	21.8	12.00	5.15	6.9	14	0.0033	8	7.4
	471	21.8	11.75	5.15	6.6	14	0.0023	7	7.2
6-Jun-19	1392	21.3	11.75	5.33	6.4	14	0.0014	7	7.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: J. Hines
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.012**	d_{30} = **0.079**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **12**	C_c = **3.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-02RT	**04/09/2019 1000**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03B
Lab ID: HAT01-11.1904001-007
Date/Time sampled: 04/09/2019 1155

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 81767.83
Weight Passing #10 (g): 13815.15
Weight Retained #10 (g): 67952.68
Weight of Hydrometer Sample (g): 91.48
Calculated Weight of Sieve Sample (g): 541.44

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	81767.83	100.00
	2"	50	0.00	0.00	81767.83	100.00
	1.5"	38.1	5190.34	5190.34	76577.49	93.65
	1"	25	13401.90	18592.24	63175.59	77.26
	3/4"	19.0	10962.42	29554.66	52213.17	63.86
	3/8"	9.5	19621.68	49176.34	32591.48	39.86
	4	4.75	12494.04	61670.38	20097.45	24.58
	10	2.00	6282.30	67952.68	13815.15	16.90
-10			(Based on calculated sieve wt.)			
	20	0.85	7.86	457.82	83.62	15.44
	40	0.425	8.91	466.73	74.71	13.80
	60	0.250	10.40	477.13	64.31	11.88
	100	0.150	9.74	486.87	54.57	10.08
	140	0.106	11.75	498.62	42.82	7.91
	200	0.075	8.97	507.59	33.85	6.25
	dry pan		1.71	509.30	32.14	
	wet pan			32.14	0.00	

d_{10} (mm): 0.15
d_{16} (mm): 1.2
d_{30} (mm): 6.1

d_{50} (mm): 13
d_{60} (mm): 17
d_{84} (mm): 30

Median Particle Diameter --d_{50} (mm): 13
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 113
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 15
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 15

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03B
Lab ID: HAT01-11.1904001-007
Date/Time sampled: 04/09/2019 1155

Test Date: 14-May-19
Start Time: 9:30

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

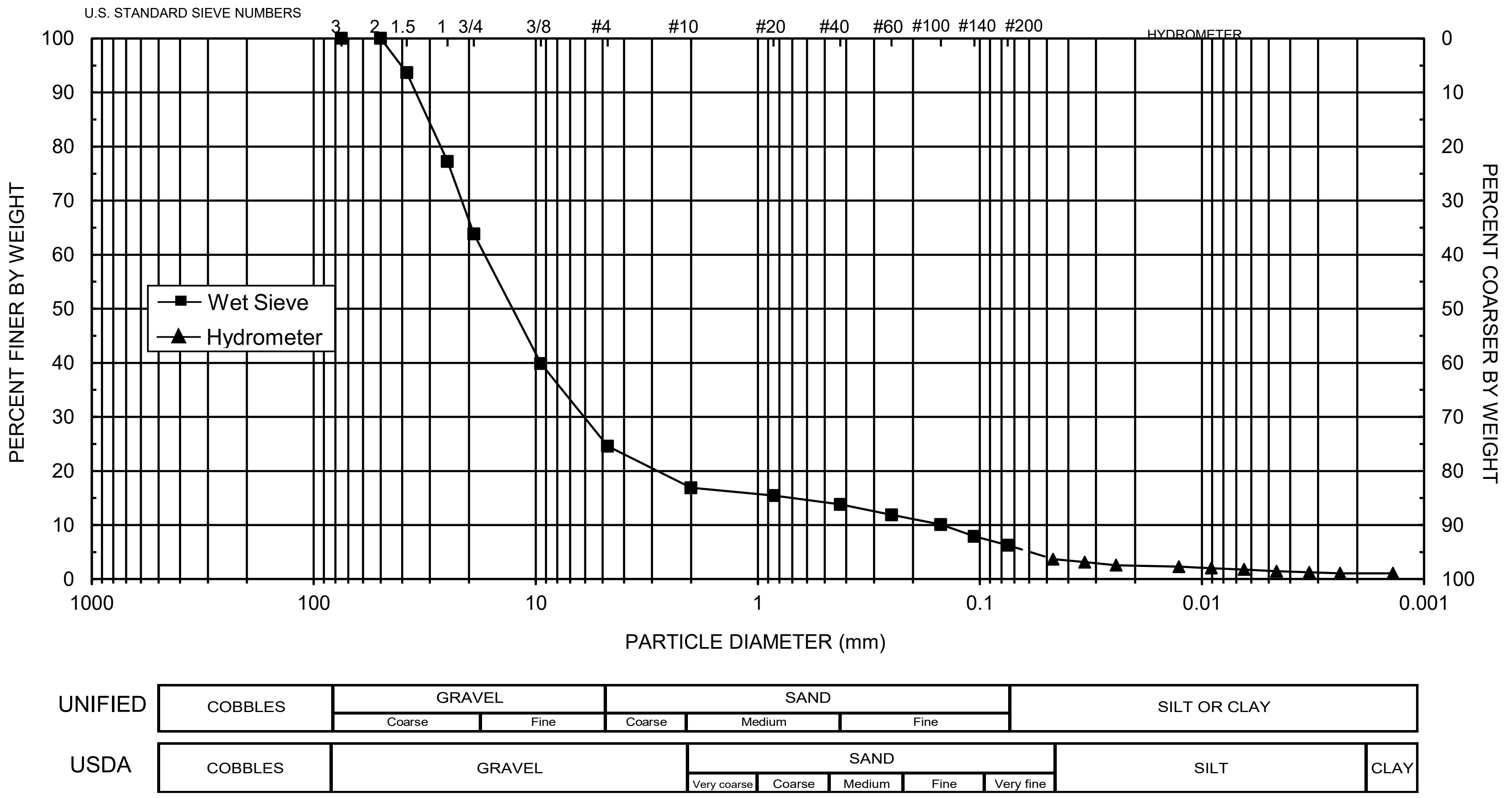
Initial Wt. *(g):* 91.48
Total Sample Wt. *(g):* 81767.83
Wt. Passing #10 *(g):* 13815.15

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	25.00	5.08	19.9	12	0.0467	22	3.7
	2	22.0	22.00	5.08	16.9	12	0.0337	18	3.1
	4	22.0	19.00	5.08	13.9	13	0.0243	15	2.6
	15	21.9	17.50	5.11	12.4	13	0.0127	14	2.3
	30	21.9	16.00	5.11	10.9	13	0.0091	12	2.0
	60	21.8	14.75	5.15	9.6	13	0.0065	10	1.8
	120	21.8	13.00	5.15	7.9	14	0.0046	9	1.4
	240	21.6	12.00	5.22	6.8	14	0.0033	7	1.3
	460	21.6	11.00	5.22	5.8	14	0.0024	6	1.1
15-May-19	1377	21.6	11.00	5.22	5.8	14	0.0014	6	1.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.15**	d_{30} = **6.1**	d_{50} = **13**	d_{60} = **17**	C_u = **113**	C_c = **15**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-03B	**04/09/2019 1155**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RB
Lab ID: HAT01-11.1904001-067
Date/Time sampled: 04/09/2019 1330

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 1095.78
Weight Passing #10 (g): 1070.66
Weight Retained #10 (g): 25.12
Weight of Hydrometer Sample (g): 105.02
Calculated Weight of Sieve Sample (g): 107.49

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1095.78	100.00
	2"	50	0.00	0.00	1095.78	100.00
	1.5"	38.1	0.00	0.00	1095.78	100.00
	1"	25	0.00	0.00	1095.78	100.00
	3/4"	19.0	0.00	0.00	1095.78	100.00
	3/8"	9.5	10.65	10.65	1085.13	99.03
	4	4.75	6.59	17.24	1078.54	98.43
	10	2.00	7.88	25.12	1070.66	97.71
-10			(Based on calculated sieve wt.)			
	20	0.85	0.64	3.10	104.38	97.11
	40	0.425	1.55	4.65	102.83	95.67
	60	0.250	10.89	15.54	91.94	85.54
	100	0.150	28.39	43.93	63.55	59.13
	140	0.106	24.72	68.65	38.83	36.13
	200	0.075	13.67	82.32	25.16	23.41
	dry pan		3.00	85.32	22.16	
	wet pan			22.16	0.00	

d_{10} (mm): 0.015
d_{16} (mm): 0.055
d_{30} (mm): 0.090
d_{50} (mm): 0.13
d_{60} (mm): 0.15
d_{84} (mm): 0.24

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 10
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RB
Lab ID: HAT01-11.1904001-067
Date/Time sampled: 04/09/2019 1330

Test Date: 24-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

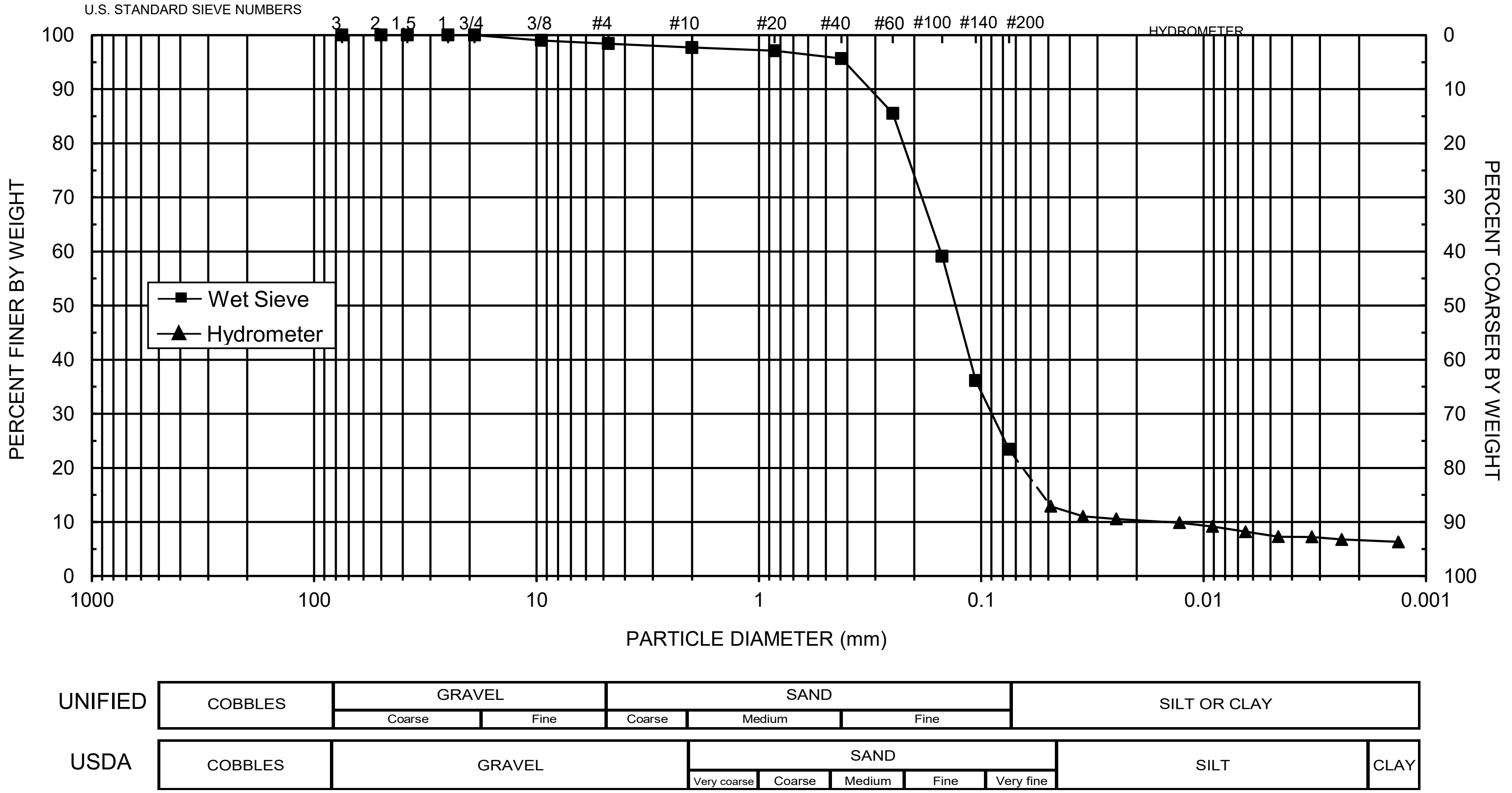
Initial Wt. (g): 105.02
Total Sample Wt. (g): 1095.78
Wt. Passing #10 (g): 1070.66

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	19.00	5.15	13.9	13	0.0486	13	12.9
	2	21.8	17.00	5.15	11.9	13	0.0348	11	11.0
	4	21.8	16.50	5.15	11.4	13	0.0247	11	10.6
	15	21.8	15.75	5.15	10.6	13	0.0128	10	9.9
	30	21.8	15.00	5.15	9.9	13	0.0091	9	9.2
	60	21.7	14.00	5.19	8.8	14	0.0065	8	8.2
	120	21.7	13.00	5.19	7.8	14	0.0046	7	7.3
	240	21.6	13.00	5.22	7.8	14	0.0033	7	7.2
	449	21.6	12.50	5.22	7.3	14	0.0024	7	6.8
25-May-19	1458	21.6	12.00	5.22	6.8	14	0.0013	6	6.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.015**	d_{30} = **0.090**	d_{50} = **0.13**	d_{60} = **0.15**	C_u = **10**	C_c = **3.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-03RB	**04/09/2019 1330**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RM
Lab ID: HAT01-11.1904001-055
Date/Time sampled: 04/09/2019 1400

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1657.70
Weight Passing #10 (g): 1638.92
Weight Retained #10 (g): 18.78
Weight of Hydrometer Sample (g): 77.20
Calculated Weight of Sieve Sample (g): 78.08

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1657.70	100.00
	2"	50	0.00	0.00	1657.70	100.00
	1.5"	38.1	0.00	0.00	1657.70	100.00
	1"	25	0.00	0.00	1657.70	100.00
	3/4"	19.0	0.00	0.00	1657.70	100.00
	3/8"	9.5	2.07	2.07	1655.63	99.88
	4	4.75	9.70	11.77	1645.93	99.29
	10	2.00	7.01	18.78	1638.92	98.87
-10			(Based on calculated sieve wt.)			
	20	0.85	0.17	1.05	77.03	98.65
	40	0.425	0.73	1.78	76.30	97.71
	60	0.250	6.33	8.11	69.97	89.61
	100	0.150	20.81	28.92	49.16	62.96
	140	0.106	18.26	47.18	30.90	39.57
	200	0.075	12.61	59.79	18.29	23.42
	dry pan		4.57	64.36	13.72	
	wet pan			13.72	0.00	

d_{10} (mm): 0.027
d_{16} (mm): 0.058
d_{30} (mm): 0.086

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 5.2
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RM
Lab ID: HAT01-11.1904001-055
Date/Time sampled: 04/09/2019 1400

Test Date: 7-Jun-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

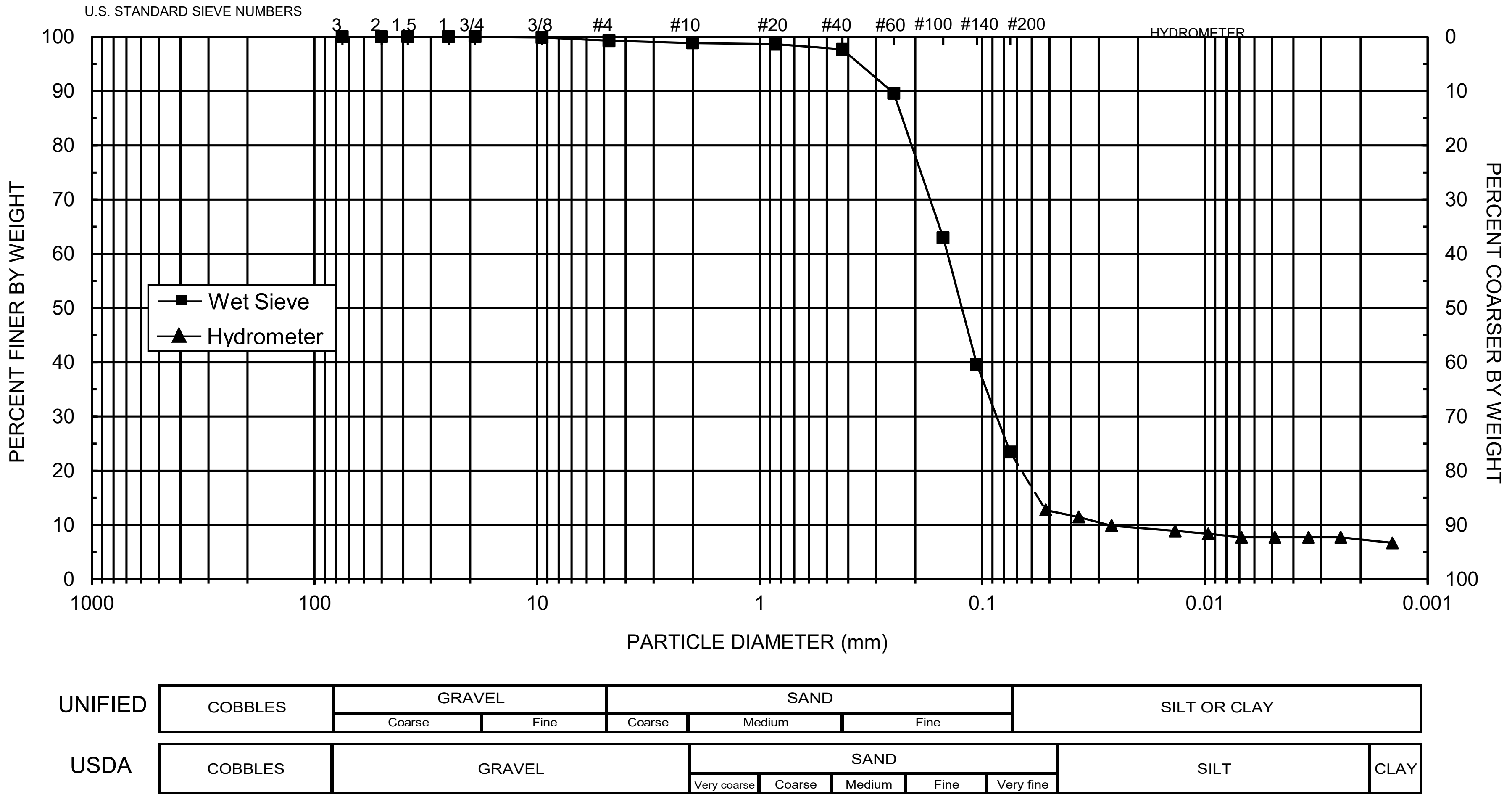
Initial Wt. (g)*:* 77.20
Total Sample Wt. (g)*:* 1657.70
Wt. Passing #10 (g)*:* 1638.92

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.5	16.00	6.06	9.9	14	0.0519	13	12.7
	2	21.5	15.00	6.06	8.9	15	0.0369	12	11.5
	4	21.5	13.75	6.06	7.7	15	0.0263	10	9.9
	15	21.5	13.00	6.06	6.9	15	0.0136	9	8.9
	30	21.7	12.50	5.99	6.5	15	0.0097	8	8.3
	60	21.7	12.00	5.99	6.0	15	0.0068	8	7.7
	120	21.7	12.00	5.99	6.0	15	0.0048	8	7.7
	240	21.7	12.00	5.99	6.0	15	0.0034	8	7.7
	469	21.7	12.00	5.99	6.0	15	0.0024	8	7.7
8-Jun-19	1372	21.5	11.25	6.06	5.2	15	0.0014	7	6.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.027**	d_{30} = **0.086**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **5.2**	C_c = **2.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-03RM	**04/09/2019 1400**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RT
Lab ID: HAT01-11.1904001-040
Date/Time sampled: 04/09/2019 1345

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1706.60
Weight Passing #10 (g): 1670.81
Weight Retained #10 (g): 35.79
Weight of Hydrometer Sample (g): 118.42
Calculated Weight of Sieve Sample (g): 120.96

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1706.60	100.00
	2"	50	0.00	0.00	1706.60	100.00
	1.5"	38.1	0.00	0.00	1706.60	100.00
	1"	25	0.00	0.00	1706.60	100.00
	3/4"	19.0	0.00	0.00	1706.60	100.00
	3/8"	9.5	17.52	17.52	1689.08	98.97
	4	4.75	7.37	24.89	1681.71	98.54
	10	2.00	10.90	35.79	1670.81	97.90
-10			(Based on calculated sieve wt.)			
	20	0.85	1.10	3.64	117.32	96.99
	40	0.425	1.07	4.71	116.25	96.11
	60	0.250	8.92	13.63	107.33	88.73
	100	0.150	30.46	44.09	76.87	63.55
	140	0.106	27.49	71.58	49.38	40.82
	200	0.075	19.02	90.60	30.36	25.10
	dry pan		4.66	95.26	25.70	
	wet pan			25.70	0.00	

d_{10} (mm): 0.013
d_{16} (mm): 0.051
d_{30} (mm): 0.084
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 11
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

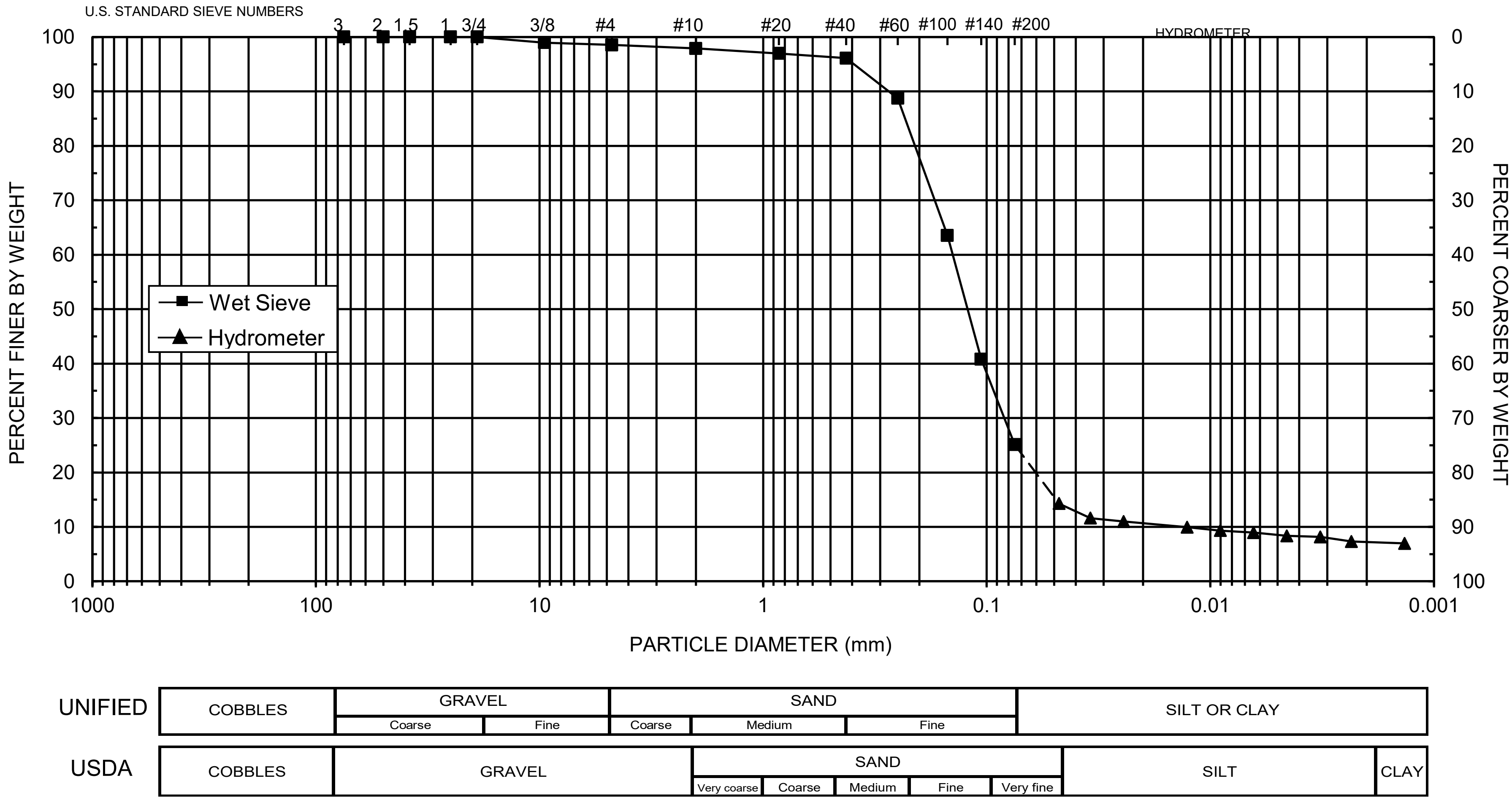
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L3-03RT	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-040	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1345	*Initial Wt.* (g):	118.42
Test Date:	5-Jun-19	*Total Sample Wt.* (g):	1706.60
Start Time:	9:24	*Wt. Passing #10* (g):	1670.81

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	22.50	5.22	17.3	12	0.0475	15	14.3
	2	21.6	19.25	5.22	14.0	13	0.0343	12	11.6
	4	21.6	18.50	5.22	13.3	13	0.0244	11	11.0
	15	21.6	17.25	5.22	12.0	13	0.0127	10	9.9
	30	21.6	16.50	5.22	11.3	13	0.0090	10	9.3
	60	21.7	16.00	5.19	10.8	13	0.0064	9	8.9
	120	21.8	15.25	5.15	10.1	13	0.0045	9	8.3
	240	21.8	15.00	5.15	9.9	13	0.0032	8	8.1
	461	21.8	14.00	5.15	8.9	14	0.0023	7	7.3
6-Jun-19	1382	21.3	13.75	5.33	8.4	14	0.0014	7	7.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: J. Hines
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.013**	d_{30} = **0.084**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **11**	C_c = **3.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-03RT	**04/09/2019 1345**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-11B
Lab ID: HAT01-11.1904001-005
Date/Time sampled: 04/09/2019 1525

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 76811.22
Weight Passing #10 (g): 2493.52
Weight Retained #10 (g): 74317.70
Weight of Hydrometer Sample (g): 88.28
Calculated Weight of Sieve Sample (g): 2719.41

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	76811.22	100.00
	2"	50	257.25	257.25	76553.97	99.67
	1.5"	38.1	4756.25	5013.50	71797.72	93.47
	1"	25	14352.20	19365.70	57445.52	74.79
	3/4"	19.0	15504.29	34869.99	41941.23	54.60
	3/8"	9.5	32423.65	67293.64	9517.58	12.39
	4	4.75	6287.60	73581.24	3229.98	4.21
	10	2.00	736.46	74317.70	2493.52	3.25
-10			(Based on calculated sieve wt.)			
	20	0.85	4.91	2636.04	83.37	3.07
	40	0.425	4.41	2640.45	78.96	2.90
	60	0.250	6.17	2646.62	72.79	2.68
	100	0.150	11.69	2658.31	61.10	2.25
	140	0.106	13.13	2671.44	47.97	1.76
	200	0.075	10.89	2682.33	37.08	1.36
	dry pan		1.82	2684.15	35.26	
	wet pan			35.26	0.00	

d_{10} (mm): 7.8
d_{16} (mm): 10
d_{30} (mm): 13
d_{50} (mm): 18
d_{60} (mm): 20
d_{84} (mm): 31

Median Particle Diameter --d_{50} (mm): 18
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 2.6
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.1
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 20

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

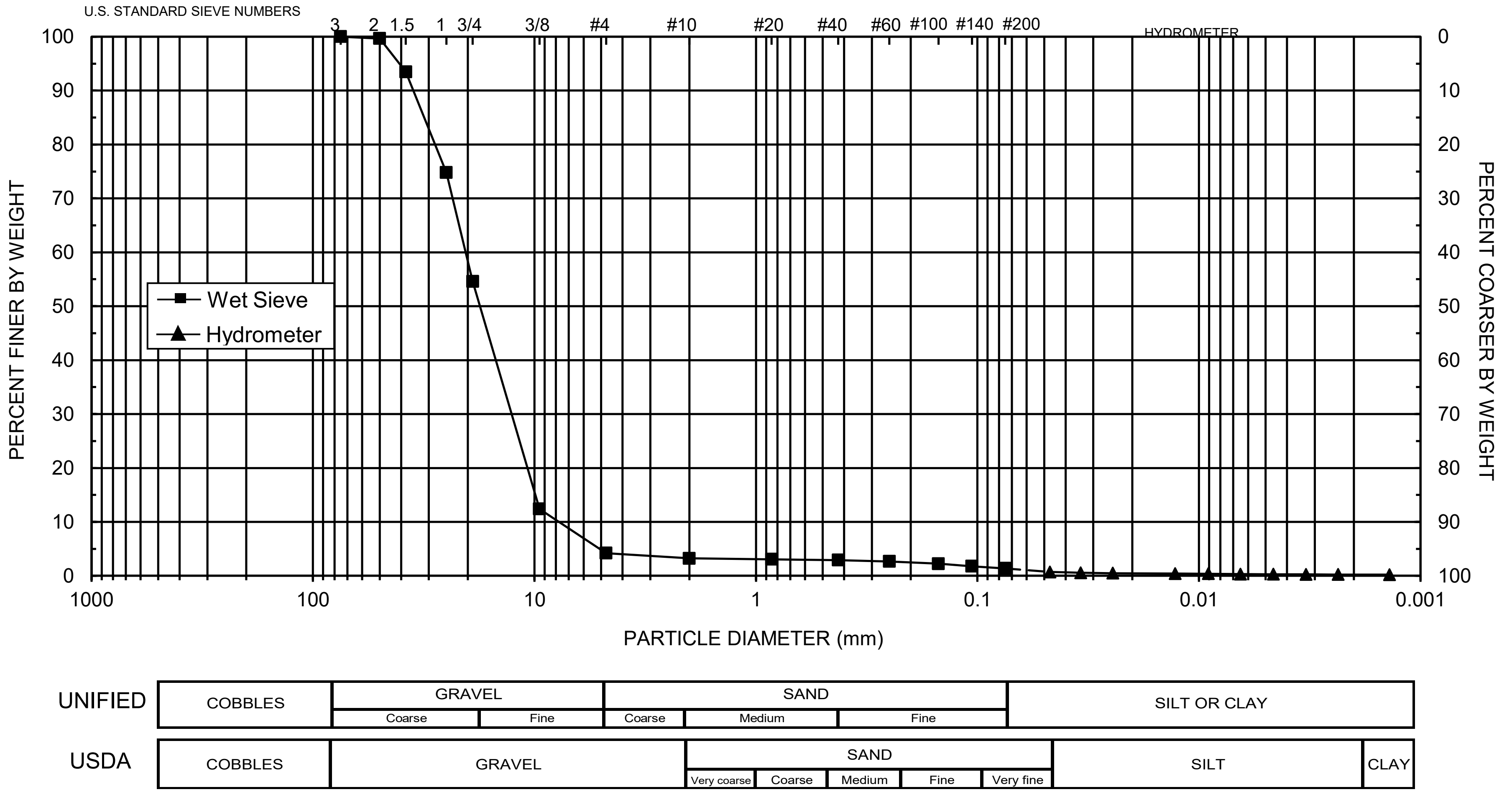
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L3-11B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-005	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1525	*Initial Wt. (g):*	88.28
Test Date:	14-May-19	*Total Sample Wt. (g):*	76811.22
Start Time:	9:18	*Wt. Passing #10 (g):*	2493.52

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	24.00	5.08	18.9	12	0.0470	21	0.7
	2	22.0	20.00	5.08	14.9	13	0.0342	17	0.5
	4	22.0	18.00	5.08	12.9	13	0.0245	15	0.5
	15	22.0	16.00	5.08	10.9	13	0.0128	12	0.4
	30	21.9	15.75	5.11	10.6	13	0.0091	12	0.4
	60	21.9	13.75	5.11	8.6	14	0.0065	10	0.3
	120	21.8	13.00	5.15	7.9	14	0.0046	9	0.3
	240	21.6	12.00	5.22	6.8	14	0.0033	8	0.2
	468	21.6	11.75	5.22	6.5	14	0.0024	7	0.2
15-May-19	1386	21.8	10.50	5.15	5.4	14	0.0014	6	0.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **7.8**	d_{30} = **13**	d_{50} = **18**	d_{60} = **20**	C_u = **2.6**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L3-11B	**04/09/2019 1525**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01B
Lab ID: HAT01-11.1904001-008
Date/Time sampled: 04/17/2019 1045

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 73845.51
Weight Passing #10 (g): 802.87
Weight Retained #10 (g): 73042.64
Weight of Hydrometer Sample (g): 97.39
Calculated Weight of Sieve Sample (g): 8957.68

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	73845.51	100.00
	2"	50	891.56	891.56	72953.95	98.79
	1.5"	38.1	20399.69	21291.25	52554.26	71.17
	1"	25	32339.10	53630.35	20215.16	27.37
	3/4"	19.0	10695.73	64326.08	9519.43	12.89
	3/8"	9.5	8282.90	72608.98	1236.53	1.67
	4	4.75	412.50	73021.48	824.03	1.12
	10	2.00	21.17	73042.64	802.87	1.09
-10			(Based on calculated sieve wt.)			
	20	0.85	1.46	8861.75	95.93	1.07
	40	0.425	1.35	8863.10	94.58	1.06
	60	0.250	4.63	8867.73	89.95	1.00
	100	0.150	17.45	8885.18	72.50	0.81
	140	0.106	19.14	8904.32	53.36	0.60
	200	0.075	14.22	8918.54	39.14	0.44
	dry pan		1.72	8920.26	37.42	
	wet pan			37.42	0.00	

d_{10} (mm): 16
d_{16} (mm): 20
d_{30} (mm): 26
d_{50} (mm): 31
d_{60} (mm): 34
d_{84} (mm): 43

Median Particle Diameter --d_{50} (mm): 31
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2.1
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 31

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01B
Lab ID: HAT01-11.1904001-008
Date/Time sampled: 04/17/2019 1045

Test Date: 14-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

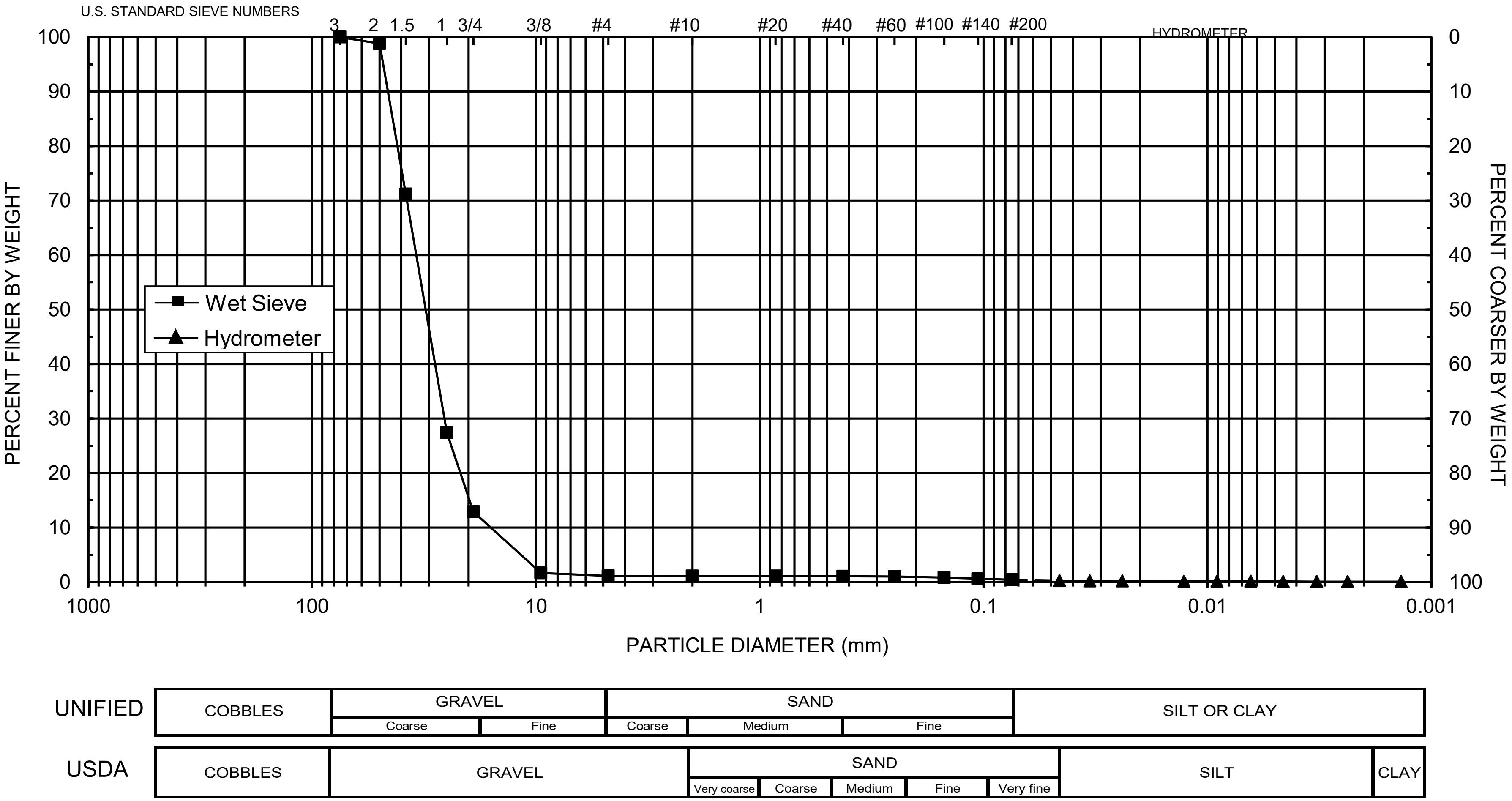
Initial Wt. *(g):* 97.39
Total Sample Wt. *(g):* 73845.51
Wt. Passing #10 *(g):* 802.87

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	28.00	5.08	22.9	11	0.0457	24	0.3
	2	22.0	23.00	5.08	17.9	12	0.0335	18	0.2
	4	22.0	21.00	5.08	15.9	12	0.0240	16	0.2
	15	22.0	17.00	5.08	11.9	13	0.0127	12	0.1
	30	21.9	16.00	5.11	10.9	13	0.0091	11	0.1
	60	21.8	16.00	5.15	10.9	13	0.0064	11	0.1
	120	21.8	14.00	5.15	8.9	14	0.0046	9	0.1
	240	21.6	13.75	5.22	8.5	14	0.0032	9	0.1
	456	21.6	13.00	5.22	7.8	14	0.0024	8	0.1
15-May-19	1372	21.6	13.00	5.22	7.8	14	0.0014	8	0.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **16**	d_{30} = **26**	d_{50} = **31**	d_{60} = **34**	C_u = **2.1**	C_c = **1.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L4-01B	**04/17/2019 1045**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02B
Lab ID: HAT01-11.1904001-009
Date/Time sampled: 04/17/2019 1145

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 80938.86
Weight Passing #10 (g): 21238.88
Weight Retained #10 (g): 59699.98
Weight of Hydrometer Sample (g): 87.90
Calculated Weight of Sieve Sample (g): 334.98

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	80938.86	100.00
	2"	50	0.00	0.00	80938.86	100.00
	1.5"	38.1	5970.32	5970.32	74968.54	92.62
	1"	25	13836.10	19806.42	61132.44	75.53
	3/4"	19.0	6208.47	26014.89	54923.98	67.86
	3/8"	9.5	13211.76	39226.65	41712.21	51.54
	4	4.75	11631.41	50858.05	30080.81	37.16
	10	2.00	8841.93	59699.98	21238.88	26.24
-10			(Based on calculated sieve wt.)			
	20	0.85	9.32	256.40	78.58	23.46
	40	0.425	11.75	268.15	66.83	19.95
	60	0.250	11.02	279.17	55.81	16.66
	100	0.150	10.06	289.23	45.75	13.66
	140	0.106	11.76	300.99	33.99	10.15
	200	0.075	8.54	309.53	25.45	7.60
	dry pan		0.90	310.43	24.55	
	wet pan			24.55	0.00	

d_{10} (mm): 0.10
d_{16} (mm): 0.22
d_{30} (mm): 2.7

d_{50} (mm): 8.8
d_{60} (mm): 14
d_{84} (mm): 31

Median Particle Diameter --d_{50} (mm): 8.8
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 140
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 5.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 13

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis

Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02B
Lab ID: HAT01-11.1904001-009
Date/Time sampled: 04/17/2019 1145

Test Date: 14-May-19
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

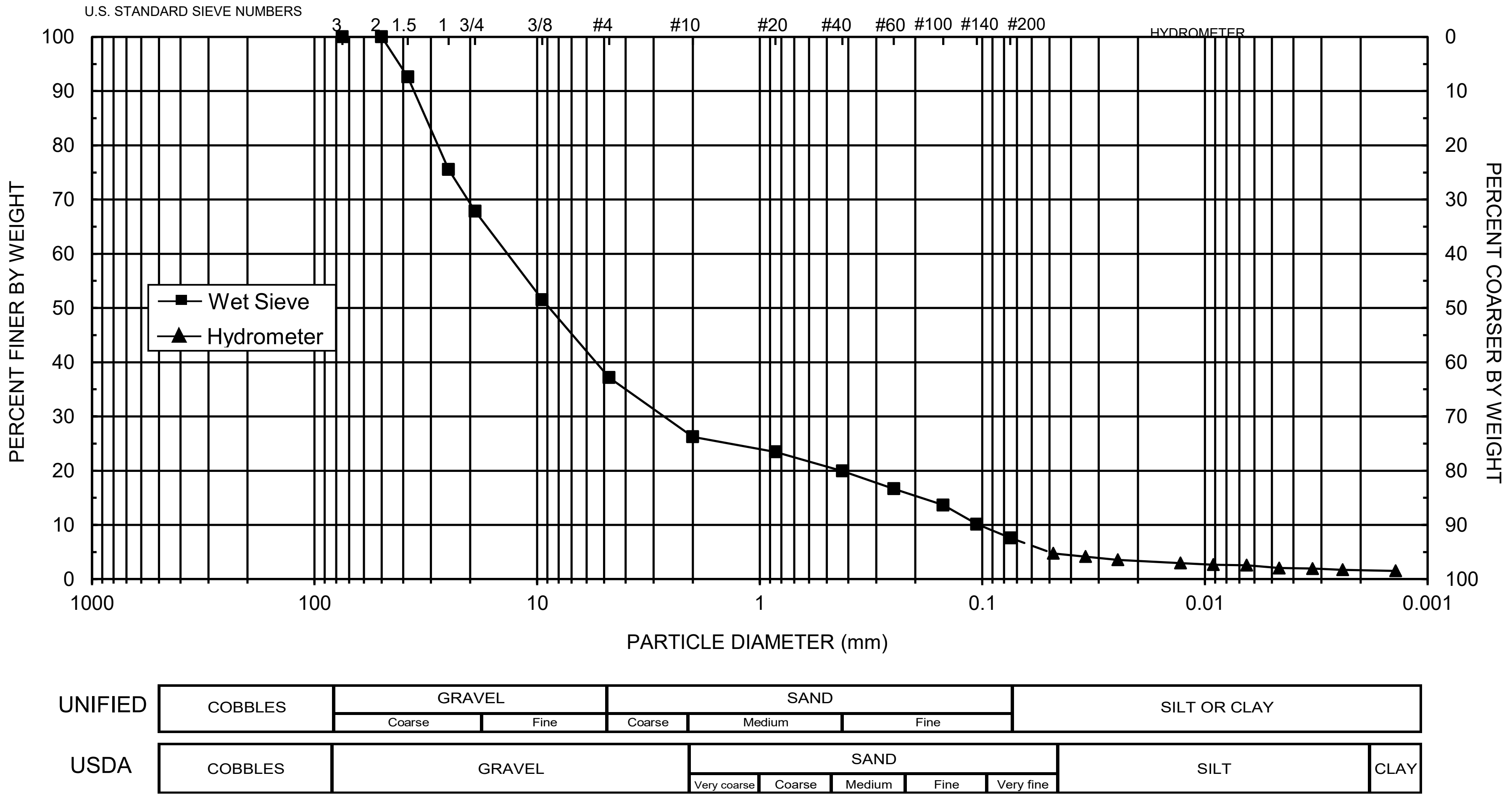
Initial Wt. (g)*:* 87.90
Total Sample Wt. (g)*:* 80938.86
Wt. Passing #10 (g)*:* 21238.88

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	21.00	5.08	15.9	12	0.0480	18	4.8
	2	22.0	19.00	5.08	13.9	13	0.0344	16	4.2
	4	22.0	17.00	5.08	11.9	13	0.0246	14	3.6
	15	21.9	15.00	5.11	9.9	13	0.0129	11	3.0
	30	21.9	14.00	5.11	8.9	14	0.0092	10	2.7
	60	21.8	13.75	5.15	8.6	14	0.0065	10	2.6
	120	21.8	12.00	5.15	6.9	14	0.0046	8	2.0
	240	21.6	11.75	5.22	6.5	14	0.0033	7	1.9
	452	21.6	11.00	5.22	5.8	14	0.0024	7	1.7
15-May-19	1367	21.8	10.25	5.15	5.1	14	0.0014	6	1.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.10**	d_{30} = **2.7**	d_{50} = **8.8**	d_{60} = **14**	C_u = **140**	C_c = **5.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L4-02B	**04/17/2019 1145**	**Classification by ASTM 2487 requires Atterberg test**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	77641.49
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	16361.53
Sample Number:	L4-03B	*Weight Retained #10 (g):*	61279.96
Lab ID:	HAT01-11.1904001-010	*Weight of Hydrometer Sample (g):*	54.61
Date/Time sampled:	04/17/2019 1340	*Calculated Weight of Sieve Sample (g):*	259.14
Test Date:	21-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	77641.49	100.00
	2"	50	0.00	0.00	77641.49	100.00
	1.5"	38.1	9019.35	9019.35	68622.14	88.38
	1"	25	15503.40	24522.75	53118.74	68.42
	3/4"	19.0	8089.91	32612.66	45028.82	58.00
	3/8"	9.5	12202.66	44815.32	32826.17	42.28
	4	4.75	9755.64	54570.97	23070.52	29.71
	10	2.00	6708.99	61279.96	16361.53	21.07
-10			(Based on calculated sieve wt.)			
	20	0.85	5.13	209.66	49.48	19.09
	40	0.425	6.25	215.91	43.23	16.68
	60	0.250	6.89	222.80	36.34	14.02
	100	0.150	6.69	229.49	29.65	11.44
	140	0.106	7.18	236.67	22.47	8.67
	200	0.075	5.34	242.01	17.13	6.61
	dry pan		0.41	242.42	16.72	
	wet pan			16.72	0.00	

d_{10} (mm):	0.13	d_{50} (mm):	13
d_{16} (mm):	0.37	d_{60} (mm):	20
d_{30} (mm):	4.8	d_{84} (mm):	35

Median Particle Diameter --d_{50} (mm): 13

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 154

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 8.9

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 16

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03B
Lab ID: HAT01-11.1904001-010
Date/Time sampled: 04/17/2019 1340

Test Date: 13-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

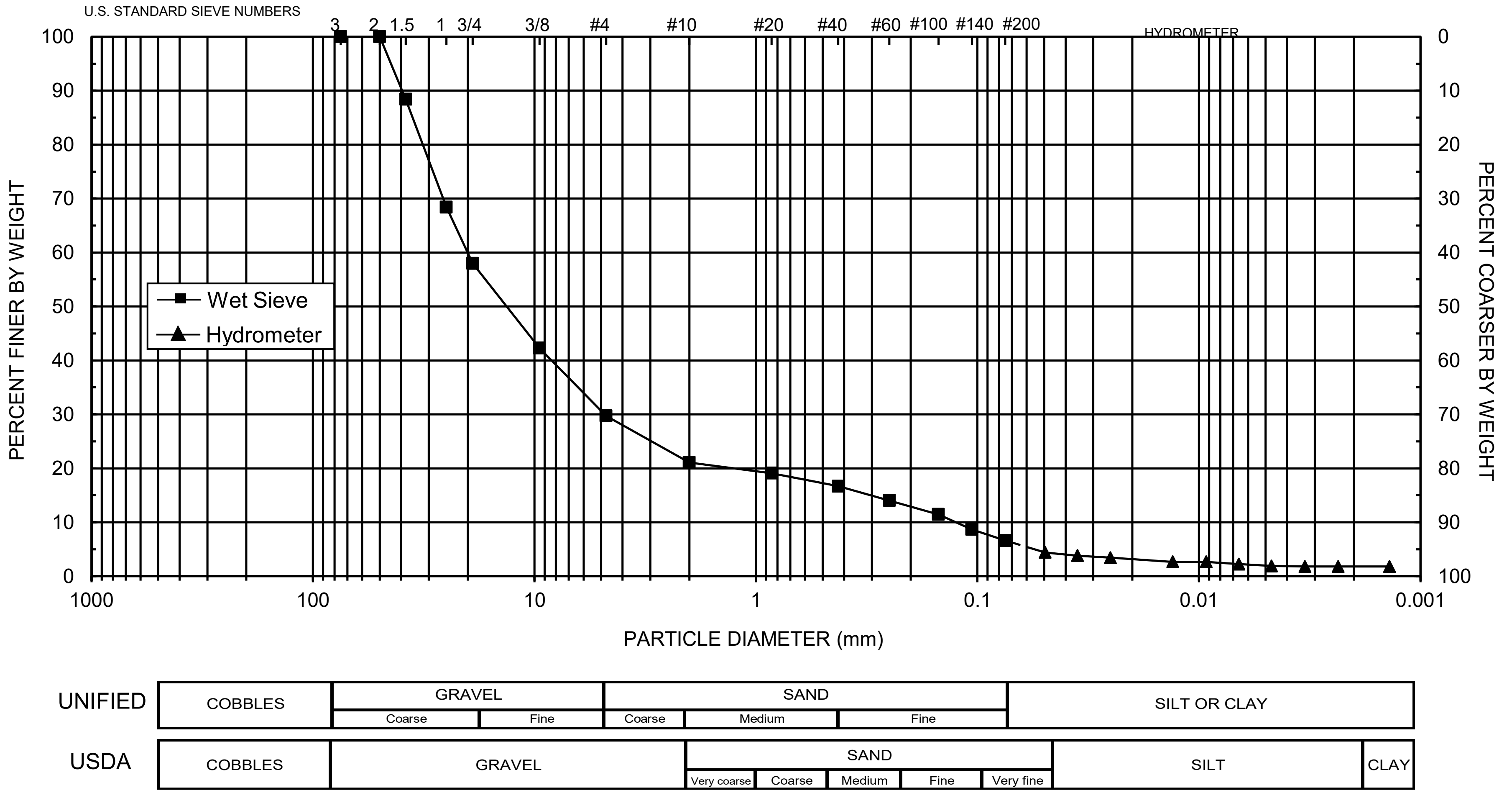
Initial Wt. (g)*:* 54.61
Total Sample Wt. (g)*:* 77641.49
Wt. Passing #10 (g)*:* 16361.53

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.9	16.50	5.11	11.4	13	0.0494	21	4.4
	2	21.9	15.00	5.11	9.9	13	0.0353	18	3.8
	4	21.9	14.00	5.11	8.9	14	0.0251	16	3.4
	15	21.9	12.00	5.11	6.9	14	0.0131	13	2.7
	30	21.9	12.00	5.11	6.9	14	0.0093	13	2.7
	60	21.7	11.00	5.19	5.8	14	0.0066	11	2.2
	120	21.9	10.00	5.11	4.9	14	0.0047	9	1.9
	240	21.9	9.75	5.11	4.6	14	0.0033	8	1.8
	480	21.9	9.75	5.11	4.6	14	0.0024	8	1.8
14-May-19	1397	21.9	9.75	5.11	4.6	14	0.0014	8	1.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.13**	d_{30} = **4.8**	d_{50} = **13**	d_{60} = **20**	C_u = **154**	C_c = **8.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L4-03B	**04/17/2019 1340**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11B
Lab ID: HAT01-11.1904001-024
Date/Time sampled: 04/17/2019 1500

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 83604.56
Weight Passing #10 (g): 6301.89
Weight Retained #10 (g): 77302.68
Weight of Hydrometer Sample (g): 105.43
Calculated Weight of Sieve Sample (g): 1398.70

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	83604.56	100.00
	2"	50	499.77	499.77	83104.79	99.40
	1.5"	38.1	11121.64	11621.41	71983.15	86.10
	1"	25	25223.20	36844.61	46759.95	55.93
	3/4"	19.0	15685.64	52530.25	31074.31	37.17
	3/8"	9.5	16812.17	69342.42	14262.14	17.06
	4	4.75	6109.73	75452.15	8152.41	9.75
	10	2.00	1850.53	77302.68	6301.89	7.54
-10			(Based on calculated sieve wt.)			
	20	0.85	9.07	1302.34	96.36	6.89
	40	0.425	6.88	1309.22	89.48	6.40
	60	0.250	8.90	1318.12	80.58	5.76
	100	0.150	14.27	1332.39	66.31	4.74
	140	0.106	17.06	1349.45	49.25	3.52
	200	0.075	11.51	1360.96	37.74	2.70
	dry pan		2.05	1363.01	35.69	
	wet pan			35.69	0.00	

d_{10} (mm): 4.9
d_{16} (mm): 8.6
d_{30} (mm): 15
d_{50} (mm): 23
d_{60} (mm): 26
d_{84} (mm): 37

Median Particle Diameter --d_{50} (mm): 23
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 5.3
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.8
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 23

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11B
Lab ID: HAT01-11.1904001-024
Date/Time sampled: 04/17/2019 1500

Test Date: 20-May-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

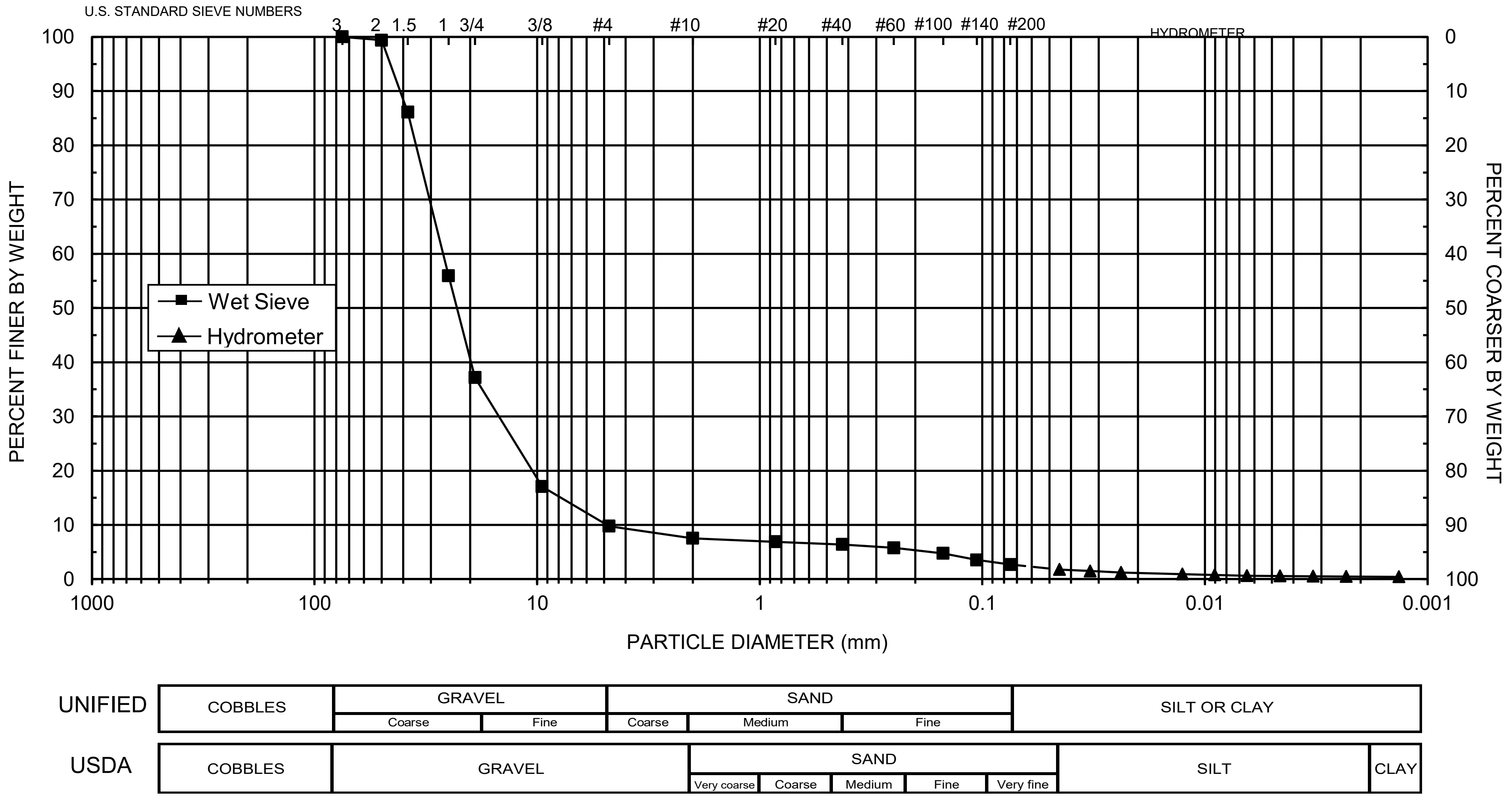
Initial Wt. (g)*:* 105.43
Total Sample Wt. (g)*:* 83604.56
Wt. Passing #10 (g)*:* 6301.89

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
20-May-19	1	21.8	30.00	5.15	24.9	11	0.0450	24	1.8
	2	21.8	26.00	5.15	20.9	12	0.0328	20	1.5
	4	21.8	22.25	5.15	17.1	12	0.0238	16	1.2
	15	21.8	18.00	5.15	12.9	13	0.0126	12	0.9
	30	21.7	16.00	5.19	10.8	13	0.0090	10	0.8
	60	21.7	14.00	5.19	8.8	14	0.0065	8	0.6
	120	21.6	13.25	5.22	8.0	14	0.0046	8	0.6
	240	21.6	12.50	5.22	7.3	14	0.0033	7	0.5
	480	21.5	12.00	5.26	6.7	14	0.0023	6	0.5
21-May-19	1429	20.6	11.75	5.57	6.2	14	0.0013	6	0.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **4.9**	d_{30} = **15**	d_{50} = **23**	d_{60} = **26**	C_u = **5.3**	C_c = **1.8**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L4-11B	**04/17/2019 1500**	**Well-graded gravel (GW)**	

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01B
Lab ID: HAT01-11.1904001-011
Date/Time sampled: 04/17/2019 1700

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 69732.68
Weight Passing #10 (g): 1164.50
Weight Retained #10 (g): 68568.18
Weight of Hydrometer Sample (g): 99.28
Calculated Weight of Sieve Sample (g): 5945.09

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	69732.68	100.00
	2"	50	342.86	342.86	69389.82	99.51
	1.5"	38.1	10952.91	11295.77	58436.91	83.80
	1"	25	29280.40	40576.17	29156.51	41.81
	3/4"	19.0	14656.93	55233.10	14499.58	20.79
	3/8"	9.5	12800.70	68033.80	1698.88	2.44
	4	4.75	496.00	68529.80	1202.88	1.72
	10	2.00	38.38	68568.18	1164.50	1.67
-10			(Based on calculated sieve wt.)			
	20	0.85	1.12	5846.93	98.16	1.65
	40	0.425	1.23	5848.16	96.93	1.63
	60	0.250	5.72	5853.88	91.21	1.53
	100	0.150	20.68	5874.56	70.53	1.19
	140	0.106	22.25	5896.81	48.28	0.81
	200	0.075	16.09	5912.90	32.19	0.54
	dry pan		1.72	5914.62	30.47	
	wet pan			30.47	0.00	

d_{10} (mm): 13
d_{16} (mm): 16
d_{30} (mm): 21

d_{50} (mm): 27
d_{60} (mm): 30
d_{84} (mm): 38

Median Particle Diameter --d_{50} (mm): 27
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 2.3
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.1
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 27

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

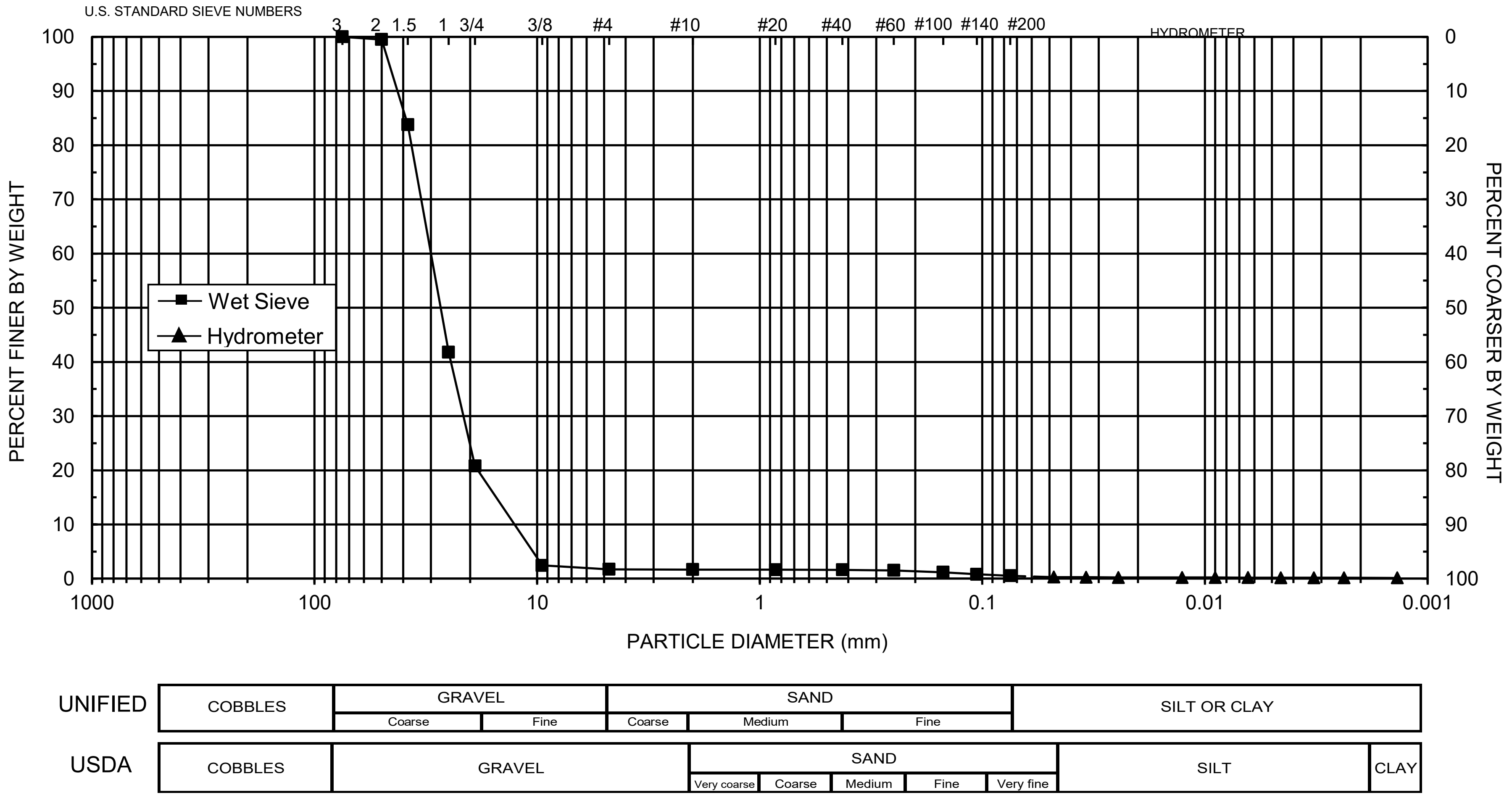
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-01B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-011	*Assumed particle density:*	2.65
Date/Time sampled:	04/17/2019 1700	*Initial Wt.* (g)*:*	99.28
Test Date:	14-May-19	*Total Sample Wt.* (g)*:*	69732.68
Start Time:	9:48	*Wt. Passing #10* (g)*:*	1164.50

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	22.00	5.08	16.9	12	0.0477	17	0.3
	2	22.0	20.00	5.08	14.9	13	0.0342	15	0.3
	4	22.0	18.00	5.08	12.9	13	0.0245	13	0.2
	15	21.9	17.75	5.11	12.6	13	0.0127	13	0.2
	30	21.9	17.00	5.11	11.9	13	0.0090	12	0.2
	60	21.8	16.00	5.15	10.9	13	0.0064	11	0.2
	120	21.8	15.00	5.15	9.9	13	0.0046	10	0.2
	240	21.6	14.00	5.22	8.8	14	0.0032	9	0.1
	448	21.6	14.00	5.22	8.8	14	0.0024	9	0.1
15-May-19	1362	21.8	13.00	5.15	7.9	14	0.0014	8	0.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **13**	d_{30} = **21**	d_{50} = **27**	d_{60} = **30**	C_u = **2.3**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01B	**04/17/2019 1700**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01C
Lab ID: HAT01-11.1904001-034
Date/Time sampled: 04/17/2019 1620

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 5445.20
Weight Passing #10 (g): 1801.40
Weight Retained #10 (g): 3643.80
Weight of Hydrometer Sample (g): 92.95
Calculated Weight of Sieve Sample (g): 280.96

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	5445.20	100.00
	2"	50	0.00	0.00	5445.20	100.00
	1.5"	38.1	488.80	488.80	4956.40	91.02
	1"	25	1310.20	1799.00	3646.20	66.96
	3/4"	19.0	781.40	2580.40	2864.80	52.61
	3/8"	9.5	907.80	3488.20	1957.00	35.94
	4	4.75	117.80	3606.00	1839.20	33.78
	10	2.00	37.80	3643.80	1801.40	33.08
-10			(Based on calculated sieve wt.)			
	20	0.85	0.94	188.95	92.01	32.75
	40	0.425	1.21	190.16	90.80	32.32
	60	0.250	5.29	195.45	85.51	30.43
	100	0.150	20.19	215.64	65.32	23.25
	140	0.106	20.93	236.57	44.39	15.80
	200	0.075	15.64	252.21	28.75	10.23
	dry pan		0.94	253.15	27.81	
	wet pan			27.81	0.00	

d_{10} (mm): 0.073
d_{16} (mm): 0.11
d_{30} (mm): 0.24
d_{50} (mm): 17
d_{60} (mm): 22
d_{84} (mm): 34

Median Particle Diameter --d_{50} (mm): 17
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 301
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.036
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 17

Classification of fines (visual method): ML

USCS Soil Classification: Poorly-graded gravel with silt and sand (GP-GM)

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01C
Lab ID: HAT01-11.1904001-034
Date/Time sampled: 04/17/2019 1620

Test Date: 14-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

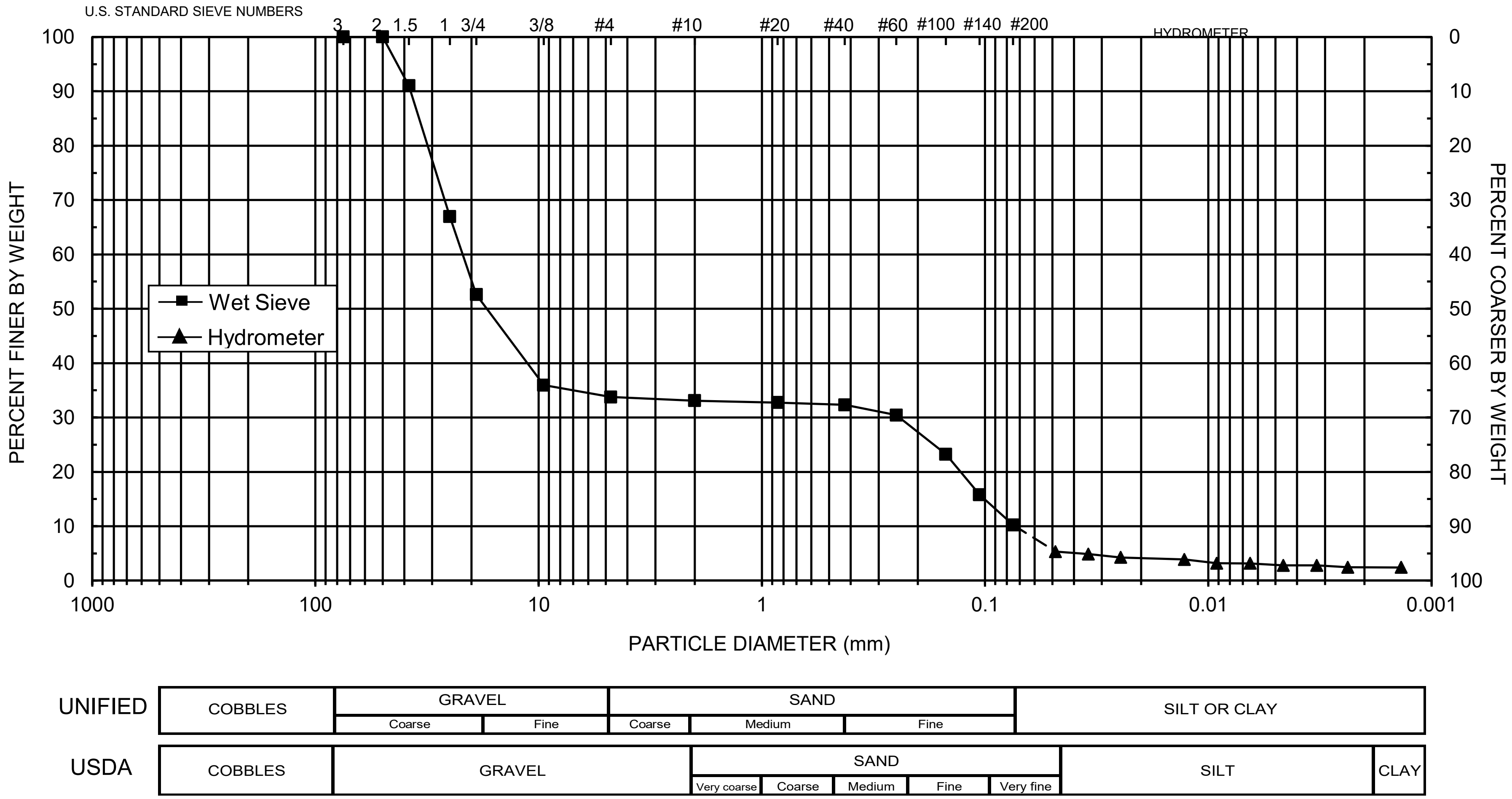
Initial Wt. (g)*:* 92.95
Total Sample Wt. (g)*:* 5445.20
Wt. Passing #10 (g)*:* 1801.40

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
15-May-19	1	22.0	20.00	5.08	14.9	13	0.0483	16	5.3
	2	22.0	18.75	5.08	13.7	13	0.0345	15	4.9
	4	22.0	17.00	5.08	11.9	13	0.0246	13	4.2
	15	22.0	16.00	5.08	10.9	13	0.0128	12	3.9
	30	22.0	14.00	5.08	8.9	14	0.0092	10	3.2
	60	21.9	14.00	5.11	8.9	14	0.0065	10	3.2
	120	21.8	13.00	5.15	7.9	14	0.0046	8	2.8
	240	21.8	13.00	5.15	7.9	14	0.0033	8	2.8
	460	21.8	12.00	5.15	6.9	14	0.0024	7	2.4
16-May-19	1387	21.7	12.00	5.19	6.8	14	0.0014	7	2.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.073**	d_{30} = **0.24**	d_{50} = **17**	d_{60} = **22**	C_u = **301**	C_c = **0.036**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01C	**04/17/2019 1620**	**Poorly-graded gravel with silt and sand (GP-GM)s**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RB
Lab ID: HAT01-11.1904001-068
Date/Time sampled: 04/18/2019 740

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 1557.52
Weight Passing #10 (g): 1449.36
Weight Retained #10 (g): 108.16
Weight of Hydrometer Sample (g): 103.80
Calculated Weight of Sieve Sample (g): 111.55

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1557.52	100.00
	2"	50	0.00	0.00	1557.52	100.00
	1.5"	38.1	0.00	0.00	1557.52	100.00
	1"	25	0.00	0.00	1557.52	100.00
	3/4"	19.0	14.34	14.34	1543.18	99.08
	3/8"	9.5	41.92	56.26	1501.26	96.39
	4	4.75	28.28	84.54	1472.98	94.57
	10	2.00	23.62	108.16	1449.36	93.06
-10			(Based on calculated sieve wt.)			
	20	0.85	1.64	9.39	102.16	91.59
	40	0.425	5.68	15.07	96.48	86.49
	60	0.250	12.58	27.65	83.90	75.22
	100	0.150	19.40	47.05	64.50	57.82
	140	0.106	15.30	62.35	49.20	44.11
	200	0.075	11.17	73.52	38.03	34.09
	dry pan		3.23	76.75	34.80	
	wet pan			34.80	0.00	

d_{10} (mm): 0.011
d_{16} (mm): 0.036
d_{30} (mm): 0.065
d_{50} (mm): 0.12
d_{60} (mm): 0.16
d_{84} (mm): 0.38

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 15
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.4
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.18

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RB
Lab ID: HAT01-11.1904001-068
Date/Time sampled: 04/18/2019 740

Test Date: 24-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

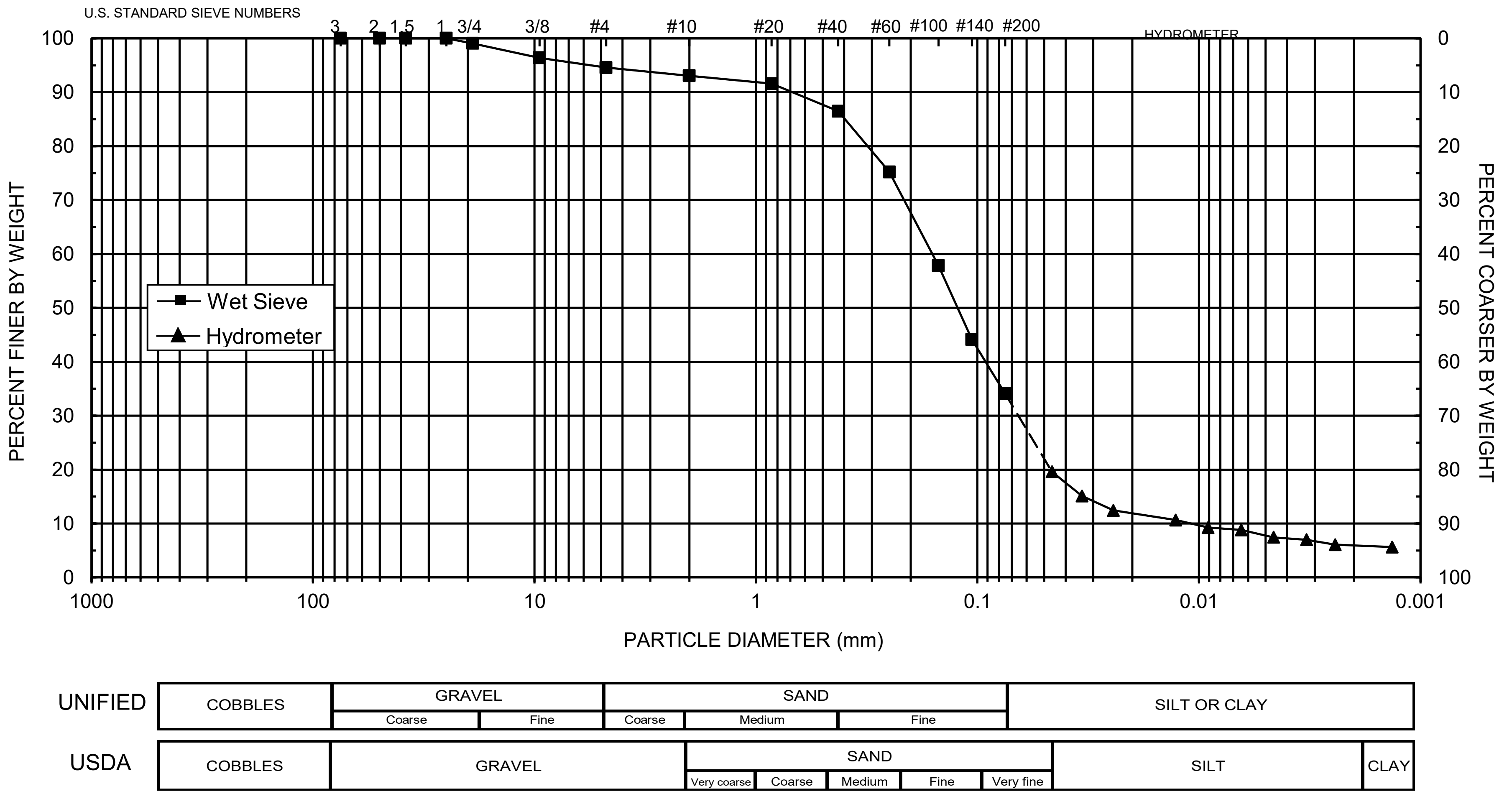
Initial Wt. *(g):* 103.80
Total Sample Wt. *(g):* 1557.52
Wt. Passing #10 *(g):* 1449.36

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	27.00	5.15	21.9	11	0.0460	21	19.6
	2	21.8	22.00	5.15	16.9	12	0.0337	16	15.1
	4	21.8	19.00	5.15	13.9	13	0.0243	13	12.4
	15	21.8	17.00	5.15	11.9	13	0.0127	11	10.6
	30	21.7	15.50	5.19	10.3	13	0.0091	10	9.2
	60	21.7	15.00	5.19	9.8	13	0.0064	9	8.8
	120	21.6	13.50	5.22	8.3	14	0.0046	8	7.4
	240	21.6	13.00	5.22	7.8	14	0.0033	7	7.0
	439	21.6	12.00	5.22	6.8	14	0.0024	7	6.1
25-May-19	1448	21.6	11.50	5.22	6.3	14	0.0013	6	5.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.011**	d_{30} = **0.065**	d_{50} = **0.12**	d_{60} = **0.16**	C_u = **15**	C_c = **2.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01RB	**04/18/2019 740**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RM
Lab ID: HAT01-11.1904001-056
Date/Time sampled: 04/18/2019 750

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1734.15
Weight Passing #10 (g): 1658.71
Weight Retained #10 (g): 75.44
Weight of Hydrometer Sample (g): 99.93
Calculated Weight of Sieve Sample (g): 104.48

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1734.15	100.00
	2"	50	0.00	0.00	1734.15	100.00
	1.5"	38.1	0.00	0.00	1734.15	100.00
	1"	25	0.00	0.00	1734.15	100.00
	3/4"	19.0	30.68	30.68	1703.47	98.23
	3/8"	9.5	17.30	47.98	1686.17	97.23
	4	4.75	14.02	62.00	1672.15	96.42
	10	2.00	13.44	75.44	1658.71	95.65
-10			(Based on calculated sieve wt.)			
	20	0.85	0.63	5.18	99.30	95.05
	40	0.425	0.85	6.03	98.45	94.23
	60	0.250	7.38	13.41	91.07	87.17
	100	0.150	25.76	39.17	65.31	62.51
	140	0.106	21.09	60.26	44.22	42.33
	200	0.075	16.00	76.26	28.22	27.01
	dry pan		2.38	78.64	25.84	
	wet pan			25.84	0.00	

d_{10} (mm): 0.018
d_{16} (mm): 0.051
d_{30} (mm): 0.080
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 7.8
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.5
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RM
Lab ID: HAT01-11.1904001-056
Date/Time sampled: 04/18/2019 750

Test Date: 16-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

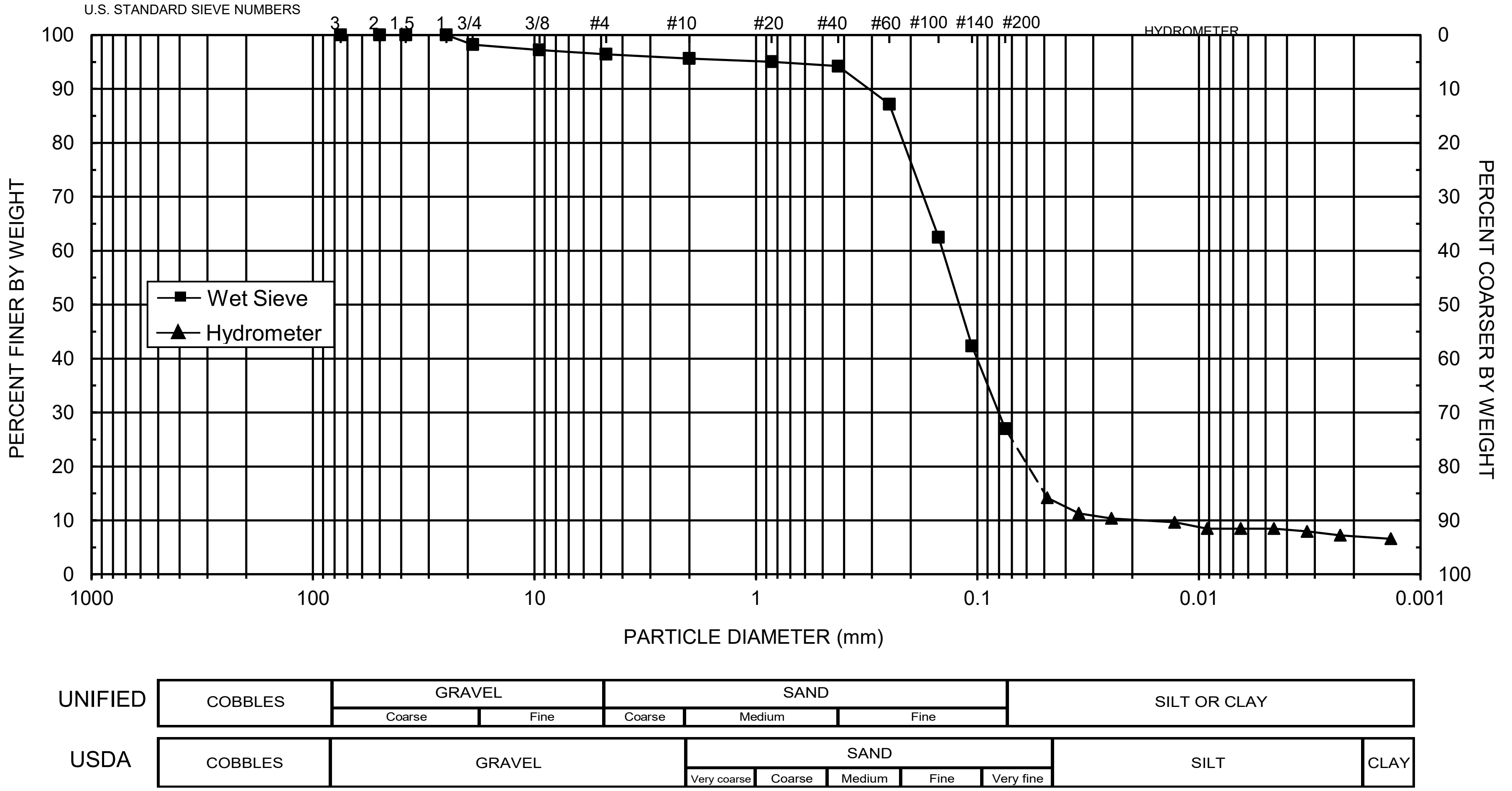
Initial Wt. (g)*:* 99.93
Total Sample Wt. (g)*:* 1734.15
Wt. Passing #10 (g)*:* 1658.71

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	20.00	5.19	14.8	13	0.0483	15	14.2
	2	21.7	17.00	5.19	11.8	13	0.0348	12	11.3
	4	21.7	16.00	5.19	10.8	13	0.0248	11	10.4
	15	21.7	15.25	5.19	10.1	13	0.0129	10	9.6
	30	21.8	14.00	5.15	8.9	14	0.0092	9	8.5
	60	21.8	14.00	5.15	8.9	14	0.0065	9	8.5
	120	21.8	14.00	5.15	8.9	14	0.0046	9	8.5
	240	21.7	13.50	5.19	8.3	14	0.0032	8	8.0
	484	21.7	12.75	5.19	7.6	14	0.0023	8	7.2
17-May-19	1400	21.9	12.00	5.11	6.9	14	0.0014	7	6.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.018**	d_{30} = **0.080**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **7.8**	C_c = **2.5**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01RM	**04/18/2019 750**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT
Lab ID: HAT01-11.1904001-041
Date/Time sampled: 04/18/2019 800

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1594.84
Weight Passing #10 (g): 1580.72
Weight Retained #10 (g): 14.12
Weight of Hydrometer Sample (g): 80.20
Calculated Weight of Sieve Sample (g): 80.92

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1594.84	100.00
	2"	50	0.00	0.00	1594.84	100.00
	1.5"	38.1	0.00	0.00	1594.84	100.00
	1"	25	0.00	0.00	1594.84	100.00
	3/4"	19.0	0.00	0.00	1594.84	100.00
	3/8"	9.5	8.19	8.19	1586.65	99.49
	4	4.75	1.42	9.61	1585.23	99.40
	10	2.00	4.51	14.12	1580.72	99.11
-10			(Based on calculated sieve wt.)			
	20	0.85	0.45	1.17	79.75	98.56
	40	0.425	0.59	1.76	79.16	97.83
	60	0.250	4.85	6.61	74.31	91.84
	100	0.150	18.25	24.86	56.06	69.28
	140	0.106	18.44	43.30	37.62	46.49
	200	0.075	14.50	57.80	23.12	28.57
	dry pan		2.48	60.28	20.64	
	wet pan			20.64	0.00	

d_{10} (mm): 0.014
d_{16} (mm): 0.055
d_{30} (mm): 0.077
d_{50} (mm): 0.11
d_{60} (mm): 0.13
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 9.3
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.3
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT
Lab ID: HAT01-11.1904001-041
Date/Time sampled: 04/18/2019 800

Test Date: 7-Jun-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

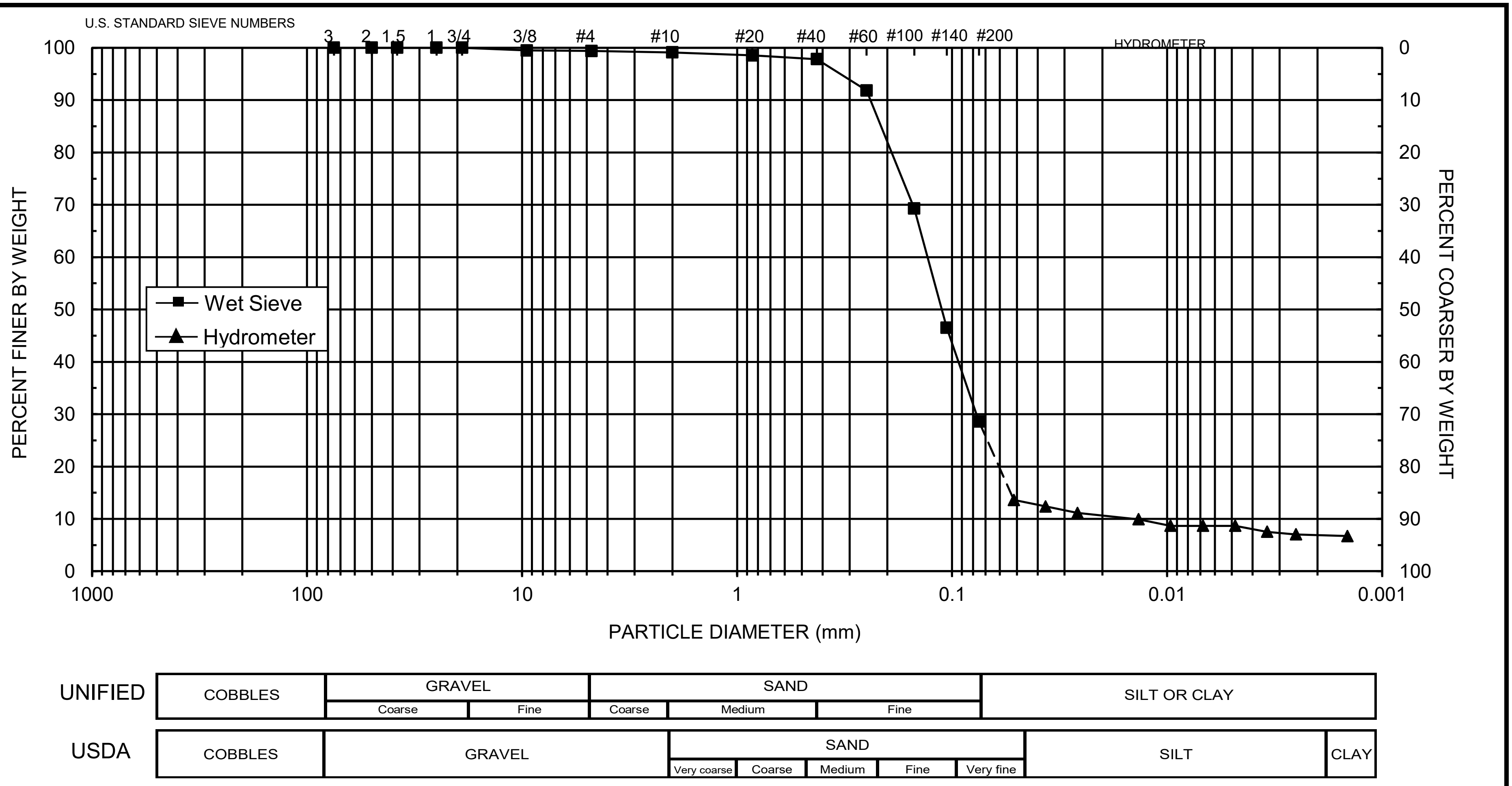
Initial Wt. (g)*:* 80.20
Total Sample Wt. (g)*:* 1594.84
Wt. Passing #10 (g)*:* 1580.72

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	17.00	5.99	11.0	14	0.0516	14	13.6
	2	21.7	16.00	5.99	10.0	14	0.0367	12	12.4
	4	21.7	15.00	5.99	9.0	15	0.0261	11	11.1
	15	21.7	14.00	5.99	8.0	15	0.0135	10	9.9
	30	21.7	13.00	5.99	7.0	15	0.0096	9	8.7
	60	21.7	13.00	5.99	7.0	15	0.0068	9	8.7
	120	21.7	13.00	5.99	7.0	15	0.0048	9	8.7
	240	21.9	12.00	5.91	6.1	15	0.0034	8	7.5
	448	22.2	11.50	5.80	5.7	15	0.0025	7	7.0
8-Jun-19	1352	21.5	11.49	6.06	5.4	15	0.0014	7	6.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.014**	d_{30} = **0.077**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **9.3**	C_c = **3.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01RT	**04/18/2019 800**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	79392.33
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	11975.08
Sample Number:	L5-02B	*Weight Retained #10 (g):*	67417.25
Lab ID:	HAT01-11.1904001-012	*Weight of Hydrometer Sample (g):*	73.92
Date/Time sampled:	04/18/2019 1230	*Calculated Weight of Sieve Sample (g):*	490.07
Test Date:	21-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	79392.33	100.00
	2"	50	527.21	527.21	78865.12	99.34
	1.5"	38.1	4894.88	5422.09	73970.24	93.17
	1"	25	13395.90	18817.99	60574.34	76.30
	3/4"	19.0	12883.87	31701.86	47690.47	60.07
	3/8"	9.5	18283.69	49985.55	29406.78	37.04
	4	4.75	11738.09	61723.63	17668.70	22.25
	10	2.00	5693.62	67417.25	11975.08	15.08
-10			(Based on calculated sieve wt.)			
	20	0.85	7.42	423.57	66.50	13.57
	40	0.425	10.21	433.78	56.29	11.49
	60	0.250	10.60	444.38	45.69	9.32
	100	0.150	8.12	452.50	37.57	7.67
	140	0.106	8.81	461.31	28.76	5.87
	200	0.075	6.68	467.99	22.08	4.51
	dry pan		0.68	468.67	21.40	
	wet pan			21.40	0.00	

d_{10} (mm):	0.30	d_{50} (mm):	14
d_{16} (mm):	2.2	d_{60} (mm):	19
d_{30} (mm):	6.8	d_{84} (mm):	30

Median Particle Diameter --d_{50} (mm): 14

Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 63

Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 8.1

Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 15

USCS Soil Classification: Poorly-graded gravel with sand (GP)

Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02B
Lab ID: HAT01-11.1904001-012
Date/Time sampled: 04/18/2019 1230

Test Date: 13-May-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

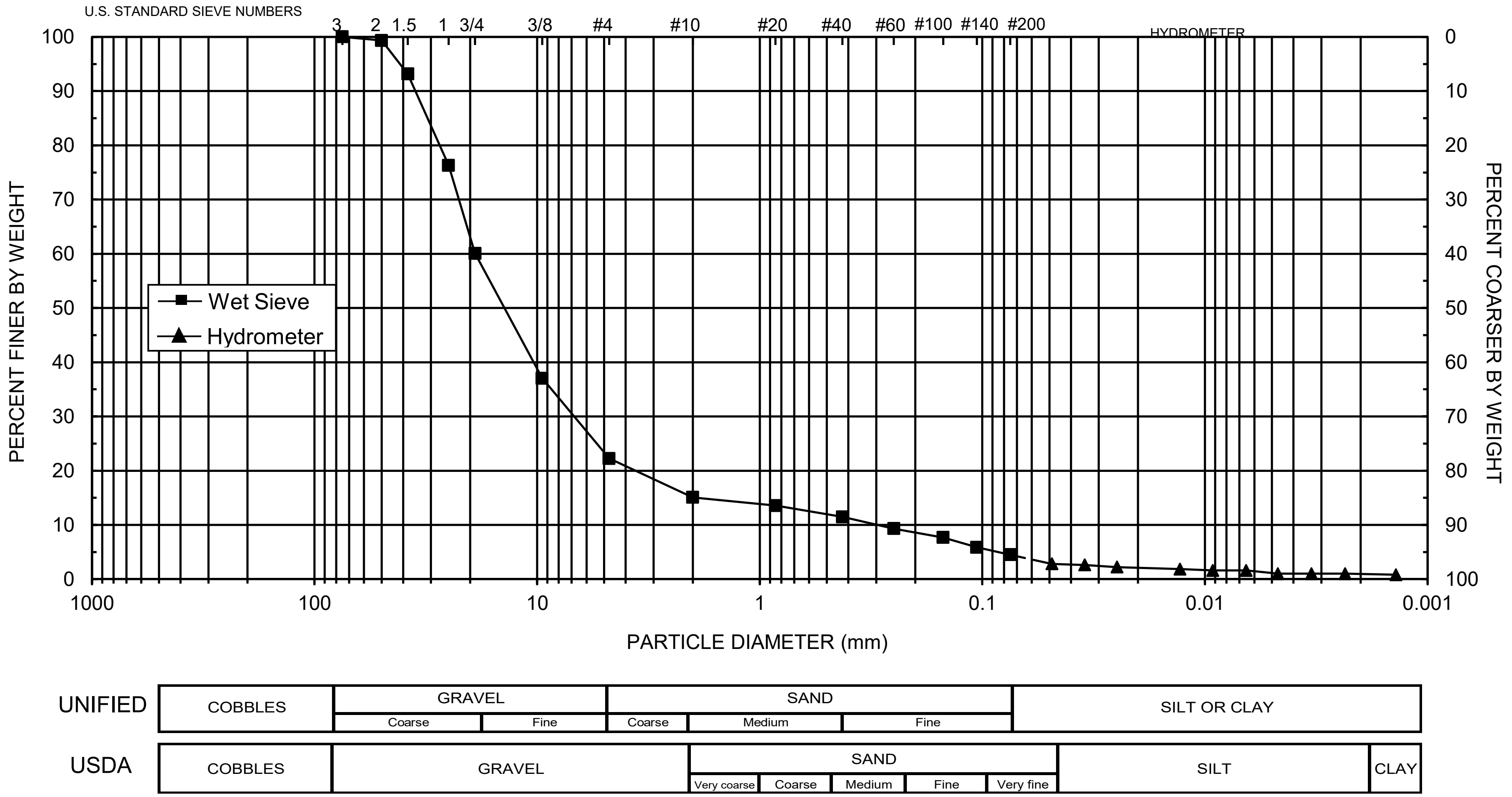
Initial Wt. (g): 73.92
Total Sample Wt. (g): 79392.33
Wt. Passing #10 (g): 11975.08

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	19.00	5.19	13.8	13	0.0486	19	2.8
	2	21.7	18.00	5.19	12.8	13	0.0346	17	2.6
	4	21.7	16.00	5.19	10.8	13	0.0248	15	2.2
	15	21.7	14.25	5.19	9.1	14	0.0129	12	1.8
	30	21.7	13.00	5.19	7.8	14	0.0092	11	1.6
	60	21.7	13.00	5.19	7.8	14	0.0065	11	1.6
	120	21.9	10.00	5.11	4.9	14	0.0047	7	1.0
	240	21.9	10.00	5.11	4.9	14	0.0033	7	1.0
	480	21.9	10.00	5.11	4.9	14	0.0023	7	1.0
14-May-19	1392	21.9	9.00	5.11	3.9	14	0.0014	5	0.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.30**	d_{30} = **6.8**	d_{50} = **14**	d_{60} = **19**	C_u = **63**	C_c = **8.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-02B	**04/18/2019 1230**	**Poorly-graded gravel with sand (GP)s**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RB
Lab ID: HAT01-11.1904001-069
Date/Time sampled: 04/18/2019 1240

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 1614.75
Weight Passing #10 (g): 1592.88
Weight Retained #10 (g): 21.87
Weight of Hydrometer Sample (g): 98.67
Calculated Weight of Sieve Sample (g): 100.02

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1614.75	100.00
	2"	50	0.00	0.00	1614.75	100.00
	1.5"	38.1	0.00	0.00	1614.75	100.00
	1"	25	0.00	0.00	1614.75	100.00
	3/4"	19.0	0.00	0.00	1614.75	100.00
	3/8"	9.5	4.80	4.80	1609.95	99.70
	4	4.75	6.83	11.63	1603.12	99.28
	10	2.00	10.24	21.87	1592.88	98.65
-10			(Based on calculated sieve wt.)			
	20	0.85	0.58	1.93	98.09	98.07
	40	0.425	0.75	2.68	97.34	97.32
	60	0.250	8.46	11.14	88.88	88.86
	100	0.150	25.27	36.41	63.61	63.59
	140	0.106	20.03	56.44	43.58	43.57
	200	0.075	15.43	71.87	28.15	28.14
	dry pan		4.93	76.80	23.22	
	wet pan			23.22	0.00	

d_{10} (mm): 0.014
d_{16} (mm): 0.048
d_{30} (mm): 0.078
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 10
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.1
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

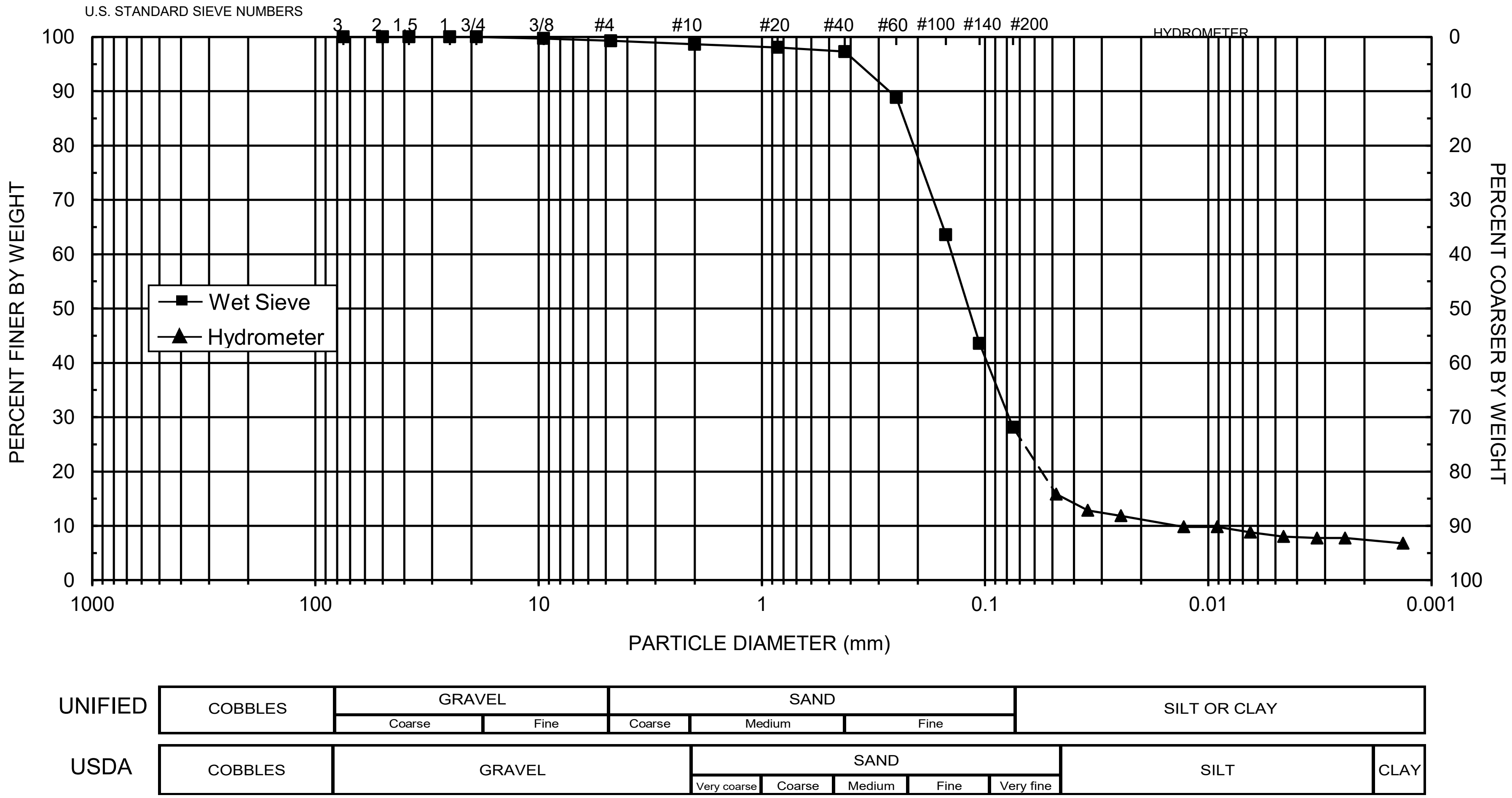
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-02RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-069	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1240	*Initial Wt. (g):*	98.67
Test Date:	24-May-19	*Total Sample Wt. (g):*	1614.75
Start Time:	9:48	*Wt. Passing #10 (g):*	1592.88

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	21.00	5.15	15.9	12	0.0480	16	15.8
	2	21.8	18.00	5.15	12.9	13	0.0346	13	12.8
	4	21.8	17.00	5.15	11.9	13	0.0246	12	11.8
	15	21.7	15.00	5.19	9.8	13	0.0129	10	9.8
	30	21.7	15.00	5.19	9.8	13	0.0091	10	9.8
	60	21.7	14.00	5.19	8.8	14	0.0065	9	8.8
	120	21.6	13.25	5.22	8.0	14	0.0046	8	8.0
	240	21.5	13.00	5.26	7.7	14	0.0033	8	7.7
	430	21.5	13.00	5.26	7.7	14	0.0024	8	7.7
25-May-19	1437	21.6	12.00	5.22	6.8	14	0.0013	7	6.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.014**	d_{30} = **0.078**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **10**	C_c = **3.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-02RB	**04/18/2019 1240**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RM
Lab ID: HAT01-11.1904001-057
Date/Time sampled: 04/18/2019 1235

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1618.52
Weight Passing #10 (g): 1600.11
Weight Retained #10 (g): 18.41
Weight of Hydrometer Sample (g): 92.07
Calculated Weight of Sieve Sample (g): 93.13

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1618.52	100.00
	2"	50	0.00	0.00	1618.52	100.00
	1.5"	38.1	0.00	0.00	1618.52	100.00
	1"	25	0.00	0.00	1618.52	100.00
	3/4"	19.0	0.00	0.00	1618.52	100.00
	3/8"	9.5	8.26	8.26	1610.26	99.49
	4	4.75	4.84	13.10	1605.42	99.19
	10	2.00	5.31	18.41	1600.11	98.86
-10			(Based on calculated sieve wt.)			
	20	0.85	0.57	1.63	91.50	98.25
	40	0.425	0.74	2.37	90.76	97.46
	60	0.250	7.18	9.55	83.58	89.75
	100	0.150	23.39	32.94	60.19	64.63
	140	0.106	20.55	53.49	39.64	42.56
	200	0.075	13.32	66.81	26.32	28.26
	dry pan		1.39	68.20	24.93	
	wet pan			24.93	0.00	

d_{10} (mm): 0.0069
d_{16} (mm): 0.045
d_{30} (mm): 0.078

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 20
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 6.3
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RM
Lab ID: HAT01-11.1904001-057
Date/Time sampled: 04/18/2019 1235

Test Date: 16-May-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

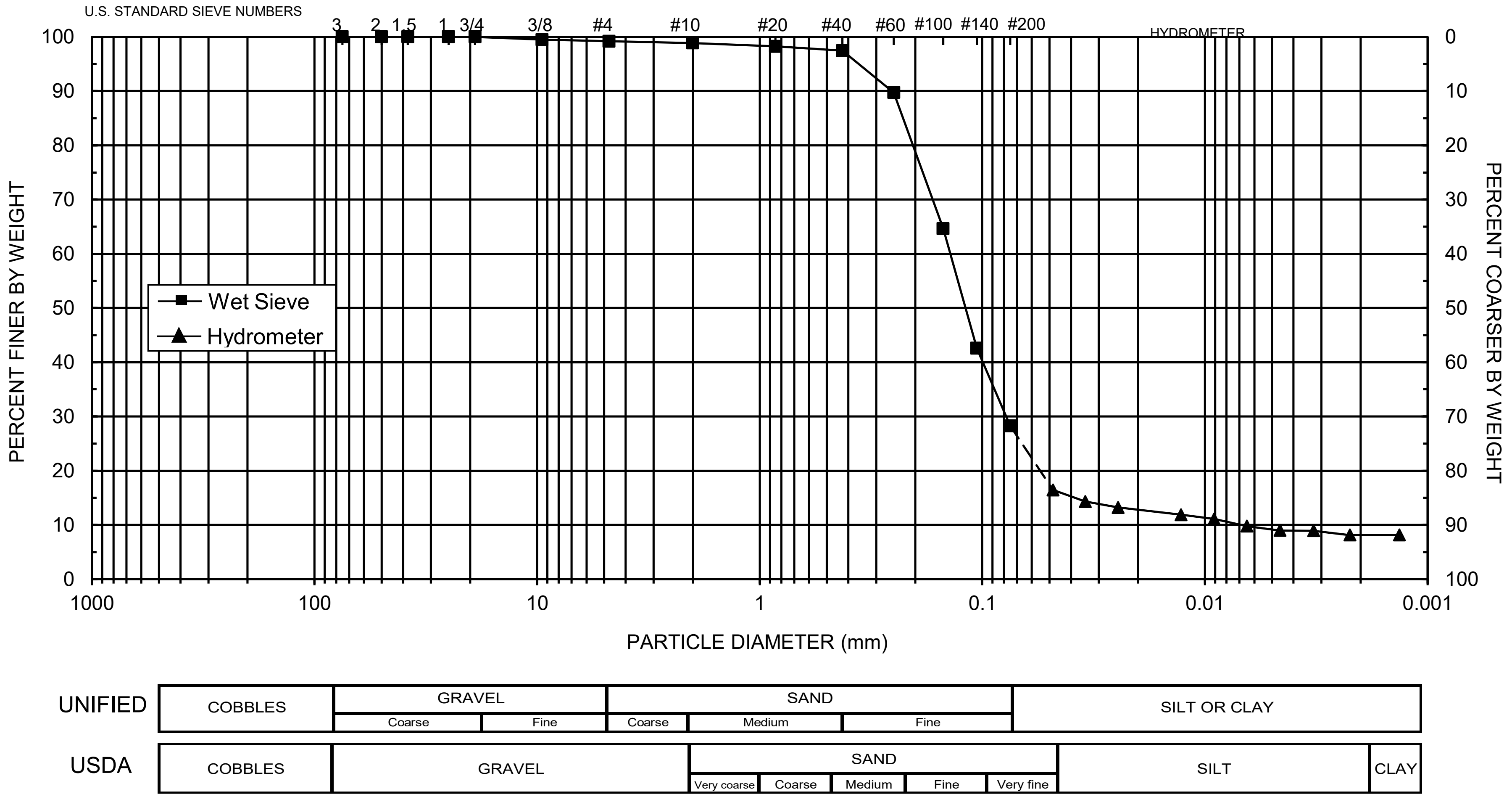
Initial Wt. (g)*:* 92.07
Total Sample Wt. (g)*:* 1618.52
Wt. Passing #10 (g)*:* 1600.11

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	20.50	5.19	15.3	12	0.0482	17	16.4
	2	21.7	18.50	5.19	13.3	13	0.0345	14	14.3
	4	21.7	17.50	5.19	12.3	13	0.0246	13	13.2
	15	21.7	16.25	5.19	11.1	13	0.0128	12	11.9
	30	21.7	15.50	5.19	10.3	13	0.0091	11	11.1
	60	21.8	14.25	5.15	9.1	14	0.0065	10	9.8
	120	21.8	13.50	5.15	8.4	14	0.0046	9	9.0
	240	21.7	13.50	5.19	8.3	14	0.0032	9	8.9
	514	21.7	12.75	5.19	7.6	14	0.0022	8	8.1
17-May-19	1430	21.7	12.75	5.19	7.6	14	0.0013	8	8.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0069**	d_{30} = **0.078**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **20**	C_c = **6.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-02RM	**04/18/2019 1235**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RT
Lab ID: HAT01-11.1904001-042
Date/Time sampled: 04/18/2019 1235

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1645.30
Weight Passing #10 (g): 1640.28
Weight Retained #10 (g): 5.02
Weight of Hydrometer Sample (g): 99.06
Calculated Weight of Sieve Sample (g): 99.36

Shape: Rounded
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1645.30	100.00
	2"	50	0.00	0.00	1645.30	100.00
	1.5"	38.1	0.00	0.00	1645.30	100.00
	1"	25	0.00	0.00	1645.30	100.00
	3/4"	19.0	0.00	0.00	1645.30	100.00
	3/8"	9.5	0.00	0.00	1645.30	100.00
	4	4.75	1.68	1.68	1643.62	99.90
	10	2.00	3.34	5.02	1640.28	99.69
-10			(Based on calculated sieve wt.)			
	20	0.85	0.26	0.56	98.80	99.43
	40	0.425	0.86	1.42	97.94	98.57
	60	0.250	6.10	7.52	91.84	92.43
	100	0.150	22.82	30.34	69.02	69.46
	140	0.106	23.26	53.60	45.76	46.05
	200	0.075	17.10	70.70	28.66	28.84
	dry pan		3.49	74.19	25.17	
	wet pan			25.17	0.00	

d_{10} (mm): 0.014
d_{16} (mm): 0.050
d_{30} (mm): 0.077

d_{50} (mm): 0.11
d_{60} (mm): 0.13
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 9.3
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.3
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

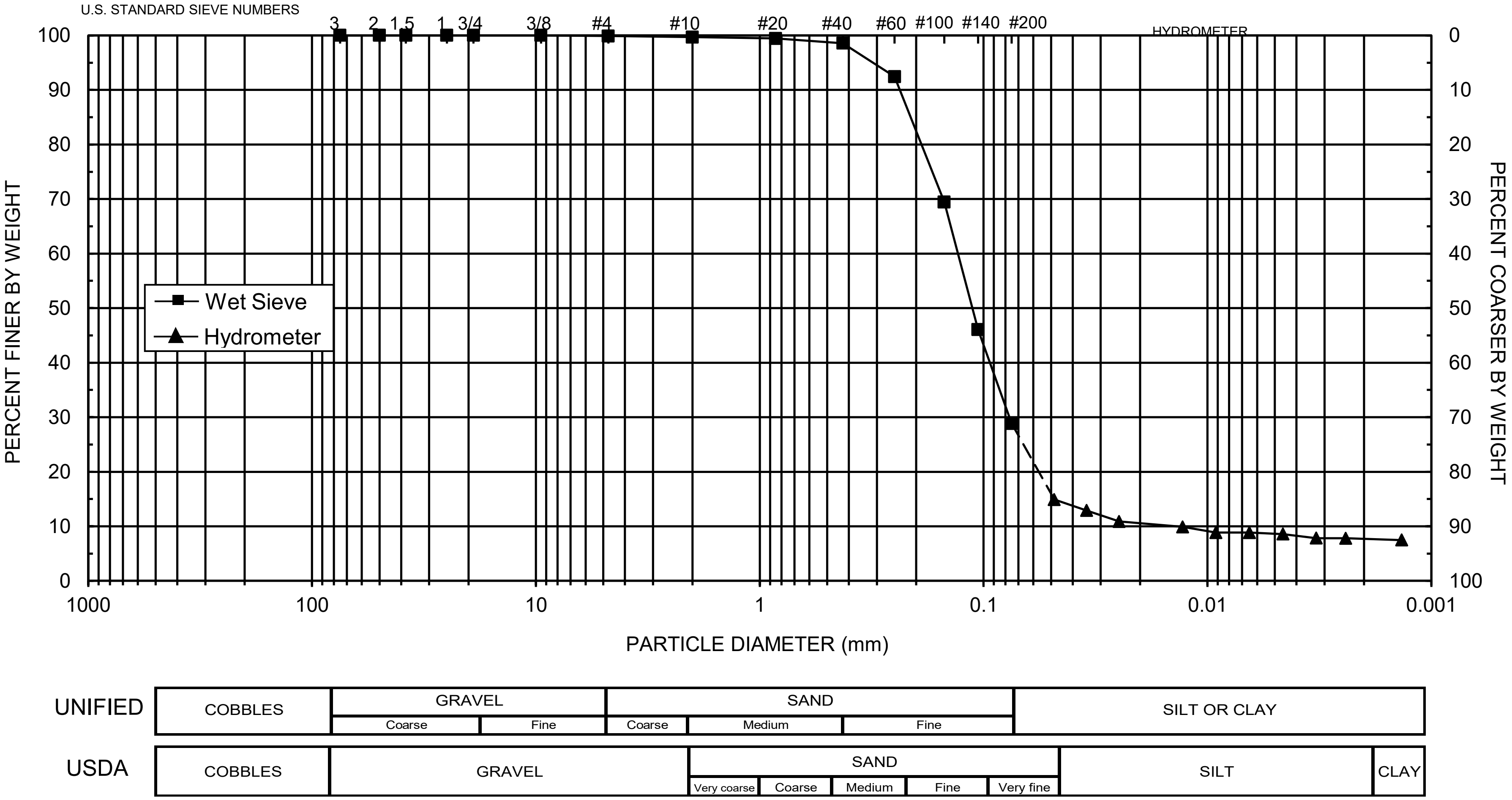
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-02RT	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-042	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1235	*Initial Wt. (g):*	99.06
Test Date:	20-May-19	*Total Sample Wt. (g):*	1645.30
Start Time:	9:48	*Wt. Passing #10 (g):*	1640.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
20-May-19	1	21.7	20.00	5.19	14.8	13	0.0483	15	14.9
	2	21.7	18.00	5.19	12.8	13	0.0346	13	12.9
	4	21.7	16.00	5.19	10.8	13	0.0248	11	10.9
	15	21.7	15.00	5.19	9.8	13	0.0129	10	9.9
	30	21.6	14.00	5.22	8.8	14	0.0092	9	8.8
	60	21.6	14.00	5.22	8.8	14	0.0065	9	8.8
	120	21.6	13.75	5.22	8.5	14	0.0046	9	8.6
	240	21.6	13.00	5.22	7.8	14	0.0033	8	7.8
	440	21.5	13.00	5.26	7.7	14	0.0024	8	7.8
21-May-19	1389	20.6	13.00	5.57	7.4	14	0.0014	8	7.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.014**	d_{30} = **0.077**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **9.3**	C_c = **3.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-02RT	**04/18/2019 1235**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03B
Lab ID: HAT01-11.1904001-013
Date/Time sampled: 04/18/2019 1015

Test Date: 16-May-19

Initial Dry Weight of Sample (g): 80849.50
Weight Passing #10 (g): 9888.56
Weight Retained #10 (g): 70960.95
Weight of Hydrometer Sample (g): 92.67
Calculated Weight of Sieve Sample (g): 757.68

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	80849.50	100.00
	2"	50	0.00	0.00	80849.50	100.00
	1.5"	38.1	9228.94	9228.94	71620.56	88.59
	1"	25	17354.40	26583.34	54266.16	67.12
	3/4"	19.0	11420.72	38004.06	42845.44	52.99
	3/8"	9.5	17229.18	55233.25	25616.26	31.68
	4	4.75	10431.74	65664.98	15184.52	18.78
	10	2.00	5295.96	70960.95	9888.56	12.23
-10			(Based on calculated sieve wt.)			
	20	0.85	11.65	676.66	81.02	10.69
	40	0.425	8.52	685.18	72.50	9.57
	60	0.250	9.46	694.64	63.04	8.32
	100	0.150	9.73	704.37	53.31	7.04
	140	0.106	11.98	716.35	41.33	5.45
	200	0.075	9.17	725.52	32.16	4.24
	dry pan		2.05	727.57	30.11	
	wet pan			30.11	0.00	

d_{10} (mm): 0.55
d_{16} (mm): 3.3
d_{30} (mm): 8.7
d_{50} (mm): 17
d_{60} (mm): 22
d_{84} (mm): 35

Median Particle Diameter --d_{50} (mm): 17
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 40
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 6.3
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 18

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03B
Lab ID: HAT01-11.1904001-013
Date/Time sampled: 04/18/2019 1015

Test Date: 14-May-19
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

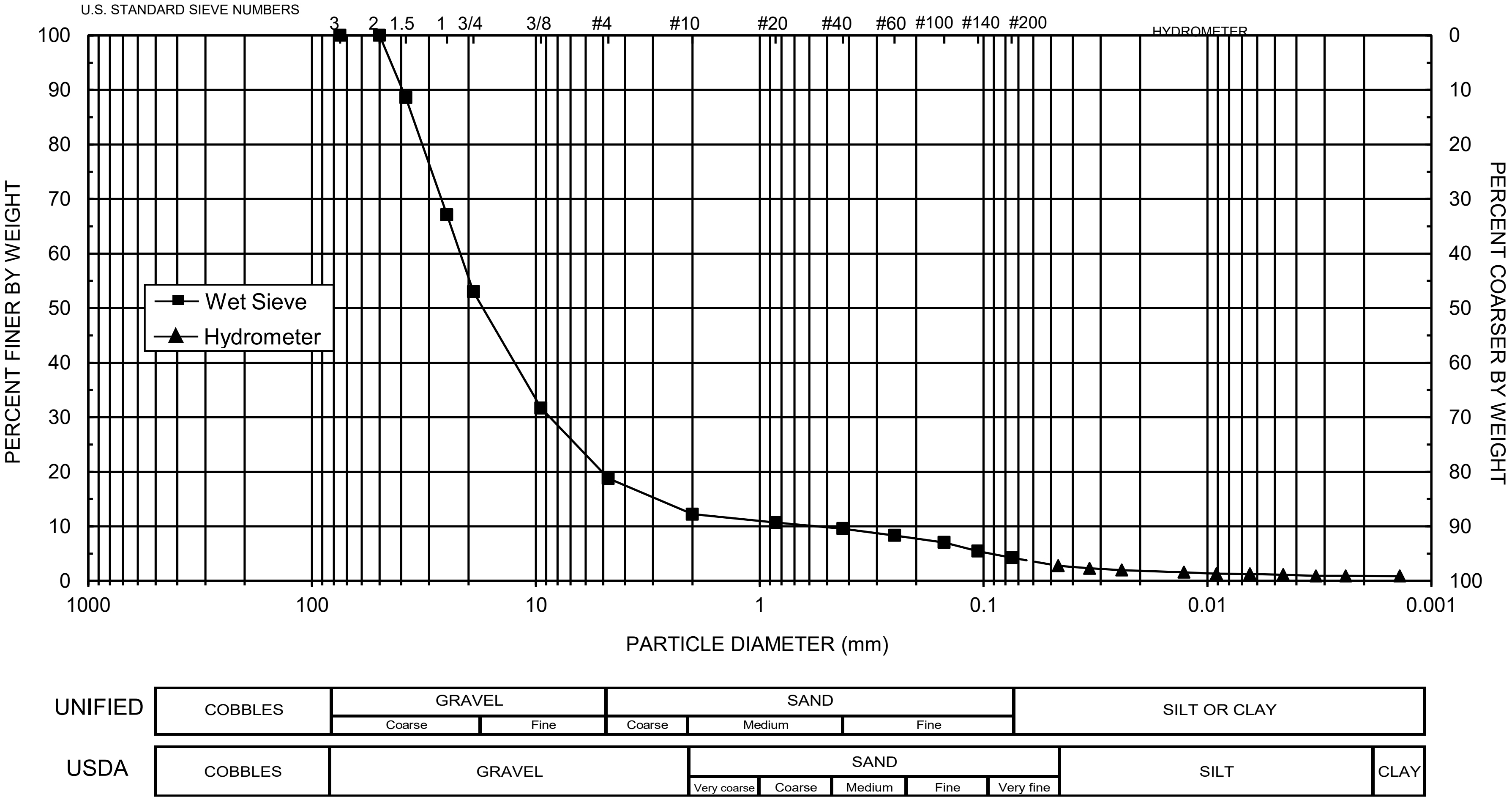
Initial Wt. (g)*:* 92.67
Total Sample Wt. (g)*:* 80849.50
Wt. Passing #10 (g)*:* 9888.56

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
14-May-19	1	22.0	26.00	5.08	20.9	12	0.0463	23	2.8
	2	22.0	22.50	5.08	17.4	12	0.0336	19	2.3
	4	21.9	20.00	5.11	14.9	13	0.0241	16	2.0
	15	21.9	17.00	5.11	11.9	13	0.0127	13	1.6
	30	21.8	15.00	5.15	9.9	13	0.0091	11	1.3
	60	21.8	14.75	5.15	9.6	13	0.0064	10	1.3
	120	21.8	13.75	5.15	8.6	14	0.0046	9	1.1
	240	21.6	12.00	5.22	6.8	14	0.0033	7	0.9
	444	21.6	12.00	5.22	6.8	14	0.0024	7	0.9
15-May-19	1357	21.8	11.75	5.15	6.6	14	0.0014	7	0.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.55**	d_{30} = **8.7**	d_{50} = **17**	d_{60} = **22**	C_u = **40**	C_c = **6.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-03B	**04/18/2019 1015**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RB
Lab ID: HAT01-11.1904001-070
Date/Time sampled: 04/18/2019 1020

Test Date: 30-May-19

Initial Dry Weight of Sample (g): 1427.38
Weight Passing #10 (g): 1385.87
Weight Retained #10 (g): 41.51
Weight of Hydrometer Sample (g): 99.10
Calculated Weight of Sieve Sample (g): 102.07

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1427.38	100.00
	2"	50	0.00	0.00	1427.38	100.00
	1.5"	38.1	0.00	0.00	1427.38	100.00
	1"	25	0.00	0.00	1427.38	100.00
	3/4"	19.0	0.00	0.00	1427.38	100.00
	3/8"	9.5	4.37	4.37	1423.01	99.69
	4	4.75	23.83	28.20	1399.18	98.02
	10	2.00	13.31	41.51	1385.87	97.09
-10			(Based on calculated sieve wt.)			
	20	0.85	0.52	3.49	98.58	96.58
	40	0.425	0.72	4.21	97.86	95.88
	60	0.250	7.19	11.40	90.67	88.83
	100	0.150	24.37	35.77	66.30	64.96
	140	0.106	19.90	55.67	46.40	45.46
	200	0.075	15.21	70.88	31.19	30.56
	dry pan		4.38	75.26	26.81	
	wet pan			26.81	0.00	

d_{10} (mm): 0.0062
d_{16} (mm): 0.039
d_{30} (mm): 0.073
d_{50} (mm): 0.11
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 23
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 6.1
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RB
Lab ID: HAT01-11.1904001-070
Date/Time sampled: 04/18/2019 1020

Test Date: 10-Jun-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

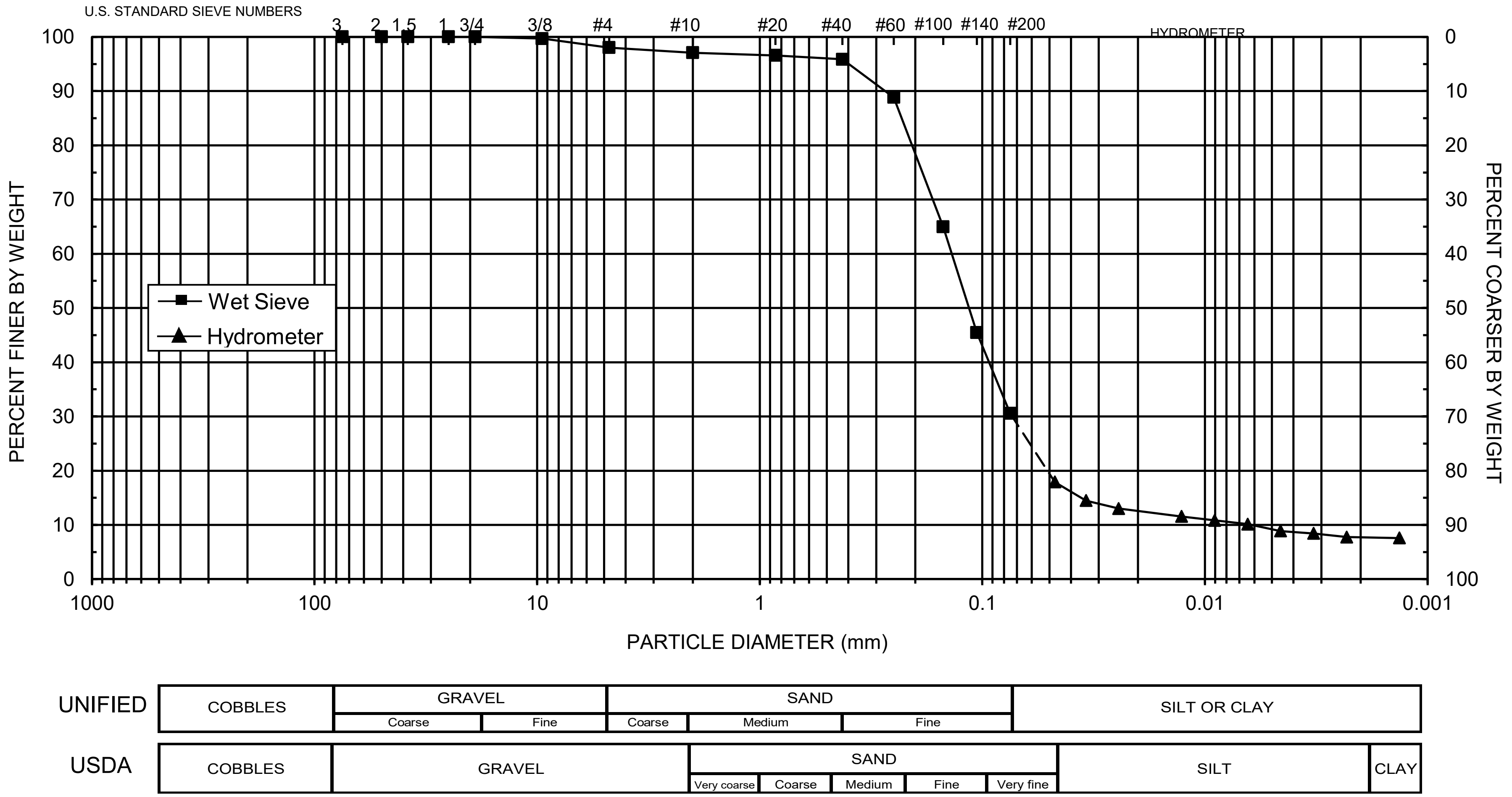
Initial Wt. (g)*:* 99.10
Total Sample Wt. (g)*:* 1427.38
Wt. Passing #10 (g)*:* 1385.87

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.6	23.50	5.22	18.3	12	0.0472	18	17.9
	2	21.6	20.00	5.22	14.8	13	0.0342	15	14.5
	4	21.6	18.50	5.22	13.3	13	0.0244	13	13.0
	15	21.6	17.00	5.22	11.8	13	0.0127	12	11.5
	30	21.7	16.25	5.19	11.1	13	0.0090	11	10.8
	60	21.8	15.50	5.15	10.4	13	0.0064	10	10.1
	120	21.7	14.25	5.19	9.1	14	0.0046	9	8.9
	240	21.8	13.75	5.15	8.6	14	0.0032	9	8.4
	479	22.0	13.00	5.08	7.9	14	0.0023	8	7.8
11-Jun-19	1426	21.5	13.00	5.26	7.7	14	0.0013	8	7.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.0062**	d_{30} = **0.073**	d_{50} = **0.11**	d_{60} = **0.14**	C_u = **23**	C_c = **6.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-03RB	**04/18/2019 1020**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RM
Lab ID: HAT01-11.1904001-058
Date/Time sampled: 04/18/2019 1020

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 1422.77
Weight Passing #10 (g): 1412.88
Weight Retained #10 (g): 9.89
Weight of Hydrometer Sample (g): 107.36
Calculated Weight of Sieve Sample (g): 108.11

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1422.77	100.00
	2"	50	0.00	0.00	1422.77	100.00
	1.5"	38.1	0.00	0.00	1422.77	100.00
	1"	25	0.00	0.00	1422.77	100.00
	3/4"	19.0	0.00	0.00	1422.77	100.00
	3/8"	9.5	3.93	3.93	1418.84	99.72
	4	4.75	3.47	7.40	1415.37	99.48
	10	2.00	2.49	9.89	1412.88	99.30
-10			(Based on calculated sieve wt.)			
	20	0.85	0.47	1.22	106.89	98.87
	40	0.425	0.69	1.91	106.20	98.23
	60	0.250	5.43	7.34	100.77	93.21
	100	0.150	29.06	36.40	71.71	66.33
	140	0.106	30.81	67.21	40.90	37.83
	200	0.075	16.34	83.55	24.56	22.71
	dry pan		2.10	85.65	22.46	
	wet pan			22.46	0.00	

d_{10} (mm): 0.025
d_{16} (mm): 0.056
d_{30} (mm): 0.089
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 5.6
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.3
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RM
Lab ID: HAT01-11.1904001-058
Date/Time sampled: 04/18/2019 1020

Test Date: 16-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

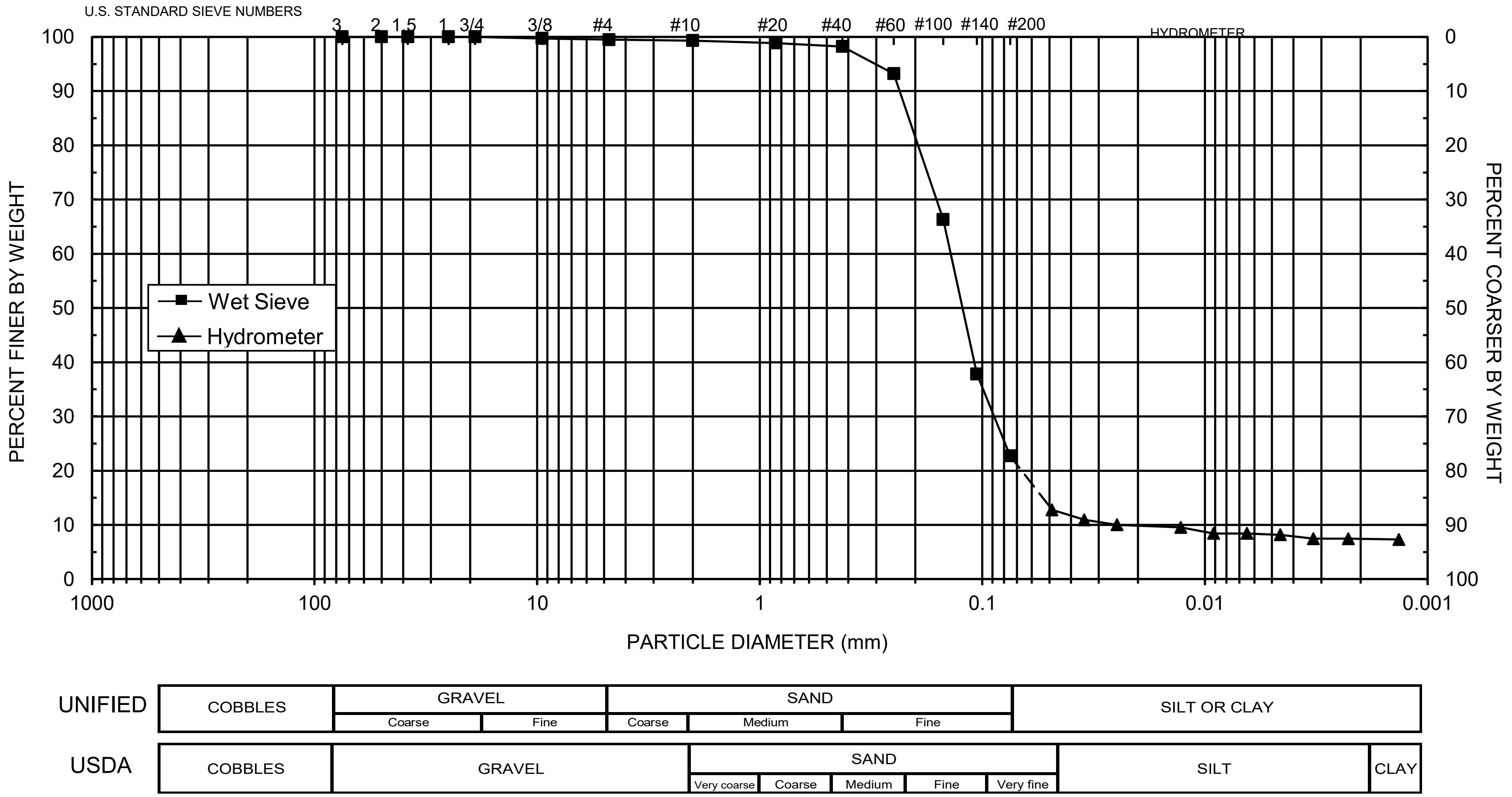
Initial Wt. (g): 107.36
Total Sample Wt. (g): 1422.77
Wt. Passing #10 (g): 1412.88

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	19.00	5.19	13.8	13	0.0486	13	12.8
	2	21.7	17.00	5.19	11.8	13	0.0348	11	10.9
	4	21.7	16.00	5.19	10.8	13	0.0248	10	10.0
	15	21.7	15.50	5.19	10.3	13	0.0128	10	9.5
	30	21.8	14.25	5.15	9.1	14	0.0091	8	8.4
	60	21.8	14.25	5.15	9.1	14	0.0065	8	8.4
	120	21.8	14.00	5.15	8.9	14	0.0046	8	8.2
	240	21.7	13.25	5.19	8.1	14	0.0033	8	7.5
	494	21.7	13.25	5.19	8.1	14	0.0023	8	7.5
17-May-19	1410	21.9	13.00	5.11	7.9	14	0.0013	7	7.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.025**	d_{30} = **0.089**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **5.6**	C_c = **2.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-03RM	**04/18/2019 1020**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RT
Lab ID: HAT01-11.1904001-043
Date/Time sampled: 04/18/2019 1020

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 1620.60
Weight Passing #10 (g): 1607.25
Weight Retained #10 (g): 13.35
Weight of Hydrometer Sample (g): 107.48
Calculated Weight of Sieve Sample (g): 108.37

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1620.60	100.00
	2"	50	0.00	0.00	1620.60	100.00
	1.5"	38.1	0.00	0.00	1620.60	100.00
	1"	25	0.00	0.00	1620.60	100.00
	3/4"	19.0	0.00	0.00	1620.60	100.00
	3/8"	9.5	0.00	0.00	1620.60	100.00
	4	4.75	6.82	6.82	1613.78	99.58
	10	2.00	6.53	13.35	1607.25	99.18
-10			(Based on calculated sieve wt.)			
	20	0.85	0.67	1.56	106.81	98.56
	40	0.425	1.16	2.72	105.65	97.49
	60	0.250	7.87	10.59	97.78	90.23
	100	0.150	26.13	36.72	71.65	66.11
	140	0.106	23.76	60.48	47.89	44.19
	200	0.075	18.85	79.33	29.04	26.80
	dry pan		4.45	83.78	24.59	
	wet pan			24.59	0.00	

d_{10} (mm): 0.016
d_{16} (mm): 0.048
d_{30} (mm): 0.080

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 8.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

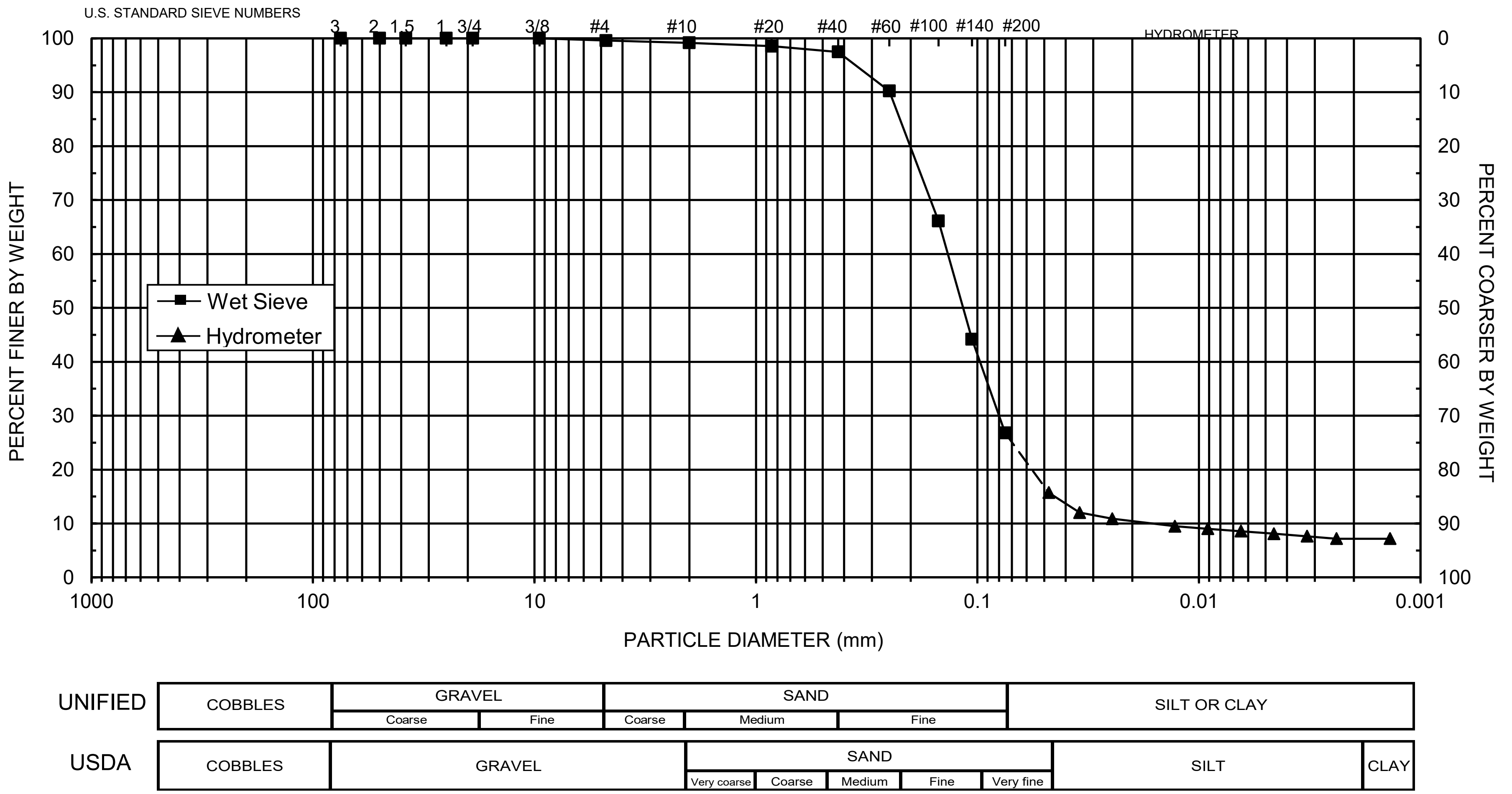
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	na
Sample Number:	L5-03RT	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-043	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1020	*Initial Wt.* (g)*:*	107.48
Test Date:	7-Jun-19	*Total Sample Wt.* (g)*:*	1620.60
Start Time:	9:24	*Wt. Passing #10* (g)*:*	1607.25

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.6	22.25	5.22	17.0	12	0.0476	16	15.7
	2	21.6	18.25	5.22	13.0	13	0.0346	12	12.0
	4	21.6	17.00	5.22	11.8	13	0.0246	11	10.9
	15	21.6	15.50	5.22	10.3	13	0.0128	10	9.5
	30	21.6	15.00	5.22	9.8	13	0.0091	9	9.0
	60	21.6	14.50	5.22	9.3	13	0.0065	9	8.6
	120	21.6	14.00	5.22	8.8	14	0.0046	8	8.1
	240	21.6	13.50	5.22	8.3	14	0.0032	8	7.6
	446	21.6	13.00	5.22	7.8	14	0.0024	7	7.2
8-Jun-19	1360	21.6	13.00	5.22	7.8	14	0.0014	7	7.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.016**	d_{30} = **0.080**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **8.8**	C_c = **2.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-03RT	**04/18/2019 1020**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	80662.55
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	18700.05
Sample Number:	L5-11B	*Weight Retained #10 (g):*	61962.50
Lab ID:	HAT01-11.1904001-107	*Weight of Hydrometer Sample (g):*	62.26
Date/Time sampled:	04/18/2019 1150	*Calculated Weight of Sieve Sample (g):*	268.56
Test Date:	29-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	80662.55	100.00
	2"	50	0.00	0.00	80662.55	100.00
	1.5"	38.1	6894.38	6894.38	73768.17	91.45
	1"	25	12998.30	19892.68	60769.87	75.34
	3/4"	19.0	8701.71	28594.39	52068.16	64.55
	3/8"	9.5	14321.31	42915.70	37746.85	46.80
	4	4.75	11344.26	54259.97	26402.58	32.73
	10	2.00	7702.54	61962.50	18700.05	23.18
-10			(Based on calculated sieve wt.)			
	20	0.85	6.72	213.02	55.54	20.68
	40	0.425	8.62	221.64	46.92	17.47
	60	0.250	9.26	230.90	37.66	14.02
	100	0.150	7.86	238.76	29.80	11.10
	140	0.106	7.87	246.63	21.93	8.17
	200	0.075	4.19	250.82	17.74	6.61
	dry pan		0.95	251.77	16.79	
	wet pan			16.79	0.00	

d_{10} (mm):	0.13	d_{50} (mm):	11
d_{16} (mm):	0.34	d_{60} (mm):	16
d_{30} (mm):	3.7	d_{84} (mm):	31

Median Particle Diameter --d_{50} (mm): 11

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 123

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 6.6

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 14

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11B
Lab ID: HAT01-11.1904001-107
Date/Time sampled: 04/18/2019 1150

Test Date: 13-May-19
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

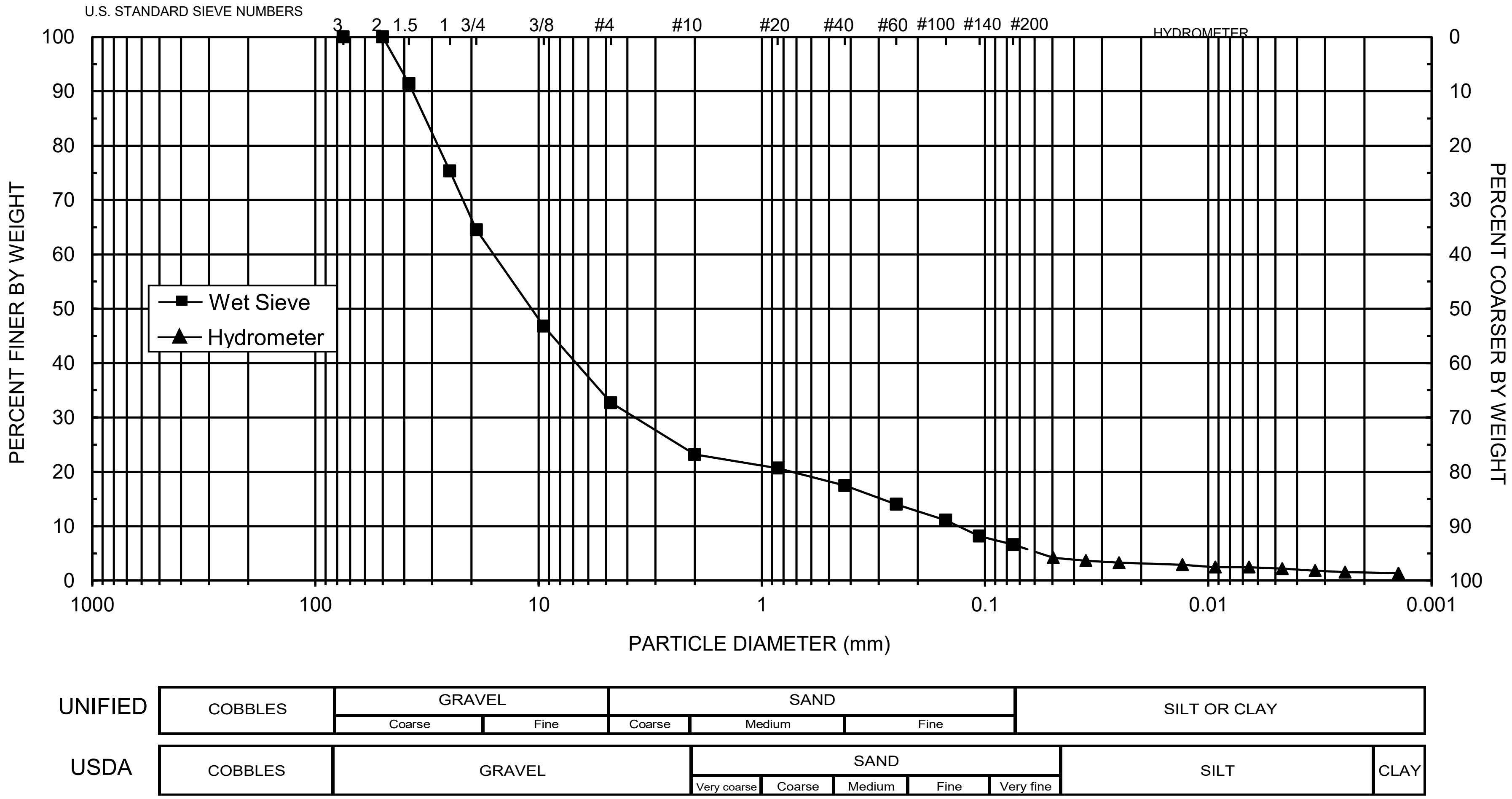
Initial Wt. (g)*:* 62.26
Total Sample Wt. (g)*:* 80662.55
Wt. Passing #10 (g)*:* 18700.05

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	16.50	5.19	11.3	13	0.0494	18	4.2
	2	21.7	15.00	5.19	9.8	13	0.0353	16	3.7
	4	21.7	14.00	5.19	8.8	14	0.0251	14	3.3
	15	21.7	13.00	5.19	7.8	14	0.0130	13	2.9
	30	21.9	11.75	5.11	6.6	14	0.0093	11	2.5
	60	21.9	11.75	5.11	6.6	14	0.0066	11	2.5
	120	21.9	11.00	5.11	5.9	14	0.0047	9	2.2
	240	21.9	10.00	5.11	4.9	14	0.0033	8	1.8
	450	21.9	9.25	5.11	4.1	14	0.0024	7	1.5
14-May-19	1357	21.9	8.75	5.11	3.6	14	0.0014	6	1.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.13**	d_{30} = **3.7**	d_{50} = **11**	d_{60} = **16**	C_u = **123**	C_c = **6.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-11B	**04/18/2019 1150**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RB
Lab ID: HAT01-11.1904001-108
Date/Time sampled: 04/18/2019 1155

Test Date: 5-Jun-19

Initial Dry Weight of Sample (g): 1286.39
Weight Passing #10 (g): 1270.39
Weight Retained #10 (g): 16.00
Weight of Hydrometer Sample (g): 102.33
Calculated Weight of Sieve Sample (g): 103.62

Shape: Rounded
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1286.39	100.00
	2"	50	0.00	0.00	1286.39	100.00
	1.5"	38.1	0.00	0.00	1286.39	100.00
	1"	25	0.00	0.00	1286.39	100.00
	3/4"	19.0	0.00	0.00	1286.39	100.00
	3/8"	9.5	6.02	6.02	1280.37	99.53
	4	4.75	4.07	10.09	1276.30	99.22
	10	2.00	5.91	16.00	1270.39	98.76
-10			(Based on calculated sieve wt.)			
	20	0.85	1.34	2.63	100.99	97.46
	40	0.425	1.18	3.81	99.81	96.32
	60	0.250	7.94	11.75	91.87	88.66
	100	0.150	25.20	36.95	66.67	64.34
	140	0.106	20.20	57.15	46.47	44.85
	200	0.075	13.57	70.72	32.90	31.75
	dry pan		4.28	75.00	28.62	
	wet pan			28.62	0.00	

d_{10} (mm): 0.0046
d_{16} (mm): 0.026
d_{30} (mm): 0.070
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 30
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 7.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

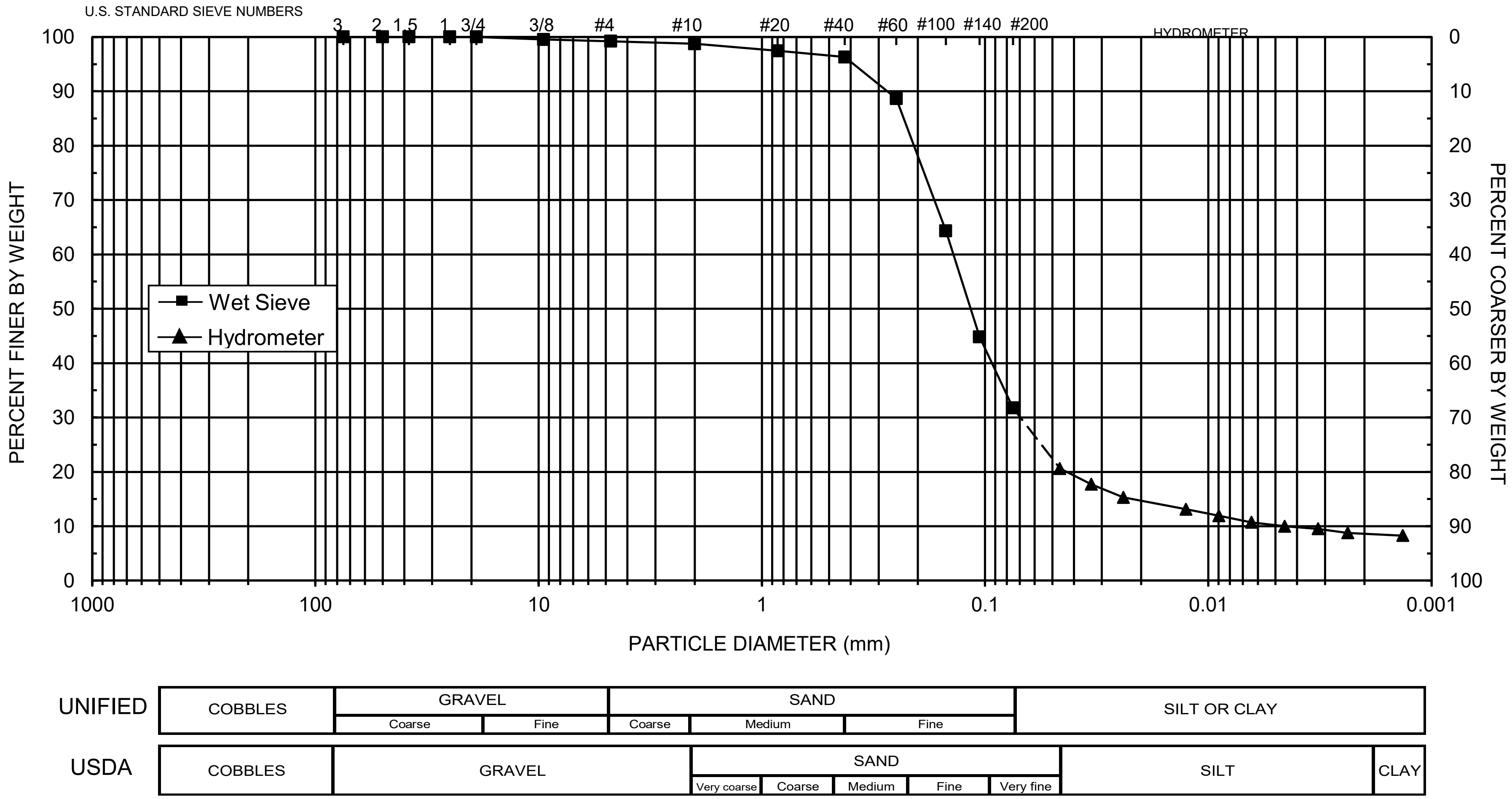
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-11RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-108	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1155	*Initial Wt. (g):*	102.33
Test Date:	3-Jun-19	*Total Sample Wt. (g):*	1286.39
Start Time:	9:42	*Wt. Passing #10 (g):*	1270.39

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	26.50	5.15	21.4	11	0.0462	21	20.6
	2	21.8	23.50	5.15	18.4	12	0.0334	18	17.7
	4	21.8	21.00	5.15	15.9	12	0.0240	15	15.3
	15	21.8	18.75	5.15	13.6	13	0.0126	13	13.1
	30	21.8	17.50	5.15	12.4	13	0.0090	12	11.9
	60	21.8	16.25	5.15	11.1	13	0.0064	11	10.7
	120	21.8	15.50	5.15	10.4	13	0.0045	10	10.0
	240	21.8	15.00	5.15	9.9	13	0.0032	10	9.5
	448	21.8	14.25	5.15	9.1	14	0.0024	9	8.8
4-Jun-19	1398	21.7	13.75	5.19	8.6	14	0.0013	8	8.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0046**	d_{30} = **0.070**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **30**	C_c = **7.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-11RB	**04/18/2019 1155**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RM
Lab ID: HAT01-11.1904001-109
Date/Time sampled: 04/18/2019 1150

Test Date: 5-Jun-19

Initial Dry Weight of Sample (g): 1474.45
Weight Passing #10 (g): 1467.24
Weight Retained #10 (g): 7.21
Weight of Hydrometer Sample (g): 107.39
Calculated Weight of Sieve Sample (g): 107.92

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1474.45	100.00
	2"	50	0.00	0.00	1474.45	100.00
	1.5"	38.1	0.00	0.00	1474.45	100.00
	1"	25	0.00	0.00	1474.45	100.00
	3/4"	19.0	0.00	0.00	1474.45	100.00
	3/8"	9.5	3.51	3.51	1470.94	99.76
	4	4.75	2.28	5.79	1468.66	99.61
	10	2.00	1.42	7.21	1467.24	99.51
-10			(Based on calculated sieve wt.)			
	20	0.85	0.66	1.19	106.73	98.90
	40	0.425	0.78	1.97	105.95	98.18
	60	0.250	6.78	8.75	99.17	91.89
	100	0.150	28.28	37.03	70.89	65.69
	140	0.106	26.86	63.89	44.03	40.80
	200	0.075	17.04	80.93	26.99	25.01
	dry pan		5.12	86.05	21.87	
	wet pan			21.87	0.00	

d_{10} (mm):	0.012	d_{50} (mm):	0.12
d_{16} (mm):	0.054	d_{60} (mm):	0.14
d_{30} (mm):	0.084	d_{84} (mm):	0.21

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 12
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RM
Lab ID: HAT01-11.1904001-109
Date/Time sampled: 04/18/2019 1150

Test Date: 10-Jun-19
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

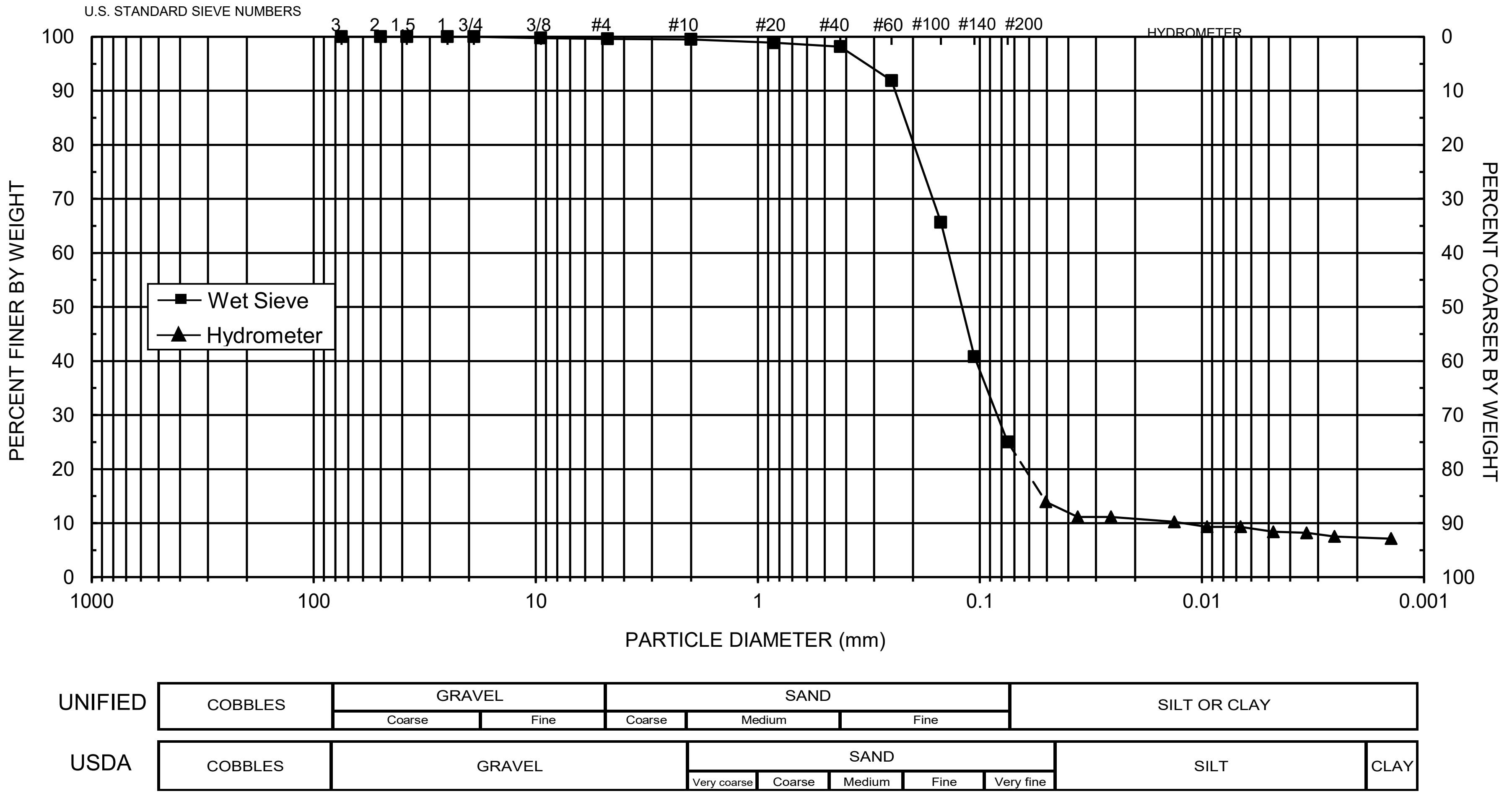
Initial Wt. (g)*:* 107.39
Total Sample Wt. (g)*:* 1474.45
Wt. Passing #10 (g)*:* 1467.24

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.8	21.00	5.95	15.1	14	0.0504	14	13.9
	2	21.8	18.00	5.95	12.1	14	0.0363	11	11.2
	4	21.8	18.00	5.95	12.1	14	0.0256	11	11.2
	15	21.8	17.00	5.95	11.1	14	0.0133	10	10.2
	30	21.8	16.00	5.95	10.1	14	0.0095	9	9.3
	60	21.8	16.00	5.95	10.1	14	0.0067	9	9.3
	120	21.8	15.00	5.95	9.1	15	0.0048	8	8.4
	240	21.9	14.75	5.91	8.8	15	0.0034	8	8.2
	431	22.0	14.00	5.88	8.1	15	0.0025	8	7.5
11-Jun-19	1397	21.5	13.75	6.06	7.7	15	0.0014	7	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.012**	d_{30} = **0.084**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **12**	C_c = **4.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-11RM	**04/18/2019 1150**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RT
Lab ID: HAT01-11.1904001-110
Date/Time sampled: 04/18/2019 1200

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1588.99
Weight Passing #10 (g): 1585.25
Weight Retained #10 (g): 3.74
Weight of Hydrometer Sample (g): 102.96
Calculated Weight of Sieve Sample (g): 103.20

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1588.99	100.00
	2"	50	0.00	0.00	1588.99	100.00
	1.5"	38.1	0.00	0.00	1588.99	100.00
	1"	25	0.00	0.00	1588.99	100.00
	3/4"	19.0	0.00	0.00	1588.99	100.00
	3/8"	9.5	0.00	0.00	1588.99	100.00
	4	4.75	0.37	0.37	1588.62	99.98
	10	2.00	3.37	3.74	1585.25	99.76
-10			(Based on calculated sieve wt.)			
	20	0.85	0.47	0.71	102.49	99.31
	40	0.425	0.98	1.69	101.51	98.36
	60	0.250	6.92	8.61	94.59	91.65
	100	0.150	23.60	32.21	70.99	68.79
	140	0.106	24.60	56.81	46.39	44.95
	200	0.075	17.37	74.18	29.02	28.12
	dry pan		2.62	76.80	26.40	
	wet pan			26.40	0.00	

d_{10} (mm):	0.018	d_{50} (mm):	0.11
d_{16} (mm):	0.051	d_{60} (mm):	0.13
d_{30} (mm):	0.078	d_{84} (mm):	0.21

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.2
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

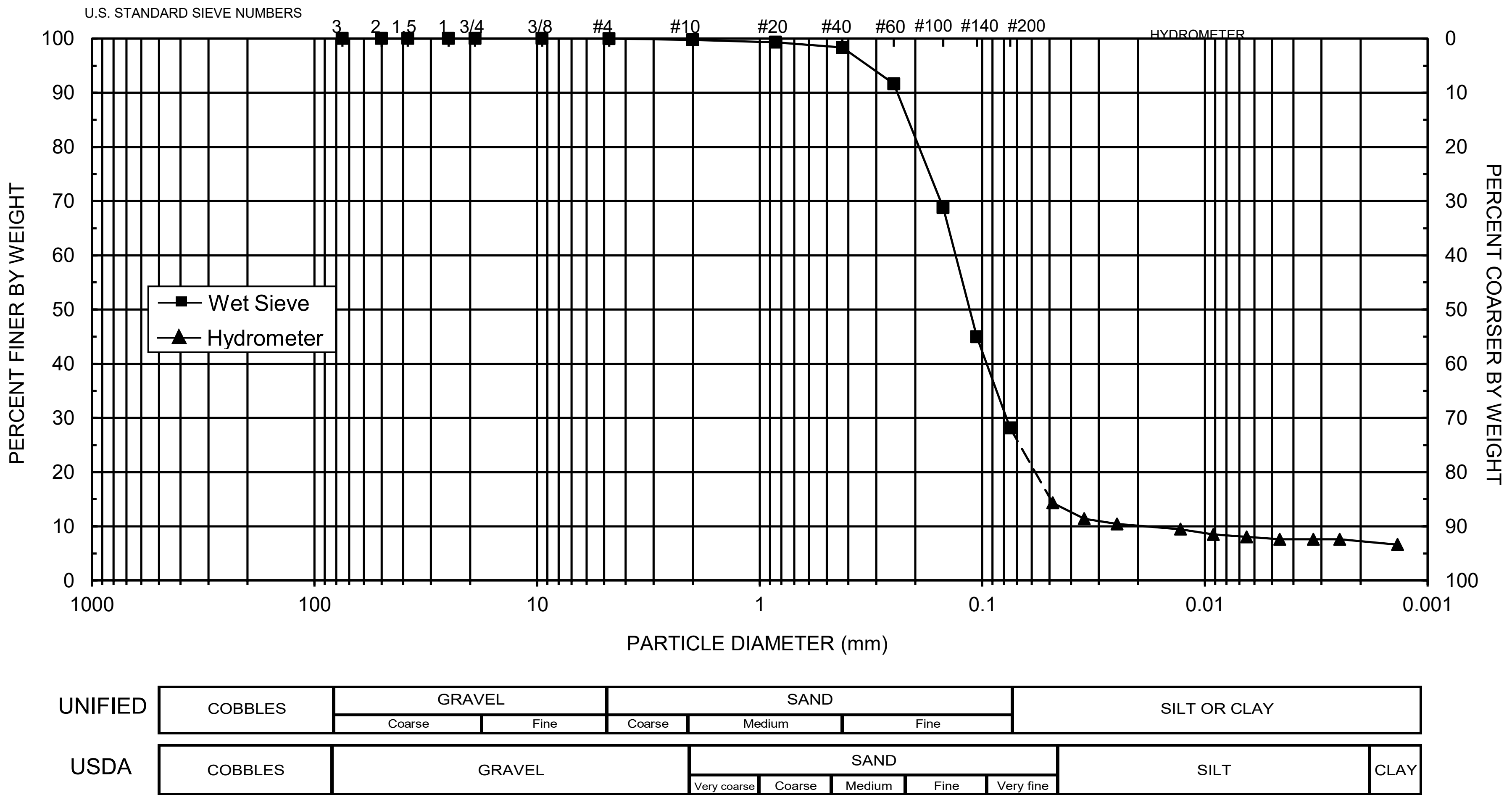
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-11RT	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-110	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1200	*Initial Wt. (g):*	102.96
Test Date:	23-May-19	*Total Sample Wt. (g):*	1588.99
Start Time:	9:48	*Wt. Passing #10 (g):*	1585.25

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	20.00	5.22	14.8	13	0.0483	14	14.3
	2	21.6	17.00	5.22	11.8	13	0.0348	11	11.4
	4	21.6	16.00	5.22	10.8	13	0.0248	10	10.4
	15	21.6	15.00	5.22	9.8	13	0.0129	9	9.5
	30	21.6	14.00	5.22	8.8	14	0.0092	9	8.5
	60	21.7	13.50	5.19	8.3	14	0.0065	8	8.1
	120	21.8	13.00	5.15	7.9	14	0.0046	8	7.6
	240	21.8	13.00	5.15	7.9	14	0.0033	8	7.6
	415	21.8	13.00	5.15	7.9	14	0.0025	8	7.6
24-May-19	1388	21.8	12.00	5.15	6.9	14	0.0014	7	6.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.018**	d_{30} = **0.078**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **7.2**	C_c = **2.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-11RT	**04/18/2019 1200**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21B
Lab ID: HAT01-11.1904001-103
Date/Time sampled: 04/18/2019 1125

Test Date: 29-May-19

Initial Dry Weight of Sample (g): 79774.33
Weight Passing #10 (g): 15785.16
Weight Retained #10 (g): 63989.16
Weight of Hydrometer Sample (g): 80.21
Calculated Weight of Sieve Sample (g): 405.36

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	79774.33	100.00
	2"	50	0.00	0.00	79774.33	100.00
	1.5"	38.1	4275.43	4275.43	75498.90	94.64
	1"	25	14226.67	18502.10	61272.23	76.81
	3/4"	19.0	10195.96	28698.06	51076.26	64.03
	3/8"	9.5	17061.00	45759.06	34015.27	42.64
	4	4.75	11375.20	57134.26	22640.06	28.38
	10	2.00	6854.90	63989.16	15785.16	19.79
-10			(Based on calculated sieve wt.)			
	20	0.85	7.24	332.39	72.97	18.00
	40	0.425	11.35	343.74	61.62	15.20
	60	0.250	10.79	354.53	50.83	12.54
	100	0.150	8.99	363.52	41.84	10.32
	140	0.106	9.51	373.03	32.33	7.98
	200	0.075	7.66	380.69	24.67	6.09
	dry pan		1.14	381.83	23.53	
	wet pan			23.53	0.00	

d_{10} (mm): 0.14
d_{16} (mm): 0.52
d_{30} (mm): 5.1

d_{50} (mm): 12
d_{60} (mm): 17
d_{84} (mm): 30

Median Particle Diameter --d_{50} (mm): 12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 121
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 11
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 14

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21B
Lab ID: HAT01-11.1904001-103
Date/Time sampled: 04/18/2019 1125

Test Date: 13-May-19
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

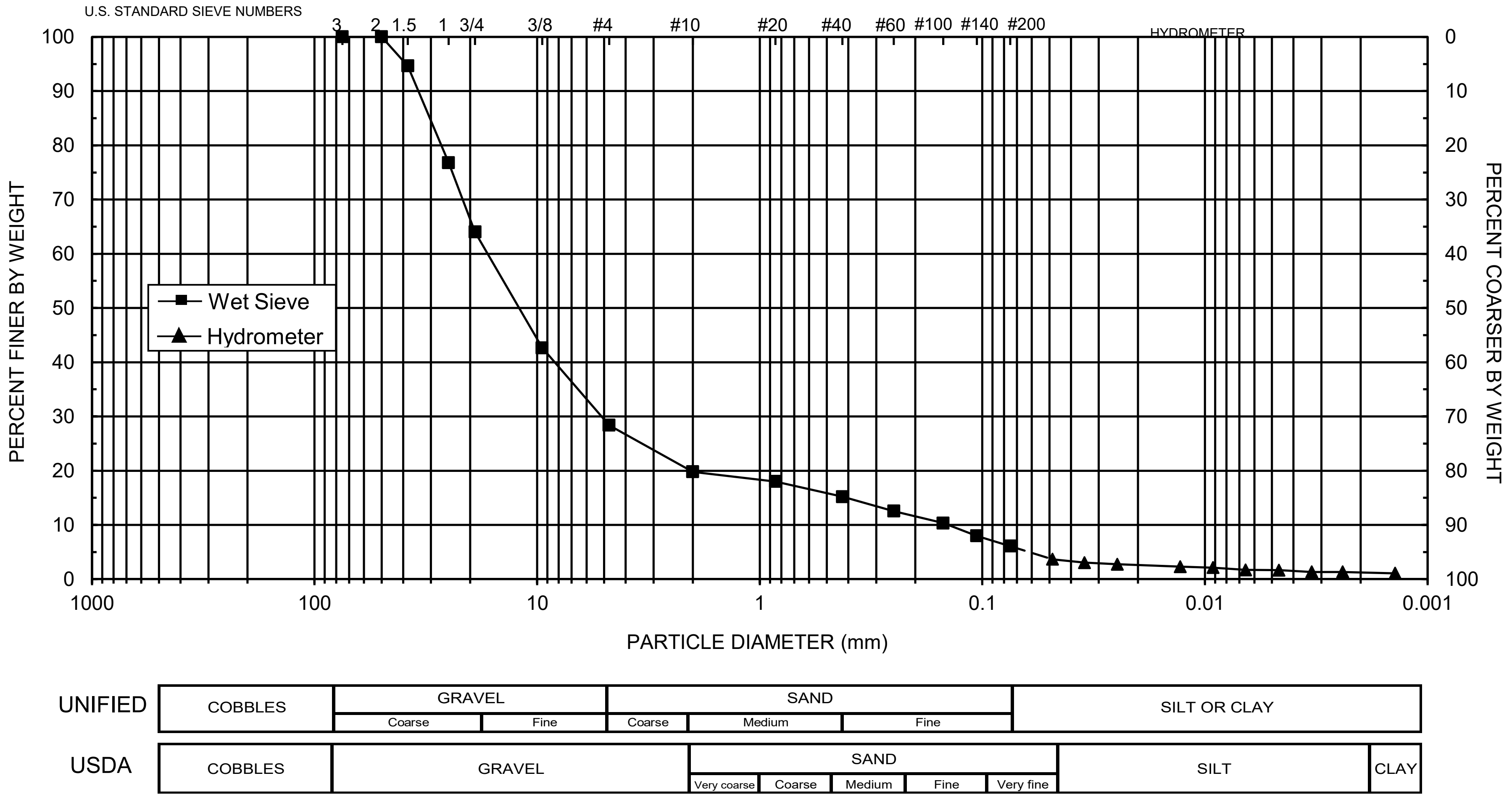
Initial Wt. *(g):* 80.21
Total Sample Wt. *(g):* 79774.33
Wt. Passing #10 *(g):* 15785.16

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	20.00	5.19	14.8	13	0.0483	18	3.7
	2	21.7	17.50	5.19	12.3	13	0.0347	15	3.0
	4	21.7	16.25	5.19	11.1	13	0.0247	14	2.7
	15	21.7	14.50	5.19	9.3	13	0.0129	12	2.3
	30	21.7	13.75	5.19	8.6	14	0.0092	11	2.1
	60	21.9	12.00	5.11	6.9	14	0.0066	9	1.7
	120	21.9	11.75	5.11	6.6	14	0.0046	8	1.6
	240	21.9	10.50	5.11	5.4	14	0.0033	7	1.3
	455	21.9	10.50	5.11	5.4	14	0.0024	7	1.3
14-May-19	1362	21.9	9.50	5.11	4.4	14	0.0014	5	1.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.14**	d_{30} = **5.1**	d_{50} = **12**	d_{60} = **17**	C_u = **121**	C_c = **11**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-21B	**04/18/2019 1125**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RB
Lab ID: HAT01-11.1904001-104
Date/Time sampled: 04/18/2019 1120

Test Date: 5-Jun-19

Initial Dry Weight of Sample (g): 1436.00
Weight Passing #10 (g): 1413.44
Weight Retained #10 (g): 22.56
Weight of Hydrometer Sample (g): 102.25
Calculated Weight of Sieve Sample (g): 103.88

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1436.00	100.00
	2"	50	0.00	0.00	1436.00	100.00
	1.5"	38.1	0.00	0.00	1436.00	100.00
	1"	25	0.00	0.00	1436.00	100.00
	3/4"	19.0	0.00	0.00	1436.00	100.00
	3/8"	9.5	7.58	7.58	1428.42	99.47
	4	4.75	2.83	10.41	1425.59	99.28
	10	2.00	12.15	22.56	1413.44	98.43
-10			(Based on calculated sieve wt.)			
	20	0.85	1.56	3.19	100.69	96.93
	40	0.425	1.18	4.37	99.51	95.79
	60	0.250	6.58	10.95	92.93	89.46
	100	0.150	24.21	35.16	68.72	66.15
	140	0.106	19.91	55.07	48.81	46.99
	200	0.075	14.05	69.12	34.76	33.46
	dry pan		5.40	74.52	29.36	
	wet pan			29.36	0.00	

d_{10} (mm): 0.0050
d_{16} (mm): 0.029
d_{30} (mm): 0.067
d_{50} (mm): 0.11
d_{60} (mm): 0.13
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 26
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 6.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

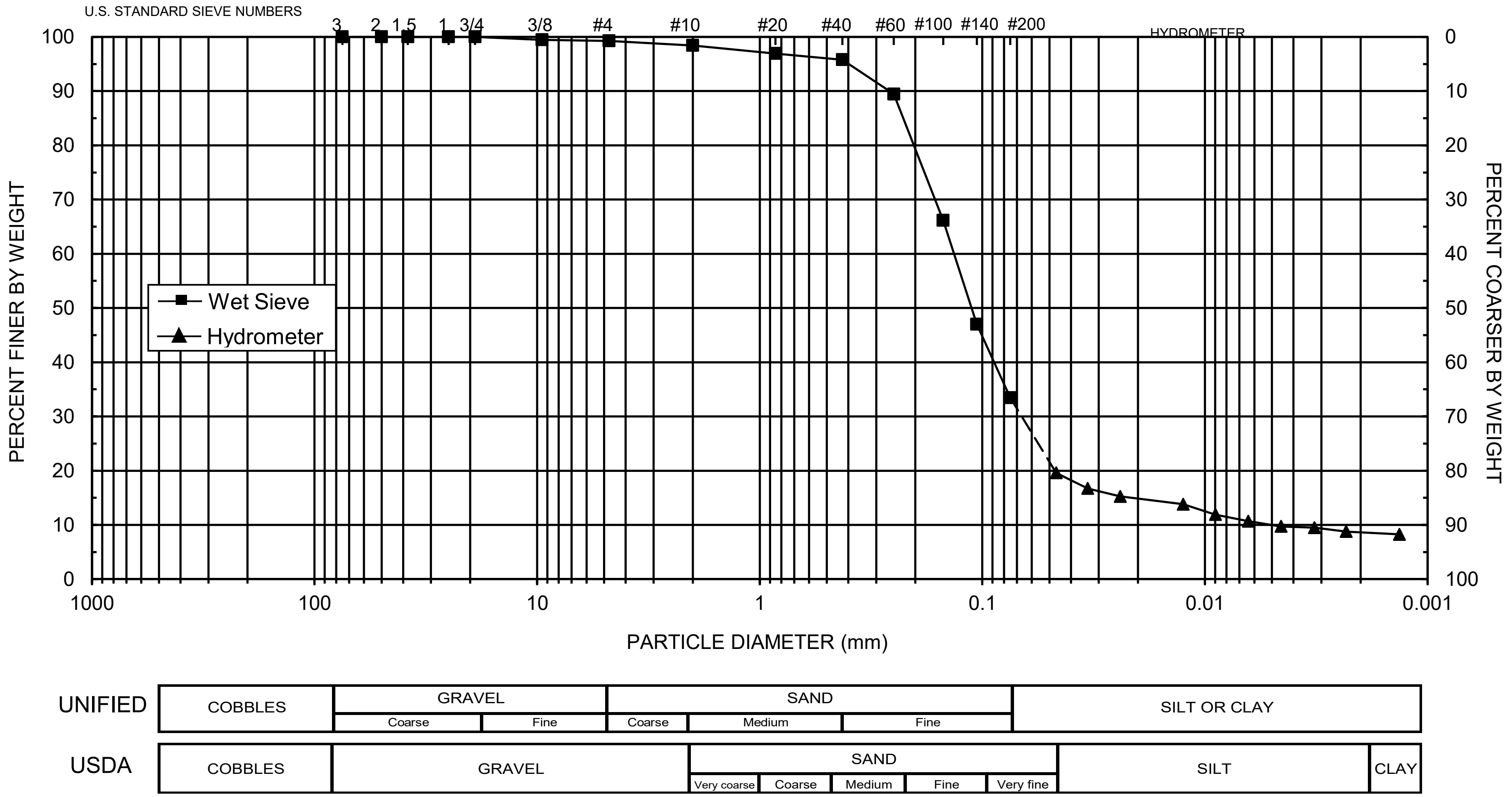
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-21RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-104	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1120	*Initial Wt. (g):*	102.25
Test Date:	3-Jun-19	*Total Sample Wt. (g):*	1436.00
Start Time:	9:18	*Wt. Passing #10 (g):*	1413.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	25.50	5.15	20.4	12	0.0465	20	19.6
	2	21.8	22.50	5.15	17.4	12	0.0336	17	16.7
	4	21.8	21.00	5.15	15.9	12	0.0240	16	15.3
	15	21.8	19.50	5.15	14.4	13	0.0125	14	13.8
	30	21.8	17.50	5.15	12.4	13	0.0090	12	11.9
	60	21.8	16.25	5.15	11.1	13	0.0064	11	10.7
	120	21.8	15.25	5.15	10.1	13	0.0045	10	9.7
	240	21.8	15.00	5.15	9.9	13	0.0032	10	9.5
	468	21.8	14.25	5.15	9.1	14	0.0023	9	8.8
4-Jun-19	1418	21.7	13.75	5.19	8.6	14	0.0013	8	8.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0050**	d_{30} = **0.067**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **26**	C_c = **6.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-21RB	**04/18/2019 1120**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1531.13
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1516.65
Sample Number:	L5-21RM	*Weight Retained #10 (g):*	14.48
Lab ID:	HAT01-11.1904001-105	*Weight of Hydrometer Sample (g):*	100.22
Date/Time sampled:	04/18/2019 1125	*Calculated Weight of Sieve Sample (g):*	101.18
Test Date:	5-Jun-19	*Shape:*	Angular
		Hardness:	Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1531.13	100.00
	2"	50	0.00	0.00	1531.13	100.00
	1.5"	38.1	0.00	0.00	1531.13	100.00
	1"	25	0.00	0.00	1531.13	100.00
	3/4"	19.0	0.00	0.00	1531.13	100.00
	3/8"	9.5	10.45	10.45	1520.68	99.32
	4	4.75	0.58	11.03	1520.10	99.28
	10	2.00	3.45	14.48	1516.65	99.05
-10			(Based on calculated sieve wt.)			
	20	0.85	0.42	1.38	99.80	98.64
	40	0.425	1.07	2.45	98.73	97.58
	60	0.250	6.31	8.76	92.42	91.35
	100	0.150	25.12	33.88	67.30	66.52
	140	0.106	24.48	58.36	42.82	42.32
	200	0.075	16.60	74.96	26.22	25.92
	dry pan		6.05	81.01	20.17	
	wet pan			20.17	0.00	

d_{10} (mm):	0.013	d_{50} (mm):	0.12
d_{16} (mm):	0.051	d_{60} (mm):	0.14
d_{30} (mm):	0.082	d_{84} (mm):	0.21

Median Particle Diameter --d_{50} (mm): 0.12

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 11

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.7

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RM
Lab ID: HAT01-11.1904001-105
Date/Time sampled: 04/18/2019 1125

Test Date: 3-Jun-19
Start Time: 9:30

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

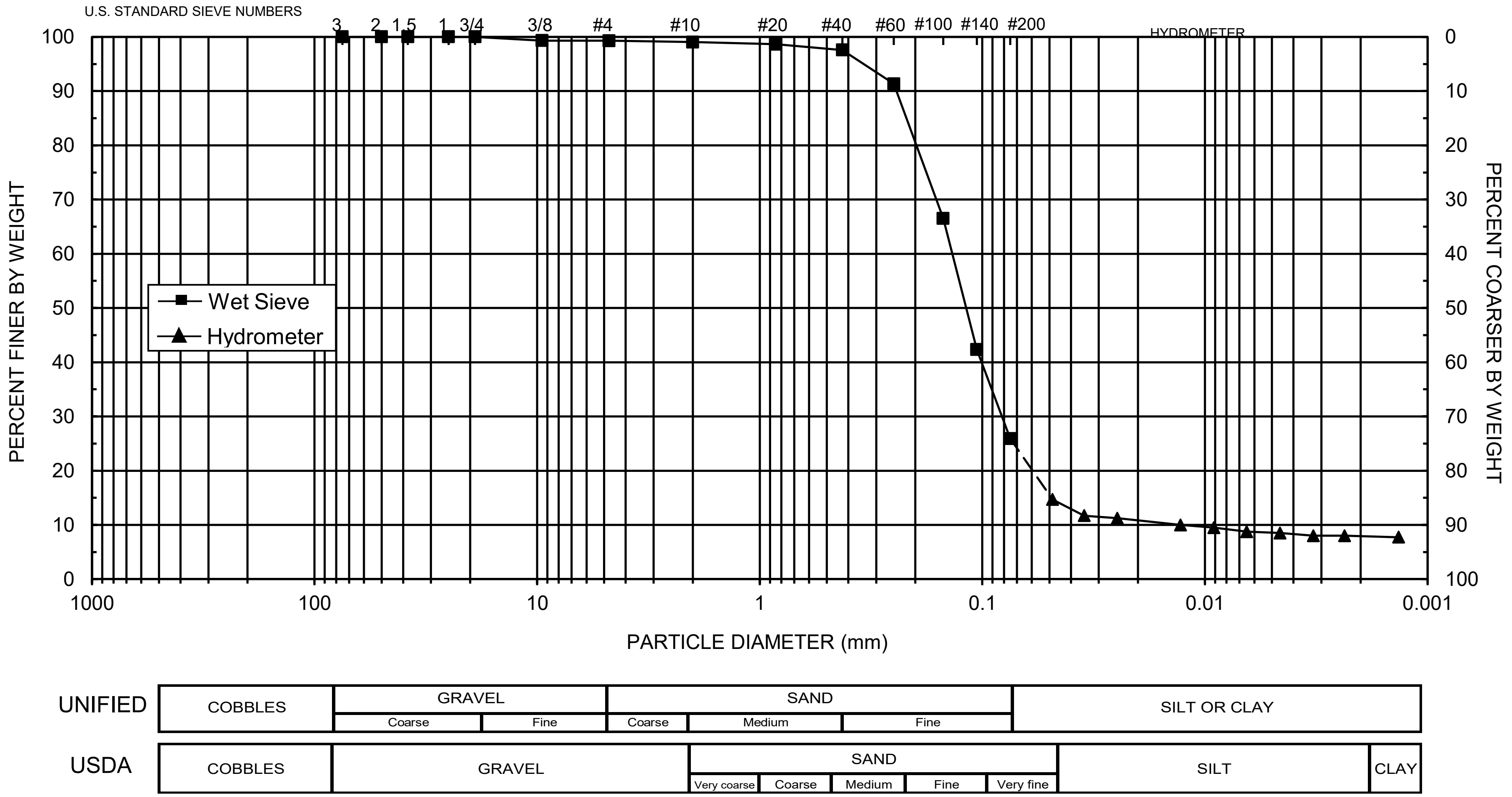
Initial Wt. (g)*:* 100.22
Total Sample Wt. (g)*:* 1531.13
Wt. Passing #10 (g)*:* 1516.65

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	20.00	5.15	14.9	13	0.0483	15	14.7
	2	21.8	17.00	5.15	11.9	13	0.0348	12	11.7
	4	21.8	16.50	5.15	11.4	13	0.0247	11	11.2
	15	21.8	15.25	5.15	10.1	13	0.0129	10	10.0
	30	21.8	14.75	5.15	9.6	13	0.0091	10	9.5
	60	21.8	14.00	5.15	8.9	14	0.0065	9	8.7
	120	21.8	13.75	5.15	8.6	14	0.0046	9	8.5
	240	21.8	13.25	5.15	8.1	14	0.0033	8	8.0
	458	21.8	13.25	5.15	8.1	14	0.0024	8	8.0
4-Jun-19	1408	21.7	13.00	5.19	7.8	14	0.0013	8	7.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.013**	d_{30} = **0.082**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **11**	C_c = **3.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-21RM	**04/18/2019 1125**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RT
Lab ID: HAT01-11.1904001-106
Date/Time sampled: 04/18/2019 1120

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1653.50
Weight Passing #10 (g): 1643.26
Weight Retained #10 (g): 10.24
Weight of Hydrometer Sample (g): 101.36
Calculated Weight of Sieve Sample (g): 101.99

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1653.50	100.00
	2"	50	0.00	0.00	1653.50	100.00
	1.5"	38.1	0.00	0.00	1653.50	100.00
	1"	25	0.00	0.00	1653.50	100.00
	3/4"	19.0	0.00	0.00	1653.50	100.00
	3/8"	9.5	5.62	5.62	1647.88	99.66
	4	4.75	1.29	6.91	1646.59	99.58
	10	2.00	3.33	10.24	1643.26	99.38
-10			(Based on calculated sieve wt.)			
	20	0.85	0.58	1.21	100.78	98.81
	40	0.425	1.06	2.27	99.72	97.77
	60	0.250	6.55	8.82	93.17	91.35
	100	0.150	23.52	32.34	69.65	68.29
	140	0.106	23.37	55.71	46.28	45.38
	200	0.075	17.50	73.21	28.78	28.22
	dry pan		1.56	74.77	27.22	
	wet pan			27.22	0.00	

d_{10} (mm): 0.021
d_{16} (mm): 0.051
d_{30} (mm): 0.078

d_{50} (mm): 0.11
d_{60} (mm): 0.13
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 6.2
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.2
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RT
Lab ID: HAT01-11.1904001-106
Date/Time sampled: 04/18/2019 1120

Test Date: 23-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

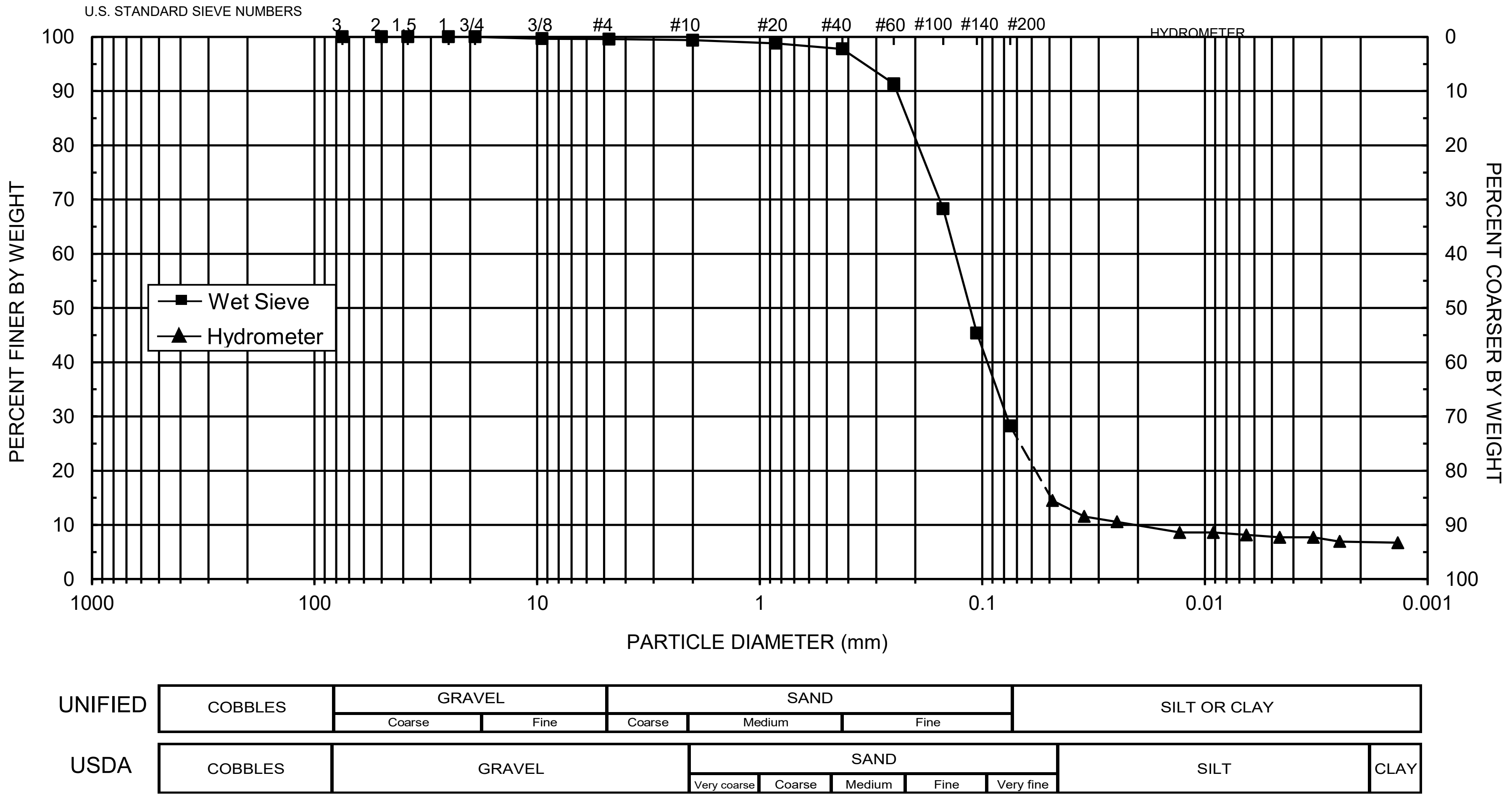
Initial Wt. (g): 101.36
Total Sample Wt. (g): 1653.50
Wt. Passing #10 (g): 1643.26

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	20.00	5.22	14.8	13	0.0483	15	14.5
	2	21.6	17.00	5.22	11.8	13	0.0348	12	11.5
	4	21.6	16.00	5.22	10.8	13	0.0248	11	10.6
	15	21.6	14.00	5.22	8.8	14	0.0130	9	8.6
	30	21.6	14.00	5.22	8.8	14	0.0092	9	8.6
	60	21.7	13.50	5.19	8.3	14	0.0065	8	8.2
	120	21.8	13.00	5.15	7.9	14	0.0046	8	7.7
	240	21.8	13.00	5.15	7.9	14	0.0033	8	7.7
	419	22.4	12.00	4.93	7.1	14	0.0025	7	6.9
24-May-19	1398	21.8	12.00	5.15	6.9	14	0.0014	7	6.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.021**	d_{30} = **0.078**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **6.2**	C_c = **2.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-21RT	**04/18/2019 1120**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	82152.16
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	12613.95
Sample Number:	L5-31B	*Weight Retained #10 (g):*	69538.22
Lab ID:	HAT01-11.1904001-027	*Weight of Hydrometer Sample (g):*	46.91
Date/Time sampled:	04/18/2019 1045	*Calculated Weight of Sieve Sample (g):*	305.52
Test Date:	28-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	82152.16	100.00
	2"	50	0.00	0.00	82152.16	100.00
	1.5"	38.1	9552.70	9552.70	72599.46	88.37
	1"	25	17535.40	27088.10	55064.06	67.03
	3/4"	19.0	10349.37	37437.47	44714.69	54.43
	3/8"	9.5	15401.71	52839.19	29312.98	35.68
	4	4.75	11521.96	64361.14	17791.02	21.66
	10	2.00	5177.07	69538.22	12613.95	15.35
-10			(Based on calculated sieve wt.)			
	20	0.85	4.68	263.29	42.23	13.82
	40	0.425	5.58	268.87	36.65	12.00
	60	0.250	5.46	274.33	31.19	10.21
	100	0.150	5.67	280.00	25.52	8.35
	140	0.106	5.56	285.56	19.96	6.53
	200	0.075	3.36	288.92	16.60	5.43
	dry pan		0.31	289.23	16.29	
	wet pan			16.29	0.00	

d_{10} (mm):	0.24	d_{50} (mm):	16
d_{16} (mm):	2.2	d_{60} (mm):	21
d_{30} (mm):	7.2	d_{84} (mm):	35

Median Particle Diameter --d_{50} (mm): 16

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 88

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 10

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 18

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

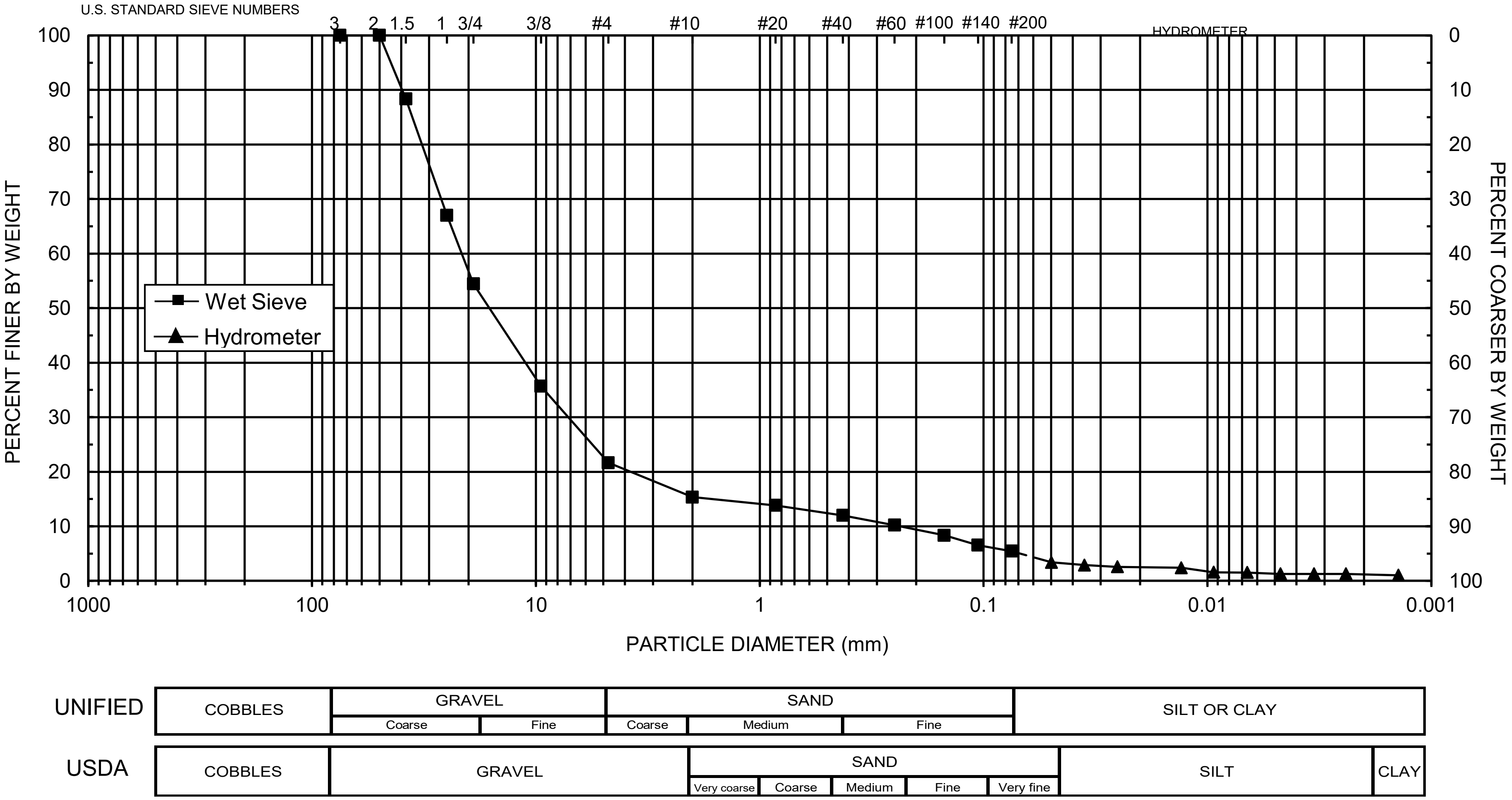
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-31B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-027	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1045	*Initial Wt.* (g)*:*	46.91
Test Date:	13-May-19	*Total Sample Wt.* (g)*:*	82152.16
Start Time:	9:36	*Wt. Passing #10* (g)*:*	12613.95

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	15.50	5.19	10.3	13	0.0497	22	3.4
	2	21.7	14.00	5.19	8.8	14	0.0355	19	2.9
	4	21.7	13.00	5.19	7.8	14	0.0252	17	2.6
	15	21.7	12.50	5.19	7.3	14	0.0131	16	2.4
	30	21.7	10.00	5.19	4.8	14	0.0094	10	1.6
	60	21.9	9.75	5.11	4.6	14	0.0066	10	1.5
	120	21.9	9.00	5.11	3.9	14	0.0047	8	1.3
	240	21.9	9.00	5.11	3.9	14	0.0033	8	1.3
	463	21.9	9.00	5.11	3.9	14	0.0024	8	1.3
14-May-19	1372	21.9	8.25	5.11	3.1	15	0.0014	7	1.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.24**	d_{30} = **7.2**	d_{50} = **16**	d_{60} = **21**	C_u = **88**	C_c = **10**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-31B	**04/18/2019 1045**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB
Lab ID: HAT01-11.1904001-100
Date/Time sampled: 04/18/2019 1045

Test Date: 4-Jun-19

Initial Dry Weight of Sample (g): 1489.74
Weight Passing #10 (g): 1460.76
Weight Retained #10 (g): 28.98
Weight of Hydrometer Sample (g): 101.47
Calculated Weight of Sieve Sample (g): 103.48

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1489.74	100.00
	2"	50	0.00	0.00	1489.74	100.00
	1.5"	38.1	0.00	0.00	1489.74	100.00
	1"	25	0.00	0.00	1489.74	100.00
	3/4"	19.0	0.00	0.00	1489.74	100.00
	3/8"	9.5	10.20	10.20	1479.54	99.32
	4	4.75	7.77	17.97	1471.77	98.79
	10	2.00	11.01	28.98	1460.76	98.05
-10			(Based on calculated sieve wt.)			
	20	0.85	0.95	2.96	100.52	97.14
	40	0.425	1.08	4.04	99.44	96.09
	60	0.250	8.24	12.28	91.20	88.13
	100	0.150	25.08	37.36	66.12	63.89
	140	0.106	20.07	57.43	46.05	44.50
	200	0.075	15.37	72.80	30.68	29.65
	dry pan		5.65	78.45	25.03	
	wet pan			25.03	0.00	

d_{10} (mm): 0.0049
d_{16} (mm): 0.041
d_{30} (mm): 0.076
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 29
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 8.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB
Lab ID: HAT01-11.1904001-100
Date/Time sampled: 04/18/2019 1045

Test Date: 31-May-19
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

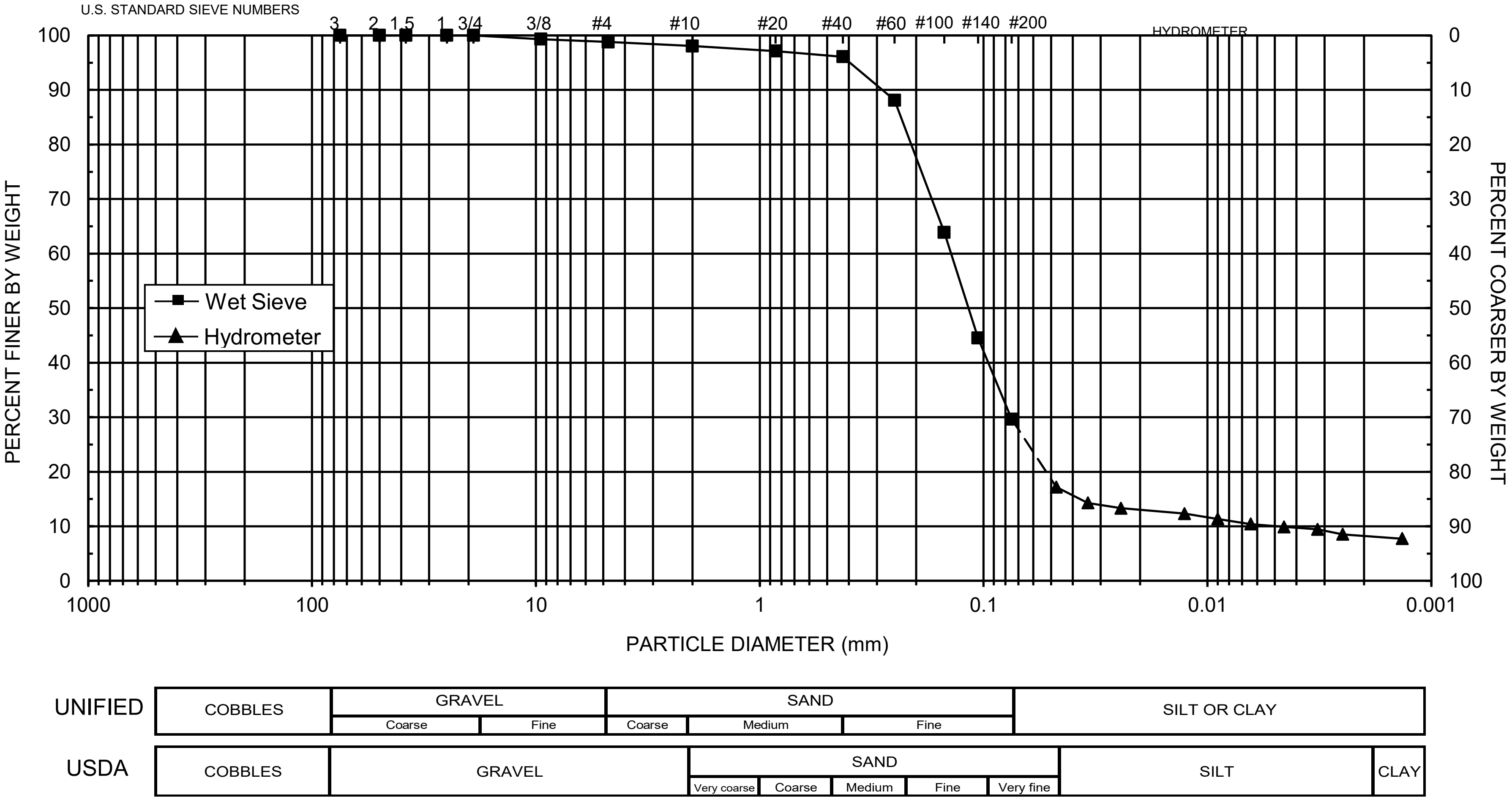
Initial Wt. (g)*:* 101.47
Total Sample Wt. (g)*:* 1489.74
Wt. Passing #10 (g)*:* 1460.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	23.00	5.22	17.8	12	0.0474	18	17.2
	2	21.6	20.00	5.22	14.8	13	0.0342	15	14.3
	4	21.6	19.00	5.22	13.8	13	0.0243	14	13.3
	15	21.5	18.00	5.26	12.7	13	0.0126	13	12.3
	30	21.5	17.00	5.26	11.7	13	0.0090	12	11.3
	60	21.6	16.00	5.22	10.8	13	0.0064	11	10.4
	120	21.5	15.50	5.26	10.2	13	0.0045	10	9.9
	240	21.6	15.00	5.22	9.8	13	0.0032	10	9.4
	408	21.7	14.00	5.19	8.8	14	0.0025	9	8.5
1-Jun-19	1403	21.5	13.25	5.26	8.0	14	0.0013	8	7.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0049**	d_{30} = **0.076**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **29**	C_c = **8.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-31RB	**04/18/2019 1045**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RM
Lab ID: HAT01-11.1904001-101
Date/Time sampled: 04/18/2019 1045

Test Date: 5-Jun-19

Initial Dry Weight of Sample (g): 1598.72
Weight Passing #10 (g): 1581.76
Weight Retained #10 (g): 16.96
Weight of Hydrometer Sample (g): 99.55
Calculated Weight of Sieve Sample (g): 100.62

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1598.72	100.00
	2"	50	0.00	0.00	1598.72	100.00
	1.5"	38.1	0.00	0.00	1598.72	100.00
	1"	25	0.00	0.00	1598.72	100.00
	3/4"	19.0	0.00	0.00	1598.72	100.00
	3/8"	9.5	2.72	2.72	1596.00	99.83
	4	4.75	7.55	10.27	1588.45	99.36
	10	2.00	6.69	16.96	1581.76	98.94
-10			(Based on calculated sieve wt.)			
	20	0.85	0.81	1.88	98.74	98.13
	40	0.425	0.90	2.78	97.84	97.24
	60	0.250	6.71	9.49	91.13	90.57
	100	0.150	25.95	35.44	65.18	64.78
	140	0.106	21.54	56.98	43.64	43.37
	200	0.075	16.12	73.10	27.52	27.35
	dry pan		4.55	77.65	22.97	
	wet pan			22.97	0.00	

d_{10} (mm): 0.0090
d_{16} (mm): 0.048
d_{30} (mm): 0.079

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 16
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 5.0
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RM
Lab ID: HAT01-11.1904001-101
Date/Time sampled: 04/18/2019 1045

Test Date: 3-Jun-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

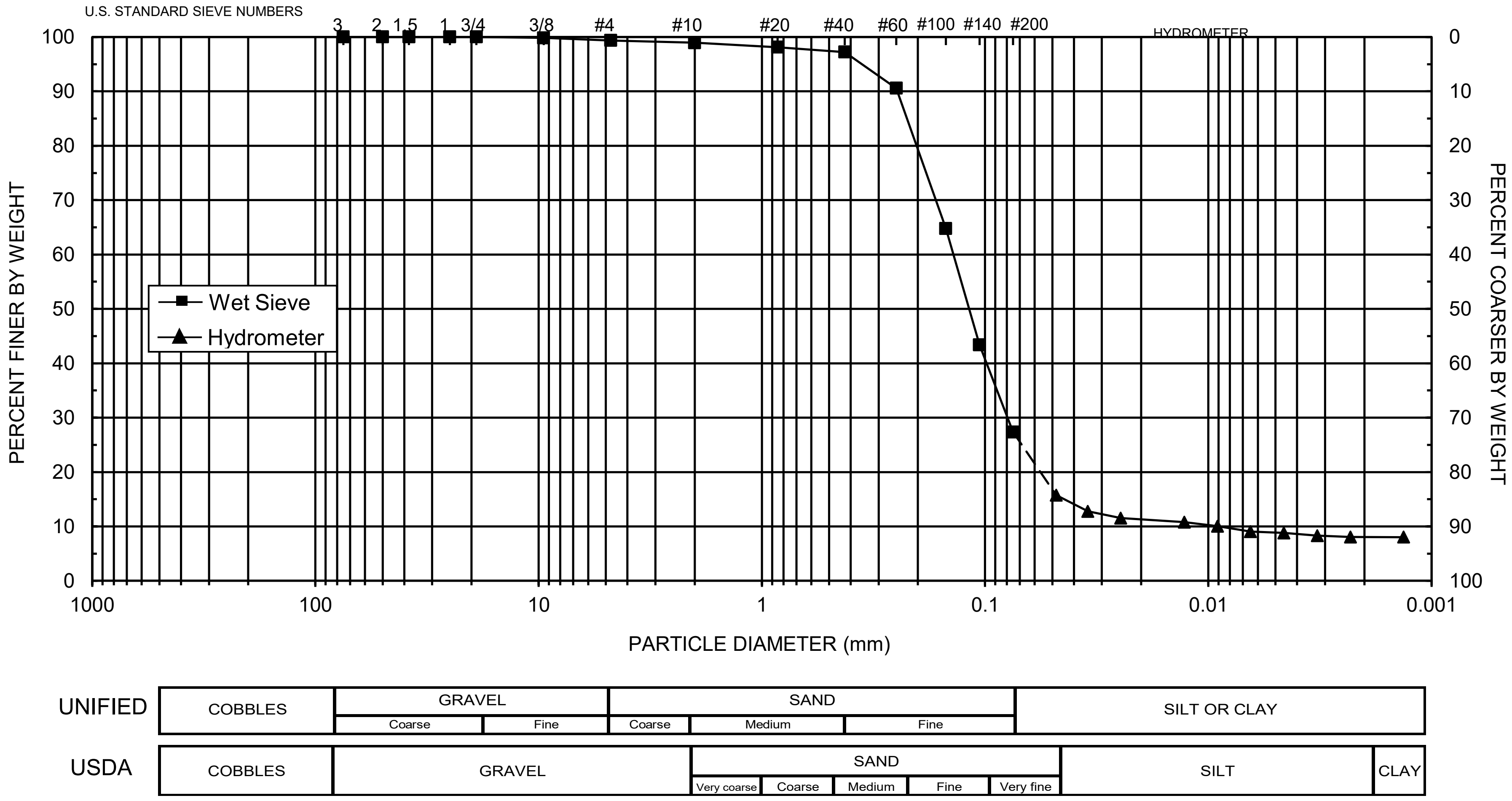
Initial Wt. *(g):* 99.55
Total Sample Wt. *(g):* 1598.72
Wt. Passing #10 *(g):* 1581.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	21.00	5.15	15.9	12	0.0480	16	15.8
	2	21.8	18.00	5.15	12.9	13	0.0346	13	12.8
	4	21.8	16.75	5.15	11.6	13	0.0247	12	11.5
	15	21.8	16.00	5.15	10.9	13	0.0128	11	10.8
	30	21.8	15.25	5.15	10.1	13	0.0091	10	10.0
	60	21.8	14.25	5.15	9.1	14	0.0065	9	9.0
	120	21.8	14.00	5.15	8.9	14	0.0046	9	8.8
	240	21.8	13.50	5.15	8.4	14	0.0032	8	8.3
	478	21.8	13.25	5.15	8.1	14	0.0023	8	8.0
4-Jun-19	1428	21.7	13.25	5.19	8.1	14	0.0013	8	8.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0090**	d_{30} = **0.079**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **16**	C_c = **5.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-31RM	**04/18/2019 1045**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1561.90
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1551.51
Sample Number:	L5-31RT	*Weight Retained #10 (g):*	10.39
Lab ID:	HAT01-11.1904001-102	*Weight of Hydrometer Sample (g):*	90.00
Date/Time sampled:	04/18/2019 1045	*Calculated Weight of Sieve Sample (g):*	90.60
Test Date:	28-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1561.90	100.00
	2"	50	0.00	0.00	1561.90	100.00
	1.5"	38.1	0.00	0.00	1561.90	100.00
	1"	25	0.00	0.00	1561.90	100.00
	3/4"	19.0	0.00	0.00	1561.90	100.00
	3/8"	9.5	2.80	2.80	1559.10	99.82
	4	4.75	4.78	7.58	1554.32	99.51
	10	2.00	2.81	10.39	1551.51	99.33
-10			(Based on calculated sieve wt.)			
	20	0.85	0.53	1.13	89.47	98.75
	40	0.425	0.74	1.87	88.73	97.93
	60	0.250	5.91	7.78	82.82	91.41
	100	0.150	21.48	29.26	61.34	67.70
	140	0.106	20.36	49.62	40.98	45.23
	200	0.075	15.82	65.44	25.16	27.77
	dry pan		6.36	71.80	18.80	
	wet pan			18.80	0.00	

d_{10} (mm):	0.0096	d_{50} (mm):	0.11
d_{16} (mm):	0.051	d_{60} (mm):	0.13
d_{30} (mm):	0.078	d_{84} (mm):	0.21

Median Particle Diameter --d_{50} (mm): 0.11

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 14

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.9

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.12

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RT
Lab ID: HAT01-11.1904001-102
Date/Time sampled: 04/18/2019 1045

Test Date: 10-Jun-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

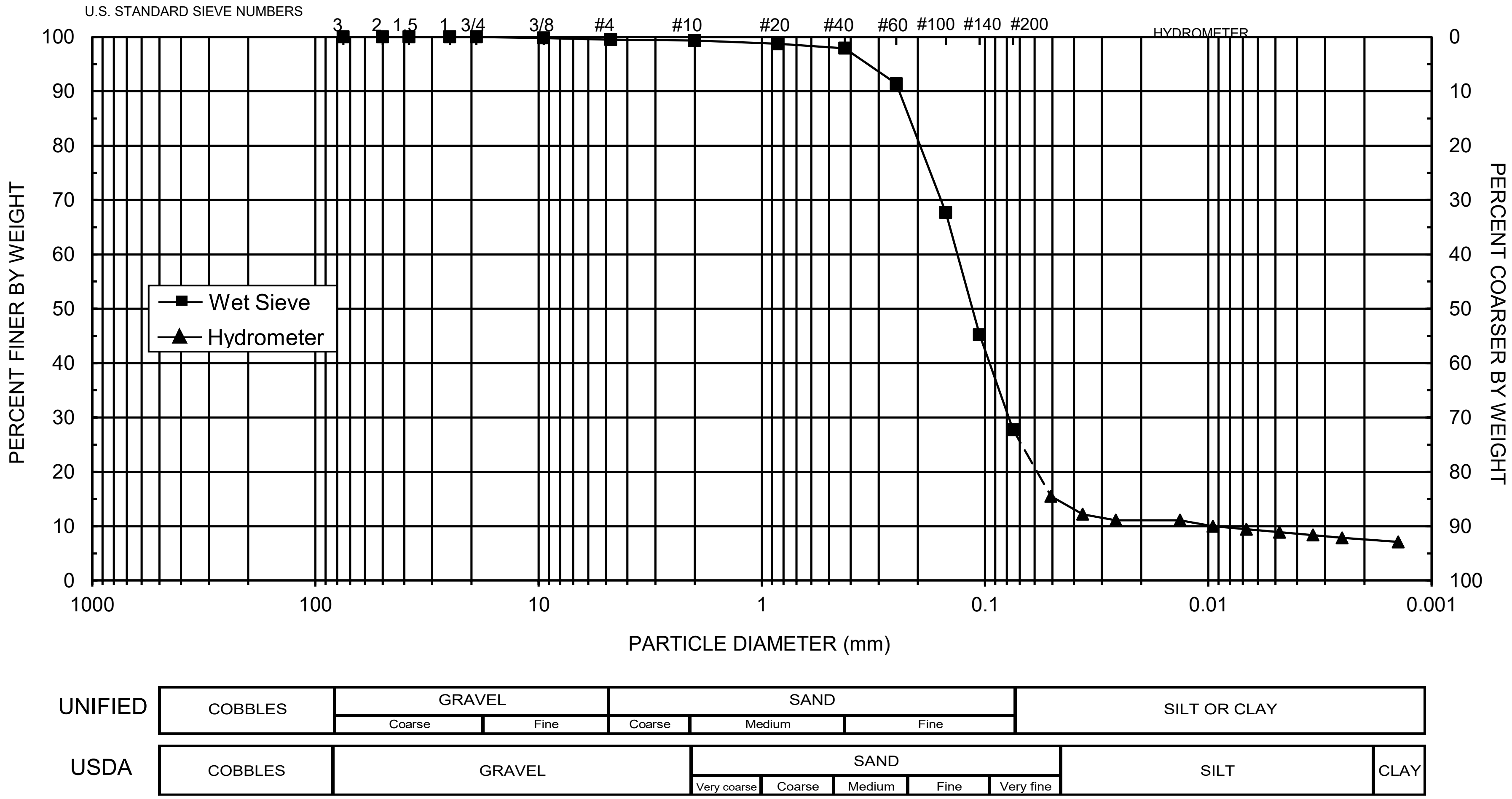
Initial Wt. *(g):* 90.00
Total Sample Wt. *(g):* 1561.90
Wt. Passing #10 *(g):* 1551.51

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.8	20.00	5.95	14.1	14	0.0507	16	15.5
	2	21.8	17.00	5.95	11.1	14	0.0365	12	12.2
	4	21.8	16.00	5.95	10.1	14	0.0259	11	11.1
	15	21.8	16.00	5.95	10.1	14	0.0134	11	11.1
	30	21.8	15.00	5.95	9.1	15	0.0095	10	10.0
	60	21.8	14.50	5.95	8.6	15	0.0068	10	9.4
	120	21.8	14.00	5.95	8.1	15	0.0048	9	8.9
	240	21.9	13.50	5.91	7.6	15	0.0034	8	8.4
	441	22.0	13.00	5.88	7.1	15	0.0025	8	7.9
11-Jun-19	1407	21.5	12.50	6.06	6.4	15	0.0014	7	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.0096**	d_{30} = **0.078**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **14**	C_c = **4.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-31RT	**04/18/2019 1045**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41B
Lab ID: HAT01-11.1904001-095
Date/Time sampled: 04/18/2019 940

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 80764.77
Weight Passing #10 (g): 3149.32
Weight Retained #10 (g): 77615.44
Weight of Hydrometer Sample (g): 69.54
Calculated Weight of Sieve Sample (g): 1783.36

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	80764.77	100.00
	2"	50	461.03	461.03	80303.74	99.43
	1.5"	38.1	10180.76	10641.79	70122.98	86.82
	1"	25	25166.10	35807.89	44956.88	55.66
	3/4"	19.0	13504.14	49312.03	31452.73	38.94
	3/8"	9.5	22163.96	71475.99	9288.78	11.50
	4	4.75	5244.61	76720.60	4044.16	5.01
	10	2.00	894.84	77615.44	3149.32	3.90
-10			(Based on calculated sieve wt.)			
	20	0.85	2.76	1716.58	66.78	3.74
	40	0.425	2.01	1718.59	64.77	3.63
	60	0.250	4.37	1722.96	60.40	3.39
	100	0.150	11.87	1734.83	48.53	2.72
	140	0.106	12.03	1746.86	36.50	2.05
	200	0.075	10.49	1757.35	26.01	1.46
	dry pan		1.73	1759.08	24.28	
	wet pan			24.28	0.00	

d_{10} (mm): 8.1
d_{16} (mm): 11
d_{30} (mm): 15
d_{50} (mm): 23
d_{60} (mm): 27
d_{84} (mm): 37

Median Particle Diameter --d_{50} (mm): 23
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.3
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 24

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

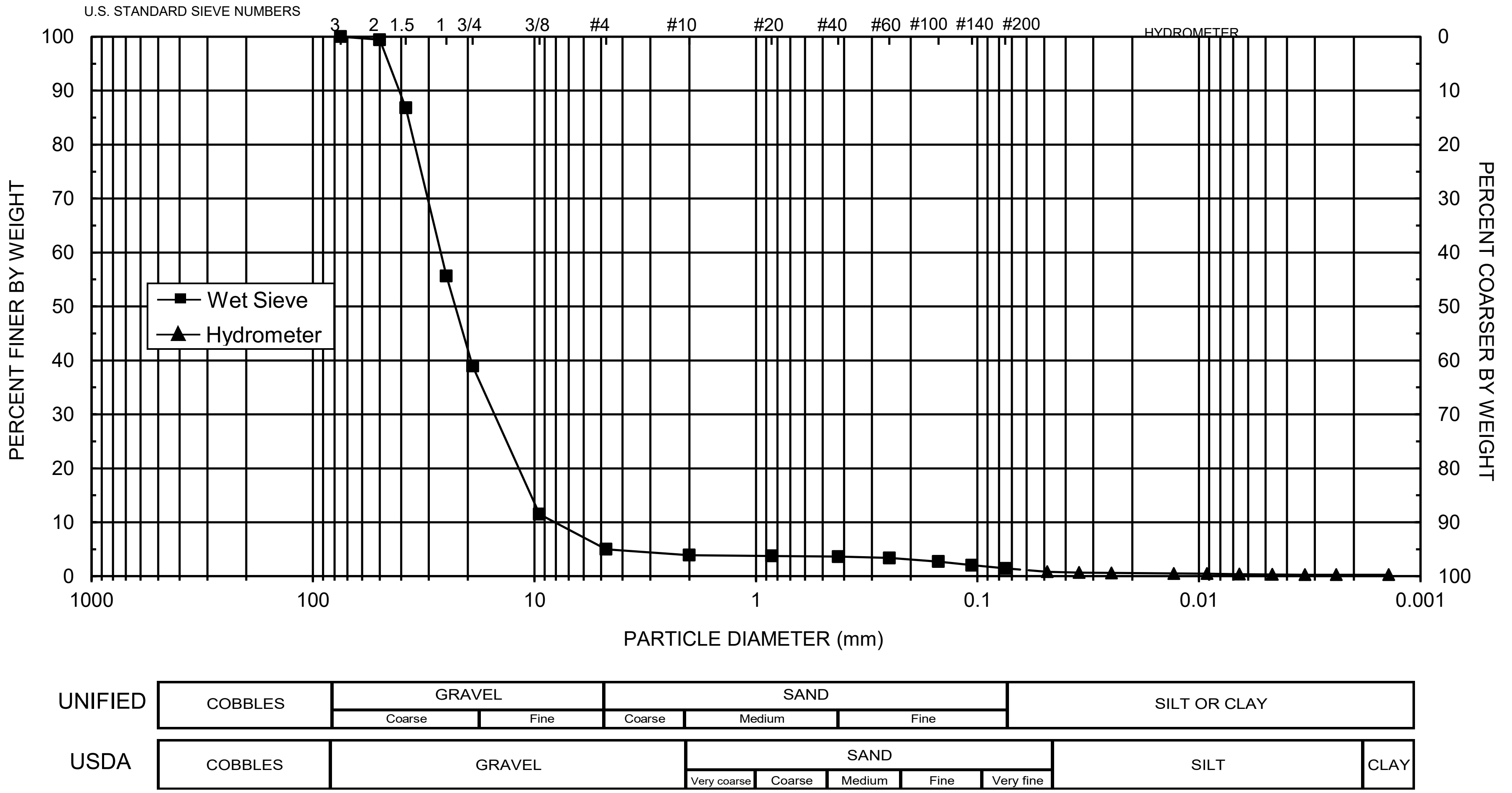
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-41B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-095	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 940	*Initial Wt. (g):*	69.54
Test Date:	13-May-19	*Total Sample Wt. (g):*	80764.77
Start Time:	9:42	*Wt. Passing #10 (g):*	3149.32

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	20.00	5.19	14.8	13	0.0483	21	0.8
	2	21.7	17.50	5.19	12.3	13	0.0347	18	0.7
	4	21.7	16.00	5.19	10.8	13	0.0248	16	0.6
	15	21.7	14.00	5.19	8.8	14	0.0130	13	0.5
	30	21.7	13.75	5.19	8.6	14	0.0092	12	0.5
	60	21.9	12.00	5.11	6.9	14	0.0066	10	0.4
	120	21.9	11.00	5.11	5.9	14	0.0047	8	0.3
	240	21.9	10.00	5.11	4.9	14	0.0033	7	0.3
	459	21.9	10.00	5.11	4.9	14	0.0024	7	0.3
14-May-19	1367	21.9	10.00	5.11	4.9	14	0.0014	7	0.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **8.1**	d_{30} = **15**	d_{50} = **23**	d_{60} = **27**	C_u = **3.3**	C_c = **1.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-41B	**04/18/2019 940**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RB
Lab ID: HAT01-11.1904001-096
Date/Time sampled: 04/18/2019 945

Test Date: 4-Jun-19

Initial Dry Weight of Sample (g): 1591.78
Weight Passing #10 (g): 1569.55
Weight Retained #10 (g): 22.23
Weight of Hydrometer Sample (g): 98.30
Calculated Weight of Sieve Sample (g): 99.69

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1591.78	100.00
	2"	50	0.00	0.00	1591.78	100.00
	1.5"	38.1	0.00	0.00	1591.78	100.00
	1"	25	0.00	0.00	1591.78	100.00
	3/4"	19.0	0.00	0.00	1591.78	100.00
	3/8"	9.5	7.41	7.41	1584.37	99.53
	4	4.75	7.23	14.64	1577.14	99.08
	10	2.00	7.59	22.23	1569.55	98.60
-10			(Based on calculated sieve wt.)			
	20	0.85	0.89	2.28	97.41	97.71
	40	0.425	0.94	3.22	96.47	96.77
	60	0.250	7.36	10.58	89.11	89.39
	100	0.150	24.53	35.11	64.58	64.78
	140	0.106	19.80	54.91	44.78	44.92
	200	0.075	15.79	70.70	28.99	29.08
	dry pan		3.79	74.49	25.20	
	wet pan			25.20	0.00	

d_{10} (mm): 0.0053
d_{16} (mm): 0.040
d_{30} (mm): 0.077
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 26
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 8.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RB
Lab ID: HAT01-11.1904001-096
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

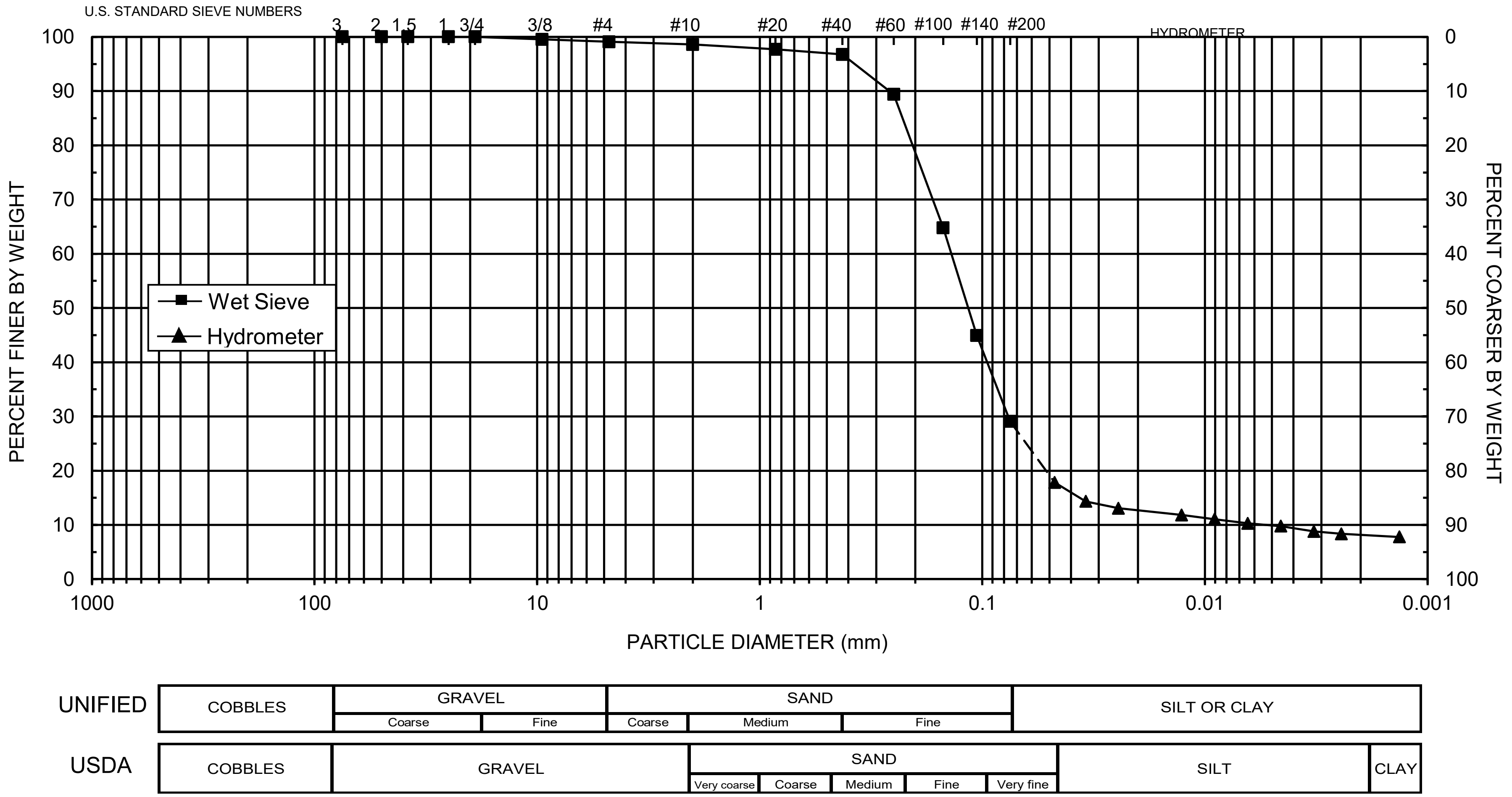
Initial Wt. *(g):* 98.30
Total Sample Wt. *(g):* 1591.78
Wt. Passing #10 *(g):* 1569.55

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	23.00	5.22	17.8	12	0.0474	18	17.8
	2	21.6	19.50	5.22	14.3	13	0.0343	15	14.3
	4	21.6	18.25	5.22	13.0	13	0.0244	13	13.1
	15	21.6	17.00	5.22	11.8	13	0.0127	12	11.8
	30	21.6	16.25	5.22	11.0	13	0.0090	11	11.1
	60	21.5	15.50	5.26	10.2	13	0.0064	10	10.3
	120	21.5	15.00	5.26	9.7	13	0.0046	10	9.8
	240	21.6	14.00	5.22	8.8	14	0.0032	9	8.8
	427	21.7	13.50	5.19	8.3	14	0.0024	8	8.3
1-Jun-19	1424	21.5	13.00	5.26	7.7	14	0.0013	8	7.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0053**	d_{30} = **0.077**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **26**	C_c = **8.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-41RB	**04/18/2019 945**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1625.13
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1618.44
Sample Number:	L5-41RM	*Weight Retained #10 (g):*	6.69
Lab ID:	HAT01-11.1904001-097	*Weight of Hydrometer Sample (g):*	103.37
Date/Time sampled:	04/18/2019 945	*Calculated Weight of Sieve Sample (g):*	103.80
Test Date:	4-Jun-19	*Shape:*	Rounded
		Hardness:	Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1625.13	100.00
	2"	50	0.00	0.00	1625.13	100.00
	1.5"	38.1	0.00	0.00	1625.13	100.00
	1"	25	0.00	0.00	1625.13	100.00
	3/4"	19.0	0.00	0.00	1625.13	100.00
	3/8"	9.5	2.26	2.26	1622.87	99.86
	4	4.75	1.59	3.85	1621.28	99.76
	10	2.00	2.84	6.69	1618.44	99.59
-10			(Based on calculated sieve wt.)			
	20	0.85	0.23	0.66	103.14	99.37
	40	0.425	0.78	1.44	102.36	98.62
	60	0.250	5.42	6.86	96.94	93.39
	100	0.150	28.27	35.13	68.67	66.16
	140	0.106	26.83	61.96	41.84	40.31
	200	0.075	17.40	79.36	24.44	23.55
	dry pan		5.16	84.52	19.28	
	wet pan			19.28	0.00	

d_{10} (mm):	0.015	d_{50} (mm):	0.12
d_{16} (mm):	0.055	d_{60} (mm):	0.14
d_{30} (mm):	0.086	d_{84} (mm):	0.21

Median Particle Diameter --d_{50} (mm): 0.12

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 9.3

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.5

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RM
Lab ID: HAT01-11.1904001-097
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

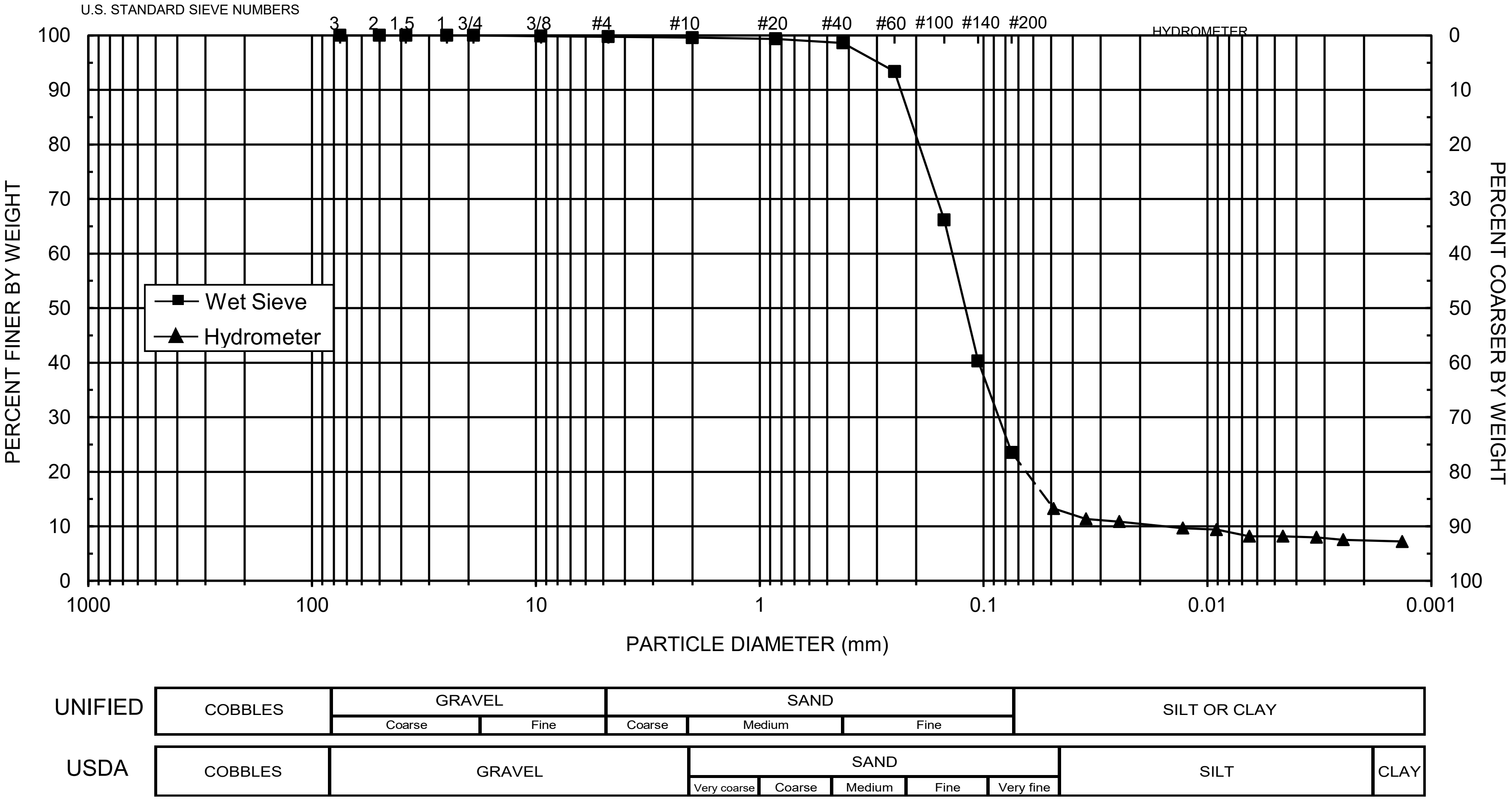
Initial Wt. *(g):* 103.37
Total Sample Wt. *(g):* 1625.13
Wt. Passing #10 *(g):* 1618.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	19.00	5.22	13.8	13	0.0487	13	13.3
	2	21.6	17.00	5.22	11.8	13	0.0349	11	11.3
	4	21.6	16.50	5.22	11.3	13	0.0247	11	10.9
	15	21.6	15.25	5.22	10.0	13	0.0129	10	9.7
	30	21.5	15.00	5.26	9.7	13	0.0091	9	9.4
	60	21.5	13.75	5.26	8.5	14	0.0065	8	8.2
	120	21.5	13.75	5.26	8.5	14	0.0046	8	8.2
	240	21.6	13.50	5.22	8.3	14	0.0033	8	8.0
	417	21.7	13.00	5.19	7.8	14	0.0025	8	7.5
1-Jun-19	1413	21.5	12.75	5.26	7.5	14	0.0013	7	7.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.015**	d_{30} = **0.086**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **9.3**	C_c = **3.5**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-41RM	**04/18/2019 945**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RT
Lab ID: HAT01-11.1904001-098
Date/Time sampled: 04/18/2019 945

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1732.20
Weight Passing #10 (g): 1729.65
Weight Retained #10 (g): 2.55
Weight of Hydrometer Sample (g): 98.17
Calculated Weight of Sieve Sample (g): 98.31

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1732.20	100.00
	2"	50	0.00	0.00	1732.20	100.00
	1.5"	38.1	0.00	0.00	1732.20	100.00
	1"	25	0.00	0.00	1732.20	100.00
	3/4"	19.0	0.00	0.00	1732.20	100.00
	3/8"	9.5	0.00	0.00	1732.20	100.00
	4	4.75	0.13	0.13	1732.07	99.99
	10	2.00	2.42	2.55	1729.65	99.85
-10			(Based on calculated sieve wt.)			
	20	0.85	0.56	0.70	97.61	99.28
	40	0.425	0.88	1.58	96.73	98.39
	60	0.250	7.51	9.09	89.22	90.75
	100	0.150	23.88	32.97	65.34	66.46
	140	0.106	24.70	57.67	40.64	41.34
	200	0.075	14.79	72.46	25.85	26.29
	dry pan		6.45	78.91	19.40	
	wet pan			19.40	0.00	

d_{10} (mm): 0.013
d_{16} (mm): 0.052
d_{30} (mm): 0.082

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 11
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RT
Lab ID: HAT01-11.1904001-098
Date/Time sampled: 04/18/2019 945

Test Date: 10-Jun-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

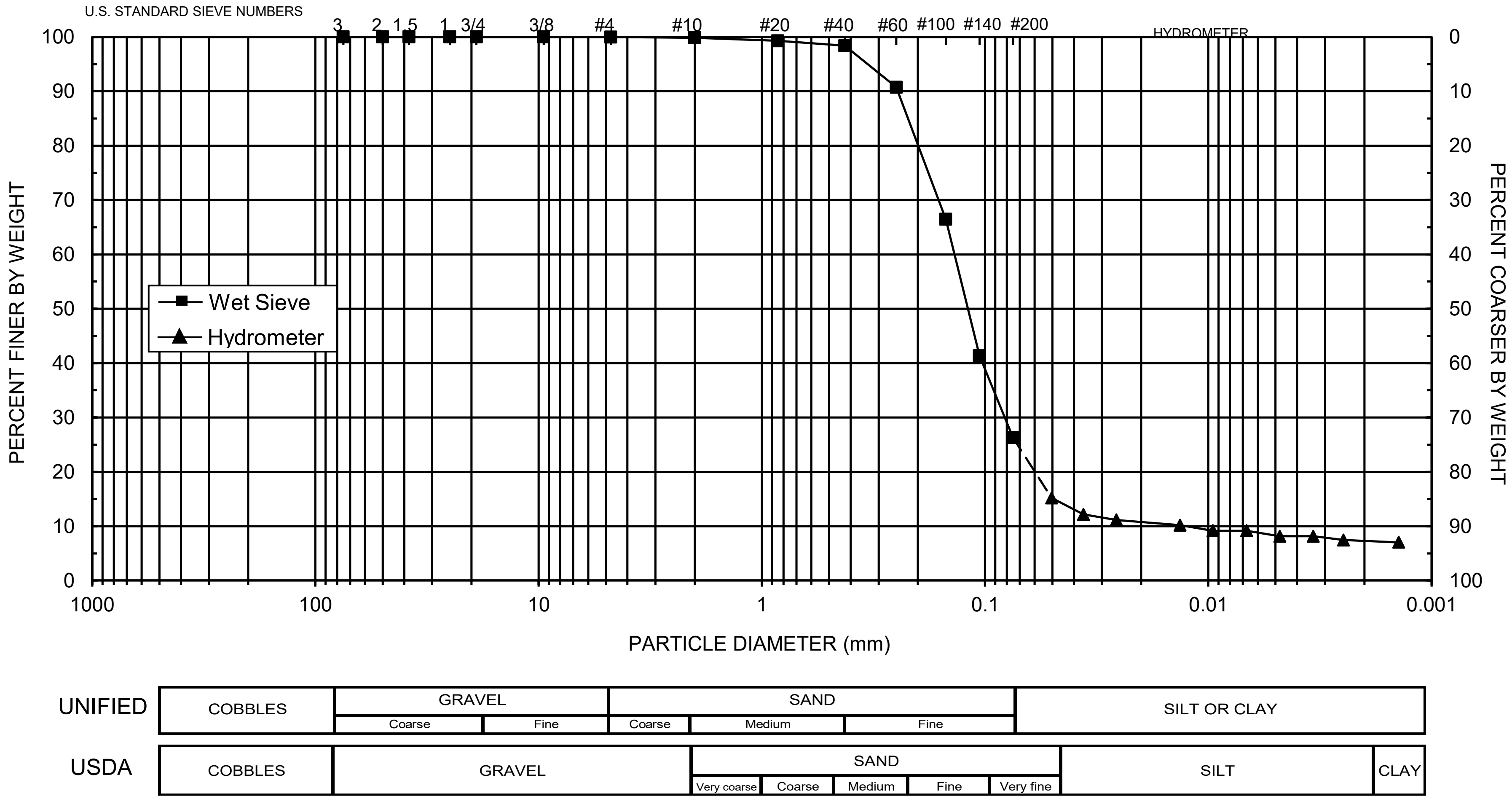
Initial Wt. *(g):* 98.17
Total Sample Wt. *(g):* 1732.20
Wt. Passing #10 *(g):* 1729.65

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	21.00	5.99	15.0	14	0.0503	15	15.2
	2	21.7	18.00	5.99	12.0	14	0.0362	12	12.2
	4	21.7	17.00	5.99	11.0	14	0.0258	11	11.2
	15	21.8	16.00	5.95	10.1	14	0.0134	10	10.2
	30	21.8	15.00	5.95	9.1	15	0.0095	9	9.2
	60	21.8	15.00	5.95	9.1	15	0.0067	9	9.2
	120	21.8	14.00	5.95	8.1	15	0.0048	8	8.2
	240	21.8	14.00	5.95	8.1	15	0.0034	8	8.2
	451	22.0	13.25	5.88	7.4	15	0.0025	7	7.5
11-Jun-19	1417	21.5	13.00	6.06	6.9	15	0.0014	7	7.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.013**	d_{30} = **0.082**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **11**	C_c = **3.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-41RT	**04/18/2019 945**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	78886.52
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	3251.12
Sample Number:	L5-51B	*Weight Retained #10 (g):*	75635.40
Lab ID:	HAT01-11.1904001-091	*Weight of Hydrometer Sample (g):*	101.74
Date/Time sampled:	04/18/2019 900	*Calculated Weight of Sieve Sample (g):*	2468.66
Test Date:	28-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	78886.52	100.00
	2"	50	0.00	0.00	78886.52	100.00
	1.5"	38.1	10271.56	10271.56	68614.96	86.98
	1"	25	25360.60	35632.16	43254.36	54.83
	3/4"	19.0	13250.94	48883.10	30003.42	38.03
	3/8"	9.5	20359.76	69242.86	9643.66	12.22
	4	4.75	5427.62	74670.48	4216.04	5.34
	10	2.00	964.92	75635.40	3251.12	4.12
-10			(Based on calculated sieve wt.)			
	20	0.85	2.77	2369.69	98.97	4.01
	40	0.425	1.31	2371.00	97.66	3.96
	60	0.250	5.99	2376.99	91.67	3.71
	100	0.150	20.50	2397.49	71.17	2.88
	140	0.106	22.58	2420.07	48.59	1.97
	200	0.075	15.91	2435.98	32.68	1.32
	dry pan		6.72	2442.70	25.96	
	wet pan			25.96	0.00	

d_{10} (mm):	7.6	d_{50} (mm):	23
d_{16} (mm):	11	d_{60} (mm):	27
d_{30} (mm):	15	d_{84} (mm):	37

Median Particle Diameter --d_{50} (mm): 23

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.6

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.1

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 24

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

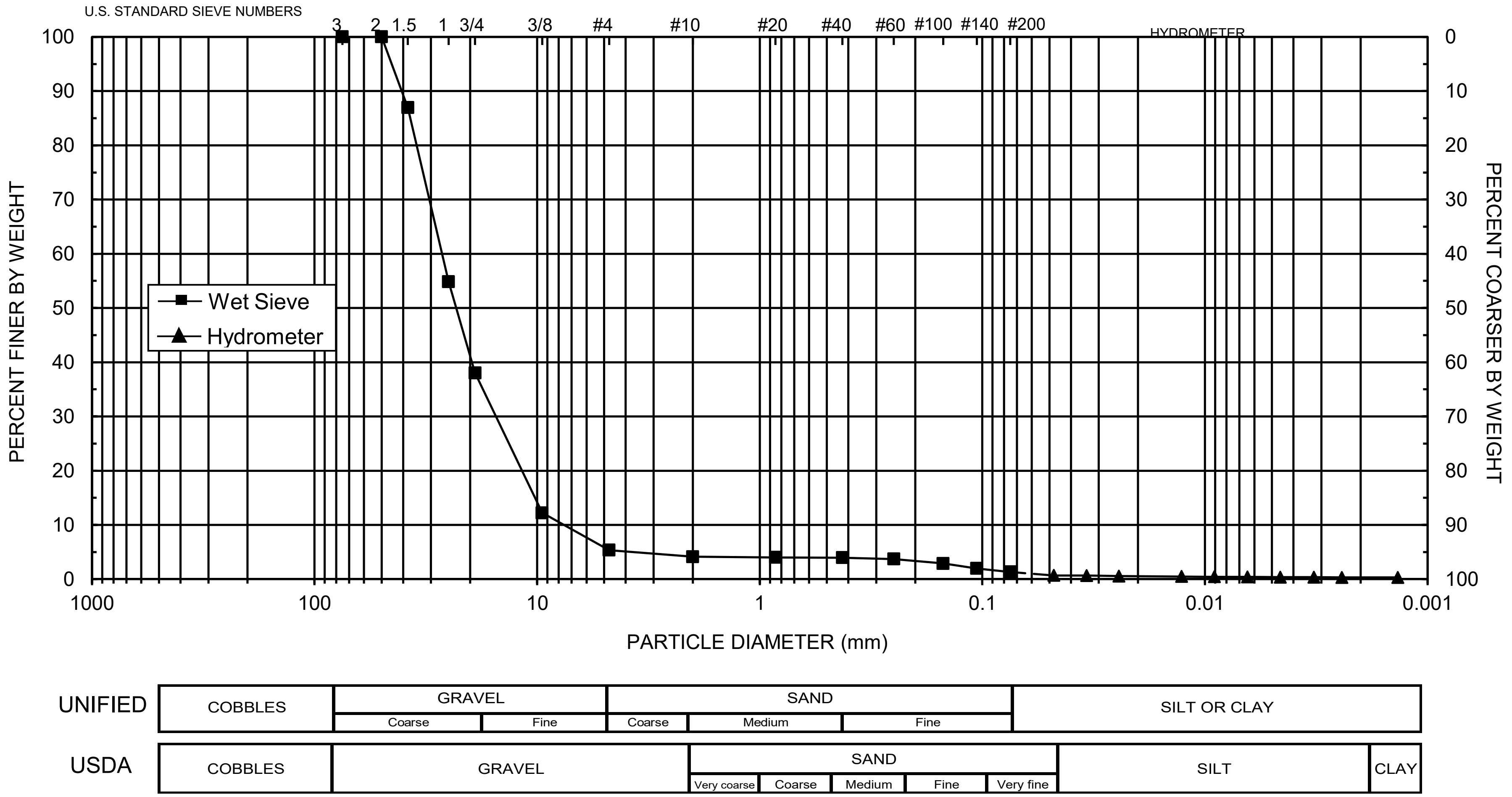
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-51B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-091	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 900	*Initial Wt. (g):*	101.74
Test Date:	29-May-19	*Total Sample Wt. (g):*	78886.52
Start Time:	9:54	*Wt. Passing #10 (g):*	3251.12

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	22.00	5.15	16.9	12	0.0477	17	0.7
	2	21.8	21.00	5.15	15.9	12	0.0339	16	0.6
	4	21.8	19.00	5.15	13.9	13	0.0243	14	0.6
	15	21.8	17.00	5.15	11.9	13	0.0127	12	0.5
	30	21.8	16.00	5.15	10.9	13	0.0091	11	0.4
	60	21.8	15.00	5.15	9.9	13	0.0064	10	0.4
	120	21.8	14.00	5.15	8.9	14	0.0046	9	0.4
	240	21.6	14.00	5.22	8.8	14	0.0032	9	0.4
	435	21.6	13.00	5.22	7.8	14	0.0024	8	0.3
30-May-19	1383	21.6	13.00	5.22	7.8	14	0.0014	8	0.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **7.6**	d_{30} = **15**	d_{50} = **23**	d_{60} = **27**	C_u = **3.6**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-51B	**04/18/2019 900**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RB
Lab ID: HAT01-11.1904001-092
Date/Time sampled: 04/18/2019 915

Test Date: 4-Jun-19

Initial Dry Weight of Sample (g): 1802.22
Weight Passing #10 (g): 1787.17
Weight Retained #10 (g): 15.05
Weight of Hydrometer Sample (g): 111.83
Calculated Weight of Sieve Sample (g): 112.77

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1802.22	100.00
	2"	50	0.00	0.00	1802.22	100.00
	1.5"	38.1	0.00	0.00	1802.22	100.00
	1"	25	0.00	0.00	1802.22	100.00
	3/4"	19.0	0.00	0.00	1802.22	100.00
	3/8"	9.5	2.49	2.49	1799.73	99.86
	4	4.75	6.32	8.81	1793.41	99.51
	10	2.00	6.24	15.05	1787.17	99.16
-10			(Based on calculated sieve wt.)			
	20	0.85	0.49	1.43	111.34	98.73
	40	0.425	1.01	2.44	110.33	97.83
	60	0.250	7.95	10.39	102.38	90.79
	100	0.150	30.00	40.39	72.38	64.18
	140	0.106	24.33	64.72	48.05	42.61
	200	0.075	17.62	82.34	30.43	26.98
	dry pan		4.13	86.47	26.30	
	wet pan			26.30	0.00	

d_{10} (mm): 0.011
d_{16} (mm): 0.046
d_{30} (mm): 0.080
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 13
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RB
Lab ID: HAT01-11.1904001-092
Date/Time sampled: 04/18/2019 915

Test Date: 31-May-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

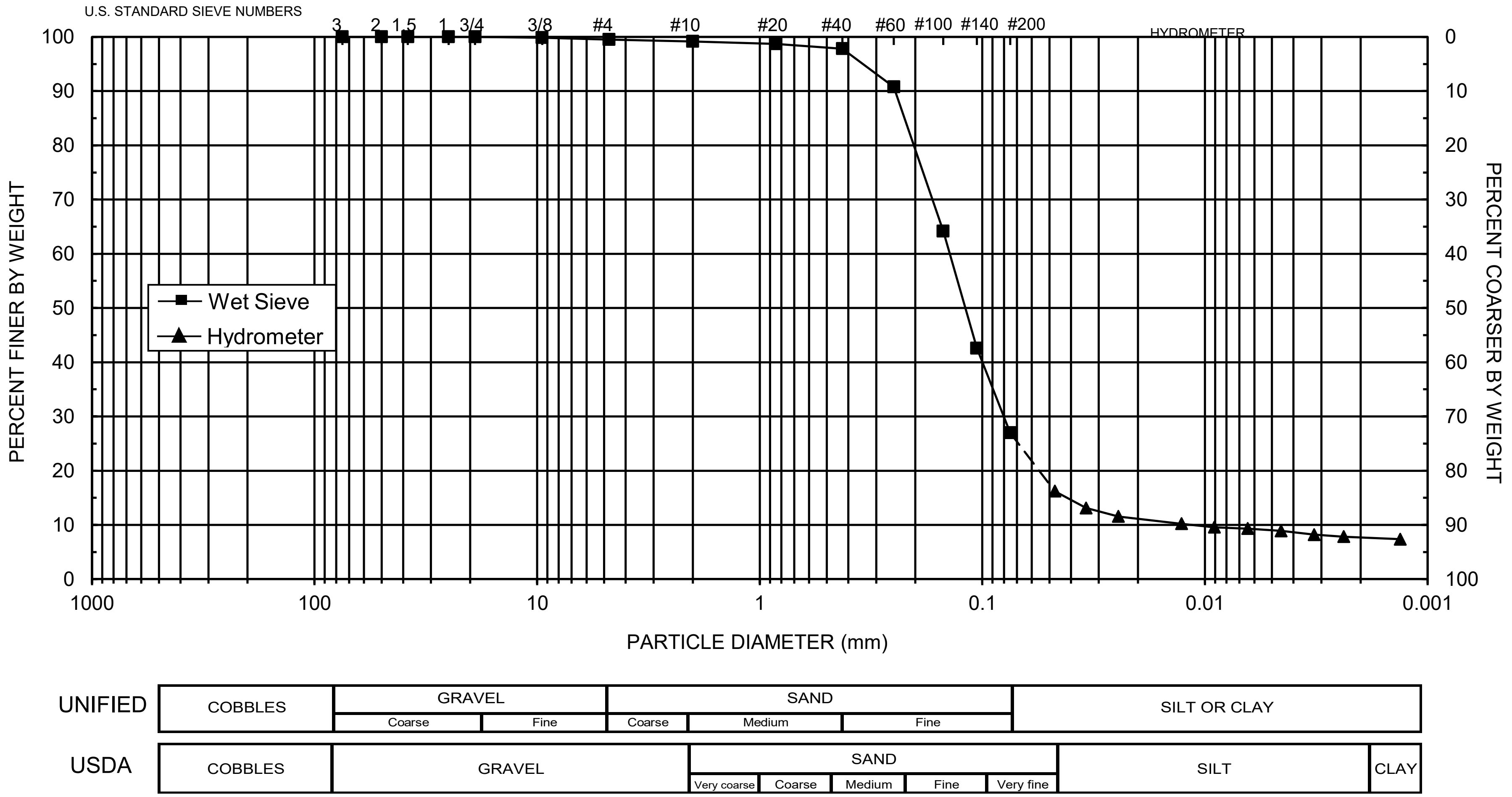
Initial Wt. (g): 111.83
Total Sample Wt. (g): 1802.22
Wt. Passing #10 (g): 1787.17

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	23.50	5.22	18.3	12	0.0472	16	16.2
	2	21.6	20.00	5.22	14.8	13	0.0342	13	13.1
	4	21.6	18.25	5.22	13.0	13	0.0244	12	11.6
	15	21.6	16.75	5.22	11.5	13	0.0127	10	10.2
	30	21.6	16.00	5.22	10.8	13	0.0091	10	9.6
	60	21.5	15.75	5.26	10.5	13	0.0064	9	9.3
	120	21.6	15.25	5.22	10.0	13	0.0045	9	8.9
	240	21.5	14.50	5.26	9.2	13	0.0032	8	8.2
	447	21.7	14.00	5.19	8.8	14	0.0024	8	7.8
1-Jun-19	1444	21.5	13.54	5.26	8.3	14	0.0013	7	7.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.011**	d_{30} = **0.080**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **13**	C_c = **4.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-51RB	**04/18/2019 915**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1556.74
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1555.77
Sample Number:	L5-51RM	*Weight Retained #10 (g):*	0.97
Lab ID:	HAT01-11.1904001-093	*Weight of Hydrometer Sample (g):*	97.71
Date/Time sampled:	04/18/2019 915	*Calculated Weight of Sieve Sample (g):*	97.77
Test Date:	4-Jun-19	*Shape:*	Angular
		Hardness:	Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1556.74	100.00
	2"	50	0.00	0.00	1556.74	100.00
	1.5"	38.1	0.00	0.00	1556.74	100.00
	1"	25	0.00	0.00	1556.74	100.00
	3/4"	19.0	0.00	0.00	1556.74	100.00
	3/8"	9.5	0.00	0.00	1556.74	100.00
	4	4.75	0.36	0.36	1556.38	99.98
	10	2.00	0.61	0.97	1555.77	99.94
-10			(Based on calculated sieve wt.)			
	20	0.85	0.16	0.22	97.55	99.77
	40	0.425	0.68	0.90	96.87	99.08
	60	0.250	3.67	4.57	93.20	95.32
	100	0.150	26.70	31.27	66.50	68.02
	140	0.106	29.35	60.62	37.15	38.00
	200	0.075	17.17	77.79	19.98	20.44
	dry pan		3.56	81.35	16.42	
	wet pan			16.42	0.00	

d_{10} (mm):	0.025	d_{50} (mm):	0.12
d_{16} (mm):	0.059	d_{60} (mm):	0.14
d_{30} (mm):	0.091	d_{84} (mm):	0.20

Median Particle Diameter --d_{50} (mm): 0.12

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 5.6

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.4

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

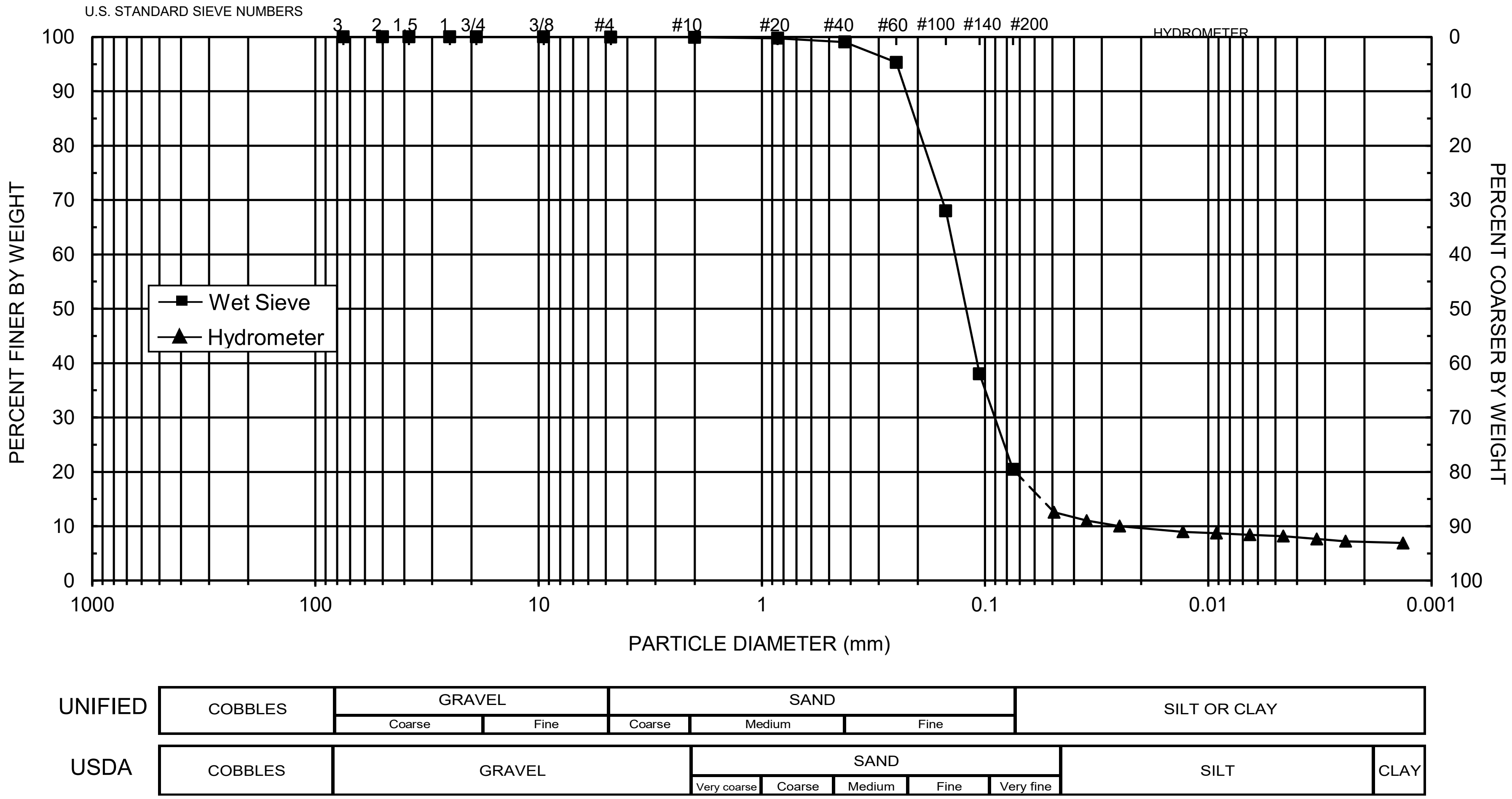
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-51RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-093	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 915	*Initial Wt.* (g)*:*	97.71
Test Date:	31-May-19	*Total Sample Wt.* (g)*:*	1556.74
Start Time:	9:12	*Wt. Passing #10* (g)*:*	1555.77

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	17.50	5.22	12.3	13	0.0491	13	12.6
	2	21.6	16.00	5.22	10.8	13	0.0351	11	11.0
	4	21.6	15.00	5.22	9.8	13	0.0249	10	10.0
	15	21.6	14.00	5.22	8.8	14	0.0130	9	9.0
	30	21.6	13.75	5.22	8.5	14	0.0092	9	8.7
	60	21.5	13.50	5.26	8.2	14	0.0065	8	8.4
	120	21.5	13.25	5.26	8.0	14	0.0046	8	8.2
	240	21.5	12.75	5.26	7.5	14	0.0033	8	7.7
	437	21.7	12.25	5.19	7.1	14	0.0024	7	7.2
1-Jun-19	1434	21.5	12.00	5.26	6.7	14	0.0013	7	6.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.025**	d_{30} = **0.091**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **5.6**	C_c = **2.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-51RM	**04/18/2019 915**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RT
Lab ID: HAT01-11.1904001-094
Date/Time sampled: 04/18/2019 915

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1686.60
Weight Passing #10 (g): 1673.43
Weight Retained #10 (g): 13.17
Weight of Hydrometer Sample (g): 101.08
Calculated Weight of Sieve Sample (g): 101.88

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1686.60	100.00
	2"	50	0.00	0.00	1686.60	100.00
	1.5"	38.1	0.00	0.00	1686.60	100.00
	1"	25	0.00	0.00	1686.60	100.00
	3/4"	19.0	0.00	0.00	1686.60	100.00
	3/8"	9.5	5.00	5.00	1681.60	99.70
	4	4.75	3.99	8.99	1677.61	99.47
	10	2.00	4.18	13.17	1673.43	99.22
-10			(Based on calculated sieve wt.)			
	20	0.85	0.64	1.44	100.44	98.59
	40	0.425	0.85	2.29	99.59	97.76
	60	0.250	7.27	9.56	92.32	90.62
	100	0.150	24.51	34.07	67.81	66.56
	140	0.106	23.10	57.17	44.71	43.89
	200	0.075	17.39	74.56	27.32	26.82
	dry pan		5.55	80.11	21.77	
	wet pan			21.77	0.00	

d_{10} (mm): 0.015
d_{16} (mm): 0.051
d_{30} (mm): 0.080
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 9.3
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 3.0
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RT
Lab ID: HAT01-11.1904001-094
Date/Time sampled: 04/18/2019 915

Test Date: 10-Jun-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

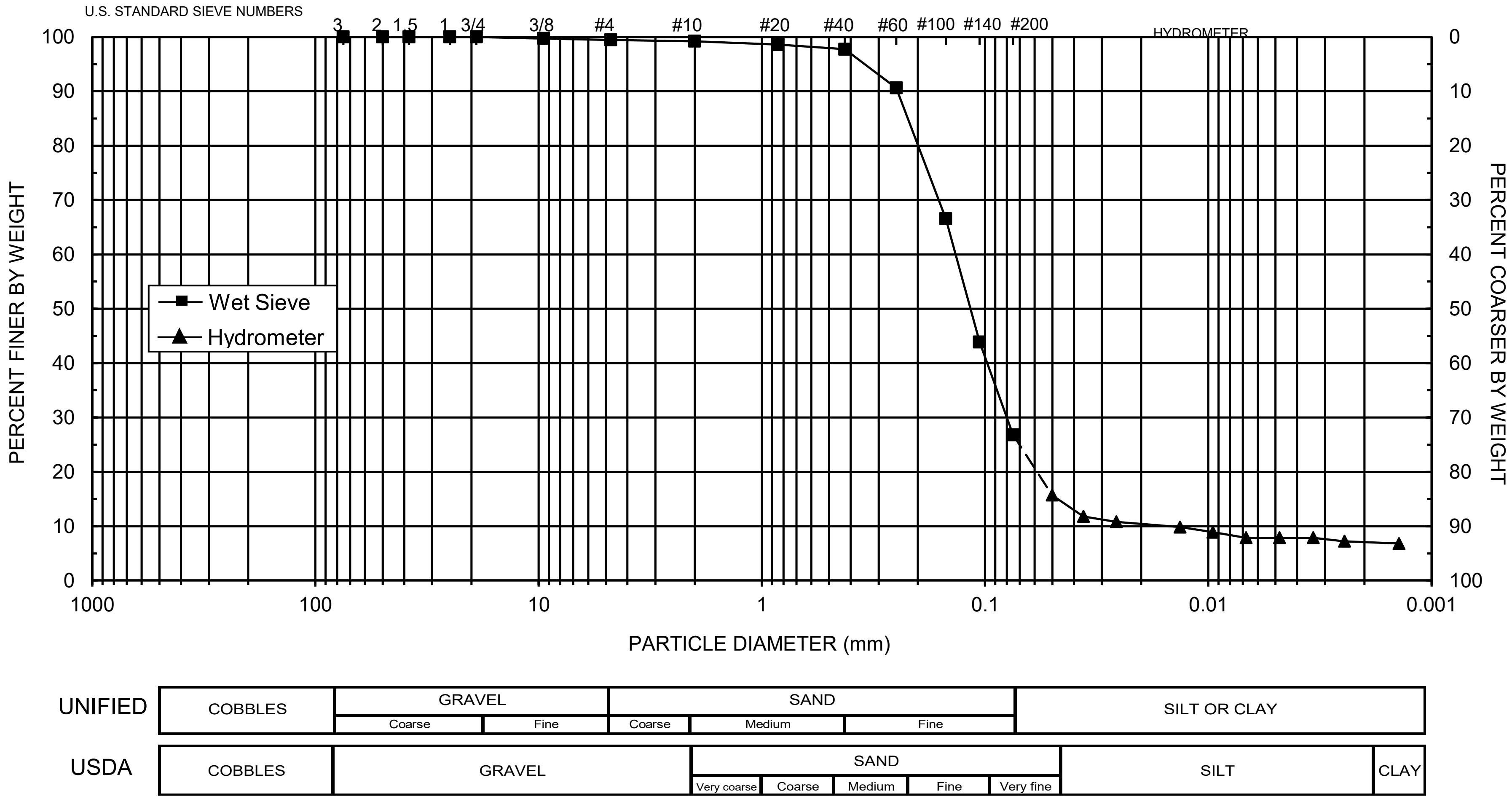
Initial Wt. (g): 101.08
Total Sample Wt. (g): 1686.60
Wt. Passing #10 (g): 1673.43

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	22.00	5.99	16.0	13	0.0501	16	15.7
	2	21.7	18.00	5.99	12.0	14	0.0362	12	11.8
	4	21.7	17.00	5.99	11.0	14	0.0258	11	10.8
	15	21.7	16.00	5.99	10.0	14	0.0134	10	9.8
	30	21.8	15.00	5.95	9.1	15	0.0095	9	8.9
	60	21.7	14.00	5.99	8.0	15	0.0068	8	7.9
	120	21.7	14.00	5.99	8.0	15	0.0048	8	7.9
	240	21.7	14.00	5.99	8.0	15	0.0034	8	7.9
	461	22.0	13.25	5.88	7.4	15	0.0025	7	7.2
11-Jun-19	1428	21.5	13.00	6.06	6.9	15	0.0014	7	6.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.015**	d_{30} = **0.080**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **9.3**	C_c = **3.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-51RT	**04/18/2019 915**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61B
Lab ID: HAT01-11.1904001-087
Date/Time sampled: 04/18/2019 815
Test Date: 28-May-19

Initial Dry Weight of Sample (g): 74222.03
Weight Passing #10 (g): 10.90
Weight Retained #10 (g): 74211.13
Weight of Hydrometer Sample (g): 0.39
Calculated Weight of Sieve Sample (g): 2655.37

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	74222.03	100.00
	2"	50	369.07	369.07	73852.96	99.50
	1.5"	38.1	7943.39	8312.46	65909.57	88.80
	1"	25	25086.20	33398.66	40823.37	55.00
	3/4"	19.0	23878.00	57276.66	16945.37	22.83
	3/8"	9.5	16558.58	73835.24	386.79	0.52
	4	4.75	371.44	74206.68	15.35	0.02
	10	2.00	4.45	74211.13	10.90	0.01
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	2654.98	0.39	0.01
	40	0.425	0.00	2654.98	0.39	0.01
	60	0.250	0.00	2654.98	0.39	0.01
	100	0.150	0.00	2654.98	0.39	0.01
	140	0.106	0.00	2654.98	0.39	0.01
	200	0.075	0.39	2655.37	0.00	0.00
	dry pan		0.00	2655.37	0.00	
	wet pan			0.00	0.00	

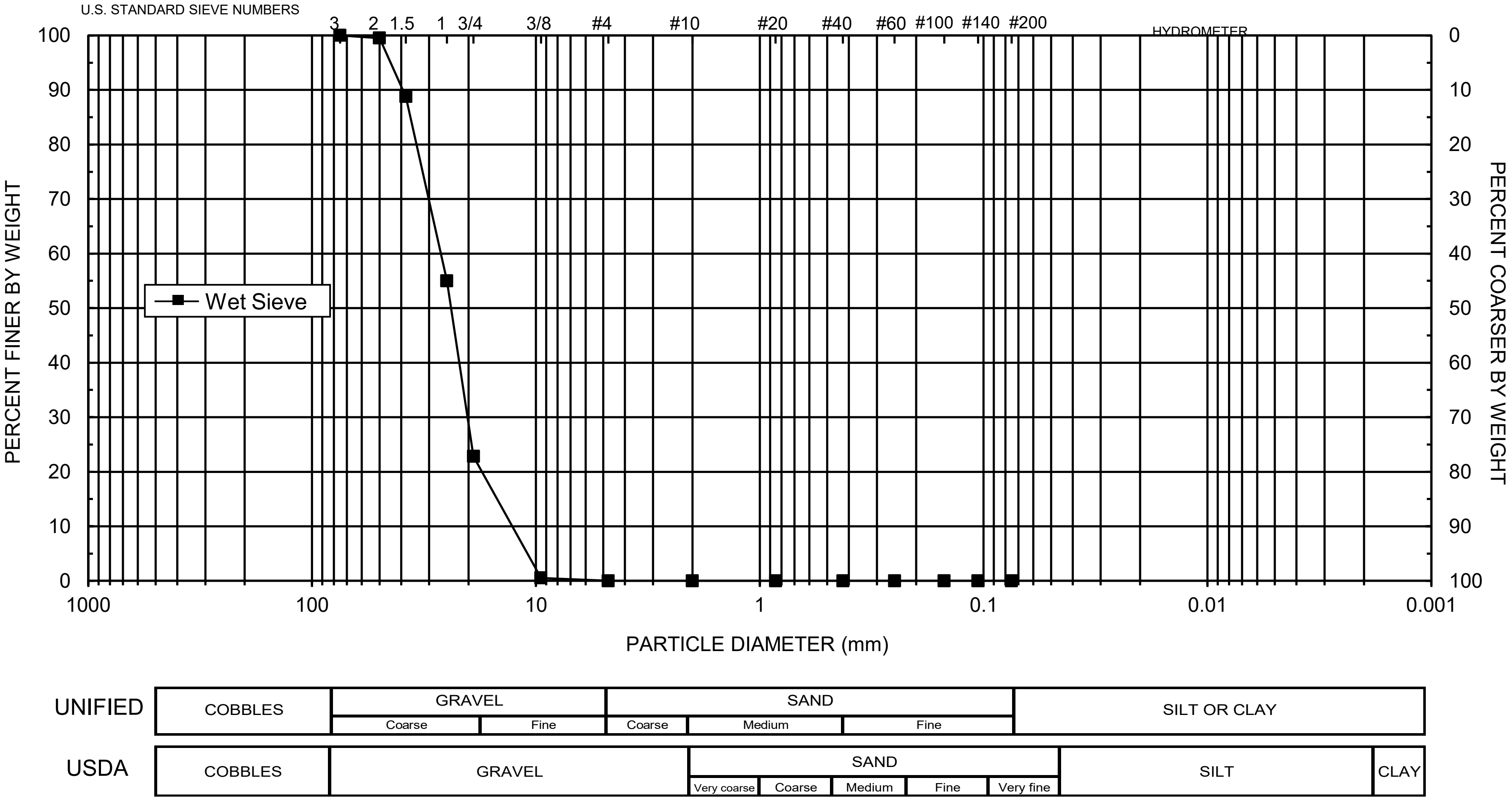
d_{10} (mm): 13
d_{16} (mm): 15
d_{30} (mm): 20
d_{50} (mm): 24
d_{60} (mm): 27
d_{84} (mm): 36

Median Particle Diameter --d_{50} (mm): 24
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 2.1
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.1
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 25

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **13**	d_{30} = **20**	d_{50} = **24**	d_{60} = **27**	C_u = **2.1**	C_c = **1.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-61B	**04/18/2019 815**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1528.33
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1513.30
Sample Number:	L5-61RB	*Weight Retained #10 (g):*	15.03
Lab ID:	HAT01-11.1904001-088	*Weight of Hydrometer Sample (g):*	103.47
Date/Time sampled:	04/18/2019 830	*Calculated Weight of Sieve Sample (g):*	104.50
Test Date:	4-Jun-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1528.33	100.00
	2"	50	0.00	0.00	1528.33	100.00
	1.5"	38.1	0.00	0.00	1528.33	100.00
	1"	25	0.00	0.00	1528.33	100.00
	3/4"	19.0	0.00	0.00	1528.33	100.00
	3/8"	9.5	3.44	3.44	1524.89	99.77
	4	4.75	5.69	9.13	1519.20	99.40
	10	2.00	5.90	15.03	1513.30	99.02
-10			(Based on calculated sieve wt.)			
	20	0.85	0.48	1.51	102.99	98.56
	40	0.425	0.82	2.33	102.17	97.77
	60	0.250	8.63	10.96	93.54	89.51
	100	0.150	26.83	37.79	66.71	63.84
	140	0.106	21.38	59.17	45.33	43.38
	200	0.075	16.85	76.02	28.48	27.25
	dry pan		4.30	80.32	24.18	
	wet pan			24.18	0.00	

d_{10} (mm):	0.019	d_{50} (mm):	0.12
d_{16} (mm):	0.051	d_{60} (mm):	0.14
d_{30} (mm):	0.080	d_{84} (mm):	0.22

Median Particle Diameter --d_{50} (mm): 0.12

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.4

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.4

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

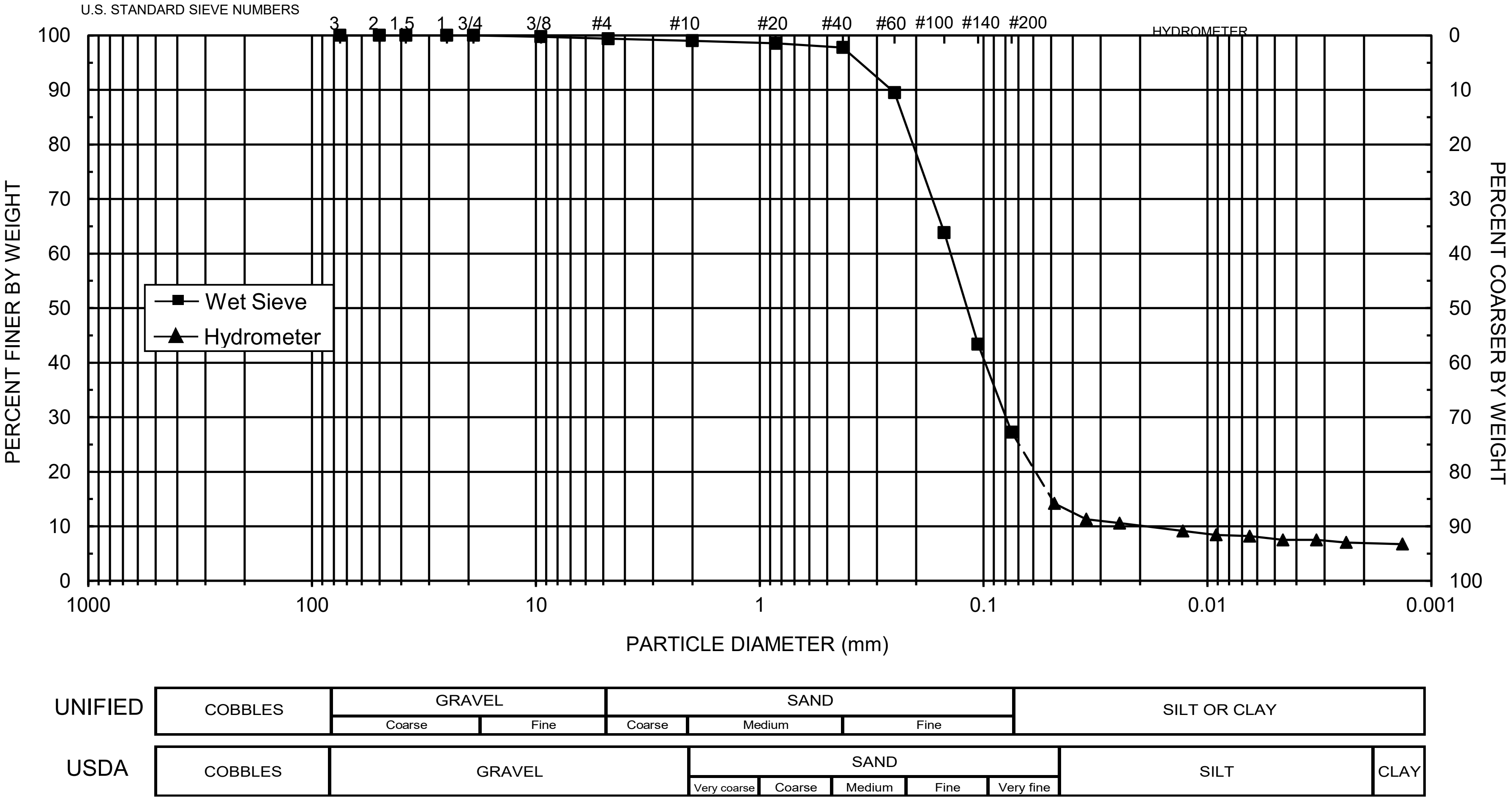
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-61RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-088	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 830	*Initial Wt. (g):*	103.47
Test Date:	30-May-19	*Total Sample Wt. (g):*	1528.33
Start Time:	9:36	*Wt. Passing #10 (g):*	1513.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
30-May-19	1	21.7	20.00	5.19	14.8	13	0.0482	14	14.2
	2	21.7	17.00	5.19	11.8	13	0.0348	11	11.3
	4	21.7	16.25	5.19	11.1	13	0.0247	11	10.6
	15	21.7	14.75	5.19	9.6	13	0.0129	9	9.2
	30	21.7	14.00	5.19	8.8	14	0.0091	9	8.4
	60	21.7	13.75	5.19	8.6	14	0.0065	8	8.2
	120	21.8	13.00	5.15	7.9	14	0.0046	8	7.5
	240	21.8	13.00	5.15	7.9	14	0.0033	8	7.5
	444	21.8	12.50	5.15	7.4	14	0.0024	7	7.0
31-May-19	1420	21.6	12.25	5.22	7.0	14	0.0013	7	6.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.019**	d_{30} = **0.080**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **7.4**	C_c = **2.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-61RB	**04/18/2019 830**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RM
Lab ID: HAT01-11.1904001-089
Date/Time sampled: 04/18/2019 830

Test Date: 4-Jun-19

Initial Dry Weight of Sample (g): 1403.33
Weight Passing #10 (g): 1400.18
Weight Retained #10 (g): 3.15
Weight of Hydrometer Sample (g): 105.61
Calculated Weight of Sieve Sample (g): 105.85

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1403.33	100.00
	2"	50	0.00	0.00	1403.33	100.00
	1.5"	38.1	0.00	0.00	1403.33	100.00
	1"	25	0.00	0.00	1403.33	100.00
	3/4"	19.0	0.00	0.00	1403.33	100.00
	3/8"	9.5	0.00	0.00	1403.33	100.00
	4	4.75	1.03	1.03	1402.30	99.93
	10	2.00	2.12	3.15	1400.18	99.78
-10			(Based on calculated sieve wt.)			
	20	0.85	0.29	0.53	105.32	99.50
	40	0.425	0.60	1.13	104.72	98.93
	60	0.250	3.82	4.95	100.90	95.33
	100	0.150	27.82	32.77	73.08	69.04
	140	0.106	32.15	64.92	40.93	38.67
	200	0.075	19.29	84.21	21.64	20.44
	dry pan		3.96	88.17	17.68	
	wet pan			17.68	0.00	

d_{10} (mm): 0.037
d_{16} (mm): 0.059
d_{30} (mm): 0.090
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.20

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

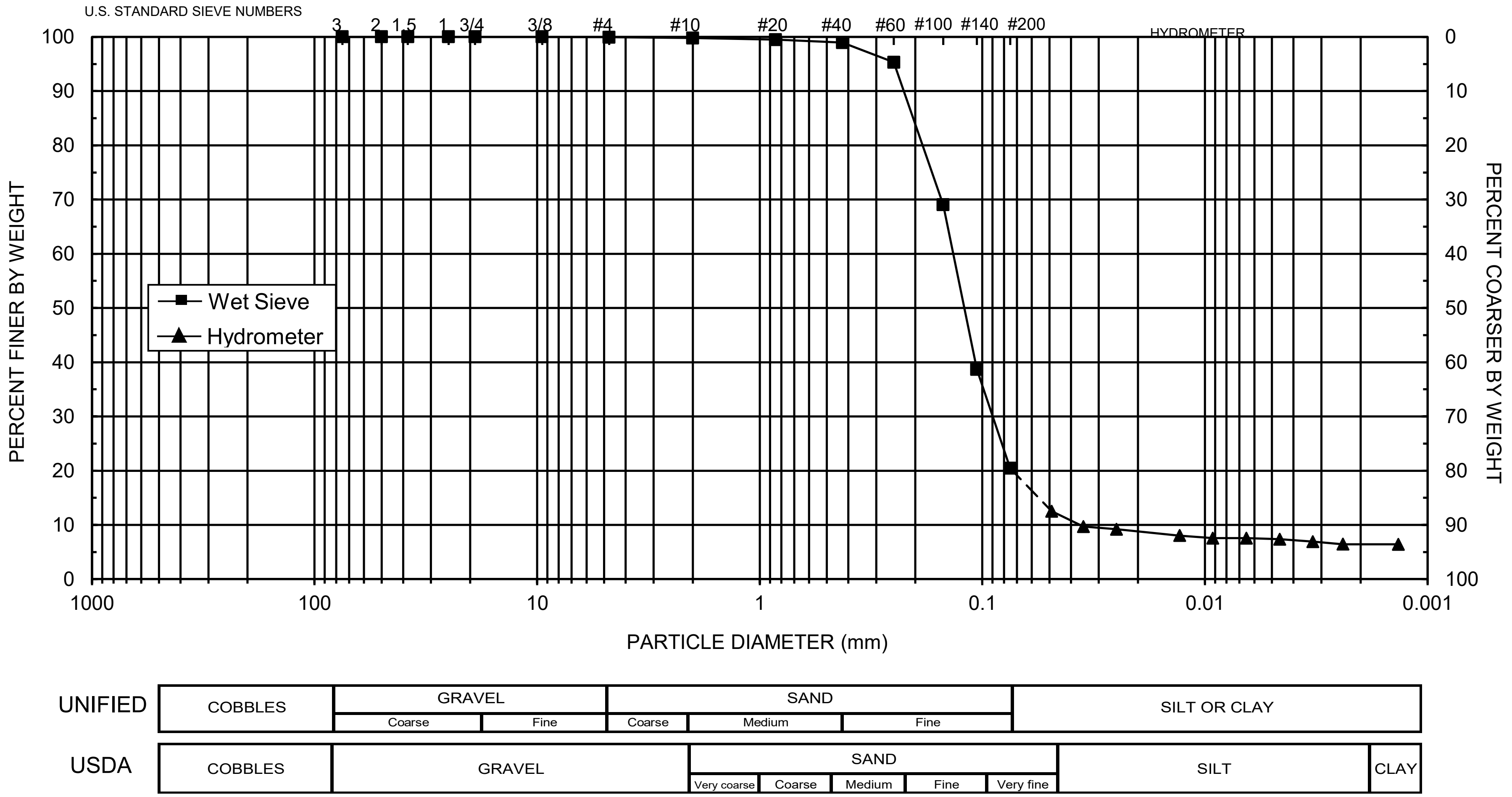
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-61RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-089	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 830	*Initial Wt. (g):*	105.61
Test Date:	11-Jun-19	*Total Sample Wt. (g):*	1403.33
Start Time:	9:24	*Wt. Passing #10 (g):*	1400.18

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
11-Jun-19	1	21.5	18.50	5.26	13.2	13	0.0488	13	12.5
	2	21.5	15.50	5.26	10.2	13	0.0352	10	9.7
	4	21.5	15.00	5.26	9.7	13	0.0249	9	9.2
	15	21.5	13.75	5.26	8.5	14	0.0130	8	8.0
	30	21.5	13.25	5.26	8.0	14	0.0092	8	7.6
	60	21.5	13.25	5.26	8.0	14	0.0065	8	7.6
	120	21.6	13.00	5.22	7.8	14	0.0046	7	7.3
	240	21.7	12.50	5.19	7.3	14	0.0033	7	6.9
	449	21.7	12.00	5.19	6.8	14	0.0024	6	6.4
12-Jun-19	1417	21.6	12.00	5.22	6.8	14	0.0013	6	6.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.037**	d_{30} = **0.090**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **3.8**	C_c = **1.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-61RM	**04/18/2019 830**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT
Lab ID: HAT01-11.1904001-090
Date/Time sampled: 04/18/2019 830

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 1454.20
Weight Passing #10 (g): 1446.59
Weight Retained #10 (g): 7.61
Weight of Hydrometer Sample (g): 104.34
Calculated Weight of Sieve Sample (g): 104.89

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1454.20	100.00
	2"	50	0.00	0.00	1454.20	100.00
	1.5"	38.1	0.00	0.00	1454.20	100.00
	1"	25	0.00	0.00	1454.20	100.00
	3/4"	19.0	0.00	0.00	1454.20	100.00
	3/8"	9.5	0.00	0.00	1454.20	100.00
	4	4.75	4.28	4.28	1449.92	99.71
	10	2.00	3.33	7.61	1446.59	99.48
-10			(Based on calculated sieve wt.)			
	20	0.85	0.55	1.10	103.79	98.95
	40	0.425	0.89	1.99	102.90	98.10
	60	0.250	7.66	9.65	95.24	90.80
	100	0.150	25.11	34.76	70.13	66.86
	140	0.106	22.99	57.75	47.14	44.94
	200	0.075	18.66	76.41	28.48	27.15
	dry pan		5.99	82.40	22.49	
	wet pan			22.49	0.00	

d_{10} (mm): 0.025
d_{16} (mm): 0.055
d_{30} (mm): 0.079

d_{50} (mm): 0.11
d_{60} (mm): 0.13
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 5.2
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.9
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis

Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT
Lab ID: HAT01-11.1904001-090
Date/Time sampled: 04/18/2019 830

Test Date: 10-Jun-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

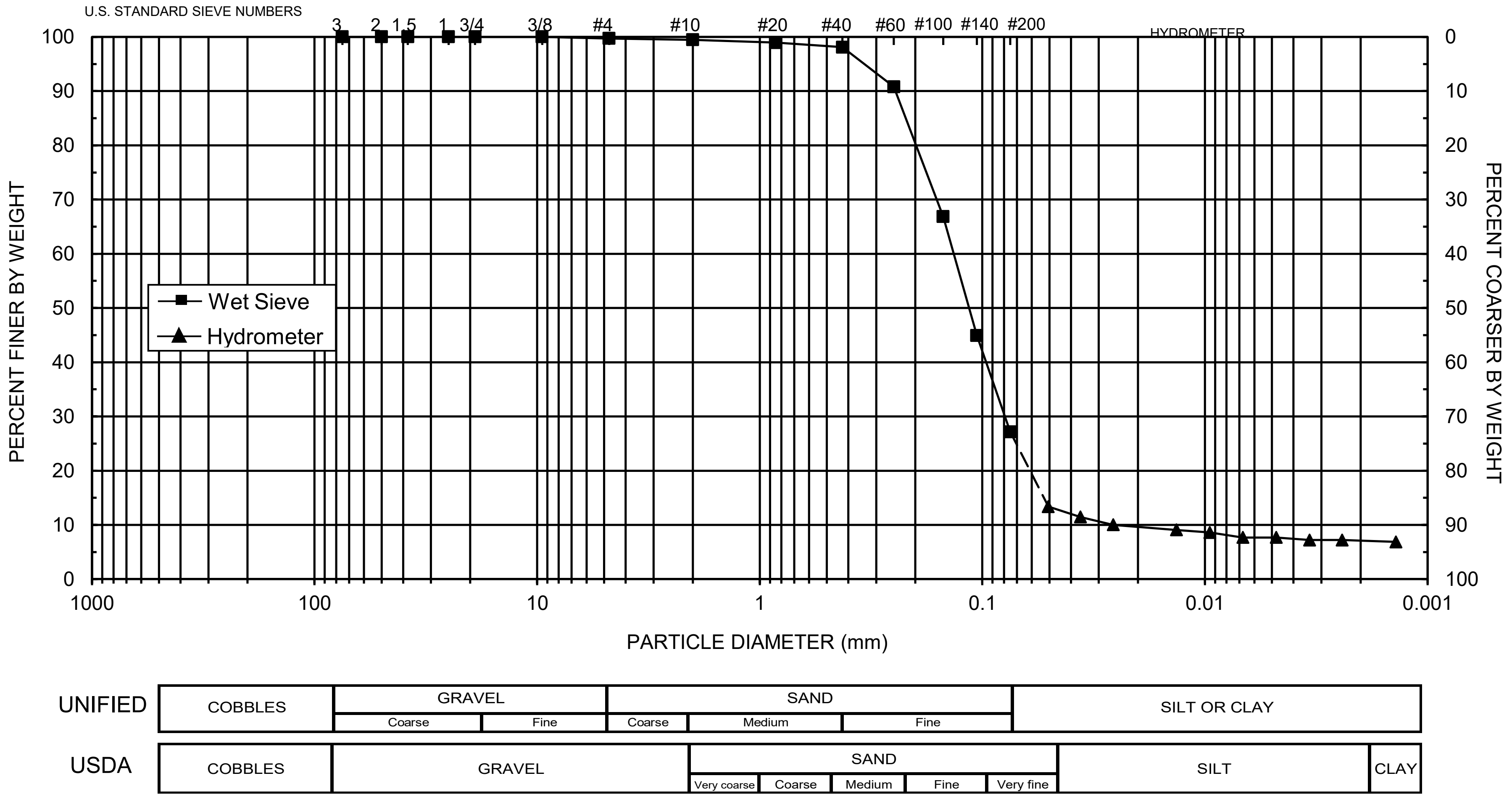
Initial Wt. (g)*:* 104.34
Total Sample Wt. (g)*:* 1454.20
Wt. Passing #10 (g)*:* 1446.59

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	20.00	5.99	14.0	14	0.0506	13	13.4
	2	21.7	18.00	5.99	12.0	14	0.0362	12	11.5
	4	21.7	16.50	5.99	10.5	14	0.0258	10	10.0
	15	21.7	15.50	5.99	9.5	15	0.0134	9	9.1
	30	21.7	15.00	5.99	9.0	15	0.0095	9	8.6
	60	21.8	14.00	5.95	8.1	15	0.0068	8	7.7
	120	21.8	14.00	5.95	8.1	15	0.0048	8	7.7
	240	21.8	13.50	5.95	7.6	15	0.0034	7	7.2
	471	21.8	13.50	5.95	7.6	15	0.0024	7	7.2
11-Jun-19	1438	21.5	13.25	6.06	7.2	15	0.0014	7	6.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.025**	d_{30} = **0.079**	d_{50} = **0.11**	d_{60} = **0.13**	C_u = **5.2**	C_c = **1.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-61RT	**04/18/2019 830**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RB
Lab ID: HAT01-11.1904001-085
Date/Time sampled: 04/17/2019 1650

Test Date: 31-May-19

Initial Dry Weight of Sample (g): 2545.62
Weight Passing #10 (g): 2526.78
Weight Retained #10 (g): 18.84
Weight of Hydrometer Sample (g): 86.87
Calculated Weight of Sieve Sample (g): 87.52

Shape: Angular
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	2545.62	100.00
	2"	50	0.00	0.00	2545.62	100.00
	1.5"	38.1	0.00	0.00	2545.62	100.00
	1"	25	0.00	0.00	2545.62	100.00
	3/4"	19.0	0.00	0.00	2545.62	100.00
	3/8"	9.5	1.55	1.55	2544.07	99.94
	4	4.75	8.57	10.12	2535.50	99.60
	10	2.00	8.72	18.84	2526.78	99.26
-10			(Based on calculated sieve wt.)			
	20	0.85	0.23	0.88	86.64	99.00
	40	0.425	0.51	1.39	86.13	98.41
	60	0.250	4.20	5.59	81.93	93.62
	100	0.150	23.11	28.70	58.82	67.21
	140	0.106	22.75	51.45	36.07	41.21
	200	0.075	15.83	67.28	20.24	23.13
	dry pan		5.07	72.35	15.17	
	wet pan			15.17	0.00	

d_{10} (mm): 0.037
d_{16} (mm): 0.058
d_{30} (mm): 0.086

d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.21

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.8
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

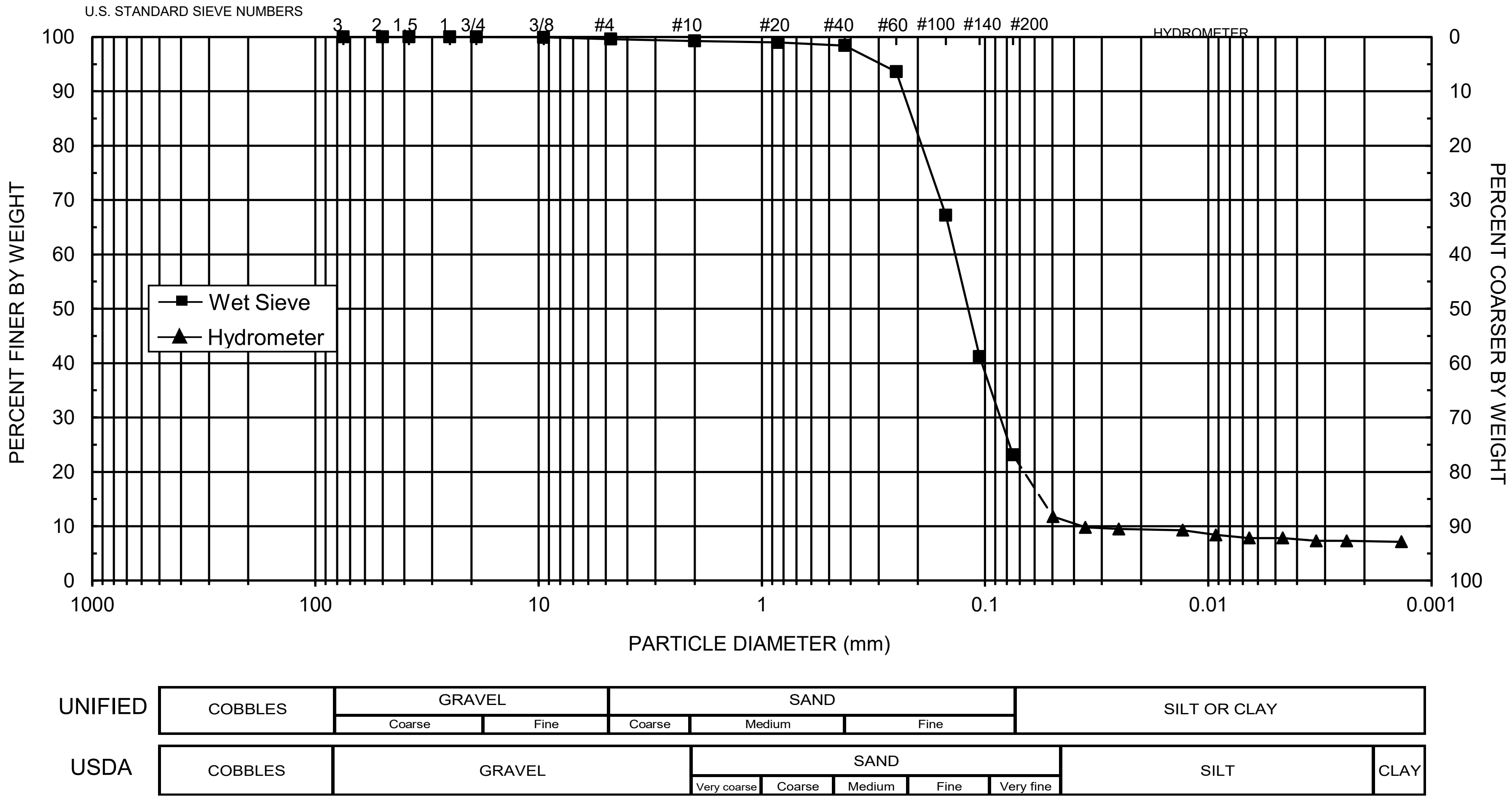
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-01A-RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-085	*Assumed particle density:*	2.65
Date/Time sampled:	04/17/2019 1650	*Initial Wt.* (g)*:*	86.87
Test Date:	10-Jun-19	*Total Sample Wt.* (g)*:*	2545.62
Start Time:	9:36	*Wt. Passing #10* (g)*:*	2526.78

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	15.50	5.19	10.3	13	0.0496	12	11.8
	2	21.7	13.75	5.19	8.6	14	0.0355	10	9.8
	4	21.7	13.50	5.19	8.3	14	0.0251	10	9.5
	15	21.8	13.25	5.15	8.1	14	0.0130	9	9.3
	30	21.8	12.50	5.15	7.4	14	0.0092	8	8.4
	60	21.8	12.00	5.15	6.9	14	0.0065	8	7.8
	120	21.8	12.00	5.15	6.9	14	0.0046	8	7.8
	240	21.9	11.50	5.11	6.4	14	0.0033	7	7.3
	450	21.9	11.50	5.11	6.4	14	0.0024	7	7.3
11-Jun-19	1396	21.5	11.50	5.26	6.2	14	0.0014	7	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.037**	d_{30} = **0.086**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **3.8**	C_c = **1.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01A-RB	**04/17/2019 1650**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RU
Lab ID: HAT01-11.1904001-086
Date/Time sampled: 04/17/2019 1655

Test Date: 4-Jun-19

Initial Dry Weight of Sample (g): 2466.13
Weight Passing #10 (g): 2231.96
Weight Retained #10 (g): 234.17
Weight of Hydrometer Sample (g): 106.08
Calculated Weight of Sieve Sample (g): 117.21

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	2466.13	100.00
	2"	50	0.00	0.00	2466.13	100.00
	1.5"	38.1	0.00	0.00	2466.13	100.00
	1"	25	30.25	30.25	2435.88	98.77
	3/4"	19.0	15.58	45.83	2420.30	98.14
	3/8"	9.5	131.89	177.72	2288.41	92.79
	4	4.75	41.63	219.35	2246.78	91.11
	10	2.00	14.82	234.17	2231.96	90.50
-10			(Based on calculated sieve wt.)			
	20	0.85	0.54	11.67	105.54	90.04
	40	0.425	1.07	12.74	104.47	89.13
	60	0.250	6.20	18.94	98.27	83.84
	100	0.150	22.80	41.74	75.47	64.39
	140	0.106	23.45	65.19	52.02	44.38
	200	0.075	19.45	84.64	32.57	27.79
	dry pan		4.06	88.70	28.51	
	wet pan			28.51	0.00	

d_{10} (mm): 0.012
d_{16} (mm): 0.049
d_{30} (mm): 0.079
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.25

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 12
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RU
Lab ID: HAT01-11.1904001-086
Date/Time sampled: 04/17/2019 1655

Test Date: 30-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

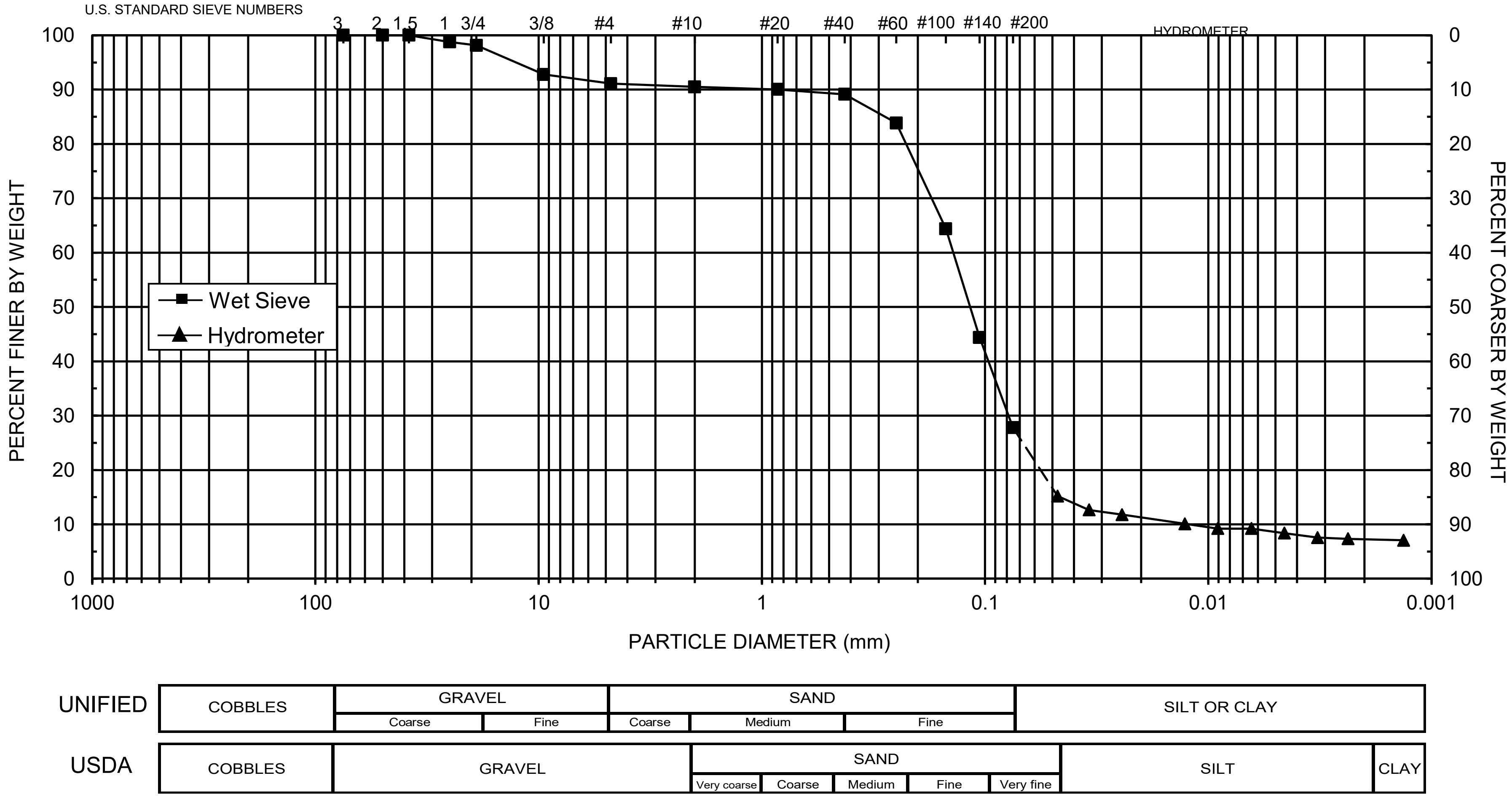
Initial Wt. (g): 106.08
Total Sample Wt. (g): 2466.13
Wt. Passing #10 (g): 2231.96

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
30-May-19	1	21.7	23.00	5.19	17.8	12	0.0474	17	15.2
	2	21.7	20.00	5.19	14.8	13	0.0342	14	12.6
	4	21.7	19.00	5.19	13.8	13	0.0243	13	11.8
	15	21.7	17.00	5.19	11.8	13	0.0127	11	10.1
	30	21.7	16.00	5.19	10.8	13	0.0091	10	9.2
	60	21.7	16.00	5.19	10.8	13	0.0064	10	9.2
	120	21.7	15.00	5.19	9.8	13	0.0046	9	8.4
	240	21.8	14.00	5.15	8.9	14	0.0032	8	7.6
	452	21.8	13.75	5.15	8.6	14	0.0024	8	7.3
31-May-19	1430	21.6	13.50	5.22	8.3	14	0.0013	8	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.012**	d_{30} = **0.079**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **12**	C_c = **3.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L5-01A-RU	**04/17/2019 1655**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L6-01B
Lab ID: HAT01-11.1904001-014
Date/Time sampled: 04/17/2019 1000

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 85327.94
Weight Passing #10 (g): 13523.47
Weight Retained #10 (g): 71804.47
Weight of Hydrometer Sample (g): 87.35
Calculated Weight of Sieve Sample (g): 551.15

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	85327.94	100.00
	2"	50	0.00	0.00	85327.94	100.00
	1.5"	38.1	5655.97	5655.97	79671.97	93.37
	1"	25	14572.60	20228.57	65099.37	76.29
	3/4"	19.0	11824.78	32053.35	53274.60	62.44
	3/8"	9.5	20838.96	52892.31	32435.63	38.01
	4	4.75	12931.61	65823.92	19504.02	22.86
	10	2.00	5980.55	71804.47	13523.47	15.85
-10			(Based on calculated sieve wt.)			
	20	0.85	9.54	473.34	77.81	14.12
	40	0.425	10.66	484.00	67.15	12.18
	60	0.250	10.13	494.13	57.02	10.35
	100	0.150	9.81	503.94	47.21	8.57
	140	0.106	10.17	514.11	37.04	6.72
	200	0.075	6.71	520.82	30.33	5.50
	dry pan		0.40	521.22	29.93	
	wet pan			29.93	0.00	

d_{10} (mm): 0.23
d_{16} (mm): 2.0
d_{30} (mm): 6.6
d_{50} (mm): 13
d_{60} (mm): 18
d_{84} (mm): 30

Median Particle Diameter --d_{50} (mm): 13
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 78
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 11
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 15

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L6-01B
Lab ID: HAT01-11.1904001-014
Date/Time sampled: 04/17/2019 1000

Test Date: 15-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

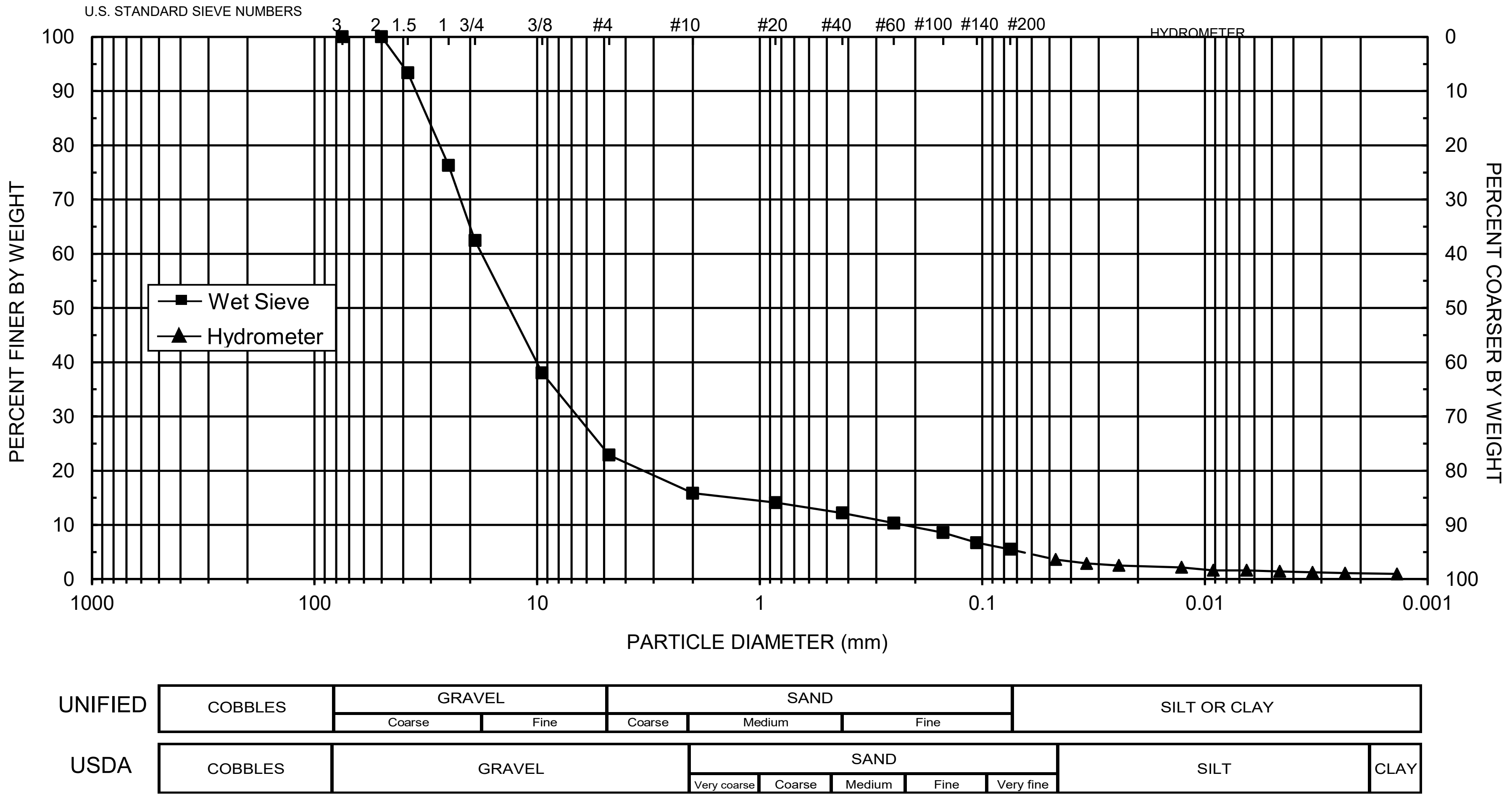
Initial Wt. (g)*:* 87.35
Total Sample Wt. (g)*:* 85327.94
Wt. Passing #10 (g)*:* 13523.47

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
15-May-19	1	22.0	25.00	5.08	19.9	12	0.0467	23	3.6
	2	22.0	21.00	5.08	15.9	12	0.0340	18	2.9
	4	22.0	19.00	5.08	13.9	13	0.0243	16	2.5
	15	22.0	17.00	5.08	11.9	13	0.0127	14	2.2
	30	22.0	14.00	5.08	8.9	14	0.0092	10	1.6
	60	22.0	14.00	5.08	8.9	14	0.0065	10	1.6
	120	21.8	13.00	5.15	7.9	14	0.0046	9	1.4
	240	21.8	12.00	5.15	6.9	14	0.0033	8	1.2
	475	21.8	11.25	5.15	6.1	14	0.0023	7	1.1
16-May-19	1402	21.7	10.50	5.19	5.3	14	0.0014	6	1.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.23**	d_{30} = **6.6**	d_{50} = **13**	d_{60} = **18**	C_u = **78**	C_c = **11**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L6-01B	**04/17/2019 1000**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-01B
Lab ID: HAT01-11.1904001-015
Date/Time sampled: 04/16/2017 1520

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 79530.57
Weight Passing #10 (g): 1936.42
Weight Retained #10 (g): 77594.15
Weight of Hydrometer Sample (g): 67.67
Calculated Weight of Sieve Sample (g): 2779.28

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	79530.57	100.00
	2"	50	0.00	0.00	79530.57	100.00
	1.5"	38.1	8439.03	8439.03	71091.54	89.39
	1"	25	21597.00	30036.03	49494.54	62.23
	3/4"	19.0	16836.60	46872.63	32657.94	41.06
	3/8"	9.5	26404.90	73277.53	6253.04	7.86
	4	4.75	3967.38	77244.91	2285.66	2.87
	10	2.00	349.25	77594.15	1936.42	2.43
-10			(Based on calculated sieve wt.)			
	20	0.85	4.54	2716.15	63.13	2.27
	40	0.425	4.83	2720.98	58.30	2.10
	60	0.250	4.73	2725.71	53.57	1.93
	100	0.150	8.68	2734.39	44.89	1.62
	140	0.106	9.18	2743.57	35.71	1.28
	200	0.075	7.32	2750.89	28.39	1.02
	dry pan		1.21	2752.10	27.18	
	wet pan			27.18	0.00	

d_{10} (mm): 9.9
d_{16} (mm): 11
d_{30} (mm): 15

d_{50} (mm): 21
d_{60} (mm): 24
d_{84} (mm): 35

Median Particle Diameter --d_{50} (mm): 21
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2.4
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.95
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 22

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-01B
Lab ID: HAT01-11.1904001-015
Date/Time sampled: 04/16/2017 1520

Test Date: 13-May-19
Start Time: 9:18

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

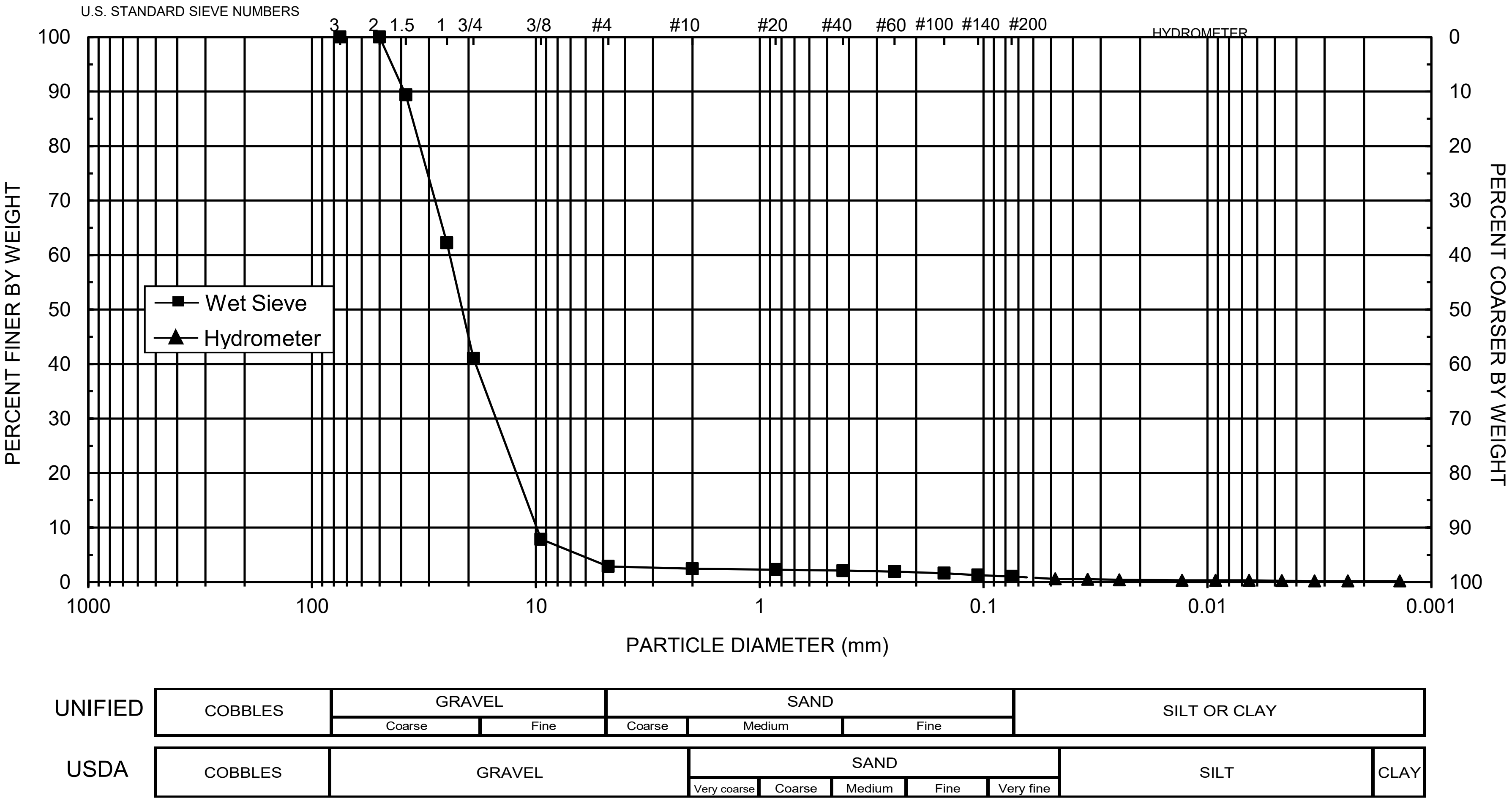
Initial Wt. *(g):* 67.67
Total Sample Wt. *(g):* 79530.57
Wt. Passing #10 *(g):* 1936.42

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	21.50	5.19	16.3	12	0.0479	24	0.6
	2	21.7	19.50	5.19	14.3	13	0.0343	21	0.5
	4	21.7	16.25	5.19	11.1	13	0.0248	16	0.4
	15	21.7	14.00	5.19	8.8	14	0.0130	13	0.3
	30	21.7	13.50	5.19	8.3	14	0.0092	12	0.3
	60	21.7	13.50	5.19	8.3	14	0.0065	12	0.3
	120	21.9	11.75	5.11	6.6	14	0.0046	10	0.2
	240	21.9	10.00	5.11	4.9	14	0.0033	7	0.2
	476	21.9	10.00	5.11	4.9	14	0.0024	7	0.2
14-May-19	1387	21.9	10.00	5.11	4.9	14	0.0014	7	0.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **9.9**	d_{30} = **15**	d_{50} = **21**	d_{60} = **24**	C_u = **2.4**	C_c = **0.95**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L7-01B	**04/16/2017 1520**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	81670.63
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	13418.96
Sample Number:	L7-02B	*Weight Retained #10 (g):*	68251.67
Lab ID:	HAT01-11.1904001-016	*Weight of Hydrometer Sample (g):*	71.00
Date/Time sampled:	04/16/2019 1630	*Calculated Weight of Sieve Sample (g):*	432.12
Test Date:	21-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	81670.63	100.00
	2"	50	169.74	169.74	81500.89	99.79
	1.5"	38.1	3887.33	4057.07	77613.56	95.03
	1"	25	14583.90	18640.97	63029.66	77.18
	3/4"	19.0	11956.29	30597.26	51073.37	62.54
	3/8"	9.5	23925.75	54523.01	27147.62	33.24
	4	4.75	9141.57	63664.58	18006.05	22.05
	10	2.00	4587.09	68251.67	13418.96	16.43
-10			(Based on calculated sieve wt.)			
	20	0.85	6.21	367.33	64.79	14.99
	40	0.425	11.45	378.78	53.34	12.34
	60	0.250	9.76	388.54	43.58	10.09
	100	0.150	9.01	397.55	34.57	8.00
	140	0.106	8.50	406.05	26.07	6.03
	200	0.075	6.00	412.05	20.07	4.64
	dry pan		0.70	412.75	19.37	
	wet pan			19.37	0.00	

d_{10} (mm):	0.24	d_{50} (mm):	14
d_{16} (mm):	1.5	d_{60} (mm):	18
d_{30} (mm):	7.8	d_{84} (mm):	29

Median Particle Diameter --d_{50} (mm): 14

Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 75

Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 14

Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 15

USCS Soil Classification: Poorly-graded gravel with sand (GP)s

Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

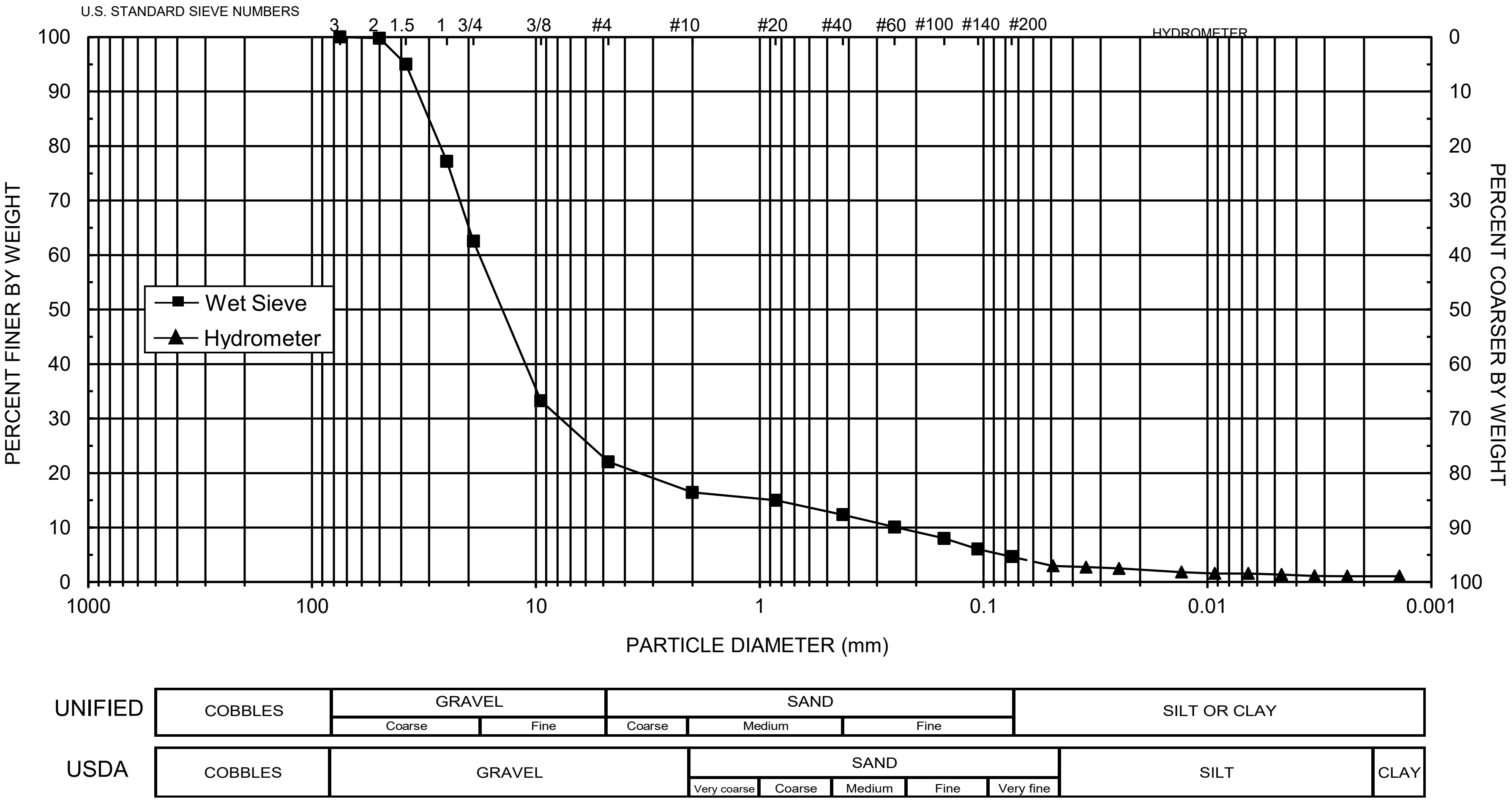
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L7-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-016	*Assumed particle density:*	2.65
Date/Time sampled:	04/16/2019 1630	*Initial Wt. (g):*	71.00
Test Date:	13-May-19	*Total Sample Wt. (g):*	81670.63
Start Time:	9:24	*Wt. Passing #10 (g):*	13418.96

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	18.00	5.19	12.8	13	0.0489	18	3.0
	2	21.7	17.00	5.19	11.8	13	0.0348	17	2.7
	4	21.7	16.00	5.19	10.8	13	0.0248	15	2.5
	15	21.7	13.00	5.19	7.8	14	0.0130	11	1.8
	30	21.7	12.00	5.19	6.8	14	0.0093	10	1.6
	60	21.7	12.00	5.19	6.8	14	0.0066	10	1.6
	120	21.9	11.00	5.11	5.9	14	0.0047	8	1.4
	240	21.9	10.00	5.11	4.9	14	0.0033	7	1.1
	472	21.9	9.75	5.11	4.6	14	0.0024	7	1.1
14-May-19	1382	21.9	9.75	5.11	4.6	14	0.0014	7	1.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **0.24**	d_{30} = **7.8**	d_{50} = **14**	d_{60} = **18**	C_u = **75**	C_c = **14**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L7-02B	**04/16/2019 1630**	**Poorly-graded gravel with sand (GP)s**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	85069.58
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	10984.00
Sample Number:	L7-03B	*Weight Retained #10 (g):*	74085.59
Lab ID:	HAT01-11.1904001-017	*Weight of Hydrometer Sample (g):*	114.29
Date/Time sampled:	04/16/2019 1705	*Calculated Weight of Sieve Sample (g):*	885.16
Test Date:	23-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	85069.58	100.00
	2"	50	471.34	471.34	84598.24	99.45
	1.5"	38.1	6507.80	6979.14	78090.44	91.80
	1"	25	17604.40	24583.54	60486.04	71.10
	3/4"	19.0	14066.61	38650.15	46419.43	54.57
	3/8"	9.5	20199.80	58849.96	26219.63	30.82
	4	4.75	10677.68	69527.63	15541.95	18.27
	10	2.00	4557.95	74085.59	10984.00	12.91
-10			(Based on calculated sieve wt.)			
	20	0.85	9.38	780.25	104.91	11.85
	40	0.425	15.09	795.34	89.82	10.15
	60	0.250	18.04	813.38	71.78	8.11
	100	0.150	14.07	827.45	57.71	6.52
	140	0.106	15.16	842.61	42.55	4.81
	200	0.075	9.69	852.30	32.86	3.71
	dry pan		0.97	853.27	31.89	
	wet pan			31.89	0.00	

d_{10} (mm): 0.41

d_{16} (mm): 3.3

d_{30} (mm): 9.1

d_{50} (mm): 17

d_{60} (mm): 21

d_{84} (mm): 33

Median Particle Diameter --d_{50} (mm)*:* 17

Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm)*:* 51

Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm)*:* 9.6

Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm)*:* 18

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-03B
Lab ID: HAT01-11.1904001-017
Date/Time sampled: 04/16/2019 1705

Test Date: 15-May-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

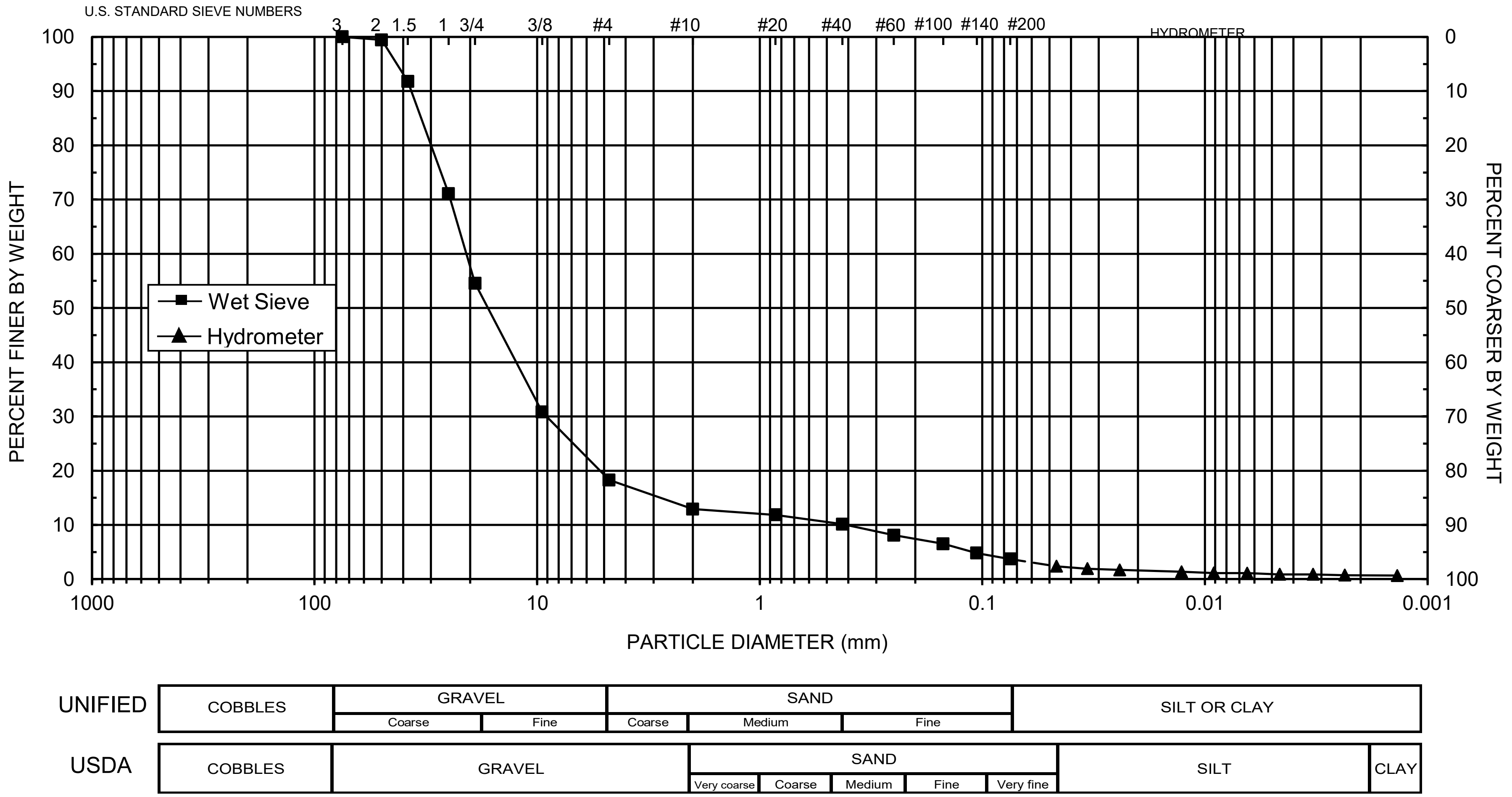
Initial Wt. (g)*:* 114.29
Total Sample Wt. (g)*:* 85069.58
Wt. Passing #10 (g)*:* 10984.00

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
15-May-19	1	22.0	26.00	5.08	20.9	12	0.0464	18	2.4
	2	22.0	22.00	5.08	16.9	12	0.0337	15	1.9
	4	22.0	20.00	5.08	14.9	13	0.0242	13	1.7
	15	22.0	17.00	5.08	11.9	13	0.0127	10	1.3
	30	22.0	15.00	5.08	9.9	13	0.0091	9	1.1
	60	22.0	14.75	5.08	9.7	13	0.0065	8	1.1
	120	21.8	13.00	5.15	7.9	14	0.0046	7	0.9
	240	21.8	13.00	5.15	7.9	14	0.0033	7	0.9
	470	21.8	11.50	5.15	6.4	14	0.0024	6	0.7
16-May-19	1397	21.7	11.00	5.19	5.8	14	0.0014	5	0.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.41**	d_{30} = **9.1**	d_{50} = **17**	d_{60} = **21**	C_u = **51**	C_c = **9.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L7-03B	**04/16/2019 1705**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L7-11B
Lab ID: HAT01-11.1904001-018
Date/Time sampled: 04/17/2019 825

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 76902.13
Weight Passing #10 (g): 10025.09
Weight Retained #10 (g): 66877.05
Weight of Hydrometer Sample (g): 96.77
Calculated Weight of Sieve Sample (g): 742.32

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	76902.13	100.00
	2"	50	0.00	0.00	76902.13	100.00
	1.5"	38.1	5882.90	5882.90	71019.23	92.35
	1"	25	17197.40	23080.30	53821.83	69.99
	3/4"	19.0	13487.71	36568.01	40334.13	52.45
	3/8"	9.5	16778.82	53346.83	23555.31	30.63
	4	4.75	9735.54	63082.37	13819.76	17.97
	10	2.00	3794.68	66877.05	10025.09	13.04
-10			(Based on calculated sieve wt.)			
	20	0.85	6.40	651.95	90.37	12.17
	40	0.425	7.88	659.83	82.49	11.11
	60	0.250	8.48	668.31	74.01	9.97
	100	0.150	14.46	682.77	59.55	8.02
	140	0.106	16.00	698.77	43.55	5.87
	200	0.075	9.77	708.54	33.78	4.55
	dry pan		0.64	709.18	33.14	
	wet pan			33.14	0.00	

d_{10} (mm): 0.25
d_{16} (mm): 3.4
d_{30} (mm): 9.2
d_{50} (mm): 18
d_{60} (mm): 21
d_{84} (mm): 33

Median Particle Diameter --d_{50} (mm): 18
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 84
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 16
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 18

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

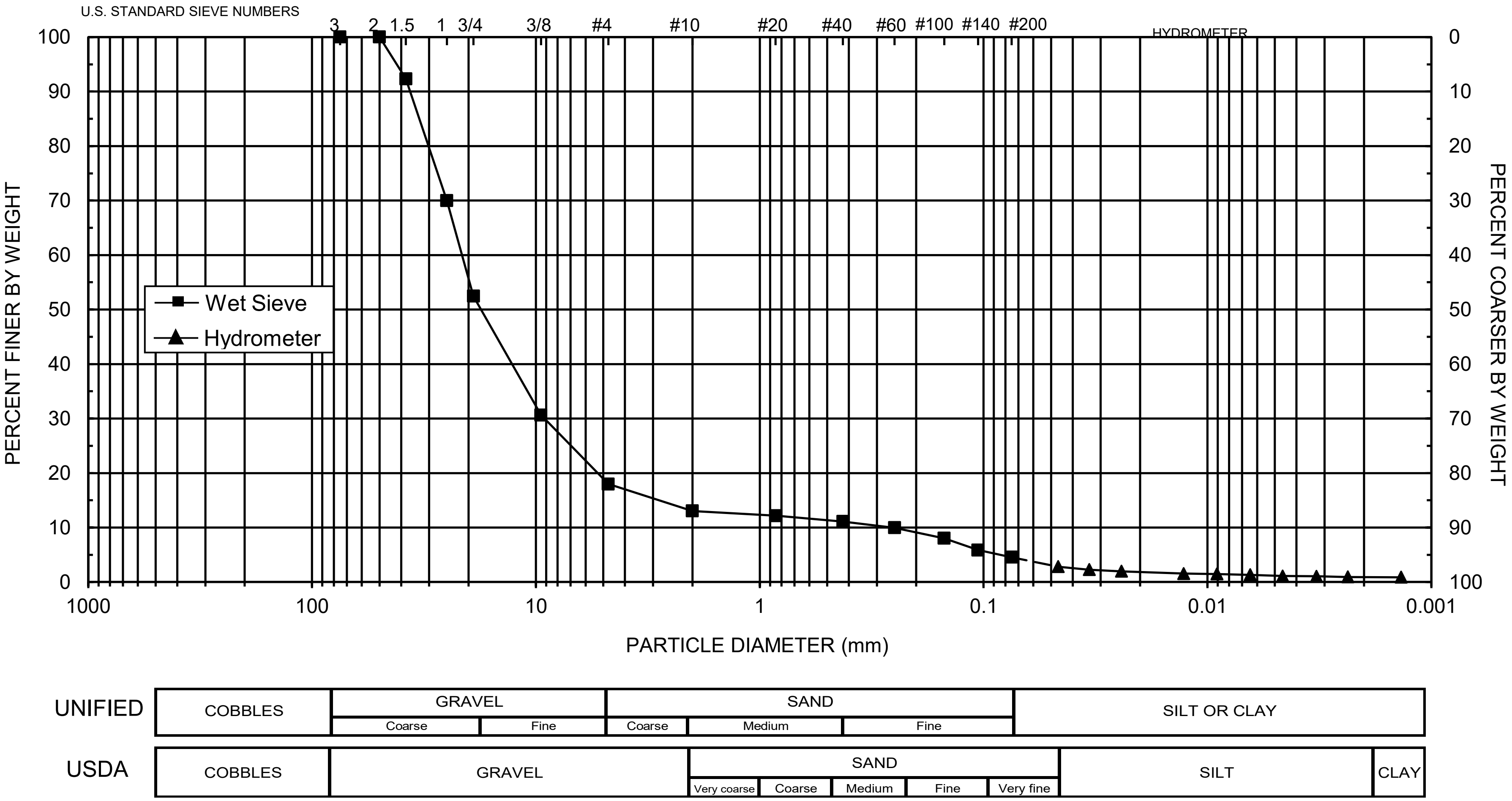
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L7-11B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-018	*Assumed particle density:*	2.65
Date/Time sampled:	04/17/2019 825	*Initial Wt. (g):*	96.77
Test Date:	15-May-19	*Total Sample Wt. (g):*	76902.13
Start Time:	9:18	*Wt. Passing #10 (g):*	10025.09

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
15-May-19	1	22.0	26.00	5.08	20.9	12	0.0464	22	2.8
	2	22.0	22.00	5.08	16.9	12	0.0337	17	2.3
	4	22.0	19.75	5.08	14.7	13	0.0242	15	2.0
	15	22.0	16.50	5.08	11.4	13	0.0128	12	1.5
	30	22.0	16.00	5.08	10.9	13	0.0091	11	1.5
	60	21.9	15.00	5.11	9.9	13	0.0064	10	1.3
	120	21.8	13.25	5.15	8.1	14	0.0046	8	1.1
	240	21.8	13.00	5.15	7.9	14	0.0033	8	1.1
	465	21.8	12.00	5.15	6.9	14	0.0024	7	0.9
16-May-19	1392	21.7	11.75	5.19	6.6	14	0.0014	7	0.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.25**	d_{30} = **9.2**	d_{50} = **18**	d_{60} = **21**	C_u = **84**	C_c = **16**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L7-11B	**04/17/2019 825**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RB
Lab ID: HAT01-11.1904001-071
Date/Time sampled: 04/10/2019 1515

Test Date: 30-May-19

Initial Dry Weight of Sample (g): 938.70
Weight Passing #10 (g): 811.02
Weight Retained #10 (g): 127.68
Weight of Hydrometer Sample (g): 78.79
Calculated Weight of Sieve Sample (g): 91.19

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	938.70	100.00
	2"	50	0.00	0.00	938.70	100.00
	1.5"	38.1	0.00	0.00	938.70	100.00
	1"	25	0.00	0.00	938.70	100.00
	3/4"	19.0	14.52	14.52	924.18	98.45
	3/8"	9.5	40.65	55.17	883.53	94.12
	4	4.75	34.83	90.00	848.70	90.41
	10	2.00	37.68	127.68	811.02	86.40
-10			(Based on calculated sieve wt.)			
	20	0.85	2.72	15.12	76.07	83.42
	40	0.425	2.36	17.48	73.71	80.83
	60	0.250	4.15	21.63	69.56	76.28
	100	0.150	12.94	34.57	56.62	62.09
	140	0.106	12.68	47.25	43.94	48.18
	200	0.075	9.30	56.55	34.64	37.98
	dry pan		3.57	60.12	31.07	
	wet pan			31.07	0.00	

d_{10} (mm): 0.0061
d_{16} (mm): 0.023
d_{30} (mm): 0.058

d_{50} (mm): 0.11
d_{60} (mm): 0.14
d_{84} (mm): 1.0

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 23
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 3.9
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.38

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

† Greater than 10% of sample is coarse material

Laboratory analysis by: A. Baldridge/A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RB
Lab ID: HAT01-11.1904001-071
Date/Time sampled: 04/10/2019 1515

Test Date: 11-Jun-19
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

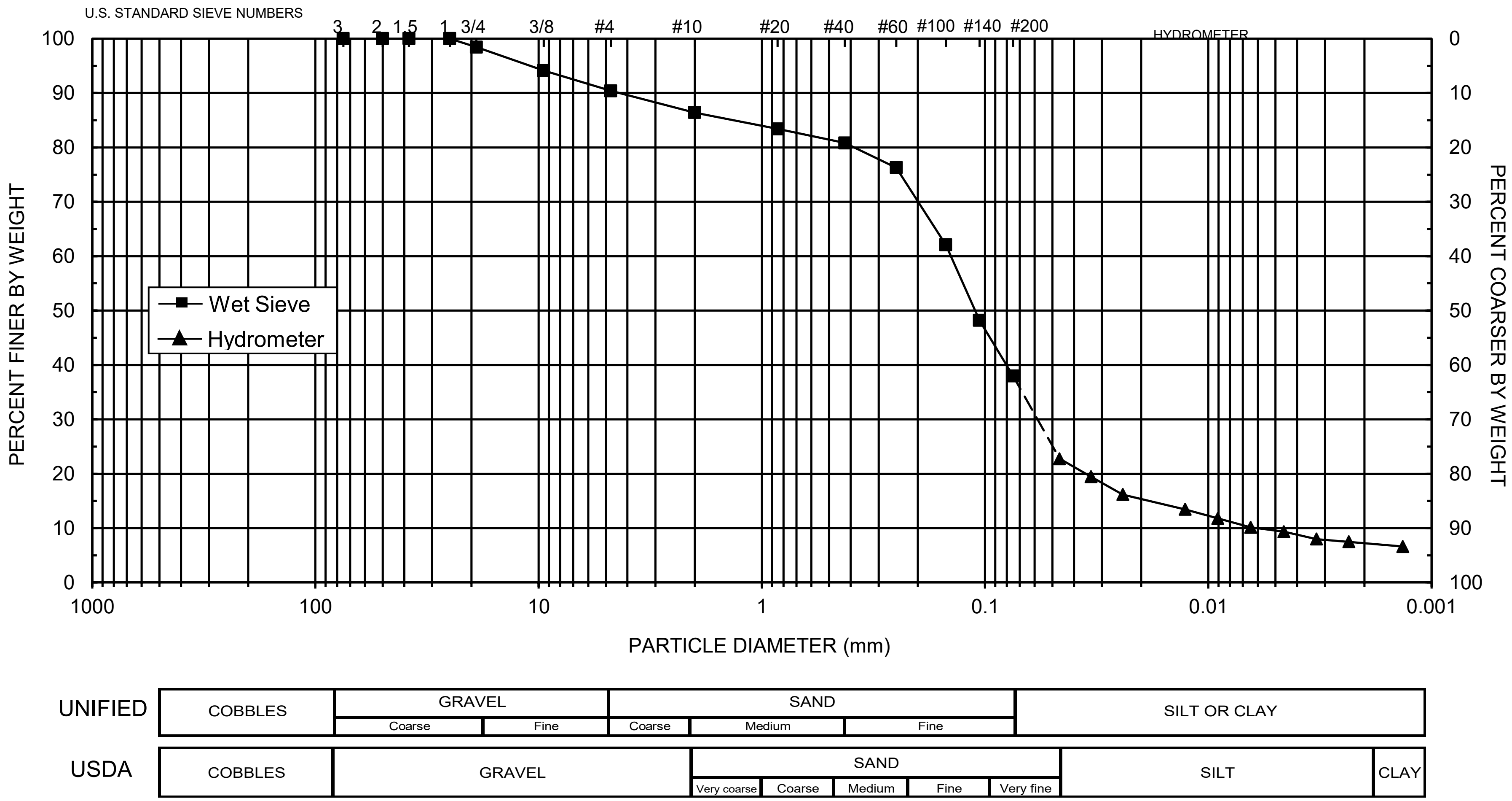
Initial Wt. (g): 78.79
Total Sample Wt. (g): 938.70
Wt. Passing #10 (g): 811.02

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
11-Jun-19	1	21.5	26.00	5.26	20.7	12	0.0464	26	22.7
	2	21.5	23.00	5.26	17.7	12	0.0335	23	19.5
	4	21.5	20.00	5.26	14.7	13	0.0242	19	16.2
	15	21.5	17.50	5.26	12.2	13	0.0127	16	13.4
	30	21.5	16.00	5.26	10.7	13	0.0091	14	11.8
	60	21.5	14.50	5.26	9.2	13	0.0065	12	10.1
	120	21.6	13.75	5.22	8.5	14	0.0046	11	9.4
	240	21.6	12.50	5.22	7.3	14	0.0033	9	8.0
	469	21.7	12.00	5.19	6.8	14	0.0023	9	7.5
12-Jun-19	1438	21.6	11.25	5.22	6.0	14	0.0013	8	6.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.0061**	d_{30} = **0.058**	d_{50} = **0.11**	d_{60} = **0.14**	C_u = **23**	C_c = **3.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-01RB	**04/10/2019 1515**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1342.25
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1306.35
Sample Number:	L8-01RM	*Weight Retained #10 (g):*	35.90
Lab ID:	HAT01-11.1904001-059	*Weight of Hydrometer Sample (g):*	110.43
Date/Time sampled:	04/11/2019 1530	*Calculated Weight of Sieve Sample (g):*	113.46
Test Date:	21-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1342.25	100.00
	2"	50	0.00	0.00	1342.25	100.00
	1.5"	38.1	0.00	0.00	1342.25	100.00
	1"	25	0.00	0.00	1342.25	100.00
	3/4"	19.0	0.00	0.00	1342.25	100.00
	3/8"	9.5	16.47	16.47	1325.78	98.77
	4	4.75	9.43	25.90	1316.35	98.07
	10	2.00	10.00	35.90	1306.35	97.33
-10			(Based on calculated sieve wt.)			
	20	0.85	1.06	4.09	109.37	96.39
	40	0.425	1.17	5.26	108.20	95.36
	60	0.250	5.10	10.36	103.10	90.87
	100	0.150	30.51	40.87	72.59	63.98
	140	0.106	29.80	70.67	42.79	37.71
	200	0.075	13.60	84.27	29.19	25.73
	dry pan		1.57	85.84	27.62	
	wet pan			27.62	0.00	

d_{10} (mm):	0.011	d_{50} (mm):	0.12
d_{16} (mm):	0.048	d_{60} (mm):	0.14
d_{30} (mm):	0.085	d_{84} (mm):	0.22

Median Particle Diameter --d_{50} (mm): 0.12

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 13

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.7

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

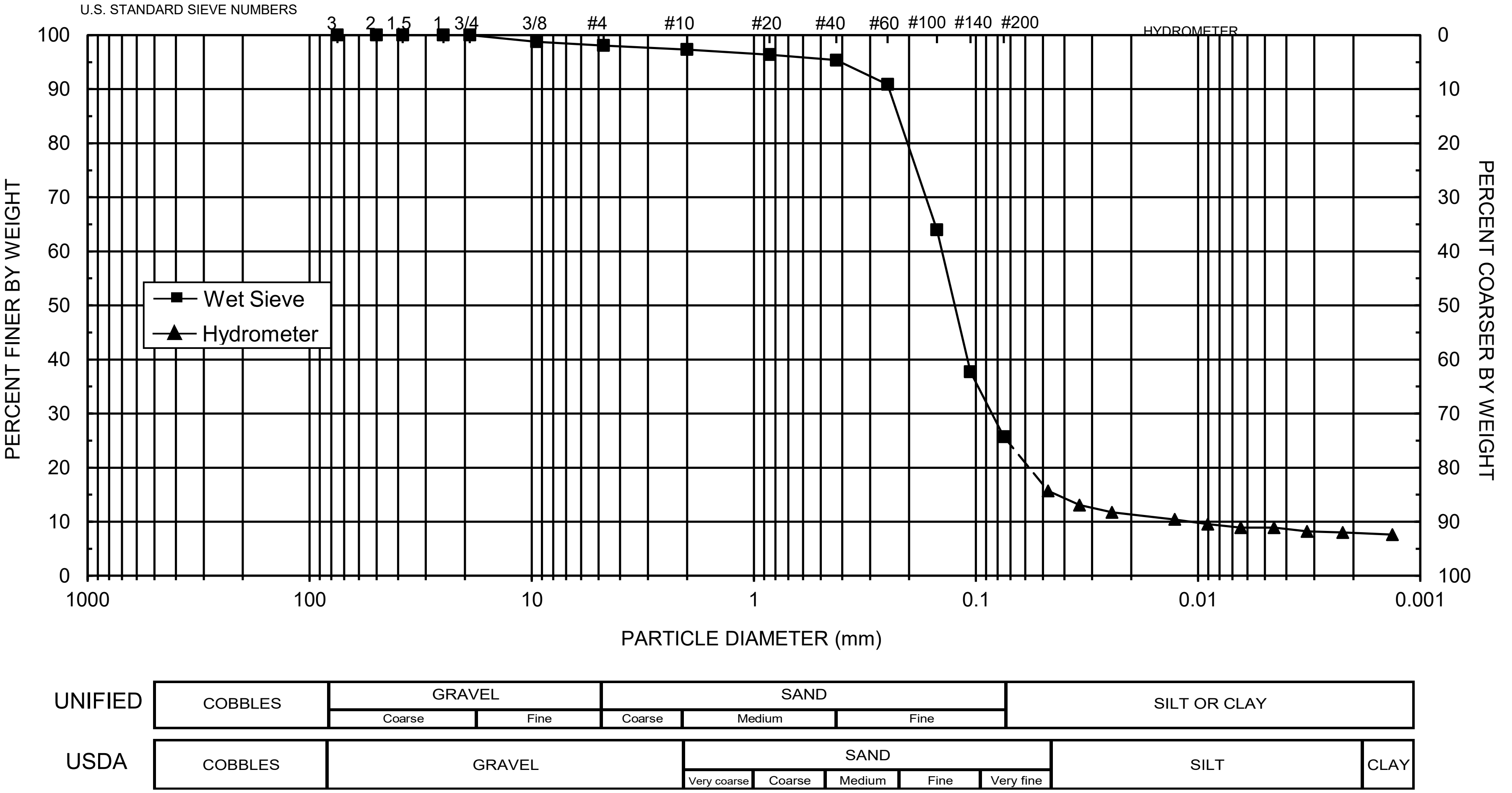
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-01RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-059	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1530	*Initial Wt. (g):*	110.43
Test Date:	16-May-19	*Total Sample Wt. (g):*	1342.25
Start Time:	9:12	*Wt. Passing #10 (g):*	1306.35

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	23.00	5.19	17.8	12	0.0473	16	15.7
	2	21.7	20.00	5.19	14.8	13	0.0341	13	13.1
	4	21.7	18.50	5.19	13.3	13	0.0244	12	11.7
	15	21.7	17.00	5.19	11.8	13	0.0127	11	10.4
	30	21.7	16.00	5.19	10.8	13	0.0090	10	9.5
	60	21.8	15.25	5.15	10.1	13	0.0064	9	8.9
	120	21.8	15.25	5.15	10.1	13	0.0045	9	8.9
	240	21.7	14.50	5.19	9.3	13	0.0032	8	8.2
	504	21.7	14.25	5.19	9.1	14	0.0022	8	8.0
17-May-19	1420	21.9	13.75	5.11	8.6	14	0.0013	8	7.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.011**	d_{30} = **0.085**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **13**	C_c = **4.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-01RM	**04/11/2019 1530**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RT
Lab ID: HAT01-11.1904001-047
Date/Time sampled: 04/10/2019 1545

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 1511.50
Weight Passing #10 (g): 1478.13
Weight Retained #10 (g): 33.37
Weight of Hydrometer Sample (g): 99.87
Calculated Weight of Sieve Sample (g): 102.12

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1511.50	100.00
	2"	50	0.00	0.00	1511.50	100.00
	1.5"	38.1	0.00	0.00	1511.50	100.00
	1"	25	0.00	0.00	1511.50	100.00
	3/4"	19.0	0.00	0.00	1511.50	100.00
	3/8"	9.5	15.05	15.05	1496.45	99.00
	4	4.75	8.76	23.81	1487.69	98.42
	10	2.00	9.56	33.37	1478.13	97.79
-10			(Based on calculated sieve wt.)			
	20	0.85	0.93	3.18	98.94	96.88
	40	0.425	1.20	4.38	97.74	95.71
	60	0.250	6.67	11.05	91.07	89.18
	100	0.150	24.40	35.45	66.67	65.28
	140	0.106	22.49	57.94	44.18	43.26
	200	0.075	14.84	72.78	29.34	28.73
	dry pan		5.81	78.59	23.53	
	wet pan			23.53	0.00	

d_{10} (mm): 0.0084
d_{16} (mm): 0.042
d_{30} (mm): 0.077
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 17
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 5.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RT
Lab ID: HAT01-11.1904001-047
Date/Time sampled: 04/10/2019 1545

Test Date: 21-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

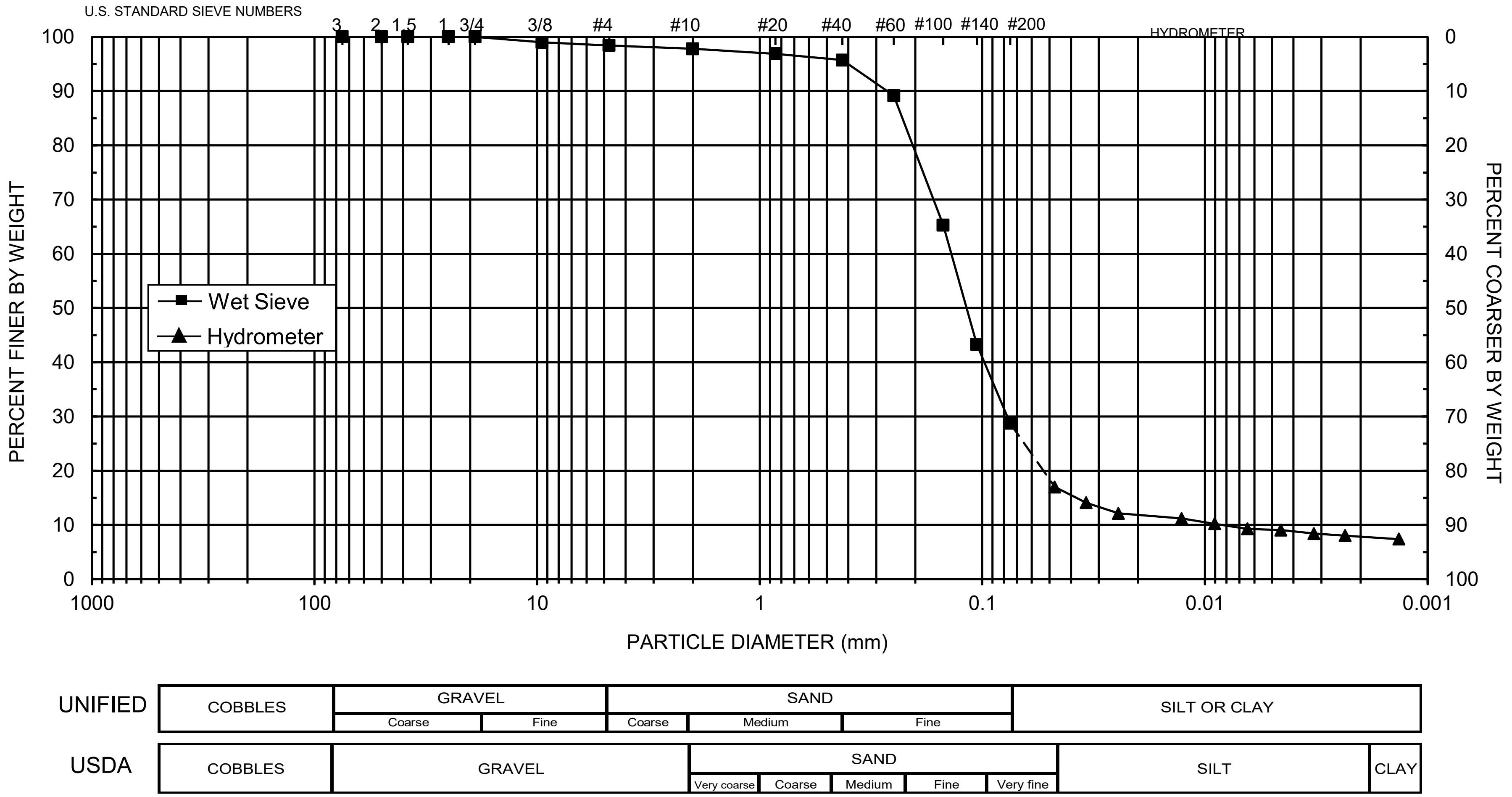
Initial Wt. (g): 99.87
Total Sample Wt. (g): 1511.50
Wt. Passing #10 (g): 1478.13

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
21-May-19	1	20.6	23.00	5.57	17.4	12	0.0473	17	17.0
	2	20.6	20.00	5.57	14.4	13	0.0341	14	14.1
	4	20.6	18.00	5.57	12.4	13	0.0245	12	12.1
	15	20.7	17.00	5.54	11.5	13	0.0127	11	11.2
	30	20.7	16.00	5.54	10.5	13	0.0090	10	10.2
	60	20.8	15.00	5.50	9.5	13	0.0064	9	9.3
	120	20.9	14.75	5.47	9.3	13	0.0046	9	9.1
	240	21.1	14.00	5.40	8.6	14	0.0032	9	8.4
	460	21.5	13.50	5.26	8.2	14	0.0023	8	8.0
22-May-19	1408	21.0	13.00	5.43	7.6	14	0.0013	8	7.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0084**	d_{30} = **0.077**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **17**	C_c = **5.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-01RT	**04/10/2019 1545**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02B
Lab ID: HAT01-11.1904001-019
Date/Time sampled: 04/10/2019 1600

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 82268.85
Weight Passing #10 (g): 7426.36
Weight Retained #10 (g): 74842.49
Weight of Hydrometer Sample (g): 114.81
Calculated Weight of Sieve Sample (g): 1271.86

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	82268.85	100.00
	2"	50	0.00	0.00	82268.85	100.00
	1.5"	38.1	4642.13	4642.13	77626.72	94.36
	1"	25	16963.00	21605.13	60663.72	73.74
	3/4"	19.0	14349.28	35954.41	46314.44	56.30
	3/8"	9.5	28609.90	64564.31	17704.54	21.52
	4	4.75	7367.83	71932.14	10336.71	12.56
	10	2.00	2910.35	74842.49	7426.36	9.03
-10			(Based on calculated sieve wt.)			
	20	0.85	9.36	1166.41	105.45	8.29
	40	0.425	15.32	1181.73	90.13	7.09
	60	0.250	15.61	1197.34	74.52	5.86
	100	0.150	14.02	1211.36	60.50	4.76
	140	0.106	14.20	1225.56	46.30	3.64
	200	0.075	10.95	1236.51	35.35	2.78
	dry pan		1.79	1238.30	33.56	
	wet pan			33.56	0.00	

d_{10} (mm): 2.5
d_{16} (mm): 6.2
d_{30} (mm): 11
d_{50} (mm): 17
d_{60} (mm): 20
d_{84} (mm): 31

Median Particle Diameter --d_{50} (mm): 17
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 8.0
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 18

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

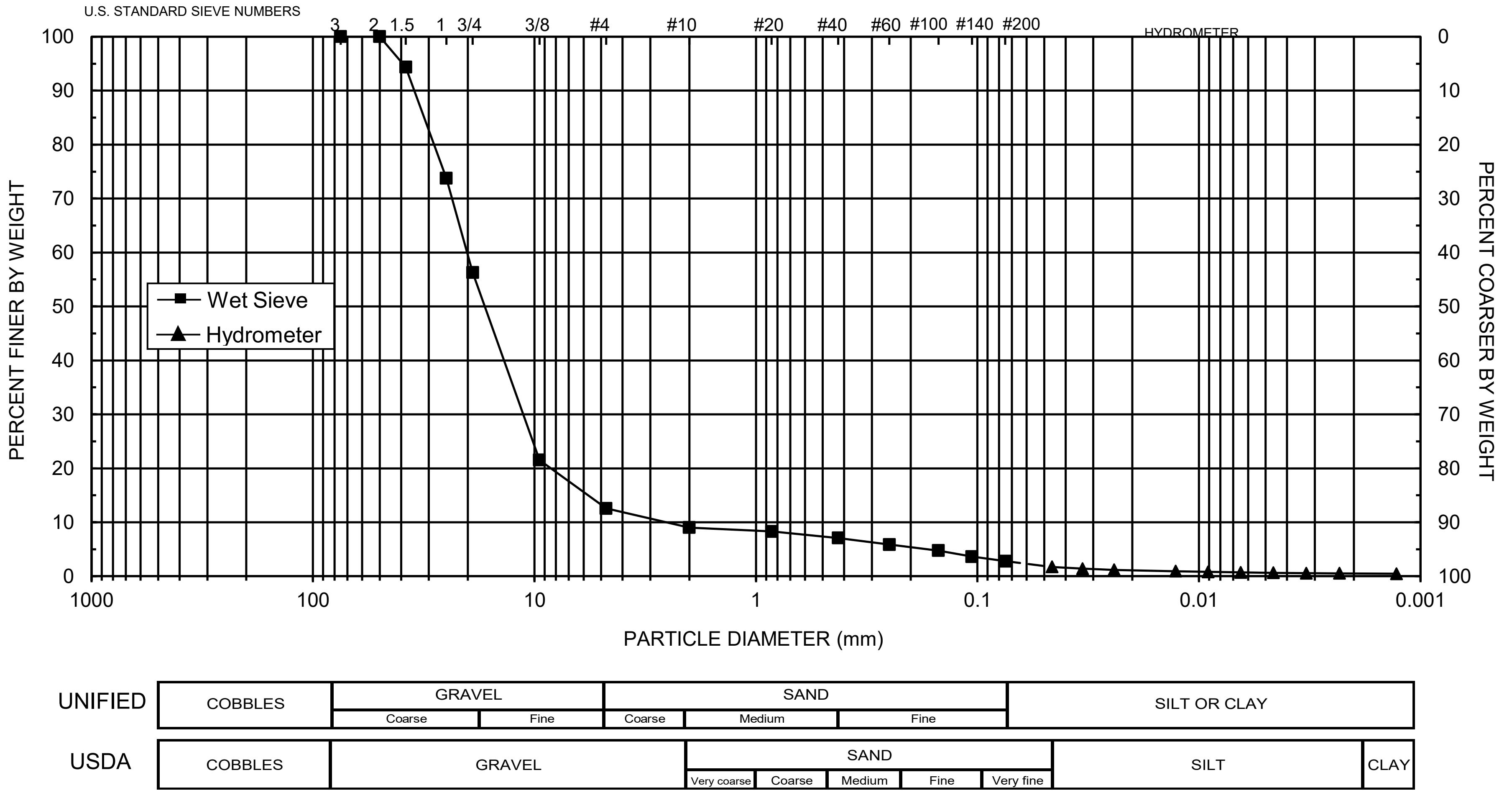
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-019	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1600	*Initial Wt.* (g)*:*	114.81
Test Date:	17-May-19	*Total Sample Wt.* (g)*:*	82268.85
Start Time:	9:00	*Wt. Passing #10* (g)*:*	7426.36

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
17-May-19	1	21.9	27.00	5.11	21.9	11	0.0460	19	1.7
	2	21.9	23.00	5.11	17.9	12	0.0335	16	1.4
	4	21.9	20.00	5.11	14.9	13	0.0242	13	1.2
	15	21.9	17.00	5.11	11.9	13	0.0127	10	0.9
	30	21.9	15.25	5.11	10.1	13	0.0091	9	0.8
	60	21.9	14.00	5.11	8.9	14	0.0065	8	0.7
	120	21.9	13.00	5.11	7.9	14	0.0046	7	0.6
	240	21.8	12.25	5.15	7.1	14	0.0033	6	0.6
	480	21.5	12.00	5.26	6.7	14	0.0023	6	0.5
18-May-19	1586	21.7	11.00	5.19	5.8	14	0.0013	5	0.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **2.5**	d_{30} = **11**	d_{50} = **17**	d_{60} = **20**	C_u = **8.0**	C_c = **2.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-02B	**04/10/2019 1600**	**Well-graded gravel (GW)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RB
Lab ID: HAT01-11.1904001-072
Date/Time sampled: 04/10/2019 1620
Test Date: 30-May-19

Initial Dry Weight of Sample (g): 1504.61
Weight Passing #10 (g): 1435.30
Weight Retained #10 (g): 69.31
Weight of Hydrometer Sample (g): 100.26
Calculated Weight of Sieve Sample (g): 105.10

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1504.61	100.00
	2"	50	0.00	0.00	1504.61	100.00
	1.5"	38.1	0.00	0.00	1504.61	100.00
	1"	25	0.00	0.00	1504.61	100.00
	3/4"	19.0	0.00	0.00	1504.61	100.00
	3/8"	9.5	30.79	30.79	1473.82	97.95
	4	4.75	15.99	46.78	1457.83	96.89
	10	2.00	22.53	69.31	1435.30	95.39
-10			(Based on calculated sieve wt.)			
	20	0.85	0.53	5.37	99.73	94.89
	40	0.425	1.03	6.40	98.70	93.91
	60	0.250	7.07	13.47	91.63	87.18
	100	0.150	24.13	37.60	67.50	64.22
	140	0.106	20.13	57.73	47.37	45.07
	200	0.075	14.71	72.44	32.66	31.07
	dry pan		6.16	78.60	26.50	
	wet pan			26.50	0.00	

d_{10} (mm): 0.0082
d_{16} (mm): 0.040
d_{30} (mm): 0.072
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 17
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.5
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

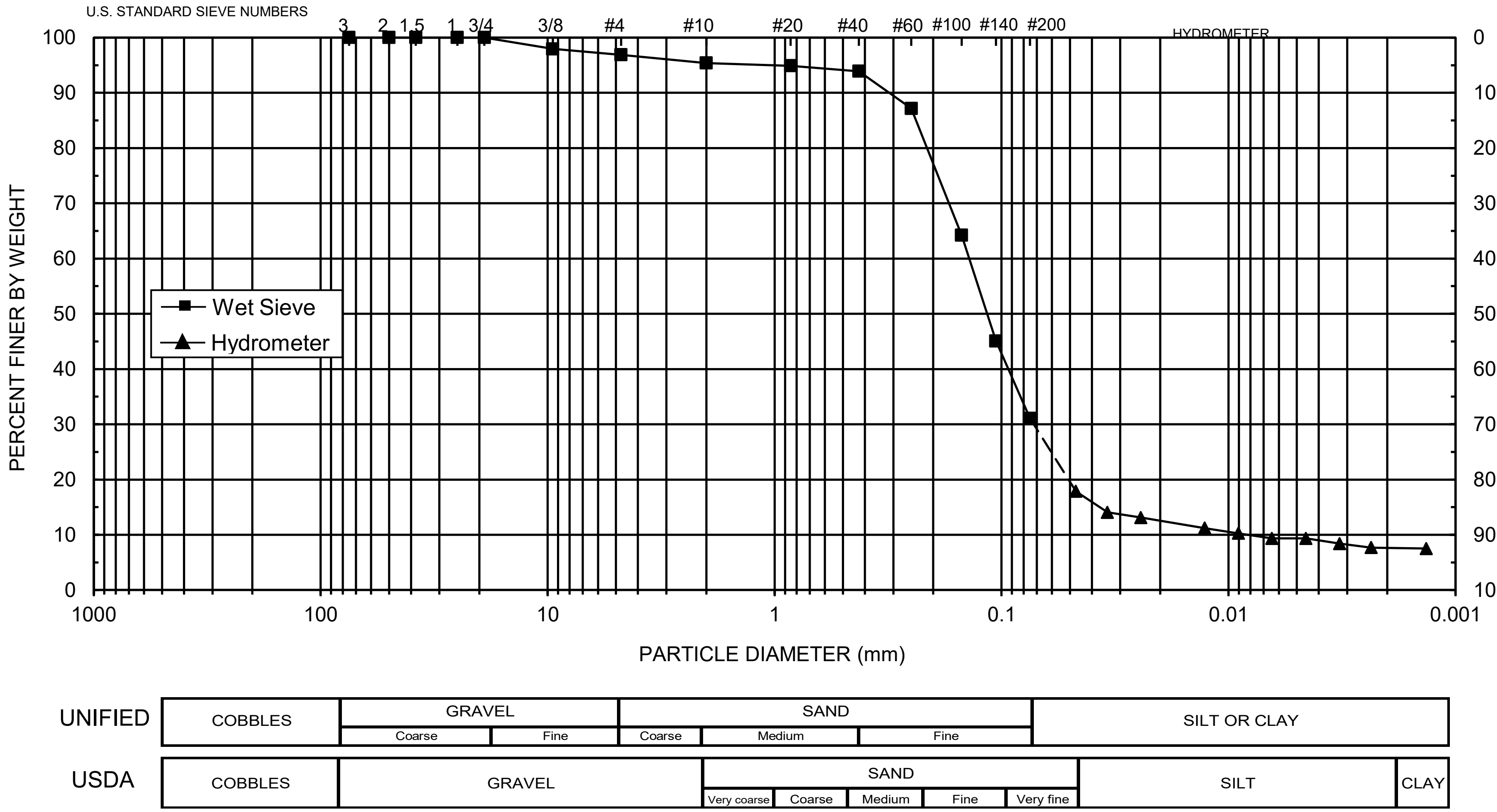
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with H_2O_2:*	NA
Sample Number:	L8-02RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-072	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1620	*Initial Wt. (g):*	100.26
Test Date:	28-May-19	*Total Sample Wt. (g):*	1504.61
Start Time:	9:24	*Wt. Passing #10 (g):*	1435.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	24.00	5.22	18.8	12	0.0470	19	17.9
	2	21.6	20.00	5.22	14.8	13	0.0342	15	14.1
	4	21.6	19.00	5.22	13.8	13	0.0243	14	13.1
	15	21.6	17.00	5.22	11.8	13	0.0127	12	11.2
	30	21.6	16.00	5.22	10.8	13	0.0090	11	10.3
	60	21.7	15.00	5.19	9.8	13	0.0064	10	9.3
	120	21.7	15.00	5.19	9.8	13	0.0046	10	9.3
	240	21.7	14.00	5.19	8.8	14	0.0032	9	8.4
	460	21.7	13.25	5.19	8.1	14	0.0024	8	7.7
29-May-19	1408	21.9	13.00	5.11	7.9	14	0.0013	8	7.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0082**	d_{30} = **0.072**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **17**	C_c = **4.5**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-02RB	**04/10/2019 1620**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RM
Lab ID: HAT01-11.1904001-060
Date/Time sampled: 04/10/2019 1625

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1756.31
Weight Passing #10 (g): 1707.85
Weight Retained #10 (g): 48.46
Weight of Hydrometer Sample (g): 91.08
Calculated Weight of Sieve Sample (g): 93.66

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1756.31	100.00
	2"	50	0.00	0.00	1756.31	100.00
	1.5"	38.1	0.00	0.00	1756.31	100.00
	1"	25	0.00	0.00	1756.31	100.00
	3/4"	19.0	0.00	0.00	1756.31	100.00
	3/8"	9.5	16.70	16.70	1739.61	99.05
	4	4.75	12.84	29.54	1726.77	98.32
	10	2.00	18.92	48.46	1707.85	97.24
-10			(Based on calculated sieve wt.)			
	20	0.85	1.55	4.13	89.53	95.59
	40	0.425	1.06	5.19	88.47	94.45
	60	0.250	4.67	9.86	83.80	89.47
	100	0.150	25.35	35.21	58.45	62.40
	140	0.106	22.75	57.96	35.70	38.11
	200	0.075	12.25	70.21	23.45	25.04
	dry pan		5.45	75.66	18.00	
	wet pan			18.00	0.00	

d_{10} (mm): 0.020
d_{16} (mm): 0.053
d_{30} (mm): 0.086

d_{50} (mm): 0.13
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.0
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

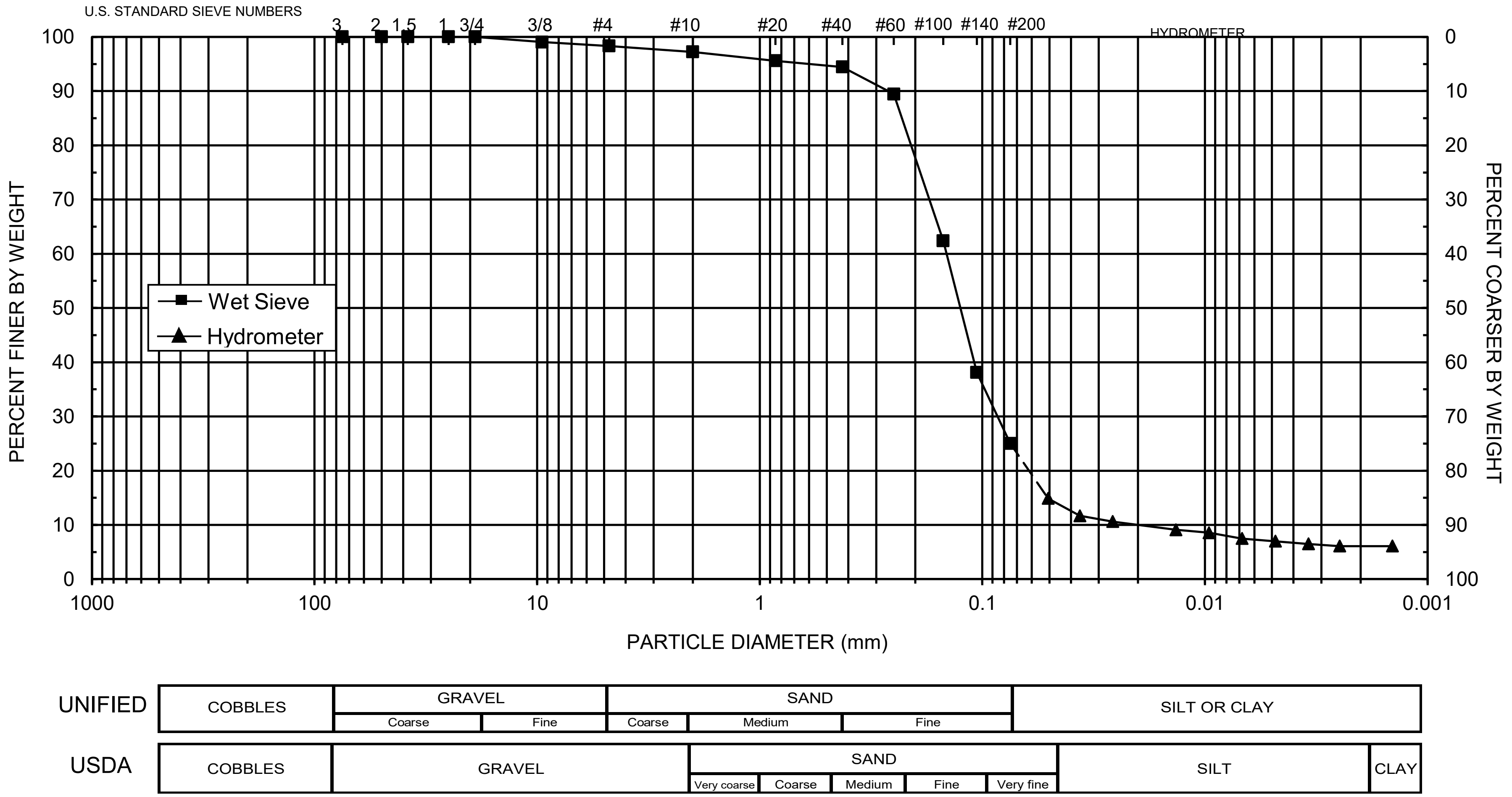
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-02RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-060	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1625	*Initial Wt. (g):*	91.08
Test Date:	7-Jun-19	*Total Sample Wt. (g):*	1756.31
Start Time:	9:24	*Wt. Passing #10 (g):*	1707.85

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.5	20.00	6.06	13.9	14	0.0506	15	14.9
	2	21.5	17.00	6.06	10.9	14	0.0364	12	11.7
	4	21.5	16.00	6.06	9.9	14	0.0259	11	10.6
	15	21.7	14.50	5.99	8.5	15	0.0135	9	9.1
	30	21.7	14.00	5.99	8.0	15	0.0096	9	8.6
	60	21.7	13.00	5.99	7.0	15	0.0068	8	7.5
	120	21.8	12.50	5.95	6.6	15	0.0048	7	7.0
	240	21.9	12.00	5.91	6.1	15	0.0034	7	6.5
	459	22.2	11.50	5.80	5.7	15	0.0025	6	6.1
8-Jun-19	1362	21.5	11.75	6.06	5.7	15	0.0014	6	6.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.020**	d_{30} = **0.086**	d_{50} = **0.13**	d_{60} = **0.14**	C_u = **7.0**	C_c = **2.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-02RM	**04/10/2019 1625**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RT
Lab ID: HAT01-11.1904001-048
Date/Time sampled: 04/10/2019 1615

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 1583.53
Weight Passing #10 (g): 1555.44
Weight Retained #10 (g): 28.09
Weight of Hydrometer Sample (g): 91.50
Calculated Weight of Sieve Sample (g): 93.15

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1583.53	100.00
	2"	50	0.00	0.00	1583.53	100.00
	1.5"	38.1	0.00	0.00	1583.53	100.00
	1"	25	0.00	0.00	1583.53	100.00
	3/4"	19.0	0.00	0.00	1583.53	100.00
	3/8"	9.5	4.84	4.84	1578.69	99.69
	4	4.75	10.05	14.89	1568.64	99.06
	10	2.00	13.20	28.09	1555.44	98.23
-10			(Based on calculated sieve wt.)			
	20	0.85	1.44	3.09	90.06	96.68
	40	0.425	1.07	4.16	88.99	95.53
	60	0.250	6.44	10.60	82.55	88.62
	100	0.150	23.44	34.04	59.11	63.46
	140	0.106	19.46	53.50	39.65	42.56
	200	0.075	12.23	65.73	27.42	29.44
	dry pan		1.54	67.27	25.88	
	wet pan			25.88	0.00	

d_{10} (mm): 0.0059
d_{16} (mm): 0.040
d_{30} (mm): 0.076
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 24
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 7.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RT
Lab ID: HAT01-11.1904001-048
Date/Time sampled: 04/10/2019 1615

Test Date: 7-Jun-19
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

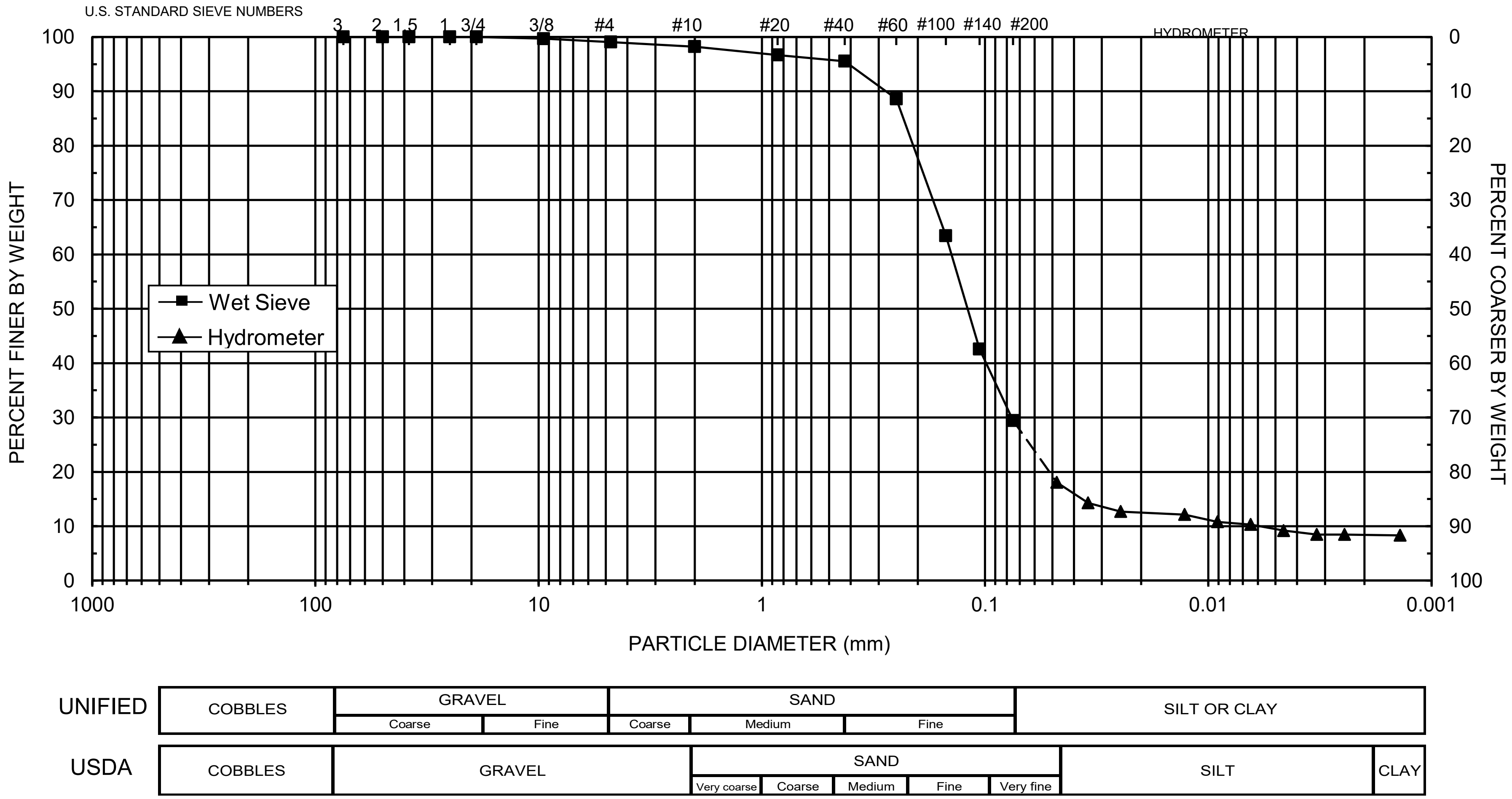
Initial Wt. *(g):* 91.50
Total Sample Wt. *(g):* 1583.53
Wt. Passing #10 *(g):* 1555.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	22.00	5.19	16.8	12	0.0477	18	18.0
	2	21.7	18.50	5.19	13.3	13	0.0345	15	14.3
	4	21.7	17.00	5.19	11.8	13	0.0246	13	12.7
	15	21.7	16.50	5.19	11.3	13	0.0128	12	12.1
	30	21.7	15.25	5.19	10.1	13	0.0091	11	10.8
	60	21.8	14.75	5.15	9.6	13	0.0065	10	10.3
	120	21.7	13.75	5.19	8.6	14	0.0046	9	9.2
	240	21.9	13.00	5.11	7.9	14	0.0033	9	8.5
	426	21.9	13.00	5.11	7.9	14	0.0024	9	8.5
8-Jun-19	1338	21.5	13.00	5.26	7.7	14	0.0014	8	8.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.0059**	d_{30} = **0.076**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **24**	C_c = **7.0**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-02RT	**04/10/2019 1615**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03B
Lab ID: HAT01-11.1904001-020
Date/Time sampled: 04/11/2019 840

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 77559.10
Weight Passing #10 (g): 4432.06
Weight Retained #10 (g): 73127.04
Weight of Hydrometer Sample (g): 110.10
Calculated Weight of Sieve Sample (g): 1926.70

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	77559.10	100.00
	2"	50	447.46	447.46	77111.64	99.42
	1.5"	38.1	11510.67	11958.13	65600.97	84.58
	1"	25	24328.50	36286.63	41272.47	53.21
	3/4"	19.0	13133.52	49420.15	28138.95	36.28
	3/8"	9.5	15031.05	64451.20	13107.90	16.90
	4	4.75	6185.84	70637.04	6922.05	8.92
	10	2.00	2490.00	73127.04	4432.06	5.71
-10			(Based on calculated sieve wt.)			
	20	0.85	14.31	1830.91	95.79	4.97
	40	0.425	12.60	1843.51	83.19	4.32
	60	0.250	12.50	1856.01	70.69	3.67
	100	0.150	9.25	1865.26	61.44	3.19
	140	0.106	10.23	1875.49	51.21	2.66
	200	0.075	9.24	1884.73	41.97	2.18
	dry pan		1.80	1886.53	40.17	
	wet pan			40.17	0.00	

d_{10} (mm): 5.2
d_{16} (mm): 8.8
d_{30} (mm): 15
d_{50} (mm): 24
d_{60} (mm): 27
d_{84} (mm): 38

Median Particle Diameter --d_{50} (mm): 24
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 5.2
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 1.6
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 24

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03B
Lab ID: HAT01-11.1904001-020
Date/Time sampled: 04/11/2019 840

Test Date: 17-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

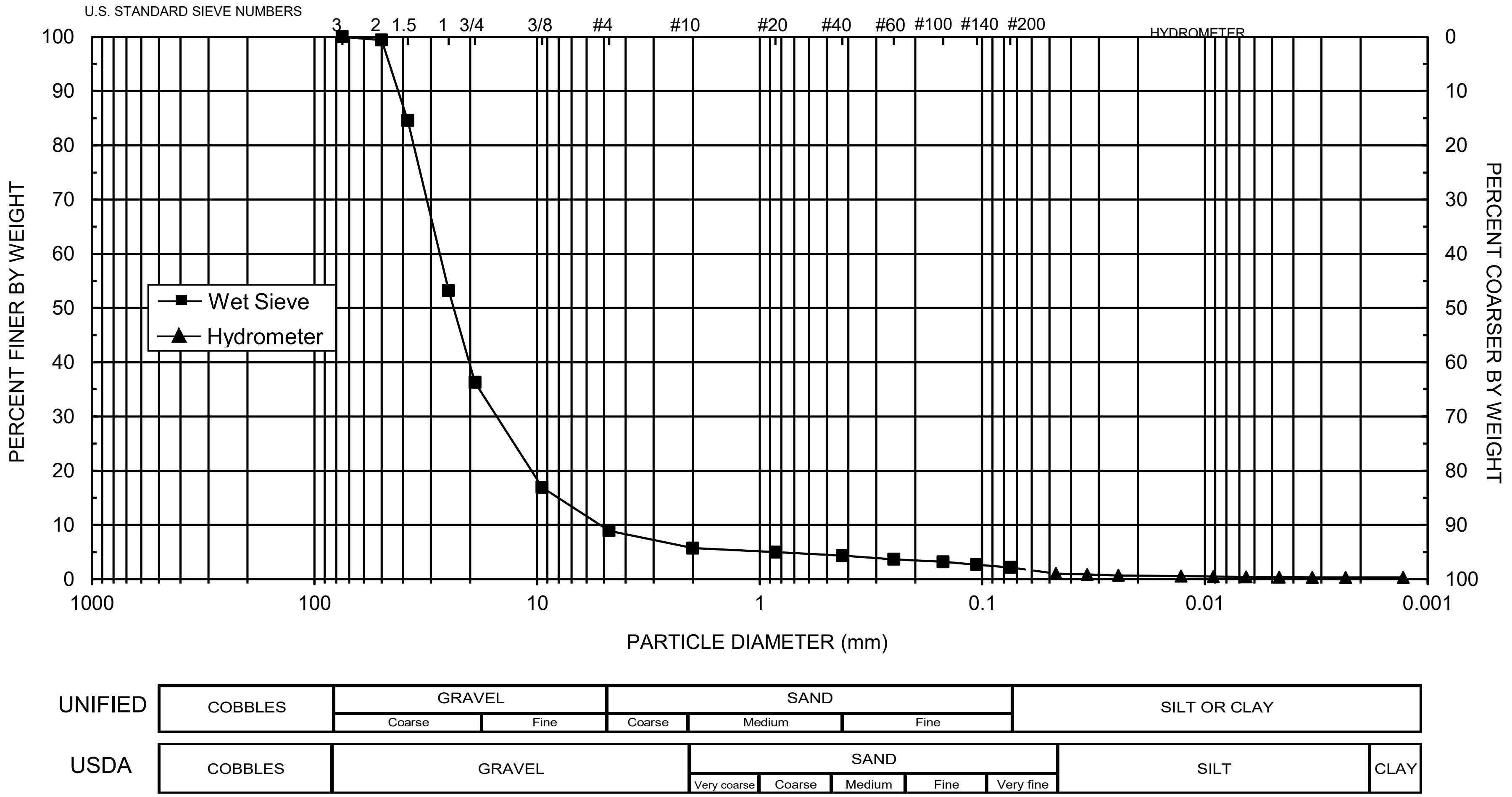
Initial Wt. (g)*:* 110.10
Total Sample Wt. (g)*:* 77559.10
Wt. Passing #10 (g)*:* 4432.06

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
17-May-19	1	21.9	25.00	5.11	19.9	12	0.0467	18	1.0
	2	21.9	21.50	5.11	16.4	12	0.0338	15	0.9
	4	21.9	18.00	5.11	12.9	13	0.0245	12	0.7
	15	21.9	16.00	5.11	10.9	13	0.0128	10	0.6
	30	21.9	14.00	5.11	8.9	14	0.0092	8	0.5
	60	21.9	13.00	5.11	7.9	14	0.0065	7	0.4
	120	21.9	12.00	5.11	6.9	14	0.0046	6	0.4
	240	21.8	11.25	5.15	6.1	14	0.0033	6	0.3
	481	21.5	11.00	5.26	5.7	14	0.0023	5	0.3
18-May-19	1581	21.5	11.00	5.26	5.7	14	0.0013	5	0.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **5.2**	d_{30} = **15**	d_{50} = **24**	d_{60} = **27**	C_u = **5.2**	C_c = **1.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-03B	**04/11/2019 840**	**Well-graded gravel (GW)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RB
Lab ID: HAT01-11.1904001-073
Date/Time sampled: 04/11/2019 855

Test Date: 30-May-19

Initial Dry Weight of Sample (g): 1501.16
Weight Passing #10 (g): 1467.76
Weight Retained #10 (g): 33.40
Weight of Hydrometer Sample (g): 101.46
Calculated Weight of Sieve Sample (g): 103.77

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1501.16	100.00
	2"	50	0.00	0.00	1501.16	100.00
	1.5"	38.1	0.00	0.00	1501.16	100.00
	1"	25	0.00	0.00	1501.16	100.00
	3/4"	19.0	0.00	0.00	1501.16	100.00
	3/8"	9.5	3.55	3.55	1497.61	99.76
	4	4.75	13.76	17.31	1483.85	98.85
	10	2.00	16.09	33.40	1467.76	97.78
-10			(Based on calculated sieve wt.)			
	20	0.85	1.41	3.72	100.05	96.42
	40	0.425	1.13	4.85	98.92	95.33
	60	0.250	7.39	12.24	91.53	88.21
	100	0.150	25.71	37.95	65.82	63.43
	140	0.106	18.94	56.89	46.88	45.18
	200	0.075	14.76	71.65	32.12	30.95
	dry pan		6.52	78.17	25.60	
	wet pan			25.60	0.00	

d_{10} (mm): 0.0078
d_{16} (mm): 0.040
d_{30} (mm): 0.072
d_{50} (mm): 0.12
d_{60} (mm): 0.14
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 18
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

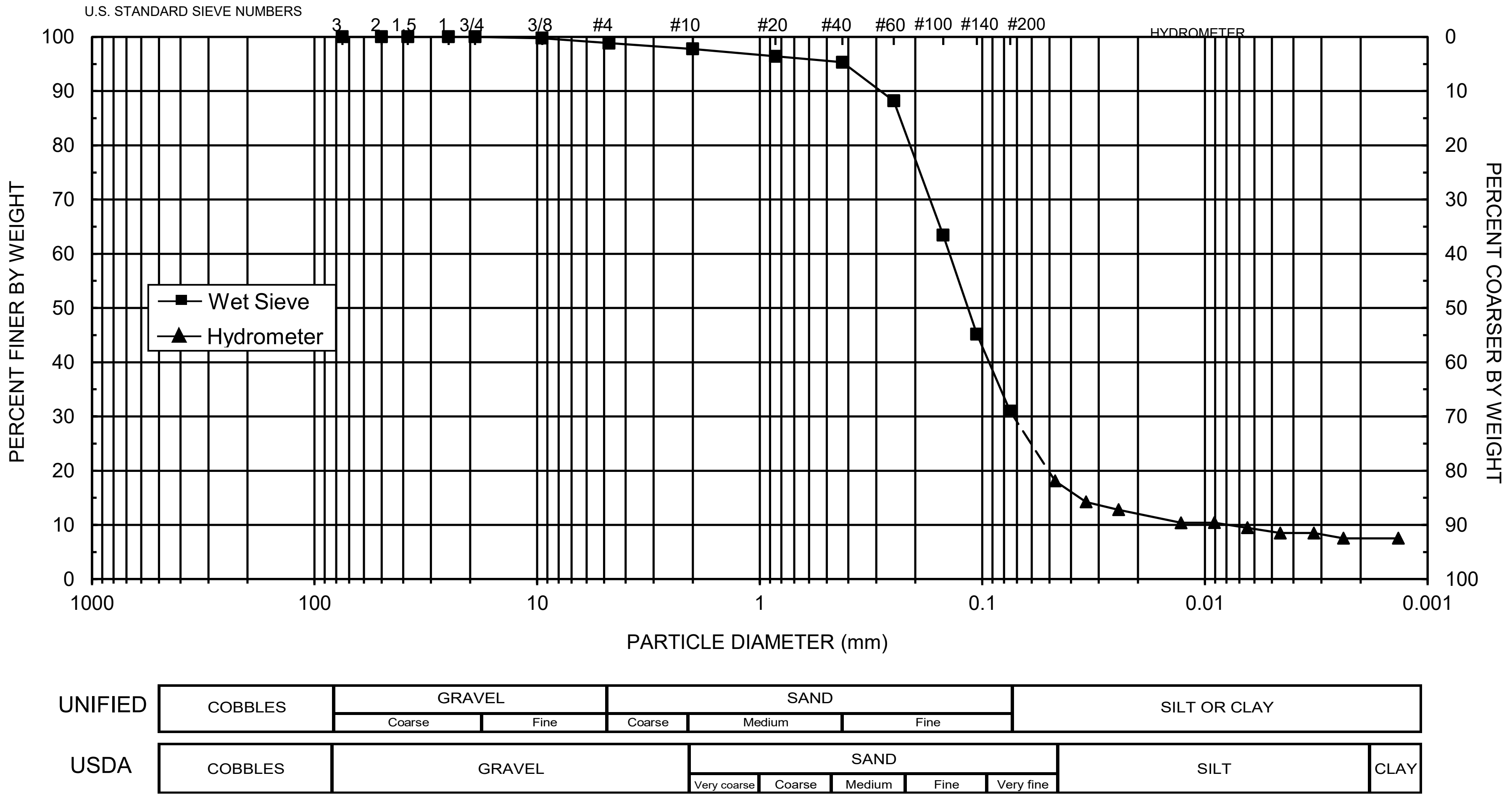
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-03RB	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-073	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 855	*Initial Wt.* (g)*:*	101.46
Test Date:	28-May-19	*Total Sample Wt.* (g)*:*	1501.16
Start Time:	9:36	*Wt. Passing #10* (g)*:*	1467.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	24.00	5.22	18.8	12	0.0471	19	18.1
	2	21.6	20.00	5.22	14.8	13	0.0342	15	14.2
	4	21.6	18.50	5.22	13.3	13	0.0244	13	12.8
	15	21.6	16.00	5.22	10.8	13	0.0128	11	10.4
	30	21.7	16.00	5.19	10.8	13	0.0091	11	10.4
	60	21.7	15.00	5.19	9.8	13	0.0064	10	9.5
	120	21.7	14.00	5.19	8.8	14	0.0046	9	8.5
	240	21.7	14.00	5.19	8.8	14	0.0032	9	8.5
	450	21.7	13.00	5.19	7.8	14	0.0024	8	7.5
29-May-19	1398	21.7	13.00	5.19	7.8	14	0.0014	8	7.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0078**	d_{30} = **0.072**	d_{50} = **0.12**	d_{60} = **0.14**	C_u = **18**	C_c = **4.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-03RB	**04/11/2019 855**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RM
Lab ID: HAT01-11.1904001-061
Date/Time sampled: 04/10/2019 900

Test Date: 22-May-19

Initial Dry Weight of Sample (g): 1254.74
Weight Passing #10 (g): 1203.63
Weight Retained #10 (g): 51.11
Weight of Hydrometer Sample (g): 58.80
Calculated Weight of Sieve Sample (g): 61.30

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1254.74	100.00
	2"	50	0.00	0.00	1254.74	100.00
	1.5"	38.1	0.00	0.00	1254.74	100.00
	1"	25	0.00	0.00	1254.74	100.00
	3/4"	19.0	17.59	17.59	1237.15	98.60
	3/8"	9.5	17.20	34.79	1219.95	97.23
	4	4.75	8.79	43.58	1211.16	96.53
	10	2.00	7.53	51.11	1203.63	95.93
-10			(Based on calculated sieve wt.)			
	20	0.85	1.04	3.54	57.76	94.23
	40	0.425	0.71	4.25	57.05	93.07
	60	0.250	2.84	7.09	54.21	88.44
	100	0.150	16.56	23.65	37.65	61.42
	140	0.106	13.71	37.36	23.94	39.06
	200	0.075	7.65	45.01	16.29	26.58
	dry pan		1.62	46.63	14.67	
	wet pan			14.67	0.00	

d_{10} (mm): 0.0073
d_{16} (mm): 0.054
d_{30} (mm): 0.082

d_{50} (mm): 0.13
d_{60} (mm): 0.15
d_{84} (mm): 0.23

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 21
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 6.1
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.14

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: A. Baldridge/J. Newcomer
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RM
Lab ID: HAT01-11.1904001-061
Date/Time sampled: 04/10/2019 900

Test Date: 7-Jun-19
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

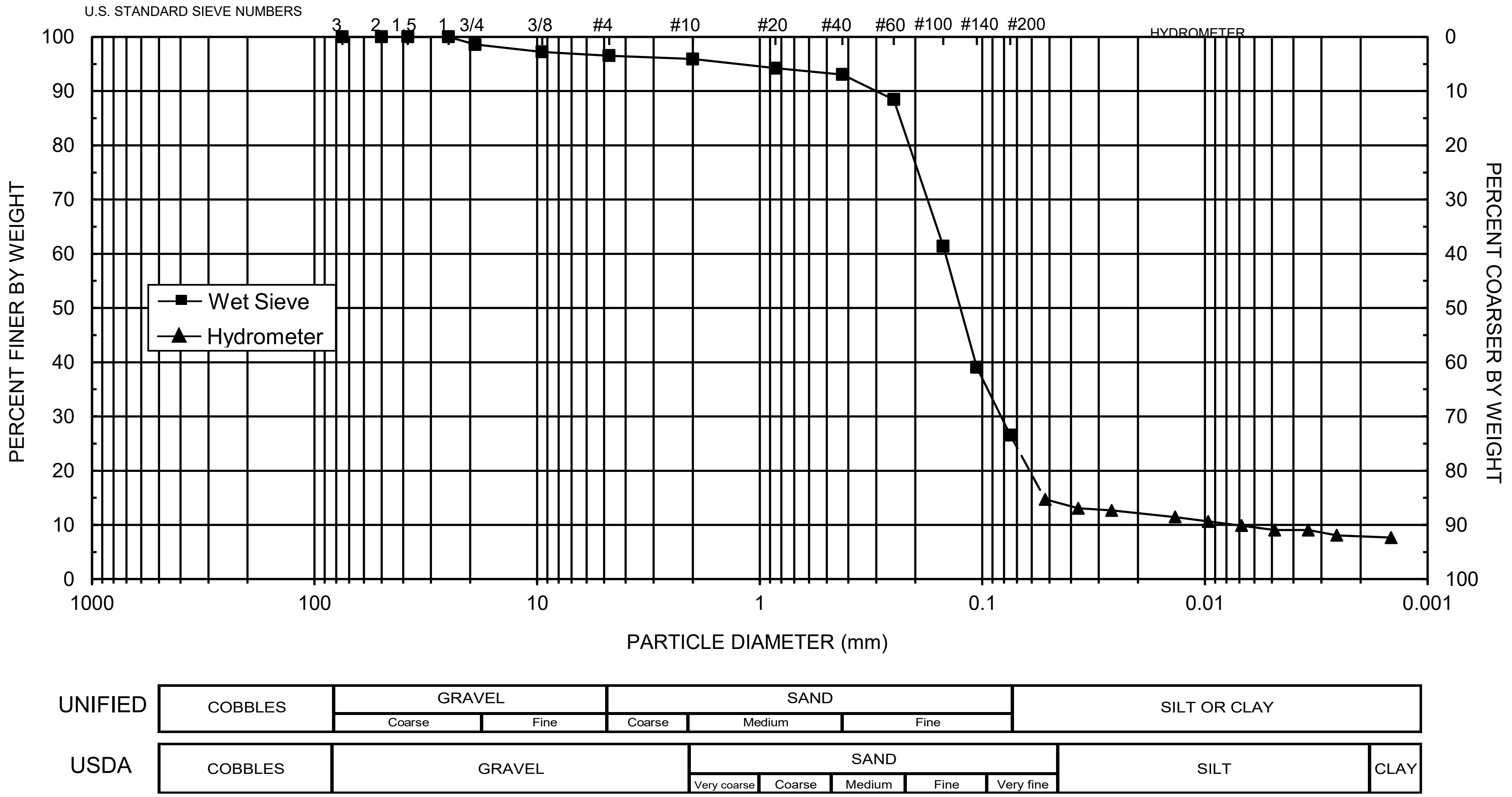
Initial Wt. *(g):* 58.80
Total Sample Wt. *(g):* 1254.74
Wt. Passing #10 *(g):* 1203.63

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	15.00	5.99	9.0	15	0.0521	15	14.7
	2	21.7	14.00	5.99	8.0	15	0.0371	14	13.1
	4	21.7	13.75	5.99	7.8	15	0.0263	13	12.7
	15	21.7	13.00	5.99	7.0	15	0.0136	12	11.4
	30	21.7	12.50	5.99	6.5	15	0.0097	11	10.6
	60	21.8	12.00	5.95	6.1	15	0.0068	10	9.9
	120	21.8	11.50	5.95	5.6	15	0.0049	9	9.1
	240	21.8	11.50	5.95	5.6	15	0.0034	9	9.1
	437	22.2	10.75	5.80	4.9	15	0.0026	8	8.1
8-Jun-19	1341	21.5	10.75	6.06	4.7	15	0.0015	8	7.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.0073**	d_{30} = **0.082**	d_{50} = **0.13**	d_{60} = **0.15**	C_u = **21**	C_c = **6.1**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-03RM	**04/10/2019 900**	**Silty sand (SM)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RT
Lab ID: HAT01-11.1904001-049
Date/Time sampled: 04/11/2019 915

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1526.50
Weight Passing #10 (g): 1509.00
Weight Retained #10 (g): 17.50
Weight of Hydrometer Sample (g): 102.44
Calculated Weight of Sieve Sample (g): 103.63

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1526.50	100.00
	2"	50	0.00	0.00	1526.50	100.00
	1.5"	38.1	0.00	0.00	1526.50	100.00
	1"	25	0.00	0.00	1526.50	100.00
	3/4"	19.0	0.00	0.00	1526.50	100.00
	3/8"	9.5	0.00	0.00	1526.50	100.00
	4	4.75	6.47	6.47	1520.03	99.58
	10	2.00	11.03	17.50	1509.00	98.85
-10			(Based on calculated sieve wt.)			
	20	0.85	1.05	2.24	101.39	97.84
	40	0.425	1.30	3.54	100.09	96.59
	60	0.250	4.49	8.03	95.60	92.25
	100	0.150	30.66	38.69	64.94	62.67
	140	0.106	27.71	66.40	37.23	35.93
	200	0.075	12.80	79.20	24.43	23.57
	dry pan		1.86	81.06	22.57	
	wet pan			22.57	0.00	

d_{10} (mm): 0.020
d_{16} (mm): 0.051
d_{30} (mm): 0.090
d_{50} (mm): 0.13
d_{60} (mm): 0.14
d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.0
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.13

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand (SM)

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RT
Lab ID: HAT01-11.1904001-049
Date/Time sampled: 04/11/2019 915

Test Date: 23-May-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

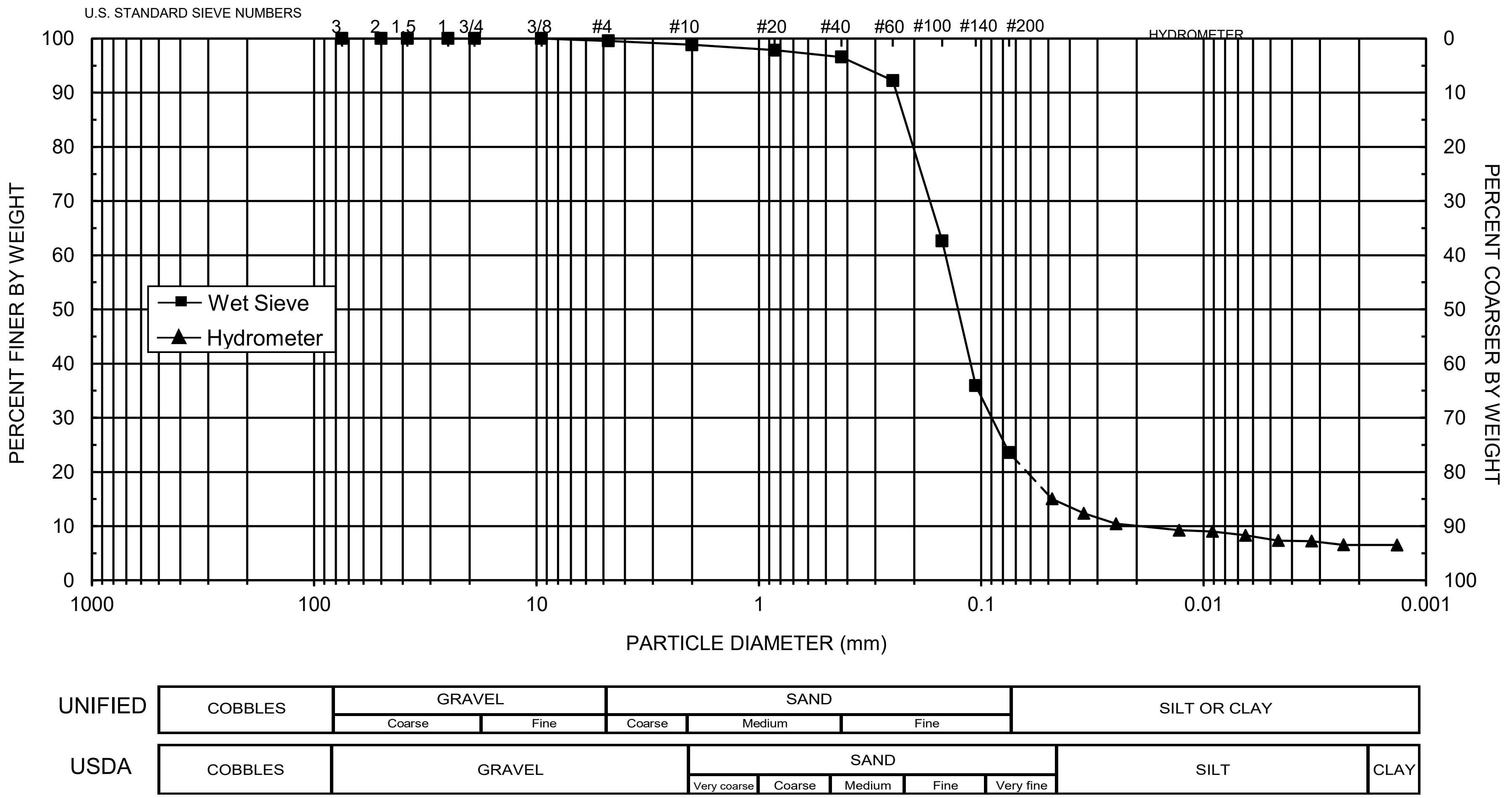
Initial Wt. *(g):* 102.44
Total Sample Wt. *(g):* 1526.50
Wt. Passing #10 *(g):* 1509.00

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	21.00	5.43	15.6	12	0.0480	15	15.0
	2	21.0	18.25	5.43	12.8	13	0.0346	13	12.4
	4	21.0	16.25	5.43	10.8	13	0.0247	11	10.4
	15	21.0	15.00	5.43	9.6	13	0.0129	9	9.2
	30	21.1	14.75	5.40	9.4	13	0.0091	9	9.0
	60	21.1	14.00	5.40	8.6	14	0.0065	8	8.3
	120	21.1	13.00	5.40	7.6	14	0.0046	7	7.3
	240	21.5	12.75	5.26	7.5	14	0.0033	7	7.2
	470	21.6	12.00	5.22	6.8	14	0.0023	7	6.5
23-May-19	1418	21.5	12.00	5.26	6.7	14	0.0013	7	6.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.020**	d_{30} = **0.090**	d_{50} = **0.13**	d_{60} = **0.14**	C_u = **7.0**	C_c = **2.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L8-03RT	**04/11/2019 915**	**Silty sand (SM)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L9-01B
Lab ID: HAT01-11.1904001-021
Date/Time sampled: 04/11/2019 1350

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 83320.41
Weight Passing #10 (g): 10420.96
Weight Retained #10 (g): 72899.45
Weight of Hydrometer Sample (g): 90.32
Calculated Weight of Sieve Sample (g): 722.15

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	83320.41	100.00
	2"	50	0.00	0.00	83320.41	100.00
	1.5"	38.1	5552.97	5552.97	77767.44	93.34
	1"	25	19130.30	24683.27	58637.14	70.38
	3/4"	19.0	8113.60	32796.87	50523.53	60.64
	3/8"	9.5	22290.65	55087.52	28232.89	33.88
	4	4.75	13102.00	68189.52	15130.89	18.16
	10	2.00	4709.93	72899.45	10420.96	12.51
-10			(Based on calculated sieve wt.)			
	20	0.85	9.53	641.36	80.79	11.19
	40	0.425	8.00	649.36	72.79	10.08
	60	0.250	8.01	657.37	64.78	8.97
	100	0.150	9.96	667.33	54.82	7.59
	140	0.106	11.16	678.49	43.66	6.05
	200	0.075	8.35	686.84	35.31	4.89
	dry pan		1.10	687.94	34.21	
	wet pan			34.21	0.00	

d_{10} (mm): 0.41
d_{16} (mm): 3.4
d_{30} (mm): 8.0

d_{50} (mm): 14
d_{60} (mm): 19
d_{84} (mm): 32

Median Particle Diameter --d_{50} (mm): 14
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 46
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 8.2
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 16

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

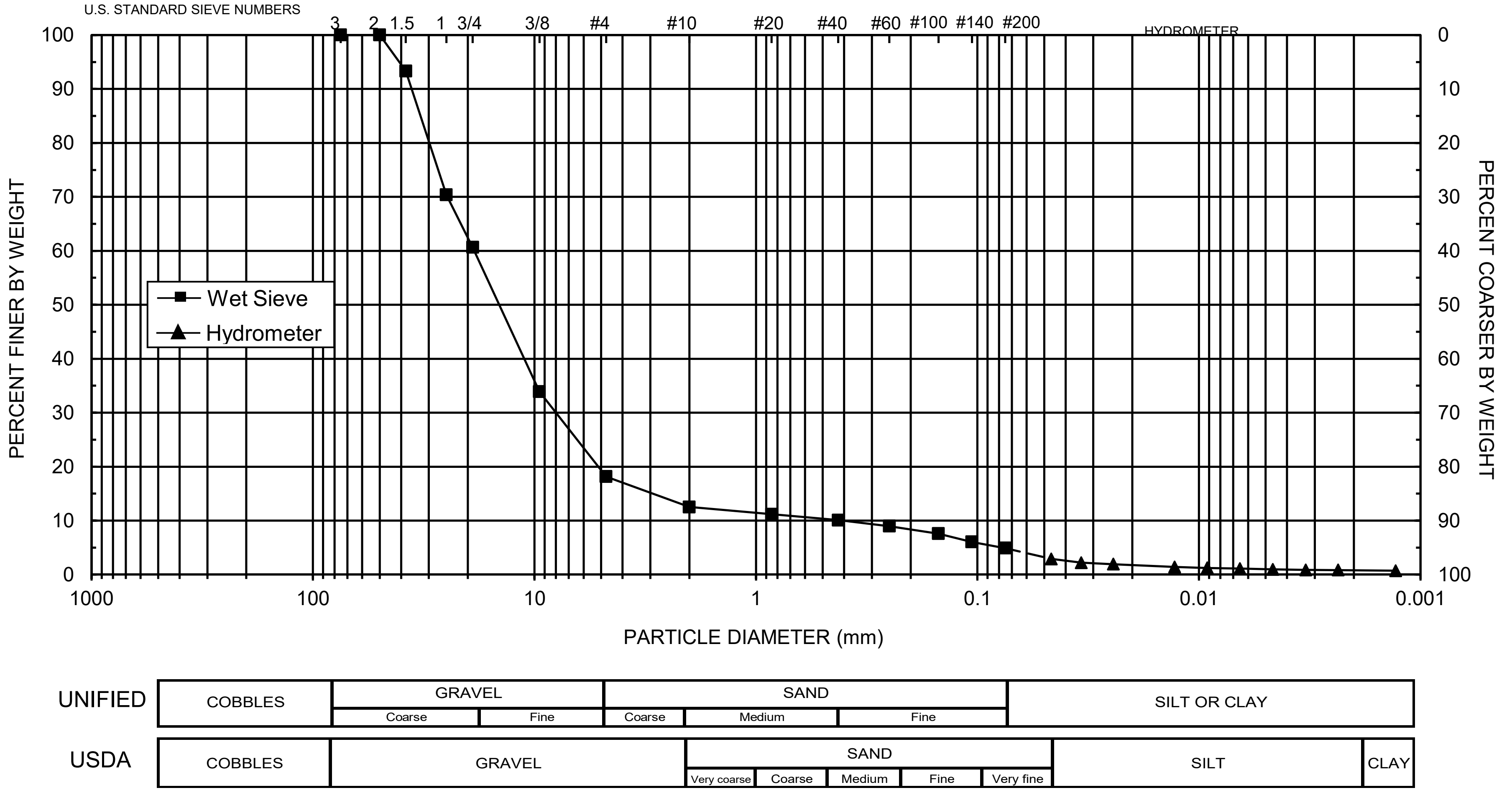
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L9-01B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-021	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1350	*Initial Wt. (g):*	90.32
Test Date:	17-May-19	*Total Sample Wt. (g):*	83320.41
Start Time:	9:12	*Wt. Passing #10 (g):*	10420.96

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
17-May-19	1	21.9	26.00	5.11	20.9	12	0.0464	23	2.9
	2	21.9	21.00	5.11	15.9	12	0.0340	18	2.2
	4	21.9	19.00	5.11	13.9	13	0.0243	15	1.9
	15	21.9	15.25	5.11	10.1	13	0.0129	11	1.4
	30	21.9	14.00	5.11	8.9	14	0.0092	10	1.2
	60	21.9	13.00	5.11	7.9	14	0.0065	9	1.1
	120	21.9	12.00	5.11	6.9	14	0.0046	8	1.0
	240	21.8	11.25	5.15	6.1	14	0.0033	7	0.8
	471	21.5	11.25	5.26	6.0	14	0.0024	7	0.8
18-May-19	1576	21.7	10.25	5.19	5.1	14	0.0013	6	0.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.41**	d_{30} = **8.0**	d_{50} = **14**	d_{60} = **19**	C_u = **46**	C_c = **8.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L9-01B	**04/11/2019 1350**	**Poorly-graded gravel (GP)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L10-01B
Lab ID: HAT01-11.1904001-022
Date/Time sampled: 04/11/2019 1030
Test Date: 28-May-19

Initial Dry Weight of Sample (g): 67591.92
Weight Passing #10 (g): 4703.59
Weight Retained #10 (g): 62888.33
Weight of Hydrometer Sample (g): 116.60
Calculated Weight of Sieve Sample (g): 1675.57

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	67591.92	100.00
	2"	50	625.90	625.90	66966.02	99.07
	1.5"	38.1	4975.19	5601.09	61990.83	91.71
	1"	25	16527.60	22128.69	45463.23	67.26
	3/4"	19.0	11389.26	33517.95	34073.97	50.41
	3/8"	9.5	20368.05	53886.00	13705.92	20.28
	4	4.75	6796.82	60682.82	6909.10	10.22
	10	2.00	2205.51	62888.33	4703.59	6.96
-10			(Based on calculated sieve wt.)			
	20	0.85	11.91	1570.88	104.69	6.25
	40	0.425	11.05	1581.93	93.64	5.59
	60	0.250	11.47	1593.40	82.17	4.90
	100	0.150	11.28	1604.68	70.89	4.23
	140	0.106	13.57	1618.25	57.32	3.42
	200	0.075	12.16	1630.41	45.16	2.70
	dry pan		2.52	1632.93	42.64	
	wet pan			42.64	0.00	

d_{10} (mm): 4.5
d_{16} (mm): 7.1
d_{30} (mm): 12

d_{50} (mm): 19
d_{60} (mm): 22
d_{84} (mm): 33

Median Particle Diameter --d_{50} (mm): 19
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 4.9
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.5
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 20

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

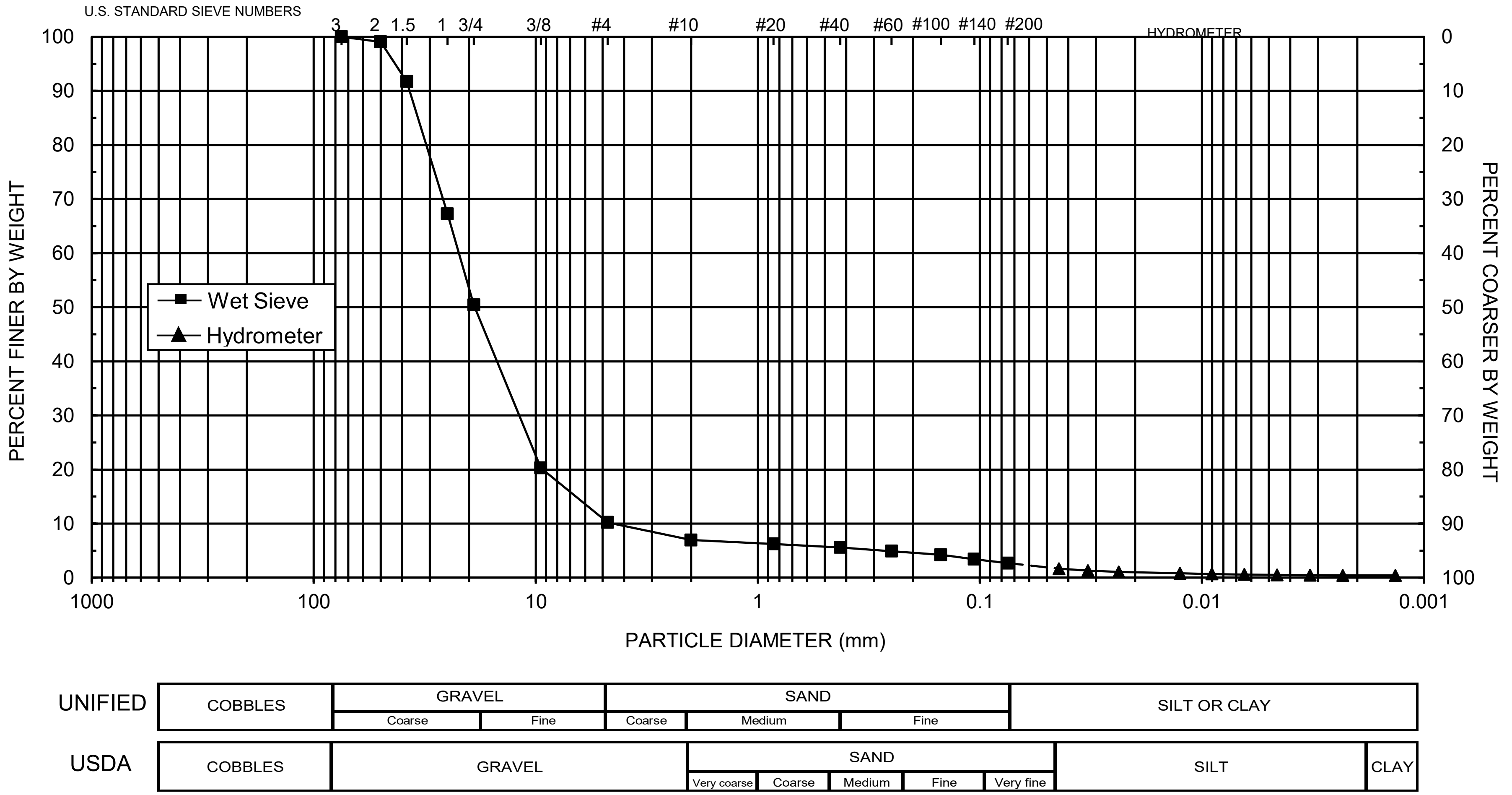
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L10-01B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-022	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1030	*Initial Wt.* (g)*:*	116.60
Test Date:	16-May-19	*Total Sample Wt.* (g)*:*	67591.92
Start Time:	9:00	*Wt. Passing #10* (g)*:*	4703.59

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	33.00	5.43	27.6	10	0.0440	24	1.6
	2	21.0	27.00	5.43	21.6	11	0.0325	18	1.3
	4	21.0	23.00	5.43	17.6	12	0.0237	15	1.0
	15	21.0	19.00	5.43	13.6	13	0.0126	12	0.8
	30	21.0	16.75	5.43	11.3	13	0.0090	10	0.7
	60	21.1	15.00	5.40	9.6	13	0.0064	8	0.6
	120	21.2	14.00	5.36	8.6	14	0.0046	7	0.5
	240	21.4	13.00	5.29	7.7	14	0.0033	7	0.5
	480	21.6	12.00	5.22	6.8	14	0.0023	6	0.4
23-May-19	1428	21.5	12.00	5.26	6.7	14	0.0013	6	0.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **4.5**	d_{30} = **12**	d_{50} = **19**	d_{60} = **22**	C_u = **4.9**	C_c = **1.5**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L10-01B	**04/11/2019 1030**	**Well-graded gravel (GW)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	74418.61
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	8808.18
Sample Number:	L10-02B	*Weight Retained #10 (g):*	65610.43
Lab ID:	HAT01-11.1904001-023	*Weight of Hydrometer Sample (g):*	104.79
Date/Time sampled:	04/11/2019 1130	*Calculated Weight of Sieve Sample (g):*	885.35
Test Date:	23-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	74418.61	100.00
	2"	50	0.00	0.00	74418.61	100.00
	1.5"	38.1	7557.06	7557.06	66861.55	89.85
	1"	25	16446.80	24003.86	50414.75	67.74
	3/4"	19.0	12459.96	36463.82	37954.79	51.00
	3/8"	9.5	16406.78	52870.60	21548.01	28.96
	4	4.75	8776.27	61646.88	12771.73	17.16
	10	2.00	3963.56	65610.43	8808.18	11.84
-10			(Based on calculated sieve wt.)			
	20	0.85	13.89	794.45	90.90	10.27
	40	0.425	11.55	806.00	79.35	8.96
	60	0.250	12.42	818.42	66.93	7.56
	100	0.150	10.65	829.07	56.28	6.36
	140	0.106	12.46	841.53	43.82	4.95
	200	0.075	9.76	851.29	34.06	3.85
	dry pan		3.03	854.32	31.03	
	wet pan			31.03	0.00	

d_{10} (mm): 0.74 d_{50} (mm): 18

d_{16} (mm): 3.9 d_{60} (mm): 22

d_{30} (mm): 9.8 d_{84} (mm): 34

Median Particle Diameter --d_{50} (mm): 18

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 30

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 5.9

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 19

USCS Soil Classification: Poorly-graded gravel (GP)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

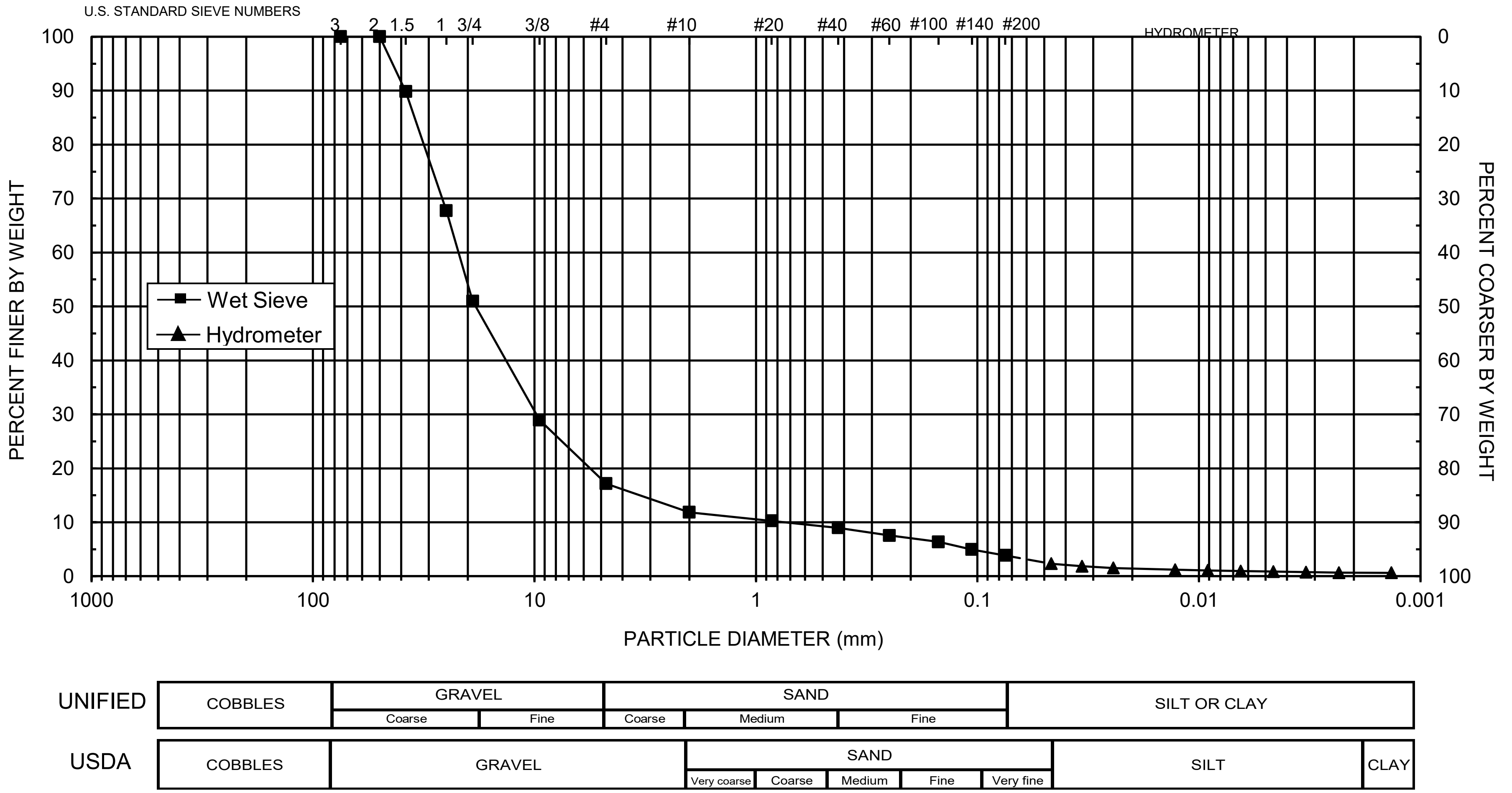
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L10-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-023	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1130	*Initial Wt. (g):*	104.79
Test Date:	16-May-19	*Total Sample Wt. (g):*	74418.61
Start Time:	9:00	*Wt. Passing #10 (g):*	8808.18

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
21-May-19	1	20.6	26.00	5.57	20.4	12	0.0464	19	2.3
	2	20.6	22.00	5.57	16.4	12	0.0337	16	1.9
	4	20.6	19.00	5.57	13.4	13	0.0243	13	1.5
	15	20.6	16.25	5.57	10.7	13	0.0128	10	1.2
	30	20.6	15.00	5.57	9.4	13	0.0091	9	1.1
	60	20.8	14.00	5.50	8.5	14	0.0065	8	1.0
	120	20.9	13.00	5.47	7.5	14	0.0046	7	0.9
	240	21.1	12.00	5.40	6.6	14	0.0033	6	0.7
	480	21.5	11.00	5.26	5.7	14	0.0023	5	0.6
22-May-19	1428	21.0	11.00	5.43	5.6	14	0.0014	5	0.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.74**	d_{30} = **9.8**	d_{50} = **18**	d_{60} = **22**	C_u = **30**	C_c = **5.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L10-02B	**04/11/2019 1130**	**Poorly-graded gravel (GP)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-01B
Lab ID: HAT01-11.1904001-025
Date/Time sampled: 04/11/2019 1510

Test Date: 23-May-19

Initial Dry Weight of Sample (g): 89934.98
Weight Passing #10 (g): 7089.94
Weight Retained #10 (g): 82845.04
Weight of Hydrometer Sample (g): 110.17
Calculated Weight of Sieve Sample (g): 1397.49

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	89934.98	100.00
	2"	50	179.49	179.49	89755.49	99.80
	1.5"	38.1	7318.19	7497.68	82437.30	91.66
	1"	25	22895.06	30392.74	59542.24	66.21
	3/4"	19.0	15072.20	45464.94	44470.04	49.45
	3/8"	9.5	23339.17	68804.11	21130.87	23.50
	4	4.75	10267.14	79071.25	10863.73	12.08
	10	2.00	3773.79	82845.04	7089.94	7.88
-10			(Based on calculated sieve wt.)			
	20	0.85	12.66	1299.98	97.51	6.98
	40	0.425	11.77	1311.75	85.74	6.14
	60	0.250	13.36	1325.11	72.38	5.18
	100	0.150	12.32	1337.43	60.06	4.30
	140	0.106	11.89	1349.32	48.17	3.45
	200	0.075	8.76	1358.08	39.41	2.82
	dry pan		1.82	1359.90	37.59	
	wet pan			37.59	0.00	

d_{10} (mm): 3.1
d_{16} (mm): 6.0
d_{30} (mm): 11
d_{50} (mm): 19
d_{60} (mm): 23
d_{84} (mm): 34

Median Particle Diameter --d_{50} (mm): 19
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.4
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 20

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

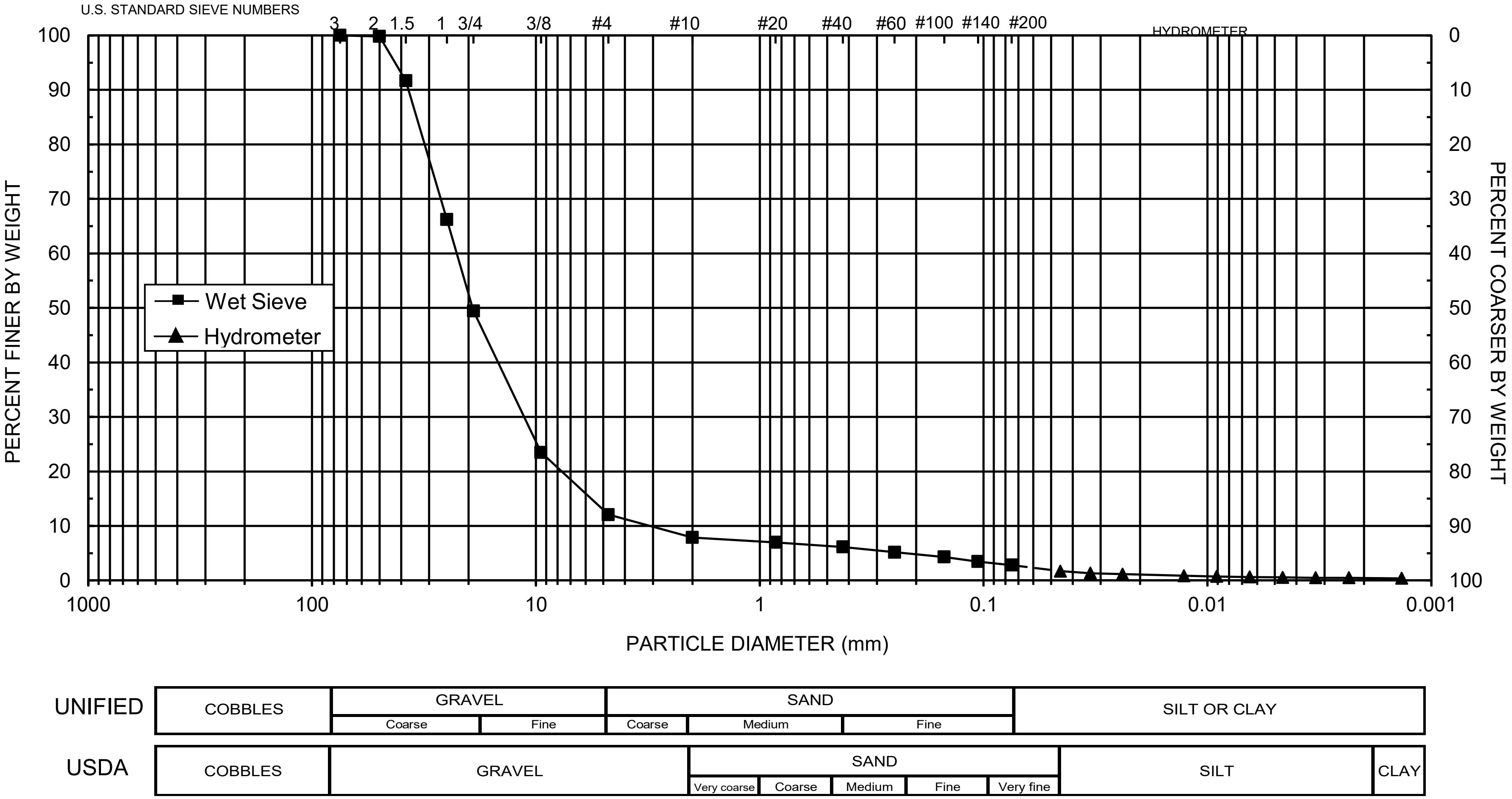
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L11-01B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-025	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1510	*Initial Wt. (g):*	110.17
Test Date:	20-May-19	*Total Sample Wt. (g):*	89934.98
Start Time:	9:06	*Wt. Passing #10 (g):*	7089.94

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
20-May-19	1	21.8	29.00	5.15	23.9	11	0.0454	22	1.7
	2	21.8	23.75	5.15	18.6	12	0.0333	17	1.3
	4	21.8	21.25	5.15	16.1	12	0.0240	15	1.2
	15	21.8	17.00	5.15	11.9	13	0.0127	11	0.8
	30	21.7	15.25	5.19	10.1	13	0.0091	9	0.7
	60	21.7	14.00	5.19	8.8	14	0.0065	8	0.6
	120	21.6	13.00	5.22	7.8	14	0.0046	7	0.6
	240	21.6	12.00	5.22	6.8	14	0.0033	6	0.5
	475	21.5	12.00	5.26	6.7	14	0.0023	6	0.5
21-May-19	1424	20.6	11.00	5.57	5.4	14	0.0014	5	0.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **3.1**	d_{30} = **11**	d_{50} = **19**	d_{60} = **23**	C_u = **7.4**	C_c = **1.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L11-01B	**04/11/2019 1510**	**Well-graded gravel (GW)**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-02B
Lab ID: HAT01-11.1904001-026
Date/Time sampled: 04/11/2019 1545

Test Date: 21-May-19

Initial Dry Weight of Sample (g): 84189.99
Weight Passing #10 (g): 4671.45
Weight Retained #10 (g): 79518.54
Weight of Hydrometer Sample (g): 46.96
Calculated Weight of Sieve Sample (g): 846.32

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	84189.99	100.00
	2"	50	0.00	0.00	84189.99	100.00
	1.5"	38.1	8200.36	8200.36	75989.63	90.26
	1"	25	29261.97	37462.33	46727.66	55.50
	3/4"	19.0	17921.03	55383.36	28806.63	34.22
	3/8"	9.5	17416.76	72800.12	11389.87	13.53
	4	4.75	5096.50	77896.63	6293.37	7.48
	10	2.00	1621.91	79518.54	4671.45	5.55
-10			(Based on calculated sieve wt.)			
	20	0.85	5.65	805.01	41.31	4.88
	40	0.425	8.21	813.22	33.10	3.91
	60	0.250	7.66	820.88	25.44	3.01
	100	0.150	5.71	826.59	19.73	2.33
	140	0.106	4.29	830.88	15.44	1.82
	200	0.075	3.11	833.99	12.33	1.46
	dry pan		0.43	834.42	11.90	
	wet pan			11.90	0.00	

d_{10} (mm): 6.3
d_{16} (mm): 10
d_{30} (mm): 16
d_{50} (mm): 23
d_{60} (mm): 26
d_{84} (mm): 35

Median Particle Diameter --d_{50} (mm): 23
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 4.1
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 23

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L11-02B
Lab ID: HAT01-11.1904001-026
Date/Time sampled: 04/11/2019 1545

Test Date: 13-May-19
Start Time: 9:30

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

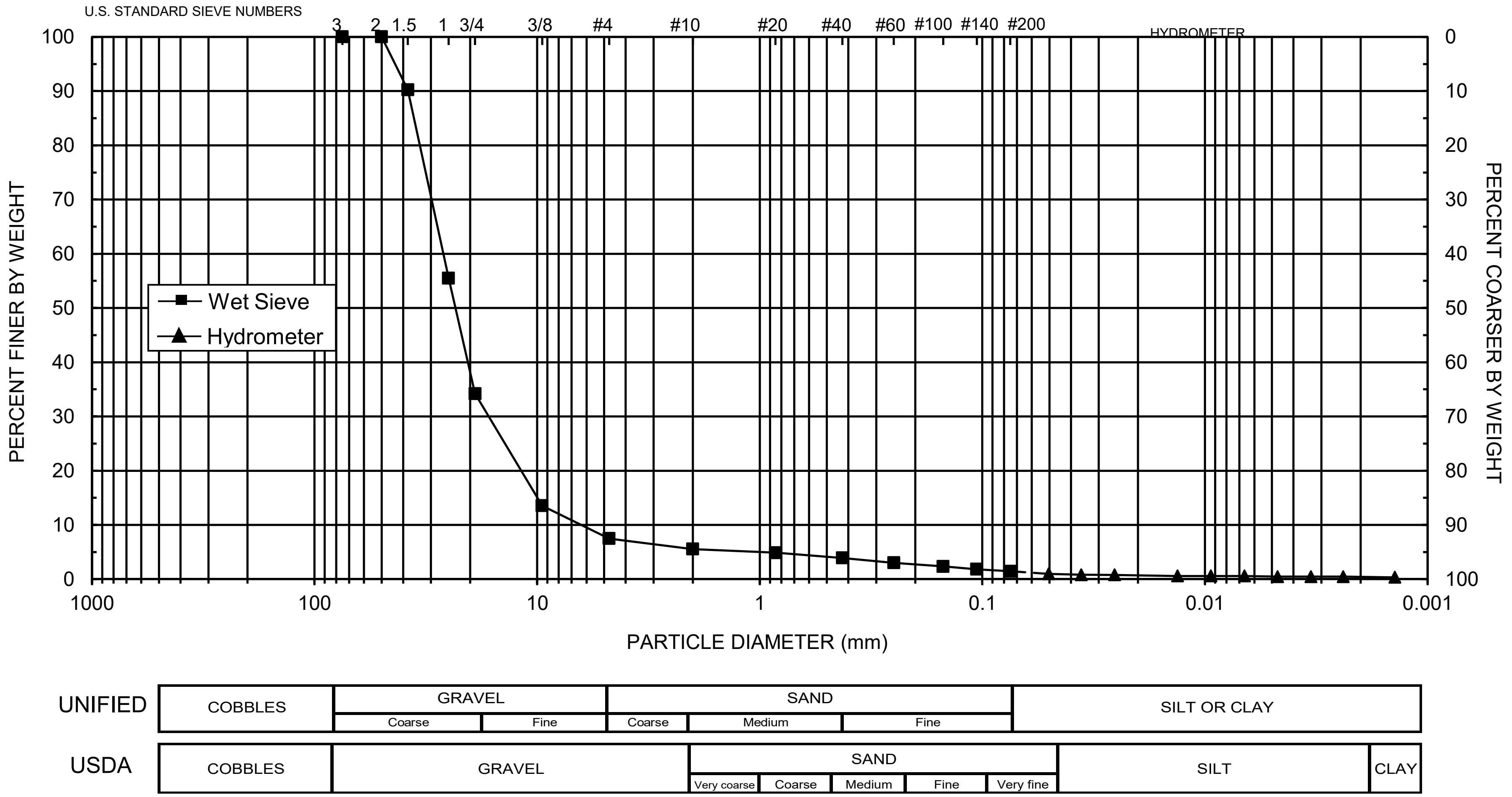
Initial Wt. (g): 46.96
Total Sample Wt. (g): 84189.99
Wt. Passing #10 (g): 4671.45

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
13-May-19	1	21.7	13.50	5.19	8.3	14	0.0503	18	1.0
	2	21.7	12.00	5.19	6.8	14	0.0359	15	0.8
	4	21.7	11.75	5.19	6.6	14	0.0254	14	0.8
	15	21.7	10.00	5.19	4.8	14	0.0133	10	0.6
	30	21.7	10.00	5.19	4.8	14	0.0094	10	0.6
	60	21.9	10.00	5.11	4.9	14	0.0066	10	0.6
	120	21.9	9.00	5.11	3.9	14	0.0047	8	0.5
	240	21.9	9.00	5.11	3.9	14	0.0033	8	0.5
	467	21.9	9.00	5.11	3.9	14	0.0024	8	0.5
14-May-19	1377	21.9	8.00	5.11	2.9	15	0.0014	6	0.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = **6.3**	d_{30} = **16**	d_{50} = **23**	d_{60} = **26**	C_u = **4.1**	C_c = **1.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L11-02B	**04/11/2019 1545**	**Well-graded gravel (GW)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	82359.65
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	6255.86
Sample Number:	L12-01B	*Weight Retained #10 (g):*	76103.80
Lab ID:	HAT01-11.1904001-028	*Weight of Hydrometer Sample (g):*	101.82
Date/Time sampled:	04/12/2019 940	*Calculated Weight of Sieve Sample (g):*	1340.48
Test Date:	23-May-19	*Shape:*	Rounded
		Hardness:	Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	82359.65	100.00
	2"	50	1003.89	1003.89	81355.76	98.78
	1.5"	38.1	7500.38	8504.27	73855.38	89.67
	1"	25	26057.02	34561.29	47798.36	58.04
	3/4"	19.0	22268.14	56829.43	25530.22	31.00
	3/8"	9.5	16564.76	73394.20	8965.46	10.89
	4	4.75	2335.15	75729.35	6630.31	8.05
	10	2.00	374.45	76103.80	6255.86	7.60
-10			(Based on calculated sieve wt.)			
	20	0.85	4.55	1243.21	97.27	7.26
	40	0.425	2.92	1246.13	94.35	7.04
	60	0.250	2.83	1248.96	91.52	6.83
	100	0.150	6.09	1255.05	85.43	6.37
	140	0.106	7.43	1262.48	78.00	5.82
	200	0.075	9.67	1272.15	68.33	5.10
	dry pan		6.43	1278.58	61.90	
	wet pan			61.90	0.00	

d_{10} (mm): 7.7

d_{16} (mm): 11

d_{30} (mm): 18

d_{50} (mm): 23

d_{60} (mm): 26

d_{84} (mm): 35

Median Particle Diameter --d_{50} (mm): 23

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 3.4

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.6

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 23

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L12-01B
Lab ID: HAT01-11.1904001-028
Date/Time sampled: 04/12/2019 940

Test Date: 18-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

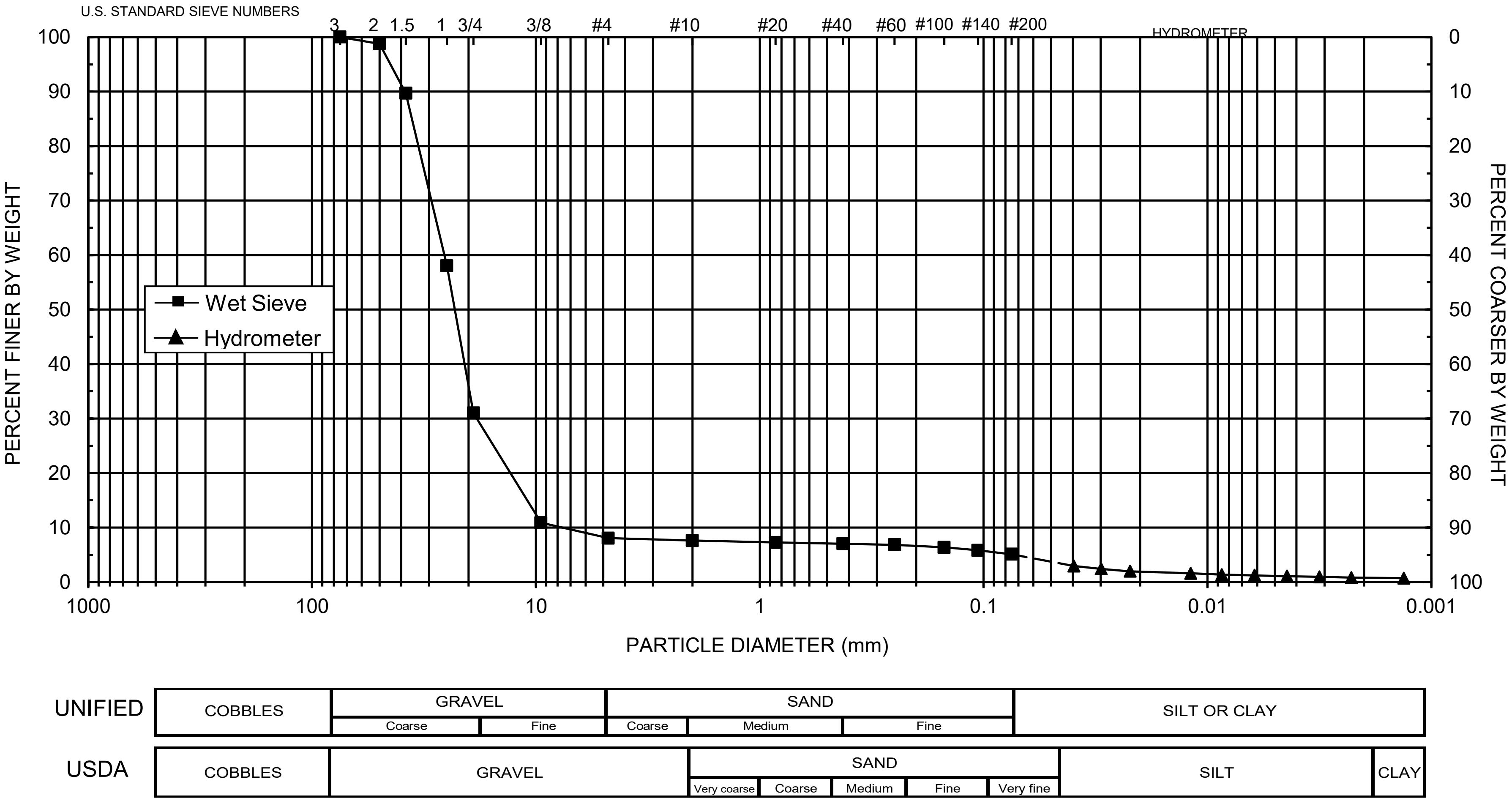
Initial Wt. *(g):* 101.82
Total Sample Wt. *(g):* 82359.65
Wt. Passing #10 *(g):* 6255.86

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
21-May-19	1	20.6	45.00	5.57	39.4	8	0.0395	39	2.9
	2	20.6	38.00	5.57	32.4	10	0.0298	32	2.4
	4	20.6	32.00	5.57	26.4	11	0.0222	26	2.0
	15	20.6	27.00	5.57	21.4	11	0.0119	21	1.6
	30	20.7	23.50	5.54	18.0	12	0.0086	18	1.3
	60	20.8	22.00	5.50	16.5	12	0.0062	16	1.2
	120	20.9	20.00	5.47	14.5	13	0.0044	14	1.1
	240	21.1	18.00	5.40	12.6	13	0.0032	12	0.9
	475	21.5	16.00	5.26	10.7	13	0.0023	11	0.8
22-May-19	1423	21.0	14.75	5.43	9.3	13	0.0013	9	0.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **7.7**	d_{30} = **18**	d_{50} = **23**	d_{60} = **26**	C_u = **3.4**	C_c = **1.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L12-01B	**04/12/2019 940**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-01B
Lab ID: HAT01-11.1904001-029
Date/Time sampled: 04/11/2019 1700

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 79659.35
Weight Passing #10 (g): 6137.73
Weight Retained #10 (g): 73521.62
Weight of Hydrometer Sample (g): 102.42
Calculated Weight of Sieve Sample (g): 1329.27

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	79659.35	100.00
	2"	50	0.00	0.00	79659.35	100.00
	1.5"	38.1	12143.66	12143.66	67515.69	84.76
	1"	25	21424.40	33568.06	46091.29	57.86
	3/4"	19.0	11957.94	45526.00	34133.35	42.85
	3/8"	9.5	17407.06	62933.06	16726.29	21.00
	4	4.75	7602.55	70535.60	9123.75	11.45
	10	2.00	2986.02	73521.62	6137.73	7.70
-10			(Based on calculated sieve wt.)			
	20	0.85	12.23	1239.08	90.19	6.78
	40	0.425	8.28	1247.36	81.91	6.16
	60	0.250	9.09	1256.45	72.82	5.48
	100	0.150	8.88	1265.33	63.94	4.81
	140	0.106	11.82	1277.15	52.12	3.92
	200	0.075	9.40	1286.55	42.72	3.21
	dry pan		2.36	1288.91	40.36	
	wet pan			40.36	0.00	

d_{10} (mm): 3.4
d_{16} (mm): 6.6
d_{30} (mm): 13
d_{50} (mm): 22
d_{60} (mm): 26
d_{84} (mm): 38

Median Particle Diameter --d_{50} (mm): 22
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 7.6
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.9
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 22

USCS Soil Classification: Well-graded gravel (GW)

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-01B
Lab ID: HAT01-11.1904001-029
Date/Time sampled: 04/11/2019 1700

Test Date: 20-May-19
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

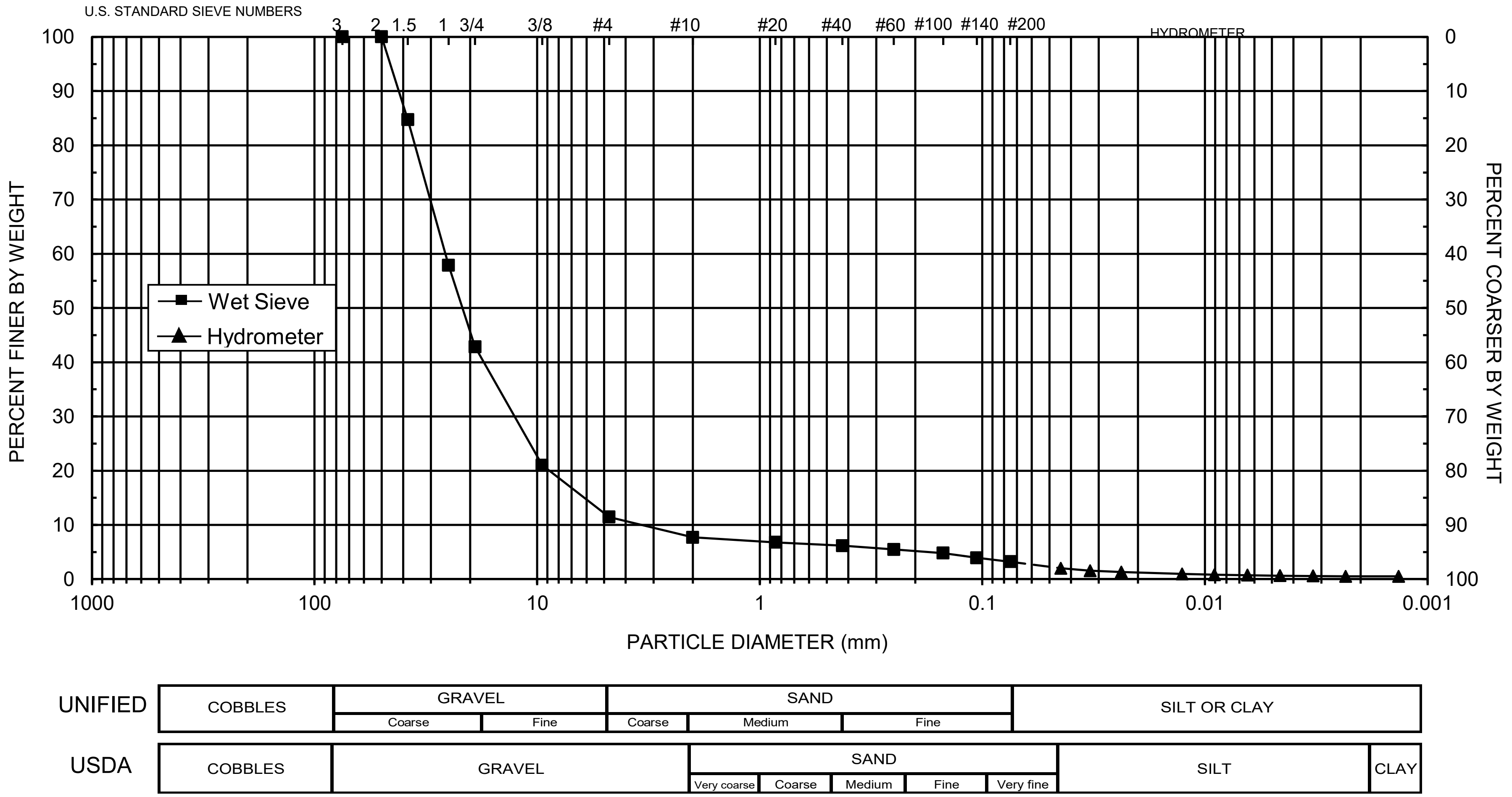
Initial Wt. *(g):* 102.42
Total Sample Wt. *(g):* 79659.35
Wt. Passing #10 *(g):* 6137.73

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	32.00	5.43	26.6	11	0.0444	26	2.0
	2	21.0	26.00	5.43	20.6	12	0.0328	20	1.5
	4	21.0	22.75	5.43	17.3	12	0.0237	17	1.3
	15	21.0	18.00	5.43	12.6	13	0.0126	12	0.9
	30	21.0	16.00	5.43	10.6	13	0.0091	10	0.8
	60	21.1	15.00	5.40	9.6	13	0.0064	9	0.7
	120	21.2	13.75	5.36	8.4	14	0.0046	8	0.6
	240	21.4	13.00	5.29	7.7	14	0.0033	8	0.6
	475	21.6	12.00	5.22	6.8	14	0.0023	7	0.5
23-May-19	1423	21.5	12.00	5.26	6.7	14	0.0013	7	0.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **3.4**	d_{30} = **13**	d_{50} = **22**	d_{60} = **26**	C_u = **7.6**	C_c = **1.9**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L13-01B	**04/11/2019 1700**	**Well-graded gravel (GW)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02B
Lab ID: HAT01-11.1904001-030
Date/Time sampled: 04/12/2019 830
Test Date: 28-May-19

Initial Dry Weight of Sample (g): 81033.00
Weight Passing #10 (g): 14810.79
Weight Retained #10 (g): 66222.22
Weight of Hydrometer Sample (g): 112.12
Calculated Weight of Sieve Sample (g): 613.43

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	81033.00	100.00
	2"	50	0.00	0.00	81033.00	100.00
	1.5"	38.1	7610.11	7610.11	73422.89	90.61
	1"	25	20570.70	28180.81	52852.19	65.22
	3/4"	19.0	9580.56	37761.37	43271.63	53.40
	3/8"	9.5	12563.51	50324.88	30708.13	37.90
	4	4.75	9558.83	59883.71	21149.30	26.10
	10	2.00	6338.51	66222.22	14810.79	18.28
-10			(Based on calculated sieve wt.)			
	20	0.85	19.05	520.36	93.07	15.17
	40	0.425	13.86	534.22	79.21	12.91
	60	0.250	11.97	546.19	67.24	10.96
	100	0.150	10.58	556.77	56.66	9.24
	140	0.106	13.09	569.86	43.57	7.10
	200	0.075	9.46	579.32	34.11	5.56
	dry pan		2.09	581.41	32.02	
	wet pan			32.02	0.00	

d_{10} (mm): 0.19
d_{16} (mm): 1.1
d_{30} (mm): 6.0

d_{50} (mm): 16
d_{60} (mm): 22
d_{84} (mm): 34

Median Particle Diameter --d_{50} (mm): 16
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 116
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 8.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 17

USCS Soil Classification: Classification by ASTM 2487 requires Atterberg test

†Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

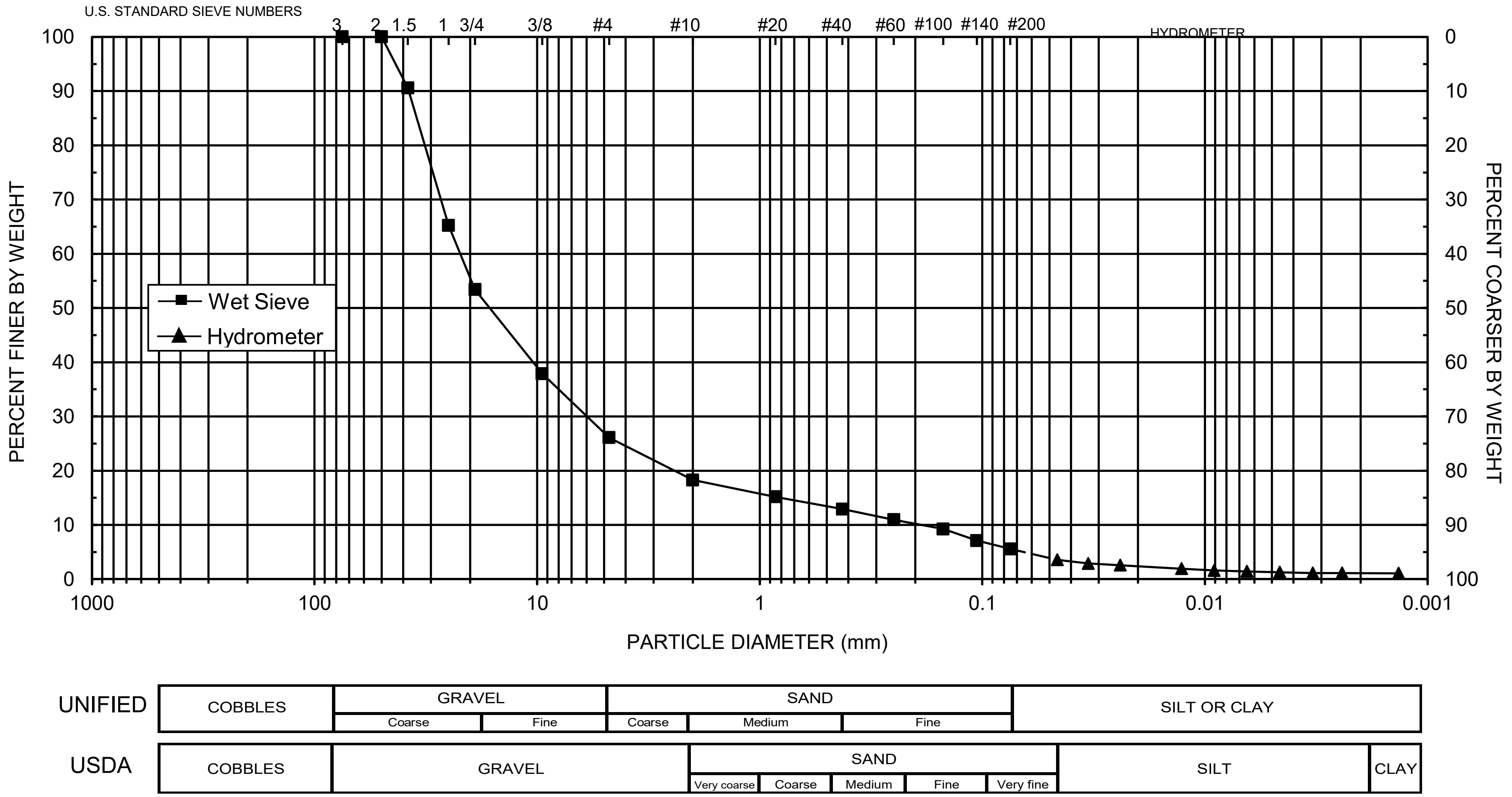
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L13-02B	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-030	*Assumed particle density:*	2.65
Date/Time sampled:	04/12/2019 830	*Initial Wt. (g):*	112.12
Test Date:	20-May-18	*Total Sample Wt. (g):*	81033.00
Start Time:	9:06	*Wt. Passing #10 (g):*	14810.79

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	27.00	5.22	21.8	11	0.0460	19	3.6
	2	21.6	23.00	5.22	17.8	12	0.0334	16	2.9
	4	21.6	21.00	5.22	15.8	12	0.0240	14	2.6
	15	21.6	17.00	5.22	11.8	13	0.0127	11	1.9
	30	21.6	15.00	5.22	9.8	13	0.0091	9	1.6
	60	21.6	14.00	5.22	8.8	14	0.0065	8	1.4
	120	21.8	13.00	5.15	7.9	14	0.0046	7	1.3
	240	21.8	12.00	5.15	6.9	14	0.0033	6	1.1
	440	21.8	12.00	5.15	6.9	14	0.0024	6	1.1
24-May-19	1423	21.8	11.75	5.15	6.6	14	0.0013	6	1.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.19**	d_{30} = **6.0**	d_{50} = **16**	d_{60} = **22**	C_u = **116**	C_c = **8.6**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L13-02B	**04/12/2019 830**	**Classification by ASTM 2487 requires Atterberg test**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RB
Lab ID: HAT01-11.1904001-075
Date/Time sampled: 04/12/2019 835

Test Date: 31-May-19

Initial Dry Weight of Sample (g): 1057.41
Weight Passing #10 (g): 893.74
Weight Retained #10 (g): 163.67
Weight of Hydrometer Sample (g): 103.01
Calculated Weight of Sieve Sample (g): 121.87

Shape: Angular
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1057.41	100.00
	2"	50	0.00	0.00	1057.41	100.00
	1.5"	38.1	0.00	0.00	1057.41	100.00
	1"	25	0.00	0.00	1057.41	100.00
	3/4"	19.0	0.00	0.00	1057.41	100.00
	3/8"	9.5	93.96	93.96	963.45	91.11
	4	4.75	42.16	136.12	921.29	87.13
	10	2.00	27.55	163.67	893.74	84.52
-10			(Based on calculated sieve wt.)			
	20	0.85	8.29	27.15	94.72	77.72
	40	0.425	3.61	30.76	91.11	74.76
	60	0.250	3.08	33.84	88.03	72.23
	100	0.150	6.92	40.76	81.11	66.55
	140	0.106	7.10	47.86	74.01	60.73
	200	0.075	6.45	54.31	67.56	55.43
	dry pan		4.92	59.23	62.64	
	wet pan			62.64	0.00	

d_{10} (mm): 0.0033
d_{16} (mm): 0.0082
d_{30} (mm): 0.028
d_{50} (mm): 0.061
d_{60} (mm): 0.10
d_{84} (mm): 1.9

Median Particle Diameter --d_{50} (mm): 0.061
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 30
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.4
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.66

Classification of fines (visual method): ML

USCS Soil Classification: Sandy silt s(ML)

† Greater than 10% of sample is coarse material

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RB
Lab ID: HAT01-11.1904001-075
Date/Time sampled: 04/12/2019 835

Test Date: 29-May-19
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

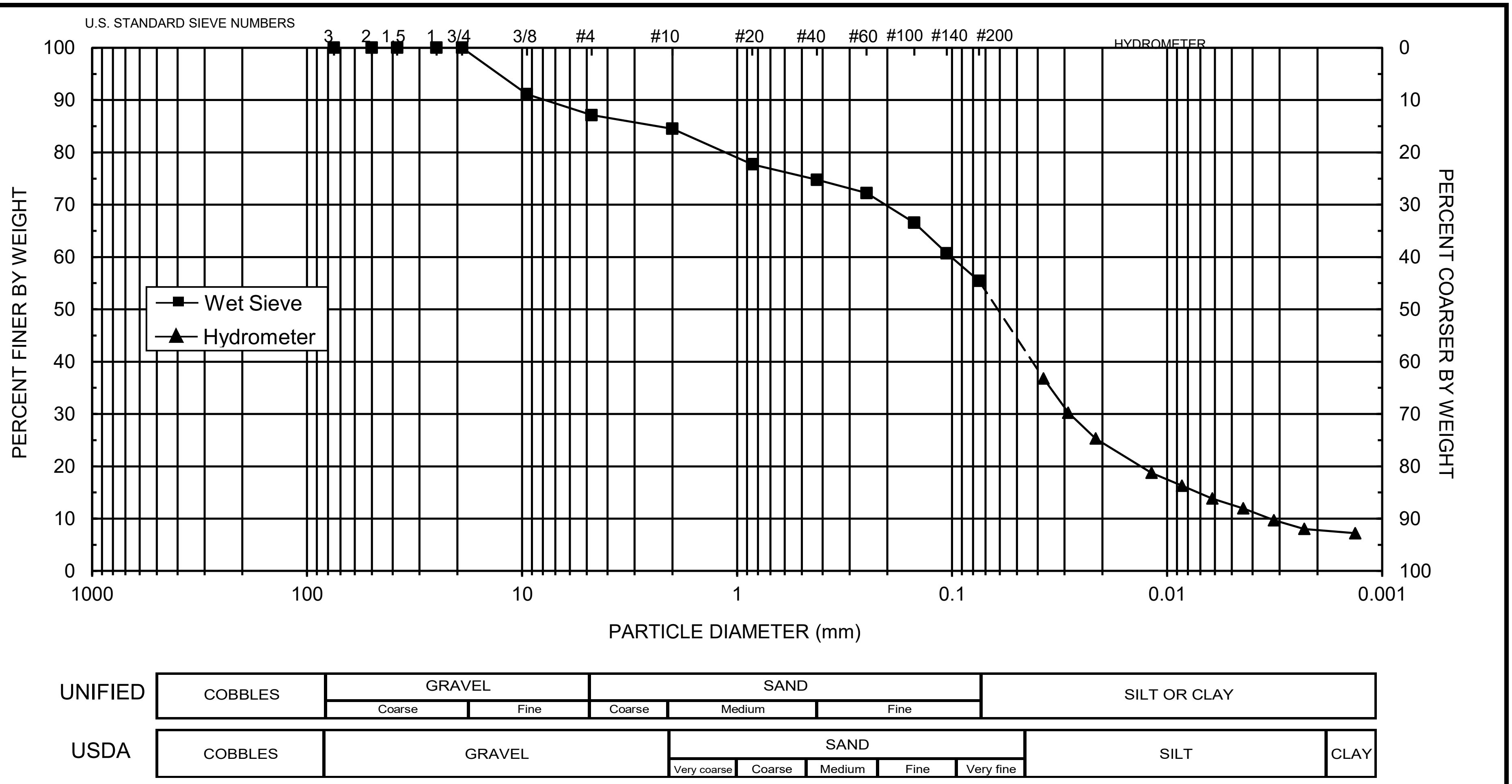
Initial Wt. (g): 103.01
Total Sample Wt. (g): 1057.41
Wt. Passing #10 (g): 893.74

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	50.00	5.15	44.9	8	0.0376	44	36.8
	2	21.8	42.00	5.15	36.9	9	0.0288	36	30.2
	4	21.8	36.00	5.15	30.9	10	0.0215	30	25.3
	15	21.8	28.00	5.15	22.9	11	0.0118	22	18.7
	30	21.8	25.00	5.15	19.9	12	0.0085	19	16.3
	60	21.8	22.00	5.15	16.9	12	0.0062	16	13.8
	120	21.7	19.75	5.19	14.6	13	0.0044	14	11.9
	240	21.7	17.00	5.19	11.8	13	0.0032	11	9.7
	470	21.6	15.00	5.22	9.8	13	0.0023	9	8.0
30-May-19	1418	21.6	14.00	5.22	8.8	14	0.0013	9	7.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0033**	d_{30} = **0.028**	d_{50} = **0.061**	d_{60} = **0.10**	C_u = **30**	C_c = **2.4**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L13-02RB	**04/12/2019 835**	**Sandy silt s(ML)**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RM
Lab ID: HAT01-11.1904001-063
Date/Time sampled: 04/12/2019 850

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1130.16
Weight Passing #10 (g): 899.50
Weight Retained #10 (g): 230.66
Weight of Hydrometer Sample (g): 100.01
Calculated Weight of Sieve Sample (g): 125.66

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1130.16	100.00
	2"	50	0.00	0.00	1130.16	100.00
	1.5"	38.1	0.00	0.00	1130.16	100.00
	1"	25	0.00	0.00	1130.16	100.00
	3/4"	19.0	18.30	18.30	1111.86	98.38
	3/8"	9.5	99.07	117.37	1012.79	89.61
	4	4.75	73.88	191.25	938.91	83.08
	10	2.00	39.41	230.66	899.50	79.59
-10			(Based on calculated sieve wt.)			
	20	0.85	5.18	30.83	94.83	75.47
	40	0.425	2.95	33.78	91.88	73.12
	60	0.250	2.72	36.50	89.16	70.96
	100	0.150	7.13	43.63	82.03	65.28
	140	0.106	7.56	51.19	74.47	59.27
	200	0.075	7.38	58.57	67.09	53.39
	dry pan		2.00	60.57	65.09	
	wet pan			65.09	0.00	

d_{10} (mm): 0.0036
d_{16} (mm): 0.0088
d_{30} (mm): 0.030
d_{50} (mm): 0.066
d_{60} (mm): 0.11
d_{84} (mm): 5.2

Median Particle Diameter --d_{50} (mm): 0.066
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 31
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.3
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 1.8

Classification of fines (visual method): ML

USCS Soil Classification: Sandy silt with gravel s(ML)g

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

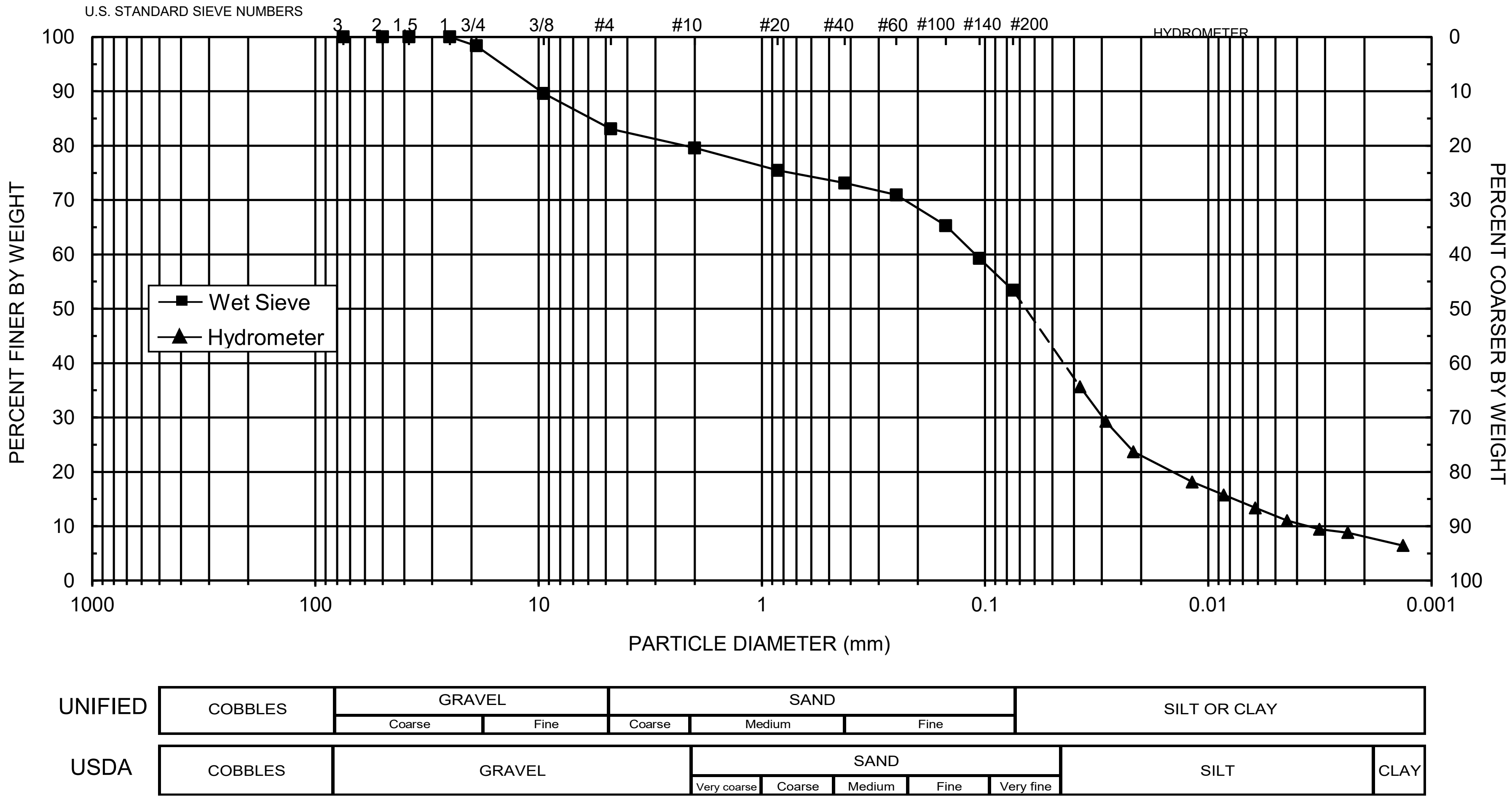
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L13-02RM	*Dispersant*:*	$(NaPO_3)_6$
Lab ID:	HAT01-11.1904001-063	*Assumed particle density:*	2.65
Date/Time sampled:	04/12/2019 850	*Initial Wt. (g):*	100.01
Test Date:	23-May-19	*Total Sample Wt. (g):*	1130.16
Start Time:	9:12	*Wt. Passing #10 (g):*	899.50

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	50.00	5.22	44.8	8	0.0375	45	35.6
	2	21.6	42.00	5.22	36.8	9	0.0288	37	29.3
	4	21.6	35.00	5.22	29.8	10	0.0216	30	23.7
	15	21.6	28.00	5.22	22.8	11	0.0118	23	18.1
	30	21.6	25.00	5.22	19.8	12	0.0085	20	15.7
	60	21.6	22.00	5.22	16.8	12	0.0062	17	13.4
	120	21.8	19.00	5.15	13.9	13	0.0044	14	11.0
	240	21.8	17.00	5.15	11.9	13	0.0032	12	9.4
	436	22.4	16.00	4.93	11.1	13	0.0024	11	8.8
24-May-19	1418	21.8	13.25	5.15	8.1	14	0.0013	8	6.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: L. Thurgood
Checked by: J. Hines



d_{10} = **0.0036**	d_{30} = **0.030**	d_{50} = **0.066**	d_{60} = **0.11**	C_u = **31**	C_c = **2.3**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L13-02RM	**04/12/2019 850**	**Sandy silt with gravel s(ML)g**	

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RT
Lab ID: HAT01-11.1904001-051
Date/Time sampled: 04/12/2019 900

Test Date: 28-May-19

Initial Dry Weight of Sample (g): 1801.93
Weight Passing #10 (g): 1308.64
Weight Retained #10 (g): 493.29
Weight of Hydrometer Sample (g): 98.69
Calculated Weight of Sieve Sample (g): 135.89

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1801.93	100.00
	2"	50	0.00	0.00	1801.93	100.00
	1.5"	38.1	161.08	161.08	1640.85	91.06
	1"	25	0.00	161.08	1640.85	91.06
	3/4"	19.0	85.75	246.83	1555.10	86.30
	3/8"	9.5	109.94	356.77	1445.16	80.20
	4	4.75	80.42	437.19	1364.74	75.74
	10	2.00	56.10	493.29	1308.64	72.62
-10			(Based on calculated sieve wt.)			
	20	0.85	4.53	41.73	94.16	69.29
	40	0.425	2.65	44.38	91.51	67.34
	60	0.250	2.64	47.02	88.87	65.40
	100	0.150	7.21	54.23	81.66	60.09
	140	0.106	7.74	61.97	73.92	54.40
	200	0.075	6.91	68.88	67.01	49.31
	dry pan		2.05	70.93	64.96	
	wet pan			64.96	0.00	

d_{10} (mm): 0.0035
d_{16} (mm): 0.0096
d_{30} (mm): 0.034
d_{50} (mm): 0.079
d_{60} (mm): 0.15
d_{84} (mm): 15

Median Particle Diameter --d_{50} (mm): 0.079
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 43
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.2
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 5.0

Classification of fines (visual method): ML

USCS Soil Classification: Silty sand with gravel (SM)g

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Newcomer
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RT
Lab ID: HAT01-11.1904001-051
Date/Time sampled: 04/12/2019 900

Test Date: 22-May-19
Start Time: 9:24

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

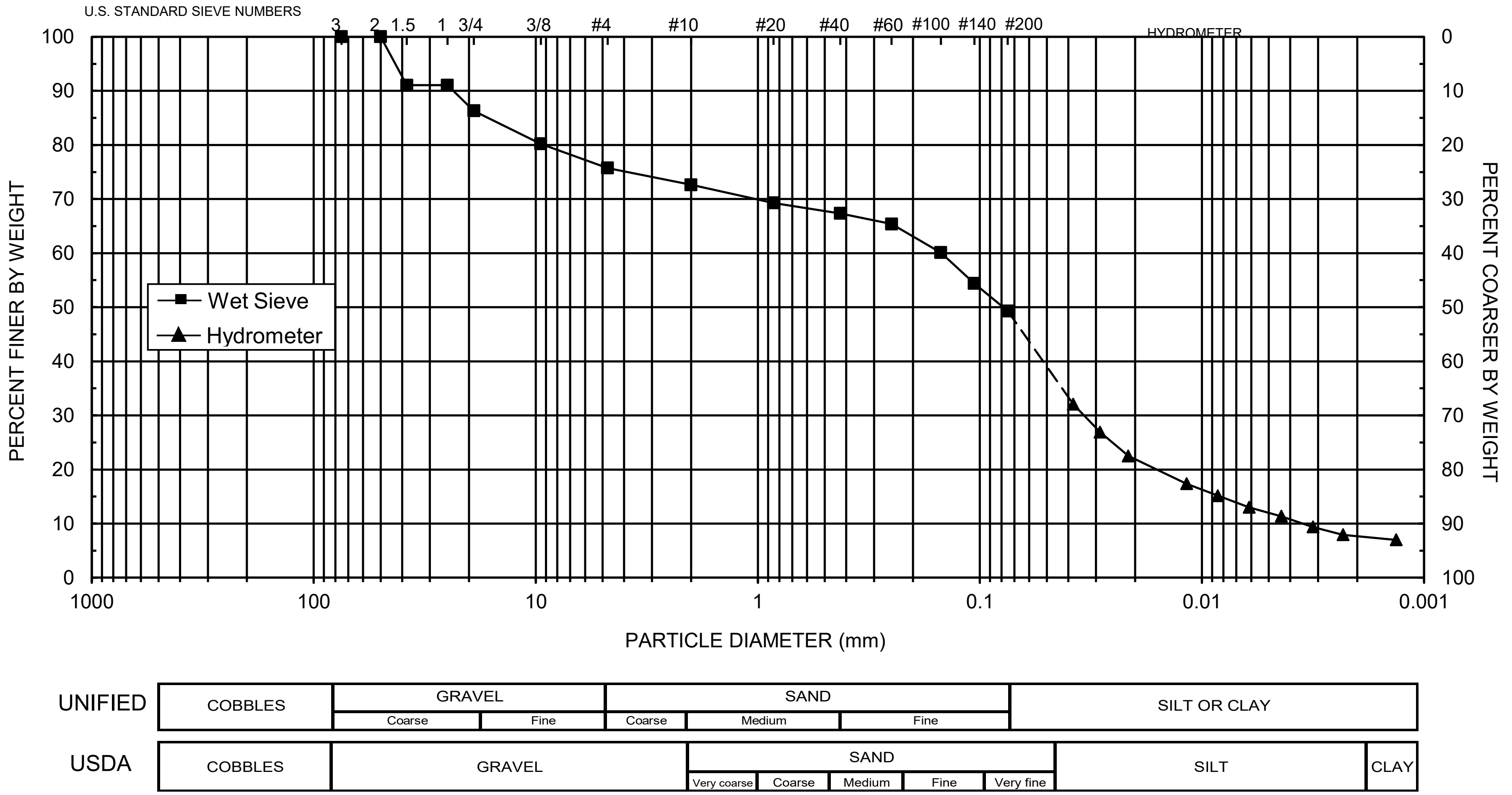
Initial Wt. *(g):* 98.69
Total Sample Wt. *(g):* 1801.93
Wt. Passing #10 *(g):* 1308.64

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	49.00	5.43	43.6	8	0.0380	44	32.1
	2	21.0	42.00	5.43	36.6	9	0.0288	37	26.9
	4	21.0	36.00	5.43	30.6	10	0.0215	31	22.5
	15	21.1	29.00	5.40	23.6	11	0.0117	24	17.4
	30	21.1	26.00	5.40	20.6	12	0.0085	21	15.2
	60	21.2	23.00	5.36	17.6	12	0.0061	18	13.0
	120	21.3	20.75	5.33	15.4	12	0.0044	16	11.3
	240	21.5	18.00	5.26	12.7	13	0.0032	13	9.4
	460	21.6	16.00	5.22	10.8	13	0.0023	11	7.9
23-May-19	1408	21.5	14.75	5.26	9.5	13	0.0013	10	7.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.0035**	d_{30} = **0.034**	d_{50} = **0.079**	d_{60} = **0.15**	C_u = **43**	C_c = **2.2**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L13-02RT	**04/12/2019 900**	**Silty sand with gravel (SM)g**	

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Navarro	*Initial Dry Weight of Sample (g):*	1083.41
Job Number:	DB19.1089.00	*Weight Passing #10 (g):*	1079.60
Sample Number:	L-compW	*Weight Retained #10 (g):*	3.81
Lab ID:	HAT01-11.1904001-080	*Weight of Hydrometer Sample (g):*	102.55
Date/Time sampled:	04/16/2019 1050	*Calculated Weight of Sieve Sample (g):*	102.91
Test Date:	4-Jun-19	*Shape:*	Angular
		Hardness:	Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1083.41	100.00
	2"	50	0.00	0.00	1083.41	100.00
	1.5"	38.1	0.00	0.00	1083.41	100.00
	1"	25	0.00	0.00	1083.41	100.00
	3/4"	19.0	0.00	0.00	1083.41	100.00
	3/8"	9.5	0.61	0.61	1082.80	99.94
	4	4.75	1.52	2.13	1081.28	99.80
	10	2.00	1.68	3.81	1079.60	99.65
-10			(Based on calculated sieve wt.)			
	20	0.85	0.30	0.66	102.25	99.36
	40	0.425	0.42	1.08	101.83	98.95
	60	0.250	0.53	1.61	101.30	98.43
	100	0.150	1.37	2.98	99.93	97.10
	140	0.106	4.30	7.28	95.63	92.92
	200	0.075	11.94	19.22	83.69	81.32
	dry pan		11.09	30.31	72.60	
	wet pan			72.60	0.00	

d_{10} (mm):	0.013	d_{50} (mm):	0.048
d_{16} (mm):	0.024	d_{60} (mm):	0.056
d_{30} (mm):	0.035	d_{84} (mm):	0.081

Median Particle Diameter --d_{50} (mm): 0.048

Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 4.3

Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.7

Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.051

Classification of fines (visual method): ML

USCS Soil Classification: Silt with sand (ML)s

Laboratory analysis by: A. Baldridge/A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L-compW
Lab ID: HAT01-11.1904001-080
Date/Time sampled: 04/16/2019 1050

Test Date: 29-May-19
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

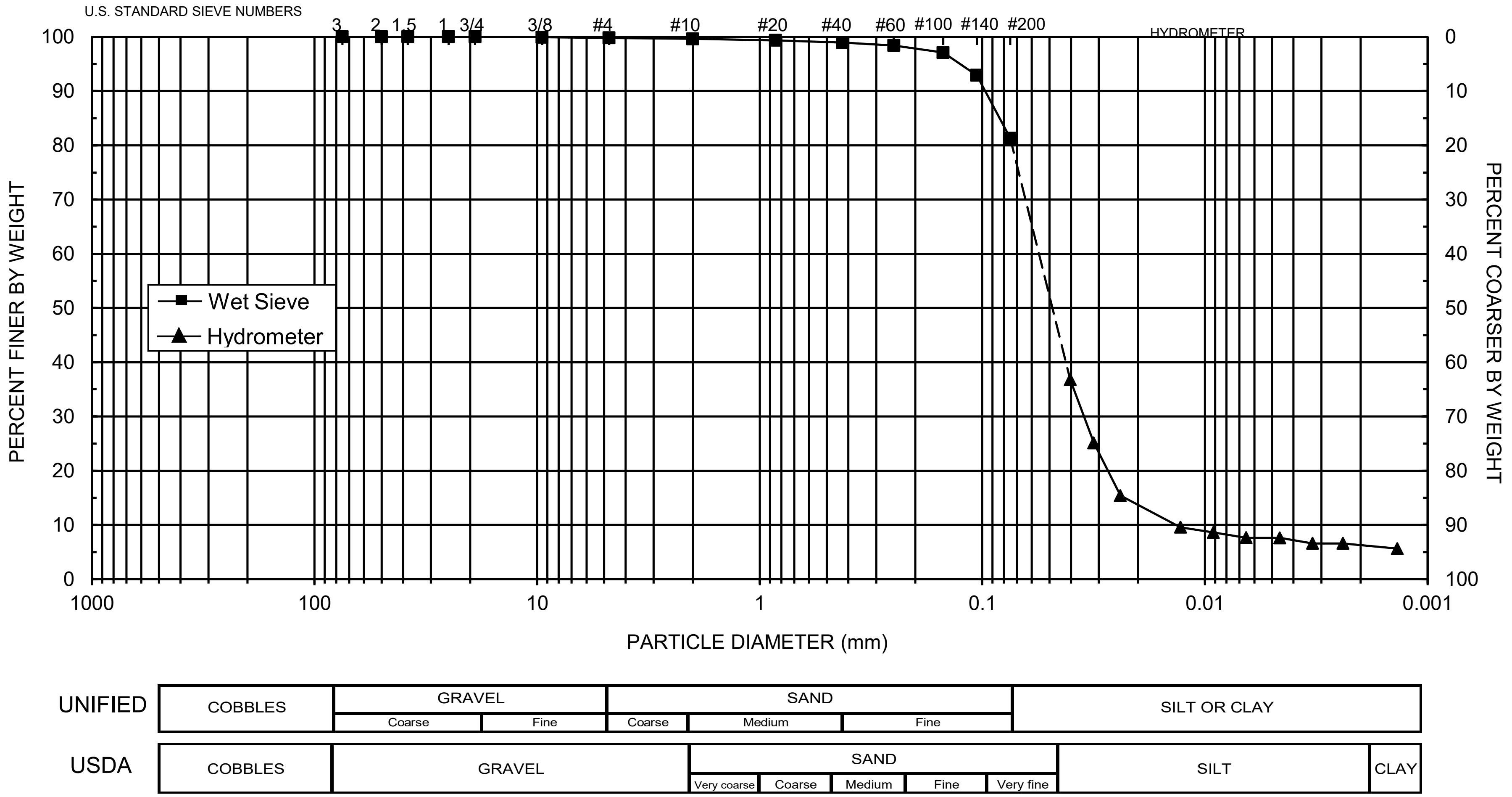
Initial Wt. *(g):* 102.55
Total Sample Wt. *(g):* 1083.41
Wt. Passing #10 *(g):* 1079.60

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	43.00	5.15	37.9	9	0.0403	37	36.8
	2	21.8	31.00	5.15	25.9	11	0.0316	25	25.1
	4	21.8	21.00	5.15	15.9	12	0.0240	15	15.4
	15	21.8	15.00	5.15	9.9	13	0.0129	10	9.6
	30	21.8	14.00	5.15	8.9	14	0.0092	9	8.6
	60	21.8	13.00	5.15	7.9	14	0.0065	8	7.6
	120	21.7	13.00	5.19	7.8	14	0.0046	8	7.6
	240	21.6	12.00	5.22	6.8	14	0.0033	7	6.6
	450	21.6	12.00	5.22	6.8	14	0.0024	7	6.6
30-May-19	1398	21.6	11.00	5.22	5.8	14	0.0014	6	5.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



d_{10} = **0.013**	d_{30} = **0.035**	d_{50} = **0.048**	d_{60} = **0.056**	C_u = **4.3**	C_c = **1.7**

SAMPLE NUMBER	DATE/TIME SAMPLED	USCS CLASSIFICATION	
L-compW	**04/16/2019 1050**	**Silt with sand (ML)s**	

Daniel B. Stephens & Associates, Inc.

Percent Dispersion by Double Hydrometer

Summary of Percent Dispersion by Double Hydrometer

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the “A” Line[1]	Dispersiveness Classification
L3-01RB	HAT01-11.1904001-065	5.4	8.3	65	No	Dispersive
L3-01RM	HAT01-11.1904001-053	8.2	7.3	100	No	Dispersive
L3-01RT	HAT01-11.1904001-038	8.0	8.0	100	No	Dispersive
L3-02RB	HAT01-11.1904001-066	3.4	6.0	57	No	Dispersive
L3-02RM	HAT01-11.1904001-054	7.1	7.2	100	No	Dispersive
L3-02RT	HAT01-11.1904001-039	7.0	7.1	100	No	Dispersive
L3-03RB	HAT01-11.1904001-067	4.8	6.6	73	No	Dispersive
L3-03RM	HAT01-11.1904001-055	7.5	7.2	100	No	Dispersive
L3-03RT	HAT01-11.1904001-040	6.6	7.2	100	No	Dispersive
L5-01RB	HAT01-11.1904001-068	1.4	5.9	24	No	Nondispersive
L5-01RM	HAT01-11.1904001-056	6.0	7.0	100	No	Dispersive
L5-01RT	HAT01-11.1904001-041	5.7	6.9	100	No	Dispersive
L5-02RB	HAT01-11.1904001-069	4.7	7.4	64	No	Dispersive
L5-02RM	HAT01-11.1904001-057	7.8	8.1	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the “A” line, and more than 12% of the soil fraction is finer than 2-µm when dispersant is used.

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L5-02RT	HAT01-11.1904001-042	7.4	7.7	100	No	Dispersive
L5-03RB	HAT01-11.1904001-070	8.7	7.7	100	No	Dispersive
L5-03RM	HAT01-11.1904001-058	5.8	7.4	78	No	Dispersive
L5-03RT	HAT01-11.1904001-043	7.7	7.2	100	No	Dispersive
L5-11RB	HAT01-11.1904001-108	7.6	8.6	100	No	Dispersive
L5-11RM	HAT01-11.1904001-109	7.0	7.3	100	No	Dispersive
L5-11RT	HAT01-11.1904001-110	6.4	7.2	100	No	Dispersive
L5-21RB	HAT01-11.1904001-104	7.4	8.6	100	No	Dispersive
L5-21RM	HAT01-11.1904001-105	7.3	7.9	100	No	Dispersive
L5-21RT	HAT01-11.1904001-106	6.8	6.9	100	No	Dispersive
L5-31RB	HAT01-11.1904001-100	8.1	8.2	100	No	Dispersive
L5-31RM	HAT01-11.1904001-101	7.9	8.0	100	No	Dispersive
L5-31RT	HAT01-11.1904001-102	6.5	7.5	100	No	Dispersive
L5-41RB	HAT01-11.1904001-096	7.8	8.1	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L5-41RM	HAT01-11.1904001-097	7.2	7.4	100	No	Dispersive
L5-41RT	HAT01-11.1904001-098	6.4	7.3	100	No	Dispersive
L5-51RB	HAT01-11.1904001-092	6.3	7.6	100	No	Dispersive
L5-51RM	HAT01-11.1904001-093	6.6	7.1	100	No	Dispersive
L5-51RT	HAT01-11.1904001-094	6.1	7.1	100	No	Dispersive
L5-61RB	HAT01-11.1904001-088	7.1	6.9	100	No	Dispersive
L5-61RM	HAT01-11.1904001-089	6.4	6.4	100	No	Dispersive
L5-61RT	HAT01-11.1904001-090	6.2	7.1	100	No	Dispersive
L5-01A-RB	HAT01-11.1904001-085	7.4	7.2	100	No	Dispersive
L5-01A-RU	HAT01-11.1904001-086	7.4	7.2	100	No	Dispersive
L8-01RB	HAT01-11.1904001-071	7.5	7.2	100	No	Dispersive
L8-01RM	HAT01-11.1904001-059	7.0	7.9	100	No	Dispersive
L8-01RT	HAT01-11.1904001-047	8.4	7.8	100	No	Dispersive
L8-02RB	HAT01-11.1904001-072	8.9	7.6	100	No	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Percent Dispersion by Double Hydrometer (Continued)

Sample Number	Lab ID	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L8-02RM	HAT01-11.1904001-060	5.8	6.1	100	No	Dispersive
L8-02RT	HAT01-11.1904001-048	8.2	8.4	100	No	Dispersive
L8-03RB	HAT01-11.1904001-073	8.2	7.5	100	No	Dispersive
L8-03RM	HAT01-11.1904001-061	7.3	7.9	100	No	Dispersive
L8-03RT	HAT01-11.1904001-049	7.5	6.5	100	No	Dispersive
L13-02RB	HAT01-11.1904001-075	6.2	7.8	79	No	Dispersive
L13-02RM	HAT01-11.1904001-063	6.2	8.0	78	No	Dispersive
L13-02RT	HAT01-11.1904001-051	5.2	7.6	68	No	Dispersive

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[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer

* In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

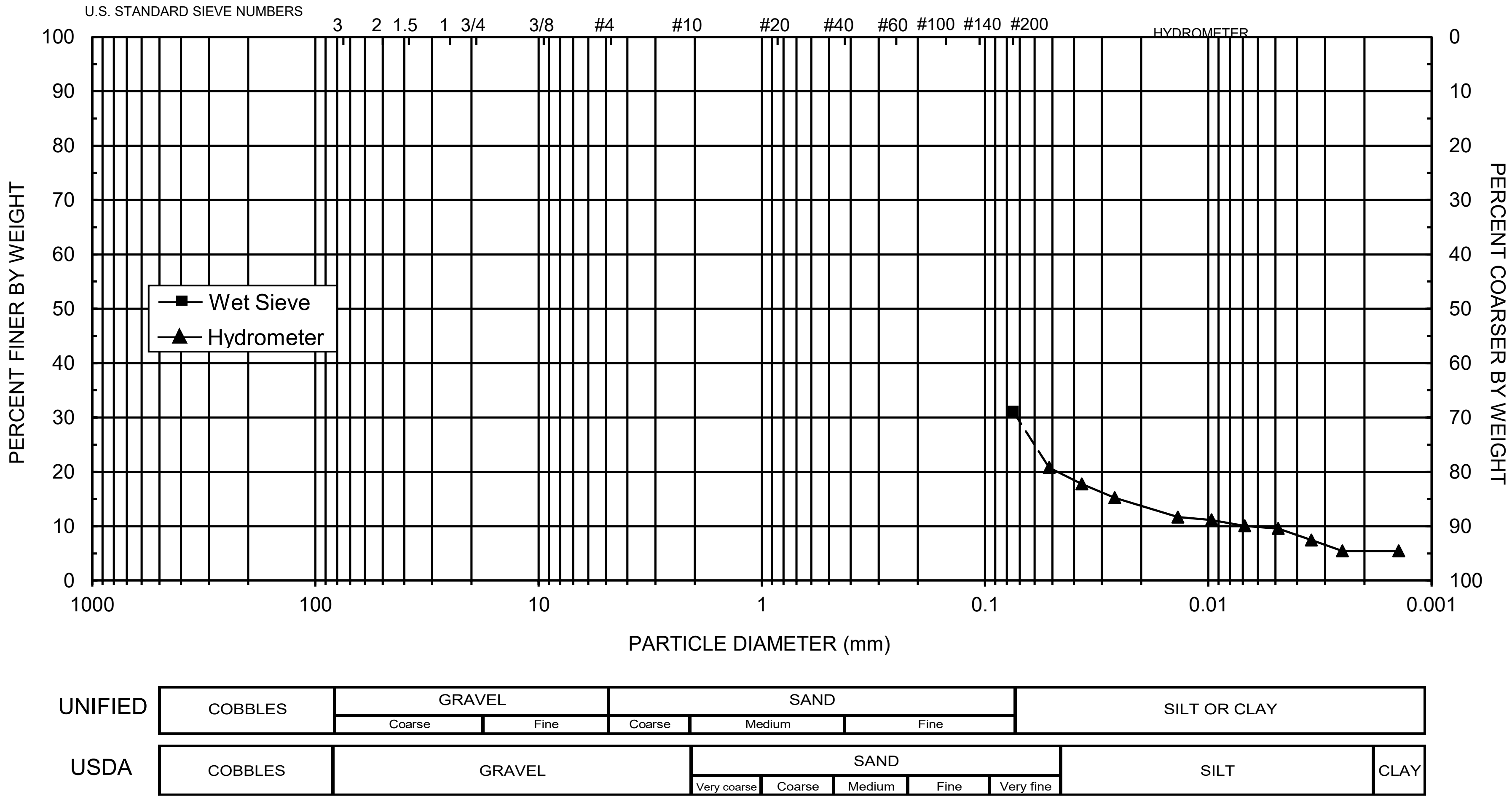
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-01RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-065 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1440	*Initial Wt. (g):*	47.49
Test Date:	24-May-19	*Total Sample Wt. (g):*	1447.10
Start Time:	9:06	*Wt. Passing #10 (g):*	1394.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	9.50	-0.75	10.3	14	0.0516	22	20.8
	2	21.8	8.00	-0.75	8.8	15	0.0368	18	17.8
	4	21.8	6.75	-0.75	7.5	15	0.0262	16	15.2
	15	21.8	5.00	-0.75	5.8	15	0.0137	12	11.7
	30	21.8	4.75	-0.75	5.5	15	0.0097	12	11.2
	60	21.7	4.25	-0.71	5.0	15	0.0069	10	10.1
	120	21.7	4.00	-0.71	4.7	15	0.0049	10	9.6
	240	21.6	3.00	-0.68	3.7	15	0.0035	8	7.5
	461	21.6	2.00	-0.68	2.7	16	0.0025	6	5.4
25-May-19	1474	21.6	2.00	-0.68	2.7	16	0.0014	6	5.4

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-01RB (No Dispersant)	**04/09/2019 1440**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RM (No Dispersant)
Lab ID: HAT01-11.1904001-053 (No Dispersant)
Date/Time sampled: 04/09/2019 1450

Test Date: 7-Jun-19
Start Time: 9:18

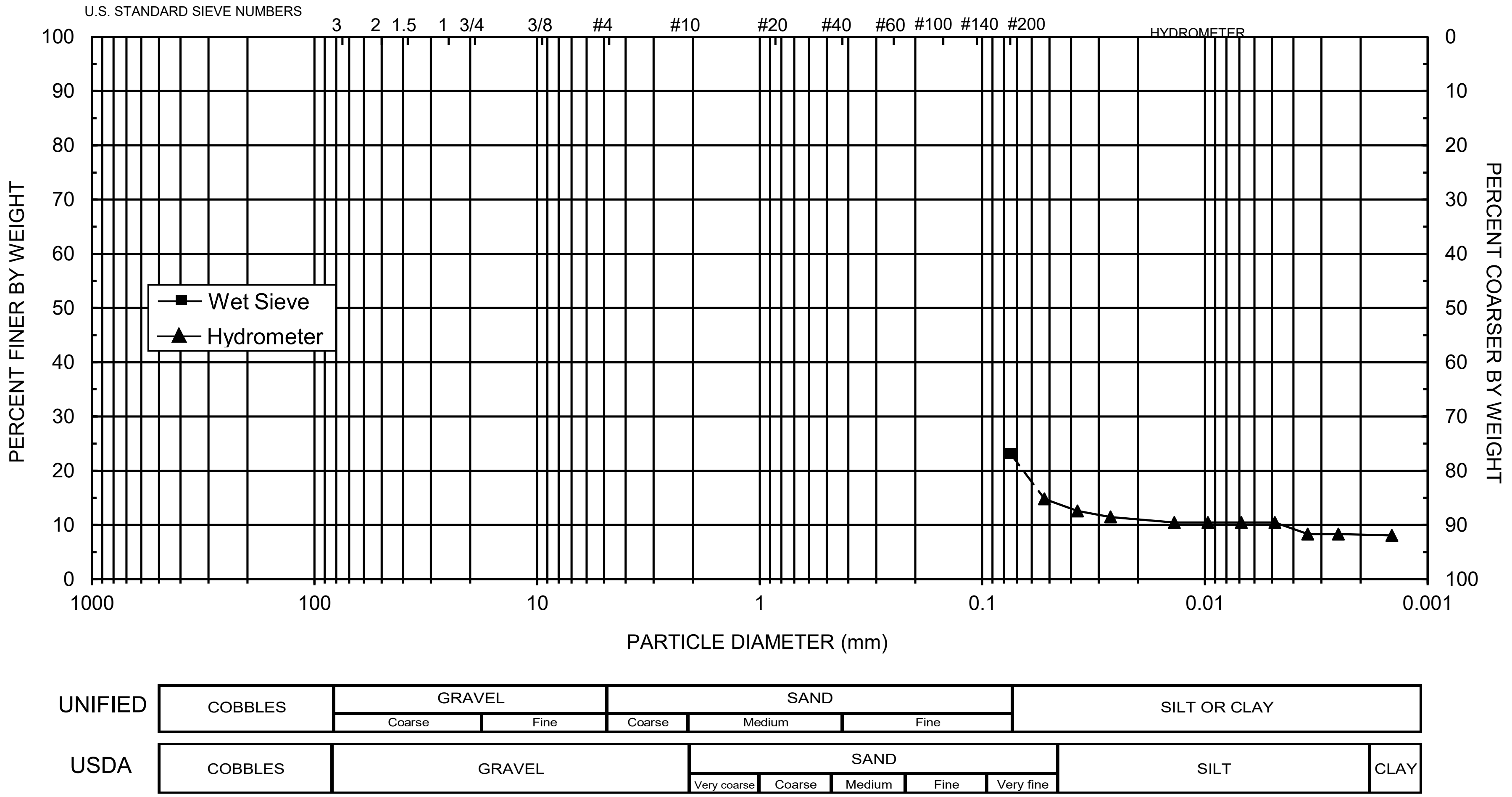
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g)*:* 44.07
Total Sample Wt. (g)*:* 1394.63
Wt. Passing #10 (g)*:* 1359.55

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.6	6.00	-0.68	6.7	15	0.0526	15	14.8
	2	21.6	5.00	-0.68	5.7	15	0.0374	13	12.6
	4	21.6	4.50	-0.68	5.2	15	0.0265	12	11.5
	15	21.7	4.00	-0.71	4.7	15	0.0137	11	10.4
	30	21.7	4.00	-0.71	4.7	15	0.0097	11	10.4
	60	21.7	4.00	-0.71	4.7	15	0.0069	11	10.4
	120	21.7	4.00	-0.71	4.7	15	0.0049	11	10.4
	240	21.8	3.00	-0.75	3.8	15	0.0034	9	8.3
	451	21.8	3.00	-0.75	3.8	15	0.0025	9	8.3
8-Jun-19	1365	21.5	3.00	-0.64	3.6	15	0.0014	8	8.1

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-01RM (No Dispersant)	**04/09/2019 1450**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RT (No Dispersant)
Lab ID: HAT01-11.1904001-038 (No Dispersant)
Date/Time sampled: 04/09/2019 1500

Test Date: 5-Jun-19
Start Time: 9:06

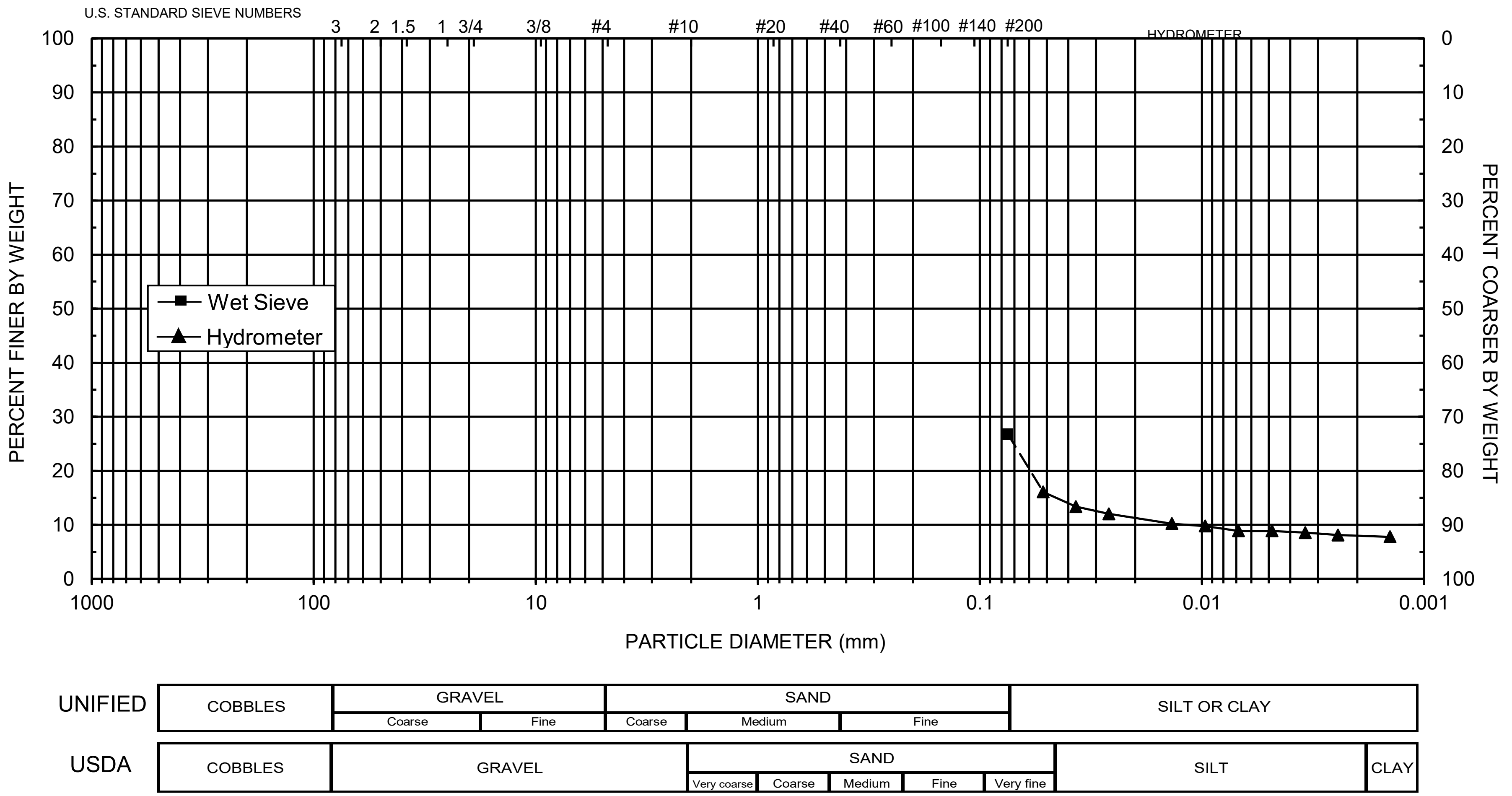
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 54.78
Total Sample Wt. (g): 1719.16
Wt. Passing #10 (g): 1694.67

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	8.25	-0.68	8.9	14	0.0518	16	16.1
	2	21.6	6.75	-0.68	7.4	15	0.0370	14	13.4
	4	21.6	6.00	-0.68	6.7	15	0.0262	12	12.0
	15	21.6	5.00	-0.68	5.7	15	0.0136	10	10.2
	30	21.6	4.75	-0.68	5.4	15	0.0096	10	9.8
	60	21.6	4.25	-0.68	4.9	15	0.0068	9	8.9
	120	21.6	4.25	-0.68	4.9	15	0.0048	9	8.9
	240	21.8	4.00	-0.75	4.8	15	0.0034	9	8.5
	476	21.8	3.75	-0.75	4.5	15	0.0024	8	8.1
6-Jun-19	1397	21.3	3.75	-0.57	4.3	15	0.0014	8	7.8

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-01RT (No Dispersant)	**04/09/2019 1500**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RB (No Dispersant)
Lab ID: HAT01-11.1904001-066 (No Dispersant)
Date/Time sampled: 04/09/2019 1100

Test Date: 24-May-19
Start Time: 9:18

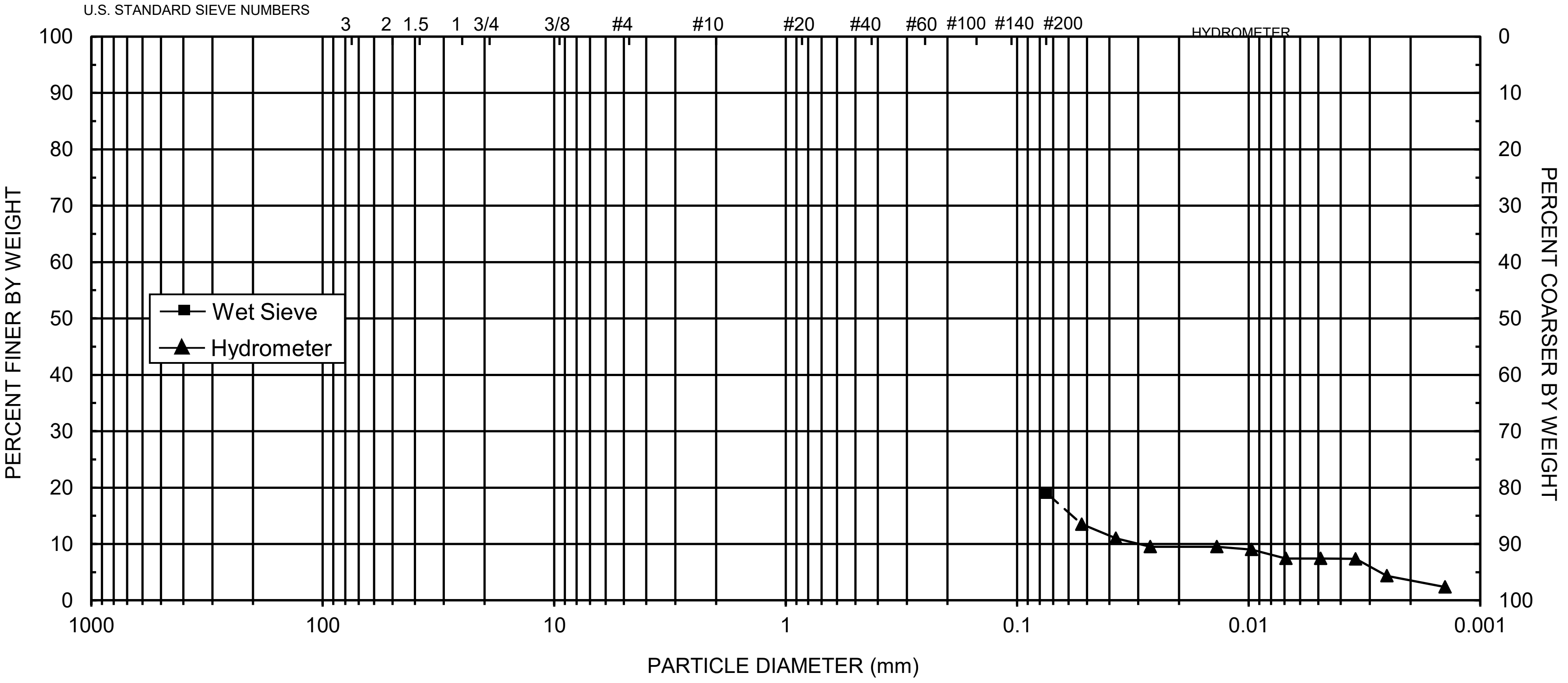
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 48.55
Total Sample Wt. (g): 1935.23
Wt. Passing #10 (g): 1881.17

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	6.00	-0.75	6.8	15	0.0526	14	13.5
	2	21.8	4.75	-0.75	5.5	15	0.0374	11	11.0
	4	21.8	4.00	-0.75	4.8	15	0.0266	10	9.5
	15	21.8	4.00	-0.75	4.8	15	0.0137	10	9.5
	30	21.8	3.75	-0.75	4.5	15	0.0097	9	9.0
	60	21.7	3.00	-0.71	3.7	15	0.0069	8	7.4
	120	21.7	3.00	-0.71	3.7	15	0.0049	8	7.4
	240	21.6	3.00	-0.68	3.7	15	0.0035	8	7.4
	454	21.6	1.50	-0.68	2.2	16	0.0025	4	4.4
25-May-19	1463	21.6	0.50	-0.68	1.2	16	0.0014	2	2.4

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED

COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

USDA

COBBLES	GRAVEL	SAND					SILT	CLAY
		Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L3-02RB (No Dispersant)	**04/09/2019 1100**

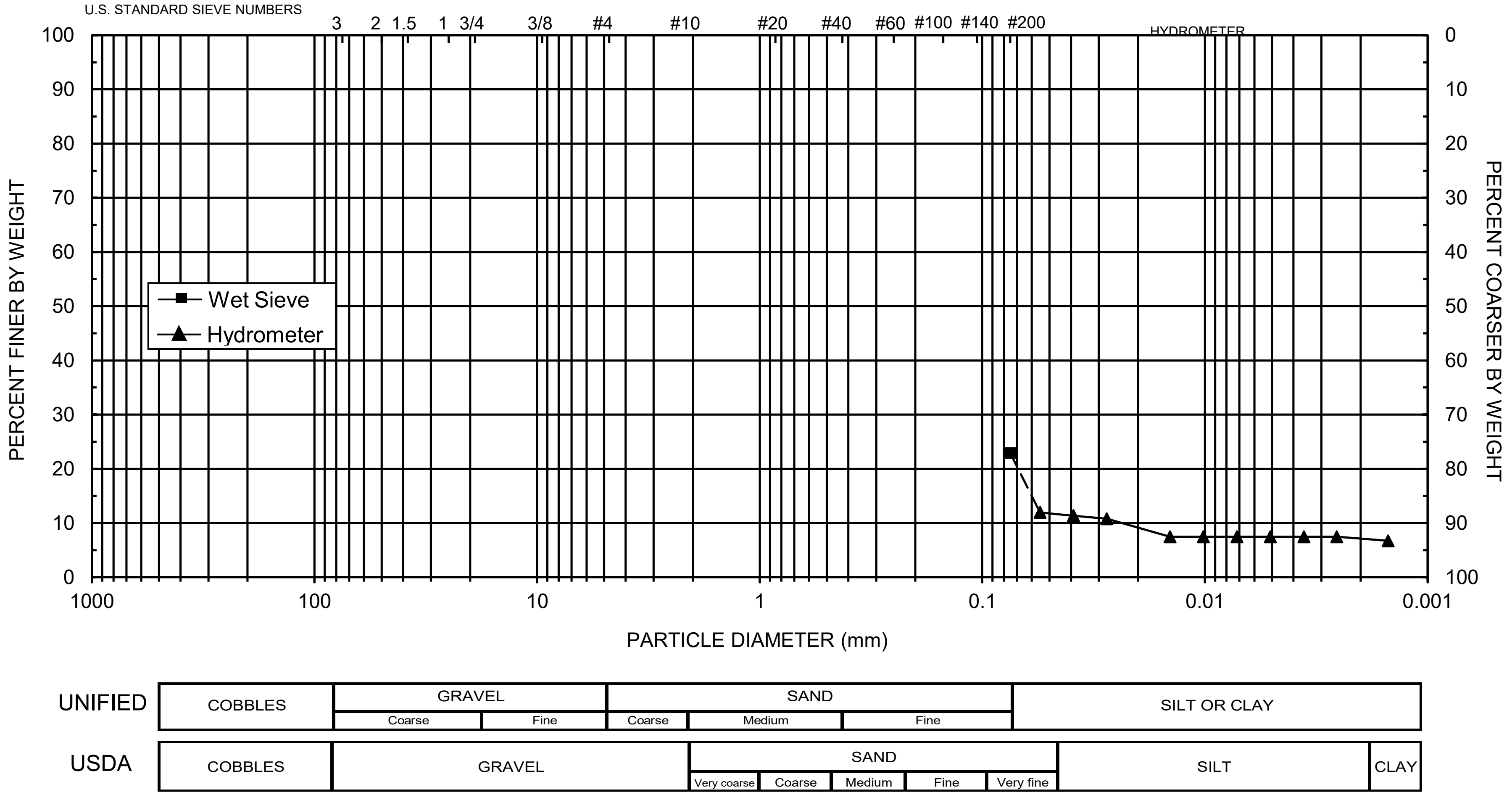
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L3-02RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-054 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1045	*Initial Wt. (g):*	42.40
Test Date:	7-Jun-19	*Total Sample Wt. (g):*	1716.95
Start Time:	9:06	*Wt. Passing #10 (g):*	1690.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.5	5.00	-0.14	5.1	16	0.0550	12	11.9
	2	21.5	4.75	-0.14	4.9	16	0.0390	12	11.4
	4	21.5	4.50	-0.14	4.6	16	0.0276	11	10.8
	15	21.7	3.00	-0.21	3.2	17	0.0144	8	7.5
	30	21.7	3.00	-0.21	3.2	17	0.0102	8	7.5
	60	21.7	3.00	-0.21	3.2	17	0.0072	8	7.5
	120	21.7	3.00	-0.21	3.2	17	0.0051	8	7.5
	240	21.7	3.00	-0.21	3.2	17	0.0036	8	7.5
	474	21.7	3.00	-0.21	3.2	17	0.0026	8	7.5
8-Jun-19	1377	21.5	2.75	-0.14	2.9	17	0.0015	7	6.7

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-02RM (No Dispersant)	**04/09/2019 1045**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

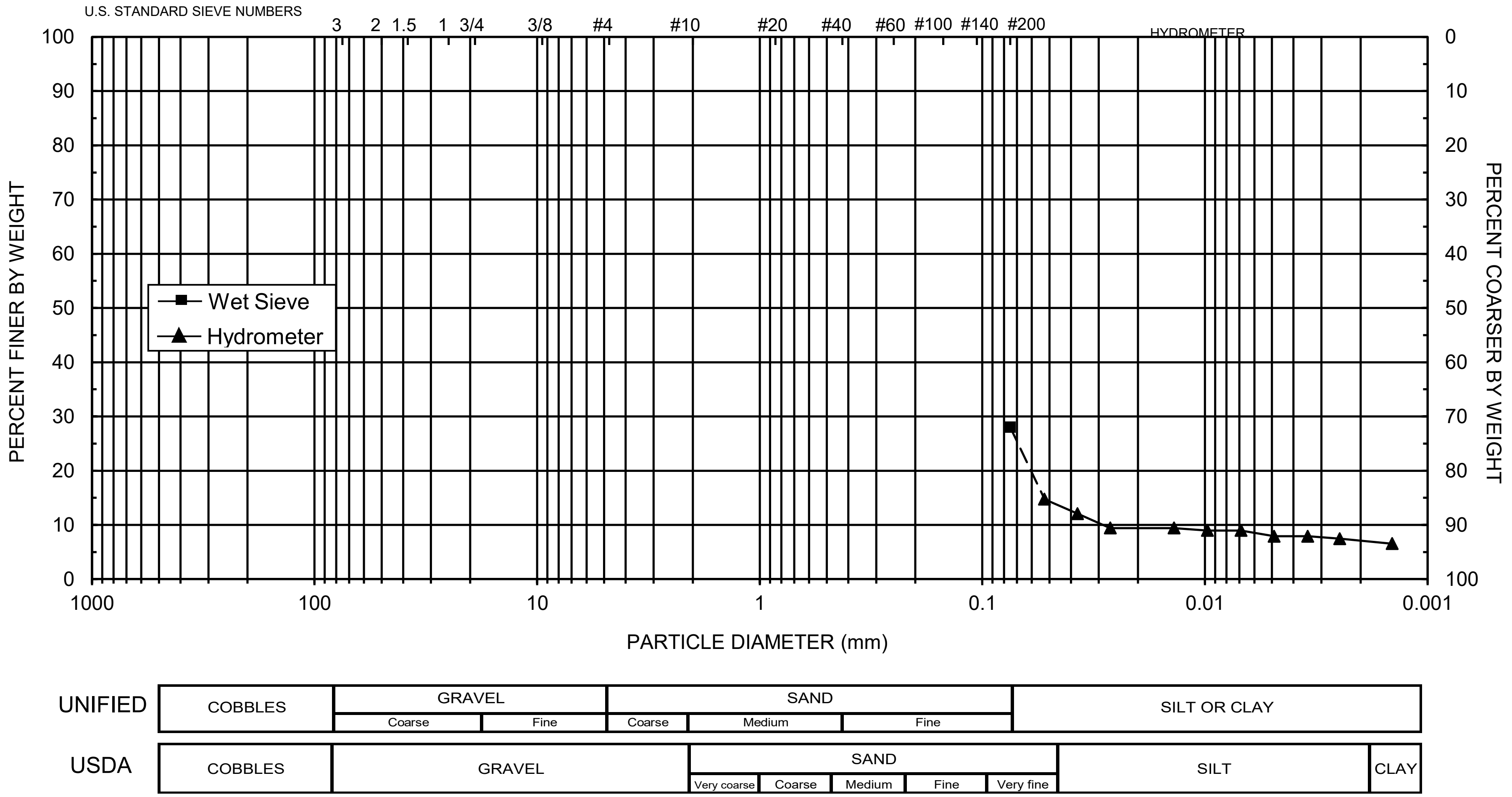
Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RT (No Dispersant)
Lab ID:	HAT01-11.1904001-039 (No Dispersant)
Date/Time sampled:	04/09/2019 1000
Test Date:	5-Jun-19
Start Time:	9:18

Type of Water Used:	DISTILLED
Reaction with H_2O_2*:*	NA
Dispersant:	None
Assumed particle density:	2.65
Initial Wt. (g)*:*	45.94
Total Sample Wt. (g)*:*	1733.41
Wt. Passing #10 (g)*:*	1693.95

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	6.25	-0.68	6.9	15	0.0525	15	14.7
	2	21.6	5.00	-0.68	5.7	15	0.0374	12	12.1
	4	21.6	3.75	-0.68	4.4	15	0.0266	10	9.4
	15	21.6	3.75	-0.68	4.4	15	0.0137	10	9.4
	30	21.7	3.50	-0.71	4.2	15	0.0097	9	9.0
	60	21.7	3.50	-0.71	4.2	15	0.0069	9	9.0
	120	21.7	3.00	-0.71	3.7	15	0.0049	8	7.9
	240	21.7	3.00	-0.71	3.7	15	0.0035	8	7.9
	466	21.8	2.75	-0.75	3.5	15	0.0025	8	7.4
6-Jun-19	1387	21.3	2.50	-0.57	3.1	15	0.0014	7	6.5

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-02RT (No Dispersant)	**04/09/2019 1000**

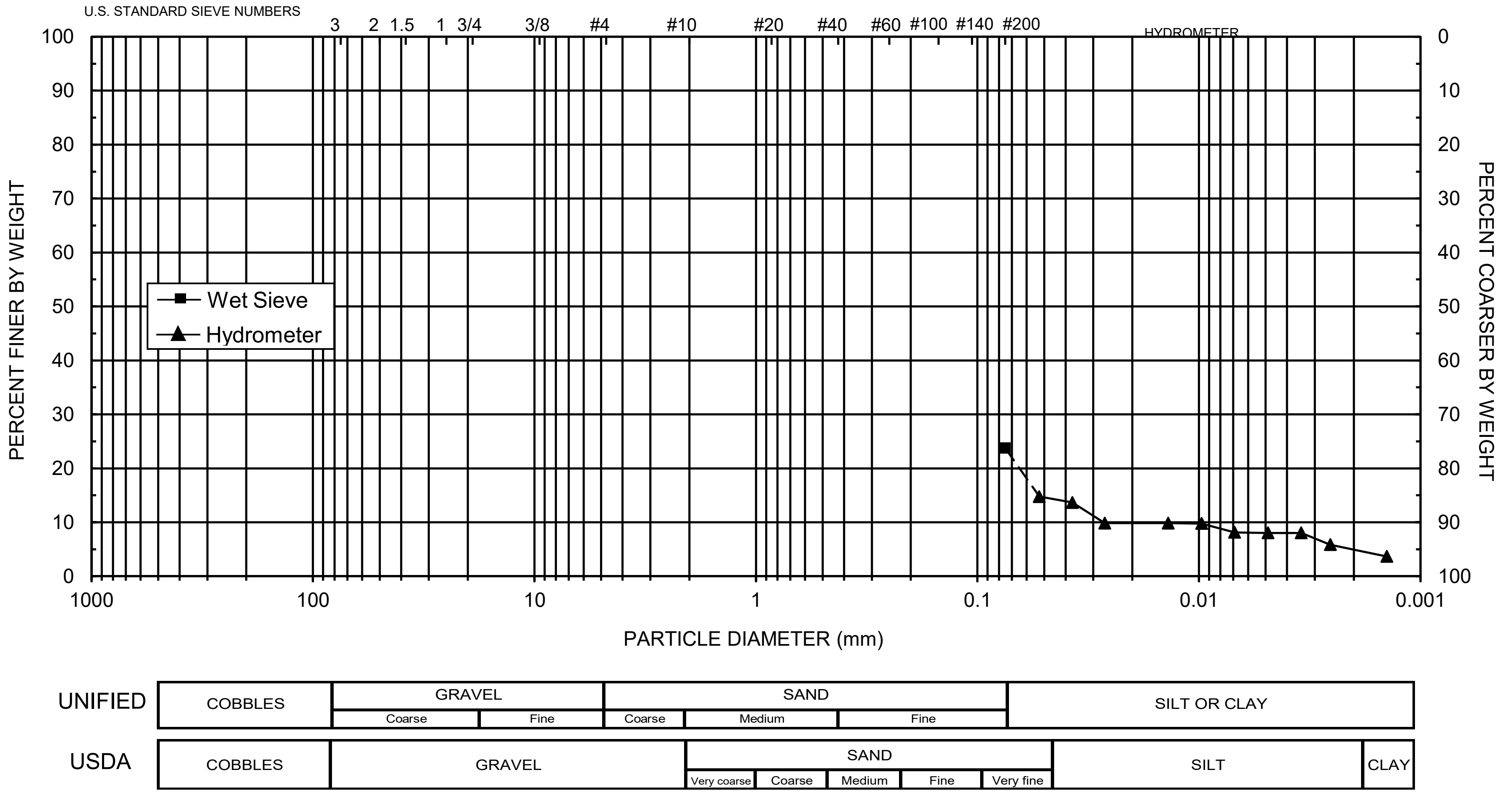
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-03RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-067 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1330	*Initial Wt. (g):*	44.72
Test Date:	24-May-19	*Total Sample Wt. (g):*	1095.78
Start Time:	9:30	*Wt. Passing #10 (g):*	1070.66

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	6.00	-0.75	6.8	15	0.0526	15	14.7
	2	21.8	5.50	-0.75	6.3	15	0.0373	14	13.7
	4	21.8	3.75	-0.75	4.5	15	0.0266	10	9.8
	15	21.8	3.75	-0.75	4.5	15	0.0137	10	9.8
	30	21.7	3.75	-0.71	4.5	15	0.0097	10	9.8
	60	21.7	3.00	-0.71	3.7	15	0.0069	8	8.1
	120	21.6	3.00	-0.68	3.7	15	0.0049	8	8.0
	240	21.6	3.00	-0.68	3.7	15	0.0034	8	8.0
	444	21.6	2.00	-0.68	2.7	16	0.0025	6	5.9
25-May-19	1453	21.6	1.00	-0.68	1.7	16	0.0014	4	3.7

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-03RB (No Dispersant)	**04/09/2019 1330**

Daniel B. Stephens & Associates, Inc.

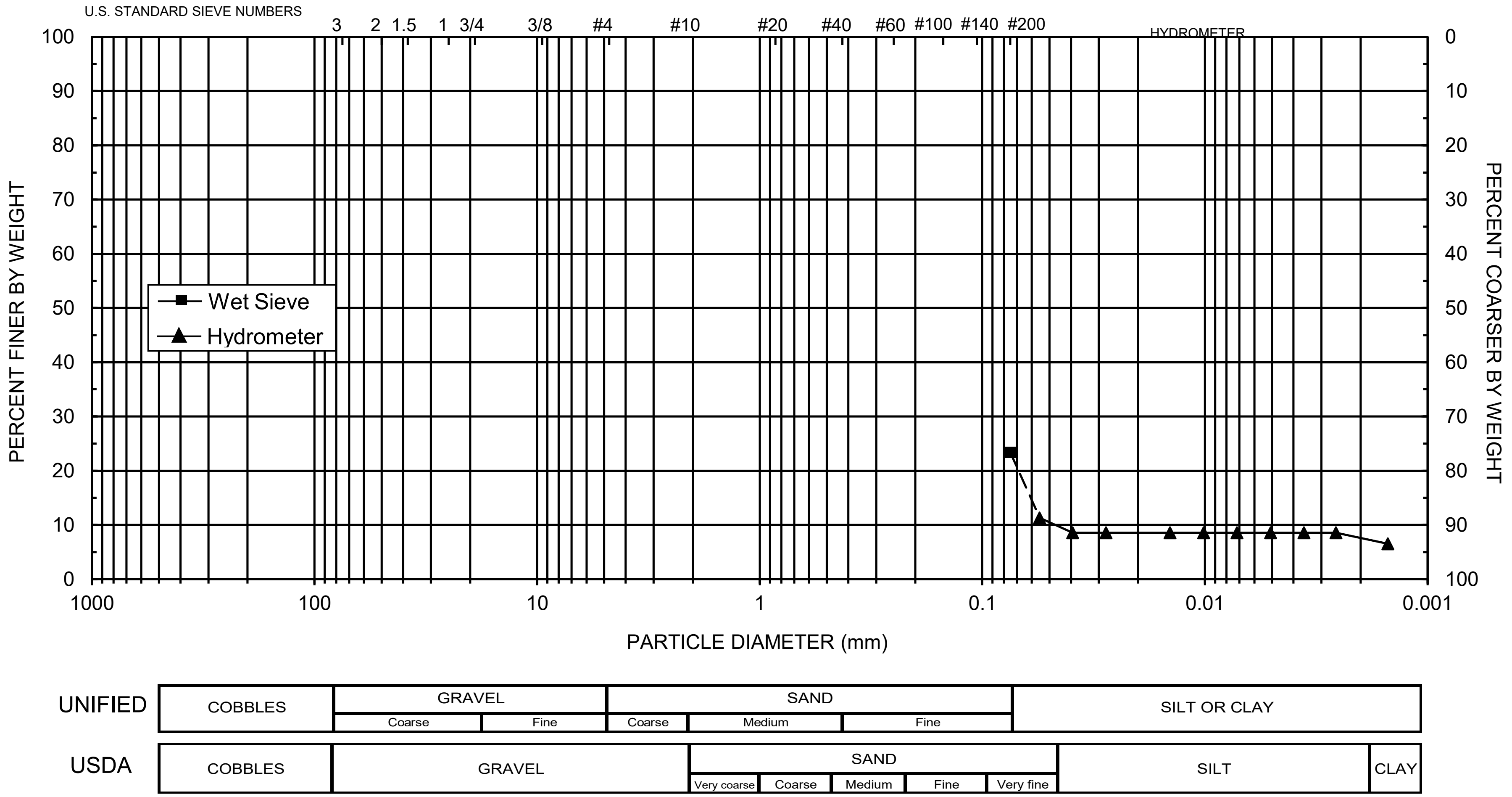
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L3-03RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-055 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/09/2019 1400	*Initial Wt. (g):*	36.33
Test Date:	7-Jun-19	*Total Sample Wt. (g):*	1657.70
Start Time:	9:18	*Wt. Passing #10 (g):*	1638.92

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.5	4.00	-0.14	4.1	16	0.0553	11	11.3
	2	21.5	3.00	-0.14	3.1	17	0.0393	9	8.6
	4	21.5	3.00	-0.14	3.1	17	0.0278	9	8.6
	15	21.5	3.00	-0.14	3.1	17	0.0143	9	8.6
	30	21.5	3.00	-0.14	3.1	17	0.0101	9	8.6
	60	21.5	3.00	-0.14	3.1	17	0.0072	9	8.6
	120	21.5	3.00	-0.14	3.1	17	0.0051	9	8.6
	240	21.5	3.00	-0.14	3.1	17	0.0036	9	8.6
	464	21.5	3.00	-0.14	3.1	17	0.0026	9	8.6
8-Jun-19	1367	21.5	2.25	-0.14	2.4	17	0.0015	7	6.5

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-03RM (No Dispersant)	**04/09/2019 1400**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RT (No Dispersant)
Lab ID: HAT01-11.1904001-040 (No Dispersant)
Date/Time sampled: 04/09/2019 1345

Test Date: 5-Jun-19
Start Time: 9:30

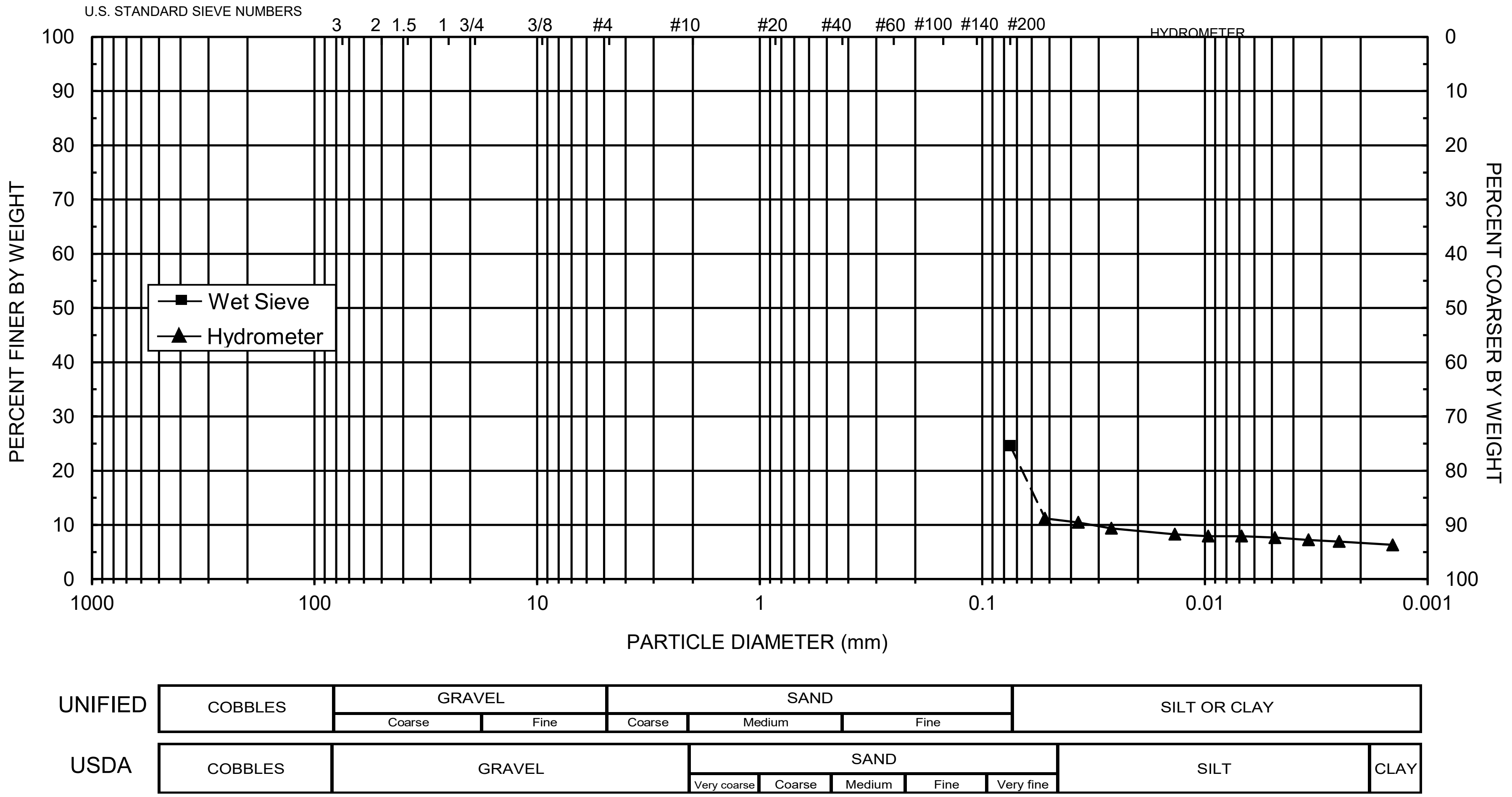
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. *(g):* 67.13
Total Sample Wt. *(g):* 1706.60
Wt. Passing #10 *(g):* 1670.81

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
5-Jun-19	1	21.6	7.00	-0.68	7.7	15	0.0523	11	11.2
	2	21.6	6.50	-0.68	7.2	15	0.0371	11	10.5
	4	21.6	5.75	-0.68	6.4	15	0.0263	10	9.4
	15	21.6	5.00	-0.68	5.7	15	0.0137	8	8.3
	30	21.6	4.75	-0.68	5.4	15	0.0097	8	7.9
	60	21.6	4.75	-0.68	5.4	15	0.0068	8	7.9
	120	21.8	4.50	-0.75	5.3	15	0.0048	8	7.7
	240	21.7	4.25	-0.71	5.0	15	0.0034	7	7.2
	456	21.8	4.00	-0.75	4.8	15	0.0025	7	6.9
6-Jun-19	1377	21.3	3.75	-0.57	4.3	15	0.0014	6	6.3

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L3-03RT (No Dispersant)	**04/09/2019 1345**

Daniel B. Stephens & Associates, Inc.

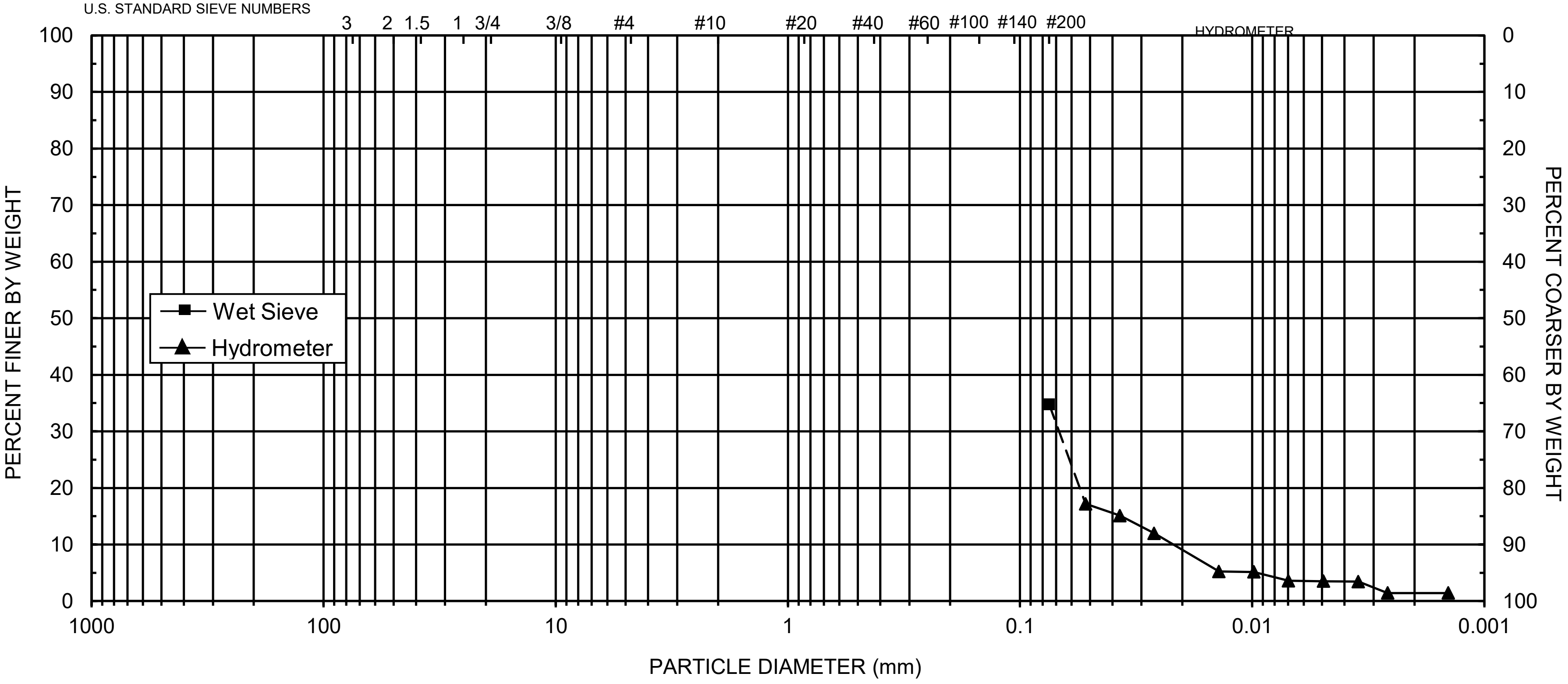
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L5-01RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-068 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 740	*Initial Wt.* (g):	44.66
Test Date:	24-May-19	*Total Sample Wt.* (g):	1557.52
Start Time:	9:42	*Wt. Passing #10* (g):	1449.36

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	7.50	-0.75	8.3	15	0.0522	18	17.2
	2	21.8	6.50	-0.75	7.3	15	0.0371	16	15.1
	4	21.8	5.00	-0.75	5.8	15	0.0264	13	12.0
	15	21.8	1.75	-0.75	2.5	16	0.0139	6	5.2
	30	21.7	1.75	-0.71	2.5	16	0.0098	6	5.1
	60	21.7	1.00	-0.71	1.7	16	0.0070	4	3.6
	120	21.6	1.00	-0.68	1.7	16	0.0049	4	3.5
	240	21.5	1.00	-0.64	1.6	16	0.0035	4	3.4
	434	21.6	0.00	-0.68	0.7	16	0.0026	2	1.4
25-May-19	1442	21.6	0.00	-0.68	0.7	16	0.0014	2	1.4

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-01RB (No Dispersant)	**04/18/2019 740**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RM (No Dispersant)
Lab ID: HAT01-11.1904001-056 (No Dispersant)
Date/Time sampled: 04/18/2019 750

Test Date: 16-May-19
Start Time: 9:42

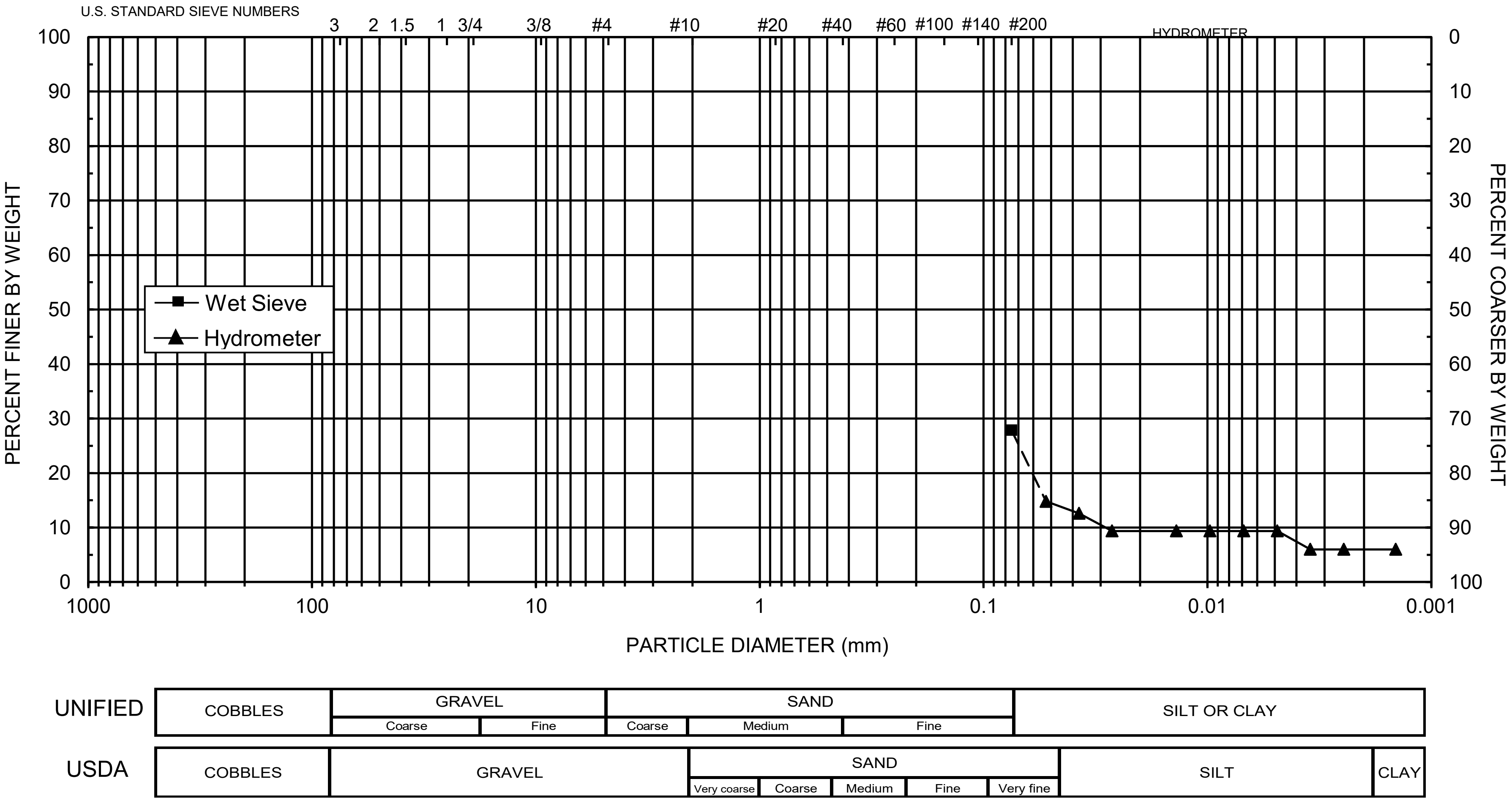
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. *(g):* 43.39
Total Sample Wt. *(g):* 1734.15
Wt. Passing #10 *(g):* 1658.71

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	6.00	-0.71	6.7	15	0.0526	15	14.8
	2	21.7	5.00	-0.71	5.7	15	0.0374	13	12.6
	4	21.8	3.50	-0.75	4.3	15	0.0267	10	9.4
	15	21.8	3.50	-0.75	4.3	15	0.0138	10	9.4
	30	21.8	3.50	-0.75	4.3	15	0.0097	10	9.4
	60	21.8	3.50	-0.75	4.3	15	0.0069	10	9.4
	120	21.8	3.50	-0.75	4.3	15	0.0049	10	9.4
	240	21.7	2.00	-0.71	2.7	16	0.0035	6	6.0
	479	21.7	2.00	-0.71	2.7	16	0.0025	6	6.0
17-May-19	1395	21.7	2.00	-0.71	2.7	16	0.0014	6	6.0

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-01RM (No Dispersant)	**04/18/2019 750**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT (No Dispersant)
Lab ID: HAT01-11.1904001-041 (No Dispersant)
Date/Time sampled: 04/18/2019 800

Test Date: 7-Jun-19
Start Time: 9:42

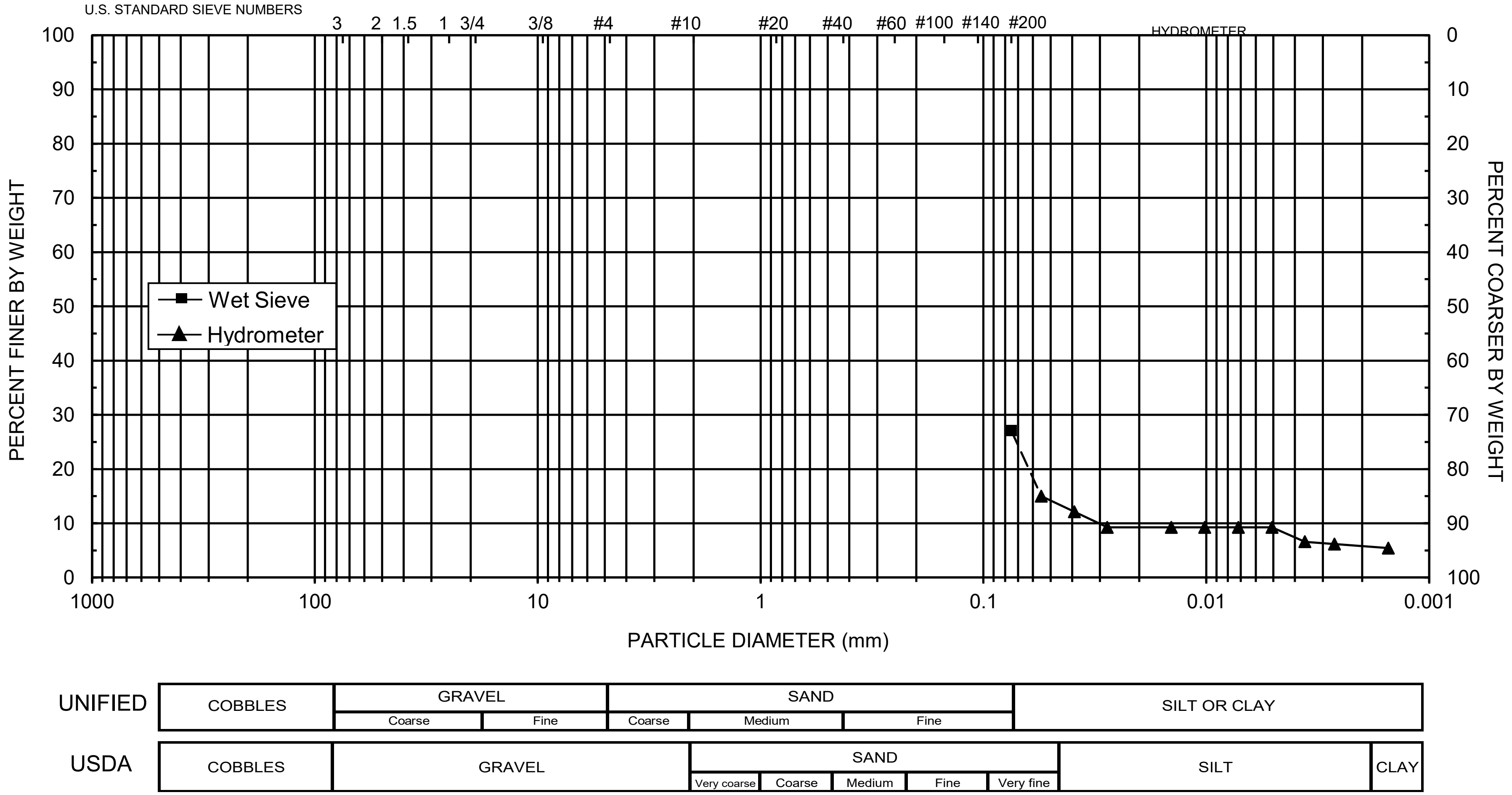
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g)*:* 34.45
Total Sample Wt. (g)*:* 1594.84
Wt. Passing #10 (g)*:* 1580.72

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	5.00	-0.21	5.2	16	0.0550	15	15.0
	2	21.7	4.00	-0.21	4.2	16	0.0391	12	12.1
	4	21.7	3.00	-0.21	3.2	17	0.0278	9	9.2
	15	21.7	3.00	-0.21	3.2	17	0.0143	9	9.2
	30	21.7	3.00	-0.21	3.2	17	0.0101	9	9.2
	60	21.7	3.00	-0.21	3.2	17	0.0072	9	9.2
	120	21.7	3.00	-0.21	3.2	17	0.0051	9	9.2
	240	21.9	2.00	-0.29	2.3	17	0.0036	7	6.6
	442	22.2	1.75	-0.40	2.1	17	0.0027	6	6.2
8-Jun-19	1346	21.5	1.74	-0.14	1.9	17	0.0015	5	5.4

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-01RT (No Dispersant)	**04/18/2019 800**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RB (No Dispersant)
Lab ID: HAT01-11.1904001-069 (No Dispersant)
Date/Time sampled: 04/18/2019 1240

Test Date: 24-May-19
Start Time: 9:54

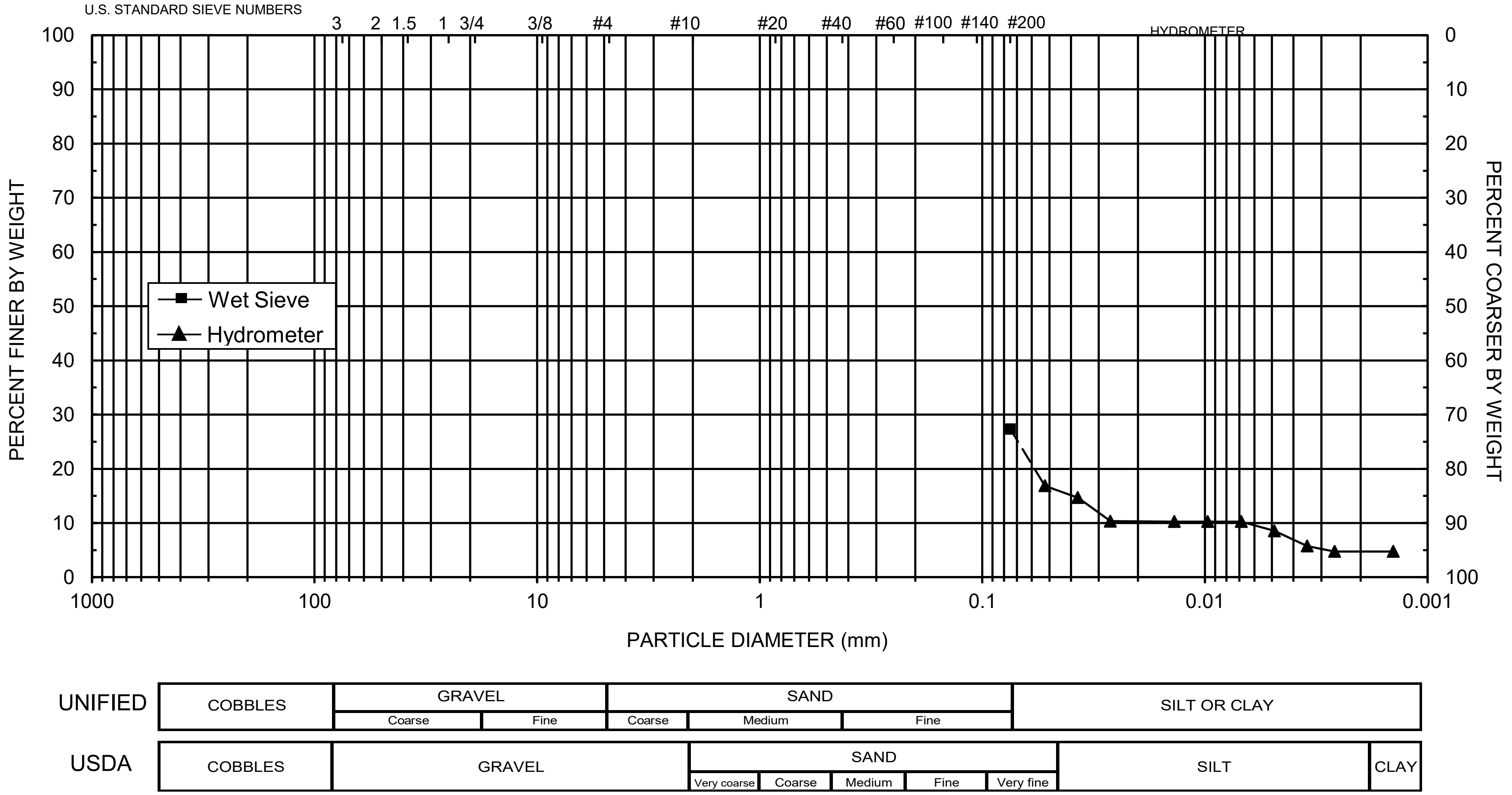
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. *(g):* 45.33
Total Sample Wt. *(g):* 1614.75
Wt. Passing #10 *(g):* 1592.88

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
24-May-19	1	21.8	7.00	-0.75	7.8	15	0.0523	17	16.9
	2	21.8	6.00	-0.75	6.8	15	0.0372	15	14.7
	4	21.8	4.00	-0.75	4.8	15	0.0266	10	10.3
	15	21.7	4.00	-0.71	4.7	15	0.0137	10	10.3
	30	21.7	4.00	-0.71	4.7	15	0.0097	10	10.3
	60	21.7	4.00	-0.71	4.7	15	0.0069	10	10.3
	120	21.6	3.25	-0.68	3.9	15	0.0049	9	8.5
	240	21.5	2.00	-0.64	2.6	16	0.0035	6	5.8
	425	21.6	1.50	-0.68	2.2	16	0.0026	5	4.7
25-May-19	1432	21.6	1.50	-0.68	2.2	16	0.0014	5	4.7

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-02RB (No Dispersant)	**04/18/2019 1240**

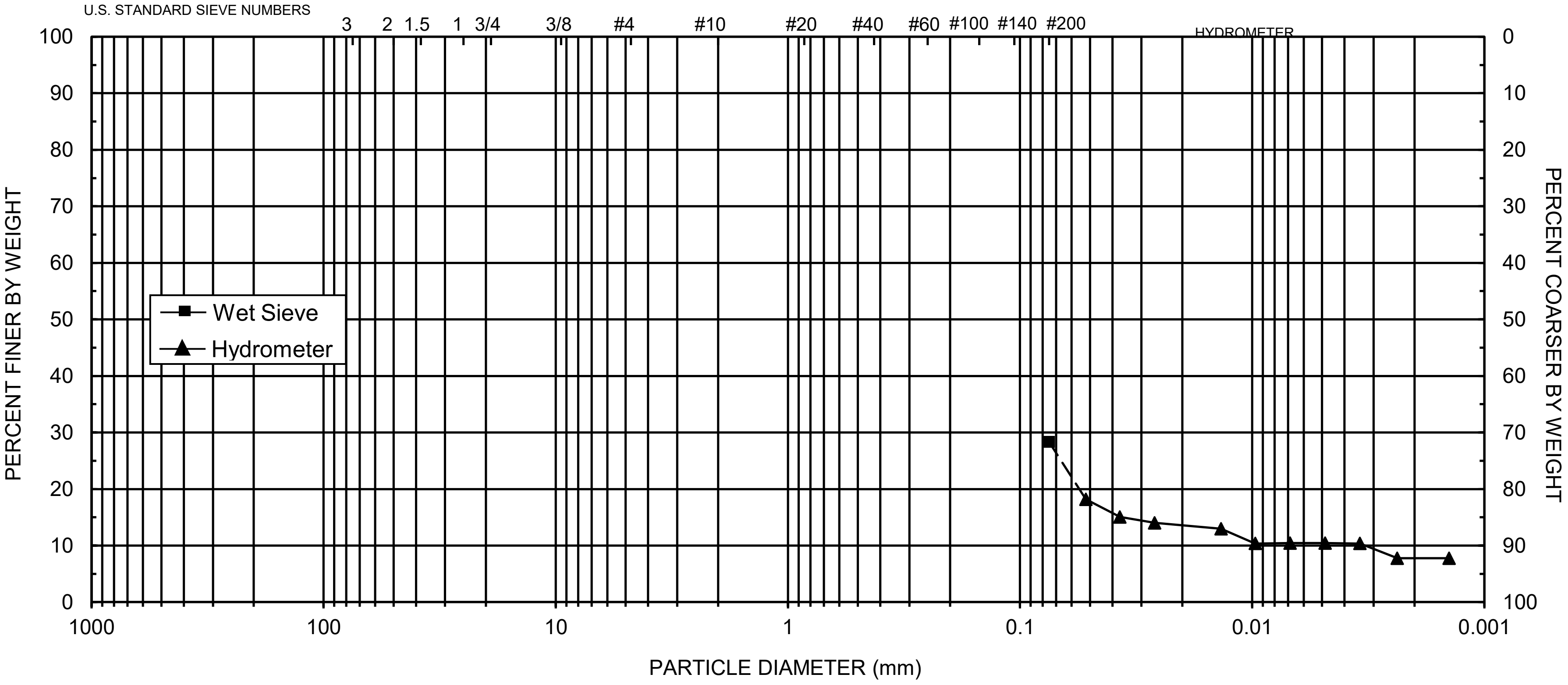
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-02RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-057 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1235	*Initial Wt.* *(g):*	47.37
Test Date:	16-May-19	*Total Sample Wt.* *(g):*	1618.52
Start Time:	9:06	*Wt. Passing #10* *(g):*	1600.11

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	8.00	-0.71	8.7	15	0.0520	18	18.2
	2	21.7	6.50	-0.71	7.2	15	0.0371	15	15.1
	4	21.7	6.00	-0.71	6.7	15	0.0263	14	14.0
	15	21.7	5.50	-0.71	6.2	15	0.0136	13	13.0
	30	21.7	4.25	-0.71	5.0	15	0.0097	10	10.4
	60	21.8	4.25	-0.75	5.0	15	0.0069	11	10.4
	120	21.8	4.25	-0.75	5.0	15	0.0048	11	10.4
	240	21.7	4.25	-0.71	5.0	15	0.0034	10	10.4
	509	21.7	3.00	-0.71	3.7	15	0.0024	8	7.8
17-May-19	1425	21.7	3.00	-0.71	3.7	15	0.0014	8	7.8

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-02RM (No Dispersant)	**04/18/2019 1235**

Daniel B. Stephens & Associates, Inc.

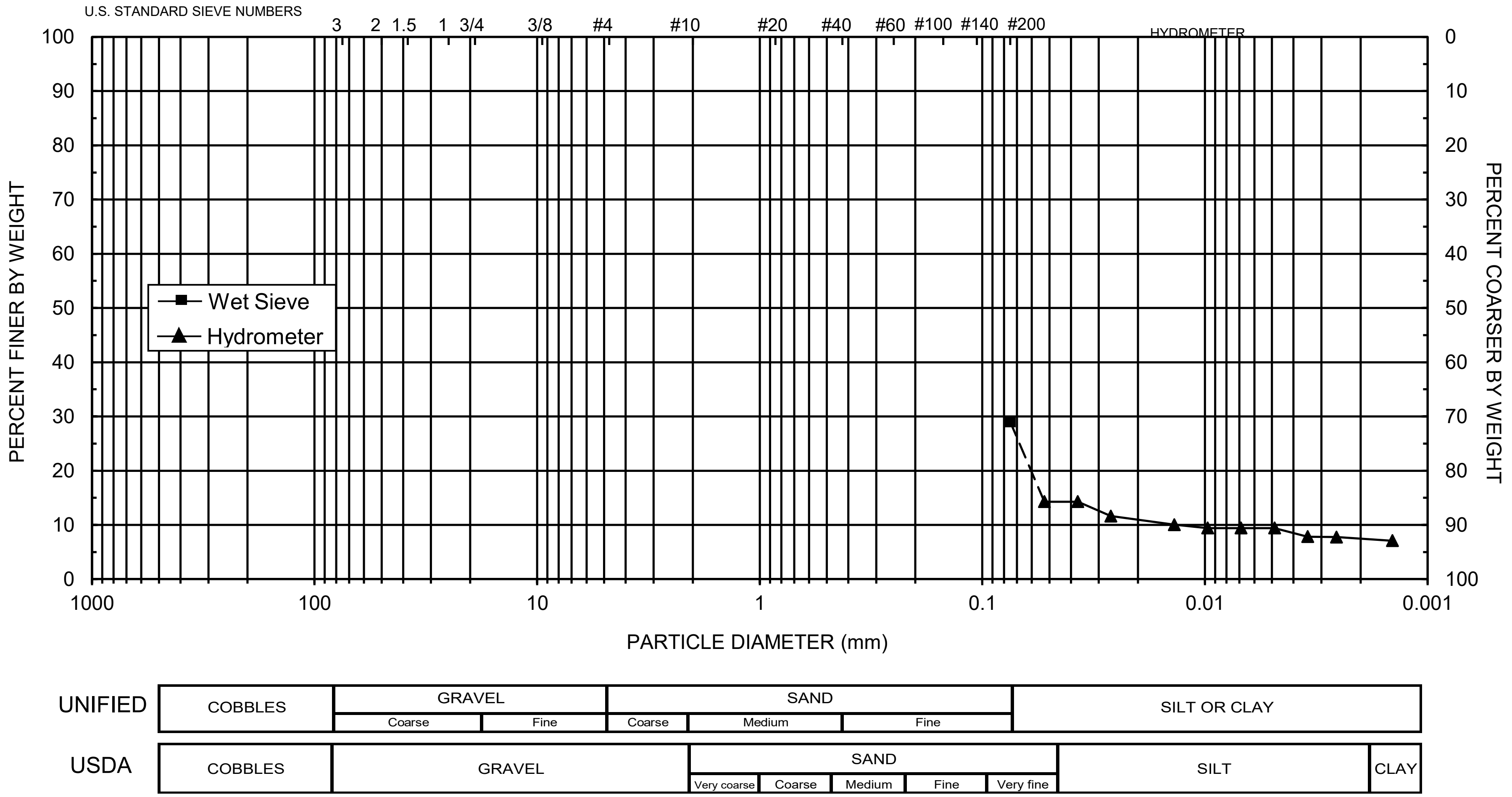
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-02RT (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-042 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1235	*Initial Wt. (g):*	46.86
Test Date:	20-May-19	*Total Sample Wt. (g):*	1645.30
Start Time:	9:54	*Wt. Passing #10 (g):*	1640.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
20-May-19	1	21.7	6.00	-0.71	6.7	15	0.0526	14	14.3
	2	21.7	6.00	-0.71	6.7	15	0.0372	14	14.3
	4	21.7	4.75	-0.71	5.5	15	0.0265	12	11.6
	15	21.7	4.00	-0.71	4.7	15	0.0137	10	10.0
	30	21.6	3.75	-0.68	4.4	15	0.0097	9	9.4
	60	21.6	3.75	-0.68	4.4	15	0.0069	9	9.4
	120	21.6	3.75	-0.68	4.4	15	0.0049	9	9.4
	240	21.6	3.00	-0.68	3.7	15	0.0035	8	7.8
	435	21.5	3.00	-0.64	3.6	15	0.0026	8	7.8
21-May-19	1384	20.6	3.00	-0.33	3.3	15	0.0014	7	7.1

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-02RT (No Dispersant)	**04/18/2019 1235**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RB (No Dispersant)
Lab ID: HAT01-11.1904001-070 (No Dispersant)
Date/Time sampled: 04/18/2019 1020

Test Date: 10-Jun-19
Start Time: 9:06

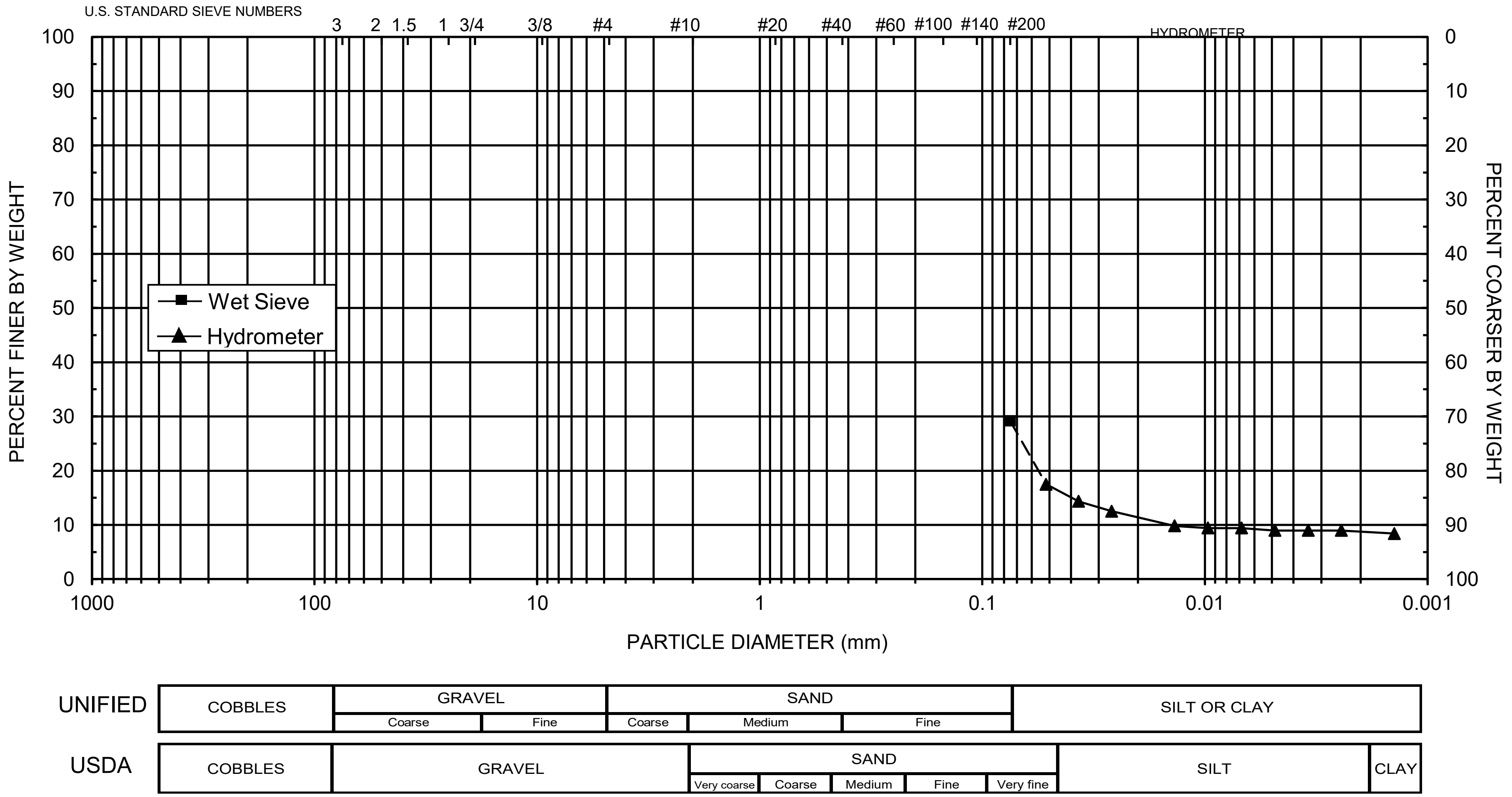
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 53.73
Total Sample Wt. (g): 1427.38
Wt. Passing #10 (g): 1385.87

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.6	9.00	-0.68	9.7	14	0.0517	18	17.5
	2	21.6	7.25	-0.68	7.9	15	0.0369	15	14.3
	4	21.6	6.25	-0.68	6.9	15	0.0263	13	12.5
	15	21.6	4.75	-0.68	5.4	15	0.0137	10	9.8
	30	21.7	4.50	-0.71	5.2	15	0.0097	10	9.4
	60	21.7	4.50	-0.71	5.2	15	0.0068	10	9.4
	120	21.7	4.25	-0.71	5.0	15	0.0048	9	9.0
	240	21.7	4.25	-0.71	5.0	15	0.0034	9	9.0
	474	21.7	4.25	-0.71	5.0	15	0.0024	9	9.0
11-Jun-19	1421	21.5	4.00	-0.64	4.6	15	0.0014	9	8.4

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-03RB (No Dispersant)	**04/18/2019 1020**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RM (No Dispersant)
Lab ID: HAT01-11.1904001-058 (No Dispersant)
Date/Time sampled: 04/18/2019 1020

Test Date: 16-May-19
Start Time: 9:30

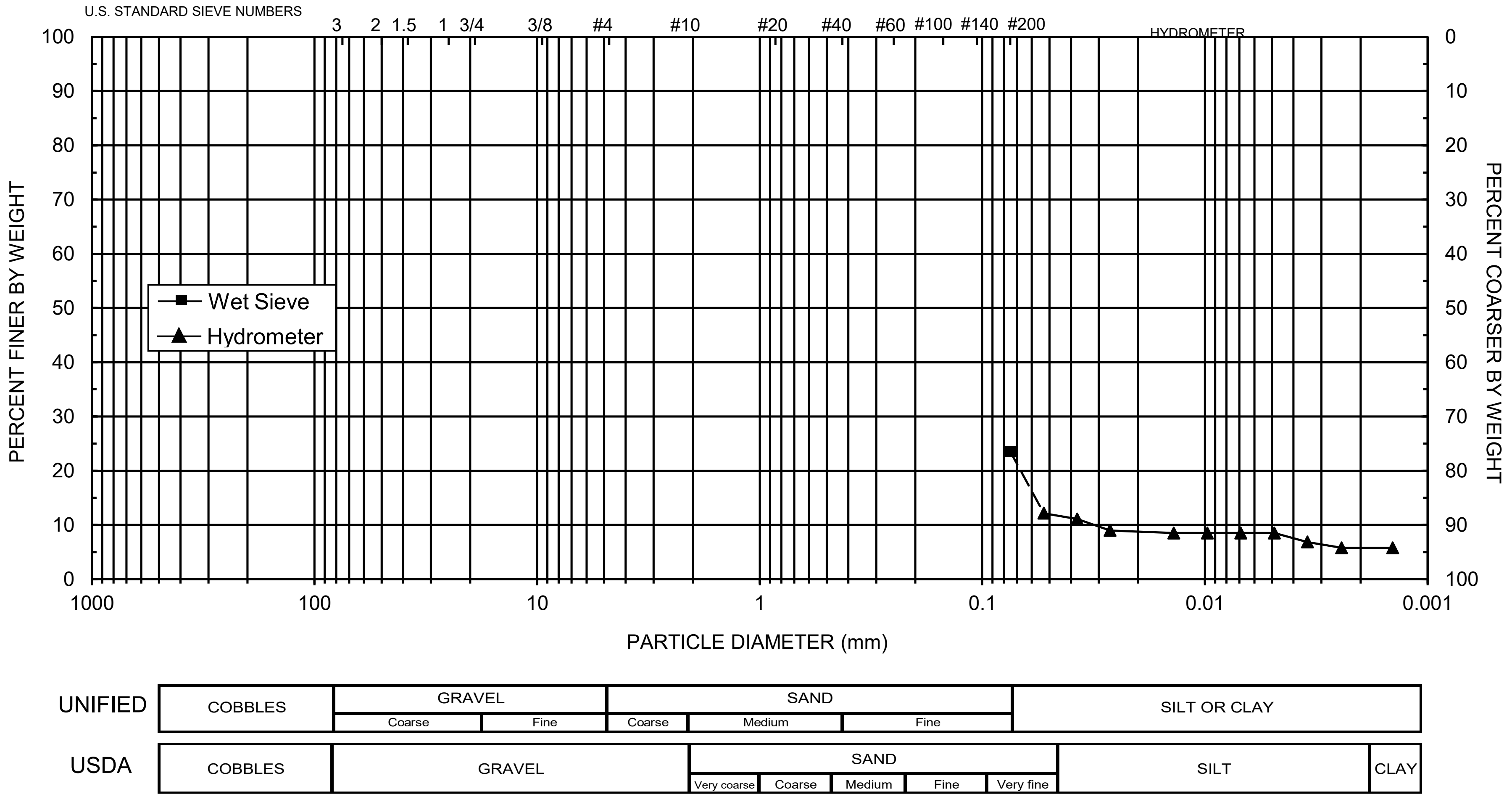
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 46.72
Total Sample Wt. (g): 1422.77
Wt. Passing #10 (g): 1412.88

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	5.00	-0.71	5.7	15	0.0529	12	12.1
	2	21.7	4.50	-0.71	5.2	15	0.0375	11	11.1
	4	21.7	3.50	-0.71	4.2	15	0.0267	9	9.0
	15	21.8	3.25	-0.75	4.0	15	0.0138	9	8.5
	30	21.8	3.25	-0.75	4.0	15	0.0097	9	8.5
	60	21.8	3.25	-0.75	4.0	15	0.0069	9	8.5
	120	21.8	3.25	-0.75	4.0	15	0.0049	9	8.5
	240	21.7	2.50	-0.71	3.2	15	0.0035	7	6.8
	489	21.7	2.00	-0.71	2.7	16	0.0024	6	5.8
17-May-19	1405	21.7	2.00	-0.71	2.7	16	0.0014	6	5.8

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-03RM (No Dispersant)	**04/18/2019 1020**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RT (No Dispersant)
Lab ID: HAT01-11.1904001-043 (No Dispersant)
Date/Time sampled: 04/18/2019 1020

Test Date: 7-Jun-19
Start Time: 9:30

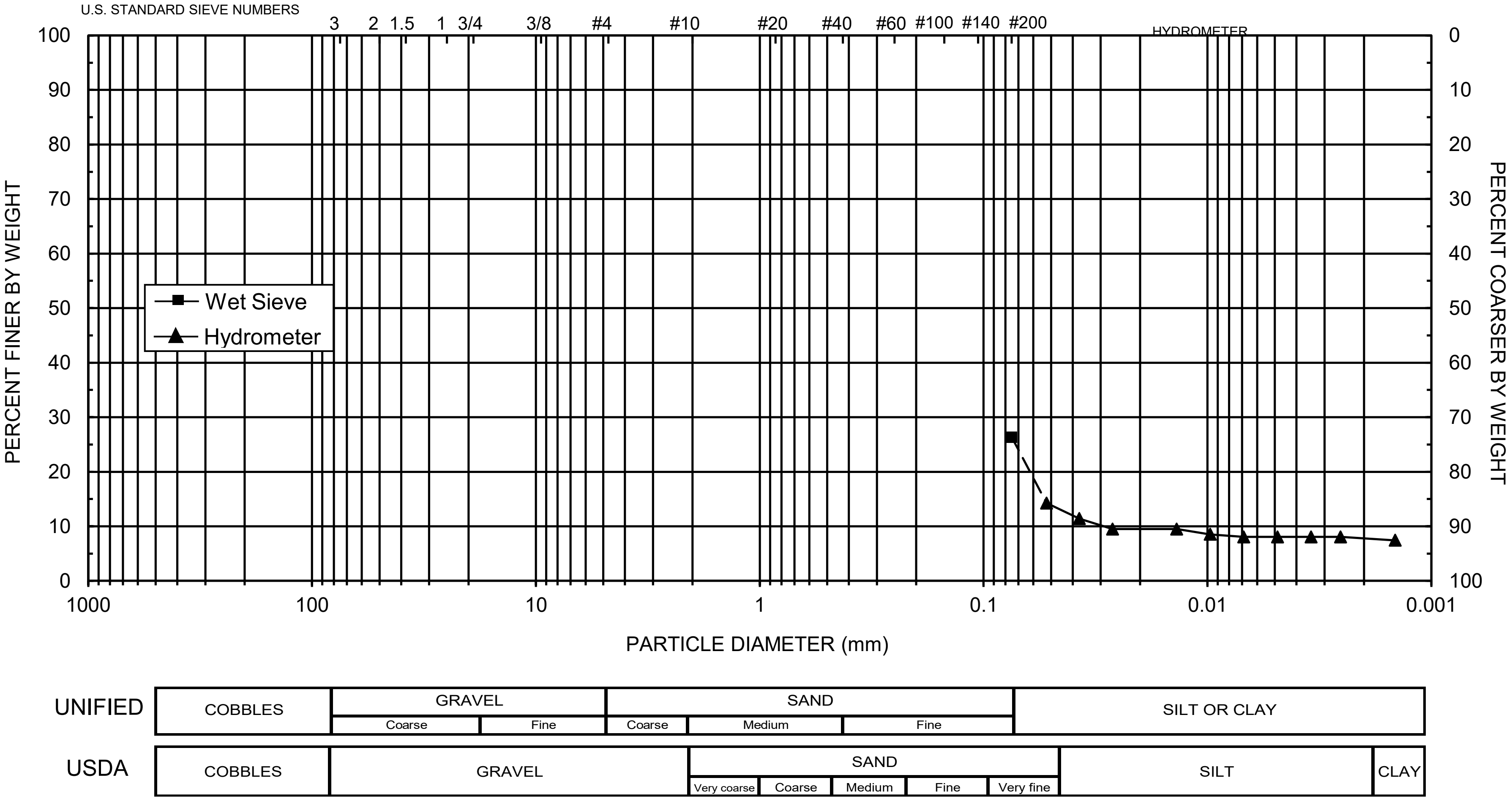
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 51.92
Total Sample Wt. (g): 1620.60
Wt. Passing #10 (g): 1607.25

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	6.75	-0.71	7.5	15	0.0523	14	14.3
	2	21.7	5.25	-0.71	6.0	15	0.0373	11	11.4
	4	21.7	4.25	-0.71	5.0	15	0.0265	10	9.5
	15	21.7	4.25	-0.71	5.0	15	0.0137	10	9.5
	30	21.7	3.75	-0.71	4.5	15	0.0097	9	8.5
	60	21.7	3.50	-0.71	4.2	15	0.0069	8	8.1
	120	21.7	3.50	-0.71	4.2	15	0.0049	8	8.1
	240	21.7	3.50	-0.71	4.2	15	0.0034	8	8.1
	441	21.7	3.50	-0.71	4.2	15	0.0025	8	8.1
8-Jun-19	1354	21.5	3.25	-0.64	3.9	15	0.0015	7	7.4

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-03RT (No Dispersant)	**04/18/2019 1020**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

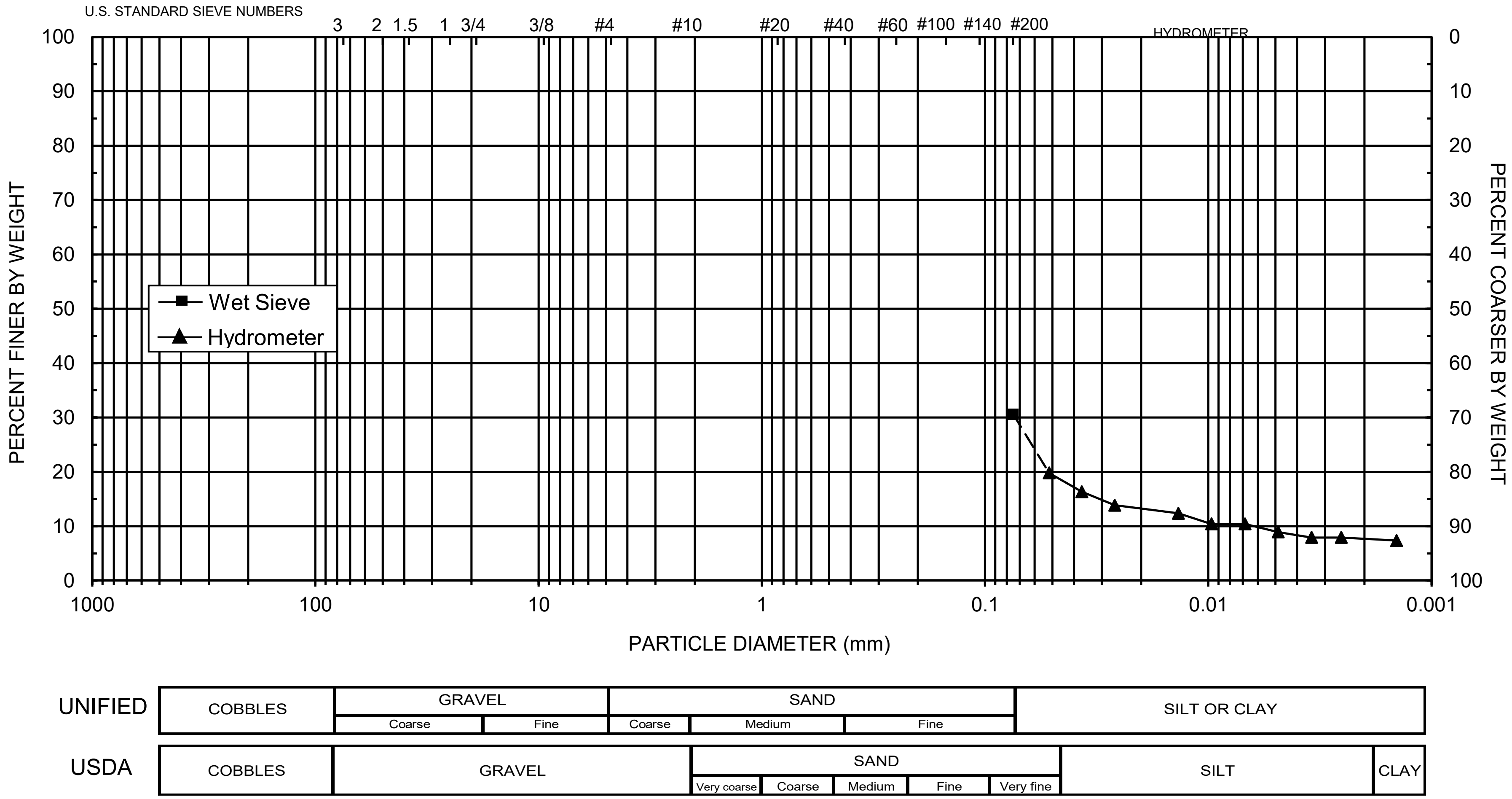
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-11RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-108 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1155	*Initial Wt. (g):*	49.66
Test Date:	3-Jun-19	*Total Sample Wt. (g):*	1286.39
Start Time:	9:48	*Wt. Passing #10 (g):*	1270.39

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	9.25	-0.75	10.0	14	0.0516	20	19.8
	2	21.8	7.50	-0.75	8.3	15	0.0368	17	16.3
	4	21.8	6.25	-0.75	7.0	15	0.0262	14	13.9
	15	21.8	5.50	-0.75	6.3	15	0.0136	13	12.4
	30	21.8	4.50	-0.75	5.3	15	0.0097	11	10.4
	60	21.8	4.50	-0.75	5.3	15	0.0068	11	10.4
	120	21.8	3.75	-0.75	4.5	15	0.0049	9	8.9
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	7.9
	443	21.8	3.25	-0.75	4.0	15	0.0025	8	7.9
4-Jun-19	1393	21.7	3.00	-0.71	3.7	15	0.0014	7	7.4

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-11RB (No Dispersant)	**04/18/2019 1155**

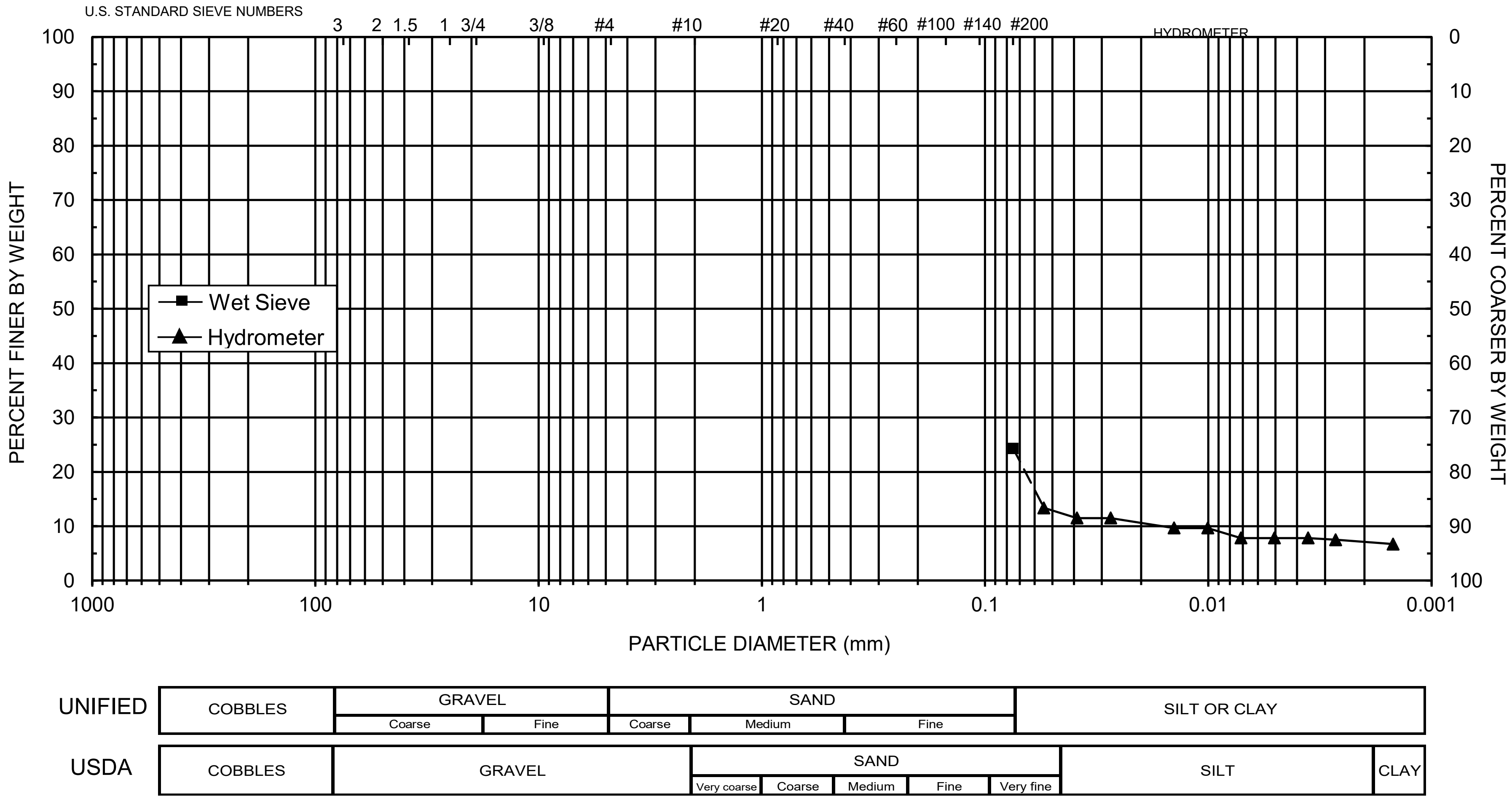
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-11RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-109 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1150	*Initial Wt. (g):*	54.04
Test Date:	10-Jun-19	*Total Sample Wt. (g):*	1474.45
Start Time:	9:54	*Wt. Passing #10 (g):*	1467.24

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.8	7.00	-0.25	7.3	16	0.0545	13	13.3
	2	21.8	6.00	-0.25	6.3	16	0.0387	12	11.5
	4	21.8	6.00	-0.25	6.3	16	0.0274	12	11.5
	15	21.8	5.00	-0.25	5.3	16	0.0142	10	9.7
	30	21.8	5.00	-0.25	5.3	16	0.0100	10	9.7
	60	21.8	4.00	-0.25	4.3	16	0.0071	8	7.8
	120	21.8	4.00	-0.25	4.3	16	0.0051	8	7.8
	240	21.8	4.00	-0.25	4.3	16	0.0036	8	7.8
	426	22.0	3.75	-0.32	4.1	17	0.0027	8	7.5
11-Jun-19	1392	21.5	3.50	-0.14	3.6	17	0.0015	7	6.7

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-11RM (No Dispersant)	**04/18/2019 1150**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RT (No Dispersant)
Lab ID: HAT01-11.1904001-110 (No Dispersant)
Date/Time sampled: 04/18/2019 1200

Test Date: 23-May-19
Start Time: 9:54

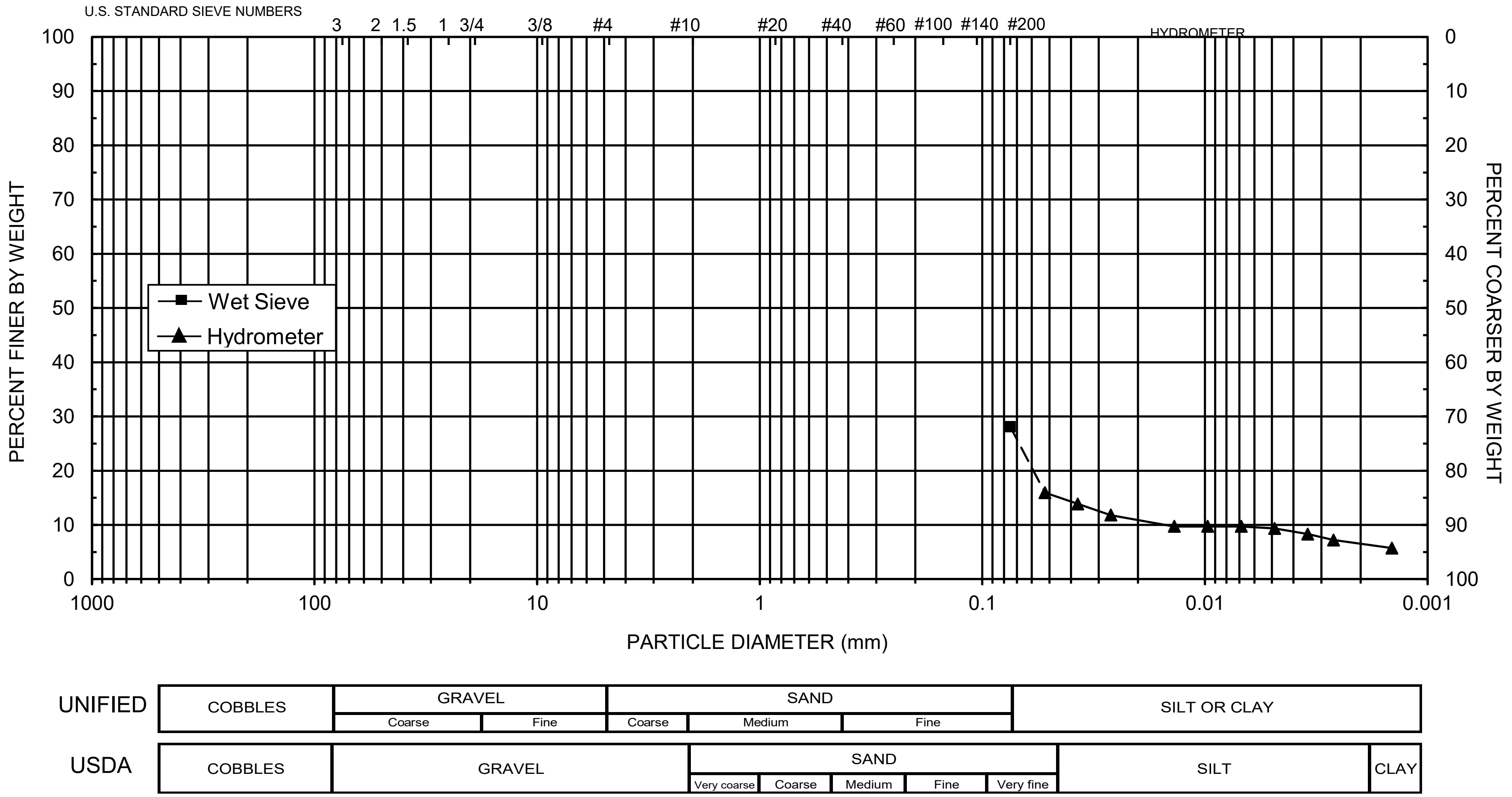
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 48.05
Total Sample Wt. (g): 1588.99
Wt. Passing #10 (g): 1585.25

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	7.00	-0.68	7.7	15	0.0523	16	15.9
	2	21.6	6.00	-0.68	6.7	15	0.0372	14	13.9
	4	21.6	5.00	-0.68	5.7	15	0.0264	12	11.8
	15	21.6	4.00	-0.68	4.7	15	0.0137	10	9.7
	30	21.6	4.00	-0.68	4.7	15	0.0097	10	9.7
	60	21.6	4.00	-0.68	4.7	15	0.0069	10	9.7
	120	21.8	3.75	-0.75	4.5	15	0.0049	9	9.3
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	8.3
	411	22.4	2.50	-0.97	3.5	15	0.0026	7	7.2
24-May-19	1383	21.8	2.00	-0.75	2.8	16	0.0014	6	5.7

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-11RT (No Dispersant)	**04/18/2019 1200**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RB (No Dispersant)
Lab ID: HAT01-11.1904001-104 (No Dispersant)
Date/Time sampled: 04/18/2019 1120

Test Date: 3-Jun-19
Start Time: 9:24

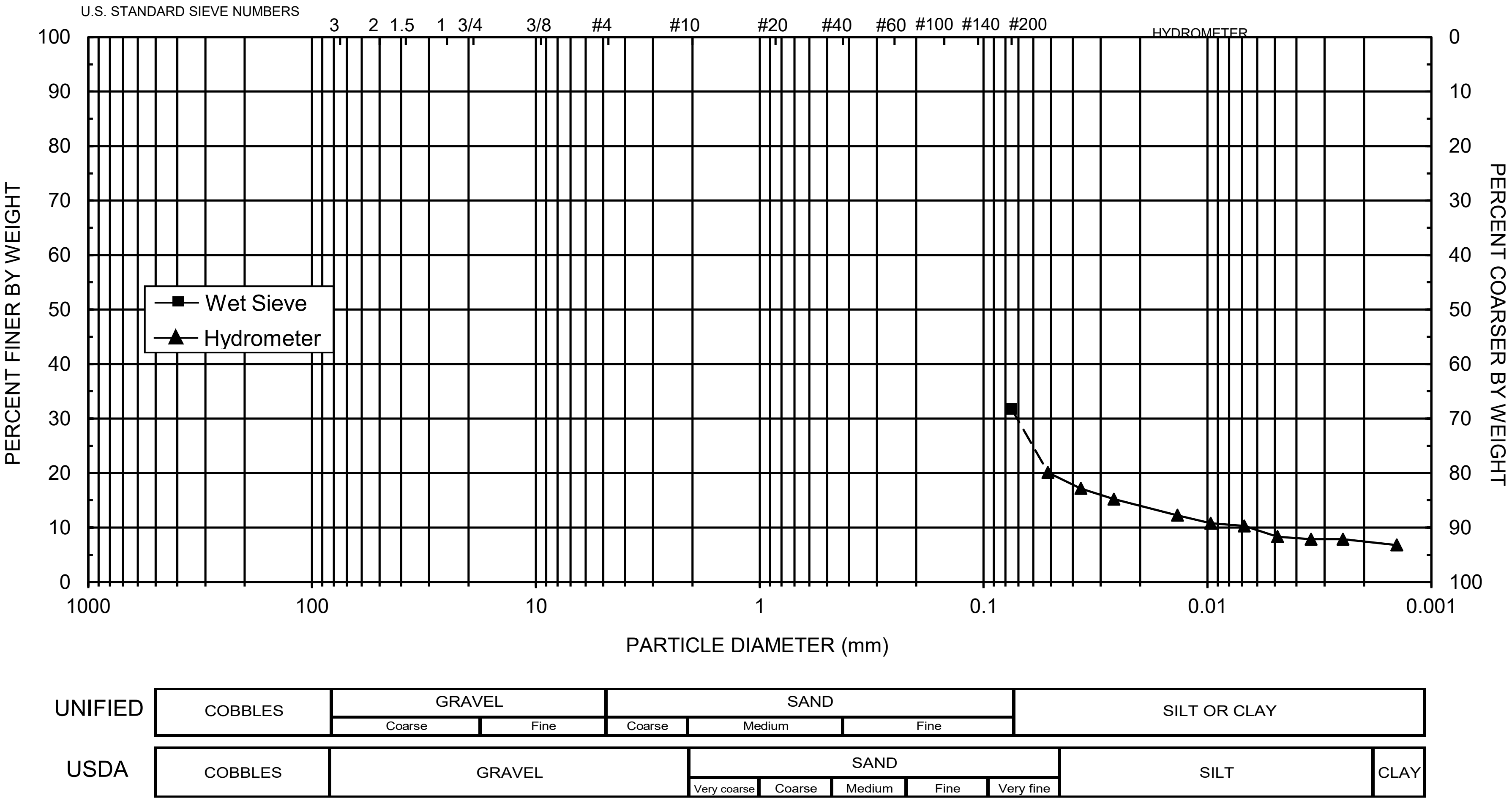
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 50.21
Total Sample Wt. (g): 1436.00
Wt. Passing #10 (g): 1413.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	9.50	-0.75	10.3	14	0.0515	20	20.1
	2	21.8	8.00	-0.75	8.8	15	0.0368	17	17.2
	4	21.8	7.00	-0.75	7.8	15	0.0261	15	15.2
	15	21.8	5.50	-0.75	6.3	15	0.0136	12	12.3
	30	21.8	4.75	-0.75	5.5	15	0.0097	11	10.8
	60	21.8	4.50	-0.75	5.3	15	0.0068	10	10.3
	120	21.8	3.50	-0.75	4.3	15	0.0049	8	8.3
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	7.8
	463	21.8	3.25	-0.75	4.0	15	0.0025	8	7.8
4-Jun-19	1413	21.7	2.75	-0.71	3.5	15	0.0014	7	6.8

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-21RB (No Dispersant)	**04/18/2019 1120**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RM (No Dispersant)
Lab ID: HAT01-11.1904001-105 (No Dispersant)
Date/Time sampled: 04/18/2019 1125

Test Date: 3-Jun-19
Start Time: 9:36

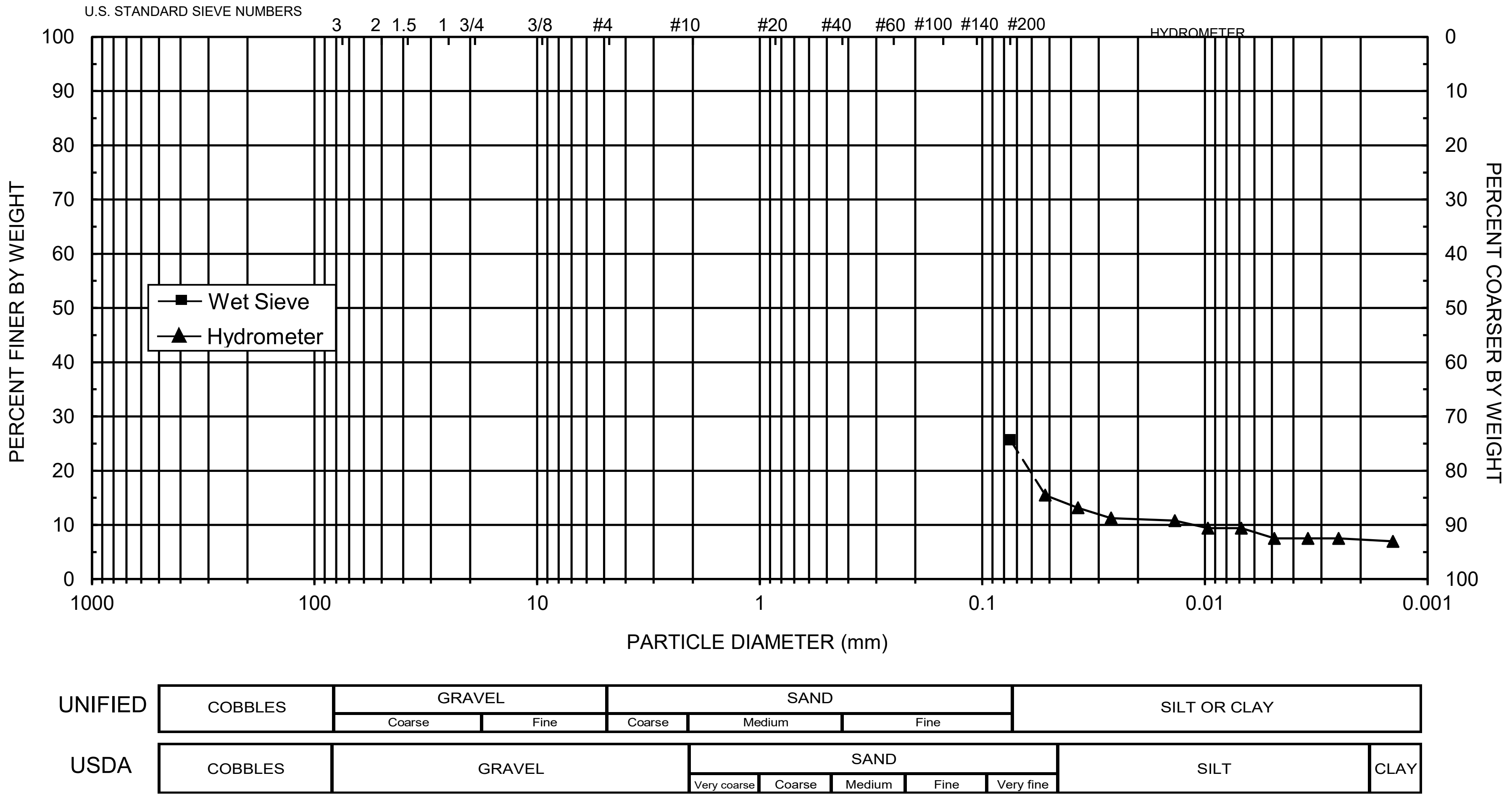
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 52.80
Total Sample Wt. (g): 1531.13
Wt. Passing #10 (g): 1516.65

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	7.50	-0.75	8.3	15	0.0521	16	15.5
	2	21.8	6.25	-0.75	7.0	15	0.0371	13	13.1
	4	21.8	5.25	-0.75	6.0	15	0.0264	11	11.3
	15	21.8	5.00	-0.75	5.8	15	0.0137	11	10.8
	30	21.8	4.25	-0.75	5.0	15	0.0097	9	9.4
	60	21.8	4.25	-0.75	5.0	15	0.0069	9	9.4
	120	21.8	3.25	-0.75	4.0	15	0.0049	8	7.5
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	7.5
	453	21.8	3.25	-0.75	4.0	15	0.0025	8	7.5
4-Jun-19	1403	21.7	3.00	-0.71	3.7	15	0.0014	7	7.0

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-21RM (No Dispersant)	**04/18/2019 1125**

Daniel B. Stephens & Associates, Inc.

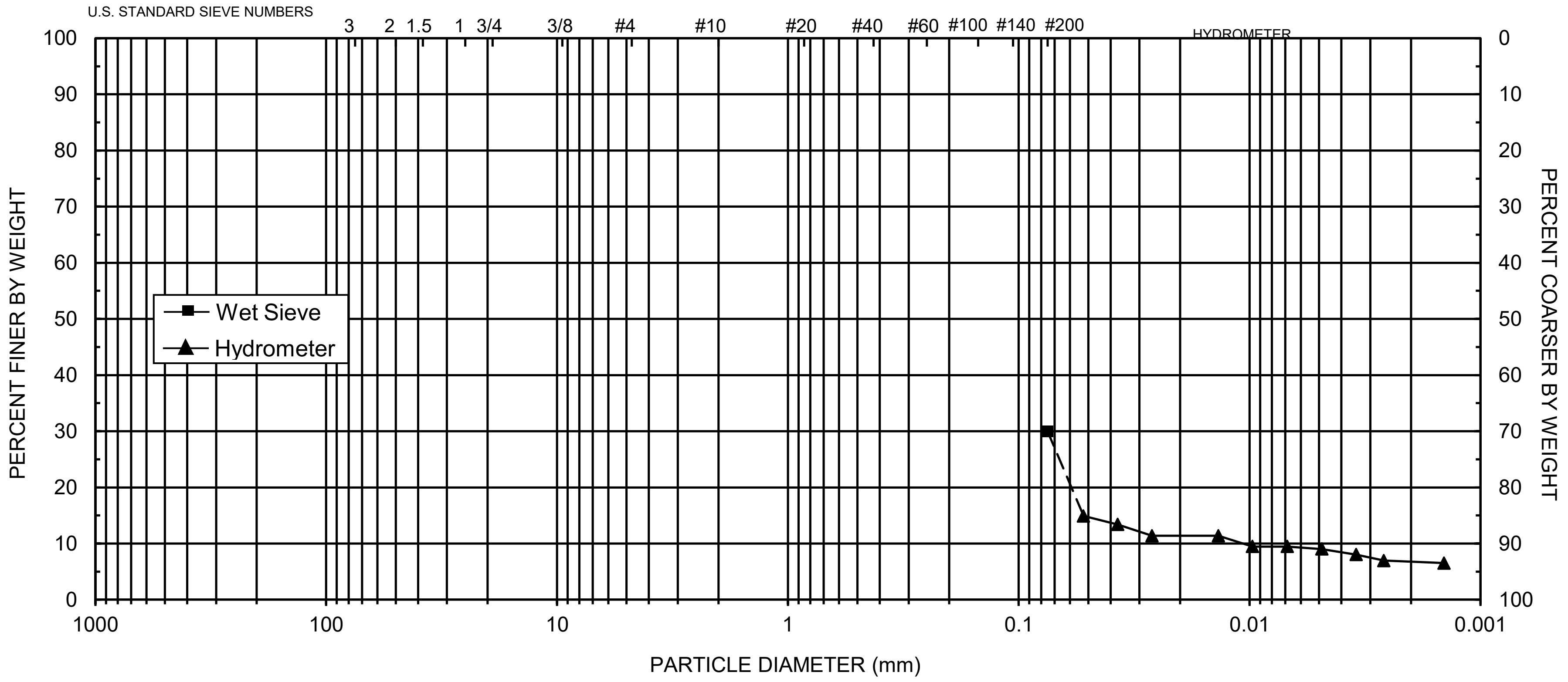
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-21RT (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-106 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 1120	*Initial Wt. (g):*	49.55
Test Date:	23-May-19	*Total Sample Wt. (g):*	1653.50
Start Time:	9:42	*Wt. Passing #10 (g):*	1643.26

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	6.75	-0.68	7.4	15	0.0524	15	14.9
	2	21.6	6.00	-0.68	6.7	15	0.0372	13	13.4
	4	21.6	5.00	-0.68	5.7	15	0.0264	11	11.4
	15	21.6	5.00	-0.68	5.7	15	0.0137	11	11.4
	30	21.7	4.00	-0.71	4.7	15	0.0097	10	9.5
	60	21.7	4.00	-0.71	4.7	15	0.0069	10	9.5
	120	21.8	3.75	-0.75	4.5	15	0.0049	9	9.0
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	8.0
	419	22.4	2.50	-0.97	3.5	15	0.0026	7	7.0
24-May-19	1393	21.8	2.50	-0.75	3.3	15	0.0014	7	6.5

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED

COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

USDA

COBBLES	GRAVEL	SAND					SILT	CLAY
		Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-21RT (No Dispersant)	**04/18/2019 1120**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB (No Dispersant)
Lab ID: HAT01-11.1904001-100 (No Dispersant)
Date/Time sampled: 04/18/2019 1045

Test Date: 31-May-19
Start Time: 9:00

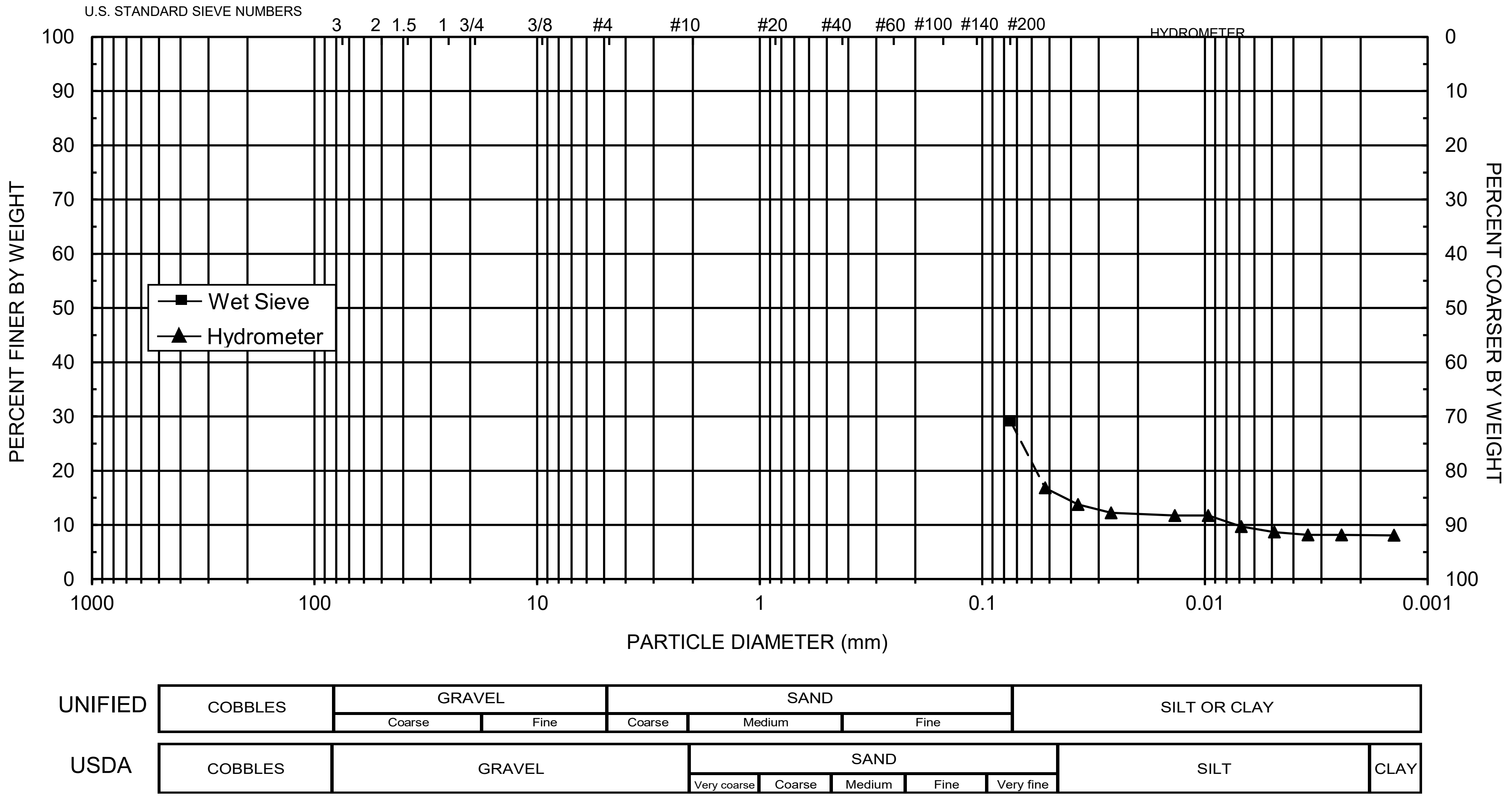
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 48.10
Total Sample Wt. (g): 1489.74
Wt. Passing #10 (g): 1460.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	7.50	-0.75	8.3	15	0.0521	17	16.8
	2	21.8	6.00	-0.75	6.8	15	0.0372	14	13.8
	4	21.8	5.25	-0.75	6.0	15	0.0264	12	12.2
	15	21.8	5.00	-0.75	5.8	15	0.0137	12	11.7
	30	21.8	5.00	-0.75	5.8	15	0.0097	12	11.7
	60	21.8	4.00	-0.75	4.8	15	0.0069	10	9.7
	120	21.8	3.50	-0.75	4.3	15	0.0049	9	8.7
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	8.2
	483	21.8	3.25	-0.75	4.0	15	0.0024	8	8.2
4-Jun-19	1430	21.7	3.25	-0.71	4.0	15	0.0014	8	8.1

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-31RB (No Dispersant)	**04/18/2019 1045**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RM (No Dispersant)
Lab ID: HAT01-11.1904001-101 (No Dispersant)
Date/Time sampled: 04/18/2019 1045

Test Date: 3-Jun-19
Start Time: 9:12

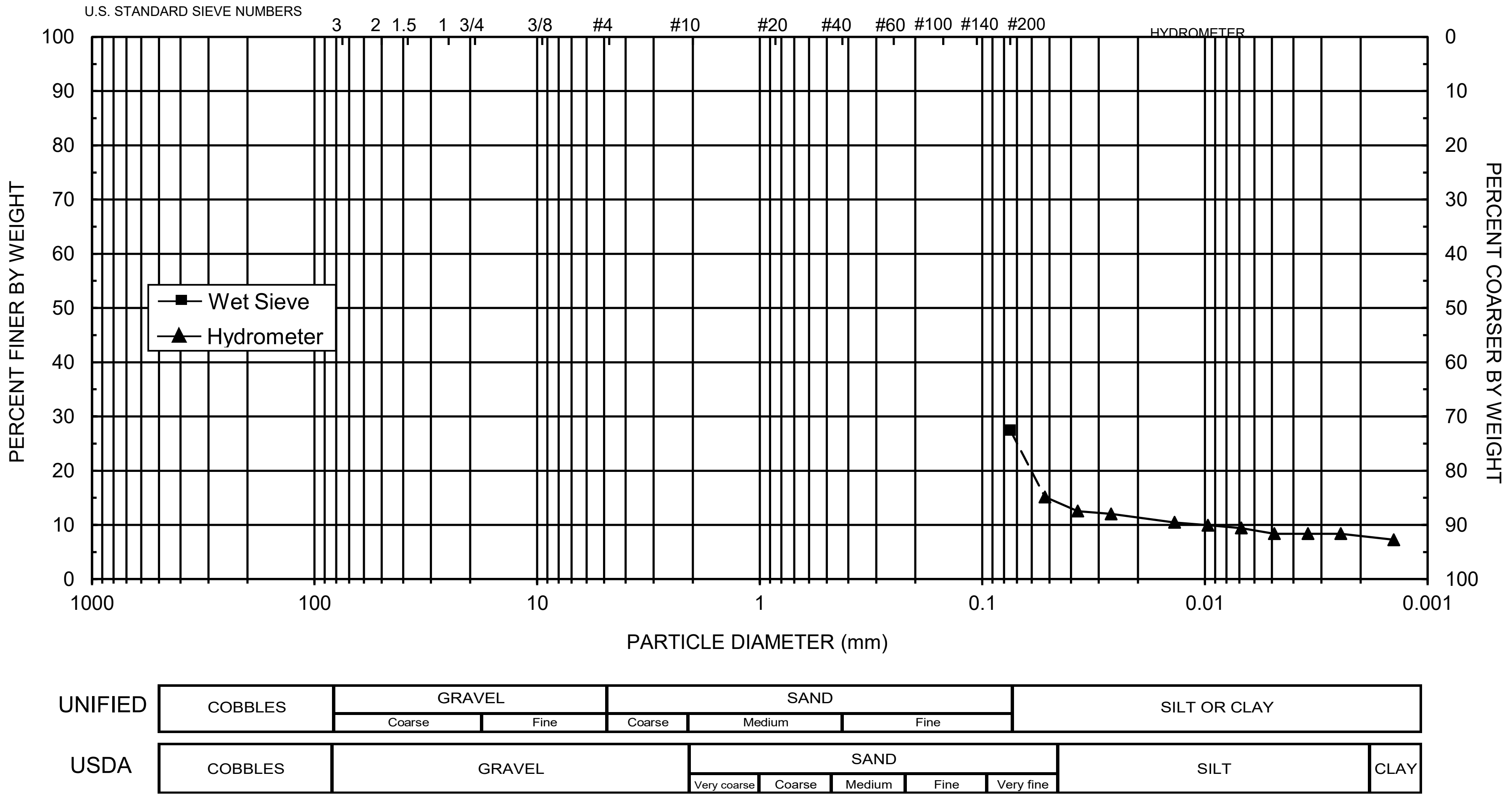
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 47.31
Total Sample Wt. (g): 1598.72
Wt. Passing #10 (g): 1581.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
3-Jun-19	1	21.8	6.50	-0.75	7.3	15	0.0524	15	15.2
	2	21.8	5.25	-0.75	6.0	15	0.0373	13	12.5
	4	21.8	5.00	-0.75	5.8	15	0.0264	12	12.0
	15	21.8	4.25	-0.75	5.0	15	0.0137	11	10.5
	30	21.8	4.00	-0.75	4.8	15	0.0097	10	9.9
	60	21.8	3.75	-0.75	4.5	15	0.0069	10	9.4
	120	21.8	3.25	-0.75	4.0	15	0.0049	8	8.4
	240	21.8	3.25	-0.75	4.0	15	0.0034	8	8.4
	473	21.8	3.25	-0.75	4.0	15	0.0025	8	8.4
4-Jun-19	1423	21.7	2.75	-0.71	3.5	15	0.0014	7	7.2

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-31RM (No Dispersant)	**04/18/2019 1045**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RT (No Dispersant)
Lab ID: HAT01-11.1904001-102 (No Dispersant)
Date/Time sampled: 04/18/2019 1045

Test Date: 10-Jun-19
Start Time: 9:42

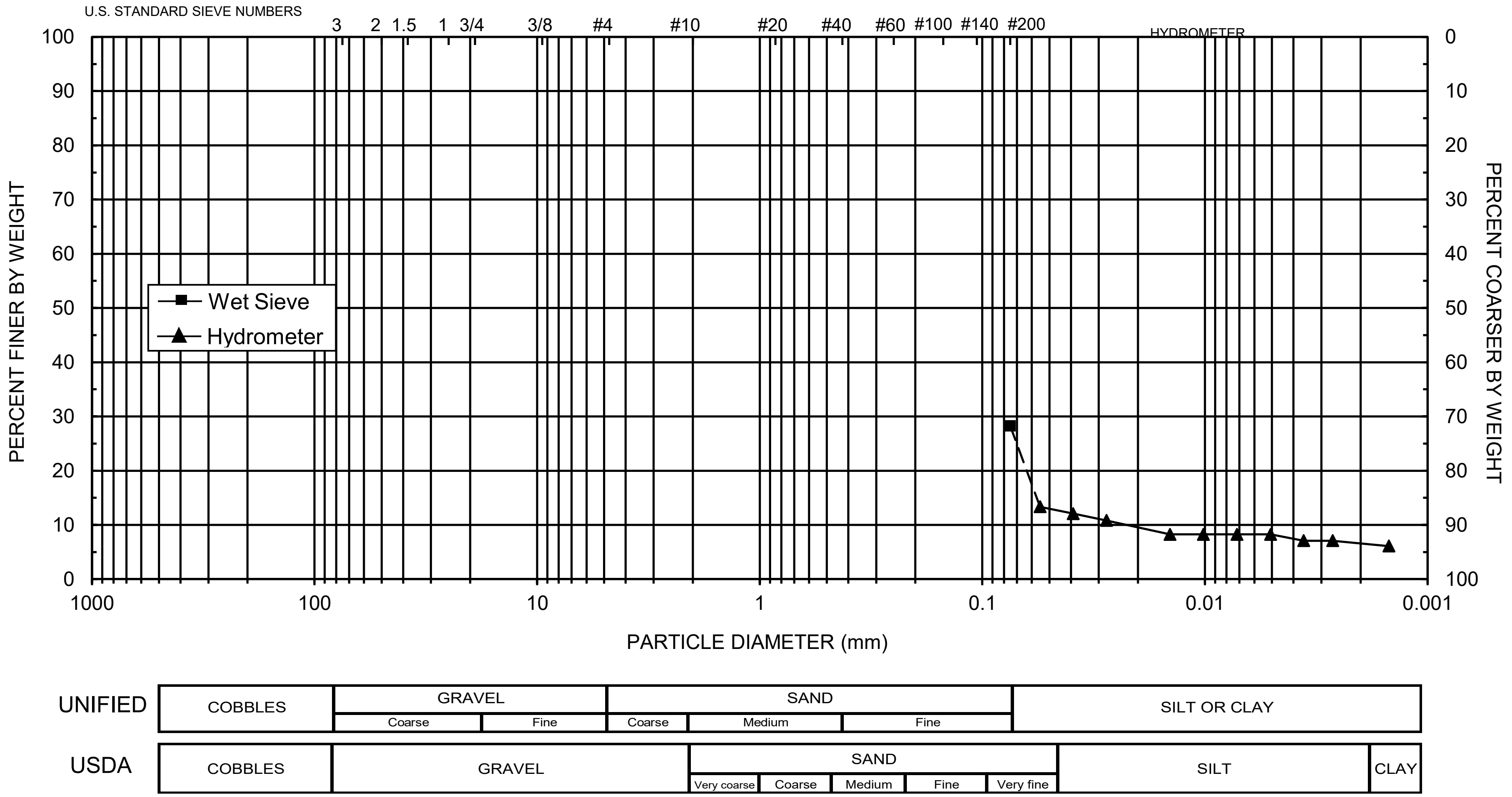
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g)*:* 39.09
Total Sample Wt. (g)*:* 1561.90
Wt. Passing #10 (g)*:* 1551.51

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.8	5.00	-0.25	5.3	16	0.0550	13	13.3
	2	21.8	4.50	-0.25	4.8	16	0.0390	12	12.1
	4	21.8	4.00	-0.25	4.3	16	0.0276	11	10.8
	15	21.8	3.00	-0.25	3.3	17	0.0143	8	8.3
	30	21.8	3.00	-0.25	3.3	17	0.0101	8	8.3
	60	21.8	3.00	-0.25	3.3	17	0.0072	8	8.3
	120	21.8	3.00	-0.25	3.3	17	0.0051	8	8.3
	240	21.9	2.50	-0.29	2.8	17	0.0036	7	7.1
	436	21.9	2.50	-0.29	2.8	17	0.0027	7	7.1
11-Jun-19	1402	21.5	2.25	-0.14	2.4	17	0.0015	6	6.1

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-31RT (No Dispersant)	**04/18/2019 1045**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RB (No Dispersant)
Lab ID: HAT01-11.1904001-096 (No Dispersant)
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19
Start Time: 9:30

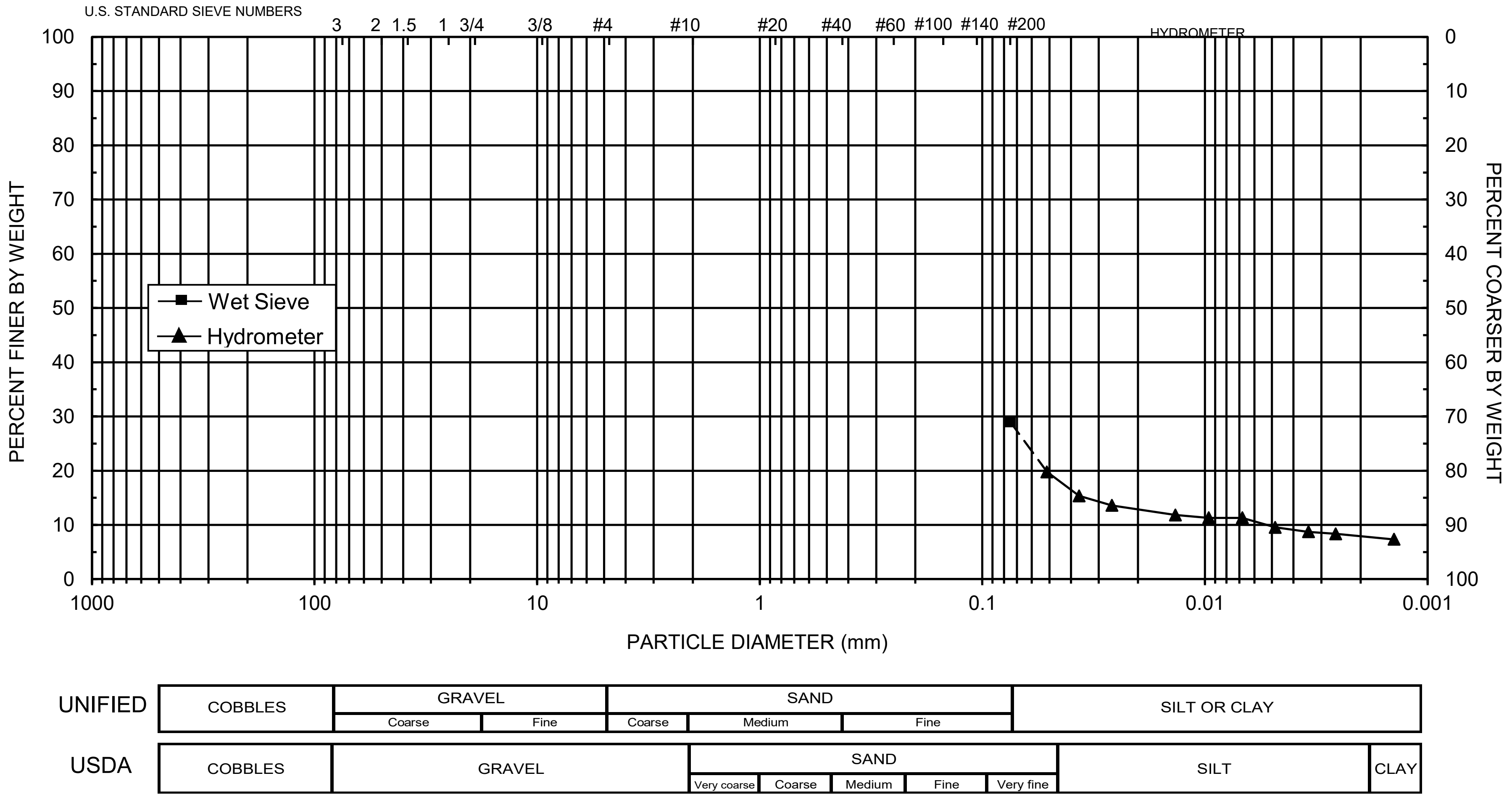
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. *(g):* 55.75
Total Sample Wt. *(g):* 1591.78
Wt. Passing #10 *(g):* 1569.55

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	10.50	-0.68	11.2	14	0.0512	20	19.8
	2	21.6	8.00	-0.68	8.7	15	0.0367	16	15.3
	4	21.6	7.00	-0.68	7.7	15	0.0261	14	13.6
	15	21.6	6.00	-0.68	6.7	15	0.0136	12	11.8
	30	21.5	5.75	-0.64	6.4	15	0.0096	11	11.3
	60	21.5	5.75	-0.64	6.4	15	0.0068	11	11.3
	120	21.5	4.75	-0.64	5.4	15	0.0048	10	9.5
	240	21.6	4.25	-0.68	4.9	15	0.0034	9	8.7
	422	21.7	4.00	-0.71	4.7	15	0.0026	8	8.3
1-Jun-19	1418	21.5	3.50	-0.64	4.1	15	0.0014	7	7.3

Comments:

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-41RB (No Dispersant)	**04/18/2019 945**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RM (No Dispersant)
Lab ID: HAT01-11.1904001-097 (No Dispersant)
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19
Start Time: 9:42

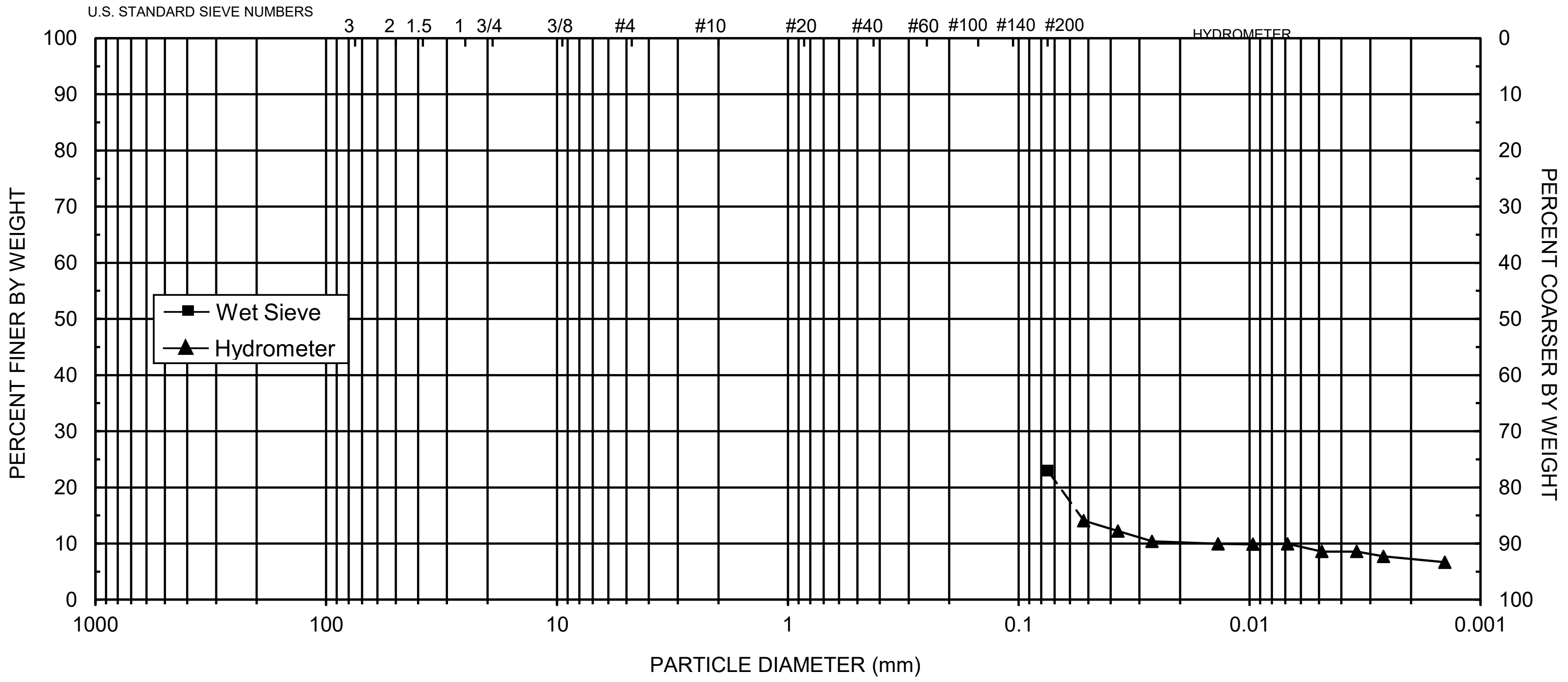
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 54.43
Total Sample Wt. (g): 1625.13
Wt. Passing #10 (g): 1618.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	7.00	-0.68	7.7	15	0.0523	14	14.0
	2	21.6	6.00	-0.68	6.7	15	0.0372	12	12.2
	4	21.6	5.00	-0.68	5.7	15	0.0264	10	10.4
	15	21.6	4.75	-0.68	5.4	15	0.0137	10	9.9
	30	21.5	4.75	-0.64	5.4	15	0.0097	10	9.9
	60	21.6	4.75	-0.68	5.4	15	0.0068	10	9.9
	120	21.6	4.00	-0.68	4.7	15	0.0049	9	8.6
	240	21.6	4.00	-0.68	4.7	15	0.0034	9	8.6
	412	21.7	3.50	-0.71	4.2	15	0.0026	8	7.7
1-Jun-19	1408	21.5	3.00	-0.64	3.6	15	0.0014	7	6.7

Comments:

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-41RM (No Dispersant)	**04/18/2019 945**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RT (No Dispersant)
Lab ID: HAT01-11.1904001-098 (No Dispersant)
Date/Time sampled: 04/18/2019 945

Test Date: 10-Jun-19
Start Time: 9:30

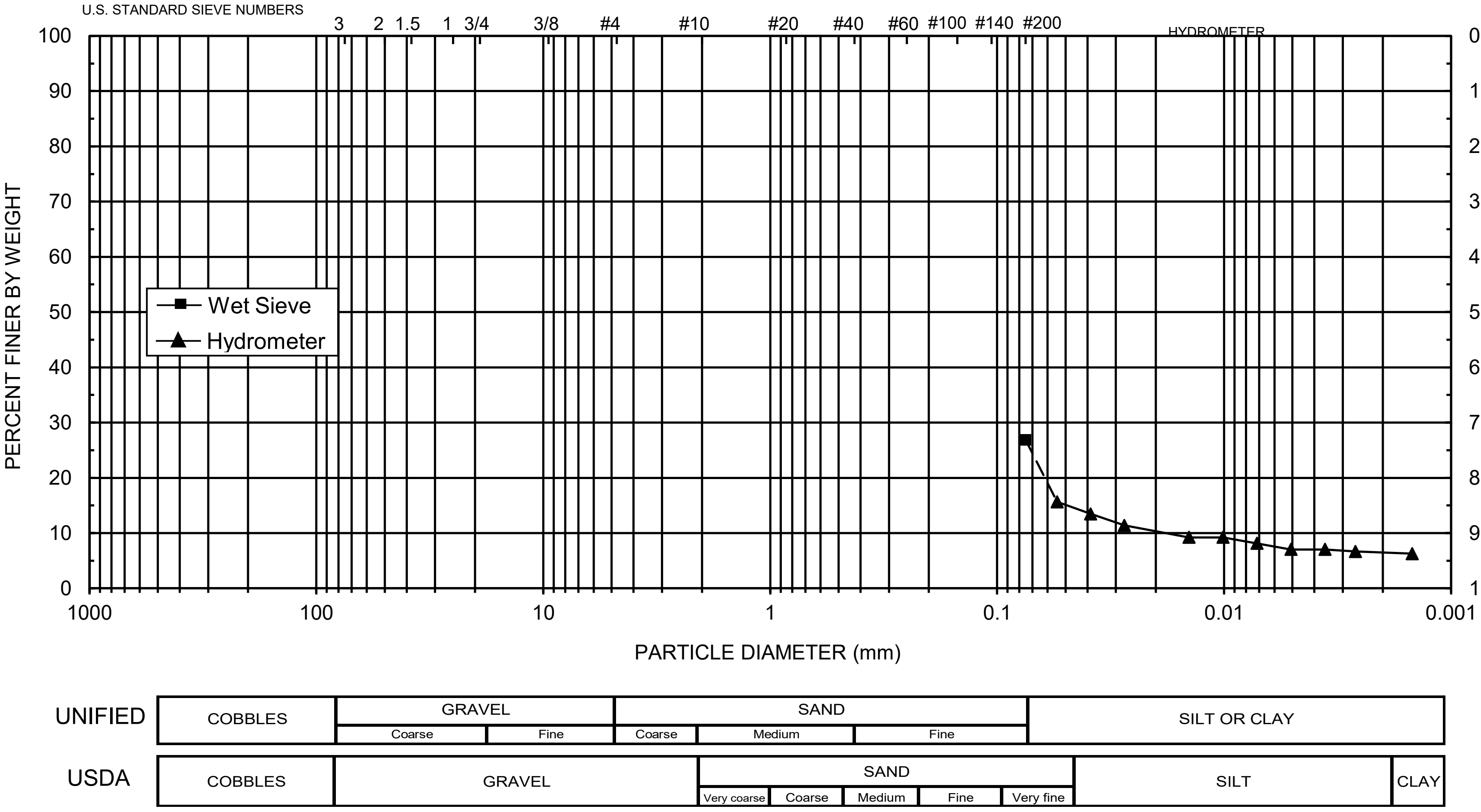
Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 46.08
Total Sample Wt. (g): 1732.20
Wt. Passing #10 (g): 1729.65

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	7.00	-0.21	7.2	16	0.0544	16	15.6
	2	21.7	6.00	-0.21	6.2	16	0.0387	13	13.5
	4	21.8	5.00	-0.25	5.3	16	0.0275	11	11.4
	15	21.8	4.00	-0.25	4.3	16	0.0143	9	9.2
	30	21.8	4.00	-0.25	4.3	16	0.0101	9	9.2
	60	21.8	3.50	-0.25	3.8	17	0.0072	8	8.1
	120	21.8	3.00	-0.25	3.3	17	0.0051	7	7.0
	240	21.8	3.00	-0.25	3.3	17	0.0036	7	7.0
	446	22.0	2.75	-0.32	3.1	17	0.0026	7	6.7
11-Jun-19	1412	21.5	2.75	-0.14	2.9	17	0.0015	6	6.3

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-41RT (No Dispersant)	**04/18/2019 945**

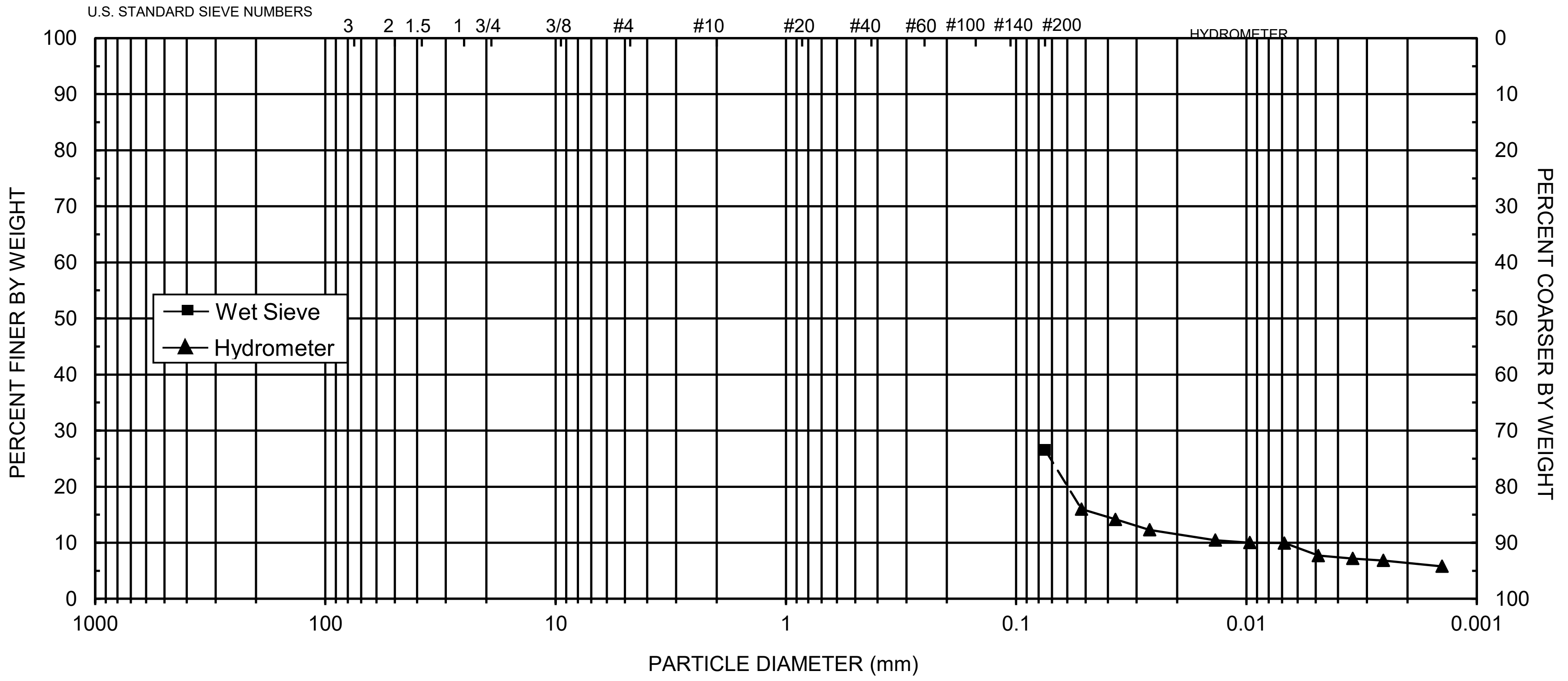
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-51RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-092 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 915	*Initial Wt. (g):*	53.81
Test Date:	31-May-19	*Total Sample Wt. (g):*	1802.22
Start Time:	9:06	*Wt. Passing #10 (g):*	1787.17

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	8.00	-0.68	8.7	15	0.0520	16	16.0
	2	21.6	7.00	-0.68	7.7	15	0.0370	14	14.1
	4	21.6	6.00	-0.68	6.7	15	0.0263	12	12.3
	15	21.6	5.00	-0.68	5.7	15	0.0137	11	10.5
	30	21.6	4.75	-0.68	5.4	15	0.0097	10	10.0
	60	21.5	4.75	-0.64	5.4	15	0.0068	10	9.9
	120	21.6	3.50	-0.68	4.2	15	0.0049	8	7.7
	240	21.5	3.25	-0.64	3.9	15	0.0034	7	7.2
	442	21.7	3.00	-0.71	3.7	15	0.0025	7	6.8
1-Jun-19	1439	21.5	2.50	-0.64	3.1	15	0.0014	6	5.8

Comments:

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-51RB (No Dispersant)	**04/18/2019 915**

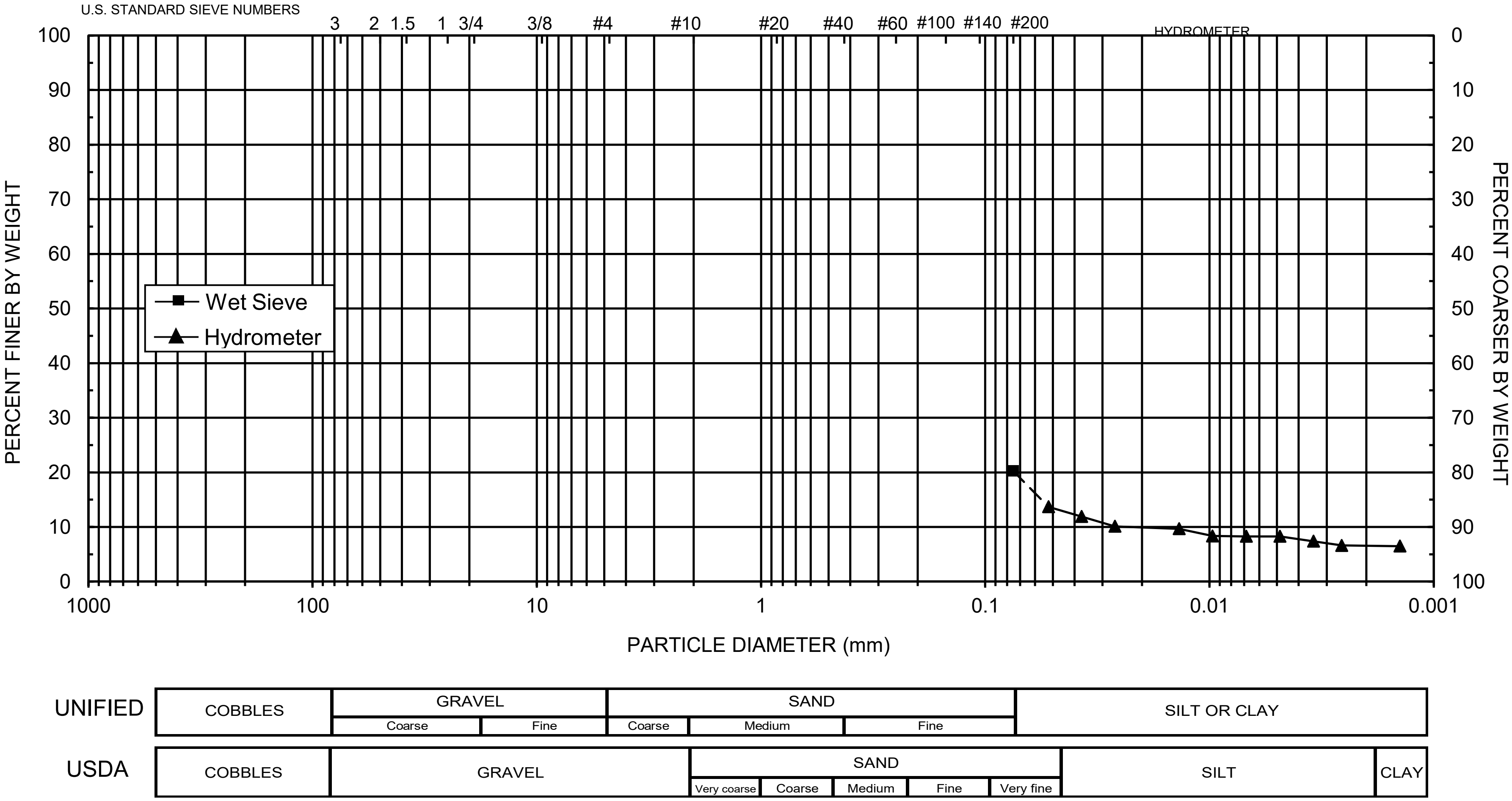
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2:	NA
Sample Number:	L5-51RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-093 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 915	*Initial Wt. (g):*	56.08
Test Date:	31-May-19	*Total Sample Wt. (g):*	1556.74
Start Time:	9:18	*Wt. Passing #10 (g):*	1555.77

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
31-May-19	1	21.6	7.00	-0.68	7.7	15	0.0522	14	13.7
	2	21.6	6.00	-0.68	6.7	15	0.0371	12	11.9
	4	21.6	5.00	-0.68	5.7	15	0.0264	10	10.1
	15	21.6	4.75	-0.68	5.4	15	0.0136	10	9.7
	30	21.6	4.00	-0.68	4.7	15	0.0097	8	8.3
	60	21.5	4.00	-0.64	4.6	15	0.0069	8	8.3
	120	21.5	4.00	-0.64	4.6	15	0.0048	8	8.3
	240	21.5	3.50	-0.64	4.1	15	0.0034	7	7.4
	432	21.7	3.00	-0.71	3.7	15	0.0026	7	6.6
1-Jun-19	1429	21.5	3.00	-0.64	3.6	15	0.0014	6	6.5

Comments:

Laboratory analysis by: A. Bland
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-51RM (No Dispersant)	**04/18/2019 915**

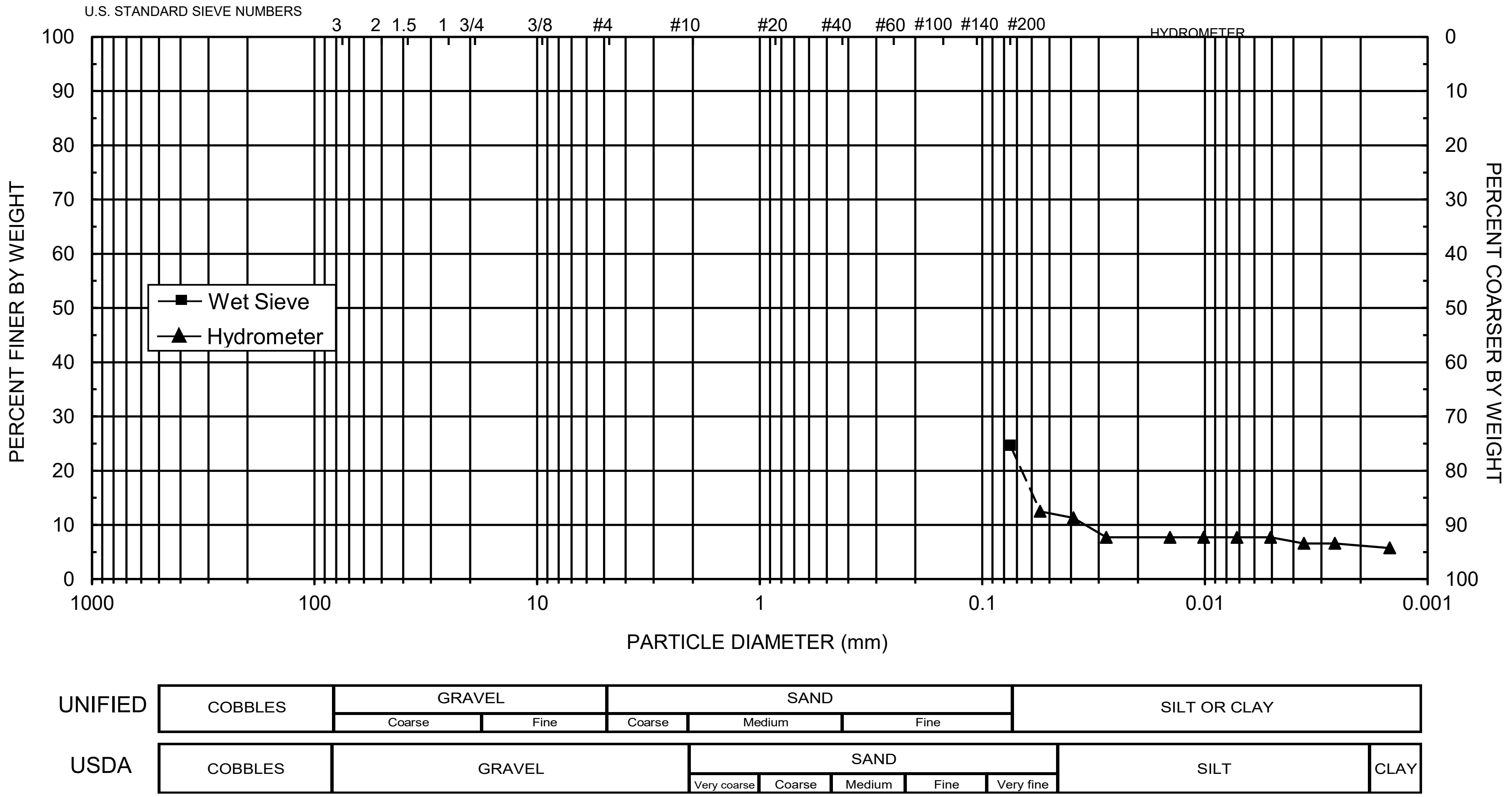
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-51RT (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-094 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/18/2019 915	*Initial Wt. (g):*	41.42
Test Date:	10-Jun-19	*Total Sample Wt. (g):*	1686.60
Start Time:	9:18	*Wt. Passing #10 (g):*	1673.43

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	5.00	-0.21	5.2	16	0.0550	13	12.5
	2	21.7	4.50	-0.21	4.7	16	0.0390	11	11.3
	4	21.7	3.00	-0.21	3.2	17	0.0278	8	7.7
	15	21.7	3.00	-0.21	3.2	17	0.0143	8	7.7
	30	21.7	3.00	-0.21	3.2	17	0.0101	8	7.7
	60	21.7	3.00	-0.21	3.2	17	0.0072	8	7.7
	120	21.7	3.00	-0.21	3.2	17	0.0051	8	7.7
	240	21.8	2.50	-0.25	2.8	17	0.0036	7	6.6
	456	21.8	2.50	-0.25	2.8	17	0.0026	7	6.6
11-Jun-19	1423	21.5	2.25	-0.14	2.4	17	0.0015	6	5.7

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-51RT (No Dispersant)	**04/18/2019 915**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

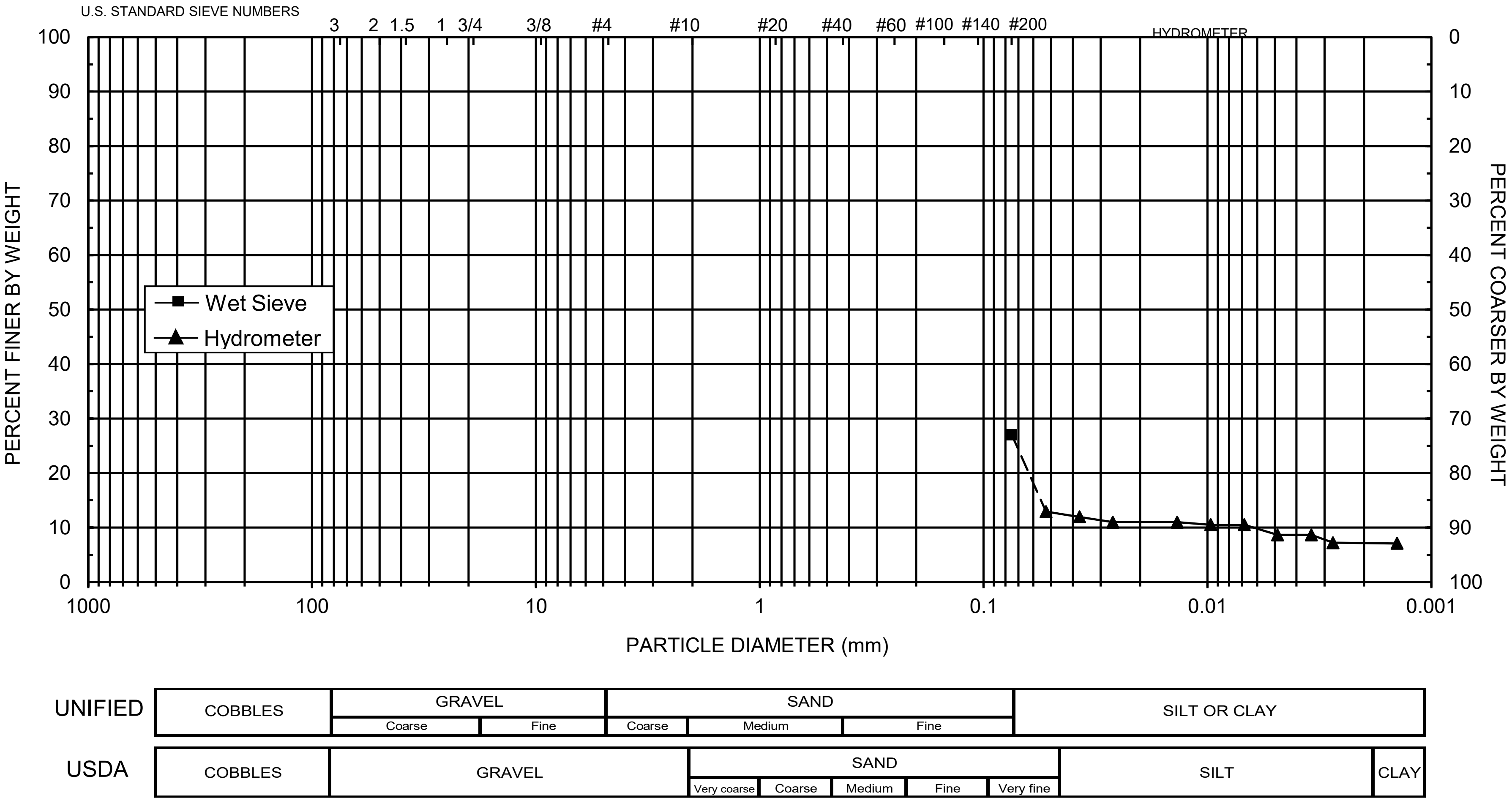
Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-61RB (No Dispersant)
Lab ID:	HAT01-11.1904001-088 (No Dispersant)
Date/Time sampled:	04/18/2019 830
Test Date:	30-May-19
Start Time:	9:42

Type of Water Used:	DISTILLED
Reaction with H_2O_2*:*	NA
Dispersant:	None
Assumed particle density:	2.65
Initial Wt. (g):	51.49
Total Sample Wt. (g):	1528.33
Wt. Passing #10 (g):	1513.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
30-May-19	1	21.7	6.00	-0.71	6.7	15	0.0526	13	12.9
	2	21.7	5.50	-0.71	6.2	15	0.0373	12	11.9
	4	21.7	5.00	-0.71	5.7	15	0.0264	11	11.0
	15	21.7	5.00	-0.71	5.7	15	0.0137	11	11.0
	30	21.7	4.75	-0.71	5.5	15	0.0097	11	10.5
	60	21.7	4.75	-0.71	5.5	15	0.0068	11	10.5
	120	21.8	3.75	-0.75	4.5	15	0.0049	9	8.7
	240	21.8	3.75	-0.75	4.5	15	0.0034	9	8.7
	379	21.8	3.00	-0.75	3.8	15	0.0027	7	7.2
31-May-19	1414	21.6	3.00	-0.68	3.7	15	0.0014	7	7.1

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-61RB (No Dispersant)	**04/18/2019 830**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RM (No Dispersant)
Lab ID: HAT01-11.1904001-089 (No Dispersant)
Date/Time sampled: 04/18/2019 830

Test Date: 11-Jun-19
Start Time: 9:30

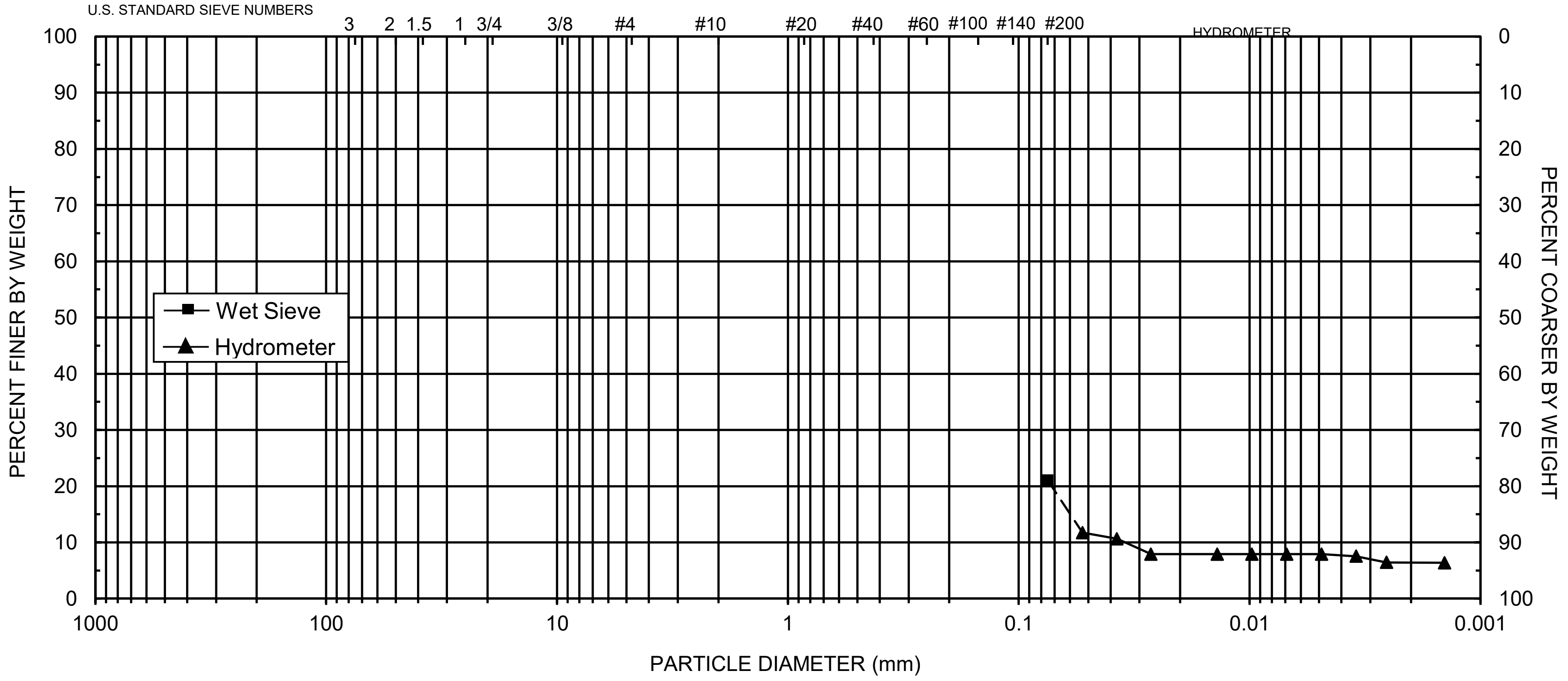
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 45.93
Total Sample Wt. (g): 1403.33
Wt. Passing #10 (g): 1400.18

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
11-Jun-19	1	21.5	4.75	-0.64	5.4	15	0.0529	12	11.7
	2	21.5	4.25	-0.64	4.9	15	0.0375	11	10.6
	4	21.5	3.00	-0.64	3.6	15	0.0267	8	7.9
	15	21.5	3.00	-0.64	3.6	15	0.0138	8	7.9
	30	21.5	3.00	-0.64	3.6	15	0.0098	8	7.9
	60	21.5	3.00	-0.64	3.6	15	0.0069	8	7.9
	120	21.5	3.00	-0.64	3.6	15	0.0049	8	7.9
	240	21.7	2.75	-0.71	3.5	15	0.0035	8	7.5
	443	21.7	2.25	-0.71	3.0	16	0.0025	6	6.4
12-Jun-19	1412	21.6	2.25	-0.68	2.9	16	0.0014	6	6.4

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L5-61RM (No Dispersant)	**04/18/2019 830**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT (No Dispersant)
Lab ID: HAT01-11.1904001-090 (No Dispersant)
Date/Time sampled: 04/18/2019 830

Test Date: 10-Jun-19
Start Time: 9:06

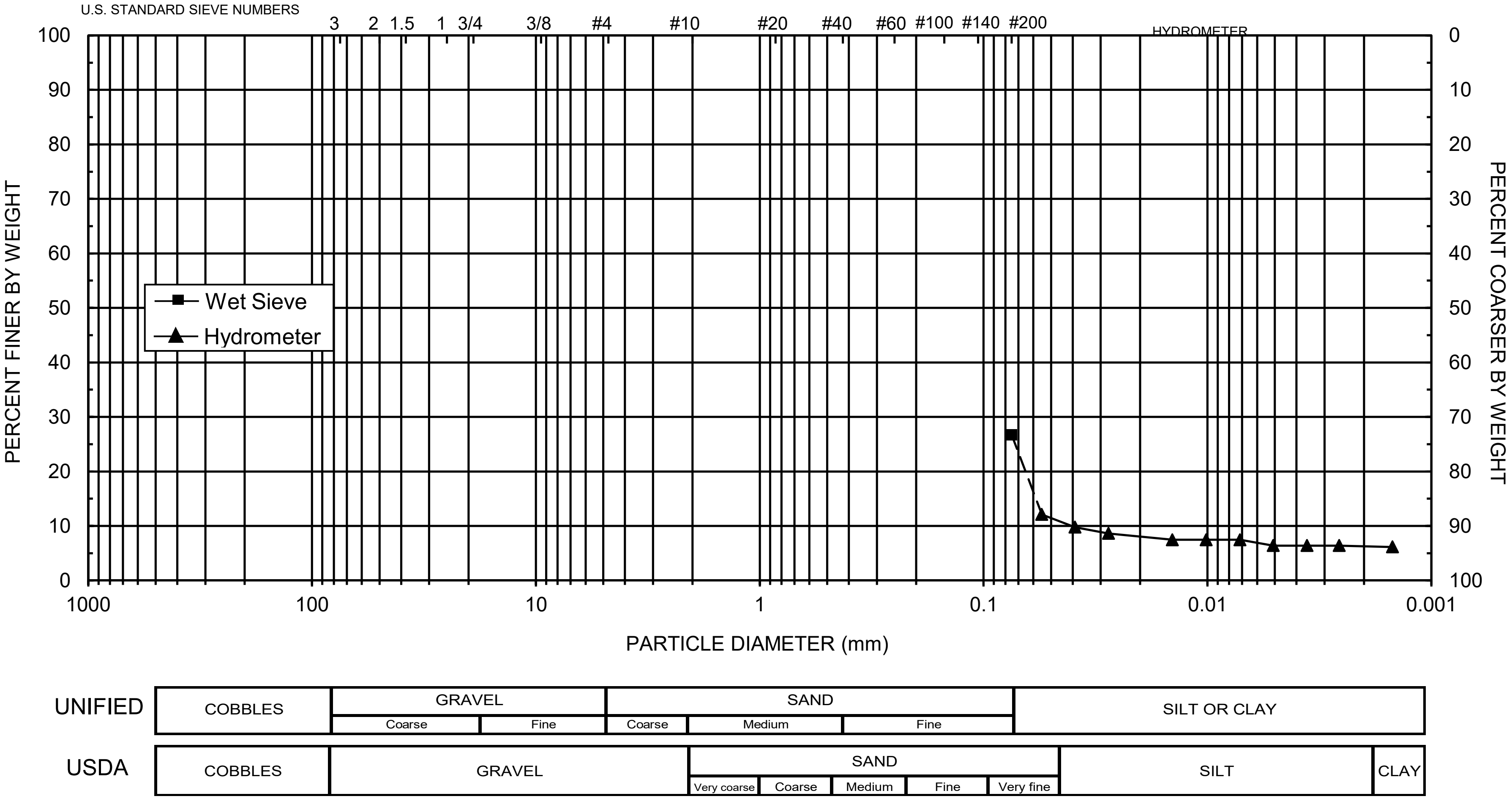
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 42.90
Total Sample Wt. (g): 1454.20
Wt. Passing #10 (g): 1446.59

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.7	5.00	-0.21	5.2	16	0.0549	12	12.1
	2	21.7	4.00	-0.21	4.2	16	0.0390	10	9.8
	4	21.7	3.50	-0.21	3.7	16	0.0277	9	8.6
	15	21.7	3.00	-0.21	3.2	17	0.0143	7	7.5
	30	21.7	3.00	-0.21	3.2	17	0.0101	7	7.5
	60	21.7	3.00	-0.21	3.2	17	0.0072	7	7.5
	120	21.8	2.50	-0.25	2.8	17	0.0051	6	6.4
	240	21.8	2.50	-0.25	2.8	17	0.0036	6	6.4
	466	21.8	2.50	-0.25	2.8	17	0.0026	6	6.4
11-Jun-19	1393	21.5	2.50	-0.14	2.6	17	0.0015	6	6.1

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-61RT (No Dispersant)	**04/18/2019 830**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RB (No Dispersant)
Lab ID: HAT01-11.1904001-085 (No Dispersant)
Date/Time sampled: 04/17/2019 1650

Test Date: 10-Jun-19
Start Time: 9:42

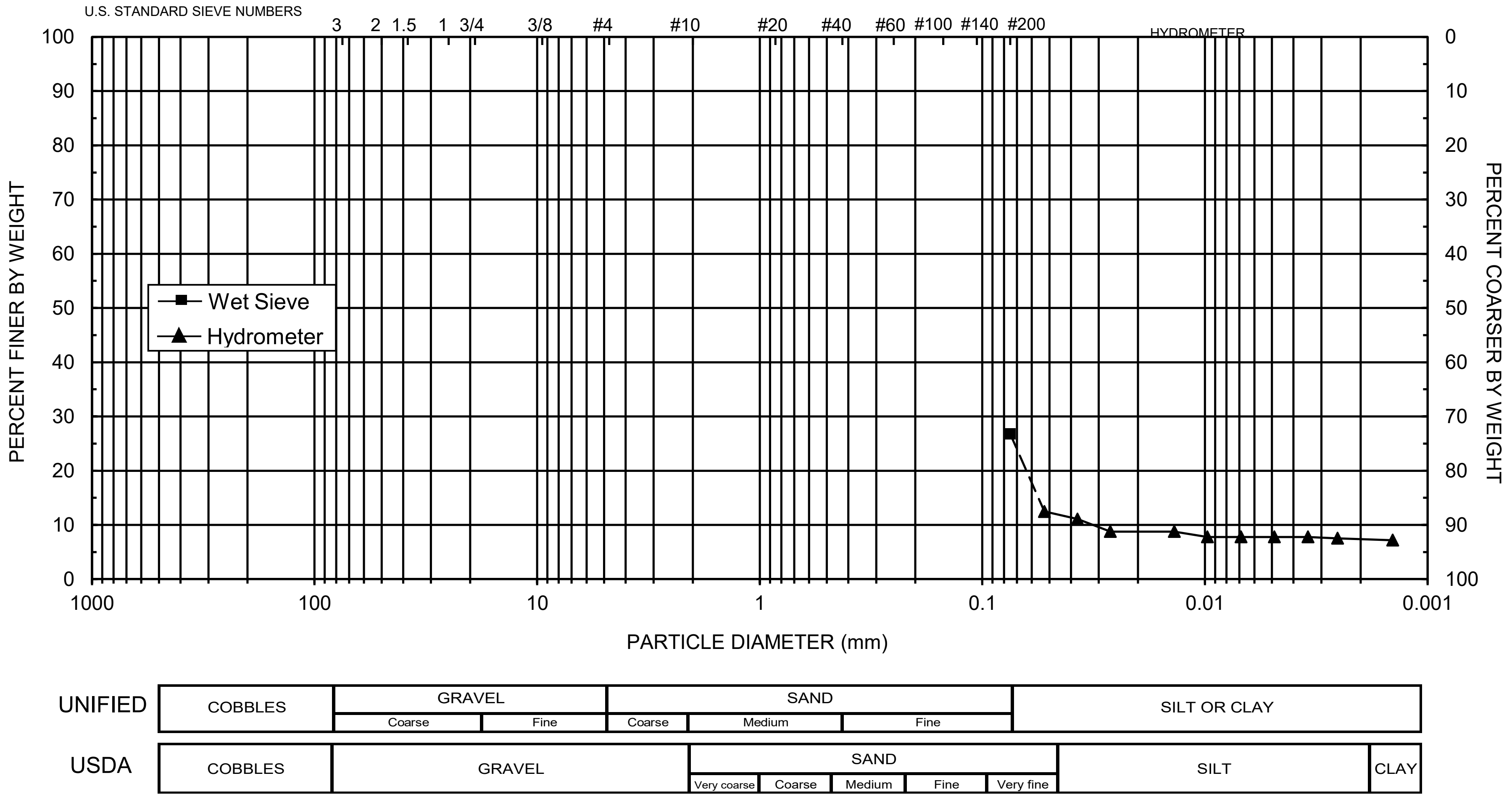
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g)*:* 53.77
Total Sample Wt. (g)*:* 2545.62
Wt. Passing #10 (g)*:* 2526.78

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
10-Jun-19	1	21.8	6.00	-0.75	6.8	15	0.0526	13	12.5
	2	21.8	5.25	-0.75	6.0	15	0.0373	11	11.1
	4	21.8	4.00	-0.75	4.8	15	0.0266	9	8.8
	15	21.8	4.00	-0.75	4.8	15	0.0137	9	8.8
	30	21.7	3.50	-0.71	4.2	15	0.0097	8	7.8
	60	21.7	3.50	-0.71	4.2	15	0.0069	8	7.8
	120	21.7	3.50	-0.71	4.2	15	0.0049	8	7.8
	240	21.7	3.50	-0.71	4.2	15	0.0034	8	7.8
	445	22.0	3.25	-0.82	4.1	15	0.0025	8	7.5
11-Jun-19	1391	21.5	3.25	-0.64	3.9	15	0.0014	7	7.2

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-01A-RB (No Dispersant)	**04/17/2019 1650**

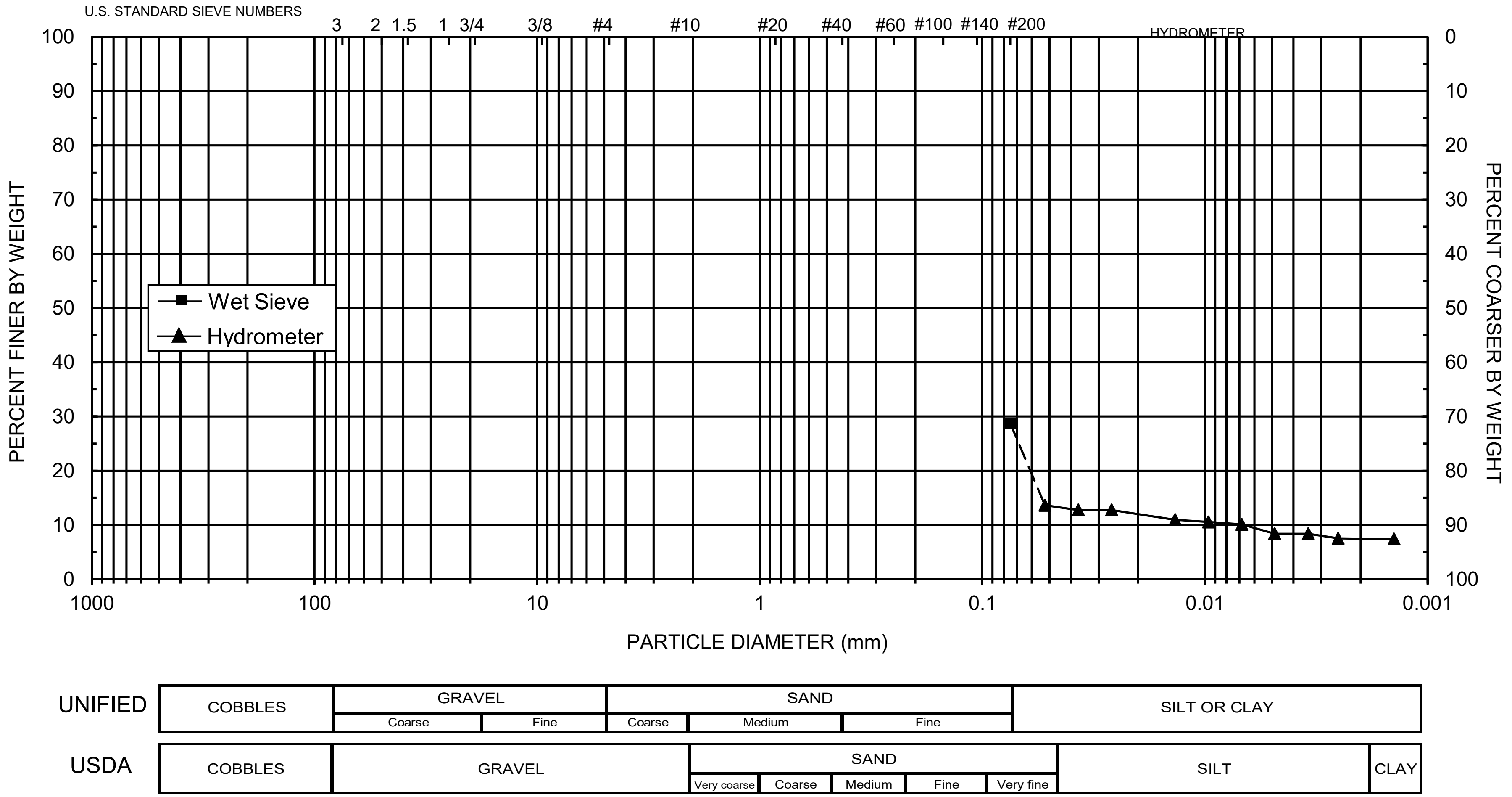
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-01A-RU (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-086 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/17/2019 1655	*Initial Wt. (g):*	51.29
Test Date:	30-May-19	*Total Sample Wt. (g):*	2466.13
Start Time:	9:30	*Wt. Passing #10 (g):*	2231.96

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
30-May-19	1	21.7	7.00	-0.71	7.7	15	0.0523	15	13.6
	2	21.7	6.50	-0.71	7.2	15	0.0371	14	12.7
	4	21.7	6.50	-0.71	7.2	15	0.0262	14	12.7
	15	21.7	5.50	-0.71	6.2	15	0.0136	12	11.0
	30	21.7	5.25	-0.71	6.0	15	0.0096	12	10.5
	60	21.7	5.00	-0.71	5.7	15	0.0068	11	10.1
	120	21.8	4.00	-0.75	4.8	15	0.0049	9	8.4
	240	21.8	4.00	-0.75	4.8	15	0.0034	9	8.4
	448	21.8	3.50	-0.75	4.3	15	0.0025	8	7.5
31-May-19	1425	21.6	3.50	-0.68	4.2	15	0.0014	8	7.4

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L5-01A-RU (No Dispersant)	**04/17/2019 1655**

Daniel B. Stephens & Associates, Inc.

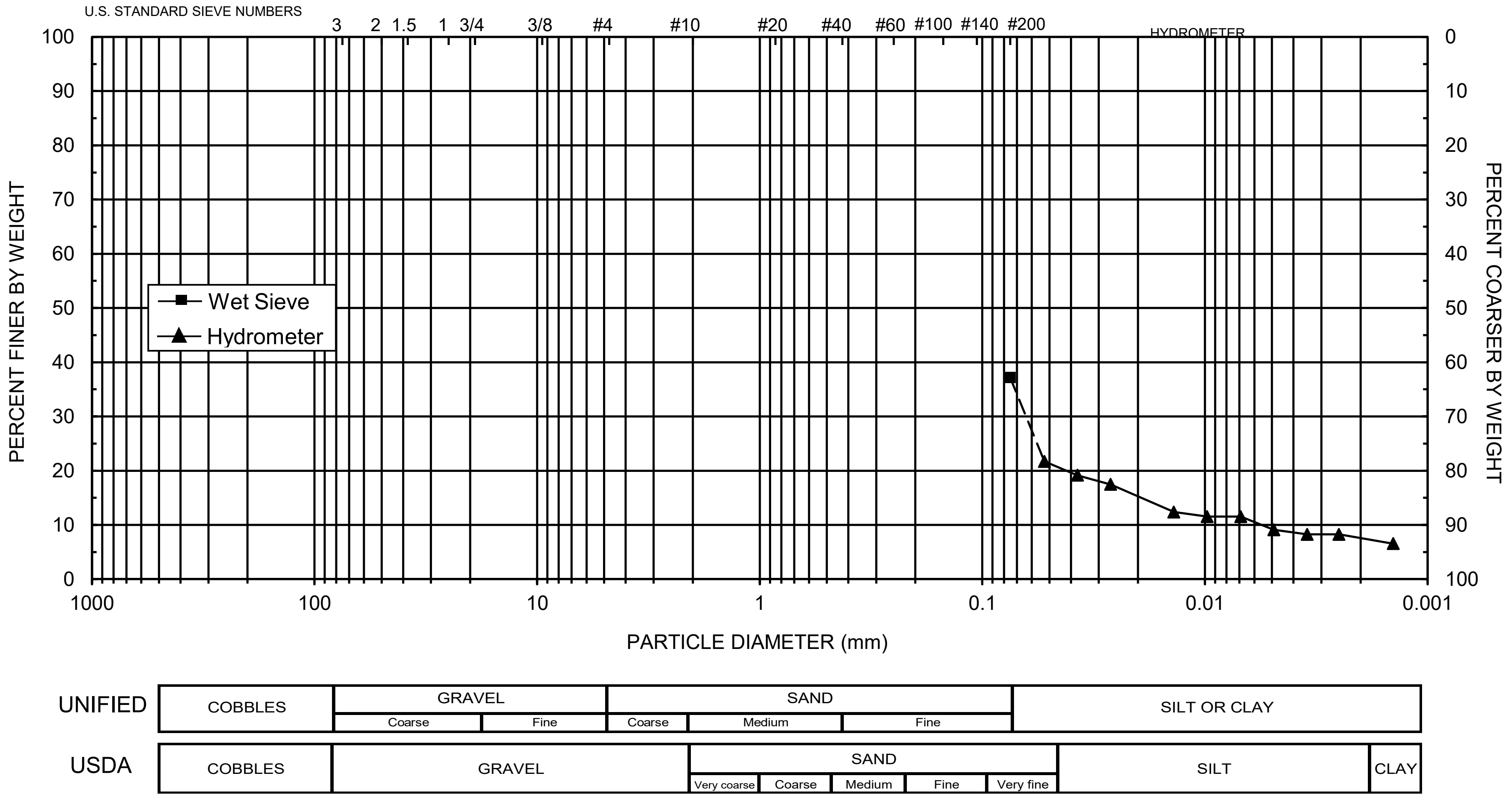
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-01RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-071 (No Dipsersent)	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1515	*Initial Wt. (g):*	25.45
Test Date:	11-Jun-19	*Total Sample Wt. (g):*	938.70
Start Time:	9:06	*Wt. Passing #10 (g):*	811.02

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
11-Jun-19	1	21.5	5.75	-0.64	6.4	15	0.0526	25	21.7
	2	21.5	5.00	-0.64	5.6	15	0.0374	22	19.2
	4	21.5	4.50	-0.64	5.1	15	0.0265	20	17.5
	15	21.5	3.00	-0.64	3.6	15	0.0138	14	12.4
	30	21.5	2.75	-0.64	3.4	15	0.0098	13	11.5
	60	21.5	2.75	-0.64	3.4	15	0.0069	13	11.5
	120	21.6	2.00	-0.68	2.7	16	0.0049	11	9.1
	240	21.6	1.75	-0.68	2.4	16	0.0035	10	8.2
	464	21.6	1.75	-0.68	2.4	16	0.0025	10	8.2
12-Jun-19	1433	21.6	1.25	-0.68	1.9	16	0.0014	8	6.5

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-01RB (No Dispersant)	**04/10/2019 1515**

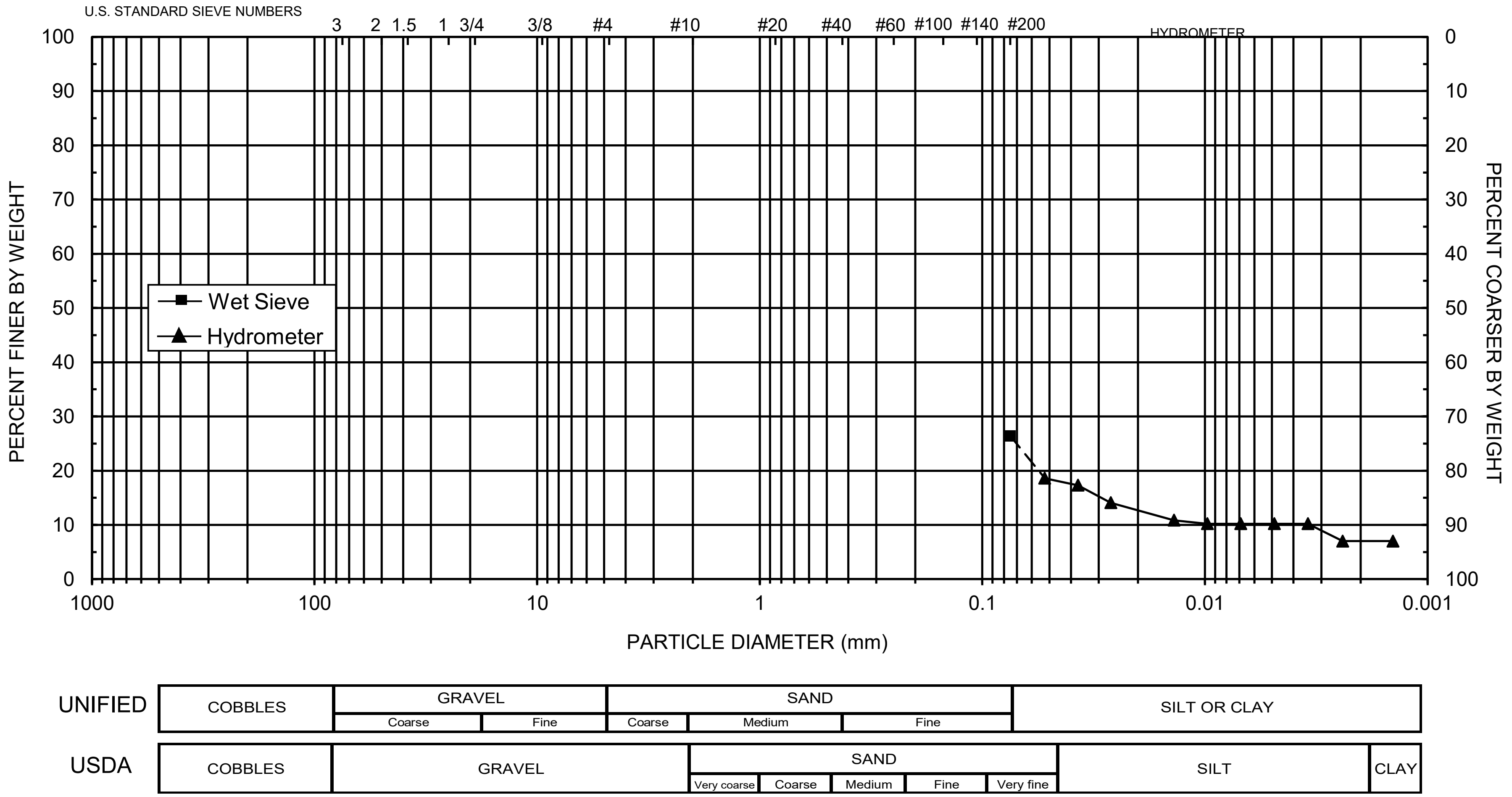
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-01RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-059 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 1530	*Initial Wt. (g):*	37.75
Test Date:	16-May-19	*Total Sample Wt. (g):*	1342.25
Start Time:	9:18	*Wt. Passing #10 (g):*	1306.35

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
16-May-19	1	21.7	6.50	-0.71	7.2	15	0.0524	19	18.6
	2	21.7	6.00	-0.71	6.7	15	0.0372	18	17.3
	4	21.7	4.75	-0.71	5.5	15	0.0265	14	14.1
	15	21.7	3.50	-0.71	4.2	15	0.0138	11	10.9
	30	21.7	3.25	-0.71	4.0	15	0.0097	11	10.2
	60	21.7	3.25	-0.71	4.0	15	0.0069	11	10.2
	120	21.7	3.25	-0.71	4.0	15	0.0049	11	10.2
	240	21.7	3.25	-0.71	4.0	15	0.0034	11	10.2
	499	21.7	2.00	-0.71	2.7	16	0.0024	7	7.0
17-May-19	1415	21.7	2.00	-0.71	2.7	16	0.0014	7	7.0

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-01RM (No Dispersant)	**04/11/2019 1530**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RT (No Dispersant)
Lab ID: HAT01-11.1904001-047 (No Dispersant)
Date/Time sampled: 04/10/2019 1545

Test Date: 21-May-19
Start Time: 9:30

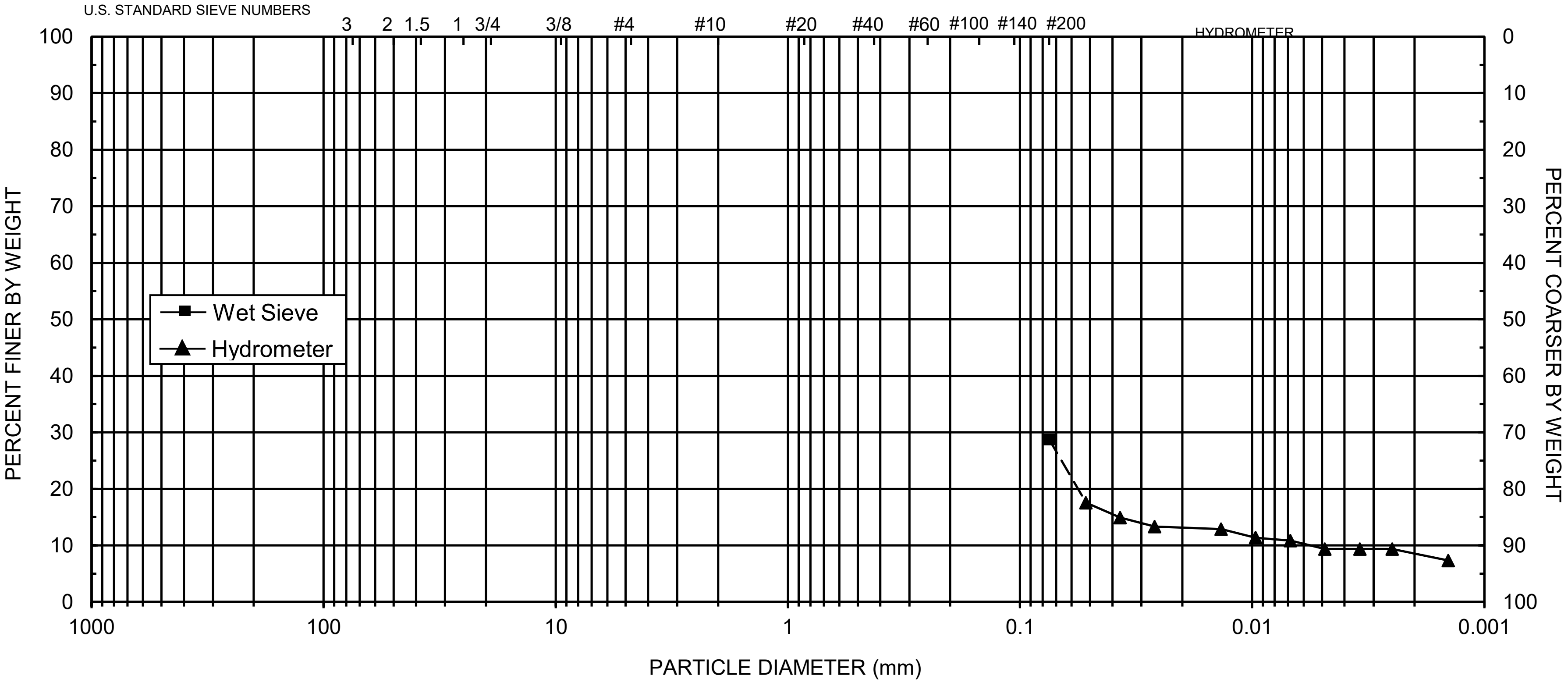
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. *(g):* 46.47
Total Sample Wt. *(g):* 1511.50
Wt. Passing #10 *(g):* 1478.13

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
21-May-19	1	20.6	8.00	-0.33	8.3	15	0.0520	18	17.5
	2	20.6	6.75	-0.33	7.1	15	0.0370	15	14.9
	4	20.6	6.00	-0.33	6.3	15	0.0263	14	13.3
	15	20.7	5.75	-0.36	6.1	15	0.0136	13	12.9
	30	20.8	5.00	-0.40	5.4	15	0.0097	12	11.4
	60	20.8	4.75	-0.40	5.1	15	0.0068	11	10.8
	120	20.9	4.00	-0.43	4.4	15	0.0049	10	9.3
	240	20.9	4.00	-0.43	4.4	15	0.0034	10	9.3
	455	20.9	4.00	-0.43	4.4	15	0.0025	10	9.3
22-May-19	1403	21.0	3.00	-0.47	3.5	15	0.0014	7	7.3

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L8-01RT (No Dispersant)	**04/10/2019 1545**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RB (No Dispersant)
Lab ID: HAT01-11.1904001-072 (No Dispersant)
Date/Time sampled: 04/10/2019 1620

Test Date: 28-May-19
Start Time: 9:30

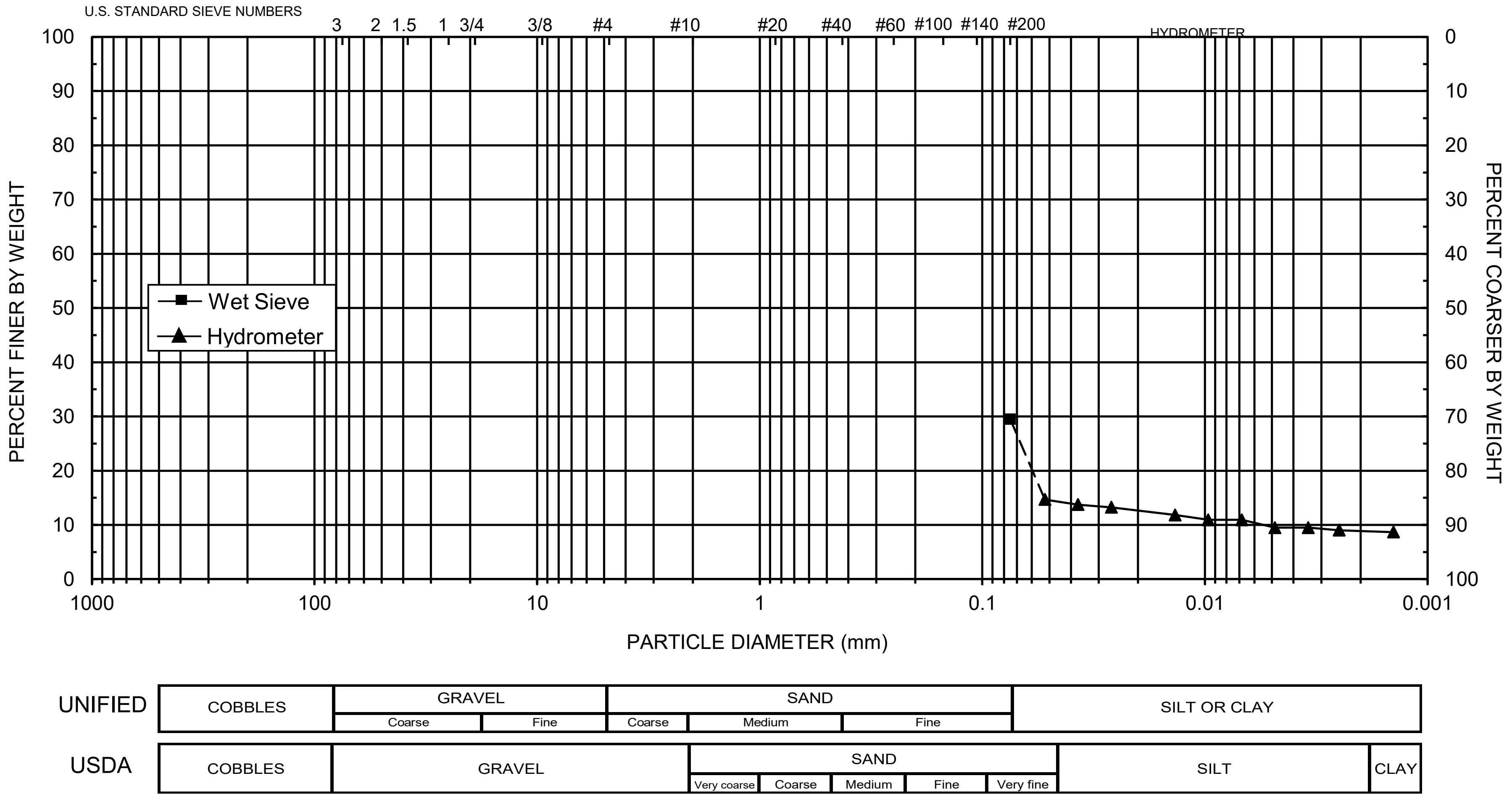
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 49.90
Total Sample Wt. (g): 1504.61
Wt. Passing #10 (g): 1435.30

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	7.00	-0.68	7.7	15	0.0523	15	14.7
	2	21.6	6.50	-0.68	7.2	15	0.0371	14	13.7
	4	21.6	6.25	-0.68	6.9	15	0.0263	14	13.2
	15	21.6	5.50	-0.68	6.2	15	0.0136	12	11.8
	30	21.7	5.00	-0.71	5.7	15	0.0097	11	10.9
	60	21.7	5.00	-0.71	5.7	15	0.0068	11	10.9
	120	21.7	4.25	-0.71	5.0	15	0.0048	10	9.5
	240	21.7	4.25	-0.71	5.0	15	0.0034	10	9.5
	455	21.7	4.00	-0.71	4.7	15	0.0025	9	9.0
29-May-19	1403	21.9	3.75	-0.79	4.5	15	0.0014	9	8.7

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-02RB (No Dispersant)	**04/10/2019 1620**

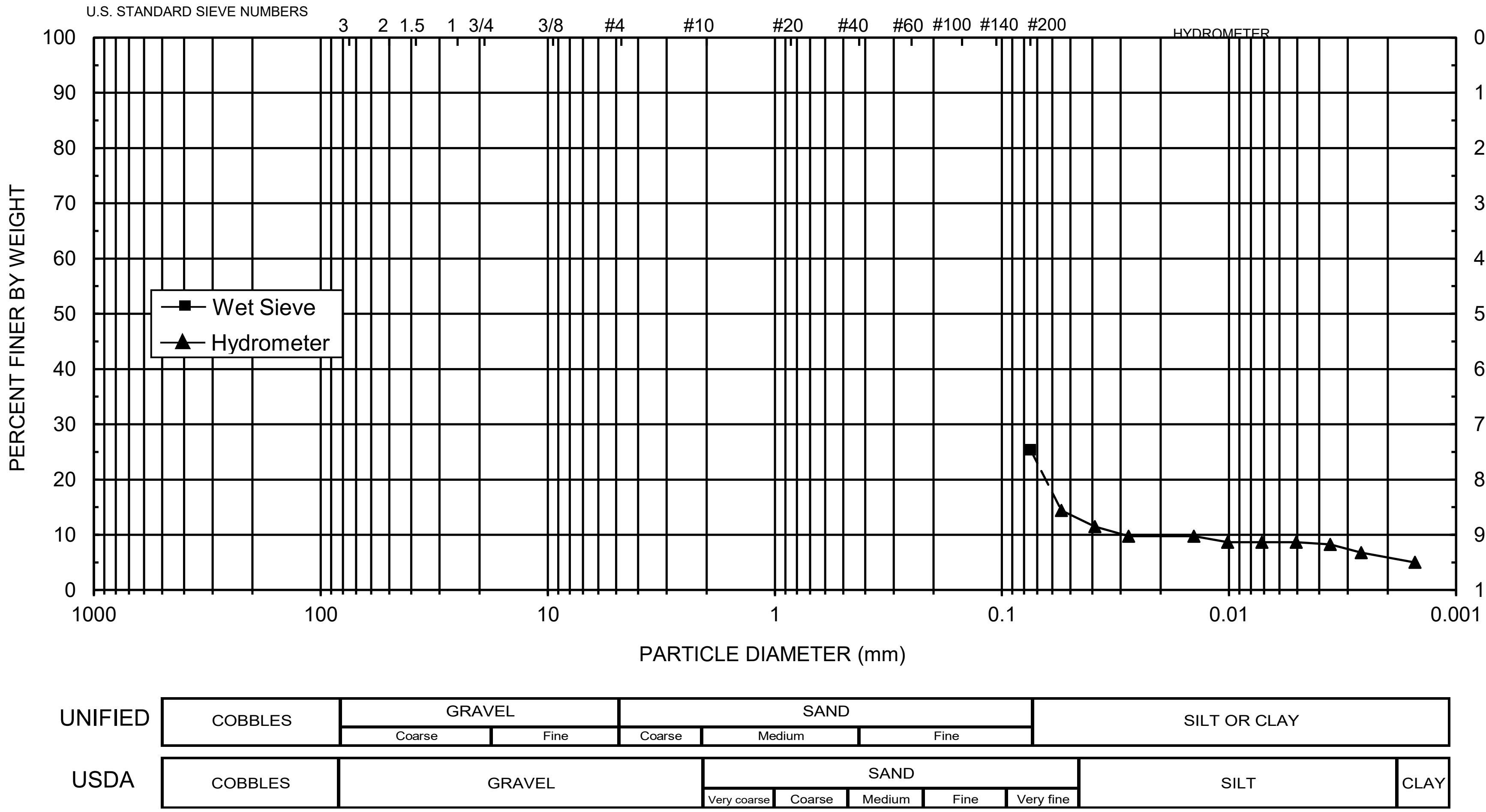
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-02RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-060 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1625	*Initial Wt. (g):*	41.72
Test Date:	7-Jun-19	*Total Sample Wt. (g):*	1756.31
Start Time:	9:30	*Wt. Passing #10 (g):*	1707.85

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.6	6.00	-0.18	6.2	16	0.0547	15	14.4
	2	21.6	4.75	-0.18	4.9	16	0.0389	12	11.5
	4	21.6	4.00	-0.18	4.2	16	0.0276	10	9.7
	15	21.6	4.00	-0.18	4.2	16	0.0143	10	9.7
	30	21.7	3.50	-0.21	3.7	17	0.0101	9	8.7
	60	21.7	3.50	-0.21	3.7	17	0.0072	9	8.7
	120	21.7	3.50	-0.21	3.7	17	0.0051	9	8.7
	240	21.9	3.25	-0.29	3.5	17	0.0036	8	8.2
	453	22.2	2.50	-0.40	2.9	17	0.0026	7	6.7
8-Jun-19	1357	21.5	2.00	-0.14	2.1	17	0.0015	5	5.0

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-02RM (No Dispersant)	**04/10/2019 1625**

Daniel B. Stephens & Associates, Inc.

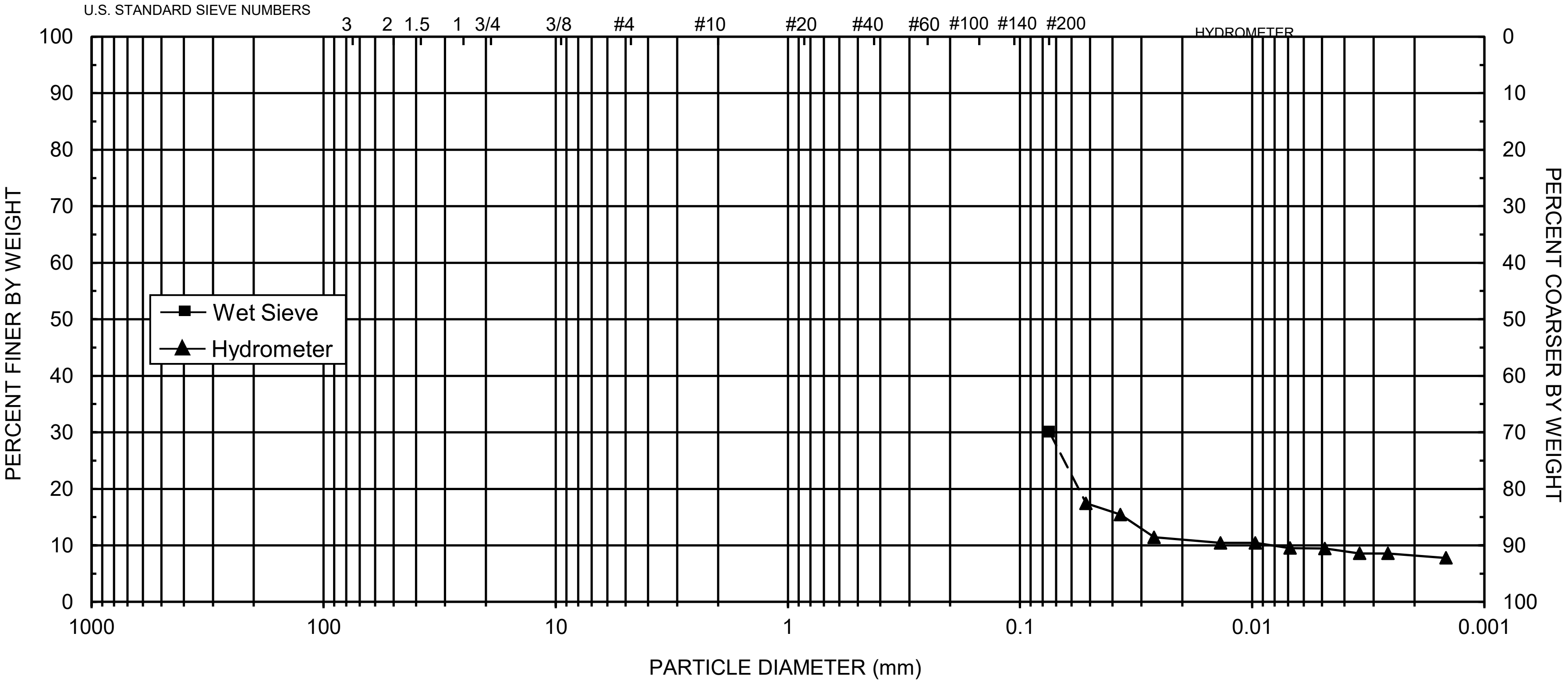
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-02RT (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-048 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 1615	*Initial Wt. (g):*	49.09
Test Date:	7-Jun-19	*Total Sample Wt. (g):*	1583.53
Start Time:	9:54	*Wt. Passing #10 (g):*	1555.44

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	8.00	-0.71	8.7	15	0.0520	18	17.4
	2	21.7	7.00	-0.71	7.7	15	0.0370	16	15.4
	4	21.7	5.00	-0.71	5.7	15	0.0264	12	11.4
	15	21.7	4.50	-0.71	5.2	15	0.0137	11	10.4
	30	21.7	4.50	-0.71	5.2	15	0.0097	11	10.4
	60	21.8	4.00	-0.75	4.8	15	0.0069	10	9.5
	120	21.7	4.00	-0.71	4.7	15	0.0049	10	9.4
	240	21.9	3.50	-0.79	4.3	15	0.0034	9	8.6
	421	21.9	3.50	-0.79	4.3	15	0.0026	9	8.6
8-Jun-19	1333	21.5	3.25	-0.64	3.9	15	0.0015	8	7.8

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Bland
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED
L8-02RT (No Dispersant)	**04/10/2019 1615**

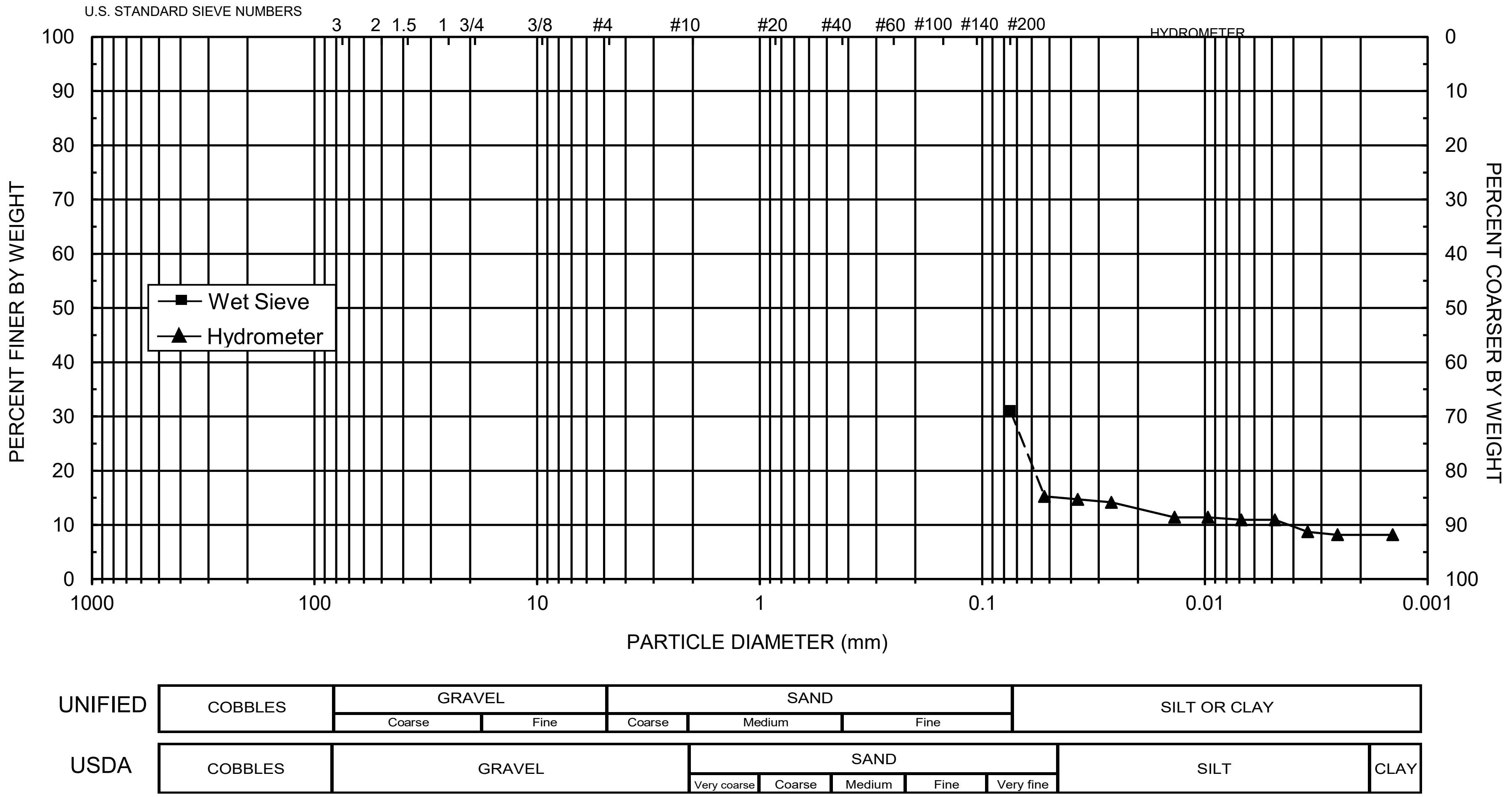
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-03RB (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-073 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/11/2019 855	*Initial Wt. (g):*	44.40
Test Date:	28-May-19	*Total Sample Wt. (g):*	1501.16
Start Time:	9:42	*Wt. Passing #10 (g):*	1467.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
28-May-19	1	21.6	6.25	-0.68	6.9	15	0.0525	16	15.3
	2	21.6	6.00	-0.68	6.7	15	0.0372	15	14.7
	4	21.6	5.75	-0.68	6.4	15	0.0263	14	14.2
	15	21.6	4.50	-0.68	5.2	15	0.0137	12	11.4
	30	21.6	4.50	-0.68	5.2	15	0.0097	12	11.4
	60	21.7	4.25	-0.71	5.0	15	0.0069	11	10.9
	120	21.7	4.25	-0.71	5.0	15	0.0048	11	10.9
	240	21.7	3.25	-0.71	4.0	15	0.0034	9	8.7
	445	21.7	3.00	-0.71	3.7	15	0.0025	8	8.2
29-May-19	1393	21.7	3.00	-0.71	3.7	15	0.0014	8	8.2

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-03RB (No Dispersant)	**04/11/2019 855**

Daniel B. Stephens & Associates, Inc.

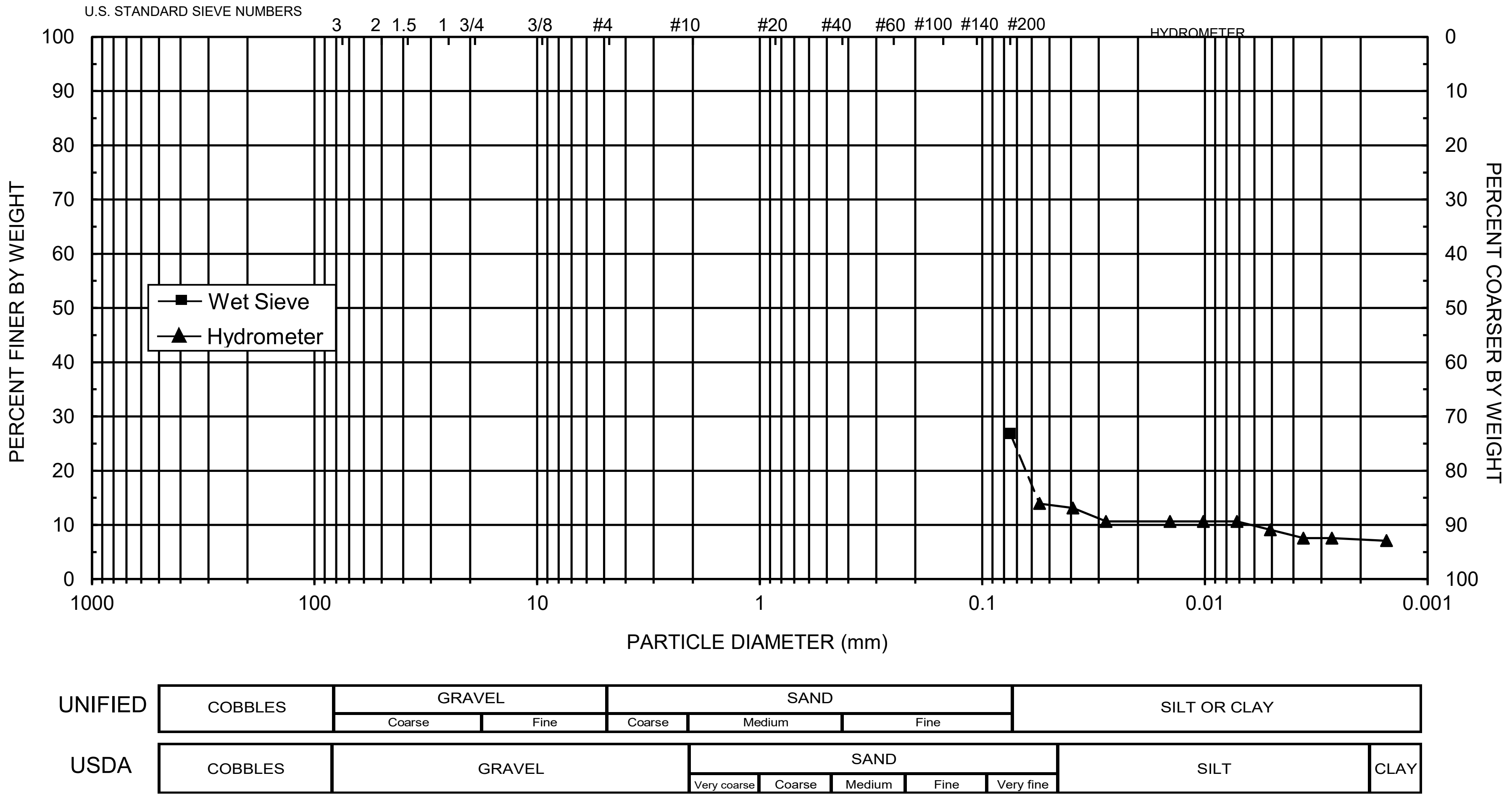
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L8-03RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-061 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/10/2019 900	*Initial Wt.* *(g):*	29.02
Test Date:	7-Jun-19	*Total Sample Wt.* *(g):*	1254.74
Start Time:	9:54	*Wt. Passing #10* *(g):*	1203.63

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
7-Jun-19	1	21.7	4.00	-0.21	4.2	16	0.0553	15	13.9
	2	21.7	3.75	-0.21	4.0	17	0.0392	14	13.1
	4	21.7	3.00	-0.21	3.2	17	0.0278	11	10.6
	15	21.7	3.00	-0.21	3.2	17	0.0144	11	10.6
	30	21.7	3.00	-0.21	3.2	17	0.0101	11	10.6
	60	21.7	3.00	-0.21	3.2	17	0.0072	11	10.6
	120	21.8	2.50	-0.25	2.8	17	0.0051	9	9.1
	240	21.9	2.00	-0.29	2.3	17	0.0036	8	7.6
	432	21.9	2.00	-0.29	2.3	17	0.0027	8	7.6
8-Jun-19	1336	21.5	2.00	-0.14	2.1	17	0.0015	7	7.1

Comments:

Laboratory analysis by: A. Baldridge
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-03RM (No Dispersant)	**04/10/2019 900**

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RT (No Dispersant)
Lab ID: HAT01-11.1904001-049 (No Dispersant)
Date/Time sampled: 04/11/2019 915

Test Date: 23-May-19
Start Time: 9:18

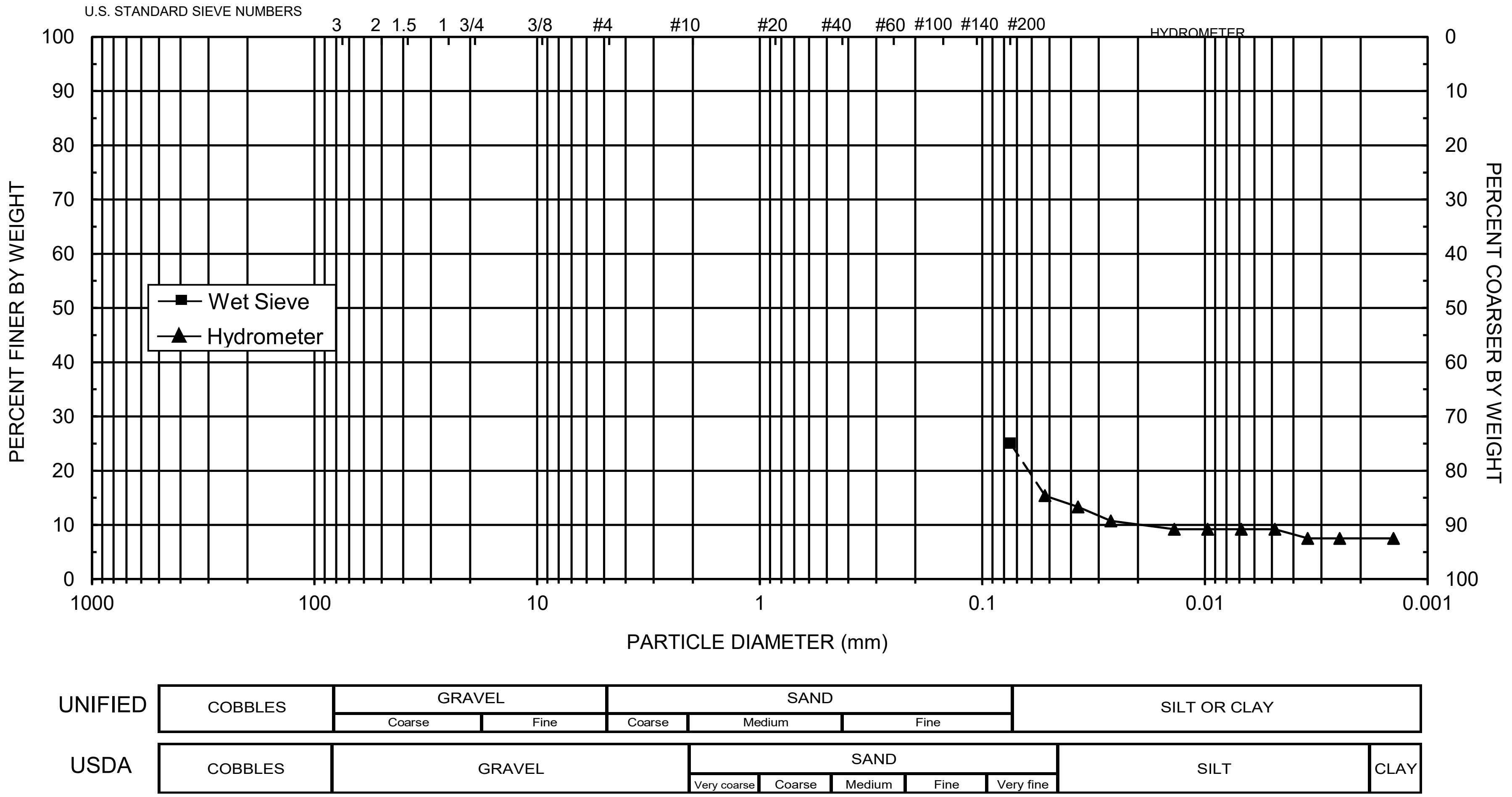
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g)*:* 48.03
Total Sample Wt. (g)*:* 1526.50
Wt. Passing #10 (g)*:* 1509.00

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	7.00	-0.47	7.5	15	0.0523	16	15.4
	2	21.0	6.00	-0.47	6.5	15	0.0372	13	13.3
	4	21.0	4.75	-0.47	5.2	15	0.0265	11	10.7
	15	21.0	4.00	-0.47	4.5	15	0.0137	9	9.2
	30	21.0	4.00	-0.47	4.5	15	0.0097	9	9.2
	60	21.0	4.00	-0.47	4.5	15	0.0069	9	9.2
	120	21.0	4.00	-0.47	4.5	15	0.0049	9	9.2
	240	21.5	3.00	-0.64	3.6	15	0.0034	8	7.5
	465	21.5	3.00	-0.64	3.6	15	0.0025	8	7.5
23-May-19	1413	21.5	3.00	-0.64	3.6	15	0.0014	8	7.5

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L8-03RT (No Dispersant)	**04/11/2019 915**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RB (No Dispersant)
Lab ID: HAT01-11.1904001-075 (No Dispersant)
Date/Time sampled: 04/12/2019 835

Test Date: 29-May-19
Start Time: 9:18

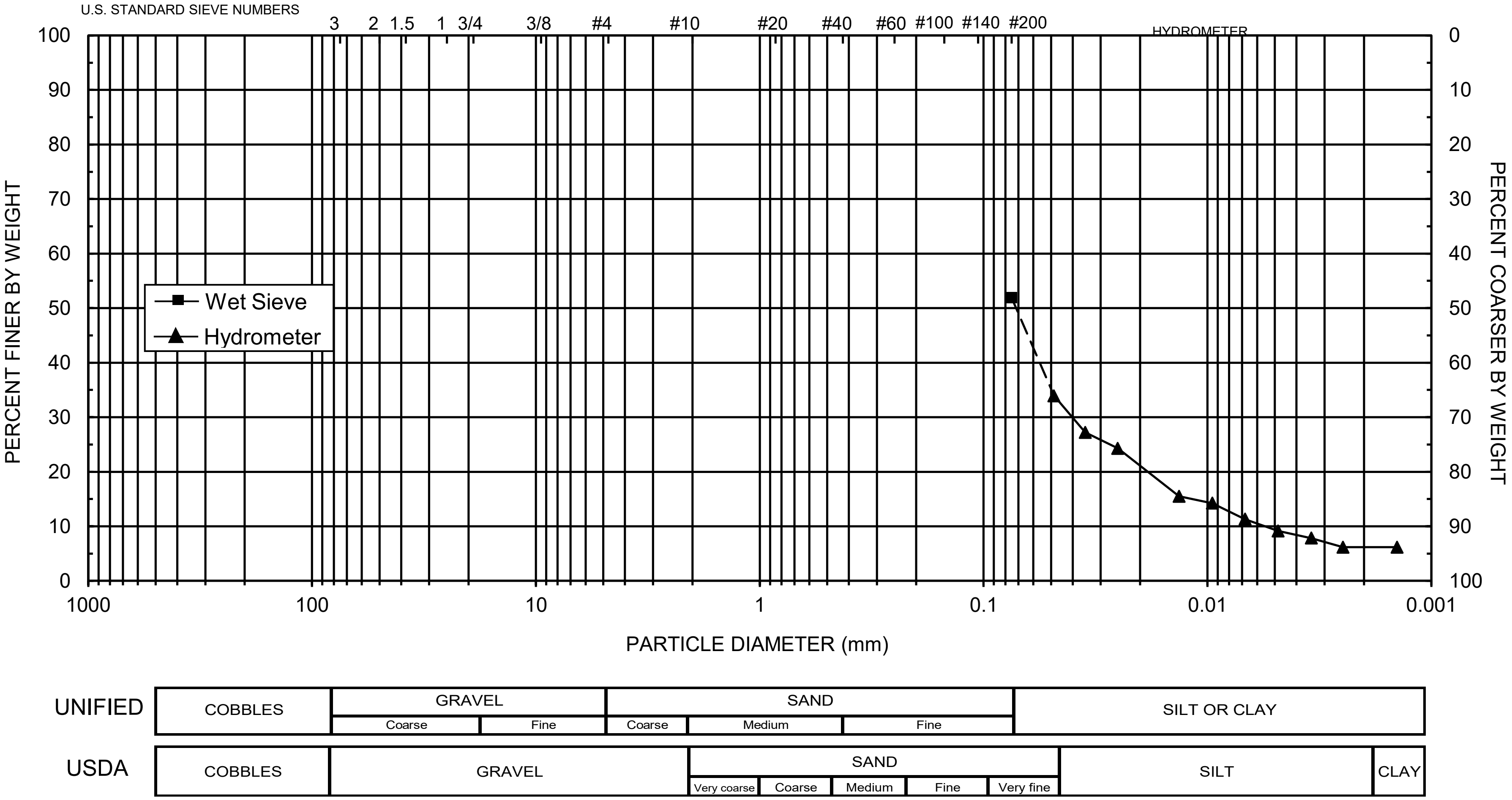
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 50.46
Total Sample Wt. (g): 1057.41
Wt. Passing #10 (g): 893.74

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-May-19	1	21.8	19.50	-0.75	20.3	13	0.0485	40	33.9
	2	21.8	15.50	-0.75	16.3	13	0.0352	32	27.2
	4	21.8	13.75	-0.75	14.5	14	0.0251	29	24.3
	15	21.8	8.50	-0.75	9.3	14	0.0134	18	15.5
	30	21.8	7.75	-0.75	8.5	15	0.0095	17	14.2
	60	21.8	6.00	-0.75	6.8	15	0.0068	13	11.3
	120	21.7	4.75	-0.71	5.5	15	0.0048	11	9.2
	240	21.6	4.00	-0.68	4.7	15	0.0034	9	7.8
	465	21.6	3.00	-0.68	3.7	15	0.0025	7	6.2
30-May-19	1413	21.6	3.00	-0.68	3.7	15	0.0014	7	6.2

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L13-02RB (No Dispersant)	**04/12/2019 835**

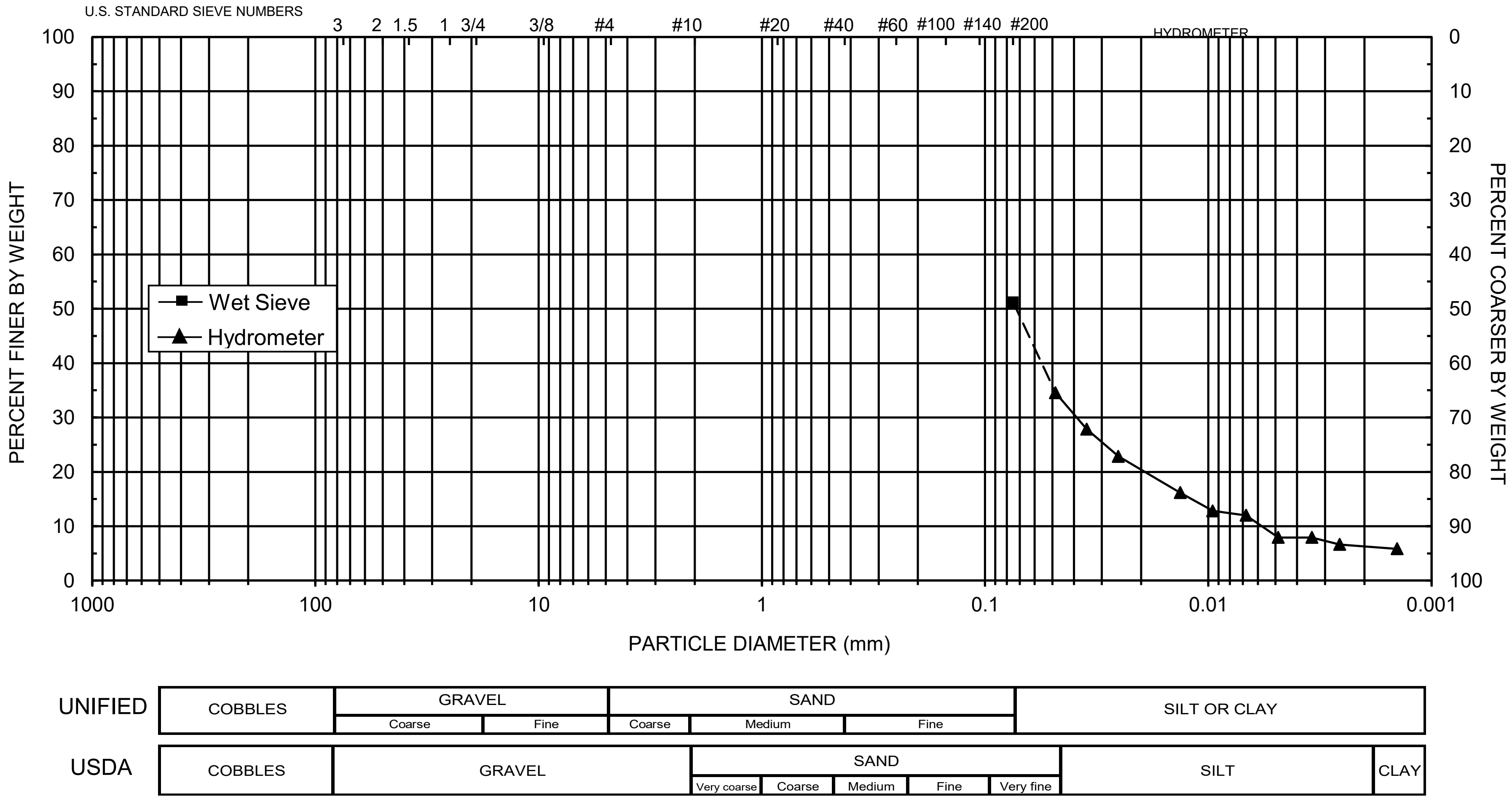
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB19.1089.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L13-02RM (No Dispersant)	*Dispersant:*	None
Lab ID:	HAT01-11.1904001-063 (No Dispersant)	*Assumed particle density:*	2.65
Date/Time sampled:	04/12/2019 850	*Initial Wt. (g):*	47.65
Test Date:	23-May-19	*Total Sample Wt. (g):*	1130.16
Start Time:	9:18	*Wt. Passing #10 (g):*	899.50

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
23-May-19	1	21.6	20.00	-0.68	20.7	13	0.0483	43	34.5
	2	21.6	16.00	-0.68	16.7	13	0.0351	35	27.9
	4	21.6	13.00	-0.68	13.7	14	0.0253	29	22.8
	15	21.6	9.00	-0.68	9.7	14	0.0134	20	16.2
	30	21.6	7.00	-0.68	7.7	15	0.0096	16	12.8
	60	21.6	6.50	-0.68	7.2	15	0.0068	15	12.0
	120	21.8	4.00	-0.75	4.8	15	0.0049	10	7.9
	240	21.8	4.00	-0.75	4.8	15	0.0034	10	7.9
	432	22.4	3.00	-0.97	4.0	15	0.0026	8	6.6
24-May-19	1413	21.8	2.75	-0.75	3.5	15	0.0014	7	5.8

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L13-02RM (No Dispersant)	**04/12/2019 850**

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RT (No Dispersant)
Lab ID: HAT01-11.1904001-051 (No Dispersant)
Date/Time sampled: 04/12/2019 900

Test Date: 22-May-19
Start Time: 9:30

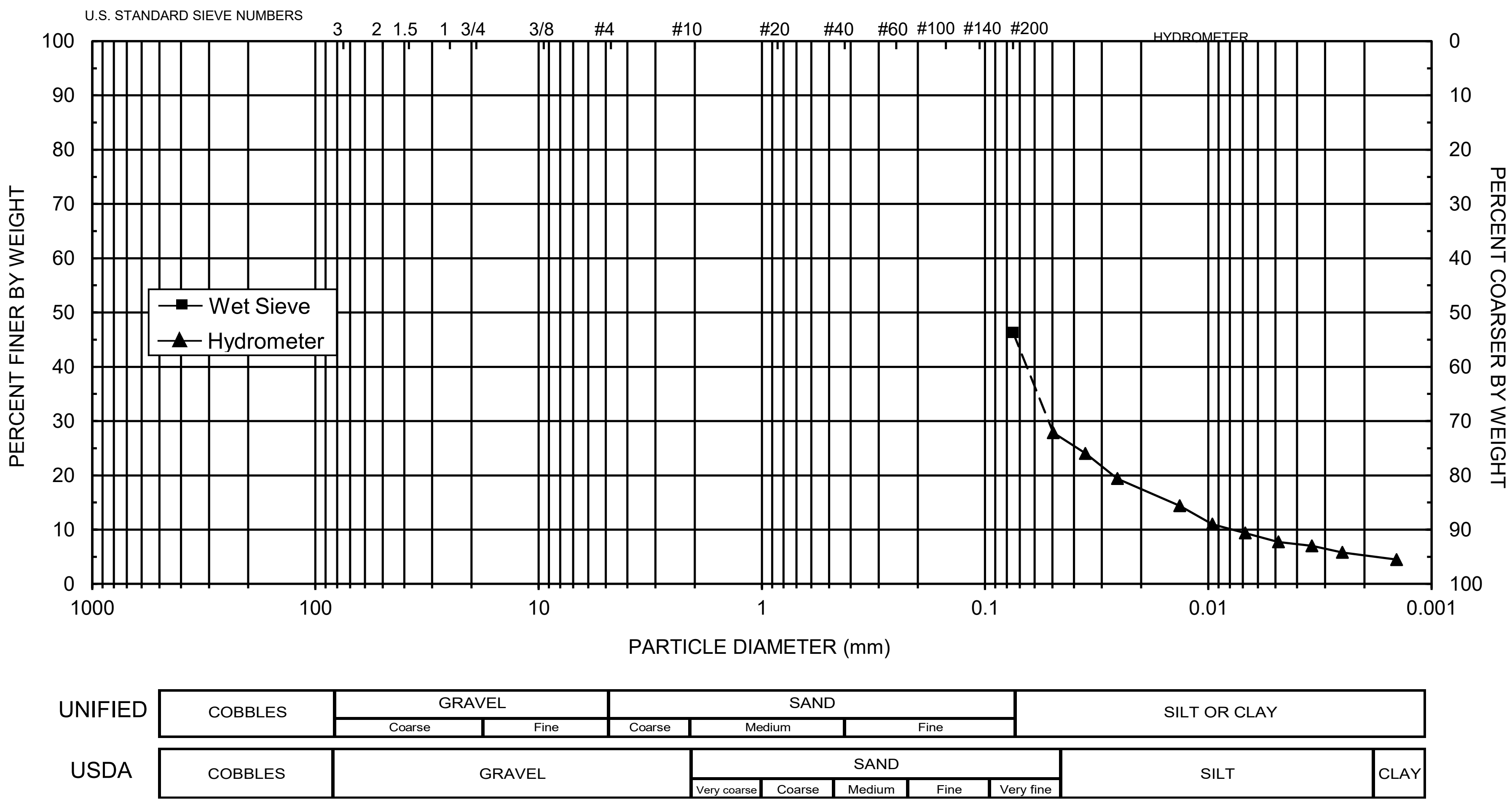
Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant: None
Assumed particle density: 2.65

Initial Wt. (g): 42.94
Total Sample Wt. (g): 1801.93
Wt. Passing #10 (g): 1308.64

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
22-May-19	1	21.0	16.00	-0.47	16.5	13	0.0495	38	27.9
	2	21.0	13.75	-0.47	14.2	14	0.0355	33	24.0
	4	21.0	11.00	-0.47	11.5	14	0.0255	27	19.4
	15	21.1	8.00	-0.50	8.5	15	0.0134	20	14.4
	30	21.1	6.00	-0.50	6.5	15	0.0096	15	11.0
	60	21.2	5.00	-0.54	5.5	15	0.0068	13	9.4
	120	21.3	4.00	-0.57	4.6	15	0.0048	11	7.7
	240	21.5	3.50	-0.64	4.1	15	0.0034	10	7.0
	455	21.6	2.75	-0.68	3.4	15	0.0025	8	5.8
23-May-19	1403	21.5	2.00	-0.64	2.6	16	0.0014	6	4.5

Comments:

Laboratory analysis by: A. Sacks
Data entered by: A. Baldridge
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED
L13-02RT (No Dispersant)	**04/12/2019 900**

Atterberg Limits/ Identification of Fines

Summary of Atterberg Tests

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
A-1	HAT01-11.1904001-077	---	---	---	ML
A-2	HAT01-11.1904001-074	---	---	---	ML
A-3	HAT01-11.1904001-062	---	---	---	ML
ASM-1	HAT01-11.1904001-078	---	---	---	ML
ASM-2	HAT01-11.1904001-079	---	---	---	ML
L3-01RB	HAT01-11.1904001-065	---	---	---	ML
L3-01RM	HAT01-11.1904001-053	---	---	---	ML
L3-01RT	HAT01-11.1904001-038	---	---	---	ML
L3-02RB	HAT01-11.1904001-066	---	---	---	ML
L3-02RM	HAT01-11.1904001-054	---	---	---	ML
L3-02RT	HAT01-11.1904001-039	---	---	---	ML
L3-03RB	HAT01-11.1904001-067	---	---	---	ML
L3-03RM	HAT01-11.1904001-055	---	---	---	ML
L3-03RT	HAT01-11.1904001-040	---	---	---	ML
L5-01C	HAT01-11.1904001-034	---	---	---	ML
L5-01RB	HAT01-11.1904001-068	---	---	---	ML
L5-01RM	HAT01-11.1904001-056	---	---	---	ML
L5-01RT	HAT01-11.1904001-041	---	---	---	ML
L5-02RB	HAT01-11.1904001-069	---	---	---	ML
L5-02RM	HAT01-11.1904001-057	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Atterberg Tests (Continued)

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
L5-02RT	HAT01-11.1904001-042	---	---	---	ML
L5-03RB	HAT01-11.1904001-070	---	---	---	ML
L5-03RM	HAT01-11.1904001-058	---	---	---	ML
L5-03RT	HAT01-11.1904001-043	---	---	---	ML
L5-11RB	HAT01-11.1904001-108	---	---	---	ML
L5-11RM	HAT01-11.1904001-109	---	---	---	ML
L5-11RT	HAT01-11.1904001-110	---	---	---	ML
L5-21RB	HAT01-11.1904001-104	---	---	---	ML
L5-21RM	HAT01-11.1904001-105	---	---	---	ML
L5-21RT	HAT01-11.1904001-106	---	---	---	ML
L5-31RB	HAT01-11.1904001-100	---	---	---	ML
L5-31RM	HAT01-11.1904001-101	---	---	---	ML
L5-31RT	HAT01-11.1904001-102	---	---	---	ML
L5-41RB	HAT01-11.1904001-096	---	---	---	ML
L5-41RM	HAT01-11.1904001-097	---	---	---	ML
L5-41RT	HAT01-11.1904001-098	---	---	---	ML
L5-51RB	HAT01-11.1904001-092	---	---	---	ML
L5-51RM	HAT01-11.1904001-093	---	---	---	ML
L5-51RT	HAT01-11.1904001-094	---	---	---	ML
L5-61RB	HAT01-11.1904001-088	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Atterberg Tests (Continued)

Sample Number	Lab ID	Liquid Limit	Plastic Limit	Plasticity Index	Fines Classification
L5-61RM	HAT01-11.1904001-089	---	---	---	ML
L5-61RT	HAT01-11.1904001-090	---	---	---	ML
L5-01A-RB	HAT01-11.1904001-085	---	---	---	ML
L5-01A-RU	HAT01-11.1904001-086	---	---	---	ML
L8-01RB	HAT01-11.1904001-071	---	---	---	ML
L8-01RM	HAT01-11.1904001-059	---	---	---	ML
L8-01RT	HAT01-11.1904001-047	---	---	---	ML
L8-02RB	HAT01-11.1904001-072	---	---	---	ML
L8-02RM	HAT01-11.1904001-060	---	---	---	ML
L8-02RT	HAT01-11.1904001-048	---	---	---	ML
L8-03RB	HAT01-11.1904001-073	---	---	---	ML
L8-03RM	HAT01-11.1904001-061	---	---	---	ML
L8-03RT	HAT01-11.1904001-049	---	---	---	ML
L13-02RB	HAT01-11.1904001-075	---	---	---	ML
L13-02RM	HAT01-11.1904001-063	---	---	---	ML
L13-02RT	HAT01-11.1904001-051	---	---	---	ML
L-compW	HAT01-11.1904001-080	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	A-1
Lab ID:	HAT01-11.1904001-077
Date/Time sampled:	04/16/2019 1330
Test Date:	3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	A-1
Lab ID:	HAT01-11.1904001-077
Date/Time sampled:	04/16/2019 1330
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 5/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-2
Lab ID: HAT01-11.1904001-074
Date/Time sampled: 04/16/2019 1335

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-2
Lab ID: HAT01-11.1904001-074
Date/Time sampled: 04/16/2019 1335

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)

Odor: None

Moisture Condition: Moist

HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: A-3
Lab ID: HAT01-11.1904001-062
Date/Time sampled: 04/16/2019 1350

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	**Trial 2**	**Trial 3**
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	**Trial 2**
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	A-3
Lab ID:	HAT01-11.1904001-062
Date/Time sampled:	04/16/2019 1350
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Dark Red (2.5YR 3/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-1
Lab ID: HAT01-11.1904001-078
Date/Time sampled: 04/16/2019 830

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-1
Lab ID: HAT01-11.1904001-078
Date/Time sampled: 04/16/2019 830

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-2
Lab ID: HAT01-11.1904001-079
Date/Time sampled: 04/16/2019 915

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: ASM-2
Lab ID: HAT01-11.1904001-079
Date/Time sampled: 04/16/2019 915

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Red (2.5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RB
Lab ID: HAT01-11.1904001-065
Date/Time sampled: 04/09/2019 1440

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-01RB
Lab ID:	HAT01-11.1904001-065
Date/Time sampled:	04/09/2019 1440
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RM
Lab ID: HAT01-11.1904001-053
Date/Time sampled: 04/09/2019 1450

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-01RM
Lab ID:	HAT01-11.1904001-053
Date/Time sampled:	04/09/2019 1450
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-01RT
Lab ID: HAT01-11.1904001-038
Date/Time sampled: 04/09/2019 1500

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-01RT
Lab ID:	HAT01-11.1904001-038
Date/Time sampled:	04/09/2019 1500
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RB
Lab ID:	HAT01-11.1904001-066
Date/Time sampled:	04/09/2019 1100
Test Date:	31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RB
Lab ID:	HAT01-11.1904001-066
Date/Time sampled:	04/09/2019 1100
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RM
Lab ID: HAT01-11.1904001-054
Date/Time sampled: 04/09/2019 1045

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RM
Lab ID:	HAT01-11.1904001-054
Date/Time sampled:	04/09/2019 1045
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-02RT
Lab ID: HAT01-11.1904001-039
Date/Time sampled: 04/09/2019 1000

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-02RT
Lab ID:	HAT01-11.1904001-039
Date/Time sampled:	04/09/2019 1000
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RB
Lab ID: HAT01-11.1904001-067
Date/Time sampled: 04/09/2019 1330

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03RB
Lab ID:	HAT01-11.1904001-067
Date/Time sampled:	04/09/2019 1330
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

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Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RM
Lab ID: HAT01-11.1904001-055
Date/Time sampled: 04/09/2019 1400

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03RM
Lab ID:	HAT01-11.1904001-055
Date/Time sampled:	04/09/2019 1400
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L3-03RT
Lab ID: HAT01-11.1904001-040
Date/Time sampled: 04/09/2019 1345

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L3-03RT
Lab ID:	HAT01-11.1904001-040
Date/Time sampled:	04/09/2019 1345
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01C
Lab ID: HAT01-11.1904001-034
Date/Time sampled: 04/17/2019 1620

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01C
Lab ID:	HAT01-11.1904001-034
Date/Time sampled:	04/17/2019 1620
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RB
Lab ID: HAT01-11.1904001-068
Date/Time sampled: 04/18/2019 740

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01RB
Lab ID:	HAT01-11.1904001-068
Date/Time sampled:	04/18/2019 740
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 3/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RM
Lab ID: HAT01-11.1904001-056
Date/Time sampled: 04/18/2019 750

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01RM
Lab ID:	HAT01-11.1904001-056
Date/Time sampled:	04/18/2019 750
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT
Lab ID: HAT01-11.1904001-041
Date/Time sampled: 04/18/2019 800

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01RT
Lab ID:	HAT01-11.1904001-041
Date/Time sampled:	04/18/2019 800
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-02RB
Lab ID:	HAT01-11.1904001-069
Date/Time sampled:	04/18/2019 1240
Test Date:	31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RB
Lab ID: HAT01-11.1904001-069
Date/Time sampled: 04/18/2019 1240

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RM
Lab ID: HAT01-11.1904001-057
Date/Time sampled: 04/18/2019 1235

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-02RM
Lab ID:	HAT01-11.1904001-057
Date/Time sampled:	04/18/2019 1235
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-02RT
Lab ID: HAT01-11.1904001-042
Date/Time sampled: 04/18/2019 1235

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-02RT
Lab ID:	HAT01-11.1904001-042
Date/Time sampled:	04/18/2019 1235
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RB
Lab ID: HAT01-11.1904001-070
Date/Time sampled: 04/18/2019 1020

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-03RB
Lab ID:	HAT01-11.1904001-070
Date/Time sampled:	04/18/2019 1020
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RM
Lab ID: HAT01-11.1904001-058
Date/Time sampled: 04/18/2019 1020

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-03RM
Lab ID:	HAT01-11.1904001-058
Date/Time sampled:	04/18/2019 1020
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-03RT
Lab ID: HAT01-11.1904001-043
Date/Time sampled: 04/18/2019 1020

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-03RT
Lab ID:	HAT01-11.1904001-043
Date/Time sampled:	04/18/2019 1020
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RB
Lab ID: HAT01-11.1904001-108
Date/Time sampled: 04/18/2019 1155

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-11RB
Lab ID:	HAT01-11.1904001-108
Date/Time sampled:	04/18/2019 1155
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RM
Lab ID: HAT01-11.1904001-109
Date/Time sampled: 04/18/2019 1150

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-11RM
Lab ID:	HAT01-11.1904001-109
Date/Time sampled:	04/18/2019 1150
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-11RT
Lab ID: HAT01-11.1904001-110
Date/Time sampled: 04/18/2019 1200

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-11RT
Lab ID:	HAT01-11.1904001-110
Date/Time sampled:	04/18/2019 1200
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RB
Lab ID:	HAT01-11.1904001-104
Date/Time sampled:	04/18/2019 1120
Test Date:	3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RB
Lab ID:	HAT01-11.1904001-104
Date/Time sampled:	04/18/2019 1120
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RM
Lab ID: HAT01-11.1904001-105
Date/Time sampled: 04/18/2019 1125

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RM
Lab ID:	HAT01-11.1904001-105
Date/Time sampled:	04/18/2019 1125
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

<u>Identification of Inorganic Fine Grained Soils:</u>

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-21RT
Lab ID: HAT01-11.1904001-106
Date/Time sampled: 04/18/2019 1120

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-21RT
Lab ID:	HAT01-11.1904001-106
Date/Time sampled:	04/18/2019 1120
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB
Lab ID: HAT01-11.1904001-100
Date/Time sampled: 04/18/2019 1045

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RB
Lab ID: HAT01-11.1904001-100
Date/Time sampled: 04/18/2019 1045

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-31RM
Lab ID:	HAT01-11.1904001-101
Date/Time sampled:	04/18/2019 1045
Test Date:	3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-31RM
Lab ID:	HAT01-11.1904001-101
Date/Time sampled:	04/18/2019 1045
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-31RT
Lab ID: HAT01-11.1904001-102
Date/Time sampled: 04/18/2019 1045

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-31RT
Lab ID:	HAT01-11.1904001-102
Date/Time sampled:	04/18/2019 1045
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-41RB
Lab ID:	HAT01-11.1904001-096
Date/Time sampled:	04/18/2019 945
Test Date:	3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-41RB
Lab ID:	HAT01-11.1904001-096
Date/Time sampled:	04/18/2019 945
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RM
Lab ID: HAT01-11.1904001-097
Date/Time sampled: 04/18/2019 945

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-41RM
Lab ID:	HAT01-11.1904001-097
Date/Time sampled:	04/18/2019 945
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RT
Lab ID: HAT01-11.1904001-098
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-41RT
Lab ID: HAT01-11.1904001-098
Date/Time sampled: 04/18/2019 945

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RB
Lab ID: HAT01-11.1904001-092
Date/Time sampled: 04/18/2019 915

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-51RB
Lab ID:	HAT01-11.1904001-092
Date/Time sampled:	04/18/2019 915
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

<u>Identification of Inorganic Fine Grained Soils:</u>

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-51RM
Lab ID:	HAT01-11.1904001-093
Date/Time sampled:	04/18/2019 915
Test Date:	3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-51RM
Lab ID:	HAT01-11.1904001-093
Date/Time sampled:	04/18/2019 915
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-51RT
Lab ID: HAT01-11.1904001-094
Date/Time sampled: 04/18/2019 915

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-51RT
Lab ID:	HAT01-11.1904001-094
Date/Time sampled:	04/18/2019 915
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RB
Lab ID: HAT01-11.1904001-088
Date/Time sampled: 04/18/2019 830

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines (Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-61RB
Lab ID:	HAT01-11.1904001-088
Date/Time sampled:	04/18/2019 830
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RM
Lab ID: HAT01-11.1904001-089
Date/Time sampled: 04/18/2019 830

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RM
Lab ID: HAT01-11.1904001-089
Date/Time sampled: 04/18/2019 830

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT
Lab ID: HAT01-11.1904001-090
Date/Time sampled: 04/18/2019 830

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-61RT
Lab ID: HAT01-11.1904001-090
Date/Time sampled: 04/18/2019 830

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

<u>Identification of Inorganic Fine Grained Soils:</u>

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RB
Lab ID: HAT01-11.1904001-085
Date/Time sampled: 04/17/2019 1650

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L5-01A-RB
Lab ID:	HAT01-11.1904001-085
Date/Time sampled:	04/17/2019 1650
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RU
Lab ID: HAT01-11.1904001-086
Date/Time sampled: 04/17/2019 1655

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01A-RU
Lab ID: HAT01-11.1904001-086
Date/Time sampled: 04/17/2019 1655

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: Low
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RB
Lab ID: HAT01-11.1904001-071
Date/Time sampled: 04/10/2019 1515

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-01RB
Lab ID:	HAT01-11.1904001-071
Date/Time sampled:	04/10/2019 1515
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Dark Red (2.5YR 3/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RM
Lab ID: HAT01-11.1904001-059
Date/Time sampled: 04/11/2019 1530

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-01RM
Lab ID:	HAT01-11.1904001-059
Date/Time sampled:	04/11/2019 1530
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-01RT
Lab ID: HAT01-11.1904001-047
Date/Time sampled: 04/10/2019 1545

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines (Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-01RT
Lab ID:	HAT01-11.1904001-047
Date/Time sampled:	04/10/2019 1545
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RB
Lab ID: HAT01-11.1904001-072
Date/Time sampled: 04/10/2019 1620

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-02RB
Lab ID:	HAT01-11.1904001-072
Date/Time sampled:	04/10/2019 1620
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-02RM
Lab ID:	HAT01-11.1904001-060
Date/Time sampled:	04/10/2019 1625
Test Date:	31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RM
Lab ID: HAT01-11.1904001-060
Date/Time sampled: 04/10/2019 1625

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RT
Lab ID: HAT01-11.1904001-048
Date/Time sampled: 04/10/2019 1615

Test Date: 31-May-19

Liquid Limit

	Trial 1	**Trial 2**	**Trial 3**
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	**Trial 2**
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-02RT
Lab ID: HAT01-11.1904001-048
Date/Time sampled: 04/10/2019 1615

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RB
Lab ID: HAT01-11.1904001-073
Date/Time sampled: 04/11/2019 855

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines (Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-03RB
Lab ID:	HAT01-11.1904001-073
Date/Time sampled:	04/11/2019 855
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RM
Lab ID: HAT01-11.1904001-061
Date/Time sampled: 04/10/2019 900

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L8-03RM
Lab ID:	HAT01-11.1904001-061
Date/Time sampled:	04/10/2019 900
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Yellowish Red (5YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RT
Lab ID: HAT01-11.1904001-049
Date/Time sampled: 04/11/2019 915

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L8-03RT
Lab ID: HAT01-11.1904001-049
Date/Time sampled: 04/11/2019 915

Test Date: 31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Yellowish Red (5YR 4/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

<u>Identification of Inorganic Fine Grained Soils:</u>

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RB
Lab ID: HAT01-11.1904001-075
Date/Time sampled: 04/12/2019 835

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L13-02RB
Lab ID:	HAT01-11.1904001-075
Date/Time sampled:	04/12/2019 835
Test Date:	3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Reddish Brown (2.5YR 4/4)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	Low
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RM
Lab ID: HAT01-11.1904001-063
Date/Time sampled: 04/12/2019 850

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L13-02RM
Lab ID:	HAT01-11.1904001-063
Date/Time sampled:	04/12/2019 850
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L13-02RT
Lab ID: HAT01-11.1904001-051
Date/Time sampled: 04/12/2019 900

Test Date: 31-May-19

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L13-02RT
Lab ID:	HAT01-11.1904001-051
Date/Time sampled:	04/12/2019 900
Test Date:	31-May-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample:	Red (2.5 YR 4/6)
Odor:	None
Moisture Condition:	Moist
HCl Reaction:	Strong

Preliminary Identification:

Dry Strength:	None
Dilatency:	Rapid
Toughness:	Low
Plasticity:	Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Baldridge
Checked by:	J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L-compW
Lab ID: HAT01-11.1904001-080
Date/Time sampled: 04/16/2019 1050

Test Date: 3-Jun-19

Liquid Limit

	Trial 1	**Trial 2**	**Trial 3**
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---

Liquid Limit: ---

Plastic Limit

	Trial 1	**Trial 2**
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---

Plastic Limit: ---

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Classification (Visual Method): ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Description and Identification of Fines (Visual-Manual Procedure)

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L-compW
Lab ID: HAT01-11.1904001-080
Date/Time sampled: 04/16/2019 1050

Test Date: 3-Jun-19

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Dark Red (2.5YR 3/6)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: Low
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Baldridge
Checked by: J. Hines

Direct Shear
Consolidated Drained

Summary of Consolidated Drained Direct Shear Estimated Friction Angle and Cohesion

Sample Number	Lab ID	c Cohesion (psf)	φ Friction Angle (°)
L4-01R	HAT01-11.1904002-006	115	31
L4-02R	HAT01-11.1904002-008	490	36
L4-03R	HAT01-11.1904002-010	503	33
L5-01R	HAT01-11.1904002-002	300	37

---

[1] The cohesion and friction angle provided represent one possible interpretation of a test results. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Summary of Consolidated Drained Direct Shear Peak Stress and Lateral Displacement

Sample Number	Lab ID	Peak Nominal Normal Stress (psf)	Peak Nominal Shear Stress (psf)	Peak Relative Lateral Displacement (%)
L4-01R (1.74 g/cc) (97 psf)	HAT01-11.1904002-006 (1.74 g/cc) (97 psf)	123	159	3.38
L4-01R (1.75 g/cc) (222 psf)	HAT01-11.1904002-006 (1.75 g/cc) (222 psf)	217	286	6.20
L4-01R (1.80 g/cc) (417 psf)	HAT01-11.1904002-006 (1.80 g/cc) (417 psf)	468	384	2.23
L4-01RT (1.82 g/cc) (409 psf)	HAT01-11.1904002-005 (1.82 g/cc) (409 psf)	426	942	4.88
L4-02R (1.78 g/cc) (102 psf)	HAT01-11.1904002-008 (1.78 g/cc) (102 psf)	101	554	2.29
L4-02R (1.73 g/cc) (202 psf)	HAT01-11.1904002-008 (1.73 g/cc) (202 psf)	202	635	2.40
L4-02R (1.72 g/cc) (398 psf)	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)	404	762	3.67
L4-02RT (1.77 g/cc) (363 psf)	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)	387	643	5.36
L4-03R (1.73 g/cc) (100 psf)	HAT01-11.1904002-010 (1.73 g/cc) (100 psf)	104	583	1.63
L4-03R (1.74 g/cc) (207 psf)	HAT01-11.1904002-010 (1.74 g/cc) (207 psf)	226	618	1.93
L4-03R (1.74 g/cc) (413 psf)	HAT01-11.1904002-010 (1.74 g/cc) (413 psf)	423	773	2.17
L4-03RT (1.77 g/cc) (399 psf)	HAT01-11.1904002-009 (1.77 g/cc) (399 psf)	400	1049	4.27
L4-11RT (1.75 g/cc) (416 psf)	HAT01-11.1904002-003 (1.75 g/cc) (416 psf)	424	657	2.53
L5-01R (1.76 g/cc) (107 psf)	HAT01-11.1904002-002 (1.76 g/cc) (107 psf)	108	361	3.37
L5-01R (1.74 g/cc) (211 psf)	HAT01-11.1904002-002 (1.74 g/cc) (211 psf)	232	493	4.04
L5-01R (1.76 g/cc) (398 psf)	HAT01-11.1904002-002 (1.76 g/cc) (398 psf)	408	576	3.32
L5-01RT (1.70 g/cc) (399 psf)	HAT01-11.1904002-001 (1.70 g/cc) (399 psf)	403	637	6.80

Direct Shear Consolidated Drained Composite Data

Sample Number: L4-01R

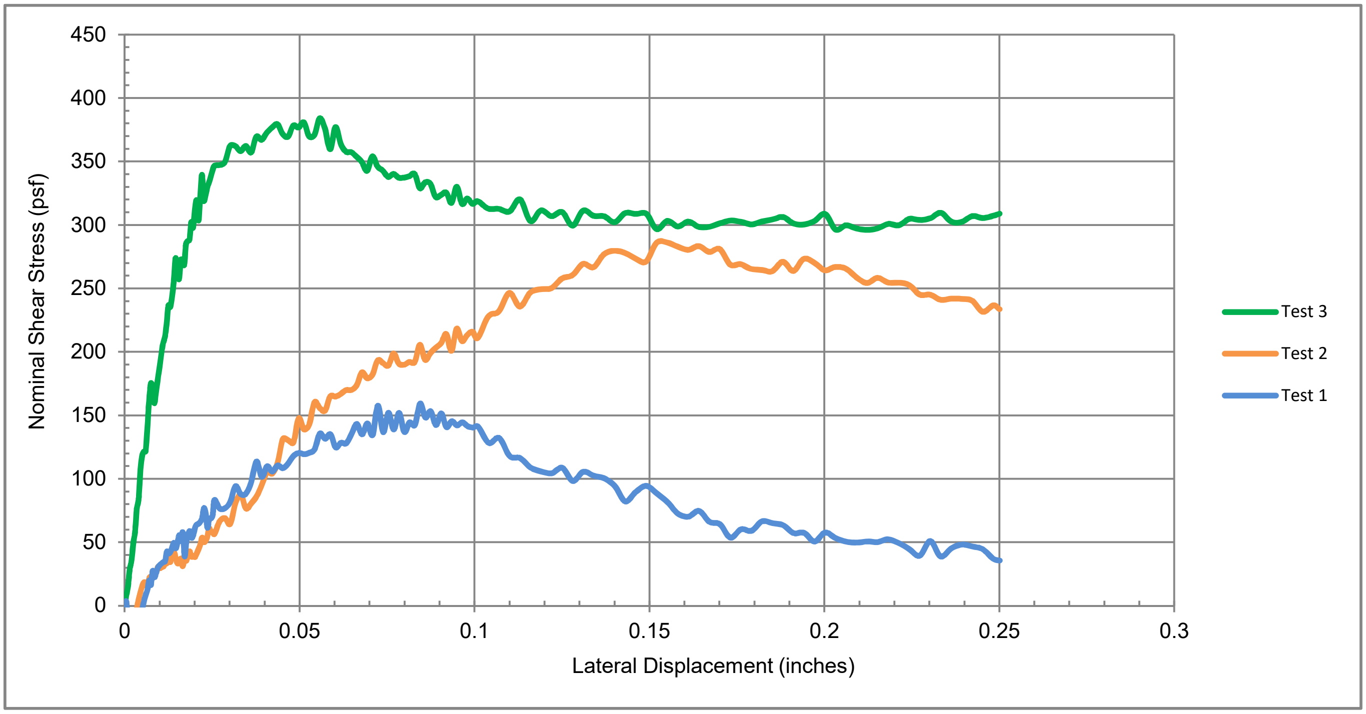
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	97	222	417
Final Normal Displacement (in)	0.000	0.004	0.004
Duration (min)	16	16	20

Shear Composite Data

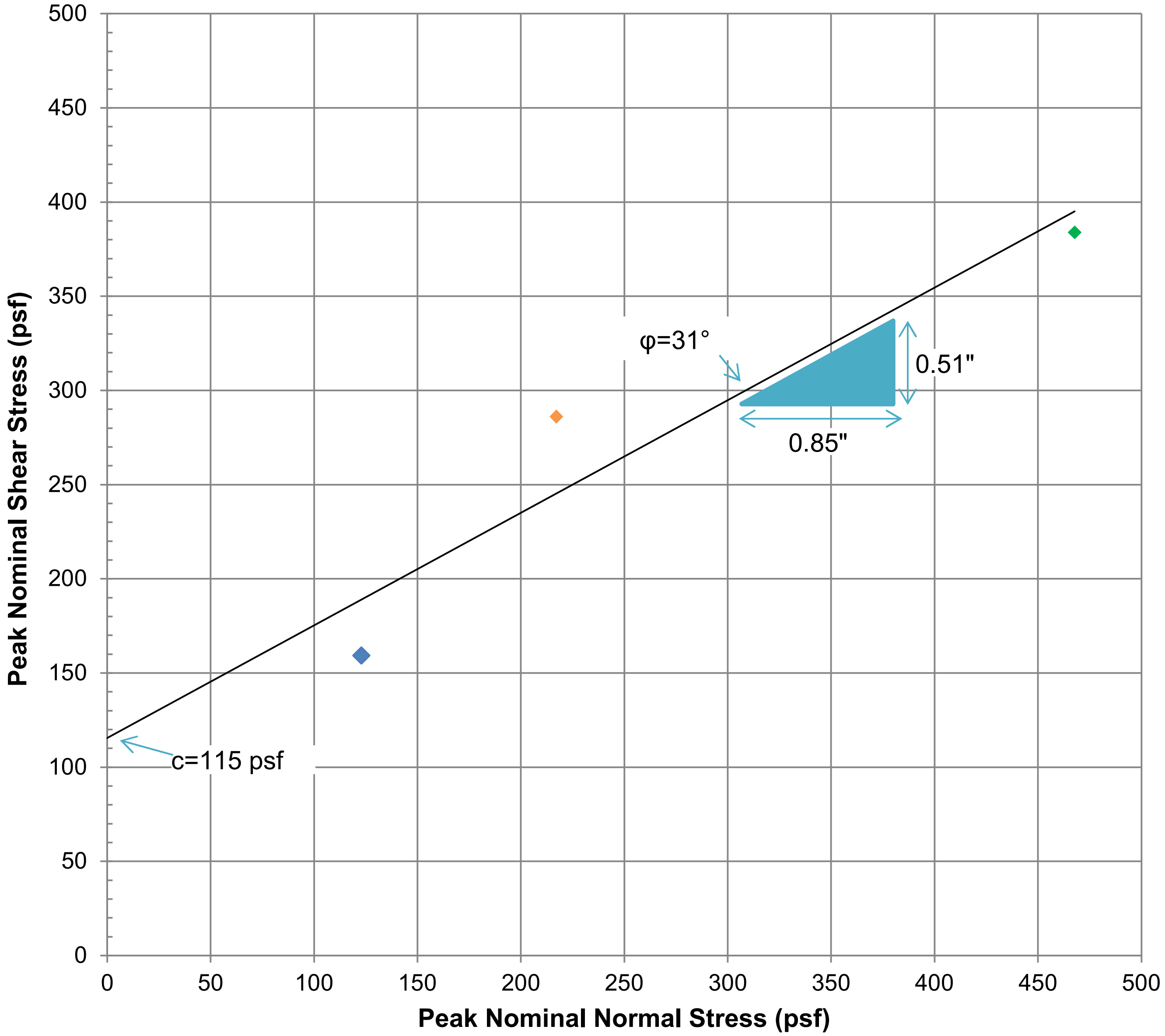
	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	123	217	468
Peak Nominal Shear Stress (psf)	159	286	384
Peak Relative Lateral Displacement (%)	3.38	6.20	2.23
Final Relative Lateral Displacement (%)	10.00	10.00	10.01
Peak Normal Displacement (in)	-0.017	-0.026	-0.009
Final Normal Displacement (in)	-0.031	-0.029	-0.019
Average Displacement Rate (in/min):	0.004	0.004	0.004

Nominal Shear Stress versus Lateral Displacement



Direct Shear: Shear Stress vs. Normal Stress Plot

Sample: L4-01R



Estimated Failure Parameters[1]:
estimated cohesion (c)(psf) = 115
estimated friction angle (ϕ)(°) = 31

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[1] The cohesion and friction angle provided represent one possible interpretation of a failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.74 g/cc) (97 psf)
Lab ID:	HAT01-11.1904002-006
Date/Time sampled:	04/17/2019 1100

Initial Sample Properties

Initial Mass (g):	158.26
Length (cm):	2.54
Diameter (cm):	6.35
Dry Mass (g):	140.17
Area (cm^2):	31.66
Volume (cm^3):	80.38
Assumed Particle Density (g/cm^3):	2.65
Wet Bulk Density (g/cm^3):	1.97
Wet Bulk Density (pcf):	122.9
Dry Bulk Density (g/cm^3):	1.74
Dry Bulk Density (pcf):	108.9
Water Content (%, g/g):	12.9
Water Content (%, vol):	22.5
Porosity (%, vol):	34.2
Void Ratio (e):	0.520
Saturation (%):	65.8

Consolidation

Normal Stress (psf):	97
Final Normal Displacement (in):	0.0004
Duration (min):	16

Pre-Shear Sample Properties

Sample Mass (g):	170.76
Length (cm):	2.54
Volume (cm^3):	80.38
Wet Bulk Density (g/cm^3):	2.12
Wet Bulk Density (pcf):	132.6
Dry Bulk Density (g/cm^3):	1.74
Dry Bulk Density (pcf):	108.9
Water Content (%, g/g):	21.8
Water Content (%, vol):	38.06
Porosity (%, vol):	34.2
Void Ratio (e):	0.520
Saturation (%):	111.3

Sample & Test Conditions

Shear Device:	Trautwein DigiShear
Condition of test:	Inundated
Failure Determination:	Peak Shear Stress
Visual Description:	Cohesive Sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Soil Structure/Preparation:	Intact
Date/Time Test Initiated:	5/30/19 820

Shear Data

Test Duration (min):	60
Peak Nominal Normal Stress (psf):	123
Peak Nominal Shear Stress (psf):	159
Peak Relative Lateral Displacement (%):	3.38
Final Relative Lateral Displacement (%):	10.00
Peak Normal Displacement (in):	-0.017
Final Normal Displacement (in):	-0.031
Average Displacement Rate (in/min):	0.004

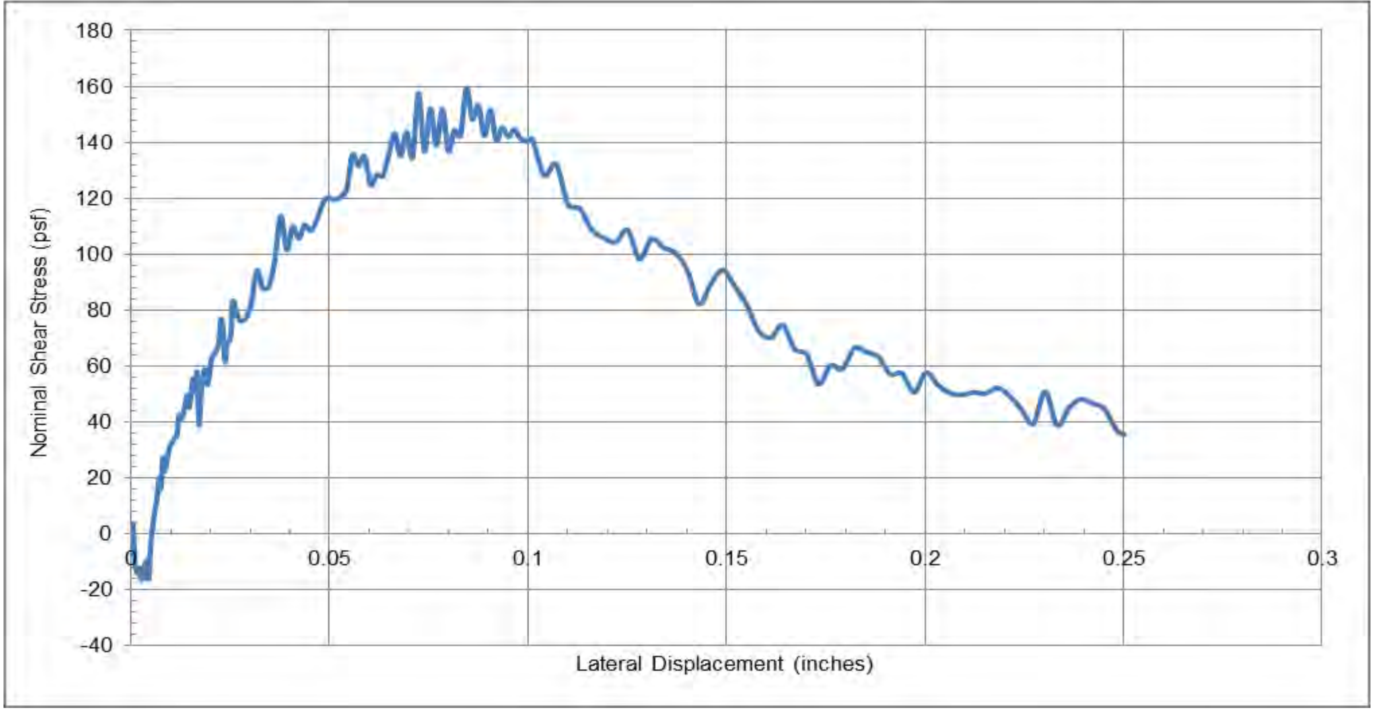
Notes: The pre-shear sample mass is assumed to be equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass was obtained prior to removal of the sample from the test apparatus and thus may include a small amount of water held within the apparatus potentially resulting in exagerated pre-shear saturation percentage. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by:	D. O'Dowd
Data entered by:	C. Krous
Checked by:	J. Hines

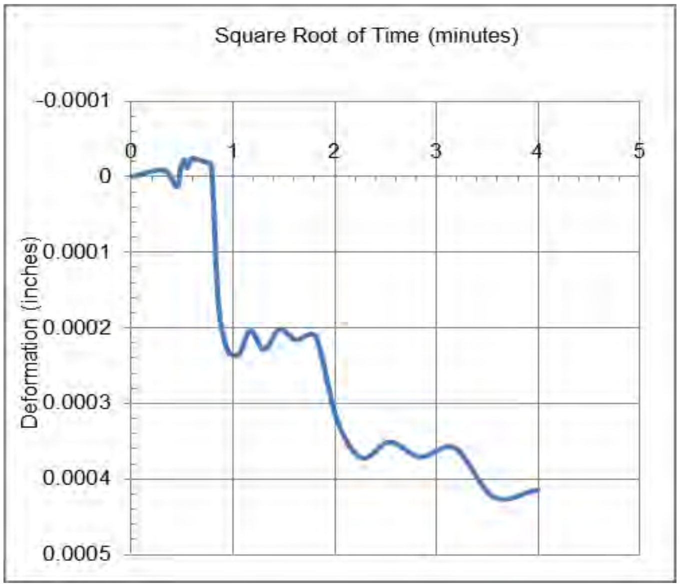
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.74 g/cc) (97 psf)
Lab ID: HAT01-11.1904002-006
Date/Time sampled: 04/17/2019 1100

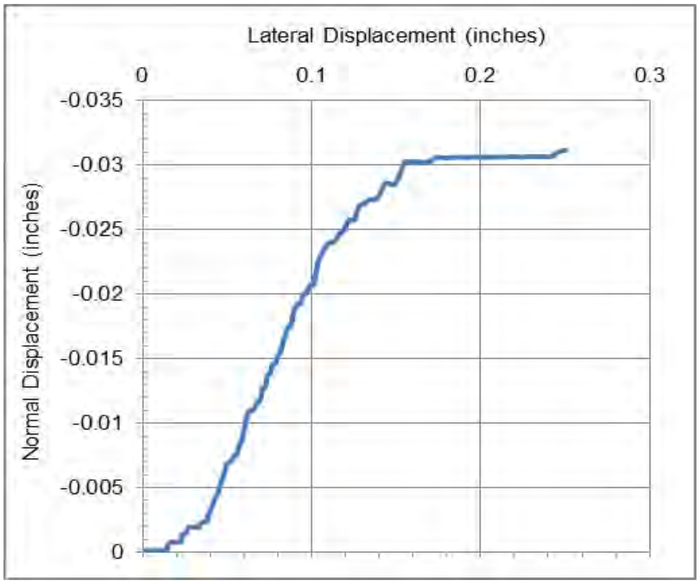
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.75 g/cc) (222 psf)
Lab ID:	HAT01-11.1904002-006
Date/Time sampled:	04/17/2019 1100

Initial Sample Properties

Initial Mass (g):	158.3
Length (cm):	2.53
Diameter (cm):	6.35
Dry Mass (g):	140.23
Area (cm^2):	31.71
Volume (cm^3):	80.26
Assumed Particle Density (g/cm^3):	2.65
Wet Bulk Density (g/cm^3):	1.97
Wet Bulk Density (pcf):	123.1
Dry Bulk Density (g/cm^3):	1.75
Dry Bulk Density (pcf):	109.1
Water Content (%, g/g):	12.9
Water Content (%, vol):	22.5
Porosity (%, vol):	34.1
Void Ratio (e):	0.517
Saturation (%):	66.1

Consolidation

Normal Stress (psf):	222
Final Normal Displacement (in):	0.004
Duration (min):	16

Pre-Shear Sample Properties

Sample Mass (g):	169.54
Length (cm):	2.52
Volume (cm^3):	79.88
Wet Bulk Density (g/cm^3):	2.12
Wet Bulk Density (pcf):	132.5
Dry Bulk Density (g/cm^3):	1.76
Dry Bulk Density (pcf):	109.6
Water Content (%, g/g):	20.9
Water Content (%, vol):	36.69
Porosity (%, vol):	33.8
Void Ratio (e):	0.509
Saturation (%):	108.7

Sample & Test Conditions

Shear Device:	Trautwein DigiShear
Condition of test:	Inundated
Failure Determination:	Peak Shear Stress
Visual Description:	Cohesive Sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Soil Structure/Preparation:	Intact
Date/Time Test Initiated:	5/30/19 1021

Shear Data

Test Duration (min):	60
Peak Nominal Normal Stress (psf):	217
Peak Nominal Shear Stress (psf):	286
Peak Relative Lateral Displacement (%):	6.20
Final Relative Lateral Displacement (%):	10.00
Peak Normal Displacement (in):	-0.026
Final Normal Displacement (in):	-0.029
Average Displacement Rate (in/min):	0.004

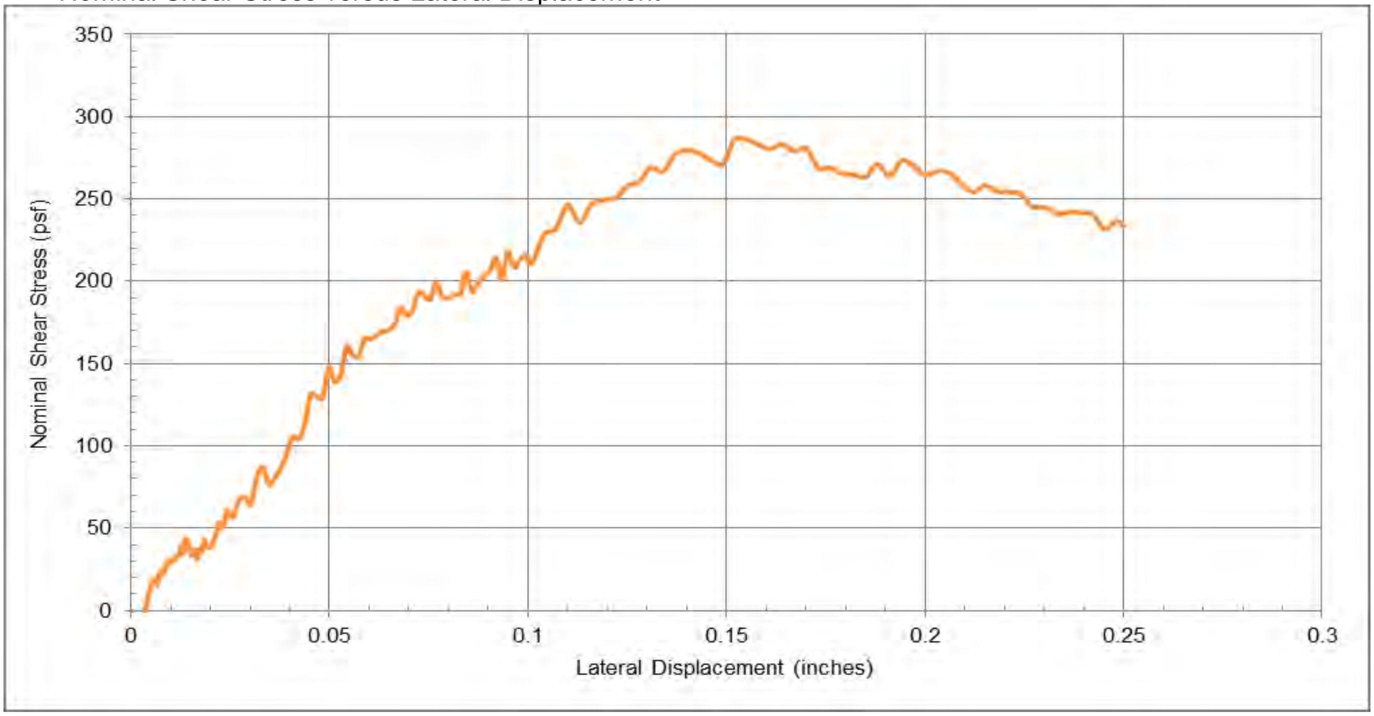
Notes: The pre-shear sample mass is assumed to be equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass was obtained prior to removal of the sample from the test apparatus and thus may include a small amount of water held within the apparatus potentially resulting in exagerated pre-shear saturation percentage. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by:	D. O'Dowd
Data entered by:	C. Krous
Checked by:	J. Hines

Direct Shear Consolidated Drained Data, ASTM D3080

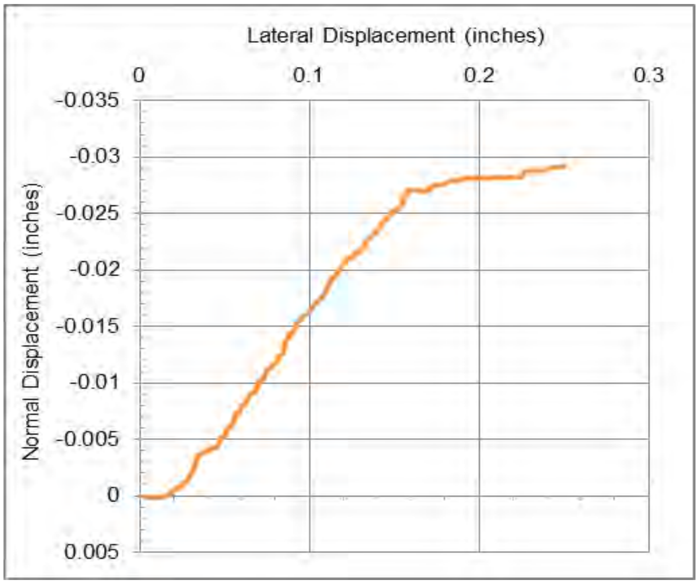
Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.75 g/cc) (222 psf)
Lab ID: HAT01-11.1904002-006
Date/Time sampled: 04/17/2019 1100

Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time

Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.80 g/cc) (417 psf)
Lab ID: HAT01-11.1904002-006
Date/Time sampled: 04/17/2019 1100

Initial Sample Properties

Initial Mass (g): 161.99
Length (cm): 2.52
Diameter (cm): 6.35
Dry Mass (g): 143.68
Area (cm^2): 31.63
Volume (cm^3): 79.71
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 2.03
Wet Bulk Density (pcf): 126.9
Dry Bulk Density (g/cm^3): 1.80
Dry Bulk Density (pcf): 112.5
Water Content (%, g/g): 12.7
Water Content (%, vol): 23.0
Porosity (%, vol): 32.0
Void Ratio (e): 0.470
Saturation (%): 71.8

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Cohesive Sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: Intact
Date/Time Test Initiated: 5/31/19 1258

Consolidation

Normal Stress (psf): 417
Final Normal Displacement (in): 0.004
Duration (min): 20

Pre-Shear Sample Properties

Sample Mass (g): 171.34
Length (cm): 2.52
Volume (cm^3): 79.78
Wet Bulk Density (g/cm^3): 2.15
Wet Bulk Density (pcf): 134.1
Dry Bulk Density (g/cm^3): 1.80
Dry Bulk Density (pcf): 112.4
Water Content (%, g/g): 19.3
Water Content (%, vol): 34.67
Porosity (%, vol): 32.0
Void Ratio (e): 0.471
Saturation (%): 108.2

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 468
Peak Nominal Shear Stress (psf): 384
Peak Relative Lateral Displacement (%): 2.23
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.009
Final Normal Displacement (in): -0.019
Average Displacement Rate (in/min): 0.004

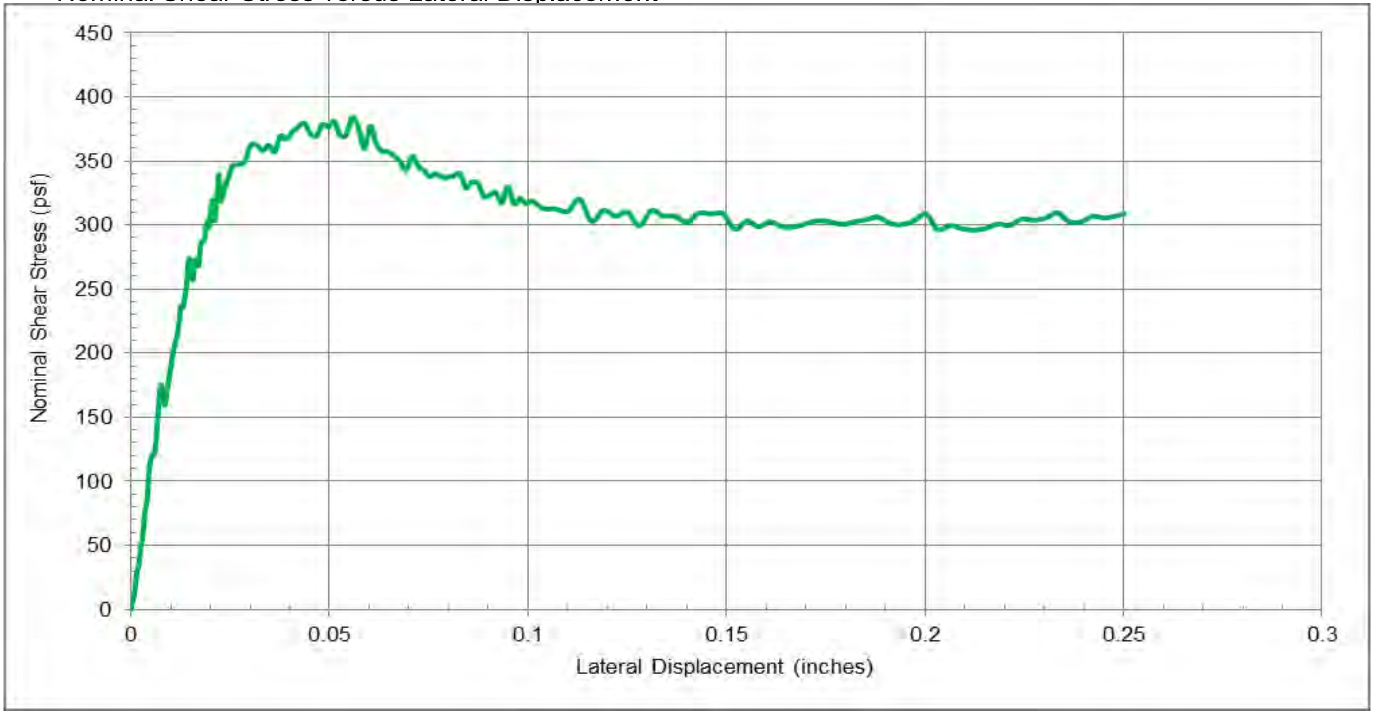
Notes: The pre-shear sample mass is assumed to be equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass was obtained prior to removal of the sample from the test apparatus and thus may include a small amount of water held within the apparatus potentially resulting in exagerated pre-shear saturation percentage. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.80 g/cc) (417 psf)
Lab ID: HAT01-11.1904002-006
Date/Time sampled: 04/17/2019 1100

Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time

Normal Displacement versus Lateral Displacement

Direct Shear Consolidated Drained Composite Data

Sample Number: L4-01RT

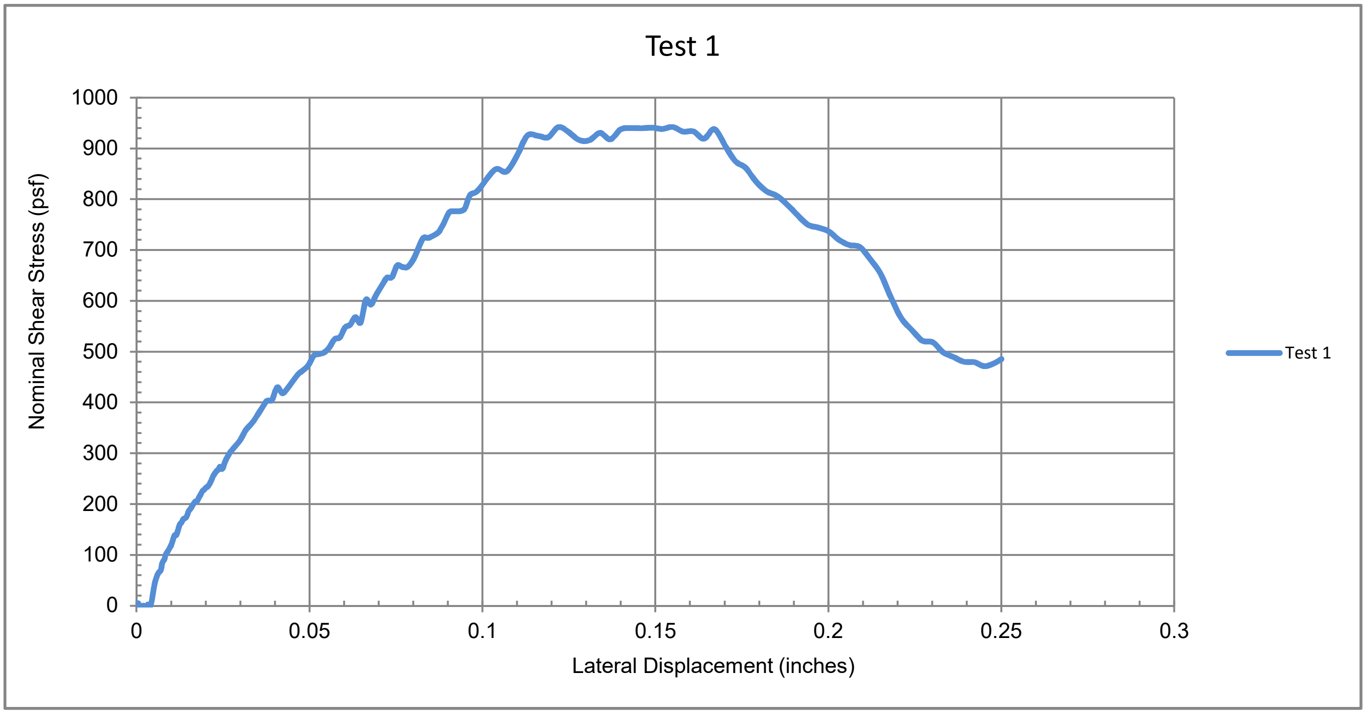
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	409	NA	NA
Final Normal Displacement (in)	0.008		
Duration (min)	16		

Shear Composite Data

	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	426		
Peak Nominal Shear Stress (psf)	942		
Peak Relative Lateral Displacement (%)	4.88		
Final Relative Lateral Displacement (%)	10.01		
Peak Normal Displacement (in)	-0.026		
Final Normal Displacement (in)	-0.046		
Average Displacement Rate (in/min):	0.004		

Nominal Shear Stress versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01RT (1.82 g/cc) (409 psf)
Lab ID: HAT01-11.1904002-005 (1.82 g/cc) (409 psf)
Date/Time sampled: 04/17/2019 1100

Initial Sample Properties

Initial Mass (g): 165.04
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 146.43
Area (cm^2): 31.65
Volume (cm^3): 80.29
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 2.06
Wet Bulk Density (pcf): 128.3
Dry Bulk Density (g/cm^3): 1.82
Dry Bulk Density (pcf): 113.8
Water Content (%, g/g): 12.7
Water Content (%, vol): 23.2
Porosity (%, vol): 31.2
Void Ratio (e): 0.453
Saturation (%): 74.3

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive clay
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/13/19 1443

Consolidation

Normal Stress (psf): 409
Final Normal Displacement (in): 0.008
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 174.65
Length (cm): 2.52
Volume (cm^3): 79.65
Wet Bulk Density (g/cm^3): 2.19
Wet Bulk Density (pcf): 136.9
Dry Bulk Density (g/cm^3): 1.84
Dry Bulk Density (pcf): 114.8
Water Content (%, g/g): 19.3
Water Content (%, vol): 35.43
Porosity (%, vol): 30.6
Void Ratio (e): 0.441
Saturation (%): 115.7

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 426
Peak Nominal Shear Stress (psf): 942
Peak Relative Lateral Displacement (%): 4.88
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.026
Final Normal Displacement (in): -0.046
Average Displacement Rate (in/min): 0.004

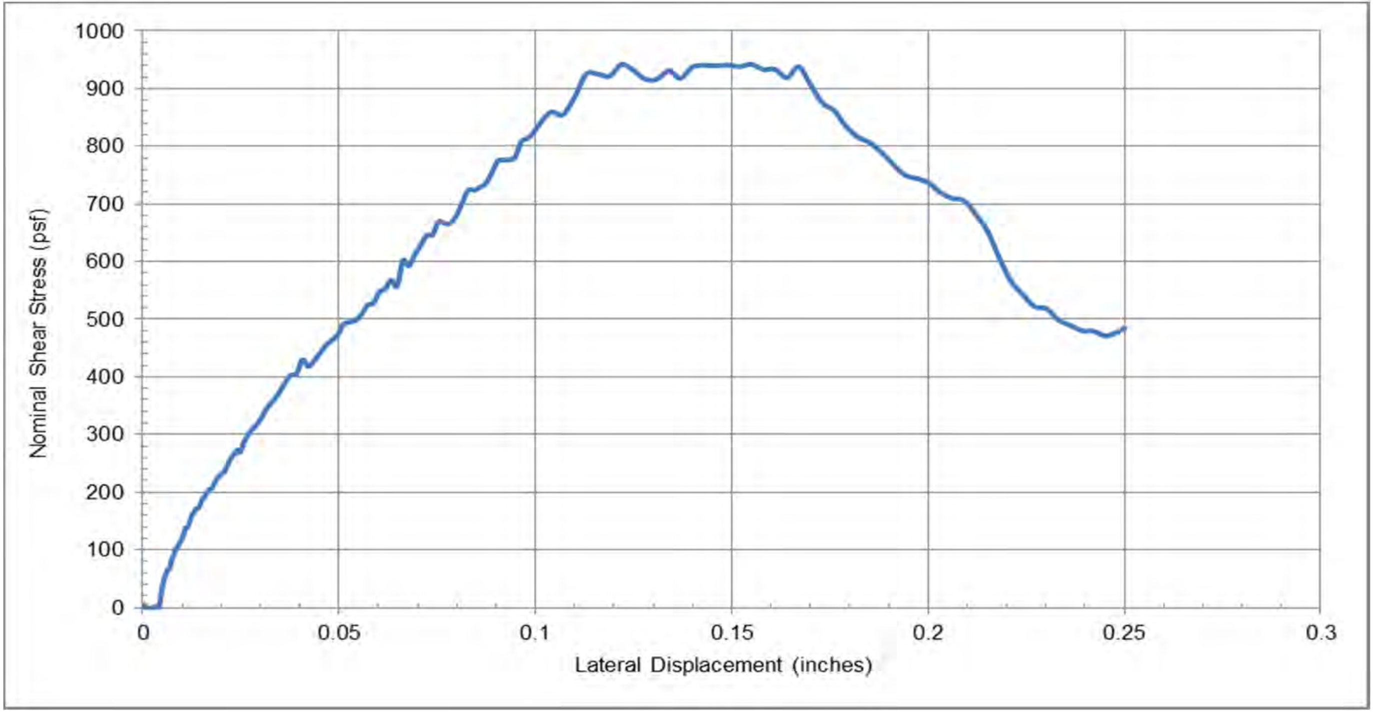
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

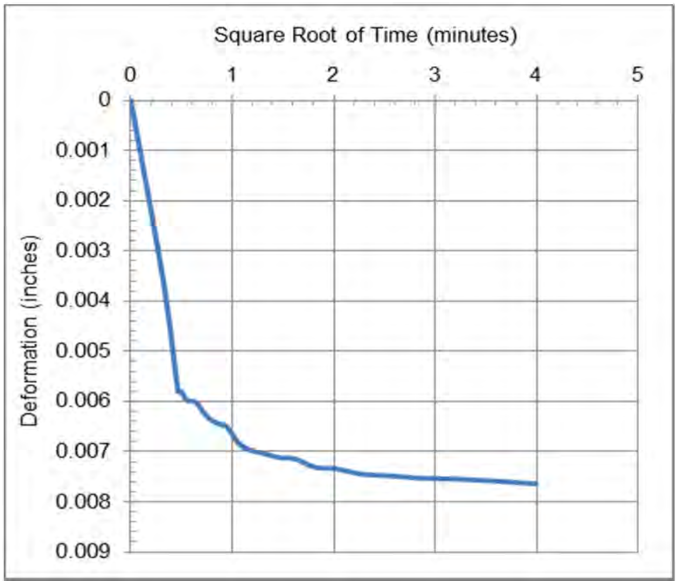
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01RT (1.82 g/cc) (409 psf)
Lab ID: HAT01-11.1904002-005 (1.82 g/cc) (409 psf)
Date/Time sampled: 04/17/2019 1100

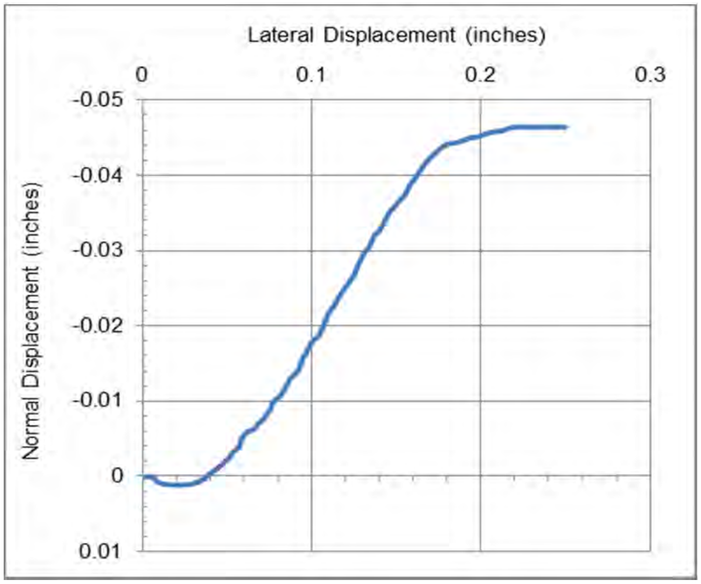
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L4-02R

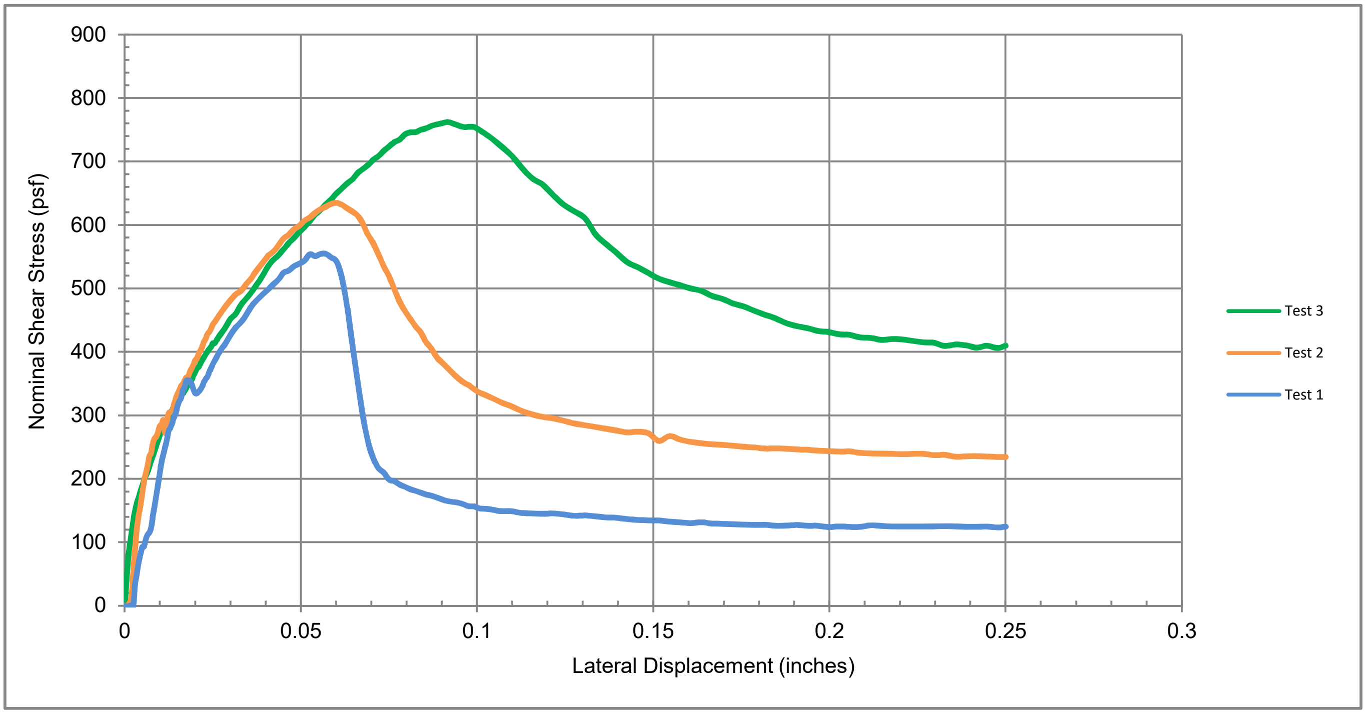
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	102	202	398
Final Normal Displacement (in)	0.003	0.004	0.011
Duration (min)	16	20	16

Shear Composite Data

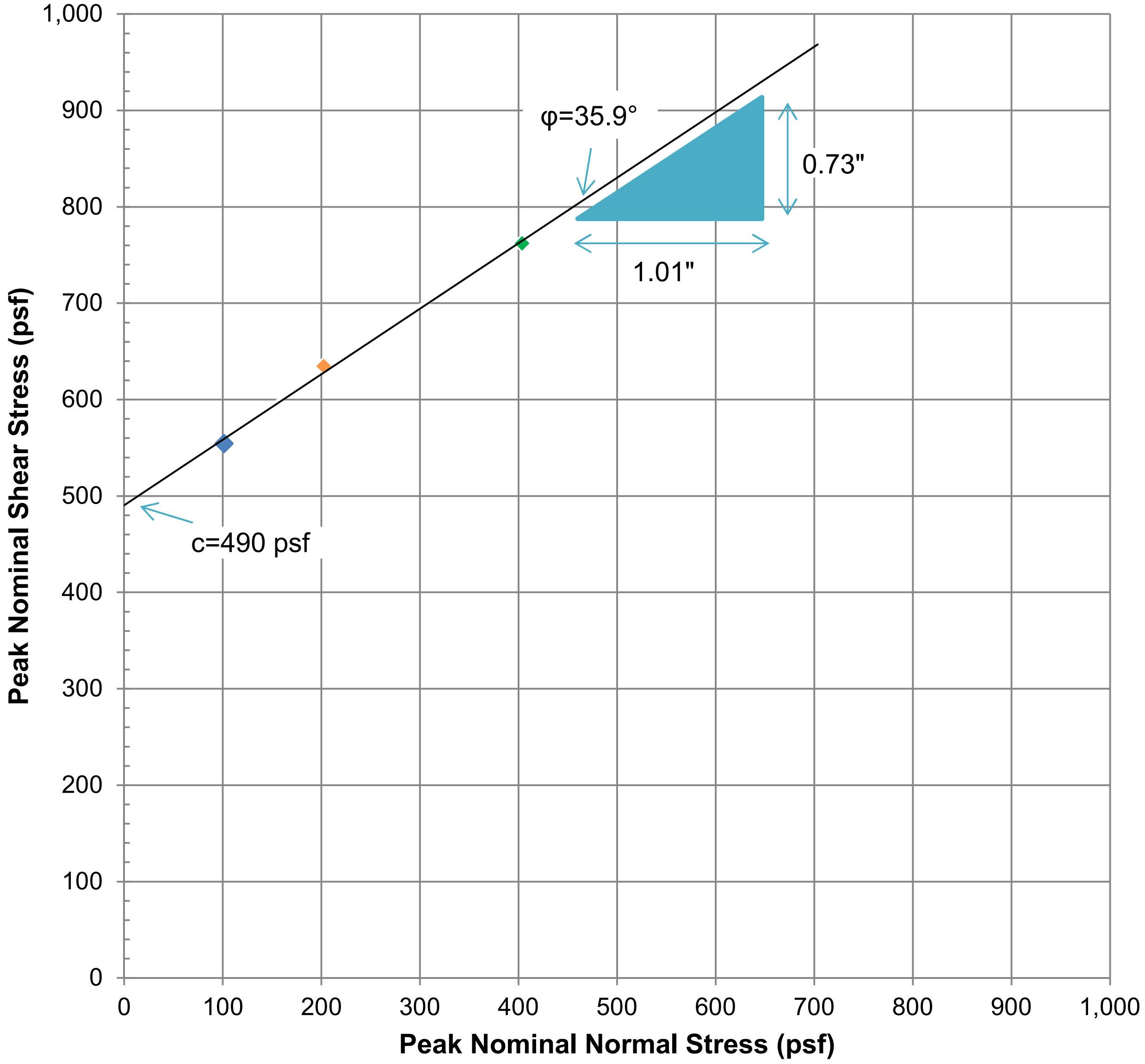
	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	101	202	404
Peak Nominal Shear Stress (psf)	554	635	762
Peak Relative Lateral Displacement (%)	2.29	2.40	3.67
Final Relative Lateral Displacement (%)	10.02	10.01	10.01
Peak Normal Displacement (in)	-0.028	-0.020	-0.020
Final Normal Displacement (in)	-0.040	-0.034	-0.047
Average Displacement Rate (in/min):	0.004	0.004	0.004

Nominal Shear Stress versus Lateral Displacement



Direct Shear: Shear Stress vs. Normal Stress Plot

Sample: L4-02R



Estimated Failure Parameters[1]:
estimated cohesion (c)(psf) = 490
estimated friction angle (ϕ)(°) = 36

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[1] The cohesion and friction angle provided represent one possible interpretation of a failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02R (1.78 g/cc) (102 psf)
Lab ID:	HAT01-11.1904002-008 (1.78 g/cc) (102 psf)
Date/Time sampled:	04/17/2019 1300

Initial Sample Properties

Initial Mass (g):	160.06
Length (cm):	2.54
Diameter (cm):	6.34
Dry Mass (g):	142.61
Area (cm^2):	31.58
Volume (cm^3):	80.15
Assumed Particle Density (g/cm^3):	2.65
Wet Bulk Density (g/cm^3):	2.00
Wet Bulk Density (pcf):	124.7
Dry Bulk Density (g/cm^3):	1.78
Dry Bulk Density (pcf):	111.1
Water Content (%, g/g):	12.2
Water Content (%, vol):	21.8
Porosity (%, vol):	32.9
Void Ratio (e):	0.489
Saturation (%):	66.3

Consolidation

Normal Stress (psf):	102
Final Normal Displacement (in):	0.003
Duration (min):	16

Pre-Shear Sample Properties

Sample Mass (g):	169.51
Length (cm):	2.53
Volume (cm^3):	79.85
Wet Bulk Density (g/cm^3):	2.12
Wet Bulk Density (pcf):	132.5
Dry Bulk Density (g/cm^3):	1.79
Dry Bulk Density (pcf):	111.5
Water Content (%, g/g):	18.9
Water Content (%, vol):	33.69
Porosity (%, vol):	32.6
Void Ratio (e):	0.484
Saturation (%):	103.3

Sample & Test Conditions

Shear Device:	Trautwein DigiShear
Condition of test:	Inundated
Failure Determination:	Peak Shear Stress
Visual Description:	Silty cohesive sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Soil Structure/Preparation:	In-Situ
Date/Time Test Initiated:	8/22/19 1005

Shear Data

Test Duration (min):	60
Peak Nominal Normal Stress (psf):	101
Peak Nominal Shear Stress (psf):	554
Peak Relative Lateral Displacement (%):	2.29
Final Relative Lateral Displacement (%):	10.02
Peak Normal Displacement (in):	-0.028
Final Normal Displacement (in):	-0.040
Average Displacement Rate (in/min):	0.004

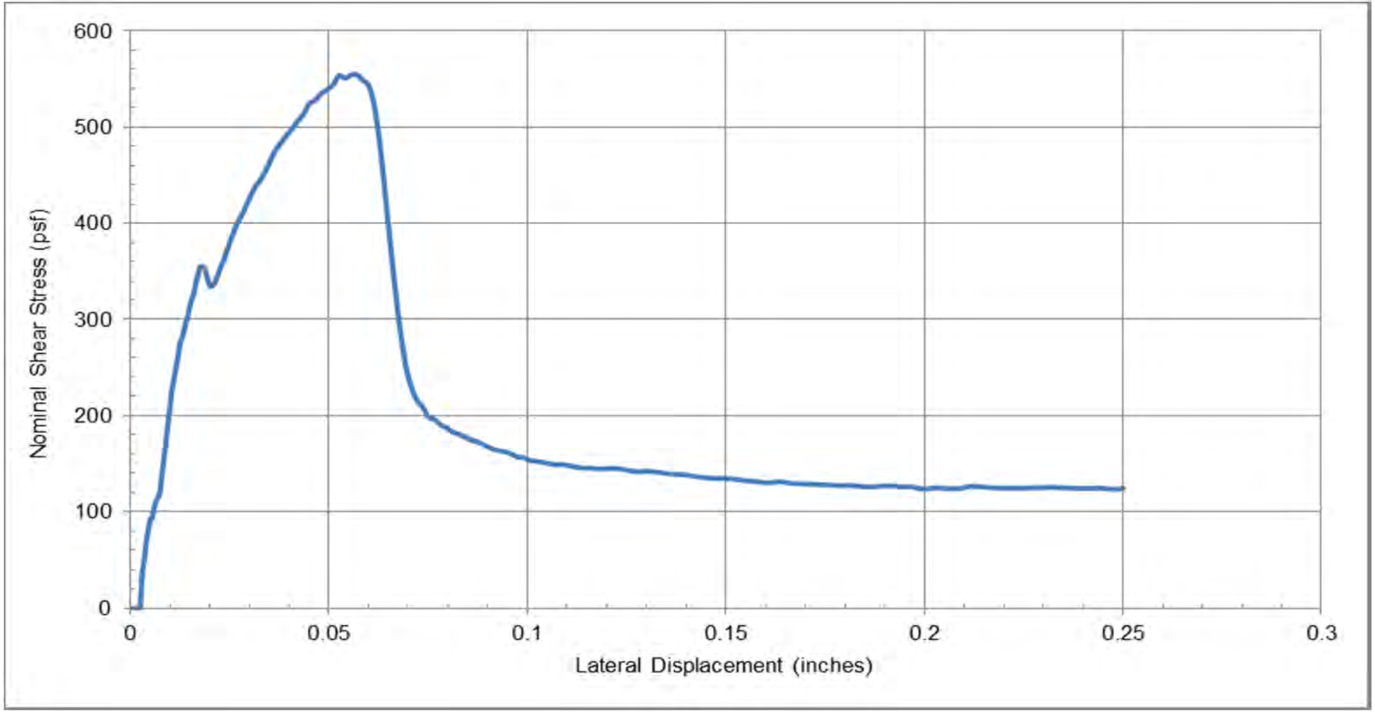
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

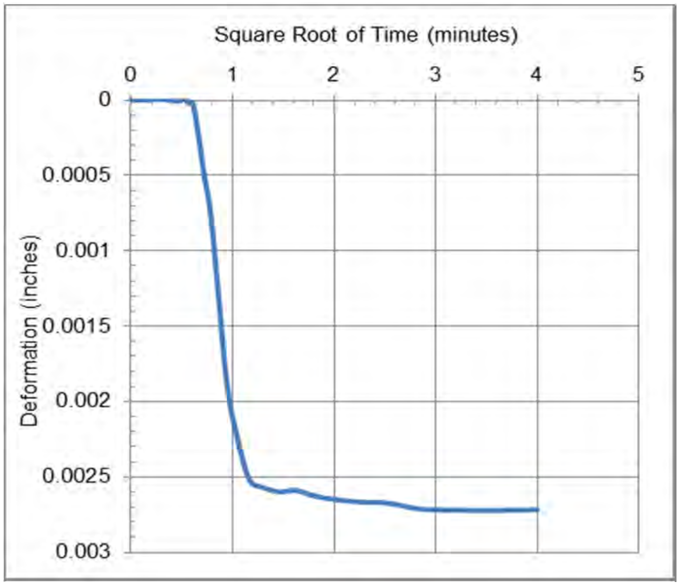
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02R (1.78 g/cc) (102 psf)
Lab ID: HAT01-11.1904002-008 (1.78 g/cc) (102 psf)
Date/Time sampled: 04/17/2019 1300

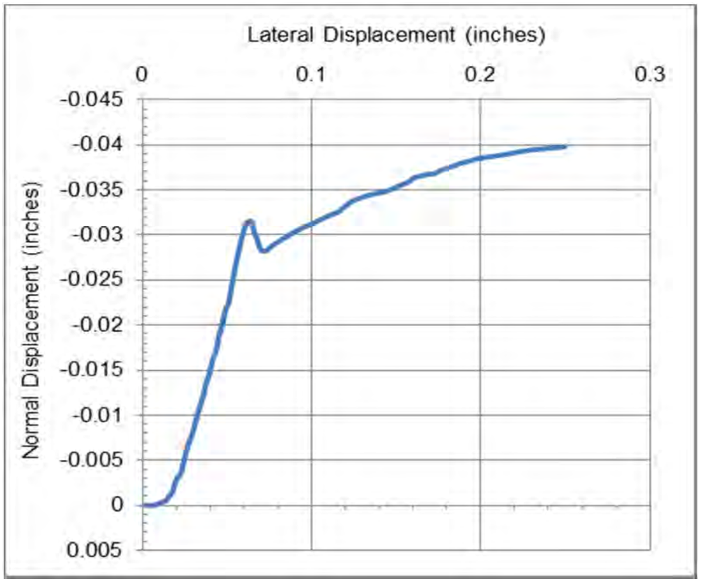
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02R (1.73 g/cc) (202 psf)
Lab ID: HAT01-11.1904002-008 (1.73 g/cc) (202 psf)
Date/Time sampled: 04/17/2019 1300

Initial Sample Properties

Initial Mass (g): 160.63
Length (cm): 2.54
Diameter (cm): 6.44
Dry Mass (g): 143.07
Area (cm^2): 32.52
Volume (cm^3): 82.54
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.95
Wet Bulk Density (pcf): 121.5
Dry Bulk Density (g/cm^3): 1.73
Dry Bulk Density (pcf): 108.2
Water Content (%, g/g): 12.3
Water Content (%, vol): 21.3
Porosity (%, vol): 34.6
Void Ratio (e): 0.529
Saturation (%): 61.5

Consolidation

Normal Stress (psf): 202
Final Normal Displacement (in): 0.004
Duration (min): 20

Pre-Shear Sample Properties

Sample Mass (g): 169.51
Length (cm): 2.52
Volume (cm^3): 81.98
Wet Bulk Density (g/cm^3): 2.07
Wet Bulk Density (pcf): 129.1
Dry Bulk Density (g/cm^3): 1.75
Dry Bulk Density (pcf): 108.9
Water Content (%, g/g): 18.5
Water Content (%, vol): 32.25
Porosity (%, vol): 34.1
Void Ratio (e): 0.519
Saturation (%): 94.4

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/22/19 1307

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 202
Peak Nominal Shear Stress (psf): 635
Peak Relative Lateral Displacement (%): 2.40
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.020
Final Normal Displacement (in): -0.034
Average Displacement Rate (in/min): 0.004

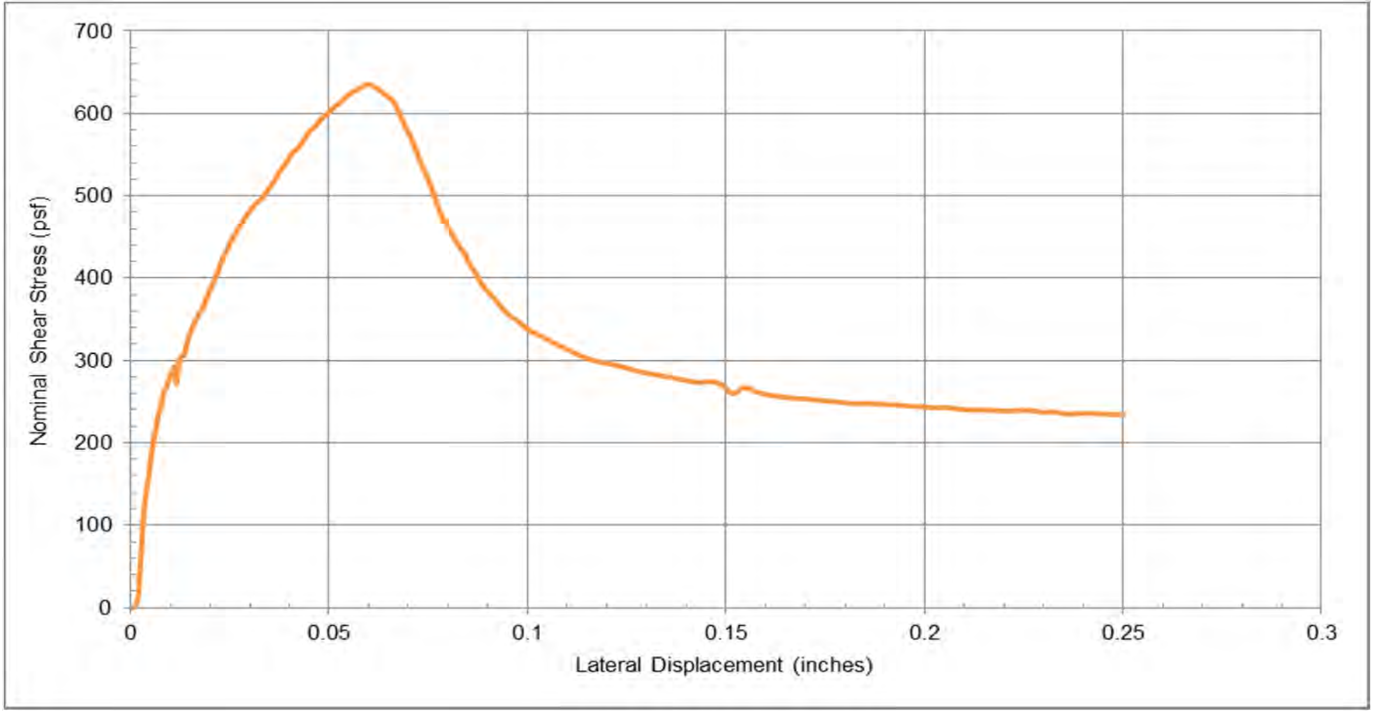
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

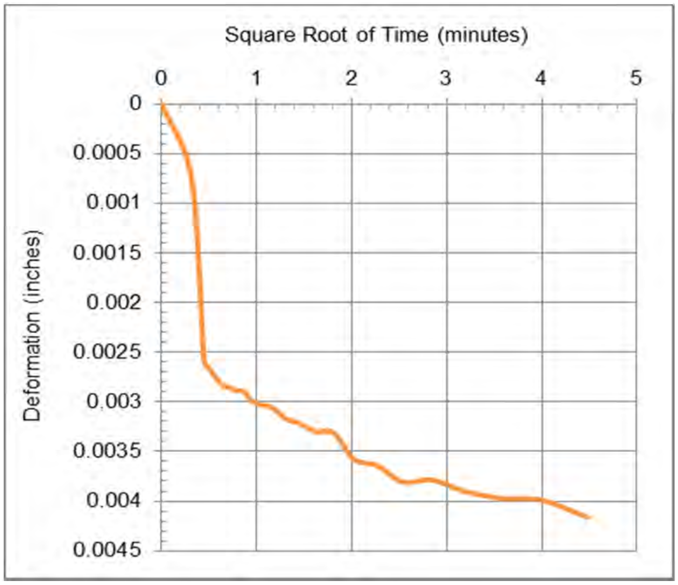
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02R (1.73 g/cc) (202 psf)
Lab ID: HAT01-11.1904002-008 (1.73 g/cc) (202 psf)
Date/Time sampled: 04/17/2019 1300

Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02R (1.72 g/cc) (398 psf)
Lab ID:	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)
Date/Time sampled:	04/17/2019 1300

Initial Sample Properties

Initial Mass (g):	157.74
Length (cm):	2.54
Diameter (cm):	6.34
Dry Mass (g):	138.06
Area (cm^2):	31.61
Volume (cm^3):	80.19
Assumed Particle Density (g/cm^3):	2.65
Wet Bulk Density (g/cm^3):	1.97
Wet Bulk Density (pcf):	122.8
Dry Bulk Density (g/cm^3):	1.72
Dry Bulk Density (pcf):	107.5
Water Content (%, g/g):	14.3
Water Content (%, vol):	24.5
Porosity (%, vol):	35.0
Void Ratio (e):	0.539
Saturation (%):	70.0

Consolidation

Normal Stress (psf):	398
Final Normal Displacement (in):	0.011
Duration (min):	16

Pre-Shear Sample Properties

Sample Mass (g):	165.83
Length (cm):	2.51
Volume (cm^3):	79.36
Wet Bulk Density (g/cm^3):	2.09
Wet Bulk Density (pcf):	130.5
Dry Bulk Density (g/cm^3):	1.74
Dry Bulk Density (pcf):	108.6
Water Content (%, g/g):	20.1
Water Content (%, vol):	34.99
Porosity (%, vol):	34.4
Void Ratio (e):	0.523
Saturation (%):	101.9

Sample & Test Conditions

Shear Device:	Trautwein DigiShear
Condition of test:	Inundated
Failure Determination:	Peak Shear Stress
Visual Description:	Silty cohesive sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Soil Structure/Preparation:	In-Situ
Date/Time Test Initiated:	8/12/19 847

Shear Data

Test Duration (min):	60
Peak Nominal Normal Stress (psf):	404
Peak Nominal Shear Stress (psf):	762
Peak Relative Lateral Displacement (%):	3.67
Final Relative Lateral Displacement (%):	10.01
Peak Normal Displacement (in):	-0.020
Final Normal Displacement (in):	-0.047
Average Displacement Rate (in/min):	0.004

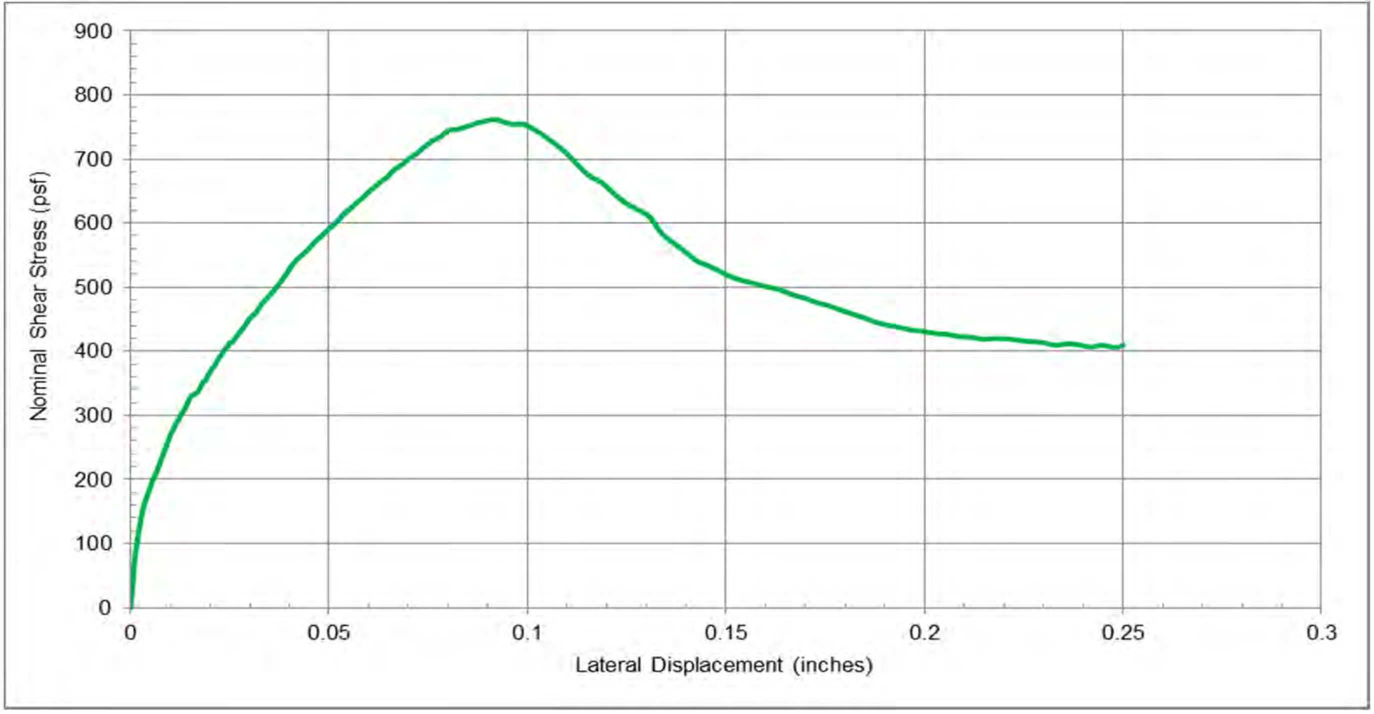
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Albay-Yenney
Checked by:	J. Hines

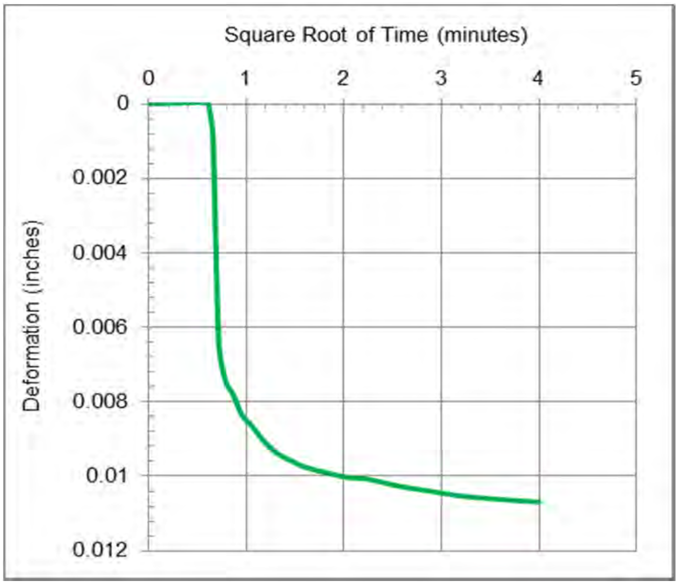
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02R (1.72 g/cc) (398 psf)
Lab ID:	HAT01-11.1904002-008 (1.72 g/cc) (398 psf)
Date/Time sampled:	04/17/2019 1300

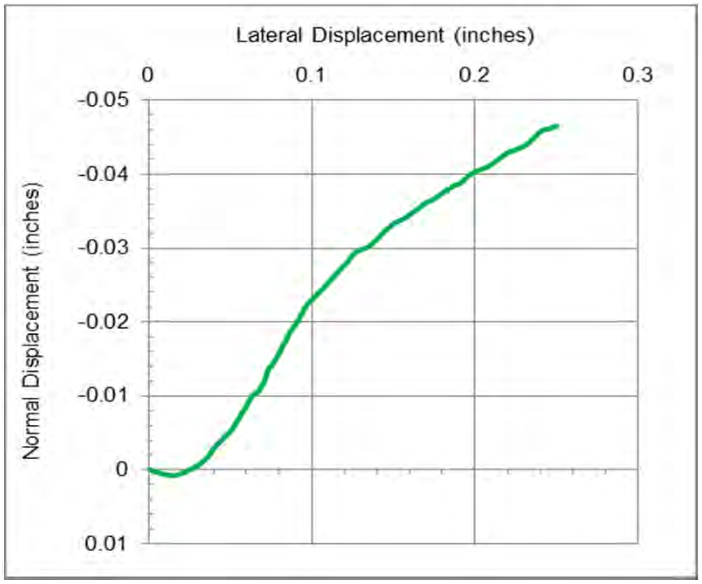
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L4-02RT

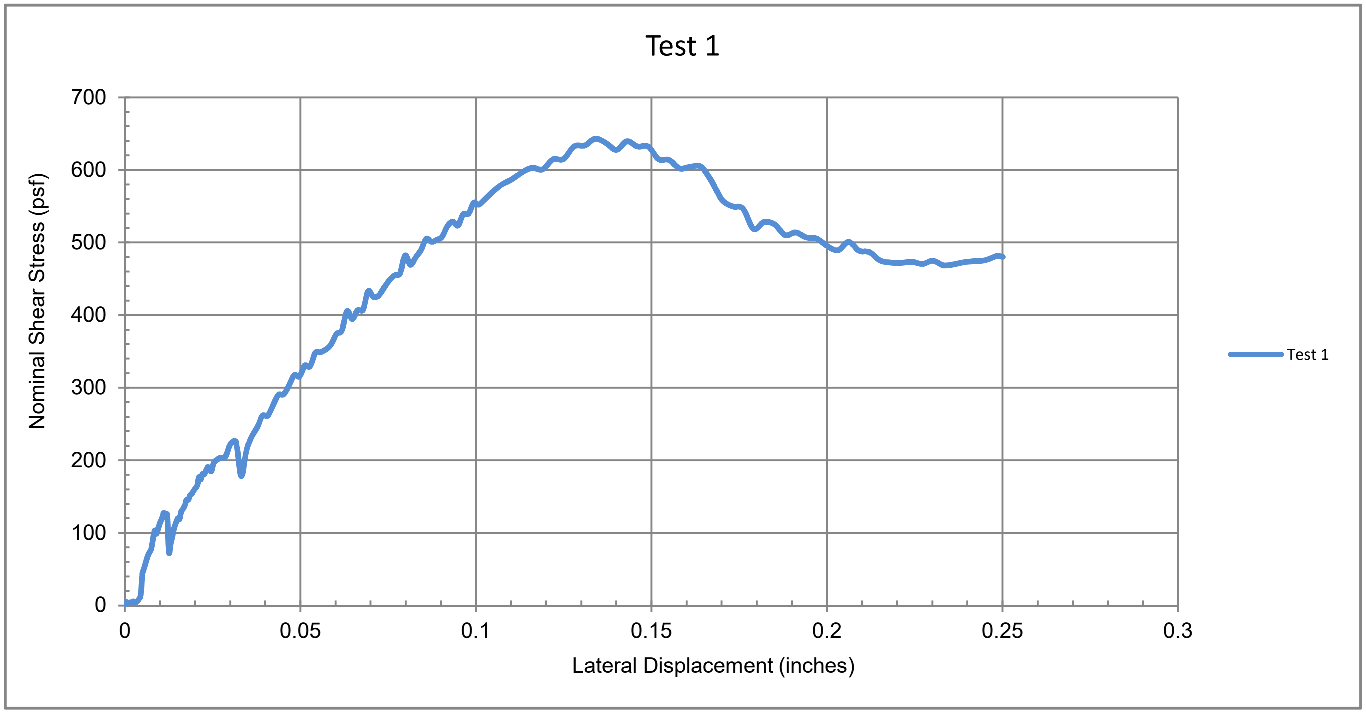
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	363	NA	NA
Final Normal Displacement (in)	0.015		
Duration (min)	16		

Shear Composite Data

	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	387		
Peak Nominal Shear Stress (psf)	643		
Peak Relative Lateral Displacement (%)	5.36		
Final Relative Lateral Displacement (%)	10.01		
Peak Normal Displacement (in)	-0.011		
Final Normal Displacement (in)	-0.021		
Average Displacement Rate (in/min):	0.004		

Nominal Shear Stress versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-02RT (1.77 g/cc) (363 psf)
Lab ID: HAT01-11.1904002-007 (1.77 g/cc) (363 psf)
Date/Time sampled: 04/17/2019 1300

Initial Sample Properties

Initial Mass (g): 155.37
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 142.4
Area (cm^2): 31.63
Volume (cm^3): 80.24
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.94
Wet Bulk Density (pcf): 120.9
Dry Bulk Density (g/cm^3): 1.77
Dry Bulk Density (pcf): 110.8
Water Content (%, g/g): 9.1
Water Content (%, vol): 16.2
Porosity (%, vol): 33.0
Void Ratio (e): 0.493
Saturation (%): 48.9

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-situ
Date/Time Test Initiated: 10/15/19 839

Consolidation

Normal Stress (psf): 363
Final Normal Displacement (in): 0.015
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 167.44
Length (cm): 2.50
Volume (cm^3): 78.96
Wet Bulk Density (g/cm^3): 2.12
Wet Bulk Density (pcf): 132.4
Dry Bulk Density (g/cm^3): 1.80
Dry Bulk Density (pcf): 112.6
Water Content (%, g/g): 17.6
Water Content (%, vol): 31.71
Porosity (%, vol): 31.9
Void Ratio (e): 0.469
Saturation (%): 99.3

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 387
Peak Nominal Shear Stress (psf): 643
Peak Relative Lateral Displacement (%): 5.36
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.011
Final Normal Displacement (in): -0.021
Average Displacement Rate (in/min): 0.004

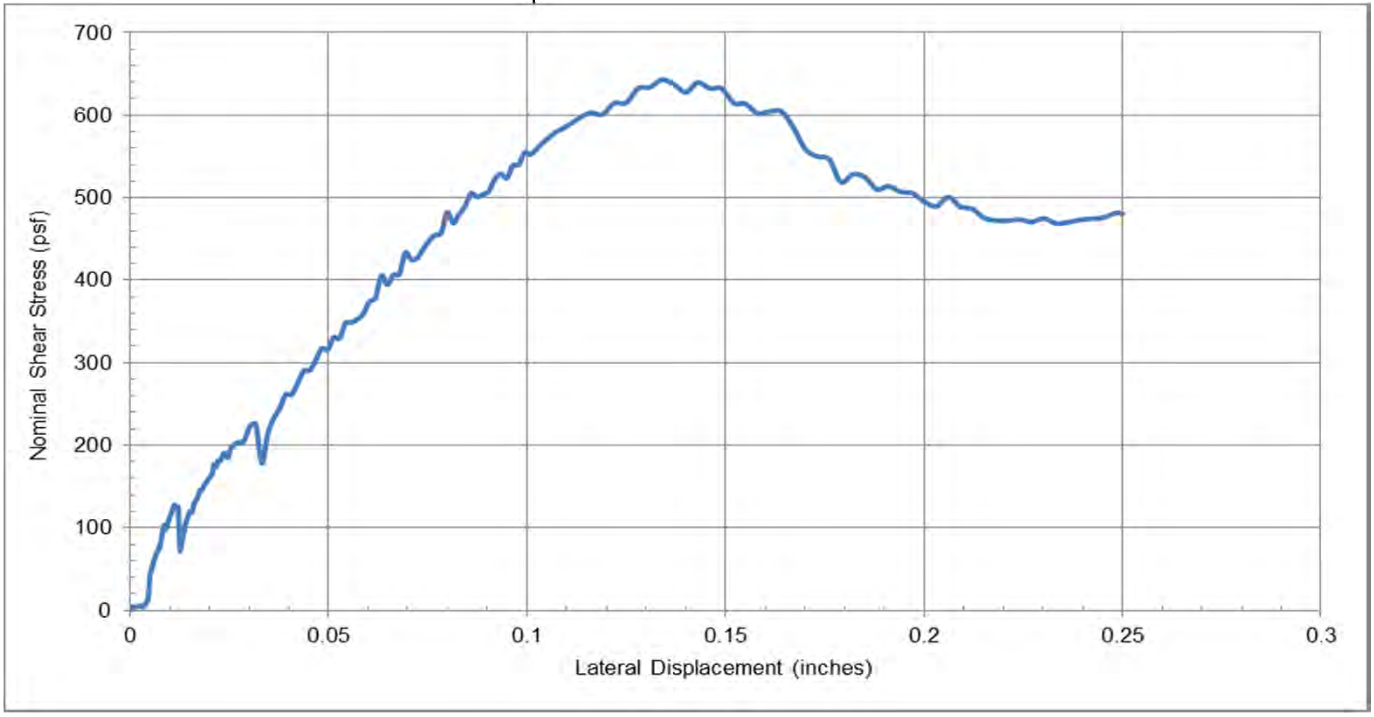
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

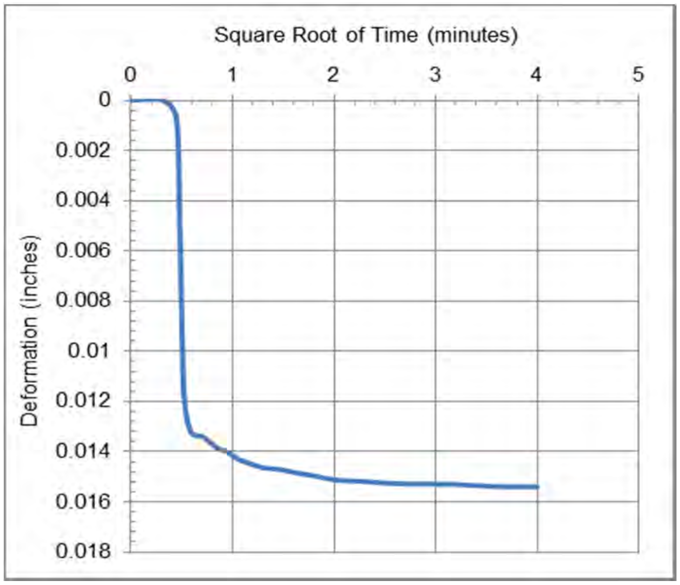
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-02RT (1.77 g/cc) (363 psf)
Lab ID:	HAT01-11.1904002-007 (1.77 g/cc) (363 psf)
Date/Time sampled:	04/17/2019 1300

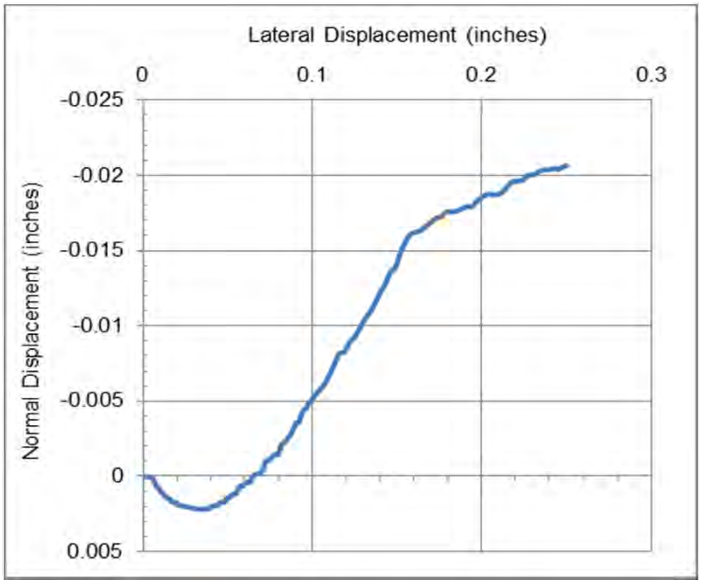
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L4-03R

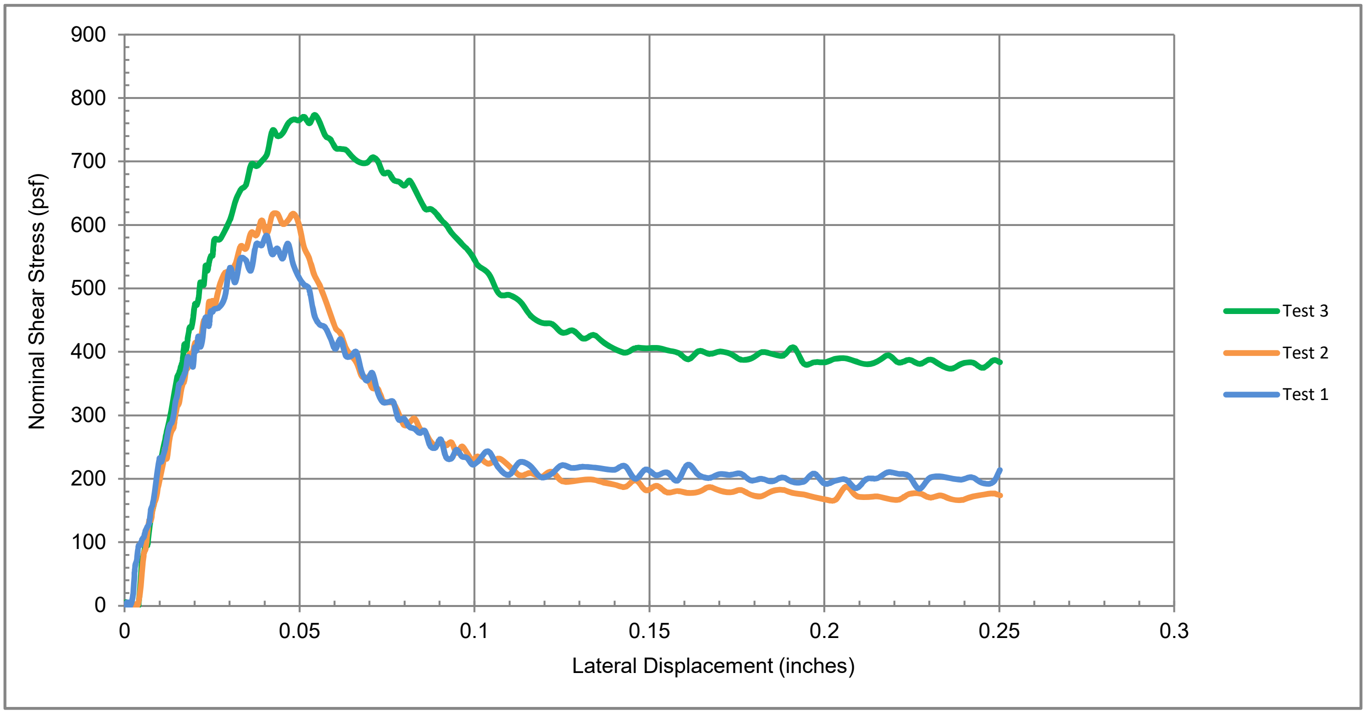
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	100	207	413
Final Normal Displacement (in)	0.001	0.004	0.007
Duration (min)	16	20	32

Shear Composite Data

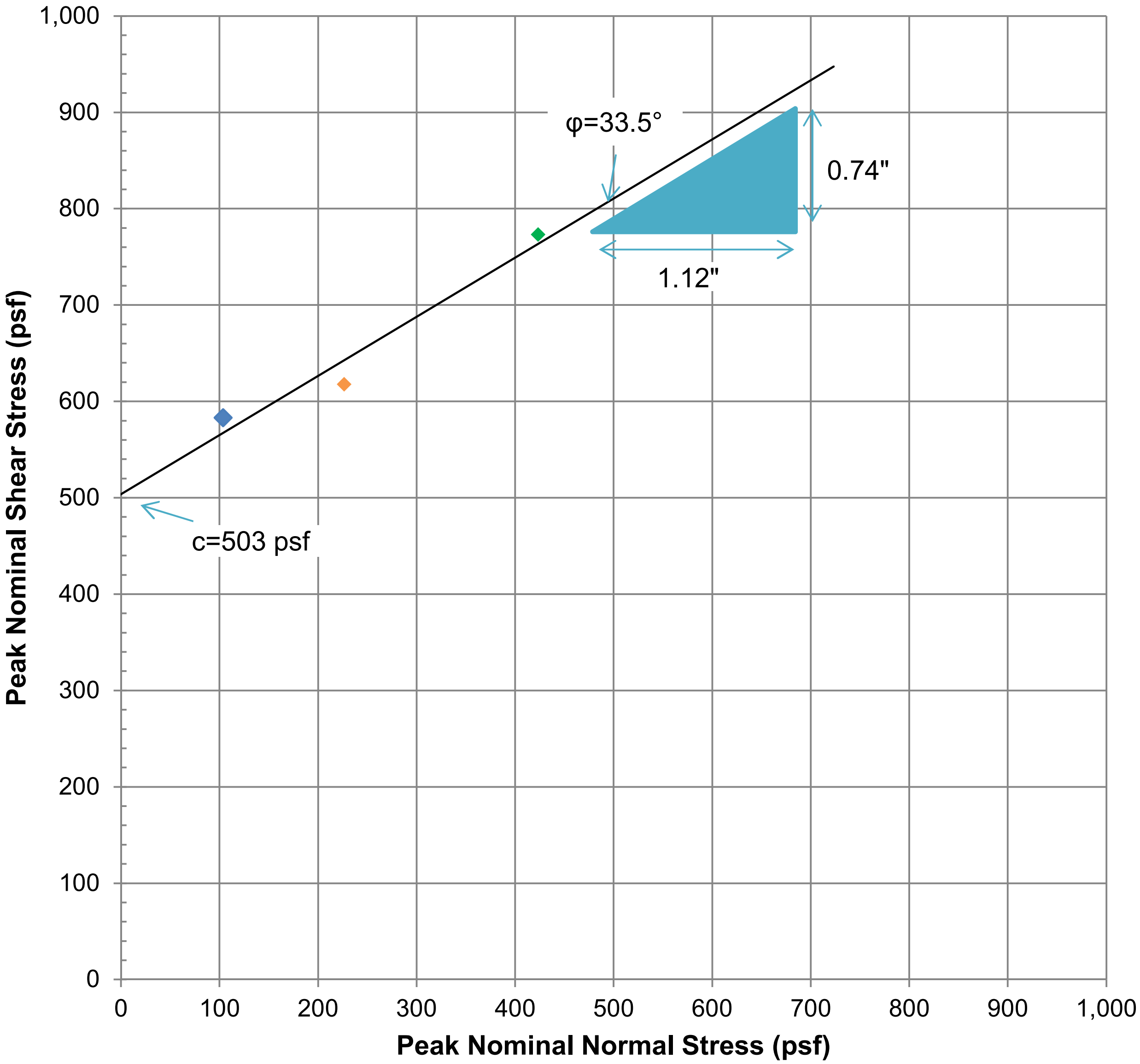
	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	104	226	423
Peak Nominal Shear Stress (psf)	583	618	773
Peak Relative Lateral Displacement (%)	1.63	1.93	2.17
Final Relative Lateral Displacement (%)	10.01	10.02	10.02
Peak Normal Displacement (in)	-0.017	-0.014	-0.011
Final Normal Displacement (in)	-0.062	-0.040	-0.029
Average Displacement Rate (in/min):	0.004	0.004	0.004

Nominal Shear Stress versus Lateral Displacement



Direct Shear: Shear Stress vs. Normal Stress Plot

Sample: L4-03R



Estimated Failure Parameters[1]:
estimated cohesion (c)(psf) = 503
estimated friction angle (ϕ)(°) = 33

---

[1] The cohesion and friction angle provided represent one possible interpretation of a failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.73 g/cc) (100 psf)
Lab ID: HAT01-11.1904002-010 (1.73 g/cc) (100 psf)
Date/Time sampled: 04/17/2019 1415

Initial Sample Properties

Initial Mass (g): 156.93
Length (cm): 2.54
Diameter (cm): 6.34
Dry Mass (g): 138.55
Area (cm^2): 31.61
Volume (cm^3): 80.16
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.96
Wet Bulk Density (pcf): 122.2
Dry Bulk Density (g/cm^3): 1.73
Dry Bulk Density (pcf): 107.9
Water Content (%, g/g): 13.3
Water Content (%, vol): 22.9
Porosity (%, vol): 34.8
Void Ratio (e): 0.533
Saturation (%): 65.9

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-situ
Date/Time Test Initiated: 8/9/19 920

Consolidation

Normal Stress (psf): 100
Final Normal Displacement (in): 0.001
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 168.74
Length (cm): 2.53
Volume (cm^3): 80.00
Wet Bulk Density (g/cm^3): 2.11
Wet Bulk Density (pcf): 131.7
Dry Bulk Density (g/cm^3): 1.73
Dry Bulk Density (pcf): 108.1
Water Content (%, g/g): 21.8
Water Content (%, vol): 37.74
Porosity (%, vol): 34.6
Void Ratio (e): 0.530
Saturation (%): 108.9

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 104
Peak Nominal Shear Stress (psf): 583
Peak Relative Lateral Displacement (%): 1.63
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.017
Final Normal Displacement (in): -0.062
Average Displacement Rate (in/min): 0.004

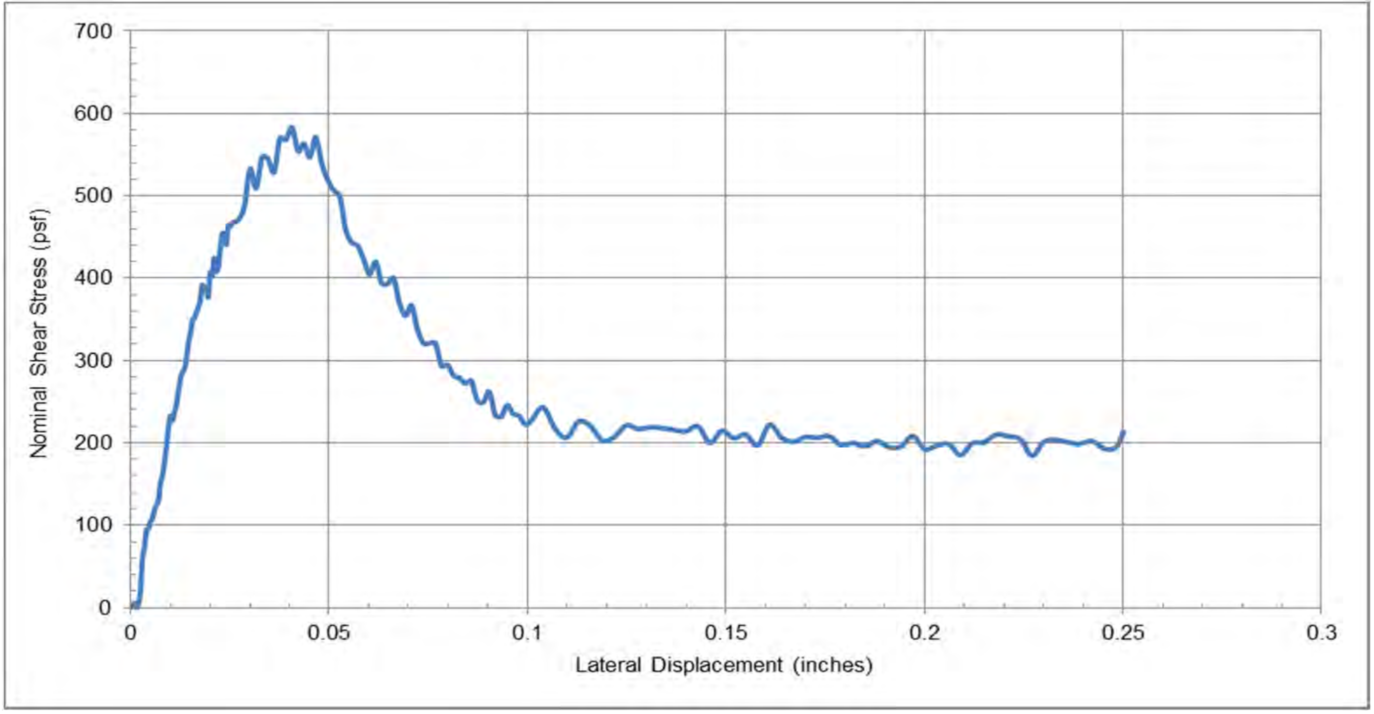
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

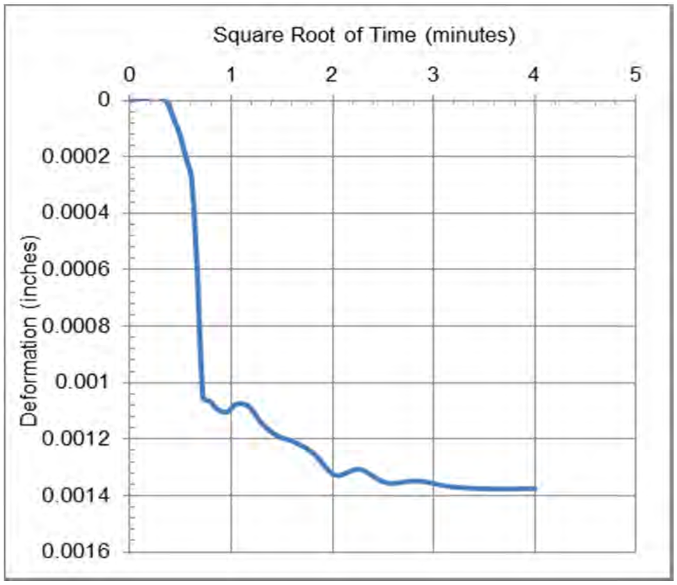
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.73 g/cc) (100 psf)
Lab ID: HAT01-11.1904002-010 (1.73 g/cc) (100 psf)
Date/Time sampled: 04/17/2019 1415

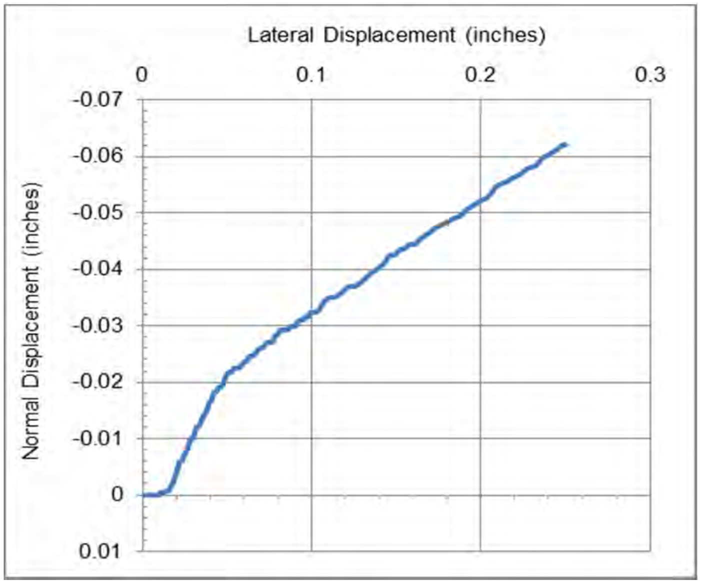
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.74 g/cc) (207 psf)
Lab ID: HAT01-11.1904002-010 (1.74 g/cc) (207 psf)
Date/Time sampled: 04/17/2019 1415

Initial Sample Properties

Initial Mass (g): 158.27
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 139.67
Area (cm^2): 31.63
Volume (cm^3): 80.28
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.97
Wet Bulk Density (pcf): 123.1
Dry Bulk Density (g/cm^3): 1.74
Dry Bulk Density (pcf): 108.6
Water Content (%, g/g): 13.3
Water Content (%, vol): 23.2
Porosity (%, vol): 34.3
Void Ratio (e): 0.523
Saturation (%): 67.5

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-situ
Date/Time Test Initiated: 8/22/19 1308

Consolidation

Normal Stress (psf): 207
Final Normal Displacement (in): 0.004
Duration (min): 20

Pre-Shear Sample Properties

Sample Mass (g): 167.03
Length (cm): 2.52
Volume (cm^3): 79.86
Wet Bulk Density (g/cm^3): 2.09
Wet Bulk Density (pcf): 130.6
Dry Bulk Density (g/cm^3): 1.75
Dry Bulk Density (pcf): 109.2
Water Content (%, g/g): 19.6
Water Content (%, vol): 34.26
Porosity (%, vol): 34.0
Void Ratio (e): 0.515
Saturation (%): 100.8

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 226
Peak Nominal Shear Stress (psf): 618
Peak Relative Lateral Displacement (%): 1.93
Final Relative Lateral Displacement (%): 10.02
Peak Normal Displacement (in): -0.014
Final Normal Displacement (in): -0.040
Average Displacement Rate (in/min): 0.004

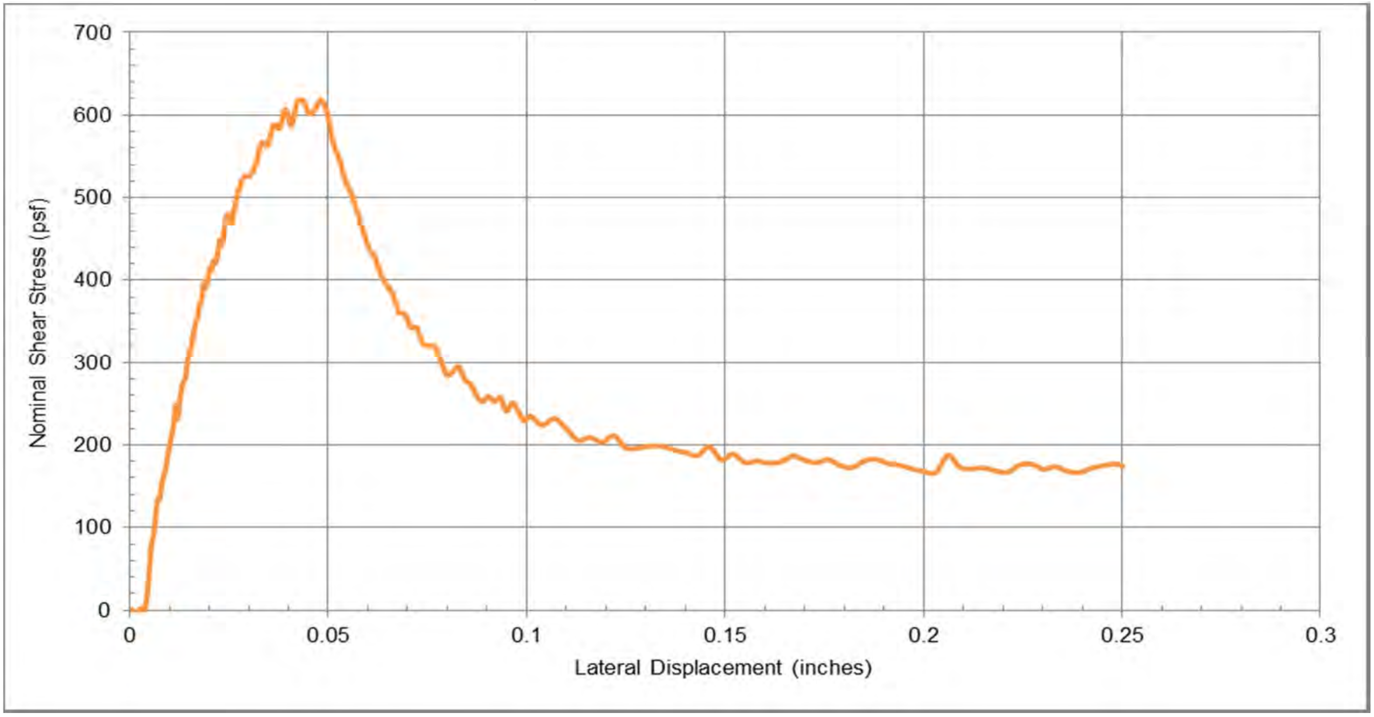
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

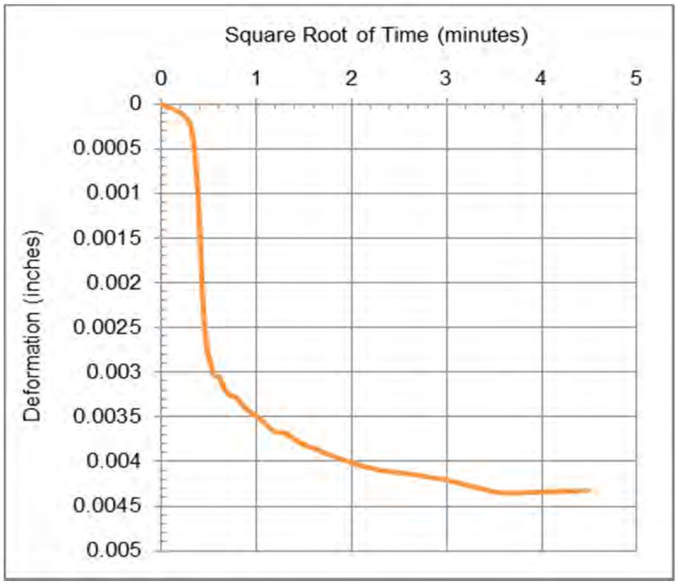
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-03R (1.74 g/cc) (207 psf)
Lab ID:	HAT01-11.1904002-010 (1.74 g/cc) (207 psf)
Date/Time sampled:	04/17/2019 1415

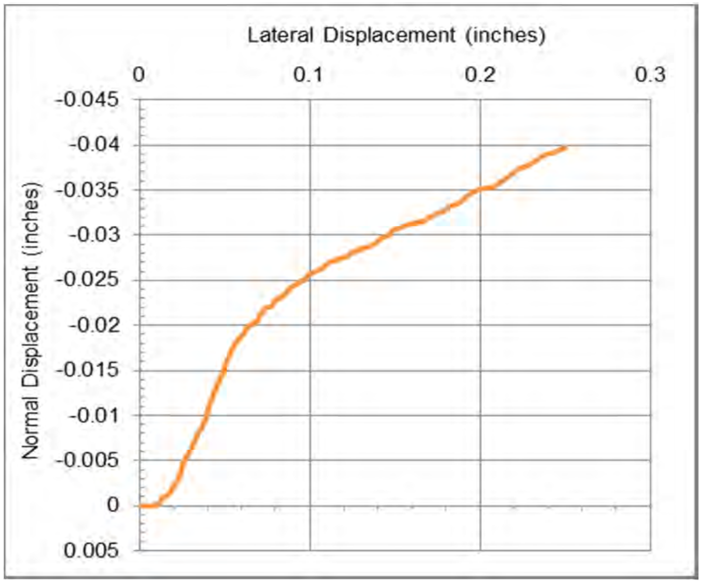
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-03R (1.74 g/cc) (413 psf)
Lab ID:	HAT01-11.1904002-010 (1.74 g/cc) (413 psf)
Date/Time sampled:	04/17/2019 1415

Initial Sample Properties

Initial Mass (g):	157.98
Length (cm):	2.54
Diameter (cm):	6.35
Dry Mass (g):	139.87
Area (cm^2):	31.62
Volume (cm^3):	80.25
Assumed Particle Density (g/cm^3):	2.65
Wet Bulk Density (g/cm^3):	1.97
Wet Bulk Density (pcf):	122.9
Dry Bulk Density (g/cm^3):	1.74
Dry Bulk Density (pcf):	108.8
Water Content (%, g/g):	12.9
Water Content (%, vol):	22.6
Porosity (%, vol):	34.2
Void Ratio (e):	0.520
Saturation (%):	65.9

Sample & Test Conditions

Shear Device:	Trautwein DigiShear
Condition of test:	Inundated
Failure Determination:	Peak Shear Stress
Visual Description:	Silty cohesive sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Soil Structure/Preparation:	In-situ
Date/Time Test Initiated:	8/23/19 800

Consolidation

Normal Stress (psf):	413
Final Normal Displacement (in):	0.007
Duration (min):	32

Pre-Shear Sample Properties

Sample Mass (g):	165.69
Length (cm):	2.52
Volume (cm^3):	79.55
Wet Bulk Density (g/cm^3):	2.08
Wet Bulk Density (pcf):	130.0
Dry Bulk Density (g/cm^3):	1.76
Dry Bulk Density (pcf):	109.8
Water Content (%, g/g):	18.5
Water Content (%, vol):	32.46
Porosity (%, vol):	33.6
Void Ratio (e):	0.507
Saturation (%):	96.5

Shear Data

Test Duration (min):	60
Peak Nominal Normal Stress (psf):	423
Peak Nominal Shear Stress (psf):	773
Peak Relative Lateral Displacement (%):	2.17
Final Relative Lateral Displacement (%):	10.02
Peak Normal Displacement (in):	-0.011
Final Normal Displacement (in):	-0.029
Average Displacement Rate (in/min):	0.004

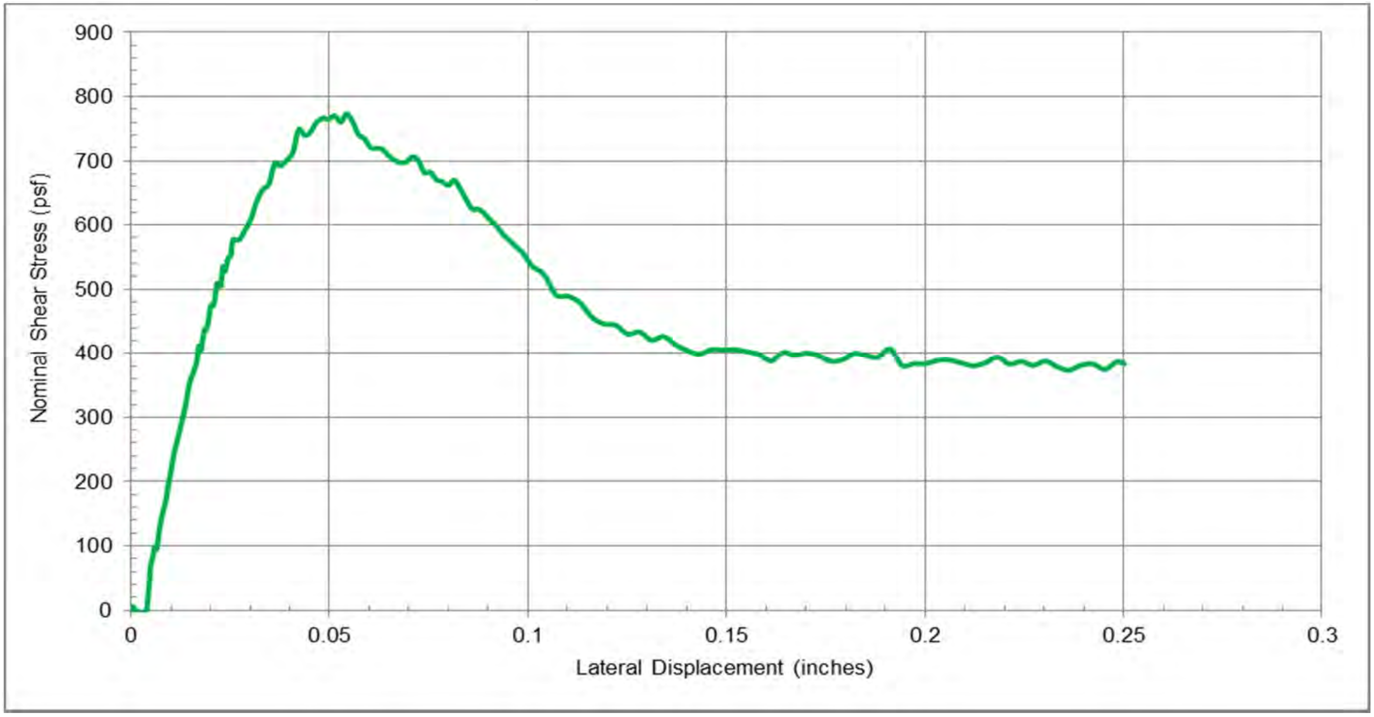
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Albay-Yenney
Checked by:	J. Hines

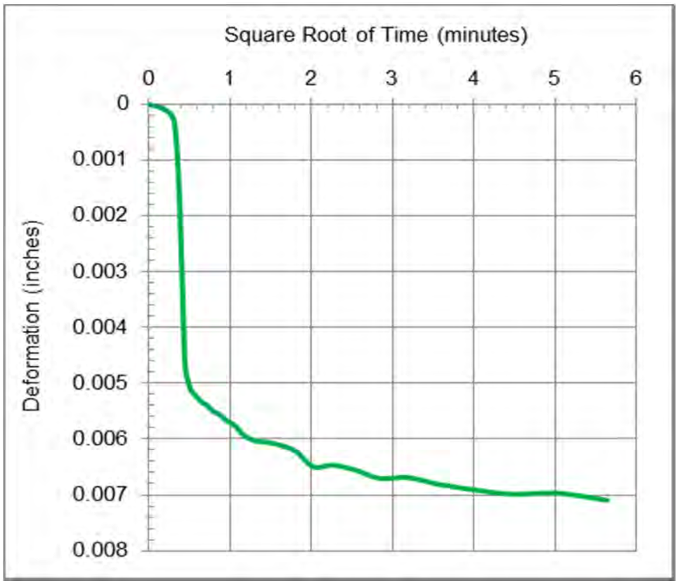
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03R (1.74 g/cc) (413 psf)
Lab ID: HAT01-11.1904002-010 (1.74 g/cc) (413 psf)
Date/Time sampled: 04/17/2019 1415

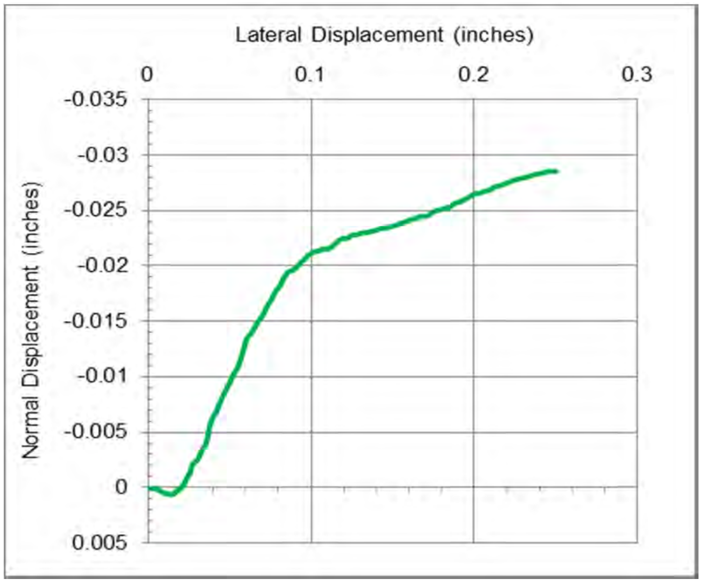
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L4-03RT

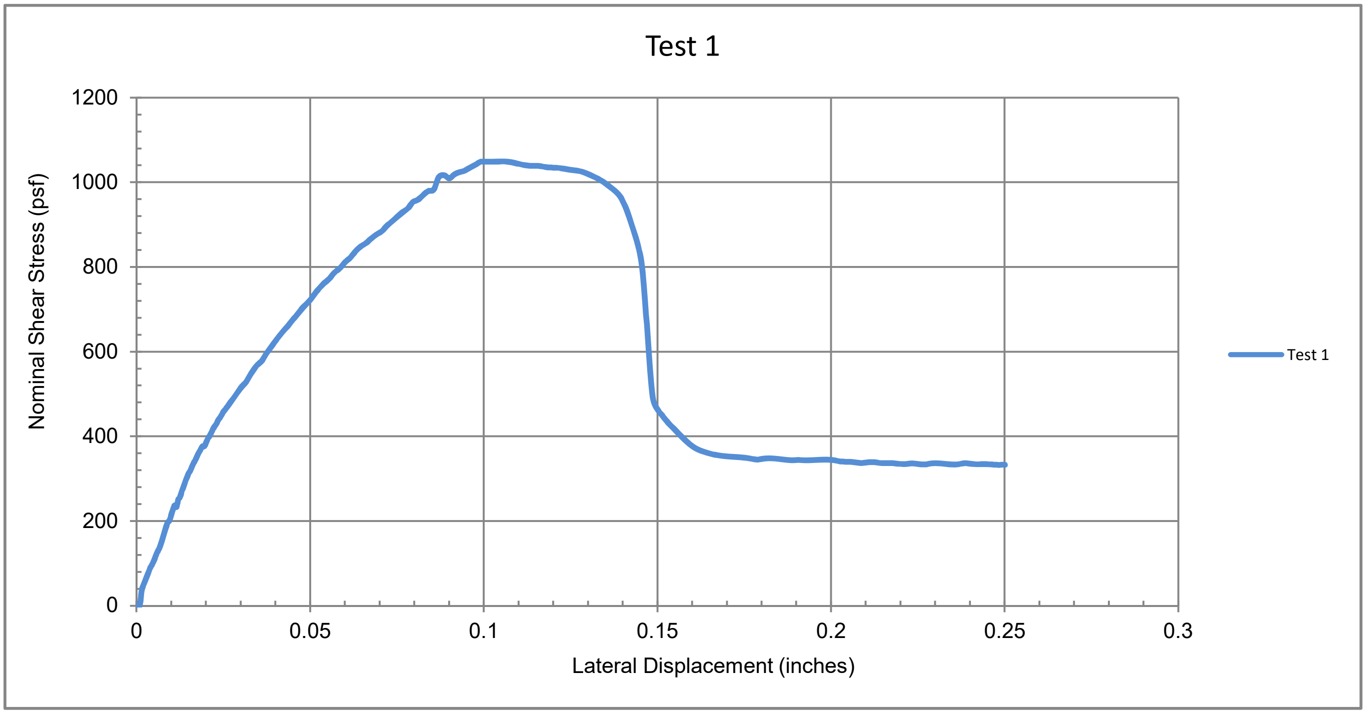
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	399	NA	NA
Final Normal Displacement (in)	0.008		
Duration (min)	16		

Shear Composite Data

	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	400		
Peak Nominal Shear Stress (psf)	1,049		
Peak Relative Lateral Displacement (%)	4.27		
Final Relative Lateral Displacement (%)	10.01		
Peak Normal Displacement (in)	-0.038		
Final Normal Displacement (in)	-0.046		
Average Displacement Rate (in/min):	0.004		

Nominal Shear Stress versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03RT (1.77 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-009 (1.77 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1415

Initial Sample Properties

Initial Mass (g): 157.31
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 142.28
Area (cm^2): 31.64
Volume (cm^3): 80.27
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.96
Wet Bulk Density (pcf): 122.3
Dry Bulk Density (g/cm^3): 1.77
Dry Bulk Density (pcf): 110.7
Water Content (%, g/g): 10.6
Water Content (%, vol): 18.7
Porosity (%, vol): 33.1
Void Ratio (e): 0.495
Saturation (%): 56.5

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-situ
Date/Time Test Initiated: 8/14/19 904

Consolidation

Normal Stress (psf): 399
Final Normal Displacement (in): 0.008
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 168.16
Length (cm): 2.52
Volume (cm^3): 79.63
Wet Bulk Density (g/cm^3): 2.11
Wet Bulk Density (pcf): 131.8
Dry Bulk Density (g/cm^3): 1.79
Dry Bulk Density (pcf): 111.5
Water Content (%, g/g): 18.2
Water Content (%, vol): 32.50
Porosity (%, vol): 32.6
Void Ratio (e): 0.483
Saturation (%): 99.8

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 400
Peak Nominal Shear Stress (psf): 1,049
Peak Relative Lateral Displacement (%): 4.27
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.038
Final Normal Displacement (in): -0.046
Average Displacement Rate (in/min): 0.004

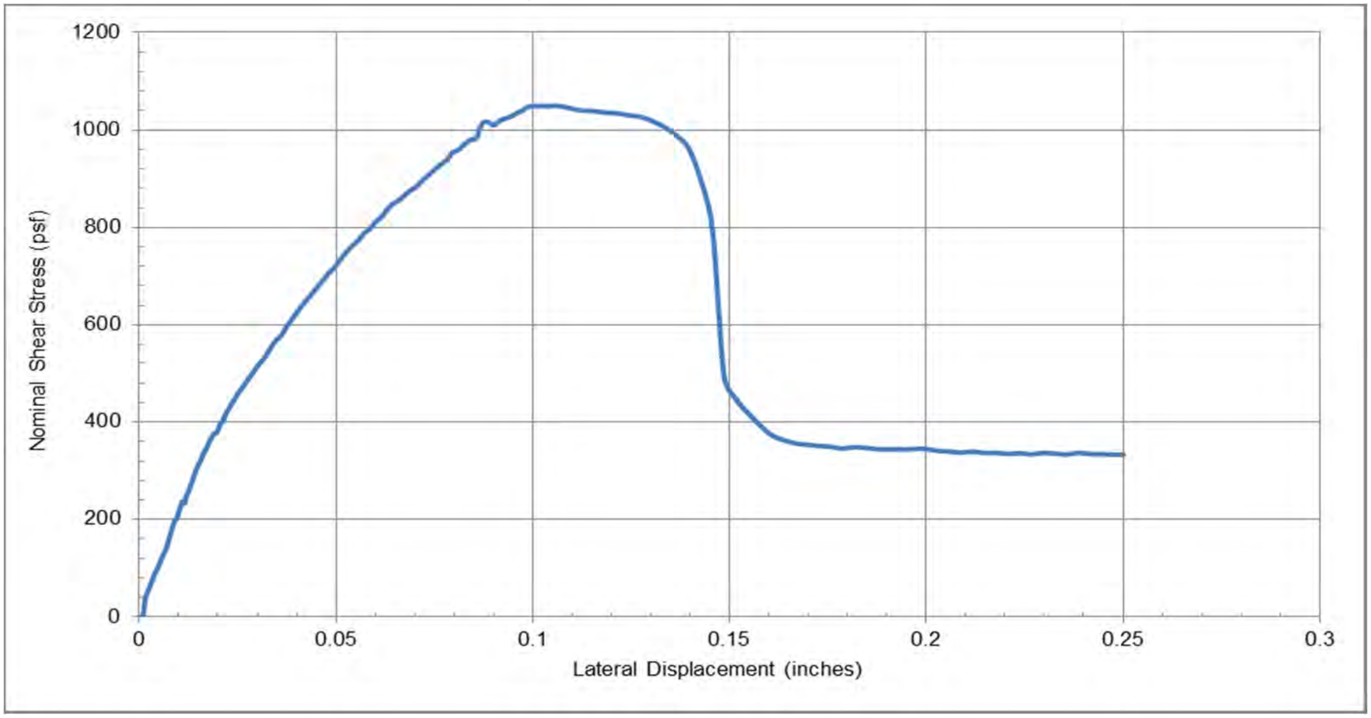
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

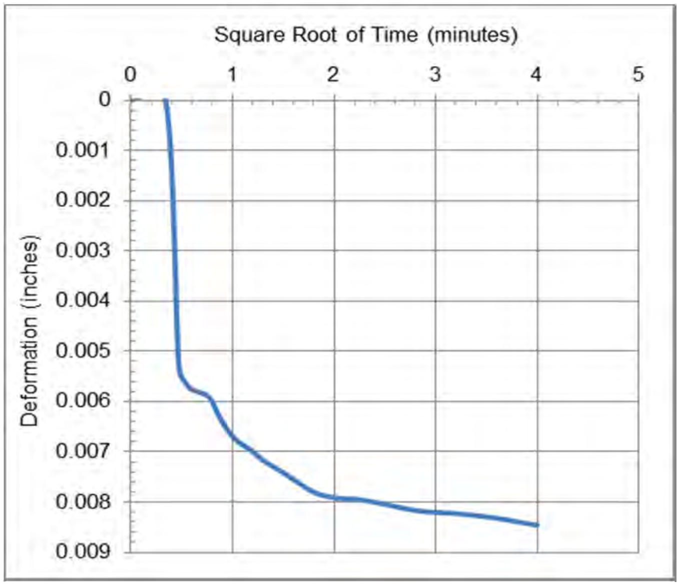
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-03RT (1.77 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-009 (1.77 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1415

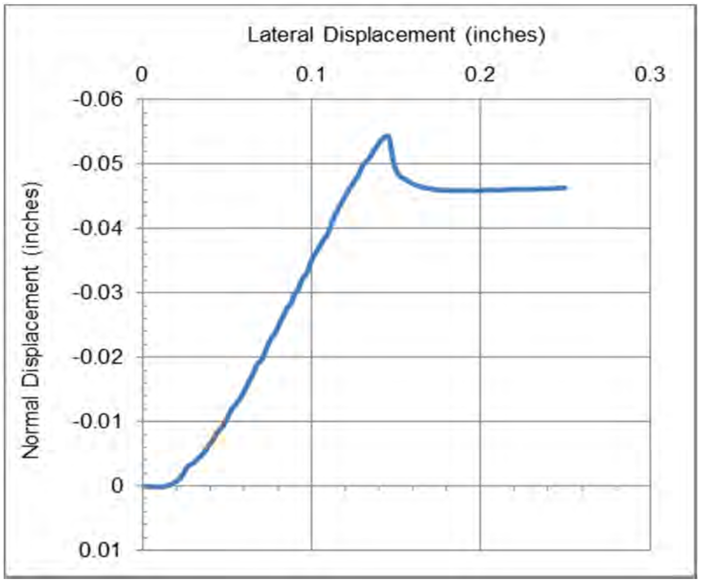
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L4-11RT

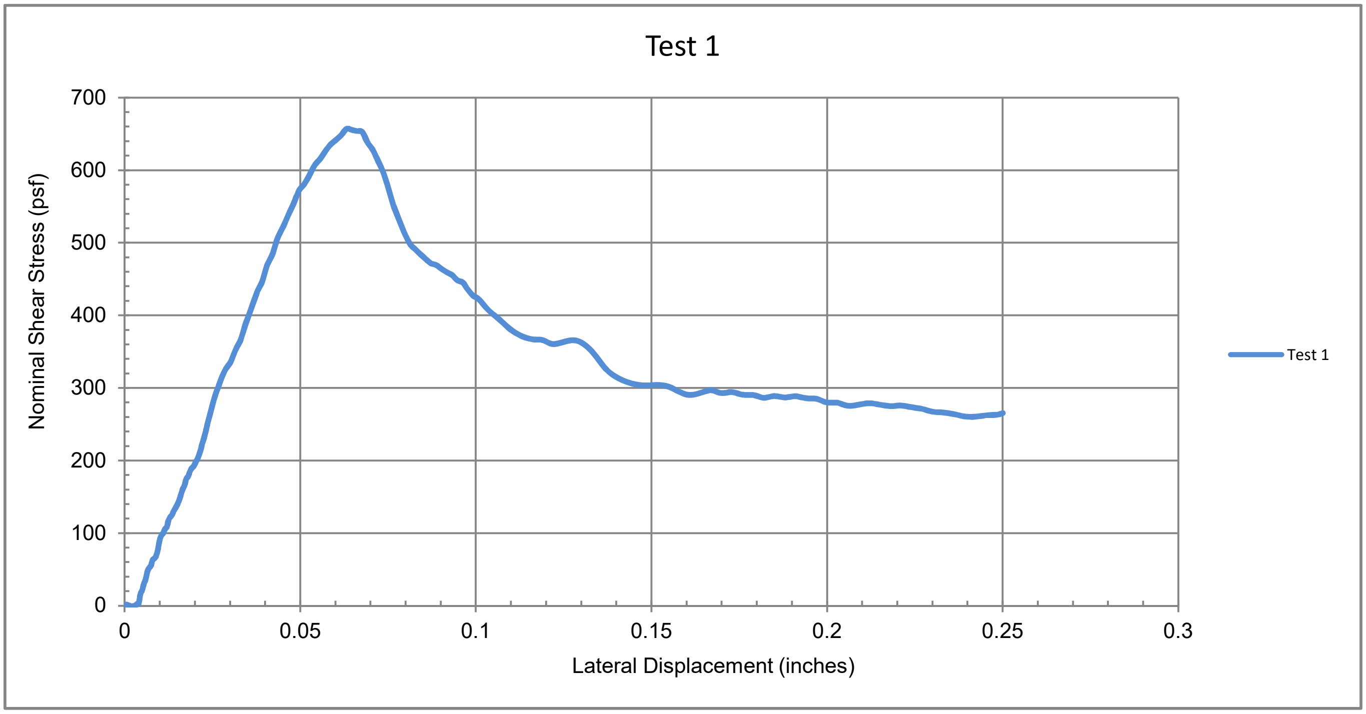
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	416	NA	NA
Final Normal Displacement (in)	0.009		
Duration (min)	16		

Shear Composite Data

	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	424		
Peak Nominal Shear Stress (psf)	657		
Peak Relative Lateral Displacement (%)	2.53		
Final Relative Lateral Displacement (%)	10.01		
Peak Normal Displacement (in)	-0.013		
Final Normal Displacement (in)	-0.036		
Average Displacement Rate (in/min):	0.004		

Nominal Shear Stress versus Lateral Displacement



Daniel B. Stephens & Associates, Inc.

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11RT (1.75 g/cc) (416 psf)
Lab ID: HAT01-11.1904002-003 (1.75 g/cc) (416 psf)
Date/Time sampled: 04/17/2019 1540

Initial Sample Properties

Initial Mass (g): 154.67
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 140.38
Area (cm^2): 31.64
Volume (cm^3): 80.27
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.93
Wet Bulk Density (pcf): 120.3
Dry Bulk Density (g/cm^3): 1.75
Dry Bulk Density (pcf): 109.2
Water Content (%, g/g): 10.2
Water Content (%, vol): 17.8
Porosity (%, vol): 34.0
Void Ratio (e): 0.515
Saturation (%): 52.4

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 10/15/19 835

Consolidation

Normal Stress (psf): 416
Final Normal Displacement (in): 0.009
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 164.73
Length (cm): 2.52
Volume (cm^3): 79.60
Wet Bulk Density (g/cm^3): 2.07
Wet Bulk Density (pcf): 129.2
Dry Bulk Density (g/cm^3): 1.76
Dry Bulk Density (pcf): 110.1
Water Content (%, g/g): 17.3
Water Content (%, vol): 30.59
Porosity (%, vol): 33.4
Void Ratio (e): 0.503
Saturation (%): 91.5

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 424
Peak Nominal Shear Stress (psf): 657
Peak Relative Lateral Displacement (%): 2.53
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.013
Final Normal Displacement (in): -0.036
Average Displacement Rate (in/min): 0.004

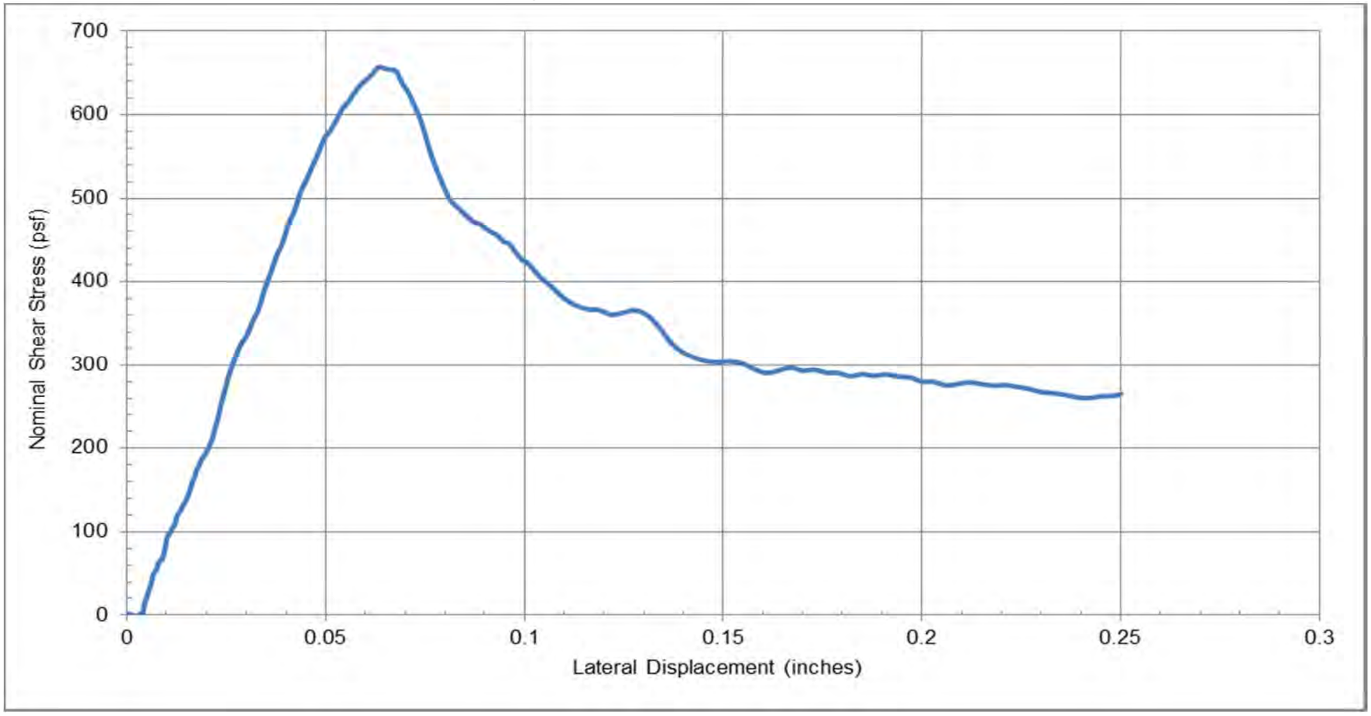
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

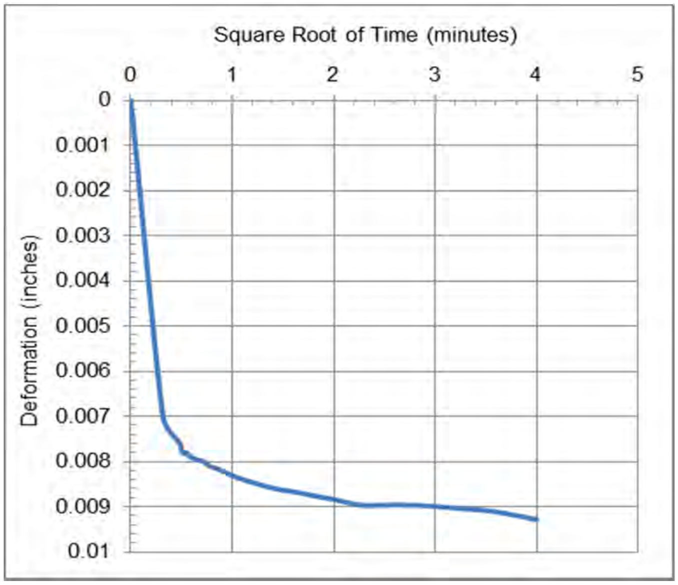
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-11RT (1.75 g/cc) (416 psf)
Lab ID: HAT01-11.1904002-003 (1.75 g/cc) (416 psf)
Date/Time sampled: 04/17/2019 1540

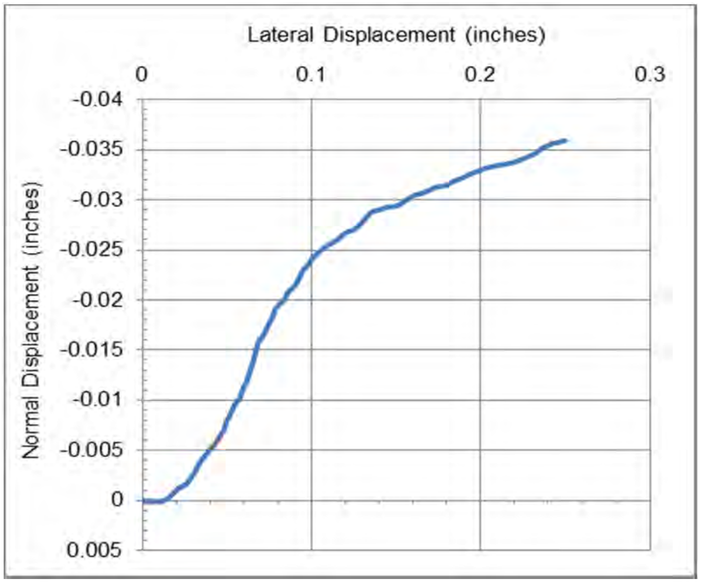
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L5-01R

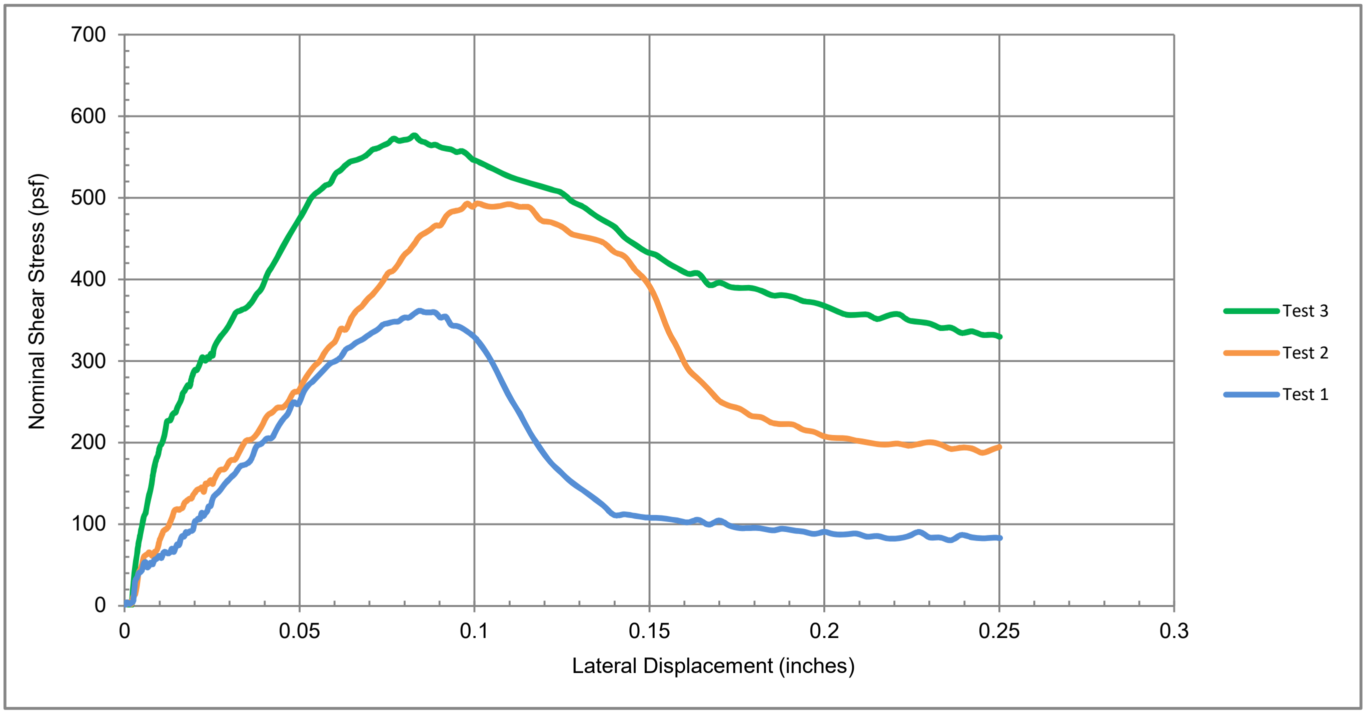
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	107	211	398
Final Normal Displacement (in)	0.001	0.005	0.007
Duration (min)	16	16	32

Shear Composite Data

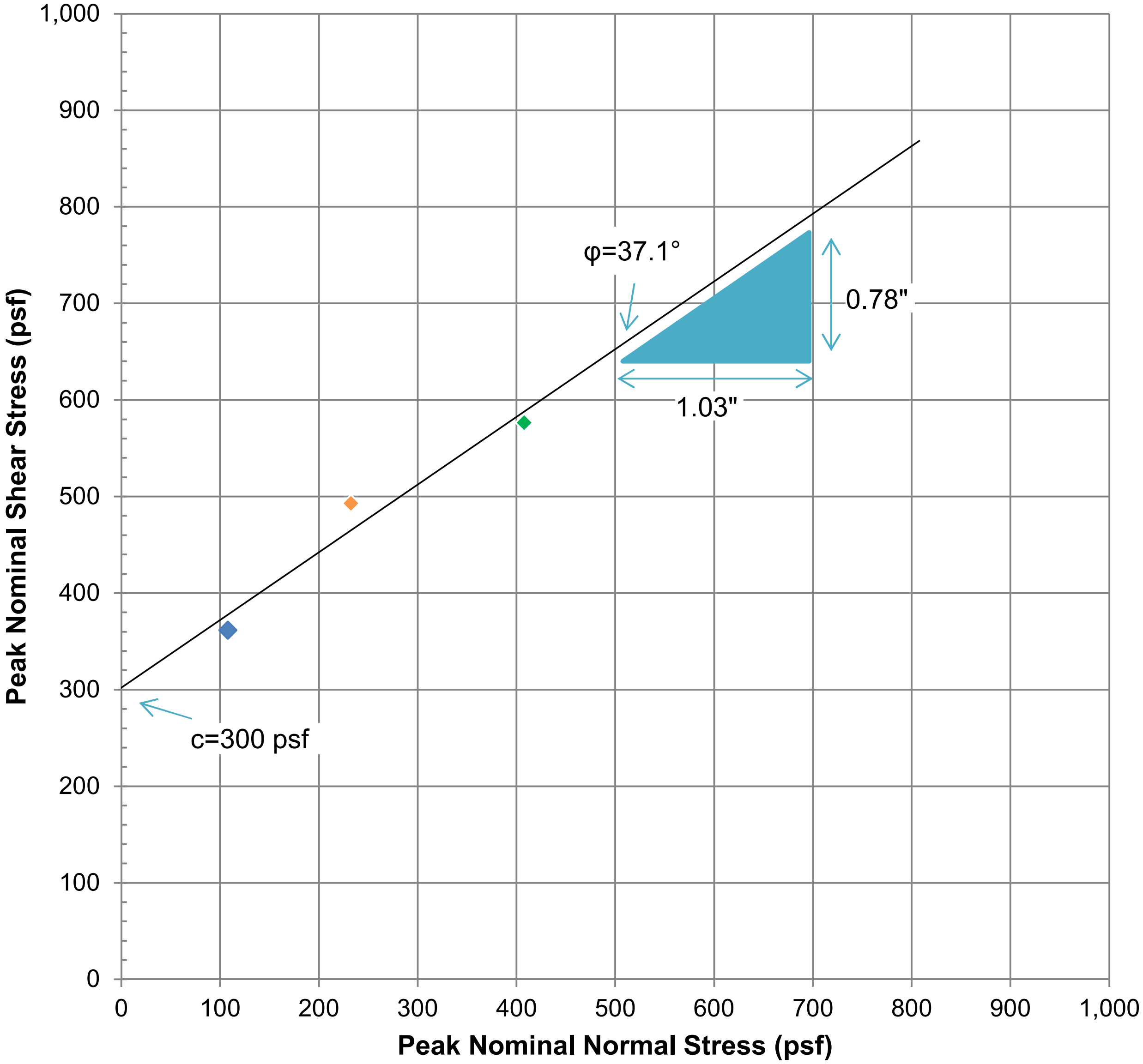
	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	108	232	408
Peak Nominal Shear Stress (psf)	361	493	576
Peak Relative Lateral Displacement (%)	3.37	4.04	3.32
Final Relative Lateral Displacement (%)	10.01	10.00	10.01
Peak Normal Displacement (in)	-0.026	-0.020	-0.019
Final Normal Displacement (in)	-0.046	-0.047	-0.033
Average Displacement Rate (in/min):	0.004	0.004	0.004

Nominal Shear Stress versus Lateral Displacement



Direct Shear: Shear Stress vs. Normal Stress Plot

Sample: L5-01R



Estimated Failure Parameters[1]**:**
estimated cohesion (c)(psf) = 300
estimated friction angle (ϕ)(°) = 37

[1] The cohesion and friction angle provided represent one possible interpretation of a failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (107 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (107 psf)
Date/Time sampled: 04/17/2019 1655

Initial Sample Properties

Initial Mass (g): 160.38
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 141.31
Area (cm^2): 31.65
Volume (cm^3): 80.36
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 2.00
Wet Bulk Density (pcf): 124.6
Dry Bulk Density (g/cm^3): 1.76
Dry Bulk Density (pcf): 109.8
Water Content (%, g/g): 13.5
Water Content (%, vol): 23.7
Porosity (%, vol): 33.6
Void Ratio (e): 0.507
Saturation (%): 70.5

Consolidation

Normal Stress (psf): 107
Final Normal Displacement (in): 0.001
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 171.54
Length (cm): 2.54
Volume (cm^3): 80.31
Wet Bulk Density (g/cm^3): 2.14
Wet Bulk Density (pcf): 133.3
Dry Bulk Density (g/cm^3): 1.76
Dry Bulk Density (pcf): 109.8
Water Content (%, g/g): 21.4
Water Content (%, vol): 37.64
Porosity (%, vol): 33.6
Void Ratio (e): 0.506
Saturation (%): 112.0

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/22/19 1003

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 108
Peak Nominal Shear Stress (psf): 361
Peak Relative Lateral Displacement (%): 3.37
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.026
Final Normal Displacement (in): -0.046
Average Displacement Rate (in/min): 0.004

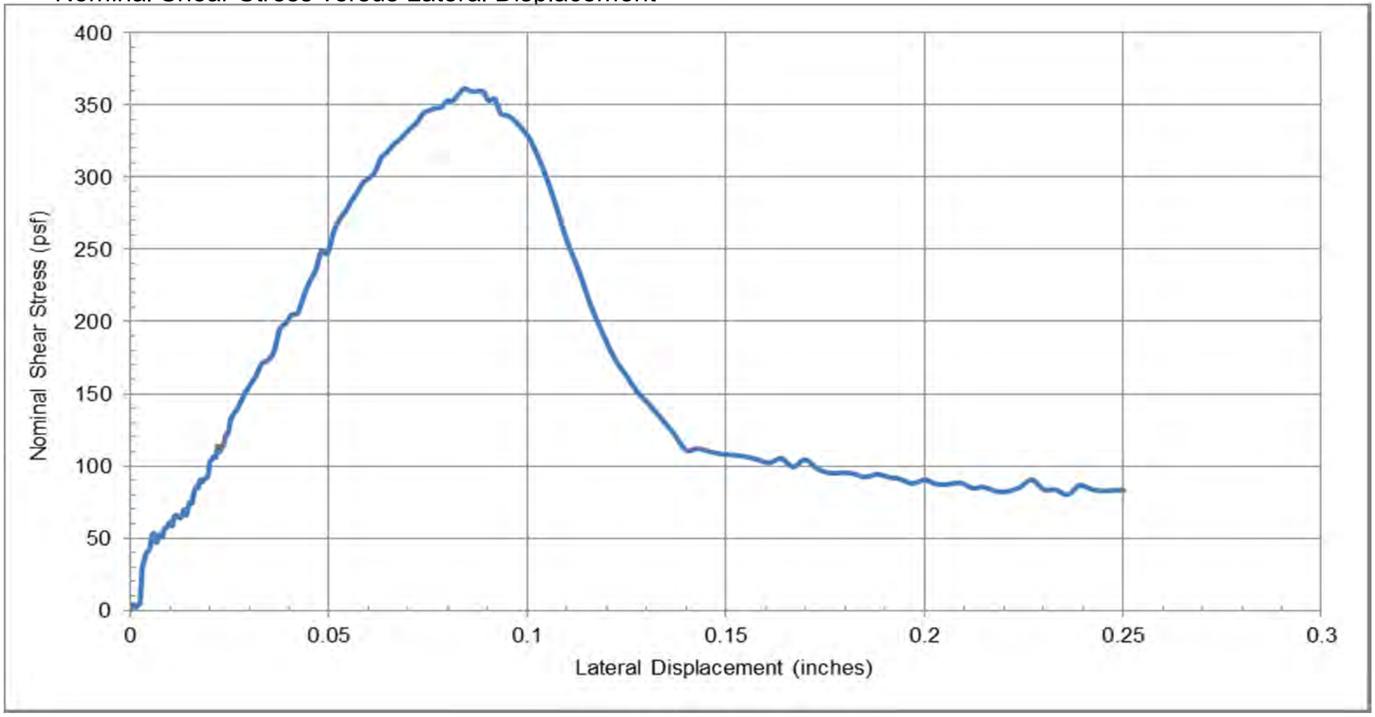
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

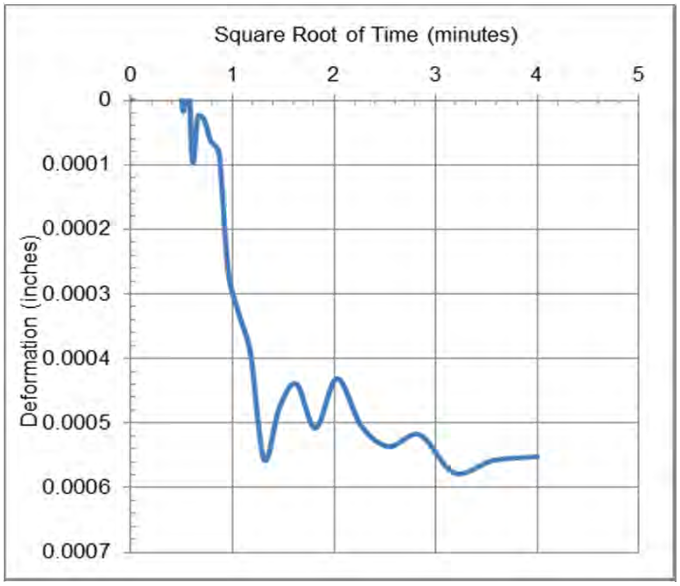
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (107 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (107 psf)
Date/Time sampled: 04/17/2019 1655

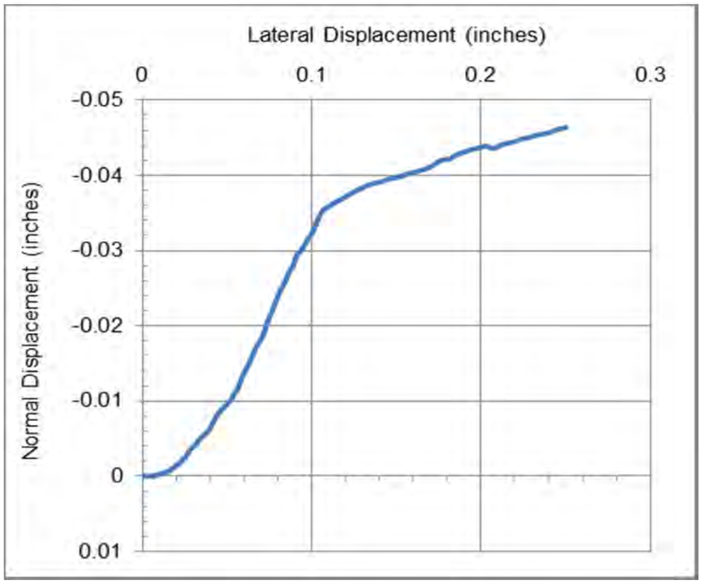
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.74 g/cc) (211 psf)
Lab ID: HAT01-11.1904002-002 (1.74 g/cc) (211 psf)
Date/Time sampled: 04/17/2019 1655

Initial Sample Properties

Initial Mass (g): 158.06
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 139.67
Area (cm^2): 31.62
Volume (cm^3): 80.22
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.97
Wet Bulk Density (pcf): 123.0
Dry Bulk Density (g/cm^3): 1.74
Dry Bulk Density (pcf): 108.7
Water Content (%, g/g): 13.2
Water Content (%, vol): 22.9
Porosity (%, vol): 34.3
Void Ratio (e): 0.522
Saturation (%): 66.8

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/9/19 1421

Consolidation

Normal Stress (psf): 211
Final Normal Displacement (in): 0.005
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 173.33
Length (cm): 2.52
Volume (cm^3): 79.81
Wet Bulk Density (g/cm^3): 2.17
Wet Bulk Density (pcf): 135.6
Dry Bulk Density (g/cm^3): 1.75
Dry Bulk Density (pcf): 109.3
Water Content (%, g/g): 24.1
Water Content (%, vol): 42.18
Porosity (%, vol): 34.0
Void Ratio (e): 0.514
Saturation (%): 124.2

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 232
Peak Nominal Shear Stress (psf): 493
Peak Relative Lateral Displacement (%): 4.04
Final Relative Lateral Displacement (%): 10.00
Peak Normal Displacement (in): -0.020
Final Normal Displacement (in): -0.047
Average Displacement Rate (in/min): 0.004

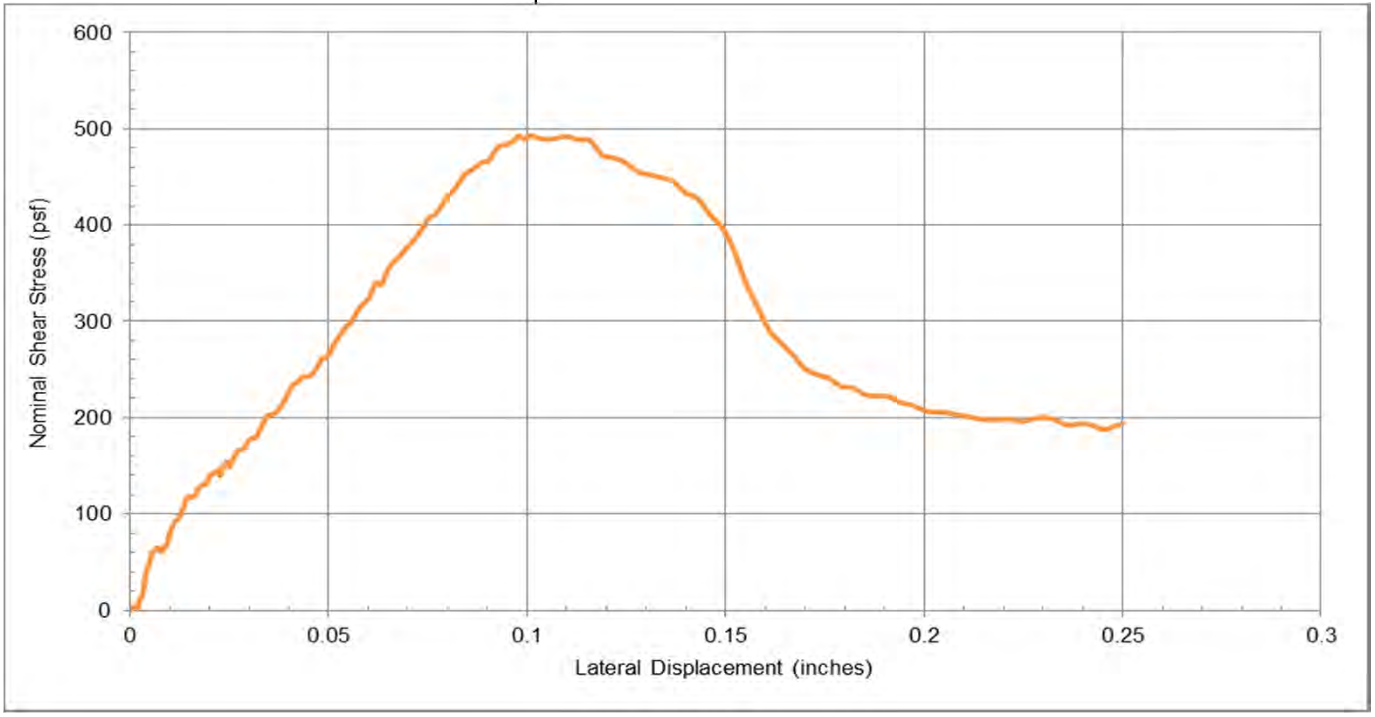
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

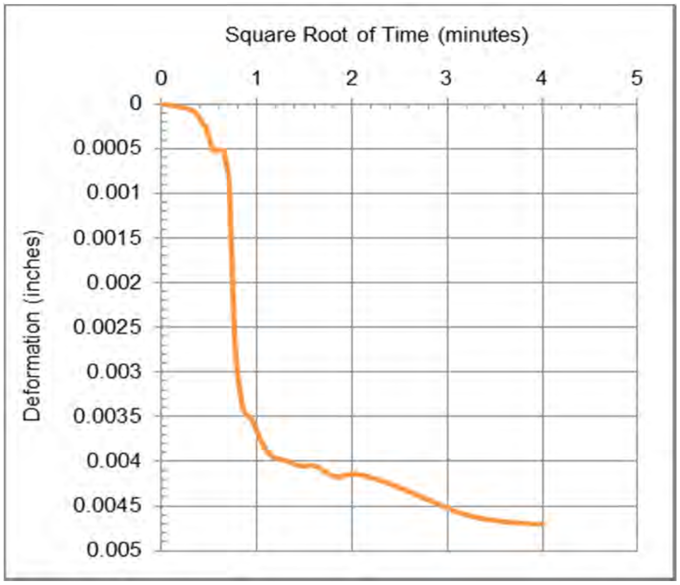
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.74 g/cc) (211 psf)
Lab ID: HAT01-11.1904002-002 (1.74 g/cc) (211 psf)
Date/Time sampled: 04/17/2019 1655

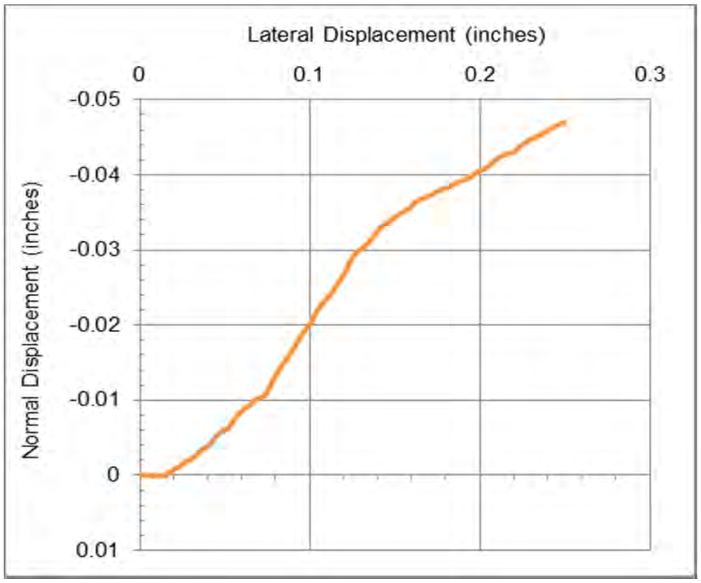
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (398 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (398 psf)
Date/Time sampled: 04/17/2019 1655

Initial Sample Properties

Initial Mass (g): 160.84
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 141.5
Area (cm^2): 31.63
Volume (cm^3): 80.28
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 2.00
Wet Bulk Density (pcf): 125.1
Dry Bulk Density (g/cm^3): 1.76
Dry Bulk Density (pcf): 110.0
Water Content (%, g/g): 13.7
Water Content (%, vol): 24.1
Porosity (%, vol): 33.5
Void Ratio (e): 0.503
Saturation (%): 72.0

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/23/19 758

Consolidation

Normal Stress (psf): 398
Final Normal Displacement (in): 0.007
Duration (min): 32

Pre-Shear Sample Properties

Sample Mass (g): 170.28
Length (cm): 2.52
Volume (cm^3): 79.68
Wet Bulk Density (g/cm^3): 2.14
Wet Bulk Density (pcf): 133.4
Dry Bulk Density (g/cm^3): 1.78
Dry Bulk Density (pcf): 110.9
Water Content (%, g/g): 20.3
Water Content (%, vol): 36.12
Porosity (%, vol): 33.0
Void Ratio (e): 0.492
Saturation (%): 109.5

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 408
Peak Nominal Shear Stress (psf): 576
Peak Relative Lateral Displacement (%): 3.32
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.019
Final Normal Displacement (in): -0.033
Average Displacement Rate (in/min): 0.004

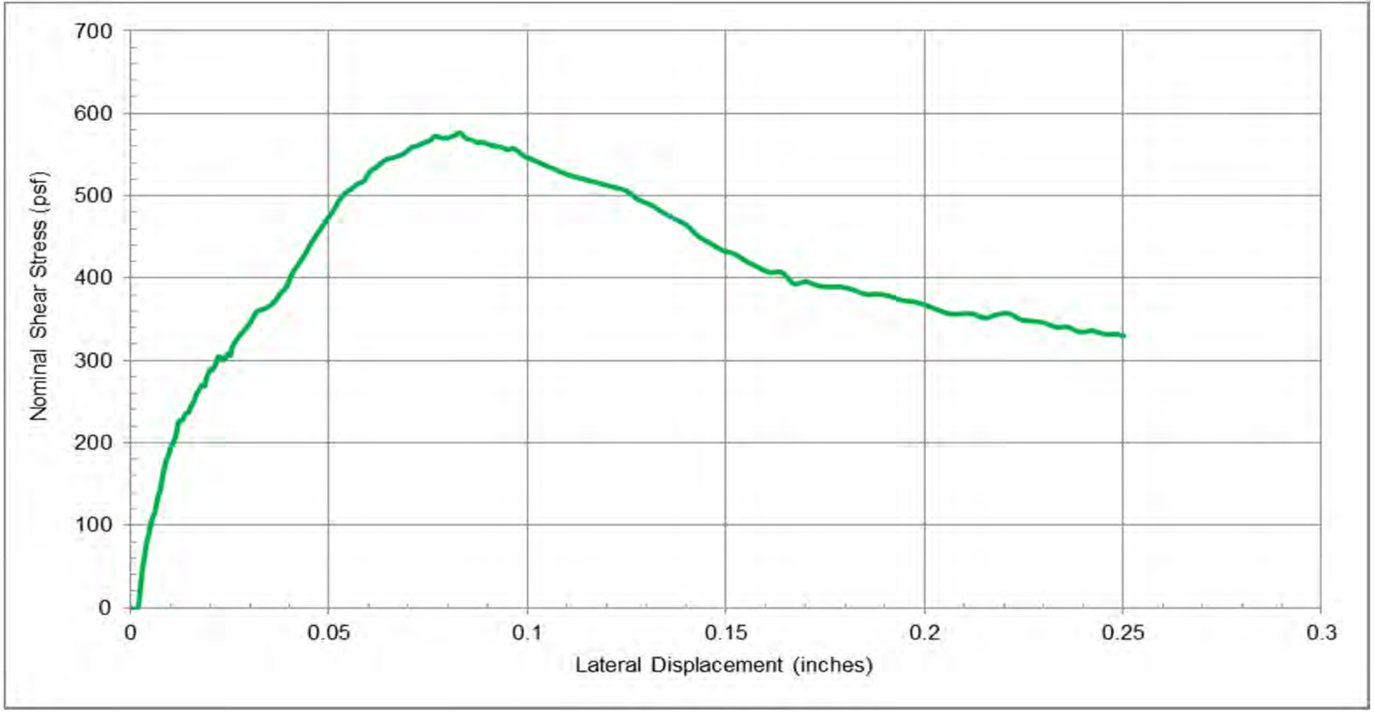
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

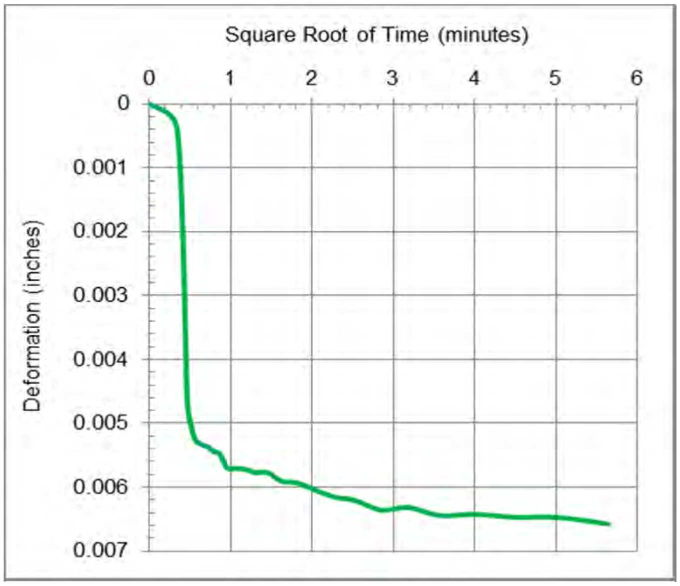
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01R (1.76 g/cc) (398 psf)
Lab ID: HAT01-11.1904002-002 (1.76 g/cc) (398 psf)
Date/Time sampled: 04/17/2019 1655

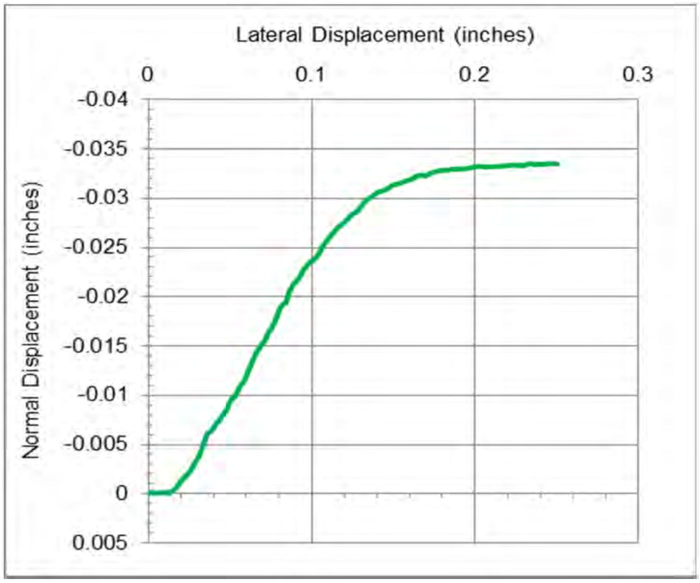
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Direct Shear Consolidated Drained Composite Data

Sample Number: L5-01RT

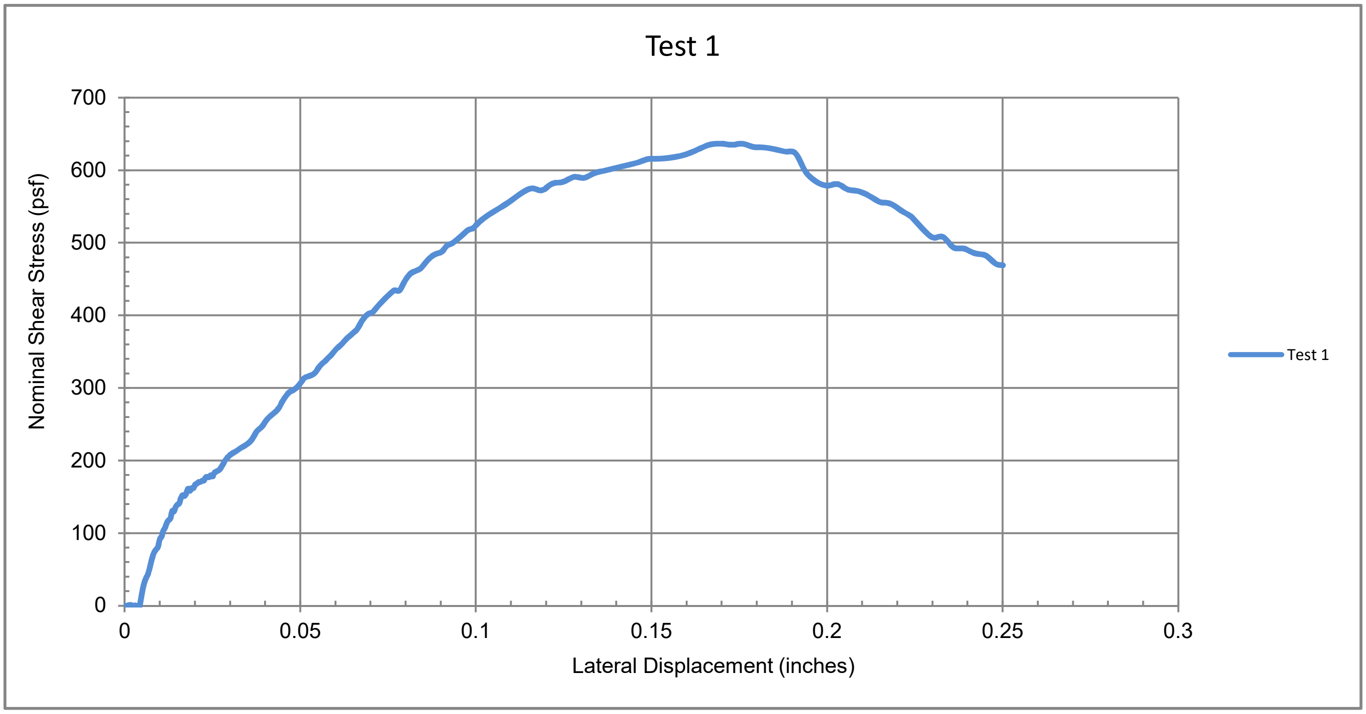
Consolidation Composite Data

	Test 1	Test 2	Test 3
Normal Stress (psf)	399	NA	NA
Final Normal Displacement (in)	0.010		
Duration (min)	16		

Shear Composite Data

	Test 1	Test 2	Test 3
Peak Nominal Normal Stress (psf)	403		
Peak Nominal Shear Stress (psf)	637		
Peak Relative Lateral Displacement (%)	6.80		
Final Relative Lateral Displacement (%)	10.01		
Peak Normal Displacement (in)	-0.027		
Final Normal Displacement (in)	-0.034		
Average Displacement Rate (in/min):	0.004		

Nominal Shear Stress versus Lateral Displacement



Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT (1.70 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-001 (1.70 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1655

Initial Sample Properties

Initial Mass (g): 153.5
Length (cm): 2.54
Diameter (cm): 6.35
Dry Mass (g): 136.2
Area (cm^2): 31.62
Volume (cm^3): 80.25
Assumed Particle Density (g/cm^3): 2.65
Wet Bulk Density (g/cm^3): 1.91
Wet Bulk Density (pcf): 119.4
Dry Bulk Density (g/cm^3): 1.70
Dry Bulk Density (pcf): 106.0
Water Content (%, g/g): 12.7
Water Content (%, vol): 21.6
Porosity (%, vol): 36.0
Void Ratio (e): 0.561
Saturation (%): 60.0

Consolidation

Normal Stress (psf): 399
Final Normal Displacement (in): 0.010
Duration (min): 16

Pre-Shear Sample Properties

Sample Mass (g): 166.4
Length (cm): 2.51
Volume (cm^3): 79.49
Wet Bulk Density (g/cm^3): 2.09
Wet Bulk Density (pcf): 130.7
Dry Bulk Density (g/cm^3): 1.71
Dry Bulk Density (pcf): 107.0
Water Content (%, g/g): 22.2
Water Content (%, vol): 37.99
Porosity (%, vol): 35.3
Void Ratio (e): 0.547
Saturation (%): 107.5

Sample & Test Conditions

Shear Device: Trautwein DigiShear
Condition of test: Inundated
Failure Determination: Peak Shear Stress
Visual Description: Silty cohesive sand
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Soil Structure/Preparation: In-Situ
Date/Time Test Initiated: 8/13/19 1441

Shear Data

Test Duration (min): 60
Peak Nominal Normal Stress (psf): 403
Peak Nominal Shear Stress (psf): 637
Peak Relative Lateral Displacement (%): 6.80
Final Relative Lateral Displacement (%): 10.01
Peak Normal Displacement (in): -0.027
Final Normal Displacement (in): -0.034
Average Displacement Rate (in/min): 0.004

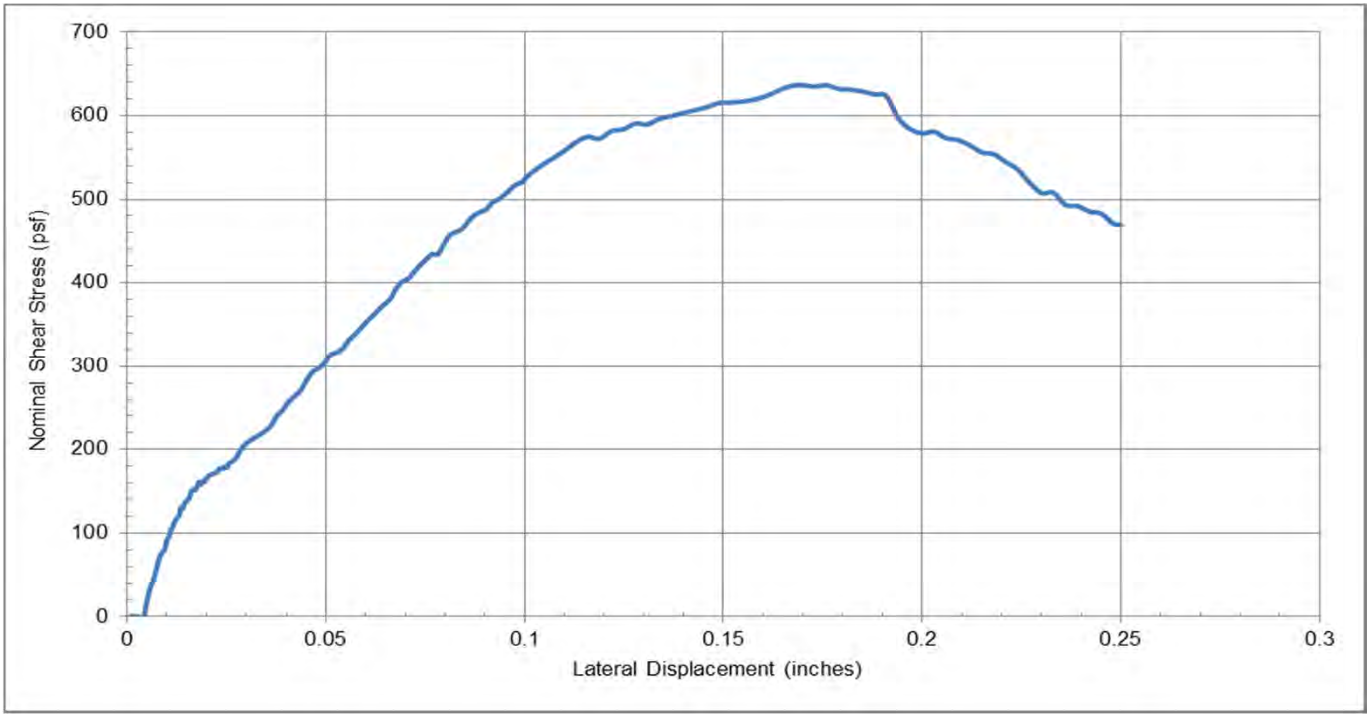
Notes: The pre-shear sample mass is set equal to the post-test sample mass (since the pre-shear mass is impossible to determine); and, the post-test mass is considered approximate as some water loss may occur before obtaining the weight, or some excess water may be held within the apparatus at the time the weight is recorded. The target displacement rate was determined for test sample #1 and used for remaining test samples for consistency.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

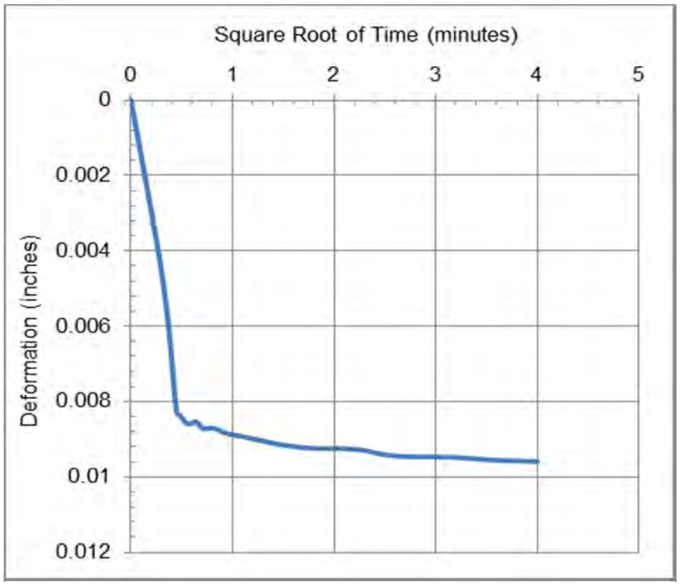
Direct Shear Consolidated Drained Data, ASTM D3080

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L5-01RT (1.70 g/cc) (399 psf)
Lab ID: HAT01-11.1904002-001 (1.70 g/cc) (399 psf)
Date/Time sampled: 04/17/2019 1655

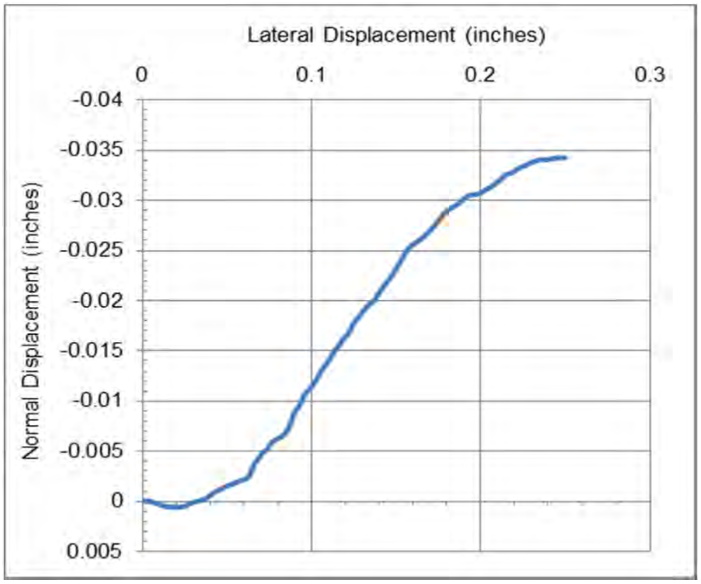
Nominal Shear Stress versus Lateral Displacement



Deformation versus Square Root of Time



Normal Displacement versus Lateral Displacement



Collapse Potential

Summary of Collapse Potential Testing

Sample Number	Lab ID	Pressure at Inundation (psf)	Collapse Potential (I_c) (%)
L4-01R (1.79 g/cc) (1,044 psf)	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)	1,044	0.02

Collapse Potential (ASTM D5333-03) Data

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.79 g/cc) (1,044 psf)
Lab ID:	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)
Date/Time sampled:	04/17/2019 1100

Remolded or Initial Sample Properties

Initial Mass (g):	160.71
Length (cm):	2.534
Diameter (cm):	6.34
Area (cm^2):	31.57
Volume (cm^3):	80.00
Dry Density (g/cm^3):	1.79
Dry Density (lbf/ft^3):	112.00
Equivalent Height of Solids (cm):	1.72
Water Content (%, g/g):	12.0
Water Content (%, vol):	21.5
Porosity (%, vol):	32.3
Void Ratio (e):	0.477
Saturation (%):	66.5
Date/Time Test Initiated:	6/14/19 644

Test and Sample Conditions

Visual Description of Sample:	Cohesive Sand
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Sample Preparation:	☑ In situ Density ☐ Remolded
Apparatus:	Automated/Digital
Split:	NA
Percent Coarse Material (%):	NA
Particle Density(g/cm^3):	2.65 ☑ Assumed ☐ Measured
Seating Load (lb/ft^2):	100
Inundation Fluid:	Deionized Water
Pressure at Inundation (lb/ft^2):	1,044

Final (Post Test) Sample Properties

Final Mass (g):	165.72
Dry Mass (g):	143.52
Length (cm):	2.506
Diameter (cm):	6.34
Area (cm^2):	31.57
Volume (cm^3):	79.11
Dry Density (g/cm^3):	1.81
Dry Density (lbf/ft^3):	113.26
Equivalent Height of Solids (cm):	1.72
Water Content (%, g/g):	15.5
Water Content (%, vol):	28.1
Porosity (%, vol):	31.5
Void Ratio (e):	0.461
Saturation (%):	89.0

Load (psf)	**H (in)**	**Void Ratio (e)**	**Axial Strain (%)**	**Load #**
100	0.9970	0.476	0.00	Seating
250	0.9961	0.475	0.09	1
500	0.9955	0.474	0.15	2
1,044	0.9937	0.471	0.33	3
1,044	0.9935	0.471	0.35	4
2,000	0.9919	0.469	0.51	5
4,000	0.9895	0.465	0.75	6
8,000	0.9866	0.461	1.04	7

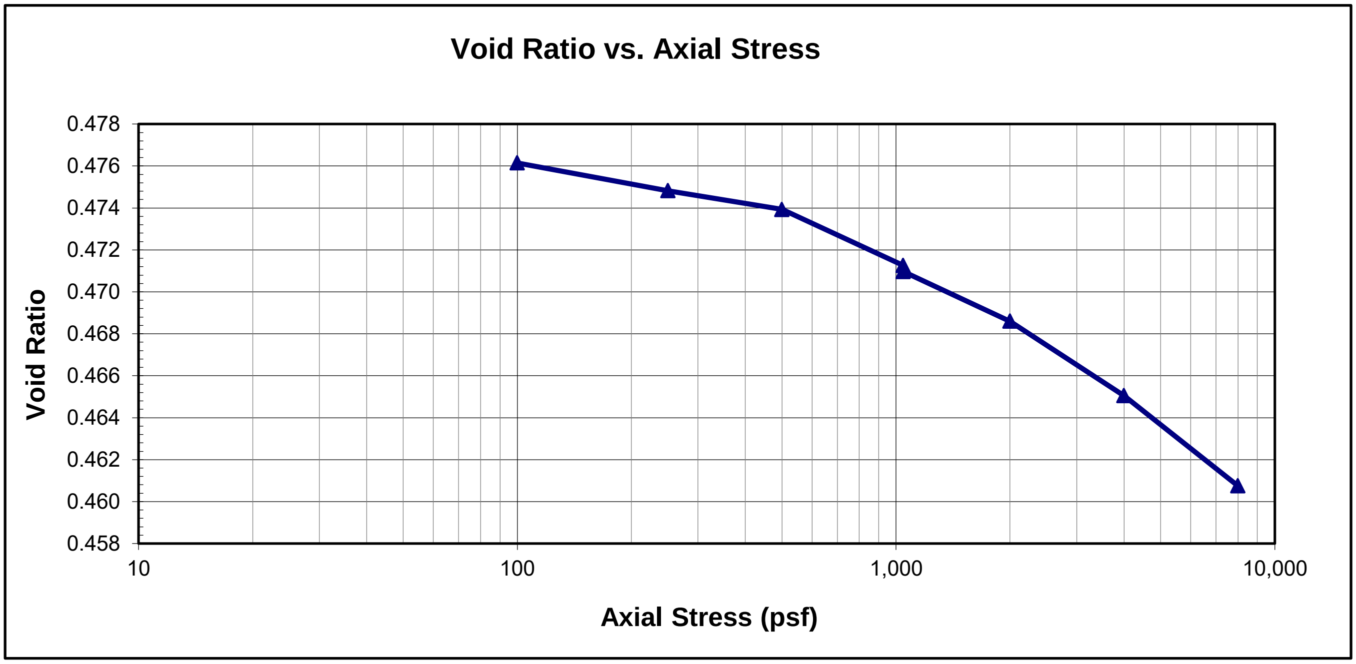
Collapse Potential (I_c) (%): **0.02**

Laboratory analysis by:	D. O'Dowd
Data entered by:	C. Krous
Checked by:	J. Hines

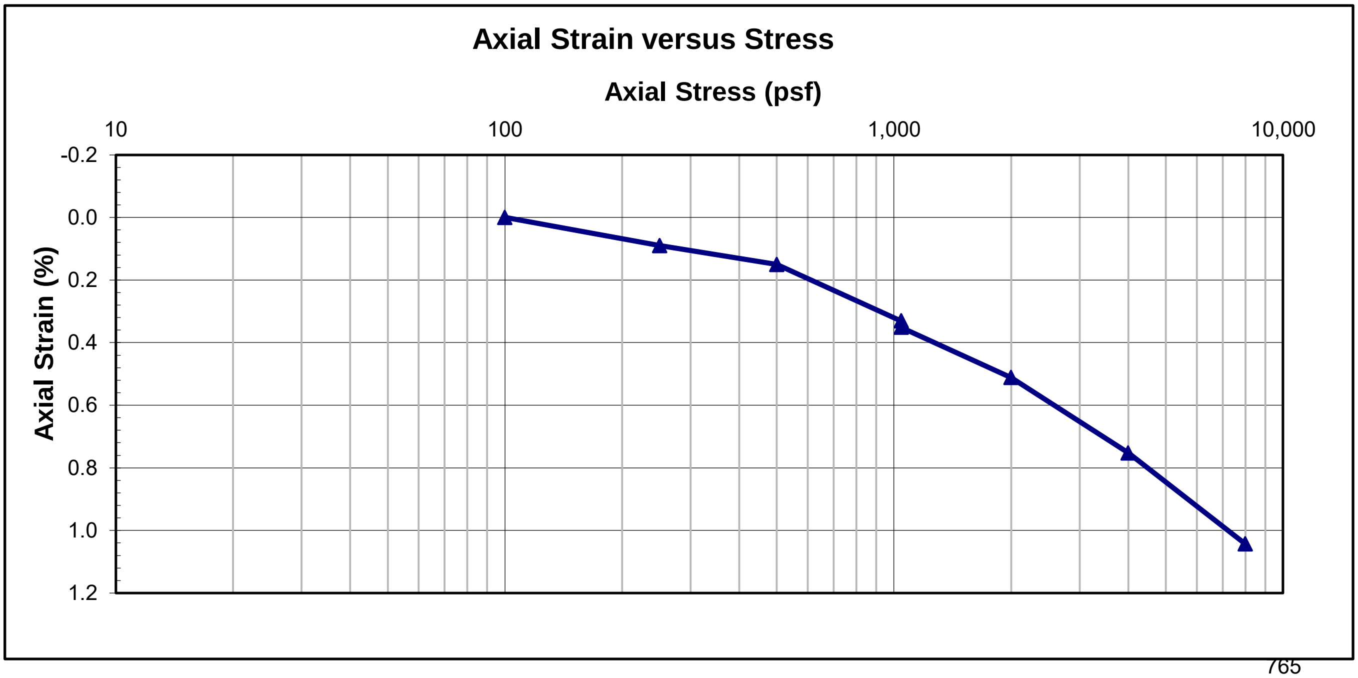
Collapse Potential (ASTM D5333-03) Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.79 g/cc) (1,044 psf)
Lab ID: HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)
Date/Time sampled: 04/17/2019 1100

Void Ratio Versus Axial Stress



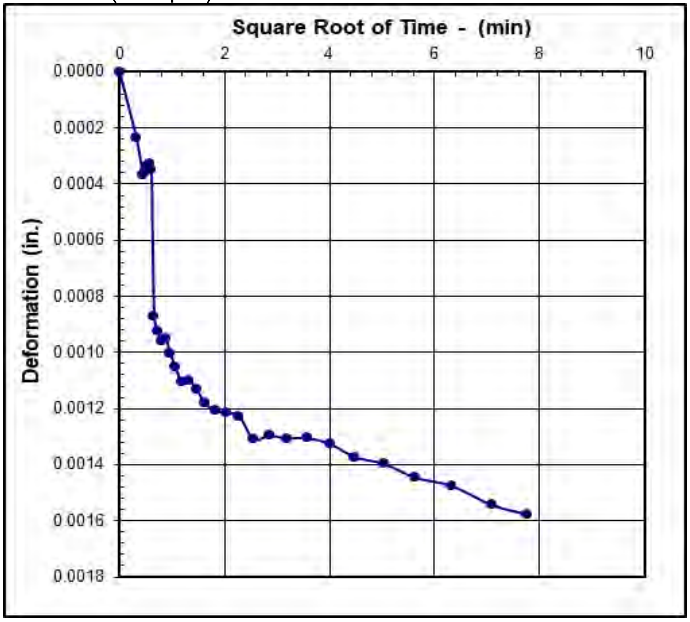
Axial Strain Versus Stress



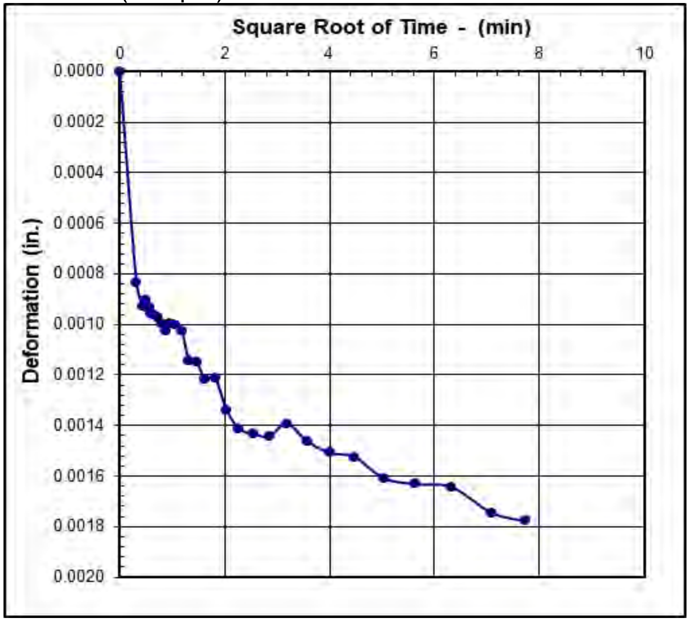
Collapse Potential (ASTM D5333-03) Data

Job Name: Navarro
Job Number: DB19.1089.00
Sample Number: L4-01R (1.79 g/cc) (1,044 psf)
Lab ID: HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)
Date/Time sampled: 04/17/2019 1100

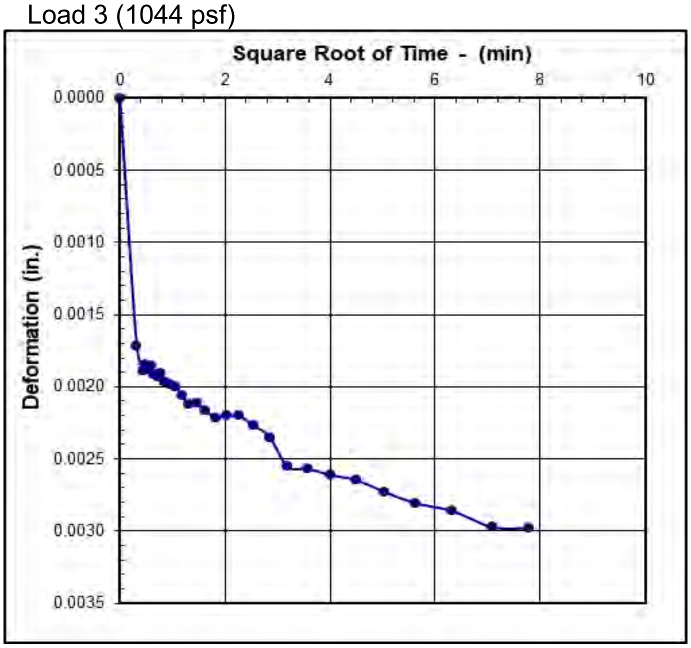
Deformation Versus Square Root of Time
Load 1 (250 psf)



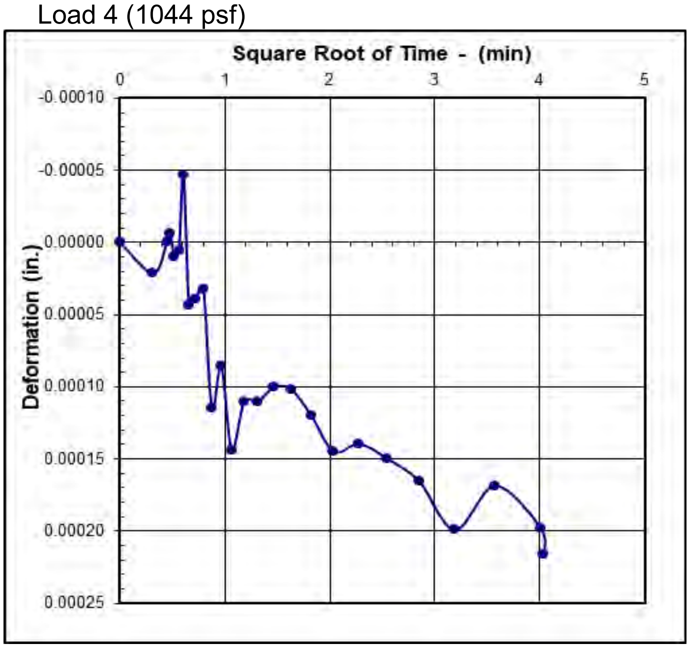
Deformation Versus Square Root of Time
Load 2 (500 psf)



Deformation Versus Square Root of Time
Load 3 (1044 psf)



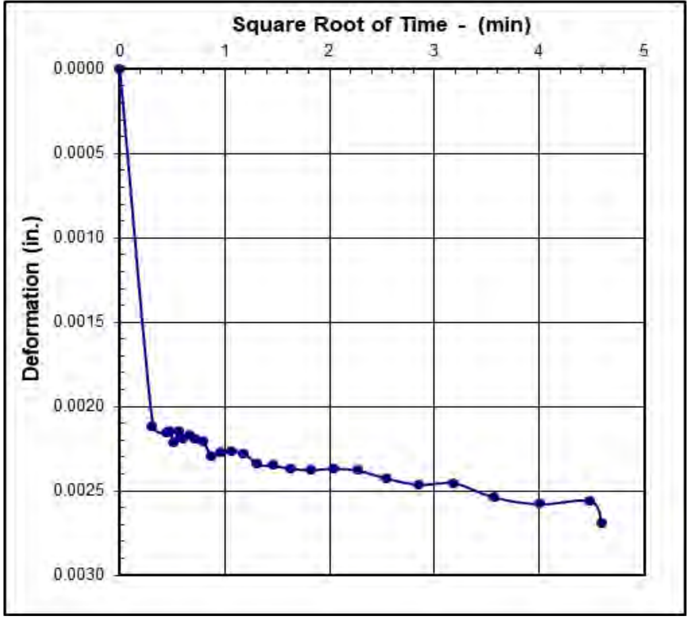
Deformation Versus Square Root of Time
Load 4 (1044 psf)



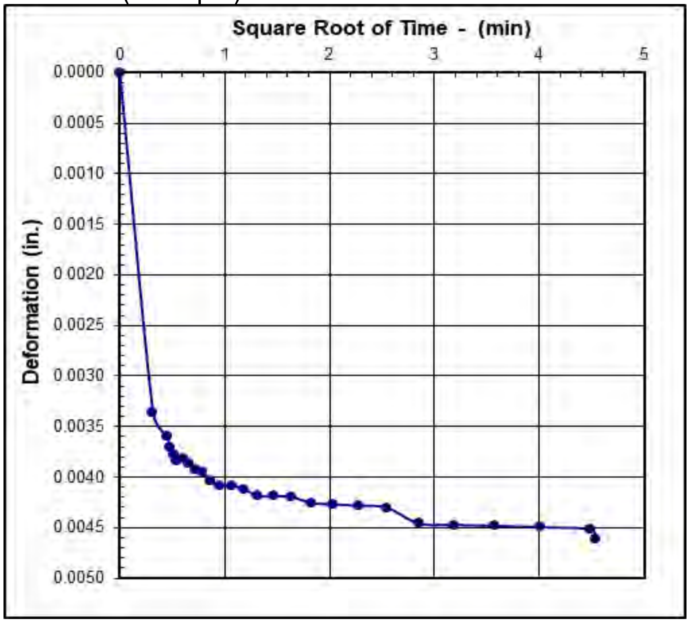
Collapse Potential (ASTM D5333-03) Data

Job Name:	Navarro
Job Number:	DB19.1089.00
Sample Number:	L4-01R (1.79 g/cc) (1,044 psf)
Lab ID:	HAT01-11.1904002-006 (1.79 g/cc) (1,044 psf)
Date/Time sampled:	04/17/2019 1100

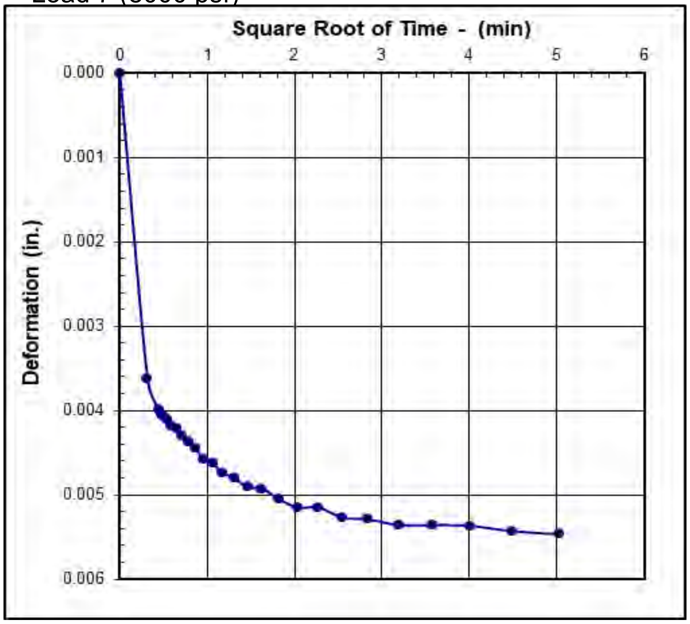
Deformation Versus Square Root of Time
Load 5 (2000 psf)



Deformation Versus Square Root of Time
Load 6 (4000 psf)



Deformation Versus Square Root of Time
Load 7 (8000 psf)



Carbonate Content, pH and Resistivity

Summary of Carbonate Content, pH, and Resistivity

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
A-1	HAT01-11.1904001-077	6	9.5	8.1	4,704
A-2	HAT01-11.1904001-074	4	9.4	8.0	7,021
A-3	HAT01-11.1904001-062	5	9.3	8.0	4,493
ASM-1	HAT01-11.1904001-078	4	7.9	7.3	13,339
ASM-2	HAT01-11.1904001-079	3	7.5	6.9	18,254
L1-02B	HAT01-11.1904001-002	6			
L1-03B	HAT01-11.1904001-003	7			
L1-11B	HAT01-11.1904001-001	8			
L2-01B	HAT01-11.1904001-004	6			
L3-01RB	HAT01-11.1904001-065	6	8.9	8.2	1,123
L3-01RM	HAT01-11.1904001-053	5	9.3	8.5	913
L3-01RT	HAT01-11.1904001-038	7			
L3-02B	HAT01-11.1904001-006	5			
L3-02RB	HAT01-11.1904001-066	5	9.5	8.1	1,615
L3-02RM	HAT01-11.1904001-054	5	9.5	8.4	1,194
L3-02RT	HAT01-11.1904001-039	6			
L3-03B	HAT01-11.1904001-007	6			
L3-03RB	HAT01-11.1904001-067	6	9.3	8.4	1,264
L3-03RM	HAT01-11.1904001-055	4	9.5	8.5	1,334
L3-03RT	HAT01-11.1904001-040	7			
L3-11B	HAT01-11.1904001-005	4			
L4-02B	HAT01-11.1904001-009	6			
L4-03B	HAT01-11.1904001-010	6			
L4-11B	HAT01-11.1904001-024	9			

---

[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L5-01C	HAT01-11.1904001-034	5	9.5	8.6	1,123
L5-01RB	HAT01-11.1904001-068	9	8.1	7.9	1,053
L5-01RM	HAT01-11.1904001-056	4	9.7	8.5	1,755
L5-01RT	HAT01-11.1904001-041	6	9.5	8.6	1,053
L5-01UNKNOWN	HAT01-11.1904001-082	4			
L5-02B	HAT01-11.1904001-012	7			
L5-02RB	HAT01-11.1904001-069	5	9.5	8.6	1,194
L5-02RM	HAT01-11.1904001-057	5	9.8	8.7	1,264
L5-02RT	HAT01-11.1904001-042	5	9.6	8.5	1,474
L5-03B	HAT01-11.1904001-013	9			
L5-03RB	HAT01-11.1904001-070	8	9.5	8.6	1,194
L5-03RM	HAT01-11.1904001-058	4	9.8	8.6	1,404
L5-03RT	HAT01-11.1904001-043	6	9.7	8.5	1,966
L5-11B	HAT01-11.1904001-107	9			
L5-11RB	HAT01-11.1904001-108	6	9.2	8.4	1,194
L5-11RM	HAT01-11.1904001-109	6	9.4	8.4	1,123
L5-11RT	HAT01-11.1904001-110	5	9.6	8.6	1,615
L5-21B	HAT01-11.1904001-103	9			
L5-21RB	HAT01-11.1904001-104	8	9.2	8.2	1,194
L5-21RM	HAT01-11.1904001-105	4	9.4	8.3	1,053
L5-21RT	HAT01-11.1904001-106	5	9.6	8.6	1,755
L5-31B	HAT01-11.1904001-027	11			
L5-31RB	HAT01-11.1904001-100	6	9.4	8.4	913
L5-31RM	HAT01-11.1904001-101	5	9.4	8.5	1,123

---

[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L5-31RT	HAT01-11.1904001-102	5	9.6	8.4	1,825
L5-41B	HAT01-11.1904001-095	7			
L5-41RB	HAT01-11.1904001-096	6	9.2	8.4	983
L5-41RM	HAT01-11.1904001-097	4	9.4	8.4	18,254
L5-41RT	HAT01-11.1904001-098	6	9.8	8.6	1,825
L5-51RB	HAT01-11.1904001-092	6	9.1	8.3	1,123
L5-51RM	HAT01-11.1904001-093	6	9.4	8.5	1,404
L5-51RT	HAT01-11.1904001-094	5	9.7	8.4	2,036
L5-61RB	HAT01-11.1904001-088	5	9.0	8.2	1,053
L5-61RM	HAT01-11.1904001-089	4	9.3	8.6	1,194
L5-61RT	HAT01-11.1904001-090	6	9.6	8.4	1,615
L5-01A-RB	HAT01-11.1904001-085	4	9.3	8.5	1,123
L5-01A-RU	HAT01-11.1904001-086	5	9.4	8.5	1,194
L6-01B	HAT01-11.1904001-014	12			
L7-01B	HAT01-11.1904001-015	9			
L7-01RT	HAT01-11.1904001-044		9.7	8.5	1,966
L7-02B	HAT01-11.1904001-016	8			
L7-02RT	HAT01-11.1904001-045		9.4	8.2	1,825
L7-03B	HAT01-11.1904001-017	8			
L7-03RT	HAT01-11.1904001-046		9.7	8.4	2,106
L7-11B	HAT01-11.1904001-018	7			
L7-11RT	HAT01-11.1904001-050		9.5	8.4	2,036
L8-01RB	HAT01-11.1904001-071	10	9.0	8.2	1,264
L8-01RM	HAT01-11.1904001-059	4	9.6	8.4	1,615

---

[1] Calcium Carbonate content precise to +/- 1.5%

Summary of Carbonate Content, pH, and Resistivity (Continued)

Sample Number	Lab ID	Calcite Equivalent[1] (%)	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride	Electrical Resistivity (ohm·cm)
L8-01RT	HAT01-11.1904001-047	5			
L8-02B	HAT01-11.1904001-019	11			
L8-02RB	HAT01-11.1904001-072	7	9.4	8.3	1,194
L8-02RM	HAT01-11.1904001-060	5	9.4	8.0	2,176
L8-02RT	HAT01-11.1904001-048	6			
L8-03B	HAT01-11.1904001-020	7			
L8-03RB	HAT01-11.1904001-073	7	9.5	8.3	1,755
L8-03RM	HAT01-11.1904001-061	6	9.6	8.3	2,036
L8-03RT	HAT01-11.1904001-049	4			
L9-01B	HAT01-11.1904001-021	8			
L10-01B	HAT01-11.1904001-022	8			
L10-02B	HAT01-11.1904001-023	7			
L11-01B	HAT01-11.1904001-025	6			
L11-02B	HAT01-11.1904001-026	7			
L12-01B	HAT01-11.1904001-028	24			
L13-01B	HAT01-11.1904001-029	9			
L13-02B	HAT01-11.1904001-030	8			
L13-02RB	HAT01-11.1904001-075	18	8.4	7.9	2,317
L13-02RM	HAT01-11.1904001-063	18	8.6	7.8	4,072
L13-02RT	HAT01-11.1904001-051	19			
L-compW	HAT01-11.1904001-080	9	7.8	7.5	913

[1] Calcium Carbonate content precise to +/- 1.5%

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	emm
Sample ID:	---	Test Date:	05/30/19	Checked By:	bfs
Depth :	---	Test Id:	505519		

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
---	034	---	Moist, red silty sand	9.5	8.6
---	041	---	Moist, red silty sand	9.5	8.6
---	042	---	Moist, red silty sand	9.6	8.5
---	043	---	Moist, red silty sand	9.7	8.5
---	044	---	Moist, red silty sand	9.7	8.5
---	045	---	Moist, red silty sand	9.4	8.2
---	046	---	Moist, red silty sand	9.7	8.4
---	050	---	Moist, red silty sand	9.5	8.4
---	053	---	Moist, red silty sand	9.3	8.5
---	054	---	Moist, red silty sand	9.5	8.4

Notes: Sample Preparation: screened through #10 sieve
Method A, pH meter used

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GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	emm
Sample ID:	---	Test Date:	05/30/19	Checked By:	bfs
Depth :	---	Test Id:	505527		

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
---	055	---	Moist, red silty sand	9.5	8.5
---	056	---	Moist, red silty sand	9.7	8.5
---	057	---	Moist, red silty sand	9.8	8.7
---	058	---	Moist, red silty sand	9.8	8.6
---	059	---	Moist, red silty sand	9.6	8.4
---	060	---	Moist, red silty sand	9.4	8.0
---	061	---	Moist, red silty sand	9.6	8.3
---	062	---	Moist, red silty sand	9.3	8.0

Notes: Sample Preparation: screened through #10 sieve

Method A, pH meter used

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	emm
Sample ID:	---	Test Date:	05/30/19	Checked By:	bfs
Depth :	---	Test Id:	505533		

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
---	090	---	Moist, red silty sand	9.6	8.4
---	094	---	Moist, red silty sand	9.7	8.4
---	098	---	Moist, red silty sand	9.8	8.6
---	102	---	Moist, red silty sand	9.6	8.4
---	106	---	Moist, red silty sand	9.6	8.6
---	110	---	Moist, red silty sand	9.6	8.6

Notes: Sample Preparation: screened through #10 sieve

Method A, pH meter used

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	06/18/19	Checked By:	jsc
Depth :	---	Test Id:	508291		

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
---	63	---	Moist, red silty sand	8.6	7.8
---	65	---	Moist, red silty sand	8.9	8.2
---	66	---	Moist, red silty sand	9.5	8.1
---	67	---	Moist, red silty sand	9.3	8.4
---	68	---	Moist, red silty sand	8.1	7.9
---	69	---	Moist, red silty sand	9.5	8.6
---	70	---	Moist, red silty sand	9.5	8.6
---	71	---	Moist, red silty sand	9.0	8.2
---	72	---	Moist, red silty sand	9.4	8.3
---	73	---	Moist, red silty sand	9.5	8.3

Notes: Sample Preparation: screened through #10 sieve

Method A, pH meter used

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	06/18/19	Checked By:	jsc
Depth :	---	Test Id:	508301		

pH of Soil by ASTM D4972

Boring ID	**Sample ID**	**Depth**	**Visual Description**	**pH of Soil in Distilled Water**	**pH of Soil in Calcium Chloride**
---	74	---	Moist, red silty sand	9.4	8.0
---	75	---	Moist, red silty sand	8.4	7.9
---	77	---	Moist, red silty sand	9.5	8.1
---	78	---	Moist, red silty sand	7.9	7.3
---	79	---	Moist, red silty sand	7.5	6.9
---	80	---	Moist, red silty sand	7.8	7.5
---	85	---	Moist, red silty sand	9.3	8.5
---	86	---	Moist, red silty sand	9.4	8.5
---	88	---	Moist, red silty sand	9.0	8.2
---	89	---	Moist, red silty sand	9.3	8.6

Notes: Sample Preparation: screened through #10 sieve
Method A, pH meter used

Client:	Daniel B. Stephens & Associates, Inc.				
Project:	Navarro				
Location:				Project No:	GTX-310030
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	06/18/19	Checked By:	jsc
Depth :	---	Test Id:	508311		

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
---	92	---	Moist, red silty sand	9.1	8.3
---	93	---	Moist, red silty sand	9.4	8.5
---	96	---	Moist, red silty sand	9.2	8.4
---	97	---	Moist, red silty sand	9.4	8.4
---	100	---	Moist, red silty sand	9.4	8.4
---	101	---	Moist, red silty sand	9.4	8.5
---	104	---	Moist, red silty sand	9.2	8.2
---	105	---	Moist, red silty sand	9.4	8.3
---	108	---	Moist, red silty sand	9.2	8.4
---	109	---	Moist, red silty sand	9.4	8.4

Notes: Sample Preparation: screened through #10 sieve
Method A, pH meter used

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	05/30/19
Tested By:	PK
Checked By:	bfs

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	034	---	Moist, red silty sand	1,123	8.90E-04
---	041	---	Moist, red silty sand	1,053	9.50E-04
---	042	---	Moist, red silty sand	1,474	6.78E-04
---	043	---	Moist, red silty sand	1,966	5.09E-04
---	044	---	Moist, red silty sand	1,966	5.09E-04
---	045	---	Moist, red silty sand	1,825	5.48E-04
---	046	---	Moist, red silty sand	2,106	4.75E-04
---	050	---	Moist, red silty sand	2,036	4.91E-04
---	053	---	Moist, red silty sand	913	1.10E-03
---	054	---	Moist, red silty sand	1,194	8.38E-04
---	055	---	Moist, red silty sand	1,334	7.50E-04

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	05/30/19
Tested By:	PK
Checked By:	bfs

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	056	---	Moist, red silty sand	1,755	5.70E-04
---	057	---	Moist, red silty sand	1,264	7.91E-04
---	058	---	Moist, red silty sand	1,404	7.12E-04
---	059	---	Moist, red silty sand	1,615	6.19E-04
---	060	---	Moist, red silty sand	2,176	4.59E-04
---	061	---	Moist, red silty sand	2,036	4.91E-04
---	062	---	Moist, red silty clay	4,493	2.23E-04
---	090	---	Moist, red silty sand	1,615	6.19E-04
---	094	---	Moist, red silty sand	2,036	4.91E-04
---	098	---	Moist, red silty sand	1,825	5.48E-04
---	102	---	Moist, red silty sand	1,825	5.48E-04

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	05/30/19
Tested By:	PK
Checked By:	bfs

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	106	---	Moist, red silty sand	1,755	5.70E-04
---	110	---	Moist, red silty sand	1,615	6.19E-04

Notes:

Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box

Water added to sample to create a thick slurry prior to testing (saturated condition).

Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)

Test conducted in standard laboratory atmosphere: 68-73 F

Above tests conducted with only 2 electrodes connected as requested.

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	06/21/19
Tested By:	PK
Checked By:	jsc

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	063	---	Moist, red silty sand	4,072	2.46E-04
---	065	---	Moist, red silty sand	1,123	8.90E-04
---	066	---	Moist, red silty sand	1,615	6.19E-04
---	067	---	Moist, red silty sand	1,264	7.91E-04
---	068	---	Moist, red silty sand	1,053	9.50E-04
---	069	---	Moist, red silty sand	1,194	8.38E-04
---	070	---	Moist, red silty sand	1,194	8.38E-04
---	071	---	Moist, red silty sand	1,264	7.91E-04
---	072	---	Moist, red silty sand	1,194	8.38E-04
---	073	---	Moist, red silty sand	1,755	5.70E-04
---	074	---	Moist, red silty sand	7,021	1.42E-04

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	06/21/19
Tested By:	PK
Checked By:	jsc

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	075	---	Moist, red silty sand	2,317	4.32E-04
---	077	---	Moist, red silty sand	4,704	2.13E-04
---	078	---	Moist, red silty sand	13,339	7.50E-05
---	079	---	Moist, red silty sand	18,254	5.48E-05
---	080	---	Moist, red silty sand	913	1.10E-03
---	085	---	Moist, red silty sand	1,123	8.90E-04
---	086	---	Moist, red silty clay	1,194	8.38E-04
---	088	---	Moist, red silty sand	1,053	9.50E-04
---	089	---	Moist, red silty sand	1,194	8.38E-04
---	092	---	Moist, red silty sand	1,123	8.90E-04
---	093	---	Moist, red silty sand	1,404	7.12E-04

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.
Project:	Navarro
Location:	---
GTX#:	310030
Test Date:	06/21/19
Tested By:	PK
Checked By:	jsc

Laboratory Measurement of Soil Resistivity Using the Wenner Two-Electrode Method by ASTM G187 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
---	096	---	Moist, red silty sand	983	1.02E-03
---	097	---	Moist, red silty sand	18,254	5.48E-05
---	100	---	Moist, red silty sand	913	1.10E-03
---	101	---	Moist, red silty sand	1,123	8.90E-04
---	104	---	Moist, red silty clay	1,194	8.38E-04
---	105	---	Moist, red silty sand	1,053	9.50E-04
---	108	---	Moist, red silty sand	1,194	8.38E-04
---	109	---	Moist, red silty sand	1,123	8.90E-04

Notes:

Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box

Water added to sample to create a thick slurry prior to testing (saturated condition).

Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)

Test conducted in standard laboratory atmosphere: 68-73 F

Above tests conducted with only 2 electrodes connected as requested.

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	06/04/19
Tested By:	ckg
Checked By:	emm

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	001	---	0.70	1.01	0.08	8
---	002	---	0.50	1.03	0.06	6
---	003	---	0.60	1.06	0.07	7
---	004	---	0.50	1.00	0.06	6
---	005	---	0.40	1.06	0.05	4
---	006	---	0.40	1.03	0.05	5
---	007	---	0.50	1.03	0.06	6
---	009	---	0.50	1.03	0.06	6
---	010	---	0.50	1.01	0.06	6
---	012	---	0.60	1.02	0.07	7
---	013	---	0.80	1.01	0.09	9
---	014	---	1.00	1.02	0.12	12
---	015	---	0.80	1.04	0.09	9
---	016	---	0.70	1.02	0.08	8
---	017	---	0.70	1.00	0.08	8
---	018	---	0.60	1.00	0.07	7
---	019	---	0.90	1.00	0.11	11

GeoTesting EXPRESS

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	06/04/19
Tested By:	ckg
Checked By:	emm

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	020	---	0.60	1.01	0.07	7
---	021	---	0.70	1.08	0.08	8
---	022	---	0.70	1.01	0.08	8
---	023	---	0.60	1.00	0.07	7
---	024	---	0.80	1.03	0.09	9
---	025	---	0.50	1.04	0.06	6
---	026	---	0.60	1.00	0.07	7
---	027	---	0.90	1.00	0.11	11
---	028	---	2.00	1.00	0.24	24
---	029	---	0.80	1.00	0.09	9
---	030	---	0.70	1.01	0.08	8
---	034	---	0.40	1.00	0.05	5
---	038	---	0.60	1.00	0.07	7
---	039	---	0.50	1.00	0.06	6
---	040	---	0.60	1.00	0.07	7
---	041	---	0.50	1.03	0.06	6
---	042	---	0.40	1.07	0.05	5

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	06/04/19
Tested By:	ckg
Checked By:	emm

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	043	---	0.50	1.02	0.06	6
---	053	---	0.40	1.00	0.05	5
---	054	---	0.40	1.03	0.05	5
---	055	---	0.30	1.07	0.04	4
---	056	---	0.30	1.02	0.04	4
---	057	---	0.40	1.04	0.05	5
---	058	---	0.30	1.01	0.04	4
---	059	---	0.30	1.02	0.04	4
---	060	---	0.40	1.00	0.05	5
---	061	---	0.50	1.08	0.06	6
---	062	---	0.40	1.01	0.05	5
---	082	---	0.30	1.04	0.04	4
---	090	---	0.50	1.07	0.06	6
---	094	---	0.40	1.04	0.05	5
---	095	---	0.60	1.02	0.08	7
---	098	---	0.50	1.00	0.06	6
---	102	---	0.40	1.08	0.05	5

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	06/04/19
Tested By:	ckg
Checked By:	emm

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	103	---	0.70	1.01	0.09	9
---	106	---	0.40	1.04	0.05	5
---	107	---	0.70	1.00	0.09	9
---	110	---	0.40	1.00	0.05	5

Notes:

Calcium Carbonate content precise to +/- 1.5%

CO_2 Pressure is based on the weight of sample as indicated in the table.

The reported Calcite Equivalent (%) is based on one gram

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	6/19/2019-6/20/2019
Tested By:	ckg
Checked By:	jsc

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	047	---	0.40	1.00	0.05	5
---	048	---	0.50	1.03	0.06	6
---	049	---	0.40	1.06	0.05	4
---	051	---	1.60	1.00	0.19	19
---	063	---	1.60	1.06	0.19	18
---	065	---	0.50	1.03	0.06	6
---	066	---	0.40	1.03	0.05	5
---	067	---	0.50	1.03	0.06	6
---	068	---	0.80	1.01	0.09	9
---	069	---	0.40	1.02	0.05	5
---	070	---	0.70	1.01	0.08	8
---	071	---	0.90	1.02	0.11	10
---	072	---	0.60	1.04	0.07	7
---	073	---	0.60	1.02	0.07	7
---	074	---	0.30	1.00	0.04	4
---	075	---	1.50	1.00	0.18	18
---	077	---	0.50	1.00	0.06	6

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	6/19/2019-6/20/2019
Tested By:	ckg
Checked By:	jsc

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	078	---	0.30	1.01	0.04	4
---	079	---	0.30	1.08	0.04	3
---	080	---	0.70	1.01	0.09	9
---	085	---	0.30	1.00	0.04	4
---	086	---	0.40	1.03	0.05	5
---	088	---	0.40	1.04	0.05	5
---	089	---	0.30	1.00	0.04	4
---	092	---	0.50	1.00	0.06	6
---	093	---	0.50	1.00	0.06	6
---	096	---	0.50	1.00	0.06	6
---	097	---	0.30	1.01	0.04	4
---	100	---	0.50	1.00	0.06	6
---	101	---	0.40	1.00	0.05	5
---	104	---	0.60	1.00	0.08	8
---	105	---	0.30	1.00	0.04	4
---	108	---	0.50	1.03	0.06	6

Client:	Daniel B. Stephens & Associates, Inc.
Project Name:	Navarro
Project Location:	---
GTX #:	310030
Test Date:	6/19/2019-6/20/2019
Tested By:	ckg
Checked By:	jsc

Rapid Determination of Carbonate Content of Soils by ASTM D4373

Boring ID	Sample ID	Depth, ft	CO_2 Pressure, psi	Weight of Sample used, g	Weight $CaCO_3$, grams	Calcite Equivalent, %
---	109	---	0.50	1.07	0.06	6

Notes:
Calcium Carbonate content precise to +/- 1.5%
CO_2 Pressure is based on the weight of sample as indicated in the table.
The reported Calcite Equivalent (%) is based on one gram

Client Project Information	
Facility Name:	Mexican Hat Disposal Site
Project Number:	1.103.1.02.112.7.20
Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Summary of Particle Size Characteristics

Sample Number	Lab ID	Sieves (% Passing) 3"	2"	1.5"	1"	3/4"	3/8"	4	10	20	40	60	100	140	200
A-1	HAT01-11.1904001-077	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.5	94.8	61.2	29.7	12.7
A-2	HAT01-11.1904001-074	100.0	100.0	100.0	100.0	100.0	99.8	99.5	99.3	99.2	98.5	92.8	58.3	27.1	11.2
A-3	HAT01-11.1904001-062	100.0	100.0	95.0	92.8	92.8	91.2	89.8	88.6	87.9	86.7	82.4	59.2	36.5	23.1
ASM-1	HAT01-11.1904001-078	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.6	85.5	37.4	13.0
ASM-2	HAT01-11.1904001-079	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	70.0	22.0	7.3
L1-02B	HAT01-11.1904001-002	100.0	97.0	90.3	71.6	56.4	34.1	20.8	14.2	12.8	10.9	9.0	7.4	5.7	4.5
L1-02B (BM)	HAT01-11.1904001-002 (BM)														
L1-03B	HAT01-11.1904001-003	100.0	100.0	93.7	69.5	58.1	24.0	8.2	5.2	4.8	4.4	4.0	3.6	3.0	2.5
L1-03B (BM)	HAT01-11.1904001-003 (BM)														
L1-11B	HAT01-11.1904001-001	100.0	100.0	90.2	60.0	46.6	17.5	9.3	7.3	6.9	6.5	5.7	4.8	3.9	3.2
L1-11B (BM)	HAT01-11.1904001-001 (BM)														
L2-01B	HAT01-11.1904001-004	100.0	99.7	86.8	52.6	22.5	2.8	1.0	0.9	0.9	0.9	0.8	0.7	0.7	0.5
L2-01B (BM)	HAT01-11.1904001-004 (BM)														
L3-01RB	HAT01-11.1904001-065	100.0	100.0	100.0	100.0	100.0	98.2	97.5	96.4	95.5	94.4	88.5	64.6	43.9	32.1
L3-01RB (No Dispersant)	HAT01-11.1904001-065 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	98.2	97.5	96.4						31.1
L3-01RM	HAT01-11.1904001-053	100.0	100.0	100.0	100.0	100.0	99.1	98.1	97.5	97.1	96.3	87.7	57.2	35.2	23.3
L3-01RM (No Dispersant)	HAT01-11.1904001-053 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.1	98.1	97.5						23.2
L3-01RT	HAT01-11.1904001-038	100.0	100.0	100.0	100.0	100.0	99.4	99.0	98.6	97.3	96.2	88.2	59.6	38.5	25.7
L3-01RT (No Dispersant)	HAT01-11.1904001-038 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.4	99.0	98.6						26.8
L3-02B	HAT01-11.1904001-006	100.0	100.0	88.7	50.3	30.6	17.4	12.6	10.4	9.7	8.7	7.6	6.1	4.8	3.7
L3-02B (BM)	HAT01-11.1904001-006 (BM)														
L3-02RB	HAT01-11.1904001-066	100.0	100.0	100.0	100.0	100.0	98.6	98.0	97.2	95.9	91.3	80.7	57.5	33.1	19.6
L3-02RB (No Dispersant)	HAT01-11.1904001-066 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	98.6	98.0	97.2						19.1
L3-02RM	HAT01-11.1904001-054	100.0	100.0	100.0	100.0	100.0	99.5	99.0	98.4	98.2	97.2	88.6	62.4	38.8	22.7
L3-02RM (No Dispersant)	HAT01-11.1904001-054 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.0	98.4						22.9
L3-02RT	HAT01-11.1904001-039	100.0	100.0	100.0	100.0	100.0	99.3	98.7	97.7	96.6	95.6	89.3	66.6	43.7	27.4
L3-02RT (No Dispersant)	HAT01-11.1904001-039 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.3	98.7	97.7						28.0
L3-03B	HAT01-11.1904001-007	100.0	100.0	93.7	77.3	63.9	39.9	24.6	16.9	15.4	13.8	11.9	10.1	7.9	6.3
L3-03B (BM)	HAT01-11.1904001-007 (BM)														
L3-03RB	HAT01-11.1904001-067	100.0	100.0	100.0	100.0	100.0	99.0	98.4	97.7	97.1	95.7	85.5	59.1	36.1	23.4
L3-03RB (No Dispersant)	HAT01-11.1904001-067 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.0	98.4	97.7						23.7
L3-03RM	HAT01-11.1904001-055	100.0	100.0	100.0	100.0	100.0	99.9	99.3	98.9	98.6	97.7	89.6	63.0	39.6	23.4
L3-03RM (No Dispersant)	HAT01-11.1904001-055 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.9	99.3	98.9						23.4
L3-03RT	HAT01-11.1904001-040	100.0	100.0	100.0	100.0	100.0	99.0	98.5	97.9	97.0	96.1	88.7	63.6	40.8	25.1
L3-03RT (No Dispersant)	HAT01-11.1904001-040 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.0	98.5	97.9						24.6
L3-11B	HAT01-11.1904001-005	100.0	99.7	93.5	74.8	54.6	12.4	4.2	3.2	3.1	2.9	2.7	2.2	1.8	1.4
L3-11B (BM)	HAT01-11.1904001-005 (BM)														
L4-01B	HAT01-11.1904001-008	100.0	98.8	71.2	27.4	12.9	1.7	1.1	1.1	1.1	1.1	1.0	0.8	0.6	0.4
L4-01B (BM)	HAT01-11.1904001-008 (BM)														
L4-02B	HAT01-11.1904001-009	100.0	100.0	92.6	75.5	67.9	51.5	37.2	26.2	23.5	20.0	16.7	13.7	10.1	7.6
L4-02B (BM)	HAT01-11.1904001-009 (BM)														
L4-03B	HAT01-11.1904001-010	100.0	100.0	88.4	68.4	58.0	42.3	29.7	21.1	19.1	16.7	14.0	11.4	8.7	6.6
L4-03B (BM)	HAT01-11.1904001-010 (BM)														
L4-11B	HAT01-11.1904001-024	100.0	99.4	86.1	55.9	37.2	17.1	9.8	7.5	6.9	6.4	5.8	4.7	3.5	2.7
L4-11B (BM)	HAT01-11.1904001-024 (BM)														
L5-01B	HAT01-11.1904001-011	100.0	99.5	83.8	41.8	20.8	2.4	1.7	1.7	1.7	1.6	1.5	1.2	0.8	0.5

Client Project Information

Facility Name: Mexican Hat Disposal Site
Project Number: 1.103.1.02.112.7.20
Project Name: Mexican Hat Disposal Site (Soil Testing)
PO Number: LMCP6198
COC ID: HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code: HAT01-11.1904001 & HAT01-11.1904002

Summary of Particle Size Characteristics

		Sieves (% Passing)													
Sample Number	Lab ID	3"	2"	1.5"	1"	3/4"	3/8"	4	10	20	40	60	100	140	200
L5-01B (BM)	HAT01-11.1904001-011 (BM)														
L5-01C	HAT01-11.1904001-034	100.0	100.0	91.0	67.0	52.6	35.9	33.8	33.1	32.7	32.3	30.4	23.2	15.8	10.2
L5-01RB	HAT01-11.1904001-068	100.0	100.0	100.0	100.0	99.1	96.4	94.6	93.1	91.6	86.5	75.2	57.8	44.1	34.1
L5-01RB (No Dispersant)	HAT01-11.1904001-068 (No Dispersant)	100.0	100.0	100.0	100.0	99.1	96.4	94.6	93.1						34.8
L5-01RM	HAT01-11.1904001-056	100.0	100.0	100.0	100.0	98.2	97.2	96.4	95.6	95.0	94.2	87.2	62.5	42.3	27.0
L5-01RM (No Dispersant)	HAT01-11.1904001-056 (No Dispersant)	100.0	100.0	100.0	100.0	98.2	97.2	96.4	95.6						27.8
L5-01RT	HAT01-11.1904001-041	100.0	100.0	100.0	100.0	100.0	99.5	99.4	99.1	98.6	97.8	91.8	69.3	46.5	28.6
L5-01RT (No Dispersant)	HAT01-11.1904001-041 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.4	99.1						27.1
L5-01UNKNOWN	HAT01-11.1904001-082														
L5-02B	HAT01-11.1904001-012	100.0	99.3	93.2	76.3	60.1	37.0	22.3	15.1	13.6	11.5	9.3	7.7	5.9	4.5
L5-02B (BM)	HAT01-11.1904001-012 (BM)														
L5-02RB	HAT01-11.1904001-069	100.0	100.0	100.0	100.0	100.0	99.7	99.3	98.6	98.1	97.3	88.9	63.6	43.6	28.1
L5-02RB (No Dispersant)	HAT01-11.1904001-069 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	99.3	98.6						27.4
L5-02RM	HAT01-11.1904001-057	100.0	100.0	100.0	100.0	100.0	99.5	99.2	98.9	98.3	97.5	89.7	64.6	42.6	28.3
L5-02RM (No Dispersant)	HAT01-11.1904001-057 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.2	98.9						28.3
L5-02RT	HAT01-11.1904001-042	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.7	99.4	98.6	92.4	69.5	46.1	28.8
L5-02RT (No Dispersant)	HAT01-11.1904001-042 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.7						29.0
L5-03B	HAT01-11.1904001-013	100.0	100.0	88.6	67.1	53.0	31.7	18.8	12.2	10.7	9.6	8.3	7.0	5.5	4.2
L5-03B (BM)	HAT01-11.1904001-013 (BM)														
L5-03RB	HAT01-11.1904001-070	100.0	100.0	100.0	100.0	100.0	99.7	98.0	97.1	96.6	95.9	88.8	65.0	45.5	30.6
L5-03RB (No Dispersant)	HAT01-11.1904001-070 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	98.0	97.1						29.2
L5-03RM	HAT01-11.1904001-058	100.0	100.0	100.0	100.0	100.0	99.7	99.5	99.3	98.9	98.2	93.2	66.3	37.8	22.7
L5-03RM (No Dispersant)	HAT01-11.1904001-058 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	99.5	99.3						23.6
L5-03RT	HAT01-11.1904001-043	100.0	100.0	100.0	100.0	100.0	100.0	99.6	99.2	98.6	97.5	90.2	66.1	44.2	26.8
L5-03RT (No Dispersant)	HAT01-11.1904001-043 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	99.6	99.2						26.4
L5-11B	HAT01-11.1904001-107	100.0	100.0	91.5	75.3	64.6	46.8	32.7	23.2	20.7	17.5	14.0	11.1	8.2	6.6
L5-11B (BM)	HAT01-11.1904001-107 (BM)														
L5-11RB	HAT01-11.1904001-108	100.0	100.0	100.0	100.0	100.0	99.5	99.2	98.8	97.5	96.3	88.7	64.3	44.8	31.8
L5-11RB (No Dispersant)	HAT01-11.1904001-108 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.2	98.8						30.6
L5-11RM	HAT01-11.1904001-109	100.0	100.0	100.0	100.0	100.0	99.8	99.6	99.5	98.9	98.2	91.9	65.7	40.8	25.0
L5-11RM (No Dispersant)	HAT01-11.1904001-109 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.8	99.6	99.5						24.3
L5-11RT	HAT01-11.1904001-110	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	99.3	98.4	91.7	68.8	45.0	28.1
L5-11RT (No Dispersant)	HAT01-11.1904001-110 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8						28.1
L5-21B	HAT01-11.1904001-103	100.0	100.0	94.6	76.8	64.0	42.6	28.4	19.8	18.0	15.2	12.5	10.3	8.0	6.1
L5-21B (BM)	HAT01-11.1904001-103 (BM)														
L5-21RB	HAT01-11.1904001-104	100.0	100.0	100.0	100.0	100.0	99.5	99.3	98.4	96.9	95.8	89.5	66.2	47.0	33.5
L5-21RB (No Dispersant)	HAT01-11.1904001-104 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.3	98.4						31.7
L5-21RM	HAT01-11.1904001-105	100.0	100.0	100.0	100.0	100.0	99.3	99.3	99.1	98.6	97.6	91.3	66.5	42.3	25.9
L5-21RM (No Dispersant)	HAT01-11.1904001-105 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.3	99.3	99.1						25.7
L5-21RT	HAT01-11.1904001-106	100.0	100.0	100.0	100.0	100.0	99.7	99.6	99.4	98.8	97.8	91.4	68.3	45.4	28.2
L5-21RT (No Dispersant)	HAT01-11.1904001-106 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	99.6	99.4						29.9
L5-31B	HAT01-11.1904001-027	100.0	100.0	88.4	67.0	54.4	35.7	21.7	15.4	13.8	12.0	10.2	8.4	6.5	5.4
L5-31B (BM)	HAT01-11.1904001-027 (BM)														
L5-31RB	HAT01-11.1904001-100	100.0	100.0	100.0	100.0	100.0	99.3	98.8	98.1	97.1	96.1	88.1	63.9	44.5	29.6
L5-31RB (No Dispersant)	HAT01-11.1904001-100 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.3	98.8	98.1						29.2
L5-31RM	HAT01-11.1904001-101	100.0	100.0	100.0	100.0	100.0	99.8	99.4	98.9	98.1	97.2	90.6	64.8	43.4	27.4

Client Project Information

Facility Name: Mexican Hat Disposal Site
Project Number: 1.103.1.02.112.7.20
Project Name: Mexican Hat Disposal Site (Soil Testing)
PO Number: LMCP6198
COC ID: HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code: HAT01-11.1904001 & HAT01-11.1904002

Summary of Particle Size Characteristics

		Sieves (% Passing)													
Sample Number	Lab ID	3"	2"	1.5"	1"	3/4"	3/8"	4	10	20	40	60	100	140	200
L5-31RM (No Dispersant)	HAT01-11.1904001-101 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.8	99.4	98.9						27.5
L5-31RT	HAT01-11.1904001-102	100.0	100.0	100.0	100.0	100.0	99.8	99.5	99.3	98.7	97.9	91.4	67.7	45.2	27.8
L5-31RT (No Dispersant)	HAT01-11.1904001-102 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.8	99.5	99.3						28.3
L5-41B	HAT01-11.1904001-095	100.0	99.4	86.8	55.7	38.9	11.5	5.0	3.9	3.7	3.6	3.4	2.7	2.0	1.5
L5-41B (BM)	HAT01-11.1904001-095 (BM)														
L5-41RB	HAT01-11.1904001-096	100.0	100.0	100.0	100.0	100.0	99.5	99.1	98.6	97.7	96.8	89.4	64.8	44.9	29.1
L5-41RB (No Dispersant)	HAT01-11.1904001-096 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.5	99.1	98.6						29.0
L5-41RM	HAT01-11.1904001-097	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.6	99.4	98.6	93.4	66.2	40.3	23.5
L5-41RM (No Dispersant)	HAT01-11.1904001-097 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.6						23.0
L5-41RT	HAT01-11.1904001-098	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.3	98.4	90.7	66.5	41.3	26.3
L5-41RT (No Dispersant)	HAT01-11.1904001-098 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9						26.9
L5-51B	HAT01-11.1904001-091	100.0	100.0	87.0	54.8	38.0	12.2	5.3	4.1	4.0	4.0	3.7	2.9	2.0	1.3
L5-51B (BM)	HAT01-11.1904001-091 (BM)														
L5-51RB	HAT01-11.1904001-092	100.0	100.0	100.0	100.0	100.0	99.9	99.5	99.2	98.7	97.8	90.8	64.2	42.6	27.0
L5-51RB (No Dispersant)	HAT01-11.1904001-092 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.9	99.5	99.2						26.6
L5-51RM	HAT01-11.1904001-093	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.1	95.3	68.0	38.0	20.4
L5-51RM (No Dispersant)	HAT01-11.1904001-093 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9						20.2
L5-51RT	HAT01-11.1904001-094	100.0	100.0	100.0	100.0	100.0	99.7	99.5	99.2	98.6	97.8	90.6	66.6	43.9	26.8
L5-51RT (No Dispersant)	HAT01-11.1904001-094 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	99.5	99.2						24.7
L5-61B	HAT01-11.1904001-087	100.0	99.5	88.8	55.0	22.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L5-61B (BM)	HAT01-11.1904001-087 (BM)														
L5-61RB	HAT01-11.1904001-088	100.0	100.0	100.0	100.0	100.0	99.8	99.4	99.0	98.6	97.8	89.5	63.8	43.4	27.3
L5-61RB (No Dispersant)	HAT01-11.1904001-088 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.8	99.4	99.0						27.1
L5-61RM	HAT01-11.1904001-089	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.5	98.9	95.3	69.0	38.7	20.4
L5-61RM (No Dispersant)	HAT01-11.1904001-089 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.8						21.1
L5-61RT	HAT01-11.1904001-090	100.0	100.0	100.0	100.0	100.0	100.0	99.7	99.5	99.0	98.1	90.8	66.9	44.9	27.2
L5-61RT (No Dispersant)	HAT01-11.1904001-090 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	99.7	99.5						26.7
L5-01A-RB	HAT01-11.1904001-085	100.0	100.0	100.0	100.0	100.0	99.9	99.6	99.3	99.0	98.4	93.6	67.2	41.2	23.1
L5-01A-RB (No Dispersant)	HAT01-11.1904001-085 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.9	99.6	99.3						26.8
L5-01A-RU	HAT01-11.1904001-086	100.0	100.0	100.0	98.8	98.1	92.8	91.1	90.5	90.0	89.1	83.8	64.4	44.4	27.8
L5-01A-RU (No Dispersant)	HAT01-11.1904001-086 (No Dispersant)	100.0	100.0	100.0	98.8	98.1	92.8	91.1	90.5						28.8
L6-01B	HAT01-11.1904001-014	100.0	100.0	93.4	76.3	62.4	38.0	22.9	15.8	14.1	12.2	10.3	8.6	6.7	5.5
L6-01B (BM)	HAT01-11.1904001-014 (BM)														
L7-01B	HAT01-11.1904001-015	100.0	100.0	89.4	62.2	41.1	7.9	2.9	2.4	2.3	2.1	1.9	1.6	1.3	1.0
L7-01B (BM)	HAT01-11.1904001-015 (BM)														
L7-01RT	HAT01-11.1904001-044														
L7-02B	HAT01-11.1904001-016	100.0	99.8	95.0	77.2	62.5	33.2	22.0	16.4	15.0	12.3	10.1	8.0	6.0	4.6
L7-02B (BM)	HAT01-11.1904001-016 (BM)														
L7-02RT	HAT01-11.1904001-045														
L7-03B	HAT01-11.1904001-017	100.0	99.4	91.8	71.1	54.6	30.8	18.3	12.9	11.9	10.1	8.1	6.5	4.8	3.7
L7-03B (BM)	HAT01-11.1904001-017 (BM)														
L7-03RT	HAT01-11.1904001-046														
L7-11B	HAT01-11.1904001-018	100.0	100.0	92.4	70.0	52.4	30.6	18.0	13.0	12.2	11.1	10.0	8.0	5.9	4.6
L7-11B (BM)	HAT01-11.1904001-018 (BM)														
L7-11RT	HAT01-11.1904001-050														
L8-01RB	HAT01-11.1904001-071	100.0	100.0	100.0	100.0	98.5	94.1	90.4	86.4	83.4	80.8	76.3	62.1	48.2	38.0

Client Project Information	
Facility Name:	Mexican Hat Disposal Site
Project Number:	1.103.1.02.112.7.20
Project Name:	Mexican Hat Disposal Site (Soil Testing)
PO Number:	LMCP6198
COC ID:	HAT01-11.1904001-COC.1 & HAT01-11.1904002-COC.1
Task Code:	HAT01-11.1904001 & HAT01-11.1904002

Summary of Particle Size Characteristics

		Sieves (% Passing)													
Sample Number	Lab ID	3"	2"	1.5"	1"	3/4"	3/8"	4	10	20	40	60	100	140	200
L8-01RB (No Dispersant)	HAT01-11.1904001-071 (No Dipsersent)	100.0	100.0	100.0	100.0	98.5	94.1	90.4	86.4						37.1
L8-01RM	HAT01-11.1904001-059	100.0	100.0	100.0	100.0	100.0	98.8	98.1	97.3	96.4	95.4	90.9	64.0	37.7	25.7
L8-01RM (No Dispersant)	HAT01-11.1904001-059 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	98.8	98.1	97.3						26.4
L8-01RT	HAT01-11.1904001-047	100.0	100.0	100.0	100.0	100.0	99.0	98.4	97.8	96.9	95.7	89.2	65.3	43.3	28.7
L8-01RT (No Dispersant)	HAT01-11.1904001-047 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.0	98.4	97.8						28.7
L8-02B	HAT01-11.1904001-019	100.0	100.0	94.4	73.7	56.3	21.5	12.6	9.0	8.3	7.1	5.9	4.8	3.6	2.8
L8-02B (BM)	HAT01-11.1904001-019 (BM)														
L8-02RB	HAT01-11.1904001-072	100.0	100.0	100.0	100.0	100.0	98.0	96.9	95.4	94.9	93.9	87.2	64.2	45.1	31.1
L8-02RB (No Dispersant)	HAT01-11.1904001-072 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	98.0	96.9	95.4						29.5
L8-02RM	HAT01-11.1904001-060	100.0	100.0	100.0	100.0	100.0	99.0	98.3	97.2	95.6	94.5	89.5	62.4	38.1	25.0
L8-02RM (No Dispersant)	HAT01-11.1904001-060 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.0	98.3	97.2						25.5
L8-02RT	HAT01-11.1904001-048	100.0	100.0	100.0	100.0	100.0	99.7	99.1	98.2	96.7	95.5	88.6	63.5	42.6	29.4
L8-02RT (No Dispersant)	HAT01-11.1904001-048 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.7	99.1	98.2						30.1
L8-03B	HAT01-11.1904001-020	100.0	99.4	84.6	53.2	36.3	16.9	8.9	5.7	5.0	4.3	3.7	3.2	2.7	2.2
L8-03B (BM)	HAT01-11.1904001-020 (BM)														
L8-03RB	HAT01-11.1904001-073	100.0	100.0	100.0	100.0	100.0	99.8	98.8	97.8	96.4	95.3	88.2	63.4	45.2	31.0
L8-03RB (No Dispersant)	HAT01-11.1904001-073 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	99.8	98.8	97.8						31.1
L8-03RM	HAT01-11.1904001-061	100.0	100.0	100.0	100.0	98.6	97.2	96.5	95.9	94.2	93.1	88.4	61.4	39.1	26.6
L8-03RM (No Dispersant)	HAT01-11.1904001-061 (No Dispersant)	100.0	100.0	100.0	100.0	98.6	97.2	96.5	95.9						26.9
L8-03RT	HAT01-11.1904001-049	100.0	100.0	100.0	100.0	100.0	100.0	99.6	98.9	97.8	96.6	92.3	62.7	35.9	23.6
L8-03RT (No Dispersant)	HAT01-11.1904001-049 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	100.0	99.6	98.9						25.1
L9-01B	HAT01-11.1904001-021	100.0	100.0	93.3	70.4	60.6	33.9	18.2	12.5	11.2	10.1	9.0	7.6	6.0	4.9
L9-01B (BM)	HAT01-11.1904001-021 (BM)														
L10-01B	HAT01-11.1904001-022	100.0	99.1	91.7	67.3	50.4	20.3	10.2	7.0	6.2	5.6	4.9	4.2	3.4	2.7
L10-01B (BM)	HAT01-11.1904001-022 (BM)														
L10-02B	HAT01-11.1904001-023	100.0	100.0	89.8	67.7	51.0	29.0	17.2	11.8	10.3	9.0	7.6	6.4	4.9	3.8
L10-02B (BM)	HAT01-11.1904001-023 (BM)														
L11-01B	HAT01-11.1904001-025	100.0	99.8	91.7	66.2	49.4	23.5	12.1	7.9	7.0	6.1	5.2	4.3	3.4	2.8
L11-01B (BM)	HAT01-11.1904001-025 (BM)														
L11-02B	HAT01-11.1904001-026	100.0	100.0	90.3	55.5	34.2	13.5	7.5	5.5	4.9	3.9	3.0	2.3	1.8	1.5
L11-02B (BM)	HAT01-11.1904001-026 (BM)														
L12-01B	HAT01-11.1904001-028	100.0	98.8	89.7	58.0	31.0	10.9	8.1	7.6	7.3	7.0	6.8	6.4	5.8	5.1
L12-01B (BM)	HAT01-11.1904001-028 (BM)														
L13-01B	HAT01-11.1904001-029	100.0	100.0	84.8	57.9	42.8	21.0	11.5	7.7	6.8	6.2	5.5	4.8	3.9	3.2
L13-01B (BM)	HAT01-11.1904001-029 (BM)														
L13-02B	HAT01-11.1904001-030	100.0	100.0	90.6	65.2	53.4	37.9	26.1	18.3	15.2	12.9	11.0	9.2	7.1	5.6
L13-02B (BM)	HAT01-11.1904001-030 (BM)														
L13-02RB	HAT01-11.1904001-075	100.0	100.0	100.0	100.0	100.0	91.1	87.1	84.5	77.7	74.8	72.2	66.6	60.7	55.4
L13-02RB (No Dispersant)	HAT01-11.1904001-075 (No Dispersant)	100.0	100.0	100.0	100.0	100.0	91.1	87.1	84.5						51.9
L13-02RM	HAT01-11.1904001-063	100.0	100.0	100.0	100.0	98.4	89.6	83.1	79.6	75.5	73.1	71.0	65.3	59.3	53.4
L13-02RM (No Dispersant)	HAT01-11.1904001-063 (No Dispersant)	100.0	100.0	100.0	100.0	98.4	89.6	83.1	79.6						51.2
L13-02RT	HAT01-11.1904001-051	100.0	100.0	91.1	91.1	86.3	80.2	75.7	72.6	69.3	67.3	65.4	60.1	54.4	49.3
L13-02RT (No Dispersant)	HAT01-11.1904001-051 (No Dispersant)	100.0	100.0	91.1	91.1	86.3	80.2	75.7	72.6						46.3
L-compW	HAT01-11.1904001-080	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.6	99.4	98.9	98.4	97.1	92.9	81.3

Appendix D

Cation Exchange and Exchangeable Cations Report

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August 23, 2019 Service Request No:T1900713

Steve Donivan
Navarro Research and Engineering, Inc.
2597 Legacy Way
Grand Junction, CO 81503

Laboratory Results for: Mexican Hat Disposal Site (ALS Soil Testing)

Dear Steve,

Enclosed are the results of the sample(s) submitted to our laboratory April 25, 2019
For your reference, these analyses have been assigned our service request number **T1900713.**

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and ALS Environmental is not responsible for use of less than the complete report. Results
apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

R.V. Poulsen

Ralph Poulsen

Data Qualifiers

Lab Standard

+	Possible Tedlar bag artifact.
A	TIC is a suspected aldol-condensation product
B	Analyte found in the associated method blank as well as in the sample.
BC	Reported results are not blank corrected.
BH	The back section of the tube yielded higher results than the front.
BT	Results indicated possible breakthrough; back section >=10% front section.
C	Result identification confirmed.
D	Compound identified in an analysis at a secondary dilution factor
D	Spike was diluted out
DE	Reported results are corrected for desorption efficiency.
E	Estimated value. Concentration above calibration range
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
H1	Sample analysis performed past holding time. See case narrative.
H2	Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3	Sample was received and analyzed past holding time.
H4	Sample was extracted past required extraction holding time, but analyzed within analysis holding time. See case narrative.
I	Internal standard not within the specified limits. See case narrative.
J	Estimated Value. Concentration found below MRL.
K	A deflection in the QC ion may indicate interference with the quantitation of this ion. The concentration of this analyte should be considered as an estimate.
K	Analyte was detected above the method reporting limit prior to normalization.
L1	Laboratory control sample recovery outside the specified limits; results may be biased high.
L2	Laboratory control sample recovery outside the specified limits; results may be biased low.
L3	Laboratory control sample recovery outside the specified limits.
M	Matrix interference; results may be biased high.
M	The duplicate injection precision not met.
M1	Matrix interference due to coelution with a non-target compound; results may be biased high.
N	Presumptive evidence of a compound for TICs that have been identified based on a mass spectral library search.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
P	Indicates chlorodiphenyl ether interference present at the retention time of the target compound.
P	Pesticide/Aroclor target analyte > 40% difference for detected concentrations between GC columns
Q	Indicates as estimated value because the P and P + 2 theoretical abundance ratio does not meet method criteria.
R	Duplicate Precision not met.
R1	Duplicate precision not within the specified limits; however, the results are below the MRL and considered estimated.
S	Surrogate recovery not within specified limits.

Data Qualifiers

Lab Standard

S	The reported value was determined by the Method of Standard Additions (MSA).
T	Analyte is a tentatively identified compound, result is estimated.
U	Compound was analyzed for, but was not detected (ND).
V1	The continuing calibration verification standard was outside (biased high) the specified limits for this compound.
V2	The continuing calibration verification standard was outside (biased low) the specified limits for this compound.
W	Result quantified, but the corresponding peak was detected outside the generated retention time window.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
X	See case narrative.
Y	Recovery outside limits
Y	The chromatogram resembles a petroleum product but does not match the calibration standard.
Z	The chromatogram does not resemble a petroleum product.
i	The MRL/MDL has been elevated due to a matrix interference.

NAVARRO

Chain of Custody / Sample Submittal Form

T1900713 1
Navarro Research and Engineering, Inc.
Mexican Hat Disposal Site (ALS Soil Testing)

Task Code: HAT01-10.1901001 **COC ID:** HAT01-10.1901001-COC.1 **TURNAROUND TIME:** 28

PROJECT INFORMATION

Facility Name: Mexican Hat Disposal Site
Project Number: 1.103.1.02.112.7.20
Project Name: Mexican Hat Disposal Site (ALS Soil Testing)

LABORATORY

Lab Name: ALS Environmental (Tucson, AZ)
Address: 3860 S Palo Verde Rd #302
City: Tucson State: AZ
Postal Code: 85714
Phone Number: 520.573.1061
PO Number:

SAMPLING / SHIPPING

Shipping Company: Fed eX
Tracking Number:
Cooler Count: 2
Date Shipped: 4/24/19
Sampled by: J. Graham
Sampler 2: K. Carlson

SAMPLE DETAILS **ANALYSIS REQUESTED** Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Location	Matrix	Date	Time (24hr)	G=Grab C=Comp	QC	# of Cont	X = shared container	Container: PLASTIC JAR 250 ML Filtered: Preserv.: None ANALYSIS: Cation Exchange Capacity	
HAT01-10.1901001-002	L5-02B	SOIL	4/18/2019	1230	G		1		1	001
HAT01-10.1901001-003	L5-03B	SOIL	4/18/2019	1015	G		1		1	002
HAT01-10.1901001-004	L7-01RB	SOIL	4/16/2019	1550	G		1		1	003
HAT01-10.1901001-005	L7-02B	SOIL	4/16/2019	1630	G		1		1	004
HAT01-10.1901001-006	L7-03B	SOIL	4/16/2019	1705	G		1		1	005
HAT01-10.1901001-007	L5-01A-RB	SOIL	4/17/2019	1650	G		1		1	006
HAT01-10.1901001-008	L5-01A-RU	SOIL	4/17/2019	1655	G		1		1	007
HAT01-10.1901001-009	L5-01C	SOIL	4/17/2019	1620	G		1		1	008
HAT01-10.1901001-011	L7-11RT	SOIL	4/17/2019	850	G		1		1	009
HAT01-10.1901001-012	L7-11RB	SOIL	4/17/2019	900	G		1		1	010
HAT01-10.1901001-013	L5-01RT	SOIL	4/18/2019	800	G		1		1	011
HAT01-10.1901001-014	L5-02RT	SOIL	4/18/2019	1235	G		1		1	012
HAT01-10.1901001-015	L5-03RT	SOIL	4/18/2019	1020	G		1		1	013
HAT01-10.1901001-016	L7-01RT	SOIL	4/16/2019	1610	G		1		1	014 4/26/19

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY	DATE/TIME	ACCEPTED BY	DATE/TIME
		4/24/19 1400	APR 25 2019 (1015)	

NAVARRO

Chain of Custody / Sample Submittal Form

T1900713 1
Navarro Research and Engineering, inc.
Mexican Hat Disposal Site (ALS Soil Testing)

Task Code: HAT01-10.1901001 **COC ID:** HAT01-10.1901001-COC.2 **TURNAROUND TIME:** 28

PROJECT INFORMATION

Facility Name Mexican Hat Disposal Site
Project Number 1.103.1.02.112.7.20
Project Name: Mexican Hat Disposal Site (ALS Soil Testing)

LABORATORY

Lab Name: ALS Environmental (Tucson, AZ)
Address: 3860 S Palo Verde Rd #302
City: Tucson State: AZ
Postal Code: 85714
Phone Number: 520.573.1061
PO Number:

SAMPLING / SHIPPING

Shipping Company: FedEx
Tracking Number:
Cooler Count: 2
Date Shipped: 4/24/19
Sampled by: J. Graham
Sampler 2: K. Carlson

SAMPLE DETAILS

ANALYSIS REQUESTED Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Container	PLASTIC JAR 250 ML
Filtered	
Preserv.	None
ANALYSIS	Cation Exchange Capacity

Sample ID	Location	Matrix	Date	Time (24hr)	G=Grab C=Comp	QC	# of Cont	X = shared container	Cation Exchange Capacity	
HAT01-10.1901001-017	L7-02RT	SOIL	4/16/2019	1655	G		1		1	015
HAT01-10.1901001-018	L7-03RT	SOIL	4/16/2019	1700	G		1		1	016
HAT01-10.1901001-019	L5-01RM	SOIL	4/18/2019	750	G		1		1	017
HAT01-10.1901001-020	L5-02RM	SOIL	4/18/2019	1235	G		1		1	018
HAT01-10.1901001-021	L5-03RM	SOIL	4/18/2019	1020	G		1		1	019
HAT01-10.1901001-022	L7-02RM	SOIL	4/16/2019	1640	G		1		1	020
HAT01-10.1901001-023	L7-03RM	SOIL	4/16/2019	1710	G		1		1	021
HAT01-10.1901001-024	L7-01RM	SOIL	4/16/2019	1600	G		1		1	022
HAT01-10.1901001-025	L5-01RB	SOIL	4/18/2019	740	G		1		1	023
HAT01-10.1901001-026	L5-02RB	SOIL	4/18/2019	1240	G		1		1	024
HAT01-10.1901001-027	L5-03RB	SOIL	4/18/2019	1020	G		1		1	025
HAT01-10.1901001-028	L7-01B	SOIL	4/16/2019	1520	G		1		1	026
HAT01-10.1901001-029	L7-02RB	SOIL	4/16/2019	1630	G		1		1	027
HAT01-10.1901001-030	L7-03RB	SOIL	4/16/2019	1700	G		1		1	028 4/24/19

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY	DATE/TIME	ACCEPTED BY	DATE/TIME
	J Graham	4/24/19 1400		
			APR 25 2019 (1015)	

NAVARRO

Chain of Custody / Sample Submittal Form

T1900713 1
Navarro Research and Engineering, Inc.
Mexican Hat Disposal Site (ALS Soil Testing)

Task Code: HAT01-10.1901001 **COC ID:** HAT01-10.1901001-COC.3 **TURNAROUND TIME:** 28

PROJECT INFORMATION		LABORATORY			SAMPLING / SHIPPING	
Facility Name	Mexican Hat Disposal Site	Lab Name:	ALS Environmental (Tucson, AZ)		Shipping Company:	Fed Ex
Project Number	1.103.1.02.112.7.20	Address:	3860 S Palo Verde Rd #302		Tracking Number:	
Project Name:	Mexican Hat Disposal Site (ALS Soil Testing)	City:	Tucson	State: AZ	Cooler Count:	2
		Postal Code:	85714		Date Shipped:	4/24/19
		Phone Number:	520.573.1061		Sampled by:	J. Graham
		PO Number:			Sampler 2:	K. Carlson

SAMPLE DETAILS **ANALYSIS REQUESTED** Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Location	Matrix	Date	Time (24hr)	G=Grab C=Comp	QC	# of Cont		Container: PLASTIC JAR 250 ML Filtered: Preserv.: None ANALYSIS: Cation Exchange Capacity	
HAT01-10.1901001-031	A-1	SOIL	4/16/2019	1330	G		1	X = shared container	1	029
HAT01-10.1901001-032	ASM-2	SOIL	4/16/2019	915	G		1		1	030
HAT01-10.1901001-033	ASM-1	SOIL	4/16/2019	830	G		1		1	031
HAT01-10.1901001-034	L1-compW	SOIL	4/16/2019	1050	G		1		1	032
HAT01-10.1901001-035	A-3	SOIL	4/16/2019	1350	G		1		1	033
HAT01-10.1901001-036	A-2	SOIL	4/16/2019	1335	G		1		1	034
HAT01-10.1901001-037	L7-11RM	SOIL	4/17/2019	850	G		1		1	035
HAT01-10.1901001-038	L5-01W	SOIL	4/18/2019	945	G		1		1	036
HAT01-10.1901001-039	L7-11B	SOIL	4/17/2019	825	G		1		1	037
										4/26/19

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY	DATE/TIME	ACCEPTED BY	DATE/TIME
	J Graham	4/24/19 1400		
			APR 25 2019 (1015)	

4208 S. Santa Rita Ave.
Tucson, AZ 85714
T: +1 520 573 1061
www.alsglobal.com

Sample Receipt Form

T1900713 1
Navarro Research and Engineering, Inc.
Mexican Hat Disposal Site (ALS Soil Testing)

Client/Project: **Navarro**

Work Order Number:

Received by: Sonia Gonzalez

Date & Time: 4/25/19 1015

Matrix: Solid

Samples were received via?: FedEx

Samples were received in: Cooler

Were custody seals on containers? ● Yes ○ No ○ NA

If yes, how many and where? 1 front each

If present were custody seals intact? ○ Yes ● No

If present, were they signed and dated? ○ Yes ● No

Arrival Temp C	Temp Blank C	Tracking Number
Ambient	N/A	Cooler 1: 7750 4874 1663
		Cooler 2: 7750 4874 1505

Packing material used? N/A

Did all the bottles arrive in good condition (unbroken)? ● Yes ○ No ○ NA

If No, record comments below

Did all sample labels and tags agree with COC? ● Yes ○ No ○ NA

If No, record discrepancies below

Were all the appropriate containers and volumes received for the tests indicated? ● Yes ○ No ○ NA

Are samples received deemed acceptable? ● Yes ○ No

Comments:
37 plastic jars, 250mL

Notes, discrepancies, & resolutions:

As a part of ISO 17025 protocols, ALS must notify clients that the quoted analytical methods performed by ALS may have minor modifications from the methods as published. These modifications are written into our Standard Operating Procedures and do not impact the quality of the data. Receipt of this document will be considered an acceptance of the procedures used by the laboratory for analysis unless notified by the client.
Modifications may include, but are not limited to:

- The analysis of a sample matrix that differs from that stated in the published method (example - ASTM D5865 Standard Test Method for Gross Calorific Value of Coal and Coke is used for other matrices such as biomass, Tire Derived Fuel, etc.).
- Analyzing a sample mass that differs from those in the published method (example - to accommodate samples with high concentrations of analyte, samples of limited volume, or to comply with the instrument manufacturer's operating guidelines).
- Instruments used for the analysis may differ from those listed in the published method (example - using ICP-OES when the method references flame Atomic Absorption Spectroscopy)

Case Narrative

Client: Navarro Research and Engineering, Inc. **ALS Project:** T1900713

Project: Mexican Hat Disposal Site (ALS Soil Testing) **Date Received:** April 25, 2019

Sample Receipt

Thirty seven sample is 250 plastic soil jars were received in good condition with no discrepancies in the COC and other sample documentation forms.

The samples were logged into the ALS LIMS for the following analyses:

- Moisture by ASTM D2216 – Gravimetric at 105C
- Extractable Cations by ASTM D7503 (Al, Ca, Mg, K, Na) – NH4OAc Extraction / ICP-OES
- Water Soluble Cations by ASTM D7503 (Al, Ca, Mg, K, Na) – DI H2O Extraction / ICP-OES
- Bound (Exchangeable) Cations by ASTM D7503 (Al, Ca, Mg, K, Na) – Calculation (Extractable – Soluble Cation)
- Cation Exchange Capacity by ASTM D7503 – Ammonium Acetate / KCl Extraction / Colorimetric Determination (Extraction performed in the Tucson laboratory, analyses performed by the ALS Ft. Collins laboratory)
- ESP and SAR by D7503 - Calculations

Sample Preparation

- Samples were air dried at 30C to 40C for several days. The Air Dry Loss moisture values were measured and used to calculate the Total Moisture
- The Air Dried samples were passed through a soil flail mill with a 2mm sieve. The < 2mm fraction was analyzed while the plus 2mm was discarded.

Analyses

The analyses were performed as written in ASTM method D7503. Analytical problems were almost immediately encountered including extreme difficulty filtering the water and NH4OAc extracts. The filtering process for the 37 and duplicates was exceedingly long with some filtrates taking several hours to complete. After completion of the filtration, both the water and extractable filtrates showed signs of colloidal clay that passed through the ashless filter paper (90mm Whatman 40) that was specified by the method. The filtrates were then acidified with HNO3. It was determined during the analyses by ICP-OES, the acidification of the extracts resulted in significant and inconsistent increases in levels of Al and Ca. The water soluble analyses were repeated with the same results.

Other problems encountered also included carryover contamination from one sample to the next during the filtration and reaction steps. The filtering and cleaning of filtering funnels and glassware were performed per the method. The alcohol rinses and cleaning processes of funnels and flasks listed in the method were not sufficient to eliminate the carryover contamination between samples. This was determined because of high hits of K in the blanks and the samples.

These problems were not totally apparent until completion of the extractions and analyses by ICP-OES. The source of the problems were research through the review of the method and data by a senior staff person plus discussions with the analyst

Changes to the method included the use of 47mm GF/F glass fiber filters with 0.6um pore size instead of the Whatman 40 filters with an 8um pore size. This change eliminated the passing of colloidal clay into the extracts and also improved the filtration speed. Another step was replacing the 90mm ceramic Buchner filtering funnel with a 47mm plastic filtering funnel that could be taken apart to be cleaned between samples. The large glass filtering flasks used to catch the filtrates were also switched to a system that uses 50 mL centrifuge tubes inserted into a filter flask to catch the filtrates. Together these changes greatly reduced the carryover contamination seen in the initial analyses.

All of the samples were retested for cation and CEC analyses after the corrections listed above were implemented.

Case Narrative (cont.)

Client:	**Navarro Research and Engineering, Inc.**	**ALS Project:**	**T1900713**
Project:	**Mexican Hat Disposal Site (ALS Soil Testing)**	**Date Received:**	**April 25, 2019**

Quality Control and Analytical Issues

The QC issues were encountered with the retests of the samples.

- Low level Sodium levels were observed in the filtration blanks at approximately 2 mg/L. The Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium.
- CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the samples and filter prior to the KCl extraction step.
- The Laboratory Control Sample for Water Soluble Sodium was prepared at approximately 0.5 cmol/Kg which is at the RL of the method. The observed values for the LCSs were 0.3 and 0.6 and had recoveries that were within the +/-50% acceptance limits for low level LCSs.
- Duplicate values for Water Soluble and Bound K exceed the +/-20 acceptance as the concentrations were less that than 10 x the RL values.

Client: **Navarro Research and Engineering, Inc.**
2597 Legacy Way
Grand Junction, CO 81503

Attn: **Steve Donivan**
Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

Certificate of Analysis

Sample ID:	Sample Date & Time:	Lab #:	Moisture D2216 wt%		
HAT01-10.1901001-002	4/18/19 1230	T1900713-001	3.71		
HAT01-10.1901001-003	4/18/19 1015	T1900713-002	3.55		
HAT01-10.1901001-004	4/16/19 1550	T1900713-003	11.56		
HAT01-10.1901001-005	4/16/19 1630	T1900713-004	4.27		
HAT01-10.1901001-006	4/16/19 1705	T1900713-005	4.53		
HAT01-10.1901001-007	4/17/19 1650	T1900713-006	12.11		
HAT01-10.1901001-008	4/17/19 1655	T1900713-007	11.19		
HAT01-10.1901001-009	4/17/19 1620	T1900713-008	2.74		
HAT01-10.1901001-011	4/17/19 0850	T1900713-009	12.29		
HAT01-10.1901001-012	4/17/19 0900	T1900713-010	10.16		
HAT01-10.1901001-013	4/18/19 0800	T1900713-011	9.37		
HAT01-10.1901001-014	4/18/19 1235	T1900713-012	11.58		
HAT01-10.1901001-015	4/18/19 1020	T1900713-013	10.44		
HAT01-10.1901001-016	4/16/19 1610	T1900713-014	10.63		
HAT01-10.1901001-017	4/16/19 1655	T1900713-015	11.16		
HAT01-10.1901001-018	4/16/19 1700	T1900713-016	12.08		
HAT01-10.1901001-019	4/18/19 0750	T1900713-017	11.71		
HAT01-10.1901001-020	4/18/19 1235	T1900713-018	10.80		
HAT01-10.1901001-021	4/18/19 1020	T1900713-019	10.78		
HAT01-10.1901001-022	4/16/19 1640	T1900713-020	13.29		
HAT01-10.1901001-023	4/16/19 1710	T1900713-021	11.36		
HAT01-10.1901001-024	4/16/19 1600	T1900713-022	11.79		
HAT01-10.1901001-025	4/18/19 0740	T1900713-023	7.58		
HAT01-10.1901001-026	4/18/19 1240	T1900713-024	11.31		
HAT01-10.1901001-027	4/18/19 1020	T1900713-025	10.44		
HAT01-10.1901001-028	4/16/19 1520	T1900713-026	2.26		
HAT01-10.1901001-029	4/16/19 1630	T1900713-027	11.17		

Client: **Navarro Research and Engineering, Inc.**
2597 Legacy Way
Grand Junction, CO 81503

Attn: **Steve Donivan**
Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

Certificate of Analysis

Sample ID:	Sample Date & Time:		Lab #:	Moisture D2216 wt%		
HAT01-10.1901001-030	4/16/19	1700	T1900713-028	11.45		
HAT01-10.1901001-031	4/16/19	1330	T1900713-029	4.43		
HAT01-10.1901001-032	4/16/19	0915	T1900713-030	0.16		
HAT01-10.1901001-033	4/16/19	0830	T1900713-031	0.32		
HAT01-10.1901001-034	4/16/19	1050	T1900713-032	0.63		
HAT01-10.1901001-035	4/16/19	1350	T1900713-033	16.45		
HAT01-10.1901001-036	4/16/19	1335	T1900713-034	10.05		
HAT01-10.1901001-037	4/17/19	0850	T1900713-035	12.03		
HAT01-10.1901001-038	4/18/19	0945	T1900713-036	1.89		
HAT01-10.1901001-039	4/17/19	0825	T1900713-037	5.09		

Client: **Navarro Research and Engineering, Inc.**
2597 Legacy Way
Grand Junction, CO 81503

Attn: **Steve Donivan**
Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

Certificate of Analysis

Analyses	**ID**	**HAT01-10.1901001-002**	**HAT01-10.1901001-003**	**HAT01-10.1901001-004**	**HAT01-10.1901001-005**	**HAT01-10.1901001-006**
	Units	T1900713-001	T1900713-002	T1900713-003	T1900713-004	T1900713-005
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	23.57	29.37	27.37	28.54	25.75
Magnesium	cmol/Kg	0.80	1.17	2.02	1.17	1.03
Potassium	cmol/Kg	0.20	0.22	0.27	0.23	0.21
Sodium	cmol/Kg	0.77	1.06	2.96	1.00	0.86
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	0.00 0.15	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	1.29	0.98	0.80	1.22	0.97
Magnesium	cmol/Kg	0.15	0.16	0.18	0.20	0.15
Potassium	cmol/Kg	< 0.13	< 0.12	0.14	< 0.12	< 0.11
Sodium	cmol/Kg	0.55	0.72	2.84	0.71	0.53
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	22.28	28.38	26.57	27.32	24.78
Magnesium	cmol/Kg	0.65	1.01	1.84	0.97	0.88
Potassium	cmol/Kg	< 0.13	< 0.12	0.13	< 0.12	< 0.11
Sodium	cmol/Kg	0.22	0.34	< 0.21	0.29	0.33
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	1.60	2.77	6.13	2.50	1.70
ESP	%	13.7	12.2	< 3.4	11.5	19.6
SAR	ratio	0.06	0.09	< 0.06	0.08	0.09

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

Client: Navarro Research and Engineering, Inc.
2597 Legacy Way
Grand Junction, CO 81503

Attn: Steve Donivan
Project: Mexican Hat Disposal Site (ALS Soil Testing) **Date Received:** April 25, 2019

Certificate of Analysis

Analyses	ID	HAT01-10.1901001-007	HAT01-10.1901001-008	HAT01-10.1901001-009	HAT01-10.1901001-011	HAT01-10.1901001-012
	Units	T1900713-006	T1900713-007	T1900713-008	T1900713-009	T1900713-010
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	20.20	27.65	24.17	30.20	33.24
Magnesium	cmol/Kg	1.65	1.81	1.45	1.75	2.13
Potassium	cmol/Kg	0.27	0.33	0.33	0.33	0.28
Sodium	cmol/Kg	3.39	3.54	2.83	2.38	2.80
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	0.75	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	0.54	1.40	0.73	0.73	0.80
Magnesium	cmol/Kg	0.14	0.52	0.15	0.14	0.17
Potassium	cmol/Kg	< 0.13	< 0.12	< 0.12	< 0.11	< 0.12
Sodium	cmol/Kg	3.11	3.37	2.51	2.23	2.45
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	19.65	26.24	23.45	29.47	32.44
Magnesium	cmol/Kg	1.51	1.29	1.30	1.61	1.96
Potassium	cmol/Kg	0.14	0.21	0.21	0.22	0.15
Sodium	cmol/Kg	0.27	0.17	0.31	< 0.21	0.35
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	4.98	5.58	4.25	3.58	5.63
ESP	%	5.5	3.1	7.3	< 5.9	6.2
SAR	ratio	0.08	0.05	0.09	< 0.05	0.08

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

Client: **Navarro Research and Engineering, Inc.**
2597 Legacy Way
Grand Junction, CO 81503

Attn: **Steve Donivan**
Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

Certificate of Analysis

Analyses	**ID**	**HAT01-10.1901001-013**	**HAT01-10.1901001-014**	**HAT01-10.1901001-015**	**HAT01-10.1901001-016**	**HAT01-10.1901001-017**
	Units	T1900713-011	T1900713-012	T1900713-013	T1900713-014	T1900713-015
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	23.16	22.59	21.85	28.81	25.63
Magnesium	cmol/Kg	1.28	1.91	1.92	1.78	1.63
Potassium	cmol/Kg	0.24	0.27	0.22	0.30	0.27
Sodium	cmol/Kg	3.76	3.31	2.63	2.92	2.21
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	0.17	< 0.13	< 0.13	0.24	< 0.13
Calcium	cmol/Kg	0.94	0.71	0.56	0.89	0.74
Magnesium	cmol/Kg	0.19	0.17	0.15	0.22	0.15
Potassium	cmol/Kg	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12
Sodium	cmol/Kg	3.88	2.78	2.46	2.91	1.88
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	22.22	21.88	21.29	27.92	24.89
Magnesium	cmol/Kg	1.09	1.74	1.77	1.56	1.48
Potassium	cmol/Kg	0.11	0.15	0.10	0.17	0.15
Sodium	cmol/Kg	< 0.21	0.54	< 0.21	< 0.21	0.32
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	4.59	5.47	5.55	5.82	5.33
ESP	%	< 4.6	9.8	< 3.8	< 3.6	6.1
SAR	ratio	< 0.06	0.16	< 0.06	< 0.05	0.09

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Analyses	ID	HAT01-10.1901001-018	HAT01-10.1901001-019	HAT01-10.1901001-020	HAT01-10.1901001-021	HAT01-10.1901001-022
	Units	T1900713-016	T1900713-017	T1900713-018	T1900713-019	T1900713-020
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	28.34	23.56	25.92	19.08	27.10
Magnesium	cmol/Kg	1.81	1.68	1.93	1.55	1.96
Potassium	cmol/Kg	0.26	0.28	0.31	0.24	0.29
Sodium	cmol/Kg	2.22	2.33	3.49	2.95	3.23
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	0.24	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	0.79	0.62	0.66	0.56	0.72
Magnesium	cmol/Kg	0.23	0.15	0.15	0.14	0.17
Potassium	cmol/Kg	< 0.11	< 0.12	< 0.12	< 0.12	< 0.13
Sodium	cmol/Kg	2.21	2.11	3.04	2.89	2.89
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	27.55	22.94	25.26	18.52	26.38
Magnesium	cmol/Kg	1.57	1.53	1.77	1.41	1.78
Potassium	cmol/Kg	0.14	0.15	0.19	0.12	0.16
Sodium	cmol/Kg	< 0.21	0.23	0.45	< 0.21	0.34
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	5.39	5.08	5.60	6.08	5.23
ESP	%	< 3.9	4.5	8.0	< 3.5	6.5
SAR	ratio	< 0.06	0.07	0.12	< 0.07	0.09

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Analyses	**ID**	**HAT01-10.1901001-023**	**HAT01-10.1901001-024**	**HAT01-10.1901001-025**	**HAT01-10.1901001-026**	**HAT01-10.1901001-027**
	Units	T1900713-021	T1900713-022	T1900713-023	T1900713-024	T1900713-025
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	25.38	24.98	44.03	24.63	24.09
Magnesium	cmol/Kg	1.76	1.85	1.63	1.96	2.00
Potassium	cmol/Kg	0.68	0.78	0.80	0.74	0.90
Sodium	cmol/Kg	2.99	3.50	1.08	3.32	2.98
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	0.83	0.82	11.54	0.71	0.86
Magnesium	cmol/Kg	0.19	0.17	0.77	0.16	0.20
Potassium	cmol/Kg	< 0.13	< 0.12	< 0.12	< 0.12	< 0.13
Sodium	cmol/Kg	2.61	2.94	0.89	2.70	2.83
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	24.54	24.16	32.49	23.92	23.23
Magnesium	cmol/Kg	1.57	1.68	0.86	1.80	1.80
Potassium	cmol/Kg	0.55	0.66	0.68	0.62	0.77
Sodium	cmol/Kg	0.37	0.56	< 0.21	0.62	< 0.21
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	6.21	6.53	3.30	5.90	4.77
ESP	%	6.0	8.6	< 6.4	10.6	< 4.4
SAR	ratio	0.10	0.16	< 0.05	0.17	< 0.06

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Analyses	**ID**	**HAT01-10.1901001-028**	**HAT01-10.1901001-029**	**HAT01-10.1901001-030**	**HAT01-10.1901001-031**	**HAT01-10.1901001-032**
	Units	T1900713-026	T1900713-027	T1900713-028	T1900713-029	T1900713-030
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	28.90	30.65	25.11	9.99	7.60
Magnesium	cmol/Kg	1.62	2.91	1.87	0.58	0.33
Potassium	cmol/Kg	0.23	0.70	0.75	0.70	0.48
Sodium	cmol/Kg	1.71	3.10	3.01	0.45	< 0.21
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	1.16	0.80	0.79	0.74	0.66
Magnesium	cmol/Kg	0.22	0.25	0.17	0.10	< 0.08
Potassium	cmol/Kg	< 0.12	< 0.13	< 0.12	< 0.12	< 0.13
Sodium	cmol/Kg	1.49	2.53	2.86	< 0.42	< 0.44
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	27.74	29.85	24.32	9.25	6.93
Magnesium	cmol/Kg	1.40	2.65	1.70	0.48	0.24
Potassium	cmol/Kg	0.11	0.57	0.62	0.58	0.35
Sodium	cmol/Kg	0.22	0.57	< 0.21	< 0.21	< 0.21
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	4.18	6.10	5.43	3.22	2.32
ESP	%	5.3	9.4	< 3.9	< 6.5	< 9.0
SAR	ratio	0.06	0.14	< 0.06	< 0.10	< 0.11

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Analyses	**ID**	**HAT01-10.1901001-033**	**HAT01-10.1901001-034**	**HAT01-10.1901001-035**	**HAT01-10.1901001-036**	**HAT01-10.1901001-037**
	Units	T1900713-031	T1900713-032	T1900713-033	T1900713-034	T1900713-035
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	8.46	28.70	31.28	10.62	24.11
Magnesium	cmol/Kg	0.46	1.64	1.22	0.45	1.64
Potassium	cmol/Kg	0.60	0.28	0.21	< 0.14	0.28
Sodium	cmol/Kg	< 0.22	0.93	0.70	0.24	2.86
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	0.67	2.02	1.04	0.78	0.64
Magnesium	cmol/Kg	< 0.08	0.28	0.16	0.11	0.14
Potassium	cmol/Kg	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12
Sodium	cmol/Kg	< 0.40	0.68	< 0.40	< 0.40	2.49
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
Calcium	cmol/Kg	7.80	26.68	30.25	9.84	23.47
Magnesium	cmol/Kg	0.38	1.36	1.05	0.34	1.50
Potassium	cmol/Kg	0.48	0.16	0.09	0.02	0.15
Sodium	cmol/Kg	< 0.21	0.26	0.30	< 0.21	0.37
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	2.00	7.28	3.13	0.19	5.00
ESP	%	< 10.5	3.5	9.5	< 112.8	7.3
SAR	ratio	< 0.10	0.07	0.07	< 0.09	0.10

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Analyses	ID	HAT01-10.1901001-038	HAT01-10.1901001-039			
	Units	T1900713-036	T1900713-037			
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13			
Calcium	cmol/Kg	16.40	28.38			
Magnesium	cmol/Kg	0.75	1.33			
Potassium	cmol/Kg	1.41	0.26			
Sodium	cmol/Kg	0.78	1.20			
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13			
Calcium	cmol/Kg	0.87	1.09			
Magnesium	cmol/Kg	0.13	0.19			
Potassium	cmol/Kg	< 0.12	< 0.12			
Sodium	cmol/Kg	0.53	0.81			
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13			
Calcium	cmol/Kg	15.54	27.29			
Magnesium	cmol/Kg	0.62	1.14			
Potassium	cmol/Kg	1.29	0.14			
Sodium	cmol/Kg	0.26	0.39			
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	1.42	6.21			
ESP	%	18.1	6.3			
SAR	ratio	0.09	0.10			

Note: Values reported on an a moisture free basis. Sodium values were corrected for low level filter blank contamination for both extractable and soluble Sodium. CEC values were corrected for low level Ammonium contamination of filters after treatment with Ammonium Acetate. The number of alcohol rinses were doubled over the method, but still failed to remove all unreacted Ammonium Acetate from the filter prior to the KCl extraction step.

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Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

Duplicate Analyses

Analyses	**ID**	**HAT01-10.1901001-002**		**RPD %**		
	Units	T1900713-001	T1900713-001D			
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	23.57	25.28	7.0		
Magnesium	cmol/Kg	0.80	0.82	2.4		
Potassium	cmol/Kg	0.20	0.17	12.7		
Sodium	cmol/Kg	0.77	0.78	1.2		
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	1.29	1.31	1.6		
Magnesium	cmol/Kg	0.15	0.15	2.0		
Potassium	cmol/Kg	< 0.13	< 0.13	n/a		
Sodium	cmol/Kg	0.55	0.55	0.0		
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	22.28	23.97	7.3		
Magnesium	cmol/Kg	0.65	0.67	2.6		
Potassium	cmol/Kg	< 0.13	< 0.13	n/a		
Sodium	cmol/Kg	0.22	0.23	4.2		
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	1.60	1.31	20.0		
ESP	%	13.7	17.5	n/a		
SAR	ratio	0.06	0.07	n/a		

Note: Values reported on an a moisture free basis.

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Duplicate Analyses

Analyses	ID	HAT01-10.1901001-013				RPD %		
	Units	T1900713-011		T1900713-011D				
Extractable Cations, ATSM D7503 ICP-OES								
Aluminum	cmol/Kg	<	0.13	<	0.13	n/a		
Calcium	cmol/Kg		23.16		24.35	5.0		
Magnesium	cmol/Kg		1.28		1.34	5.1		
Potassium	cmol/Kg		0.24		0.31	25.4		
Sodium	cmol/Kg		3.76		3.99	6.1		
Water Soluble Cations, ATSM D7503 ICP-OES								
Aluminum	cmol/Kg		0.17		0.20	12.5		
Calcium	cmol/Kg		0.94		0.92	1.6		
Magnesium	cmol/Kg		0.19		0.19	1.0		
Potassium	cmol/Kg	<	0.12	<	0.12	n/a		
Sodium	cmol/Kg		3.88		3.54	8.9		
Bound (Exchangeable) Cations, ATSM D7503 Calculation								
Aluminum	cmol/Kg	<	0.13	<	0.13	n/a		
Calcium	cmol/Kg		22.22		23.43	5.3		
Magnesium	cmol/Kg		1.09		1.16	6.1		
Potassium	cmol/Kg		0.11		0.18	47.3		
Sodium	cmol/Kg	<	0.21		0.45	n/a		
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric								
CEC	cmol/Kg		4.59		4.11	11.2		
ESP	%		4.6		11.0	n/a		
SAR	ratio		0.06		0.13	n/a		

Note: Values reported on an a moisture free basis.

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Duplicate Analyses

Analyses	ID	HAT01-10.1901001-023		RPD %		
	Units	T1900713-021	T1900713-021D			
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	25.38	24.80	2.3		
Magnesium	cmol/Kg	1.76	1.78	1.2		
Potassium	cmol/Kg	0.68	1.15	51.4		
Sodium	cmol/Kg	2.99	3.02	1.3		
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	0.83	0.71	15.4		
Magnesium	cmol/Kg	0.19	0.14	25.4		
Potassium	cmol/Kg	< 0.13	< 0.11	n/a		
Sodium	cmol/Kg	2.61	2.68	2.4		
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	24.54	24.09	1.9		
Magnesium	cmol/Kg	1.57	1.64	3.9		
Potassium	cmol/Kg	0.55	1.04	61.7		
Sodium	cmol/Kg	0.37	0.35	6.9		
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	6.21	5.44	13.2		
ESP	%	6.0	6.4	n/a		
SAR	ratio	0.10	0.10	n/a		

Note: Values reported on an a moisture free basis.

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Duplicate Analyses

Analyses	ID	HAT01-10.1901001-033		RPD %		
	Units	T1900713-031	T1900713-031D			
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	8.46	8.66	2.4		
Magnesium	cmol/Kg	0.46	0.45	0.5		
Potassium	cmol/Kg	0.60	0.86	35.5		
Sodium	cmol/Kg	< 0.22	< 0.21	n/a		
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	0.67	0.78	15.3		
Magnesium	cmol/Kg	< 0.08	< 0.08	n/a		
Potassium	cmol/Kg	< 0.12	< 0.13	n/a		
Sodium	cmol/Kg	< 0.40	< 0.43	n/a		
Bound (Exchangeable) Cations, ATSM D7503 Calculation						
Aluminum	cmol/Kg	< 0.13	< 0.13	n/a		
Calcium	cmol/Kg	7.80	7.89	1.2		
Magnesium	cmol/Kg	0.38	0.37	2.1		
Potassium	cmol/Kg	0.48	0.73	41.2		
Sodium	cmol/Kg	< 0.21	< 0.21	n/a		
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	2.00	2.70	29.7		
ESP	%	10.5	7.8	n/a		
SAR	ratio	0.10	0.10	n/a		

Note: Values reported on an a moisture free basis.

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Project: Mexican Hat Disposal Site (ALS Soil Testing) **Date Received:** April 25, 2019

QC Data

Analyses	ID	Preparation Blank 1		Laboratory Control Sample 1		R%
	Units			OV	TV	
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.14		0.55	0.56	98.1
Calcium	cmol/Kg	< 0.06		0.28	0.25	109.3
Magnesium	cmol/Kg	< 0.04		0.39	0.42	94.3
Potassium	cmol/Kg	< 0.13		1.29	1.29	100.2
Sodium	cmol/Kg	< 0.23		0.23	0.22	104.6
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.14		1.18	1.07	109.8
Calcium	cmol/Kg	< 0.10		0.55	0.48	113.5
Magnesium	cmol/Kg	< 0.08		0.83	0.79	104.3
Potassium	cmol/Kg	< 0.13		2.67	2.47	108.4
Sodium	cmol/Kg	< 0.43		0.29	0.42	69.5
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	< 0.54		1.91	1.78	107.0

Note: Values reported on an a moisture free basis.

Client: **Navarro Research and Engineering, Inc.**
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Attn: **Steve Donivan**
Project: **Mexican Hat Disposal Site (ALS Soil Testing)** **Date Received:** **April 25, 2019**

QC Data

Analyses	ID	Preparation Blank 2		Laboratory Control Sample 2		R%
	Units			OV	TV	
Extractable Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.14		0.56	0.57	98.3
Calcium	cmol/Kg	< 0.06		0.26	0.25	103.7
Magnesium	cmol/Kg	< 0.04		0.41	0.42	96.7
Potassium	cmol/Kg	< 0.13		1.68	1.30	128.6
Sodium	cmol/Kg	< 0.21		0.22	0.22	97.9
Water Soluble Cations, ATSM D7503 ICP-OES						
Aluminum	cmol/Kg	< 0.14		1.18	1.21	98.2
Calcium	cmol/Kg	< 0.10		0.54	0.54	100.2
Magnesium	cmol/Kg	< 0.08		0.84	0.89	93.5
Potassium	cmol/Kg	< 0.13		2.61	2.77	94.2
Sodium	cmol/Kg	< 0.43		0.62	0.47	132.2
Cation Exchange Capacity, ATSM D7503 Ammonia by Colorimetric						
CEC	cmol/Kg	< 0.54		1.84	1.78	103.0

Note: Values reported on an a moisture free basis.

Appendix E

X-Ray Diffraction Report

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An Investigation of the Mineral Composition of 14 Soil Samples from the Mexican Hat, Utah Area

Prepared for:

Navarro Research and Engineering
2597 Legacy Way
Grand Junction, CO 81503

Prepared by:

William C. Hood
515 Dove Court
Grand Junction, CO 81507
June 12, 2019

An Investigation of the Mineral Composition of 14 Soil Samples from the Mexican Hat, Utah Area

Summary

Fourteen soil samples from the Mexican Hat, Utah area were submitted to me for mineralogical analyses. The request was for the identification of the minerals present and their abundance, with emphasis on the clay mineralogy. The submitted samples are listed in Table 1.

Table 1. List of samples submitted for analysis.

Sample	Location
HAT01-12.1904001-001	L-comp W
HAT01-12.1904001-002	A-3
HAT01-12.1904001-002	A-2
HAT01-12.1904001-004	L5-01C
HAT01-12.1904001-005	L5-01A-RB
HAT01-12.1904001-006	L5-03B
HAT01-12.1904001-007	L5-01A-RU
HAT01-12.1904001-008	L3-03RM
HAT01-12.1904001-009	L5-03RM
HAT01-12.1904001-0010	A-1
HAT01-12.1904001-0011	ASM-1
HAT01-12.1904001-0012	ASM-2
HAT01-12.1904001-0013	LS-01W
HAT01-12.1904001-0014	L5-Unknown

For convenience, in the remainder of this report the samples will be referred to by the location, rather than the lengthier formal sample number.

Although these sample matrix for each of these was listed as soil, the material was mainly sand-size grains that passed through a 1 mm mesh. The one exception to this was L5-03B, which had the appearance of stream gravel. The mineralogical analyses were conducted on the less-than-1 mm size fraction. The larger pebbles and the gravel of L5-03B were not crushed and included in the analyses.

Table 2 on the following page summarizes the results of the mineralogical investigation. Table 3 presents the amounts of the various clay minerals in more detail. The results are in weight percent of the various minerals. The narrative portion of the text explains how these numbers were derived.

Table 2. Mineral composition of 14 soil samples from the Mexican Hat, Utah area.

	Quartz	Orthoclase	Plagioclase	Calcite	Dolomite	Rutile	Pyrolusite	Hematite	Apatite	Gypsum	Smectite	Illite	Chlorite	Kaolinite	Sum
A-1	79.1	9.3	3.0	2.4	1.2	0.1	0.1	0.8	0.4	0.7	2.7	0.5	0.4	0.2	100.9
A-2	79.1	8.8	3.3	2.2	2.2	0.2	0.1	0.9	0.4	0.8	2.7	0.2	0.3	0.1	101.2
A-3	59.4	11.5	9.1	7.4	2.3	0.4	0.1	2.2	0.6	0.8	4.3	1.6	2.5	0.6	102.6
ASM-1	79.2	10.4	1.3	0.7	2.1	0.1	0.1	1.0	0.4	0.9	1	2.4	2.4	0.8	102.7
ASM-2	81.2	8.9	2.9	1.5	1.0	0.1	0.1	0.9	0.3	0.8	2.6	0.5	0.7	0.2	101.8
L3-03 RM	63.0	9.5	10.6	4.7	1.7	0.4	0.1	2.0	0.4	0.8	5.4	0.1	0	0.3	98.9
L5-01 C	66.7	10.0	4.2	5.7	1.7	0.3	0.1	1.9	0.5	0.8	9.7	0.3	0	0.5	102.3
L5-01 Unknown	60.9	9.5	12.9	4.7	1.9	0.4	0.1	2.2	0.5	0.8	7.2	0.2	0	0.4	101.5
L5-01 W	67.4	9.8	13.3	5.6	1.6	0.4	0.1	1.4	0.6	1.0	2.9	0.3	0	0.3	104.6
L5-01A RB	74.2	10.2	0.9	3.5	4.5	0.3	0.1	2.0	0.5	0.9	6.8	0.1	0.5	0.2	104.6
L5-01A RU	68.2	10.7	4.2	5.9	2.1	0.3	0.1	2.1	0.5	0.9	7.7	0.3	0.1	0.4	103.3
L5-03 RM	64.5	9.2	8.0	5.4	0.4	0.4	0.1	2.0	0.5	0.8	9.2	0.2	0.7	0.6	100.3
L5-03B	59.7	13.3	5.2	8.1	3.3	0.4	0.1	2.6	0.5	0.9	4.7	0.7	0.7	2.9	104.8
L-Comp W	54.2	13.4	13.1	4.9	5.2	0.6	0.1	2.4	0.6	1.1	3.3	1.8	1	1.3	102.9

Table 3. Clay mineralogy of 14 soil samples from the Mexican Hat, Utah area.

	Chlorite	Smectite	Illite	Kaolinite	Sum
A-1	11.5	69.8	13.1	5.6	100.0
A-2	9.7	80.3	6.7	3.3	100.0
A-3	28.1	47.6	17.8	6.5	100.0
ASM-1	36.7	15.4	36.3	11.6	100.0
ASM-2	17.2	65.5	13.0	4.3	100.0
L3-03RM	0.0	92.1	2.3	5.6	100.0
L5-01C	0.0	93.1	2.5	4.4	100.0
L5-01Unk	0.0	92.6	2.7	4.7	100.0
L5-01W	0.0	84.7	7.8	7.5	100.0
L5-01A-RB	7.1	89.1	1.6	2.2	100.0
L5-01A-RU	1.7	90.6	3.3	4.4	100.0
L5-03-RM	6.5	85.6	2.0	5.9	100.0
L5-03B	7.3	52.2	8.1	32.3	100.0
L-comp W	13.9	44.4	23.8	17.9	100.0

These values are the percent of each mineral in the clay size-fraction. They were multiplied by the calculated amount of total clay in the bulk samples to get the percentages shown in Table 2.

Introduction

At the request of Mr. John Manee, I conducted a mineralogical investigation of 14 samples identified as soil from the Mexican Hat, Utah, area. The purchase order requesting this work, LMCP6090, specified that the results be delivered as a letter report summarizing the results. This was submitted to Mr. Manee on June 2, 2019. This report explains how the data were derived. All analytical work on the samples was done using the equipment of the Colorado Mesa University geology program's x-ray laboratory.

The samples were dried, weighed and passed through a 1-mm mesh sieve. This process indicated that most of the samples were sand, with very little clay (Table 4). Having been told that the reason for the investigation was excessive erosion of material capping a containment cell, I contacted Mr. Manee, and suggested that the problem was probably mechanical rather than mineralogical and recommended that a thorough grain size analysis be run, which CMU does not have the ability to do. I then asked if he wanted me to continue with the mineralogical analysis. He referred me to Dr. Ray Johnson for his opinion. Dr. Johnson thought that the analysis would probably be beneficial and instructed me to continue.

Table 4. Sample weights

Sample	Total Weight	Weight > 1 mm	Percent < 1 mm	Comments
A-1	97.4	0.0	100.0	Loose sand
A-2	145.5	1.1	99.2	Very little material sticking together
A-3	170.5	37.8	77.8	Contained hard pebbles
ASM-1	124.2	0.0	100.0	Loose sand
ASM-2	181.4	0.0	100.0	Loose sand
L3-03RM	81.1	0.0	100.0	Lumps that needed to be broken up
L5-01C	182.8	44.4	75.7	Many pebbles
L5-Unknown	123.0	1.9	98.5	A few clay lumps but easily broken apart
LS-01W	147.2	14.2	90.4	Some clay lumps and pebbles
L5-01A-RB	187.5	1.2	99.4	Some clay lumps that broke up
L5-01A-RU	207.2	8.4	95.9	Some clay lumps plus pebbles
L5-03RM	145.0	0.3	99.8	A few pebbles
L5-03B	335.6	285.1	15.0	Stream gravel
L-comp W	90.6	2.3	97.5	Some clay lumps

Note: Clay lumps were easily broken by gentle crushing; pebbles were not broken.

X-ray Diffraction Analyses.

A portion of each sample was removed and pulverized in a micromill to reduce the size to about 40 microns or less. X-ray diffraction of the pulverized material was done using a Rigaku Miniflex x-ray diffractometer (XRD) run at 35 kilovolts and 15 milliamps. Scans were run from 3 to 40 degrees 2-theta at two degrees per minute. The diffraction patterns are included as Appendix 1. Each pattern set consists of the plain pattern, the pattern with peak d-spacings identified and a tabular listing of the peaks and their attributes. The diffraction results indicated that quartz is the predominant mineral present, with lesser amounts of orthoclase and plagioclase feldspars, calcite and dolomite. Very small amounts of the clay mineral illite were present on some of the patterns. No other minerals were visible on the diffraction patterns. Figure 1 shows a typical diffraction pattern with the peaks identified. The illite peak and the low intensity feldspar peaks do not appear on every pattern. Not shown on Fig. 1 is the main diffraction peak for the clay mineral illite. This appears as a very small peak at approximately 8.7 degrees 2-theta on the patterns for samples A-3, L5-01 W, and l-Comp W.

The bulk sample x-ray analyses were used mainly to guide the determination of mineral abundance, which was determined primarily from chemical analyses. The relative heights of the calcite and dolomite peaks were used to determine the relative amounts of these two minerals in the chemical computations. To facilitate this, I re-ran the diffraction analyses over that part of the spectrum that contains the calcite and dolomite diffraction peaks (29 to 32 degrees) at a slow scan rate to obtain better data. In several samples the dolomite peak was shifted to higher d-spacings than for pure dolomite, suggesting that the mineral contains appreciable amounts of iron. These patterns are in Appendix 2 and the data used as a starting

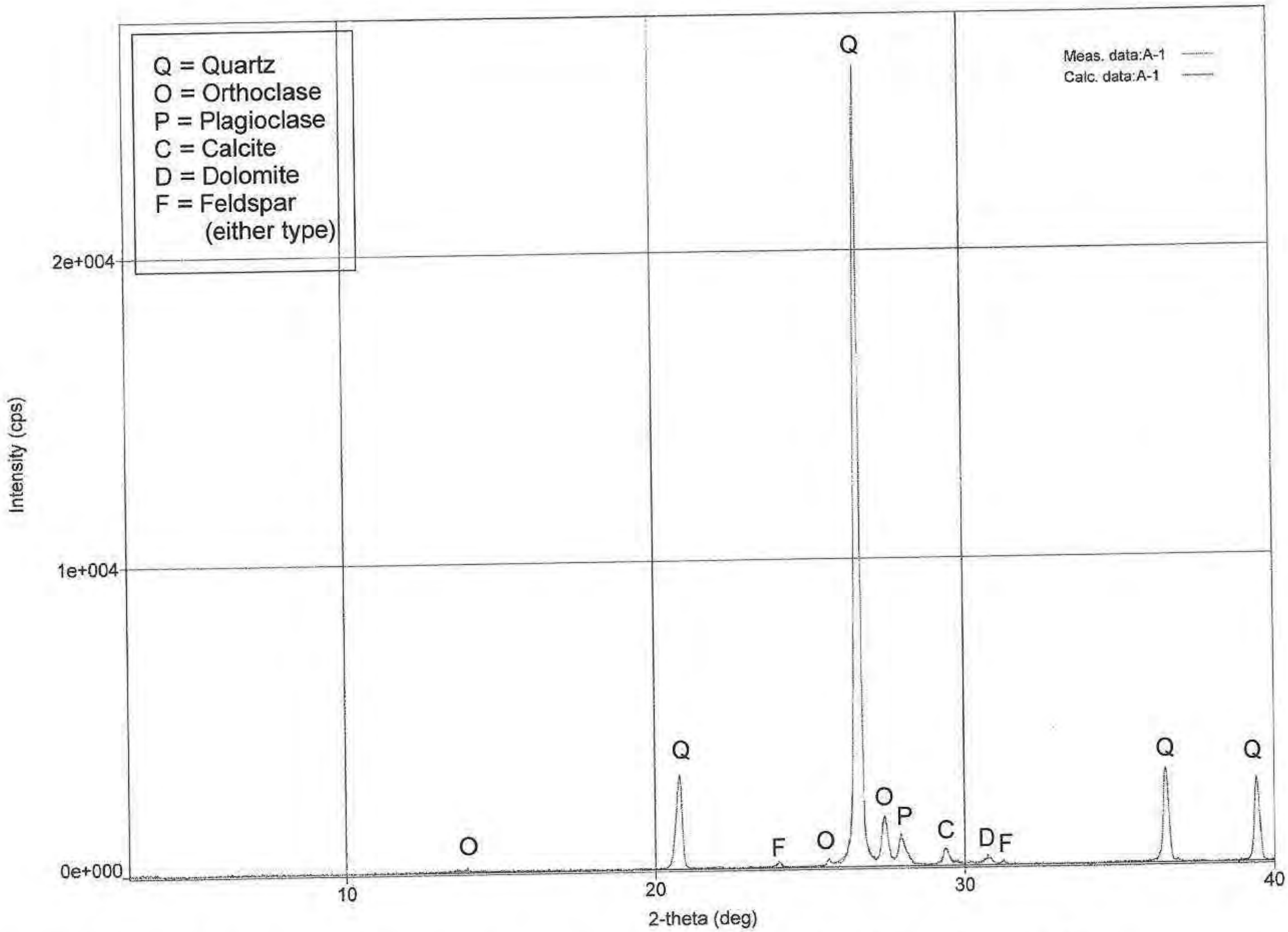

Figure 1. Typical XRD pattern showing the identification of the diffraction peaks.

point to apportion the carbon dioxide analyses between these two minerals. However, to get the overall mineralogy to balance with the chemistry, some ratios had to be adjusted, as shown in Table 5.

Table 5. Calcite to dolomite ratios indicated by XRD and calcimeter pressure behavior.

	A-1	A-2	A-3	ASM-1	ASM-2	L3-03RM	L5-01C	L5-01Unk	L5-01W	L5-01A-RB	L5-01A-RU	L5-03-RM	L5-03B	L-comp W
By XRD	0.79	0.94	0.86	0.95	0.75	0.84	0.86	0.82	0.87	0.81	0.84	0.82	0.96	0.63
Final ratio	0.65	0.65	0.86	0.40	0.73	0.84	0.86	0.82	0.87	0.59	0.84	0.96	0.82	0.64

Chemical analyses.

Because it is difficult to get significant precision in the peak heights of the major diffraction peaks, the lab uses a geochemical method to determine the mineralogy. The method used is similar to the published programs MinLith and SedNorm but differs from those programs by using XRD to determine which major minerals to include. A portion of each sample was pressed into a pellet and analyzed for major elements by x-ray fluorescence. The instrument used was a Bruker Tracer III-SD, which when used with the tube and detector under vacuum, is capable of detecting sodium and elements of higher atomic number. The raw spectral information from the instrument is converted into an elemental analysis using a conversion matrix supplied by the manufacturer. The resulting elemental concentrations were then slightly corrected for instrument and other variations using an N.I.S.T. certified standard and an in-house shale sample that was analyzed by a certified commercial lab. The carbon dioxide content of each sample was determined using a calcimeter. Because XRF cannot determine the oxidation state of an element, all of the iron was assumed to be in the ferric (+3) oxidation state in the mineral calculations. This is a realistic assumption because all of the samples were red, indicative of ferric iron. Because no pyrite was detected, all of the sulfur was assumed to be in the +6-oxidation state and exist as sulfate. The results of the chemical analyses are presented in Table 6.

The method used to derive mineralogy from the chemical analyses is outlined here.

- Step 1. Convert the elemental analyses that are in weight percent into number of moles of each element.
- Step 2. Allot all titanium to rutile, manganese to pyrolusite and iron to hematite.
- Step 3. Allot all phosphorus to apatite. Remove the corresponding amount of calcium from the original amount.
- Step 4. Allot all sulfur to gypsum. Remove the corresponding amount of calcium.
- Step 5. From XRD, calculate the calcite to dolomite ratio and allot the carbon dioxide accordingly.
- Step 6. Use the CO2 allotted to calcite to create calcite and reduce calcium by the appropriate amount. In the current set of samples, using the calcite to dolomite ratio from XRD resulted in numerous problems further along in the calculations, so the ratios had to be reduced to resolve those issues. The ratios that worked were closer to those suggested by the pressure behaviors during the calcimeter analyses.

Table 6. Results of the chemical analyses. The top part contains the elemental values and the lower part has the values converted to oxides.

	A-1	A-2	A-3	ASM-1	ASM-2	L3-03 RM	L5-01 C	L5-01 Unk	L5-01 W	L5-01A RB	L5-01A RU	L5-03 RM	L5-03B	L-Comp W
Na	0.28	0.30	0.13	0.12	0.28	0.38	0.15	0.24	0.12	0.08	0.07	0.26	-0.04	0.15
Mg	0.94	0.86	2.01	1.53	0.88	1.09	1.69	1.68	1.71	1.73	1.66	1.42	2.24	2.16
Al	1.46	1.53	3.86	1.91	1.52	3.49	3.72	4.15	2.54	2.50	3.21	3.78	4.13	4.48
Si	41.35	41.30	34.86	43.86	42.29	36.25	37.83	35.70	37.75	41.64	37.90	36.95	35.23	33.46
P	0.07	0.07	0.10	0.08	0.06	0.07	0.09	0.08	0.10	0.08	0.08	0.08	0.09	0.10
S	0.14	0.14	0.14	0.16	0.14	0.14	0.15	0.14	0.19	0.16	0.17	0.15	0.16	0.21
K	1.32	1.25	1.63	1.47	1.26	1.35	1.42	1.35	1.39	1.45	1.52	1.31	1.89	1.91
Ca	1.51	1.45	4.72	0.89	1.00	3.31	3.19	3.92	4.60	2.26	3.45	3.33	4.81	4.63
Ti	0.08	0.10	0.23	0.08	0.08	0.22	0.19	0.21	0.22	0.19	0.19	0.23	0.23	0.36
Mn	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.04
Fe	0.56	0.63	1.57	0.70	0.66	1.38	1.35	1.53	0.95	1.41	1.45	1.39	1.83	1.70
CO2	1.59	1.49	3.81	0.82	0.89	2.47	2.88	2.51	2.85	2.6	3.07	2.48	4.36	3.37

	A-1	A-2	A-3	ASM-1	ASM-2	L3-03 RM	L5-01 C	L5-01 Unk	L5-01 W	L5-01A RB	L5-01A RU	L5-03 RM	L5-03B	L-Comp W
Na2O	0.37	0.41	0.18	0.16	0.37	0.51	0.20	0.32	0.17	0.11	0.10	0.35	-0.05	0.20
MgO	1.56	1.42	3.33	2.53	1.46	1.81	2.80	2.79	2.83	2.88	2.76	2.35	3.72	3.59
Al2O3	2.77	2.90	7.29	3.61	2.87	6.59	7.03	7.83	4.80	4.73	6.06	7.14	7.81	8.46
SiO2	88.46	88.36	74.57	93.84	90.47	77.55	80.94	76.37	80.77	89.08	81.08	79.05	75.36	71.58
P2O5	0.15	0.16	0.22	0.18	0.14	0.16	0.20	0.19	0.24	0.19	0.19	0.19	0.21	0.23
SO3	0.34	0.36	0.35	0.40	0.35	0.35	0.38	0.35	0.47	0.40	0.41	0.38	0.41	0.52
K2O	1.59	1.50	1.96	1.77	1.52	1.62	1.70	1.63	1.68	1.75	1.83	1.57	2.27	2.30
CaO	2.11	2.02	6.61	1.25	1.39	4.64	4.47	5.48	6.44	3.16	4.83	4.66	6.73	6.48
TiO2	0.08	0.10	0.23	0.08	0.08	0.22	0.19	0.21	0.22	0.19	0.19	0.23	0.23	0.36
MnO	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.05
FeO	0.80	0.81	2.02	0.89	0.85	1.77	1.74	1.97	1.22	1.81	1.87	1.78	2.35	2.19
CO2	1.59	1.49	3.81	0.82	0.89	2.47	2.88	2.51	2.85	2.6	3.07	2.48	4.36	3.37
Sum	99.88	99.57	100.61	105.60	100.46	97.75	102.58	99.69	101.73	106.95	102.44	100.22	103.48	99.32

- Step 7. Create dolomite with the remaining CO2. Reduce calcium and magnesium accordingly. If either calcium or magnesium overused, set the amount remaining to zero
- Step 8. Use the remaining calcium to form anorthite, the calcium-rich component of plagioclase feldspar. Reduce aluminum and silicon.
- Step 9. Apportion the sodium between albite (a component of plagioclase feldspar) and smectite (expandable clay minerals).
- Step 10. Use the designated amount of sodium to make albite, the sodium-rich plagioclase feldspar. Reduce aluminum and silicon.
- Step 11. Apportion potassium between orthoclase feldspar and illite (potassium-bearing clay mineral).
- Step 12. Use the potassium to create orthoclase feldspar. Reduce aluminum and silicon.
- Step 13. Use the remaining potassium to form illite. Reduce silicon and aluminum.
- Step 14. Use the remaining sodium to form smectite, which are expandable clay minerals.
- Reduce silicon, aluminum and magnesium.
- Step 13. Use up the remaining magnesium to make clinochlore, a chlorite mineral. Remove the appropriate amounts of aluminum and silicon.
- Step 12. Use the remaining aluminum to form the clay mineral kaolinite. Reduce silicon correspondingly.
- Step 12. Use the remaining silicon to form the mineral quartz. At this point, all of the major mineral-forming elements are accounted for. Trace elements in the ppm range are ignored.
- If the calculations give negative results for elements from step 10 or farther along, adjust the original estimated mineral ratios and re-run the spreadsheet again.

The results of these calculations were previously presented in Table 2. The shortcoming of this spreadsheet method is that it requires an estimation of the ratios of albite to smectite to partition sodium and the ratio of orthoclase to illite to partition potassium. These were estimated from the original XRD patterns, but had to be adjusted to balance the chemistry and mineralogy.

Clay mineral analyses

Because clay mineral composition of the samples was requested, a separate set of analyses was done to provide this information. Twenty grams of each sample were removed and placed in a NutraBullet mechanical disintegrator along with 5 ml of Calgon solution and 200 ml of water. The device was run for one minute per sample to disaggregate the clays and put them into suspension. The suspension was allowed to sit for 8 hours after which the upper approximately 9 cm were removed. (Clay minerals are for the most part smaller than 2 microns. The settling velocity of 2-micron equivalent spherical diameter particles in water at room temperature is 10 cm in 8 hours and 19 minutes). Magnesium sulfate was added to the separated suspensions to both flocculate the clays and to magnesium-saturate any ion exchange positions. The original material re-agitated and a new but more dilute suspension created. After the appropriate the less-than 2-micron material was removed and added to the original separation. The clays were then concentrated by centrifuge. The water was removed and oriented slides of the clays were made by the smear method. After the clays had dried, each slide was x-rayed in the unaltered state, after saturation with ethylene glycol and finally, after heating to 550° C. The plain unaltered slides allow

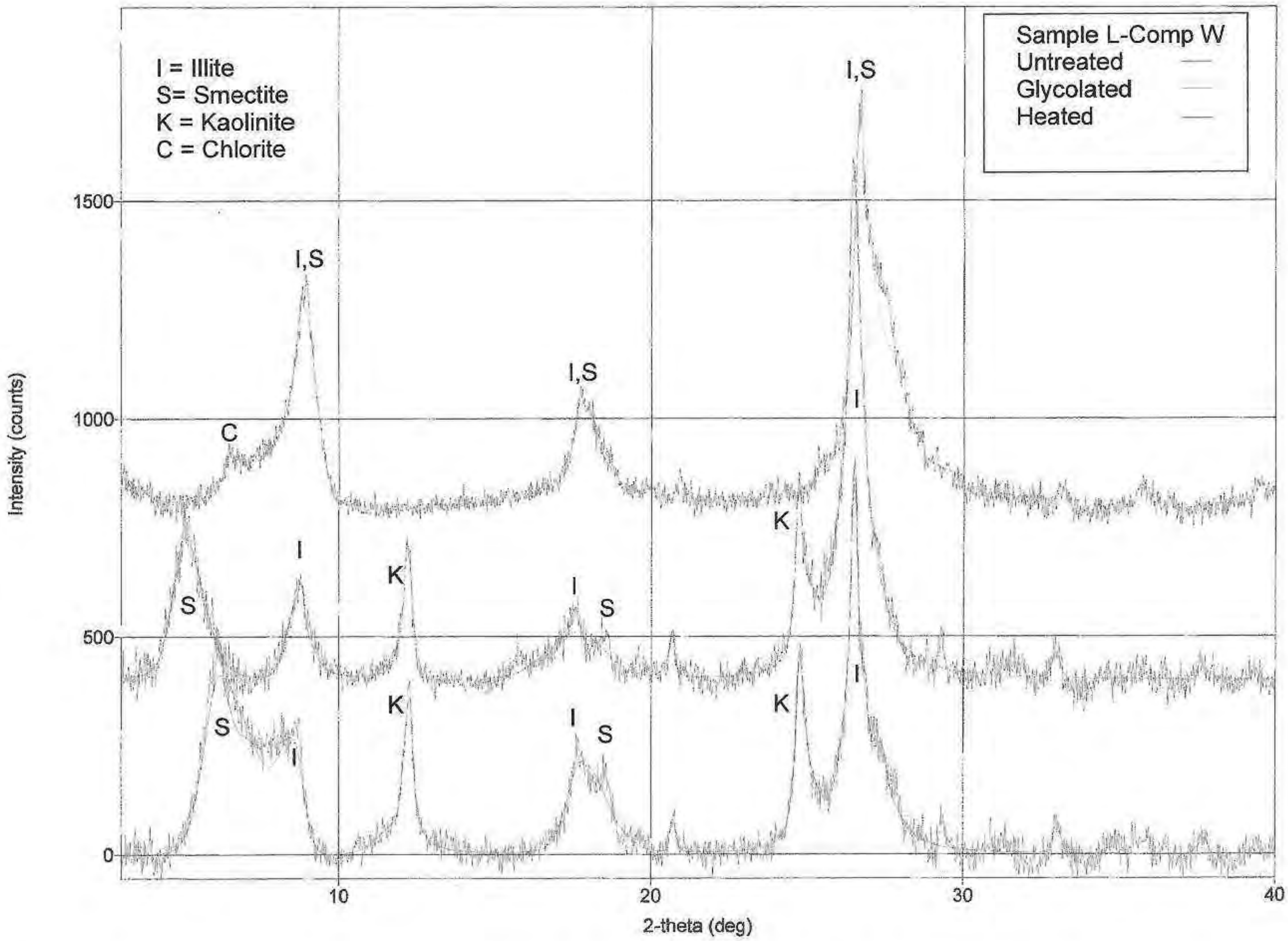

Figure 2. Stacked XRD patterns showing the behavior of the identified clay minerals under different conditions.

the identification of most of the minerals that might be present but because of peak overlaps do not allow for very good estimations of relative amounts of the minerals present. The ethylene glycol treatment expands any smectite clays and separates them from illite so that the presence of an expandable clay mineral is confirmed. The separation of the smectite and illite components allows for much better measurement of the area under the curves. The heat treatment collapses any expandable layers to approximately 9.9 angstroms but more importantly destroys kaolinite. This treatment reveals any 14-angstrom chlorite that might have been hidden within the smectite peak in the plain and glycolated samples. Figure 2 shows a typical set of the patterns, in this case stacked peak shifts caused by the various treatments. The x-ray patterns and the corresponding areas under the curve as well as other diffraction peak information are in Appendix 3. The results of the analyses were presented earlier in Table 2. They were incorporated into Table 1 by multiplying the relative amounts of the four clay minerals identified by the amount of total clay calculated by the "Chemistry to Mineralogy" spreadsheet program described earlier.

Respectfully submitted,

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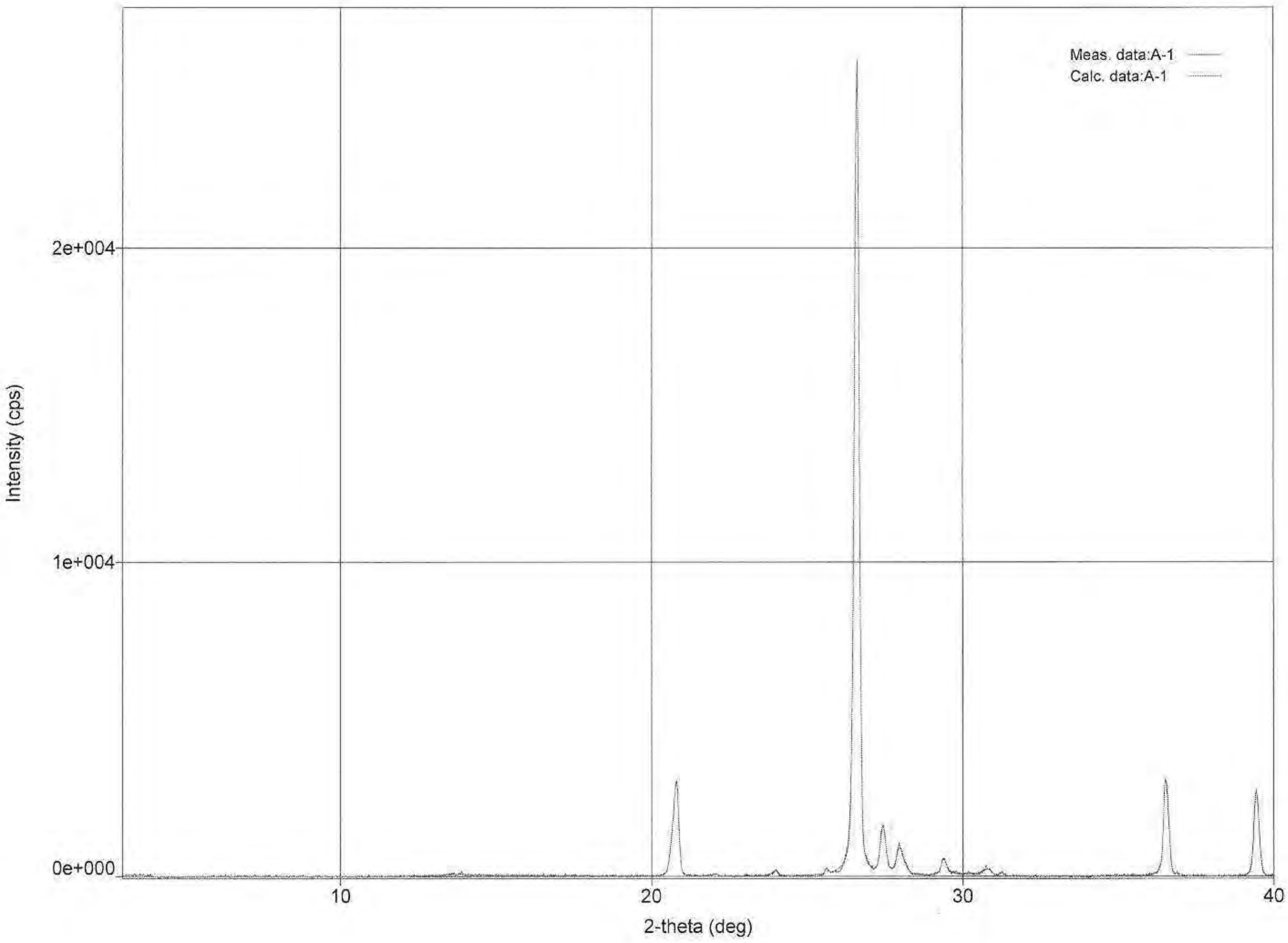
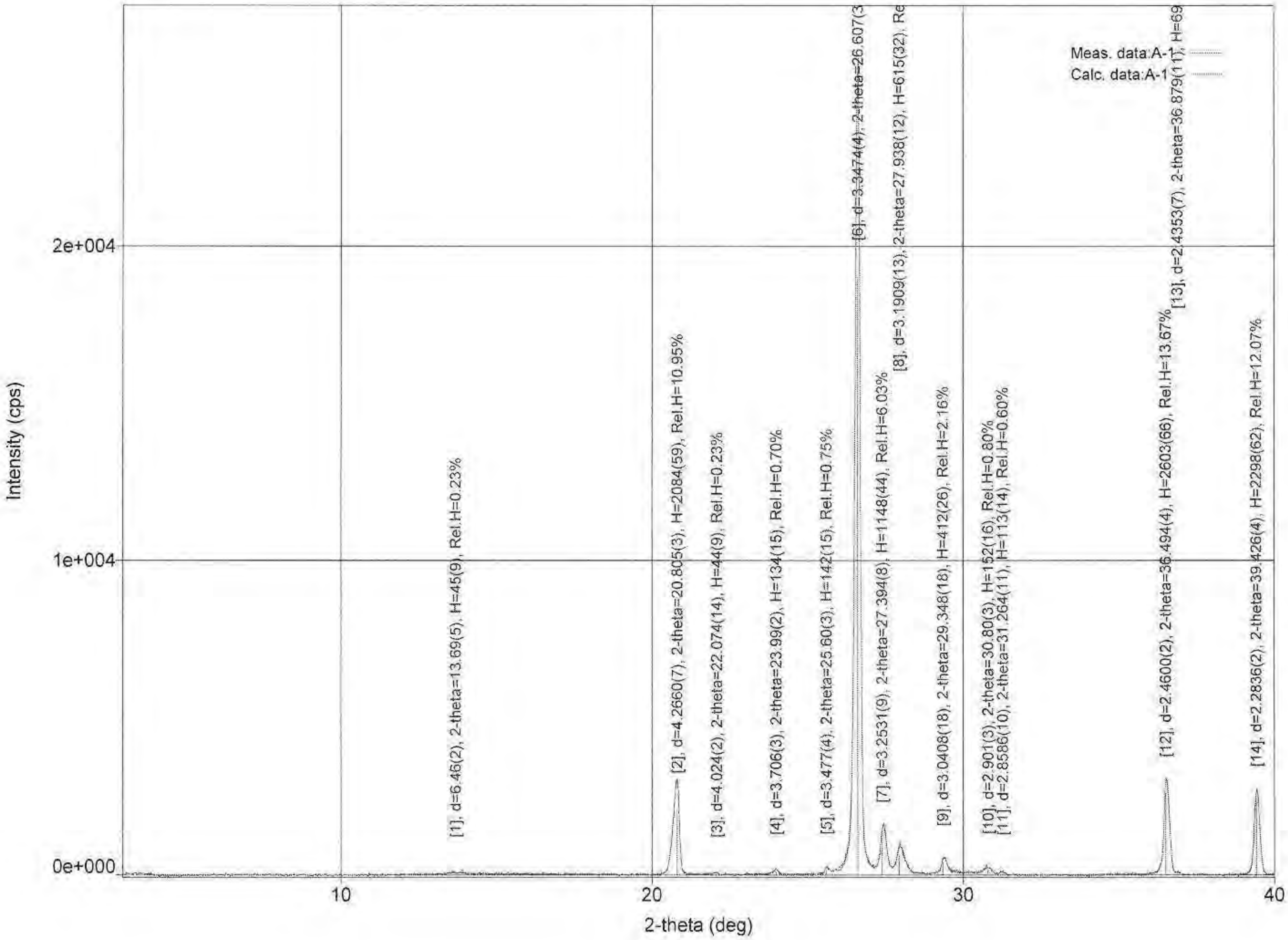
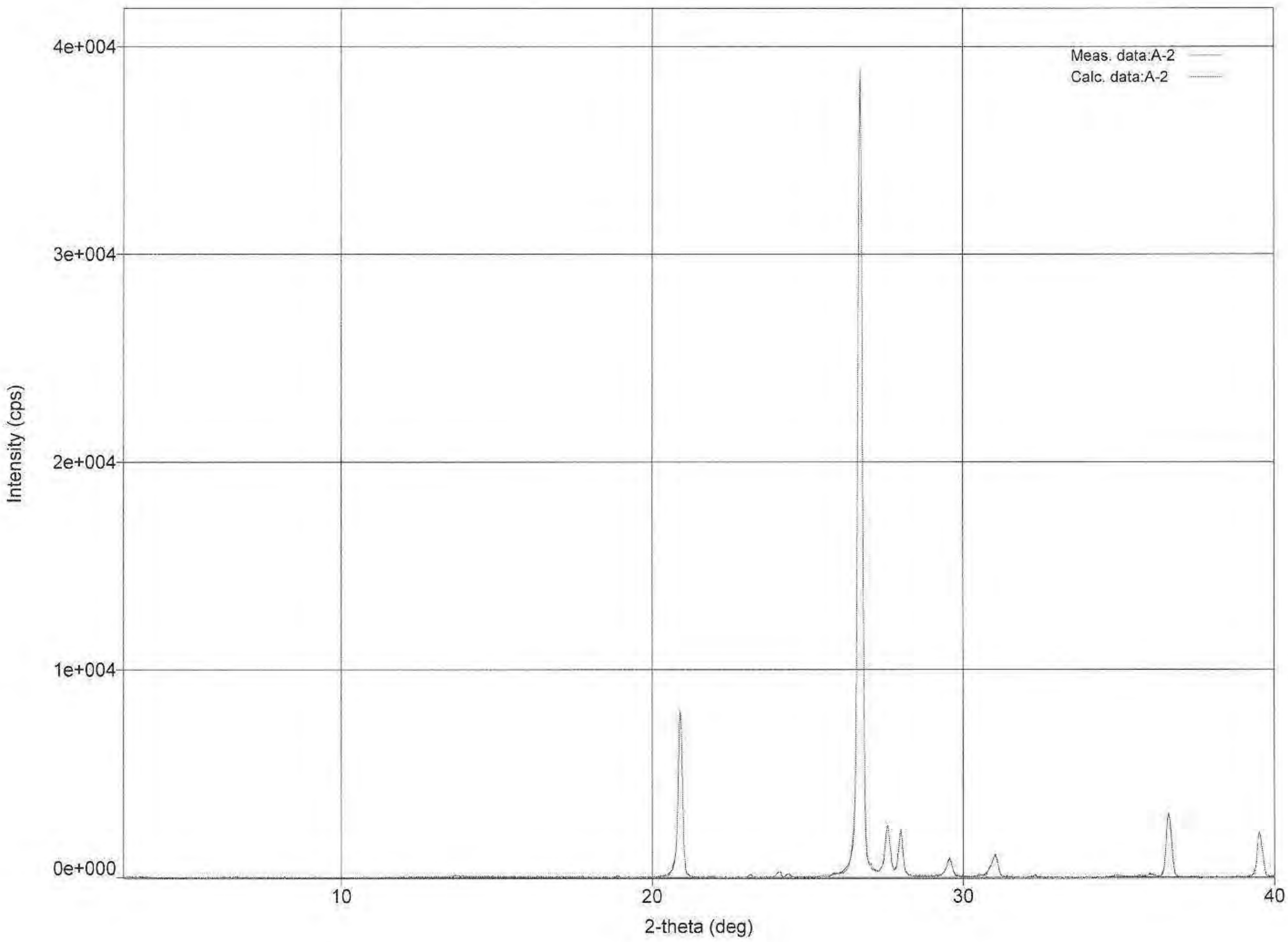
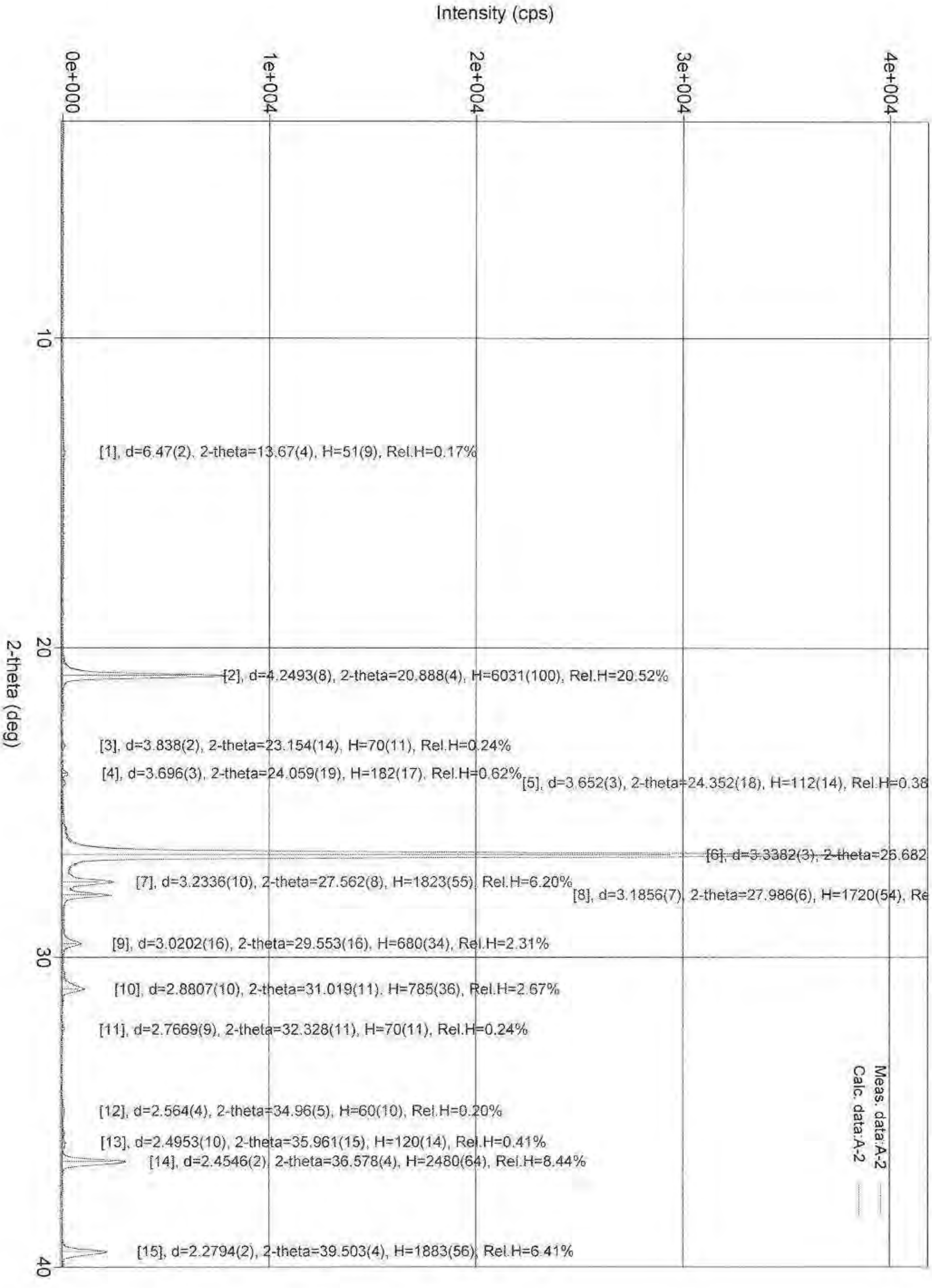
Appendix 1. X-ray diffraction patterns of the bulk samples. Each pattern set contains three items: the unmarked pattern, the same pattern with peak information on the pattern, and a list of the peaks and corresponding information.


Meas. data:A-1
Calc. data:A-1
Intensity (cps)
2e+004
1e+004
0e+000
10
20
30
40
2-theta (deg)

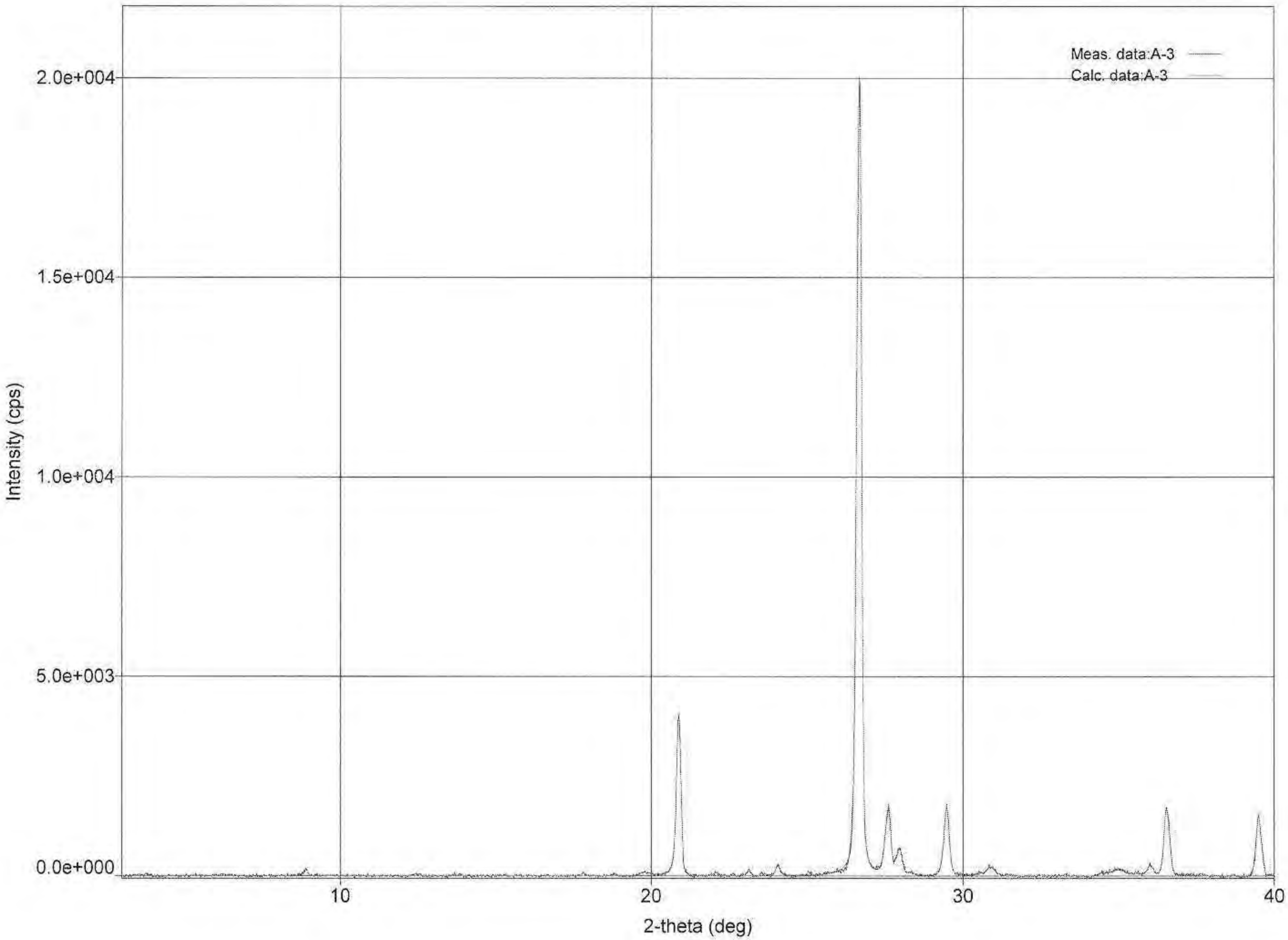

Intensity (cps)
2e+004
1e+004
0e+000
10
20
30
40
2-theta (deg)
Meas. data:A-1
Calc. data:A-1
[1], d=6.46(2), 2-theta=13.69(5), H=45(9), Rel.H=0.23%
[2], d=4.2660(7), 2-theta=20.805(3), H=2084(59), Rel.H=10.95%
[3], d=4.024(2), 2-theta=22.074(14), H=44(9), Rel.H=0.23%
[4], d=3.706(3), 2-theta=23.99(2), H=134(15), Rel.H=0.70%
[5], d=3.477(4), 2-theta=25.60(3), H=142(15), Rel.H=0.75%
[6], d=3.3474(4), 2-theta=26.607(3
[7], d=3.2531(9), 2-theta=27.394(8), H=1148(44), Rel.H=6.03%
[8], d=3.1909(13), 2-theta=27.938(12), H=615(32), Re
[9], d=3.0408(18), 2-theta=29.348(18), H=412(26), Rel.H=2.16%
[10], d=2.901(3), 2-theta=30.80(3), H=152(16), Rel.H=0.80%
[11], d=2.8586(10), 2-theta=31.264(11), H=113(14), Rel.H=0.60%
[12], d=2.4600(2), 2-theta=36.494(4), H=2603(66), Rel.H=13.67%
[13], d=2.4353(7), 2-theta=36.879(11), H=69
[14], d=2.2836(2), 2-theta=39.426(4), H=2298(62), Rel.H=12.07%

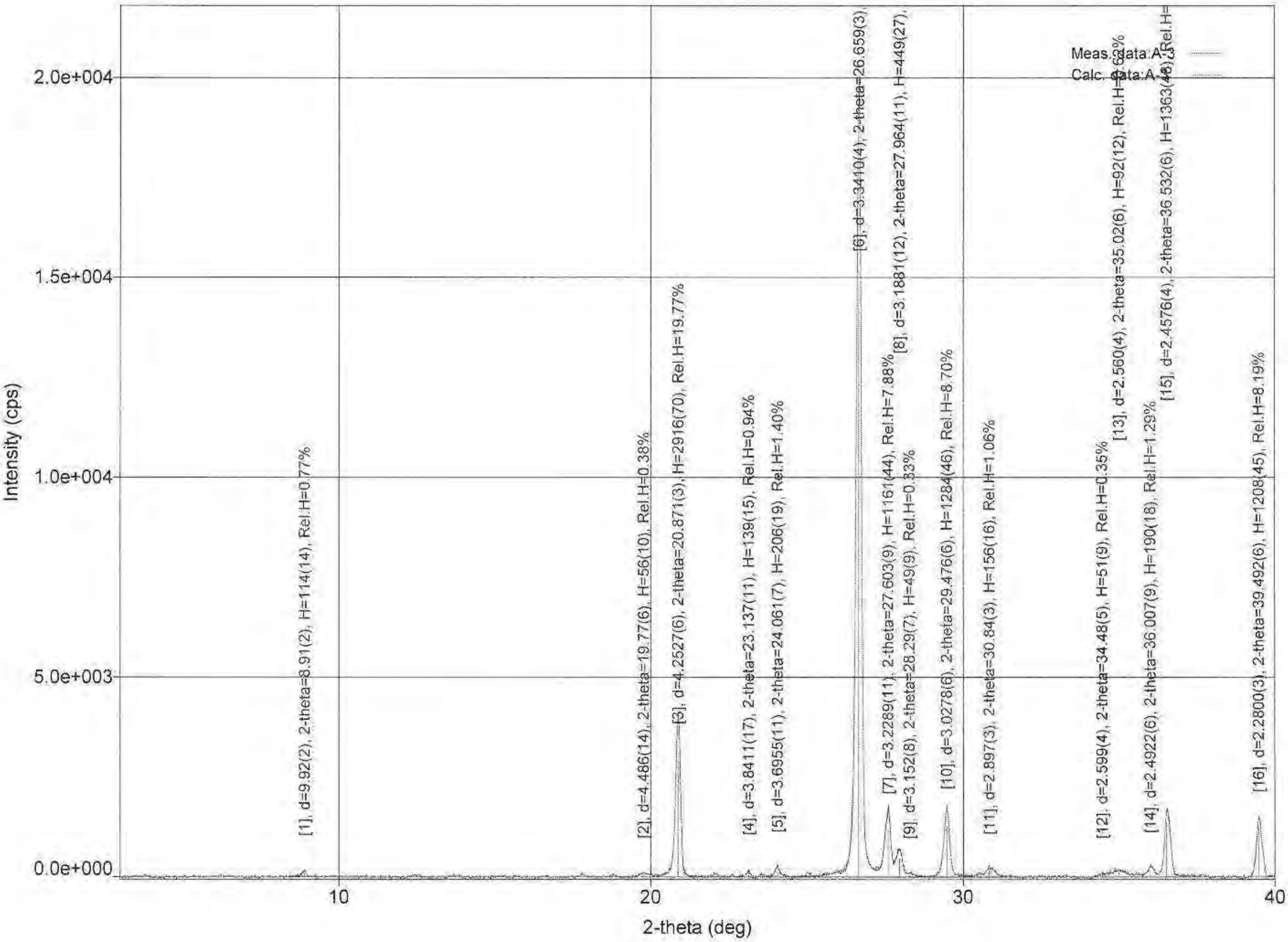
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	13.69(5)	6.46(2)	45(9)	1.8(2)	156(8)	3.5(9)	47(5)
▨ 2	20.805(3)	4.2660(7)	2084(59)	0.213(2)	512(4)	0.246(9)	395(5)
▨ 3	22.074(14)	4.024(2)	44(9)	0.25(6)	15(3)	0.34(12)	337(82)
▨ 4	23.99(2)	3.706(3)	134(15)	0.17(4)	38(3)	0.29(5)	497(129)
▨ 5	25.60(3)	3.477(4)	142(15)	0.08(4)	13(4)	0.09(4)	1028(439)
▨ 6	26.607(3)	3.3474(4)	19039(178)	0.161(2)	3797(26)	0.199(3)	529(7)
▨ 7	27.394(8)	3.2531(9)	1148(44)	0.176(9)	277(7)	0.241(15)	486(25)
▨ 8	27.938(12)	3.1909(13)	615(32)	0.264(14)	223(6)	0.36(3)	324(17)
▨ 9	29.348(18)	3.0408(18)	412(26)	0.17(3)	118(5)	0.29(3)	517(101)
▨ 10	30.80(3)	2.901(3)	152(16)	0.36(5)	97(7)	0.63(11)	237(32)
▨ 11	31.264(11)	2.8586(10)	113(14)	0.10(3)	19(4)	0.17(6)	886(301)
▨ 12	36.494(4)	2.4600(2)	2603(66)	0.146(3)	476(5)	0.183(7)	600(14)
▨ 13	36.879(11)	2.4353(7)	69(11)	0.08(3)	7.0(18)	0.10(4)	1082(343)
▨ 14	39.426(4)	2.2836(2)	2298(62)	0.150(4)	404(5)	0.176(7)	589(15)


Meas. data:A-2
Calc. data:A-2
4e+004
3e+004
2e+004
1e+004
0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

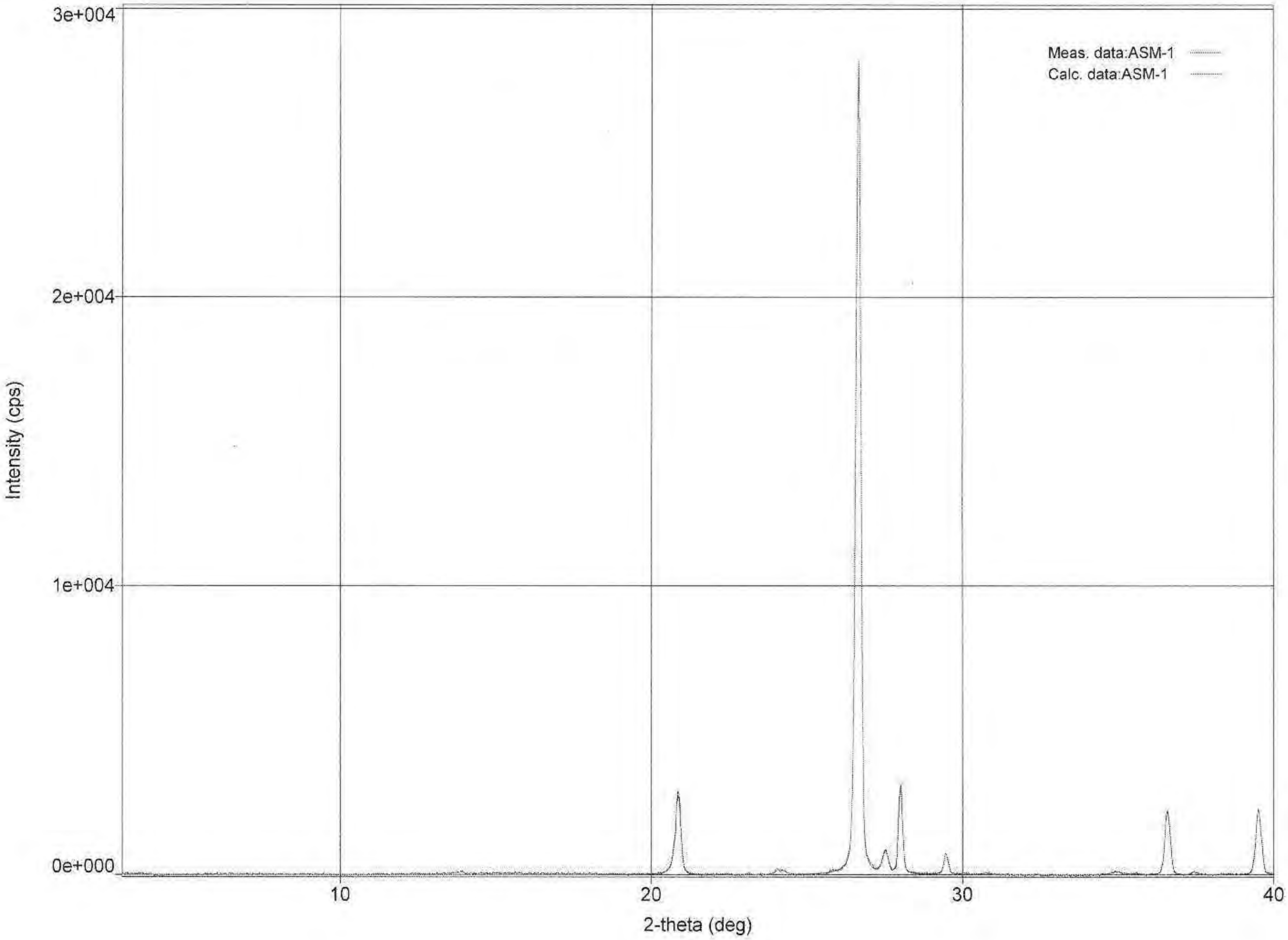

Intensity (cps)
0e+000
1e+004
2e+004
3e+004
4e+004
2-theta (deg)
10
20
30
40
[1], d=6.47(2), 2-theta=13.67(4), H=51(9), Rel.H=0.17%
[2], d=4.2493(8), 2-theta=20.888(4), H=6031(100), Rel.H=20.52%
[3], d=3.838(2), 2-theta=23.154(14), H=70(11), Rel.H=0.24%
[4], d=3.696(3), 2-theta=24.059(19), H=182(17), Rel.H=0.62%
[5], d=3.652(3), 2-theta=24.352(18), H=112(14), Rel.H=0.38
[6], d=3.3382(3), 2-theta=26.682
[7], d=3.2336(10), 2-theta=27.562(8), H=1823(55), Rel.H=6.20%
[8], d=3.1856(7), 2-theta=27.986(6), H=1720(54), Re
[9], d=3.0202(16), 2-theta=29.553(16), H=680(34), Rel.H=2.31%
[10], d=2.8807(10), 2-theta=31.019(11), H=785(36), Rel.H=2.67%
[11], d=2.7669(9), 2-theta=32.328(11), H=70(11), Rel.H=0.24%
[12], d=2.564(4), 2-theta=34.96(5), H=60(10), Rel.H=0.20%
[13], d=2.4953(10), 2-theta=35.961(15), H=120(14), Rel.H=0.41%
[14], d=2.4546(2), 2-theta=36.578(4), H=2480(64), Rel.H=8.44%
[15], d=2.2794(2), 2-theta=39.503(4), H=1883(56), Rel.H=6.41%
Meas. data:A-2
Calc. data:A-2

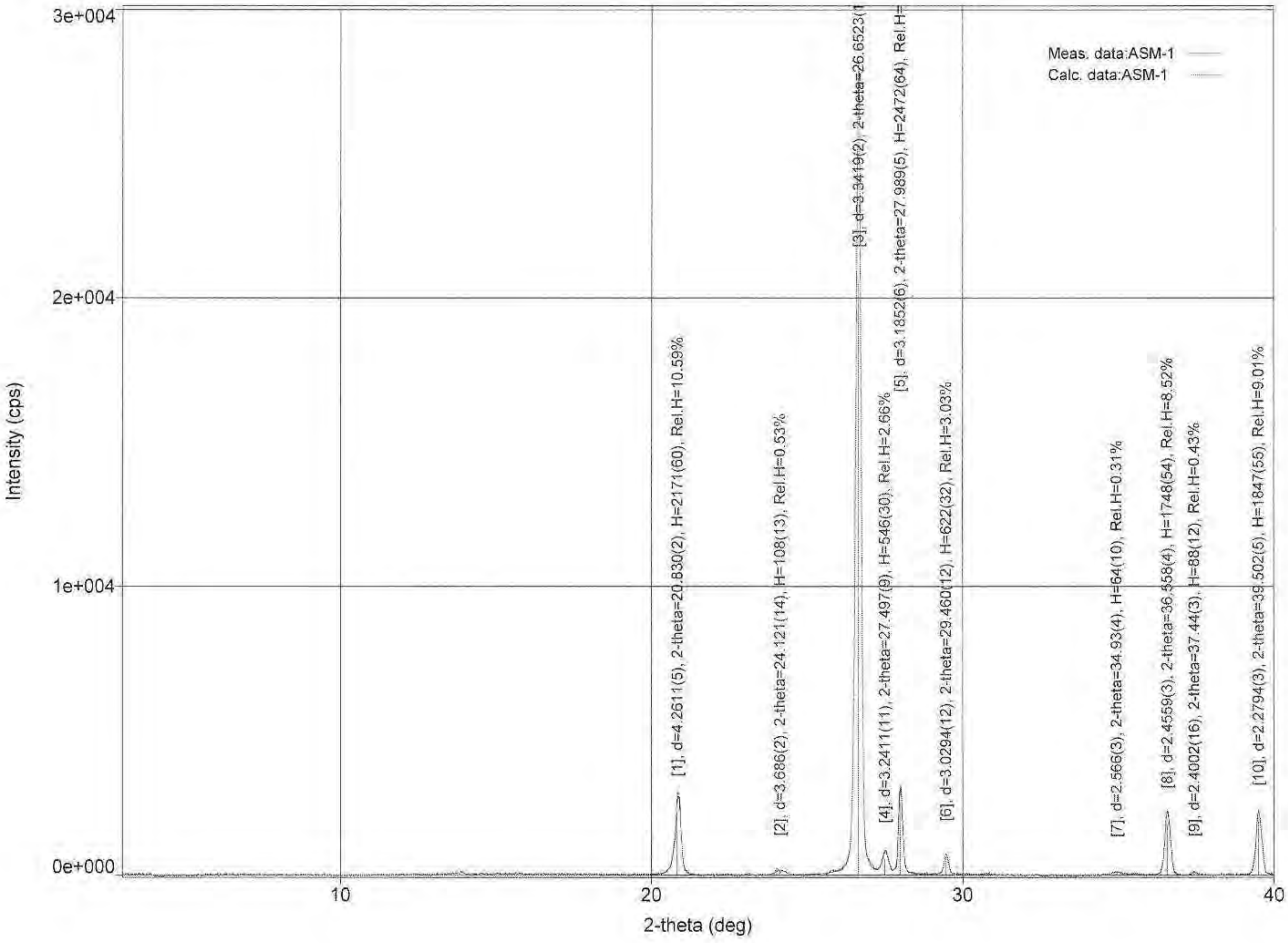
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	13.67(4)	6.47(2)	51(9)	1.6(2)	179(10)	3.5(8)	51(6)
☐ 2	20.888(4)	4.2493(8)	6031(100)	0.128(3)	1005(11)	0.167(5)	658(17)
☐ 3	23.154(14)	3.838(2)	70(11)	0.17(4)	12(3)	0.18(8)	512(126)
☐ 4	24.059(19)	3.696(3)	182(17)	0.144(15)	28(3)	0.15(3)	588(60)
☐ 5	24.352(18)	3.652(3)	112(14)	0.13(3)	15.3(17)	0.14(3)	662(132)
☐ 6	26.682(3)	3.3382(3)	29393(221)	0.1466(17)	5247(36)	0.179(3)	582(7)
☐ 7	27.562(8)	3.2336(10)	1823(55)	0.153(10)	397(10)	0.218(12)	559(35)
☐ 8	27.986(6)	3.1856(7)	1720(54)	0.123(9)	301(9)	0.175(11)	697(51)
☐ 9	29.553(16)	3.0202(16)	680(34)	0.169(17)	179(5)	0.26(2)	509(50)
☐ 10	31.019(11)	2.8807(10)	785(36)	0.210(12)	245(5)	0.31(2)	409(24)
☐ 11	32.328(11)	2.7669(9)	70(11)	0.16(3)	12(3)	0.18(6)	524(104)
☐ 12	34.96(5)	2.564(4)	60(10)	0.53(10)	54(6)	0.9(2)	164(31)
☐ 13	35.961(15)	2.4953(10)	120(14)	0.12(3)	25(3)	0.21(5)	703(150)
☐ 14	36.578(4)	2.4546(2)	2480(64)	0.155(3)	433(5)	0.175(6)	564(10)
☐ 15	39.503(4)	2.2794(2)	1883(56)	0.140(4)	321(5)	0.170(8)	628(18)


Meas. data:A-3
Calc. data:A-3
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

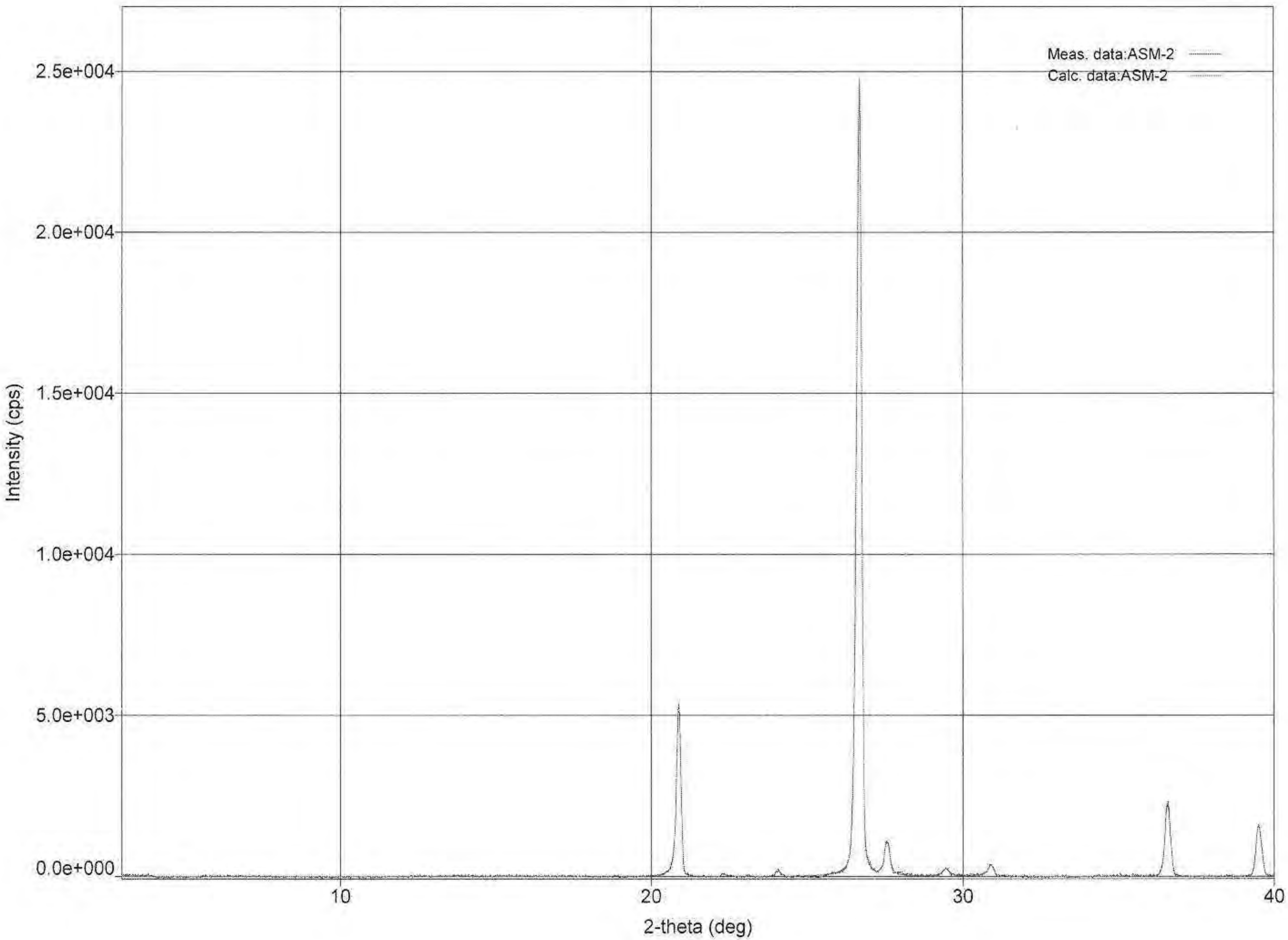

Meas. data:A-3
Calc. data:A-3
[1], d=9.92(2), 2-theta=8.91(2), H=114(14), Rel.H=0.77%
[2], d=4.486(14), 2-theta=19.77(6), H=56(10), Rel.H=0.38%
[3], d=4.2527(6), 2-theta=20.871(3), H=2916(70), Rel.H=19.77%
[4], d=3.8411(17), 2-theta=23.137(11), H=139(15), Rel.H=0.94%
[5], d=3.6955(11), 2-theta=24.061(7), H=206(19), Rel.H=1.40%
[6], d=3.3410(4), 2-theta=26.659(3),
[7], d=3.2289(11), 2-theta=27.603(9), H=1161(44), Rel.H=7.88%
[8], d=3.1881(12), 2-theta=27.964(11), H=449(27),
[9], d=3.152(8), 2-theta=28.29(7), H=49(9), Rel.H=0.33%
[10], d=3.0278(6), 2-theta=29.476(6), H=1284(46), Rel.H=8.70%
[11], d=2.897(3), 2-theta=30.84(3), H=156(16), Rel.H=1.06%
[12], d=2.599(4), 2-theta=34.48(5), H=51(9), Rel.H=0.35%
[13], d=2.560(4), 2-theta=35.02(6), H=92(12), Rel.H=0.62%
[14], d=2.4922(6), 2-theta=36.007(9), H=190(18), Rel.H=1.29%
[15], d=2.4576(4), 2-theta=36.532(6), H=1363(48), Rel.H=
[16], d=2.2800(3), 2-theta=39.492(6), H=1208(45), Rel.H=8.19%
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

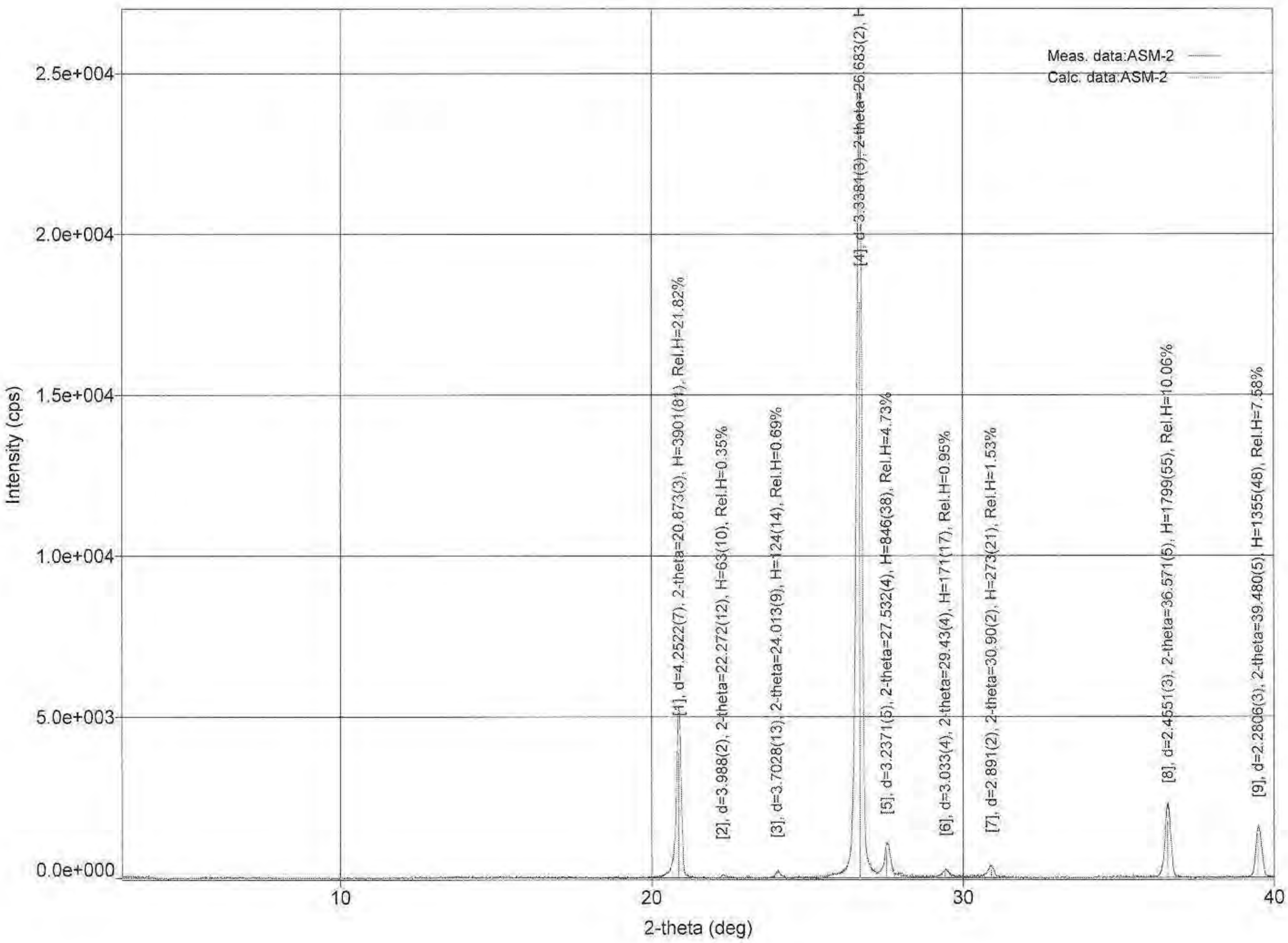
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	8.91(2)	9.92(2)	114(14)	0.12(3)	22(2)	0.19(4)	696(160)
☐ 2	19.77(6)	4.486(14)	56(10)	0.32(5)	20(4)	0.36(13)	267(46)
☐ 3	20.871(3)	4.2527(6)	2916(70)	0.151(2)	543(5)	0.186(6)	558(8)
☐ 4	23.137(11)	3.8411(17)	139(15)	0.074(15)	17(2)	0.12(3)	1151(232)
☐ 5	24.061(7)	3.6955(11)	206(19)	0.12(2)	38(3)	0.19(3)	692(123)
☐ 6	26.659(3)	3.3410(4)	14748(157)	0.161(2)	2894(20)	0.196(3)	529(6)
☐ 7	27.603(9)	3.2289(11)	1161(44)	0.192(7)	259(8)	0.223(15)	444(17)
☐ 8	27.964(11)	3.1881(12)	449(27)	0.24(2)	125(13)	0.28(5)	355(32)
☐ 9	28.29(7)	3.152(8)	49(9)	0.4(3)	21(13)	0.4(3)	228(154)
☐ 10	29.476(6)	3.0278(6)	1284(46)	0.171(5)	271(4)	0.211(11)	502(15)
☐ 11	30.84(3)	2.897(3)	156(16)	0.31(4)	72(5)	0.46(8)	281(36)
☐ 12	34.48(5)	2.599(4)	51(9)	0.30(13)	24(14)	0.5(4)	291(129)
☐ 13	35.02(6)	2.560(4)	92(12)	0.54(10)	79(15)	0.9(3)	160(28)
☐ 14	36.007(9)	2.4922(6)	190(18)	0.17(2)	39(3)	0.21(3)	512(60)
☐ 15	36.532(6)	2.4576(4)	1363(48)	0.167(5)	274(5)	0.201(10)	524(16)
☐ 16	39.492(6)	2.2800(3)	1208(45)	0.166(5)	219(5)	0.182(11)	532(17)


Meas. data:ASM-1
Calc. data:ASM-1
3e+004
2e+004
1e+004
0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

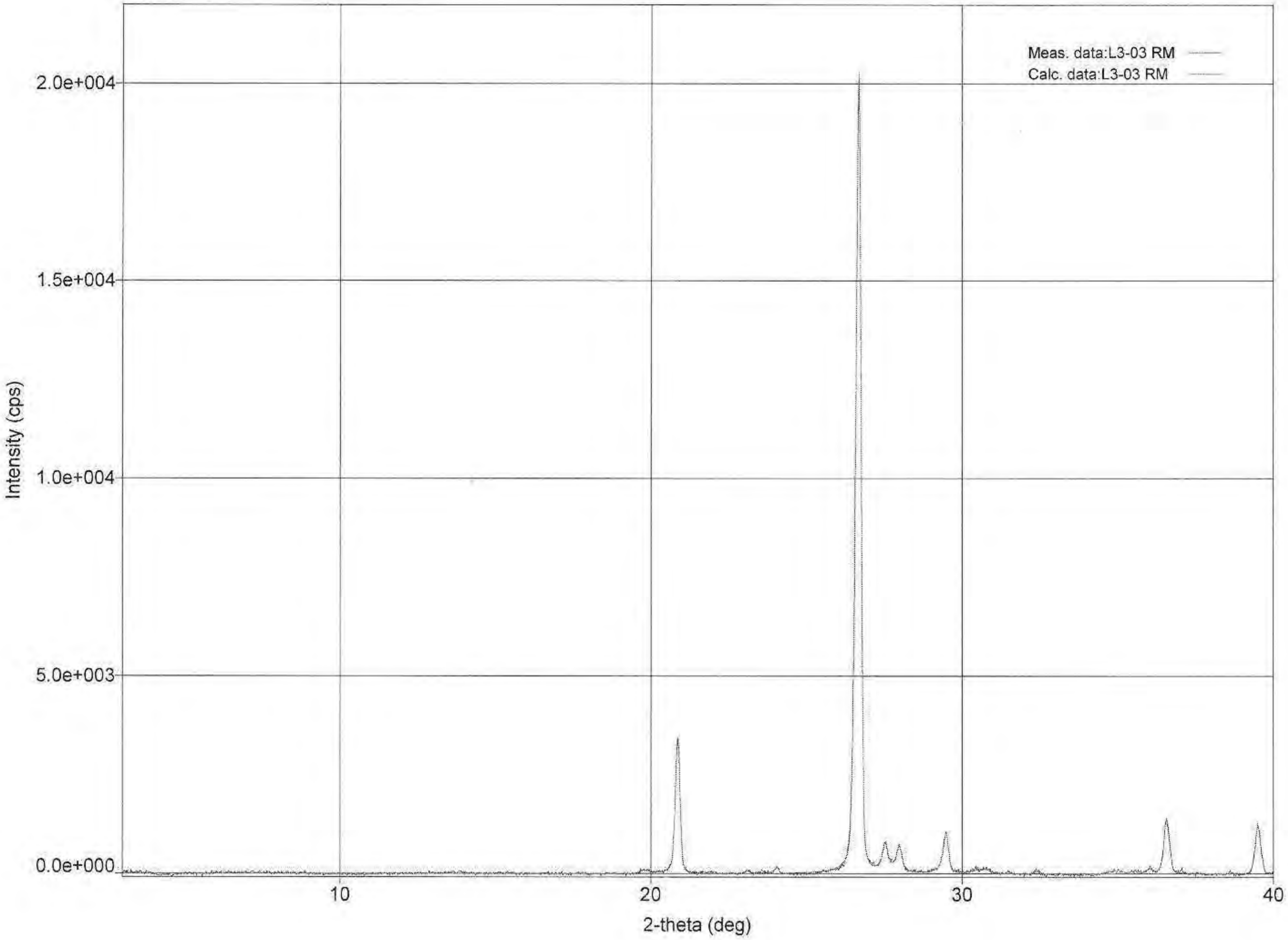

Meas. data:ASM-1
Calc. data:ASM-1
[1], d=4.2611(5), 2-theta=20.830(2), H=2171(60), Rel.H=10.59%
[2], d=3.686(2), 2-theta=24.121(14), H=108(13), Rel.H=0.53%
[3], d=3.3419(2), 2-theta=26.6523(
[4], d=3.2411(11), 2-theta=27.497(9), H=546(30), Rel.H=2.66%
[5], d=3.1852(6), 2-theta=27.989(5), H=2472(64), Rel.H=
[6], d=3.0294(12), 2-theta=29.460(12), H=622(32), Rel.H=3.03%
[7], d=2.566(3), 2-theta=34.93(4), H=64(10), Rel.H=0.31%
[8], d=2.4559(3), 2-theta=36.558(4), H=1748(54), Rel.H=8.52%
[9], d=2.4002(16), 2-theta=37.44(3), H=88(12), Rel.H=0.43%
[10], d=2.2794(3), 2-theta=39.502(5), H=1847(55), Rel.H=9.01%
Intensity (cps)
0e+000
1e+004
2e+004
3e+004
10
20
30
40
2-theta (deg)

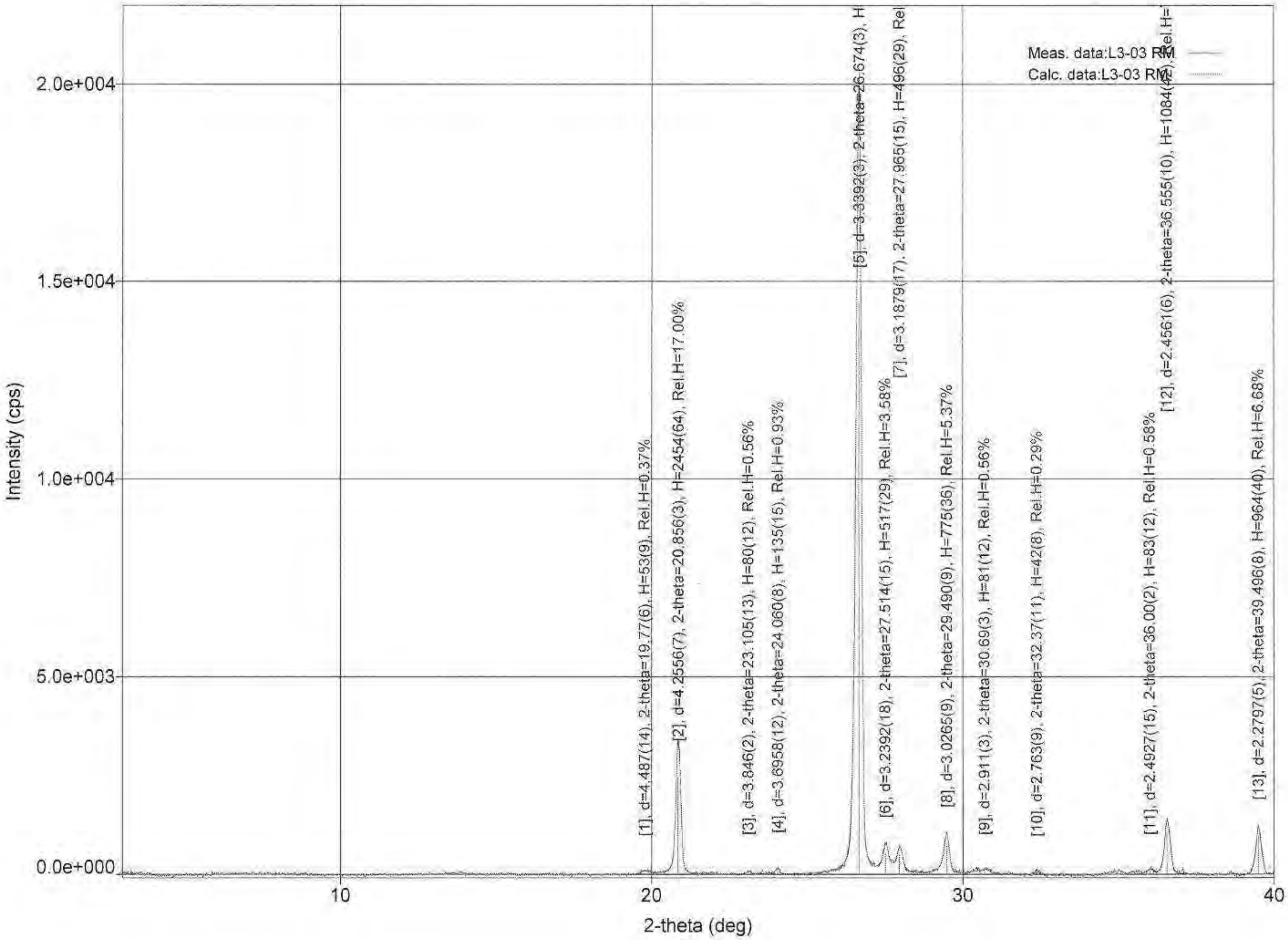
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	20.830(2)	4.2611(5)	2171(60)	0.148(5)	486(7)	0.224(9)	570(19)
☐ 2	24.121(14)	3.686(2)	108(13)	0.37(4)	42(5)	0.39(10)	231(22)
☐ 3	26.6523(19)	3.3419(2)	20510(185)	0.1683(13)	4154(19)	0.203(3)	507(4)
☐ 4	27.497(9)	3.2411(11)	546(30)	0.211(12)	145(5)	0.27(2)	404(24)
☐ 5	27.989(5)	3.1852(6)	2472(64)	0.119(5)	369(7)	0.149(7)	720(28)
☐ 6	29.460(12)	3.0294(12)	622(32)	0.116(14)	109(4)	0.175(15)	741(92)
☐ 7	34.93(4)	2.566(3)	64(10)	0.44(6)	45(5)	0.69(19)	196(26)
☐ 8	36.558(4)	2.4559(3)	1748(54)	0.166(3)	332(3)	0.190(8)	526(9)
☐ 9	37.44(3)	2.4002(16)	88(12)	0.13(3)	14(2)	0.15(4)	687(154)
☐ 10	39.502(5)	2.2794(3)	1847(55)	0.163(4)	355(4)	0.192(8)	542(13)


Meas. data:ASM-2
Calc. data:ASM-2
Intensity (cps)
2.5e+004
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

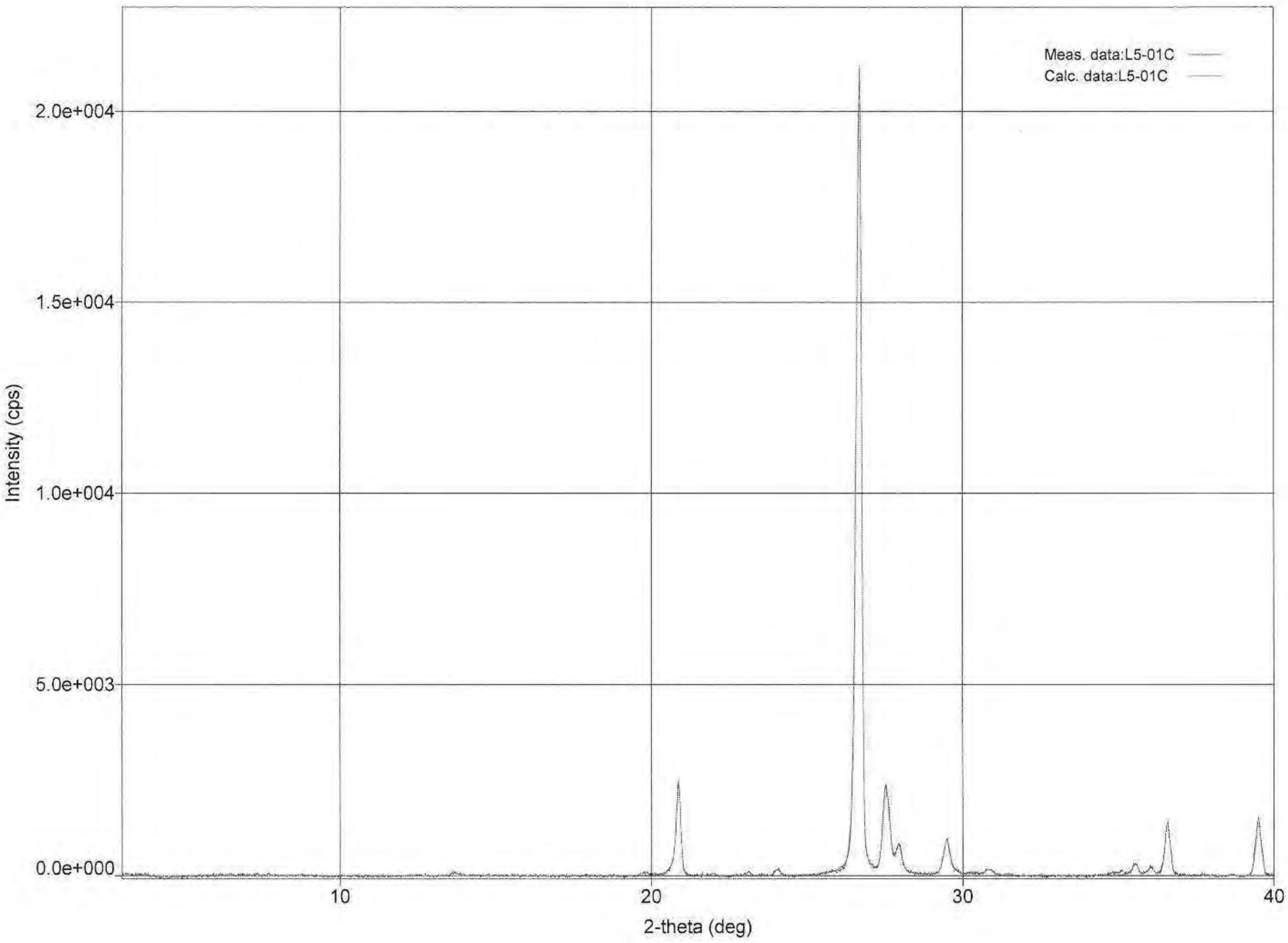

Meas. data:ASM-2
Calc. data:ASM-2
[1], d=4.2522(7), 2-theta=20.873(3), H=3901(81), Rel.H=21.82%
[2], d=3.988(2), 2-theta=22.272(12), H=63(10), Rel.H=0.35%
[3], d=3.7028(13), 2-theta=24.013(9), H=124(14), Rel.H=0.69%
[4], d=3.3381(3), 2-theta=26.683(2), H
[5], d=3.2371(5), 2-theta=27.532(4), H=846(38), Rel.H=4.73%
[6], d=3.033(4), 2-theta=29.43(4), H=171(17), Rel.H=0.95%
[7], d=2.891(2), 2-theta=30.90(2), H=273(21), Rel.H=1.53%
[8], d=2.4551(3), 2-theta=36.571(5), H=1799(55), Rel.H=10.06%
[9], d=2.2806(3), 2-theta=39.480(5), H=1355(48), Rel.H=7.58%
Intensity (cps)
0.0e+000
5.0e+003
1.0e+004
1.5e+004
2.0e+004
2.5e+004
2-theta (deg)
10
20
30
40

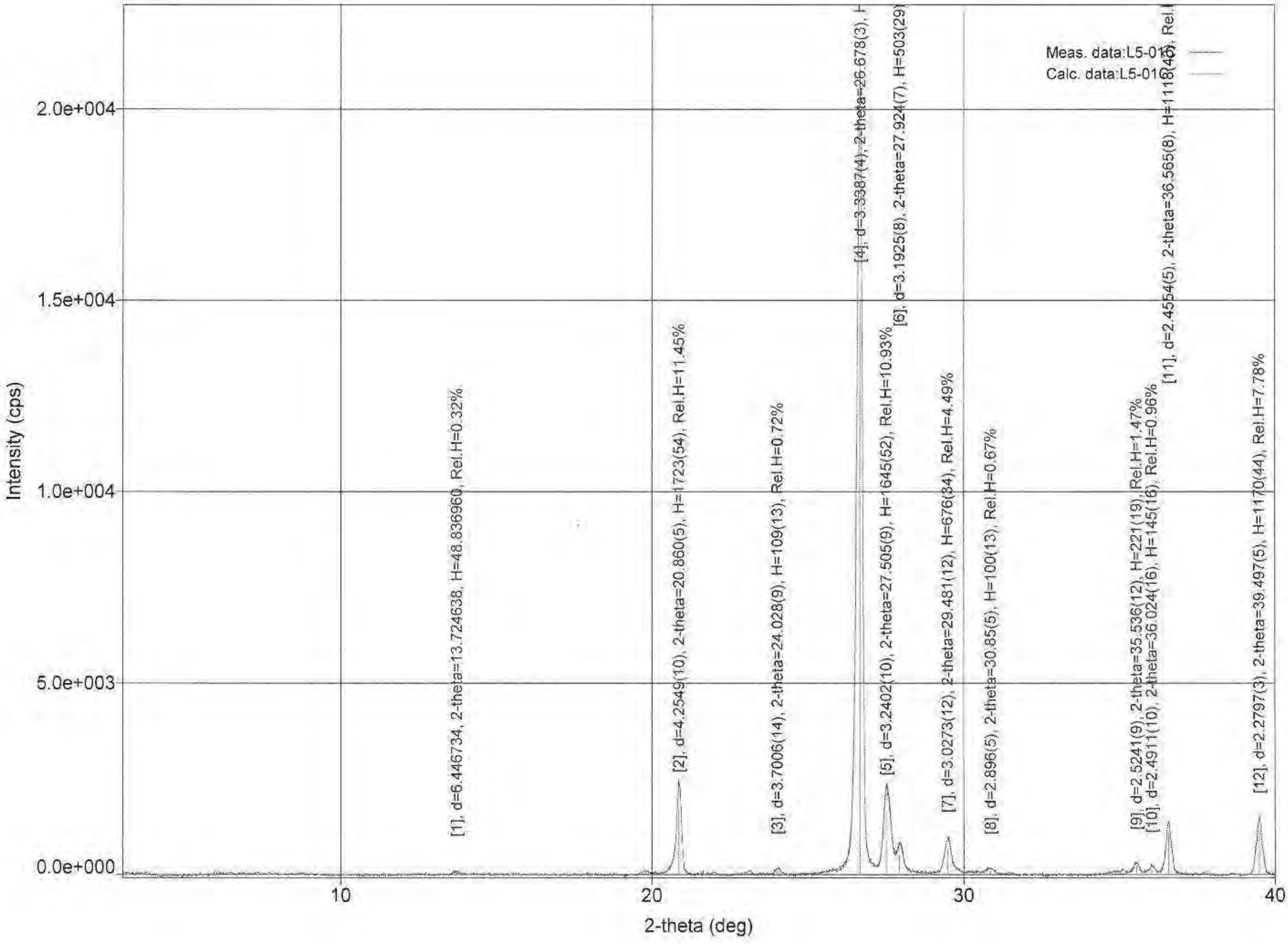
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	20.873(3)	4.2522(7)	3901(81)	0.142(3)	712(7)	0.182(5)	595(11)
☐ 2	22.272(12)	3.988(2)	63(10)	0.16(5)	14(2)	0.23(7)	537(153)
☐ 3	24.013(9)	3.7028(13)	124(14)	0.17(3)	23(3)	0.18(5)	505(76)
☐ 4	26.683(2)	3.3381(3)	17876(173)	0.1733(17)	3680(22)	0.206(3)	492(5)
☐ 5	27.532(4)	3.2371(5)	846(38)	0.16(2)	210(6)	0.248(19)	547(76)
☐ 6	29.43(4)	3.033(4)	171(17)	0.22(7)	68(4)	0.40(7)	383(118)
☐ 7	30.90(2)	2.891(2)	273(21)	0.19(3)	87(4)	0.32(4)	458(83)
☐ 8	36.571(5)	2.4551(3)	1799(55)	0.167(4)	354(5)	0.197(9)	524(13)
☐ 9	39.480(5)	2.2806(3)	1355(48)	0.158(4)	248(4)	0.183(9)	557(14)


Meas. data:L3-03 RM
Calc. data:L3-03 RM
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

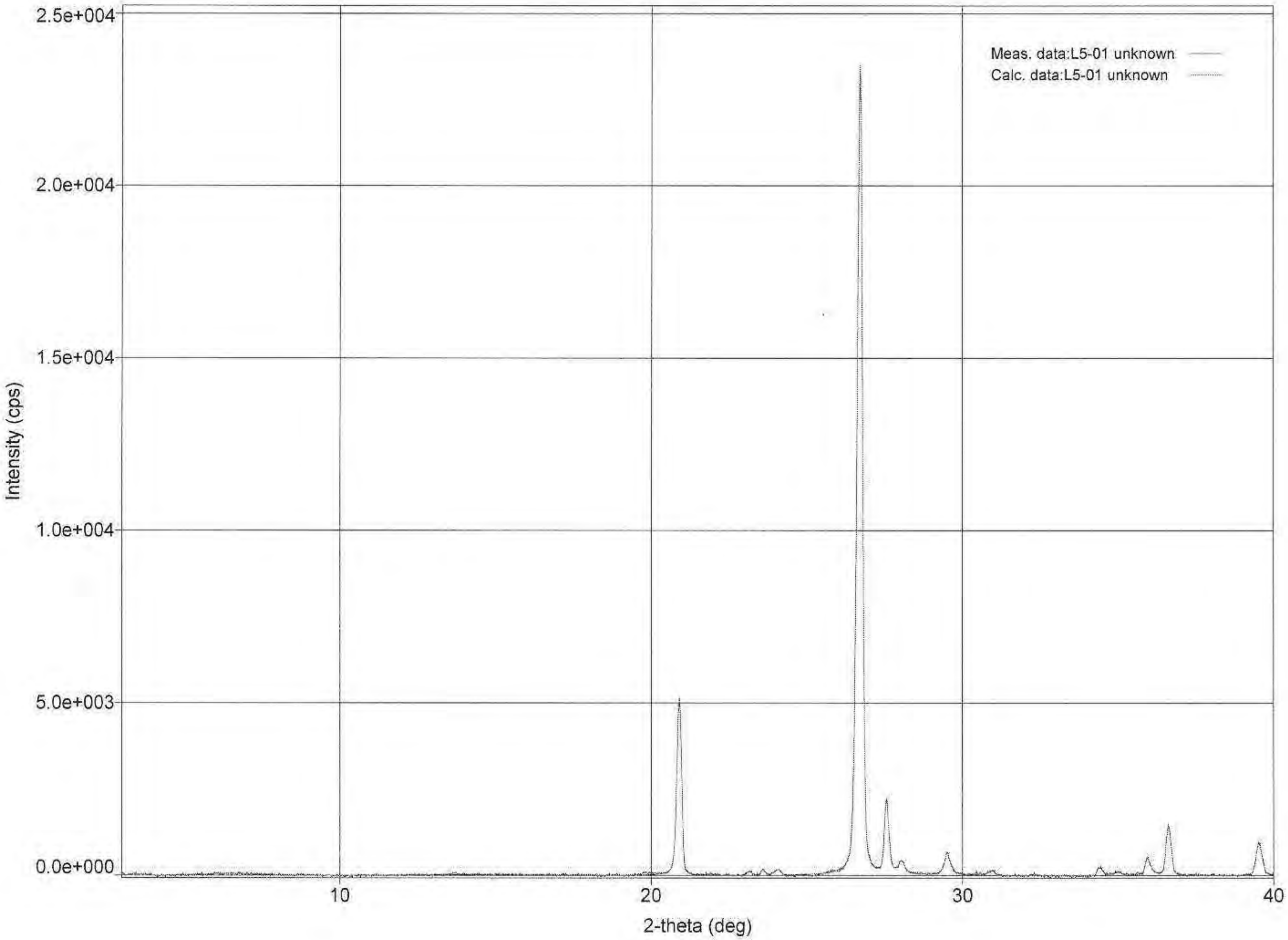

Intensity (cps)
0.0e+000
5.0e+003
1.0e+004
1.5e+004
2.0e+004
10
20
30
40
2-theta (deg)
Meas. data:L3-03 RM
Calc. data:L3-03 RM
[1], d=4.487(14), 2-theta=19.77(6), H=53(9), Rel.H=0.37%
[2], d=4.2556(7), 2-theta=20.856(3), H=2454(64), Rel.H=17.00%
[3], d=3.846(2), 2-theta=23.105(13), H=80(12), Rel.H=0.56%
[4], d=3.6958(12), 2-theta=24.060(8), H=135(15), Rel.H=0.93%
[5], d=3.3392(3), 2-theta=26.674(3), H
[6], d=3.2392(18), 2-theta=27.514(15), H=517(29), Rel.H=3.58%
[7], d=3.1879(17), 2-theta=27.965(15), H=496(29), Rel
[8], d=3.0265(9), 2-theta=29.490(9), H=775(36), Rel.H=5.37%
[9], d=2.911(3), 2-theta=30.69(3), H=81(12), Rel.H=0.56%
[10], d=2.763(9), 2-theta=32.37(11), H=42(8), Rel.H=0.29%
[11], d=2.4927(15), 2-theta=36.00(2), H=83(12), Rel.H=0.58%
[12], d=2.4561(6), 2-theta=36.555(10), H=1084(42), Rel.H=
[13], d=2.2797(5), 2-theta=39.496(8), H=964(40), Rel.H=6.68%

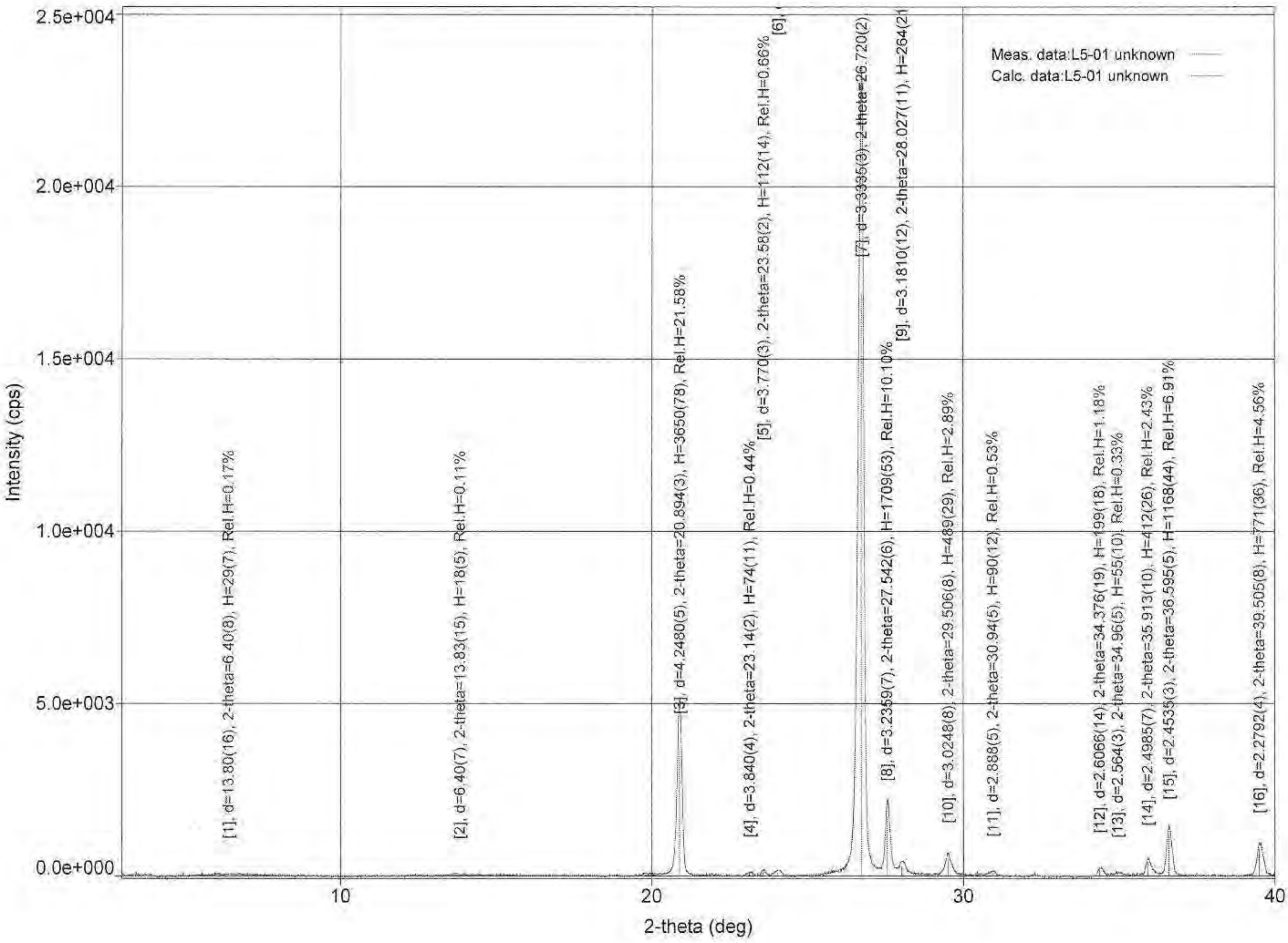
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	19.77(6)	4.487(14)	53(9)	0.36(9)	30(4)	0.55(18)	237(59)
▨ 2	20.856(3)	4.2556(7)	2454(64)	0.159(2)	486(5)	0.198(7)	530(8)
▨ 3	23.105(13)	3.846(2)	80(12)	0.07(4)	10(2)	0.12(4)	1174(689)
▨ 4	24.060(8)	3.6958(12)	135(15)	0.11(2)	24(3)	0.18(4)	768(166)
▨ 5	26.674(3)	3.3392(3)	14435(155)	0.1802(19)	3129(20)	0.217(4)	473(5)
▨ 6	27.514(15)	3.2392(18)	517(29)	0.19(2)	165(12)	0.32(4)	444(55)
▨ 7	27.965(15)	3.1879(17)	496(29)	0.18(3)	150(11)	0.30(4)	469(67)
▨ 8	29.490(9)	3.0265(9)	775(36)	0.168(11)	193(4)	0.248(17)	510(33)
▨ 9	30.69(3)	2.911(3)	81(12)	0.58(7)	69(5)	0.86(19)	147(18)
▨ 10	32.37(11)	2.763(9)	42(8)	0.13(11)	6(4)	0.15(12)	641(501)
▨ 11	36.00(2)	2.4927(15)	83(12)	0.21(6)	22(4)	0.27(9)	425(116)
▨ 12	36.555(10)	2.4561(6)	1084(42)	0.171(9)	241(6)	0.222(14)	510(26)
▨ 13	39.496(8)	2.2797(5)	964(40)	0.176(7)	196(5)	0.203(13)	501(20)


Meas. data:L5-01C
Calc. data:L5-01C
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

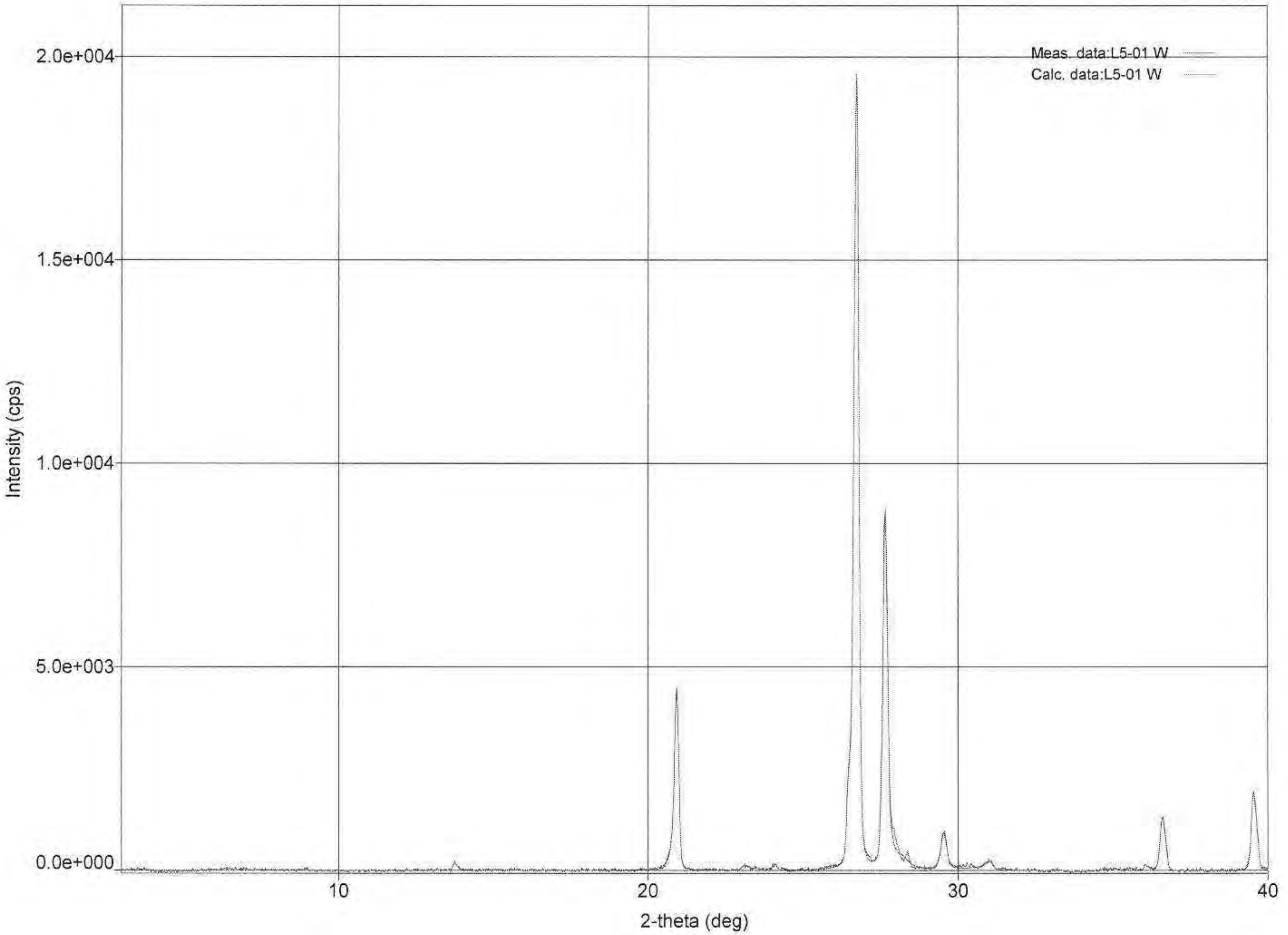

Meas. data:L5-016
Calc. data:L5-016
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
[1], d=6.446734, 2-theta=13.724638, H=48.836960, Rel.H=0.32%
[2], d=4.2549(10), 2-theta=20.860(5), H=1723(54), Rel.H=11.45%
[3], d=3.7006(14), 2-theta=24.028(9), H=109(13), Rel.H=0.72%
[4], d=3.3387(4), 2-theta=26.678(3), H
[5], d=3.2402(10), 2-theta=27.505(9), H=1645(52), Rel.H=10.93%
[6], d=3.1925(8), 2-theta=27.924(7), H=503(29)
[7], d=3.0273(12), 2-theta=29.481(12), H=676(34), Rel.H=4.49%
[8], d=2.896(5), 2-theta=30.85(5), H=100(13), Rel.H=0.67%
[9], d=2.5241(9), 2-theta=35.536(12), H=221(19), Rel.H=1.47%
[10], d=2.4911(10), 2-theta=36.024(16), H=145(16), Rel.H=0.96%
[11], d=2.4554(5), 2-theta=36.565(8), H=1118(46), Rel.
[12], d=2.2797(3), 2-theta=39.497(5), H=1170(44), Rel.H=7.78%

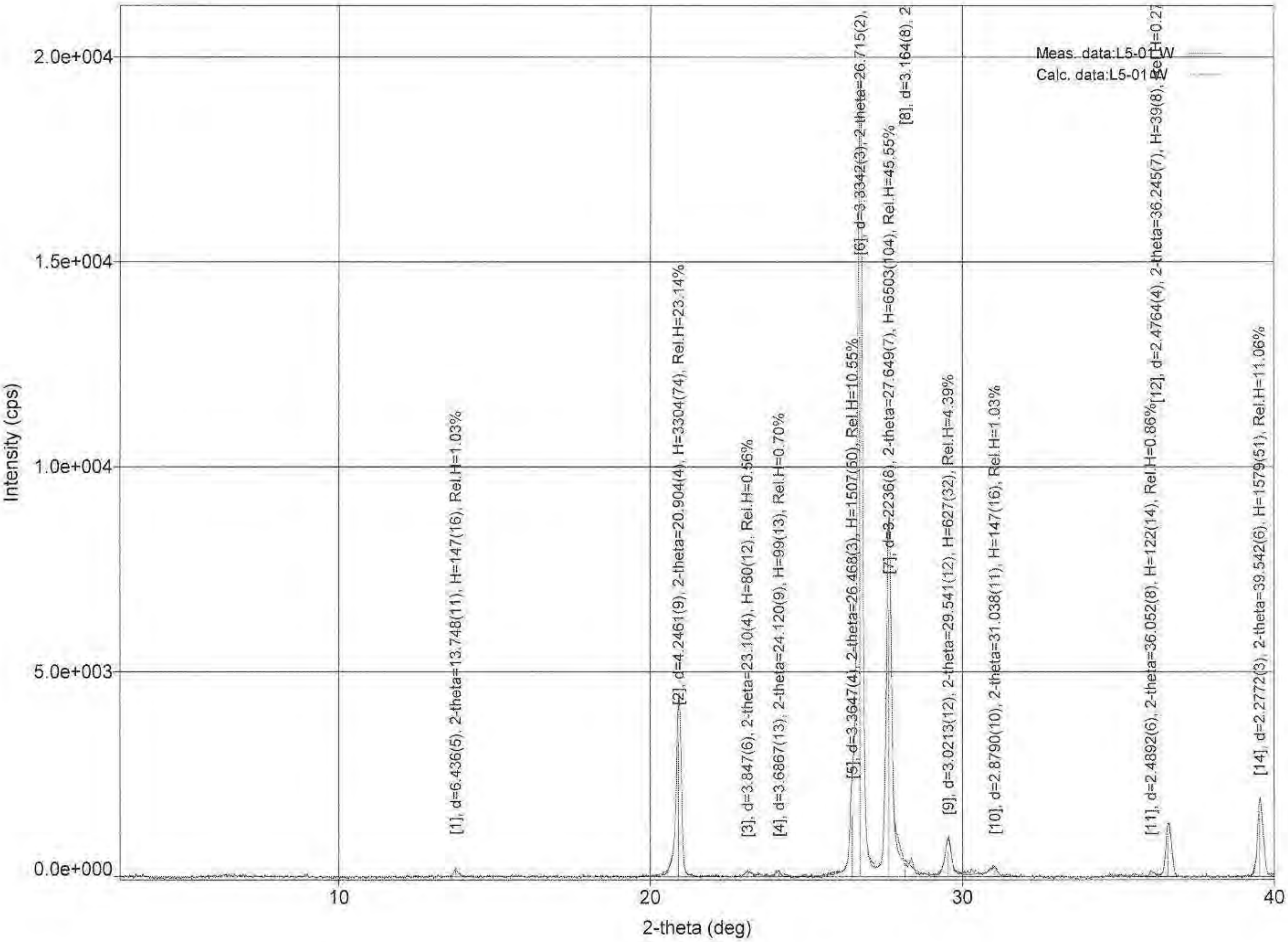
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	13.724638	6.446734	48.836960	0.178803	11.4194	0.233826	467.388
☐ 2	20.860(5)	4.2549(10)	1723(54)	0.156(5)	362(5)	0.210(9)	542(16)
☐ 3	24.028(9)	3.7006(14)	109(13)	0.18(3)	20(3)	0.19(5)	484(73)
☐ 4	26.678(3)	3.3387(4)	15048(158)	0.179(2)	3246(21)	0.216(4)	477(6)
☐ 5	27.505(9)	3.2402(10)	1645(52)	0.238(7)	522(13)	0.317(18)	359(11)
☐ 6	27.924(7)	3.1925(8)	503(29)	0.179(19)	120(9)	0.24(3)	478(50)
☐ 7	29.481(12)	3.0273(12)	676(34)	0.216(13)	207(4)	0.31(2)	398(24)
☐ 8	30.85(5)	2.896(5)	100(13)	0.35(6)	61(5)	0.60(12)	245(45)
☐ 9	35.536(12)	2.5241(9)	221(19)	0.20(2)	59(4)	0.26(4)	443(54)
☐ 10	36.024(16)	2.4911(10)	145(16)	0.18(4)	34(4)	0.24(6)	493(110)
☐ 11	36.565(8)	2.4554(5)	1118(43)	0.149(9)	224(6)	0.200(13)	588(37)
☐ 12	39.497(5)	2.2797(3)	1170(44)	0.177(4)	229(4)	0.195(10)	498(12)


Meas. data:L5-01 unknown
Calc. data:L5-01 unknown
Intensity (cps)
2.5e+004
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

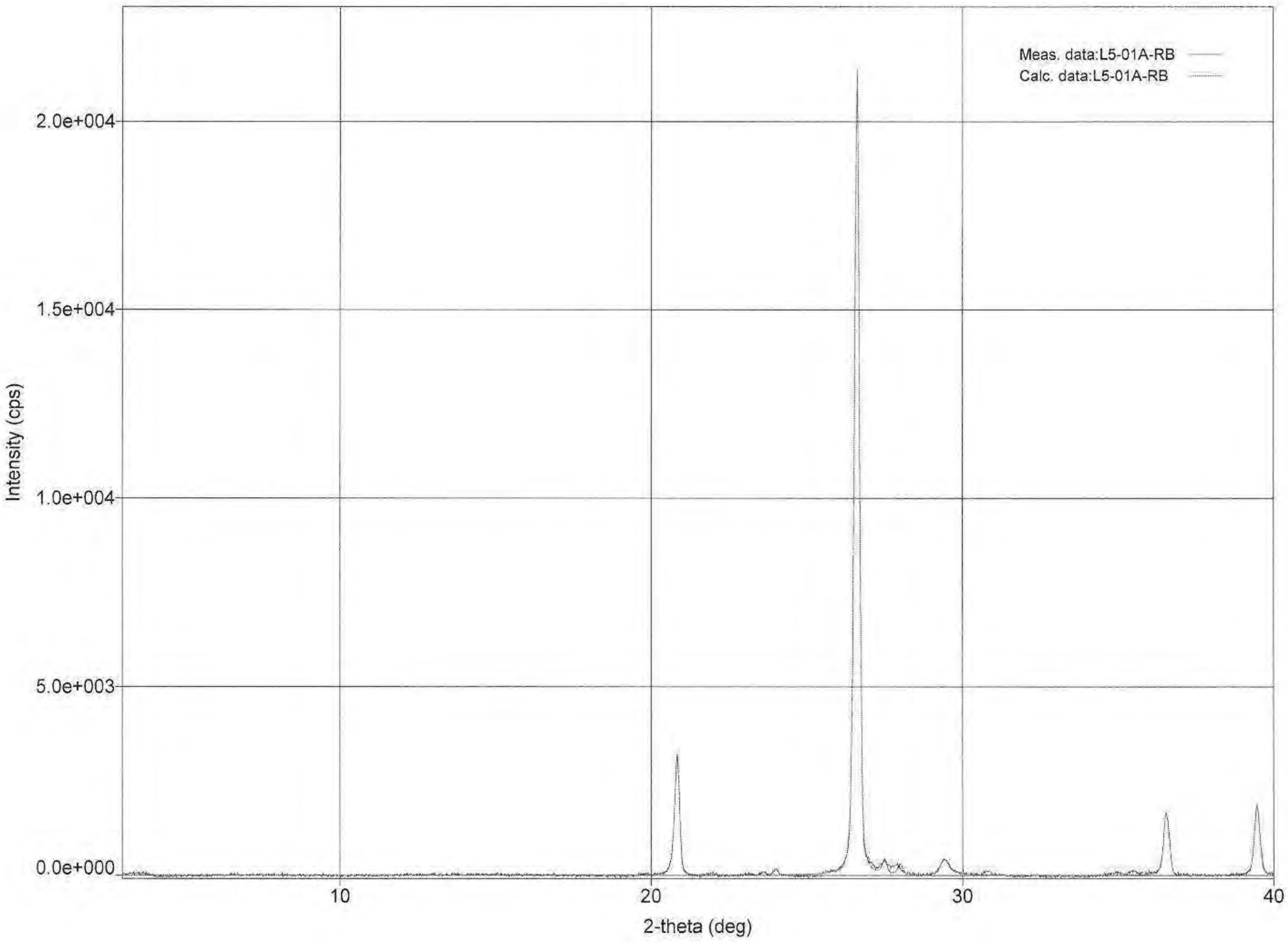

Intensity (cps)
2.5e+004
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
Meas. data:L5-01 unknown
Calc. data:L5-01 unknown
[1], d=13.80(16), 2-theta=6.40(8), H=29(7), Rel.H=0.17%
[2], d=6.40(7), 2-theta=13.83(15), H=18(5), Rel.H=0.11%
[3], d=4.2480(5), 2-theta=20.894(3), H=3650(78), Rel.H=21.58%
[4], d=3.840(4), 2-theta=23.14(2), H=74(11), Rel.H=0.44%
[5], d=3.770(3), 2-theta=23.58(2), H=112(14), Rel.H=0.66%
[6],
[7], d=3.3335(3), 2-theta=26.720(2)
[8], d=3.2359(7), 2-theta=27.542(6), H=1709(53), Rel.H=10.10%
[9], d=3.1810(12), 2-theta=28.027(11), H=264(2
[10], d=3.0248(8), 2-theta=29.506(8), H=489(29), Rel.H=2.89%
[11], d=2.888(5), 2-theta=30.94(5), H=90(12), Rel.H=0.53%
[12], d=2.6066(14), 2-theta=34.376(19), H=199(18), Rel.H=1.18%
[13], d=2.564(3), 2-theta=34.96(5), H=55(10), Rel.H=0.33%
[14], d=2.4985(7), 2-theta=35.913(10), H=412(26), Rel.H=2.43%
[15], d=2.4535(3), 2-theta=36.595(5), H=1168(44), Rel.H=6.91%
[16], d=2.2792(4), 2-theta=39.505(8), H=771(36), Rel.H=4.56%

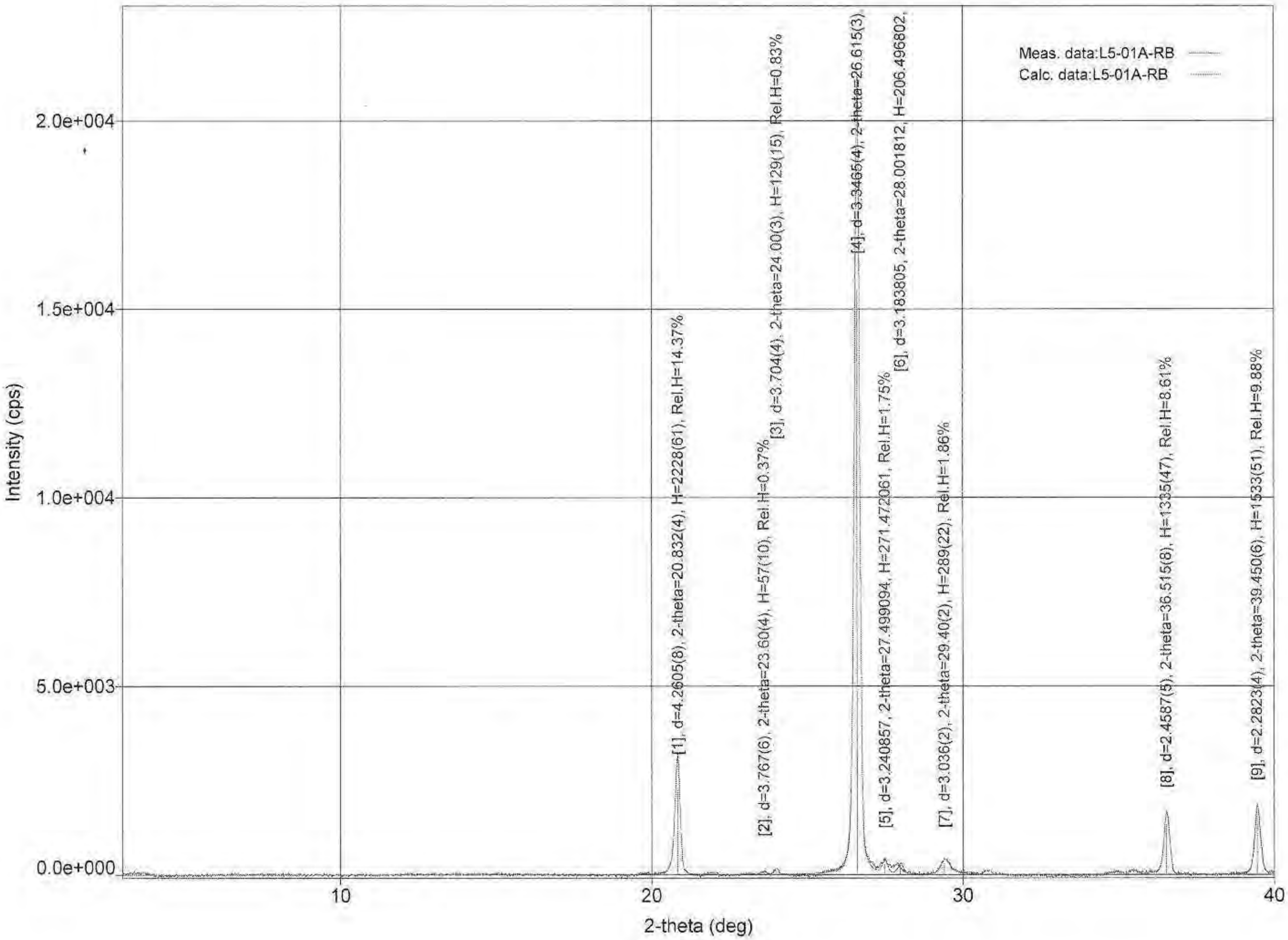
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.40(8)	13.80(16)	29(7)	1.9(2)	62(9)	2.1(8)	43(5)
☐ 2	13.83(15)	6.40(7)	18(5)	2.8(6)	70(12)	3.9(18)	29(6)
☐ 3	20.894(3)	4.2480(5)	3650(78)	0.1582(19)	702(6)	0.192(6)	533(6)
☐ 4	23.14(2)	3.840(4)	74(11)	0.17(4)	14(2)	0.19(6)	509(114)
☐ 5	23.58(2)	3.770(3)	112(14)	0.14(3)	18(2)	0.16(4)	596(115)
☐ 6	24.03(3)	3.700(4)	109(13)	0.22(3)	27(3)	0.25(6)	381(50)
☐ 7	26.720(2)	3.3335(3)	16910(168)	0.1800(15)	3692(18)	0.218(3)	474(4)
☐ 8	27.542(6)	3.2359(7)	1709(53)	0.134(6)	323(5)	0.189(9)	638(28)
☐ 9	28.027(11)	3.1810(12)	264(21)	0.220(19)	82(4)	0.31(4)	388(33)
☐ 10	29.506(8)	3.0248(8)	489(29)	0.170(16)	137(4)	0.28(2)	505(48)
☐ 11	30.94(5)	2.888(5)	90(12)	0.25(7)	35(4)	0.39(10)	351(104)
☐ 12	34.376(19)	2.6066(14)	199(18)	0.13(3)	39(4)	0.20(4)	646(156)
☐ 13	34.96(5)	2.564(3)	55(10)	0.34(10)	28(5)	0.50(17)	256(72)
☐ 14	35.913(10)	2.4985(7)	412(26)	0.141(17)	90(3)	0.22(2)	620(77)
☐ 15	36.595(5)	2.4535(3)	1168(44)	0.149(5)	207(4)	0.178(10)	585(19)
☐ 16	39.505(8)	2.2792(4)	771(36)	0.180(7)	167(3)	0.217(14)	491(19)


Meas. data:L5-01 W
Calc. data:L5-01 W
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

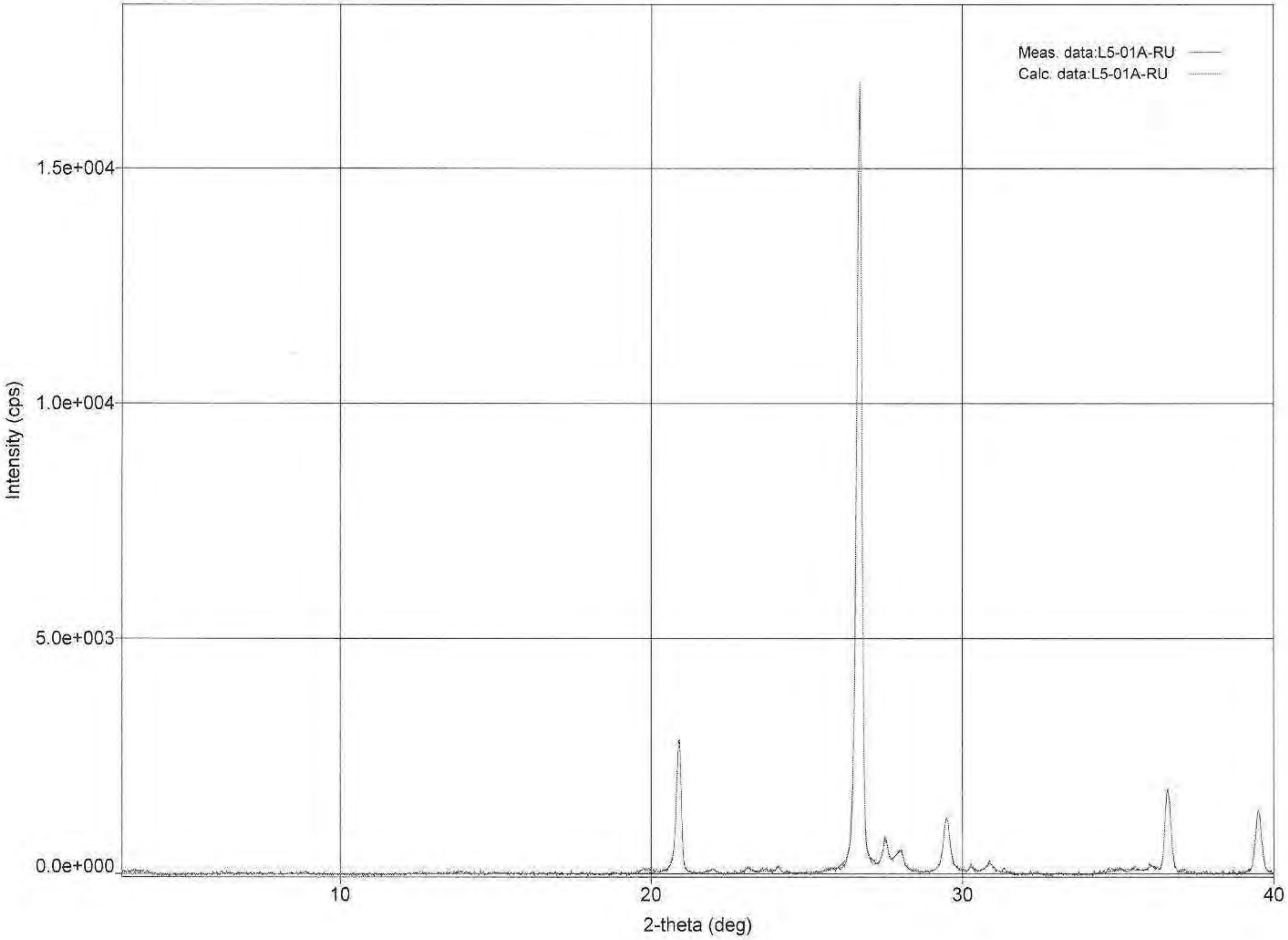

Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
Meas. data:L5-01 W
Calc. data:L5-01 W
[1], d=6.436(5), 2-theta=13.748(11), H=147(16), Rel.H=1.03%
[2], d=4.2461(9), 2-theta=20.904(4), H=3304(74), Rel.H=23.14%
[3], d=3.847(6), 2-theta=23.10(4), H=80(12), Rel.H=0.56%
[4], d=3.6867(13), 2-theta=24.120(9), H=99(13), Rel.H=0.70%
[5], d=3.3647(4), 2-theta=26.468(3), H=1507(60), Rel.H=10.55%
[6], d=3.3342(3), 2-theta=26.715(2),
[7], d=3.2236(8), 2-theta=27.649(7), H=6503(104), Rel.H=45.55%
[8], d=3.164(8), 2
[9], d=3.0213(12), 2-theta=29.541(12), H=627(32), Rel.H=4.39%
[10], d=2.8790(10), 2-theta=31.038(11), H=147(16), Rel.H=1.03%
[11], d=2.4892(6), 2-theta=36.052(8), H=122(14), Rel.H=0.86%
[12], d=2.4764(4), 2-theta=36.245(7), H=39(8), Rel.H=0.27
[14], d=2.2772(3), 2-theta=39.542(6), H=1579(51), Rel.H=11.06%

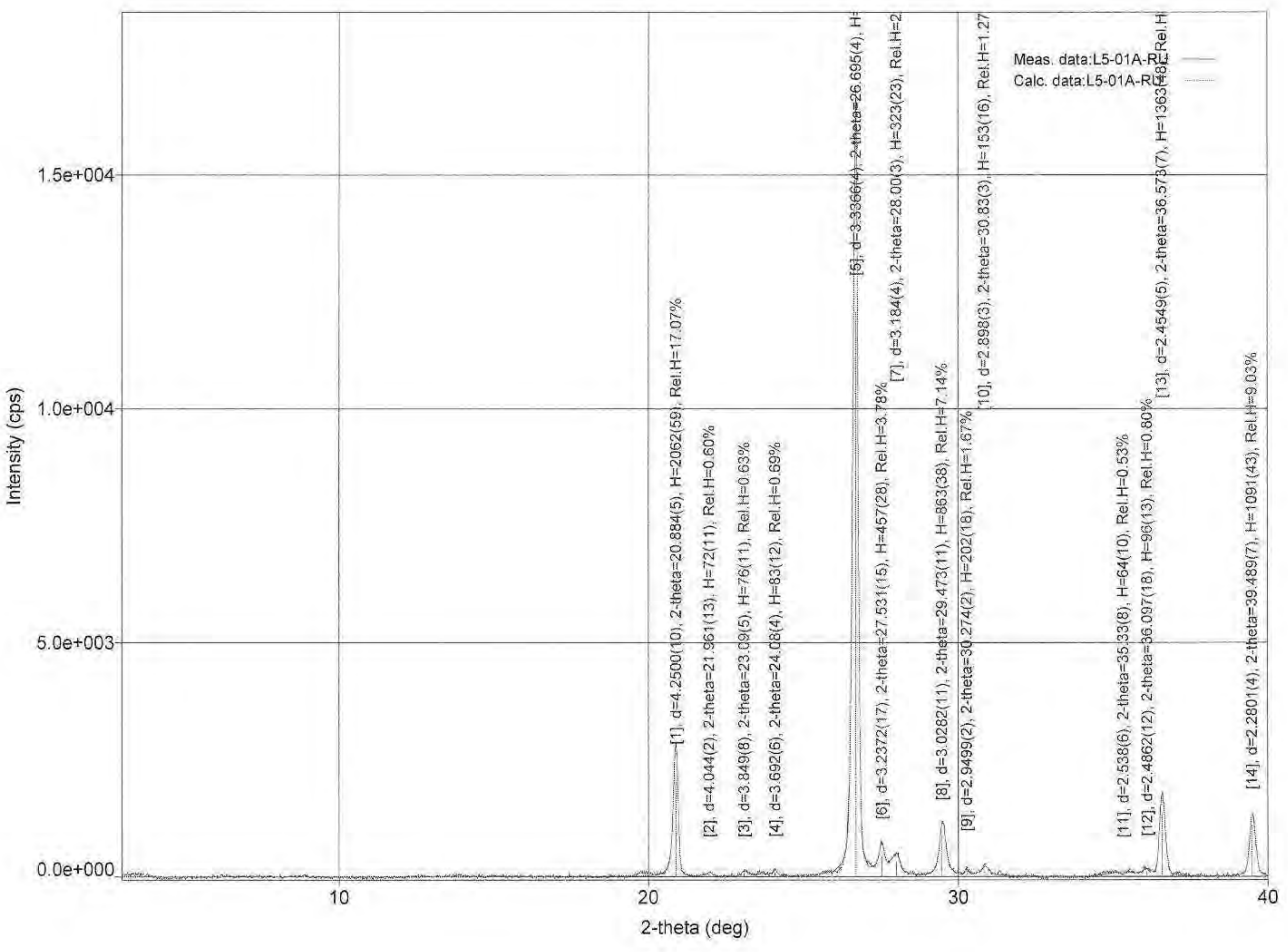
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	13.748(11)	6.436(5)	147(16)	0.126(14)	28(2)	0.19(4)	666(76)
▨ 2	20.904(4)	4.2461(9)	3304(74)	0.142(4)	637(7)	0.193(6)	595(17)
▨ 3	23.10(4)	3.847(6)	80(12)	0.26(5)	35(5)	0.44(12)	325(60)
▨ 4	24.120(9)	3.6867(13)	99(13)	0.15(4)	21(3)	0.21(6)	557(152)
▨ 5	26.468(3)	3.3647(4)	1507(50)	0.133(7)	236(14)	0.157(15)	643(35)
▨ 6	26.715(2)	3.3342(3)	14277(154)	0.1629(16)	2753(19)	0.193(3)	523(5)
▨ 7	27.649(7)	3.2236(8)	6503(104)	0.153(7)	1295(52)	0.199(11)	558(25)
▨ 8	28.18(8)	3.164(8)	178(17)	0.7(2)	160(53)	0.9(4)	124(38)
▨ 9	29.541(12)	3.0213(12)	627(32)	0.208(11)	160(8)	0.25(3)	413(23)
▨ 10	31.038(11)	2.8790(10)	147(16)	0.38(4)	97(6)	0.66(11)	229(24)
▨ 11	36.052(8)	2.4892(6)	122(14)	0.11(2)	15.2(16)	0.12(3)	813(154)
▨ 12	36.245(7)	2.4764(4)	39(8)	0.025(16)	1.1(8)	0.03(3)	3492(2229)
▨ 13	36.590(7)	2.4538(4)	1042(42)	0.168(5)	202(4)	0.194(11)	520(16)
▨ 14	39.542(6)	2.2772(3)	1579(51)	0.158(5)	287(5)	0.181(9)	559(17)


Meas. data:L5-01A-RB
Calc. data:L5-01A-RB
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

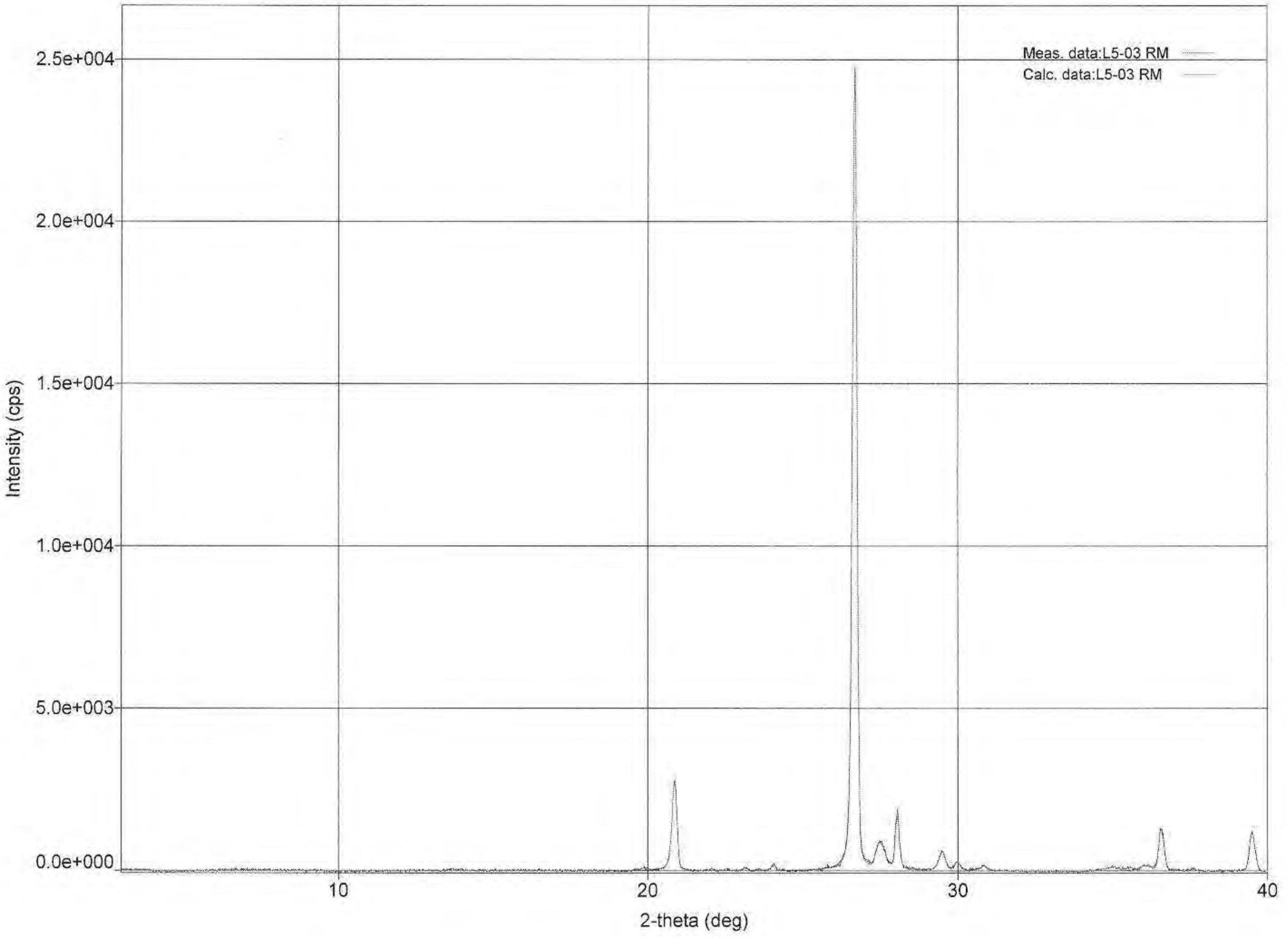

Meas. data:L5-01A-RB
Calc. data:L5-01A-RB
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
[1], d=4.2605(8), 2-theta=20.832(4), H=2228(61), Rel.H=14.37%
[2], d=3.767(6), 2-theta=23.60(4), H=57(10), Rel.H=0.37%
[3], d=3.704(4), 2-theta=24.00(3), H=129(15), Rel.H=0.83%
[4], d=3.3465(4), 2-theta=26.615(3),
[5], d=3.240857, 2-theta=27.499094, H=271.472061, Rel.H=1.75%
[6], d=3.183805, 2-theta=28.001812, H=206.496802,
[7], d=3.036(2), 2-theta=29.40(2), H=289(22), Rel.H=1.86%
[8], d=2.4587(5), 2-theta=36.515(8), H=1335(47), Rel.H=8.61%
[9], d=2.2823(4), 2-theta=39.450(6), H=1533(51), Rel.H=9.88%

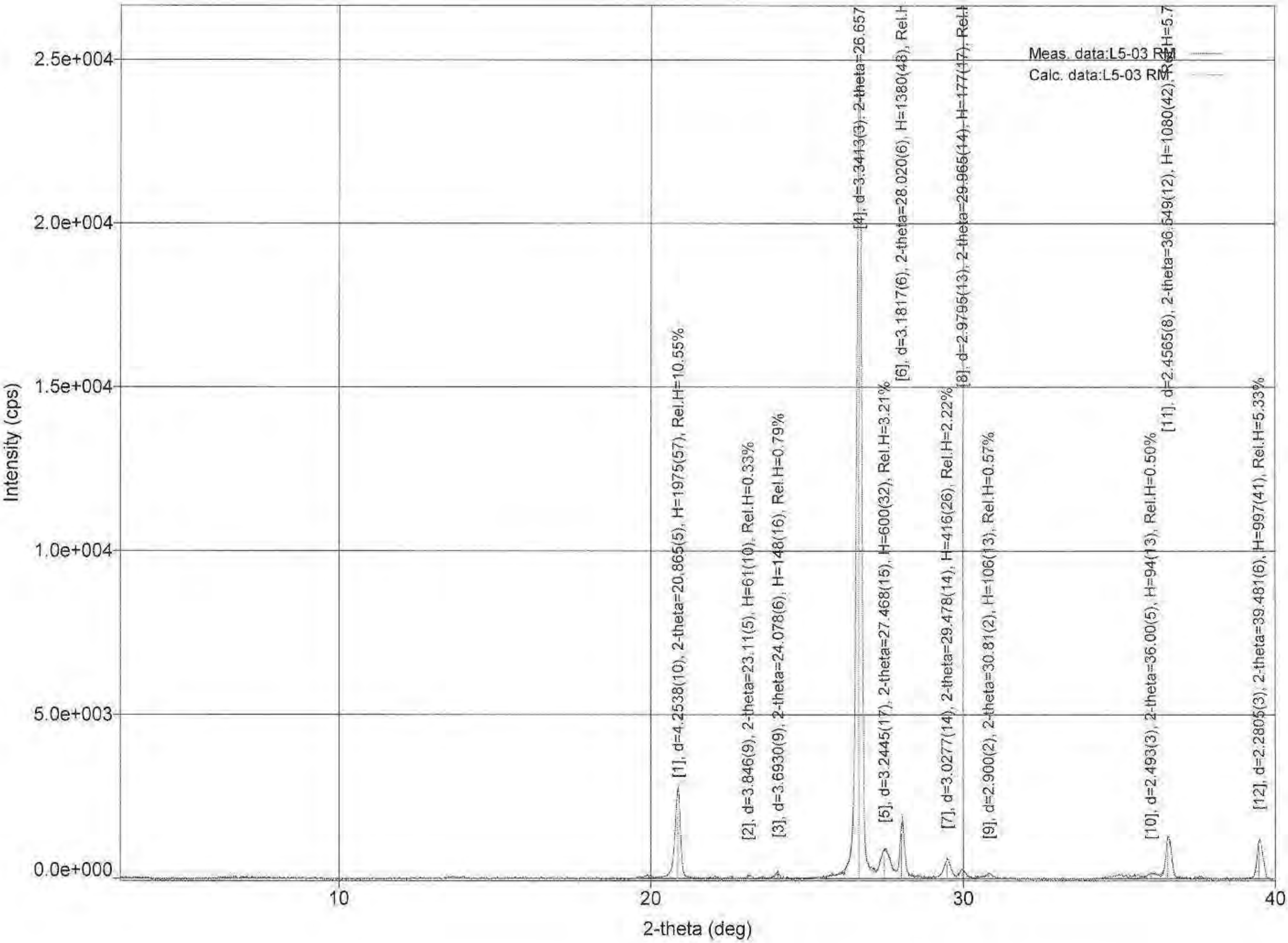
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	20.832(4)	4.2605(8)	2228(61)	0.174(3)	487(5)	0.219(8)	484(8)
☐ 2	23.60(4)	3.767(6)	57(10)	0.17(5)	12(2)	0.21(7)	493(136)
☐ 3	24.00(3)	3.704(4)	129(15)	0.13(3)	21(3)	0.16(4)	637(120)
☐ 4	26.615(3)	3.3465(4)	15512(161)	0.170(2)	3239(22)	0.209(4)	502(6)
☐ 5	27.499094	3.240857	271.472061	0.169846	58.181	0.214317	502.923
☐ 6	28.001812	3.183805	206.496802	0.169846	44.2557	0.214317	503.468
☐ 7	29.40(2)	3.036(2)	289(22)	0.32(2)	141(5)	0.49(5)	267(19)
☐ 8	36.515(8)	2.4587(5)	1335(47)	0.168(7)	291(5)	0.218(11)	519(20)
☐ 9	39.450(6)	2.2823(4)	1533(51)	0.160(6)	328(5)	0.214(10)	552(22)


Meas. data:L5-01A-RU
Calc. data:L5-01A-RU
Intensity (cps)
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

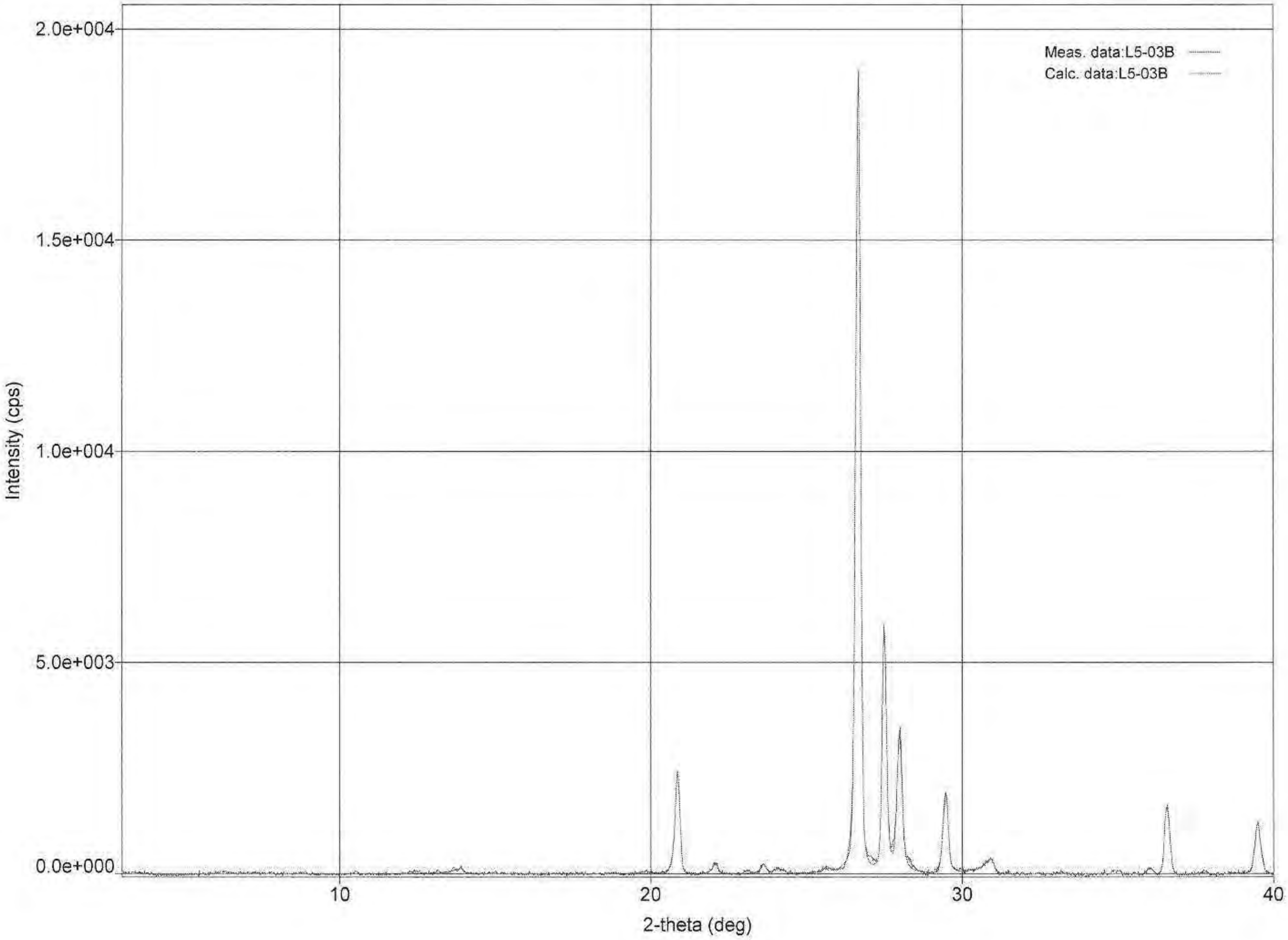

Meas. data:L5-01A-RU
Calc. data:L5-01A-RU
[1], d=4.2500(10), 2-theta=20.884(5), H=2062(59), Rel.H=17.07%
[2], d=4.044(2), 2-theta=21.961(13), H=72(11), Rel.H=0.60%
[3], d=3.849(8), 2-theta=23.09(5), H=76(11), Rel.H=0.63%
[4], d=3.692(6), 2-theta=24.08(4), H=83(12), Rel.H=0.69%
[5], d=3.3366(4), 2-theta=26.695(4), H=
[6], d=3.2372(17), 2-theta=27.531(15), H=457(28), Rel.H=3.78%
[7], d=3.184(4), 2-theta=28.00(3), H=323(23), Rel.H=2
[8], d=3.0282(11), 2-theta=29.473(11), H=863(38), Rel.H=7.14%
[9], d=2.9499(2), 2-theta=30.274(2), H=202(18), Rel.H=1.67%
[10], d=2.898(3), 2-theta=30.83(3), H=153(16), Rel.H=1.27
[11], d=2.538(6), 2-theta=35.33(8), H=64(10), Rel.H=0.53%
[12], d=2.4862(12), 2-theta=36.097(18), H=96(13), Rel.H=0.80%
[13], d=2.4549(5), 2-theta=36.573(7), H=1363(48), Rel.H
[14], d=2.2801(4), 2-theta=39.489(7), H=1091(43), Rel.H=9.03%
Intensity (cps)
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

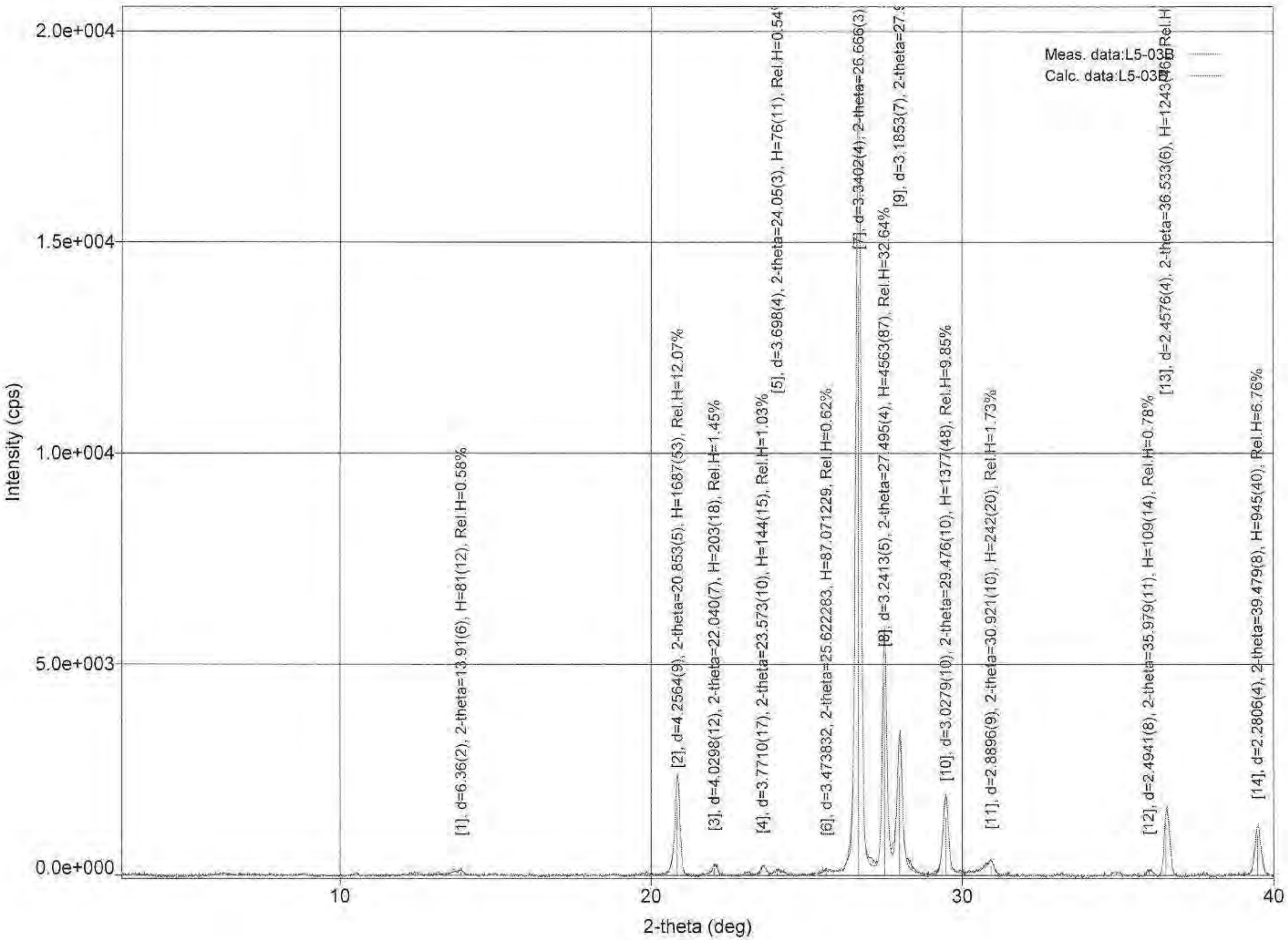
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	20.884(5)	4.2500(10)	2062(59)	0.152(4)	421(5)	0.204(8)	554(14)
☐ 2	21.961(13)	4.044(2)	72(11)	0.19(5)	24(3)	0.33(9)	444(124)
☐ 3	23.09(5)	3.849(8)	76(11)	0.34(7)	47(5)	0.62(16)	253(52)
☐ 4	24.08(4)	3.692(6)	83(12)	0.18(4)	24(3)	0.29(8)	471(113)
☐ 5	26.695(4)	3.3366(4)	12081(142)	0.172(2)	2557(20)	0.212(4)	495(7)
☐ 6	27.531(15)	3.2372(17)	457(28)	0.17(3)	126(15)	0.28(5)	495(80)
☐ 7	28.00(3)	3.184(4)	323(23)	0.35(5)	181(19)	0.56(10)	244(37)
☐ 8	29.473(11)	3.0282(11)	863(38)	0.210(9)	274(4)	0.318(19)	408(18)
☐ 9	30.274(2)	2.9499(2)	202(18)	0.040(11)	16.9(19)	0.084(17)	2175(598)
☐ 10	30.83(3)	2.898(3)	153(16)	0.27(6)	77(5)	0.50(8)	323(78)
☐ 11	35.33(8)	2.538(6)	64(10)	1.08(17)	81(11)	1.3(4)	81(13)
☐ 12	36.097(18)	2.4862(12)	96(13)	0.35(6)	40(7)	0.42(13)	247(41)
☐ 13	36.573(7)	2.4549(5)	1363(48)	0.181(6)	289(5)	0.212(11)	484(15)
☐ 14	39.489(7)	2.2801(4)	1091(43)	0.174(6)	243(4)	0.223(12)	506(19)


Meas. data:L5-03 RM
Calc. data:L5-03 RM
Intensity (cps)
2.5e+004
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)

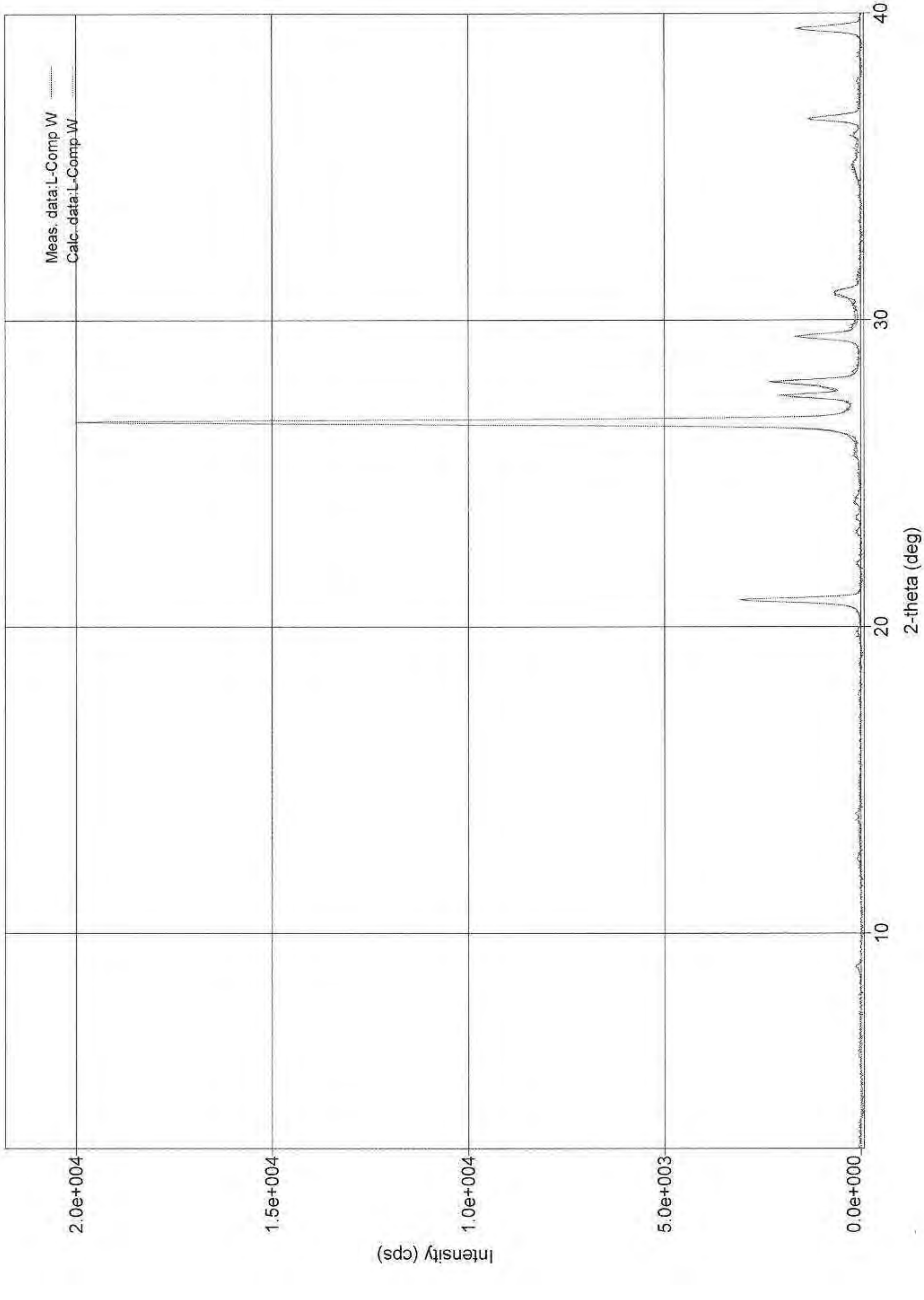

Meas. data:L5-03 RM
Calc. data:L5-03 RM
Intensity (cps)
2.5e+004
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
[1], d=4.2538(10), 2-theta=20.865(5), H=1975(57), Rel.H=10.55%
[2], d=3.846(9), 2-theta=23.11(5), H=61(10), Rel.H=0.33%
[3], d=3.6930(9), 2-theta=24.078(6), H=148(16), Rel.H=0.79%
[4], d=3.3413(3), 2-theta=26.657
[5], d=3.2445(17), 2-theta=27.468(15), H=600(32), Rel.H=3.21%
[6], d=3.1817(6), 2-theta=28.020(6), H=1380(48), Rel.H
[7], d=3.0277(14), 2-theta=29.478(14), H=416(26), Rel.H=2.22%
[8], d=2.9795(13), 2-theta=29.965(14), H=177(17), Rel.H
[9], d=2.900(2), 2-theta=30.81(2), H=106(13), Rel.H=0.57%
[10], d=2.493(3), 2-theta=36.00(5), H=94(13), Rel.H=0.50%
[11], d=2.4565(8), 2-theta=36.549(12), H=1080(42), Rel.H=5.7
[12], d=2.2805(3), 2-theta=39.481(6), H=997(41), Rel.H=5.33%

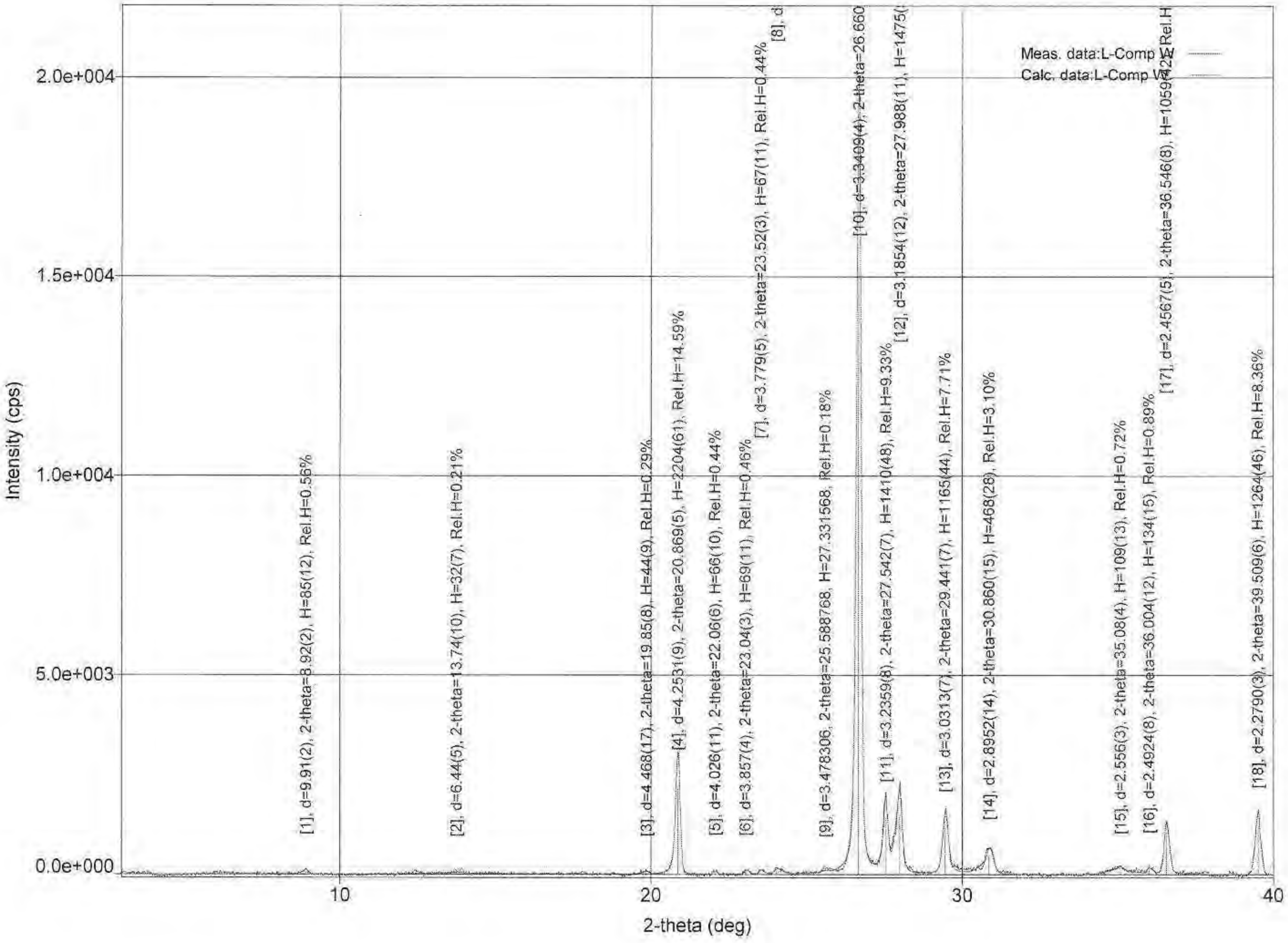
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	20.865(5)	4.2538(10)	1975(57)	0.167(4)	420(5)	0.213(9)	506(11)
☐ 2	23.11(5)	3.846(9)	61(10)	0.14(7)	11(3)	0.18(8)	621(308)
☐ 3	24.078(6)	3.6930(9)	148(16)	0.12(2)	25(2)	0.17(3)	691(130)
☐ 4	26.657(2)	3.3413(3)	18723(177)	0.1483(16)	3366(21)	0.180(3)	575(6)
☐ 5	27.468(15)	3.2445(17)	600(32)	0.322(17)	257(8)	0.43(4)	265(14)
☐ 6	28.020(6)	3.1817(6)	1380(48)	0.120(8)	220(7)	0.159(10)	713(46)
☐ 7	29.478(14)	3.0277(14)	416(26)	0.212(12)	120(4)	0.29(3)	404(24)
☐ 8	29.965(14)	2.9795(13)	177(17)	0.18(3)	44(3)	0.25(4)	470(65)
☐ 9	30.81(2)	2.900(2)	106(13)	0.20(3)	33(3)	0.31(7)	430(72)
☐ 10	36.00(5)	2.493(3)	94(13)	0.37(11)	46(10)	0.49(17)	237(68)
☐ 11	36.549(12)	2.4565(8)	1080(42)	0.149(11)	213(11)	0.197(18)	585(45)
☐ 12	39.481(6)	2.2805(3)	997(41)	0.162(4)	181(3)	0.181(11)	543(14)


Meas. data:L5-03B
Calc. data:L5-03B
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)


Meas. data:L5-03B
Calc. data:L5-03B
[1], d=6.36(2), 2-theta=13.91(6), H=81(12), Rel.H=0.58%
[2], d=4.2564(9), 2-theta=20.853(5), H=1687(53), Rel.H=12.07%
[3], d=4.0298(12), 2-theta=22.040(7), H=203(18), Rel.H=1.45%
[4], d=3.7710(17), 2-theta=23.573(10), H=144(15), Rel.H=1.03%
[5], d=3.698(4), 2-theta=24.05(3), H=76(11), Rel.H=0.54
[6], d=3.473832, 2-theta=25.622283, H=87.071229, Rel.H=0.62%
[7], d=3.3402(4), 2-theta=26.666(3)
[8], d=3.2413(5), 2-theta=27.495(4), H=4563(87), Rel.H=32.64%
[9], d=3.1853(7), 2-theta=27.
[10], d=3.0279(10), 2-theta=29.476(10), H=1377(48), Rel.H=9.85%
[11], d=2.8896(9), 2-theta=30.921(10), H=242(20), Rel.H=1.73%
[12], d=2.4941(8), 2-theta=35.979(11), H=109(14), Rel.H=0.78%
[13], d=2.4576(4), 2-theta=36.533(6), H=1243(46), Rel.H
[14], d=2.2806(4), 2-theta=39.479(8), H=945(40), Rel.H=6.76%
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	13.91(6)	6.36(2)	81(12)	0.43(10)	66(5)	0.81(18)	192(45)
☐ 2	20.853(5)	4.2564(9)	1687(53)	0.165(4)	346(5)	0.205(9)	510(11)
☐ 3	22.040(7)	4.0298(12)	203(18)	0.14(2)	47(3)	0.23(4)	592(103)
☐ 4	23.573(10)	3.7710(17)	144(15)	0.18(4)	33(5)	0.23(6)	476(98)
☐ 5	24.05(3)	3.698(4)	76(11)	0.37(8)	36(6)	0.48(14)	232(48)
☐ 6	25.622283	3.473832	87.071229	0.171216	18.409	0.211425	496.973
☐ 7	26.666(3)	3.3402(4)	13980(153)	0.160(2)	2705(22)	0.194(4)	532(7)
☐ 8	27.495(4)	3.2413(5)	4563(87)	0.127(5)	768(11)	0.168(6)	674(25)
☐ 9	27.988(6)	3.1853(7)	2351(63)	0.171(7)	534(11)	0.227(11)	499(20)
☐ 10	29.476(10)	3.0279(10)	1377(48)	0.170(9)	276(8)	0.200(13)	504(27)
☐ 11	30.921(10)	2.8896(9)	242(20)	0.38(6)	147(9)	0.61(9)	229(33)
☐ 12	35.979(11)	2.4941(8)	109(14)	0.17(3)	20(2)	0.18(4)	508(82)
☐ 13	36.533(6)	2.4576(4)	1243(46)	0.166(4)	220(4)	0.177(10)	525(13)
☐ 14	39.479(8)	2.2806(4)	945(40)	0.180(6)	199(4)	0.210(13)	491(17)

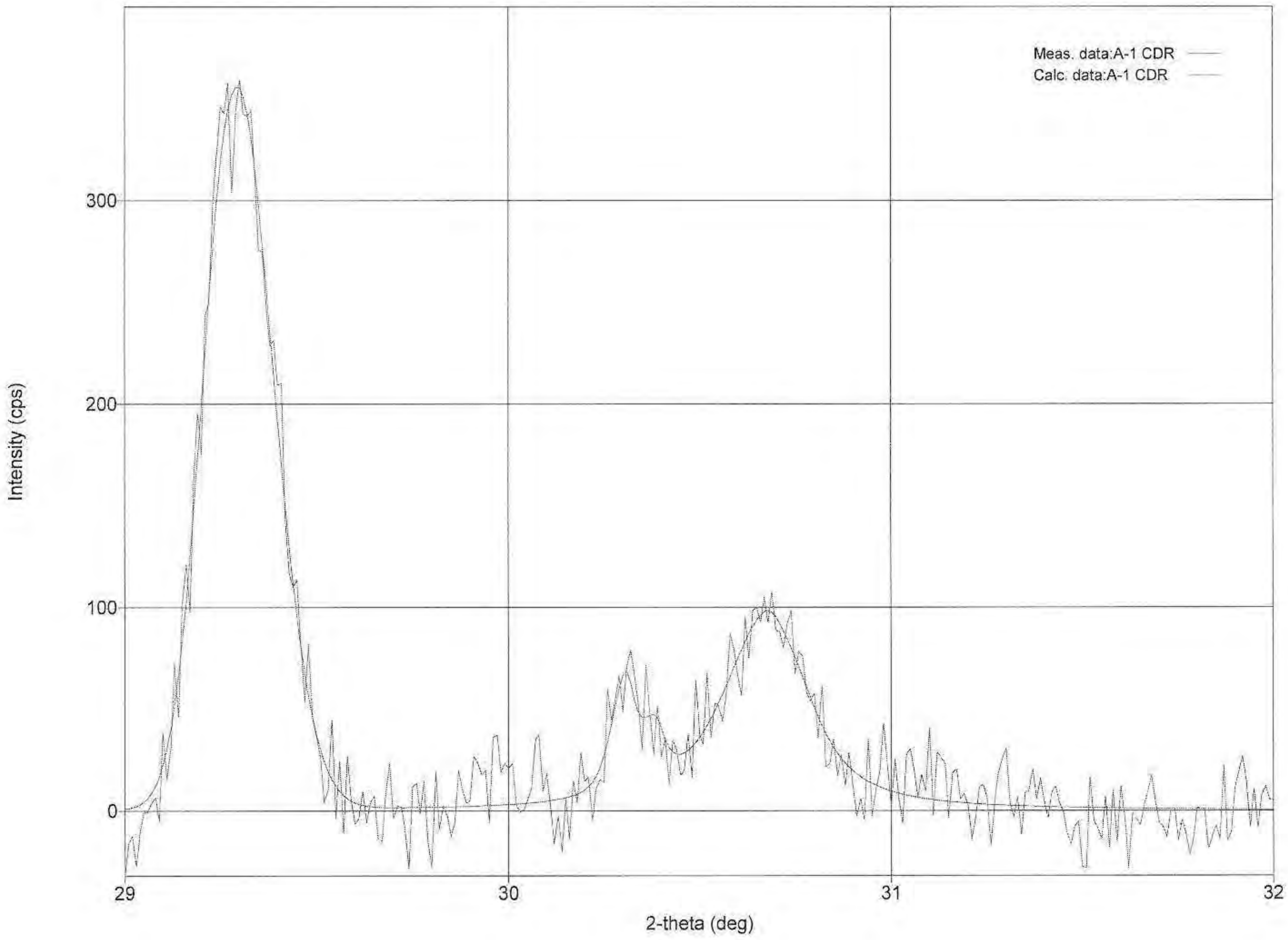

Meas. data:L-Comp W
Calc. data:L-Comp W
Intensity (cps)
0.0e+000
5.0e+003
1.0e+004
1.5e+004
2.0e+004
2-theta (deg)
10
20
30
40



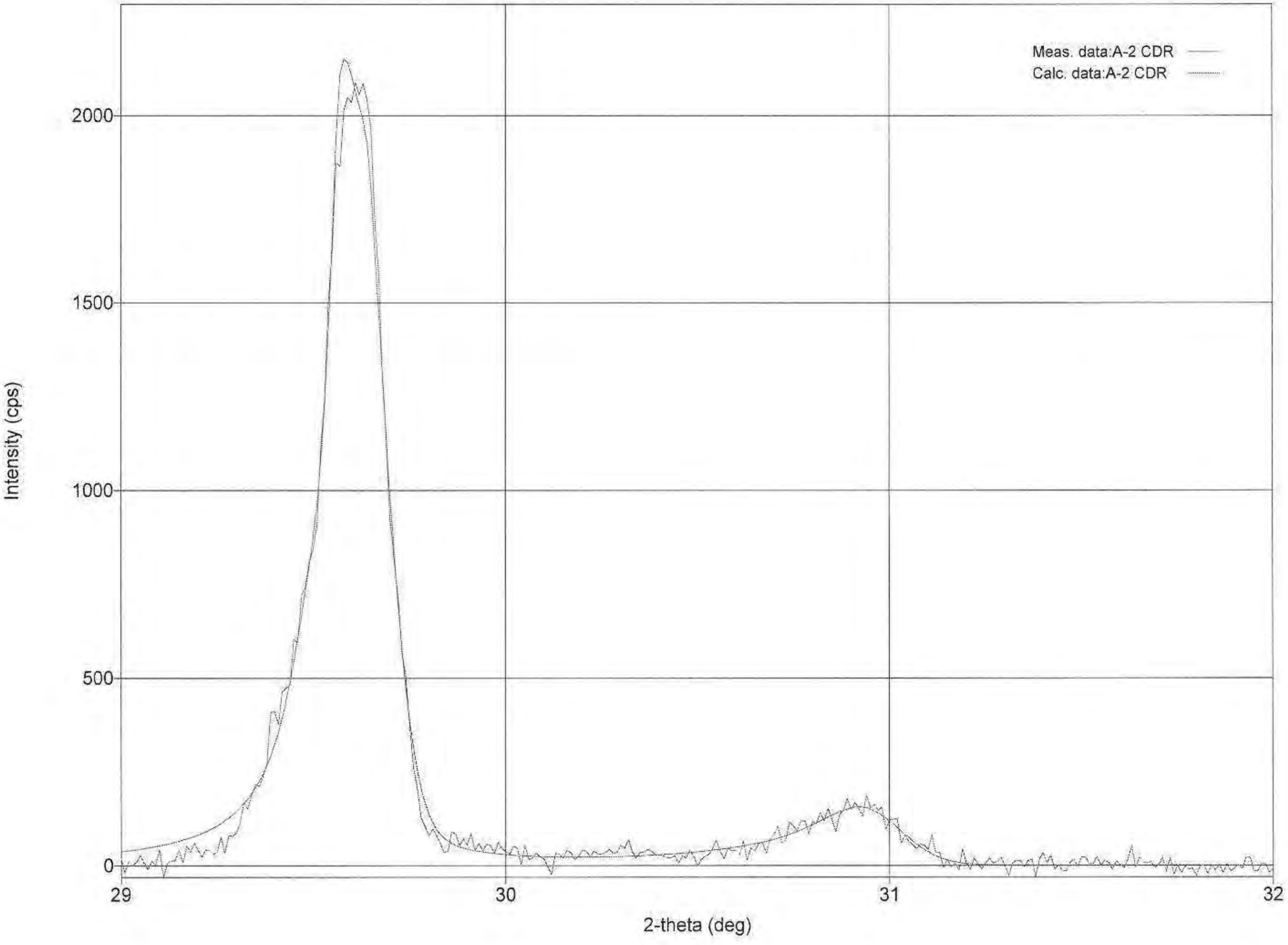
Meas. data:L-Comp W
Calc. data:L-Comp W
Intensity (cps)
2.0e+004
1.5e+004
1.0e+004
5.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
[1], d=9.91(2), 2-theta=8.92(2), H=85(12), Rel.H=0.56%
[2], d=6.44(5), 2-theta=13.74(10), H=32(7), Rel.H=0.21%
[3], d=4.468(17), 2-theta=19.85(8), H=44(9), Rel.H=0.29%
[4], d=4.2531(9), 2-theta=20.869(5), H=2204(61), Rel.H=14.59%
[5], d=4.026(11), 2-theta=22.06(6), H=66(10), Rel.H=0.44%
[6], d=3.857(4), 2-theta=23.04(3), H=69(11), Rel.H=0.46%
[7], d=3.779(5), 2-theta=23.52(3), H=67(11), Rel.H=0.44%
[8], d
[9], d=3.478306, 2-theta=25.588768, H=27.331568, Rel.H=0.18%
[10], d=3.3409(4), 2-theta=26.660
[11], d=3.2359(8), 2-theta=27.542(7), H=1410(48), Rel.H=9.33%
[12], d=3.1854(12), 2-theta=27.988(11), H=1475(
[13], d=3.0313(7), 2-theta=29.441(7), H=1165(44), Rel.H=7.71%
[14], d=2.8952(14), 2-theta=30.860(15), H=468(28), Rel.H=3.10%
[15], d=2.556(3), 2-theta=35.08(4), H=109(13), Rel.H=0.72%
[16], d=2.4924(8), 2-theta=36.004(12), H=134(15), Rel.H=0.89%
[17], d=2.4567(5), 2-theta=36.546(8), H=1059(42), Rel.H
[18], d=2.2790(3), 2-theta=39.509(6), H=1264(46), Rel.H=8.36%

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	8.92(2)	9.91(2)	85(12)	0.16(3)	22(2)	0.26(7)	514(92)
☐ 2	13.74(10)	6.44(5)	32(7)	1.8(3)	82(10)	2.6(9)	46(7)
☐ 3	19.85(8)	4.468(17)	44(9)	0.25(6)	12(4)	0.27(14)	335(84)
☐ 4	20.869(5)	4.2531(9)	2204(61)	0.155(3)	424(6)	0.192(8)	545(12)
☐ 5	22.06(6)	4.026(11)	66(10)	0.13(5)	9(3)	0.14(7)	645(228)
☐ 6	23.04(3)	3.857(4)	69(11)	0.17(4)	13(2)	0.18(6)	510(125)
☐ 7	23.52(3)	3.779(5)	67(11)	0.19(5)	14(2)	0.21(7)	435(108)
☐ 8	24.04(4)	3.698(6)	87(12)	0.28(4)	27(4)	0.31(8)	303(44)
☐ 9	25.588768	3.478306	27.331568	0.171256	5.37549	0.196677	496.823
☐ 10	26.660(3)	3.3409(4)	15112(159)	0.148(2)	2809(21)	0.186(3)	578(9)
☐ 11	27.542(7)	3.2359(8)	1410(48)	0.136(12)	276(12)	0.196(15)	627(55)
☐ 12	27.988(11)	3.1854(12)	1475(50)	0.220(14)	465(16)	0.32(2)	389(25)
☐ 13	29.441(7)	3.0313(7)	1165(44)	0.179(8)	291(7)	0.250(16)	479(22)
☐ 14	30.860(15)	2.8952(14)	468(28)	0.27(2)	214(8)	0.46(5)	316(24)
☐ 15	35.08(4)	2.556(3)	109(13)	0.71(6)	113(9)	1.0(2)	123(11)
☐ 16	36.004(12)	2.4924(8)	134(15)	0.11(3)	22(3)	0.16(4)	788(190)
☐ 17	36.546(8)	2.4567(5)	1059(42)	0.161(6)	203(5)	0.191(12)	542(21)
☐ 18	39.509(6)	2.2790(3)	1264(46)	0.171(5)	237(5)	0.187(11)	515(16)

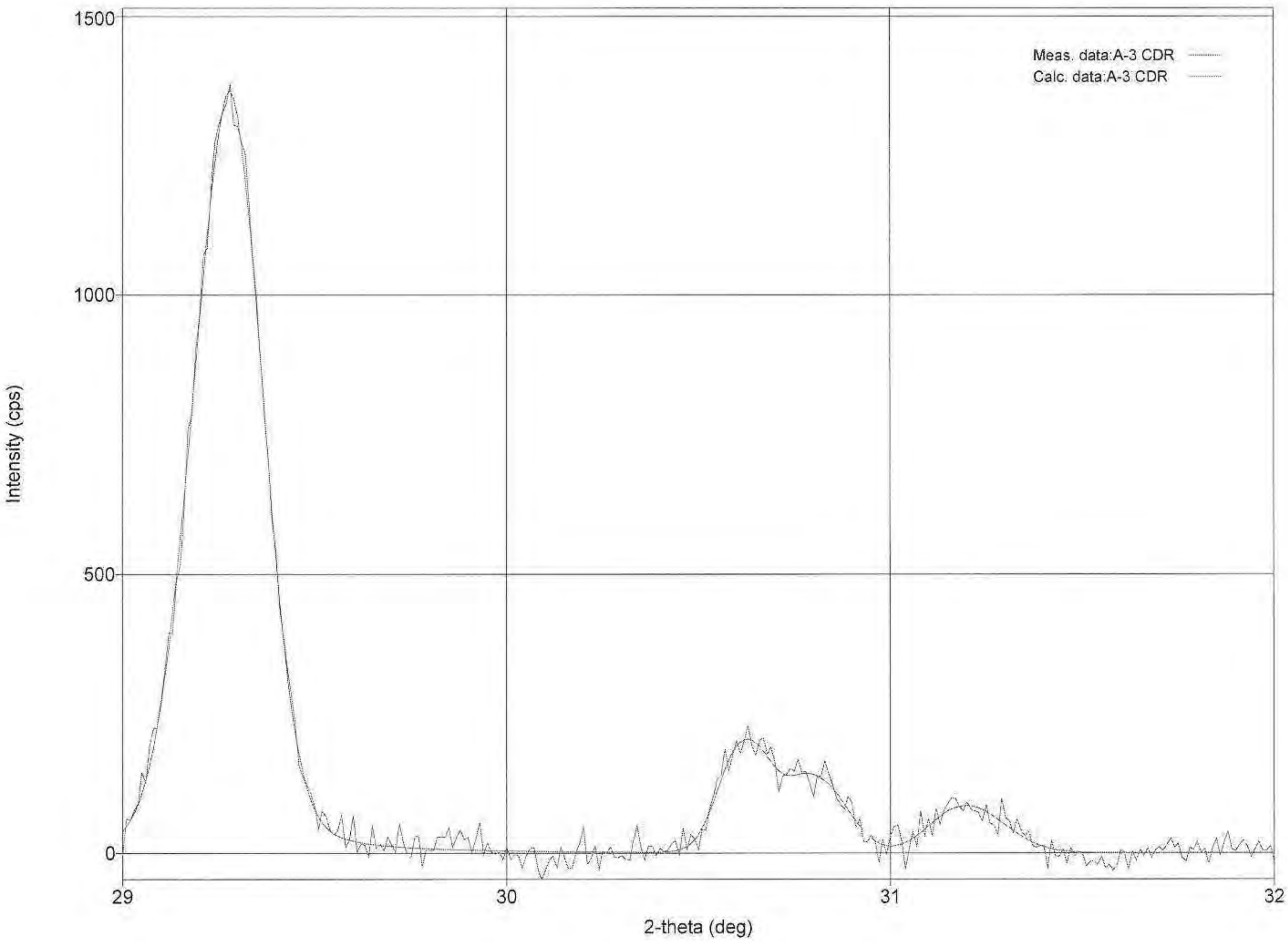
Appendix 2. X-ray patterns run to determine initial calcite-dolomite ratios. Each pattern is accompanied by the data sheet with peak information.


Meas. data:A-1 CDR
Calc. data:A-1 CDR
300
200
100
0
Intensity (cps)
29
30
31
32
2-theta (deg)

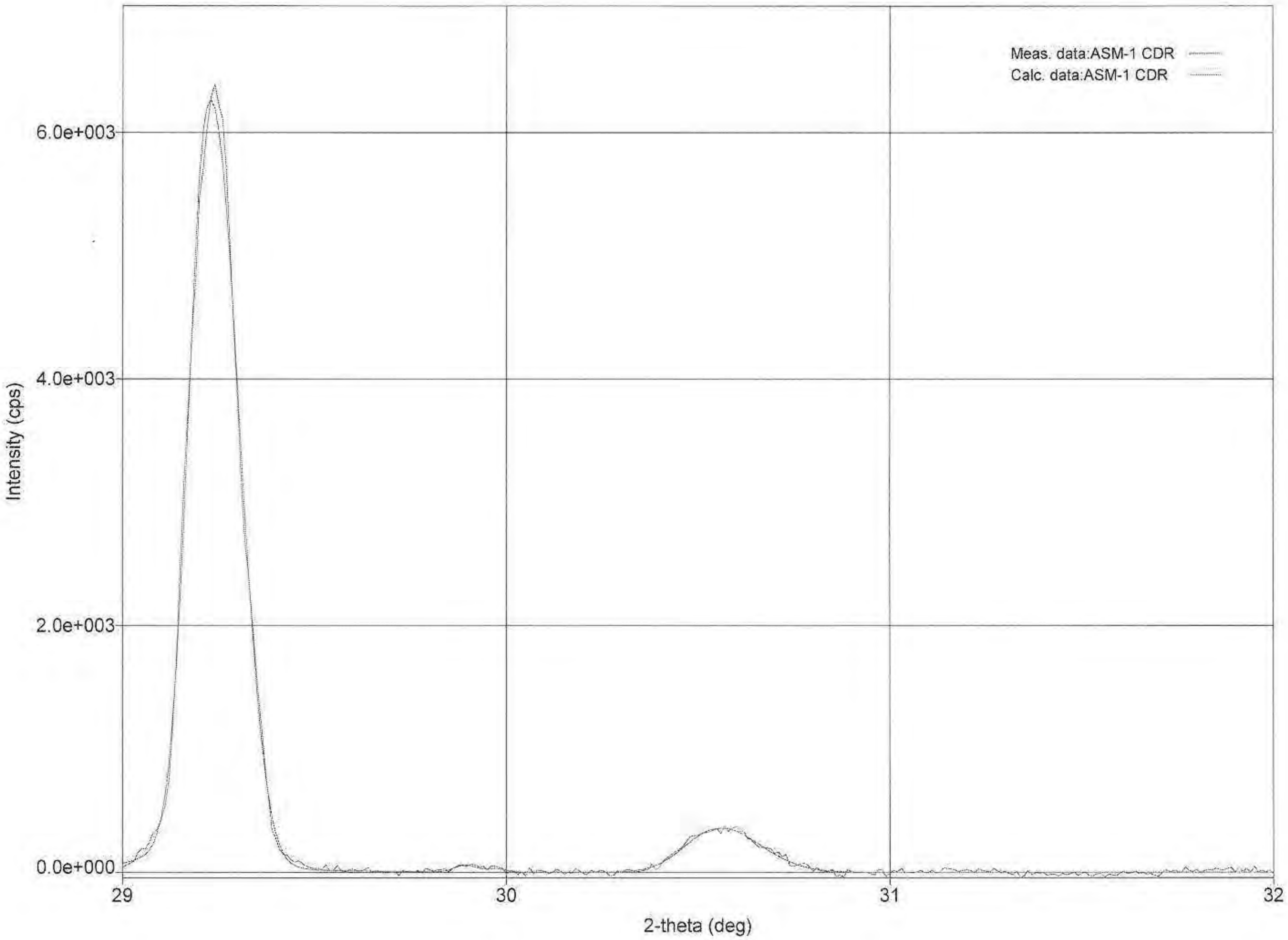
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.265(8)	3.0492(8)	261(15)	0.194(6)	54.0(17)	0.207(18)	442(13)
▨ 2	30.307(10)	2.9467(10)	57(7)	0.08(2)	6.1(10)	0.11(3)	1141(302)
▨ 3	30.67(3)	2.913(3)	70(8)	0.23(3)	23.3(18)	0.33(6)	369(48)


Meas. data:A-2 CDR
Calc. data:A-2 CDR
Intensity (cps)
2000
1500
1000
500
0
29
30
31
32
2-theta (deg)

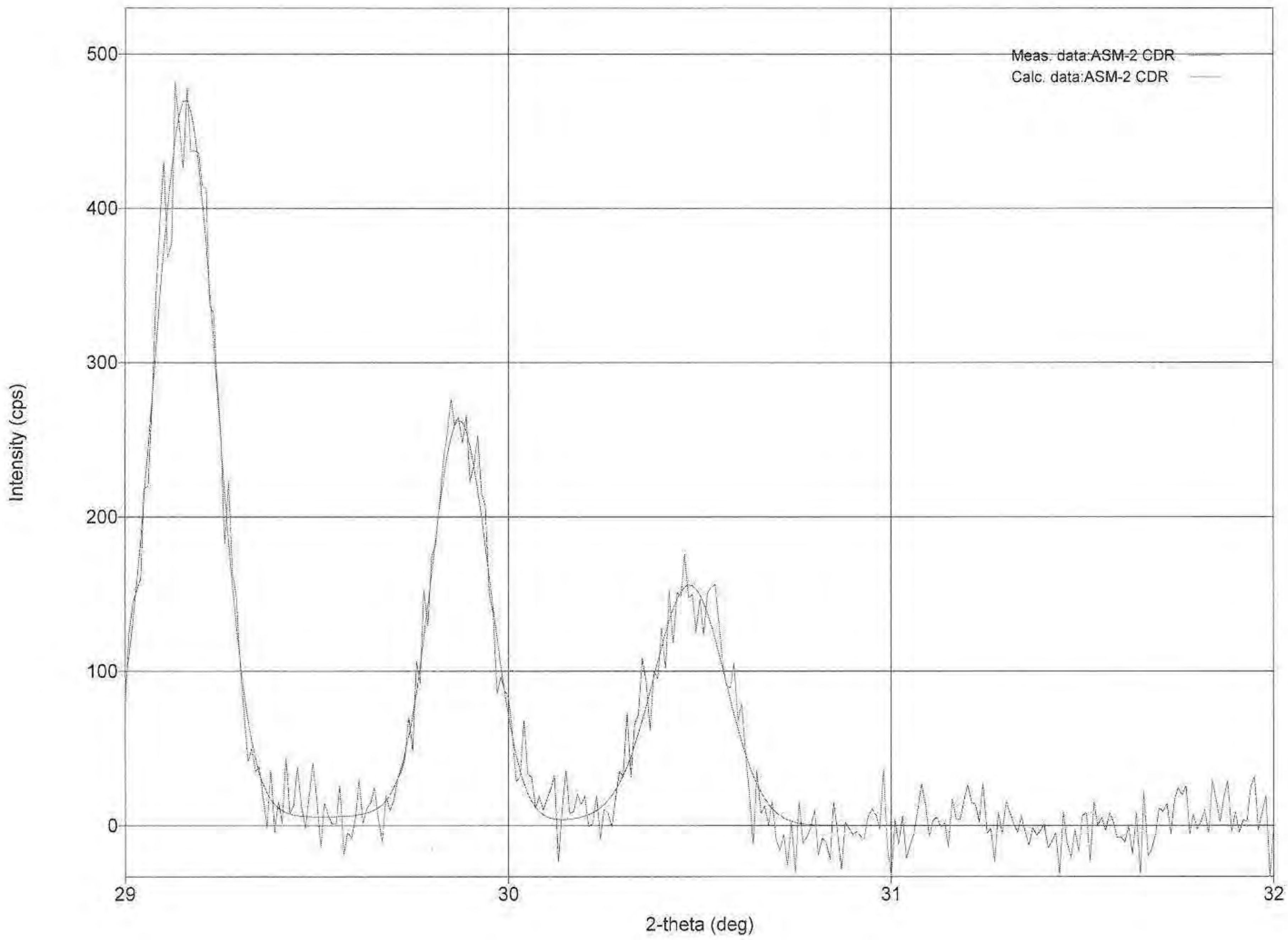
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.574(3)	3.0180(3)	1791(39)	0.128(4)	342(4)	0.191(6)	670(20)
▨ 2	30.91(3)	2.891(3)	107(9)	0.29(3)	47(3)	0.44(7)	292(34)


1500
1000
500
0
29
30
31
32
2-theta (deg)
Intensity (cps)
Meas. data:A-3 CDR
Calc. data:A-3 CDR

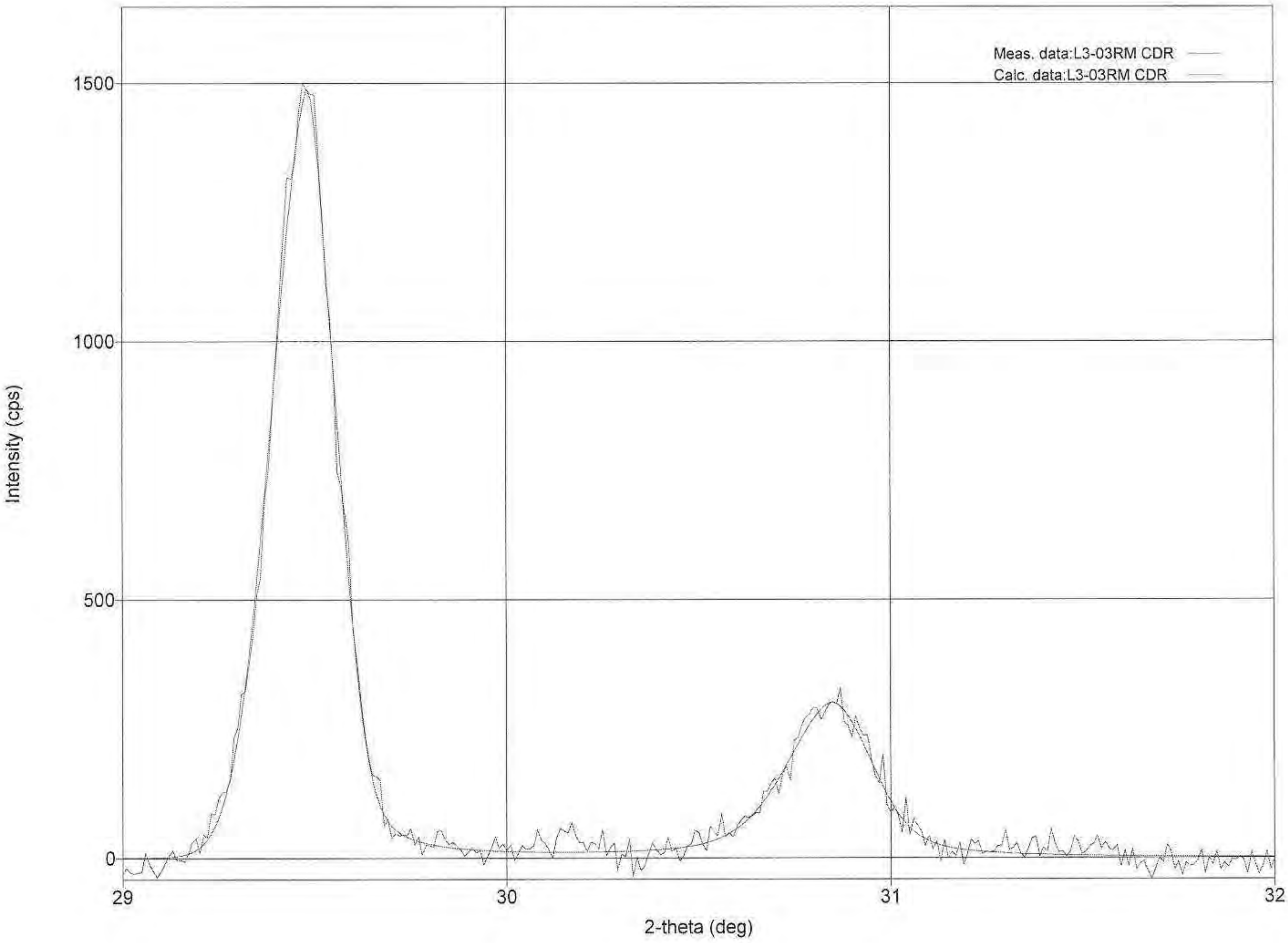
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.266(4)	3.0491(4)	984(29)	0.199(3)	221(3)	0.225(10)	431(6)
☐ 2	30.602(11)	2.9189(10)	161(12)	0.15(2)	25(4)	0.16(3)	590(96)
☐ 3	30.791(12)	2.9014(11)	103(9)	0.13(3)	14(3)	0.14(4)	653(136)
☐ 4	31.17(2)	2.8671(19)	62(7)	0.20(3)	13.4(10)	0.22(4)	426(55)


Meas. data:ASM-1 CDR
Calc. data:ASM-1 CDR
6.0e+003
4.0e+003
2.0e+003
0.0e+000
Intensity (cps)
29
30
31
32
2-theta (deg)

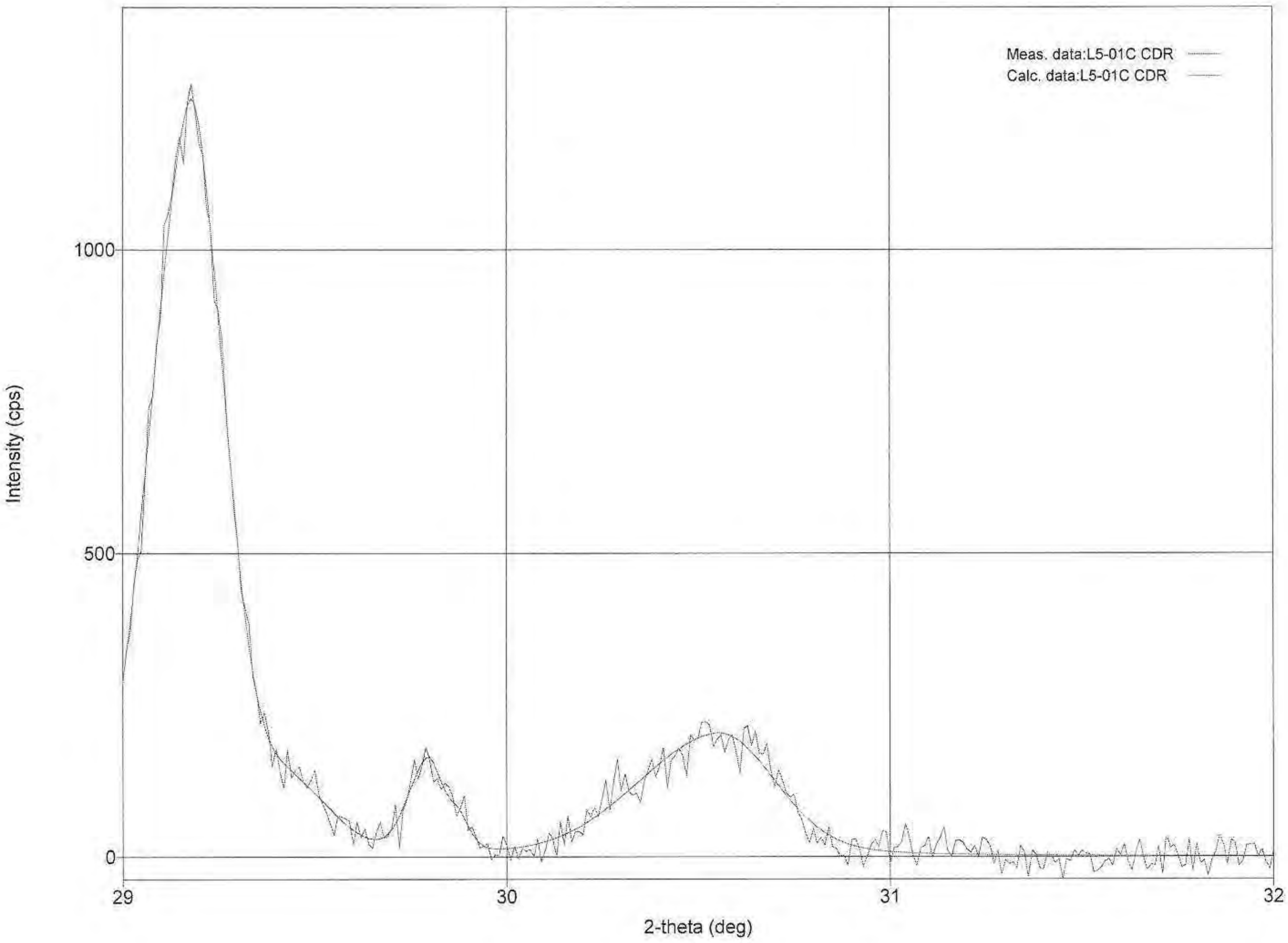
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.2114(18)	3.05466(19)	5329(67)	0.1165(13)	695(5)	0.130(3)	736(9)
☐ 2	29.894(12)	2.9865(12)	56(7)	0.062(11)	3.7(9)	0.07(2)	1393(250)
☐ 3	30.530(9)	2.9257(8)	261(15)	0.210(6)	58.4(18)	0.22(2)	409(12)


Meas. data:ASM-2 CDR
Calc. data:ASM-2 CDR
Intensity (cps)
500
400
300
200
100
0
29
30
31
32
2-theta (deg)

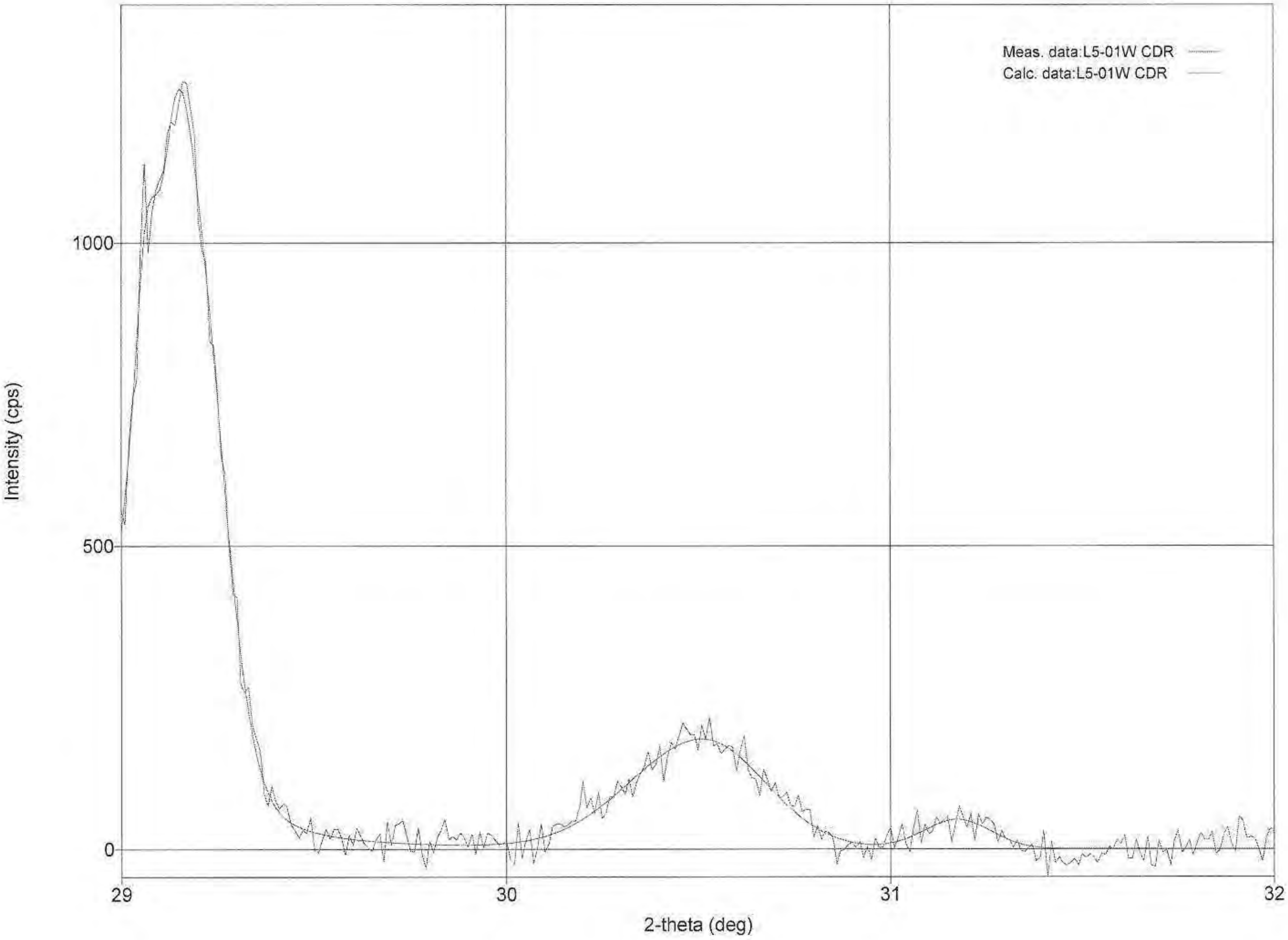
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.140(7)	3.0620(7)	346(17)	0.176(5)	67.8(15)	0.196(14)	486(13)
▨ 2	29.854(8)	2.9903(8)	201(13)	0.155(7)	34.5(11)	0.172(17)	556(26)
▨ 3	30.452(11)	2.9330(11)	114(10)	0.203(11)	25.7(10)	0.23(3)	423(23)


Meas. data:L3-03RM CDR
Calc. data:L3-03RM CDR
Intensity (cps)
1500
1000
500
0
29
30
31
32
2-theta (deg)

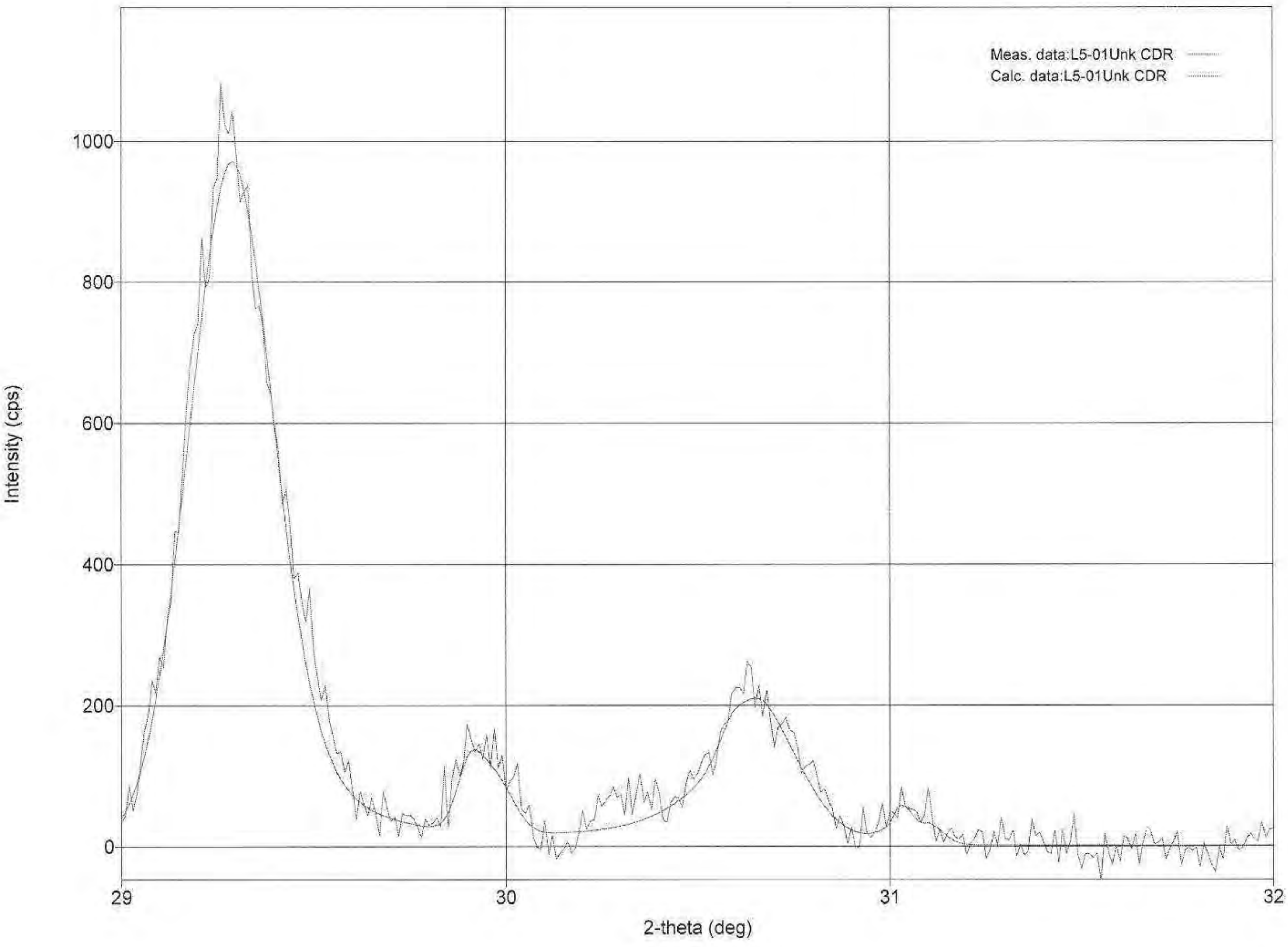
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.475(4)	3.0279(4)	1079(30)	0.175(3)	213(2)	0.198(8)	490(8)
▨ 2	30.837(14)	2.8973(13)	213(13)	0.243(11)	68(2)	0.32(3)	354(16)


Meas. data:L5-01C CDR
Calc. data:L5-01C CDR
Intensity (cps)
1000
500
0
29
30
31
32
2-theta (deg)

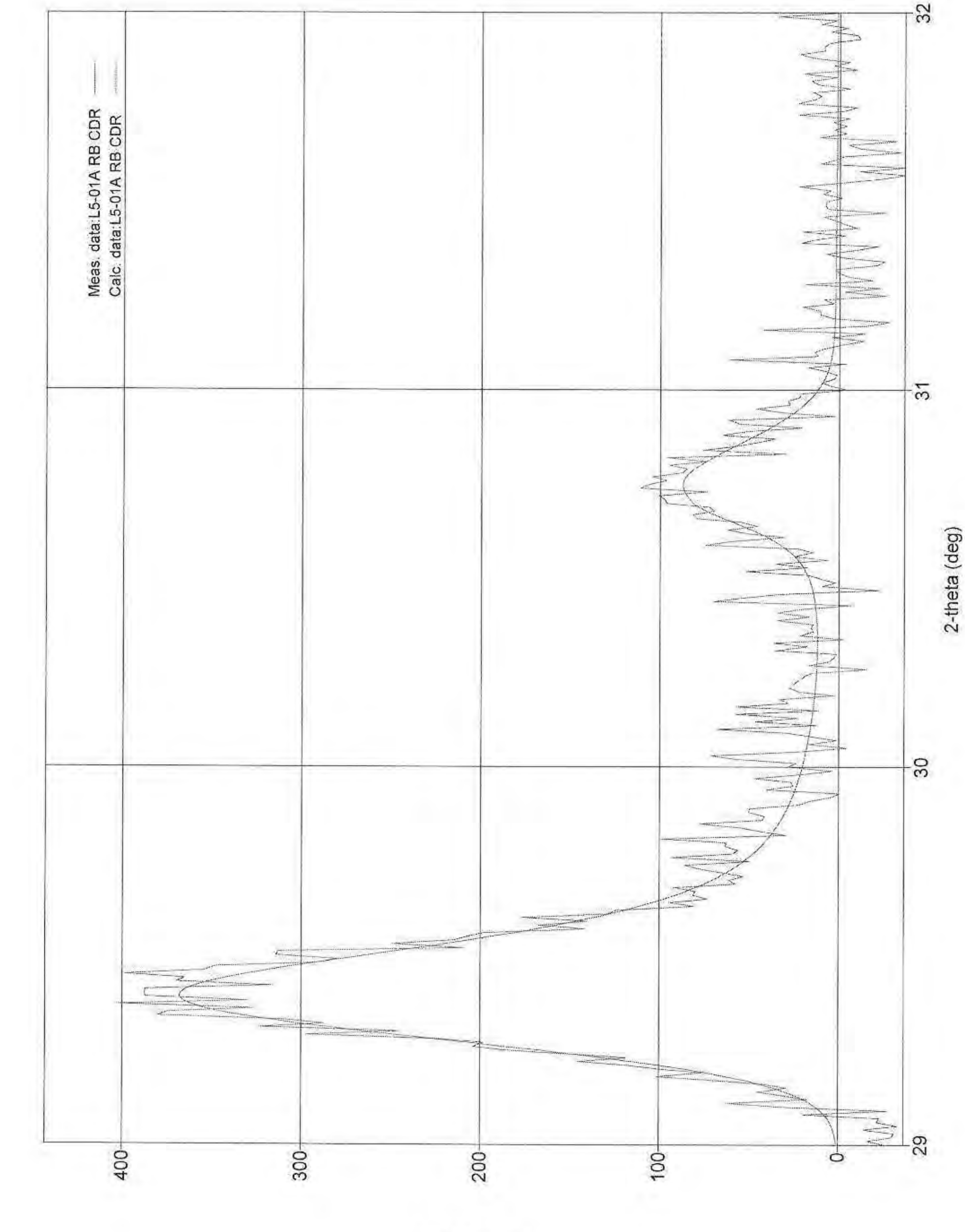
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.169(7)	3.0590(7)	867(27)	0.204(5)	197(29)	0.23(4)	420(10)
☐ 2	29.41(5)	3.035(5)	75(8)	0.31(12)	25(13)	0.3(2)	280(107)
☐ 3	29.792(5)	2.9965(5)	132(10)	0.100(12)	15(2)	0.11(2)	861(102)
☐ 4	30.543(14)	2.9245(13)	138(11)	0.411(19)	63(10)	0.46(11)	209(10)


Meas. data:L5-01W CDR
Calc. data:L5-01W CDR
Intensity (cps)
1000
500
0
29
30
31
32
2-theta (deg)

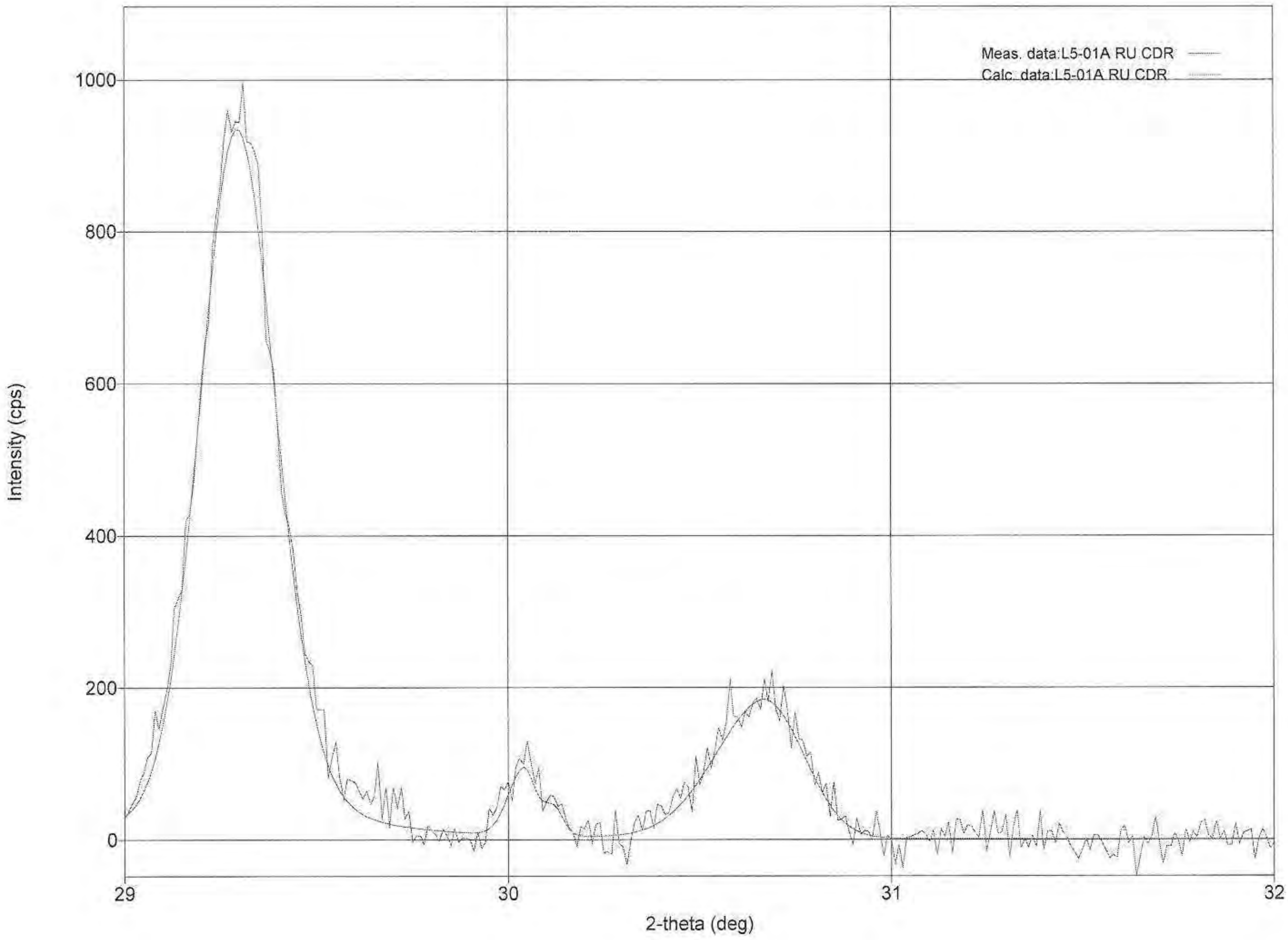
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.063(4)	3.0699(4)	467(20)	0.089(14)	63(17)	0.14(4)	961(152)
☐ 2	29.162(8)	3.0598(8)	800(26)	0.171(14)	207(24)	0.26(4)	502(42)
☐ 3	30.491(19)	2.9293(18)	123(10)	0.404(16)	53(3)	0.43(6)	213(8)
☐ 4	31.159(15)	2.8681(14)	36(5)	0.18(4)	7.0(12)	0.20(6)	468(107)


Meas. data:L5-01Unk CDR
Calc. data:L5-01Unk CDR
Intensity (cps)
1000
800
600
400
200
0
29
30
31
32
2-theta (deg)

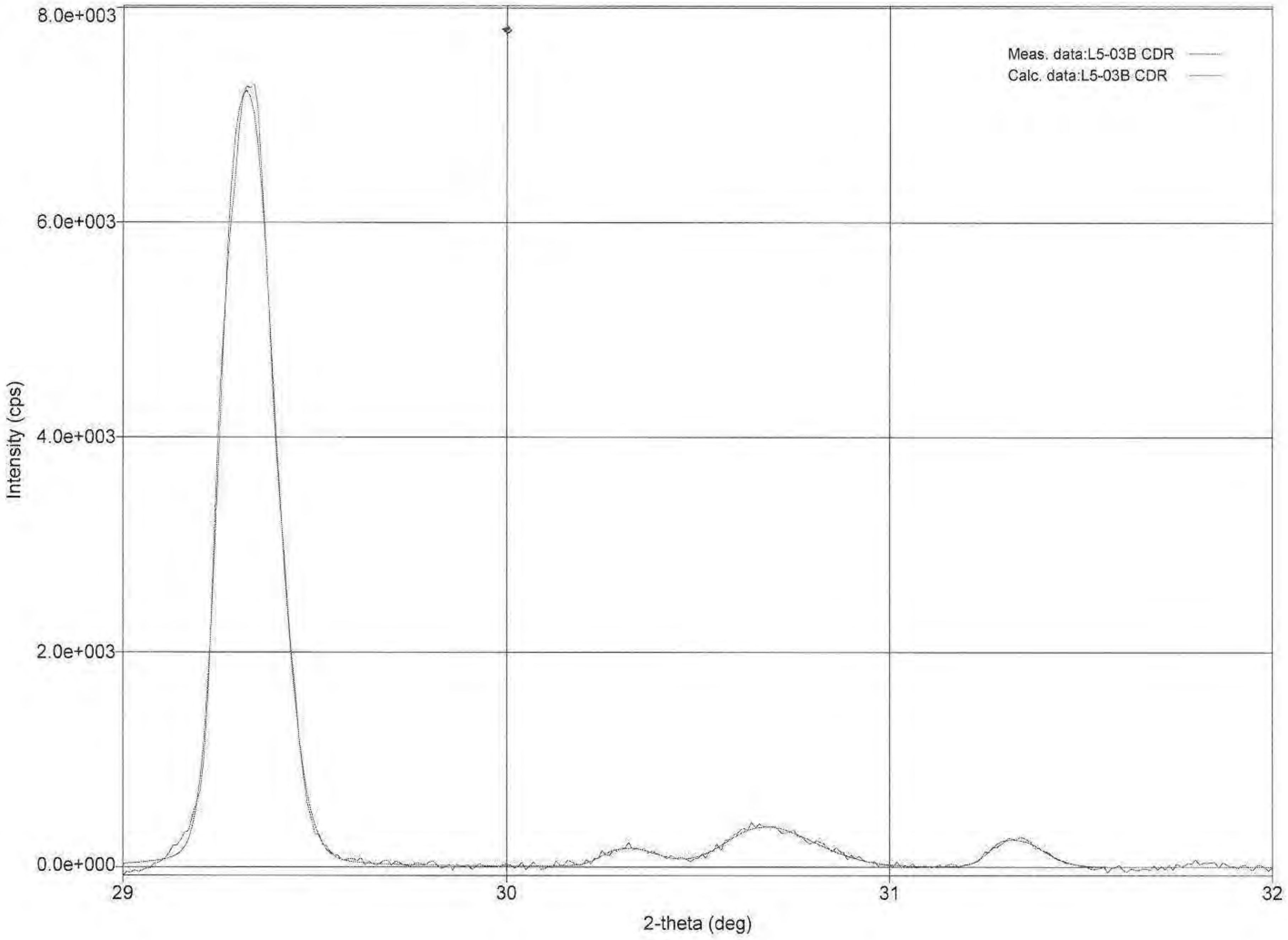
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.2715(17)	3.04853(18)	684(24)	0.249(4)	200(3)	0.292(14)	345(6)
☐ 2	29.912(16)	2.9847(16)	109(10)	0.092(19)	10.7(18)	0.10(3)	936(189)
☐ 3	30.605(6)	2.9187(5)	153(11)	0.219(17)	46(3)	0.30(4)	393(31)
☐ 4	31.026(9)	2.8800(8)	51(7)	0.07(2)	5.0(11)	0.10(3)	1191(411)


Meas. data:L5-01A RB CDR
Calc. data:L5-01A RB CDR
Intensity (cps)
400
300
200
100
0
29
30
31
32
2-theta (deg)

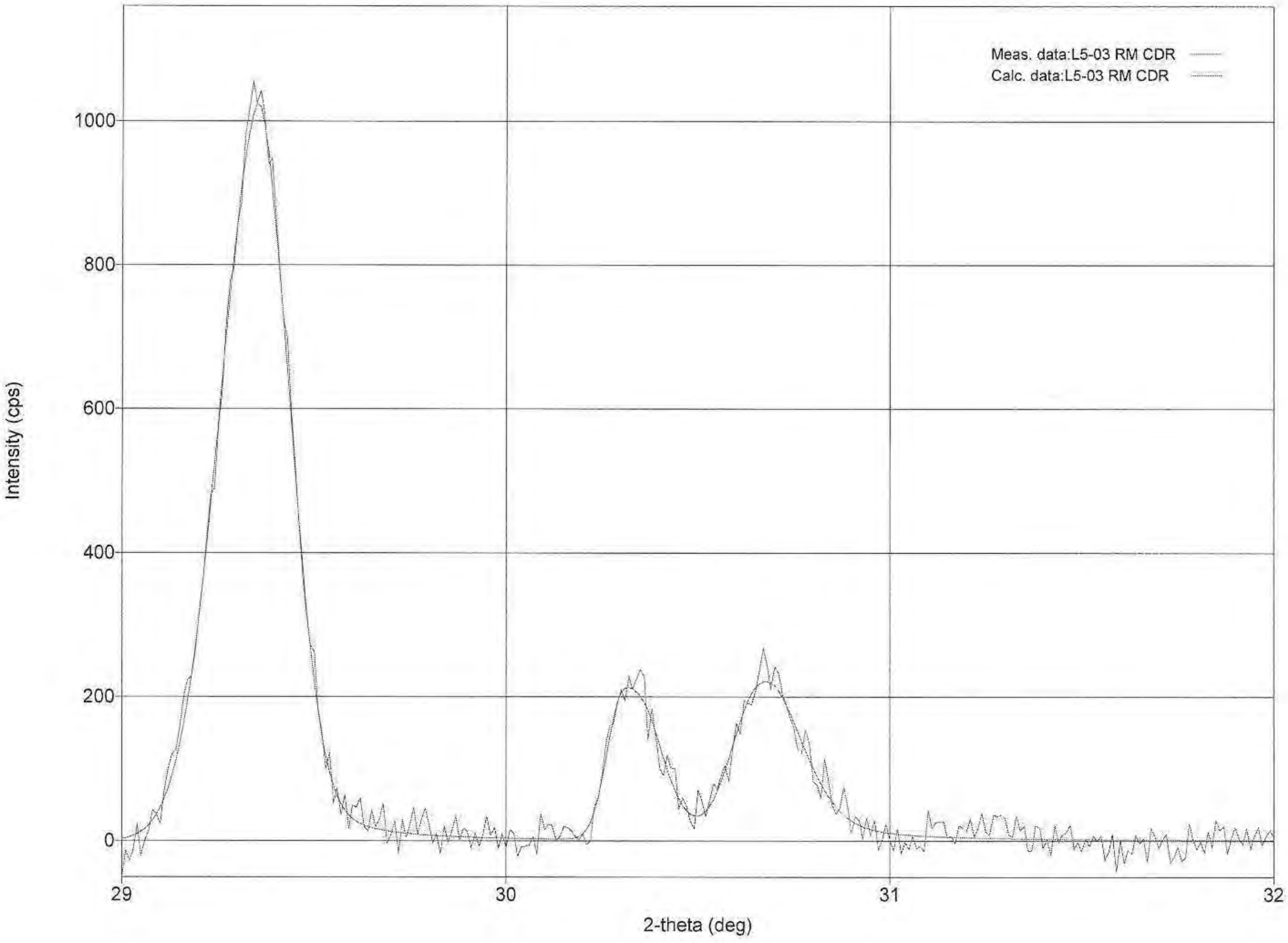
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.367(12)	3.0388(13)	259(15)	0.280(11)	94(3)	0.36(3)	306(12)
☐ 2	30.704(9)	2.9095(9)	61(7)	0.23(3)	17.3(18)	0.28(6)	369(45)


Meas. data:L5-01A RU CDR
Calc. data:L5-01A RU CDR
Intensity (cps)
1000
800
600
400
200
0
29
30
31
32
2-theta (deg)

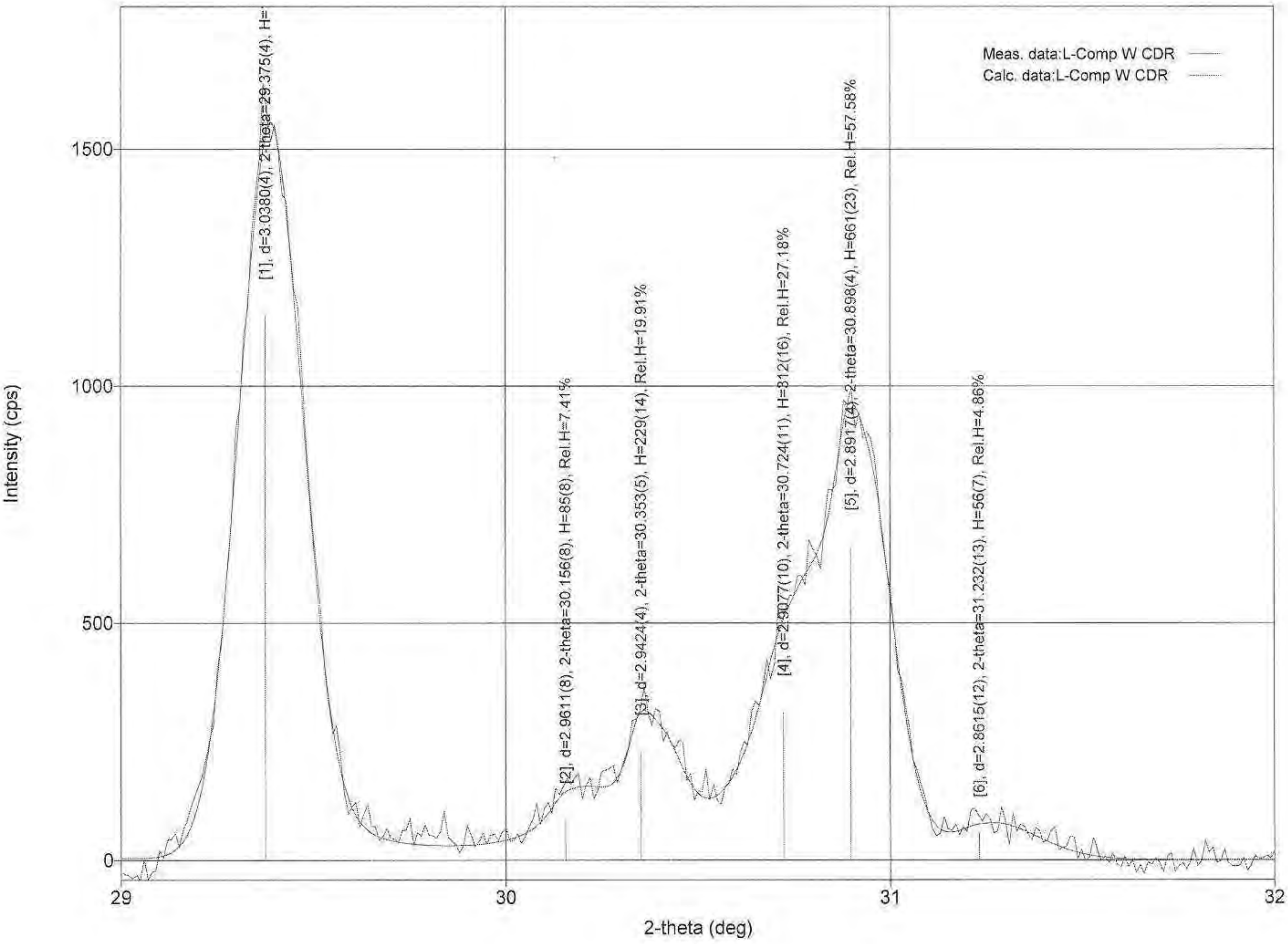
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.273(5)	3.0484(6)	673(24)	0.219(4)	174(3)	0.258(14)	392(7)
☐ 2	30.039(7)	2.9724(6)	83(8)	0.078(12)	6.8(7)	0.083(17)	1107(178)
☐ 3	30.656(16)	2.9139(15)	128(10)	0.257(12)	35.1(19)	0.27(4)	334(16)


Meas. data:L5-03B CDR
Calc. data:L5-03B CDR
8.0e+003
6.0e+003
4.0e+003
2.0e+003
0.0e+000
Intensity (cps)
29
30
31
32
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	29.2926(19)	3.04638(19)	6113(71)	0.1240(14)	846(6)	0.138(3)	692(8)
▨ 2	30.289(4)	2.9484(4)	137(11)	0.131(16)	19.6(16)	0.14(2)	657(80)
▨ 3	30.642(3)	2.9153(3)	264(15)	0.258(8)	75(2)	0.28(2)	334(10)
▨ 4	31.299(3)	2.8555(2)	226(14)	0.116(8)	28.8(11)	0.127(13)	744(50)

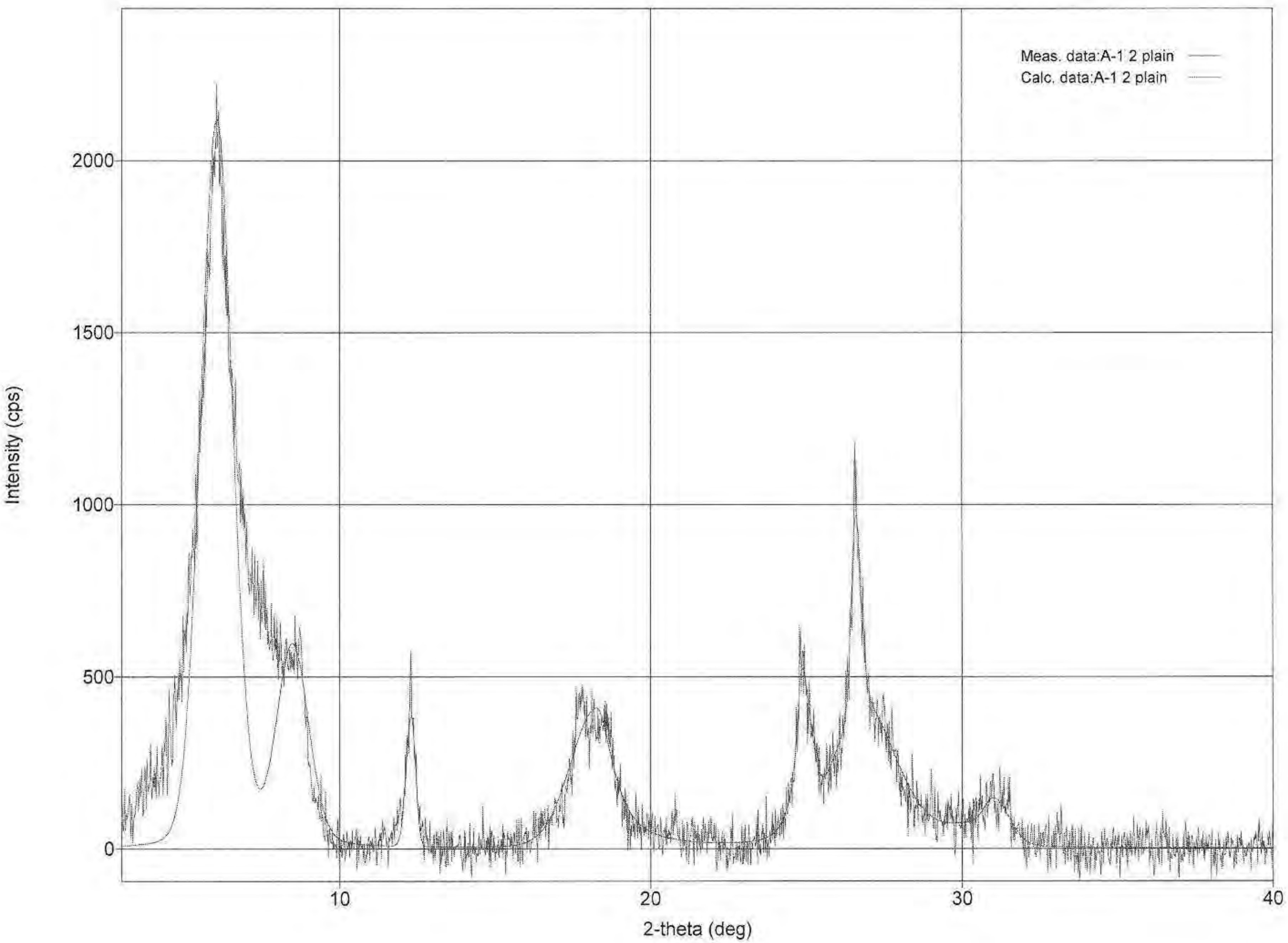

Meas. data:L5-03 RM CDR
Calc. data:L5-03 RM CDR
Intensity (cps)
1000
800
600
400
200
0
29
30
31
32
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.343(4)	3.0412(4)	735(25)	0.196(3)	160(2)	0.217(10)	438(7)
☐ 2	30.302(6)	2.9472(6)	191(13)	0.111(9)	24.9(11)	0.130(14)	775(65)
☐ 3	30.647(10)	2.9148(9)	165(12)	0.181(11)	35.1(14)	0.21(2)	474(29)

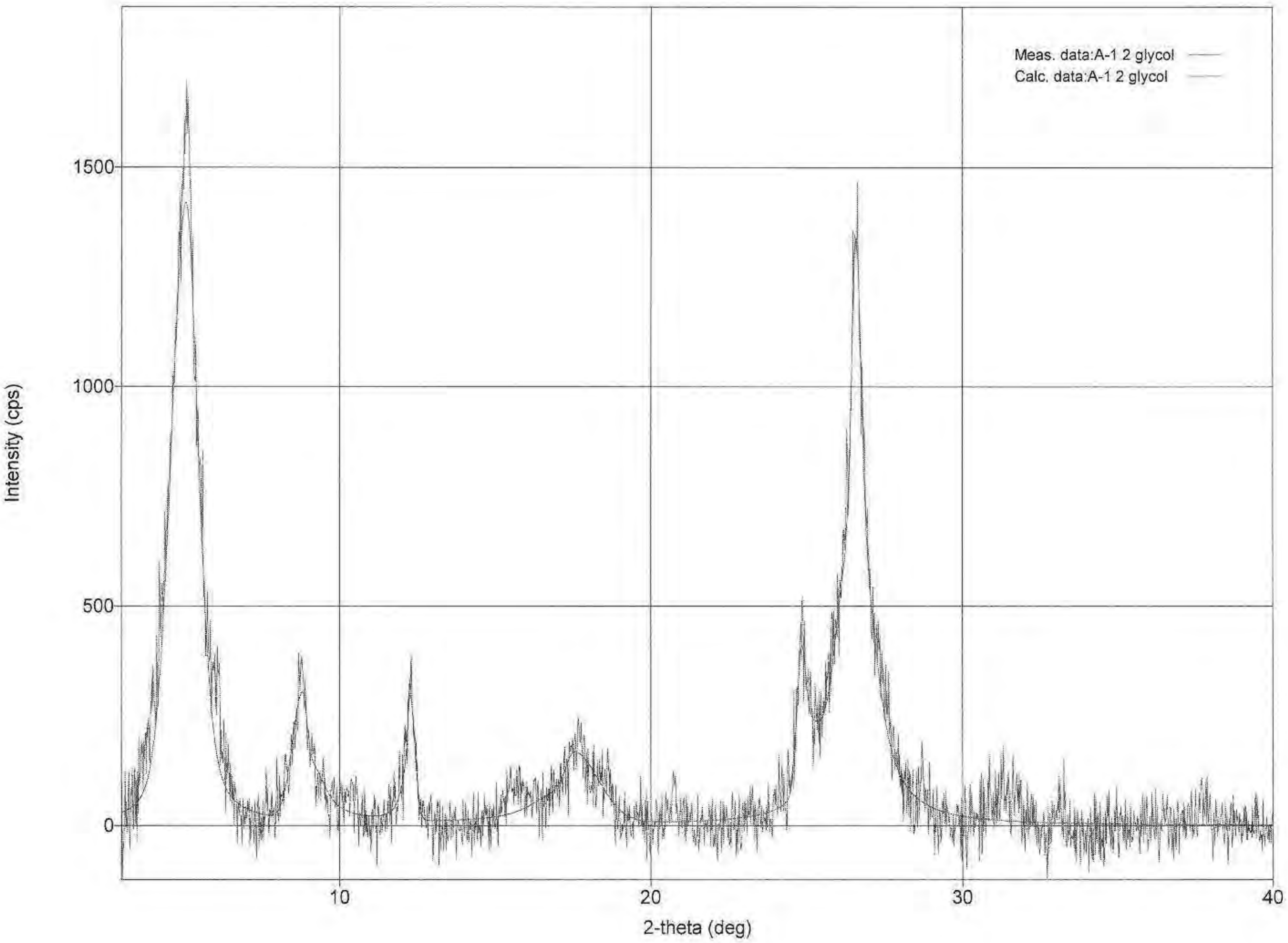

Meas. data:L-Comp W CDR
Calc. data:L-Comp W CDR
[1], d=3.0380(4), 2-theta=29.375(4), H=
[2], d=2.9611(8), 2-theta=30.156(8), H=85(8), Rel.H=7.41%
[3], d=2.9424(4), 2-theta=30.353(5), H=229(14), Rel.H=19.91%
[4], d=2.9077(10), 2-theta=30.724(11), H=312(16), Rel.H=27.18%
[5], d=2.8917(4), 2-theta=30.898(4), H=661(23), Rel.H=57.58%
[6], d=2.8615(12), 2-theta=31.232(13), H=56(7), Rel.H=4.86%
Intensity (cps)
0
500
1000
1500
29
30
31
32
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	29.375(4)	3.0380(4)	1148(31)	0.174(3)	225(3)	0.196(8)	492(8)
☐ 2	30.156(8)	2.9611(8)	85(8)	0.14(4)	15(3)	0.18(6)	627(164)
☐ 3	30.353(5)	2.9424(4)	229(14)	0.108(11)	32(3)	0.14(2)	795(78)
☐ 4	30.724(11)	2.9077(10)	312(16)	0.21(4)	87(25)	0.28(9)	404(81)
☐ 5	30.898(4)	2.8917(4)	661(23)	0.140(11)	121(25)	0.18(4)	614(46)
☐ 6	31.232(13)	2.8615(12)	56(7)	0.26(3)	19(2)	0.34(8)	336(42)

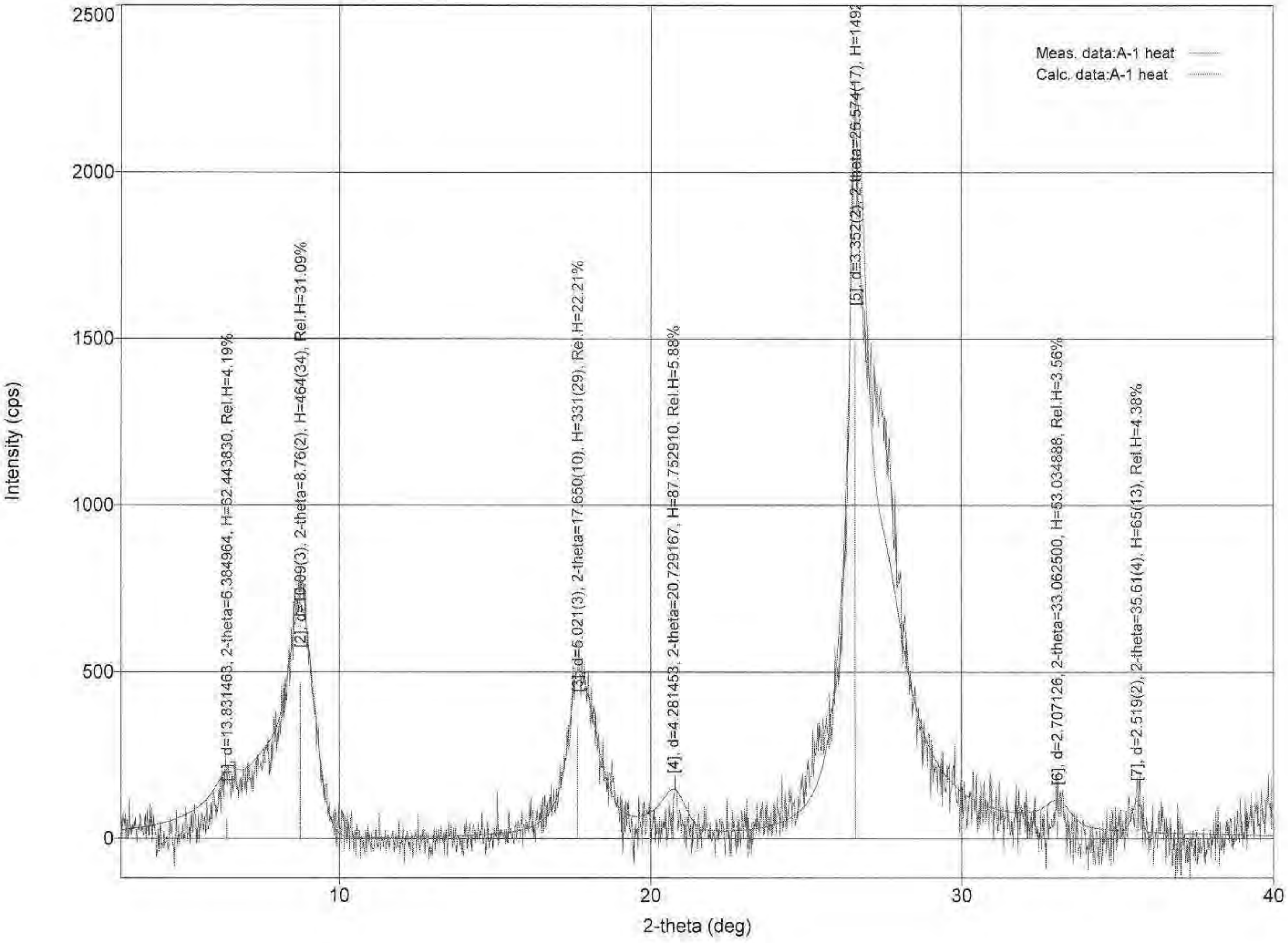
Appendix 3. X-ray diffraction patterns run for clay mineralogy determinations. Each sample set has three patterns plus accompanying data sheets. These are the plain, untreated sample, the ethylene glycol saturated sample and the sample after heating to 550° C.


Meas. data:A-1 2 plain
Calc. data:A-1 2 plain
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)

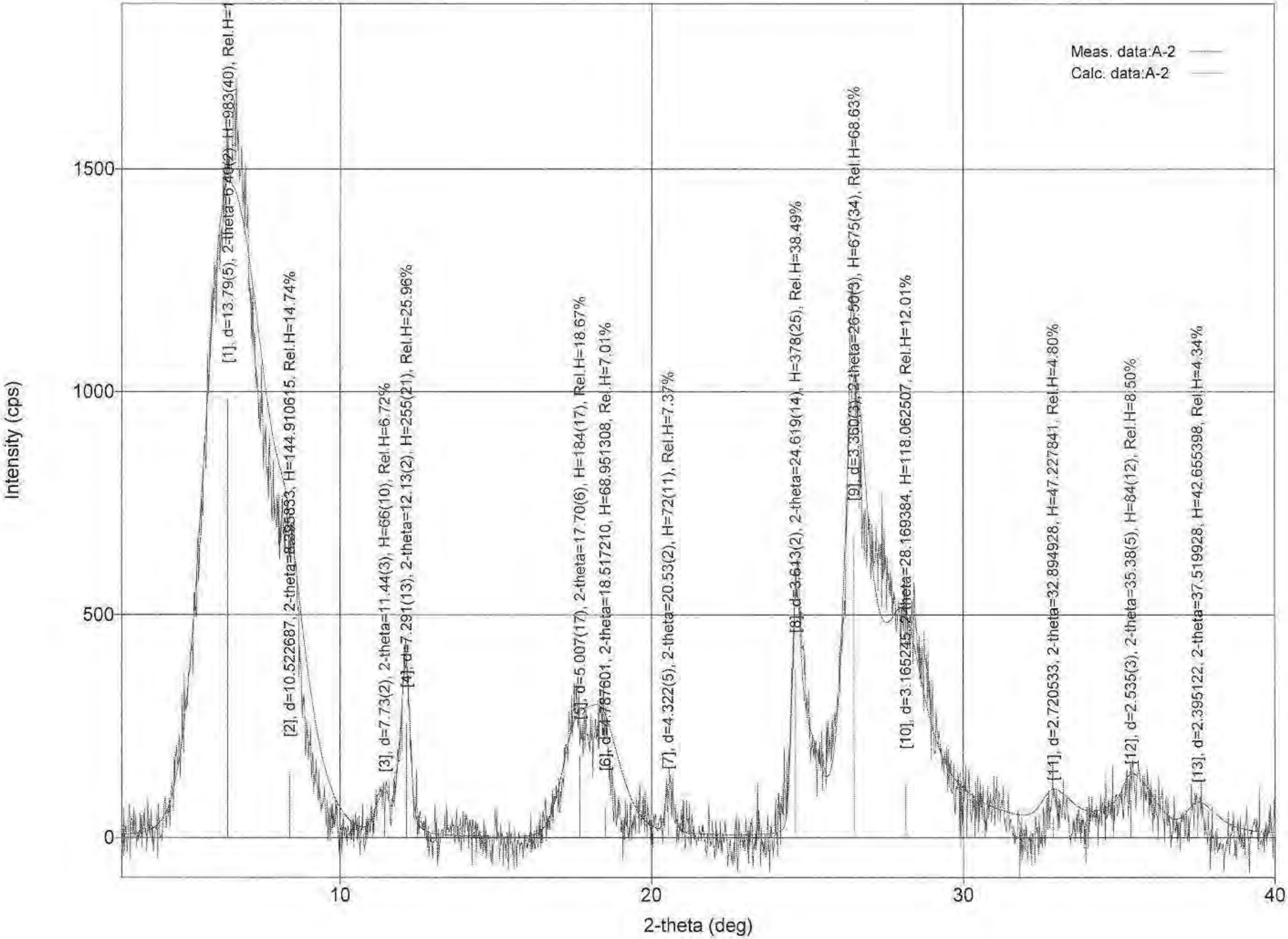
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	6.049819	14.596919	1413.876974	1.2107	1930.34	1.365279	68.6273
▨ 2	8.496377	10.398389	386.067501	1.2107	527.09	1.365279	68.7205
▨ 3	12.30(3)	7.191(15)	253(25)	0.36(2)	96(8)	0.38(7)	235(14)
▨ 4	18.25(6)	4.858(16)	271(26)	1.64(6)	568(17)	2.1(3)	51.3(18)
▨ 5	24.822(11)	3.5840(16)	305(28)	0.53(3)	214(11)	0.70(10)	159(10)
▨ 6	26.58(3)	3.351(3)	387(31)	0.36(2)	156(11)	0.40(6)	234(14)
▨ 7	26.83(7)	3.320(8)	272(26)	2.45(6)	776(22)	2.8(4)	34.8(9)
▨ 8	30.96(9)	2.886(8)	91(15)	1.21(13)	175(17)	1.9(5)	71(7)


Meas. data:A-1 2 glycol
Calc. data:A-1 2 glycol
Intensity (cps)
1500
1000
500
0
10
20
30
40
2-theta (deg)

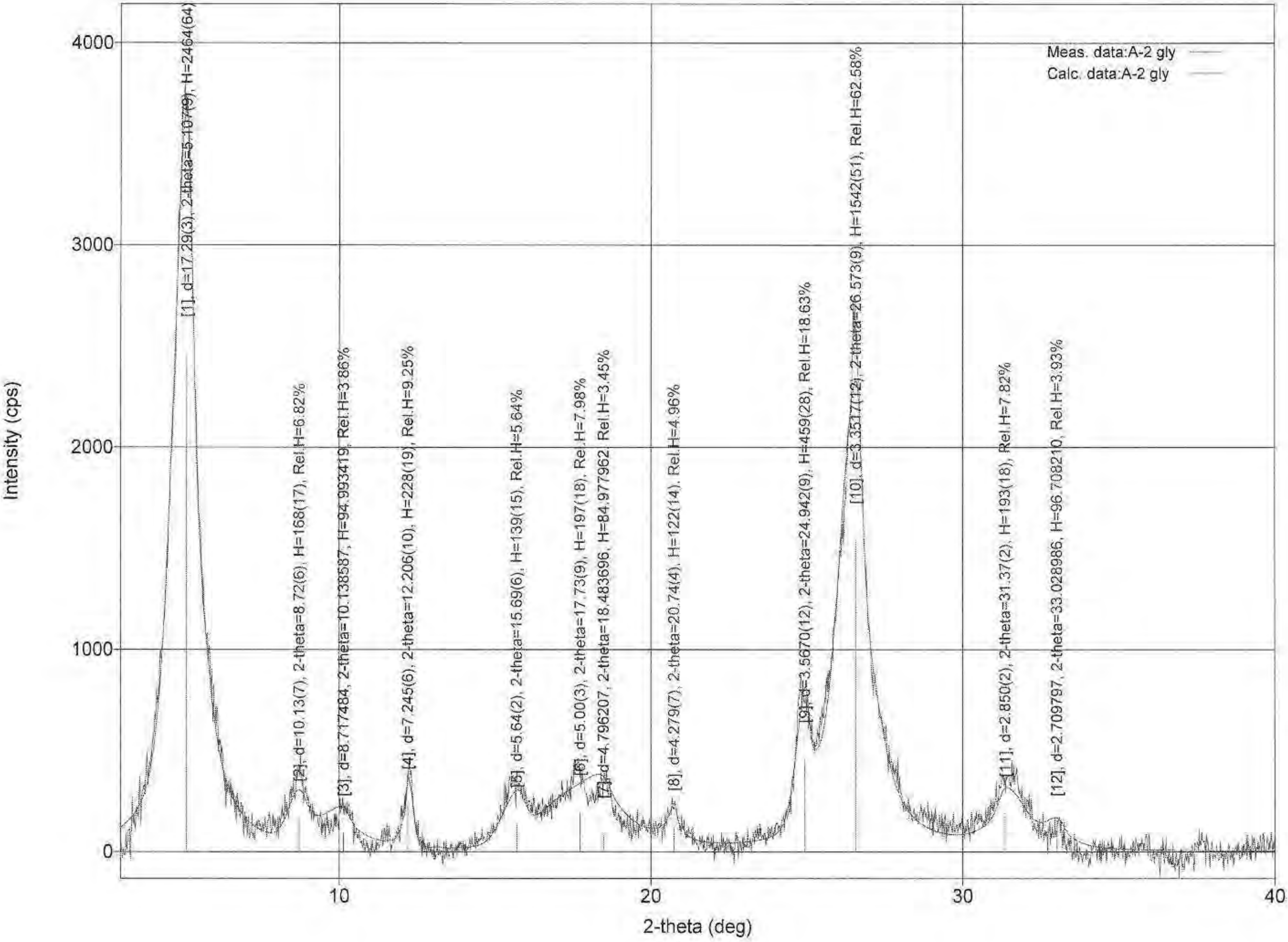
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	5.05(2)	17.48(7)	948(49)	1.03(2)	1230(22)	1.30(9)	80.3(15)
▨ 2	8.82(4)	10.02(5)	195(22)	0.67(6)	198(13)	1.01(18)	124(10)
▨ 3	12.25(2)	7.219(12)	193(22)	0.31(3)	85(7)	0.44(8)	265(28)
▨ 4	17.52(7)	5.06(2)	109(17)	1.50(11)	241(16)	2.2(5)	56(4)
▨ 5	24.826(13)	3.5835(18)	230(24)	0.42(5)	157(10)	0.68(11)	201(23)
▨ 6	26.569(12)	3.3522(15)	899(47)	0.60(2)	1086(14)	1.21(8)	141(5)


Meas. data:A-1 heat
Calc. data:A-1 heat
[1], d=13.831463, 2-theta=6.384964, H=62.443830, Rel.H=4.19%
[2], d=10.09(3), 2-theta=8.76(2), H=464(34), Rel.H=31.09%
[3], d=5.021(3), 2-theta=17.650(10), H=331(29), Rel.H=22.21%
[4], d=4.281453, 2-theta=20.729167, H=87.752910, Rel.H=5.88%
[5], d=3.352(2), 2-theta=26.574(17), H=1492
[6], d=2.707126, 2-theta=33.062500, H=53.034888, Rel.H=3.56%
[7], d=2.519(2), 2-theta=35.61(4), H=65(13), Rel.H=4.38%
Intensity (cps)
2500
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)

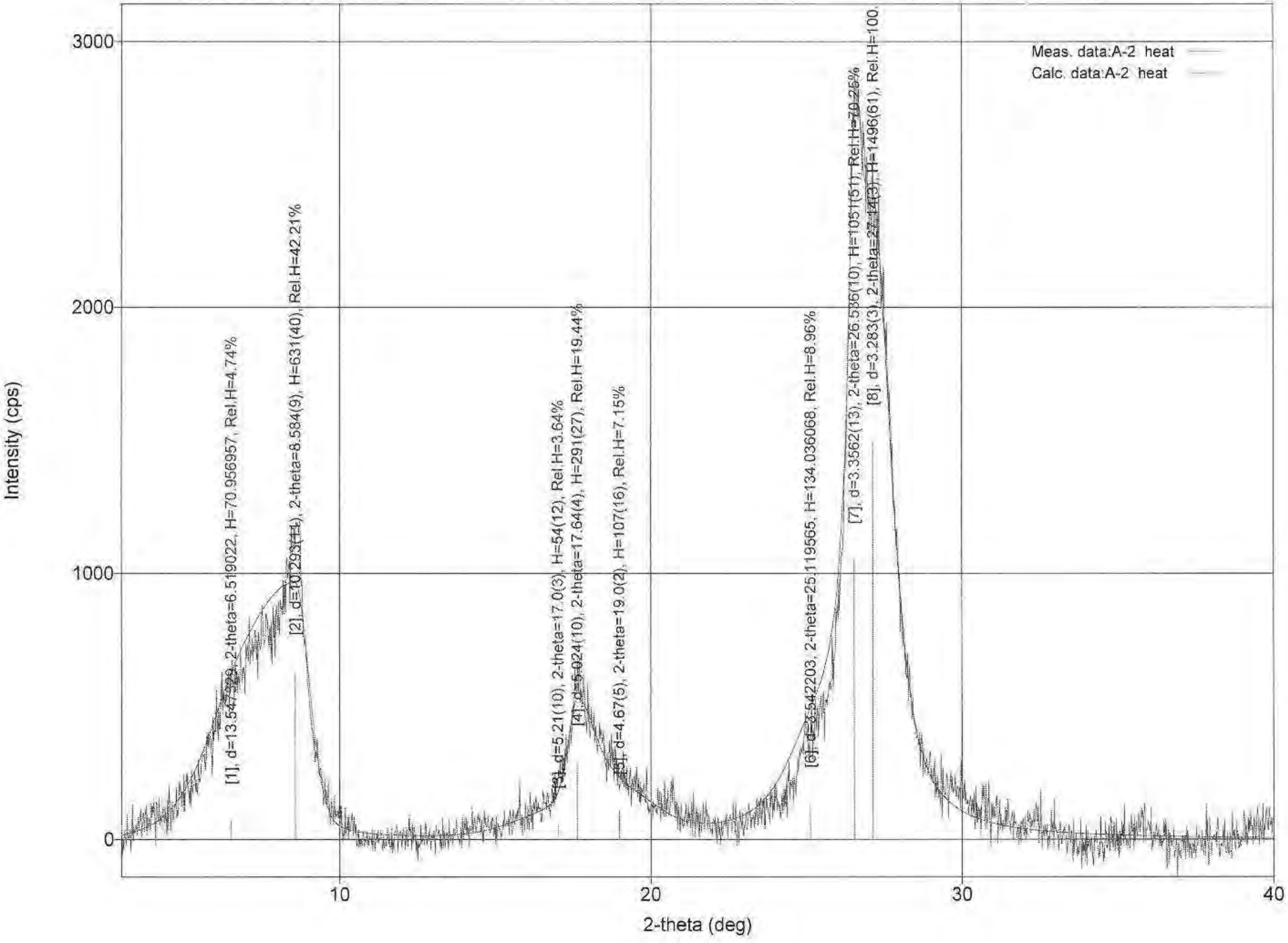
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.384964	13.831463	62.443830	1.06139	103.784	1.662031	78.294
☐ 2	8.76(2)	10.09(3)	464(34)	1.22(3)	932(15)	2.01(18)	68.5(19)
☐ 3	17.650(10)	5.021(3)	331(29)	1.06(3)	484(11)	1.46(16)	79(3)
☐ 4	20.729167	4.281453	87.752910	1.06139	145.848	1.662031	79.4692
☐ 5	26.574(17)	3.352(2)	1492(61)	0.88(3)	2637(30)	1.77(9)	97(3)
☐ 6	33.062500	2.707126	53.034888	1.06139	88.1456	1.662031	81.5431
☐ 7	35.61(4)	2.519(2)	65(13)	0.32(11)	22(9)	0.3(2)	273(91)


Meas. data:A-2
Calc. data:A-2
[1], d=13.79(5), 2-theta=6.40(2), H=983(40), Rel.H=1
[2], d=10.522687, 2-theta=8.395833, H=144.910615, Rel.H=14.74%
[3], d=7.73(2), 2-theta=11.44(3), H=66(10), Rel.H=6.72%
[4], d=7.291(13), 2-theta=12.13(2), H=255(21), Rel.H=25.96%
[5], d=5.007(17), 2-theta=17.70(6), H=184(17), Rel.H=18.67%
[6], d=4.787601, 2-theta=18.517210, H=68.951308, Rel.H=7.01%
[7], d=4.322(5), 2-theta=20.53(2), H=72(11), Rel.H=7.37%
[8], d=3.613(2), 2-theta=24.619(14), H=378(25), Rel.H=38.49%
[9], d=3.360(3), 2-theta=26.50(3), H=675(34), Rel.H=68.63%
[10], d=3.165245, 2-theta=28.169384, H=118.062507, Rel.H=12.01%
[11], d=2.720533, 2-theta=32.894928, H=47.227841, Rel.H=4.80%
[12], d=2.535(3), 2-theta=35.38(5), H=84(12), Rel.H=8.50%
[13], d=2.395122, 2-theta=37.519928, H=42.655398, Rel.H=4.34%
Intensity (cps)
0
500
1000
1500
10
20
30
40
2-theta (deg)

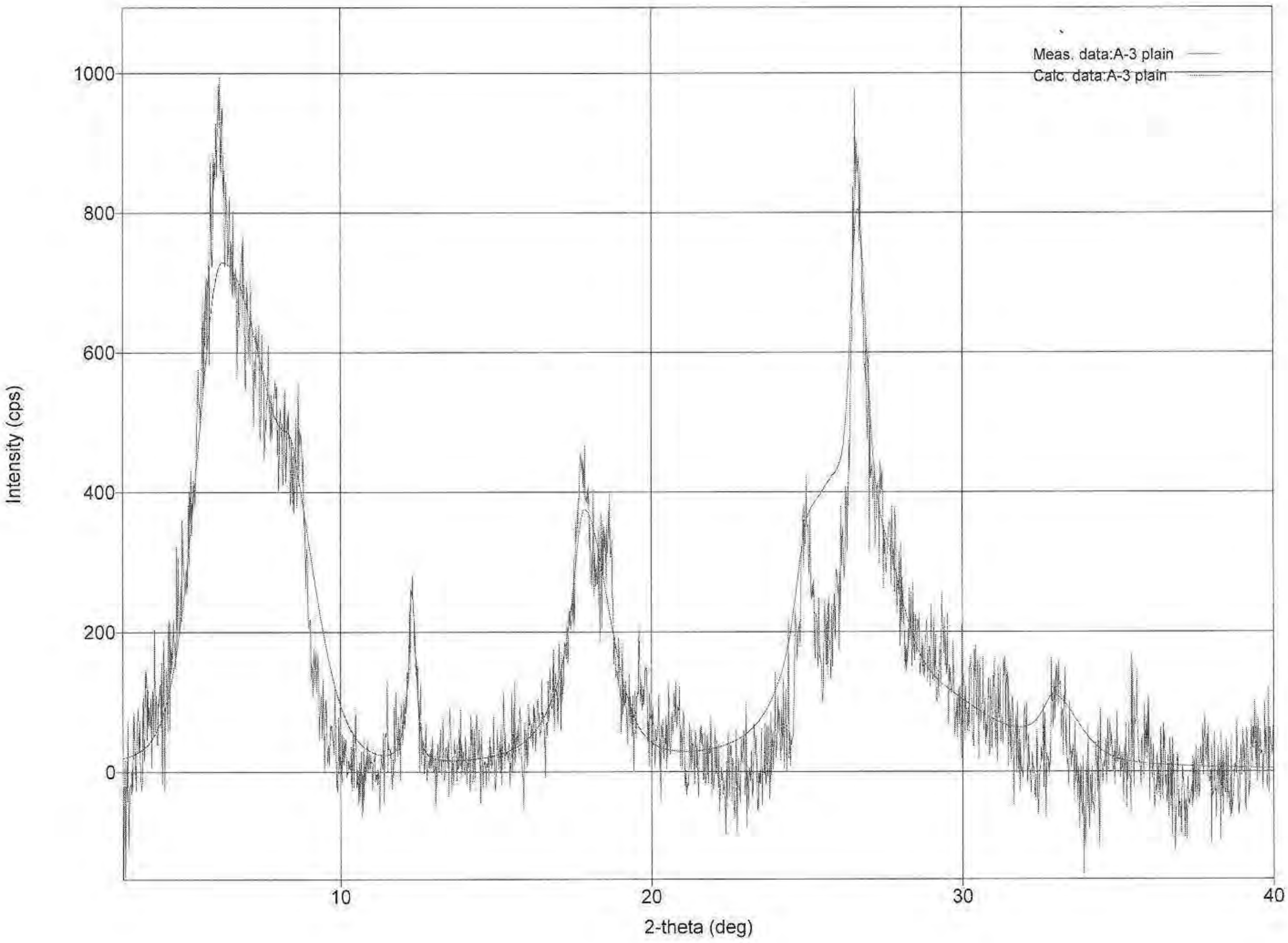
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.40(2)	13.79(5)	983(40)	2.475(19)	2625(24)	2.67(13)	33.6(3)
☐ 2	8.395833	10.522687	144.910615	1.10601	203.426	1.403804	75.2207
☐ 3	11.44(3)	7.73(2)	66(10)	0.49(7)	38(5)	0.58(17)	169(26)
☐ 4	12.13(2)	7.291(13)	255(21)	0.37(2)	113(5)	0.44(5)	223(13)
☐ 5	17.70(6)	5.007(17)	184(17)	1.59(6)	328(14)	1.8(2)	52.7(19)
☐ 6	18.517210	4.787601	68.951308	1.10601	96.7941	1.403804	76.0091
☐ 7	20.53(2)	4.322(5)	72(11)	0.30(5)	24(4)	0.34(10)	282(51)
☐ 8	24.619(14)	3.613(2)	378(25)	0.44(4)	299(20)	0.79(11)	194(20)
☐ 9	26.50(3)	3.360(3)	675(34)	1.11(4)	1345(34)	1.99(15)	77(3)
☐ 10	28.169384	3.165245	118.062507	1.10601	165.737	1.403804	77.344
☐ 11	32.894928	2.720533	47.227841	1.10601	66.2986	1.403804	78.2196
☐ 12	35.38(5)	2.535(3)	84(12)	1.27(15)	154(14)	1.8(4)	68(8)
☐ 13	37.519928	2.395122	42.655398	1.10601	59.8798	1.403804	79.2279


Meas. data:A-2 gly
Calc. data:A-2 gly
Intensity (cps)
4000
3000
2000
1000
0
10
20
30
40
2-theta (deg)
[1], d=17.29(3), 2-theta=5.107(9), H=2464(64)
[2], d=10.13(7), 2-theta=8.72(6), H=168(17), Rel.H=6.82%
[3], d=8.717484, 2-theta=10.138587, H=94.993419, Rel.H=3.86%
[4], d=7.245(6), 2-theta=12.206(10), H=228(19), Rel.H=9.25%
[5], d=5.64(2), 2-theta=15.69(6), H=139(15), Rel.H=5.64%
[6], d=5.00(3), 2-theta=17.73(9), H=197(18), Rel.H=7.98%
[7], d=4.796207, 2-theta=18.483696, H=84.977962, Rel.H=3.45%
[8], d=4.279(7), 2-theta=20.74(4), H=122(14), Rel.H=4.96%
[9], d=3.5670(12), 2-theta=24.942(9), H=459(28), Rel.H=18.63%
[10], d=3.3517(12), 2-theta=26.573(9), H=1542(51), Rel.H=62.58%
[11], d=2.850(2), 2-theta=31.37(2), H=193(18), Rel.H=7.82%
[12], d=2.709797, 2-theta=33.028986, H=96.708210, Rel.H=3.93%

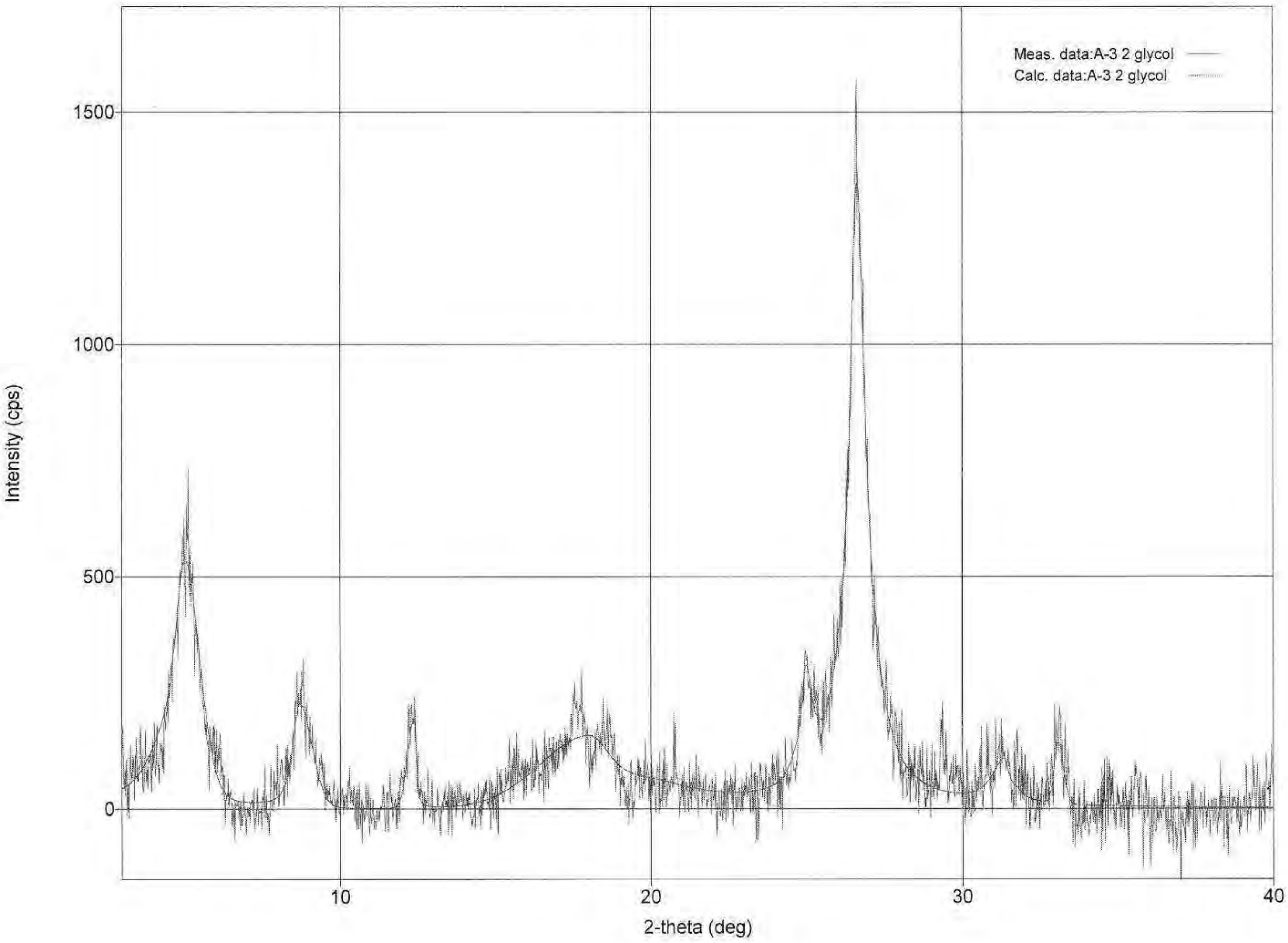
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.107(9)	17.29(3)	2464(64)	0.866(11)	3241(22)	1.32(4)	95.9(13)
☐ 2	8.72(6)	10.13(7)	168(17)	0.88(9)	240(17)	1.4(2)	94(9)
☐ 3	10.138587	8.717484	94.993419	0.866274	119.107	1.253844	96.156
☐ 4	12.206(10)	7.245(6)	228(19)	0.27(3)	88(7)	0.38(6)	307(30)
☐ 5	15.69(6)	5.64(2)	139(15)	0.84(6)	124(12)	0.89(18)	100(7)
☐ 6	17.73(9)	5.00(3)	197(18)	2.90(9)	701(22)	3.6(4)	29.0(9)
☐ 7	18.483696	4.796207	84.977962	0.866274	106.549	1.253844	97.0396
☐ 8	20.74(4)	4.279(7)	122(14)	0.38(9)	87(8)	0.71(15)	222(50)
☐ 9	24.942(9)	3.5670(12)	459(28)	0.55(2)	374(16)	0.82(8)	154(7)
☐ 10	26.573(9)	3.3517(12)	1542(51)	1.028(14)	2348(25)	1.52(7)	83.0(11)
☐ 11	31.37(2)	2.850(2)	193(18)	1.16(7)	296(15)	1.5(2)	74(4)
☐ 12	33.028986	2.709797	96.708210	0.866274	121.257	1.253844	99.9011


Meas. data:A-2 heat
Calc. data:A-2 heat
[1], d=13.547929, 2-theta=6.519022, H=70.956957, Rel.H=4.74%
[2], d=10.293(11), 2-theta=8.584(9), H=631(40), Rel.H=42.21%
[3], d=5.21(10), 2-theta=17.0(3), H=54(12), Rel.H=3.64%
[4], d=5.024(10), 2-theta=17.64(4), H=291(27), Rel.H=19.44%
[5], d=4.67(5), 2-theta=19.0(2), H=107(16), Rel.H=7.15%
[6], d=3.542203, 2-theta=25.119565, H=134.036068, Rel.H=8.96%
[7], d=3.3562(13), 2-theta=26.536(10), H=1051(51), Rel.H=70.26%
[8], d=3.283(3), 2-theta=27.14(3), H=1496(61), Rel.H=100.
Intensity (cps)
3000
2000
1000
0
10
20
30
40
2-theta (deg)

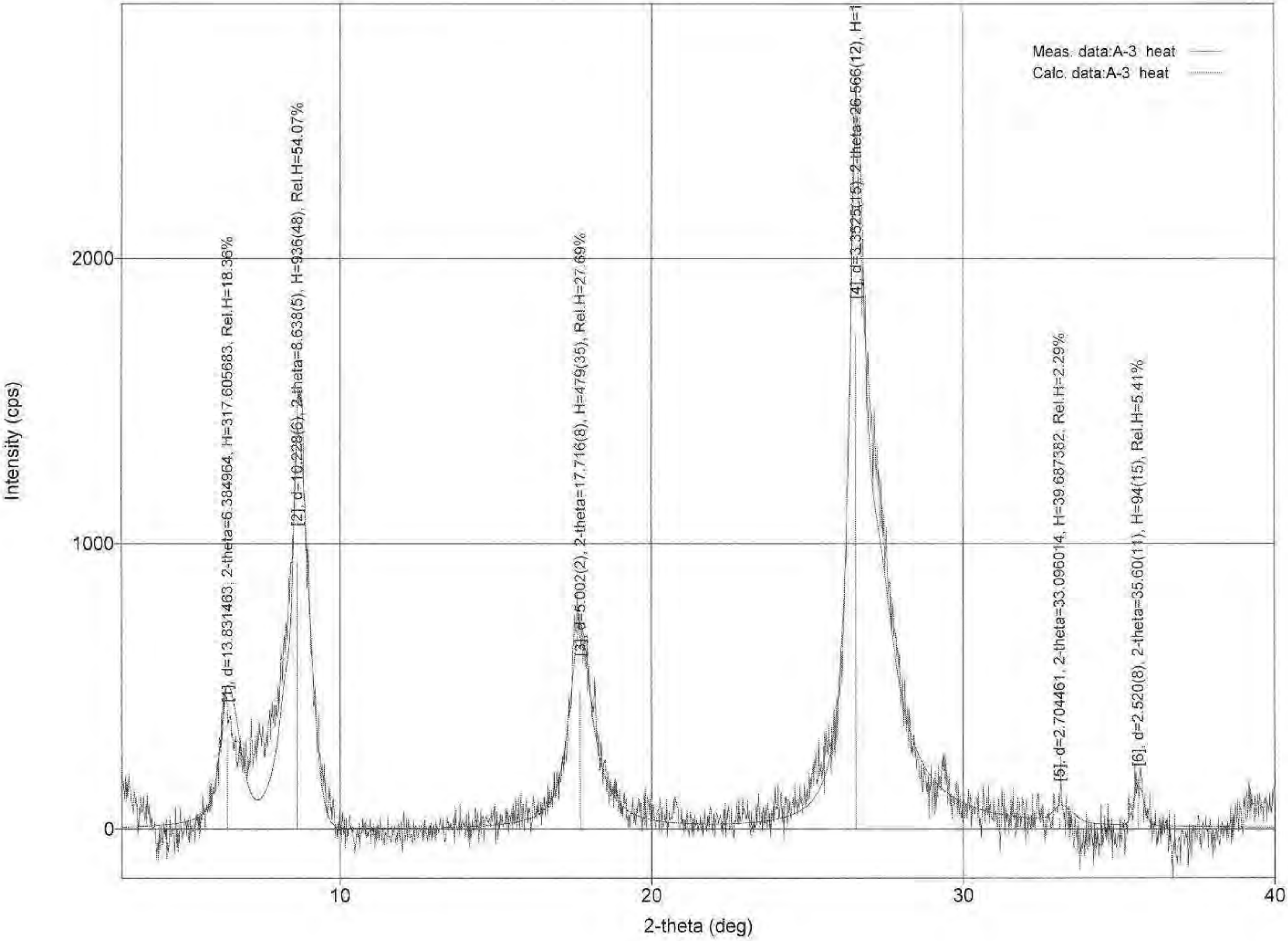
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.519022	13.547329	70.956957	1.96682	187.506	2.642534	42.254
☐ 2	8.584(9)	10.293(11)	631(40)	2.75(3)	1899(17)	3.0(2)	30.3(3)
☐ 3	17.0(3)	5.21(10)	54(12)	2.6(3)	173(22)	3.2(11)	32(4)
☐ 4	17.64(4)	5.024(10)	291(27)	1.08(11)	357(54)	1.2(3)	78(8)
☐ 5	19.0(2)	4.67(5)	107(16)	2.0(2)	239(52)	2.2(8)	43(5)
☐ 6	25.119565	3.542203	134.036068	1.96682	354.195	2.642534	43.2199
☐ 7	26.536(10)	3.3562(13)	1051(51)	0.47(3)	746(132)	0.71(16)	183(13)
☐ 8	27.14(3)	3.283(3)	1496(61)	1.39(7)	3169(142)	2.12(18)	61(3)


Meas. data:A-3 plain
Calc. data:A-3 plain
Intensity (cps)
1000
800
600
400
200
0
10
20
30
40
2-theta (deg)

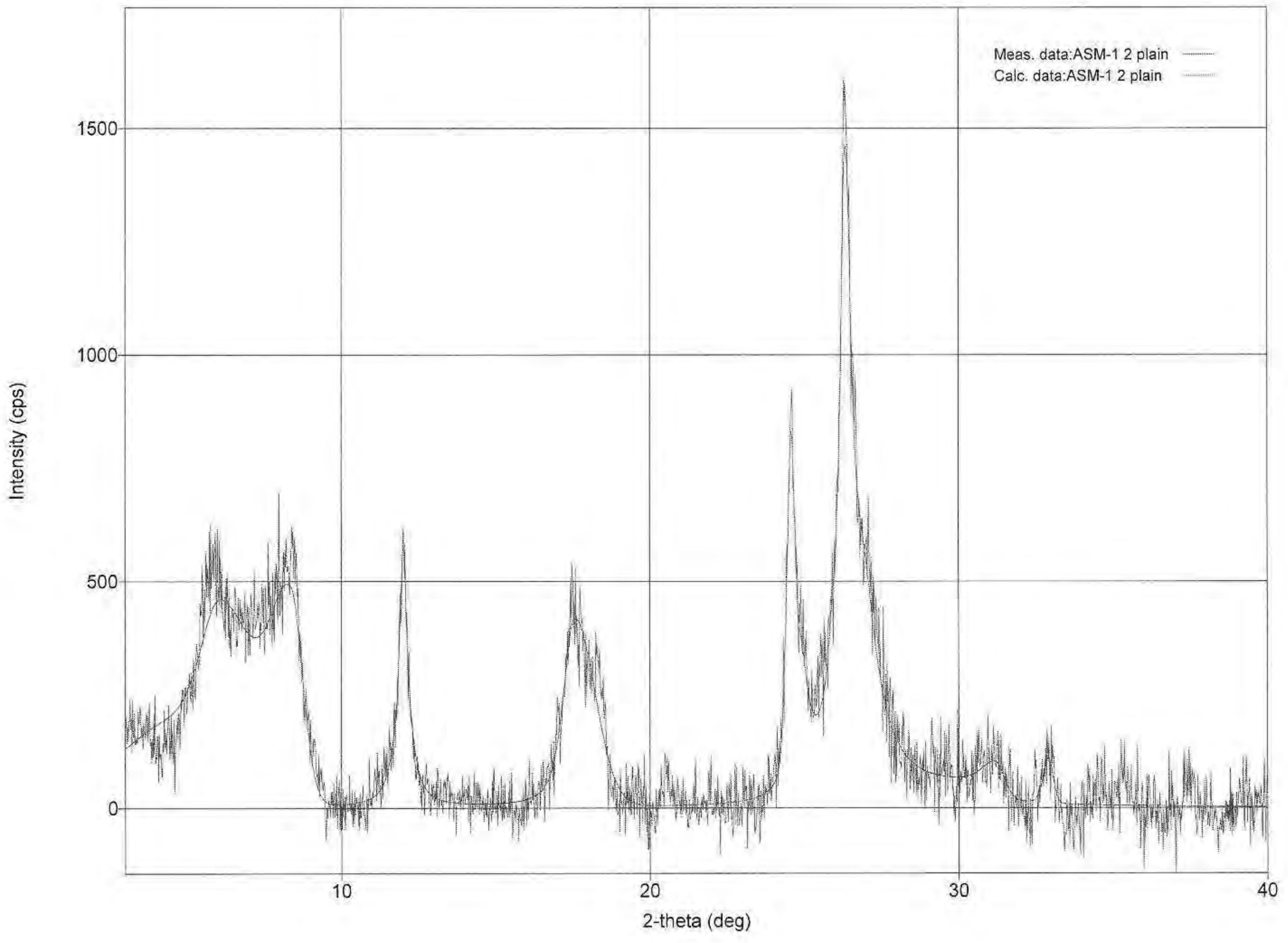
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.180(17)	14.29(4)	476(34)	2.90(4)	1528(30)	3.2(3)	28.7(4)
☐ 2	8.496377	10.398389	131.033962	1.5068	284.338	2.169953	55.2166
☐ 3	12.27(3)	7.21(2)	167(20)	0.27(4)	71(6)	0.43(9)	304(48)
☐ 4	17.83(2)	4.970(7)	246(25)	1.51(8)	533(20)	2.2(3)	56(3)
☐ 5	24.985507	3.560904	169.554740	1.5068	367.926	2.169953	56.4002
☐ 6	26.62(3)	3.345(3)	508(36)	1.04(5)	1112(21)	2.2(2)	82(4)
☐ 7	29.7(7)	3.00(7)	32(9)	3.2(6)	109(31)	3.5(19)	27(5)
☐ 8	32.928442	2.717841	59.638951	1.5068	129.414	2.169953	57.4192


Meas. data:A-3 2 glycol
Calc. data:A-3 2 glycol
1500
1000
500
0
Intensity (cps)
10
20
30
40
2-theta (deg)

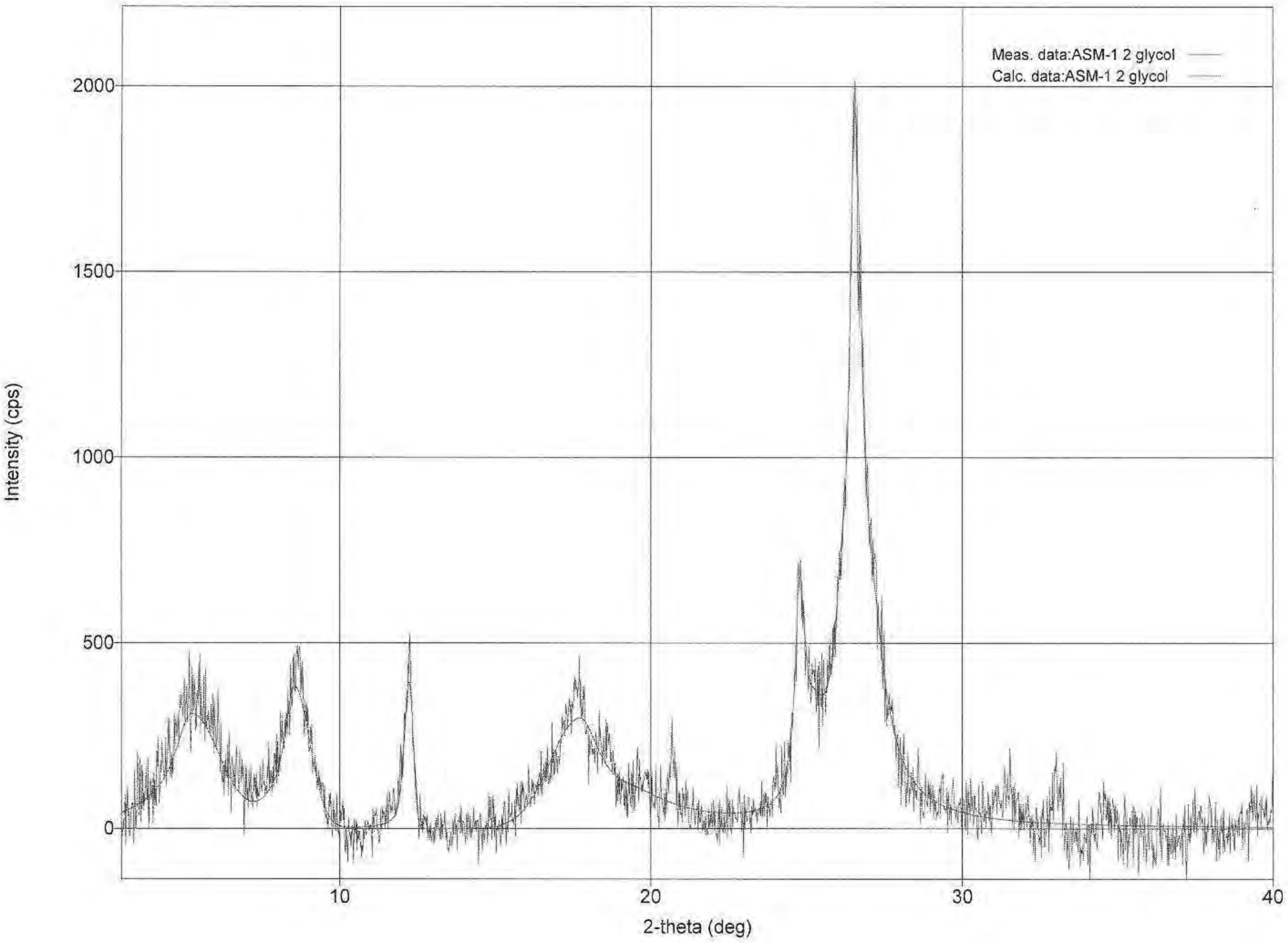
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	5.01(4)	17.61(13)	359(30)	1.05(5)	557(16)	1.55(17)	79(4)
▨ 2	8.714(16)	10.139(19)	149(19)	0.73(5)	131(9)	0.88(17)	114(7)
▨ 3	12.379(11)	7.144(6)	130(18)	0.32(3)	48(6)	0.37(9)	260(26)
▨ 4	17.99(9)	4.93(3)	104(16)	3.10(14)	475(21)	4.6(9)	27.1(12)
▨ 5	24.956(19)	3.565(3)	161(20)	0.46(6)	131(14)	0.81(19)	184(25)
▨ 6	26.588(16)	3.3498(19)	902(47)	0.65(2)	1035(16)	1.15(8)	131(5)
▨ 7	31.33(5)	2.853(4)	64(13)	0.69(19)	74(11)	1.2(4)	125(35)
▨ 8	33.03(2)	2.7095(18)	94(15)	0.33(7)	34(8)	0.36(15)	262(52)


Meas. data:A-3 heat
Calc. data:A-3 heat
[1], d=13.831463, 2-theta=6.384964, H=317.605683, Rel.H=18.36%
[2], d=10.228(6), 2-theta=8.638(5), H=936(48), Rel.H=54.07%
[3], d=5.002(2), 2-theta=17.716(8), H=479(35), Rel.H=27.69%
[4], d=3.3525(15), 2-theta=26.566(12), H=1
[5], d=2.704461, 2-theta=33.096014, H=39.687382, Rel.H=2.29%
[6], d=2.520(8), 2-theta=35.60(11), H=94(15), Rel.H=5.41%
Intensity (cps)
2000
1000
0
10
20
30
40
2-theta (deg)

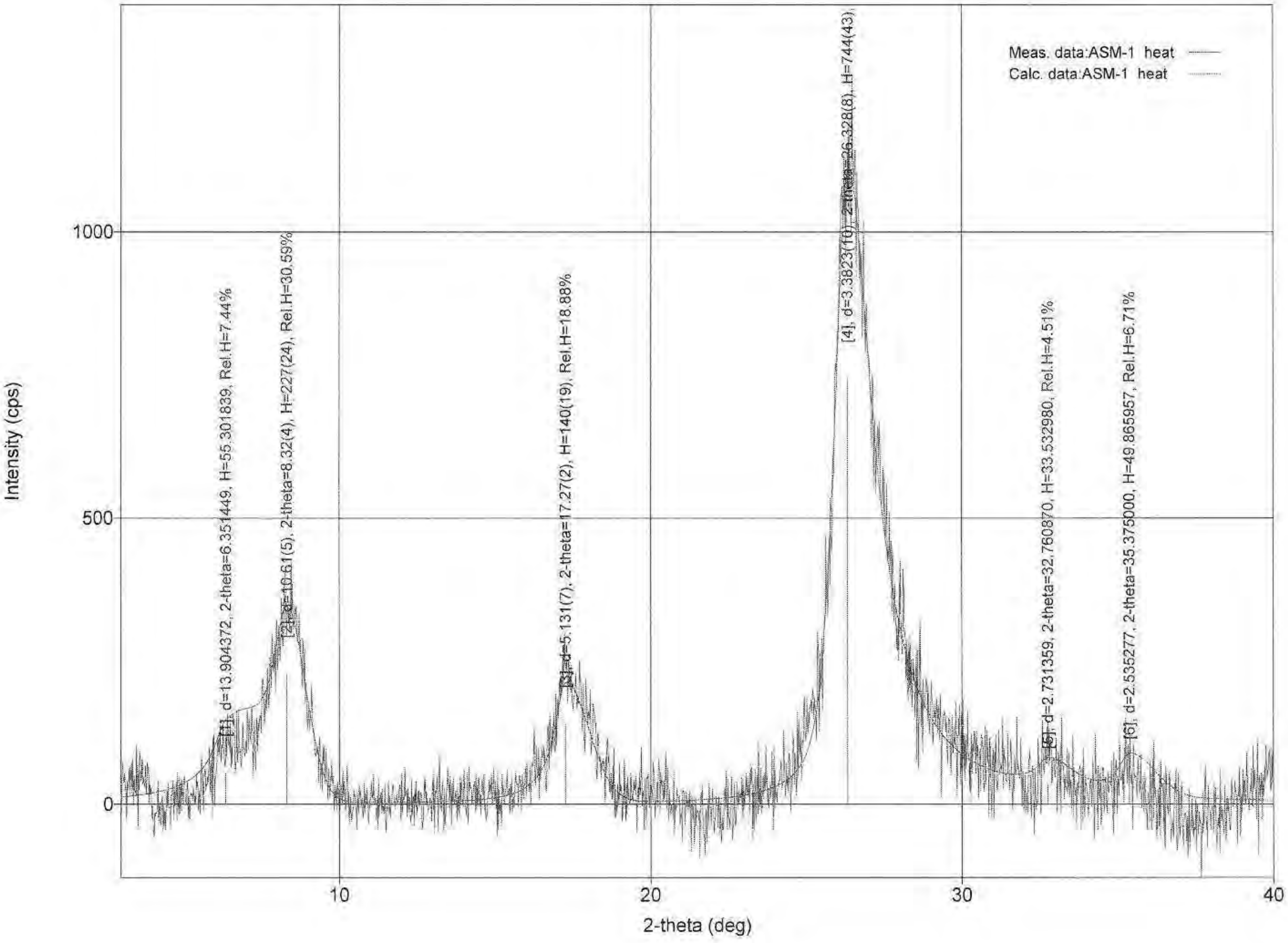
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	6.384964	13.831463	317.605683	0.709189	275.975	0.868925	117.177
▨ 2	8.638(5)	10.228(6)	936(48)	0.654(13)	874(13)	0.93(6)	127(2)
▨ 3	17.716(8)	5.002(2)	479(35)	0.85(3)	633(11)	1.32(12)	99(3)
▨ 4	26.566(12)	3.3525(15)	1730(66)	0.709(19)	2387(22)	1.38(7)	120(3)
▨ 5	33.096014	2.704461	39.687382	0.709189	34.4854	0.868925	122.05
▨ 6	35.60(11)	2.520(8)	94(15)	0.36(9)	36(12)	0.38(19)	242(61)


Meas. data:ASM-1 2 plain
Calc. data:ASM-1 2 plain
Intensity (cps)
1500
1000
500
0
10
20
30
40
2-theta (deg)

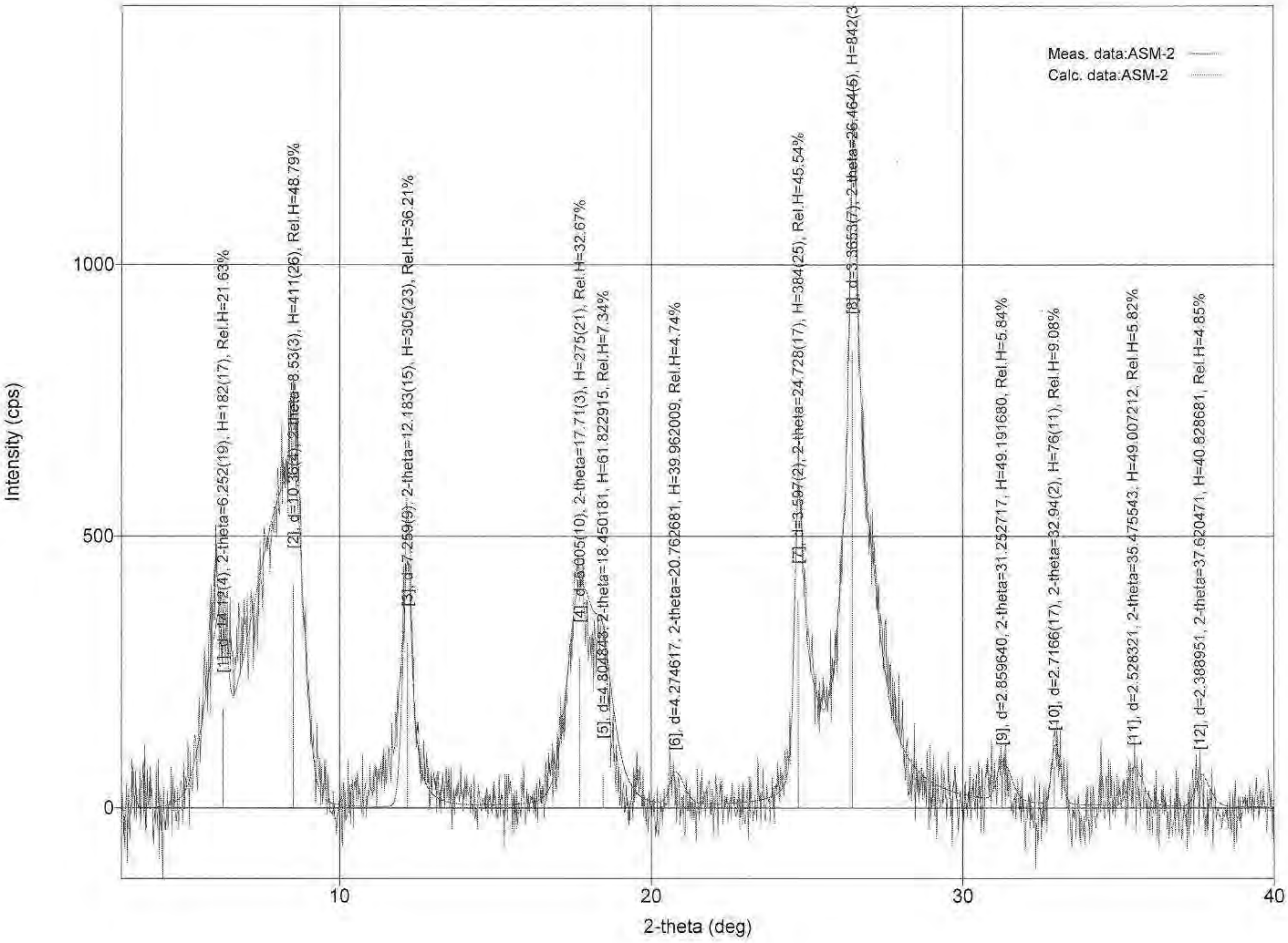
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.04(9)	14.6(2)	302(27)	2.62(12)	1243(49)	4.1(5)	31.7(15)
☐ 2	8.37(5)	10.56(6)	286(27)	1.24(5)	394(19)	1.4(2)	67(2)
☐ 3	12.006(19)	7.365(11)	385(31)	0.34(3)	231(7)	0.60(7)	243(19)
☐ 4	17.53(4)	5.054(13)	279(26)	1.21(4)	396(14)	1.42(19)	69(2)
☐ 5	24.566(12)	3.6207(17)	543(37)	0.363(18)	339(10)	0.62(6)	234(12)
☐ 6	26.308(12)	3.3848(15)	978(49)	0.56(2)	1130(15)	1.16(7)	152(6)
☐ 7	31.15(17)	2.869(15)	57(12)	1.2(3)	124(25)	2.2(9)	70(18)
☐ 8	32.88(3)	2.722(3)	69(13)	0.37(9)	29(9)	0.4(2)	235(60)


Meas. data:ASM-1 2 glycol
Calc. data:ASM-1 2 glycol
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)

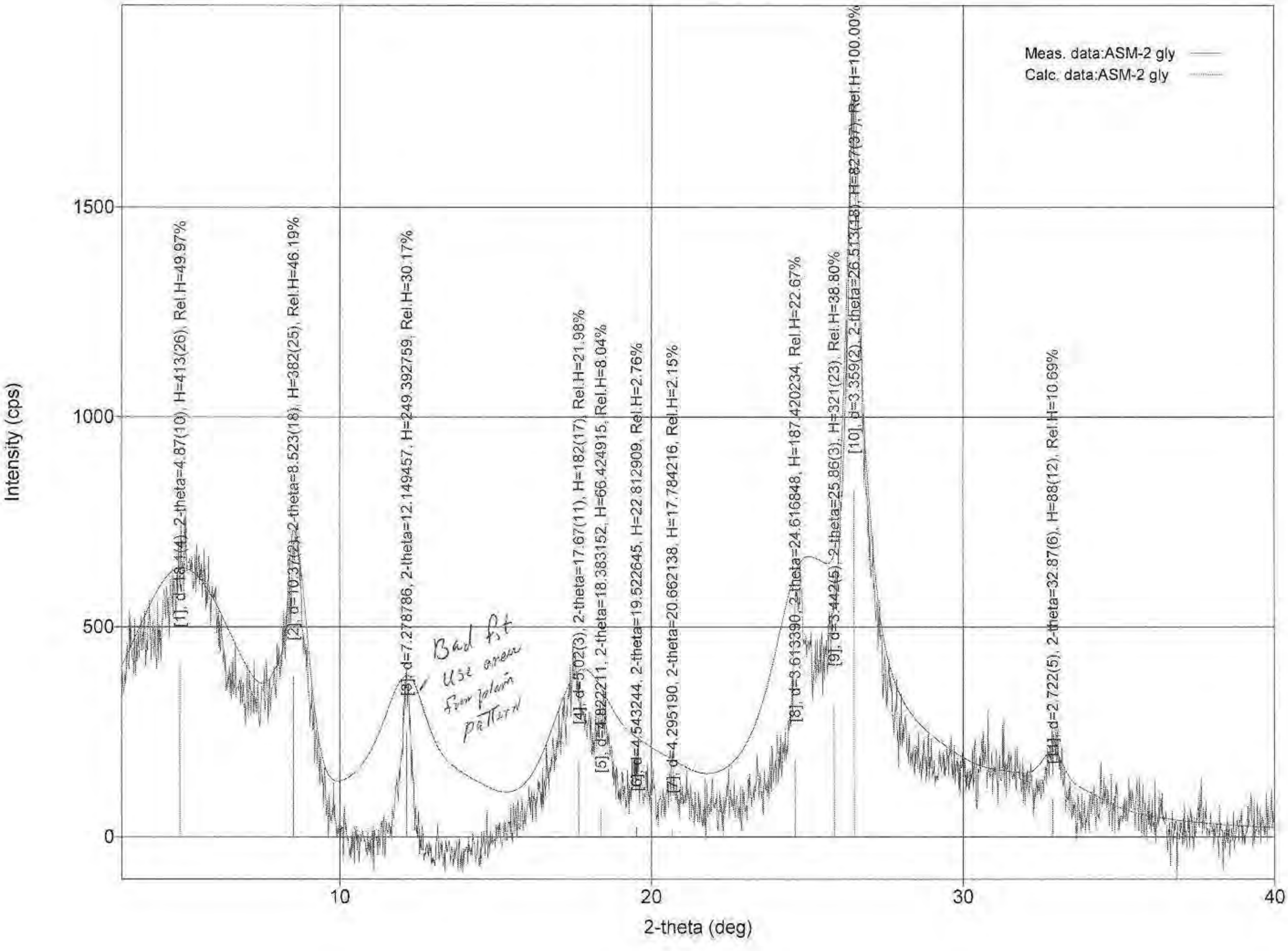
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	5.25(7)	16.8(2)	201(22)	1.82(10)	490(19)	2.4(4)	46(2)
▨ 2	8.55(4)	10.34(4)	256(25)	1.00(5)	342(13)	1.33(18)	84(4)
▨ 3	12.22(2)	7.237(14)	266(26)	0.33(2)	109(7)	0.41(7)	251(18)
▨ 4	17.69(7)	5.01(2)	197(22)	2.18(10)	657(21)	3.3(5)	38.5(18)
▨ 5	24.755(14)	3.594(2)	421(32)	0.44(3)	373(11)	0.89(10)	193(14)
▨ 6	26.510(9)	3.3595(11)	1283(57)	0.586(17)	1504(15)	1.17(6)	146(4)


Meas. data:ASM-1 heat
Calc. data:ASM-1 heat
[1], d=13.904372, 2-theta=6.351449, H=55.301839, Rel.H=7.44%
[2], d=10.61(5), 2-theta=8.32(4), H=227(24), Rel.H=30.59%
[3], d=5.131(7), 2-theta=17.27(2), H=140(19), Rel.H=18.88%
[4], d=3.3823(10), 2-theta=26.328(8), H=744(43),
[5], d=2.731359, 2-theta=32.760870, H=33.532980, Rel.H=4.51%
[6], d=2.535277, 2-theta=35.375000, H=49.865957, Rel.H=6.71%
Intensity (cps)
1000
500
0
10
20
30
40
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.351449	13.904372	55.301839	1.41747	100.356	1.814701	58.6252
☐ 2	8.32(4)	10.61(5)	227(24)	1.42(6)	484(12)	2.1(3)	59(2)
☐ 3	17.27(2)	5.131(7)	140(19)	1.34(7)	238(11)	1.7(3)	63(3)
☐ 4	26.328(8)	3.3823(10)	744(43)	1.52(3)	1729(18)	2.32(16)	56.1(11)
☐ 5	32.760870	2.731359	33.532980	1.41747	60.8523	1.814701	61.0116
☐ 6	35.375000	2.535277	49.865957	1.41747	90.4918	1.814701	61.4395

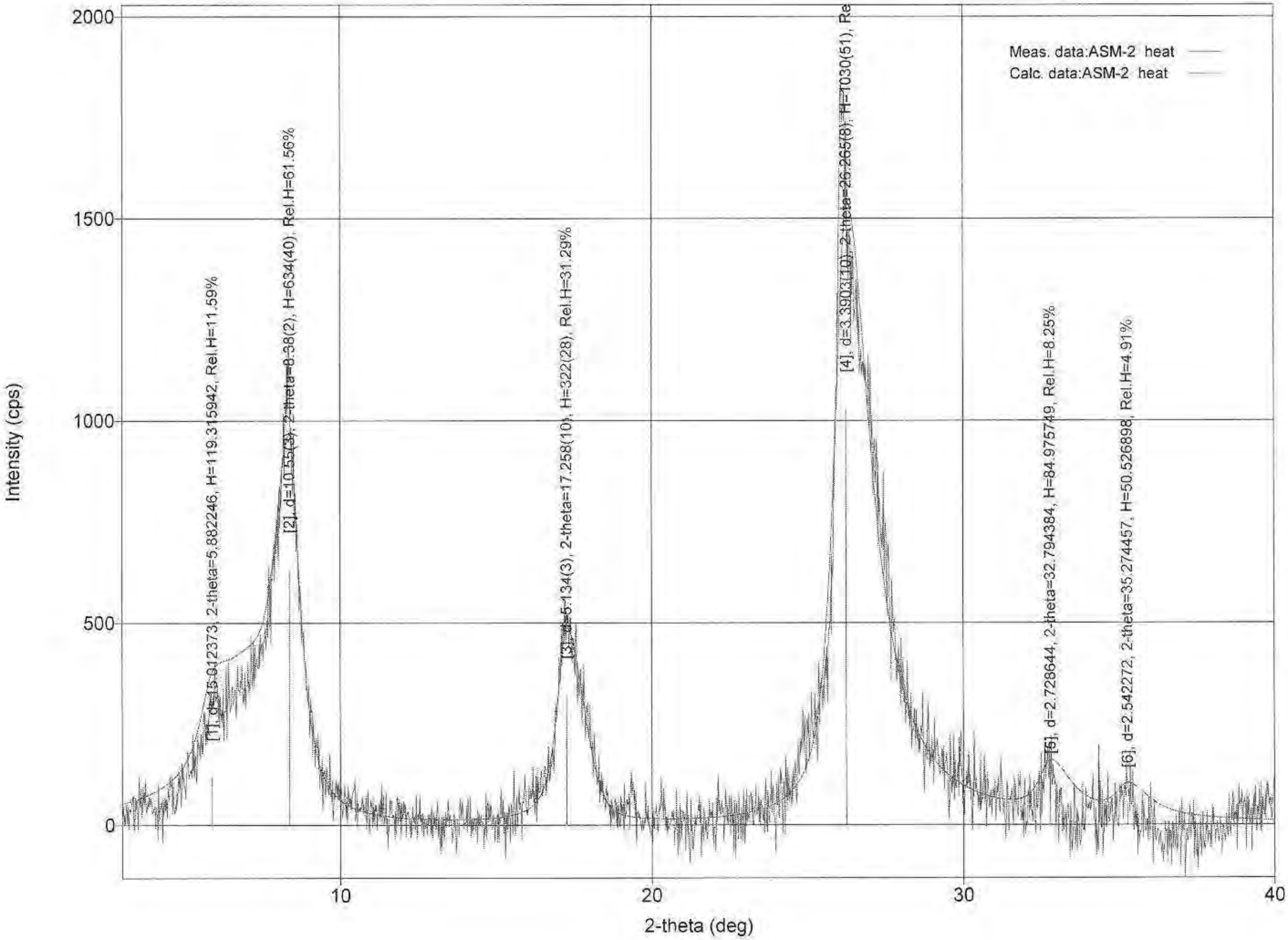

Meas. data:ASM-2
Calc. data:ASM-2
Intensity (cps)
1000
500
0
10
20
30
40
2-theta (deg)
[1], d=14.12(4), 2-theta=6.252(19), H=182(17), Rel.H=21.63%
[2], d=10.36(4), 2-theta=8.53(3), H=411(26), Rel.H=48.79%
[3], d=7.259(9), 2-theta=12.183(15), H=305(23), Rel.H=36.21%
[4], d=5.005(10), 2-theta=17.71(3), H=275(21), Rel.H=32.67%
[5], d=4.804843, 2-theta=18.450181, H=61.822915, Rel.H=7.34%
[6], d=4.274617, 2-theta=20.762681, H=39.962009, Rel.H=4.74%
[7], d=3.597(2), 2-theta=24.728(17), H=384(25), Rel.H=45.54%
[8], d=3.3653(7), 2-theta=26.464(5), H=842(3
[9], d=2.859640, 2-theta=31.252717, H=49.191680, Rel.H=5.84%
[10], d=2.7166(17), 2-theta=32.94(2), H=76(11), Rel.H=9.08%
[11], d=2.528321, 2-theta=35.475543, H=49.007212, Rel.H=5.82%
[12], d=2.388951, 2-theta=37.620471, H=40.828681, Rel.H=4.85%

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.252(19)	14.12(4)	182(17)	0.76(5)	150(12)	0.82(14)	109(8)
☐ 2	8.53(3)	10.36(4)	411(26)	1.87(5)	830(25)	2.02(19)	44.5(11)
☐ 3	12.183(15)	7.259(9)	305(23)	0.35(2)	146(11)	0.48(7)	236(13)
☐ 4	17.71(3)	5.005(10)	275(21)	1.32(3)	420(12)	1.53(16)	63.5(16)
☐ 5	18.450181	4.804843	61.822915	0.524532	36.2645	0.586587	160.255
☐ 6	20.762681	4.274617	39.962009	0.524532	23.4412	0.586587	160.815
☐ 7	24.728(17)	3.597(2)	384(25)	0.40(2)	255(7)	0.66(6)	213(13)
☐ 8	26.464(5)	3.3653(7)	842(37)	0.525(12)	920(9)	1.09(6)	162(4)
☐ 9	31.252717	2.859640	49.191680	0.524532	28.8552	0.586587	164.253
☐ 10	32.94(2)	2.7166(17)	76(11)	0.33(6)	27(7)	0.35(14)	260(49)
☐ 11	35.475543	2.528321	49.007212	0.524532	28.747	0.586587	166.077
☐ 12	37.620471	2.388951	40.828681	0.524532	23.9496	0.586587	167.107

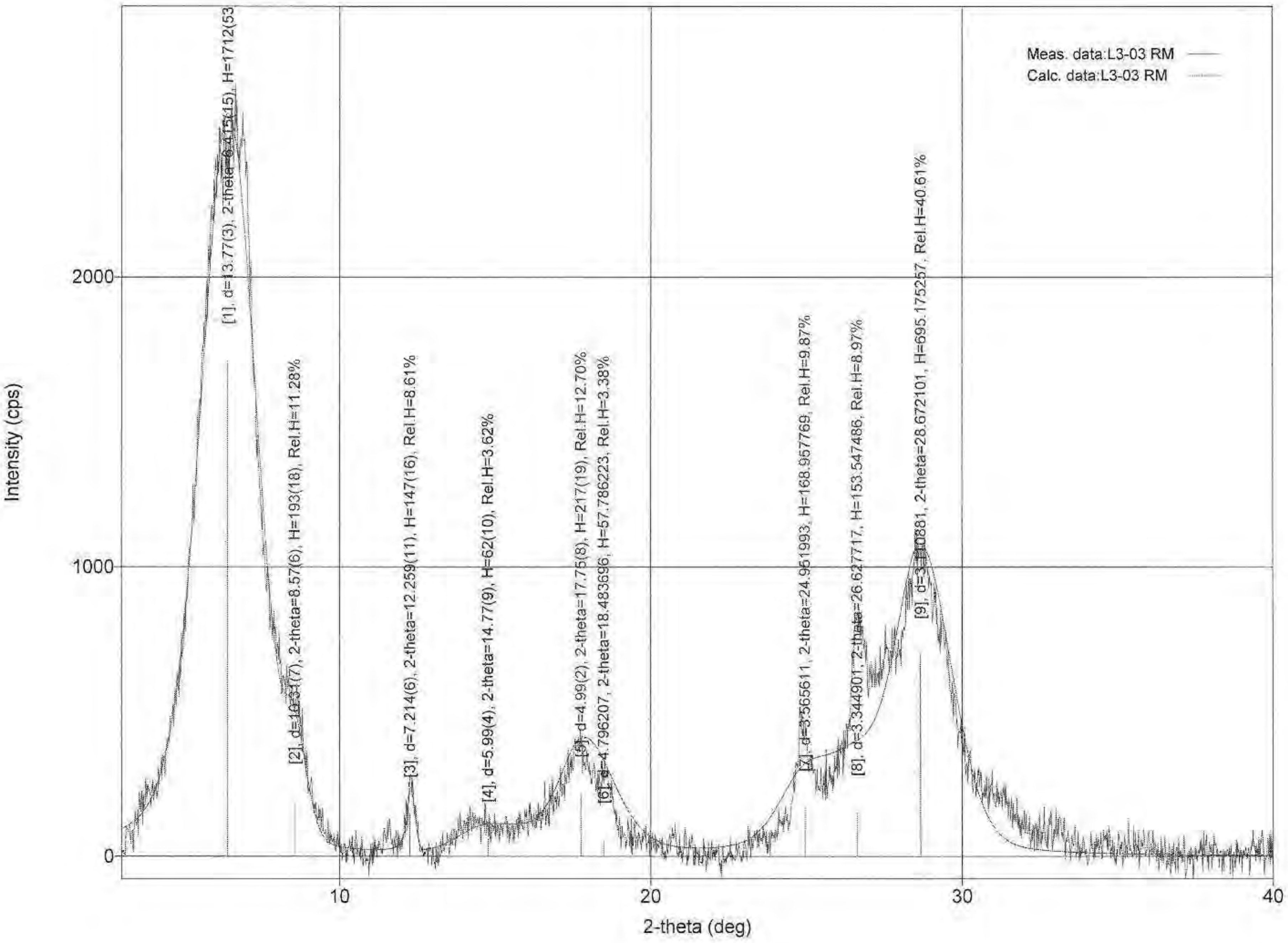


Bad fit
Use area
from pattern

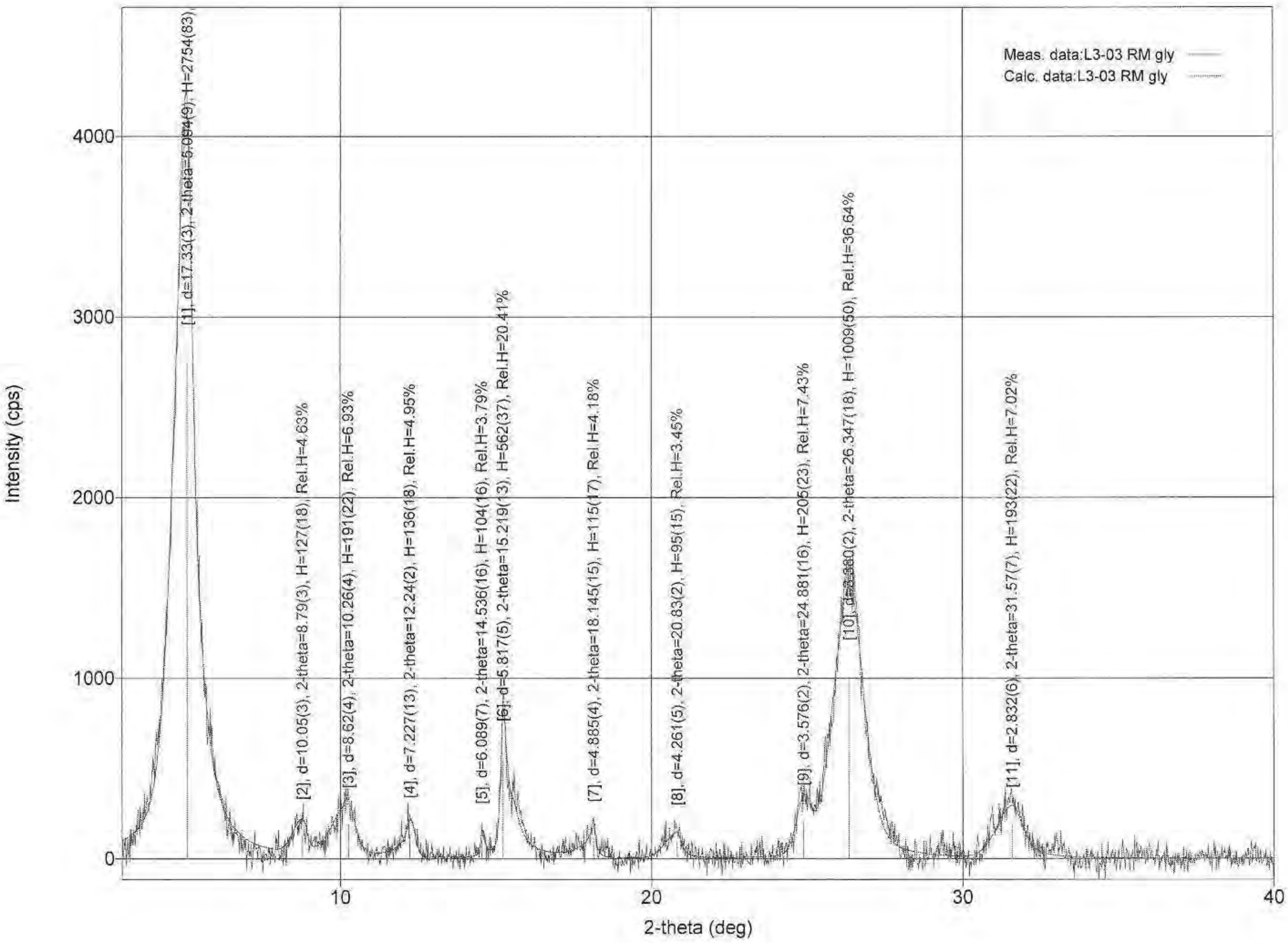
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	4.87(10)	18.1(4)	413(26)	4.8(2)	2802(158)	6.8(8)	17.2(8)
☐ 2	8.523(18)	10.37(2)	382(25)	0.82(5)	442(20)	1.16(13)	101(6)
☐ 3	12.149457	7.278786	249.392759	2.29214	1049.13	4.206736	36.4027
☐ 4	17.67(11)	5.02(3)	182(17)	2.29(16)	648(29)	3.6(5)	37(3)
☐ 5	18.383152	4.822211	66.424915	2.29214	279.432	4.206736	36.6692
☐ 6	19.522645	4.543244	22.812909	2.29214	95.9679	4.206736	36.7301
☐ 7	20.662138	4.295190	17.784216	2.29214	74.8135	4.206736	36.7948
☐ 8	24.616848	3.613390	187.420234	2.29214	788.427	4.206736	37.0499
☐ 9	25.86(3)	3.442(5)	321(23)	3.39(10)	1711(31)	5.3(5)	25.1(7)
☐ 10	26.513(18)	3.359(2)	827(37)	0.54(2)	640(18)	0.77(6)	159(7)
☐ 11	32.87(6)	2.722(5)	88(12)	1.4(2)	266(19)	3.0(6)	61(10)


Meas. data:ASM-2 heat
Calc. data:ASM-2 heat
[1], d=15.012373, 2-theta=5.882246, H=119.315942, Rel.H=11.59%
[2], d=10.55(3), 2-theta=8.38(2), H=634(40), Rel.H=61.56%
[3], d=5.134(3), 2-theta=17.258(10), H=322(28), Rel.H=31.29%
[4], d=3.3903(10), 2-theta=26.265(8), H=1030(51), Re
[5], d=2.728644, 2-theta=32.794384, H=84.975749, Rel.H=8.25%
[6], d=2.542272, 2-theta=35.274457, H=50.526898, Rel.H=4.91%
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)

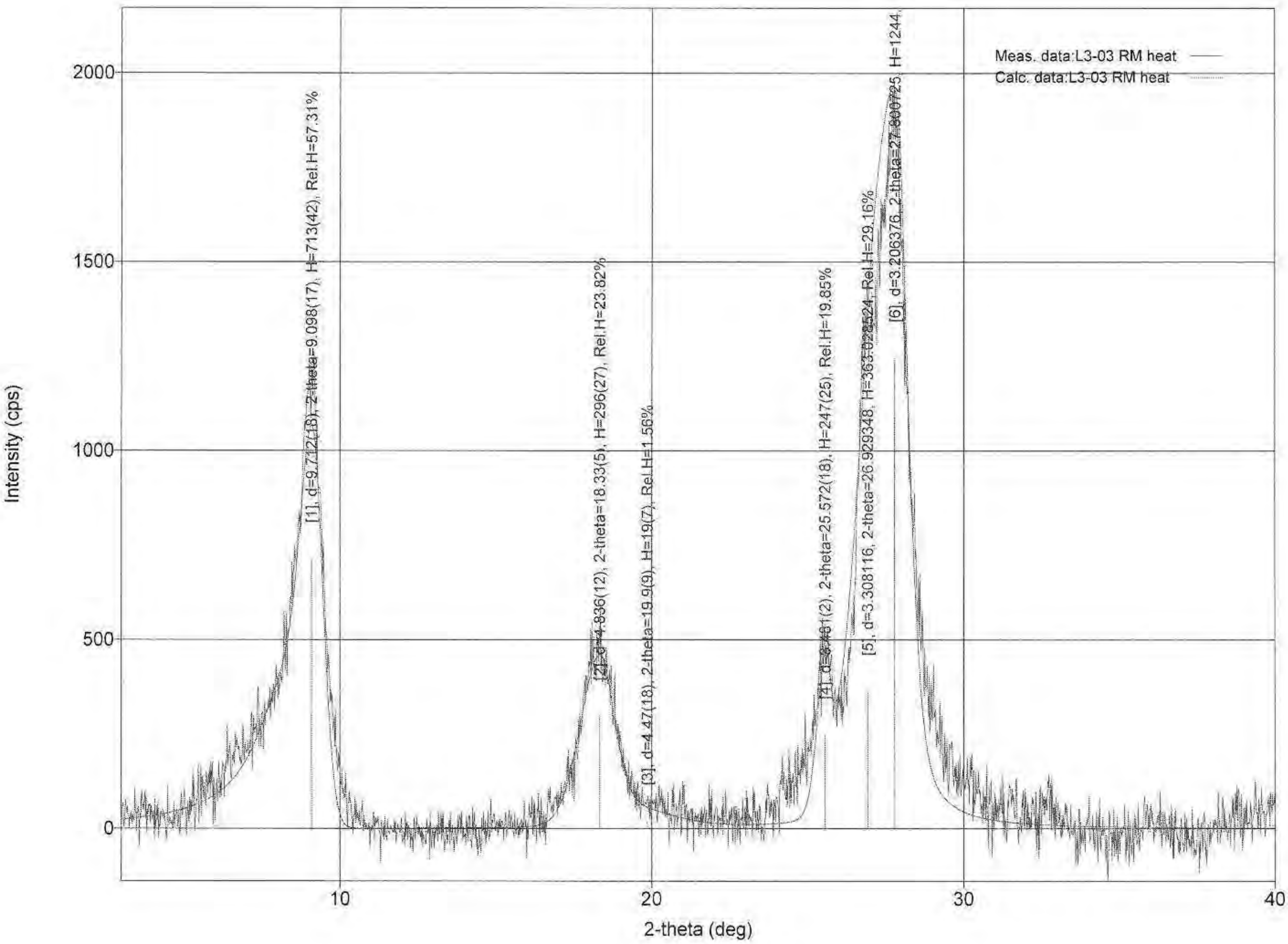
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.882246	15.012373	119.315942	1.2487	226.983	1.902368	66.534
☐ 2	8.38(2)	10.55(3)	634(40)	1.25(3)	1535(17)	2.42(18)	66.6(18)
☐ 3	17.258(10)	5.134(3)	322(28)	1.02(3)	433(11)	1.34(15)	82(3)
☐ 4	26.265(8)	3.3903(10)	1030(51)	1.43(3)	2250(24)	2.19(13)	59.8(13)
☐ 5	32.794384	2.728644	84.975749	1.2487	161.655	1.902368	69.2635
☐ 6	35.274457	2.542272	50.526898	1.2487	96.1208	1.902368	69.7238


Meas. data:L3-03 RM
Calc. data:L3-03 RM
[1], d=13.77(3), 2-theta=6.415(15), H=1712(53
[2], d=10.31(7), 2-theta=8.57(6), H=193(18), Rel.H=11.28%
[3], d=7.214(6), 2-theta=12.259(11), H=147(16), Rel.H=8.61%
[4], d=5.99(4), 2-theta=14.77(9), H=62(10), Rel.H=3.62%
[5], d=4.99(2), 2-theta=17.75(8), H=217(19), Rel.H=12.70%
[6], d=4.796207, 2-theta=18.483696, H=57.786223, Rel.H=3.38%
[7], d=3.565611, 2-theta=24.951993, H=168.957769, Rel.H=9.87%
[8], d=3.344901, 2-theta=26.627717, H=153.547486, Rel.H=8.97%
[9], d=3.110881, 2-theta=28.672101, H=695.175257, Rel.H=40.61%
Intensity (cps)
0
1000
2000
10
20
30
40
2-theta (deg)

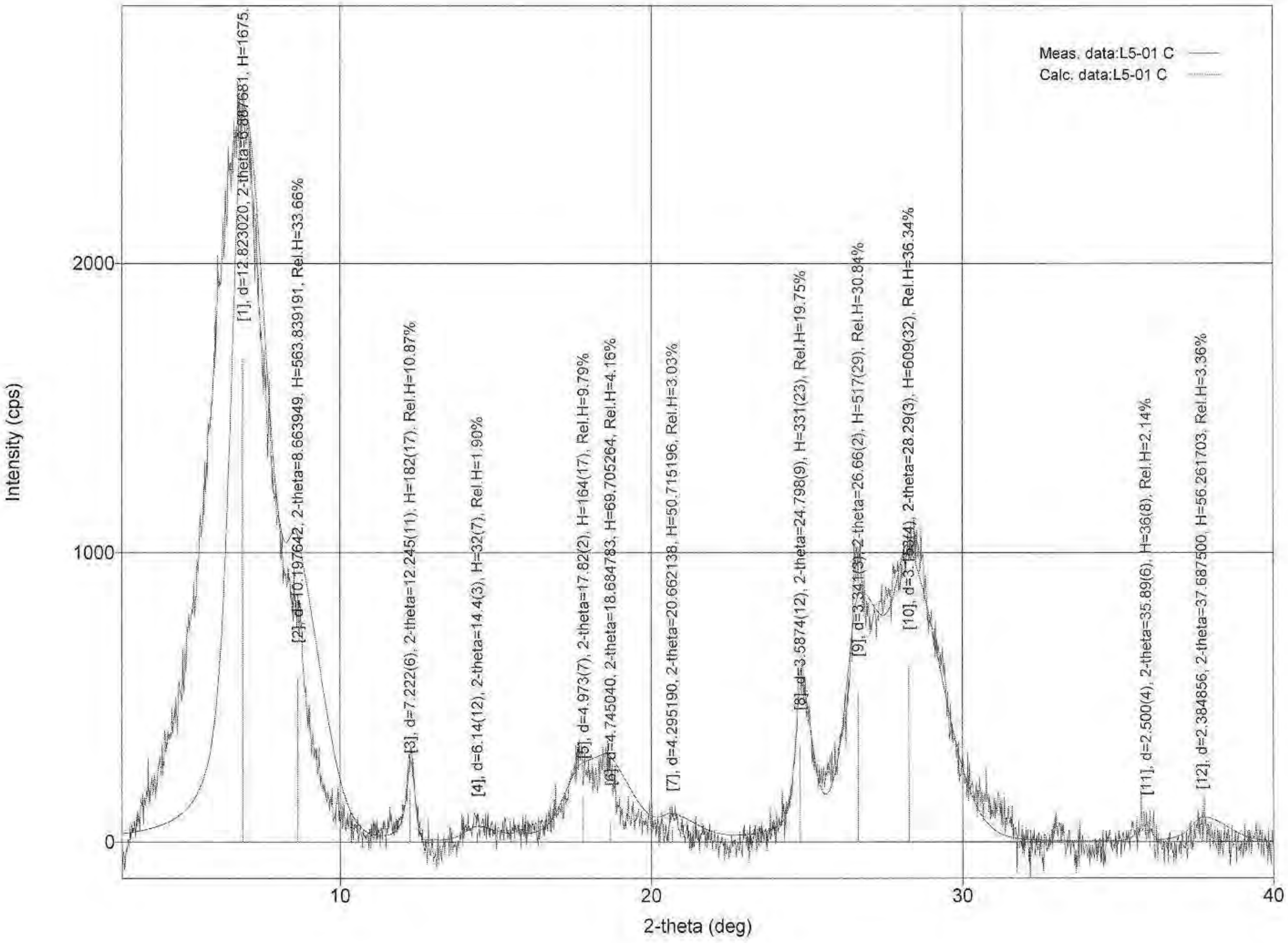
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.415(15)	13.77(3)	1712(53)	2.150(13)	4416(26)	2.58(10)	38.6(2)
☐ 2	8.57(6)	10.31(7)	193(18)	0.80(5)	165(16)	0.86(16)	104(7)
☐ 3	12.259(11)	7.214(6)	147(16)	0.27(3)	53(5)	0.36(7)	309(36)
☐ 4	14.77(9)	5.99(4)	62(10)	3.0(3)	207(25)	3.3(10)	28(3)
☐ 5	17.75(8)	4.99(2)	217(19)	1.89(7)	502(20)	2.3(3)	44.5(17)
☐ 6	18.483696	4.796207	57.786223	2.15017	149.766	2.591730	39.096
☐ 7	24.951993	3.565611	168.957769	2.15017	437.893	2.591730	39.5217
☐ 8	26.627717	3.344901	153.547486	2.15017	397.954	2.591730	39.6543
☐ 9	28.672101	3.110881	695.175257	2.15017	1801.71	2.591730	39.8287


Meas. data:L3-03 RM gly
Calc. data:L3-03 RM gly
[1], d=17.33(3), 2-theta=5.094(9), H=2754(83),
[2], d=10.05(3), 2-theta=8.79(3), H=127(18), Rel.H=4.63%
[3], d=8.62(4), 2-theta=10.26(4), H=191(22), Rel.H=6.93%
[4], d=7.227(13), 2-theta=12.24(2), H=136(18), Rel.H=4.95%
[5], d=6.089(7), 2-theta=14.536(16), H=104(16), Rel.H=3.79%
[6], d=5.817(5), 2-theta=15.219(13), H=562(37), Rel.H=20.41%
[7], d=4.885(4), 2-theta=18.145(15), H=115(17), Rel.H=4.18%
[8], d=4.261(5), 2-theta=20.83(2), H=95(15), Rel.H=3.45%
[9], d=3.576(2), 2-theta=24.881(16), H=205(23), Rel.H=7.43%
[10], d=3.380(2), 2-theta=26.347(18), H=1009(50), Rel.H=36.64%
[11], d=2.832(6), 2-theta=31.57(7), H=193(22), Rel.H=7.02%
Intensity (cps)
0
1000
2000
3000
4000
2-theta (deg)
10
20
30
40

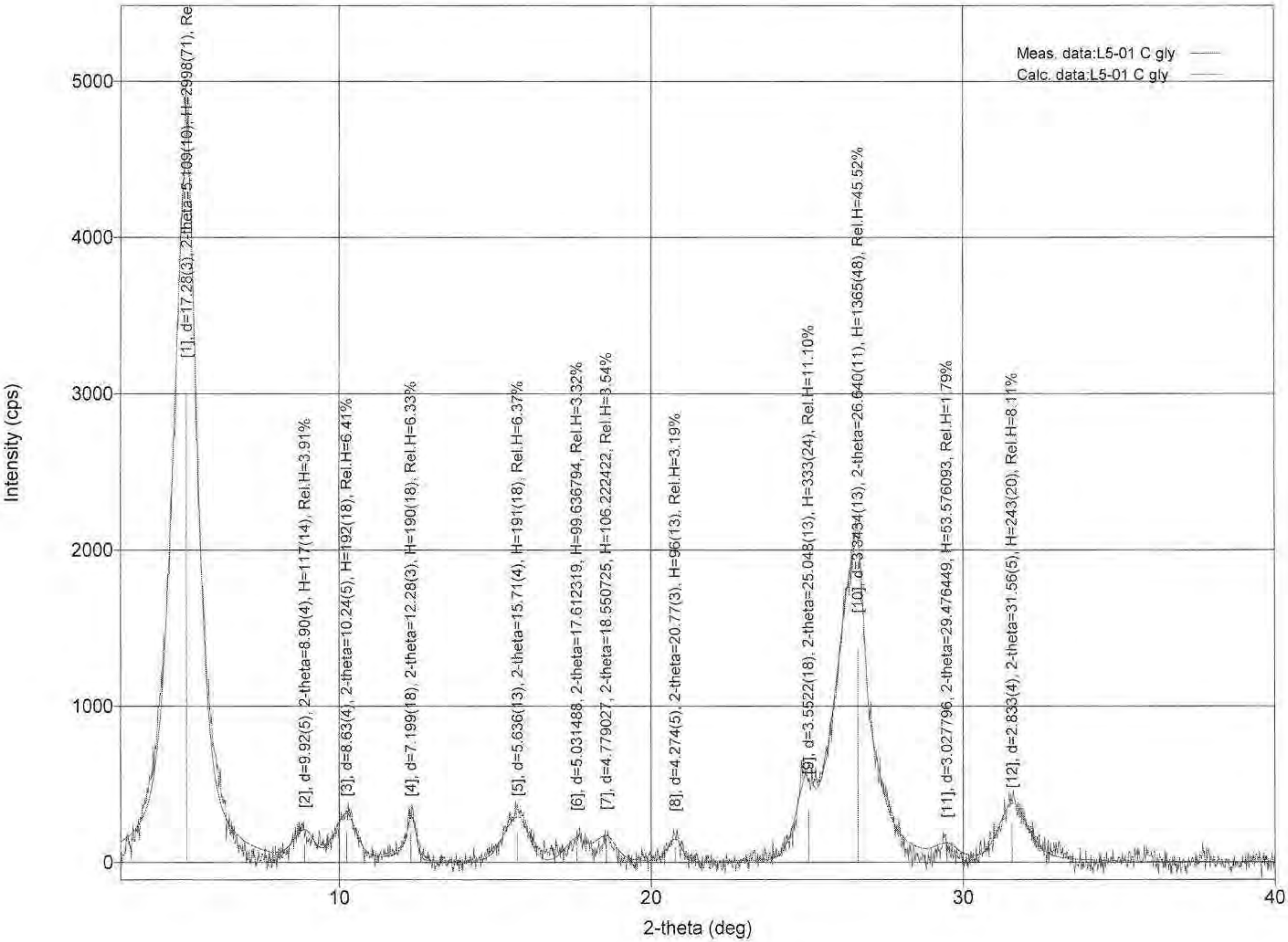
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.094(9)	17.33(3)	2754(83)	0.758(11)	3047(24)	1.11(4)	109.6(16)
☐ 2	8.79(3)	10.05(3)	127(18)	0.52(5)	75(6)	0.59(13)	161(15)
☐ 3	10.26(4)	8.62(4)	191(22)	0.85(5)	185(7)	0.97(15)	98(5)
☐ 4	12.24(2)	7.227(13)	136(18)	0.37(4)	78(6)	0.57(12)	223(23)
☐ 5	14.536(16)	6.089(7)	104(16)	0.12(7)	21(5)	0.20(8)	706(431)
☐ 6	15.219(13)	5.817(5)	562(37)	0.274(19)	292(9)	0.52(5)	305(21)
☐ 7	18.145(15)	4.885(4)	115(17)	0.30(6)	68(7)	0.59(15)	281(52)
☐ 8	20.83(2)	4.261(5)	95(15)	0.59(7)	67(9)	0.7(2)	144(17)
☐ 9	24.881(16)	3.576(2)	205(23)	0.55(5)	135(12)	0.66(13)	153(13)
☐ 10	26.347(18)	3.380(2)	1009(50)	1.149(17)	1383(24)	1.37(9)	74.2(11)
☐ 11	31.57(7)	2.832(6)	193(22)	0.97(7)	226(15)	1.2(2)	89(6)


Meas. data:L3-03 RM heat
Calc. data:L3-03 RM heat
[1], d=9.712(18), 2-theta=9.098(17), H=713(42), Rel.H=57.31%
[2], d=4.836(12), 2-theta=18.33(5), H=296(27), Rel.H=23.82%
[3], d=4.47(18), 2-theta=19.9(9), H=19(7), Rel.H=1.56%
[4], d=3.481(2), 2-theta=25.572(18), H=247(25), Rel.H=19.85%
[5], d=3.308116, 2-theta=26.929348, H=363.028524, Rel.H=29.16%
[6], d=3.206376, 2-theta=27.800725, H=1244,
Intensity (cps)
0
500
1000
1500
2000
10
20
30
40
2-theta (deg)

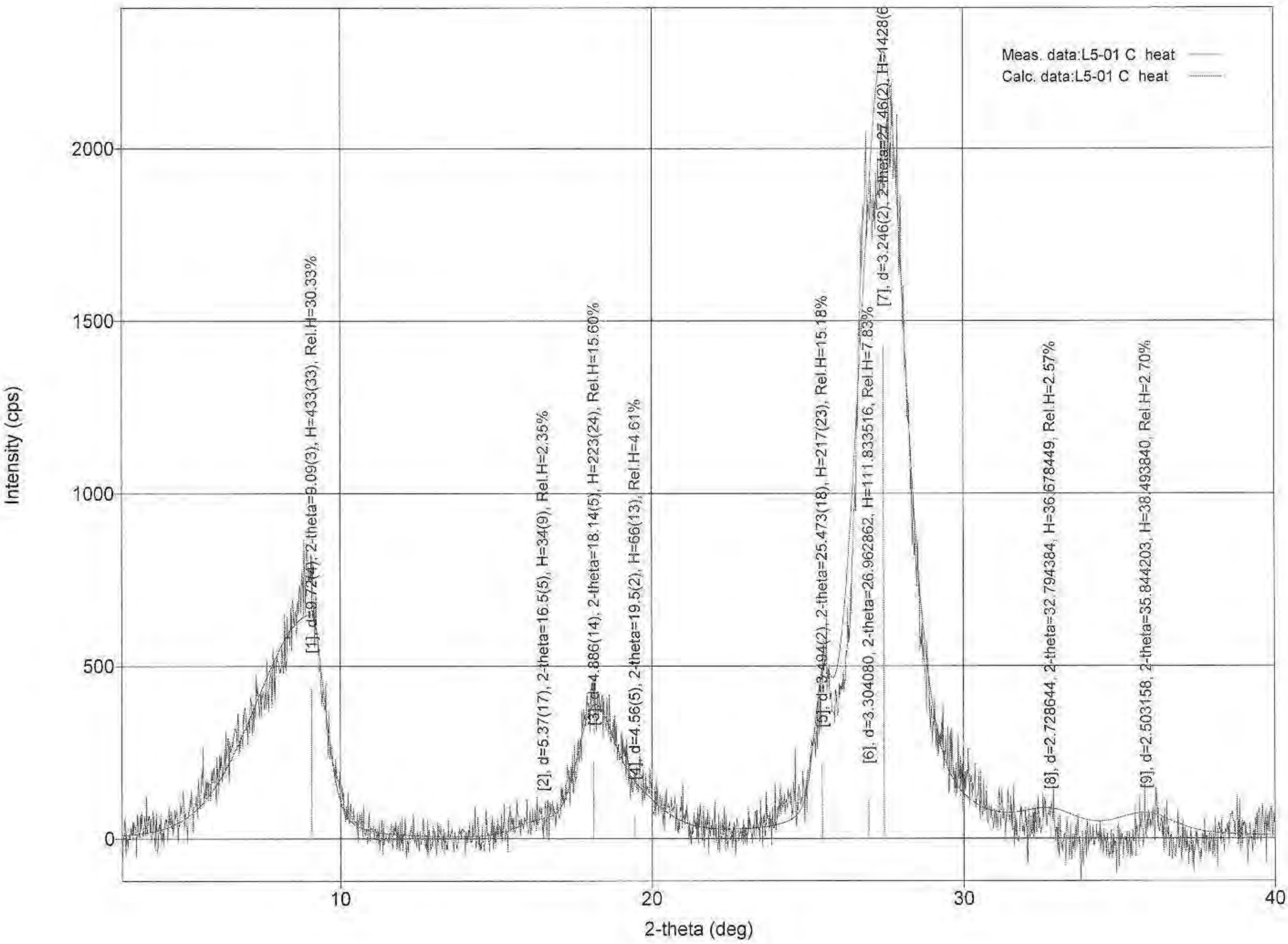
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	9.098(17)	9.712(18)	713(42)	1.12(5)	1279(137)	1.8(3)	75(4)
☐ 2	18.33(5)	4.836(12)	296(27)	1.30(7)	455(55)	1.5(3)	65(4)
☐ 3	19.9(9)	4.47(18)	19(7)	3(2)	68(57)	4(4)	28(20)
☐ 4	25.572(18)	3.481(2)	247(25)	0.51(7)	158(26)	0.64(17)	168(24)
☐ 5	26.929348	3.308116	363.028524	1.29772	552.318	1.521417	65.7433
☐ 6	27.800725	3.206376	1244.929874	1.29772	1894.06	1.521417	65.8652


Meas. data:L5-01 C
Calc. data:L5-01 C
Intensity (cps)
2000
1000
0
10
20
30
40
2-theta (deg)
[1], d=12.823020, 2-theta=6.887681, H=1675.
[2], d=10.197642, 2-theta=8.663949, H=563.839191, Rel.H=33.66%
[3], d=7.222(6), 2-theta=12.245(11), H=182(17), Rel.H=10.87%
[4], d=6.14(12), 2-theta=14.4(3), H=32(7), Rel.H=1.90%
[5], d=4.973(7), 2-theta=17.82(2), H=164(17), Rel.H=9.79%
[6], d=4.745040, 2-theta=18.684783, H=69.705264, Rel.H=4.16%
[7], d=4.295190, 2-theta=20.662138, H=50.715196, Rel.H=3.03%
[8], d=3.5874(12), 2-theta=24.798(9), H=331(23), Rel.H=19.75%
[9], d=3.341(3), 2-theta=26.66(2), H=517(29), Rel.H=30.84%
[10], d=3.153(4), 2-theta=28.29(3), H=609(32), Rel.H=36.34%
[11], d=2.500(4), 2-theta=35.89(6), H=36(8), Rel.H=2.14%
[12], d=2.384856, 2-theta=37.687500, H=56.261703, Rel.H=3.36%

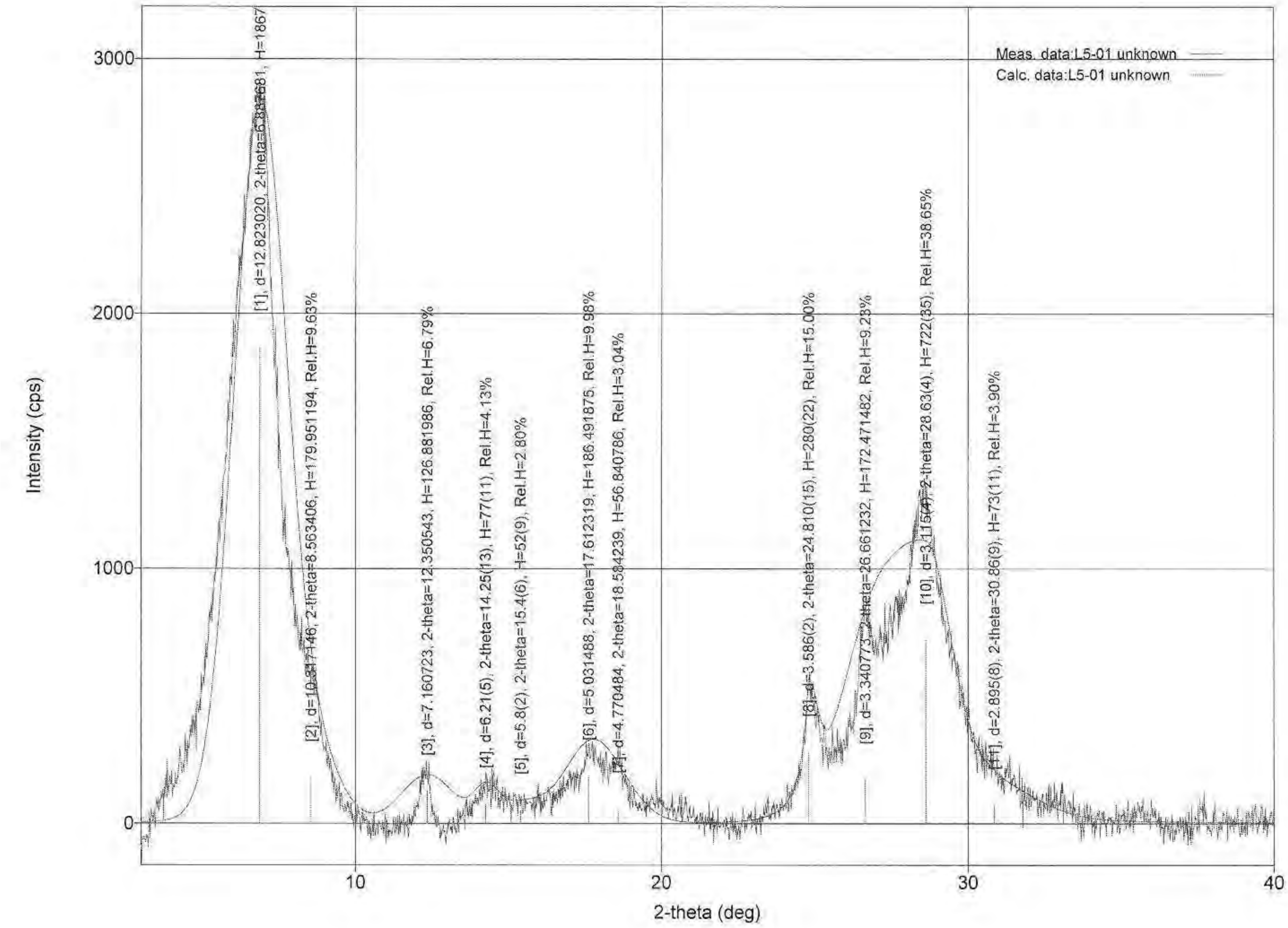
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.887681	12.823020	1675.147824	1.38469	2781.83	1.660648	60.029
☐ 2	8.663949	10.197642	563.839191	1.38469	936.338	1.660648	60.0922
☐ 3	12.245(11)	7.222(6)	182(17)	0.31(3)	74(6)	0.41(7)	272(28)
☐ 4	14.4(3)	6.14(12)	32(7)	1.4(5)	78(27)	2.5(14)	60(23)
☐ 5	17.82(2)	4.973(7)	164(17)	1.97(7)	347(17)	2.1(3)	42.7(15)
☐ 6	18.684783	4.745040	69.705264	1.38469	115.756	1.660648	60.726
☐ 7	20.662138	4.295190	50.715196	1.38469	84.2201	1.660648	60.908
☐ 8	24.798(9)	3.5874(12)	331(23)	0.59(3)	236(9)	0.71(8)	143(7)
☐ 9	26.66(2)	3.341(3)	517(29)	1.44(8)	890(55)	1.7(2)	59(3)
☐ 10	28.29(3)	3.153(4)	609(32)	1.85(4)	1352(61)	2.2(2)	46.2(9)
☐ 11	35.89(6)	2.500(4)	36(8)	0.48(18)	18(9)	0.5(4)	181(69)
☐ 12	37.687500	2.384856	56.261703	1.38469	93.4309	1.660648	63.314


Meas. data:L5-01 C gly
Calc. data:L5-01 C gly
[1], d=17.28(3), 2-theta=5.109(10), H=2998(71), Re
[2], d=9.92(5), 2-theta=8.90(4), H=117(14), Rel.H=3.91%
[3], d=8.63(4), 2-theta=10.24(5), H=192(18), Rel.H=6.41%
[4], d=7.199(18), 2-theta=12.28(3), H=190(18), Rel.H=6.33%
[5], d=5.636(13), 2-theta=15.71(4), H=191(18), Rel.H=6.37%
[6], d=5.031488, 2-theta=17.612319, H=99.636794, Rel.H=3.32%
[7], d=4.779027, 2-theta=18.550725, H=106.222422, Rel.H=3.54%
[8], d=4.274(5), 2-theta=20.77(3), H=96(13), Rel.H=3.19%
[9], d=3.5522(18), 2-theta=25.048(13), H=333(24), Rel.H=11.10%
[10], d=3.3434(13), 2-theta=26.640(11), H=1365(48), Rel.H=45.52%
[11], d=3.027796, 2-theta=29.476449, H=53.576093, Rel.H=1.79%
[12], d=2.833(4), 2-theta=31.56(5), H=243(20), Rel.H=8.11%
Intensity (cps)
0
1000
2000
3000
4000
5000
10
20
30
40
2-theta (deg)

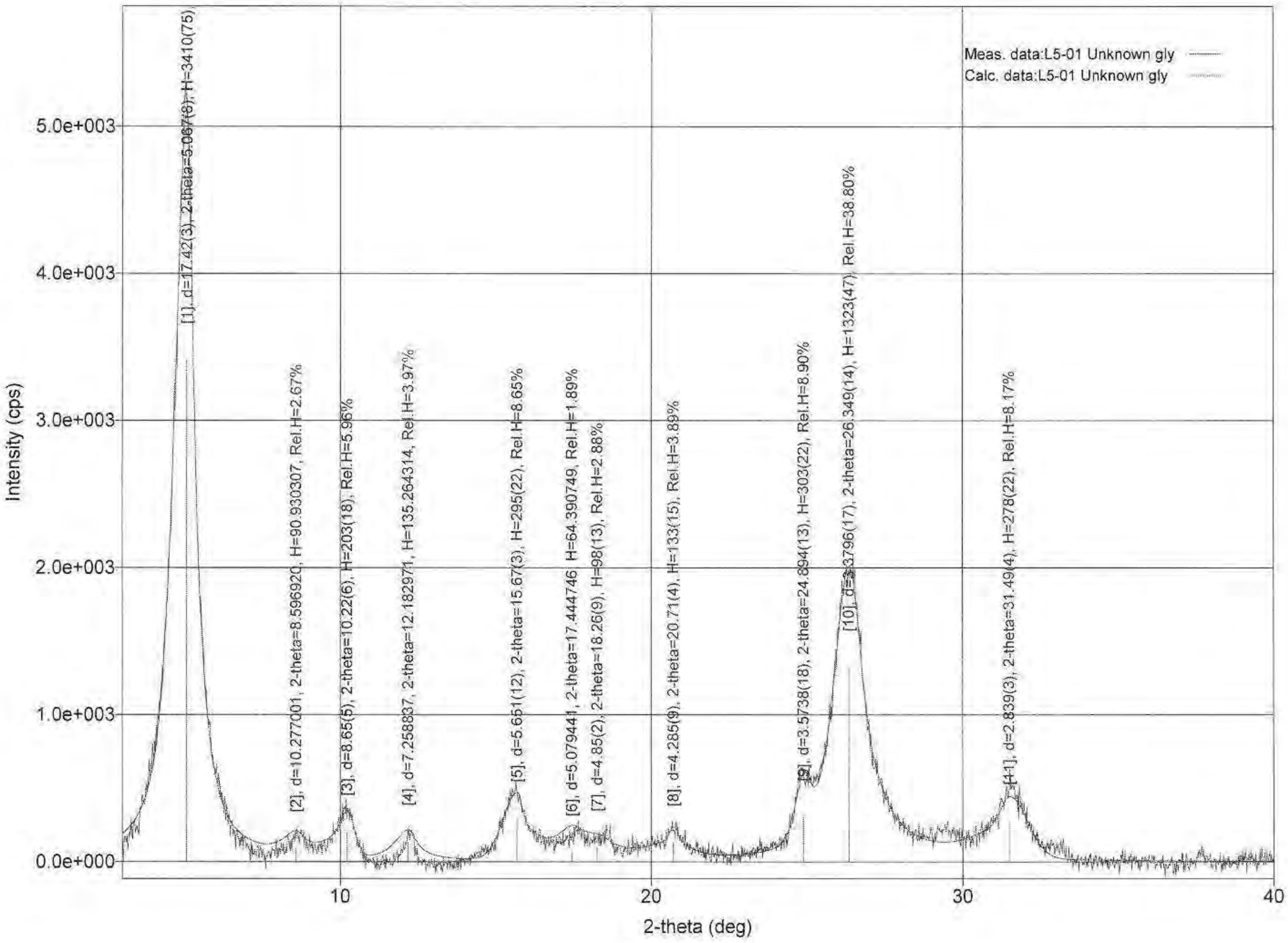
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	5.109(10)	17.28(3)	2998(71)	0.918(10)	3752(27)	1.25(4)	90.5(10)
▨ 2	8.90(4)	9.92(5)	117(14)	0.75(8)	102(10)	0.87(19)	111(12)
▨ 3	10.24(5)	8.63(4)	192(18)	0.79(5)	177(8)	0.92(13)	105(7)
▨ 4	12.28(3)	7.199(18)	190(18)	0.34(4)	90(6)	0.48(8)	243(26)
▨ 5	15.71(4)	5.636(13)	191(18)	0.91(4)	185(13)	0.97(16)	92(4)
▨ 6	17.612319	5.031488	99.636794	0.790944	93.8541	0.941962	106.153
▨ 7	18.550725	4.779027	106.222422	0.790944	100.057	0.941962	106.292
▨ 8	20.77(3)	4.274(5)	96(13)	0.52(5)	53(4)	0.55(12)	163(16)
▨ 9	25.048(13)	3.5522(18)	333(24)	0.64(3)	286(15)	0.86(11)	133(7)
▨ 10	26.640(11)	3.3434(13)	1365(48)	1.075(15)	1973(24)	1.45(7)	79.4(11)
▨ 11	29.476449	3.027796	53.576093	0.790944	50.4666	0.941962	108.471
▨ 12	31.56(5)	2.833(4)	243(20)	1.06(5)	320(14)	1.32(17)	81(4)


Meas. data:L5-01 C heat
Calc. data:L5-01 C heat
Intensity (cps)
2000
1500
1000
500
0
2-theta (deg)
10
20
30
40
[1], d=9.72(4), 2-theta=9.09(3), H=433(33), Rel.H=30.33%
[2], d=5.37(17), 2-theta=16.5(5), H=34(9), Rel.H=2.35%
[3], d=4.886(14), 2-theta=18.14(5), H=223(24), Rel.H=15.60%
[4], d=4.56(5), 2-theta=19.5(2), H=66(13), Rel.H=4.61%
[5], d=3.494(2), 2-theta=25.473(18), H=217(23), Rel.H=15.18%
[6], d=3.304080, 2-theta=26.962862, H=111.833516, Rel.H=7.83%
[7], d=3.246(2), 2-theta=27.46(2), H=1428(6
[8], d=2.728644, 2-theta=32.794384, H=36.678449, Rel.H=2.57%
[9], d=2.503158, 2-theta=35.844203, H=38.493840, Rel.H=2.70%

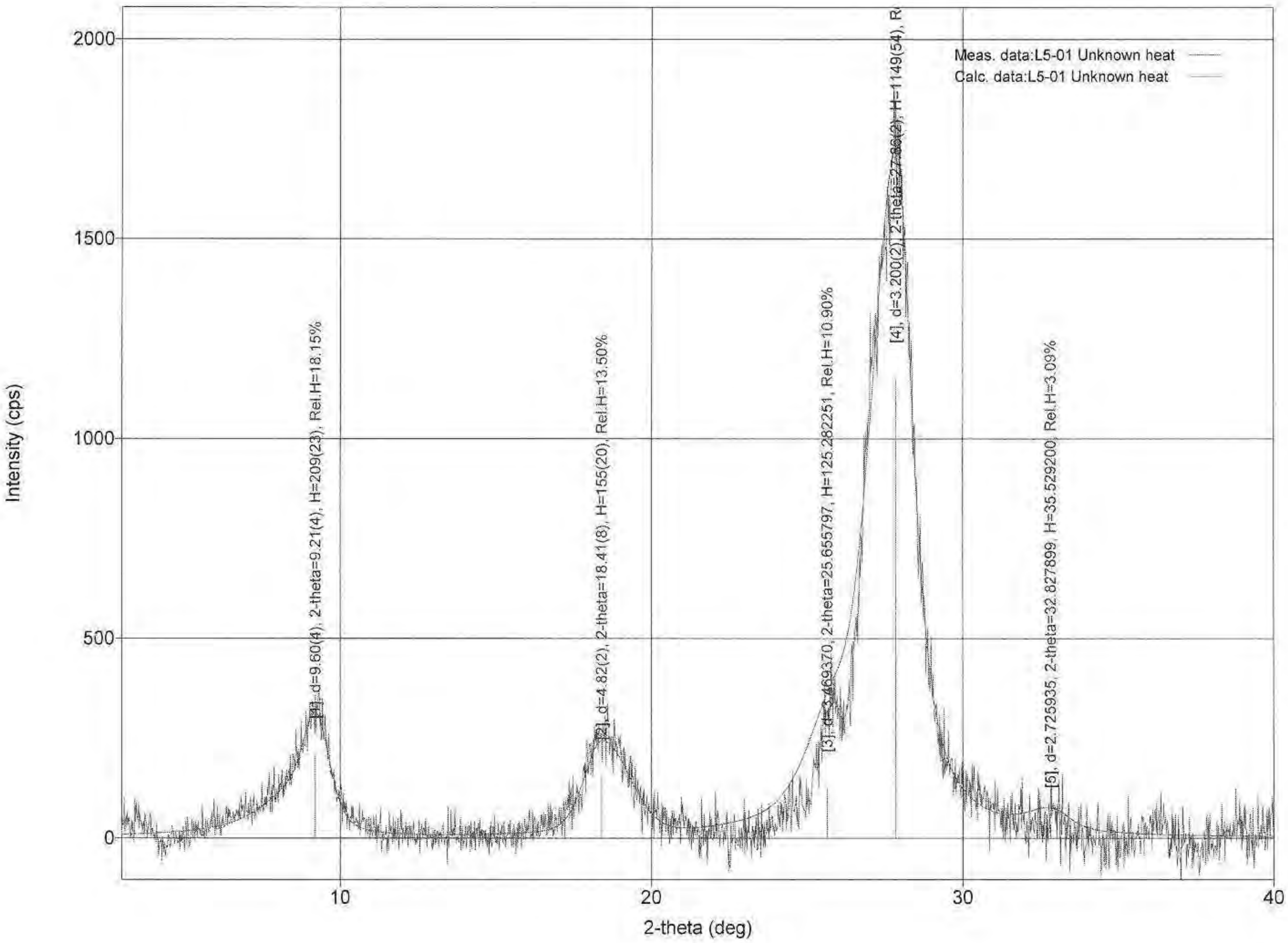
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	9.09(3)	9.72(4)	433(33)	2.60(4)	1300(23)	3.0(3)	32.0(5)
☐ 2	16.5(5)	5.37(17)	34(9)	2.1(4)	83(18)	2.5(12)	40(7)
☐ 3	18.14(5)	4.886(14)	223(24)	1.38(5)	359(24)	1.6(3)	61(2)
☐ 4	19.5(2)	4.56(5)	66(13)	2.2(2)	171(19)	2.6(8)	39(4)
☐ 5	25.473(18)	3.494(2)	217(23)	0.61(5)	167(15)	0.77(15)	139(12)
☐ 6	26.962862	3.304080	111.833516	2.11451	288.618	2.580778	40.351
☐ 7	27.46(2)	3.246(2)	1428(60)	1.709(18)	3067(32)	2.15(11)	50.0(5)
☐ 8	32.794384	2.728644	36.678449	2.11451	94.6589	2.580778	40.9028
☐ 9	35.844203	2.503158	38.493840	2.11451	99.3441	2.580778	41.2403


Meas. data:L5-01 unknown
Calc. data:L5-01 unknown
[1], d=12.823020, 2-theta=6.887681, H=1867
[2], d=10.317146, 2-theta=8.563406, H=179.951194, Rel.H=9.63%
[3], d=7.160723, 2-theta=12.350543, H=126.881986, Rel.H=6.79%
[4], d=6.21(5), 2-theta=14.25(13), H=77(11), Rel.H=4.13%
[5], d=5.8(2), 2-theta=15.4(6), H=52(9), Rel.H=2.80%
[6], d=5.031488, 2-theta=17.612319, H=186.491875, Rel.H=9.98%
[7], d=4.770484, 2-theta=18.584239, H=56.840786, Rel.H=3.04%
[8], d=3.586(2), 2-theta=24.810(15), H=280(22), Rel.H=15.00%
[9], d=3.340773, 2-theta=26.661232, H=172.471482, Rel.H=9.23%
[10], d=3.115(4), 2-theta=28.63(4), H=722(35), Rel.H=38.65%
[11], d=2.895(8), 2-theta=30.86(9), H=73(11), Rel.H=3.90%
Intensity (cps)
3000
2000
1000
0
10
20
30
40
2-theta (deg)

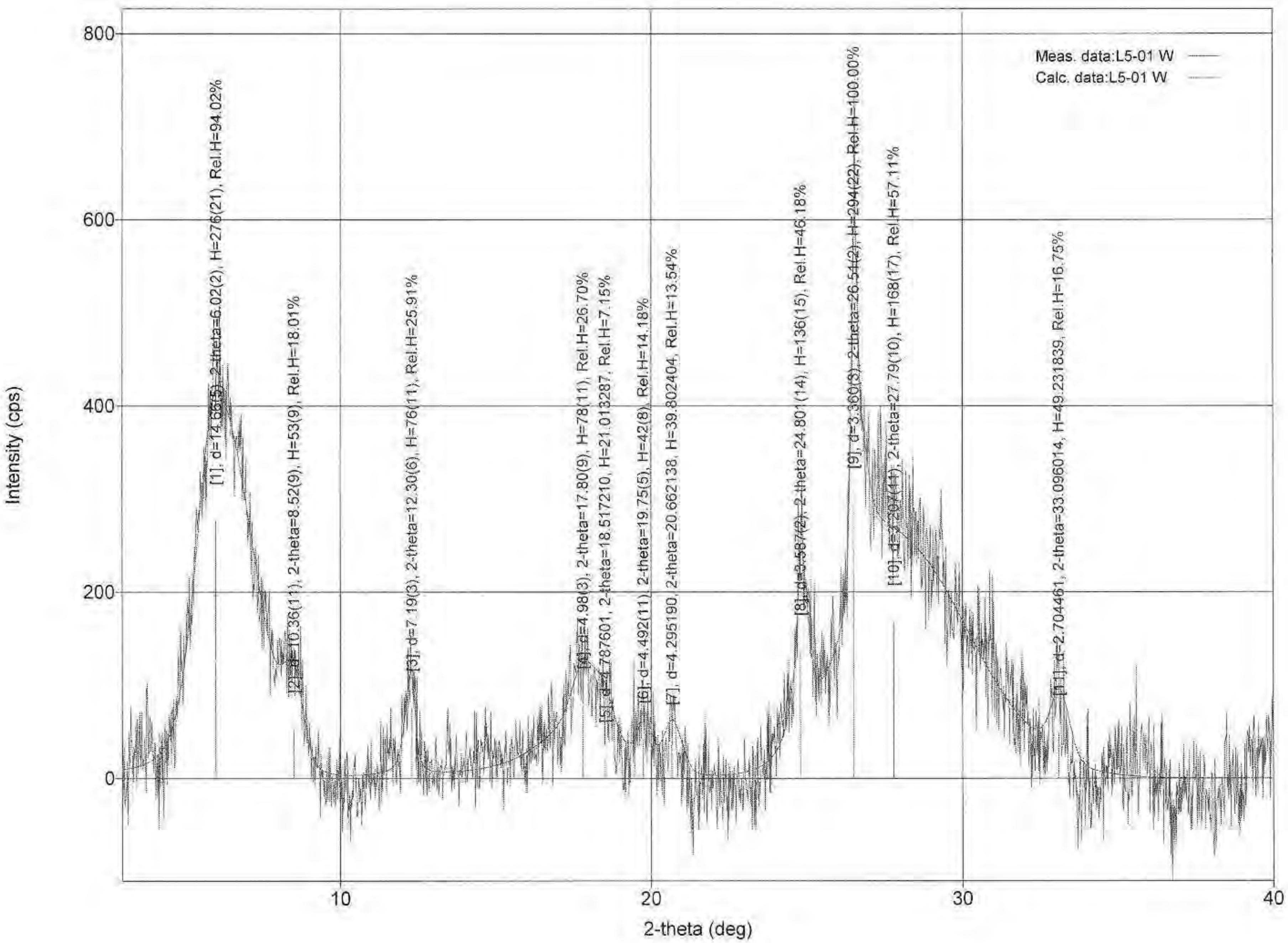
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.887681	12.823020	1867.835238	2.02047	4042.98	2.164525	41.1398
☐ 2	8.563406	10.317146	179.951194	2.02047	389.509	2.164525	41.1805
☐ 3	12.350543	7.160723	126.881986	2.02047	274.639	2.164525	41.3052
☐ 4	14.25(13)	6.21(5)	77(11)	0.9(4)	76(93)	1.0(14)	91(35)
☐ 5	15.4(6)	5.8(2)	52(9)	1.9(13)	106(81)	2.0(19)	44(30)
☐ 6	17.612319	5.031488	186.491875	2.02047	403.666	2.164525	41.5554
☐ 7	18.584239	4.770484	56.840786	2.02047	123.033	2.164525	41.6116
☐ 8	24.810(15)	3.586(2)	280(22)	0.53(5)	215(14)	0.77(11)	160(15)
☐ 9	26.661232	3.340773	172.471482	2.02047	373.319	2.164525	42.2027
☐ 10	28.63(4)	3.115(4)	722(35)	3.13(3)	2549(30)	3.5(2)	27.3(3)
☐ 11	30.86(9)	2.895(8)	73(11)	2.4(2)	207(26)	2.9(8)	36(4)


Meas. data:L5-01 Unknown gly
Calc. data:L5-01 Unknown gly
Intensity (cps)
5.0e+003
4.0e+003
3.0e+003
2.0e+003
1.0e+003
0.0e+000
10
20
30
40
2-theta (deg)
[1], d=17.42(3), 2-theta=5.067(8), H=3410(75)
[2], d=10.277001, 2-theta=8.596920, H=90.930307, Rel.H=2.67%
[3], d=8.65(5), 2-theta=10.22(6), H=203(18), Rel.H=5.96%
[4], d=7.258837, 2-theta=12.182971, H=135.264314, Rel.H=3.97%
[5], d=5.651(12), 2-theta=15.67(3), H=295(22), Rel.H=8.65%
[6], d=5.079441, 2-theta=17.444746 H=64.390749, Rel.H=1.89%
[7], d=4.85(2), 2-theta=18.26(9), H=98(13), Rel.H=2.88%
[8], d=4.285(9), 2-theta=20.71(4), H=133(15), Rel.H=3.89%
[9], d=3.5738(18), 2-theta=24.894(13), H=303(22), Rel.H=8.90%
[10], d=3.3796(17), 2-theta=26.349(14), H=1323(47), Rel.H=38.80%
[11], d=2.839(3), 2-theta=31.49(4), H=278(22), Rel.H=8.17%

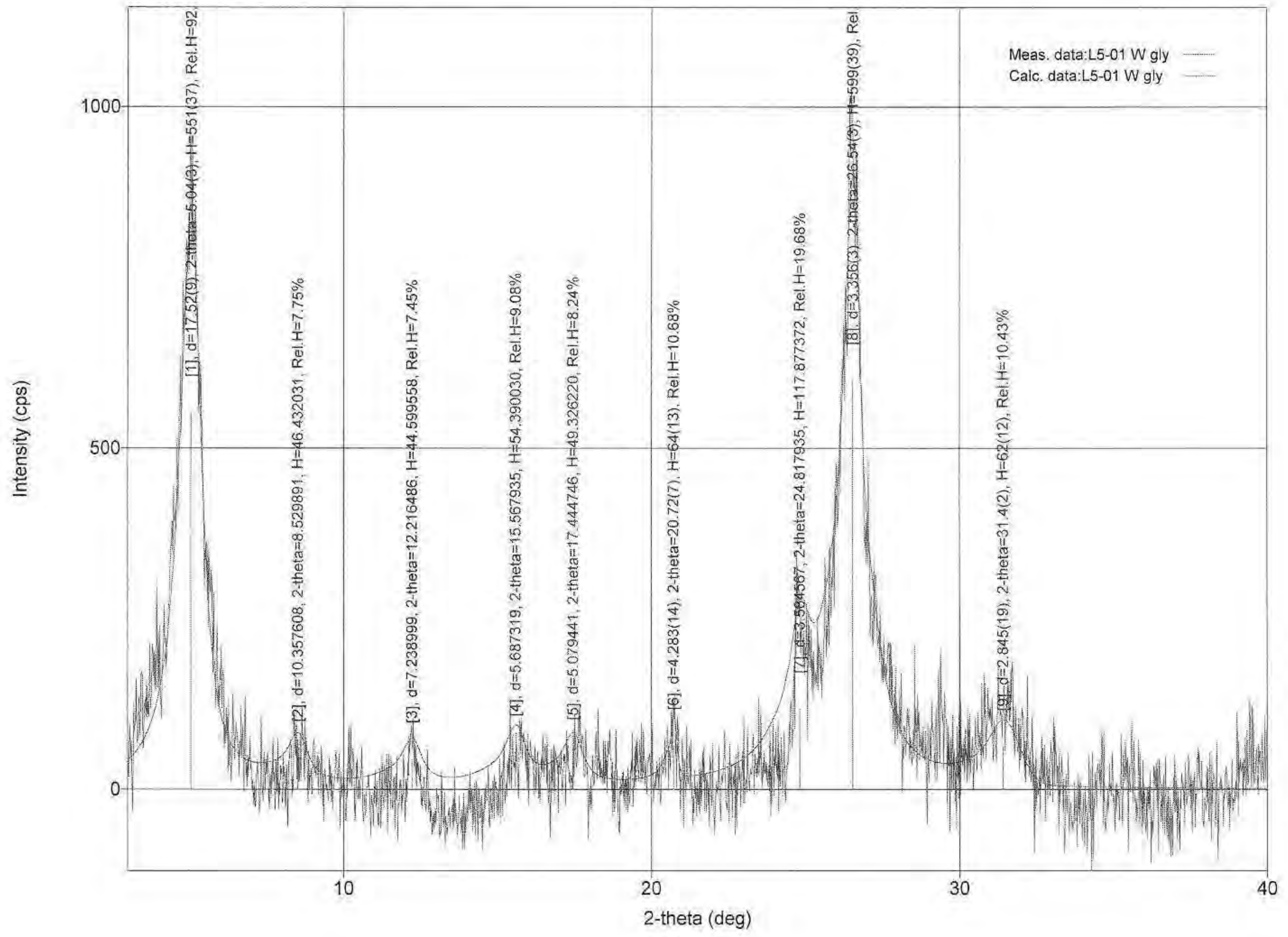
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.067(8)	17.42(3)	3410(75)	0.780(9)	4046(22)	1.19(3)	106.5(13)
☐ 2	8.596920	10.277001	90.930307	0.839097	116.48	1.280985	99.1609
☐ 3	10.22(6)	8.65(5)	203(18)	0.68(8)	206(15)	1.01(17)	123(15)
☐ 4	12.182971	7.258837	135.264314	0.839097	173.272	1.280985	99.4435
☐ 5	15.67(3)	5.651(12)	295(22)	0.84(5)	343(14)	1.16(14)	100(5)
☐ 6	17.444746	5.079441	64.390749	0.839097	82.4836	1.280985	100.039
☐ 7	18.26(9)	4.85(2)	98(13)	2.10(14)	286(20)	2.9(6)	40(3)
☐ 8	20.71(4)	4.285(9)	133(15)	0.59(8)	158(8)	1.2(2)	142(19)
☐ 9	24.894(13)	3.5738(18)	303(22)	0.64(4)	290(20)	0.96(14)	133(9)
☐ 10	26.349(14)	3.3796(17)	1323(47)	1.131(16)	2228(28)	1.68(8)	75.4(11)
☐ 11	31.49(4)	2.839(3)	278(22)	1.27(5)	528(16)	1.9(2)	68(3)


Meas. data:L5-01 Unknown heat
Calc. data:L5-01 Unknown heat
[1], d=9.60(4), 2-theta=9.21(4), H=209(23), Rel.H=18.15%
[2], d=4.82(2), 2-theta=18.41(8), H=155(20), Rel.H=13.50%
[3], d=3.469370, 2-theta=25.655797, H=125.282251, Rel.H=10.90%
[4], d=3.200(2), 2-theta=27.86(2), H=1149(54), R
[5], d=2.725935, 2-theta=32.827899, H=35.529200, Rel.H=3.09%
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)

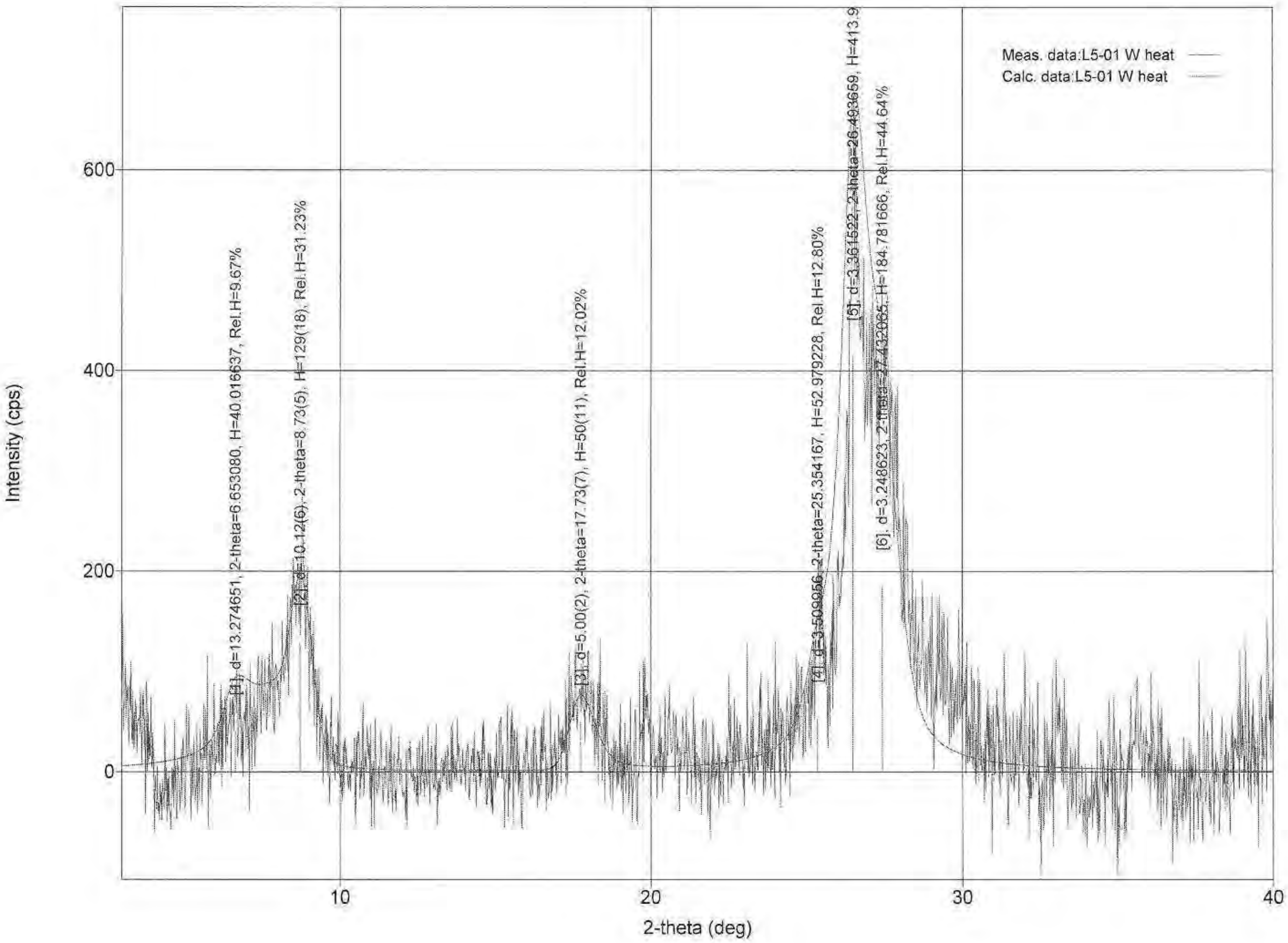
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	9.21(4)	9.60(4)	209(23)	1.29(6)	449(9)	2.2(3)	64(3)
☐ 2	18.41(8)	4.82(2)	155(20)	1.70(7)	300(15)	1.9(3)	49(2)
☐ 3	25.655797	3.469370	125.282251	1.63253	272.843	2.177830	52.125
☐ 4	27.86(2)	3.200(2)	1149(54)	1.63(2)	2612(21)	2.27(12)	52.4(7)
☐ 5	32.827899	2.725935	35.529200	1.63253	77.3766	2.177830	52.9833


Meas. data:L5-01 W
Calc. data:L5-01 W
[1], d=14.68(5), 2-theta=6.02(2), H=276(21), Rel.H=94.02%
[2], d=10.36(11), 2-theta=8.52(9), H=53(9), Rel.H=18.01%
[3], d=7.19(3), 2-theta=12.30(6), H=76(11), Rel.H=25.91%
[4], d=4.98(3), 2-theta=17.80(9), H=78(11), Rel.H=26.70%
[5], d=4.787601, 2-theta=18.517210, H=21.013287, Rel.H=7.15%
[6], d=4.492(11), 2-theta=19.75(5), H=42(8), Rel.H=14.18%
[7], d=4.295190, 2-theta=20.662138, H=39.802404, Rel.H=13.54%
[8], d=3.587(2), 2-theta=24.801(14), H=136(15), Rel.H=46.18%
[9], d=3.360(3), 2-theta=26.51(2), H=294(22), Rel.H=100.00%
[10], d=3.207(11), 2-theta=27.79(10), H=168(17), Rel.H=57.11%
[11], d=2.704461, 2-theta=33.096014, H=49.231839, Rel.H=16.75%
Intensity (cps)
800
600
400
200
0
10
20
30
40
2-theta (deg)

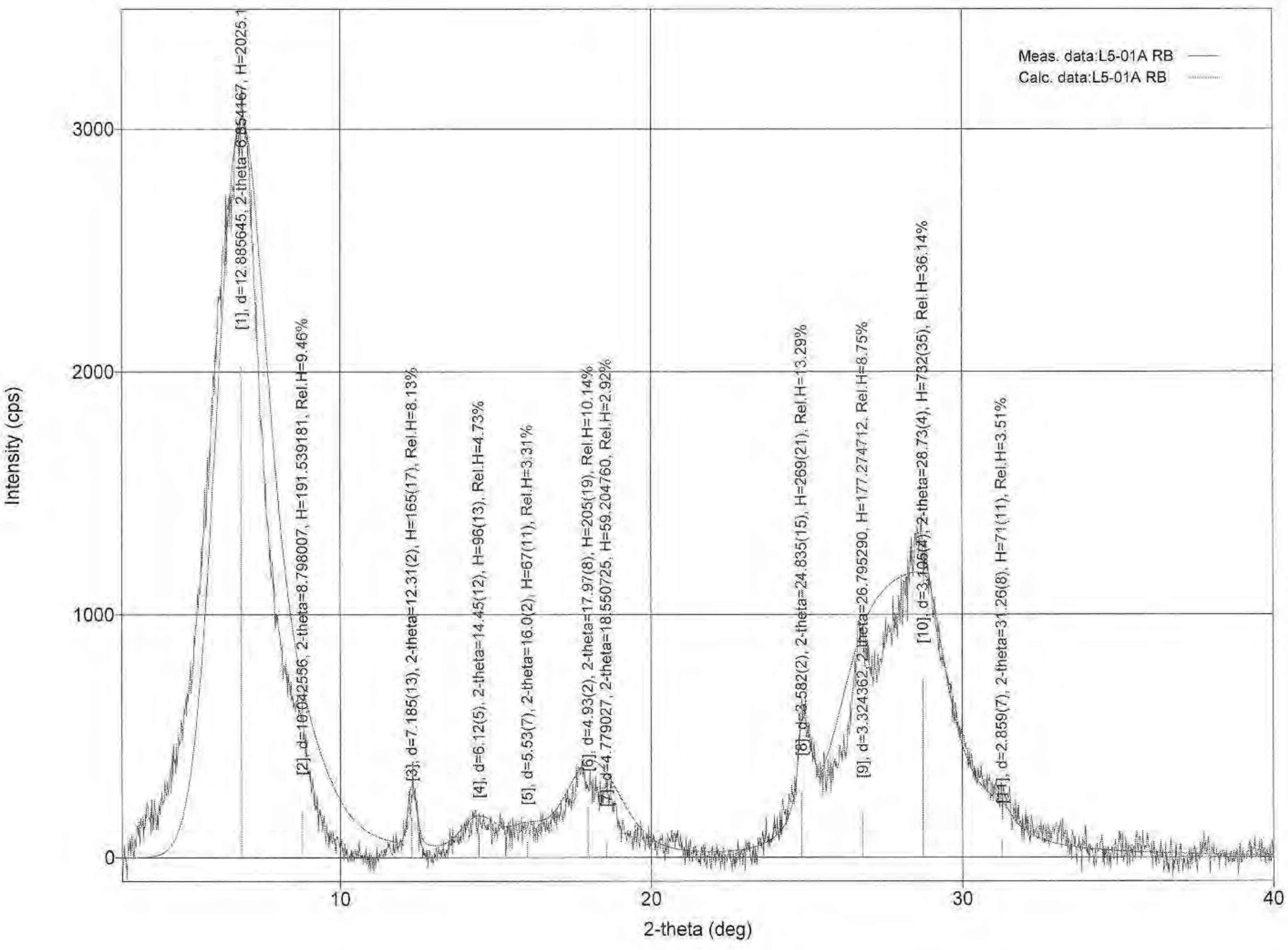
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.02(2)	14.66(5)	276(21)	2.12(3)	663(10)	2.4(2)	39.2(5)
☐ 2	8.52(9)	10.36(11)	53(9)	0.73(8)	41(7)	0.8(3)	114(12)
☐ 3	12.30(6)	7.19(3)	76(11)	0.38(6)	40(5)	0.52(14)	220(34)
☐ 4	17.80(9)	4.98(3)	78(11)	1.51(14)	182(15)	2.3(5)	56(5)
☐ 5	18.517210	4.787601	21.013287	0.731715	19.4542	0.925805	114.89
☐ 6	19.75(5)	4.492(11)	42(8)	0.55(16)	36(9)	0.9(4)	152(43)
☐ 7	20.662138	4.295190	39.802404	0.731715	36.8493	0.925805	115.262
☐ 8	24.801(14)	3.587(2)	136(15)	0.42(5)	90(6)	0.67(12)	200(26)
☐ 9	26.51(2)	3.360(3)	294(22)	0.29(3)	153(7)	0.52(6)	290(31)
☐ 10	27.79(10)	3.207(11)	168(17)	4.70(9)	840(23)	5.0(6)	18.2(3)
☐ 11	33.096014	2.704461	49.231839	0.731715	45.5791	0.925805	118.293


Meas. data:L5-01 W gly
Calc. data:L5-01 W gly
Intensity (cps)
1000
500
0
10
20
30
40
2-theta (deg)
[1], d=17.52(9), 2-theta=5.04(3), H=551(37), Rel.H=92.
[2], d=10.357608, 2-theta=8.529891, H=46.432031, Rel.H=7.75%
[3], d=7.238999, 2-theta=12.216486, H=44.599558, Rel.H=7.45%
[4], d=5.687319, 2-theta=15.567935, H=54.390030, Rel.H=9.08%
[5], d=5.079441, 2-theta=17.444746, H=49.326220, Rel.H=8.24%
[6], d=4.283(14), 2-theta=20.72(7), H=64(13), Rel.H=10.68%
[7], d=3.584567, 2-theta=24.817935, H=117.877372, Rel.H=19.68%
[8], d=3.356(3), 2-theta=26.54(3), H=599(39), Rel
[9], d=2.845(19), 2-theta=31.4(2), H=62(12), Rel.H=10.43%

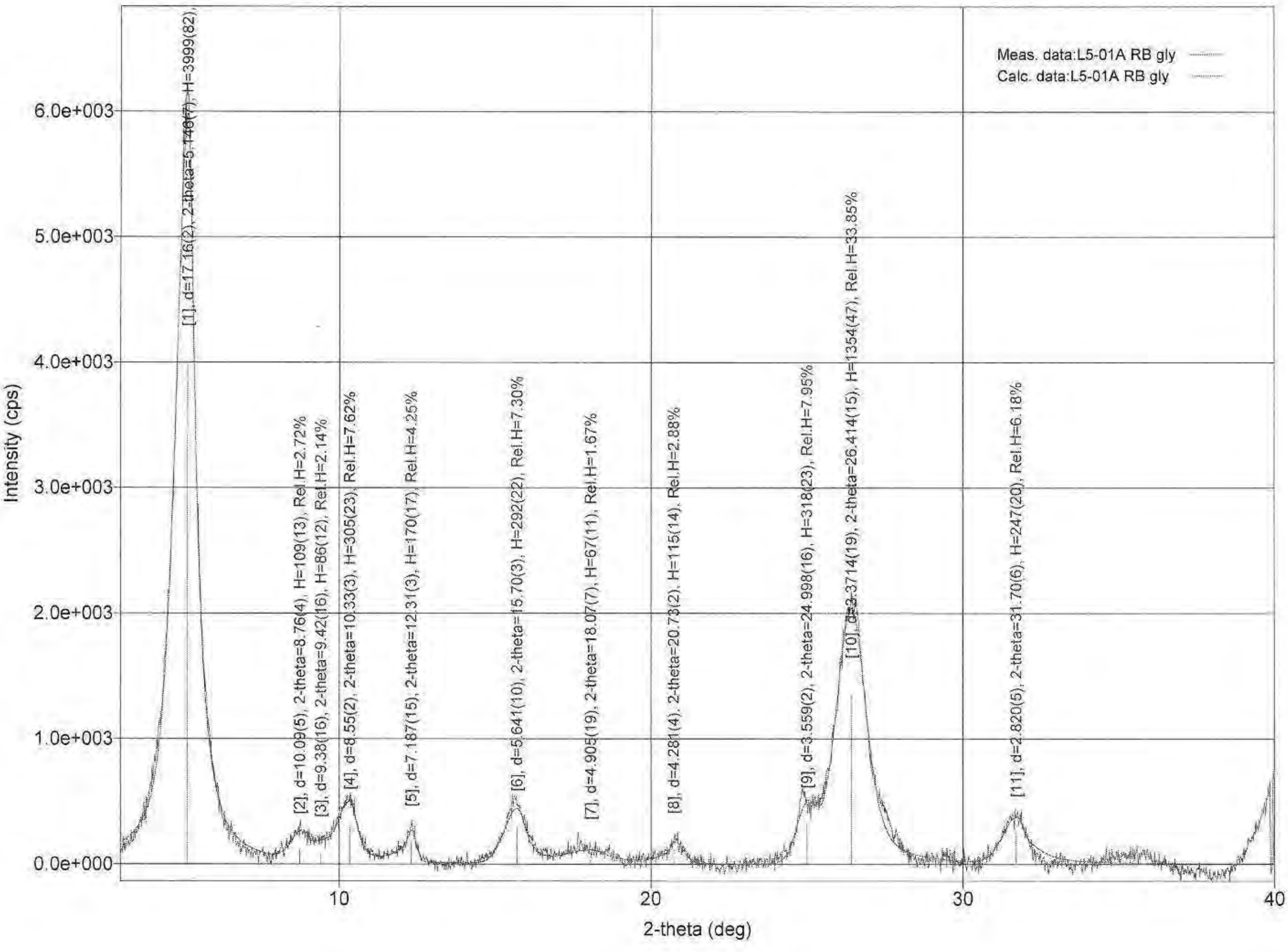
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.04(3)	17.52(9)	551(37)	0.87(3)	735(13)	1.33(11)	96(3)
☐ 2	8.529891	10.357608	46.432031	0.868624	68.0352	1.465263	95.7861
☐ 3	12.216486	7.238999	44.599558	0.868624	65.3501	1.465263	96.0662
☐ 4	15.567935	5.687319	54.390030	0.868624	79.6957	1.465263	96.4091
☐ 5	17.444746	5.079441	49.326220	0.868624	72.2759	1.465263	96.6385
☐ 6	20.72(7)	4.283(14)	64(13)	0.26(10)	28(6)	0.44(18)	329(122)
☐ 7	24.817935	3.584567	117.877372	0.868624	172.721	1.465263	97.8057
☐ 8	26.54(3)	3.356(3)	599(39)	0.85(4)	947(16)	1.58(13)	101(5)
☐ 9	31.4(2)	2.845(19)	62(12)	1.3(3)	119(17)	1.9(6)	65(13)


Meas. data:L5-01 W heat
Calc. data:L5-01 W heat
[1], d=13.274651, 2-theta=6.653080, H=40.016637, Rel.H=9.67%
[2], d=10.12(6), 2-theta=8.73(5), H=129(18), Rel.H=31.23%
[3], d=5.00(2), 2-theta=17.73(7), H=50(11), Rel.H=12.02%
[4], d=3.509956, 2-theta=25.354167, H=52.979228, Rel.H=12.80%
[5], d=3.361522, 2-theta=26.493659, H=413.9
[6], d=3.248623, 2-theta=27.432065, H=184.781666, Rel.H=44.64%
Intensity (cps)
600
400
200
0
10
20
30
40
2-theta (deg)

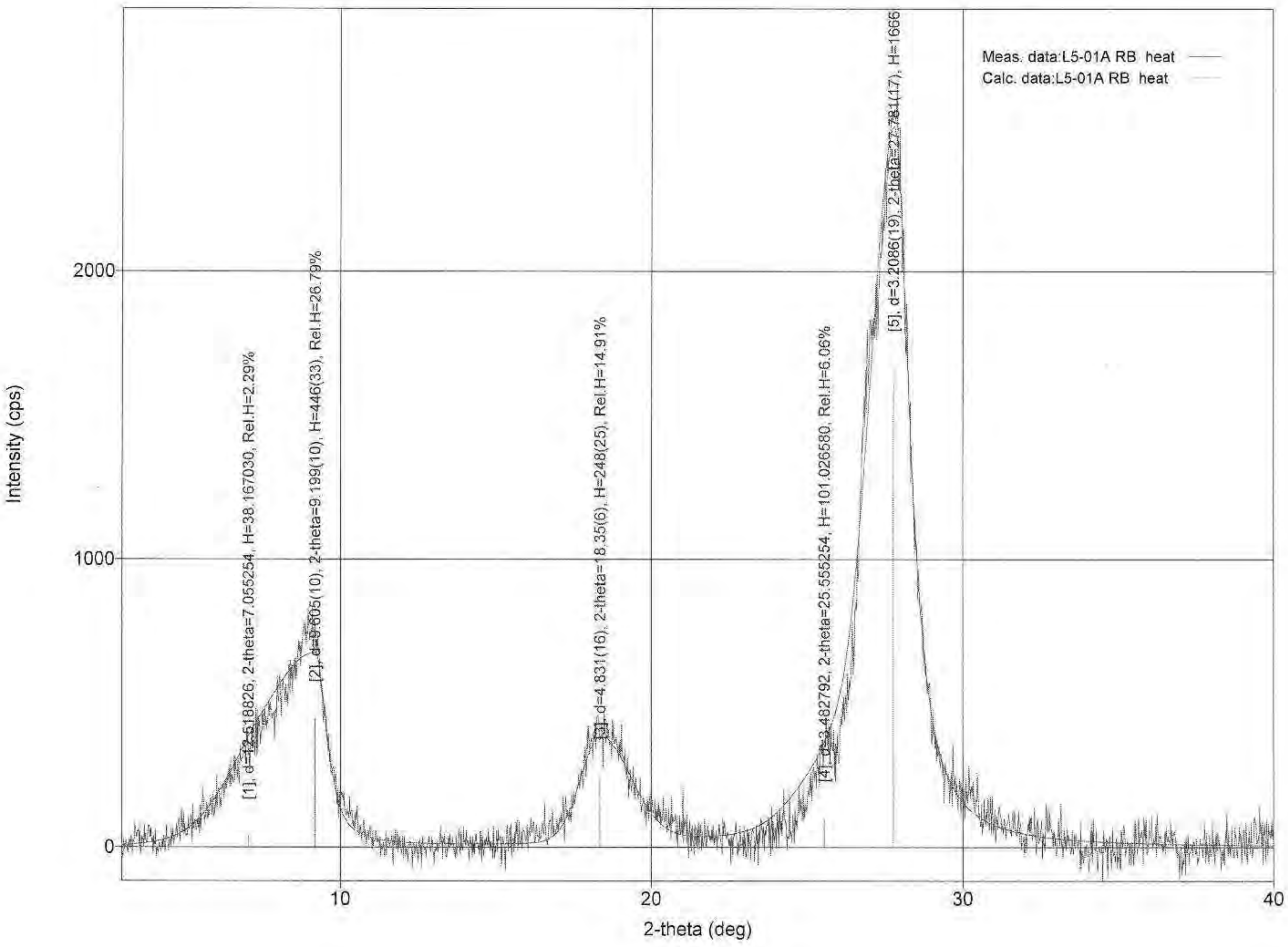
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.653080	13.274651	40.016637	1.06957	58.5752	1.463771	77.706
☐ 2	8.73(5)	10.12(6)	129(18)	1.07(8)	240(11)	1.9(3)	78(6)
☐ 3	17.73(7)	5.00(2)	50(11)	0.97(11)	59(7)	1.2(4)	86(10)
☐ 4	25.354167	3.509956	52.979228	1.06957	77.5494	1.463771	79.5134
☐ 5	26.493659	3.361522	413.951489	1.06957	605.93	1.463771	79.6956
☐ 6	27.432065	3.248623	184.781666	1.06957	270.478	1.463771	79.8522


Meas. data:L5-01A RB
Calc. data:L5-01A RB
[1], d=12.885645, 2-theta=6.854467, H=2025.1
[2], d=10.042556, 2-theta=8.798007, H=191.539181, Rel.H=9.46%
[3], d=7.185(13), 2-theta=12.31(2), H=165(17), Rel.H=8.13%
[4], d=6.12(5), 2-theta=14.45(12), H=96(13), Rel.H=4.73%
[5], d=5.53(7), 2-theta=16.0(2), H=67(11), Rel.H=3.31%
[6], d=4.93(2), 2-theta=17.97(8), H=205(19), Rel.H=10.14%
[7], d=4.779027, 2-theta=18.550725, H=59.204760, Rel.H=2.92%
[8], d=3.582(2), 2-theta=24.835(15), H=269(21), Rel.H=13.29%
[9], d=3.324362, 2-theta=26.795290, H=177.274712, Rel.H=8.75%
[10], d=3.106(4), 2-theta=28.73(4), H=732(35), Rel.H=36.14%
[11], d=2.859(7), 2-theta=31.26(8), H=71(11), Rel.H=3.51%
Intensity (cps)
0
1000
2000
3000
10
20
30
40
2-theta (deg)

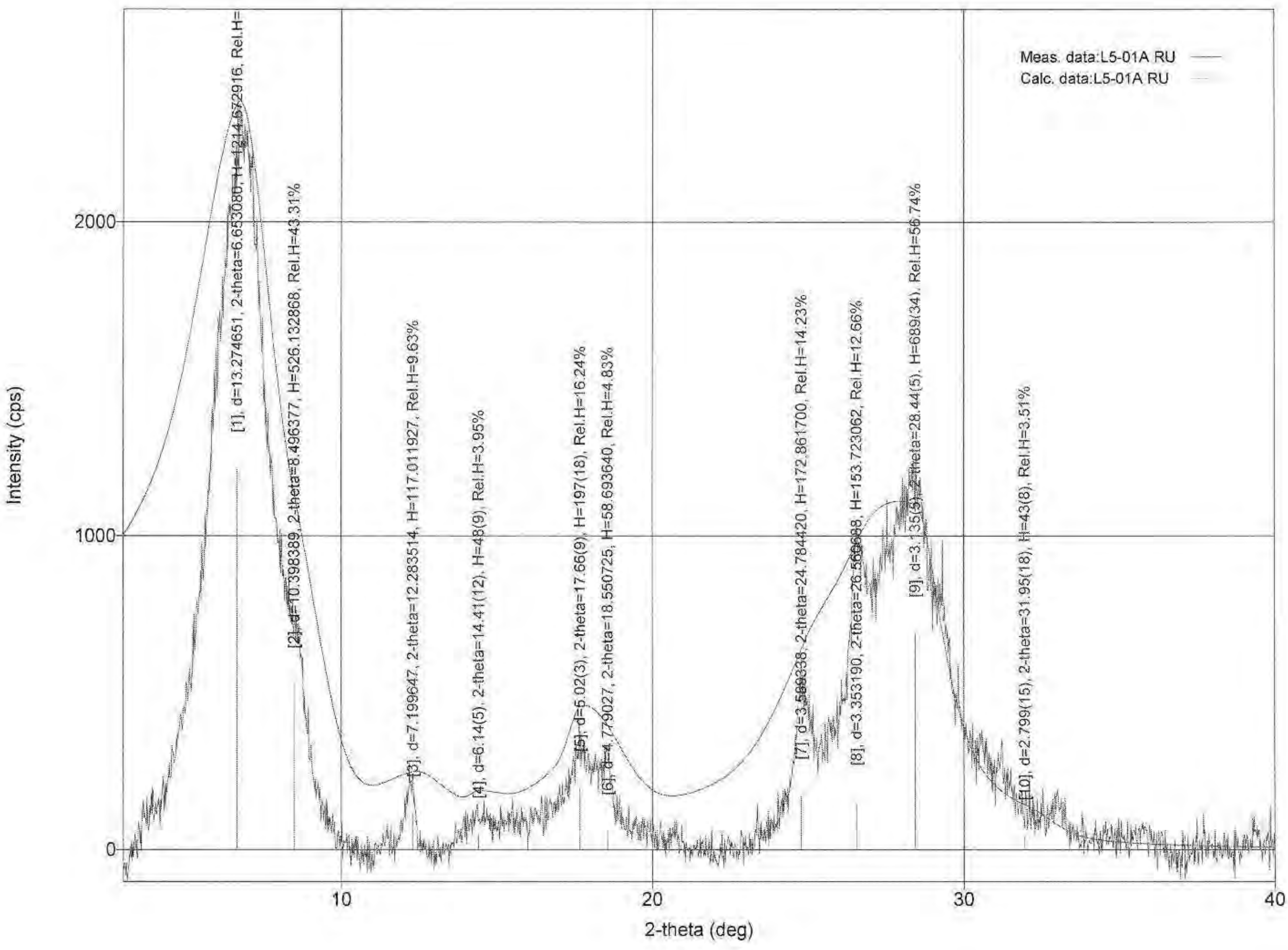
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.854167	12.885645	2025.134159	1.97878	4670.69	2.306359	42.0058
☐ 2	8.798007	10.042556	191.539181	1.97878	441.758	2.306359	42.0545
☐ 3	12.31(2)	7.185(13)	165(17)	0.33(3)	64(5)	0.39(7)	250(23)
☐ 4	14.45(12)	6.12(5)	96(13)	1.4(2)	153(31)	1.6(5)	61(11)
☐ 5	16.0(2)	5.53(7)	67(11)	1.4(5)	112(55)	1.7(11)	58(21)
☐ 6	17.97(8)	4.93(2)	205(19)	1.98(18)	474(49)	2.3(4)	42(4)
☐ 7	18.550725	4.779027	59.204760	1.97878	136.547	2.306359	42.4862
☐ 8	24.835(15)	3.582(2)	269(21)	0.47(4)	162(14)	0.60(10)	180(16)
☐ 9	26.795290	3.324362	177.274712	1.97878	408.859	2.306359	43.1037
☐ 10	28.73(4)	3.105(4)	732(35)	3.21(4)	2789(31)	3.8(2)	26.7(3)
☐ 11	31.26(8)	2.859(7)	71(11)	2.3(4)	232(27)	3.3(9)	37(6)


Meas. data:L5-01A RB gly
Calc. data:L5-01A RB gly
Intensity (cps)
6.0e+003
5.0e+003
4.0e+003
3.0e+003
2.0e+003
1.0e+003
0.0e+000
2-theta (deg)
10
20
30
40
[1], d=17.16(2), 2-theta=5.146(7), H=3999(82),
[2], d=10.09(5), 2-theta=8.76(4), H=109(13), Rel.H=2.72%
[3], d=9.38(16), 2-theta=9.42(16), H=86(12), Rel.H=2.14%
[4], d=8.55(2), 2-theta=10.33(3), H=305(23), Rel.H=7.62%
[5], d=7.187(15), 2-theta=12.31(3), H=170(17), Rel.H=4.25%
[6], d=5.641(10), 2-theta=15.70(3), H=292(22), Rel.H=7.30%
[7], d=4.905(19), 2-theta=18.07(7), H=67(11), Rel.H=1.67%
[8], d=4.281(4), 2-theta=20.73(2), H=115(14), Rel.H=2.88%
[9], d=3.559(2), 2-theta=24.998(16), H=318(23), Rel.H=7.95%
[10], d=3.3714(19), 2-theta=26.414(15), H=1354(47), Rel.H=33.85%
[11], d=2.820(5), 2-theta=31.70(6), H=247(20), Rel.H=6.18%

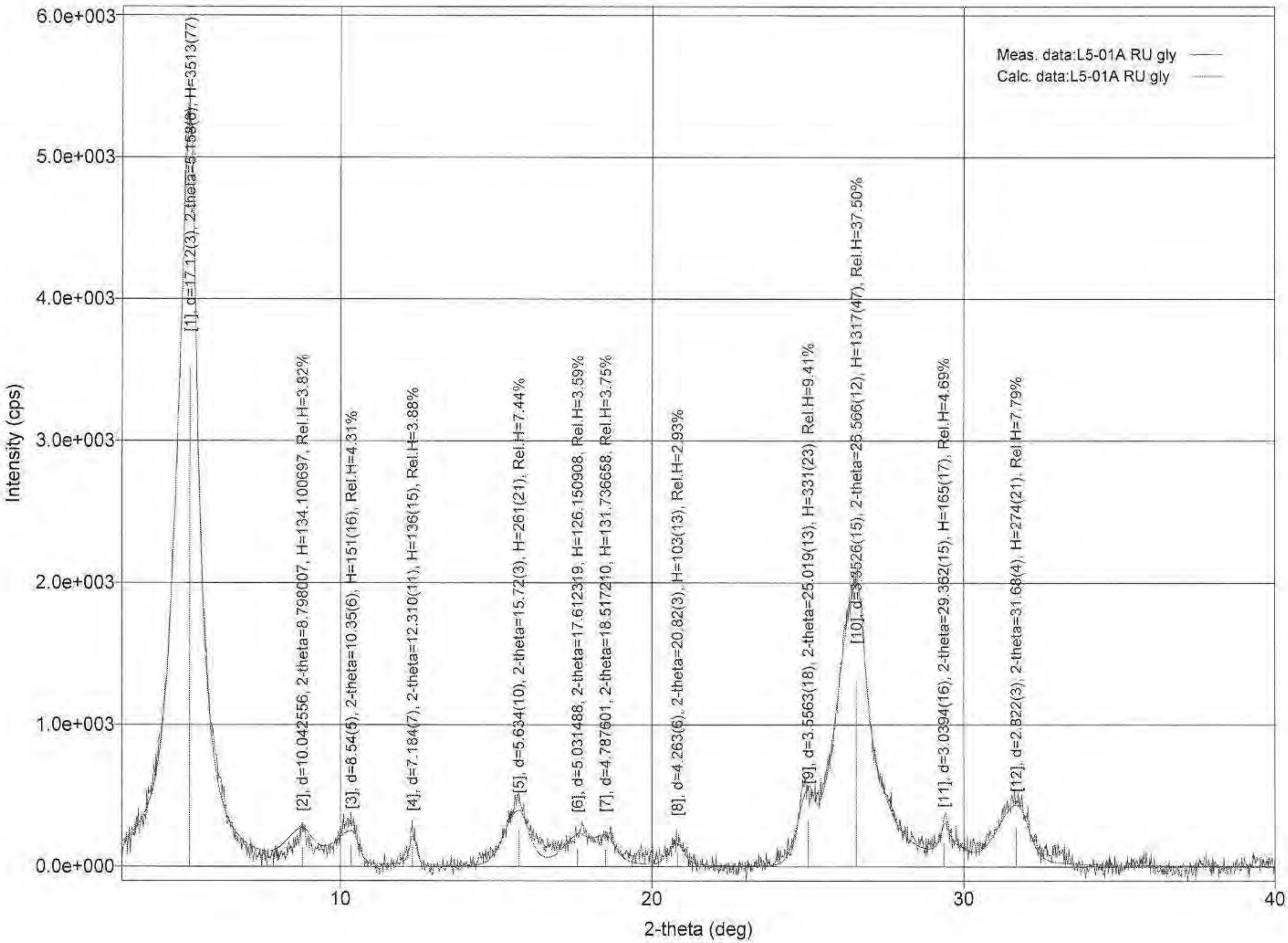
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.146(7)	17.16(2)	3999(82)	0.762(8)	4488(24)	1.12(3)	109.0(12)
☐ 2	8.76(4)	10.09(5)	109(13)	0.60(14)	77(52)	0.7(6)	138(31)
☐ 3	9.42(16)	9.38(16)	86(12)	1.0(7)	103(91)	1.2(12)	82(58)
☐ 4	10.33(3)	8.55(2)	305(23)	0.70(9)	253(48)	0.8(2)	119(15)
☐ 5	12.31(3)	7.187(15)	170(17)	0.41(4)	111(6)	0.65(10)	205(19)
☐ 6	15.70(3)	5.641(10)	292(22)	0.82(3)	300(12)	1.03(12)	102(4)
☐ 7	18.07(7)	4.905(19)	67(11)	1.54(19)	128(11)	1.9(5)	55(7)
☐ 8	20.73(2)	4.281(4)	115(14)	0.56(6)	95(8)	0.83(17)	151(16)
☐ 9	24.998(16)	3.559(2)	318(23)	0.80(5)	304(21)	0.96(13)	106(7)
☐ 10	26.414(15)	3.3714(19)	1354(47)	1.120(15)	1816(29)	1.34(7)	76.1(10)
☐ 11	31.70(6)	2.820(5)	247(20)	0.87(6)	306(16)	1.24(17)	99(6)
☐ 12	39.991860	2.252591	1089(43)	0.0205422	27(3)	0.025(4)	4298.19


Meas. data:L5-01A RB heat
Calc. data:L5-01A RB heat
[1], d=12.518826, 2-theta=7.055254, H=38.167030, Rel.H=2.29%
[2], d=9.605(10), 2-theta=9.199(10), H=446(33), Rel.H=26.79%
[3], d=4.831(16), 2-theta=18.35(6), H=248(25), Rel.H=14.91%
[4], d=3.482792, 2-theta=25.555254, H=101.026580, Rel.H=6.06%
[5], d=3.2086(19), 2-theta=27.781(17), H=1666
Intensity (cps)
0
1000
2000
10
20
30
40
2-theta (deg)

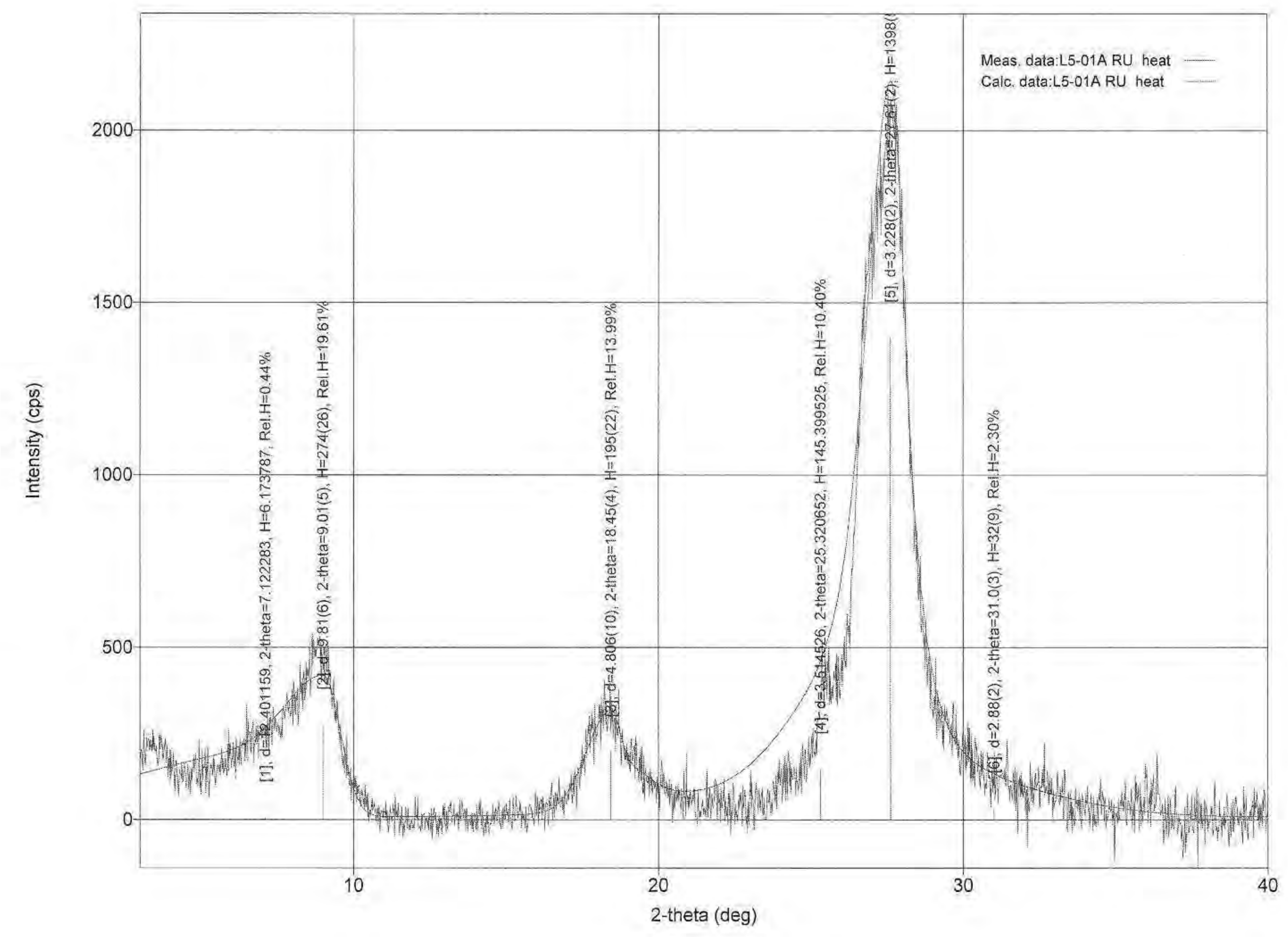
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	7.055254	12.518826	38.167030	1.93253	91.3457	2.393315	43.0157
☐ 2	9.199(10)	9.605(10)	446(33)	2.55(3)	1312(20)	2.9(3)	32.7(4)
☐ 3	18.35(6)	4.831(16)	248(25)	1.93(6)	545(19)	2.2(3)	43.5(13)
☐ 4	25.555254	3.482792	101.026580	1.93253	241.788	2.393315	44.0244
☐ 5	27.781(17)	3.2086(19)	1666(65)	1.588(17)	3614(24)	2.17(10)	53.8(6)


Meas. data:L5-01A RU
Calc. data:L5-01A RU
[1], d=13.274651, 2-theta=6.653080, H=1214.672916, Rel.H=
[2], d=10.398389, 2-theta=8.496377, H=526.132868, Rel.H=43.31%
[3], d=7.199647, 2-theta=12.283514, H=117.011927, Rel.H=9.63%
[4], d=6.14(5), 2-theta=14.41(12), H=48(9), Rel.H=3.95%
[5], d=5.02(3), 2-theta=17.66(9), H=197(18), Rel.H=16.24%
[6], d=4.779027, 2-theta=18.550725, H=58.693640, Rel.H=4.83%
[7], d=3.589338, 2-theta=24.784420, H=172.861700, Rel.H=14.23%
[8], d=3.353190, 2-theta=26.560688, H=153.723062, Rel.H=12.66%
[9], d=3.135(3), 2-theta=28.44(5), H=689(34), Rel.H=56.74%
[10], d=2.799(15), 2-theta=31.95(18), H=43(8), Rel.H=3.51%
Intensity (cps)
2000
1000
0
10
20
30
40
2-theta (deg)

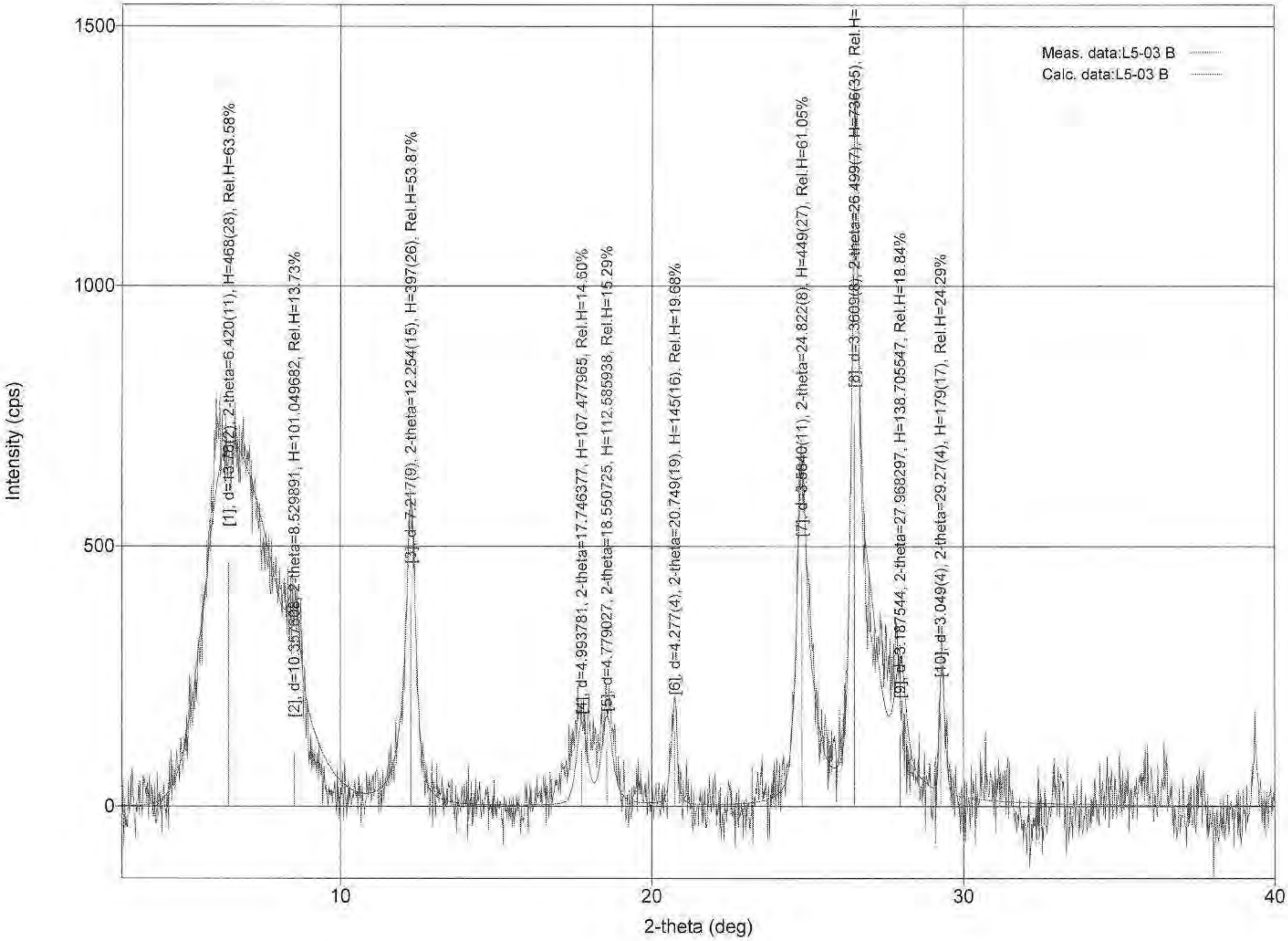
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.653080	13.274651	1214.672916	3.58459	7565.31	6.228266	23.1858
☐ 2	8.496377	10.398389	526.132868	3.58459	3276.9	6.228266	23.2105
☐ 3	12.283514	7.199647	117.011927	3.58459	728.781	6.228266	23.2804
☐ 4	14.41(12)	6.14(5)	48(9)	1.5(4)	105(31)	2.2(11)	55(15)
☐ 5	17.66(9)	5.02(3)	197(18)	1.93(14)	544(44)	2.8(5)	43(3)
☐ 6	18.550725	4.779027	58.693640	3.58459	365.56	6.228266	23.4534
☐ 7	24.784420	3.589338	172.861700	3.58459	1076.63	6.228266	23.6989
☐ 8	26.560688	3.353190	153.723062	3.58459	957.428	6.228266	23.7828
☐ 9	28.44(5)	3.135(5)	689(34)	3.58(5)	2963(34)	4.3(3)	23.9(3)
☐ 10	31.95(18)	2.799(15)	43(8)	5.1(7)	230(37)	5.4(19)	17(2)


Meas. data:L5-01A RU gly
Calc. data:L5-01A RU gly
Intensity (cps)
6.0e+003
5.0e+003
4.0e+003
3.0e+003
2.0e+003
1.0e+003
0.0e+000
2-theta (deg)
10
20
30
40
[1], d=17.12(3), 2-theta=5.158(6), H=3513(77)
[2], d=10.042556, 2-theta=8.798007, H=134.100697, Rel.H=3.82%
[3], d=8.54(5), 2-theta=10.35(6), H=151(16), Rel.H=4.31%
[4], d=7.184(7), 2-theta=12.310(11), H=136(15), Rel.H=3.88%
[5], d=5.634(10), 2-theta=15.72(3), H=261(21), Rel.H=7.44%
[6], d=5.031488, 2-theta=17.612319, H=126.150908, Rel.H=3.59%
[7], d=4.787601, 2-theta=18.517210, H=131.736658, Rel.H=3.75%
[8], d=4.263(6), 2-theta=20.82(3), H=103(13), Rel.H=2.93%
[9], d=3.5563(18), 2-theta=25.019(13), H=331(23), Rel.H=9.41%
[10], d=3.3526(15), 2-theta=26.566(12), H=1317(47), Rel.H=37.50%
[11], d=3.0394(16), 2-theta=29.362(15), H=165(17), Rel.H=4.69%
[12], d=2.822(3), 2-theta=31.68(4), H=274(21), Rel.H=7.79%

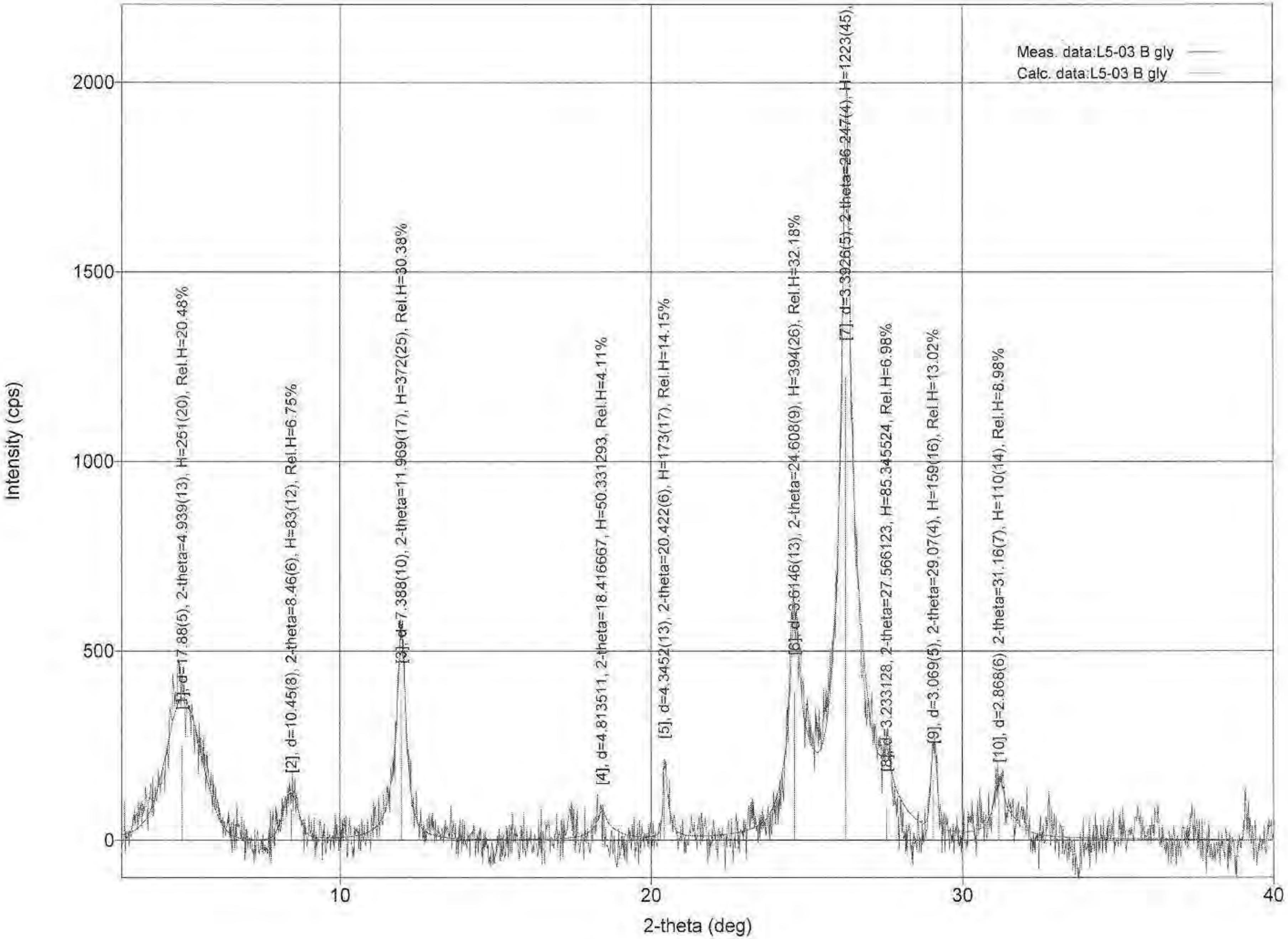
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.158(8)	17.12(3)	3513(77)	0.764(9)	4098(21)	1.17(3)	108.7(13)
☐ 2	8.798007	10.042556	134.100697	0.904782	146.482	1.092326	91.9744
☐ 3	10.35(6)	8.54(5)	151(16)	0.90(9)	196(15)	1.3(2)	92(9)
☐ 4	12.310(11)	7.184(7)	136(15)	0.28(3)	45(6)	0.33(8)	301(35)
☐ 5	15.72(3)	5.634(10)	261(21)	0.92(4)	288(22)	1.10(17)	91(4)
☐ 6	17.612319	5.031488	126.150908	0.904782	137.798	1.092326	92.7974
☐ 7	18.517210	4.787601	131.736658	0.904782	143.899	1.092326	92.9139
☐ 8	20.82(3)	4.263(6)	103(13)	0.59(6)	73(6)	0.70(15)	144(16)
☐ 9	25.019(13)	3.5563(18)	331(23)	0.66(3)	298(16)	0.90(11)	128(6)
☐ 10	26.566(12)	3.3526(15)	1317(47)	1.133(16)	2033(24)	1.54(7)	75.3(11)
☐ 11	29.362(15)	3.0394(16)	165(17)	0.41(8)	134(9)	0.81(13)	211(39)
☐ 12	31.68(4)	2.822(3)	274(21)	1.12(4)	344(14)	1.26(15)	77(2)


Meas. data:L5-01A RU heat
Calc. data:L5-01A RU heat
[1], d=12.401159, 2-theta=7.122283, H=6.173787, Rel.H=0.44%
[2], d=9.81(6), 2-theta=9.01(5), H=274(26), Rel.H=19.61%
[3], d=4.806(10), 2-theta=18.45(4), H=195(22), Rel.H=13.99%
[4], d=3.514526, 2-theta=25.320652, H=145.399525, Rel.H=10.40%
[5], d=3.228(2), 2-theta=27.61(2), H=1398(
[6], d=2.88(2), 2-theta=31.0(3), H=32(9), Rel.H=2.30%
Intensity (cps)
0
500
1000
1500
2000
2-theta (deg)
10
20
30
40

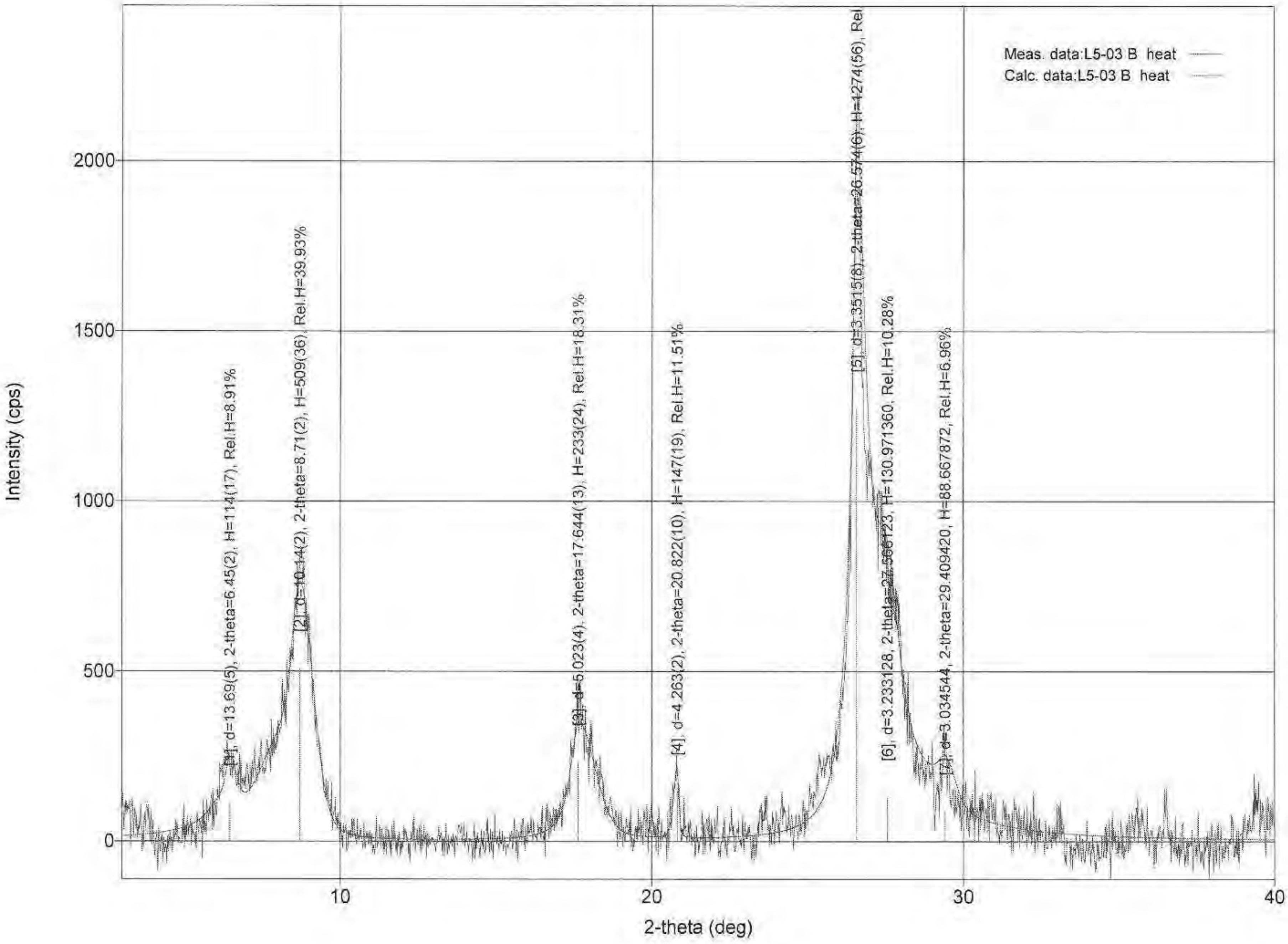
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	7.122283	12.401159	6.173787	3.2914	29.0175	4.700120	25.2574
☐ 2	9.01(5)	9.81(6)	274(26)	3.29(14)	1729(49)	6.3(8)	25.3(10)
☐ 3	18.45(4)	4.806(10)	195(22)	1.54(5)	425(14)	2.2(3)	54.6(18)
☐ 4	25.320652	3.514526	145.399525	3.2914	683.395	4.700120	25.8368
☐ 5	27.61(2)	3.228(2)	1398(59)	1.71(2)	3427(24)	2.45(12)	49.8(6)
☐ 6	31.0(3)	2.88(2)	32(9)	4.8(7)	164(39)	5(3)	18(3)


Meas. data:L5-03 B
Calc. data:L5-03 B
[1], d=13.76(2), 2-theta=6.420(11), H=468(28), Rel.H=63.58%
[2], d=10.357606, 2-theta=8.529891, H=101.049682, Rel.H=13.73%
[3], d=7.217(9), 2-theta=12.254(15), H=397(26), Rel.H=53.87%
[4], d=4.993781, 2-theta=17.746377, H=107.477965, Rel.H=14.60%
[5], d=4.779027, 2-theta=18.550725, H=112.585938, Rel.H=15.29%
[6], d=4.277(4), 2-theta=20.749(19), H=145(16), Rel.H=19.68%
[7], d=3.5840(11), 2-theta=24.822(8), H=449(27), Rel.H=61.05%
[8], d=3.3609(8), 2-theta=26.499(7), H=736(35), Rel.H=
[9], d=3.187544, 2-theta=27.968297, H=138.705547, Rel.H=18.84%
[10], d=3.049(4), 2-theta=29.27(4), H=179(17), Rel.H=24.29%
Intensity (cps)
1500
1000
500
0
10
20
30
40
2-theta (deg)

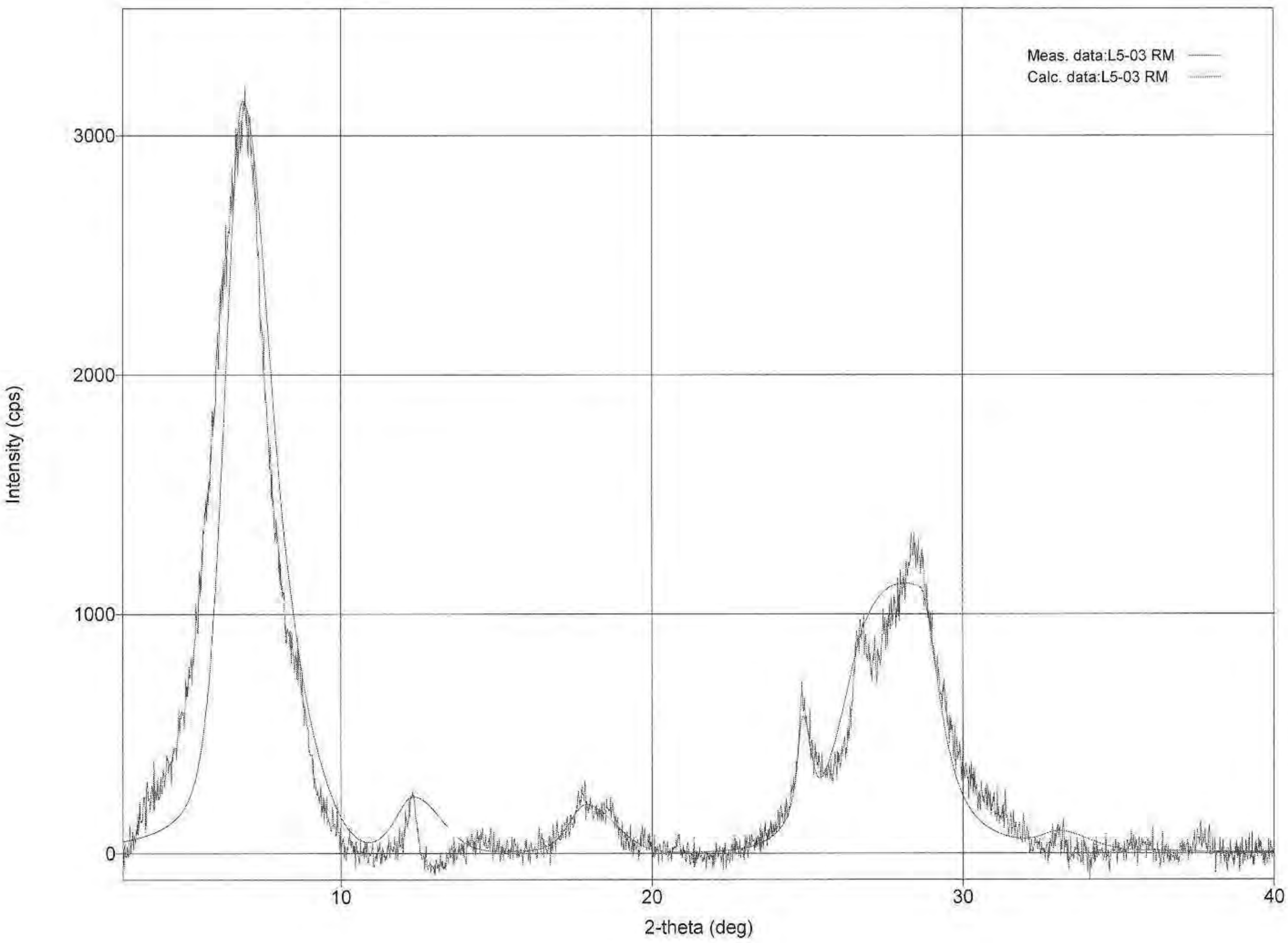
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.420(11)	13.76(2)	468(28)	2.65(3)	1325(19)	2.8(2)	31.3(3)
☐ 2	8.529891	10.357608	101.049682	0.403979	53.5275	0.529714	205.956
☐ 3	12.254(15)	7.217(9)	397(26)	0.369(19)	234(5)	0.59(5)	226(11)
☐ 4	17.746377	4.993781	107.477965	0.403979	56.9326	0.529714	207.874
☐ 5	18.550725	4.779027	112.585938	0.403979	59.6384	0.529714	208.107
☐ 6	20.749(19)	4.277(4)	145(16)	0.21(2)	39(3)	0.27(5)	409(49)
☐ 7	24.822(8)	3.5840(11)	449(27)	0.40(3)	296(10)	0.66(6)	210(14)
☐ 8	26.499(7)	3.3609(8)	736(35)	0.43(3)	581(15)	0.79(6)	198(12)
☐ 9	27.968297	3.187544	138.705547	0.403979	73.4743	0.529714	211.659
☐ 10	29.27(4)	3.049(4)	179(17)	0.18(3)	34(6)	0.19(5)	474(79)

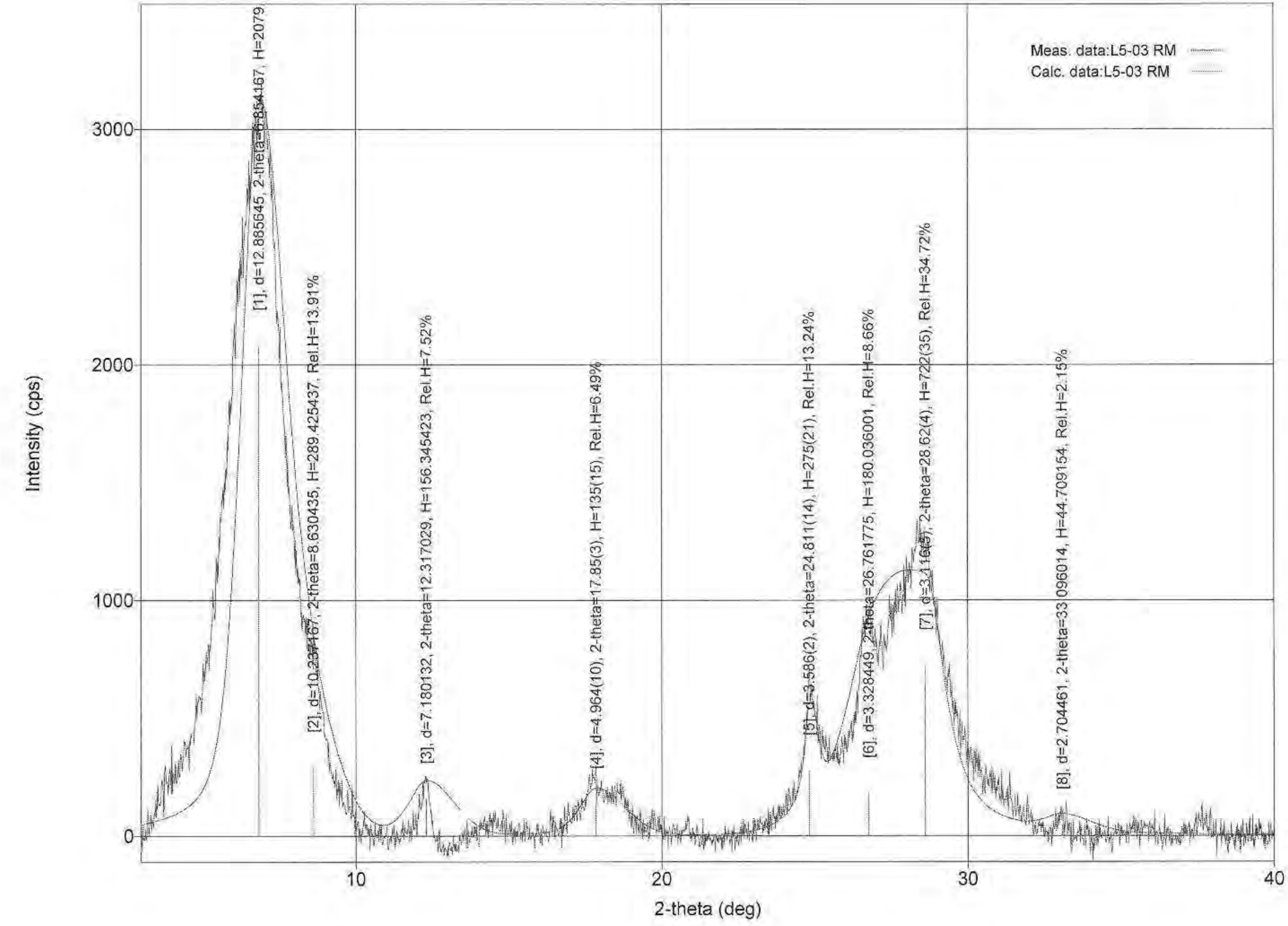

Meas. data:L5-03 B gly
Calc. data:L5-03 B gly
[1], d=17.88(5), 2-theta=4.939(13), H=251(20), Rel.H=20.48%
[2], d=10.45(8), 2-theta=8.46(6), H=83(12), Rel.H=6.75%
[3], d=7.388(10), 2-theta=11.969(17), H=372(25), Rel.H=30.38%
[4], d=4.813511, 2-theta=18.416667, H=50.331293, Rel.H=4.11%
[5], d=4.3452(13), 2-theta=20.422(6), H=173(17), Rel.H=14.15%
[6], d=3.6146(13), 2-theta=24.608(9), H=394(26), Rel.H=32.18%
[7], d=3.3926(5), 2-theta=26.247(4), H=1223(45),
[8], d=3.233128, 2-theta=27.566123, H=85.345524, Rel.H=6.98%
[9], d=3.069(5), 2-theta=29.07(4), H=159(16), Rel.H=13.02%
[10], d=2.868(6), 2-theta=31.16(7), H=110(14), Rel.H=8.98%
Intensity (cps)
0
500
1000
1500
2000
10
20
30
40
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	4.939(13)	17.88(5)	251(20)	1.35(4)	396(12)	1.58(18)	61.3(16)
☐ 2	8.46(6)	10.45(8)	83(12)	0.57(6)	54(7)	0.66(17)	146(15)
☐ 3	11.969(17)	7.388(10)	372(25)	0.35(2)	215(6)	0.58(5)	237(14)
☐ 4	18.416667	4.813511	50.331293	0.453093	42.0527	0.835517	185.513
☐ 5	20.422(6)	4.3452(13)	173(17)	0.108(15)	37(3)	0.22(4)	779(106)
☐ 6	24.608(9)	3.6146(13)	394(26)	0.45(3)	333(15)	0.85(9)	187(14)
☐ 7	26.247(4)	3.3926(5)	1223(45)	0.453(18)	1032(16)	0.84(4)	188(8)
☐ 8	27.566123	3.233128	85.345524	0.453093	71.3076	0.835517	188.552
☐ 9	29.07(4)	3.069(5)	159(16)	0.20(3)	35(6)	0.22(6)	420(68)
☐ 10	31.16(7)	2.868(6)	110(14)	0.42(10)	85(8)	0.77(17)	205(50)

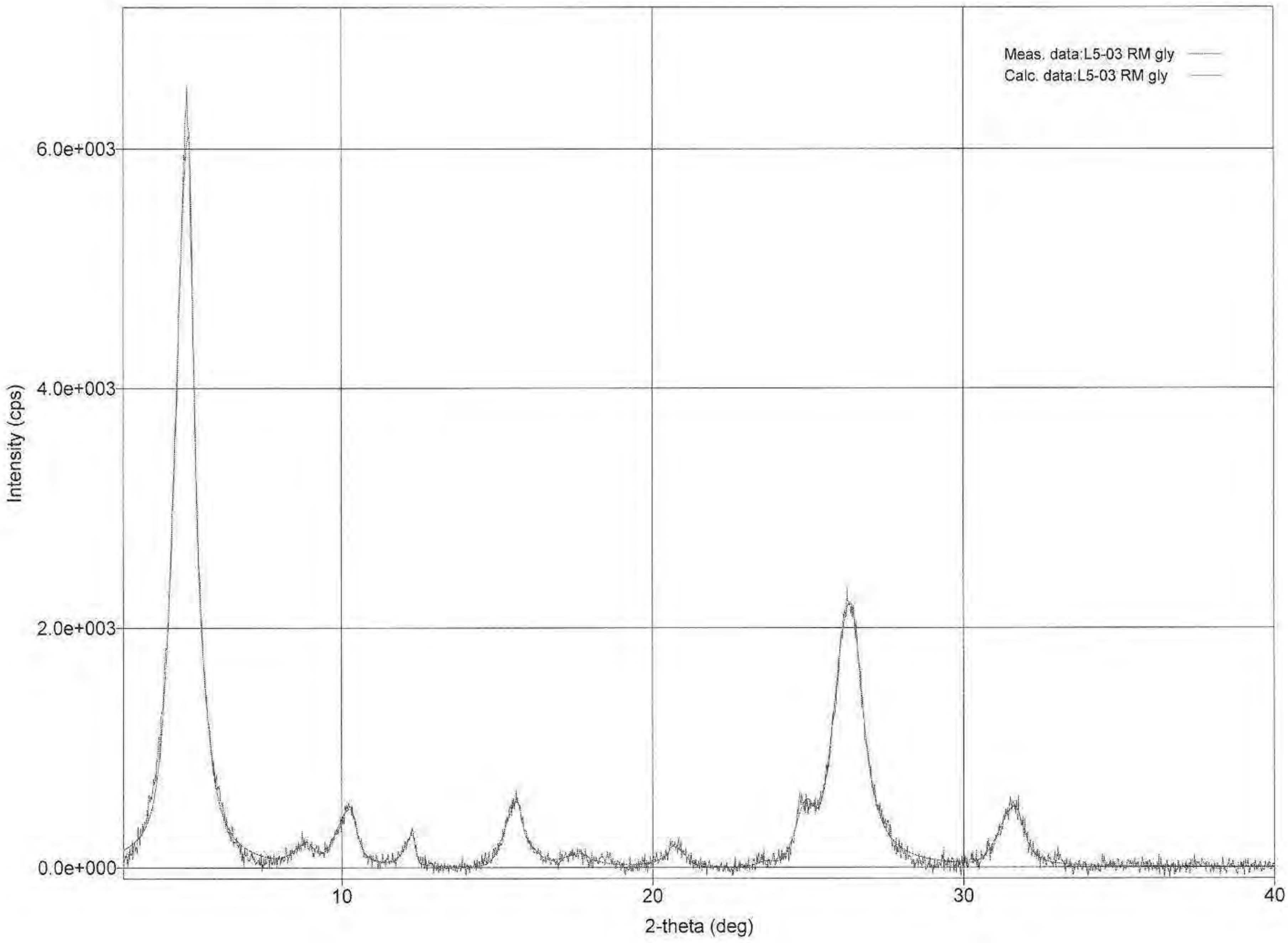

Meas. data:L5-03 B heat
Calc. data:L5-03 B heat
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)
[1], d=13.69(5), 2-theta=6.45(2), H=114(17), Rel.H=8.91%
[2], d=10.14(2), 2-theta=8.71(2), H=509(36), Rel.H=39.93%
[3], d=5.023(4), 2-theta=17.644(13), H=233(24), Rel.H=18.31%
[4], d=4.263(2), 2-theta=20.822(10), H=147(19), Rel.H=11.51%
[5], d=3.3515(8), 2-theta=26.574(6), H=1274(56), Rel
[6], d=3.233128, 2-theta=27.566123, H=130.971360, Rel.H=10.28%
[7], d=3.034544, 2-theta=29.409420, H=88.667872, Rel.H=6.96%

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.45(2)	13.69(5)	114(17)	0.53(6)	99(10)	0.9(2)	157(18)
☐ 2	8.71(2)	10.14(2)	509(36)	1.02(3)	860(16)	1.69(15)	81(2)
☐ 3	17.644(13)	5.023(4)	233(24)	0.95(4)	296(10)	1.27(18)	88(4)
☐ 4	20.822(10)	4.263(2)	147(19)	0.18(3)	33(5)	0.23(6)	462(80)
☐ 5	26.574(6)	3.3515(8)	1274(56)	0.74(3)	1881(24)	1.48(8)	115(4)
☐ 6	27.566123	3.233128	130.971360	0.743213	143.174	1.093173	114.949
☐ 7	29.409420	3.034544	88.667872	0.743213	96.9293	1.093173	115.419

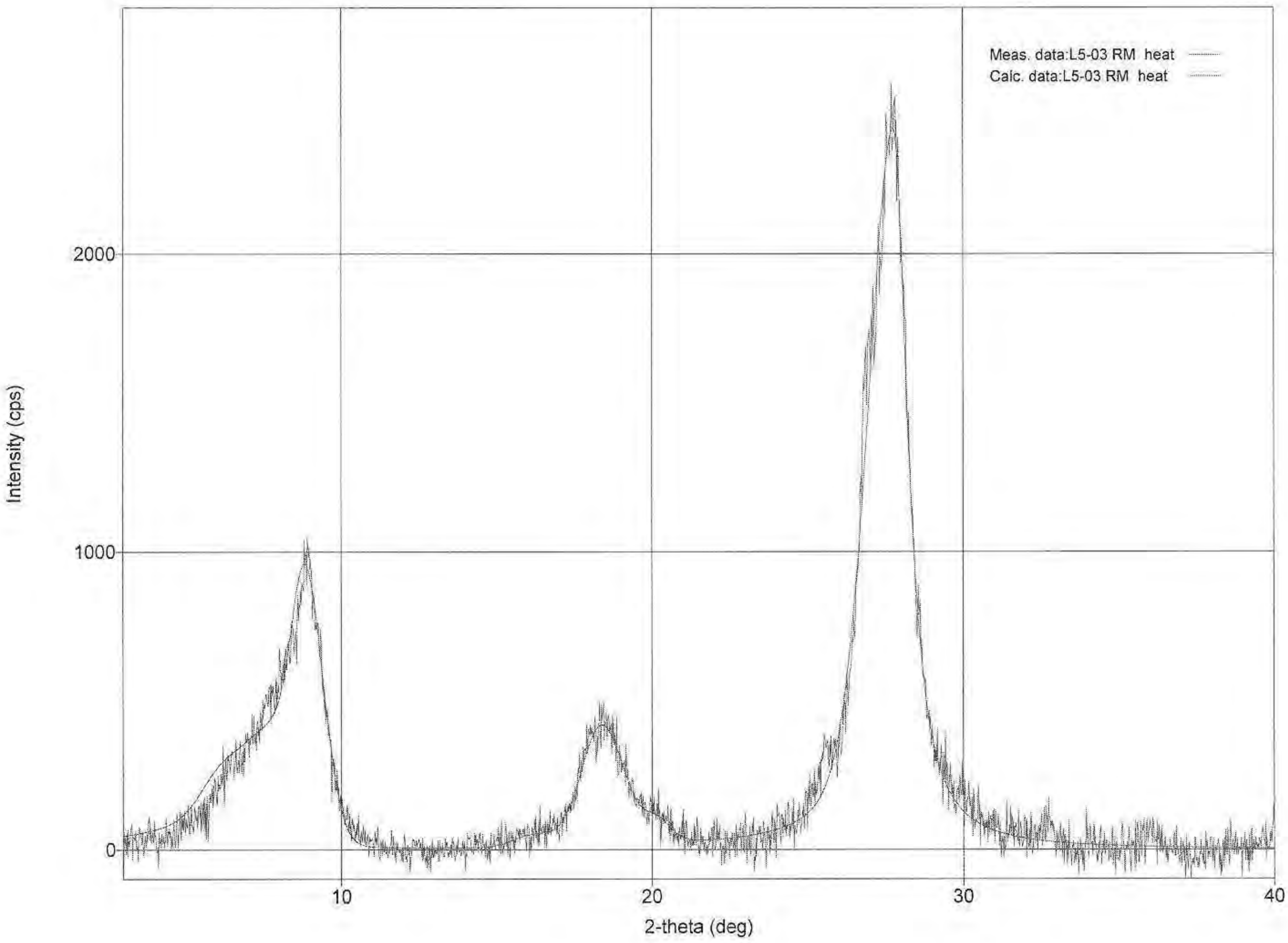
Meas. data:L5-03 RM
Calc. data:L5-03 RM
Intensity (cps)
3000
2000
1000
0
10
20
30
40
2-theta (deg)

Meas. data:L5-03 RM
Calc. data:L5-03 RM
[1], d=12.885645, 2-theta=6.854167, H=2079
[2], d=10.237167, 2-theta=8.630435, H=289.425437, Rel.H=13.91%
[3], d=7.180132, 2-theta=12.317029, H=156.345423, Rel.H=7.52%
[4], d=4.964(10), 2-theta=17.85(3), H=135(15), Rel.H=6.49%
[5], d=3.586(2), 2-theta=24.811(14), H=275(21), Rel.H=13.24%
[6], d=3.328449, 2-theta=26.761775, H=180.036001, Rel.H=8.66%
[7], d=3.116(5), 2-theta=28.62(4), H=722(35), Rel.H=34.72%
[8], d=2.704461, 2-theta=33.096014, H=44.709154, Rel.H=2.15%
Intensity (cps)
0
1000
2000
3000
2-theta (deg)
10
20
30
40

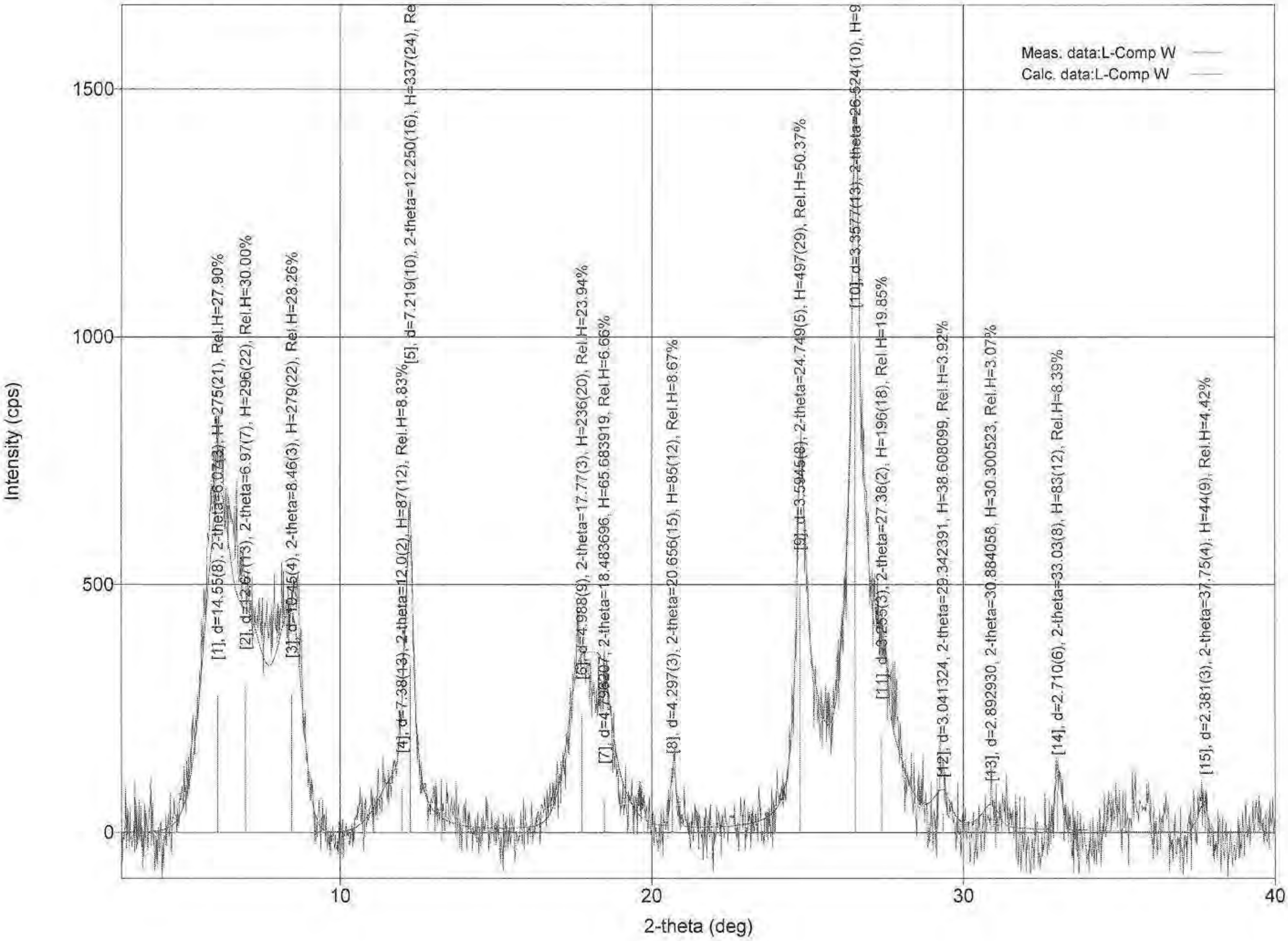
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	6.854167	12.885645	2079.957255	1.73805	4187.62	2.013320	47.8238
▨ 2	8.630435	10.237167	289.425437	1.73805	582.706	2.013320	47.874
▨ 3	12.317029	7.180132	156.345423	1.73805	314.773	2.013320	48.0153
▨ 4	17.85(3)	4.964(10)	135(15)	1.74(10)	270(18)	2.0(4)	48(3)
▨ 5	24.811(14)	3.586(2)	275(21)	0.48(4)	168(14)	0.61(10)	178(16)
▨ 6	26.761775	3.328449	180.036001	1.73805	362.47	2.013320	49.0704
▨ 7	28.62(4)	3.116(5)	722(35)	2.98(4)	2545(33)	3.5(2)	28.7(4)
▨ 8	33.096014	2.704461	44.709154	1.73805	90.0138	2.013320	49.8009


Meas. data:L5-03 RM gly
Calc. data:L5-03 RM gly
6.0e+003
4.0e+003
2.0e+003
0.0e+000
Intensity (cps)
10
20
30
40
2-theta (deg)

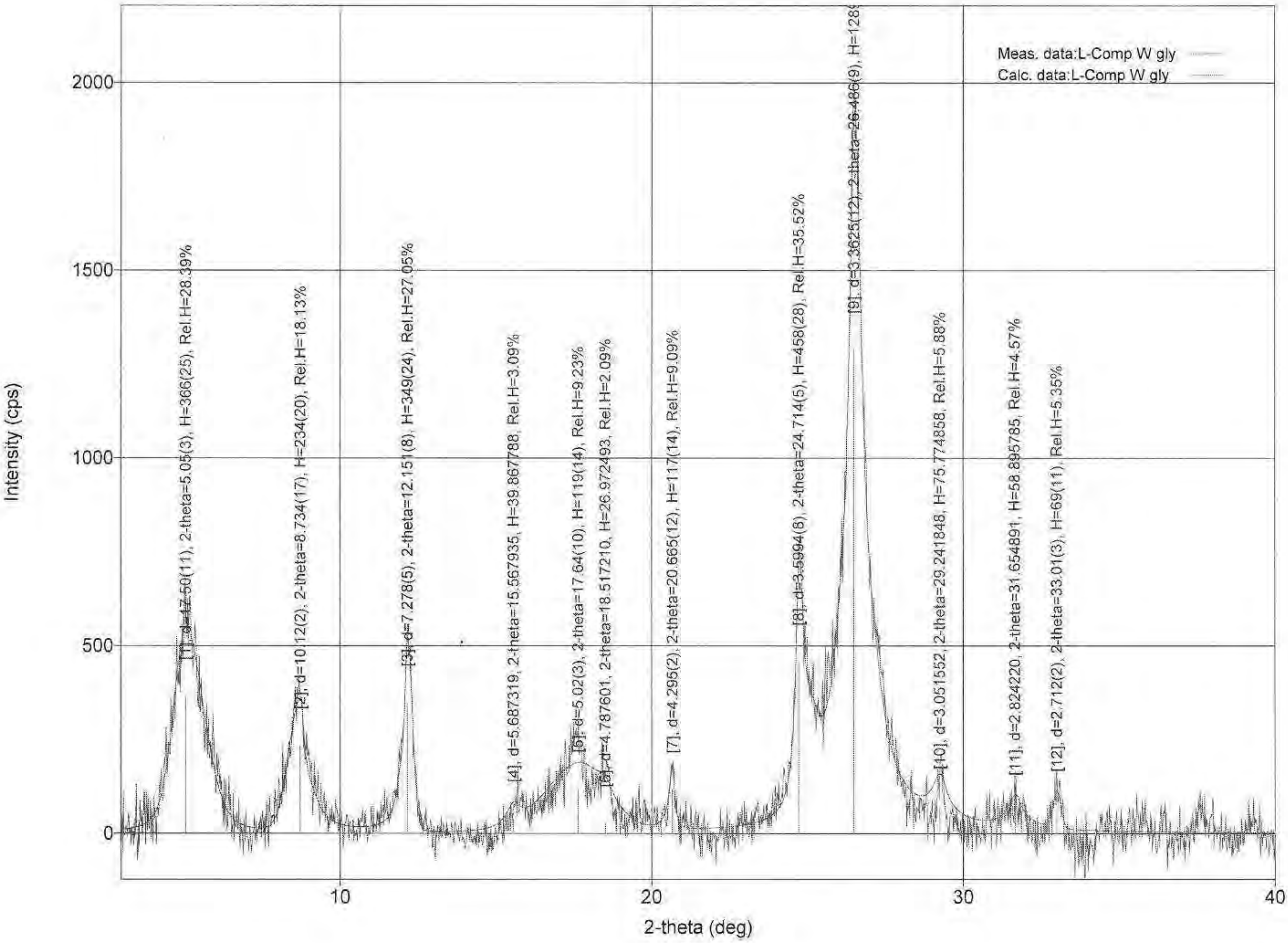
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	5.083(7)	17.37(3)	4079(82)	0.753(9)	4468(29)	1.10(3)	110.3(14)
☐ 2	8.92(3)	9.90(3)	112(14)	0.73(6)	99(7)	0.88(17)	114(10)
☐ 3	10.27(3)	8.61(2)	308(23)	0.77(3)	284(7)	0.92(9)	108(4)
☐ 4	12.26(3)	7.216(16)	169(17)	0.41(3)	89(6)	0.52(9)	205(15)
☐ 5	15.64(2)	5.663(8)	360(24)	0.70(3)	347(10)	0.97(9)	119(5)
☐ 6	17.74(5)	4.995(13)	66(11)	0.95(12)	86(9)	1.3(3)	89(11)
☐ 7	20.63(2)	4.301(4)	117(14)	0.64(6)	105(8)	0.90(18)	132(13)
☐ 8	23.73(10)	3.746(15)	34(8)	0.8(2)	34(8)	1.0(5)	108(32)
☐ 9	24.932(13)	3.5684(18)	350(24)	0.77(4)	340(17)	0.97(11)	111(5)
☐ 10	26.342(12)	3.3806(16)	1463(49)	1.070(13)	1982(17)	1.35(6)	79.6(9)
☐ 11	31.63(3)	2.827(3)	328(23)	0.94(3)	370(13)	1.13(12)	92(3)


Meas. data:L5-03 RM heat
Calc. data:L5-03 RM heat
Intensity (cps)
2000
1000
0
10
20
30
40
2-theta (deg)

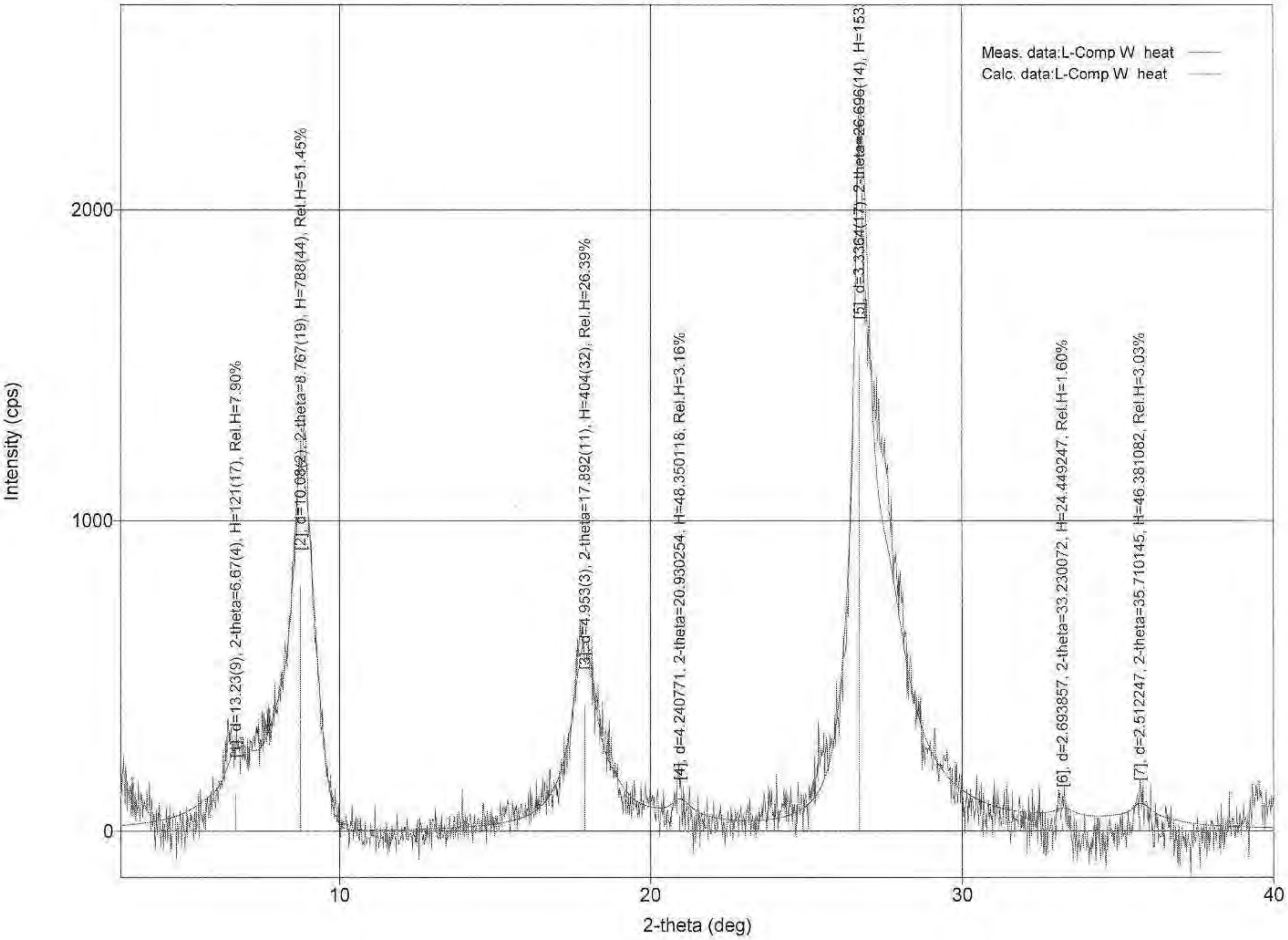
No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	6.083333	14.516577	64.265208	1.5616	111.094	1.728681	53.2074
▨ 2	8.81(2)	10.02(2)	639(40)	1.56(3)	1669(19)	2.61(19)	53.3(10)
▨ 3	16.2(3)	5.46(10)	29(9)	1.7(8)	55(34)	1.9(17)	50(23)
▨ 4	18.38(7)	4.824(17)	271(26)	1.66(9)	498(46)	1.8(3)	51(3)
▨ 5	20.15(10)	4.40(2)	44(11)	1.0(3)	49(23)	1.1(8)	85(27)
▨ 6	27.740(17)	3.2133(19)	1620(64)	1.535(16)	3405(22)	2.10(10)	55.7(6)


Meas. data:L-Comp W
Calc. data:L-Comp W
Intensity (cps)
0
500
1000
1500
2-theta (deg)
10
20
30
40
[1], d=14.55(8), 2-theta=6.07(3), H=275(21), Rel.H=27.90%
[2], d=12.67(13), 2-theta=6.97(7), H=296(22), Rel.H=30.00%
[3], d=10.45(4), 2-theta=8.46(3), H=279(22), Rel.H=28.26%
[4], d=7.38(13), 2-theta=12.0(2), H=87(12), Rel.H=8.83%
[5], d=7.219(10), 2-theta=12.250(16), H=337(24), Re
[6], d=4.988(9), 2-theta=17.77(3), H=236(20), Rel.H=23.94%
[7], d=4.796207, 2-theta=18.483696, H=65.683919, Rel.H=6.66%
[8], d=4.297(3), 2-theta=20.656(15), H=85(12), Rel.H=8.67%
[9], d=3.5945(8), 2-theta=24.749(5), H=497(29), Rel.H=50.37%
[10], d=3.3577(13), 2-theta=26.524(10), H=9
[11], d=3.255(3), 2-theta=27.38(2), H=196(18), Rel.H=19.85%
[12], d=3.041324, 2-theta=29.342391, H=38.608099, Rel.H=3.92%
[13], d=2.892930, 2-theta=30.884058, H=30.300523, Rel.H=3.07%
[14], d=2.710(6), 2-theta=33.03(8), H=83(12), Rel.H=8.39%
[15], d=2.381(3), 2-theta=37.75(4), H=44(9), Rel.H=4.42%

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.07(3)	14.55(8)	275(21)	0.88(8)	258(62)	0.9(3)	94(8)
☐ 2	6.97(7)	12.67(13)	296(22)	1.8(3)	565(101)	1.9(5)	46(8)
☐ 3	8.46(3)	10.45(4)	279(22)	0.93(12)	277(66)	1.0(3)	89(12)
☐ 4	12.0(2)	7.38(13)	87(12)	1.22(12)	139(11)	1.6(3)	68(7)
☐ 5	12.250(16)	7.219(10)	337(24)	0.313(18)	138(11)	0.41(6)	266(15)
☐ 6	17.77(3)	4.988(9)	236(20)	1.44(4)	397(11)	1.68(19)	58.2(15)
☐ 7	18.483696	4.796207	65.683919	0.579564	41.8256	0.636771	145.045
☐ 8	20.656(15)	4.297(3)	85(12)	0.21(4)	21(3)	0.25(7)	398(72)
☐ 9	24.749(5)	3.5945(8)	497(29)	0.43(3)	383(9)	0.77(6)	199(13)
☐ 10	26.524(10)	3.3577(13)	986(41)	0.35(2)	700(29)	0.71(6)	241(13)
☐ 11	27.38(2)	3.255(3)	196(18)	0.58(7)	227(33)	1.2(3)	147(18)
☐ 12	29.342391	3.041324	38.608099	0.579564	24.5845	0.636771	147.987
☐ 13	30.884058	2.892930	30.300523	0.579564	19.2945	0.636771	148.524
☐ 14	33.03(8)	2.710(6)	83(12)	0.25(6)	22(7)	0.27(12)	344(83)
☐ 15	37.75(4)	2.381(3)	44(9)	0.31(13)	15(7)	0.3(2)	281(116)


Meas. data:L-Comp W gly
Calc. data:L-Comp W gly
Intensity (cps)
2000
1500
1000
500
0
10
20
30
40
2-theta (deg)
[1], d=17.50(11), 2-theta=5.05(3), H=366(25), Rel.H=28.39%
[2], d=10.12(2), 2-theta=8.734(17), H=234(20), Rel.H=18.13%
[3], d=7.278(5), 2-theta=12.151(8), H=349(24), Rel.H=27.05%
[4], d=5.687319, 2-theta=15.567935, H=39.867788, Rel.H=3.09%
[5], d=5.02(3), 2-theta=17.64(10), H=119(14), Rel.H=9.23%
[6], d=4.787601, 2-theta=18.517210, H=26.972493, Rel.H=2.09%
[7], d=4.295(2), 2-theta=20.665(12), H=117(14), Rel.H=9.09%
[8], d=3.5994(8), 2-theta=24.714(5), H=458(28), Rel.H=35.52%
[9], d=3.3625(12), 2-theta=26.486(9), H=128
[10], d=3.051552, 2-theta=29.241848, H=75.774858, Rel.H=5.88%
[11], d=2.824220, 2-theta=31.654891, H=58.895785, Rel.H=4.57%
[12], d=2.712(2), 2-theta=33.01(3), H=69(11), Rel.H=5.35%

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
▨ 1	5.05(3)	17.50(11)	366(25)	1.15(3)	516(14)	1.41(13)	72(2)
▨ 2	8.734(17)	10.12(2)	234(20)	0.65(3)	211(9)	0.90(11)	127(5)
▨ 3	12.151(8)	7.278(5)	349(24)	0.311(11)	159(5)	0.46(5)	269(10)
▨ 4	15.567935	5.687319	39.867788	0.587498	39.6438	0.994382	142.542
▨ 5	17.64(10)	5.02(3)	119(14)	2.20(8)	284(15)	2.4(4)	38.2(15)
▨ 6	18.517210	4.787601	26.972493	0.587498	26.821	0.994382	143.093
▨ 7	20.665(12)	4.295(2)	117(14)	0.20(7)	39(4)	0.33(8)	423(149)
▨ 8	24.714(5)	3.5994(8)	458(28)	0.35(3)	316(8)	0.69(6)	244(17)
▨ 9	26.486(9)	3.3625(12)	1289(46)	0.587(17)	1419(13)	1.10(5)	145(4)
▨ 10	29.241848	3.051552	75.774858	0.587498	75.3492	0.994382	145.955
▨ 11	31.654891	2.824220	58.895785	0.587498	58.5649	0.994382	146.794
▨ 12	33.01(3)	2.712(2)	69(11)	0.29(10)	23(8)	0.33(16)	303(101)


Meas. data:L-Comp W heat
Calc. data:L-Comp W heat
[1], d=13.23(9), 2-theta=6.67(4), H=121(17), Rel.H=7.90%
[2], d=10.08(2), 2-theta=8.767(19), H=788(44), Rel.H=51.45%
[3], d=4.953(3), 2-theta=17.892(11), H=404(32), Rel.H=26.39%
[4], d=4.240771, 2-theta=20.930254, H=48.350118, Rel.H=3.16%
[5], d=3.3364(17), 2-theta=26.696(14), H=153
[6], d=2.693857, 2-theta=33.230072, H=24.449247, Rel.H=1.60%
[7], d=2.512247, 2-theta=35.710145, H=46.381082, Rel.H=3.03%
Intensity (cps)
0
1000
2000
10
20
30
40
2-theta (deg)

No.	2-theta	d	Height	FWHM	Int. I	Int. W	Size
	(deg)	(ang.)	(cps)	(deg)	(cps deg)	(deg)	(ang.)
☐ 1	6.67(4)	13.23(9)	121(17)	1.16(17)	210(31)	1.7(5)	71(10)
☐ 2	8.767(19)	10.08(2)	788(44)	0.93(3)	1092(34)	1.39(12)	89(3)
☐ 3	17.892(11)	4.953(3)	404(32)	1.03(5)	719(13)	1.78(17)	82(4)
☐ 4	20.930254	4.240771	48.350118	1.02773	95.3086	1.971217	82.0987
☐ 5	26.696(14)	3.3364(17)	1532(62)	0.81(2)	2494(24)	1.63(8)	105(3)
☐ 6	33.230072	2.693857	24.449247	1.02773	48.1948	1.971217	84.2507
☐ 7	35.710145	2.512247	46.381082	1.02773	91.4272	1.971217	84.8183

Appendix F

Supplemental Geotechnical Laboratory Report

Laboratory Report for
Navarro Research and Engineering, Inc.

Mexican Hat, Geotechnical Materials Testing

Contract # DE-LM0000421, PO# LMCP7413

May 13, 2020

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

May 13, 2020

Morgan Williams
Navarro Research and Engineering, Inc.
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503
(970) 248-6242

Re: DBS&A Laboratory Report for Navarro Research and Engineering, Inc. PO# LMCP7413

Dear Mr. Williams:

Enclosed is the report for the Navarro Research and Engineering, Inc., PO# LMCP7413 samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Navarro Research and Engineering, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Crumb Test	Pinhole Dispersion
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DH	WS	H	F	C				
L5-01 <200															X	X	X				X	X	
L5-03 <200															X	X	X				X	X	
L4-01 <200															X	X	X				X	X	
L4-03 <200															X	X	X				X	X	
L5-01 <10																						X	X
L5-03 <10																						X	X
L4-01 <10																						X	X

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DH = Double Hydrometer, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Seven samples, each as approximately 400 grams of loose material in a resealable plastic bag, were received on April 24, 2020. The samples were delivered in a cardboard box and were received in good order.

Sample Preparation and Testing Notes:
All seven samples were subjected to dispersive characteristics testing by the crumb test.

Four of the samples were subjected to Atterberg limits testing, particle size analysis, and secondary hydrometer analysis to determine dispersion characteristics using the double hydrometer analysis. In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion by double hydrometer is reported as 100. Particle diameter calculations in the hydrometer portion of the analysis are based on the use of an assumed specific gravity value of 2.65. The percent passing results are reported to 0.1%, rather than 1% as specified in the test method.

The remaining three samples were subjected to pinhole dispersion testing. Sub-samples were prepared for testing by remolding a portion of the sample to a target dry bulk density of 1.72 g/cm^3 at a 11.5% gravimetric moisture content. The samples were placed in an airtight bag and allowed to equilibrate for 24 hours prior to testing.

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
L5-01 <200	1.7E-05	0.038	0.044	2588	535	WS/H	Lean clay (CL)	Silt Loam	(Est)
L5-03 <200	8.3E-05	0.039	0.046	554	95	WS/H	Fat clay (CH)	Loam	(Est)
L4-01 <200	0.00029	0.043	0.048	166	52	WS/H	Lean clay (CL)	Loam	(Est)
L4-03 <200	1.8E-05	0.045	0.050	2778	810	WS/H	Fat clay (CH)	Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-01 <200	0.0	0.0	82.8	17.1
L5-03 <200	0.0	0.3	80.8	18.9
L4-01 <200	0.0	0.2	85.7	14.1
L4-03 <200	0.0	0.2	83.2	16.6

---

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Summary of Percent Dispersion by Double Hydrometer

Sample Number	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L5-01 <200	18.0	17.1	100	Yes	Dispersive
L5-03 <200	18.2	18.8	100	Yes	Dispersive
L4-01 <200	14.3	14.1	100	Yes	Dispersive
L4-03 <200	16.3	16.5	100	Yes	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer than 2-µm when dispersant is used.

* In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L5-01 <200	49	21	28	CL
L5-03 <200	65	28	37	CH
L4-01 <200	48	24	24	CL
L4-03 <200	65	22	43	CH

--- = Soil requires visual-manual classification due to non-plasticity

Summary of Crumb Dispersion Tests

Sample Number	Grade of Reaction	Reaction	Classification
L5-01 <200	IV	Strong Reaction	Highly Dispersive
L5-03 <200	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L4-01 <200	IV	Strong Reaction	Highly Dispersive
L4-03 <200	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L5-01 <10	III	Moderate Reaction	Dispersive
L5-03 <10	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L4-01 <10	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive

Summary of Pinhole Dispersion Testing

Sample Number	Percent Finer Than 5-μm[1]	Plasticity Index[1]	Dispersion Classification
L5-01 <10	NA	NA	D2 - Dispersive
L5-03 <10	NA	NA	D1 - Dispersive
L4-01 <10	NA	NA	D1 - Dispersive

---

[1] This test method is applicable to soils that have a plasticity index greater than or equal to 4, and more than 12% of the soil fraction is finer than 5-μm.

"NA" Not Analyzed

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
L5-01 <200	1.7E-05	0.038	0.044	2588	535	WS/H	Lean clay (CL)	Silt Loam	(Est)
L5-03 <200	8.3E-05	0.039	0.046	554	95	WS/H	Fat clay (CH)	Loam	(Est)
L4-01 <200	0.00029	0.043	0.048	166	52	WS/H	Lean clay (CL)	Loam	(Est)
L4-03 <200	1.8E-05	0.045	0.050	2778	810	WS/H	Fat clay (CH)	Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

[†] Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L5-01 <200	0.0	0.0	82.8	17.1
L5-03 <200	0.0	0.3	80.8	18.9
L4-01 <200	0.0	0.2	85.7	14.1
L4-03 <200	0.0	0.2	83.2	16.6

---

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20

Initial Dry Weight of Sample (g): 393.36
Weight Passing #10 (g): 393.36
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 59.59
Calculated Weight of Sieve Sample (g): 59.59

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	393.36	100.00
	2"	50	0.00	0.00	393.36	100.00
	1.5"	38.1	0.00	0.00	393.36	100.00
	1"	25	0.00	0.00	393.36	100.00
	3/4"	19.0	0.00	0.00	393.36	100.00
	3/8"	9.5	0.00	0.00	393.36	100.00
	4	4.75	0.00	0.00	393.36	100.00
	10	2.00	0.00	0.00	393.36	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	0.00	59.59	100.00
	40	0.425	0.00	0.00	59.59	100.00
	60	0.250	0.00	0.00	59.59	100.00
	100	0.150	0.00	0.00	59.59	100.00
	140	0.106	0.01	0.01	59.58	99.98
	200	0.075	0.01	0.02	59.57	99.97
	dry pan		5.08	5.10	54.49	
	wet pan			54.49	0.00	

d_{10} (mm): 1.7E-05
d_{16} (mm): 0.00094
d_{30} (mm): 0.020

d_{50} (mm): 0.038
d_{60} (mm): 0.044
d_{84} (mm): 0.061

Median Particle Diameter --d_{50} (mm): 0.038
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 2588
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 535
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.033

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)
USDA Soil Classification: Silt Loam

Laboratory analysis by: A. Bland
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

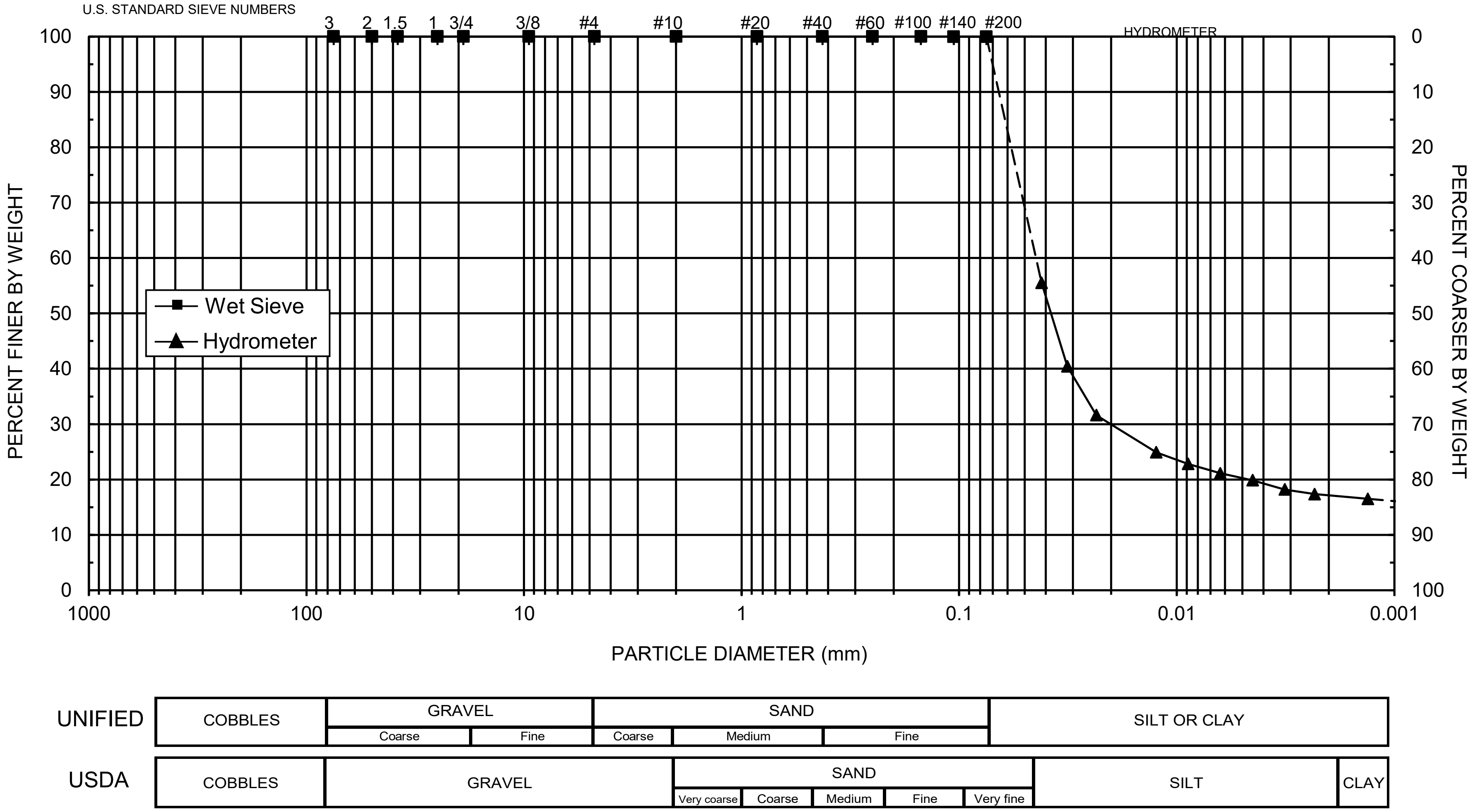
Initial Wt. (g)*:* 59.59
Total Sample Wt. (g)*:* 393.36
Wt. Passing #10 (g)*:* 393.36

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
4-May-20	1	21.9	39.00	5.91	33.1	9	0.0418	56	55.5
	2	21.9	30.00	5.91	24.1	11	0.0318	40	40.4
	4	21.9	24.75	5.91	18.8	12	0.0234	32	31.6
	15	21.9	20.75	5.91	14.8	12	0.0124	25	24.9
	30	21.9	19.50	5.91	13.6	13	0.0088	23	22.8
	60	21.9	18.50	5.91	12.6	13	0.0063	21	21.1
	120	21.9	17.75	5.91	11.8	13	0.0045	20	19.9
	240	21.9	16.75	5.91	10.8	13	0.0032	18	18.2
	454	21.9	16.25	5.91	10.3	13	0.0023	17	17.3
5-May-20	1413	21.9	15.75	5.91	9.8	13	0.0013	17	16.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **1.7E-05**	d_{30} = **0.020**	d_{50} = **0.038**	d_{60} = **0.044**	C_u = **2588**	C_c = **535**

SAMPLE NUMBER	DATE/TIME SAMPLED	ASTM CLASSIFICATION	USDA CLASSIFICATION
L5-01 <200	**NA**	**Lean clay (CL)**	**Silt Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20

Initial Dry Weight of Sample (g): 379.64
Weight Passing #10 (g): 379.64
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 60.82
Calculated Weight of Sieve Sample (g): 60.82

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	379.64	100.00
	2"	50	0.00	0.00	379.64	100.00
	1.5"	38.1	0.00	0.00	379.64	100.00
	1"	25	0.00	0.00	379.64	100.00
	3/4"	19.0	0.00	0.00	379.64	100.00
	3/8"	9.5	0.00	0.00	379.64	100.00
	4	4.75	0.00	0.00	379.64	100.00
	10	2.00	0.00	0.00	379.64	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	0.00	60.82	100.00
	40	0.425	0.00	0.00	60.82	100.00
	60	0.250	0.00	0.00	60.82	100.00
	100	0.150	0.01	0.01	60.81	99.98
	140	0.106	0.05	0.06	60.76	99.90
	200	0.075	0.11	0.17	60.65	99.72
	dry pan		4.84	5.01	55.81	
	wet pan			55.81	0.00	

d_{10} (mm): 8.3E-05
d_{16} (mm): 0.00070
d_{30} (mm): 0.019
d_{50} (mm): 0.039
d_{60} (mm): 0.046
d_{84} (mm): 0.062

Median Particle Diameter --d_{50} (mm): 0.039
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 554
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 95
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.034

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)
USDA Soil Classification: Loam

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

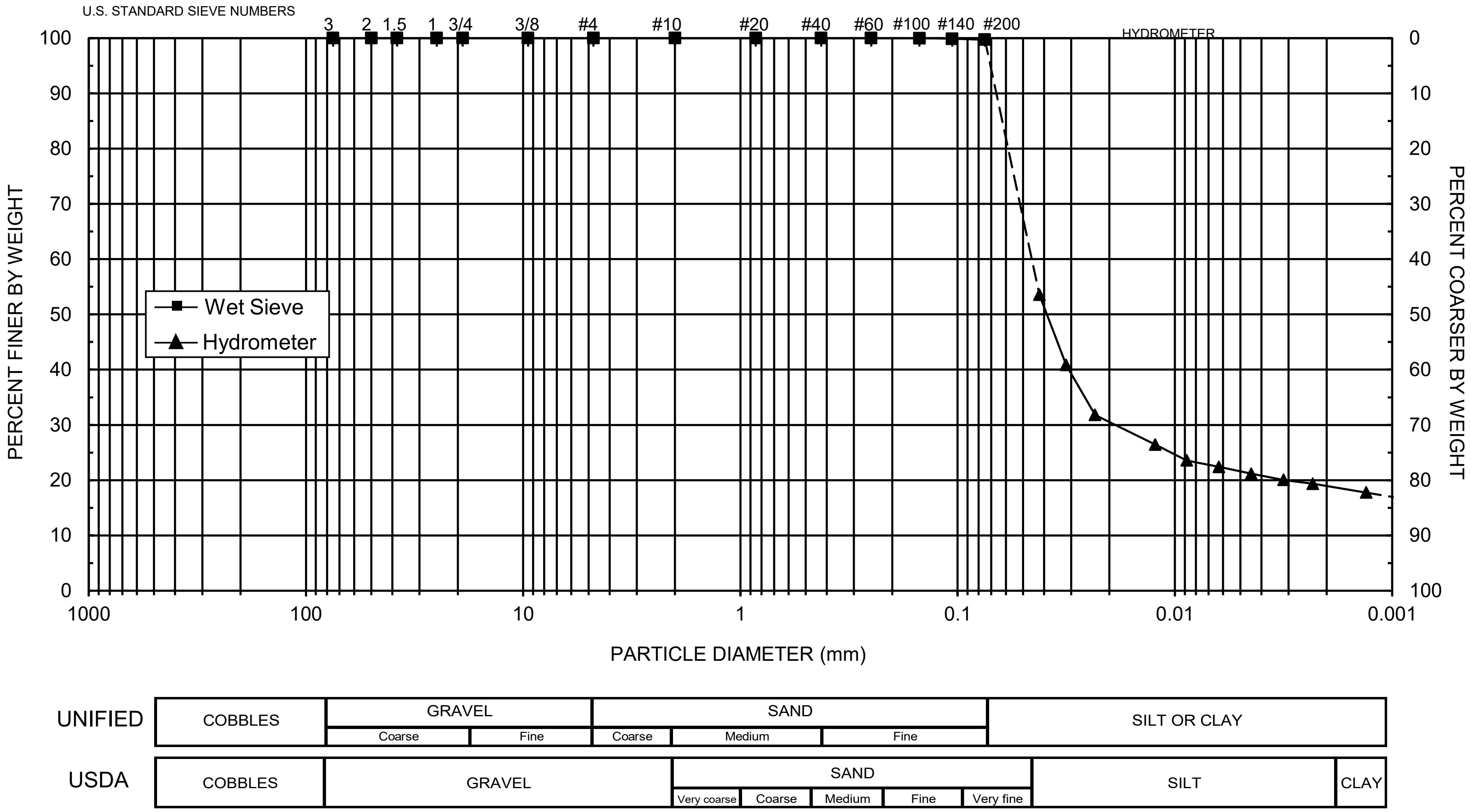
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB20.1144.00	*Reaction with* H_2O_2:	NA
Sample Number:	L5-03 <200	*Dispersant*:*	$(NaPO_3)_6$
PO Number:	LMCP7413	*Assumed particle density:*	2.65
Date/Time sampled:	NA	*Initial Wt.* (g):	60.82
Test Date:	4-May-20	*Total Sample Wt.* (g):	379.64
Start Time:	9:18	*Wt. Passing #10* (g):	379.64

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
4-May-20	1	21.9	38.50	5.91	32.6	10	0.0420	54	53.6
	2	21.9	30.75	5.91	24.8	11	0.0317	41	40.8
	4	21.9	25.25	5.91	19.3	12	0.0233	32	31.8
	15	21.9	22.00	5.91	16.1	12	0.0123	26	26.4
	30	21.9	20.25	5.91	14.3	13	0.0088	24	23.6
	60	22.0	19.50	5.88	13.6	13	0.0063	22	22.4
	120	22.0	18.75	5.88	12.9	13	0.0044	21	21.2
	240	22.2	18.00	5.80	12.2	13	0.0032	20	20.0
	449	22.4	17.50	5.73	11.8	13	0.0023	19	19.3
5-May-20	1408	21.8	16.75	5.95	10.8	13	0.0013	18	17.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **8.3E-05**	d_{30} = **0.019**	d_{50} = **0.039**	d_{60} = **0.046**	C_u = **554**	C_c = **95**

SAMPLE NUMBER	DATE/TIME SAMPLED	ASTM CLASSIFICATION	USDA CLASSIFICATION
L5-03 <200	**NA**	**Fat clay (CH)**	**Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20

Initial Dry Weight of Sample (g): 394.29
Weight Passing #10 (g): 394.29
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 60.72
Calculated Weight of Sieve Sample (g): 60.72

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	394.29	100.00
	2"	50	0.00	0.00	394.29	100.00
	1.5"	38.1	0.00	0.00	394.29	100.00
	1"	25	0.00	0.00	394.29	100.00
	3/4"	19.0	0.00	0.00	394.29	100.00
	3/8"	9.5	0.00	0.00	394.29	100.00
	4	4.75	0.00	0.00	394.29	100.00
	10	2.00	0.00	0.00	394.29	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	0.00	60.72	100.00
	40	0.425	0.00	0.00	60.72	100.00
	60	0.250	0.00	0.00	60.72	100.00
	100	0.150	0.00	0.00	60.72	100.00
	140	0.106	0.03	0.03	60.69	99.95
	200	0.075	0.08	0.11	60.61	99.82
	dry pan		5.57	5.68	55.04	
	wet pan			55.04	0.00	

d_{10} (mm): 0.00029
d_{16} (mm): 0.0047
d_{30} (mm): 0.027
d_{50} (mm): 0.043
d_{60} (mm): 0.048
d_{84} (mm): 0.063

Median Particle Diameter --d_{50} (mm)*:* 0.043
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm)*:* 166
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm)*:* 52
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm)*:* 0.037

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)
USDA Soil Classification: Loam

Laboratory analysis by: A. Bland
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

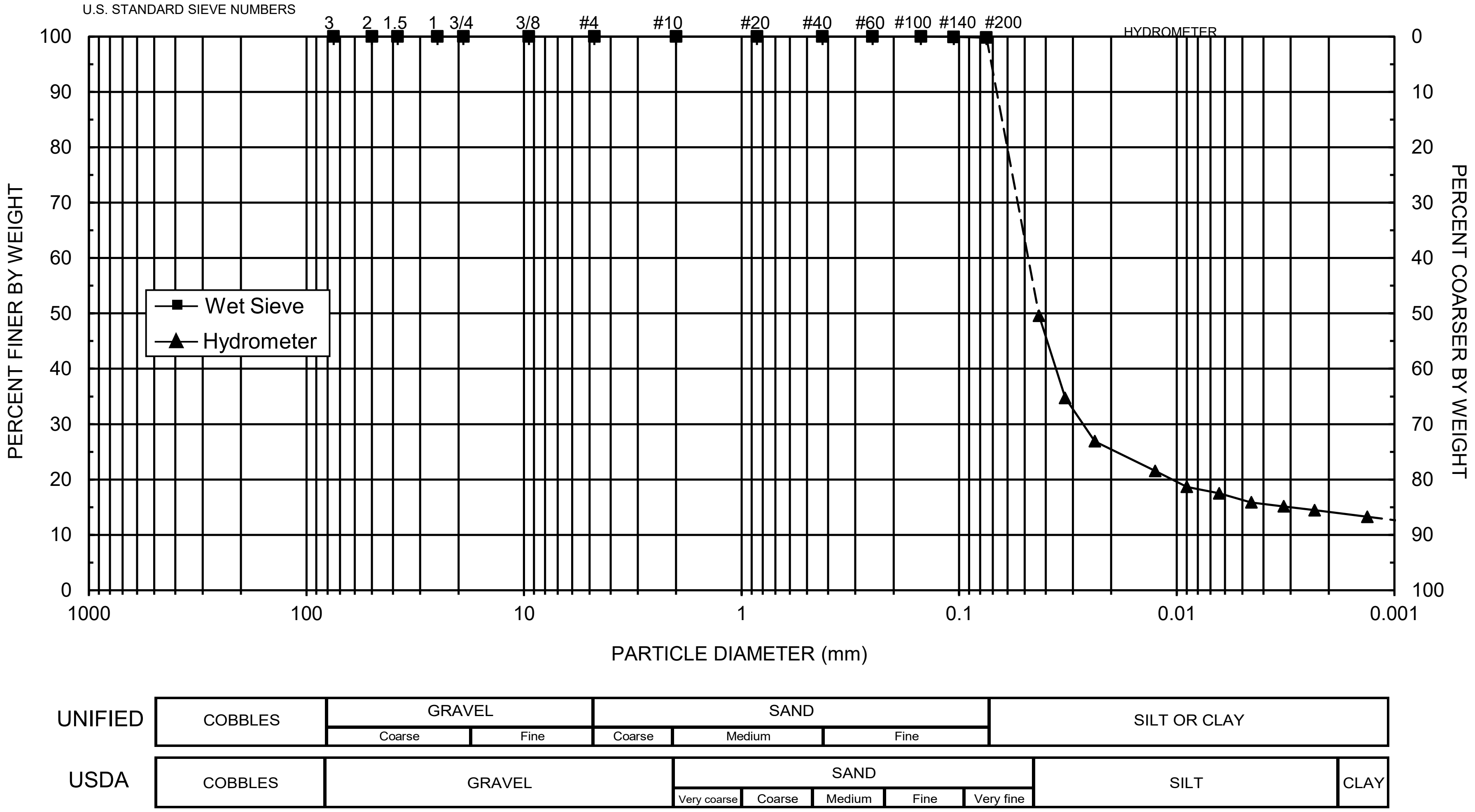
Initial Wt. (g)*:* 60.72
Total Sample Wt. (g)*:* 394.29
Wt. Passing #10 (g)*:* 394.29

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
4-May-20	1	21.9	36.00	5.91	30.1	10	0.0429	50	49.5
	2	21.9	27.00	5.91	21.1	11	0.0325	35	34.7
	4	21.9	22.25	5.91	16.3	12	0.0238	27	26.9
	15	21.9	19.00	5.91	13.1	13	0.0126	22	21.6
	30	21.9	17.25	5.91	11.3	13	0.0090	19	18.7
	60	22.0	16.50	5.88	10.6	13	0.0064	17	17.5
	120	22.0	15.50	5.88	9.6	13	0.0045	16	15.8
	240	22.2	15.00	5.80	9.2	13	0.0032	15	15.1
	464	22.4	14.50	5.73	8.8	13	0.0023	14	14.4
5-May-20	1423	21.8	14.00	5.95	8.1	14	0.0013	13	13.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **0.00029**	d_{30} = **0.027**	d_{50} = **0.043**	d_{60} = **0.048**	C_u = **166**	C_c = **52**

SAMPLE NUMBER	DATE/TIME SAMPLED	ASTM CLASSIFICATION	USDA CLASSIFICATION
L4-01 <200	**NA**	**Lean clay (CL)**	**Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 4-May-20

Initial Dry Weight of Sample (g): 394.50
Weight Passing #10 (g): 394.50
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 59.76
Calculated Weight of Sieve Sample (g): 59.76

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	394.50	100.00
	2"	50	0.00	0.00	394.50	100.00
	1.5"	38.1	0.00	0.00	394.50	100.00
	1"	25	0.00	0.00	394.50	100.00
	3/4"	19.0	0.00	0.00	394.50	100.00
	3/8"	9.5	0.00	0.00	394.50	100.00
	4	4.75	0.00	0.00	394.50	100.00
	10	2.00	0.00	0.00	394.50	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.00	0.00	59.76	100.00
	40	0.425	0.00	0.00	59.76	100.00
	60	0.250	0.00	0.00	59.76	100.00
	100	0.150	0.02	0.02	59.74	99.97
	140	0.106	0.02	0.04	59.72	99.93
	200	0.075	0.08	0.12	59.64	99.80
	dry pan		7.31	7.43	52.33	
	wet pan			52.33	0.00	

d_{10} (mm): 1.8E-05
d_{16} (mm): 0.0013
d_{30} (mm): 0.027
d_{50} (mm): 0.045
d_{60} (mm): 0.050
d_{84} (mm): 0.064

Median Particle Diameter --d_{50} (mm): 0.045
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2778
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 810
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.037

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)
USDA Soil Classification: Loam

Laboratory analysis by: A. Bland
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

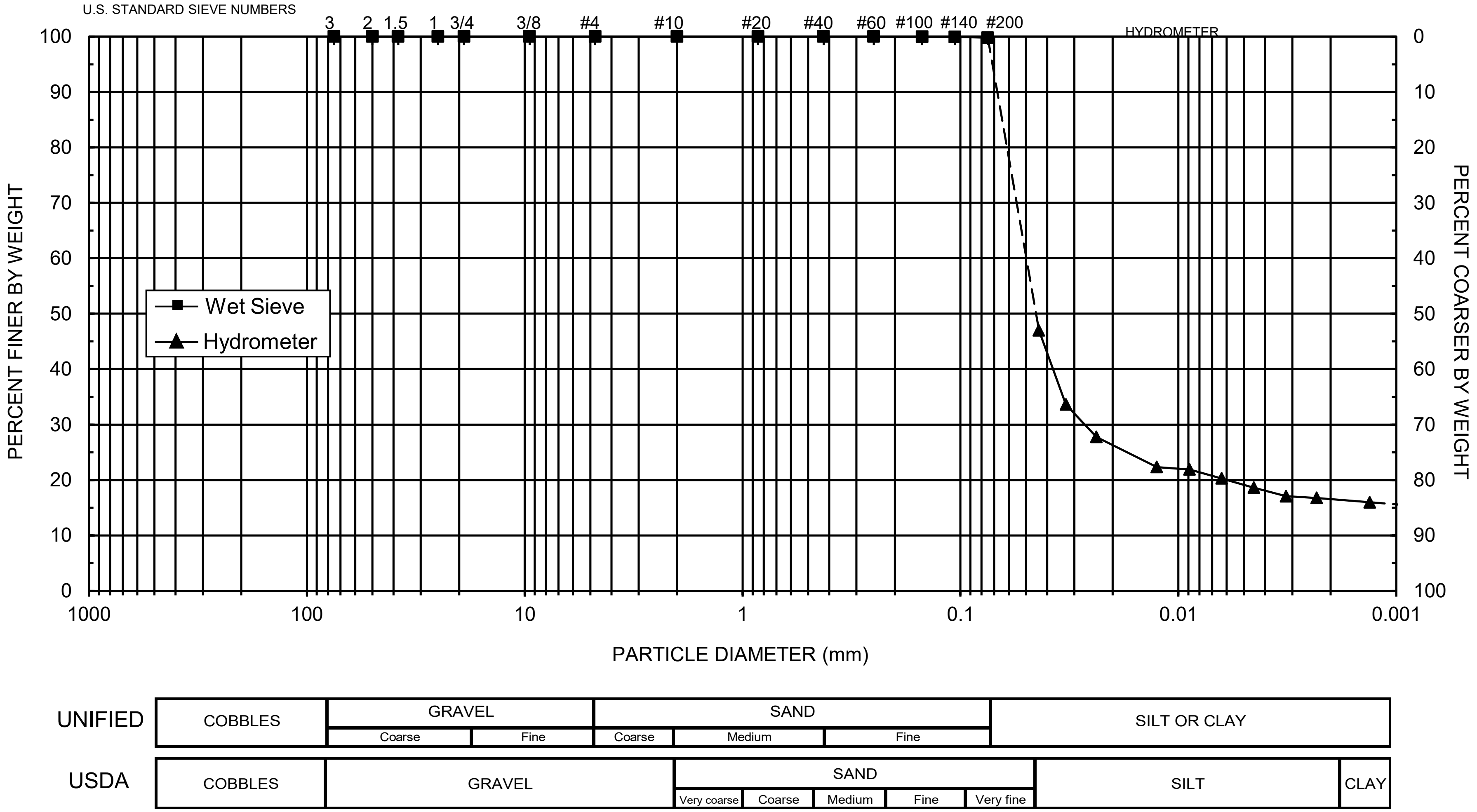
Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB20.1144.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L4-03 <200	*Dispersant*:*	$(NaPO_3)_6$
PO Number:	LMCP7413	*Assumed particle density:*	2.65
Date/Time sampled:	NA	*Initial Wt.* (g)*:*	59.76
Test Date:	4-May-20	*Total Sample Wt.* (g)*:*	394.50
Start Time:	9:06	*Wt. Passing #10* (g)*:*	394.50

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
4-May-20	1	21.9	34.00	5.91	28.1	10	0.0436	47	47.0
	2	21.9	26.00	5.91	20.1	12	0.0328	34	33.6
	4	21.9	22.50	5.91	16.6	12	0.0238	28	27.8
	15	21.9	19.25	5.91	13.3	13	0.0125	22	22.3
	30	21.9	19.00	5.91	13.1	13	0.0089	22	21.9
	60	22.0	18.00	5.88	12.1	13	0.0063	20	20.3
	120	22.0	17.00	5.88	11.1	13	0.0045	19	18.6
	240	22.2	16.00	5.80	10.2	13	0.0032	17	17.1
	459	22.4	15.75	5.73	10.0	13	0.0023	17	16.8
5-May-20	1418	21.8	15.50	5.95	9.6	13	0.0013	16	16.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



d_{10} = **1.8E-05**	d_{30} = **0.027**	d_{50} = **0.045**	d_{60} = **0.050**	C_u = **2778**	C_c = **810**

SAMPLE NUMBER	DATE/TIME SAMPLED	ASTM CLASSIFICATION	USDA CLASSIFICATION
L4-03 <200	**NA**	**Fat clay (CH)**	**Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Percent Dispersion by Double Hydrometer

Summary of Percent Dispersion by Double Hydrometer

Sample Number	Percent Finer Than 2-µm, Not Dispersed	Percent Finer Than 2-µm, Dispersed[1]	Percent Dispersion*	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line[1]	Dispersiveness Classification
L5-01 <200	18.0	17.1	100	Yes	Dispersive
L5-03 <200	18.2	18.8	100	Yes	Dispersive
L4-01 <200	14.3	14.1	100	Yes	Dispersive
L4-03 <200	16.3	16.5	100	Yes	Dispersive

[1] This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer than 2-µm when dispersant is used.

[*] In cases where the difference between the percent finer than 2-µm with and without dispersant is less than the lower limit of the expected range for duplicate samples (<1.48% difference), the percent dispersion is reported as 100.

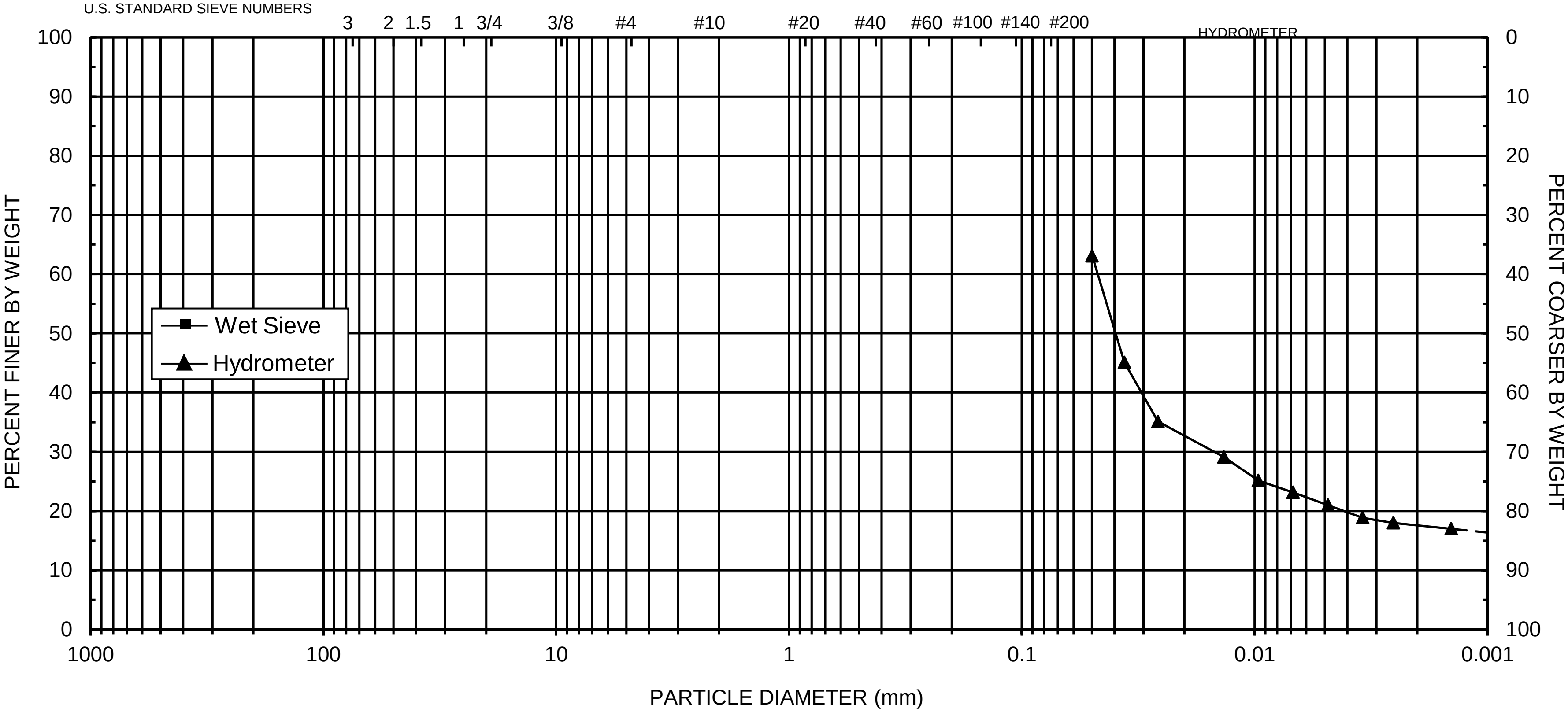
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB20.1144.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-01 <200 (No Dispersant)	*Dispersant:*	None
PO Number:	LMCP7413	*Assumed particle density:*	2.65
Date/Time sampled:	NA	*Initial Wt.* (g)*:*	25.02
Test Date:	29-Apr-20	*Total Sample Wt.* (g)*:*	393.36
Start Time:	9:24	*Wt. Passing #10* (g)*:*	393.36

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-Apr-20	1	21.9	15.00	-0.79	15.8	13	0.0499	63	63.1
	2	21.9	10.50	-0.79	11.3	14	0.0362	45	45.1
	4	21.9	8.00	-0.79	8.8	15	0.0260	35	35.1
	15	21.9	6.50	-0.79	7.3	15	0.0135	29	29.1
	30	21.9	5.50	-0.79	6.3	15	0.0096	25	25.1
	60	21.9	5.00	-0.79	5.8	15	0.0068	23	23.1
	120	21.8	4.50	-0.75	5.3	15	0.0048	21	21.0
	240	21.7	4.00	-0.71	4.7	15	0.0034	19	18.8
	441	21.8	3.75	-0.75	4.5	15	0.0025	18	18.0
30-Apr-20	1390	21.8	3.50	-0.75	4.3	15	0.0014	17	17.0

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Albay-Yenney
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	

USDA	COBBLES	GRAVEL	SAND					SILT	CLAY
			Very coarse	Coarse	Medium	Fine	Very fine		

SAMPLE NUMBER	DATE/TIME SAMPLED	
L5-01 <200 (No Dispersant)	**NA**	

Daniel B. Stephens & Associates, Inc.

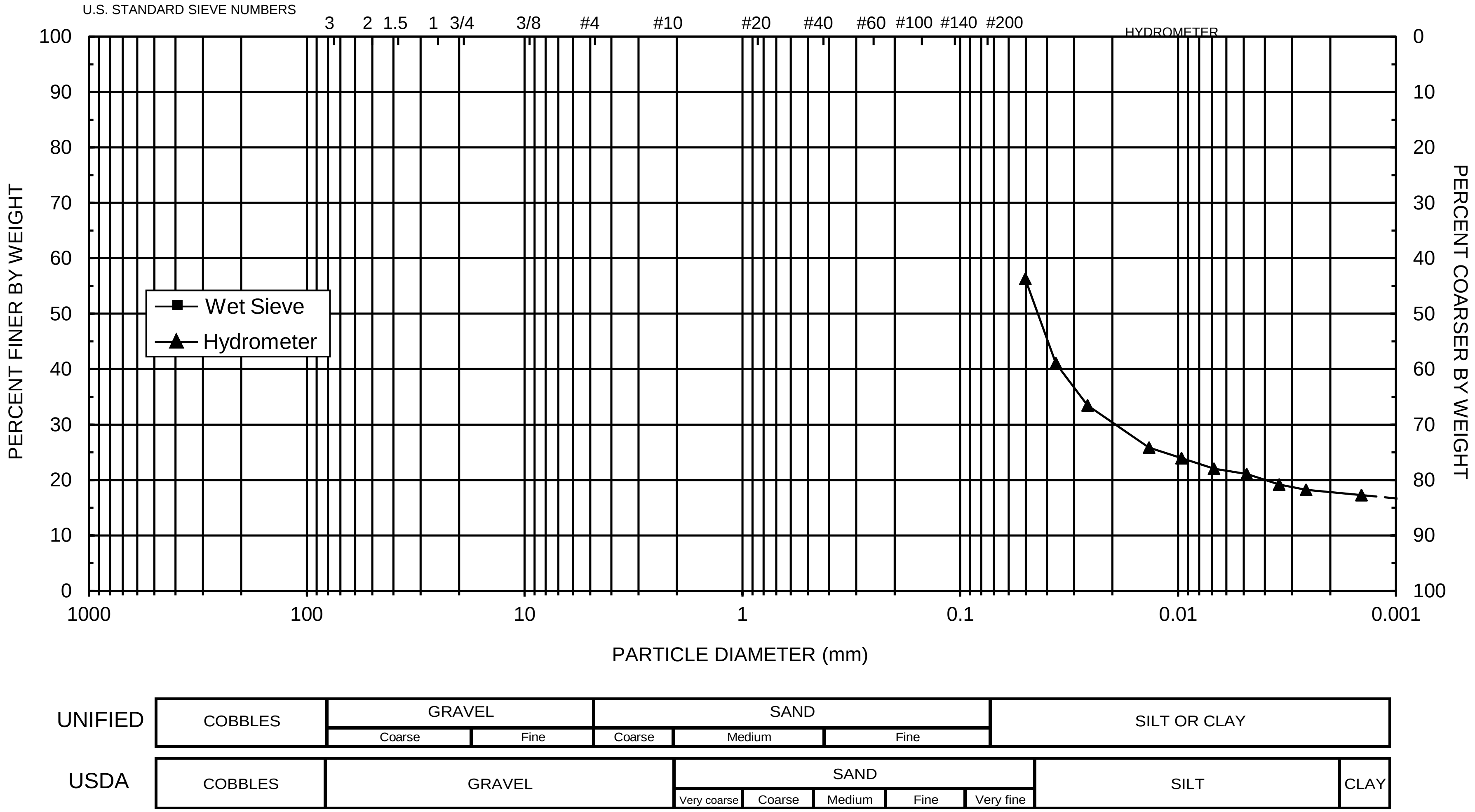
Particle Size Analysis
Hydrometer Data

Job Name:	Navarro	*Type of Water Used:*	DISTILLED
Job Number:	DB20.1144.00	*Reaction with* H_2O_2*:*	NA
Sample Number:	L5-03 <200 (No Dispersant)	*Dispersant:*	None
PO Number:	LMCP7413	*Assumed particle density:*	2.65
Date/Time sampled:	NA	*Initial Wt.* (g)*:*	26.28
Test Date:	29-Apr-20	*Total Sample Wt.* (g)*:*	379.64
Start Time:	9:42	*Wt. Passing #10* (g)*:*	379.64

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-Apr-20	1	21.9	14.00	-0.79	14.8	14	0.0502	56	56.3
	2	21.9	10.00	-0.79	10.8	14	0.0364	41	41.0
	4	21.9	8.00	-0.79	8.8	15	0.0260	33	33.4
	15	21.9	6.00	-0.79	6.8	15	0.0136	26	25.8
	30	21.9	5.50	-0.79	6.3	15	0.0096	24	23.9
	60	21.9	5.00	-0.79	5.8	15	0.0068	22	22.0
	120	21.9	4.75	-0.79	5.5	15	0.0048	21	21.1
	240	21.9	4.25	-0.79	5.0	15	0.0034	19	19.2
	425	21.9	4.00	-0.79	4.8	15	0.0026	18	18.2
30-Apr-20	1375	21.9	3.75	-0.79	4.5	15	0.0014	17	17.3

Comments:

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Albay-Yenney
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED	
L5-03 <200 (No Dispersant)	**NA**	

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <200 (No Dispersion)
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 29-Apr-20
Start Time: 9:18

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

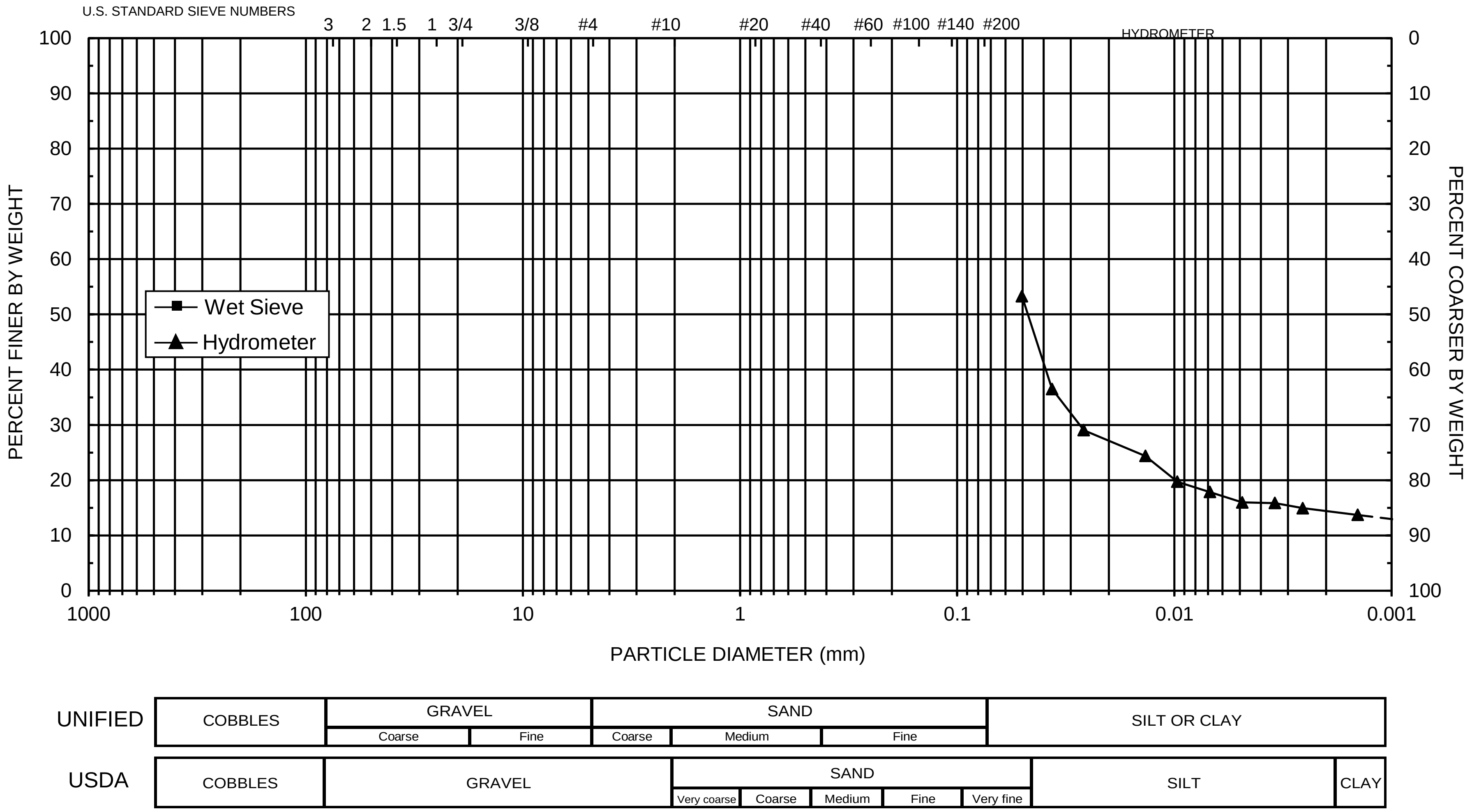
Initial Wt. (g)*:* 26.82
Total Sample Wt. (g)*:* 394.29
Wt. Passing #10 (g)*:* 394.29

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-Apr-20	1	21.9	13.50	-0.79	14.3	14	0.0503	53	53.3
	2	21.9	9.00	-0.79	9.8	14	0.0365	36	36.5
	4	21.9	7.00	-0.79	7.8	15	0.0261	29	29.0
	15	21.9	5.75	-0.79	6.5	15	0.0136	24	24.4
	30	21.9	4.50	-0.79	5.3	15	0.0097	20	19.7
	60	21.9	4.00	-0.79	4.8	15	0.0069	18	17.8
	120	21.9	3.50	-0.79	4.3	15	0.0049	16	16.0
	240	21.8	3.50	-0.75	4.3	15	0.0034	16	15.8
	435	21.8	3.25	-0.75	4.0	15	0.0026	15	14.9
30-Apr-20	1395	21.6	3.00	-0.68	3.7	15	0.0014	14	13.7

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED	
L4-01 <200 (No Dispersion)	**NA**	

Particle Size Analysis
Hydrometer Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-03 <200 (No Dispersant)
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 29-Apr-20
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant: None
Assumed particle density: 2.65

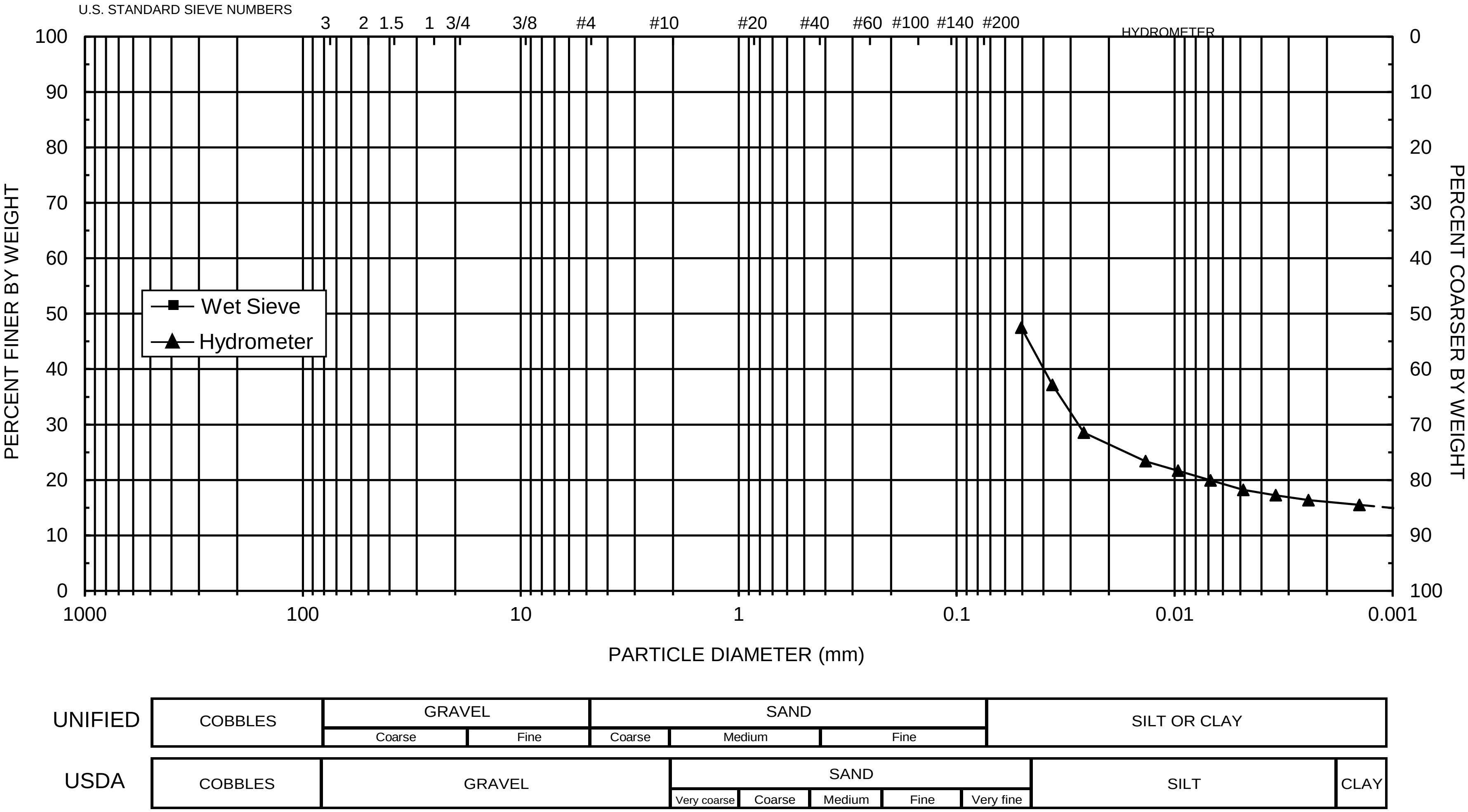
Initial Wt. (g)*:* 29.03
Total Sample Wt. (g)*:* 399.79
Wt. Passing #10 (g)*:* 399.79

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	H_m (cm)	D (mm)	P (%)	% Finer
29-Apr-20	1	21.9	13.00	-0.79	13.8	14	0.0505	47	47.5
	2	21.9	10.00	-0.79	10.8	14	0.0364	37	37.2
	4	21.9	7.50	-0.79	8.3	15	0.0261	29	28.5
	15	21.9	6.00	-0.79	6.8	15	0.0136	23	23.4
	30	21.9	5.50	-0.79	6.3	15	0.0096	22	21.7
	60	21.9	5.00	-0.79	5.8	15	0.0068	20	19.9
	120	21.9	4.50	-0.79	5.3	15	0.0048	18	18.2
	240	21.8	4.25	-0.75	5.0	15	0.0034	17	17.2
	480	21.8	4.00	-0.75	4.8	15	0.0024	16	16.4
30-Apr-20	1410	21.8	3.75	-0.75	4.5	15	0.0014	16	15.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Albay-Yenney
Data entered by: A. Albay-Yenney
Checked by: J. Hines



SAMPLE NUMBER	DATE/TIME SAMPLED	
L4-03 <200 (No Dispersant)	**NA**	

Atterberg Limits/ Identification of Fines

Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L5-01 <200	49	21	28	CL
L5-03 <200	65	28	37	CH
L4-01 <200	48	24	24	CL
L4-03 <200	65	22	43	CH

--- = Soil requires visual-manual classification due to non-plasticity

Atterberg Limits

Job Name:	Navarro
Job Number:	DB20.1144.00
Sample Number:	L5-01 <200
PO Number:	LMCP7413
Date/Time sampled:	NA
Test Date:	29-Apr-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	21
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.45	131.11	125.51
Weight of pan plus dry soil (g)	122.32	125.29	121.58
Weight of pan (g):	113.43	113.17	113.70
Gravimetric moisture content (% g/g):	46.46	48.02	49.87
Liquid Limit:	49		

Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.24	126.28
Weight of pan plus dry soil (g)	125.43	124.34
Weight of pan (g):	117.02	115.29
Gravimetric moisture content (% g/g):	21.52	21.44
Plastic Limit:	21	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	49
Plastic Limit:	21
Plasticity Index:	28
Classification:	CL

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 29-Apr-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	22
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	128.62	131.46	127.50
Weight of pan plus dry soil (g)	122.33	126.04	121.50
Weight of pan (g):	112.00	117.64	112.54
Gravimetric moisture content (% g/g):	60.89	64.52	66.96
Liquid Limit:	65		

Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	120.34	123.59
Weight of pan plus dry soil (g)	118.68	121.70
Weight of pan (g):	112.68	114.79
Gravimetric moisture content (% g/g):	27.67	27.35
Plastic Limit:	28	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 65
Plastic Limit: 28
Plasticity Index: 37

Classification: CH

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 29-Apr-20

Liquid Limit

	Trial 1	**Trial 2**	**Trial 3**
Number of drops:	34	26	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	130.21	130.42	128.92
Weight of pan plus dry soil (g)	124.81	125.51	124.21
Weight of pan (g):	113.15	115.28	114.78
Gravimetric moisture content (% g/g):	46.31	48.00	49.95

Liquid Limit: 48

Plastic Limit

	Trial 1	**Trial 2**
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	122.04	121.08
Weight of pan plus dry soil (g)	120.70	119.77
Weight of pan (g):	115.18	114.42
Gravimetric moisture content (% g/g):	24.28	24.49

Plastic Limit: 24

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 48
Plastic Limit: 24
Plasticity Index: 24

Classification: CL

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Atterberg Limits

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 29-Apr-20

Liquid Limit

	Trial 1	**Trial 2**	**Trial 3**
Number of drops:	33	27	23
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	129.90	129.33	129.60
Weight of pan plus dry soil (g)	124.21	124.33	124.27
Weight of pan (g):	114.82	116.48	116.25
Gravimetric moisture content (% g/g):	60.60	63.69	66.46

Liquid Limit: 65

Plastic Limit

	Trial 1	**Trial 2**
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.38	117.47
Weight of pan plus dry soil (g)	120.43	116.48
Weight of pan (g):	116.05	111.99
Gravimetric moisture content (% g/g):	21.69	22.05

Plastic Limit: 22

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 65
Plastic Limit: 22
Plasticity Index: 43

Classification: CH

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Crumb Test

Summary of Crumb Dispersion Tests

Sample Number	Grade of Reaction	Reaction	Classification
L5-01 <200	IV	Strong Reaction	Highly Dispersive
L5-03 <200	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L4-01 <200	IV	Strong Reaction	Highly Dispersive
L4-03 <200	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L5-01 <10	III	Moderate Reaction	Dispersive
L5-03 <10	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive
L4-01 <10	III -> IV	Moderate to Strong Reaction	Dispersive to Highly Dispersive

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/6/20

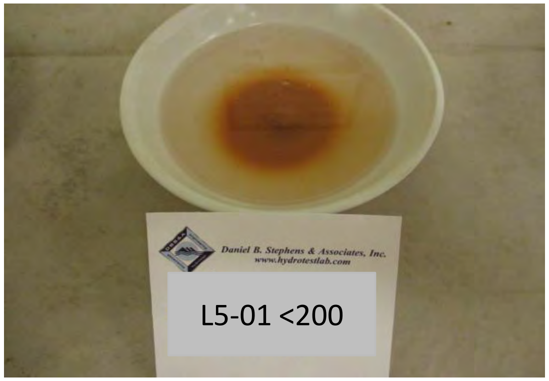
Color: Reddish Brown
Date Remolded: 5/6/2020

Moisture Content (% g/g): 15.0
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L5-01 <200	7:39:00	3 to 4	21.5	4	21.0	4	21.0



Classification: **Grade 4 Highly Dispersive**

*Grade Classification:
Grade 1 Non-dispersive; No reaction
Grade 2 Intermediate; Slight reaction
Grade 3 Dispersive; Moderate reaction
Grade 4 Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/6/20

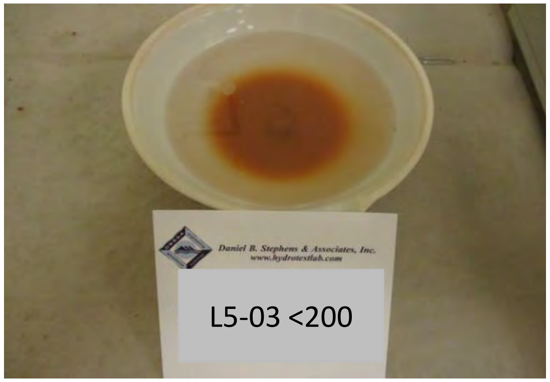
Color: Reddish Brown
Date Remolded: 5/6/2020

Moisture Content (% g/g): 15.0
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L5-03 <200	7:40:00	2 to 3	21.5	3 to 4	21.0	4	21.0



Classification: **Grade 3->4 Moderate to Highly Dispersive**

*Grade Classification:
- Grade 1 Non-dispersive; No reaction
- Grade 2 Intermediate; Slight reaction
- Grade 3 Dispersive; Moderate reaction
- Grade 4 Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/6/20

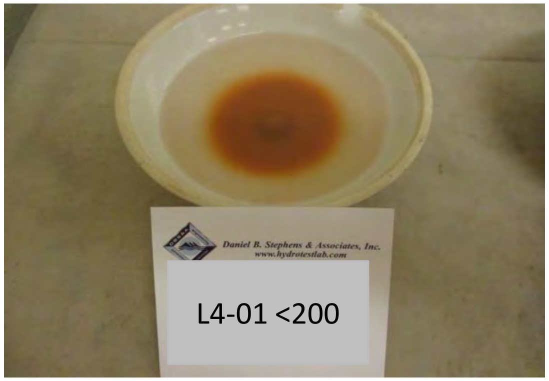
Color: Reddish Brown
Date Remolded: 5/6/2020

Moisture Content (% g/g): 15.0
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L4-01 <200	7:37:00	3	21.5	4	21.0	4	21.0



Classification: **Grade 4 Highly Dispersive**

*Grade Classification:

Grade 1	Non-dispersive; No reaction
Grade 2	Intermediate; Slight reaction
Grade 3	Dispersive; Moderate reaction
Grade 4	Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-03 <200
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/6/20

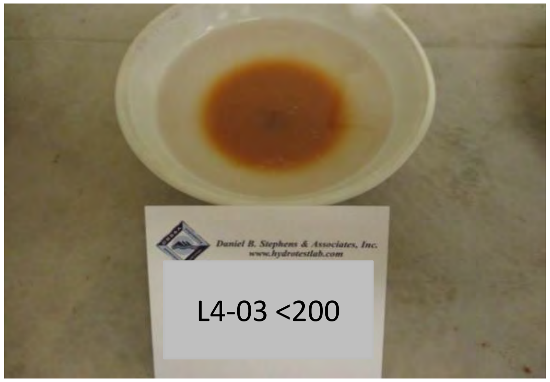
Color: Reddish Brown
Date Remolded: 5/6/2020

Moisture Content (% g/g): 15.0
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type: ☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used: ☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L4-03 <200	7:38:00	2 to 3	21.5	3 to 4	21.0	4	21.0



Classification: **Grade 3->4 Moderate to Highly Dispersive**

*Grade Classification:
Grade 1 Non-dispersive; No reaction
Grade 2 Intermediate; Slight reaction
Grade 3 Dispersive; Moderate reaction
Grade 4 Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-01 <10
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/5/20

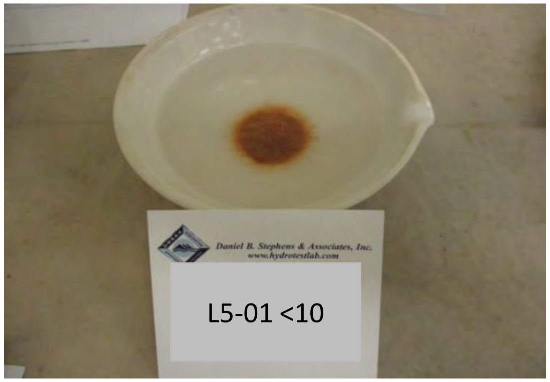
Color: Reddish Brown
Date Remolded: 5/5/2020

Moisture Content (% g/g): 11.5
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L5-01 <10	8:55:00	3	22.5	3	21.0	3	21.0



Classification: **Grade 3 Dispersive**

*Grade Classification:
- Grade 1 Non-dispersive; No reaction
- Grade 2 Intermediate; Slight reaction
- Grade 3 Dispersive; Moderate reaction
- Grade 4 Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Comments:
The block immediately fell apart when placed in the water; however, the radius of the halo limited the classification to Grade 3

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-03 <10
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/5/20

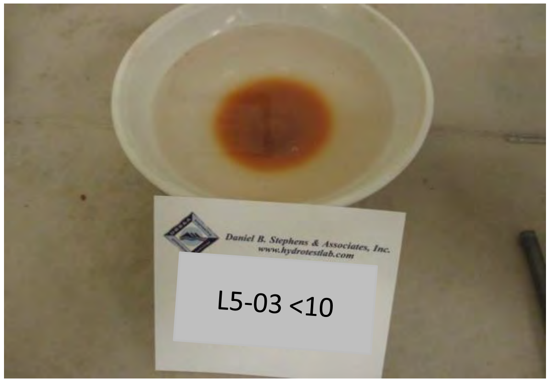
Color: Reddish Brown
Date Remolded: 5/5/2020

Moisture Content (% g/g): 11.5
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L5-03 <10	8:57:00	3 to 4	22.5	3 to 4	21.0	3 to 4	21.0



Classification: **Grade 3->4 Moderate to Highly Dispersive**

*Grade Classification:

Grade 1	Non-dispersive; No reaction
Grade 2	Intermediate; Slight reaction
Grade 3	Dispersive; Moderate reaction
Grade 4	Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Crumb Test For Dispersability of Clayey Soils Data

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L4-01 <10
PO Number: LMCP7413
Date/Time sampled: NA

Test Date: 5/5/20

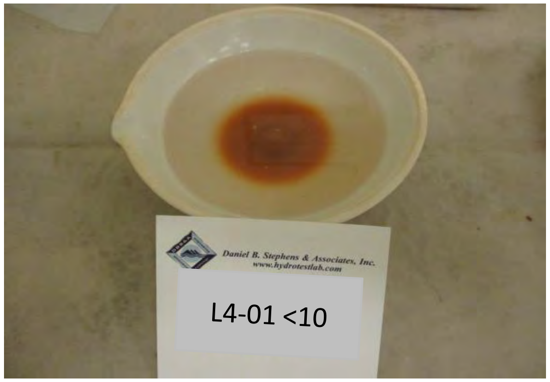
Color: Reddish Brown
Date Remolded: 5/5/2020

Moisture Content (% g/g): 11.5
☐ Natural Moisture
☐ Air-dried
☑ Moisture Adjusted

Specimen Type:
☐ Natural irregularly shaped crumb
☑ Remolded crumb cube

Water Used:
☐ Tap
☑ Distilled

		2 minutes		1 hour		6 hours	
Specimen Number	Start Time	Grade*	Temp (°C)	Grade*	Temp (°C)	Grade*	Temp (°C)
L4-01 <10	8:56:00	3 to 4	22.5	3 to 4	21.0	3 to 4	21.0



Classification: **Grade 3->4 Moderate to Highly Dispersive**

*Grade Classification:
- Grade 1 Non-dispersive; No reaction
- Grade 2 Intermediate; Slight reaction
- Grade 3 Dispersive; Moderate reaction
- Grade 4 Highly Dispersive; Strong reaction

Interpretation:
Under normal conditions, use the one hour reading to determine dispersive grade. However, if the dispersive grade changes from 2 to 3 or from 3 to 4 between the 1 and 6 hour readings, use the 6 hour reading instead.

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Pinhole Dispersion

Summary of Pinhole Dispersion Testing

Sample Number	Percent Finer Than 5-µm[1]	Plasticity Index[1]	Dispersion Classification
L5-01 <10	NA	NA	D2 - Dispersive
L5-03 <10	NA	NA	D1 - Dispersive
L4-01 <10	NA	NA	D1 - Dispersive

---

[1] This test method is applicable to soils that have a plasticity index greater than or equal to 4, and more than 12% of the soil fraction is finer than 5-µm.

"NA" Not Analyzed

Pinhole Dispersion Test Data
ASTM D4647

Job Name:	Navarro
Job Number:	DB20.1144.00
Sample Number:	L4-01 <10
PO Number:	LMCP7413
Date/Time sampled:	NA

Sample Properties

Sample Type:	Disturbed Remolded
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Classification of Fines:	NA
Percent Coarse Material (+2mm) (%):	0
As Received Water Content (%, g/g):	0.8
Target Relative Compaction (%):	NA
Target Remold Density (g/cm^3):	1.72
Target Remold Density (pcf):	107.4
Target Remold Water Content (%, g/g):	11.5
Test Sample Density (g/cm^3):	1.72
Test Sample Density (pcf):	107.4
Test Sample Water Content (%, g/g):	11.5

Test Conditions

Test Date:	4-May-20
Curing Time (Hours):	24
Test Method:	A
Water Type:	Distilled

Test Data

Hydraulic Head		Test Time	Flow Rate	Cloudiness of Flow at End of Test	Hole Diameter After Test
(inches)	(mm)	(min:sec)	(ml/sec)		(mm)
2.0	50.8	0:00:00	---	NA	---
2.0	50.8	0:01:00	0.62	Slightly Dark	---
2.0	50.8	0:02:00	0.87	Slightly Dark	---
2.0	50.8	0:03:00	1.03	Moderately Dark	---
2.0	50.8	0:04:00	1.07	Dark	---
2.0	50.8	0:05:00	1.18	Very Dark	1.92 to 2.91

Dispersive Classification: **D1 -Dispersive**

Comments:

Laboratory analysis by:	D. O'Dowd
Data entered by:	A. Albay-Yenney
Checked by:	J. Hines

Pinhole Dispersion Test Data
ASTM D4647

Job Name:	Navarro
Job Number:	DB20.1144.00
Sample Number:	L5-01 <10
PO Number:	LMCP7413
Date/Time sampled:	NA

Sample Properties

Sample Type:	Disturbed Remolded
USCS Classification:	NA
Plastic Limit:	NA
Liquid Limit:	NA
Classification of Fines:	NA
Percent Coarse Material (+2mm) (%):	0
As Received Water Content (%, g/g):	0.8
Target Relative Compaction (%):	NA
Target Remold Density (g/cm^3):	1.72
Target Remold Density (pcf):	107.4
Target Remold Water Content (%, g/g):	11.5
Test Sample Density (g/cm^3):	1.72
Test Sample Density (pcf):	107.4
Test Sample Water Content (%, g/g):	11.5

Test Conditions

Test Date:	1-May-20
Curing Time (Hours):	24
Test Method:	A
Water Type:	Distilled

Test Data

Hydraulic Head		Test Time	Flow Rate	Cloudiness of Flow at End of Test	Hole Diameter After Test
(inches)	(mm)	(min:sec)	(ml/sec)		(mm)
2	50.8	0:00:00	---	NA	---
2	50.8	0:01:00	0.95	Slightly Dark	---
2	50.8	0:02:00	1.05	Moderately Dark	---
2	50.8	0:03:00	0.84	Moderately Dark	---
2	50.8	0:04:00	0.95	Dark	---
2	50.8	0:05:00	0.98	Dark	---
2	50.8	0:10:00	1.12	Dark	NA*

Dispersive Classification: **D2 - Dispersive**

Comments:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Pinhole Dispersion Test Data
ASTM D4647

Job Name: Navarro
Job Number: DB20.1144.00
Sample Number: L5-03 <10
PO Number: LMCP7413
Date/Time sampled: NA

Sample Properties

Sample Type: Disturbed Remolded
USCS Classification: NA
Plastic Limit: NA
Liquid Limit: NA
Classification of Fines: NA
Percent Coarse Material (+2mm) (%): 0
As Received Water Content (%, g/g): 0.7
Target Relative Compaction (%): NA
Target Remold Density (g/cm^3): 1.72
Target Remold Density (pcf): 107.4
Target Remold Water Content (%, g/g): 11.5
Test Sample Density (g/cm^3): 1.72
Test Sample Density (pcf): 107.4
Test Sample Water Content (%, g/g): 11.5

Test Conditions

Test Date: 5-May-20
Curing Time (Hours): 24
Test Method: A
Water Type: Distilled

Test Data

Hydraulic Head		Test Time	Flow Rate	Cloudiness of Flow at End of Test	Hole Diameter After Test
(inches)	(mm)	(min:sec)	(ml/sec)		(mm)
2	50.8	0:00:00	---	NA	---
2	50.8	0:01:00	0.91	Moderately Dark	---
2	50.8	0:02:00	1.14	Moderately Dark	---
2	50.8	0:03:00	1.17	Dark	---
2	50.8	0:04:00	1.28	Very Dark	---
2	50.8	0:05:00	1.31	Very Dark	2.75 to 3.45

Dispersive Classification: **D1 - Dispersive**

Comments:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Particle Size Analysis:	ASTM D7928, ASTM D6913
Double Hydrometer:	ASTM D4221
USCS (ASTM) Classification:	ASTM D6913, ASTM D4318, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Crumb Dispersion Test:	ASTM D6572
Pinhole Dispersion Test:	ASTM D4647

Appendix G

University of California, Davis Mexican Hat Phase II Data

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UC DAVIS ANALYTICAL LABORATORY
UNIVERSITY OF CALIFORNIA

SUBMITTED BY: WILLIAMS, MORGAN
AFFILIATION EXT: NAVARRO RESEARCH & ENGINEERING
COPY TO: Not Specified
COMMODITY: Not Specified

UPDATED REPORT as per Client Request
http://anlab.ucdavis.edu

WORK REQ #: 20S126
OF SAMPLES: 7
DATE RECEIVED: 04/24/20
UPDATE REPORT: 05/06/20
CLIENT ID #: XWILM
TURN AROUND TIME IN WORKING DAYS: 7

WILLIAMS, MORGAN
EXT: NAVARRO RESEARCH & ENGINEERING
Not Specified
Not Specified
http://anlab.ucdavis.edu

WORK REQ #: 20S126
OF SAMPLES: 7
DATE RECEIVED: 04/24/20
DATE REPORTED: 05/04/20
CLIENT ID #: XWILM
TURN AROUND TIME IN WORKING DAYS: 7

Sample Type: SOIL

Date Sampled: 4/11/20; Grower/Location/Project: Mexican Hat ICP

Date Sampled: 4/11/20; Grower/Location/Project: Mexican Hat ICP

		SP	pH	EC	Ca (SP)	Mg (SP)	Na (SP)	Cl (SP)	B (SP)	HCO3 (SP)	CO3 (SP)	K (SP)	SAR	CEC	CaCO3		K(SP)	ESP
		[SOP 200.2]	[SOP 205.2]	[SOP 215.02]	[SOP 235.4]	[SOP 235.04]	[SOP 235.04]	[SOP 227.2]	[SOP 235.04]	[SOP 220.04]	[SOP 220.4]	[SOP 235.04]	[SOP 240.2]	[SOP 430.3]	[SOP 440.2]			
SAMPLE #	DESC	%		dS/m	meq/L	meq/L	meq/L	meq/L	mg/L	meq/L	meq/L	mg/L		meq/100g	%		meq/L	%
1		122	8.40	4.12	4.85	1.63	37.2	3.43	0.23	1.5	<0.1	10.2	21	12.2	16.6		0.26	23
1 dup			8.39	4.11	5.08	1.70	37.4	3.48	0.23	ISM	ISM	10.8	20	13.5	18.4		0.28	22
2		129	8.84	1.50	0.33	0.20	13.1	4.26	0.49	2.5	<0.1	3.2	26	14.0	19.0		0.08	27
3		133	8.95	1.34	0.32	0.19	11.8	3.84	0.50	3.0	<0.1	3.2	23	15.3	18.9		0.08	25
4		118	8.88	1.44	0.36	0.20	12.6	3.50	0.47	2.5	<0.1	3.6	24	15.1	20.9		0.09	25
5		115	8.64	2.14	1.00	0.44	19.2	3.17	0.31	2.6	<0.1	6.6	23	12.6	19.1		0.17	24
6		125	8.89	1.66	0.37	0.17	15.7	4.15	0.28	2.5	<0.1	4.4	30	15.4	18.6		0.11	30
7		129	8.88	1.92	0.47	0.24	17.2	5.47	0.27	2.5	<0.1	5.0	29	15.7	17.6		0.13	29
7 dup			8.87	1.91	0.48	0.23	16.9	5.43	0.28	ISM	ISM	5.0	28	14.5	19.9		0.13	29

	SP	pH	EC	Ca (SP)	Mg (SP)	Na (SP)	Cl (SP)	B (SP)	HCO3 (SP)	CO3 (SP)	K (SP)	SAR	CEC	CaCO3
Analysis Date:	4/27/2020	4/28/2020	4/28/2020	4/28/2020	4/28/2020	4/28/2020	4/29/2020	4/28/2020	4/29/2020	4/29/2020	4/28/2020	4/28/2020	4/28/2020	5/4/2020
Method Detection Limit:	1	0.01	0.01	0.10	0.10	0.10	0.10	0.05	0.1	0.1	0.1	1	2.0	0.2
Blank Concentration:	-	-	-	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	-	0.0	-
Standard Ref as Tested:	-	6.43	0.28	0.43	0.73	1.69	0.26	0.35	2.10	-	23.9	2.2	30.0	-
Standard Ref Acceptable:	-	6.45±0.06	0.28±0.02	0.44±0.04	0.74±0.04	1.76±0.12	0.26±0.03	0.35±0.03	2.09±0.3	-	24.4±3.6	2.2±0.2	31.0±3.0	-
Standard Reference:	-	UCD 004	UCD 006C	UCD 006C	UCD 006C	UCD 006C	UCD 006C	UCD 006C	UCD 006C	-	PW34G	UCD 006C	NORD	-

NOTE: The SOP # (Standard Operating Procedure number) is a reference to the laboratory method used.
The SOP heading in this Excel file is linked to the method summary on the Laboratory website. http://anlab.ucdavis.edu

NOTE: No result within this report is accurate to more than 3 significant figures. More figures may be present due to software rounding rules.

NOTE: ISM indicates there was insufficient sample material to perform the requested analysis.

Report updated to include K(SP) in meq/L and ESP data

Checked and Approved: *{electronically signed by Traci Francis}*
Traci Francis, Laboratory Supervisor

Please address questions regarding these results to the Lab at (530) 752-0147 or anlab@ucdavis.edu.

Samples for this Work Request (20S126) will be returned to you after 6/3/20.

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Appendix H

ESL Batch Leaching Method CB(BT-1)

Sample ID	Analysis Date	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Ca (meq/l)	Mg (meq/l)	K (meq/l)	Na (meq/l)
L4-01 RT	8/2/2019	11.47	2.95	7.84	1.09	0.29	0.12	0.03	0.34
L4-02 RT	8/2/2019	11.22	3.22	10.76	1.09	0.28	0.13	0.03	0.47
L4-03 RT	8/2/2019	12.80	3.34	12.47	1.14	0.32	0.14	0.03	0.54
L4-11 RT	8/2/2019	13.04	3.12	10.84	0.98	0.33	0.13	0.03	0.47
L4-01 RB	8/2/2019	9.81	2.01	8.03	0.79	0.24	0.08	0.02	0.35
L4-02 RB	8/2/2019	12.36	2.87	13.09	1.15	0.31	0.12	0.03	0.57
L4-03 RB	8/2/2019	7.77	2.40	12.20	0.88	0.19	0.10	0.02	0.53
L4-11 RB	8/2/2019	10.16	2.46	11.65	1.08	0.25	0.10	0.03	0.51
L4-01 RM	8/2/2019	9.99	2.21	8.71	0.94	0.25	0.09	0.02	0.38
L4-02 RM	8/2/2019	14.98	3.27	14.07	1.27	0.37	0.13	0.03	0.61
L4-03 RM	8/2/2019	9.36	2.87	13.03	1.10	0.23	0.12	0.03	0.57
L4-11 RM	8/2/2019	10.05	2.70	12.27	1.09	0.25	0.11	0.03	0.53

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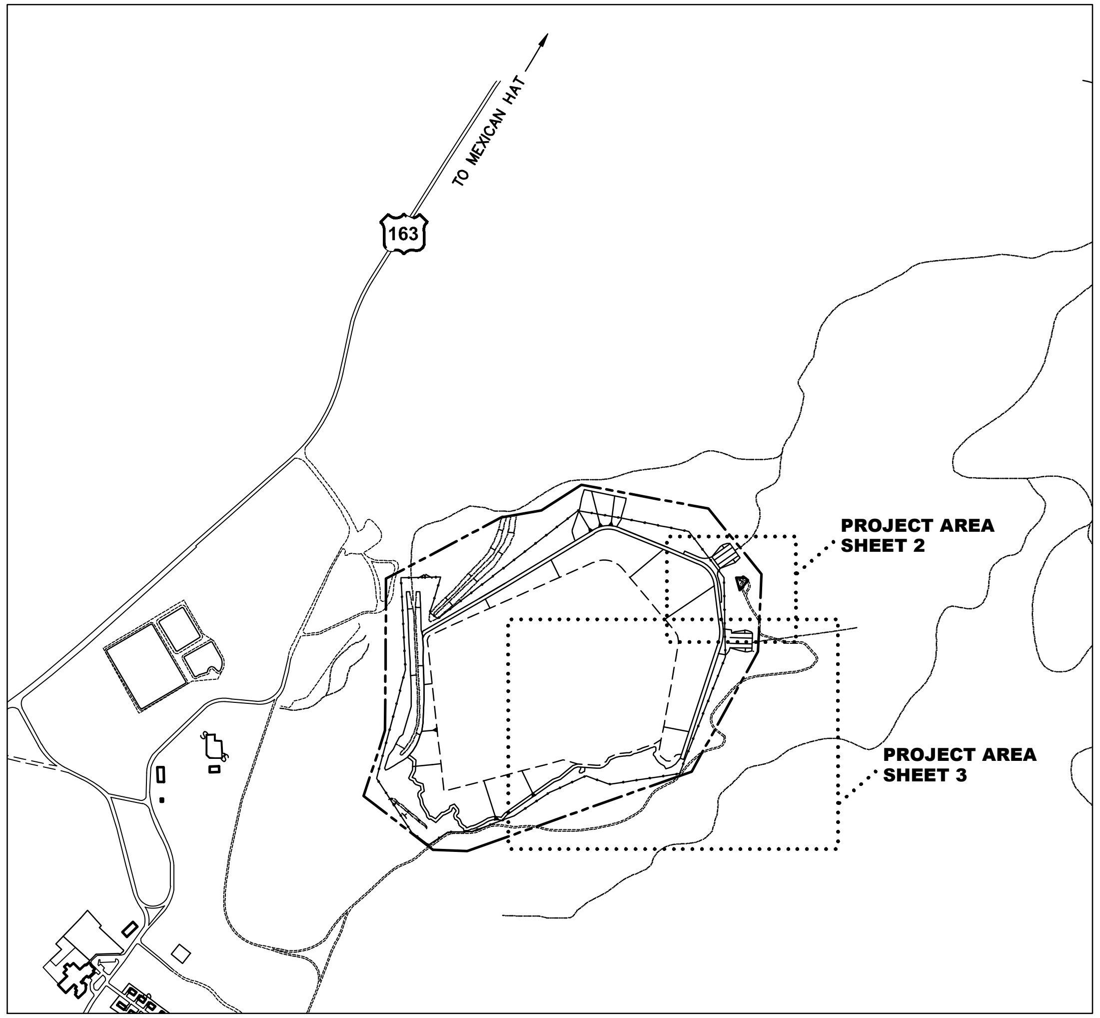
Appendix I

Mexican Hat Northeast Side Slope Interim Cover Protection Drawings



PROJECT PLAN

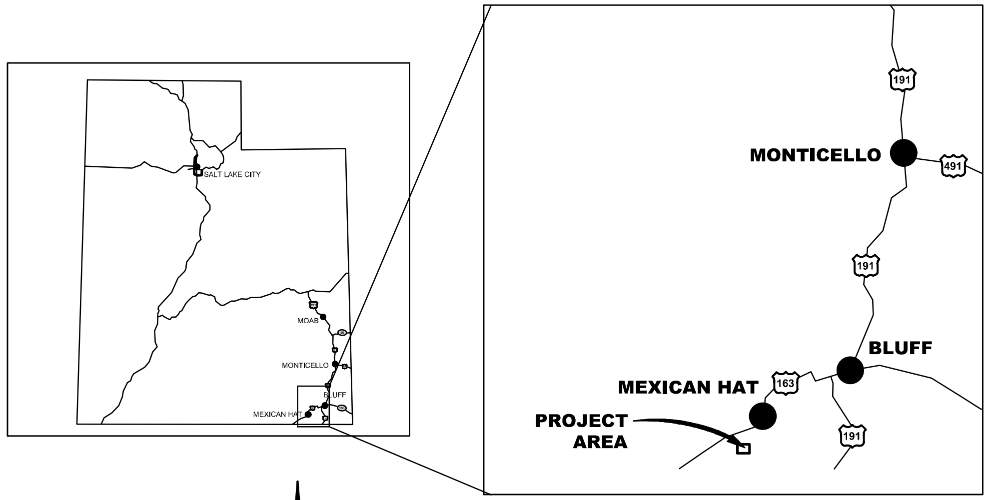
UNITED STATES DEPARTMENT OF ENERGY

OFFICE OF LEGACY MANAGEMENT

MEXICAN HAT NORTHEAST SIDE SLOPE INTERIM COVER PROTECTION

MEXICAN HAT, UTAH, DISPOSAL SITE

INDEX OF DRAWINGS



LOCATION PLAN

ABBREVIATIONS

APPROX.	APPROXIMATE
BOTT.	BOTTOM
℄	CENTER LINE
EXIST.	EXISTING
MAX.	MAXIMUM
MIN.	MINIMUM
NTS	NOT TO SCALE

DRAWING LEGEND

PLAN

5210	EXIST. CONTOUR – MINOR (2 FT)
5210	EXIST. CONTOUR – MAJOR (10 FT)
5210	EXCAVATION CONTOUR – MINOR (1 FT)
5210	EXCAVATION CONTOUR – MAJOR (5 FT)
—— - - ——	SITE PROPERTY BOUNDARY
——×——	CELL PERIMETER FENCE
–o——o——o–	TEMP. CONSTRUCTION FENCE
------------	SITE DRAINAGE FEATURE
============	SITE ACCESS ROAD
————	MAPPED DEPRESSION FEATURE (TYP.)
— — — —	LIMITS OF CONSTRUCTION
—— —— ——	PROP. DEPRESSION WORK AREA
||||||||||||	STRAW WATTLE PLACEMENT
————	PREFERRED RIP RAP LAYDOWN AREAS
◓	SURVEY CONTROL POINT
▤	PROPOSED GEOMAT ACCESS ROUTE
▨	PROPOSED EQUIPMENT TRAVEL LIMITS

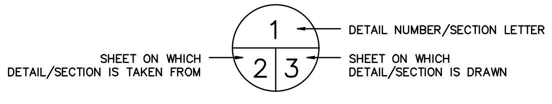
SECTION

▤	UNDISTURBED SOIL
▦	AGGREGATE BASE COURSE
▢	REUSED BEDDING MATERIAL
▦	EXISTING DRAINAGE CHANNEL
▦	RIP RAP COVER
▒	BEDDING MATERIAL COVER
▭	SCARIFIED RADON BARRIER
▨	EXCAVATED RADON BARRIER
▤	SUPPLEMENTAL RADON BARRIER
▩	STRAW WATTLE

GENERAL PROJECT NOTES:

1. THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH THESE PLANS AND THE ATTACHED STATEMENT OF WORK AND SPECIFICATIONS, DOCUMENT NO S23420.
2. PLOTTING OR PRINTING OF THESE DRAWINGS TO ANY SHEET SIZE OTHER THAN 22 X 34 OR BY USING FORMATS OTHER THAN AutoCAD PDF FILES WILL RESULT IN INCORRECT SCALES AND HATCH PATTERN DISTORTIONS. THE USER IS CAUTIONED AND SHOULD OBTAIN A HARD COPY PRINT–OUT FROM THE CONTRACTOR.

DETAIL SYMBOL



DESIGN CHANGES SHALL NOT BE MADE WITHOUT WRITTEN CONSENT OF THE PROJECT ENGINEER

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL

No. 9582333–2202
JOHN B. MANEE
STATE OF UTAH

Digitally signed by JOHN MANEE (Affiliate)
DN: c=US, o=U.S. Government, ou=Department of Energy, 0.9.2342.19200300.100.1.1=89001003555678, cn=JOHN MANEE (Affiliate)
Date: 2019.04.24 11:31:46 -06'00'

PROJECT LOCATION
MEXICAN HAT, UTAH, DISPOSAL SITE

REFERENCE
REFERENCE NAMES HERE

APPROVALS

DRAWN BY	C. MUELLER	04/24/19
ENGINEER	C. MUELLER	04/24/19
PROJECT ENGINEER	J. MANEE	04/24/19
ENGINEERING MANAGER	D. BRENNECKE	04/24/19
PROJECT LEAD	M. BUTHERUS	04/24/19
SITE MANAGER/LEAD	K. LOTT	04/24/19

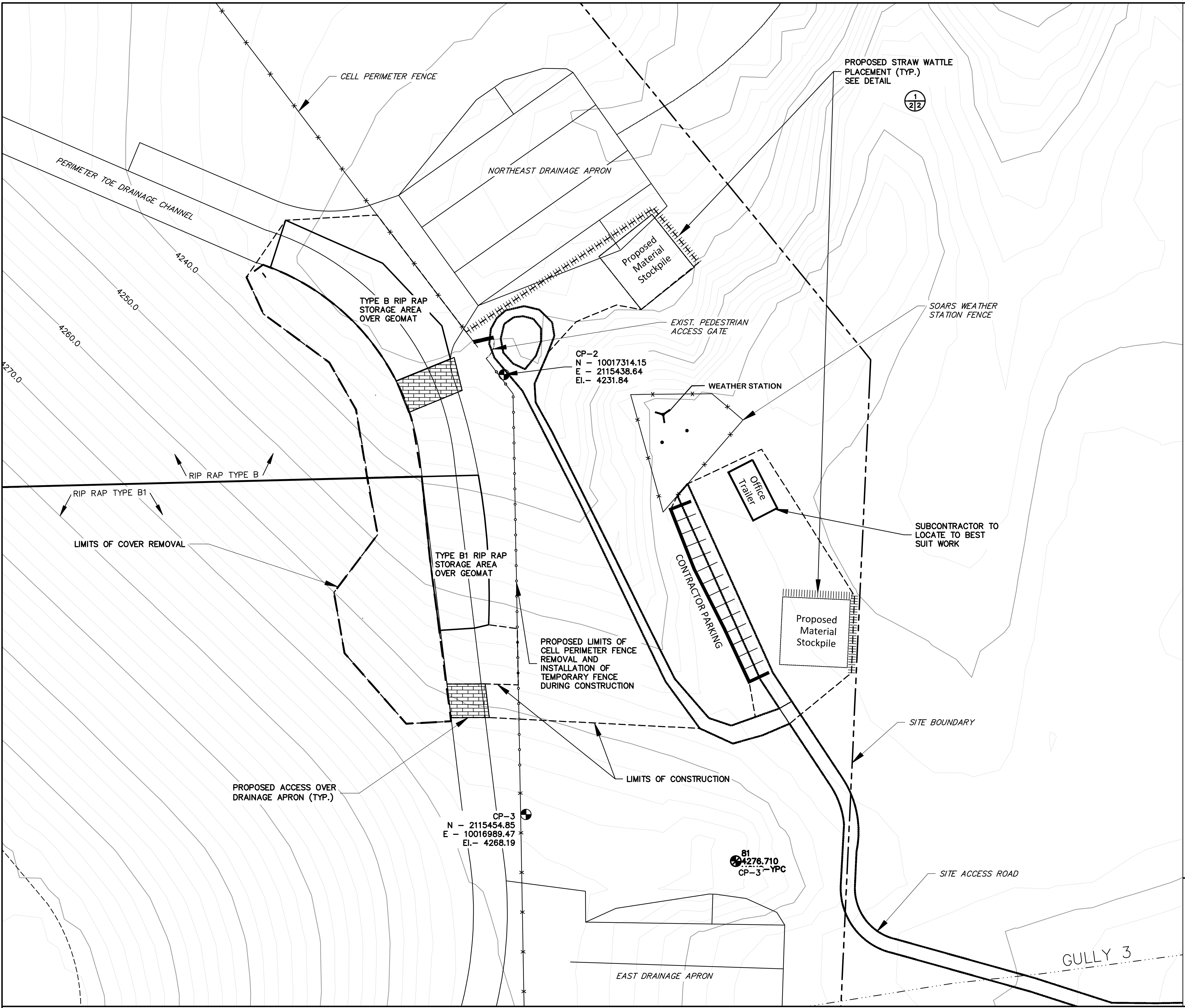
U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE–LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

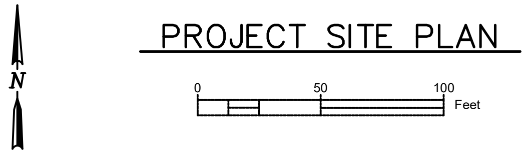
MEXICAN HAT NE SIDE SLOPE INTERIM COVER PROTECTION

TITLE SHEET

PROJECT NO. LTS–111–0014–16–000
DRAWING NO. S23410–RAB–T01–D
SHT. 1 OF 6

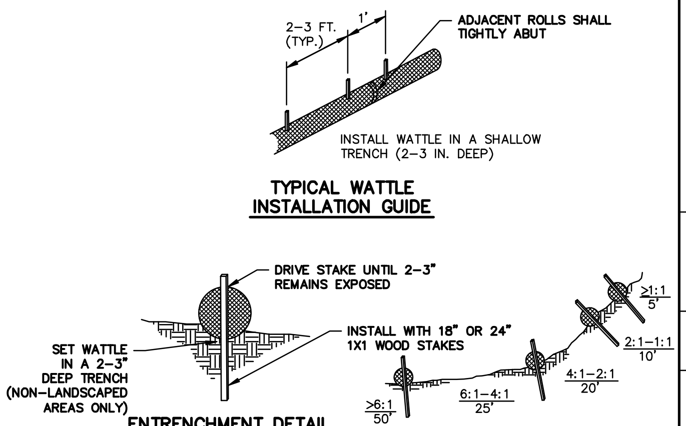


PROJECT SITE PLAN



NOTES:

1. PRIOR TO START OF WORK, EROSION AND SEDIMENTATION CONTROLS SHOULD BE INSTALLED AS SHOWN IN THESE DRAWINGS AT A MINIMUM. IT MAY BE NECESSARY TO ADD EROSION CONTROL FEATURES IN AREAS NOT SHOWN ON THE PLAN SHEETS. DEPENDING ON THE SUBCONTRACTOR OPERATIONS AND ASSOCIATED DISTURBED AREAS.
2. AT THE END OF EACH WORK DAY, TEMPORARY FENCING SHALL BE INSTALLED WHERE EVER THE PERMANENT CELL PERIMETER FENCE HAS BEEN REMOVED. PERMANENT SITE FENCING SHALL BE TAKEN DOWN IN A WAY TO PRESERVE MATERIAL INTEGRITY AND ALLOW FOR REINSTALLATION BY SUBCONTRACTOR AT THE END OF THE WORK EFFORT.
3. TEMPORARY FENCING SHALL BE STANDARD ORANGE PLASTIC CONSTRUCTION FENCING. EXISTING FENCE POSTS CAN BE USED IN AREAS THAT DO NOT REQUIRE DAILY REMOVAL AND REPLACEMENT. OTHERWISE, WOODEN STAKES SHALL BE USED,
4. TEMPORARY FENCING IS NECESSARY TO PREVENT WILD BURROS AND OTHER INTRUDERS FROM ACCESSING THE CELL WHEN THE CONTRACTOR IS NOT PRESENT.
5. STOCKPILE AREAS SHALL BE DEVELOPED IN SUCH A WAY TO PREVENT SEDIMENT TRANSPORT OUT OF THE STOCKPILE AREA. ALL EROSION CONTROL FEATURES SHALL BE IN PLACE PRIOR TO PLACEMENT OF ANY STOCKPILED MATERIALS.
6. CONTRACTOR WILL DOCUMENT AREAS OF VEGETATION PRIOR TO THE START OF CONSTRUCTION. IN THOSE AREAS WHERE VEGETATION IS DISTURBED, THE AREA(S) SHALL BE REVEGETATED AT THE END OF THIS WORK EFFORT. GUIDELINES FOR REVEGETATION ARE LOCATED IN SPECIFICATION SECTION 02920.



TYPICAL WATTLE INSTALLATION GUIDE

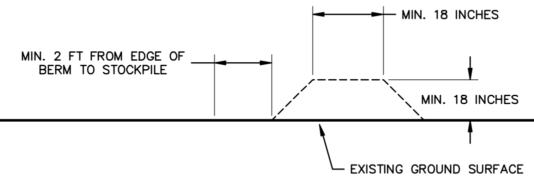
ENTRENCHMENT DETAIL

TYPICAL WATTLE SPACING BASED ON SLOPE GRADIENT

1. BEGIN AT THE LOCATION WHERE THE WATTLE IS TO BE INSTALLED BY EXCAVATING A 2-3" (5-7.5CM) DEEP X 9" (22.9 CM) WIDE TRENCH ALONG THE CONTOUR OF THE SLOPE.
2. PLACE THE WATTLE IN THE TRENCH SO THAT IT CONTOURS TO THE SOIL SURFACE. COMPACT SOIL FROM THE EXCAVATED TRENCH AGAINST THE WATTLE ON THE UPHILL SIDE. ADJACENT WATTLES SHOULD TIGHTLY ABUT.
3. SECURE THE WATTLE WITH 18"-24" (45.7-61 CM) STAKES EVERY 2-3' AND WITH A STAKE ON EACH END. STAKES SHOULD BE DRIVEN THROUGH THE MIDDLE OF THE WATTLE LEAVING AT LEAST 2-3" (5-7.5 CM) OF STAKE EXTENDING ABOVE THE WATTLE. STAKES SHOULD BE DRIVEN PERPENDICULAR TO SLOPE FACE.
4. IF BEDROCK IS TOO SHALLOW TO ALLOW WATTLE INSTALLATION, A PERIMETER BERM, AS SHOWN IN DETAIL 2 BELOW, IS AN ACCEPTABLE ALTERNATIVE.

1/2 2 STRAW WATTLE INSTALLATION GUIDE

NTS



1. IF BEDROCK IS TOO SHALLOW TO ALLOW WATTLE INSTALLATION, A PERIMETER BERM IS AN ACCEPTABLE ALTERNATIVE.

2/2 2 BERM EROSION CONTROL ALTERNATIVE

NTS

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY PROJECT A/E	APPROVAL

No. 9502333-2202
JOHN B. MANEE

J. B. Manee

Digitally signed by JOHN MANEE (Affiliate)
DN: c=US, o=U.S. Government, ou=Department of Energy, 0.9.2342.19200300.100.1.1=89001003555678, cn=JOHN MANEE (Affiliate)
Date: 2019.04.24 11:32:25 -06'00'

PROJECT LOCATION
MEXICAN HAT, UTAH,
DISPOSAL SITE

REFERENCE
SURVEYS BY: Souder Miller & Associates, Inc.

TERRESTRIAL LIDAR - SEPT. 2018
AERIAL LIDAR - MAY 2018

APPROVALS	
DRAWN BY C. MUELLER	04/24/19
ENGINEER C. MUELLER	04/24/19
PROJECT ENGINEER J. MANEE	04/24/19
ENGINEERING MANAGER D. BRENNECKE	04/24/19
PROJECT LEAD M. BUTHERUS	04/24/19
SITE MANAGER/LEAD K. LOTT	04/24/19

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE-LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

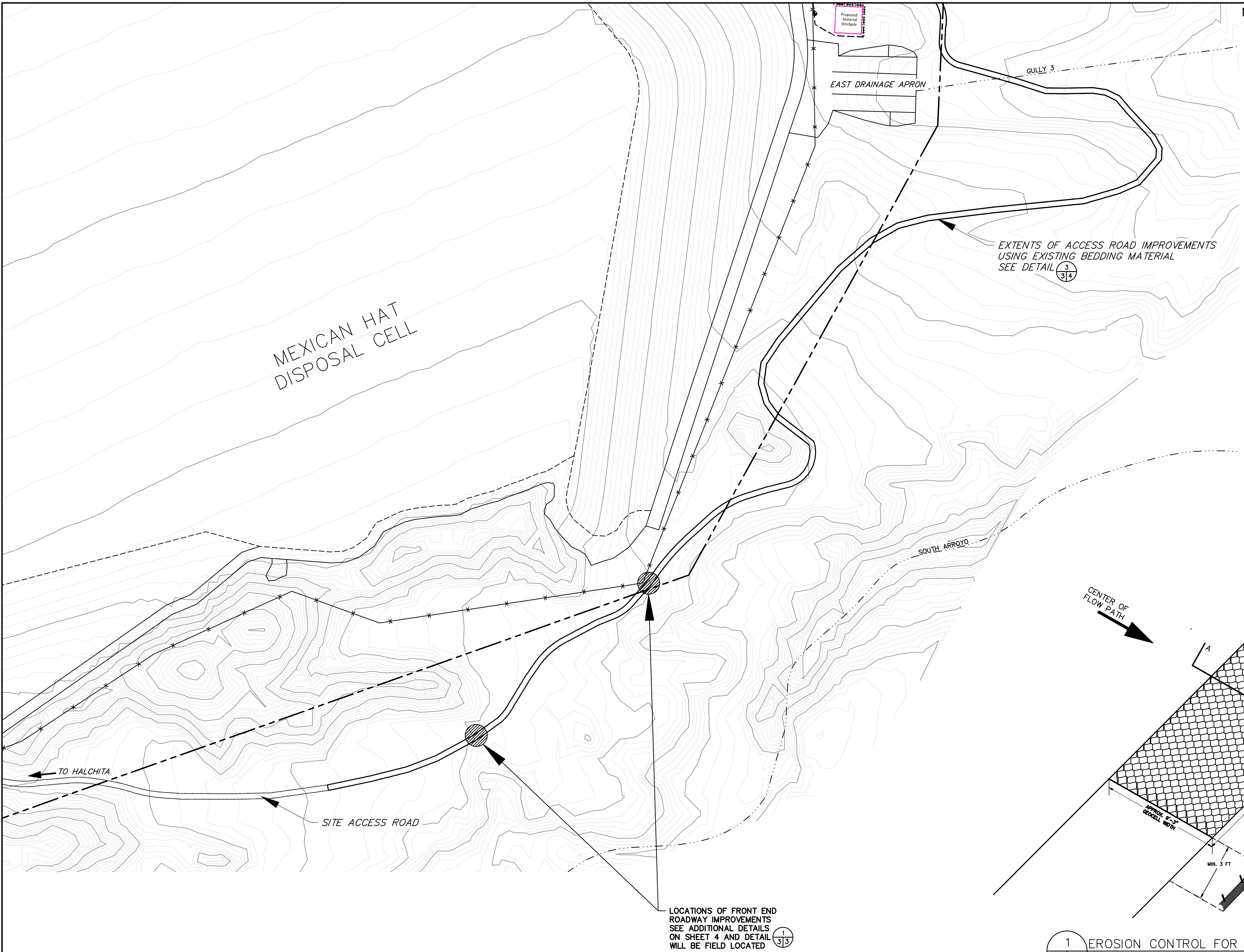
MEXICAN HAT NE SIDE SLOPE
INTERIM COVER PROTECTION

PROJECT SITE PLAN

PROJECT NO. LTS-111-0014-16-000
DRAWING NO. S23411-RAB-C01-D
SHT. 2 OF 6

NOTES:

1. FRONT END ROAD IMPROVEMENTS SHALL BE PERFORMED PRIOR TO THE BEGINNING OF WORK ON THE DISPOSAL CELL COVER.
2. PRIOR TO START OF WORK, EROSION AND SEDIMENTATION CONTROLS SHOULD BE INSTALLED AS SHOWN ON THIS DRAWING AT A MINIMUM. IT MAY BE NECESSARY TO ADD EROSION CONTROL FEATURES IN AREAS NOT SHOWN ON THIS PLAN SHEET.
3. EXCAVATED SOIL SHALL BE PLACED IN A TEMPORARY STOCKPILE TO BE INCORPORATED WITH SUPPLEMENTAL RADON BARRIER MATERIAL.
4. PLACEMENT OF GEOCELL FEATURES SHALL BE CENTERED ON THE AREA OF DEGRADATION IN THE ROADWAY



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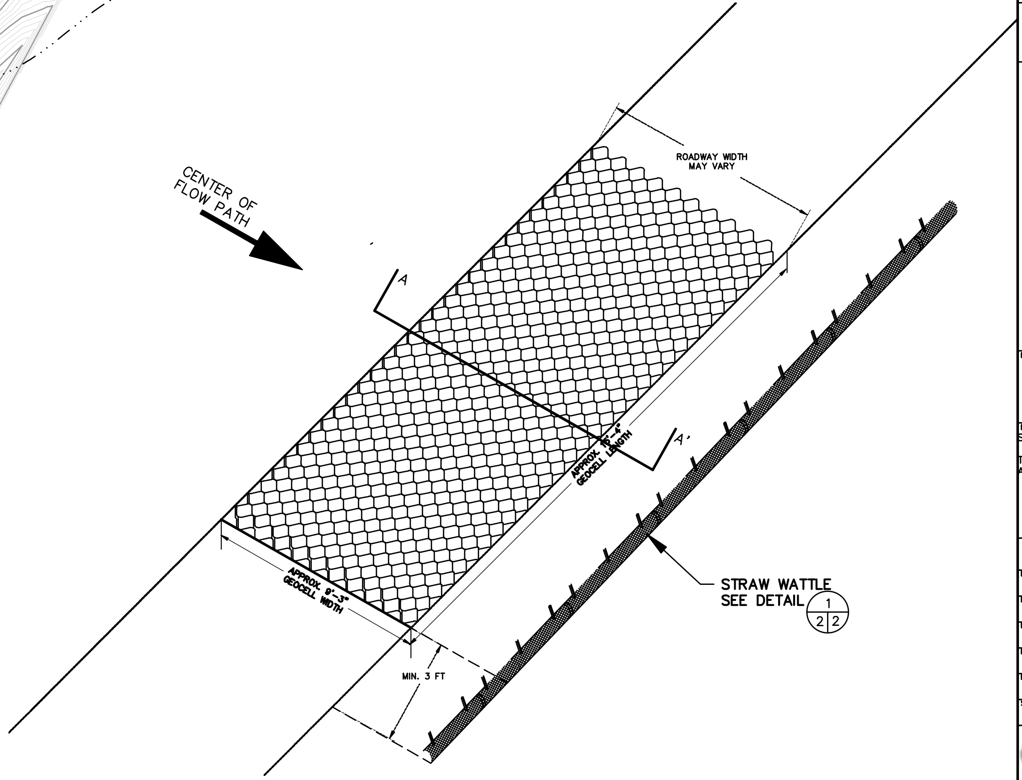
ROADWAY WORK PLAN



1/3|3 EROSION CONTROL FOR FRONT END ROADWAY IMPROVEMENTS

NTS

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No. 9582333-2202
JOHN B. MANEE
STATE OF UTAH

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Date: 2019.04.24 11:32:58 -06'00'

PROJECT LOCATION
MEXICAN HAT, UTAH, DISPOSAL SITE

REFERENCE
SURVEYS BY: Souder Miller & Associates, Inc.
TERRESTRIAL LIDAR – SEPT. 2018
AERIAL LIDAR – MAY 2018

APPROVALS

DRAWN BY C. MUELLER	04/24/19
ENGINEER C. MUELLER	04/24/19
PROJECT ENGINEER J. MANEE	04/24/19
ENGINEERING MANAGER D. BRENNECKE	04/24/19
PROJECT LEAD M. BUTHERUS	04/24/19
SITE MANAGER/LEAD K. LOTT	04/24/19

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE-LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

MEXICAN HAT NE SIDE SLOPE INTERIM COVER PROTECTION

LOCAL AREA ROAD IMPROVEMENTS

PROJECT NO. LTS-111-0014-16-000
DRAWING NO. S23412-RAB-C02-D
SHT. 3 OF 6

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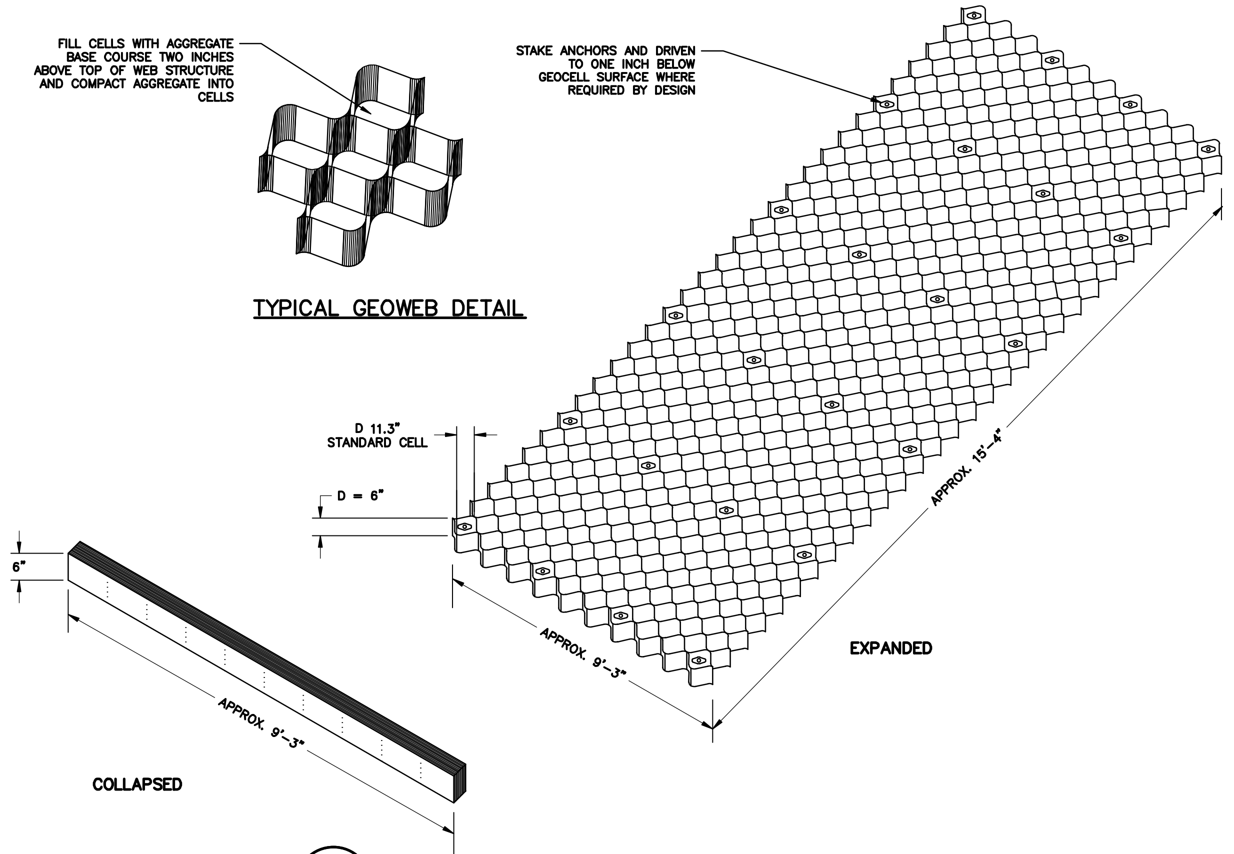
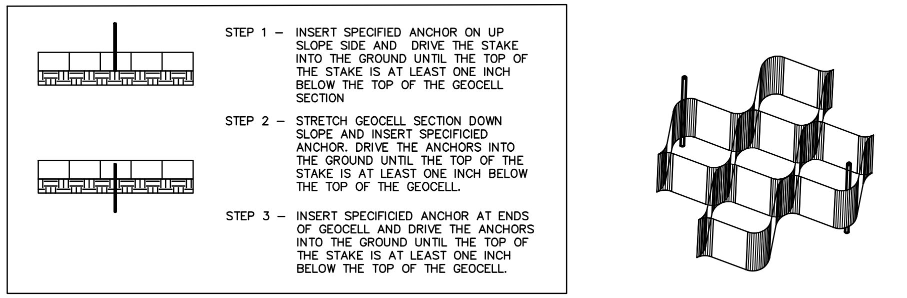


1 STANDARD GEOCELL SECTION DIMENSIONS
3 | 4 NTS



STEP 1 – INSERT SPECIFIED ANCHOR ON UP SLOPE SIDE AND DRIVE THE STAKE INTO THE GROUND UNTIL THE TOP OF THE STAKE IS AT LEAST ONE INCH BELOW THE TOP OF THE GEOCELL SECTION

STEP 2 – STRETCH GEOCELL SECTION DOWN SLOPE AND INSERT SPECIFICIED ANCHOR. DRIVE THE ANCHORS INTO THE GROUND UNTIL THE TOP OF THE STAKE IS AT LEAST ONE INCH BELOW THE TOP OF THE GEOCELL.

STEP 3 – INSERT SPECIFICIED ANCHOR AT ENDS OF GEOCELL AND DRIVE THE ANCHORS INTO THE GROUND UNTIL THE TOP OF THE STAKE IS AT LEAST ONE INCH BELOW THE TOP OF THE GEOCELL.

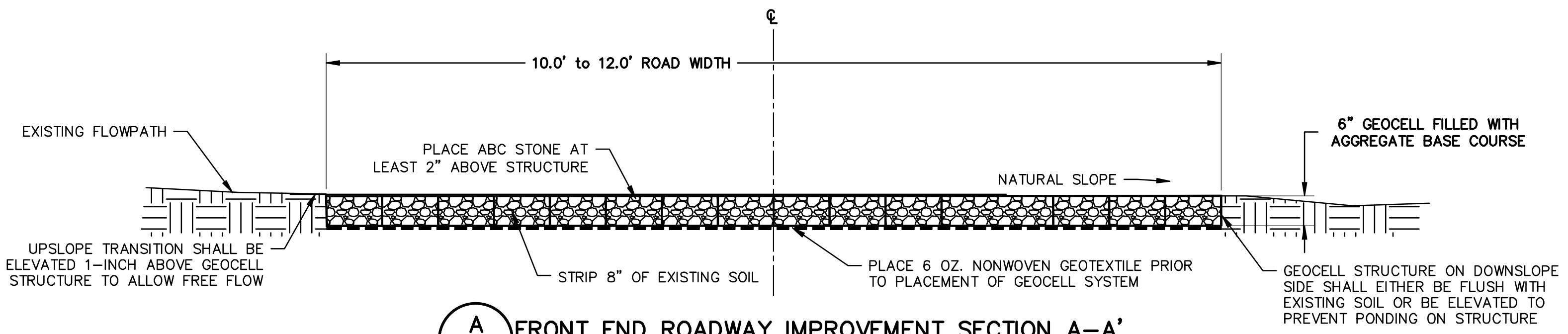
STAKE ANCHOR INSTALLATION

TYPICAL ANCHOR DETAIL

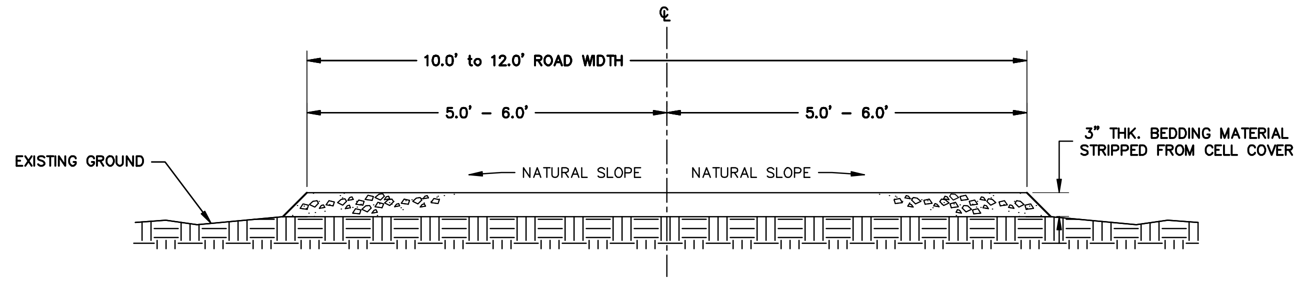
2 GEOCELL ANCHOR DETAILS
3 | 4 NTS

NOTES:

1. FRONT END ROAD IMPROVEMENTS
   - 1.1. SUBGRADE
     - 1.1.1. EXCAVATED SUBGRADE MATERIAL SHALL BE HAULED TO THE STOCKPILE AREA ADJACENT TO THE CELL COVER WORK AREA FOR MIXING INTO SUPPLEMENTAL RADON BARRIER MATERIAL
   - 1.2. GEOCELL
     - 1.2.1. SHALL BE ANCHORED TO THE SUBGRADE THROUGH THE GEOTEXTILE PLACED BETWEEN THE GEOCELL STRUCTURE AND BOTTOM OF THE EXCAVATION.
     - 1.2.2. ANCHORS SHALL BE #4 REBAR AT LEAST 12 INCHES IN LENGTH.
     - 1.2.3. ANCHORS SHALL BE PLACED TO PREVENT ANY SAGGING OR COMPRESSION OF THE GEOCELL STRUCTURE. A MINIMUM OF ONE ANCHOR FOR EVERY 8 CELLS LONGITUDINALLY WITH A MINIMUM OF 4 ANCHORS PER ROW.
   - 1.3. AGGREGATE BASE COURSE
     - 1.3.1. SHALL BE PLACED DIRECTLY ADJACENT TO THE GEOCELL AREA ON THE ROADWAY AND THEN BE PLACED USING A SMALL TRACKED VEHICLE.
     - 1.3.2. SHALL BE COMPACTED USING THE WEIGHT OF THE TRACKED VEHICLE SO THAT VERTICAL MOVEMENT OF THE AGGREGATE IS MINIMIZED.
2. ACCESS ROADWAY SURFACE IMPROVEMENTS
   - 2.1. BEDDING MATERIAL
     - 2.1.1. CAN BE EITHER HAULED AND PLACED DIRECTLY ONTO THE ROADWAY FROM THE CELL COVER OR TEMPORARILY STOCKPILED.
     - 2.1.2. IF MATERIAL IS TO BE TEMPORARILY STOCKPILED, PROPER EROSION AND SEDIMENTATION CONTROL SHALL BE PLACED IN PROPOSED STOCKPILE AREA PRIOR TO PLACEMENT OF ANY MATERIAL.



A FRONT END ROADWAY IMPROVEMENT SECTION A–A'
3 | 4 NTS



3 BEDDING MATERIAL REUSE FOR ACCESS ROADWAY SURFACE IMPROVEMENTS
3 | 4 NTS

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY PROJECT A/E	APPROVAL

No. 9582333-2202
JOHN B. MANEE
STATE OF UTAH

J. B. Manee

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Date: 2019.04.24 11:33:31 -06'00'

PROJECT LOCATION
MEXICAN HAT, UTAH, DISPOSAL SITE

REFERENCE
SURVEYS BY: Souder Miller & Associates, Inc.

TERRESTRIAL LIDAR – SEPT. 2018
AERIAL LIDAR – MAY 2018

APPROVALS

DRAWN BY C. MUELLER	04/24/19
ENGINEER C. MUELLER	04/24/19
PROJECT ENGINEER J. MANEE	04/24/19
ENGINEERING MANAGER D. BRENNECKE	04/24/19
PROJECT LEAD M. BUTHERUS	04/24/19
SITE MANAGER/LEAD K. LOTT	04/24/19

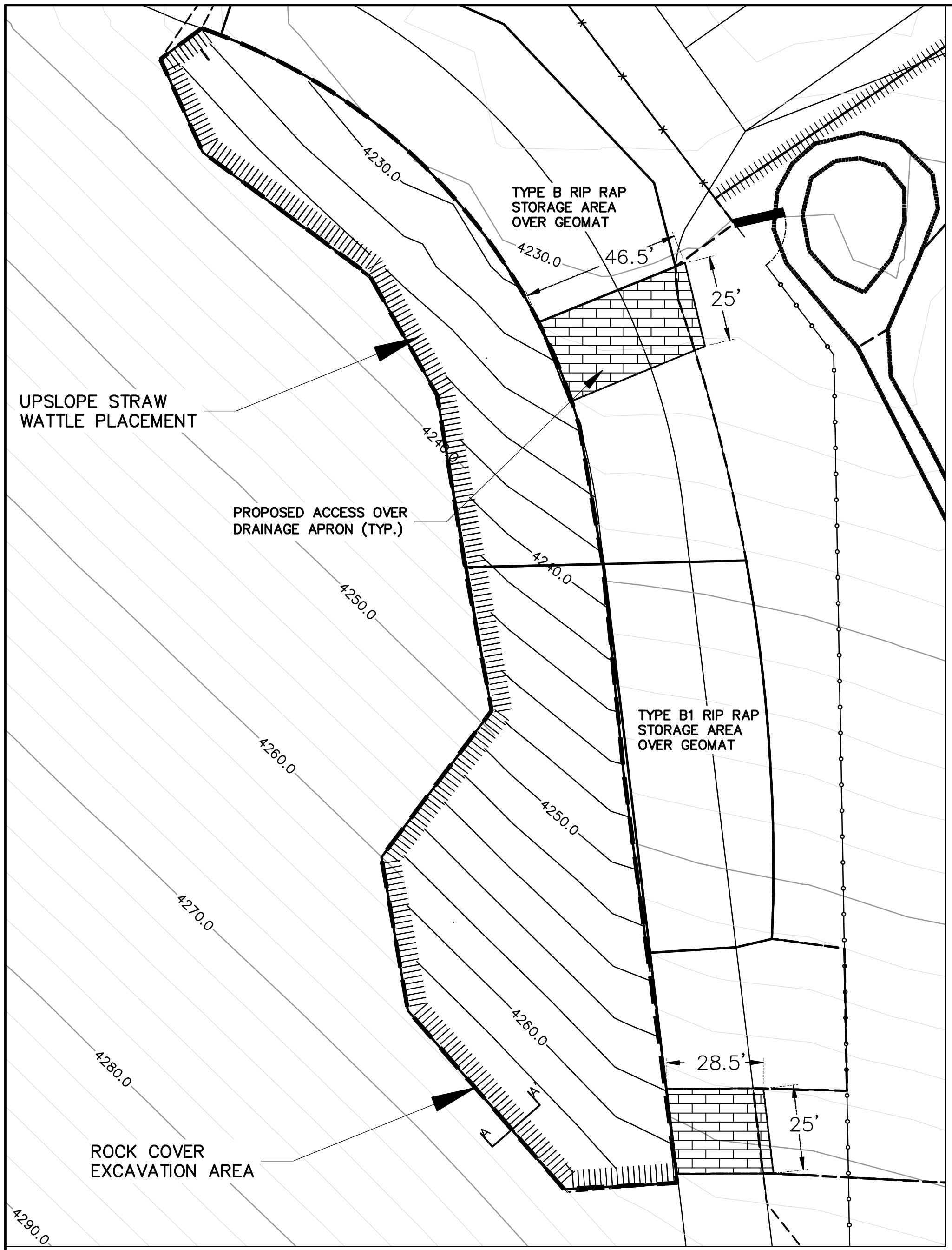
U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE–LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

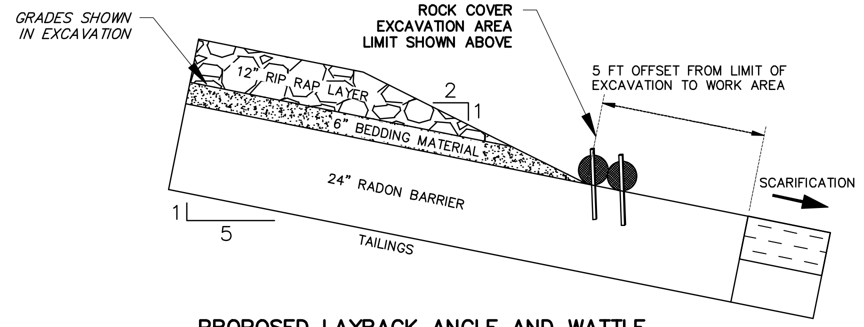
MEXICAN HAT NE SIDE SLOPE INTERIM COVER PROTECTION

ROADWAY SECTIONS AND DETAILS

PROJECT NO. LTS–111–0014–16–000
DRAWING NO. S23413–RAB–C03–D
SHT. 4 OF 6

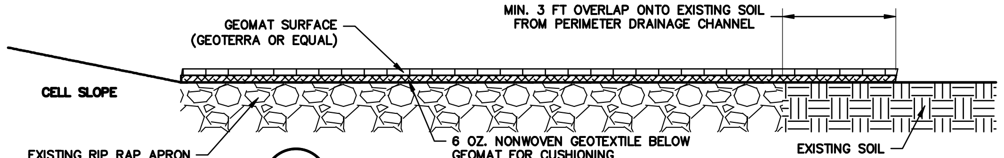


ANTICIPATED TOP OF BEDDING LAYER



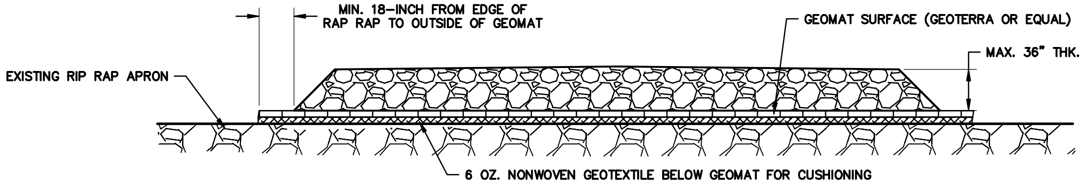
A/5 PROPOSED LAYBACK ANGLE AND WATTLE PLACEMENT FOR BEDDING MATERIAL

NTS



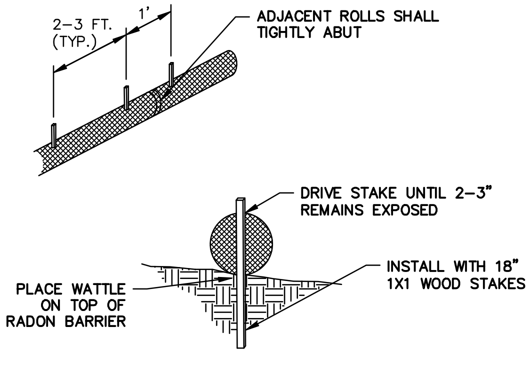
2/5 SITE ACCESS OVER APRON USING GEOMAT

NTS



3/5 RIP RAP STORAGE OVER APRON USING GEOMAT

NTS



4/5 STRAW WATTLE PLACEMENT DETAILS FOR EXCAVATION PROTECTION ON RADON BARRIER

NTS

NOTES:

1. SURVEYING
   - 1.1. ELEVATIONS SHOWN ARE ANTICIPATED ELEVATIONS BASED UPON SURFACE AND AERIAL LIDAR SURVEYS PERFORMED ON THE DISPOSAL CELL COVER AS PART OF LONG-TERM MONITORING. ACTUAL ELEVATIONS MAY VARY.
2. EQUIPMENT LIMITATIONS
   - 2.1. CONSTRUCTION EQUIPMENT SHALL LIMIT OPERATION OVER THE EXPOSED RIP RAP COVER TO THE LARGEST DEGREE POSSIBLE.
   - 2.2. TRACKED CONSTRUCTION EQUIPMENT SHALL UTILIZE RUBBER TRACKS. ONLY RUBBER TRACKED EQUIPMENT IS PERMITTED TO TRAVEL OVER EXPOSED RIP RAP.
   - 2.3. EFFORT SHALL BE MADE TO CONTROL VEHICLE AND EQUIPMENT TRAVEL DIRECTION ON THE CELL SLOPE TO PREVENT OVERTURNING.
   - 2.4. EQUIPMENT USED TO EXCAVATE THE RIP RAP MATERIAL SHALL LIMIT THE AMOUNT OF DAMAGE TO RIP RAP MATERIAL TO THE EXTENT REASONABLY POSSIBLE.
   - 2.5. EQUIPMENT SHOULD BE SELECTED TO EFFICIENTLY EXCAVATE THE BEDDING MATERIAL AGGREGATE WITHOUT DISTURBING THE UNDERLYING RADON BARRIER MATERIAL.
3. GEOMAT:
   - 3.1. PLACEMENT OF GEOMAT OVER DRAINAGE APRON SHALL OCCUR PRIOR TO PLACING ANY PIECE OF EQUIPMENT ON THE DISPOSAL CELL COVER.
   - 3.2. GEOMAT MATERIAL SHALL BE PLACED IN ACCORDANCE WITH THE INSTALLATION GUIDE PROVIDED BY THE MANUFACTURER.
   - 3.3. GEOMAT MATERIAL SHALL BE REMOVED AND STOCKPILED ONCE ALL WORK HAS BEEN COMPLETED ON THE DISPOSAL CELL COVER. THE STOCKPILES SHALL BE ELEVATED ON TOP OF PALLETS AND COVERED WITH WHITE PLASTIC SHEETING. THE SHEETING SHALL BE ANCHORED TO THE GROUND USING SANDBAGS.
4. EXCAVATION
   - 4.1. REMOVED RIP RAP SHALL BE SEPARATED BY SIZE. THE MIXING OF THE TWO SIZES OF RIP RAP IS NOT ALLOWED.
   - 4.2. RIP RAP SHALL BE MOVED INTO THE TEMPORARY LAYDOWN AREAS ONCE THEY HAVE BEEN COVERED WITH GEOMAT.
   - 4.3. EFFORT SHALL BE MADE TO LIMIT THE EXCAVATION OF THE UNDERLYING BEDDING MATERIAL DURING THE REMOVAL OF THE RIP RAP FROM THE COVER CROSS-SECTION.
   - 4.4. THE ONSITE RADIATION SCREENING TECHNICIAN WILL SCREEN ALL BEDDING MATERIAL PRIOR TO BEING REMOVED FROM THE CELL COVER.
   - 4.5. BEDDING MATERIAL IS TO BE EXCAVATED FROM THE EXPOSED CELL COVER SURFACE WITHOUT THE EXCAVATION OF THE UNDERLYING RADON BARRIER MATERIAL.
   - 4.6. SOME HAND EXCAVATION OF BEDDING MATERIAL FROM EROSION OR OTHER DEPRESSION FEATURES IN THE RADON BARRIER WILL BE NECESSARY.
   - 4.7. ADDITIONAL EXCAVATION, BEYOND THE DEFINED LIMITS OF COVER REMOVAL, MAY BE REQUIRED TO FULLY ADDRESS EROSION AND OTHER DEPRESSION FEATURES NOT SHOWN ON THESE PLANS. THE DEGREE TO WHICH SUBCONTRACTOR IS TO OVER EXCAVATE OUTSIDE OF THE PROPOSED WORK AREA WILL BE DETERMINED BY THE CONTRACTOR'S CONSTRUCTION SITE SUPERVISOR.
   - 4.8. THE BEDDING MATERIAL SHALL BE REUSED FOR ACCESS ROADWAY IMPROVEMENTS OVER APPROVED ROAD AREAS.
   - 4.9. SUBCONTRACTOR CAN PLACE BEDDING MATERIAL INTO A TEMPORARY STOCKPILE PRIOR TO FINAL PLACEMENT ON THE APPROVED ROAD AREAS.
   - 4.10. IF USED, TEMPORARY STOCKPILE SHALL MEET EROSION AND SEDIMENTATION CONTROL REQUIREMENTS FOUND IN THESE PLANS.
5. PERIMETER EROSION AND STORMWATER CONTROL
   - 5.1. STRAW WATTLE SHALL BE PLACED AROUND THE PERIMETER OF THE EXCAVATION TO PREVENT, TO THE DEGREE POSSIBLE, EROSION AND SEDIMENT TRANSPORT OF THE RADON BARRIER SURFACE AND TO HELP LIMIT MOVEMENT OF SURROUNDING ROCK COVER MATERIAL.
   - 5.2. STRAW WATTLES SHOULD REMAIN IN-PLACE UNTIL NEW BEDDING MATERIAL IS BEING PLACED AT THEIR LOCATION.
   - 5.3. STRAW WATTLE STAKE HOLES SHALL BE BACKFILLED WITH BENTONITE MATERIAL AND HYDRATED. THIS SHALL BE PERFORMED IN SUCH A MANNER THAT BENTONITE EXPANSION FILLS THE HOLES WITHOUT EXCESSIVE INTERMINGLING WITH THE BEDDING MATERIAL PLACED ABOVE.
6. WORK HOLD:
   - 6.1. A WORK HOLD WILL BE REQUIRED ONCE THE FULL EXTENT OF THE RADON BARRIER HAS BEEN EXPOSED. THIS HOLD WILL BE FOR NO MORE THAN TWO WORKING DAYS FOR THE INSPECTION OF THE EXPOSED RADON BARRIER MATERIAL BY CONTRACTOR PERSONNEL, RADIATION SCREENING BY THE ON-SITE RADIATION TECHNICIAN, EXCAVATION EXTENT AND SURFACE TOPOGRAPHIC SURVEYING OF THE RADON BARRIER, AND DETERMINATION OF THE VOLUME OF MATERIAL REQUIRED TO RESTORE THE RADON BARRIER TO ITS DESIGN THICKNESS.
7. NEW BEDDING MATERIAL PLACEMENT
   - 7.1. BEDDING MATERIAL SHALL BE PLACED FROM THE BOTTOM TO TOP OF SLOPES IN A FASHION THAT PREVENTS THE FINES CONTENT FROM BEING UNEQUALLY DISTRIBUTED OVER THE SLOPE.
   - 7.2. THICKNESS CONFIRMATION FOR THE 6-INCH THICK BEDDING MATERIAL LAYER SHALL BE CONDUCTED BOTH BY SURVEY FROM THE FINAL GRADE OF COMPLETED RADON BARRIER WORK AND BY HAND VERIFICATION.
8. RIP RAP REPLACEMENT
   - 8.1. UPON COMPLETION OF THE RADON AND BEDDING MATERIAL WORK, THE RIP RAP SHALL BE MOVED BACK INTO PLACE ON THE CELL COVER.
   - 8.2. RIP RAP SHALL BE PLACED IN A SINGLE LIFT FROM DOWN-GRADIENT TO UP-GRADIENT ON THE SLOPE.
   - 8.3. RIP RAP TYPES SHALL BE PLACED IN THE SAME AREAS THEY WERE REMOVED FROM AND SHALL NOT BE MIXED.
   - 8.4. EQUIPMENT SHALL BE SELECTED TO PREVENT DAMAGE OF THE RIP RAP DURING PLACEMENT.

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ROCK COVER REMOVAL AND PLACEMENT PLAN

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REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL

No. 9502333-2202
JOHN B. MANEE

Digitally signed by JOHN MANEE (Affiliate)
DN: c=US, o=U.S. Government, ou=Department of Energy, 0.9.2342.19200300.100.1.1=89001003555678, cn=JOHN MANEE (Affiliate)
Date: 2019.04.24 11:34:22 -06'00'

PROJECT LOCATION
MEXICAN HAT, UTAH, DISPOSAL SITE

REFERENCE
SURVEYS BY: Souder Miller & Associates, Inc.
TERRESTRIAL LIDAR – SEPT. 2018
AERIAL LIDAR – MAY 2018

APPROVALS

DRAWN BY C. MUELLER	04/24/19
ENGINEER C. MUELLER	04/24/19
PROJECT ENGINEER J. MANEE	04/24/19
ENGINEERING MANAGER D. BRENNECKE	04/24/19
PROJECT LEAD M. BUTHERUS	04/24/19
SITE MANAGER/LEAD K. LOTT	04/24/19

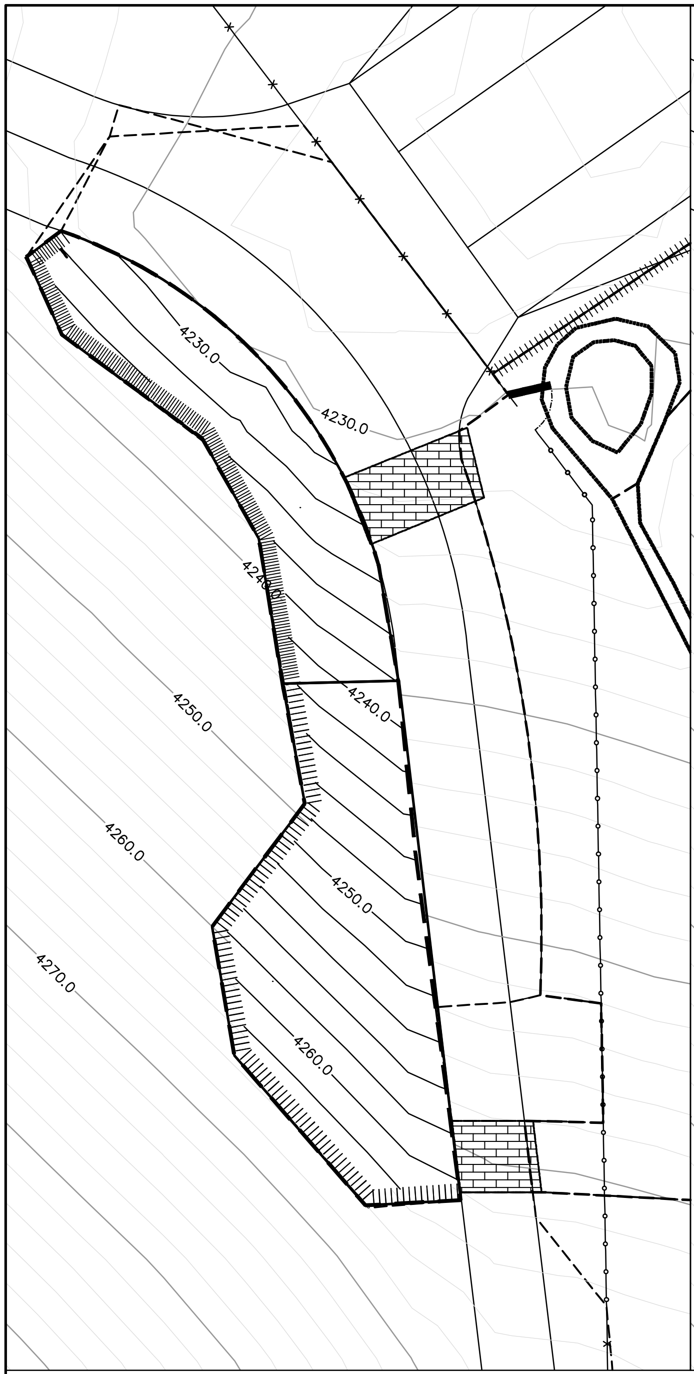
U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under
DOE Contract No. DE-LM0000421
Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

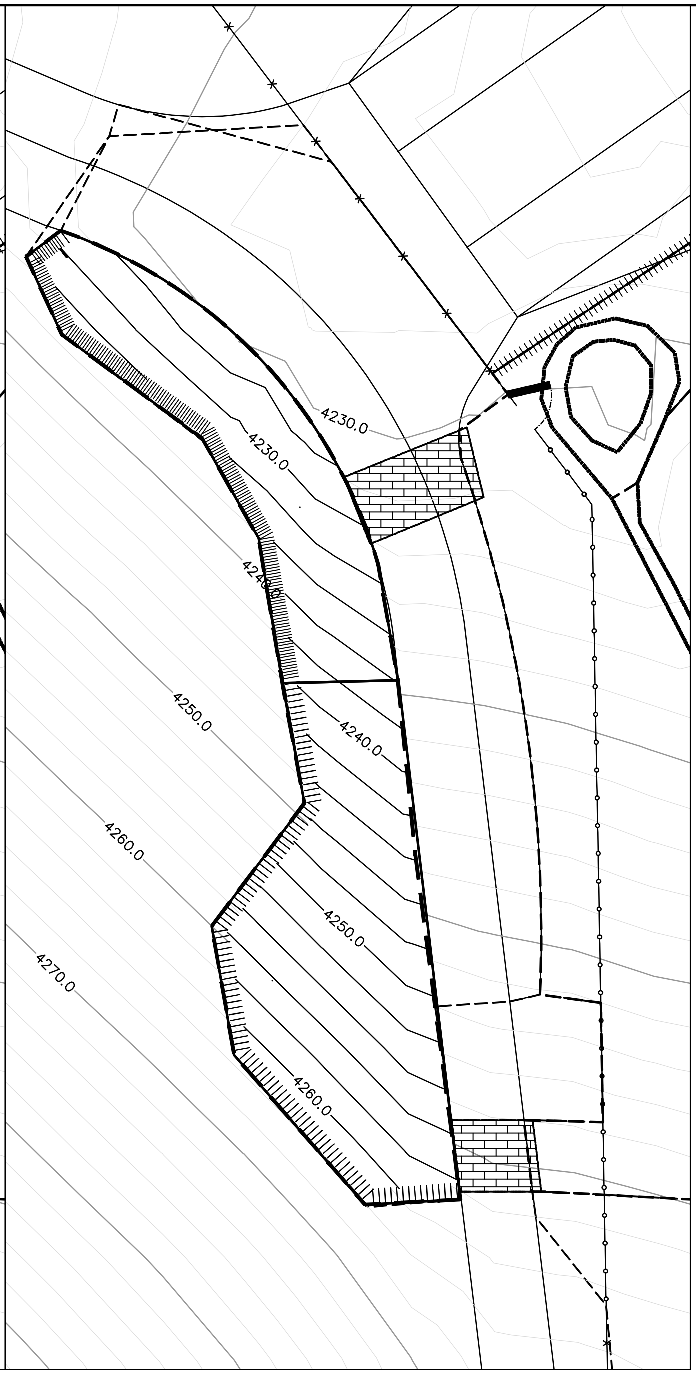
MEXICAN HAT NE SIDE SLOPE INTERIM COVER PROTECTION

ROCK COVER REMOVAL AND PLACEMENT PLANS AND DETAILS

PROJECT NO. LTS-111-0014-16-000
DRAWING NO. S23415-RAB-C04-D
SHT. 5 OF 6



ANTICIPATED TOP OF RADON BARRIER



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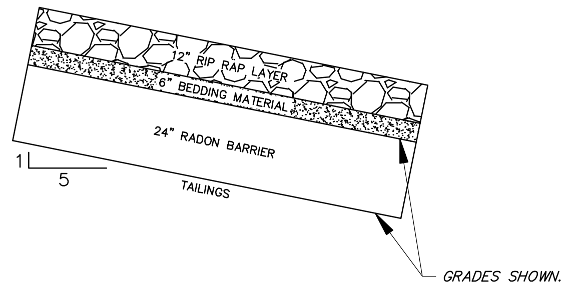

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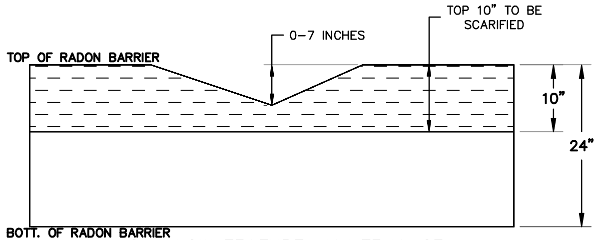
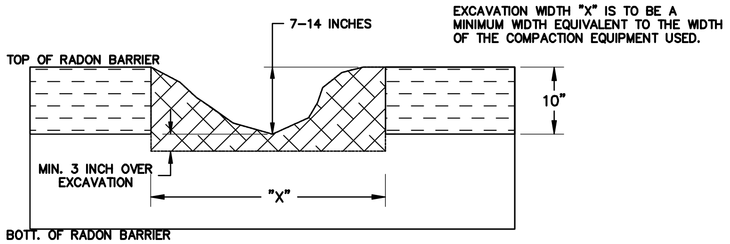
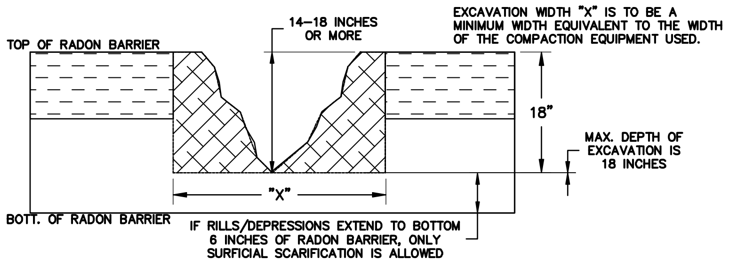


SHALLOW FEATURE MAINTENANCE

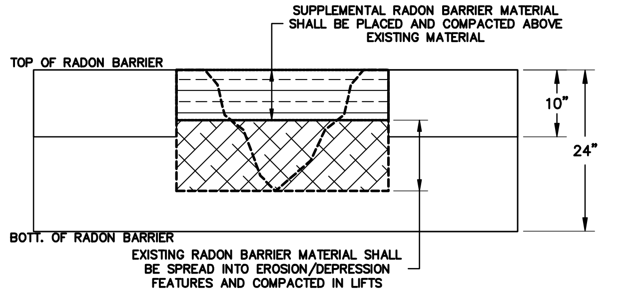


INTERMEDIATE FEATURE MAINTENANCE

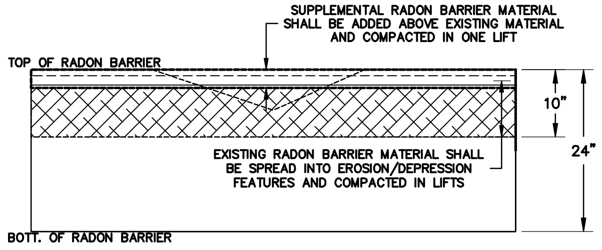


DEEP FEATURE MAINTENANCE

1 / 6 | 6 RADON BARRIER EROSION EXCAVATION AND SCARIFICATION DETAILS (BASED ON DEPTH)



2 / 6 | 6 INTERMEDIATE/DEEP EROSION FEATURE MAINTENANCE DETAIL
NTS



3 / 6 | 6 SHALLOW EROSION FEATURE MAINTENANCE DETAIL
NTS

RADON BARRIER RESTORATION PLAN

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NOTES:

1. WORK HOLD:
   - 1.1. A WORK HOLD SHALL BE REQUIRED ONCE THE FULL EXTENT OF THE RADON BARRIER HAS BEEN EXPOSED. THIS HOLD WILL BE FOR NO MORE THAN TWO WORKING DAYS FOR THE INSPECTION OF THE EXPOSED RADON BARRIER MATERIAL BY CONTRACTOR PERSONNEL, RADIATION SCREENING BY THE ONSITE RADIATION TECHNICIAN, EXCAVATION EXTENT AND SURFACE TOPOGRAPHIC SURVEYING OF THE RADON BARRIER, AND DETERMINATION OF THE VOLUME OF MATERIAL REQUIRED TO RESTORE THE RADON BARRIER TO ITS DESIGN THICKNESS.
   - 1.2. DEPRESSION AND RILL FEATURES SHALL BE MEASURED BY HAND TO DETERMINE THE VOLUME OF MATERIAL REQUIRED TO REFILL AREAS WHERE THERE WAS MATERIAL LOSS.
   - 1.3. WORK SHALL RESUME ONCE CONTRACTOR AND SUBCONTRACTOR AGREE UPON QUANTITIES FOR EROSION AND DEPRESSION FEATURE REPAIR.
2. SURVEYING
   - 2.1. THE INITIAL RADON BARRIER SURVEY WILL DETERMINE THE GRADES THE RADON BARRIER SHALL BE RESTORED TO DURING THIS WORK. CONTRACTOR WILL ISSUE A GRADING SCHEME FOR FINAL CONFIRMATION.
   - 2.2. SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THEIR OWN DAILY SURVEYING AND GRADE CONTROL NEEDS..
   - 2.3. UPON COMPLETION OF THE RADON BARRIER RESTORATION, A FINAL AS-BUILT SURVEY WILL BE PERFORMED BY CONTRACTOR PERSONNEL. AT THIS TIME THE SUBCONTRACTOR WILL NEED TO LIMIT WORK ACTIVITY ON THE COVER AND PROVIDE SURFACE PROTECTION ONCE THE SURVEY IS COMPLETE.
3. EQUIPMENT LIMITATIONS
   - 3.1. COMPACTION EQUIPMENT SELECTED BY THE SUBCONTRACTOR MUST BE CAPABLE OF COMPACTING THE RADON BARRIER MATERIAL TO 100 PERCENT COMPACTION AS MEASURED BY THE MAXIMUM DRY DENSITY DETERMINED BY THE STANDARD PROCTOR (ASTM D698).
   - 3.2. COMPACTION EQUIPMENT SHALL NOT OPERATE OVER EXPOSED ROCK MATERIAL.
   - 3.3. EFFORT SHALL BE MADE TO CONTROL VEHICLE AND EQUIPMENT TRAVEL DIRECTION ON THE CELL SLOPE TO PREVENT OVERTURNING.
4. THIRD PARTY CONSTRUCTION QUALITY ASSURANCE
   - 4.1. THE SUBCONTRACTOR SHALL PROVIDE A THIRD PARTY CQA TECHNICIAN AS PART OF THE RADON BARRIER WORK EFFORT.
   - 4.2. MATERIAL AND COMPACTION TESTING SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT DRAWINGS AND SPECIFICATIONS.
   - 4.3. A FIELD PROCTOR, PERFORMED BY THE THIRD PARTY CQA, WILL BE NECESSARY TO DETERMINE AND CONFIRM THE MAXIMUM DRY DENSITY OF THE EXISTING RADON BARRIER MATERIAL.
5. EXCAVATION AND SCARIFICATION
   - 5.1. RILL AND DEPRESSION FEATURES SHALL BE OVER EXCAVATED IN ACCORDANCE WITH THE DETAILS SHOWN ON THIS PLAN SHEET.
   - 5.2. THE EXPOSED RADON BARRIER WORK SURFACE SHALL BE SCARIFIED UP TO A DEPTH OF 12 INCHES FROM THE EXPOSED SURFACE.
   - 5.3. ONLY SURFACE SCARIFICATION SHALL BE PERFORMED WITH HAND TOOLS ON RADON BARRIER MATERIAL AT A DEPTH OF 18 INCHES BELOW THE TOP OF THE RADON BARRIER.
6. COMPACTION
   - 6.1. ONCE SCARIFIED, MATERIAL SHALL BE HANDLED IN SUCH A MANNER THAT COMPACTION OF THE RADON BARRIER OCCURS WITH A MAXIMUM LOOSE LIFT THICKNESS OF 10 INCHES THROUGHOUT THE WORK EFFORT.
   - 6.2. MOISTURE CONDITIONING OF EXISTING AND SUPPLEMENTAL MATERIAL MAY BE NECESSARY AND IS THE RESPONSIBILITY OF THE SUBCONTRACTOR.
   - 6.3. EXISTING RADON BARRIER MATERIAL SHALL BE USED FOR FILLING OF EROSION AND DEPRESSION FEATURES ONCE ADEQUATE SCARIFICATION, OVER EXCAVATION, AND MOISTURE CONDITIONING HAS OCCURRED.
   - 6.4. SUPPLEMENTAL RADON BARRIER MATERIAL SHALL BE PLACED AFTER EXISTING RADON BARRIER MATERIAL HAS BEEN FULLY COMPACTED.
   - 6.5. A PROTECTIVE COVER SHALL BE READILY AVAILABLE TO HELP PROTECT THE EXPOSED RADON BARRIER FROM EROSION AND MOISTURE INUNDATION DURING PRECIPITATION EVENTS WHILE THE RADON BARRIER SURFACE IS EXPOSED.

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E APPROVAL

No. 9582333-2202
JOHN B. MANEE

Digitally signed by JOHN MANEE (Affiliate)
DN: c=US, o=U.S. Government, ou=Department of Energy, 0.9.2342.19200300.100.1.1=89001003555678, cn=JOHN MANEE (Affiliate)
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RADON BARRIER RESTORATION PLANS AND DETAILS

PROJECT NO. LTS–111–0014–16–000
DRAWING NO. S23416–RAB–C05–D
SHT. 6 OF 6

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