

# Jackson Harbor Breakwater Project Manual

Jackson Park Outer Harbor, Chicago, IL 60649

Westrec

Project Number: 60283337

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## Section 00800 – Supplementary Conditions

### PART 1 - COORDINATION WITH SITE OPERATORS

- 1.1 All construction activities must be coordinated with other site activities as directed by the Owner and Engineer. The contractor shall coordinate with the Engineer regarding site access and work limits

### PART 2 - PERMITS, FEES, AND NOTICES

- 2.1 The Contractor expressly acknowledges and agrees that the Engineer has been required to obtain various regulatory and other permits in conjunction with the construction and operation of the Project. The Contractor expressly covenants and agrees to comply (and cause all Subcontractors and all other persons or entities conducting any work on the Project to comply) with such permits. The Contractor shall perform all work hereunder, and supervise the work of all Subcontractors and all others providing services or goods in connection with the Project in conformance with the Terms and Conditions of any required permits. Work shall not be initiated until all permits have been issued

### PART 3 - OWNER'S RIGHTS TO PERFORM WORK AND AWARD SEPARATE CONTRACTS

- 3.1 The Contractor expressly acknowledges and agrees that Owner shall have the right to perform work with his own employees or agents or with any separate Contractor in the event that the Contractor is in default. In the event that Owner exercises its rights under this section, it shall adjust the amounts paid to the Contractor to compensate the Contractor for the work done, and the Contractor shall be obligated to assist Owner (or the separate Contractor as applicable) in the transition of all work from the Contractor to Owner or such separate Contractor.

### PART 4 - QUALITY ASSURANCE/ QUALITY CONTROL

- 4.1 The Contractor expressly acknowledges and agrees that the Owner intends to conduct a Quality Assurance and Quality Control Program pursuant to which, among other things, the Owner shall conduct construction monitoring of the work, tests of the materials and other such procedures as it shall deem necessary or advisable. The Contractor expressly covenants and agrees to assist Owner in implementing this quality assurance/quality control program as requested by Owner, provided however, that nothing in this Section shall relieve the Contractor of its responsibility for the quality of the work. Owner may do its own independent testing if there is a dispute with the Contractor over quality assurance. However, Owner is not required to do so in order to assist the Contractor in its Quality Assurance Program.

### PART 5 - COMPETENT PERSON

- 5.1 The Contractor shall delegate a competent person as required to satisfy OSHA requirements.

END OF SECTION

## Section 01019 – Contract Considerations

### PART 1 - GENERAL

#### 1.1 SECTION INCLUSIONS:

- A. Contract Drawings and Specifications
- B. Contractor's Materials, Equipment and Workmanship
- C. Payments
- D. Preliminary and Final Field Tests
- E. Record Drawings

### PART 2 - PRODUCTS

Not Used

### PART 3 - EXECUTION

#### 3.1 Contract Drawings and Specifications

- A. The Work to be done is shown in a set of Contract Documents which bears the general title:

Jackson Harbor Breakwater Project  
Jackson Harbor, Chicago, IL

- B. After the Contract has been executed the Contractor will be furnished with five (5) sets of paper prints of both the Contract Drawings and Reference Drawings, and five (5) sets of Specifications.

If the Contractor requires additional copies of Contract Drawings, Reference Drawings and Specifications, he will be charged for the reproduction cost of those additional copies.

- C. Supplementary Drawings: When the Engineer decides to show more fully the work to be done, or to show required changes, or to rectify errors which may have been discovered, drawings to be known as supplementary drawings and revision sheets with specifications pertaining thereto will be prepared by the Engineer and five (5) paper prints thereof will be given to the Contractor. Changes of a minor nature may be made on the Contract Drawings, in which case five (5) copies of the revised Contract Drawings will be issued to the Contractor. The supplementary drawings and revised Contract Drawings shall be as fully binding as the original Contract Drawings, and if such supplementary or revised Contract Drawings required either less or more than the estimated quantities of work, credit to the Owner or compensation therefore to the Contractor shall be subject to the terms of the AGREEMENT.
- D. Items Specified by Name: In these Specifications and Contract Drawings, there are specified by name certain materials which are believed suitable for the service required. It is the intent of these Specifications that other materials, equally as good and efficient may be used. The Contractor shall submit full details of such materials (for approval by the Engineer). Determination as to whether such materials meet with these specifications shall rest solely with the Engineer.
- E. Drawings and Specifications Explanatory of Each Other: The Contract Drawings and Specifications are intended to be explanatory of each other, but should any discrepancy

appear or any misunderstanding arise as to the import of anything contained in either, the explanation of the Engineer shall be final and binding upon the Contractor. Any correction of errors or omissions in the Contract Drawings or Specifications may be made by the Engineer when such correction is necessary for the proper fulfillment of their intent as construed by him.

- F. All work called for in the Specifications but not shown on the Contract Drawings in the present form or vice versa, and work not specified in either the Contract Drawings or in the Specifications but necessary in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
- G. The apparent silence of the Specifications as to any detail or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that the best material and workmanship are to be used. Interpretation of these Specifications shall be made on this basis.
- H. All dimensions, quantities and details shown on plans, sketches, schedules or other data received from the Engineer shall be verified and the Contractor shall notify him of all errors, omissions, conflicts and discrepancies found therein.
- I. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. Figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.
- J. The Contractor acknowledges that he has visited the Site of the Work to familiarize himself with the grounds and conditions surrounding it before enacting the Contract. He shall take all necessary measurements and data at the structures and verify such dimensions and quantities as may be given on the Contract Drawings and in the Specifications.
- K. No extra compensation will be allowed the Contractor because of his failure to inform himself fully and to include in his prices all items of labor and material to be furnished.
- L. The Contractor may, if the approval of the Engineer is obtained, modify the Contract Drawings or change the details if necessary to suit existing conditions. However, the general arrangement and essential details shall be followed to the fullest extent possible.
- M. No Advertising Signs: No Contractor shall display advertising signs on or about the Site of the Work other than those specified, without the written permission of the Engineer.

### 3.2 CONTRACTOR'S MATERIALS, EQUIPMENT, AND WORKMANSHIP

- A. Laws and Certificates: All materials, appliances and types of methods of construction shall be in accordance with the Specifications. All work done requiring approval hereunder will be accepted only after the Contractor shall have obtained all the necessary permits and shall have furnished the Engineer with all the necessary certificates of approval issued by the Official heads of the appropriate City, Department, or other public body having jurisdiction thereof.

### 3.3 PAYMENTS

- A. The Contractor is directed to Measurement, Payment, and Definition of Work Items for Package in Section 01601 of the Specifications for a description of what is included under each Bid item.

- B. Partial payment will be made to the Contractor of the estimated value of the Work done, such value being computed on the basis of the unit prices and lump sums established in the schedule of prices.

#### 3.4 RECORD DRAWINGS

- A. The Contractor shall provide an "As-Built" plan for the project. In addition, the Contractor shall provide "As-Constructed" topography to illustrate that the finished grades attained design grades.

END OF SECTION

## Section 01039 – Coordination and Meetings

### PART 1 - GENERAL

- 1.1 SECTION INCLUSIONS:
- A. Coordination
  - B. Preconstruction Conference
  - C. Progress Meetings

### PART 2 - PRODUCTS

Not Used

### PART 3 - EXECUTION

- 3.1 COORDINATION
- A. Coordinate schedules, submittals, and work of the various sections of specifications to effect efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
  - B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
  - C. Coordinate completion and clean up of work.
  - D. Correct all defective work and work not in accordance with contract documents.
- 3.2 PRECONSTRUCTION CONFERENCE
- A. Engineer will schedule a conference after Notice of Award.
  - B. Attendance Required: Owner's Representative, Engineer, and Contractor.
  - C. Agenda:
    - 1. Execution of Owner-Contractor Agreement.
    - 2. Submission of executed bonds and insurance certificates.
    - 3. Distribution of contract documents.
    - 4. Submission of list of subcontractors, list of products, Schedule of Value, and progress schedule.
    - 5. Designation of personnel representing the parties in contract.
    - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and contract close-out procedures.
    - 7. Submittal of any concerns or anticipated problems with construction activities as presented in the bid documents. Lack of submittal of concerns in writing at the

preconstruction conference signifies acceptance of the construction drawings, plans, and specifications as presented.

8. Scheduling.

3.3 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Engineer, Owner, participants, and those affected by decisions made.
- C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner's representative, Engineer, as appropriate to agenda topics for each meeting.
- D. Agenda:
  - 1. Review of work progress.
  - 2. Field observations, problems, and decisions.
  - 3. Identification of problems that may impede planned progress.
  - 4. Review of submittals, schedule and status of submittals.
  - 5. Review of off-site fabrication and delivery schedules.
  - 6. Maintenance of progress schedule.
  - 7. Corrective measures to regain projected schedules.
  - 8. Planned progress during succeeding work period.
  - 9. Coordination of projected progress.
  - 10. Maintenance of quality and work standards.
  - 11. Effect of proposed changes on progress schedule and coordination.
  - 12. Other business relating to work.

END OF SECTION



## Section 01050 – Field Engineering

### PART 1 - GENERAL

#### 1.1 SUBMITTALS

- A. On Request, submit documentation verifying acceptance and accuracy of the existing site conditions provided on the Construction Drawings.

#### 1.2 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.

#### 1.3 EXAMINATION

- A. Verify locations of survey control points prior to starting Work.
- B. Promptly notify Engineer of any discrepancies discovered.

#### 1.4 SURVEY REFERENCE POINTS

- A. Engineer will provide survey and elevation reference points on the Construction Drawings.
- B. Contractor shall establish and maintain survey control for the project.
- C. Contractor shall provide their own surveyor to accomplish construction to the lines and grades required by the Construction Documents.
- D. Control datum for survey is that established by Engineer on the Construction Drawings.

#### 1.5 SURVEY REQUIREMENTS

- A. Provide field engineering services.
- B. Utilize recognized engineering survey practices.
- C. Prepare a survey of ground elevations after excavation of poor soil and native soil areas, and before placement of sand, crushed stone, compacted fill, and rooting media.
- D. Provide a survey of ground elevations after placement of sand, crushed stone, and rooting media and completion of final grading.
- E. The Contractor shall notify the Engineer when excavation of any given area is complete, and when the placement of sand, crushed stone, and compacted fill layers are complete, so that the Engineer can perform check surveys.
- F. The Contractor shall provide an "As-Constructed" topography survey plan to illustrate the design was completed at the required finished grades illustrated in the plans.

#### 1.6 COST OF FIELD ENGINEERING

- A. The cost for Field Engineering shall be considered incidental to the other cost items and will not be paid for separately.

END OF SECTION

## Section 01300 -- Submittals

### PART 2 - GENERAL

#### 2.1 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number the transmittal forms. Resubmittals shall include the original number with an alphabetic suffix.
- C. Identify Project, Contractor, Subcontractor or Supplier: Pertinent drawing sheet and detail number(s), and specification Section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite the project, and deliver to Engineer. Coordinate submission of related items.
- F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed work.
- G. Provide space for Contractor and Engineer review stamps.
- H. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

#### 2.2 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within 10 days after date of Notice of Award for Engineer's review.
- B. Revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- D. Submit a horizontal bar chart with separate line for each major section of work or operation, identifying first work day of each week.
- E. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of work at each submission.
- G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those finished by Owner and under Allowances.

### 2.3 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice of Award, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number for each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

### 2.4 PRODUCT DATA

- A. Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Engineer.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.
- C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents.

### 2.5 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

### 2.6 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify in writing any and all conflicts between manufacturers' instructions and maintenance requirements and Contract Documents.

### 2.7 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product Data.
- B. Indicate whether material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

END OF SECTION

Jackson Harbor Breakwater  
Project Specifications

## **SECTION 02272**

### **GEOTEXTILES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work covered by this Section includes furnishing and installing geotextile material above water to separate soil from stone fill, and below water over existing or cleared lake bottom.

##### **1.2 APPLICABLE PUBLICATIONS**

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

###### **1.2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM D 4354 (1999)	Sampling of Geosynthetics for Testing
ASTM D 4355 (1999)	Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491 (1999a)	Water Permeability of Geotextiles by Permittivity
ASTM D 4533(1996)	Trapezoid Tearing Strength of Geotextiles
ASTM D 4632 (1997)	Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751 (1999a)	Determining Apparent Opening Size of a Geotextile
ASTM D 4759 (1996)	Determining the Specification Conformance of Geosynthetics
ASTM D 4833 (2000)	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873(2000)	Identification, Storage, and Handling of Geosynthetic Rolls

##### **1.3 SUBMITTALS**

The following shall be submitted in accordance with the Contract Conditions. The Contractor's Quality Control organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

1.3.1 Manufacturing, Sampling, and Testing Data. A minimum of 14 days prior to scheduled use, Manufacturer's quality control manual including instructions for storage, handling, installation, seaming, and repair

1.3.1.1 Materials Tests. Certified material test reports showing that the geotextile meets the requirements of this section. This submittal shall include copies of manufacturer's quality control test results. For needle-punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturing company.

## PART 2 PRODUCTS

### 2.1 GEOTEXTILES

The geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimming, and other scraps that have never reached the consumer may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. The geotextile physical properties shall equal or exceed the minimum average roll values listed in Table 1. Acceptance of geotextile shall be in accordance with ASTM D 4759. Strength values shown are for the weaker principal direction.

**TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES**

Property	Test Method	Test Value
Apparent Opening Size (U.S. Sieve)	ASTM D 4751	100
Permittivity, sec <sup>-1</sup>	ASTM D 4491	1.4
Puncture, lbs	ASTM D 4833	130
Grab Tensile, lbs.	ASTM D 4632	200
Trapezoidal Tear, lbs.	ASTM D 4533	80
Ultraviolet Degradation (percent strength retained at 500 hours)	ASTM D 4355	70

### 2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Manufacturing, Sampling, and Testing. Geotextiles and factory seams shall meet the requirements specified in Table 1. Manufacturing quality control testing shall be performed in accordance with the manufacturer's approved quality control manual.

2.2.2 Site Verification Sampling and Testing. Samples shall be collected upon delivery to the site at the request of the Owner. Samples shall be tested at the request of the Owner to verify that the geotextile meets the requirements specified in Table 1.

### **2.3 DELIVERY, STORAGE AND HANDLING**

2.3.1 Geotextiles shall be labeled, handled, and stored in accordance with ASTM D 4873 and as specified herein. Each roll shall be wrapped in an opaque and waterproof layer of plastic during shipment and storage. The plastic wrapping shall not be removed until deployment. Each roll shall be labeled with the manufacturers name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight). Geotextile or plastic wrapping damaged as a result of storage or handling shall be repaired or replaced, as directed. Geotextile shall not be exposed to temperatures in excess of 140 degrees F or less if recommended by the manufacturer.

2.3.2 Handling. No hooks, tongs or other sharp instruments shall be used for handling geotextile. Geotextile shall not be dragged along the ground.

## **PART 3 EXECUTION**

### **3.1 SURFACE PREPARATION**

Geotextiles are to be placed as shown on the drawings. The surface underlying the geotextile shall be smooth and free of ruts or protrusions that could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with the relevant Sections.

### **3.2 INSTALLATION**

The Owner's Representative shall be present during handling and installation. Geotextile rolls that are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid smooth so as to be free of tensile stresses, folds, and wrinkles. The geotextile shall be laid with the machine direction of the fabric perpendicular to the shoreline.

### **3.3 PROTECTION**

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. Staples or pins shall not be used to hold the geotextile in place. The geotextile shall not be left uncovered for more than 14 days during installation. The initial loose soil lift height over the geotextile shall be between 8 inches and 12 inches, subject to any limits stated in the applicable placement specifications for the material being placed.

Equipment with ground pressures less than 5.0 psi shall be used to place the first lift over the geotextile. Overlying materials shall be deployed such that the geotextile is not shifted, damaged,

or placed in tension. Cover soil placed from a bucket shall be dropped from a height no greater than 3 feet.

### **3.4 SEAMING**

3.4.1 Overlap Seams. Geotextile panels shall be continuously overlapped a minimum of 12 inches. Successive geotextile sheets shall be overlapped in such a manner that the upslope sheet is placed over the downslope sheet. The Contractor has the option of field sewing instead of overlapping.

3.4.2 Sewn Seams. Sewn seams shall be performed with a thread material meeting the chemical requirements given for geotextile yarn and shall be bonded by cementing or heat. Sewn seams shall be done with a thread of contrasting color to the fabric. The seams of the geotextile shall be overlapped a minimum of 12 inches for sewing.

### **3.5 REPAIRS**

Geotextile damaged during installation shall be repaired by placing a patch of the same type of geotextile which extends a minimum of 12 inches beyond the edge of the damage or defect. Patches shall be continuously fastened using a sewn seam or other approved method. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Any geotextile which cannot be repaired shall be replaced.

### **3.6 QUALITY CONTROL**

3.6.1 The Contractor shall establish and maintain quality control for work under this Section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including, but not limited to, the following:

1. Materials including manufacturer's quality control tests data;
2. Surface preparation;
3. Placement of geotextile;
4. Fill placement and compaction;
5. Seams; and
6. Repairs or replacements.

3.6.2 A copy of the records of inspections, as well as the records of corrective actions taken, shall be furnished to the City as directed by the Owner in accordance with Section 01440 CONTRACTOR QUALITY CONTROL.

### **3.7 REPAIRS**

Geotextile damaged during installation shall be repaired by placing a patch of the same type of geotextile which extends a minimum of 12 inches beyond the edge of the damage or defect. Patches shall be continuously fastened using a sewn seam or other approved method. The



machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Any geotextile which cannot be repaired shall be replaced.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 MEASUREMENT**

Geotextile placed under the Type A Armor Stone and Type C Core Stone will be measured for payment on the basis of the total number of square yards of as-built surface area of geotextile acceptably placed within the limits shown on the drawings. No allowance will be made for seams, overlaps, or waste.

### **4.2 PAYMENT**

4.2.1 Payment for geotextile placed under the Type A Armor Stone and Type C Core Stone will be made at the contract price per square yard, multiplied by the total area of geotextile actually installed, subject to the provisions of this section. Such payment shall cover all cost of furnishing, handling, storing and installing geotextile including placing, seaming, repairs, and other materials and work incident thereto.

4.2.2 Bidding Schedule Items. Bidding schedule items applicable to the work of this section are as follows:

<b>Item No.</b>	<b>Description</b>	<b>Unit</b>
2.0	Separation/Filtration Geotextile	Square Yards

**END OF SECTION**

## SECTION 02485

### STONE MATERIALS

#### PART 1 GENERAL

#### 1.1 SCOPE

This section contains the requirements for furnishing all plant, labor, equipment, materials, transportation and delivery, incidentals, and performing all operations in connection with the procurement and delivery of all specified grades of stone, including armor stone (A1, A2, and A3 Stone), core stone (C Stone) and crushed stone fill.

#### 1.2 APPLICABLE PUBLICATIONS

The following applicable publications and test numbers listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by reference thereto:

##### 1.2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1999)	Standard Specification for Concrete Aggregates
ASTM C42/C42M (1999)	Standard Test Method for Obtaining and Testing Drilled Core and Sawed Beams of Concrete
ASTM C 88 (1999)	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 127 (1998)	Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 295 (1998)	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C 535 (1996e1)	Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 653 (1997)	Standard Terminology Relating to Soil, Rock & Contained Fluids
ASTM D 4992 (1994)	Standard Practice for Evaluation of Rock to be Used for Erosion Control

ASTM D 5312 (1997) Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions – 35 Cycles

ASTM D 5313 (1997) Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying –80 Cycles

#### 1.2.2 CORPS OF ENGINEERS' HANDBOOK FOR CONCRETE AND CEMENT (CRD)

CRD 137 (1992) Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate

CRD 148(1969) Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol

#### 1.2.3 U.S. ARMY CORPS OF ENGINEERS' ROCK TESTING HANDBOOK (RTH)

RTH-102 Recommended Practice for Petrographic Examination of Rock Cores

RTH-103 Preparation of Test Specimens

RTH 106 Method for Determination of the Water Content of a Rock Sample, 1993

RTH 108 Method of Determining Density of Solids, 1993

RTH 109 Method of Determining Effective (as received) and Dry Unit Weights and Total Porosity of Rock Cores, 1993

#### 1.2.4 ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT)

Standard Specification for Road and Bridge Construction, 2002.

### 1.3 SUBMITTALS

1.3.1 The following shall be submitted in accordance with the SUBMITTAL PROCEDURES Section.

1.3.2 Stone Source. The submission of information for all proposed stone source(s) shall include: (1) areas and lifts of the quarry or pit to be worked, (2) the specific geological stratum or strata to be utilized, (3) available laboratory testing records, and (4) bulk specific gravity range. For each type of stone material the Contractor proposes to furnish, the Contractor shall, at least 60 calendar days in advance of using a source, designate in writing the proposed source(s).

The Contractor may also propose other sources as explained in paragraphs 2.2.1 and 2.2.2. Special requirements for approval of such sources are given in paragraphs 2.1.2 and 2.4.

- 1.3.3 Stone Materials Control (SMC) Plan. The Contractor shall submit a written Stone Materials Control (SMC) Plan that describes the means and methods to be used for production, handling, transporting and placement and the effective inspection of material quality and gradation testing of stone materials in a manner which will result in a satisfactory quality of in-place stone construction.

Provide for the Owner's engineer/geologist to observe the stone before it leaves the quarry.

## 1.4 RECORDS

Bulk Specific Gravity of Stone. At least 30 calendar days in advance of shipment of stone to the work site, submit a copy of bulk specific gravity (ASTM C 127) test results for each gradation range proposed to be furnished. The information shall be furnished prior to preparation of the Pre-Production Reference Stones.

## 1.5 PRE-PRODUCTION QUALITY CONTROL

- 1.5.1 Material Quality. Before selecting a source the Contractor shall be reasonably certain that the source is capable of meeting the quality, quantity and source requirements specified in this Section.

- 1.5.2 Approval of Pre-Production Reference Stones. The Owner will make an acceptance determination of the Pre-Production Reference Stones based on visual inspection and laboratory testing, conducted in accordance with paragraphs 2.2.1 and 2.2.2 where applicable. The Contractor will be notified in writing within ten (10) working days of a finding by the Owner that the Pre-Production Reference Stones, and SMC Plan are acceptable. The Contractor may then proceed with production of materials for this contract. If the Pre-Production Reference Stones are not accepted, the Owner will notify the Contractor in writing within ten (10) working days of the inspection.

# PART 2 PRODUCTS

## 2.1 STONE MATERIALS

- 2.1.1 General. The materials to be furnished shall meet all requirements specified in this Section of the specification. Materials that have been delivered to the project site and are rejected, whether in stockpile or in place in the structure, shall be removed from the

project site at the Contractor's expense. All rejected material that does not meet the requirements of this specification shall be disposed of at the Contractor's expense.

## 2.1.2 Material Quality.

2.1.2.1 General. All stone shall be of a quality to ensure permanence of the structure in the climate in which it is to be used. The stone shall be durable, sound, and free of features, which may tend to increase deterioration from natural causes or breakage during handling, transportation, or placement. These features may include (but are not limited to) fractures, seams, vugs, bedding, stylolites, planes of separation, weathering, argillaceous material, and micaceous minerals. Inclusions of any dirt, sand, clay, shale, chert, oil and oil-stained stones and rock fines and bituminous or any organic or other deleterious material will not be permitted. All stone shall be highly resistant to weathering and disintegration under freeze / thaw and wetting / drying conditions.

2.1.2.2 Acceptability of Stone Material. Acceptability of stone material will be based on the criteria in paragraph 2.1.2.1 as determined by the Owner by visual inspections, evaluation of service records, and applicable laboratory test results. All materials shall meet the minimum quality requirements listed in Table 1 below, based on field examination and applicable laboratory testing. Laboratory results shall be representative of the same lithologic unit as the corresponding stones or materials. Laboratory test results shall be from a City or City-approved laboratory capable of handling sample sizes described in the subscript of Table 1, and shall be less than 5 years old at the time of submittal, unless otherwise accepted by the Owner. If test results are more than 5 years old, or if they are not representative of the material proposed for this contract, the Owner may select samples from the Pre-Production Reference Stones or materials designated by the Contractor as proposed sources, and direct the Contractor to have selected stones tested by a City or City-approved laboratory in accordance with the requirements of Table 1 below. Field and Laboratory tests to which the material may be subjected are listed in the paragraph titled REFERENCES (Section 1.2). Under no circumstances will the Contractor be allowed a Contract extension for the time necessary to evaluate materials for acceptability.

Table 1. Stone Quality Criteria

Test	Test Method	Acceptance Criteria
Specific Gravity <sup>2/3/</sup>	ASTM C 127	2.6 - 3.0
Absorption <sup>2/</sup>	ASTM C 127	< 2 percent
Los Angeles Abrasion <sup>2/</sup>	ASTM C 535	< 20 percent loss after 500 revolutions
Freeze-Thaw <sup>1/2</sup>	ASTM D 5312	<2 percent loss after 35 cycles
Wetting-Drying <sup>1/2</sup>	ASTM D 5313	<2 percent loss after 80 cycles
Petrographic Examination <sup>2/</sup>	ASTM C 295	No deleterious materials allowed
Field Examination <sup>2/</sup>	ASTM D 4992	No deleterious materials allowed
Sodium Sulphate Soundness	ASTM C-88	< 5 percent loss after 5 cycles

<sup>1/</sup> The minimum sample size for A-Stone shall be a stone of 2,000 pounds. Contractor shall ensure that the selected laboratory is approved for the required capacity/equipment to allow for testing of this sample size. The minimum testing slab size dimension shall be 13x15x2 inches for designation ASTM 5312 and ASTM 5313, and the long dimensions shall be cut perpendicular to the bedding planes within the stone.

<sup>2/</sup> See paragraph 2.4 for applicability of the tests.

<sup>3/</sup> Stone having specific gravity outside the range of 2.6 to 3.0 is not acceptable. Reference paragraph 2.1.2.1 for further restriction on the geologic types of stone that are acceptable.

2.1.2.3 Type A-Stone. Type A1, A2, and A3 stone in this specification shall be consistent with the provisions of paragraph 2.1.2.1 above, except for vugs. Vugs totaling not more than five (5) percent of the total surface area of the stone and less than four inches maximum diameter, provided that they are not aligned along bedding planes, will be accepted for under water placement.

2.1.2.4 Proportional Dimension Limitation. The maximum aspect ratio (greatest dimension: least dimension) of any piece of stone for size ranges that are not graded with a screen or grizzly, shall be not greater than 3:1 when measured across three mutually perpendicular axes. Not more than 10% of the stone within a gradation range shall have aspect ratio greater than 2.5:1.

## **2.2 STONE MATERIAL SOURCES**

2.2.1 Stone materials may be furnished from any source, provided stone quality and quantity meet the specifications. The Contractor will make such investigations and evaluation as necessary to determine whether or not materials meeting the requirements of project can be produced from the proposed source.

2.2.2 No Engineer Warranty. It is the responsibility of the Contractor to visit a source to verify and determine whether a source is capable of producing the required quantity, quality, size, gradation, or weight specified, and in a timely manner.

2.2.3 Material Acceptability. The right is reserved not to approve use of materials from certain localized areas, zones, strata, or channels of any approved source, when such materials are determined by the Engineer to be unsatisfactory based upon quality requirements herein. Rejection or disapproval of any source or any material by the Engineer shall not be grounds for a time extension, or for a change in the contract price.

## **2.3 STONE GRADATIONS**

2.3.1 Gradations. Material having the gradations listed below shall be placed as indicated in Section 02485, STONE PLACEMENT and on the drawings. Gradation limits are in-

place requirements. Adjustments in production and placing methods shall be made as necessary to assure final placed materials are within specified ranges.

- 2.3.1.1 Type A1 Stone. The stone furnished for A1-Stone shall weigh between 3.5 and 6.8 tons each and shall be free of fines. Fifty (50) percent of the stones by count shall weigh more than 5.2 tons each.
- 2.3.1.2 Type A2 Stone. The stone furnished for A2-Stone shall weigh between 1.8 tons and 3.2 tons each and shall be free of fines. Fifty (50) percent of the stones by count shall weigh more than 2.5 tons each.
- 2.3.1.3 Type A3 Stone. The stone furnished for A3-Stone shall weigh between 0.5 tons and 1.0 tons each and shall be free of fines. Fifty (50) percent of the stones by count shall weigh more than 0.75 tons each.
- 2.3.1.4 Type C Stone. The stone furnished for C Stone shall conform to the following gradation requirements: 100% smaller than 50 lbs, 50%  $\pm$  20% smaller than 10 lbs, 8%  $\pm$  8% smaller than 1 lb. C-Stone shall be free of fines. The gradation for C-Stone is equivalent to IDOT Gradation No. 3, Article 1005.01.
- 2.3.1.5 CA-6. The stone furnished for CA-6 shall conform to IDOT Standard Specification for Road and Bridge Construction, Article 1004.01, CA-6. The CA-6 stone shall be well graded and meet the quality requirements in paragraph 2.1.2.1.
- 2.3.1.6 CA-7. The stone furnished for CA-7 shall conform to IDOT Standard Specification for Road and Bridge Construction, Article 1004.01, CA-7. The CA-7 shall be well graded and meet the quality requirements in paragraph 2.1.2.1.

## 2.4 STONE SAMPLING AND LABORATORY TESTING.

At a minimum, the frequency and type of required tests shall be as indicated in Table 2, below. The Freeze-Thaw test, Wet and Dry test and Petrographic Examination in Table 1 shall only be performed for the initial set of testing required for quarry approval, and whenever geological changes occur in a quarry. The test samples shall be selected by the Owner.

For information, the following are Corps or Corps approved laboratories:

U.S. Army Corps of Engineers  
Waterways Experiment Station (WES)  
3990 Halls Ferry Road  
Vicksburg, MS 390180-6199

Phone (601) 634-3278

- 2.4.1 Stone Test Results. The Contractor shall submit copies of test results, as indicated in Table 1, for City approval at least sixty (60) calendar days in advance of shipment of

stone to the work site, and no later than the time of inspection of the Pre-Production Reference Stones by the Owner.

Table-2. Sample Testing Frequency

Stone Type	Gradation		Stone Quality Testing (from Table 1)	Visual Inspection
	Sample Size	Frequency		
A-Stone (A1, A2, and A3)	30 Stones	Every 4000 Tons	One to three stone samples at any geological change in the quarry as directed by the Owner	Each stone, see paragraph 2.1.2.1
C-Stone	2000 lbs.	Every 1000 Tons	Not Applicable	Every 500 tons

Each Type A stone used in gradation testing shall be numbered, tracked and documented in accordance with the procedures submitted and approved in the SMC plan. Gradation test reports for A-Stone shall include the three axis dimensions for aspect ratio measurement and the basis of individual stone weight calculations.

## 2.5 QUARRY OPERATIONS

- 2.5.1 Quarry operations shall be conducted by the Contractor in a manner that will produce stone conforming to the requirements specified and may involve selective quarrying, handling, processing, blending, and loading as necessary, all of which shall be described in detail in the SMC Plan. Blasting and handling of rock shall be controlled by the Contractor to produce rock of the size ranges and quality specified. Technique such as the use of proper hole diameter, hole depth, hole angle, burden and spacing distances, types and distribution of explosives, delay intervals and sequence, removal of muck piles between each shot, and special handling techniques are required as necessary to produce the specified materials. All aspects of blasting shall be specifically designed so that the end product is not damaged by the blasting technique and the stone is suitable for the intended purpose.
- 2.5.2 Curing Stone. The Contractor shall conduct curing operations on freshly quarried A-Stone to allow it to release stored energy and moisture. This is to demonstrate that the stone will not fracture during the energy release and drying out phase. Type A-Stones shall be temporarily stockpiled in a single layer at the quarry site for a minimum of 30 consecutive calendar days with no air temperatures at or below 32 degrees Fahrenheit before being inspected from all sides for approved and shipping to the project site. Daily record of minimum temperature in the quarry shall be maintained during the curing period for all stones.
- 2.5.3 Curing Stone Quarried In Freezing Weather. Type A-Stone quarried between 16th of September and 14th of April (North of 43<sup>rd</sup> parallel) and between 02 October and 14th of



April (South of 43<sup>rd</sup> parallel) will not be inspected or approved for use in the project, until after it has cured at the quarry for at least 30 consecutive calendar days without any occurrences of 32 degrees F or less at the quarry, or 15 May, whichever is earlier.

- 2.5.4 Temporary Storage. Storage of stone material subsequent to shipment from the quarry and prior to permanent placement in the required work shall be subject to approval of the Owner. Underwater storage of stone materials is prohibited.

## 2.6 PRODUCTION QUALITY CONTROL

- 2.6.1 General. The Contractor shall perform all quality control in accordance with Section 01440, CONTRACTOR QUALITY CONTROL. It is the Contractor's responsibility to assure that quality control for all work performed at the quarry or quarries and the delivery site comply with all contract requirements. Contractor shall ensure that records are maintained of quality control tests, inspections and corrective actions. Quality control measures shall cover all materials, equipment, and tests including but not limited to the following:

- 2.6.2 Inspection and Tests. At the quarry and project site, visual inspections shall be made of each A-Stone and stockpiles of the other stone materials randomly as scheduled in Table 2 of paragraph 2.4.1. The visual inspections shall check size, gradation, elongation, fractures, deterioration and other defects to assure that handling during loading, transporting, unloading and placement has not caused damage to the materials and to assure they are placed in accordance with the requirements of this Section. Weighing of stones or re-measuring them shall be performed to verify computed weights when the Owner brings the size of specific stones into question. Except as allowed by gradation tolerances, any material broken, cracked, out of gradation or weight limitation or improperly placed in the work shall be removed and replaced with satisfactory stones and corrective action taken at no additional expense to the City. Rejected material shall be promptly removed from the project site unless it meets the requirements of this specification for a separate class of material. Rejected materials are excluded from measurement for payment.

- 2.6.3 Quality Assurance. During the contract period, both prior to and after materials are delivered to the job site/storage site, visual inspections and measurements of the stone materials may be performed by the Owner. If the Owner, during the inspections, finds that the stone quality, gradation or weights of stone being furnished are not as specified or are questionable, re-sampling and retesting by the Contractor will be required. Sampling and the manner in which the testing of the delivered stones/stockpiled stone at the source or Dock for shipment is to be performed, shall be directed by the Owner. The Contractor shall pay the cost of this additional testing of stone, if the evaluation of the tests by the Owner determines the stone does not meet the specification. If the test evaluation by the Owner determines that the stone meets the specifications then the Owner will pay the cost. However, the final acceptability of the stone will depend on meeting the requirements for visual inspection and service records, as stated in the

specifications. Any material rejected shall be removed or disposed off as specified or directed by the Owner. Removal of rejected stone shall be at Contractor's expense.

### **PART 3 EXECUTION**

#### **3.1 PLACEMENT**

Adhere to the requirements of Section 02486, STONE PLACEMENT.

### **PART 4 MEASUREMENT AND PAYMENT**

#### **4.1 MEASUREMENT**

Stone materials will be measured as described in Section 02486, STONE PLACEMENT.

#### **4.2 PAYMENT**

All stone material, required testing, and transportation for final placement shall be included in the contract price as described in Section 02486, STONE PLACEMENT.

### **END OF SECTION**

## **SECTION 02486**

### **STONE PLACEMENT**

#### **PART 1 GENERAL**

#### **1.1 SCOPE**

The work covered in this section consists of furnishing all plant labor and equipment for performing operations in connection with the placement of new Armor Stone (A1, A2, and A3 stone and C-stone), CA-6 and CA-7 including the modification of existing lakebed incidental to stone placement.

#### **1.2 APPLICABLE PUBLICATIONS**

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by reference thereto:

##### **1.2.1 U.S. ARMY CORPS OF ENGINEERS (USACE)**

EM 1110-2-1003	Hydrographic Surveying Manual
EM 1110-2-2302	Construction with Large Stone, 1990

##### **1.2.2 U.S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS (NBS) HANDBOOK**

H-44	Specifications of Tolerances and Other Technical Requirements of Commercial Weighing and Measuring Devices
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##### **1.2.3 ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT)**

Standard Specifications for Road and Bridge Construction, 2002

#### **1.3 SUBMITTALS**

The Contractor's Quality Control (CQC) organization shall be responsible for certifying that all submittals meet the contract requirements.

1.3.1 Proposed method of construction, including sequence of stone placement, methods of placement, equipment to be used during each phase, and estimated production rates.

1.3.2 Proposed method for performing check and post surveys.

1.3.3 Check Surveys and Post Surveys, including videotapes.

- 1.3.4 Certified Gauging (Load) Tables.
- 1.3.5 Weigh Scale Certification: Submit copies of the certifications of the accuracy of all scales to be used to measure materials delivered to the site. If an on-site scale is to be used, prior to the use thereof, submit details on the location and construction of the scale and a copy of the certification of the scale's accuracy from the local weights and measures regulating agency.
- 1.3.6 Certified Weight Scale Tickets: A copy of each weigh bill, including certification of exact weight, time of weighing and delivery and certification of proper placement in the work shall be submitted within one work day after weighing.
- 1.3.7 Stone Material and Placement Control (SMPC) Plan: The Plan shall be submitted as described in Section 02485, STONE MATERIALS.

## **PART 2 PRODUCTS**

### **2.1 STONE MATERIALS**

All stone necessary to complete the project shall be provided by the Contractor as specified in Section 02485, STONE MATERIALS.

## **PART 3 EXECUTION**

### **3.1 BASELINES AND VERTICAL CONTROL**

The Contractor shall establish baselines as shown on the Contract Plans, and establish vertical control as required to perform the work.

### **3.2 TEMPORARY STORAGE**

Storage of stone material on the lake bottom prior to permanent placement shall not be permitted. The Contractor shall be responsible for obtaining the use of any facilities or lands that may be required for stockpiling of stone materials. The Contractor shall be responsible for all costs associated with the handling and stockpiling of materials.

### **3.3 PLACEMENT OF STONE**

#### **3.3.1 General Requirements**

- 3.3.1.1 The Contractor shall submit the proposed method of construction including sequence of stone placement, methods of placement, and equipment to be used during each phase. Care shall be taken to place the stone of the various classifications so that they will make a compact mass and form as nearly as practicable a cross section of uniform height,

width, and slopes as shown on the contract plans. Stones shall be carefully placed to leave no large voids between them. Stone shall be placed in accordance with the construction sequence.

3.3.1.2 All stone material shall be placed uniformly within the slope lines, grades, and limits as indicated on the contract drawings to the tolerance limitations specified. Side slopes shall transition smoothly from the head section to the trunk section.

3.3.1.3 The material shall be placed by equipment suitable for handling materials of the size specified. All stone shall be placed in a way that produces a mass of unsegregated stone with maximum interlocking and rock to rock contact with a minimum of voids.

3.3.1.4 Prior to placing stone, organic material and debris on the existing stone or lakebed shall be removed and disposed of by the Contractor.

3.3.1.5 The Contractor shall control the placement of stone materials in a way that minimizes the turbidity of lake waters. The Contractor's operations shall comply with State and Federal Laws.

### 3.3.2 Toe Stone Placement

3.3.2.1 C-Stone. The C-Stone is intended to provide proper filter requirements between the A-Stone and the lakebed. The Contractor shall inform the Owner's Representative of the limits of C-Stone layer as the stone is placed. The method used in placement of C-Stone shall be such that any soft and organic materials on the lake bed will be displaced outward toward the extreme outside toes of the required sections of the structure, and in the direction of construction. The C-Stone material shall be handled and placed in a manner to minimize segregation and provide a well-graded mass. The bedding shall not be dropped from a height exceeding two (2) feet above the existing lake bottom. Stone shall be placed by clamshell or similar equipment. Bottom dump scows will not be allowed. The finished surface of the material shall be free of mounds, holes or wind rows. The Contractor shall be responsible for loss of C-Stone material due to wave, current or other actions prior to placement of the A-Stone (or salvaged limestone blocks), and shall replace lost C-Stone material as required at no additional cost to the Owner.

3.3.2.2 A-Stone. A1, A2, and A3-Stone shall be individually placed to the thickness and elevations shown on the drawings in a manner to avoid displacing underlying materials or placing undue impact force on underlying material that would cause the breaking of stones. A-Stone shall be individually placed with a rock grab, orange peel grab, grapple, crane, or similar equipment. The stone shall not be dropped or tipped into position, but shall be placed piece by piece into the layer and shall be interlocked or keyed in juxtaposition with adjacent stones by rotating or setting them for maximum contact based on their angular shape with no continuous void through the two layers of A-stone. The longitudinal axis of each outer A-Stone shall be placed perpendicular to the revetment face. The stone shall be placed as quickly as practical following placement of the C-Stone. The Contractor shall be responsible for loss of C-Stone due to wave, current or

other actions prior to placement of the A-Stone, and shall replace lost C-Stone material as required at no additional cost to the Owner.

- 3.3.2.3 No excavated / demolished material shall be used as Toe Stone. All new Toe Stone shall be fresh material prior to placement.
- 3.3.3 Breakwater cells shall be filled with IDOT Type CA-6 and Type CA-7 stone. The top two feet of the fill shall be IDOT Type CA-6 stone.
- 3.3.4 Geotextile: Geotextile shall be placed per Contract Drawings, and in accordance with Section 02272, GEOTEXTILES.

### 3.4 INTERRUPTIONS

If the Owner or Contractor anticipate that the structure construction will be interrupted for more than four (4) continuous days, including weekends and Holidays, the Contractor will be required to complete the placement of the C-Stone and the A-Stone to the top of the structure and provide protection for the exposed end prior to start of the interruption. All material used for protecting the exposed ends of the structure shall become the property of the Contractor and shall be removed after the need has ended. The removed materials may be incorporated into the permanent construction, as appropriate. All protective materials removed and placed in the permanent construction will be measured and paid for only once.

### 3.5 TOLERANCE

- 3.5.1 The finished surface and stone layer thickness shall not deviate from the lines and grades shown on the contract drawings by more than the tolerances listed below. Tolerance thickness is measured perpendicular to the indicated neat lines.

<b>NEATLINE TOLERANCES</b>		
<b>MATERIAL</b>	<b>ABOVE NEATLINE</b>	<b>BELOW NEATLINE</b>
A1 Stone	24 inches	12 inches
A2 and A3 Stone	12 inches	6 inches
C-Stone	6 inches	0 inches
CA-6	0 inch	2 inches

- 3.5.2 The intention is that the work will be built generally to the required elevations, slope, and grade and that the outer surfaces shall be even and present a neat appearance. Placed material not meeting these limits shall be removed or reworked. Excess placed material will not be paid for and the cost of replacing and/or removing this stone will be deducted from amounts due the Contractor.

### 3.6 MAINTENANCE

- 3.6.1 Contractor shall be responsible for care and maintenance of all rock slopes and materials until final acceptance by the Owner. Damage to any incomplete section due to any cause prior to acceptance shall be repaired by the Contractor at no additional cost to the City. Incomplete sections are defined as sections of the structure where the stone materials have not been placed to their final configuration.
- 3.6.2 In the event of the sliding or failure of any completed section of the structure during construction, but prior to its acceptance, the Contractor shall, upon written order of the Owner's Representative, cut the slide from the structure and rebuild that portion of the structure. The Contractor may reuse the material if deemed appropriate by the Owner's Representative. The Owner's Representative shall determine the nature of the slide. If, in the opinion of the Owner's Representative, the slide is caused through fault of the Contractor, the foregoing operations shall be performed without cost to the City.
- 3.6.3 The contractor shall take adequate precautions to protect all stone materials including landside stone materials in the event of lake storms. The Contractor shall not be entitled to additional time to repair impacted sections is, in the sole opinion of the Owner, inadequate precautions were taken to prevent damage. All repair operations shall be performed without cost to the City.

### 3.7 SURVEYS

The Contractor shall make checks as the work progresses to verify slope lines and grades of each type of stone material placed within the completed repair areas. A check survey will be completed prior to and after the placement of each type of stone. Plotted cross sections will be submitted and approved by the Owner (minimum 24 hour review time) prior to beginning placement of the next type of stone. If the plotted cross section indicates that the stone layer is not placed in accordance with the tolerances specified the stone layer shall be reworked and a new check survey performed. A minimum of one (1) check survey shall be performed by the Contractor for each 25-foot baseline interval using stationing shown on the plans. For each cross section, readings shall be taken on five (5) foot intervals and at breaks along the range lines. Other cross section spacing and reading intervals may be required by the Owner. All surveys shall be conducted in the presence of the Owner's Representative, unless waived by the Owner. Contractor shall notify the Owner at least 24 hours before conducting any surveys. The Contractor shall furnish the original field notes and plotted cross sections of the check survey to the Owner's Representative on the next workday following the survey. Approval of cross sections does not constitute final acceptance. Check surveys shall be performed by mechanical methods only in accordance with EM-1110-2-1003 and as specified. The use of a fathometer is not permitted. Costs of the check survey(s) shall be included in the unit prices for furnishing and placing stone materials.

- 3.7.1 Above Water. Elevations of stone above the water surface shall be determined by using a leveling instrument and a rod having a base twelve (12) inches in diameter. Other means, if approved by the Owner, may also be used.
- 3.7.2 Below Water. For portions of the work that are under water, surveys shall be performed by mechanical methods only as specified below, or otherwise approved by the Owner.
- 3.7.3 Lead Line. If the lead line method is used, each survey will consist of soundings taken by a sounding basket weighing approximately 7-9 pounds, which has a base measuring twelve (12) inches in diameter. Measurement is made upon free fall to refusal, and shall be read within five (5) seconds of apparent refusal. Proper account shall be taken to minimize line slope due to currents. In soft-bottomed materials, the reading shall be taken at apparent refusal.
- 3.7.4 Sounding Pole. If a sounding pole method is used, soundings will be taken by a sounding pole that does not exceed twenty (20) feet in length, has a base measuring twelve (12) inches in diameter and weighs approximately 4-6 pounds. Measurement is made upon free fall to refusal, and shall be read within five (5) seconds of apparent refusal. Conventional level rods may be used in place of the sounding pole provided that the base plate characteristics and overall weight conform to the sounding pole described in this Paragraph. Observations are referred to the water surface and are corrected to the final datum by applying appropriate corrections.
- 3.7.5 Checking Gage. The Contractor shall install a temporary lake level gage at a convenient location within the work area. The gage will be checked prior to each survey and periodically throughout the survey to record changing lake elevations and recorded along with the time of day in the field notes. The gage shall be calibrated to Low Water Datum (LWD). The recorded gage reading shall be noted with corresponding date and time.

### **3.8 QUALITY CONTROL**

- 3.8.1 Requirements. The Contractor shall establish and maintain Quality Control (QC) for all work performed at the job site, to assure compliance with Contract requirements. He shall maintain records of his QC tests, inspections and corrective actions. QC measures shall cover all materials, equipment, tests and construction operations including but not limited to the following:
- 3.8.1.1 Placement of all materials to the slope and grade lines shown on the Contract Plans and in accordance with this Section.
- 3.8.1.2 Check Surveys.
- 3.8.1.3 Environmental Protection.
- 3.8.1.4 Safety Requirements.



- 3.8.2 Reporting Required. The Contractor shall prepare and maintain a daily record of his operations and a QC report, furnishing copies thereof to the Owner's Representative. Reports shall always include handling and placement methods. A minimum of one report containing required information shall be made for each shift.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 MEASUREMENT**

- 4.1.1 Stone (including A1, A2, and A3-Stone, C-Stone, CA-6 and CA-7) will be measured for payment by the ton (2,000 pounds) of material acceptably placed in the work, as determined by carrier displacement, certified scale weight tickets or by volume calculations performed by the Owner. If volume calculations are used, the weight of material for payment shall be determined by the volume of material incorporated into the work as calculated by the Owner using the average-end-area method. Lake bottom clearing for preparation of A-Stone placement will not be measured for payment but shall be considered incidental to Bid Items 3.1, 3.2, and 3.3, Type A1, A2, and A3 Armor Stone.
- 4.1.2 Determination of Stone Weight. A weighing record will accompany each delivery, and shall indicate the name of the shipper, date, trailer number, gross, tare and net weights. The weigher shall sign each weigh record. The Contractor shall propose a method of determining weight of new materials to be delivered by Vessel or Barge. The proposed method shall be submitted to the Owner for review and approval. Methods shall be generally consistent with methods described in USACE publication EM-1110-2-2302, Construction with Large Stones.
- 4.1.3 Determination of Stone Volumes.
- 4.1.3.1 The Contractor shall provide pre-construction and post-construction survey cross sections for the determination of in-place volumes. Volume computations will be done by the Owner. Cross section surveys will be taken perpendicular to the baseline, and utilizing the approved means outlined in Paragraph 3.7 of this Section.
- 4.1.3.2 Computations. Stone permitted by the Owner to remain outside the limits and tolerances of a cross section of the structure will not be paid for. The volume of stone will be computed using the average-end-area of two successive cross sections, multiplied by the distance between the cross sections. The volume so computed for each type of stone shall be converted to weight using 1.56 tons per cubic yard for stone. The Owner may conduct investigations to determine actual as-placed weights for materials and adjust the above ratios accordingly. Measurements for cross sections shall be obtained in accordance with Paragraph 3.7 of this Section.

4.1.3.3 The cost of replacing stone that has been lost or wasted or otherwise not properly incorporated into the final required work shall be deducted from the Contractor's payment.

## 4.2 PAYMENT

4.2.1 Payment for stone materials (A1, A2, and A3-Stone, C-Stone, CA-6 and CA-7) shall be made at the contract unit prices for the various items of the bidding schedule listed below, which price shall include all costs as applicable for material, transportation, placement, labor, equipment, testing, surveying, quality control, and incidentals required to complete the work specified and shown on the Contract Plans, including the modification of existing lakebed.

4.2.2 Bidding schedule items applicable to the work of this section are as follows:

ITEM NO.	DESCRIPTION	UNIT
3.1	Type A1 Armor Stone	Tons
3.2	Type A2 Armor Stone	Tons
3.3	Type A3 Armor Stone	Tons
3.4	Type C Core Stone	Tons
3.5	CA-6 Aggregate Fill	Tons
3.6	CA-7 Aggregate Fill	Tons

**END OF SECTION**

## SECTION 03151

### EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS IN CONCRETE

#### PART 1 GENERAL

##### 1.1 SCOPE

The Contractor shall furnish and install joint materials and shall construct expansion, contraction, and construction joints in concrete structures as shown on the contract drawings.

##### 1.2 APPLICABLE PUBLICATIONS

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

###### 1.2.1 AMERICAN CONCRETE INSTITUTE (ACI).

224.3R        Joints in Concrete Construction

504R        Guide to Sealing Joints in Concrete Structures

###### 1.2.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

A 615        Standard Specification for Deformed and Plain Billet-Steel Bars  
for Concrete Reinforcement

C 920        Standard Specification for Elastomeric Joint Sealants

D 1752       Standard Specification for Preformed Rubber and Cork Expansion  
Joint Fillers for Concrete Paving and Structural Construction

###### 1.2.3 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO).

M 254        Corrosion Resistant Coated Dowel Bars

##### 1.3 SUBMITTALS

1.3.1 Prior to the use of materials, the Contractor shall submit to the Owner, for approval, copies

of purchase orders, certifications, and samples of all materials as specified herein. However, acceptance of the material will not be made until all materials as specified herein have been satisfactorily fabricated and installed in the Work. Each purchase order, certification, and sample shall be identified with a manufacturer's product identification and the quantity ordered.

1.3.2 The manufacturer's certification shall cover all material requirements and shall include all physical property test data and installation instructions. The Contractor shall be responsible for the accuracy of the manufacturer's certification and the sample certification.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

2.1.1 Premolded Expansion Joint Filler. Premolded expansion joint filler shall conform to ASTM D 1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D 1752. Adhesive for securing the joint filler in place shall be a non-bituminous adhesive as recommended by the manufacturer of the joint filler.

#### 2.1.2 Joint Sealant

2.1.2.1 Field Molded Sealants and Primer. Field molded sealants and primer shall conform to ASTM C 920, Type M, Grade NS, Class 50, Use NT for vertical joints and Type M, Grade P, Class 50, Use T for horizontal joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The backer rod material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene foam rubber.

2.1.3 Bond Breaker. Bond breaker for contraction joint surfaces shall be curing compound as specified in Section 03300, CAST-IN-PLACE CONCRETE, or bituminous paint.

2.1.4 Dowel Bars. Dowel bars shall be plain steel bars conforming to ASTM A 615, Grade 60, and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site, a minimum of two-thirds of the length of each dowel bar shall be painted with one coat of zinc-chromate. If plastic or epoxy-coated steel dowels are used, no zinc-chromate coating is required. Coated dowels shall conform to the requirements given in AASHTO M 254.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

3.1.1 General. Joint locations and details, including materials and methods of installation of joint

fillers shall be as specified, shown on the contract drawings, and as approved by the Engineer. Joints and joint material installation practices shall follow the guidelines contained in ACI 224.3R and ACI 503R. In no case shall any fixed metal be continuous through an expansion joint.

### 3.1.2 Expansion Joints

3.1.2.1 Pre-molded filler strips shall have oiled wood strips or pre-molded plastic strips secured to the top thereof and shall be accurately positioned and secured against displacement to clean, smooth concrete surfaces. The wood or plastic strips shall be slightly tapered, dressed and of the size required to install filler strips at the desired level below the finished concrete surface to form the groove for the joint sealant to the size shown on the contract drawings. Material used to secure pre-molded fillers and wood or plastic strips to concrete shall not harm the concrete and shall be compatible with the joint sealant. The wood or plastic strips shall not be removed until after the concrete curing period. The groove shall be thoroughly cleaned of all laitance, curing compound, foreign materials, protrusions of hardened concrete and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.2.2 Dowel bars of approved type shall be placed across expansion joints in the manner as shown on the contract drawings. Dowel bars shall be of the dimensions and spacings as shown and shall be held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by methods approved by the Engineer. The dowel bars shall be checked for exact position and alignment prior to, during, and after concrete placement. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 2 percent or 1/4-inch per foot of a dowel bar.

3.1.2.3 Joints shall not be sealed when the sealant, air or concrete temperature is less than 40° F. Allow enough time for curing of the concrete before installation of the sealant, as recommended by the sealant manufacturer. Bond breaker and backer rod shall be installed where required. Joints shall be primed and filled to the required depth with joint sealant in accordance with the contract drawings.

3.1.2.4 If air bubbles are observed when installing sealant, the bubbles shall be opened with a small hand tool and smoothed over. After a sealant has been installed, it shall be tooled to ensure intimate contact with the sides of the joint, to assist in filling voids, and to consolidate the sealant. Exposed surfaces of the sealant shall be uniformly smooth and free from wrinkles. Any excess sealant shall be removed, and all exposed concrete surfaces that become soiled during the installation of joint primer or sealant shall be thoroughly cleaned. Joint sealant shall be protected from damage until it has achieved adequate curing so as not to be damaged by normal activities.

3.1.2.5 Sealant that is not of the proper configuration, not homogenous, does not bond to the surfaces of the joint, or is otherwise defective shall be removed from the joints and the joints shall be re-cleaned and the sealant re-installed at the Contractor's expense.

### 3.1.3 Contraction Joints

3.1.3.1 Contraction joints shall be made by forming the concrete on one side of the joint and

allowing it to set before concrete is placed on the other side of the joint. The surface of the concrete first placed at a contraction joint shall be coated with bond breaker before the concrete is placed on the other side of the joint. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint.

3.1.3.2 The top and bottom reinforcing steel shall be made continuous through the contraction joints, as shown on Drawings. Extend the bars across the contraction joints on one side by specified overlap length, to achieve the required continuity in the reinforcing steel across the contraction joints. It may be required that contraction and construction joints coincide, as shown on Drawings. .

3.1.3.3 Contraction joint grooves shall be prepared and sealed with sealant as specified above for expansion joints.

#### 3.1.4 Construction Joints

3.1.4.1 Construction joints in concrete work shall be thoroughly cleaned of loose or defective concrete, coatings, sand, curing compound, and any other foreign material that may reduce bond and water tightness of the joint. A construction joint is defined as a planned joint where two placements of concrete meet, across which development and maintenance of bond and water tightness are required, and through which any reinforcement that may be present is not interrupted. Construction joints can be vertical or horizontal. After concrete in the placement has hardened, all construction joints shall be initially cleaned to remove all laitance, stains, and weak or unsound concrete such that clean, sound mortar and some coarse aggregate are exposed. Unless otherwise approved, initial construction joint cleaning shall be done at the latest practicable time and as the last operation before setting forms and installing items to be embedded. Methods for cleaning these surfaces may include wet sandblasting, high-pressure water-blasting, or other methods that do not damage the bond surface, cause excessive cutting of the surface or undercutting of the coarse aggregate particles, or poor uniformity of the surface treatment as approved by the Engineer. High-pressure water-blasting shall be performed at a pressure of no less than 6,000 psi.

### 3.2 QUALITY CONTROL

3.2.1 The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of its quality control for all construction operations in accordance with Section 01440, CONTRACTOR QUALITY CONTROL and including, but not limited to the following:

3.2.1.1 Joint materials and embedded items shall be inspected during installation, during concrete placement, and after concrete placement. The results of each inspection shall be reported in writing.

3.2.1.2 A copy of the records of inspections and tests, as well as the records of corrective action taken, shall be furnished as directed by the Owner.

## **PART 4 MEASUREMENT AND PAYMENT**

The work of this section will not be measured for separate payment and costs; therefore, shall be included in the price bid for the feature to which the work pertains.

**END OF SECTION**

## SECTION 03200

### CONCRETE REINFORCEMENT AND ACCESSORIES

#### PART 1 GENERAL

##### 1.1 SCOPE

This section covers the furnishing of all equipment, materials, techniques and labor for furnishing and installing concrete reinforcing steel bars, dowels and accessories.

##### 1.2 APPLICABLE PUBLICATIONS

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

###### 1.2.1 AMERICAN CONCRETE INSTITUTE (ACI).

ACI 117      Standard Specifications for Tolerances for Concrete Construction and Materials

ACI 315      Details and Detailing of Concrete Reinforcement

ACI 318      Building Code Requirements for Structural Concrete

###### 1.2.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

A 615      Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A 775      Standard Specification for Epoxy-Coated Reinforcing Steel Bars

##### 1.3 SUBMITTALS

All submittals shall be in accordance with the Contract Conditions. The Contractor's Quality Control organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

###### 1.3.1 Shop Drawings.

1.3.1.1 Reinforcement steel schedules showing quantity, size, shape, dimensions, weight per foot and total weights, and bending details.



1.3.1.2 Details of bar supports showing types, sizes, spacing and sequence.

1.3.1.3 Location of couplers to be used and details of how they are to be installed in the formwork.

1.3.2 Test Reports. Certified mill test reports of reinforcement steel, including chemical and physical analysis, showing that the steel complies with the applicable specifications shall be furnished for each steel shipment and identified with specific lots prior to placement.

1.3.3 Disposition Records. A system of identification which shows the disposition of specific lots of approved materials in the work shall be established and submitted before completion of the contract.

1.3.4 Catalogue Cuts and Samples. Manufacturers' catalogue cuts shall be submitted for grout, epoxy resin, adhesive, couplers, or other material used for anchoring reinforcing steel dowels to existing stone or concrete.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

2.1.1 Steel bars and dowels shall conform to the sizes and lengths shown on the drawings. All steel bars and dowels shall be ASTM A 615, Grade 60, non-coated steel. If required, epoxy coated reinforcing bars shall conform to ASTM A 775.

2.1.2 Reinforcement Accessories:

2.1.2.1 Bar supports shall conform to ACI 315. Supports for formed surfaces exposed to view shall be plastic protected wire, stainless steel, or pre-cast concrete supports. Pre-cast concrete supports shall be wedge-shaped, not larger than 3-1/2 x 3-1/2 inches, of thickness equal to that indicated for concrete cover, and shall have an embedded hooked tie wire for anchorage. If formed surface is exposed to view, pre-cast concrete supports shall be the same quality, texture, and color as the finished surface.

2.1.2.2 Wire ties shall be 16-gage or heavier black annealed wire.

2.1.2.3 Chairs, wire ties, and other devices used to support, position or fasten epoxy coated reinforcement shall be made of or coated with a dielectric material. The specific hardware that the Contractor proposes to use shall be approved by the Owner.

2.1.2.4 Mechanical Couplers shall develop a minimum of 125 percent of yield capacity of bars to be spliced when tested as assembly in accordance with ASTM A370 and A615.

2.1.3 Material used to embed the reinforcing steel dowels shall be resistant to water, such as Hilti

RE 500 V3 Adhesive, Williams HS 200 Epoxy Paste, or approved equal. Minimum embedment shall be as required by the manufacturer to develop the full yield strength of the bar.

## PART 3 EXECUTION

### 3.1 PLACEMENT

3.1.1 Reinforcement steel and accessories shall be placed as specified and as shown on contract drawings and approved shop drawings. Placement details of steel and accessories not specified or shown on the drawings shall be in accordance with ACI 315 and ACI 318 or as directed by the Engineer. Steel shall be fabricated to shapes and dimensions shown, placed where indicated within specified tolerances and adequately supported during concrete placement. At the time of concrete placement all steel shall be free from loose, flaky rust, scale (except tight mill scale), mud, oil, grease or any other coating that might reduce the bond with the concrete.

3.1.2 If use of epoxy-coated bars is required, field bending of epoxy-coated bars shall not be allowed when the ambient and bar temperatures are less than 40° F. Damaged areas of epoxy bar coatings shall be field repaired as directed by the Engineer. Bars with severely damaged coatings shall be replaced. When epoxy coated reinforcing bars are cut in the field, coat the ends of the bars with the same material used for repair of coating damage. Materials used for field repair of coatings shall be that supplied by the coating manufacturer.

3.1.3 Hooks and Bends: Steel shall be bent cold unless otherwise authorized by the Engineer. No steel bars shall be bent after being partially embedded in concrete unless indicated on the drawings or otherwise authorized by the Engineer.

3.1.4 Placing Tolerances. Placing tolerances shall be in accordance with ACI 117 except as specified otherwise hereinafter.

3.1.4.1 Spacing. The spacing between adjacent bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than one inch.

3.1.4.2 Concrete Cover. The minimum concrete cover of reinforcement steel shall be as shown on the drawings. The allowable tolerances shall be as follows:

<u>REQUIRED MINIMUM COVER</u> (Inches)	<u>MAXIMUM VARIATION</u> (Inches)
6	+1/2
4	+ 3/8
3	+ 3/8
2	+ 1/4
1-1/2	+ 1/4
1	+ 1/8

3/4

+ 1/8

3.1.5 Splicing. Splicing in steel shall be made only as required. Bars may be spliced at alternate or additional locations at no additional cost to the Owner, subject to the approval of the Engineer.

3.1.6 Lap splices shall be used only for bars smaller than size No. 14. Lapped bars may be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each in concrete, but shall not be spaced farther apart than one-fifth the required length of lap nor 6 inches.

3.1.7 Couplers that are located at a joint face can be a type that can be set either flush or recessed from the face as indicated. Seal couplers during concrete placement to completely eliminate concrete or cement paste from entering. Unless indicated otherwise, provide mechanical coupler spacing and size to match the spacing and size of the reinforcement indicated for the adjacent section.

## 3.2 QUALITY CONTROL

3.2.1 The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of its quality control of all construction operations in accordance with Section 01440, CONTRACTOR QUALITY CONTROL and including, but not limited to the following:

3.2.1.1 Documentation of materials supplied to the site and inspection of embedded items prior to concrete placement. Results of each inspection shall be reported in writing.

3.2.1.2 A copy of the records of inspections and tests, as well as the records of corrective action taken, shall be furnished as directed by the Owner.

## PART 4 MEASUREMENT AND PAYMENT

The work of this section will not be measured for separate payment, and all costs therefore shall be included in the price bid for the feature to which the work pertains.

## END OF SECTION

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**SECTION 03300**  
**CAST-IN-PLACE CONCRETE**  
**PART 1 GENERAL**

**1.1 SCOPE**

The work of this section covers the furnishing of all equipment, labor, and materials for providing and placing cast-in-place concrete.

**1.2 APPLICABLE PUBLICATIONS**

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

**1.2.1 AMERICAN CONCRETE INSTITUTE (ACI).**

117 Standard Specifications for Tolerances for Concrete Construction and Materials

211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

211.5R Guide for Submittal of Concrete Proportions

301 Specifications for Structural Concrete

304R Guide for Measuring, Mixing, Transporting, and Placing Concrete

305R Hot Weather Concreting

306R Cold Weather Concreting

318 Building Code Requirements for Structural Concrete

**1.2.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).**

C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field

C 33 Standard Specification for Concrete Aggregates

C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

- C 42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C 94 Standard Specification for Ready-Mixed Concrete
- C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C 143 Standard Test Method for Slump of Hydraulic-Cement Concrete
- C 150 Standard Specification for Portland Cement
- C 171 Standard Specification for Sheet Materials for Curing Concrete
- C 172 Standard Practice for Sampling Freshly Mixed Concrete
- C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
- C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- C 260 Standard Specification for Air-Entraining Admixtures for Concrete
- C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C 494 Standard Specification for Chemical Admixture for Concrete
- C 597 Standard Test Method for Pulse Velocity Through Concrete
- C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C 803 Standard Test Method for Penetration Resistance of Hardened Concrete
- C 805 Standard Test Method for Rebound Number of Hardened Concrete
- C 1064 Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
- C 1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
- D 75 Standard Practice for Sampling Aggregates

### 1.2.3 ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT).

Standard Specifications for Road and Bridge Construction

### 1.2.4 U.S. ARMY CORPS OF ENGINEERS HANDBOOK FOR CONCRETE AND CEMENT (CRD).

C 400 Water for Use in Mixing or Curing Concrete

C 521 Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

## 1.3 SUBMITTALS

All submittals shall be in accordance with the Contract Conditions. The Contractor's Quality Control organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

1.3.1 Contractor's Concrete Operation Plan. A plan for all concrete operations planned under this contract shall be submitted for approval within 30 days after notice to proceed. The plan shall demonstrate a thorough understanding of all involved technical and logistical conditions necessary for the production of concrete that meets all requirements of these specifications. The plan shall provide as a minimum:

1. Sources of cement, pozzolan, and aggregates;
2. Location of aggregate stockpiles, batching plant, and mixing plant;
3. Method of conveying concrete to and within the project area;
4. Provisions for replacement of required equipment in the event of breakdown;
5. Provisions for protection of fresh concrete from freezing, wave action, or other damaging effects during conveyance, placement and curing;
6. Method and equipment used for consolidation, finishing, and curing; and
7. Contractor quality control measures.

Concrete operations under this contract shall not begin until the Owner has reviewed, commented on, and approved in writing the concrete operation plan. The Owner will return the plan, with comments and any necessary revisions or additions, within 30 calendar days of receiving the plan.

### 1.3.2 Mix Design and Test Reports.

1.3.2.1 Concrete mixture proportions shall be determined by the contractor in accordance with

ACI 211.1 and submitted for approval at least 30 days in advance of concrete placement. The submittal of mixture proportions and materials test data and certification shall follow the guidelines in ACI 211.5R. The proportions of all ingredients and the size number of the coarse aggregate gradation (as defined by ASTM C 33) that will be used in the manufacture of concrete shall be stated. Proportions shall indicate weight of cement, water, and weights of aggregates in a saturated surface-dry condition, and type, quantity and name of admixtures per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project. The submittal shall be accompanied by test reports from a laboratory complying with ASTM C 1077, which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the new materials and quality of concrete are satisfactory.

1.3.2.2 Laboratory test data on the coarse and fine aggregate shall be submitted showing that these materials conform to the specified requirements. Test data shall be no older than 12 months.

1.3.2.3 Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which it is furnished.

1.3.2.4 Results of all tests specified herein to be performed by the Contractor shall be submitted promptly upon their completion.

1.3.3 Admixtures. Manufacturer's literature shall be submitted for review and approval for conformance with these specifications. All admixtures in a mix design shall be compatible with each other and certified for compliance with all specification requirements as evidenced by a Manufacturer's Certificate of Compliance.

1.3.4 Curing. The curing medium, method, and manufacturer's literature shall be submitted for review and approval for conformance with these specifications. The curing medium used shall be certified for compliance with all contract requirements as evidenced by a Manufacturer's Certificate of Compliance.

1.3.5 Cold-Weather Requirements. If concrete is to be placed under cold weather conditions the procedures, materials, methods, and protection proposed to accomplish it shall follow the guidelines of ACI 306R and be submitted for review.

1.3.6 Hot-Weather Requirements. If concrete is to be placed under hot weather conditions the procedures, materials, methods, and protection proposed to accomplish it shall follow the guidelines of ACI 305R and be submitted for review.

1.3.7 Underwater Requirements. If concrete is to be placed underwater, the procedures, materials, mix design, methods, and protection proposed to accomplish the work shall follow the guidelines of ACI 304R, and be submitted for review.

## PART 2 PRODUCTS

### 2.1 MATERIALS

2.1.1 General. Concrete shall be composed of cementitious material, water, fine and coarse aggregates and admixtures. The admixture shall be an air-entraining agent and, at the Contractor's option, water reducer and during cold weather a non-chloride accelerator. Materials shall meet the requirements of the respective standards as specified below.

2.1.2 Cementitious Material. Cementitious material shall be portland cement or portland cement in combination with pozzolan. Optional pozzolan replacement of cement shall be limited to 25% by weight of the total cementitious material in the mixture.

Portland Cement. ASTM C 150, Type II.

Pozzolan. Pozzolan shall conform to ASTM C 618, Class C or F.

2.1.3 Aggregates.

2.1.3.1 Composition. Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, or a combination thereof.

2.1.3.2 Quality and Gradation. The aggregate particles shall be clean, hard, unweathered, and uncoated. The shape of the particles shall be generally cubical or spherical. Where required, fines shall be removed from the coarse aggregates by adequate washing. Total deleterious materials shall not exceed 5 percent. Fine aggregates as delivered to the mixer shall meet the requirements of ASTM C 33. The coarse aggregate shall meet the quality requirements of ASTM C 33 Class Designation 4S or better. Grading of the coarse aggregate shall comply with size number 67 as tested in accordance with ASTM C 136, with the exception of coarse aggregate for seiche cable post concrete infill, which shall comply with size number 8 as tested in accordance with ASTM C 136.

2.1.4 Admixtures

2.1.4.1 General. Air-entraining admixture or other chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the Contractor when directed and shall be rejected if test results are not satisfactory.

2.1.4.2 Air-entraining Admixture. Air-entraining admixture conforming to ASTM C 260 shall be batched in the mixing water.

2.1.4.3 Water-reducing admixture. Water-reducing admixture shall conform to ASTM C 494, Type A or D. High-range water-reducing admixtures will not be allowed.



2.1.4.4 Accelerating admixture. Accelerating admixture shall be non-chloride and shall conform to ASTM C 494, Type C.

2.1.4.5 Curing Materials. Membrane-Forming Curing Compound: The membrane-forming curing compound shall conform to ASTM C 309, Type 1-D or 2. The curing compound selected shall be compatible with any subsequent paint, roofing, coating, or flooring specified. Non-pigmented compound shall contain a red fugitive dye and shall have the reflective requirements in ASTM C 309 waived. Burlap used for curing shall conform to COE CRD-C 318.

2.1.5 Water. Water for mixing shall be fresh, clean and drinkable, except that undrinkable water may be used if it meets the requirements of CRD-C 400. Water for curing shall not contain any substance that stains or is injurious to the concrete.

2.1.6 Ready Mixed Concrete. Ready-Mixed Concrete shall conform to ASTM C94 except as otherwise specified.

## 2.2 MIXTURE PROPORTIONING

2.2.1 Quality. Proportions for mixtures shall be selected so that the following requirements are met.

2.2.1.1 Strength. The specified compressive strength ( $f_c$ ) shall be 4,000 pounds per square inch in 28 calendar days unless pozzolan is used in which case the specified strength shall be met in 90 calendar days provided the 90-day period does not extend past the contract expiration date. Concrete shall be proportioned to provide an average compressive strength as prescribed in ACI 301.

2.2.1.2 Water/cement Ratio. Water/cement ratio shall not exceed 0.45.

2.2.1.3 Air Content. Air content as determined by ASTM C 231 shall be between 6 and 8 percent.

2.2.1.4 Slump. Slump shall be between 2 and 4 inches as determined in accordance with ASTM C 143.

2.2.2 Concrete Proportioning. Trial design batches and testing requirements shall be submitted if concrete will be batched on site. These requirements shall be the responsibility of the Contractor. If concrete is batched at a ready-mix plant, mix design, material gradations, cement composition, and compressive strength results from the plant shall be submitted in lieu of trial design batches. Samples of approved aggregates shall be obtained in accordance with the requirements of ASTM D 75. Samples of materials other than aggregate shall be representative of those proposed for the project and shall be accompanied by the manufacturer's test reports indicating compliance with applicable specified requirements. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios, which will produce a range of strength encompassing those required for the work. The target water-cement ratios will be converted to a weight ratio of water to cement plus pozzolan by weight equivalency as described in ACI 211.1. Trial mixtures

shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days (and 90 days if pozzolan is used) in accordance with ASTM C 39. From these tests, a curve will be plotted showing the relationship between water-cement ratio and strength.

2.2.3 Evaluation and Acceptance Criteria. The criteria for evaluation and acceptance of concrete strength shall be as prescribed in ACI 301.

## 2.3 CONVEYING EQUIPMENT

2.3.1 General. The conveying equipment shall have a sufficient capacity so that concrete placement is kept plastic and free of cold joints while being placed. Concrete shall be conveyed from mixer to forms as rapidly as practicable, within the time interval specified, and by methods that will prevent segregation or loss of ingredients. Concrete transferred from one conveying device to another shall be passed through a hopper that is conical in shape and shall not be dropped vertically more than 5 feet, except where suitable equipment is provided to prevent segregation and where specifically authorized.

2.3.2 Buckets. The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

2.3.3 Transfer Hoppers. Concrete may be charged into non-agitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and have conical-shaped discharge features. The machine shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete and facile discharge. Concrete shall not be held in non-agitating transfer hoppers more than 30 minutes.

2.3.4 Truck Mixers. Truck mixers or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94.

2.3.5 Chutes. When concrete can be placed directly from a truck mixer, agitator, or non-agitating equipment, the chutes attached to this equipment may be used. A discharge deflector shall be used when required by the Owner.

2.3.6 Belt Conveyors. Belt conveyors may be used when approved. Such conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete at the transfer points and the point of discharge. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. If concrete

is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant trunk that is long enough to extend through the reinforcing bars. In no case shall concrete be discharged to free fall through the reinforcing bars.

2.3.7 Concrete Pumps. Concrete may be conveyed by positive displacement pump when approved by the Owner. The pumping equipment shall be piston or squeeze pressure type. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 5 inches. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the concrete pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place and at an approved location by the Owner. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms and in compliance with all environmental requirements.

## **PART 3 EXECUTION**

### **3.1 PREPARATION FOR PLACING**

3.1.1 Surface Preparation. Surfaces upon which concrete is to be placed shall be clean, free from frost, snow, ice, loose particles, debris and foreign matter. Earth foundations shall be satisfactorily compacted. Surfaces upon which concrete is to be placed which have openings or voids through which concrete might flow freely shall have these openings or voids filled with crushed stone prior to start of concrete placement, as directed by the Owner.

3.1.2 Equipment. All equipment needed to place and consolidate the concrete shall be at the placement site and in good operating condition. Spare vibrators shall be available at the placement site. The entire preparation is subject to approval by the Owner prior to placing. Aluminum pipes, chutes, troughs, spouts or tremies shall not be used for pumping, conveying or placing concrete.

3.1.3 Embedded Items. Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place. Embedded items shall be free of oil and other foreign matter such as loose coatings or rust, paint and scale.

3.1.4 Sampling. The Contractor shall provide suitable facilities and labor for obtaining representative samples of concrete for Contractor quality control and the Owner's quality assurance testing. All necessary platforms, tools, and equipment for furnishing samples shall be furnished by the Contractor.

3.1.5 Protection. The Contractor shall take all necessary precautions to protect the concrete from any condition that will damage the concrete, including preventing waves from splashing on the concrete during and immediately after placement. Precautions shall include but not be limited to scheduling concrete placements when waves are small and constructing wave barricades around concrete work.

## 3.2 PLACING

3.2.1 General. Concrete work shall comply with ACI 301 except as specified otherwise hereinafter.

3.2.1.1 The Contractor shall schedule concrete placements so that disruption of initial set and/or concrete strength gain is not affected by pile driving, wave action, or any other cause. Contractor shall, at his expense, core and test concrete where directed when disruption of initial set or inadequate concrete strength gain is suspected.

3.2.1.2 Concrete placement will not be permitted when weather conditions prevent proper placement and consolidation, as determined by the Owner.

3.2.1.3 Concrete shall be deposited as close as possible to its final position, and in so depositing there shall be no vertical drop greater than four feet except where suitable equipment is provided to prevent segregation and where specifically authorized by the Owner. For all concrete the amount deposited in each location shall be that which can be readily and thoroughly consolidated in horizontal layers not to exceed 12 inches in thickness. The top of the lift should be level and made reasonably even by means of vibration. Holes from previous vibrator insertions shall be closed. Large aggregate shall be completely embedded. The surfaces of construction joints shall be kept continuously wet for the first twelve hours during the twenty-four hour period prior to placing concrete. Free water shall be removed prior to placement of concrete unless underwater concrete placement procedures are implemented and approved. As a lift is completed, the top surface shall be immediately and carefully protected from any condition that will damage the concrete. The Contractor shall provide adequate walkways for workers to prevent deep foot printing.

3.2.2 Cold Joints. In the event of formation of a cold joint not shown on the drawings or approved in advance, the Contractor shall notify the Engineer. If directed, the Contractor shall remove concrete for the corresponding placement and replace the concrete without cold joints. All concrete removed and replaced due to unauthorized cold joints shall be at the Contractor's expense. If it appears that a cold joint will occur, the concrete along the leading edge of the advancing concrete shall be thoroughly vibrated to a uniform and stable slope.

3.2.3 Time Interval Between Mixing and Placing. Concrete shall be placed within thirty (30) minutes after discharge into non-agitating equipment. When concrete is truck mixed or when a truck mixer or agitator is used for transporting concrete mixed by a concrete plant mixer, the concrete shall be delivered to the site of the work and discharge and final placement shall be completed within 1-1/2 hour after introduction of the cement to the aggregates.

3.2.4 Cold-Weather Placing. Concrete shall be properly placed and finished with approved procedures in accordance with Paragraph 1.3.5 when the concrete is likely to be subjected to freezing temperatures before the expiration of the curing period. The ambient temperature of the space adjacent to the concrete placement and surfaces to receive concrete shall be above 40 degrees F. Materials entering the mixer shall be free from ice, snow or frozen lumps.

3.2.5 Hot-Weather Placing. Concrete shall be properly placed and finished with approved procedures in accordance with Paragraph 1.3.6. The concrete placing temperature shall not exceed 80 degrees F when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water and/or aggregates will be required to obtain an adequate placing temperature. Conveying and placing equipment shall be cooled if necessary to maintain proper placing temperature.

3.2.6 Underwater Placing. Placement of concrete underwater shall follow the guidelines of ACI 304R.

3.2.7 Consolidation. Immediately after placement, each layer of concrete shall be consolidated by internal vibrating equipment. Vibrators shall not be used to transport or move concrete within the forms. Hand spading may be required if necessary with internal vibrating along formed surfaces permanently exposed to view. The Contractor shall have on hand a minimum of two vibrators (in case of breakdown/mechanical failure of first) of the proper size, frequency, and amplitude for the type of work being performed in conformance with the following requirements:

<b>Application</b>	<b>Head Diameter Inches</b>	<b>Frequency VPM</b>	<b>Amplitude Inches</b>
General construction	2 - 3-½	8,000 - 12,000	0.025 - 0.05

Vibration shall be systematically accomplished by inserting the vibrator through fresh concrete into the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator and overlay the adjacent, just vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer, and at least 6 inches into the layer below, if such exists, and held stationary until the concrete is consolidated (normally 4 to 6 seconds, but some mixes may require more time) and then withdrawn slowly.

### 3.3 CONSTRUCTION TOLERANCES

Concrete work for which more precise tolerances are not indicated shall be constructed so that the finished work does not exceed the tolerance limits specified in ACI 117. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing. When forms or shoring are used, the measurements shall be made prior to removal. Tolerances are not cumulative. The most restrictive tolerance shall control. Under no circumstances shall concrete that permits ponding of water be acceptable.

### 3.4 FINISHING

3.4.1 General. The ambient temperature of spaces adjacent to surfaces being finished shall not be less than 40 degrees F.

3.4.2 Unformed Surfaces. All unformed surfaces that are not to be covered by additional concrete or backfill shall be float and broom finished to elevations shown. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left true and regular.

3.4.2.1 Float Finish. Surfaces shall be screeded and darbied or bullfloated to bring the surface to the required finish level with no coarse aggregate visible. No cement or mortar shall be added to the surface during the finishing operation. The concrete, while still green but sufficiently hardened to bear a worker's weight without deep imprint, shall be floated to a true and even plane, sloped to drain as shown. Floating may be performed by use of suitable hand floats.

3.4.2.2 Broom Finish. Deck level shall be broom finished. The concrete shall be finished with a float finish and after surface moisture has disappeared, the surface shall be broom finished.

3.4.2.3 Tine Finish. After broom finishing the deck level concrete, the deck shall be hand tined in accordance with Article 420.11 of the IDOT Specification for Road and Bridge Construction.

### **3.5 CURING AND PROTECTION**

3.5.1 General. Immediately after placement, concrete shall be protected from wave action, premature drying, extremes in temperatures, rapid temperature change, freezing, and mechanical injury. All materials and equipment needed for adequate curing and protection shall be available and at the placement site prior to start of concrete placement. All concrete shall be moist cured continuously for a minimum of 7 days, followed by application of an approved curing compound.

3.5.2 Moist Curing. Concrete moist-cured shall be maintained continuously (not periodically) wet for the entire curing period. Where wooden form sheathing is left in place during curing, the sheathing shall be kept wet at all times. Horizontal surfaces shall be moist cured by ponding, by covering with a minimum uniform thickness of 2 inches of continuously saturated sand, or by covering with saturated non-staining burlap or cotton mats or approved methods using sealed impervious sheet materials.

#### **3.5.3 Membrane-Forming Curing Compound.**

3.5.3.1 Concrete shall be cured with an approved membrane-forming curing compound after completion of moist curing except that membrane curing will not be permitted on any surface to which a grout-cleaned finish is to be applied or other concrete is to be bonded, on any surface containing protruding steel reinforcement, on an abrasive aggregate finish, or any surface maintained at curing temperature by use of free steam. A styrene acrylate or chlorinated rubber compound may be used for surfaces that are to be painted or are to receive bituminous roofing or waterproofing, or for floors that are to receive adhesive applications of resilient flooring.

3.5.3.2 Nonpigmented Curing Compound. A nonpigmented curing compound containing a red fugitive dye may be used on surfaces that will be exposed to view when the project is completed. Concrete cured with nonpigmented curing compound must be shaded from the sun for the first 3 days when the ambient temperature is 90 degrees F or higher.

3.5.3.3 Application. The curing compound shall be applied to vertical formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The surfaces shall be thoroughly moistened with water, and the curing compound applied as soon as free water

disappears. The curing compound shall be applied to unformed surfaces after completion of wet curing and as soon as free water has disappeared and bleeding has stopped. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 250 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces that have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. All concrete surfaces on which the curing compound has been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause that will disrupt the continuity of the curing membrane.

**3.5.4 Cold Weather Protection.** When the daily outdoor low temperature is less than 32 degrees F, the temperature of the concrete shall be maintained above 40 degrees F for the required curing period. In addition, during the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by measurement of ambient and concrete temperatures. (Indicated by suitable thermometers furnished by the Contractor as required and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor at such locations as may be directed.) Curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by use of free steam.

**3.5.5 Hot-Weather Protection.** In hot weather when the rate of evaporation of surface moisture, as determined by ACI 305R may exceed 0.2 pounds per square feet per hour, provision for windbreaks, shading, fog spraying, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

**3.5.6 Other Protection.** The Contractor shall take all necessary precautions to protect the concrete from any condition that will damage the concrete, including preventing waves from splashing on the concrete during and immediately after placement. Precautions shall include but not be limited to scheduling concrete placements when waves are small and constructing wave barricades around concrete work.

## **3.6 EVALUATION AND ACCEPTANCE**

**3.6.1 Concrete Strength.** The criteria for evaluation and acceptance of concrete strength shall be as prescribed in ACI 301. Additional analysis or testing may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient. Nondestructive testing in accordance with ASTM C 597, C 803, or C 805 may be permitted by the Owner to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection. At least three representative 4-inch diameter cores shall be obtained from each member or area of concrete that is considered potentially deficient. The location of the cores will be determined by the Owner and shall be tested after moisture conditioning in accordance with ASTM

C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Concrete work considered inadequate shall be reinforced with additional construction as directed by the Owner at the Contractor's expense or shall be replaced at the Contractor's expense.

3.6.2 Appearance. Permanently exposed surfaces shall be cleaned, if stained or otherwise discolored, by an approved method that does not harm the concrete. Abrupt variations in color, shade or tint will not be permitted on these surfaces.

3.6.3 Damage to Concrete. Concrete that is damaged due to wave action, contractor activities or negligence, or sub-contractor activities or negligence during construction shall be replaced to the satisfaction of the Owner at the Contractor's expense. Contractor shall submit a repair plan to the Owner for approval prior to commencing repairs. Repair plan submittal shall abide by the Contract Conditions. All repairs shall be full-depth removal and replacement.

### **3.7 CONTRACTOR QUALITY CONTROL**

#### **3.7.1 Testing and Inspection**

3.7.1.1 General. The Contractor shall perform the inspection and tests described in the following paragraphs. The laboratory performing the tests shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum Guidelines for Certification of Concrete Field Testing Technicians, Grade I. The testing frequencies given herein are minimum testing frequencies and additional tests shall be made if required to maintain adequate quality control.

3.7.1.2 Preparation for Placing. Foundation or construction joints, forms, and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor in order to certify to the Owner that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.7.1.3 Concrete Air Content. Two tests for air content shall be made for each 100 cubic yards of concrete placed, but at least one test for air content shall be made during each 8-hour shift during which concrete is placed. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or as directed by the Owner's Representative. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 231.

3.7.1.4 Concrete Slump and Temperature. Two tests for slump and concrete temperature shall be made for each 100 cubic yards of concrete placed, but at least one test for slump and temperature shall be made during each 8-hour shift during which concrete is placed. Additional tests shall be made when excessive variation in workability or high concrete temperature are reported by the placing foreman or Owner's Representative. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143 and ASTM C 1064.



3.7.1.5 Concrete Strength. Two samples for strength testing shall be taken for each 100 cubic yards of concrete placed, but at least one test for strength shall be made during each 8-hour shift during which concrete is placed. A minimum of three specimens shall be made from each sample, one shall be tested at 7 day and two at 28 days. If a fly-ash mix is used, two additional specimens shall be made and tested at 90 days. Compression test specimens shall be made and cured in accordance with ASTM C 31 and compression test specimens tested in accordance with ASTM C 39.

3.7.1.6 Vibrators. The frequency and amplitude of each vibrator shall be determined in accordance with CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made when a vibrator does not appear to be adequately consolidating the concrete. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Placing foreman shall not permit placing to begin until he has verified that an adequate number of acceptable vibrators in working order and with competent operators are available. Placing shall not be continued if any concrete is inadequately consolidated.

3.7.1.7 Placing. The placing foreman shall supervise all placing operations, shall determine that the correct quality of concrete is placed in each location and shall be responsible for measuring and recording concrete temperatures, ambient temperature, weather conditions, time of placement, yardage placed, and method of placement. A report shall be submitted in writing to the Owner.

3.7.1.8 Curing. At least once each day during the curing period, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be reported in writing.

3.7.1.9 Protection. At least once a day during the curing period, an inspection shall be made of all areas subject to cold-weather protection. Deficiencies shall be noted.

### 3.7.2 Corrective Action.

3.7.2.1 Concrete Air Content. Whenever a test result is outside the specified limits, the concrete shall not be delivered to the form and an adjustment shall be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the correctness of the adjustment.

3.7.2.2 Concrete Slump. Whenever a test result is outside the specified limits, the concrete shall not be delivered to the forms and an adjustment should be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the water-cement ratio does not exceed that specified. As soon as practical after each adjustment, another test shall be made to verify the correctness of the adjustment.

3.7.2.3 Concrete Temperature. If any batch of concrete fails to meet the temperature requirements as determined in accordance with ASTM C 1064, immediate steps shall be taken to improve temperature controls.

3.7.2.4 Curing. When a daily inspection report lists an area of inadequate curing, the required curing period for that area shall be extended by 1 day.

3.7.2.5 Protection. When any concrete temperature during the period of protection or protection removal fails to comply with the specifications, that fact shall be reported to the Owner, and immediate steps should be taken to correct the situation.

3.7.3 Reports. The results of all tests and inspections conducted at the site shall be reported informally at the end of each shift and in writing weekly and shall be delivered to the Owner within 3 days after the end of each weekly reporting period. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Owner has the right to examine all Contractor quality control records.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 MEASUREMENT**

4.1.1 Measurement of reinforced concrete will be made on the basis of the number of cubic yards of concrete in-place within the neat lines shown on the Drawings. No allowance will be made for excess quantity beyond the dimensions specified.

### **4.2 PAYMENT**

4.2.1 Payment for cast-in-place concrete and all incidental work will not be measured for payment and all costs associated therewith shall be included in the applicable lump-sum amounts contained in the Schedule of Prices for the various items of the bidding schedule listed below, except as noted, which price shall include the cost of furnishing all material and equipment and performing all labor for the manufacture, transporting, placing, finishing, curing, and protecting of concrete; the furnishing and installing of form work and reinforcing steel; foundation and subgrade preparation, and all other items incidental to the proper construction of concrete in accordance with the Specifications and Contract Plans.

4.2.2 Bidding schedule items applicable to this section are as follows:

<b>Item No.</b>	<b>Description</b>	<b>Unit</b>
4.0	Cast-in-Place Reinforced Concrete	Lump Sum

**END OF SECTION**

## SECTION 05500

### MISCELLANEOUS METALS

#### PART 1 GENERAL

##### 1.1 SCOPE

This section establishes the general criteria for materials, production, erection and evaluation of the safety ladders to be connected to the steel sheet piling, seiche cable posts, and miscellaneous metal items required herein and as noted on the drawings or any related section of these specifications. The work to be performed under this section of the specifications shall include all labor, material, equipment, related services, and supervision required for manufacture, assembly, and installation of the miscellaneous metals shown on the drawings.

##### 1.2 REFERENCES

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

###### 1.2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	Structural Steel
ASTM A 240	Specification for Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 666	Specification for Anoded or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate or Flat Bar
ASTM A500/A500M	Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM D7803	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating
ASTM A 1085	

###### 1.2.2 AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	Structural Welding Code – Steel
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###### 1.2.3 AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

## AISC Steel Construction Manual

### 1.2.4 INTERNATIONAL CODE COUNCIL – EVALUATION SERVICES (ICC-ES)

ICC-ES Acceptance Criteria 308: Post-installed adhesive anchors in concrete elements.

## 1.3 SUBMITTALS

The following shall be submitted in accordance with contract conditions:

### 1.3.1 Shop Drawings

Shop Drawings shall show all ladders (elevations and sections); including dimensions; finishes; joint and connection details, weld sizes, types and lengths, locations, dimensional tolerances, and construction handling procedures. Determine field conditions by actual measurements prior to fabrication and installation.

## 1.4 QUALITY ASSURANCE

### 1.4.1 Workmanship

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Contractor may propose additional welding to enhance his installation. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with approved drawings, cuts, and details.

1.4.2 Adhesive anchor installers shall be trained and certified by manufacturer.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Unless otherwise stated within the specifications, all materials shall comply with the specifications, standards, references, and codes given for each material covered in this Section.

2.1.1 Ladders. Ladders shall conform to and be constructed of ASTM A 36 structural steel.

2.1.2 Seiche Cable Posts. Posts shall conform to and be constructed per ASTM A 1085.

2.1.3 Seiche Cable Post Base Plates. Plates shall conform to and be constructed per ASTM A 36.

#### 2.1.4 Adhesive Anchors

2.1.4.1 Epoxy Adhesive shall be Hilti, HIT RE-500 V3 or approved equal.

2.1.4.2 Adhesive anchors shall be hot-dipped galvanized

2.1.4.3 Epoxy adhesive shall be ANSI/NSF approved for use in contact with potable water.

## 2.2 FINISHES

2.2.1. Ladders. After fabrication and before installation ladders and steel sheet pile web shall be painted as specified under Section 09900.

2.2.2. Seiche Cable Posts and Base Plates. After fabrication and before installation seiche cable posts shall be painted as specified under Section 09900. Apply primer and finish coat to outside of post, top cap, and side plates. Apply primer only to inside of post. Tops and side of base plates shall receive primer and finish coats. Mask fraying surfaces prior to finish coat. Apply primer only to bottoms of base plates.

## 2.3 FABRICATION

All items shall be shop assembled and finished as specified.

# PART 3 EXECUTION

Not used.

# PART 4 MEASUREMENT AND PAYMENT

## 4.1 MEASUREMENT

4.1.1 Ladders, seiche cable posts, and miscellaneous metals shall not be measured for payment.

## 4.2 PAYMENT

4.2.1 Payment for Metal Safety Ladders shall be made at the at the Lump Sum price for this item. This price shall include the cost of furnishing all material and equipment and performing all labor for the manufacture, transport, and installation of the ladders in accordance with the Specifications and Contract Plans.

4.2.2. Payment for seiche cable posts and base plates shall be made at the Lump Sum price for this item. This price shall include the cost of furnishing all material and equipment and performing all the manufacture, transport, and installation of the seiche cable posts, base plates, and concrete

anchors.

4.2.3 Bidding schedule items applicable to the work of this section are as follows:

<b>Item No.</b>	<b>Description</b>	<b>Unit</b>
5.0	Metal Safety Ladders	Lump Sum
9.0	Seiche Cable Posts	Lump Sum

**END OF SECTION**

## SECTION 05502

### METAL SHEET PILING, WALERS AND STRUTS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work covered by this section includes furnishing all plant, equipment, labor and materials and performing all operations in connection with the installation and protection of metal sheet piling wall system, including walers and/or bolted or structural connections, in accordance with these specifications and applicable drawings.

##### 1.2 REFERENCES

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

###### 1.2.1 AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC                      Steel Construction Manual

###### 1.2.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6                General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ASTM A 36              Carbon Structural Steel

ASTM A 325             Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 328             Steel Sheet Piling

ASTM A 490             Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

ASTM A 563             Carbon and Alloy Steel Nuts

ASTM A 572             High-Strength Low-Alloy Columbian-Vanadium Structural Steel

ASTM A 615             Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A 690	High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
ASTM A 722	Uncoated High Strength Steel Bar for Prestressing Concrete
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ASTM F 436	Hardened Steel Washers

### 1.2.3 AMERICAN WELDING SOCIETY

AWS D1.1	Structural Welding Code – Steel
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## 1.3 RELATED SECTIONS

1.3.1 Section 01440 Contractor Quality Control

1.3.2 Section 02100 Site Preparation and Demolition

## 1.4 SUBMITTALS

The Contractor's Quality Control organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

### 1.4.1 Data

Manufacturer's literature, available from suppliers, which demonstrates compliance with applicable specifications for the materials listed below:

1.4.1.1 Complete descriptions of driving equipment including hammers, extractors, protection caps and other installation appurtenances shall be submitted for approval prior to commencement of work.

### 1.4.2 Reports

Test reports or certificates of compliance which show that the materials to be provided are in compliance with the applicable specifications. Testing of sheet piling and walers for mechanical properties shall be performed after the completion of all rolling and forming operations.

1.4.2.1 Materials test certificates and test reports shall be submitted for each shipment of steel sheet piling, walers, plates and structural tees and identified with specific lots prior to installing piling. Identification data should include piling type, heat analysis number, chemical composition, mechanical properties and the steel manufacturer's name.

1.4.2.2 Records of the sheet piling driving operations shall be submitted after driving is completed. These records shall provide a system of identification which shows the disposition of approved



piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling.

1.4.2.3 Design calculations for the use of alternative pile sections shall be stamped by a Structural Engineer registered in the State of Illinois and submitted prior to installing piling.

1.4.2.4 Test calibration data for the Bolt Tension Calibrator unit via Skidmore or equal calibration testing device.

1.4.2.5 Written work plan, design calculations and drawings showing temporary support of the sheet pile wall during construction.

### 1.4.3 Shop Drawings

Shop drawings for steel sheet piling, including fabricated sections, shall show complete piling dimensions and details, driving sequence and location of installed piling. Shop drawings shall include details and dimensions of templates and other temporary guide structures for installing sheet piling. Shop drawings shall provide details of the method of handling sheet piling to prevent permanent deflection, distortion or damage to piling interlocks.

### 1.4.4 Winter Closure Design

The winter closure design as described in Paragraph 3.6 of this section shall be submitted to the Owner for approval a minimum of 30 days prior to installation of the winter closure.

## **PART 2 PRODUCTS**

### **2.1 METAL SHEET PILING**

#### 2.1.1 Steel Sheet Piling

Steel sheet piling shall be of the type shown on the drawings conforming to the requirements of ASTM A 572 Grade 50. The interlocks of the sheet piling shall be free-sliding, provide a swing angle suitable for the intended installation, but not less than four (4) degrees when interlocked, and maintain continuous interlocking when installed throughout their entire length. The sheet piling shall be homogeneous for the full thickness of the section and shall be capable of developing the structural capacity using the full section modulus. The Owner reserves the right to perform supplemental nondestructive examination of the sheet piling prior to installation of the piling. The cost of such inspection will be borne by the Owner. Any sheets determined to be defective shall be rejected and replaced as directed by the Owner and at no cost to the Owner. Sheet piling shall be provided with standard pulling holes.

#### 2.1.2 Alternative Steel Sheet Piling

Alternative steel sheet pile sections may be substituted for the section shown on the drawings. Piling substituted for the section shown on the drawings shall have as a minimum the properties listed in the following table:

Section Substituted For	Minimum Value for Substitution					
	Section Modulus In <sup>3</sup> /ft	Moment of Inertia In <sup>4</sup> /ft	Section Depth in	Flange Thickness in	Yield Strength Kips/in <sup>2</sup>	Width of Sheet In
SKZ 20	31.69	253.51	16.0	0.315	50.0	28.5

Sections substituted for those shown on the drawings shall have a “Z” profile. Substituted sections shall conform to all other requirements of this specification in addition to the requirements of this paragraph. The Contractor shall provide detailed design calculations for any alternative pile section proposed by the Contractor and accepted by the Owner. The calculations shall include, but not be limited to, battered pile design, walers and connections. Any changes to the batter pile spacing as indicated on the drawings may require revision to the batter pile tip elevations. The design calculations shall be stamped by a Structural Engineer registered in the state of Illinois and submitted to the Owner for approval. The Contractor is responsible for detailing all revisions to the layout and drawings affected by the selected alternative piling. Revised layouts and drawings shall be submitted as shop drawings for approval. Preparation of design calculations, revised drawings, and revised layouts shall be incidental to the applicable bid item.

## 2.2 APPURTENANT METAL MATERIALS

### 2.2.1 Bolts

All bolts shall conform to ASTM A 325 with threads excluded from the shear plane. All bolts shall be installed at the proper location and set straight and square with connecting members. Hardened washers conforming to ASTM F 436-93, shall be provided under the head and nut. Until final acceptance of the completed work, the Contractor shall be required to check, straighten and tighten bolts in any part of the structure. Installation shall conform to the requirements of AISC Specification for Structural Joints using ASTM A 325 bolts. The Calibrated Wrench Tightening Method or Turn of the Nut (with match marking) outlined in the AISC Steel Construction Manual shall be used for confirmation of bolt and nut tightening. No reuse of bolts will be permitted.

### 2.2.2 Bolt Holes

All holes for bolts shall be provided at the proper location or position as specified on the Plans. Holes in metal members shall be made by the applicable method for the connection being made, either drilling or torching. After drilling or torching, holes in metal which are too small or out of shape shall be reamed to the required size. Unless otherwise indicated or specified, all holes for items that are to be inserted through metal members shall not be more than one-sixteenth inch larger than the diameter of the item being installed.

### 2.2.3 Structural Tees, Miscellaneous Plates and Shapes

Structural tees, miscellaneous plates and shapes, as shown on the drawings, shall conform to Grade 50 ksi, ASTM A 572.

### **2.3 WALERS**

Walers shall be of the sections shown on the drawings and shall conform to Grade 50 ksi, ASTM A 992, unless otherwise shown on the drawings.

### **2.4 TIE RODS**

2.4.1 Tie rods shall be as shown on the drawings and shall conform to Grade 75 ksi steel, ASTM A615.

2.4.2 Tie rods shall be coated with one coat of Sherwin Williams Zinc Clad II primer (or equal) and one coat of Sherwin Williams Dura-Plate 235 epoxy paint system (or equal).

## **PART 3 EXECUTION**

### **3.1 GENERAL**

#### **3.1.1 Delivery and Storage**

Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the sheet piling as required by the referenced specifications. Sheet piling shall be stored and handled in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage. Storage of piling should also facilitate required inspection activities.

#### **3.1.2 Field Measurements**

The Contractor shall obtain all field measurements required for proper and adequate fabrication and installation of the work. Exact measurements are the Contractor's responsibility.

#### **3.1.3 Preparation**

The Contractor shall relocate/remove all pilings, stone, concrete, submerged timbers, and other materials interfering with the proper alignment and performance of the work. See Section 02100 SITE PREPARATION AND DEMOLITION for further direction on site preparation.

### **3.2 PILING DRIVING EQUIPMENT - HAMMER**

Driving Hammers. Hammers shall be steam, air, or diesel drop, single-acting, double-acting, differential-acting type, or vibratory type. The driving energy of the hammers shall be as

recommended by the manufacturer for the piling weights and subsurface materials to be encountered.

### 3.3 PLACING AND DRIVING

#### 3.3.1 Driving Line

The driving line shall be cleared of any debris or stone prior to the placing of the sheet piling.

#### 3.3.2 Placing

Any excavation required within the area where piling is to be installed shall be completed prior to placing sheet piling. Piling shall be carefully located as shown on the drawings or directed by the Owner. Piling shall be placed plumb with out-of-plumbness not exceeding one-eighth inch per foot of length and true to line. Permanent walers, templates, or temporary guide structures shall be provided to ensure that the piling is placed and driven to the correct alignment. At least two templates in the vertical direction shall be used in placing each piling, and the maximum spacing of templates shall not exceed 20 feet. Sheet pile shall be placed and driven with the interlock ball leading in the direction of driving. Properly placed and driven sheet piling shall be interlocked throughout its entire length with the adjacent piling to form a continuous diaphragm throughout the length or run of piling wall.

#### 3.3.3 Driving

Piling shall be driven with the proper size hammer and by approved methods so as not to subject the piling to damage and to insure proper sheet pile interlock throughout its length. Piles shall be driven to the depths shown on the plans, or until refusal is encountered. Driving resistance in excess of 10 blows per inch per single pile unit shall be considered practical refusal for impact hammers. The Contractor is restricted to impact hammers having a rated capacity less than 24,450 foot-pounds of energy. For vibratory hammers, a pile penetration rate less than six (6) inches per minute for a period of 5 minutes shall be considered practical refusal. If a pile fails to reach the design tip elevation using a vibratory hammer, the Contractor shall attempt to drive a single sheet pile unit using an appropriate impact hammer as discussed above. Driving hammers shall be maintained in proper alignment during driving operations by use of leads or guides attached to the hammer. A protecting cap shall be employed in driving when using impact hammers to prevent damage to the top of piling. Piling damaged during driving or driven out of interlock shall be removed and replaced at the Contractor's expense. Adequate precautions shall be taken to insure that piling is driven plumb. If at any time the forward or leading edge of the sheet piling wall is found to be out-of-plumb in the plane of the wall, the piling being driven shall be driven to the required depth and tapered piling shall be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures shall be taken to insure the plumbness of succeeding piling. The maximum permissible taper for any tapered piling shall be one-eighth inch per foot of length. The horizontal alignment of the steel sheet pile wall shall be within one inch of required location after completion of driving and after assembly and tightening of wales. Piling in each run or continuous length wall shall be driven alternately in increments of depth to the required depth or elevation. No piling shall be driven to a lower elevation than those behind it in

the same run except when those behind it cannot be driven deeper. If the sheet piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling. If obstructions restrict driving a piling to the specified penetration, the obstructions shall be removed or penetrated with chisel beam by means of pre-drilling through the obstructions. If the Contractor demonstrates that removal or penetration is impractical, the Contractor shall make changes in the design alignment of the piling structure as directed by the Owner to insure the adequacy and stability of the structure. Piling shall be driven to depths shown on the drawings and shall extend up to the elevation shown on the drawings for the top of pilings. A tolerance of one inch above the required top elevations will be permitted. Piling shall not be driven within 100 feet of cast-in-place concrete or grouted earth anchors less than seven days old.

### **3.4 CUTTING OFF AND SPLICING**

Piling driven to refusal or to the point where additional penetration cannot be attained and are extending above the required top elevation shall be cut off to the required elevation, as directed by the Owner. Piling driven below the required top elevation and piling damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed by the Owner at no additional cost to the Owner. If directed by the Owner, piling shall be spliced as required to drive them to depths greater than shown on the drawings and extend them up to the required top elevation. Splices shall be made by an approved butt weld, making full penetration of the pile section, or as otherwise directed or approved by the Owner. Piling adjoining spliced pilings shall be full length unless otherwise approved. Piling ends to be spliced shall be squared before splicing to eliminate dips or camber. Concentric alignment of the spliced piling interlocks shall be provided so that there are no discontinuities, dips or camber at the abutting interlocks. Spliced piling shall be free sliding and able to obtain the maximum swing with contiguous piling. The tops of excessively battered piling shall be trimmed when directed at no cost to the Owner. Piling cutoffs shall become the property of the Contractor and shall be removed from the site. The Contractor shall cut necessary holes in piling for bolts, rods, drains, or utilities as shown on the drawings or as directed. All cutting shall be done in a neat and workmanlike manner. A straight edge shall be used in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling shall be drilled or may be burned and reamed by approved methods that will not damage the surrounding metal. Driven sheeting shall have no handling holes left in place after piles have been driven to the minimum pile tip elevation.

#### **3.4.1 Inspection of Driven Piling**

The Contractor shall inspect the interlocked joints of driven sheet piling extending above ground. Piling found to be out of interlock shall be removed and replaced at the Contractor's expense.

#### **3.4.2 Pulling and Redriving**

The Contractor shall pull selected piling after driving to determine the condition of the underground portions of pilings, when directed by the Owner. The Owner shall approve the Contractor's method for pulling piling. Any piling so pulled and found to be damaged to the extent that its usefulness in the structure is impaired shall be removed and replaced at the Contractor's

expense. Piling pulled and found to be in satisfactory condition shall be redriven, when directed by the Owner.

### **3.5 REMOVAL**

The removal of pilings shall consist of pulling, sorting, cleaning, inventorying and storing previously installed piling as shown on the drawings and directed by the Owner.

#### **3.5.1 Pulling**

The method of pulling piling must be approved by the Owner. Pulling holes shall be provided as required. Extractors shall be of suitable type and size. Care shall be exercised during pulling to avoid damaging piling interlocks and adjacent construction. If the Owner determines that adjacent permanent construction has been damaged during pulling, the Contractor will be required to repair this construction at no cost to the Owner. Piling shall be pulled one sheet at a time. Piling fused together shall be separated prior to pulling unless the Contractor demonstrates to the satisfaction of the Owner that the piling cannot be separated. The Contractor will not be paid for the removal of piling damaged beyond structural use due to proper care not being exercised during pulling.

#### **3.5.2 Sorting, Cleaning, Inventorying and Storing**

Pulled piling shall be sorted, cleaned, inventoried and stored, by type, into groups as:

- a. Piling usable without reconditioning;
- b. Piling requiring reconditioning; and
- c. Piling damaged beyond structural use.

### **3.6 WINTER CLOSURE**

At the time of cessation of work for an extended period, be it winter conditions, or other reasons, details described herein, as winter closure shall apply. No rubble removal or site preparation shall be done beyond the limits of the anticipated winter closure until work resumes after the shutdown. The new structure shall be complete, including concrete placement and Toe Stone, up to the winter closure. The Contractor shall provide a winter closure design for approval by the Owner. The winter closure shall be designed, as a minimum, to contain the stone fill within the new portions of the structure, protect the new structure from storm, wind, wave and other damage, and provide a method for preserving the continuity of the structure after work resumes.

### **3.7 TEMPORARY CONSTRUCTION**

The Contractor is responsible for temporary bracing and support of the structure during construction and shall protect all exposed partially complete work against damage. The Contractor shall take precautions to assure that the structure is adequately braced to avoid damage from wave action during construction. Any structural component damaged during construction shall be replaced by the Contractor at no cost to the Owner. The Contractor's means and methods of providing temporary protection shall be as included in the work plan as approved by the Owner.

The Contractor is fully responsible to maintain sheet pile alignment and stability during construction. The Contractor should place toe stone and the deck slab as soon as practical after the backfill is in place to avoid storm or water overtopping damage.

### **3.8 QUALITY CONTROL**

3.8.1 The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including, but not limited to, the following:

- a. Materials;
- b. Sheet piling driving operations, including type and rating of hammer; and
- c. Driving depth or depth of refusal.

3.8.2 A copy of the records of inspections, as well as the records of corrective actions taken, shall be furnished to the Owner as directed by the Owner in accordance with the "Section 01440 CONTRACTOR QUALITY CONTROL" section of this document.

## **MEASUREMENT AND PAYMENT**

### **4.1 MEASUREMENT**

Steel sheet pile shall be measured for payment by using the area of 2-dimensional projection of the wall area. Projected wall area shall be computed by multiplying the horizontal length of wall measured along the top of the pile centerline multiplied by the length of piles, measured from the tip elevation to the cut-off elevation. For installed pilings directed to be cut off before reaching the penetration depth shown on drawings, the portion cut off will be measured for payment as the difference between the total length of piling shown on the plans for that location and the length of piling installed below the point of cut-off. This will equal the square footage of sheet pile.

### **4.2 PAYMENT**

Payment shall cover all costs of furnishing, handling, storing and installing the steel sheet piling and wales including clearing the drive line, placing, driving, cutting holes, connections and other appurtenant materials and work incident thereto. Payment for steel sheet piling in-place shall be made at the contract unit price per square foot of sheet pile as described in Paragraph 4.1 above for Bid Item 6.0 (Steel Sheet Piles). Payment for design and installation of the winter closure shall be incidental to the cost of the steel sheet pile. Payment for steel walers, braces, tie rods, bolts, plates and angles, and associated items shall be made at the contract Lump Sum price for Bid Item 7.0 (Steel Walers). Payment for weldments, drilling, cutting and installing bolts and tie rods shall be incidental to the cost of the Steel Walers.

4.2.1 Pilings not driven to the penetration depths shown on the drawings, which are directed by the Owner to be cutoff, except for those cutoffs necessitated by natural subsurface obstructions,

will be paid by each square foot of sheet pile for the portion cut off. Payment will be as stipulated in Paragraph 4.1 at the rate of 50 percent of the applicable contract unit price.

4.2.3 The cost of each splice made shall be incidental to the cost of the square foot area of the pile extension. An additional sum will be paid for each square foot of piling extension at the contract unit price per square foot of Bid Item 6.0 (Steel Sheet Piles). Payment will be made for each piling spliced, at the direction of the Owner, to drive the piling to a depth greater than shown on the drawings and extend the piling up to the required top elevation.

4.2.4 Contractor-furnished pilings, which have been installed and are pulled at the direction of the Owner and found to be in good condition, will be paid for at the applicable contract unit price for furnishing and installing the pilings in their initial position plus an equal amount for the cost of pulling. When such pulled pilings are redriven, an additional amount equal to 50 percent of the applicable contract unit price for furnishing and driving the pilings will be paid for redriving pilings. This additional price constitutes payment for redriving only. The cost of furnishing, initial driving and pulling the pilings is to be paid for as specified herein. When pilings are pulled and found to be damaged no payment will be made for the initial furnishing and driving or for the pulling of such pilings. Pilings replacing damaged pilings will be paid for at the applicable contract unit prices.

4.2.5 Bidding schedule items applicable to this section are as follows:

<b>Item No.</b>	<b>Description</b>	<b>Unit</b>
6.0	Steel Sheet Piles	Square Foot
7.0	Steel Walers	Lump Sum

**END OF SECTION**



## **SECTION 05522**

### **BARRIER CABLE SYSTEMS**

#### **PART 1 GENERAL**

#### **1.1 SCOPE**

The Contractor shall furnish and install barrier cable system as shown on the contract drawings.

#### **1.2 APPLICABLE PUBLICATIONS**

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

##### **1.2.1 POST-TENSIONING INSTITUTE (PTI)**

TAB.1-06      Post-Tensioning Manual, 6<sup>th</sup> Edition

##### **1.2.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).**

A 475              Standard Specification for Zinc-Coated Wire Strand

#### **1.3 SUBMITTALS**

1.3.1. Prior to the use of materials, the Contractor shall submit to the Owner, for approval, copies of purchase orders, certifications, and samples of all materials as specified herein. However, acceptance of the material will not be made until all materials as specified herein have been satisfactorily fabricated and installed in the Work. Each purchase order, certification, and sample shall be identified with a manufacturer's product identification and the quantity ordered.

1.3.2 The manufacturer's certification shall cover all material requirements and shall include all physical property test data and installation instructions. The Contractor shall be responsible for the accuracy of the manufacturer's certification and the sample certification.

##### **1.3.3. Submittal Requirements:**

1.3.3.1 Shop Drawings: Provide installation drawings including plans, elevation, section, details, and notes prepared by or under supervision of qualified installer. Drawings shall indicate the following: cable (seiche) run arrangement and lengths, post locations and details, and cable anchor component details.

1.3.3.2 Stressing Procedures: Indicate proposed sequence of stressing and jacking forces needed for final effective stress. Stressing procedures shall abide by the PTI Post-Tensioning Manual. Refer to drawings for required lock-off load.

1.3.3.3 Stressing Records: Indicate date of stressing operation, weather conditions including temperature and rainfall, name of individual in charge of stressing operation, serial or identification numbers of jacks and gage, date of jack and gage calibration certification, gage pressure to achieve required stressing force per calibration chart, tendon identification mark, and actual gage pressure.

1.3.3.4 Certified Mill Test Reports: For each coil, submit coil number, ultimate tensile strength, and nominal diameter and steel area of strand.

1.3.3.5 Hardware Data Sheet: Furnish for each hardware component used in the cable anchor system.

## **1.4 QUALIFICATIONS**

1.4.1 The design of the anchoring components at end posts shall be accomplished by a specialty barrier system company with a minimum of three years and 15 related projects worth of experience.

1.4.2 Cable system installation shall be performed under direct supervision by a PTI certified installer or technician.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

2.1.1 Cables: Prestressing steel used for barrier cable shall be wire steel strand which consists of one center wire and six wires spirally wrapped around it. The 7 Wire strand shall conform to Galvanized Post-tensioning steel strand (GPC) Zinc coating class A as designated per ASTM A475, table 4. MUTS shall be 250 ksi or higher.

2.1.2 Galvanized Coating: Coating shall be free from damage or cracking. Repair damaged or cracked galvanizing per barrier cable system manufacturer recommendations.

2.1.3 Barrier Cable Hardware: Inserts, wedges, adjustable anchors, and other anchoring components at end posts shall be per Barrier Cable Systems, Inc., or approved equal. Barrier cable hardware shall be sized for design loads shown on the drawings.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

3.1.1 Install cable system (cable, insert, wedge, etc) per cable system manufacturer's approved shop drawings.

3.1.2. Stress cables per approved stressing procedures.

3.1.3 Installation shall be performed using properly calibrated equipment.

3.1.4 Remove grease from the inside of posts prior to concrete infill.

3.1.5 Infill post with concrete grout per the design drawings.

3.1.6 Seal holes in end posts to prevent water intrusion into post.

### **3.2 FINAL PROTECTION AND ACCEPTANCE**

3.2.1 Touch up any damaged coatings in accordance with cable system manufacturer's recommendations.

3.2.1 If requested by the owner, tension verification shall be performed by means of a cable tension gage without removing or damaging the cables. The cable tension gage shall be per the cable system manufacturer's recommendations.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 PAYMENT**

4.1.1 Payment for barrier cable systems and all incidental work will not be measured for payment and all costs associated therewith shall be included in the applicable lump-sum amounts contained in the Schedule of Prices for the various items of the bidding schedule listed below, except as noted, which price shall include the cost of furnishing and installing barrier cable systems in accordance with the Specifications and Contract Plans. Costs associated with posts and base plates should be included in Bit Item No. 9.0, refer to specification section 05500.

4.1.2 Bidding schedule items applicable to this section are as follows:

<b>Item No.</b>	<b>Description</b>	<b>Unit</b>
8.0	Barrier Cable System	Lump Sum

**END OF SECTION**

## **SECTION 09900**

### **PAINTING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

Each ladder, grab bar, both sides of the top 10 feet of the two SKZ 20 sheets at the ladders installed under this Contract, and seiche cable posts shall be prepared and painted prior to driving the sheet pile, as specified herein. In addition, the Contractor shall paint “No Diving” symbols on the lakeward edge of the promenade slab as specified.

##### **1.2 APPLICABLE PUBLICATIONS**

The following publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto. Reference to standard specifications, guides, reports, and practices stated herein shall be interpreted to mean the latest version or revision as of the date noted in the footer of this section.

1.2.1 STEEL STRUCTURES PAINTING COUNCIL (SSPC) SSPC Volumes I and II

##### **1.3 SUBMITTALS**

All submittals shall be in accordance with the Contract Conditions. The Contractor's Quality Control organization shall be responsible for certifying that all submittals meet the contract requirements. The following items shall be submitted:

1.3.1 Paint. Product data for each paint system to be used, including primers shall be submitted, including label analysis and instructions for handling, storage and application.

1.3.2 Samples. A 6-inch by 6-inch sample of each finish shall be prepared. The sample finish shall be applied on identical type materials to which they will be applied in the work. Each sample shall be identified as to finish, formula, color name and number. When requested by the Owner, the samples shall be stepped, defining each separate coat, including primers.

##### **1.4 DELIVERY, STORAGE AND HANDLING**

1.4.1 Paints shall be delivered to the site in sealed, original labeled containers bearing the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C. (40 and 95 degrees F.) Paints shall be stored on the

project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing. Precautionary measures shall be taken to prevent fire hazards and spontaneous combustion.

## 1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C (45 and 95 degrees F) when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C (50 and 90 degrees F). Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

## PART 2 PRODUCTS

### 2.1 PAINT

2.1.1 The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the respective specifications listed for use in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 200 liters (50 gallons) or less, an approved first-line proprietary paint material with similar intended usage and color to that specified may be used. Additional requirements are as follows:

2.1.2 Colors and Tints. Color for all ladders, ladder wells, and grab bars, as well as seiche cable posts, shall be two coats of Sherwin Williams MTLX SG Safety Yellow B42Y37, or approved equal. Colors for "No Diving" symbols shall be painted in Sherwin Williams (or approved equal) MTLX SG Safety Red Paint B42R38-620-4069, MTLX SG Pure White Paint B42W101-8799-99993, and MTLX SG Black Paint B42B3-620-0505. Manufacturer's standard color is for identification of color only or equal. Tinting of epoxy, and urethane, paints shall be done by the manufacturer. Color will be approved by the Owner upon sample approval.

2.1.3 Lead. Paints containing lead shall not be used.

2.1.4 Chromium. Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content. Paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

## PART 3 EXECUTION

### 3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

### 3.2 INSPECTION

Surfaces to be painted shall be thoroughly examined prior to commencement of the work. The Contractor shall report in writing to the Owner any condition that may potentially affect the proper application, and not commence work until such defects have been corrected at no additional cost to the Owner.

### 3.3 SURFACE PREPARATION

3.3.1 Concrete Surfaces. New concrete surfaces shall be permitted to age for a minimum of 30 days prior to painting. Grease and oil removal shall be accomplished by solvent cleaning and/or detergent washing followed by rinsing. Loosely adherent materials such as dirt, dust, laitance, efflorescence, bleed water residues, or other foreign substances shall be removed by wire or fiber brushing, scrapers, light sandblasting, or other approved means. Surface glaze, if present, shall be removed by light blasting. Prior to painting, the concrete shall be dry.

3.3.2 Galvanized Surfaces. Galvanized Surfaces to be painted shall be treated with a phosphatizing solution to provide the necessary paint bond, and be free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 38 degrees C (100 degrees F). Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3.3 Ferrous Surfaces. Ferrous surfaces, including those that have been shop-coated, shall be solvent-cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection. The Contractor shall take adequate precautions to prevent loose material and dust from falling into Lake Michigan.

3.3.4 Previously Painted Surfaces. Previously painted surfaces damaged during construction

shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas. Edges of chipped paint shall be feather edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting. The Contractor shall take adequate precautions to prevent loose material and dust from falling into Lake Michigan.

### **3.4 MIXING AND THINNING**

3.4.1 When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.5 L (1 pint) of suitable thinner per liter (gallon). The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed local limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.4.2 Two-Component Systems. Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### **3.5 APPLICATION**

3.5.1 General. Painting practices shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch. Unless otherwise specified by the manufacturer, two coats of primer shall be applied. Contractor shall take adequate precautions to prevent paint from being spilled in Lake Michigan.

3.5.2 Respirators. Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.5.3 Contractor shall paint each ladder, ladder rung, grab bar, and both sides of the top 10 feet of the two SKZ 20 sheets at ladders prior to driving the sheet pile. After sheet pile driving is complete, any damage to the newly painted surface shall be touched up.

3.5.4 Contractor shall paint “No Diving” symbols on both east and west edges of the deck at locations established in the field by a representative of the Owner (spacing shall be no more than 40ft on center). The symbol pattern shall be “swimmer” / “submerged rock” / “diver” / “submerged rock” / “swimmer” / “submerged rock” / “diver” / “submerged rock” etc. or as approved by the Owner. Templates for the “No Diving” symbols shall be provided by the Owner. Contractor shall notify the Owner at least 7 days in advance of requiring the templates on site.

3.5.5 Painting shall be carried out when Lake Michigan conditions are suitable so as not to let wet paint come into contact with the waters of Lake Michigan.

### **3.6 TIMING**

3.6.1 Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall be allowed to elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, and curing and drying time between coats of two-component systems shall be followed.

### **3.7 CLEANING**

3.7.1 Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

## **PART 4 MEASUREMENT AND PAYMENT**

The work of this section will not be measured for separate payment and all costs associated therewith shall be included in the applicable unit prices or lump-sum amounts contained in the Schedule of Prices.

### **END OF SECTION**



**Appendix A**  
**Sand Boring Data 2020**



N: 1863191.49  
E: 1191548.01

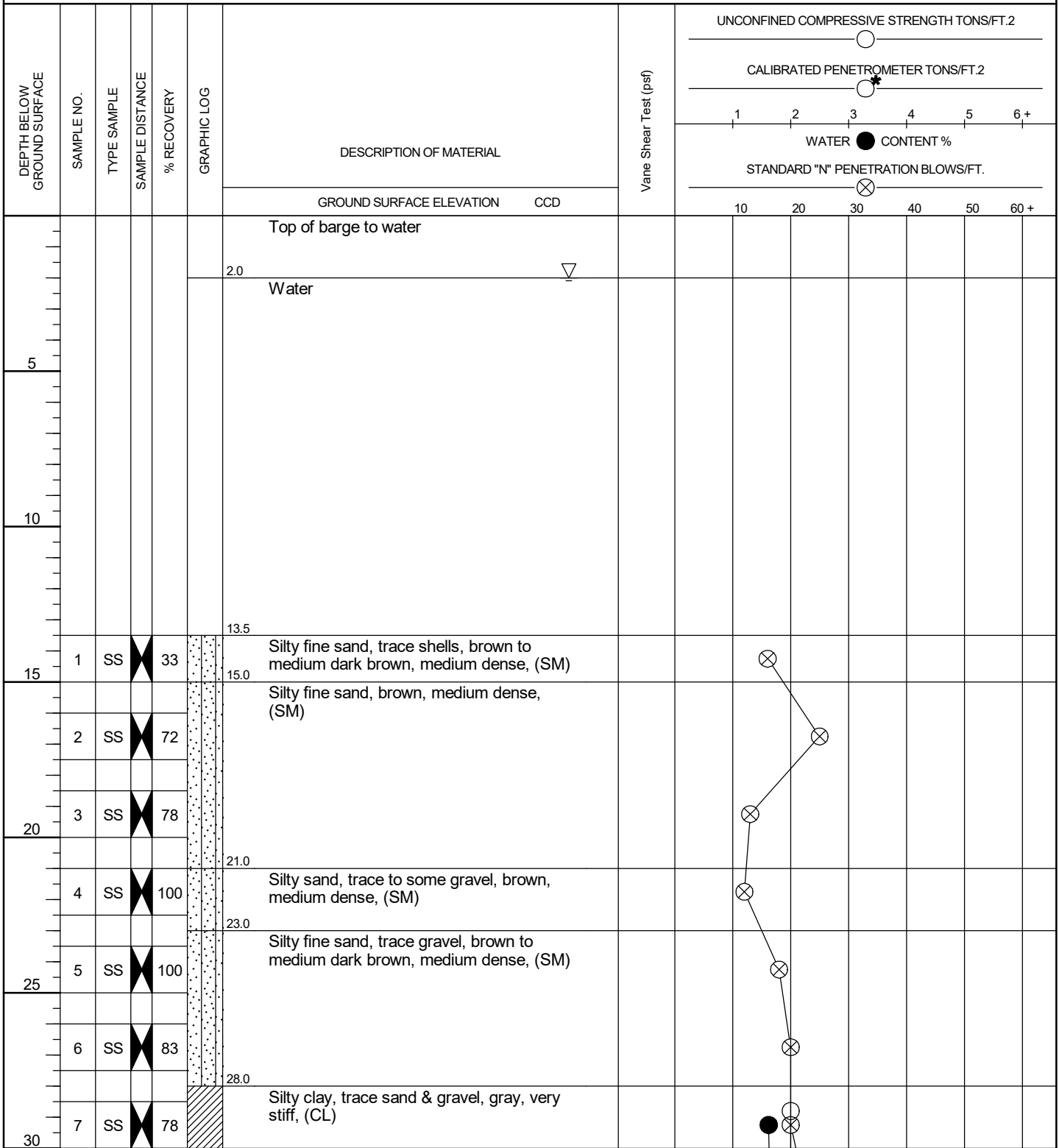
N: 1863210.54  
E: 1191792.58

CLIENT: Chicago Harbors

PROJECT: Proposed Breakwater

COORDINATES:

LOCATION: Jackson Harbor  
Chicago, Illinois



Continued Next Page

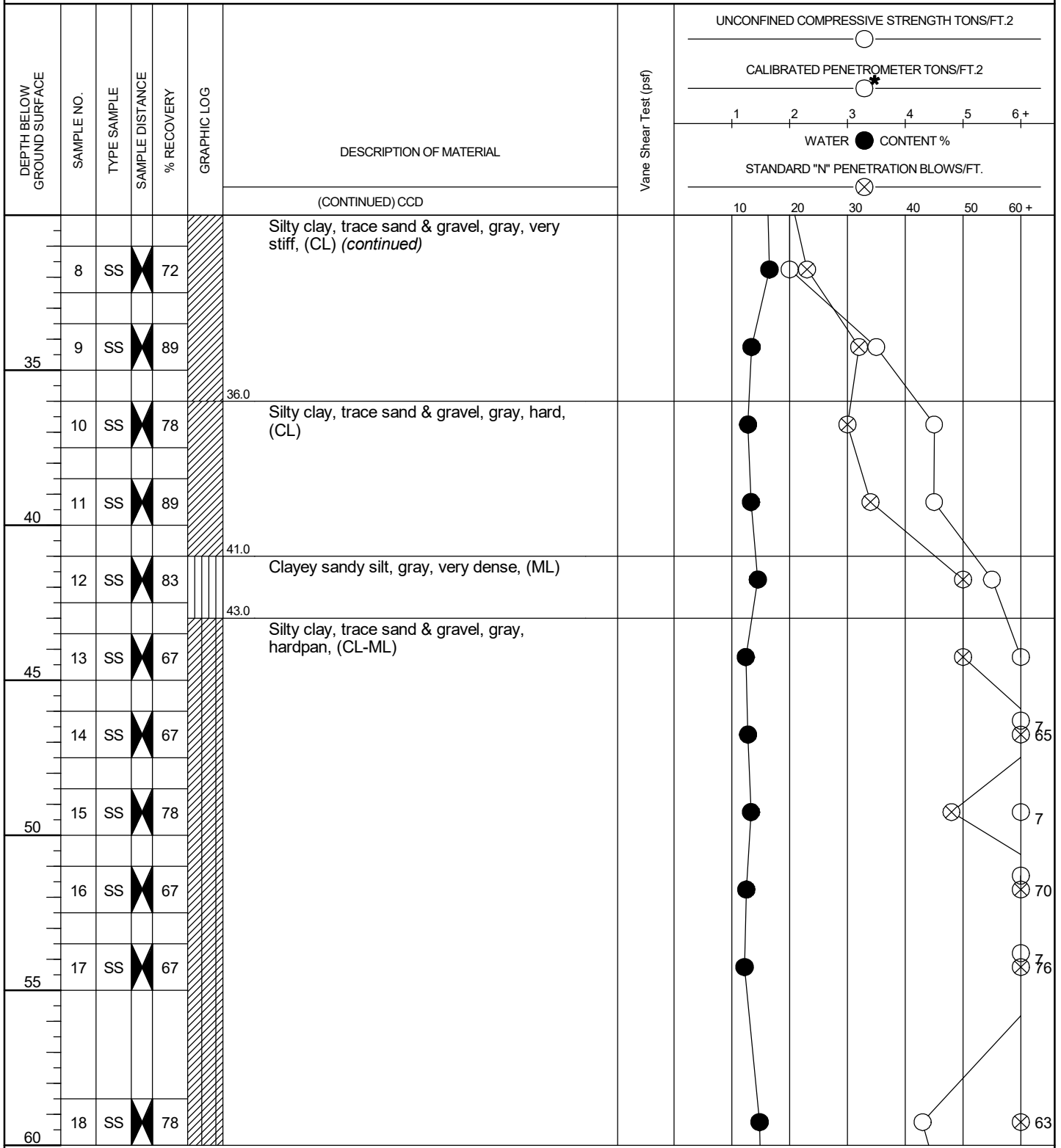
WATER LEVEL OBSERVATIONS			<b>Ground Engineering Consultants, Inc.</b> 350 Pfingsten Road, Suite 106 Northbrook, Illinois 60062 Tel: (847) 559-0085 Fax: (847) 559-0181	BORING STARTED	1/29/20
W.L.	2 Lake	▽		BORING COMPLETED	1/29/20
W.L.		▽		DRILLING COMPANY	FOREMAN Dan
W.L.		▽		STRATA	APPR. BY RL

CLIENT: Chicago Harbors

PROJECT: Proposed Breakwater

COORDINATES:

LOCATION: Jackson Harbor  
Chicago, Illinois



Continued Next Page

WATER LEVEL OBSERVATIONS		<b>Ground Engineering Consultants, Inc.</b> 350 Pfingsten Road, Suite 106 Northbrook, Illinois 60062 Tel: (847) 559-0085 Fax: (847) 559-0181	BORING STARTED	1/29/20
W.L.	2 Lake		BORING COMPLETED	1/29/20
W.L.			DRILLING COMPANY	FOREMAN Dan
W.L.			STRATA	APPR. BY RL



CLIENT: Chicago Harbors

PROJECT: Proposed Breakwater

COORDINATES:

LOCATION: Jackson Harbor  
Chicago, Illinois

DEPTH BELOW GROUND SURFACE	SAMPLE NO.	TYPE SAMPLE	SAMPLE DISTANCE	% RECOVERY	GRAPHIC LOG	DESCRIPTION OF MATERIAL	GROUND SURFACE ELEVATION	CCD	Vane Shear Test (psf)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2							
										CALIBRATED PENETROMETER TONS/FT.2 WATER CONTENT % STANDARD "N" PENETRATION BLOWS/FT.							
						Top of barge to water											
						Water	2.0										
5																	
10																	
15																	
19.0	1	SS	50			Silty fine to coarse sand, trace shells, dark brown, loose, (SM)											
23.0	2	SS	89			Silty fine to medium sand, trace grave & shale particles, brown with layers of dark brown, loose, (SM)											
25.5	3	SS	89			Silty clay, trace sand & gravel, gray, stiff, (CL)											
	4	SS	44														
	5	SS	33														
30																	

Continued Next Page

WATER LEVEL OBSERVATIONS		
W.L.	2 Lake	
W.L.		
W.L.		

**Ground Engineering Consultants, Inc.**

350 Pfingsten Road, Suite 106  
Northbrook, Illinois 60062

Tel: (847) 559-0085 Fax: (847) 559-0181

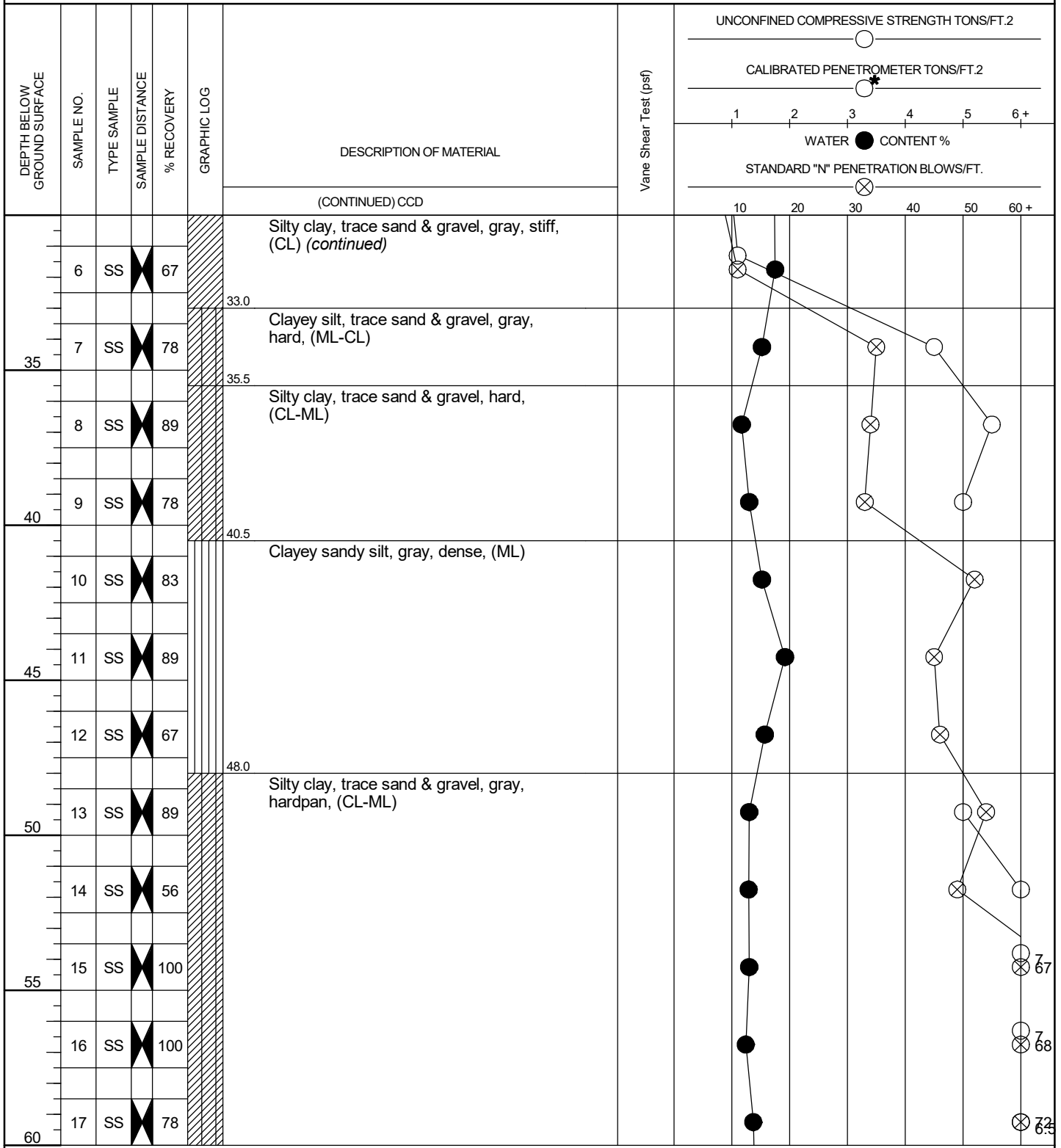
BORING STARTED	1/30/20
BORING COMPLETED	1/30/20
DRILLING COMPANY	FOREMAN Dan
STRATA	APPR. BY RL

CLIENT: Chicago Harbors

PROJECT: Proposed Breakwater

COORDINATES:

LOCATION: Jackson Harbor  
Chicago, Illinois



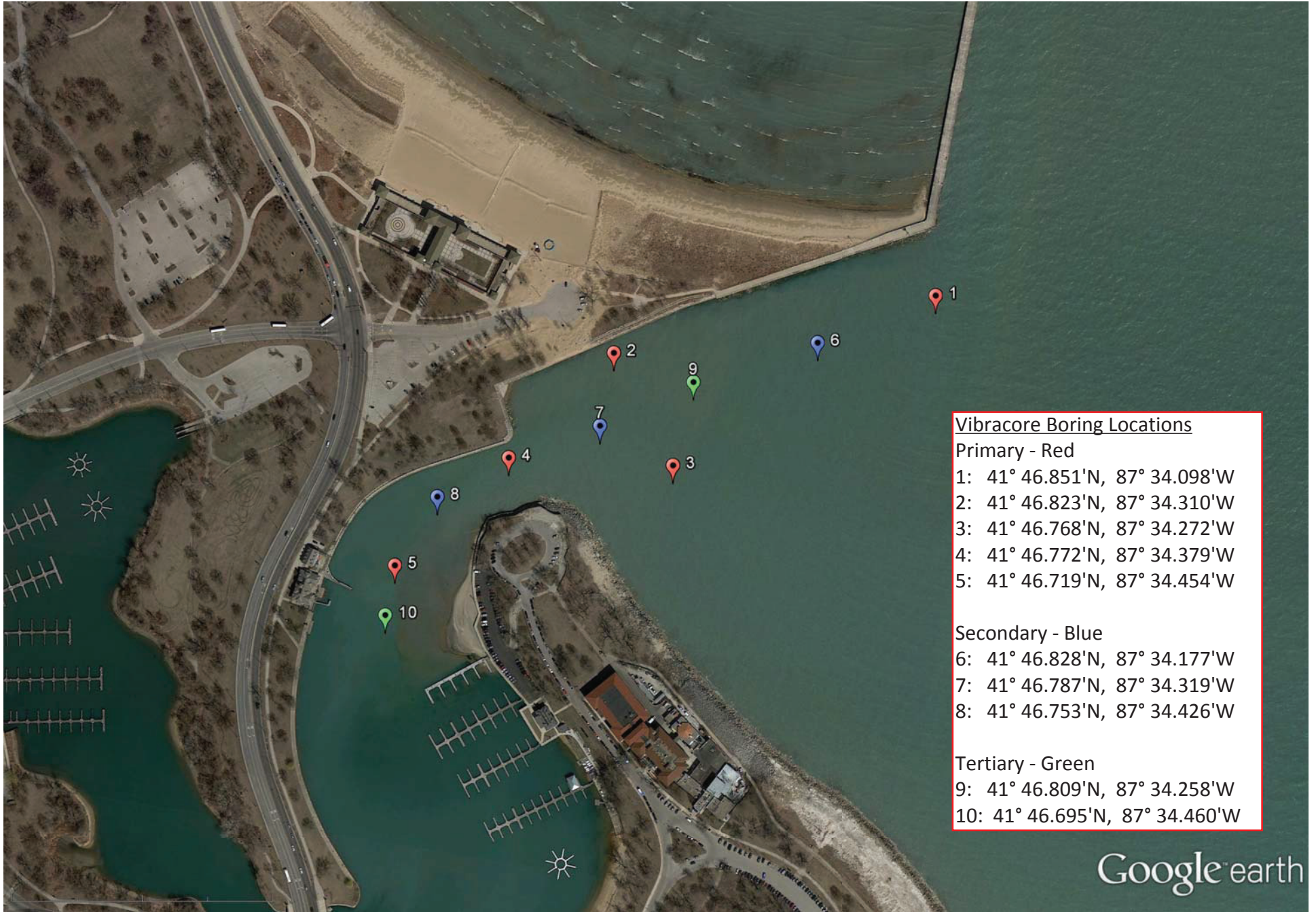
Continued Next Page

WATER LEVEL OBSERVATIONS		<b>Ground Engineering Consultants, Inc.</b> 350 Pfingsten Road, Suite 106 Northbrook, Illinois 60062 Tel: (847) 559-0085 Fax: (847) 559-0181	BORING STARTED	1/30/20
W.L.	2 Lake		BORING COMPLETED	1/30/20
W.L.			DRILLING COMPANY	FOREMAN Dan
W.L.			STRATA	APPR. BY RL





**Appendix B**  
**Vibracore Boring Data 2013**



Vibracore Boring Locations	
Primary - Red	
1:	41° 46.851'N, 87° 34.098'W
2:	41° 46.823'N, 87° 34.310'W
3:	41° 46.768'N, 87° 34.272'W
4:	41° 46.772'N, 87° 34.379'W
5:	41° 46.719'N, 87° 34.454'W
Secondary - Blue	
6:	41° 46.828'N, 87° 34.177'W
7:	41° 46.787'N, 87° 34.319'W
8:	41° 46.753'N, 87° 34.426'W
Tertiary - Green	
9:	41° 46.809'N, 87° 34.258'W
10:	41° 46.695'N, 87° 34.460'W



## LOG OF VIBRACORE NO. GSI-01

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.78087 Easting: 087.56828
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>					
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+					
			SURFACE WATER ELEVATION      577.4		WATER ● CONTENT % 10      20      30      40      50      60+					
5.0			LAKE WATER							
10.0			565.4							
15.0			Poorly Graded SILTY SAND, Trace GRAVEL-gray (SM) <span style="float: right;">563.4</span>							
			Poorly Graded SAND, Trace WHITE SHELL-gray (SP) <span style="float: right;">561.4</span>							
			Poorly Graded SAND with SILT-gray (SP-SM) <span style="float: right;">559.4</span>							
20.0			Poorly Graded SAND, Trace GRAVEL-gray (SP) <span style="float: right;">555.4</span>							
25.0			END OF CORE							

COMMENTS	
Water Depth	12.0'
Core Depth	10.0'
Capped Core Length	7.6'
Time Capped (CST)	1155



**Geo Services, Inc.**  
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 805 Amherst Court, Suite 204  
 Naperville, Illinois 60565  
 (630) 355-2838

CORE STARTED		November 7, 2013	
CORE COMPLETED		November 7, 2013	
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

## LOG OF VIBRACORE NO. GSI-02

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.78033 Easting: 087.57182
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>							
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+							
			SURFACE WATER ELEVATION      577.4		WATER ● CONTENT % 10      20      30      40      50      60+							
			LAKE WATER  572.5									
5.0			Poorly Graded SAND with SILT, Trace WHITE SHELL-gray (SP-SM)  568.5									
10.0			Poorly Graded SAND, Trace GRAVEL-gray (SP)  566.5									
			Poorly Graded SILTY SAND, Trace WHITE SHELL-gray (SM)  562.5									
15.0			END OF CORE									
20.0												
25.0												

COMMENTS	
Water Depth	4.9'
Core Depth	10.0'
Capped Core Length	7.9'
Time Capped (CST)	1040



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 (630) 355-2838

CORE STARTED	November 7, 2013		
CORE COMPLETED	November 7, 2013		
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

**LOG OF VIBRACORE NO. GSI-03**

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77951 Easting: 087.57114
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>					
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup>					
SURFACE WATER ELEVATION				577.4	1	2	3	4	5	6+
					10	20	30	40	50	60+
5.0			LAKE WATER	571.3						
10.0			Poorly Graded SAND with SILT-gray (SP-SM)	567.3						
			Poorly Graded SILTY SAND-gray (SM)	565.3						
15.0			Poorly Graded SAND with SILT-gray (SP-SM)	561.3						
20.0			END OF CORE							
25.0										

COMMENTS	
Water Depth	6.1'
Core Depth	10.0'
Capped Core Length	7.8'
Time Capped (CST)	1310

  
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 Naperville, Illinois 60565  
 (630) 355-2838

CORE STARTED	November 7, 2013		
CORE COMPLETED	November 7, 2013		
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

## LOG OF VIBRACORE NO. GSI-04

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77954 Easting: 087.57296
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>					
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+					
SURFACE WATER ELEVATION					WATER CONTENT %					
					10	20	30	40	50	60+
5.0			LAKE WATER							
10.0			567.4							
			565.4							
15.0			561.4							
20.0			557.4							
25.0			END OF CORE							

COMMENTS	
Water Depth	10.0'
Core Depth	10.0'
Capped Core Length	6.7'
Time Capped (CST)	0910



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 (630) 355-2838

CORE STARTED		November 7, 2013	
CORE COMPLETED		November 7, 2013	
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

## LOG OF VIBRACORE NO. GSI-05

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77866 Easting: 087.57432
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>														
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+														
SURFACE WATER ELEVATION								WATER ● CONTENT %											
				10      20      30      40      50      60+															
5.0			LAKE WATER 577.4																
			Poorly Graded SAND, Trace WHITE SHELL-gray (SP) 570.3																
10.0			Poorly Graded SAND with SILT, Trace GRAVEL (SP-SM) 568.3																
			Poorly Graded SAND, Trace WOOD and GRAVEL-gray (SP) 566.3																
15.0			LEAN CLAY, Trace SAND and GRAVEL-gray-soft (CL) 563.1																
			LEAN CLAY, Trace SAND and GRAVEL-gray-soft (CL) 560.3																
20.0				○ 0.25															
25.0																			

COMMENTS	
Water Depth	7.1'
Core Depth	10.0'
Capped Core Length	7.2'
Time Capped (CST)	0755



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 Naperville, Illinois 60565  
 (630) 355-2838

CORE STARTED	November 7, 2013		
CORE COMPLETED	November 7, 2013		
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

**LOG OF VIBRACORE NO. GSI-06**

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.78048 Easting: 087.56947
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>					
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup>					
					1	2	3	4	5	6+
			SURFACE WATER ELEVATION	577.4						
					10	20	30	40	50	60+
5.0			LAKE WATER	568.6						
10.0			Poorly Graded SAND with SILT, Trace WHITE SHELL-gray (SP-SM)	566.6						
			Poorly Graded SAND, Trace WHITE SHELL and GRAVEL-gray (SP)	564.6						
15.0			Poorly Graded SILTY SAND-gray (SM)	558.6						
20.0			END OF CORE							
25.0										

COMMENTS	
Water Depth	8.8'
Core Depth	10.0'
Capped Core Length	6.2'
Time Capped (CST)	1115

  
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 (630) 355-2838

CORE STARTED	November 7, 2013		
CORE COMPLETED	November 7, 2013		
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1



**LOG OF VIBRACORE NO. GSI-07**

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77984 Easting: 087.57194
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>						
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup>						
			SURFACE WATER ELEVATION	577.4							
			LAKE WATER								
5.0				570.2							
			Poorly Graded SAND with SILT, Trace GRAVEL and WOOD-dark gray (SP-SM)	568.2							
10.0			Poorly Graded SAND with SILT, Trace GRAVEL and WHITE SHELL-gray (SP-SM)	566.2							
			Poorly Graded SAND with SILT, Trace WHITE SHELL-gray (SP-SM)	564.2							
15.0			Poorly Graded SAND, Trace GRAVEL-gray (SP)	560.2							
			END OF CORE								
20.0											
25.0											

COMMENTS	
Water Depth	7.2'
Core Depth	10.0'
Capped Core Length	7.1'
Time Capped (CST)	0950


  
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 Naperville, Illinois 60565  
 (630) 355-2838

CORE STARTED	November 7, 2013		
CORE COMPLETED	November 7, 2013		
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1

## LOG OF VIBRACORE NO. GSI-08

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77930 Easting: 087.57366
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>														
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+														
SURFACE WATER ELEVATION								WATER CONTENT %											
								10      20      30      40      50      60+											
5.0			LAKE WATER																
10.0			567.3																
15.0			563.3																
20.0			557.3																
25.0			END OF CORE																

COMMENTS	
Water Depth	10.1'
Core Depth	10.0'
Capped Core Length	5.7'
Time Capped (CST)	0825



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CORE STARTED		November 7, 2013	
CORE COMPLETED		November 7, 2013	
RIG	Vibracore	FOREMAN	JK
DRAWN	MT	APPROVED	AJP
GSI JOB No.	13158	SHEET	1 OF 1



## LOG OF VIBRACORE NO. GSI-10

<b>CLIENT</b> AECOM	<b>CORE LOCATION</b> Northing: 41.77827 Easting: 087.57434
------------------------	--

<b>PROJECT LOCATION</b> Jackson Harbor Chicago, Illinois	<b>PROJECT DESCRIPTION</b> Jackson Harbor
--	--

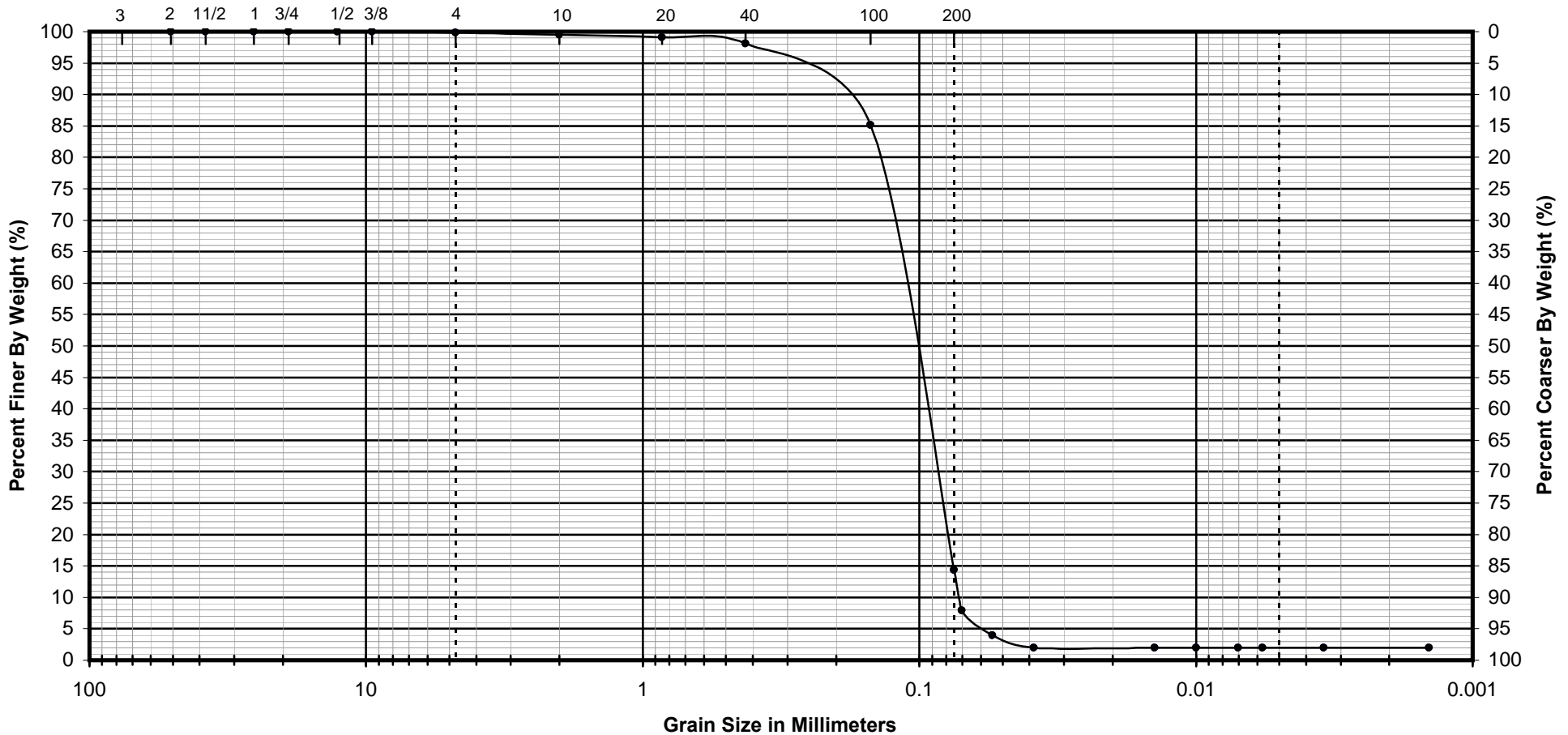
DEPTH (ft.) BELOW WATER SURFACE	SAMPLE DISTANCE	SAMPLE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. <sup>3</sup>	UNCONFINED COMPRESSIVE STRENGTH TONS/FT. <sup>2</sup>														
					CALIBRATED PENETROMETER TONS/FT. <sup>2</sup> 1      2      3      4      5      6+														
SURFACE WATER ELEVATION				577.4				10      20      30      40      50      60+											
5.0			LAKE WATER																
			570.8																
10.0			Poorly Graded SILTY SAND—dark gray (SM)																
			566.8																
15.0			Poorly Graded SAND with SILT—gray (SP—SM)																
			564.8																
15.0			Poorly Graded SAND, Trace GRAVEL—gray (SP)																
			560.8																
20.0			END OF CORE																
25.0																			

COMMENTS	
Water Depth	6.6'
Core Depth	10.0'
Capped Core Length	8.1'
Time Capped (CST)	1345



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CORE STARTED	November 7, 2013
CORE COMPLETED	November 7, 2013
RIG	Vibracore
FOREMAN	JK
DRAWN	MT
APPROVED	AJP
GSI JOB No. 13158	SHEET 1 OF 1







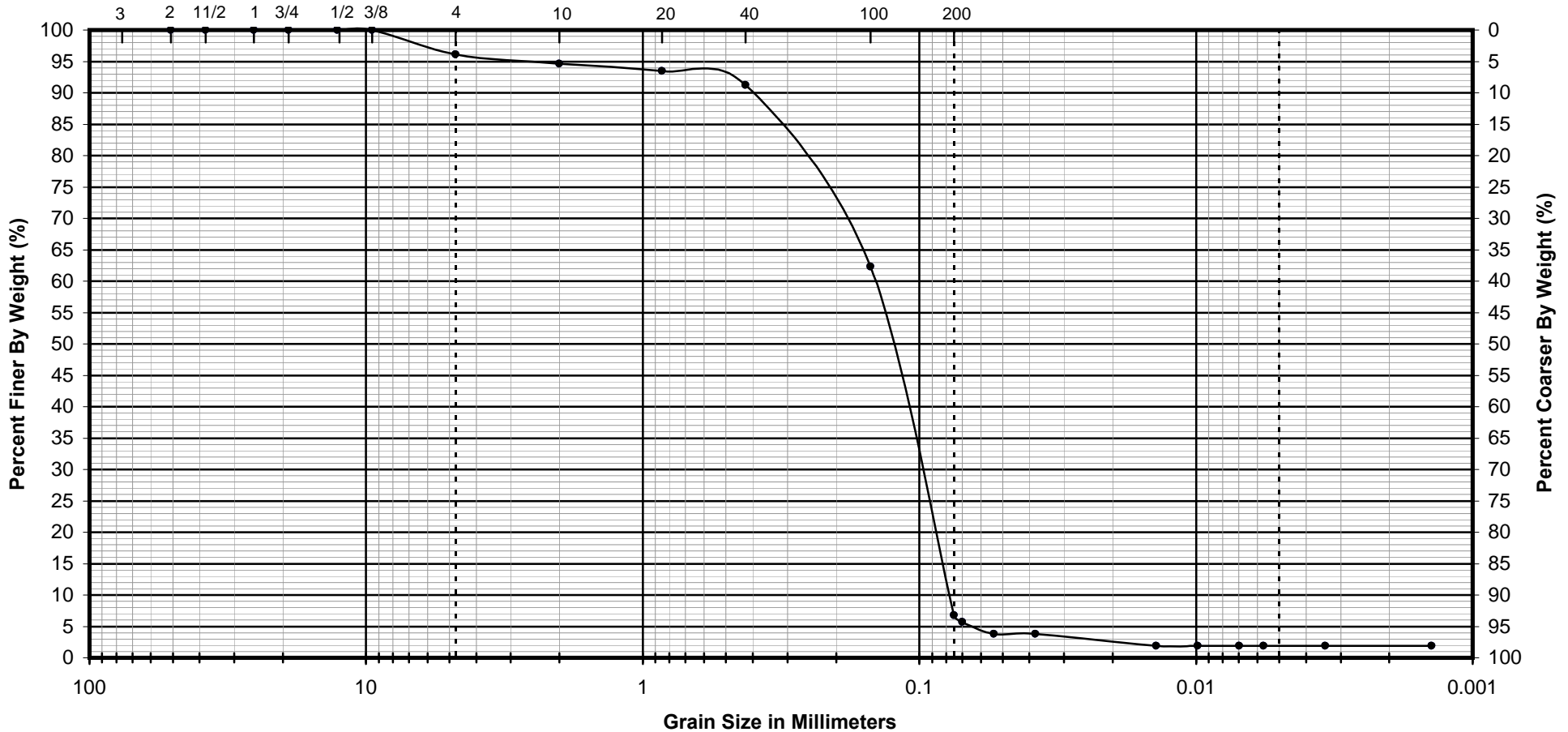







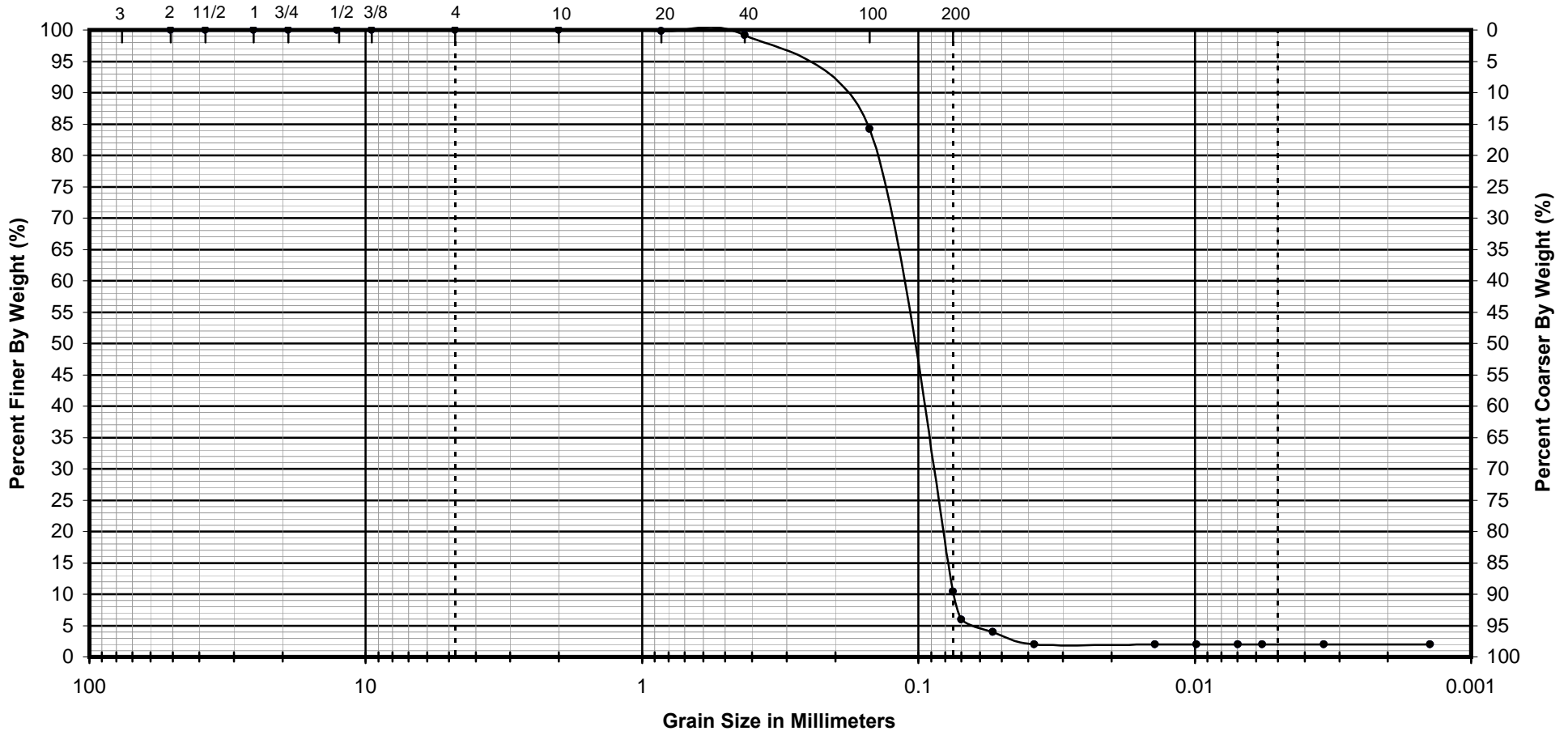






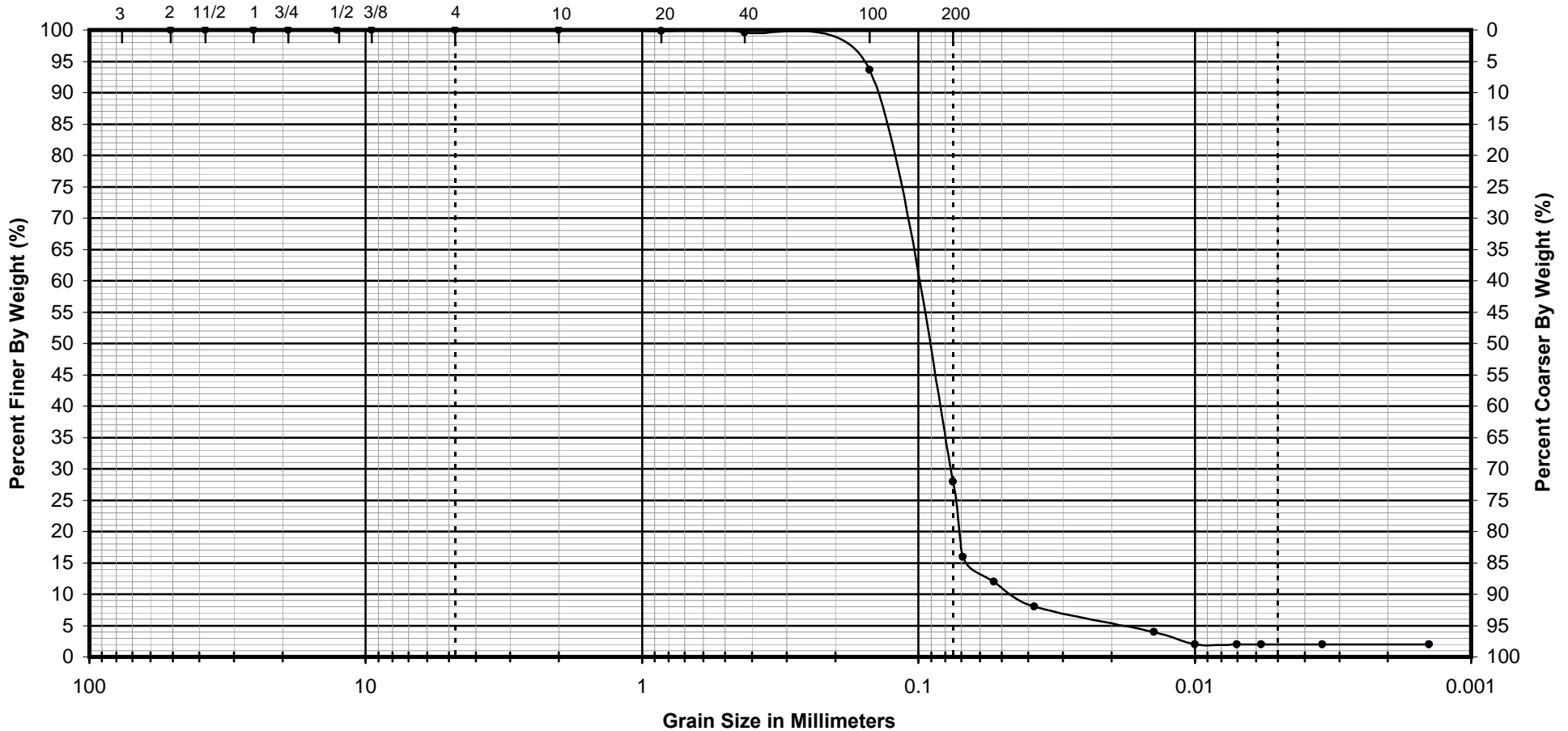
GRAVEL	SAND			SILT	CLAY
	COARSE	MEDIUM	FINE		

Boring No.	GS-8	CLASSIFICATION-ASTM D 2487	PARTICLE SIZE ANALYSIS-ASTM D 422
Sample No.	1	POORLY GRADED SAND with SILT (SP-SM)	Jackson Harbor Dredging & Modification Project Chicago Park District Chicago, Illinois
Depth	0.0'-2.0'		
Liquid Limit	-	gray	 <b>Geo Services, Inc.</b> Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm
Plastic Limit	-	Cu 1.9	
Plasticity Index	NP	Cc 0.8	1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482
Test By	CC	% Gravel 3.9	
Date	11/20/13	% Sand 89.3	
Reviewed By	KA	% Silt 4.9	
Job No	13158	% Clay 1.9	




GRAVEL	SAND			SILT	CLAY
	COARSE	MEDIUM	FINE		

Boring No.	GS-9	CLASSIFICATION-ASTM D 2487	PARTICLE SIZE ANALYSIS-ASTM D 422
Sample No.	1	<b>POORLY GRADED SAND with SILT (SP-SM)</b>  gray Cu            1.7 Cc            0.8 % Gravel    0.0 % Sand       89.6 % Silt        8.4 % Clay       2.0	<b>Jackson Harbor Dredging &amp; Modification Project</b> Chicago Park District Chicago, Illinois  <b>Geo Services, Inc.</b> <small>Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm</small>  1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482
Depth	0.0'-2.0'		
Liquid Limit	-		
Plastic Limit	-		
Plasticity Index	NP		
Test By	CC		
Date	11/20/13		
Reviewed By	KA		
Job No	13158		



GRAVEL	SAND			SILT	CLAY
	COARSE	MEDIUM	FINE		

Boring No.	GS-10	CLASSIFICATION-ASTM D 2487		PARTICLE SIZE ANALYSIS-ASTM D 422	
Sample No.	4	SILTY SAND (SM)		Jackson Harbor Dredging & Modification Project Chicago Park District Chicago, Illinois	
Depth	6.0'-8.0'				
Liquid Limit	-	gray		 <b>Geo Services, Inc.</b> Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm	
Plastic Limit	-				
Plasticity Index	NP	% Gravel	0.0	1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482	
Test By	CC	% Sand	72.1		
Date	11/20/13	% Silt	25.9		
Reviewed By	KA	% Clay	2.0		
Job No	13158				