Project Manual Cover

PROJECT MANUAL

CDB #102-311-099
IDNR #2-20-044
SHORELINE STABILIZATION
ILLINOIS BEACH STATE PARK
300 LAKE FRONT DRIVE
ZION (LAKE COUNTY), ILLINOIS
CONTRACT: BRIDGING DOCUMENTS

State of Illinois

CAPITAL DEVELOPMENT BOARD

USING AGENCY: ILLINOIS DEPARTMENT OF NATURAL RESOURCES

BY: SMITHGROUP, INC.
35 E. WACKER DR. #900
CHICAGO, IL 60601
DESIGN FIRM REG # 184005141-0007

DATE: May 29, 2021

License Expiration Date: 11/30/2021

Signature:

Date Signed: 4/29/2021

LICENSED PROFESSIONAL ENGINEER
Robert S Wright
062.072931
EXP 11/30/21
STATE OF ILLINOIS

State of Illinois
CAPITAL DEVELOPMENT BOARD

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PROJECT MANUAL FOR
CDB 102-311-099
Stabilize Shoreline
Illinois Beach State Park
300 Lake Front Dr.
Zion (Lake County), Illinois

DATE: April 29, 2021

BRIDGING DOCUMENTS

SPECIFIERS: Bridging Documents – Not for Construction

Civil/Coastal	SmithGroup	Robert Wright	608-327-4433

END 00 01 10

LIST OF DRAWINGS

A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

G-001 TITLE SHEET
G-002 GENERAL NOTES
G-003 CONSTRUCTION SITE ACCESS - AREAS 1 & 2
G-004 CONSTRUCTION SITE ACCESS - AREA 3
G-005 CONSTRUCTION SITE ACCESS - ENLARGEMENT
C-001 EXISTING CONDITIONS - AREA 1
C-002 EXISTING CONDITIONS - AREA 2
C-003 EXISTING CONDITIONS - AREA 3
C-004 EXISTING CONDITIONS - LCPWD ENLARGEMENT
C-100 OVERALL PLAN - AREA 1
C-101 PLAN & TYPICAL SECTIONS - BW1.1
C-102 PROFILE - BW1.1
C-103 SECTIONS - BW1.1 (STA 1100+96 TO 1102+00)
C-104 SECTIONS - BW1.1 (STA 1102+25 TO 1103+25)
C-105 PLAN, TYPICAL SECTION & PROFILE - BW1.2
C-106 SECTIONS - BW1.2 (STA 1200+50 TO 1201+48)
C-107 PLAN, TYPICAL SECTION & PROFILE - BW1.3
C-108 SECTIONS - BW1.3 (STA 1300+50 TO 1302+00)
C-109 PLAN & TYPICAL SECTION - BW1.4
C-110 PROFILE - BW1.4
C-111 SECTIONS - BW1.4 (STA 1400+75 TO 1401+25)
C-112 SECTIONS - BW1.4 (STA 1401+75 TO 1402+25)
C-113 SECTIONS - BW1.4 (STA 1402+55)
C-114 PLAN & TYPICAL SECTION - BW1.5
C-115 PROFILE - BW1.5
C-116 SECTIONS - BW1.5 (STA 1500+75 TO 1501+25)
C-117 SECTIONS - BW1.5 (STA 1501+75 TO 1502+25)
C-118 SECTIONS - BW1.5 (STA 1502+75 TO 1502+83)
C-119 PLAN & TYPICAL SECTIONS - BW1.6
C-120 PROFILE - BW1.6
C-121 PROFILE - BW1.6 FISHTAILS
C-122 SECTIONS - BW1.6 (STA 1600+75 TO 1601+25)
C-123 SECTIONS - BW1.6 (STA 1601+75 TO 1602+25)
C-124 SECTIONS - BW1.6 (STA 1062+75 TO 1603+25)
C-125 SECTIONS - BW1.6 (STA 1603+75 TO 1614+50)
C-126 SECTIONS - BW1.6 (STA 1624+25 TO 1624+50)
C-127 PLAN & TYPICAL SECTIONS - BW1.7
C-128 PROFILE - BW1.7
C-129 PROFILE - BW1.7

C-130 SECTIONS - BW1.7 (STA 1700+50 TO 1700+65)
C-131 SECTIONS - BW1.7 (STA 1700+88 TO 1701+10)
C-132 SECTIONS - BW1.7 (STA 1701+26 1701+76)
C-133 SECTIONS - BW1.7 (STA 1702+26 TO 1702+50)
C-134 SECTIONS - BW1.7 (STA 1702+75 TO 1703+01)
C-135 SECTIONS - BW1.7 (STA 1703+20 TO 1703+35)
C-136 PLAN & TYPICAL SECTIONS - BW1.8
C-137 PROFILE - BW1.8 WITH WEST FISHTAIL
C-138 PROFILE - BW1.8 WITH EAST FISHTAIL
C-139 SECTIONS - BW1.8 (STA 1800+50 TO 1801+30)
C-140 SECTIONS - BW1.8 (STA 1811+67 TO 1822+00)
C-141 PLAN & TYPICAL SECTIONS - BW1.9
C-142 PROFILE - BW1.9
C-143 SECTIONS - BW1.9 (STA 1900+50 TO 1900+82)
C-144 SECTIONS - BW1.9 (STA 1901+03 TO 1901+35)
C-145 SECTIONS - BW1.9 (STA 1911+68 TO 1912+00)
C-146 PLAN, TYPICAL SECTION & PROFILE - BW1.10
C-147 SECTIONS - BW1.10 (STA 110 00+50 TO 110 02+25)
C-148 KELLOGG CREEK GROIN PLAN
C-200 AREA 2 - OVERALL PLAN
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C-202 PROFILE - BW2.1
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C-204 SECTIONS - BW2.1 (STA 2101+00 TO 2103+50)
C-205 SECTIONS - BW2.1 (STA 2103+75 TO 2104+30)
C-206 PLAN & TYPICAL SECTIONS - BW2.2
C-207 PROFILE - BW2.2
C-208 SECTIONS - BW2.2 (STA 2200+50 TO 2202+25)
C-209 SECTIONS - BW2.2 (STA 2202+50 TO 2202+70)
C-210 PLAN & TYPICAL SECTIONS - BW2.3
C-211 PROFILE - BW2.3
C-212 SECTIONS - BW2.3 (STA 2300+50 TO 2301+75)
C-213 SECTIONS - BW2.3 (STA 2302+10 TO 2302+95)
C-214 PLAN & TYPICAL SECTIONS - BW2.4
C-215 PROFILE - BW2.4
C-216 PROFILE - BW2.4
C-217 SECTIONS - BW2.4 (STA 2400+50 TO 2401+50)
C-218 SECTIONS - BW2.4 (STA 2402+00 TO 2403+75)
C-219 SECTIONS - BW2.4 (STA 2417+35 TO 2418+25)
C-220 SECTIONS - BW2.4 (STA 2423+41 TO 2424+50)
C-221 PLAN & TYPICAL SECTIONS - BW2.5
C-222 PROFILE - BW2.5
C-223 PROFILE - BW2.5

C-224 SECTIONS - BW2.5 (STA 2500+75 TO 2501+75)
C-225 SECTIONS - BW2.5 (STA 2501+89 TO 2503+75)
C-226 SECTIONS - BW2.5 (STA 2504+05)
C-227 PLAN & TYPICAL SECTIONS - BW2.6
C-228 PROFILE - BW2.6
C-229 PROFILE - BW2.6
C-230 SECTIONS - BW2.6 (STA 2600+50 TO 2605+70)
C-231 PLAN & TYPICAL SECTION - BW2.7
C-232 PROFILE - BW2.7
C-233 SECTIONS - BW2.7 (STA 2700+50 TO 2703+00)
C-234 SECTIONS - BW2.7 (STA 2703+50 TO 2704+21)
C-300 AREA 3 - OVERALL PLAN
C-301 PLAN & TYPICAL SECTIONS - BW3.1
C-302 PROFILE - BW3.1
C-303 PROFILE - BW3.1
C-304 SECTIONS - BW3.1 (STA 3100+50 TO 3103+00)
C-305 SECTIONS - BW3.5 (STA 3103+30 TO 3104+31)
C-306 PLAN & TYPICAL SECTIONS - BW3.2
C-307 PROFILE - BW3.2
C-308 PROFILE - BW3.2
C-309 SECTIONS - BW3.2 (STA 3200+50 TO 3201+50)
C-310 SECTIONS - BW3.2 (STA 3202+00 TO 3203+50)
C-311 SECTIONS - BW3.2 (STA 3204+00 TO 3205+50)
C-312 SECTIONS - BW3.2 (STA 3206+03)
C-313 PLAN & TYPICAL SECTIONS - BW3.3
C-314 PROFILE - BW3.3
C-315 SECTIONS - BW3.3 (STA 3300+50 TO 3301+75)
C-316 SECTIONS - BW3.3 (STA 3302+41 TO 3303+44)
C-317 PLAN & TYPICAL SECTION - BW3.4
C-318 PROFILE - BW3.4
C-319 PROFILE - BW3.4
C-320 SECTIONS - BW3.4 (STA 3400+50 TO 3402+00)
C-321 SECTIONS - BW3.4 (STA 3403+00 TO 3405+02)
C-322 PLAN & TYPICAL SECTION - BW3.5
C-323 PROFILE - BW3.5
C-324 PROFILE - BW3.5
C-325 SECTIONS - BW3.5 (STA 3500+50 TO 3504+09)

END 000115

DOCUMENT 003143 - PERMIT APPLICATION

1.1 PERMIT APPLICATION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide CDB's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.

B. Permit Application: Permit Applications based on the Design Build Bridging Documents have been prepared and submitted to the U.S. Army Corps of Engineers and Illinois Department of Natural Resources. Refinements to design made by the Design Build contractor shall be submitted to the appropriate regulatory authorities. Design Build contractor is responsible for completing permitting with Authorities Having Jurisdiction prior to the start of construction. A copy of the Permit Applications filed is attached to this Document.

C. Comprehensive Environmental Review Process (CERP): A CERP review is in progress. Additional construction restrictions will result based on this review.

END OF DOCUMENT 003143

SECTION 01 11 00 - PROJECT SUMMARY

1.1 STANDARD DOCUMENTS FOR CONSTRUCTION:

A. CDB's (2009) edition of the Standard Documents for Construction (SDC) and the Supplement to Standard Documents for Construction (Section 01 11 01) shall apply to this project.

1.2 GENERAL PROJECT INFORMATION:

A. DESCRIPTION:

1. The scope of this project is the final design and construction of a new shoreline protection and stabilization system including breakwaters, sand placement and habitat structures to stabilize the shoreline, protect critical infrastructure and reduce natural shoreline transitory processes. To the maximum extent possible within the technical performance limitations of the shore protection design, and within the available design and construction budget, the defense works shall be designed to embody intrinsic characteristics that are habitat enhancing or advancing.

2. The Project consists of the follow elements.

a. Detached Breakwaters

1) Permeable: offshore breakwater structure constructed of Armor Stone, Filter Stone and Core Stone. Intended to reduce wave action reaching the shoreline.

2) Impermeable: offshore breakwater structure constructed of Armor Stone, Filter Stone and Core Stone with an additional segment of re-purposed concrete block or steel sheet pile which acts to create and impermeable layer within the breakwater. Structure is intended to reduce or block wave action reaching the shoreline.

b. Attached Breakwaters: Impermeable structure constructed of a combination of rock, concrete and steel connected to the existing shoreline and acting to contain beach sand placed as a part of the project.

c. Habitat Structures: Avian and aquatic habitat enhancement features can include nesting pods, anchored driftwood of tree stumps, trunks or rootwads, and cobble beds. (See Basis of Design)

d. Kellogg Creek Groin: Impermeable structure constructed of rock, concrete or steel sheet piles or a combination thereof.

e. Beach Sand: Sand used within the design shall be all-natural material with a median size appropriate for location and function. Material shall be narrowly graded to promote water drainage to reduce surface retention. Sand may be sourced from upland or offshore sources. Upland sources are limited to approved quarries with sufficient quantity and appropriate gradation. Effort shall be made to find a single quarry to supply the full quantity needed to maintain color and consistency. Material relocated to the shoreline from within the park will not be allowed. Offshore sand would be hydraulically dredged and pumped or excavated and barge hauled to the project sites. This sand source is dependent on regulatory approval.

3. Design and performance criteria for each of the project elements is outlined in the Basis of Design.

4. To the extent feasible all work to deliver and place beach and breakwater materials shall be water based to limit the potential impacts to the landside sensitive habitats.

B. EXISTING CONDITIONS:

1. The project sites consist of wetland habitat, critical infrastructure and several waterways which discharge to Lake Michigan. Wetland habitat is located adjacent to each of the three project areas and impacts to these habitat areas from construction activities is to be avoided. Creek outlets to Lake Michigan exist within Area 1 and 2. The function of these outlets are to be maintained both during construction and incorporated into the final design. Intake pipe lines exist within Area 2 and 3, the function of these structures is to be incorporated, where applicable, into the design of the shoreline stabilization system. In each project area, existing shoreline protection and stabilization measures exist including, rubble revetments, concrete block walls, steel sheet pile walls and rock revetments. Within Area 2 there are two known shipwreck locations, located at 42.452535N, -87.796740W and 42.458913N, -87.796902W. Construction within the area of the shipwrecks is subject to review by the Illinois State Historic Preservation Office.

C. RELATED WORK:

1. Work by Others: Healthy Ports Futures – Rubble Ridge Pilot Project

1.3 CONTRACT TIME:

A. Refer to Articles 00 72 10 and 01 32 00 of the Standard Documents for Construction. The contractor shall complete all work through Substantial Completion in accord with the contract within **635** consecutive calendar days from the date of the Authorization to Proceed and shall complete all remaining work in accordance with the contract (Final Acceptance) within 90 consecutive calendar days from the date of Substantial Completion.

1.4 CONTRACT(S). Construct project under single prime contract. All work shown on the bidding documents is the responsibility of the contractor, regardless of the trade or specialty involved.

1.5 PRE-BID CONFERENCE. The pre-bid meeting will be as indicated in 00 11 13. Bidders are strongly urged to attend this meeting. See SDC 00 21 10 and 00 25 00.

END 01 11 00

SECTION 02 21 13 - SITE SURVEYS

1. GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Requirements for a pre-construction topographic and bathymetric surveys.

1.2 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related specif cation Sections include, but are not necessarily limited to:

1. Division 0

2. Division 1

3. Section 31 20 00 - Earth Moving

4. Section 35 31 19 - Stone Revetments and Breakwaters

5. Section 35 31 21 - Beach Construction

1.3 ACTION SUBMITTALS

A. Field Quality Control Submittals

1. Documentation verifying accuracy of field engineering work, including coordinate conversions if plans do not indicate grid or ground coordinates.

B. Survey Submittals

1. Survey Maps and documentaion in an agreed upon format of the surveys prior to construction.

2. Contractor shall maintain a copy of all survey notes and provide a copy to A/E upon request.

1.4 QUALITY ASSURANCE

A. Pre-construction Survey

1. Pre-construction Survey will be performed by the Contractor.

2. Coordination

a. Contractor to verify that design survey and control

3. General

a. Pre-construction survey will be performed by the contractor in order to construct the work in the documents and to verify the any movement or erosion of the shoreline and lake bed from the time of the design survey to the time of construction.

2. PRODUCTS

2.1 The pre-construction survey will produce, but will not be limited to:

A. Establishment of relevant control points, points of curvature and points of intersection.

B. Establishment of temporary horizontal and vertical control elevations (benchmarks) sufficiently permanent and located in a manner to be used throughout construction.

C. The establishment of a base-line condition of elevations of the shoreline, lake bed, utilities, and improvements at the location of planned facilities, easements and improvements.

D. Digital survey files in the following formats shall be acceptable: a. AutoCAD (.dwg)

3. EXECUTION

3.1 INSTALLERS:

A. Tolerances:

1. The staked location of any improvement or facility should be as accurate as practical and necessary. The degree of precision required is dependent on many factors all of which must remain judgmental. The tolerances listed hereafter are based on generalities and, under certain circumstances, shall yield to specific requirements. The surveyor shall assess any situation by review of the overall plans and through consultation with responsible parties as to the need for specific tolerances.

a. Bathymetry: Grades for bathymetric surveys should not exceed 0.1 ft. vertical tolerance. Horizontal alignment for bathymetric surveys should not exceed 1.0 ft. tolerance.

b. Upland/Site Survey:Grades for upland surveys should not exceed 0.1 ft. vertical tolerance. Horizontal alignment for upland surveys should not exceed 0.1ft. tolerance.

B. Surveying instruments shall be kept in close adjustment according to manufacturer's specifications or in compliance to standards. The A/E reserves the right to request a calibration report at any time and recommends regular maintenance schedule be performed by a certified technician every 6 months.

END 02 21 13

SECTION 02 41 19 - SELECTIVE STRUCTURE DEMOLITION

1. GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Salvage of existing items to be reused or recycled.

2. Protection of Historic Structures (shipwrecks).

1.3 DEFINITIONS

A. Remove and Reinstall: Excavate and detach items from the shoreline and lake bed, prepare for reuse, and reinstall where required

1. Eco blocks shall be reused in shore protection structures.

2. Revetment and rip rap stone to be reused in shore protection structures.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to commemorative plaques and tablets, and other items of interest or value to Using Agency that may be uncovered during demolition remain the property of the Using Agency.

1. Carefully salvage in a manner to prevent damage and promptly return to Using Agency.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, for protection of utilities and culverts, l and for protection of offshore shipwrecks noted on the drawings in the vicinity of the project.. Indicate proposed locations and construction of barriers.

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Using Agency as far as practical.

1. As the site is continually undergoing erosion of the shoreline and lake bed, a pre-construction surveys of the upland and lake bed are required in Section 02 21 13 - Site Surveys to document the existing conditions.

B. Notify A/E of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Residential ruins and foundations

1. The site was a previous residential subdivision and foundations are present. Remnants of the foundations are submerged and or covered by sand along the near shore of the project.

2. Foundations encountered during installation of breakwaters, revetments, bulkheads, impervious cores, and beach sand that impede construction shall be removed from the project site and be considered incidental to construction.

D. Historic Areas: Demolition, staging of equipment and placement of construction materials in proximity to the shipwrecks shall be at a suitable distance to provide complete protection of artifacts.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing operational utilities and protect them against damage during all operations.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA and IDNR/IEPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

3. EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by CDB. CDB does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to A/E.

3.2 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically. Complete selective demolition operations in each area before disturbing adjacent areas.

B. Removed and Reinstalled Items:

1. Reinstall items in locations required by contractor's design.

END 02 41 19

SECTION 31 20 00 - EARTH MOVING

1. GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.

2. Rework of breakwaters for tying in of new structures

3. Excavtion needed for grading and placement of sand

4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 8 CY for bulk excavation.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.

2. Laboratory compaction curve according to ASTM D 698.

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "One Call" for area where Project is located before beginning earth-moving operations.

C. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Foot traffic.

4. Erection of sheds or structures.

5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

D. Do not direct vehicle or equipment exhaust towards protection zones.

E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

2. PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches **(**75 mm**)** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Sand: ASTM C 33/C 33M; fine aggregate.

E. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

3. EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, roadways, culverts and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches **(**300 mm**)** higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches **(**300 mm**)** each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches **(**100 mm**)** deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches **(**150 mm**)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Notify A/E when excavations have reached required subgrade.

B. If A/E determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by A/E, without additional compensation.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring, bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways: Provide 4-inch- **(**100-mm-**)** thick, concrete-base slab support for piping or conduit less than 30 inches **(**750 mm**)** below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches **(**100 mm**)** of concrete before backfilling or placing roadway subbase course.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch **(**25 mm**)** in any dimension, to a height of 12 inches **(**300 mm**)** over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches **(**200 mm**)** in loose depth for material compacted by heavy compaction equipment and not more than 4 inches **(**100 mm**)** in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under turf or unpaved areas, scarify and recompact top 6 inches **(**150 mm**)** below subgrade and compact each layer of backfill or fill soil material at 85 percent.

2. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch **(**25 mm**)**.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by A/E; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Using Agency's property.

END 31 20 00

SECTION 33 41 00 - STORM DRAINAGE PIPING

1. GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.

2. Manholes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Using Agency or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify A/E and Using Agency no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without A/E's and Using Agency's written permission.

2. PRODUCTS

2.1 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

2.2 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

4. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

7. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

3. EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.

2. Install piping with 36-inch (915-mm) minimum cover.

3. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.5 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

   a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.

   b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

   1. Close open ends of piping with at least 8-inch- (203-mm-) thick, brick masonry bulkheads.

   2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

   1. Remove manhole or structure and close open ends of remaining piping.

   2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.

b. Option: Test plastic piping according to ASTM F 1417.

c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END 33 41 00

1. GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Quarry Stone Revetment and Breakwater materials and placement for all shore protection structures in the Project.

1.3 DESIGN ALTERNATIVES

A. Impervious Barrier:

1. The design of the impermeable barrier is left as an alternative for the design-build team. This barrier can be constructed from steel (safely embedded within the structure) or concrete. Concrete options may include additional design features which benefit habitat creation or reuse onsite derelict materials. The impermeable barrier should restrict water flow through the armor and filter layers of the breakwater structure.

1.4 ACTION SUBMITTALS

A. Product Data:

1. At the initial preconstruction meeting, submit intended revetment construction procedures and quality control plan containing the following information as a minimum:

a. Placement equipment for each stone classification.

b. Anticipated placement and delivery rates for each stone classification.

c. Survey control and check survey procedures.

d. Stone quality control procedures.

B. Source Quality Control Submittals: Immediately after the start of stone production and at two week intervals thereafter, submit stone quality control results of all visual inspections, gradation tests, check surveys and a written summary report.

C. Field Quality Control Submittals: Submit daily placement summaries described in Article 3.3.

1.5 QUALITY CONTROL

A. General

1. The Contractor is responsible for, and shall establish and maintain, quality control for all stone production and transport under this contract to assure compliance with the specifications.

2. The Contractor shall exercise care in loading, hauling and unloading of stone during all phases of construction to prevent cracking and splitting that would otherwise lead to rejection at the job site.

B. Production Quality control and Quarry Inspection

1. The Contractor shall provide a Quality Control Plan (QCP) and an appropriate full time stone source and loading facility inspector(s), who shall verify that all stone produced and delivered to the job site conforms to the requirements of this section. The QCP and inspector(s) activities will include, but not limited to, the following general elements:

   a. visually inspecting every Armor stone to verify that the stone meets the quality requirements of this section;

   b. measuring each Armor stone along three mutually perpendicular axes to determine the volume of each piece of armor stone intended for this Project, converting this volume to weight based on available recognized specific gravity and clearly marking the corresponding weight on each stone;

   c. periodically checking measured weights against scale weights using a system approved by A/E;

   d. clearly marking every Armor stone using a color and/or symbol system approved by A/E;

   e. conducting stone gradation tests and making appropriate production modifications on Core, Filter and Armor stone as required to ensure that gradation requirements of this section are met;

   f. maintaining separate stockpiles of stone materials by stone;

   g. tabulating each truckload the total tonnage of stone loaded on truck by classification;

   h. maintaining clear, legible daily log of activities and observations in a format to be approved by A/E.

C. Test Section:

1. General: The initial revetment and breakwater sections for each typical cross section will be considered as a test section. The purpose of the test sections will be to establish an in-the-field standard, built in accordance with the requirements of the Contract Documents, to which the remainder of the revetment shall be constructed. The Contractor will make whatever modifications are necessary to placement procedures such that this standard will be achieved consistently during construction of the remainder of the revetment. Based on these solutions, the A/E may make modifications to the revetment cross section dimensions.

2. Execution:

   a. Lay out the Work, provide survey control, and perform check surveys in accordance with the requirements of this section and the dimensions shown on the Contract Drawings.

   b. Place the stone to the lines, grades and course thicknesses shown on the Contract Drawings. Intentional over-building or under-building to influence estimated stone quantities will constitute the basis for rejection and reconstruction of the test section.

   c. Provide equipment and handle each classification of stone such that all placement requirements of this section are satisfied.

   d. Record the approximate stone tonnage placed in the test section as specified in this section.

3. Approval: Rework deficient portions of the test section to meet these requirements. If during construction of the test section, it becomes evident that the required neat lines and course thicknesses cannot be achieved due to the type of stone being used, modifications to the section will be made. Upon approval, the test section can be incorporated into the remaining Work such that removal will not be necessary.

4. Modifications:

   a. The A/E will observe the Contractor's survey techniques to verify that they are in accordance with standard survey practice and the requirements of these specifications. The Contractor will make changes to its survey techniques as necessary, or as directed by the A/E, such that stone placement is adequately controlled and measured cross sections accurately define the limits of the stone in place.

   b. Make any necessary modifications to placement equipment and procedures to achieve the specified in-place requirements.

   c. It is expected that modifications to course thicknesses and neat lines will primarily minimize inconsistencies between actual stone types and the desired placed section dimensions so that the desired number of layers fit within the stone course. No adjustment of bid prices will be allowed for stone materials if such modifications occur.

D. Survey:

1. General: Maintain records of all quality control tests, surveys, inspections and corrective actions, and submit copies to the A/E.

2. Survey Control:

   a. Provide range poles, marker buoys, templates, batter boards, and/or any other means of guidance and control as necessary to construct the stone courses to the required tolerances.

b. Maintain temporary vertical and horizontal control monuments and staff gauges in the immediate vicinity of the Work being performed.

3. Check Surveys:

a. Perform check surveys as the Work progresses to verify that lines, grades and thicknesses for the completed Work are within the specified tolerances.

b. Provide all boats, personnel and equipment necessary to adequately and safely perform check surveys.

c. Perform check surveys for each stone course as cross sections at intervals of 25 feet or at intervals approved by the A/E. Check survey locations shall be referenced to stations along the revetment reference line. Individual cross sections shall be measured perpendicular to a tangent on the reference line. Using a surveyor's tape or tag line for each cross section, measurements shall be taken every 5 feet and at any change in grade. Additional elevations and soundings shall also be taken as the A/E may deem necessary or advisable. The check surveys shall be conducted in the presence of the A/E, unless waived by the A/E.

d. Check surveys conducted above the water surface shall be determined by the use of a leveling instrument and an elevation rod having a base of 12 inches in diameter. The elevation of each point should represent the average elevation of the surrounding area encompassed by a 2.5 foot radius circle whose center is the exact point. The intent of this is to obtain the average elevation, not the elevation of a void or high point.

e. Elevations below the water surface shall be determined in the same manner as those above water or by soundings. Soundings shall be performed using a sounding pole or lead line with a sounding basket weighing approximately 8.5 pounds. Either sounding instrument shall have a 12 inch diameter base.

f. The check survey record shall contain the following information as a minimum:

1) Check survey location (revetment station)

2) Stone course surveyed

3) Date and time of survey

4) Weather conditions

5) Lake elevation at time of survey

6) Elevation readings (nearest 0.1 foot)

7) Distance readings relative to reference line (nearest 0.5 foot)

8) Any off-sets from reference line

9) The exact format of the check survey record will be agreed upon by the A/E and Contractor.

g. Plot check surveys at the same scale as the Contract Drawings and provide to the A/E no more than two working days after the completion of each 100 foot long section of revetment.

h. Before placement of armor stone, the cross section of the filter / sub-armor stone shall be approved by the A/E. Before placement of filter / sub-armor stone, the core / bedding shall be approved by the A/E.

1.6 QUALITY ASSURANCE

A. General

1. Quality Assurance (QA) activities will be performed by the A/E. These activities are intended to provide independent observations of the conformance to the requirements of this section prior to shipment of the stone to the site, and in no way relive the contractor of his responsibilities for Quality Control and in-place requirements.

2. In the event that QA activities indicate non-conformance to the requirements of this Section, the A/E will reject the non-conforming stones identified during review and testing. Continues non-conformance will be considered justification for rejection of the QCP, including the replacement of the QCP inspector(s). If the QCP is rejected, the Contractor is responsible for preparing a new QCP to the satisfaction of the A/E and CDB prior to continuing stone production for the project, at no additional cost to the CDB.

B. Gradation Testing:

1. In addition to quality control gradations conducted by the Contractor's stone source inspector, quality assurance gradations shall be performed by the QCP inspector(s) in the presence of the A/E at the stone source. The A/E may also perform quality assurance gradations at the project site. Quality assurance gradation procedures for each stone classification will be presented as below:

a. For Armor Stone:

1) The A/E will select a random sample of stone equal to at least 30 times the average stone weight. Each individual piece in the sample will be measured along three mutually perpendicular axis. Weights will be computed from the measurements and recorded in tabular format. Using the recorded information , a gradation curve will be assembled. Quality assurance gradations will be performed at intervals selected by the A/E. It is anticipated that three to five gradations will be conducted by the contractor for each stone type, unless gradation tests or observations of stone materials indicate additional gradations are required.

2) For Filter Stone:

a) A/E will select random samples of stone. Samples will be taken at a rate of approximately 1 per 1,000 tons of Filter Stone used on the project, unless gradation test results or observations of stone materials indicate additional gradations required.

2. For gradations taken in accordance with this Section, Contractor shall provide A/E with all loaders, scales, other labor and equipment, and operators of such equipment as required to gather samples and weigh each individual stone. Methods used to weigh each individual stone must be accurate to +/- 5 pounds.

3. Provide a quarry inspector for each stone source. The inspector's responsibilities shall include, but not be limited to:

   a. Perform a visual test of each stone for elongation, cracks, deterioration and other defects visible to the naked eye on at least 2/3 of the surface area of the stone. Ten percent of the stone checked for cracks shall be wetted and re-inspected for minute cracks to determine if they would be detrimental to the stone quality and if additional inspections are necessary on all stone. Stones with cracks that are detrimental to a long-lasting product shall not be shipped to the Project site.

   b. Measure each stone along three mutually perpendicular axes to determine the volume of each piece of armor stone intended for this Project, converting this volume to weight based on available recognized specific gravity and clearly marking the corresponding weight on each stone.

   c. Maintain a log for all armor stone, compiled in table form, presented in a clear and legible fashion indicating the date when stone was blasted, when stone was shipped from the quarry and the quantity of stone shipped. This information will be transmitted to the A/E at the end of each Working day for comparison to stone received. The format of this table will be approved by the A/E.

   d. Conduct biweekly stone gradations on sub-armor stone and bedding stone. Gradations shall be conducted by taking a random sample of stone equal to at least 30 times the average stone weight in each classification, weighing each individual piece and recording in table format such that a gradation curve may be assembled.

4. The A/E reserves the right to inspect the quarry operations at any time to check for compliance to the specifications.

C. Material Quality

1. The A/E will observe a random sampling of the Armor stones that have passed the Contractor's QCP for conformance with the quality requirements of this section.

2. The Contractor shall provide equipment and operators to turn and handle questionable stones for further evaluation by the A/E. In addition, rejected stones shall be segregated and removed from the stockpile are.

3. The A/E may elect to obtain samples of any of the stone types for laboratory testing of material quality.

D. Test Section:

1. General: The initial revetment and breakwater sections for each typical cross section will be considered as a test section. The purpose of the test sections will be to establish an in-the-field standard, built in accordance with the requirements of the Contract Documents, to which the remainder of the revetment shall be constructed. The Contractor will make whatever modifications are necessary to placement procedures such that this standard will be achieved consistently during construction of the remainder of the revetment. Based on these solutions, the A/E may make modifications to the revetment cross section dimensions.

2. Execution:

   a. Lay out the Work, provide survey control, and perform check surveys in accordance with the requirements of this section and the dimensions shown on the Contract Drawings.

   b. Place the stone to the lines, grades and course thicknesses shown on the Contract Drawings. Intentional over-building or under-building to influence estimated stone quantities will constitute the basis for rejection and reconstruction of the test section.

   c. Provide equipment and handle each classification of stone such that all placement requirements of this section are satisfied.

   d. Record the approximate stone tonnage placed in the test section as specified in this section.

3. Approval: Rework deficient portions of the test section to meet these requirements. If during construction of the test section, it becomes evident that the required neat lines and course thicknesses cannot be achieved due to the type of stone being used, modifications to the section will be made. Upon approval, the test section can be incorporated into the remaining Work such that removal will not be necessary.

4. Modifications:

   a. The A/E will observe the Contractor's survey techniques to verify that they are in accordance with standard survey practice and the requirements of these specifications. The Contractor will make changes to its survey techniques as necessary, or as directed by the A/E, such that stone placement is adequately controlled and measured cross sections accurately define the limits of the stone in place.

   b. Make any necessary modifications to placement equipment and procedures to achieve the specified in-place requirements.

   c. It is expected that modifications to course thicknesses and neat lines will primarily minimize inconsistencies between actual stone types and the desired placed section dimensions so that the desired number of layers fit within the stone course. No adjustment of bid prices will be allowed for stone materials if such modifications occur.

E. Survey:

1. General: Maintain records of all quality control tests, surveys, inspections and corrective actions, and submit copies to the A/E.

2. Survey Control:

   a. Provide range poles, marker buoys, templates, batter boards, and/or any other means of guidance and control as necessary to construct the stone courses to the required tolerances.

   b. Maintain temporary vertical and horizontal control monuments and staff gauges in the immediate vicinity of the Work being performed.

3. Check Surveys:

   a. Perform check surveys as the Work progresses to verify that lines, grades and thicknesses for the completed Work are within the specified tolerances.

   b. Provide all boats, personnel and equipment necessary to adequately and safely perform check surveys.

   c. Perform check surveys for each stone course as cross sections at intervals of 25 feet or at intervals approved by the A/E. Check survey locations shall be referenced to stations along the revetment reference line. Individual cross sections shall be measured perpendicular to a tangent on the reference line. Using a surveyor's tape or tag line for each cross section, measurements shall be taken every 5 feet and at any change in grade. Additional elevations and soundings shall also be taken as the A/E may deem necessary or advisable. The check surveys shall be conducted in the presence of the A/E, unless waived by the A/E.

   d. Check surveys conducted above the water surface shall be determined by the use of a leveling instrument and an elevation rod having a base of 12 inches in diameter. The elevation of each point should represent the average elevation of the surrounding area encompassed by a 2.5 foot radius circle whose center is the exact point. The intent of this is to obtain the average elevation, not the elevation of a void or high point.

   e. Elevations below the water surface shall be determined in the same manner as those above water or by soundings. Soundings shall be performed using a sounding pole or lead line with a sounding basket weighing approximately 8.5 pounds. Either sounding instrument shall have a 12 inch diameter base.

   f. The check survey record shall contain the following information as a minimum:

      1) Check survey location (revetment station)

      2) Stone course surveyed

      3) Date and time of survey

      4) Weather conditions

5) Lake elevation at time of survey

6) Elevation readings (nearest 0.1 foot)

7) Distance readings relative to reference line (nearest 0.5 foot)

8) Any off-sets from reference line

9) The exact format of the check survey record will be agreed upon by the A/E and Contractor.

g. Plot check surveys at the same scale as the Contract Drawings and provide to the A/E no more than two working days after the completion of each 100 foot long section of revetment.

h. Before placement of armor stone, the cross section of the filter / sub-armor stone shall be approved by the A/E. Before placement of filter / sub-armor stone, the core / bedding shall be approved by the A/E.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Exercise care in the transportation of all stone materials to prevent cracking, splitting, spalling, etc. that would otherwise lead to rejection at the job site.

B. Stone shall be delivered by barge to the maximum extent possible to prevent excessive damage to Park roadways.

C. Handle and store bedding material to ensure that stockpiles are not contaminated with other soils and materials, and to limit the segregation of material sizes.

2. PRODUCTS

2.1 MATERIALS

A. General:

1. All shore protection stone materials to be furnished under this Agreement shall meet all requirements specified in this section of the specifications. The A/E, at any time during the Agreement, will reject materials at the source or at the job site for failure to meet the specified requirements. Inspection of materials at the quarry or at the job site shall be as specified in Quality Assurance. Inspection and testing of materials shall be as specified in Material Quality. Materials which 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.

B. STONE GRADATIONS

1. Materials having the gradations listed below shall be placed in the work at the locations shown on the drawings. Gradation limits are in-place requirements. Adjustments in production, transportation and placement methods shall be made as necessary to assure final placed materials are within specified ranges. Stone shall be well graded, and not exhibit gap grading or scalping from individual stone size ranges.

2. Armor Stone:

    a. Material having the gradations listed in the drawings shall be placed in the Work at the locations as shown on the Contract Drawings. Gradation limits are in-place requirements. Adjustments in production, transportation and placement methods shall be made as necessary to ensure final placed materials are within specified ranges. Within each gradation, a minimum of 50% of the stones by number shall be larger than the median stone weight.

3. Filter Stone:

    a. Material having the gradations listed in the drawings shall be placed in the Work at the locations as shown on the Contract Drawings. Gradation limits are in-place requirements. Adjustments in production, transportation and placement methods shall be made as necessary to ensure final placed materials are within specified ranges.

4. Core Stone:

    a. Core Stone Shall shall be a widely graded material with a maximum dimension of 6-inches. P200 shall be less than 5% or pre-washed.

5. All stone shall have a minimum specific gravity of 2.6 based on water having a unit weight of 62.4 pounds per cubic foot.

6. The Maximum aspect ratio (greasest dimension:least dimension) of any piece of armor; filter or stone shall not be greater than 3:1 when measured on mutually perpendicular axes.

7. The neat lines representing the limits of the armor stone and the sub-armor stone for revetment construction, as shown on the Contract Drawings, are based on either one or two layers of stone with an average weight of 162 pounds per cubic foot (specific gravity 2.6). If the specific gravity of the stone selected by the Contractor differs to the extent that the layer thicknesses change from what is indicated on the Contract Drawings, redesigning of the section will be required by the A/E.

8. The least dimension of any piece of armor shall not be less than one-half of its greatest dimension when measured mutually perpendicular. The least dimension of any piece of sub-armor stone shall not be less than one-quarter of its greatest dimension.

9. All armor stone shall have angular faces that are fractured, split or the actual bedding plane surface.

C. Composite Geotextile/Geogrid: shall be a bi-axial geogrid faced with geotextile fabric to separate lakebed from breakwater structure.

2.2 MATERIAL QUALITY

A. All stone shall be highly resistant to weathering and disintegration under freezing/thawing and wetting/drying conditions, and 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, free from detrimental cracks, seams and other defects which tend to increase deterioration from natural causes or cause breakage in handling and/or placing. A high argillaceous or shale content is often indicative of poorer quality rock being more susceptible to weathering, abrasion, thin bedding, close fracturing and other undesirable rock properties and will not be accepted. Petrography shall be fresh, interlocking crystaline, with few vugs, no clay mineerals, and no soluble minerals.

B. The stone shall be free of damage as a result of blasting during production. Blasting damage is a significant cause of rejection of stone. Blast cracks that have the potential of causing more than 10% loss of weight of an individual stone, if the crack opens in service, are not acceptable. Not more than 20% of the number of stones accepted into the Work may exhibit blast cracks. Stones with minor cracking may be re-worked at the Contractor's option, with cracked portions being removed by jacking or other suitable method. The remaining stone, if within the gradation limits, may be re-evaluated for acceptance.

C. The Contractor shall submit evidence that all armor and filter stone meets the following requirements:

Test	**Required Value**	**Test Method**
Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials	Specified Gradation	ASTM D5519
Standard Test Method for Evaluation of the Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate	<5% loss (after 5 cycles)	ASTM D5240
Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	<5% loss (after 5 cycles)	ASTM C88
Standard Test Method for Field Determination of Rapid Specific Gravity of Rock and Manmade Materials for Erosion Control	Specific Gravity >2.6	ASTM D5779
Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control	Specific Gravity >2.6 Absorption <1.0%	ASTM D6473

Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate	Specific Gravity >2.6 Absorption <1.0%	ASTM C127
Standard Test Method for Determination of Rock Hardness by Rebound Hammer Method	<5% loss	ASTM 5873
Petrographic Examination	No deleterious materials allowed.	ASTM C 295
Freezeing-Thawings	<2% loss after 35 cycles	ASTM D5312

D. All stone shall be from Illinois Department of Transportation (IDOT), Indiana Department of Transportation (InDOT), Wisconsin Department of Transportation (WisDOT) or US Army Corps of Engineers (USACE) inspected, tested and approved quarries for similar armor stone shore protection applications or shall be submitted and approved prior to acceptance and use.

2.3 SOURCES

A. Sources for Armor Stone

1. Provide all Armor stone for within each breakwater or area of the Project from a single quarry.

2. Armor stone for this project shall meet all of the requirements specified herein.

3. List of Quarries

a. The following listed sources have been approved by the USACE, IDOT, or WISDOT for similar armor stone (and sub-armor stone) shore protection applications. All stone shall be produced from the sources listed below, or meet the requirements of Other Sources.

b.

Name	**Address**	**Owned/Operated By**	**Riprap**
Allied Stone	601 US Route 67 North, Milan, IL. 61264	Riverstone Group	Ledge 1A&1B, 4-9, 11
Aux Sable	4225 East Dellos Rd., Morris, IL. 60450	Lafarge NA	LWR 50' Ledge 2006 FL
Central Limestone	16805 Quarry Rd., Morris, IL. 60450	Central Limestone	2013 Full Face Galena Form.

Cleveland	1069 North Broadway St., Colona, IL. 61241	Riverstone Group	Ledge 1, 2, 3, 4, 8, 9
Dallas City	IL-96, Dallas City, IL. 62330	Cessford Const.	Cedar Fork Beds 2 & 3
Fox River Quarry/Mine	1310 Route 31, South Elgin, IL. 60177	Lafarge NA	Level 1 Breast and Bench
Gold Mine	14204 W. Goldmine Rd., Pearl City, IL. 61062	Civil Constructors	Full 50' N. Face 1992
Irene	4151 Irene Rd., Belvidere, IL. 61008	Rockford S&G	6'-85' 1991 Face
Kankakee	1277 South 7000 West Rd., Kankakee, IL. 60901	Vulcan Materials	Ledges D & E
Kendall County	10501 Joliet Rd., Newark, IL. 60541	Lafarge NA	75' Face Above 2011 Floor
Lafarge Joliet Mine	2509 Mound Rd., Joliet, IL. 60436	Lafarge NA	Kankakee FM
Lemont #360	1361 North Joliet Rd., Romeoville, IL. 60446	Vulcan Materials	Galena Lev. 1, 2, 3, Romeoville & Markgraf = UPR40
Marblehead CS-21	46445 Sweetbay Ln., Marblehead, IL. 63401	Central Stone	Lower 30' Above 1991 FL
McCook	5500 Joliet Rd., McCook, IL. 60525	Vulcan Materials	MWRD Ledges 1, 2, 3; Quarry Ledges 3, 4
Midway	2721 248th St. North, Hillsdale, IL. 61257	Riverstone Group	Ledges 1-6
Mill Creek CS-42	46445 Sweetbay Ln. Quincy, IL. 63401	Central Stone	Lower 28'of FM;
Mining International	1955 Patterson Rd., Joliet, IL. 60436	Richard Brolly	Upper and Lower Bench
	10212 Quarr	y Rd., Mt. Carroll, IL. 61053	Wendling Quarries
Mount Carroll Fischer	15653 Benton St., Mount Carroll, IL. 61053	Fischer Excavating	Entire Face Excluding Lower 6 Feet
Mulford	5982 Columbia Pkwy., Rockford, IL. 61108	Rockford S&G	63-88' Wiselake;
New Hartford	2882 US-54, Rockport, IL. 62370	Callender Const.	30' Chrtfreeburlabv
Nimtz	5953 Windy Knoll Ct., Loves Park, IL. 61111	Rockford S&G	Nachusa-Lwr Gry Beds
Romeoville	Route 53, Romeoville, IL. 60446	Hanson Material Service	Markgraf & Romeo Mbrs
Savanna	9859 Scenic Bluff Rd., Savanna, IL. 61074	Savanna Quarry Inc.	Full 2004 85' Face
Sproule	12810 Hwy 20, Galena, IL. 61036	Sproule Construction	49' Abv Chert Beds
Sycamore	12502 Lloyd Rd. Sycamore, IL. 61078	Vulcan Materials	60' of Upper Galena
Thomas	24 Hillview Rd., Winchester, IL. 62694	Callender Const.	60' Above 1991 Floor
Thornton	1322 South Williams St., Thornton, IL. 60476	Hanson Material Service	Massive-Nonargillac
Tranel	12810 Hwy 20, Galena, IL. 61036	Conmat, Inc.	Full 51' Face Above 2014 Floor
Triumph	765 US Rt 52, Utica, IL. 61373	Lafarge NA	Full 2002 Face
Troy Grove	539 Route 52, Utica, IL. 61373	Riverstone Group	Mifflin/Pecatonica
Utica	IL Rt. 178 & N. 27th Rd., North Utica, IL. 61373	Lafarge NA	Unit 6 ESP, +Unit 7

Valley	772 175th St., St. Augustine, IL. 61474	Riverstone Group	Burlington Formation
Valley City	46619 2100 E, Griggsville, IL. 62340	Callender Const.	75' Abv 2000 Floor
Valley Run	10425 Joliet Rd., Libson, IL. 60541	Vulcan Materials	Full 70' Face 1992
Vermilion	2273 North Illinois 178, Oglesby, IL. 61348	Riverstone Group	1989 Full Face = Kimmswk
Yard 10	1474 675th Ave., Lincoln, IL. 62656	Hanson Material Service	11' "Bottom Rock"
Yard 671	3706 Catlin-Homer Rd., Fairmount, IL. 61841	Hanson Material Group	Millersville LS Member from 34.7' to 55.6'
Yard 672	25142 Quarry Ave., Athens, IL. 62613	Hanson Material Group	Lower Lonsdale Limestone Member from 52' to 68.7'
Bagley	11134 County Rd. X, Bagley, WI. 53801	Kraemer Company	Upper 60' Above SH
Cassville	10714 WI-133, Cassville, WI. 53806	Bard Materials	Full Face Dubuque and Wiselake FM
Deiter	3271 Quarry Rd., Cuba City, WI. 53807	Bard Materials	Full Face Wiselake FM
Frank Bros	6717 WI-59, Milton, WI. 53563	Frank Bros, Inc.	2002 Upr 30-35' Ledge
Grosser	7983 WI-133, Potosi, WI. 53820	Wamsley Ex. & Quarry Prod.	70' Face 2006 Floor
Haverland	3134 Busch Ln., Cuba City, WI. 53807	Kraemer Company	55' Above 2002 Floor
Johnson Creek	W5904 Hwy N, Jefferson, WI. 53549	Hausz Bros. Inc.	2002 Lwr 20' Face
Pembine	N19304 Mine Rd, Pembine, WI 54156	SGI Quarry	meta-andesite
Tennyson	4906 Co. Hwy. O, Potosi, WI. 53820	Bard Materials	Full Face Stewartville and Platteville Mbr.
Wamsley	6657 Camel Ridge Rd., Cassville, WI. 53806	Wamsley Ex. & Quarry Prod.	80' Face 2006 Floor
Waterloo	W11184 Hubbleton Rd., Waterloo, WI. 53594	Michels Naterials	Quartzite & Basalt
Wausau	T9543 Quarry Rd, Wausau, WI 54403	Michels Naterials	Granite

4. The potential suppliers listed have not been investigated with respect to the availability of specific quantities and sizes of the material required for the Project at the proposed time of construction. The listing of potential suppliers only indicates that there could be some material at the source, if selected areas and appropriate quarrying techniques are used, that meets all the requirements specified. The listing of potential suppliers does not guarantee that the quality or sufficient quantities of materials necessary for this contract are available in any of the sources listed nor does it guarantee that economical production can be obtained from that source.

5. Nothing herein is to be construed as implying that potential suppliers listed are actually interested in or capable of producing or offering stone in the size, gradation, weights or quantities required, or that transportation from the supplier is available. The Contractor shall verify each supplier for its capability to produce the quantity required of the quality, sizes, gradation or weights specified in the time frame allocated for this Project.

6. By providing a price proposal for this Project, the contractor is providing verification that he has the capability to produce the quantity required of the appearance, quality, sizes, gradation or weights specified in the time frame allocated for this project.

7. If it is found during the contract that acceptable materials and quantities of materials cannot be obtained by the Contractor from the original source(s), the Contractor may request approval to use alternate source(s) from the list of approved suppliers. Obtaining and furnishing materials from the substitute source(s) shall be at no additional cost to the CDB.

B. Other Sources:

1. If the Contractor elects to use stone from a source not indicated as previously approved, the material must be approved by the A/E, prior to its production, for use on this Project. This approval process may include any or all of the following, as directed by the A/E.

a. Test samples of the proposed stone shall be obtained by the Contractor at its own expense. Samples selected for testing shall be representative of material formations in the quarry to be used or being used on the Project. The A/E or its representative must be present and agree on the selection of all test samples prior to shipment. The A/E may personally select all samples if he so elects. If specified sizes are in excess of 2,000 pounds, 1 ton samples will be taken.

b. The samples shall be shipped or delivered by the Contractor, at its expense, to a testing laboratory in accordance with USACE protocol.

c. Tests to which the material may be subject to include one or more of the following: petrographic examination; specific gravity; abrasion; absorption; wetting and drying; freezing and thawing; soundness; compressive strength; expansion; tensile strength; pulse velocity; gradation; water content; dry unit weight and total porosity; elastic modulus; direct shear; and any other tests determined necessary to ensure that the stone is suitable for its intended use.

d. Allow sufficient time for the testing to be completed such that there are no delays in construction.

e. If the Contractor elects to use material from a source not previously approved, all costs incurred as a result of testing to verify material acceptability shall be the responsibility of the Contractor.

3. EXECUTION

3.1 QUARRY OPERATIONS

A. Quarry operations shall be conducted by the Contractor/supplier in a manner that will produce stone conforming to the requirements specified, and may involve selective quarrying, handling and loading as necessary. Blasting and handling of rock shall be controlled by the Contractor/supplier to produce rock of the size ranges and quality specified. Techniques such as the use of proper hole diameter, hole depth, hole angle, burden and spacing distances, types and distribution of explosives, delay interval and sequence, removal of muck piles between each shot and special handling techniques will be required as necessary to produce the specified materials. All specifications of blasting operations shall be specifically designed so that the end product is not damaged from the blasting technique and that the stone is suitable for the intended purpose.

B. Submit, in writing, to the A/E the anticipated production rates for the various types of stone materials. If the production rates change significantly such that delays are caused at the job site, the A/E shall be notified in advanced writing with the reason for the delay.

3.2 CURING STONE

A. All sedimentary quarry stone from any source shall be stockpiled at the quarry a minimum of 48 hours prior to shipment to the Project site. No stone production shall be allowed prior to 1 April or after 1 November; unless quarry history is available to ensure that durable stone can be quarried in freezing temperatures.

3.3 PLACEMENT

A. General:

1. Placement of all stone materials shall not deviate from the neat lines as shown on the Contract Drawings by more than the tolerances described in this section, unless directed by the A/E.

2. Approval of placement and/or check surveys for any stone set, or portion thereof, does not constitute final acceptance. The stone Work will be considered substantially complete when the A/E has approved placement and check surveys for all sets comprising the total length of revetment Work for the Project. Any damages to approved sets prior to substantial completion, due to Contractor or subcontractor operations, wave activity, or otherwise, shall be repaired by the Contractor at no additional cost to the CDB.

B. Core Material:

1. Equipment suitable for handling bedding material of the specified gradation shall be used.

2. If the materials are placed by clamshell, dragline buckets, skips or other similar equipment, the stone shall not be dropped from a height exceeding 2 feet above the existing lake bottom or previously placed material.

3. All material shall be placed uniformly within the lines and grades indicated on the Contract Drawings and within the tolerances described in this section.

4. The method used in placement shall be such that any soft sub-grade materials will be displaced outward towards the extreme outside toes of the required sections of the structure and in the direction of the construction.

5. The material shall be handled and placed in such a manner as to minimize segregation and provide a well-graded mass.

6. Shaping and finishing to the required tolerances, as well as check surveys, shall be performed immediately prior to the commencement of sub-armor stone placement.

7. At the end of each day that bedding material is placed; provide a Bedding Placement Summary to the A/E. The exact format of the Bedding Placement Summary shall be determined and agreed upon by the A/E and Contractor prior to commencement of bedding stone sub-armor placement. This summary shall include as a minimum: the tonnage of bedding material placed; the revetment stations between which bedding material was placed and; total bedding placement time.

C. Filter Stone:

1. Filter stone shall be placed in sets starting at the toe and proceeding lengthwise along the set and upward, placing both layers simultaneously, with stones placed firmly on the stones beneath. Do not place armor stone on the primary filter stone until the placement of that set is completed as specified and approved by the A/E, and check surveys indicate that the set is built to the required lines, grades and tolerances. If the Contractor elects to use multiple placement operations to construct separate primary sub-armor stone sets, it must ensure that the specified requirements are met in areas where the sets are to be jointed.

2. Equipment suitable for handling primary filter stone of the specified gradation shall be used.

3. All filter stone shall be placed uniformly within the lines and grades indicated on the Contract Drawings and within the tolerances described in this section.

4. Filter stones shall be placed in such a manner as to avoid displacing underlying materials and placing undue impact force on underlying materials and to minimize cracking or chipping of stones.

5. Dumping and/or pushing, or the use of dragline buckets or skips, will not be acceptable for placement of filter stone.

6. Finishing of slopes will be done as the filter stone is being placed. The finished primary filter stone course shall be a well-graded, interlocked mass with rock-to-rock contact.

7. Any damage to the filter stone occurring subsequent to approval, but prior to armor placement, shall be corrected and resurveyed by the Contractor at no additional cost to the CDB.

8. At the end of each work day that filter stone is placed, the Contractor will provide a Filter Stone Placement Summary to the CDB representative. The exact format of the Primary Filter Stone Placement Summary shall be determined and agreed upon by the A/E and Contractor prior to commencement of sub-armor placement. This summary shall include as a minimum: the tonnage of filter stone placed; the revetment stations between which the primary filter stone was placed; and total primary filter placement time.

D. Armor Stone:

1. Where indicated on the Contract Drawings, construction of the armor course shall begin at the toe of the structure with the placement of uniformly sized select toe stones. These toe stones will serve to delineate the outer limits of the armor course and act as an anchor stone.

2. The remaining armor stones shall be placed in sets starting adjacent to the toe stone or at the outer limits of the revetment and proceeding upward, with each stone placed firmly on the stones beneath. Each armor stone set shall be as long as practicable so as to provide the Contractor the opportunity to select the most suitable position for each size and shape of rock in order to achieve the results specified herein. The Contractor shall not commence a new set until the previous set is completed as specified and approved by the A/E, and check surveys indicate that the set has been constructed to the required lines, grades and tolerances. If the Contractor elects to use multiple placement operations to construct separate sets, it must ensure that the specified requirements are met in areas where the sets are to be joined.

3. Equipment proposed for armor stone placement shall be capable of placing the stone at its final position before release and also will be capable of moving and repositioning a released stone, if necessary. Casting or dropping of stone over 1 foot, or moving stones by drifting or manipulating down the slope will not be permitted. Buckets or skips will not be acceptable for placement of armor stone.

4. Armor stone shall be placed individually between the designated neat lines and to the grades shown on the Contract Drawings, within the tolerances described in this section.

5. Armor stones shall be placed in such a manner as to avoid displacing or placing undue impact force on underlying materials and to minimize cracking or chipping of stones.

6. Where more than one layer of stone is required, armor stone shall be placed to its full course thickness in one operation such that stones are keyed and layers are interlocked.

7. Finishing of the slopes will be done as the armor stone is being placed. Stockpiling of stones on approved sections of the breakwater will not be permitted. The finished armor stone course shall have uniform slope and crest surfaces and a well-defined break at the shoulder. The armor stone course shall be stable, tightly placed, keyed and interlocked, with rock-to-rock contact and no overhanging stones. All gaps, seams, holes, etc., in the armor surface shall be of a size not greater than the maximum allowable void defined in this section.

8. Re-handling of individual stones after initial placement will be required as necessary to achieve the results specified above.

9. At the end of each work day that armor stone is placed, provide an Armor Stone Placement Summary to the A/E. The exact format of the Armor Stone Placement Summary shall be determined and agreed upon by the A/E and Contractor prior to commencement of armor placement. This summary shall include as a minimum: a tally of each stone placed; the stations between which armor stones were placed; and total armor placement time.

E. Composite Geotextile/Geogrid Placement: Composite Geotextile/Geogrid shall be placed as follows:

1. Placement of Geotextile/Geogrid shall conform to manufacturer's requirements to assure a continuous layer unbroken by rips, tears, punctures, or other physical damage from placement of the fabric or placement of materials over the fabric.

2. Seams between individual pieces of Geotextile/Geogrid shall be joined or overlapped to provide a continuous layer. To the maximum extent possible, seams should be joined in the shop. Geotextile/Geogrid shall be overlapped at a minimum of 18 inches at all longitudinal joints and a minimum of 36 inches at all transverse joints.

3. Geotextile/Geogrid shall be placed in areas that the new rubble mound breakwater will be on top of the lakebed to separate core and filter materials from the existing lakebed.

3.4 TOLERANCES

A. 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. Tolerances are measured perpendicular to the indicated neat lines. Extreme limits of the tolerance given below shall not be continuous in any direction for more than five times the median stone dimension and/or for any area greater than 1,000 square feet of the structure surface. Any section of a stone course built to the upper tolerance limit shall not be immediately adjacent to a section built to the lower tolerance limits and vice versa (i.e., transitions between extreme tolerance limits shall be smooth).

Material	Above Neat Line	Below Neat Line
Armor	12 inches	12 inches
Filter	12 inches	12 inches
Core or Bedding	6 inches	12 inches
Sub-grade	3 inches	6 inches

B. In addition to the vertical tolerances above, the horizontal alignment for the finished stone courses shall be +2 feet from that shown on the Contract Drawings provided lines, arcs, curves and transition zones are smooth and continuous without visible deflections, bends, kinks, etc. The horizontal tolerance for the landward edge of the armor stone crest adjacent to the reference line shall be +12 inches.

C. The intention of the above tolerances is that the Work will be built to the required elevation, slopes and grades, and that the outer surfaces shall present a neat and positive aesthetic appearance. Placed material not meeting these intentions shall be removed and/or reworked to the satisfaction of the A/E. Material beyond the upper tolerance limit permitted to remain in place by the A/E will not be paid for, as discussed previously in this section.

END 35 31 19

1. GENERAL

1.1 SUMMARY

A. Section Includes: Providing, placing and grading sand for beaches.

1.2 REFERENCES

A. ASTM International, as referenced herein as ASTM.

1.3 SUBMITTALS

1. Source Quality Control:

a. Contractor to submit batch samples of proposed beach sand for A/E approval, prior to placement.

b. Prior to construction, submit certified test reports for Contractor-supplied sand materials as listed in Article 1.3.

1.4 QUALITY ASSURANCE

A. Engage a soil testing and inspection service to perform sampling and testing of sand materials proposed for use in the Work. Initially perform one test for each material source. Visual observations during construction may require additional testing to be performed to gain assurance that the material has consistent properties.

B. Conduct mechanical analysis and consistency tests to determine the gradation and amount of non-durable and organic material. Test may include ASTM D422 (Particle Size), D1140 (Fines).

C. Prepare and provide a report for each test to the A/E. The reports shall certify that the material as delivered to the site complies with the specifications. In the event that the reports make recommendations, the Contractor shall comply with such recommendations.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and store materials in a manner to prevent contamination or segregation. Storage areas will be as designated by the A/E and Using Agency.

2. PRODUCTS

2.1 MATERIALS

A. Sand:

1. Sand materials shall be clean, “tan color, natural sand from off-site sources.

2. Sand materials shall be free of debris, roots, wood, scrap material, vegetative matter, refuse, soft unsound particles, and frozen, deleterious or objectionable materials.

3. Sand material for beaches shall be rounded; clean, free draining sand obtained from natural deposits meeting the general requirements of soil materials above, and shall meet the following gradation requirements:

   a. Narrowly graded

      1) ratio of d85/d15 less than 6

   b. Size: d50 to range between 0.4mm and 0.8mm

   c. Maximum Percent Loss by Washing (ASTM C117): 5%

B. Beach Area Fill:

1. Beach area fill shall be on-site sand, clean quarry spoils, core or bedding materials.

2. Bedding and core stone materials, if required for beach area fill, are as specified in Section 35 31 19 .

3. EXECUTION

3.1 EXAMINATION

A. Examine Work in place on which this Work is dependent. Defects which may influence satisfactory completion and performance of this Work shall be corrected in accordance with the requirements of the applicable section of Work prior to commencement of the Work. Commencement shall be construed as Work in place being acceptable for satisfying the requirements of this section.

3.2 SUB-GRADE EXCAVATION

1. See Section 31 20 00 Site Earthwork for sub-grade excavation.

3.3 PLACING AND COMPACTING BEACH AREA FILL

1. See Section 35 31 19 for bedding stone fill materials, placement and tolerances if required in the drawings.

   a. Beach area fill other than bedding stone fill materials shall be placed in successive horizontal layers. Each layer shall not exceed 12 inches thick, loose measurement. Spread the fill material by approved means.

3.4 PLACING AND COMPACTING BEACH SAND FILL

A. Do not place fill material upon a frozen surface.

B. Place sand fill materials in successive horizontal layers over the entire width and breadth of the section under construction. Each layer shall not be over 18 inches thick, loose measurement. Spread the fill material by approved means.

C. Maintain the entire surface of a section under construction in such condition that construction equipment can travel on all parts of all sections. Fill ruts in surface before proceeding with compaction operations.

D. Compact all "above-water" areas and all "below-water" areas that are reachable by track mounted spreading equipment by a minimum of two passes of tracks of the spreading equipment on all area.

3.5 GRADING BEACH SAND

A. Grade all beach areas to elevations set by the plans.

B. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between such points and existing grades. The finish surface shall be reasonably smooth, compacted and free from irregular surface changes.

C. The finished surface shall be not more than 0.2 foot above or below the established grade or cross section.

D. Reshape graded areas that are rutted or otherwise disturbed during construction operations. Rake the final beach surface with a beach rake pulled by a tractor. Remove all debris gathering by the raking operations.

E. Protect newly graded and raked areas from traffic and erosion. Before final acceptance of the Work, repair and reestablish grades in settled, washed-away or rutted areas and re-rake the entire surface.

3.6 DISPOSAL OF SURPLUS OR UNSUITABLE MATERIAL

A. Excess excavated material or material unsuitable for filling or grading operations shall be removed.

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