

Addendum No. 04

July 09, 2024



John Pershing, Alpha, & Virginia Lee Rose ES UTK

OWNER: MADERA UNIFIED SCHOOL DISTRICT
1902 HOWARD ROAD
MADERA, CA 93637

PREPARED BY: PBK Architects, Inc.
7790 N. Palm Avenue
Fresno, California 93711

PBK PROJECT NO.: 220485, 220487, 220488
DSA FILE NO.: 20-30
DSA APPLICATION NO.: 02-121585, 02-121586, 02-121588

NOTICE TO BIDDERS

- A. Receipt of this Addendum shall be acknowledged on the Proposal Form.
 - B. This Addendum forms part of the Contract Documents for the above referenced project and shall be incorporated integrally therewith.
 - C. Each proposer shall make necessary adjustments and submit their proposal with full knowledge of all modifications, clarifications, and supplemental data included therein. Where provisions of the following supplemental data differ from those of the original Contract Documents, this Addendum shall govern.
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SPECIFICATION SECTIONS:

- 4-01** Specification section **05 40 00 - COLD-FORMED METAL FRAMING** to projects Pershing, Alpha and Virginia Lee Rose. See attached specification with a delta 4.
- 4-02** Specification section **08 41 13 – STOREFRONT, Part 2 Products, section 2.1 Materials, paragraph A Basis of Design, item line 1.** “US Aluminum Corporation, Series 450SF Center Glazed Storefront. See attached brochure for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by one of the following: “shall now read as “US Aluminum Corporation, Series 451 Center Glazed Storefront. See attached brochure for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by any of the following or comparable system:” remove and replace specification with attached revised specification version with clouds and delta 4.
- 4-03** Specification section **08 71 00 – DOOR HARDWARE, Part 4 Door Hardware Sets**, added item line *D. The Door Schedule on the drawings indicates which hardware set is used with each door.* remove and replace specification with attached revised specification version with clouds and delta 4.
- 4-04** Specifications section **10 21 13 - TOILET COMPARTMENTS** to projects Pershing, Alpha and Virginia Lee Rose. See attached specification with a delta 4.

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- 4-05 Specifications section **21 00 00 – FIRE SUPPRESSION SPRINKLER SYSTEM** to projects Pershing and Virginia Lee Rose. See attached specification with a delta 4.
 - 4-06 Specifications section **21 00 01 – COMMON WORK RESULTS FOR FIRE SUPPRESSION** to projects Pershing and Virginia Lee Rose. See attached specification with a delta 4.
 - 4-07 Specifications section **21 00 02 – IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT** to projects Pershing and Virginia Lee Rose. See attached specification with a delta 4.
 - 4-08 Specifications section **23 00 00 – GENERAL MECHANICAL PROVISIONS** to projects Pershing, Alpha and Virginia Lee Rose. See attached specification with a delta 4.
 - 4-09 Specifications section **23 00 01 – HEATING, VENTILATING AND AIR CONDITIONING** to projects Pershing, Alpha and Virginia Lee Rose. See attached specification with a delta 4.

JOHN PERSHING DRAWINGS – 02-121585:

- 4-10 **Sheet AS.4 – FLOOR PLAN**, revise as follows:
 - a. Added door tags for coordination with door schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- 4-11 **Sheet AS.9 – EXTERIOR FINISH ELEVATIONS**, revise as follows:
 - a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- 4-12 **Sheet AS.10 – EXTERIOR FINISH ELEVATIONS**, revise as follows:
 - a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- 4-13 **Sheet AS.11 – DOOR HARDWARE**, revise as follows:
 - a. revised door schedule to coordinate with the sheet AS.4 Floor plan and PC drawing set door schedule. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- 4-14 **SHEET LS.1.1 – IRRIGATION PLAN**, revise as follows:
 - a. added to irrigation legend: remote control valve toro 220-26-0 globe symbol, control wire sleeve symbol, and install new control valves to existing main line. Intercept existing station wires 32,33,35,36 and connect to the new control valves. Extend controls wire as needed symbol. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
 - b. clouded control wire plus one (1) common wire on plans. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

ALPHA DRAWINGS – 02-121586:

- 4-15 **Sheet AS.4 – FLOOR PLAN**, revise as follows:
 - a. Added door tags for coordination with door schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- 4-16 **Sheet AS.9 – EXTERIOR FINISH ELEVATIONS**, revise as follows:
 - a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

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4-17 Sheet AS.10 – EXTERIOR FINISH ELEVATIONS, revise as follows:

- a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-18 Sheet AS.11 – DOOR HARDWARE, revise as follows:

- a. revised door schedule to coordinate with the sheet AS.4 Floor plan and PC drawing set door schedule. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

VIRGINIA LEE ROSE DRAWINGS – 02-121588:

4-19 Sheet AS.4 – FLOOR PLAN, revise as follows:

- a. Added door tags for coordination with door schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-20 Sheet AS.9 – EXTERIOR FINISH ELEVATIONS, revise as follows:

- a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-21 Sheet AS.10 – EXTERIOR FINISH ELEVATIONS, revise as follows:

- a. The ground floor windows clouded for coordination to window schedule on sheet AS.11. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-22 Sheet AS.11 – DOOR HARDWARE, revise as follows:

- a. Revised door schedule to coordinate with the sheet AS.4 Floor plan and PC drawing set door schedule. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-23 SHEET L1.1 – IRRIGATION PLAN, revise as follows:

- a. Added to irrigation legend, remote control valve toro P220-26-0 globe symbol and clouded plan. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- b. clouded valves A-23, A-24, A-25 and A-26. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

4-24 Sheet L1.2 – IRRIGATION PLANS, revise as follows:

- a. Revised text on irrigation trench backfill detail A/L1.2, Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.
- b. Revised text on detail N/L1.2. Revisions have been clouded with a delta 4, remove and replace sheet with attached revised version.

CLARIFICATIONS:

4-25 See attached Pre-Bid RFI log for responses

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END OF ADDENDUM NO. 4

A handwritten signature in blue ink, appearing to be 'M. Schoen', written over a horizontal line.

NAME OF ARCHITECT, Architect





SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Load bearing wall framing.
 - 2. Exterior non-load bearing wall framing.
 - 3. Floor joist framing.
 - 4. Roof rafter framing.
 - 5. Ceiling joist framing.
 - 6. Soffit framing.
 - 7. Accessories necessary for a complete installation.
- B. Related Sections:
- C. Related Sections:
 - 1. Section 03 30 00: Cast in Place Concrete.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.
 - 5. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: General Contractor shall engage a qualified professional engineer, licensed in the State of California, to design cold formed steel framing.
- B. Structural Performance - Delegated design engineer shall provide cold-formed steel framing designs capable of withstanding all code required design loads within limits and under conditions indicated on the construction documents and within this Specification:
 - 1. Design loads: Designs shall be capable of withstanding the worst case loading as indicated on the structural drawings, and/or as required by the locally adopted Building Code. The design shall cover the worst case loading in all instances.
 - 2. Coordinate the requirements on the structural and architectural Drawings with the requirements of this Section. If a conflict exists, notations on the structural drawings take precedence.
 - 3. The following document governs the Work, except where more restrictive items are specified:
 - a. AISI Design of Cold-Formed Steel Structural Members Wind Load:
 - 1) Minimum design loads for exterior and/or load bearing and/or soffit applications:
 - a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 16 gauge minimum, unless noted otherwise.
 - 2) Minimum design loads for interior and/or exterior suspended furr-downs with a maximum vertical drop on either side of five feet (5') or greater:



- a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 20 gauge minimum, unless noted otherwise.
 4. It is a common practice for studs thinner than 20 gauge to be crimped and/or ribbed to increase the strength of the overall stud cross section for various loading applications. These studs are typically noted by manufacturer as "equivalent" to a thicker gauge. These "equivalent" type studs are not allowed in a vertically suspended application with greater than five feet (5') of vertical wall drop, 20 gauge is the minimum thickness allowed for these applications.
 5. Welding qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
 6. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
 7. Fire-rated assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
 8. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
 9. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
 - a. Upward and downward movement of 1-1/2 inches (38 mm).
 10. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold Formed Steel Framing Design Standards:
1. Wall studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral design: AISI S213.

1.4 SUBMITTALS

- A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.
- B. Shop Drawings:
1. Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners:
 - a. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - b. Shall bear the seal of a Registered Professional Engineer, licensed in the State of California.
- C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations and shop drawings to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of California. Calculations and shop drawings must show design will withstand wind loading commiserate with class and rating of the Project.

1.5 QUALITY ASSURANCE



- A. Regulatory Requirements:
 - 1. Welding qualifications:
 - a. Qualify procedures and personnel according to the following:
 - 1) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - 2) CCFSS Technical Bulletin: "AISI Specification Provision for Screw Connections."
 - 2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions:
 - a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
 - 3. Fire resistance ratings: ASTM E119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory*.
 - 4. Installer qualifications: Company specializing in the installation of cold formed metal framing components with minimum five (5) years' documented experience.
 - 5. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 6. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 7. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
- B. Professional Engineer Qualifications:
 - 1. A professional engineer who is legally qualified to practice in the State of California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent:
 - a. Engineering responsibility: Preparation of shop drawings, design calculations, and structural data.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. CEMCO.
 - 2. ClarkDietrich Building Systems.
 - 3. Consolidated Fabricators Corp.
 - 4. SCAFCO Corporation.
 - 5. Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

2.2 LOAD BEARING WALL FRAMING



- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with straight flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Steel Box or Back to Back Headers:
 - 1. C-shape used to form header beams, of web depths indicated, unpunched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
- D. Steel Single or Double L Headers:
 - 1. L-shapes used to form header beams, of web depths indicated:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Top flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips:
 - 1. Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) ClarkDietrich Building Systems.
 - 2) SCAFCO Corporation.
 - 3) Simpson Strong-Tie Co., Inc.
 - 4) Steeler, Inc.
 - 5) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.
- D. Single Deflection Track:



1. Single, deep leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- E. Double Deflection Tracks:
 1. Double, deep leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges:
 - a. Outer track - Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - 1) Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - 2) Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
 - b. Inner track - of web depth indicated:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists:
 1. C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm).
 - b. Flange width: Two inches (51 mm), minimum.

2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame:
 1. C-shaped steel sections, of web depths indicated, with stiffened flanges:
 - a. Minimum base metal thickness: **[0.0538 inch (1.37 mm)]**.
 - b. Flange width: 1-5/8 inches (41 mm) minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.



5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.
- C. Anchors, Clips, and Fasteners:
1. Steel shapes and clips: ASTM A36/A36M, zinc coated by hot dip process according to ASTM A123/A123M.
 2. Expansion anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.
 3. Power actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
 4. Mechanical fasteners:
 - a. ASTM C1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws:
 - 1) Head type: Low profile head beneath sheathing.
 5. Welding electrodes: Comply with AWS standards.
- D. Miscellaneous Materials:
1. Galvanizing repair paint: SSPC-Paint 20 or ASTM A780.
 2. Non-metallic, non-shrink grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.
 3. Shims: Load bearing, high density multimonomer plastic, and non-leaching; or of cold formed steel of same grade and coating as framing members supported by shims.
 4. Sealer gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements:
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted:
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three (3) exposed screw threads.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances:
1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance



variation of 1/8 inch in ten (10) feet (1:960) and as follows:

- a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- b. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

- A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

- A. General:
 1. Track anchors: Install anchors maximum four feet (4') on center; design anchors and spacing to carry live, dead, and wind loads.
 2. Track splices: Provide channel inserts or weld track splices.
 3. Erection: Install members plumb, level, and in a true plane.
 4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.
- B. Install metal framing systems in accordance with stud manufacturer's printed instructions.
- C. Runner Tracks:
 1. Install continuous tracks sized to match studs.
 2. Align tracks accurately to layout at base and tops of studs.
 3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
 4. Provide fasteners at corners and ends of tracks.
 5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
 6. Provide deflection track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2-inch movement of primary structure. Do not attach studs directly to deflection track.
 7. Vertical deflection clips: Provide manufacturer's standard bypass and head clips,

capable of accommodating upward and downward vertical displacement of primary structure.

- D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."
- E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum two feet (2') on center vertical.
- G. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
- H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
- I. Install bracing/bridging in accordance with manufacturer's instructions and design conditions.
- J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.
- K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.
- L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

3.4 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track:
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud sections as indicated on shop drawings.
- C. Space joists not more than two inches (51 mm) from abutting walls:
 - 1. Joist spacing: 16 inches (406 mm).



- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on shop drawings:
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on shop drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold down angles, anchors, and fasteners, to provide a complete and stable joist framing assembly.

END OF SECTION 05 40 00

SECTION 08 41 13 STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Exterior and interior storefront framing.
 - 2. Exterior and interior manual swing entrance doors.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 12 00: Structural Steel Framing.
 - 2. Section 05 40 00: Cold-Formed Metal Framing.
 - 3. Section 05 50 00: Metal Fabrications.
 - 4. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 5. Section 07 92 00: Joint Sealants.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.
- B. Shop Drawings:
 - 1. Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other work:
 - a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Engineer's calculations of performance requirements.
- D. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or fail due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

- d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units.
- B. Structural Loads:
- 1. Wind loads: Ultimate wind speed gust 115 mph; exposure D.
- C. Deflection of Framing Members:
- 1. Deflection normal to wall plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch (19 mm), whichever is less.
 - 2. Deflection parallel to glazing plane: Limited to $L/360$ of clear span or $1/8$ inch (3.2 mm), whichever is smaller.
- D. Structural Test Performance - Provide aluminum framed systems tested according to ASTM E330 as follows:
- 1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test durations: As required by design wind velocity, but not fewer than ten (10) seconds.
- E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. 0.03 L/s per sq. m of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa.)
- F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa.)
- G. Windborne Debris Impact Resistance:
- 1. Pass missile impact and cyclic pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996 for Wind Zone 4:
 - a. Large missile test: For glazed openings located within 30 feet (9.1 m) of grade.
- H. Thermal Movements:
- 1. Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature change (range): 120 degrees F (67 degrees C, ambient; 180 degrees F, 100 degrees C, material surfaces.
 - b. Interior ambient-air temperature: 75 degrees F (24 degrees C).
- I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing

areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F3.23
W/sq. m x K when tested according to AAMA 1503.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessibility requirements:
 - a. 2022 California Building Code: Section 11B-404.3 accessible route.
 - b. 2022 California Building Code: Section 11B-309.4 operable parts interior usage.
 - c. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - d. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
- B. Installer Qualifications: Installer having minimum ten (10) years' documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.
- C. Engineering Responsibility: Prepare data for aluminum framed systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.
- D. Product Options:
 - 1. Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance:
 - a. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.
- F. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

- A. Written warranty signed by manufacturer, Contractor, and installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Water leakage through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty period: Two (2) years from date of Substantial Completion.
- B. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:
 - 1. Warranty period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design:
 - 1. **US Aluminum Corporation, Series 451 Center Glazed Storefront.** See attached brochure for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by any of the following or comparable system:
 - a. Arcadia
 - b. Kawneer.
- B. Aluminum:
 - 1. Alloy and temper recommended by manufacturer for type of use and finish indicated:
 - a. Sheet and plate: ASTM B209/ASTM B209M.
 - b. Extruded bars, rods, profiles, and tubes: ASTM B221/ASTM B221M.
 - c. Extruded structural pipe and tubes: ASTM B429.
- C. Framing Members:
 - 1. Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads:
 - a. Construction: Nonthermal/thermal.
 - b. Glazing system: Retained mechanically with gaskets on four sides.
 - c. Glazing plane: Center.
- D. Accessories:
 - 1. Brackets and reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
 - 2. Fasteners and accessories:
 - a. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
 - 1) Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2) Reinforce members as required to receive fastener threads.
 - 3. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.
 - 4. Concealed flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
 - 5. Framing system gaskets and sealants: Recommended by manufacturer for joint type.
- E. Glazing:
 - 1. Refer to Section 08 80 00: Glazing for impact resistant laminated insulating glass with low-e coating on Number 2 surface:
 - a. Glazing gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
 - b. Spacers and setting blocks: Elastomeric type.
- F. Accessories:
 - 1. Joint sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00: Joint Sealants.
 - 2. Bituminous paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil 0.762 mm thickness per coat.

2.2 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members:
 - 1. Fabricate components that, when assembled, have specified characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - f. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - h. Provide sill receptors with end dams at all sill conditions.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Storefront Framing: Fabricate components for assembly using screw spline system.
- E. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.3 ALUMINUM FINISHES

- A. Class I, Clear Anodic Finish (#14): AA-M10C21A41 / AA-M45C22A41, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on shop drawings.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work:
 - 1. Do not install damaged components.
 - 2. Fit joints to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 5. Seal joints watertight unless otherwise indicated.
 - 6. Min anchorage #8 with two-inch (2") minimum embedment; minimum two inches (2")

from edges. Refer to shop drawings.

- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing specified in Section 08 80 00: Glazing.
- G. Install perimeter joint sealants as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

3.4 ERECTION TOLERANCES

- A. Install aluminum framed systems to comply with the following maximum erection tolerances:
 - 1. Location and plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to three inches (75 mm) from the latch, measured to the leading door edge.

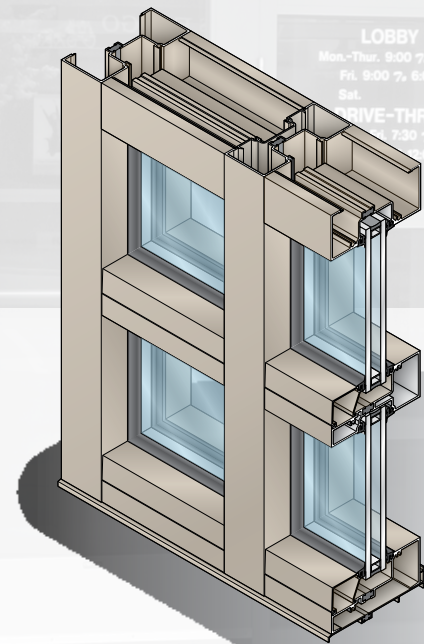
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STOREFRONT SYSTEMS

SERIES 451 & IT451 CENTER GLAZE



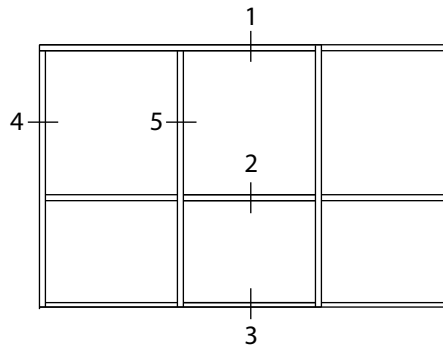
- Series 451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Non-Thermal
- Series IT451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Thermal
- 1" (25 mm) Glazing Infills
- Injection Molded Water Deflectors
- Screw Spline Assembly
- Shear Block Assembly
- Stacking Installation Option
- Full Range of Accessory Components
- Available in Anodized or Painted Finishes



Series IT451 offers improved thermal performance using the Poly-Aluminizer™ and Struct-Link™ Thermal Break Technology. Series 451 and IT451 may be interior or exterior glazed. A top load E.P.D.M. gasket is used to position and weatherseal the glass in the aluminum pocket. Center Glazed Systems are compatible with all United States Aluminum Entrance Doors.

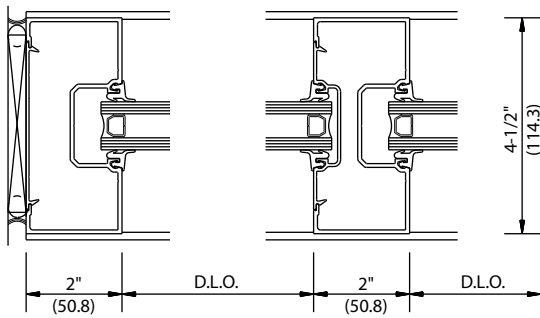
SERIES 451 & IT451 STOREFRONTS TYPICAL DETAILS

For Specifications, Details, and
Testing Data go to **usalum.com**.



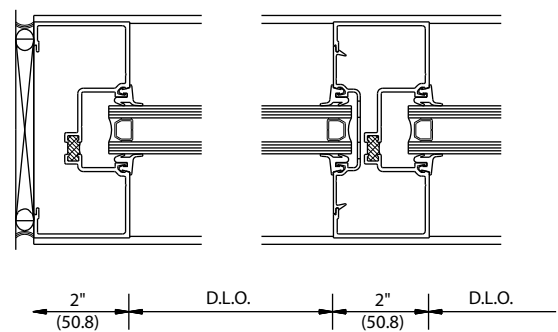
Series 451

Series IT451



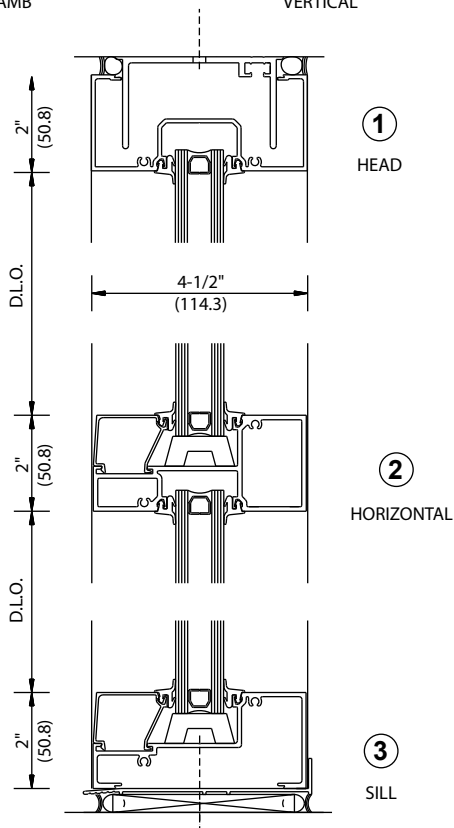
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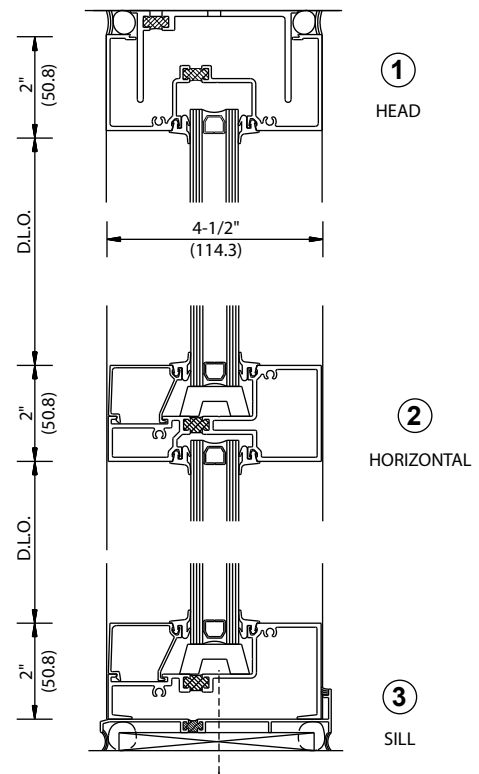
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SILL

NOT TO SCALE

SECTION 08 71 00 DOOR HARDWARE

PART 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. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other Sections.
- C. Related Sections:
 - 1. Section 08 11 13: Hollow Metal Doors and Frames.
- D. Reference Standards:
 - 1. Comply with the version year adopted by the Authority Having Jurisdiction:
 - a. CBC California Building Code: Section 11B-404.
 - b. ICC A117.1 Accessible and Usable Buildings and Facilities.
 - c. NFPA 70 National Electrical Code.
 - d. NFPA 80 Fire Doors and Windows.
 - e. NFPA 101 Life Safety Code.
 - f. NFPA 105 Installation of Smoke Door Assemblies.
 - g. State Building Codes, Local Amendments, if applicable.
 - 2. All hardware specified herein shall comply with the following industry standards:
 - a. ANSI Certified Product Standards A156 Series
 - b. UL10C Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- C. Format: Comply with scheduling sequence and vertical format in DHI's Sequence and Format for the Hardware Schedule.
- D. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets of Part 4. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to

resubmission.

- E. Content:
 - 1. Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
- F. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- G. Keying Schedule: After a keying meeting with the Owner has taken place, prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- H. Informational Submittals.
- I. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- J. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01 for Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage qualified manufacturers with a minimum five (5) years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum three (3) years' documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum five (5) years' documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- D. Source Limitations: Obtain each type and variety of door hardware specified in this Section from a single source unless otherwise indicated.
- E. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference:
 - 1. Conduct conference to comply with requirements in Division 01 Section for Project Meetings. Keying conference to incorporate the following criteria into the final keying schedule document:
 - a. Function of building, purpose of each area, and degree of security required.
 - b. Plans for existing and future key system expansion.
 - c. Requirements for key control storage and software.
 - d. Installation of permanent keys, cylinder cores, and software.
 - e. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section for Project Meetings with attendance by representatives of supplier(s), installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
- I. Prior to installation of door hardware, conduct a Project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedules, templates, and physical product samples as required.
- J. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades:
 - 1. Review sequence of operation narratives for each unique access-controlled opening.
 - 2. Review and finalize construction schedule and verify availability of materials.
 - 3. Review the required inspecting, testing, commissioning, and demonstration procedures.
- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period:
 - 1. Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of the hardware.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One (1) year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven (7) years for heavy duty cylindrical (bored) locks and latches.
 - 2. Ten (10) years for manual surface door closer bodies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software, or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the Keying Conference.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations:
 - 1. Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets of Part 4. Products are identified by using door hardware designations, as follows:
 - a. Named manufacturer's products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Section 01 33 00: Substitution Procedures. Approval of requests is at the discretion of the Architect, Owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges - ANSI A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets:
 - 1. Quantity - Provide the following hinge quantity:
 - a. Two (2) hinges: For doors with heights up to 60 inches.
 - b. Three (3) hinges: For doors with heights 61 to 90 inches.
 - c. Four (4) hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide four (4) hinges, plus one (1)

hinge for every 30 inches of door height greater than 120 inches.

- B. Hinge Size:
 - 1. Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to three feet (3'0"): 4-1/2-inch standard or heavy weight as specified.
 - b. Sizes from three feet-one inch (3'1") to four feet (4'0"): Five inches (5") standard or heavy weight as specified.
- C. Hinge Weight and Base Material:
 - 1. Unless otherwise indicated, provide the following:
 - a. Exterior doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- D. Hinge Options:
 - 1. Comply with the following:
 - a. Non-removable pins: Provide set screw in hinge barrel that when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
- E. Manufacturers:
 - 1. Hager Companies (HA) - CB Series.
 - 2. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - 3. Stanley Hardware (ST) - CB Series.

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum ten (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders:
 - 1. Original manufacturer cylinders complying with the following:
 - a. Mortise type: Threaded cylinders with rings and cams to suit hardware application.
 - b. Rim type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - c. Bored-lock type: Cylinders with tailpieces to suit locks.
 - d. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - e. Keyway: Match facility standard.
- D. Keying System:
 - 1. Each type of lock and cylinders to be factory keyed:
 - a. Conduct specified Keying Conference to define and document keying system instructions and requirements.
 - b. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - c. Existing system: Key locks to Owner's existing system.
- E. Key Quantity:
 - 1. Provide the following minimum number of keys:

- a. Change keys per cylinder: Two (2).
- b. Master keys (per master key level/group): Five (5).
- c. Construction keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty) – ANSI A156.2, Series 4000, Grade 1 Certified:
1. Furnish with solid cast levers, standard 2-3/4-inch backset, and 1/2-inch (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 2. Locks are to be non-handed and fully field reversible.
 - a. Manufacturers: Sargent Manufacturing (SA) – 10 Line.

2.5 LOCK AND LATCH STRIKES

- A. Strikes:
1. Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - a. Flat-lip strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - b. Extra-long-lip strikes: For locks used on frames with applied wood casing trim.
 - c. Aluminum-frame strike box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - d. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards:
1. Comply with the following:
 - a. Strikes for Mortise Locks and Latches: ANSI A156.13.
 - b. Strikes for Bored Locks and Latches: ANSI A156.2.
 - c. Strikes for Auxiliary Deadlocks: ANSI A156.36.
 - d. Dustproof Strikes: ANSI A156.16.

2.6 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one (1) manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be UL listed for use of fire rated doors.
 3. Size of units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ICC A117.1.
 4. Closer arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers, and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty):
 - 1. ANSI A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard:
 - a. Manufacturers:
 - 1) LCN Closers (LC) - 4040 Series.
 - 2) Sargent Manufacturing (SA) - 351 Series.
 - 3) Norton Door Controls (NO) - 7500 Series.

2.7 DOORSTOPS AND HOLDERS

- A. General: Doorstops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Doorstops and Bumpers:
 - 1. ANSI A156.16, Grade 1 certified doorstops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of doorstops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders:
 - a. Manufacturers:
 - 1) Hiawatha, Inc. (HI).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Trimco (TC).
- C. Overhead Doorstops and Holders:
 - 1. ANSI A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm, and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function:
 - a. Manufacturers:
 - 1) Rixson Door Controls (RF).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Sargent Manufacturing (SA).

2.8 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications, provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing:
 - 1. Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784:
 - a. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing:
 - 1. Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings

indicated, based on testing according to UL 10C:

- a. Provide intumescent seals as indicated to meet UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.9 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.10 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced, and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling, and access control system hardware without additional in-field modifications.

3.2 EXAMINATION

- A. Examine scheduled openings, with installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify Architect of any discrepancies or conflicts between the door schedule, door types, Drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.3 PREPARATION

- A. Wood Doors: Comply with ANSI A115.W series.

3.4 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications:
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including hanging devices, locking devices, closing devices, and seals.
- B. Mounting Heights:
 - 1. Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - a. Standard steel doors and frames: DHI 141 Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - b. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 Accessibility Guidelines for Buildings and Facilities.
 - c. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09: Finishes Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00: Joint Sealants.
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating, and adjusted.

3.6 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.7 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Owner occupancy.

3.8 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 4 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. See DSA approved plans 04-122304 pc for hardware schedule.

- D. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

IVE	=	Ives	Hinges, Door Stops, Kick Plates & Silencers
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HW GROUP NO. 01

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 02

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 03

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	20-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

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HW GROUP NO. 04

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 05

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 06

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

END OF SECTION 08 71 00



SECTION 10 21 13 TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Solid Color Reinforced Composite (SCRC) Substrate (Bobrick Sierra Series):
 - 1. Toilet partitions.
 - 2. Urinal privacy screens.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 09 30 00: Tiling.
 - 4. Section 10 28 13: Toilet Accessories.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00: Submittal Procedures.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
- C. Shop Drawings:
 - 1. Submit manufacturer's shop drawings for each product specified, including the following:
 - a. Plans, elevations, details of construction and attachment to adjacent construction.
 - b. Show anchorage locations and accessory items.
 - c. Verify dimensions with field measurements prior to final production of toilet compartments.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.
- F. Mock-Up:
 - 1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship:
 - a. Finish areas designated by Architect.
 - b. Do not proceed with remaining work until workmanship is approved by Architect.
 - c. Refinish mock-up area as required to produce acceptable work.

1.4 PERFORMANCE REQUIREMENTS

- A. Accessible Toilet Compartments:
1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be a minimum of 9 inches high above the finish floor, and a minimum of 6 inches deep beyond the compartment side face of the partition, exclusive of partition support members. It shall be a minimum of 12 inches high above the finish floor for children's use. Partition components at toe clearances shall be smoother without shop edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets total six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.
 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. See CBC Figure 11B-604.8.2.
 5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
 6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. See CBC Section 11B-604.8.2.2.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Accessibility Requirements - Comply with applicable requirements:
 - d. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
 - e. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 2. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
- B. Manufacturer Qualifications: Minimum 10 years' experience manufacturing similar products.
- C. Installer Qualifications: Minimum 2 years' experience installing similar products.
- D. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- E. Preinstallation Meeting:
1. Convene minimum two weeks prior to starting work of this section.

1.6 WARRANTY

- A. Manufacturer's Warranty (Sierra Series): Manufacturer's standard 25-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.



1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00: Product Requirements.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (BOBRICK SIERRA SERIES)

- A. Solid Color Reinforced Composite (SCRC) Toilet Partitions - Bobrick Sierra Series 1092G.67P:
 - 1. Design Type:
 - c. Standard Height.
 - 1) Door/Panel Height: 58 inches.
 - 2) Floor Clearance: 12 inches.
 - 2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches from the edge to allow for 0.175-inch overlap to prevent line-of-sight into the toilet compartment. Privacystrips fastened or adhered onto the partition material are not acceptable.
 - 3. Mounting:
 - a. Floor-Mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065-inch-thick with anti-grip profile:
 - 1) Stile Maximum Height: 83 inches.
- B. Solid Color Reinforced Composite (SCRC) Urinal Screens - Bobrick Sierra Series:
 - 1. Mounting Configuration:
 - a. Wall-Hung:
 - 1) Screen Height: 48 inches with 12 inches floor clearance.
- C. Materials:
 - 1. Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick Graffiti Off coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable:
 - a. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - b. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
 - c. Edges: Same color as the surface.
 - d. Color:
 - 1) SC04 Forest Green.
 - e. Acceptable SCRC Products:
 - 2) Ultimate Corian System by Shower Shapes.
 - 3) WilsonArt Gibraltar Material.



- 4) WilsonArt Earth Stone Material.
 - 5) Or manufacturer approved equal.
- D. Performance Requirements:
1. Graffiti Resistance (ASTM D6578): Passed cleanability test; 5 staining agents.
 2. Scratch Resistance (ASTM D2197): Maximum load value exceeds 10 kilograms.
 3. Impact Resistance (ASTM D2794): Maximum impact force exceeds 30 inch-pounds.
 4. Smoke Developed Index (ASTM E84): Less than 450.
 5. Flame Spread Index (ASTM E84): Less than 75.
 6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
 7. Uniform Building Code: Class II.
- E. Finished Thickness:
1. Stiles and Doors: 3/4 inch.
 2. Panels and Screens: 1/2 inch.
- F. Stiles:
1. Floor-Anchored stiles furnished with expansion shields and threaded rods:
 - a. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8-inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - b. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4-inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1-inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- G. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00: Metal Fabrications.
- H. Hardware:
1. Chrome-plated "Zamak", aluminum, extruded plastic hardware not acceptable:
 - a. Compliance: Operating force of less than 5 lb.
 - b. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - c. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - d. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 - e. Fastening:
 - 1) Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable:
 - a) Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb per insert.
 - f. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.
 - g. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16-gauge sliding door latch, 14-gauge keeper.
 - h. Locking: Door locked from inside by sliding door latch into keeper.
 - i. Hinge Type:
 - 1) Standard.
 - a) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - j. Mounting Brackets:



- 1) Full-Height:
 - a) Mounting Brackets: 18-gauge stainless steel and extend full height of panel.
 - b) U-Channels: Secure panels to stiles.
 - c) Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions:
 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

3.3 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

3.4 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 2. Verify location does not interfere with door swings or use of fixtures.
 3. Use fasteners and anchors suitable for substrate and project conditions.
 4. Install units rigid, straight, plumb, and level.
 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 6. Test for proper operation.

3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.



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- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10 21 13



SECTION 21 00 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wet-Pipe Fire Sprinkler System.
- B. System Design, Installation and Certification.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 28 31 00 – Fire Detection and Alarm.
- C. Section 21 00 01 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
- D. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- E. Divisions 22/ 23 – Plumbing/ Mechanical.
- F. Division 26 – Electrical.
- G. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association 2022.
- C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.
- D. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- E. ASTM B75 - Seamless Copper Tube.
- F. ASTM B88 - Seamless Copper Water Tube.
- G. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper Alloy Tube.
- H. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

1.4 SUBMITTALS



- A. See Division 01 for Administrative Requirements, for Submittal Procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings: Fire sprinkler system design is not a deferred submittal. The overall system design is approved by DSA. The overall system design is a directive for the installation of the system.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to the Architectural Team.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain PBK Architects approval prior to relocation of equipment and materials.
 - 5. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 6. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components, and accessories. Indicate system controls.
 - 7. Submit shop drawings to PBK Architects for approval prior to fabrication or installation.
 - 8. Installation is to conform to the DSA approved fire sprinkler plans.
 - 9. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
 - 10. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- D. Material Data: DSA Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to PBK Architects for review of project compliance. DSA approval must be obtained prior to installation. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.
- E. Substitutions:
 - 1. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project.
 - 2. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.
 - 3. Only one request for substitution will be considered for each item of equipment or material.
 - 4. Substitution requests shall include the following:
 - a. Reason for substitution request.
 - b. Complete submittal information.
- F. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.



- G. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- I. Maintenance Materials: Furnish the following for the Districts use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- J. Section 01 91 00 - Commissioning.

1.5 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL and FM requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years' experience. Installing company must have a valid State of California contractors' license with a C-16 classification.
- F. Equipment and Components: Provide products that bear UL and FM label or marking.
- G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2022 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
 - 1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
 - 2. Drawings, details, and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.
- C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits, and other components.
- D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply details shown on the fire sprinkler plans and



structural plans.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT DOCUMENTS INCLUDING APPROVED MATERIAL DATA.

2.1 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.
- B. Occupancy: Classroom: Light Hazard, Concession/Restroom: Light Hazard, Locker Room: Comply with NFPA 13, 2022. All storage rooms to have sprinklers spaced for ordinary hazard.
- C. Interface system with building fire and smoke alarm system.
- D. Provide fire department connections where indicated.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

2.2 SPRINKLERS

- A. Exposed Area Type: Upright.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Application: Areas with exposed construction and all spaces above ceiling.
- B. Finished Gypsum Board Ceilings and Suspended Ceilings: Semi-Recessed Pendent.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome sprinkler with White escutcheon.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.3 PIPING SPECIALTIES

- A. Zone Control Valves:
 - 1. Outside screw and yoke or butterfly, U.L. listed.
 - 2. Valves shall be sealed open using approved seal.
 - 3. Provide weatherproof actuator housing with two single pole double throw switches.
- B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.



- D. Fire Department Connections:
 - 1. Type: Free Standing with brass finish.
 - 2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
 - 3. Drain: 3/4 inch automatic drip, outside.
 - 4. Label: "Sprinkler - Fire Department Connection".

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standards, DSA requirements and DSA approved plans.
- B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other disciplines.
- C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic calculations, structural review or calculations, or seismic calculations, shall be submitted to PBK Architects for review prior to making changes.
- D. Install equipment in accordance with manufacturer's instructions.
- E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- F. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- G. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.
- H. Place pipe runs to minimize obstruction to other work.
- I. Place piping in concealed spaces above finished ceilings.
- J. Center sprinklers in two ft. direction in ceiling tile and provide piping offsets as required. Flex drops are not permitted.
- K. All pendent or horizontal sidewall sprinklers are to be installed on return bends
- L. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- M. Flush entire piping system of foreign matter.
- N. Install guards on sprinklers where subject to damage as in attic space where mechanical equipment is located and in mechanical room.
- O. Hydrostatically test entire system.
- P. Required test to be witnessed by IOR.



Q. Verification of weld inspection required prior to installation of fire sprinkler system.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 00 00



SECTION 21 00 01 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 21 00 00 – Fire Suppression Sprinkler Systems: Sprinkler systems design.
- C. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- D. Divisions 22/ 23 – Plumbing/ Mechanical.
- E. Division 26 – Electrical.
- F. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.
- D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers.
- E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers.
- F. ASTM A 47/ A 47M - Standard Specification for Ferritic Malleable Iron Castings.
- G. ASTM A 53/ A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- H. ASTM A 795/ A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- I. AWWA C110/ A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association.
- J. AWWA C111/ A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/ AWWA C111/ A21.11).



- K. AWWA C151/ A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association (ANSI/ AWWA C151/ A21.51).
- L. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2022.
- M. NFPA 14 - Standpipe and Hose Systems.
- N. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.
- O. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.
- P. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, seismic restraints and calculations, and piping connections.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
 - 5. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 - 6. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work or work directly connected to same are installed and providing no additional material is required.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- F. Section 01 91 00 - Commissioning.



1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience.
- D. Conform to UL and FM requirements.
- E. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform work to NFPA 13 and DSA requirements.
- B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black, or as approved by DSA:
 - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
 - a. Schedule 10 Pipe: Shall be U.L. approved with U.L. approved grooved fittings and couplings for pipe sizes 2-1/2" and larger only. Schedule 10 pipe shall not be used for pipe sizes less than 2-1/2". Threaded fittings shall not be used for any Schedule 10 pipe.
 - 2. Cast Iron Fittings: ASME B16.1, flanges, and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings, and ASTM A 47/ A 47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical formed fittings, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.
- B. Cast Iron Pipe: AWWA C151/ A21.51.



1. Fittings: AWWA C110/ A21.10, standard thickness.
2. Joints: AWWA C111, rubber gasket.
3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 inch and Over: Carbon steel, adjustable, split ring, galvanized.
- B. Vertical Support: Steel riser clamp.
- C. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 GATE VALVES

- A. Up to and including 2 inches:
 1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged ends.
- C. Over 4 inches:
 1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.5 GLOBE OR ANGLE VALVES

- A. Up to and including 2 inches:
 1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- B. Over 2 inches:
 1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat, and disc.

2.6 BALL VALVES

- A. Up to and including 2 inches:
 1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

2.7 BUTTERFLY VALVES

- A. Cast or Ductile Iron Body:
 1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.8 CHECK VALVES



- A. Up to and including 2 inches:
 - 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches and less than 4 inches:
 - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
 - 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- H. Slope piping and arrange systems to drain at low points.
- I. Prepare pipe, fittings, supports, and accessories for finish painting.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.



- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- N. Provide gate valves for shut-off or isolating service.
- O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 21 00 01



SECTION 21 00 02 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 General Requirements apply to this section.
- B. Section 09 90 00 – Painting and Coating.

1.3 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

- A. See Section 01 33 00 – Submittals Procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.
- F. Section 01 91 00 - Commissioning.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc.: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.



2. Letter Height: Equipment, control panels, 1 inch.
3. Letter Height: Controls and small components, 1/4 inch.
4. Background Color: Black.

2.3 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify valves in main and branch piping with tags.
- G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 21 00 02

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 2. California Building Code – CBC.
 3. California Mechanical Code – CMC.
 4. California Plumbing Code – CPC.
 5. California Fire Code – CFC.
 6. California Green Building Code.
 7. Air Diffusion Council – ADC.
 8. American Gas Association – AGA.
 9. Air Moving and Conditioning Association – AMCA.
 10. American National Standards Institute – ANSI.
 11. Air Conditioning and Refrigeration Institute – ARI.
 12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 13. American Society of Mechanical Engineers – ASME.
 14. American Society for Testing and Materials – ASTM.
 15. American Water Works Association – AWWA.
 16. California Electrical Code – CEC.
 17. National Electrical Manufacturers Association – NEMA.
 18. National Fire Protection Association – NFPA.
 19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 20. Underwriters' Laboratory – UL.
 21. Occupational Safety and Health Act - OSHA.
 22. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK



- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and

modifications to the work caused by these items.

- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. (These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up



prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.4 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.
- D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.5 EQUIPMENT SUPPORT FRAMES



- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.

3.3 EXCAVATION AND BACKFILL

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and



compaction requirements.

- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

- A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. System insulation.
 - 4. Controls and control wiring and conduit for control wiring.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- D. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp or equal.
- E. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.
- F. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

- G. Duct Joints:
 - 1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.
- H. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

2.2 AIR TERMINALS AND DUCT FITTINGS

- A. Grilles: (Grilles, Registers and Diffusers)
 - 1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
 - 2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
 - 3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
 - 4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

2.3 DUCTWORK INSULATION MATERIALS

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at



a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.

- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 EQUIPMENT

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 - 3. Ratings:
 - a. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 - 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.

- e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
6. Fan Selection:
- a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
- B. Exhaust Fans:
- 1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
 - 2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME,

- Greenheck or equal.
3. Roof Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Down blast type UL listed. Cook, Greenheck, Penn, ACME or equal.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

- A. General:
 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
 2. Seismic bracing: All ducts shall be braced and supported per details on the drawings.
 3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
 4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
 5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
 6. Open ends of ductwork shall be covered during construction to keep inside clean.
- B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):
 1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
 - 1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 - e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
 - f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
 2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on



drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

- B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.
- C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 EQUIPMENT INSTALLATION

- A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.5 TEMPERATURE CONTROL SYSTEM

- A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

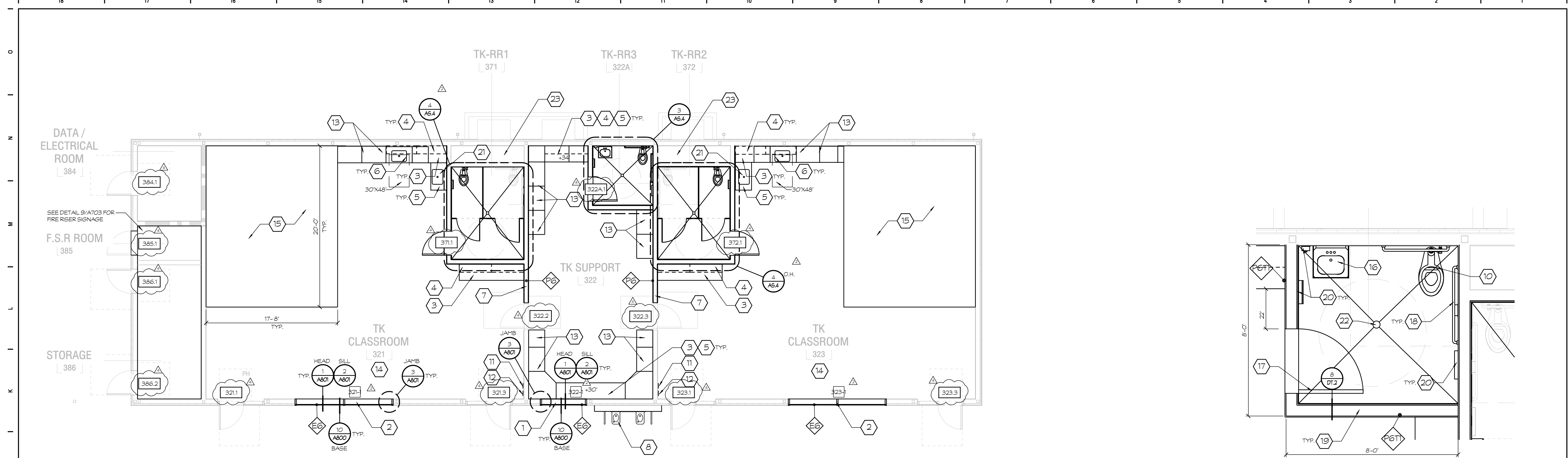
3.6 SYSTEM AIR BALANCE

- A. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.

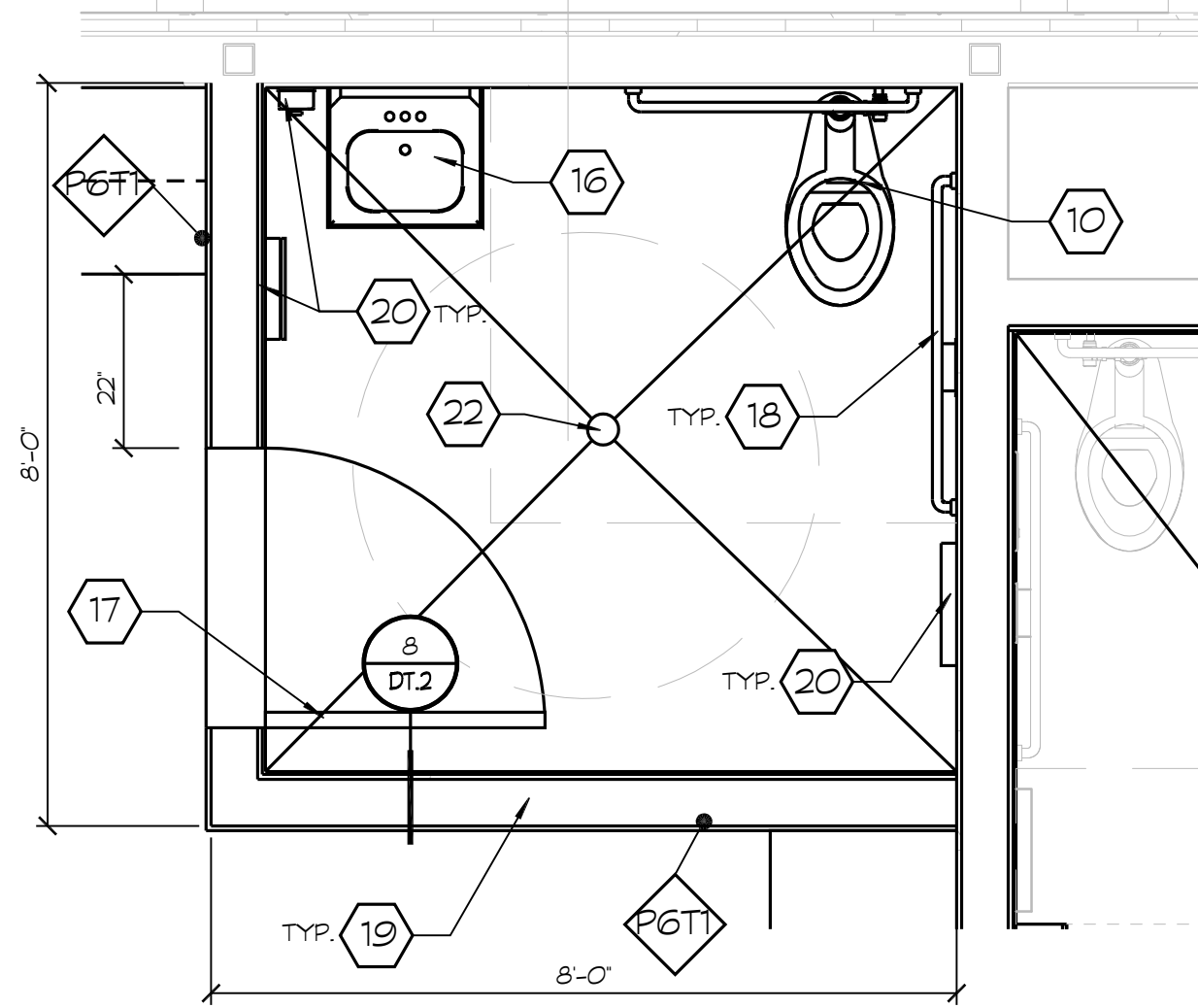


- B. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.
- C. As a part of the work of this contract, THIS DIVISION shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.

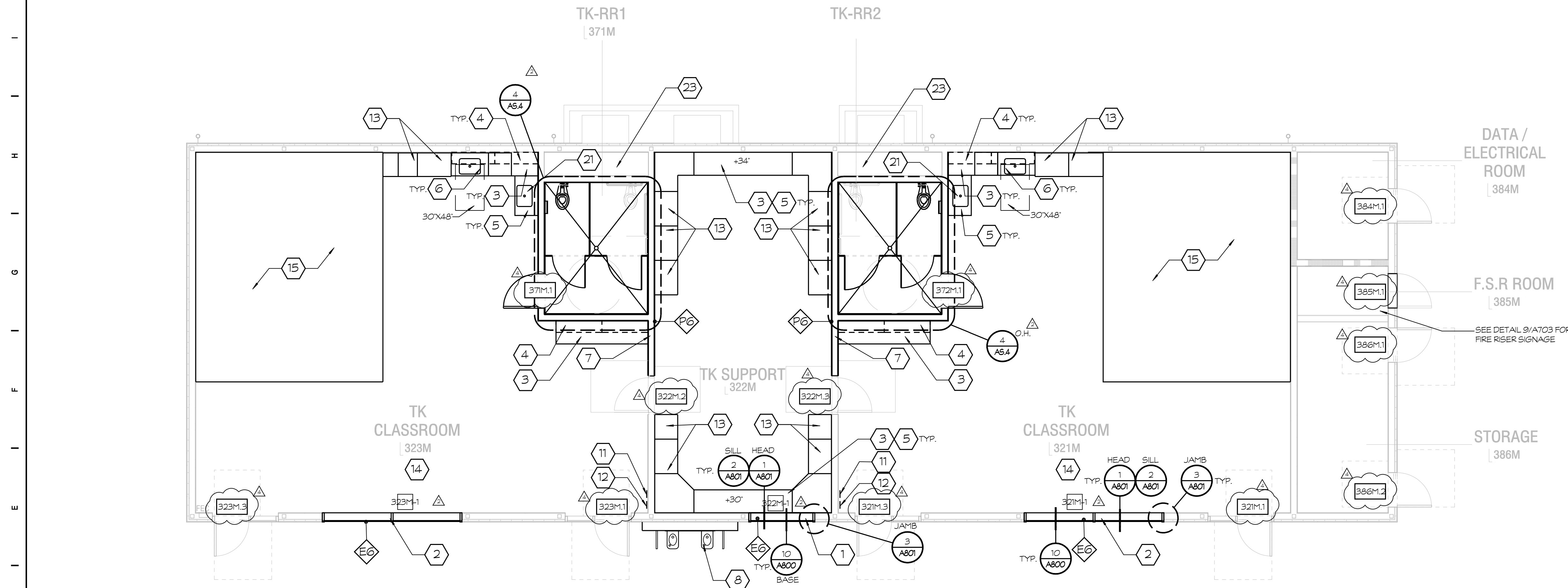
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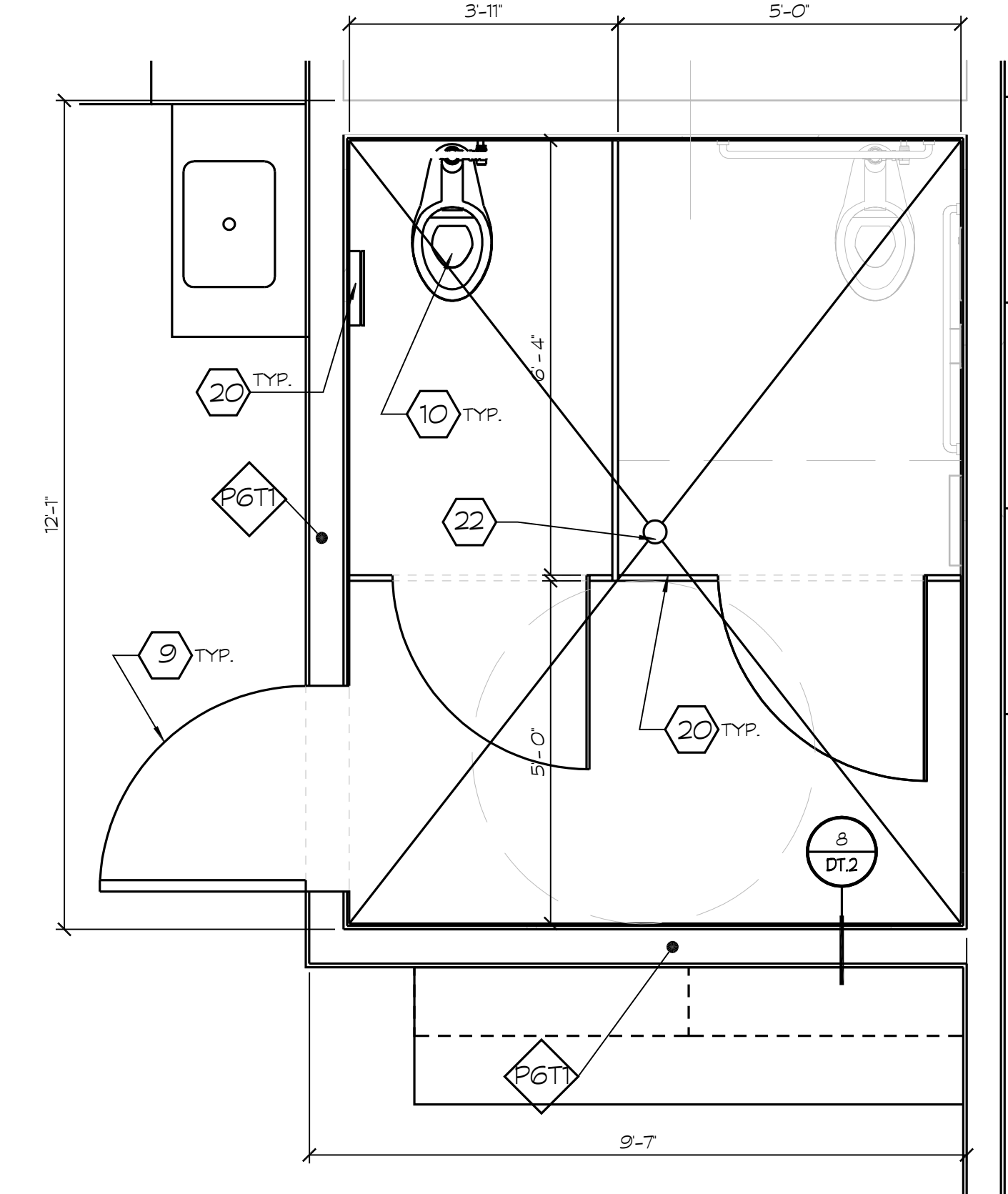
FLOOR PLAN
BUILDING 'B' TK-2 CLASSROOM 04-122304 PC
SCALE: 3/16" = 1'-0"



ENLARGE RESTROOM PLAN
TK-2 CLASSROOM 04-122304 PC
SCALE: 1/2" = 1'-0"



FLOOR PLAN
BUILDING 'A' TK-2 CLASSROOM MIRROR 04-122304 PC
SCALE: 3/16" = 1'-0"



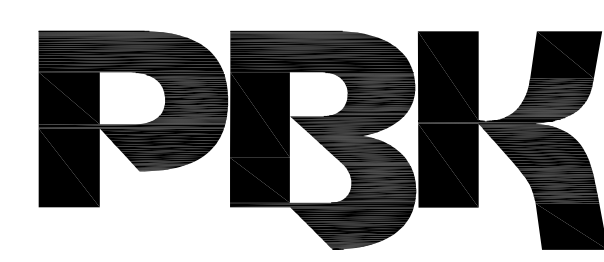
ENLARGE RESTROOM PLAN
TK-2 CLASSROOM & MIRROR 04-122304 PC
SCALE: 1/2" = 1'-0"

GENERAL NOTES

- RELOCATE RETURN AIR VENTS TO NEW LOCATION SEE INTERIOR ELEVATIONS.
- GENERAL CONTRACTOR TO REFER TO PC SET 04-122304 FOR ALL CONSTRUCTION DOCUMENT.
- FOR WALL TYPES SEE PC SET 04-122304 SHEET A600.
- FOR DOOR HARDWARE SEE PC SET 04-122304 SHEET A700.
- REFER TO FLOOR PLANS PC SET 04-122304 SHEET A205 AND A209M FOR MORE INFORMATION.
- SEE PC SET 04-122304 FOR ALL DETAILS U.O.N.

KEYNOTES

- INFILL DOOR OPENING WITH METAL FRAMING WITH NEW WINDOW SYSTEM. SEE DETAILS 1.2 & 3 ON SHEET A801
- INFILL ROLL UP DOOR OPENINGS WITH METAL FRAMING AND NEW WINDOW SYSTEM. SEE DETAILS 1.2 & 3 ON SHEET A801
- NEW LOWER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2
- NEW UPPER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2
- NEW COUNTER TOP. SEE DETAIL 1/DT.2
- NEW ADA SINK. SEE DETAIL 6/DT.2
- NEW METAL FRAMING INFILL. SEE DETAIL 8/DT.2
- NEW DRINKING FOUNTAIN. SEE DETAIL 7/DT.2
- NEW 3'-0" X 7'-0" DUTCH DOOR. MATCH FINISH FROM 04-122304 PC.
- NEW WATER CLOSET AND ACCESSORIES CONNECT WATER AND SEWER WITH 04-122304 PC PLANS.
- ASSISTED LISTENING SYSTEM SIGN. SEE DETAIL 3/A703
- OCCUPANT LOAD SIGN. SEE DETAIL 4/A703
- NEW FULL HEIGHT CASEWORK. SEE DETAIL 1/DT.2
- CONCRETE POLISH FLOOR.
- NEW CARPET AREA.
- NEW ADA LAVATORY.
- NEW 3' X 7' H.M. DOOR AND FRAME. SEE DETAIL 6/A803 & 1/A801
- NEW ADA GRAB BARS. SEE DETAIL 3/A802
- NEW METAL FRAMING AND FINISHES. SEE DETAIL 9/DT.2
- TOILET ACCESSORIES.
- NEW SINK FOR KINDERGARTEN
- NEW FLOOR DRAIN LOCATION
- PLUMBING WALL CAVITIES TO BE FILLED WITH NON-COMBUSTIBLE INSULATION

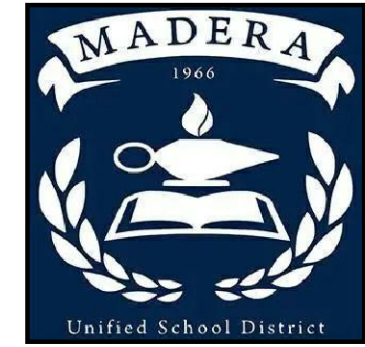


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STATUS



PROFESSIONAL SEAL



PROJECT NUMBER

220487

DATE

7/3/23

DSA APPLICATION NO.

02-121585

FILE NO.

20-30

PTN NO.

65243-143

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Author

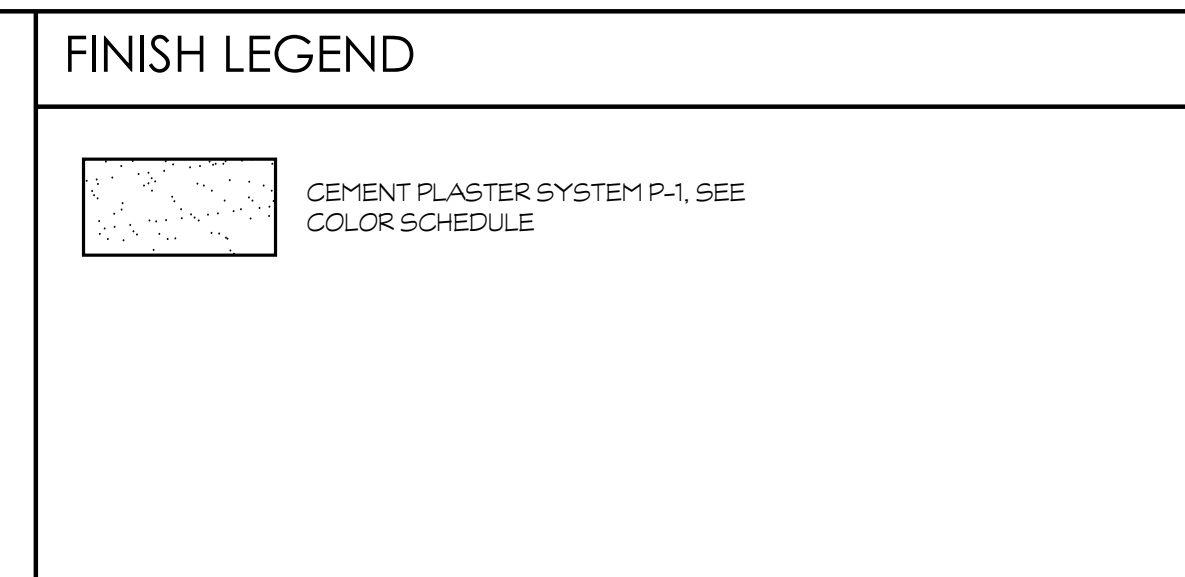
REVISIONS

#	DESCRIPTION	DATE
2	ADDENDUM	7/25/24
4	ADDENDUM	8/09/24

STATUS

FLOOR PLAN

AS.4



GENERAL NOTES

1. REFER TO COLOR SCHEDULE FOR DOOR PAINT.
2. REFER TO DSA SET # 04-122304PC FOR MORE INFO.
3. REFER TO AS-1 FOR NORTH ARROW.

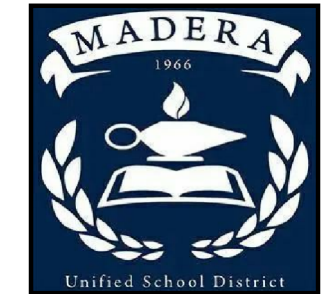
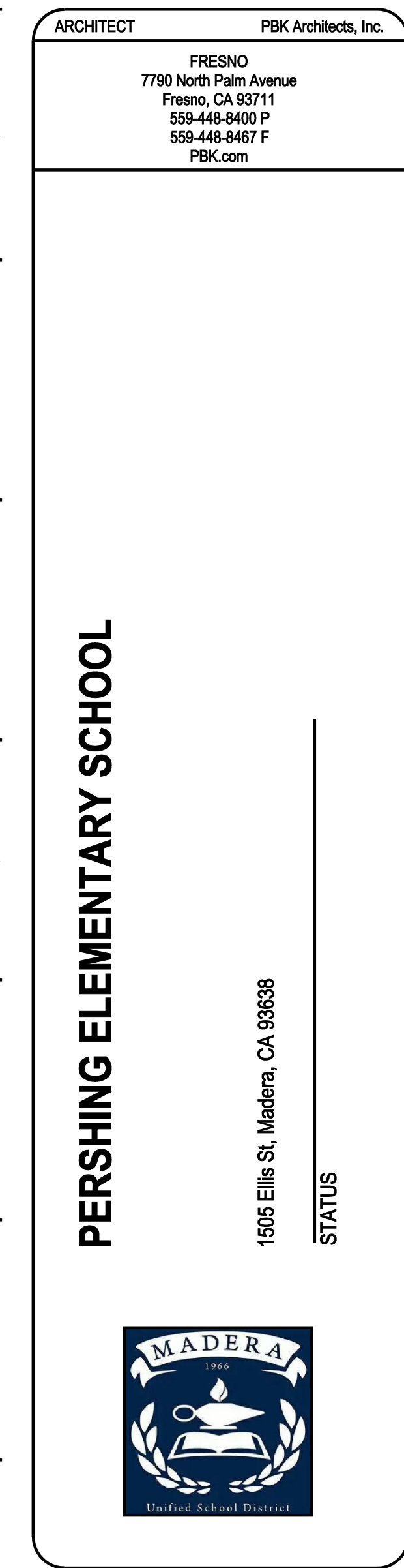
TK-2 SCALE 3/16" = 1'-0"



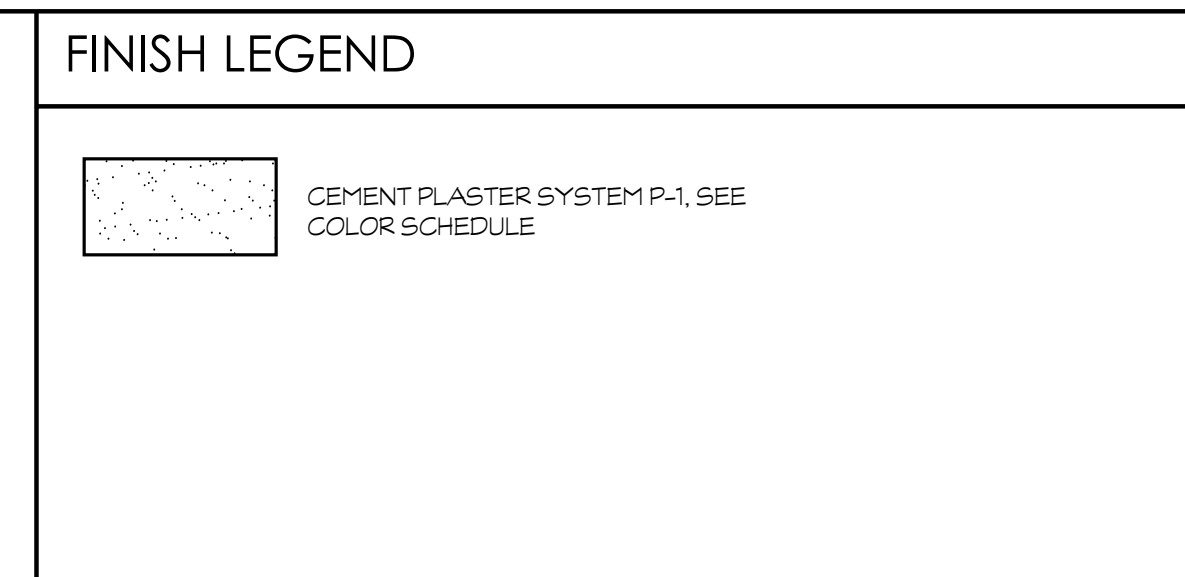
TK-2 SCALE 3/16" = 1'-0"

TK-2 SCALE 3/16" = 1'-0"

TK-2 SCALE 3/16" = 1'-0"

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AS.9



GENERAL NOTES

1. REFER TO COLOR SCHEDULE FOR DOOR PAINT.
2. REFER TO DSA SET # 04-122304PC FOR MORE INFO.
3. REFER TO AS.1 FOR NORTH ARROW.

TK-2M SCALE 3/16" = 1'-0"



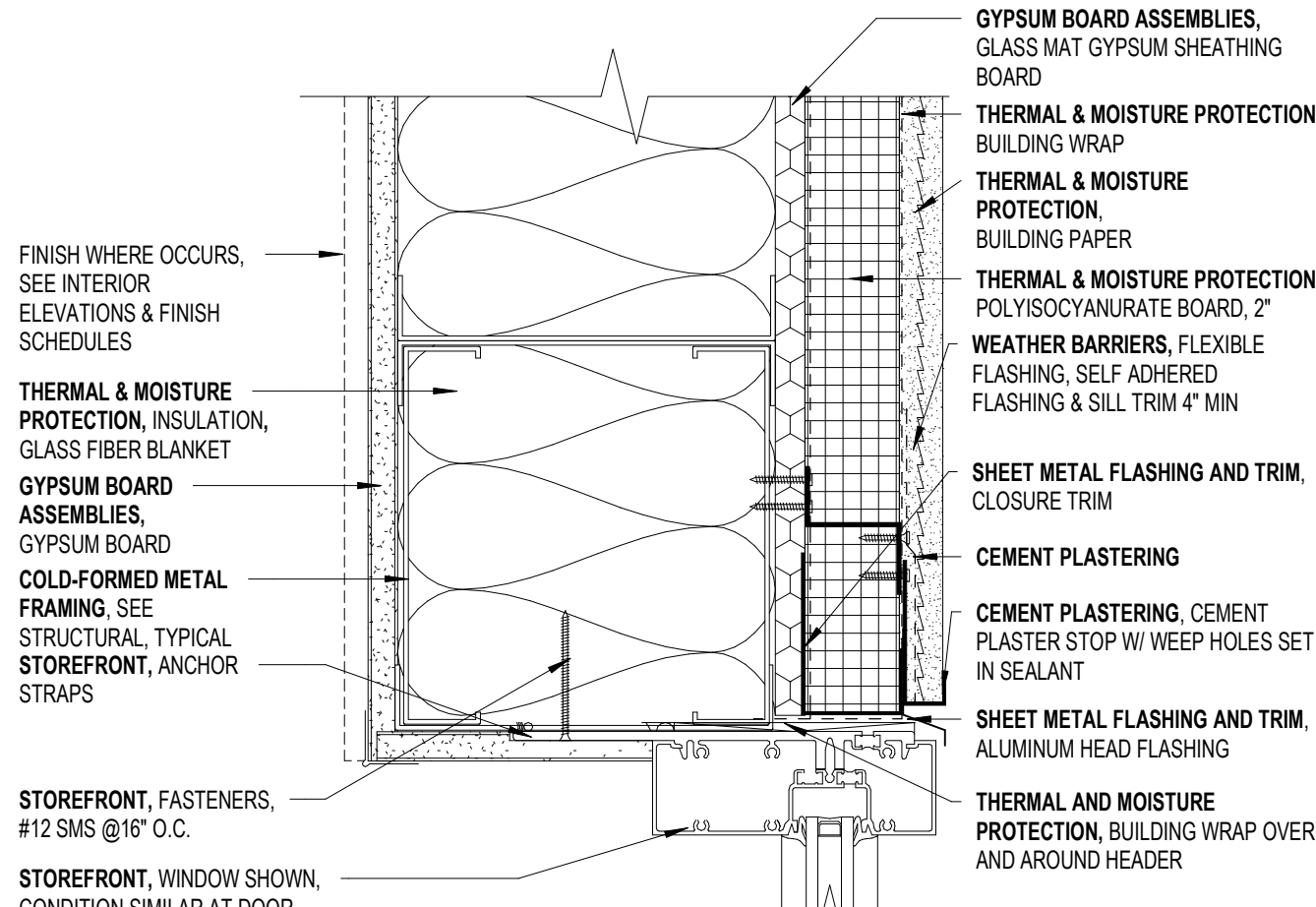
TK-2M SCALE 3/16" = 1'-0"



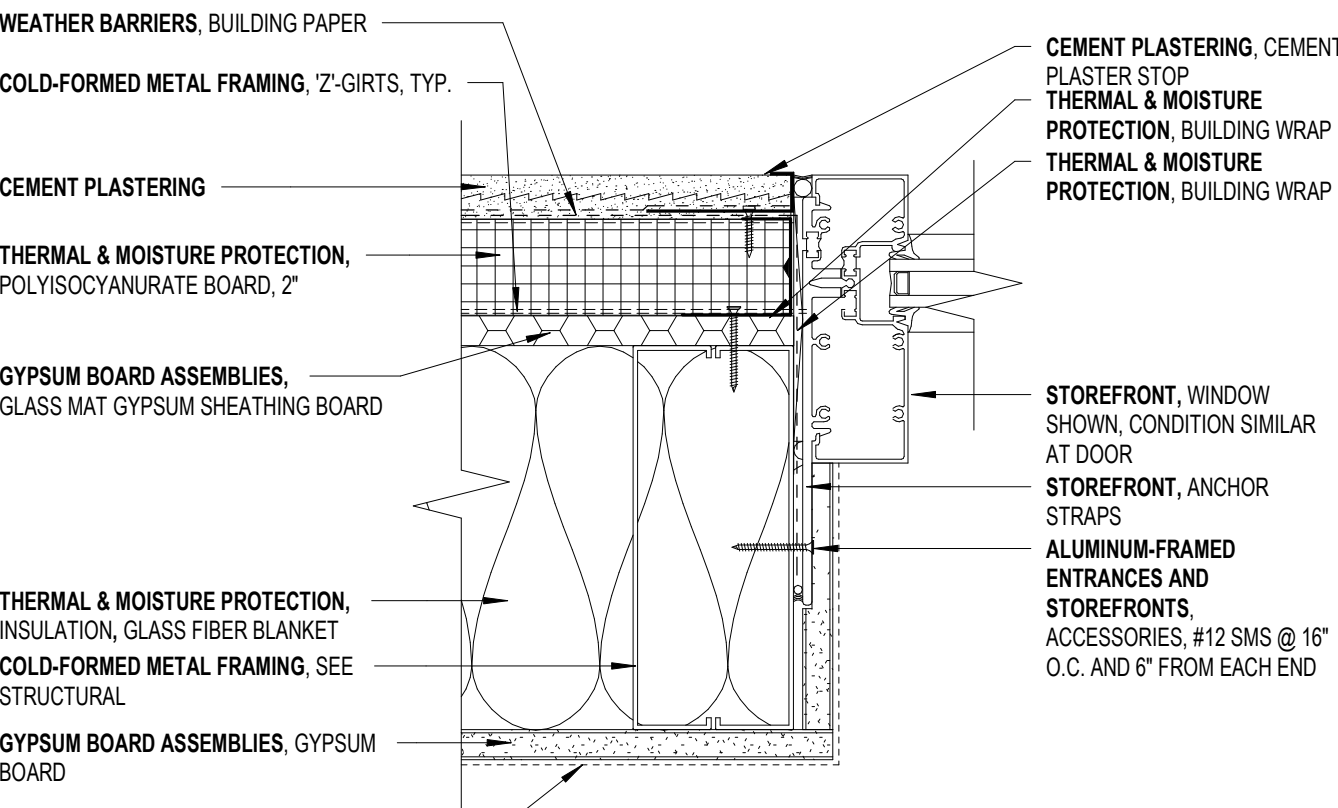
TK-2M SCALE 3/16" = 1'-0"

TK-2M SCALE 3/16" = 1'-0"

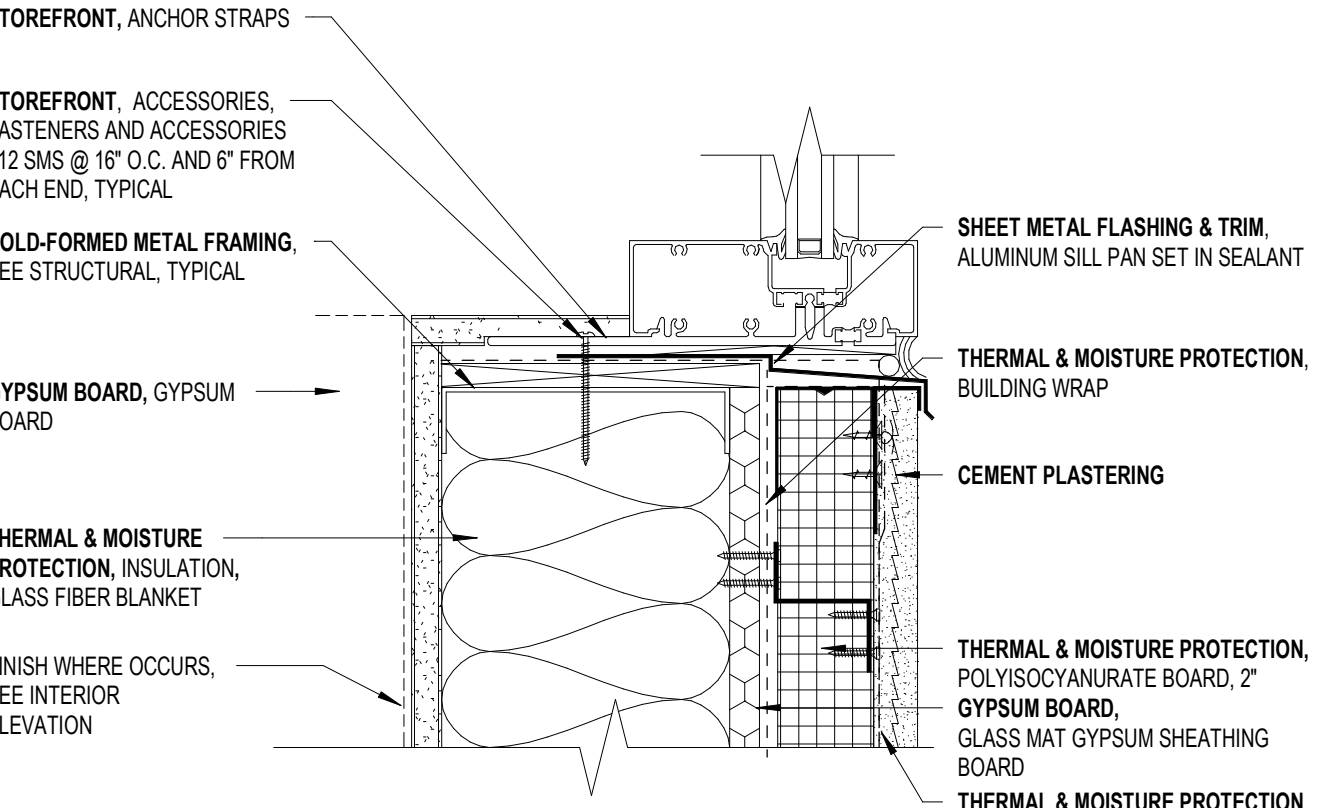
[illegible]



1 ALUMINUM STOREFRONT HEAD @ CP
SCALE: 3" = 1'-0"



2 ALUMINUM STOREFRONT JAMB @ CP
SCALE: 3" = 1'-0"



3 ALUMINUM STOREFRONT SILL @ CP
SCALE: 3" = 1'-0"

DOOR GENERAL NOTES

- CONTRACTOR TO COORDINATE EXACT SIZE OF DOOR WITH MANUFACTURER
- INSTALL STOREFRONT MULLIONS AND HOLLOW METAL FRAMES WITH 1/4 INCH SHIM AND JOINT SEALANT AROUND PERIMETER OF FRAME
- PROVIDE HEAD RECEIVERS AT ALUM. STOREFRONTS AS REQUIRED FOR STRUCTURAL AND FRAME DEFLECTION
- JAMBS SHALL MAINTAIN 6 INCH MIN. FROM ADJACENT WALLS AND PARTITIONS U.N.O
- WHERE REQUIRED, EXIT DEVICES (PANIC HARDWARE), SHALL BE INSTALLED WITH ACTIVATING MEMBER CENTERED AT A HEIGHT OF NO LESS THAN 34 INCH OR MORE THAN 44 INCH ABOVE THE FLOOR. PER CBC 11B-404.2.7 AND 11B-309.4
- PANIC HARDWARE IS REQUIRED FROM ROOMS AND CORRIDORS OF E OCCUPANCY WHERE OCCUPANT LOAD EXCEEDS 49
- PRESSURE TO OPERATE DOORS SHALL NOT EXCEED 5 POUNDS FOR EXTERIOR AND INTERIOR DOORS AND 15 POUNDS FOR FIRE DOORS. PER CBC 11B-404.2.9
- ALL OPERATING DOOR HARDWARE SHALL COMPLY WITH THE REQUIREMENTS IN CBC 11B-404.2.7, 100B.1.0 AND 11B-309.4 AND SHALL NOT REQUIRE MORE THAN 5 POUNDS OF FORCE
- THRESHOLDS SHALL COMPLY WITH CBC 11B-404.2.5 AND SHALL BE 1/2" MAX IN HEIGHT AND BEVELLED 1:2
- DOOR AND GATE CLOSERS SHALL BE ADJUSTED TO FORM AN OPEN POSITION OF 12 DEGREES FROM THE LATCH IN 5 SECONDS MINIMUM. PER CBC 11B-404.2.8.1
- SEE GENERAL SHEETS FOR DOOR SIGNAGE INFORMATION AND DETAILS ON SIGNS ON DOORS AND SIGNS RELATED TO EXIT AND ENTRANCE
- NEW BUILDINGS SERVING ANY EDUCATIONAL OCCUPANCY SHALL INCLUDE LOCKS THAT ALLOW DOORS TO CLASSROOM AND ANY OCCUPIED ROOM TO BE LOCKED FROM THE INSIDE PER CBC 1010.2.8

GLAZING NOTES AND SCHEDULE

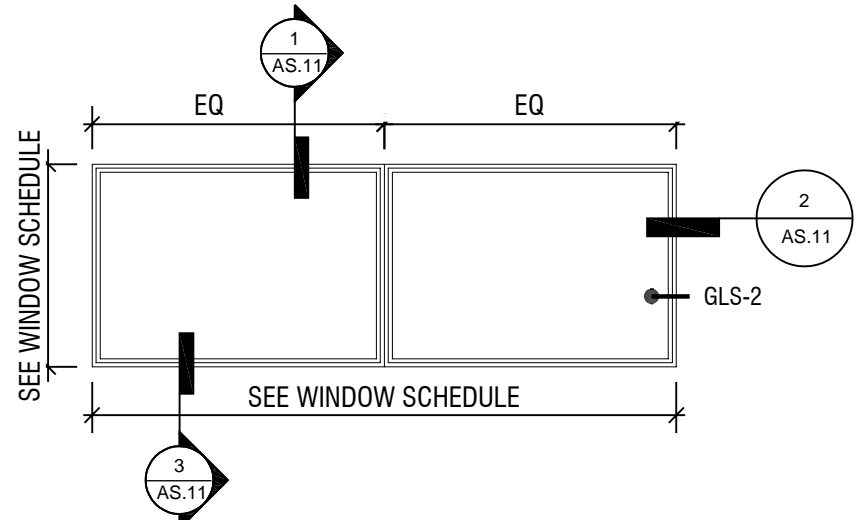
NOTES:

- GLAZING SHALL MEET THE MINIMUM FRAME LAP AND GLASS EDGE CLEARANCE PER CBC 2403.2.1 PROVIDE CONTINUOUS GLAZING RABBET AND GLASS RETAINER
- NFRC COMPLIANCE: COMPLETE SITE-BUILT ASSEMBLIES SHALL CONFORM TO NFRC REQUIREMENTS AND TESTED AND LABELED TESTED IN ACCORDANCE WITH THAT STANDARD
- NFRC LABELS SHALL REMAIN ON WINDOWS FOR VERIFICATION BY INSPECTOR
- SAFETY GLAZING SHALL BE PROVIDED WHERE REQUIRED PER CBC 2406

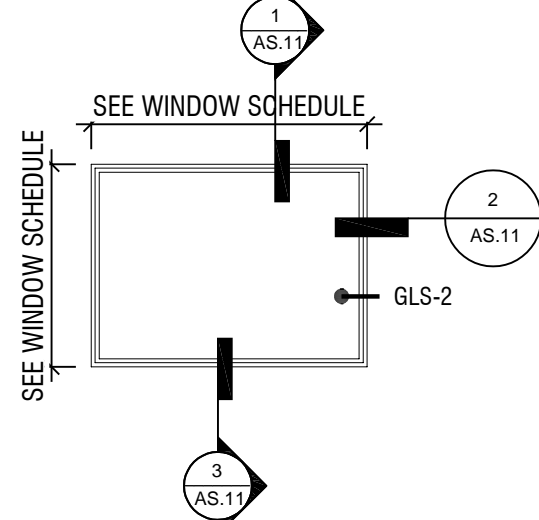
SCHEDULE:

- GLS-1: MONOLITHIC VISION GLASS, CLEAR, 1/4 INCH THICK, TEMPERED
- GLS-2, GLS-2A: INSULATED GLASS UNIT (IGU):
 - GLASS SPEC. SOLARBAN 70
 - A. OVERALL THICKNESS: 1 INCH
 - B. ASSEMBLY: 1/4" GLASS ON EITHER SIDE + 1/2" AIR
 - C. SPACER: ALUM., BLACK
 - D. INNER AND OUTER LIGHTS: GLS-1
 - E. NO.2 SURFACE: LOW-E COATING
 - F. NO.3 SURFACE (GLS-2A ONLY): TRANSLUCENT COATING
- MINIMUM PERFORMANCE REQUIREMENTS FOR GLASS:
 - 1. THERMAL TRANSMITTANCE, WINTER - CENTER OF GLASS: 0.29, NOMINAL
 - 2. VISIBLE LIGHT TRANSMITTANCE: 70%, NOMINAL
 - 3. SOLAR HEAT GAIN COEFFICIENT: 0.39, NOMINAL
 - 4. VISIBLE LIGHT REFLECTANCE, OUTSIDE: 11%, NOMINAL

WINDOW SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING									
BUILDING ID	WINDOW ID	WINDOW DIMENSION		GLAZING	WINDOW/FRAME TYPE	FRAME FINISH	FIRE RATED	DETAILS (SEE SHEET A801)	REMARKS
		WIDTH	HEIGHT						
TK-2 - A	321M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS
TK-2 - A	322M-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS
TK-2 - A	323M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS
TK-2 - B	321-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS
TK-2 - B	322-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS
TK-2 - B	323-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4" DEPTH WINDOWS



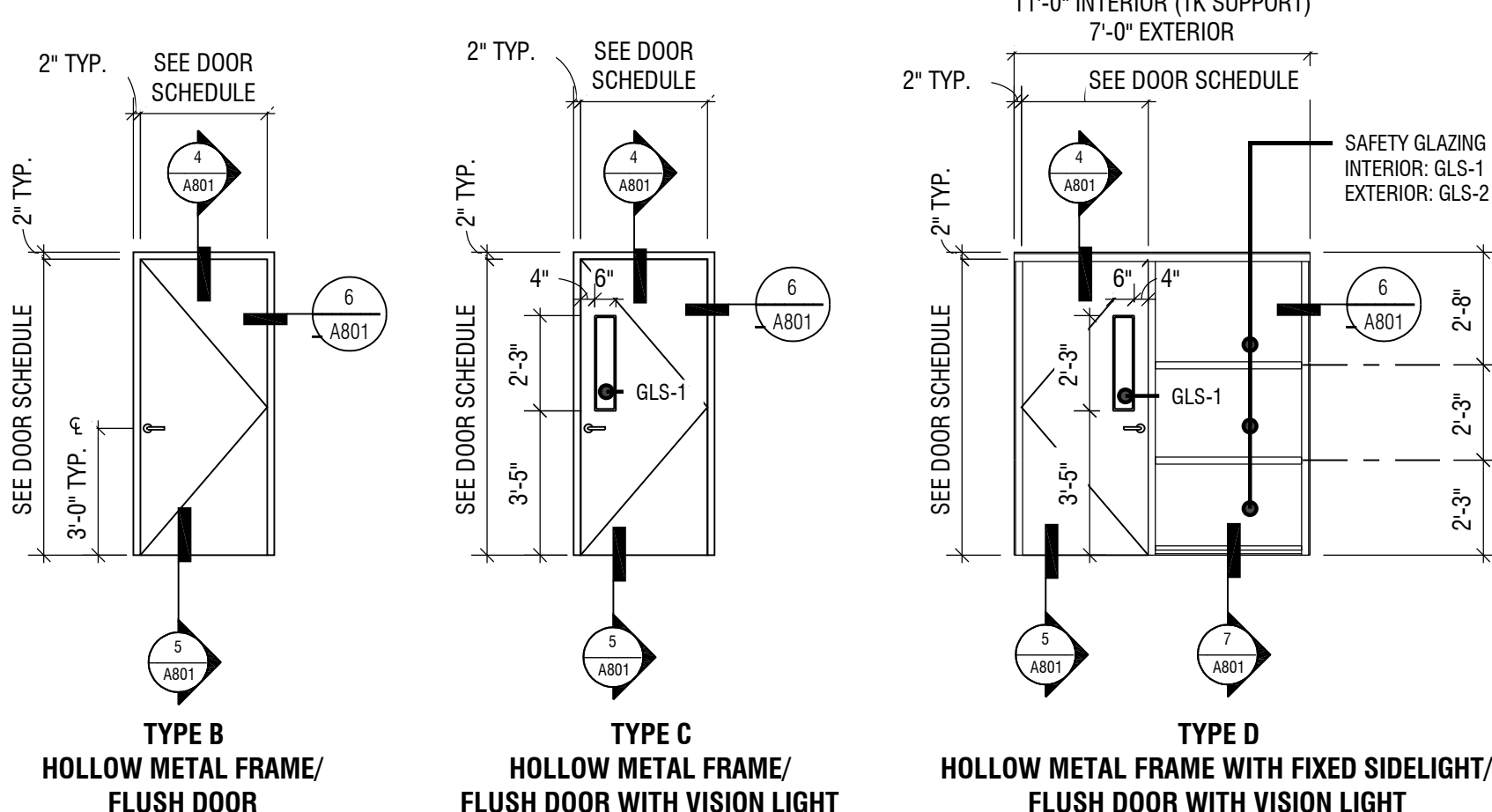
ALUMINUM WINDOW STOREFRONT



ALUMINUM WINDOW STOREFRONT

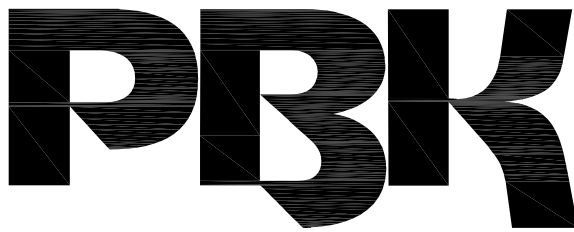
DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING									
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE
		WIDTH	HEIGHT						
TK-2	321.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes
TK-2	321.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2	322.2	3'-0"	7'-0"	WOOD	D	HM	04		
TK-2	322.3	3'-0"	7'-0"	WOOD	D	HM	04		
TK-2	322A.1	3'-0"	7'-0"	WOOD	D	HM	06		
TK-2	323.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2	323.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2	371.1	3'-0"	7'-0"	WOOD	B	HM	05		
TK-2	372.1	3'-0"	7'-0"	WOOD	B	HM	05		
TK-2	384.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2	385.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2	386.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2	386.2	3'-0"	7'-0"	HM	B	HM	03		

DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN (MIRRORED) BUILDING									
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE
		WIDTH	HEIGHT						
TK-2 - MRR	321M.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes
TK-2 - MRR	321M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2 - MRR	322M.2	3'-0"	7'-0"	WOOD	D	HM	04		
TK-2 - MRR	322M.3	3'-0"	7'-0"	WOOD	D	HM	04		
TK-2 - MRR	322MA.1	3'-0"	7'-0"	WOOD	D	HM	06		
TK-2 - MRR	323M.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2 - MRR	323M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes
TK-2 - MRR	371M.1	3'-0"	7'-0"	WOOD	B	HM	05		
TK-2 - MRR	372M.1	3'-0"	7'-0"	WOOD	B	HM	05		
TK-2 - MRR	384M.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2 - MRR	385M.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2 - MRR	386M.1	3'-0"	7'-0"	HM	B	HM	03		
TK-2 - MRR	386M.2	3'-0"	7'-0"	HM	B	HM	03		



WINDOW EFFICIENCY VALUES FOR SITE-BUILT FENESTRATION

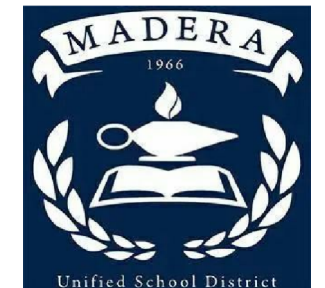
BASED ON IAB ALTERNATE DEFAULT FENESTRATION PROCEDURE TO CALCULATE THERMAL PERFORMANCE		
	TYPE A	TYPE D
U _t	= 0.55	0.55
SHGC _t	= 0.31	0.31
VT _t	= 0.88	0.77



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PROFESSIONAL SEAL



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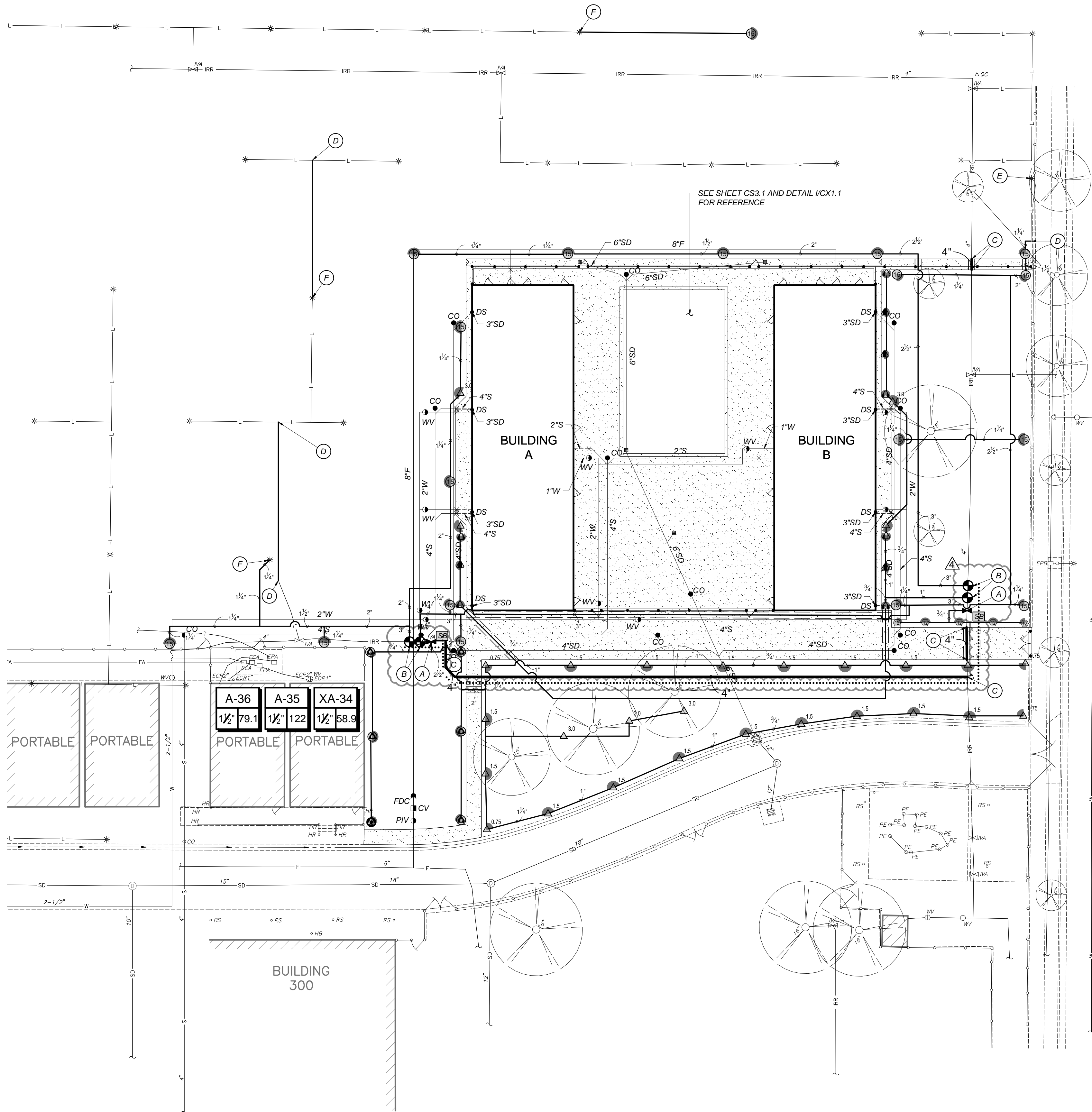
REVISIONS		
#	DESCRIPTION	DATE
2	ADDENDUM	7/25/24
4	ADDENDUM	8/09/24

STATUS

DOOR
HARDWARE

AS.11

Drawing: P:\223-0162\Site\production\drawings\223162_IRR1.dwg, IRR1.1 - BCF.ctb
Plot by: gbaulista Aug 08, 2024 - 4:46pm



ERICHO DRIVE

A-33	1 1/2" 31.1
A-32	1" 91.2
XA-31	1 1/2" 12.4

POINT OF CONNECTION

WATER SERVICE SIZE MAX FLOW: 4" / 280 GPM
WATER METER SIZE/75% MAX FLOW: 4" / 210 GPM
MAXIMUM STATION FLOW: 45.9 GPM
IRRIGATION BACKFLOW SIZE: 4"
IRRIGATION WATER SOURCE: CITY OF MADERA
MINIMUM EXISTING MINIMUM STATIC PRESSURE H/L: 30' / 20 PSI
SEE IRRIGATION GENERAL NOTE #3
MINIMUM OPERATING PRESSURE: 15.3 PSI ROTORS

EXISTING CONTROLLER 'A' (RAINMASTER SENTAR III) IS LOCATED IN MAINTENANCE YARD, WEST OF BLDG. 200 (AREA NOT SHOWN ON PLAN).
CONTROLLER 'A' IS AT FULL CAPACITY (36 OF 36 STATIONS USED). INTERCEPT EXISTING STATION WIRES A-32, A-33, A-35, & A-36 AND RECONNECT TO NEW VALVE. NEW LOCATION IS INDICATED ON PLANS.

IRRIGATION LEGEND

SYMBOL	MANUFACTURER/MODEL/DESCRIPTION	ARC	PSI	GPM	RADIUS	DETAIL
	TURF SPRAY 12H HUNTER PROS-06-PRS40	180	40	1.52	13'	G/L S1.2
	TURF SPRAY 12Q HUNTER PROS-06-PRS40	90	40	0.78	13'	G/L S1.2
	TURF ROTATOR LST HUNTER MP STRIP PROS-04-PRS40-CV	LCS	40	0.22	5'x15'	G/L S1.2
	TURF ROTATOR RST HUNTER MP STRIP PROS-04-PRS40-CV	RCS	40	0.22	5'x15'	G/L S1.2
	TURF ROTATOR SST HUNTER MP STRIP PROS-04-PRS40-CV	SST	40	0.44	5'x30'	G/L S1.2
	TURF ROTATOR B HUNTER MP3000 PROS-04-PRS40-CV B	90-210	40		30'	G/L S1.2
	TURF ROTATOR LB HUNTER MP3500 PROS-04-PRS40-CV LB	90-210	40		35'	G/L S1.2
SYMBOL	MANUFACTURER/MODEL/DESCRIPTION	PSI	GPM	RADIUS	DETAIL	
	TURF ROTOR 15 HUNTER I-25-06	70	15.2	57'	H/L S1.2	
	TURF ROTOR 15 HUNTER I-25-04	70	15.2	57'	H/L S1.2	
	TURF ROTOR SR 0.75 HUNTER I-20-06-PRB-SR	60	0.63	26'	H/L S1.2	
	TURF ROTOR SR 1.5 HUNTER I-20-06-PRB-SR	60	1.6	26'	H/L S1.2	
	TURF ROTOR SR 3.0 HUNTER I-20-06-PRB-SR	60	3.1	26'	H/L S1.2	
SYMBOL	MANUFACTURER/MODEL/DESCRIPTION	DETAIL				
	EXISTING REMOTE CONTROL VALVE					
	REMOTE CONTROL VALVE TORO 220-26-0 GLOBE	F/L S1.2				
	SPLICE BOX	J/L S1.2				
	IRRIGATION LATERAL LINE: PVC SCHEDULE 40 SOLVENT WELD, BELL END, GASKETED, SIZE AS NOTED	C/L S1.2				
	IRRIGATION MAINLINE: PVC CLASS 200 SDR 21 RUBBER GASKETED, SIZE AS NOTED	C/L S1.2				
	PIPE SLEEVE: PVC SCHEDULE 40 TWICE PIPE SIZE	H/L S1.2				
	CONTROL WIRE PLUS ONE (1) COMMON WIRE	E/L S1.2				
	CONTROL WIRE SLEEVE	D/L S1.2				
	VALVE NUMBER					
	VALVE FLOW (GPM)					
	VALVE SIZE					
	PROTECT EXISTING VALVE. CONNECT NEW LATERAL LINE TO THE VALVE.					
	INSTALL NEW CONTROL VALVES TO EXISTING MAIN LINE. INTERCEPT EXISTING STATION WIRES 32, 33, 35, 36 AND CONNECT TO THE NEW CONTROL VALVES. EXTEND CONTROL WIRE AS NEEDED					
	CONNECT NEW MAIN LINE TO EXISTING MAIN LINE					
	CONNECT NEW LATERAL LINE TO EXISTING LATERAL LINE					
	PROTECT AND ADJUST EXISTING IRRIGATION HEAD/NOZZLE TO QUARTER RADIUS. SEE GENERAL NOTE #17					
	CONNECT NEW LATERAL LINE TO EXISTING IRRIGATION HEAD					

CONTRACTOR SPECIAL IRRIGATION NOTES:

- THE CONTRACTOR SHALL PERFORM AN OPERATIONAL ASSESSMENT OF THE EXISTING IRRIGATION SYSTEM WITHIN THE AREA OF WORK WITH THE OWNER'S REPRESENTATIVE PRIOR TO THE START OF CONSTRUCTION OPERATIONS.
- THE CONTRACTOR SHALL ENSURE THAT ALL EXISTING PLANTING SCHEDULED TO REMAIN SHALL CONTINUE TO BE IRRIGATED THROUGHOUT THE COURSE OF CONSTRUCTION OPERATIONS. ANY DAMAGE TO THE EXISTING IRRIGATION SYSTEM THAT IMPACTS EXISTING PLANTING TO REMAIN SHALL BE IMMEDIATELY REPAIRED TO THE OWNER'S SATISFACTION.
- PRIOR TO THE START OF ANY SHRUB, GROUND COVER, AND/OR TURFGRASS PLANTING, AN OPERATIONAL REVIEW OF THE IRRIGATION SYSTEM SHALL BE PERFORMED FOR PROPER COVERAGE AND SOIL MOISTURE DEPTH BY THE OWNER'S REPRESENTATIVE. ALL CORRECTIONS AND/OR ADJUSTMENTS SHALL BE COMPLETED AND VERIFIED BY THE OWNER'S REPRESENTATIVE BEFORE GROUND LEVEL PLANTING MAY COMMENCE.
- THE ORIGINAL IRRIGATION SYSTEM OBSERVATION LOG SHALL BE MAINTAINED ON THE AS-BUILT RECORD DRAWING SET.
- THE AS-BUILT RECORD DRAWING SET AND OTHER CLOSE-OUT ITEMS SHALL BE SUBMITTED AND ACCEPTED PRIOR TO THE SCHEDULING OF A FINAL ACCEPTANCE REVIEW.
- UNLESS NOTED OTHERWISE, SALVAGE AND RETURN TO THE OWNER ALL IRRIGATION VALVES, HEADS AND OTHER EQUIPMENT COMPONENTS REMOVED AS PART OF THE WORK. SALVAGED COMPONENTS SHALL BE CLEAN AND IN WORKING CONDITION UNLESS NOTED AS NON-OPERATIONAL DURING THE OPERATIONAL ASSESSMENT.

WATER CONSERVATION COMPLIANCE STATEMENT:

I HAVE COMPLIED WITH THE CRITERIA OF THE LANDSCAPE WATER CONSERVATION ORDINANCE AND GUIDELINES, AND HAVE APPLIED THEM FOR THE EFFICIENT USE OF WATER IN THE IRRIGATION DESIGN PLAN.

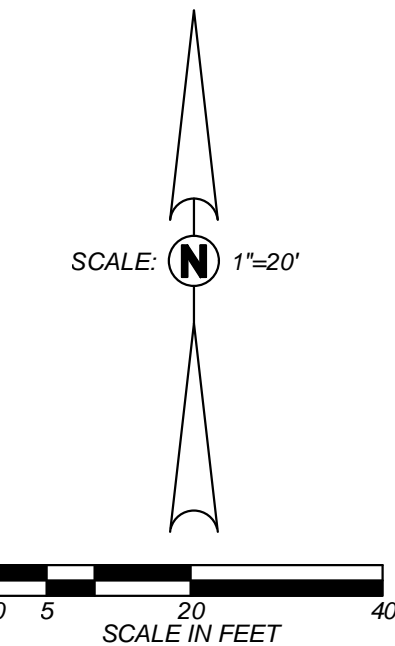
David W. Briley
DAVID W. BRILEY, P.E. 2787

IRRIGATION SYSTEM BID ALLOWANCE:

CONTRACTOR SHALL INCLUDE A BID ALLOWANCE IN THE AMOUNT OF \$1,000 FOR THE REPLACEMENT OF EXISTING OR THE INSTALLATION OF NEW SPRINKLER HEADS, VALVES, PIPING AND OTHER EQUIPMENT AND ACCESSORIES NECESSARY FOR THE PROPER OPERATION OF THE EXISTING SYSTEM WHERE NOT SPECIFICALLY SHOWN ON THE DRAWINGS FOR REPLACEMENT OR NEW INSTALLATION.

IRRIGATION SYSTEM OBSERVATION LOG			
ITEM NO.	WORK ITEM DESCRIPTION	REVIEWED & ACCEPTED BY OWNER'S REP OR LAND ARCH	
		PRINT NAME	SIGNATURE
IR-1	EXISTING SYSTEM OPERATION & PRESSURE CHECK		
IR-2	PIPING/WIRE SLEEVES UNDER PAVEMENT		
IR-3	MAIN LINE INSTALLATION & PRESSURE TEST		
IR-4	VALVE INSTALLATIONS		
IR-5	IRRIGATION COVERAGE PRIOR TO PLANTING		
IR-6	CONTROL EQUIPMENT INSTALLATION	N/A	N/A
IR-7	BOOSTER PUMP INSTALLATION & START-UP (MANUF.)	N/A	N/A
IR-8	FINAL SYSTEM OPERATION REVIEW		
NOTE: THE ORIGINAL VERSION OF THIS LOG SHALL BE MAINTAINED ON THE AS-BUILT RECORD DRAWING SET. WORK ITEMS MAY NOT BE REVIEWED IF PRIOR WORK ITEMS HAVE NOT BEEN ACCEPTED.			

SEE SHEET LS1.2
FOR IRRIGATION NOTES,
DETAILS AND MWEL
CALCS



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PERSHING ELEMENTARY SCHOOL

1505 ELLIS STREET, MADERA, CA 93638
CONSTRUCTION DOCUMENTS



PROJECT NUMBER 220487		
DATE 7/31/23		
DSA APPLICATION NO. 02-121585		
FILE NO. 20-30		
PTN NO. 65243-143		
DRAWN BY DZ		
REVISIONS		
#	DESCRIPTION	DATE
1	ADDENDUM 1	7/8/2024
2	BID ADDENDUM 4	8/8/2024

CONSTRUCTION DOCUMENTS

IRRIGATION PLAN

LS1.1



SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Load bearing wall framing.
 - 2. Exterior non-load bearing wall framing.
 - 3. Floor joist framing.
 - 4. Roof rafter framing.
 - 5. Ceiling joist framing.
 - 6. Soffit framing.
 - 7. Accessories necessary for a complete installation.
- B. Related Sections:
- C. Related Sections:
 - 1. Section 03 30 00: Cast in Place Concrete.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.
 - 5. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: General Contractor shall engage a qualified professional engineer, licensed in the State of California, to design cold formed steel framing.
- B. Structural Performance - Delegated design engineer shall provide cold-formed steel framing designs capable of withstanding all code required design loads within limits and under conditions indicated on the construction documents and within this Specification:
 - 1. Design loads: Designs shall be capable of withstanding the worst case loading as indicated on the structural drawings, and/or as required by the locally adopted Building Code. The design shall cover the worst case loading in all instances.
 - 2. Coordinate the requirements on the structural and architectural Drawings with the requirements of this Section. If a conflict exists, notations on the structural drawings take precedence.
 - 3. The following document governs the Work, except where more restrictive items are specified:
 - a. AISI Design of Cold-Formed Steel Structural Members Wind Load:
 - 1) Minimum design loads for exterior and/or load bearing and/or soffit applications:
 - a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 16 gauge minimum, unless noted otherwise.
 - 2) Minimum design loads for interior and/or exterior suspended furr-downs with a maximum vertical drop on either side of five feet (5') or greater:

- a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 20 gauge minimum, unless noted otherwise.
 4. It is a common practice for studs thinner than 20 gauge to be crimped and/or ribbed to increase the strength of the overall stud cross section for various loading applications. These studs are typically noted by manufacturer as "equivalent" to a thicker gauge. These "equivalent" type studs are not allowed in a vertically suspended application with greater than five feet (5') of vertical wall drop, 20 gauge is the minimum thickness allowed for these applications.
 5. Welding qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
 6. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
 7. Fire-rated assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
 8. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
 9. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
 - a. Upward and downward movement of 1-1/2 inches (38 mm).
 10. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold Formed Steel Framing Design Standards:
1. Wall studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral design: AISI S213.

1.4 SUBMITTALS

- A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.
- B. Shop Drawings:
1. Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners:
 - a. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - b. Shall bear the seal of a Registered Professional Engineer, licensed in the State of California.
- C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations and shop drawings to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of California. Calculations and shop drawings must show design will withstand wind loading commiserate with class and rating of the Project.

1.5 QUALITY ASSURANCE



- A. Regulatory Requirements:
 - 1. Welding qualifications:
 - a. Qualify procedures and personnel according to the following:
 - 1) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - 2) CCFSS Technical Bulletin: "AISI Specification Provision for Screw Connections."
 - 2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions:
 - a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
 - 3. Fire resistance ratings: ASTM E119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory*.
 - 4. Installer qualifications: Company specializing in the installation of cold formed metal framing components with minimum five (5) years' documented experience.
 - 5. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 6. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 7. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
- B. Professional Engineer Qualifications:
 - 1. A professional engineer who is legally qualified to practice in the State of California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent:
 - a. Engineering responsibility: Preparation of shop drawings, design calculations, and structural data.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. CEMCO.
 - 2. ClarkDietrich Building Systems.
 - 3. Consolidated Fabricators Corp.
 - 4. SCAFCO Corporation.
 - 5. Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

2.2 LOAD BEARING WALL FRAMING



- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with straight flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Steel Box or Back to Back Headers:
 - 1. C-shape used to form header beams, of web depths indicated, unpunched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
- D. Steel Single or Double L Headers:
 - 1. L-shapes used to form header beams, of web depths indicated:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Top flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips:
 - 1. Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) ClarkDietrich Building Systems.
 - 2) SCAFCO Corporation.
 - 3) Simpson Strong-Tie Co., Inc.
 - 4) Steeler, Inc.
 - 5) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.
- D. Single Deflection Track:



1. Single, deep leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- E. Double Deflection Tracks:
 1. Double, deep leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges:
 - a. Outer track - Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - 1) Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - 2) Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
 - b. Inner track - of web depth indicated:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists:
 1. C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm).
 - b. Flange width: Two inches (51 mm), minimum.

2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame:
 1. C-shaped steel sections, of web depths indicated, with stiffened flanges:
 - a. Minimum base metal thickness: **[0.0538 inch (1.37 mm)]**.
 - b. Flange width: 1-5/8 inches (41 mm) minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.



5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.
- C. Anchors, Clips, and Fasteners:
1. Steel shapes and clips: ASTM A36/A36M, zinc coated by hot dip process according to ASTM A123/A123M.
 2. Expansion anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.
 3. Power actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
 4. Mechanical fasteners:
 - a. ASTM C1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws:
 - 1) Head type: Low profile head beneath sheathing.
 5. Welding electrodes: Comply with AWS standards.
- D. Miscellaneous Materials:
1. Galvanizing repair paint: SSPC-Paint 20 or ASTM A780.
 2. Non-metallic, non-shrink grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.
 3. Shims: Load bearing, high density multimonomer plastic, and non-leaching; or of cold formed steel of same grade and coating as framing members supported by shims.
 4. Sealer gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements:
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted:
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three (3) exposed screw threads.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances:
1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance



variation of 1/8 inch in ten (10) feet (1:960) and as follows:

- a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- b. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

- A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

- A. General:
 1. Track anchors: Install anchors maximum four feet (4') on center; design anchors and spacing to carry live, dead, and wind loads.
 2. Track splices: Provide channel inserts or weld track splices.
 3. Erection: Install members plumb, level, and in a true plane.
 4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.
- B. Install metal framing systems in accordance with stud manufacturer's printed instructions.
- C. Runner Tracks:
 1. Install continuous tracks sized to match studs.
 2. Align tracks accurately to layout at base and tops of studs.
 3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
 4. Provide fasteners at corners and ends of tracks.
 5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
 6. Provide deflection track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2-inch movement of primary structure. Do not attach studs directly to deflection track.
 7. Vertical deflection clips: Provide manufacturer's standard bypass and head clips,

capable of accommodating upward and downward vertical displacement of primary structure.

- D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."
- E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum two feet (2') on center vertical.
- G. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
- H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
- I. Install bracing/bridging in accordance with manufacturer's instructions and design conditions.
- J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.
- K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.
- L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

3.4 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track:
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud sections as indicated on shop drawings.
- C. Space joists not more than two inches (51 mm) from abutting walls:
 - 1. Joist spacing: 16 inches (406 mm).



- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on shop drawings:
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on shop drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold down angles, anchors, and fasteners, to provide a complete and stable joist framing assembly.

END OF SECTION 05 40 00

SECTION 08 41 13 STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Exterior and interior storefront framing.
 - 2. Exterior and interior manual swing entrance doors.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 12 00: Structural Steel Framing.
 - 2. Section 05 40 00: Cold-Formed Metal Framing.
 - 3. Section 05 50 00: Metal Fabrications.
 - 4. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 5. Section 07 92 00: Joint Sealants.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.
- B. Shop Drawings:
 - 1. Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other work:
 - a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Engineer's calculations of performance requirements.
- D. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or fail due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

- d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units.
- B. Structural Loads:
- 1. Wind loads: Ultimate wind speed gust 115 mph; exposure D.
- C. Deflection of Framing Members:
- 1. Deflection normal to wall plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch (19 mm), whichever is less.
 - 2. Deflection parallel to glazing plane: Limited to $L/360$ of clear span or $1/8$ inch (3.2 mm), whichever is smaller.
- D. Structural Test Performance - Provide aluminum framed systems tested according to ASTM E330 as follows:
- 1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test durations: As required by design wind velocity, but not fewer than ten (10) seconds.
- E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. 0.03 L/s per sq. m of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa.)
- F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa.)
- G. Windborne Debris Impact Resistance:
- 1. Pass missile impact and cyclic pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996 for Wind Zone 4:
 - a. Large missile test: For glazed openings located within 30 feet (9.1 m) of grade.
- H. Thermal Movements:
- 1. Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature change (range): 120 degrees F (67 degrees C, ambient; 180 degrees F, 100 degrees C, material surfaces.
 - b. Interior ambient-air temperature: 75 degrees F (24 degrees C).
- I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing

areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F3.23
W/sq. m x K when tested according to AAMA 1503.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessibility requirements:
 - a. 2022 California Building Code: Section 11B-404.3 accessible route.
 - b. 2022 California Building Code: Section 11B-309.4 operable parts interior usage.
 - c. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - d. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
- B. Installer Qualifications: Installer having minimum ten (10) years' documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.
- C. Engineering Responsibility: Prepare data for aluminum framed systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.
- D. Product Options:
 - 1. Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance:
 - a. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.
- F. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

- A. Written warranty signed by manufacturer, Contractor, and installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Water leakage through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty period: Two (2) years from date of Substantial Completion.
- B. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:
 - 1. Warranty period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design:
 - 1. **US Aluminum Corporation, Series 451 Center Glazed Storefront.** See attached brochure for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by any of the following or comparable system:
 - a. Arcadia
 - b. Kawneer.
- B. Aluminum:
 - 1. Alloy and temper recommended by manufacturer for type of use and finish indicated:
 - a. Sheet and plate: ASTM B209/ASTM B209M.
 - b. Extruded bars, rods, profiles, and tubes: ASTM B221/ASTM B221M.
 - c. Extruded structural pipe and tubes: ASTM B429.
- C. Framing Members:
 - 1. Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads:
 - a. Construction: Nonthermal/thermal.
 - b. Glazing system: Retained mechanically with gaskets on four sides.
 - c. Glazing plane: Center.
- D. Accessories:
 - 1. Brackets and reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
 - 2. Fasteners and accessories:
 - a. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
 - 1) Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2) Reinforce members as required to receive fastener threads.
 - 3. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.
 - 4. Concealed flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
 - 5. Framing system gaskets and sealants: Recommended by manufacturer for joint type.
- E. Glazing:
 - 1. Refer to Section 08 80 00: Glazing for impact resistant laminated insulating glass with low-e coating on Number 2 surface:
 - a. Glazing gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
 - b. Spacers and setting blocks: Elastomeric type.
- F. Accessories:
 - 1. Joint sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00: Joint Sealants.
 - 2. Bituminous paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil 0.762 mm thickness per coat.

2.2 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members:
 - 1. Fabricate components that, when assembled, have specified characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - f. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - h. Provide sill receptors with end dams at all sill conditions.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Storefront Framing: Fabricate components for assembly using screw spline system.
- E. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.3 ALUMINUM FINISHES

- A. Class I, Clear Anodic Finish (#14): AA-M10C21A41 / AA-M45C22A41, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on shop drawings.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work:
 - 1. Do not install damaged components.
 - 2. Fit joints to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 5. Seal joints watertight unless otherwise indicated.
 - 6. Min anchorage #8 with two-inch (2") minimum embedment; minimum two inches (2")

from edges. Refer to shop drawings.

- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing specified in Section 08 80 00: Glazing.
- G. Install perimeter joint sealants as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

3.4 ERECTION TOLERANCES

- A. Install aluminum framed systems to comply with the following maximum erection tolerances:
 - 1. Location and plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to three inches (75 mm) from the latch, measured to the leading door edge.

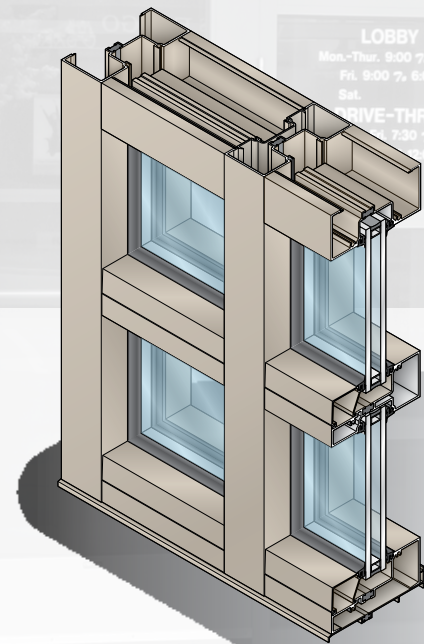
END OF SECTION 08 41 13

STOREFRONT SYSTEMS

SERIES 451 & IT451 CENTER GLAZE



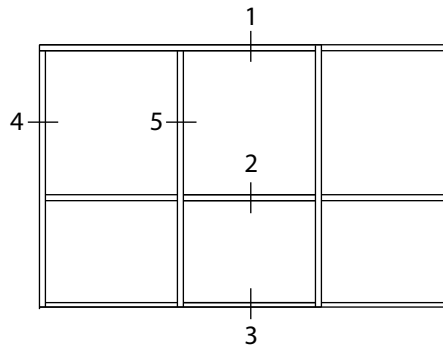
- Series 451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Non-Thermal
- Series IT451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Thermal
- 1" (25 mm) Glazing Infills
- Injection Molded Water Deflectors
- Screw Spline Assembly
- Shear Block Assembly
- Stacking Installation Option
- Full Range of Accessory Components
- Available in Anodized or Painted Finishes



Series IT451 offers improved thermal performance using the Poly-Aluminizer™ and Struct-Link™ Thermal Break Technology. Series 451 and IT451 may be interior or exterior glazed. A top load E.P.D.M. gasket is used to position and weatherseal the glass in the aluminum pocket. Center Glazed Systems are compatible with all United States Aluminum Entrance Doors.

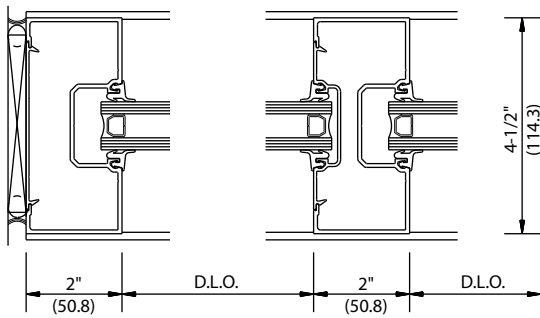
SERIES 451 & IT451 STOREFRONTS TYPICAL DETAILS

For Specifications, Details, and
Testing Data go to **usalum.com**.



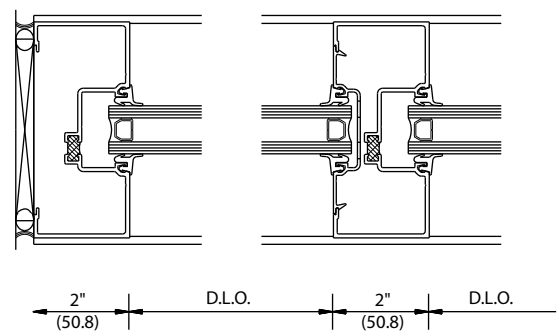
Series 451

Series IT451



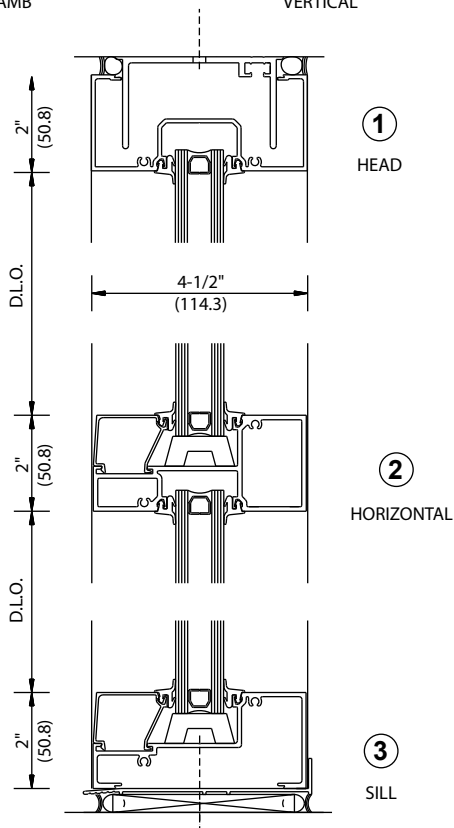
④
JAMB

⑤
VERTICAL



④
JAMB

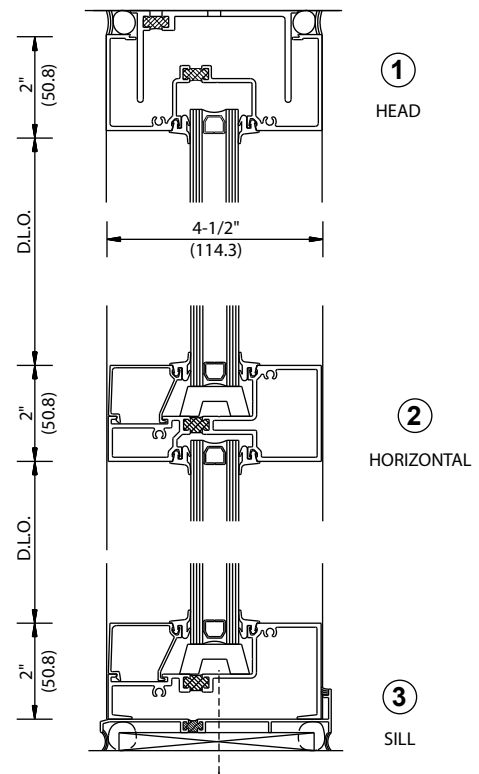
⑤
VERTICAL



①
HEAD

②
HORIZONTAL

③
SILL



①
HEAD

②
HORIZONTAL

③
SILL

NOT TO SCALE

SECTION 08 71 00 DOOR HARDWARE

PART 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. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other Sections.
- C. Related Sections:
 - 1. Section 08 11 13: Hollow Metal Doors and Frames.
- D. Reference Standards:
 - 1. Comply with the version year adopted by the Authority Having Jurisdiction:
 - a. CBC California Building Code: Section 11B-404.
 - b. ICC A117.1 Accessible and Usable Buildings and Facilities.
 - c. NFPA 70 National Electrical Code.
 - d. NFPA 80 Fire Doors and Windows.
 - e. NFPA 101 Life Safety Code.
 - f. NFPA 105 Installation of Smoke Door Assemblies.
 - g. State Building Codes, Local Amendments, if applicable.
 - 2. All hardware specified herein shall comply with the following industry standards:
 - a. ANSI Certified Product Standards A156 Series
 - b. UL10C Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- C. Format: Comply with scheduling sequence and vertical format in DHI's Sequence and Format for the Hardware Schedule.
- D. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets of Part 4. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to

resubmission.

- E. Content:
 - 1. Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
- F. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- G. Keying Schedule: After a keying meeting with the Owner has taken place, prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- H. Informational Submittals.
- I. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- J. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01 for Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage qualified manufacturers with a minimum five (5) years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum three (3) years' documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum five (5) years' documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- D. Source Limitations: Obtain each type and variety of door hardware specified in this Section from a single source unless otherwise indicated.
- E. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference:
 - 1. Conduct conference to comply with requirements in Division 01 Section for Project Meetings. Keying conference to incorporate the following criteria into the final keying schedule document:
 - a. Function of building, purpose of each area, and degree of security required.
 - b. Plans for existing and future key system expansion.
 - c. Requirements for key control storage and software.
 - d. Installation of permanent keys, cylinder cores, and software.
 - e. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section for Project Meetings with attendance by representatives of supplier(s), installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
- I. Prior to installation of door hardware, conduct a Project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedules, templates, and physical product samples as required.
- J. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades:
 - 1. Review sequence of operation narratives for each unique access-controlled opening.
 - 2. Review and finalize construction schedule and verify availability of materials.
 - 3. Review the required inspecting, testing, commissioning, and demonstration procedures.
- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period:
 - 1. Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of the hardware.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One (1) year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven (7) years for heavy duty cylindrical (bored) locks and latches.
 - 2. Ten (10) years for manual surface door closer bodies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software, or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the Keying Conference.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations:
 - 1. Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets of Part 4. Products are identified by using door hardware designations, as follows:
 - a. Named manufacturer's products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Section 01 33 00: Substitution Procedures. Approval of requests is at the discretion of the Architect, Owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges - ANSI A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets:
 - 1. Quantity - Provide the following hinge quantity:
 - a. Two (2) hinges: For doors with heights up to 60 inches.
 - b. Three (3) hinges: For doors with heights 61 to 90 inches.
 - c. Four (4) hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide four (4) hinges, plus one (1)

hinge for every 30 inches of door height greater than 120 inches.

- B. Hinge Size:
 - 1. Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to three feet (3'0"): 4-1/2-inch standard or heavy weight as specified.
 - b. Sizes from three feet-one inch (3'1") to four feet (4'0"): Five inches (5") standard or heavy weight as specified.
- C. Hinge Weight and Base Material:
 - 1. Unless otherwise indicated, provide the following:
 - a. Exterior doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- D. Hinge Options:
 - 1. Comply with the following:
 - a. Non-removable pins: Provide set screw in hinge barrel that when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
- E. Manufacturers:
 - 1. Hager Companies (HA) - CB Series.
 - 2. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - 3. Stanley Hardware (ST) - CB Series.

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum ten (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders:
 - 1. Original manufacturer cylinders complying with the following:
 - a. Mortise type: Threaded cylinders with rings and cams to suit hardware application.
 - b. Rim type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - c. Bored-lock type: Cylinders with tailpieces to suit locks.
 - d. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - e. Keyway: Match facility standard.
- D. Keying System:
 - 1. Each type of lock and cylinders to be factory keyed:
 - a. Conduct specified Keying Conference to define and document keying system instructions and requirements.
 - b. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - c. Existing system: Key locks to Owner's existing system.
- E. Key Quantity:
 - 1. Provide the following minimum number of keys:

- a. Change keys per cylinder: Two (2).
- b. Master keys (per master key level/group): Five (5).
- c. Construction keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty) – ANSI A156.2, Series 4000, Grade 1 Certified:
 - 1. Furnish with solid cast levers, standard 2-3/4-inch backset, and 1/2-inch (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 - 2. Locks are to be non-handed and fully field reversible.
 - a. Manufacturers: Sargent Manufacturing (SA) – 10 Line.

2.5 LOCK AND LATCH STRIKES

- A. Strikes:
 - 1. Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - a. Flat-lip strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - b. Extra-long-lip strikes: For locks used on frames with applied wood casing trim.
 - c. Aluminum-frame strike box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - d. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards:
 - 1. Comply with the following:
 - a. Strikes for Mortise Locks and Latches: ANSI A156.13.
 - b. Strikes for Bored Locks and Latches: ANSI A156.2.
 - c. Strikes for Auxiliary Deadlocks: ANSI A156.36.
 - d. Dustproof Strikes: ANSI A156.16.

2.6 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one (1) manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be UL listed for use of fire rated doors.
 - 3. Size of units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ICC A117.1.
 - 4. Closer arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers, and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty):
 - 1. ANSI A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard:
 - a. Manufacturers:
 - 1) LCN Closers (LC) - 4040 Series.
 - 2) Sargent Manufacturing (SA) - 351 Series.
 - 3) Norton Door Controls (NO) - 7500 Series.

2.7 DOORSTOPS AND HOLDERS

- A. General: Doorstops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Doorstops and Bumpers:
 - 1. ANSI A156.16, Grade 1 certified doorstops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of doorstops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders:
 - a. Manufacturers:
 - 1) Hiawatha, Inc. (HI).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Trimco (TC).
- C. Overhead Doorstops and Holders:
 - 1. ANSI A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm, and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function:
 - a. Manufacturers:
 - 1) Rixson Door Controls (RF).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Sargent Manufacturing (SA).

2.8 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications, provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing:
 - 1. Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784:
 - a. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing:
 - 1. Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings

indicated, based on testing according to UL 10C:

- a. Provide intumescent seals as indicated to meet UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.9 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.10 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced, and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling, and access control system hardware without additional in-field modifications.

3.2 EXAMINATION

- A. Examine scheduled openings, with installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify Architect of any discrepancies or conflicts between the door schedule, door types, Drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.3 PREPARATION

- A. Wood Doors: Comply with ANSI A115.W series.

3.4 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications:
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including hanging devices, locking devices, closing devices, and seals.
- B. Mounting Heights:
 - 1. Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - a. Standard steel doors and frames: DHI 141 Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - b. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 Accessibility Guidelines for Buildings and Facilities.
 - c. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09: Finishes Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00: Joint Sealants.
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating, and adjusted.

3.6 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.7 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Owner occupancy.

3.8 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 4 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. See DSA approved plans 04-122304 pc for hardware schedule.

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- D. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

IVE	=	Ives	Hinges, Door Stops, Kick Plates & Silencers
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HW GROUP NO. 01

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 02

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 03

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	20-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

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HW GROUP NO. 04

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 05

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 06

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

END OF SECTION 08 71 00



SECTION 10 21 13 TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Solid Color Reinforced Composite (SCRC) Substrate (Bobrick Sierra Series):
 - 1. Toilet partitions.
 - 2. Urinal privacy screens.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 09 30 00: Tiling.
 - 4. Section 10 28 13: Toilet Accessories.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00: Submittal Procedures.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
- C. Shop Drawings:
 - 1. Submit manufacturer's shop drawings for each product specified, including the following:
 - a. Plans, elevations, details of construction and attachment to adjacent construction.
 - b. Show anchorage locations and accessory items.
 - c. Verify dimensions with field measurements prior to final production of toilet compartments.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.
- F. Mock-Up:
 - 1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship:
 - a. Finish areas designated by Architect.
 - b. Do not proceed with remaining work until workmanship is approved by Architect.
 - c. Refinish mock-up area as required to produce acceptable work.

1.4 PERFORMANCE REQUIREMENTS

- A. Accessible Toilet Compartments:
1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be a minimum of 9 inches high above the finish floor, and a minimum of 6 inches deep beyond the compartment side face of the partition, exclusive of partition support members. It shall be a minimum of 12 inches high above the finish floor for children's use. Partition components at toe clearances shall be smoother without shop edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets total six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.
 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. See CBC Figure 11B-604.8.2.
 5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
 6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. See CBC Section 11B-604.8.2.2.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Accessibility Requirements - Comply with applicable requirements:
 - d. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
 - e. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 2. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
- B. Manufacturer Qualifications: Minimum 10 years' experience manufacturing similar products.
- C. Installer Qualifications: Minimum 2 years' experience installing similar products.
- D. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- E. Preinstallation Meeting:
1. Convene minimum two weeks prior to starting work of this section.

1.6 WARRANTY

- A. Manufacturer's Warranty (Sierra Series): Manufacturer's standard 25-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.



1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00: Product Requirements.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (BOBRICK SIERRA SERIES)

- A. Solid Color Reinforced Composite (SCRC) Toilet Partitions - Bobrick Sierra Series 1092G.67P:
 - 1. Design Type:
 - c. Standard Height.
 - 1) Door/Panel Height: 58 inches.
 - 2) Floor Clearance: 12 inches.
 - 2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches from the edge to allow for 0.175-inch overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.
 - 3. Mounting:
 - a. Floor-Mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065-inch-thick with anti-grip profile:
 - 1) Stile Maximum Height: 83 inches.
- B. Solid Color Reinforced Composite (SCRC) Urinal Screens - Bobrick Sierra Series:
 - 1. Mounting Configuration:
 - a. Wall-Hung:
 - 1) Screen Height: 48 inches with 12 inches floor clearance.
- C. Materials:
 - 1. Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick Graffiti Off coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable:
 - a. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - b. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
 - c. Edges: Same color as the surface.
 - d. Color:
 - 1) SC04 Forest Green.
 - e. Acceptable SCRC Products:
 - 2) Ultimate Corian System by Shower Shapes.
 - 3) WilsonArt Gibraltar Material.

- 4) WilsonArt Earth Stone Material.
 - 5) Or manufacturer approved equal.
- D. Performance Requirements:
1. Graffiti Resistance (ASTM D6578): Passed cleanability test; 5 staining agents.
 2. Scratch Resistance (ASTM D2197): Maximum load value exceeds 10 kilograms.
 3. Impact Resistance (ASTM D2794): Maximum impact force exceeds 30 inch-pounds.
 4. Smoke Developed Index (ASTM E84): Less than 450.
 5. Flame Spread Index (ASTM E84): Less than 75.
 6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
 7. Uniform Building Code: Class II.
- E. Finished Thickness:
1. Stiles and Doors: 3/4 inch.
 2. Panels and Screens: 1/2 inch.
- F. Stiles:
1. Floor-Anchored stiles furnished with expansion shields and threaded rods:
 - a. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8-inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - b. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4-inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1-inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- G. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00: Metal Fabrications.
- H. Hardware:
1. Chrome-plated "Zamak", aluminum, extruded plastic hardware not acceptable:
 - a. Compliance: Operating force of less than 5 lb.
 - b. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - c. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - d. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 - e. Fastening:
 - 1) Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable:
 - a) Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb per insert.
 - f. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.
 - g. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16-gauge sliding door latch, 14-gauge keeper.
 - h. Locking: Door locked from inside by sliding door latch into keeper.
 - i. Hinge Type:
 - 1) Standard.
 - a) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - j. Mounting Brackets:



- 1) Full-Height:
 - a) Mounting Brackets: 18-gauge stainless steel and extend full height of panel.
 - b) U-Channels: Secure panels to stiles.
 - c) Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions:
 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

3.3 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

3.4 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 2. Verify location does not interfere with door swings or use of fixtures.
 3. Use fasteners and anchors suitable for substrate and project conditions.
 4. Install units rigid, straight, plumb, and level.
 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 6. Test for proper operation.

3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.



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- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10 21 13

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 2. California Building Code – CBC.
 3. California Mechanical Code – CMC.
 4. California Plumbing Code – CPC.
 5. California Fire Code – CFC.
 6. California Green Building Code.
 7. Air Diffusion Council – ADC.
 8. American Gas Association – AGA.
 9. Air Moving and Conditioning Association – AMCA.
 10. American National Standards Institute – ANSI.
 11. Air Conditioning and Refrigeration Institute – ARI.
 12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 13. American Society of Mechanical Engineers – ASME.
 14. American Society for Testing and Materials – ASTM.
 15. American Water Works Association – AWWA.
 16. California Electrical Code – CEC.
 17. National Electrical Manufacturers Association – NEMA.
 18. National Fire Protection Association – NFPA.
 19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 20. Underwriters' Laboratory – UL.
 21. Occupational Safety and Health Act - OSHA.
 22. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK



- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and

modifications to the work caused by these items.

- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. (These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up



prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.4 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.
- D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.5 EQUIPMENT SUPPORT FRAMES



- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.

3.3 EXCAVATION AND BACKFILL

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and



compaction requirements.

- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

- A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. System insulation.
 - 4. Controls and control wiring and conduit for control wiring.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- D. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp or equal.
- E. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.
- F. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

- G. Duct Joints:
 - 1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.
- H. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

2.2 AIR TERMINALS AND DUCT FITTINGS

- A. Grilles: (Grilles, Registers and Diffusers)
 - 1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
 - 2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
 - 3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
 - 4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

2.3 DUCTWORK INSULATION MATERIALS

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at

- a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.
- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 EQUIPMENT

- A. General Requirements:
1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 3. Ratings:
 - a. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.

- e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
6. Fan Selection:
- a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
- B. Exhaust Fans:
- 1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
 - 2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME,

- Greenheck or equal.
3. Roof Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Down blast type UL listed. Cook, Greenheck, Penn, ACME or equal.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

- A. General:
 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
 2. Seismic bracing: All ducts shall be braced and supported per details on the drawings.
 3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
 4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
 5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
 6. Open ends of ductwork shall be covered during construction to keep inside clean.
- B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):
 1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
 - 1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 - e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
 - f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
 2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on

drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

- B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.
- C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 EQUIPMENT INSTALLATION

- A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.5 TEMPERATURE CONTROL SYSTEM

- A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

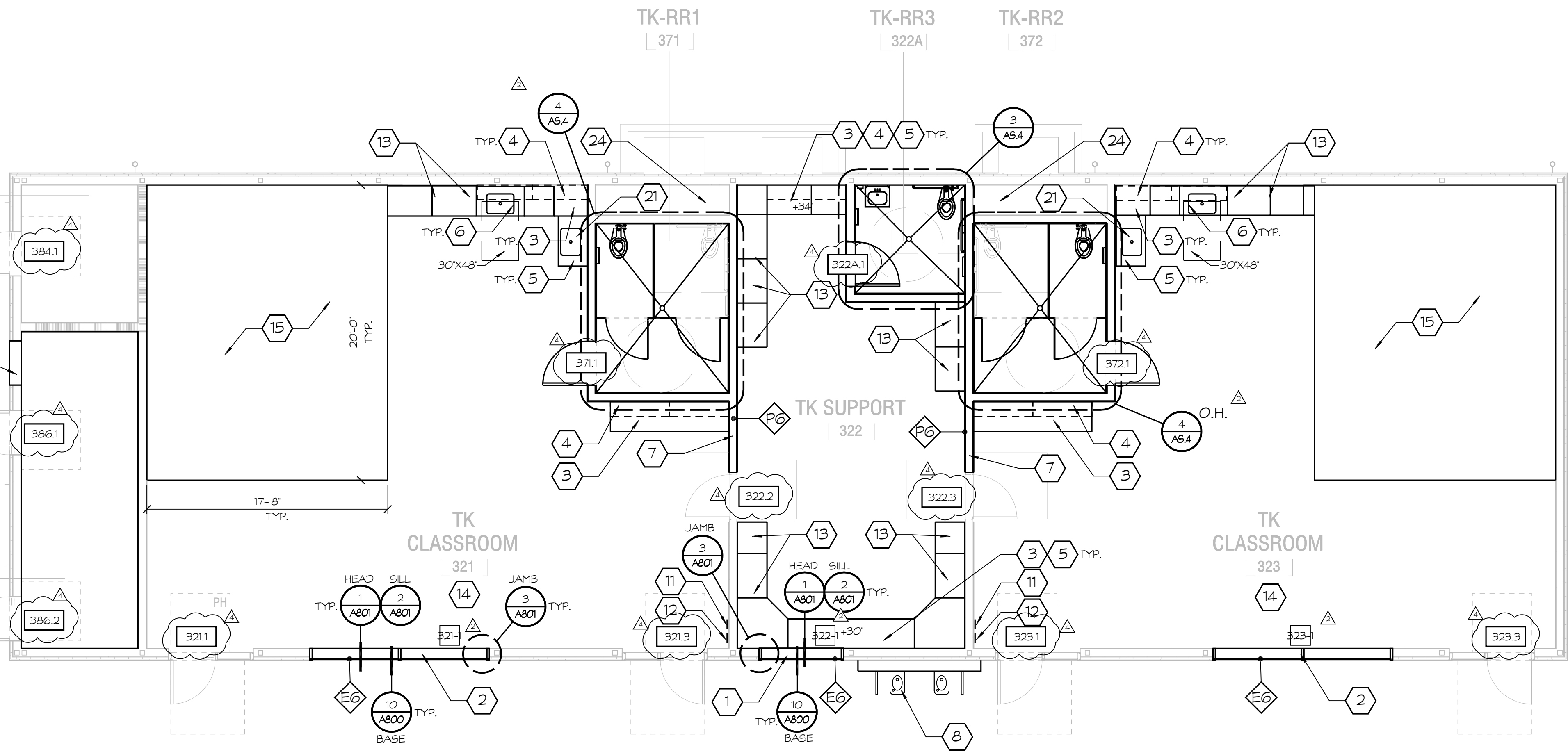
3.6 SYSTEM AIR BALANCE

- A. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.

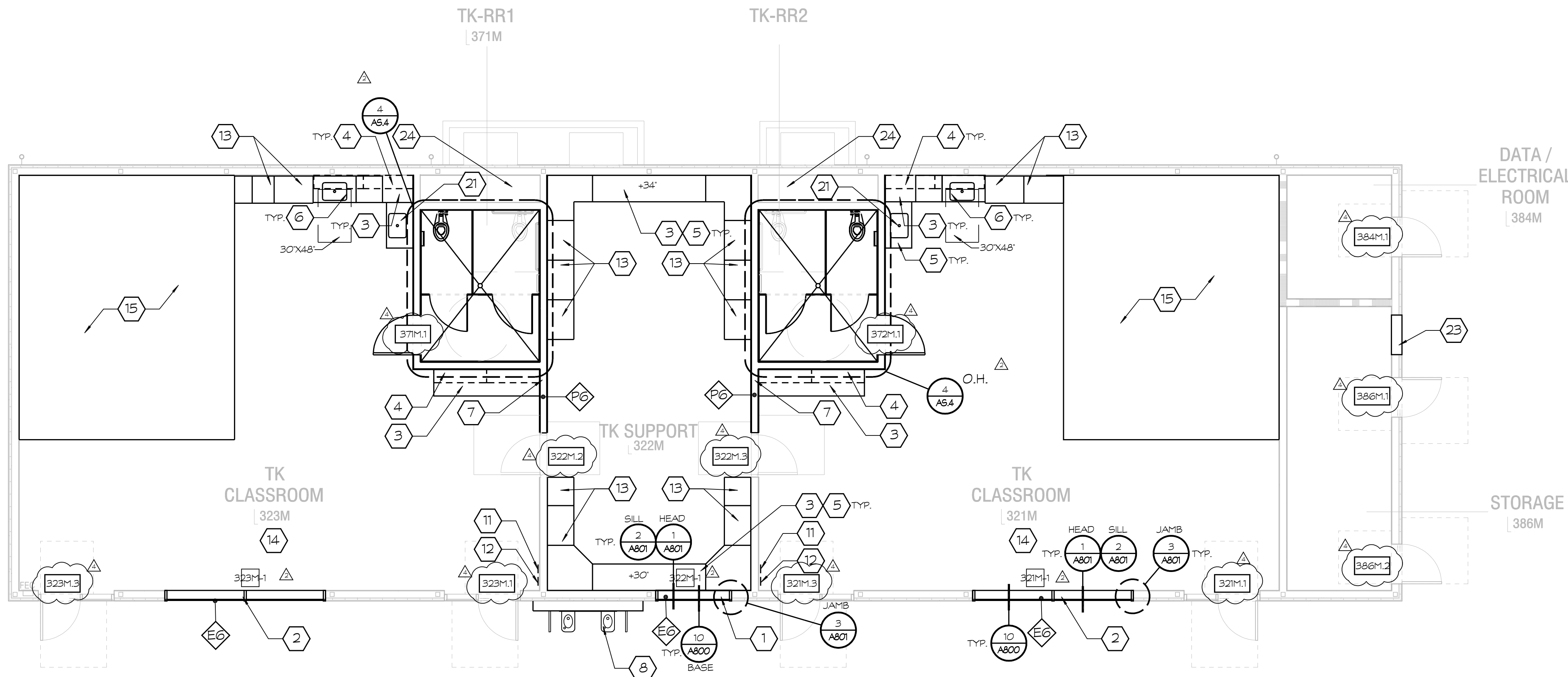


- B. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.
- C. As a part of the work of this contract, THIS DIVISION shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.

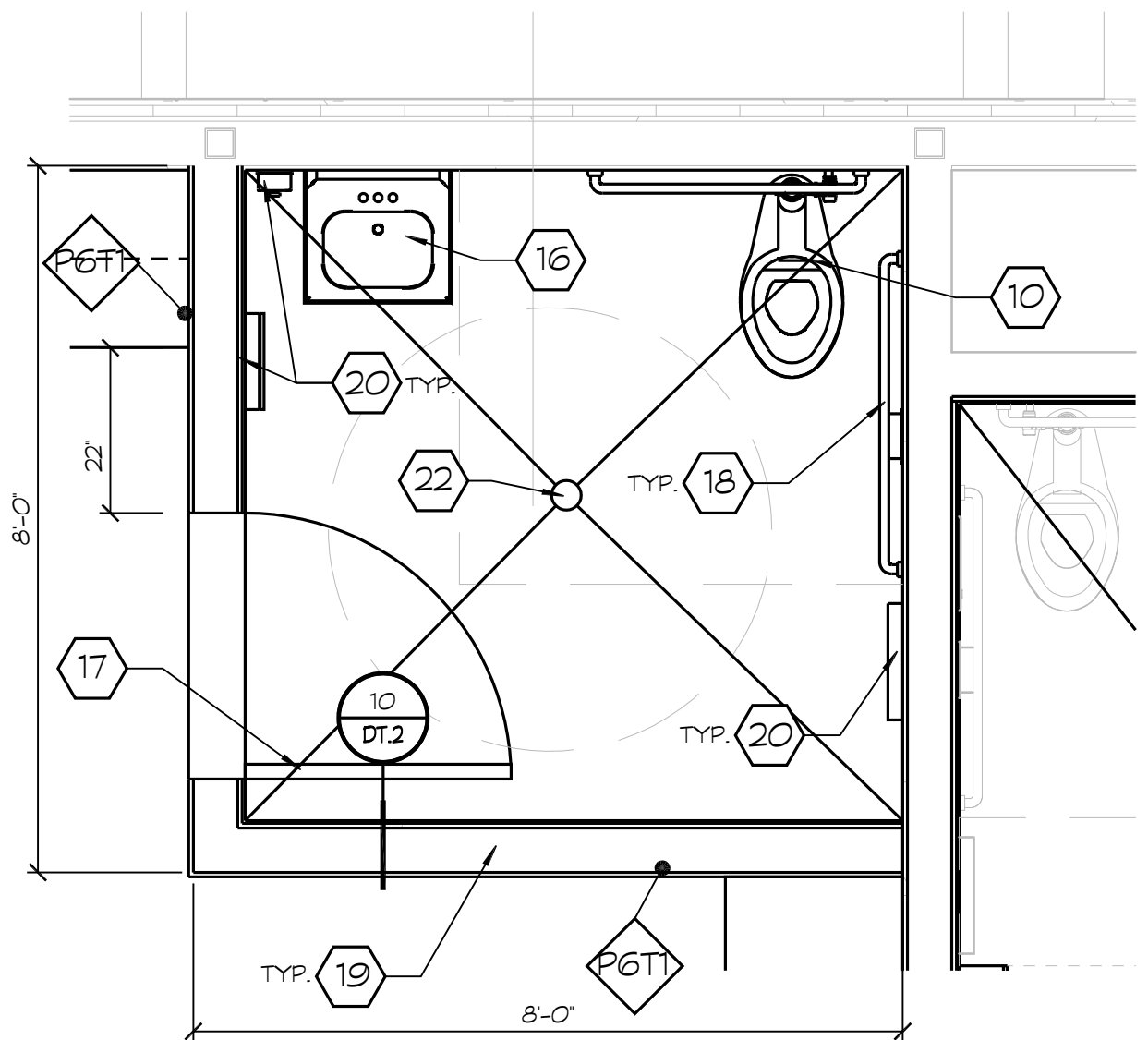
END OF SECTION 23 00 01



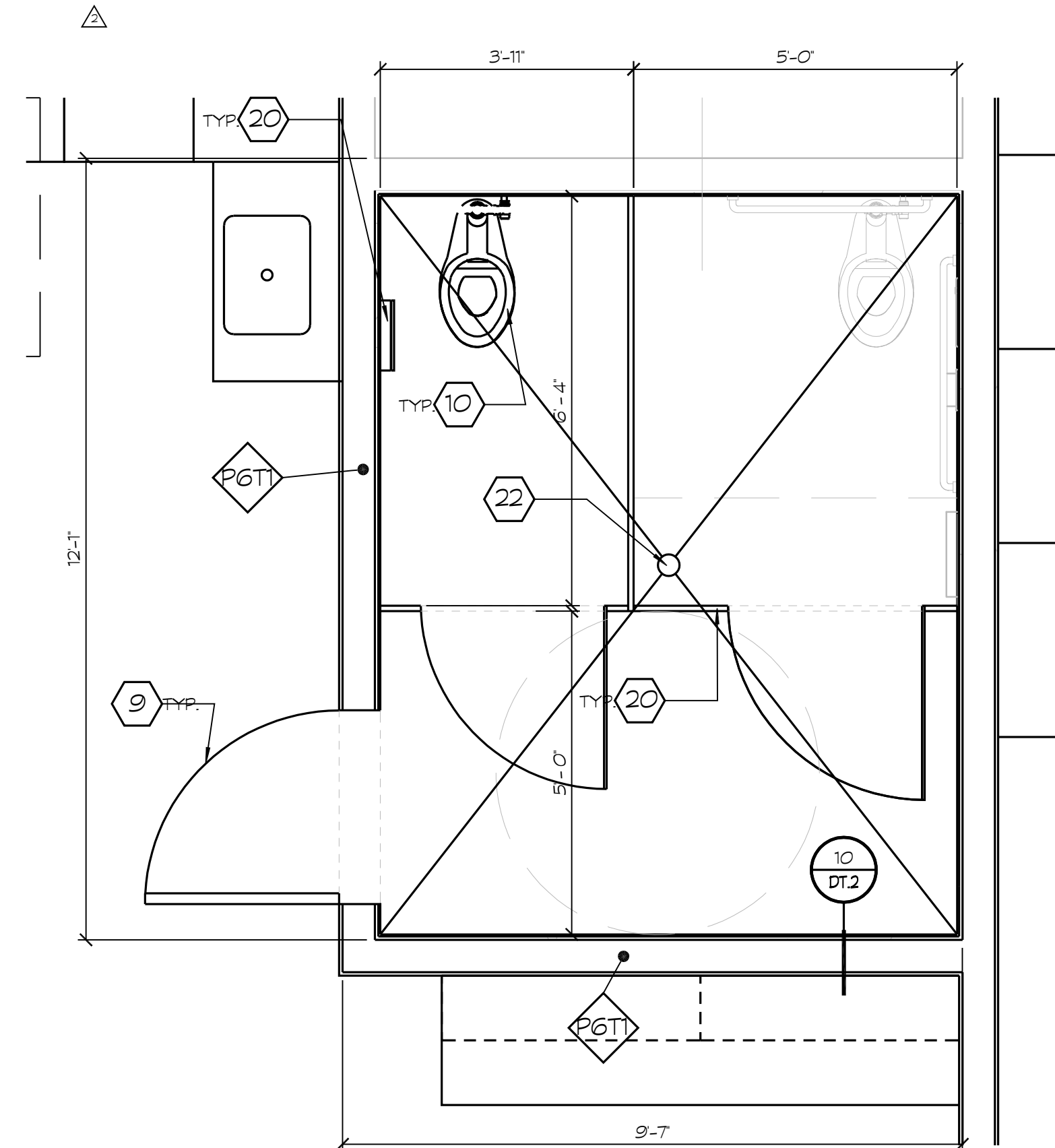
FLOOR PLAN
BUILDING 'A' TK-2 CLASSROOM 04-122304 PC
SCALE: 3/16" = 1'-0"



FLOOR PLAN
BUILDING 'B' TK-2 CLASSROOM MIRROR 04-122304 PC
SCALE: 3/16" = 1'-0"



ENLARGE RESTROOM PLAN
TK-2 CLASSROOM 04-122304 PC
SCALE: 1/2" = 1'-0"



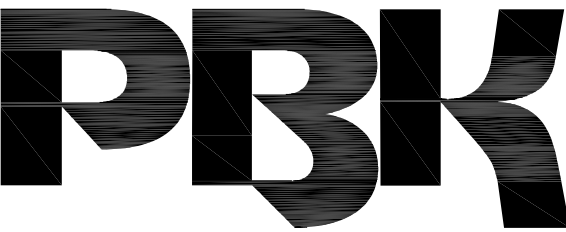
ENLARGE RESTROOM PLAN
TK-2 CLASSROOM & MIRROR 04-122304 PC
SCALE: 1/2" = 1'-0"

GENERAL NOTES

1. RELOCATE RETURN AIR VENTS TO NEW LOCATION. SEE INTERIOR ELEVATIONS.
2. GENERAL CONTRACTOR TO REFER TO PC SET 04-122304 FOR ALL CONSTRUCTION DOCUMENT.
3. FOR WALL TYPES SEE PC SET 04-122304 SHEET A800.
4. FOR DOOR HARDWARE SEE PC SET 04-122304 SHEET A700.
5. REFER TO FLOOR PLANS PC SET 04-122304 SHEET A205 AND A206 FOR MORE INFORMATION.
6. SEE PC SET 04-122304 FOR ALL DETAILS U.O.N.

KEYNOTES

1. INFILL DOOR OPENING WITH METAL FRAMING WITH NEW WINDOW SYSTEM. SEE DETAILS 1.2, & 3 ON SHEET A801
2. INFILL ROLL UP DOOR OPENING WITH METAL FRAMING AND NEW WINDOW SYSTEM. SEE DETAILS 1.2, & 3 ON SHEET A801
3. NEW LOWER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2
4. NEW UPPER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2
5. NEW COUNTER TOP. SEE DETAIL 1/DT.2
6. NEW ADA SINK. SEE DETAIL 6/DT.2
7. NEW METAL FRAMING INFILL. SEE DETAIL 10/DT.2
8. NEW DRINKING FOUNTAIN. SEE DETAIL 7/DT.2
9. NEW 3'-0"X7'-0" DUTCH DOOR. SEE DETAIL 6/A803 & 1/A801. MATCH FINISH FROM 04-122304 PC PLANS.
10. NEW WATER CLOSET AND ACCESSORIES CONNECT WATER AND SEWER WITH 04-122304 PC PLANS.
11. ASSISTED LISTENING SYSTEM SIGN. SEE DETAIL 3/A703
12. OCCUPANT LOAD SIGN. SEE DETAIL 4/A703
13. NEW FULL HEIGHT CASEWORK. SEE DETAIL 1/DT.2
14. CONCRETE POLISH FLOOR.
15. NEW CARPET AREA
16. NEW ADA LAVATORY.
17. NEW 3' X 7'H.M. DOOR AND FRAME. SEE DETAIL 6/A803 & 1/A801
18. NEW ADA GRAB BARS. SEE DETAIL 3/A802
19. NEW METAL FRAMING AND FINISHES. SEE DETAIL 10/DT.2
20. TOILET ACCESSORIES.
21. NEW SINK FOR KINDERGARTEN
22. NEW FLOOR DRAIN LOCATION
23. INFILL EXTERIOR DOOR OPENING. SEE DETAIL 6/DT.2
24. PLUMBING WALL CAVITIES TO BE FILLED WITH NON-COMBUSTIBLE INSULATION

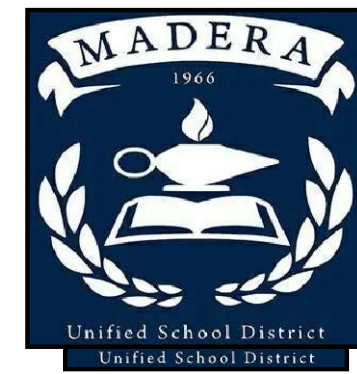


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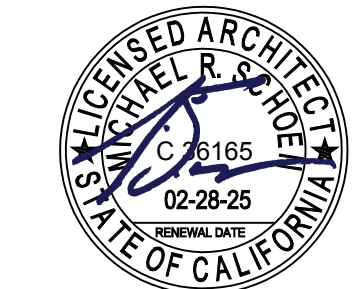
ALPHA ELEMENTARY SCHOOL

900 Stadium Rd, Madera, CA 93637

STATUS



PROFESSIONAL SEAL



PROJECT NUMBER

220105

DATE

7/3/23

DSA APPLICATION NO.

02-121586

FILE NO.

20-30

PTN NO.

65243-144

DRAWN BY

Author

REVISIONS

DESCRIPTION DATE

2 ADDENDUM 7/25/24

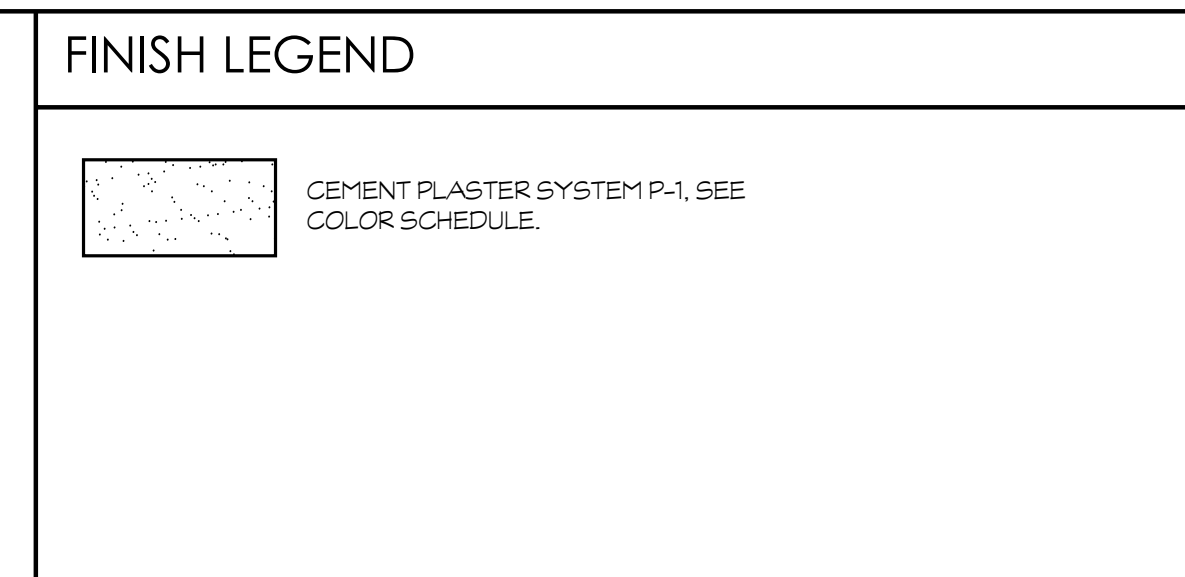
4 ADDENDUM 8/09/24

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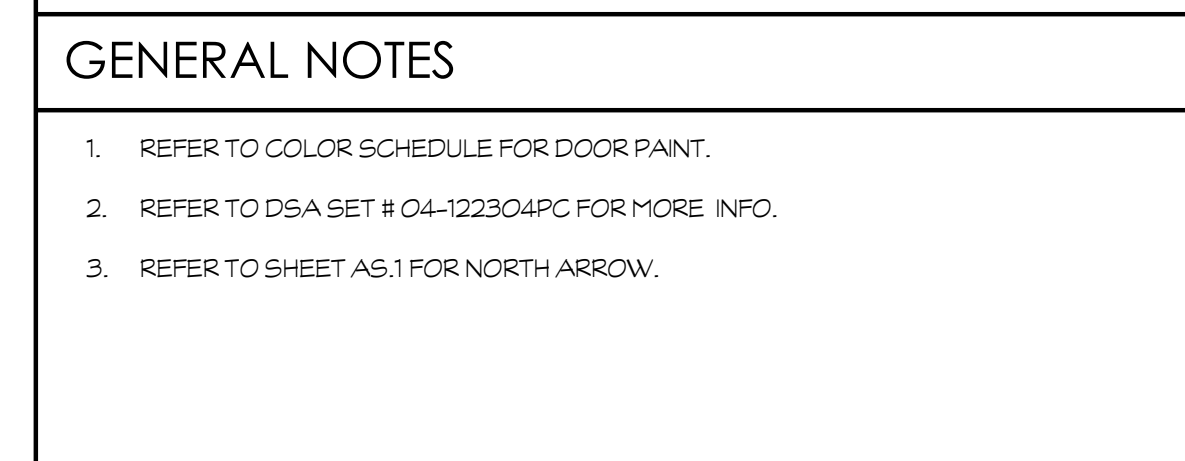
FLOOR

PLAN

AS.4



TK-2 SCALE 3/16" = 1'-0"



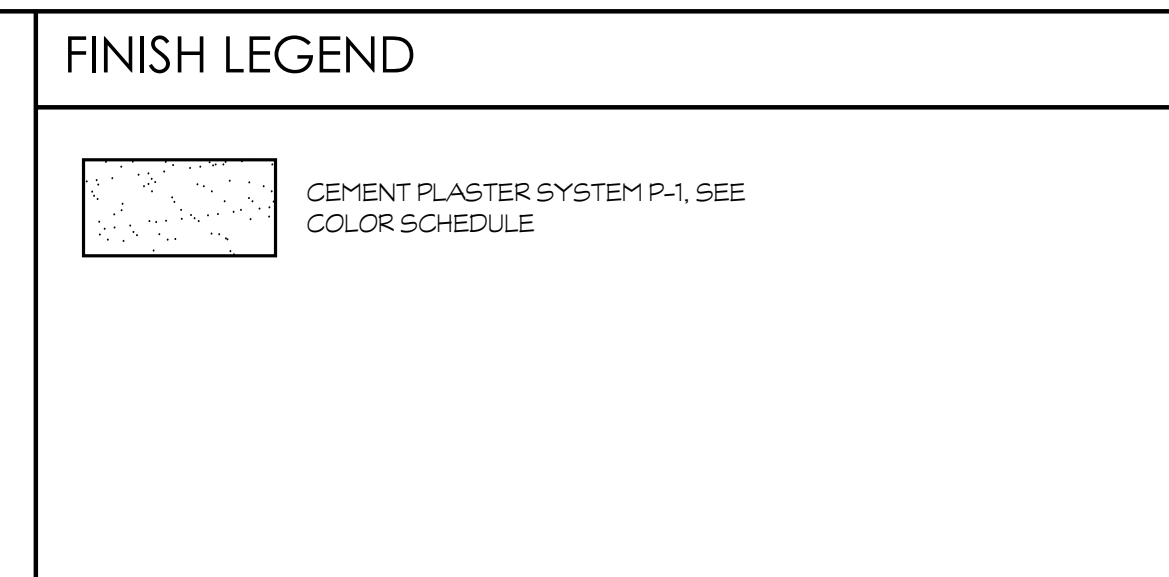
TK-2 SCALE 3/16" = 1'-0"



TK-2 SCALE 1/8" = 1'-0"

TK-2 SCALE 1/8" = 1'-0"

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GENERAL NOTES

1. REFER TO COLOR SCHEDULE FOR DOOR PAINT,
2. REFER TO DSA SET # 04-122304PC FOR MORE INFO.
3. REFER TO SHEET AS.1 FOR NORTH ARROW.

TK-2M SCALE 3/16" = 1'-0"

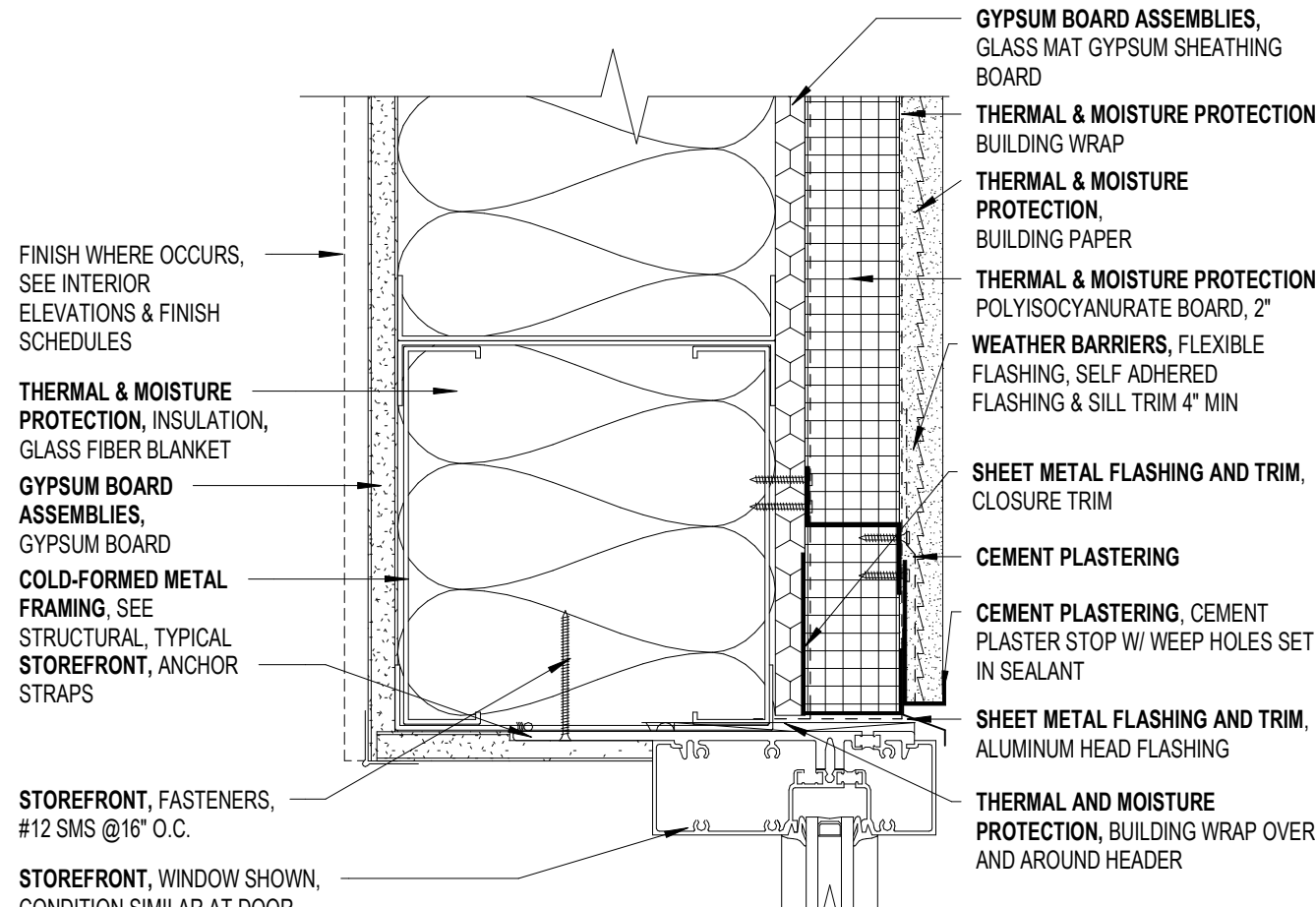


TK-2M SCALE 3/16" = 1'-0"

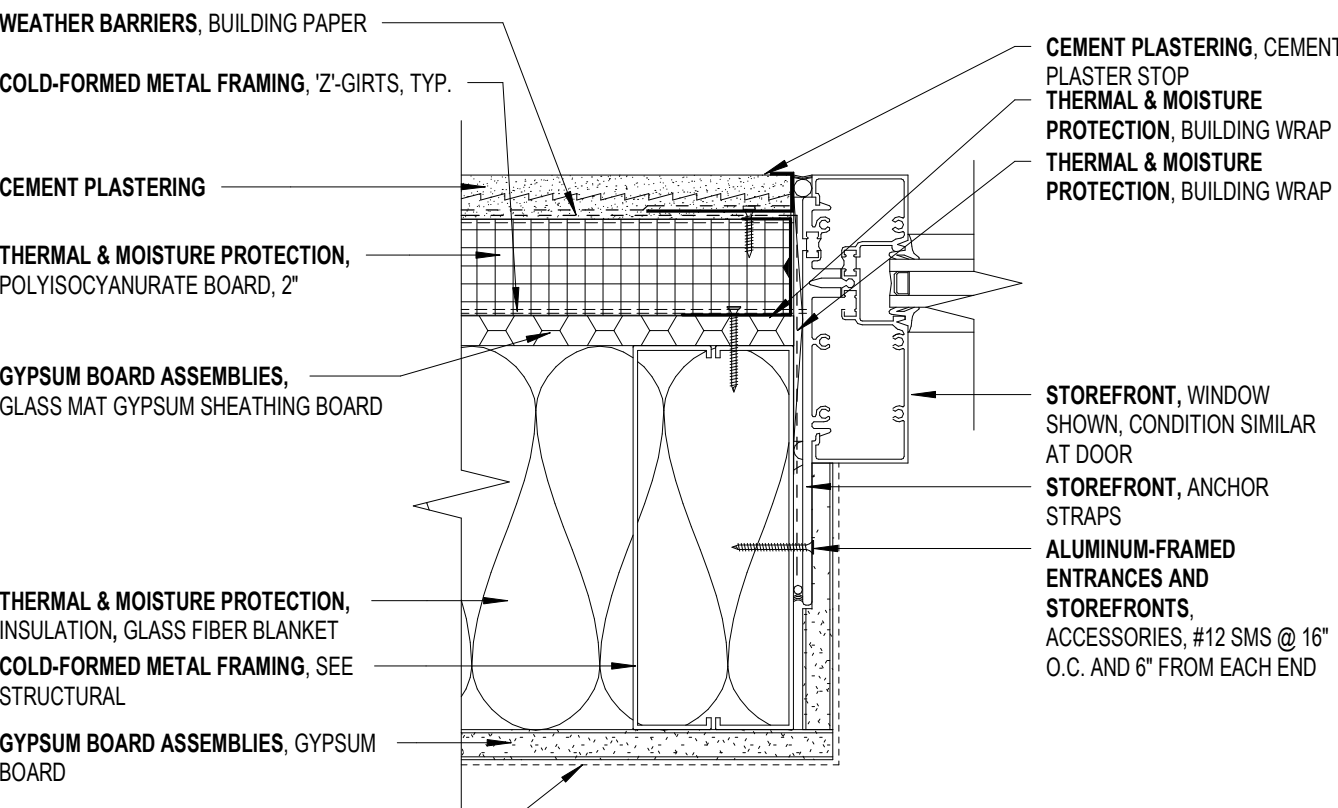
TK-2M SCALE 3/16" = 1'-0"

TK-2M SCALE 3/16" = 1'-0"

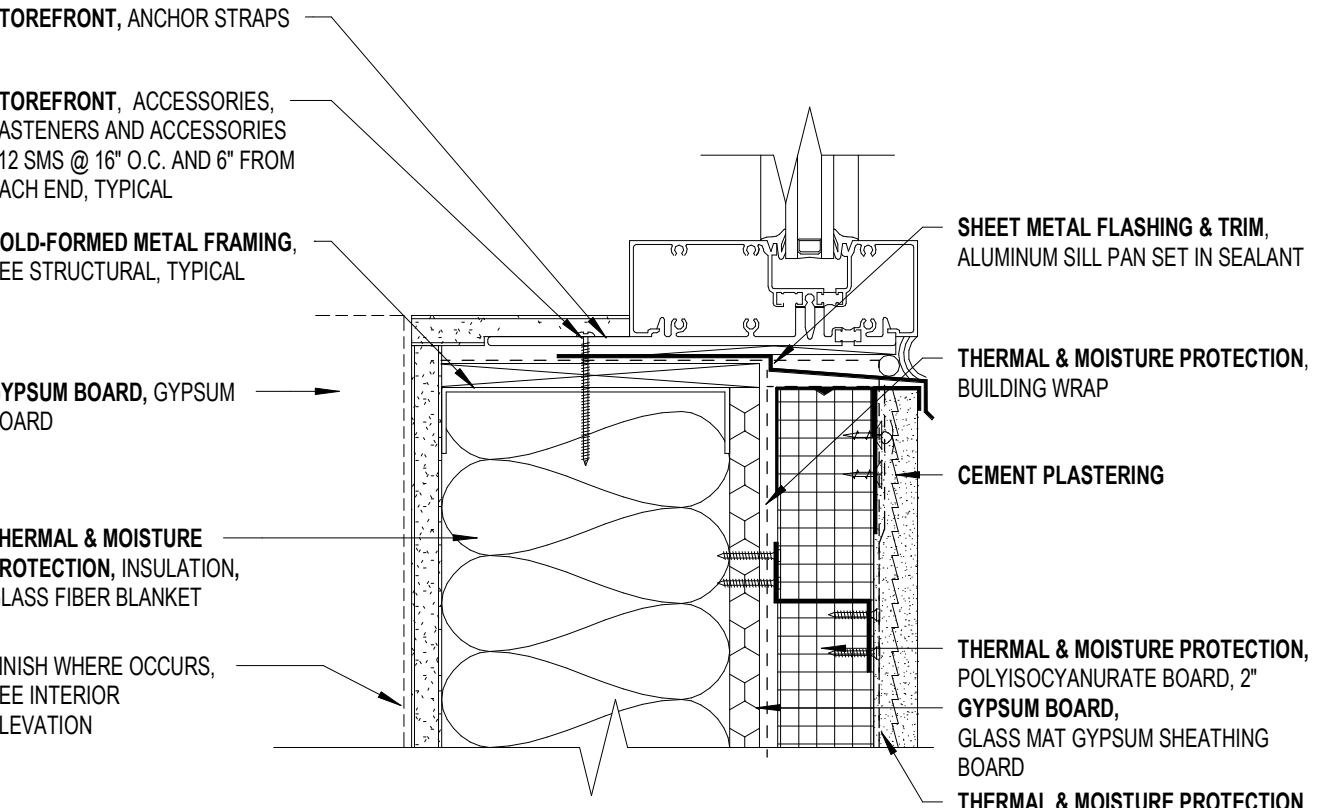
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1 ALUMINUM STOREFRONT HEAD @ CP
SCALE: 3" = 1'-0"

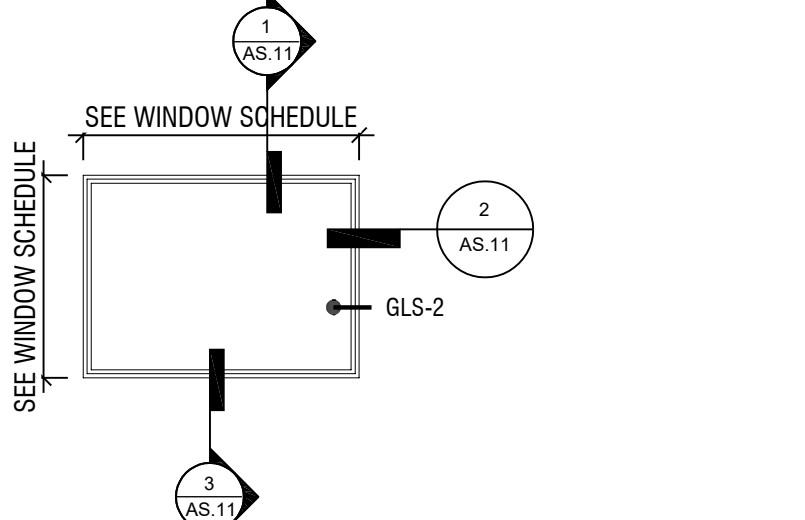
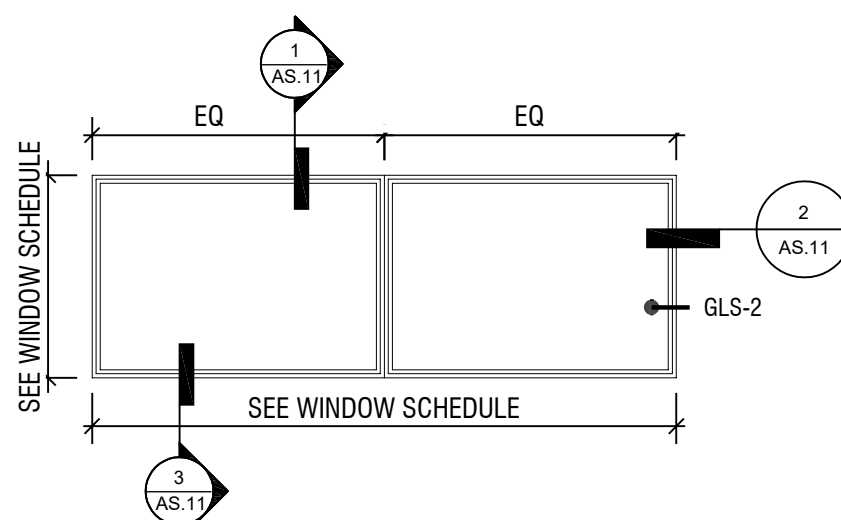


2 ALUMINUM STOREFRONT JAMB @ CP
SCALE: 3" = 1'-0"



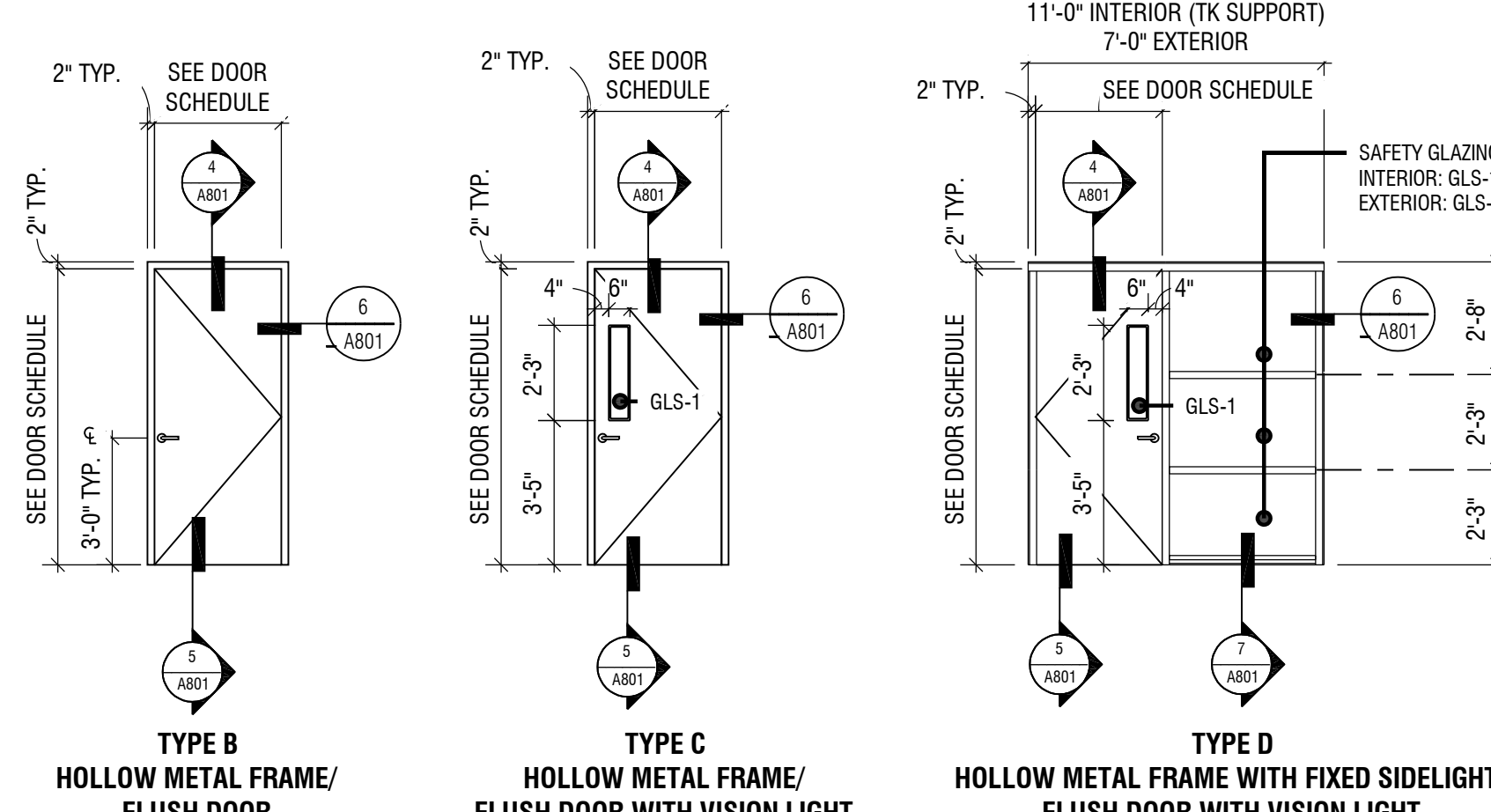
3 ALUMINUM STOREFRONT SILL @ CP
SCALE: 3" = 1'-0"

WINDOW SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING										
BUILDING ID	WINDOW ID	WINDOW DIMENSION		GLAZING	WINDOW/FRAME TYPE	FRAME FINISH	FIRE RATED	DETAILS (SEE SHEET A801)		REMARKS
		WIDTH	HEIGHT							
TK-2 - B	321M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS
	322M-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS
TK-2 - B	323M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS
	321-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS
TK-2 - A	322-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS
	323-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS



DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING										
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE	
		WIDTH	HEIGHT							
TK-2	321.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes	
	321.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
TK-2	322.2	3'-0"	7'-0"	WOOD	D	HM	04			
	322.3	3'-0"	7'-0"	WOOD	D	HM	04			
TK-2	322A.1	3'-0"	7'-0"	WOOD	D	HM	06			
	323.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
TK-2	323.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
	371.1	3'-0"	7'-0"	WOOD	B	HM	05			
TK-2	372.1	3'-0"	7'-0"	WOOD	B	HM	05			
	384.1	3'-0"	7'-0"	HM	B	HM	03			
TK-2	386.1	3'-0"	7'-0"	HM	B	HM	03			
	386.2	3'-0"	7'-0"	HM	B	HM	03			

DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN (MIRRORED) BUILDING										
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE	
		WIDTH	HEIGHT							
TK-2 - MRR	321M.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes	
	321M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
TK-2 - MRR	322M.2	3'-0"	7'-0"	WOOD	D	HM	04			
	322M.3	3'-0"	7'-0"	WOOD	D	HM	04			
TK-2 - MRR	323M.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
	323M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes	
TK-2 - MRR	371M.1	3'-0"	7'-0"	WOOD	B	HM	05			
	372M.1	3'-0"	7'-0"	WOOD	B	HM	05			
TK-2 - MRR	384M.1	3'-0"	7'-0"	HM	B	HM	03			
TK-2 - MRR	386M.1	3'-0"	7'-0"	HM	B	HM	03			
	386M.2	3'-0"	7'-0"	HM	B	HM	03			



WINDOW EFFICIENCY VALUES
FOR SITE-BUILT
FENESTRATION
BASED ON NAB ALTERNATE
DEFAULT FENESTRATION
PROCEDURE TO CALCULATE
THERMAL PERFORMANCE

	TYPE A	TYPE D
U _f	= 0.55	0.55
SHGC _i	= 0.31	0.31
VT _i	= 0.88	0.77

DOOR GENERAL NOTES

- CONTRACTOR TO COORDINATE EXACT SIZE OF DOOR WITH MANUFACTURER
- INSTALL STOREFRONT MULLIONS AND HOLLOW METAL FRAMES WITH 1/4 INCH SHIM AND JOINT SEALANT AROUND PERIMETER OF FRAME
- PROVIDE HEAD RECEIVERS AT ALUM. STOREFRONTS AS REQUIRED FOR STRUCTURAL AND FRAME DEFLECTION
- JAMBS SHALL MAINTAIN 6 INCH MIN. FROM ADJACENT WALLS AND PARTITIONS U.N.O
- WHERE REQUIRED, EXIT DEVICES (PANIC HARDWARE), SHALL BE INSTALLED WITH ACTIVATING MEMBER CENTERED AT A HEIGHT OF NO LESS THAN 34 INCH OR MORE THAN 44 INCH ABOVE THE FLOOR. PER CBC 11B-404.2.7 AND 11B-309.4
- PANIC HARDWARE IS REQUIRED FROM ROOMS AND CORRIDORS OF E OCCUPANCY WHERE OCCUPANT LOAD EXCEEDS 49
- PRESSURE TO OPERATE DOORS SHALL NOT EXCEED 5 POUNDS FOR EXTERIOR AND INTERIOR DOORS AND 15 POUNDS FOR FIRE DOORS. PER CBC 11B-404.2.9
- ALL OPERATING DOOR HARDWARE SHALL COMPLY WITH THE REQUIREMENTS IN CBC 11B-404.2.7, 1008.1.0 AND 11B-309.4 AND SHALL NOT REQUIRE MORE THAN 5 POUNDS OF FORCE
- THRESHOLDS SHALL COMPLY WITH CBC 11B-404.2.5 AND SHALL BE 1/2" MAX IN HEIGHT AND BEVELED 1:2
- DOOR AND GATE CLOSERS SHALL BE ADJUSTED TO FORM AN OPEN POSITION OF 12 DEGREES FROM THE LATCH IN 5 SECONDS MINIMUM. PER CBC 11B-404.2.8.1
- SEE GENERAL SHEETS FOR DOOR SIGNAGE INFORMATION AND DETAILS ON SIGNS ON DOORS AND SIGNS RELATED TO EXIT AND ENTRANCE
- NEW BUILDINGS SERVING ANY EDUCATIONAL OCCUPANCY SHALL INCLUDE LOCKS THAT ALLOW DOORS TO CLASSROOM AND ANY OCCUPIED ROOM TO BE LOCKED FROM THE INSIDE PER CBC 1010.2.8

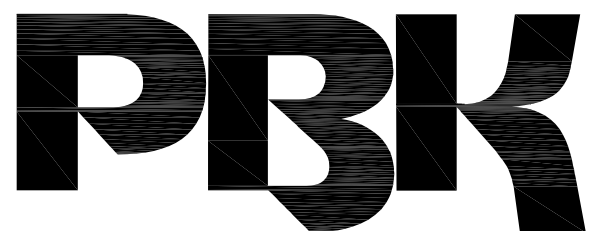
GLAZING NOTES AND SCHEDULE

NOTES:

- GLAZING SHALL MEET THE MINIMUM FRAME LAP AND GLASS EDGE CLEARANCE PER CBC 2403.2.1 PROVIDE CONTINUOUS GLAZING RABBET AND GLASS RETAINER
- NFRC COMPLIANCE: COMPLETE SITE-BUILT ASSEMBLIES SHALL CONFORM TO NFRC REQUIREMENTS AND TESTED AND LABELED TESTED IN ACCORDANCE WITH THAT STANDARD
- NFRC LABELS SHALL REMAIN ON WINDOWS FOR VERIFICATION BY INSPECTOR
- SAFETY GLAZING SHALL BE PROVIDED WHERE REQUIRED PER CBC 2406

SCHEDULE:

- GLS-1: MONOLITHIC VISION GLASS, CLEAR, 1/4 INCH THICK, TEMPERED
- GLS-2, GLS-2A: INSULATED GLASS UNIT (IGU):
 - GLASS SPEC. SOLARBAN 70
 - A. OVERALL THICKNESS: 1 INCH
 - B. ASSEMBLY: 1/4" GLASS ON EITHER SIDE + 1/2" AIR
 - C. SPACER: ALUM., BLACK
 - D. INNER AND OUTER LIGHTS: GLS-1
 - E. NO.2 SURFACE: LOW-E COATING
 - F. NO.3 SURFACE (GLS-2A ONLY): TRANSLUCENT COATING
- MINIMUM PERFORMANCE REQUIREMENTS FOR GLASS:
 - 1. THERMAL TRANSMITTANCE, WINTER - CENTER OF GLASS: 0.29, NOMINAL
 - 2. VISIBLE LIGHT TRANSMITTANCE: 70%, NOMINAL
 - 3. SOLAR HEAT GAIN COEFFICIENT: 0.39, NOMINAL
 - 4. VISIBLE LIGHT REFLECTANCE, OUTSIDE: 11%, NOMINAL

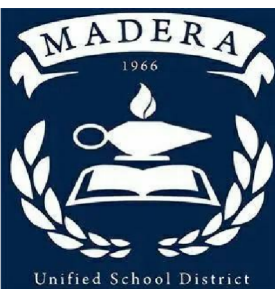


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STATUS



PROFESSIONAL SEAL



PROJECT NUMBER
220105
DATE
7/3/23

DSA APPLICATION NO.
02-121586

FILE NO.
20-30

PTN NO.
65243-144

DRAWN BY
Author

REVISIONS

#	DESCRIPTION	DATE
2	ADDENDUM	7/25/24
4	ADDENDUM	8/09/24

STATUS

DOOR
HARDWARE

AS.11



SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Load bearing wall framing.
 - 2. Exterior non-load bearing wall framing.
 - 3. Floor joist framing.
 - 4. Roof rafter framing.
 - 5. Ceiling joist framing.
 - 6. Soffit framing.
 - 7. Accessories necessary for a complete installation.
- B. Related Sections:
- C. Related Sections:
 - 1. Section 03 30 00: Cast in Place Concrete.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.
 - 5. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: General Contractor shall engage a qualified professional engineer, licensed in the State of California, to design cold formed steel framing.
- B. Structural Performance - Delegated design engineer shall provide cold-formed steel framing designs capable of withstanding all code required design loads within limits and under conditions indicated on the construction documents and within this Specification:
 - 1. Design loads: Designs shall be capable of withstanding the worst case loading as indicated on the structural drawings, and/or as required by the locally adopted Building Code. The design shall cover the worst case loading in all instances.
 - 2. Coordinate the requirements on the structural and architectural Drawings with the requirements of this Section. If a conflict exists, notations on the structural drawings take precedence.
 - 3. The following document governs the Work, except where more restrictive items are specified:
 - a. AISI Design of Cold-Formed Steel Structural Members Wind Load:
 - 1) Minimum design loads for exterior and/or load bearing and/or soffit applications:
 - a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 16 gauge minimum, unless noted otherwise.
 - 2) Minimum design loads for interior and/or exterior suspended furr-downs with a maximum vertical drop on either side of five feet (5') or greater:



- a) As required by code officials having jurisdiction.
 - b) Deflection: 1/600 for clear simple spans.
 - c) Deflection: 1/300 for cantilever conditions and roof parapets.
 - d) Gauge: 20 gauge minimum, unless noted otherwise.
 4. It is a common practice for studs thinner than 20 gauge to be crimped and/or ribbed to increase the strength of the overall stud cross section for various loading applications. These studs are typically noted by manufacturer as "equivalent" to a thicker gauge. These "equivalent" type studs are not allowed in a vertically suspended application with greater than five feet (5') of vertical wall drop, 20 gauge is the minimum thickness allowed for these applications.
 5. Welding qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
 6. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
 7. Fire-rated assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
 8. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
 9. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
 - a. Upward and downward movement of 1-1/2 inches (38 mm).
 10. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold Formed Steel Framing Design Standards:
1. Wall studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral design: AISI S213.

1.4 SUBMITTALS

- A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.
- B. Shop Drawings:
1. Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners:
 - a. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - b. Shall bear the seal of a Registered Professional Engineer, licensed in the State of California.
- C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations and shop drawings to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of California. Calculations and shop drawings must show design will withstand wind loading commiserate with class and rating of the Project.

1.5 QUALITY ASSURANCE



- A. Regulatory Requirements:
 - 1. Welding qualifications:
 - a. Qualify procedures and personnel according to the following:
 - 1) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - 2) CCFSS Technical Bulletin: "AISI Specification Provision for Screw Connections."
 - 2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions:
 - a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
 - 3. Fire resistance ratings: ASTM E119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory*.
 - 4. Installer qualifications: Company specializing in the installation of cold formed metal framing components with minimum five (5) years' documented experience.
 - 5. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 6. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 7. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
- B. Professional Engineer Qualifications:
 - 1. A professional engineer who is legally qualified to practice in the State of California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent:
 - a. Engineering responsibility: Preparation of shop drawings, design calculations, and structural data.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. CEMCO.
 - 2. ClarkDietrich Building Systems.
 - 3. Consolidated Fabricators Corp.
 - 4. SCAFCO Corporation.
 - 5. Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

2.2 LOAD BEARING WALL FRAMING



- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with straight flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Steel Box or Back to Back Headers:
 - 1. C-shape used to form header beams, of web depths indicated, unpunched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
- D. Steel Single or Double L Headers:
 - 1. L-shapes used to form header beams, of web depths indicated:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Top flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

- A. Steel Studs:
 - 1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-5/8 inches (41 mm).
 - c. Section properties: Refer to the Drawings.
- B. Steel Track:
 - 1. U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - a. Minimum base metal thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips:
 - 1. Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) ClarkDietrich Building Systems.
 - 2) SCAFCO Corporation.
 - 3) Simpson Strong-Tie Co., Inc.
 - 4) Steeler, Inc.
 - 5) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.
- D. Single Deflection Track:



1. Single, deep leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- E. Double Deflection Tracks:
 1. Double, deep leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges:
 - a. Outer track - Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
 - 1) Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - 2) Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
 - b. Inner track - of web depth indicated:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
 - b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.
- F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists:
 1. C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges:
 - a. Minimum base metal thickness: 0.0428 inch (1.09 mm).
 - b. Flange width: Two inches (51 mm), minimum.

2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame:
 1. C-shaped steel sections, of web depths indicated, with stiffened flanges:
 - a. Minimum base metal thickness: **[0.0538 inch (1.37 mm)]**.
 - b. Flange width: 1-5/8 inches (41 mm) minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.



5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.
- C. Anchors, Clips, and Fasteners:
1. Steel shapes and clips: ASTM A36/A36M, zinc coated by hot dip process according to ASTM A123/A123M.
 2. Expansion anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.
 3. Power actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
 4. Mechanical fasteners:
 - a. ASTM C1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws:
 - 1) Head type: Low profile head beneath sheathing.
 5. Welding electrodes: Comply with AWS standards.
- D. Miscellaneous Materials:
1. Galvanizing repair paint: SSPC-Paint 20 or ASTM A780.
 2. Non-metallic, non-shrink grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.
 3. Shims: Load bearing, high density multimonomer plastic, and non-leaching; or of cold formed steel of same grade and coating as framing members supported by shims.
 4. Sealer gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements:
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted:
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three (3) exposed screw threads.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances:
1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance



variation of 1/8 inch in ten (10) feet (1:960) and as follows:

- a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- b. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

- A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

- A. General:
 1. Track anchors: Install anchors maximum four feet (4') on center; design anchors and spacing to carry live, dead, and wind loads.
 2. Track splices: Provide channel inserts or weld track splices.
 3. Erection: Install members plumb, level, and in a true plane.
 4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.
- B. Install metal framing systems in accordance with stud manufacturer's printed instructions.
- C. Runner Tracks:
 1. Install continuous tracks sized to match studs.
 2. Align tracks accurately to layout at base and tops of studs.
 3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
 4. Provide fasteners at corners and ends of tracks.
 5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
 6. Provide deflection track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2-inch movement of primary structure. Do not attach studs directly to deflection track.
 7. Vertical deflection clips: Provide manufacturer's standard bypass and head clips,

capable of accommodating upward and downward vertical displacement of primary structure.

- D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."
- E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum two feet (2') on center vertical.
- G. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
- H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
- I. Install bracing/bridging in accordance with manufacturer's instructions and design conditions.
- J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.
- K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.
- L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

3.4 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track:
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud sections as indicated on shop drawings.
- C. Space joists not more than two inches (51 mm) from abutting walls:
 - 1. Joist spacing: 16 inches (406 mm).



- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on shop drawings:
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on shop drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold down angles, anchors, and fasteners, to provide a complete and stable joist framing assembly.

END OF SECTION 05 40 00

SECTION 08 41 13 STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Exterior and interior storefront framing.
 - 2. Exterior and interior manual swing entrance doors.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 12 00: Structural Steel Framing.
 - 2. Section 05 40 00: Cold-Formed Metal Framing.
 - 3. Section 05 50 00: Metal Fabrications.
 - 4. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 5. Section 07 92 00: Joint Sealants.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.
- B. Shop Drawings:
 - 1. Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other work:
 - a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Engineer's calculations of performance requirements.
- D. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or fail due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

- d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units.
- B. Structural Loads:
 - 1. Wind loads: Ultimate wind speed gust 115 mph; exposure D.
- C. Deflection of Framing Members:
 - 1. Deflection normal to wall plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch (19 mm), whichever is less.
 - 2. Deflection parallel to glazing plane: Limited to $L/360$ of clear span or $1/8$ inch (3.2 mm), whichever is smaller.
- D. Structural Test Performance - Provide aluminum framed systems tested according to ASTM E330 as follows:
 - 1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test durations: As required by design wind velocity, but not fewer than ten (10) seconds.
- E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. 0.03 L/s per sq. m of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa.)
- F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa.)
- G. Windborne Debris Impact Resistance:
 - 1. Pass missile impact and cyclic pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996 for Wind Zone 4:
 - a. Large missile test: For glazed openings located within 30 feet (9.1 m) of grade.
- H. Thermal Movements:
 - 1. Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature change (range): 120 degrees F (67 degrees C, ambient; 180 degrees F, 100 degrees C, material surfaces.
 - b. Interior ambient-air temperature: 75 degrees F (24 degrees C).
- I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing

areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F3.23
W/sq. m x K when tested according to AAMA 1503.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessibility requirements:
 - a. 2022 California Building Code: Section 11B-404.3 accessible route.
 - b. 2022 California Building Code: Section 11B-309.4 operable parts interior usage.
 - c. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - d. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
- B. Installer Qualifications: Installer having minimum ten (10) years' documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.
- C. Engineering Responsibility: Prepare data for aluminum framed systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.
- D. Product Options:
 - 1. Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance:
 - a. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.
- F. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

- A. Written warranty signed by manufacturer, Contractor, and installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Water leakage through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty period: Two (2) years from date of Substantial Completion.
- B. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:
 - 1. Warranty period: Ten (10) years from date of Substantial Completion.

4

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design:
 - 1. **US Aluminum Corporation, Series 451 Center Glazed Storefront.** See attached brochure for frame size and locations. Subject to compliance with requirements, provide comparable storefront system by any of the following or comparable system:
 - a. Arcadia
 - b. Kawneer.
- B. Aluminum:
 - 1. Alloy and temper recommended by manufacturer for type of use and finish indicated:
 - a. Sheet and plate: ASTM B209/ASTM B209M.
 - b. Extruded bars, rods, profiles, and tubes: ASTM B221/ASTM B221M.
 - c. Extruded structural pipe and tubes: ASTM B429.
- C. Framing Members:
 - 1. Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads:
 - a. Construction: Nonthermal/thermal.
 - b. Glazing system: Retained mechanically with gaskets on four sides.
 - c. Glazing plane: Center.
- D. Accessories:
 - 1. Brackets and reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
 - 2. Fasteners and accessories:
 - a. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
 - 1) Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2) Reinforce members as required to receive fastener threads.
 - 3. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.
 - 4. Concealed flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
 - 5. Framing system gaskets and sealants: Recommended by manufacturer for joint type.
- E. Glazing:
 - 1. Refer to Section 08 80 00: Glazing for impact resistant laminated insulating glass with low-e coating on Number 2 surface:
 - a. Glazing gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
 - b. Spacers and setting blocks: Elastomeric type.
- F. Accessories:
 - 1. Joint sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00: Joint Sealants.
 - 2. Bituminous paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil 0.762 mm thickness per coat.

2.2 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members:
 - 1. Fabricate components that, when assembled, have specified characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - f. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - h. Provide sill receptors with end dams at all sill conditions.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Storefront Framing: Fabricate components for assembly using screw spline system.
- E. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.3 ALUMINUM FINISHES

- A. Class I, Clear Anodic Finish (#14): AA-M10C21A41 / AA-M45C22A41, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on shop drawings.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work:
 - 1. Do not install damaged components.
 - 2. Fit joints to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 5. Seal joints watertight unless otherwise indicated.
 - 6. Min anchorage #8 with two-inch (2") minimum embedment; minimum two inches (2")

from edges. Refer to shop drawings.

- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing specified in Section 08 80 00: Glazing.
- G. Install perimeter joint sealants as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

3.4 ERECTION TOLERANCES

- A. Install aluminum framed systems to comply with the following maximum erection tolerances:
 - 1. Location and plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to three inches (75 mm) from the latch, measured to the leading door edge.

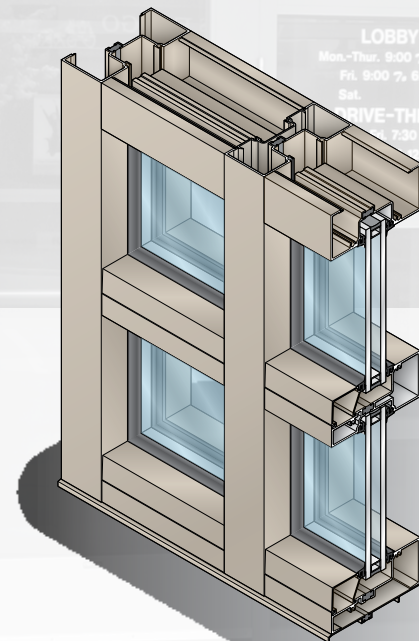
END OF SECTION 08 41 13

STOREFRONT SYSTEMS

SERIES 451 & IT451 CENTER GLAZE



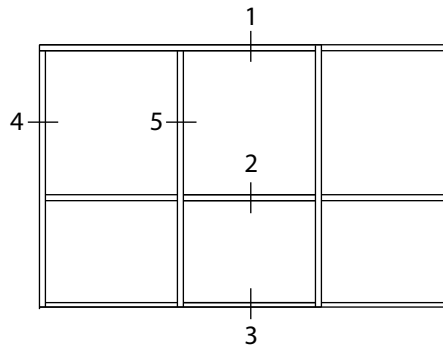
- Series 451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Non-Thermal
- Series IT451 - 2" x 4-1/2"
(50.8 x 114.3 mm) Thermal
- 1" (25 mm) Glazing Infills
- Injection Molded Water Deflectors
- Screw Spline Assembly
- Shear Block Assembly
- Stacking Installation Option
- Full Range of Accessory Components
- Available in Anodized or Painted Finishes



Series IT451 offers improved thermal performance using the Poly-Aluminizer™ and Struct-Link™ Thermal Break Technology. Series 451 and IT451 may be interior or exterior glazed. A top load E.P.D.M. gasket is used to position and weatherseal the glass in the aluminum pocket. Center Glazed Systems are compatible with all United States Aluminum Entrance Doors.

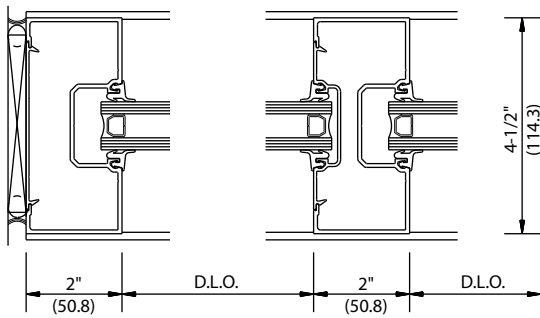
SERIES 451 & IT451 STOREFRONTS TYPICAL DETAILS

For Specifications, Details, and
Testing Data go to **usalum.com**.



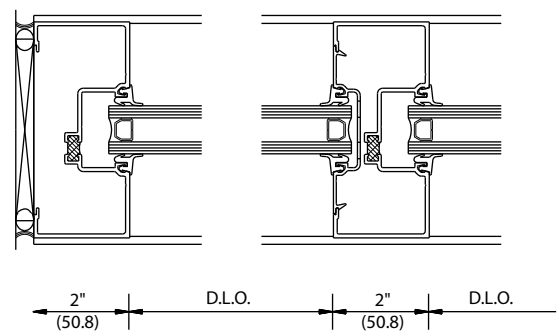
Series 451

Series IT451



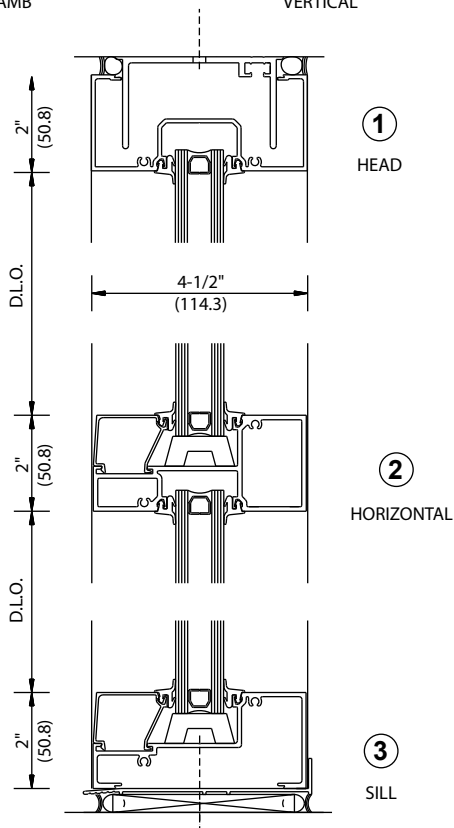
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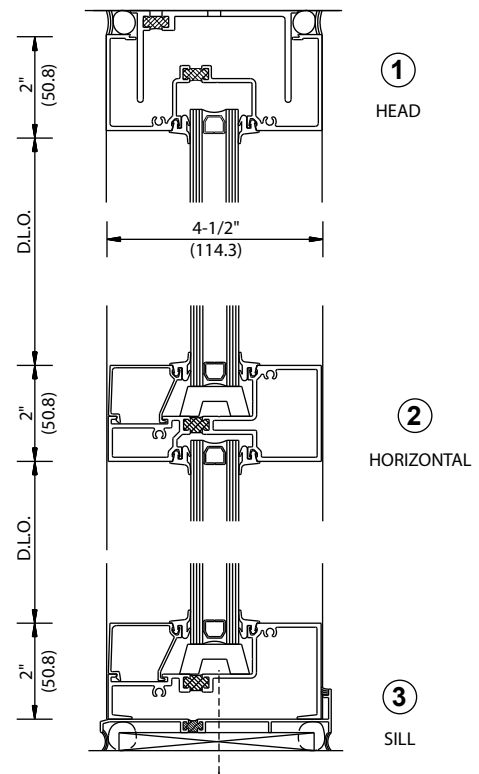
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HEAD

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HORIZONTAL

③
SILL



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HEAD

②
HORIZONTAL

③
SILL

NOT TO SCALE

SECTION 08 71 00 DOOR HARDWARE

PART 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. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other Sections.
- C. Related Sections:
 - 1. Section 08 11 13: Hollow Metal Doors and Frames.
- D. Reference Standards:
 - 1. Comply with the version year adopted by the Authority Having Jurisdiction:
 - a. CBC California Building Code: Section 11B-404.
 - b. ICC A117.1 Accessible and Usable Buildings and Facilities.
 - c. NFPA 70 National Electrical Code.
 - d. NFPA 80 Fire Doors and Windows.
 - e. NFPA 101 Life Safety Code.
 - f. NFPA 105 Installation of Smoke Door Assemblies.
 - g. State Building Codes, Local Amendments, if applicable.
 - 2. All hardware specified herein shall comply with the following industry standards:
 - a. ANSI Certified Product Standards A156 Series
 - b. UL10C Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- C. Format: Comply with scheduling sequence and vertical format in DHI's Sequence and Format for the Hardware Schedule.
- D. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets of Part 4. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to

resubmission.

- E. Content:
 - 1. Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
- F. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- G. Keying Schedule: After a keying meeting with the Owner has taken place, prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- H. Informational Submittals.
- I. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- J. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01 for Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage qualified manufacturers with a minimum five (5) years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum three (3) years' documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum five (5) years' documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- D. Source Limitations: Obtain each type and variety of door hardware specified in this Section from a single source unless otherwise indicated.
- E. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference:
 - 1. Conduct conference to comply with requirements in Division 01 Section for Project Meetings. Keying conference to incorporate the following criteria into the final keying schedule document:
 - a. Function of building, purpose of each area, and degree of security required.
 - b. Plans for existing and future key system expansion.
 - c. Requirements for key control storage and software.
 - d. Installation of permanent keys, cylinder cores, and software.
 - e. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section for Project Meetings with attendance by representatives of supplier(s), installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
- I. Prior to installation of door hardware, conduct a Project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedules, templates, and physical product samples as required.
- J. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades:
 - 1. Review sequence of operation narratives for each unique access-controlled opening.
 - 2. Review and finalize construction schedule and verify availability of materials.
 - 3. Review the required inspecting, testing, commissioning, and demonstration procedures.
- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period:
 - 1. Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of the hardware.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One (1) year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven (7) years for heavy duty cylindrical (bored) locks and latches.
 - 2. Ten (10) years for manual surface door closer bodies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software, or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the Keying Conference.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations:
 - 1. Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets of Part 4. Products are identified by using door hardware designations, as follows:
 - a. Named manufacturer's products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Section 01 33 00: Substitution Procedures. Approval of requests is at the discretion of the Architect, Owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges - ANSI A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets:
 - 1. Quantity - Provide the following hinge quantity:
 - a. Two (2) hinges: For doors with heights up to 60 inches.
 - b. Three (3) hinges: For doors with heights 61 to 90 inches.
 - c. Four (4) hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide four (4) hinges, plus one (1)

hinge for every 30 inches of door height greater than 120 inches.

- B. Hinge Size:
 - 1. Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to three feet (3'0"): 4-1/2-inch standard or heavy weight as specified.
 - b. Sizes from three feet-one inch (3'1") to four feet (4'0"): Five inches (5") standard or heavy weight as specified.
- C. Hinge Weight and Base Material:
 - 1. Unless otherwise indicated, provide the following:
 - a. Exterior doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- D. Hinge Options:
 - 1. Comply with the following:
 - a. Non-removable pins: Provide set screw in hinge barrel that when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
- E. Manufacturers:
 - 1. Hager Companies (HA) - CB Series.
 - 2. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - 3. Stanley Hardware (ST) - CB Series.

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum ten (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders:
 - 1. Original manufacturer cylinders complying with the following:
 - a. Mortise type: Threaded cylinders with rings and cams to suit hardware application.
 - b. Rim type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - c. Bored-lock type: Cylinders with tailpieces to suit locks.
 - d. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - e. Keyway: Match facility standard.
- D. Keying System:
 - 1. Each type of lock and cylinders to be factory keyed:
 - a. Conduct specified Keying Conference to define and document keying system instructions and requirements.
 - b. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - c. Existing system: Key locks to Owner's existing system.
- E. Key Quantity:
 - 1. Provide the following minimum number of keys:

- a. Change keys per cylinder: Two (2).
- b. Master keys (per master key level/group): Five (5).
- c. Construction keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty) – ANSI A156.2, Series 4000, Grade 1 Certified:
1. Furnish with solid cast levers, standard 2-3/4-inch backset, and 1/2-inch (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 2. Locks are to be non-handed and fully field reversible.
 - a. Manufacturers: Sargent Manufacturing (SA) – 10 Line.

2.5 LOCK AND LATCH STRIKES

- A. Strikes:
1. Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - a. Flat-lip strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - b. Extra-long-lip strikes: For locks used on frames with applied wood casing trim.
 - c. Aluminum-frame strike box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - d. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards:
1. Comply with the following:
 - a. Strikes for Mortise Locks and Latches: ANSI A156.13.
 - b. Strikes for Bored Locks and Latches: ANSI A156.2.
 - c. Strikes for Auxiliary Deadlocks: ANSI A156.36.
 - d. Dustproof Strikes: ANSI A156.16.

2.6 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one (1) manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be UL listed for use of fire rated doors.
 3. Size of units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ICC A117.1.
 4. Closer arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers, and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty):
 - 1. ANSI A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard:
 - a. Manufacturers:
 - 1) LCN Closers (LC) - 4040 Series.
 - 2) Sargent Manufacturing (SA) - 351 Series.
 - 3) Norton Door Controls (NO) - 7500 Series.

2.7 DOORSTOPS AND HOLDERS

- A. General: Doorstops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Doorstops and Bumpers:
 - 1. ANSI A156.16, Grade 1 certified doorstops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of doorstops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders:
 - a. Manufacturers:
 - 1) Hiawatha, Inc. (HI).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Trimco (TC).
- C. Overhead Doorstops and Holders:
 - 1. ANSI A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm, and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function:
 - a. Manufacturers:
 - 1) Rixson Door Controls (RF).
 - 2) Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - 3) Sargent Manufacturing (SA).

2.8 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications, provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing:
 - 1. Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784:
 - a. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing:
 - 1. Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings

indicated, based on testing according to UL 10C:

- a. Provide intumescent seals as indicated to meet UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.9 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.10 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced, and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling, and access control system hardware without additional in-field modifications.

3.2 EXAMINATION

- A. Examine scheduled openings, with installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify Architect of any discrepancies or conflicts between the door schedule, door types, Drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.3 PREPARATION

- A. Wood Doors: Comply with ANSI A115.W series.

3.4 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications:
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including hanging devices, locking devices, closing devices, and seals.
- B. Mounting Heights:
 - 1. Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - a. Standard steel doors and frames: DHI 141 Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - b. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 Accessibility Guidelines for Buildings and Facilities.
 - c. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09: Finishes Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00: Joint Sealants.
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating, and adjusted.

3.6 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.7 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Owner occupancy.

3.8 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 4 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. See DSA approved plans 04-122304 pc for hardware schedule.

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- D. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

IVE	=	Ives	Hinges, Door Stops, Kick Plates & Silencers
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HW GROUP NO. 01

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 02

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948	626	SCH
1	EA	FSIC CORE	20-030 (FOR EXTERIOR NL TRIM)	626	SCH
1	EA	FSIC CORE	23-030 (FOR INTERIOR CYLINDER DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 03

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	20-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

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HW GROUP NO. 04

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 05

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 06

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

END OF SECTION 08 71 00



SECTION 10 21 13 TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Solid Color Reinforced Composite (SCRC) Substrate (Bobrick Sierra Series):
 - 1. Toilet partitions.
 - 2. Urinal privacy screens.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 09 30 00: Tiling.
 - 4. Section 10 28 13: Toilet Accessories.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00: Submittal Procedures.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
- C. Shop Drawings:
 - 1. Submit manufacturer's shop drawings for each product specified, including the following:
 - a. Plans, elevations, details of construction and attachment to adjacent construction.
 - b. Show anchorage locations and accessory items.
 - c. Verify dimensions with field measurements prior to final production of toilet compartments.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.
- F. Mock-Up:
 - 1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship:
 - a. Finish areas designated by Architect.
 - b. Do not proceed with remaining work until workmanship is approved by Architect.
 - c. Refinish mock-up area as required to produce acceptable work.

1.4 PERFORMANCE REQUIREMENTS

- A. Accessible Toilet Compartments:
1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be a minimum of 9 inches high above the finish floor, and a minimum of 6 inches deep beyond the compartment side face of the partition, exclusive of partition support members. It shall be a minimum of 12 inches high above the finish floor for children's use. Partition components at toe clearances shall be smoother without shop edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets total six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.
 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. See CBC Figure 11B-604.8.2.
 5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
 6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. See CBC Section 11B-604.8.2.2.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Accessibility Requirements - Comply with applicable requirements:
 - d. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
 - e. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 2. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
- B. Manufacturer Qualifications: Minimum 10 years' experience manufacturing similar products.
- C. Installer Qualifications: Minimum 2 years' experience installing similar products.
- D. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- E. Preinstallation Meeting:
1. Convene minimum two weeks prior to starting work of this section.

1.6 WARRANTY

- A. Manufacturer's Warranty (Sierra Series): Manufacturer's standard 25-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.



1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00: Product Requirements.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (BOBRICK SIERRA SERIES)

- A. Solid Color Reinforced Composite (SCRC) Toilet Partitions - Bobrick Sierra Series 1092G.67P:
 - 1. Design Type:
 - c. Standard Height.
 - 1) Door/Panel Height: 58 inches.
 - 2) Floor Clearance: 12 inches.
 - 2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches from the edge to allow for 0.175-inch overlap to prevent line-of-sight into the toilet compartment. Privacystrips fastened or adhered onto the partition material are not acceptable.
 - 3. Mounting:
 - a. Floor-Mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065-inch-thick with anti-grip profile:
 - 1) Stile Maximum Height: 83 inches.
- B. Solid Color Reinforced Composite (SCRC) Urinal Screens - Bobrick Sierra Series:
 - 1. Mounting Configuration:
 - a. Wall-Hung:
 - 1) Screen Height: 48 inches with 12 inches floor clearance.
- C. Materials:
 - 1. Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick Graffiti Off coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable:
 - a. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - b. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
 - c. Edges: Same color as the surface.
 - d. Color:
 - 1) SC04 Forest Green.
 - e. Acceptable SCRC Products:
 - 2) Ultimate Corian System by Shower Shapes.
 - 3) WilsonArt Gibraltar Material.



- 4) WilsonArt Earth Stone Material.
 - 5) Or manufacturer approved equal.
- D. Performance Requirements:
1. Graffiti Resistance (ASTM D6578): Passed cleanability test; 5 staining agents.
 2. Scratch Resistance (ASTM D2197): Maximum load value exceeds 10 kilograms.
 3. Impact Resistance (ASTM D2794): Maximum impact force exceeds 30 inch-pounds.
 4. Smoke Developed Index (ASTM E84): Less than 450.
 5. Flame Spread Index (ASTM E84): Less than 75.
 6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
 7. Uniform Building Code: Class II.
- E. Finished Thickness:
1. Stiles and Doors: 3/4 inch.
 2. Panels and Screens: 1/2 inch.
- F. Stiles:
1. Floor-Anchored stiles furnished with expansion shields and threaded rods:
 - a. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8-inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - b. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4-inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1-inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- G. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00: Metal Fabrications.
- H. Hardware:
1. Chrome-plated "Zamak", aluminum, extruded plastic hardware not acceptable:
 - a. Compliance: Operating force of less than 5 lb.
 - b. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - c. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - d. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 - e. Fastening:
 - 1) Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable:
 - a) Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb per insert.
 - f. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.
 - g. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16-gauge sliding door latch, 14-gauge keeper.
 - h. Locking: Door locked from inside by sliding door latch into keeper.
 - i. Hinge Type:
 - 1) Standard.
 - a) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - j. Mounting Brackets:



- 1) Full-Height:
 - a) Mounting Brackets: 18-gauge stainless steel and extend full height of panel.
 - b) U-Channels: Secure panels to stiles.
 - c) Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions:
 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

3.3 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

3.4 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 2. Verify location does not interfere with door swings or use of fixtures.
 3. Use fasteners and anchors suitable for substrate and project conditions.
 4. Install units rigid, straight, plumb, and level.
 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 6. Test for proper operation.

3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.



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- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10 21 13



SECTION 21 00 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wet-Pipe Fire Sprinkler System.
- B. System Design, Installation and Certification.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 28 31 00 – Fire Detection and Alarm.
- C. Section 21 00 01 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
- D. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- E. Divisions 22/ 23 – Plumbing/ Mechanical.
- F. Division 26 – Electrical.
- G. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association 2022.
- C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.
- D. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- E. ASTM B75 - Seamless Copper Tube.
- F. ASTM B88 - Seamless Copper Water Tube.
- G. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper Alloy Tube.
- H. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

1.4 SUBMITTALS



- A. See Division 01 for Administrative Requirements, for Submittal Procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings: Fire sprinkler system design is not a deferred submittal. The overall system design is approved by DSA. The overall system design is a directive for the installation of the system.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to the Architectural Team.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain PBK Architects approval prior to relocation of equipment and materials.
 - 5. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 6. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components, and accessories. Indicate system controls.
 - 7. Submit shop drawings to PBK Architects for approval prior to fabrication or installation.
 - 8. Installation is to conform to the DSA approved fire sprinkler plans.
 - 9. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
 - 10. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- D. Material Data: DSA Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to PBK Architects for review of project compliance. DSA approval must be obtained prior to installation. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.
- E. Substitutions:
 - 1. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project.
 - 2. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.
 - 3. Only one request for substitution will be considered for each item of equipment or material.
 - 4. Substitution requests shall include the following:
 - a. Reason for substitution request.
 - b. Complete submittal information.
- F. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.



- G. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- I. Maintenance Materials: Furnish the following for the Districts use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- J. Section 01 91 00 - Commissioning.

1.5 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL and FM requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years' experience. Installing company must have a valid State of California contractors' license with a C-16 classification.
- F. Equipment and Components: Provide products that bear UL and FM label or marking.
- G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2022 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
 - 1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
 - 2. Drawings, details, and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.
- C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits, and other components.
- D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply details shown on the fire sprinkler plans and



structural plans.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT DOCUMENTS INCLUDING APPROVED MATERIAL DATA.

2.1 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.
- B. Occupancy: Classroom: Light Hazard, Concession/Restroom: Light Hazard, Locker Room: Comply with NFPA 13, 2022. All storage rooms to have sprinklers spaced for ordinary hazard.
- C. Interface system with building fire and smoke alarm system.
- D. Provide fire department connections where indicated.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

2.2 SPRINKLERS

- A. Exposed Area Type: Upright.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Application: Areas with exposed construction and all spaces above ceiling.
- B. Finished Gypsum Board Ceilings and Suspended Ceilings: Semi-Recessed Pendent.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome sprinkler with White escutcheon.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.3 PIPING SPECIALTIES

- A. Zone Control Valves:
 - 1. Outside screw and yoke or butterfly, U.L. listed.
 - 2. Valves shall be sealed open using approved seal.
 - 3. Provide weatherproof actuator housing with two single pole double throw switches.
- B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.



- D. Fire Department Connections:
 - 1. Type: Free Standing with brass finish.
 - 2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
 - 3. Drain: 3/4 inch automatic drip, outside.
 - 4. Label: "Sprinkler - Fire Department Connection".

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standards, DSA requirements and DSA approved plans.
- B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other disciplines.
- C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic calculations, structural review or calculations, or seismic calculations, shall be submitted to PBK Architects for review prior to making changes.
- D. Install equipment in accordance with manufacturer's instructions.
- E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- F. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- G. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.
- H. Place pipe runs to minimize obstruction to other work.
- I. Place piping in concealed spaces above finished ceilings.
- J. Center sprinklers in two ft. direction in ceiling tile and provide piping offsets as required. Flex drops are not permitted.
- K. All pendent or horizontal sidewall sprinklers are to be installed on return bends
- L. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- M. Flush entire piping system of foreign matter.
- N. Install guards on sprinklers where subject to damage as in attic space where mechanical equipment is located and in mechanical room.
- O. Hydrostatically test entire system.
- P. Required test to be witnessed by IOR.



- Q. Verification of weld inspection required prior to installation of fire sprinkler system.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 00 00



SECTION 21 00 01 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 21 00 00 – Fire Suppression Sprinkler Systems: Sprinkler systems design.
- C. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- D. Divisions 22/ 23 – Plumbing/ Mechanical.
- E. Division 26 – Electrical.
- F. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.
- D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers.
- E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers.
- F. ASTM A 47/ A 47M - Standard Specification for Ferritic Malleable Iron Castings.
- G. ASTM A 53/ A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- H. ASTM A 795/ A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- I. AWWA C110/ A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association.
- J. AWWA C111/ A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/ AWWA C111/ A21.11).



- K. AWWA C151/ A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association (ANSI/ AWWA C151/ A21.51).
- L. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2022.
- M. NFPA 14 - Standpipe and Hose Systems.
- N. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.
- O. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.
- P. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, seismic restraints and calculations, and piping connections.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
 - 5. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 - 6. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work or work directly connected to same are installed and providing no additional material is required.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- F. Section 01 91 00 - Commissioning.



1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience.
- D. Conform to UL and FM requirements.
- E. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform work to NFPA 13 and DSA requirements.
- B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black, or as approved by DSA:
 - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
 - a. Schedule 10 Pipe: Shall be U.L. approved with U.L. approved grooved fittings and couplings for pipe sizes 2-1/2" and larger only. Schedule 10 pipe shall not be used for pipe sizes less than 2-1/2". Threaded fittings shall not be used for any Schedule 10 pipe.
 - 2. Cast Iron Fittings: ASME B16.1, flanges, and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings, and ASTM A 47/ A 47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical formed fittings, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.
- B. Cast Iron Pipe: AWWA C151/ A21.51.



1. Fittings: AWWA C110/ A21.10, standard thickness.
2. Joints: AWWA C111, rubber gasket.
3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 inch and Over: Carbon steel, adjustable, split ring, galvanized.
- B. Vertical Support: Steel riser clamp.
- C. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 GATE VALVES

- A. Up to and including 2 inches:
 1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged ends.
- C. Over 4 inches:
 1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.5 GLOBE OR ANGLE VALVES

- A. Up to and including 2 inches:
 1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- B. Over 2 inches:
 1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat, and disc.

2.6 BALL VALVES

- A. Up to and including 2 inches:
 1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

2.7 BUTTERFLY VALVES

- A. Cast or Ductile Iron Body:
 1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.8 CHECK VALVES



- A. Up to and including 2 inches:
 - 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches and less than 4 inches:
 - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
 - 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- H. Slope piping and arrange systems to drain at low points.
- I. Prepare pipe, fittings, supports, and accessories for finish painting.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.



- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- N. Provide gate valves for shut-off or isolating service.
- O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 21 00 01



SECTION 21 00 02 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 General Requirements apply to this section.
- B. Section 09 90 00 – Painting and Coating.

1.3 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

- A. See Section 01 33 00 – Submittals Procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.
- F. Section 01 91 00 - Commissioning.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc.: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.



2. Letter Height: Equipment, control panels, 1 inch.
3. Letter Height: Controls and small components, 1/4 inch.
4. Background Color: Black.

2.3 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify valves in main and branch piping with tags.
- G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 21 00 02



SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
 - 1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 - 2. California Building Code – CBC.
 - 3. California Mechanical Code – CMC.
 - 4. California Plumbing Code – CPC.
 - 5. California Fire Code – CFC.
 - 6. California Green Building Code.
 - 7. Air Diffusion Council – ADC.
 - 8. American Gas Association – AGA.
 - 9. Air Moving and Conditioning Association – AMCA.
 - 10. American National Standards Institute – ANSI.
 - 11. Air Conditioning and Refrigeration Institute – ARI.
 - 12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 - 13. American Society of Mechanical Engineers – ASME.
 - 14. American Society for Testing and Materials – ASTM.
 - 15. American Water Works Association – AWWA.
 - 16. California Electrical Code – CEC.
 - 17. National Electrical Manufacturers Association – NEMA.
 - 18. National Fire Protection Association – NFPA.
 - 19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 - 20. Underwriters' Laboratory – UL.
 - 21. Occupational Safety and Health Act - OSHA.
 - 22. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK



- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and



modifications to the work caused by these items.

- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. (These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up



prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.4 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.
- D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.5 EQUIPMENT SUPPORT FRAMES



- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.

3.3 EXCAVATION AND BACKFILL

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and



compaction requirements.

- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

- A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00



SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. System insulation.
 - 4. Controls and control wiring and conduit for control wiring.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- D. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp or equal.
- E. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.
- F. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

- G. Duct Joints:
 - 1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.
- H. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

2.2 AIR TERMINALS AND DUCT FITTINGS

- A. Grilles: (Grilles, Registers and Diffusers)
 - 1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
 - 2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
 - 3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
 - 4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

2.3 DUCTWORK INSULATION MATERIALS

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at



a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.

- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 EQUIPMENT

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 - 3. Ratings:
 - a. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 - 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.

- e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
- f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
- 6. Fan Selection:
 - a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
- 7. Filters:
 - a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
- 8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
- 9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
- 10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
- B. Exhaust Fans:
 - 1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
 - 2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME,

- Greenheck or equal.
3. Roof Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Down blast type UL listed. Cook, Greenheck, Penn, ACME or equal.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

- A. General:
 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
 2. Seismic bracing: All ducts shall be braced and supported per details on the drawings.
 3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
 4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
 5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
 6. Open ends of ductwork shall be covered during construction to keep inside clean.
- B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):
 1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
 - 1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 - e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
 - f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
 2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on



drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

- B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.
- C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 EQUIPMENT INSTALLATION

- A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.5 TEMPERATURE CONTROL SYSTEM

- A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.6 SYSTEM AIR BALANCE

- A. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.



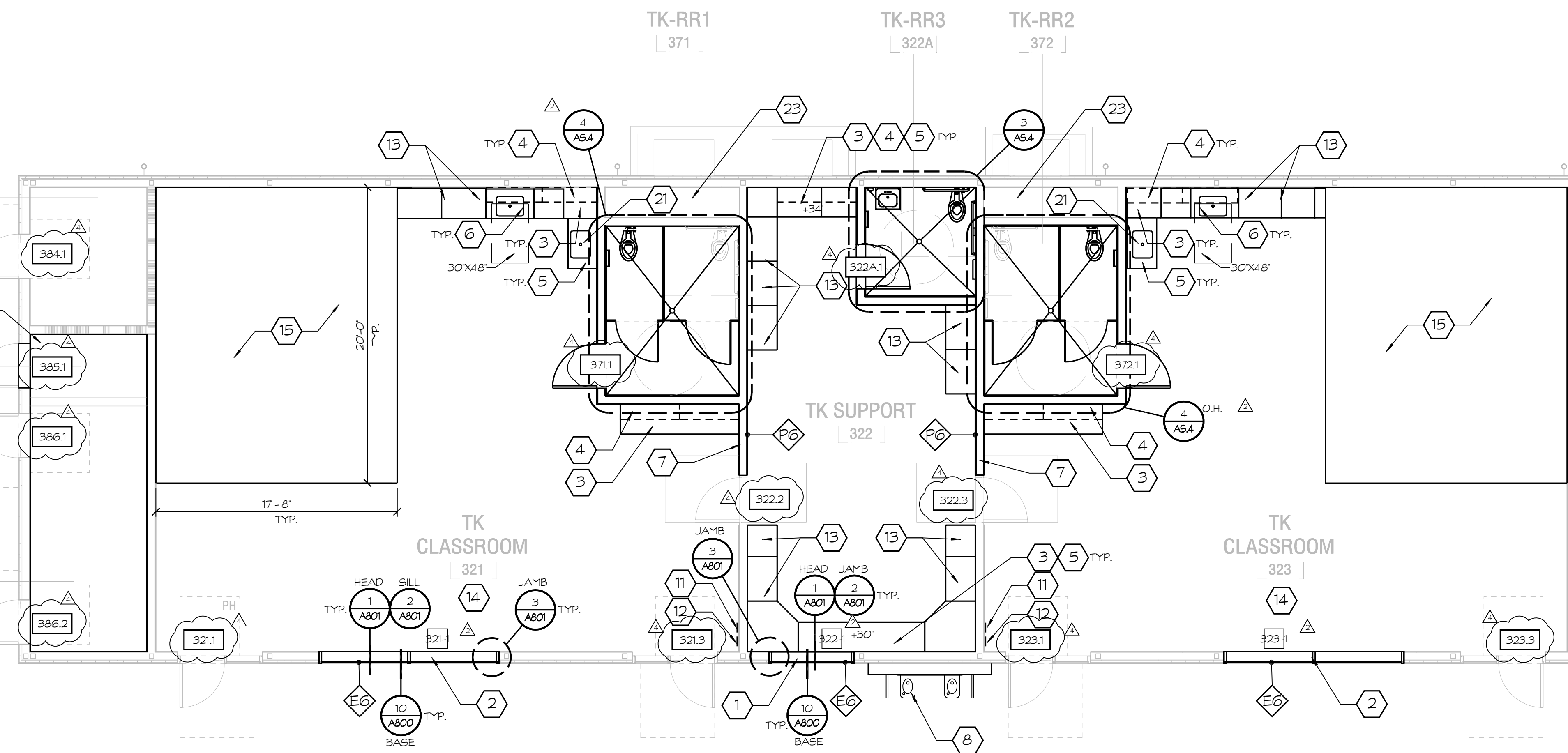
- B. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.
- C. As a part of the work of this contract, THIS DIVISION shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.

END OF SECTION 23 00 01

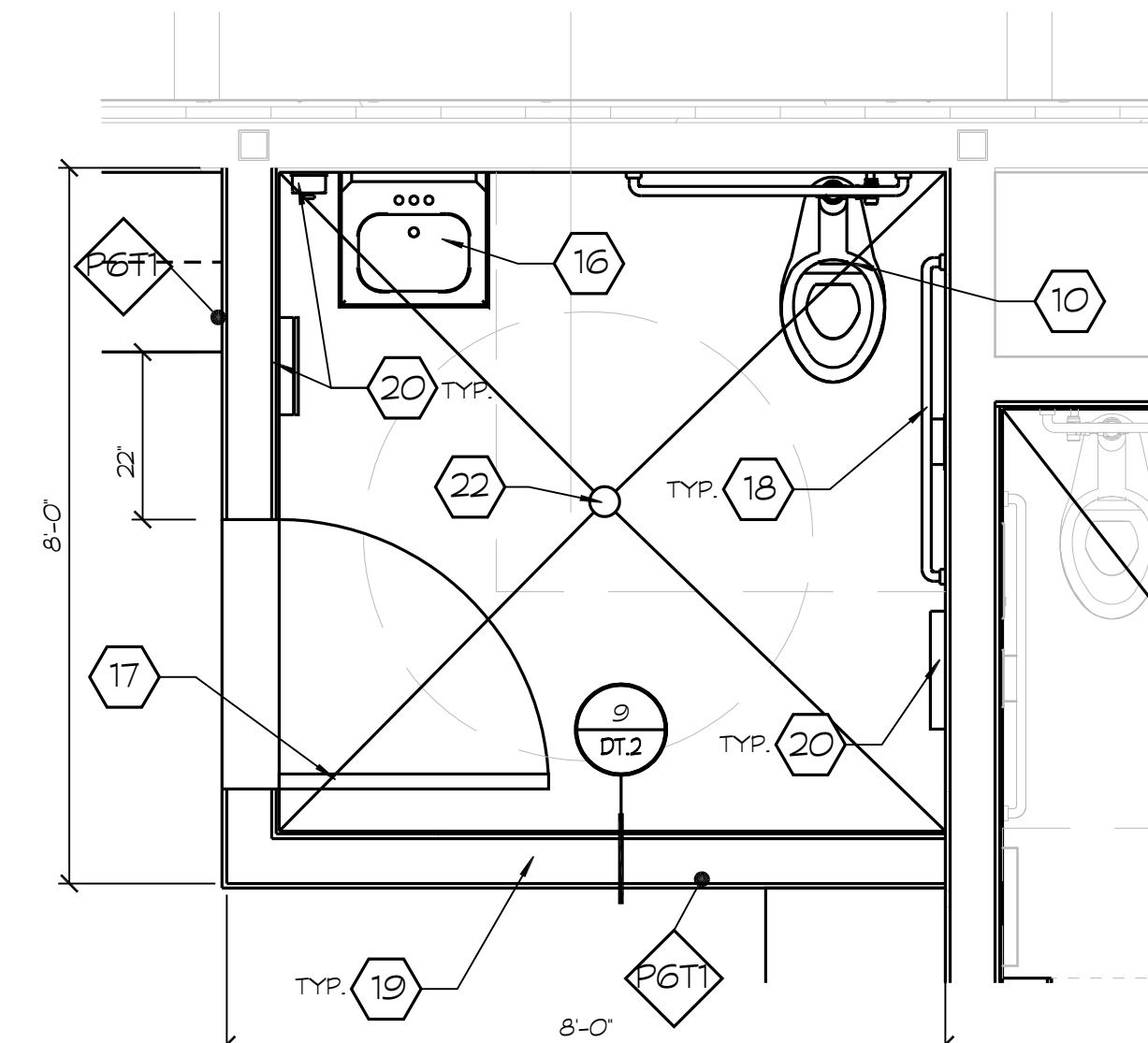
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ROOM
384

SEE DETAIL 9/A703 FOR
FIRE RISER SIGNAGE
F.S.R ROOM
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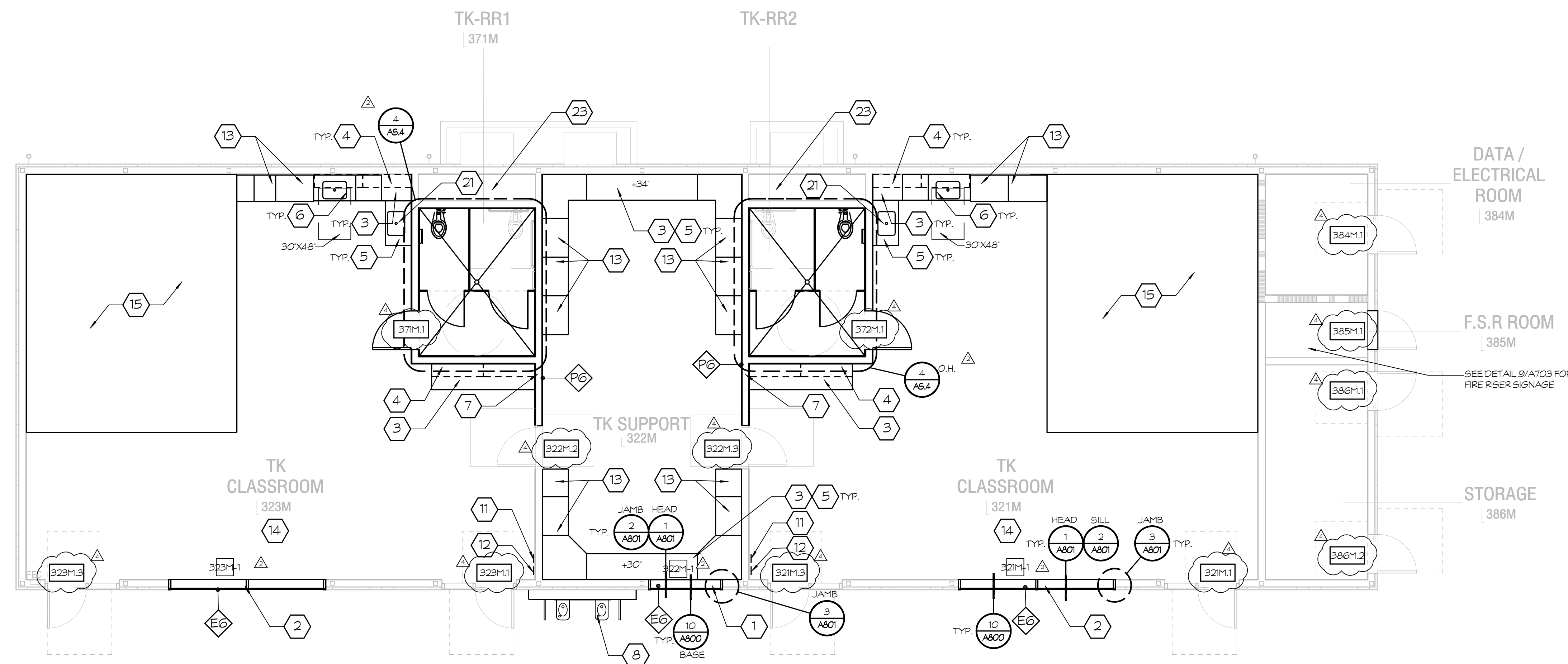
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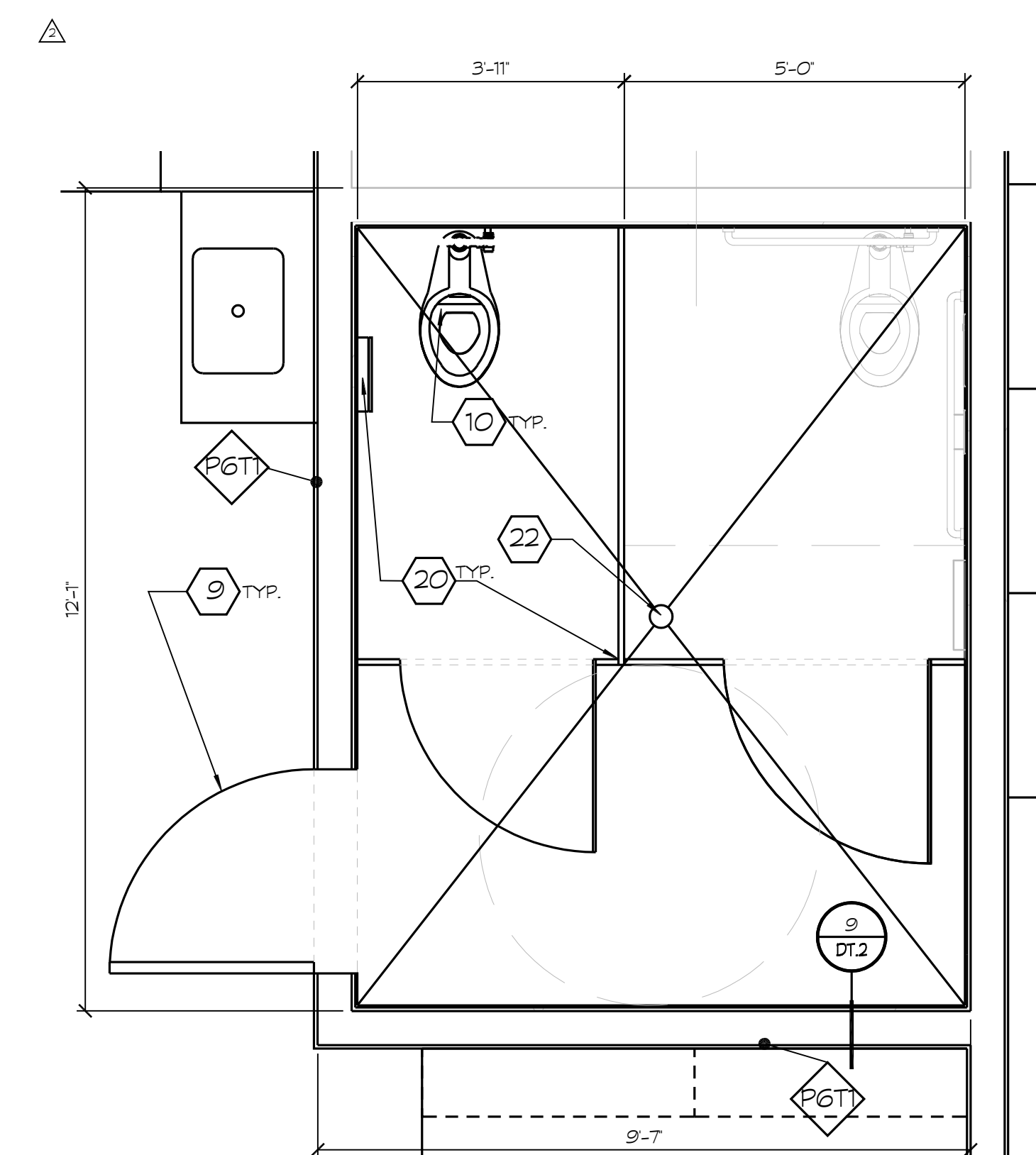
FLOOR PLAN
BUILDING 'A' TK-2 CLASSROOM 04-122304 PC SCALE: 3/16" = 1'-0"



ENLARGE RESTROOM PLAN
TK-2 CLASSROOM 04-122304 PC SCALE: 1/2" = 1'-0"



FLOOR PLAN
BUILDING 'B' TK-2 CLASSROOM MIRROR 04-122304 PC SCALE: 3/16" = 1'-0"



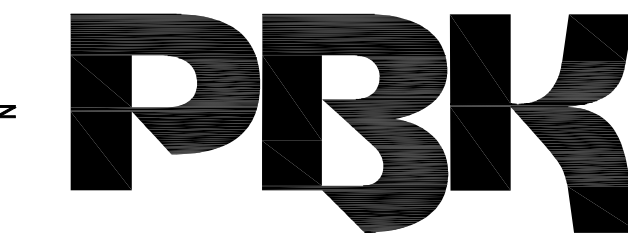
ENLARGE RESTROOM PLAN
TK-2 CLASSROOM & MIRROR 04-122304 PC SCALE: 1/2" = 1'-0"

GENERAL NOTES

- RELOCATE RETURN AIR VENTS TO NEW LOCATION SEE INTERIOR ELEVATIONS.
- GENERAL CONTRACTOR TO REFER TO PC SET 04-122304 FOR ALL CONSTRUCTION DOCUMENT.
- FOR WALL TYPES SEE PC SET 04-122304 SHEET A800.
- FOR DOOR HARDWARE SEE PC SET 04-122304 SHEET A700.
- REFER TO FLOOR PLANS PC SET 04-122304 SHEET A205 AND A205M FOR MORE INFORMATION.
- SEE PC SET 04-122304 FOR ALL DETAILS U.O.N.
- SEE PC SET 04-122304 FOR SIGNAGE DETAILS ON A703

KEYNOTES

- INFILL DOOR OPENING WITH METAL FRAMING WITH NEW WINDOW SYSTEM. SEE DETAILS 1.2 & 3 ON SHEET A801.
- INFILL ROLL UP DOOR OPENING WITH METAL FRAMING AND NEW WINDOW SYSTEM. SEE DETAILS 1.2 & 3 ON SHEET A801.
- NEW LOWER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2.
- NEW UPPER CASE WORK WITH LOCKS. SEE DETAIL 1/DT.2.
- NEW COUNTER TOP. SEE DETAIL 1/DT.2.
- NEW ADA SINK. SEE DETAIL 6/DT.2.
- NEW METAL FRAMING INFILL. SEE DETAIL 9/DT.2.
- NEW DRINKING FOUNTAIN. SEE DETAIL 7/DT.2.
- NEW 3'-0" X 7'-0" DUTCH DOOR. MATCH FINISH FROM 04-122304 PC. SEE ANCHORAGE DETAIL 6/A803 ON 04-122304 PLANS.
- NEW WATER CLOSET AND ACCESSORIES CONNECT WATER AND SEWER WITH 04-122304 PC PLANS.
- ASSISTED LISTENING SYSTEM SIGN. SEE DETAIL 3/A703.
- OCCUPANT LOAD SIGN. SEE DETAIL 4/A703.
- NEW CASEWORK. SEE DETAIL 1/DT.2.
- CONCRETE POLISH FLOOR.
- NEW CARPET AREA.
- NEW ADA LAVATORY.
- NEW 3' X 7' H.M. DOOR AND FRAME. SEE DETAIL 6/A803 & 1/A801.
- NEW ADA GRAB BARS. SEE DETAIL 3/A802.
- NEW METAL FRAMING AND FINISHES. SEE DETAIL 9/DT.2.
- TOILET ACCESSORIES.
- NEW SINK FOR KINDERGARTEN.
- NEW FLOOR DRAIN LOCATION.
- PLUMBING WALLS CAVITIES TO BE FILLED WITH NON-COMBUSTIBLE INSULATION.

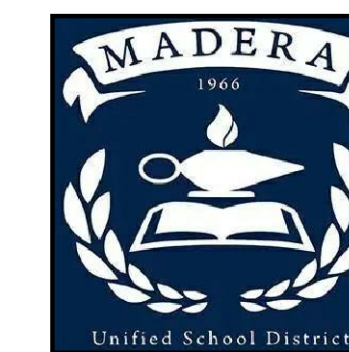


ARCHITECT PBK Architects, Inc.
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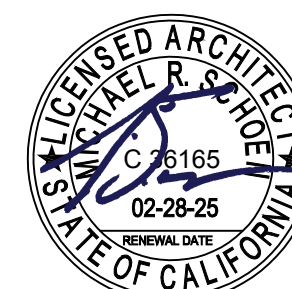
Virginia Lee Rose Elementary School

1001 Lily St.
Madera, CA 93638

STATUS



PROFESSIONAL SEAL



PROJECT NUMBER

220488

DATE

7/3/2023

DSA APPLICATION NO.

02-121588

FILE NO.

20-30

PTN NO.

65243-142

DRAWN BY

Author

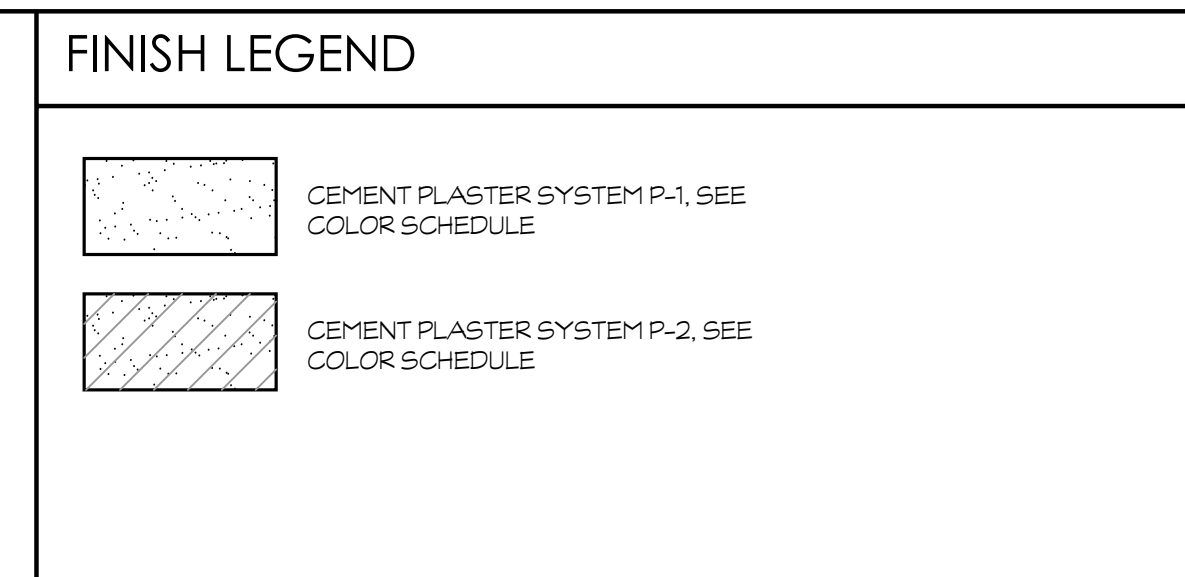
REVISIONS

#	DESCRIPTION	DATE
2	ADDENDUM	7/25/24
4	ADDENDUM	8/09/24

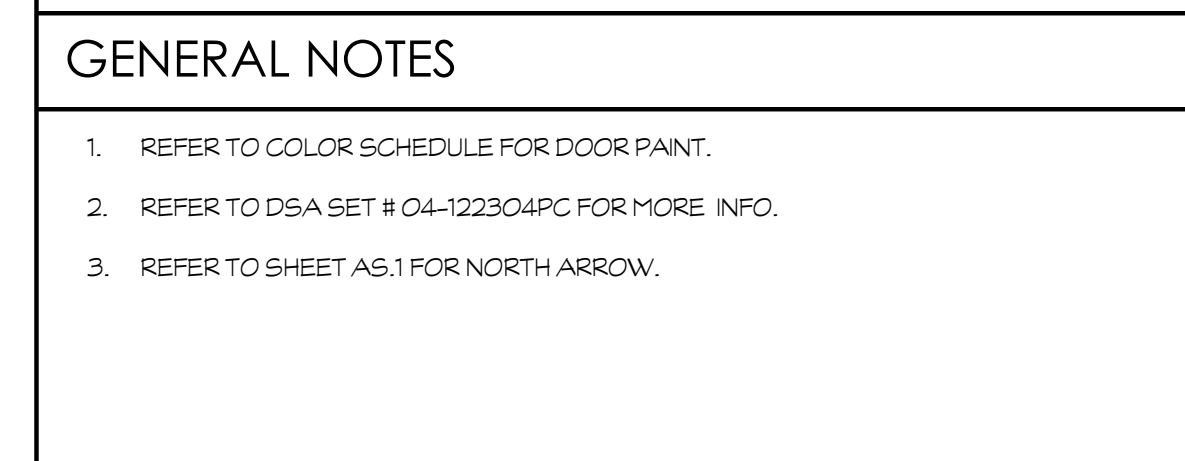
STATUS

FLOOR
PLAN

AS.4



TK-2M BUILDING 'B' SCALE 3/16" = 1'-0"




TK-2M BUILDING 'B' SCALE 3/16" = 1'-0"

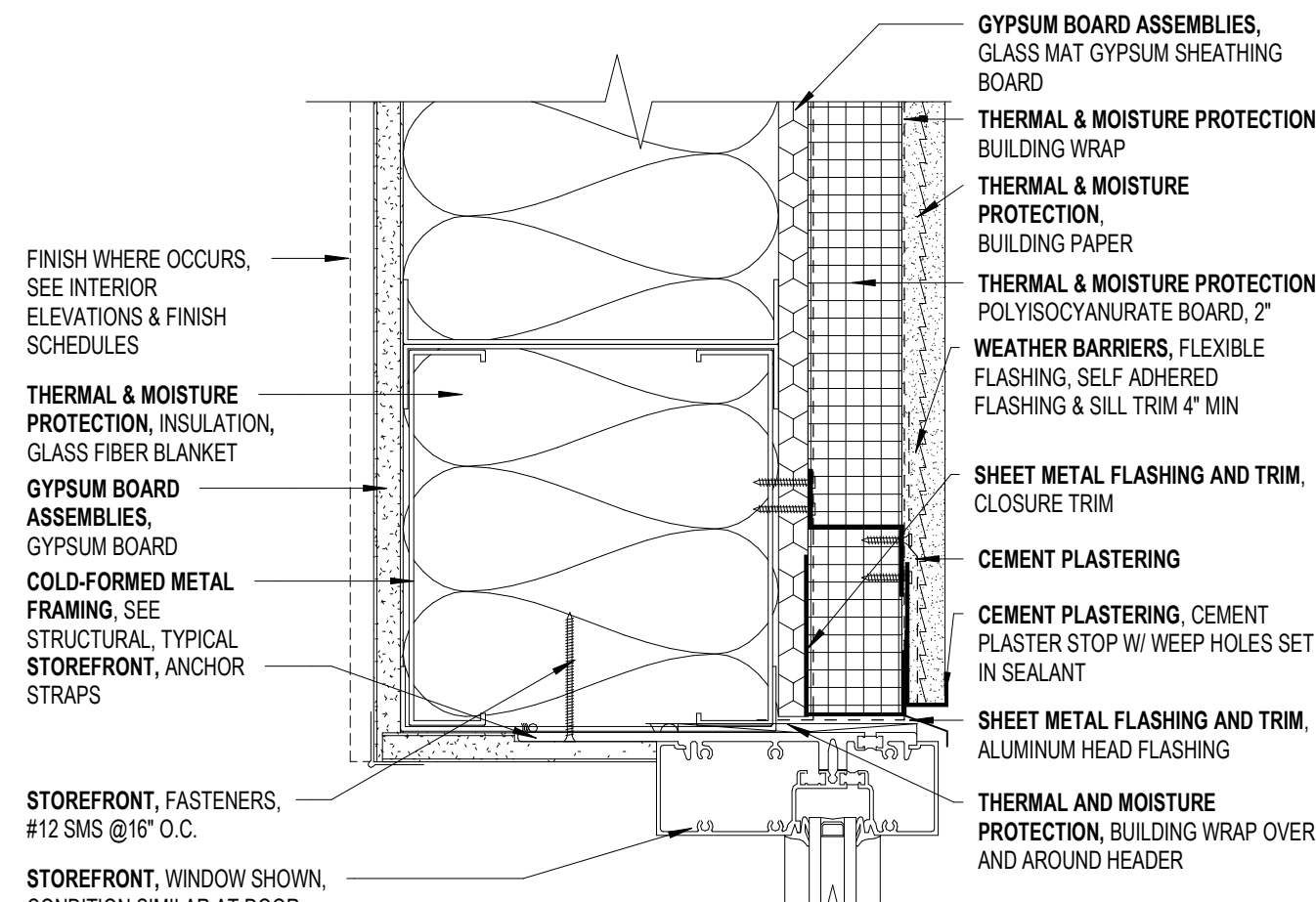


TK-2M BUILDING 'B' SCALE 1/8" = 1'-0"

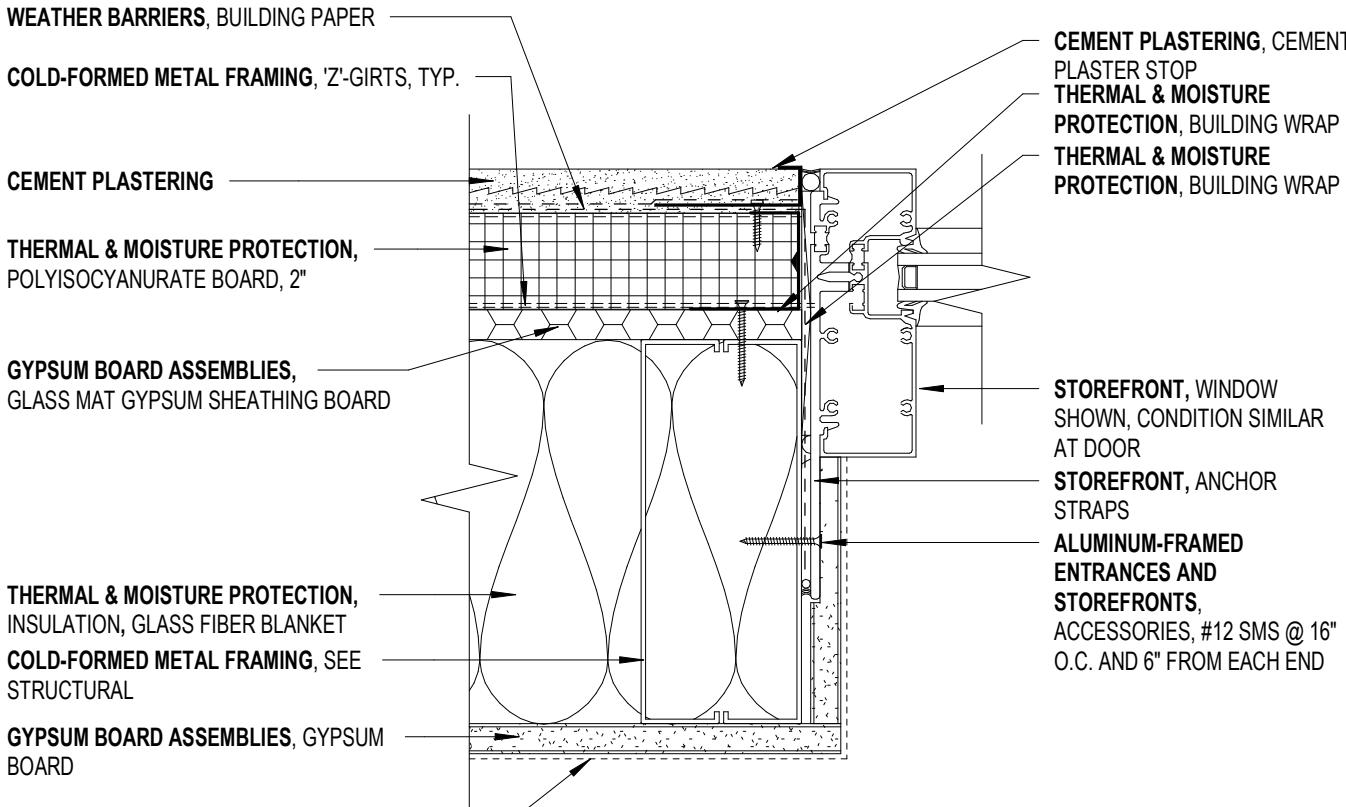


TK-2M BUILDING 'B' SCALE 1/8" = 1'-0"

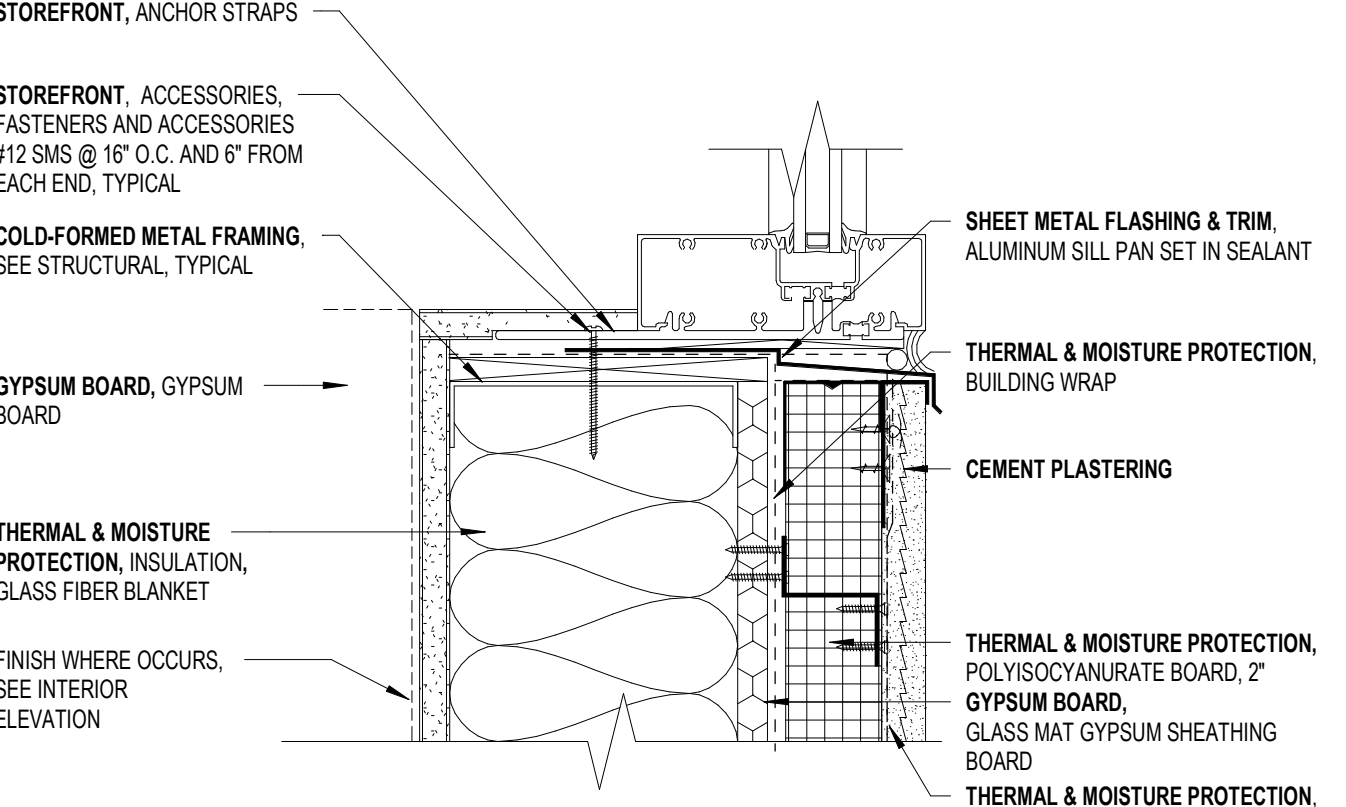
ARCHITECT	PBK Architects, Inc. FRESNO 7790 North Palm Avenue Fresno, CA 93711 559-446-8400 P 559-446-8467 F PBK.com	
Virginia Lee Rose Elementary School		
STATUS		
<div style="float: left; width: 40%;">1001 Lilly St. Madera, CA 93638</div> <div style="clear: both;"></div> 		
PROFESSIONAL SEAL		
		
PROJECT NUMBER 220488		
DATE 7/3/2023		
DSA APPLICATION NO. 02-121588		
FILE NO. 20-30		
PTN NO. 65243-142		
DRAWN BY Author		
REVISONS		
#	DESCRIPTION	DATE
4	ADDENDUM	8/09/24
STATUS		
EXTERIOR ELEVATIONS		
AS.10		



1 ALUMINUM STOREFRONT HEAD @ CP
SCALE: 3" = 1'-0"

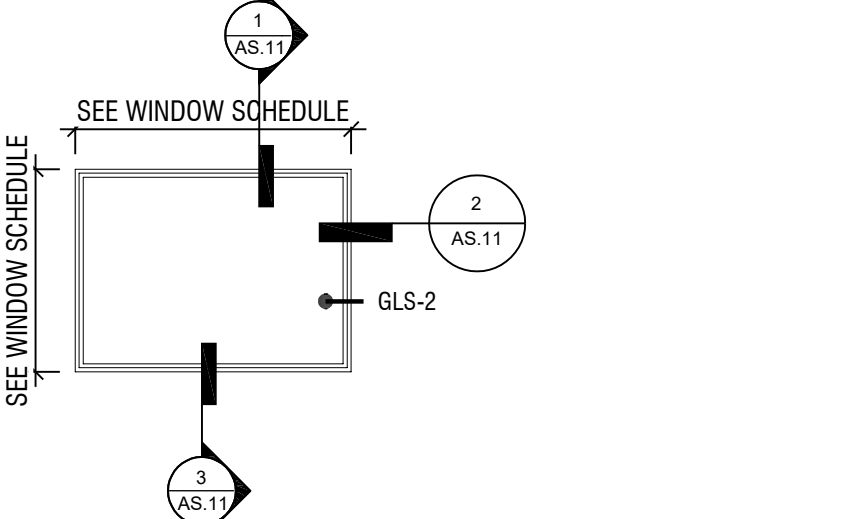
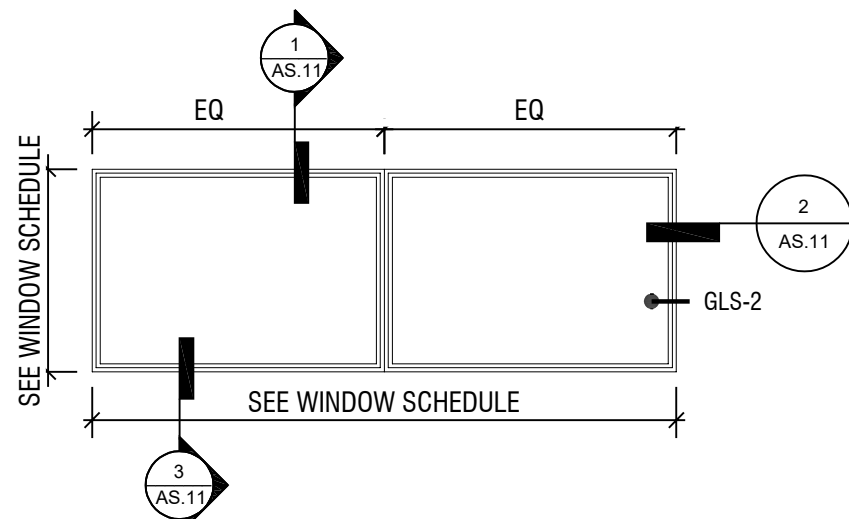


2 ALUMINUM STOREFRONT JAMB @ CP
SCALE: 3" = 1'-0"



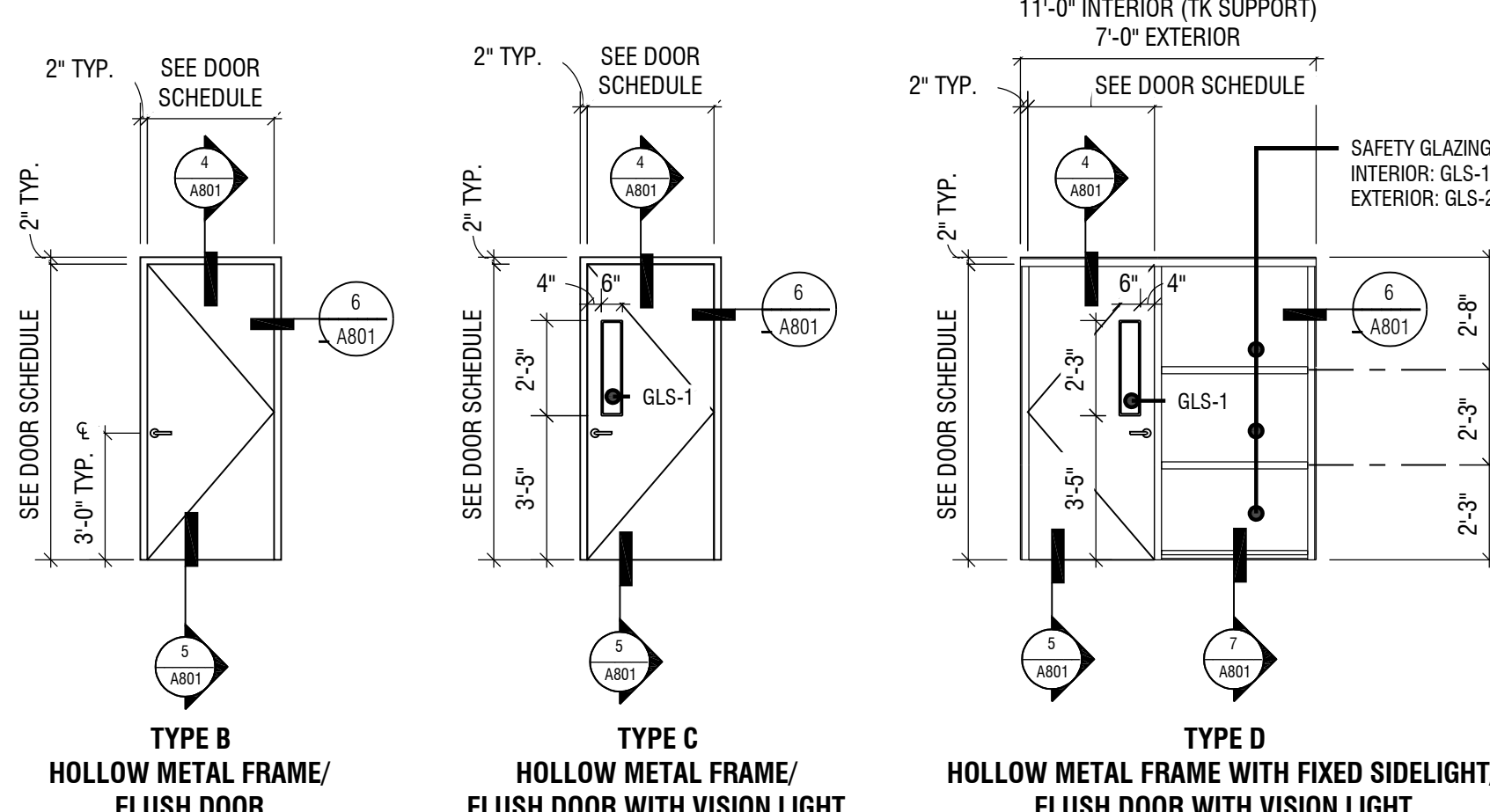
3 ALUMINUM STOREFRONT SILL @ CP
SCALE: 3" = 1'-0"

WINDOW SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING											
BUILDING ID	WINDOW ID	WINDOW DIMENSION		GLAZING	WINDOW/FRAME TYPE	FRAME FINISH	FIRE RATED	DETAILS (SEE SHEET A801)		REMARKS	
		WIDTH	HEIGHT								
TK-2 - B	321M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	
	322M-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	
TK-2 - B	323M-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	
	321-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	
TK-2 - A	322-1	9'-9"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	
	323-1	12'-2"	4'-3"	GLS-2	AL	FF	NONE	1,2,3	4"	DEPTH WINDOWS	



DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN BUILDING											
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE		
		WIDTH	HEIGHT								
TK-2	321.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes		
	321.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
TK-2	322.2	3'-0"	7'-0"	WOOD	D	HM	04				
	322.3	3'-0"	7'-0"	WOOD	D	HM	04				
TK-2	322A.1	3'-0"	7'-0"	WOOD	D	HM	06				
	323.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
TK-2	323.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
	371.1	3'-0"	7'-0"	WOOD	B	HM	05				
TK-2	372.1	3'-0"	7'-0"	WOOD	B	HM	05				
	384.1	3'-0"	7'-0"	HM	B	HM	03				
TK-2	385.1	3'-0"	7'-0"	HM	B	HM	03				
	386.1	3'-0"	7'-0"	HM	B	HM	03				
TK-2	386.2	3'-0"	7'-0"	HM	B	HM	03				

DOOR SCHEDULE - 2-TRANSITIONAL KINDERGARTEN (MIRRORED) BUILDING											
BUILDING TYPE	DOOR ID	DOOR		DOOR MATERIAL	DOOR/FRAME TYPE	FRAME MATERIAL	HARDWARE SET	PANIC HARDWARE	SECURITY HARDWARE		
		WIDTH	HEIGHT								
TK-2 - MRR	321M.1	3'-0"	7'-0"	HM	D	HM	02	Yes	Yes		
	321M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
TK-2 - MRR	322M.2	3'-0"	7'-0"	WOOD	D	HM	04				
	322M.3	3'-0"	7'-0"	WOOD	D	HM	04				
TK-2 - MRR	323M.1	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
	323M.3	3'-0"	7'-0"	HM	D	HM	01	Yes	Yes		
TK-2 - MRR	371M.1	3'-0"	7'-0"	WOOD	B	HM	05				
	372M.1	3'-0"	7'-0"	WOOD	B	HM	05				
TK-2 - MRR	384M.1	3'-0"	7'-0"	HM	B	HM	03				
	385M.1	3'-0"	7'-0"	HM	B	HM	03				
TK-2 - MRR	386M.1	3'-0"	7'-0"	HM	B	HM	03				
	386M.2	3'-0"	7'-0"	HM	B	HM	03				



WINDOW EFFICIENCY VALUES
FOR SITE-BUILT
FENESTRATION
BASED ON IAB ALTERNATE
DEFAULT FENESTRATION
PROCEDURE TO CALCULATE
THERMAL PERFORMANCE

	TYPE A	TYPE D
U _t	= 0.55	0.55
SHGC _t	= 0.31	0.31
VT _t	= 0.88	0.77

DOOR GENERAL NOTES

- CONTRACTOR TO COORDINATE EXACT SIZE OF DOOR WITH MANUFACTURER
- INSTALL STOREFRONT MULLIONS AND HOLLOW METAL FRAMES WITH 1/4 INCH SHIM AND JOINT SEALANT AROUND PERIMETER OF FRAME
- PROVIDE HEAD RECEIVERS AT ALUM. STOREFRONTS AS REQUIRED FOR STRUCTURAL AND FRAME DEFLECTION
- JAMBS SHALL MAINTAIN 6 INCH MIN. FROM ADJACENT WALLS AND PARTITIONS U.N.O
- WHERE REQUIRED, EXIT DEVICES (PANIC HARDWARE), SHALL BE INSTALLED WITH ACTIVATING MEMBER CENTERED AT A HEIGHT OF NO LESS THAN 34 INCH OR MORE THAN 44 INCH ABOVE THE FLOOR. PER CBC 11B-404.2.7 AND 11B-309.4
- PANIC HARDWARE IS REQUIRED FROM ROOMS AND CORRIDORS OF E OCCUPANCY WHERE OCCUPANT LOAD EXCEEDS 49
- PRESSURE TO OPERATE DOORS SHALL NOT EXCEED 5 POUNDS FOR EXTERIOR AND INTERIOR DOORS AND 15 POUNDS FOR FIRE DOORS. PER CBC 11B-404.2.9
- ALL OPERATING DOOR HARDWARE SHALL COMPLY WITH THE REQUIREMENTS IN CBC 11B-404.2.7, 1008.1.0 AND 11B-309.4 AND SHALL NOT REQUIRE MORE THAN 5 POUNDS OF FORCE
- THRESHOLDS SHALL COMPLY WITH CBC 11B-404.2.5 AND SHALL BE 1/2" MAX IN HEIGHT AND BEVELLED 1:2
- DOOR AND GATE CLOSERS SHALL BE ADJUSTED TO FORM AN OPEN POSITION OF 12 DEGREES FROM THE LATCH IN 5 SECONDS MINIMUM. PER CBC 11B-404.2.8.1
- SEE GENERAL SHEETS FOR DOOR SIGNAGE INFORMATION AND DETAILS ON SIGNS ON DOORS AND SIGNS RELATED TO EXIT AND ENTRANCE
- NEW BUILDINGS SERVING ANY EDUCATIONAL OCCUPANCY SHALL INCLUDE LOCKS THAT ALLOW DOORS TO CLASSROOM AND ANY OCCUPIED ROOM TO BE LOCKED FROM THE INSIDE PER CBC 1010.2.8

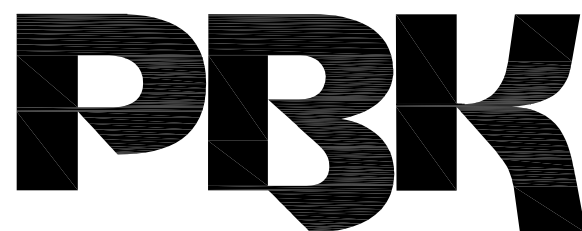
GLAZING NOTES AND SCHEDULE

NOTES:

- GLAZING SHALL MEET THE MINIMUM FRAME LAP AND GLASS EDGE CLEARANCE PER CBC 2403.2.1 PROVIDE CONTINUOUS GLAZING RABBET AND GLASS RETAINER
- NFRC COMPLIANCE: COMPLETE SITE-BUILT ASSEMBLIES SHALL CONFORM TO NFRC REQUIREMENTS AND TESTED AND LABELED TESTED IN ACCORDANCE WITH THAT STANDARD
- NFRC LABELS SHALL REMAIN ON WINDOWS FOR VERIFICATION BY INSPECTOR
- SAFETY GLAZING SHALL BE PROVIDED WHERE REQUIRED PER CBC 2406

SCHEDULE:

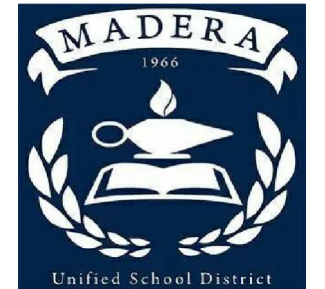
- GLS-1: MONOLITHIC VISION GLASS, CLEAR, 1/4 INCH THICK, TEMPERED
- GLS-2, GLS-2A: INSULATED GLASS UNIT (IGU):
 - GLASS SPEC. SOLARBAN 70
 - A. OVERALL THICKNESS: 1 INCH
 - B. ASSEMBLY: 1/4" GLASS ON EITHER SIDE + 1/2" AIR
 - C. SPACER: ALUM., BLACK
 - D. INNER AND OUTER LIGHTS: GLS-1
 - E. NO.2 SURFACE: LOW-E COATING
 - F. NO.3 SURFACE (GLS-2A ONLY): TRANSLUCENT COATING
- MINIMUM PERFORMANCE REQUIREMENTS FOR GLASS:
 - 1. THERMAL TRANSMITTANCE, WINTER - CENTER OF GLASS: 0.29, NOMINAL
 - 2. VISIBLE LIGHT TRANSMITTANCE: 70%, NOMINAL
 - 3. SOLAR HEAT GAIN COEFFICIENT: 0.39, NOMINAL
 - 4. VISIBLE LIGHT REFLECTANCE, OUTSIDE: 11%, NOMINAL



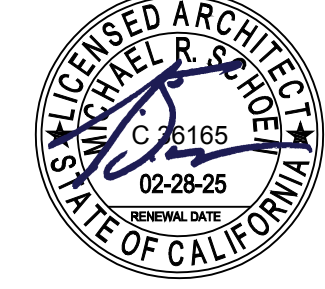
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PROJECT NUMBER
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Author

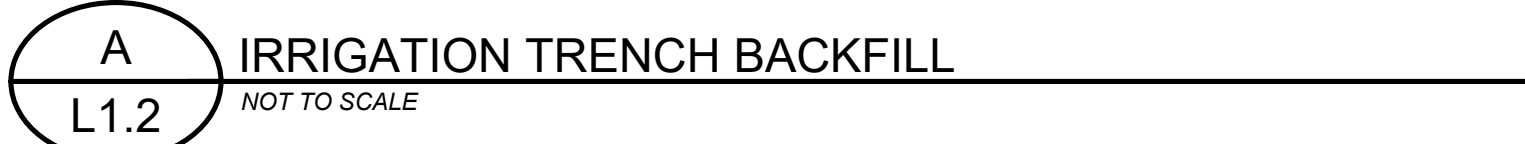
REVISIONS

#	DESCRIPTION	DATE
2	ADDENDUM	7/25/24
4	ADDENDUM	8/09/24

STATUS

DOOR
HARDWARE

AS.11



PIPE DIAMETER	≤4"	6"	8"	10"	12"
CROSS, TEE, 90° BEND, FLUG, FIRE HYDRANT	1	3	5	8	11
45° BEND	1	2	3	4	6
22-1/2" BEND	0.5	1	2	2	3
11-1/4" BEND	0	0	1	1	2
GATE VALVE (IN-LINE)	0	1	2.5	4	9



NOTE: SLEEVE FOR PIPE IS 2X THE PIPE DIAMETER



- [illegible]



0 CONTROL WIRE
L1.2 NOT TO SCALE

11

L1.2



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PRE-BID REQUEST FOR INFORMATION LOG

ARCHITECT'S PROJECT NO: **220485, 220487, 220488**

UNIVERSAL TRANSITIONAL

PROJECT NAME: **KINDERGARTEN ALPHA, JOHN
PERSHING, VIRGINIA LEE ROSE
ELEMENTARY SCHOOL**

CONTRACTOR:

DSA File No: **20-30**

DSA App No: **02-121585, 02-121586, 02-121588**

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNE D	RESOLVED IN ADDENDUM #
1		COULD YOU TELL ME IF THIS BID IS FOR THE MANUFACTURING OF NEW MODULAR TK BUILDINGS? OR COULD YOU CLARIFY THE SCOPE OF WORK?	ERICKA WALKER, GVDI	SCOPE OF WORK: THIS PROJECT INCLUDES THE ERECTION OF KIT OF PARTS (EXTERIOR SHELL OF PRE-PURCHASED METAL BUILDING) SUPPLIED BY THE KYA GROUP. ALL ASSOCIATED SITE WORK, UTILITIES, AND TENANT IMPROVEMENTS THAT ARE NECESSARY FOR A COMPLETE CLASSROOM BUILDING.				1
2		1. IS THIS PROJECT FOR SITEWORK ONLY? 2. HAS THE DISTRICT ALREADY CONTRACTED FOR THE BUILDINGS ON THIS PROJECT? IF SO, WAS IT THROUGH A CMAS PROJECT OR WILL IT BE FORMALLY BID AS A SEPARATE COMPONENT? 3. IS THE DSA APPROVAL ON THE PLANS FOR INCREMENT 1 SITEWORK ONLY? OR ARE THE BUILDINGS DSA APPROVED AS WELL?	MEEHLEIS MODULAR	1. RESPONSE: NO, THE SCOPE OF WORK INCLUDES THE ERECTION OF A PRE-APPROVED STEEL BUILDING (SUPPLIED BY A SEPARATE VENDOR AS A KIT OF PARTS), ALL TENANT IMPROVEMENTS INCLUDING INTERIOR AND EXTERIOR FINISHES, ALL SITE WORK AND UTILITIES ASSOCIATED WITH THE CONSTRUCTION OF THE NEW BUILDINGS. 2. RESPONSE: THROUGH A CMAS CONTRACT, THE DISTRICT HAS PURCHASED A KIT OF PARTS TO BE ERECTED UNDER THE SCOPE OF WORK INCLUDED IN THIS PROJECT. PLEASE SEE THE KIT OF PARTS MATRIX ATTACHED TO THE NOTICE TO BIDDERS. 3. RESPONSE: THE BUILDINGS AND SITE WORK ARE BOTH APPROVED THROUGH DSA AS A COMPLETE PROJECT WITH A DISTINCT DSA APPLICATION NUMBER.				1/2/00
3		CAN THE DISTRICT PLEASE PROVIDE MANUFACTURER AND MODEL INFORMATION, AS WELL AS PHOTOGRAPHIC EVIDENCE OF AVAILABLE BREAKER SPACE ON PANEL MSB AT ALPHA ES, PANEL DP AT PERSHING ES, AND PANEL PSL AT ROSE ES? THIS IS NECESSARY INFORMATION FOR PROCUREMENT OF NEW BREAKERS TO BE INSTALLED.	INDUSTRIAL ELECTRICAL	ALPHA - SIEMENS, SEE ATTACHED PHOTOS. PERSHING - SQUARE D, SEE ATTACHED PHOTOS. VIRGINIA LEE ROSE - GE, SEE ATTACHED PHOTOS				1/2/00
4		ITEMS 1 AND 2 SPECIFICALLY STATE DSA INSPECTIONS ARE PROVIDED BY THE OWNER, HOWEVER 3 AND 7 DO NOT SPECIFY WHO PROVIDES THIS. PLEASE CLARIFY.	DIEDE CONSTRUCTION	LINE ITEMS 3 AND 7 UNDER ADMINSTRATIVE REQUIREMENTS ARE PROVIDED BY THE OWNER, HOWEVER THE CONTRACTOR WILL BE RESPONSIBLE FOR COSTS ASSOCIATED WITH RETESTING AS A RESULT OF FAILED TESTS.				
5		THE LIST CALLS OUT STRUCTURAL, DECK, INSULATED ROOF PANELS, METAL STUDS (EXCLUDING THE BATHROOM STUDS) IT IS NOT CLEAR IF THE 5/8" ROOF BOARD IS OWNER SUPPLIED OR NOT.	DIEDE CONSTRUCTION	PER THE UTK KOP MATRIX, "ALL STRUCTURAL/ACOUSTICAL/ CEILING DECKING, INSULATION, RIGID INSULATED ROOF PANELS, SCREWS TO ASSEMBLE THE ROOF/CEILING SYSTEM AND ANY SEALANTS THAT ARE REQUIRED FOR A COMPLETE SYSTEM." SO THE ROOF BOARD IS PART OF THAT COMPLETE SYSTEM AND OWNER SUPPLIED BY THE KYA GROUP WHICH IS PART OF THE CMAS CONTRACT THE DISTRICT HAS WITH THEM.				1/2/00

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNED	RESOLVED IN ADDENDUM #
6		ON PAGE AS.4 THERE IS ONE BATHROOM WITH DARKER WALLS AND SOME FILL IN WALLS THAT ARE DARKER. YOUR OWNER FURISHED LIST SAYS THAT THE BATHROOMS ARE EXCLUDED. DOES THAT MEAN ALL BATHROOMS OR JUST THE DARKER ONE.	DIEDE CONSTRUCTION	ON THE UTK KOP MATRIX WHERE IS STATES RESTROOM WALLS TO BE EXCLUDED. ALL RESTROOM WALLS WILL BE EXCLUDED BY THE OWNER. CONTRACTORS ARE RESPONSIBLE FOR THE PARTS AND COMPLETE SYSTEM.				1/2/00
7		PLEASE CONFIRM WHAT TYPE OF WINDOWS WE SHOULD BE FIGURING FOR THE UTK ELEMENTARY SCHOOLS FOR THE ALPHA, PERSHING AND VIRGINIA LEE ROSE SITES. SHEET A702 SHOWS SOME WINDOW FRAMES, AND DETAILS 1-3 ON A801 SHOW SOME TYPE OF WINDOW FRAME DEPICTED; HOWEVER THERES IS NOT AN ALUMINUM FRAMED WINDOW SPEC SECTION PROVIDED. THERE IS ONLY A HOLLOW METAL SPEC SECTION PROVIDED. PLEASE CONFIRM WHAT WINDOW SYSTEM WE ARE SUPPOSED TO QUOTE. THANK YOU.	SAN JOAQUIN GLASS	SEE FORTH COMING ADDENDUM				1/2/00
8		ADDENDA 1 CAME OUT WITH REVISED PLANS, HOWEVER SOME OF THE DRAWINGS CAME OUT BLURRY WHEN WE DOWNLOADED THEM SO IT DOES NOT CLEARLY SHOW THE INFO OR CALL OUTS. IS IT POSSIBLE FOR YOU TO SEND ME A DIFFERENT ADDENDUM FILE?	MARINA	NEW PDF OF ADD 01 IS POSTED TO MUSD PURCHASING WEBSITE, ALL PRE-BID WALK ATTENDEES WERE ISSUED AN EMAIL WITH THE PDF ATTACHMENT.				1/2/00
9		FOR ALL THREE SCHOOL SITES, ALPHA, PERSHING, AND ROSE, NOTE #2 OF THE "PACKAGED VERTICAL UNITS SCHEDULE" ON DRAWING NUMBER M003 CALLS OUT THE FOLLOWING: PROVIDE PROGRAMMABLE THERMOSTATS. SET ROOM T-STAT AT 74 F. THERMOSTAT WILL BE PROGRAMMED WHEN THE MODULAR BUILDINGS ARE PLACED ON SITE TO ENSURE THE MINIMUM AIR RATE WILL BE SUPPLIED TO THE SPACE AT ALL USUALLY OCCUPIED TIMES AND PROGRAMED TO PROVIDE A PRE-OCCUPANT PURGE ONE HOUR PRIOR TO THE MODULAR BUILDING BEING NORMALLY OCCUPIED PER ENERGY CODE 120.1(D)1. THERMOSTAT SHALL BE ABLE FOR THE ANNUAL OVERRIDE AS NEEDED. FOR ALL THREE SCHOOL SITE, ALPHA, PERSHING, AND ROSE, DRAWING NUMBER M401 CALLS FOR THE USE OF AN IP (ETHERNET) UNIT CONTROLLER/PROGRAMMABLE LOGIC CONTROLLER (PLC) THAT MATCHES THE DISTRICT'S STANDARD. PLEASE SEE BELOW. PLEASE ADVISE IF THE "PACKAGED VERTICAL UNITS" SHOULD BE CONTROLLED BY "PROGRAMMABLE THERMOSTATS" OR BY "UNIT CONTROLLERS" CONNECTED TO THE CONTROL SYSTEM PER THE DISTRICT'S STANDARD. IF "UNIT CONTROLLERS" ARE TO BE USED, PLEASE ADVISE THE MANUFACTURER AND MANUFACTURER'S BRAND OF THE DISTRICT'S CONTROL SYSTEM STANDARD.	BEDARD CONTROLS, INC.	UNITS SHOULD BE CONTROLLED WITH PROGRAMMABLE THERMOSTATS. USE VENSTAR COLORTOUCH T8850. SEE ATTACHED PHOTO. (SEE ATTACHED PDF)				1/3/00
10		WOULD THIS DISTRICT CONSIDER MOVING THE BID SUBMISSION DEADLINE TIME TO THE AFTERNOON OF THE 15TH INSTEAD OF 10:0AM? THIS WOULD HELP BIDDING PRIMES PROVIDE MORE ACCURATE AND COMPETITIVE PROPOSALS BY ALLOWING TIME FOR MORE SUBCONTRACTORS TURN-OUT AS WELL AS ENSURING SCOPR COVERAGE.	BMV CONSTRUCTION GROUP	THE DISTRICT WILL RESCHEDULE THE BID OPENING TO 2:00PM ON AUGUST 15TH, 2024. REFER TO ADDENDA 02				1/3/00
11		HVAC ENCLOSURES: SHEET A802 HVAC ENCLOSURES ELEVATIONS & DETAILS 10, 11, AND 12. ARE ALL THE HVAC ENCLOSURES MATERIALS POSTS, ANGLES, KICKPLATE, GATE HARDWARE AND METAL SIDING FOR A COMPLETE ASSEMBLY OWNER FURISHED CONTRACTORS INSTALLED? PLEASE CLARIFY.	ARDENT GENERAL INC.	NO, THE HVAC ENCLOSURES MATERIALS: POSTS, ANGLES, KICKPLATES, GATE HARDWARE AND METAL SIDING FOR A COMPLETE ASSEMBLY CONTRACTOR FURNISHED CONTRACTOR INSTALLED.				
12		Z-Furring Attached to Steel Web Sheet A901 Details 4 and 10 Z-Furring Attachment Is the Z-Furring materials Owner Furnished Contractor Installed? Please Clarify	ARDENT GENERAL INC.	YES, IT IS OFCI				

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNED	RESOLVED IN ADDENDUM #
13		Metal Stud Backing Materials for Metal Stud Backing of Mechanical, Electrical, Plumbing, Fire Sprinklers and Cabinets. Are the materials for the metal stud backing where required Owner Furnished Contractor Installed? Please Clarify	ARDENT GENERAL INC.	This will be CFCI.				
14		HSS4x3x 1/4" Typ. Wall Mounted Mech Unit Sheet S008 Detail 9 Are the materials for the HSS4x3x 1/4" each side of the units Owner Furnished Contractor Installed? Please Clarify	ARDENT GENERAL INC.	YES, IT IS OFCI				
15		Paint Exterior Exposed; Structural Steel, Underside of Metal Decking, Flashing, Trim and Gutters Is the exterior exposed, structural steel, underside of metal decking, flashing, trim and gutters painted and what paint designation? Please Clarify	ARDENT GENERAL INC.	Alpha – Underside of metal decking and gutters (P-1 Sherwin Williams – MAD21-431 Paris White), exposed structural steel (P-2 Sherwin Williams – MAD22-345 New Alpha Green) Pershing – Underside of metal decking and gutters (P-1 Sherwin Williams – MAD23-0126 Persian Gray), exposed structural steel (P-2 Sherwin Williams – MAD-0505 Chavez Blue) Virginia Lee Rose – Underside of metal decking and gutters (P-1 Sherwin Williams – Manual Revere Pewter), exposed structural steel (P-3 Sherwin Williams – MAD23-0510 Knoxville Grey) Any Down-spouts shall match the wall adjacent.				
16		Paint Interior Exposed; Fire Sprinklers, Conduits, Hangers, Braces, Cables, Mechanical, Etc.. Is the exposed interior, fire sprinkler system, braces, conduits, hangers, cables, mechanical, mechanical ducts and brackets, etc. painted and what paint designation? Please Clarify	ARDENT GENERAL INC.	Yes, the exposed interior, fire sprinkler system, braces, conduits, hangers, cables, mechanical, mechanical ducts and brackets shall be painted. Items attached to the ceiling shall match the ceiling (P-3 Sherwin Williams – Natural Choice SW 7011). Items mounted to or running down vertical surfaces shall match the surface to which they are attached.				
17		Concrete Polished Floor or Luxury Vinyl Tile Sheet AS.4 Keynotes #14 Polished Concrete Sheet AS.5 Finish Schedule Luxury Vinyl Tile TK Classrooms Polished Concrete or Luxury Vinyl Tile? Please Clarify	ARDENT GENERAL INC.	Sheet AS.4, Keynote #14 should read LVT not polished concrete.				
18		(N) Play Equipment and Rubber Base Sheet AS.3 Site Legend Is the New Play Equipment and Rubber Base Owner Furnished Owner Installed? Please Clarify If Contractor Furnished Contractor Installed more information is required (Pay Equipment Manufacturer Model, Rubber Base Material Specifications and Depth per Required Fall Height)? Please Clarify	ARDENT GENERAL INC.	The play equipment and rubber base at play equipment is OFOI.				
19		Interior Elevations Television Brackets and Undercounter Refrigerator Sheet AS.7 & AS.8 Keynotes 7 Television and Keynote 12 Undercounter Refrigerator Television Location and Undercounter Refrigerator Not Shown on the Plans? Please Clarify Is the Television and Undercounter Owner Furnished and Owner Installed? Please Clarify	ARDENT GENERAL INC.	Yes, television monitors and undercounter refrigerator are OFOI.				
20		Wood Blocking or 6"x16 Ga. Metal Track Sheet DT.2 Detail 3 & 10 Is the material for the blocking (Wood) or (6" x 16 Ga. Metal Track), or Contractors Option? Please Clarify	ARDENT GENERAL INC.	Blocking material is contractor's choice. Details are provided for each. See Sheet DT.2 Detail 9 Condition depicted in Sheet DT.2 Detail 10 does not apply.				

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNE D	RESOLVED IN ADDENDUM #
21		Exterior Windows Conflict Exterior Elevations/Window Schedule Sheet AS.9, AS.10 and A702 Window Schedule Sheet AS.9 and AS.10 Exterior Elevation 10 Each Lower Windows Not Shown On Sheet A702 Window Schedule? Please Clarify	ARDENT GENERAL INC.	SEE ADDENDUM 3, SHEETS AS.4 AND AS.11 FOR ALPHA, PERSHING AND VIRGINIA LEE ROSE FOR THE WINDOW SCHEDULE AND WINDOW LABELS.				
22	8/5/24	WHO IS RESPONSE FOR PROVIDING AND INSTALLING EQUIPMENT SUCH AS TELEVISIONS AND UNDER COUNTER REFRIGERATORS?	BMV CONSTRUCTION GROUP	TELEVISION MONITORS AND UNDER COUNTER REFRIGERATORS ARE OWNER FURNISHED OWNER INSTALLED.				
23	8/5/24	DOES THE BUILDING KIT COME WITH THE HVAC ENCLOSURES, EAVE AND RAKE TRIM, GUTTERS, DOWNSPOUTS AND CANOPIES OR ARE THEY CUSTOM FABRICATED FOR EACH BUILDING?	BMV CONSTRUCTION GROUP	REFER TO PRE-BID RFI 11 FOR RESPONSE				
24	8/5/24	IS A GEO-TECHNICAL REPORT AVAILABLE FOR EACH SITE? IF SO, WILL THIS PROVIDED VIA ADDENDUM?	BMV CONSTRUCTION GROUP	YES, REFER TO ADDENDUM 4 ATTACHMENTS				
25	8/5/24	DOES THE CONTRACTOR HAVE TO PROVIDE DEDICATED TEMPORARY FIELD OFFICES FOR THE INSPECTORS USE? IF SO, IS AN INSPECTOR FIELD OFFICE REQUIRED AT EACH SITE?	BMV CONSTRUCTION GROUP	YES, THE INSPECTOR WILL NEED A FIELD OFFICE. ONE OFFICE SHOULD SUFFICE. THE INSPECTOR'S FIELD OFFICE SHOULD BE LOCATED AT THE PERSHING ES FOR THE LEAST AMOUNT OF IMPACT TO SCHOOL OPERATIONS..				
26	8/5/24	IS THE CONTRACTOR REQUIRED TO PROVIDE DEDICATED SUPERVISION FOR EACH PROJECT SITE?	BMV CONSTRUCTION GROUP	YES, THE CONTRACTOR SHALL PROVIDE A REPRESENTATIVE ON EACH SITE AS WORK IS IN PROGRESS.				
27	8/5/24	IF TEMPORARY OFFICES ARE REQUIRED, WILL THE CONTRACTOR BE ABLE TO USE EXISTING POWER ON SITE, OR WILL THEY NEED TO RUN GENERATORS ON ANY/ALL TEMPORARY OFFICES? IF POWER ON SITE IS AVAILABLE, WHERE WILL THE CONNECTION POINTS BE?	BMV CONSTRUCTION GROUP	PROBABLY AT PERSHING ES ONLY. CONTRACTOR SHOULD BE ABLE TO CONNECT INTO EXISTING PANEL BEHIND THE EXISTING PORTABLES JUST WEST OF THE CONSTRUCTION SITE.				
28	8/5/24	ARTICLE 10 OF THE GENERAL CONDITIONS STATES THAT THE DISTRICT WILL PROCURE BUILDER'S RISK INSURANCE FOR THE PROJECT, HOWEVER ARTICLE 44 STATES THAT IT IS THE RESPONSIBILITY OF THE CONTRACTOR. PLEASE CONFIRM IF THE CONTRACTOR IS RESPONSIBLE FOR PROCURING BUILDER'S RISK INSURANCE COVERAGE.	BMV CONSTRUCTION GROUP	ARTICLE 44 WILL PREVAIL. THE CONTRACTOR IS RESPONSIBLE FOR PROCURING BUILDER'S RISK INSURANCE COVERAGE.				
29	8/5/24	WILL THE CONTRACTOR BE REQUIRED TO PROVIDE FIRE WATCH AT ANY TIME?	BMV CONSTRUCTION GROUP	ONLY IF THE CONTRACTOR TAKES DOWN THE SCHOOL WIDE FIRE ALARM DURING SCHOOL OPERATIONS.				
30	8/5/24	THIS SYMBOL IS SHOWN ON THE TECHNOLOGY FLOOR PLAN SHEETS, HOWEVER IT IS NOT CALLED OUT IN THE LEGEND. PLEASE CLARIFY WHAT THIS SYMBOL IS INTENDED TO BE USED FOR.	BMV CONSTRUCTION GROUP	THIS SYMBOL INDICATES LOCATIONS OF POE SECURITY CAMERAS MOUNTED +/- 12' AG, CAMERAS WILL BE OFOI, ALL PATHWAYS, WEATHER PROOF TERMINATION BOXES AT EXTERIOR LOCATIONS AND TERMINATION DEVICES SHALL BE CONTRACTOR FURNISHED CONTRACTOR INSTALLED.				
31	8/6/24	DOOR SCHEDULE STATES DOOR #322.1 & 322MA.1 (WOOD DOOR IN HM FRAME). NOT SHOWN ON FLOOR PLAN OF ANY SCHOOL. FLOOR PLAN SHOW: DR. # 385.1 & 385M.1 HM/HM DOOR (EXTERIOR) NOT LISTED ON DOOR SCHEDULE. THE DOOR SCHEDULES DO NOT SEEM TO ALIGN WITH THE FLOOR PLANS OF THE MODULAR SHEETS.	BMV CONSTRUCTION GROUP	DOORS #322.1 AND 322M.1 WERE CHANGES TOO ALUMINUM WINDOWS, SEE WINDOW SCHEDULES ON SHEET AS.11 FROM ADDENDUM 2. DOORS SCHEDULES WILL BE UPDATED IN ADDENDUM 4 TO REFLECT ALIGNMENT FROM THE MODULAR SHEETS.				

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNED	RESOLVED IN ADDENDUM #
32	8/6/24	ADDENDUM 02 PROVIDES A SPEC FOR US ALUMINUM 450 SERIES STOREFRONT, WHICH IS A 1 3/4" X 4 1/2" STOREFRONT SYSTEM THAT DOESN'T ALLOW FOR 1" GLASS. ADDITIONALLY, THE STOREFRONT DETAILS PROVIDED IN ADDENDUM 02 SHEET AS.11 SHOWS 6" DEPTH STOREFRONT, AND WINDOW DIMENSIONS THAT DON'T MATCH THE EXTERIOR ELEVATIONS IN SHEET A305 AND A305M. PLEASE ADVISE.	BMV CONSTRUCTION GROUP	SEE FORTH COMING ADDENDUM NARRATIVE				
33	8/6/24	ADDENDUM 02 SHEET AS.11 SHOWS WINDOWS 321-1, 322-1, 323-1, 321M-1, 322M-1 AND 323M-1. WILL ALL THE CLERESTORY WINDOWS SHOWN IN AS.9 AND A305, A305M BE PART OF THIS BID OR ONLY GROUND FLOOR WINDOWS 321-1 THROUGH 323M-1	BMV CONSTRUCTION GROUP	ALL WINDOWS ARE PART OF THE BID FOR THE PROJECT				
34	8/6/24	1. THE HARDWARE SPECIFICATIONS DIRECT YOU TOO THE PLANS FOR THE HARDWARE GROUPS. PAGE A700 HAS HARDWARE SCHEDULED GROUPS, BUT THEY ARE CROSED OUT. PLEASE ADVISE. 2. THE WOOD DOOR SPECIFICATIONS LIST, PAINT GRADE, PLASTIC LAMINATE, AND STAIN GRADE WOOD DOORS. WHICH IS THE DOOR WE SHOULD USE ON THIS PROJECT? 3. WOOD DOOR SPECIFICATIONS CALL FOR WI CERTIFICATION. SINCE THEY ARE DOING THREE SCHOOLS, THIS WILL BE A SUBSTANTIAL COST INCREASE. WILL WI CERTIFICATION BE NECESSARY ON THIS PROJECT?	ARDENT GENERAL INC.	1. SEE FORTH COMING ADDENDA NARRATIVE 2. PAINT GRADE FOR THE WOOD DOORS 3. NO WI CERTIFICATION WILL BE REQUIRED				
35	8/6/24	REGARDING THE UTK BUILDINGS AT VARIOUS EL SCH (ALPHA, PERSHING AND ROSE) PROJECT, THERE ARE TWO DOOR SCHEUDLES FOR EACH JOB. ONE DOOR SCHEDULE (PLAN PAGE AS.11) HAS HARDWARE GROUPS FOR THE DOORS AND THE OTHER DOOR SCHEDULE (PLAN PAGE A700) HAS THE HARDWARE GROUPS REMOVED. CAN YOU TELL ME IF THERE IS ANY WORK FOR US ON THIS PROJECT? ARE DOORS, FRAMES AND HARDWARE NEEDED ON THIS PROJECT?	CHILDS & COMPANY	SEE FORTH COMING ADDENDUM NARRATIVE				
36	8/6/24	PLEASE REFERENCE THE LIGHTING FIXTURE SCHEDULE SHOWN ON SHEET E003 FOR ALL THREE CAMPUSES, AND E205 FOR ALL THREE CAMPUSES. IS THE ELECTRICAL CONTRACTOR TO PROVIDE THE EXIT LIGHTS SHOWN ON E205? IF SO, PLEASE PROVIDE DESCRIPTION, LAMP, MOUNTING, AND MANUFACTURER CATALOG NUMBER INFORMATION FOR THE EXIT LIGHTS SHOWN ON E205 FOR ALPHA ES, PERSHING ES, AND ROSE ES.	INDUSTRIAL ELECTRICAL	Yes, the contractor is to provide the exit signs shown on E205. Provide Cooper LPX-7-SD. See attached cut sheet to this RFI/ addendum 4.				
37	8/7/24	1. IS A FULL TIME SUPERINTENDENT REQUIRED FOR EACH SITE? 2. IS A JOB TRAILER REQUIRED FOR EACH SITE? 3. THE PLANS FOR ROSE ELEMENTARY DO NOT HAVE THE SAME SCOPE OF WORK NOTES AS THE OTHER TWO SITES. ARE THE NOTES THE SAME FOR KYA SCOPE OF WORK AND THE GC SCOPE OF WORK? ARE THE SAME MATERIALS PROVIDED BY OWNER AT ROSE ELEMENTARY?	KATCH GENERAL	1. SEE PRE-BID RFI # 25 AND 26 RESPONSE. 2. SEE PRE-BID RFI # 26 FOR RESPONSE. 3. FOR ALL SCHOOL SITES IN BIDDING THE SCOPE OF WORK IS THE SAME WITH THE EXCEPTION OF PERSHING AND VIRGINIA LEE ROSE THAT NEED FIRE SPRINKLERS DUE TO CBC CODES.				

RFI #	DATE RECEIVED	QUESTION	CONTRACTOR/SUBCONTRACTOR TRADE	RESPONSE	TO	FROM	DATE RETURNE D	RESOLVED IN ADDENDUM #
38	8/7/24	VIRGINIA LEE ROSE ELEMENTARY SCHOOL: 1. According to Point of connection is on sheet L1.1, the water source is potable water. However, the detail A/L1.2 shows all pipes used as purple color. Please clarify. 2. Reference to irrigation legend on sheet L1.1, remote control valve is existing. However, callout "D" indicates new remote-control valve. Please clarify. 3. Reference to sheet L1.1, control valve station indicates 5 stations (XA-22 to XA-26). However, the plan shows 4 symbol of valve stations only. Please clarify. 4. Per irrigation legend on sheet L1.1, rain master decoder module is TW-D. However, detail N on sheet L1.2 indicates HUNTER Dual decoder. Please clarify. 5. Please provide model of resilient wedge gate valve shown in legend on sheet L1.1. 6. Please confirm that booster pump shown in note on sheet L1.1 is existing. 7. Reference to detail B on sheet CX1.1, legend number 3 indicates wood 2x4 header with beveled joints. However, the technical specs section 32 15 40/ 2.3 shows aluminum edging 3/16"x 5 1/2". Please clarify.	MARINIA	1. PROVIDE STANDARD WHITE PVC, PER IRRIGATION LEGEND. 2. PROVIDE NEW REMOTE-CONTROL VALVE (TORO P220-26-0 GLOBE) 3. XA-22 IS AN EXISTING VALVE THAT IS LOCATED BEFORE THE NEW GATE VALVE. THE FOUR (4) BANK OF NEW VALVES ARE A-23, A-24, A-25, A-26. 4. PROVIDE TW-D DECORDER, PER IRRIGATION LEGEND. 5. MODEL TYPE WILL BE REVIEWED DURING SUBMITTAL REVIEW. FOR REQUIREMENTS OF RESILIENT WEDGE GATE VALVE, REFER TO DETAIL E, SHEET L1.2 AND SPEC 32 84 00 IRRIGATION SYSTEM, SECTION 2.3 VALVE (C. ISOLATION VALVES) 6. BOOSTER PUMP IS EXISTING. 7. USE WOOD 2X4 HEADER PER THE DETAIL.				
		PERSHING ELEMENTARY SCHOOL: 1. Reference to irrigation legend on sheet LS1.1, there is not shown model for new remote-control valve. Please provide. 2. Please assume how many existing wire shall be rerun due to installing new mainline. 3. Please confirm existing valves 32, 33, 35 & 36 per note B/LS1.1 is the same location with new remote control valve A32, A33, A35 & A36. If not, please clarify location of existing valves. 4. Please confirm planting & irrigation allowance shall be included all applicable markups.	MARINIA	1. PROVIDE DISTRICT STANDARD, TORO P220-26-0 GLOBE. 2. CONTRACTOR TO VERIFY THREE (3) EXISTING IRRIGATION WIRES. 3. CONTRACTOR SHALL VERIFY LOCATION OF EXISTING REMOTE CONTROL VALVES. EXISTING REMOTE CONTROL VALVES 32,33,35,36 WILL BE REMOVED AND RETURNED TO DISTRICT, PER DEMOLITION PLANS. NEW VALVES WILL BE PROPOSED AND LOCATED PER PLAN. EXISTING WIRES WILL NEED TO BE INTERCEPTED AND RECONNECTED TO THE NEW VALVE LOCATIONS. 4. YES, TOTAL COSTS ALLOWANCE INCLUDES ALL MARKUPS.				
		ALPHA ELEMENTARY SCHOOL: 1. Reference to point of connection call-out in sheet IR1.2, mainline shall be schedule 40 pvc but legend in sheet IR1.2 shows class 200 pvc. Please clarify. 2. Please confirm booster pump shown in note on sheet IR1.2 is existing. 3. Can we connected new wire to ex.wire at point of connection per note A in sheet IR1.1? or Do we need to trench and rerun new wire through existing landscape to controller?	MARINIA	1. THE CORRECT MAIN LINE IS PVC CLASS 200. 2. YES, THE BOOSTER PUMP IS EXISTING. 3. PLEASE CONFIRM PLANTING & IRRIGATION ALLOWANCE SHALL BE INCLUDED ALL APPLICABLE MARKUPS. THE PLANS CALLS FOR CONTROL WIRE FROM THE CONTROLLER TO FIVE NEW RCVs (A-33:37), FOUR SPARE WIRES PLUS A SPARE COMMON TO THE SOUTHERN A-33 VALVE BOX, AND FOUR SPARE WIRES PLUS A SPARE COMMON TO THE EASTERN MAIN LINE TERMINATION. THE ACTIVE COMMON WIRE CAN BE SPLICED AT THE MAIN LINE POC IN A SPLICE BOX. THIS RESULTS IN 13 CONTROL WIRES PLUS ONE SPACE COMMON FROM CONTROLLER 'A' DISTRIBUTED TO THE CONTROL WIRE TERMINATIONS, LESS ANY EXISTING SPARE CONTROL WIRE THAT FOLLOWS THE EXISTING MAIN LINE THAT CAN BE INTERCEPTED AND SPLICED AT THE NEW MAIN LINE POC.				

[illegible]

[illegible]

August 28, 2023

Project No. 07-230526-0

Ms. Rosalind Cox
Madera Unified School District
1205 South Madera Avenue
Madera, CA 93637

Subject: Geotechnical Investigation and Geohazards Study Report
New Kindergarten Classrooms at Pershing Elementary School
1505 Ellis Street
Madera, CA 93638


Dear Ms. Cox:

In accordance with your request, we have performed a geotechnical investigation and geohazards study for the subject project. This work was performed in accordance with Section 1803A.6 of the 2022 California Building Code (CBC). The results of our geotechnical investigation and geohazards study are presented in the accompanying report, which includes a description of site conditions and potential geologic hazards, results of our field investigation and laboratory testing, conclusions, and recommendations.


We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,


RMA GeoScience, Inc.



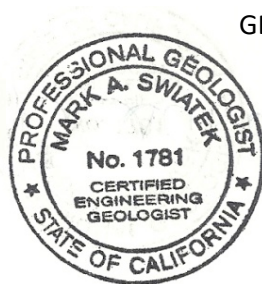
Megan J. Stewart, GIT
Staff Geologist



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Principal Geotechnical Engineer
GE 2904



Mark A. Swiatek, PG|CEG
President
EG 1781



Distribution: Addressee (4 Originals and a pdf copy to rosalindcox@maderausd.org)

**GEOTECHNICAL INVESTIGATION AND GEOHAZARDS STUDY REPORT
NEW KINDERGARTEN CLASSROOMS AT PERSHING ELEMENTARY SCHOOL
1505 ELLIS STREET
MADERA, CALIFORNIA 93638**

for

Madera Unified School District
1205 South Madera Avenue
Madera, California 93637

August 28, 2023

Project No. 07-230526-0

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APPENDICES

Appendix A	Field Investigation
Appendix B	Laboratory Tests
Appendix C	Liquefaction/Seismic Settlement Analysis
Appendix D	References

1.00 INTRODUCTION

1.01 Purpose

A geotechnical investigation and geohazards study has been completed for the New Kindergarten Classrooms at Pershing Elementary School project in Madera, California. The purpose of the investigation was to summarize geotechnical and geologic conditions at the site, to assess their potential impact on the proposed development, and to develop geotechnical engineering design parameters for the project.

1.02 Scope of the Study

The general scope of this study included the following:

- Review of published and unpublished geologic, seismic, groundwater and geotechnical literature. This included reviewing the following geotechnical reports:
- Examination of aerial photographs and topographic maps.
- Contacting of Underground Service Alert to locate onsite utility lines.
- Logging, sampling, and backfilling of three exploratory borings drilled with a SIMCO 2800 drill rig: one to an approximate depth of 51 feet and two to an approximate depth of 21 feet.
- Laboratory testing of representative soil samples.
- Geotechnical evaluation of the compiled data.
- Preparation of this report presenting our findings and conclusions.

As part of the geohazards study associated with our geotechnical investigation, our scope of services included addressing applicable items in California Geological Survey – Note 48, Checklist for the review of engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Service Buildings, October 2013.

Our scope of work did not include a preliminary site assessment for the potential of hazardous materials onsite.

1.03 Site Location and Description

The project site lies within the existing Pershing Elementary School in Madera, California, which was constructed between 2006 and 2009. The location of the site relative to nearby streets is indicated on Figure 1, Site Vicinity Map. Its geographic position is 36.9886° north latitude and 120.0456° west longitude. The existing ground surface is relatively flat and the elevation above mean sea level at the project site is approximately 292 feet according to the USGS Madera 7.5 Minute Quadrangle (see Figure 2).



Photo taken near the southeast corner of the site, facing northwest. Taken on July 21, 2023.



Photo taken near the northwest corner of the site, facing southeast. Taken on July 21, 2023.

1.04 Planned Improvements

Based on our review of the information provided, which included a site plan prepared by PBK, we understand the project will consist primarily of the installation/construction of two (2) new modular buildings with an approximate footprint area of 3,550 square feet each. It is anticipated that the new buildings will be wood-framed, with concrete slab-on-grade floors, and shallow reinforced-concrete foundations. Maximum wall and column loads (dead plus live, not including wind or seismic loads) are anticipated to be less than 2.0 kips per foot and 50 kips, respectively. Appurtenant improvements are anticipated to be various underground utilities, new concrete flatwork, and landscaping. No grading plan was available at the time of the preparation of this report.

1.05 Investigation Methods

Our investigation consisted of office research, review of the compiled data, and preparation of this report. It has been performed in a manner consistent with generally accepted engineering and geologic principles and practices and has incorporated applicable requirements of California Building Code. Definitions of technical terms and symbols used in this report include those of the ASTM International, the California Building Code, and commonly used geologic nomenclature. Technical supporting data are presented in the attached appendices. Appendix A presents a description of the methods and equipment used in performing the field exploration and logs of our subsurface exploration. Appendix B presents a description of our laboratory testing and the test results. Results of our liquefaction and seismic settlement analysis are provided in Appendix C. References are presented in Appendix D.

2.00 FINDINGS

2.01 Geologic Setting

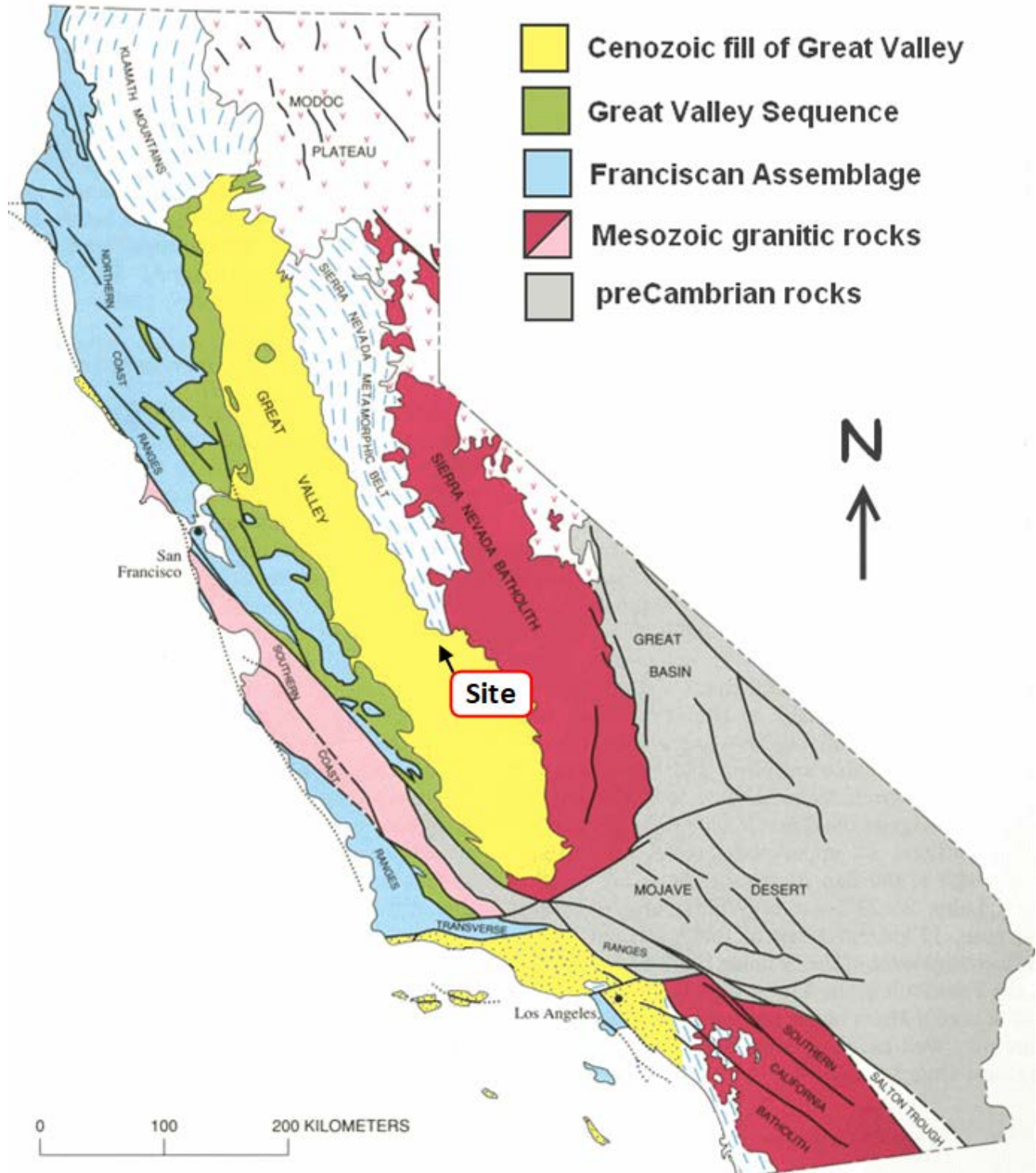
The subject site is located in the south-central San Joaquin Valley, which comprises the southern half of the Great Valley geomorphic province. The valley is a westward-titling trough which forms a broad alluvial fan, approximately 200 miles long and 50 to 70 miles wide, where the eastern flank is broad and gently inclined, as opposed to the western flank which is relatively narrow (Bartow, 1991; Page, 1968). The Central Valley consists of the Great Valley Sequence, overlain by Cenozoic alluvium. Underlying the Great Valley Sequence are the Franciscan Assemblage to the west and the Sierra Nevada batholith to the east (Bailey, Irwin, and Jones, 1964).

The Franciscan Assemblage, made up of deformed and high pressure and low temperature metamorphosed mafic and ultramafic rocks, was formed around the Late Jurassic through the Miocene (160 to about 20 million years ago) by the offscraping of rocks from a subducting plate dipping to the east (Wakabayashi, 1992; Wakabayashi, 2010).

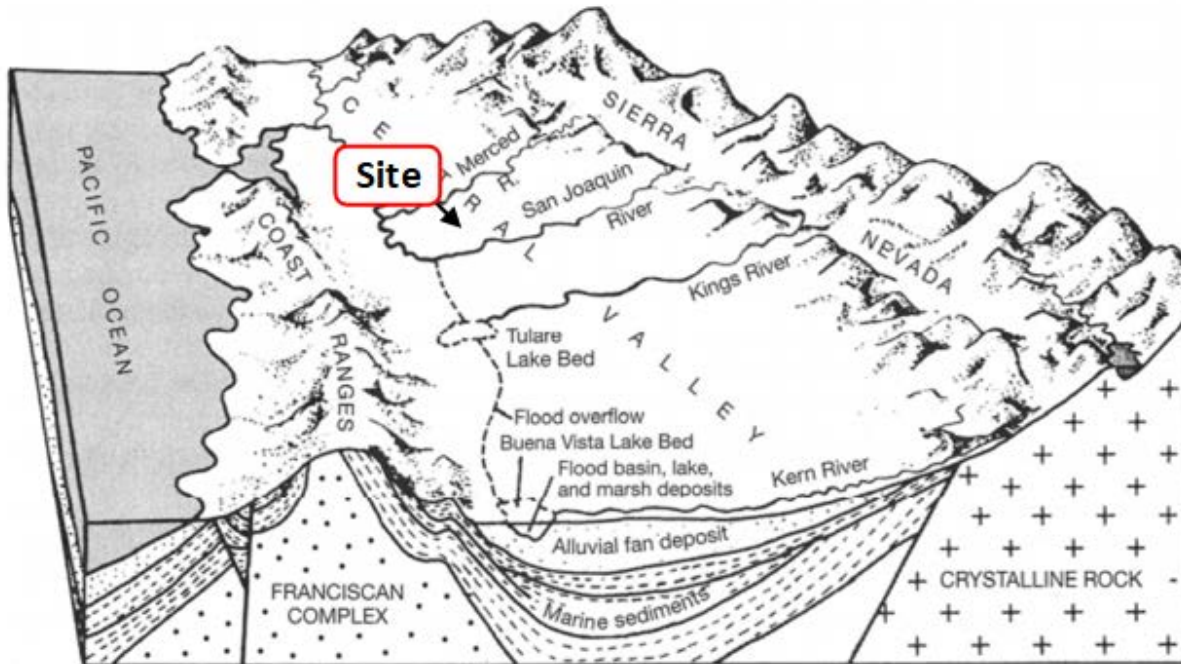
The Sierra Nevada started to form during the Early Jurassic (around 200 million years ago) when the Farallon Plate began subducting under the North American Plate. This subduction resulted in several orogenies, or mountain building events, that created the granitic Sierra Nevada Batholith deep below the surface. During the

Miocene (around 10 million years ago), vertical movement along the Sierra Nevada Frontal Fault Zone (part of the Eastern California Shear Zone) began to uplift the Sierra Nevada. This uplift and erosion exposed the batholiths to the surface. From the Pleistocene (commonly known as the most recent Ice Age) to the present, glaciers have been carving out many parts of the Sierras. The current uplift of the Sierra Nevada is 1 - 2mm per year (Hammond, et al. 2012).

The Great Valley Sequence is a 40,000 foot sequence of marine shale, sandstone, and conglomerate beds, deposited in a deep marine environment during the Late Jurassic through the Cretaceous (150 – 65 million years ago). Overlying the Great Valley Sequence is several thousand feet of Cenozoic alluvium, deposited by: streams and rivers draining from the mountains and creating alluvial fans; by lakes that covered parts of the valley floor from time to time; flooding; and marsh environments (Page, 1986). In some places, it is thousands of feet thick, and more than half of this thickness is composed of fine grained fluvial and lacustrine deposits. Holocene deposition consists mainly of episodic deposition of alluvial sediments (Bartow, 1991; Page, 1986). A generalized geologic map for the State of California is shown below and Figure 3A illustrates the geologic setting within the regional area of the project site. As shown on Figure 3A, the project site is situated on Quaternary deposits of alluvium that are estimated to be several thousand feet deep.



Geologic map showing the locations of Cenozoic alluvium/fill (yellow) overlying the Great Valley Sequence (green), the Franciscan Assemblage (blue), and the Sierra Nevada Batholith (red). Modified from: Irwin (1990).



Geologic block diagram of California. From: Harden (2004). Not to scale.

2.02 Earth Materials

The soils encountered in our test borings consisted primarily of both reworked and native soils. The reworked soil consisted of silty sand which extended from the surface to a depth of approximately 1 foot. The native soil profile consisted of silty sand with varying amounts of clay and cementation, sandy silt with varying amounts of clay, clayey sand, silty clay, and poorly graded sand to the maximum depth explored of approximately 51 feet. These layers varied in thickness and appear to be horizontally discontinuous across the project site. The granular soils generally had a relative density of medium dense to very dense, while the fine-grained soils had a relative consistency of stiff to very stiff. As indicated above, the soils encountered in the test borings are related to deep alluvial deposits that have been deposited over the past several thousand years.

A Boring Location Map showing the locations of the referenced test borings is presented as Figure 5. The logs of our recent exploratory borings are presented in Appendix A, which provide more detailed information of the soils that were encountered to a depth of approximately 51 feet at the project site.

2.03 Expansive Soils

Our field exploration indicates that the near surface soils at the project site have a low expansion potential (Expansion Index, EI, of 0 and Plasticity Index of 12). Results of our laboratory tests are presented in Appendix B.

2.04 Surface and Groundwater Conditions

Groundwater was not encountered during our subsurface exploration. No areas of ponding or standing water were observed at the time of our study, and no seepage was observed in the exploratory borings to the maximum depth explored of approximately 51 feet below existing ground surface.

According to recent groundwater data from the SGMA Data Viewer application, the depth to groundwater in the vicinity of the project site is approximately 214 feet as of Fall 2022. Historical data derived from wells (State Well Number 11S18E07L001M, 11S18E18A001M, 11S18E17L001M, 11S18E05J001M, 11S18E04E001M, and 11S17E02Q001M) located approximately 0.30 miles southwest, 0.66 miles south-southeast, 1.36 miles southeast, 1.58 miles northeast, 1.98 miles northeast, and 2.13 miles northwest, respectively, of the project site indicates the depth to ground water in the vicinity of the project site was approximately 35 feet deep in the 1930's, gradually declined to a depth of approximately 71 feet by the 1960's, and declined further to a depth of approximately 95 feet by the 1990's, with a historical high of 31.8 feet in March 1939.

Since November 1934 (the earliest well data available) the depth to groundwater has increased significantly, falling 174 feet in 89 years. Some recovery in the groundwater could occur, especially following a period of wet years. However, in consideration of the demand for groundwater related to domestic and agricultural purposes, it is highly unlikely that the groundwater table will recover much above the levels observed during, or prior to, the 1980's. Thus, although the "historical high" groundwater table is approximately 31.8 feet at the project site, a design "high" groundwater table of 75 feet is recommended for Civil Engineering purposes.

2.05 Faults

The site is not located within the boundaries of an Earthquake Fault Zone for fault-rupture hazard as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no faults are known to pass through the property. The nearest active earthquake fault zones are the Ortigalita Fault Zone, the Nunez Fault, the San Andreas Fault Zone, the Calaveras Fault Zone, and the Quien Sabe Fault located approximately 48.9 miles west-southwest, 56.3 miles south-southwest, 66.0 miles southwest, 67.8 miles west-southwest, and 68.0 miles west, respectively, of the project site. The location of the project site relative to these and other fault zones is illustrated on Figure 4a.

Our research of regional geologic and seismic data did not reveal any known instances of ground failure in the vicinity of the site associated with regional seismic activity. Seismic design parameters relative to the requirements of the 2022 California Building Code (CBC) are presented in Section 3.10.

2.06 Historic Seismicity

According to the California Historical Earthquakes Online Database maintained by the California Geological Survey and the United States Geological Survey (USGS) database, there have been no historic earthquakes with a magnitude greater than or equal to 5.5 with an epicenter within 50 miles of the site. Large historic earthquakes in California with an epicenter of less than 100 miles away from the site are summarized in the table below.

Large Historic Earthquakes

Event	Date	Magnitude	Distance from Site (Miles)
NE of San Juan Bautista	June 10, 1836	6.4	81
E of San Juan Bautista	January 18, 1840	6.5	81
SE of San Juan Bautista	July 3, 1841	6.0	81
E of King City	September 2, 1853	6.3	66
W of Coalinga	January 9, 1857	6.1	70
Fort Tejon	January 9, 1857	7.9	90
NE of King City	April 17, 1860	6.0	67
NE of Morgan Hill	February 26, 1864	6.1	87
SW of Tracy	July 15, 1866	6.0	94
NW of Bishop	April 11, 1872	6.8	92
NW of Parkfield	February 2, 1881	6.0	71
SW of Patterson	April 10, 1881	6.3	73
SW of Hollister	March 30, 1883	6.0	82
E of King City	April 12, 1885	6.5	69
SW of Bishop	September 30, 1889	6.0	76
E of Watsonville	April 24, 1890	6.3	86
SW of Independence	August 17, 1896	6.3	99
E of Gilroy	June 20, 1897	6.3	80
W of San Juan Bautista	April 30, 1899	6.0	87
NW of Parkfield	March 3, 1901	6.4	73
SE of Morgan Hill	July 21, 1911	6.5	88
SE of Mammoth Lakes	May 25, 1980	6.1	79
E of Mammoth Lakes	May 25, 1980	6.0	79
SE of Mammoth Lakes	May 25, 1980	6.1	79
SE of Mammoth Lakes	May 27, 1980	6.2	77
NE of Coalinga	May 2, 1983	6.7	54
E of San Jose	April 4, 1984	6.2	93
NW of Bishop	November 23, 1984	6.1	86
N of Bishop	July 21, 1986	6.4	96
SE of Parkfield	September 28, 2004	6.0	83

2.07 Flooding Potential

According to the Federal Emergency Management Agency (Flood Insurance Rate Map #06039C1160E, effective September 26, 2008), the site is located within an unshaded area of “Zone X”, which is an “area determined to be outside the 0.2% annual chance floodplain”.

Control of surface runoff originating from within and outside of the site should be included in design of the project.

2.08 Landslides

Since there are no natural or manmade slopes in the vicinity of the project site, landslides are not a hazard at this site.

2.09 Other Geologic Hazards

California Geologic Survey Note 48 (2011) identifies a number of exceptional geologic hazards that can occur at individual sites, but do not occur statewide. Evaluation of these exceptional conditions is referred to as a conditional geologic assessment by Note 48. Specific assessment items listed in Note 48 are addressed in the table below.

Conditional Geologic Assessment

Hazard	Assessment	Reference
Methane gas, hydrogen-sulfide gas, tar seeps	Not applicable; site is not located within an oil field identified as a high risk area for hazardous gas accumulations.	See Section 1.03.
Volcanic eruption	Not applicable; site is not located in a known hazard area for volcanic eruptions.	Miller, 1989 (U.S.G.S. Bulletin 1847)
Flooding	The proposed development area is not located within the boundaries of a 100-year or 500-year flood zone.	See Section 2.07.
Tsunami and seiches inundation	Not applicable.	See Section 3.11.
Radon-222 gas	Not applicable; typically a concern in the California Coast Ranges.	See Section 2.01 and CGS Note 48.
Naturally occurring asbestos	Not applicable; site is not located in an area likely to contain naturally occurring asbestos.	Churchill and Hill, 2000 (DMG OFR 2000-19)
Hydrocollapse due to anthropic use of water	Due to the density of the underlying soils, hydrocollapse due to anthropic use of water is unlikely.	See Sections 2.01, 2.02, and Appendix A.

Hazard	Assessment	Reference
Regional land subsidence	The site is not identified in an area of large historic subsidence within the California Central Valley. Control of subsidence will dependent upon proper jurisdictional management of groundwater resources.	Madera County General Plan Background Report, 1995, and Borches and Carpenter, 2014.
Clays and cyclic softening	Soils within the upper 51 feet of the ground surface are primarily granular rather than clays. Expansive properties of near-surface soils have been considered in foundation design.	See Sections 2.03, 3.04, and 3.12.

3.00 CONCLUSIONS AND RECOMMENDATIONS

3.01 General Conclusions

Based on specific data and information contained in this report, our understanding of the project, and our geotechnical engineering experience, it is our professional judgment that the proposed development is geologically and geotechnically feasible. Our review of geological literature and the field exploration performed for this project did not indicate any unusual conditions at the site that would entail special design considerations or construction procedures. Specific geotechnical recommendations and guidelines are presented below to provide information for other members of the design team that can be used to prepare the project plans and specifications for the planned improvements to the administration building.

3.02 General Earthwork and Grading

All grading should be performed in accordance with the recommendations provided below, the project plans and specifications, Appendix J of the 2022 California Building Code and all applicable governmental agency requirements. In the event of conflicts between this report and the other referenced documents, this report shall govern. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 laboratory test procedures.

3.03 Rippability and Rock Disposal

Exploratory borings that have been done at the project site were advanced without difficulty and no oversize materials were encountered. Accordingly, we expect that all earth materials will be rippable with conventional grading equipment and oversized materials are not expected.

3.04 Earthwork Recommendations

All vegetation, organic rich soils (soils containing more than 2 percent organics by weight), trash, debris, existing pavement sections and underground utilities, should be cleared from the grading area and removed from the site. After the removal of deleterious materials and the stripping of organic-rich soils, the following over-excavation must be done within the area of the planned improvements:

- Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 12 inches below the stripped subgrade surface or 12 inches below the bottom of footings, whichever is lower. The bottom of the over-excavation within each building area must be level and at a uniform depth below the finished pad elevation.
- Outside of the “building pad” area indicated above, no over-excavation should be required unless loose or unstable soils are present that will require some over-excavation prior to the scarification, moisture conditioning, and compaction as recommended below.

Following the over-excavation indicated above, a designated representative for the Project Geotechnical Engineer must review the exposed ground surface and determine if any additional over-excavation is required.

The over-excavated ground surface in all areas determined to be satisfactory for the support of fills must be scarified to a minimum depth of 12 inches. Scarification should continue until the soils are broken down and free from lumps or clods and until the scarified zone is uniform. The moisture content of the scarified zone shall be adjusted to near optimum moisture content. The scarified zone must then be uniformly compacted to at least 90 percent relative compaction within the building pad area and concrete flatwork and to at least 95 percent relative compaction within paved areas that will be subject to vehicular traffic.

Removed and/or over-excavated soils, free of organics and other deleterious material, may be used as engineered fill. Fill material should be placed in nearly horizontal layers, uniformly moisture conditioned to near optimum moisture content, and then compacted in layers that do not exceed approximately 8 inches in thickness. Thicker lifts may be placed if testing indicates the compaction procedures are such that the required compaction is being achieved and the geotechnical consultant approves their use. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Engineered fill must be compacted to achieve a relative compaction of at least 90 percent, except for the upper 12 inches of subgrade below asphalt or concrete pavement sections subject to vehicular traffic, which must be compacted to at least 95 percent. Based on our observations of the existing field conditions and lab testing data, a shrinkage factor (decrease in volume of soil upon removal and recompaction) in the range of 5 to 10 percent is considered applicable for this project.

The above recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. Hence, over-excavation depths must be verified, and adjusted if

necessary, at the time of grading. In addition, any contaminated soils within three (3) feet of the finished subgrade surface, must be removed and properly disposed of outside the area the planned improvements.

3.05 Imported Fill Material

If required, imported fill materials that will be placed within building or concrete flatwork areas must be non-hazardous and be obtained from a single, uniform source that meets the following criteria:

Gradation			
Sieve Size		Percent Passing	
3-inch		100%	
3/4-inch		90% - 100%	
#4		60% - 100%	
#200		20% - 50%	
Maximum Expansion Index		Maximum Plasticity Index	
20		10	
Minimum R-Value (in paved areas)			
50			
Maximum Organic Content			
< 2% by weight			
Corrosivity			
pH	Minimum Resistivity (ohm-cm)	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)
6.0 to 8.5	> 5,000*	< 1,000	< 200

*unless other requirement established by the Design Engineer

3.06 Temporary Slopes and Shoring

Our geotechnical investigation indicates that excavations less than 4 feet in depth may generally be constructed with vertical sidewalls without shoring or shielding. Temporary excavations in existing alluvial soils that are deeper than 4 feet may be safely made at an inclination of 1:1 or flatter. If vertical sidewalls are required in excavations greater than 4 feet in depth, the use of cantilevered or braced shoring is recommended. The following geotechnical parameters can be used to design a shoring system:

Moist Unit Weight of Soils: 130 pcf
 Angle of Internal Friction (ϕ): 30°
 Cohesion: 200 psf

Unless vehicles, equipment, materials, etc., are kept a minimum distance equal to the height of the excavation away from the edge of the excavation, a surcharge load equal to a uniform lateral pressure of 72 psf should be assumed to act on the shoring in addition to the earth pressure calculated using the above geotechnical parameters.

Vehicles, equipment, materials, etc. should be set back a minimum distance of 10 feet from the top edge of sloped or vertical excavations. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation. In any case, Cal/OSHA construction safety orders should be observed during all underground work.

3.07 Fill and Cut Slopes

Due to the low gradient of the property, it appears that construction of cut and fill slopes will not be required. If such slopes are proposed, they should be inclined no steeper than 2 horizontal to 1 vertical. In addition, appropriate landscaping measures should be taken to protect the face of slopes from erosion.

3.08 Utility Trench Backfill

The existing onsite soils will generally not be suitable for use as pipe bedding for buried utilities. All pipes should be bedded in sand or other suitable material as specified by the Project Civil Engineer and/or as specified by the pipe/conduit manufacturer. We recommend the bedding material have a Sand Equivalent (SE) of at least 30 and have less than 8 percent, by weight, passing the #200 Sieve. The geotechnical consultant should review and approve proposed bedding materials prior to use. Bedding materials should be compacted to at least 90% relative compaction (ASTM D1557) by mechanical methods.

The on-site soils are expected to be suitable as trench backfill provided they are screened of organic matter and other deleterious material. Trench backfill must be compacted to at least 90% relative compaction (ASTM D1557) and the upper 12 inches of trench backfill beneath pavement sections should be compacted to at least 95% relative compaction. Trench backfill should be compacted using mechanical methods; no jetting of backfill should be allowed. A minimum trench width of 24 inches or 18 inches plus the diameter of the utility line, whichever is greater, should be provided to permit uniform compaction on both sides of utility line and allow for a technician to perform in-place density tests. If narrower trenches are desired, a sand-cement slurry should be used to backfill the trenches to within 8 inches of the top of trench. The sand-cement slurry should contain at

least 2 sacks of cement per yard of mix and have a 4- to 6-inch slump. In addition, slurry should be consolidated using a suitable vibratory or mechanical method.

All utility trench backfill within street right of ways, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing. Where utility crossings are located within 12 inches of bottoms of footings, conduits should be wrapped with polystyrene foam or other suitable material with a minimum thickness of one inch. Conduits extending through footings shall be “sleeved” as determined by the Project Structural Engineer.

3.09 Faulting

Since the site is not located within the boundaries of an Earthquake Fault Zone and no faults are known to pass through or near the property, surface fault rupture within the site is considered unlikely.

3.10 Seismic Design Parameters

Seismic design parameters have been developed in accordance with Section 1613A of the 2022 California Building Code (CBC) using the online SEAOC and OSHPD Seismic Design Maps Calculator (ASCE 7-16 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented below:

2022 California Building Code (CBC) Seismic Parameters

Parameter	Value
Site Location	Latitude = 36.9886 degrees Longitude = -120.0456 degrees
Site Class	Site Class = D* Soil Profile Name = "Stiff Soil"
Risk Category	III
Mapped Spectral Accelerations	S_s (0.2-second period) = 0.576g S_1 (1-second period) = 0.228g
Site Coefficients (Site Class D)	F_a = 1.340 F_v = Null - Section 11.4.8
Maximum Considered Earthquake Spectral Accelerations (Site Class D)	S_{MS} (0.2-second period) = 0.771g S_{M1} (1-second period) = Null - Section 11.4.8
Design Earthquake Spectral Accelerations (Site Class D)	S_{DS} (0.2-second period) = 0.514g S_{D1} (1-second period) = Null - Section 11.4.8

*As defined in Chapter 20 of ASCE 7-16, a Site Class D is applicable to predominantly cohesionless soils with an **average** standard penetration resistance of 15 to 50 within the upper 100 feet. Based on the geologic setting, our 50-foot deep test boring (see Appendix A), and other historical geotechnical data (see Section 1.02), the soil profile at the project site meets these criteria.

As the Site Class is D and the S_1 value is greater than 0.200g, then per ASCE 7-16 Section 11.4.8 a site-specific ground motions procedure is required with several exceptions. We assume that Exception 2 is applicable to this site, and hence the seismic parameters indicated in the table above have been calculated. If Exception 2 does not apply, the structural engineer should contact us so we develop the site-specific seismic parameters.

The above table shows that the mapped spectral response acceleration parameter for a 1-second period (S_1) is less than 0.750g and the spectral response acceleration parameter (S_{DS}) is greater than 0.500g. Therefore, the Seismic Design Category using 2022 CBC Tables 1613.2.5(1) and 1613.2.5(2) is D for all Occupancy Categories (2022 CBC Section 1613.2.5). Consequently, as required for Seismic Design Categories C through F by CBC Section 1803.5.12, slope instability, liquefaction, total and differential settlement, and surface displacement by faulting or seismically lateral spreading or lateral flow have been evaluated.

Peak earthquake ground acceleration adjusted for site class effects (PGA_M) has been calculated in accordance with ASCE 7-16 Section 11.8.3 as follows: $PGA_M = F_{PGA} \times PGA = 1.351 \times 0.249 = 0.336g$.

3.11 Liquefaction and Secondary Earthquake Hazards

Potential secondary seismic hazards that can affect land development projects include liquefaction, tsunamis, seiches, and seismically induced settlement.

Liquefaction

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, and intensity and duration of ground shaking. In order for liquefaction to occur, three criteria must be met: "low density", coarse-grained (sandy) soils, a groundwater depth of less than about 51 feet, and a potential for seismic shaking from nearby large-magnitude earthquake.

Research has shown that saturated, loose sands with a silt content less than about 25 percent are most susceptible to liquefaction, whereas other soil types are generally considered to have a low susceptibility. According to the California Geologic Survey (CGS) Special Publication SP-117A (2008), "Guidelines for Evaluating and Mitigating Seismic Hazards in California," any materials with a PI > 12 and moisture content < 85% of the liquid limit were considered not subject to liquefaction. Liquefaction susceptibility is related to numerous factors, and the following conditions must exist for liquefaction to occur:

- Sediments must be relatively young in age and must not have developed large amounts of cementation
- Sediments must consist mainly of cohesionless sands and silts
- The sediment must not have a high relative density
- Free groundwater must exist in the sediment; and
- The site must be exposed to seismic events of a magnitude large enough to induce straining of soils particles

The soils in the upper 51 feet at the project site consist primarily of silty sand, sandy silt, clayey sand, silty clay, and poorly graded sand. A liquefaction analysis was performed using the sampler blow count and soil data from the deep boring that was performed at the project site (Boring B-2), using corrected SPT value $[(N_1)_{60}]$. The analysis was performed using LiquefyPro Version 5 (2015 edition) for two groundwater conditions: at a depth of 31.8 feet (historical high groundwater condition as required by CGS) and at a depth of 75 feet (representative of a recommended design "high groundwater condition" based on historical DWR data in the past 30 years). The analysis also took into account that the (PGA_M) is 0.336g and the Modal Magnitude (M_M) for the design level earthquake is 5.5 (based on the PSH Deaggregation tool on the USGS website at <https://earthquake.usgs.gov/hazards/interactive/>) for a 2-percent probability for exceedance in 50 years (a return period of 2,475 years). A summary of the input data and the results of this liquefaction analysis are provided in Appendix C of this report. Based on this analysis, there appears to be a low risk of liquefaction occurring at the project site during a design level earthquake (Factor-of-Safety against liquefaction is greater than 1.2).

It should be noted that the California Geological Survey has not yet prepared a Seismic Hazard Zone Map of potential liquefaction hazards for the quadrangle in which the site is located. In addition, there are no liquefaction hazard zones identified near the site according to the Madera County General Plan. Because there

are no mapped liquefaction hazard zones near the site, a map depicting such a zone relative to the site has not been prepared.

Tsunamis and Seiches

Tsunamis are sea waves that are generated in response to large-magnitude earthquakes. When these waves reach shorelines, they sometimes produce coastal flooding. Seiches are the oscillation of large bodies of standing water, such as lakes, that can occur in response to ground shaking. Tsunamis and seiches do not pose hazards due to the inland location of the site and lack of nearby bodies of standing water.

Seismically Induced Settlement

Seismically induced settlement occurs most frequently in areas underlain by loose, granular sediments. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

A seismic settlement analysis was performed using LiquefyPro Version 5 (2015 edition) in conjunction with the liquefaction analysis that was performed for this project as indicated above. A summary of the input data and the results of the seismic settlement analysis are provided in Appendix C of this report. Based on this analysis, a seismic settlement of less than 1/4 inch is expected to occur at the project site during a design level earthquake.

Seismically Induced Flooding

The City and County of Madera General Plans indicates the site is located within the potential dam inundation area of Hensley Lake/Hidden Dam. However, the chances of this of this dam failing while at full capacity is considered remote. Consequently, seismically induced flooding at the site is unlikely.

Seismically Induced Landslides

There are no cut or fill slopes that currently exist or are planned at the project site; therefore, the potential for seismically induced landslides is nil.

3.12 Foundations

Isolated spread footings and/or continuous wall footings are recommended to support the proposed new building. New footings should be embedded at least 12 inches below the lowest adjacent grade and must be constructed on properly compacted fill as recommended in Section 3.04 of this report. Continuous and isolated spread footings with a minimum width of 12 and 24 inches, respectively, may be designed using an allowable bearing capacity of 3,000 pounds per square foot (psf). An allowable increase of 750 psf per additional 12 inches of embedment, and an allowable increase of 500 psf per additional 12 inches of width, can be used in design, up to a maximum allowable bearing capacity of 5,000 psf. This allowable bearing capacity represents an allowable

net increase in soil pressure over existing soil pressure and may be increased by one-third for short-term wind or seismic loads. The maximum expected settlement of footings is expected to be less than 3/4 inch with a differential settlement of less than 1/4 inch between similarly sized and loaded footings or less than 1/4 inch over a distance of 30 feet for continuous footings. This assumes that the maximum column and wall loads (dead plus live, not including wind or seismic) associated with new building improvements will not exceed 40 kips and 2.0 kips per foot, respectively.

Our lab testing indicates that the upper 5 feet of soils at the site should have a low expansion potential (Expansion Index ≤ 50). The type and dimensions of concrete, and the size and location of reinforcing steel, used in foundations should be specified by the Project Structural Engineer. As a minimum, reinforcement for continuous footings should include at least one #4 bar located near both the top and bottom of continuous footings.

It will be very important for all footing excavations to be observed by the geotechnical engineer to verify that they have been excavated into the recommended bearing material. Where zones of relatively loose or disturbed soils are present at the bottom of foundation excavations, these soils should be properly compacted to provide a uniform bearing surface that meets the approval of the geotechnical engineer (refer to Section 3.04).

3.13 Lateral Load Resistance and Earth Pressures

Lateral loads may be resisted by soil friction and the passive resistance of the soil. The following parameters are recommended.

- Allowable Passive Earth Pressure = 350 psf (equivalent fluid weight, includes a factor of safety = 2.0)
- Allowable Coefficient of Friction (soil to footing) = 0.35 (includes a factor of safety = 1.5)
- Retaining structures should be designed to resist a lateral active earth pressure of 35 pcf (equivalent fluid weight) for a level, non-expansive granular backfill with drainage provided.

The active earth pressure provided above is only applicable if the retained earth is allowed to strain sufficiently to achieve the active state. The required minimum horizontal strain to achieve the active state is approximately 0.0025H. Retaining structures should be designed to resist an at-rest lateral earth pressure of 55 pcf (equivalent fluid weight) if this horizontal strain cannot be achieved.

The Mononobe-Okabe method is commonly utilized for calculating seismically induced active and passive lateral earth pressures and is based on the limit equilibrium Coulomb theory for static stress conditions. This method entails three fundamental assumptions (e.g., Seed and Whitman, 1970): Wall movement is sufficient to ensure either active or passive conditions, the driving soil wedge inducing the lateral earth pressures is formed by a planar failure surface starting at the heel of the wall and extending to the free surface of the backfill, and the driving soil wedge and the retaining structure act as rigid bodies, and therefore, experiences uniform accelerations throughout the respective bodies (U.S. Army Corps of Engineers, 2003, Engineering and Design - Stability Analysis of Concrete Structures).

- Seismic Lateral Earth Pressure for level backfill = 18 pcf (equivalent fluid weight)

The seismic lateral earth pressure given above is a triangular distribution increasing with depth, and the resultant of this pressure is an increment of force which should be applied to the back of the wall at 1/3 of the wall height from the wall base. The seismic increment of earth pressure should be added to the static active pressure. Even for the at-rest (K_0) condition, the seismic increment of earth pressure should be added to the static active soil pressure, not to the at-rest (SEAOC Seismology Committee 2019). Per CBC Section 1803.5.12 dynamic seismic lateral earth pressures shall be applied to foundation walls and retaining walls supporting more than 6 feet of backfill. Dynamic seismic lateral earth pressures may also be applied to shorter walls at the discretion of the structural engineer.

3.14 Pole Type Foundations

It is anticipated that light poles, signs, or canopies may be supported on pole-type foundations or drilled piers. This type of foundation should be designed in accordance with Section 1807.3 of the 2022 CBC. It is recommended that an allowable lateral soil bearing pressure of 300 psf per foot of embedment be used to develop parameters S1 and S3 rather than one of the values given in Table 1806.2. This value includes a factor of safety of 2 and may be increased as indicated in Section 1806.3.4. In landscape areas, the upper 12 inches of soil should be ignored when calculating the minimum depth of embedment.

An allowable end bearing pressure of 3,000 psf (includes a factor of safety of 3.0) and an allowable average skin friction of 300 psf (includes a factor of safety of 2.0) may be used to support compressive vertical loads applied to pier foundations that are embedded at least 5 feet. The end bearing should be ignored if the drilled pier excavation is not properly cleaned out prior to installing the reinforcing steel and placing concrete. The uplift capacity of drilled piers can be calculated using an allowable skin friction of 190 psf plus the weight of the pier. In landscape areas, the skin friction within the upper 12 inches of embedded length should be ignored for compressive or uplift loads. The total settlement of pier foundations designed in accordance with these recommendations should not exceed one-half inch.

Prior to placing reinforcing steel or concrete, loose or disturbed soils should be removed from drilled pier excavations. A representative of the Geotechnical Engineer should observe the drilling and clean-out associated with the construction of pier foundations in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. Therefore, for drilled piers that extend to depths of sandy soils, the contractor should be prepared to take measures to prevent caving or significant sloughing in drilled holes (such as temporary casing) from occurring during the drilling and installation of reinforcing steel and concrete. In any case, reinforcing steel and concrete should be installed in an expeditious manner after each drilled hole is cleaned out. The contractor must take responsibility for staging the installation of drilled piers so that significant amounts of sloughing or caving do not occur prior to installing the reinforcing steel and concrete. The annular space around the pole must be backfilled using approved CLSM (controlled low strength material).

3.15 Interior Slabs on Grade

Concrete floors with a minimum thickness of 4 inches are recommended for interior slabs on grade. Existing on-site soils within 5 feet of the ground surface may be considered to have a low expansion potential for design purposes (Expansion Index of ≤ 50). However, to reduce the potential for excessive cracks as a result of differential movement, consideration should be given to reinforcing concrete slab-on-grade floors with at least #3 bars spaced 24 inches on-center in both directions. Reinforcement consisting of welded or woven wire mesh should not be used, due to the difficulty of keeping it centered in the slab during the construction process. If heavy concentrated or moving loads are anticipated, slabs should be designed using a modulus of subgrade reaction (k) of 180 pci. The concrete mix, reinforcement of slabs, and the location of construction and control joints should be specified by the Design Engineer.

Special care should be taken on floors slabs to be covered with thin-set tile or other inflexible coverings. These areas should have suitable reinforcement that is placed at the mid-height of the slab, to mitigate drying shrinkage cracks. Alternatively, inflexible flooring may be installed with unbonded fabric or liners to prevent reflection of slab cracks through the flooring.

A moisture vapor retarder/barrier is recommended beneath all slabs-on-grade that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2022 California Building Code and pertinent sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

The moisture vapor retarder/barrier should consist of a minimum 10 mils thick polyethylene with a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

The moisture vapor retarder/barrier may be placed directly beneath the floor slab with no intermediate granular fill layer. The vapor barrier should be placed directly on a smooth compacted subgrade surface consistent with the recommendations provided in Section 3.02 of this report. This method of construction will provide improved curing of the slab bottom and will eliminate potential problems caused by water being trapped in a granular fill layer. However, concrete slabs poured directly on a moisture vapor retarder/barrier can experience shrinkage cracking and curling due to differential rates of curing through the thickness of the slab. Therefore, for concrete placed directly on the moisture vapor retarder/barrier, we recommend a maximum water to cement ratio of 0.45 and the use of water-reducing admixtures to increase workability and decrease bleeding.

Alternatively, the slabs may be constructed over 2 inches of sand that is placed on the moisture vapor retarder/barrier. Granular fill should consist of clean, fine-graded materials with 100% passing the No. 4 sieve, 10% to 30% passing the No. 100 sieve, and less than 5% passing the No. 200 sieve. The granular layer should be moist but not saturated and uniformly compacted by making at least one pass with a vibratory base compactor or some other mechanical method that is approved by the Project Geotechnical Engineer. If uneven, the surface of the sand should be trimmed to provide the full design thickness of the proposed slab. The granular fill layer should not be left exposed to rain or other sources of water such as wet-grinding, power washing, pipe leaks or other processes, and should be damp but not saturated at the time of concrete placement. Granular fill layers that become saturated should be removed and replaced prior to concrete placement.

3.16 Miscellaneous Concrete Flatwork

Miscellaneous concrete flatwork and walkways may be designed with a minimum thickness of 4 inches. Large slabs (greater than 6 feet in width) should be reinforced with a minimum of #3 rebar placed 24 inches on-center in both directions. The reinforcement must be placed at mid-height in the slab. Control joints should be constructed to create squares or rectangles with a maximum spacing of 12 feet. The Project Civil Engineer should provide design details and specifications for all exterior concrete flatwork include walkways. In addition, walkways should be separated from foundations with a thick expansion joint filler.

The subgrade beneath all miscellaneous concrete flatwork and equipment pads should be constructed in accordance with Section 3.04 of this report. The geotechnical engineer should monitor the moisture conditioning and compaction of the subgrade soils in order to verify compliance with our recommendations.

3.17 Footing Excavations and Concrete Subgrade

All footing excavations should be observed by the geotechnical consultant to verify that they have been excavated into competent soils. The foundation excavations should be observed prior to the placement of forms, reinforcement steel, or concrete. These excavations should be evenly trimmed and level. Prior to concrete placement, any loose or soft soils should be removed. Excavated soils should not be placed within slab or footing areas unless properly compacted (see Section 3.04).

Prior to the placement of the moisture barrier and sand, the subgrade soils underlying the slab should be observed by the geotechnical consultant to verify that all under-slab utility trenches have been properly backfilled and compacted, that no loose or soft soils are present, and that the slab subgrade has been properly compacted to a minimum of 90 percent relative compaction within the upper 12 inches.

Footings may experience an overall loss in bearing capacity or an increased potential to settle where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom of a parallel utility trench.

The subgrade below slabs on grade and walkways should be brought to a minimum of 0% and a maximum of 4% above the optimum moisture content for a depth of 6 inches prior to the placement of concrete or a moisture barrier. The geotechnical consultant should perform insitu moisture tests to verify that the appropriate moisture content has been achieved a maximum of 72 hours prior to the placement of concrete or moisture barriers.

3.18 Drainage and Moisture Proofing

Surface drainage should be directed away from the proposed improvements into suitable drainage devices (see Section 1804.4 of the 2022 CBC). Neither excess irrigation nor rainwater should be allowed to collect or pond against building foundations or within low-lying or level areas of the lot. Surface waters should be diverted away from the tops of slopes and prevented from draining over the top of slopes and down the slope face.

Walls and portions thereof that retain soil and enclose interior spaces and floors below grade should be waterproofed and damp-proofed in accordance with Section 1805 of the 2022 CBC.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Backdrains should be installed behind all retaining walls exceeding 3 feet in height. All backdrains should be outlet to suitable drainage devices. Retaining walls less than 3 feet in height should be provided with backdrains or weep holes. Damp-proofing and/or waterproofing should also be provided on all retaining walls exceeding 3 feet in height.

3.19 Cement Type and Corrosion Potential

A soluble sulfate test was performed on a near-surface soil sample indicated a soluble sulfate content of 8.7 mg/kg (0.00087 percent by weight). Thus, below-grade concrete at the subject site should have a negligible exposure to water-soluble sulfate in the soil. Our recommendations for concrete exposed to sulfate-containing soils are presented in the table below.

Recommendations for Concrete Exposed to Soils Containing Soluble Sulfate

Sulfate Exposure	Water Soluble Sulfate (SO₄) in Soil (% by Weight)	Sulfate (SO₄) in Water (ppm)	Cement Type (ASTM C150)	Maximum Water-Cement Ratio (by Weight)	Minimum Compressive Strength (psi)
Negligible	0.00 - 0.10	0-150	--	--	2,500
Moderate	0.10 - 0.20	150-1,500	II	0.50	4,000
Severe	0.20 - 2.00	1,500-10,000	V	0.45	4,500
Very Severe	Over 2.00	Over 10,000	V plus pozzolan or slag	0.45	4,500

Use of alternate combinations of cementitious materials may be permitted if the combinations meet design recommendations contained in American Concrete Institute guideline ACI 318-11.

Our testing also indicates that there is a low concentration of soluble chloride (30.0 mg/kg) in the onsite soils; therefore, no special protection of reinforcing steel should be required due to soil conditions.

The soils were also tested for soil reactivity (pH) and electrical resistivity (ohm-cm). The test results indicate that the on-site soils have a pH of 6.06 and a minimum electrical resistivity of 4,240 ohm-cm. A neutral or non-corrosive soil has a value ranging from 6.0 to 8.5; thus, the onsite soils can be considered neutral. Generally, soils that could be considered moderately corrosive to ferrous metals have minimum resistivity values of about 3,000 ohm-cm to 10,000 ohm-cm. Soils with resistivity values less than 3,000 ohm-cm can be considered corrosive and soils with resistivity values less than 1,000 ohm-cm can be considered extremely corrosive. In any case, buried metal conduits should have a protective coating in accordance with the manufacturer's specifications. A corrosion specialist should be consulted if more detailed recommendations are required.

3.20 Plan Review

Once formal grading and foundation plans are prepared for the subject project, this office should review the plans from a geotechnical viewpoint, comment on changes from the plan used during preparation of this report and revise the recommendations of this report where necessary.

3.21 Geotechnical Observation and Testing During Grading

The geotechnical engineer should be contacted to provide observation and testing during the following stages of grading:

- During the clearing and grubbing of the site.
- During the demolition of any existing structures, buried utilities or other existing improvements.
- During excavation and over-excavation of existing subgrade.
- During all phases of grading including ground preparation and filling operations.
- When any unusual conditions are encountered during grading.

A grading and compaction report summarizing conditions encountered during grading and the in-place density testing that was performed should be submitted upon completion of the earthwork construction.

3.22 Post-Grading Geotechnical Observation and Testing

After the completion of grading the geotechnical engineer should be contacted to provide additional observation and testing during the following construction activities:

- During trenching and backfilling operations of buried improvements and utilities to verify proper backfill and compaction of the utility trenches.

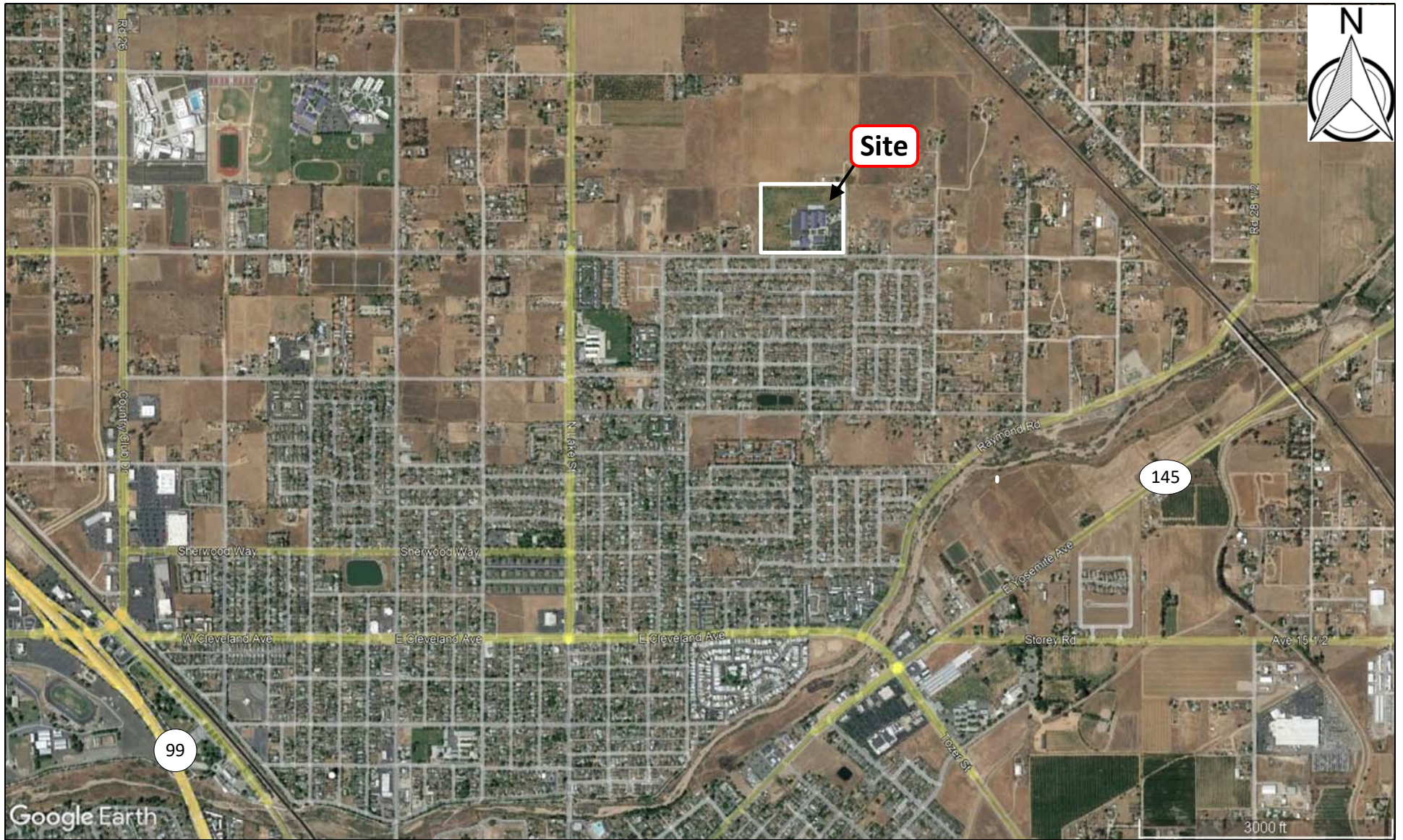
- After excavation and prior to placement of reinforcing steel or concrete within footing excavations to verify that footings are properly founded in competent materials.
- During fine or precise grading involving the placement of any fills underlying driveways, sidewalks, walkways, or other miscellaneous concrete flatwork to verify proper placement, mixing and compaction of fills.
- When any unusual ground or soil conditions are encountered during construction.

4.00 CLOSURE

The findings, conclusions and recommendations in this report were prepared in accordance with generally accepted engineering and geologic principles and practices. No other warranty, either express or implied, is made. This report has been prepared for the Madera Unified School District and other members of the Project Design Team to be used for the design and construction of improvements at the project site. Anyone using this report for any other purpose must draw their own conclusions regarding required construction procedures and subsurface conditions.

RMA GeoScience should be retained during the earthwork and foundation phases of construction to monitor compliance with the design concepts and recommendations and to provide additional recommendations as needed. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

FIGURES



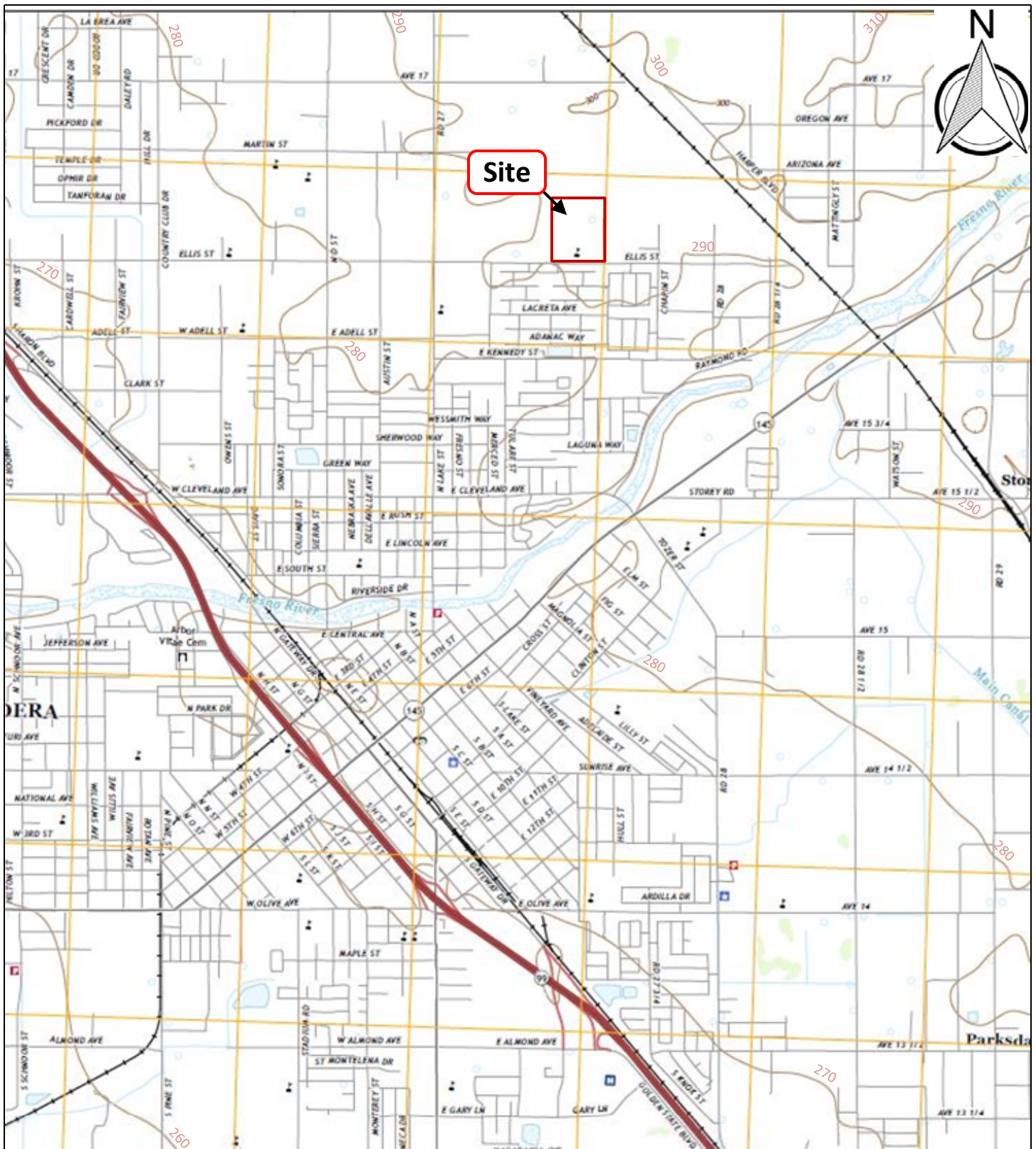
Reference: Google Earth Pro, 2023

Scale: 1" ≈ 1,785'

FIGURE 1

SITE VICINITY MAP

New Kindergarten Classrooms at Pershing Elementary School
 1505 Ellis Street
 Madera, California 93638
 Project #07-230526-0



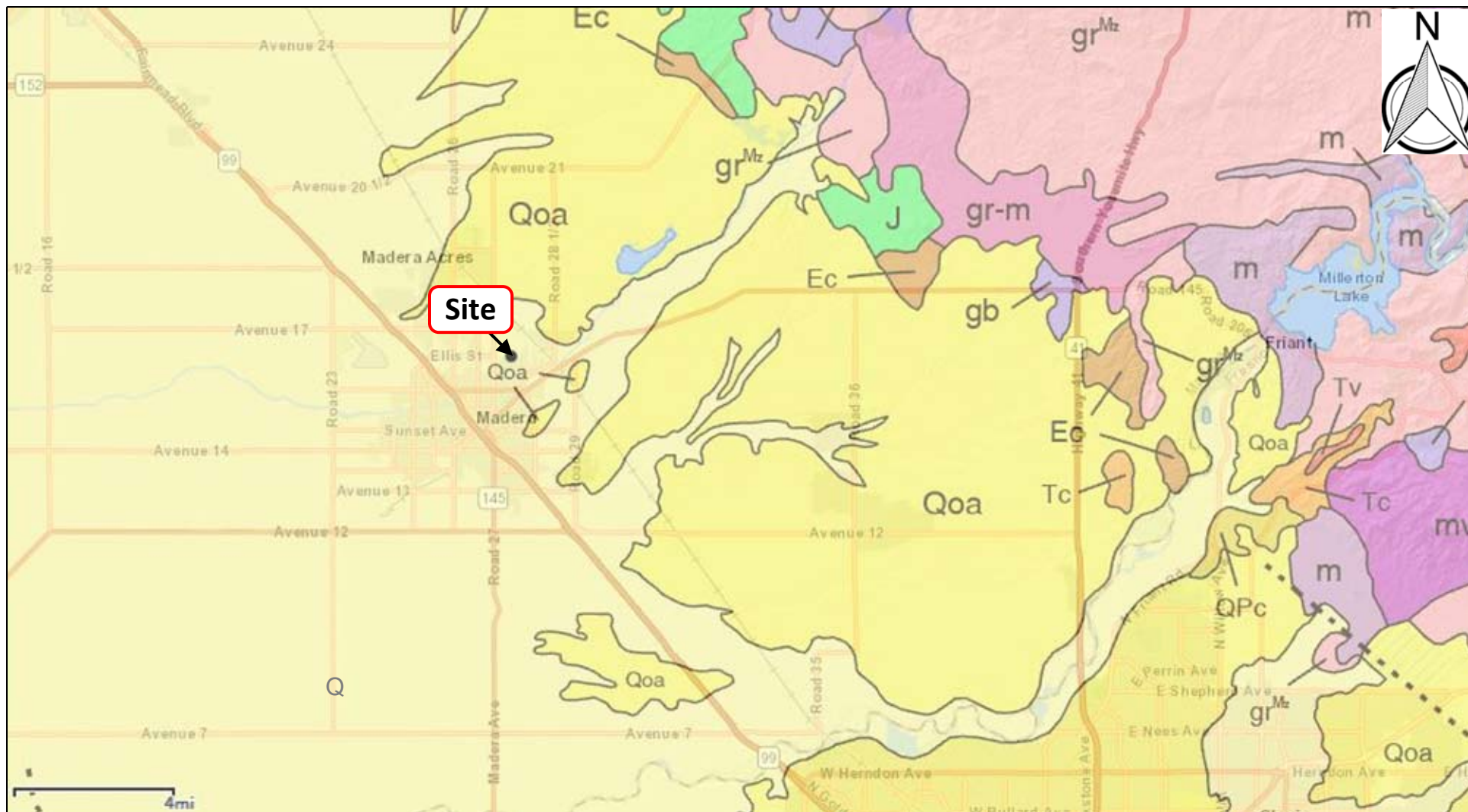
Reference: USGS Madera
Quadrangle, California 7.5-
Minute Series, 2018

Scale: 1" ≈ 0.50 miles

FIGURE 2

USGS CONTOUR MAP

New Classroom Buildings at Pershing Elementary School
1505 Ellis Street
Madera, California 93638
Project #07-230526-0



Source: Gutierrez, et al., 2010, Geologic Map of California, California Geologic Survey Map No. 2

FIGURE 3A

REGIONAL GEOLOGIC MAP

New Kindergarten Classrooms at Pershing Elementary School
1505 Ellis Street
Madera, California 93638
Project #07-230526-0



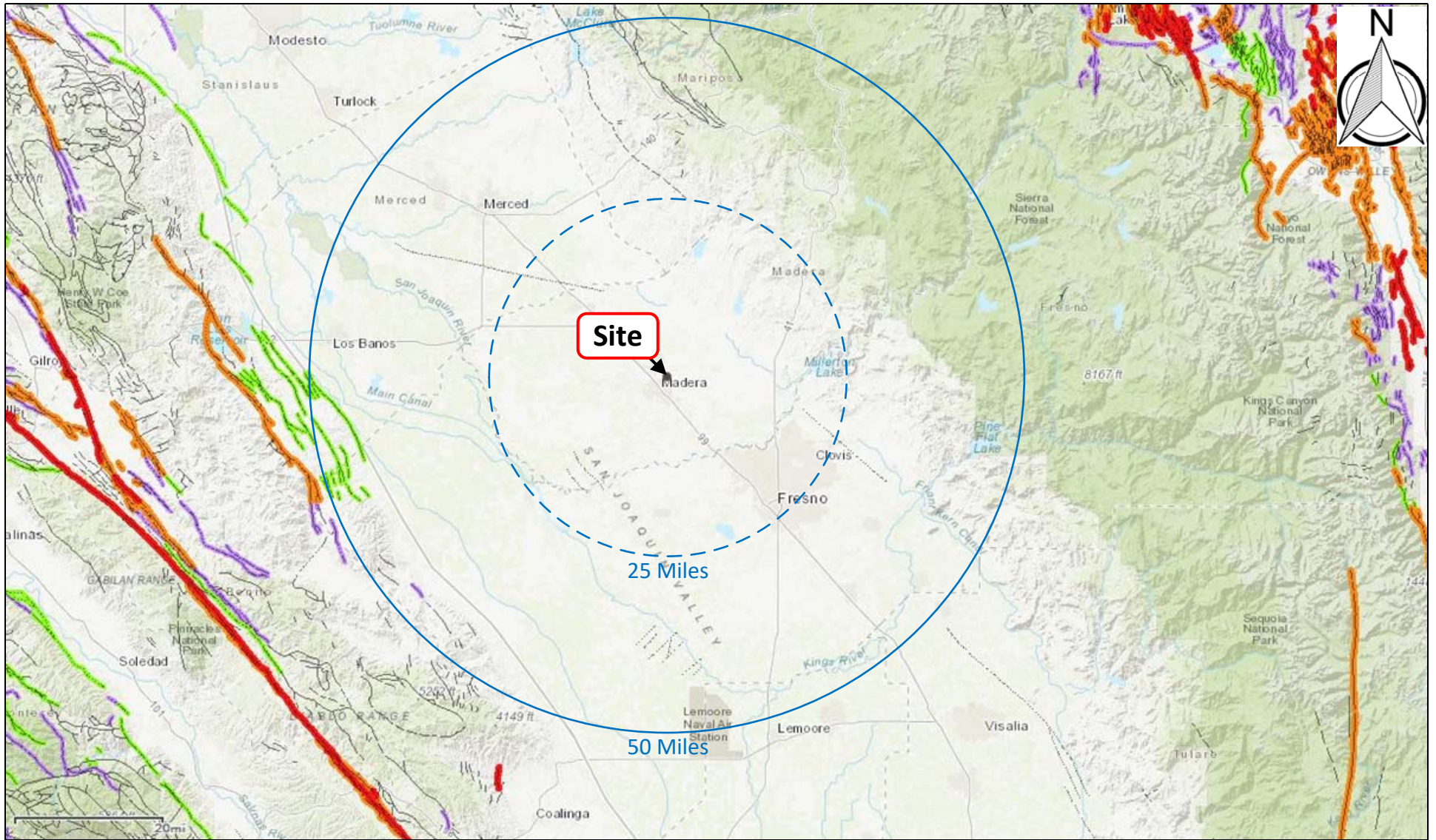
Q	Alluvium, lake, playa, and terrace deposits; consolidated and unconsolidated
Qoa	Older alluvium, lake, playa, and terrace deposits
Tc	Undivided Tertiary nonmarine sandstone, shale, conglomerate, breccia, and ancient lake deposits
Ec	Eocene nonmarine sandstone, shale, and conglomerate; moderately to well consolidated
Tv	Tertiary volcanic flow rocks; minor pyroclastic deposits
J	Jurassic shale and sandstone; minor conglomerate, chert, slate, limestone, and pyroclastic rocks
gr-m	Mesozoic to Precambrian granitic and metamorphic rocks; mostly gneiss and other metamorphic rocks injected by granitic rocks
mv	Undivided pre-Cenozoic metavolcanic rocks. Includes latite, dacite, tuff, and greenstone; commonly schistose
grMz	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
gb	Gabbro and dark dioritic rocks; chiefly Mesozoic.
m	Undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble

Source: Gutierrez, et al., 2010, Geologic Map of
California, California Geologic Survey Map No. 2

FIGURE 3B

LEGEND FOR REGIONAL GEOLOGIC MAP

New Kindergarten Classrooms at Pershing Elementary School
1505 Ellis Street
Madera, California 93638
Project #07-230526-0



Source: Jennings, C. W., and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey, Geologic Data Map No. 6.

Scale: 1" ≈ 20 miles

FIGURE 4A






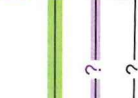

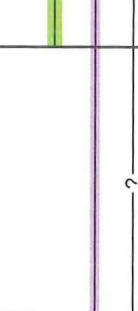

FAULT ACTIVITY MAP

New Kindergarten Classrooms at Pershing Elementary School

1505 Ellis Street

Madera, California 93638

Project #07-230526-0

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	200			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
			11,700			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary	Pleistocene	700,000			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
			1,600,000				
Pre-Quaternary			4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

Source: Jennings, C. W., and Bryant, W. A., 2010, Fault Activity Map of California, California Geologic Survey, Geologic Data Map No. 6.

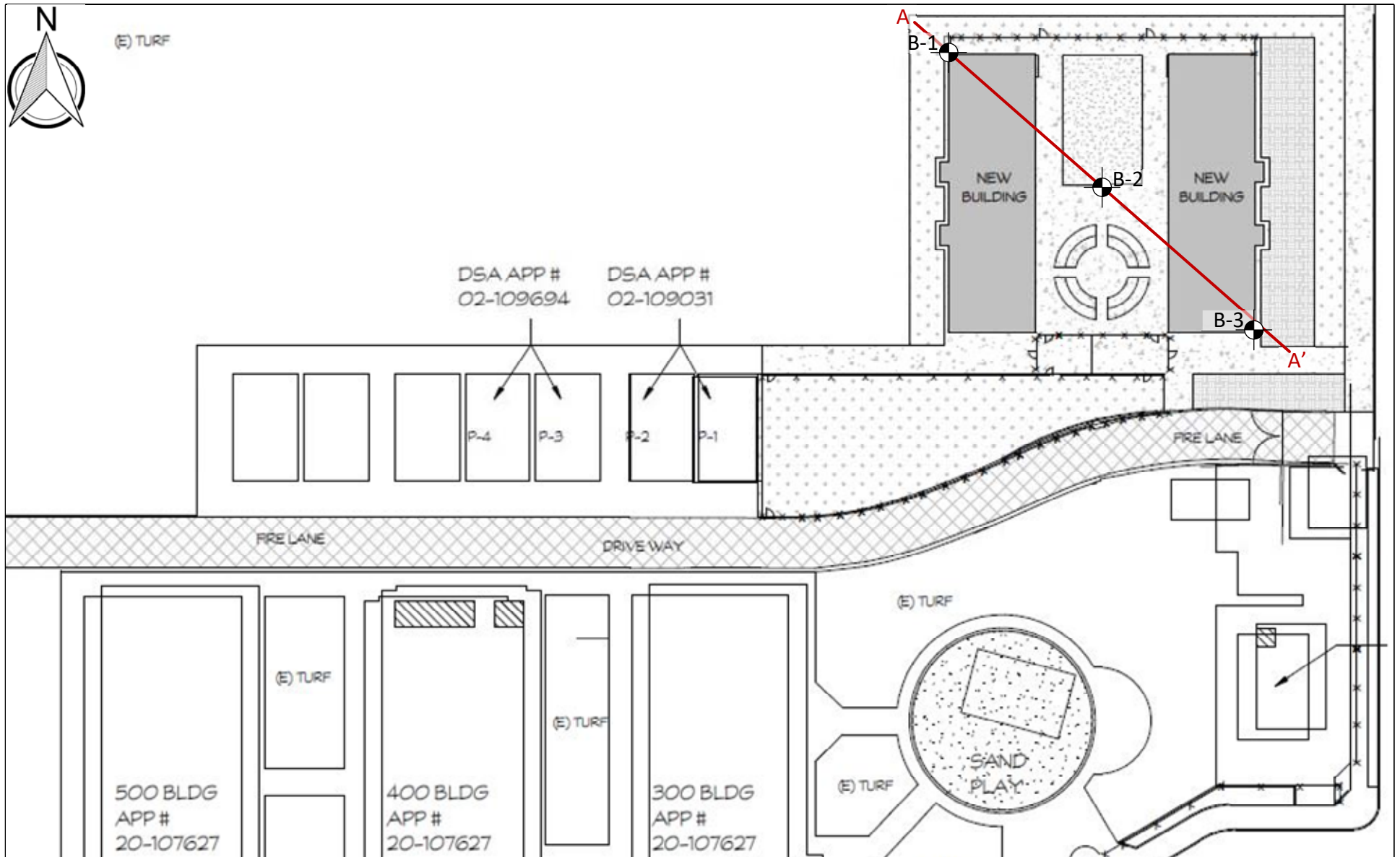


FIGURE 5

BORING LOCATION MAP

New Kindergarten Classrooms at Pershing Elementary School
 1505 Ellis Street
 Madera, California 93638
 Project #07-230526-0

B-2 Approximate Boring
 Locations

A ——— A' Cross Section Line

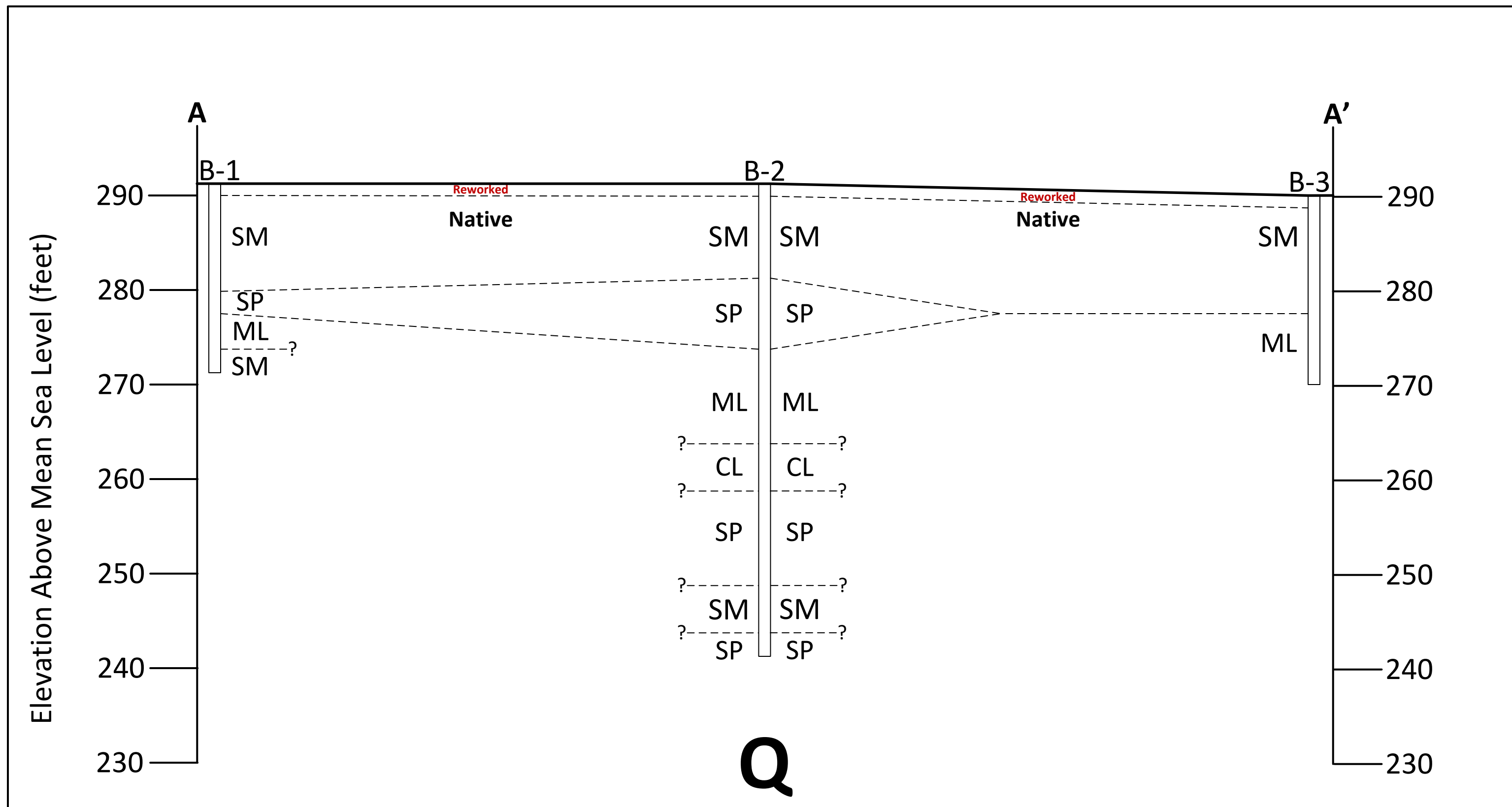


FIGURE 6

CROSS SECTION A TO A'

New Kindergarten Classrooms at Pershing Elementary School
 1505 Ellis Street
 Madera, California 93638
 Project #07-230526-0

Horizontal Scale: 1" = 13.3'
 Vertical Scale: 1" = 10'

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Borings

Our subsurface investigation consisted of excavating three test borings to a maximum depth of approximately 51 feet below existing grade. The test borings were excavated with a SIMCO 2800 drill rig equipped with a 4-inch solid stem auger and a 140-pound auto-hammer on July 21, 2023.

A-1.02 Location of Borings

The approximate locations of the borings are shown on Figure 5, Boring Location Map. GPS coordinates indicated on the logs are based on information provided by Google Earth Pro.

A-1.03 Logging Borings

Boring logs were prepared by one of our staff and are included in this appendix. The log contains factual information and interpretation of subsurface conditions between samples. The stratum indicated on the boring logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend defining the terms used in describing the relative compaction, consistency or firmness of the soil, and moisture level is provided on the following page. Bag, ring, or tube samples of the major earth units were obtained for laboratory inspection and testing.

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

Compactness of sand		Consistency of clay	
Penetration Resistance N (blows/ft)	Compactness	Penetration Resistance N (blows/ft)	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

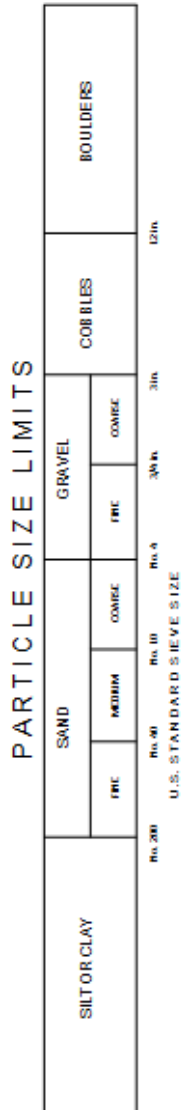
N = Number of blows of 140 lb. weight falling 30 in. to drive 2-in OD sampler 1 ft. (corrected)

BASED ON RELATIVE COMPACTION

Compactness of sand		Consistency of clay	
% Compaction	Compactness	% Compaction	Consistency
<75	Loose	<80	Soft
75-83	Medium Dense	80-85	Medium Stiff
83-90	Dense	85-90	Stiff
>90	Very Dense	>90	Very Stiff

II. SOIL MOISTURE

Moisture of sands		Moisture of clays	
% Moisture	Description	% Moisture	Description
<5%	Dry	<12%	Dry
5-12%	Moist	12-20%	Moist
>12%	Very Moist, wet	>20%	Very Moist, wet



MAJOR DIVISIONS		GROUP SYMBOLS		TYPICAL NAMES	
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravel, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravel or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour silty or clayey fine sands or clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
			OL	Organic silts and organic silty clays of low plasticity.	
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
			CH	Inorganic clays of high plasticity, fat clays.	
			OH	Organic clays of medium to high plasticity, organic silts.	
			Pt	Peat and other highly organic soils.	
	HIGHLY ORGANIC SOILS				

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

Exploratory Boring Log

Boring No. B-1

Sheet 1 of 1

Date Drilled: July 21st, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV

Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.988751°, -120.045772°





Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	R	65		10.3	131.2	SM		REWORKED: dark brown, fine to medium SILTY SAND, moist, loose NATIVE: red brown, fine to medium SILTY SAND with CLAY, moist, very dense
	R	39				SM		... brown, dense
10	R	14		6.5	119.1	SP		... no CLAY, medium dense
	S	13				ML		Light brown, fine to coarse SAND, moist, medium dense
15								Brown, fine SANDY SILT minor CLAY, moist, stiff
20	S	11				SM		Brown, fine SILTY SAND with interlayers of SANDY SILT, moist, medium dense
25								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
30								
35								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

-  - SPT Sample
  - Bulk Sample
 - Modified California Tube Sample
 - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 1 of 2

Date Drilled: July 21st, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV








Borehole Diameter: 7"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.988608°, -120.045581°





Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	R	61		3.1	115.4	SM		REWOKED: dark brown, fine to medium SILTY SAND, moist, loose NATIVE: red brown, fine to medium SILTY SAND with CLAY, moist, very dense
5	R	50/4"		11.1	123.1	SM		... brown, partially cemented
10	S	21						... no CLAY, medium dense, no cementation
15	R	11		2.1	106.8	SP		Light brown, fine to medium SAND, dry, medium dense
15	R	11						... light gray brown, fine to coarse grained
20	S	11				ML		Brown, fine SANDY SILT minor CLAY, moist, stiff
25	R	21		22.8	87.4			... gray brown, increasing CLAY content, very moist, very stiff
25	R	21						... with interlayers of SILTY CLAY
30	S	13				CL		Brown, SILTY CLAY, very moist, stiff
35	R	34		11.8	104.0	SP		Gray brown, fine SAND, moist, dense
35	R	34						... with interlayers of CLAYEY SAND and SILTY CLAY, very moist
35	R	34						... no interlayers



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

 - SPT Sample
 - Bulk Sample
 - Modified California Tube Sample
 - Modified California Ring Sample

Symbols:

 - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 2 of 2

Date Drilled: July 21st, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV




Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.988608°, -120.045581°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
45	[S]	21		12.9	119.8	SP		...light gray brown, fine to coarse grained, moist, medium dense
	[R]	36				SC		White to light gray brown, fine to medium CLAYEY SAND, very moist, dense ...with interlayers of SAND and SILTY CLAY
50	[S]	15				SP		Light gray brown, fine to medium SAND, dry, medium dense
55							Notes: 1. Boring terminated at approximately 51' 2. No groundwater encountered 3. Boring backfilled with soil cuttings	
60								
65								
70								
75								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-3

Sheet 1 of 1

Date Drilled: July 21st, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV


Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.988462°, -120.045390°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
						SM		This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
	[R]	36		5.0	136.6			REWORKED: dark brown, fine to medium SILTY SAND, moist, loose
5	[R]	50/5"		10.6	118.7	SM		NATIVE: red brown, fine to medium SILTY SAND, moist, dense
								...light brown, with CLAY, very dense, partially cemented
10	[R]	58		16.2	123.1			...brown, very moist
15	[S]	19				ML		Brown, fine SANDY SILT with CLAY, moist, very stiff
20	[S]	7						...increasing CLAY content, medium stiff
25								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
30								
35								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

[S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

 - Groundwater
 - End of Boring

APPENDIX B

LABORATORY TESTS

APPENDIX B

B-1.00 LABORATORY TESTS

B-1.01 Moisture Determination

The moisture content of tube and ring samples obtained from the test borings was determined in accordance with ASTM D2216, the standard method for determining the water content of soil using a drying oven. The mass of material remaining after oven drying is used as the mass of the solid particles. The results of these tests are provided on the boring logs in Appendix A.

B-1.02 Density of Split-Barrel Samples

The densities of ring and tube samples, which were obtained using a split-barrel sampler, were determined in accordance with ASTM D2937. The results of these tests are provided on the boring logs in Appendix A.

B-1.03 Soluble Sulfates and Chlorides

Tests were performed in accordance with California Test Methods 417 and 422 on a near-surface soil sample obtained during the field exploration. These tests were performed by Dellavalle Laboratory, Inc. located in Fresno, California (see Table B1 for results).

B-1.04 Soil Reactivity (pH) and Minimum Electrical Resistivity

One near-surface soil sample was tested for soil reactivity (pH) and minimum electrical resistivity using California Test Method 643 (see Table B1). The pH measurement determines the degree of acidity or alkalinity in the soils. The minimum electrical resistivity is used as an indicator of how corrosive the soil is relative to buried metallic items.

TABLE B1: SUMMARY OF CORROSIVITY TESTS

Sample Location	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)	pH	Minimum Resistivity (ohm-cm)
B-2 @ 1' – 3'	8.7	30.0	6.06	4,240

B-1.05 Percent Passing #200 Sieve

Three soil samples were tested in accordance with ASTM D1140 to determine the percent passing the #200 sieve (see Table B2). This represents the amount of silt and clay that is present in the soil.

TABLE B2: PERCENT PASSING #200 SIEVE TEST RESULTS

Sample Location	Dry Weight Before Wash (grams)	Dry Weight After Wash (grams)	Percent Passing #200 Sieve
B-1 @ 1' – 3'	275.1	156.9	43
B-2 @ 15.5'	293.8	282.6	4
B-3 @ 5.5'	273.4	176.3	36

B-1.06 Atterberg Limits

The liquid limit, plastic limit, and the plasticity index of a near-surface soil sample were determined using the standard test methods of ASTM D4318 (See Figure B1).

B-1.07 Expansion Index

Expansion index testing was performed on a near-surface sample of the on-site soils in accordance with the standard test methods of ASTM D4829. The results of this test are shown on Figure B2.

B-1.08 Direct Shear

One 3-point direct shear test was performed on a representative near-surface sample of soil using the standard test method of ASTM D3080 (consolidated and drained). The shear tests were performed on a direct shear machine of the strain-controlled type. To simulate possible adverse field conditions, the samples were saturated prior to shearing. Three soil specimens were sheared at varying normal loads for the test and the results plotted to establish the angle of the internal friction and cohesion of the tested sample. The results of this test are shown on Figure B3.

B-1.09 One-Dimensional Consolidation Properties

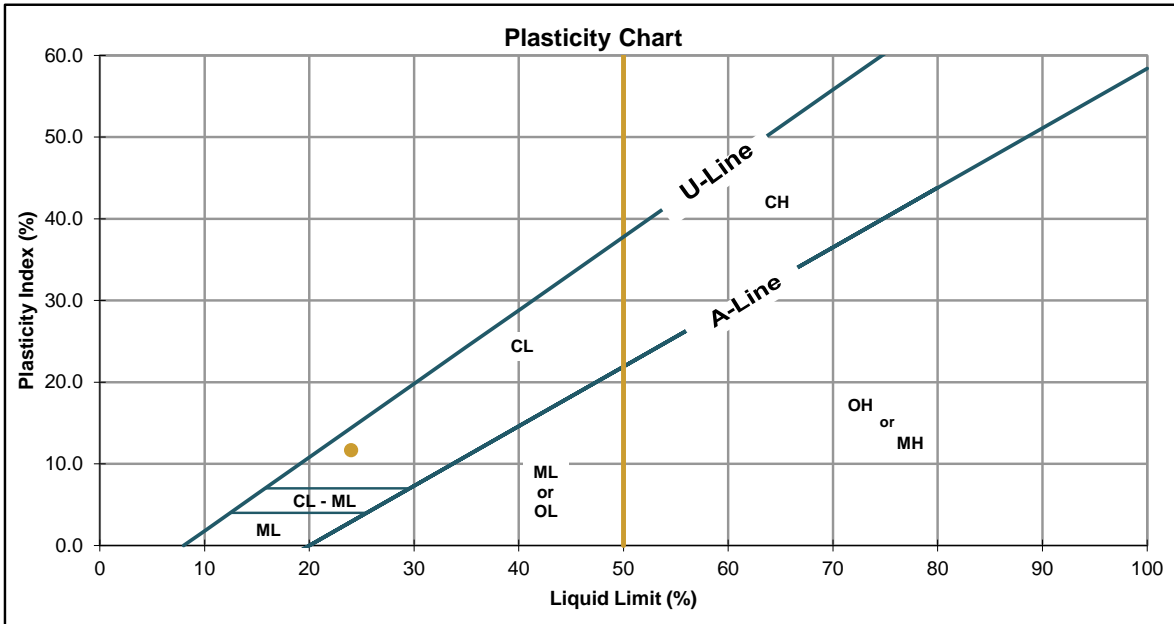
The magnitude and rate of consolidation of soils obtained from test borings, when it is restrained laterally and drained axially while subjected to incrementally applied controlled-stress loading, was determined using the standard test methods of ASTM D2435. The results of these tests are shown on Figure B4.

Figure B1
Laboratory Test Form | ASTM D4318
Plasticity Index (PI) of Soils

Project Number:	07-230526-0/02	Lab ID:	23-013466
Project Name:	New Kindergarten Classrooms at Pershing ES	Date Tested:	8/1/2023
Sampled By:	Gabe V.	Tested By:	Jason M.
Sample Date:	7/21/2023		
Sample Location:	B-1 @ 1ft - 3ft		
Sample Description:	Silty SAND with Clay, fine to medium grained, brown to red brown		

Plasticity Index Results

Liquid Limit:	24
Average Plastic Limit :	12
Plasticity Index:	12



Liquid Limit Data

	Trial 1	Trial 2	Trial 3
Wet Weight (gm.)	20.07	23.74	21.64
Dry Weight (gm.)	18.15	21.17	19.66
Tare Weight (gm.)	10.46	10.38	10.58
Number of Blows	18	25	31
Moisture Content (%)	25.0	23.8	21.8

Plastic Limit Data

	Trial 1	Trial 2
Wet Weight (gm.)	26.93	32.71
Dry Weight (gm.)	26.13	31.71
Tare Weight (gm.)	19.77	23.42
Moisture Content (%)	12.6	12.1

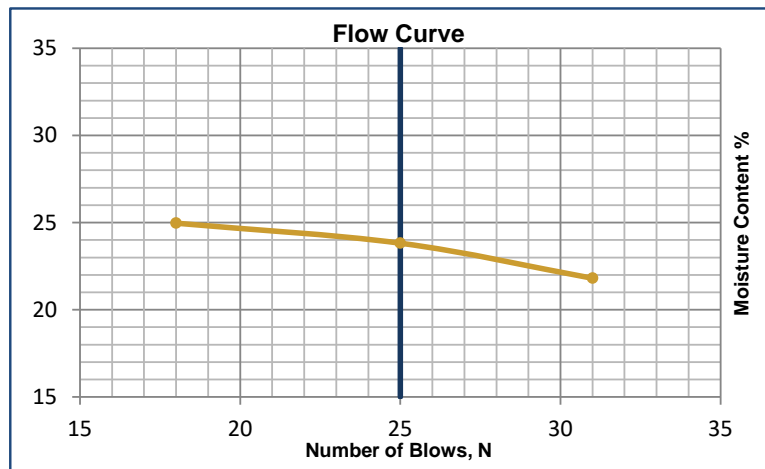




Figure B2

Laboratory Test Form | ASTM D4829

Expansion Index of Soils

Project Number: <u>07-230526-0/02</u>	Lab ID: <u>23-013477</u>
Project Name: <u>New Kindergarten Classrooms at Pershing ES</u>	Date Sampled: <u>7/21/2023</u>
Sampled By: <u>Gabe V.</u>	Date Tested: <u>8/9/2023</u>
Tested By: <u>Jason M.</u>	
Sample Location: <u>B-3 @ 1ft - 3ft</u>	
Sample Description: <u>Silty SAND, fine to medium, brown to red brown</u>	

Expansion Readings

Initial Sample Height (in):	0.0248
Final Sample Height (in):	0.0250
Expansion (in):	0.0002
Expansion Index, EI:	0

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Expansion Index Data

Initial Set-Up Data		Final Data	
Sample + Tare Weight (gm):	780.1	Sample + Tare Weight (gm):	821.8
Tare Weight (gm):	365.9	Tare Weight (gm):	365.9
Initial Gauge Reading (in):	0.0248	Final Gauge Reading (in):	0.0250

Moisture Content And Density Data

Wet Weight + Tare (gm):	100.0	Wet Weight + Tare (gm):	821.8
Dry Weight + Tare (gm):	91.7	Dry Weight + Tare (gm):	766.9
Tare Weight (gm):	0	Tare Weight (gm):	365.9
Moisture Content:	9.1%	Moisture Content:	13.7%
Initial Volume (ft ³):	0.007345	Final Volume (ft ³):	0.007274
Remolded Wet Density (pcf):	124.3	Final Wet Density (pcf):	138.2
Remolded Dry Density (pcf):	114.0	Final Dry Density (pcf):	121.5
Degree of Saturation:	51	Assumed Specific Gravity:	2.7

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Figure B4a
Laboratory Test Form | ASTM D2435
 Consolidation, No Time Rate

Project Number: 07-230526-0/02	Lab ID: 23-013472
Project Name: New Kindergarten Classrooms at Pershing ES	Date Sampled: 7/21/2023
Sampled By: Gabe V.	Date Tested: 8/2/23 - 8/16/23
Tested By: Jennifer K.	
Sample Location: B-2 @ 5.5ft	
Sample Description: Silty SAND minor Clay, fine to medium grained, brown	
Sample Preparation: In-Situ Ring Sample	

Consolidation Test Data

Initial Data		Final Data	
Initial Sample Height (in):	1.0000	Final Sample Height (in):	0.9495
Initial Void Ratio:	0.37	Final Void Ratio:	0.30
Initial Gauge Reading (in):	0.2519	Final Gauge Reading (in):	0.3024

Moisture Content and Density Data

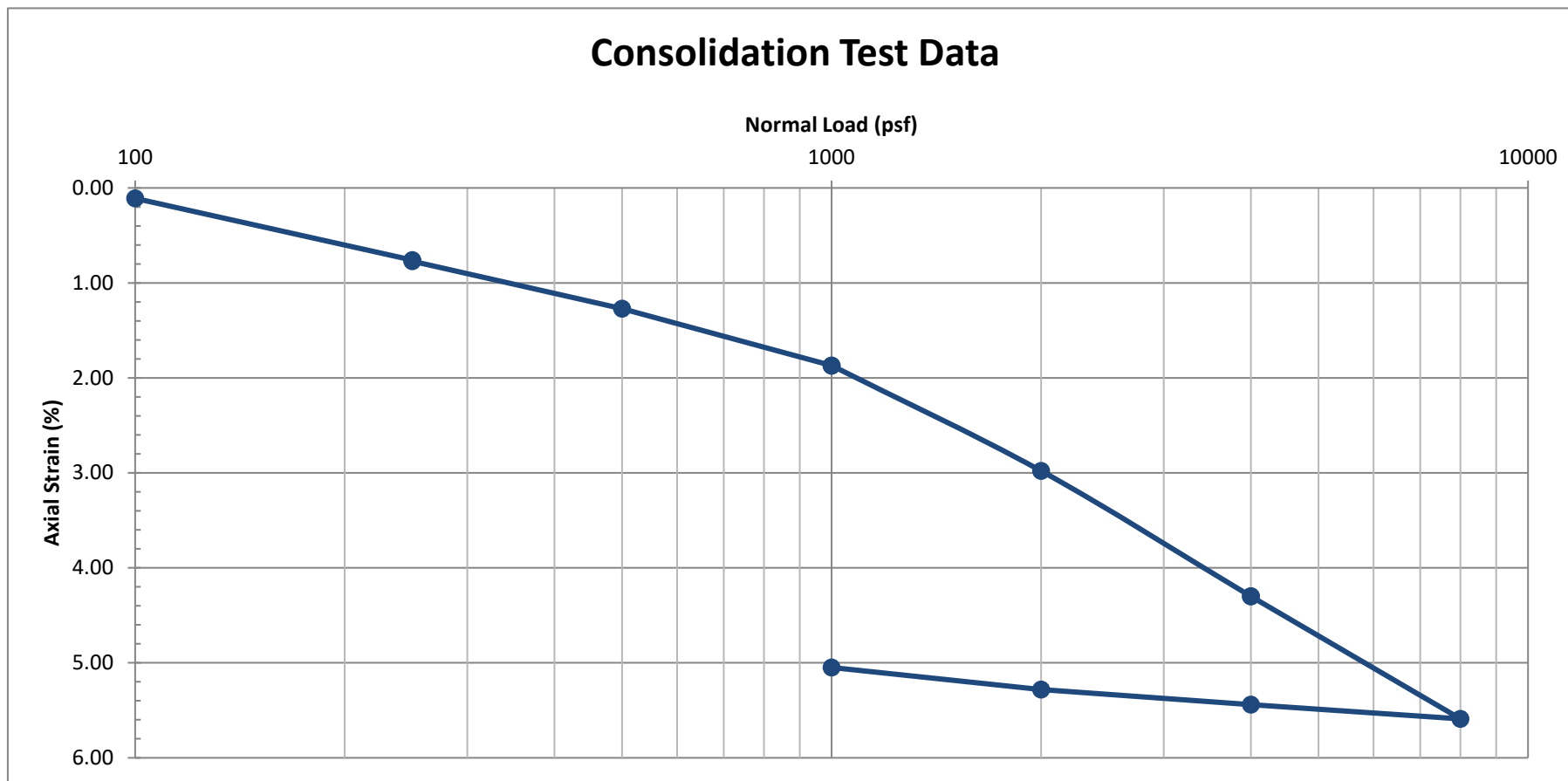
Initial Wet Weight + Tare (gm):	195.98	Final Wet Weight + Tare (gm):	203.20
Initial Dry Weight + Tare (gm):	183.00	Final Dry Weight + Tare (gm):	183.00
Tare Weight (gm):	44.70	Tare Weight (gm):	44.70
Initial Moisture Content:	9.39%	Final Moisture Content:	14.61%
Initial Volume (ft ³):	0.002531	Final Volume (ft ³):	0.002404
Initial Wet Density (pcf):	131.75	Final Wet Density (pcf):	145.38
Initial Dry Density (pcf):	120.44	Final Dry Density (pcf):	126.85
Initial Degree of Saturation:	63.5	Final Degree of Saturation:	120.2

Moisture Condition	Load (psf)	Dial Reading (in)	Sample Height (in)	Axial Strain (%)
In Situ	0	0.2519	1.0000	0.00
	100	0.2530	0.9989	0.11
	250	0.2595	0.9924	0.76
Saturated	250	0.2596	0.9923	0.77
	500	0.2646	0.9873	1.27
	1000	0.2706	0.9813	1.87
	2000	0.2817	0.9702	2.98
	4000	0.2949	0.9570	4.30
	8000	0.3078	0.9441	5.59
	4000	0.3063	0.9456	5.44
	2000	0.3047	0.9472	5.28
	1000	0.3024	0.9495	5.05

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Project Number:	07-230526-0/02	Project Name:	New Kindergarten Classrooms at Pershing Elementary School	
Date Tested:	8/2/23 - 8/16/23	Lab ID:	23-013472	Sample Location:
Tested By:	Jennifer K.	Description:	SM	Sampled By:
				Gabe V.

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APPENDIX C

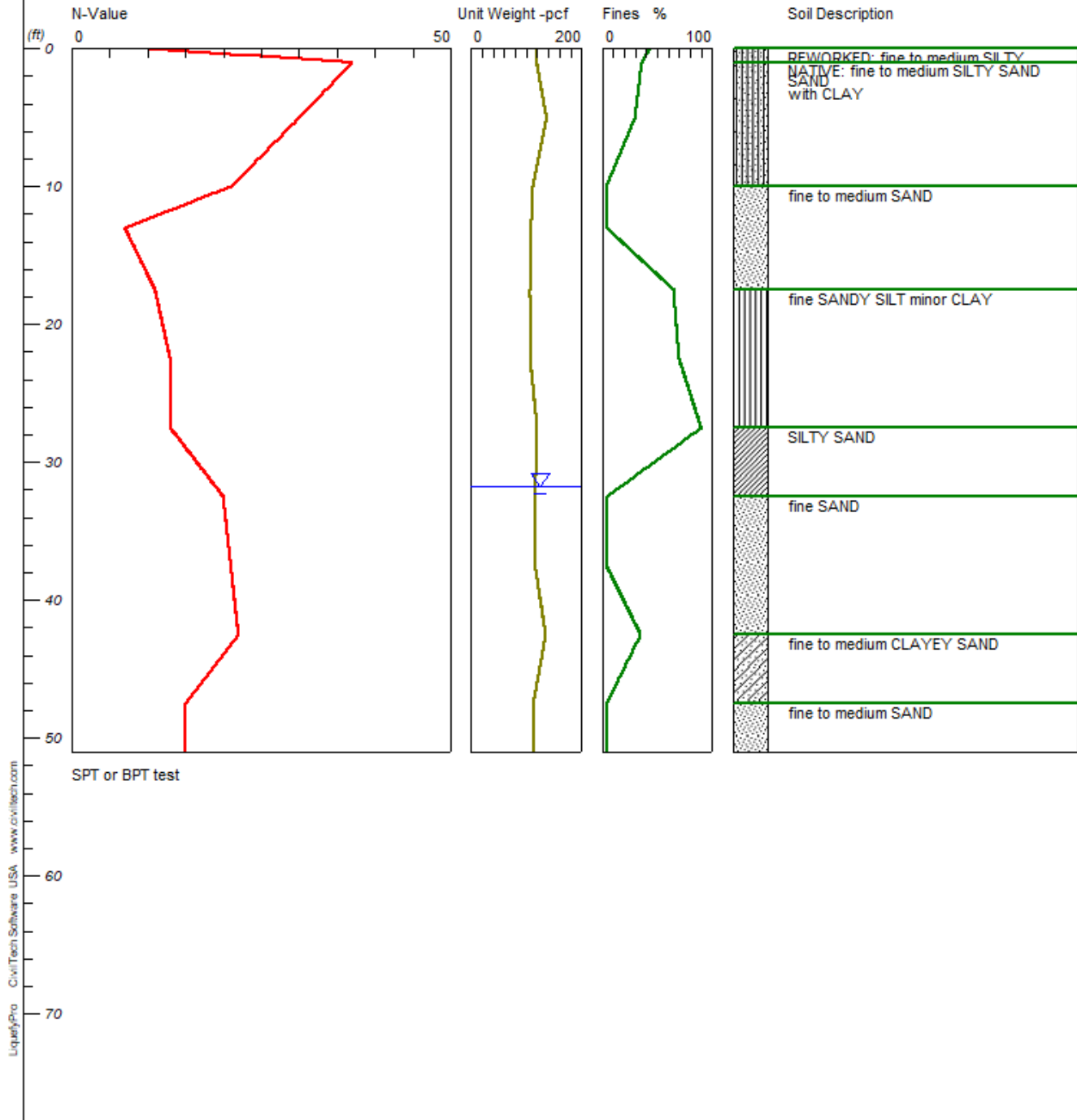
LIQUIFACTION AND SEISMIC SETTLEMENT ANALYSIS (Figures and Analysis Summary)

LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Pershing Elementary

Hole No.=B-2 Water Depth=31.8 ft Surface Elev.=292

Magnitude=5.5
Acceleration=0.336g

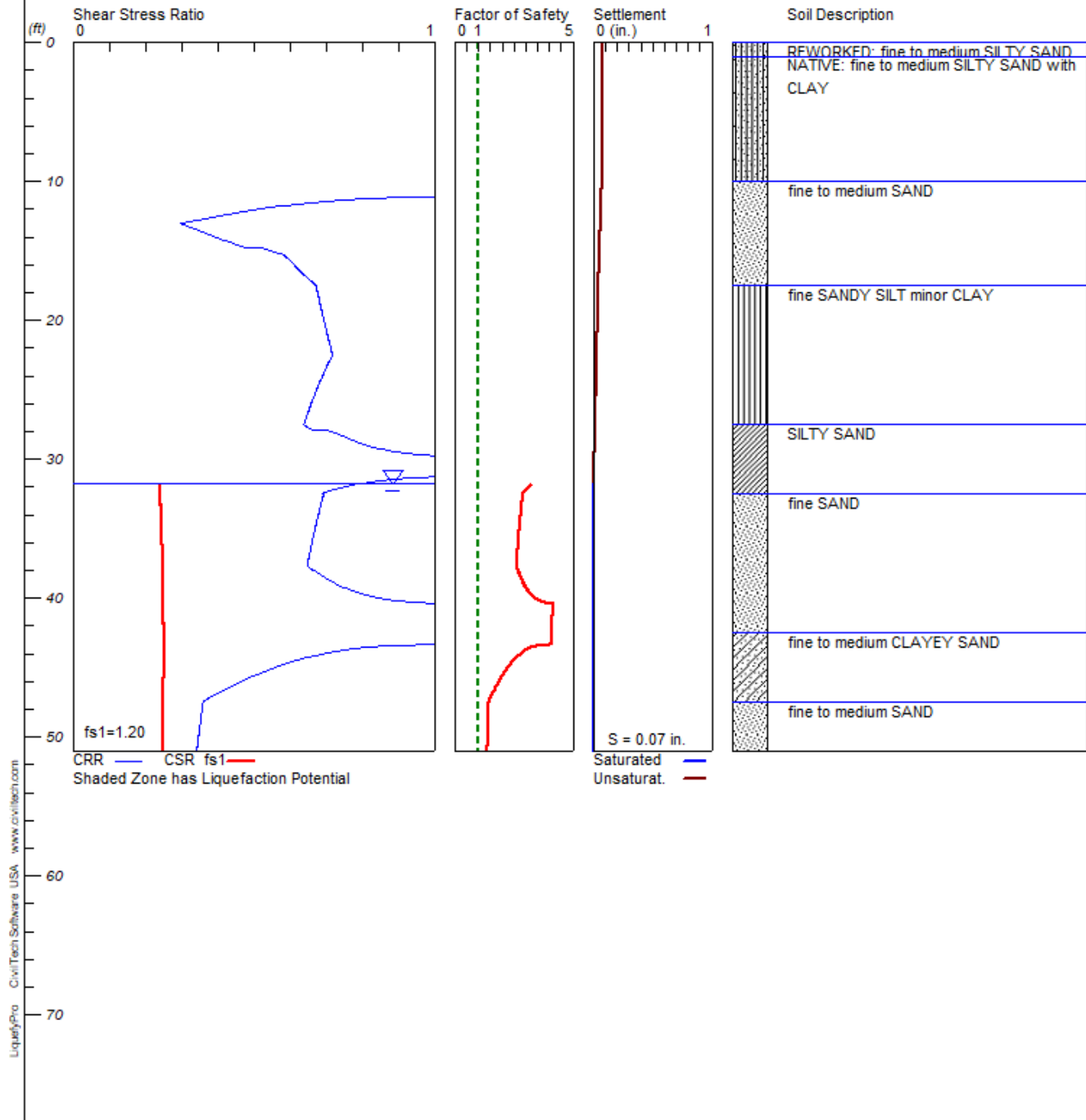


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Pershing Elementary

Hole No.=B-2 Water Depth=31.8 ft Surface Elev.=292

Magnitude=5.5
Acceleration=0.336g

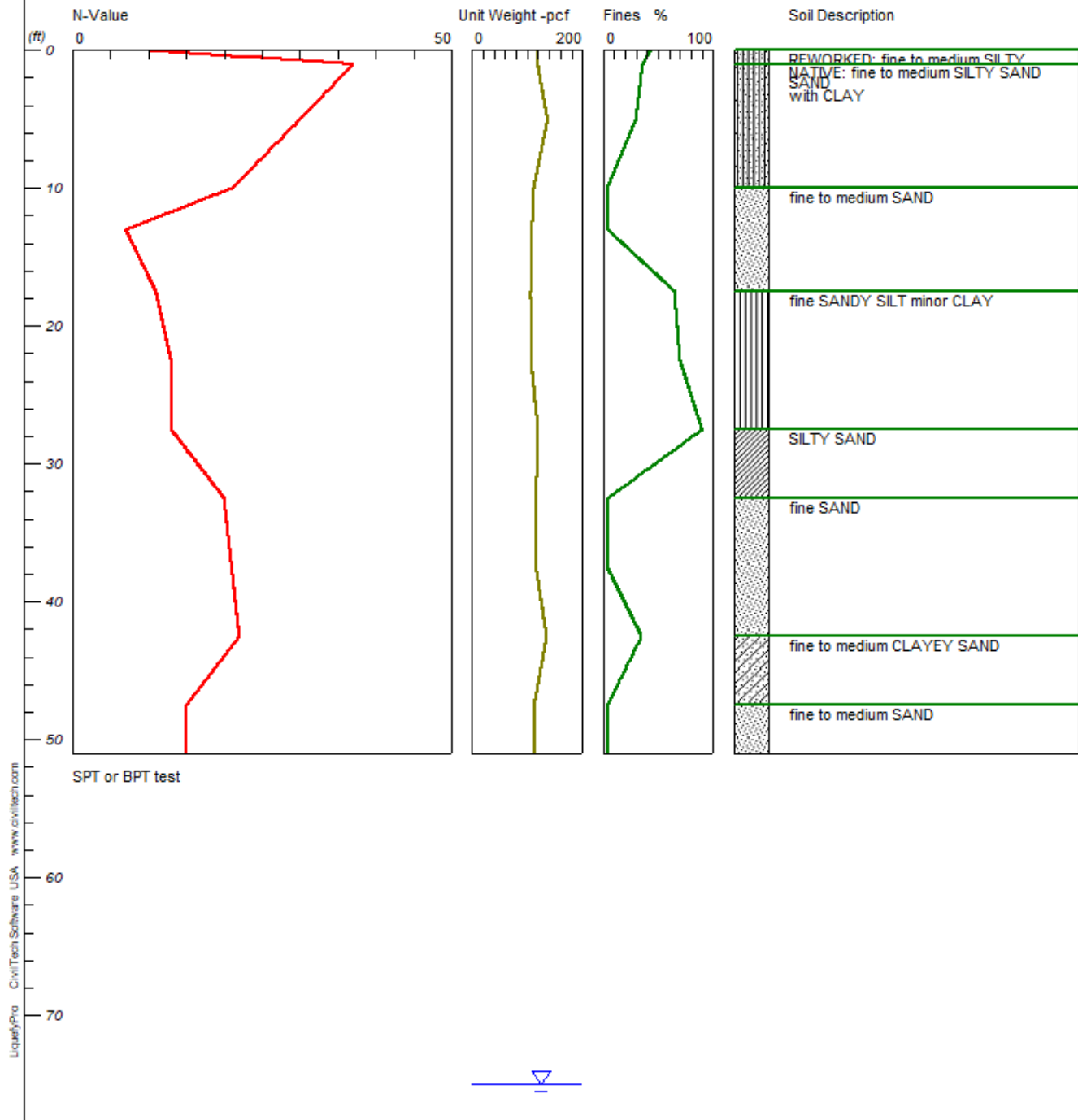


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Pershing Elementary

Hole No.=B-2 Water Depth=75 ft Surface Elev.=292

Magnitude=5.5
Acceleration=0.336g

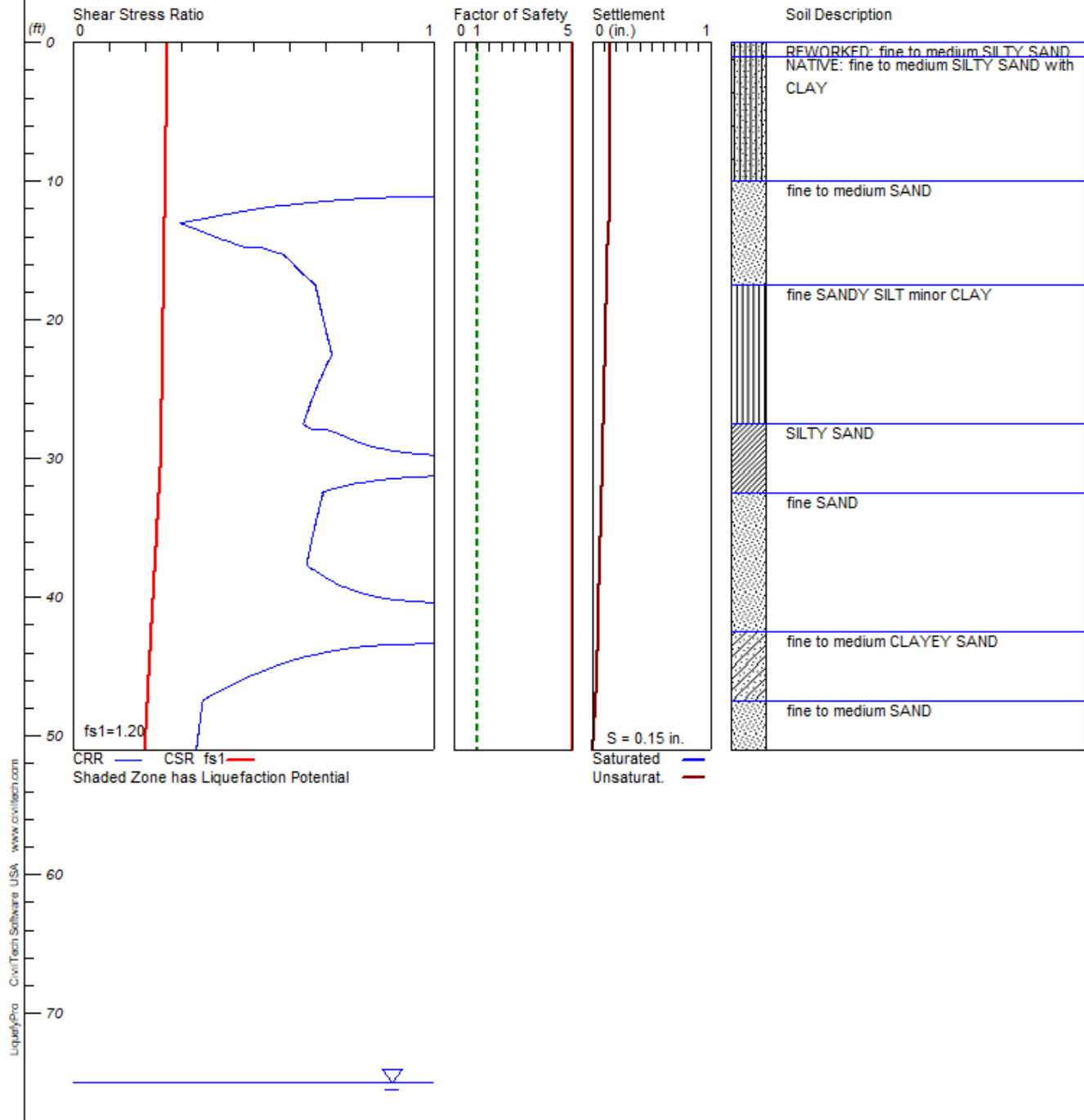


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Pershing Elementary

Hole No.=B-2 Water Depth=75 ft Surface Elev.=292

Magnitude=5.5
Acceleration=0.336g



LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\Engineering\Desktop\07-230526-0.liq
Title: New Kindergarten Classrooms at Pershing Elementary
Subtitle: 07-230526-0

Surface Elev.=292
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 31.80 ft
Water Table during In-Situ Testing= 214.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=292
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 31.80 ft
Water Table during In-Situ Testing= 214.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT gamma pcf	Fines %
-------------	------------------	------------

0.00	10.00	119.00	43.00
1.00	37.00	119.00	36.00

5.00	30.00	136.80	30.00
10.00	21.00	112.00	4.00
13.00	7.00	109.00	4.00
17.50	11.00	107.00	65.00
22.50	13.00	107.30	70.00
27.50	13.00	120.00	90.00
32.50	20.00	116.30	4.00
37.50	21.00	116.30	4.00
42.50	22.00	135.30	35.00
47.50	15.00	113.00	4.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.07 in.
Total Settlement of Saturated and Unsaturated Sands=0.07 in.
Differential Settlement=0.036 to 0.047 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat. in.	S_dry	S_all
-------------	------	--------------	-------------	---------------	-------	-------

0.00	1.11	0.26	5.00	0.00	0.07	0.07
0.05	1.11	0.26	5.00	0.00	0.07	0.07
0.10	1.11	0.26	5.00	0.00	0.07	0.07
0.15	1.11	0.26	5.00	0.00	0.07	0.07
0.20	1.11	0.26	5.00	0.00	0.07	0.07
0.25	1.11	0.26	5.00	0.00	0.07	0.07
0.30	1.11	0.26	5.00	0.00	0.07	0.07
0.35	1.11	0.26	5.00	0.00	0.07	0.07
0.40	1.11	0.26	5.00	0.00	0.07	0.07
0.45	1.11	0.26	5.00	0.00	0.07	0.07
0.50	1.11	0.26	5.00	0.00	0.07	0.07
0.55	1.11	0.26	5.00	0.00	0.07	0.07
0.60	1.11	0.26	5.00	0.00	0.07	0.07
0.65	1.11	0.26	5.00	0.00	0.07	0.07
0.70	1.11	0.26	5.00	0.00	0.07	0.07
0.75	1.11	0.26	5.00	0.00	0.07	0.07
0.80	1.11	0.26	5.00	0.00	0.07	0.07
0.85	1.11	0.26	5.00	0.00	0.07	0.07
0.90	1.11	0.26	5.00	0.00	0.07	0.07
0.95	1.11	0.26	5.00	0.00	0.07	0.07
1.00	1.11	0.26	5.00	0.00	0.07	0.07
1.05	1.11	0.26	5.00	0.00	0.07	0.07
1.10	1.11	0.26	5.00	0.00	0.07	0.07
1.15	1.11	0.26	5.00	0.00	0.07	0.07
1.20	1.11	0.26	5.00	0.00	0.07	0.07
1.25	1.11	0.26	5.00	0.00	0.07	0.07
1.30	1.11	0.26	5.00	0.00	0.07	0.07
1.35	1.11	0.26	5.00	0.00	0.07	0.07
1.40	1.11	0.26	5.00	0.00	0.07	0.07
1.45	1.11	0.26	5.00	0.00	0.07	0.07
1.50	1.11	0.26	5.00	0.00	0.07	0.07
1.55	1.11	0.26	5.00	0.00	0.07	0.07
1.60	1.11	0.26	5.00	0.00	0.07	0.07

1.65 1.11 0.26 5.00 0.00 0.07 0.07
1.70 1.11 0.26 5.00 0.00 0.07 0.07
1.75 1.11 0.26 5.00 0.00 0.07 0.07
1.80 1.11 0.26 5.00 0.00 0.07 0.07
1.85 1.11 0.26 5.00 0.00 0.07 0.07
1.90 1.11 0.26 5.00 0.00 0.07 0.07
1.95 1.11 0.26 5.00 0.00 0.07 0.07
2.00 1.11 0.26 5.00 0.00 0.07 0.07
2.05 1.11 0.26 5.00 0.00 0.07 0.07
2.10 1.11 0.26 5.00 0.00 0.07 0.07
2.15 1.11 0.26 5.00 0.00 0.07 0.07
2.20 1.11 0.26 5.00 0.00 0.07 0.07
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2.30 1.11 0.26 5.00 0.00 0.07 0.07
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2.50 1.11 0.26 5.00 0.00 0.07 0.07
2.55 1.11 0.26 5.00 0.00 0.07 0.07
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2.65 1.11 0.26 5.00 0.00 0.07 0.07
2.70 1.11 0.26 5.00 0.00 0.07 0.07
2.75 1.11 0.26 5.00 0.00 0.07 0.07
2.80 1.11 0.26 5.00 0.00 0.07 0.07
2.85 1.11 0.26 5.00 0.00 0.07 0.07
2.90 1.11 0.26 5.00 0.00 0.07 0.07
2.95 1.11 0.26 5.00 0.00 0.07 0.07
3.00 1.11 0.26 5.00 0.00 0.07 0.07
3.05 1.11 0.26 5.00 0.00 0.07 0.07
3.10 1.11 0.26 5.00 0.00 0.07 0.07
3.15 1.11 0.26 5.00 0.00 0.07 0.07
3.20 1.11 0.26 5.00 0.00 0.07 0.07
3.25 1.11 0.26 5.00 0.00 0.07 0.07
3.30 1.11 0.26 5.00 0.00 0.07 0.07
3.35 1.11 0.26 5.00 0.00 0.07 0.07
3.40 1.11 0.26 5.00 0.00 0.07 0.07
3.45 1.11 0.26 5.00 0.00 0.07 0.07
3.50 1.11 0.26 5.00 0.00 0.07 0.07
3.55 1.11 0.26 5.00 0.00 0.07 0.07
3.60 1.11 0.26 5.00 0.00 0.07 0.07
3.65 1.11 0.26 5.00 0.00 0.07 0.07
3.70 1.11 0.26 5.00 0.00 0.07 0.07
3.75 1.11 0.26 5.00 0.00 0.07 0.07
3.80 1.11 0.26 5.00 0.00 0.07 0.07
3.85 1.11 0.26 5.00 0.00 0.07 0.07
3.90 1.11 0.26 5.00 0.00 0.07 0.07
3.95 1.11 0.26 5.00 0.00 0.07 0.07
4.00 1.11 0.26 5.00 0.00 0.07 0.07
4.05 1.11 0.26 5.00 0.00 0.07 0.07
4.10 1.11 0.26 5.00 0.00 0.07 0.07
4.15 1.11 0.26 5.00 0.00 0.07 0.07
4.20 1.11 0.26 5.00 0.00 0.07 0.07
4.25 1.11 0.26 5.00 0.00 0.07 0.07
4.30 1.11 0.26 5.00 0.00 0.07 0.07

4.35 1.11 0.26 5.00 0.00 0.07 0.07
4.40 1.11 0.26 5.00 0.00 0.07 0.07
4.45 1.11 0.26 5.00 0.00 0.07 0.07
4.50 1.11 0.26 5.00 0.00 0.07 0.07
4.55 1.11 0.26 5.00 0.00 0.07 0.07
4.60 1.11 0.26 5.00 0.00 0.07 0.07
4.65 1.11 0.26 5.00 0.00 0.07 0.07
4.70 1.11 0.26 5.00 0.00 0.07 0.07
4.75 1.11 0.26 5.00 0.00 0.07 0.07
4.80 1.11 0.26 5.00 0.00 0.07 0.07
4.85 1.11 0.26 5.00 0.00 0.07 0.07
4.90 1.11 0.26 5.00 0.00 0.07 0.07
4.95 1.11 0.26 5.00 0.00 0.07 0.07
5.00 1.11 0.26 5.00 0.00 0.07 0.07
5.05 1.11 0.26 5.00 0.00 0.07 0.07
5.10 1.11 0.26 5.00 0.00 0.07 0.07
5.15 1.11 0.26 5.00 0.00 0.07 0.07
5.20 1.11 0.26 5.00 0.00 0.07 0.07
5.25 1.11 0.26 5.00 0.00 0.07 0.07
5.30 1.11 0.26 5.00 0.00 0.07 0.07
5.35 1.11 0.26 5.00 0.00 0.07 0.07
5.40 1.11 0.26 5.00 0.00 0.07 0.07
5.45 1.11 0.26 5.00 0.00 0.07 0.07
5.50 1.11 0.26 5.00 0.00 0.07 0.07
5.55 1.11 0.26 5.00 0.00 0.07 0.07
5.60 1.11 0.26 5.00 0.00 0.07 0.07
5.65 1.11 0.26 5.00 0.00 0.07 0.07
5.70 1.11 0.26 5.00 0.00 0.07 0.07
5.75 1.11 0.26 5.00 0.00 0.07 0.07
5.80 1.11 0.26 5.00 0.00 0.07 0.07
5.85 1.11 0.26 5.00 0.00 0.07 0.07
5.90 1.11 0.26 5.00 0.00 0.07 0.07
5.95 1.11 0.26 5.00 0.00 0.07 0.07
6.00 1.11 0.26 5.00 0.00 0.07 0.07
6.05 1.11 0.26 5.00 0.00 0.07 0.07
6.10 1.11 0.26 5.00 0.00 0.07 0.07
6.15 1.11 0.26 5.00 0.00 0.07 0.07
6.20 1.11 0.26 5.00 0.00 0.07 0.07
6.25 1.11 0.26 5.00 0.00 0.07 0.07
6.30 1.11 0.26 5.00 0.00 0.07 0.07
6.35 1.11 0.26 5.00 0.00 0.07 0.07
6.40 1.11 0.26 5.00 0.00 0.07 0.07
6.45 1.11 0.26 5.00 0.00 0.07 0.07
6.50 1.11 0.26 5.00 0.00 0.07 0.07
6.55 1.11 0.26 5.00 0.00 0.07 0.07
6.60 1.11 0.26 5.00 0.00 0.07 0.07
6.65 1.11 0.26 5.00 0.00 0.07 0.07
6.70 1.11 0.26 5.00 0.00 0.07 0.07
6.75 1.11 0.26 5.00 0.00 0.07 0.07
6.80 1.11 0.26 5.00 0.00 0.07 0.07
6.85 1.11 0.26 5.00 0.00 0.07 0.07
6.90 1.11 0.26 5.00 0.00 0.07 0.07
6.95 1.11 0.26 5.00 0.00 0.07 0.07
7.00 1.11 0.26 5.00 0.00 0.07 0.07

7.05 1.11 0.26 5.00 0.00 0.07 0.07
7.10 1.11 0.26 5.00 0.00 0.07 0.07
7.15 1.11 0.26 5.00 0.00 0.07 0.07
7.20 1.11 0.26 5.00 0.00 0.07 0.07
7.25 1.11 0.26 5.00 0.00 0.07 0.07
7.30 1.11 0.26 5.00 0.00 0.07 0.07
7.35 1.11 0.26 5.00 0.00 0.07 0.07
7.40 1.11 0.26 5.00 0.00 0.07 0.07
7.45 1.11 0.26 5.00 0.00 0.07 0.07
7.50 1.11 0.26 5.00 0.00 0.07 0.07
7.55 1.11 0.26 5.00 0.00 0.07 0.07
7.60 1.11 0.26 5.00 0.00 0.07 0.07
7.65 1.11 0.26 5.00 0.00 0.07 0.07
7.70 1.11 0.26 5.00 0.00 0.07 0.07
7.75 1.11 0.26 5.00 0.00 0.07 0.07
7.80 1.11 0.26 5.00 0.00 0.07 0.07
7.85 1.11 0.26 5.00 0.00 0.07 0.07
7.90 1.11 0.26 5.00 0.00 0.07 0.07
7.95 1.11 0.26 5.00 0.00 0.07 0.07
8.00 1.11 0.26 5.00 0.00 0.07 0.07
8.05 1.11 0.26 5.00 0.00 0.07 0.07
8.10 1.11 0.26 5.00 0.00 0.07 0.07
8.15 1.11 0.26 5.00 0.00 0.07 0.07
8.20 1.11 0.26 5.00 0.00 0.07 0.07
8.25 1.11 0.26 5.00 0.00 0.07 0.07
8.30 1.11 0.26 5.00 0.00 0.07 0.07
8.35 1.11 0.26 5.00 0.00 0.07 0.07
8.40 1.11 0.26 5.00 0.00 0.07 0.07
8.45 1.11 0.26 5.00 0.00 0.07 0.07
8.50 1.11 0.26 5.00 0.00 0.07 0.07
8.55 1.11 0.26 5.00 0.00 0.07 0.07
8.60 1.11 0.26 5.00 0.00 0.07 0.07
8.65 1.11 0.26 5.00 0.00 0.07 0.07
8.70 1.11 0.26 5.00 0.00 0.07 0.07
8.75 1.11 0.26 5.00 0.00 0.07 0.07
8.80 1.11 0.26 5.00 0.00 0.07 0.07
8.85 1.11 0.26 5.00 0.00 0.07 0.07
8.90 1.11 0.26 5.00 0.00 0.07 0.07
8.95 1.11 0.26 5.00 0.00 0.07 0.07
9.00 1.11 0.26 5.00 0.00 0.07 0.07
9.05 1.11 0.26 5.00 0.00 0.07 0.07
9.10 1.11 0.26 5.00 0.00 0.07 0.07
9.15 1.11 0.26 5.00 0.00 0.07 0.07
9.20 1.11 0.26 5.00 0.00 0.07 0.07
9.25 1.11 0.26 5.00 0.00 0.07 0.07
9.30 1.11 0.26 5.00 0.00 0.07 0.07
9.35 1.11 0.26 5.00 0.00 0.07 0.07
9.40 1.11 0.26 5.00 0.00 0.07 0.07
9.45 1.11 0.26 5.00 0.00 0.07 0.07
9.50 1.11 0.26 5.00 0.00 0.07 0.07
9.55 1.11 0.26 5.00 0.00 0.07 0.07
9.60 1.11 0.26 5.00 0.00 0.07 0.07
9.65 1.11 0.26 5.00 0.00 0.07 0.07
9.70 1.11 0.26 5.00 0.00 0.07 0.07

9.75	1.11	0.26	5.00	0.00	0.07	0.07
9.80	1.11	0.26	5.00	0.00	0.07	0.07
9.85	1.11	0.26	5.00	0.00	0.07	0.07
9.90	1.11	0.26	5.00	0.00	0.07	0.07
9.95	1.11	0.26	5.00	0.00	0.07	0.07
10.00	1.11	0.26	5.00	0.00	0.07	0.07
10.05	1.11	0.26	5.00	0.00	0.07	0.07
10.10	1.11	0.26	5.00	0.00	0.07	0.07
10.15	1.11	0.26	5.00	0.00	0.07	0.07
10.20	1.11	0.26	5.00	0.00	0.07	0.07
10.25	1.11	0.26	5.00	0.00	0.07	0.07
10.30	1.11	0.26	5.00	0.00	0.07	0.07
10.35	1.11	0.26	5.00	0.00	0.07	0.07
10.40	1.11	0.26	5.00	0.00	0.07	0.07
10.45	1.11	0.26	5.00	0.00	0.07	0.07
10.50	1.11	0.26	5.00	0.00	0.07	0.07
10.55	1.11	0.26	5.00	0.00	0.07	0.07
10.60	1.11	0.26	5.00	0.00	0.07	0.07
10.65	1.11	0.26	5.00	0.00	0.07	0.07
10.70	1.11	0.26	5.00	0.00	0.07	0.07
10.75	1.11	0.26	5.00	0.00	0.07	0.07
10.80	1.11	0.26	5.00	0.00	0.07	0.07
10.85	1.11	0.26	5.00	0.00	0.07	0.07
10.90	1.11	0.26	5.00	0.00	0.07	0.07
10.95	1.11	0.26	5.00	0.00	0.07	0.07
11.00	1.11	0.26	5.00	0.00	0.07	0.07
11.05	1.11	0.26	5.00	0.00	0.07	0.07
11.10	1.09	0.26	5.00	0.00	0.07	0.07
11.15	0.90	0.26	5.00	0.00	0.07	0.07
11.20	0.84	0.26	5.00	0.00	0.07	0.07
11.25	0.80	0.26	5.00	0.00	0.07	0.07
11.30	0.77	0.26	5.00	0.00	0.07	0.07
11.35	0.74	0.26	5.00	0.00	0.07	0.07
11.40	0.71	0.26	5.00	0.00	0.07	0.07
11.45	0.69	0.26	5.00	0.00	0.07	0.07
11.50	0.67	0.26	5.00	0.00	0.07	0.07
11.55	0.65	0.26	5.00	0.00	0.07	0.07
11.60	0.63	0.25	5.00	0.00	0.07	0.07
11.65	0.61	0.25	5.00	0.00	0.07	0.07
11.70	0.60	0.25	5.00	0.00	0.07	0.07
11.75	0.58	0.25	5.00	0.00	0.07	0.07
11.80	0.57	0.25	5.00	0.00	0.07	0.07
11.85	0.55	0.25	5.00	0.00	0.07	0.07
11.90	0.54	0.25	5.00	0.00	0.07	0.07
11.95	0.53	0.25	5.00	0.00	0.06	0.06
12.00	0.51	0.25	5.00	0.00	0.06	0.06
12.05	0.50	0.25	5.00	0.00	0.06	0.06
12.10	0.49	0.25	5.00	0.00	0.06	0.06
12.15	0.48	0.25	5.00	0.00	0.06	0.06
12.20	0.47	0.25	5.00	0.00	0.06	0.06
12.25	0.46	0.25	5.00	0.00	0.06	0.06
12.30	0.44	0.25	5.00	0.00	0.06	0.06
12.35	0.43	0.25	5.00	0.00	0.06	0.06
12.40	0.42	0.25	5.00	0.00	0.06	0.06

12.45	0.41	0.25	5.00	0.00	0.06	0.06
12.50	0.40	0.25	5.00	0.00	0.06	0.06
12.55	0.39	0.25	5.00	0.00	0.06	0.06
12.60	0.38	0.25	5.00	0.00	0.06	0.06
12.65	0.37	0.25	5.00	0.00	0.06	0.06
12.70	0.36	0.25	5.00	0.00	0.06	0.06
12.75	0.35	0.25	5.00	0.00	0.06	0.06
12.80	0.34	0.25	5.00	0.00	0.06	0.06
12.85	0.33	0.25	5.00	0.00	0.06	0.06
12.90	0.32	0.25	5.00	0.00	0.06	0.06
12.95	0.31	0.25	5.00	0.00	0.06	0.06
13.00	0.30	0.25	5.00	0.00	0.06	0.06
13.05	0.30	0.25	5.00	0.00	0.06	0.06
13.10	0.30	0.25	5.00	0.00	0.06	0.06
13.15	0.31	0.25	5.00	0.00	0.06	0.06
13.20	0.31	0.25	5.00	0.00	0.06	0.06
13.25	0.32	0.25	5.00	0.00	0.06	0.06
13.30	0.32	0.25	5.00	0.00	0.06	0.06
13.35	0.33	0.25	5.00	0.00	0.06	0.06
13.40	0.33	0.25	5.00	0.00	0.06	0.06
13.45	0.34	0.25	5.00	0.00	0.06	0.06
13.50	0.34	0.25	5.00	0.00	0.06	0.06
13.55	0.35	0.25	5.00	0.00	0.05	0.05
13.60	0.35	0.25	5.00	0.00	0.05	0.05
13.65	0.36	0.25	5.00	0.00	0.05	0.05
13.70	0.36	0.25	5.00	0.00	0.05	0.05
13.75	0.37	0.25	5.00	0.00	0.05	0.05
13.80	0.37	0.25	5.00	0.00	0.05	0.05
13.85	0.38	0.25	5.00	0.00	0.05	0.05
13.90	0.38	0.25	5.00	0.00	0.05	0.05
13.95	0.39	0.25	5.00	0.00	0.05	0.05
14.00	0.39	0.25	5.00	0.00	0.05	0.05
14.05	0.40	0.25	5.00	0.00	0.05	0.05
14.10	0.40	0.25	5.00	0.00	0.05	0.05
14.15	0.41	0.25	5.00	0.00	0.05	0.05
14.20	0.41	0.25	5.00	0.00	0.05	0.05
14.25	0.42	0.25	5.00	0.00	0.05	0.05
14.30	0.42	0.25	5.00	0.00	0.05	0.05
14.35	0.43	0.25	5.00	0.00	0.05	0.05
14.40	0.44	0.25	5.00	0.00	0.05	0.05
14.45	0.44	0.25	5.00	0.00	0.05	0.05
14.50	0.45	0.25	5.00	0.00	0.05	0.05
14.55	0.45	0.25	5.00	0.00	0.05	0.05
14.60	0.46	0.25	5.00	0.00	0.05	0.05
14.65	0.46	0.25	5.00	0.00	0.05	0.05
14.70	0.47	0.25	5.00	0.00	0.05	0.05
14.75	0.47	0.25	5.00	0.00	0.05	0.05
14.80	0.52	0.25	5.00	0.00	0.05	0.05
14.85	0.53	0.25	5.00	0.00	0.05	0.05
14.90	0.53	0.25	5.00	0.00	0.05	0.05
14.95	0.54	0.25	5.00	0.00	0.05	0.05
15.00	0.55	0.25	5.00	0.00	0.05	0.05
15.05	0.55	0.25	5.00	0.00	0.05	0.05
15.10	0.56	0.25	5.00	0.00	0.05	0.05

15.15	0.57	0.25	5.00	0.00	0.05	0.05
15.20	0.57	0.25	5.00	0.00	0.05	0.05
15.25	0.58	0.25	5.00	0.00	0.05	0.05
15.30	0.58	0.25	5.00	0.00	0.05	0.05
15.35	0.59	0.25	5.00	0.00	0.05	0.05
15.40	0.59	0.25	5.00	0.00	0.05	0.05
15.45	0.59	0.25	5.00	0.00	0.05	0.05
15.50	0.59	0.25	5.00	0.00	0.05	0.05
15.55	0.59	0.25	5.00	0.00	0.05	0.05
15.60	0.60	0.25	5.00	0.00	0.05	0.05
15.65	0.60	0.25	5.00	0.00	0.05	0.05
15.70	0.60	0.25	5.00	0.00	0.05	0.05
15.75	0.60	0.25	5.00	0.00	0.04	0.04
15.80	0.60	0.25	5.00	0.00	0.04	0.04
15.85	0.61	0.25	5.00	0.00	0.04	0.04
15.90	0.61	0.25	5.00	0.00	0.04	0.04
15.95	0.61	0.25	5.00	0.00	0.04	0.04
16.00	0.61	0.25	5.00	0.00	0.04	0.04
16.05	0.61	0.25	5.00	0.00	0.04	0.04
16.10	0.61	0.25	5.00	0.00	0.04	0.04
16.15	0.62	0.25	5.00	0.00	0.04	0.04
16.20	0.62	0.25	5.00	0.00	0.04	0.04
16.25	0.62	0.25	5.00	0.00	0.04	0.04
16.30	0.62	0.25	5.00	0.00	0.04	0.04
16.35	0.62	0.25	5.00	0.00	0.04	0.04
16.40	0.63	0.25	5.00	0.00	0.04	0.04
16.45	0.63	0.25	5.00	0.00	0.04	0.04
16.50	0.63	0.25	5.00	0.00	0.04	0.04
16.55	0.63	0.25	5.00	0.00	0.04	0.04
16.60	0.63	0.25	5.00	0.00	0.04	0.04
16.65	0.64	0.25	5.00	0.00	0.04	0.04
16.70	0.64	0.25	5.00	0.00	0.04	0.04
16.75	0.64	0.25	5.00	0.00	0.04	0.04
16.80	0.64	0.25	5.00	0.00	0.04	0.04
16.85	0.64	0.25	5.00	0.00	0.04	0.04
16.90	0.65	0.25	5.00	0.00	0.04	0.04
16.95	0.65	0.25	5.00	0.00	0.04	0.04
17.00	0.65	0.25	5.00	0.00	0.04	0.04
17.05	0.65	0.25	5.00	0.00	0.04	0.04
17.10	0.65	0.25	5.00	0.00	0.04	0.04
17.15	0.66	0.25	5.00	0.00	0.04	0.04
17.20	0.66	0.25	5.00	0.00	0.04	0.04
17.25	0.66	0.25	5.00	0.00	0.04	0.04
17.30	0.66	0.25	5.00	0.00	0.04	0.04
17.35	0.67	0.25	5.00	0.00	0.04	0.04
17.40	0.67	0.25	5.00	0.00	0.04	0.04
17.45	0.67	0.25	5.00	0.00	0.04	0.04
17.50	0.67	0.25	5.00	0.00	0.04	0.04
17.55	0.67	0.25	5.00	0.00	0.04	0.04
17.60	0.67	0.25	5.00	0.00	0.04	0.04
17.65	0.67	0.25	5.00	0.00	0.04	0.04
17.70	0.67	0.25	5.00	0.00	0.04	0.04
17.75	0.67	0.25	5.00	0.00	0.04	0.04
17.80	0.67	0.25	5.00	0.00	0.04	0.04

17.85	0.67	0.25	5.00	0.00	0.04	0.04
17.90	0.68	0.25	5.00	0.00	0.04	0.04
17.95	0.68	0.25	5.00	0.00	0.04	0.04
18.00	0.68	0.25	5.00	0.00	0.04	0.04
18.05	0.68	0.25	5.00	0.00	0.04	0.04
18.10	0.68	0.25	5.00	0.00	0.04	0.04
18.15	0.68	0.25	5.00	0.00	0.04	0.04
18.20	0.68	0.25	5.00	0.00	0.04	0.04
18.25	0.68	0.25	5.00	0.00	0.04	0.04
18.30	0.68	0.25	5.00	0.00	0.04	0.04
18.35	0.68	0.25	5.00	0.00	0.04	0.04
18.40	0.68	0.25	5.00	0.00	0.04	0.04
18.45	0.68	0.25	5.00	0.00	0.04	0.04
18.50	0.68	0.25	5.00	0.00	0.04	0.04
18.55	0.68	0.25	5.00	0.00	0.04	0.04
18.60	0.68	0.25	5.00	0.00	0.04	0.04
18.65	0.68	0.25	5.00	0.00	0.04	0.04
18.70	0.68	0.25	5.00	0.00	0.04	0.04
18.75	0.68	0.25	5.00	0.00	0.04	0.04
18.80	0.68	0.25	5.00	0.00	0.04	0.04
18.85	0.68	0.25	5.00	0.00	0.04	0.04
18.90	0.68	0.25	5.00	0.00	0.04	0.04
18.95	0.68	0.25	5.00	0.00	0.04	0.04
19.00	0.68	0.25	5.00	0.00	0.04	0.04
19.05	0.69	0.25	5.00	0.00	0.04	0.04
19.10	0.69	0.25	5.00	0.00	0.04	0.04
19.15	0.69	0.25	5.00	0.00	0.04	0.04
19.20	0.69	0.25	5.00	0.00	0.04	0.04
19.25	0.69	0.25	5.00	0.00	0.04	0.04
19.30	0.69	0.25	5.00	0.00	0.03	0.03
19.35	0.69	0.25	5.00	0.00	0.03	0.03
19.40	0.69	0.25	5.00	0.00	0.03	0.03
19.45	0.69	0.25	5.00	0.00	0.03	0.03
19.50	0.69	0.25	5.00	0.00	0.03	0.03
19.55	0.69	0.25	5.00	0.00	0.03	0.03
19.60	0.69	0.25	5.00	0.00	0.03	0.03
19.65	0.69	0.25	5.00	0.00	0.03	0.03
19.70	0.69	0.25	5.00	0.00	0.03	0.03
19.75	0.69	0.25	5.00	0.00	0.03	0.03
19.80	0.69	0.25	5.00	0.00	0.03	0.03
19.85	0.69	0.25	5.00	0.00	0.03	0.03
19.90	0.69	0.25	5.00	0.00	0.03	0.03
19.95	0.69	0.25	5.00	0.00	0.03	0.03
20.00	0.69	0.25	5.00	0.00	0.03	0.03
20.05	0.69	0.25	5.00	0.00	0.03	0.03
20.10	0.69	0.25	5.00	0.00	0.03	0.03
20.15	0.70	0.25	5.00	0.00	0.03	0.03
20.20	0.70	0.25	5.00	0.00	0.03	0.03
20.25	0.70	0.25	5.00	0.00	0.03	0.03
20.30	0.70	0.25	5.00	0.00	0.03	0.03
20.35	0.70	0.25	5.00	0.00	0.03	0.03
20.40	0.70	0.25	5.00	0.00	0.03	0.03
20.45	0.70	0.25	5.00	0.00	0.03	0.03
20.50	0.70	0.25	5.00	0.00	0.03	0.03

20.55	0.70	0.25	5.00	0.00	0.03	0.03
20.60	0.70	0.25	5.00	0.00	0.03	0.03
20.65	0.70	0.25	5.00	0.00	0.03	0.03
20.70	0.70	0.25	5.00	0.00	0.03	0.03
20.75	0.70	0.25	5.00	0.00	0.03	0.03
20.80	0.70	0.25	5.00	0.00	0.03	0.03
20.85	0.70	0.25	5.00	0.00	0.03	0.03
20.90	0.70	0.25	5.00	0.00	0.03	0.03
20.95	0.70	0.25	5.00	0.00	0.03	0.03
21.00	0.70	0.25	5.00	0.00	0.03	0.03
21.05	0.70	0.25	5.00	0.00	0.03	0.03
21.10	0.70	0.25	5.00	0.00	0.03	0.03
21.15	0.70	0.25	5.00	0.00	0.03	0.03
21.20	0.70	0.25	5.00	0.00	0.03	0.03
21.25	0.71	0.25	5.00	0.00	0.03	0.03
21.30	0.71	0.25	5.00	0.00	0.03	0.03
21.35	0.71	0.25	5.00	0.00	0.03	0.03
21.40	0.71	0.25	5.00	0.00	0.03	0.03
21.45	0.71	0.25	5.00	0.00	0.03	0.03
21.50	0.71	0.25	5.00	0.00	0.03	0.03
21.55	0.71	0.25	5.00	0.00	0.03	0.03
21.60	0.71	0.25	5.00	0.00	0.03	0.03
21.65	0.71	0.25	5.00	0.00	0.03	0.03
21.70	0.71	0.25	5.00	0.00	0.03	0.03
21.75	0.71	0.25	5.00	0.00	0.03	0.03
21.80	0.71	0.25	5.00	0.00	0.03	0.03
21.85	0.71	0.25	5.00	0.00	0.03	0.03
21.90	0.71	0.25	5.00	0.00	0.03	0.03
21.95	0.71	0.25	5.00	0.00	0.03	0.03
22.00	0.71	0.25	5.00	0.00	0.03	0.03
22.05	0.71	0.25	5.00	0.00	0.03	0.03
22.10	0.71	0.25	5.00	0.00	0.03	0.03
22.15	0.71	0.25	5.00	0.00	0.03	0.03
22.20	0.71	0.25	5.00	0.00	0.03	0.03
22.25	0.72	0.25	5.00	0.00	0.03	0.03
22.30	0.72	0.25	5.00	0.00	0.03	0.03
22.35	0.72	0.25	5.00	0.00	0.03	0.03
22.40	0.72	0.25	5.00	0.00	0.03	0.03
22.45	0.72	0.25	5.00	0.00	0.03	0.03
22.50	0.72	0.25	5.00	0.00	0.03	0.03
22.55	0.72	0.25	5.00	0.00	0.03	0.03
22.60	0.72	0.25	5.00	0.00	0.03	0.03
22.65	0.71	0.25	5.00	0.00	0.03	0.03
22.70	0.71	0.25	5.00	0.00	0.03	0.03
22.75	0.71	0.25	5.00	0.00	0.03	0.03
22.80	0.71	0.25	5.00	0.00	0.03	0.03
22.85	0.71	0.25	5.00	0.00	0.03	0.03
22.90	0.71	0.25	5.00	0.00	0.03	0.03
22.95	0.71	0.25	5.00	0.00	0.03	0.03
23.00	0.71	0.25	5.00	0.00	0.02	0.02
23.05	0.71	0.25	5.00	0.00	0.02	0.02
23.10	0.71	0.25	5.00	0.00	0.02	0.02
23.15	0.70	0.25	5.00	0.00	0.02	0.02
23.20	0.70	0.25	5.00	0.00	0.02	0.02

23.25	0.70	0.25	5.00	0.00	0.02	0.02
23.30	0.70	0.25	5.00	0.00	0.02	0.02
23.35	0.70	0.25	5.00	0.00	0.02	0.02
23.40	0.70	0.25	5.00	0.00	0.02	0.02
23.45	0.70	0.25	5.00	0.00	0.02	0.02
23.50	0.70	0.25	5.00	0.00	0.02	0.02
23.55	0.70	0.25	5.00	0.00	0.02	0.02
23.60	0.70	0.25	5.00	0.00	0.02	0.02
23.65	0.70	0.25	5.00	0.00	0.02	0.02
23.70	0.69	0.25	5.00	0.00	0.02	0.02
23.75	0.69	0.25	5.00	0.00	0.02	0.02
23.80	0.69	0.25	5.00	0.00	0.02	0.02
23.85	0.69	0.25	5.00	0.00	0.02	0.02
23.90	0.69	0.25	5.00	0.00	0.02	0.02
23.95	0.69	0.25	5.00	0.00	0.02	0.02
24.00	0.69	0.25	5.00	0.00	0.02	0.02
24.05	0.69	0.25	5.00	0.00	0.02	0.02
24.10	0.69	0.25	5.00	0.00	0.02	0.02
24.15	0.69	0.25	5.00	0.00	0.02	0.02
24.20	0.69	0.25	5.00	0.00	0.02	0.02
24.25	0.69	0.25	5.00	0.00	0.02	0.02
24.30	0.68	0.25	5.00	0.00	0.02	0.02
24.35	0.68	0.25	5.00	0.00	0.02	0.02
24.40	0.68	0.25	5.00	0.00	0.02	0.02
24.45	0.68	0.25	5.00	0.00	0.02	0.02
24.50	0.68	0.25	5.00	0.00	0.02	0.02
24.55	0.68	0.25	5.00	0.00	0.02	0.02
24.60	0.68	0.25	5.00	0.00	0.02	0.02
24.65	0.68	0.25	5.00	0.00	0.02	0.02
24.70	0.68	0.25	5.00	0.00	0.02	0.02
24.75	0.68	0.25	5.00	0.00	0.02	0.02
24.80	0.68	0.25	5.00	0.00	0.02	0.02
24.85	0.68	0.25	5.00	0.00	0.02	0.02
24.90	0.67	0.25	5.00	0.00	0.02	0.02
24.95	0.67	0.25	5.00	0.00	0.02	0.02
25.00	0.67	0.25	5.00	0.00	0.02	0.02
25.05	0.67	0.25	5.00	0.00	0.02	0.02
25.10	0.67	0.25	5.00	0.00	0.02	0.02
25.15	0.67	0.25	5.00	0.00	0.02	0.02
25.20	0.67	0.25	5.00	0.00	0.02	0.02
25.25	0.67	0.25	5.00	0.00	0.02	0.02
25.30	0.67	0.25	5.00	0.00	0.02	0.02
25.35	0.67	0.25	5.00	0.00	0.02	0.02
25.40	0.67	0.25	5.00	0.00	0.02	0.02
25.45	0.67	0.25	5.00	0.00	0.02	0.02
25.50	0.67	0.25	5.00	0.00	0.02	0.02
25.55	0.66	0.25	5.00	0.00	0.02	0.02
25.60	0.66	0.25	5.00	0.00	0.02	0.02
25.65	0.66	0.25	5.00	0.00	0.02	0.02
25.70	0.66	0.25	5.00	0.00	0.02	0.02
25.75	0.66	0.25	5.00	0.00	0.02	0.02
25.80	0.66	0.25	5.00	0.00	0.02	0.02
25.85	0.66	0.25	5.00	0.00	0.02	0.02
25.90	0.66	0.25	5.00	0.00	0.02	0.02

25.95	0.66	0.25	5.00	0.00	0.02	0.02
26.00	0.66	0.25	5.00	0.00	0.02	0.02
26.05	0.66	0.25	5.00	0.00	0.02	0.02
26.10	0.66	0.25	5.00	0.00	0.02	0.02
26.15	0.66	0.25	5.00	0.00	0.02	0.02
26.20	0.66	0.25	5.00	0.00	0.02	0.02
26.25	0.65	0.25	5.00	0.00	0.02	0.02
26.30	0.65	0.25	5.00	0.00	0.02	0.02
26.35	0.65	0.25	5.00	0.00	0.02	0.02
26.40	0.65	0.25	5.00	0.00	0.02	0.02
26.45	0.65	0.25	5.00	0.00	0.02	0.02
26.50	0.65	0.25	5.00	0.00	0.01	0.01
26.55	0.65	0.25	5.00	0.00	0.01	0.01
26.60	0.65	0.25	5.00	0.00	0.01	0.01
26.65	0.65	0.25	5.00	0.00	0.01	0.01
26.70	0.65	0.25	5.00	0.00	0.01	0.01
26.75	0.65	0.25	5.00	0.00	0.01	0.01
26.80	0.65	0.25	5.00	0.00	0.01	0.01
26.85	0.65	0.25	5.00	0.00	0.01	0.01
26.90	0.65	0.25	5.00	0.00	0.01	0.01
26.95	0.65	0.25	5.00	0.00	0.01	0.01
27.00	0.64	0.25	5.00	0.00	0.01	0.01
27.05	0.64	0.25	5.00	0.00	0.01	0.01
27.10	0.64	0.25	5.00	0.00	0.01	0.01
27.15	0.64	0.25	5.00	0.00	0.01	0.01
27.20	0.64	0.25	5.00	0.00	0.01	0.01
27.25	0.64	0.25	5.00	0.00	0.01	0.01
27.30	0.64	0.25	5.00	0.00	0.01	0.01
27.35	0.64	0.25	5.00	0.00	0.01	0.01
27.40	0.64	0.25	5.00	0.00	0.01	0.01
27.45	0.64	0.25	5.00	0.00	0.01	0.01
27.50	0.64	0.25	5.00	0.00	0.01	0.01
27.55	0.64	0.25	5.00	0.00	0.01	0.01
27.60	0.64	0.25	5.00	0.00	0.01	0.01
27.65	0.65	0.25	5.00	0.00	0.01	0.01
27.70	0.65	0.25	5.00	0.00	0.01	0.01
27.75	0.65	0.25	5.00	0.00	0.01	0.01
27.80	0.66	0.25	5.00	0.00	0.01	0.01
27.85	0.66	0.25	5.00	0.00	0.01	0.01
27.90	0.71	0.25	5.00	0.00	0.01	0.01
27.95	0.71	0.25	5.00	0.00	0.01	0.01
28.00	0.71	0.24	5.00	0.00	0.01	0.01
28.05	0.72	0.24	5.00	0.00	0.01	0.01
28.10	0.72	0.24	5.00	0.00	0.01	0.01
28.15	0.73	0.24	5.00	0.00	0.01	0.01
28.20	0.73	0.24	5.00	0.00	0.01	0.01
28.25	0.74	0.24	5.00	0.00	0.01	0.01
28.30	0.74	0.24	5.00	0.00	0.01	0.01
28.35	0.75	0.24	5.00	0.00	0.01	0.01
28.40	0.75	0.24	5.00	0.00	0.01	0.01
28.45	0.76	0.24	5.00	0.00	0.01	0.01
28.50	0.76	0.24	5.00	0.00	0.01	0.01
28.55	0.77	0.24	5.00	0.00	0.01	0.01
28.60	0.77	0.24	5.00	0.00	0.01	0.01

28.65	0.77	0.24	5.00	0.00	0.01	0.01
28.70	0.78	0.24	5.00	0.00	0.01	0.01
28.75	0.78	0.24	5.00	0.00	0.01	0.01
28.80	0.79	0.24	5.00	0.00	0.01	0.01
28.85	0.80	0.24	5.00	0.00	0.01	0.01
28.90	0.80	0.24	5.00	0.00	0.01	0.01
28.95	0.81	0.24	5.00	0.00	0.01	0.01
29.00	0.81	0.24	5.00	0.00	0.01	0.01
29.05	0.82	0.24	5.00	0.00	0.01	0.01
29.10	0.83	0.24	5.00	0.00	0.01	0.01
29.15	0.83	0.24	5.00	0.00	0.01	0.01
29.20	0.84	0.24	5.00	0.00	0.01	0.01
29.25	0.85	0.24	5.00	0.00	0.01	0.01
29.30	0.86	0.24	5.00	0.00	0.01	0.01
29.35	0.87	0.24	5.00	0.00	0.01	0.01
29.40	0.88	0.24	5.00	0.00	0.01	0.01
29.45	0.89	0.24	5.00	0.00	0.01	0.01
29.50	0.90	0.24	5.00	0.00	0.01	0.01
29.55	0.91	0.24	5.00	0.00	0.01	0.01
29.60	0.93	0.24	5.00	0.00	0.01	0.01
29.65	0.95	0.24	5.00	0.00	0.01	0.01
29.70	0.98	0.24	5.00	0.00	0.01	0.01
29.75	1.01	0.24	5.00	0.00	0.01	0.01
29.80	1.05	0.24	5.00	0.00	0.01	0.01
29.85	1.10	0.24	5.00	0.00	0.01	0.01
29.90	1.10	0.24	5.00	0.00	0.00	0.00
29.95	1.10	0.24	5.00	0.00	0.00	0.00
30.00	1.10	0.24	5.00	0.00	0.00	0.00
30.05	1.10	0.24	5.00	0.00	0.00	0.00
30.10	1.10	0.24	5.00	0.00	0.00	0.00
30.15	1.10	0.24	5.00	0.00	0.00	0.00
30.20	1.10	0.24	5.00	0.00	0.00	0.00
30.25	1.10	0.24	5.00	0.00	0.00	0.00
30.30	1.10	0.24	5.00	0.00	0.00	0.00
30.35	1.10	0.24	5.00	0.00	0.00	0.00
30.40	1.10	0.24	5.00	0.00	0.00	0.00
30.45	1.10	0.24	5.00	0.00	0.00	0.00
30.50	1.10	0.24	5.00	0.00	0.00	0.00
30.55	1.10	0.24	5.00	0.00	0.00	0.00
30.60	1.10	0.24	5.00	0.00	0.00	0.00
30.65	1.10	0.24	5.00	0.00	0.00	0.00
30.70	1.10	0.24	5.00	0.00	0.00	0.00
30.75	1.10	0.24	5.00	0.00	0.00	0.00
30.80	1.10	0.24	5.00	0.00	0.00	0.00
30.85	1.10	0.24	5.00	0.00	0.00	0.00
30.90	1.10	0.24	5.00	0.00	0.00	0.00
30.95	1.10	0.24	5.00	0.00	0.00	0.00
31.00	1.09	0.24	5.00	0.00	0.00	0.00
31.05	1.09	0.24	5.00	0.00	0.00	0.00
31.10	1.09	0.24	5.00	0.00	0.00	0.00
31.15	1.09	0.24	5.00	0.00	0.00	0.00
31.20	1.09	0.24	5.00	0.00	0.00	0.00
31.25	1.03	0.24	5.00	0.00	0.00	0.00
31.30	0.97	0.24	5.00	0.00	0.00	0.00

31.35	0.93	0.24	5.00	0.00	0.00	0.00
31.40	0.90	0.24	5.00	0.00	0.00	0.00
31.45	0.88	0.24	5.00	0.00	0.00	0.00
31.50	0.86	0.24	5.00	0.00	0.00	0.00
31.55	0.84	0.24	5.00	0.00	0.00	0.00
31.60	0.83	0.24	5.00	0.00	0.00	0.00
31.65	0.82	0.24	5.00	0.00	0.00	0.00
31.70	0.81	0.24	5.00	0.00	0.00	0.00
31.75	0.80	0.24	5.00	0.00	0.00	0.00
31.80	0.79	0.24	5.00	0.00	0.00	0.00
31.85	0.78	0.24	3.24	0.00	0.00	0.00
31.90	0.77	0.24	3.20	0.00	0.00	0.00
31.95	0.76	0.24	3.16	0.00	0.00	0.00
32.00	0.75	0.24	3.13	0.00	0.00	0.00
32.05	0.74	0.24	3.10	0.00	0.00	0.00
32.10	0.74	0.24	3.06	0.00	0.00	0.00
32.15	0.73	0.24	3.03	0.00	0.00	0.00
32.20	0.72	0.24	3.00	0.00	0.00	0.00
32.25	0.71	0.24	2.97	0.00	0.00	0.00
32.30	0.71	0.24	2.94	0.00	0.00	0.00
32.35	0.70	0.24	2.91	0.00	0.00	0.00
32.40	0.69	0.24	2.89	0.00	0.00	0.00
32.45	0.69	0.24	2.86	0.00	0.00	0.00
32.50	0.69	0.24	2.88	0.00	0.00	0.00
32.55	0.69	0.24	2.87	0.00	0.00	0.00
32.60	0.69	0.24	2.87	0.00	0.00	0.00
32.65	0.69	0.24	2.87	0.00	0.00	0.00
32.70	0.69	0.24	2.86	0.00	0.00	0.00
32.75	0.69	0.24	2.86	0.00	0.00	0.00
32.80	0.69	0.24	2.86	0.00	0.00	0.00
32.85	0.69	0.24	2.85	0.00	0.00	0.00
32.90	0.69	0.24	2.85	0.00	0.00	0.00
32.95	0.69	0.24	2.85	0.00	0.00	0.00
33.00	0.69	0.24	2.84	0.00	0.00	0.00
33.05	0.69	0.24	2.84	0.00	0.00	0.00
33.10	0.69	0.24	2.84	0.00	0.00	0.00
33.15	0.69	0.24	2.84	0.00	0.00	0.00
33.20	0.69	0.24	2.83	0.00	0.00	0.00
33.25	0.69	0.24	2.83	0.00	0.00	0.00
33.30	0.68	0.24	2.83	0.00	0.00	0.00
33.35	0.68	0.24	2.82	0.00	0.00	0.00
33.40	0.68	0.24	2.82	0.00	0.00	0.00
33.45	0.68	0.24	2.82	0.00	0.00	0.00
33.50	0.68	0.24	2.81	0.00	0.00	0.00
33.55	0.68	0.24	2.81	0.00	0.00	0.00
33.60	0.68	0.24	2.81	0.00	0.00	0.00
33.65	0.68	0.24	2.81	0.00	0.00	0.00
33.70	0.68	0.24	2.80	0.00	0.00	0.00
33.75	0.68	0.24	2.80	0.00	0.00	0.00
33.80	0.68	0.24	2.80	0.00	0.00	0.00
33.85	0.68	0.24	2.79	0.00	0.00	0.00
33.90	0.68	0.24	2.79	0.00	0.00	0.00
33.95	0.68	0.24	2.79	0.00	0.00	0.00
34.00	0.68	0.24	2.79	0.00	0.00	0.00

34.05	0.68	0.24	2.78	0.00	0.00	0.00
34.10	0.68	0.24	2.78	0.00	0.00	0.00
34.15	0.68	0.24	2.78	0.00	0.00	0.00
34.20	0.68	0.24	2.77	0.00	0.00	0.00
34.25	0.68	0.24	2.77	0.00	0.00	0.00
34.30	0.68	0.24	2.77	0.00	0.00	0.00
34.35	0.67	0.24	2.77	0.00	0.00	0.00
34.40	0.67	0.24	2.76	0.00	0.00	0.00
34.45	0.67	0.24	2.76	0.00	0.00	0.00
34.50	0.67	0.24	2.76	0.00	0.00	0.00
34.55	0.67	0.24	2.76	0.00	0.00	0.00
34.60	0.67	0.24	2.75	0.00	0.00	0.00
34.65	0.67	0.24	2.75	0.00	0.00	0.00
34.70	0.67	0.24	2.75	0.00	0.00	0.00
34.75	0.67	0.24	2.74	0.00	0.00	0.00
34.80	0.67	0.24	2.74	0.00	0.00	0.00
34.85	0.67	0.24	2.74	0.00	0.00	0.00
34.90	0.67	0.24	2.74	0.00	0.00	0.00
34.95	0.67	0.24	2.73	0.00	0.00	0.00
35.00	0.67	0.24	2.73	0.00	0.00	0.00
35.05	0.67	0.24	2.73	0.00	0.00	0.00
35.10	0.67	0.25	2.73	0.00	0.00	0.00
35.15	0.67	0.25	2.72	0.00	0.00	0.00
35.20	0.67	0.25	2.72	0.00	0.00	0.00
35.25	0.67	0.25	2.72	0.00	0.00	0.00
35.30	0.67	0.25	2.72	0.00	0.00	0.00
35.35	0.67	0.25	2.71	0.00	0.00	0.00
35.40	0.67	0.25	2.71	0.00	0.00	0.00
35.45	0.67	0.25	2.71	0.00	0.00	0.00
35.50	0.66	0.25	2.71	0.00	0.00	0.00
35.55	0.66	0.25	2.70	0.00	0.00	0.00
35.60	0.66	0.25	2.70	0.00	0.00	0.00
35.65	0.66	0.25	2.70	0.00	0.00	0.00
35.70	0.66	0.25	2.70	0.00	0.00	0.00
35.75	0.66	0.25	2.69	0.00	0.00	0.00
35.80	0.66	0.25	2.69	0.00	0.00	0.00
35.85	0.66	0.25	2.69	0.00	0.00	0.00
35.90	0.66	0.25	2.69	0.00	0.00	0.00
35.95	0.66	0.25	2.68	0.00	0.00	0.00
36.00	0.66	0.25	2.68	0.00	0.00	0.00
36.05	0.66	0.25	2.68	0.00	0.00	0.00
36.10	0.66	0.25	2.68	0.00	0.00	0.00
36.15	0.66	0.25	2.68	0.00	0.00	0.00
36.20	0.66	0.25	2.67	0.00	0.00	0.00
36.25	0.66	0.25	2.67	0.00	0.00	0.00
36.30	0.66	0.25	2.67	0.00	0.00	0.00
36.35	0.66	0.25	2.67	0.00	0.00	0.00
36.40	0.66	0.25	2.66	0.00	0.00	0.00
36.45	0.66	0.25	2.66	0.00	0.00	0.00
36.50	0.66	0.25	2.66	0.00	0.00	0.00
36.55	0.66	0.25	2.66	0.00	0.00	0.00
36.60	0.66	0.25	2.66	0.00	0.00	0.00
36.65	0.66	0.25	2.65	0.00	0.00	0.00
36.70	0.65	0.25	2.65	0.00	0.00	0.00

36.75	0.65	0.25	2.65	0.00	0.00	0.00
36.80	0.65	0.25	2.65	0.00	0.00	0.00
36.85	0.65	0.25	2.64	0.00	0.00	0.00
36.90	0.65	0.25	2.64	0.00	0.00	0.00
36.95	0.65	0.25	2.64	0.00	0.00	0.00
37.00	0.65	0.25	2.64	0.00	0.00	0.00
37.05	0.65	0.25	2.64	0.00	0.00	0.00
37.10	0.65	0.25	2.63	0.00	0.00	0.00
37.15	0.65	0.25	2.63	0.00	0.00	0.00
37.20	0.65	0.25	2.63	0.00	0.00	0.00
37.25	0.65	0.25	2.63	0.00	0.00	0.00
37.30	0.65	0.25	2.63	0.00	0.00	0.00
37.35	0.65	0.25	2.62	0.00	0.00	0.00
37.40	0.65	0.25	2.62	0.00	0.00	0.00
37.45	0.65	0.25	2.62	0.00	0.00	0.00
37.50	0.65	0.25	2.62	0.00	0.00	0.00
37.55	0.65	0.25	2.61	0.00	0.00	0.00
37.60	0.65	0.25	2.61	0.00	0.00	0.00
37.65	0.65	0.25	2.61	0.00	0.00	0.00
37.70	0.65	0.25	2.62	0.00	0.00	0.00
37.75	0.65	0.25	2.63	0.00	0.00	0.00
37.80	0.65	0.25	2.64	0.00	0.00	0.00
37.85	0.66	0.25	2.65	0.00	0.00	0.00
37.90	0.66	0.25	2.66	0.00	0.00	0.00
37.95	0.66	0.25	2.67	0.00	0.00	0.00
38.00	0.67	0.25	2.68	0.00	0.00	0.00
38.05	0.67	0.25	2.69	0.00	0.00	0.00
38.10	0.67	0.25	2.70	0.00	0.00	0.00
38.15	0.67	0.25	2.71	0.00	0.00	0.00
38.20	0.68	0.25	2.73	0.00	0.00	0.00
38.25	0.68	0.25	2.74	0.00	0.00	0.00
38.30	0.68	0.25	2.75	0.00	0.00	0.00
38.35	0.69	0.25	2.76	0.00	0.00	0.00
38.40	0.69	0.25	2.77	0.00	0.00	0.00
38.45	0.69	0.25	2.79	0.00	0.00	0.00
38.50	0.70	0.25	2.80	0.00	0.00	0.00
38.55	0.70	0.25	2.81	0.00	0.00	0.00
38.60	0.70	0.25	2.82	0.00	0.00	0.00
38.65	0.71	0.25	2.84	0.00	0.00	0.00
38.70	0.71	0.25	2.85	0.00	0.00	0.00
38.75	0.71	0.25	2.86	0.00	0.00	0.00
38.80	0.72	0.25	2.88	0.00	0.00	0.00
38.85	0.72	0.25	2.89	0.00	0.00	0.00
38.90	0.72	0.25	2.91	0.00	0.00	0.00
38.95	0.73	0.25	2.92	0.00	0.00	0.00
39.00	0.73	0.25	2.93	0.00	0.00	0.00
39.05	0.73	0.25	2.95	0.00	0.00	0.00
39.10	0.74	0.25	2.97	0.00	0.00	0.00
39.15	0.74	0.25	2.98	0.00	0.00	0.00
39.20	0.75	0.25	3.00	0.00	0.00	0.00
39.25	0.75	0.25	3.02	0.00	0.00	0.00
39.30	0.76	0.25	3.03	0.00	0.00	0.00
39.35	0.76	0.25	3.05	0.00	0.00	0.00
39.40	0.77	0.25	3.07	0.00	0.00	0.00

39.45	0.77	0.25	3.09	0.00	0.00	0.00
39.50	0.78	0.25	3.11	0.00	0.00	0.00
39.55	0.78	0.25	3.13	0.00	0.00	0.00
39.60	0.79	0.25	3.15	0.00	0.00	0.00
39.65	0.79	0.25	3.18	0.00	0.00	0.00
39.70	0.80	0.25	3.20	0.00	0.00	0.00
39.75	0.81	0.25	3.23	0.00	0.00	0.00
39.80	0.81	0.25	3.26	0.00	0.00	0.00
39.85	0.82	0.25	3.29	0.00	0.00	0.00
39.90	0.83	0.25	3.32	0.00	0.00	0.00
39.95	0.84	0.25	3.35	0.00	0.00	0.00
40.00	0.85	0.25	3.39	0.00	0.00	0.00
40.05	0.86	0.25	3.44	0.00	0.00	0.00
40.10	0.87	0.25	3.49	0.00	0.00	0.00
40.15	0.89	0.25	3.55	0.00	0.00	0.00
40.20	0.91	0.25	3.62	0.00	0.00	0.00
40.25	0.93	0.25	3.71	0.00	0.00	0.00
40.30	0.96	0.25	3.83	0.00	0.00	0.00
40.35	0.99	0.25	3.98	0.00	0.00	0.00
40.40	1.04	0.25	4.16	0.00	0.00	0.00
40.45	1.04	0.25	4.16	0.00	0.00	0.00
40.50	1.04	0.25	4.16	0.00	0.00	0.00
40.55	1.04	0.25	4.16	0.00	0.00	0.00
40.60	1.04	0.25	4.16	0.00	0.00	0.00
40.65	1.04	0.25	4.15	0.00	0.00	0.00
40.70	1.04	0.25	4.15	0.00	0.00	0.00
40.75	1.04	0.25	4.15	0.00	0.00	0.00
40.80	1.04	0.25	4.15	0.00	0.00	0.00
40.85	1.04	0.25	4.15	0.00	0.00	0.00
40.90	1.04	0.25	4.15	0.00	0.00	0.00
40.95	1.04	0.25	4.14	0.00	0.00	0.00
41.00	1.04	0.25	4.14	0.00	0.00	0.00
41.05	1.04	0.25	4.14	0.00	0.00	0.00
41.10	1.04	0.25	4.14	0.00	0.00	0.00
41.15	1.04	0.25	4.14	0.00	0.00	0.00
41.20	1.04	0.25	4.14	0.00	0.00	0.00
41.25	1.03	0.25	4.14	0.00	0.00	0.00
41.30	1.03	0.25	4.13	0.00	0.00	0.00
41.35	1.03	0.25	4.13	0.00	0.00	0.00
41.40	1.03	0.25	4.13	0.00	0.00	0.00
41.45	1.03	0.25	4.13	0.00	0.00	0.00
41.50	1.03	0.25	4.13	0.00	0.00	0.00
41.55	1.03	0.25	4.13	0.00	0.00	0.00
41.60	1.03	0.25	4.13	0.00	0.00	0.00
41.65	1.03	0.25	4.12	0.00	0.00	0.00
41.70	1.03	0.25	4.12	0.00	0.00	0.00
41.75	1.03	0.25	4.12	0.00	0.00	0.00
41.80	1.03	0.25	4.12	0.00	0.00	0.00
41.85	1.03	0.25	4.12	0.00	0.00	0.00
41.90	1.03	0.25	4.12	0.00	0.00	0.00
41.95	1.03	0.25	4.12	0.00	0.00	0.00
42.00	1.03	0.25	4.11	0.00	0.00	0.00
42.05	1.03	0.25	4.11	0.00	0.00	0.00
42.10	1.03	0.25	4.11	0.00	0.00	0.00

42.15	1.03	0.25	4.11	0.00	0.00	0.00
42.20	1.03	0.25	4.11	0.00	0.00	0.00
42.25	1.03	0.25	4.11	0.00	0.00	0.00
42.30	1.03	0.25	4.11	0.00	0.00	0.00
42.35	1.03	0.25	4.10	0.00	0.00	0.00
42.40	1.03	0.25	4.10	0.00	0.00	0.00
42.45	1.03	0.25	4.10	0.00	0.00	0.00
42.50	1.03	0.25	4.10	0.00	0.00	0.00
42.55	1.03	0.25	4.10	0.00	0.00	0.00
42.60	1.03	0.25	4.10	0.00	0.00	0.00
42.65	1.03	0.25	4.10	0.00	0.00	0.00
42.70	1.03	0.25	4.10	0.00	0.00	0.00
42.75	1.03	0.25	4.09	0.00	0.00	0.00
42.80	1.03	0.25	4.09	0.00	0.00	0.00
42.85	1.03	0.25	4.09	0.00	0.00	0.00
42.90	1.02	0.25	4.09	0.00	0.00	0.00
42.95	1.02	0.25	4.09	0.00	0.00	0.00
43.00	1.02	0.25	4.09	0.00	0.00	0.00
43.05	1.02	0.25	4.09	0.00	0.00	0.00
43.10	1.02	0.25	4.09	0.00	0.00	0.00
43.15	1.02	0.25	4.08	0.00	0.00	0.00
43.20	1.02	0.25	4.08	0.00	0.00	0.00
43.25	1.02	0.25	4.08	0.00	0.00	0.00
43.30	1.02	0.25	4.08	0.00	0.00	0.00
43.35	0.99	0.25	3.96	0.00	0.00	0.00
43.40	0.91	0.25	3.62	0.00	0.00	0.00
43.45	0.86	0.25	3.43	0.00	0.00	0.00
43.50	0.83	0.25	3.31	0.00	0.00	0.00
43.55	0.81	0.25	3.22	0.00	0.00	0.00
43.60	0.79	0.25	3.14	0.00	0.00	0.00
43.65	0.77	0.25	3.08	0.00	0.00	0.00
43.70	0.76	0.25	3.02	0.00	0.00	0.00
43.75	0.74	0.25	2.97	0.00	0.00	0.00
43.80	0.73	0.25	2.92	0.00	0.00	0.00
43.85	0.72	0.25	2.88	0.00	0.00	0.00
43.90	0.71	0.25	2.84	0.00	0.00	0.00
43.95	0.70	0.25	2.80	0.00	0.00	0.00
44.00	0.69	0.25	2.76	0.00	0.00	0.00
44.05	0.68	0.25	2.73	0.00	0.00	0.00
44.10	0.68	0.25	2.69	0.00	0.00	0.00
44.15	0.67	0.25	2.66	0.00	0.00	0.00
44.20	0.66	0.25	2.63	0.00	0.00	0.00
44.25	0.65	0.25	2.60	0.00	0.00	0.00
44.30	0.64	0.25	2.57	0.00	0.00	0.00
44.35	0.64	0.25	2.54	0.00	0.00	0.00
44.40	0.63	0.25	2.51	0.00	0.00	0.00
44.45	0.62	0.25	2.49	0.00	0.00	0.00
44.50	0.62	0.25	2.46	0.00	0.00	0.00
44.55	0.61	0.25	2.43	0.00	0.00	0.00
44.60	0.60	0.25	2.41	0.00	0.00	0.00
44.65	0.60	0.25	2.38	0.00	0.00	0.00
44.70	0.59	0.25	2.36	0.00	0.00	0.00
44.75	0.59	0.25	2.34	0.00	0.00	0.00
44.80	0.58	0.25	2.31	0.00	0.00	0.00

44.85	0.57	0.25	2.29	0.00	0.00	0.00
44.90	0.57	0.25	2.27	0.00	0.00	0.00
44.95	0.56	0.25	2.25	0.00	0.00	0.00
45.00	0.56	0.25	2.22	0.00	0.00	0.00
45.05	0.55	0.25	2.20	0.00	0.00	0.00
45.10	0.55	0.25	2.18	0.00	0.00	0.00
45.15	0.54	0.25	2.16	0.00	0.00	0.00
45.20	0.54	0.25	2.14	0.00	0.00	0.00
45.25	0.53	0.25	2.12	0.00	0.00	0.00
45.30	0.53	0.25	2.10	0.00	0.00	0.00
45.35	0.52	0.25	2.08	0.00	0.00	0.00
45.40	0.52	0.25	2.07	0.00	0.00	0.00
45.45	0.51	0.25	2.05	0.00	0.00	0.00
45.50	0.51	0.25	2.03	0.00	0.00	0.00
45.55	0.50	0.25	2.01	0.00	0.00	0.00
45.60	0.50	0.25	1.99	0.00	0.00	0.00
45.65	0.49	0.25	1.97	0.00	0.00	0.00
45.70	0.49	0.25	1.96	0.00	0.00	0.00
45.75	0.49	0.25	1.94	0.00	0.00	0.00
45.80	0.48	0.25	1.92	0.00	0.00	0.00
45.85	0.48	0.25	1.91	0.00	0.00	0.00
45.90	0.47	0.25	1.89	0.00	0.00	0.00
45.95	0.47	0.25	1.87	0.00	0.00	0.00
46.00	0.46	0.25	1.86	0.00	0.00	0.00
46.05	0.46	0.25	1.84	0.00	0.00	0.00
46.10	0.46	0.25	1.82	0.00	0.00	0.00
46.15	0.45	0.25	1.81	0.00	0.00	0.00
46.20	0.45	0.25	1.79	0.00	0.00	0.00
46.25	0.44	0.25	1.78	0.00	0.00	0.00
46.30	0.44	0.25	1.76	0.00	0.00	0.00
46.35	0.44	0.25	1.75	0.00	0.00	0.00
46.40	0.43	0.25	1.73	0.00	0.00	0.00
46.45	0.43	0.25	1.72	0.00	0.00	0.00
46.50	0.43	0.25	1.70	0.00	0.00	0.00
46.55	0.42	0.25	1.69	0.00	0.00	0.00
46.60	0.42	0.25	1.67	0.00	0.00	0.00
46.65	0.41	0.25	1.66	0.00	0.00	0.00
46.70	0.41	0.25	1.64	0.00	0.00	0.00
46.75	0.41	0.25	1.63	0.00	0.00	0.00
46.80	0.40	0.25	1.61	0.00	0.00	0.00
46.85	0.40	0.25	1.60	0.00	0.00	0.00
46.90	0.40	0.25	1.58	0.00	0.00	0.00
46.95	0.39	0.25	1.57	0.00	0.00	0.00
47.00	0.39	0.25	1.55	0.00	0.00	0.00
47.05	0.39	0.25	1.54	0.00	0.00	0.00
47.10	0.38	0.25	1.53	0.00	0.00	0.00
47.15	0.38	0.25	1.51	0.00	0.00	0.00
47.20	0.37	0.25	1.50	0.00	0.00	0.00
47.25	0.37	0.25	1.48	0.00	0.00	0.00
47.30	0.37	0.25	1.47	0.00	0.00	0.00
47.35	0.36	0.25	1.46	0.00	0.00	0.00
47.40	0.36	0.25	1.45	0.00	0.00	0.00
47.45	0.36	0.25	1.44	0.00	0.00	0.00
47.50	0.36	0.25	1.43	0.00	0.00	0.00

47.55	0.36	0.25	1.43	0.00	0.00	0.00
47.60	0.36	0.25	1.43	0.00	0.00	0.00
47.65	0.36	0.25	1.43	0.00	0.00	0.00
47.70	0.36	0.25	1.43	0.00	0.00	0.00
47.75	0.36	0.25	1.43	0.00	0.00	0.00
47.80	0.36	0.25	1.43	0.00	0.00	0.00
47.85	0.36	0.25	1.43	0.00	0.00	0.00
47.90	0.36	0.25	1.43	0.00	0.00	0.00
47.95	0.36	0.25	1.43	0.00	0.00	0.00
48.00	0.36	0.25	1.42	0.00	0.00	0.00
48.05	0.36	0.25	1.42	0.00	0.00	0.00
48.10	0.36	0.25	1.42	0.00	0.00	0.00
48.15	0.36	0.25	1.42	0.00	0.00	0.00
48.20	0.35	0.25	1.42	0.00	0.00	0.00
48.25	0.35	0.25	1.42	0.00	0.00	0.00
48.30	0.35	0.25	1.42	0.00	0.00	0.00
48.35	0.35	0.25	1.42	0.00	0.00	0.00
48.40	0.35	0.25	1.42	0.00	0.00	0.00
48.45	0.35	0.25	1.42	0.00	0.00	0.00
48.50	0.35	0.25	1.42	0.00	0.00	0.00
48.55	0.35	0.25	1.41	0.00	0.00	0.00
48.60	0.35	0.25	1.41	0.00	0.00	0.00
48.65	0.35	0.25	1.41	0.00	0.00	0.00
48.70	0.35	0.25	1.41	0.00	0.00	0.00
48.75	0.35	0.25	1.41	0.00	0.00	0.00
48.80	0.35	0.25	1.41	0.00	0.00	0.00
48.85	0.35	0.25	1.41	0.00	0.00	0.00
48.90	0.35	0.25	1.41	0.00	0.00	0.00
48.95	0.35	0.25	1.41	0.00	0.00	0.00
49.00	0.35	0.25	1.41	0.00	0.00	0.00
49.05	0.35	0.25	1.41	0.00	0.00	0.00
49.10	0.35	0.25	1.40	0.00	0.00	0.00
49.15	0.35	0.25	1.40	0.00	0.00	0.00
49.20	0.35	0.25	1.40	0.00	0.00	0.00
49.25	0.35	0.25	1.40	0.00	0.00	0.00
49.30	0.35	0.25	1.40	0.00	0.00	0.00
49.35	0.35	0.25	1.40	0.00	0.00	0.00
49.40	0.35	0.25	1.40	0.00	0.00	0.00
49.45	0.35	0.25	1.40	0.00	0.00	0.00
49.50	0.35	0.25	1.40	0.00	0.00	0.00
49.55	0.35	0.25	1.40	0.00	0.00	0.00
49.60	0.35	0.25	1.40	0.00	0.00	0.00
49.65	0.35	0.25	1.40	0.00	0.00	0.00
49.70	0.35	0.25	1.39	0.00	0.00	0.00
49.75	0.35	0.25	1.39	0.00	0.00	0.00
49.80	0.35	0.25	1.39	0.00	0.00	0.00
49.85	0.35	0.25	1.39	0.00	0.00	0.00
49.90	0.35	0.25	1.39	0.00	0.00	0.00
49.95	0.35	0.25	1.39	0.00	0.00	0.00
50.00	0.35	0.25	1.39	0.00	0.00	0.00
50.05	0.35	0.25	1.39	0.00	0.00	0.00
50.10	0.35	0.25	1.39	0.00	0.00	0.00
50.15	0.35	0.25	1.39	0.00	0.00	0.00
50.20	0.34	0.25	1.39	0.00	0.00	0.00

50.25	0.34 0.25 1.39 0.00 0.00 0.00
50.30	0.34 0.25 1.38 0.00 0.00 0.00
50.35	0.34 0.25 1.38 0.00 0.00 0.00
50.40	0.34 0.25 1.38 0.00 0.00 0.00
50.45	0.34 0.25 1.38 0.00 0.00 0.00
50.50	0.34 0.25 1.38 0.00 0.00 0.00
50.55	0.34 0.25 1.38 0.00 0.00 0.00
50.60	0.34 0.25 1.38 0.00 0.00 0.00
50.65	0.34 0.25 1.38 0.00 0.00 0.00
50.70	0.34 0.25 1.38 0.00 0.00 0.00
50.75	0.34 0.25 1.38 0.00 0.00 0.00
50.80	0.34 0.25 1.38 0.00 0.00 0.00
50.85	0.34 0.25 1.38 0.00 0.00 0.00
50.90	0.34 0.25 1.37 0.00 0.00 0.00
50.95	0.34 0.25 1.37 0.00 0.00 0.00
51.00	0.34 0.25 1.37 0.00 0.00 0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\Engineering\Desktop\07-230526-0.liq
Title: New Kindergarten Classrooms at Pershing Elementary
Subtitle: 07-230526-0

Surface Elev.=292
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 75.00 ft
Water Table during In-Situ Testing= 214.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=292
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 75.00 ft
Water Table during In-Situ Testing= 214.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT gamma pcf	Fines %
-------------	------------------	------------

0.00	10.00	119.00	43.00
1.00	37.00	119.00	36.00

5.00	30.00	136.80	30.00
10.00	21.00	112.00	4.00
13.00	7.00	109.00	4.00
17.50	11.00	107.00	65.00
22.50	13.00	107.30	70.00
27.50	13.00	120.00	90.00
32.50	20.00	116.30	4.00
37.50	21.00	116.30	4.00
42.50	22.00	135.30	35.00
47.50	15.00	113.00	4.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.15 in.
Total Settlement of Saturated and Unsaturated Sands=0.15 in.
Differential Settlement=0.076 to 0.100 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat. in.	S_dry	S_all
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0.00	1.11	0.26	5.00	0.00	0.15	0.15
0.05	1.11	0.26	5.00	0.00	0.15	0.15
0.10	1.11	0.26	5.00	0.00	0.15	0.15
0.15	1.11	0.26	5.00	0.00	0.15	0.15
0.20	1.11	0.26	5.00	0.00	0.15	0.15
0.25	1.11	0.26	5.00	0.00	0.15	0.15
0.30	1.11	0.26	5.00	0.00	0.15	0.15
0.35	1.11	0.26	5.00	0.00	0.15	0.15
0.40	1.11	0.26	5.00	0.00	0.15	0.15
0.45	1.11	0.26	5.00	0.00	0.15	0.15
0.50	1.11	0.26	5.00	0.00	0.15	0.15
0.55	1.11	0.26	5.00	0.00	0.15	0.15
0.60	1.11	0.26	5.00	0.00	0.15	0.15
0.65	1.11	0.26	5.00	0.00	0.15	0.15
0.70	1.11	0.26	5.00	0.00	0.15	0.15
0.75	1.11	0.26	5.00	0.00	0.15	0.15
0.80	1.11	0.26	5.00	0.00	0.15	0.15
0.85	1.11	0.26	5.00	0.00	0.15	0.15
0.90	1.11	0.26	5.00	0.00	0.15	0.15
0.95	1.11	0.26	5.00	0.00	0.15	0.15
1.00	1.11	0.26	5.00	0.00	0.15	0.15
1.05	1.11	0.26	5.00	0.00	0.15	0.15
1.10	1.11	0.26	5.00	0.00	0.15	0.15
1.15	1.11	0.26	5.00	0.00	0.15	0.15
1.20	1.11	0.26	5.00	0.00	0.15	0.15
1.25	1.11	0.26	5.00	0.00	0.15	0.15
1.30	1.11	0.26	5.00	0.00	0.15	0.15
1.35	1.11	0.26	5.00	0.00	0.15	0.15
1.40	1.11	0.26	5.00	0.00	0.15	0.15
1.45	1.11	0.26	5.00	0.00	0.15	0.15
1.50	1.11	0.26	5.00	0.00	0.15	0.15
1.55	1.11	0.26	5.00	0.00	0.15	0.15
1.60	1.11	0.26	5.00	0.00	0.15	0.15

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9.75	1.11	0.26	5.00	0.00	0.15	0.15
9.80	1.11	0.26	5.00	0.00	0.15	0.15
9.85	1.11	0.26	5.00	0.00	0.15	0.15
9.90	1.11	0.26	5.00	0.00	0.15	0.15
9.95	1.11	0.26	5.00	0.00	0.15	0.15
10.00	1.11	0.26	5.00	0.00	0.15	0.15
10.05	1.11	0.26	5.00	0.00	0.15	0.15
10.10	1.11	0.26	5.00	0.00	0.15	0.15
10.15	1.11	0.26	5.00	0.00	0.15	0.15
10.20	1.11	0.26	5.00	0.00	0.15	0.15
10.25	1.11	0.26	5.00	0.00	0.15	0.15
10.30	1.11	0.26	5.00	0.00	0.15	0.15
10.35	1.11	0.26	5.00	0.00	0.15	0.15
10.40	1.11	0.26	5.00	0.00	0.15	0.15
10.45	1.11	0.26	5.00	0.00	0.15	0.15
10.50	1.11	0.26	5.00	0.00	0.15	0.15
10.55	1.11	0.26	5.00	0.00	0.15	0.15
10.60	1.11	0.26	5.00	0.00	0.15	0.15
10.65	1.11	0.26	5.00	0.00	0.15	0.15
10.70	1.11	0.26	5.00	0.00	0.15	0.15
10.75	1.11	0.26	5.00	0.00	0.15	0.15
10.80	1.11	0.26	5.00	0.00	0.15	0.15
10.85	1.11	0.26	5.00	0.00	0.15	0.15
10.90	1.11	0.26	5.00	0.00	0.15	0.15
10.95	1.11	0.26	5.00	0.00	0.15	0.15
11.00	1.11	0.26	5.00	0.00	0.15	0.15
11.05	1.11	0.26	5.00	0.00	0.15	0.15
11.10	1.09	0.26	5.00	0.00	0.15	0.15
11.15	0.90	0.26	5.00	0.00	0.15	0.15
11.20	0.84	0.26	5.00	0.00	0.15	0.15
11.25	0.80	0.26	5.00	0.00	0.15	0.15
11.30	0.77	0.26	5.00	0.00	0.15	0.15
11.35	0.74	0.26	5.00	0.00	0.15	0.15
11.40	0.71	0.26	5.00	0.00	0.15	0.15
11.45	0.69	0.26	5.00	0.00	0.15	0.15
11.50	0.67	0.26	5.00	0.00	0.15	0.15
11.55	0.65	0.26	5.00	0.00	0.15	0.15
11.60	0.63	0.25	5.00	0.00	0.15	0.15
11.65	0.61	0.25	5.00	0.00	0.15	0.15
11.70	0.60	0.25	5.00	0.00	0.15	0.15
11.75	0.58	0.25	5.00	0.00	0.15	0.15
11.80	0.57	0.25	5.00	0.00	0.15	0.15
11.85	0.55	0.25	5.00	0.00	0.15	0.15
11.90	0.54	0.25	5.00	0.00	0.14	0.14
11.95	0.53	0.25	5.00	0.00	0.14	0.14
12.00	0.51	0.25	5.00	0.00	0.14	0.14
12.05	0.50	0.25	5.00	0.00	0.14	0.14
12.10	0.49	0.25	5.00	0.00	0.14	0.14
12.15	0.48	0.25	5.00	0.00	0.14	0.14
12.20	0.47	0.25	5.00	0.00	0.14	0.14
12.25	0.46	0.25	5.00	0.00	0.14	0.14
12.30	0.44	0.25	5.00	0.00	0.14	0.14
12.35	0.43	0.25	5.00	0.00	0.14	0.14
12.40	0.42	0.25	5.00	0.00	0.14	0.14

12.45	0.41	0.25	5.00	0.00	0.14	0.14
12.50	0.40	0.25	5.00	0.00	0.14	0.14
12.55	0.39	0.25	5.00	0.00	0.14	0.14
12.60	0.38	0.25	5.00	0.00	0.14	0.14
12.65	0.37	0.25	5.00	0.00	0.14	0.14
12.70	0.36	0.25	5.00	0.00	0.14	0.14
12.75	0.35	0.25	5.00	0.00	0.14	0.14
12.80	0.34	0.25	5.00	0.00	0.14	0.14
12.85	0.33	0.25	5.00	0.00	0.14	0.14
12.90	0.32	0.25	5.00	0.00	0.14	0.14
12.95	0.31	0.25	5.00	0.00	0.14	0.14
13.00	0.30	0.25	5.00	0.00	0.14	0.14
13.05	0.30	0.25	5.00	0.00	0.14	0.14
13.10	0.30	0.25	5.00	0.00	0.14	0.14
13.15	0.31	0.25	5.00	0.00	0.14	0.14
13.20	0.31	0.25	5.00	0.00	0.14	0.14
13.25	0.32	0.25	5.00	0.00	0.14	0.14
13.30	0.32	0.25	5.00	0.00	0.14	0.14
13.35	0.33	0.25	5.00	0.00	0.14	0.14
13.40	0.33	0.25	5.00	0.00	0.14	0.14
13.45	0.34	0.25	5.00	0.00	0.14	0.14
13.50	0.34	0.25	5.00	0.00	0.14	0.14
13.55	0.35	0.25	5.00	0.00	0.13	0.13
13.60	0.35	0.25	5.00	0.00	0.13	0.13
13.65	0.36	0.25	5.00	0.00	0.13	0.13
13.70	0.36	0.25	5.00	0.00	0.13	0.13
13.75	0.37	0.25	5.00	0.00	0.13	0.13
13.80	0.37	0.25	5.00	0.00	0.13	0.13
13.85	0.38	0.25	5.00	0.00	0.13	0.13
13.90	0.38	0.25	5.00	0.00	0.13	0.13
13.95	0.39	0.25	5.00	0.00	0.13	0.13
14.00	0.39	0.25	5.00	0.00	0.13	0.13
14.05	0.40	0.25	5.00	0.00	0.13	0.13
14.10	0.40	0.25	5.00	0.00	0.13	0.13
14.15	0.41	0.25	5.00	0.00	0.13	0.13
14.20	0.41	0.25	5.00	0.00	0.13	0.13
14.25	0.42	0.25	5.00	0.00	0.13	0.13
14.30	0.42	0.25	5.00	0.00	0.13	0.13
14.35	0.43	0.25	5.00	0.00	0.13	0.13
14.40	0.44	0.25	5.00	0.00	0.13	0.13
14.45	0.44	0.25	5.00	0.00	0.13	0.13
14.50	0.45	0.25	5.00	0.00	0.13	0.13
14.55	0.45	0.25	5.00	0.00	0.13	0.13
14.60	0.46	0.25	5.00	0.00	0.13	0.13
14.65	0.46	0.25	5.00	0.00	0.13	0.13
14.70	0.47	0.25	5.00	0.00	0.13	0.13
14.75	0.47	0.25	5.00	0.00	0.13	0.13
14.80	0.52	0.25	5.00	0.00	0.13	0.13
14.85	0.53	0.25	5.00	0.00	0.13	0.13
14.90	0.53	0.25	5.00	0.00	0.13	0.13
14.95	0.54	0.25	5.00	0.00	0.13	0.13
15.00	0.55	0.25	5.00	0.00	0.13	0.13
15.05	0.55	0.25	5.00	0.00	0.13	0.13
15.10	0.56	0.25	5.00	0.00	0.13	0.13

15.15	0.57	0.25	5.00	0.00	0.13	0.13
15.20	0.57	0.25	5.00	0.00	0.13	0.13
15.25	0.58	0.25	5.00	0.00	0.13	0.13
15.30	0.58	0.25	5.00	0.00	0.13	0.13
15.35	0.59	0.25	5.00	0.00	0.13	0.13
15.40	0.59	0.25	5.00	0.00	0.13	0.13
15.45	0.59	0.25	5.00	0.00	0.13	0.13
15.50	0.59	0.25	5.00	0.00	0.13	0.13
15.55	0.59	0.25	5.00	0.00	0.13	0.13
15.60	0.60	0.25	5.00	0.00	0.13	0.13
15.65	0.60	0.25	5.00	0.00	0.13	0.13
15.70	0.60	0.25	5.00	0.00	0.12	0.12
15.75	0.60	0.25	5.00	0.00	0.12	0.12
15.80	0.60	0.25	5.00	0.00	0.12	0.12
15.85	0.61	0.25	5.00	0.00	0.12	0.12
15.90	0.61	0.25	5.00	0.00	0.12	0.12
15.95	0.61	0.25	5.00	0.00	0.12	0.12
16.00	0.61	0.25	5.00	0.00	0.12	0.12
16.05	0.61	0.25	5.00	0.00	0.12	0.12
16.10	0.61	0.25	5.00	0.00	0.12	0.12
16.15	0.62	0.25	5.00	0.00	0.12	0.12
16.20	0.62	0.25	5.00	0.00	0.12	0.12
16.25	0.62	0.25	5.00	0.00	0.12	0.12
16.30	0.62	0.25	5.00	0.00	0.12	0.12
16.35	0.62	0.25	5.00	0.00	0.12	0.12
16.40	0.63	0.25	5.00	0.00	0.12	0.12
16.45	0.63	0.25	5.00	0.00	0.12	0.12
16.50	0.63	0.25	5.00	0.00	0.12	0.12
16.55	0.63	0.25	5.00	0.00	0.12	0.12
16.60	0.63	0.25	5.00	0.00	0.12	0.12
16.65	0.64	0.25	5.00	0.00	0.12	0.12
16.70	0.64	0.25	5.00	0.00	0.12	0.12
16.75	0.64	0.25	5.00	0.00	0.12	0.12
16.80	0.64	0.25	5.00	0.00	0.12	0.12
16.85	0.64	0.25	5.00	0.00	0.12	0.12
16.90	0.65	0.25	5.00	0.00	0.12	0.12
16.95	0.65	0.25	5.00	0.00	0.12	0.12
17.00	0.65	0.25	5.00	0.00	0.12	0.12
17.05	0.65	0.25	5.00	0.00	0.12	0.12
17.10	0.65	0.25	5.00	0.00	0.12	0.12
17.15	0.66	0.25	5.00	0.00	0.12	0.12
17.20	0.66	0.25	5.00	0.00	0.12	0.12
17.25	0.66	0.25	5.00	0.00	0.12	0.12
17.30	0.66	0.25	5.00	0.00	0.12	0.12
17.35	0.67	0.25	5.00	0.00	0.12	0.12
17.40	0.67	0.25	5.00	0.00	0.12	0.12
17.45	0.67	0.25	5.00	0.00	0.12	0.12
17.50	0.67	0.25	5.00	0.00	0.12	0.12
17.55	0.67	0.25	5.00	0.00	0.12	0.12
17.60	0.67	0.25	5.00	0.00	0.12	0.12
17.65	0.67	0.25	5.00	0.00	0.12	0.12
17.70	0.67	0.25	5.00	0.00	0.12	0.12
17.75	0.67	0.25	5.00	0.00	0.12	0.12
17.80	0.67	0.25	5.00	0.00	0.12	0.12

17.85	0.67	0.25	5.00	0.00	0.12	0.12
17.90	0.68	0.25	5.00	0.00	0.12	0.12
17.95	0.68	0.25	5.00	0.00	0.12	0.12
18.00	0.68	0.25	5.00	0.00	0.12	0.12
18.05	0.68	0.25	5.00	0.00	0.12	0.12
18.10	0.68	0.25	5.00	0.00	0.12	0.12
18.15	0.68	0.25	5.00	0.00	0.12	0.12
18.20	0.68	0.25	5.00	0.00	0.12	0.12
18.25	0.68	0.25	5.00	0.00	0.12	0.12
18.30	0.68	0.25	5.00	0.00	0.12	0.12
18.35	0.68	0.25	5.00	0.00	0.12	0.12
18.40	0.68	0.25	5.00	0.00	0.12	0.12
18.45	0.68	0.25	5.00	0.00	0.12	0.12
18.50	0.68	0.25	5.00	0.00	0.12	0.12
18.55	0.68	0.25	5.00	0.00	0.12	0.12
18.60	0.68	0.25	5.00	0.00	0.12	0.12
18.65	0.68	0.25	5.00	0.00	0.12	0.12
18.70	0.68	0.25	5.00	0.00	0.12	0.12
18.75	0.68	0.25	5.00	0.00	0.12	0.12
18.80	0.68	0.25	5.00	0.00	0.12	0.12
18.85	0.68	0.25	5.00	0.00	0.12	0.12
18.90	0.68	0.25	5.00	0.00	0.12	0.12
18.95	0.68	0.25	5.00	0.00	0.12	0.12
19.00	0.68	0.25	5.00	0.00	0.12	0.12
19.05	0.69	0.25	5.00	0.00	0.12	0.12
19.10	0.69	0.25	5.00	0.00	0.12	0.12
19.15	0.69	0.25	5.00	0.00	0.12	0.12
19.20	0.69	0.25	5.00	0.00	0.12	0.12
19.25	0.69	0.25	5.00	0.00	0.11	0.11
19.30	0.69	0.25	5.00	0.00	0.11	0.11
19.35	0.69	0.25	5.00	0.00	0.11	0.11
19.40	0.69	0.25	5.00	0.00	0.11	0.11
19.45	0.69	0.25	5.00	0.00	0.11	0.11
19.50	0.69	0.25	5.00	0.00	0.11	0.11
19.55	0.69	0.25	5.00	0.00	0.11	0.11
19.60	0.69	0.25	5.00	0.00	0.11	0.11
19.65	0.69	0.25	5.00	0.00	0.11	0.11
19.70	0.69	0.25	5.00	0.00	0.11	0.11
19.75	0.69	0.25	5.00	0.00	0.11	0.11
19.80	0.69	0.25	5.00	0.00	0.11	0.11
19.85	0.69	0.25	5.00	0.00	0.11	0.11
19.90	0.69	0.25	5.00	0.00	0.11	0.11
19.95	0.69	0.25	5.00	0.00	0.11	0.11
20.00	0.69	0.25	5.00	0.00	0.11	0.11
20.05	0.69	0.25	5.00	0.00	0.11	0.11
20.10	0.69	0.25	5.00	0.00	0.11	0.11
20.15	0.70	0.25	5.00	0.00	0.11	0.11
20.20	0.70	0.25	5.00	0.00	0.11	0.11
20.25	0.70	0.25	5.00	0.00	0.11	0.11
20.30	0.70	0.25	5.00	0.00	0.11	0.11
20.35	0.70	0.25	5.00	0.00	0.11	0.11
20.40	0.70	0.25	5.00	0.00	0.11	0.11
20.45	0.70	0.25	5.00	0.00	0.11	0.11
20.50	0.70	0.25	5.00	0.00	0.11	0.11

20.55	0.70	0.25	5.00	0.00	0.11	0.11
20.60	0.70	0.25	5.00	0.00	0.11	0.11
20.65	0.70	0.25	5.00	0.00	0.11	0.11
20.70	0.70	0.25	5.00	0.00	0.11	0.11
20.75	0.70	0.25	5.00	0.00	0.11	0.11
20.80	0.70	0.25	5.00	0.00	0.11	0.11
20.85	0.70	0.25	5.00	0.00	0.11	0.11
20.90	0.70	0.25	5.00	0.00	0.11	0.11
20.95	0.70	0.25	5.00	0.00	0.11	0.11
21.00	0.70	0.25	5.00	0.00	0.11	0.11
21.05	0.70	0.25	5.00	0.00	0.11	0.11
21.10	0.70	0.25	5.00	0.00	0.11	0.11
21.15	0.70	0.25	5.00	0.00	0.11	0.11
21.20	0.70	0.25	5.00	0.00	0.11	0.11
21.25	0.71	0.25	5.00	0.00	0.11	0.11
21.30	0.71	0.25	5.00	0.00	0.11	0.11
21.35	0.71	0.25	5.00	0.00	0.11	0.11
21.40	0.71	0.25	5.00	0.00	0.11	0.11
21.45	0.71	0.25	5.00	0.00	0.11	0.11
21.50	0.71	0.25	5.00	0.00	0.11	0.11
21.55	0.71	0.25	5.00	0.00	0.11	0.11
21.60	0.71	0.25	5.00	0.00	0.11	0.11
21.65	0.71	0.25	5.00	0.00	0.11	0.11
21.70	0.71	0.25	5.00	0.00	0.11	0.11
21.75	0.71	0.25	5.00	0.00	0.11	0.11
21.80	0.71	0.25	5.00	0.00	0.11	0.11
21.85	0.71	0.25	5.00	0.00	0.11	0.11
21.90	0.71	0.25	5.00	0.00	0.11	0.11
21.95	0.71	0.25	5.00	0.00	0.11	0.11
22.00	0.71	0.25	5.00	0.00	0.11	0.11
22.05	0.71	0.25	5.00	0.00	0.11	0.11
22.10	0.71	0.25	5.00	0.00	0.11	0.11
22.15	0.71	0.25	5.00	0.00	0.11	0.11
22.20	0.71	0.25	5.00	0.00	0.11	0.11
22.25	0.72	0.25	5.00	0.00	0.11	0.11
22.30	0.72	0.25	5.00	0.00	0.11	0.11
22.35	0.72	0.25	5.00	0.00	0.11	0.11
22.40	0.72	0.25	5.00	0.00	0.11	0.11
22.45	0.72	0.25	5.00	0.00	0.11	0.11
22.50	0.72	0.25	5.00	0.00	0.11	0.11
22.55	0.72	0.25	5.00	0.00	0.11	0.11
22.60	0.72	0.25	5.00	0.00	0.11	0.11
22.65	0.71	0.25	5.00	0.00	0.11	0.11
22.70	0.71	0.25	5.00	0.00	0.11	0.11
22.75	0.71	0.25	5.00	0.00	0.11	0.11
22.80	0.71	0.25	5.00	0.00	0.11	0.11
22.85	0.71	0.25	5.00	0.00	0.11	0.11
22.90	0.71	0.25	5.00	0.00	0.11	0.11
22.95	0.71	0.25	5.00	0.00	0.10	0.10
23.00	0.71	0.25	5.00	0.00	0.10	0.10
23.05	0.71	0.25	5.00	0.00	0.10	0.10
23.10	0.71	0.25	5.00	0.00	0.10	0.10
23.15	0.70	0.25	5.00	0.00	0.10	0.10
23.20	0.70	0.25	5.00	0.00	0.10	0.10

23.25	0.70	0.25	5.00	0.00	0.10	0.10
23.30	0.70	0.25	5.00	0.00	0.10	0.10
23.35	0.70	0.25	5.00	0.00	0.10	0.10
23.40	0.70	0.25	5.00	0.00	0.10	0.10
23.45	0.70	0.25	5.00	0.00	0.10	0.10
23.50	0.70	0.25	5.00	0.00	0.10	0.10
23.55	0.70	0.25	5.00	0.00	0.10	0.10
23.60	0.70	0.25	5.00	0.00	0.10	0.10
23.65	0.70	0.25	5.00	0.00	0.10	0.10
23.70	0.69	0.25	5.00	0.00	0.10	0.10
23.75	0.69	0.25	5.00	0.00	0.10	0.10
23.80	0.69	0.25	5.00	0.00	0.10	0.10
23.85	0.69	0.25	5.00	0.00	0.10	0.10
23.90	0.69	0.25	5.00	0.00	0.10	0.10
23.95	0.69	0.25	5.00	0.00	0.10	0.10
24.00	0.69	0.25	5.00	0.00	0.10	0.10
24.05	0.69	0.25	5.00	0.00	0.10	0.10
24.10	0.69	0.25	5.00	0.00	0.10	0.10
24.15	0.69	0.25	5.00	0.00	0.10	0.10
24.20	0.69	0.25	5.00	0.00	0.10	0.10
24.25	0.69	0.25	5.00	0.00	0.10	0.10
24.30	0.68	0.25	5.00	0.00	0.10	0.10
24.35	0.68	0.25	5.00	0.00	0.10	0.10
24.40	0.68	0.25	5.00	0.00	0.10	0.10
24.45	0.68	0.25	5.00	0.00	0.10	0.10
24.50	0.68	0.25	5.00	0.00	0.10	0.10
24.55	0.68	0.25	5.00	0.00	0.10	0.10
24.60	0.68	0.25	5.00	0.00	0.10	0.10
24.65	0.68	0.25	5.00	0.00	0.10	0.10
24.70	0.68	0.25	5.00	0.00	0.10	0.10
24.75	0.68	0.25	5.00	0.00	0.10	0.10
24.80	0.68	0.25	5.00	0.00	0.10	0.10
24.85	0.68	0.25	5.00	0.00	0.10	0.10
24.90	0.67	0.25	5.00	0.00	0.10	0.10
24.95	0.67	0.25	5.00	0.00	0.10	0.10
25.00	0.67	0.25	5.00	0.00	0.10	0.10
25.05	0.67	0.25	5.00	0.00	0.10	0.10
25.10	0.67	0.25	5.00	0.00	0.10	0.10
25.15	0.67	0.25	5.00	0.00	0.10	0.10
25.20	0.67	0.25	5.00	0.00	0.10	0.10
25.25	0.67	0.25	5.00	0.00	0.10	0.10
25.30	0.67	0.25	5.00	0.00	0.10	0.10
25.35	0.67	0.25	5.00	0.00	0.10	0.10
25.40	0.67	0.25	5.00	0.00	0.10	0.10
25.45	0.67	0.25	5.00	0.00	0.10	0.10
25.50	0.67	0.25	5.00	0.00	0.10	0.10
25.55	0.66	0.25	5.00	0.00	0.10	0.10
25.60	0.66	0.25	5.00	0.00	0.10	0.10
25.65	0.66	0.25	5.00	0.00	0.10	0.10
25.70	0.66	0.25	5.00	0.00	0.10	0.10
25.75	0.66	0.25	5.00	0.00	0.10	0.10
25.80	0.66	0.25	5.00	0.00	0.10	0.10
25.85	0.66	0.25	5.00	0.00	0.10	0.10
25.90	0.66	0.25	5.00	0.00	0.10	0.10

25.95	0.66	0.25	5.00	0.00	0.10	0.10
26.00	0.66	0.25	5.00	0.00	0.10	0.10
26.05	0.66	0.25	5.00	0.00	0.10	0.10
26.10	0.66	0.25	5.00	0.00	0.10	0.10
26.15	0.66	0.25	5.00	0.00	0.10	0.10
26.20	0.66	0.25	5.00	0.00	0.10	0.10
26.25	0.65	0.25	5.00	0.00	0.10	0.10
26.30	0.65	0.25	5.00	0.00	0.10	0.10
26.35	0.65	0.25	5.00	0.00	0.10	0.10
26.40	0.65	0.25	5.00	0.00	0.10	0.10
26.45	0.65	0.25	5.00	0.00	0.10	0.10
26.50	0.65	0.25	5.00	0.00	0.09	0.09
26.55	0.65	0.25	5.00	0.00	0.09	0.09
26.60	0.65	0.25	5.00	0.00	0.09	0.09
26.65	0.65	0.25	5.00	0.00	0.09	0.09
26.70	0.65	0.25	5.00	0.00	0.09	0.09
26.75	0.65	0.25	5.00	0.00	0.09	0.09
26.80	0.65	0.25	5.00	0.00	0.09	0.09
26.85	0.65	0.25	5.00	0.00	0.09	0.09
26.90	0.65	0.25	5.00	0.00	0.09	0.09
26.95	0.65	0.25	5.00	0.00	0.09	0.09
27.00	0.64	0.25	5.00	0.00	0.09	0.09
27.05	0.64	0.25	5.00	0.00	0.09	0.09
27.10	0.64	0.25	5.00	0.00	0.09	0.09
27.15	0.64	0.25	5.00	0.00	0.09	0.09
27.20	0.64	0.25	5.00	0.00	0.09	0.09
27.25	0.64	0.25	5.00	0.00	0.09	0.09
27.30	0.64	0.25	5.00	0.00	0.09	0.09
27.35	0.64	0.25	5.00	0.00	0.09	0.09
27.40	0.64	0.25	5.00	0.00	0.09	0.09
27.45	0.64	0.25	5.00	0.00	0.09	0.09
27.50	0.64	0.25	5.00	0.00	0.09	0.09
27.55	0.64	0.25	5.00	0.00	0.09	0.09
27.60	0.64	0.25	5.00	0.00	0.09	0.09
27.65	0.65	0.25	5.00	0.00	0.09	0.09
27.70	0.65	0.25	5.00	0.00	0.09	0.09
27.75	0.65	0.25	5.00	0.00	0.09	0.09
27.80	0.66	0.25	5.00	0.00	0.09	0.09
27.85	0.66	0.25	5.00	0.00	0.09	0.09
27.90	0.71	0.25	5.00	0.00	0.09	0.09
27.95	0.71	0.25	5.00	0.00	0.09	0.09
28.00	0.71	0.24	5.00	0.00	0.09	0.09
28.05	0.72	0.24	5.00	0.00	0.09	0.09
28.10	0.72	0.24	5.00	0.00	0.09	0.09
28.15	0.73	0.24	5.00	0.00	0.09	0.09
28.20	0.73	0.24	5.00	0.00	0.09	0.09
28.25	0.74	0.24	5.00	0.00	0.09	0.09
28.30	0.74	0.24	5.00	0.00	0.09	0.09
28.35	0.75	0.24	5.00	0.00	0.09	0.09
28.40	0.75	0.24	5.00	0.00	0.09	0.09
28.45	0.76	0.24	5.00	0.00	0.09	0.09
28.50	0.76	0.24	5.00	0.00	0.09	0.09
28.55	0.77	0.24	5.00	0.00	0.09	0.09
28.60	0.77	0.24	5.00	0.00	0.09	0.09

28.65	0.77	0.24	5.00	0.00	0.09	0.09
28.70	0.78	0.24	5.00	0.00	0.09	0.09
28.75	0.78	0.24	5.00	0.00	0.09	0.09
28.80	0.79	0.24	5.00	0.00	0.09	0.09
28.85	0.80	0.24	5.00	0.00	0.09	0.09
28.90	0.80	0.24	5.00	0.00	0.09	0.09
28.95	0.81	0.24	5.00	0.00	0.09	0.09
29.00	0.81	0.24	5.00	0.00	0.09	0.09
29.05	0.82	0.24	5.00	0.00	0.09	0.09
29.10	0.83	0.24	5.00	0.00	0.09	0.09
29.15	0.83	0.24	5.00	0.00	0.09	0.09
29.20	0.84	0.24	5.00	0.00	0.09	0.09
29.25	0.85	0.24	5.00	0.00	0.09	0.09
29.30	0.86	0.24	5.00	0.00	0.09	0.09
29.35	0.87	0.24	5.00	0.00	0.09	0.09
29.40	0.88	0.24	5.00	0.00	0.09	0.09
29.45	0.89	0.24	5.00	0.00	0.09	0.09
29.50	0.90	0.24	5.00	0.00	0.09	0.09
29.55	0.91	0.24	5.00	0.00	0.09	0.09
29.60	0.93	0.24	5.00	0.00	0.09	0.09
29.65	0.95	0.24	5.00	0.00	0.09	0.09
29.70	0.98	0.24	5.00	0.00	0.09	0.09
29.75	1.01	0.24	5.00	0.00	0.09	0.09
29.80	1.05	0.24	5.00	0.00	0.09	0.09
29.85	1.10	0.24	5.00	0.00	0.08	0.08
29.90	1.10	0.24	5.00	0.00	0.08	0.08
29.95	1.10	0.24	5.00	0.00	0.08	0.08
30.00	1.10	0.24	5.00	0.00	0.08	0.08
30.05	1.10	0.24	5.00	0.00	0.08	0.08
30.10	1.10	0.24	5.00	0.00	0.08	0.08
30.15	1.10	0.24	5.00	0.00	0.08	0.08
30.20	1.10	0.24	5.00	0.00	0.08	0.08
30.25	1.10	0.24	5.00	0.00	0.08	0.08
30.30	1.10	0.24	5.00	0.00	0.08	0.08
30.35	1.10	0.24	5.00	0.00	0.08	0.08
30.40	1.10	0.24	5.00	0.00	0.08	0.08
30.45	1.10	0.24	5.00	0.00	0.08	0.08
30.50	1.10	0.24	5.00	0.00	0.08	0.08
30.55	1.10	0.24	5.00	0.00	0.08	0.08
30.60	1.10	0.24	5.00	0.00	0.08	0.08
30.65	1.10	0.24	5.00	0.00	0.08	0.08
30.70	1.10	0.24	5.00	0.00	0.08	0.08
30.75	1.10	0.24	5.00	0.00	0.08	0.08
30.80	1.10	0.24	5.00	0.00	0.08	0.08
30.85	1.10	0.24	5.00	0.00	0.08	0.08
30.90	1.10	0.24	5.00	0.00	0.08	0.08
30.95	1.10	0.24	5.00	0.00	0.08	0.08
31.00	1.09	0.24	5.00	0.00	0.08	0.08
31.05	1.09	0.24	5.00	0.00	0.08	0.08
31.10	1.09	0.24	5.00	0.00	0.08	0.08
31.15	1.09	0.24	5.00	0.00	0.08	0.08
31.20	1.09	0.24	5.00	0.00	0.08	0.08
31.25	1.03	0.24	5.00	0.00	0.08	0.08
31.30	0.97	0.24	5.00	0.00	0.08	0.08

31.35	0.93	0.24	5.00	0.00	0.08	0.08
31.40	0.90	0.24	5.00	0.00	0.08	0.08
31.45	0.88	0.24	5.00	0.00	0.08	0.08
31.50	0.86	0.24	5.00	0.00	0.08	0.08
31.55	0.84	0.24	5.00	0.00	0.08	0.08
31.60	0.83	0.24	5.00	0.00	0.08	0.08
31.65	0.82	0.24	5.00	0.00	0.08	0.08
31.70	0.81	0.24	5.00	0.00	0.08	0.08
31.75	0.80	0.24	5.00	0.00	0.08	0.08
31.80	0.79	0.24	5.00	0.00	0.08	0.08
31.85	0.78	0.24	5.00	0.00	0.08	0.08
31.90	0.77	0.24	5.00	0.00	0.08	0.08
31.95	0.76	0.24	5.00	0.00	0.08	0.08
32.00	0.75	0.24	5.00	0.00	0.08	0.08
32.05	0.74	0.24	5.00	0.00	0.08	0.08
32.10	0.74	0.24	5.00	0.00	0.08	0.08
32.15	0.73	0.24	5.00	0.00	0.08	0.08
32.20	0.72	0.24	5.00	0.00	0.08	0.08
32.25	0.71	0.24	5.00	0.00	0.08	0.08
32.30	0.71	0.24	5.00	0.00	0.08	0.08
32.35	0.70	0.24	5.00	0.00	0.08	0.08
32.40	0.69	0.24	5.00	0.00	0.08	0.08
32.45	0.69	0.24	5.00	0.00	0.08	0.08
32.50	0.69	0.24	5.00	0.00	0.08	0.08
32.55	0.69	0.24	5.00	0.00	0.08	0.08
32.60	0.69	0.24	5.00	0.00	0.08	0.08
32.65	0.69	0.24	5.00	0.00	0.08	0.08
32.70	0.69	0.24	5.00	0.00	0.08	0.08
32.75	0.69	0.24	5.00	0.00	0.08	0.08
32.80	0.69	0.24	5.00	0.00	0.08	0.08
32.85	0.69	0.24	5.00	0.00	0.08	0.08
32.90	0.69	0.24	5.00	0.00	0.08	0.08
32.95	0.69	0.24	5.00	0.00	0.08	0.08
33.00	0.69	0.24	5.00	0.00	0.08	0.08
33.05	0.69	0.24	5.00	0.00	0.08	0.08
33.10	0.69	0.24	5.00	0.00	0.08	0.08
33.15	0.69	0.24	5.00	0.00	0.08	0.08
33.20	0.69	0.24	5.00	0.00	0.08	0.08
33.25	0.69	0.24	5.00	0.00	0.08	0.08
33.30	0.68	0.24	5.00	0.00	0.08	0.08
33.35	0.68	0.24	5.00	0.00	0.07	0.07
33.40	0.68	0.24	5.00	0.00	0.07	0.07
33.45	0.68	0.24	5.00	0.00	0.07	0.07
33.50	0.68	0.24	5.00	0.00	0.07	0.07
33.55	0.68	0.24	5.00	0.00	0.07	0.07
33.60	0.68	0.24	5.00	0.00	0.07	0.07
33.65	0.68	0.24	5.00	0.00	0.07	0.07
33.70	0.68	0.24	5.00	0.00	0.07	0.07
33.75	0.68	0.24	5.00	0.00	0.07	0.07
33.80	0.68	0.24	5.00	0.00	0.07	0.07
33.85	0.68	0.24	5.00	0.00	0.07	0.07
33.90	0.68	0.24	5.00	0.00	0.07	0.07
33.95	0.68	0.24	5.00	0.00	0.07	0.07
34.00	0.68	0.24	5.00	0.00	0.07	0.07

34.05	0.68	0.24	5.00	0.00	0.07	0.07
34.10	0.68	0.23	5.00	0.00	0.07	0.07
34.15	0.68	0.23	5.00	0.00	0.07	0.07
34.20	0.68	0.23	5.00	0.00	0.07	0.07
34.25	0.68	0.23	5.00	0.00	0.07	0.07
34.30	0.68	0.23	5.00	0.00	0.07	0.07
34.35	0.67	0.23	5.00	0.00	0.07	0.07
34.40	0.67	0.23	5.00	0.00	0.07	0.07
34.45	0.67	0.23	5.00	0.00	0.07	0.07
34.50	0.67	0.23	5.00	0.00	0.07	0.07
34.55	0.67	0.23	5.00	0.00	0.07	0.07
34.60	0.67	0.23	5.00	0.00	0.07	0.07
34.65	0.67	0.23	5.00	0.00	0.07	0.07
34.70	0.67	0.23	5.00	0.00	0.07	0.07
34.75	0.67	0.23	5.00	0.00	0.07	0.07
34.80	0.67	0.23	5.00	0.00	0.07	0.07
34.85	0.67	0.23	5.00	0.00	0.07	0.07
34.90	0.67	0.23	5.00	0.00	0.07	0.07
34.95	0.67	0.23	5.00	0.00	0.07	0.07
35.00	0.67	0.23	5.00	0.00	0.07	0.07
35.05	0.67	0.23	5.00	0.00	0.07	0.07
35.10	0.67	0.23	5.00	0.00	0.07	0.07
35.15	0.67	0.23	5.00	0.00	0.07	0.07
35.20	0.67	0.23	5.00	0.00	0.07	0.07
35.25	0.67	0.23	5.00	0.00	0.07	0.07
35.30	0.67	0.23	5.00	0.00	0.07	0.07
35.35	0.67	0.23	5.00	0.00	0.07	0.07
35.40	0.67	0.23	5.00	0.00	0.07	0.07
35.45	0.67	0.23	5.00	0.00	0.07	0.07
35.50	0.66	0.23	5.00	0.00	0.07	0.07
35.55	0.66	0.23	5.00	0.00	0.07	0.07
35.60	0.66	0.23	5.00	0.00	0.07	0.07
35.65	0.66	0.23	5.00	0.00	0.07	0.07
35.70	0.66	0.23	5.00	0.00	0.07	0.07
35.75	0.66	0.23	5.00	0.00	0.07	0.07
35.80	0.66	0.23	5.00	0.00	0.07	0.07
35.85	0.66	0.23	5.00	0.00	0.07	0.07
35.90	0.66	0.23	5.00	0.00	0.07	0.07
35.95	0.66	0.23	5.00	0.00	0.07	0.07
36.00	0.66	0.23	5.00	0.00	0.07	0.07
36.05	0.66	0.23	5.00	0.00	0.07	0.07
36.10	0.66	0.23	5.00	0.00	0.07	0.07
36.15	0.66	0.23	5.00	0.00	0.07	0.07
36.20	0.66	0.23	5.00	0.00	0.07	0.07
36.25	0.66	0.23	5.00	0.00	0.06	0.06
36.30	0.66	0.23	5.00	0.00	0.06	0.06
36.35	0.66	0.23	5.00	0.00	0.06	0.06
36.40	0.66	0.23	5.00	0.00	0.06	0.06
36.45	0.66	0.23	5.00	0.00	0.06	0.06
36.50	0.66	0.23	5.00	0.00	0.06	0.06
36.55	0.66	0.23	5.00	0.00	0.06	0.06
36.60	0.66	0.23	5.00	0.00	0.06	0.06
36.65	0.66	0.23	5.00	0.00	0.06	0.06
36.70	0.65	0.23	5.00	0.00	0.06	0.06

36.75	0.65	0.23	5.00	0.00	0.06	0.06
36.80	0.65	0.23	5.00	0.00	0.06	0.06
36.85	0.65	0.23	5.00	0.00	0.06	0.06
36.90	0.65	0.23	5.00	0.00	0.06	0.06
36.95	0.65	0.23	5.00	0.00	0.06	0.06
37.00	0.65	0.23	5.00	0.00	0.06	0.06
37.05	0.65	0.23	5.00	0.00	0.06	0.06
37.10	0.65	0.23	5.00	0.00	0.06	0.06
37.15	0.65	0.23	5.00	0.00	0.06	0.06
37.20	0.65	0.23	5.00	0.00	0.06	0.06
37.25	0.65	0.23	5.00	0.00	0.06	0.06
37.30	0.65	0.23	5.00	0.00	0.06	0.06
37.35	0.65	0.23	5.00	0.00	0.06	0.06
37.40	0.65	0.23	5.00	0.00	0.06	0.06
37.45	0.65	0.23	5.00	0.00	0.06	0.06
37.50	0.65	0.23	5.00	0.00	0.06	0.06
37.55	0.65	0.23	5.00	0.00	0.06	0.06
37.60	0.65	0.23	5.00	0.00	0.06	0.06
37.65	0.65	0.23	5.00	0.00	0.06	0.06
37.70	0.65	0.23	5.00	0.00	0.06	0.06
37.75	0.65	0.23	5.00	0.00	0.06	0.06
37.80	0.65	0.23	5.00	0.00	0.06	0.06
37.85	0.66	0.23	5.00	0.00	0.06	0.06
37.90	0.66	0.23	5.00	0.00	0.06	0.06
37.95	0.66	0.23	5.00	0.00	0.06	0.06
38.00	0.67	0.23	5.00	0.00	0.06	0.06
38.05	0.67	0.23	5.00	0.00	0.06	0.06
38.10	0.67	0.23	5.00	0.00	0.06	0.06
38.15	0.67	0.23	5.00	0.00	0.06	0.06
38.20	0.68	0.23	5.00	0.00	0.06	0.06
38.25	0.68	0.23	5.00	0.00	0.06	0.06
38.30	0.68	0.23	5.00	0.00	0.06	0.06
38.35	0.69	0.23	5.00	0.00	0.06	0.06
38.40	0.69	0.23	5.00	0.00	0.06	0.06
38.45	0.69	0.23	5.00	0.00	0.06	0.06
38.50	0.70	0.23	5.00	0.00	0.06	0.06
38.55	0.70	0.23	5.00	0.00	0.06	0.06
38.60	0.70	0.23	5.00	0.00	0.06	0.06
38.65	0.71	0.23	5.00	0.00	0.06	0.06
38.70	0.71	0.23	5.00	0.00	0.06	0.06
38.75	0.71	0.23	5.00	0.00	0.06	0.06
38.80	0.72	0.22	5.00	0.00	0.06	0.06
38.85	0.72	0.22	5.00	0.00	0.06	0.06
38.90	0.72	0.22	5.00	0.00	0.06	0.06
38.95	0.73	0.22	5.00	0.00	0.06	0.06
39.00	0.73	0.22	5.00	0.00	0.06	0.06
39.05	0.73	0.22	5.00	0.00	0.06	0.06
39.10	0.74	0.22	5.00	0.00	0.05	0.05
39.15	0.74	0.22	5.00	0.00	0.05	0.05
39.20	0.75	0.22	5.00	0.00	0.05	0.05
39.25	0.75	0.22	5.00	0.00	0.05	0.05
39.30	0.76	0.22	5.00	0.00	0.05	0.05
39.35	0.76	0.22	5.00	0.00	0.05	0.05
39.40	0.77	0.22	5.00	0.00	0.05	0.05

39.45	0.77	0.22	5.00	0.00	0.05	0.05
39.50	0.78	0.22	5.00	0.00	0.05	0.05
39.55	0.78	0.22	5.00	0.00	0.05	0.05
39.60	0.79	0.22	5.00	0.00	0.05	0.05
39.65	0.79	0.22	5.00	0.00	0.05	0.05
39.70	0.80	0.22	5.00	0.00	0.05	0.05
39.75	0.81	0.22	5.00	0.00	0.05	0.05
39.80	0.81	0.22	5.00	0.00	0.05	0.05
39.85	0.82	0.22	5.00	0.00	0.05	0.05
39.90	0.83	0.22	5.00	0.00	0.05	0.05
39.95	0.84	0.22	5.00	0.00	0.05	0.05
40.00	0.85	0.22	5.00	0.00	0.05	0.05
40.05	0.86	0.22	5.00	0.00	0.05	0.05
40.10	0.87	0.22	5.00	0.00	0.05	0.05
40.15	0.89	0.22	5.00	0.00	0.05	0.05
40.20	0.91	0.22	5.00	0.00	0.05	0.05
40.25	0.93	0.22	5.00	0.00	0.05	0.05
40.30	0.96	0.22	5.00	0.00	0.05	0.05
40.35	0.99	0.22	5.00	0.00	0.05	0.05
40.40	1.04	0.22	5.00	0.00	0.05	0.05
40.45	1.04	0.22	5.00	0.00	0.05	0.05
40.50	1.04	0.22	5.00	0.00	0.05	0.05
40.55	1.04	0.22	5.00	0.00	0.05	0.05
40.60	1.04	0.22	5.00	0.00	0.05	0.05
40.65	1.04	0.22	5.00	0.00	0.05	0.05
40.70	1.04	0.22	5.00	0.00	0.05	0.05
40.75	1.04	0.22	5.00	0.00	0.05	0.05
40.80	1.04	0.22	5.00	0.00	0.05	0.05
40.85	1.04	0.22	5.00	0.00	0.05	0.05
40.90	1.04	0.22	5.00	0.00	0.05	0.05
40.95	1.04	0.22	5.00	0.00	0.05	0.05
41.00	1.04	0.22	5.00	0.00	0.05	0.05
41.05	1.04	0.22	5.00	0.00	0.05	0.05
41.10	1.04	0.22	5.00	0.00	0.05	0.05
41.15	1.04	0.22	5.00	0.00	0.05	0.05
41.20	1.04	0.22	5.00	0.00	0.05	0.05
41.25	1.03	0.22	5.00	0.00	0.05	0.05
41.30	1.03	0.22	5.00	0.00	0.05	0.05
41.35	1.03	0.22	5.00	0.00	0.05	0.05
41.40	1.03	0.22	5.00	0.00	0.05	0.05
41.45	1.03	0.22	5.00	0.00	0.05	0.05
41.50	1.03	0.22	5.00	0.00	0.05	0.05
41.55	1.03	0.22	5.00	0.00	0.05	0.05
41.60	1.03	0.22	5.00	0.00	0.05	0.05
41.65	1.03	0.22	5.00	0.00	0.05	0.05
41.70	1.03	0.22	5.00	0.00	0.05	0.05
41.75	1.03	0.22	5.00	0.00	0.05	0.05
41.80	1.03	0.22	5.00	0.00	0.05	0.05
41.85	1.03	0.22	5.00	0.00	0.05	0.05
41.90	1.03	0.22	5.00	0.00	0.05	0.05
41.95	1.03	0.22	5.00	0.00	0.05	0.05
42.00	1.03	0.22	5.00	0.00	0.05	0.05
42.05	1.03	0.22	5.00	0.00	0.05	0.05
42.10	1.03	0.22	5.00	0.00	0.05	0.05

42.15	1.03	0.22	5.00	0.00	0.05	0.05
42.20	1.03	0.22	5.00	0.00	0.05	0.05
42.25	1.03	0.22	5.00	0.00	0.05	0.05
42.30	1.03	0.22	5.00	0.00	0.05	0.05
42.35	1.03	0.22	5.00	0.00	0.05	0.05
42.40	1.03	0.22	5.00	0.00	0.05	0.05
42.45	1.03	0.22	5.00	0.00	0.05	0.05
42.50	1.03	0.22	5.00	0.00	0.05	0.05
42.55	1.03	0.22	5.00	0.00	0.05	0.05
42.60	1.03	0.22	5.00	0.00	0.05	0.05
42.65	1.03	0.22	5.00	0.00	0.05	0.05
42.70	1.03	0.22	5.00	0.00	0.05	0.05
42.75	1.03	0.22	5.00	0.00	0.05	0.05
42.80	1.03	0.22	5.00	0.00	0.05	0.05
42.85	1.03	0.22	5.00	0.00	0.05	0.05
42.90	1.02	0.22	5.00	0.00	0.05	0.05
42.95	1.02	0.22	5.00	0.00	0.04	0.04
43.00	1.02	0.22	5.00	0.00	0.04	0.04
43.05	1.02	0.22	5.00	0.00	0.04	0.04
43.10	1.02	0.22	5.00	0.00	0.04	0.04
43.15	1.02	0.22	5.00	0.00	0.04	0.04
43.20	1.02	0.22	5.00	0.00	0.04	0.04
43.25	1.02	0.22	5.00	0.00	0.04	0.04
43.30	1.02	0.22	5.00	0.00	0.04	0.04
43.35	0.99	0.22	5.00	0.00	0.04	0.04
43.40	0.91	0.22	5.00	0.00	0.04	0.04
43.45	0.86	0.22	5.00	0.00	0.04	0.04
43.50	0.83	0.21	5.00	0.00	0.04	0.04
43.55	0.81	0.21	5.00	0.00	0.04	0.04
43.60	0.79	0.21	5.00	0.00	0.04	0.04
43.65	0.77	0.21	5.00	0.00	0.04	0.04
43.70	0.76	0.21	5.00	0.00	0.04	0.04
43.75	0.74	0.21	5.00	0.00	0.04	0.04
43.80	0.73	0.21	5.00	0.00	0.04	0.04
43.85	0.72	0.21	5.00	0.00	0.04	0.04
43.90	0.71	0.21	5.00	0.00	0.04	0.04
43.95	0.70	0.21	5.00	0.00	0.04	0.04
44.00	0.69	0.21	5.00	0.00	0.04	0.04
44.05	0.68	0.21	5.00	0.00	0.04	0.04
44.10	0.68	0.21	5.00	0.00	0.04	0.04
44.15	0.67	0.21	5.00	0.00	0.04	0.04
44.20	0.66	0.21	5.00	0.00	0.04	0.04
44.25	0.65	0.21	5.00	0.00	0.04	0.04
44.30	0.64	0.21	5.00	0.00	0.04	0.04
44.35	0.64	0.21	5.00	0.00	0.04	0.04
44.40	0.63	0.21	5.00	0.00	0.04	0.04
44.45	0.62	0.21	5.00	0.00	0.04	0.04
44.50	0.62	0.21	5.00	0.00	0.04	0.04
44.55	0.61	0.21	5.00	0.00	0.04	0.04
44.60	0.60	0.21	5.00	0.00	0.04	0.04
44.65	0.60	0.21	5.00	0.00	0.04	0.04
44.70	0.59	0.21	5.00	0.00	0.04	0.04
44.75	0.59	0.21	5.00	0.00	0.04	0.04
44.80	0.58	0.21	5.00	0.00	0.04	0.04

44.85	0.57	0.21	5.00	0.00	0.04	0.04
44.90	0.57	0.21	5.00	0.00	0.04	0.04
44.95	0.56	0.21	5.00	0.00	0.04	0.04
45.00	0.56	0.21	5.00	0.00	0.04	0.04
45.05	0.55	0.21	5.00	0.00	0.04	0.04
45.10	0.55	0.21	5.00	0.00	0.04	0.04
45.15	0.54	0.21	5.00	0.00	0.04	0.04
45.20	0.54	0.21	5.00	0.00	0.04	0.04
45.25	0.53	0.21	5.00	0.00	0.04	0.04
45.30	0.53	0.21	5.00	0.00	0.04	0.04
45.35	0.52	0.21	5.00	0.00	0.04	0.04
45.40	0.52	0.21	5.00	0.00	0.04	0.04
45.45	0.51	0.21	5.00	0.00	0.04	0.04
45.50	0.51	0.21	5.00	0.00	0.04	0.04
45.55	0.50	0.21	5.00	0.00	0.04	0.04
45.60	0.50	0.21	5.00	0.00	0.04	0.04
45.65	0.49	0.21	5.00	0.00	0.04	0.04
45.70	0.49	0.21	5.00	0.00	0.04	0.04
45.75	0.49	0.21	5.00	0.00	0.04	0.04
45.80	0.48	0.21	5.00	0.00	0.04	0.04
45.85	0.48	0.21	5.00	0.00	0.04	0.04
45.90	0.47	0.21	5.00	0.00	0.04	0.04
45.95	0.47	0.21	5.00	0.00	0.04	0.04
46.00	0.46	0.21	5.00	0.00	0.04	0.04
46.05	0.46	0.21	5.00	0.00	0.04	0.04
46.10	0.46	0.21	5.00	0.00	0.03	0.03
46.15	0.45	0.21	5.00	0.00	0.03	0.03
46.20	0.45	0.21	5.00	0.00	0.03	0.03
46.25	0.44	0.21	5.00	0.00	0.03	0.03
46.30	0.44	0.21	5.00	0.00	0.03	0.03
46.35	0.44	0.21	5.00	0.00	0.03	0.03
46.40	0.43	0.21	5.00	0.00	0.03	0.03
46.45	0.43	0.21	5.00	0.00	0.03	0.03
46.50	0.43	0.21	5.00	0.00	0.03	0.03
46.55	0.42	0.21	5.00	0.00	0.03	0.03
46.60	0.42	0.21	5.00	0.00	0.03	0.03
46.65	0.41	0.21	5.00	0.00	0.03	0.03
46.70	0.41	0.21	5.00	0.00	0.03	0.03
46.75	0.41	0.21	5.00	0.00	0.03	0.03
46.80	0.40	0.21	5.00	0.00	0.03	0.03
46.85	0.40	0.21	5.00	0.00	0.03	0.03
46.90	0.40	0.21	5.00	0.00	0.03	0.03
46.95	0.39	0.21	5.00	0.00	0.03	0.03
47.00	0.39	0.21	5.00	0.00	0.03	0.03
47.05	0.39	0.21	5.00	0.00	0.03	0.03
47.10	0.38	0.21	5.00	0.00	0.03	0.03
47.15	0.38	0.21	5.00	0.00	0.03	0.03
47.20	0.37	0.21	5.00	0.00	0.03	0.03
47.25	0.37	0.21	5.00	0.00	0.03	0.03
47.30	0.37	0.21	5.00	0.00	0.03	0.03
47.35	0.36	0.21	5.00	0.00	0.03	0.03
47.40	0.36	0.21	5.00	0.00	0.03	0.03
47.45	0.36	0.21	5.00	0.00	0.03	0.03
47.50	0.36	0.21	5.00	0.00	0.03	0.03

47.55	0.36	0.21	5.00	0.00	0.03	0.03
47.60	0.36	0.21	5.00	0.00	0.03	0.03
47.65	0.36	0.21	5.00	0.00	0.03	0.03
47.70	0.36	0.21	5.00	0.00	0.03	0.03
47.75	0.36	0.21	5.00	0.00	0.02	0.02
47.80	0.36	0.21	5.00	0.00	0.02	0.02
47.85	0.36	0.21	5.00	0.00	0.02	0.02
47.90	0.36	0.21	5.00	0.00	0.02	0.02
47.95	0.36	0.21	5.00	0.00	0.02	0.02
48.00	0.36	0.21	5.00	0.00	0.02	0.02
48.05	0.36	0.21	5.00	0.00	0.02	0.02
48.10	0.36	0.21	5.00	0.00	0.02	0.02
48.15	0.36	0.20	5.00	0.00	0.02	0.02
48.20	0.35	0.20	5.00	0.00	0.02	0.02
48.25	0.35	0.20	5.00	0.00	0.02	0.02
48.30	0.35	0.20	5.00	0.00	0.02	0.02
48.35	0.35	0.20	5.00	0.00	0.02	0.02
48.40	0.35	0.20	5.00	0.00	0.02	0.02
48.45	0.35	0.20	5.00	0.00	0.02	0.02
48.50	0.35	0.20	5.00	0.00	0.02	0.02
48.55	0.35	0.20	5.00	0.00	0.02	0.02
48.60	0.35	0.20	5.00	0.00	0.02	0.02
48.65	0.35	0.20	5.00	0.00	0.02	0.02
48.70	0.35	0.20	5.00	0.00	0.02	0.02
48.75	0.35	0.20	5.00	0.00	0.02	0.02
48.80	0.35	0.20	5.00	0.00	0.02	0.02
48.85	0.35	0.20	5.00	0.00	0.02	0.02
48.90	0.35	0.20	5.00	0.00	0.02	0.02
48.95	0.35	0.20	5.00	0.00	0.02	0.02
49.00	0.35	0.20	5.00	0.00	0.02	0.02
49.05	0.35	0.20	5.00	0.00	0.02	0.02
49.10	0.35	0.20	5.00	0.00	0.01	0.01
49.15	0.35	0.20	5.00	0.00	0.01	0.01
49.20	0.35	0.20	5.00	0.00	0.01	0.01
49.25	0.35	0.20	5.00	0.00	0.01	0.01
49.30	0.35	0.20	5.00	0.00	0.01	0.01
49.35	0.35	0.20	5.00	0.00	0.01	0.01
49.40	0.35	0.20	5.00	0.00	0.01	0.01
49.45	0.35	0.20	5.00	0.00	0.01	0.01
49.50	0.35	0.20	5.00	0.00	0.01	0.01
49.55	0.35	0.20	5.00	0.00	0.01	0.01
49.60	0.35	0.20	5.00	0.00	0.01	0.01
49.65	0.35	0.20	5.00	0.00	0.01	0.01
49.70	0.35	0.20	5.00	0.00	0.01	0.01
49.75	0.35	0.20	5.00	0.00	0.01	0.01
49.80	0.35	0.20	5.00	0.00	0.01	0.01
49.85	0.35	0.20	5.00	0.00	0.01	0.01
49.90	0.35	0.20	5.00	0.00	0.01	0.01
49.95	0.35	0.20	5.00	0.00	0.01	0.01
50.00	0.35	0.20	5.00	0.00	0.01	0.01
50.05	0.35	0.20	5.00	0.00	0.01	0.01
50.10	0.35	0.20	5.00	0.00	0.01	0.01
50.15	0.35	0.20	5.00	0.00	0.01	0.01
50.20	0.34	0.20	5.00	0.00	0.01	0.01

50.25	0.34 0.20 5.00 0.00 0.01 0.01
50.30	0.34 0.20 5.00 0.00 0.01 0.01
50.35	0.34 0.20 5.00 0.00 0.01 0.01
50.40	0.34 0.20 5.00 0.00 0.00 0.00
50.45	0.34 0.20 5.00 0.00 0.00 0.00
50.50	0.34 0.20 5.00 0.00 0.00 0.00
50.55	0.34 0.20 5.00 0.00 0.00 0.00
50.60	0.34 0.20 5.00 0.00 0.00 0.00
50.65	0.34 0.20 5.00 0.00 0.00 0.00
50.70	0.34 0.20 5.00 0.00 0.00 0.00
50.75	0.34 0.20 5.00 0.00 0.00 0.00
50.80	0.34 0.20 5.00 0.00 0.00 0.00
50.85	0.34 0.20 5.00 0.00 0.00 0.00
50.90	0.34 0.20 5.00 0.00 0.00 0.00
50.95	0.34 0.20 5.00 0.00 0.00 0.00
51.00	0.34 0.20 5.00 0.00 0.00 0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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August 28, 2023

Project No. 07-230524-0

Ms. Rosalind Cox
Madera Unified School District
1205 South Madera Avenue
Madera, CA 93637

Subject: Geotechnical Investigation and Geohazards Study Report
New Kindergarten Classrooms at Alpha Elementary School
900 Stadium Road
Madera, CA 93637

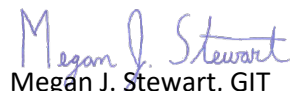
Dear Ms. Cox:

In accordance with your request, we have performed a geotechnical investigation and geohazards study for the subject project. This work was performed in accordance with Section 1803A.6 of the 2022 California Building Code (CBC). The results of our geotechnical investigation and geohazards study are presented in the accompanying report, which includes a description of site conditions and potential geologic hazards, results of our field investigation and laboratory testing, conclusions, and recommendations.

We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,

RMA GeoScience, Inc.



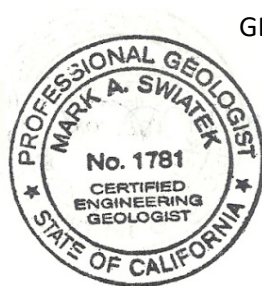
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Josue Montes, PE|GE
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GE 2904



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President
EG 1781



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**GEOTECHNICAL INVESTIGATION AND GEOHAZARDS STUDY REPORT
NEW KINDERGARTEN CLASSROOMS AT ALPHA ELEMENTARY SCHOOL
900 STADIUM ROAD
MADERA, CALIFORNIA 93637**

for

Madera Unified School District
1205 South Madera Avenue
Madera, California 93637

August 28, 2023

Project No. 07-230524-0

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1.00 INTRODUCTION

1.01 Purpose

A geotechnical investigation and geohazards study has been completed for the New Kindergarten Classrooms at Alpha Elementary School project in Madera, California. The purpose of the investigation was to summarize geotechnical and geologic conditions at the site, to assess their potential impact on the proposed development, and to develop geotechnical engineering design parameters for the project.

1.02 Scope of the Study

The general scope of this study included the following:

- Review of published and unpublished geologic, seismic, groundwater and geotechnical literature. This included reviewing the following geotechnical reports:
- Examination of aerial photographs and topographic maps.
- Contacting of Underground Service Alert to locate onsite utility lines.
- Logging, sampling, and backfilling of three exploratory borings drilled with a SIMCO 2800 drill rig: one to an approximate depth of 51 feet and two to an approximate depth of 21 feet.
- Laboratory testing of representative soil samples.
- Geotechnical evaluation of the compiled data.
- Preparation of this report presenting our findings and conclusions.

As part of the geohazards study associated with our geotechnical investigation, our scope of services included addressing applicable items in California Geological Survey – Note 48, Checklist for the review of engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Service Buildings, October 2013.

Our scope of work did not include a preliminary site assessment for the potential of hazardous materials onsite.

1.03 Site Location and Description

The project site lies within the existing Alpha Elementary School in Madera, California, which was constructed before 1998. The location of the site relative to nearby streets is indicated on Figure 1, Site Vicinity Map. Its geographic position is 36.9435° north latitude and 120.0662° west longitude. The existing ground surface is relatively flat and the elevation above mean sea level at the project site is approximately 263 feet according to the USGS Madera 7.5 Minute Quadrangle (see Figure 2).



Photo taken near the northeast corner of the site, facing southwest. Taken on July 25, 2023.



Photo taken near the southwest corner of the site, facing northeast. Taken on July 25, 2023.

1.04 Planned Improvements

Based on our review of the information provided, which included a site plan prepared by PBK, we understand the project will consist primarily of the installation/construction of two (2) new modular buildings with an approximate footprint area of 3,550 square feet each. It is anticipated that the new buildings will be wood-framed, with concrete slab-on-grade floors, and shallow reinforced-concrete foundations. Maximum wall and column loads (dead plus live, not including wind or seismic loads) are anticipated to be less than 2.0 kips per foot and 50 kips, respectively. Appurtenant improvements are anticipated to be various underground utilities, new concrete flatwork, and landscaping. No grading plan was available at the time of the preparation of this report.

1.05 Investigation Methods

Our investigation consisted of office research, review of the compiled data, and preparation of this report. It has been performed in a manner consistent with generally accepted engineering and geologic principles and practices and has incorporated applicable requirements of California Building Code. Definitions of technical terms and symbols used in this report include those of the ASTM International, the California Building Code, and commonly used geologic nomenclature. Technical supporting data are presented in the attached appendices. Appendix A presents a description of the methods and equipment used in performing the field exploration and logs of our subsurface exploration. Appendix B presents a description of our laboratory testing and the test results. Results of our liquefaction and seismic settlement analysis are provided in Appendix C. References are presented in Appendix D.

2.00 FINDINGS

2.01 Geologic Setting

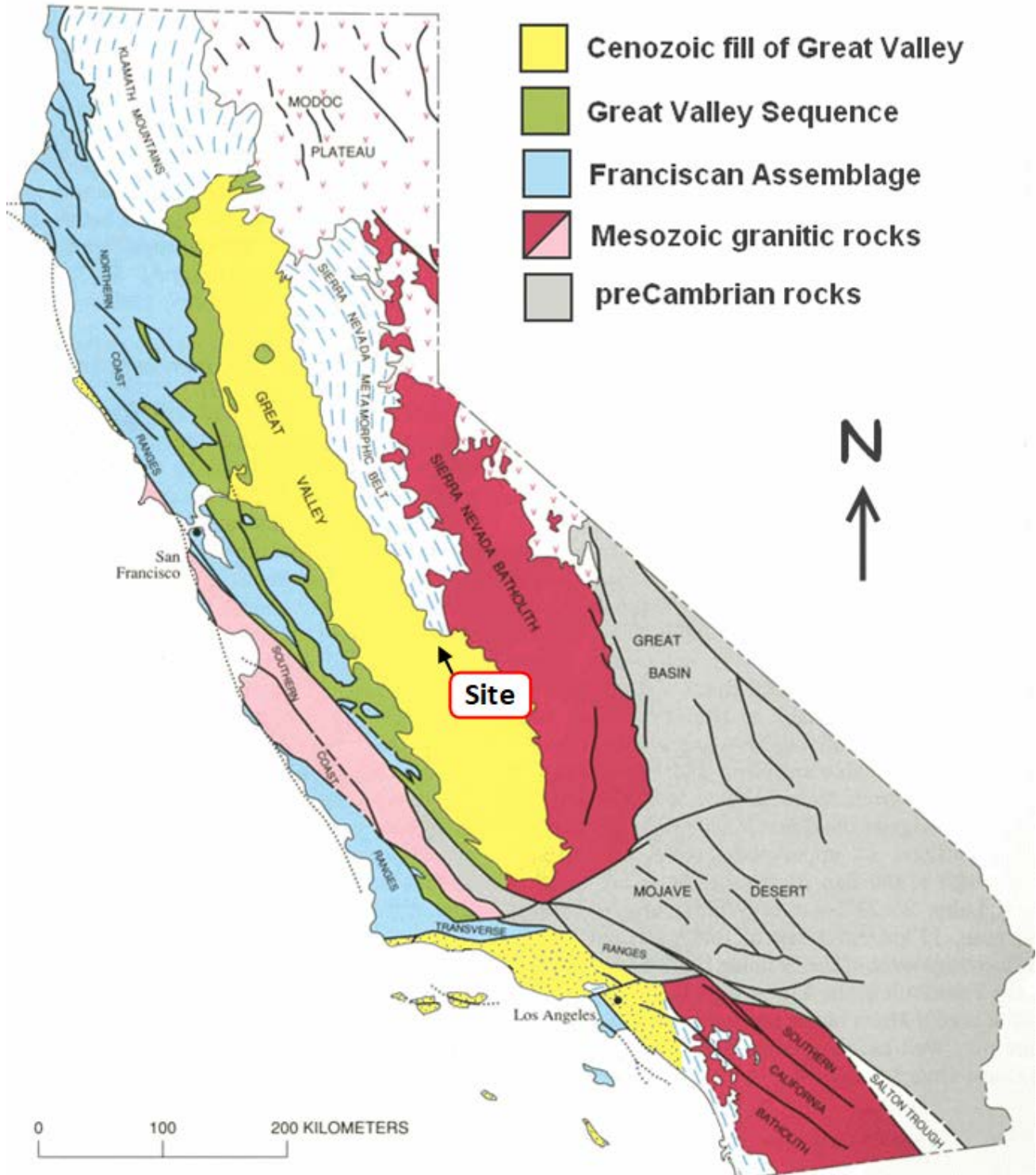
The subject site is located in the south-central San Joaquin Valley, which comprises the southern half of the Great Valley geomorphic province. The valley is a westward-titling trough which forms a broad alluvial fan, approximately 200 miles long and 50 to 70 miles wide, where the eastern flank is broad and gently inclined, as opposed to the western flank which is relatively narrow (Bartow, 1991; Page, 1968). The Central Valley consists of the Great Valley Sequence, overlain by Cenozoic alluvium. Underlying the Great Valley Sequence are the Franciscan Assemblage to the west and the Sierra Nevada batholith to the east (Bailey, Irwin, and Jones, 1964).

The Franciscan Assemblage, made up of deformed and high pressure and low temperature metamorphosed mafic and ultramafic rocks, was formed around the Late Jurassic through the Miocene (160 to about 20 million years ago) by the offscraping of rocks from a subducting plate dipping to the east (Wakabayashi, 1992; Wakabayashi, 2010).

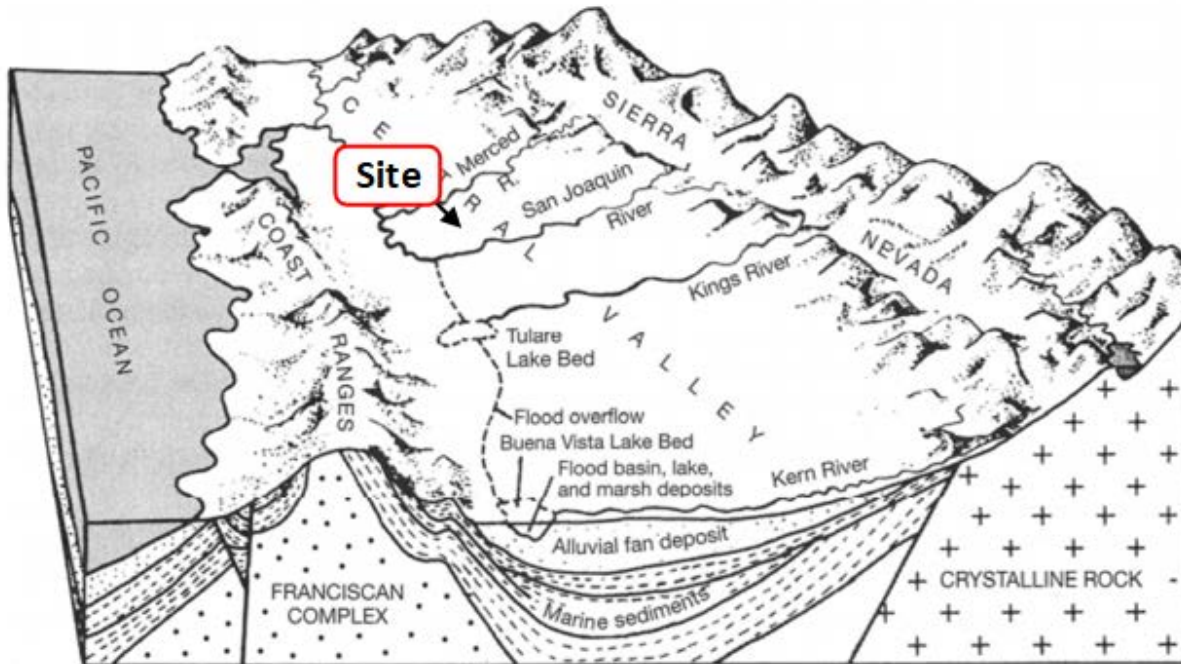
The Sierra Nevada started to form during the Early Jurassic (around 200 million years ago) when the Farallon Plate began subducting under the North American Plate. This subduction resulted in several orogenies, or mountain building events, that created the granitic Sierra Nevada Batholith deep below the surface. During the

Miocene (around 10 million years ago), vertical movement along the Sierra Nevada Frontal Fault Zone (part of the Eastern California Shear Zone) began to uplift the Sierra Nevada. This uplift and erosion exposed the batholiths to the surface. From the Pleistocene (commonly known as the most recent Ice Age) to the present, glaciers have been carving out many parts of the Sierras. The current uplift of the Sierra Nevada is 1 - 2mm per year (Hammond, et al. 2012).

The Great Valley Sequence is a 40,000 foot sequence of marine shale, sandstone, and conglomerate beds, deposited in a deep marine environment during the Late Jurassic through the Cretaceous (150 – 65 million years ago). Overlying the Great Valley Sequence is several thousand feet of Cenozoic alluvium, deposited by: streams and rivers draining from the mountains and creating alluvial fans; by lakes that covered parts of the valley floor from time to time; flooding; and marsh environments (Page, 1986). In some places, it is thousands of feet thick, and more than half of this thickness is composed of fine grained fluvial and lacustrine deposits. Holocene deposition consists mainly of episodic deposition of alluvial sediments (Bartow, 1991; Page, 1986). A generalized geologic map for the State of California is shown below and Figure 3A illustrates the geologic setting within the regional area of the project site. As shown on Figure 3A, the project site is situated on Quaternary deposits of alluvium that are estimated to be several thousand feet deep.



Geologic map showing the locations of Cenozoic alluvium/fill (yellow) overlying the Great Valley Sequence (green), the Franciscan Assemblage (blue), and the Sierra Nevada Batholith (red). Modified from: Irwin (1990).



Geologic block diagram of California. From: Harden (2004). Not to scale.

2.02 Earth Materials

The soils encountered in our test borings consisted primarily of both reworked and native soils. The reworked soil consisted of fine-grained sandy silt which extended from the surface to a depth of approximately 1 to 3 feet. The native soil profile consisted of silty sand with varying amounts of clay, sandy silt with varying amounts of clay, and poorly graded sand to the maximum depth explored of approximately 51 feet. These layers varied in thickness and appear to be horizontally discontinuous across the project site. The granular soils generally had a relative density of loose to very dense, while the fine-grained soils had a relative consistency of stiff to hard. As indicated above, the soils encountered in the test borings are related to deep alluvial deposits that have been deposited over the past several thousand years.

A Boring Location Map showing the locations of the referenced test borings is presented as Figure 5. The logs of our recent exploratory borings are presented in Appendix A, which provide more detailed information of the soils that were encountered to a depth of approximately 51 feet at the project site.

2.03 Expansive Soils

Our field exploration indicates that the near surface soils at the project site have a very low expansion potential (Expansion Index, EI, of 19). Results of our laboratory tests are presented in Appendix B.

2.04 Surface and Groundwater Conditions

Groundwater was not encountered during our subsurface exploration. No areas of ponding or standing water were observed at the time of our study, and no seepage was observed in the exploratory borings to the maximum depth explored of approximately 51 feet below existing ground surface.

According to recent groundwater data from the SGMA Data Viewer application, the depth to groundwater in the vicinity of the project site is approximately 179 feet as of Fall 2022. Historical data derived from wells (State Well Number 11S17E36B001M, 11S18E30D001M, 11S17E26A001M, 11S17E35C001M, and 11S18E31C001M) located approximately 0.43 miles southeast, 0.84 miles northeast, 0.86 miles northwest, 1.07 miles southwest, and 1.09 miles southeast, respectively, of the project site indicates the depth to ground water in the vicinity of the project site was approximately 37 feet deep in the 1930's, gradually declined to a depth of approximately 72 feet by the 1960's, and declined further to a depth of approximately 107 feet by the 1990's, with a historical high of 19.2 feet in May 1945.

Since the 1930's (the earliest well data available) the depth to groundwater has increased significantly, falling 160 feet in 93 years. Some recovery in the groundwater could occur, especially following a period of wet years. However, in consideration of the demand for groundwater related to domestic and agricultural purposes, it is highly unlikely that the groundwater table will recover much above the levels observed during, or prior to, the 1980's. Thus, although the "historical high" groundwater table is approximately 19.2 feet at the project site, a design "high" groundwater table of 90 feet is recommended for Civil Engineering purposes.

2.05 Faults

The site is not located within the boundaries of an Earthquake Fault Zone for fault-rupture hazard as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no faults are known to pass through the property. The nearest active earthquake fault zones are the Ortigalita Fault Zone, the Nunez Fault, the San Andreas Fault Zone, the Calaveras Fault Zone, and the Quien Sabe Fault located approximately 46.9 miles west-southwest, 53.0 miles south-southwest, 63.2 miles southwest, 65.6 miles west-southwest, and 66.4 miles west, respectively, of the project site. The location of the project site relative to these and other fault zones is illustrated on Figure 4a.

Our research of regional geologic and seismic data did not reveal any known instances of ground failure in the vicinity of the site associated with regional seismic activity. Seismic design parameters relative to the requirements of the 2022 California Building Code (CBC) are presented in Section 3.10.

2.06 Historic Seismicity

According to the California Historical Earthquakes Online Database maintained by the California Geological Survey and the United States Geological Survey (USGS) database, there have been no historic earthquakes with a magnitude greater than or equal to 5.5 with an epicenter within 50 miles of the site. Large historic earthquakes in California with an epicenter of less than 100 miles away from the site are summarized in the table below.

Large Historic Earthquakes

Event	Date	Magnitude	Distance from Site (Miles)
NE of San Juan Bautista	June 10, 1836	6.4	79
E of San Juan Bautista	January 18, 1840	6.5	80
SE of San Juan Bautista	July 3, 1841	6.0	80
E of King City	September 2, 1853	6.3	63
W of Coalinga	January 9, 1857	6.1	67
Fort Tejon	January 9, 1857	7.9	87
NE of King City	April 17, 1860	6.0	64
NE of Morgan Hill	February 26, 1864	6.1	87
SW of Tracy	July 15, 1866	6.0	95
NW of Bishop	April 11, 1872	6.8	95
NW of Parkfield	February 2, 1881	6.0	67
SW of Patterson	April 10, 1881	6.3	72
SW of Hollister	March 30, 1883	6.0	80
E of King City	April 12, 1885	6.5	66
SW of Bishop	September 30, 1889	6.0	78
E of Watsonville	April 24, 1890	6.3	85
SW of Independence	August 17, 1896	6.3	99
E of Gilroy	June 20, 1897	6.3	79
W of San Juan Bautista	April 30, 1899	6.0	85
NW of Parkfield	March 3, 1901	6.4	69
SE of Morgan Hill	July 21, 1911	6.5	88
SE of Mammoth Lakes	May 25, 1980	6.1	81
E of Mammoth Lakes	May 25, 1980	6.0	82
SE of Mammoth Lakes	May 25, 1980	6.1	81
SE of Mammoth Lakes	May 27, 1980	6.2	81
NE of Coalinga	May 2, 1983	6.7	51
E of San Jose	April 4, 1984	6.2	93
NW of Bishop	November 23, 1984	6.1	88
N of Bishop	July 21, 1986	6.4	98
SE of Parkfield	September 28, 2004	6.0	79

2.07 Flooding Potential

According to the Federal Emergency Management Agency (Flood Insurance Rate Map #06039C1155E, effective September 26, 2008), the site is located within an unshaded area of “Zone X”, which is an “area determined to be outside the 0.2% annual chance floodplain”.

Control of surface runoff originating from within and outside of the site should be included in design of the project.

2.08 Landslides

Since there are no natural or manmade slopes in the vicinity of the project site, landslides are not a hazard at this site.

2.09 Other Geologic Hazards

California Geologic Survey Note 48 (2011) identifies a number of exceptional geologic hazards that can occur at individual sites, but do not occur statewide. Evaluation of these exceptional conditions is referred to as a conditional geologic assessment by Note 48. Specific assessment items listed in Note 48 are addressed in the table below.

Conditional Geologic Assessment

Hazard	Assessment	Reference
Methane gas, hydrogen-sulfide gas, tar seeps	Not applicable; site is not located within an oil field identified as a high risk area for hazardous gas accumulations.	See Section 1.03.
Volcanic eruption	Not applicable; site is not located in a known hazard area for volcanic eruptions.	Miller, 1989 (U.S.G.S. Bulletin 1847)
Flooding	The proposed development area is not located within the boundaries of a 100-year or 500-year flood zone.	See Section 2.07.
Tsunami and seiches inundation	Not applicable.	See Section 3.11.
Radon-222 gas	Not applicable; typically a concern in the California Coast Ranges.	See Section 2.01 and CGS Note 48.
Naturally occurring asbestos	Not applicable; site is not located in an area likely to contain naturally occurring asbestos.	Churchill and Hill, 2000 (DMG OFR 2000-19)
Hydrocollapse due to anthropic use of water	Due to the density of the underlying soils, hydrocollapse due to anthropic use of water is unlikely.	See Sections 2.01, 2.02, and Appendix A.

Hazard	Assessment	Reference
Regional land subsidence	The site is not identified in an area of large historic subsidence within the California Central Valley. Control of subsidence will dependent upon proper jurisdictional management of groundwater resources.	Madera County General Plan Background Report, 1995, and Borches and Carpenter, 2014.
Clays and cyclic softening	Soils within the upper 51 feet of the ground surface are primarily granular rather than clays. Expansive properties of near-surface soils have been considered in foundation design.	See Sections 2.03, 3.04, and 3.12.

3.00 CONCLUSIONS AND RECOMMENDATIONS

3.01 General Conclusions

Based on specific data and information contained in this report, our understanding of the project, and our geotechnical engineering experience, it is our professional judgment that the proposed development is geologically and geotechnically feasible. Our review of geological literature and the field exploration performed for this project did not indicate any unusual conditions at the site that would entail special design considerations or construction procedures. Specific geotechnical recommendations and guidelines are presented below to provide information for other members of the design team that can be used to prepare the project plans and specifications for the planned improvements to the administration building.

3.02 General Earthwork and Grading

All grading should be performed in accordance with the recommendations provided below, the project plans and specifications, Appendix J of the 2022 California Building Code and all applicable governmental agency requirements. In the event of conflicts between this report and the other referenced documents, this report shall govern. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 laboratory test procedures.

3.03 Rippability and Rock Disposal

Exploratory borings that have been done at the project site were advanced without difficulty and no oversize materials were encountered. Accordingly, we expect that all earth materials will be rippable with conventional grading equipment and oversized materials are not expected.

3.04 Earthwork Recommendations

All vegetation, organic rich soils (soils containing more than 2 percent organics by weight), trash, debris, existing pavement sections and underground utilities, should be cleared from the grading area and removed from the site. After the removal of deleterious materials and the stripping of organic-rich soils, the following over-excavation must be done within the area of the planned improvements:

- Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 24 inches below the stripped subgrade surface or 12 inches below the bottom of footings, whichever is lower. The bottom of the over-excavation within each building area must be level and at a uniform depth below the finished pad elevation.
- Outside of the “building pad” area indicated above, no over-excavation should be required unless loose or unstable soils are present that will require some over-excavation prior to the scarification, moisture conditioning, and compaction as recommended below.

Following the over-excavation indicated above, a designated representative for the Project Geotechnical Engineer must review the exposed ground surface and determine if any additional over-excavation is required.

The over-excavated ground surface in all areas determined to be satisfactory for the support of fills must be scarified to a minimum depth of 12 inches. Scarification should continue until the soils are broken down and free from lumps or clods and until the scarified zone is uniform. The moisture content of the scarified zone shall be adjusted to near optimum moisture content. The scarified zone must then be uniformly compacted to at least 90 percent relative compaction within the building pad area and concrete flatwork and to at least 95 percent relative compaction within paved areas that will be subject to vehicular traffic.

Removed and/or over-excavated soils, free of organics and other deleterious material, may be used as engineered fill. Fill material should be placed in nearly horizontal layers, uniformly moisture conditioned to near optimum moisture content, and then compacted in layers that do not exceed approximately 8 inches in thickness. Thicker lifts may be placed if testing indicates the compaction procedures are such that the required compaction is being achieved and the geotechnical consultant approves their use. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Engineered fill must be compacted to achieve a relative compaction of at least 90 percent, except for the upper 12 inches of subgrade below asphalt or concrete pavement sections subject to vehicular traffic, which must be compacted to at least 95 percent. Based on our observations of the existing field conditions and lab testing data, a shrinkage factor (decrease in volume of soil upon removal and recompaction) in the range of 5 to 10 percent is considered applicable for this project.

The above recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. Hence, over-excavation depths must be verified, and adjusted if

necessary, at the time of grading. In addition, any contaminated soils within three (3) feet of the finished subgrade surface, must be removed and properly disposed of outside the area the planned improvements.

3.05 Imported Fill Material

If required, imported fill materials that will be placed within building or concrete flatwork areas must be non-hazardous and be obtained from a single, uniform source that meets the following criteria:

Gradation			
Sieve Size		Percent Passing	
3-inch		100%	
3/4-inch		90% - 100%	
#4		60% - 100%	
#200		20% - 50%	
Maximum Expansion Index		Maximum Plasticity Index	
20		10	
Minimum R-Value (in paved areas)			
50			
Maximum Organic Content			
< 2% by weight			
Corrosivity			
pH	Minimum Resistivity (ohm-cm)	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)
6.0 to 8.5	> 5,000*	< 1,000	< 200

*unless other requirement established by the Design Engineer

3.06 Temporary Slopes and Shoring

Our geotechnical investigation indicates that excavations less than 4 feet in depth may generally be constructed with vertical sidewalls without shoring or shielding. Temporary excavations in existing alluvial soils that are deeper than 4 feet may be safely made at an inclination of 1:1 or flatter. If vertical sidewalls are required in excavations greater than 4 feet in depth, the use of cantilevered or braced shoring is recommended. The following geotechnical parameters can be used to design a shoring system:

Moist Unit Weight of Soils: 130 pcf
 Angle of Internal Friction (ϕ): 30°
 Cohesion: 200 psf

Unless vehicles, equipment, materials, etc., are kept a minimum distance equal to the height of the excavation

away from the edge of the excavation, a surcharge load equal to a uniform lateral pressure of 72 psf should be assumed to act on the shoring in addition to the earth pressure calculated using the above geotechnical parameters.

Vehicles, equipment, materials, etc. should be set back a minimum distance of 10 feet from the top edge of sloped or vertical excavations. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation. In any case, Cal/OSHA construction safety orders should be observed during all underground work.

3.07 Fill and Cut Slopes

Due to the low gradient of the property, it appears that construction of cut and fill slopes will not be required. If such slopes are proposed, they should be inclined no steeper than 2 horizontal to 1 vertical. In addition, appropriate landscaping measures should be taken to protect the face of slopes from erosion.

3.08 Utility Trench Backfill

The existing onsite soils will generally not be suitable for use as pipe bedding for buried utilities. All pipes should be bedded in sand or other suitable material as specified by the Project Civil Engineer and/or as specified by the pipe/conduit manufacturer. We recommend the bedding material have a Sand Equivalent (SE) of at least 30 and have less than 8 percent, by weight, passing the #200 Sieve. The geotechnical consultant should review and approve proposed bedding materials prior to use. Bedding materials should be compacted to at least 90% relative compaction (ASTM D1557) by mechanical methods.

The on-site soils are expected to be suitable as trench backfill provided they are screened of organic matter and other deleterious material. Trench backfill must be compacted to at least 90% relative compaction (ASTM D1557) and the upper 12 inches of trench backfill beneath pavement sections should be compacted to at least 95% relative compaction. Trench backfill should be compacted using mechanical methods; no jetting of backfill should be allowed. A minimum trench width of 24 inches or 18 inches plus the diameter of the utility line, whichever is greater, should be provided to permit uniform compaction on both sides of utility line and allow for a technician to perform in-place density tests. If narrower trenches are desired, a sand-cement slurry should be used to backfill the trenches to within 8 inches of the top of trench. The sand-cement slurry should contain at least 2 sacks of cement per yard of mix and have a 4- to 6-inch slump. In addition, slurry should be consolidated

using a suitable vibratory or mechanical method.

All utility trench backfill within street right of ways, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing. Where utility crossings are located within 12 inches of bottoms of footings, conduits should be wrapped with polystyrene foam or other suitable material with a minimum thickness of one inch. Conduits extending through footings shall be “sleeved” as determined by the Project Structural Engineer.

3.09 Faulting

Since the site is not located within the boundaries of an Earthquake Fault Zone and no faults are known to pass through or near the property, surface fault rupture within the site is considered unlikely.

3.10 Seismic Design Parameters

Seismic design parameters have been developed in accordance with Section 1613A of the 2022 California Building Code (CBC) using the online SEAOC and OSHPD Seismic Design Maps Calculator (ASCE 7-16 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented below:

2022 California Building Code (CBC) Seismic Parameters

Parameter	Value
Site Location	Latitude = 36.9435 degrees Longitude = -120.0662 degrees
Site Class	Site Class = D* Soil Profile Name = "Stiff Soil"
Risk Category	III
Mapped Spectral Accelerations	S_s (0.2-second period) = 0.606g S_1 (1-second period) = 0.236g
Site Coefficients (Site Class D)	F_a = 1.315 F_v = Null - Section 11.4.8
Maximum Considered Earthquake Spectral Accelerations (Site Class D)	S_{MS} (0.2-second period) = 0.797g S_{M1} (1-second period) = Null - Section 11.4.8
Design Earthquake Spectral Accelerations (Site Class D)	S_{DS} (0.2-second period) = 0.531g S_{D1} (1-second period) = Null - Section 11.4.8

*As defined in Chapter 20 of ASCE 7-16, a Site Class D is applicable to predominantly cohesionless soils with an **average** standard penetration resistance of 15 to 50 within the upper 100 feet. Based on the geologic setting, our 50-foot deep test boring (see Appendix A), and other historical geotechnical data (see Section 1.02), the soil profile at the project site meets these criteria.

As the Site Class is D and the S_1 value is greater than 0.200g, then per ASCE 7-16 Section 11.4.8 a site-specific ground motions procedure is required with several exceptions. We assume that Exception 2 is applicable to this site, and hence the seismic parameters indicated in the table above have been calculated. If Exception 2 does not apply, the structural engineer should contact us so we develop the site-specific seismic parameters.

The above table shows that the mapped spectral response acceleration parameter for a 1-second period (S_1) is less than 0.75g and the spectral response acceleration parameter (S_{DS}) is greater than 0.50g. Therefore, the Seismic Design Category using 2022 CBC Tables 1613.2.5(1) and 1613.2.5(2) is D for all Occupancy Categories (2022 CBC Section 1613.2.5). Consequently, as required for Seismic Design Categories C through F by CBC Section 1803.5.12, slope instability, liquefaction, total and differential settlement, and surface displacement by faulting or seismically lateral spreading or lateral flow have been evaluated.

Peak earthquake ground acceleration adjusted for site class effects (PGA_M) has been calculated in accordance with ASCE 7-16 Section 11.8.3 as follows: $PGA_M = F_{PGA} \times PGA = 1.338 \times 0.262 = 0.350g$.

3.11 Liquefaction and Secondary Earthquake Hazards

Potential secondary seismic hazards that can affect land development projects include liquefaction, tsunamis, seiches, and seismically induced settlement.

Liquefaction

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, and intensity and duration of ground shaking. In order for liquefaction to occur, three criteria must be met: "low density", coarse-grained (sandy) soils, a groundwater depth of less than about 51 feet, and a potential for seismic shaking from nearby large-magnitude earthquake.

Research has shown that saturated, loose sands with a silt content less than about 25 percent are most susceptible to liquefaction, whereas other soil types are generally considered to have a low susceptibility. According to the California Geologic Survey (CGS) Special Publication SP-117A (2008), "Guidelines for Evaluating and Mitigating Seismic Hazards in California," any materials with a PI > 12 and moisture content < 85% of the liquid limit were considered not subject to liquefaction. Liquefaction susceptibility is related to numerous factors, and the following conditions must exist for liquefaction to occur:

- Sediments must be relatively young in age and must not have developed large amounts of cementation
- Sediments must consist mainly of cohesionless sands and silts
- The sediment must not have a high relative density
- Free groundwater must exist in the sediment; and
- The site must be exposed to seismic events of a magnitude large enough to induce straining of soils particles

The soils in the upper 51 feet at the project site consist primarily of silty sand, sandy silt, and poorly graded sand. A liquefaction analysis was performed using the sampler blow count and soil data from the deep boring that was performed at the project site (Boring B-2), using corrected SPT value $[(N_1)_{60}]$. The analysis was performed using LiquefyPro Version 5 (2015 edition) for two groundwater conditions: at a depth of 19.2 feet (historical high groundwater condition as required by CGS) and at a depth of 90 feet (representative of a recommended design "high groundwater condition" based on historical DWR data in the past 30 years). The analysis also took into account that the (PGA_M) is 0.350g and the Modal Magnitude (M_M) for the design level earthquake is 5.5 (based on the PSH Deaggregation tool on the USGS website at <https://earthquake.usgs.gov/hazards/interactive/>) for a 2-percent probability for exceedance in 50 years (a return period of 2,475 years). A summary of the input data and the results of this liquefaction analysis are provided in Appendix C of this report. Based on this analysis, there appears to be a low risk of liquefaction occurring at the project site during a design level earthquake (Factor-of-Safety against liquefaction is greater than 1.2).

It should be noted that the California Geological Survey has not yet prepared a Seismic Hazard Zone Map of potential liquefaction hazards for the quadrangle in which the site is located. In addition, there are no liquefaction hazard zones identified near the site according to the Madera County General Plan. Because there are no mapped liquefaction hazard zones near the site, a map depicting such a zone relative to the site has not

been prepared.

Tsunamis and Seiches

Tsunamis are sea waves that are generated in response to large-magnitude earthquakes. When these waves reach shorelines, they sometimes produce coastal flooding. Seiches are the oscillation of large bodies of standing water, such as lakes, that can occur in response to ground shaking. Tsunamis and seiches do not pose hazards due to the inland location of the site and lack of nearby bodies of standing water.

Seismically Induced Settlement

Seismically induced settlement occurs most frequently in areas underlain by loose, granular sediments. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

A seismic settlement analysis was performed using LiquefyPro Version 5 (2015 edition) in conjunction with the liquefaction analysis that was performed for this project as indicated above. A summary of the input data and the results of the seismic settlement analysis are provided in Appendix C of this report. Based on this analysis, a seismic settlement of less than 1/4 inch is expected to occur at the project site during a design level earthquake.

Seismically Induced Flooding

The City and County of Madera General Plans indicates the site is located within the potential dam inundation area of Hensley Lake/Hidden Dam. However, the chances of this of this dam failing while at full capacity is considered remote. Consequently, seismically induced flooding at the site is unlikely.

Seismically Induced Landslides

There are no cut or fill slopes that currently exist or are planned at the project site; therefore, the potential for seismically induced landslides is nil.

3.12 Foundations

Isolated spread footings and/or continuous wall footings are recommended to support the proposed new building. New footings should be embedded at least 12 inches below the lowest adjacent grade and must be constructed on properly compacted fill as recommended in Section 3.04 of this report. Continuous and isolated spread footings with a minimum width of 12 and 24 inches, respectively, may be designed using an allowable bearing capacity of 3,000 pounds per square foot (psf). An allowable increase of 750 psf per additional 12 inches of embedment, and an allowable increase of 500 psf per additional 12 inches of width, can be used in design, up to a maximum allowable bearing capacity of 5,000 psf. This allowable bearing capacity represents an allowable net increase in soil pressure over existing soil pressure and may be increased by one-third for short-term wind or

seismic loads. The maximum expected settlement of footings is expected to be less than 3/4 inch with a differential settlement of less than 1/4 inch between similarly sized and loaded footings or less than 1/4 inch over a distance of 30 feet for continuous footings. This assumes that the maximum column and wall loads (dead plus live, not including wind or seismic) associated with new building improvements will not exceed 40 kips and 2.0 kips per foot, respectively.

Our lab testing indicates that the upper 5 feet of soils at the site should have a very low expansion potential (Expansion Index ≤ 20). The type and dimensions of concrete, and the size and location of reinforcing steel, used in foundations should be specified by the Project Structural Engineer. As a minimum, reinforcement for continuous footings should include at least one #4 bar located near both the top and bottom of continuous footings.

It will be very important for all footing excavations to be observed by the geotechnical engineer to verify that they have been excavated into the recommended bearing material. Where zones of relatively loose or disturbed soils are present at the bottom of foundation excavations, these soils should be properly compacted to provide a uniform bearing surface that meets the approval of the geotechnical engineer (refer to Section 3.04).

3.13 Lateral Load Resistance and Earth Pressures

Lateral loads may be resisted by soil friction and the passive resistance of the soil. The following parameters are recommended.

- Allowable Passive Earth Pressure = 350 psf (equivalent fluid weight, includes a factor of safety = 2.0)
- Allowable Coefficient of Friction (soil to footing) = 0.35 (includes a factor of safety = 1.5)
- Retaining structures should be designed to resist a lateral active earth pressure of 35 pcf (equivalent fluid weight) for a level, non-expansive granular backfill with drainage provided.

The active earth pressure provided above is only applicable if the retained earth is allowed to strain sufficiently to achieve the active state. The required minimum horizontal strain to achieve the active state is approximately 0.0025H. Retaining structures should be designed to resist an at-rest lateral earth pressure of 55 pcf (equivalent fluid weight) if this horizontal strain cannot be achieved.

The Mononobe-Okabe method is commonly utilized for calculating seismically induced active and passive lateral earth pressures and is based on the limit equilibrium Coulomb theory for static stress conditions. This method entails three fundamental assumptions (e.g., Seed and Whitman, 1970): Wall movement is sufficient to ensure either active or passive conditions, the driving soil wedge inducing the lateral earth pressures is formed by a planar failure surface starting at the heel of the wall and extending to the free surface of the backfill, and the driving soil wedge and the retaining structure act as rigid bodies, and therefore, experiences uniform accelerations throughout the respective bodies (U.S. Army Corps of Engineers, 2003, Engineering and Design - Stability Analysis of Concrete Structures).

- Seismic Lateral Earth Pressure for level backfill = 18 pcf (equivalent fluid weight)

The seismic lateral earth pressure given above is a triangular distribution increasing with depth, and the resultant of this pressure is an increment of force which should be applied to the back of the wall at 1/3 of the wall height from the wall base. The seismic increment of earth pressure should be added to the static active pressure. Even for the at-rest (K_0) condition, the seismic increment of earth pressure should be added to the static active soil pressure, not to the at-rest (SEAOC Seismology Committee 2019). Per CBC Section 1803.5.12 dynamic seismic lateral earth pressures shall be applied to foundation walls and retaining walls supporting more than 6 feet of backfill. Dynamic seismic lateral earth pressures may also be applied to shorter walls at the discretion of the structural engineer.

3.14 Pole Type Foundations

It is anticipated that light poles, signs, or canopies may be supported on pole-type foundations or drilled piers. This type of foundation should be designed in accordance with Section 1807.3 of the 2022 CBC. It is recommended that an allowable lateral soil bearing pressure of 300 psf per foot of embedment be used to develop parameters S1 and S3 rather than one of the values given in Table 1806.2. This value includes a factor of safety of 2 and may be increased as indicated in Section 1806.3.4. In landscape areas, the upper 12 inches of soil should be ignored when calculating the minimum depth of embedment.

An allowable end bearing pressure of 3,000 psf (includes a factor of safety of 3.0) and an allowable average skin friction of 300 psf (includes a factor of safety of 2.0) may be used to support compressive vertical loads applied to pier foundations that are embedded at least 5 feet. The end bearing should be ignored if the drilled pier excavation is not properly cleaned out prior to installing the reinforcing steel and placing concrete. The uplift capacity of drilled piers can be calculated using an allowable skin friction of 190 psf plus the weight of the pier. In landscape areas, the skin friction within the upper 12 inches of embedded length should be ignored for compressive or uplift loads. The total settlement of pier foundations designed in accordance with these recommendations should not exceed one-half inch.

Prior to placing reinforcing steel or concrete, loose or disturbed soils should be removed from drilled pier excavations. A representative of the Geotechnical Engineer should observe the drilling and clean-out associated with the construction of pier foundations in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. Therefore, for drilled piers that extend to depths of sandy soils, the contractor should be prepared to take measures to prevent caving or significant sloughing in drilled holes (such as temporary casing) from occurring during the drilling and installation of reinforcing steel and concrete. In any case, reinforcing steel and concrete should be installed in an expeditious manner after each drilled hole is cleaned out. The contractor must take responsibility for staging the installation of drilled piers so that significant amounts of sloughing or caving do not occur prior to installing the reinforcing steel and concrete. The annular space around the pole must be backfilled using approved CLSM (controlled low strength material).

3.15 Interior Slabs on Grade

Concrete floors with a minimum thickness of 4 inches are recommended for interior slabs on grade. Existing on-

site soils within 5 feet of the ground surface may be considered to have a very low expansion potential for design purposes (Expansion Index of ≤ 20). However, to reduce the potential for excessive cracks as a result of differential movement, consideration should be given to reinforcing concrete slab-on-grade floors with at least #3 bars spaced 24 inches on-center in both directions. Reinforcement consisting of welded or woven wire mesh should not be used, due to the difficulty of keeping it centered in the slab during the construction process. If heavy concentrated or moving loads are anticipated, slabs should be designed using a modulus of subgrade reaction (k) of 180 pci. The concrete mix, reinforcement of slabs, and the location of construction and control joints should be specified by the Design Engineer.

Special care should be taken on floors slabs to be covered with thin-set tile or other inflexible coverings. These areas should have suitable reinforcement that is placed at the mid-height of the slab, to mitigate drying shrinkage cracks. Alternatively, inflexible flooring may be installed with unbonded fabric or liners to prevent reflection of slab cracks through the flooring.

A moisture vapor retarder/barrier is recommended beneath all slabs-on-grade that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2022 California Building Code and pertinent sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

The moisture vapor retarder/barrier should consist of a minimum 10 mils thick polyethylene with a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

The moisture vapor retarder/barrier may be placed directly beneath the floor slab with no intermediate granular fill layer. The vapor barrier should be placed directly on a smooth compacted subgrade surface consistent with the recommendations provided in Section 3.02 of this report. This method of construction will provide improved curing of the slab bottom and will eliminate potential problems caused by water being trapped in a granular fill layer. However, concrete slabs poured directly on a moisture vapor retarder/barrier can experience shrinkage cracking and curling due to differential rates of curing through the thickness of the slab. Therefore, for concrete placed directly on the moisture vapor retarder/barrier, we recommend a maximum water to cement ratio of 0.45 and the use of water-reducing admixtures to increase workability and decrease bleeding.

Alternatively, the slabs may be constructed over 2 inches of sand that is placed on the moisture vapor retarder/barrier. Granular fill should consist of clean, fine-graded materials with 100% passing the No. 4 sieve,

10% to 30% passing the No. 100 sieve, and less than 5% passing the No. 200 sieve. The granular layer should be moist but not saturated and uniformly compacted by making at least one pass with a vibratory base compactor or some other mechanical method that is approved by the Project Geotechnical Engineer. If uneven, the surface of the sand should be trimmed to provide the full design thickness of the proposed slab. The granular fill layer should not be left exposed to rain or other sources of water such as wet-grinding, power washing, pipe leaks or other processes, and should be damp but not saturated at the time of concrete placement. Granular fill layers that become saturated should be removed and replaced prior to concrete placement.

3.16 Miscellaneous Concrete Flatwork

Miscellaneous concrete flatwork and walkways may be designed with a minimum thickness of 4 inches. Large slabs (greater than 6 feet in width) should be reinforced with a minimum of #3 rebar placed 24 inches on-center in both directions. The reinforcement must be placed at mid-height in the slab. Control joints should be constructed to create squares or rectangles with a maximum spacing of 12 feet. The Project Civil Engineer should provide design details and specifications for all exterior concrete flatwork include walkways. In addition, walkways should be separated from foundations with a thick expansion joint filler.

The subgrade beneath all miscellaneous concrete flatwork and equipment pads should be constructed in accordance with Section 3.04 of this report. The geotechnical engineer should monitor the moisture conditioning and compaction of the subgrade soils in order to verify compliance with our recommendations.

3.17 Footing Excavations and Concrete Subgrade

All footing excavations should be observed by the geotechnical consultant to verify that they have been excavated into competent soils. The foundation excavations should be observed prior to the placement of forms, reinforcement steel, or concrete. These excavations should be evenly trimmed and level. Prior to concrete placement, any loose or soft soils should be removed. Excavated soils should not be placed within slab or footing areas unless properly compacted (see Section 3.04).

Prior to the placement of the moisture barrier and sand, the subgrade soils underlying the slab should be observed by the geotechnical consultant to verify that all under-slab utility trenches have been properly backfilled and compacted, that no loose or soft soils are present, and that the slab subgrade has been properly compacted to a minimum of 90 percent relative compaction within the upper 12 inches.

Footings may experience an overall loss in bearing capacity or an increased potential to settle where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom of a parallel utility trench.

The subgrade below slabs on grade and walkways should be brought to a minimum of 0% and a maximum of 4% above the optimum moisture content for a depth of 6 inches prior to the placement of concrete or a moisture

barrier. The geotechnical consultant should perform insitu moisture tests to verify that the appropriate moisture content has been achieved a maximum of 72 hours prior to the placement of concrete or moisture barriers.

3.18 Drainage and Moisture Proofing

Surface drainage should be directed away from the proposed improvements into suitable drainage devices (see Section 1804.4 of the 2022 CBC). Neither excess irrigation nor rainwater should be allowed to collect or pond against building foundations or within low-lying or level areas of the lot. Surface waters should be diverted away from the tops of slopes and prevented from draining over the top of slopes and down the slope face.

Walls and portions thereof that retain soil and enclose interior spaces and floors below grade should be waterproofed and damp-proofed in accordance with Section 1805 of the 2022 CBC.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Backdrains should be installed behind all retaining walls exceeding 3 feet in height. All backdrains should be outlet to suitable drainage devices. Retaining walls less than 3 feet in height should be provided with backdrains or weep holes. Damp-proofing and/or waterproofing should also be provided on all retaining walls exceeding 3 feet in height.

3.19 Cement Type and Corrosion Potential

A soluble sulfate test was performed on a near-surface soil sample indicated a soluble sulfate content of 63.2 mg/kg (0.00632 percent by weight). Thus, below-grade concrete at the subject site should have a negligible exposure to water-soluble sulfate in the soil. Our recommendations for concrete exposed to sulfate-containing soils are presented in the table below.

Recommendations for Concrete Exposed to Soils Containing Soluble Sulfate

Sulfate Exposure	Water Soluble Sulfate (SO ₄) in Soil (% by Weight)	Sulfate (SO ₄) in Water (ppm)	Cement Type (ASTM C150)	Maximum Water-Cement Ratio (by Weight)	Minimum Compressive Strength (psi)
Negligible	0.00 - 0.10	0-150	--	--	2,500
Moderate	0.10 - 0.20	150-1,500	II	0.50	4,000
Severe	0.20 - 2.00	1,500-10,000	V	0.45	4,500
Very Severe	Over 2.00	Over 10,000	V plus pozzolan or slag	0.45	4,500

Use of alternate combinations of cementitious materials may be permitted if the combinations meet design recommendations contained in American Concrete Institute guideline ACI 318-11.

Our testing also indicates that there is a moderate concentration of soluble chloride (59.8 mg/kg) in the onsite soils; therefore, no special protection of reinforcing steel should be required due to soil conditions.

The soils were also tested for soil reactivity (pH) and electrical resistivity (ohm-cm). The test results indicate that the on-site soils have a pH of 6.65 and a minimum electrical resistivity of 1,930 ohm-cm. A neutral or non-corrosive soil has a value ranging from 6.0 to 8.5; thus, the onsite soils can be considered neutral. Generally, soils that could be considered moderately corrosive to ferrous metals have minimum resistivity values of about 3,000 ohm-cm to 10,000 ohm-cm. Soils with resistivity values less than 3,000 ohm-cm can be considered corrosive and soils with resistivity values less than 1,000 ohm-cm can be considered extremely corrosive. In any case, buried metal conduits should have a protective coating in accordance with the manufacturer's specifications. A corrosion specialist should be consulted if more detailed recommendations are required.

3.20 Plan Review

Once formal grading and foundation plans are prepared for the subject project, this office should review the plans from a geotechnical viewpoint, comment on changes from the plan used during preparation of this report and revise the recommendations of this report where necessary.

3.21 Geotechnical Observation and Testing During Grading

The geotechnical engineer should be contacted to provide observation and testing during the following stages of grading:

- During the clearing and grubbing of the site.
- During the demolition of any existing structures, buried utilities or other existing improvements.
- During excavation and over-excavation of existing subgrade.
- During all phases of grading including ground preparation and filling operations.
- When any unusual conditions are encountered during grading.

A grading and compaction report summarizing conditions encountered during grading and the in-place density testing that was performed should be submitted upon completion of the earthwork construction.

3.22 Post-Grading Geotechnical Observation and Testing

After the completion of grading the geotechnical engineer should be contacted to provide additional observation and testing during the following construction activities:

- During trenching and backfilling operations of buried improvements and utilities to verify proper backfill and compaction of the utility trenches.
- After excavation and prior to placement of reinforcing steel or concrete within footing excavations to verify that footings are properly founded in competent materials.
- During fine or precise grading involving the placement of any fills underlying driveways, sidewalks,

walkways, or other miscellaneous concrete flatwork to verify proper placement, mixing and compaction of fills.

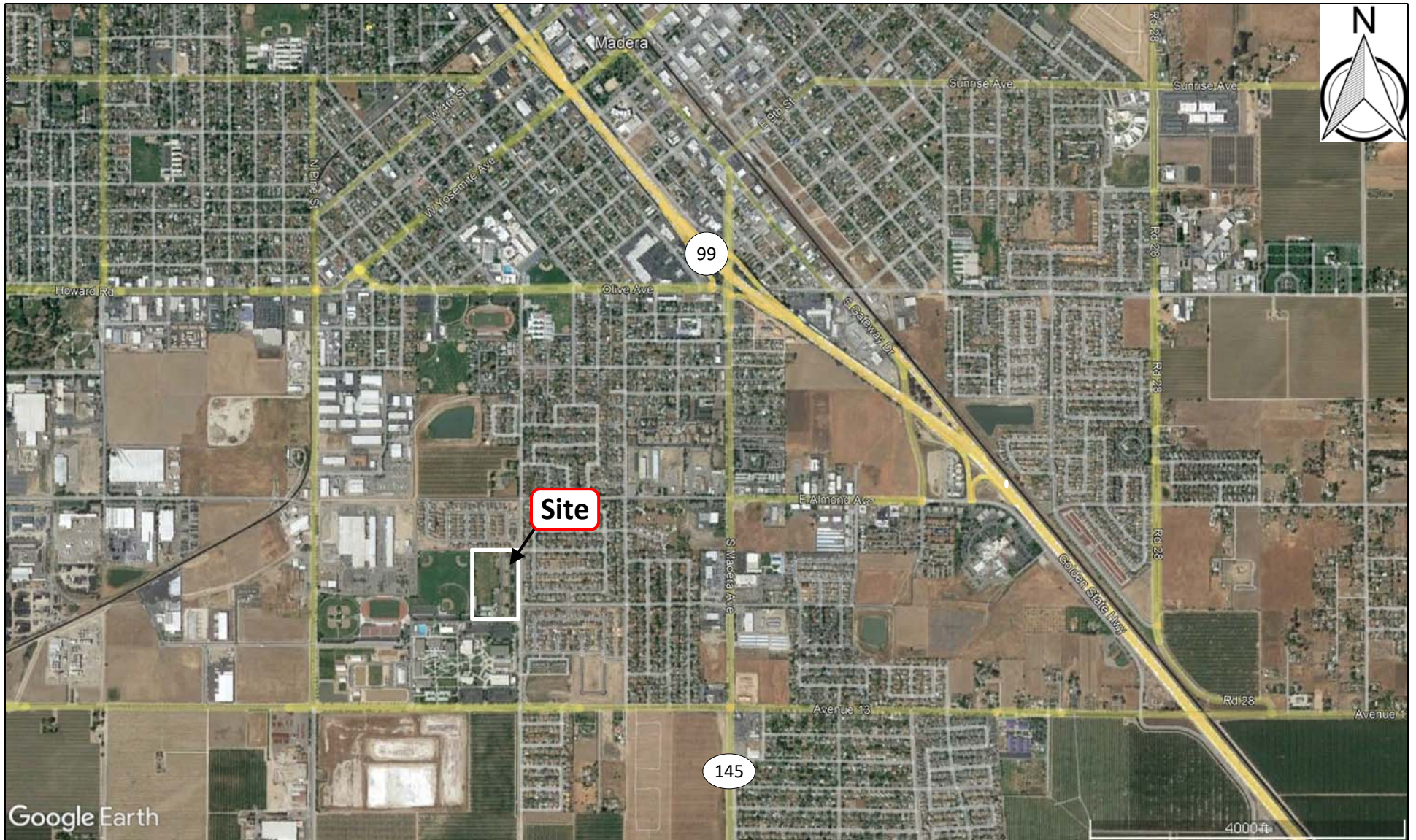
- When any unusual ground or soil conditions are encountered during construction.

4.00 CLOSURE

The findings, conclusions and recommendations in this report were prepared in accordance with generally accepted engineering and geologic principles and practices. No other warranty, either express or implied, is made. This report has been prepared for the Madera Unified School District and other members of the Project Design Team to be used for the design and construction of improvements at the project site. Anyone using this report for any other purpose must draw their own conclusions regarding required construction procedures and subsurface conditions.

RMA GeoScience should be retained during the earthwork and foundation phases of construction to monitor compliance with the design concepts and recommendations and to provide additional recommendations as needed. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

FIGURES



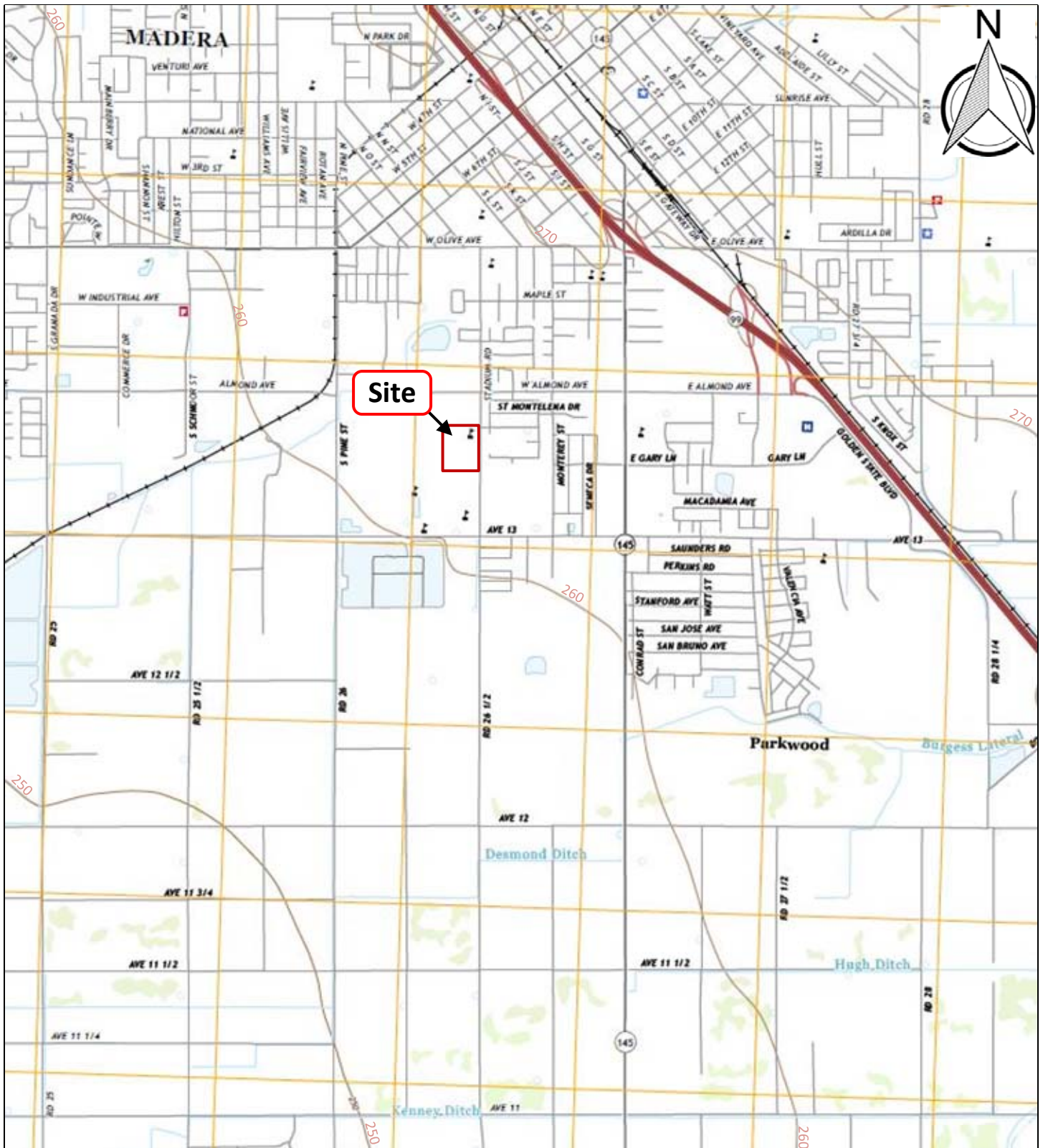
Reference: Google Earth Pro, 2023

Scale: 1" ≈ 1,785'

FIGURE 1

SITE VICINITY MAP

New Kindergarten Classrooms at Alpha Elementary School
 900 Stadium Road
 Madera, California 93637
 Project #07-230524-0



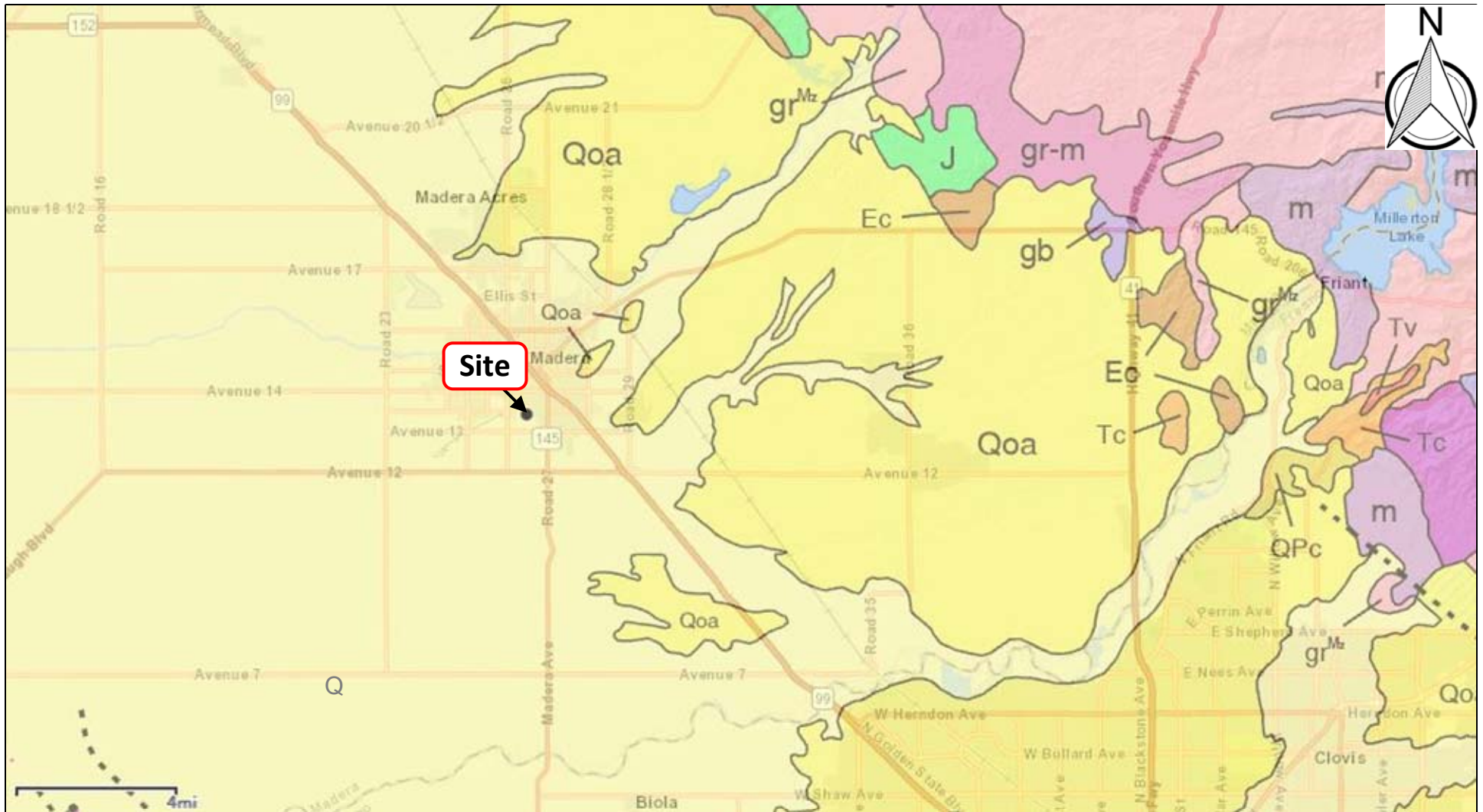
Reference: USGS Madera
Quadrangle, California 7.5-
Minute Series, 2018

Scale: 1" ≈ 0.48 miles

FIGURE 2

USGS CONTOUR MAP

New Classroom Buildings at Alpha Elementary School
900 Stadium Road
Madera, California 93637
Project #07-230524-0



Source: Gutierrez, et al., 2010, Geologic Map of California, California Geologic Survey Map No. 2

FIGURE 3A

REGIONAL GEOLOGIC MAP

New Kindergarten Classrooms at Alpha Elementary School
 900 Stadium Road
 Madera, California 93637
 Project #07-230524-0

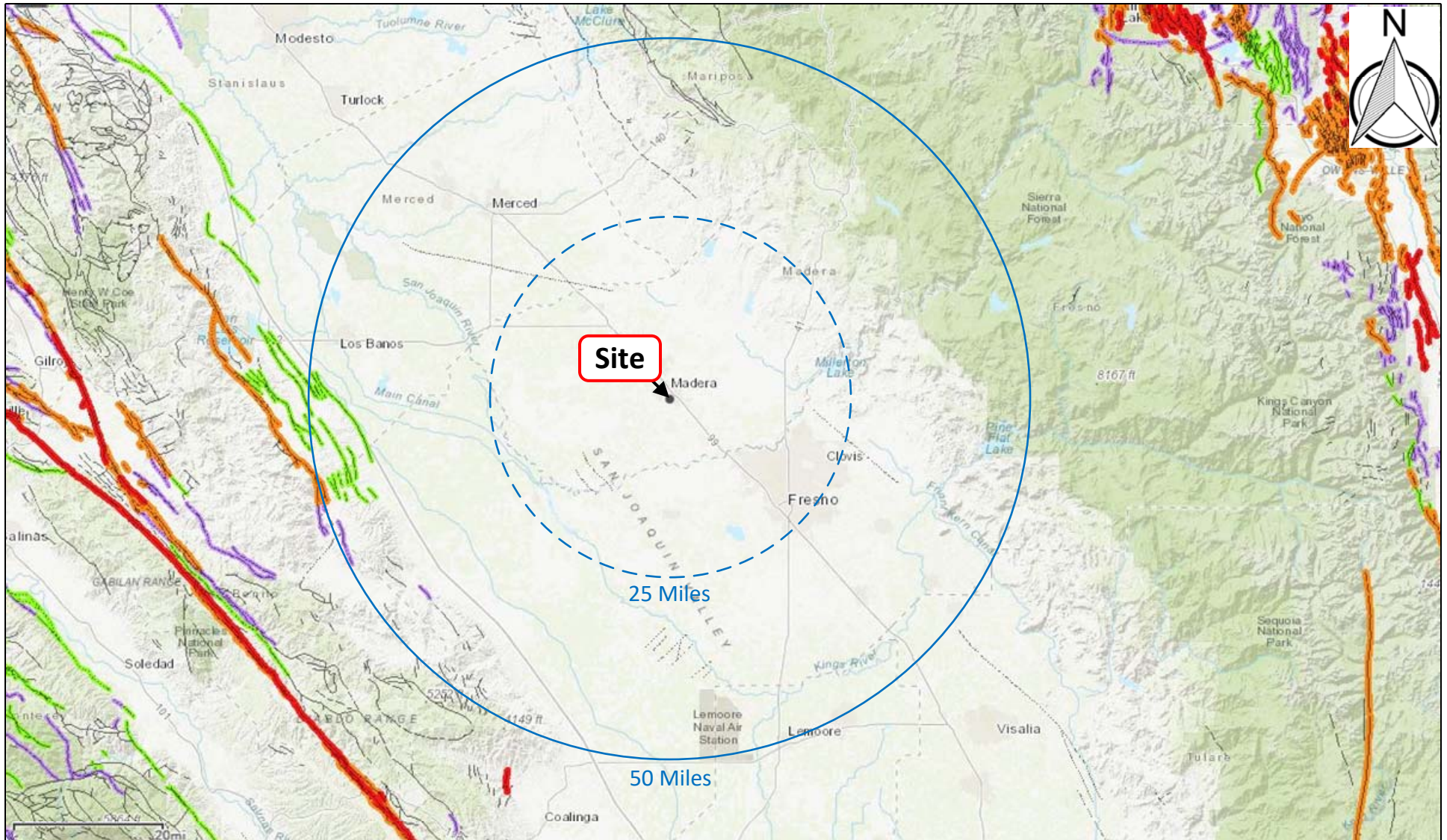
Q	Alluvium, lake, playa, and terrace deposits; consolidated and unconsolidated
Qoa	Older alluvium, lake, playa, and terrace deposits
Tc	Undivided Tertiary nonmarine sandstone, shale, conglomerate, breccia, and ancient lake deposits
Ec	Eocene nonmarine sandstone, shale, and conglomerate; moderately to well consolidated
Tv	Tertiary volcanic flow rocks; minor pyroclastic deposits
J	Jurassic shale and sandstone; minor conglomerate, chert, slate, limestone, and pyroclastic rocks
gr-m	Mesozoic to Precambrian granitic and metamorphic rocks; mostly gneiss and other metamorphic rocks injected by granitic rocks
mv	Undivided pre-Cenozoic metavolcanic rocks. Includes latite, dacite, tuff, and greenstone; commonly schistose
grMz	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
gb	Gabbro and dark dioritic rocks; chiefly Mesozoic.
m	Undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble

Source: Gutierrez, et al., 2010, Geologic Map of
California, California Geologic Survey Map No. 2

FIGURE 3B

LEGEND FOR REGIONAL GEOLOGIC MAP

New Kindergarten Classrooms at Alpha Elementary School
900 Stadium Road
Madera, California 93637
Project #07-230524-0



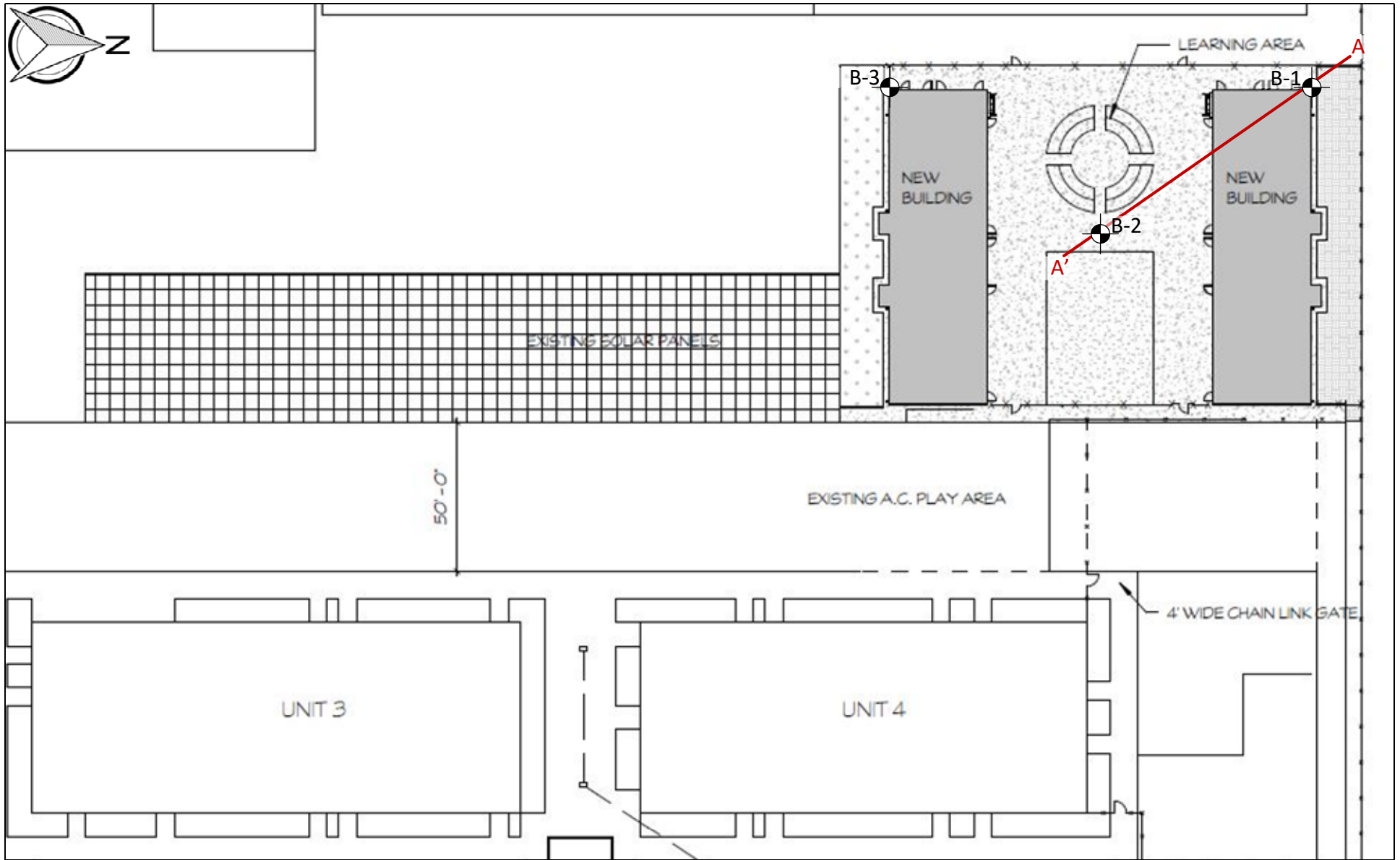
Source: Jennings, C. W., and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey, Geologic Data Map No. 6.

Scale: 1" ≈ 20 miles

FIGURE 4A

FAULT ACTIVITY MAP

New Kindergarten Classrooms at Alpha Elementary School
900 Stadium Road
Madera, California 93637
Project #07-230524-0



Site Plan prepared by: PBK

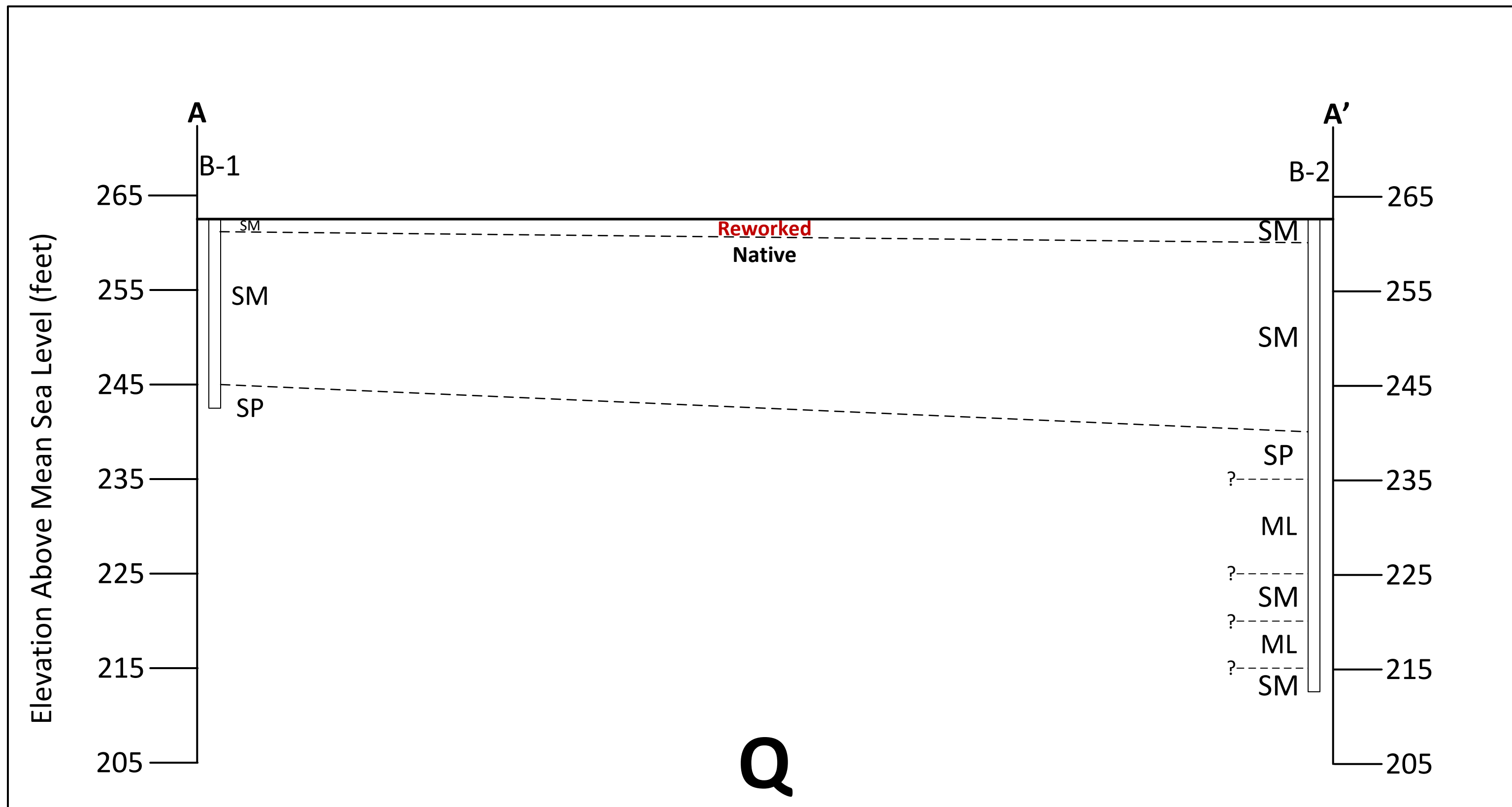
FIGURE 5

BORING LOCATION MAP

New Kindergarten Classrooms at Alpha Elementary School
 900 Stadium Road
 Madera, California 93637
 Project #07-230524-0

B-2 Approximate Boring
 Locations

A ——— A' Cross Section Line



Q

FIGURE 6

CROSS SECTION A TO A'

New Kindergarten Classrooms at Alpha Elementary School
 900 Stadium Road
 Madera, California 93637
 Project #07-230524-0

Horizontal Scale: 1" = 8'
 Vertical Scale: 1" = 10'

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Borings

Our subsurface investigation consisted of excavating three test borings to a maximum depth of approximately 51 feet below existing grade. The test borings were excavated with a SIMCO 2800 drill rig equipped with a 4-inch solid stem auger and a 140-pound auto-hammer on July 25, 2023.

A-1.02 Location of Borings

The approximate locations of the borings are shown on Figure 5, Boring Location Map. GPS coordinates indicated on the logs are based on information provided by Google Earth Pro.

A-1.03 Logging Borings

Boring logs were prepared by one of our staff and are included in this appendix. The log contains factual information and interpretation of subsurface conditions between samples. The stratum indicated on the boring logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend defining the terms used in describing the relative compaction, consistency or firmness of the soil, and moisture level is provided on the following page. Bag, ring, or tube samples of the major earth units were obtained for laboratory inspection and testing.

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

Compactness of sand		Consistency of clay	
Penetration Resistance N (blows/ft)	Compactness	Penetration Resistance N (blows/ft)	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

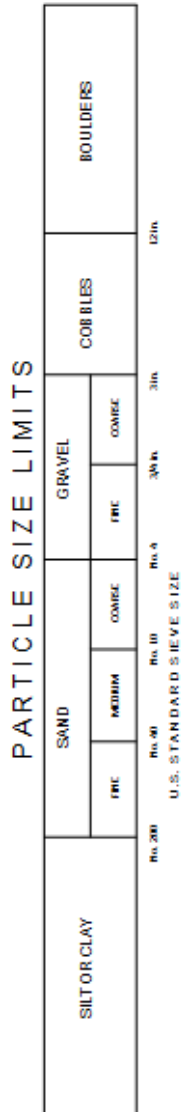
N = Number of blows of 140 lb. weight falling 30 in. to drive 2-in OD sampler 1 ft. (corrected)

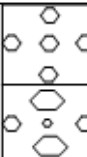














BASED ON RELATIVE COMPACTION

Compactness of sand		Consistency of clay	
% Compaction	Compactness	% Compaction	Consistency
<75	Loose	<80	Soft
75-83	Medium Dense	80-85	Medium Stiff
83-90	Dense	85-90	Stiff
>90	Very Dense	>90	Very Stiff

II. SOIL MOISTURE

Moisture of sands		Moisture of clays	
% Moisture	Description	% Moisture	Description
<5%	Dry	<12%	Dry
5-12%	Moist	12-20%	Moist
>12%	Very Moist, wet	>20%	Very Moist, wet



MAJOR DIVISIONS		GROUP SYMBOLS		TYPICAL NAMES	
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravel, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravel or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
			OL	Organic silts and organic silty clays of low plasticity.	
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
			CH	Inorganic clays of high plasticity, fat clays.	
			OH	Organic clays of medium to high plasticity, organic silts.	
		HIGHLY ORGANIC SOILS			Pt

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

Exploratory Boring Log

Boring No. B-1

Sheet 1 of 1

Date Drilled: July 25th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV





Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.943712°, -120.066371°





Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	R	10		8.4	107.8	SM		REWORKED: light brown, fine to medium SILTY SAND, moist, medium dense NATIVE: brown, fine to medium SILTY SAND with CLAY, moist, medium dense
9	R	9		6.8	118.8			... fine to coarse grained, no CLAY, loose
10	R	19		7.3	123.3	SM		... fine to medium grained, with interlayers of SANDY CLAY, medium dense
15	S	7						... loose
20	S	11				SP		Light gray brown, fine to medium SAND, moist, medium dense
21								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

-  - SPT Sample
  - Bulk Sample
 - Modified California Tube Sample
 - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 1 of 2

Date Drilled: July 25th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV











Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.943505°, -120.066187°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
	[R]	22		9.5	86.3	SM		REWORKED: light brown, fine to medium SILTY SAND, moist, medium dense
5	[R]	8						NATIVE: brown, fine to medium SILTY SAND with CLAY, moist, medium dense ...no CLAY, loose
10	[S]	6				SM		...fine to coarse grained, minor CLAY
15	[R]	20		8.8	123.7			...fine to medium grained, with CLAY, medium dense ...with interlayers of CLAYEY SAND
20	[S]	16						
25	[R]	50/5"		8.3	120.7	SP		Light gray brown, fine to coarse SAND with fine GRAVEL, moist, very dense ...with interlayers of GRAVELY SAND
30	[S]	25				ML		Gray to gray brown, fine SANDY SILT, moist, very stiff ...with interlayers of SAND
35	[R]	47		20.7	116.1			...brown to gray brown, very moist, hard, micaceous
	[S]					SM		Brown, fine to medium SILTY SAND minor CLAY, moist, dense



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 2 of 2

Date Drilled: July 25th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV





Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.943505°, -120.066187°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
42	[S]	42				SM		
45	[S]	23				ML		Light brown, fine to medium SANDY SILT with CLAY, moist, very stiff ...with interlayers of SILTY SAND
50	[R]	36		15.6	117.7	SM		Light brown, fine to medium SILTY SAND with CLAY, very moist, dense
51								Notes: 1. Boring terminated at approximately 51' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
55								
60								
65								
70								
75								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-3

Sheet 1 of 1

Date Drilled: July 25th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV





Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.943332°, -120.066371°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	[R]	8		10.9	97.8	SM		REWORKED: light brown, fine to medium SILTY SAND, moist, loose
10	[R]	11		8.5	119.9			NATIVE: brown, fine to medium SILTY SAND with CLAY, moist, medium dense
15	[R]	18		11.7	127.1	SM		...with interlayers of SANDY CLAY
20	[S]	8						...light brown, loose
25	[S]	13				ML		Gray brown with red staining, fine SANDY SILT, moist, stiff, micaceous
30								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
35								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

APPENDIX B

LABORATORY TESTS

APPENDIX B

B-1.00 LABORATORY TESTS

B-1.01 Moisture Determination

The moisture content of tube and ring samples obtained from the test borings was determined in accordance with ASTM D2216, the standard method for determining the water content of soil using a drying oven. The mass of material remaining after oven drying is used as the mass of the solid particles. The results of these tests are provided on the boring logs in Appendix A.

B-1.02 Density of Split-Barrel Samples

The densities of ring and tube samples, which were obtained using a split-barrel sampler, were determined in accordance with ASTM D2937. The results of these tests are provided on the boring logs in Appendix A.

B-1.03 Soluble Sulfates and Chlorides

Tests were performed in accordance with California Test Methods 417 and 422 on a near-surface soil sample obtained during the field exploration. These tests were performed by Dellavalle Laboratory, Inc. located in Fresno, California (see Table B1 for results).

B-1.04 Soil Reactivity (pH) and Minimum Electrical Resistivity

One near-surface soil sample was tested for soil reactivity (pH) and minimum electrical resistivity using California Test Method 643 (see Table B1). The pH measurement determines the degree of acidity or alkalinity in the soils. The minimum electrical resistivity is used as an indicator of how corrosive the soil is relative to buried metallic items.

TABLE B1: SUMMARY OF CORROSIVITY TESTS

Sample Location	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)	pH	Minimum Resistivity (ohm-cm)
B-2 @ 1' – 3'	63.2	59.8	6.65	1,930

B-1.05 Percent Passing #200 Sieve

Three soil samples were tested in accordance with ASTM D1140 to determine the percent passing the #200 sieve (see Table B2). This represents the amount of silt and clay that is present in the soil.

TABLE B2: PERCENT PASSING #200 SIEVE TEST RESULTS

Sample Location	Dry Weight Before Wash (grams)	Dry Weight After Wash (grams)	Percent Passing #200 Sieve
B-1 @ 5.5'	281.3	227.6	19
B-2 @ 1' – 3'	274.4	153.1	44
B-2 @ 25.5'	282.5	160.3	8

B-1.06 Atterberg Limits

The liquid limit, plastic limit, and the plasticity index of a near-surface soil sample were determined using the standard test methods of ASTM D4318 (See Figure B1).

B-1.07 Expansion Index

Expansion index testing was performed on a near-surface sample of the on-site soils in accordance with the standard test methods of ASTM D4829. The results of this test are shown on Figure B2.

B-1.08 Direct Shear

One 3-point direct shear test was performed on a representative near-surface sample of soil using the standard test method of ASTM D3080 (consolidated and drained). The shear tests were performed on a direct shear machine of the strain-controlled type. To simulate possible adverse field conditions, the samples were saturated prior to shearing. Three soil specimens were sheared at varying normal loads for the test and the results plotted to establish the angle of the internal friction and cohesion of the tested sample. The results of this test are shown on Figure B3.

B-1.09 One-Dimensional Consolidation Properties

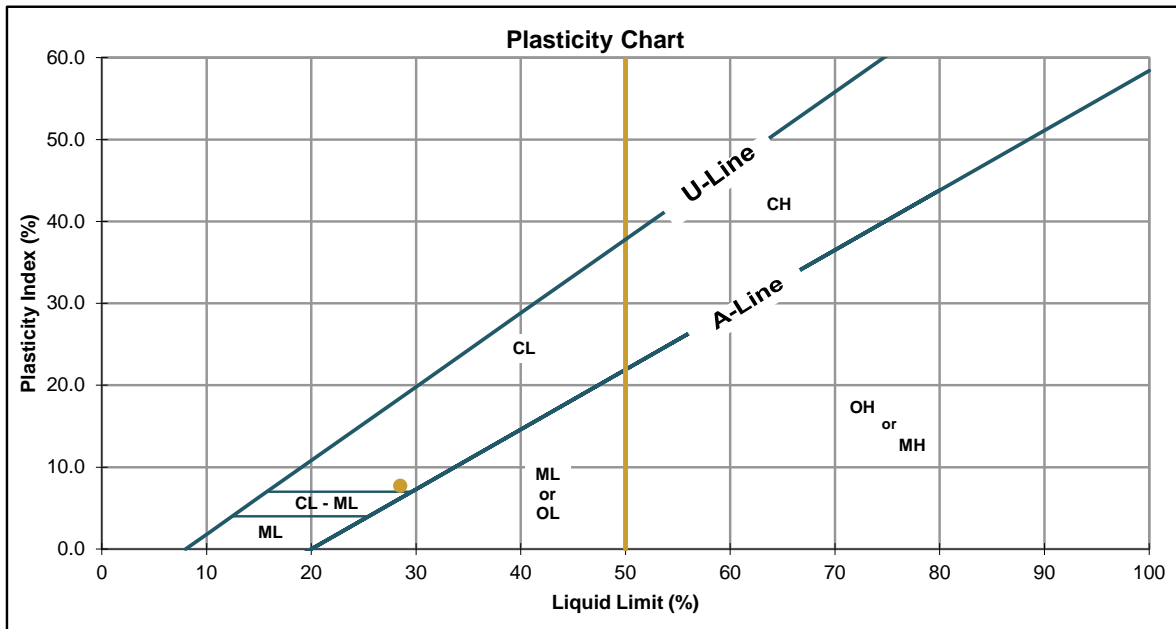
The magnitude and rate of consolidation of soils obtained from test borings, when it is restrained laterally and drained axially while subjected to incrementally applied controlled-stress loading, was determined using the standard test methods of ASTM D2435. The results of these tests are shown on Figure B4.

Figure B1
Laboratory Test Form | ASTM D4318
Plasticity Index (PI) of Soils

Project Number:	07-230524-0/02	Lab ID:	23-013504
Project Name:	New Kindergarten Classrooms at Alpha ES	Date Tested:	7/31/2023
Sampled By:	Gabe V.	Tested By:	Jason M.
Sample Date:	7/25/2023		
Sample Location:	B-1 @ 1ft - 3ft		
Sample Description:	Silty SAND with Clay, fine to medium grained, brown		

Plasticity Index Results

Liquid Limit:	29
Average Plastic Limit :	21
Plasticity Index:	8



Liquid Limit Data

	Trial 1	Trial 2	Trial 3
Wet Weight (gm.)	20.60	19.32	20.81
Dry Weight (gm.)	18.40	17.39	18.44
Tare Weight (gm.)	10.38	10.59	10.47
Number of Blows	32	26	20
Moisture Content (%)	27.4	28.4	29.7

Plastic Limit Data

	Trial 1	Trial 2
Wet Weight (gm.)	34.28	31.77
Dry Weight (gm.)	32.42	29.70
Tare Weight (gm.)	23.43	19.77
Moisture Content (%)	20.7	20.8

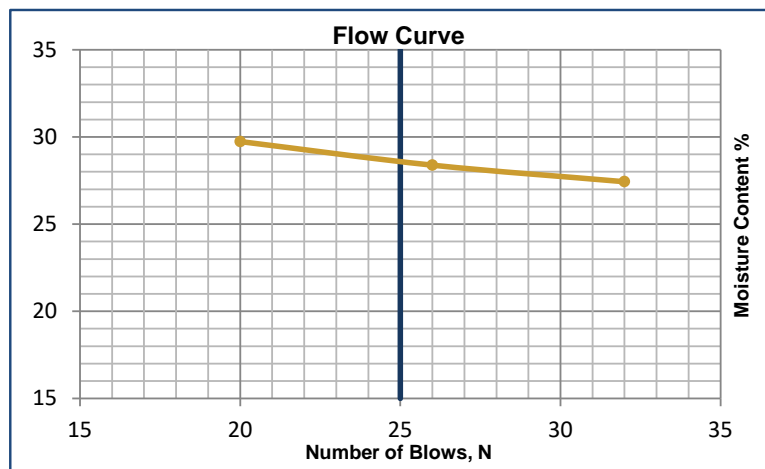




Figure B2

Laboratory Test Form | ASTM D4829

Expansion Index of Soils

Project Number: <u>07-230524-0/02</u>	Lab ID: <u>23-013515</u>
Project Name: <u>New Kindergarten Classrooms at Alpha ES</u>	Date Sampled: <u>7/25/2023</u>
Sampled By: <u>Gabe V.</u>	Date Tested: <u>8/3/2023</u>
Tested By: <u>Jason M.</u>	
Sample Location: <u>B-3 @ 1ft - 3ft</u>	
Sample Description: <u>Silty SAND with Clay, fine to medium grained, brown</u>	

Expansion Readings

Initial Sample Height (in):	<u>0.0198</u>
Final Sample Height (in):	<u>0.0386</u>
Expansion (in):	<u>0.0188</u>
 Expansion Index, EI:	 <u>19</u>

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Expansion Index Data

Initial Set-Up Data		Final Data	
Sample + Tare Weight (gm):	<u>795.2</u>	Sample + Tare Weight (gm):	<u>823.9</u>
Tare Weight (gm):	<u>365.9</u>	Tare Weight (gm):	<u>365.9</u>
Initial Gauge Reading (in):	<u>0.1980</u>	Final Gauge Reading (in):	<u>0.0386</u>

Moisture Content And Density Data

Wet Weight + Tare (gm):	<u>100.0</u>	Wet Weight + Tare (gm):	<u>823.9</u>
Dry Weight + Tare (gm):	<u>92.9</u>	Dry Weight + Tare (gm):	<u>762.3</u>
Tare Weight (gm):	<u>0</u>	Tare Weight (gm):	<u>365.9</u>
Moisture Content:	<u>7.6%</u>	Moisture Content:	<u>15.5%</u>
Initial Volume (ft ³):	<u>0.007345</u>	Final Volume (ft ³):	<u>0.007409</u>
Remolded Wet Density (pcf):	<u>128.9</u>	Final Wet Density (pcf):	<u>136.3</u>
Remolded Dry Density (pcf):	<u>119.7</u>	Final Dry Density (pcf):	<u>118.0</u>
Degree of Saturation:	<u>51</u>	Assumed Specific Gravity:	<u>2.7</u>

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Figure B4a
Laboratory Test Form | ASTM D2435
 Consolidation, No Time Rate

Project Number: 07-230524-0/02	Lab ID: 23-013517
Project Name: New Kindergarten Classrooms at Alpha ES	Date Sampled: 7/25/2023
Sampled By: Gabe V.	Date Tested: 8/2/23 - 8/16/23
Tested By: Jennifer K.	
Sample Location: B-3 @ 5.5ft	
Sample Description: Silty SAND, fine to medium grained, brown	
Sample Preparation: In-Situ Ring Sample	

Consolidation Test Data

Initial Data		Final Data	
Initial Sample Height (in):	1.0000	Final Sample Height (in):	0.9363
Initial Void Ratio:	0.50	Final Void Ratio:	0.41
Initial Gauge Reading (in):	0.2500	Final Gauge Reading (in):	0.3137

Moisture Content and Density Data

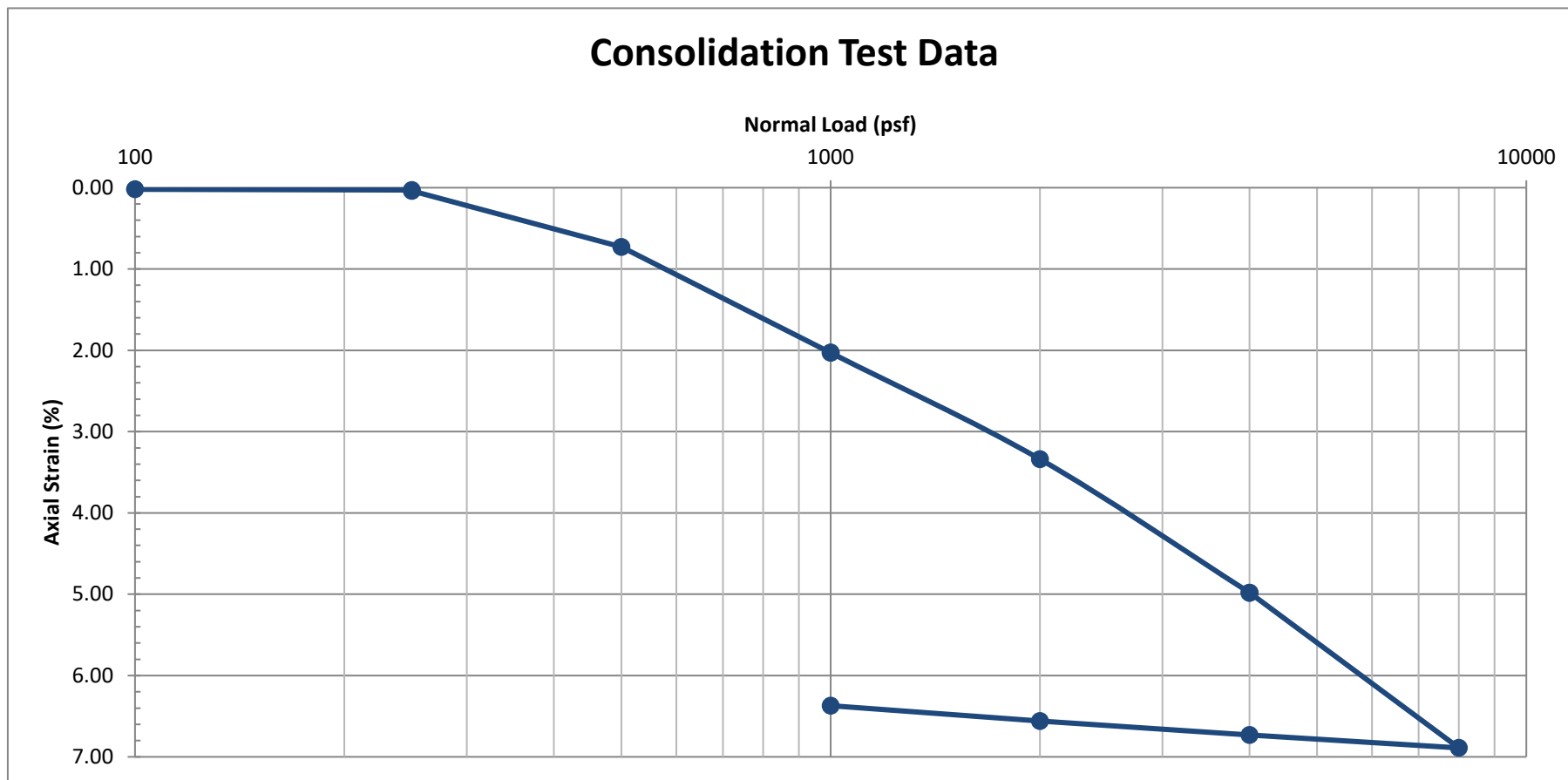
Initial Wet Weight + Tare (gm):	180.99	Final Wet Weight + Tare (gm):	192.40
Initial Dry Weight + Tare (gm):	171.60	Final Dry Weight + Tare (gm):	171.60
Tare Weight (gm):	45.20	Tare Weight (gm):	45.20
Initial Moisture Content:	7.43%	Final Moisture Content:	16.46%
Initial Volume (ft ³):	0.002531	Final Volume (ft ³):	0.002370
Initial Wet Density (pcf):	118.26	Final Wet Density (pcf):	136.92
Initial Dry Density (pcf):	110.08	Final Dry Density (pcf):	117.57
Initial Degree of Saturation:	37.8	Final Degree of Saturation:	102.6

Moisture Condition	Load (psf)	Dial Reading (in)	Sample Height (in)	Axial Strain (%)
In Situ	0	0.2500	1.0000	0.00
	100	0.2502	0.9998	0.02
	250	0.2503	0.9997	0.03
Saturated	250	0.2504	0.9996	0.04
	500	0.2573	0.9927	0.73
	1000	0.2703	0.9797	2.03
	2000	0.2834	0.9666	3.34
	4000	0.2998	0.9502	4.98
	8000	0.3189	0.9311	6.89
	4000	0.3173	0.9327	6.73
	2000	0.3156	0.9344	6.56
	1000	0.3137	0.9363	6.37

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Project Number:	07-230524-0/02	Project Name:	New Kindergarten Classrooms at Alpha Elementary School		
Date Tested:	8/2/23 - 8/16/23	Lab ID:	23-013517	Sample Location:	B-3 @ 5.5ft
Tested By:	Jennifer K.	Description:	SM	Sampled By:	Gabe V.

Results relate only to the items inspected or tested. Report shall not be reproduced, except in full, without written approval of the agency. (As required by ASTM E-329-18)

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APPENDIX C

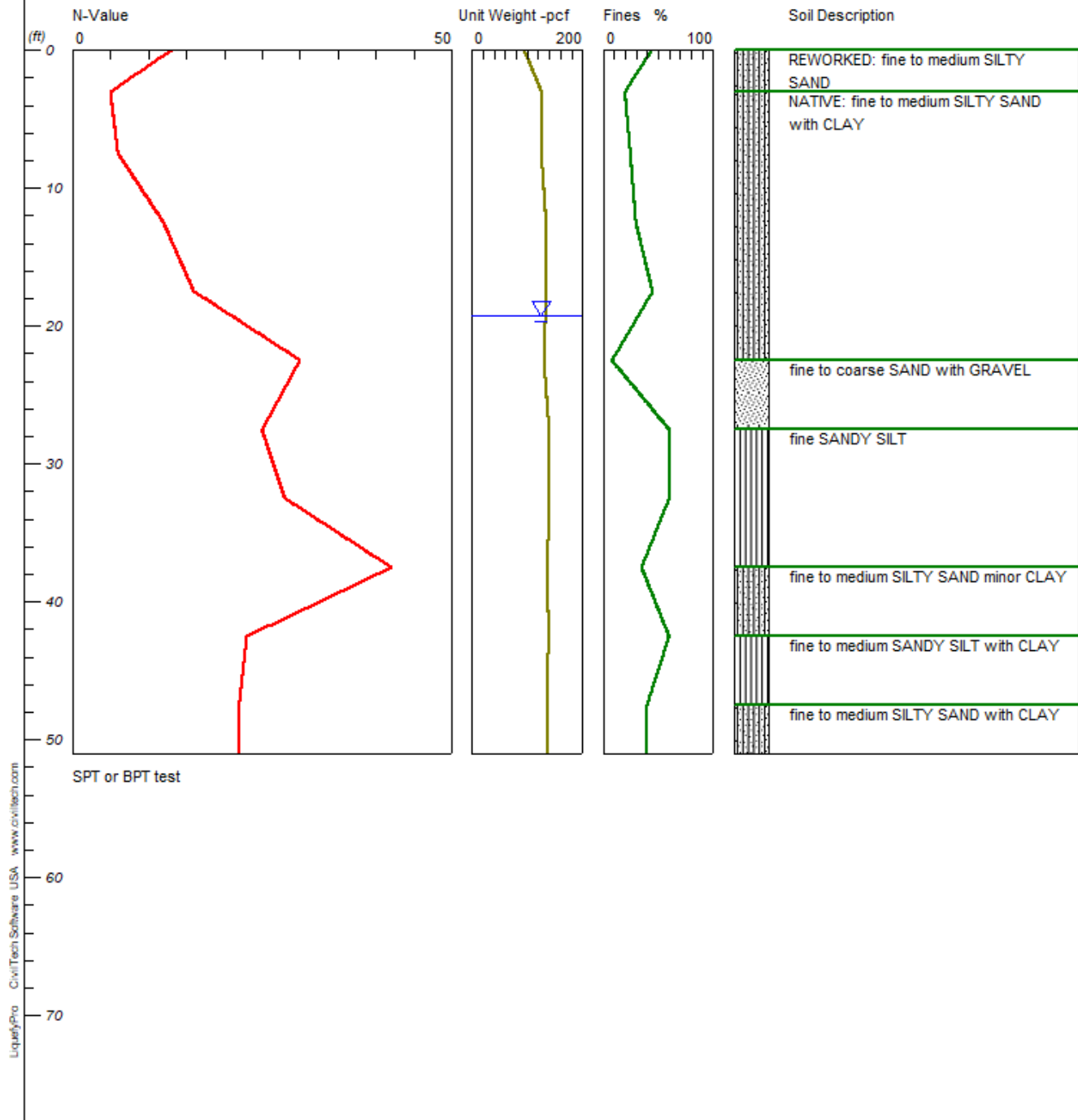
LIQUIFACTION AND SEISMIC SETTLEMENT ANALYSIS (Figures and Analysis Summary)

LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Alpha Elementary School

Hole No.=B-2 Water Depth=19.2 ft Surface Elev.=263

Magnitude=5.5
Acceleration=0.350g

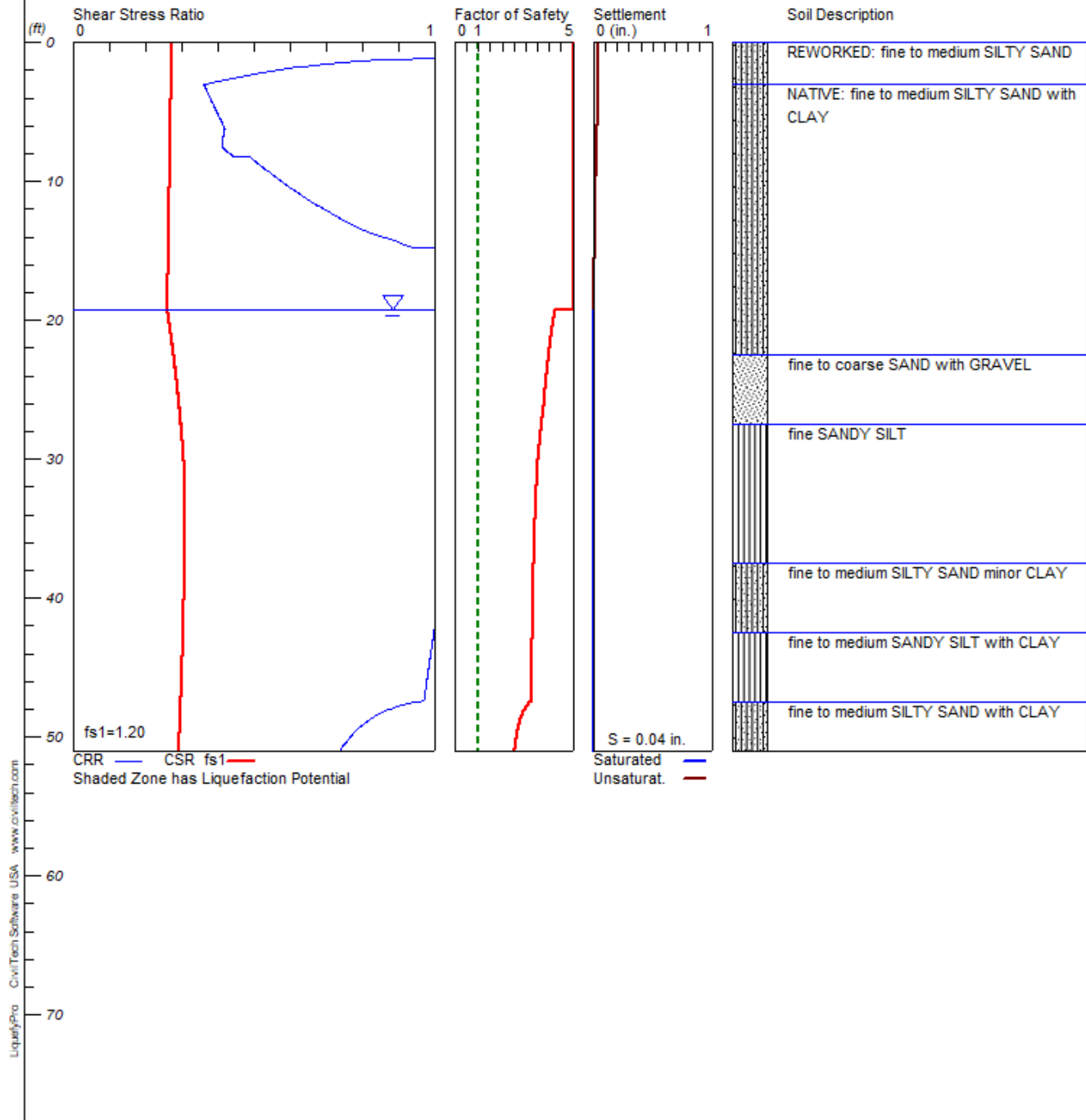


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Alpha Elementary School

Hole No.=B-2 Water Depth=19.2 ft Surface Elev.=263

Magnitude=5.5
Acceleration=0.350g

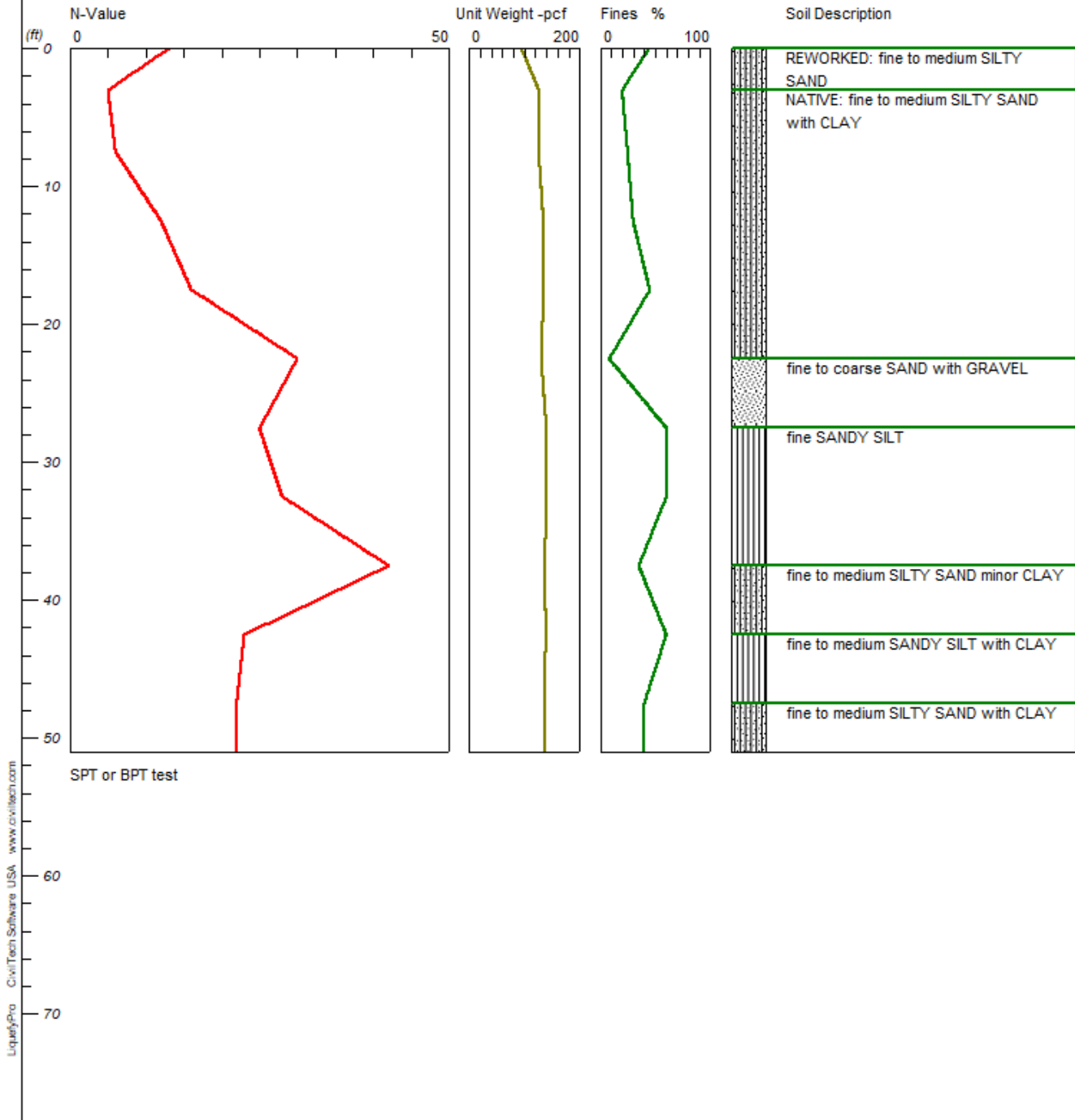


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Alpha Elementary School

Hole No.=B-2 Water Depth=90 ft Surface Elev.=263

Magnitude=5.5
Acceleration=0.350g

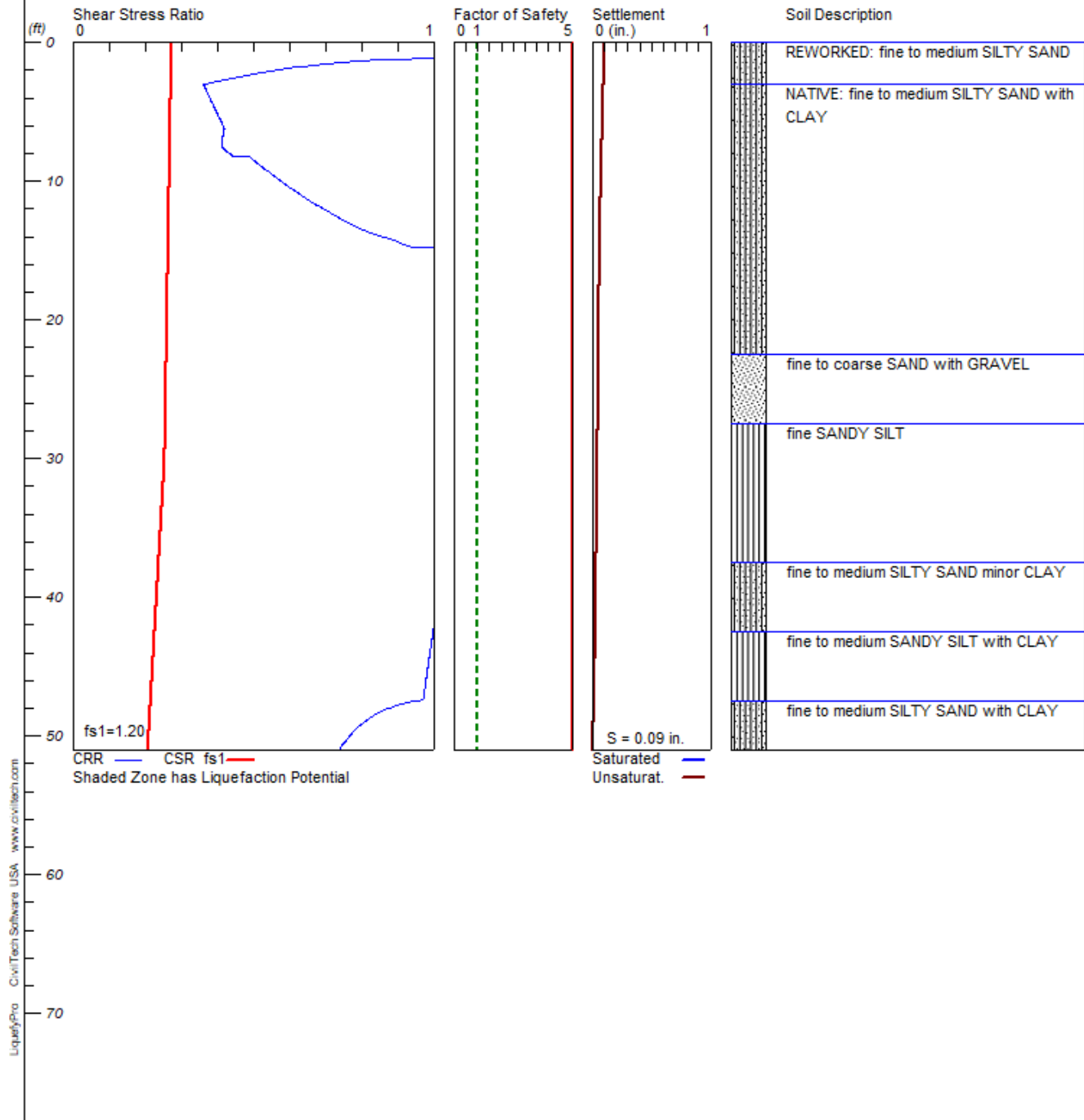


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Alpha Elementary School

Hole No.=B-2 Water Depth=90 ft Surface Elev.=263

Magnitude=5.5
Acceleration=0.350g



LIQUEFACTION ANALYSIS SUMMARY
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Font: Courier New, Regular, Size 8 is recommended for this report.
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Input File Name: C:\Users\Engineering\Desktop\07-230524-0.liq
Title: New Kindergarten Classrooms at Alpha Elementary School
Subtitle: 07-230524-0

Surface Elev.=263
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 19.20 ft
Water Table during In-Situ Testing= 179.00 ft
Max. Acceleration= 0.35 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=263
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 19.20 ft
Water Table during In-Situ Testing= 179.00 ft
Max. Acceleration=0.35 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT gamma pcf	Fines %
-------------	------------------	------------

0.00	13.00	94.50
44.00		
3.00	5.00	126.00
20.00		

7.50	6.00	126.00	25.00
12.50	12.00	134.60	30.00
17.50	16.00	135.00	45.00
22.50	30.00	130.70	8.00
27.50	25.00	140.00	60.00
32.50	28.00	140.10	60.00
37.50	42.00	137.00	35.00
42.50	23.00	139.00	60.00
47.50	22.00	136.10	40.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.04 in.
Total Settlement of Saturated and Unsaturated Sands=0.04 in.
Differential Settlement=0.021 to 0.028 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat.	S_dry	S_all
-------------	------	--------------	-------------	--------	-------	-------

0.00	1.11	0.27	5.00	0.00	0.04	0.04
0.05	1.11	0.27	5.00	0.00	0.04	0.04
0.10	1.11	0.27	5.00	0.00	0.04	0.04
0.15	1.11	0.27	5.00	0.00	0.04	0.04
0.20	1.11	0.27	5.00	0.00	0.04	0.04
0.25	1.11	0.27	5.00	0.00	0.04	0.04
0.30	1.11	0.27	5.00	0.00	0.04	0.04
0.35	1.11	0.27	5.00	0.00	0.04	0.04
0.40	1.11	0.27	5.00	0.00	0.04	0.04
0.45	1.11	0.27	5.00	0.00	0.04	0.04
0.50	1.11	0.27	5.00	0.00	0.04	0.04
0.55	1.11	0.27	5.00	0.00	0.04	0.04
0.60	1.11	0.27	5.00	0.00	0.04	0.04
0.65	1.11	0.27	5.00	0.00	0.04	0.04
0.70	1.11	0.27	5.00	0.00	0.04	0.04
0.75	1.11	0.27	5.00	0.00	0.04	0.04
0.80	1.11	0.27	5.00	0.00	0.04	0.04
0.85	1.11	0.27	5.00	0.00	0.04	0.04
0.90	1.11	0.27	5.00	0.00	0.04	0.04
0.95	1.11	0.27	5.00	0.00	0.04	0.04
1.00	1.11	0.27	5.00	0.00	0.04	0.04
1.05	1.11	0.27	5.00	0.00	0.04	0.04
1.10	1.11	0.27	5.00	0.00	0.04	0.04
1.15	0.99	0.27	5.00	0.00	0.04	0.04
1.20	0.89	0.27	5.00	0.00	0.04	0.04
1.25	0.84	0.27	5.00	0.00	0.04	0.04
1.30	0.81	0.27	5.00	0.00	0.04	0.04
1.35	0.78	0.27	5.00	0.00	0.04	0.04
1.40	0.75	0.27	5.00	0.00	0.04	0.04
1.45	0.73	0.27	5.00	0.00	0.04	0.04
1.50	0.71	0.27	5.00	0.00	0.04	0.04
1.55	0.69	0.27	5.00	0.00	0.04	0.04
1.60	0.68	0.27	5.00	0.00	0.04	0.04
1.65	0.66	0.27	5.00	0.00	0.04	0.04

1.70	0.64	0.27	5.00	0.00	0.04	0.04
1.75	0.63	0.27	5.00	0.00	0.04	0.04
1.80	0.62	0.27	5.00	0.00	0.04	0.04
1.85	0.60	0.27	5.00	0.00	0.04	0.04
1.90	0.59	0.27	5.00	0.00	0.04	0.04
1.95	0.58	0.27	5.00	0.00	0.04	0.04
2.00	0.56	0.27	5.00	0.00	0.04	0.04
2.05	0.55	0.27	5.00	0.00	0.04	0.04
2.10	0.54	0.27	5.00	0.00	0.04	0.04
2.15	0.53	0.27	5.00	0.00	0.04	0.04
2.20	0.52	0.27	5.00	0.00	0.04	0.04
2.25	0.51	0.27	5.00	0.00	0.04	0.04
2.30	0.50	0.27	5.00	0.00	0.04	0.04
2.35	0.49	0.27	5.00	0.00	0.04	0.04
2.40	0.48	0.27	5.00	0.00	0.04	0.04
2.45	0.47	0.27	5.00	0.00	0.04	0.04
2.50	0.46	0.27	5.00	0.00	0.04	0.04
2.55	0.45	0.27	5.00	0.00	0.04	0.04
2.60	0.44	0.27	5.00	0.00	0.04	0.04
2.65	0.43	0.27	5.00	0.00	0.04	0.04
2.70	0.42	0.27	5.00	0.00	0.04	0.04
2.75	0.41	0.27	5.00	0.00	0.04	0.04
2.80	0.40	0.27	5.00	0.00	0.04	0.04
2.85	0.39	0.27	5.00	0.00	0.04	0.04
2.90	0.38	0.27	5.00	0.00	0.04	0.04
2.95	0.37	0.27	5.00	0.00	0.04	0.04
3.00	0.36	0.27	5.00	0.00	0.04	0.04
3.05	0.36	0.27	5.00	0.00	0.04	0.04
3.10	0.36	0.27	5.00	0.00	0.04	0.04
3.15	0.36	0.27	5.00	0.00	0.04	0.04
3.20	0.36	0.27	5.00	0.00	0.04	0.04
3.25	0.37	0.27	5.00	0.00	0.04	0.04
3.30	0.37	0.27	5.00	0.00	0.04	0.04
3.35	0.37	0.27	5.00	0.00	0.04	0.04
3.40	0.37	0.27	5.00	0.00	0.04	0.04
3.45	0.37	0.27	5.00	0.00	0.04	0.04
3.50	0.37	0.27	5.00	0.00	0.04	0.04
3.55	0.37	0.27	5.00	0.00	0.04	0.04
3.60	0.37	0.27	5.00	0.00	0.04	0.04
3.65	0.37	0.27	5.00	0.00	0.04	0.04
3.70	0.37	0.27	5.00	0.00	0.04	0.04
3.75	0.37	0.27	5.00	0.00	0.04	0.04
3.80	0.38	0.27	5.00	0.00	0.04	0.04
3.85	0.38	0.27	5.00	0.00	0.04	0.04
3.90	0.38	0.27	5.00	0.00	0.04	0.04
3.95	0.38	0.27	5.00	0.00	0.04	0.04
4.00	0.38	0.27	5.00	0.00	0.04	0.04
4.05	0.38	0.27	5.00	0.00	0.04	0.04
4.10	0.38	0.27	5.00	0.00	0.04	0.04
4.15	0.38	0.27	5.00	0.00	0.04	0.04
4.20	0.38	0.27	5.00	0.00	0.04	0.04
4.25	0.38	0.27	5.00	0.00	0.04	0.04
4.30	0.38	0.27	5.00	0.00	0.04	0.04
4.35	0.39	0.27	5.00	0.00	0.04	0.04

4.40 0.39 0.27 5.00 0.00 0.04 0.04
4.45 0.39 0.27 5.00 0.00 0.04 0.04
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4.70 0.39 0.27 5.00 0.00 0.03 0.03
4.75 0.39 0.27 5.00 0.00 0.03 0.03
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8.75 0.51 0.27 5.00 0.00 0.02 0.02
8.80 0.52 0.27 5.00 0.00 0.02 0.02
8.85 0.52 0.27 5.00 0.00 0.02 0.02
8.90 0.52 0.27 5.00 0.00 0.02 0.02
8.95 0.52 0.27 5.00 0.00 0.02 0.02
9.00 0.53 0.27 5.00 0.00 0.02 0.02
9.05 0.53 0.27 5.00 0.00 0.02 0.02
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9.60 0.56 0.27 5.00 0.00 0.02 0.02
9.65 0.56 0.27 5.00 0.00 0.02 0.02
9.70 0.56 0.27 5.00 0.00 0.02 0.02
9.75 0.56 0.27 5.00 0.00 0.02 0.02

9.80	0.57	0.27	5.00	0.00	0.02	0.02
9.85	0.57	0.27	5.00	0.00	0.02	0.02
9.90	0.57	0.27	5.00	0.00	0.02	0.02
9.95	0.57	0.27	5.00	0.00	0.02	0.02
10.00	0.58	0.27	5.00	0.00	0.02	0.02
10.05	0.58	0.27	5.00	0.00	0.02	0.02
10.10	0.58	0.27	5.00	0.00	0.02	0.02
10.15	0.58	0.27	5.00	0.00	0.02	0.02
10.20	0.59	0.27	5.00	0.00	0.02	0.02
10.25	0.59	0.27	5.00	0.00	0.02	0.02
10.30	0.59	0.27	5.00	0.00	0.02	0.02
10.35	0.60	0.27	5.00	0.00	0.02	0.02
10.40	0.60	0.27	5.00	0.00	0.02	0.02
10.45	0.60	0.27	5.00	0.00	0.02	0.02
10.50	0.60	0.27	5.00	0.00	0.02	0.02
10.55	0.61	0.27	5.00	0.00	0.02	0.02
10.60	0.61	0.27	5.00	0.00	0.02	0.02
10.65	0.61	0.27	5.00	0.00	0.02	0.02
10.70	0.61	0.27	5.00	0.00	0.02	0.02
10.75	0.62	0.27	5.00	0.00	0.02	0.02
10.80	0.62	0.27	5.00	0.00	0.02	0.02
10.85	0.62	0.27	5.00	0.00	0.02	0.02
10.90	0.63	0.27	5.00	0.00	0.02	0.02
10.95	0.63	0.27	5.00	0.00	0.02	0.02
11.00	0.63	0.27	5.00	0.00	0.02	0.02
11.05	0.63	0.27	5.00	0.00	0.02	0.02
11.10	0.64	0.27	5.00	0.00	0.01	0.01
11.15	0.64	0.27	5.00	0.00	0.01	0.01
11.20	0.64	0.27	5.00	0.00	0.01	0.01
11.25	0.65	0.27	5.00	0.00	0.01	0.01
11.30	0.65	0.27	5.00	0.00	0.01	0.01
11.35	0.65	0.27	5.00	0.00	0.01	0.01
11.40	0.66	0.27	5.00	0.00	0.01	0.01
11.45	0.66	0.27	5.00	0.00	0.01	0.01
11.50	0.66	0.27	5.00	0.00	0.01	0.01
11.55	0.66	0.27	5.00	0.00	0.01	0.01
11.60	0.67	0.27	5.00	0.00	0.01	0.01
11.65	0.67	0.27	5.00	0.00	0.01	0.01
11.70	0.67	0.27	5.00	0.00	0.01	0.01
11.75	0.68	0.27	5.00	0.00	0.01	0.01
11.80	0.68	0.27	5.00	0.00	0.01	0.01
11.85	0.68	0.27	5.00	0.00	0.01	0.01
11.90	0.69	0.27	5.00	0.00	0.01	0.01
11.95	0.69	0.27	5.00	0.00	0.01	0.01
12.00	0.69	0.27	5.00	0.00	0.01	0.01
12.05	0.70	0.27	5.00	0.00	0.01	0.01
12.10	0.70	0.27	5.00	0.00	0.01	0.01
12.15	0.70	0.27	5.00	0.00	0.01	0.01
12.20	0.71	0.27	5.00	0.00	0.01	0.01
12.25	0.71	0.27	5.00	0.00	0.01	0.01
12.30	0.71	0.27	5.00	0.00	0.01	0.01
12.35	0.72	0.27	5.00	0.00	0.01	0.01
12.40	0.72	0.27	5.00	0.00	0.01	0.01
12.45	0.73	0.27	5.00	0.00	0.01	0.01

12.50	0.73	0.27	5.00	0.00	0.01	0.01
12.55	0.73	0.27	5.00	0.00	0.01	0.01
12.60	0.74	0.26	5.00	0.00	0.01	0.01
12.65	0.74	0.26	5.00	0.00	0.01	0.01
12.70	0.74	0.26	5.00	0.00	0.01	0.01
12.75	0.75	0.26	5.00	0.00	0.01	0.01
12.80	0.75	0.26	5.00	0.00	0.01	0.01
12.85	0.75	0.26	5.00	0.00	0.01	0.01
12.90	0.76	0.26	5.00	0.00	0.01	0.01
12.95	0.76	0.26	5.00	0.00	0.01	0.01
13.00	0.76	0.26	5.00	0.00	0.01	0.01
13.05	0.77	0.26	5.00	0.00	0.01	0.01
13.10	0.77	0.26	5.00	0.00	0.01	0.01
13.15	0.77	0.26	5.00	0.00	0.01	0.01
13.20	0.78	0.26	5.00	0.00	0.01	0.01
13.25	0.78	0.26	5.00	0.00	0.01	0.01
13.30	0.79	0.26	5.00	0.00	0.01	0.01
13.35	0.79	0.26	5.00	0.00	0.01	0.01
13.40	0.79	0.26	5.00	0.00	0.01	0.01
13.45	0.80	0.26	5.00	0.00	0.01	0.01
13.50	0.80	0.26	5.00	0.00	0.01	0.01
13.55	0.81	0.26	5.00	0.00	0.01	0.01
13.60	0.81	0.26	5.00	0.00	0.01	0.01
13.65	0.82	0.26	5.00	0.00	0.01	0.01
13.70	0.82	0.26	5.00	0.00	0.01	0.01
13.75	0.83	0.26	5.00	0.00	0.01	0.01
13.80	0.83	0.26	5.00	0.00	0.01	0.01
13.85	0.84	0.26	5.00	0.00	0.01	0.01
13.90	0.84	0.26	5.00	0.00	0.01	0.01
13.95	0.85	0.26	5.00	0.00	0.01	0.01
14.00	0.86	0.26	5.00	0.00	0.01	0.01
14.05	0.86	0.26	5.00	0.00	0.01	0.01
14.10	0.87	0.26	5.00	0.00	0.01	0.01
14.15	0.88	0.26	5.00	0.00	0.01	0.01
14.20	0.89	0.26	5.00	0.00	0.01	0.01
14.25	0.89	0.26	5.00	0.00	0.01	0.01
14.30	0.89	0.26	5.00	0.00	0.01	0.01
14.35	0.90	0.26	5.00	0.00	0.01	0.01
14.40	0.90	0.26	5.00	0.00	0.01	0.01
14.45	0.91	0.26	5.00	0.00	0.01	0.01
14.50	0.91	0.26	5.00	0.00	0.01	0.01
14.55	0.92	0.26	5.00	0.00	0.01	0.01
14.60	0.92	0.26	5.00	0.00	0.01	0.01
14.65	0.93	0.26	5.00	0.00	0.01	0.01
14.70	0.93	0.26	5.00	0.00	0.01	0.01
14.75	0.94	0.26	5.00	0.00	0.01	0.01
14.80	1.11	0.26	5.00	0.00	0.01	0.01
14.85	1.11	0.26	5.00	0.00	0.01	0.01
14.90	1.11	0.26	5.00	0.00	0.01	0.01
14.95	1.11	0.26	5.00	0.00	0.01	0.01
15.00	1.11	0.26	5.00	0.00	0.01	0.01
15.05	1.11	0.26	5.00	0.00	0.01	0.01
15.10	1.11	0.26	5.00	0.00	0.01	0.01
15.15	1.11	0.26	5.00	0.00	0.01	0.01

15.20	1.11	0.26	5.00	0.00	0.01	0.01
15.25	1.11	0.26	5.00	0.00	0.01	0.01
15.30	1.11	0.26	5.00	0.00	0.01	0.01
15.35	1.11	0.26	5.00	0.00	0.01	0.01
15.40	1.11	0.26	5.00	0.00	0.01	0.01
15.45	1.11	0.26	5.00	0.00	0.01	0.01
15.50	1.11	0.26	5.00	0.00	0.01	0.01
15.55	1.11	0.26	5.00	0.00	0.01	0.01
15.60	1.11	0.26	5.00	0.00	0.01	0.01
15.65	1.11	0.26	5.00	0.00	0.01	0.01
15.70	1.11	0.26	5.00	0.00	0.01	0.01
15.75	1.11	0.26	5.00	0.00	0.01	0.01
15.80	1.11	0.26	5.00	0.00	0.01	0.01
15.85	1.11	0.26	5.00	0.00	0.01	0.01
15.90	1.11	0.26	5.00	0.00	0.01	0.01
15.95	1.11	0.26	5.00	0.00	0.01	0.01
16.00	1.11	0.26	5.00	0.00	0.01	0.01
16.05	1.11	0.26	5.00	0.00	0.01	0.01
16.10	1.11	0.26	5.00	0.00	0.01	0.01
16.15	1.11	0.26	5.00	0.00	0.00	0.00
16.20	1.11	0.26	5.00	0.00	0.00	0.00
16.25	1.11	0.26	5.00	0.00	0.00	0.00
16.30	1.11	0.26	5.00	0.00	0.00	0.00
16.35	1.11	0.26	5.00	0.00	0.00	0.00
16.40	1.11	0.26	5.00	0.00	0.00	0.00
16.45	1.11	0.26	5.00	0.00	0.00	0.00
16.50	1.11	0.26	5.00	0.00	0.00	0.00
16.55	1.11	0.26	5.00	0.00	0.00	0.00
16.60	1.11	0.26	5.00	0.00	0.00	0.00
16.65	1.11	0.26	5.00	0.00	0.00	0.00
16.70	1.11	0.26	5.00	0.00	0.00	0.00
16.75	1.11	0.26	5.00	0.00	0.00	0.00
16.80	1.11	0.26	5.00	0.00	0.00	0.00
16.85	1.11	0.26	5.00	0.00	0.00	0.00
16.90	1.11	0.26	5.00	0.00	0.00	0.00
16.95	1.11	0.26	5.00	0.00	0.00	0.00
17.00	1.11	0.26	5.00	0.00	0.00	0.00
17.05	1.11	0.26	5.00	0.00	0.00	0.00
17.10	1.11	0.26	5.00	0.00	0.00	0.00
17.15	1.11	0.26	5.00	0.00	0.00	0.00
17.20	1.11	0.26	5.00	0.00	0.00	0.00
17.25	1.11	0.26	5.00	0.00	0.00	0.00
17.30	1.11	0.26	5.00	0.00	0.00	0.00
17.35	1.11	0.26	5.00	0.00	0.00	0.00
17.40	1.11	0.26	5.00	0.00	0.00	0.00
17.45	1.11	0.26	5.00	0.00	0.00	0.00
17.50	1.11	0.26	5.00	0.00	0.00	0.00
17.55	1.11	0.26	5.00	0.00	0.00	0.00
17.60	1.11	0.26	5.00	0.00	0.00	0.00
17.65	1.11	0.26	5.00	0.00	0.00	0.00
17.70	1.11	0.26	5.00	0.00	0.00	0.00
17.75	1.11	0.26	5.00	0.00	0.00	0.00
17.80	1.11	0.26	5.00	0.00	0.00	0.00
17.85	1.11	0.26	5.00	0.00	0.00	0.00

17.90	1.11	0.26	5.00	0.00	0.00	0.00
17.95	1.11	0.26	5.00	0.00	0.00	0.00
18.00	1.11	0.26	5.00	0.00	0.00	0.00
18.05	1.11	0.26	5.00	0.00	0.00	0.00
18.10	1.11	0.26	5.00	0.00	0.00	0.00
18.15	1.11	0.26	5.00	0.00	0.00	0.00
18.20	1.11	0.26	5.00	0.00	0.00	0.00
18.25	1.11	0.26	5.00	0.00	0.00	0.00
18.30	1.11	0.26	5.00	0.00	0.00	0.00
18.35	1.11	0.26	5.00	0.00	0.00	0.00
18.40	1.11	0.26	5.00	0.00	0.00	0.00
18.45	1.11	0.26	5.00	0.00	0.00	0.00
18.50	1.11	0.26	5.00	0.00	0.00	0.00
18.55	1.11	0.26	5.00	0.00	0.00	0.00
18.60	1.11	0.26	5.00	0.00	0.00	0.00
18.65	1.11	0.26	5.00	0.00	0.00	0.00
18.70	1.11	0.26	5.00	0.00	0.00	0.00
18.75	1.11	0.26	5.00	0.00	0.00	0.00
18.80	1.11	0.26	5.00	0.00	0.00	0.00
18.85	1.11	0.26	5.00	0.00	0.00	0.00
18.90	1.11	0.26	5.00	0.00	0.00	0.00
18.95	1.11	0.26	5.00	0.00	0.00	0.00
19.00	1.11	0.26	5.00	0.00	0.00	0.00
19.05	1.11	0.26	5.00	0.00	0.00	0.00
19.10	1.11	0.26	5.00	0.00	0.00	0.00
19.15	1.11	0.26	5.00	0.00	0.00	0.00
19.20	1.11	0.26	5.00	0.00	0.00	0.00
19.25	1.11	0.26	4.24	0.00	0.00	0.00
19.30	1.11	0.26	4.24	0.00	0.00	0.00
19.35	1.11	0.26	4.23	0.00	0.00	0.00
19.40	1.11	0.26	4.23	0.00	0.00	0.00
19.45	1.11	0.26	4.22	0.00	0.00	0.00
19.50	1.11	0.26	4.22	0.00	0.00	0.00
19.55	1.11	0.26	4.21	0.00	0.00	0.00
19.60	1.11	0.26	4.21	0.00	0.00	0.00
19.65	1.11	0.26	4.20	0.00	0.00	0.00
19.70	1.11	0.26	4.20	0.00	0.00	0.00
19.75	1.11	0.26	4.19	0.00	0.00	0.00
19.80	1.11	0.26	4.19	0.00	0.00	0.00
19.85	1.11	0.26	4.18	0.00	0.00	0.00
19.90	1.11	0.26	4.18	0.00	0.00	0.00
19.95	1.11	0.26	4.18	0.00	0.00	0.00
20.00	1.11	0.27	4.17	0.00	0.00	0.00
20.05	1.11	0.27	4.17	0.00	0.00	0.00
20.10	1.11	0.27	4.16	0.00	0.00	0.00
20.15	1.11	0.27	4.16	0.00	0.00	0.00
20.20	1.11	0.27	4.15	0.00	0.00	0.00
20.25	1.11	0.27	4.15	0.00	0.00	0.00
20.30	1.11	0.27	4.14	0.00	0.00	0.00
20.35	1.11	0.27	4.14	0.00	0.00	0.00
20.40	1.11	0.27	4.14	0.00	0.00	0.00
20.45	1.11	0.27	4.13	0.00	0.00	0.00
20.50	1.11	0.27	4.13	0.00	0.00	0.00
20.55	1.11	0.27	4.12	0.00	0.00	0.00

20.60	1.11	0.27	4.12	0.00	0.00	0.00
20.65	1.11	0.27	4.11	0.00	0.00	0.00
20.70	1.11	0.27	4.11	0.00	0.00	0.00
20.75	1.11	0.27	4.11	0.00	0.00	0.00
20.80	1.11	0.27	4.10	0.00	0.00	0.00
20.85	1.11	0.27	4.10	0.00	0.00	0.00
20.90	1.11	0.27	4.09	0.00	0.00	0.00
20.95	1.11	0.27	4.09	0.00	0.00	0.00
21.00	1.11	0.27	4.09	0.00	0.00	0.00
21.05	1.11	0.27	4.08	0.00	0.00	0.00
21.10	1.11	0.27	4.08	0.00	0.00	0.00
21.15	1.11	0.27	4.07	0.00	0.00	0.00
21.20	1.11	0.27	4.07	0.00	0.00	0.00
21.25	1.11	0.27	4.07	0.00	0.00	0.00
21.30	1.11	0.27	4.06	0.00	0.00	0.00
21.35	1.11	0.27	4.06	0.00	0.00	0.00
21.40	1.11	0.27	4.05	0.00	0.00	0.00
21.45	1.11	0.27	4.05	0.00	0.00	0.00
21.50	1.11	0.27	4.05	0.00	0.00	0.00
21.55	1.11	0.27	4.04	0.00	0.00	0.00
21.60	1.11	0.27	4.04	0.00	0.00	0.00
21.65	1.11	0.27	4.04	0.00	0.00	0.00
21.70	1.11	0.27	4.03	0.00	0.00	0.00
21.75	1.11	0.27	4.03	0.00	0.00	0.00
21.80	1.11	0.27	4.02	0.00	0.00	0.00
21.85	1.11	0.28	4.02	0.00	0.00	0.00
21.90	1.11	0.28	4.02	0.00	0.00	0.00
21.95	1.11	0.28	4.01	0.00	0.00	0.00
22.00	1.11	0.28	4.01	0.00	0.00	0.00
22.05	1.11	0.28	4.01	0.00	0.00	0.00
22.10	1.11	0.28	4.00	0.00	0.00	0.00
22.15	1.11	0.28	4.00	0.00	0.00	0.00
22.20	1.11	0.28	4.00	0.00	0.00	0.00
22.25	1.11	0.28	3.99	0.00	0.00	0.00
22.30	1.11	0.28	3.99	0.00	0.00	0.00
22.35	1.11	0.28	3.98	0.00	0.00	0.00
22.40	1.11	0.28	3.98	0.00	0.00	0.00
22.45	1.11	0.28	3.98	0.00	0.00	0.00
22.50	1.11	0.28	3.97	0.00	0.00	0.00
22.55	1.11	0.28	3.97	0.00	0.00	0.00
22.60	1.11	0.28	3.97	0.00	0.00	0.00
22.65	1.11	0.28	3.96	0.00	0.00	0.00
22.70	1.11	0.28	3.96	0.00	0.00	0.00
22.75	1.11	0.28	3.96	0.00	0.00	0.00
22.80	1.11	0.28	3.95	0.00	0.00	0.00
22.85	1.11	0.28	3.95	0.00	0.00	0.00
22.90	1.11	0.28	3.95	0.00	0.00	0.00
22.95	1.11	0.28	3.94	0.00	0.00	0.00
23.00	1.11	0.28	3.94	0.00	0.00	0.00
23.05	1.11	0.28	3.94	0.00	0.00	0.00
23.10	1.11	0.28	3.93	0.00	0.00	0.00
23.15	1.11	0.28	3.93	0.00	0.00	0.00
23.20	1.11	0.28	3.93	0.00	0.00	0.00
23.25	1.11	0.28	3.92	0.00	0.00	0.00

23.30	1.11	0.28	3.92	0.00	0.00	0.00
23.35	1.11	0.28	3.92	0.00	0.00	0.00
23.40	1.11	0.28	3.91	0.00	0.00	0.00
23.45	1.11	0.28	3.91	0.00	0.00	0.00
23.50	1.11	0.28	3.91	0.00	0.00	0.00
23.55	1.11	0.28	3.91	0.00	0.00	0.00
23.60	1.11	0.28	3.90	0.00	0.00	0.00
23.65	1.11	0.28	3.90	0.00	0.00	0.00
23.70	1.11	0.28	3.90	0.00	0.00	0.00
23.75	1.11	0.28	3.89	0.00	0.00	0.00
23.80	1.11	0.28	3.89	0.00	0.00	0.00
23.85	1.11	0.28	3.89	0.00	0.00	0.00
23.90	1.11	0.28	3.88	0.00	0.00	0.00
23.95	1.11	0.28	3.88	0.00	0.00	0.00
24.00	1.11	0.29	3.88	0.00	0.00	0.00
24.05	1.11	0.29	3.88	0.00	0.00	0.00
24.10	1.11	0.29	3.87	0.00	0.00	0.00
24.15	1.11	0.29	3.87	0.00	0.00	0.00
24.20	1.11	0.29	3.87	0.00	0.00	0.00
24.25	1.11	0.29	3.86	0.00	0.00	0.00
24.30	1.11	0.29	3.86	0.00	0.00	0.00
24.35	1.11	0.29	3.86	0.00	0.00	0.00
24.40	1.11	0.29	3.85	0.00	0.00	0.00
24.45	1.11	0.29	3.85	0.00	0.00	0.00
24.50	1.11	0.29	3.85	0.00	0.00	0.00
24.55	1.11	0.29	3.85	0.00	0.00	0.00
24.60	1.11	0.29	3.84	0.00	0.00	0.00
24.65	1.11	0.29	3.84	0.00	0.00	0.00
24.70	1.11	0.29	3.84	0.00	0.00	0.00
24.75	1.11	0.29	3.84	0.00	0.00	0.00
24.80	1.11	0.29	3.83	0.00	0.00	0.00
24.85	1.11	0.29	3.83	0.00	0.00	0.00
24.90	1.11	0.29	3.83	0.00	0.00	0.00
24.95	1.11	0.29	3.82	0.00	0.00	0.00
25.00	1.11	0.29	3.82	0.00	0.00	0.00
25.05	1.11	0.29	3.82	0.00	0.00	0.00
25.10	1.11	0.29	3.82	0.00	0.00	0.00
25.15	1.11	0.29	3.81	0.00	0.00	0.00
25.20	1.11	0.29	3.81	0.00	0.00	0.00
25.25	1.11	0.29	3.81	0.00	0.00	0.00
25.30	1.11	0.29	3.83	0.00	0.00	0.00
25.35	1.11	0.29	3.82	0.00	0.00	0.00
25.40	1.11	0.29	3.82	0.00	0.00	0.00
25.45	1.11	0.29	3.82	0.00	0.00	0.00
25.50	1.11	0.29	3.81	0.00	0.00	0.00
25.55	1.11	0.29	3.81	0.00	0.00	0.00
25.60	1.11	0.29	3.81	0.00	0.00	0.00
25.65	1.11	0.29	3.80	0.00	0.00	0.00
25.70	1.11	0.29	3.80	0.00	0.00	0.00
25.75	1.11	0.29	3.79	0.00	0.00	0.00
25.80	1.11	0.29	3.79	0.00	0.00	0.00
25.85	1.11	0.29	3.79	0.00	0.00	0.00
25.90	1.11	0.29	3.78	0.00	0.00	0.00
25.95	1.11	0.29	3.78	0.00	0.00	0.00

26.00	1.11	0.29	3.78	0.00	0.00	0.00
26.05	1.11	0.29	3.77	0.00	0.00	0.00
26.10	1.11	0.29	3.77	0.00	0.00	0.00
26.15	1.11	0.29	3.76	0.00	0.00	0.00
26.20	1.11	0.29	3.76	0.00	0.00	0.00
26.25	1.11	0.29	3.76	0.00	0.00	0.00
26.30	1.10	0.29	3.75	0.00	0.00	0.00
26.35	1.10	0.29	3.75	0.00	0.00	0.00
26.40	1.10	0.29	3.75	0.00	0.00	0.00
26.45	1.10	0.29	3.74	0.00	0.00	0.00
26.50	1.10	0.30	3.74	0.00	0.00	0.00
26.55	1.10	0.30	3.74	0.00	0.00	0.00
26.60	1.10	0.30	3.73	0.00	0.00	0.00
26.65	1.10	0.30	3.73	0.00	0.00	0.00
26.70	1.10	0.30	3.72	0.00	0.00	0.00
26.75	1.10	0.30	3.72	0.00	0.00	0.00
26.80	1.10	0.30	3.72	0.00	0.00	0.00
26.85	1.10	0.30	3.71	0.00	0.00	0.00
26.90	1.10	0.30	3.71	0.00	0.00	0.00
26.95	1.10	0.30	3.71	0.00	0.00	0.00
27.00	1.10	0.30	3.70	0.00	0.00	0.00
27.05	1.10	0.30	3.70	0.00	0.00	0.00
27.10	1.10	0.30	3.70	0.00	0.00	0.00
27.15	1.10	0.30	3.69	0.00	0.00	0.00
27.20	1.10	0.30	3.69	0.00	0.00	0.00
27.25	1.10	0.30	3.69	0.00	0.00	0.00
27.30	1.10	0.30	3.68	0.00	0.00	0.00
27.35	1.10	0.30	3.68	0.00	0.00	0.00
27.40	1.10	0.30	3.68	0.00	0.00	0.00
27.45	1.10	0.30	3.67	0.00	0.00	0.00
27.50	1.10	0.30	3.67	0.00	0.00	0.00
27.55	1.10	0.30	3.67	0.00	0.00	0.00
27.60	1.10	0.30	3.66	0.00	0.00	0.00
27.65	1.10	0.30	3.66	0.00	0.00	0.00
27.70	1.09	0.30	3.66	0.00	0.00	0.00
27.75	1.09	0.30	3.65	0.00	0.00	0.00
27.80	1.09	0.30	3.65	0.00	0.00	0.00
27.85	1.09	0.30	3.65	0.00	0.00	0.00
27.90	1.09	0.30	3.64	0.00	0.00	0.00
27.95	1.09	0.30	3.64	0.00	0.00	0.00
28.00	1.09	0.30	3.64	0.00	0.00	0.00
28.05	1.09	0.30	3.63	0.00	0.00	0.00
28.10	1.09	0.30	3.63	0.00	0.00	0.00
28.15	1.09	0.30	3.63	0.00	0.00	0.00
28.20	1.09	0.30	3.63	0.00	0.00	0.00
28.25	1.09	0.30	3.62	0.00	0.00	0.00
28.30	1.09	0.30	3.62	0.00	0.00	0.00
28.35	1.09	0.30	3.62	0.00	0.00	0.00
28.40	1.09	0.30	3.61	0.00	0.00	0.00
28.45	1.09	0.30	3.61	0.00	0.00	0.00
28.50	1.09	0.30	3.61	0.00	0.00	0.00
28.55	1.09	0.30	3.60	0.00	0.00	0.00
28.60	1.09	0.30	3.60	0.00	0.00	0.00
28.65	1.09	0.30	3.60	0.00	0.00	0.00

28.70	1.09	0.30	3.59	0.00	0.00	0.00
28.75	1.09	0.30	3.59	0.00	0.00	0.00
28.80	1.09	0.30	3.59	0.00	0.00	0.00
28.85	1.09	0.30	3.58	0.00	0.00	0.00
28.90	1.09	0.30	3.58	0.00	0.00	0.00
28.95	1.09	0.30	3.58	0.00	0.00	0.00
29.00	1.09	0.30	3.58	0.00	0.00	0.00
29.05	1.08	0.30	3.57	0.00	0.00	0.00
29.10	1.08	0.30	3.57	0.00	0.00	0.00
29.15	1.08	0.30	3.57	0.00	0.00	0.00
29.20	1.08	0.30	3.56	0.00	0.00	0.00
29.25	1.08	0.30	3.56	0.00	0.00	0.00
29.30	1.08	0.30	3.56	0.00	0.00	0.00
29.35	1.08	0.30	3.56	0.00	0.00	0.00
29.40	1.08	0.30	3.55	0.00	0.00	0.00
29.45	1.08	0.30	3.55	0.00	0.00	0.00
29.50	1.08	0.30	3.55	0.00	0.00	0.00
29.55	1.08	0.31	3.54	0.00	0.00	0.00
29.60	1.08	0.31	3.54	0.00	0.00	0.00
29.65	1.08	0.31	3.54	0.00	0.00	0.00
29.70	1.08	0.31	3.53	0.00	0.00	0.00
29.75	1.08	0.31	3.53	0.00	0.00	0.00
29.80	1.08	0.31	3.53	0.00	0.00	0.00
29.85	1.08	0.31	3.53	0.00	0.00	0.00
29.90	1.08	0.31	3.52	0.00	0.00	0.00
29.95	1.08	0.31	3.52	0.00	0.00	0.00
30.00	1.08	0.31	3.52	0.00	0.00	0.00
30.05	1.08	0.31	3.52	0.00	0.00	0.00
30.10	1.08	0.31	3.52	0.00	0.00	0.00
30.15	1.08	0.31	3.51	0.00	0.00	0.00
30.20	1.08	0.31	3.51	0.00	0.00	0.00
30.25	1.08	0.31	3.51	0.00	0.00	0.00
30.30	1.08	0.31	3.51	0.00	0.00	0.00
30.35	1.08	0.31	3.51	0.00	0.00	0.00
30.40	1.08	0.31	3.51	0.00	0.00	0.00
30.45	1.07	0.31	3.50	0.00	0.00	0.00
30.50	1.07	0.31	3.50	0.00	0.00	0.00
30.55	1.07	0.31	3.50	0.00	0.00	0.00
30.60	1.07	0.31	3.50	0.00	0.00	0.00
30.65	1.07	0.31	3.50	0.00	0.00	0.00
30.70	1.07	0.31	3.50	0.00	0.00	0.00
30.75	1.07	0.31	3.49	0.00	0.00	0.00
30.80	1.07	0.31	3.49	0.00	0.00	0.00
30.85	1.07	0.31	3.49	0.00	0.00	0.00
30.90	1.07	0.31	3.49	0.00	0.00	0.00
30.95	1.07	0.31	3.49	0.00	0.00	0.00
31.00	1.07	0.31	3.49	0.00	0.00	0.00
31.05	1.07	0.31	3.48	0.00	0.00	0.00
31.10	1.07	0.31	3.48	0.00	0.00	0.00
31.15	1.07	0.31	3.48	0.00	0.00	0.00
31.20	1.07	0.31	3.48	0.00	0.00	0.00
31.25	1.07	0.31	3.48	0.00	0.00	0.00
31.30	1.07	0.31	3.48	0.00	0.00	0.00
31.35	1.07	0.31	3.48	0.00	0.00	0.00

31.40	1.07	0.31	3.47	0.00	0.00	0.00
31.45	1.07	0.31	3.47	0.00	0.00	0.00
31.50	1.07	0.31	3.47	0.00	0.00	0.00
31.55	1.07	0.31	3.47	0.00	0.00	0.00
31.60	1.07	0.31	3.47	0.00	0.00	0.00
31.65	1.07	0.31	3.47	0.00	0.00	0.00
31.70	1.07	0.31	3.47	0.00	0.00	0.00
31.75	1.07	0.31	3.46	0.00	0.00	0.00
31.80	1.07	0.31	3.46	0.00	0.00	0.00
31.85	1.07	0.31	3.46	0.00	0.00	0.00
31.90	1.06	0.31	3.46	0.00	0.00	0.00
31.95	1.06	0.31	3.46	0.00	0.00	0.00
32.00	1.06	0.31	3.46	0.00	0.00	0.00
32.05	1.06	0.31	3.46	0.00	0.00	0.00
32.10	1.06	0.31	3.45	0.00	0.00	0.00
32.15	1.06	0.31	3.45	0.00	0.00	0.00
32.20	1.06	0.31	3.45	0.00	0.00	0.00
32.25	1.06	0.31	3.45	0.00	0.00	0.00
32.30	1.06	0.31	3.45	0.00	0.00	0.00
32.35	1.06	0.31	3.45	0.00	0.00	0.00
32.40	1.06	0.31	3.45	0.00	0.00	0.00
32.45	1.06	0.31	3.44	0.00	0.00	0.00
32.50	1.06	0.31	3.44	0.00	0.00	0.00
32.55	1.06	0.31	3.44	0.00	0.00	0.00
32.60	1.06	0.31	3.44	0.00	0.00	0.00
32.65	1.06	0.31	3.44	0.00	0.00	0.00
32.70	1.06	0.31	3.44	0.00	0.00	0.00
32.75	1.06	0.31	3.44	0.00	0.00	0.00
32.80	1.06	0.31	3.44	0.00	0.00	0.00
32.85	1.06	0.31	3.43	0.00	0.00	0.00
32.90	1.06	0.31	3.43	0.00	0.00	0.00
32.95	1.06	0.31	3.43	0.00	0.00	0.00
33.00	1.06	0.31	3.43	0.00	0.00	0.00
33.05	1.06	0.31	3.43	0.00	0.00	0.00
33.10	1.06	0.31	3.43	0.00	0.00	0.00
33.15	1.06	0.31	3.43	0.00	0.00	0.00
33.20	1.06	0.31	3.43	0.00	0.00	0.00
33.25	1.06	0.31	3.42	0.00	0.00	0.00
33.30	1.06	0.31	3.42	0.00	0.00	0.00
33.35	1.05	0.31	3.42	0.00	0.00	0.00
33.40	1.05	0.31	3.42	0.00	0.00	0.00
33.45	1.05	0.31	3.42	0.00	0.00	0.00
33.50	1.05	0.31	3.42	0.00	0.00	0.00
33.55	1.05	0.31	3.42	0.00	0.00	0.00
33.60	1.05	0.31	3.42	0.00	0.00	0.00
33.65	1.05	0.31	3.41	0.00	0.00	0.00
33.70	1.05	0.31	3.41	0.00	0.00	0.00
33.75	1.05	0.31	3.41	0.00	0.00	0.00
33.80	1.05	0.31	3.41	0.00	0.00	0.00
33.85	1.05	0.31	3.41	0.00	0.00	0.00
33.90	1.05	0.31	3.41	0.00	0.00	0.00
33.95	1.05	0.31	3.41	0.00	0.00	0.00
34.00	1.05	0.31	3.41	0.00	0.00	0.00
34.05	1.05	0.31	3.40	0.00	0.00	0.00

34.10	1.05	0.31	3.40	0.00	0.00	0.00
34.15	1.05	0.31	3.40	0.00	0.00	0.00
34.20	1.05	0.31	3.40	0.00	0.00	0.00
34.25	1.05	0.31	3.40	0.00	0.00	0.00
34.30	1.05	0.31	3.40	0.00	0.00	0.00
34.35	1.05	0.31	3.40	0.00	0.00	0.00
34.40	1.05	0.31	3.40	0.00	0.00	0.00
34.45	1.05	0.31	3.40	0.00	0.00	0.00
34.50	1.05	0.31	3.39	0.00	0.00	0.00
34.55	1.05	0.31	3.39	0.00	0.00	0.00
34.60	1.05	0.31	3.39	0.00	0.00	0.00
34.65	1.05	0.31	3.39	0.00	0.00	0.00
34.70	1.05	0.31	3.39	0.00	0.00	0.00
34.75	1.05	0.31	3.39	0.00	0.00	0.00
34.80	1.05	0.31	3.39	0.00	0.00	0.00
34.85	1.04	0.31	3.39	0.00	0.00	0.00
34.90	1.04	0.31	3.39	0.00	0.00	0.00
34.95	1.04	0.31	3.39	0.00	0.00	0.00
35.00	1.04	0.31	3.38	0.00	0.00	0.00
35.05	1.04	0.31	3.38	0.00	0.00	0.00
35.10	1.04	0.31	3.38	0.00	0.00	0.00
35.15	1.04	0.31	3.38	0.00	0.00	0.00
35.20	1.04	0.31	3.38	0.00	0.00	0.00
35.25	1.04	0.31	3.38	0.00	0.00	0.00
35.30	1.04	0.31	3.38	0.00	0.00	0.00
35.35	1.04	0.31	3.38	0.00	0.00	0.00
35.40	1.04	0.31	3.38	0.00	0.00	0.00
35.45	1.04	0.31	3.38	0.00	0.00	0.00
35.50	1.04	0.31	3.37	0.00	0.00	0.00
35.55	1.04	0.31	3.37	0.00	0.00	0.00
35.60	1.04	0.31	3.37	0.00	0.00	0.00
35.65	1.04	0.31	3.37	0.00	0.00	0.00
35.70	1.04	0.31	3.37	0.00	0.00	0.00
35.75	1.04	0.31	3.37	0.00	0.00	0.00
35.80	1.04	0.31	3.37	0.00	0.00	0.00
35.85	1.04	0.31	3.37	0.00	0.00	0.00
35.90	1.04	0.31	3.37	0.00	0.00	0.00
35.95	1.04	0.31	3.37	0.00	0.00	0.00
36.00	1.04	0.31	3.36	0.00	0.00	0.00
36.05	1.04	0.31	3.36	0.00	0.00	0.00
36.10	1.04	0.31	3.36	0.00	0.00	0.00
36.15	1.04	0.31	3.36	0.00	0.00	0.00
36.20	1.04	0.31	3.36	0.00	0.00	0.00
36.25	1.04	0.31	3.36	0.00	0.00	0.00
36.30	1.04	0.31	3.36	0.00	0.00	0.00
36.35	1.04	0.31	3.36	0.00	0.00	0.00
36.40	1.04	0.31	3.36	0.00	0.00	0.00
36.45	1.03	0.31	3.36	0.00	0.00	0.00
36.50	1.03	0.31	3.36	0.00	0.00	0.00
36.55	1.03	0.31	3.35	0.00	0.00	0.00
36.60	1.03	0.31	3.35	0.00	0.00	0.00
36.65	1.03	0.31	3.35	0.00	0.00	0.00
36.70	1.03	0.31	3.35	0.00	0.00	0.00
36.75	1.03	0.31	3.35	0.00	0.00	0.00

36.80	1.03	0.31	3.35	0.00	0.00	0.00
36.85	1.03	0.31	3.35	0.00	0.00	0.00
36.90	1.03	0.31	3.35	0.00	0.00	0.00
36.95	1.03	0.31	3.35	0.00	0.00	0.00
37.00	1.03	0.31	3.35	0.00	0.00	0.00
37.05	1.03	0.31	3.35	0.00	0.00	0.00
37.10	1.03	0.31	3.35	0.00	0.00	0.00
37.15	1.03	0.31	3.34	0.00	0.00	0.00
37.20	1.03	0.31	3.34	0.00	0.00	0.00
37.25	1.03	0.31	3.34	0.00	0.00	0.00
37.30	1.03	0.31	3.34	0.00	0.00	0.00
37.35	1.03	0.31	3.34	0.00	0.00	0.00
37.40	1.03	0.31	3.34	0.00	0.00	0.00
37.45	1.03	0.31	3.34	0.00	0.00	0.00
37.50	1.03	0.31	3.34	0.00	0.00	0.00
37.55	1.03	0.31	3.34	0.00	0.00	0.00
37.60	1.03	0.31	3.34	0.00	0.00	0.00
37.65	1.03	0.31	3.34	0.00	0.00	0.00
37.70	1.03	0.31	3.34	0.00	0.00	0.00
37.75	1.03	0.31	3.33	0.00	0.00	0.00
37.80	1.03	0.31	3.33	0.00	0.00	0.00
37.85	1.03	0.31	3.33	0.00	0.00	0.00
37.90	1.03	0.31	3.33	0.00	0.00	0.00
37.95	1.03	0.31	3.33	0.00	0.00	0.00
38.00	1.03	0.31	3.33	0.00	0.00	0.00
38.05	1.02	0.31	3.33	0.00	0.00	0.00
38.10	1.02	0.31	3.33	0.00	0.00	0.00
38.15	1.02	0.31	3.33	0.00	0.00	0.00
38.20	1.02	0.31	3.33	0.00	0.00	0.00
38.25	1.02	0.31	3.33	0.00	0.00	0.00
38.30	1.02	0.31	3.33	0.00	0.00	0.00
38.35	1.02	0.31	3.33	0.00	0.00	0.00
38.40	1.02	0.31	3.33	0.00	0.00	0.00
38.45	1.02	0.31	3.32	0.00	0.00	0.00
38.50	1.02	0.31	3.32	0.00	0.00	0.00
38.55	1.02	0.31	3.32	0.00	0.00	0.00
38.60	1.02	0.31	3.32	0.00	0.00	0.00
38.65	1.02	0.31	3.32	0.00	0.00	0.00
38.70	1.02	0.31	3.32	0.00	0.00	0.00
38.75	1.02	0.31	3.32	0.00	0.00	0.00
38.80	1.02	0.31	3.32	0.00	0.00	0.00
38.85	1.02	0.31	3.32	0.00	0.00	0.00
38.90	1.02	0.31	3.32	0.00	0.00	0.00
38.95	1.02	0.31	3.32	0.00	0.00	0.00
39.00	1.02	0.31	3.32	0.00	0.00	0.00
39.05	1.02	0.31	3.32	0.00	0.00	0.00
39.10	1.02	0.31	3.32	0.00	0.00	0.00
39.15	1.02	0.31	3.31	0.00	0.00	0.00
39.20	1.02	0.31	3.31	0.00	0.00	0.00
39.25	1.02	0.31	3.31	0.00	0.00	0.00
39.30	1.02	0.31	3.31	0.00	0.00	0.00
39.35	1.02	0.31	3.31	0.00	0.00	0.00
39.40	1.02	0.31	3.31	0.00	0.00	0.00
39.45	1.02	0.31	3.31	0.00	0.00	0.00

39.50	1.02	0.31	3.31	0.00	0.00	0.00
39.55	1.02	0.31	3.31	0.00	0.00	0.00
39.60	1.02	0.31	3.31	0.00	0.00	0.00
39.65	1.02	0.31	3.31	0.00	0.00	0.00
39.70	1.01	0.31	3.31	0.00	0.00	0.00
39.75	1.01	0.31	3.31	0.00	0.00	0.00
39.80	1.01	0.31	3.31	0.00	0.00	0.00
39.85	1.01	0.31	3.31	0.00	0.00	0.00
39.90	1.01	0.31	3.31	0.00	0.00	0.00
39.95	1.01	0.31	3.31	0.00	0.00	0.00
40.00	1.01	0.31	3.30	0.00	0.00	0.00
40.05	1.01	0.31	3.30	0.00	0.00	0.00
40.10	1.01	0.31	3.30	0.00	0.00	0.00
40.15	1.01	0.31	3.30	0.00	0.00	0.00
40.20	1.01	0.31	3.30	0.00	0.00	0.00
40.25	1.01	0.31	3.30	0.00	0.00	0.00
40.30	1.01	0.31	3.30	0.00	0.00	0.00
40.35	1.01	0.31	3.30	0.00	0.00	0.00
40.40	1.01	0.31	3.30	0.00	0.00	0.00
40.45	1.01	0.31	3.30	0.00	0.00	0.00
40.50	1.01	0.31	3.30	0.00	0.00	0.00
40.55	1.01	0.31	3.30	0.00	0.00	0.00
40.60	1.01	0.31	3.30	0.00	0.00	0.00
40.65	1.01	0.31	3.30	0.00	0.00	0.00
40.70	1.01	0.31	3.30	0.00	0.00	0.00
40.75	1.01	0.31	3.30	0.00	0.00	0.00
40.80	1.01	0.31	3.30	0.00	0.00	0.00
40.85	1.01	0.31	3.30	0.00	0.00	0.00
40.90	1.01	0.31	3.29	0.00	0.00	0.00
40.95	1.01	0.31	3.29	0.00	0.00	0.00
41.00	1.01	0.31	3.29	0.00	0.00	0.00
41.05	1.01	0.31	3.29	0.00	0.00	0.00
41.10	1.01	0.31	3.29	0.00	0.00	0.00
41.15	1.01	0.31	3.29	0.00	0.00	0.00
41.20	1.01	0.31	3.29	0.00	0.00	0.00
41.25	1.01	0.31	3.29	0.00	0.00	0.00
41.30	1.01	0.31	3.29	0.00	0.00	0.00
41.35	1.00	0.31	3.29	0.00	0.00	0.00
41.40	1.00	0.31	3.29	0.00	0.00	0.00
41.45	1.00	0.31	3.29	0.00	0.00	0.00
41.50	1.00	0.31	3.29	0.00	0.00	0.00
41.55	1.00	0.31	3.29	0.00	0.00	0.00
41.60	1.00	0.31	3.29	0.00	0.00	0.00
41.65	1.00	0.31	3.29	0.00	0.00	0.00
41.70	1.00	0.31	3.29	0.00	0.00	0.00
41.75	1.00	0.31	3.29	0.00	0.00	0.00
41.80	1.00	0.30	3.29	0.00	0.00	0.00
41.85	1.00	0.30	3.29	0.00	0.00	0.00
41.90	1.00	0.30	3.29	0.00	0.00	0.00
41.95	1.00	0.30	3.29	0.00	0.00	0.00
42.00	1.00	0.30	3.28	0.00	0.00	0.00
42.05	1.00	0.30	3.28	0.00	0.00	0.00
42.10	1.00	0.30	3.28	0.00	0.00	0.00
42.15	1.00	0.30	3.28	0.00	0.00	0.00

42.20	1.00	0.30	3.28	0.00	0.00	0.00
42.25	1.00	0.30	3.28	0.00	0.00	0.00
42.30	1.00	0.30	3.28	0.00	0.00	0.00
42.35	1.00	0.30	3.28	0.00	0.00	0.00
42.40	1.00	0.30	3.28	0.00	0.00	0.00
42.45	1.00	0.30	3.28	0.00	0.00	0.00
42.50	1.00	0.30	3.28	0.00	0.00	0.00
42.55	1.00	0.30	3.28	0.00	0.00	0.00
42.60	1.00	0.30	3.28	0.00	0.00	0.00
42.65	1.00	0.30	3.28	0.00	0.00	0.00
42.70	1.00	0.30	3.28	0.00	0.00	0.00
42.75	1.00	0.30	3.28	0.00	0.00	0.00
42.80	1.00	0.30	3.28	0.00	0.00	0.00
42.85	1.00	0.30	3.28	0.00	0.00	0.00
42.90	1.00	0.30	3.28	0.00	0.00	0.00
42.95	1.00	0.30	3.28	0.00	0.00	0.00
43.00	1.00	0.30	3.28	0.00	0.00	0.00
43.05	1.00	0.30	3.28	0.00	0.00	0.00
43.10	0.99	0.30	3.28	0.00	0.00	0.00
43.15	0.99	0.30	3.28	0.00	0.00	0.00
43.20	0.99	0.30	3.28	0.00	0.00	0.00
43.25	0.99	0.30	3.28	0.00	0.00	0.00
43.30	0.99	0.30	3.27	0.00	0.00	0.00
43.35	0.99	0.30	3.27	0.00	0.00	0.00
43.40	0.99	0.30	3.27	0.00	0.00	0.00
43.45	0.99	0.30	3.27	0.00	0.00	0.00
43.50	0.99	0.30	3.27	0.00	0.00	0.00
43.55	0.99	0.30	3.27	0.00	0.00	0.00
43.60	0.99	0.30	3.27	0.00	0.00	0.00
43.65	0.99	0.30	3.27	0.00	0.00	0.00
43.70	0.99	0.30	3.27	0.00	0.00	0.00
43.75	0.99	0.30	3.27	0.00	0.00	0.00
43.80	0.99	0.30	3.27	0.00	0.00	0.00
43.85	0.99	0.30	3.27	0.00	0.00	0.00
43.90	0.99	0.30	3.27	0.00	0.00	0.00
43.95	0.99	0.30	3.27	0.00	0.00	0.00
44.00	0.99	0.30	3.27	0.00	0.00	0.00
44.05	0.99	0.30	3.27	0.00	0.00	0.00
44.10	0.99	0.30	3.27	0.00	0.00	0.00
44.15	0.99	0.30	3.27	0.00	0.00	0.00
44.20	0.99	0.30	3.27	0.00	0.00	0.00
44.25	0.99	0.30	3.27	0.00	0.00	0.00
44.30	0.99	0.30	3.27	0.00	0.00	0.00
44.35	0.99	0.30	3.27	0.00	0.00	0.00
44.40	0.99	0.30	3.27	0.00	0.00	0.00
44.45	0.99	0.30	3.27	0.00	0.00	0.00
44.50	0.99	0.30	3.27	0.00	0.00	0.00
44.55	0.99	0.30	3.27	0.00	0.00	0.00
44.60	0.99	0.30	3.27	0.00	0.00	0.00
44.65	0.99	0.30	3.27	0.00	0.00	0.00
44.70	0.99	0.30	3.27	0.00	0.00	0.00
44.75	0.99	0.30	3.27	0.00	0.00	0.00
44.80	0.99	0.30	3.27	0.00	0.00	0.00
44.85	0.98	0.30	3.27	0.00	0.00	0.00

44.90	0.98	0.30	3.27	0.00	0.00	0.00
44.95	0.98	0.30	3.27	0.00	0.00	0.00
45.00	0.98	0.30	3.27	0.00	0.00	0.00
45.05	0.98	0.30	3.27	0.00	0.00	0.00
45.10	0.98	0.30	3.27	0.00	0.00	0.00
45.15	0.98	0.30	3.27	0.00	0.00	0.00
45.20	0.98	0.30	3.26	0.00	0.00	0.00
45.25	0.98	0.30	3.26	0.00	0.00	0.00
45.30	0.98	0.30	3.26	0.00	0.00	0.00
45.35	0.98	0.30	3.26	0.00	0.00	0.00
45.40	0.98	0.30	3.26	0.00	0.00	0.00
45.45	0.98	0.30	3.26	0.00	0.00	0.00
45.50	0.98	0.30	3.26	0.00	0.00	0.00
45.55	0.98	0.30	3.26	0.00	0.00	0.00
45.60	0.98	0.30	3.26	0.00	0.00	0.00
45.65	0.98	0.30	3.26	0.00	0.00	0.00
45.70	0.98	0.30	3.26	0.00	0.00	0.00
45.75	0.98	0.30	3.26	0.00	0.00	0.00
45.80	0.98	0.30	3.26	0.00	0.00	0.00
45.85	0.98	0.30	3.26	0.00	0.00	0.00
45.90	0.98	0.30	3.26	0.00	0.00	0.00
45.95	0.98	0.30	3.26	0.00	0.00	0.00
46.00	0.98	0.30	3.26	0.00	0.00	0.00
46.05	0.98	0.30	3.26	0.00	0.00	0.00
46.10	0.98	0.30	3.26	0.00	0.00	0.00
46.15	0.98	0.30	3.26	0.00	0.00	0.00
46.20	0.98	0.30	3.26	0.00	0.00	0.00
46.25	0.98	0.30	3.26	0.00	0.00	0.00
46.30	0.98	0.30	3.26	0.00	0.00	0.00
46.35	0.98	0.30	3.26	0.00	0.00	0.00
46.40	0.98	0.30	3.26	0.00	0.00	0.00
46.45	0.98	0.30	3.26	0.00	0.00	0.00
46.50	0.98	0.30	3.26	0.00	0.00	0.00
46.55	0.98	0.30	3.26	0.00	0.00	0.00
46.60	0.98	0.30	3.26	0.00	0.00	0.00
46.65	0.98	0.30	3.26	0.00	0.00	0.00
46.70	0.97	0.30	3.26	0.00	0.00	0.00
46.75	0.97	0.30	3.26	0.00	0.00	0.00
46.80	0.97	0.30	3.26	0.00	0.00	0.00
46.85	0.97	0.30	3.26	0.00	0.00	0.00
46.90	0.97	0.30	3.26	0.00	0.00	0.00
46.95	0.97	0.30	3.26	0.00	0.00	0.00
47.00	0.97	0.30	3.26	0.00	0.00	0.00
47.05	0.97	0.30	3.26	0.00	0.00	0.00
47.10	0.97	0.30	3.26	0.00	0.00	0.00
47.15	0.97	0.30	3.26	0.00	0.00	0.00
47.20	0.97	0.30	3.26	0.00	0.00	0.00
47.25	0.97	0.30	3.26	0.00	0.00	0.00
47.30	0.97	0.30	3.26	0.00	0.00	0.00
47.35	0.97	0.30	3.26	0.00	0.00	0.00
47.40	0.97	0.30	3.26	0.00	0.00	0.00
47.45	0.96	0.30	3.21	0.00	0.00	0.00
47.50	0.94	0.30	3.15	0.00	0.00	0.00
47.55	0.93	0.30	3.13	0.00	0.00	0.00

47.60	0.92	0.30	3.10	0.00	0.00	0.00
47.65	0.92	0.30	3.08	0.00	0.00	0.00
47.70	0.91	0.30	3.06	0.00	0.00	0.00
47.75	0.90	0.30	3.03	0.00	0.00	0.00
47.80	0.90	0.30	3.01	0.00	0.00	0.00
47.85	0.89	0.30	3.00	0.00	0.00	0.00
47.90	0.89	0.30	2.98	0.00	0.00	0.00
47.95	0.88	0.30	2.96	0.00	0.00	0.00
48.00	0.87	0.30	2.94	0.00	0.00	0.00
48.05	0.87	0.30	2.93	0.00	0.00	0.00
48.10	0.87	0.30	2.91	0.00	0.00	0.00
48.15	0.86	0.30	2.90	0.00	0.00	0.00
48.20	0.86	0.30	2.89	0.00	0.00	0.00
48.25	0.85	0.30	2.87	0.00	0.00	0.00
48.30	0.85	0.30	2.86	0.00	0.00	0.00
48.35	0.85	0.30	2.85	0.00	0.00	0.00
48.40	0.84	0.30	2.84	0.00	0.00	0.00
48.45	0.84	0.30	2.83	0.00	0.00	0.00
48.50	0.83	0.30	2.82	0.00	0.00	0.00
48.55	0.83	0.30	2.81	0.00	0.00	0.00
48.60	0.83	0.30	2.80	0.00	0.00	0.00
48.65	0.83	0.30	2.79	0.00	0.00	0.00
48.70	0.82	0.30	2.78	0.00	0.00	0.00
48.75	0.82	0.30	2.77	0.00	0.00	0.00
48.80	0.82	0.30	2.76	0.00	0.00	0.00
48.85	0.81	0.30	2.75	0.00	0.00	0.00
48.90	0.81	0.30	2.74	0.00	0.00	0.00
48.95	0.81	0.30	2.74	0.00	0.00	0.00
49.00	0.81	0.30	2.73	0.00	0.00	0.00
49.05	0.80	0.30	2.72	0.00	0.00	0.00
49.10	0.80	0.30	2.71	0.00	0.00	0.00
49.15	0.80	0.30	2.71	0.00	0.00	0.00
49.20	0.80	0.30	2.70	0.00	0.00	0.00
49.25	0.79	0.30	2.69	0.00	0.00	0.00
49.30	0.79	0.30	2.69	0.00	0.00	0.00
49.35	0.79	0.29	2.68	0.00	0.00	0.00
49.40	0.79	0.29	2.67	0.00	0.00	0.00
49.45	0.79	0.29	2.67	0.00	0.00	0.00
49.50	0.78	0.29	2.66	0.00	0.00	0.00
49.55	0.78	0.29	2.66	0.00	0.00	0.00
49.60	0.78	0.29	2.65	0.00	0.00	0.00
49.65	0.78	0.29	2.64	0.00	0.00	0.00
49.70	0.78	0.29	2.64	0.00	0.00	0.00
49.75	0.78	0.29	2.63	0.00	0.00	0.00
49.80	0.77	0.29	2.63	0.00	0.00	0.00
49.85	0.77	0.29	2.62	0.00	0.00	0.00
49.90	0.77	0.29	2.62	0.00	0.00	0.00
49.95	0.77	0.29	2.61	0.00	0.00	0.00
50.00	0.77	0.29	2.61	0.00	0.00	0.00
50.05	0.76	0.29	2.60	0.00	0.00	0.00
50.10	0.76	0.29	2.60	0.00	0.00	0.00
50.15	0.76	0.29	2.59	0.00	0.00	0.00
50.20	0.76	0.29	2.59	0.00	0.00	0.00
50.25	0.76	0.29	2.58	0.00	0.00	0.00

50.30	0.76	0.29	2.58	0.00	0.00	0.00
50.35	0.76	0.29	2.58	0.00	0.00	0.00
50.40	0.75	0.29	2.57	0.00	0.00	0.00
50.45	0.75	0.29	2.57	0.00	0.00	0.00
50.50	0.75	0.29	2.56	0.00	0.00	0.00
50.55	0.75	0.29	2.56	0.00	0.00	0.00
50.60	0.75	0.29	2.56	0.00	0.00	0.00
50.65	0.75	0.29	2.55	0.00	0.00	0.00
50.70	0.75	0.29	2.55	0.00	0.00	0.00
50.75	0.74	0.29	2.54	0.00	0.00	0.00
50.80	0.74	0.29	2.54	0.00	0.00	0.00
50.85	0.74	0.29	2.54	0.00	0.00	0.00
50.90	0.74	0.29	2.53	0.00	0.00	0.00
50.95	0.74	0.29	2.53	0.00	0.00	0.00
51.00	0.74	0.29	2.53	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\Engineering\Desktop\07-230524-0.liq
Title: New Kindergarten Classrooms at Alpha Elementary School
Subtitle: 07-230524-0

Surface Elev.=263
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 90.00 ft
Water Table during In-Situ Testing= 179.00 ft
Max. Acceleration= 0.35 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=263
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 90.00 ft
Water Table during In-Situ Testing= 179.00 ft
Max. Acceleration=0.35 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT gamma pcf	Fines %
-------------	------------------	------------

0.00	13.00	94.50	44.00
3.00	5.00	126.00	20.00

7.50	6.00	126.00	25.00
12.50	12.00	134.60	30.00
17.50	16.00	135.00	45.00
22.50	30.00	130.70	8.00
27.50	25.00	140.00	60.00
32.50	28.00	140.10	60.00
37.50	42.00	137.00	35.00
42.50	23.00	139.00	60.00
47.50	22.00	136.10	40.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.09 in.
Total Settlement of Saturated and Unsaturated Sands=0.09 in.
Differential Settlement=0.047 to 0.062 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat. in.	S_dry	S_all
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0.00	1.11	0.27	5.00	0.00	0.09	0.09
0.05	1.11	0.27	5.00	0.00	0.09	0.09
0.10	1.11	0.27	5.00	0.00	0.09	0.09
0.15	1.11	0.27	5.00	0.00	0.09	0.09
0.20	1.11	0.27	5.00	0.00	0.09	0.09
0.25	1.11	0.27	5.00	0.00	0.09	0.09
0.30	1.11	0.27	5.00	0.00	0.09	0.09
0.35	1.11	0.27	5.00	0.00	0.09	0.09
0.40	1.11	0.27	5.00	0.00	0.09	0.09
0.45	1.11	0.27	5.00	0.00	0.09	0.09
0.50	1.11	0.27	5.00	0.00	0.09	0.09
0.55	1.11	0.27	5.00	0.00	0.09	0.09
0.60	1.11	0.27	5.00	0.00	0.09	0.09
0.65	1.11	0.27	5.00	0.00	0.09	0.09
0.70	1.11	0.27	5.00	0.00	0.09	0.09
0.75	1.11	0.27	5.00	0.00	0.09	0.09
0.80	1.11	0.27	5.00	0.00	0.09	0.09
0.85	1.11	0.27	5.00	0.00	0.09	0.09
0.90	1.11	0.27	5.00	0.00	0.09	0.09
0.95	1.11	0.27	5.00	0.00	0.09	0.09
1.00	1.11	0.27	5.00	0.00	0.09	0.09
1.05	1.11	0.27	5.00	0.00	0.09	0.09
1.10	1.11	0.27	5.00	0.00	0.09	0.09
1.15	0.99	0.27	5.00	0.00	0.09	0.09
1.20	0.89	0.27	5.00	0.00	0.09	0.09
1.25	0.84	0.27	5.00	0.00	0.09	0.09
1.30	0.81	0.27	5.00	0.00	0.09	0.09
1.35	0.78	0.27	5.00	0.00	0.09	0.09
1.40	0.75	0.27	5.00	0.00	0.09	0.09
1.45	0.73	0.27	5.00	0.00	0.09	0.09
1.50	0.71	0.27	5.00	0.00	0.09	0.09
1.55	0.69	0.27	5.00	0.00	0.09	0.09
1.60	0.68	0.27	5.00	0.00	0.09	0.09
1.65	0.66	0.27	5.00	0.00	0.09	0.09

1.70	0.64	0.27	5.00	0.00	0.09	0.09
1.75	0.63	0.27	5.00	0.00	0.09	0.09
1.80	0.62	0.27	5.00	0.00	0.09	0.09
1.85	0.60	0.27	5.00	0.00	0.09	0.09
1.90	0.59	0.27	5.00	0.00	0.09	0.09
1.95	0.58	0.27	5.00	0.00	0.09	0.09
2.00	0.56	0.27	5.00	0.00	0.09	0.09
2.05	0.55	0.27	5.00	0.00	0.09	0.09
2.10	0.54	0.27	5.00	0.00	0.09	0.09
2.15	0.53	0.27	5.00	0.00	0.09	0.09
2.20	0.52	0.27	5.00	0.00	0.09	0.09
2.25	0.51	0.27	5.00	0.00	0.09	0.09
2.30	0.50	0.27	5.00	0.00	0.09	0.09
2.35	0.49	0.27	5.00	0.00	0.09	0.09
2.40	0.48	0.27	5.00	0.00	0.09	0.09
2.45	0.47	0.27	5.00	0.00	0.09	0.09
2.50	0.46	0.27	5.00	0.00	0.09	0.09
2.55	0.45	0.27	5.00	0.00	0.09	0.09
2.60	0.44	0.27	5.00	0.00	0.09	0.09
2.65	0.43	0.27	5.00	0.00	0.09	0.09
2.70	0.42	0.27	5.00	0.00	0.09	0.09
2.75	0.41	0.27	5.00	0.00	0.09	0.09
2.80	0.40	0.27	5.00	0.00	0.09	0.09
2.85	0.39	0.27	5.00	0.00	0.09	0.09
2.90	0.38	0.27	5.00	0.00	0.09	0.09
2.95	0.37	0.27	5.00	0.00	0.09	0.09
3.00	0.36	0.27	5.00	0.00	0.09	0.09
3.05	0.36	0.27	5.00	0.00	0.09	0.09
3.10	0.36	0.27	5.00	0.00	0.09	0.09
3.15	0.36	0.27	5.00	0.00	0.09	0.09
3.20	0.36	0.27	5.00	0.00	0.09	0.09
3.25	0.37	0.27	5.00	0.00	0.09	0.09
3.30	0.37	0.27	5.00	0.00	0.09	0.09
3.35	0.37	0.27	5.00	0.00	0.09	0.09
3.40	0.37	0.27	5.00	0.00	0.09	0.09
3.45	0.37	0.27	5.00	0.00	0.09	0.09
3.50	0.37	0.27	5.00	0.00	0.09	0.09
3.55	0.37	0.27	5.00	0.00	0.09	0.09
3.60	0.37	0.27	5.00	0.00	0.09	0.09
3.65	0.37	0.27	5.00	0.00	0.09	0.09
3.70	0.37	0.27	5.00	0.00	0.09	0.09
3.75	0.37	0.27	5.00	0.00	0.09	0.09
3.80	0.38	0.27	5.00	0.00	0.09	0.09
3.85	0.38	0.27	5.00	0.00	0.09	0.09
3.90	0.38	0.27	5.00	0.00	0.09	0.09
3.95	0.38	0.27	5.00	0.00	0.09	0.09
4.00	0.38	0.27	5.00	0.00	0.09	0.09
4.05	0.38	0.27	5.00	0.00	0.09	0.09
4.10	0.38	0.27	5.00	0.00	0.09	0.09
4.15	0.38	0.27	5.00	0.00	0.09	0.09
4.20	0.38	0.27	5.00	0.00	0.09	0.09
4.25	0.38	0.27	5.00	0.00	0.09	0.09
4.30	0.38	0.27	5.00	0.00	0.09	0.09
4.35	0.39	0.27	5.00	0.00	0.09	0.09

4.40 0.39 0.27 5.00 0.00 0.09 0.09
4.45 0.39 0.27 5.00 0.00 0.09 0.09
4.50 0.39 0.27 5.00 0.00 0.09 0.09
4.55 0.39 0.27 5.00 0.00 0.09 0.09
4.60 0.39 0.27 5.00 0.00 0.09 0.09
4.65 0.39 0.27 5.00 0.00 0.09 0.09
4.70 0.39 0.27 5.00 0.00 0.09 0.09
4.75 0.39 0.27 5.00 0.00 0.09 0.09
4.80 0.39 0.27 5.00 0.00 0.09 0.09
4.85 0.39 0.27 5.00 0.00 0.09 0.09
4.90 0.40 0.27 5.00 0.00 0.09 0.09
4.95 0.40 0.27 5.00 0.00 0.09 0.09
5.00 0.40 0.27 5.00 0.00 0.09 0.09
5.05 0.40 0.27 5.00 0.00 0.09 0.09
5.10 0.40 0.27 5.00 0.00 0.09 0.09
5.15 0.40 0.27 5.00 0.00 0.09 0.09
5.20 0.40 0.27 5.00 0.00 0.09 0.09
5.25 0.40 0.27 5.00 0.00 0.09 0.09
5.30 0.40 0.27 5.00 0.00 0.08 0.08
5.35 0.40 0.27 5.00 0.00 0.08 0.08
5.40 0.40 0.27 5.00 0.00 0.08 0.08
5.45 0.41 0.27 5.00 0.00 0.08 0.08
5.50 0.41 0.27 5.00 0.00 0.08 0.08
5.55 0.41 0.27 5.00 0.00 0.08 0.08
5.60 0.41 0.27 5.00 0.00 0.08 0.08
5.65 0.41 0.27 5.00 0.00 0.08 0.08
5.70 0.41 0.27 5.00 0.00 0.08 0.08
5.75 0.41 0.27 5.00 0.00 0.08 0.08
5.80 0.41 0.27 5.00 0.00 0.08 0.08
5.85 0.41 0.27 5.00 0.00 0.08 0.08
5.90 0.41 0.27 5.00 0.00 0.08 0.08
5.95 0.41 0.27 5.00 0.00 0.08 0.08
6.00 0.42 0.27 5.00 0.00 0.08 0.08
6.05 0.42 0.27 5.00 0.00 0.08 0.08
6.10 0.42 0.27 5.00 0.00 0.08 0.08
6.15 0.42 0.27 5.00 0.00 0.08 0.08
6.20 0.42 0.27 5.00 0.00 0.08 0.08
6.25 0.42 0.27 5.00 0.00 0.08 0.08
6.30 0.42 0.27 5.00 0.00 0.08 0.08
6.35 0.42 0.27 5.00 0.00 0.08 0.08
6.40 0.42 0.27 5.00 0.00 0.08 0.08
6.45 0.42 0.27 5.00 0.00 0.08 0.08
6.50 0.42 0.27 5.00 0.00 0.08 0.08
6.55 0.42 0.27 5.00 0.00 0.08 0.08
6.60 0.42 0.27 5.00 0.00 0.08 0.08
6.65 0.42 0.27 5.00 0.00 0.08 0.08
6.70 0.42 0.27 5.00 0.00 0.08 0.08
6.75 0.41 0.27 5.00 0.00 0.08 0.08
6.80 0.41 0.27 5.00 0.00 0.08 0.08
6.85 0.41 0.27 5.00 0.00 0.08 0.08
6.90 0.41 0.27 5.00 0.00 0.08 0.08
6.95 0.41 0.27 5.00 0.00 0.08 0.08
7.00 0.41 0.27 5.00 0.00 0.08 0.08
7.05 0.41 0.27 5.00 0.00 0.08 0.08

7.10 0.41 0.27 5.00 0.00 0.08 0.08
7.15 0.41 0.27 5.00 0.00 0.08 0.08
7.20 0.41 0.27 5.00 0.00 0.08 0.08
7.25 0.41 0.27 5.00 0.00 0.08 0.08
7.30 0.41 0.27 5.00 0.00 0.08 0.08
7.35 0.41 0.27 5.00 0.00 0.08 0.08
7.40 0.41 0.27 5.00 0.00 0.08 0.08
7.45 0.41 0.27 5.00 0.00 0.08 0.08
7.50 0.41 0.27 5.00 0.00 0.08 0.08
7.55 0.41 0.27 5.00 0.00 0.08 0.08
7.60 0.42 0.27 5.00 0.00 0.08 0.08
7.65 0.42 0.27 5.00 0.00 0.08 0.08
7.70 0.42 0.27 5.00 0.00 0.08 0.08
7.75 0.42 0.27 5.00 0.00 0.08 0.08
7.80 0.42 0.27 5.00 0.00 0.08 0.08
7.85 0.43 0.27 5.00 0.00 0.08 0.08
7.90 0.43 0.27 5.00 0.00 0.08 0.08
7.95 0.43 0.27 5.00 0.00 0.08 0.08
8.00 0.43 0.27 5.00 0.00 0.08 0.08
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8.10 0.44 0.27 5.00 0.00 0.08 0.08
8.15 0.44 0.27 5.00 0.00 0.08 0.08
8.20 0.44 0.27 5.00 0.00 0.07 0.07
8.25 0.49 0.27 5.00 0.00 0.07 0.07
8.30 0.49 0.27 5.00 0.00 0.07 0.07
8.35 0.49 0.27 5.00 0.00 0.07 0.07
8.40 0.50 0.27 5.00 0.00 0.07 0.07
8.45 0.50 0.27 5.00 0.00 0.07 0.07
8.50 0.50 0.27 5.00 0.00 0.07 0.07
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8.60 0.51 0.27 5.00 0.00 0.07 0.07
8.65 0.51 0.27 5.00 0.00 0.07 0.07
8.70 0.51 0.27 5.00 0.00 0.07 0.07
8.75 0.51 0.27 5.00 0.00 0.07 0.07
8.80 0.52 0.27 5.00 0.00 0.07 0.07
8.85 0.52 0.27 5.00 0.00 0.07 0.07
8.90 0.52 0.27 5.00 0.00 0.07 0.07
8.95 0.52 0.27 5.00 0.00 0.07 0.07
9.00 0.53 0.27 5.00 0.00 0.07 0.07
9.05 0.53 0.27 5.00 0.00 0.07 0.07
9.10 0.53 0.27 5.00 0.00 0.07 0.07
9.15 0.53 0.27 5.00 0.00 0.07 0.07
9.20 0.54 0.27 5.00 0.00 0.07 0.07
9.25 0.54 0.27 5.00 0.00 0.07 0.07
9.30 0.54 0.27 5.00 0.00 0.07 0.07
9.35 0.54 0.27 5.00 0.00 0.07 0.07
9.40 0.55 0.27 5.00 0.00 0.07 0.07
9.45 0.55 0.27 5.00 0.00 0.07 0.07
9.50 0.55 0.27 5.00 0.00 0.07 0.07
9.55 0.55 0.27 5.00 0.00 0.07 0.07
9.60 0.56 0.27 5.00 0.00 0.07 0.07
9.65 0.56 0.27 5.00 0.00 0.07 0.07
9.70 0.56 0.27 5.00 0.00 0.07 0.07
9.75 0.56 0.27 5.00 0.00 0.07 0.07

9.80	0.57	0.27	5.00	0.00	0.07	0.07
9.85	0.57	0.27	5.00	0.00	0.07	0.07
9.90	0.57	0.27	5.00	0.00	0.07	0.07
9.95	0.57	0.27	5.00	0.00	0.07	0.07
10.00	0.58	0.27	5.00	0.00	0.07	0.07
10.05	0.58	0.27	5.00	0.00	0.07	0.07
10.10	0.58	0.27	5.00	0.00	0.07	0.07
10.15	0.58	0.27	5.00	0.00	0.07	0.07
10.20	0.59	0.27	5.00	0.00	0.07	0.07
10.25	0.59	0.27	5.00	0.00	0.07	0.07
10.30	0.59	0.27	5.00	0.00	0.07	0.07
10.35	0.60	0.27	5.00	0.00	0.07	0.07
10.40	0.60	0.27	5.00	0.00	0.07	0.07
10.45	0.60	0.27	5.00	0.00	0.07	0.07
10.50	0.60	0.27	5.00	0.00	0.07	0.07
10.55	0.61	0.27	5.00	0.00	0.07	0.07
10.60	0.61	0.27	5.00	0.00	0.07	0.07
10.65	0.61	0.27	5.00	0.00	0.07	0.07
10.70	0.61	0.27	5.00	0.00	0.07	0.07
10.75	0.62	0.27	5.00	0.00	0.07	0.07
10.80	0.62	0.27	5.00	0.00	0.07	0.07
10.85	0.62	0.27	5.00	0.00	0.07	0.07
10.90	0.63	0.27	5.00	0.00	0.07	0.07
10.95	0.63	0.27	5.00	0.00	0.07	0.07
11.00	0.63	0.27	5.00	0.00	0.07	0.07
11.05	0.63	0.27	5.00	0.00	0.07	0.07
11.10	0.64	0.27	5.00	0.00	0.07	0.07
11.15	0.64	0.27	5.00	0.00	0.07	0.07
11.20	0.64	0.27	5.00	0.00	0.07	0.07
11.25	0.65	0.27	5.00	0.00	0.07	0.07
11.30	0.65	0.27	5.00	0.00	0.07	0.07
11.35	0.65	0.27	5.00	0.00	0.07	0.07
11.40	0.66	0.27	5.00	0.00	0.07	0.07
11.45	0.66	0.27	5.00	0.00	0.07	0.07
11.50	0.66	0.27	5.00	0.00	0.07	0.07
11.55	0.66	0.27	5.00	0.00	0.07	0.07
11.60	0.67	0.27	5.00	0.00	0.07	0.07
11.65	0.67	0.27	5.00	0.00	0.07	0.07
11.70	0.67	0.27	5.00	0.00	0.07	0.07
11.75	0.68	0.27	5.00	0.00	0.07	0.07
11.80	0.68	0.27	5.00	0.00	0.07	0.07
11.85	0.68	0.27	5.00	0.00	0.07	0.07
11.90	0.69	0.27	5.00	0.00	0.07	0.07
11.95	0.69	0.27	5.00	0.00	0.07	0.07
12.00	0.69	0.27	5.00	0.00	0.07	0.07
12.05	0.70	0.27	5.00	0.00	0.07	0.07
12.10	0.70	0.27	5.00	0.00	0.07	0.07
12.15	0.70	0.27	5.00	0.00	0.07	0.07
12.20	0.71	0.27	5.00	0.00	0.07	0.07
12.25	0.71	0.27	5.00	0.00	0.06	0.06
12.30	0.71	0.27	5.00	0.00	0.06	0.06
12.35	0.72	0.27	5.00	0.00	0.06	0.06
12.40	0.72	0.27	5.00	0.00	0.06	0.06
12.45	0.73	0.27	5.00	0.00	0.06	0.06

12.50	0.73	0.27	5.00	0.00	0.06	0.06
12.55	0.73	0.27	5.00	0.00	0.06	0.06
12.60	0.74	0.26	5.00	0.00	0.06	0.06
12.65	0.74	0.26	5.00	0.00	0.06	0.06
12.70	0.74	0.26	5.00	0.00	0.06	0.06
12.75	0.75	0.26	5.00	0.00	0.06	0.06
12.80	0.75	0.26	5.00	0.00	0.06	0.06
12.85	0.75	0.26	5.00	0.00	0.06	0.06
12.90	0.76	0.26	5.00	0.00	0.06	0.06
12.95	0.76	0.26	5.00	0.00	0.06	0.06
13.00	0.76	0.26	5.00	0.00	0.06	0.06
13.05	0.77	0.26	5.00	0.00	0.06	0.06
13.10	0.77	0.26	5.00	0.00	0.06	0.06
13.15	0.77	0.26	5.00	0.00	0.06	0.06
13.20	0.78	0.26	5.00	0.00	0.06	0.06
13.25	0.78	0.26	5.00	0.00	0.06	0.06
13.30	0.79	0.26	5.00	0.00	0.06	0.06
13.35	0.79	0.26	5.00	0.00	0.06	0.06
13.40	0.79	0.26	5.00	0.00	0.06	0.06
13.45	0.80	0.26	5.00	0.00	0.06	0.06
13.50	0.80	0.26	5.00	0.00	0.06	0.06
13.55	0.81	0.26	5.00	0.00	0.06	0.06
13.60	0.81	0.26	5.00	0.00	0.06	0.06
13.65	0.82	0.26	5.00	0.00	0.06	0.06
13.70	0.82	0.26	5.00	0.00	0.06	0.06
13.75	0.83	0.26	5.00	0.00	0.06	0.06
13.80	0.83	0.26	5.00	0.00	0.06	0.06
13.85	0.84	0.26	5.00	0.00	0.06	0.06
13.90	0.84	0.26	5.00	0.00	0.06	0.06
13.95	0.85	0.26	5.00	0.00	0.06	0.06
14.00	0.86	0.26	5.00	0.00	0.06	0.06
14.05	0.86	0.26	5.00	0.00	0.06	0.06
14.10	0.87	0.26	5.00	0.00	0.06	0.06
14.15	0.88	0.26	5.00	0.00	0.06	0.06
14.20	0.89	0.26	5.00	0.00	0.06	0.06
14.25	0.89	0.26	5.00	0.00	0.06	0.06
14.30	0.89	0.26	5.00	0.00	0.06	0.06
14.35	0.90	0.26	5.00	0.00	0.06	0.06
14.40	0.90	0.26	5.00	0.00	0.06	0.06
14.45	0.91	0.26	5.00	0.00	0.06	0.06
14.50	0.91	0.26	5.00	0.00	0.06	0.06
14.55	0.92	0.26	5.00	0.00	0.06	0.06
14.60	0.92	0.26	5.00	0.00	0.06	0.06
14.65	0.93	0.26	5.00	0.00	0.06	0.06
14.70	0.93	0.26	5.00	0.00	0.06	0.06
14.75	0.94	0.26	5.00	0.00	0.06	0.06
14.80	1.11	0.26	5.00	0.00	0.06	0.06
14.85	1.11	0.26	5.00	0.00	0.06	0.06
14.90	1.11	0.26	5.00	0.00	0.06	0.06
14.95	1.11	0.26	5.00	0.00	0.06	0.06
15.00	1.11	0.26	5.00	0.00	0.06	0.06
15.05	1.11	0.26	5.00	0.00	0.06	0.06
15.10	1.11	0.26	5.00	0.00	0.06	0.06
15.15	1.11	0.26	5.00	0.00	0.06	0.06

15.20	1.11	0.26	5.00	0.00	0.06	0.06
15.25	1.11	0.26	5.00	0.00	0.06	0.06
15.30	1.11	0.26	5.00	0.00	0.06	0.06
15.35	1.11	0.26	5.00	0.00	0.06	0.06
15.40	1.11	0.26	5.00	0.00	0.06	0.06
15.45	1.11	0.26	5.00	0.00	0.06	0.06
15.50	1.11	0.26	5.00	0.00	0.06	0.06
15.55	1.11	0.26	5.00	0.00	0.06	0.06
15.60	1.11	0.26	5.00	0.00	0.06	0.06
15.65	1.11	0.26	5.00	0.00	0.06	0.06
15.70	1.11	0.26	5.00	0.00	0.06	0.06
15.75	1.11	0.26	5.00	0.00	0.06	0.06
15.80	1.11	0.26	5.00	0.00	0.06	0.06
15.85	1.11	0.26	5.00	0.00	0.06	0.06
15.90	1.11	0.26	5.00	0.00	0.06	0.06
15.95	1.11	0.26	5.00	0.00	0.06	0.06
16.00	1.11	0.26	5.00	0.00	0.06	0.06
16.05	1.11	0.26	5.00	0.00	0.06	0.06
16.10	1.11	0.26	5.00	0.00	0.06	0.06
16.15	1.11	0.26	5.00	0.00	0.06	0.06
16.20	1.11	0.26	5.00	0.00	0.06	0.06
16.25	1.11	0.26	5.00	0.00	0.06	0.06
16.30	1.11	0.26	5.00	0.00	0.06	0.06
16.35	1.11	0.26	5.00	0.00	0.06	0.06
16.40	1.11	0.26	5.00	0.00	0.06	0.06
16.45	1.11	0.26	5.00	0.00	0.06	0.06
16.50	1.11	0.26	5.00	0.00	0.06	0.06
16.55	1.11	0.26	5.00	0.00	0.06	0.06
16.60	1.11	0.26	5.00	0.00	0.06	0.06
16.65	1.11	0.26	5.00	0.00	0.06	0.06
16.70	1.11	0.26	5.00	0.00	0.06	0.06
16.75	1.11	0.26	5.00	0.00	0.06	0.06
16.80	1.11	0.26	5.00	0.00	0.06	0.06
16.85	1.11	0.26	5.00	0.00	0.06	0.06
16.90	1.11	0.26	5.00	0.00	0.06	0.06
16.95	1.11	0.26	5.00	0.00	0.06	0.06
17.00	1.11	0.26	5.00	0.00	0.06	0.06
17.05	1.11	0.26	5.00	0.00	0.06	0.06
17.10	1.11	0.26	5.00	0.00	0.06	0.06
17.15	1.11	0.26	5.00	0.00	0.06	0.06
17.20	1.11	0.26	5.00	0.00	0.06	0.06
17.25	1.11	0.26	5.00	0.00	0.06	0.06
17.30	1.11	0.26	5.00	0.00	0.06	0.06
17.35	1.11	0.26	5.00	0.00	0.06	0.06
17.40	1.11	0.26	5.00	0.00	0.06	0.06
17.45	1.11	0.26	5.00	0.00	0.06	0.06
17.50	1.11	0.26	5.00	0.00	0.06	0.06
17.55	1.11	0.26	5.00	0.00	0.05	0.05
17.60	1.11	0.26	5.00	0.00	0.05	0.05
17.65	1.11	0.26	5.00	0.00	0.05	0.05
17.70	1.11	0.26	5.00	0.00	0.05	0.05
17.75	1.11	0.26	5.00	0.00	0.05	0.05
17.80	1.11	0.26	5.00	0.00	0.05	0.05
17.85	1.11	0.26	5.00	0.00	0.05	0.05

17.90	1.11	0.26	5.00	0.00	0.05	0.05
17.95	1.11	0.26	5.00	0.00	0.05	0.05
18.00	1.11	0.26	5.00	0.00	0.05	0.05
18.05	1.11	0.26	5.00	0.00	0.05	0.05
18.10	1.11	0.26	5.00	0.00	0.05	0.05
18.15	1.11	0.26	5.00	0.00	0.05	0.05
18.20	1.11	0.26	5.00	0.00	0.05	0.05
18.25	1.11	0.26	5.00	0.00	0.05	0.05
18.30	1.11	0.26	5.00	0.00	0.05	0.05
18.35	1.11	0.26	5.00	0.00	0.05	0.05
18.40	1.11	0.26	5.00	0.00	0.05	0.05
18.45	1.11	0.26	5.00	0.00	0.05	0.05
18.50	1.11	0.26	5.00	0.00	0.05	0.05
18.55	1.11	0.26	5.00	0.00	0.05	0.05
18.60	1.11	0.26	5.00	0.00	0.05	0.05
18.65	1.11	0.26	5.00	0.00	0.05	0.05
18.70	1.11	0.26	5.00	0.00	0.05	0.05
18.75	1.11	0.26	5.00	0.00	0.05	0.05
18.80	1.11	0.26	5.00	0.00	0.05	0.05
18.85	1.11	0.26	5.00	0.00	0.05	0.05
18.90	1.11	0.26	5.00	0.00	0.05	0.05
18.95	1.11	0.26	5.00	0.00	0.05	0.05
19.00	1.11	0.26	5.00	0.00	0.05	0.05
19.05	1.11	0.26	5.00	0.00	0.05	0.05
19.10	1.11	0.26	5.00	0.00	0.05	0.05
19.15	1.11	0.26	5.00	0.00	0.05	0.05
19.20	1.11	0.26	5.00	0.00	0.05	0.05
19.25	1.11	0.26	5.00	0.00	0.05	0.05
19.30	1.11	0.26	5.00	0.00	0.05	0.05
19.35	1.11	0.26	5.00	0.00	0.05	0.05
19.40	1.11	0.26	5.00	0.00	0.05	0.05
19.45	1.11	0.26	5.00	0.00	0.05	0.05
19.50	1.11	0.26	5.00	0.00	0.05	0.05
19.55	1.11	0.26	5.00	0.00	0.05	0.05
19.60	1.11	0.26	5.00	0.00	0.05	0.05
19.65	1.11	0.26	5.00	0.00	0.05	0.05
19.70	1.11	0.26	5.00	0.00	0.05	0.05
19.75	1.11	0.26	5.00	0.00	0.05	0.05
19.80	1.11	0.26	5.00	0.00	0.05	0.05
19.85	1.11	0.26	5.00	0.00	0.05	0.05
19.90	1.11	0.26	5.00	0.00	0.05	0.05
19.95	1.11	0.26	5.00	0.00	0.05	0.05
20.00	1.11	0.26	5.00	0.00	0.05	0.05
20.05	1.11	0.26	5.00	0.00	0.05	0.05
20.10	1.11	0.26	5.00	0.00	0.05	0.05
20.15	1.11	0.26	5.00	0.00	0.05	0.05
20.20	1.11	0.26	5.00	0.00	0.05	0.05
20.25	1.11	0.26	5.00	0.00	0.05	0.05
20.30	1.11	0.26	5.00	0.00	0.05	0.05
20.35	1.11	0.26	5.00	0.00	0.05	0.05
20.40	1.11	0.26	5.00	0.00	0.05	0.05
20.45	1.11	0.26	5.00	0.00	0.05	0.05
20.50	1.11	0.26	5.00	0.00	0.05	0.05
20.55	1.11	0.26	5.00	0.00	0.05	0.05

20.60	1.11	0.26	5.00	0.00	0.05	0.05
20.65	1.11	0.26	5.00	0.00	0.05	0.05
20.70	1.11	0.26	5.00	0.00	0.05	0.05
20.75	1.11	0.26	5.00	0.00	0.05	0.05
20.80	1.11	0.26	5.00	0.00	0.05	0.05
20.85	1.11	0.26	5.00	0.00	0.05	0.05
20.90	1.11	0.26	5.00	0.00	0.05	0.05
20.95	1.11	0.26	5.00	0.00	0.05	0.05
21.00	1.11	0.26	5.00	0.00	0.05	0.05
21.05	1.11	0.26	5.00	0.00	0.05	0.05
21.10	1.11	0.26	5.00	0.00	0.05	0.05
21.15	1.11	0.26	5.00	0.00	0.05	0.05
21.20	1.11	0.26	5.00	0.00	0.05	0.05
21.25	1.11	0.26	5.00	0.00	0.05	0.05
21.30	1.11	0.26	5.00	0.00	0.05	0.05
21.35	1.11	0.26	5.00	0.00	0.05	0.05
21.40	1.11	0.26	5.00	0.00	0.05	0.05
21.45	1.11	0.26	5.00	0.00	0.05	0.05
21.50	1.11	0.26	5.00	0.00	0.05	0.05
21.55	1.11	0.26	5.00	0.00	0.05	0.05
21.60	1.11	0.26	5.00	0.00	0.05	0.05
21.65	1.11	0.26	5.00	0.00	0.05	0.05
21.70	1.11	0.26	5.00	0.00	0.05	0.05
21.75	1.11	0.26	5.00	0.00	0.05	0.05
21.80	1.11	0.26	5.00	0.00	0.05	0.05
21.85	1.11	0.26	5.00	0.00	0.05	0.05
21.90	1.11	0.26	5.00	0.00	0.05	0.05
21.95	1.11	0.26	5.00	0.00	0.05	0.05
22.00	1.11	0.26	5.00	0.00	0.05	0.05
22.05	1.11	0.26	5.00	0.00	0.05	0.05
22.10	1.11	0.26	5.00	0.00	0.05	0.05
22.15	1.11	0.26	5.00	0.00	0.05	0.05
22.20	1.11	0.26	5.00	0.00	0.05	0.05
22.25	1.11	0.26	5.00	0.00	0.05	0.05
22.30	1.11	0.26	5.00	0.00	0.05	0.05
22.35	1.11	0.26	5.00	0.00	0.05	0.05
22.40	1.11	0.26	5.00	0.00	0.05	0.05
22.45	1.11	0.26	5.00	0.00	0.05	0.05
22.50	1.11	0.26	5.00	0.00	0.05	0.05
22.55	1.11	0.26	5.00	0.00	0.05	0.05
22.60	1.11	0.26	5.00	0.00	0.05	0.05
22.65	1.11	0.26	5.00	0.00	0.05	0.05
22.70	1.11	0.26	5.00	0.00	0.05	0.05
22.75	1.11	0.26	5.00	0.00	0.05	0.05
22.80	1.11	0.26	5.00	0.00	0.05	0.05
22.85	1.11	0.26	5.00	0.00	0.05	0.05
22.90	1.11	0.26	5.00	0.00	0.05	0.05
22.95	1.11	0.26	5.00	0.00	0.05	0.05
23.00	1.11	0.26	5.00	0.00	0.05	0.05
23.05	1.11	0.26	5.00	0.00	0.05	0.05
23.10	1.11	0.26	5.00	0.00	0.05	0.05
23.15	1.11	0.26	5.00	0.00	0.05	0.05
23.20	1.11	0.26	5.00	0.00	0.05	0.05
23.25	1.11	0.26	5.00	0.00	0.05	0.05

23.30	1.11	0.26	5.00	0.00	0.05	0.05
23.35	1.11	0.26	5.00	0.00	0.05	0.05
23.40	1.11	0.26	5.00	0.00	0.05	0.05
23.45	1.11	0.26	5.00	0.00	0.05	0.05
23.50	1.11	0.26	5.00	0.00	0.05	0.05
23.55	1.11	0.26	5.00	0.00	0.05	0.05
23.60	1.11	0.26	5.00	0.00	0.05	0.05
23.65	1.11	0.26	5.00	0.00	0.05	0.05
23.70	1.11	0.26	5.00	0.00	0.05	0.05
23.75	1.11	0.26	5.00	0.00	0.05	0.05
23.80	1.11	0.26	5.00	0.00	0.05	0.05
23.85	1.11	0.26	5.00	0.00	0.05	0.05
23.90	1.11	0.26	5.00	0.00	0.05	0.05
23.95	1.11	0.26	5.00	0.00	0.05	0.05
24.00	1.11	0.26	5.00	0.00	0.05	0.05
24.05	1.11	0.26	5.00	0.00	0.05	0.05
24.10	1.11	0.26	5.00	0.00	0.05	0.05
24.15	1.11	0.26	5.00	0.00	0.05	0.05
24.20	1.11	0.26	5.00	0.00	0.05	0.05
24.25	1.11	0.26	5.00	0.00	0.05	0.05
24.30	1.11	0.26	5.00	0.00	0.05	0.05
24.35	1.11	0.26	5.00	0.00	0.05	0.05
24.40	1.11	0.26	5.00	0.00	0.05	0.05
24.45	1.11	0.26	5.00	0.00	0.05	0.05
24.50	1.11	0.26	5.00	0.00	0.05	0.05
24.55	1.11	0.26	5.00	0.00	0.05	0.05
24.60	1.11	0.26	5.00	0.00	0.05	0.05
24.65	1.11	0.26	5.00	0.00	0.05	0.05
24.70	1.11	0.26	5.00	0.00	0.05	0.05
24.75	1.11	0.26	5.00	0.00	0.05	0.05
24.80	1.11	0.26	5.00	0.00	0.05	0.05
24.85	1.11	0.26	5.00	0.00	0.05	0.05
24.90	1.11	0.26	5.00	0.00	0.05	0.05
24.95	1.11	0.26	5.00	0.00	0.05	0.05
25.00	1.11	0.26	5.00	0.00	0.05	0.05
25.05	1.11	0.26	5.00	0.00	0.05	0.05
25.10	1.11	0.26	5.00	0.00	0.05	0.05
25.15	1.11	0.26	5.00	0.00	0.05	0.05
25.20	1.11	0.26	5.00	0.00	0.05	0.05
25.25	1.11	0.26	5.00	0.00	0.05	0.05
25.30	1.11	0.26	5.00	0.00	0.05	0.05
25.35	1.11	0.26	5.00	0.00	0.05	0.05
25.40	1.11	0.26	5.00	0.00	0.05	0.05
25.45	1.11	0.26	5.00	0.00	0.05	0.05
25.50	1.11	0.26	5.00	0.00	0.05	0.05
25.55	1.11	0.26	5.00	0.00	0.05	0.05
25.60	1.11	0.26	5.00	0.00	0.05	0.05
25.65	1.11	0.26	5.00	0.00	0.05	0.05
25.70	1.11	0.26	5.00	0.00	0.05	0.05
25.75	1.11	0.26	5.00	0.00	0.05	0.05
25.80	1.11	0.26	5.00	0.00	0.05	0.05
25.85	1.11	0.26	5.00	0.00	0.05	0.05
25.90	1.11	0.26	5.00	0.00	0.05	0.05
25.95	1.11	0.26	5.00	0.00	0.05	0.05

26.00	1.11	0.26	5.00	0.00	0.05	0.05
26.05	1.11	0.26	5.00	0.00	0.05	0.05
26.10	1.11	0.26	5.00	0.00	0.05	0.05
26.15	1.11	0.26	5.00	0.00	0.05	0.05
26.20	1.11	0.26	5.00	0.00	0.04	0.04
26.25	1.11	0.26	5.00	0.00	0.04	0.04
26.30	1.10	0.26	5.00	0.00	0.04	0.04
26.35	1.10	0.26	5.00	0.00	0.04	0.04
26.40	1.10	0.26	5.00	0.00	0.04	0.04
26.45	1.10	0.26	5.00	0.00	0.04	0.04
26.50	1.10	0.26	5.00	0.00	0.04	0.04
26.55	1.10	0.26	5.00	0.00	0.04	0.04
26.60	1.10	0.26	5.00	0.00	0.04	0.04
26.65	1.10	0.26	5.00	0.00	0.04	0.04
26.70	1.10	0.26	5.00	0.00	0.04	0.04
26.75	1.10	0.26	5.00	0.00	0.04	0.04
26.80	1.10	0.26	5.00	0.00	0.04	0.04
26.85	1.10	0.26	5.00	0.00	0.04	0.04
26.90	1.10	0.26	5.00	0.00	0.04	0.04
26.95	1.10	0.26	5.00	0.00	0.04	0.04
27.00	1.10	0.26	5.00	0.00	0.04	0.04
27.05	1.10	0.26	5.00	0.00	0.04	0.04
27.10	1.10	0.26	5.00	0.00	0.04	0.04
27.15	1.10	0.26	5.00	0.00	0.04	0.04
27.20	1.10	0.26	5.00	0.00	0.04	0.04
27.25	1.10	0.26	5.00	0.00	0.04	0.04
27.30	1.10	0.26	5.00	0.00	0.04	0.04
27.35	1.10	0.26	5.00	0.00	0.04	0.04
27.40	1.10	0.26	5.00	0.00	0.04	0.04
27.45	1.10	0.26	5.00	0.00	0.04	0.04
27.50	1.10	0.26	5.00	0.00	0.04	0.04
27.55	1.10	0.26	5.00	0.00	0.04	0.04
27.60	1.10	0.26	5.00	0.00	0.04	0.04
27.65	1.10	0.26	5.00	0.00	0.04	0.04
27.70	1.09	0.26	5.00	0.00	0.04	0.04
27.75	1.09	0.26	5.00	0.00	0.04	0.04
27.80	1.09	0.26	5.00	0.00	0.04	0.04
27.85	1.09	0.26	5.00	0.00	0.04	0.04
27.90	1.09	0.26	5.00	0.00	0.04	0.04
27.95	1.09	0.26	5.00	0.00	0.04	0.04
28.00	1.09	0.26	5.00	0.00	0.04	0.04
28.05	1.09	0.26	5.00	0.00	0.04	0.04
28.10	1.09	0.26	5.00	0.00	0.04	0.04
28.15	1.09	0.26	5.00	0.00	0.04	0.04
28.20	1.09	0.26	5.00	0.00	0.04	0.04
28.25	1.09	0.26	5.00	0.00	0.04	0.04
28.30	1.09	0.25	5.00	0.00	0.04	0.04
28.35	1.09	0.25	5.00	0.00	0.04	0.04
28.40	1.09	0.25	5.00	0.00	0.04	0.04
28.45	1.09	0.25	5.00	0.00	0.04	0.04
28.50	1.09	0.25	5.00	0.00	0.04	0.04
28.55	1.09	0.25	5.00	0.00	0.04	0.04
28.60	1.09	0.25	5.00	0.00	0.04	0.04
28.65	1.09	0.25	5.00	0.00	0.04	0.04

28.70	1.09	0.25	5.00	0.00	0.04	0.04
28.75	1.09	0.25	5.00	0.00	0.04	0.04
28.80	1.09	0.25	5.00	0.00	0.04	0.04
28.85	1.09	0.25	5.00	0.00	0.04	0.04
28.90	1.09	0.25	5.00	0.00	0.04	0.04
28.95	1.09	0.25	5.00	0.00	0.04	0.04
29.00	1.09	0.25	5.00	0.00	0.04	0.04
29.05	1.08	0.25	5.00	0.00	0.04	0.04
29.10	1.08	0.25	5.00	0.00	0.04	0.04
29.15	1.08	0.25	5.00	0.00	0.04	0.04
29.20	1.08	0.25	5.00	0.00	0.04	0.04
29.25	1.08	0.25	5.00	0.00	0.04	0.04
29.30	1.08	0.25	5.00	0.00	0.04	0.04
29.35	1.08	0.25	5.00	0.00	0.04	0.04
29.40	1.08	0.25	5.00	0.00	0.04	0.04
29.45	1.08	0.25	5.00	0.00	0.04	0.04
29.50	1.08	0.25	5.00	0.00	0.04	0.04
29.55	1.08	0.25	5.00	0.00	0.04	0.04
29.60	1.08	0.25	5.00	0.00	0.04	0.04
29.65	1.08	0.25	5.00	0.00	0.04	0.04
29.70	1.08	0.25	5.00	0.00	0.04	0.04
29.75	1.08	0.25	5.00	0.00	0.04	0.04
29.80	1.08	0.25	5.00	0.00	0.04	0.04
29.85	1.08	0.25	5.00	0.00	0.04	0.04
29.90	1.08	0.25	5.00	0.00	0.04	0.04
29.95	1.08	0.25	5.00	0.00	0.04	0.04
30.00	1.08	0.25	5.00	0.00	0.04	0.04
30.05	1.08	0.25	5.00	0.00	0.04	0.04
30.10	1.08	0.25	5.00	0.00	0.04	0.04
30.15	1.08	0.25	5.00	0.00	0.04	0.04
30.20	1.08	0.25	5.00	0.00	0.04	0.04
30.25	1.08	0.25	5.00	0.00	0.04	0.04
30.30	1.08	0.25	5.00	0.00	0.04	0.04
30.35	1.08	0.25	5.00	0.00	0.04	0.04
30.40	1.08	0.25	5.00	0.00	0.04	0.04
30.45	1.07	0.25	5.00	0.00	0.04	0.04
30.50	1.07	0.25	5.00	0.00	0.04	0.04
30.55	1.07	0.25	5.00	0.00	0.04	0.04
30.60	1.07	0.25	5.00	0.00	0.04	0.04
30.65	1.07	0.25	5.00	0.00	0.04	0.04
30.70	1.07	0.25	5.00	0.00	0.04	0.04
30.75	1.07	0.25	5.00	0.00	0.04	0.04
30.80	1.07	0.25	5.00	0.00	0.04	0.04
30.85	1.07	0.25	5.00	0.00	0.04	0.04
30.90	1.07	0.25	5.00	0.00	0.04	0.04
30.95	1.07	0.25	5.00	0.00	0.04	0.04
31.00	1.07	0.25	5.00	0.00	0.04	0.04
31.05	1.07	0.25	5.00	0.00	0.04	0.04
31.10	1.07	0.25	5.00	0.00	0.04	0.04
31.15	1.07	0.25	5.00	0.00	0.04	0.04
31.20	1.07	0.25	5.00	0.00	0.04	0.04
31.25	1.07	0.25	5.00	0.00	0.04	0.04
31.30	1.07	0.25	5.00	0.00	0.04	0.04
31.35	1.07	0.25	5.00	0.00	0.04	0.04

31.40	1.07	0.25	5.00	0.00	0.04	0.04
31.45	1.07	0.25	5.00	0.00	0.04	0.04
31.50	1.07	0.25	5.00	0.00	0.04	0.04
31.55	1.07	0.25	5.00	0.00	0.04	0.04
31.60	1.07	0.25	5.00	0.00	0.04	0.04
31.65	1.07	0.25	5.00	0.00	0.04	0.04
31.70	1.07	0.25	5.00	0.00	0.04	0.04
31.75	1.07	0.25	5.00	0.00	0.04	0.04
31.80	1.07	0.25	5.00	0.00	0.04	0.04
31.85	1.07	0.25	5.00	0.00	0.04	0.04
31.90	1.06	0.25	5.00	0.00	0.04	0.04
31.95	1.06	0.25	5.00	0.00	0.04	0.04
32.00	1.06	0.25	5.00	0.00	0.04	0.04
32.05	1.06	0.25	5.00	0.00	0.04	0.04
32.10	1.06	0.25	5.00	0.00	0.04	0.04
32.15	1.06	0.25	5.00	0.00	0.04	0.04
32.20	1.06	0.25	5.00	0.00	0.04	0.04
32.25	1.06	0.25	5.00	0.00	0.04	0.04
32.30	1.06	0.25	5.00	0.00	0.04	0.04
32.35	1.06	0.25	5.00	0.00	0.04	0.04
32.40	1.06	0.25	5.00	0.00	0.04	0.04
32.45	1.06	0.25	5.00	0.00	0.04	0.04
32.50	1.06	0.25	5.00	0.00	0.04	0.04
32.55	1.06	0.25	5.00	0.00	0.04	0.04
32.60	1.06	0.25	5.00	0.00	0.04	0.04
32.65	1.06	0.25	5.00	0.00	0.04	0.04
32.70	1.06	0.25	5.00	0.00	0.04	0.04
32.75	1.06	0.25	5.00	0.00	0.04	0.04
32.80	1.06	0.25	5.00	0.00	0.04	0.04
32.85	1.06	0.25	5.00	0.00	0.04	0.04
32.90	1.06	0.25	5.00	0.00	0.04	0.04
32.95	1.06	0.25	5.00	0.00	0.04	0.04
33.00	1.06	0.25	5.00	0.00	0.04	0.04
33.05	1.06	0.25	5.00	0.00	0.04	0.04
33.10	1.06	0.25	5.00	0.00	0.04	0.04
33.15	1.06	0.25	5.00	0.00	0.04	0.04
33.20	1.06	0.25	5.00	0.00	0.04	0.04
33.25	1.06	0.25	5.00	0.00	0.04	0.04
33.30	1.06	0.25	5.00	0.00	0.04	0.04
33.35	1.05	0.25	5.00	0.00	0.04	0.04
33.40	1.05	0.25	5.00	0.00	0.04	0.04
33.45	1.05	0.25	5.00	0.00	0.04	0.04
33.50	1.05	0.25	5.00	0.00	0.04	0.04
33.55	1.05	0.25	5.00	0.00	0.03	0.03
33.60	1.05	0.25	5.00	0.00	0.03	0.03
33.65	1.05	0.25	5.00	0.00	0.03	0.03
33.70	1.05	0.25	5.00	0.00	0.03	0.03
33.75	1.05	0.25	5.00	0.00	0.03	0.03
33.80	1.05	0.25	5.00	0.00	0.03	0.03
33.85	1.05	0.25	5.00	0.00	0.03	0.03
33.90	1.05	0.25	5.00	0.00	0.03	0.03
33.95	1.05	0.25	5.00	0.00	0.03	0.03
34.00	1.05	0.24	5.00	0.00	0.03	0.03
34.05	1.05	0.24	5.00	0.00	0.03	0.03

34.10	1.05	0.24	5.00	0.00	0.03	0.03
34.15	1.05	0.24	5.00	0.00	0.03	0.03
34.20	1.05	0.24	5.00	0.00	0.03	0.03
34.25	1.05	0.24	5.00	0.00	0.03	0.03
34.30	1.05	0.24	5.00	0.00	0.03	0.03
34.35	1.05	0.24	5.00	0.00	0.03	0.03
34.40	1.05	0.24	5.00	0.00	0.03	0.03
34.45	1.05	0.24	5.00	0.00	0.03	0.03
34.50	1.05	0.24	5.00	0.00	0.03	0.03
34.55	1.05	0.24	5.00	0.00	0.03	0.03
34.60	1.05	0.24	5.00	0.00	0.03	0.03
34.65	1.05	0.24	5.00	0.00	0.03	0.03
34.70	1.05	0.24	5.00	0.00	0.03	0.03
34.75	1.05	0.24	5.00	0.00	0.03	0.03
34.80	1.05	0.24	5.00	0.00	0.03	0.03
34.85	1.04	0.24	5.00	0.00	0.03	0.03
34.90	1.04	0.24	5.00	0.00	0.03	0.03
34.95	1.04	0.24	5.00	0.00	0.03	0.03
35.00	1.04	0.24	5.00	0.00	0.03	0.03
35.05	1.04	0.24	5.00	0.00	0.03	0.03
35.10	1.04	0.24	5.00	0.00	0.03	0.03
35.15	1.04	0.24	5.00	0.00	0.03	0.03
35.20	1.04	0.24	5.00	0.00	0.03	0.03
35.25	1.04	0.24	5.00	0.00	0.03	0.03
35.30	1.04	0.24	5.00	0.00	0.03	0.03
35.35	1.04	0.24	5.00	0.00	0.03	0.03
35.40	1.04	0.24	5.00	0.00	0.03	0.03
35.45	1.04	0.24	5.00	0.00	0.03	0.03
35.50	1.04	0.24	5.00	0.00	0.03	0.03
35.55	1.04	0.24	5.00	0.00	0.03	0.03
35.60	1.04	0.24	5.00	0.00	0.03	0.03
35.65	1.04	0.24	5.00	0.00	0.03	0.03
35.70	1.04	0.24	5.00	0.00	0.03	0.03
35.75	1.04	0.24	5.00	0.00	0.03	0.03
35.80	1.04	0.24	5.00	0.00	0.03	0.03
35.85	1.04	0.24	5.00	0.00	0.03	0.03
35.90	1.04	0.24	5.00	0.00	0.03	0.03
35.95	1.04	0.24	5.00	0.00	0.03	0.03
36.00	1.04	0.24	5.00	0.00	0.03	0.03
36.05	1.04	0.24	5.00	0.00	0.03	0.03
36.10	1.04	0.24	5.00	0.00	0.03	0.03
36.15	1.04	0.24	5.00	0.00	0.03	0.03
36.20	1.04	0.24	5.00	0.00	0.03	0.03
36.25	1.04	0.24	5.00	0.00	0.03	0.03
36.30	1.04	0.24	5.00	0.00	0.03	0.03
36.35	1.04	0.24	5.00	0.00	0.03	0.03
36.40	1.04	0.24	5.00	0.00	0.03	0.03
36.45	1.03	0.24	5.00	0.00	0.03	0.03
36.50	1.03	0.24	5.00	0.00	0.03	0.03
36.55	1.03	0.24	5.00	0.00	0.03	0.03
36.60	1.03	0.24	5.00	0.00	0.03	0.03
36.65	1.03	0.24	5.00	0.00	0.03	0.03
36.70	1.03	0.24	5.00	0.00	0.03	0.03
36.75	1.03	0.24	5.00	0.00	0.03	0.03

36.80	1.03	0.24	5.00	0.00	0.03	0.03
36.85	1.03	0.24	5.00	0.00	0.03	0.03
36.90	1.03	0.24	5.00	0.00	0.03	0.03
36.95	1.03	0.24	5.00	0.00	0.03	0.03
37.00	1.03	0.24	5.00	0.00	0.03	0.03
37.05	1.03	0.24	5.00	0.00	0.03	0.03
37.10	1.03	0.24	5.00	0.00	0.03	0.03
37.15	1.03	0.24	5.00	0.00	0.03	0.03
37.20	1.03	0.24	5.00	0.00	0.03	0.03
37.25	1.03	0.24	5.00	0.00	0.03	0.03
37.30	1.03	0.24	5.00	0.00	0.03	0.03
37.35	1.03	0.24	5.00	0.00	0.03	0.03
37.40	1.03	0.24	5.00	0.00	0.03	0.03
37.45	1.03	0.24	5.00	0.00	0.03	0.03
37.50	1.03	0.24	5.00	0.00	0.03	0.03
37.55	1.03	0.24	5.00	0.00	0.03	0.03
37.60	1.03	0.24	5.00	0.00	0.03	0.03
37.65	1.03	0.24	5.00	0.00	0.03	0.03
37.70	1.03	0.24	5.00	0.00	0.03	0.03
37.75	1.03	0.24	5.00	0.00	0.03	0.03
37.80	1.03	0.24	5.00	0.00	0.03	0.03
37.85	1.03	0.24	5.00	0.00	0.03	0.03
37.90	1.03	0.24	5.00	0.00	0.03	0.03
37.95	1.03	0.24	5.00	0.00	0.03	0.03
38.00	1.03	0.24	5.00	0.00	0.03	0.03
38.05	1.02	0.24	5.00	0.00	0.03	0.03
38.10	1.02	0.24	5.00	0.00	0.03	0.03
38.15	1.02	0.24	5.00	0.00	0.03	0.03
38.20	1.02	0.24	5.00	0.00	0.03	0.03
38.25	1.02	0.24	5.00	0.00	0.03	0.03
38.30	1.02	0.24	5.00	0.00	0.03	0.03
38.35	1.02	0.24	5.00	0.00	0.03	0.03
38.40	1.02	0.24	5.00	0.00	0.03	0.03
38.45	1.02	0.24	5.00	0.00	0.03	0.03
38.50	1.02	0.23	5.00	0.00	0.03	0.03
38.55	1.02	0.23	5.00	0.00	0.03	0.03
38.60	1.02	0.23	5.00	0.00	0.03	0.03
38.65	1.02	0.23	5.00	0.00	0.03	0.03
38.70	1.02	0.23	5.00	0.00	0.03	0.03
38.75	1.02	0.23	5.00	0.00	0.03	0.03
38.80	1.02	0.23	5.00	0.00	0.03	0.03
38.85	1.02	0.23	5.00	0.00	0.03	0.03
38.90	1.02	0.23	5.00	0.00	0.03	0.03
38.95	1.02	0.23	5.00	0.00	0.03	0.03
39.00	1.02	0.23	5.00	0.00	0.03	0.03
39.05	1.02	0.23	5.00	0.00	0.03	0.03
39.10	1.02	0.23	5.00	0.00	0.03	0.03
39.15	1.02	0.23	5.00	0.00	0.03	0.03
39.20	1.02	0.23	5.00	0.00	0.03	0.03
39.25	1.02	0.23	5.00	0.00	0.03	0.03
39.30	1.02	0.23	5.00	0.00	0.03	0.03
39.35	1.02	0.23	5.00	0.00	0.03	0.03
39.40	1.02	0.23	5.00	0.00	0.03	0.03
39.45	1.02	0.23	5.00	0.00	0.03	0.03

39.50	1.02	0.23	5.00	0.00	0.03	0.03
39.55	1.02	0.23	5.00	0.00	0.03	0.03
39.60	1.02	0.23	5.00	0.00	0.03	0.03
39.65	1.02	0.23	5.00	0.00	0.03	0.03
39.70	1.01	0.23	5.00	0.00	0.03	0.03
39.75	1.01	0.23	5.00	0.00	0.03	0.03
39.80	1.01	0.23	5.00	0.00	0.03	0.03
39.85	1.01	0.23	5.00	0.00	0.03	0.03
39.90	1.01	0.23	5.00	0.00	0.03	0.03
39.95	1.01	0.23	5.00	0.00	0.03	0.03
40.00	1.01	0.23	5.00	0.00	0.03	0.03
40.05	1.01	0.23	5.00	0.00	0.03	0.03
40.10	1.01	0.23	5.00	0.00	0.03	0.03
40.15	1.01	0.23	5.00	0.00	0.03	0.03
40.20	1.01	0.23	5.00	0.00	0.03	0.03
40.25	1.01	0.23	5.00	0.00	0.03	0.03
40.30	1.01	0.23	5.00	0.00	0.03	0.03
40.35	1.01	0.23	5.00	0.00	0.03	0.03
40.40	1.01	0.23	5.00	0.00	0.03	0.03
40.45	1.01	0.23	5.00	0.00	0.03	0.03
40.50	1.01	0.23	5.00	0.00	0.03	0.03
40.55	1.01	0.23	5.00	0.00	0.03	0.03
40.60	1.01	0.23	5.00	0.00	0.03	0.03
40.65	1.01	0.23	5.00	0.00	0.03	0.03
40.70	1.01	0.23	5.00	0.00	0.03	0.03
40.75	1.01	0.23	5.00	0.00	0.03	0.03
40.80	1.01	0.23	5.00	0.00	0.03	0.03
40.85	1.01	0.23	5.00	0.00	0.03	0.03
40.90	1.01	0.23	5.00	0.00	0.03	0.03
40.95	1.01	0.23	5.00	0.00	0.03	0.03
41.00	1.01	0.23	5.00	0.00	0.03	0.03
41.05	1.01	0.23	5.00	0.00	0.03	0.03
41.10	1.01	0.23	5.00	0.00	0.03	0.03
41.15	1.01	0.23	5.00	0.00	0.03	0.03
41.20	1.01	0.23	5.00	0.00	0.03	0.03
41.25	1.01	0.23	5.00	0.00	0.03	0.03
41.30	1.01	0.23	5.00	0.00	0.03	0.03
41.35	1.00	0.23	5.00	0.00	0.03	0.03
41.40	1.00	0.23	5.00	0.00	0.03	0.03
41.45	1.00	0.23	5.00	0.00	0.02	0.02
41.50	1.00	0.23	5.00	0.00	0.02	0.02
41.55	1.00	0.23	5.00	0.00	0.02	0.02
41.60	1.00	0.23	5.00	0.00	0.02	0.02
41.65	1.00	0.23	5.00	0.00	0.02	0.02
41.70	1.00	0.23	5.00	0.00	0.02	0.02
41.75	1.00	0.23	5.00	0.00	0.02	0.02
41.80	1.00	0.23	5.00	0.00	0.02	0.02
41.85	1.00	0.23	5.00	0.00	0.02	0.02
41.90	1.00	0.23	5.00	0.00	0.02	0.02
41.95	1.00	0.23	5.00	0.00	0.02	0.02
42.00	1.00	0.23	5.00	0.00	0.02	0.02
42.05	1.00	0.23	5.00	0.00	0.02	0.02
42.10	1.00	0.23	5.00	0.00	0.02	0.02
42.15	1.00	0.23	5.00	0.00	0.02	0.02

42.20	1.00	0.23	5.00	0.00	0.02	0.02
42.25	1.00	0.23	5.00	0.00	0.02	0.02
42.30	1.00	0.23	5.00	0.00	0.02	0.02
42.35	1.00	0.23	5.00	0.00	0.02	0.02
42.40	1.00	0.23	5.00	0.00	0.02	0.02
42.45	1.00	0.23	5.00	0.00	0.02	0.02
42.50	1.00	0.23	5.00	0.00	0.02	0.02
42.55	1.00	0.23	5.00	0.00	0.02	0.02
42.60	1.00	0.23	5.00	0.00	0.02	0.02
42.65	1.00	0.23	5.00	0.00	0.02	0.02
42.70	1.00	0.23	5.00	0.00	0.02	0.02
42.75	1.00	0.23	5.00	0.00	0.02	0.02
42.80	1.00	0.23	5.00	0.00	0.02	0.02
42.85	1.00	0.23	5.00	0.00	0.02	0.02
42.90	1.00	0.23	5.00	0.00	0.02	0.02
42.95	1.00	0.23	5.00	0.00	0.02	0.02
43.00	1.00	0.22	5.00	0.00	0.02	0.02
43.05	1.00	0.22	5.00	0.00	0.02	0.02
43.10	0.99	0.22	5.00	0.00	0.02	0.02
43.15	0.99	0.22	5.00	0.00	0.02	0.02
43.20	0.99	0.22	5.00	0.00	0.02	0.02
43.25	0.99	0.22	5.00	0.00	0.02	0.02
43.30	0.99	0.22	5.00	0.00	0.02	0.02
43.35	0.99	0.22	5.00	0.00	0.02	0.02
43.40	0.99	0.22	5.00	0.00	0.02	0.02
43.45	0.99	0.22	5.00	0.00	0.02	0.02
43.50	0.99	0.22	5.00	0.00	0.02	0.02
43.55	0.99	0.22	5.00	0.00	0.02	0.02
43.60	0.99	0.22	5.00	0.00	0.02	0.02
43.65	0.99	0.22	5.00	0.00	0.02	0.02
43.70	0.99	0.22	5.00	0.00	0.02	0.02
43.75	0.99	0.22	5.00	0.00	0.02	0.02
43.80	0.99	0.22	5.00	0.00	0.02	0.02
43.85	0.99	0.22	5.00	0.00	0.02	0.02
43.90	0.99	0.22	5.00	0.00	0.02	0.02
43.95	0.99	0.22	5.00	0.00	0.02	0.02
44.00	0.99	0.22	5.00	0.00	0.02	0.02
44.05	0.99	0.22	5.00	0.00	0.02	0.02
44.10	0.99	0.22	5.00	0.00	0.02	0.02
44.15	0.99	0.22	5.00	0.00	0.02	0.02
44.20	0.99	0.22	5.00	0.00	0.02	0.02
44.25	0.99	0.22	5.00	0.00	0.02	0.02
44.30	0.99	0.22	5.00	0.00	0.02	0.02
44.35	0.99	0.22	5.00	0.00	0.02	0.02
44.40	0.99	0.22	5.00	0.00	0.02	0.02
44.45	0.99	0.22	5.00	0.00	0.02	0.02
44.50	0.99	0.22	5.00	0.00	0.02	0.02
44.55	0.99	0.22	5.00	0.00	0.02	0.02
44.60	0.99	0.22	5.00	0.00	0.02	0.02
44.65	0.99	0.22	5.00	0.00	0.02	0.02
44.70	0.99	0.22	5.00	0.00	0.02	0.02
44.75	0.99	0.22	5.00	0.00	0.02	0.02
44.80	0.99	0.22	5.00	0.00	0.02	0.02
44.85	0.98	0.22	5.00	0.00	0.02	0.02

44.90	0.98	0.22	5.00	0.00	0.02	0.02
44.95	0.98	0.22	5.00	0.00	0.02	0.02
45.00	0.98	0.22	5.00	0.00	0.02	0.02
45.05	0.98	0.22	5.00	0.00	0.02	0.02
45.10	0.98	0.22	5.00	0.00	0.02	0.02
45.15	0.98	0.22	5.00	0.00	0.02	0.02
45.20	0.98	0.22	5.00	0.00	0.02	0.02
45.25	0.98	0.22	5.00	0.00	0.02	0.02
45.30	0.98	0.22	5.00	0.00	0.02	0.02
45.35	0.98	0.22	5.00	0.00	0.02	0.02
45.40	0.98	0.22	5.00	0.00	0.02	0.02
45.45	0.98	0.22	5.00	0.00	0.02	0.02
45.50	0.98	0.22	5.00	0.00	0.02	0.02
45.55	0.98	0.22	5.00	0.00	0.02	0.02
45.60	0.98	0.22	5.00	0.00	0.02	0.02
45.65	0.98	0.22	5.00	0.00	0.02	0.02
45.70	0.98	0.22	5.00	0.00	0.01	0.01
45.75	0.98	0.22	5.00	0.00	0.01	0.01
45.80	0.98	0.22	5.00	0.00	0.01	0.01
45.85	0.98	0.22	5.00	0.00	0.01	0.01
45.90	0.98	0.22	5.00	0.00	0.01	0.01
45.95	0.98	0.22	5.00	0.00	0.01	0.01
46.00	0.98	0.22	5.00	0.00	0.01	0.01
46.05	0.98	0.22	5.00	0.00	0.01	0.01
46.10	0.98	0.22	5.00	0.00	0.01	0.01
46.15	0.98	0.22	5.00	0.00	0.01	0.01
46.20	0.98	0.22	5.00	0.00	0.01	0.01
46.25	0.98	0.22	5.00	0.00	0.01	0.01
46.30	0.98	0.22	5.00	0.00	0.01	0.01
46.35	0.98	0.22	5.00	0.00	0.01	0.01
46.40	0.98	0.22	5.00	0.00	0.01	0.01
46.45	0.98	0.22	5.00	0.00	0.01	0.01
46.50	0.98	0.22	5.00	0.00	0.01	0.01
46.55	0.98	0.22	5.00	0.00	0.01	0.01
46.60	0.98	0.22	5.00	0.00	0.01	0.01
46.65	0.98	0.22	5.00	0.00	0.01	0.01
46.70	0.97	0.22	5.00	0.00	0.01	0.01
46.75	0.97	0.22	5.00	0.00	0.01	0.01
46.80	0.97	0.22	5.00	0.00	0.01	0.01
46.85	0.97	0.22	5.00	0.00	0.01	0.01
46.90	0.97	0.22	5.00	0.00	0.01	0.01
46.95	0.97	0.22	5.00	0.00	0.01	0.01
47.00	0.97	0.22	5.00	0.00	0.01	0.01
47.05	0.97	0.22	5.00	0.00	0.01	0.01
47.10	0.97	0.22	5.00	0.00	0.01	0.01
47.15	0.97	0.22	5.00	0.00	0.01	0.01
47.20	0.97	0.22	5.00	0.00	0.01	0.01
47.25	0.97	0.22	5.00	0.00	0.01	0.01
47.30	0.97	0.22	5.00	0.00	0.01	0.01
47.35	0.97	0.22	5.00	0.00	0.01	0.01
47.40	0.97	0.22	5.00	0.00	0.01	0.01
47.45	0.96	0.22	5.00	0.00	0.01	0.01
47.50	0.94	0.21	5.00	0.00	0.01	0.01
47.55	0.93	0.21	5.00	0.00	0.01	0.01

47.60	0.92	0.21	5.00	0.00	0.01	0.01
47.65	0.92	0.21	5.00	0.00	0.01	0.01
47.70	0.91	0.21	5.00	0.00	0.01	0.01
47.75	0.90	0.21	5.00	0.00	0.01	0.01
47.80	0.90	0.21	5.00	0.00	0.01	0.01
47.85	0.89	0.21	5.00	0.00	0.01	0.01
47.90	0.89	0.21	5.00	0.00	0.01	0.01
47.95	0.88	0.21	5.00	0.00	0.01	0.01
48.00	0.87	0.21	5.00	0.00	0.01	0.01
48.05	0.87	0.21	5.00	0.00	0.01	0.01
48.10	0.87	0.21	5.00	0.00	0.01	0.01
48.15	0.86	0.21	5.00	0.00	0.01	0.01
48.20	0.86	0.21	5.00	0.00	0.01	0.01
48.25	0.85	0.21	5.00	0.00	0.01	0.01
48.30	0.85	0.21	5.00	0.00	0.01	0.01
48.35	0.85	0.21	5.00	0.00	0.01	0.01
48.40	0.84	0.21	5.00	0.00	0.01	0.01
48.45	0.84	0.21	5.00	0.00	0.01	0.01
48.50	0.83	0.21	5.00	0.00	0.01	0.01
48.55	0.83	0.21	5.00	0.00	0.01	0.01
48.60	0.83	0.21	5.00	0.00	0.01	0.01
48.65	0.83	0.21	5.00	0.00	0.01	0.01
48.70	0.82	0.21	5.00	0.00	0.01	0.01
48.75	0.82	0.21	5.00	0.00	0.01	0.01
48.80	0.82	0.21	5.00	0.00	0.01	0.01
48.85	0.81	0.21	5.00	0.00	0.01	0.01
48.90	0.81	0.21	5.00	0.00	0.01	0.01
48.95	0.81	0.21	5.00	0.00	0.01	0.01
49.00	0.81	0.21	5.00	0.00	0.01	0.01
49.05	0.80	0.21	5.00	0.00	0.01	0.01
49.10	0.80	0.21	5.00	0.00	0.01	0.01
49.15	0.80	0.21	5.00	0.00	0.01	0.01
49.20	0.80	0.21	5.00	0.00	0.01	0.01
49.25	0.79	0.21	5.00	0.00	0.01	0.01
49.30	0.79	0.21	5.00	0.00	0.00	0.00
49.35	0.79	0.21	5.00	0.00	0.00	0.00
49.40	0.79	0.21	5.00	0.00	0.00	0.00
49.45	0.79	0.21	5.00	0.00	0.00	0.00
49.50	0.78	0.21	5.00	0.00	0.00	0.00
49.55	0.78	0.21	5.00	0.00	0.00	0.00
49.60	0.78	0.21	5.00	0.00	0.00	0.00
49.65	0.78	0.21	5.00	0.00	0.00	0.00
49.70	0.78	0.21	5.00	0.00	0.00	0.00
49.75	0.78	0.21	5.00	0.00	0.00	0.00
49.80	0.77	0.21	5.00	0.00	0.00	0.00
49.85	0.77	0.21	5.00	0.00	0.00	0.00
49.90	0.77	0.21	5.00	0.00	0.00	0.00
49.95	0.77	0.21	5.00	0.00	0.00	0.00
50.00	0.77	0.21	5.00	0.00	0.00	0.00
50.05	0.76	0.21	5.00	0.00	0.00	0.00
50.10	0.76	0.21	5.00	0.00	0.00	0.00
50.15	0.76	0.21	5.00	0.00	0.00	0.00
50.20	0.76	0.21	5.00	0.00	0.00	0.00
50.25	0.76	0.21	5.00	0.00	0.00	0.00

50.30	0.76	0.21	5.00	0.00	0.00	0.00
50.35	0.76	0.21	5.00	0.00	0.00	0.00
50.40	0.75	0.21	5.00	0.00	0.00	0.00
50.45	0.75	0.21	5.00	0.00	0.00	0.00
50.50	0.75	0.21	5.00	0.00	0.00	0.00
50.55	0.75	0.21	5.00	0.00	0.00	0.00
50.60	0.75	0.21	5.00	0.00	0.00	0.00
50.65	0.75	0.21	5.00	0.00	0.00	0.00
50.70	0.75	0.21	5.00	0.00	0.00	0.00
50.75	0.74	0.21	5.00	0.00	0.00	0.00
50.80	0.74	0.21	5.00	0.00	0.00	0.00
50.85	0.74	0.21	5.00	0.00	0.00	0.00
50.90	0.74	0.21	5.00	0.00	0.00	0.00
50.95	0.74	0.21	5.00	0.00	0.00	0.00
51.00	0.74	0.21	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

APPENDIX D

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APPENDIX D

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August 28, 2023

Project No. 07-230527-0

Ms. Rosalind Cox
Madera Unified School District
1205 South Madera Avenue
Madera, CA 93637

Subject: Geotechnical Investigation and Geohazards Study Report
New Kindergarten Classrooms at Virginia Lee Rose Elementary School
1001 Lilly Street
Madera, CA 93638


Dear Ms. Cox:

In accordance with your request, we have performed a geotechnical investigation and geohazards study for the subject project. This work was performed in accordance with Section 1803A.6 of the 2022 California Building Code (CBC). The results of our geotechnical investigation and geohazards study are presented in the accompanying report, which includes a description of site conditions and potential geologic hazards, results of our field investigation and laboratory testing, conclusions, and recommendations.


We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,


RMA GeoScience, Inc.



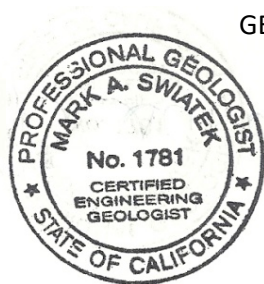
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**GEOTECHNICAL INVESTIGATION AND GEOHAZARDS STUDY REPORT
NEW KINDERGARTEN CLASSROOMS AT VIRGINIA LEE ROSE ELEMENTARY SCHOOL
1001 LILLY STREET
MADERA, CALIFORNIA 93638**

for

Madera Unified School District
1205 South Madera Avenue
Madera, California 93637

August 28, 2023

Project No. 07-230527-0

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Figure 5	Boring Location Map
Figure 6	Cross Section A to A'

APPENDICES

Appendix A	Field Investigation
Appendix B	Laboratory Tests
Appendix C	Liquefaction/Seismic Settlement Analysis
Appendix D	References

1.00 INTRODUCTION

1.01 Purpose

A geotechnical investigation and geohazards study has been completed for the New Kindergarten Classrooms at Virginia Lee Rose Elementary School project in Madera, California. The purpose of the investigation was to summarize geotechnical and geologic conditions at the site, to assess their potential impact on the proposed development, and to develop geotechnical engineering design parameters for the project.

1.02 Scope of the Study

The general scope of this study included the following:

- Review of published and unpublished geologic, seismic, groundwater and geotechnical literature. This included reviewing the following geotechnical reports:
- Examination of aerial photographs and topographic maps.
- Contacting of Underground Service Alert to locate onsite utility lines.
- Logging, sampling, and backfilling of three exploratory borings drilled with a SIMCO 2800 drill rig: one to an approximate depth of 51 feet and two to an approximate depth of 21 feet.
- Laboratory testing of representative soil samples.
- Geotechnical evaluation of the compiled data.
- Preparation of this report presenting our findings and conclusions.

As part of the geohazards study associated with our geotechnical investigation, our scope of services included addressing applicable items in California Geological Survey – Note 48, Checklist for the review of engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Service Buildings, October 2013.

Our scope of work did not include a preliminary site assessment for the potential of hazardous materials onsite.

1.03 Site Location and Description

The project site lies within the existing Virginia Lee Rose Elementary School in Madera, California, which was constructed prior to 2017. The location of the site relative to nearby streets is indicated on Figure 1, Site Vicinity Map. Its geographic position is 36.9572° north latitude and 120.0392° west longitude. The existing ground surface is relatively flat and the elevation above mean sea level at the project site is approximately 275 feet according to the USGS Madera 7.5 Minute Quadrangle (see Figure 2).



Photo taken near the northeast corner of the site, facing southwest. Taken on July 24, 2023.



Photo taken near the southwest corner of the site, facing northeast. Taken on July 24, 2023.

1.04 Planned Improvements

Based on our review of the information provided, which included a site plan prepared by PBK, we understand the project will consist primarily of the installation/construction of two (2) new modular buildings with an approximate footprint area of 3,550 square feet each. It is anticipated that the new buildings will be wood-framed, with concrete slab-on-grade floors, and shallow reinforced-concrete foundations. Maximum wall and column loads (dead plus live, not including wind or seismic loads) are anticipated to be less than 2.0 kips per foot and 50 kips, respectively. Appurtenant improvements are anticipated to be various underground utilities, new concrete flatwork, and landscaping. No grading plan was available at the time of the preparation of this report.

1.05 Investigation Methods

Our investigation consisted of office research, review of the compiled data, and preparation of this report. It has been performed in a manner consistent with generally accepted engineering and geologic principles and practices and has incorporated applicable requirements of California Building Code. Definitions of technical terms and symbols used in this report include those of the ASTM International, the California Building Code, and commonly used geologic nomenclature. Technical supporting data are presented in the attached appendices. Appendix A presents a description of the methods and equipment used in performing the field exploration and logs of our subsurface exploration. Appendix B presents a description of our laboratory testing and the test results. Results of our liquefaction and seismic settlement analysis are provided in Appendix C. References are presented in Appendix D.

2.00 FINDINGS

2.01 Geologic Setting

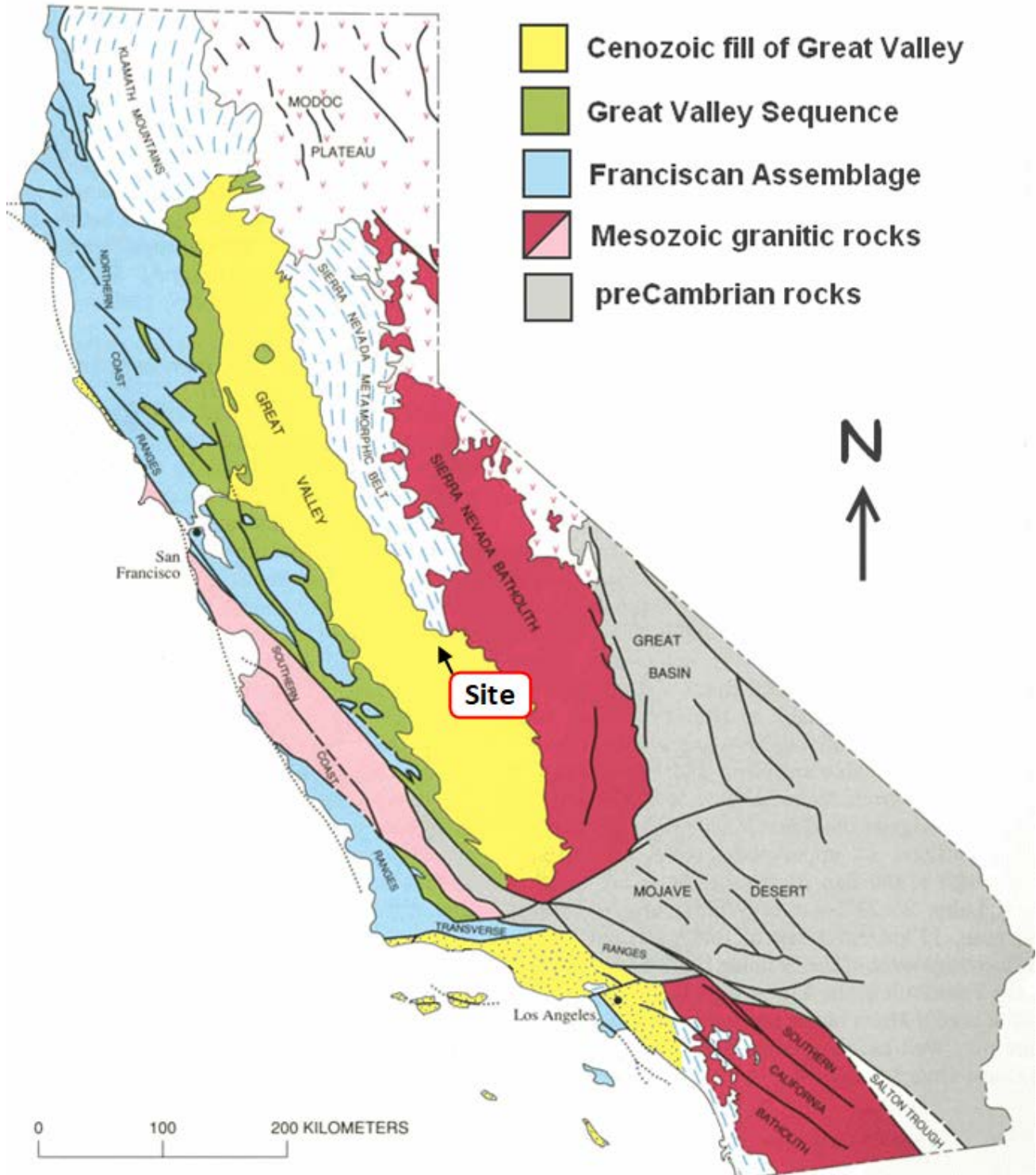
The subject site is located in the south-central San Joaquin Valley, which comprises the southern half of the Great Valley geomorphic province. The valley is a westward-titling trough which forms a broad alluvial fan, approximately 200 miles long and 50 to 70 miles wide, where the eastern flank is broad and gently inclined, as opposed to the western flank which is relatively narrow (Bartow, 1991; Page, 1968). The Central Valley consists of the Great Valley Sequence, overlain by Cenozoic alluvium. Underlying the Great Valley Sequence are the Franciscan Assemblage to the west and the Sierra Nevada batholith to the east (Bailey, Irwin, and Jones, 1964).

The Franciscan Assemblage, made up of deformed and high pressure and low temperature metamorphosed mafic and ultramafic rocks, was formed around the Late Jurassic through the Miocene (160 to about 20 million years ago) by the offscraping of rocks from a subducting plate dipping to the east (Wakabayashi, 1992; Wakabayashi, 2010).

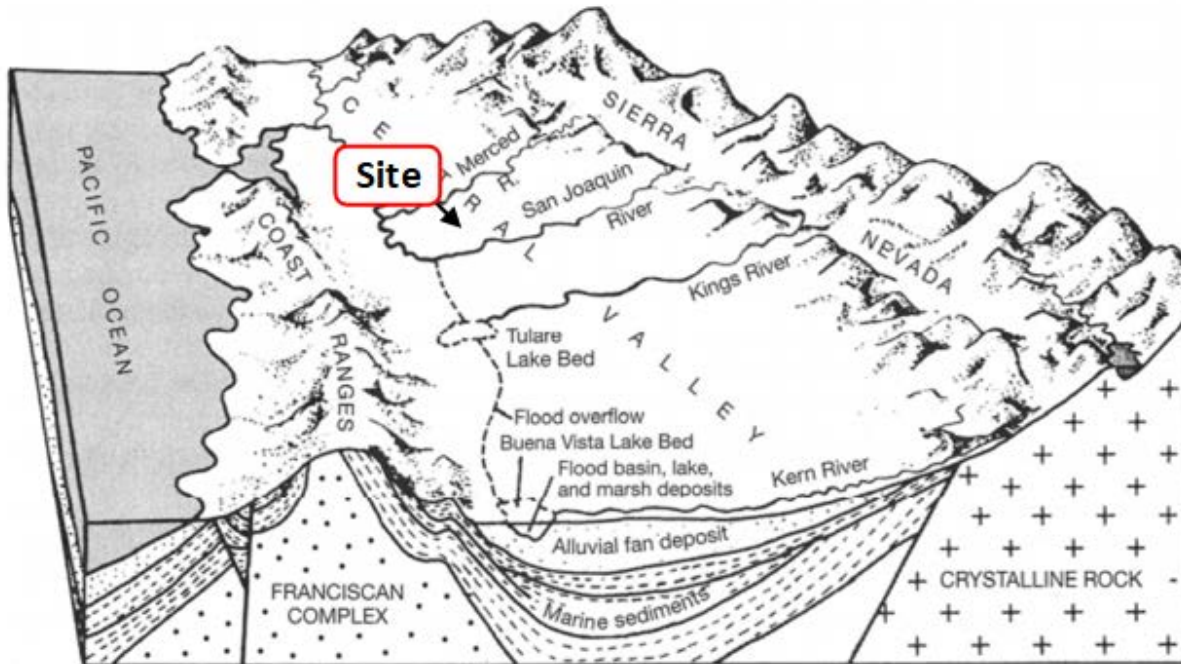
The Sierra Nevada started to form during the Early Jurassic (around 200 million years ago) when the Farallon Plate began subducting under the North American Plate. This subduction resulted in several orogenies, or mountain building events, that created the granitic Sierra Nevada Batholith deep below the surface. During the

Miocene (around 10 million years ago), vertical movement along the Sierra Nevada Frontal Fault Zone (part of the Eastern California Shear Zone) began to uplift the Sierra Nevada. This uplift and erosion exposed the batholiths to the surface. From the Pleistocene (commonly known as the most recent Ice Age) to the present, glaciers have been carving out many parts of the Sierras. The current uplift of the Sierra Nevada is 1 - 2mm per year (Hammond, et al. 2012).

The Great Valley Sequence is a 40,000 foot sequence of marine shale, sandstone, and conglomerate beds, deposited in a deep marine environment during the Late Jurassic through the Cretaceous (150 – 65 million years ago). Overlying the Great Valley Sequence is several thousand feet of Cenozoic alluvium, deposited by: streams and rivers draining from the mountains and creating alluvial fans; by lakes that covered parts of the valley floor from time to time; flooding; and marsh environments (Page, 1986). In some places, it is thousands of feet thick, and more than half of this thickness is composed of fine grained fluvial and lacustrine deposits. Holocene deposition consists mainly of episodic deposition of alluvial sediments (Bartow, 1991; Page, 1986). A generalized geologic map for the State of California is shown below and Figure 3A illustrates the geologic setting within the regional area of the project site. As shown on Figure 3A, the project site is situated on Quaternary deposits of alluvium that are estimated to be several thousand feet deep.



Geologic map showing the locations of Cenozoic alluvium/fill (yellow) overlying the Great Valley Sequence (green), the Franciscan Assemblage (blue), and the Sierra Nevada Batholith (red). Modified from: Irwin (1990).



Geologic block diagram of California. From: Harden (2004). Not to scale.

2.02 Earth Materials

The soils encountered in our test borings consisted primarily of both reworked and native soils. The reworked soil consisted of sandy silt extended from the surface to a depth of approximately 2 to 3 feet. The native soil profile consisted of sandy silt with varying amounts of clay, silty sand with varying amounts of clay, and poorly graded sand to the maximum depth explored of approximately 51 feet. These layers varied in thickness and appear to be horizontally discontinuous across the project site. The granular soils generally had a relative density of loose to dense, while the fine-grained soils had a relative consistency of soft to hard. As indicated above, the soils encountered in the test borings are related to deep alluvial deposits that have been deposited over the past several thousand years.

A Boring Location Map showing the locations of the referenced test borings is presented as Figure 5. The logs of our recent exploratory borings are presented in Appendix A, which provide more detailed information of the soils that were encountered to a depth of approximately 51 feet at the project site.

2.03 Expansive Soils

Our field exploration indicates that the near surface soils at the project site have a medium expansion potential (Expansion Index, EI, of 51). Results of our laboratory tests are presented in Appendix B.

2.04 Surface and Groundwater Conditions

Groundwater was not encountered during our subsurface exploration. No areas of ponding or standing water were observed at the time of our study, and no seepage was observed in the exploratory borings to the maximum depth explored of approximately 51 feet below existing ground surface.

According to recent groundwater data from the SGMA Data Viewer application, the depth to groundwater in the vicinity of the project site is approximately 193 feet as of Fall 2022. Historical data derived from wells (State Well Number 11S18E20N001M, 11S18E30D001M, 11S18E21E001M, 11S18E29H001M, and 11S18E17L001M) located approximately 0.31 miles southeast, 0.97 miles southwest, 1.18 miles northeast, 1.18 miles southeast, and 1.19 miles north/northeast, respectively, of the project site indicates the depth to ground water in the vicinity of the project site was approximately 35 feet deep in the 1930's, gradually declined to a depth of approximately 73 feet by the 1960's, and declined further to a depth of approximately 107 feet by the 1990's, with a historical high of 20.7 feet in November 1923.

Since November 1920 (the earliest well data available) the depth to groundwater has increased significantly, falling 173 feet in 103 years. Some recovery in the groundwater could occur, especially following a period of wet years. However, in consideration of the demand for groundwater related to domestic and agricultural purposes, it is highly unlikely that the groundwater table will recover much above the levels observed during, or prior to, the 1980's. Thus, although the "historical high" groundwater table is approximately 20.7 feet at the project site, a design "high" groundwater table of 86 feet is recommended for Civil Engineering purposes.

2.05 Faults

The site is not located within the boundaries of an Earthquake Fault Zone for fault-rupture hazard as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no faults are known to pass through the property. The nearest active earthquake fault zones are the Ortigalita Fault Zone, the Nunez Fault, the San Andreas Fault Zone, the Calaveras Fault Zone, and the Quien Sabe Fault located approximately 48.6 miles west-southwest, 54.5 miles south-southwest, 65.0 miles southwest, 67.3 miles west-southwest, and 68.0 miles west, respectively, of the project site. The location of the project site relative to these and other fault zones is illustrated on Figure 4a.

Our research of regional geologic and seismic data did not reveal any known instances of ground failure in the vicinity of the site associated with regional seismic activity. Seismic design parameters relative to the requirements of the 2022 California Building Code (CBC) are presented in Section 3.10.

2.06 Historic Seismicity

According to the California Historical Earthquakes Online Database maintained by the California Geological Survey and the United States Geological Survey (USGS) database, there have been no historic earthquakes with a magnitude greater than or equal to 5.5 with an epicenter within 50 miles of the site. Large historic earthquakes in California with an epicenter of less than 100 miles away from the site are summarized in the table below.

Large Historic Earthquakes

Event	Date	Magnitude	Distance from Site (Miles)
NE of San Juan Bautista	June 10, 1836	6.4	81
E of San Juan Bautista	January 18, 1840	6.5	81
SE of San Juan Bautista	July 3, 1841	6.0	81
E of King City	September 2, 1853	6.3	65
W of Coalinga	January 9, 1857	6.1	68
Fort Tejon	January 9, 1857	7.9	88
NE of King City	April 17, 1860	6.0	66
NE of Morgan Hill	February 26, 1864	6.1	88
SW of Tracy	July 15, 1866	6.0	95
NW of Bishop	April 11, 1872	6.8	93
NW of Parkfield	February 2, 1881	6.0	69
SW of Patterson	April 10, 1881	6.3	74
SW of Hollister	March 30, 1883	6.0	82
E of King City	April 12, 1885	6.5	67
SW of Bishop	September 30, 1889	6.0	76
E of Watsonville	April 24, 1890	6.3	87
SW of Independence	August 17, 1896	6.3	98
E of Gilroy	June 20, 1897	6.3	81
W of San Juan Bautista	April 30, 1899	6.0	87
NW of Parkfield	March 3, 1901	6.4	71
SE of Morgan Hill	July 21, 1911	6.5	89
SE of Mammoth Lakes	May 25, 1980	6.1	80
E of Mammoth Lakes	May 25, 1980	6.0	80
SE of Mammoth Lakes	May 25, 1980	6.1	79
SE of Mammoth Lakes	May 27, 1980	6.2	78
NE of Coalinga	May 2, 1983	6.7	52
E of San Jose	April 4, 1984	6.2	94
NW of Bishop	November 23, 1984	6.1	86
N of Bishop	July 21, 1986	6.4	97
SE of Parkfield	September 28, 2004	6.0	81

2.07 Flooding Potential

According to Federal Emergency Management Agency Flood Insurance Rate Map Panel #06039C1160E (effective on September 26, 2008), the site is located within a shaded area of “Zone X”, which is defined as “areas of 0.2% annual chance flood”, “areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile”, and “areas protected by levees from 1% annual chance flood”.

Control of surface runoff originating from within and outside of the site should be included in design of the project.

2.08 Landslides

Since there are no natural or manmade slopes in the vicinity of the project site, landslides are not a hazard at this site.

2.09 Other Geologic Hazards

California Geologic Survey Note 48 (2011) identifies a number of exceptional geologic hazards that can occur at individual sites, but do not occur statewide. Evaluation of these exceptional conditions is referred to as a conditional geologic assessment by Note 48. Specific assessment items listed in Note 48 are addressed in the table below.

Conditional Geologic Assessment

Hazard	Assessment	Reference
Methane gas, hydrogen-sulfide gas, tar seeps	Not applicable; site is not located within an oil field identified as a high risk area for hazardous gas accumulations.	See Section 1.03.
Volcanic eruption	Not applicable; site is not located in a known hazard area for volcanic eruptions.	Miller, 1989 (U.S.G.S. Bulletin 1847)
Flooding	The proposed development area is located within the boundaries of a 100-year or 500-year flood zone.	See Section 2.07.
Tsunami and seiches inundation	Not applicable.	See Section 3.11.
Radon-222 gas	Not applicable; typically a concern in the California Coast Ranges.	See Section 2.01 and CGS Note 48.
Naturally occurring asbestos	Not applicable; site is not located in an area likely to contain naturally occurring asbestos.	Churchill and Hill, 2000 (DMG OFR 2000-19)
Hydrocollapse due to anthropic use of water	Due to the density of the underlying soils, hydrocollapse due to anthropic use of water is unlikely.	See Sections 2.01, 2.02, and Appendix A.

Hazard	Assessment	Reference
Regional land subsidence	The site is not identified in an area of large historic subsidence within the California Central Valley. Control of subsidence will dependent upon proper jurisdictional management of groundwater resources.	Madera County General Plan Background Report, 1995, and Borches and Carpenter, 2014.
Clays and cyclic softening	Soils within the upper 51 feet of the ground surface are primarily granular rather than clays. Expansive properties of near-surface soils have been considered in foundation design.	See Sections 2.03, 3.04, and 3.12.

3.00 CONCLUSIONS AND RECOMMENDATIONS

3.01 General Conclusions

Based on specific data and information contained in this report, our understanding of the project, and our geotechnical engineering experience, it is our professional judgment that the proposed development is geologically and geotechnically feasible. Our review of geological literature and the field exploration performed for this project did not indicate any unusual conditions at the site that would entail special design considerations or construction procedures. Specific geotechnical recommendations and guidelines are presented below to provide information for other members of the design team that can be used to prepare the project plans and specifications for the planned improvements to the administration building.

3.02 General Earthwork and Grading

All grading should be performed in accordance with the recommendations provided below, the project plans and specifications, Appendix J of the 2022 California Building Code and all applicable governmental agency requirements. In the event of conflicts between this report and the other referenced documents, this report shall govern. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 laboratory test procedures.

3.03 Rippability and Rock Disposal

Exploratory borings that have been done at the project site were advanced without difficulty and no oversize materials were encountered. Accordingly, we expect that all earth materials will be rippable with conventional grading equipment and oversized materials are not expected.

3.04 Earthwork Recommendations

All vegetation, organic rich soils (soils containing more than 2 percent organics by weight), trash, debris, existing pavement sections and underground utilities, should be cleared from the grading area and removed from the site. After the removal of deleterious materials and the stripping of organic-rich soils, the following over-excavation must be done within the area of the planned improvements:

- Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 24 inches below the stripped subgrade surface or 12 inches below the bottom of footings, whichever is lower. The bottom of the over-excavation within each building area must be level and at a uniform depth below the finished pad elevation.
- Outside of the “building pad” area indicated above, no over-excavation should be required unless loose or unstable soils are present that will require some over-excavation prior to the scarification, moisture conditioning, and compaction as recommended below.

Following the over-excavation indicated above, a designated representative for the Project Geotechnical Engineer must review the exposed ground surface and determine if any additional over-excavation is required.

The over-excavated ground surface in all areas determined to be satisfactory for the support of fills must be scarified to a minimum depth of 12 inches. Scarification should continue until the soils are broken down and free from lumps or clods and until the scarified zone is uniform. The moisture content of the scarified zone shall be adjusted to near optimum moisture content. The scarified zone must then be uniformly compacted to at least 90 percent relative compaction within the building pad area and concrete flatwork and to at least 95 percent relative compaction within paved areas that will be subject to vehicular traffic.

Removed and/or over-excavated soils, free of organics and other deleterious material, may be used as engineered fill. Fill material should be placed in nearly horizontal layers, uniformly moisture conditioned to near optimum moisture content, and then compacted in layers that do not exceed approximately 8 inches in thickness. Thicker lifts may be placed if testing indicates the compaction procedures are such that the required compaction is being achieved and the geotechnical consultant approves their use. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Engineered fill must be compacted to achieve a relative compaction of at least 90 percent, except for the upper 12 inches of subgrade below asphalt or concrete pavement sections subject to vehicular traffic, which must be compacted to at least 95 percent. Based on our observations of the existing field conditions and lab testing data, a shrinkage factor (decrease in volume of soil upon removal and recompaction) in the range of 5 to 10 percent is considered applicable for this project.

The above recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. Hence, over-excavation depths must be verified, and adjusted if

necessary, at the time of grading. In addition, any contaminated soils within three (3) feet of the finished subgrade surface, must be removed and properly disposed of outside the area the planned improvements.

3.05 Imported Fill Material

If required, imported fill materials that will be placed within building or concrete flatwork areas must be non-hazardous and be obtained from a single, uniform source that meets the following criteria:

Gradation			
Sieve Size		Percent Passing	
3-inch		100%	
3/4-inch		90% - 100%	
#4		60% - 100%	
#200		20% - 50%	
Maximum Expansion Index		Maximum Plasticity Index	
20		10	
Minimum R-Value (in paved areas)			
50			
Maximum Organic Content			
< 2% by weight			
Corrosivity			
pH	Minimum Resistivity (ohm-cm)	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)
6.0 to 8.5	> 5,000*	< 1,000	< 200

*unless other requirement established by the Design Engineer

3.06 Temporary Slopes and Shoring

Our geotechnical investigation indicates that excavations less than 4 feet in depth may generally be constructed with vertical sidewalls without shoring or shielding. Temporary excavations in existing alluvial soils that are deeper than 4 feet may be safely made at an inclination of 1:1 or flatter. If vertical sidewalls are required in excavations greater than 4 feet in depth, the use of cantilevered or braced shoring is recommended. The following geotechnical parameters can be used to design a shoring system:

Moist Unit Weight of Soils: 130 pcf
 Angle of Internal Friction (ϕ): 30°
 Cohesion: 200 psf

Unless vehicles, equipment, materials, etc., are kept a minimum distance equal to the height of the excavation away from the edge of the excavation, a surcharge load equal to a uniform lateral pressure of 72 psf should be assumed to act on the shoring in addition to the earth pressure calculated using the above geotechnical parameters.

Vehicles, equipment, materials, etc. should be set back a minimum distance of 10 feet from the top edge of sloped or vertical excavations. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation. In any case, Cal/OSHA construction safety orders should be observed during all underground work.

3.07 Fill and Cut Slopes

Due to the low gradient of the property, it appears that construction of cut and fill slopes will not be required. If such slopes are proposed, they should be inclined no steeper than 2 horizontal to 1 vertical. In addition, appropriate landscaping measures should be taken to protect the face of slopes from erosion.

3.08 Utility Trench Backfill

The existing onsite soils will generally not be suitable for use as pipe bedding for buried utilities. All pipes should be bedded in sand or other suitable material as specified by the Project Civil Engineer and/or as specified by the pipe/conduit manufacturer. We recommend the bedding material have a Sand Equivalent (SE) of at least 30 and have less than 8 percent, by weight, passing the #200 Sieve. The geotechnical consultant should review and approve proposed bedding materials prior to use. Bedding materials should be compacted to at least 90% relative compaction (ASTM D1557) by mechanical methods.

The on-site soils are expected to be suitable as trench backfill provided they are screened of organic matter and other deleterious material. Trench backfill must be compacted to at least 90% relative compaction (ASTM D1557) and the upper 12 inches of trench backfill beneath pavement sections should be compacted to at least 95% relative compaction. Trench backfill should be compacted using mechanical methods; no jetting of backfill should be allowed. A minimum trench width of 24 inches or 18 inches plus the diameter of the utility line, whichever is greater, should be provided to permit uniform compaction on both sides of utility line and allow for a technician to perform in-place density tests. If narrower trenches are desired, a sand-cement slurry should be used to backfill the trenches to within 8 inches of the top of trench. The sand-cement slurry should contain at

least 2 sacks of cement per yard of mix and have a 4- to 6-inch slump. In addition, slurry should be consolidated using a suitable vibratory or mechanical method.

All utility trench backfill within street right of ways, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing. Where utility crossings are located within 12 inches of bottoms of footings, conduits should be wrapped with polystyrene foam or other suitable material with a minimum thickness of one inch. Conduits extending through footings shall be “sleeved” as determined by the Project Structural Engineer.

3.09 Faulting

Since the site is not located within the boundaries of an Earthquake Fault Zone and no faults are known to pass through or near the property, surface fault rupture within the site is considered unlikely.

3.10 Seismic Design Parameters

Seismic design parameters have been developed in accordance with Section 1613A of the 2022 California Building Code (CBC) using the online SEAOC and OSHPD Seismic Design Maps Calculator (ASCE 7-16 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented below:

2022 California Building Code (CBC) Seismic Parameters

Parameter	Value
Site Location	Latitude = 36.9572 degrees Longitude = -120.0392 degrees
Site Class	Site Class = D* Soil Profile Name = "Stiff Soil"
Risk Category	III
Mapped Spectral Accelerations	S_s (0.2-second period) = 0.590g S_1 (1-second period) = 0.232g
Site Coefficients (Site Class D)	F_a = 1.328 F_v = Null - Section 11.4.8
Maximum Considered Earthquake Spectral Accelerations (Site Class D)	S_{MS} (0.2-second period) = 0.784g S_{M1} (1-second period) = Null - Section 11.4.8
Design Earthquake Spectral Accelerations (Site Class D)	S_{DS} (0.2-second period) = 0.523g S_{D1} (1-second period) = Null - Section 11.4.8

*As defined in Chapter 20 of ASCE 7-16, a Site Class D is applicable to predominantly cohesionless soils with an **average** standard penetration resistance of 15 to 50 within the upper 100 feet. Based on the geologic setting, our 50-foot deep test boring (see Appendix A), and other historical geotechnical data (see Section 1.02), the soil profile at the project site meets these criteria.

As the Site Class is D and the S_1 value is greater than 0.200g, then per ASCE 7-16 Section 11.4.8 a site-specific ground motions procedure is required with several exceptions. We assume that Exception 2 is applicable to this site, and hence the seismic parameters indicated in the table above have been calculated. If Exception 2 does not apply, the structural engineer should contact us so we develop the site-specific seismic parameters.

The above table shows that the mapped spectral response acceleration parameter for a 1-second period (S_1) is less than 0.750g and the spectral response acceleration parameter (S_{DS}) is greater than 0.500g. Therefore, the Seismic Design Category using 2022 CBC Tables 1613.2.5(1) and 1613.2.5(2) is D for all Occupancy Categories (2022 CBC Section 1613.2.5). Consequently, as required for Seismic Design Categories C through F by CBC Section 1803.5.12, slope instability, liquefaction, total and differential settlement, and surface displacement by faulting or seismically lateral spreading or lateral flow have been evaluated.

Peak earthquake ground acceleration adjusted for site class effects (PGA_M) has been calculated in accordance with ASCE 7-16 Section 11.8.3 as follows: $PGA_M = F_{PGA} \times PGA = 1.345 \times 0.255 = 0.343g$.

3.11 Liquefaction and Secondary Earthquake Hazards

Potential secondary seismic hazards that can affect land development projects include liquefaction, tsunamis, seiches, and seismically induced settlement.

Liquefaction

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, and intensity and duration of ground shaking. In order for liquefaction to occur, three criteria must be met: "low density", coarse-grained (sandy) soils, a groundwater depth of less than about 51 feet, and a potential for seismic shaking from nearby large-magnitude earthquake.

Research has shown that saturated, loose sands with a silt content less than about 25 percent are most susceptible to liquefaction, whereas other soil types are generally considered to have a low susceptibility. According to the California Geologic Survey (CGS) Special Publication SP-117A (2008), "Guidelines for Evaluating and Mitigating Seismic Hazards in California," any materials with a PI > 12 and moisture content < 85% of the liquid limit were considered not subject to liquefaction. Liquefaction susceptibility is related to numerous factors, and the following conditions must exist for liquefaction to occur:

- Sediments must be relatively young in age and must not have developed large amounts of cementation
- Sediments must consist mainly of cohesionless sands and silts
- The sediment must not have a high relative density
- Free groundwater must exist in the sediment; and
- The site must be exposed to seismic events of a magnitude large enough to induce straining of soils particles

The soils in the upper 51 feet at the project site consist primarily of silty sand, sandy silt, and poorly graded sand. A liquefaction analysis was performed using the sampler blow count and soil data from the deep boring that was performed at the project site (Boring B-2), using corrected SPT value $[(N_1)_{60}]$. The analysis was performed using LiquefyPro Version 5 (2015 edition) for two groundwater conditions: at a depth of 20.7 feet (historical high groundwater condition as required by CGS) and at a depth of 86 feet (representative of a recommended design "high groundwater condition" based on historical DWR data in the past 30 years). The analysis also took into account that the (PGA_M) is 0.343g and the Modal Magnitude (M_M) for the design level earthquake is 5.5 (based on the PSH Deaggregation tool on the USGS website at <https://earthquake.usgs.gov/hazards/interactive/>) for a 2-percent probability for exceedance in 50 years (a return period of 2,475 years). A summary of the input data and the results of this liquefaction analysis are provided in Appendix C of this report. Based on this analysis, there appears to be a low risk of liquefaction occurring at the project site during a design level earthquake (Factor-of-Safety against liquefaction is greater than 1.2).

It should be noted that the California Geological Survey has not yet prepared a Seismic Hazard Zone Map of potential liquefaction hazards for the quadrangle in which the site is located. In addition, there are no liquefaction hazard zones identified near the site according to the Madera County General Plan. Because there are no mapped liquefaction hazard zones near the site, a map depicting such a zone relative to the site has not

been prepared.

Tsunamis and Seiches

Tsunamis are sea waves that are generated in response to large-magnitude earthquakes. When these waves reach shorelines, they sometimes produce coastal flooding. Seiches are the oscillation of large bodies of standing water, such as lakes, that can occur in response to ground shaking. Tsunamis and seiches do not pose hazards due to the inland location of the site and lack of nearby bodies of standing water.

Seismically Induced Settlement

Seismically induced settlement occurs most frequently in areas underlain by loose, granular sediments. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

A seismic settlement analysis was performed using LiquefyPro Version 5 (2015 edition) in conjunction with the liquefaction analysis that was performed for this project as indicated above. A summary of the input data and the results of the seismic settlement analysis are provided in Appendix C of this report. Based on this analysis, a seismic settlement of less than 1/4 inch is expected to occur at the project site during a design level earthquake.

Seismically Induced Flooding

The City and County of Madera General Plans indicates the site is located within the potential dam inundation area of Hensley Lake/Hidden Dam. However, the chances of this of this dam failing while at full capacity is considered remote. Consequently, seismically induced flooding at the site is unlikely.

Seismically Induced Landslides

There are no cut or fill slopes that currently exist or are planned at the project site; therefore, the potential for seismically induced landslides is nil.

3.12 Foundations

Isolated spread footings and/or continuous wall footings are recommended to support the proposed new building. New footings should be embedded at least 12 inches below the lowest adjacent grade and must be constructed on properly compacted fill as recommended in Section 3.04 of this report. Continuous and isolated spread footings with a minimum width of 12 and 24 inches, respectively, may be designed using an allowable bearing capacity of 3,000 pounds per square foot (psf). An allowable increase of 750 psf per additional 12 inches of embedment, and an allowable increase of 500 psf per additional 12 inches of width, can be used in design, up to a maximum allowable bearing capacity of 5,000 psf. This allowable bearing capacity represents an allowable net increase in soil pressure over existing soil pressure and may be increased by one-third for short-term wind or

seismic loads. The maximum expected settlement of footings is expected to be less than 3/4 inch with a differential settlement of less than 1/4 inch between similarly sized and loaded footings or less than 1/4 inch over a distance of 30 feet for continuous footings. This assumes that the maximum column and wall loads (dead plus live, not including wind or seismic) associated with new building improvements will not exceed 40 kips and 2.0 kips per foot, respectively.

Our lab testing indicates that the upper 5 feet of soils at the site should have a medium expansion potential (Expansion Index ≤ 90). The type and dimensions of concrete, and the size and location of reinforcing steel, used in foundations should be specified by the Project Structural Engineer. As a minimum, reinforcement for continuous footings should include at least one #4 bar located near both the top and bottom of continuous footings.

It will be very important for all footing excavations to be observed by the geotechnical engineer to verify that they have been excavated into the recommended bearing material. Where zones of relatively loose or disturbed soils are present at the bottom of foundation excavations, these soils should be properly compacted to provide a uniform bearing surface that meets the approval of the geotechnical engineer (refer to Section 3.04).

3.13 Lateral Load Resistance and Earth Pressures

Lateral loads may be resisted by soil friction and the passive resistance of the soil. The following parameters are recommended.

- Allowable Passive Earth Pressure = 350 psf (equivalent fluid weight, includes a factor of safety = 2.0)
- Allowable Coefficient of Friction (soil to footing) = 0.35 (includes a factor of safety = 1.5)
- Retaining structures should be designed to resist a lateral active earth pressure of 35 pcf (equivalent fluid weight) for a level, non-expansive granular backfill with drainage provided.

The active earth pressure provided above is only applicable if the retained earth is allowed to strain sufficiently to achieve the active state. The required minimum horizontal strain to achieve the active state is approximately 0.0025H. Retaining structures should be designed to resist an at-rest lateral earth pressure of 55 pcf (equivalent fluid weight) if this horizontal strain cannot be achieved.

The Mononobe-Okabe method is commonly utilized for calculating seismically induced active and passive lateral earth pressures and is based on the limit equilibrium Coulomb theory for static stress conditions. This method entails three fundamental assumptions (e.g., Seed and Whitman, 1970): Wall movement is sufficient to ensure either active or passive conditions, the driving soil wedge inducing the lateral earth pressures is formed by a planar failure surface starting at the heel of the wall and extending to the free surface of the backfill, and the driving soil wedge and the retaining structure act as rigid bodies, and therefore, experiences uniform accelerations throughout the respective bodies (U.S. Army Corps of Engineers, 2003, Engineering and Design - Stability Analysis of Concrete Structures).

- Seismic Lateral Earth Pressure for level backfill = 18 pcf (equivalent fluid weight)

The seismic lateral earth pressure given above is a triangular distribution increasing with depth, and the resultant of this pressure is an increment of force which should be applied to the back of the wall at 1/3 of the wall height from the wall base. The seismic increment of earth pressure should be added to the static active pressure. Even for the at-rest (K_0) condition, the seismic increment of earth pressure should be added to the static active soil pressure, not to the at-rest (SEAOC Seismology Committee 2019). Per CBC Section 1803.5.12 dynamic seismic lateral earth pressures shall be applied to foundation walls and retaining walls supporting more than 6 feet of backfill. Dynamic seismic lateral earth pressures may also be applied to shorter walls at the discretion of the structural engineer.

3.14 Pole Type Foundations

It is anticipated that light poles, signs, or canopies may be supported on pole-type foundations or drilled piers. This type of foundation should be designed in accordance with Section 1807.3 of the 2022 CBC. It is recommended that an allowable lateral soil bearing pressure of 300 psf per foot of embedment be used to develop parameters S1 and S3 rather than one of the values given in Table 1806.2. This value includes a factor of safety of 2 and may be increased as indicated in Section 1806.3.4. In landscape areas, the upper 12 inches of soil should be ignored when calculating the minimum depth of embedment.

An allowable end bearing pressure of 3,000 psf (includes a factor of safety of 3.0) and an allowable average skin friction of 300 psf (includes a factor of safety of 2.0) may be used to support compressive vertical loads applied to pier foundations that are embedded at least 5 feet. The end bearing should be ignored if the drilled pier excavation is not properly cleaned out prior to installing the reinforcing steel and placing concrete. The uplift capacity of drilled piers can be calculated using an allowable skin friction of 190 psf plus the weight of the pier. In landscape areas, the skin friction within the upper 12 inches of embedded length should be ignored for compressive or uplift loads. The total settlement of pier foundations designed in accordance with these recommendations should not exceed one-half inch.

Prior to placing reinforcing steel or concrete, loose or disturbed soils should be removed from drilled pier excavations. A representative of the Geotechnical Engineer should observe the drilling and clean-out associated with the construction of pier foundations in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. Therefore, for drilled piers that extend to depths of sandy soils, the contractor should be prepared to take measures to prevent caving or significant sloughing in drilled holes (such as temporary casing) from occurring during the drilling and installation of reinforcing steel and concrete. In any case, reinforcing steel and concrete should be installed in an expeditious manner after each drilled hole is cleaned out. The contractor must take responsibility for staging the installation of drilled piers so that significant amounts of sloughing or caving do not occur prior to installing the reinforcing steel and concrete. The annular space around the pole must be backfilled using approved CLSM (controlled low strength material).

3.15 Interior Slabs on Grade

Concrete floors with a minimum thickness of 4 inches are recommended for interior slabs on grade. Existing on-site soils within 5 feet of the ground surface may be considered to have a medium expansion potential for design purposes (Expansion Index of ≤ 90). However, to reduce the potential for excessive cracks as a result of differential movement, consideration should be given to reinforcing concrete slab-on-grade floors with at least #3 bars spaced 24 inches on-center in both directions. Reinforcement consisting of welded or woven wire mesh should not be used, due to the difficulty of keeping it centered in the slab during the construction process. If heavy concentrated or moving loads are anticipated, slabs should be designed using a modulus of subgrade reaction (k) of 180 pci. The concrete mix, reinforcement of slabs, and the location of construction and control joints should be specified by the Design Engineer.

Special care should be taken on floors slabs to be covered with thin-set tile or other inflexible coverings. These areas should have suitable reinforcement that is placed at the mid-height of the slab, to mitigate drying shrinkage cracks. Alternatively, inflexible flooring may be installed with unbonded fabric or liners to prevent reflection of slab cracks through the flooring.

A moisture vapor retarder/barrier is recommended beneath all slabs-on-grade that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2022 California Building Code and pertinent sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

The moisture vapor retarder/barrier should consist of a minimum 10 mils thick polyethylene with a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

The moisture vapor retarder/barrier may be placed directly beneath the floor slab with no intermediate granular fill layer. The vapor barrier should be placed directly on a smooth compacted subgrade surface consistent with the recommendations provided in Section 3.02 of this report. This method of construction will provide improved curing of the slab bottom and will eliminate potential problems caused by water being trapped in a granular fill layer. However, concrete slabs poured directly on a moisture vapor retarder/barrier can experience shrinkage cracking and curling due to differential rates of curing through the thickness of the slab. Therefore, for concrete placed directly on the moisture vapor retarder/barrier, we recommend a maximum water to cement ratio of 0.45 and the use of water-reducing admixtures to increase workability and decrease bleeding.

Alternatively, the slabs may be constructed over 2 inches of sand that is placed on the moisture vapor retarder/barrier. Granular fill should consist of clean, fine-graded materials with 100% passing the No. 4 sieve, 10% to 30% passing the No. 100 sieve, and less than 5% passing the No. 200 sieve. The granular layer should be moist but not saturated and uniformly compacted by making at least one pass with a vibratory base compactor or some other mechanical method that is approved by the Project Geotechnical Engineer. If uneven, the surface of the sand should be trimmed to provide the full design thickness of the proposed slab. The granular fill layer should not be left exposed to rain or other sources of water such as wet-grinding, power washing, pipe leaks or other processes, and should be damp but not saturated at the time of concrete placement. Granular fill layers that become saturated should be removed and replaced prior to concrete placement.

3.16 Miscellaneous Concrete Flatwork

Miscellaneous concrete flatwork and walkways may be designed with a minimum thickness of 4 inches. Large slabs (greater than 6 feet in width) should be reinforced with a minimum of #3 rebar placed 24 inches on-center in both directions. The reinforcement must be placed at mid-height in the slab. Control joints should be constructed to create squares or rectangles with a maximum spacing of 12 feet. The Project Civil Engineer should provide design details and specifications for all exterior concrete flatwork include walkways. In addition, walkways should be separated from foundations with a thick expansion joint filler.

The subgrade beneath all miscellaneous concrete flatwork and equipment pads should be constructed in accordance with Section 3.04 of this report. The geotechnical engineer should monitor the moisture conditioning and compaction of the subgrade soils in order to verify compliance with our recommendations.

3.17 Footing Excavations and Concrete Subgrade

All footing excavations should be observed by the geotechnical consultant to verify that they have been excavated into competent soils. The foundation excavations should be observed prior to the placement of forms, reinforcement steel, or concrete. These excavations should be evenly trimmed and level. Prior to concrete placement, any loose or soft soils should be removed. Excavated soils should not be placed within slab or footing areas unless properly compacted (see Section 3.04).

Prior to the placement of the moisture barrier and sand, the subgrade soils underlying the slab should be observed by the geotechnical consultant to verify that all under-slab utility trenches have been properly backfilled and compacted, that no loose or soft soils are present, and that the slab subgrade has been properly compacted to a minimum of 90 percent relative compaction within the upper 12 inches.

Footings may experience an overall loss in bearing capacity or an increased potential to settle where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom of a parallel utility trench.

The subgrade below slabs on grade and walkways should be brought to a minimum of 0% and a maximum of 4% above the optimum moisture content for a depth of 6 inches prior to the placement of concrete or a moisture barrier. The geotechnical consultant should perform insitu moisture tests to verify that the appropriate moisture content has been achieved a maximum of 72 hours prior to the placement of concrete or moisture barriers.

3.18 Drainage and Moisture Proofing

Surface drainage should be directed away from the proposed improvements into suitable drainage devices (see Section 1804.4 of the 2022 CBC). Neither excess irrigation nor rainwater should be allowed to collect or pond against building foundations or within low-lying or level areas of the lot. Surface waters should be diverted away from the tops of slopes and prevented from draining over the top of slopes and down the slope face.

Walls and portions thereof that retain soil and enclose interior spaces and floors below grade should be waterproofed and damp-proofed in accordance with Section 1805 of the 2022 CBC.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Backdrains should be installed behind all retaining walls exceeding 3 feet in height. All backdrains should be outlet to suitable drainage devices. Retaining walls less than 3 feet in height should be provided with backdrains or weep holes. Damp-proofing and/or waterproofing should also be provided on all retaining walls exceeding 3 feet in height.

3.19 Cement Type and Corrosion Potential

A soluble sulfate test was performed on a near-surface soil sample indicated a soluble sulfate content of 33.8 mg/kg (0.00338 percent by weight). Thus, below-grade concrete at the subject site should have a negligible exposure to water-soluble sulfate in the soil. Our recommendations for concrete exposed to sulfate-containing soils are presented in the table below.

Recommendations for Concrete Exposed to Soils Containing Soluble Sulfate

Sulfate Exposure	Water Soluble Sulfate (SO₄) in Soil (% by Weight)	Sulfate (SO₄) in Water (ppm)	Cement Type (ASTM C150)	Maximum Water-Cement Ratio (by Weight)	Minimum Compressive Strength (psi)
Negligible	0.00 - 0.10	0-150	--	--	2,500
Moderate	0.10 - 0.20	150-1,500	II	0.50	4,000
Severe	0.20 - 2.00	1,500-10,000	V	0.45	4,500
Very Severe	Over 2.00	Over 10,000	V plus pozzolan or slag	0.45	4,500

Use of alternate combinations of cementitious materials may be permitted if the combinations meet design recommendations contained in American Concrete Institute guideline ACI 318-11.

Our testing also indicates that there is a moderate concentration of soluble chloride (39.1 mg/kg) in the onsite soils; therefore, no special protection of reinforcing steel should be required due to soil conditions.

The soils were also tested for soil reactivity (pH) and electrical resistivity (ohm-cm). The test results indicate that the on-site soils have a pH of 7.12 and a minimum electrical resistivity of 3,910 ohm-cm. A neutral or non-corrosive soil has a value ranging from 6.0 to 8.5; thus, the onsite soils can be considered neutral. Generally, soils that could be considered moderately corrosive to ferrous metals have minimum resistivity values of about 3,000 ohm-cm to 10,000 ohm-cm. Soils with resistivity values less than 3,000 ohm-cm can be considered corrosive and soils with resistivity values less than 1,000 ohm-cm can be considered extremely corrosive. In any case, buried metal conduits should have a protective coating in accordance with the manufacturer's specifications. A corrosion specialist should be consulted if more detailed recommendations are required.

3.20 Plan Review

Once formal grading and foundation plans are prepared for the subject project, this office should review the plans from a geotechnical viewpoint, comment on changes from the plan used during preparation of this report and revise the recommendations of this report where necessary.

3.21 Geotechnical Observation and Testing During Grading

The geotechnical engineer should be contacted to provide observation and testing during the following stages of grading:

- During the clearing and grubbing of the site.
- During the demolition of any existing structures, buried utilities or other existing improvements.
- During excavation and over-excavation of existing subgrade.
- During all phases of grading including ground preparation and filling operations.
- When any unusual conditions are encountered during grading.

A grading and compaction report summarizing conditions encountered during grading and the in-place density testing that was performed should be submitted upon completion of the earthwork construction.

3.22 Post-Grading Geotechnical Observation and Testing

After the completion of grading the geotechnical engineer should be contacted to provide additional observation and testing during the following construction activities:

- During trenching and backfilling operations of buried improvements and utilities to verify proper backfill and compaction of the utility trenches.

- After excavation and prior to placement of reinforcing steel or concrete within footing excavations to verify that footings are properly founded in competent materials.
- During fine or precise grading involving the placement of any fills underlying driveways, sidewalks, walkways, or other miscellaneous concrete flatwork to verify proper placement, mixing and compaction of fills.
- When any unusual ground or soil conditions are encountered during construction.

4.00 CLOSURE

The findings, conclusions and recommendations in this report were prepared in accordance with generally accepted engineering and geologic principles and practices. No other warranty, either express or implied, is made. This report has been prepared for the Madera Unified School District and other members of the Project Design Team to be used for the design and construction of improvements at the project site. Anyone using this report for any other purpose must draw their own conclusions regarding required construction procedures and subsurface conditions.

RMA GeoScience should be retained during the earthwork and foundation phases of construction to monitor compliance with the design concepts and recommendations and to provide additional recommendations as needed. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

FIGURES



Reference: Google Earth Pro, 2023

Scale: 1" ≈ 1,650'

FIGURE 1

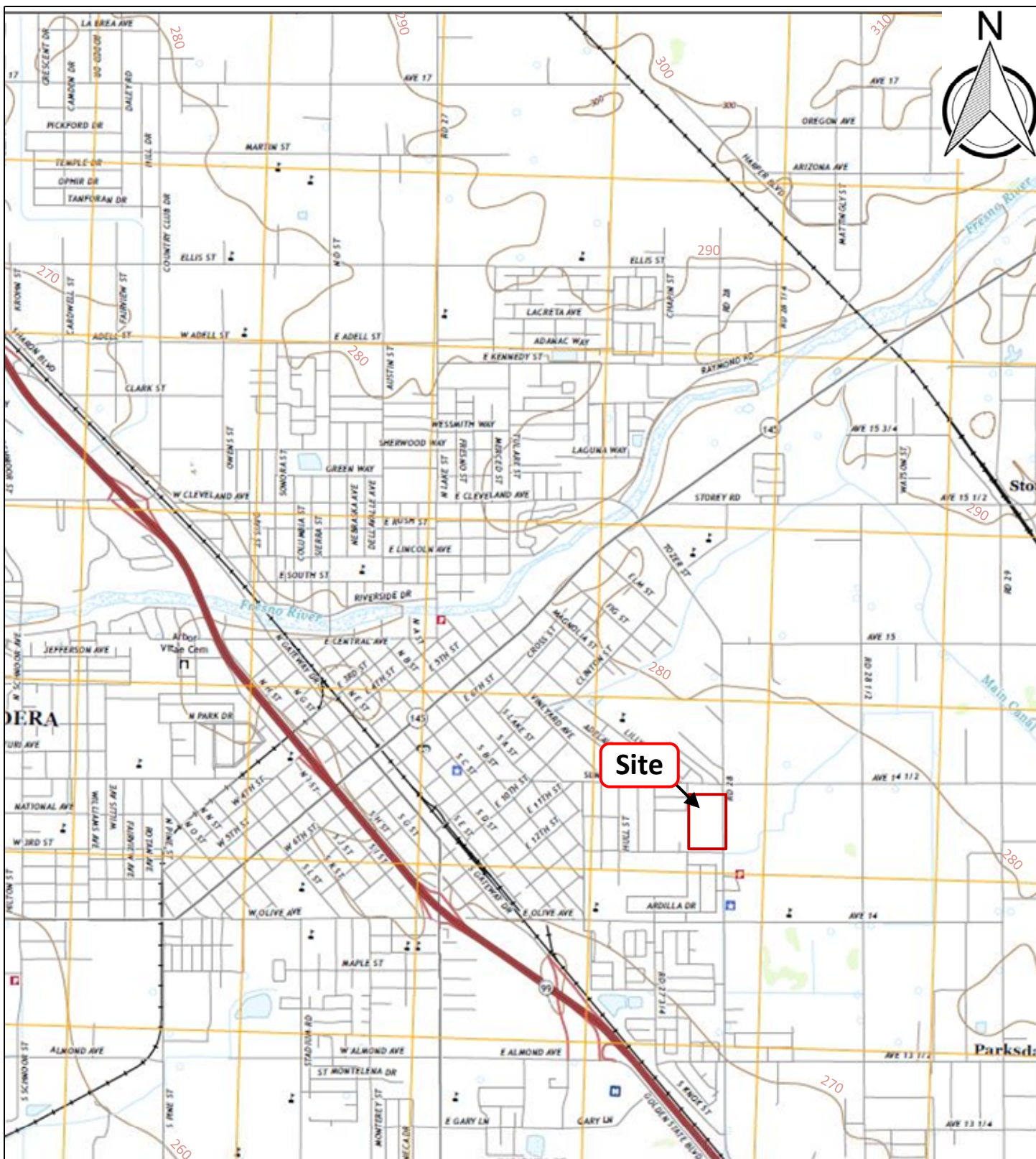
SITE VICINITY MAP

New Kindergarten Classrooms at Virginia Lee Rose Elementary School

1001 Lilly Street

Madera, California 93638

Project #07-230527-0



Reference: USGS Madera
Quadrangle, California 7.5-
Minute Series, 2018

Scale: 1" ≈ 0.50 miles

FIGURE 2

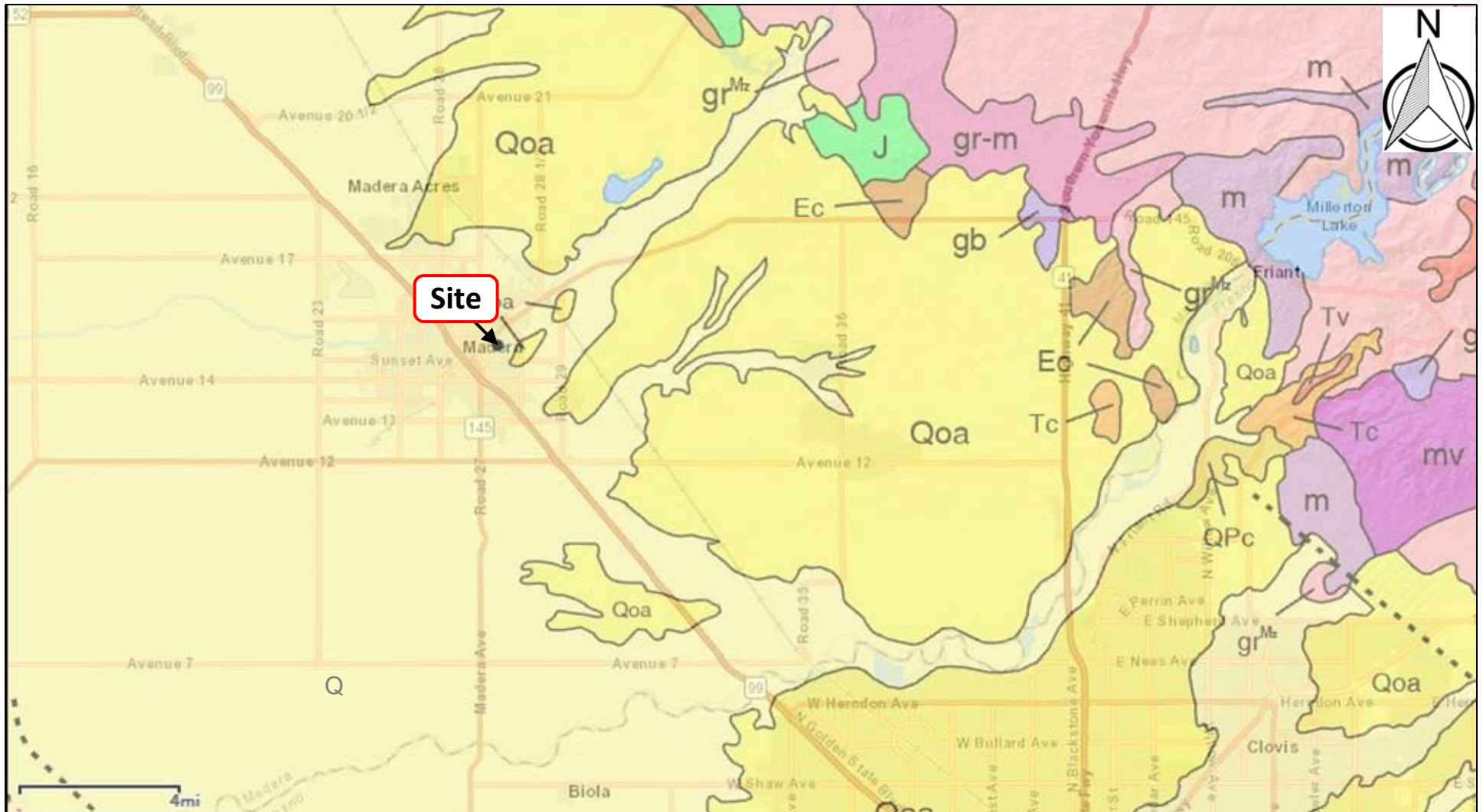
USGS CONTOUR MAP

New Classroom Buildings at Virginia Lee Rose Elementary School

1001 Lilly Street

Madera, California 93638

Project #07-230527-0



Source: Gutierrez, et al., 2010, Geologic Map of California, California Geologic Survey Map No. 2

FIGURE 3A
REGIONAL GEOLOGIC MAP
 New Kindergarten Classrooms at Virginia Lee Rose Elementary School
 1001 Lilly Street
 Madera, California 93638
 Project #07-230527-0

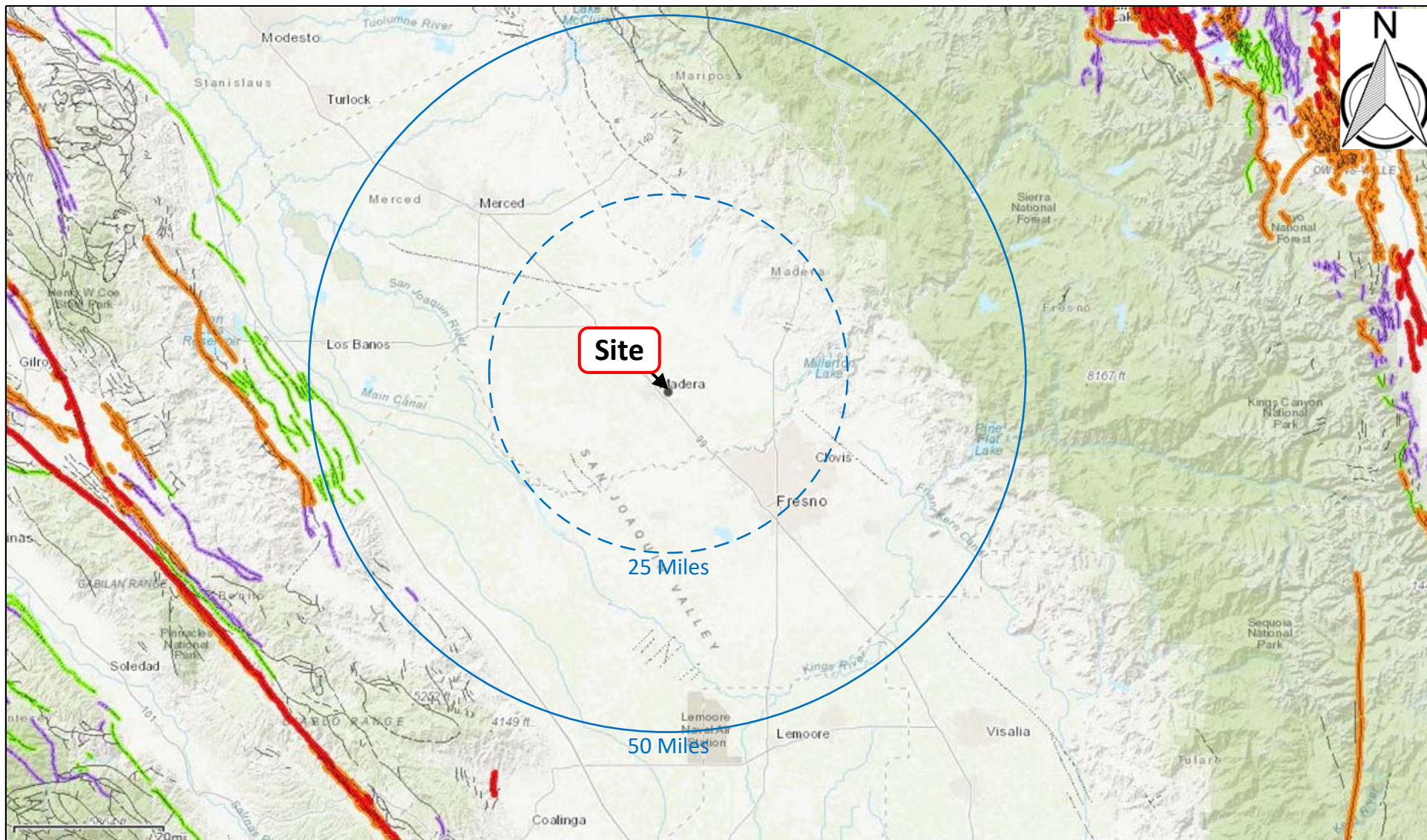
Q	Alluvium, lake, playa, and terrace deposits; consolidated and unconsolidated
Qoa	Older alluvium, lake, playa, and terrace deposits
Tc	Undivided Tertiary nonmarine sandstone, shale, conglomerate, breccia, and ancient lake deposits
Ec	Eocene nonmarine sandstone, shale, and conglomerate; moderately to well consolidated
Tv	Tertiary volcanic flow rocks; minor pyroclastic deposits
J	Jurassic shale and sandstone; minor conglomerate, chert, slate, limestone, and pyroclastic rocks
gr-m	Mesozoic to Precambrian granitic and metamorphic rocks; mostly gneiss and other metamorphic rocks injected by granitic rocks
mv	Undivided pre-Cenozoic metavolcanic rocks. Includes latite, dacite, tuff, and greenstone; commonly schistose
grMz	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
gb	Gabbro and dark dioritic rocks; chiefly Mesozoic.
m	Undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble

Source: Gutierrez, et al., 2010, Geologic Map of
California, California Geologic Survey Map No. 2

FIGURE 3B

LEGEND FOR REGIONAL GEOLOGIC MAP

New Kindergarten Classrooms at Virginia Lee Rose Elementary School
1001 Lilly Street
Madera, California 93638
Project #07-230527-0



Source: Jennings, C. W., and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey, Geologic Data Map No. 6.

Scale: 1" ≈ 20 miles

FIGURE 4A











FAULT ACTIVITY MAP

New Kindergarten Classrooms at Virginia Lee Rose Elementary School

1001 Lilly Street

Madera, California 93638

Project #07-230527-0

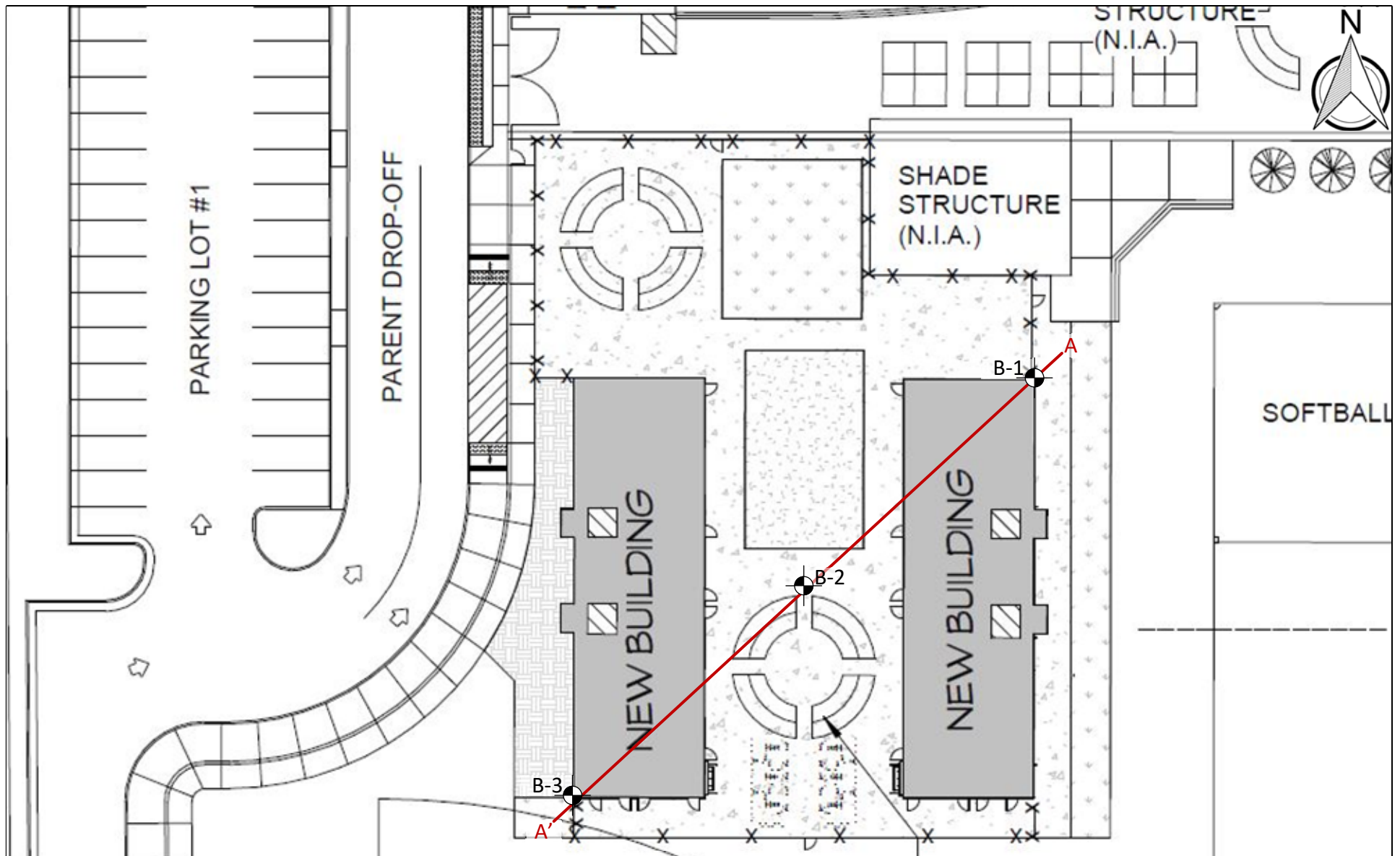
Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	—200—			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
			—11,700—			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary	Pleistocene	—700,000—			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
				—1,600,000*			
Pre-Quaternary			—1,600,000*			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of Earth)				

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

Source: Jennings, C. W., and Bryant, W. A., 2010, Fault Activity Map of California, California Geologic Survey, Geologic Data Map No. 6.

FIGURE 4B Legend for Fault Activity Map

New Kindergarten Classrooms at Virginia Lee Rose Elementary School
 1001 Lilly Street
 Madera, California 93638
 Project #07-230527-0



Site Plan prepared by: PBK

FIGURE 5

Scale: 1" ≈ 36'

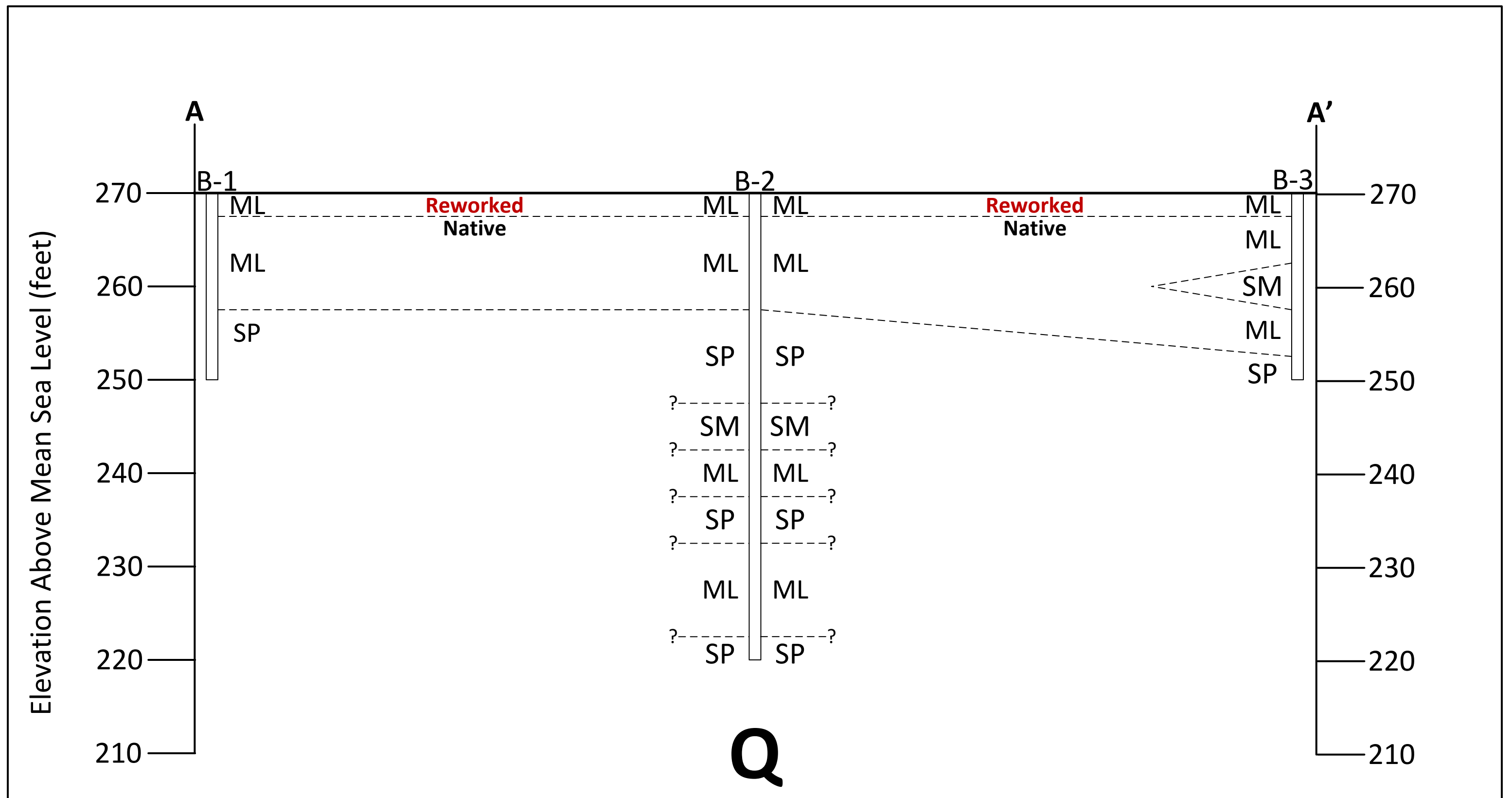


FIGURE 6

CROSS SECTION A TO A'

New Kindergarten Classrooms at Virginia Lee Rose Elementary School
 1001 Lilly Street
 Madera, California 93638
 Project #07-230527-0

Horizontal Scale: 1" = 13.3'
 Vertical Scale: 1" = 10'

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Borings

Our subsurface investigation consisted of excavating three test borings to a maximum depth of approximately 51 feet below existing grade. The test borings were excavated with a SIMCO 2800 drill rig equipped with a 4-inch solid stem auger and a 140-pound auto-hammer on July 24, 2023.

A-1.02 Location of Borings

The approximate locations of the borings are shown on Figure 5, Boring Location Map. GPS coordinates indicated on the logs are based on information provided by Google Earth Pro.

A-1.03 Logging Borings

Boring logs were prepared by one of our staff and are included in this appendix. The log contains factual information and interpretation of subsurface conditions between samples. The stratum indicated on the boring logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend defining the terms used in describing the relative compaction, consistency or firmness of the soil, and moisture level is provided on the following page. Bag, ring, or tube samples of the major earth units were obtained for laboratory inspection and testing.

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

Compactness of sand		Consistency of clay	
Penetration Resistance N (blows/ft)	Compactness	Penetration Resistance N (blows/ft)	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

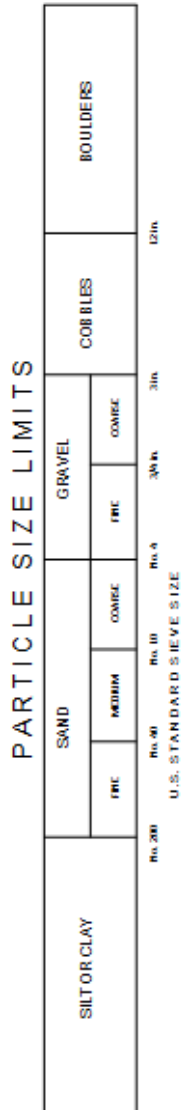
N = Number of blows of 140 lb. weight falling 30 in. to drive 2-in OD sampler 1 ft. (corrected)

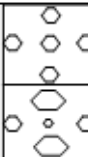














BASED ON RELATIVE COMPACTION

Compactness of sand		Consistency of clay	
% Compaction	Compactness	% Compaction	Consistency
<75	Loose	<80	Soft
75-83	Medium Dense	80-85	Medium Stiff
83-90	Dense	85-90	Stiff
>90	Very Dense	>90	Very Stiff

II. SOIL MOISTURE

Moisture of sands		Moisture of clays	
% Moisture	Description	% Moisture	Description
<5%	Dry	<12%	Dry
5-12%	Moist	12-20%	Moist
>12%	Very Moist, wet	>20%	Very Moist, wet



MAJOR DIVISIONS		GROUP SYMBOLS		TYPICAL NAMES	
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravel, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravel or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour silty or clayey fine sands or clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
			OL	Organic silts and organic silty clays of low plasticity.	
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
			CH	Inorganic clays of high plasticity, fat clays.	
			OH	Organic clays of medium to high plasticity, organic silts.	
		HIGHLY ORGANIC SOILS			Pt

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

Exploratory Boring Log

Boring No. B-1

Sheet 1 of 1

Date Drilled: July 24th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV







Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.957301°, -120.039063°





Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	R	5		19.8	104.6	ML		REWOKED: dark brown, fine to medium SANDY SILT with CLAY, moist, medium stiff, with roots and organics
10	R	4				ML		NATIVE: brown, fine to medium SANDY SILT with CLAY, moist, medium stiff ...minor CLAY
15	R	17		30.4	95.7	ML		...very moist, very stiff
20	S	13				SP		Light gray brown, fine to medium SAND, moist, medium dense ...with interlayers of SILTY SAND
25	S	6				SP		...light gray, no interlayers, dry, loose
30								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
35								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

 - SPT Sample
 - Bulk Sample
 - Modified California Tube Sample
 - Modified California Ring Sample

Symbols:

 - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 1 of 2

Date Drilled: July 24th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV











Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.957167°, -120.039248°


Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
	[R]	6		15.8	98.1	ML		REWORKED: dark brown, fine to medium SANDY SILT minor CLAY, moist, medium stiff, with roots and organics
5	[R]	7		17.6	109.1	ML		NATIVE: brown, fine to medium SANDY SILT minor CLAY, moist, medium stiff
10	[S]	11						...stiff
15	[R]	22		8.5	95.6	SP		Light gray brown, fine to medium SAND, moist, medium dense
20	[S]	13						...light gray
25	[R]	40		12.3	130.4	SM		Brown, fine to coarse SILTY SAND with CLAY, very moist, dense
30	[S]	14				ML		Gray, fine SANDY SILT, moist, stiff
35	[R]	28		5.5	98.9	SP		Dark gray, fine to medium SAND, moist, medium dense
	[S]					ML		Gray, fine SANDY SILT, moist, stiff



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample  - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-2

Sheet 2 of 2

Date Drilled: July 24th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV



Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.957167°, -120.039248°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
45	[S]	9		24.7	96.7	ML		...with interlayers of SILTY SAND
	[R]	50						...gray, with CLAY, very moist, hard
50	[S]	8				SP		Light gray, fine to medium SAND, dry, loose
55								Notes: 1. Boring terminated at approximately 51' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
60								
65								
70								
75								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

- [S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

-  - Groundwater
 - End of Boring

Exploratory Boring Log

Boring No. B-3

Sheet 1 of 1

Date Drilled: July 24th, 2023

Drilling Equipment: SIMCO 2800, Solid Stem Auger

Logged By: GJV







Borehole Diameter: 4"

Location: See Boring Location Map

Drive Weights: 140 lbs. (Autohammer)

Geographic Position: 36.957028°, -120.039454°

Drop Height: 30"

Depth (ft)	Samples			Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
	Sample Type	Blows (blows/ft)	Bulk Sample					
5	[R]	12		18.3	109.6	ML		REWOKED: dark brown, fine to medium SANDY SILT minor CLAY, moist, medium stiff, with roots and organics
	[R]	7		17.9	91.0	ML		NATIVE: dark brown, fine to medium SANDY SILT minor CLAY, moist, stiff ... brown, medium stiff
10	[R]	27		17.3	118.3	SM		Light brown, fine to medium SILTY SAND minor CLAY, very moist, medium dense ... light gray brown, with interlayers of SAND
15	[S]	7				ML		Brown, fine SANDY SILT with CLAY, moist, medium stiff
20	[S]	7				SP		Light gray brown, fine to medium SAND, dry, loose ... with interlayers of SILTY SAND
25								Notes: 1. Boring terminated at approximately 21' 2. No groundwater encountered 3. Boring backfilled with soil cuttings
30								
35								



***Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
ID = 2.5" OD = 3"

Sample Types:

[S] - SPT Sample [] - Bulk Sample
[T] - Modified California Tube Sample
[R] - Modified California Ring Sample

Symbols:

 - Groundwater
 - End of Boring

APPENDIX B

LABORATORY TESTS

APPENDIX B

B-1.00 LABORATORY TESTS

B-1.01 Moisture Determination

The moisture content of tube and ring samples obtained from the test borings was determined in accordance with ASTM D2216, the standard method for determining the water content of soil using a drying oven. The mass of material remaining after oven drying is used as the mass of the solid particles. The results of these tests are provided on the boring logs in Appendix A.

B-1.02 Density of Split-Barrel Samples

The densities of ring and tube samples, which were obtained using a split-barrel sampler, were determined in accordance with ASTM D2937. The results of these tests are provided on the boring logs in Appendix A.

B-1.03 Soluble Sulfates and Chlorides

Tests were performed in accordance with California Test Methods 417 and 422 on a near-surface soil sample obtained during the field exploration. These tests were performed by Dellavalle Laboratory, Inc. located in Fresno, California (see Table B1 for results).

B-1.04 Soil Reactivity (pH) and Minimum Electrical Resistivity

One near-surface soil sample was tested for soil reactivity (pH) and minimum electrical resistivity using California Test Method 643 (see Table B1). The pH measurement determines the degree of acidity or alkalinity in the soils. The minimum electrical resistivity is used as an indicator of how corrosive the soil is relative to buried metallic items.

TABLE B1: SUMMARY OF CORROSIVITY TESTS

Sample Location	Soluble Sulfates (mg/kg)	Soluble Chlorides (mg/kg)	pH	Minimum Resistivity (ohm-cm)
B-2 @ 1' – 3'	33.8	38.1	7.12	3,910

B-1.05 Percent Passing #200 Sieve

Three soil samples were tested in accordance with ASTM D1140 to determine the percent passing the #200 sieve (see Table B2). This represents the amount of silt and clay that is present in the soil.

TABLE B2: PERCENT PASSING #200 SIEVE TEST RESULTS

Sample Location	Dry Weight Before Wash (grams)	Dry Weight After Wash (grams)	Percent Passing #200 Sieve
B-1 @ 1' – 3'	254.7	101.8	60
B-2 @ 15.5'	279.9	257.1	8
B-3 @ 10.5'	256.8	163.9	36

B-1.06 Atterberg Limits

The liquid limit, plastic limit, and the plasticity index of a near-surface soil sample were determined using the standard test methods of ASTM D4318 (See Figure B1).

B-1.07 Expansion Index

Expansion index testing was performed on a near-surface sample of the on-site soils in accordance with the standard test methods of ASTM D4829. The results of this test are shown on Figure B2.

B-1.08 Direct Shear

One 3-point direct shear test was performed on a representative near-surface sample of soil using the standard test method of ASTM D3080 (consolidated and drained). The shear tests were performed on a direct shear machine of the strain-controlled type. To simulate possible adverse field conditions, the samples were saturated prior to shearing. Three soil specimens were sheared at varying normal loads for the test and the results plotted to establish the angle of the internal friction and cohesion of the tested sample. The results of this test are shown on Figure B3.

B-1.09 One-Dimensional Consolidation Properties

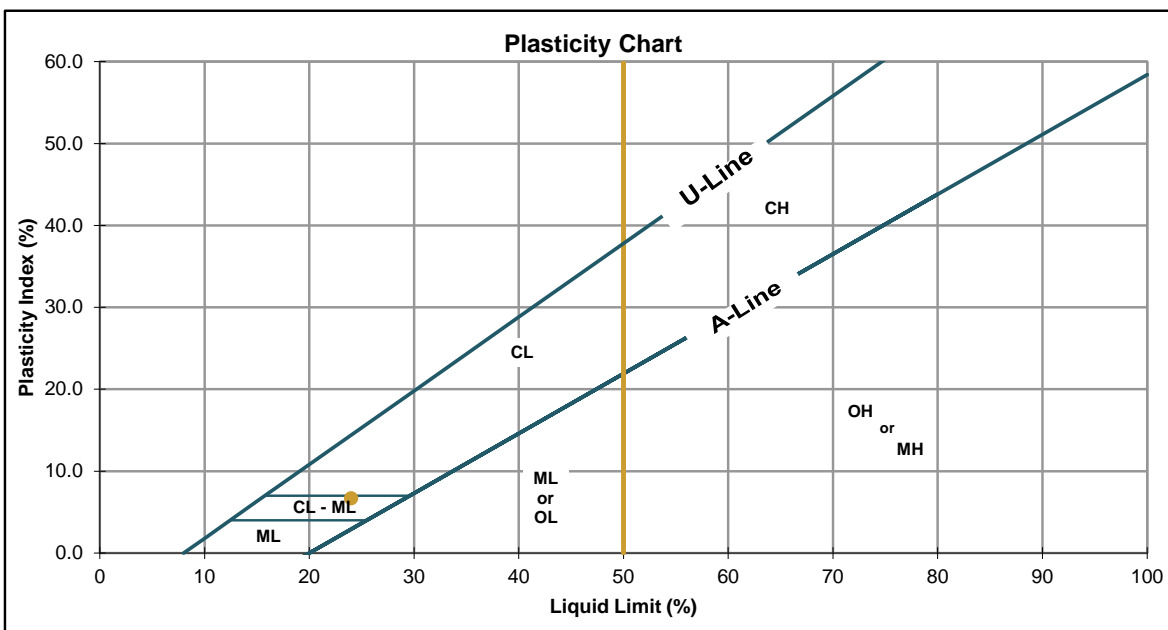
The magnitude and rate of consolidation of soils obtained from test borings, when it is restrained laterally and drained axially while subjected to incrementally applied controlled-stress loading, was determined using the standard test methods of ASTM D2435. The results of these tests are shown on Figure B4.

Project Number: 07-230527-0/2
Project Name: New Kindergarten Classrooms at Virginia Lee ES
Sampled By: Gabe V.
Sample Date: 7/24/2023
Sample Location: B-3 @ 1ft - 3ft
Sample Description: Sandy SILT minor Clay, fine to medium grained, brown

Lab ID: 23-01498
Date Tested: 8/1/2023
Tested By: Jason M.

Plasticity Index Results

Liquid Limit:	24
Average Plastic Limit :	17
Plasticity Index:	7



Liquid Limit Data

	Trial 1	Trial 2	Trial 3
Wet Weight (gm.)	18.97	19.67	17.86
Dry Weight (gm.)	16.90	17.57	16.12
Tare Weight (gm.)	8.74	8.76	8.64
Number of Blows	17	24	32
Moisture Content (%)	25.4	23.8	23.3

Plastic Limit Data

	Trial 1	Trial 2
Wet Weight (gm.)	29.52	29.42
Dry Weight (gm.)	28.11	27.97
Tare Weight (gm.)	19.84	19.73
Moisture Content (%)	17.0	17.6

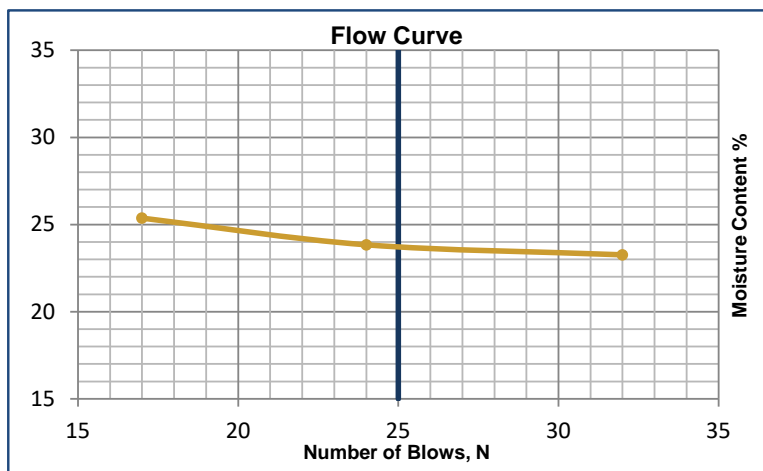




Figure B2

Laboratory Test Form | ASTM D4829

Expansion Index of Soils

Project Number: <u>07-230527-0/02</u>	Lab ID: <u>23-013487</u>
Project Name: <u>New Kindergarten Classrooms at Virginia Lee ES</u>	Date Sampled: <u>7/24/2023</u>
Sampled By: <u>Gabe V.</u>	Date Tested: <u>8/10/2023</u>
Tested By: <u>Jason M.</u>	
Sample Location: <u>B-1 @ 1ft - 3ft</u>	
Sample Description: <u>Sandy SILT with Clay, fine to medium grained, dark brown</u>	

Expansion Readings

Initial Sample Height (in):	<u>0.0180</u>
Final Sample Height (in):	<u>0.0693</u>
Expansion (in):	<u>0.0513</u>
 Expansion Index, EI:	 <u>51</u>

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Expansion Index Data

Initial Set-Up Data		Final Data	
Sample + Tare Weight (gm):	<u>769.2</u>	Sample + Tare Weight (gm):	<u>813.5</u>
Tare Weight (gm):	<u>365.6</u>	Tare Weight (gm):	<u>365.6</u>
Initial Gauge Reading (in):	<u>0.0180</u>	Final Gauge Reading (in):	<u>0.0693</u>

Moisture Content And Density Data

Wet Weight + Tare (gm):	<u>100.0</u>	Wet Weight + Tare (gm):	<u>813.5</u>
Dry Weight + Tare (gm):	<u>91.3</u>	Dry Weight + Tare (gm):	<u>738.7</u>
Tare Weight (gm):	<u>0</u>	Tare Weight (gm):	<u>365.6</u>
Moisture Content:	<u>9.5%</u>	Moisture Content:	<u>20.0%</u>
Initial Volume (ft ³):	<u>0.007345</u>	Final Volume (ft ³):	<u>0.007645</u>
Remolded Wet Density (pcf):	<u>121.1</u>	Final Wet Density (pcf):	<u>129.2</u>
Remolded Dry Density (pcf):	<u>110.6</u>	Final Dry Density (pcf):	<u>107.6</u>
Degree of Saturation:	<u>49</u>	Assumed Specific Gravity:	<u>2.7</u>

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Figure B4a
Laboratory Test Form | ASTM D2435
 Consolidation, No Time Rate

Project Number: <u>07-230527-0/02</u>	Lab ID: <u>23-013500</u>
Project Name: <u>New Kindergarten Classrooms at Virginia Lee ES</u>	Date Sampled: <u>7/24/2023</u>
Sampled By: <u>Gabe V.</u>	Date Tested: <u>8/2/23 - 8/16/23</u>
Tested By: <u>Jennifer K.</u>	
Sample Location: <u>B-3 @ 5.5ft</u>	
Sample Description: <u>Sandy SILT minor Clay, fine to medium grained, brown</u>	
Sample Preparation: <u>In-Situ Ring Sample</u>	

Consolidation Test Data

Initial Data		Final Data	
Initial Sample Height (in):	<u>1.0000</u>	Final Sample Height (in):	<u>0.9529</u>
Initial Void Ratio:	<u>0.56</u>	Final Void Ratio:	<u>0.48</u>
Initial Gauge Reading (in):	<u>0.2491</u>	Final Gauge Reading (in):	<u>0.2962</u>

Moisture Content and Density Data

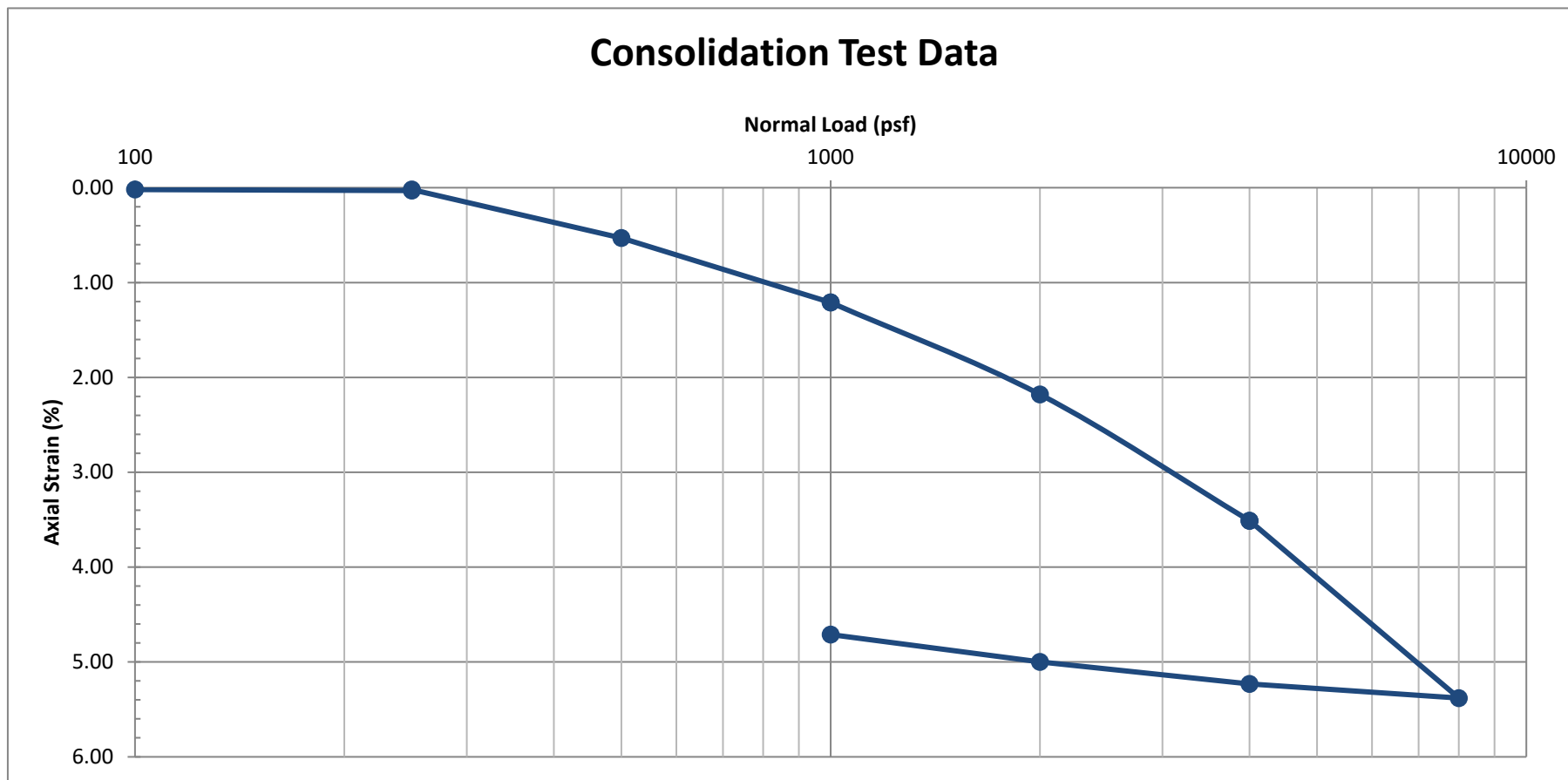
Initial Wet Weight + Tare (gm):	<u>186.65</u>	Final Wet Weight + Tare (gm):	<u>191.60</u>
Initial Dry Weight + Tare (gm):	<u>166.70</u>	Final Dry Weight + Tare (gm):	<u>166.70</u>
Tare Weight (gm):	<u>44.70</u>	Tare Weight (gm):	<u>44.70</u>
Initial Moisture Content:	<u>16.35%</u>	Final Moisture Content:	<u>20.41%</u>
Initial Volume (ft ³):	<u>0.002531</u>	Final Volume (ft ³):	<u>0.002412</u>
Initial Wet Density (pcf):	<u>123.62</u>	Final Wet Density (pcf):	<u>134.26</u>
Initial Dry Density (pcf):	<u>106.25</u>	Final Dry Density (pcf):	<u>111.50</u>
Initial Degree of Saturation:	<u>75.4</u>	Final Degree of Saturation:	<u>107.8</u>

Moisture Condition	Load (psf)	Dial Reading (in)	Sample Height (in)	Axial Strain (%)
In Situ	0	0.2491	1.0000	0.00
	100	0.2493	0.9998	0.02
	250	0.2494	0.9997	0.03
Saturated	250	0.2493	0.9998	0.02
	500	0.2544	0.9947	0.53
	1000	0.2612	0.9879	1.21
	2000	0.2709	0.9782	2.18
	4000	0.2842	0.9649	3.51
	8000	0.3029	0.9462	5.38
	4000	0.3014	0.9477	5.23
	2000	0.2991	0.9500	5.00
	1000	0.2962	0.9529	4.71

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(As required by ASTM E-329-18)

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Project Number:	07-230527-0/02	Project Name:	New Kindergarten Classrooms at Virginia Lee Rose Elementary School		
Date Tested:	8/2/23 - 8/16/23	Lab ID:	23-013500	Sample Location:	B-3 @ 5.5ft
Tested By:	Jennifer K.	Description:	ML	Sampled By:	Gabe V.

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APPENDIX C

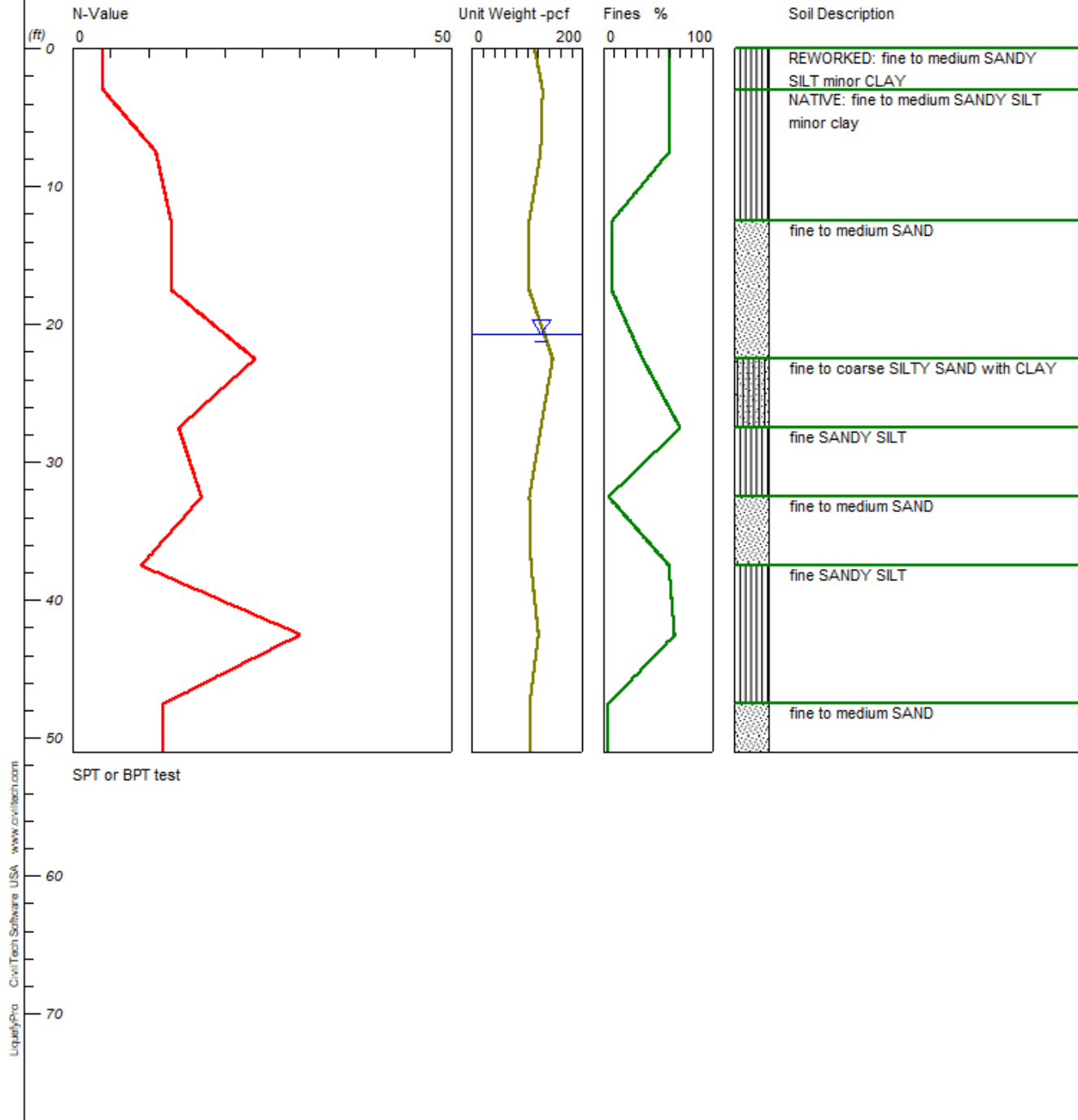
LIQUIFACTION AND SEISMIC SETTLEMENT ANALYSIS (Figures and Analysis Summary)

LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Virginia Lee Rose Elementary

Hole No.=B-2 Water Depth=20.7 ft Surface Elev.=275

Magnitude=5.5
Acceleration=0.343g

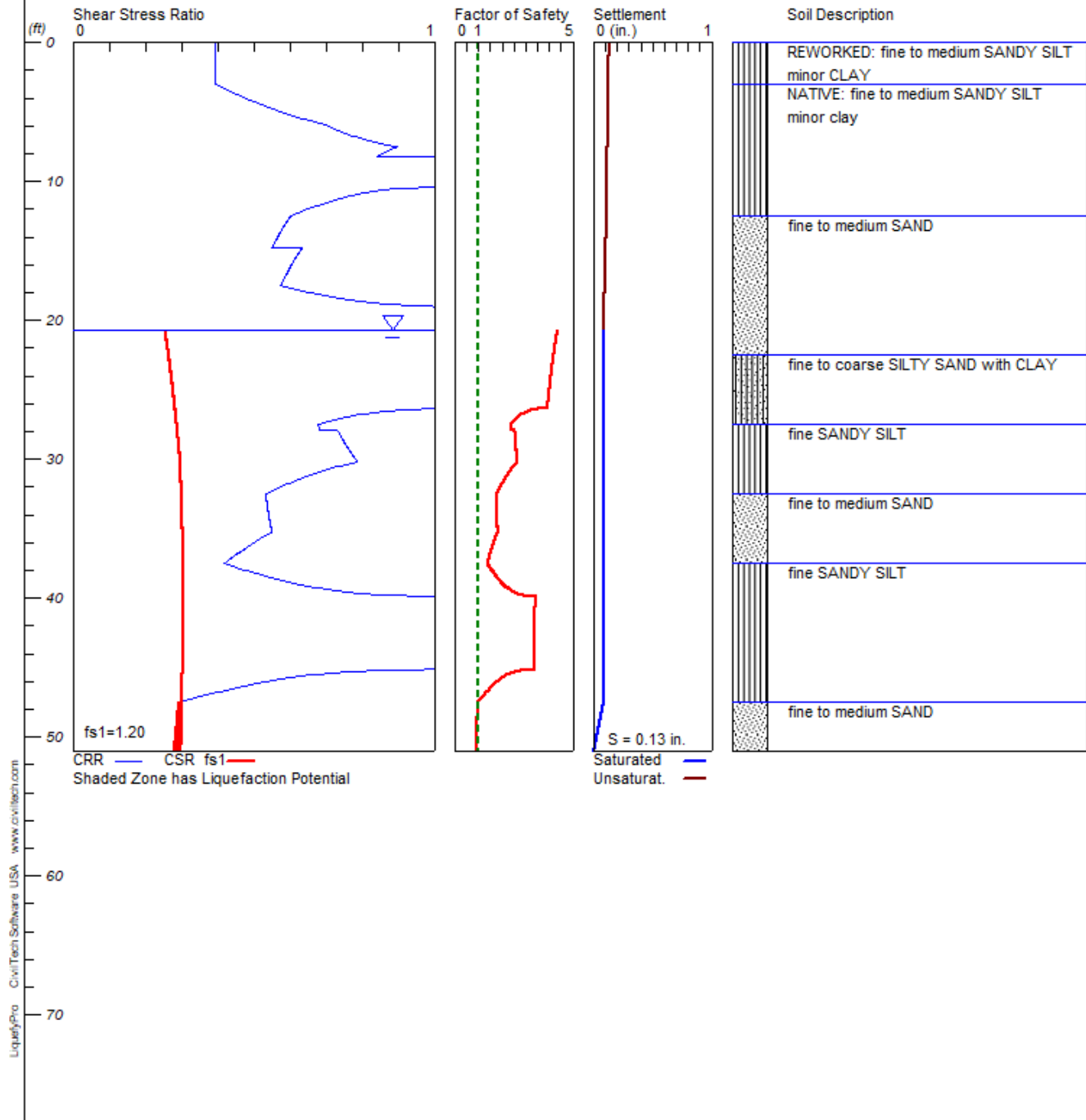


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Virginia Lee Rose Elementary

Hole No.=B-2 Water Depth=20.7 ft Surface Elev.=275

Magnitude=5.5
Acceleration=0.343g

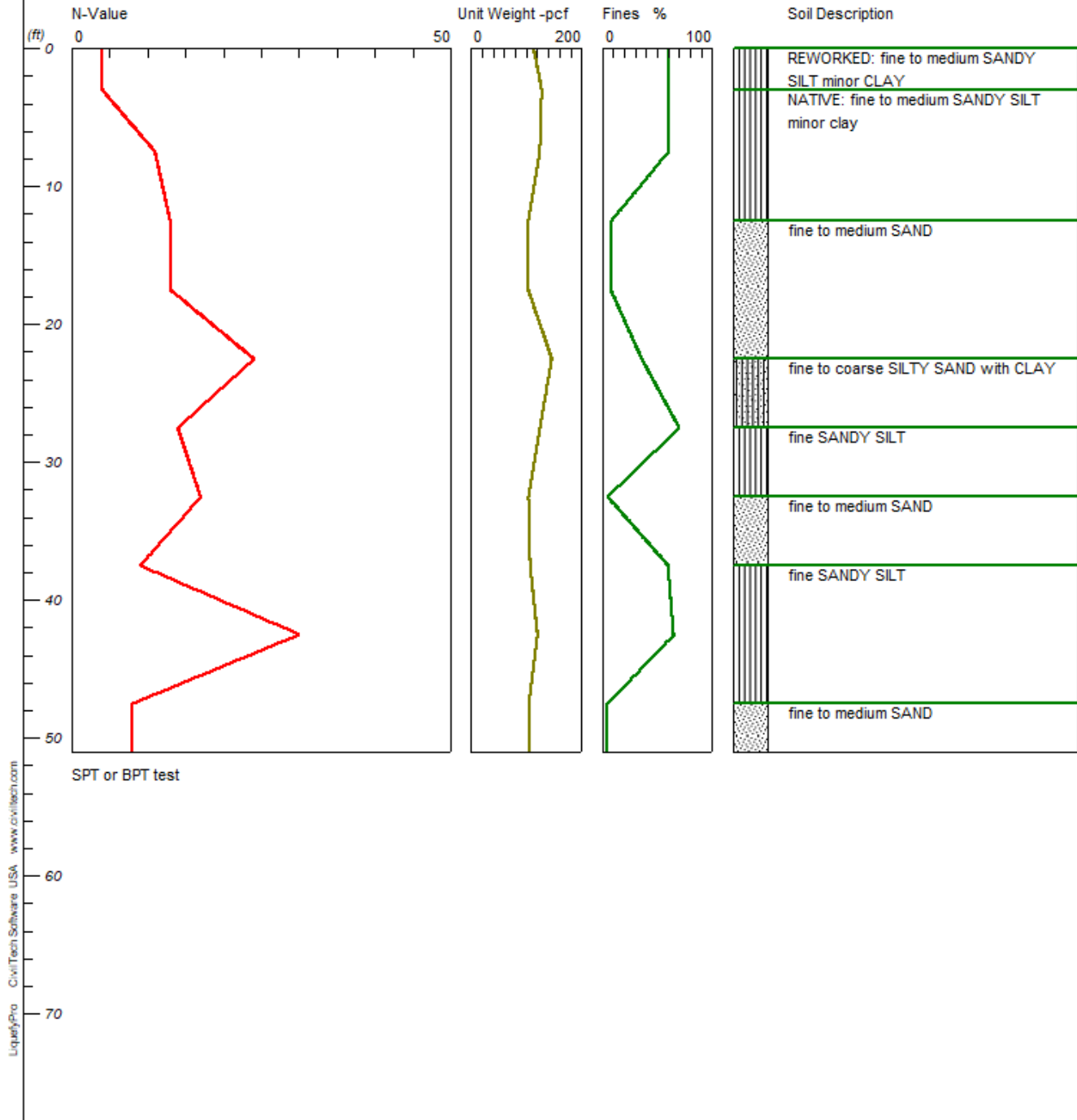


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Virginia Lee Rose Elementary

Hole No.=B-2 Water Depth=86 ft Surface Elev.=275

Magnitude=5.5
Acceleration=0.343g

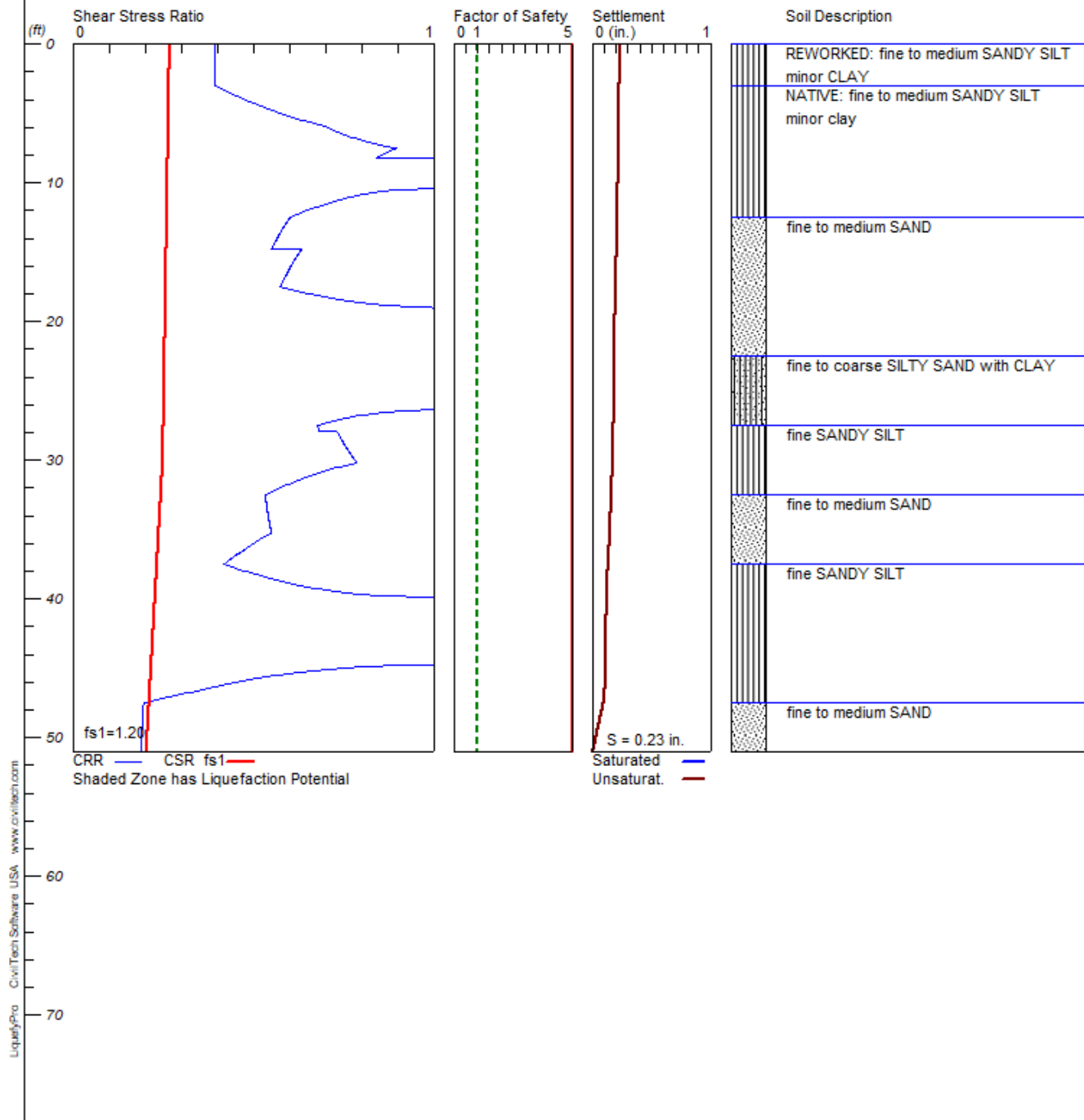


LIQUEFACTION ANALYSIS

New Kindergarten Classrooms at Virginia Lee Rose Elementary

Hole No.=B-2 Water Depth=86 ft Surface Elev.=275

Magnitude=5.5
Acceleration=0.343g



LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\Engineering\Desktop\07-230527-0.liq
Title: New Kindergarten Classrooms at Virginia Lee Rose Elementary
Subtitle: 07-230527-0

Surface Elev.=275
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 20.70 ft
Water Table during In-Situ Testing= 193.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=275
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 20.70 ft
Water Table during In-Situ Testing= 193.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT gamma pcf	Fines %
-------------	------------------	------------

0.00	4.00	113.60	60.00
3.00	4.00	128.30	60.00

7.50	11.00	124.80	60.00
12.50	13.00	103.70	8.00
17.50	13.00	103.70	8.00
22.50	24.00	146.40	36.00
27.50	14.00	125.00	70.00
32.50	17.00	104.30	5.00
37.50	9.00	107.30	60.00
42.50	30.00	120.60	65.00
47.50	12.00	105.00	5.00

Output Results:

Settlement of Saturated Sands=0.09 in.
Settlement of Unsaturated Sands=0.04 in.
Total Settlement of Saturated and Unsaturated Sands=0.13 in.
Differential Settlement=0.065 to 0.085 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat. in.	S_dry	S_all
-------------	------	--------------	-------------	---------------	-------	-------

0.00	0.39	0.27	5.00	0.09	0.04	0.13
0.05	0.39	0.27	5.00	0.09	0.04	0.13
0.10	0.39	0.27	5.00	0.09	0.04	0.13
0.15	0.39	0.27	5.00	0.09	0.04	0.13
0.20	0.39	0.27	5.00	0.09	0.04	0.13
0.25	0.39	0.27	5.00	0.09	0.04	0.13
0.30	0.39	0.27	5.00	0.09	0.04	0.13
0.35	0.39	0.27	5.00	0.09	0.04	0.13
0.40	0.39	0.27	5.00	0.09	0.04	0.13
0.45	0.39	0.27	5.00	0.09	0.04	0.13
0.50	0.39	0.27	5.00	0.09	0.04	0.13
0.55	0.39	0.27	5.00	0.09	0.04	0.13
0.60	0.39	0.27	5.00	0.09	0.04	0.13
0.65	0.39	0.27	5.00	0.09	0.04	0.13
0.70	0.39	0.27	5.00	0.09	0.04	0.13
0.75	0.39	0.27	5.00	0.09	0.04	0.13
0.80	0.39	0.27	5.00	0.09	0.04	0.13
0.85	0.39	0.27	5.00	0.09	0.04	0.13
0.90	0.39	0.27	5.00	0.09	0.04	0.13
0.95	0.39	0.27	5.00	0.09	0.04	0.13
1.00	0.39	0.27	5.00	0.09	0.04	0.13
1.05	0.39	0.27	5.00	0.09	0.04	0.13
1.10	0.39	0.27	5.00	0.09	0.04	0.13
1.15	0.39	0.27	5.00	0.09	0.04	0.13
1.20	0.39	0.27	5.00	0.09	0.04	0.13
1.25	0.39	0.27	5.00	0.09	0.04	0.13
1.30	0.39	0.27	5.00	0.09	0.04	0.13
1.35	0.39	0.27	5.00	0.09	0.04	0.13
1.40	0.39	0.27	5.00	0.09	0.04	0.13
1.45	0.39	0.27	5.00	0.09	0.04	0.13
1.50	0.39	0.27	5.00	0.09	0.04	0.13
1.55	0.39	0.27	5.00	0.09	0.04	0.13
1.60	0.39	0.27	5.00	0.09	0.04	0.13
1.65	0.39	0.27	5.00	0.09	0.04	0.13

1.70 0.39 0.27 5.00 0.09 0.04 0.13
1.75 0.39 0.27 5.00 0.09 0.04 0.13
1.80 0.39 0.27 5.00 0.09 0.04 0.13
1.85 0.39 0.27 5.00 0.09 0.04 0.13
1.90 0.39 0.27 5.00 0.09 0.04 0.13
1.95 0.39 0.27 5.00 0.09 0.04 0.13
2.00 0.39 0.27 5.00 0.09 0.04 0.13
2.05 0.39 0.27 5.00 0.09 0.04 0.13
2.10 0.39 0.27 5.00 0.09 0.04 0.13
2.15 0.39 0.27 5.00 0.09 0.04 0.13
2.20 0.39 0.27 5.00 0.09 0.04 0.13
2.25 0.39 0.27 5.00 0.09 0.04 0.13
2.30 0.39 0.27 5.00 0.09 0.04 0.13
2.35 0.39 0.27 5.00 0.09 0.04 0.13
2.40 0.39 0.27 5.00 0.09 0.04 0.13
2.45 0.39 0.27 5.00 0.09 0.04 0.13
2.50 0.39 0.27 5.00 0.09 0.04 0.13
2.55 0.39 0.27 5.00 0.09 0.04 0.13
2.60 0.39 0.27 5.00 0.09 0.04 0.13
2.65 0.39 0.27 5.00 0.09 0.04 0.13
2.70 0.39 0.27 5.00 0.09 0.04 0.13
2.75 0.39 0.27 5.00 0.09 0.04 0.13
2.80 0.39 0.27 5.00 0.09 0.04 0.12
2.85 0.39 0.27 5.00 0.09 0.04 0.12
2.90 0.39 0.27 5.00 0.09 0.04 0.12
2.95 0.39 0.27 5.00 0.09 0.04 0.12
3.00 0.39 0.27 5.00 0.09 0.04 0.12
3.05 0.40 0.27 5.00 0.09 0.04 0.12
3.10 0.40 0.27 5.00 0.09 0.04 0.12
3.15 0.40 0.27 5.00 0.09 0.04 0.12
3.20 0.41 0.27 5.00 0.09 0.04 0.12
3.25 0.41 0.27 5.00 0.09 0.04 0.12
3.30 0.42 0.27 5.00 0.09 0.04 0.12
3.35 0.42 0.27 5.00 0.09 0.04 0.12
3.40 0.42 0.27 5.00 0.09 0.04 0.12
3.45 0.43 0.27 5.00 0.09 0.04 0.12
3.50 0.43 0.27 5.00 0.09 0.04 0.12
3.55 0.44 0.27 5.00 0.09 0.04 0.12
3.60 0.44 0.27 5.00 0.09 0.04 0.12
3.65 0.45 0.27 5.00 0.09 0.04 0.12
3.70 0.45 0.27 5.00 0.09 0.04 0.12
3.75 0.45 0.27 5.00 0.09 0.04 0.12
3.80 0.46 0.27 5.00 0.09 0.04 0.12
3.85 0.46 0.27 5.00 0.09 0.04 0.12
3.90 0.47 0.27 5.00 0.09 0.04 0.12
3.95 0.47 0.27 5.00 0.09 0.04 0.12
4.00 0.48 0.27 5.00 0.09 0.04 0.12
4.05 0.48 0.27 5.00 0.09 0.04 0.12
4.10 0.49 0.26 5.00 0.09 0.04 0.12
4.15 0.49 0.26 5.00 0.09 0.04 0.12
4.20 0.50 0.26 5.00 0.09 0.04 0.12
4.25 0.50 0.26 5.00 0.09 0.04 0.12
4.30 0.50 0.26 5.00 0.09 0.04 0.12
4.35 0.51 0.26 5.00 0.09 0.04 0.12

4.40 0.51 0.26 5.00 0.09 0.03 0.12
4.45 0.52 0.26 5.00 0.09 0.03 0.12
4.50 0.52 0.26 5.00 0.09 0.03 0.12
4.55 0.53 0.26 5.00 0.09 0.03 0.12
4.60 0.53 0.26 5.00 0.09 0.03 0.12
4.65 0.54 0.26 5.00 0.09 0.03 0.12
4.70 0.54 0.26 5.00 0.09 0.03 0.12
4.75 0.55 0.26 5.00 0.09 0.03 0.12
4.80 0.55 0.26 5.00 0.09 0.03 0.12
4.85 0.56 0.26 5.00 0.09 0.03 0.12
4.90 0.56 0.26 5.00 0.09 0.03 0.12
4.95 0.57 0.26 5.00 0.09 0.03 0.12
5.00 0.58 0.26 5.00 0.09 0.03 0.12
5.05 0.58 0.26 5.00 0.09 0.03 0.12
5.10 0.59 0.26 5.00 0.09 0.03 0.12
5.15 0.59 0.26 5.00 0.09 0.03 0.12
5.20 0.60 0.26 5.00 0.09 0.03 0.12
5.25 0.60 0.26 5.00 0.09 0.03 0.12
5.30 0.61 0.26 5.00 0.09 0.03 0.12
5.35 0.62 0.26 5.00 0.09 0.03 0.12
5.40 0.62 0.26 5.00 0.09 0.03 0.12
5.45 0.63 0.26 5.00 0.09 0.03 0.12
5.50 0.64 0.26 5.00 0.09 0.03 0.12
5.55 0.64 0.26 5.00 0.09 0.03 0.12
5.60 0.65 0.26 5.00 0.09 0.03 0.12
5.65 0.66 0.26 5.00 0.09 0.03 0.12
5.70 0.66 0.26 5.00 0.09 0.03 0.12
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5.80 0.68 0.26 5.00 0.09 0.03 0.12
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5.90 0.69 0.26 5.00 0.09 0.03 0.12
5.95 0.70 0.26 5.00 0.09 0.03 0.12
6.00 0.70 0.26 5.00 0.09 0.03 0.12
6.05 0.71 0.26 5.00 0.09 0.03 0.12
6.10 0.71 0.26 5.00 0.09 0.03 0.12
6.15 0.72 0.26 5.00 0.09 0.03 0.12
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6.30 0.73 0.26 5.00 0.09 0.03 0.12
6.35 0.74 0.26 5.00 0.09 0.03 0.12
6.40 0.74 0.26 5.00 0.09 0.03 0.12
6.45 0.74 0.26 5.00 0.09 0.03 0.12
6.50 0.75 0.26 5.00 0.09 0.03 0.12
6.55 0.75 0.26 5.00 0.09 0.03 0.12
6.60 0.76 0.26 5.00 0.09 0.03 0.12
6.65 0.77 0.26 5.00 0.09 0.03 0.12
6.70 0.77 0.26 5.00 0.09 0.03 0.12
6.75 0.78 0.26 5.00 0.09 0.03 0.12
6.80 0.78 0.26 5.00 0.09 0.03 0.12
6.85 0.79 0.26 5.00 0.09 0.03 0.12
6.90 0.79 0.26 5.00 0.09 0.03 0.12
6.95 0.80 0.26 5.00 0.09 0.03 0.12
7.00 0.81 0.26 5.00 0.09 0.03 0.12
7.05 0.81 0.26 5.00 0.09 0.03 0.12

7.10 0.82 0.26 5.00 0.09 0.03 0.12
7.15 0.83 0.26 5.00 0.09 0.03 0.12
7.20 0.84 0.26 5.00 0.09 0.03 0.12
7.25 0.84 0.26 5.00 0.09 0.03 0.12
7.30 0.85 0.26 5.00 0.09 0.03 0.12
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7.40 0.87 0.26 5.00 0.09 0.03 0.12
7.45 0.88 0.26 5.00 0.09 0.03 0.12
7.50 0.90 0.26 5.00 0.09 0.03 0.12
7.55 0.89 0.26 5.00 0.09 0.03 0.12
7.60 0.89 0.26 5.00 0.09 0.03 0.12
7.65 0.88 0.26 5.00 0.09 0.03 0.12
7.70 0.88 0.26 5.00 0.09 0.03 0.12
7.75 0.87 0.26 5.00 0.09 0.03 0.12
7.80 0.87 0.26 5.00 0.09 0.03 0.12
7.85 0.87 0.26 5.00 0.09 0.03 0.12
7.90 0.86 0.26 5.00 0.09 0.03 0.12
7.95 0.86 0.26 5.00 0.09 0.03 0.12
8.00 0.85 0.26 5.00 0.09 0.03 0.12
8.05 0.85 0.26 5.00 0.09 0.03 0.12
8.10 0.85 0.26 5.00 0.09 0.03 0.12
8.15 0.85 0.26 5.00 0.09 0.03 0.12
8.20 0.84 0.26 5.00 0.09 0.03 0.12
8.25 1.11 0.26 5.00 0.09 0.03 0.12
8.30 1.11 0.26 5.00 0.09 0.03 0.12
8.35 1.11 0.26 5.00 0.09 0.03 0.12
8.40 1.11 0.26 5.00 0.09 0.03 0.11
8.45 1.11 0.26 5.00 0.09 0.03 0.11
8.50 1.11 0.26 5.00 0.09 0.03 0.11
8.55 1.11 0.26 5.00 0.09 0.03 0.11
8.60 1.11 0.26 5.00 0.09 0.03 0.11
8.65 1.11 0.26 5.00 0.09 0.03 0.11
8.70 1.11 0.26 5.00 0.09 0.03 0.11
8.75 1.11 0.26 5.00 0.09 0.03 0.11
8.80 1.11 0.26 5.00 0.09 0.03 0.11
8.85 1.11 0.26 5.00 0.09 0.03 0.11
8.90 1.11 0.26 5.00 0.09 0.03 0.11
8.95 1.11 0.26 5.00 0.09 0.03 0.11
9.00 1.11 0.26 5.00 0.09 0.03 0.11
9.05 1.11 0.26 5.00 0.09 0.03 0.11
9.10 1.11 0.26 5.00 0.09 0.03 0.11
9.15 1.11 0.26 5.00 0.09 0.03 0.11
9.20 1.11 0.26 5.00 0.09 0.03 0.11
9.25 1.11 0.26 5.00 0.09 0.03 0.11
9.30 1.11 0.26 5.00 0.09 0.03 0.11
9.35 1.11 0.26 5.00 0.09 0.03 0.11
9.40 1.11 0.26 5.00 0.09 0.03 0.11
9.45 1.11 0.26 5.00 0.09 0.03 0.11
9.50 1.11 0.26 5.00 0.09 0.03 0.11
9.55 1.11 0.26 5.00 0.09 0.03 0.11
9.60 1.11 0.26 5.00 0.09 0.03 0.11
9.65 1.11 0.26 5.00 0.09 0.03 0.11
9.70 1.11 0.26 5.00 0.09 0.03 0.11
9.75 1.11 0.26 5.00 0.09 0.03 0.11

9.80	1.11	0.26	5.00	0.09	0.03	0.11
9.85	1.11	0.26	5.00	0.09	0.03	0.11
9.90	1.11	0.26	5.00	0.09	0.03	0.11
9.95	1.11	0.26	5.00	0.09	0.03	0.11
10.00	1.11	0.26	5.00	0.09	0.03	0.11
10.05	1.11	0.26	5.00	0.09	0.03	0.11
10.10	1.11	0.26	5.00	0.09	0.03	0.11
10.15	1.11	0.26	5.00	0.09	0.03	0.11
10.20	1.11	0.26	5.00	0.09	0.03	0.11
10.25	1.11	0.26	5.00	0.09	0.03	0.11
10.30	1.11	0.26	5.00	0.09	0.03	0.11
10.35	1.05	0.26	5.00	0.09	0.03	0.11
10.40	0.98	0.26	5.00	0.09	0.03	0.11
10.45	0.94	0.26	5.00	0.09	0.03	0.11
10.50	0.91	0.26	5.00	0.09	0.03	0.11
10.55	0.89	0.26	5.00	0.09	0.03	0.11
10.60	0.87	0.26	5.00	0.09	0.03	0.11
10.65	0.85	0.26	5.00	0.09	0.03	0.11
10.70	0.84	0.26	5.00	0.09	0.03	0.11
10.75	0.82	0.26	5.00	0.09	0.03	0.11
10.80	0.81	0.26	5.00	0.09	0.03	0.11
10.85	0.80	0.26	5.00	0.09	0.03	0.11
10.90	0.79	0.26	5.00	0.09	0.03	0.11
10.95	0.78	0.26	5.00	0.09	0.03	0.11
11.00	0.78	0.26	5.00	0.09	0.03	0.11
11.05	0.77	0.26	5.00	0.09	0.03	0.11
11.10	0.76	0.26	5.00	0.09	0.02	0.11
11.15	0.75	0.26	5.00	0.09	0.02	0.11
11.20	0.74	0.26	5.00	0.09	0.02	0.11
11.25	0.74	0.26	5.00	0.09	0.02	0.11
11.30	0.73	0.26	5.00	0.09	0.02	0.11
11.35	0.72	0.26	5.00	0.09	0.02	0.11
11.40	0.72	0.26	5.00	0.09	0.02	0.11
11.45	0.71	0.26	5.00	0.09	0.02	0.11
11.50	0.70	0.26	5.00	0.09	0.02	0.11
11.55	0.70	0.26	5.00	0.09	0.02	0.11
11.60	0.69	0.26	5.00	0.09	0.02	0.11
11.65	0.69	0.26	5.00	0.09	0.02	0.11
11.70	0.68	0.26	5.00	0.09	0.02	0.11
11.75	0.67	0.26	5.00	0.09	0.02	0.11
11.80	0.67	0.26	5.00	0.09	0.02	0.11
11.85	0.66	0.26	5.00	0.09	0.02	0.11
11.90	0.66	0.26	5.00	0.09	0.02	0.11
11.95	0.65	0.26	5.00	0.09	0.02	0.11
12.00	0.65	0.26	5.00	0.09	0.02	0.11
12.05	0.64	0.26	5.00	0.09	0.02	0.11
12.10	0.64	0.26	5.00	0.09	0.02	0.11
12.15	0.63	0.26	5.00	0.09	0.02	0.11
12.20	0.63	0.26	5.00	0.09	0.02	0.11
12.25	0.62	0.26	5.00	0.09	0.02	0.11
12.30	0.62	0.26	5.00	0.09	0.02	0.11
12.35	0.61	0.26	5.00	0.09	0.02	0.11
12.40	0.61	0.26	5.00	0.09	0.02	0.11
12.45	0.61	0.26	5.00	0.09	0.02	0.11

12.50	0.60	0.26	5.00	0.09	0.02	0.11
12.55	0.60	0.26	5.00	0.09	0.02	0.11
12.60	0.60	0.26	5.00	0.09	0.02	0.11
12.65	0.60	0.26	5.00	0.09	0.02	0.11
12.70	0.60	0.26	5.00	0.09	0.02	0.11
12.75	0.59	0.26	5.00	0.09	0.02	0.11
12.80	0.59	0.26	5.00	0.09	0.02	0.11
12.85	0.59	0.26	5.00	0.09	0.02	0.11
12.90	0.59	0.26	5.00	0.09	0.02	0.11
12.95	0.59	0.26	5.00	0.09	0.02	0.11
13.00	0.59	0.26	5.00	0.09	0.02	0.11
13.05	0.59	0.26	5.00	0.09	0.02	0.11
13.10	0.59	0.26	5.00	0.09	0.02	0.11
13.15	0.58	0.26	5.00	0.09	0.02	0.11
13.20	0.58	0.26	5.00	0.09	0.02	0.11
13.25	0.58	0.26	5.00	0.09	0.02	0.11
13.30	0.58	0.26	5.00	0.09	0.02	0.11
13.35	0.58	0.26	5.00	0.09	0.02	0.11
13.40	0.58	0.26	5.00	0.09	0.02	0.11
13.45	0.58	0.26	5.00	0.09	0.02	0.11
13.50	0.58	0.26	5.00	0.09	0.02	0.11
13.55	0.58	0.26	5.00	0.09	0.02	0.11
13.60	0.57	0.26	5.00	0.09	0.02	0.11
13.65	0.57	0.26	5.00	0.09	0.02	0.11
13.70	0.57	0.26	5.00	0.09	0.02	0.11
13.75	0.57	0.26	5.00	0.09	0.02	0.11
13.80	0.57	0.26	5.00	0.09	0.02	0.10
13.85	0.57	0.26	5.00	0.09	0.02	0.10
13.90	0.57	0.26	5.00	0.09	0.02	0.10
13.95	0.57	0.26	5.00	0.09	0.02	0.10
14.00	0.57	0.26	5.00	0.09	0.02	0.10
14.05	0.56	0.26	5.00	0.09	0.02	0.10
14.10	0.56	0.26	5.00	0.09	0.02	0.10
14.15	0.56	0.26	5.00	0.09	0.02	0.10
14.20	0.56	0.26	5.00	0.09	0.02	0.10
14.25	0.56	0.26	5.00	0.09	0.02	0.10
14.30	0.56	0.26	5.00	0.09	0.02	0.10
14.35	0.56	0.26	5.00	0.09	0.02	0.10
14.40	0.56	0.26	5.00	0.09	0.02	0.10
14.45	0.56	0.26	5.00	0.09	0.02	0.10
14.50	0.55	0.26	5.00	0.09	0.02	0.10
14.55	0.55	0.26	5.00	0.09	0.02	0.10
14.60	0.55	0.26	5.00	0.09	0.02	0.10
14.65	0.55	0.26	5.00	0.09	0.02	0.10
14.70	0.55	0.26	5.00	0.09	0.02	0.10
14.75	0.55	0.26	5.00	0.09	0.02	0.10
14.80	0.63	0.26	5.00	0.09	0.02	0.10
14.85	0.63	0.26	5.00	0.09	0.02	0.10
14.90	0.63	0.26	5.00	0.09	0.02	0.10
14.95	0.63	0.26	5.00	0.09	0.02	0.10
15.00	0.63	0.26	5.00	0.09	0.02	0.10
15.05	0.63	0.26	5.00	0.09	0.01	0.10
15.10	0.63	0.26	5.00	0.09	0.01	0.10
15.15	0.62	0.26	5.00	0.09	0.01	0.10

15.20	0.62	0.26	5.00	0.09	0.01	0.10
15.25	0.62	0.26	5.00	0.09	0.01	0.10
15.30	0.62	0.26	5.00	0.09	0.01	0.10
15.35	0.62	0.26	5.00	0.09	0.01	0.10
15.40	0.62	0.26	5.00	0.09	0.01	0.10
15.45	0.62	0.26	5.00	0.09	0.01	0.10
15.50	0.62	0.26	5.00	0.09	0.01	0.10
15.55	0.61	0.26	5.00	0.09	0.01	0.10
15.60	0.61	0.26	5.00	0.09	0.01	0.10
15.65	0.61	0.26	5.00	0.09	0.01	0.10
15.70	0.61	0.26	5.00	0.09	0.01	0.10
15.75	0.61	0.26	5.00	0.09	0.01	0.10
15.80	0.61	0.26	5.00	0.09	0.01	0.10
15.85	0.61	0.26	5.00	0.09	0.01	0.10
15.90	0.61	0.26	5.00	0.09	0.01	0.10
15.95	0.60	0.26	5.00	0.09	0.01	0.10
16.00	0.60	0.26	5.00	0.09	0.01	0.10
16.05	0.60	0.26	5.00	0.09	0.01	0.10
16.10	0.60	0.26	5.00	0.09	0.01	0.10
16.15	0.60	0.26	5.00	0.09	0.01	0.10
16.20	0.60	0.26	5.00	0.09	0.01	0.10
16.25	0.60	0.26	5.00	0.09	0.01	0.10
16.30	0.60	0.26	5.00	0.09	0.01	0.10
16.35	0.60	0.26	5.00	0.09	0.01	0.10
16.40	0.60	0.26	5.00	0.09	0.01	0.10
16.45	0.59	0.26	5.00	0.09	0.01	0.10
16.50	0.59	0.26	5.00	0.09	0.01	0.10
16.55	0.59	0.26	5.00	0.09	0.01	0.10
16.60	0.59	0.26	5.00	0.09	0.01	0.10
16.65	0.59	0.26	5.00	0.09	0.01	0.10
16.70	0.59	0.26	5.00	0.09	0.01	0.10
16.75	0.59	0.26	5.00	0.09	0.01	0.10
16.80	0.59	0.26	5.00	0.09	0.01	0.10
16.85	0.59	0.26	5.00	0.09	0.01	0.10
16.90	0.59	0.26	5.00	0.09	0.01	0.10
16.95	0.58	0.26	5.00	0.09	0.01	0.10
17.00	0.58	0.26	5.00	0.09	0.01	0.10
17.05	0.58	0.26	5.00	0.09	0.01	0.10
17.10	0.58	0.26	5.00	0.09	0.01	0.10
17.15	0.58	0.26	5.00	0.09	0.01	0.09
17.20	0.58	0.26	5.00	0.09	0.01	0.09
17.25	0.58	0.26	5.00	0.09	0.01	0.09
17.30	0.58	0.26	5.00	0.09	0.01	0.09
17.35	0.58	0.26	5.00	0.09	0.01	0.09
17.40	0.58	0.26	5.00	0.09	0.01	0.09
17.45	0.57	0.26	5.00	0.09	0.01	0.09
17.50	0.57	0.26	5.00	0.09	0.01	0.09
17.55	0.58	0.26	5.00	0.09	0.01	0.09
17.60	0.59	0.26	5.00	0.09	0.01	0.09
17.65	0.60	0.26	5.00	0.09	0.01	0.09
17.70	0.60	0.26	5.00	0.09	0.01	0.09
17.75	0.61	0.26	5.00	0.09	0.01	0.09
17.80	0.62	0.26	5.00	0.09	0.01	0.09
17.85	0.63	0.26	5.00	0.09	0.01	0.09

17.90	0.64	0.26	5.00	0.09	0.01	0.09
17.95	0.64	0.26	5.00	0.09	0.01	0.09
18.00	0.65	0.26	5.00	0.09	0.01	0.09
18.05	0.66	0.26	5.00	0.09	0.01	0.09
18.10	0.67	0.26	5.00	0.09	0.01	0.09
18.15	0.68	0.26	5.00	0.09	0.01	0.09
18.20	0.69	0.26	5.00	0.09	0.01	0.09
18.25	0.70	0.26	5.00	0.09	0.01	0.09
18.30	0.71	0.26	5.00	0.09	0.00	0.09
18.35	0.72	0.26	5.00	0.09	0.00	0.09
18.40	0.73	0.26	5.00	0.09	0.00	0.09
18.45	0.74	0.26	5.00	0.09	0.00	0.09
18.50	0.76	0.26	5.00	0.09	0.00	0.09
18.55	0.77	0.26	5.00	0.09	0.00	0.09
18.60	0.78	0.26	5.00	0.09	0.00	0.09
18.65	0.80	0.26	5.00	0.09	0.00	0.09
18.70	0.82	0.26	5.00	0.09	0.00	0.09
18.75	0.84	0.26	5.00	0.09	0.00	0.09
18.80	0.86	0.26	5.00	0.09	0.00	0.09
18.85	0.89	0.26	5.00	0.09	0.00	0.09
18.90	0.92	0.26	5.00	0.09	0.00	0.09
18.95	0.99	0.26	5.00	0.09	0.00	0.09
19.00	1.11	0.26	5.00	0.09	0.00	0.09
19.05	1.11	0.26	5.00	0.09	0.00	0.09
19.10	1.11	0.26	5.00	0.09	0.00	0.09
19.15	1.11	0.26	5.00	0.09	0.00	0.09
19.20	1.11	0.26	5.00	0.09	0.00	0.09
19.25	1.11	0.26	5.00	0.09	0.00	0.09
19.30	1.11	0.26	5.00	0.09	0.00	0.09
19.35	1.11	0.26	5.00	0.09	0.00	0.09
19.40	1.11	0.26	5.00	0.09	0.00	0.09
19.45	1.11	0.26	5.00	0.09	0.00	0.09
19.50	1.11	0.26	5.00	0.09	0.00	0.09
19.55	1.11	0.26	5.00	0.09	0.00	0.09
19.60	1.11	0.26	5.00	0.09	0.00	0.09
19.65	1.11	0.26	5.00	0.09	0.00	0.09
19.70	1.11	0.26	5.00	0.09	0.00	0.09
19.75	1.11	0.26	5.00	0.09	0.00	0.09
19.80	1.11	0.26	5.00	0.09	0.00	0.09
19.85	1.11	0.26	5.00	0.09	0.00	0.09
19.90	1.11	0.26	5.00	0.09	0.00	0.09
19.95	1.11	0.26	5.00	0.09	0.00	0.09
20.00	1.11	0.26	5.00	0.09	0.00	0.09
20.05	1.11	0.26	5.00	0.09	0.00	0.09
20.10	1.11	0.26	5.00	0.09	0.00	0.09
20.15	1.11	0.25	5.00	0.09	0.00	0.09
20.20	1.11	0.25	5.00	0.09	0.00	0.09
20.25	1.11	0.25	5.00	0.09	0.00	0.09
20.30	1.11	0.25	5.00	0.09	0.00	0.09
20.35	1.11	0.25	5.00	0.09	0.00	0.09
20.40	1.11	0.25	5.00	0.09	0.00	0.09
20.45	1.11	0.25	5.00	0.09	0.00	0.09
20.50	1.11	0.25	5.00	0.09	0.00	0.09
20.55	1.11	0.25	5.00	0.09	0.00	0.09

20.60	1.11	0.25	5.00	0.09	0.00	0.09
20.65	1.11	0.25	5.00	0.09	0.00	0.09
20.70	1.11	0.25	5.00	0.09	0.00	0.09
20.75	1.11	0.25	4.34	0.09	0.00	0.09
20.80	1.11	0.25	4.34	0.09	0.00	0.09
20.85	1.11	0.26	4.33	0.09	0.00	0.09
20.90	1.11	0.26	4.33	0.09	0.00	0.09
20.95	1.11	0.26	4.32	0.09	0.00	0.09
21.00	1.11	0.26	4.32	0.09	0.00	0.09
21.05	1.11	0.26	4.31	0.09	0.00	0.09
21.10	1.11	0.26	4.31	0.09	0.00	0.09
21.15	1.11	0.26	4.30	0.09	0.00	0.09
21.20	1.11	0.26	4.30	0.09	0.00	0.09
21.25	1.11	0.26	4.29	0.09	0.00	0.09
21.30	1.11	0.26	4.29	0.09	0.00	0.09
21.35	1.11	0.26	4.28	0.09	0.00	0.09
21.40	1.11	0.26	4.28	0.09	0.00	0.09
21.45	1.11	0.26	4.27	0.09	0.00	0.09
21.50	1.11	0.26	4.27	0.09	0.00	0.09
21.55	1.11	0.26	4.27	0.09	0.00	0.09
21.60	1.11	0.26	4.26	0.09	0.00	0.09
21.65	1.11	0.26	4.26	0.09	0.00	0.09
21.70	1.11	0.26	4.25	0.09	0.00	0.09
21.75	1.11	0.26	4.25	0.09	0.00	0.09
21.80	1.11	0.26	4.24	0.09	0.00	0.09
21.85	1.11	0.26	4.24	0.09	0.00	0.09
21.90	1.11	0.26	4.23	0.09	0.00	0.09
21.95	1.11	0.26	4.23	0.09	0.00	0.09
22.00	1.11	0.26	4.22	0.09	0.00	0.09
22.05	1.11	0.26	4.22	0.09	0.00	0.09
22.10	1.11	0.26	4.22	0.09	0.00	0.09
22.15	1.11	0.26	4.21	0.09	0.00	0.09
22.20	1.11	0.26	4.21	0.09	0.00	0.09
22.25	1.11	0.26	4.20	0.09	0.00	0.09
22.30	1.11	0.26	4.20	0.09	0.00	0.09
22.35	1.11	0.26	4.19	0.09	0.00	0.09
22.40	1.11	0.26	4.19	0.09	0.00	0.09
22.45	1.11	0.26	4.19	0.09	0.00	0.09
22.50	1.11	0.26	4.18	0.09	0.00	0.09
22.55	1.11	0.26	4.18	0.09	0.00	0.09
22.60	1.11	0.26	4.17	0.09	0.00	0.09
22.65	1.11	0.27	4.17	0.09	0.00	0.09
22.70	1.11	0.27	4.17	0.09	0.00	0.09
22.75	1.11	0.27	4.16	0.09	0.00	0.09
22.80	1.11	0.27	4.16	0.09	0.00	0.09
22.85	1.11	0.27	4.15	0.09	0.00	0.09
22.90	1.11	0.27	4.15	0.09	0.00	0.09
22.95	1.11	0.27	4.15	0.09	0.00	0.09
23.00	1.11	0.27	4.14	0.09	0.00	0.09
23.05	1.11	0.27	4.14	0.09	0.00	0.09
23.10	1.11	0.27	4.13	0.09	0.00	0.09
23.15	1.11	0.27	4.13	0.09	0.00	0.09
23.20	1.11	0.27	4.13	0.09	0.00	0.09
23.25	1.11	0.27	4.12	0.09	0.00	0.09

23.30	1.11	0.27	4.12	0.09	0.00	0.09
23.35	1.11	0.27	4.11	0.09	0.00	0.09
23.40	1.11	0.27	4.11	0.09	0.00	0.09
23.45	1.11	0.27	4.11	0.09	0.00	0.09
23.50	1.11	0.27	4.10	0.09	0.00	0.09
23.55	1.11	0.27	4.10	0.09	0.00	0.09
23.60	1.11	0.27	4.10	0.09	0.00	0.09
23.65	1.11	0.27	4.09	0.09	0.00	0.09
23.70	1.11	0.27	4.09	0.09	0.00	0.09
23.75	1.11	0.27	4.09	0.09	0.00	0.09
23.80	1.11	0.27	4.08	0.09	0.00	0.09
23.85	1.11	0.27	4.08	0.09	0.00	0.09
23.90	1.11	0.27	4.07	0.09	0.00	0.09
23.95	1.11	0.27	4.07	0.09	0.00	0.09
24.00	1.11	0.27	4.07	0.09	0.00	0.09
24.05	1.11	0.27	4.06	0.09	0.00	0.09
24.10	1.11	0.27	4.06	0.09	0.00	0.09
24.15	1.11	0.27	4.06	0.09	0.00	0.09
24.20	1.11	0.27	4.05	0.09	0.00	0.09
24.25	1.11	0.27	4.05	0.09	0.00	0.09
24.30	1.11	0.27	4.05	0.09	0.00	0.09
24.35	1.11	0.27	4.04	0.09	0.00	0.09
24.40	1.11	0.27	4.04	0.09	0.00	0.09
24.45	1.11	0.27	4.04	0.09	0.00	0.09
24.50	1.11	0.27	4.03	0.09	0.00	0.09
24.55	1.11	0.27	4.03	0.09	0.00	0.09
24.60	1.11	0.27	4.03	0.09	0.00	0.09
24.65	1.11	0.27	4.02	0.09	0.00	0.09
24.70	1.11	0.28	4.02	0.09	0.00	0.09
24.75	1.11	0.28	4.02	0.09	0.00	0.09
24.80	1.11	0.28	4.01	0.09	0.00	0.09
24.85	1.11	0.28	4.01	0.09	0.00	0.09
24.90	1.11	0.28	4.01	0.09	0.00	0.09
24.95	1.11	0.28	4.00	0.09	0.00	0.09
25.00	1.11	0.28	4.00	0.09	0.00	0.09
25.05	1.11	0.28	4.00	0.09	0.00	0.09
25.10	1.11	0.28	3.99	0.09	0.00	0.09
25.15	1.11	0.28	3.99	0.09	0.00	0.09
25.20	1.11	0.28	3.99	0.09	0.00	0.09
25.25	1.11	0.28	3.98	0.09	0.00	0.09
25.30	1.11	0.28	3.98	0.09	0.00	0.09
25.35	1.11	0.28	3.98	0.09	0.00	0.09
25.40	1.11	0.28	3.98	0.09	0.00	0.09
25.45	1.11	0.28	3.97	0.09	0.00	0.09
25.50	1.11	0.28	3.97	0.09	0.00	0.09
25.55	1.11	0.28	3.97	0.09	0.00	0.09
25.60	1.11	0.28	3.96	0.09	0.00	0.09
25.65	1.11	0.28	3.96	0.09	0.00	0.09
25.70	1.11	0.28	3.96	0.09	0.00	0.09
25.75	1.11	0.28	3.95	0.09	0.00	0.09
25.80	1.11	0.28	3.95	0.09	0.00	0.09
25.85	1.11	0.28	3.95	0.09	0.00	0.09
25.90	1.11	0.28	3.95	0.09	0.00	0.09
25.95	1.11	0.28	3.94	0.09	0.00	0.09

26.00	1.11	0.28	3.94	0.09	0.00	0.09
26.05	1.11	0.28	3.94	0.09	0.00	0.09
26.10	1.11	0.28	3.93	0.09	0.00	0.09
26.15	1.11	0.28	3.93	0.09	0.00	0.09
26.20	1.11	0.28	3.93	0.09	0.00	0.09
26.25	1.11	0.28	3.93	0.09	0.00	0.09
26.30	1.08	0.28	3.84	0.09	0.00	0.09
26.35	0.99	0.28	3.50	0.09	0.00	0.09
26.40	0.94	0.28	3.32	0.09	0.00	0.09
26.45	0.90	0.28	3.20	0.09	0.00	0.09
26.50	0.88	0.28	3.11	0.09	0.00	0.09
26.55	0.86	0.28	3.03	0.09	0.00	0.09
26.60	0.84	0.28	2.97	0.09	0.00	0.09
26.65	0.83	0.28	2.92	0.09	0.00	0.09
26.70	0.81	0.28	2.87	0.09	0.00	0.09
26.75	0.80	0.28	2.82	0.09	0.00	0.09
26.80	0.79	0.28	2.78	0.09	0.00	0.09
26.85	0.78	0.28	2.74	0.09	0.00	0.09
26.90	0.77	0.28	2.70	0.09	0.00	0.09
26.95	0.76	0.28	2.69	0.09	0.00	0.09
27.00	0.75	0.28	2.65	0.09	0.00	0.09
27.05	0.75	0.28	2.62	0.09	0.00	0.09
27.10	0.74	0.29	2.59	0.09	0.00	0.09
27.15	0.73	0.29	2.55	0.09	0.00	0.09
27.20	0.72	0.29	2.52	0.09	0.00	0.09
27.25	0.71	0.29	2.50	0.09	0.00	0.09
27.30	0.71	0.29	2.47	0.09	0.00	0.09
27.35	0.70	0.29	2.44	0.09	0.00	0.09
27.40	0.69	0.29	2.41	0.09	0.00	0.09
27.45	0.68	0.29	2.39	0.09	0.00	0.09
27.50	0.68	0.29	2.36	0.09	0.00	0.09
27.55	0.68	0.29	2.36	0.09	0.00	0.09
27.60	0.68	0.29	2.36	0.09	0.00	0.09
27.65	0.68	0.29	2.37	0.09	0.00	0.09
27.70	0.68	0.29	2.37	0.09	0.00	0.09
27.75	0.68	0.29	2.37	0.09	0.00	0.09
27.80	0.68	0.29	2.37	0.09	0.00	0.09
27.85	0.68	0.29	2.37	0.09	0.00	0.09
27.90	0.73	0.29	2.54	0.09	0.00	0.09
27.95	0.73	0.29	2.54	0.09	0.00	0.09
28.00	0.73	0.29	2.54	0.09	0.00	0.09
28.05	0.73	0.29	2.54	0.09	0.00	0.09
28.10	0.74	0.29	2.54	0.09	0.00	0.09
28.15	0.74	0.29	2.55	0.09	0.00	0.09
28.20	0.74	0.29	2.55	0.09	0.00	0.09
28.25	0.74	0.29	2.55	0.09	0.00	0.09
28.30	0.74	0.29	2.55	0.09	0.00	0.09
28.35	0.74	0.29	2.55	0.09	0.00	0.09
28.40	0.74	0.29	2.56	0.09	0.00	0.09
28.45	0.74	0.29	2.56	0.09	0.00	0.09
28.50	0.74	0.29	2.56	0.09	0.00	0.09
28.55	0.75	0.29	2.56	0.09	0.00	0.09
28.60	0.75	0.29	2.57	0.09	0.00	0.09
28.65	0.75	0.29	2.57	0.09	0.00	0.09

28.70	0.75	0.29	2.57	0.09	0.00	0.09
28.75	0.75	0.29	2.57	0.09	0.00	0.09
28.80	0.75	0.29	2.57	0.09	0.00	0.09
28.85	0.75	0.29	2.58	0.09	0.00	0.09
28.90	0.75	0.29	2.58	0.09	0.00	0.09
28.95	0.75	0.29	2.58	0.09	0.00	0.09
29.00	0.76	0.29	2.58	0.09	0.00	0.09
29.05	0.76	0.29	2.59	0.09	0.00	0.09
29.10	0.76	0.29	2.59	0.09	0.00	0.09
29.15	0.76	0.29	2.59	0.09	0.00	0.09
29.20	0.76	0.29	2.59	0.09	0.00	0.09
29.25	0.76	0.29	2.60	0.09	0.00	0.09
29.30	0.76	0.29	2.60	0.09	0.00	0.09
29.35	0.76	0.29	2.60	0.09	0.00	0.09
29.40	0.77	0.29	2.61	0.09	0.00	0.09
29.45	0.77	0.29	2.61	0.09	0.00	0.09
29.50	0.77	0.29	2.61	0.09	0.00	0.09
29.55	0.77	0.29	2.61	0.09	0.00	0.09
29.60	0.77	0.29	2.62	0.09	0.00	0.09
29.65	0.77	0.29	2.62	0.09	0.00	0.09
29.70	0.77	0.29	2.62	0.09	0.00	0.09
29.75	0.77	0.30	2.63	0.09	0.00	0.09
29.80	0.78	0.30	2.63	0.09	0.00	0.09
29.85	0.78	0.30	2.63	0.09	0.00	0.09
29.90	0.78	0.30	2.64	0.09	0.00	0.09
29.95	0.78	0.30	2.64	0.09	0.00	0.09
30.00	0.78	0.30	2.64	0.09	0.00	0.09
30.05	0.78	0.30	2.65	0.09	0.00	0.09
30.10	0.78	0.30	2.65	0.09	0.00	0.09
30.15	0.79	0.30	2.66	0.09	0.00	0.09
30.20	0.79	0.30	2.65	0.09	0.00	0.09
30.25	0.78	0.30	2.62	0.09	0.00	0.09
30.30	0.77	0.30	2.59	0.09	0.00	0.09
30.35	0.76	0.30	2.56	0.09	0.00	0.09
30.40	0.75	0.30	2.53	0.09	0.00	0.09
30.45	0.74	0.30	2.51	0.09	0.00	0.09
30.50	0.74	0.30	2.48	0.09	0.00	0.09
30.55	0.73	0.30	2.46	0.09	0.00	0.09
30.60	0.72	0.30	2.43	0.09	0.00	0.09
30.65	0.72	0.30	2.41	0.09	0.00	0.09
30.70	0.71	0.30	2.39	0.09	0.00	0.09
30.75	0.70	0.30	2.36	0.09	0.00	0.09
30.80	0.70	0.30	2.34	0.09	0.00	0.09
30.85	0.69	0.30	2.32	0.09	0.00	0.09
30.90	0.68	0.30	2.30	0.09	0.00	0.09
30.95	0.68	0.30	2.28	0.09	0.00	0.09
31.00	0.67	0.30	2.26	0.09	0.00	0.09
31.05	0.67	0.30	2.24	0.09	0.00	0.09
31.10	0.66	0.30	2.22	0.09	0.00	0.09
31.15	0.65	0.30	2.20	0.09	0.00	0.09
31.20	0.65	0.30	2.18	0.09	0.00	0.09
31.25	0.64	0.30	2.16	0.09	0.00	0.09
31.30	0.64	0.30	2.14	0.09	0.00	0.09
31.35	0.63	0.30	2.13	0.09	0.00	0.09

31.40	0.63	0.30	2.11	0.09	0.00	0.09
31.45	0.62	0.30	2.09	0.09	0.00	0.09
31.50	0.62	0.30	2.08	0.09	0.00	0.09
31.55	0.61	0.30	2.06	0.09	0.00	0.09
31.60	0.61	0.30	2.04	0.09	0.00	0.09
31.65	0.60	0.30	2.03	0.09	0.00	0.09
31.70	0.60	0.30	2.01	0.09	0.00	0.09
31.75	0.60	0.30	1.99	0.09	0.00	0.09
31.80	0.59	0.30	1.98	0.09	0.00	0.09
31.85	0.59	0.30	1.96	0.09	0.00	0.09
31.90	0.58	0.30	1.95	0.09	0.00	0.09
31.95	0.58	0.30	1.93	0.09	0.00	0.09
32.00	0.57	0.30	1.92	0.09	0.00	0.09
32.05	0.57	0.30	1.90	0.09	0.00	0.09
32.10	0.56	0.30	1.89	0.09	0.00	0.09
32.15	0.56	0.30	1.87	0.09	0.00	0.09
32.20	0.56	0.30	1.86	0.09	0.00	0.09
32.25	0.55	0.30	1.85	0.09	0.00	0.09
32.30	0.55	0.30	1.83	0.09	0.00	0.09
32.35	0.54	0.30	1.82	0.09	0.00	0.09
32.40	0.54	0.30	1.81	0.09	0.00	0.09
32.45	0.54	0.30	1.79	0.09	0.00	0.09
32.50	0.53	0.30	1.78	0.09	0.00	0.09
32.55	0.53	0.30	1.78	0.09	0.00	0.09
32.60	0.53	0.30	1.78	0.09	0.00	0.09
32.65	0.53	0.30	1.78	0.09	0.00	0.09
32.70	0.53	0.30	1.78	0.09	0.00	0.09
32.75	0.53	0.30	1.78	0.09	0.00	0.09
32.80	0.53	0.30	1.78	0.09	0.00	0.09
32.85	0.53	0.30	1.78	0.09	0.00	0.09
32.90	0.53	0.30	1.78	0.09	0.00	0.09
32.95	0.53	0.30	1.78	0.09	0.00	0.09
33.00	0.54	0.30	1.78	0.09	0.00	0.09
33.05	0.54	0.30	1.78	0.09	0.00	0.09
33.10	0.54	0.30	1.78	0.09	0.00	0.09
33.15	0.54	0.30	1.78	0.09	0.00	0.09
33.20	0.54	0.30	1.78	0.09	0.00	0.09
33.25	0.54	0.30	1.78	0.09	0.00	0.09
33.30	0.54	0.30	1.78	0.09	0.00	0.09
33.35	0.54	0.30	1.78	0.09	0.00	0.09
33.40	0.54	0.30	1.78	0.09	0.00	0.09
33.45	0.54	0.30	1.79	0.09	0.00	0.09
33.50	0.54	0.30	1.79	0.09	0.00	0.09
33.55	0.54	0.30	1.79	0.09	0.00	0.09
33.60	0.54	0.30	1.79	0.09	0.00	0.09
33.65	0.54	0.30	1.79	0.09	0.00	0.09
33.70	0.54	0.30	1.79	0.09	0.00	0.09
33.75	0.54	0.30	1.79	0.09	0.00	0.09
33.80	0.54	0.30	1.79	0.09	0.00	0.09
33.85	0.54	0.30	1.79	0.09	0.00	0.09
33.90	0.54	0.30	1.79	0.09	0.00	0.09
33.95	0.54	0.30	1.79	0.09	0.00	0.09
34.00	0.54	0.30	1.79	0.09	0.00	0.09
34.05	0.54	0.30	1.79	0.09	0.00	0.09

34.10	0.54	0.30	1.79	0.09	0.00	0.09
34.15	0.54	0.30	1.79	0.09	0.00	0.09
34.20	0.54	0.30	1.80	0.09	0.00	0.09
34.25	0.54	0.30	1.80	0.09	0.00	0.09
34.30	0.54	0.30	1.80	0.09	0.00	0.09
34.35	0.54	0.30	1.80	0.09	0.00	0.09
34.40	0.54	0.30	1.80	0.09	0.00	0.09
34.45	0.54	0.30	1.80	0.09	0.00	0.09
34.50	0.54	0.30	1.80	0.09	0.00	0.09
34.55	0.54	0.30	1.80	0.09	0.00	0.09
34.60	0.54	0.30	1.80	0.09	0.00	0.09
34.65	0.55	0.30	1.80	0.09	0.00	0.09
34.70	0.55	0.30	1.80	0.09	0.00	0.09
34.75	0.55	0.30	1.81	0.09	0.00	0.09
34.80	0.55	0.30	1.81	0.09	0.00	0.09
34.85	0.55	0.30	1.81	0.09	0.00	0.09
34.90	0.55	0.30	1.81	0.09	0.00	0.09
34.95	0.55	0.30	1.81	0.09	0.00	0.09
35.00	0.55	0.30	1.81	0.09	0.00	0.09
35.05	0.55	0.30	1.81	0.09	0.00	0.09
35.10	0.55	0.30	1.81	0.09	0.00	0.09
35.15	0.55	0.30	1.81	0.09	0.00	0.09
35.20	0.55	0.30	1.82	0.09	0.00	0.09
35.25	0.55	0.30	1.81	0.09	0.00	0.09
35.30	0.54	0.30	1.80	0.09	0.00	0.09
35.35	0.54	0.30	1.79	0.09	0.00	0.09
35.40	0.54	0.30	1.78	0.09	0.00	0.09
35.45	0.53	0.30	1.77	0.09	0.00	0.09
35.50	0.53	0.30	1.75	0.09	0.00	0.09
35.55	0.53	0.30	1.74	0.09	0.00	0.09
35.60	0.52	0.30	1.73	0.09	0.00	0.09
35.65	0.52	0.30	1.72	0.09	0.00	0.09
35.70	0.52	0.30	1.71	0.09	0.00	0.09
35.75	0.52	0.30	1.70	0.09	0.00	0.09
35.80	0.51	0.30	1.69	0.09	0.00	0.09
35.85	0.51	0.30	1.68	0.09	0.00	0.09
35.90	0.51	0.30	1.67	0.09	0.00	0.09
35.95	0.50	0.30	1.66	0.09	0.00	0.09
36.00	0.50	0.30	1.65	0.09	0.00	0.09
36.05	0.50	0.30	1.64	0.09	0.00	0.09
36.10	0.49	0.30	1.63	0.09	0.00	0.09
36.15	0.49	0.30	1.62	0.09	0.00	0.09
36.20	0.49	0.30	1.61	0.09	0.00	0.09
36.25	0.49	0.30	1.60	0.09	0.00	0.09
36.30	0.48	0.30	1.59	0.09	0.00	0.09
36.35	0.48	0.30	1.58	0.09	0.00	0.09
36.40	0.48	0.30	1.57	0.09	0.00	0.09
36.45	0.47	0.30	1.56	0.09	0.00	0.09
36.50	0.47	0.30	1.55	0.09	0.00	0.09
36.55	0.47	0.30	1.54	0.09	0.00	0.09
36.60	0.47	0.30	1.53	0.09	0.00	0.09
36.65	0.46	0.30	1.52	0.09	0.00	0.09
36.70	0.46	0.30	1.51	0.09	0.00	0.09
36.75	0.46	0.30	1.50	0.09	0.00	0.09

36.80	0.45	0.30	1.50	0.09	0.00	0.09
36.85	0.45	0.30	1.49	0.09	0.00	0.09
36.90	0.45	0.30	1.48	0.09	0.00	0.09
36.95	0.45	0.30	1.47	0.09	0.00	0.09
37.00	0.44	0.30	1.46	0.09	0.00	0.09
37.05	0.44	0.30	1.45	0.09	0.00	0.09
37.10	0.44	0.30	1.44	0.09	0.00	0.09
37.15	0.44	0.30	1.43	0.09	0.00	0.09
37.20	0.43	0.30	1.42	0.09	0.00	0.09
37.25	0.43	0.30	1.42	0.09	0.00	0.09
37.30	0.43	0.30	1.41	0.09	0.00	0.09
37.35	0.43	0.30	1.40	0.09	0.00	0.09
37.40	0.42	0.30	1.39	0.09	0.00	0.09
37.45	0.42	0.30	1.38	0.09	0.00	0.09
37.50	0.42	0.30	1.37	0.09	0.00	0.09
37.55	0.42	0.30	1.39	0.09	0.00	0.09
37.60	0.43	0.30	1.41	0.09	0.00	0.09
37.65	0.44	0.30	1.43	0.09	0.00	0.09
37.70	0.44	0.30	1.45	0.09	0.00	0.09
37.75	0.45	0.30	1.47	0.09	0.00	0.09
37.80	0.45	0.30	1.49	0.09	0.00	0.09
37.85	0.46	0.30	1.51	0.09	0.00	0.09
37.90	0.46	0.30	1.53	0.09	0.00	0.09
37.95	0.47	0.30	1.55	0.09	0.00	0.09
38.00	0.48	0.30	1.57	0.09	0.00	0.09
38.05	0.48	0.30	1.59	0.09	0.00	0.09
38.10	0.49	0.30	1.61	0.09	0.00	0.09
38.15	0.50	0.30	1.63	0.09	0.00	0.09
38.20	0.50	0.30	1.65	0.09	0.00	0.09
38.25	0.51	0.30	1.67	0.09	0.00	0.09
38.30	0.52	0.30	1.69	0.09	0.00	0.09
38.35	0.52	0.30	1.71	0.09	0.00	0.09
38.40	0.53	0.30	1.74	0.09	0.00	0.09
38.45	0.54	0.30	1.76	0.09	0.00	0.09
38.50	0.54	0.30	1.78	0.09	0.00	0.09
38.55	0.55	0.30	1.80	0.09	0.00	0.09
38.60	0.56	0.30	1.83	0.09	0.00	0.09
38.65	0.56	0.30	1.85	0.09	0.00	0.09
38.70	0.57	0.30	1.88	0.09	0.00	0.09
38.75	0.58	0.30	1.90	0.09	0.00	0.09
38.80	0.59	0.30	1.93	0.09	0.00	0.09
38.85	0.60	0.30	1.96	0.09	0.00	0.09
38.90	0.60	0.30	1.99	0.09	0.00	0.09
38.95	0.61	0.30	2.01	0.09	0.00	0.09
39.00	0.62	0.30	2.04	0.09	0.00	0.09
39.05	0.63	0.30	2.07	0.09	0.00	0.09
39.10	0.64	0.30	2.10	0.09	0.00	0.09
39.15	0.65	0.30	2.14	0.09	0.00	0.09
39.20	0.66	0.30	2.17	0.09	0.00	0.09
39.25	0.67	0.30	2.20	0.09	0.00	0.09
39.30	0.68	0.30	2.24	0.09	0.00	0.09
39.35	0.69	0.30	2.28	0.09	0.00	0.09
39.40	0.71	0.30	2.32	0.09	0.00	0.09
39.45	0.72	0.30	2.36	0.09	0.00	0.09

39.50	0.73	0.30	2.41	0.09	0.00	0.09
39.55	0.75	0.30	2.46	0.09	0.00	0.09
39.60	0.77	0.30	2.51	0.09	0.00	0.09
39.65	0.79	0.30	2.58	0.09	0.00	0.09
39.70	0.81	0.30	2.65	0.09	0.00	0.09
39.75	0.84	0.30	2.75	0.09	0.00	0.09
39.80	0.88	0.30	2.90	0.09	0.00	0.09
39.85	0.96	0.30	3.16	0.09	0.00	0.09
39.90	1.04	0.30	3.41	0.09	0.00	0.09
39.95	1.04	0.30	3.41	0.09	0.00	0.09
40.00	1.04	0.30	3.41	0.09	0.00	0.09
40.05	1.04	0.30	3.41	0.09	0.00	0.09
40.10	1.04	0.30	3.41	0.09	0.00	0.09
40.15	1.04	0.30	3.41	0.09	0.00	0.09
40.20	1.04	0.30	3.41	0.09	0.00	0.09
40.25	1.04	0.30	3.41	0.09	0.00	0.09
40.30	1.04	0.30	3.41	0.09	0.00	0.09
40.35	1.04	0.30	3.40	0.09	0.00	0.09
40.40	1.04	0.30	3.40	0.09	0.00	0.09
40.45	1.04	0.30	3.40	0.09	0.00	0.09
40.50	1.04	0.30	3.40	0.09	0.00	0.09
40.55	1.04	0.30	3.40	0.09	0.00	0.09
40.60	1.04	0.30	3.40	0.09	0.00	0.09
40.65	1.04	0.30	3.40	0.09	0.00	0.09
40.70	1.04	0.30	3.40	0.09	0.00	0.09
40.75	1.04	0.30	3.40	0.09	0.00	0.09
40.80	1.04	0.30	3.40	0.09	0.00	0.09
40.85	1.04	0.30	3.40	0.09	0.00	0.09
40.90	1.03	0.30	3.40	0.09	0.00	0.09
40.95	1.03	0.30	3.40	0.09	0.00	0.09
41.00	1.03	0.30	3.39	0.09	0.00	0.09
41.05	1.03	0.30	3.39	0.09	0.00	0.09
41.10	1.03	0.30	3.39	0.09	0.00	0.09
41.15	1.03	0.30	3.39	0.09	0.00	0.09
41.20	1.03	0.30	3.39	0.09	0.00	0.09
41.25	1.03	0.30	3.39	0.09	0.00	0.09
41.30	1.03	0.30	3.39	0.09	0.00	0.09
41.35	1.03	0.30	3.39	0.09	0.00	0.09
41.40	1.03	0.30	3.39	0.09	0.00	0.09
41.45	1.03	0.30	3.39	0.09	0.00	0.09
41.50	1.03	0.30	3.39	0.09	0.00	0.09
41.55	1.03	0.30	3.39	0.09	0.00	0.09
41.60	1.03	0.30	3.39	0.09	0.00	0.09
41.65	1.03	0.30	3.39	0.09	0.00	0.09
41.70	1.03	0.30	3.38	0.09	0.00	0.09
41.75	1.03	0.30	3.38	0.09	0.00	0.09
41.80	1.03	0.30	3.38	0.09	0.00	0.09
41.85	1.03	0.30	3.38	0.09	0.00	0.09
41.90	1.03	0.30	3.38	0.09	0.00	0.09
41.95	1.03	0.30	3.38	0.09	0.00	0.09
42.00	1.03	0.30	3.38	0.09	0.00	0.09
42.05	1.03	0.30	3.38	0.09	0.00	0.09
42.10	1.03	0.30	3.38	0.09	0.00	0.09
42.15	1.03	0.30	3.38	0.09	0.00	0.09

42.20	1.03	0.30	3.38	0.09	0.00	0.09
42.25	1.03	0.30	3.38	0.09	0.00	0.09
42.30	1.03	0.30	3.38	0.09	0.00	0.09
42.35	1.03	0.30	3.38	0.09	0.00	0.09
42.40	1.03	0.30	3.38	0.09	0.00	0.09
42.45	1.03	0.30	3.37	0.09	0.00	0.09
42.50	1.03	0.30	3.37	0.09	0.00	0.09
42.55	1.03	0.30	3.37	0.09	0.00	0.09
42.60	1.03	0.30	3.37	0.09	0.00	0.09
42.65	1.03	0.30	3.37	0.09	0.00	0.09
42.70	1.03	0.30	3.37	0.09	0.00	0.09
42.75	1.02	0.30	3.37	0.09	0.00	0.09
42.80	1.02	0.30	3.37	0.09	0.00	0.09
42.85	1.02	0.30	3.37	0.09	0.00	0.09
42.90	1.02	0.30	3.37	0.09	0.00	0.09
42.95	1.02	0.30	3.37	0.09	0.00	0.09
43.00	1.02	0.30	3.37	0.09	0.00	0.09
43.05	1.02	0.30	3.37	0.09	0.00	0.09
43.10	1.02	0.30	3.37	0.09	0.00	0.09
43.15	1.02	0.30	3.37	0.09	0.00	0.09
43.20	1.02	0.30	3.37	0.09	0.00	0.09
43.25	1.02	0.30	3.37	0.09	0.00	0.09
43.30	1.02	0.30	3.36	0.09	0.00	0.09
43.35	1.02	0.30	3.36	0.09	0.00	0.09
43.40	1.02	0.30	3.36	0.09	0.00	0.09
43.45	1.02	0.30	3.36	0.09	0.00	0.09
43.50	1.02	0.30	3.36	0.09	0.00	0.09
43.55	1.02	0.30	3.36	0.09	0.00	0.09
43.60	1.02	0.30	3.36	0.09	0.00	0.09
43.65	1.02	0.30	3.36	0.09	0.00	0.09
43.70	1.02	0.30	3.36	0.09	0.00	0.09
43.75	1.02	0.30	3.36	0.09	0.00	0.09
43.80	1.02	0.30	3.36	0.09	0.00	0.09
43.85	1.02	0.30	3.36	0.09	0.00	0.09
43.90	1.02	0.30	3.36	0.09	0.00	0.09
43.95	1.02	0.30	3.36	0.09	0.00	0.09
44.00	1.02	0.30	3.36	0.09	0.00	0.09
44.05	1.02	0.30	3.36	0.09	0.00	0.09
44.10	1.02	0.30	3.36	0.09	0.00	0.09
44.15	1.02	0.30	3.36	0.09	0.00	0.09
44.20	1.02	0.30	3.36	0.09	0.00	0.09
44.25	1.02	0.30	3.35	0.09	0.00	0.09
44.30	1.02	0.30	3.35	0.09	0.00	0.09
44.35	1.02	0.30	3.35	0.09	0.00	0.09
44.40	1.02	0.30	3.35	0.09	0.00	0.09
44.45	1.02	0.30	3.35	0.09	0.00	0.09
44.50	1.02	0.30	3.35	0.09	0.00	0.09
44.55	1.02	0.30	3.35	0.09	0.00	0.09
44.60	1.02	0.30	3.35	0.09	0.00	0.09
44.65	1.02	0.30	3.35	0.09	0.00	0.09
44.70	1.01	0.30	3.35	0.09	0.00	0.09
44.75	1.01	0.30	3.35	0.09	0.00	0.09
44.80	1.01	0.30	3.35	0.09	0.00	0.09
44.85	1.01	0.30	3.35	0.09	0.00	0.09

44.90	1.01	0.30	3.35	0.09	0.00	0.09	
44.95	1.01	0.30	3.35	0.09	0.00	0.09	
45.00	1.01	0.30	3.35	0.09	0.00	0.09	
45.05	1.01	0.30	3.35	0.09	0.00	0.09	
45.10	1.01	0.30	3.35	0.09	0.00	0.09	
45.15	0.94	0.30	3.12	0.09	0.00	0.09	
45.20	0.84	0.30	2.76	0.09	0.00	0.09	
45.25	0.79	0.30	2.60	0.09	0.00	0.09	
45.30	0.75	0.30	2.49	0.09	0.00	0.09	
45.35	0.73	0.30	2.41	0.09	0.00	0.09	
45.40	0.71	0.30	2.34	0.09	0.00	0.09	
45.45	0.69	0.30	2.27	0.09	0.00	0.09	
45.50	0.67	0.30	2.21	0.09	0.00	0.09	
45.55	0.65	0.30	2.16	0.09	0.00	0.09	
45.60	0.64	0.30	2.11	0.09	0.00	0.09	
45.65	0.62	0.30	2.06	0.09	0.00	0.09	
45.70	0.61	0.30	2.01	0.09	0.00	0.09	
45.75	0.60	0.30	1.97	0.09	0.00	0.09	
45.80	0.58	0.30	1.93	0.09	0.00	0.09	
45.85	0.57	0.30	1.89	0.09	0.00	0.09	
45.90	0.56	0.30	1.85	0.09	0.00	0.09	
45.95	0.55	0.30	1.81	0.09	0.00	0.09	
46.00	0.54	0.30	1.78	0.09	0.00	0.09	
46.05	0.53	0.30	1.74	0.09	0.00	0.09	
46.10	0.52	0.30	1.71	0.09	0.00	0.09	
46.15	0.51	0.30	1.68	0.09	0.00	0.09	
46.20	0.50	0.30	1.65	0.09	0.00	0.09	
46.25	0.49	0.30	1.61	0.09	0.00	0.09	
46.30	0.48	0.30	1.58	0.09	0.00	0.09	
46.35	0.47	0.30	1.56	0.09	0.00	0.09	
46.40	0.46	0.30	1.53	0.09	0.00	0.09	
46.45	0.45	0.30	1.50	0.09	0.00	0.09	
46.50	0.44	0.30	1.47	0.09	0.00	0.09	
46.55	0.44	0.30	1.44	0.09	0.00	0.09	
46.60	0.43	0.30	1.42	0.09	0.00	0.09	
46.65	0.42	0.30	1.39	0.09	0.00	0.09	
46.70	0.41	0.30	1.36	0.09	0.00	0.09	
46.75	0.40	0.30	1.34	0.09	0.00	0.09	
46.80	0.40	0.30	1.31	0.09	0.00	0.09	
46.85	0.39	0.30	1.29	0.09	0.00	0.09	
46.90	0.38	0.30	1.26	0.09	0.00	0.09	
46.95	0.37	0.30	1.24	0.09	0.00	0.09	
47.00	0.36	0.30	1.21	0.09	0.00	0.09	
47.05	0.36	0.30	1.19	0.09	0.00	0.09	
47.10	0.35	0.30	1.16	0.09	0.00	0.09	
47.15	0.34	0.30	1.14	0.09	0.00	0.09	
47.20	0.33	0.30	1.11	0.09	0.00	0.09	
47.25	0.33	0.30	1.09	0.09	0.00	0.09	
47.30	0.32	0.30	1.06	0.09	0.00	0.09	
47.35	0.31	0.30	1.04	0.09	0.00	0.09	
47.40	0.30	0.30	1.01	0.08	0.00	0.08	
47.45	0.30	0.30	0.99*		0.08	0.00	0.08
47.50	0.29	0.30	0.96*		0.08	0.00	0.08
47.55	0.29	0.30	0.96*		0.08	0.00	0.08

47.60	0.29 0.30 0.96*	0.08 0.00 0.08
47.65	0.29 0.30 0.96*	0.08 0.00 0.08
47.70	0.29 0.30 0.96*	0.08 0.00 0.08
47.75	0.29 0.30 0.96*	0.08 0.00 0.08
47.80	0.29 0.30 0.96*	0.08 0.00 0.08
47.85	0.29 0.30 0.96*	0.07 0.00 0.07
47.90	0.29 0.30 0.96*	0.07 0.00 0.07
47.95	0.29 0.30 0.96*	0.07 0.00 0.07
48.00	0.29 0.30 0.95*	0.07 0.00 0.07
48.05	0.29 0.30 0.95*	0.07 0.00 0.07
48.10	0.29 0.30 0.95*	0.07 0.00 0.07
48.15	0.29 0.30 0.95*	0.07 0.00 0.07
48.20	0.29 0.30 0.95*	0.07 0.00 0.07
48.25	0.29 0.30 0.95*	0.07 0.00 0.07
48.30	0.29 0.30 0.95*	0.06 0.00 0.06
48.35	0.29 0.30 0.95*	0.06 0.00 0.06
48.40	0.29 0.30 0.95*	0.06 0.00 0.06
48.45	0.29 0.30 0.95*	0.06 0.00 0.06
48.50	0.29 0.30 0.95*	0.06 0.00 0.06
48.55	0.28 0.30 0.95*	0.06 0.00 0.06
48.60	0.28 0.30 0.95*	0.06 0.00 0.06
48.65	0.28 0.30 0.95*	0.06 0.00 0.06
48.70	0.28 0.30 0.95*	0.06 0.00 0.06
48.75	0.28 0.30 0.95*	0.05 0.00 0.05
48.80	0.28 0.30 0.95*	0.05 0.00 0.05
48.85	0.28 0.30 0.95*	0.05 0.00 0.05
48.90	0.28 0.30 0.95*	0.05 0.00 0.05
48.95	0.28 0.30 0.94*	0.05 0.00 0.05
49.00	0.28 0.30 0.94*	0.05 0.00 0.05
49.05	0.28 0.30 0.94*	0.05 0.00 0.05
49.10	0.28 0.30 0.94*	0.05 0.00 0.05
49.15	0.28 0.30 0.94*	0.04 0.00 0.04
49.20	0.28 0.30 0.94*	0.04 0.00 0.04
49.25	0.28 0.30 0.94*	0.04 0.00 0.04
49.30	0.28 0.30 0.94*	0.04 0.00 0.04
49.35	0.28 0.30 0.94*	0.04 0.00 0.04
49.40	0.28 0.30 0.94*	0.04 0.00 0.04
49.45	0.28 0.30 0.94*	0.04 0.00 0.04
49.50	0.28 0.30 0.94*	0.04 0.00 0.04
49.55	0.28 0.30 0.94*	0.04 0.00 0.04
49.60	0.28 0.30 0.94*	0.03 0.00 0.03
49.65	0.28 0.30 0.94*	0.03 0.00 0.03
49.70	0.28 0.30 0.94*	0.03 0.00 0.03
49.75	0.28 0.30 0.94*	0.03 0.00 0.03
49.80	0.28 0.30 0.94*	0.03 0.00 0.03
49.85	0.28 0.30 0.94*	0.03 0.00 0.03
49.90	0.28 0.30 0.94*	0.03 0.00 0.03
49.95	0.28 0.30 0.93*	0.03 0.00 0.03
50.00	0.28 0.30 0.93*	0.02 0.00 0.02
50.05	0.28 0.30 0.93*	0.02 0.00 0.02
50.10	0.28 0.30 0.93*	0.02 0.00 0.02
50.15	0.28 0.30 0.93*	0.02 0.00 0.02
50.20	0.28 0.30 0.93*	0.02 0.00 0.02
50.25	0.28 0.30 0.93*	0.02 0.00 0.02

50.30	0.28 0.30 0.93*	0.02 0.00 0.02
50.35	0.28 0.30 0.93*	0.02 0.00 0.02
50.40	0.28 0.30 0.93*	0.02 0.00 0.02
50.45	0.28 0.30 0.93*	0.01 0.00 0.01
50.50	0.28 0.30 0.93*	0.01 0.00 0.01
50.55	0.28 0.30 0.93*	0.01 0.00 0.01
50.60	0.28 0.30 0.93*	0.01 0.00 0.01
50.65	0.28 0.30 0.93*	0.01 0.00 0.01
50.70	0.28 0.30 0.93*	0.01 0.00 0.01
50.75	0.28 0.30 0.93*	0.01 0.00 0.01
50.80	0.28 0.30 0.93*	0.01 0.00 0.01
50.85	0.28 0.30 0.93*	0.00 0.00 0.00
50.90	0.28 0.30 0.93*	0.00 0.00 0.00
50.95	0.28 0.30 0.93*	0.00 0.00 0.00
51.00	0.28 0.30 0.93*	0.00 0.00 0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\Engineering\Desktop\07-230527-0.liq
Title: New Kindergarten Classrooms at Virginia Lee Rose Elementary
Subtitle: 07-230527-0

Surface Elev.=275
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 86.00 ft
Water Table during In-Situ Testing= 193.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:

Surface Elev.=275
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 86.00 ft
Water Table during In-Situ Testing= 193.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu, M-correction
 3. Fines Correction for Liquefaction: Stark/Olson et al.*
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.5
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1.2
 9. User request factor of safety (apply to CSR) , User= 1.2
Plot one CSR curve (fs1=User)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth	SPT gamma	Fines
ft	pcf %	

0.00	4.00	113.60	60.00
3.00	4.00	128.30	60.00

7.50	11.00	124.80	60.00
12.50	13.00	103.70	8.00
17.50	13.00	103.70	8.00
22.50	24.00	146.40	36.00
27.50	14.00	125.00	70.00
32.50	17.00	104.30	5.00
37.50	9.00	107.30	60.00
42.50	30.00	120.60	65.00
47.50	8.00	105.00	5.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.23 in.
Total Settlement of Saturated and Unsaturated Sands=0.23 in.
Differential Settlement=0.115 to 0.152 in.

Depth ft	CRRm	CSRfs in.	F.S. in.	S_sat. in.	S_dry	S_all
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0.00	0.39	0.27	5.00	0.00	0.23	0.23
0.05	0.39	0.27	5.00	0.00	0.23	0.23
0.10	0.39	0.27	5.00	0.00	0.23	0.23
0.15	0.39	0.27	5.00	0.00	0.23	0.23
0.20	0.39	0.27	5.00	0.00	0.23	0.23
0.25	0.39	0.27	5.00	0.00	0.23	0.23
0.30	0.39	0.27	5.00	0.00	0.23	0.23
0.35	0.39	0.27	5.00	0.00	0.23	0.23
0.40	0.39	0.27	5.00	0.00	0.23	0.23
0.45	0.39	0.27	5.00	0.00	0.23	0.23
0.50	0.39	0.27	5.00	0.00	0.23	0.23
0.55	0.39	0.27	5.00	0.00	0.23	0.23
0.60	0.39	0.27	5.00	0.00	0.23	0.23
0.65	0.39	0.27	5.00	0.00	0.23	0.23
0.70	0.39	0.27	5.00	0.00	0.23	0.23
0.75	0.39	0.27	5.00	0.00	0.23	0.23
0.80	0.39	0.27	5.00	0.00	0.23	0.23
0.85	0.39	0.27	5.00	0.00	0.23	0.23
0.90	0.39	0.27	5.00	0.00	0.23	0.23
0.95	0.39	0.27	5.00	0.00	0.23	0.23
1.00	0.39	0.27	5.00	0.00	0.23	0.23
1.05	0.39	0.27	5.00	0.00	0.23	0.23
1.10	0.39	0.27	5.00	0.00	0.23	0.23
1.15	0.39	0.27	5.00	0.00	0.23	0.23
1.20	0.39	0.27	5.00	0.00	0.23	0.23
1.25	0.39	0.27	5.00	0.00	0.23	0.23
1.30	0.39	0.27	5.00	0.00	0.23	0.23
1.35	0.39	0.27	5.00	0.00	0.23	0.23
1.40	0.39	0.27	5.00	0.00	0.23	0.23
1.45	0.39	0.27	5.00	0.00	0.23	0.23
1.50	0.39	0.27	5.00	0.00	0.23	0.23
1.55	0.39	0.27	5.00	0.00	0.23	0.23
1.60	0.39	0.27	5.00	0.00	0.23	0.23
1.65	0.39	0.27	5.00	0.00	0.23	0.23

1.70 0.39 0.27 5.00 0.00 0.23 0.23
1.75 0.39 0.27 5.00 0.00 0.23 0.23
1.80 0.39 0.27 5.00 0.00 0.23 0.23
1.85 0.39 0.27 5.00 0.00 0.23 0.23
1.90 0.39 0.27 5.00 0.00 0.23 0.23
1.95 0.39 0.27 5.00 0.00 0.23 0.23
2.00 0.39 0.27 5.00 0.00 0.23 0.23
2.05 0.39 0.27 5.00 0.00 0.23 0.23
2.10 0.39 0.27 5.00 0.00 0.23 0.23
2.15 0.39 0.27 5.00 0.00 0.23 0.23
2.20 0.39 0.27 5.00 0.00 0.23 0.23
2.25 0.39 0.27 5.00 0.00 0.23 0.23
2.30 0.39 0.27 5.00 0.00 0.23 0.23
2.35 0.39 0.27 5.00 0.00 0.23 0.23
2.40 0.39 0.27 5.00 0.00 0.23 0.23
2.45 0.39 0.27 5.00 0.00 0.23 0.23
2.50 0.39 0.27 5.00 0.00 0.23 0.23
2.55 0.39 0.27 5.00 0.00 0.23 0.23
2.60 0.39 0.27 5.00 0.00 0.23 0.23
2.65 0.39 0.27 5.00 0.00 0.23 0.23
2.70 0.39 0.27 5.00 0.00 0.23 0.23
2.75 0.39 0.27 5.00 0.00 0.23 0.23
2.80 0.39 0.27 5.00 0.00 0.23 0.23
2.85 0.39 0.27 5.00 0.00 0.23 0.23
2.90 0.39 0.27 5.00 0.00 0.23 0.23
2.95 0.39 0.27 5.00 0.00 0.23 0.23
3.00 0.39 0.27 5.00 0.00 0.23 0.23
3.05 0.40 0.27 5.00 0.00 0.23 0.23
3.10 0.40 0.27 5.00 0.00 0.23 0.23
3.15 0.40 0.27 5.00 0.00 0.23 0.23
3.20 0.41 0.27 5.00 0.00 0.23 0.23
3.25 0.41 0.27 5.00 0.00 0.23 0.23
3.30 0.42 0.27 5.00 0.00 0.23 0.23
3.35 0.42 0.27 5.00 0.00 0.23 0.23
3.40 0.42 0.27 5.00 0.00 0.22 0.22
3.45 0.43 0.27 5.00 0.00 0.22 0.22
3.50 0.43 0.27 5.00 0.00 0.22 0.22
3.55 0.44 0.27 5.00 0.00 0.22 0.22
3.60 0.44 0.27 5.00 0.00 0.22 0.22
3.65 0.45 0.27 5.00 0.00 0.22 0.22
3.70 0.45 0.27 5.00 0.00 0.22 0.22
3.75 0.45 0.27 5.00 0.00 0.22 0.22
3.80 0.46 0.27 5.00 0.00 0.22 0.22
3.85 0.46 0.27 5.00 0.00 0.22 0.22
3.90 0.47 0.27 5.00 0.00 0.22 0.22
3.95 0.47 0.27 5.00 0.00 0.22 0.22
4.00 0.48 0.27 5.00 0.00 0.22 0.22
4.05 0.48 0.27 5.00 0.00 0.22 0.22
4.10 0.49 0.26 5.00 0.00 0.22 0.22
4.15 0.49 0.26 5.00 0.00 0.22 0.22
4.20 0.50 0.26 5.00 0.00 0.22 0.22
4.25 0.50 0.26 5.00 0.00 0.22 0.22
4.30 0.50 0.26 5.00 0.00 0.22 0.22
4.35 0.51 0.26 5.00 0.00 0.22 0.22

4.40 0.51 0.26 5.00 0.00 0.22 0.22
4.45 0.52 0.26 5.00 0.00 0.22 0.22
4.50 0.52 0.26 5.00 0.00 0.22 0.22
4.55 0.53 0.26 5.00 0.00 0.22 0.22
4.60 0.53 0.26 5.00 0.00 0.22 0.22
4.65 0.54 0.26 5.00 0.00 0.22 0.22
4.70 0.54 0.26 5.00 0.00 0.22 0.22
4.75 0.55 0.26 5.00 0.00 0.22 0.22
4.80 0.55 0.26 5.00 0.00 0.22 0.22
4.85 0.56 0.26 5.00 0.00 0.22 0.22
4.90 0.56 0.26 5.00 0.00 0.22 0.22
4.95 0.57 0.26 5.00 0.00 0.22 0.22
5.00 0.58 0.26 5.00 0.00 0.22 0.22
5.05 0.58 0.26 5.00 0.00 0.22 0.22
5.10 0.59 0.26 5.00 0.00 0.22 0.22
5.15 0.59 0.26 5.00 0.00 0.22 0.22
5.20 0.60 0.26 5.00 0.00 0.22 0.22
5.25 0.60 0.26 5.00 0.00 0.22 0.22
5.30 0.61 0.26 5.00 0.00 0.22 0.22
5.35 0.62 0.26 5.00 0.00 0.22 0.22
5.40 0.62 0.26 5.00 0.00 0.22 0.22
5.45 0.63 0.26 5.00 0.00 0.22 0.22
5.50 0.64 0.26 5.00 0.00 0.22 0.22
5.55 0.64 0.26 5.00 0.00 0.22 0.22
5.60 0.65 0.26 5.00 0.00 0.22 0.22
5.65 0.66 0.26 5.00 0.00 0.22 0.22
5.70 0.66 0.26 5.00 0.00 0.22 0.22
5.75 0.67 0.26 5.00 0.00 0.22 0.22
5.80 0.68 0.26 5.00 0.00 0.22 0.22
5.85 0.69 0.26 5.00 0.00 0.22 0.22
5.90 0.69 0.26 5.00 0.00 0.22 0.22
5.95 0.70 0.26 5.00 0.00 0.22 0.22
6.00 0.70 0.26 5.00 0.00 0.22 0.22
6.05 0.71 0.26 5.00 0.00 0.22 0.22
6.10 0.71 0.26 5.00 0.00 0.22 0.22
6.15 0.72 0.26 5.00 0.00 0.22 0.22
6.20 0.72 0.26 5.00 0.00 0.22 0.22
6.25 0.73 0.26 5.00 0.00 0.22 0.22
6.30 0.73 0.26 5.00 0.00 0.22 0.22
6.35 0.74 0.26 5.00 0.00 0.22 0.22
6.40 0.74 0.26 5.00 0.00 0.22 0.22
6.45 0.74 0.26 5.00 0.00 0.22 0.22
6.50 0.75 0.26 5.00 0.00 0.22 0.22
6.55 0.75 0.26 5.00 0.00 0.22 0.22
6.60 0.76 0.26 5.00 0.00 0.22 0.22
6.65 0.77 0.26 5.00 0.00 0.22 0.22
6.70 0.77 0.26 5.00 0.00 0.22 0.22
6.75 0.78 0.26 5.00 0.00 0.22 0.22
6.80 0.78 0.26 5.00 0.00 0.22 0.22
6.85 0.79 0.26 5.00 0.00 0.22 0.22
6.90 0.79 0.26 5.00 0.00 0.22 0.22
6.95 0.80 0.26 5.00 0.00 0.22 0.22
7.00 0.81 0.26 5.00 0.00 0.22 0.22
7.05 0.81 0.26 5.00 0.00 0.22 0.22

7.10 0.82 0.26 5.00 0.00 0.22 0.22
7.15 0.83 0.26 5.00 0.00 0.22 0.22
7.20 0.84 0.26 5.00 0.00 0.22 0.22
7.25 0.84 0.26 5.00 0.00 0.22 0.22
7.30 0.85 0.26 5.00 0.00 0.22 0.22
7.35 0.86 0.26 5.00 0.00 0.22 0.22
7.40 0.87 0.26 5.00 0.00 0.22 0.22
7.45 0.88 0.26 5.00 0.00 0.22 0.22
7.50 0.90 0.26 5.00 0.00 0.22 0.22
7.55 0.89 0.26 5.00 0.00 0.22 0.22
7.60 0.89 0.26 5.00 0.00 0.22 0.22
7.65 0.88 0.26 5.00 0.00 0.22 0.22
7.70 0.88 0.26 5.00 0.00 0.22 0.22
7.75 0.87 0.26 5.00 0.00 0.22 0.22
7.80 0.87 0.26 5.00 0.00 0.22 0.22
7.85 0.87 0.26 5.00 0.00 0.22 0.22
7.90 0.86 0.26 5.00 0.00 0.22 0.22
7.95 0.86 0.26 5.00 0.00 0.22 0.22
8.00 0.85 0.26 5.00 0.00 0.22 0.22
8.05 0.85 0.26 5.00 0.00 0.22 0.22
8.10 0.85 0.26 5.00 0.00 0.22 0.22
8.15 0.85 0.26 5.00 0.00 0.22 0.22
8.20 0.84 0.26 5.00 0.00 0.22 0.22
8.25 1.11 0.26 5.00 0.00 0.22 0.22
8.30 1.11 0.26 5.00 0.00 0.22 0.22
8.35 1.11 0.26 5.00 0.00 0.22 0.22
8.40 1.11 0.26 5.00 0.00 0.22 0.22
8.45 1.11 0.26 5.00 0.00 0.22 0.22
8.50 1.11 0.26 5.00 0.00 0.22 0.22
8.55 1.11 0.26 5.00 0.00 0.22 0.22
8.60 1.11 0.26 5.00 0.00 0.22 0.22
8.65 1.11 0.26 5.00 0.00 0.22 0.22
8.70 1.11 0.26 5.00 0.00 0.22 0.22
8.75 1.11 0.26 5.00 0.00 0.22 0.22
8.80 1.11 0.26 5.00 0.00 0.22 0.22
8.85 1.11 0.26 5.00 0.00 0.22 0.22
8.90 1.11 0.26 5.00 0.00 0.22 0.22
8.95 1.11 0.26 5.00 0.00 0.22 0.22
9.00 1.11 0.26 5.00 0.00 0.22 0.22
9.05 1.11 0.26 5.00 0.00 0.22 0.22
9.10 1.11 0.26 5.00 0.00 0.22 0.22
9.15 1.11 0.26 5.00 0.00 0.22 0.22
9.20 1.11 0.26 5.00 0.00 0.22 0.22
9.25 1.11 0.26 5.00 0.00 0.22 0.22
9.30 1.11 0.26 5.00 0.00 0.22 0.22
9.35 1.11 0.26 5.00 0.00 0.22 0.22
9.40 1.11 0.26 5.00 0.00 0.22 0.22
9.45 1.11 0.26 5.00 0.00 0.22 0.22
9.50 1.11 0.26 5.00 0.00 0.22 0.22
9.55 1.11 0.26 5.00 0.00 0.22 0.22
9.60 1.11 0.26 5.00 0.00 0.21 0.21
9.65 1.11 0.26 5.00 0.00 0.21 0.21
9.70 1.11 0.26 5.00 0.00 0.21 0.21
9.75 1.11 0.26 5.00 0.00 0.21 0.21

9.80	1.11	0.26	5.00	0.00	0.21	0.21
9.85	1.11	0.26	5.00	0.00	0.21	0.21
9.90	1.11	0.26	5.00	0.00	0.21	0.21
9.95	1.11	0.26	5.00	0.00	0.21	0.21
10.00	1.11	0.26	5.00	0.00	0.21	0.21
10.05	1.11	0.26	5.00	0.00	0.21	0.21
10.10	1.11	0.26	5.00	0.00	0.21	0.21
10.15	1.11	0.26	5.00	0.00	0.21	0.21
10.20	1.11	0.26	5.00	0.00	0.21	0.21
10.25	1.11	0.26	5.00	0.00	0.21	0.21
10.30	1.11	0.26	5.00	0.00	0.21	0.21
10.35	1.05	0.26	5.00	0.00	0.21	0.21
10.40	0.98	0.26	5.00	0.00	0.21	0.21
10.45	0.94	0.26	5.00	0.00	0.21	0.21
10.50	0.91	0.26	5.00	0.00	0.21	0.21
10.55	0.89	0.26	5.00	0.00	0.21	0.21
10.60	0.87	0.26	5.00	0.00	0.21	0.21
10.65	0.85	0.26	5.00	0.00	0.21	0.21
10.70	0.84	0.26	5.00	0.00	0.21	0.21
10.75	0.82	0.26	5.00	0.00	0.21	0.21
10.80	0.81	0.26	5.00	0.00	0.21	0.21
10.85	0.80	0.26	5.00	0.00	0.21	0.21
10.90	0.79	0.26	5.00	0.00	0.21	0.21
10.95	0.78	0.26	5.00	0.00	0.21	0.21
11.00	0.78	0.26	5.00	0.00	0.21	0.21
11.05	0.77	0.26	5.00	0.00	0.21	0.21
11.10	0.76	0.26	5.00	0.00	0.21	0.21
11.15	0.75	0.26	5.00	0.00	0.21	0.21
11.20	0.74	0.26	5.00	0.00	0.21	0.21
11.25	0.74	0.26	5.00	0.00	0.21	0.21
11.30	0.73	0.26	5.00	0.00	0.21	0.21
11.35	0.72	0.26	5.00	0.00	0.21	0.21
11.40	0.72	0.26	5.00	0.00	0.21	0.21
11.45	0.71	0.26	5.00	0.00	0.21	0.21
11.50	0.70	0.26	5.00	0.00	0.21	0.21
11.55	0.70	0.26	5.00	0.00	0.21	0.21
11.60	0.69	0.26	5.00	0.00	0.21	0.21
11.65	0.69	0.26	5.00	0.00	0.21	0.21
11.70	0.68	0.26	5.00	0.00	0.21	0.21
11.75	0.67	0.26	5.00	0.00	0.21	0.21
11.80	0.67	0.26	5.00	0.00	0.21	0.21
11.85	0.66	0.26	5.00	0.00	0.21	0.21
11.90	0.66	0.26	5.00	0.00	0.21	0.21
11.95	0.65	0.26	5.00	0.00	0.21	0.21
12.00	0.65	0.26	5.00	0.00	0.21	0.21
12.05	0.64	0.26	5.00	0.00	0.21	0.21
12.10	0.64	0.26	5.00	0.00	0.21	0.21
12.15	0.63	0.26	5.00	0.00	0.21	0.21
12.20	0.63	0.26	5.00	0.00	0.21	0.21
12.25	0.62	0.26	5.00	0.00	0.21	0.21
12.30	0.62	0.26	5.00	0.00	0.21	0.21
12.35	0.61	0.26	5.00	0.00	0.21	0.21
12.40	0.61	0.26	5.00	0.00	0.21	0.21
12.45	0.61	0.26	5.00	0.00	0.21	0.21

12.50	0.60	0.26	5.00	0.00	0.21	0.21
12.55	0.60	0.26	5.00	0.00	0.21	0.21
12.60	0.60	0.26	5.00	0.00	0.21	0.21
12.65	0.60	0.26	5.00	0.00	0.21	0.21
12.70	0.60	0.26	5.00	0.00	0.21	0.21
12.75	0.59	0.26	5.00	0.00	0.21	0.21
12.80	0.59	0.26	5.00	0.00	0.21	0.21
12.85	0.59	0.26	5.00	0.00	0.21	0.21
12.90	0.59	0.26	5.00	0.00	0.21	0.21
12.95	0.59	0.26	5.00	0.00	0.21	0.21
13.00	0.59	0.26	5.00	0.00	0.21	0.21
13.05	0.59	0.26	5.00	0.00	0.21	0.21
13.10	0.59	0.26	5.00	0.00	0.21	0.21
13.15	0.58	0.26	5.00	0.00	0.21	0.21
13.20	0.58	0.26	5.00	0.00	0.21	0.21
13.25	0.58	0.26	5.00	0.00	0.21	0.21
13.30	0.58	0.26	5.00	0.00	0.21	0.21
13.35	0.58	0.26	5.00	0.00	0.21	0.21
13.40	0.58	0.26	5.00	0.00	0.21	0.21
13.45	0.58	0.26	5.00	0.00	0.21	0.21
13.50	0.58	0.26	5.00	0.00	0.21	0.21
13.55	0.58	0.26	5.00	0.00	0.21	0.21
13.60	0.57	0.26	5.00	0.00	0.21	0.21
13.65	0.57	0.26	5.00	0.00	0.21	0.21
13.70	0.57	0.26	5.00	0.00	0.21	0.21
13.75	0.57	0.26	5.00	0.00	0.21	0.21
13.80	0.57	0.26	5.00	0.00	0.21	0.21
13.85	0.57	0.26	5.00	0.00	0.21	0.21
13.90	0.57	0.26	5.00	0.00	0.21	0.21
13.95	0.57	0.26	5.00	0.00	0.21	0.21
14.00	0.57	0.26	5.00	0.00	0.21	0.21
14.05	0.56	0.26	5.00	0.00	0.21	0.21
14.10	0.56	0.26	5.00	0.00	0.21	0.21
14.15	0.56	0.26	5.00	0.00	0.21	0.21
14.20	0.56	0.26	5.00	0.00	0.21	0.21
14.25	0.56	0.26	5.00	0.00	0.21	0.21
14.30	0.56	0.26	5.00	0.00	0.20	0.20
14.35	0.56	0.26	5.00	0.00	0.20	0.20
14.40	0.56	0.26	5.00	0.00	0.20	0.20
14.45	0.56	0.26	5.00	0.00	0.20	0.20
14.50	0.55	0.26	5.00	0.00	0.20	0.20
14.55	0.55	0.26	5.00	0.00	0.20	0.20
14.60	0.55	0.26	5.00	0.00	0.20	0.20
14.65	0.55	0.26	5.00	0.00	0.20	0.20
14.70	0.55	0.26	5.00	0.00	0.20	0.20
14.75	0.55	0.26	5.00	0.00	0.20	0.20
14.80	0.63	0.26	5.00	0.00	0.20	0.20
14.85	0.63	0.26	5.00	0.00	0.20	0.20
14.90	0.63	0.26	5.00	0.00	0.20	0.20
14.95	0.63	0.26	5.00	0.00	0.20	0.20
15.00	0.63	0.26	5.00	0.00	0.20	0.20
15.05	0.63	0.26	5.00	0.00	0.20	0.20
15.10	0.63	0.26	5.00	0.00	0.20	0.20
15.15	0.62	0.26	5.00	0.00	0.20	0.20

15.20	0.62	0.26	5.00	0.00	0.20	0.20
15.25	0.62	0.26	5.00	0.00	0.20	0.20
15.30	0.62	0.26	5.00	0.00	0.20	0.20
15.35	0.62	0.26	5.00	0.00	0.20	0.20
15.40	0.62	0.26	5.00	0.00	0.20	0.20
15.45	0.62	0.26	5.00	0.00	0.20	0.20
15.50	0.62	0.26	5.00	0.00	0.20	0.20
15.55	0.61	0.26	5.00	0.00	0.20	0.20
15.60	0.61	0.26	5.00	0.00	0.20	0.20
15.65	0.61	0.26	5.00	0.00	0.20	0.20
15.70	0.61	0.26	5.00	0.00	0.20	0.20
15.75	0.61	0.26	5.00	0.00	0.20	0.20
15.80	0.61	0.26	5.00	0.00	0.20	0.20
15.85	0.61	0.26	5.00	0.00	0.20	0.20
15.90	0.61	0.26	5.00	0.00	0.20	0.20
15.95	0.60	0.26	5.00	0.00	0.20	0.20
16.00	0.60	0.26	5.00	0.00	0.20	0.20
16.05	0.60	0.26	5.00	0.00	0.20	0.20
16.10	0.60	0.26	5.00	0.00	0.20	0.20
16.15	0.60	0.26	5.00	0.00	0.20	0.20
16.20	0.60	0.26	5.00	0.00	0.20	0.20
16.25	0.60	0.26	5.00	0.00	0.20	0.20
16.30	0.60	0.26	5.00	0.00	0.20	0.20
16.35	0.60	0.26	5.00	0.00	0.20	0.20
16.40	0.60	0.26	5.00	0.00	0.20	0.20
16.45	0.59	0.26	5.00	0.00	0.20	0.20
16.50	0.59	0.26	5.00	0.00	0.20	0.20
16.55	0.59	0.26	5.00	0.00	0.20	0.20
16.60	0.59	0.26	5.00	0.00	0.20	0.20
16.65	0.59	0.26	5.00	0.00	0.20	0.20
16.70	0.59	0.26	5.00	0.00	0.20	0.20
16.75	0.59	0.26	5.00	0.00	0.20	0.20
16.80	0.59	0.26	5.00	0.00	0.20	0.20
16.85	0.59	0.26	5.00	0.00	0.20	0.20
16.90	0.59	0.26	5.00	0.00	0.20	0.20
16.95	0.58	0.26	5.00	0.00	0.20	0.20
17.00	0.58	0.26	5.00	0.00	0.20	0.20
17.05	0.58	0.26	5.00	0.00	0.20	0.20
17.10	0.58	0.26	5.00	0.00	0.20	0.20
17.15	0.58	0.26	5.00	0.00	0.20	0.20
17.20	0.58	0.26	5.00	0.00	0.20	0.20
17.25	0.58	0.26	5.00	0.00	0.20	0.20
17.30	0.58	0.26	5.00	0.00	0.20	0.20
17.35	0.58	0.26	5.00	0.00	0.20	0.20
17.40	0.58	0.26	5.00	0.00	0.20	0.20
17.45	0.57	0.26	5.00	0.00	0.20	0.20
17.50	0.57	0.26	5.00	0.00	0.20	0.20
17.55	0.58	0.26	5.00	0.00	0.20	0.20
17.60	0.59	0.26	5.00	0.00	0.19	0.19
17.65	0.60	0.26	5.00	0.00	0.19	0.19
17.70	0.60	0.26	5.00	0.00	0.19	0.19
17.75	0.61	0.26	5.00	0.00	0.19	0.19
17.80	0.62	0.26	5.00	0.00	0.19	0.19
17.85	0.63	0.26	5.00	0.00	0.19	0.19

17.90	0.64	0.26	5.00	0.00	0.19	0.19
17.95	0.64	0.26	5.00	0.00	0.19	0.19
18.00	0.65	0.26	5.00	0.00	0.19	0.19
18.05	0.66	0.26	5.00	0.00	0.19	0.19
18.10	0.67	0.26	5.00	0.00	0.19	0.19
18.15	0.68	0.26	5.00	0.00	0.19	0.19
18.20	0.69	0.26	5.00	0.00	0.19	0.19
18.25	0.70	0.26	5.00	0.00	0.19	0.19
18.30	0.71	0.26	5.00	0.00	0.19	0.19
18.35	0.72	0.26	5.00	0.00	0.19	0.19
18.40	0.73	0.26	5.00	0.00	0.19	0.19
18.45	0.74	0.26	5.00	0.00	0.19	0.19
18.50	0.76	0.26	5.00	0.00	0.19	0.19
18.55	0.77	0.26	5.00	0.00	0.19	0.19
18.60	0.78	0.26	5.00	0.00	0.19	0.19
18.65	0.80	0.26	5.00	0.00	0.19	0.19
18.70	0.82	0.26	5.00	0.00	0.19	0.19
18.75	0.84	0.26	5.00	0.00	0.19	0.19
18.80	0.86	0.26	5.00	0.00	0.19	0.19
18.85	0.89	0.26	5.00	0.00	0.19	0.19
18.90	0.92	0.26	5.00	0.00	0.19	0.19
18.95	0.99	0.26	5.00	0.00	0.19	0.19
19.00	1.11	0.26	5.00	0.00	0.19	0.19
19.05	1.11	0.26	5.00	0.00	0.19	0.19
19.10	1.11	0.26	5.00	0.00	0.19	0.19
19.15	1.11	0.26	5.00	0.00	0.19	0.19
19.20	1.11	0.26	5.00	0.00	0.19	0.19
19.25	1.11	0.26	5.00	0.00	0.19	0.19
19.30	1.11	0.26	5.00	0.00	0.19	0.19
19.35	1.11	0.26	5.00	0.00	0.19	0.19
19.40	1.11	0.26	5.00	0.00	0.19	0.19
19.45	1.11	0.26	5.00	0.00	0.19	0.19
19.50	1.11	0.26	5.00	0.00	0.19	0.19
19.55	1.11	0.26	5.00	0.00	0.19	0.19
19.60	1.11	0.26	5.00	0.00	0.19	0.19
19.65	1.11	0.26	5.00	0.00	0.19	0.19
19.70	1.11	0.26	5.00	0.00	0.19	0.19
19.75	1.11	0.26	5.00	0.00	0.19	0.19
19.80	1.11	0.26	5.00	0.00	0.19	0.19
19.85	1.11	0.26	5.00	0.00	0.19	0.19
19.90	1.11	0.26	5.00	0.00	0.19	0.19
19.95	1.11	0.26	5.00	0.00	0.19	0.19
20.00	1.11	0.26	5.00	0.00	0.19	0.19
20.05	1.11	0.26	5.00	0.00	0.19	0.19
20.10	1.11	0.26	5.00	0.00	0.19	0.19
20.15	1.11	0.25	5.00	0.00	0.19	0.19
20.20	1.11	0.25	5.00	0.00	0.19	0.19
20.25	1.11	0.25	5.00	0.00	0.19	0.19
20.30	1.11	0.25	5.00	0.00	0.19	0.19
20.35	1.11	0.25	5.00	0.00	0.19	0.19
20.40	1.11	0.25	5.00	0.00	0.19	0.19
20.45	1.11	0.25	5.00	0.00	0.19	0.19
20.50	1.11	0.25	5.00	0.00	0.19	0.19
20.55	1.11	0.25	5.00	0.00	0.19	0.19

20.60	1.11	0.25	5.00	0.00	0.19	0.19
20.65	1.11	0.25	5.00	0.00	0.19	0.19
20.70	1.11	0.25	5.00	0.00	0.19	0.19
20.75	1.11	0.25	5.00	0.00	0.19	0.19
20.80	1.11	0.25	5.00	0.00	0.19	0.19
20.85	1.11	0.25	5.00	0.00	0.19	0.19
20.90	1.11	0.25	5.00	0.00	0.19	0.19
20.95	1.11	0.25	5.00	0.00	0.19	0.19
21.00	1.11	0.25	5.00	0.00	0.19	0.19
21.05	1.11	0.25	5.00	0.00	0.19	0.19
21.10	1.11	0.25	5.00	0.00	0.19	0.19
21.15	1.11	0.25	5.00	0.00	0.19	0.19
21.20	1.11	0.25	5.00	0.00	0.19	0.19
21.25	1.11	0.25	5.00	0.00	0.19	0.19
21.30	1.11	0.25	5.00	0.00	0.19	0.19
21.35	1.11	0.25	5.00	0.00	0.19	0.19
21.40	1.11	0.25	5.00	0.00	0.19	0.19
21.45	1.11	0.25	5.00	0.00	0.19	0.19
21.50	1.11	0.25	5.00	0.00	0.19	0.19
21.55	1.11	0.25	5.00	0.00	0.19	0.19
21.60	1.11	0.25	5.00	0.00	0.19	0.19
21.65	1.11	0.25	5.00	0.00	0.19	0.19
21.70	1.11	0.25	5.00	0.00	0.19	0.19
21.75	1.11	0.25	5.00	0.00	0.19	0.19
21.80	1.11	0.25	5.00	0.00	0.19	0.19
21.85	1.11	0.25	5.00	0.00	0.19	0.19
21.90	1.11	0.25	5.00	0.00	0.19	0.19
21.95	1.11	0.25	5.00	0.00	0.19	0.19
22.00	1.11	0.25	5.00	0.00	0.19	0.19
22.05	1.11	0.25	5.00	0.00	0.19	0.19
22.10	1.11	0.25	5.00	0.00	0.19	0.19
22.15	1.11	0.25	5.00	0.00	0.19	0.19
22.20	1.11	0.25	5.00	0.00	0.19	0.19
22.25	1.11	0.25	5.00	0.00	0.19	0.19
22.30	1.11	0.25	5.00	0.00	0.19	0.19
22.35	1.11	0.25	5.00	0.00	0.19	0.19
22.40	1.11	0.25	5.00	0.00	0.19	0.19
22.45	1.11	0.25	5.00	0.00	0.19	0.19
22.50	1.11	0.25	5.00	0.00	0.19	0.19
22.55	1.11	0.25	5.00	0.00	0.19	0.19
22.60	1.11	0.25	5.00	0.00	0.19	0.19
22.65	1.11	0.25	5.00	0.00	0.19	0.19
22.70	1.11	0.25	5.00	0.00	0.19	0.19
22.75	1.11	0.25	5.00	0.00	0.19	0.19
22.80	1.11	0.25	5.00	0.00	0.19	0.19
22.85	1.11	0.25	5.00	0.00	0.19	0.19
22.90	1.11	0.25	5.00	0.00	0.19	0.19
22.95	1.11	0.25	5.00	0.00	0.19	0.19
23.00	1.11	0.25	5.00	0.00	0.19	0.19
23.05	1.11	0.25	5.00	0.00	0.19	0.19
23.10	1.11	0.25	5.00	0.00	0.19	0.19
23.15	1.11	0.25	5.00	0.00	0.19	0.19
23.20	1.11	0.25	5.00	0.00	0.19	0.19
23.25	1.11	0.25	5.00	0.00	0.19	0.19

23.30	1.11	0.25	5.00	0.00	0.19	0.19
23.35	1.11	0.25	5.00	0.00	0.19	0.19
23.40	1.11	0.25	5.00	0.00	0.19	0.19
23.45	1.11	0.25	5.00	0.00	0.19	0.19
23.50	1.11	0.25	5.00	0.00	0.19	0.19
23.55	1.11	0.25	5.00	0.00	0.18	0.18
23.60	1.11	0.25	5.00	0.00	0.18	0.18
23.65	1.11	0.25	5.00	0.00	0.18	0.18
23.70	1.11	0.25	5.00	0.00	0.18	0.18
23.75	1.11	0.25	5.00	0.00	0.18	0.18
23.80	1.11	0.25	5.00	0.00	0.18	0.18
23.85	1.11	0.25	5.00	0.00	0.18	0.18
23.90	1.11	0.25	5.00	0.00	0.18	0.18
23.95	1.11	0.25	5.00	0.00	0.18	0.18
24.00	1.11	0.25	5.00	0.00	0.18	0.18
24.05	1.11	0.25	5.00	0.00	0.18	0.18
24.10	1.11	0.25	5.00	0.00	0.18	0.18
24.15	1.11	0.25	5.00	0.00	0.18	0.18
24.20	1.11	0.25	5.00	0.00	0.18	0.18
24.25	1.11	0.25	5.00	0.00	0.18	0.18
24.30	1.11	0.25	5.00	0.00	0.18	0.18
24.35	1.11	0.25	5.00	0.00	0.18	0.18
24.40	1.11	0.25	5.00	0.00	0.18	0.18
24.45	1.11	0.25	5.00	0.00	0.18	0.18
24.50	1.11	0.25	5.00	0.00	0.18	0.18
24.55	1.11	0.25	5.00	0.00	0.18	0.18
24.60	1.11	0.25	5.00	0.00	0.18	0.18
24.65	1.11	0.25	5.00	0.00	0.18	0.18
24.70	1.11	0.25	5.00	0.00	0.18	0.18
24.75	1.11	0.25	5.00	0.00	0.18	0.18
24.80	1.11	0.25	5.00	0.00	0.18	0.18
24.85	1.11	0.25	5.00	0.00	0.18	0.18
24.90	1.11	0.25	5.00	0.00	0.18	0.18
24.95	1.11	0.25	5.00	0.00	0.18	0.18
25.00	1.11	0.25	5.00	0.00	0.18	0.18
25.05	1.11	0.25	5.00	0.00	0.18	0.18
25.10	1.11	0.25	5.00	0.00	0.18	0.18
25.15	1.11	0.25	5.00	0.00	0.18	0.18
25.20	1.11	0.25	5.00	0.00	0.18	0.18
25.25	1.11	0.25	5.00	0.00	0.18	0.18
25.30	1.11	0.25	5.00	0.00	0.18	0.18
25.35	1.11	0.25	5.00	0.00	0.18	0.18
25.40	1.11	0.25	5.00	0.00	0.18	0.18
25.45	1.11	0.25	5.00	0.00	0.18	0.18
25.50	1.11	0.25	5.00	0.00	0.18	0.18
25.55	1.11	0.25	5.00	0.00	0.18	0.18
25.60	1.11	0.25	5.00	0.00	0.18	0.18
25.65	1.11	0.25	5.00	0.00	0.18	0.18
25.70	1.11	0.25	5.00	0.00	0.18	0.18
25.75	1.11	0.25	5.00	0.00	0.18	0.18
25.80	1.11	0.25	5.00	0.00	0.18	0.18
25.85	1.11	0.25	5.00	0.00	0.18	0.18
25.90	1.11	0.25	5.00	0.00	0.18	0.18
25.95	1.11	0.25	5.00	0.00	0.18	0.18

26.00	1.11	0.25	5.00	0.00	0.18	0.18
26.05	1.11	0.25	5.00	0.00	0.18	0.18
26.10	1.11	0.25	5.00	0.00	0.18	0.18
26.15	1.11	0.25	5.00	0.00	0.18	0.18
26.20	1.11	0.25	5.00	0.00	0.18	0.18
26.25	1.11	0.25	5.00	0.00	0.18	0.18
26.30	1.08	0.25	5.00	0.00	0.18	0.18
26.35	0.99	0.25	5.00	0.00	0.18	0.18
26.40	0.94	0.25	5.00	0.00	0.18	0.18
26.45	0.90	0.25	5.00	0.00	0.18	0.18
26.50	0.88	0.25	5.00	0.00	0.18	0.18
26.55	0.86	0.25	5.00	0.00	0.18	0.18
26.60	0.84	0.25	5.00	0.00	0.18	0.18
26.65	0.83	0.25	5.00	0.00	0.18	0.18
26.70	0.81	0.25	5.00	0.00	0.18	0.18
26.75	0.80	0.25	5.00	0.00	0.18	0.18
26.80	0.79	0.25	5.00	0.00	0.18	0.18
26.85	0.78	0.25	5.00	0.00	0.18	0.18
26.90	0.77	0.25	5.00	0.00	0.18	0.18
26.95	0.76	0.25	5.00	0.00	0.18	0.18
27.00	0.75	0.25	5.00	0.00	0.18	0.18
27.05	0.75	0.25	5.00	0.00	0.18	0.18
27.10	0.74	0.25	5.00	0.00	0.18	0.18
27.15	0.73	0.25	5.00	0.00	0.18	0.18
27.20	0.72	0.25	5.00	0.00	0.18	0.18
27.25	0.71	0.25	5.00	0.00	0.18	0.18
27.30	0.71	0.25	5.00	0.00	0.18	0.18
27.35	0.70	0.25	5.00	0.00	0.18	0.18
27.40	0.69	0.25	5.00	0.00	0.18	0.18
27.45	0.68	0.25	5.00	0.00	0.18	0.18
27.50	0.68	0.25	5.00	0.00	0.18	0.18
27.55	0.68	0.25	5.00	0.00	0.18	0.18
27.60	0.68	0.25	5.00	0.00	0.18	0.18
27.65	0.68	0.25	5.00	0.00	0.18	0.18
27.70	0.68	0.25	5.00	0.00	0.18	0.18
27.75	0.68	0.25	5.00	0.00	0.18	0.18
27.80	0.68	0.25	5.00	0.00	0.18	0.18
27.85	0.68	0.25	5.00	0.00	0.18	0.18
27.90	0.73	0.25	5.00	0.00	0.18	0.18
27.95	0.73	0.25	5.00	0.00	0.18	0.18
28.00	0.73	0.25	5.00	0.00	0.18	0.18
28.05	0.73	0.25	5.00	0.00	0.17	0.17
28.10	0.74	0.25	5.00	0.00	0.17	0.17
28.15	0.74	0.25	5.00	0.00	0.17	0.17
28.20	0.74	0.25	5.00	0.00	0.17	0.17
28.25	0.74	0.25	5.00	0.00	0.17	0.17
28.30	0.74	0.25	5.00	0.00	0.17	0.17
28.35	0.74	0.25	5.00	0.00	0.17	0.17
28.40	0.74	0.25	5.00	0.00	0.17	0.17
28.45	0.74	0.25	5.00	0.00	0.17	0.17
28.50	0.74	0.25	5.00	0.00	0.17	0.17
28.55	0.75	0.25	5.00	0.00	0.17	0.17
28.60	0.75	0.25	5.00	0.00	0.17	0.17
28.65	0.75	0.25	5.00	0.00	0.17	0.17

28.70	0.75	0.25	5.00	0.00	0.17	0.17
28.75	0.75	0.25	5.00	0.00	0.17	0.17
28.80	0.75	0.25	5.00	0.00	0.17	0.17
28.85	0.75	0.25	5.00	0.00	0.17	0.17
28.90	0.75	0.25	5.00	0.00	0.17	0.17
28.95	0.75	0.25	5.00	0.00	0.17	0.17
29.00	0.76	0.25	5.00	0.00	0.17	0.17
29.05	0.76	0.25	5.00	0.00	0.17	0.17
29.10	0.76	0.25	5.00	0.00	0.17	0.17
29.15	0.76	0.25	5.00	0.00	0.17	0.17
29.20	0.76	0.25	5.00	0.00	0.17	0.17
29.25	0.76	0.25	5.00	0.00	0.17	0.17
29.30	0.76	0.25	5.00	0.00	0.17	0.17
29.35	0.76	0.25	5.00	0.00	0.17	0.17
29.40	0.77	0.25	5.00	0.00	0.17	0.17
29.45	0.77	0.25	5.00	0.00	0.17	0.17
29.50	0.77	0.25	5.00	0.00	0.17	0.17
29.55	0.77	0.25	5.00	0.00	0.17	0.17
29.60	0.77	0.25	5.00	0.00	0.17	0.17
29.65	0.77	0.25	5.00	0.00	0.17	0.17
29.70	0.77	0.25	5.00	0.00	0.17	0.17
29.75	0.77	0.25	5.00	0.00	0.17	0.17
29.80	0.78	0.25	5.00	0.00	0.17	0.17
29.85	0.78	0.25	5.00	0.00	0.17	0.17
29.90	0.78	0.25	5.00	0.00	0.17	0.17
29.95	0.78	0.25	5.00	0.00	0.17	0.17
30.00	0.78	0.25	5.00	0.00	0.17	0.17
30.05	0.78	0.25	5.00	0.00	0.17	0.17
30.10	0.78	0.25	5.00	0.00	0.17	0.17
30.15	0.79	0.25	5.00	0.00	0.17	0.17
30.20	0.79	0.25	5.00	0.00	0.17	0.17
30.25	0.78	0.25	5.00	0.00	0.17	0.17
30.30	0.77	0.25	5.00	0.00	0.17	0.17
30.35	0.76	0.25	5.00	0.00	0.17	0.17
30.40	0.75	0.25	5.00	0.00	0.17	0.17
30.45	0.74	0.25	5.00	0.00	0.17	0.17
30.50	0.74	0.25	5.00	0.00	0.17	0.17
30.55	0.73	0.25	5.00	0.00	0.17	0.17
30.60	0.72	0.25	5.00	0.00	0.17	0.17
30.65	0.72	0.25	5.00	0.00	0.17	0.17
30.70	0.71	0.25	5.00	0.00	0.17	0.17
30.75	0.70	0.25	5.00	0.00	0.17	0.17
30.80	0.70	0.25	5.00	0.00	0.17	0.17
30.85	0.69	0.25	5.00	0.00	0.17	0.17
30.90	0.68	0.25	5.00	0.00	0.17	0.17
30.95	0.68	0.25	5.00	0.00	0.17	0.17
31.00	0.67	0.25	5.00	0.00	0.17	0.17
31.05	0.67	0.25	5.00	0.00	0.17	0.17
31.10	0.66	0.25	5.00	0.00	0.17	0.17
31.15	0.65	0.25	5.00	0.00	0.17	0.17
31.20	0.65	0.25	5.00	0.00	0.16	0.16
31.25	0.64	0.25	5.00	0.00	0.16	0.16
31.30	0.64	0.25	5.00	0.00	0.16	0.16
31.35	0.63	0.25	5.00	0.00	0.16	0.16

31.40	0.63	0.25	5.00	0.00	0.16	0.16
31.45	0.62	0.25	5.00	0.00	0.16	0.16
31.50	0.62	0.25	5.00	0.00	0.16	0.16
31.55	0.61	0.25	5.00	0.00	0.16	0.16
31.60	0.61	0.25	5.00	0.00	0.16	0.16
31.65	0.60	0.25	5.00	0.00	0.16	0.16
31.70	0.60	0.25	5.00	0.00	0.16	0.16
31.75	0.60	0.24	5.00	0.00	0.16	0.16
31.80	0.59	0.24	5.00	0.00	0.16	0.16
31.85	0.59	0.24	5.00	0.00	0.16	0.16
31.90	0.58	0.24	5.00	0.00	0.16	0.16
31.95	0.58	0.24	5.00	0.00	0.16	0.16
32.00	0.57	0.24	5.00	0.00	0.16	0.16
32.05	0.57	0.24	5.00	0.00	0.16	0.16
32.10	0.56	0.24	5.00	0.00	0.16	0.16
32.15	0.56	0.24	5.00	0.00	0.16	0.16
32.20	0.56	0.24	5.00	0.00	0.16	0.16
32.25	0.55	0.24	5.00	0.00	0.16	0.16
32.30	0.55	0.24	5.00	0.00	0.16	0.16
32.35	0.54	0.24	5.00	0.00	0.16	0.16
32.40	0.54	0.24	5.00	0.00	0.16	0.16
32.45	0.54	0.24	5.00	0.00	0.16	0.16
32.50	0.53	0.24	5.00	0.00	0.16	0.16
32.55	0.53	0.24	5.00	0.00	0.16	0.16
32.60	0.53	0.24	5.00	0.00	0.16	0.16
32.65	0.53	0.24	5.00	0.00	0.16	0.16
32.70	0.53	0.24	5.00	0.00	0.16	0.16
32.75	0.53	0.24	5.00	0.00	0.16	0.16
32.80	0.53	0.24	5.00	0.00	0.16	0.16
32.85	0.53	0.24	5.00	0.00	0.16	0.16
32.90	0.53	0.24	5.00	0.00	0.16	0.16
32.95	0.53	0.24	5.00	0.00	0.16	0.16
33.00	0.54	0.24	5.00	0.00	0.16	0.16
33.05	0.54	0.24	5.00	0.00	0.16	0.16
33.10	0.54	0.24	5.00	0.00	0.16	0.16
33.15	0.54	0.24	5.00	0.00	0.16	0.16
33.20	0.54	0.24	5.00	0.00	0.16	0.16
33.25	0.54	0.24	5.00	0.00	0.16	0.16
33.30	0.54	0.24	5.00	0.00	0.16	0.16
33.35	0.54	0.24	5.00	0.00	0.15	0.15
33.40	0.54	0.24	5.00	0.00	0.15	0.15
33.45	0.54	0.24	5.00	0.00	0.15	0.15
33.50	0.54	0.24	5.00	0.00	0.15	0.15
33.55	0.54	0.24	5.00	0.00	0.15	0.15
33.60	0.54	0.24	5.00	0.00	0.15	0.15
33.65	0.54	0.24	5.00	0.00	0.15	0.15
33.70	0.54	0.24	5.00	0.00	0.15	0.15
33.75	0.54	0.24	5.00	0.00	0.15	0.15
33.80	0.54	0.24	5.00	0.00	0.15	0.15
33.85	0.54	0.24	5.00	0.00	0.15	0.15
33.90	0.54	0.24	5.00	0.00	0.15	0.15
33.95	0.54	0.24	5.00	0.00	0.15	0.15
34.00	0.54	0.24	5.00	0.00	0.15	0.15
34.05	0.54	0.24	5.00	0.00	0.15	0.15

34.10	0.54	0.24	5.00	0.00	0.15	0.15
34.15	0.54	0.24	5.00	0.00	0.15	0.15
34.20	0.54	0.24	5.00	0.00	0.15	0.15
34.25	0.54	0.24	5.00	0.00	0.15	0.15
34.30	0.54	0.24	5.00	0.00	0.15	0.15
34.35	0.54	0.24	5.00	0.00	0.15	0.15
34.40	0.54	0.24	5.00	0.00	0.15	0.15
34.45	0.54	0.24	5.00	0.00	0.15	0.15
34.50	0.54	0.24	5.00	0.00	0.15	0.15
34.55	0.54	0.24	5.00	0.00	0.15	0.15
34.60	0.54	0.24	5.00	0.00	0.15	0.15
34.65	0.55	0.24	5.00	0.00	0.15	0.15
34.70	0.55	0.24	5.00	0.00	0.15	0.15
34.75	0.55	0.24	5.00	0.00	0.15	0.15
34.80	0.55	0.24	5.00	0.00	0.15	0.15
34.85	0.55	0.24	5.00	0.00	0.15	0.15
34.90	0.55	0.24	5.00	0.00	0.15	0.15
34.95	0.55	0.24	5.00	0.00	0.15	0.15
35.00	0.55	0.24	5.00	0.00	0.15	0.15
35.05	0.55	0.24	5.00	0.00	0.15	0.15
35.10	0.55	0.24	5.00	0.00	0.15	0.15
35.15	0.55	0.24	5.00	0.00	0.15	0.15
35.20	0.55	0.24	5.00	0.00	0.15	0.15
35.25	0.55	0.24	5.00	0.00	0.15	0.15
35.30	0.54	0.24	5.00	0.00	0.15	0.15
35.35	0.54	0.24	5.00	0.00	0.14	0.14
35.40	0.54	0.24	5.00	0.00	0.14	0.14
35.45	0.53	0.24	5.00	0.00	0.14	0.14
35.50	0.53	0.24	5.00	0.00	0.14	0.14
35.55	0.53	0.24	5.00	0.00	0.14	0.14
35.60	0.52	0.24	5.00	0.00	0.14	0.14
35.65	0.52	0.24	5.00	0.00	0.14	0.14
35.70	0.52	0.24	5.00	0.00	0.14	0.14
35.75	0.52	0.24	5.00	0.00	0.14	0.14
35.80	0.51	0.24	5.00	0.00	0.14	0.14
35.85	0.51	0.24	5.00	0.00	0.14	0.14
35.90	0.51	0.24	5.00	0.00	0.14	0.14
35.95	0.50	0.24	5.00	0.00	0.14	0.14
36.00	0.50	0.24	5.00	0.00	0.14	0.14
36.05	0.50	0.24	5.00	0.00	0.14	0.14
36.10	0.49	0.24	5.00	0.00	0.14	0.14
36.15	0.49	0.24	5.00	0.00	0.14	0.14
36.20	0.49	0.24	5.00	0.00	0.14	0.14
36.25	0.49	0.24	5.00	0.00	0.14	0.14
36.30	0.48	0.24	5.00	0.00	0.14	0.14
36.35	0.48	0.23	5.00	0.00	0.14	0.14
36.40	0.48	0.23	5.00	0.00	0.14	0.14
36.45	0.47	0.23	5.00	0.00	0.14	0.14
36.50	0.47	0.23	5.00	0.00	0.14	0.14
36.55	0.47	0.23	5.00	0.00	0.14	0.14
36.60	0.47	0.23	5.00	0.00	0.14	0.14
36.65	0.46	0.23	5.00	0.00	0.14	0.14
36.70	0.46	0.23	5.00	0.00	0.14	0.14
36.75	0.46	0.23	5.00	0.00	0.14	0.14

36.80	0.45	0.23	5.00	0.00	0.14	0.14
36.85	0.45	0.23	5.00	0.00	0.14	0.14
36.90	0.45	0.23	5.00	0.00	0.14	0.14
36.95	0.45	0.23	5.00	0.00	0.14	0.14
37.00	0.44	0.23	5.00	0.00	0.13	0.13
37.05	0.44	0.23	5.00	0.00	0.13	0.13
37.10	0.44	0.23	5.00	0.00	0.13	0.13
37.15	0.44	0.23	5.00	0.00	0.13	0.13
37.20	0.43	0.23	5.00	0.00	0.13	0.13
37.25	0.43	0.23	5.00	0.00	0.13	0.13
37.30	0.43	0.23	5.00	0.00	0.13	0.13
37.35	0.43	0.23	5.00	0.00	0.13	0.13
37.40	0.42	0.23	5.00	0.00	0.13	0.13
37.45	0.42	0.23	5.00	0.00	0.13	0.13
37.50	0.42	0.23	5.00	0.00	0.13	0.13
37.55	0.42	0.23	5.00	0.00	0.13	0.13
37.60	0.43	0.23	5.00	0.00	0.13	0.13
37.65	0.44	0.23	5.00	0.00	0.13	0.13
37.70	0.44	0.23	5.00	0.00	0.13	0.13
37.75	0.45	0.23	5.00	0.00	0.13	0.13
37.80	0.45	0.23	5.00	0.00	0.13	0.13
37.85	0.46	0.23	5.00	0.00	0.13	0.13
37.90	0.46	0.23	5.00	0.00	0.13	0.13
37.95	0.47	0.23	5.00	0.00	0.13	0.13
38.00	0.48	0.23	5.00	0.00	0.13	0.13
38.05	0.48	0.23	5.00	0.00	0.13	0.13
38.10	0.49	0.23	5.00	0.00	0.13	0.13
38.15	0.50	0.23	5.00	0.00	0.13	0.13
38.20	0.50	0.23	5.00	0.00	0.13	0.13
38.25	0.51	0.23	5.00	0.00	0.13	0.13
38.30	0.52	0.23	5.00	0.00	0.13	0.13
38.35	0.52	0.23	5.00	0.00	0.13	0.13
38.40	0.53	0.23	5.00	0.00	0.13	0.13
38.45	0.54	0.23	5.00	0.00	0.12	0.12
38.50	0.54	0.23	5.00	0.00	0.12	0.12
38.55	0.55	0.23	5.00	0.00	0.12	0.12
38.60	0.56	0.23	5.00	0.00	0.12	0.12
38.65	0.56	0.23	5.00	0.00	0.12	0.12
38.70	0.57	0.23	5.00	0.00	0.12	0.12
38.75	0.58	0.23	5.00	0.00	0.12	0.12
38.80	0.59	0.23	5.00	0.00	0.12	0.12
38.85	0.60	0.23	5.00	0.00	0.12	0.12
38.90	0.60	0.23	5.00	0.00	0.12	0.12
38.95	0.61	0.23	5.00	0.00	0.12	0.12
39.00	0.62	0.23	5.00	0.00	0.12	0.12
39.05	0.63	0.23	5.00	0.00	0.12	0.12
39.10	0.64	0.23	5.00	0.00	0.12	0.12
39.15	0.65	0.23	5.00	0.00	0.12	0.12
39.20	0.66	0.23	5.00	0.00	0.12	0.12
39.25	0.67	0.23	5.00	0.00	0.12	0.12
39.30	0.68	0.23	5.00	0.00	0.12	0.12
39.35	0.69	0.23	5.00	0.00	0.12	0.12
39.40	0.71	0.23	5.00	0.00	0.12	0.12
39.45	0.72	0.23	5.00	0.00	0.12	0.12

39.50	0.73	0.23	5.00	0.00	0.12	0.12
39.55	0.75	0.23	5.00	0.00	0.12	0.12
39.60	0.77	0.23	5.00	0.00	0.12	0.12
39.65	0.79	0.23	5.00	0.00	0.12	0.12
39.70	0.81	0.23	5.00	0.00	0.12	0.12
39.75	0.84	0.23	5.00	0.00	0.12	0.12
39.80	0.88	0.23	5.00	0.00	0.12	0.12
39.85	0.96	0.23	5.00	0.00	0.12	0.12
39.90	1.04	0.23	5.00	0.00	0.12	0.12
39.95	1.04	0.23	5.00	0.00	0.12	0.12
40.00	1.04	0.23	5.00	0.00	0.12	0.12
40.05	1.04	0.23	5.00	0.00	0.12	0.12
40.10	1.04	0.23	5.00	0.00	0.12	0.12
40.15	1.04	0.23	5.00	0.00	0.12	0.12
40.20	1.04	0.23	5.00	0.00	0.12	0.12
40.25	1.04	0.23	5.00	0.00	0.12	0.12
40.30	1.04	0.23	5.00	0.00	0.12	0.12
40.35	1.04	0.23	5.00	0.00	0.12	0.12
40.40	1.04	0.23	5.00	0.00	0.12	0.12
40.45	1.04	0.23	5.00	0.00	0.12	0.12
40.50	1.04	0.23	5.00	0.00	0.12	0.12
40.55	1.04	0.23	5.00	0.00	0.12	0.12
40.60	1.04	0.23	5.00	0.00	0.12	0.12
40.65	1.04	0.23	5.00	0.00	0.12	0.12
40.70	1.04	0.23	5.00	0.00	0.12	0.12
40.75	1.04	0.23	5.00	0.00	0.12	0.12
40.80	1.04	0.23	5.00	0.00	0.12	0.12
40.85	1.04	0.23	5.00	0.00	0.12	0.12
40.90	1.03	0.23	5.00	0.00	0.12	0.12
40.95	1.03	0.22	5.00	0.00	0.12	0.12
41.00	1.03	0.22	5.00	0.00	0.12	0.12
41.05	1.03	0.22	5.00	0.00	0.12	0.12
41.10	1.03	0.22	5.00	0.00	0.12	0.12
41.15	1.03	0.22	5.00	0.00	0.12	0.12
41.20	1.03	0.22	5.00	0.00	0.12	0.12
41.25	1.03	0.22	5.00	0.00	0.12	0.12
41.30	1.03	0.22	5.00	0.00	0.12	0.12
41.35	1.03	0.22	5.00	0.00	0.12	0.12
41.40	1.03	0.22	5.00	0.00	0.12	0.12
41.45	1.03	0.22	5.00	0.00	0.12	0.12
41.50	1.03	0.22	5.00	0.00	0.12	0.12
41.55	1.03	0.22	5.00	0.00	0.12	0.12
41.60	1.03	0.22	5.00	0.00	0.12	0.12
41.65	1.03	0.22	5.00	0.00	0.12	0.12
41.70	1.03	0.22	5.00	0.00	0.12	0.12
41.75	1.03	0.22	5.00	0.00	0.12	0.12
41.80	1.03	0.22	5.00	0.00	0.12	0.12
41.85	1.03	0.22	5.00	0.00	0.12	0.12
41.90	1.03	0.22	5.00	0.00	0.12	0.12
41.95	1.03	0.22	5.00	0.00	0.12	0.12
42.00	1.03	0.22	5.00	0.00	0.11	0.11
42.05	1.03	0.22	5.00	0.00	0.11	0.11
42.10	1.03	0.22	5.00	0.00	0.11	0.11
42.15	1.03	0.22	5.00	0.00	0.11	0.11

42.20	1.03	0.22	5.00	0.00	0.11	0.11
42.25	1.03	0.22	5.00	0.00	0.11	0.11
42.30	1.03	0.22	5.00	0.00	0.11	0.11
42.35	1.03	0.22	5.00	0.00	0.11	0.11
42.40	1.03	0.22	5.00	0.00	0.11	0.11
42.45	1.03	0.22	5.00	0.00	0.11	0.11
42.50	1.03	0.22	5.00	0.00	0.11	0.11
42.55	1.03	0.22	5.00	0.00	0.11	0.11
42.60	1.03	0.22	5.00	0.00	0.11	0.11
42.65	1.03	0.22	5.00	0.00	0.11	0.11
42.70	1.03	0.22	5.00	0.00	0.11	0.11
42.75	1.02	0.22	5.00	0.00	0.11	0.11
42.80	1.02	0.22	5.00	0.00	0.11	0.11
42.85	1.02	0.22	5.00	0.00	0.11	0.11
42.90	1.02	0.22	5.00	0.00	0.11	0.11
42.95	1.02	0.22	5.00	0.00	0.11	0.11
43.00	1.02	0.22	5.00	0.00	0.11	0.11
43.05	1.02	0.22	5.00	0.00	0.11	0.11
43.10	1.02	0.22	5.00	0.00	0.11	0.11
43.15	1.02	0.22	5.00	0.00	0.11	0.11
43.20	1.02	0.22	5.00	0.00	0.11	0.11
43.25	1.02	0.22	5.00	0.00	0.11	0.11
43.30	1.02	0.22	5.00	0.00	0.11	0.11
43.35	1.02	0.22	5.00	0.00	0.11	0.11
43.40	1.02	0.22	5.00	0.00	0.11	0.11
43.45	1.02	0.22	5.00	0.00	0.11	0.11
43.50	1.02	0.22	5.00	0.00	0.11	0.11
43.55	1.02	0.22	5.00	0.00	0.11	0.11
43.60	1.02	0.22	5.00	0.00	0.11	0.11
43.65	1.02	0.22	5.00	0.00	0.11	0.11
43.70	1.02	0.22	5.00	0.00	0.11	0.11
43.75	1.02	0.22	5.00	0.00	0.11	0.11
43.80	1.02	0.22	5.00	0.00	0.11	0.11
43.85	1.02	0.22	5.00	0.00	0.11	0.11
43.90	1.02	0.22	5.00	0.00	0.11	0.11
43.95	1.02	0.22	5.00	0.00	0.11	0.11
44.00	1.02	0.22	5.00	0.00	0.11	0.11
44.05	1.02	0.22	5.00	0.00	0.11	0.11
44.10	1.02	0.22	5.00	0.00	0.11	0.11
44.15	1.02	0.22	5.00	0.00	0.11	0.11
44.20	1.02	0.22	5.00	0.00	0.11	0.11
44.25	1.02	0.22	5.00	0.00	0.11	0.11
44.30	1.02	0.22	5.00	0.00	0.11	0.11
44.35	1.02	0.22	5.00	0.00	0.11	0.11
44.40	1.02	0.22	5.00	0.00	0.11	0.11
44.45	1.02	0.22	5.00	0.00	0.11	0.11
44.50	1.02	0.22	5.00	0.00	0.11	0.11
44.55	1.02	0.22	5.00	0.00	0.11	0.11
44.60	1.02	0.22	5.00	0.00	0.11	0.11
44.65	1.02	0.22	5.00	0.00	0.11	0.11
44.70	1.01	0.22	5.00	0.00	0.11	0.11
44.75	1.01	0.22	5.00	0.00	0.11	0.11
44.80	0.89	0.22	5.00	0.00	0.11	0.11
44.85	0.83	0.22	5.00	0.00	0.11	0.11

44.90	0.79	0.22	5.00	0.00	0.11	0.11
44.95	0.77	0.22	5.00	0.00	0.11	0.11
45.00	0.75	0.22	5.00	0.00	0.11	0.11
45.05	0.72	0.22	5.00	0.00	0.11	0.11
45.10	0.70	0.22	5.00	0.00	0.11	0.11
45.15	0.68	0.22	5.00	0.00	0.11	0.11
45.20	0.66	0.22	5.00	0.00	0.11	0.11
45.25	0.64	0.22	5.00	0.00	0.11	0.11
45.30	0.62	0.22	5.00	0.00	0.11	0.11
45.35	0.61	0.22	5.00	0.00	0.11	0.11
45.40	0.59	0.22	5.00	0.00	0.11	0.11
45.45	0.58	0.22	5.00	0.00	0.11	0.11
45.50	0.56	0.22	5.00	0.00	0.11	0.11
45.55	0.55	0.21	5.00	0.00	0.11	0.11
45.60	0.54	0.21	5.00	0.00	0.11	0.11
45.65	0.53	0.21	5.00	0.00	0.11	0.11
45.70	0.52	0.21	5.00	0.00	0.11	0.11
45.75	0.51	0.21	5.00	0.00	0.11	0.11
45.80	0.49	0.21	5.00	0.00	0.11	0.11
45.85	0.48	0.21	5.00	0.00	0.11	0.11
45.90	0.47	0.21	5.00	0.00	0.11	0.11
45.95	0.46	0.21	5.00	0.00	0.11	0.11
46.00	0.45	0.21	5.00	0.00	0.11	0.11
46.05	0.44	0.21	5.00	0.00	0.11	0.11
46.10	0.44	0.21	5.00	0.00	0.11	0.11
46.15	0.43	0.21	5.00	0.00	0.11	0.11
46.20	0.42	0.21	5.00	0.00	0.11	0.11
46.25	0.41	0.21	5.00	0.00	0.11	0.11
46.30	0.40	0.21	5.00	0.00	0.10	0.10
46.35	0.39	0.21	5.00	0.00	0.10	0.10
46.40	0.38	0.21	5.00	0.00	0.10	0.10
46.45	0.37	0.21	5.00	0.00	0.10	0.10
46.50	0.36	0.21	5.00	0.00	0.10	0.10
46.55	0.36	0.21	5.00	0.00	0.10	0.10
46.60	0.35	0.21	5.00	0.00	0.10	0.10
46.65	0.34	0.21	5.00	0.00	0.10	0.10
46.70	0.33	0.21	5.00	0.00	0.10	0.10
46.75	0.32	0.21	5.00	0.00	0.10	0.10
46.80	0.31	0.21	5.00	0.00	0.10	0.10
46.85	0.30	0.21	5.00	0.00	0.10	0.10
46.90	0.30	0.21	5.00	0.00	0.10	0.10
46.95	0.29	0.21	5.00	0.00	0.10	0.10
47.00	0.28	0.21	5.00	0.00	0.10	0.10
47.05	0.27	0.21	5.00	0.00	0.10	0.10
47.10	0.26	0.21	5.00	0.00	0.10	0.10
47.15	0.25	0.21	5.00	0.00	0.10	0.10
47.20	0.24	0.21	5.00	0.00	0.10	0.10
47.25	0.24	0.21	5.00	0.00	0.10	0.10
47.30	0.23	0.21	5.00	0.00	0.09	0.09
47.35	0.22	0.21	5.00	0.00	0.09	0.09
47.40	0.21	0.21	5.00	0.00	0.09	0.09
47.45	0.20	0.21	5.00	0.00	0.09	0.09
47.50	0.19	0.21	5.00	0.00	0.09	0.09
47.55	0.19	0.21	5.00	0.00	0.09	0.09

47.60	0.19	0.21	5.00	0.00	0.09	0.09
47.65	0.19	0.21	5.00	0.00	0.09	0.09
47.70	0.19	0.21	5.00	0.00	0.09	0.09
47.75	0.19	0.21	5.00	0.00	0.08	0.08
47.80	0.19	0.21	5.00	0.00	0.08	0.08
47.85	0.19	0.21	5.00	0.00	0.08	0.08
47.90	0.19	0.21	5.00	0.00	0.08	0.08
47.95	0.19	0.21	5.00	0.00	0.08	0.08
48.00	0.19	0.21	5.00	0.00	0.08	0.08
48.05	0.19	0.21	5.00	0.00	0.08	0.08
48.10	0.19	0.21	5.00	0.00	0.08	0.08
48.15	0.19	0.21	5.00	0.00	0.07	0.07
48.20	0.19	0.21	5.00	0.00	0.07	0.07
48.25	0.19	0.21	5.00	0.00	0.07	0.07
48.30	0.19	0.21	5.00	0.00	0.07	0.07
48.35	0.19	0.21	5.00	0.00	0.07	0.07
48.40	0.19	0.21	5.00	0.00	0.07	0.07
48.45	0.19	0.21	5.00	0.00	0.07	0.07
48.50	0.19	0.21	5.00	0.00	0.06	0.06
48.55	0.19	0.21	5.00	0.00	0.06	0.06
48.60	0.19	0.21	5.00	0.00	0.06	0.06
48.65	0.19	0.21	5.00	0.00	0.06	0.06
48.70	0.19	0.21	5.00	0.00	0.06	0.06
48.75	0.19	0.21	5.00	0.00	0.06	0.06
48.80	0.19	0.21	5.00	0.00	0.06	0.06
48.85	0.19	0.21	5.00	0.00	0.06	0.06
48.90	0.19	0.21	5.00	0.00	0.05	0.05
48.95	0.19	0.21	5.00	0.00	0.05	0.05
49.00	0.19	0.21	5.00	0.00	0.05	0.05
49.05	0.19	0.21	5.00	0.00	0.05	0.05
49.10	0.19	0.21	5.00	0.00	0.05	0.05
49.15	0.19	0.21	5.00	0.00	0.05	0.05
49.20	0.19	0.21	5.00	0.00	0.05	0.05
49.25	0.19	0.21	5.00	0.00	0.05	0.05
49.30	0.19	0.21	5.00	0.00	0.04	0.04
49.35	0.19	0.21	5.00	0.00	0.04	0.04
49.40	0.19	0.21	5.00	0.00	0.04	0.04
49.45	0.19	0.21	5.00	0.00	0.04	0.04
49.50	0.19	0.21	5.00	0.00	0.04	0.04
49.55	0.19	0.21	5.00	0.00	0.04	0.04
49.60	0.19	0.21	5.00	0.00	0.04	0.04
49.65	0.19	0.21	5.00	0.00	0.04	0.04
49.70	0.19	0.21	5.00	0.00	0.03	0.03
49.75	0.19	0.21	5.00	0.00	0.03	0.03
49.80	0.19	0.21	5.00	0.00	0.03	0.03
49.85	0.19	0.21	5.00	0.00	0.03	0.03
49.90	0.19	0.21	5.00	0.00	0.03	0.03
49.95	0.19	0.21	5.00	0.00	0.03	0.03
50.00	0.19	0.21	5.00	0.00	0.03	0.03
50.05	0.19	0.21	5.00	0.00	0.02	0.02
50.10	0.19	0.21	5.00	0.00	0.02	0.02
50.15	0.19	0.20	5.00	0.00	0.02	0.02
50.20	0.19	0.20	5.00	0.00	0.02	0.02
50.25	0.19	0.20	5.00	0.00	0.02	0.02

50.30	0.19 0.20 5.00 0.00 0.02 0.02
50.35	0.19 0.20 5.00 0.00 0.02 0.02
50.40	0.19 0.20 5.00 0.00 0.02 0.02
50.45	0.19 0.20 5.00 0.00 0.01 0.01
50.50	0.19 0.20 5.00 0.00 0.01 0.01
50.55	0.19 0.20 5.00 0.00 0.01 0.01
50.60	0.19 0.20 5.00 0.00 0.01 0.01
50.65	0.19 0.20 5.00 0.00 0.01 0.01
50.70	0.19 0.20 5.00 0.00 0.01 0.01
50.75	0.19 0.20 5.00 0.00 0.01 0.01
50.80	0.19 0.20 5.00 0.00 0.01 0.01
50.85	0.19 0.20 5.00 0.00 0.00 0.00
50.90	0.19 0.20 5.00 0.00 0.00 0.00
50.95	0.19 0.20 5.00 0.00 0.00 0.00
51.00	0.19 0.20 5.00 0.00 0.00 0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft²)

CRRm Cyclic resistance ratio from soils

CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)

F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf

S_sat Settlement from saturated sands

S_dry Settlement from Unsaturated Sands

S_all Total Settlement from Saturated and Unsaturated Sands

NoLiq No-Liquefy Soils

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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070924 New UTK at Multiple Sites

DATE: 8/6/2024
FROM: Michael Crumley
EMAIL: mcrumley@iecmail.com
PHONE #: (559) 292-4714

QUOTE #: _____
PROJECT #: _____
BID #: 070924
ARCHITECT: PBK Architects
RFI #: 2

RFI SUBJECT

Exit Lights

REFERENCE

Sheets E003 & E205

QUESTION(S)

- 1 Please reference the lighting fixture schedules shown on sheet E003 for all three campuses, and sheet E205 for all three campuses. Is the electrical contractor to provide the exit lights shown on E205? If so, please provide description, lamp, mounting, and manufacturer catalog number information for the exit lights shown on E205 for Alpha ES, Pershing ES, and Rose ES.

2

3

4

RESPONSE(S)

- 1 Yes, the contractor is to provide the exit signs shown on E205. Provide Cooper LPX-7-SD. See attached cut sheet to this RFI.

- 2 Charlie Musser, PE - LEAF Engineers - 8/7/24

3

4

Project		Catalog #		Type	
Prepared by		Notes		Date	



Sure-Lites

LPX Series

LED polycarbonate Exit with 90 minutes of run time

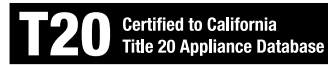
Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Industrial • Manufacturing

Interactive Menu

- Order Information page 2
- Product Warranty

Product Certification



Product Features



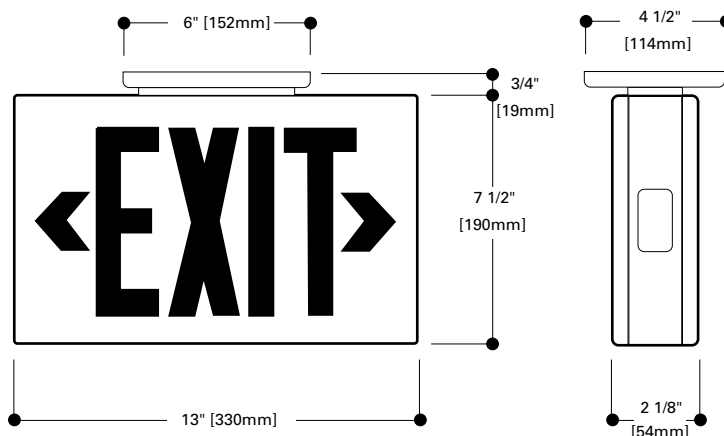
damp location



Top Product Features

- LED Polycarbonate Exit available in white or black housings
- UL 924 damp location certified
- Field selectable for Red or Green illumination and single or double faces
- 90 minutes of emergency run time with self-powered (battery backup) models
- Maintenance free nickel cadmium battery
- Self-diagnostic and remote capacity options
- DLVP option

Dimensional Details



Ordering Information

SAMPLE ORDER NUMBER: LPX6, LPX6BK, LPX7SD, LPX7BKSD

Family	Series	Face Options	Housing Finish	Options	Accessories
Family	Series ⁽¹⁾	Face Options	Housing Finish ⁽²⁾	Options	Accessories
LPX=Polycarbonate Exit, LED	6=AC Only 7=Self-Powered	[Blank]=Single and Double	[Blank]=White Housing BK=Black Housing (available with AC series and self-powered, self-diagnostics only)	[Blank]=No additional options SD=self-diagnostics/LPX7 only	WG10=Wall mount wire guard WGS11=Ceiling or End VS1=Polycarbonate Vandal Shield VS1WP=Polycarbonate Vandal Shield, Weather Proof Pendant Kit LPX18PKWH=18" Pendant Kit, White LPX18PKHTWH=18" Hang True Pendant Kit, White LPX18PKBK=18" Pendant Kit, Black LPX18PKHTBK=18" Hang True Pendant Kit, Black
Notes (1) Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation. (2) LPX7 (no self-diagnostics) units are not available in black. LPX7BKSD (self-diagnostics) units are available in black. (3) For 2 circuit capability on the LPX6 series, order the SL2CPK in addition to the exit sign. The 2 circuit kit does not accept two hot circuits.					

LPXR5SD Ordering Information

Family	Coverage	Remote Capability	Color	Self-Diagnostics	Full Catalog Logic
Family	Coverage	Remote Capability	Color	Self-Diagnostics	Full Catalog Logic
LPX=LED Polycarbonate Exit	non-applicable	R5=5 watts	[Blank]=White BK=Black	SD=Self-diagnostic (standard)	LPXR5SD, LPXR5BXSD

Remote Logic for LPXR5SD Only

SEL Series Outdoor Capable Remotes							
Series		Single Head Remotes			Double Head Remotes		
Catalog number		SRP/SRM13	SRP/SRM25	SRP/SRM30	SRP25D/SRM25D	SRP50D/SRM50D	SRP60D/SRM60D
Watts Consumed		1.25	2.5	4.1	2.5	5	8.2
Catalog Number	Remote Watts Available	# of SRP/SRM13 remotes fixture will power	# of SRP/SRM25 remotes fixture will power	# of SRP/SRM30 remotes fixture will power	# of SRP25D/SRM25D remotes fixture will power	# of SRP50D/SRM50D remotes fixture will power	# of SRP60D/SRM60D remotes fixture will power
LPXR5SD	5	4	2	1	2	1	NA

DLVP Options

Family	Series	Face Options	Color	Options	DLVP	Full Catalog Logic
Family	Series	Face Options	Color	Options	DLVP	Full Catalog Logic
LPX=LED Polycarbonate Exit	6=AC Only 7=Self-Powered	[Blank]=Single and Double	[Blank]=White BK=Black	SD=Self-diagnostics (standard for LPX7, not available for LPX6)	DLVP=DLVP	LPX6DLVP, LPX6BKDLVP, LPX7SDDLVP, LPX7BKSDDLVP

Energy and Performance Data

Maximum power consumption under all charge conditions:

AC Only

Input Voltage	Input Amps	Input Watts
120 Volts	0.07	1.02
277 Volts	0.07	1.12

AC Only, DLVP (57 Vdc)

Input Voltage	Input Amps	Input Watts
57Vdc	0.02	1.2

Self-Powered

Input Voltage	Input Amps
120 Volts	0.07
277 Volts	0.07

Self-Powered, DLVP (57 Vdc)

Input Voltage	Input Amps
57Vdc	0.07

Self-Powered, LPX5R Only

Input Voltage	Input Watts
120 Volts	2.2
240 Volts	2.5
277 Volts	3.2

Product Specifications

Electrical

- Field selectable red and green sign capability standard on all units (units shipped red, field convert to green with supplied parts)
- Dual Voltage Input 120/277 VAC, 60Hz
- 2C capability enabled with the SL2CPK kit. Note: 2 circuit kit does not accept two hot circuits.
- Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost
- Sure-Lites EZ Key patented external battery disconnect feature - prevents unnecessary battery drainage, saves on installation time
- Solid-state Voltage Limited Charger
- Brownout Circuit
- Low-Voltage Disconnect
- Test Switch/Power Indicator Light
- Standard 24 hour recharge time (max)
- Self-Diagnostic feature available as option
- DLVP enabled with field installable kit

Housing Construction

- All components are injection molded, color stable, high impact UL 94-5VA rated, polycarbonate material
- White or black textured finish standard
- Faces can be field selectable as single or double faced
- Snap-out or snap-in chevron directional indicators have full 3/4" stroke
- Components are of snap-fit construction to facilitate under 5-minute installation
- Reinforcing ribs throughout to provide maximum strength
- Molded-in wireways facilitate internal wire routing and connections
- All components including battery and electronics are located inside the exit housing
- Knockout provided on housing for surface conduit attachment
- Snap-fit canopy with captive mounting screws included with all exits
- Exit can be ceiling, wall, or end mounted
- Universal J-box mounting pattern

Lamp Data

- AC LED: Red and green LED lamps provide uniform diffused illumination
- DC: Red and green LED DC lamps (Brighter in emergency mode)

Code Compliance

- UL 924 Listed
- UL Damp Location (0-40° C)
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes
- Suitable for Floor Proximity Installation
- UL Listed for 2C (FTBR)

Warranty

- 5 year product warranty
- 7 year pro-rated battery warranty

Technical Data

Lamps

- Long life, red and green LEDs, provide uniform diffuse illumination of the exit face
- Low operating costs and no maintenance required
- Consumes on average less than one watt

Housing Construction

- Rugged, durable, injection molded polycarbonate
- Structural components designed with reinforcing ribs for additional rigidity and structural integrity
- Impact and scratch resistant
- UV stabilized to resist discoloration due to age and ultraviolet radiation
- Snap-fit construction (no mechanical fasteners) to facilitate installation in under five minutes
- Installation components included (wire nuts, wire leads, universal metal J-box bracket, etc.)
- Universal design enables exit to be field selectable as single face or double face
- Wall, ceiling or end mounting
- Rugged, snap-fit, low-profile canopy with captive screws included for ceiling and end mounting
- Housing color available in white or black

Lens

- Durable, impact-resistant polycarbonate
- Field selectable red or green; ships with red lenses installed and green lenses included
- Full 3/4" stroke snap-out or snap-in chevron directional indicators ensure maximum visibility and code compliances

Sure-Lites EZ Key External Battery Disconnect (Self Powered Only*)

- The Patented EZ key is an external battery disconnect that allows the product to be shipped with the battery connected internally.
- This prevents battery drain during the construction cycle to insure that the battery isn't damaged and is fully charged for inspection.
- EZ Key also saves the labor of internally connecting the battery after construction is complete.

Brownout Circuit (Self Powered Only*)

- Monitors the flow of AC current
- Activates the emergency lighting system when a predetermined reduction/dip of AC power occurs (a dip in voltage will cause most ballasted products to extinguish, causing loss of normal lighting even though a total power failure has not occurred)

Low Voltage Disconnect (Self Powered Only*)

- Low-voltage circuitry disconnects the lighting load when battery's terminal voltage falls
- Disconnect remains in effect until normal utility power is restored, preventing deep battery discharge

Test Switch/Power Indicator Light (Self Powered Only*)

- Switch located on the side of the exit permits the activation of the emergency circuit for complete operational systems check
- Indicator light provides visual assurance that the AC power is on
- LPXR5SD only - switch located on bottom of the exit

Self-Diagnostics Option (Self Powered Only*)

- Automatically performs all tests required by UL924 and NFPA 101
- Indicates the status of the exit at all times using the LED indicator near the test switch on the side of the unit
- 90-minute battery power (emergency mode) simulation test occurs randomly once every 12 months
- 30-second battery power simulation test occurs every 30 days

Photocell Test Switch for LPXR5SD Model Only

- Allows verification of proper operation of the transfer circuit and emergency lamps with a laser pointer (laser is sold as an accessory). The emergency lamps will test for 30 seconds when activated.
- Located on bottom of the unit



Laser tester
Part Number=LASER
(sold separately)

* Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.