January 5, 2012

ADDENDUM NO. 5

SAN BERNARDINO UNIFIED SCHOOL DISTRICT
ROOSEVELT II ELEMENTARY SCHOOL
(AKA DR. MILDRED D. HENRY)
NEW SCHOOL CONSTRUCTION
D.S.A. A# 04-107199 / FILE# 36-55

Rebid No. 09-02

January 5, 2012

NOTICE TO BIDDERS:

A. This Addendum shall be considered part of the contract documents for the above mentioned project as though it has been issued at the same time and shall be incorporated integrally within. Where provisions of the following supplementary data differ from those of the original documents, this Addendum shall govern and take precedence.

B. Bidders are hereby notified that they shall make any necessary adjustment in their estimates on account of this Addendum. It will be construed that each Bidder's proposal is submitted with full knowledge of all modifications and supplemental data specified herein.

PSWC GROUP, ARCHITECTS

RE-BID #F09-02 ROOSEVELT II (HENRY) ES

NEW CONSTRUCTION BID ISSUANCE SET

By: _____
Jim Stinson, Architect

270/032/M1017
1/11

January 5, 2012

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SAN BERNARDINO UNIFIED SCHOOL DISTRICT
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ITEM NO.	DESCRIPTION

BID OPENING:

5.1 **The Bid Opening** shall remain Thursday, January 12, 2012 at 1:00 PM.

CLARIFICATIONS

5.2 **Requests for substitutions:** May be submitted in compliance with Contract Documents, Specification Section 01250 Substitution Procedures and Substitution Request form for such requests. Incomplete and/or non-compliant requests will be rejected.

5.3 **Utility connection fees:** Per specification 00700, paragraph 3.7.1 the District will reimburse Contractor the costs for permits and utility fees.

5.4 **Addenda 1 through 4**: Are incorporated into the initial bidding document drawings, specifications and exhibits, therefore will not be issued separately.

BID DOCUMENTS

5.5 **Section 00180, Supplemental Bid Information (Alternates)**: has been revised and shall be replaced with the attached.

5.6 **Drawing Sheet 10 of 10 Street Lighting Plans:** was inadvertently excluded form initial bid document distribution. This sheet is now posted on the Plan Well Web Page and incorporated into this Addendum 5.

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5.7 **Drawing Sheet E-1.8 Lighting Riser Diagram:** Although not listed on the Cover Sheet Index of Drawings, this electrical sheet shall be included in Bid Additive Alternate #3, in addition to Solar Tube Skylights.

5.8 **Drawing Sheet A-10.3, Detail 19**: Delete this detail in its entirety.

5.9 **Water Quality Management Plan**: dated December 15, 2006 is hereby added in its entirety to this bid.

5.10 **Specification Section 02915 Irrigation System:** Although listed in the Table of Contents, was inadvertently missed. Section added to bid documents per this addendum.

5.11 **Specification Section 10651 Operable Panel Partitions:** Although listed in the specification Table of Contents, is not included within this project's scope of work.

5.12 **Specification Section 12495 Curtain and Track:** Section 12494 Curtain and Track-Cubicle was inadvertently provided for this section (miss-labeled). Replace existing section with new Section 12495 Curtain and Track provided with this addendum.

5.13 **Specification Section 15900 Building Management System:** Replace existing section with revised section included in this addendum.

5.14 **Specification Section 16762 Data System:** Replace existing section with revised section included in this addendum.

5.15 **Specification Section 16930 Network Lighting:** Added to the bidding documents and included in Bidding Additive Alternate #3, in addition to Solar Tube Skylights.

BRFI

5.16 **Q**: Street improvement plans on sheet 9 of 10 – note 34 mentions that the light fixtures are owned by the City. Does that mean the contractor will be only responsible for installation?
A: Bid Package 05 Contractor is responsible for all light poles including pole, mast, luminaire, lamp, base, anchor bolts, footing, etc. for a complete installation.

5.17 **Q**: Paragraph 39 in the information for bidders states that the contractor must perform at last 15% of associated work. When you take the estimate of the bid package No.1 and you minus the cost of all staging, supervisory work, office work, and allowances, that number is roughly equal to $800,000 worth of work. Is it required that the bid package No.1 be held to this requirement?

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A: Contractor will be required to perform at a minimum 15% of the work associated with the base bid. The 15% requirement will be evaluated as described in paragraph 39 of section 00020, Information for Bidders.

5.18 **Q**: Section 01010 page 118 item 5.78 states to provide all required documentation to qualify as an acceptable contractor as required per the specifications. Please advise if any qualification documents are requested to be submitted within the bid documents.
A: Bids to receive consideration shall be submitted as outlined in section 00020 Information for Bidders. Once a responsive low bidder is selected they will need to comply with all required documentation per specifications.

5.19 **Q**: Would we be able to use Primavera P3 instead of Primavera P6?
A: Responsive low bidder will be required to provide P6 schedule as outlined in section 01322 Construction Project Schedule.

5.20 **Q**: Is the "insect control fan" specified anywhere?
A: Refer to Specification Section 15834 Air Curtains.

5.21 **Q**: Plumbing Plan P-K2 shows a callout for LV-3 but is not shown in fixture legend. Please clarify.
A: Same as LV-2

5.22 **Q**: Plan also shows a callout for SK-4 next to FS-2. Which is it?
A: See sheet AK-2 for sink. Sink drains to floor sink

5.23 **Q**: Plan P-K2 shows PR-1 and DW-1 for Kitchen. I cannot find this in plumbing or Kitchen drawings. Please clarify.
A: Provide In Sink-Erator #SS-75 Garbage disposal

5.24 **Q**: Plan P-K2: LV-2 shown on callout at bottom of plan but no symbol for a lavatory. Please clarify.
A: Only one lavatory in this restroom

5.25 **Q**: Sheet U-2 sewer note (1) in legend is shown as VCP lateral but the location shown is a point of connection in the street. Please clarify.
A: Yes VCP only being used from point of connection at public line to right of way and changes to SDR once onsite.

5.26 **Q**: Please indicate the gallon capacity for the grease interceptor #8044 as it comes in many sizes.
A: 750 gallons as shown on Sheet P-0.1 Grease Interceptor Schedule.

5.27 **Q:** On U-3 (2) of the fire hydrants on Mt. Vernon are shown as being installed by the City and the one on 16th is not. Is there a reason for this? Will the contractor cut and patch the street here?
A: No. Delete any reference to contractor coordination with City-installed fire hydrants.

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5.28 **Q**: Please provide hydro seed turf area planting rates. (Sheet L-6)
A: 10-12 lbs. per 1000 SF (400-500 lbs per acre)

5.29 **Q**. Chain link fence on 16Th St. and Garner St. and between existing buildings is to be removed per A-1.0, per A-1.1 the chain link fence in these areas calls for "existing to remain".
A. Existing chain link fencing at 16th Street and Garner Street shall be protected in place. Existing chain link fence between buildings (existing and new school sites) shall be removed and replaced with 8 feet high chain link fence per Key Note 23C on Sheets A-1.1 and A-1.2.2.

5.30 **Q.** (2) double chain link gates on fence line between new construction and existing, sheet A-1.2.2, are not specified. Is the trash enclosure behind (1) of the gates chain link fence enclosure?
A. Both gates shown shall be new, double 8 foot wide (16 feet total width), 8 feet high chain link, in addition to the trash enclosure fence.

5.31 **Q**. Specifications do not list what the diameter concrete footing for line, corners, and end posts should be.
A. 12 inches

5.32 **Q**. Electrical Enclosure detail 16/A-1.5 not clear.
A. Refer to Architectural Clarification Sketch ASK 001.

5.33 **Q**. Any Ornamental Steel Fencing on this project?
A. No

5.34 **Q**. Equipment slab details for emergency generator different between E-1. 0 and 16/A1.5.
A. Refer to Architectural Clarification Sketch ASK 001 Generator slab shall be 12 inches thick with #4 reinforcing 12 inches on center both ways. All other electrical equipment slabs shall be 6 inches thick with #4 reinforcing 12 inches on center middle of slab.

5.35 **Q**. Is the contractor required to provide a full tank of fuel for the generator? Section 16620-3.02-B only states that they are to provide fuel for tests. Should they be required to provide a full tank of gas upon completion?
A. Yes. Contractor shall provide a full tank of gas for generator.

5.36 **Q.** Sheets L-4, L-5, L-5a and L-6:
Plant names and symbols have been provided but all plant and tree counts have been omitted, we are finding it difficult to differentiate between the tree symbols, i.e. we have not been able to locate any of the "Geijera Parviflora / Australian willow" either this tree has been omitted or it is just too hard to locate. All of the symbols are overlaid with other shrubs and ground cover symbols. Please provide plant and tree counts or clarifications to help us establish quantities.
A. Following is the revised plant list with sizes and quantities:

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TREES

Qty.	Botanical Name	Size
37	Alnus rhombifolia	36" box
81	Koelreuteria bipinnata	36" box
38	Prunus cerasifera 'Purple Pony'	36" box
32	Podocarpus gracilior	48" box
42	Pyrus calleryana 'Aristocrat'	36" box
33	Sequoia sempervirens 'Soquel'	48" box

SHRUBS

Qty.	Botanical Name	Size
404	Ceanothus 'Yankee Point'	5 gal.
464	Hemerocallis 'Evergreen Yellow'	5 gal.
67	Nandina Compacta	15 gal.
34	Nandina 'Moon Bay'	5 gal.
22	Pittosporum 'Wheeler's Dwarf'	15 gal.
182	Rhaphiolepis indica 'Jack Evans'	5 gal.
300	Rhaphiolepis 'Majestic Beauty'	15 gal.
495	Salvia greggii	5 gal.
896	Trachelospermum jasminoides (bush)	5 gal.
67	Trachelospermum jasminiodes (staked)	5 gal.
223	Tecomaria capensis	5 gal.
70	Viburnum 'Spring Bouquet'	5 gal.
254	Westringia frut. 'Wynnyabie Gem'	5 gal.

Please note that the Geijera, Euonymus and Loropetalum have been deleted from the original plants shown on the Planting Legend.

5.37 **Q.** On the Irrigation drawings it calls for a Flow sensor and a Master Valve. The drawings do not indicate which controller to hook this up to.
Can you please clarify?
A. Following are the part numbers needed to have the two controllers on share a point of connection and Ethernet modem.

Controller "B" ET 2000e-XX-EN-M-FL-RRe-TPP/RRE-DOME/FM XX/RRe-TRAN
CAT-5 cable with a RJ-45 jack to be provided to controller "B" location. Run including bends and twists not to exceed 300'.
Controller"A" ET 2000e-XX-M-FL-RRe-TPP/RRE-DOME
Controllers to be hardwired together with Paige cable P-7171-D in conduit. Run not to exceed 5,000 ft.
Use 14 AWG wire in conduit only between flow meter and controller "B". Run not to exceed 2,000'. Please use a Calsense flow meter. Refer to the sizing chart found on Calsense.com.

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5.38 **Q.** What changes were made on the E-sheets?

A. Drawing E-1.0, Symbol List, Fixture Schedule and General Notes

1. Fixture Schedule, Fixture Type 9. In lieu of the specified "Lightolier" provide the following: "H.E. Williams XT Extended Trunk System or equal with 4'-0: parabolic louver light fixtures (PBL-PRF) and two (2) T8 lamps in each and Juno T293 or equal track heads with Par 75 watt 30 lamps. The trunk system and fixture finishes shall be as selected by the Architect. Refer to Lighting Plans E-B.1 and E-C.1 for quantity and configurations of light fixtures and trunk system. Provide cable and all attachment hardware for a complete installation."

B. Drawing E-1.3, Fire Alarm Riser Notes and Details

1. Add monitor modules for Ansuel System and overhead coiling door per attachment SKE-5.1.

2. Fixture Schedule, Fixture Type 1. Add Fixture Type IF to read as follows:

   "Type IF: Provide with 0-10v. electronic dimming ballast(s), compatible with the specific lighting controls."

C. Drawing E-A.3 Building A Panel Schedules

1. Panel Schedules HA1 and EHA. X1 and X2 designations shall indicate exterior lighting circuits controlled by the "lighting control system" in lieu of "energy management system." Provide minimum 18 circuit lighting relay control panel. See Drawing E1.8 and specifications.

D. Drawing E-B.3 Building B Panel Schedules

1. Panel Schedule HB1. X1 designation shall indicate exterior lighting circuits controlled by the "lighting control systems" in lieu of "energy management systems." Provide minimum 18 circuit lighting relay control panel. See Drawing E1-8 and specifications.

E. Drawing E-C.2 Building C Fire Alarm, Roof Electrical Plans and Panel Schedules

1. Panel Schedule HC1. X2 designation shall indicate exterior lighting circuits controlled by the "lighting control system" in lieu of "energy management system." Provide minimum 18 circuit lighting relay control panel. See Drawing E1.8 and specifications.

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F. Drawing E-DE.1 Building D and E Lighting and Power Plans

1. Lighting Plan Detail A. Typical Classroom Lighting Plan A. Change item indicated with Plan Note #13 to Plan Note #11.

G. Drawing E-DE.3 Building D and E Roof Plan, Enlarged Electrical Rooms and Panel Schedules

1 Panel Schedule HD2. X designation shall indicate exterior lighting circuits controlled by the "lighting control system" in lieu of "energy management system." Provide minimum 18 circuit lighting relay control panel. See Drawing E1.8 and specifications.

H. Drawing E-F.3 Building F Roof and Enlarged Electrical Room Plans

1. Panel Schedules HF2 and EHF. X1 and X2 designations shall indicate exterior lighting circuits controlled by the "lighting control system" in lieu of "energy management system." Provide minimum 18 circuit lighting relay control panel. See Drawing E1.8 and specifications.

Delete Plan Note #7.

I. Drawing E-K.4 Kitchens Panel Schedules

1. Panel Schedules HK1 and EHK. X1 and X2 designations shall indicate exterior lighting circuits controlled by the "lighting control system" in lieu of "energy management system." Provide minimum 18 circuit lighting relay control panel. See Drawing E1.8 and specifications.

5.39 **Q**: A.1.1 FROM THE LEGEND NOTE NUMBER 13 MENTION ABOUT 18" CONCRETE APRON PLEASE CLARIFY LOCATION FOR THAT.
A: Shown on Sheets A-1.2.1 and A-1.2.2 where edges of buildings are adjacent to planter areas.

5.40 **Q.** Section 08625 / Tubular Skylights – Please clarify whether the solatube skylights are 14" diameter 290DS series (as noted on roof plans) or 21" 750DS series as noted on Detail 10/A11.8
A. Tubular Skylights shall be 14" diameter.

5.41 **Q**: Sheet A-10.1 Opening Schedule / Kitchen "K": Opening marked #10 frame type 11- 2'4"x4'6", there is not glass called out, marked 60 minute fire rated.
A: Doors 8 and 10 in Kitchen Building K are stainless steel roll-up. Door 8 is 12'8"x4'6" and Door 10 is 2'4"x4'6". Door 10 listed on Opening Schedule Sheet A-10.1 is incorrectly shown to be painted.

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5.42 **Q**. On sheet A- C2 note 72 indicates glue up tile in MPB #1 .On Sheet A9.1 finish schedule indicates T&G wood. Please advise as to which one is correct.
A. Glue up tile is correct. Omit reference to T&G wood.

SUBSTITUTIONS

5.43 **Specification Section 15834 Air Curtains 2.1**: Berner International Corporation (724-658-3551) is an acceptable manufacturer.

5.44 **Specification Section 16761 Clock System 2.01**: Site Sync IQ Clock system by American Time and Signal Company (877-666-1203) is an acceptable substitution.

5.45 **Specification Section 10105 Markerboards and Tackboards 2.01**: ADP/LEMCO (800-575-3626) is an acceptable manufacturer.

SPECIFICATIONS

CHANGES TO SCOPE OF WORK

5.46 **Section 01010, Summary of Work, Bid Package 01**, General Construction/ Building, delete Section 12494 Curtain and Track - Cubicle from the list of Specifications that are primary to this Bid Package.

5.47 **Section 01010, Summary of Work, Bid Package 01**, General Construction/ Building, delete item 1.388 from the list of Inclusions for the work of this Bid Package.

5.48 **Section 01010, Summary of Work, Bid Package 02**, Site Work (On-Site), add the following items to the list of Inclusions for the work of this Bid Package:

2.16.1 This Bid Package Contractor shall perform the work of this project in accordance with the requirements of the San Bernardino County Storm Water Program Water Quality Management Plan dated December 15, 2006. Contractor shall perform all work to satisfy the requirements of this Plan and shall provide all required reporting.

5.49 **Section 01010, Summary of Work, Bid Package 03**, Off-Site Improvements and On/Off-Site Utilities, add the following items to the list of Inclusions for the work of this Bid Package:

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3.11.1 This Bid Package Contractor shall perform the work of this project in accordance with the requirements of the San Bernardino County Storm Water Program Water Quality Management Plan dated December 15, 2006. Contractor shall perform all work to satisfy the requirements of this Plan and shall provide all required reporting.

5.50 Section 01010, Summary of Work, Bid Package 05, Electrical, add the following item to the list of Inclusions for the work of this Bid Package:

5.157.1 At the completion of all testing and certification, provide full tank of fuel as required per the Specifications.

5.51 Section 01010, Summary of Work, Bid Package 05, Electrical, add Section 16930 Network Lighting to the list of Specifications that are primary to this Bid Package.

5.52 Section 01010, Summary of Work, Bid Package 05, Electrical, add the following items to the list of Inclusions for the work of this Bid Package:

Division 16, Section 16930 – Network Lighting

5.190.1 This Bid Package Contractor shall furnish and install Network Lighting as required and as indicated in the Drawings and/or Specifications.

5.190.2 Includes all lighting control devices as indicated per the Plans, Specifications, and the Lighting Riser Diagram including skylight control devices, digital gateways, photocells, modules, internet connection, connection and interface with the BMS, equipment, software, and programming as required for a complete and operable system.

5.53 Section 01230, Alternates, Item 1.05-C, change the name to "ALTERNATE #3: ADDITIVE, Solar Tubes including Structural and Architectural Modifications and Network Lighting Control"

5.54 Section 01230, Alternates, add the following Item 1.05-C-2:

2. Provide Network Lighting control (as shown) at all locations shown. Includes all lighting skylight control devices and associated conduit, wire, and boxes.

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Includes connections to solar tubes provided by Others. Network Lighting control shall not be included in the Base Bid.

5.55 Specification Section 16720 Integrated Fire Alarm/Security System:
Edwards certified installers can be found on website, as noted in specs: Equipment suppliers, installation and service for the equipment specified can be found at https://est.edwardsutcfs.com/EST_Dist_Search.cfm.

Edwards EST-3 integrated fire alarm & security system to have two (2) loops; one for fire alarm, and one for security.

5.56 Specification Section 16762 Data System:

2.2 Cabling System. Change item in second paragraph to read: "....Panduit or equal...." In lieu of ".....Commscope/Systimax..."

END OF ADDENDUM 5

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SECTION 02915

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Automatic Irrigation system and control, and all miscellanea required to provide a complete operational system.

1.02 RELATED SECTIONS

A. Section 02310 - Grading.

B. Section 02316 - Filling and Backfilling.

C. Section 02910 - Landscaping.

1.03 SUBMITTALS:

A. Materials Listed: Submit detailed list of materials proposed for use.

B. Prepare typewritten material list using the following format. Double space between

C. each item.
   1. ITEM NO. DESCRIPTION MANUFACTURER MODEL NO.
   2. 1. Contractor shall submit shop drawing submittal indicating existing and
   3. new irrigation adequate to cover all existing and new planting.

D. Record Drawings:
   1. Record drawings shall be CAD reproducible sheets provided by the Architect. Drawings shall be professionally drafted, clean and legible, and at the same scale as the reproducibles provided by the Architect.
   2. Dimensions, from two permanent points of reference, the location of the following items.
      a. The routing of main lines.
      b. 24 volt control and common wiring.
      c. Automatic valves.
      d. Point of connection.
      e. Gate valves.
      f. Quick couplers.
      g. Other related equipment.

E. Operating and Maintenance Data: The requirements as set forth in the General Conditions.

F. Other Submittals:
   1. Controller Chart:
      a. Do not prepare chart until Record Drawings have been approved.
      b. Provide one controller chart as follows:
      c. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage. Following approval of charts, they shall be hermetically sealed between two layers of 20 mil thick plastic sheets.
      d. Charts must be completed and approved prior to final review of irrigation system.
   2. Checklist:
      a. Provide a signed checklist and submit prior to final review of the work.
      b. Use the following format:
         1) Plumbing Permits: If not required, so note.
         2) Material Approvals: Approved by and date.
         3) Pressure Line Tests: By whom and date.
         4) Record Drawings: Received by and date.

5) Controller Charts: Received by and date.
6) Material Furnished: Received by and date.
7) Operating and Maintenance Data: Received by and date.
8) System and Equipment Operations Instructions: Received by and date.
9) Manufacturer's Warranties (if required): Received by and date.
10) Written Guarantee: Received by and date.
11) Lowering of heads in Lawn Areas: If incomplete, so state.

3. Miscellaneous Items: Furnish the following tools as a part of this contract.
   a. One set of keys for each automatic controller cabinet, and each controller enclosure cabinet lock.
   b. One tool for disassembly and assembly, or adjustment, of each type equipment used in this installation requiring such special tools.
   c. One valve box key for every 12 lock lid valve boxes used in this installation.

1.04 QUALITY ASSURANCE

A. Installer qualifications: Regularly engaged, and specializing, in the installation of equivalent irrigation systems using solvent - gasket joints.

B. Regulatory Requirements:
   1. Comply with applicable portions of codes and regulations of governmental agencies of codes having jurisdiction.
   2. Where the requirements of codes and regulations conflict with the provisions of this Specification, comply with the more stringent.

C. Equipment and Material Listing and Labeling: Electrical wiring, controls, motors and devices, shall be UL listed and labeled. Label reclaimed and potable water per plans.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protection: Protect all material to prevent intrusion of dirt and moisture. Protect the installed work and materials of other trades.

B. Storage: Store materials at a location directed by the Districts Representative. Store materials in an orderly manner. Avoid interferences with other construction activities.

PART 2 - PRODUCTS

2.01 PIPE

A. Pressure supply line from point of connection through pressure regulator and "Y" strainer unit shall be copper or brass.
   1. Copper Pipe and Fittings:
      a. Fittings: Wrought copper, soldier joint type.
      b. Joints shall be soldered with silver solder, 45 percent silver, 15 percent copper, 16 percent zinc, 24 percent cadmium, solids at 1125 F and liquids at 1145 F.
   2. Brass Pipe and Fittings:
      a. Brass pipe shall be 85 percent red brass, ANSI schedule 40 screwed pipe.
      b. Fittings shall be medium brass, screwed 125 pound class.

B. Pressure supply lines two inches and smaller downstream of pressure regulator and "Y" strainer assembly shall be schedule 40 PVC. Pressure lines larger than two inches shall be class 315 PVC.
   1. Identification Markings: Identify all pipe with the following indelible markings:
      a. Manufacturer's name
      b. Nominal pipe size
      c. Schedule or class
      d. Pressure rating, in psi

e. NSF Seal of approval
f. Date of extrusion
g. Thrust blocks must be spelled out.

2. Pipe (Solvent Weld Type): Manufacture from virgin polyvinyl chloride compound in accordance with ASTM D 1784 or ASTM D 224, cell classification 1235 B. Hydrostatic design stress rating not less than 2,000 psi.
3. Fittings: Standard weight, schedule 40, injection molded PVC. Comply with ASTM D 1784, cell classification 1325B.
   a. Threads (where required): Injection molded type.
   b. Tees and Ells: Side gated.
4. Threaded Nipples: Standard weight, Schedule 80 with molded threads.

C. Non-pressure Lines: Schedule 40 PVC. Comply with requirements for pressure lines.

D. Visible Pipe and Fittings:
1. General: Integral gray color.
2. Threaded Risers and Nipples: Schedule 80 PVC.
3. Other Risers and Fittings: Schedule 40 PVC, Type 1, solvent weld.

E. Sleeves:
1. 4 inches and smaller: Schedule 40 PVC.
2. Larger than 4 inches: Class 315 PVC.

F. Conduit: Schedule 80 PVC.

2.02 JOINT CEMENT AND PRIMER

A. Non-pressure plastic pipe and fittings shall be cemented using a 100 percent active solvent, blue color.

B. Pressure plastic pipe and fittings shall be coated with a primer and then with a 100 percent active solvent.

C. Both solvent and primer shall be similar in all respects to that manufactured by Christy's or approved equal.

2.03 VALVES

A. Gate Valves:
1. 1-1/2 inches and smaller (unless otherwise noted on drawings): ASTM B 62 brass body, 150 pound saturated steam-rated with screwed joints, non-rising stem, screwed bonnet, solid disc. Provide with handwheel.

B. Quick Coupling Valves:
1. Two piece type brass body, 150 pound class, with 3/4 inch female threads opening at base, permitting operation with a special connecting device (coupler) designed for this purpose.
   a. Coupler Threads: Lug type.

C. Remote Control Valves:
1. Valve type: Spring-loaded, packless diaphragm activated, normally closed type with DuPont - Zytel body, equipped with flow control.
2. Valve Solenoid: 24 Volt AC 4.5 watt maximum, 500 milliamp maximum surge, corrosion-proof, stainless steel construction, epoxy encapsulated to form a single integral unit.
3. Provide bleeder valve to permit operation in the field without power at the controller.

D. Valve Boxes: Plastic box with locking lid. Brooks, or equal. Rectangular for remote control valves. Round for gate valves. Provide locking cover.

E. Valve Sleeves: For manual control valves, Champion Model 20 valve sleeve or equal.

2.04 HEADS

A. Lawn Sprinkler Heads:
1. Sprinkler shall be similar in all respects to type noted in legend on drawing.
2. Body shall be plastic (unless otherwise noted within the legend) with a 1/2, 3/4 or 1 inch IPS inlet.
3. Nozzles shall be similar in all respects to type specified and shall be provided in full, half, quarter, circle configurations.
4. Nozzles shall rise (pop-up) a minimum of 3 inches in lawn areas.

B. Shrubbery Sprinkler Heads:
1. Sprinkler shall be similar in all respects to type noted in legend on drawing.
2. Body shall be plastic (unless otherwise noted within the legend) with a 1/2, 3/4 or 1 inch IPS inlet.
3. Nozzles shall be similar in all respects to type specified and shall be provided in full, half, quarter, circle configurations.
4. Nozzles shall rise (pop-up) a minimum of 12 inches in shrub areas adjacent to pedestrian walk ways and adjacent curbs unless otherwise indicated.

2.05 AUTOMATIC CONTROLLER(S)

A. Type: Fully automatic operation, capable of operating the number of stations and remote control valves indicated on drawings.
1. Pedestal mount type in a housing with locking hinged cover.
2. Fuse and chassis ground all controller components.
3. Provide UL approved on-off switch and electrical outlet for 155 volt electrical service. Locate inside housing.

B. Operation: Unit programmable for multiple schedules entirely by setting switches, dials or touch plate. Provide the following features:
1. Operation switch for each day of the week, for three schedules, allowing each station to be scheduled independently as to days of watering.
2. A minute operation switch for each station with a positive increment range of 0 to 60 minutes. Time settings accurate within one percent.
3. Repeat switch to all selected schedule, and to allow repeat operations to be scheduled throughout a 24-hour period.
4. Adjustment to increase or decrease length of watering period of all stations in a program from 0 - 300 percent.

2.06 ELECTRICAL WIRING AND SERVICE

A. High Voltage:
1. Service to automatic controller shall be in accordance with Section 16100. Provide final hookup to equipment as a part of the Work of this Section.

B. Low Voltage:
1. Connections between controller and remote control valves shall be made with direct burial AWG-UF, 600 volt wire, insulation thickness 3/64 inch, utilizing low density high molecular weight polyethylene insulation.
2. Splices, where permitted, shall be waterproofed using Rain Bird, Pen-Tite Connectors of fusible heat shrinking tubing.

2.07 OPERATING AND MAINTENANCE TOOLS

A. Deliver the following items to the Owner when work is completed and prior to final acceptance of the Work.

1. Two wrenches for disassembly and adjustment of each type of sprinkler head supplied.
2. One 30-inch sprinkler key for operation of control valves.
3. Two keys for automatic controller.
4. Two couplers and matching hose swivels with globe valves.
5. Two keys for opening valve boxes.
6. One 36-inch soil probe, Model B or approved equivalent.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before any work commences, a conference shall be held with the District regarding requirements of the Work of this Section.

B. Examine surfaces for conditions that will adversely affect execution, permanence and quality of Work.
   1. Verify that grading has been completed and the work of this section can properly proceed.
   2. Exercise extreme care in excavating and working near existing utilities. Be responsible for existing utilities and for damages to utilities which are caused by operations or neglect. Check existing utility drawings for locations.

C. Notify the District in writing, of unacceptable conditions.

D. Do not proceed with work until unacceptable site conditions are corrected or existing utilities are located.

E. Inspection(s) by the Architect and/or Districts representative shall be on a continuous basis. No work shall be covered or concealed until it has been inspected. Mandatory inspections include, but are not limited to:
   1. Preinstallation conference.
   2. Mainline and valve locations.
   3. Mainline and pressure test.
   4. Valve and control wiring.
   5. Controller installation.
   6. Head layout with flags.
   7. Lateral installation.
   8. Inspect main and laterals before backfill.
   9. Coverage test.
   10. System pre-final before planting.

3.02 PREPARATION

A. Do not willfully install the irrigation system as designed if it is in error, or when it is obvious in the field that unknown obstructions, grade differences or differences in the area dimensions exist that were not known during design. Such conditions shall be brought to the attention of the Architect, otherwise the Contractor/Subcontractor must assume all responsibility for any and all necessary revisions with no additional cost to the District.

B. Piping, valves or equipment shown diagrammatically on drawing outside of planting areas shall be installed inside planting areas whenever possible or as directed.

C. Layout sprinkler heads and make any minor adjustments required due to differences between actual site conditions and the Drawings. Minor adjustments shall be maintained within the original design intent.

D. Layout each system using staking method as approved by the District. Maintain and protect approved staking layout.

3.03 TRENCHING AND BACKFILLING

A. Excavate trenches to required depths. Follow approved layout for each system.

B. Trench bottom shall be flat to insure piping is supported continuously on an even grade.

C. Where lines occur under paved areas, consider dimension to be below the subgrade.

D. Provide minimum coverage as follows:
   1. Pressure supply lines: 18 inches.
   2. Non-pressure lines: 12 inches.
   3. Control wire: 18 inches. Along pressure supply line and taped at 10' on center.

E. Provide not less than 4 inches clearance between each line and not less than 6 inches clearance between lines of other trades, unless otherwise noted. Do not install parallel lines directly over any other lines.

F. Initial Backfill: Clean, fine granular material as approved by the District.

G. Compact trench backfill to a dry density equal to adjacent undisturbed soil. Restore to adjacent grade, free of dips, depressions, humps, or other irregularities.

3.04 INSTALLATION

A. Plastic pipe and fittings shall be installed in complete accord with manufacturer's instructions.

B. Brass pipe and fittings: Assemble using Teflon tape applied to male threads only.

C. Plastic pipe and threaded fittings: Assemble using Teflon tape applied to male threads only.

D. Quick coupling valves: Unless otherwise indicated, locate valves within 12 inches of hardscape.

E. Controllers: Verify exact location with the Architect.

F. Sprinkler Heads:
   1. Shrub heads shall be installed as noted on Drawings.
   2. Elevate full heads in lawn areas to a minimum of 3 inches above grade.
   3. Elevate heads along curbs, walks, paving, etc., 1/2" above grade in lawn areas.
   4. Lower raised heads within ten days after notification by the District.

3.05 UTILITY SERVICES

A. Water: Connect to existing water outlet or gate valve at locations indicated on Drawings and make any minor changes in location necessary due to actual site conditions as a part of this Contract.

B. Electrical: Connect to existing electrical service. Make minor changes in location as necessary due to actual site conditions as part of this work.

3.06 NEW PAVED AREAS

A. Coordinate installation of piping and wires under paved areas with the work of applicable Sections of this Specification.

B. If the only piping installed is over 20 feet long, pressure testing is required for that section at the time of installation. Upon completion of piping installation, the entire system shall be tested and inspected by the Architect.

C. If wires under paved areas cannot be continuous, splices shall be enclosed in an approved box.

3.07 VALVE BOXES

A. Fill area under box with a minimum of 1 cubic feet of pea gravel before box is installed.

B. Identification:
   1. Attach identification tag shown valve number on each solenoid "pigtail".

2. Tags shall be manufactured of polyurethane Behr Desopald, yellow in color with black letters 2-3/4 inches by 2-1/4 inches.
3. Tags shall manufactured by Christy's or equal.

3.08 LOW VOLTAGE WIRING

A. Place wiring in the same trench and along the same routing as the pressure supply lines unless otherwise approved.
   1. Except as otherwise between controller and remote control valves.
   2. All approved splices shall be enclosed in an acceptable box.

3.09 FIELD QUALITY CONTROL

A. Contractor's Responsibility:
   1. Notify the District/Architect for the inspections listed in "3:01 INSPECTION" within 48 hours minimum notice.
   2. Provide "walkie-talkie" equipment and/or personnel to maintain communication from review area to automatic controllers.
   3. Provide up-to-date as-built drawings at each review.

B. Pressure Test:
   1. Provide equipment necessary to test systems, including force pump.
   2. Perform hydrostatic test in presence of the District/Architect.
   3. Test all pressure supply line under hydrostatic pressure of 150 psi for a period of four hours, unless otherwise approved.
   4. Do not backfill over any line more than necessary for testing, until it has been inspected, tested and approved.
   5. Do not install remote control valves, quick couplers or any other valve assembly until testing is completed and approved.

C. Coverage Test:
   1. Perform coverage test after sprinkler system is completed, but prior to any planting; in the presence of the District/Architect.
   2. Test system to assure that planting areas are watered completely and uniformly.
   3. Make necessary adjustments, including realignment of heads, to provide required coverage as directed by the District/Architect.

3.10 SYSTEM FLUSHING

A. After sprinkler pipe lines and risers are in place and connected, and prior to installation of sprinkler heads, thoroughly flush all lines with a full head of water.

B. Do not install sprinkler heads until lines have been flushed to the satisfaction of the District.

3.11 ADJUSTING AND CLEANING

A. Valves: Adjust flow control for proper operation.

B. Heads: Adjust for alignment and coverage.

C. Nozzles: If it is determined that coverage can be improved by a nozzle change, make such changes or arrange with the manufacturer to have changes made, as part of the Work of this Section.

D. Finish: Upon completion of the work, restore ground surfaces to required elevations and remove excess materials, debris and equipment from the site to the satisfaction of the District.

3.12 INSTRUCTION

A. Provide instruction of Districts maintenance personnel in proper operation of equipment in accordance with the General Conditions.

END OF SECTION

SECTION 12495

CURTAIN AND TRACK - STAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Curtains, tracks, and installation.

B. Accessories.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 09260 - Gypsum Board Assemblies.

C. Section 09511 - Suspended Acoustical Panel Ceilings.

1.03 REFERENCES

A. California Building Code (CBC), Section 303.

B. Uniform Building Code - UBC Standard 4-1.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data for products specified.

C. Shop Drawings: Plans and details indicating anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for correct installation.

D. Samples: Submit drapery track section, 12 inches long, and six fabric samples, 8 inches x 12 inches, indicating fabric content.

E. Certificate showing compliance with this section.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of ten years of documented experience producing products of the types specified in this section.

B. Installer's Qualifications: Regularly engaged and specializing for the preceding three years in the installation of drapery and track systems of equivalent type and approved by the manufacturer for this installation.

C. Proscenium curtains shall conform to the requirements set forth in UBC Standard 4-1.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials protectively wrapped and store in a dry location.

1.07 WARRANTY

A. Furnish to the District, a written guarantee against defects in the material or workmanship for a period of two (2) years from the date of building acceptance. Furnish to District documentation of flame spread and smoke spread of curtain and drapery fabrics.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Design is based on the use of products manufactured by Rose Brand West, Sun Valley, CA, 800-360-5056.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted by the Architect prior to bid date.

2.02 MATERIALS

A. Stage Drapery and Valance: Fabric shall comply with the following:
   1. Unit Weight: 22 oz.per yd.
   2. Width: 64 inches.
   3. Inherently Flame Retardant - California State Fire Marshal Reg.#: C-14101.
   4. Fiber Content: 100% Avora Polyester.
   5. Flammability: passes.
      a. UFAC Class 1
      b. NFPA 701
      c. CA Administrative Code
         1) Title 19 Paragraph 1237.1
         2) CAFM Reg. # F-52101
   6. Lightfastness: AATCC 16E (40 to 80 hours).

B. Product: Encore, Colors, IFR, as manufactured by Rose Brand West.

C. Stage Drapery Track: 280-A Series Track System, CWANA, with polyethylene ball bearing wheel in a steel block (Part No. 2801-B), and 2.4 inch per lineal foot of track curtain stacking. Provide the following accessories:
   1. Track channel.
   2. Single and master carriers spaced at 12 inch centers.
   3. End pulleys.
   4. Lap clamps.
   5. Hanging clamps.
   6. End stops.
   7. Operating cord.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Curtain and track shall be clean prior to and after installation. If there are any defects in material, they shall be immediately reported to the general contractor and in writing to the Architect. Defective material shall not be installed.

B. Install drapery and track in accordance with manufacturer's written instructions.

C. Stage Drapery and Valance: Fabric shall be pleated with 50% fullness at the top, triple stitched to heavy 3-1/2 inch jute webbing. Swivel snap hooks triple riveted to jute header at 12 inches on center. Side hems 4 inches, on-stage hems to be 18 inches, bottom hems to be 6 inches with jack sewn into separate pocket.

D. Stage Drapery Track: Attach track to structural framing above per drawings. All attaching bolts shall be firmly imbedded in wood.

3.02 CLEANING

A. Upon completion of installation of the curtains and tracks, clean up and remove all debris resulting from this work from the site; leave the areas broom clean.

END OF SECTION

SECTION 15900
BUILDING MANAGEMENT SYSTEM

1. Part 1 – General

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1.1 Related Documents

A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.2 Definitions

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an "ON" condition is represented by one discrete signal level and an "OFF" condition is represented by a second discrete signal level.

C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.

D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.

E. Control Sequence: An BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

H. Node: A digitally programmable entity existing on the BMS network.

I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.

J. Provide: The term "Provide" and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.

K. PC: IBM-compatible Personal Computer from a recognized major manufacturer

L. Furnish: The term "Furnish" and its derivatives when used in this Division shall mean supply at the BMS Contractor's cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.

M. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.

N. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.

O. Protocol: The term "protocol" and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.

P. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific

digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.

S. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC	-	Analog to Digital Converter
AI	-	Analog Input
AN	-	Application Node
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASHRAE		American Society of Heating, Refrigeration and Air Conditioning Engineers
AWG	-	American Wire Gauge
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer

RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current
WAN	-	Wide Area Network

1.3 BMS Description

A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
3. Diagnostic monitoring and reporting of BMS functions.
4. Offsite monitoring and management access.
5. Energy management
6. Standard applications for terminal HVAC systems.

1.4 Quality Assurance

A. General

1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
3. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.

B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.

4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:
   a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
   b. Manage the financial aspects of the BMS Contract.
   c. Coordinate as necessary with other trades.
   d. Be responsible for the work and actions of the BMS workforce on site.

1.5 References

1. National Fire Protection Association (NFPA) Standards.
2. National Electric Code (NEC) and applicable local Electric Code.
3. Underwriters Laboratories (UL) listing and labels.
4. UL 864 UUKL Smoke Control
5. UL 268 Smoke Detectors.

6. UL 916 Energy Management
7. NFPA 70 - National Electrical Code.
8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
9. NFPA 92A and 92B Smoke Purge/Control Equipment.
10. Factory Mutual (FM).
11. American National Standards Institute (ANSI).
12. National Electric Manufacturer's Association (NEMA).
13. American Society of Mechanical Engineers (ASME).
14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
15. Air Movement and Control Association (AMCA).
16. Institute of Electrical and Electronic Engineers (IEEE).
17. American Standard Code for Information Interchange (ASCII).
18. Electronics Industries Association (EIA).
19. Occupational Safety and Health Administration (OSHA).
20. American Society for Testing and Materials (ASTM).
21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
22. Americans Disability Act (ADA)
24 ANSI/ASHRAE Standard 195-2004 (BacNet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.6 Work By Others

A) The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

BMS RESPONSIBILITY MATRIX				
WORK	**FURNISH**	**INSTALL**	**Low Volt. WIRING**	**LINE POWER**
BMS low voltage and communication wiring	BMS	BMS	BMS	N/A
VAV box nodes	BMS	15	BMS	16
BMS conduits and raceway	BMS	BMS	BMS	16
Automatic dampers	BMS	15	N/A	N/A
Manual valves	15	15	N/A	N/A
Automatic valves	BMS	15	BMS	N/A
VAV boxes	15	15	N/A	N/A
Pipe insertion devices and taps including thermowells, flow and	BMS	15	BMS	16

pressure stations.				
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
Power distribution system monitoring interfaces	16	16	BMS	16
Control air compressors	BMS	BMS	N/A	16
Concrete and/or inertia equipment pads and seismic bracing	15	15	N/A	N/A
BMS interface with Chiller controls(if applicable)	BMS	BMS	BMS	16
Chiller controls interface with BMS(if applicable)	15	15	BMS	16
BMS interface with Classroom unit controls	BMS	BMS	BMS	16
Classroom unit controls interface with BMS	15	15	BMS	16
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	16
Smoke Detectors	16	16	16	16
Fire/Smoke Dampers	15	15	16	16
Fire Dampers	15	15	N/A	N/A
Chiller Flow Switches (as applicable)	15	15	BMS	N/A
Boiler wiring (as applicable)	15	15	15	16
Water treatment system (as applicable)	15	15	15	16
VFDs	15	16	BMS	16
Refrigerant monitors(as applicable)	15	BMS	BMS	16
Computer Room A/C Unit field-mounted controls	15*	15	BMS	16
Fire Alarm shutdown relay interlock wiring	16	16	16	16
Fire Alarm smoke control relay interlock wiring	16	16	16	16
Fireman's Smoke Control Override Panel	16	16	16	16
Fan Coil Unit controls	BMS	BMS	BMS	16
Unit Heater controls	BMS	BMS	BMS	16
Packaged RTU space mounted controls	15*	BMS	BMS	16
Packaged RTU factory-mounted controls	15*	15	BMS	16
Packaged RTU field-mounted controls	BMS	BMS	BMS	16
Cooling Tower Vibration Switches (as applicable)	15	15	16	16
Cooling Tower Level Control Devices (as applicable)	15	15	16	16
Cooling Tower makeup water control	15	15	16	16

devices (as applicable)				
Pool Dehumidification Unit Controls (as applicable)	15*	15	BMS	16
Starters, HOA switches	16	16	N/A	16
Control damper actuators	BMS	BMS	BMS	16

1.7 Submittals

A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BMS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:
   a. BMS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.
   c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
   d. Samples of Graphic Display screen types and associated menus.
   e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
   f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
   g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size,

Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.

~~h.~~ Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address

i. Details of all BMS interfaces and connections to the work of other trades.

j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
   a. Table of contents.
   b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
   c. Manufacturers product data sheets or catalog pages for all products including software.
   d. System Operator's manuals.
   e. Archive copy of all site-specific databases and sequences.
   f. BMS network diagrams.
   g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide Letter of Warranty from Factory Main Branch Office for all BMS items being provided. Letter of warranty shall be provided by Johnson Controls, Cypress CA Building Systems, No exceptions.. Letter of Warranty provided shall require main branch office approval and acceptance prior to any submittal review. This includes all BMS controls, controllers, and building interface panels. NO EXCEPTION. Letter of warranty from any distributors, resellers, wholesalers, or any non- Main Branch BMS factory owned control representative shall not be accepted.
2. Provide a one-year labor and material warranty on the BMS.
3. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation,

workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

4. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

2. Part 2 – Products

2.1 General Description

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. The Building Management System shall consist of the following:

1. REFER TO MECHANICAL CONTROL DRAWINGS FOR REQUIRED CONTROL DEVICES. Refer to this specification for cross reference o products required as shown on Mechanical Control drawings. Where no control drawings are provided or additional items are required to meet sequence of operation, refer to this specification for product and installation requirements.
2. Standalone Network Automation Engine(s)
3. Field Equipment Controller(s)
4. Input/Output Module(s)
5. Local Display Device(s)
6. Portable Operator's Terminal(s)
7. Distributed User Interface(s)
8. Network processing, data storage and communications equipment
9. Other components required for a complete and working BMS

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
2. The System shall maintain all settings and overrides through a system reboot.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

E. Acceptable Manufacturers

SECTION 15900
BUILDING MANAGEMENT SYSTEM
1) Johnson Controls, Metasys Main Branch, Cypress CA (DISTRICT STANDARD)

2.2 BMS Architecture

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers.
3. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
4. Network Automation Engines (NAE) shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
6. Tie into existing JCI District Network and front End.

B. Control Network (Building Control Panels and interface)

1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support the following communication protocols:
   a. BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
      - ◊ The NAE shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
      - ◊ The NAE shall be tested and certified as a BacNet Building Controller (B-BC).
2. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. The Network Control Engine (NCE) shall be a fully user-programmable, supervisory controller. The NCE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
6. The Network Control Engine (NCE) shall be a fully user-programmable, digital controller that includes a minimum of 33 I/O points.

7. Automation Network – The NCE shall reside on the automation network and shall support a subnet of 32 Field controllers.
8. User Interface – Each NCE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

C. Integration

1. Hardwired
   a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
   b. There will be one separate physical point on each system for each point to be integrated between the systems.
2. Direct Protocol
   a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels.
   b. All data required by the applications shall be mapped into the Automation Engine's database and shall be transparent to the operator.
   c. Point inputs and outputs from third-party controllers shall have real-time interoperability with BMS software features such as Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization and Local Area Network Communications.
3. BacNet Protocol Integration
   a. The neutral protocol used between systems will be BacNet over Ethernet and comply with ASHRAE BacNet standard 135-2003.
   b. The ability to command, share point object data, change of state data and schedules between the host and BacNet systems shall be provided.

2.3 User Interface

A. Dedicated Web Based User Interface

1. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can

accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

a. Microsoft Internet Explorer for user interface functions
b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries

3. PC Hardware – The personal computer(s) shall be configured as follows:
   a. Minimum Memory – 4 GB
   b. CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)
   c. Hard Drive –1 TB free hard drive space minimum
   d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
   e. CD/DVD RW ROM Drive –
   f. Ports – (2) Serial and (1) parallel, (2) USB ports
   g. Keyboard – 101 Keyboard and 2 Button Mouse
   h. Display:
      ◊ Each Display – 24" Flat Panel Monitor 1280 x 1024 resolution minimum
   i. LAN communications – Ethernet communications board; 3Comm or equal
4. Operating System Software
   a. Windows XP Professional or latest
   b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
   c. Provide software registration cards to the Owner for all included software.

B. Distributed Web Based User Interface

1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.

2. The software shall run on the Microsoft Internet Explorer (8.0 or higher) browser supporting the following functions:

- ◊ Configuration
- ◊ Commissioning
- ◊ Data Archiving
- ◊ Monitoring
- ◊ Commanding
- ◊ System Diagnostics

3. Minimum hardware requirements:
   - ◊ 512 MB RAM
   - ◊ 2.0 GHz Clock Speed Pentium 4 Microprocessor
   - ◊ 100.0 GB Hard Drive.
   - ◊ 1 Keyboard with 83 keys (minimum).
   - ◊ SVGA 1024x768 resolution display with 64K colors and 16 bit color depth
   - ◊ Mouse or other pointing device

C. Site Management User Interface Application Components

1. Operator Interface
   a. An integrated browser based client application shall be used as the user operator interface program.
   b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
   c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
   d. The user interface software shall provide help menus and instructions for each operation and/or application.
   e. The system shall support customization of the UI configuration and a home page display for each operator.
   f. The system shall support user preferences in the following screen presentations:
      - ◊ Alarm
      - ◊ Trend
      - ◊ Display
      - ◊ Applications
   g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
   h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
      - ◊ User access for selective information retrieval and control command execution

- ◊ Monitoring and reporting
- ◊ Alarm, non-normal, and return to normal condition annunciation
- ◊ Selective operator override and other control actions
- ◊ Information archiving, manipulation, formatting, display and reporting
- ◊ BMS internal performance supervision and diagnostics
- ◊ On-line access to user HELP menus
- ◊ On-line access to current BMS as-built records and documentation
- ◊ Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications

i. The system shall support a list of application programs configured by the users that are called up by the following means:
- ◊ The Tools Menu
- ◊ Hyperlinks within the graphics displays
- ◊ Key sequences

j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees

a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.

c. The navigation trees shall be "dockable" to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Alarms

a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
- ◊ Log date and time of alarm occurrence.

- ◊ Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
- ◊ Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
- ◊ Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
- ◊ Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
- ◊ Any attribute of any object in the system may be designated to report an alarm.

b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

c. The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.

d. The BMS shall annunciate application alarms at minimum, as required by Part 3.

4. Reports and Summaries

a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:

- ◊ All points in the BMS
- ◊ All points in each BMS application
- ◊ All points in a specific controller
- ◊ All points in a user-defined group of points
- ◊ All points currently in alarm
- ◊ All points locked out
- ◊ All BMS schedules
- ◊ All user defined and adjustable variables, schedules, interlocks and the like.

b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.

c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.

d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.

e. Provide the capability to view, command and modify large quantities of similar data in tailored summaries created online without the use of a secondary application like a spreadsheet. Summary definition shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported. Summary viewing shall be available over the network using a standard Web browser.

5. Schedules
   a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
      - ◊ Weekly schedules
      - ◊ Exception Schedules
      - ◊ Monthly calendars
   b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
   c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
   d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
   e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
   f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BacNet Standard.
   g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
6. Password
   a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
   b. Each user shall have the following: a username, password and access level.
   c. The system shall allow each user to change his or her password at will.
   d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
   e. A minimum of five levels of access shall be supported
   f. A minimum of 100 unique passwords shall be supported.

g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

7. Screen Manager

a. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

8. Dynamic Color Graphics

a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.

b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.

c. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:

- ◊ All graphics shall be fully scalable
- ◊ The graphics shall support a maintained aspect ratio.
- ◊ Multiple fonts shall be supported.
- ◊ Unique background shall be assignable on a per graphic basis.
- ◊ The color of all animations and values on displays shall indicate if the status of the object attribute.

d. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device

e. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.

- ◊ The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.

- ◊ In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.

f. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.

9. Historical trending and data collection
   a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
      - ◊ Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
        - Defined time interval
        - Upon a change of value
      - ◊ Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
10. Trend data viewing and analysis
    a. Provide a trend viewing utility that shall have access to all database points.
    b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
    c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
    d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
    e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
    f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
    g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
    h. The Display shall support the user's ability to change colors, sample sizes, and types of markers.
11. Database Management
    a. Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the

database monitoring and managing functions by supporting two separate windows.

b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.

c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
   - ◊ Backup
   - ◊ Purge
   - ◊ Restore

d. The Database Manager shall support four tabs:
   - ◊ Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Databases.
   - ◊ Maintenance – shall provide an easy method of purging records from the Server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.
   - ◊ Backup – Shall provide the means to create a database backup file and select a storage location.
   - ◊ Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.

e. The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:
   - ◊ Ready
   - ◊ Purging Record from a database
   - ◊ Action Failed
   - ◊ Refreshing Statistics
   - ◊ Restoring database
   - ◊ Shrinking a database
   - ◊ Backing up a database
   - ◊ Resetting internet information Services
   - ◊ Starting the Device Manager
   - ◊ Shutting down the Device Manager
   - ◊ Action successful

f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.

g. The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

h. The Monitoring Settings window shall have the following sections:

- ◊ General – Shall allow the user to set and review scan intervals and start times.
- ◊ Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
- ◊ Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.
- ◊ Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
- ◊ Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.

i. The Monitoring Settings Taskbar shall provide the following informational icons:

- ◊ Normal – Indicates by color and size that all databases are within their limits.
- ◊ Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
- ◊ Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.

j. The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

D. Portable Operator Terminal

1. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BMS Contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:

a. Personal Laptop Computer Manufacturer – Dell, Compaq or HP
b. 1 GB RAM (256 MB minimum) – XP Professional
c. 1.8 GHz Clock Speed Pentium 4 Microprocessor (800 MHz minimum)
d. 40 GB Hard Drive (40 GB minimum)
e. (1) CD-ROM Drive, 32x speed
f. (1) Serial (1) Parallel (2) USB ports
g. 1 Keyboard with 83 keys (minimum).
h. Integral 2 button Track Point or Track Ball.
i. 10" SVGA 1024x768 resolution color display
j. Two PCMCIA Type II or one Type III card slot
k. Complete operator workstation software package, including any hardware or software.

l. Original printed manuals for all software and peripherals.
m. Original installation disks or CD for all software, device drivers, and peripherals
n. Software registration cards for all included software shall be provided to the Owner.
o. Carrying case
p. Spare battery.
q. External power supply/battery charger

2. Proprietary Portable Terminal
   a. Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
   b. The proprietary terminal shall meet the same operator interface software requirements as specified above.
3. Software
   a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
   b. When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
   c. When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

E. Access Portal User Interface
1. BMS Contractor shall provide and install all computer hardware and software required for the purpose of configuration and consolidation of information and programs required for the delivery of a Task Focused, Web Based Portal to the BMS. This Access Portal shall provide a natural, complementary extension to the site management user interface previously described.
2. Access Portal Architecture – The architecture of the system shall be implemented to conform to industry standards, so that it can accommodate the required applications provided by the BMS Contractor as well as communicate information too and from the system Site Director.
3. PC Hardware – The personal computer(s) shall be configured as follows:
   a. Memory – 2 GB (1 GB Minimum)
   b. CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)
   c. Hard Drive – 200 GB free hard drive space (80 GB minimum)
   d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
   e. DVD ROM Drive – 16X performance
   f. Ports – (1) Serial, (2) USB ports
   g. Keyboard – 101 Keyboard and 2 Button Mouse
   h. CRT configuration

- ◊ 17" Flat Panel Monitor 1280 x 1024 resolution minimum
- ◊ 16 bit or higher color resolution

i. LAN communications – Ethernet communications board; 100Mbps Min.

4. Operating System Software
   a. Windows XP Professional, IIS Version 5.1, .Net Version 2.0, SQL server 2005 Express software with SP2 or <Alternately> Microsoft Windows Server 2003 OS with SP2, IIS Version 6.0, .Net version 2.0 and SQL Server 2005 with SP@
   b. Provide required software and hardware required for for integration of computing hardware on enterprise IT network.
   c. Provide software registration cards to the Owner for all included software.
5. User Interface Application Components
   a. The ready access portal shall provide an intuitive user interface to key functions and tasks via web browser.
   b. Plug-ins or special software shall not be required for access to alarm, summary, schedule and trend data.
   c. The portal shall include- the ability to view full graphical representations of systems and equipment on PC platforms
   d. The control system shall provide Secure Sockets Level (SSL) and Active Directory service support. If the Active Directory service and Single Sign-On features are enabled and the user is logged in to the Windows desktop, the login screen does not appear and access to the system is automatic.
   e. Provide a common tool for graphics creation, schedule creation, custom programming, user access and hardware definition
   f. Information shall be accessible on both personal computer and handheld device platforms as follows:
      - ◊ Personal computers – Internet Explorer Version 7.0 recommended
      - ◊ Handheld devices – Internet Explorer for Window Mobile Version 5.0 or 6.0 recommended. UI is optimized for devices with a 240 x 320 pixel screen size (QVGA). Other devices may display the UI but full functionality is not guaranteed.
6. Operator Interface
   a. Password access shall be as described previously for management portal UI
   b. Once logged in, the System shall display a pre-selected screen tailored to the task requirements of the individual user.
   c. The User Interface shall utilize an intuitive navigation and display method designed for operators who access the system for casual information and control or on an infrequent basis. It shall feature three basic components.

- ◊ Radio buttons for selection of the type of information to be displayed including Alerts, Summary, Schedules and Diagnostics
- ◊ Navigation tree for selection of the specific data to be displayed on screen for the selected type. The navigation tree may be hidden and expanded by the operator to optimize the display of information
- ◊ A display window that provides the selected information by type in a pre-configured tabular format

d. The user interface software shall provide help menus and instructions for each operation and/or application.

e. The system shall provide support for up to 100 concurrent users from an unlimited universe individuals with defined password access to the system

f. The system shall utilize Secure Sockets Level (SSL) support as required to allow the access portal to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery. It provides endpoint authentication and communications privacy over the network using cryptography

g. The system shall have the capability to display multiple navigation trees that correspond to the user views configured in the management portal UI.

h. The alert summary of the remote access portal shall, at the minimum, provide the following information
- ◊ Alert (Alarm) type
- ◊ Date and time of alert occurrence
- ◊ Priority (color coded to level)
- ◊ Item name.
- ◊ Item value (if applicable)
- ◊ Message
- ◊ Any attribute of any object in the system may be designated to report an alarm

i. A standard summary on the remote access portal shall, at the minimum, provide the following information
- ◊ Point type graphic icon
- ◊ Item name
- ◊ Item value
- ◊ Item status
- ◊ Access to the Change Value window (if applicable) for the purpose of setting, holding or releasing an item value

j. The schedule detail summary of the remote access portal shall, at the minimum, provide the following information
- ◊ Scheduled occurrences including time and value
- ◊ Scheduled overrides including start time, end time and value

- ◊ A list of all scheduled items including name and attribute, value, status and priority
- ◊ Access to the Add Temporary Override window for the purpose of adding a temporary override to the schedule

k. The diagnostic (trend) summary of the remote access portal as viewed on a personal computing device shall provide the following information.

- ◊ Item name
- ◊ Item status
- ◊ Trend name
- ◊ Trend status
- ◊ Full path name
- ◊ Access to trend detail summary including trended value, time and date arranged in a user selectable format of 1 hour, 12 hours, 24 hours, 48 hours or 72 hours

2.4 DDC System Controllers

A. Field Equipment Controller (Ancillary Devices)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BacNet MS/TP protocol.
   a. The FEC shall support BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
      1) The FEC shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
      2) The FEC shall be tested and certified as a BacNet Application Specific Controller (B-ASC).
      3) A BacNet Protocol Implementation Conformance Statement shall be provided for the FEC.
      4) The Conformance Statement shall be submitted 10 days prior to bidding.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

~~3.~~ Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

~~4.~~3. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

5.4. The FEC shall include a removable base to allow pre-wiring without the controller.

B. Networked Thermostat (by Johnson Controls, Inc. only District standard)

1. The Network Thermostat shall communicate over the Field Controller Bus using BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
2. The Network Thermostat shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
   a. The Network Thermostat shall be tested and certified as a BacNet Application Specific Controller (B-ASC).
   b. A BacNet Protocol Implementation Conformance Statement shall be provided for the Network Thermostat.
   c. The Conformance Statement shall be submitted 10 days prior to bidding.
   d. The Network shall be available in ZigBee BacNet Application.
3. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine only.
4. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Fan, Heat, and Cool status
   c. Five (5) User Interface Keys
      ◊ Mode
      ◊ Fan
      ◊ Override
      ◊ Degrees C/F
      ◊ Up/Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms
5. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor
   b. Duct Mount Air Temperature Sensor
   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
   d. Two configurable binary inputs
6. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:

a. Three Speed Fan Control
b. Two On/Off
c. Two Floating
d. Two Proportional (0 to 10V)

7. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
8. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
9. Adjustable heating/cooling cycles per hour from 4 to 8
10. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

C. Networked Thermostat **(TEC 26X6 By Johnson Controls, Inc.)**

1. The Networked Thermostat shall be capable of controlling constant volume units for DX units, DX with gas heating, HP units, FC units DX, FC units with chill and hot water coils modulating control valves.
2. The Networked Thermostat shall communicate over the Field Controller Bus using BacNet Standard protocol SSPC-135, Clause 9.
   a. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interface able through a Network Automation Engine.
3. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Fan, Heat, and Cool status
   c. Five (5) User Interface Keys
      ◊ Mode
      ◊ Fan
      ◊ Override
      ◊ Degrees C/F
      ◊ Up/Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms
4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor

b. Duct Mount Air Temperature Sensor
c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
d. Two configurable binary inputs

5. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
   a. Three Speed Fan Control
   b. Two On/Off
   c. Two Floating
   d. Two Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

D. Networked Thermostat **(TEC 26X7 By Johnson Controls, Inc.)**
1. The Networked Thermostat shall be capable of controlling a pressure dependent Variable Air Volume System or other similar zoning type systems employing reheat.
2. The Networked Thermostat shall communicate over the FC Bus using BacNet Standard protocol SSPC-135, Clause 9.
   a. The Networked Thermostat shall be capable of remote read/write and parameter adjustment from the web based User Interface (UI) through an NAE.
3. The Networked Thermostat shall include an intuitive UI providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Heating, and cooling status
   c. Three (3) User Interface Keys
      ◊ Override
      ◊ Up
      ◊ Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms

4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor
   b. Duct Mount Air Temperature Sensor
   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
   d. Two configurable binary inputs
5. The Networked Thermostat shall provide the flexibility to support either of the following outputs:
   a. Two On/Off or Floating
   b. Two Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

E. Network Sensors **(By Johnson Controls, Inc.)**

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
   a. Zone Temperature
   b. Zone Humidity
   c. Zone Setpoint
   d. Discharge Air Temperature
2. The NS shall transmit the information back to the controller on the Sensor-Actuator Bus (SA Bus) using BacNet Standard protocol SSPC-135, Clause 9.
3. The NS shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
   a. The NS shall be tested and certified as a BacNet Smart Sensors (B-SS).
   b. A BacNet Protocol Implementation Conformance Statement shall be provided for the NS.
   c. The Conformance Statement shall be submitted 10 days prior to bidding.
4. The Network Zone Sensors shall include the following items:
   a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
   b. An LED to indicate the status of the Override feature

c. A button to toggle the temperature display between Fahrenheit and Celsius
d. A button to initiate a timed override command
e. Available in either surface mount or wall mount
f. Available with either screw terminals or phone jack

3. Part 3 – Performance / Execution

3.1 Installation Practices

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

   Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – Genera1

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors
   a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
   b. Sensors shall be installed with a rain proof, perforated cover.
6. Water Differential Pressure Sensors
   a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
   b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
   c. The transmitters shall be installed in an accessible location wherever possible.
7. Building Differential Air Pressure Applications (-1" to +1" w.c.):
   a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
   b. The interior tip shall be inconspicuous and located as shown on the drawings.
8. Duct Temperature Sensors:
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
   d. The sensor shall be mounted to suitable supports using factory approved element holders.
9. Space Sensors:
   a. Shall be mounted per ADA requirements.
   b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
10. Low Temperature Limit Switches:
   a. Install on the discharge side of the first water or steam coil in the air stream.
   b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.

c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

11. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings, and air filter.
12. Water Differential Pressure Status Switches:
    a. Install with shut off valves for isolation.

I. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.2 Training

A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
2. Provide Owner Factory training at Main Branch Johnson Controls, Cypress, CA office for designated personnel at the district for complete software orientation, software training, troubleshooting and programming of system.

3.3 Commissioning

A. Fully commission all aspects of the Building Management System work.

B. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the BMS
2. Submit the check sheet to the Engineer for approval
3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.
4. Provide Sign off from **Corporate Main Branch** Johnson controls office Controls, Cypress California, All items to be verified by main Branch for proper installation and programming prior to Acceptance to the district. Resellers, distributors, wholesalers, venders, etc. are not allowed to provide sign off.

C. VAV box performance verification and documentation:

1. The BMS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.
2. The BMS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.

D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

3.4 Control System Demonstration and Acceptance

A. Demonstration:

1. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification Provide Engineer with log documenting completion of startup tests.
2. Engineer will be present to observe and review system demonstration. Notify Engineer at least 10 days before system demonstration begins.
3. Demonstration shall follow process submitted and approved (Submittals). Complete approved checklists and forms for each system as part of system demonstration.
4. Demonstrate actual field operation of each sequence of operation as specified. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.
5. Demonstrate compliance with sequences of operation through each operational mode.

6. Demonstrate complete operation of operator interface.
7. Demonstrate each of the following.
8. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.
9. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting set point, and status of set points and other affected equipment parameters.
10. Building system interface ie, Lighting, Electrical, Fire, Sprinklers, etc. as required for project.
11. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs (Trend Configuration).
12. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.

1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required.

Roosevelt II Elementary School
San Bernardino City U.S.D.

SECTION 16762

DATA SYSTEM

1. PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes all labor, materials, equipment and accessories required to furnish and install a complete Data Cabling System as indicated on the drawings and as specified herein.

1.2 APPLICABLE DOCUMENTS

A. The system design described in this document and depicted in the attached drawing package is derived in part from recommendations made in industry standard documents. The list of documents below are incorporated by reference:
   1. This Technical Specification
   2. ANSI/EIA/TIA-568-B series of standards
      ANSI/EIA/TIA-568-B-1 Commercial Building Telecommunications Cabling Standard – April 2001.
      ANSI/EIA/TIA-568-B-2 Commercial Building Telecommunications Cabling Standard - April 2001
      ANSI/EIA/TIA-568-B-3 Optical Fiber Cabling Components Standard – April 2000
   3. ANSI/EIA/TIA-568 Commercial Building Wiring Standard - July 1991, and Standards Proposal No. 2840-A, Proposed Revision of EIA/TIA-568 Commercial Building Cabling Standard (published as TIA/EIA-568-A)
   4. ANSI/ TIA/ EIA- 492AAAA (multi-mode 62.5/ 125 µm fiber specifications)
   5. ANSI/ TIA/ EIA- 83- 596 (indoor multi-mode optical cables)
   6. ANSI/ TIA/ EIA- 87- 640 (indoor multi-mode optical cables)
   7. ANSI/ TIA/ EIA- 492CAAA (single-mode fiber specifications)
   8. ANSI/ ICEA S- 83- 596 (indoor single-mode optical cable)
   9. ANSI/ ICEA S- 87- 640 (outdoor single-mode optical cable)
   10. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables - November, 1991
   11. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware - January, 1994
   12. TIA/EIA-TSB-75 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling - January, 1997
   13. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces - October 1990
   14. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February 1993
   15. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications - August, 1994
   16. Building Industries Consulting Services, International (BICSI)Telecommunications Distribution Methods Manual (TDMM) - 1996
   17. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) -1997

B. If a conflict exists between applicable documents then the order in the list above shall dictate order of precedence in resolving conflicts. This order of precedence shall be maintained unless lesser order document has been adopted as code by local, state or federal entity, and is therefore enforceable as law by local, state or federal inspection agency.

C. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. It is important to note, that all documents listed above are believed to be the most current releases of the standards at the time of this writing, however, the vendor is totally responsible for determining and adhering to the most recent cable standards when developing the proposal for installation.

D. Contractors bidding on District projects shall have as a minimum, the following qualifications:

1. Contractor must be a Panduit Value Added Reseller (VAR) if installing Panduit products. **Site certifications are not allowed.**
2. Must have a current and in good standing, California C-10 and C-7 contractors licenses.
3. Must have completed at least 10 projects of similar size and scope for public entities within the past 3 years.

2.PART 2 - PRODUCTS

2.1 ASSOCIATED REFERENCES

A. This document describes a system to be installed in accordance with recognized telecommunications industry cabling standards. Although the intent of the standard is to provide an application independent cable system, one or more of the following documents, describing specific network types and topologies, may be pertinent to the overall operation of the system and should be considered associated reference materials.
   1. ISO/IEC 8802-3 (IEEE 802.3)
   2. ISO/IEC 8802-5 (IEEE 802.5)
   3. ANSI ANSI X3T9.5 Fiber Distributed Data Interface (FDDI) Physical Medium Dependent (PMD)
   4. ANSI ANSI X3T9.5 Twisted Pair Physical Medium Dependent (TP-PMD)

2.2 CABLING SYSTEM

All components of the copper horizontal system and entire fiber optic cabling system shall be of the same manufacturer or manufacturer partnered system in order to provide one single product component and cabling system performance warranty direct from a single point of contact to the San Bernardino City Unified School District. The factory warranties must include a product component warranty and a system performance warranty to the Category 6 standard and revision in force at the time the system is installed. The factory warranty period shall be not less than 20 years.

The San Bernardino City Unified School District has established Panduit as the standard for the network structured cabling plant (to eliminate additional training time and costs as well as reduce spare parts costs and database information); or District-approved equal.

2.3 CABLE TYPES

A. New Construction and New IDF/MDF. The new planned cable system shall utilize the following cable types for horizontal distribution. Each cable shall meet or exceed the mechanical and electrical performance characteristics listed below.
   1. Horizontal Distribution Cable--Unshielded Twisted Pair Cable: construction shall be 24 AWG, 4-pair, Category 6 Enhanced, with a bandwidth of not less than 250mhz.
   2. 50/125 multi-mode optical fiber cable with dual bandwidth minimums of 850nm and 1300nm at 500mhz. Optical fiber cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/Km @ 1300 nm.
   3. For IDF

B. For additional cabling in an existing IDF/MDF. To ensure proper specification adherence please contact IT. The planned cable system added to current category 5e systems shall completely utilize all available Cat 5e patch panel terminations. Any additional patch panels installed will be category 6 horizontal cable drops that terminate into the new category 6 patch panel. Cables and drops added to existing network systems should continue with the existing MDF/IDF numbering pattern.
   1. Horizontal Distribution Cable--Unshielded Twisted Pair Cable: construction shall be 24 AWG, 4-pair, Category 5 Enhanced or Category 6 Enhanced (as defined above,) with a bandwidth of not less than 100mhz.
   2. 50/125 multi-mode optical fiber cable with dual bandwidth minimums of 850nm and 1300nm at 500mhz. Optical fiber cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/Km @ 1300 nm.

C. For MDF to IDF connections longer than 800 feet, use Single-mode fiber for the medium.

When new data cabling is specified for a room or office location at any District site, and there is existing data

cabling in the room or office location then designated site personnel and designated IT personnel must approve the exact placement for each new data jack, the removal of any existing data jacks, the terminations into existing patch panels for each new data jack, and the data connection to any existing electronics equipment such as switches or hubs. Additionally, if new data jacks are required in a room or office location with no existing data jacks, but the new data jacks will be terminated into an existing IDF or MDF then designated IT personnel must approve all connections into existing equipment and any new patch panel and cabinet installations at that IDF. Furthermore, any new equipment required to support the new data cabling must be calculated and incorporated into the cost of the new cabling. This standard should be followed exactly, and any deviation needs to be approved by IT management prior to implementation of the deviation.

2.4 COPPER SYSTEM

A. JACKS AND PATCH PANELS
1. Eight-wire, eight-position modular jacks shall be used for all telecommunications outlets. Each jack shall be fed by a separate four pair cable sheath. All four (4) pair shall be wired to the jack using TIA/EIA-568-B wiring scheme. The jacks shall employ PC board mounted (110 or IDC) contacts for termination of the wire.
2. The jacks shall be matched to the Category rating of the attached horizontal distribution cable which will all be enhanced Category 6 compliant or better.
5. Patch panels supporting Category 6 enhanced cabling shall be 24 or 48 ports as needed. Panels shall be factory assembled with eight-wire, eight-position modular jacks that employ PC board mounted (110 or IDC) contacts for termination of the wire. Panels shall be wired to the TIA/EIA-568-B wiring scheme.

B. TELECOMMUNICATIONS OUTLET PLATE
1. The outlet shall be configured so that the interconnect couplings are at an acute angle to, or parallel with, the wall surface.
2. The outlet plate shall be affixed to an in-wall or surface mount box with two screws, which match the color of the outlet plate, or a previously installed floor mount device.
3. To meet district standards faceplates shall be two port, four port, six port or duplex mounting straps as required in any floor box or surface raceway application.

C. OUTLET INSTALLATION
1. All outlets shall be installed in the following manner:
   a. Wall mount boxes shall be attached to (*box eliminators, 4"X4" boxes, old work boxes*) provided by the (*contractor providing raceway and boxes*).
   b. Wall mount boxes shall be installed with the center of the plate at (*15" IAW ADA requirements or match existing*) above finished floor (AFF). The faceplates shall be installed in a horizontal or vertical orientation.
   c. Any unused faceplate positions shall be covered/filled with a blank insert made of the same or compatible material as the faceplate and shall be molded in the same color. Blank spaces shall be incorporated between populated positions on the faceplate.
   d. Cables shall be coiled in the in-wall or surface-mount boxes. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall.
   e. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack for these situations shall be neatly coiled in the ceiling above drop location. The amount of cable slack in the ceiling is not to exceed 4 feet per horizontal run. Enough slack must be provided, however, for at least one jack re-termination at the outlet plate.

D. HORIZONTAL DISTRIBUTION CABLE
1. Horizontal distribution cables shall be installed from the MDF and IDF to the designated locations in the Work Area Information Outlet (IO). Horizontal distribution cables shall be manufactured in compliance with the mechanical and electrical specifications detailed in the TIA/EIA-568-B document, as applicable. Cables not supported under the current revision of the standard shall be of recent design and manufacture and be capable of supporting the application (e.g., broadband coaxial, baseband coaxial).
2. All cables shall be furnished by the contractor in full, factory packaged reels or pull boxes. The packages shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by

the Owner, the contractor shall provide manufacturer's proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for replacement of the entire reel. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.

E. HORIZONTAL DISTRIBUTION CABLE SHALL BE INSTALLED AND TERMINATED AS BELOW

1. 100 Ω Unshielded Twisted Pair—Jacks/Patch Panels
2. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturers' recommendations and/or best industry practices.
3. Pair untwist at the termination shall not exceed one-half an inch.
4. Bend radius of the cable in the termination area and at any point along the distribution path shall not exceed four (4) times the outside diameter of the cable.
5. The cable jacket shall be maintained as close as possible to the termination point.
6. All modular jacks shall be oriented with the locking tab slot towards the floor.
7. Voice jacks shall be located in the top or top left position of each faceplate. In instances where there is more than one voice jack per faceplate, then the second shall occupy the top right or second position, continuing top to bottom or left to right. Voice jacks in horizontally oriented faceplates shall occupy the left-most position. Modem jacks shall be considered the last voice jack in the sequence.
8. Data jacks that are in surface metal/plastic raceway (Panduit/Wiremold) shall be mounted in the proper termination plate compatible with manufacturer of the raceway to ensure that the District receives a professional end installation. <u>These termination plates and trim are to be provided by the electrical contractor installing the raceway and power outlets to ensure that all outlets and trim will match. The mounting straps shall be provided by the data contractor.</u>
9. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type. New raceway installations should not be filled more than 60% of the NEC maximum to allow for growth. Conduit sizing shall be a minimum of 3/4 inch conduit for each outlet with no more than two outlets fed by one 1" homerun. If two outlets are fed by one homerun the conduit shall be 1" to the IDF or MDF and ¾ inch to the end box. For conduits feeding a multiple outlet surface raceway the sizing shall be as follows: 1" for raceways 6' long and under, 1 ¼" for raceways 6' to 18' long and multiple conduits to meet this pattern for lengths greater than 18'. These specifications shall take precedence over conduit routing shown on the plans that deviate from this method. The data contractor shall bring any discrepancies to the attention of the owner before bid time.
10. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
11. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose.
12. Maximum pulling tension shall not exceed 25 pounds for a single cable or for a cable bundle.
13. When not installed in conduit, (per the plans and electrical specifications requirements), all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels, nor shall they be attached to ceiling grid wires. Horizontal distribution cables shall be bundled in groups not greater than 48 cables. Bundles shall be supported by cable tray, conduit, trapezes, or multiple support strap made by Erico, Caddy part # CAT21 and CAT32. Saddle supports are not allowed. Plenum rated cable is to be installed in plenum rated areas only and non-plenum cable to be installed in non-plenum areas.
14. The cable system shall not be attached to the fire sprinkler system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes or other control devices.
15. Cables shall not be attached to ceiling grid or lighting support wires. Where light support style wires for drop cable legs are required, the contractor shall install clips to support the cabling.
16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
17. Cables shall be identified by a computer generated, permanent, self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

F. IDF/MDF Data Labeling.
   1. Data Patch Panel Labels at each IDF/MDF shall be labeled with 2 lines of information. The top line should indicate the drop number and the second line shall indicate the building and room number of the drop. The drop numbers shall be numbered consecutively beginning at one (1) through and including the total number of drops connected to all IDF/MDF patch panels. If a particular installation is an addition to an existing IDF/MDF, the newly added drops and patch panels shall continue the number sequence from the last number of the previous patch panel.
      a. Example Line 1: Two (2) 48-port patch panels newly installed will be numbered one (1) through 96. Later, when a 48-port patch panel is installed, the number sequence on the newly installed patch panel shall begin at 97 and continue.
      b. Example Line 2: Under drops 1 through 8 the label says B5, under drops 9 through 15 the label says Lib6. This indicates that drops 1 through 8 are located in the B building room 5, while drops 9 through 15 are located in the Library building, room 6.

G. Drop Plate Labeling.
   1. Each data drop plate shall list the following 2 items.
      a. IDF/MDF name or number and the location of that IDF/MDF, ie "IDF-3 B-2" for IDF 3 in room B-2.
      b. Each data drop port shall list the drop number that corresponds with their drop number as listed at the IDF/MDF patch panel. Example: 4 data drop ports should be numbered like d-110, d-111, d-112, and d-113.

2.5 FIBER OPTIC SYSTEM

A. FIBER OPTIC CONNNECTORS
   1. Fiber optic connectors shall be SC-style.
   2. Connectors shall incorporate zircona ceramic ferrules. The same type shall be used throughout the installation.
   3. All connectors provided by Contractor shall be of same manufacturer and termination method throughout this contract.
   4. Fiber optic connectors shall be rated for a mean loss not greater than 0.3 dB per mated pair.

B. OPTICAL FIBER COUPLERS
   1. Multimode optical fibers shall be terminated with (duplex *SC -style*) connectors and attached to (*duplex SC, duplex SC to duplex SC*) feed-through couplers.
   2. Single-mode optical fibers shall be terminated with (duplex SC) connectors and attached to (duplex SC) feed-through couplers.
   3. All fiber optic terminations shall be installed in boxes with bend limiting provisions for fiber slack storage.

C. FIBER TERMINATION PANELS
   1. Fiber termination panels shall be capable of handling a minimum of 24 fiber optic connectors with the appropriate number of connector panels and couplers. All unused locations shall be filled with blank panels.
   2. Fiber termination panels shall be 19" rack mountable.
   3. Fiber termination panels shall be hinged to provide complete access to connectors and slack storage from the front.
   4. Fiber termination panels shall be complete with 12 **SC**-style interconnect couplers.
   5. Fiber termination panels shall be equipped with cable strain relief brackets.
   6. Fiber termination panels shall provide ample storage and handling for up to 36" of slack per fiber strand.
   7. Fiber termination panels shall protect both the installed cable and patch cord cable interface when the panel is in the closed position.
   8. Fiber termination panels must be of the same manufacturer as the fiber cable and SC connectors, as well as the horizontal cabling system to ensure the owner will not have any coordination problems in the future.

D. FIBER OPTIC CABLE
   The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-A Standard specification. Fiber runs **less than 800 ft** should be labeled orange at both IDF and MDF patch panels, and they

should be **multimode** fiber. Fiber runs **greater than 800 ft** should be labeled [illegible] at both IDF and MDF patch panels, and they should be **single mode** fiber.

1. Optical fiber cables used outside shall be housed in an OSP indoor/outdoor jacket. Inside fiber shall be riser or plenum tight buffered.
2. Use OFNR construction if used as a riser cable.
3. Use Plenum construction if used in an air plenum of any kind.
4. Optical fiber shall be rated a minimum of 100 Mbps.
5. Each optical fiber component shall be surrounded by an individual aramid yarn strength member.
6. The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-B Standard specification
7. Optical fiber cable shall withstand a minimum short term tensile load of 105 pounds without damage to the optical fiber
8. Optical fiber cable shall be able to withstand a minimum bend radius of 45 millimeters (mm) during installation without damage to the optical fiber elements
9. Optical fiber cable shall have a minimum crush resistance of 200 N/cm
10. Optical fiber shall be rated a minimum of 100 Kpsi.
11. Optical fiber cable shall withstand a minimum short-term tensile load of 448 pounds without damage to the optical fiber.
12. Optical fiber cable shall be able to withstand a minimum bend radius of 128 mm during installation without damage to the optical fiber elements.
13. All fiber optic cable shall be installed per industry standards. This includes using a proper *break-away swivel* and sealing the end of all cables before pulling through any conduit system. 10 feet of slack cable shall be left at each end of the cable run for future maintenance purposes.
14. OSP, loose-tube cables shall be properly prepared and protected per industry standards. All cables shall be properly cleaned. The cable ends shall be terminated through a breakout unit and a 900 micron buffer tube for each fiber strand. Each cable OSP buffer tube shall be labeled for strand counts contained therein. Provide proper break out kits as manufactured by AT&T, Corning, or equal.
15. When distribution style fiber cable is installed, strength members shall be mechanically secured to the outlet box and distribution enclosure.
16. A minimum of 12-inches of slack shall be stored at the drop end and 36-inches shall be stored at the TC termination enclosure.
17. Where 250-micron coated cable is field terminated, breakout kits that build up the fiber to a minimum of 900 microns shall be used.
18. Any splices, fusion only, shall be housed in fiber trays and an enclosure with splice tray organizers.

2.6 BACKBONE CABLING SUBSYSTEM

A. The backbone cable subsystem is comprised of all cable, connecting hardware, pathways and cable management hardware required to form a continuous path from the Telecommunications Entrance Facility (EF) to the Equipment Room, from the ER (MDF) to each TC (IDF), and between TCs (IDFs) on the same floor.

B. BACKBONE CABLE
   1. Backbone cables will be installed between the locations described in the scope of work and on the plans. An inner-duct shall be pulled in all backbone conduits along with the fiber-optic cable. This inner-duct shall be left with only a pull rope for future use and shall be of the size and quantity called out in other areas of this specification. All conduits shall be plugged with snug plugs and duct seal after inner-duct installation is completed.
   2. All cables shall be furnished by the contractor in full, factory packaged reels. The reels shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by the Owner, the contractor shall provide manufacturers' proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for replacement. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.

C. BACKBONE CABLE INSTALLATION: All backbone cables shall be installed in the following manner:
   1. Backbone cables shall be installed separately from horizontal distribution cables.
   2. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate inner-ducts within conduits.
   3. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum inner-duct to provide protection to the cable
   4. Where backbone cables and distribution cables are installed in a cable tray or wire-way, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
   5. Backbone fiber cable shall consist of a six (6) strand count unless specified differently on the plans and in the scope of work. These cables shall emanate from the MDF to each IDF. These cables shall be of the same manufacturer of all the other fiber and copper cabling system and terminations. These cables shall be FDDI+ grade per EIA/TIA standards.
   6. All backbone conduit shall have (1) 3/4" inner-duct with pull ropes if in a 2" conduit, (2) 1" inner-duct with pull ropes if in a 3" conduit, and (4) 1" inner-duct with proper "Jack-moon" plugs if installed in a 4" conduit. This inner-duct will be for future use in the 2" and 3" conduits and one or as many as necessary will be utilized in the 4" conduit leaving the remainder for future use. All unused inner-duct shall have a rubber snug plug with rope tie off installed and all inner-duct occupied with cable shall have the appropriate cable seal.

D. HORIZONTAL CROSS-CONNECT TERMINATION HARDWARE
   1. The backbone side of the horizontal cross-connect, and the main cross connect shall be terminated in the same termination panels as the horizontal cables. The backbone fibers shall be maintained in separate termination panels from the horizontal distribution fiber cables. The backbone termination panels shall be installed in the double swing enclosed rack. Termination details and rack elevations for fiber panel placement shall be provided in the contractor submittals.
   2. The contractor shall be required to install, secure and ground the racks. The Contractor shall only be required to install those fiber termination panels to fully terminate all newly installed fiber strands unless otherwise noted. Placement of the enclosures shall be detailed in the contractors working drawings.
   3. Each fiber optic cable shall be terminated in the telecommunications closet in a 12, 24, 48, or 72 fiber port rack mounted patch panel enclosure providing protection to the terminated fibers. The enclosures shall provide a strain relief bracket for attaching the optical fiber cable and support slack storage of a minimum of 36" per fiber cable. The enclosure shall provide a minimum of 12 ports for fiber terminations and fully enclose both the hardwired cable and the patch cord terminations when the shelf is closed.
   4. Products for this installation shall be furnished in new and factory packaged condition. Each product shall be inspected by the Contractor to ensure completeness and that no damage was incurred during shipping. The contractor shall return to the manufacturer, any product found to be deficient. The cost of the return and replacement product shall be borne by the Contractor.

E. CONDUIT AND TRENCHING.
   1. Trenching. When no conduit pathway is available between an MDF/IDF and the proposed drop installations in another building, trenching should occur between buildings to install a 3" conduit to be a pathway for installing either Category 5e, Category 6e or appropriate fiber optic cables.
      a. Trenching may occur within any single or any combinations of the following the physical mediums: dirt, turf, asphalt, concrete.
      b. Conduit used in trenches should be rated appropriately for the environment and conditions.
   2. Conduit. Wherever and whenever possible during any data cable installations conduits and cable should be installed inside the walls. When this is not possible, use neutral colored surface mounted hinged raceway, such as Panduit Pan-Way Type LD Surface raceway, sized appropriately for the number of cables installed.
      a. Dual Channel raceway can be used for approved locations when additional electrical power is also a consideration.

2.7 RACKS/CABINETS

A. The products supplied shall meet the following specifications:
   1. All MDF racks/cabinets shall be an APW or equivalent 7' open relay rack or a 7' enclosed cabinet manufactured by APW or equal.
      a. Enclosed rack should be a minimum of 24" wide and 42" deep.

b. Cabinet must be adequately equipped with self-contained ventilation system such as fans or similar means.

2. A cable trough shall be supplied at the bottom of each open rack to support patch cord routing between racks.
3. Server Racks (minimum one per campus) shall be floor-mounted racks with (2) peripheral shelves, server sliding shelf (150lb capacity), and monitor and keyboard shelf all as manufactured by APW or equal. (More detail in Paragraph 2.12.C)
4. Inter-bay and end-cap cable managers shall be a single piece full height unit supporting front and rear cable routing and attachment.
5. The inter-bay manager shall have integral routing and slack storage loops supporting a 1.5" minimum bend radius.
6. Inter-bay and end-cap management panels shall be supplied with adjustable routing guides.
7. Both inter-bay and end-cap units shall have removable covers secured with 1/4 turn fasteners.
8. Inter-bay and end-cap cable managers shall securely attach to the rear rail of the rack with #12-24 screws.
9. All IDF locations shall be 2', 3' or 4' wall-mount enclosures manufactured by APW or equal. Size of IDF cabinet shall depend on the number of switches, cabling connectivity, and cable management devices for IDF, or as stated on plans and in scope of work. Each cabinet is to provide space for 25% equipment growth. Cabinets shall:
   a. Be a minimum of 24" and a maximum of 30" deep
   b. Be double-swing design and 3-piece construction
   c. Provide in-field door hinge reversing
   d. Shall include louvered sides
   e. Shall include a solid metal door
   f. Shall be mounted on 1" plywood back-board, anchored sufficiently to mount the cabinet.
10. All cabinets and racks shall be keyed alike with key code ch751.
11. All cabinets shall provide a minimum of two cooling fans in the top cover.

B. CABLE MANAGEMENT

1. Horizontal cable management shall be provided in each rack. A minimum of two front wire- management panels shall be provided in each rack. One combination front and rear horizontal wire management shall be provided for each fiber termination box, for each 24 ports of RJ45 panels, and each 24 ports of switches. Cable dressing at all racks/enclosures shall utilize velcro straps. The use of cable ties is not permitted. All cables and their termination on each end shall be labeled per EIA/TIA administration standards. All labeling schemes and label designations shall be reflected on the CAD drawings at the end of the project and in the submittals.

C. RACK MOUNTING AND HARDWARE

1. Vertical wire management shall be supplied for all open racks.
2. A TGMB ground buss shall be provided at the MDF and a TGB ground buss shall be provided at each IDF. All racks shall be grounded to the telecommunications ground bus bar. <u>The buss bars will be installed by an electrical contractor and not part of the scope of work in this specification section.</u>
3. Floor mount open racks shall be securely attached to the concrete floor using 3/8" hardware and a minimum of 3 feet and a maximum of 10 feet away from the most adjacent wall. The contractor shall install a 12" wide ladder tray system, as manufactured by APW or equal, from the most adjacent wall to the rack. Appropriate wall and rack mounting from the same manufacturer shall be installed as well. These racks should have a minimum of 30" clearance on all sides for access.
4. Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation.
5. Inter-bay and end-cap managers shall be installed to the rear mounting rail of the rack using all available mounting holes.
6. Inner-ducts and cables shall be securely fastened to the cable managers.
7. Cable feeds shall alternate left and right to minimize congestion at the top of the rack.
8. Wall mounted racks shall be installed with a minimum of six 5/16" lag bolts or masonry anchors into structural building members.

2.8 OTHER NETWORK CABLING NOTES

A. Data cabling shall not occupy the same conduits as other low-voltage systems to ensure the data network can be up-graded and expanded in the future without disturbing the other critical communications systems.

B. Each RJ45 workstation outlet shall be provided with one (1) 3' patch cord for the rack location and one (1) 7' workstation cord for the future computer. These patch cords shall be of the same manufacturer as the cabling system. Patch cord shall be factory assembled and include *snagless* color-coded strain relief boot. No field assembled patch cords allowed.

2.9 ACTIVE COMPONENTS

A. MDF GENERAL REQUIREMENTS "CORE" SWITCHES
1. Core Switches vary by school. In general the follow the specifications listed below.
   a. High Schools, Cisco Catalyst 6509, dual power supplies, populated with minimum boards so support 18 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), Supervisor card and 64MB RAM.
   b. Middle Schools, Cisco Catalyst 4507, dual power supplies, populated with minimum boards to support 16 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), supervisor card and 64 MB RAM.
   C Elementary Schools, Cisco Catalys 4506, dual power supplies, populate with minimum boards to support 16 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), supervisor card and 64 MB RAM
2. A true on-line battery backup UPS system shall be provided for each Core switch installed and shall provide a minimum of 60 minutes run time, and shall include a SNMP module with alert notification software as manufactured by TrippLite or APC.
3. Core-switch will contain modules capable of providing gigabit Ethernet to each of the IDF's it supports.
4. Core-switch will provide one (1) gigabit link for each (96) drops supported by the respective IDF.
5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC or LC style connectors on 50/125 multimode fiber optic zip-cord style cable that meet the Category 5e or Category 6e standard. Cords must be the same manufacturer as the cabling system being installed. **No field terminated cords are allowed.**
6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location.

B. IDF GENERAL REQUIREMENTS "EDGE" SWITCHES
1. Edge Switches, Cisco Catalyst 3750 power switch with 4 LC fiber ports, 1 gbic and patch cable, and stacking cable.
2. Each switch at the IDF will be a minimum of forty-eight (48) 10/100Base-TX ports.
3. All IDF switches will be the Enterprise Edition switch.
4. One 1000BaseSfp GBIC module will support no more than 96 drops before adding subsequent 1000BaseSX GBIC modules in the IDF for additional gigabit links to the MDF.
5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC or LC style connectors on 50/125 multimode fiber optic zip-cord style cable that meet the Category 5e or Category 6e standard. Cords must be the same manufacturer as the cabling system being installed. **No field terminated cords are allowed.**
6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location.

C. SERVER RACKS GENERAL REQUIREMENTS (minimum one per campus)
1. Data contractor will provide one (1) enclosed 7 ft server cabinet which will be provided with proper shelving and ventilation (2 fans minimum) to support a minimum of two file servers (see rack specifications section).
2. A true on-line battery backup UPS system shall be provided for each server installed and shall provide a minimum of 60 minutes run time, and shall include an SNMP module with alert notification software, as manufactured by TrippLite or APC.
3. The server rack shall be compatible to house multiple modular HP file servers with associated mounting rails.
4. The data contractor shall provide a 1U combination KVM switch with attached keyboard, mouse touchpad, and LCD monitor and sufficient cables to connect 2 servers. This unit should be capable to connect up to 4 workstations/servers.

D. ROUTER

Most routing is done through layer 3 switches. However, in site specified cases only, Cisco Catalyst 3745 router with dual power supplies and with 2 T1 ports and 2 Ethernet Ports, latest Enterprise IOS.

PART 3 - EXECUTION

3.1 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified as useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Copper: Each cable shall be tested for continuity on all pairs and/or conductors. Coaxial cables shall be tested for continuity, opens shorts and resistance using a volt/ohm meter (VOM) and installed length using a Time Domain Reflectometer (TDR). Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All Category 6 cables shall be tested to ensure the Category 6 standard performance to 100Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for Maintenance & Operations turn-over documents as well as one CD copy for the owner's use. These data cabling links shall be tested with a Level III cable analyzer utilizing bi-directional swept frequency testing procedures.

C. Continuity: Each pair of installed multi-conductor inter-building phone cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

D. Length: Category 5 and Category 6 unshielded twisted pair (UTP) data cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

E. Performance Verification: Category 5 and Category 6 unshielded twisted pair (UTP) data cable shall be performance verified using an automated, electronic test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
   1. Near End Cross-Talk (NEXT)
   2. Attenuation
   3. Ambient Noise
   4. Attenuation to Cross-Talk Ratio (ACR)
   5. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

F. Fiber: All fiber terminations shall be visually inspected with a minimum 200 X microscope to ensure that no surface imperfections exist after final polishing. This step is not necessary of factory pre-polished connectors are installed. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source. *Cable length and splice attenuation shall be verified and documented using an OTDR.*

G. Attenuation:
   1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm

and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference--two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in **the EIA/TIA-568-A** Annex H, Optical Fiber Link Performance Testing.

2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
3. Single-mode optical fiber attenuation shall be measured at 1310 nm and 1500 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two meter patch cords shall be used as test references and for the actual test. This test method utilizes a one jumper reference, two jumper test to estimate the actual link loss of the install cable plus two patch cords.
4. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing.
   **For this application, the length based on cable length measurements marked on the jacket, will be suitable. OTDR testing is to be performed in accordance with 8.2.2, then the actual measured length shall be used. Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number.*
   ***The testing for this project is measuring the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors. Subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test.*

H. Length and Splice Loss
   1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturers' recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.
   2. OTDR and power meter testing is specifically requested by the Owner.
   3. Each strand shall be tested on all outside plant and tight-buffered cables and/or where splices exist.
   4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the TIA/EIA-568-B Standard.

3.2 FIRESTOP SYSTEMS

A. A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.3 GROUNDING AND BONDING

All grounding and bonding work is to be completed by an electrical contactor and not part of this scope of work. This information is placed here for reference only.

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB shall be installed independent of the buildings electrical and building ground and shall be designed in accordance with the recommendations contained in the TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

   1. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications closet shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

B. Product Specifications
   1. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TC or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack to not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using the appropriate compression connector.
   2. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables, and buss-bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

C. Ground System Installation
   1. The TBB shall be designed and/or approved by a qualified PE, licensed (actual or reciprocal) in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIA/EIA-607 standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed C10 electrical contractor.

3.4 SYSTEM DOCUMENTATION

A. The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the contractor during the course of the installation. The documentation required will allow the owner to create a TIA/EIA 606 compliant administration system.

B. Cable System Labeling
   1. The contractor shall develop and submit for approval a labeling system for this cable installation. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. All data drops numbers shall be unique within each IDF/MDF and they shall be continuous from patch panel to patch panel. See sections 2.4 F and 2.4 G for drop labeling details. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme
   2. All label printing will be machine generated using indelible ink ribbons or cartridges. Self laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.

C. As-Built Drawings
   1. The installation contractor will be provided with (*two*) set(*s*) of (*D*-)size drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner. Contractor shall also redraw the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 81/2" x 11" sheets of paper and be turned over to the owner with the O&M manuals.
   2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project in both electronic CAD format as well as hardcopy. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system. The hardcopy drawings should be provided in an organized binder with tabular divisions.

D. Test Documentation
   1. Test documentation shall be provided in a three ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail test method used and specific settings of the equipment during the test.
   2. Scanner tests shall be printed on 8-1/2" x 11". Hand written test results (attenuation results and green light results) shall be *documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in test documentation binder.*
   3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall collocated in the binder.

3.5 WARRANTY AND SERVICES

A. The contractor shall provide a system warranty covering the installed cable system against defects in workmanship, components, and performance, and follow-on support after project completion.

B. Installation Warranty: The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

C. Cable System Warranty: The contractor shall facilitate a warranty between the manufacturer and the Owner that provides coverage of the installed cabling system to a minimum of 25 years. An extended component warranty shall be provided which warrants functionality of all components used in the system for a minimum of 25 years from the date of acceptance. All fiber cable, copper cable, fiber termination hardware and housings, copper termination hardware and trim shall be of one manufacturer to ensure the owner can establish one relationship for the warranty. A performance warranty in excess of 25 years shall also be provided which warrants the installed 100 MHz horizontal copper (HC to WA) and for both the horizontal and the backbone optical fiber (HC to WA, or cross-connect to cross-connect) portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project. Certificates of factory training by the manufacturer, or authorized representative, of the cabling system being installed must be made available if requested by the District or District's representative.

3.6 CABLE SYSTEM ACCEPTANCE

A. The Owner's Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the fire-stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

B. Final Inspection: Upon completion of the project, the Owner's Technical Representative will perform a final inspection of the installed cable system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the District.

C. Test Verification: Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. **If significant discrepancies are found, the Contractor will be notified for resolution**.

D. System Performance: During the three-week period between final inspection and delivery of the test and as-built documentation, the Owner will activate the cabling system as a validation of operation.

E. Final Acceptance: Completion of the installation and in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the system for a two-week period will constitute acceptance of the system.

SECTION 16930
NETWORK LIGHTING CONTROL

PART 1 – GENERAL

1.01 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the specifications.

B. Contractor shall coordinate all of the work in this section with all the trades covered in the other sections of the specification to provide a complete and operative system.

1.02 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by drawings, and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.

Type of lighting control equipment and wiring specified in this section include the following:

- Low Voltage Lighting Control Panels

Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring.

1.03 QUALITY ASSURANCE

A. UL & ULc Approvals
The control panels shall be tested and listed under the UL 916 Energy Management Equipment standard and CSA C22.2 #205 by a nationally recognized testing laboratory.

B. NEC Compliance
The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.

C. NEMA Compliance
The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.

D. Component Pre-testing
All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

E. System Checkout
A factory trained technician or factory authorized personnel or contractor shall functionally test the control system and verify performance after installation.

F. Manufacturer
Manufacturer shall have a minimum of 20 years experience in control systems. Manufacturer shall provide off the shelf control products from its inventory. Control systems that require custom assembly and sizing shall not be acceptable. Manufacturer shall be Cooper Controls. Product shall be ControlKeeper® 4A control panel or approved equal.

1.04 SUBMITTALS

A. Product Data
Submit manufacturer's data on lighting control system and components.

B. Shop Drawings
Submit drawings of lighting control panel and accessories including, but not necessarily limited to the low voltage relay panels, power wiring, and switch inputs.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. SYSTEM DESCRIPTION

1. The lighting control system shall consist of stand alone programmable low voltage relay control panels with 64 programmable switch inputs and shall offer 4 ON/OFF control relays.

2. The lighting control system shall provide 4 analog outputs to control 0 – 10 VDC outputs for dimming control. The controller shall provide 4 analog inputs for adjustable analog photocell control.

3. Each low voltage lighting control panel shall be microprocessor controlled. Programming shall be accomplished through either the RS-232 port or through the network connection employing the Keeper Enterprise software.

4. Programmable intelligence shall include Time-Of-Day control, 32 holiday dates, warn occupants of an impending off, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, and local control, digital switches and network overrides.

TOD	64 Time-Of-Day/holiday schedules for 365 day programming
Holidays	32 holiday dates
Warn Off	Flash lights and provide an extra 1 second to 99 minutes of illumination

Preset	Pre-programmed switch patterns
Timed Inputs	Switch input timers 1-999 minutes
Timed Overrides	Timed override 1-999 minutes, resumes to normal schedule
Local Control	From local switch
Astronomical Clock	Longitude and latitude input with sunset-sunrise offsets to customize outdoor lighting
Auto Daylight Savings Adjust	Automatically adjusts the clock at the appropriate dates, selectable
Priorities	Establishes a hierarchy for inputs and network control commands
Masking	Provides permission orientation to switch inputs and network commands thereby ensuring building lighting control integrity.
Soft-Linking	Group linking for rapid programming
Global Linking	Each panel shall provide 64 addressable groups for network linking of control commands

5. Relays within this control system are auto-configurable. The controller shall auto-sense the type of relay card and automatically configure the type of card to the controller's database. The controller shall inherently "know" what type and the electrical configuration of the relays. This shall be called the IntelliRelay design. Relays may be inverted to create custom control algorithms so the control system can be fine-tuned for the specific control application. Relay status shall not only disclose commanded relay status, but next scheduled state to occur.

6. Each control panel shall provide a Warn Off (flash the lights) to inform the occupants of an impending Off command. The Warn Off command shall provide an adjustable time duration of 1 second to 99 extra minutes. The occupants may exit the premises with adequate lighting or cancel the Warn Off by overriding the lighting zone. This option occurs with all Off commands except local overrides.

7. The controller shall permit lighting to be overridden On for after hours use or cleaning. The controller shall provide optional switch timer assignments or timed overrides. The override choices for various relays shall provide special event occurrences and the controller shall return to the programmed state after the override event. Also, the controller shall provide priority and masking choices to customize the functions of switch inputs, thereby enabling switches to function differently at different times of the

day to meet special facility operational requirements. These overrides shall be digital, network, or hard-wired inputs.

8. Programming the controller shall be through the RS-232 port or through the network connection. Communication to the panel or network can be accomplished via, RS-232, RS-485, modem, or TCP/IP.

9. Priorities and/or Masking shall be assigned to inputs, telephone override, and global commands to insure building integrity. Priorities enable or disable the inputs based on user actuation of overrides. Masks shall permit: On only, Off only, Ignored, No Timer, Re-evaluate Now, and On & Off control permissions for intelligent after hours utilization of the controlled facility based on Time-Of-Day scheduling within each controller.

10. Control station inputs shall provide 8 fully programmable dry contact type inputs and 64 digital switch inputs per controller. Each button or switch input shall be configurable as described in the following table.

    a. Control Station Profiles: (each may be defined uniquely)
       1) A press on a button
       2) A hold on a button (of which three options are programmable)
          .5 sec, 2 sec & 5 sec (each time period may invoke a specialized command)
       3) A tap on a button
       4) A release definition for a button
       5) Ramp rate adjustments

11. The control system shall provide dimming profiles to account for the differences of lamp and ballast combinations. Profiles are permitted to be diverse and fully adjustable to accomplish the most appropriate control based on user acceptability. Each output shall permit a unique preset or fully configurable option per output. Output profiles shall also include: Minimum Off Level, Minimum & Maximum dimming levels.

    a. Dimming Output Execution: (dimming output commands)
       1) Ramp rate
       2) Ramp time
       3) Change by %
       4) Go to a level
       5) Hold

12. The control system shall provide fully configurable photocell control algorithms. Photocell control shall permit open loop control for daylight or outdoor applications. The controller shall also provide closed loop control for sophisticated indoor applications. Both control algorithms shall permit adjustments to the upper and lower thresholds. The Keeper Enterprise software shall permit the user to create custom control loops for each of the analog output dimming loops. The loops in each controller shall be available to be modified remotely via the programming software.

13. The control system shall provide networking between lighting control panels. One network may support a maximum of 254 control panels. Panels shall permit data sharing for global control. All inputs (no limitation) are transferable over the network to create any switching pattern required. The maximum length of the lighting control network shall be 4000 feet. Repeaters are available to extend the network as needed. Networks that rely on a single time clock for system operation shall not be acceptable.

14. The lighting control system shall be able to log all control events. The controller shall monitor all relay actuations, switch inputs and user intervention. Log reports shall be available for any duration of time the operator chooses through the Keeper Enterprise Software. Runtimes for each relay shall be available from the Keeper Enterprise Software.

15. (Optional) The lighting control system shall permit LED annunciated digital switches. Each digital switch shall provide status feedback of any control relay in the entire lighting control network.

B. HARDWARE FEATURES

1. Diagnostic Aids
   Each control panel shall incorporate diagnostic aids for confirmation of proper operation, or in case of failure these aids shall guide the individual in rapid troubleshooting of the system.

   a. The control panels shall employ LED's to indicate:
      1) POWER (LED)
      2) SYSTEM OK (LED)
      3) NETWORK COMMUNICATIONS (LED)
      4) ON/OFF STATUS of EACH RELAY (LED)
      5) DIGITAL SWITCH NETWORK COMMUNICATION LED's – (TX & RX)

   Control systems that do not provide visual self-help diagnostics shall not be acceptable.

   b. Status Indication of Relays
      The system shall provide visible status indication of all relays. The visual indication shall disclose On/Off status and relay number. Systems that do not provide relay status shall not be acceptable.

2. Operator Interface
   The control panel programming interface resides in firmware in the control panel. The programming interface shall consist of external software that provides access to all the controller's features. Each panel shall control its own loads from internal memory. A control system that relies on a central control computer/processor or external time clocks shall not be permitted. Systems that utilize blocking diode technology for relay assignments shall not be acceptable.

3. Overrides
   The controller shall provide timers for each override. Each override timer shall be

capable of 0-999 minutes. Software shall enable or disable overrides based on Priorities, Masks or Time Of Day scheduling.

a. Digital Switch (Digita™)
The lighting controller shall support digitally addressable LED annunciated switches. The maximum total number of digital switches that may exist on the lighting control network is 16,256. Each Subnet shall support 64 buttons. The digital switch network requires CAT 5 cable between switches. The digital switches shall control any relay group combination on the lighting control network. Data communications status feedback for system checkout and troubleshooting (transmit and receive LED'S) shall be visible on both the controller and interface. The digital switch configuration system shall permit custom labeling for multiple button switch locations. The digital switch configuration shall be Decora® form and function.

b. Dry Contact Inputs
The control system shall permit 8 dry contacts inputs for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Maintained contacts shall be supported as 2 wire (SPST) inputs. Inputs shall be dry contacts (24 VDC @ 12 ma. internally supplied to the inputs). The 24 VDC power supply is provided with an auto-resettable fuse. Should an inappropriate electrical connection be made the design will protect the board and switches until the fault is removed. Any switch input shall be software linked to any number of relays for override control. The control panel shall have dry contact inputs on the logic board. Control systems that utilize separate accessories to allow for dry contact switches shall not be acceptable. Control systems that do not supply both digital switches and analog switches from the same controller shall not be permitted.

c. Photocell Control
The controller shall accept either dry contact or analog ambient light sensors. The controller shall provide power for the sensor thereby eliminating any external power supply. Sensors shall provide for outdoor, indoor or skylight applications and issue a command to the controller once the threshold is reached. The sensor shall provide either software or user adjustable dead band control. Photocells shall be 0-10 VDC type and available in ranges based on the application for best granularity of control.

d. Network Overrides
The controller shall accept network commands issued from other inputs or controllers on the network. The controller shall provide this feature without the need to add extra equipment to the controller. Network overrides can be issued from the Telephone Interface Module (TIM), Modbus® Gateway, DMX Gateway, Photocells, Motion Sensors, Digital or Dry Contact Switches, or other controllers. Lighting systems that need to add extra equipment to receive network overrides are not acceptable.

4. Service Override & Priority Override

The control panel shall provide a three position master-service override for the control unit. The service override shall not be accessible from the exterior. Systems that provide a service override on the exterior of the controller shall not be acceptable.

The master service override provides a single three-position switch with the option of All Off, Auto, and All On, respectively. This master switch shall operate all of the relays in the controller. This switch shall override and supersede all commands from the logic board when the switch is in the All On or All Off position. The master switch shall function to override all the relays should the logic board programming differ from the space function.

The system shall report all master service overrides to the controller and shall be accessible via network query. Systems that cannot determine when the service override is in use shall not be acceptable.

The system shall remember the last command to the individual relays. Upon returning the master override switch to the Auto position, the relays shall return to the most recent command state. This will occur even if the last command happened during the master override condition.

5. Relays
   The controller shall come standard with 4-20amp 120/277VAC electrically held relays. The wire terminations shall be able to accept 10 AWG. relays. Select from the Relay Output Options which additional relays will be utilized in the ControlKeeper® 4A controller for your application.

   a. Serial Standard Relay Card (sSRC-NO)
      The system shall utilize normally open control relays, which are rated to 20 amps at 120/277 VAC. The relays shall be magnetically held and are provided in-groups of four relays per card. Each relay card shall permit individual override and LED confirmation of relay state. The relays shall be rated for 10 million mechanical operations. The wire terminations shall be able to accept 10 AWG. A limited 10-year warranty shall be provided on the individual relay cards. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.

   b. Serial Standard Relay Card (sSRC-NC)
      The system shall utilize normally closed control relays, which are rated to 20 amps at 120/277 VAC. The relays shall be magnetically held and are provided in-groups of four relays per card. Each relay card shall permit individual override and LED confirmation of relay state. The relays shall be rated for 10 million mechanical operations. The wire terminations shall be able to accept 10 AWG. A limited 10-year warranty shall be provided on the individual relay cards. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.

   c. Serial Two Pole Relay Card (sTPRC-NO/NC)
      The controller shall provide an option for two-pole relay control. The Two Pole Relay Card shall offer the feature of controlling two pole voltages such as 208, 240, and 480VAC in a Normally Open or Normally Closed configuration. This relay card shall also provide visual indication of relay status. The wire terminations

shall be able to accept 6 AWG wire. Two pole modules require two relay locations for a maximum of two-two pole relays per card. All Two Pole Relay Module components shall be warranted for 10 years. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.

d. Serial Latching Relay Card (sLRC)
The controller shall provide an option to provide latching relays that are rated to 20 amps at 347 VAC. The relay shall provide an integral switch for both manual hand operation and visual indication of relay status. The relays shall be rated for 10 million mechanical operations. The wire terminations shall be able to accept 6 AWG wire. A limited 10-year warranty shall be provided on the individual relays. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.

6. RS-232 port
The controller shall provide an RJ-12 connection for RS-232 communications. Programming shall be permitted through either a local connection or remotely through a modem. The Keeper Enterprise software accessory includes a six wire communication cable to connect to the controller. Systems that do not include an on-board RS-232 port at each controller location for communications are not acceptable.

7. RS-485 Network
The controller shall be able to communicate to other controllers on a daisy chain twisted pair of wires. The RS-485 network shall support 254 controllers with a maximum distance of 4000 feet. Each controller shall be optically isolated on the network. The networked controllers shall provide optical isolation between controller power supplies for true electrical isolation (communication grounds are 100% isolated). CAT-5 or Belden #9841 shall be approved for network wiring.

8. Modular Design
The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on standoffs for quick field replacement. All connections for the switch inputs shall incorporate modular connectors. Systems that do not employ modular connectors shall not be acceptable.

9. Memory Back-up
The system shall utilize a memory back-up device that is system integrated and shall be non-serviceable.

The data in RAM shall be protected against power interruptions lasting as long as 7 days. The power interrupt protection circuit shall be entirely maintenance-free.

10. Multi-tapped Transformer
The control panel employs a voltage specific transformer. The panel provides both 120 and 277 VAC for each controller location.

11. Enclosure
Each control panel shall be enclosed in a NEMA class 1 enclosure. The low voltage controller shall exist in one size enclosure (10"H x 14"W x 3.5"D) with 4 relays per

cabinet. The enclosure provides a locked open feature for ease of installation and future access for control confirmation.

12. Keeper Enterprise Software
The PC based interface software accessory provides access to lighting control system files within a Microsoft® Windows® environment. The Keeper Enterprise software shall support Windows® 2000, Windows® XP and above. The optional software package shall allow individual and network panel programming to be executed locally, via direct connection or remotely through a TCP/IP connection or modem. The central programming software shall permit the user to modify the control panel programming or configuration in an "OFF-LINE" mode. This software package shall store all programmed data and archive for future use. Systems using third party software are not acceptable. Systems that are not capable of creating program backups are not acceptable.

13. The following features shall be standard in the PC based software:

    a. Standard Software Features:

    - Real Time Relay Status Monitoring
    - Alpha-Numeric Descriptors
    - Communications: Direct, Network, TCP/IP and Modem
    - Network Status Indication
    - Global Software Modifications
    - Manual Relay Commands
    - Remote Pattern Commands
    - Preset Options
    - User Management – Password protection, and privilege modification for multi-user security
    - Logging of Controller Actions (switch inputs, TIM commands, & relay actuations)
    - Remote Commander –(entire network global commands from one screen)
    - Runtime of each controlled circuit in hours.

    b. File Maintenance

    Archive Programs
    Data Base Restoration
    Uploading and Downloading of Programs
    Snap Shots — indication of changes and flawless panel restoration

    Software package shall permit the PC to be utilized for other functions (i.e. word processing, database, and etc..) besides lighting control. Systems that require an "on-line" dedicated computer for control system operation shall not be acceptable.

14. System Management Software Accessories require the Ethernet Interface Module (EIM) accessory, connection to the building LAN and Windows® 2000, Windows® XP or above operating system.

a. VisionTouch®
The lighting zones may be controlled through a graphical representation software package called VisionTouch®. The software permits up to 255 floors or site plans to be illustrated for intuitive control. The software provides real-time feedback to the operator of network control overrides. The software shall be accessible through an Ethernet network permitting more than one location control access to the site. The software shall accept AutoCAD® drawing files to reduce programming set up of the control software.

b. VisionSwitch®
A lighting control tool which, when integrated on a computer desktop, shall employ Ethernet communications and shall control up to four load-groups per computer desktop. Each load-group shall span several panels and relays. VisionSwitch® requires the Cooper Controls Ethernet Interface Module.

15. Network Hardware Accessories
The ControlKeeper® 4A has several hardware accessories that may be utilized to enhance your lighting control application. Select from the network hardware accessories which accessories will be utilized for your application.

a. ControlKeeper®-TouchScreen (CK-T)
The CK-T shall provide additional flexibility by providing up to 48 relays that are addressable and fully programmable from the network. The CK-T controllers although accessible through the network shall be fully stand-alone in their control capability. The controller (CK-T) provides full status indication of CPU status, network communication, power, and HOA overrides. The controller shall provide 32 dry contact inputs that may be configured as a maintained, or momentary inputs. The controller shall provide up to 64 digital buttons for overrides. The controller shall provide 64 additional global commands for network control and shall reside in the CK-T. Systems that utilize the master slave topology shall not be acceptable.

b. ControlKeeper® 2 (CK 2)
The CK 2 shall provide additional flexibility by providing two 20 amp @ 277 VAC rated relays that are addressable and fully programmable from the network. The relay wire terminations shall be able to accept 10 AWG. The CK 2 controllers although accessible through the network shall be fully stand-alone in their control capability. The CK 2 provides full status indication of CPU status, network communication, power, and HOA overrides. The controller shall provide 2 dry contact inputs that may be configured as a maintained, or momentary inputs. The controller shall provide four analog inputs. The controller shall provide up to 64 digital buttons for overrides. The controller shall provide 64 additional global commands for network control and shall reside in the CK 2. Networks that rely on a single time clock for system operation shall not be acceptable.

c. ControlKeeper® 4 (CK 4)
The CK-4 shall provide additional flexibility by providing four normally open or normally closed 20 amp @ 277 VAC rated relays that are addressable and fully programmable from the network. The relay wire terminations shall be able to

accept 10 AWG. The CK-4 controllers although accessible through the network shall be fully stand-alone in their control capability. The CK-4 provides full status indication of CPU status, network communication, power, and HOA overrides. The controller shall provide 4 dry contact inputs that may be configured as a maintained, or momentary inputs. The controller shall provide up to 64 digital buttons for overrides. The controller shall provide 64 additional global commands for network control and shall reside in the CK-4. Networks that rely on a single time clock for system operation shall not be acceptable.

d. AnalogKeeper™ (AK)
Provides the ability to provide additional analog remote sensing to the Control-Keeper® network. An analog photo sensor connected to the Analog-Keeper™ shall broadcast photocell light levels/thresholds onto the ControlKeeper®'s network for any specific relay or group of relays to employ. The actual network broadcasted data shall be available for any relay to actuate either an "on/off" at any preset analog value for total global control. All relays connected to the network are capable of being set to different analog photo sensor values for total building control.

The AK shall permit custom sensors with varying sensing ranges for more user choices. The AK shall also supply adjustable Minimum ON's, OFF's and Maximum OFF's. The AK shall provide analog sensor logging so information may be recorded for proper switching control choices.

e. Ethernet Interface Module (EIM)
Internet Connection Specifications: The control system accessory provides easy access to control panels over a TCP/IP connection by converting sent information into RS-232 communication capable information. This unit operates on standard 110VAC. Manufacturer shall provide proper cabling from controller to Ethernet Interface Modules. RJ-45 connections are the responsibilities of others.

This specification will outline the respective responsibilities of lighting control systems manufacturer and of the customer when a TCP/IP connection is used for communication to the Lighting control systems manufacturer network.

1) Lighting Control Systems Manufacturer's Responsibility to the Customer
Lighting control systems manufacturer will supply one Ethernet Interface Module per network when a TCP/IP connection is used.
Instructions on how to install and configure the Ethernet Interface Module shall be supplied by Lighting control systems manufacturer.
2) Contractor's Responsibility
The Contractor will provide an IP address, Subnet Mask, Default Gateway, and a TCP Port Number for each Ethernet Interface Module required. The customer shall provide a qualified Network Administrator to properly configure the device(s). Any future changes to the customers TCP/IP network that affect the operation of the device(s) will be the customer's responsibility.
The Contractor will be responsible for any Internet and Virus Protection Security measures. This includes, but is not limited to, Firewall, Proxy Servers, and Virus Protection Software.

The Contractor will provide a qualified Technician to install and connect the Ethernet Interface Module to the building's LAN and to the lighting panel. The Ethernet wire should be Category 5 wire and installed per Category 5 wiring specifications.

VPN hardware device accessory: An optional VPN hardware device may be added to your lighting control network and building LAN to ensure security of your building LAN and lighting control network.

f. Telephone Interface Module (TIM)
The control system shall provide intelligent software for the Telephone Interface Module (TIM) option. The optional TIM unit shall allow modem communications and touch-tone overrides from any touch-tone phone. The control system shall be multi-tasking and permit up to one TIM for each control panel.

Override Operation: Touch-tone interface shall permit the control panel to command pre-assigned control points On/Off. All user interfaces shall be through the twelve Touch-tone keys on the telephone. All entries into the override system shall be prompted by a digitized voice. Systems not employing voice guided override instruction are not acceptable.

The TIM shall provide individual control passwords. Each password shall allow a preset group designation (number of relays) and the duration of the telephone override. TIM shall also provide a password to prevent entry into the override control system.

g. Modem
The control system shall be capable of modem communications. Each control panel shall provide a serial communications port for external telecommunications. The modem shall utilize the Hayes compatibility standard and enable modem access as defined by the Bell 212A and CCITT V.22 protocol standards.

The system shall be a multi-tasking system and permit more than one modem in operation at a time communicating on the network. Communication speed shall be a minimum of 14,400 baud.

h. Inter-Operability
The controller shall provide accessories that allow for inter-operability to other building automation technologies. Select the appropriate inter-operability accessory that will be utilized for your application.

1) MODBUS® Gateway
The ControlKeeper® network shall permit data protocol translation through a MODBUS® Gateway. The MODBUS® Gateway permits MODBUS® communication to operate individual relays, relay groups and read the status of the coils (status read). The ControlKeeper® shall respond efficiently to the requested MODBUS® commands as a MODBUS® slave listening to commands from a MODBUS® master. The MODBUS® Gateway shall provide

data messaging structure to rapidly increase data throughput by employing relay groups directly from the MODBUS® Gateway.

2) DMX Gateway
The ControlKeeper® network shall permit data protocol translation through a DMX Gateway. The DMX Gateway permits DMX communication to operate individual relays, and relay groups. The ControlKeeper® shall respond efficiently to the requested DMX commands. The DMX Gateway shall provide data messaging structure to rapidly increase data throughput by employing relay groups directly from the DMX Gateway.

3) N2 Gateway
The ControlKeeper® network shall permit data protocol translation through a building automation interface Gateway. The N2 Gateway shall permit Johnson N2 communication protocol to operate individual relays, relay groups and read the status of those relays. The ControlKeeper® network shall respond efficiently to the requested information from the Johnson Controls N2 network.

4) BACnet Gateway
The ControlKeeper® network shall permit data protocol translation through a building automation interface Gateway. The BACnet Gateway shall permit BACnet communication protocol to operate individual relays, relay groups and read the status of those relays. The ControlKeeper® network shall respond efficiently to the requested information from the BACnet network.

5) LON Gateway
The ControlKeeper® network shall permit data protocol translation through a building automation interface Gateway. The LON Gateway shall permit LonWorks communication protocol to operate individual relays, relay groups and read the status of those relays. The ControlKeeper® network shall respond efficiently to the requested information from the LonWorks network.

C. ACCEPTABLE PRODUCTS

1. Product

ControlKeeper® lighting control unit manufactured by Cooper Controls, 6 Green Tree Drive, So. Burlington, VT 05403-6025

PART 3 – EXECUTION

3.01 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation
The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits, and override wiring.

B. Documentation
The contractor shall provide accurate "as-built" drawings to the owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals

The factory shall supply all operation and service manuals.

3.02 PRODUCT SUPPORT AND SERVICE

A. Factory Support
Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.03 SYSTEM DELIVERY AND ACCEPTANCE

A. Delivery
The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements. The following items shall constitute factory standards and requirements:

1. All system equipment shall operate in accordance with specification and industrial standard procedures.

2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.

3. Demonstration of program integrity during normal operation and pursuant to a power outage.

4. Contractor shall provide a minimum of two training hours on the operation and use of the control system. Additional support services shall be negotiated between the contractor and the building owner or manager.

3.04 WARRANTY

A. Warranty

Manufacturer shall supply a 3-year warranty on all hardware and software. A 10-year warranty is provided on the relay card module. These warranties will be in affect for all installations. Systems that provide special warranties based on installation shall not be acceptable.

END OF SECTION 16931
120711/270032

PROJECT NAME: Roosevelt II (Henry) Elementary School
New Elementary School Construction Project
BID NUMBER: F09-02 RE-BID

ATTACHMENT NO. 8 TO BID FORM

SUPPLEMENTAL BID INFORMATION
ALTERNATES

The Bidders shall provide, on this form, a listing of the proposed price for each identified Alternate as it pertains to the work of the Bid Package being proposed on. Reference Specification Section 01230 Alternates for a complete description of the work required for each identified alternate.

Price shall include all associated costs required to perform the work including applicable markups and any incidental work required.

Bidders shall incorporate the following supplemental information as part of their Bid (failure to comply with this requirement may render the proposal non-responsive and may cause its rejection). A value must be entered for each Alternate that corresponds to the Bid Package that is being proposed on.

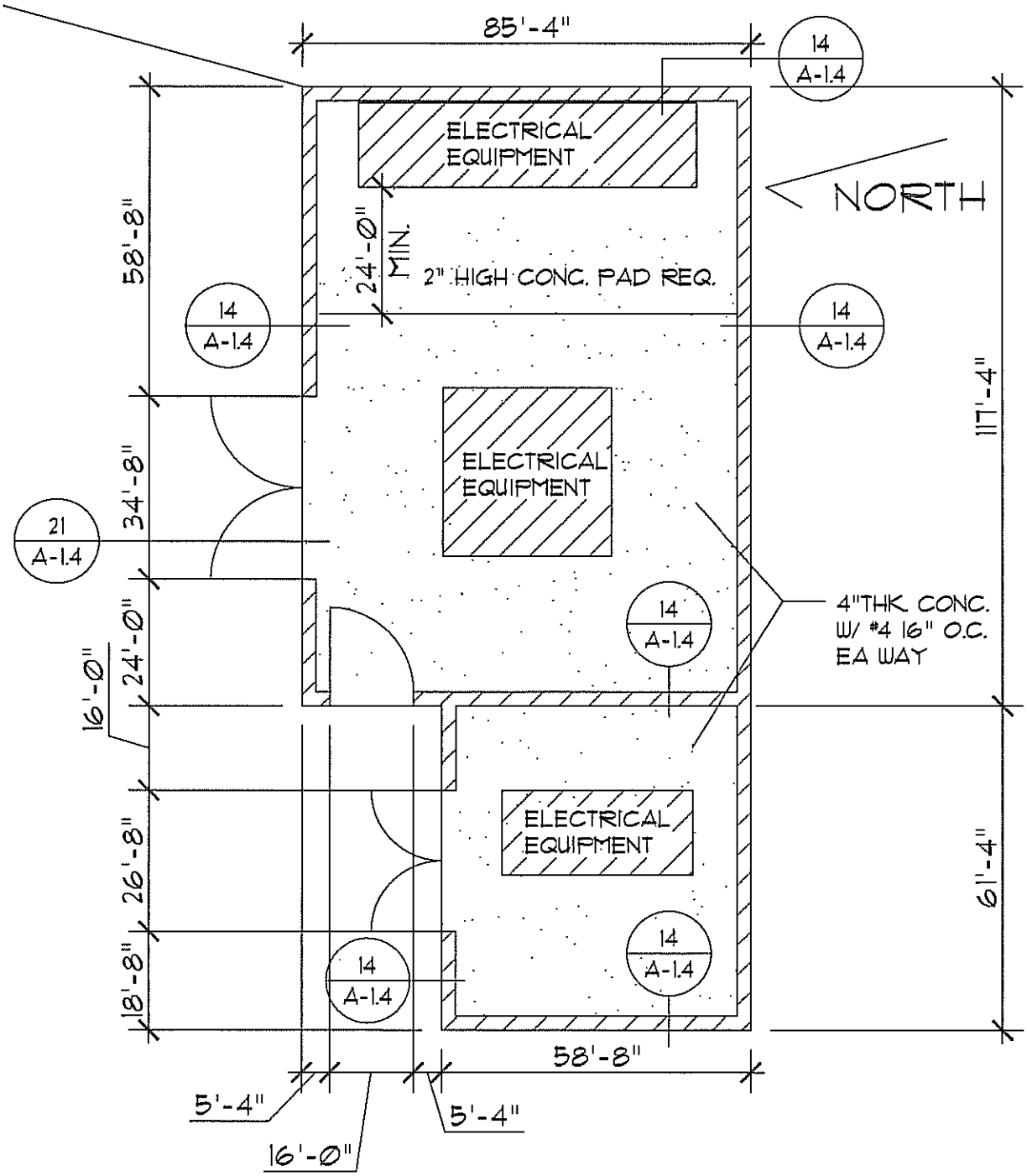
BID PACKAGE 01 – GENERAL CONSTRUCTION / BUILDING		
		PRICE
ALTERNATE #1 – Learning Walls / Added Casework / HP Laminate at Casework	**ADDITIVE**	
ALTERNATE #2 – Tack Wall Surface at Classrooms	**DEDUCTIVE**	
ALTERNATE #3 – Solar Tubes including Structural and Architectural Modifications and Network Lighting Control	**ADDITIVE**	
ALTERNATE #4 – Louver Blinds / Stage Curtains	**ADDITIVE**	
If providing a bid for Bid Package 01, all above prices must be provided		

BID PACKAGE 02 – SITEWORK (ON-SITE)		
		PRICE
ALTERNATE #5 – Playground Equipment / Play Surfacing / Monument Signs	**ADDITIVE**	
If providing a bid for Bid Package 02, all above price must be provided		

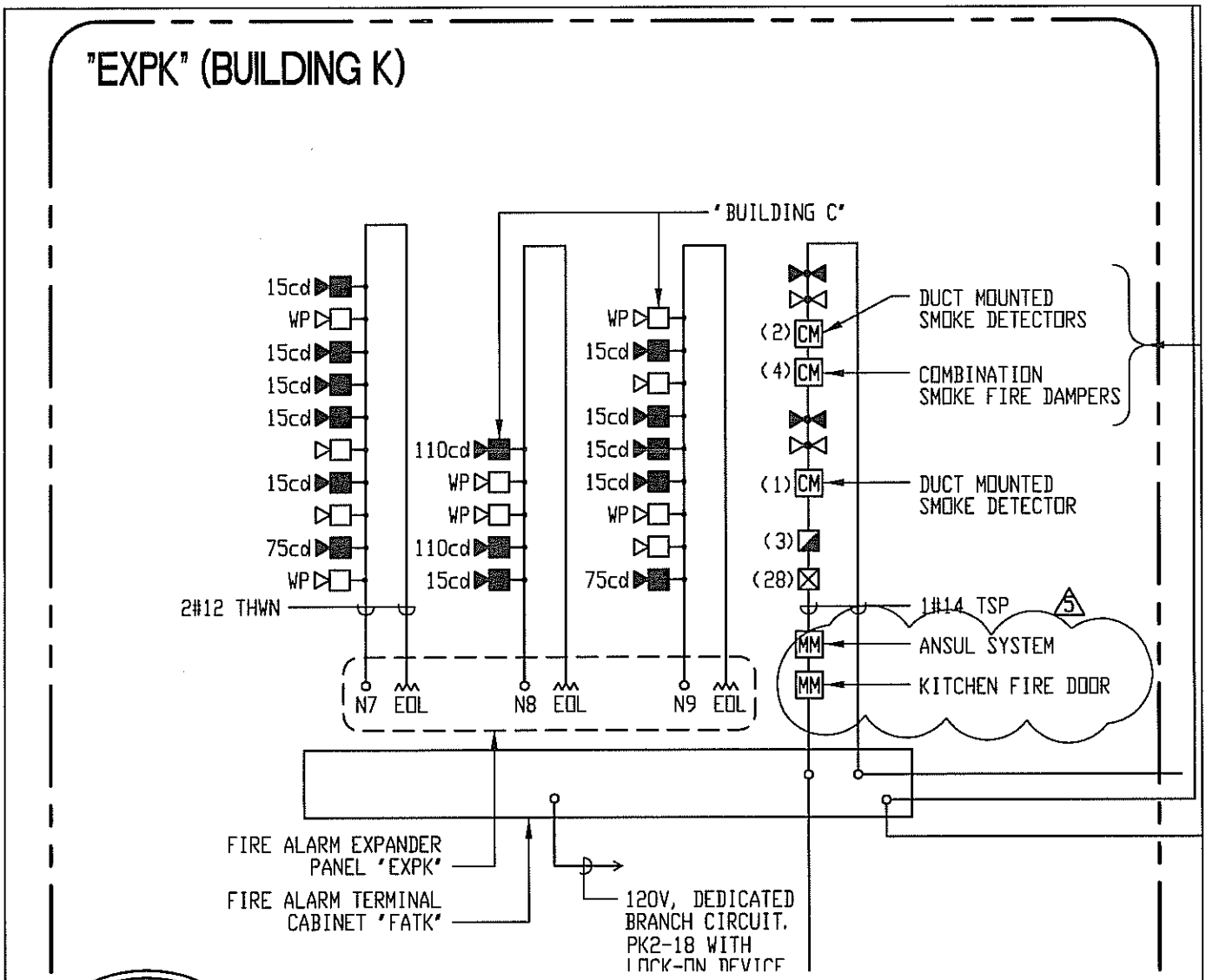
BID PACKAGE 05 – ELECTRICAL		PRICE
ALTERNATE #3 – Solar Tubes including Structural and Architectural Modifications and Network Lighting Control	**ADDITIVE**	
ALTERNATE #6 – Video Surveillance System Infrastructure	**ADDITIVE**	
If providing a bid for Bid Package 05, all above prices must be provided		

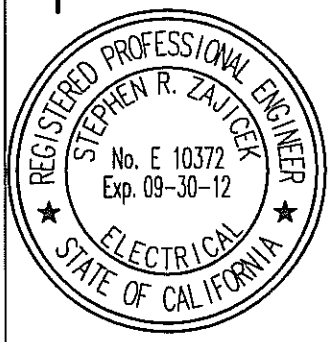
The lowest Bid shall be the lowest BASE BID without consideration of the prices on the additive or deductive alternates.

ADDENDUM SKETCH	DATE:01/05/12	NO. ASK-001
ROOSEVELT II ELEMENTARY	ADDENDUM ITEM# 5.32	
P S W C GROUP ARCHITECTS / PLANNERS 1667 BUISNESS CENTER DR., #3, SAN BERNARDINO, CA. 92408 (909) 890-2233 FAX. (909) 890-2644	SHEET REF: A-1.5	
	DETAIL REF. 16	
	SCALE: NTS	A#04-107199



ELECTRICAL ENCLOSURE





5 ADDENDUM #5

(REFERENCE SHEET: E-1.3

FIRE ALARM RISER

		FBA# 270.032
FBA # 270.032	DATE 01/05/12	SCALE N.T.S.
FBA Engineering Consulting Electrical Engineers 3420 Irvine Avenue Suite 200 Newport Beach, California 92660-3189 TEL: 949 852 9995 FAX: 949 852 1657 EMAIL: fba@fbaengineering.net	DRAWN BY FBA	SHEET NO.
ROOSEVELT II ELEMENTARY SCHOOLS SAN BERNARDINO CITY UNIFIED SCHOOL DISTRICT	CHECKED BY FBA	SKE-5.1
PSWC ARCHITECTS		

Water Quality Management Plan

ROOSEVELT II

December 15, 2006

PREPARED FOR:

SAN BERNARDINO SCHOOL DISTRICT

Fraco Enterprises Inc
Engineering and Construction Services

12139 Mount Vernon Ave. Suite 210
Grand Terrace, California 92313
Tel: (909) 824-7230 Fax: (909) 824-7385

San Bernardino County Stormwater Program

WATER QUALITY MANAGEMENT PLAN FOR ROOSEVELT II ELEMENTARY SCHOOL

SAN BERNARDINO CITY
UNIFIED SCHOOL DISTRICT

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Attachment C Pollutants of Concern

Attachment D Flow- and Volume-Based BMP Design Calculations

Attachment E Best Management Practice Drawings
Source Control BPM Drawings
Treatment Control BMP drawings

Attachment F Percolation Rates

WATER QUALITY MANAGEMENT PLAN (WQMP)

For compliance with Santa Ana Regional Water Quality Control Board

WDID#:

For

ROOSEVELT II
ELEMENTARY SCHOOL

Prepared for:

SAN BERNARDINO UNIFIED SCHOOL DISTRICT

WQMP Preparation Date
December 15, 2006

WATER QUALITY MANAGEMENT PLAN (WQMP)

PROJECT SITE INFORMATION

Name of Project: ROOSEVELT II ELEMENTARY SCHOOL

Project Location: 1554 Garner Ave. SAN BERNARDINO, CA

Size of Significant Re-Development on an Already Developed Site (in feet^2): 0

Size of New Development (in feet^2) 585,882

Number of Home Subdivisions: N/A. SCHOOL SITE

SIC Codes: 8211-Elementary and Secondary schools

Erosive Site Conditions?: NO

Natural Slope More Than 25%?: NO

WATER QUALITY MANAGEMENT PLAN (WQMP)

Check the appropriate project category below:

Check below	**Project Categories**
	1. All significant re-development projects. Significant re-development is defined as the addition or creation of 5,000 or more square feet of impervious surface on an already developed site. This includes, but is not limited to, additional buildings and/or structures, extension of existing footprint of a building, construction of parking lots, etc. Where redevelopment results in an increase of less than fifty percent of the impervious surfaces of a previously existing development, and the existing development was not subject to SUSMPs, the design standards apply only to the addition, and not the entire development. When the redevelopment results in an increase of more than fifty percent of the impervious surfaces, then a WQMP is required for the entire development (new and existing).
	2. Home subdivisions of 10 units or more. This includes single family residences, multi-family residence, condominiums, apartments, etc.
	3. Industrial/commercial developments of 100,000 square feet or more. Commercial developments include non-residential developments such as hospitals, educational institutions, recreational facilities, mini-malls, hotels, office buildings, warehouses, and light industrial facilities.
	4. Automotive repair shops (with SIC codes 5013, 5014, 5541, 7532- 7534, 7536-7539).
	5. Restaurants where the land area of development is 5,000 square feet or more.
	6. Hillside developments of 10,000 square feet or more which are located on areas with known erosive soil conditions or where the natural slope is twenty-five percent or more.
	7. Developments of 2,500 square feet of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas such as areas designated in the Ocean Plan as areas of special biological significance or water bodies listed on the CWA Section 303(d) list of impaired waters.
	8. Parking lots of 5,000 square feet or more exposed to storm water. Parking lot is defined as land area or facility for the temporary storage of motor vehicles.
✓	The project does not fall into any of the categories described above. (If the project requires a precise plan of development [e.g. all commercial or industrial projects, residential projects of less than 10 dwelling units, and all other land development projects with potential for significant adverse water quality impacts] or subdivision of land, it is defined as a Non-Category Project.)

Section 1
Introduction and Project Description

1.1 Project Information

- PSWC
  1887 Business Center Dr., San Bernardino, Ca 92408
  Contact: Steve Varner
- APN 0144-143-001

1.2 Permits

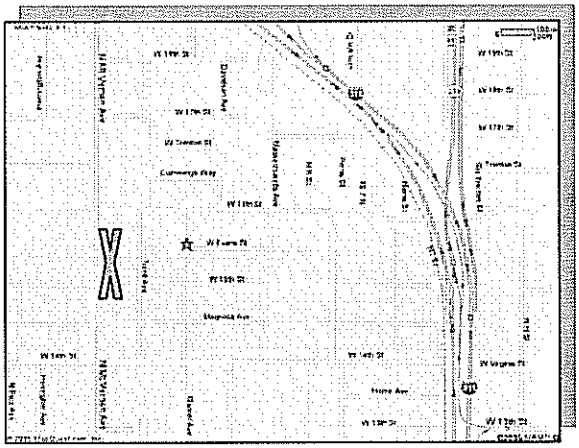
- Grading Plan and Utility Plan, Street Improvements, water line relocation.
- WDID Forthcoming

1.3 Project Description

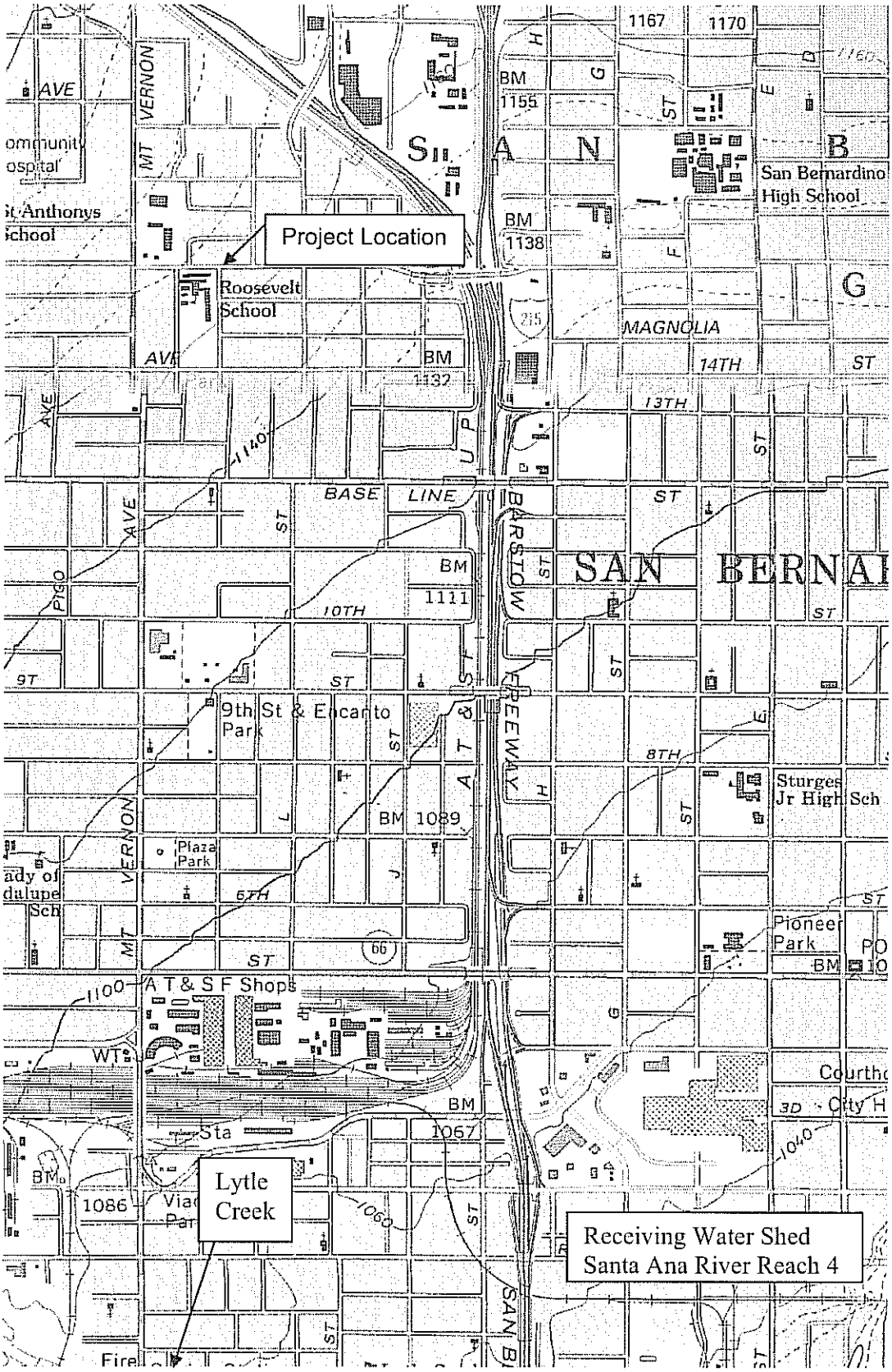
Roosevelt Elementary School is an existing elementary school, located in the city of San Bernardino, that is expanding its property to the west, an existing single-family residential developed area. The project is approximately 13.45 acres in size and it is bounded by 16th Street to the north, 14th Avenue to the south, Mount Vernon to the west, and the existing elementary school and residential properties to the east.
The proposed land use will be for a public school. The property will be maintained by the San Bernardino Unified School District. The School will consist of the following:

- Building A: Administration
  5,049 sq. ft.
- Building B: Library
  3,651 sq. ft.
- Building C: Multipurpose
  4,737 sq. ft.
- Building D/E: Classrooms
  8,582 sq. ft.
- Building F: Classroom
  8,582 sq. ft.
- Building G: Classrooms/Offices
  9,100 sq. ft.
- Building H: Shelter
  2,400 sq. ft.
- Building K: Kitchen
  2,400 sq. ft.

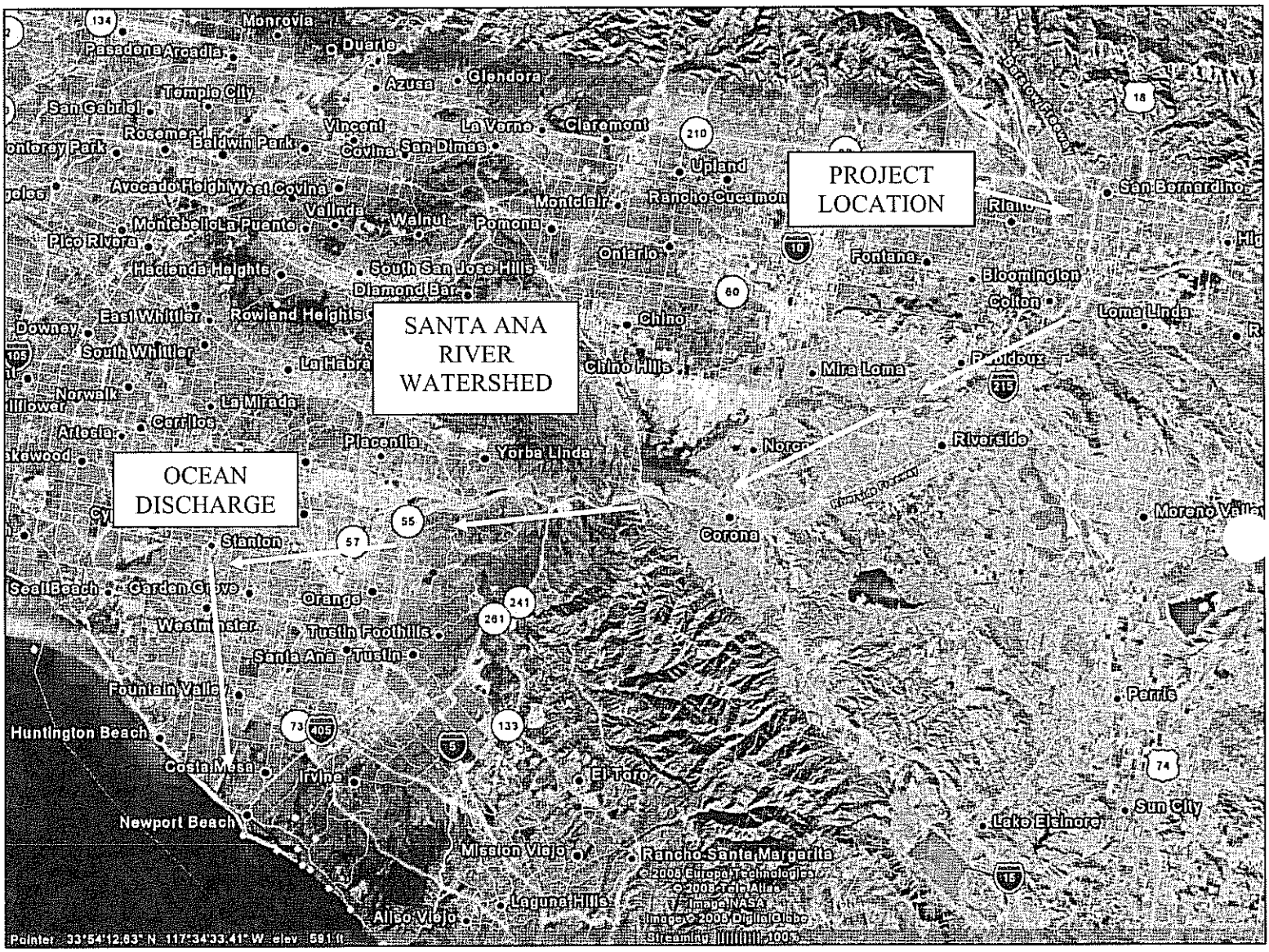
VICINITY MAP



DRAINAGE FACILITIES
MAP LOCATION



RECEIVING WATERS
MAP 2



1.4 Site Description

Pre-Development Conditions

The project area runoff flows in the southeasterly direction to the adjacent streets. There is a catch basin on 11th Street on the north side west of Pico Avenue, and two catch basins on the south side of Pico Avenue, north of 11th Street. The catch basins pick up and conveys the flows south to an existing 72" RCP storm drain at the intersection of 11th Street and Pico Street continuing to flow south on Pico Street.

Post-Development Conditions

The post-development project area runoff flows in the southeasterly direction. An underground storm drain system conveys the water to an onsite detention basin. There are no MS4's in the area. Therefore, water will have no percolation into the ground.

Section 2

Pollutants of concern and hydrologic conditions of concern

2.1 Pollutants of Concern

Based on Table 2-1 of the San Bernardino Water Storm Water Program guide, the project would be classified as significant re-development.

The expected pollutants of concern for the project site as directed below:

Pollutant of Concern Summary Table

Pollutant Type	Expected	Potential	Listed for Receiving Water
Bacteria/Virus			✓ Santa Ana River Reach 4
Heavy Metals	✓		
Nutrients		✓	
Pesticides		✓	
Organic Compounds	✓		
Sediments		✓	
Trash & Debris	✓		
Oxygen Demanding Substances		✓	
Oil & Grease	✓		
Other—specify pollutant(s):		✓	

The proximate receiving water for the project's runoff is Lytle Creek, which carries the flows to Warm Creek and ultimately to the Santa Ana River Watershed, Reach 4.

The most recent 303(d) list for the receiving watershed, Santa Ana River Reach 4, identifies pathogens as a pollutant/stressor. Potential source is identified as follows:

1. Unknown non point source the list of expected pollutants for which the receiving waters are impaired was compared with the list of pollutants expected to be generated and the following were common to both lists:

    1. Pollutants of Concern

Table 2-1 (adapted from OC 2003)
Pollutants of Concern for Project Categories and Land Uses

Project Categories/Land Uses	General Pollutant Categories								
	Bacteria/ Virus	Heavy Metals	Nutrients	Pesticides	Organic Compounds	Sediments	Trash & Debris	Oxygen Demanding Substances	Oil & Grease
Residential Development (Detached)	E	N	E	E	N	E	E	E	E
Residential Development (Attached)	P	N	E	E	N	E	E	P(1)	P(2)
Industrial/Commercial Development (>100,000 ft^2)	P(3)	P	P(1)	P(1)	P(5)	P(1)	E	P(1)	E
Automotive Repair Shops	N	P	N	N	E(4,5)	N	E	N	E
Restaurants (>5,000 ft^2)	E	N	N	N	N	N	E	E	E
Hillside Development (>10,000 ft^2)	E	N	E	E	N	E	E	E	E
Parking Lots (>5,000 ft^2)	P(6)	E	P(1)	P(1)	E(4)	P(1)	E	P(1)	E
Streets/Highways /Freeways	P(6)	E	P(1)	P(1)	E(4)	E	E	P(1)	E

2.2 HYDROLOGIC CONDITIONS OF CONCERN

All Category projects must identify any hydrologic condition of concern (HCOC) that will be caused by the project, and implement Site Design, Source Control, and/or Treatment Control BMPs to address identified impacts. Project proponents must follow the procedure for identifying HCOCs specified in Section 2.3 of the Model WQMP.
Use the following Table and instructions as a guide.

1. (from Section 2.3, Part 2): Determine if the project will create a Hydrologic Condition of Concern. Check "yes" or "no" as applicable and proceed to the appropriate section as outlined below.	**Yes**	**No**
A. All downstream conveyance channels, that will receive runoff from the project, are engineered, hardened (concrete, riprap or other), and regularly maintained to ensure design flow capacity, and no sensitive stream habitat areas will be affected. Engineered, hardened, and maintained channels include channel reaches that have been fully and properly approved (including CEQA review, and permitting by USACOE, RWQCB and California Dept. of Fish & Game) by June 1, 2004 for construction and hardening to achieve design capacity, whether construction of the channels is complete. Discharge from the project will be in full compliance with Agency requirements for connections and discharges to the MS4, including both quality and quantity requirements, and the project will be permitted by the Agency for the connection or discharge to the MS4.		NO
B. Project runoff rates, volumes, velocities, and flow duration for the post-development condition will not exceed those of the pre-development condition for 1-year, 2-year and 5-year frequency storm events. This condition will be substantiated with hydrologic modeling methods that are acceptable to the Agency, to the U.S. Army Corps of Engineers (USACOE), and to local watershed authorities. See method described below in Parts B1- B3.	YES	
C. Can the conditions in part A or B above be demonstrated for the project?	YES	

- If the answer for A, B, and/or C above is yes, then the project does not create a HCOC—in this case go to Section 3 (page A-12).
- If the answer for C above is no, the go to section 2.3. Part 3, below.

2. (from Section 2.3, Part 3): The WQMP for projects that create a HCOC must include an evaluation of whether the project will adversely impact downstream erosion, sedimentation or stream habitat. The Agency may require that the evaluation be conducted by a registered civil engineer in the State of California, with experience in fluvial geomorphology. Perform the required evaluation as specified in A – F below. Check the boxes "yes" or "no" to verify a complete report and proceed to appropriate section based on results.

Does the evaluation include:	Yes	No
A. An evaluation of potential impacts to all downstream channel reaches.	N/A	
B. Consideration of the hydrology of the entire watershed. Review all applicable drainage area master plans to the extent available, to identify BMP requirements for new development that address cumulative inputs from development in the watershed.	N/A	
C. Consultation with all applicable agencies including the USACOE; local watershed authorities (e.g. San Timoteo Watershed Management Authority and SAWPA [Santa Ana Watershed Project Authority]); U.S. Geological Survey (USGS); California Dept. of Fish & Game (CDFG); and the San Bernardino County Flood Control District; to determine any areas of potential hydrologic impact.	N/A	
D. An evaluation of any available hydrologic modeling results. Modeling may have been performed by USGS, USACOE, local watershed authorities, the-San Bernardino County Flood Control District, or other local jurisdiction.	N/A	
E. A field reconnaissance to evaluate any natural or partially natural downstream reaches, or other sensitive habitat. The field reconnaissance must evaluate representative downstream conditions, including undercutting erosion, slope/bank stability, vegetative stress (due to flooding, erosion, water quality degradation, or loss of water supplies), and the area's susceptibility to adverse impacts resulting from an altered flow regime or change in sediment supply and/or sediment transport .	N/A	
F. A report that summarizes the findings of evaluation components A through E above, and that considers the project's location, topography, soil and vegetation conditions, proportion of impervious surfaces, natural and infrastructure drainage features, and any other relevant hydrologic and environmental factors to be protected specific to the project's watershed. The report must provide a determination of whether the project will adversely impact any downstream erosion, sedimentation or stream habitat, and identify any areas where adverse impacts are expected.	N/A	

- Is the report required by 2.3, Part 3.f complete? (Attach the report) If not, perform the required evaluation and add to the report.
- Does the report determine that the project will have an adverse downstream impact?
- If yes, then go to Section 2.3, Part 4, below.
- If no, then go to Section 3.

2.3 WATERSHED IMPACT OF PROJECT

Run off from this project is discharged directly to a public-owned, operated and maintained MS4; the discharge is in full compliance with Co-Permittee requirements for connections and discharges to the MS4 (including both quality and quantity requirements); the discharge would ***not significantly*** impact stream habitat in proximate Receiving Waters; and the discharge is authorized by the C0-Permitte.

Site's run off for the pre and post development condition for a 10-year storm are as follows , 20.58 cfs and 24.06 cfs (using Civil design's software and in accordance with the County of San Bernardino's hydrology criteria).

All flows that do reach drainage inlets will be cleaned prior entering an MS4.

Mitigation for pollutants of concern will include the following:

1. Filter at all catch basins
2. Roof drains and parking lot areas' runoff will be treated in the water quality basin which will contain grassy or vegetated soils prior leaving the site and outleting into the street or infiltrating into the ground.

This project will not cause downstream erosion or habitat loss.

SECTION 3
BEST MANAGEMENT PRACTICE SELECTION PROCESS

3.1 SITE DESIGN BMPS

ROOSEVELT II Elementary School Site Design BMPs has incorporated site features such as vegetation to reduce and control post-development runoff rates. Every attempt has been made via the use of BMP's to reduce direct runoff and increase infiltration onsite, to reduce the transport mechanism for moving pollutants off site.

The use of BMP's will minimize changes in flow regime and reduces the size of necessary structural treatment control BMPs to treat runoff prior to discharge from the site or at regional facilities.

The following table list indicates Site Design BMPs, and whether it will be used (yes/no) and describes how used, or, if not used it provides a justification or alternative.

1. Minimize Stormwater Runoff, Minimize Project's Impervious Footprint, and Conserve Natural Areas

Maximize the permeable area. This can be achieved in various ways, including but not limited to, increasing building density (number of stories above or below ground) and developing land use regulations seeking to limit impervious surfaces.

Yes	No	**YES**

Describe actions taken or justification/alternative:

Every effort has been made in maintaining the maximum landscape area in an attempt to provide for more the most permeable area, thence reducing runoff.

Runoff from developed areas may be reduced by using alternative materials or surfaces with a lower Coefficient of Runoff, or "C-Factor".

Yes	No	**NO**

Describe actions taken or justification/alternative:

Alternate materials have not been use.

Conserve natural areas. This can be achieved by concentrating or clustering development on the least environmentally sensitive portions of a site while leaving the remaining land in a natural, undisturbed condition.

Yes	No	**NO**

Describe actions taken or justification/alternative:

There are not environmentally sensitive areas around this site that justify this approach. However we have been able to incorporate sufficient landscape areas into the site design.

Construct walkways, trails, patios, overflow parking lots, alleys, driveways, low-traffic streets, and other low-traffic areas with open-jointed paving materials or permeable surfaces, such as pervious concrete, porous asphalt, unit pavers, and granular materials.		
Yes	No	**NO**
Describe actions taken or justification/alternative: *Not applicable to this project. Landscape areas have been incorporated into the design.*		
Construct streets, sidewalks, and parking lot aisles to the minimum widths necessary, provided that public safety and a pedestrian friendly environment are not compromised[1]. Incorporate landscaped buffer areas between sidewalks and streets.		
Yes	No	**YES**
Describe actions taken or justification/alternative: *Landscape areas and buffers have been incorporated within the parking lots area and within the entire site i.e. landscape islands and landscape buffers areas between the sidewalks and other landscape elements. Please see landscape plans*		
Reduce widths of street where off-street parking is available[2].		
Yes	No	**NO**
Describe actions taken or justification/alternative: *Not applicable to this project. All proposed improvements are within private property. However, some offsite street improvements are required but street widths cannot be reduced due to the City of San Bernardino's standards/*		
Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.		
Yes	No	**YES**
Describe actions taken or justification/alternative: *Site does not contain trees that warrant preservation. However, the project proposes to plant native or drought tolerant trees and large shrubs see landscape plan.*		

[1] Sidewalk widths must still comply with Americans with Disabilities Act regulations and other life safety requirements.

[2] However, street widths must still comply with life safety requirements for fire and emergency vehicle access.

Other comparable site design options, that are equally effective.		
Describe actions taken or justification/alternative: *None*		
Minimize the use of impervious surfaces, such as decorative concrete, in the landscape design.		
Yes	No	**YES**
Describe actions taken or justification/alternative: *Not applicable. Concrete has been minimized and only used where access to the buildings is necessary to provide path of travel that meets ADA requirements.*		
Use natural drainage systems.		
Yes	No	**No**
Describe actions taken or justification/alternative: *Not applicable*		
Where soils conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration[3].		
Yes	No	**No**
Describe actions taken or justification/alternative: *Not applicable*		
Construct onsite ponding areas, rain gardens, or retention facilities to increase opportunities for infiltration, while being cognizant of the need to prevent the development of vector breeding areas.		
Yes	No	**No**
Describe actions taken or justification/alternative:		

[3]However, projects must still comply with hillside grading ordinances that limit or restrict infiltration of runoff. Infiltration areas may be subject to regulation as Class V injection wells and may require a report to the USEPA. Consult the Agency for more information on use of this type of facility.

2. Minimize Directly Connected Impervious Areas

Where landscaping is proposed, drain rooftops into adjacent landscaping prior to discharging to the storm drain.

Yes	No	Yes

Describe actions taken or justification/alternative:
Roof top drains have been designed to discharges into grassy areas prior reaching a storm drain system.

Where landscaping is proposed, drain impervious sidewalks, walkways, trails, and patios into adjacent landscaping.

Yes	No	Yes

Describe actions taken or justification/alternative:
Sidewalks around the building have been designed to either drain into grassy swales, to catch basins containing Fossil filter units, and to water quality basin prior to reaching a public storm drain facility.

Increase the use of vegetated drainage swales in lieu of underground piping or imperviously lined swales.

Yes	No	NO

Describe actions taken or justification/alternative:
Site design not occupied by buildings, parking lot or path of travel. Has been utilized as landscaped areas.

Use one or more of the following:

Yes	No	Design Feature
	✓	Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings
	✓	Urban curb/swale system; street slopes to curb; periodic swale inlets drain to vegetated swale/biofilter.
	✓	Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to municipal storm drain systems. **Onsite**
		Other comparable design concepts that are equally effective.

Describe actions taken or justification/alternative:

Use one or more of the following features for design of driveways and private residential parking areas:		
Yes	No	Design Feature
	✓	▪ Design driveways with shared access, flared (single lane at street) or wheel strips (paving only under tires); or, drain into landscaping prior to discharging to the municipal storm drain system.
	✓	▪ Uncovered temporary or guest parking on private residential lots may be paved with a permeable surface; or designed to drain into landscaping prior to discharging to the municipal storm drain system.
	✓	▪ Other comparable design concepts that are equally effective.
Describe actions taken_or justification/alternative:		

Use one or more of the following design concepts for the design of parking areas:		
Yes	**No**	Design Feature
✓		Where landscaping is proposed in parking areas, incorporate landscape areas into the drainage design.
	✓	Overflow parking (parking stalls provided in excess of the Agency's minimum parking requirements) may be constructed with permeable paving.
	✓	Other comparable design concepts that are equally effective.
Describe actions taken_or justification/alternative: Landscape has been incorporated as part of the drainage design for the westerly areas		

3.2 SOURCE CONTROL BMPS

Source Control BMPs reduce the potential for stormwater runoff and pollutants from coming into contact with one another. Source Control BMPs are defined as any administrative action, design of a structural facility, usage of alternative materials, and operation, maintenance, inspection, and compliance of an area that aims to eliminate or reduce stormwater pollution

The following Source Control BMPs are included and will be implemented as part of the project.

3.2.1. Routine Non-Structural BMPS E

3.2.1.1. Education for Property Owners, Tenants, and Occupants

The Property Owner's Association (POA) will provide environmental awareness education materials. These materials will contain the information such as good housekeeping practices that contribute to the protection of the storm water quality and BMPs to eliminate or reduce pollution plus describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins, and storm drains. These materials will be made available by the City of Upland. The owner/developer is required to request these materials in writing at least 30 days prior to intended distribution and shall then be responsible for their timely distribution at the time of occupancy.

3.2.1.2 Spill Contingency Plan

A "Spill Contingency Plan" (Business Emergency/Contingency Plan Guidelines and Forms) shall be provided in accordance with Section 6.95 of the California Health and Safety Code.

3.2.1.3 Employee Training/Education Program

Materials based upon information provided through the Area-wide Stormwater Program Public Education Program will be used. Training and education program commitments will be conveyed, for the development via POA or development purchaser and this document.

3.2.1.4 Sweeping Private Parking Lot

Parking lot must be swept at least twice annually, prior to the storm season in the late summer or early fall, to reduce the amount of sediment, garden waste, and trash entering the storm drain systems.

3.2.1.5 Common Area Catch Basin Inspection

Drainage facilities (inlets, open channels and basins) must be inspected annually, in the late summer or early fall, and cleaned as needed, or if accumulated sediment/

debris fills 25% or more of the sediment/debris storage capacity of the facility. The POA will be responsible for post-construction operation and maintenance of drainage facilities shall evaluate all portions of the drainage facilities annually to determine the adequacy of the inspection and maintenance frequency, and report the evaluation findings to the Agency.

3.2.1.6 Activity Restrictions

The proposed project, will consists of an Educational Facility and although the following are not potential, there are still restricted as they would be on any other site of with similar intent.

Activity Restrictions will be enforced by this document and by education of The San Bernardino Unified School Districts employees, and Maintenance Staff thru education. ***Educations Material's have been included in Appendix F***

The following activities are restricted on all areas of this site:

- Fueling within any area on site
- Air/Water Supply area drainage
- Vehicle washing
- Outdoor material storage
- Pesticides
- Outdoor food processing
- Wash water for food preparation

Surface water quality protection will be required of San Bernardino Unified School District. Surface water quality activities shall also be conducted in conformance with the Water Quality Management Plan as it relates to the handling and disposal of contaminants. The following provides additional direction for controlling activities that may affect the environment of the project and/or surrounding areas.

3.2.2 Routine Structural BMPs

3.2.2.1 Landscape Planning

Landscape planning has considered the land suitability for urban uses and has taken into consideration the surrounding community goals and projected growth. This project landscape has been design to conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels. Plants have been grouped with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Landscaping

correlates to the climate, soil, related natural resources and existing vegetation of the site, as well as the type of development proposed. Ongoing maintenance consistent with County and City of San Bernardino Administrative Design Guidelines, plus fertilizer and pesticide usage consistent with the instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation shall be implemented.

3.2.2.2 Roof Runoff Controls

Residential and commercial sites must be designed to contain and infiltrate roof runoff, or direct roof runoff to vegetative swales or buffer areas.

3.2.2.3 Efficient Irrigation

Irrigation methods to minimize runoff of excess irrigation water across impervious surfaces and into the stormwater conveyance system have been utilized. Such measures included employing rain-triggered shutoff devices to eliminate or reduce irrigation during and immediately after precipitation, using mulches (such as wood chips) to minimize sediment in runoff and to maintain soil infiltration capacity, and coordinating design of the irrigation system and landscape to minimize overspray and runoff. Irrigation systems should consider the use of flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or water supply lines. Water conservation devices such as programmable irrigation timers are used.

3.2.2.4 Storm Drain Signage

Signage such as notices regarding discharge prohibitions at storm drain inlets to eliminate or reduce dumping and littering are required. The phrase "No Dumping - Flows to Creek," or an equally effective phrase as approved by the NPDES General Committee, must be stenciled on catch basins (inlets) to alert the public as to the destination of pollutants discharged into storm drains. This signage will be maintained by the POA.

3.2.2.5 Inlet Trash Racks

To reduce intake and transport through the storm drain system of large floatable debris, trash racks be provided where drainage from open areas enters storm drains. Grated inlets are considered a form of trash rack.

3.2.2.6 Trash Storage Areas and Litter Control

Trash container (dumpster) areas have been designed so that drainage from adjoining roofs and pavements is diverted around the area(s). Dumpsters will be leak proof and have attached workable covers. Trash area drains, will not be allowed to discharge offsite, or be connected to the municipal storm drain system.

POA will implement trash management and litter control procedures in the common areas aimed at reducing pollution of stormwater. The POAs will contract with a landscape maintenance contractor to provide this service during regularly scheduled maintenance, which should consist of litter patrol, proper disposal of pet litter,

emptying of trash receptacles in common areas, and noting trash disposal violations by homeowners or businesses and reporting the violations to the Association.

3.2.4 Source Control BMP Selection Matrix*

Project Category	Source Control BMPs																								
	Education of Property Owners	*Activity Restrictions*	*Spill Contingency Plan*	*Employee Training/Education Program*	*Street Sweeping Private Street and Parking Lots*	*Common Areas Catch Basin Inspection*	*Landscape Planning (SD-10)*	*Hillside Landscaping*	*Roof Runoff Controls (SD-11)*	*Efficient Irrigation (SD-12)*	*Protect Slopes and Channels*	*Storm Drain Signage (SD-13)*	*Inlet Trash Racks*	*Energy Dissipaters*	*Trash Storage Areas (SD-32) and Litter Control*	*Fueling Areas (SD-30)*	*Air/Water Supply Area Drainage*	*Maintenance Bays and Docks (SD-31)*	*Vehicle Washing Areas (SD-33)*	*Outdoor Material Storage Areas (SD-34)*	*Outdoor Work Areas (SD-35)*	*Outdoor Processing Areas (SD-36)*	*Wash Water Controls for Food Preparation Areas*	*Pervious Pavement (SD-20)*	*Alternative Building Materials (SD-21)*
Significant Re-development																									
Home subdivisions of 10 or more units																									
Commercial/ Industrial Development >100,000 ft^2	✓	✓		✓	✓	✓	✓		✓	✓		✓			✓										
Automotive Repair Shop																									
Restaurants																									
Hillside Development >10,000 ft^2																									
Development of impervious surface >2,500 ft^2																									
Parking Lots >5,000 ft^2 of exposed storm water	Y	N/A	Y	Y	Y	Y	Y	N/A	Y	Y	N/A	Y	Y	N/A	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N

* Provide justification of each Source Control BMP that will not be incorporated in the project WQMP, or explanation of proposed equally effective alternatives in the following table.

3.2.5 Justification for Source Control BMPs not incorporated into the project WQMP			
Source Control BMP	Yes	Justification/Alternative*	Implementation Description
Education of Property Owners	Yes		Refer to Section 3.2.1
Activity Restrictions	N/A		Refer to Section 3.2.1
Spill Contingency Plan	N/A		
Employee Training/Education Program	YES		
Street Sweeping Private Street and Parking Lots	YES		Refer to Section 3.2.1
Common Areas Catch Basin Inspection	YES		Refer to Section 3.2.1
Landscape Planning (SD-10)	YES	See map	Refer to Section 3.2.2
Hillside Landscaping	N/A		Refer to Section 3.2.2
Roof Runoff Controls (SD-11)	Yes	See map	Refer to Section 3.2.2
Efficient Irrigation (SD-12)	Yes		Refer to Section 3.2.2
Protect Slopes and Channels	N/A		
Storm Drain Signage (SD-13)	Yes	Per SD-13	Refer to Section 3.2.2
Inlet Trash Racks	Yes	Grated basins act as Trash racks	Refer to Section 3.2.2
Energy Dissipaters	N/A	Not a Project Feature	
Trash Storage Areas (SD-32) and Litter Control	Yes		Refer to Section 3.2.2
Fueling Areas (SD-30)	N/A	Not a Project Feature	
Air/Water Supply Area Drainage	N/A	Not a Project Feature	
Maintenance Bays and Docks (SD-31)	N/A	Not a Project Feature	
Vehicle Washing Areas (SD-33)	N/A	Not a Project Feature	
Outdoor Material Storage Areas (SD-34)	N/A	Not a Project Feature	
Outdoor Work Areas (SD-35)	N/A	Not a Project Feature	
Outdoor Processing Areas (SD-36)	N/A	Not a Project Feature	
Wash Water Controls for Food Preparation Areas	N	Not a Project Feature	
Pervious Pavement (SD-20)	N	Not a Project Feature	
Alternative Building Materials (SD-21)	N	Not a Project Feature	
*Attach additional sheets if necessary for justification.			

3.3 TREATMENT CONTROL BMPS

The project has been designed to eliminate or reduce the introduction of expected pollutants of concern into runoff from the project site through the implementation of Site Design and Source Control BMPs, the development may still have the potential for pollutants of concern to enter the MS4 or receiving waters. Pollutants of concern have adequately been addressed via Site Design and Source Control BMPs, Treatment Control BMPs are required. Project BMP's haven bee designed to minimize or eliminate pollutants in discharges from the project to achieve the appropriate standard, as specified in the Permit.

Treatment Control BMPs have been selected to address the identified pollutants and hydrologic conditions of concern. Treatment control BMPs must be designed to treat the stormwater quality flow or the stormwater quality volume from a development, and must be located to treat the required runoff volume or flow prior to discharging to any receiving water. Treatment control BMPs may also be provided offsite or through a regional-based BMP.

The following table summarizes the expected performance of Treatment Control BMPs in removing various pollutants of concern. This project design and WQMP has incorporated one or more Treatment Control BMPs of medium or high effectiveness in reducing those pollutants.

The following table lists Treatment Control BMPs and the primary design basis (flow-based or volume-based) to be used for designing BMPs. Sections 2.5.3.1 and 2.5.3.2 provide detailed guidance for determining the flow or volume of runoff from a project to be treated via Treatment Control BMPs.

The obligation to install treatment control BMPs at new development and redevelopment sites is met if, for a common scheme of development, BMPs are constructed with the requisite capacity to serve the entire common scheme, even if certain phases of the common scheme may not have BMP capacity located on that phase. BMP capacity must be functional before any phased work begins, thus may not be added on at the end of phased development.

3.3.1 Treatment Control BMP Effectiveness Matrix [1] (OC 2003)

Pollutant of Concern	Treatment Control BMP Categories							
	Biofilters	Detention Basins[2]	Infiltration Basins[3]	Wet Ponds or Wetlands	Filtration	Water Quality Inlets	Hydrodynamic Separator Systems [4]	Manufactured/ Proprietary Devices
Sediment/Turbidity	H/M	M	H/M	H/M	H/M	L	H/M (L for turbidity)	U
Nutrients	L	M	H/M	H/M	L/M	L	L	U
Organic Compounds	U	U	U	U	H/M	L	L	U
Trash & Debris	L	M	U	U	H/M	M	H/M	U
Oxygen Demanding Substances	L	M	H/M	H/M	H/M	L	L	U
Bacteria & Viruses	U	U	H/M	U	H/M	L	L	U
Oils & Grease	H/M	M	U	U	H/M	M	L/M	U
Pesticides (non-soil bound)	U	U	U	U	U	L	L	U
Metals	H/M	M	H	H	H	L	L	U

(1) Cooperative periodic performance assessment may be necessary. This Treatment Control BMP table will be updated as needed and as knowledge of stormwater treatment BMPs improves. (2) For detention basins with minimum 36-48-hour drawdown time. (3) Including trenches and porous pavement. (4) Also known as hydrodynamic devices and baffle boxes.	L: Low removal efficiency; H/M: High or medium removal efficiency; U: Unknown removal efficiency Sources: Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (1993), National Stormwater Best Management Practices Database (2001), and Guide for BMP Selection in Urban Developed Areas (2001), California Stormwater BMP Handbook—New Development and Redevelopment (2003).
Biofilters include: ▪ Grass swales ▪ Grass strips ▪ Wetland vegetation swales ▪ Bioretention Detention Basins include: ▪ Extended/dry detention basins with grass lining ▪ Extended/dry detention basins with impervious lining Infiltration Basins include: ▪ Infiltration basins ▪ Infiltration trenches Wet Ponds and Wetlands include: ▪ Wet ponds (permanent pool) ▪ Constructed wetlands	Filtration Systems include: ▪ Media filtration ▪ Sand filtration Water Quality Inlets include: ▪ Trapping catch basins ▪ Oil water separators Hydrodynamic Separation Systems Include ▪ Swirl Concentrators ▪ Cyclone Separators Manufactured/Proprietary Devices include: ▪ Other proprietary stormwater treatment devices as listed in the CASQA BMP Handbook ▪ Effective stormwater BMPs not specifically listed in this WQMP and/or newly developed treatment devices—treatment efficiencies are unknown but must be determined if proposed in the WQMP

3.4 BMP DESIGN CRITERIA

- The following Treatment Control BMP(s) (Flow Based or Volume Based) will be implemented even though the project is considered non-categorical.

Design Basis of Treatment Control BMPs

Implemented	Treatment Control BMP	Design Basis
	Vegetated Buffer Strips	Flow Based
✓	Vegetated Swale	
	Multiple Systems	
	Manufactured/Proprietary	
	Bioretention	Volume Based
	Wet Pond	
	Constructed Wetland	
	Extended Detention Basin	
✓	Water Quality Basin	
	Retention/Irrigation	
	Infiltration Basin	
	Infiltration Trench	
✓	Media Filter	
✓	Manufactured/Proprietary	

3.4.1 Flow Based Design Criteria

- Detailed calculations included in Attachment D.

3.4.2 Volume-Based Design Criteria

- Detailed calculations included in Attachment D.

Section 4
Operation and Maintenance

4.1 Operations and Maintenance

Operation and maintenance (O&M) requirements for all Source Control, Site Design, and Treatment Control BMPs shall be identified within the WQMP. The WQMP shall include the following:

SOURCE CONTROL BMP	Start up date	Implementation	Frequency	Inspection Frequency	Responsible Party
Education Of Property Owners	Building Operation	Per section 3.2.1.1	Once/yr		Building Facilities Manager
Employee Training /Education Program	Building Operation	Per section 3.2.1.2	Twice/year		Building Facilities Manager
Parking Lot Sweeping	Installation and/or Building Operation	Per section 3.2.1.3	Twice/year		Building Facilities Manager
Underside walk drain inspection	Installation and/or Building Operation	Per section 3.2.1.4	Twice/year		Building Facilities Manager
Efficient Irrigation	Installation and/or Building Operation	Per section 3.2.2.3	As part of landscape schedule		Building Facilities Manager
Roof runoff control	Installation and/or Building Operation	Per section 3.2.2.2	Twice/year		Building Facilities Manager
Trash Storage areas and Litter control	Installation and/or Building Operation	Per section 3.2.2.4	As part of landscape schedule		Building Facilities Manager
TREATMENT CONTROL BMPS					Building Facilities Manager
Vegetated Swale	Installation and/or Building Operation	Maintain all swales free of debris, trash and sediment	As part of landscape schedule		Building Facilities Manager

4.1.1 O&M DESCRIPTION AND SCHEDULE THAT MUST:

- BMP's that will require O&M and schedule of frequency :
  - ***Parking sweeping (2 times per year)***
  - ***Trash storage area clean up (as often as needed to keep area free of debris and trash.***
  - ***Maintenance of grassy swale as often as needed to keep free of trash, debris, and sediments that impede their efficiency.***
  - ***Maintenance of Efficient Irrigation (adjustments to irrigation system as needed and as part of the landscape maintenance schedule)***

- BMP start-up date will be immediately after installation of the site design feature (i.e. parking, trash enclosure) and/or building operation.

4.1.2 INSPECTION & MONITORING REQUIREMENTS THAT MUST:

- Water quality monitoring for the site.
- Self-inspections, record keeping and/or annual reporting requirements for BMP's will be as prescribed by the City of Upland for BMPs
- Should the City required Annual Reporting and/or Record Keeping, the responsible party will be:

  Contact: Jorge C. Mendez, AIA Assoc.
  Project Manager
  SBCUSD
  Facilities Management
  (909) 381-1238 x 4913

4.1.3 IDENTIFICATION OF RESPONSIBLE PARTIES THAT MUST:

- BMP O&M will be the responsibility of
  SBCUSD
  Facilities Management
  (909) 381-1238 x 4913

SECTION 5

FUNDING

5.1 Funding

The Permit requires that for all Treatment Control BMPs, a funding source or sources for operation and maintenance of each BMP be identified within the WQMP. Project proponents must:

- The owner via their facilities and operations department will be responsible for the funding and implementation of the BMPs.
- Funding source for O&M for this project will be implemented via the San Bernardino City School District yearly budget for operation and maintenance of all their facilities including the Little Mountain School.
- San Bernardino Unified School District (SBUSD) Facilities Management
  Jorge Mendez, AIA Assoc. Project Manager
  777 North F Street, San Bernardino, Ca 92410
  Phone (909) 381-1238 ext. 4915 Fax (909) 885-4218
  Jorge.Mendez@SBUSD.k12.ca.us

SECTION 6
WQMP Certification

6.1 Certification

This WQMP is in conformance with Santa Ana Regional Water Quality Control Board Order Number R8-2002-0012 (NPDES Permit No. CAS618036).

"This Water Quality Management Plan has been prepared for ***SBCUSD*** by ***Fraco Enterprises, Inc,*** it is intended to comply with the requirements of the ***City of San Bernardino,*** County of San Bernardino for **ROOSEVELT Elementary School II** as per City's design criteria requiring the preparation of a Water Quality Management Plan (WQMP). The undersigned is aware that Best Management Practices (BMPs) are enforceable pursuant to the City's/County's Water Quality Ordinance No. _____. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Stormwater Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity. "

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

_____ _____

Applicant's Signature Date

SBCUSD
Jorge C. Mendez,
Project Manager

_____ (909) 381-1238

Applicant's Name Applicant's Telephone Number

ARTICLE II

A-1: Maintenance Mechanism

A-2: Access & Maintenance

Attachment A-1

Maintenance Mechanisms

A-1.1 The Agency shall not accept stormwater structural BMPs as meeting the WQMP requirements standard, unless an O&M Plan is prepared (see WQMP Section 2.6) and a mechanism is in place that will ensure ongoing long-term maintenance of all structural and non-structural BMPs. This mechanism can be provided by the Agency or by the project proponent. As part of project review, if a project proponent is required to include interim or permanent structural and non-structural BMPs in project plans, and if the Agency does not provide a mechanism for BMP maintenance, the Agency shall require that the applicant provide verification of maintenance requirements through such means as may be appropriate, at the discretion of the Agency, including, but not limited to covenants, legal agreements, maintenance agreements, conditional use permits and/or funding arrangements (OC 2003)

A-1.2 Maintenance Mechanisms

1. **Public entity maintenance**: The Agency may approve a public or acceptable quasi-public entity (e.g., the County Flood Control District, or annex to an existing assessment district, an existing utility district, a state or federal resource agency, or a conservation conservancy) to assume responsibility for operation, maintenance, repair and replacement of the BMP. Unless otherwise acceptable to individual Agencies, public entity maintenance agreements shall ensure estimated costs are front-funded or reliably guaranteed, (e.g., through a trust fund, assessment district fees, bond, letter of credit or similar means). In addition, the Permittees may seek protection from liability by appropriate releases and indemnities.

   The Agency shall have the authority to approve stormwater BMPs proposed for transfer to any other public entity within its jurisdiction before installation. The Permittee shall be involved in the negotiation of maintenance requirements with any other public entities accepting maintenance responsibilities within their respective jurisdictions; and in negotiations with the resource agencies responsible for issuing permits for the construction and/or maintenance of the facilities. The Agency must be identified as a third party beneficiary empowered to enforce any such maintenance agreement within their respective jurisdictions.

2. **Project proponent agreement to maintain stormwater BMPs:** The Agency may enter into a contract with the project proponent obliging the project proponent to maintain, repair and replace the stormwater BMP as necessary into perpetuity. Security or a funding mechanism with a "no sunset" clause may be required.

3. **Assessment districts:** The Agency may approve an Assessment District or other funding mechanism created by the project proponent to provide funds for stormwater BMP maintenance, repair and replacement on an ongoing basis. Any agreement with such a District shall be subject to the Public Entity Maintenance Provisions above.

4. **Lease provisions:** In those cases where the Agency holds title to the land in question, and the land is being leased to another party for private or public use, the Agency may assure stormwater BMP maintenance, repair and replacement through conditions in the lease.

5. **Conditional use permits:** For discretionary projects only, the Agency may assure maintenance of stormwater BMPs through the inclusion of maintenance conditions in the conditional use permit. Security may be required.

6. **Alternative mechanisms:** The Agency may accept alternative maintenance mechanisms if such mechanisms are as protective as those listed above.

Attachment A-2

Water Quality Management Plan and Stormwater BMP Transfer, Access and Maintenance Agreement (adapted from documents from the Ventura County Stormwater Management Program)

Recorded at the request of:

City of _____

After recording, return to:

City of _____

City Clerk _____

Water Quality Management Plan and Stormwater BMP Transfer, Access and Maintenance Agreement

OWNER: _____

PROPERTY ADDRESS: _____

_____

APN: _____

THIS AGREEMENT is made and entered into in

_____, California, this _____ day of

_____ , by and between

_____, herein after

referred to as "Owner" and the CITY OF _____, a municipal corporation, located in the County of San Bernardino, State of California hereinafter referred to as "CITY";

WHEREAS, the Owner owns real property ("Property") in the City of

_____, County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as

_____ within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the City, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City;

WHEREAS, said BMPs, with installation and/or implementation on private property and draining only private property, are part of a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner in accordance with the terms of this Agreement;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner hereby provides the City of City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full.

4. The City may require the owner to post security in form and for a time period satisfactory to the city to guarantee the performance of the obligations state herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director may withdraw any previous stormwater-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

5. This agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

6. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

7. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

8. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

9. Time is of the essence in the performance of this Agreement.

10. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

IF TO CITY:

_____

_____

_____

_____

IF TO OWNER:

_____

_____

_____

_____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

APPROVED AS TO FORM:

_____
City Attorney

_____
CITY OF

_____
Name

_____
Title

ATTEST:

_____
City Clerk Date

OWNER:

_____
Name

_____
Title

OWNER:

_____
Name

_____
Title

NOTARIES ON FOLLOWING PAGE

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/Illustration)

Attachment B
Tables

Table B-1
303(d) List of Impaired Water Bodies

Waterbody	Pollutant					
	Bacteria Indicators/ Pathogens	Metals	Nutrients	Organic Enrichment	Sedimentation/Siltation	Suspended Solids
Big Bear Lake		X	X		X	
Canyon Lake (Railroad Canyon Reservoir)	X		X			
Chino Creek Reach 1	X		X			
Chino Creek Reach 2	X					
Cucamonga Creek, Valley Reach	X					
Grout Creek		X	X			
Knickerbocker Creek	X	X				
Lytle Creek	X					
Mill Creek (Prado Area)	X		X			X
Mill Creek Reach 1	X					
Mill Creek Reach 2	X					
Mountain Home Creek	X					
Mountain Home Creek, East Fork	X					
Prado Park Lake	X		X			
Rathbone (Rathbun Creek)			X		X	
Santa Ana River, Reach 3	X					
Santa Ana River, Reach 4	X					
Summit Creek			X			

NOTES:

1) Summary of the 2002 303(d) Listed Water Bodies and Associated Pollutants of Concern from RWQCB Region 8. Check for updated lists from the RWQCB.

2) Chlorides, pesticides, salinity, total dissolved solids (TDS), toxicity, and trash are listed impairments within the 303(d) table, however, they are not impairments in the above waterbodies.

Table B-2
C Values Based on Impervious/Pervious Area Ratios

% Impervious	% Pervious	C
0	100	0.15
5	95	0.19
10	90	0.23
15	85	0.26
20	80	0.30
25	75	0.34
30	70	0.38
35	65	0.41
40	60	0.45
45	55	0.49
50	50	0.53
55	45	0.56
60	40	0.60
65	35	0.64
70	30	0.68
75	25	0.71
80	20	0.75
85	15	0.79
90	10	0.83
95	5	0.86
100	0	0.90

NOTE:

Obtain individual runoff coefficient C-Factors from the local agency or from the local flood control district.

If C-Factors are not available locally, obtain factors from hydrology text books or estimate using this table.

Composite the individual C-Factors using area-weighted averages to calculate the Composite C Factor for the area draining to a treatment control BMP.

Do not use the C-Factors in this table for flood control design or related work.

Attachment C
Pollutants of Concern

Pollutants of Concern

- *Bacteria and Viruses* – Bacteria and Viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically cause by the transport of animal or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses, can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

- *Metals* – The primary source of metal pollution in stormwater is typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. Metals are also raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. At low concentrations naturally occurring in soil, metals may not be toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications (OC 2003).

- *Nutrients* – Nutrients are inorganic substances, such as nitrogen and phosphorus. Excessive discharge of nutrients to water bodies and streams causes eutrophication, where aquatic plants and algae growth can lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms. Primary sources of nutrients in urban runoff are fertilizers and eroded soils.

- *Pesticides* – Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Relatively low levels of the active component of pesticides can result in conditions of aquatic toxicity. Excessive or improper application of a pesticide may result in runoff containing toxic levels of its active ingredient (OC 2003).

- *Organic Compounds* – Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life (OC 2003).

- *Sediments* – Sediments are solid materials that are eroded from the land surface. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

- *Trash and Debris* – Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may

have a significant impact on the recreational value of a water body and aquatic habitat. Trash impacts water quality by increasing biochemical oxygen demand.

- *Oxygen-Demanding Substances* – This category includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions. A reduction of dissolved oxygen is detrimental to aquatic life and can generate hazardous compounds such as hydrogen sulfides.

- *Oil and Grease* – Oil and grease in water bodies decreases the aesthetic value of the water body, as well as the water quality. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.

Attachment D
Flow- and Volume-Based BMP Design Calculations

INSTRUCTIONS FOR ESTIMATING VOLUME- AND FLOW-BASED BMP DESIGN RUNOFF QUANTITIES[4]

1) Identify the "BMP Drainage Area" that drains to the proposed BMP element. This includes all areas that will drain to the proposed BMP element, including pervious areas, impervious areas, and off-site areas, whether or not they are directly or indirectly connected to the BMP element. Calculate the BMP Drainage Area (A) in acres.

2) Outline the Drainage Area on the NOAA Atlas 14 Precipitation Depths (2-year 1-hour Rainfall) map (Figure D-1).

3) Determine the area-averaged 2-year 1-hour rainfall value for the Drainage Area outlined above.

A. Flow-Based BMP Design

1) Calculate the composite runoff coefficient, C_{BMP}, as defined in part A.2, above.

2) Determine which Region the BMP Drainage Area is located in (Valley, Mountain or Desert).

3) Determine BMP design rainfall intensity, I_{BMP}, by multiplying the area-averaged 2-year 1-hour value from the NOAA Atlas 14 map by the appropriate regression coefficient from Table D-1 ("I"), and then multiplying by the safety factor specified in the criteria – usually a factor of 2.

---

[4] Rainfall analysis to develop regression coefficients in Table D-1 and modifications to the NOAA Atlas 14 map were conducted by:

Hromadka II, T.V., Professor Emeritus, Department of Mathematics, California State University, Fullerton, and Adjunct Professor, Department of Mathematical Sciences, United States Military Academy, West Point, NY

Laton, W.R , Assistant Professor, Department of Geological Sciences, California State University, Fullerton

Picciuto J.A.., Assistant Professor, Department of Mathematical Sciences, United States Military Academy, West Point, NY

With assistance from:

Rene Perez, M.S. Candidate, Department of Geological Sciences, California State University, Fullerton, and

Jim Friel, Ph.D. Professor Emeritus, Department of Mathematics, California State University, Fullerton

Reported as follows:

1. Hromadka II, T.V., Laton, W.R., and Picciuto J.A., 2005. Estimating Runoff Quantities for Flow and Volume-based BMP Design. Final Report to the San Bernardino County Flood Control District.
2. Laton, W.R., Hromadka II, T.V., and Picciuto J.A., 2005. Estimating Runoff Quantities for Flow and Volume-based BMP Design (submitted). Journal of the American Water Resources Association.

4) Calculate the target BMP flow rate, Q, by using the following formula (see Table D-2 below for limitations on the use of this formula):

$$Q = C_{BMP} \cdot I_{BMP} \cdot A$$

where: **Q** = flow in ft^3/s

I_{BMP} = BMP design rainfall intensity, in inches/hour

A = Drainage Area in acres

C_{BMP} = composite runoff coefficient

Table D-1: Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P_6).

Quantity	Valley 85% upper confidence limit	Mountain 85% upper confidence limit	Desert 85% upper confidence limit
I	0.2787	0.3614	0.3250
P_6	1.4807	1.9090	1.2371

Table D-2: Use of the flow-based formula for BMP Design (CASQA 2003).

	Composite Runoff Coefficient, "C"			
BMP Drainage Area (Acres)	**0.00 to 0.25**	**0.26 to 0.50**	**0.51 to 0.75**	**0.76 to 1.00**
0 to 25	**Caution**	**Yes**	**Yes**	**Yes**
26 to 50	**High Caution**	**Caution**	**Yes**	**Yes**
51 to 75	**Not Recommended**	**High Caution**	**Caution**	**Yes**
76 to 100	**Not Recommended**	**High Caution**	**Caution**	**Yes**

If the flow-based BMP formula use case, as determined by Table D-2, shows "Caution," "High Caution," or "Not Recommended," considering the project's characteristics, then he project proponent must calculate the BMP design flow using the unit hydrograph method, as specified in the most current version of the San Bernardino County Hydrology Manual, using the design storm pattern with rainfall return frequency such that the peak one hour rainfall depth equals the 85th-percentile 1-hour rainfall multiplied by two.

B. Volume-Based BMP Design

1) Calculate the "Watershed Imperviousness Ratio", i, which is equal to the percent of impervious area in the BMP Drainage Area divided by 100.

2) Calculate the composite runoff coefficient C_{BMP} for the Drainage Area above using the following equation:

$$\mathbf{C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04}$$

where: $\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

i = watershed imperviousness ratio.

3) Determine which Region the Drainage Area is located in (Valley, Mountain or Desert).

4) Determine the area-averaged "6-hour Mean Storm Rainfall", P_6, for the Drainage Area. This is calculated by multiplying the area averaged 2-year 1-hour value by the appropriate regression coefficient from Table 1.

5) Determine the appropriate drawdown time. Use the regression constant a = 1.582 for 24 hours and a = 1.963 for 48 hours. *Note: Regression constants are provided for both 24 hour and 48 hour drawdown times; however, 48 hour drawdown times should be used in most areas of California. Drawdown times in excess of 48 hours should be used with caution as vector breeding can be a problem after water has stood in excess of 72 hours. (Use of the 24 hour drawdown time should be limited to drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.)*

6) Calculate the "Maximized Detention Volume", P_0, using the following equation:

$$\mathbf{P_0 = a \cdot C_{BMP} \cdot P_6}$$

where: $\mathbf{P_0}$ = Maximized Detention Volume, in inches

a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,

$\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

$\mathbf{P_6}$ = 6-hour Mean Storm Rainfall, in inches

7) Calculate the "Target Capture Volume", V_0, using the following equation:

$$\mathbf{V_0 = (P_0 \cdot A) / 12}$$

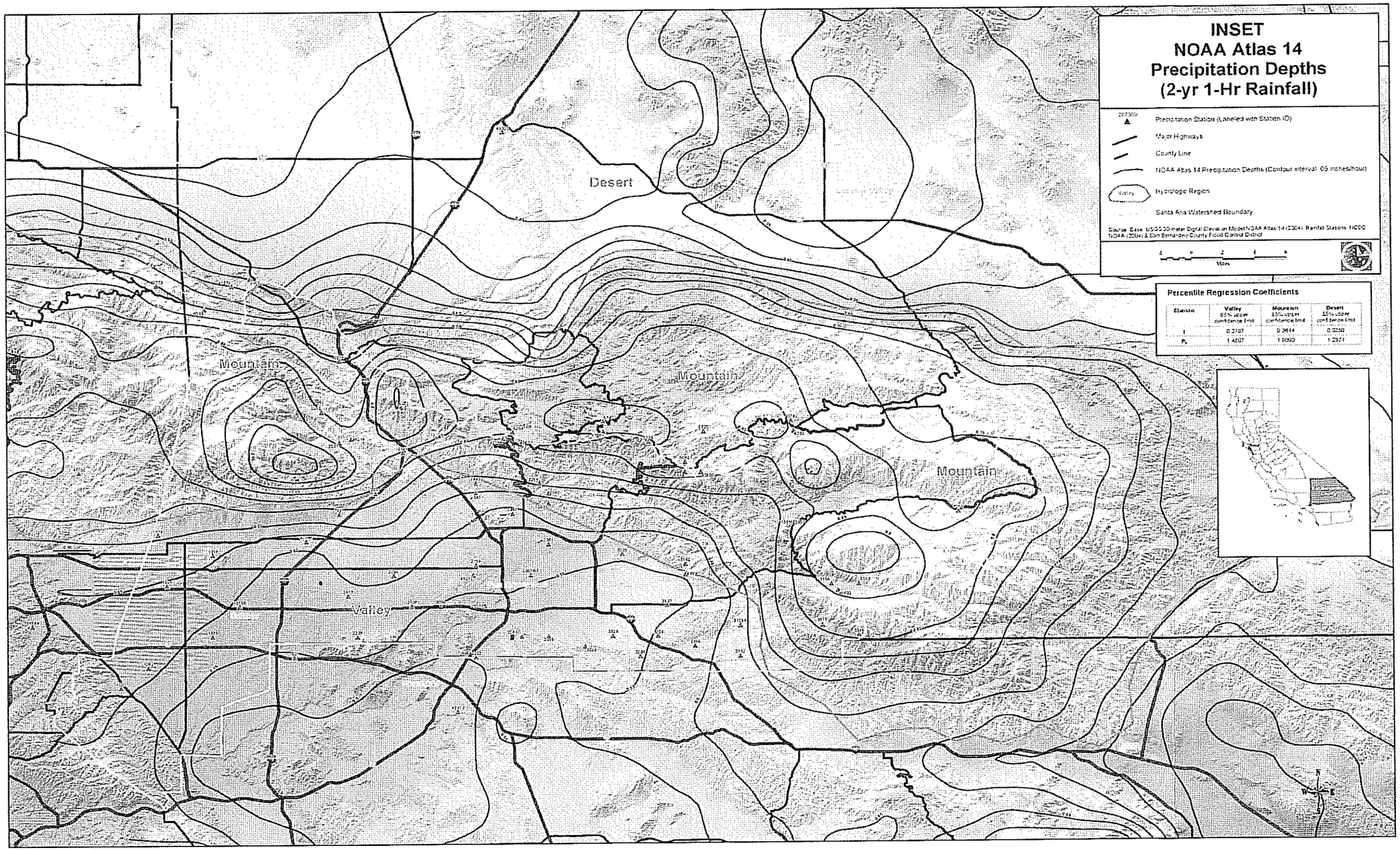
where:

$\mathbf{V_0}$ = Target Capture Volume, in acre-feet

$\mathbf{P_0}$ = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

Figure D-1: NOAA Atlas 14 Inset Map.



Attachment F
Percolation Rates

RESULTS OF PERCOLATION TESTING
Proposed Roosevelt II Elementary School
San Bernardino, California

October 14, 2008

Converse Project No. 04-81-156-04

Converse Consultants
Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

October 14, 2008

Mr. Michael Plunkett
Project Manager
San Bernardino City Unified School District
777 North "F" Street
San Bernardino, CA 92410

Subject: RESULTS OF PERCOLATION TESTING
Proposed Roosevelt II Elementary School
San Bernardino, California
Converse Project No. 04-81-156-04

Reference: "Geotechnical Investigation Report, Roosevelt II - Elementary School, DSA Application No. 04-107199, DSA File No. 36-55, Southeast Corner of Mount Vernon Avenue and 16th Street, City of San Bernardino, California", Converse Consultants, Project No. 04-81-156-03, dated November 20, 2006.

Dear Mr. Plunkett:

Converse has prepared this letter report to present percolation rate for the infiltration basin within the proposed Roosevelt II Elementary School site in San Bernardino, California. The project site is shown in Figure No. 1, *Site Location Map*. The above referenced geotechnical investigation report was prepared for the Roosevelt II Elementary School site dated November 20, 2006 and has been provided to the San Bernardino City Unified School District.

Location of the percolation testing is shown on Figure No. 2, *Approximate Percolation Test / Boring Location Map*.

PERCOLATION TESTING PROCEDURES

One (1) boring (BH-1) was drilled to five (5) feet below existing ground surface (bgs) on October 13, 2008. A detailed description is provided in Appendix A, *Logs of Borings*. An open-end 2-inch diameter perforated pipe was installed in the hollow stem augers prior to removal of the augers.

Percolation testing was conducted in accordance with the County of San Bernardino, Department of Environmental Health Services, On-Site Waste Water Disposal System, Soil Percolation Test, Report Standards: Suitability of Lots and Soils for Use of Leachlines or Seepage Pits, dated August 1992.

10391 Corporate Drive, Redlands, California 92374
Telephone: (909) 796-0544 ◆ Facsimile: (909) 796-7675 ◆ e-mail: redlands@converseconsultants.com

The continuous pre-soak (falling-head) test procedure was utilized for percolation testing as outlined in the above referenced guidelines. The percolation test hole was filled with water and allowed to presoak prior to testing.

During testing, the borehole was filled with water to the existing ground surface. When approximately thirty (30) minutes elapsed, the water depth in the boring was measured and logged. Following each reading, the test hole was refilled to the existing ground surface. This method was repeated for a minimum of six (6) hours for the percolation test hole. The last two (2) readings were made without adding water to the hole. The drop in water level was recorded to the nearest 1/100th inch.

PERCOLATION TEST RESULTS

The test data sheet is provided in Appendix B, *Percolation Test Data Sheet*. The test result is provided in the table below.

Table No. 1, Percolation Test Result

Boring Number	Percolation Results (g/sf/d*)
BH-1	2.2

*gallons per square foot per day.

Please contact us at (909) 796-0544 if you have any further questions. The opportunity to be of continued service to San Bernardino City Unified School District is appreciated.

CONVERSE CONSULTANTS

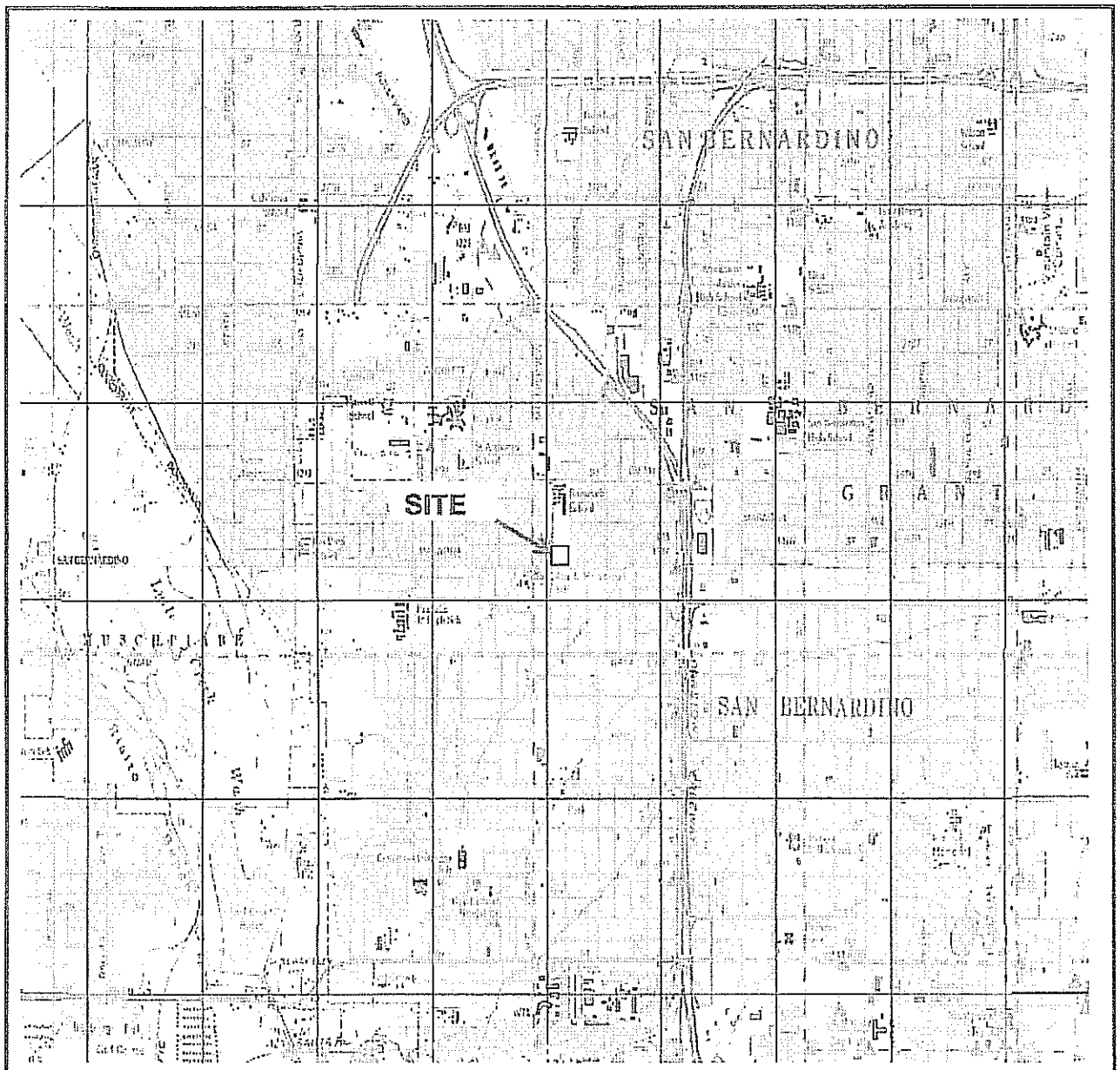
Roy J. Rushing, C.E.G.
Senior Geologist

PROFESSIONAL GEOLOGIST
ROY J. RUSHING
NO. 1080
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Dist: 2/Addressee

Encl: Figure No. 1, *Site Location Map*
Figure No. 2, *Approximate Percolation Test / Boring Location Map*
Appendix A, *Log of Boring*
Appendix B, *Percolation Test Data Sheet*

JPG/RJR/HSQ/mjr



Source:
United States Geological Survey, 7.5 Minute Series Quadrangle, San Bernardino North, California 1996.

SITE LOCATION MAP

ROOSEVELT II ELEMENTARY SCHOOL

San Bernardino, California

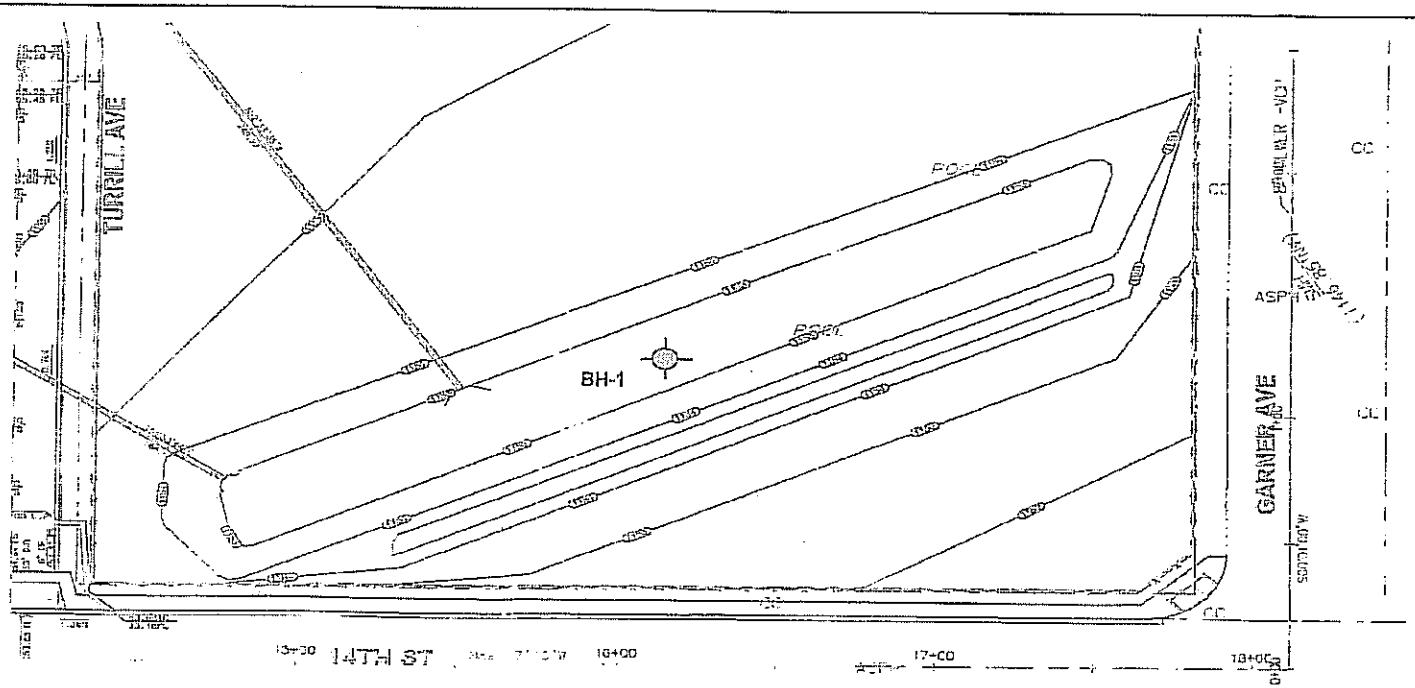
04-81-156-04

For: San Bernardino City Unified School District

Figure No.:

1

Converse Consultants



EXPLANATION

BH-1 Number and Approximate Boring location

APPROXIMATE PERCOLATION TEST/BORING LOCATION MAP

ROOSEVELT II ELEMENTARY SCHOOL

San Bernardino, California

For: San Bernardino City Unified School district

Converse Consultants

Project Number: 04-81-155-04

Scale: NTS

Date: Oct-03

Figure No: 2

APPENDIX A

LOG OF BORING

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

- STANDARD PENETRATION TEST — Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE — 2.42" I.D. sampler
- DRIVE SAMPLE — No recovery
- BULK SAMPLE
- GROUNDWATER WHILE DRILLING
- GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE (Results shown in Appendix B)		STRENGTH	
		Pocket Penetrometer	p
		Direct Shear	ds
		Direct Shear (single point)	ds*
		Unconfined Compression	uc
		Triaxial Compression	tx
CLASSIFICATION		Vane Shear	vs
Plasticity	pl		
Grain Size Analysis	mc	Consolidation	c
Passing No. 200 Sieve	wa	Collapse Test	cl
Sand Equivalent	se	Resistance (R) Value	r
Expansion Index	ei	Chemical Analysis	ca
Compaction Curve	md	Electrical Resistivity	er
Hydrometer	h	Permeability	perm
Distort	Dist.	Soil Cement	sc

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Roosevelt II Elementary School Site
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-04

Drawing No A - 1

Log of Boring No. BH - 1

Dates Drilled: 10/13/2008 Logged by: JG Checked By: RJR

Equipment: CME 75/ 8" HSA Driving Weight and Drop: N/A

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal): **SILTY SAND (SM):** fine-grained, light brownish gray.						
5		End of boring at 5.0 feet. No groundwater encountered. 5 feet of 2" diameter slotted PVC pipe installed for percolation testing. Hole presoaked at 8:00 am on 10/13/2008.						

Converse Consultants

Roosevelt II Elementary School Site
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-04 Drawing No. A - 2

Log of Boring No. BH - 1

Dates Drilled: 10/13/2008 Logged by: JG Checked By: RJR

Equipment: CME 75/ 8" HSA Driving Weight and Drop: N/A

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal): **SILTY SAND (SM):** fine-grained, light brownish gray.						
5		End of boring at 5.0 feet. No groundwater encountered. 5 feet of 2" diameter slotted PVC pipe installed for percolation testing. Hole presoaked at 8:00 am on 10/13/2008.						

Converse Consultants

Roosevelt II Elementary School Site
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-04 Drawing No. A - 2

APPENDIX B

PERCOLATION TEST DATA SHEET

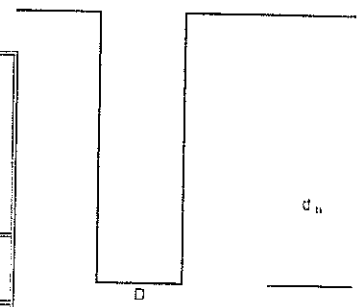
Percolation Testing

Test No BH-1

Job Name: Roosevelt 2 Elementary School
Job No. 04-81-156-04
Location: San Bernardino, CA
Test Date: October 13, 2006

Depth of Boring (d_b): 5.0 feet
Diameter of Boring (D): 0.50 feet
Technician: CG
Concerns/Issues:

Time of Testing			Depth to Water Level						
Initial Time T_i	Final Time T_f	Time Interval ΔT (hr)	Depth to Bottom d_b (feet)	Initial Height d_i (feet)	Final Height d_f (feet)	Drop in Height $F = d_i - d_f = \Delta d$ (feet)	Average length of water column L_{ave} (feet)	Q $(F D 9) / (L_{ave} \Delta T)$ g/sf/d	
Presoak									
Percolation Test									
10:27 AM	10:57 AM	0.50	4.5	0.0	1.1	1.10	3.95	2.51	
11:02 AM	11:32 AM	0.50	4.5	0.0	1.1	1.10	3.95	2.51	
11:33 AM	12:02 PM	0.48	4.4	0.0	1.1	1.10	3.85	2.66	
12:03 PM	12:34 PM	0.52	4.4	0.0	1.1	1.10	3.85	2.49	
12:35 PM	1:04 PM	0.48	4.4	0.0	1.1	1.10	3.85	2.66	
1:05 PM	1:34 PM	0.48	4.4	0.0	1.1	1.10	3.85	2.66	
1:35 PM	2:05 PM	0.50	4.4	0.0	1.1	1.10	3.85	2.57	
2:06 PM	2:36 PM	0.50	4.4	0.0	1.1	1.10	3.85	2.57	
2:36 PM	3:05 PM	0.48	4.4	1.1	1.8	0.70	2.95	2.21	
3:06 PM	3:36 PM	0.50	4.4	1.8	2.4	0.60	2.30	2.35	



Most Conservative Q (g/sf/d)= 2.2

Figure No B-3