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Technical Assignment 1

Unionville High School
Additions and Renovations

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Executive Summary

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Technical Report One analyzes and discusses several main features of this construction project. Readers of this report will find key information and descriptions that allow for familiarization and an understanding of both the building itself as well as the construction process.

The Unionville High School Building Additions and Renovations is a 319,000 square foot public high school building residing in the public sector. New additions, renovations, and permanent demolition of certain portions of the existing building make up the majority of this construction project, with smaller items such as sitework and paving taking place as well. Wohlsen Construction was selected by the Owner, Unionville-Chadds Ford School District, to carry out the constrution of the building desiged by MM Architects, Inc.

Educational buildings are often in need of expansion or renovation, as is the case with Unionville High School. Cost, while important, is not the main driving factor for this project. On the other hand, keeing the building open during construction is of utmost importance. An elaborately phased construction process has been developed and incorporated in this project. Keeping certain spaces in use while others are built or renovated is imperative as disruption of students or staff members is not an option. Phasing also allowed Wohlsen to employ a relatively small on-site staff, as the construction process was divided and mapped out precisely using multipe phases and subphases.

The Unionville High School Building serves as both the Unionville-Chadds Ford School District Administrative Office building as well as the home of Unionville High School. Although no rating has been specified, the building design incorporates numerous sustainable features and building construction practices and a LEED certification is the goal. All waste material is to be recycled per LEED standards. Other features such as low slow lavatory fixtures and occupancy sensprs have been incorporated in the building design as well. High end finishes are to be installed in many locations within the building, specifically the new state-of-the-art auditorium and adjacent entry way which will utilize ceramic floor tile and stained wood strim. Further discussion regarding the owner and the building design intent is provided as well as a comprehensive building summary and cost analyses.

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Project Schedule Summary

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Upon receiving design documents from MM Architects, Inc., Wohlsen construction began the scheduling process. Once complete, Wohlsen had created an elaborately phased schedule to effectively manage the project throuhgout the construction process. In total, 4 phases are to be used with a total of 17 subphases. Phased construction made the most sense for a project of this size. Firstly, the contruction was to happen at several locations on the site. Phasing the construction allowed for a systematic approach to the building process. Another reason to break the projet into phases was the owner's desired use of the building. With a new auditorium set to cap the North end of the building, the existing auditorium would no longer be needed. Until the new auditorium was ready, however, the existing auditorium needed to remain useable. The same line of thought can be applied to the new gymnasium.

Phase 1 starts the construction of the project with the addition of the Unionville-Chadds For School District Administrative Building. As all of this project was new construction, no demolition was required. Phase 2 and 3 focus on both new renovations and renovations of existing spaces. The new auditorium is the focal point of phase 2, with renovations to existing classroom space and the existing auditorium taking place as well. Finally, phase 4 focuses on the demolition of existing one story classroom space and building the new gymnasium at that location. During this fourth and final phase, the existing auditorium will be renovated into athletic spaces such as wrestling and weight room, while the eastern most portion of the building will be completely demolished. A phasing diagram and building area key can be seen in APPENDIX A. Each phase incorporates roughly the same construction process as the rest of the phases. A summary schedule has been prepared for Phase 1, area D of the building. A project summary schedule can be seen in APPENDIX B.

Building Systems Summary

Building Systems Summary

The chart below shows a breakdown of the building systems summarized in this portion of the report. Each section describes the system and outlines the important information regarding that system.

Yes	No	Scope of Work
✓		Demolition
✓		Structural Steel Frame
✓		Cast-In-Place Concrete
	✓	Precast Concrete
✓		Mechanical System
✓		Electrical System
✓		Masonry
	✓	Curtain Wall
	✓	Support of Excavation

Figure 1: Building Systems Breakdown

Demolition

Many new spaces are planned as part of this large public education project. In addition to the new construction on the building, demolition is required as many renovations are to take place during the project. Wrestling, physical education, and fitness and weight room space are set to replace half of the existing gymnasium once demolition of the existing facility have been demolished, and a new gymnasium is set to be constructed on the West side of the building. The existing auditorium is to be renovated into classroom space as a brand new 1,200-seat auditorium set to be built at the North end of the building, certain to become the new focal point of the building.

Material to be removed includes structural CMU block, brick, windows, doors, structural steel, cast-in-place concrete, stage flooring, drywall, and roofing materials. Some items, such as acoustical wall panels from the existing auditorium, are to be saved and reused in other locations within the new building. All material is to be demoed by B&P Neal Demolition, who is also responsible for the proper removal of all materials. One exception is asbestos: the owner, Unionville-Chadds Ford School District, is responsible for all removal of asbestos. Once removed, B&P Neal is required to wait 10 calendar days before they are permitted to return to their demolition duties. During the process, several instances of asbestos occurred including readings from both ceiling and floor tiles.

Figure 2: Demolition during Phase 4

Structural

Several types of structural elements are to be incorporated in the new Unionville High School Building. The primary foundation system uses several types and sizes of structural steel columns in tandem with reinforced concrete piers and footers, a 4" concrete slab on grade on top of 4" of crushed stone, and 16" CMU block for the foundation walls. Although primarily made up of W-flange columns, several locations throughout the foundation system utilize hollow structural steel members. HSS8x8x1/2 columns are used on the Western side of the building, while W10x33 and W14x90 are the two most prevalent w-flange sizes used in the foundation system. In most areas, the steel columns and CMU block walls run more than one story and make up the structure for exterior walls for the building. Reinforced concrete piers designed to carry the load of the columns range from 1'10" x 1'10" to 3'0" x 1'10" in size. There are several sizes of strip footings using primarily #5 rebar as well as various column spread footing sizes using #4, #6, and #8 rebar.

The steel erection on this project required the use of a 90-ton crawler crane. The need to move laterally along the portion of the building during each phase of construction made a crawler crane the best choice for this specific project. Structural steel erection is present in each phase, meaning the crane will be used at several points throughout the projects lifetime. Due to the many phases and subphases during construction, crane location changes several times throughout the project.

The upper floors of the building utilize a structural steel skeleton system composed almost entirely of W-flange beams, primarily W10, W14, W18, and W21 members. In the instance of an elevator shaft, however, 8" CMU block is to make up the structure for the wall. Due to the multiple elevations of the land on site, several types of flooring systems have been designed. A 4" slab on grade on top of 4" crushed rock serves as the flooring system for the portion of the building sitting on soil, while a concrete on metal deck system is to be used when an area is above a preceding floor.

A variety of roofing systems are to be used throughout the building, depending on the area. Due to the large span and the barreled roof design, 48LH13 joists have been chosen as the structure for the auditorium roof. Each joist has 8 foot wide bays, a curved top chord, and a 7 ½" height between the seat and the bottom chord. The new gymnasium will feature a similar roofing system, utilizing W10x39 truss with a curved top chord.

Figure 3: Barreled Auditorium Roof

Cast-In-Place Concrete

All cast-in-place concrete used on the UHS Additions and Renovations project is to be designed per ACI 301. Items using CIP concrete include column piers, spread footings, strip footings, foundation walls, suspended slabs, stairs and access ramps, and retaining walls. All CIP concrete must meet minimum 28-day strength of 4000psi with a slump ranging from 2" to 4".

Formwork and shoring is to be provided by the subcontractor and designed to meet ACI 301 standards. Formwork is to remain in place until the concrete in question has reached at least 90% of its 28 day compressive strength. Form-facing panels are to be used for any smooth-formed finished concrete. These panels are designed to provide continuous smooth concrete surfaces, suitable for an exposed finished face. Plywood, metal, or other materials approved by the owner are acceptable to meet this requirement. Rough-formed concrete will be used in most applications and can also be formed using the same materials listed above. Any cylindrical member, including columns and pedestals, is to be constructed from metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce minimal or no irregularities on the surface of the concrete.

Reinforcement and formwork installation must be checked before any concrete placement can occur. Concrete is to be placed in layers such that no new concrete is placed on already hardened concrete, eliminating the possibility of seams or weak planes within the slab. Construction joints are to be provided for any slab that cannot be poured continuously. A mechanical vibrator is to be used in order to ensure equal and should be used only on the newest layer of concrete. Over vibration can compromise the quality of the concrete, so care must be taken when consolidating.

Figure 4: New Floor: Concrete over Geofoam Blocks

Mechanical

With 319,000 square feet to condition, the Unionville High School Building utilizes 22 Air Handling Units, 4 existing and 18 new. The 4 existing units as well as 15 of the new AHU's are located on the roof, with the remaining 3 new units housed in mechanical rooms within the building. The mechanical rooms housing these units are located on the 2nd and 3rd floors, with AHU's 10 and 11 located in mechanical room 30.9A and AHU 17 located in mechanical room 201.1. All standard classrooms loads are handles by Innovent Laser Dedicated Outside Air Systems (DOAS), with supply fan loads ranging from 5,500 to 9,900 CFM. The auditorium is supplied completely by one unit, an Innovent RHXC Single Zone Heat Recovery VAV Unit with a max supply fan load of 26,000 CFM. Another single zone heat recovery system is used in the Gymnasium, with an Innovent 5000 VAV unit supplying a maximum of 32,000 CFM. In total 11 DOAS, 2 combinations DOAS/VAV, 7 VAV, and 2 CAV units are to be used to service the building.

A total of 10 Blower Coil Units service the building as well, all of which are provided by Trane. Each 4 pipe BCU uses interlocks with a specific AHU and services multiple locations. The maximum loading capacity of the air sides of the units range from 300 to 2,770 CFM, while the cooling coil system loads range from 1.0 to 7.0 GPM and the heat coil loads range from 1.0 to 4.5 GPM. Finally, Vulcan DV-412 baseboard radiators have been used in several locations, generally some of the smaller spaces within the school including special education classrooms and personal offices. Each radiator is to be installed 4" from the top of the finished floor and is designed to handle a capacity of 5,400, 9,000, or 15,300 (corridor) BTU load depending on the space.

The new gymnasium and auditorium are to be fully sprinklered per NFPA 13 specifications. Sprinklers are required in all renovated spaces and every area within the newly built portion of the building, with renovated spaces remaining protected under the existing system. Pendant sprinklers are used in all spaces, most of which have covers. Sprinklers without covers are located in mechanical rooms, storage space, or other rooms with no ceiling.

Electrical

The Unionville High School utilizes a 35000 Volt service entrance into metal-enclosed switchgear provided by S&C Electric Company which feeds into a 2500KVA 34.5/19.9KV to 4.16/2.4KV Outdoor Oil Filled Transformer, through a metering station, and finally into a 1500KVA Oil Filled Transformer with a 4160 Volt, 3 Phase primary, and a 480/277V, 3 phase, 4 wire Y transformer secondary. Due to the varying uses throughout the building, both 480/277V and 280/120V service is used throughout the building. All of the lighting within the building is serviced by 480/277V, 3 phase power as well as all blower coil units (BCU) and air handling units (AHU). All equipment used in the shop is fed with 480/277V power, while kitchen equipment and other miscellaneous items run on 208/120V power.

Lighting

Many different fixtures are used throughout the building based on which area they are serving. Classrooms are designed using a 2' x 4' recessed fixture with a fluorescent troffer and an acrylic diffuser, utilizing a 2, 3, or 4 lamp electronic ballasts (figure 6). 2' x 4' recessed fixtures are also used in the corridors of the buildings, although each fixture used in the corridor uses just two lamps. All 2'x'4 recessed fluorescent fixtures, classroom and corridor alike, utilize F32T8 lamps. Almost every classroom and restroom is designed with occupancy sensors in order to cut down on unnecessary use of electricity.

Figure 5: 2' x 4' Recessed Classroom Fixtures

With a brand new auditorium comes a state of the art lighting system. The main lighting system for the auditorium uses a 9" diameter x 16" long metal cylindrical fixture. Both Metal Halide and Fluorescent lamps are used with this fixture type using Q500 T4 or 70W MH in the front and majority of the auditorium, or Q250 T4 or 50W MH lamps above the balcony towards the back of the balcony. Two different fixture types (research ongoing) are designed to be mounted on the three catwalks and will be utilized to illuminate the stage during use.

Masonry

Masonry is used on this project both as a load bearing material and an architectural veneer. CMU blocks are used in some locations throughout the building, as well as a portion of the foundation. 20" CMU units are used for the new gymnasium, 16" CMU blocks are used for foundation walls, and 12" CMU are used to construct the walls of the new auditorium. 6" 8" CMU units will be used to construct walls dividing standard classrooms and other standard spaces. Rock face architectural block and standard red brick is to be used as part of the building façade. Structural masonry units will be connected using masonry ties or adjustable anchors, depending on their use. Wire ties can be made of a number of materials and can come in the form of wire ties or corrugated metal ties. Adjustable anchors for units connected to steel framing are designed to allow horizontal or vertical adjustment but to resist tension and compression forces perpendicular to the wall. Units used as a part of the veneer are to use adjustable anchors capable of withstanding a 100 lb.-f load in tension and compression.

Figure 6: Rock Face Architectural Block

Project Cost Evaluation

Construction Cost

The Construction Cost for the Unionville High School Additions and Renovations project is based on figures as of summer 2011. The following items have been excluded in order to arrive at the Construction Cost of the project.

- General Conditions
- Site Work
- Contingency
- Fee
- Controls
- Insurance

All cost data is provided by Wohlsen Construction; approved change orders to date have been included. A total project size of 319,000 is assumed.

Actual Building Construction Cost

Total Building Construction Cost	**$46,051,101.52**
Total Building Construction Cost/S.F.	**$150.30**

To calculate Total Building Cost, all line items have been totaled including the items excluded to obtain actual project cost.

Total Building Cost

Total Building Cost	**$52,744,833,02**
Total Building Cost/S.F.	**$165.34**

Listed in the chart below is the breakdown of the Major Building systems, their total cost, and their cost per square foot.

Major Building System Costs

	Total Cost	Cost/S.F.
Site Work	**$2,638,575.00**	**$8.27**
Substructure	**$2,073,459.00**	**$6.50**
Superstructure	**$3,710,829.32**	**$11.63**
Building Enclosure	**$5,562,196.13**	**$17.44**
Roofing	**$2,475,495.00**	**$7.76**
Fire Protection	**$360,366.25**	**$1.13**
Mechanical System	**$9,764,531.92**	**$30.61**
Plumbing System	**$2,610,852.54**	**$8.18**
Electrical System	**$5,931,113.41**	**$18.59**

RS Means Square Foot Cost Estimate

In order to develop a Square Foot estimate, the CostWorks software from RS Means was utilized. Below is a chart showing all information used to develop the estimate.

Estimate Parameters

Building Type	**School, High, 2-3 Story**
Facade	**Decorative Concrete Block**
Structure	**Steel Frame**
Area	**319,000 Square Feet**
Perimeter	**4,650 Linear Feet**
Stories	**3 Stories**
Story Height	**13.5 Feet**

After entering the above information and running the analysis, RS Means CostWorks produced the following results for the Square Foot and Assembly analyses:

RS Means Square Foot Estimate Results

Total Building Cost	**$38,878,000.00**
Building Construction Cost/S.F.	**$121.87**

RS Means provides information based on general parameters (see above chart). These parameters included building type, size, and location. Also, renovation work costs are not provided by RS Means cost works therefore all work was estimated as new construction. Another reason for the lower total building cost and cost per square foot is due to RS Mean's lack of knowledge of what specific spaces are within the building. For example, the new auditorium is fit out with high end finishes.

RS Means MEP Assembly Estimate Results

Total MEP Cost	**$4,393,272.28**
Building Construction Cost/S.F.	**$13.77**

This assembly estimate was calculated by selecting only the major items within the MEP systems. Items such as ductwork, wiring, and conduit were not included, thus the large different in $/S.F. between both the square foot estimate and actual building costs.

Cost Comparison

	Total Building Cost	Construction Cost/S.F.
Actual Building Cost	**$46,051,101.52**	**$150.30**
RS Means S.F. Estimate	**$38,878,000.00**	**$121.87**
RS Means S.F. Estimate with MEP Assembly	**$36,396,272.28**	**$114.09**
Actual MEP Cost	**$18,666,864.12**	**$58.52**
RS Means MEP Assembly Estimate	**$ 4,393,272.28**	**$13.77**

As total cost includes items such as insurance, sitework, contingencies, etc., using this value to compare to the other estimates is not practical. Instead, the actual construction cost will be used. Using RS Means Cost Works estimating survey, an estimate was developed on numerous parameters. Information inputted into the software included a building height of 3 stories, an area of 319,000 square feet, a story height of 13.5', and a building perimeter of 4,650 linear feet. Comparison of the actual project cost and the RS Means Square Foot estimate show a difference of $7,173,101.52 or $28.43 per square foot. The lower cost may be a result of the lack of renovation values in RS Means Costworks estimating software.

Using this software allowed for a standardized, easy to use estimating tool. The limited parameters and cost values may have decreased the accuracy of the estimate. Inclusion of other factors like certain additives such interior finishes or specialized construction methods may have brought the RS Means estimate up as well.

An assembly estimate was also produced using the same RS Means software. A total cost of $13.77 per square foot for the MEP system is significantly lower than $58.52, the sum of the MEP cost per square foot values from the overall cost calculation. To calculate the assembly estimate, only large items within the MEP systems were included. The exclusion of smaller items such as ductwork and wiring may have accounted for a large portion of the difference.

Overall, RS Means is a relatively simple to use tool to produce rough estimates. Their square foot estimating tool is quite effective, despite producing a low estimate. On the other hand, the assembly tool is somewhat confusing to use and produced an even less accurate estimate.

Full reports on all estimates can be found in APPENDIX C.

Site Plans

Existing Conditions Site Plan Summary

Initally, this site was home to only the Unionville High School. As a result of this project, the site now houses both the Unionville High School as well as the Unionville-Chadds Ford School District Administration Building. As a result of the construction, several multi-purpose fields were removed near the north east of the site and in their place went a new parking lot. The parking lot in the front of the existing building was expanded slightly and a one-way vehicular entrance to the parking lot was added from Unionville Willowdale Road.

With both renovations and additions taking place, two scenarios of adding to the building exist. Several portions of the existing high school building are to be completely demolished, with a new gymnasium taking that spot on the lot. On the other hand, UCFSD Administration Building is to be constructed at the south of the site, an area previously undeveloped on the site. Interior demolition will also ensue with renovations occuring at those locations. The only building on the site other than the existing Unionville High School Building is the Patton Middle School building, which is immidately to the north of UHS. At no point in construction is the middle school affected in any way.

Site utilities come from both the (magnetic) east and west, with several different branches feeding either the High School or the adjacent middle school depending on specific utilities. A few small access roads links both schools' parking areas and vehicular access paths. No covered pathways or temporary lighting is used at any point for students or staff members during the project as there was no need to reroute any pedestrian traffic. Several parking areas are shown on the site plan with most belonging to the high school. Throughout the project, contractor parking locations and UCFSD parking locations will vary; this information will be further explained in the Site Layout Planning section of the report. A site fence lines most of the perimeter of the site, with the south and west portions of the site as the primary focuses.

A full existing conditions site plan can be viewed in APPENDIX D.

Site Layout Plan Summary: Phase 1

Each site layout plan is designed to explain a specific phase of the project. A phasing plan and building area breakdown is available in APPENDIX A to better understand the breakdown of the phasing. Phase 1 focuses on the construction of the new Unionville-Chadds Ford School District Administrative Office portion of the building. Located at the east of the site, Area D is the portion of the building to be constructed during this phase. Area D is to be built from t he ground up during this phase, encompassing excavation, foundations, structure, interiors, facades, and finishes.

There is one primary entrance to the site, located in the southwest corner of the site. Two-way traffic can flow here, with access to both the front and rear parking lots from this location. A second entrance is available, located in the southeast corner of the site, allowing one-way traffing into the front parking lot. This entrance is meant for school busses once construction is complete and will be used only for deliveries during construction. Dumpsters are available at several locations, with one in the back parking lot and a second in the front parking lot near the storage trailer.

Several multi-purpose field were replaced by a large parking lot in the rear of the building. Wohlsen's construction trailer is located in this lot, along with several subcontract trailer. The trailers are located at the eastern most side of the lot, keeping them out of the way but still allowing a clear view of the construction during the phase. Limited parking is available in the back of the building at this point of the project; Wohlsen' on-site team, as well as subcontractor project managers are eligible for parking here. Limiting the amount of vehicles and the vehicular traffing in this parking lot during construction helps to keep the area clear and free of delays.

During phase 1, contractors will be parking in the parking lot at the front of the building. A second Wohlsen trailer located here, along with several subcontractor storage trailers. Porta-johns are located all over the site; two units are located between the Wohlsen trailer and the subcontractor trailer at the back of the site. This area recieves much foot traffic, especially during meetings, so having a facility close by is a must. Two more units are located in the front parking lot near the storage trailers. With all subcontractors parking in this location, units must be placed here to accommodate the needs.

The crawler crane will be located in the parking lot at the back of school, with a steel laydown are immidiately adjecent to the cranes location. Although it will move during construction based on where it is needed, the contrete truck is shown at the east of the new building addition. This location allows for efficient placement and keeps the truck out of the way. Material storage trailers are available near the job site trailers at the back of the school. Several units are available, with one dedicated to Wohlsen and several others available for subcontractor use. A space between the trailers allows for the laydown of material, including brick, CMU, and metal conduit. The site soil stockpile is located at the eastern edge of the site, near the material storage.

Overall, this site layout is effective for this phase of construction. A large steel laydown area is available and is in close proximity to the crane. Site trailers are out of the way, but still in close proximity to the building. Material storage is near to trailers but is also far enough away to eliminate clutter.

A full Phase 1 site plan can be viewed in APPENDIX E.

Site Layout Plan Summary: Phase 2 and 3

During phases 2 and 3, the main focus of construction is on the addition in area F, and renovations in areas G and H. The main entrance does not change, and the secondary entrance in the front parking lot is still available for use. The second Wohlsen trailer is removed late in phase 2, as the front parking lot will be re-paved during phase 3. Both porta-johns and the tool trailer will also be removed at the same time.

A structural steel frame is to be erected as part of the construction of the new auditorium. No building demolition occurred in order to make room for this addition. Both the crane location and the steel lay down area shift from the rear parking lot to the front parking lot. With the crane and steel laydown area now gone from the rear parking lot and the new portion of the building finished, UCFSD staff members will park in that lot. Cast-in-place concrete is seen several times during this phase. In addition to the foundations of the new auditorium, the existing auditorium's floor will be leveled with geofoam blocks and covered with a 4" concrete slab. On this site plan, concerete truck is located at the entrance of the existing auditorium.

Dumpster locations also change during this phase. In the rear parking lot, the dumpster moves towards the center of the building and away from the Administrative Building addition. Two more dumpsters have been added near the entrance to the existing auditorium. With demoltions and renovations ongoing at that location in the building, easy access to dumpsters is a must. Porta-johns are added near the dumpster, as well as on the western edge of the building. Much of the work during this phase is done in the new auditorium (west building addition) and in the existing auditorium, leading to heavy foot traffic at the location of the building.

Subcontractors are still eligible to park in the front parking lot. An additional parking lot located at the west of the existing high school has been opened to use to the contractors. Both contractors and building staff will be using this lot, so contractors must work with the staff in the event that parking is limited. UCFSD staff will remain in the rear lot during this phase, as will Wohlsen's on-site staff and the subcontractor project managers.

This site plan again is effective. Additional parking locations allow for faster transportation for the subcontractors performing the work. A new location for the crane and steel lay down area opens up parking spots for the new inhabitants of the administrative portion of the building. Porta-johns and dumpster have been added to accommodate the new location of the work. All other items, as shown on the plan, remain the same as the previous phase and continue to serve their purpose effectively.

A full Phase 2 and 3 site plan can be viewed in APPENDIX E.

Site Layout Plan Summary: Phase 4

Phase 4 is the final phase of this project. During this phase, the new gymnasium (area B) is to be built, area A is to be demolished completely, and area H will be renovated. With the removal of area A, area H will now be the exposed end of the building. Despite this face, renovations to area H are to be completed prior to the demolition of area A.

As with the two previous phases, the primary entrance remains the same. One difference, however, is the removal of the second entrance. With all work being done at the back of the building there is no need for contractors or deliveries to access the front parking lot. Closing this entrance is the best way to ensure that no contractors or delivery truck will mistake it for an open site entrance.

Demolition of the existing structure is the first step of the phase, with a one-story section of the building housing classrooms coming down in order to make room for the new gymnasium. For this reason, equipment storage is available at the edge of the site. Dumpster locations have again moved, with the dumpster moving from the parking lot to the area just behind the subcontractor trailer. This allows for ease of access and also provides room for easy dumpster removal. Porta-johns are now completely gone from the front lot. Several have been relocated, with the units on the western side of the building now moving to east of the new gymnasium addition.

With more structural steel erection as a part of phase 4, the crane's location moves to the rear parking lot. Steel laydown will be available at the end of the new building footprint. As a result of this steel erection work, a major factor during this phase is the new for a change in parking locations; all contractors will now park in the rear parking lot, while UCFSD staff members will move their location to the front parking lot. This allows the most direct access for workers to the site, and also keeps UCFSD staff members away from the active part of the construction site.

Changes made to the previous site plan allow for an effective use of phasing. Changing parking locations works very well and improves efficency for all parties involve. Closing the one-way entrance eliminates mix-ups or deliverys going to the wrong location of the site. The concrete truck is shown in the rear parking lot, adjacent to where pours will be made. Again, all other items have remained in position from the previous phase.

A full phase 4 site plan can be viewed in APPENDIX E.

Local Conditions

Local Conditions

Kennett Square Pennsylvania, known as the "The Mushroom Capital of the World", is home to the Unionville-Chadds Ford school district. Designed at a size of 3 stories above great with an overall size 319,000 square feet, the Unionville High School Building will undergo demolition, renovation, and addition during the course of the construction project. The map below shows an aerial view of the site prior to the beginning of construction. Will students onsite it is vitally important that as little of the building is disturbed during construction as possible. Phasing was utilized during this project in order to keep the school in operation and disturb building inhabitants as little as possible. All material removed during the construction process is to be recycled according to LEED requirements.

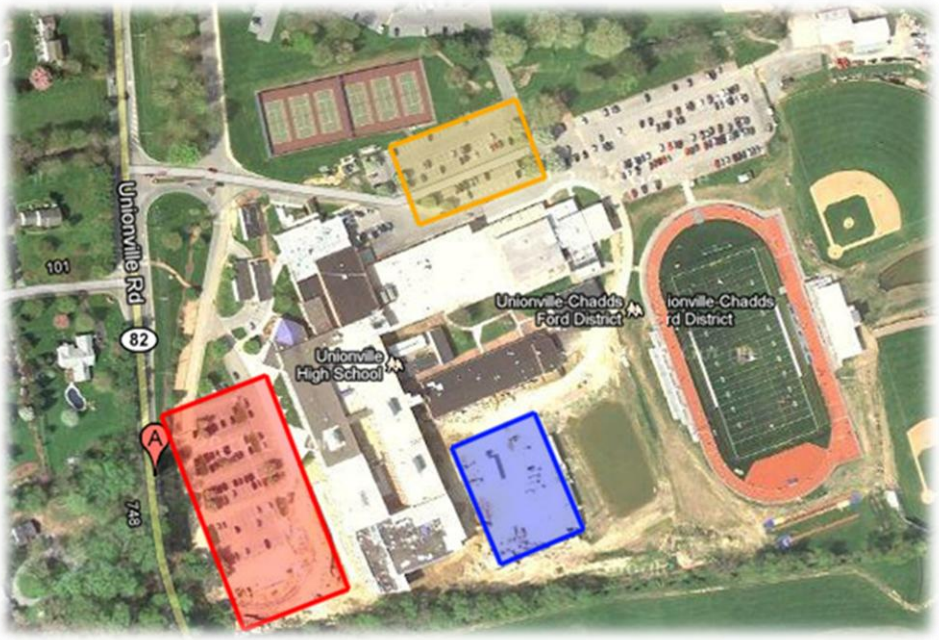


Figure 7: Aerial View of Site

A soil engineer is required to be on site at all times when excavation is occurring, per the project specifications. Neither soil nor water issues were a problem during preconstruction or during the construction up to this point. Parking is available for contractors in several locations depending on the current construction phase; the red region shows available contactor parking for phases 1, 2, and part of phase 3, the orange region is available for parking during phase 3, and the blue region shows available parking for phase 4. Parking availability varies throughout the project in order to accommodate both the phasing of the project as well as the UCFSD Administrative Staff; UCFSD Administrative Staff members will park in the blue region until phase 4, when their parking location moves to the red region and the contractors begin to occupy the blue region. Wohlsen on-site staff members are permitted to park in the southwest corner of the blue region at all times, as jobsite trailer are located here. No specific permitting issues have been identified for this public education project.

Client Information

Unionville-Chadds Ford School District is a public school district in Pennsylvania, including several other schools besides Unionville High School including Charles F. Patton Middle School and Unionville, Chadds Ford, Hillendale, and Pocopson Elementary Schools. The map below illustrates the layout of the Unionville-Chadds Ford School District and the location of each educational facilitiy, including the new Unionville High School Building.

Figure 8: Unionville-Chadds Ford School District

A growing population within the school district led to discussions of expanding the school district's only high school. In addition to the new building accommodating the growing needs of Unionville High School it would also be the new home to the Unionville-Chadds Ford School District Administrative Offices. While increasing the space of Unionville High School is a key factor, many spaces and features within the high school were well outdated and the old administrative office was well overdue for an upgrade.

Among the outdated facilities within the old building included classrooms, art rooms, lockers rooms, the gymnasium, and namely, the auditorium. Renovations to classroom space will not only improve the look of these spaces but also the functionality and energy efficiency. The new Auditorium will sport hi-tech audio, video, and lighting equipment and an expanded seating capacity, leading to a space that better suit students involved in arts programs throughout the district. Several spaces including the new gymnasium, wrestling area, and locker rooms will improve the portions of the building that directly affect the student athletes and members of the athletic programs for the school.

Cost, while not completely unimportant, is the not the focus of this project. The schedule, on the other hand, is of great importance. As with most educational projects, construction disrupts the flow of everyday life. With a project such as this that includes both new construction and renovation, seamless phasing is even more important. 4 phases and 17 sub phases are to be utilized in order to minimize the construction process' effect on the students, faculty, and other inhabitants of Unionville High School. As a site note, the school required that no smoking occur on site, inside or outside of any structure, at any time.

Project Delivery System

Project Delivery System

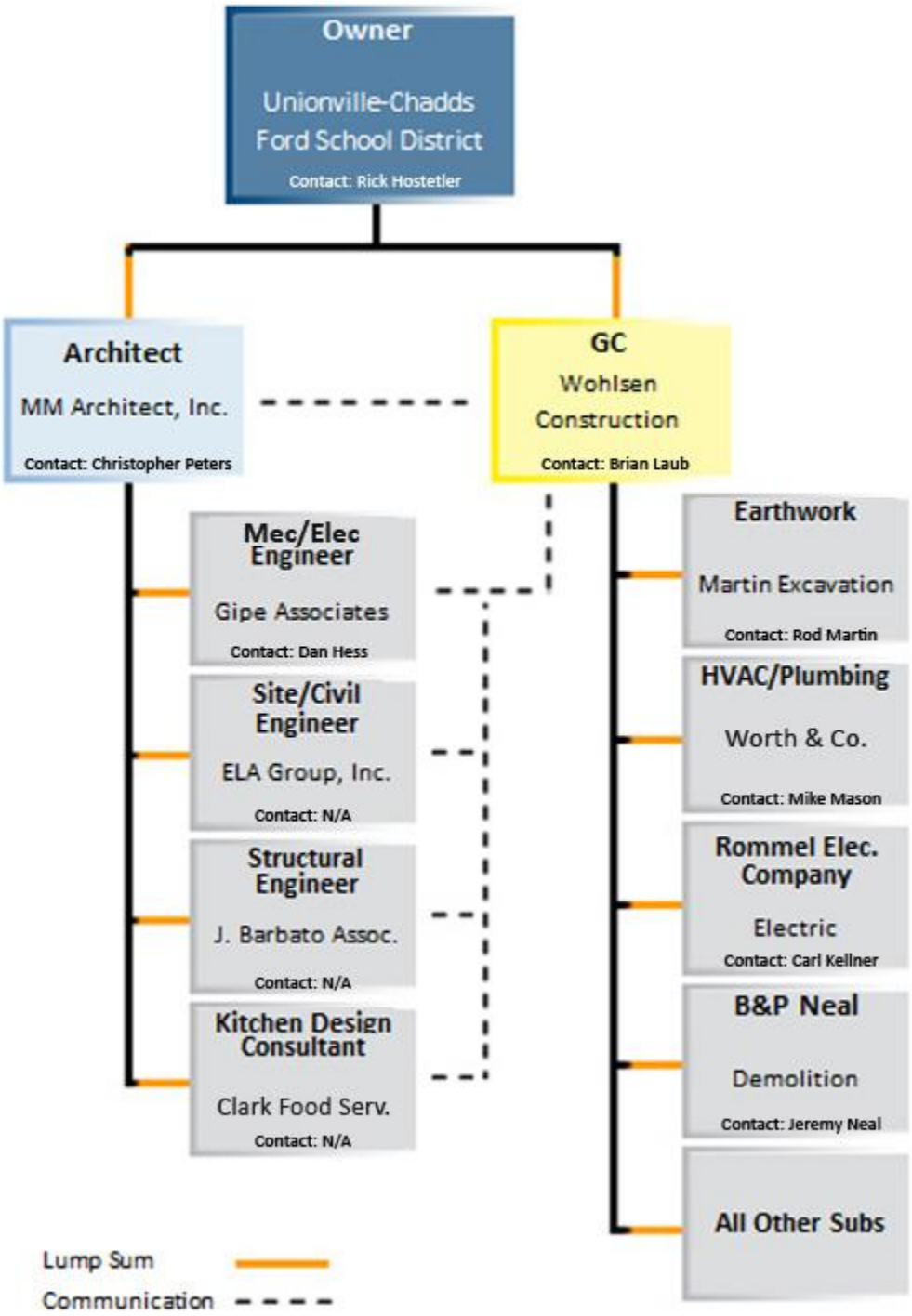


Figure 9: Project Delivery Method

The chart above (figure 2) shows the breakdown of the project from a contractual standpoint. As the Unionville High School Additions and Renovations project is in the public sector, a hard bid method was used during the design phase and the project delivery method chosen for the project is a Design-Bid-Build. The Owner, Unionville-Chadds Ford School District, is contracted directly with both MM Architects, Inc. and Wohlsen Construction, both of which are Lump Sum contracts. MM Architects has Lump Sum contracts with all engineers for this project, including Gipe Associates, Inc., ELA Group, Inc., and Joseph Barbato Associates, LLC. Wohlsen Construction is acting as the General Contractor and was awarded the Unionville High School Building project after submitting the lowest bid. As the GC for the project Wohlsen owns all contracts (also Lump Sum) with subcontractors, who are prequalified and selected based on the lowest bid. All subcontractors are required to be completely bonded, a key part of the contract in terms of keeping work moving. In addition to managing the contracts of all on-site contractors, Wohlsen is also self-performing some work such as portions of the on-site concrete work and interior carpentry work.

Utilizing a Design-Bid-Build project delivery method was the best option for this particular project. The owner has complete jurisdiction over the design and is able to speak directly with both the architect and the general contractor regarding the project. UCFSD has done similar educational construction projects in the past, so their knowledge of the industry is above average and although management of the entire project is not feasible, this previous experience allows for effective communication with both Wohlsen and the other parties involved throughout the project. Wohlsen's experience in the educational sector made them an easy choice for UCFSD. Their knowledge of past works offers significant experience and makes them an ideal GC for the project. Despite the lack of a contract between parties, Wohlsen is able to communicate directly with MM Architects, Inc. and all Engineers contracted to them. Open lines of communication not only increase productivity but also help to solve issues as they arise in an efficient manner.

Staffing Plan

Staffing Plan

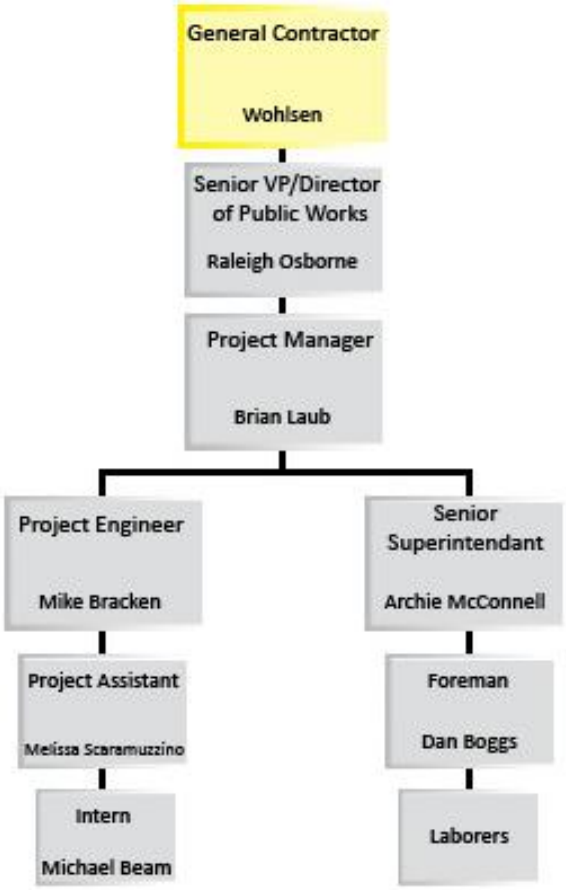


Figure 10: Staffing Plan

Wohlsen's staffing plan (figure 3) for the Unionville High School Building Additions and Renovations project can be seen above. The above plan is consistent with standard Wohlsen staffing plans, utilizing a Project Manager, Project Engineer, Project Assistant, Superintendent, and Foreman. The above staff includes the entire project team, however only the Project Engineer, Superintendent, Foreman, and Intern located on-site at all times. The Project Manager and Director of Public works visit the site as well, with the PM making trips at least once per week. Wohlsen's Director of Safety and other safety department members, although not a member of just this project team, oversees all Wohlsen projects. No safety coordinator was needed on-site for this particular project. Generally speaking, a Project Manager oversees between 2-3 projects and teams, while the Director of Public Works oversees all projects in the public sector. Project assistants generally work with the same PM on all projects, working on 2-3 projects at a time as well.

Note: All non-sited photographs and figures were created by myself, Michael Beam.

APPENDIX A – Phasing Plan and Building Area Key

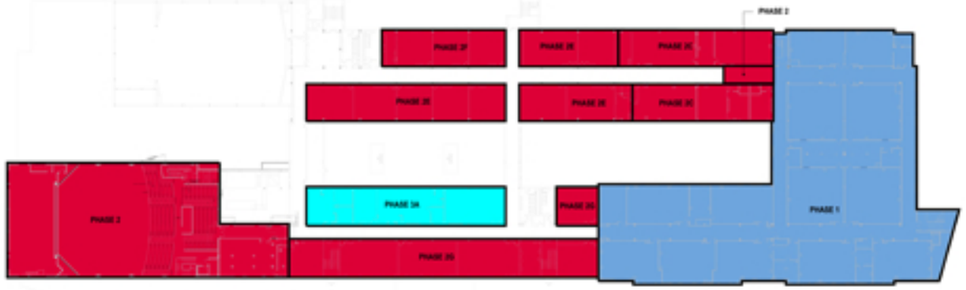
Building Phasing Plan and Building Area Key

FIRST FLOOR LEVEL MASTER PHASING PLAN

SCALE: 1"=40'-0"

SECOND FLOOR LEVEL MASTER PHASING PLAN

SCALE: 1"=40'-0"



THIRD FLOOR LEVEL MASTER PHASING PLAN

SCALE: 1"=40'-0"

PHASING KEY:	
PHASE 1	22 JUNE, 2009 - 25 JUNE, 2010
PHASE 2	28 JUNE, 2010 - 01 JULY, 2011
PHASE 2A	14 JUNE, 2010 - 15 AUGUST, 2010
PHASE 2B	28 JUNE, 2010 - 31 DECEMBER, 2010
PHASE 2C	06 SEPTEMBER, 2010 - 31 DECEMBER, 2010
PHASE 2D	03 JANUARY, 2011 - 01 JULY 2011
PHASE 2E	03 JANUARY, 2011 - 21 JANUARY, 2011
PHASE 2F	24 JANUARY, 2011 - 11 FEBRUARY, 2011
PHASE 2G	14 FEBRUARY, 2011 - 04 MARCH, 2011
PHASE 2H	07 MARCH, 2011 - 25 MARCH, 2011
PHASE 2I	28 MARCH, 2011 - 15 APRIL, 2011
PHASE 2J	18 APRIL, 2011 - 06 MAY, 2011
PHASE 3	04 JULY, 2011 - 30 DECEMBER, 2011
PHASE 3A	13 JUNE, 2011 - 12 AUGUST, 2011
PHASE 4	02 JANUARY, 2012 - 28 SEPTEMBER, 2012
PHASE 4A	16 JUNE, 2012 - 02 NOVEMBER, 2012
PHASE 4B	05 NOVEMBER, 2012 - 28 DECEMBER, 2012

architectural practicum

MM architects, inc.

ADDITIONS & RENOVATIONS to the UNIONVILLE HIGH SCHOOL
UNIONVILLE-CHADDS FORD SCHOOL DISTRICT
KENNETT SQUARE, PA

KEY PLAN:

PHASING PLANS

SHEET NUMBER:

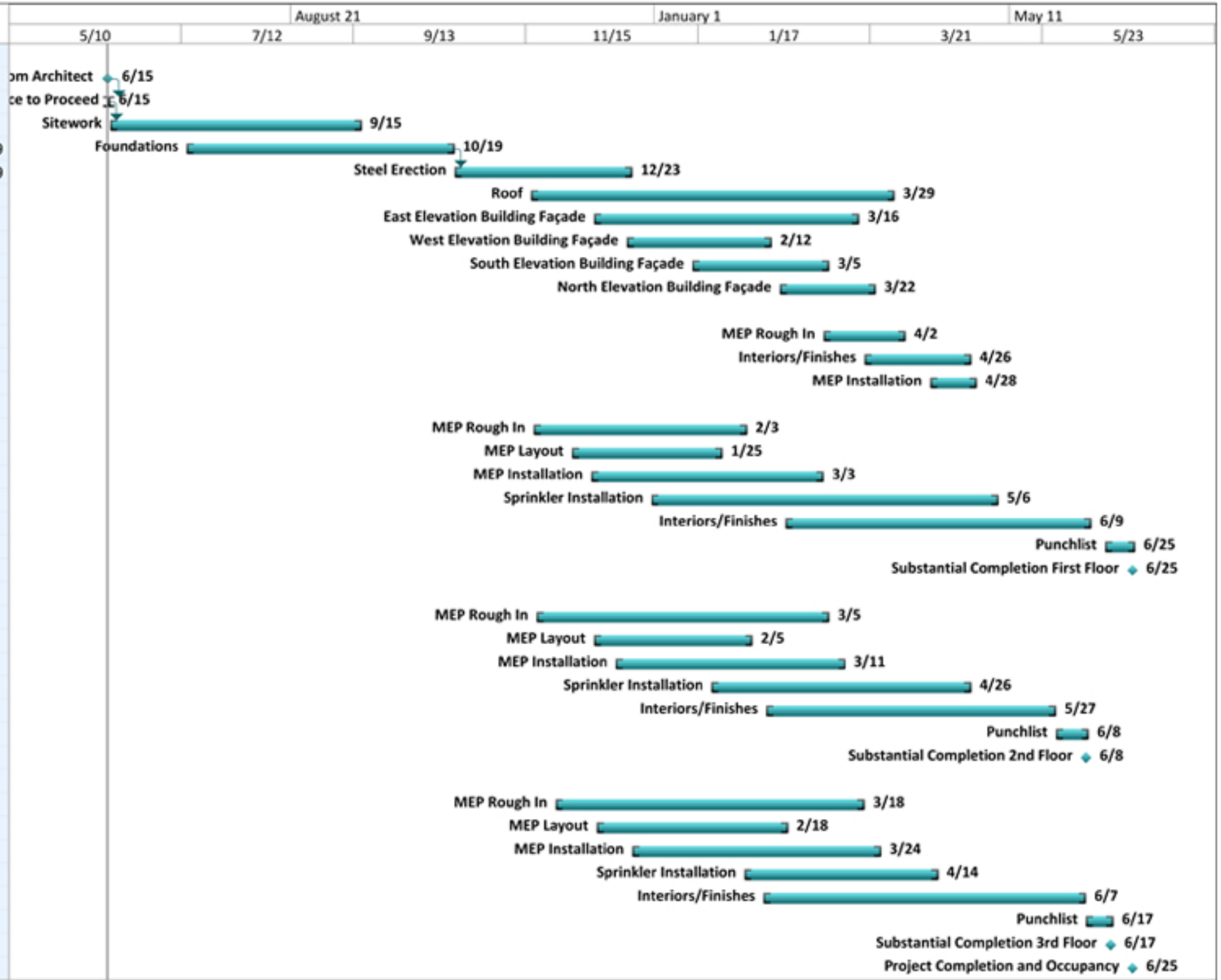
PH.1

BID DOCUMENTS

APPENDIX B – Project Schedule Summary

Project Schedule Summary: Phase 1

ID	Task Name	Duration	Start	Finish
1	**Phase 1 - Area D**			
2	Obtain Design From Architect	0 days	Mon 6/15/09	Mon 6/15/09
3	Notice to Proceed	1 day	Mon 6/15/09	Mon 6/15/09
4	Sitework	66 days	Tue 6/16/09	Tue 9/15/09
5	Foundations	70 days	Tue 7/14/09	Mon 10/19/09
6	Steel Erection	47 days	Tue 10/20/09	Wed 12/23/09
7	Roof	95 days	Tue 11/17/09	Mon 3/29/10
8	East Elevation Building Façade	69 days	Thu 12/10/09	Tue 3/16/10
9	West Elevation Building Façade	39 days	Tue 12/22/09	Fri 2/12/10
10	South Elevation Building Façade	36 days	Fri 1/15/10	Fri 3/5/10
11	North Elevation Building Façade	25 days	Tue 2/16/10	Mon 3/22/10
12	**Stair Towers**			
13	MEP Rough In	22 days	Thu 3/4/10	Fri 4/2/10
14	Interiors/Finishes	27 days	Fri 3/19/10	Mon 4/26/10
15	MEP Installation	13 days	Mon 4/12/10	Wed 4/28/10
16	**First Floor**			
17	MEP Rough In	56 days	Wed 11/18/09	Wed 2/3/10
18	MEP Layout	39 days	Wed 12/2/09	Mon 1/25/10
19	MEP Installation	61 days	Wed 12/9/09	Wed 3/3/10
20	Sprinkler Installation	91 days	Thu 12/31/09	Thu 5/6/10
21	Interiors/Finishes	80 days	Thu 2/18/10	Wed 6/9/10
22	Punchlist	9 days	Tue 6/15/10	Fri 6/25/10
23	Substantial Completion First Floor	0 days	Fri 6/25/10	Fri 6/25/10
24	**Second Floor**			
25	MEP Rough In	77 days	Thu 11/19/09	Fri 3/5/10
26	MEP Layout	42 days	Thu 12/10/09	Fri 2/5/10
27	MEP Installation	60 days	Fri 12/18/09	Thu 3/11/10
28	Sprinkler Installation	67 days	Fri 1/22/10	Mon 4/26/10
29	Interiors/Finishes	76 days	Thu 2/11/10	Thu 5/27/10
30	Punchlist	8 days	Fri 5/28/10	Tue 6/8/10
31	Substantial Completion 2nd Floor	0 days	Tue 6/8/10	Tue 6/8/10
32	**Third Floor**			
33	MEP Rough In	81 days	Thu 11/26/09	Thu 3/18/10
34	MEP Layout	50 days	Fri 12/11/09	Thu 2/18/10
35	MEP Installation	65 days	Thu 12/24/09	Wed 3/24/10
36	Sprinkler Installation	51 days	Wed 2/3/10	Wed 4/14/10
37	Interiors/Finishes	84 days	Wed 2/10/10	Mon 6/7/10
38	Punchlist	8 days	Tue 6/8/10	Thu 6/17/10
39	Substantial Completion 3rd Floor	0 days	Thu 6/17/10	Thu 6/17/10
40	**Project Completion and Occupancy**	0 days	Fri 6/25/10	Fri 6/25/10



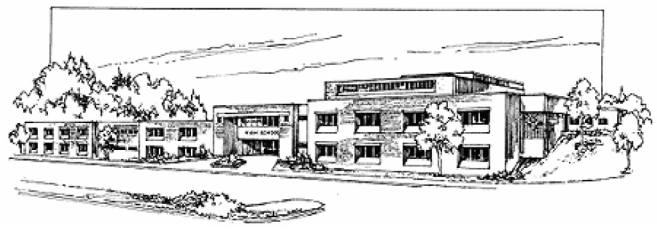
Project: Project2
Date: Thu 9/22/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

APPENDIX C – Estimate Reports

Square Foot Cost Estimate Report

Estimate Name:	**Unionville SF**
	Kennett Square
	Pennsylvania
Building Type:	**School, High, 2-3 Story with Decorative Concrete Block / Steel Frame**
Location:	WESTCHESTER, PA
Stories Count (L.F.):	**3.00**
Stories Height	**13.50**
Floor Area (S.F.):	**319,000.00**
LaborType	**Open Shop**
Basement Included:	No
Data Release:	**Year 2011 Quarter 3**
Cost Per Square Foot	**$121.87**
Total Building Cost	**$38,878,000**



Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.
Parameters are not within the ranges recommended byRSMeans.

		% of Total	Cost Per SF	Cost
A Substructure		**3.2%**	**3.86**	**$1,231,000**
A1010	**Standard Foundations**		**1.08**	**$345,500**
	Strip footing, concrete, reinforced, load 5.1 KLF, soil bearing capacity 3 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 100K, soil bearing capacity 6 KSF, 4' - 6" square x 15" deep			
	Spread footings, 3000 PSI concrete, load 150K, soil bearing capacity 6 KSF, 5' - 6" square x 18" deep			
A1030	**Slab on Grade**		**1.65**	**$525,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.06**	**$19,500**
	Excavate and fill, 30,000 SF, 4' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**1.07**	**$341,000**
	Foundation wall, CIP, 4' wall height, direct chute, .148 CY/LF, 7.2 PLF, 12" thick			
B Shell		**33.4%**	**40.71**	**$12,987,500**
B1010	**Floor Construction**		**14.08**	**$4,492,000**
	Steel column, W8, 100 KIPS, 16' unsupported height, 31 PLF			
	Steel column, W10, 150 KIPS, 16' unsupported height, 45 PLF			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 25'x25' bay, 29" deep, 100 PSF su			
	Fireproofing, gypsum board, fire rated, 2 layers, 1" thick, 8" steel column, 3 hour rating, 14 PLF			
B1020	**Roof Construction**		**2.47**	**$786,500**
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60			
B2010	**Exterior Walls**		**8.75**	**$2,791,000**
	Concrete block (CMU) wall, split rib, 8 ribs, hollow, regular weight, 12x8x16, reinforced, vertical #5@32", grouted			
B2020	**Exterior Windows**		**10.77**	**$3,435,000**
	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, 2 intermediate horizontals			
	Glazing panel, insulating, 1/2" thick, 2 lites 1/8" float glass, tinted			
B2030	**Exterior Doors**		**0.49**	**$157,500**
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening			
	Door, steel 24 gauge, overhead, sectional, manual operation, 8'-0" x 8'-0" opening			

		% of Total	Cost Per SF	Cost
B3010	**Roof Coverings**		**4.13**	**$1,318,500**
	Roofing, single ply membrane, EPDM, 60 mils, fully adhered			
	Formed roofing, zinc-copper alloy, standing seam, 2-1/2" min slope, .020" thick, 0.87 PSF			
	Insulation, rigid, roof deck, polyisocyanurate, 2#/CF, 2" thick			
	Insulation, rigid, roof deck, polyisocyanurate, tapered for drainage			
	Base flashing, aluminum, .016" thick, fabric 2 sides, .025" aluminum reglet, .032" counter flashing			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
B3020	**Roof Openings**		**0.02**	**$7,000**
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
C Interiors		**22.2%**	**27.03**	**$8,624,000**
C1010	**Partitions**		**6.62**	**$2,112,000**
	Concrere block (CMU) partition, light weight, hollow, 6" thick, no finish			
	1/2" fire ratedgypsum board, taped & finished, painted on metal furring			
C1020	**Interior Doors**		**1.48**	**$471,000**
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		**1.15**	**$365,500**
	Toilet partitions, cubicles, ceiling hung, stainless steel			
	Chalkboards, liquid chalk type, aluminum frame & chalktrough			
C2010	**Stair Construction**		**0.56**	**$179,000**
	Stairs, steel, cement filled metal pan & picket rail, 16 risers, with landing			
C3010	**Wall Finishes**		**3.45**	**$1,099,500**
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Painting, masonry or concrete, latex, brushwork, addition for block filler			
	Wall coatings, acrylic glazed coatings, maximum			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		**6.79**	**$2,166,500**
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		**6.99**	**$2,230,500**
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			
D Services		**37.3%**	**45.40**	**$14,481,500**
D1010	**Elevators and Lifts**		**1.01**	**$323,500**
	2 - Hydraulic, passenger elevator, 2500 lb, 2 floors, 100 FPM			
	Hydraulic passenger elevator, 2500 lb., 2 floor, 125 FPM			
D2010	**Plumbing Fixtures**		**4.92**	**$1,570,000**
	Water closet, vitreous china, bowl only with flush valve, floor mount			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 20" x 18"			
	Kitchen sink w/trim, countertop, stainless steel, 44" x 22" triple bowl			
	Lab sink w/trim, polyethylene, single bowl, flanged, 23-1/2" x 20-1/2" OD			
	Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 24" x 20"			
	Group wash fountain, stainless steel, circular, 54" diam			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**0.36**	**$116,000**
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH			
D2040	**Rain Water Drainage**		**0.66**	**$209,500**

		% of Total	Cost Per SF	Cost
	Roof drain, CI, soil,single hub, 4" diam, 10' high			
	Roof drain, CI, soil,single hub, 4" diam, for each additional foot add			
	Roof drain, CI, soil,single hub, 5" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3010	**Energy Supply**		**4.78**	**$1,523,500**
	Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors			
D3030	**Cooling Generating Systems**		**15.65**	**$4,992,500**
	Packaged chiller, water cooled, with fan coil unit, schools and colleges, 60,000 SF, 230.00 ton			
D4010	**Sprinklers**		**2.53**	**$806,500**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 50,000 SF			
D4020	**Standpipes**		**0.29**	**$92,000**
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, additional floors			
D5010	**Electrical Service/Distribution**		**0.57**	**$181,000**
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 2000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A			
D5020	**Lighting and Branch Wiring**		**10.01**	**$3,193,500**
	Receptacles incl plate, box, conduit, wire, 8 per 1000 SF, .9 W per SF, with transformer			
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Motor feeder systems, three phase, feed to 200 V 5 HP, 230 V 7.5 HP, 460 V 15 HP, 575 V 20 HP			
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		**4.06**	**$1,295,500**
	Communication and alarm systems, includes outlets, boxes, conduit and wire, sound systems, 100 outlets			
	Communication and alarm systems, fire detection, addressable, 100 detectors, includes outlets, boxes, conduit and			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master clock systems, 50 rooms			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems,100 outle			
	Internet wiring, 2 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**0.56**	**$178,000**
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 250 kW			
E Equipment & Furnishings		**4.0%**	**4.82**	**$1,538,000**
E1020	**Institutional Equipment**		**1.90**	**$606,500**
	Architectural equipment, laboratory equipment, counter tops, acid proof, economy			
	Architectural equipment, laboratory equipment, counter tops, stainless steel			
	Architectural equipment, laboratory equipment, cabinets, wall, open			
	Architectural equipment, laboratory equipment, cabinets, base, drawer units			
E1090	**Other Equipment**		**2.92**	**$931,500**
	1200 - Auditorium chair, fully upholstered, spring seat			
	1500 - Lockers, steel, baked enamel, single tier, 60" or 72", minimum			
	1 - Flagpoles, aluminum, tapered, ground set, 20' high, excludes base or foundation			
	1 - Master time clock system, master controller, clocks & bells, 20 room, excl. wires & conduits			
	Architectural equipment, school equipment basketball backstops, suspended type, electrically operated			
	Architectural equipment, school equipment bleachers-telescoping, manual operation, 15 tier, economy (per seat)			
	Architectural equipment, school equipment, weight lifting gym, universal, economy			
F Special Construction		**0.0%**	**0.00**	**$0**

		% of Total	Cost Per SF	Cost
G Building Sitework		**0.0%**	**0.05**	**$16,000**
G2040	**Site Development**		**0.05**	**$16,000**
	Specialties, flagpole, on grade, aluminum, tapered, 59' high			
Sub Total		**100%**	**$121.87**	**$38,878,000**
Contractor's Overhead & Profit		**0.0%**	**$0.00**	**$0**
Architectural Fees		**0.0%**	**$0.00**	**$0**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$121.87**	**$38,878,000**

Assembly Detail Report

Kennett Square,

Year 2011 Quarter 3

Date: 21-Sep-11

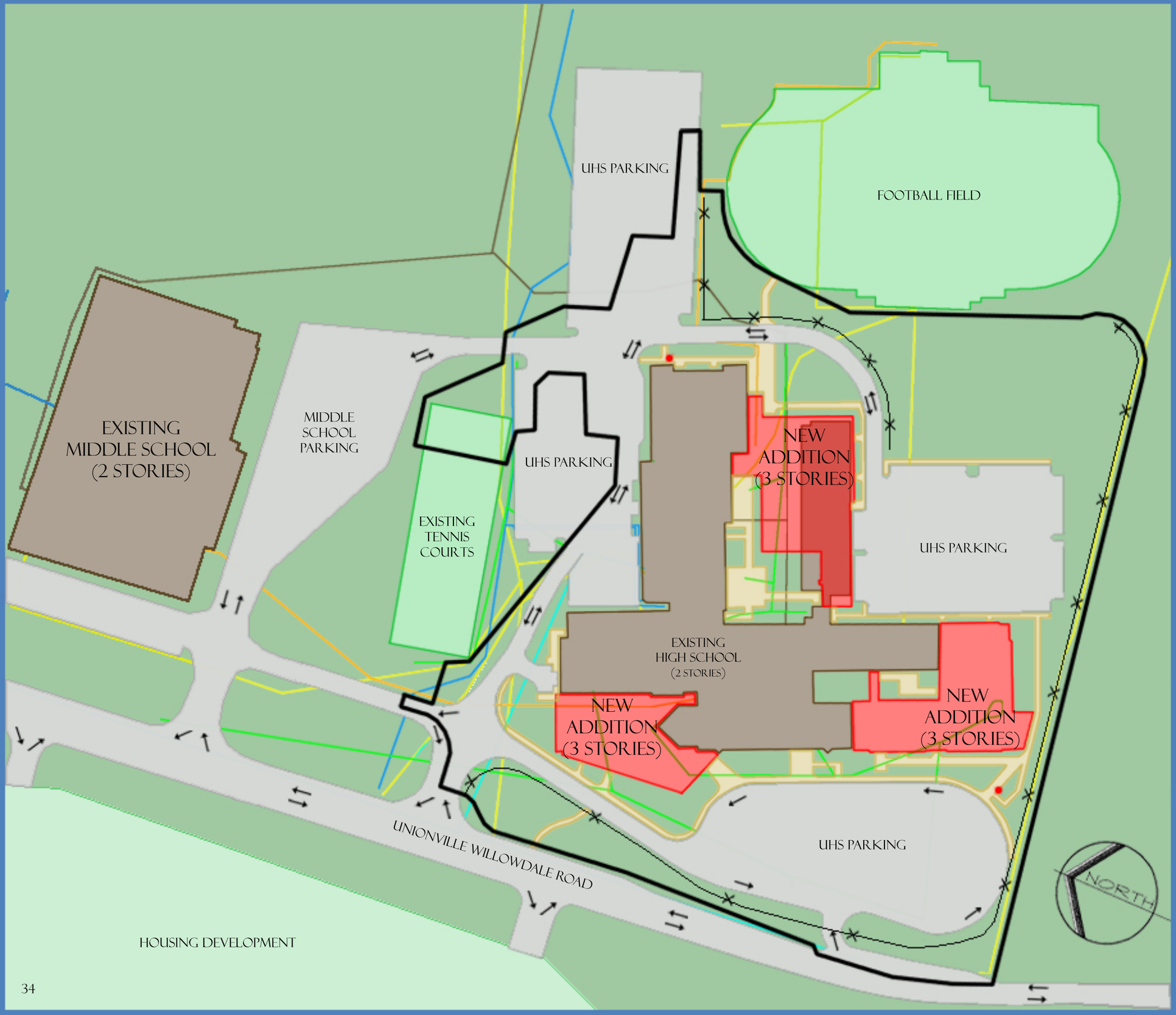
Unionville Assembly

Prepared By:
Michael Beam
Penn State University

Assembly Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D	**Services**						
D20101101920			Water closet, vitreous china, tank type, floor mount, 1 piece	125.00	Ea.	$2,213.63	$276,703.75
D20101102080			Water closet, vitreous china, bowl only with flush valve, wall hung	10.00	Ea.	$2,466.55	$24,665.50
D20102102000			Urinal, vitreous china, wall hung	25.00	Ea.	$1,386.25	$34,656.25
D20103101600			Lavatory w/trim, vanity top, PE on CI, 19" x 16" oval	110.00	Ea.	$1,242.11	$136,632.10
D20104101720			Kitchen sink w/trim, countertop, PE on CI, 24" x 21", single bowl	5.00	Ea.	$1,469.04	$7,345.20
D20104301640			Lab sink w/trim, polyethylene, single bowl, single drainboard, 47" x 24"OD	110.00	Ea.	$2,684.93	$295,342.30
D20104404260			Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard	5.00	Ea.	$3,094.17	$15,470.85
D20107101800			Shower, stall, fiberglass 1 piece, three walls, 32" square	30.00	Ea.	$1,786.83	$53,604.90
D20107101960			Shower, built-in head, arm, bypass, stops and handles	50.00	Ea.	$426.94	$21,347.00
D20108101920			Drinking fountain, 1 bubbler, wall mounted, non recessed, stainless steel, no back	10.00	Ea.	$1,754.05	$17,540.50
D20108201920			Water cooler, electric, wall hung, wheelchair type, 7.5 GPH	10.00	Ea.	$1,958.37	$19,583.70
D20202401860			Electric water heater, commercial, 100< F rise, 80 gal, 12 KW 49 GPH	3.00	Ea.	$7,491.00	$22,473.00
D20202502060			Gas fired water heater, commercial, 100< F rise, 200 MBH input, 192 GPH	2.00	Ea.	$12,778.90	$25,557.80
D20402102200			Roof drain, DWV PVC, 6" diam, 10' high	60.00	Ea.	$2,297.35	$137,841.00
D30401141020			AHU, rooftop, cool/heat coils, constant volume, filters, 5,000 CFM	7.00	Ea.	$41,993.50	$293,954.50
D30401141030			AHU, rooftop, cool/heat coils, constant volume, filters, 10,000 CFM	3.00	Ea.	$78,434.80	$235,304.40
D30401141040			AHU, rooftop, cool/heat coils, constant volume, filters, 15,000 CFM	1.00	Ea.	$111,942.30	$111,942.30
D30401141050			AHU, rooftop, cool/heat coils, constant volume, filters, 20,000 CFM	1.00	Ea.	$148,324.50	$148,324.50
D30401161020			AHU, rooftop, cool/heat coils, VAV, filters, 10,000 CFM	5.00	Ea.	$85,612.60	$428,063.00
D30401161030			AHU, rooftop, cool/heat coils, VAV, filters, 15,000 CFM	2.00	Ea.	$124,155.10	$248,310.20
D30401161050			AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM	2.00	Ea.	$209,189.40	$418,378.80
D30501401020			Unit heater, cabinet type, horizontal blower, hot water, 60 MBH	11.00	Ea.	$4,656.18	$51,217.98
D30501401030			Unit heater, cabinet type, horizontal blower, hot water, 100 MBH	3.00	Ea.	$5,169.63	$15,508.89
D30903101030			Fume hood exhaust system, 6 FT long, 3500 CFM	3.00	Ea.	$28,259.70	$84,779.10
D40104101080			Wet pipe sprinkler systems, steel, ordinary hazard, 1 floor, 10,000 SF	9.00	S.F.	$4.42	$39.78
D40203100600			Wet standpipe risers, class I, steel, black, sch 40, 6" diam pipe, 1 floor	1.00	Floor	$12,183.83	$12,183.83
D40203100620			Wet standpipe risers, class I, steel, black, sch 40, 6" diam pipe, additional floors	1.00	Floor	$3,152.95	$3,152.95
D50101200320			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 400 A	148.00	Ea.	$7,920.40	$1,172,219.20

Assembly Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D50101200560			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 2000 A	1.00	Ea.	$42,068.70	$42,068.70
D50102400240			Switchgear installation, incl switchboard, panels & circuit breaker, 600 A	2.00	Ea.	$19,530.15	$39,060.30
D	**Services Subtotal**						**$4,393,272.28**

APPENDIX D – Existing Conditions Site Plan



LEGEND

UTILITIES

- ELECTRIC
- STORM
- WATER
- TELECOM
- GAS
- SANITARY

SYMBOLS

- SITE PERIMITER
- SIDEWALK
- SITE FENCE
- FIRE HYDRANT

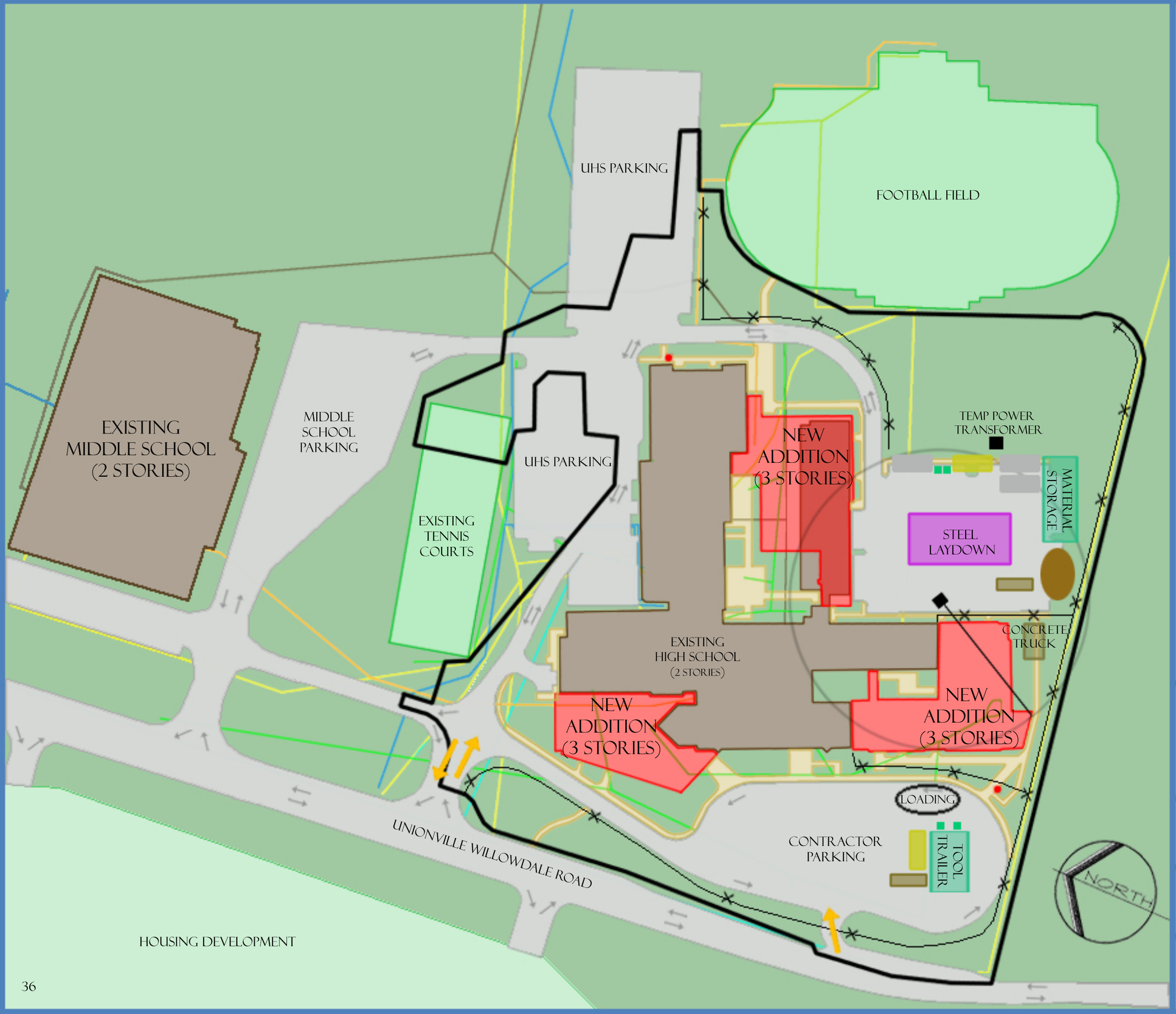
UNIONVILLE HIGH SCHOOL ADDITIONS AND RENOVATIONS

EXISTING CONDITIONS SITE PLAN

SEPTEMBER 20TH, 2011

MICHAEL BEAM - CM

APPENDIX E – Site Layout Plans



LEGEND

UTILITIES

- ELECTRIC
- STORM
- WATER
- TELECOM
- GAS
- SANITARY

SYMBOLS

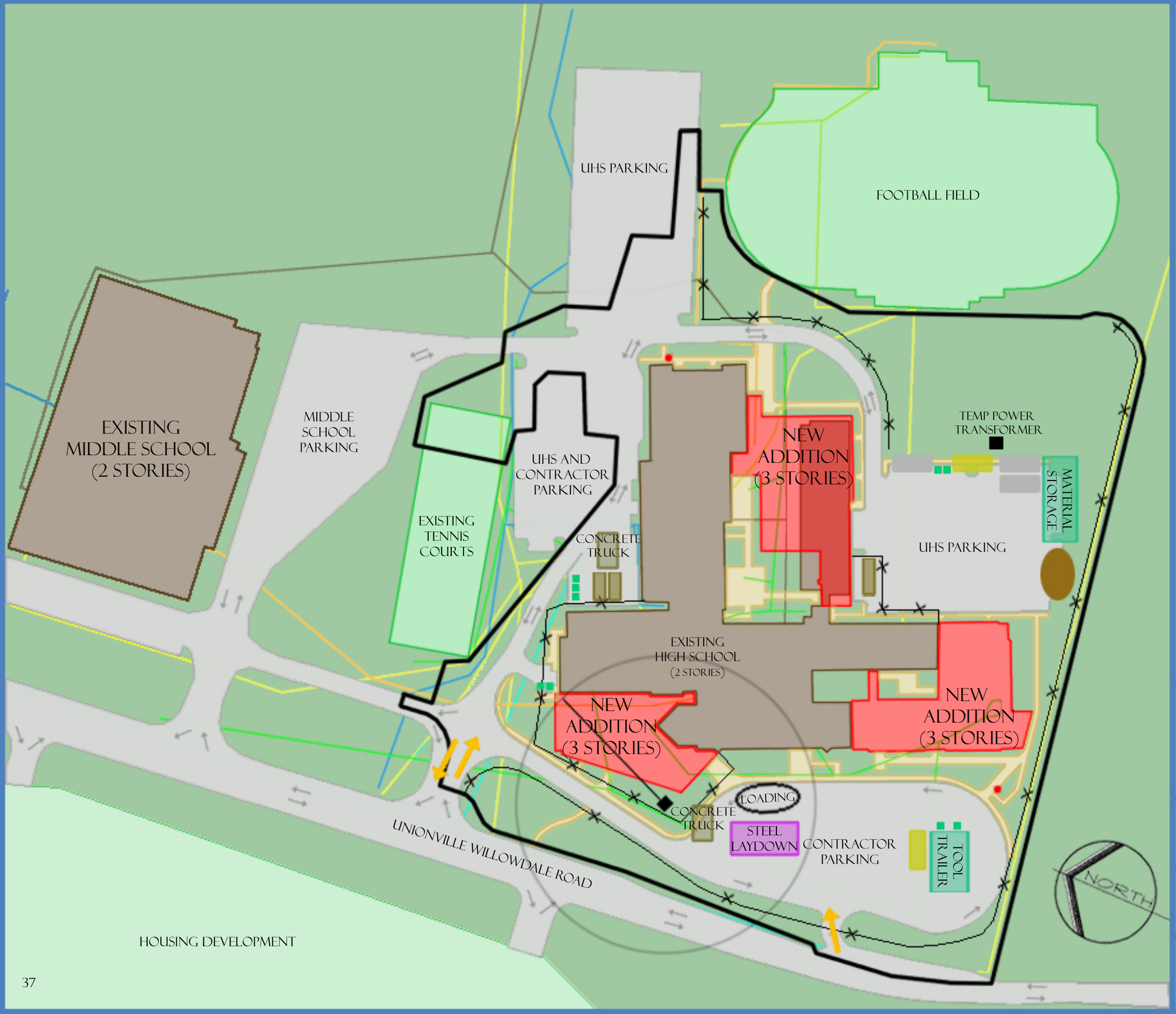
- SITE PERIMITER
- SIDEWALK
- SITE FENCE
- FIRE HYDRANT
- CRANE
- GC TRAILER
- ENTRANCE/EXIT
- PORTA-JOHN
- SUB TRAILER
- SOIL STOCKPILE
- DUMPSTER

UNIONVILLE HIGH SCHOOL ADDITIONS AND RENOVATIONS

PHASE 1 SITE LAYOUT PLAN

SEPTEMBER 20TH, 2011

MICHAEL BEAM - CM



LEGEND

UTILITIES

- ELECTRIC
- STORM
- WATER
- TELECOM
- GAS
- SANITARY

SYMBOLS

- SITE PERIMITER
- SIDEWALK
- SITE FENCE
- FIRE HYDRANT
- CRANE
- GC TRAILER
- ENTRANCE/EXIT
- PORTA-JOHN
- SUB TRAILER
- SOIL STOCKPILE
- DUMPSTER

UNIONVILLE HIGH SCHOOL ADDITIONS AND RENOVATIONS

PHASE 2 & 3 SITE LAYOUT PLAN

SEPTEMBER 20TH, 2011

MICHAEL BEAM - CM

LEGEND

UTILITIES

- ELECTRIC
- STORM
- WATER
- TELECOM
- GAS
- SANITARY

SYMBOLS

- SITE PERIMITER
- SIDEWALK
- SITE FENCE
- FIRE HYDRANT
- CRANE
- GC TRAILER
- ENTRANCE/EXIT
- PORTA-JOHN
- SUB TRAILER
- SOIL STOCKPILE
- DUMPSTER

UNIONVILLE HIGH SCHOOL ADDITIONS AND RENOVATIONS

PHASE 4
SITE LAYOUT PLAN

SEPTEMBER 20TH, 2011

MICHAEL BEAM - CM