Technical Report 1

September 23, 2011

Masonic Village at Sewickley

Sewickley, PA

Jason Drake

Construction Option

Advisor: Craig Dubler

Executive Summary

Technical Report 1 analyzes the existing conditions of Masonic Village at Sewickley. The report details project background, schedule, cost data, phasing, and a number of other advantages and restraints that may have an impact on the project team. Individual construction activities were thoroughly analyzed and detailed within Technical Report 1 in a manner that would best promote the advancement of the overall project development. This was done by comparing hard project background with theoretical or estimated values for the equivalent activity.

Construction on Masonic Village at Sewickley involves both 66,455 SF of additions as well as roughly 40,000 SF of heavy renovation work to the previously existing resident living center. One of the most challenging aspects of the project is trying to have the smallest impact on health care faculty and everyday resident life, despite working directly adjacent and having to and having to relocate them throughout various construction stages.

Projected cost of the building was also analyzed through the use of square foot and assemblies estimates. Tabulated data gathered from RS Means was utilized to compare the theoretical cost of the project versus the actual bid packages. The square foot estimate was approximately 8.3% under the actual cost, which is as expected. Furthermore, the assemblies varied across the board but were all within their allowable 10% tolerance. Cost is a driving factor on the project and needs to be carefully documented. Proper knowledge of existing conditions and site layout planning could easily make or break the project team when it comes to the budget. Given that the project was delivered through a GMP, savings sharing clauses are a valuable way to benefit both the owner and the construction manager.

Upon completion of the analysis performed in Technical Report 1, phasing is certainly one of the project's more unique procedures conducted throughout the construction process. The project is made up of five distinct phases, each of which needs be completed in the exact sequence outlined by the construction team. Not phasing the project in the way it has been outlined below would make it nearly impossible for construction to move forward while simultaneously maintaining active resident life within the existing facility. The phasing of Masonic Village at Sewickley will undoubtedly be a major focus on future thesis research.

Table of Contents

Project Schedule Summary

- Please reference **Appendix A** for a full project schedule summary, which notes entities such as preconstruction processes, milestone activities, and owner turnover dates.

Foundation:

Several different activities compromise the foundation work of the project. Following any preliminary site work, caissons are drilled and poured for each of the two additions. This process is then pursued sequentially by pouring caisson caps, grade beams, and various column footings. Concrete is first placed for Building B and later followed by Building A. Foundation walls are then put into place, given adequate cure time of the concrete. For the most part, walls are primarily made up of CMUs. However, Building A does contain several poured concrete walls in locations surrounding the first floor, which is partially below grade. Nonetheless the building's primary load carrying foundation elements are ultimately caissons and grade beams.

Structure:

A concrete slab on grade is the first part of the structure to be put in place. The slab is poured only in Building A, where the first floor is partially below grade. Precast concrete planks are positioned on top of both the poured concrete and CMU foundation walls. Once into place, CMU exterior walls are built up to what is technically designated as the 'third' floor, where another layer of precast concrete planks are set. The erection process is then followed by adding the third floor's CMU walls; at which point the roof framing process can begin. Wooden roof trusses and sheathing are subsequently placed atop the CMU exterior walls, which finally completes the buildings structural skeleton.

Enclosure:

Whereas asphalt shingles are applied to the new gabled rooftops, fully adhered EPDM roofing replaces the existing flat roof of the original structure. While roof coverings are being added, brick veneer works its way up the building simultaneously. Small regions of vinyl siding are also added to certain areas following a solid head start of the brick casing. As each trade begins to wrap up, the enclosure is finally complete with the installation of windows and exterior doors.

Finishes:

Finishes are one of the biggest portions of the project schedule. Even after the two additions are completed and turned over to the owner, the project will just be entering phase three of five. The remaining phases are dedicated to renovating the previously existing building, which is almost entirely nothing but finish work. Work includes things like drywall, painting, flooring, trim, etc. Finish work for phases two through five is expected to last approximately one year.

Building Systems Summary

(**Table 1:** Building Systems Checklist)

Yes	No	Work Scope
X		**Demolition Required**
	X	**Structural Steel Frame**
X		**Cast-in-Place Concrete**
X		**Precast Concrete**
X		**Mechanical System**
X		**Electrical System**
X		**Masonry**
	X	**Curtain Wall/Glazing**
	X	**Support of Excavation**

Demolition:

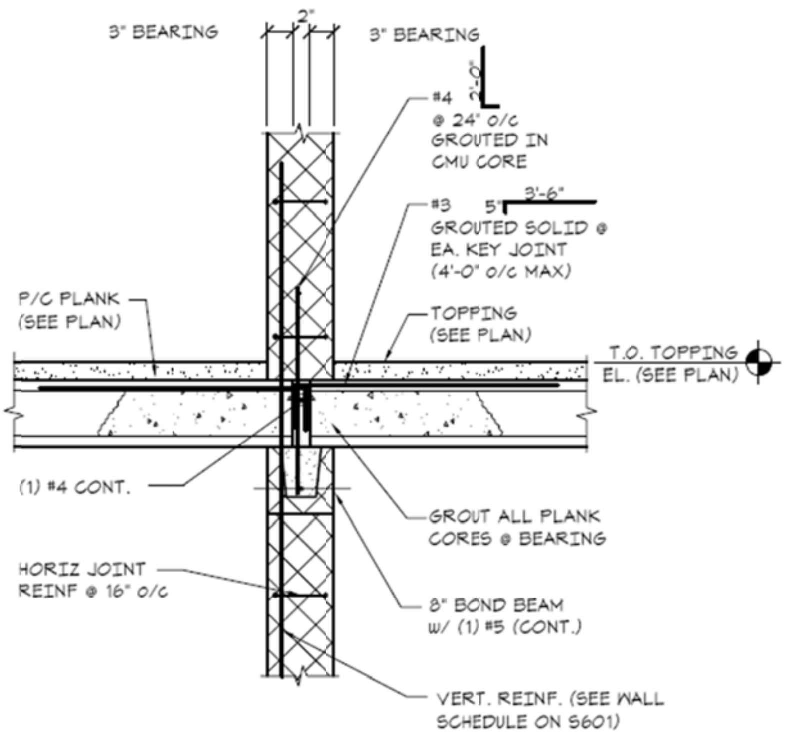
Demolition work occurring on the project is not scheduled to take place until Phase 3, when interior renovation work begins on the existing building. Since the purpose of the project is to add resident rooms to the newly constructed additions, most existing resident rooms will inevitably be demolished and relocated, leaving the previous space to be utilized in a different fashion. Much of the building's waste will come from demolition of interior walls. These assemblies are predominantly composed of metal stud framing, with small sections of masonry in some of the building's main internal bearing walls. Other waste includes floor tile, gypsum wall board (GWB), carpet, acoustical ceiling tile, etc.

Cast-in-Place Concrete:

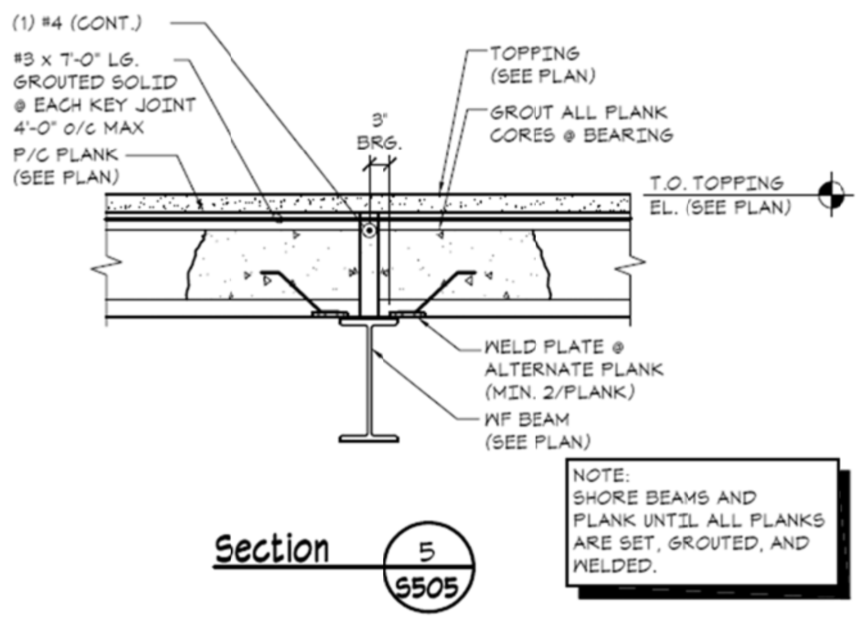
The amount of concrete used on the project is relatively low compared to the size of the building. The entire first floor contains a 4" slab on grade. Since the building itself is positioned on a hillside, portions of the second floor will also contain a 4" slab on grade. Any elevated floor space within the second floor, as well as the entire third floor, needs a 2" topping slab atop precast concrete planks. This can be viewed below in Figure 1 and Figure 2. The only vertical concrete placement occurs where the small first floor region of Building A is located below grade. This is done through the use of metal wall forms. All concrete placement for the project is executed through the use of a concrete pump truck.

Precast Concrete:

Precast concrete is very abundant on the site. Planks are produced at a fabrication plant off site and trucked in for erection. Designers have implemented both hollow core and solid core concrete planks within the building's structural framework. A 50 ton truck crane is used to make all the necessary lifts on the project. Individual units span across the addition to each load bearing CMU wall. 2' long #4 anchor bolts are grouted into the CMU core at 24" on center to properly secure the units. Once in position, anchor bolts are then grouted to the precast planks as well. In some locations, steel wide flange beams are used for structural support of the planks over wide openings. These connections are made through the use of two weld plates that were installed in the planks during fabrication. Connection details are illustrated in Figure 1 and Figure 2.



(**Figure 1:** Precast to CMU Connection Detail)



(**Figure 2:** Precast to Wide Flange Connection Detail)

(**Figure 3:** Precast Plank Lifts)

Mechanical System:

On the northwest corner of the site, an Evapco cooling tower is placed on a concrete pad. It is a closed circuit cooler and has a maximum capacity of 90,900 CFM. Intended to supply both the additions and the existing building, dimensions of the tower are roughly 12' wide x 12' deep x 21' high. Once fluid leaves the tower it is transported underground into the mechanical room, which is located on the first floor. The mechanical room also contains 3 natural gas Fulton boilers, each of which are about 3,500 lbs. One of the boilers is dedicated to domestic hot water. It is rated at 84% efficient and has an output of 1,680 MBH. The other two boilers are WSHP (water source heat pumps). These boilers achieve an efficiency of 98% and each have an output of 1,960 MBH. Two 675 lb. Bell & Gossett water condenser pumps are responsible for dispersing fluid from the mechanical room at a rate of 826 GPM. In the attics of the two additions, two 2,500 CFM heat recovery units are used for the newly added zones.

The existing structure is also going to be tied into the mechanical system of the additions. Two rooftop units currently exist atop the flat roof of the present building. These units are to be demolished and replaced by new equipment. One apparatus is designated as a 2,500 CFM ventilation unit, whereas the other is going to be a 4,000 CFM WSHP. Also being added to the existing building are 4 make-up air units for the kitchen areas. Two units will be dedicated to each area and supply the zone with an additional 1,560 CFM. The fire suppression system of the addition is a wet pipe sprinkler system. The pipes contain pressurized water at all times and individual sprinkler heads will activate when they absorb excessive heat.

(**Figure 4:** Cooling Tower)

Electrical System:

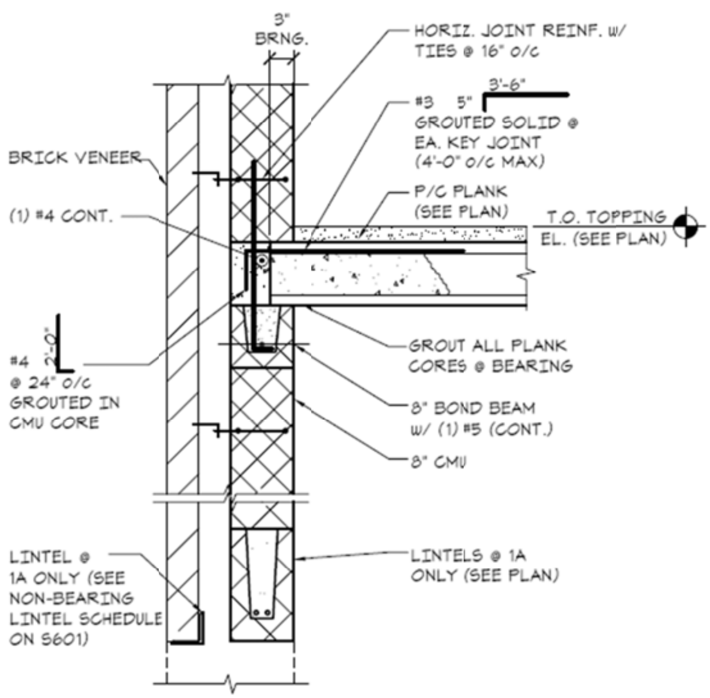
The electrical room is located on the first floor of the new addition directly next to the mechanical room. A 15kV feed is delivered underground from the utility and enters the electrical room on the west side. As the power enters the room it runs through a 480-208/120V Square D transformer rated at 75 kW. From here it is delivered to a 2000A QED main distribution switchboard connected to a main breaker that has been rated for the load. The MDP then sends power to numerous subpanels, including both 480/277V and 208/120V throughout the rest of the building. An 800kw 480/277V, 3 phase, 4 wire generator also exists next to the building's cooling tower. The generator's feed is also delivered underground to the west side of the electrical room. When it arrives in the room it enters a 2000A generator distribution panel that is responsible for providing power to its proper locations.

Masonry:

Masonry is the most abundant system within the building. Nearly all of the project's exterior walls, as well as many interior walls, are built with standard 8"x16" CMU blocks. These blocks are used for load bearing walls and comply with ASTM C 90 standards, which rate them at an average compressive strength of 2,000 psi. Two main classifications of mortar are used for bonding. Masonry set bellowed grade or containing reinforcing is to be of Type S; whereas applications of interior load-bearing or non-load bearing partition walls is to be set with Type N mortar. Nearly all exterior wall surfaces are also finished with a brick veneer. Ties and anchors are made from hot-dipped galvanized carbon steel with a class B-2 corrosion protective coating. Wire ties extend a minimum of halfway through the veneer with at least 5/8 inch cover on the outside face. The outer ends of the wire are to be bent at 90 degrees and extend at least 2 inches parallel to the face of the veneer. Face brick for the project is a product of Hanson Brick. The material is graded SW (severe weather) and is classified as FBS, which is standard face brick size. Actual dimensions are 3-5/8" wide by 3-5/8" high by 7-5/8" long. Application of the veneer is intended for areas in which the brick is directly exposed to the exterior. Concealed locations will use building (common) brick that match the properties of the face brick.

Free-standing scaffolding was used for all masonry construction on the project. Much more scaffolding needed to be set up than originally planned for. Rather than relocating portions of the scaffolding for cost efficiency, the project team decided to take a different route in order to help make up time on the schedule. Rather than completely finishing the CMU erection before starting the brick veneer, the two tasks were completed simultaneously. As each section of CMU wall became finished, the brick veneer would chase it around the building. Figure 6 shows an exterior wall section with both CMU and brick veneer. Although it requires a much less efficient use of the scaffolding, the added equipment helped recover some lost time in the schedule.

(**Figure 5:** Area B Masonry)



(**Figure 6:** Brick Veneer & Exterior Wall Detail)

Cost Information Omitted

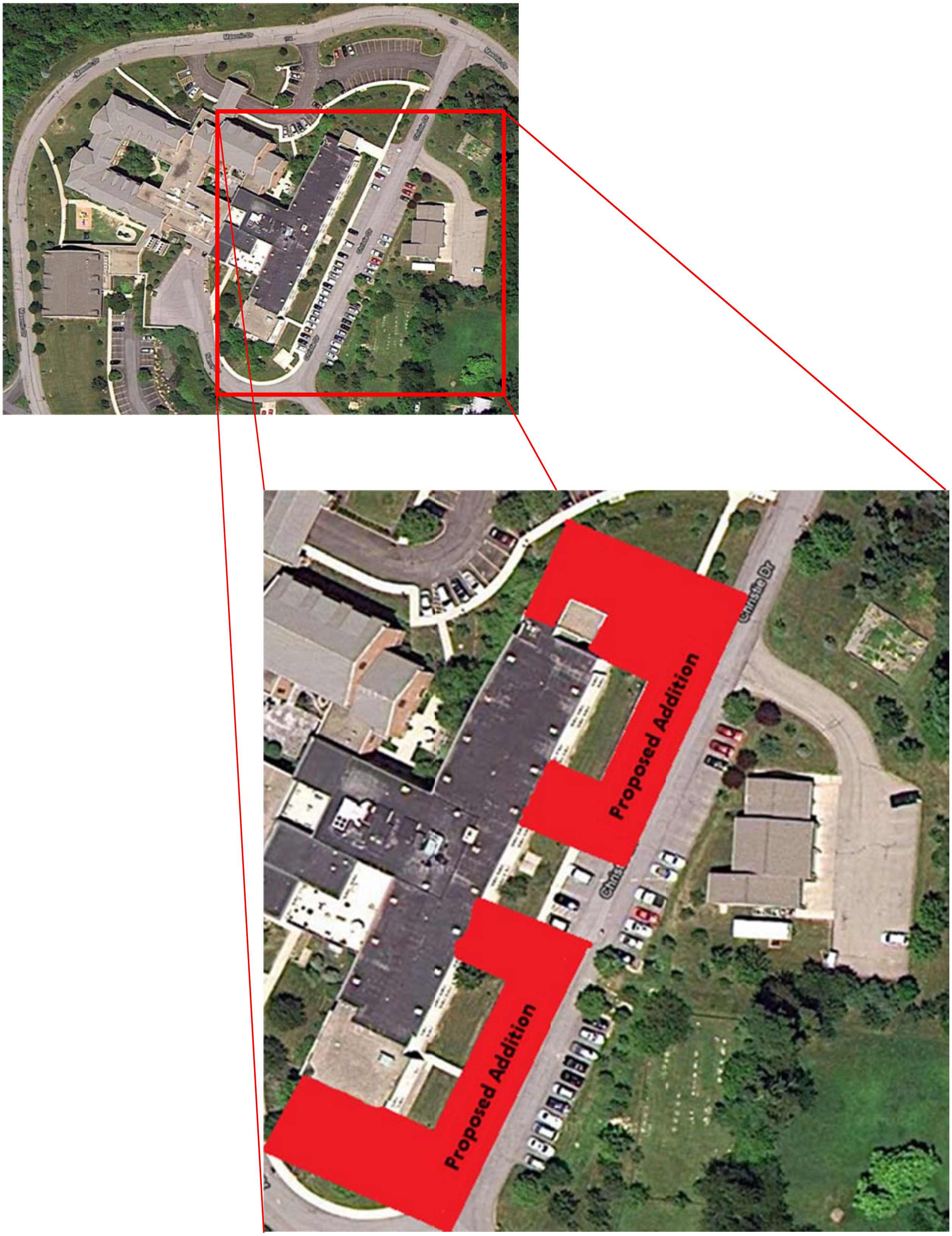
At Request of Owner

Existing Conditions

The primary function of the building is to serve as a retirement home/health care facility. Construction on Masonic Village at Sewickley will expand across roughly 100,000 SF of building area. Nonetheless, only 66,455 SF will be new construction, whereas the remaining 40,000 SF will be dedicated to interior renovations of the existing building. The structure contains two floors completely above grade with one much smaller floor partially submerged in a hillside.

The project design team created a plan that not only fit the owner's needs but also allowed for the best ease of flow between interrelated spaces. They did a great job of keeping resident rooms in more private areas of the building, while maintaining public areas on the building's north side. The duration of construction has been slated from September 13, 2010 – September 27, 2012. However, weather and other external factors may pose issues with reaching the completion date on time. As the construction manager of the project, it is up to Weber Murphy Fox to adequately oversee the project and keep things on schedule.

Arial images of the site as well as proposed areas of construction can be viewed in Figure 7. It is important for the CM to have a solid understanding of the site and its surroundings in order for the job to run smoothly. Nothing is more important for the construction phase than proper planning. A more comprehensive graphic of underground utility locations is detailed in **Appendix D**.



(**Figure 7:** Arial View of Site)

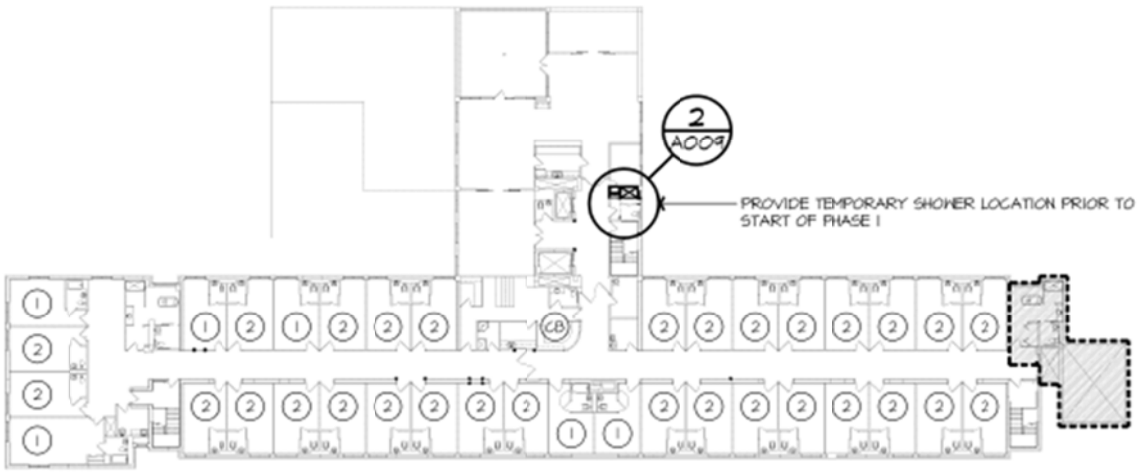
Site Layout Planning

Phasing on the Masonic Village project is a very intricate process. The job consists of five phases and has several major milestones that need to be well-tracked, including health board inspections and owner move-in dates of various areas. Phase 1, seen in Figure 8, is merely preliminary site work, foundations, and the relocation of existing parking lots. The property is fairly sizable, making equipment and material storage of lesser concern. Benching is used to excavate the 3,000 SF first floor. Although most of the second floor is at grade level, the excavated soil is used to backfill an ivany wall on the east side of the site. A more detailed layout of phase 1 can be viewed in **Appendix E**.

Phase two, detailed in Figure 9, is where most of the major new construction occurs. It involves the majority of the development of both the east and west wings. It is important for the additions to remain on schedule, considering dates have already been set to relocate residents from their current rooms. CMU load bearing walls provide structural support for the building. A 50 ton truck crane then follows behind by moving east and west along the site's access road, as seen in **Appendix E**, and sets the precast concrete planks for the floors above. Once the floors are set, scaffolding is shuffled around and the CMU walls continue upward.

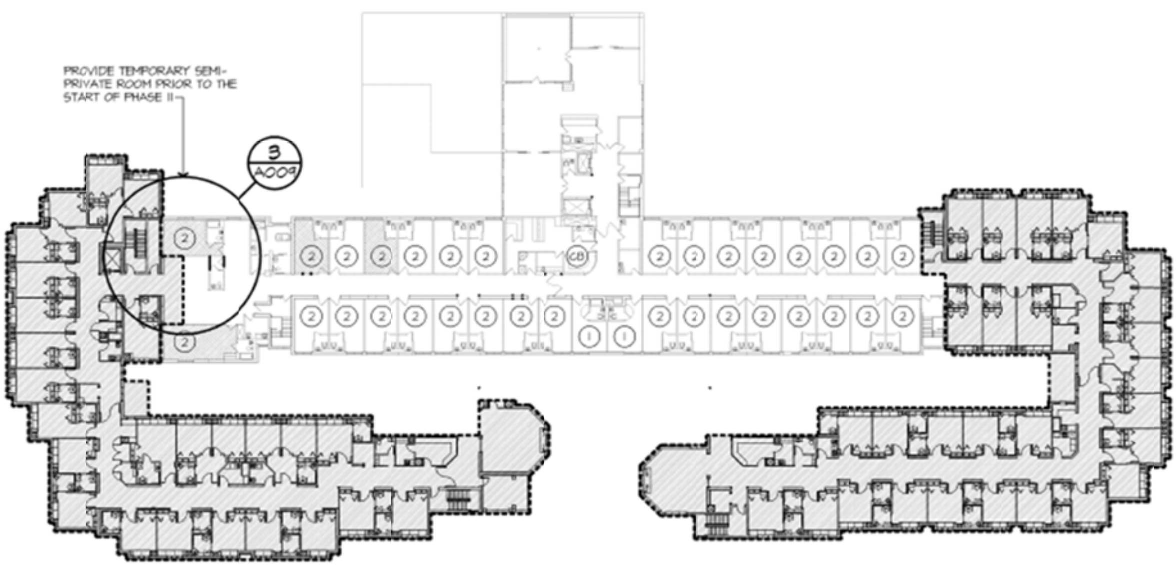
After both wings have been capped off, phase three reconnects the additions to the existing building at a second point along the existing south wall. Upon being reconnected to the original structure, heavy renovation work takes place within the existing building. Patient rooms are demolished and relocated away from the building's core. A graphic of Phase 3 can be seen in Figure 10 and a more detailed layout of the region is also displayed in **Appendix E**.

Upon completion of all new construction, work proceeds forward with the 40,000 SF of renovation work that makes up phases four and five of the project, seen in Figure 11 and Figure 12. Phase four focuses on renovating spaces near the two points at which the new additions were first connected to the previously existing structure and phase five involves wrapping up the remodel of public gathering spaces at the front of the nursing building. These areas consist of nurse stations and other specialized healthcare rooms.



(**Figure 8:** Phase 1 [Site Development])

- Courtesy of Reese, Lower, Patrick, and Scott Architects

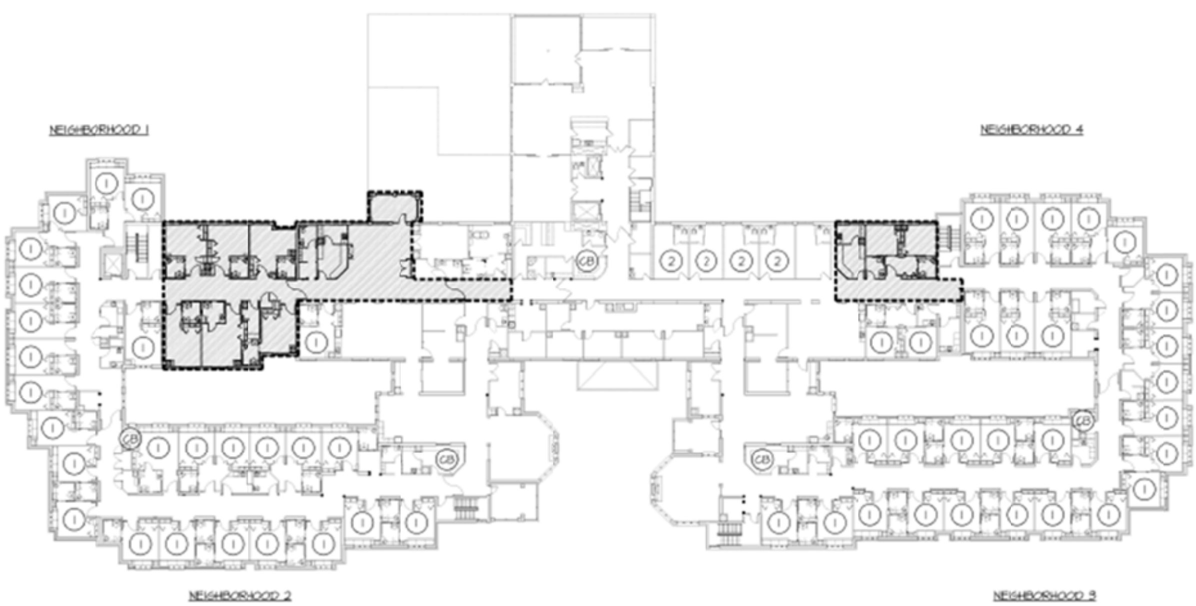


(**Figure 9:** Phase 2 [Constructing Additions])

- Courtesy of Reese, Lower, Patrick, and Scott Architects

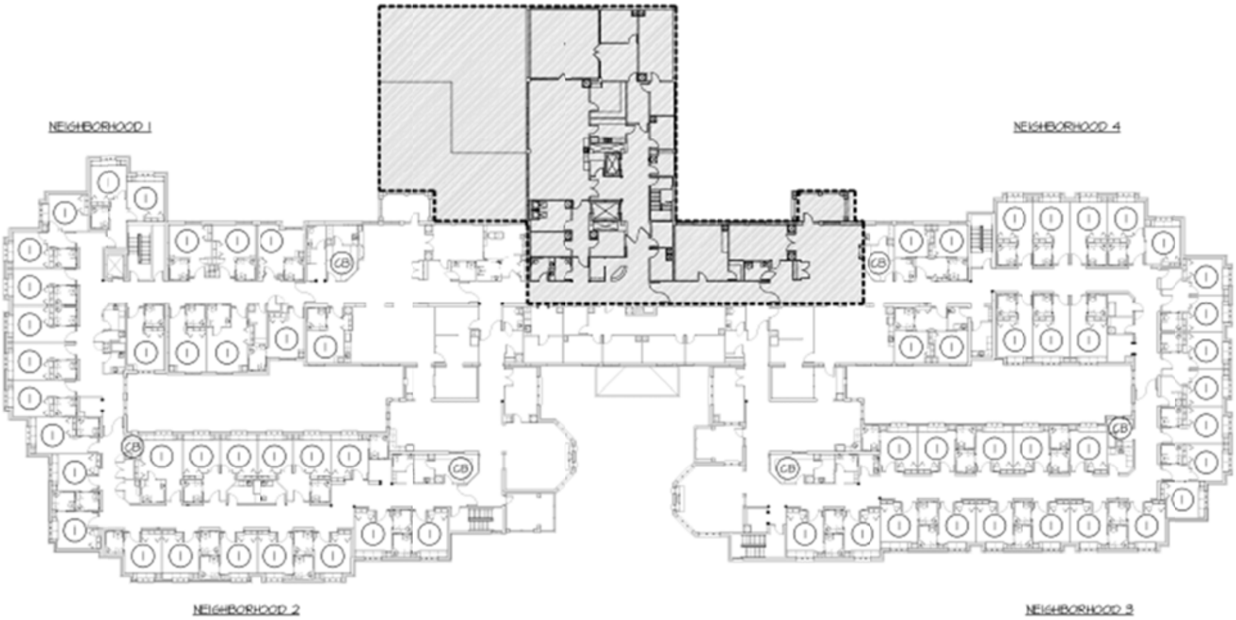
(**Figure 10:** Phase 3 [Connecting the Additions])

- Courtesy of Reese, Lower, Patrick, and Scott Architects



(**Figure 11:** Phase 4 [Heavy Renovations])

- Courtesy of Reese, Lower, Patrick, and Scott Architects



(**Figure 12:** Phase 5 [Light Renovations])

- Courtesy of Reese, Lower, Patrick, and Scott Architects

Local Conditions

Masonic Village at Sewickley is located at 1000 Masonic Drive in Sewickley, PA. The size of the property itself is approximately 54 acres, located in the peaceful hills of the Sewickley Valley. The skilled care facility itself will be comprised of two wings connected to the existing building at two separate points. The additions will provide an extra 64 bed spaces to the facility.

With the relocation of the existing parking lot and the addition of another, laborers are allotted 50 spaces near the site. As the crew begins to reach its maximum work force, parking for laborers may become somewhat tight. In a typical day there are only 30-35 personnel on site. Nonetheless, the peak work force is expected to top out at about 70 people. As a result of the construction, health care employees at Masonic Village are expected to park in lots further away than they otherwise typically would. Parking for the nursing facility is oriented around the north and west sides of the site, with plenty of yard space and small wooded areas located in close proximity.

Given the name of the facility, “Masonic” Village, the preferred means of construction throughout the complex is masonry. Buildings in the surrounding area as well as the existing portion of the structure are typically CMU load bearing walls covered with a brick veneer. Tipping fees on site are about $54 per ton and no effort has been put forth to implement any sort of organized recycling plan.

Zoning for Masonic Village at Sewickley is classified under multifamily residential. Given the size of the site, developers had virtually no problem keeping building lines well within the required setbacks of 15’ during the design development process. Most setbacks reach up to one hundred feet or more. Furthermore, the excessive size of the property made it very easy to satisfy zoning requirements in regards to the desired number of parking spaces for the facility.

According to code, each resident is to be provided with an exterior window. Since each wing laps back along the south wall, courtyards were added as a buffer, providing light-wells for individuals residing at the building’s core. This technique will provide natural light to all rooms that remain in the original half of the structure.

The geotechnical report presented a number of different findings. The topsoil is a medium damp, tan organic clayey silt. At depth of three feet, the soil becomes a light brown silt with traces of stiff rock fragments. Continuing deeper down the boring sample, light brown siltstone is evident at approximately eight feet. From eight to twenty feet on the boring sample, the soil is a gray and brown sandstone with angular joints and frequently soft seams. Ground water was not present in any test boring and is assumed to be much deeper than twenty feet.

Client Information

The history of Masonic Village at Sewickley is relatively young. The organization has occupied the property since 1999 when the campus was purchased from the Valley Care Association. Masonic Village has long envisioned establishing a superior retirement care community. Quality service for residents is of top priority. Since the possession of the property, a 60 apartment personal care facility and a 227 retirement living apartment building with 43 villas has been constructed. Each expansion indirectly proves their exceptional ability to satisfy the needs of residents and their families. In September of 2010, Masonic Village has once again chosen to expand, with two 30,000 SF additions to their retirement living center. The expansion is intended to double the number of beds currently located in the facility from 64 spaces to 128 spaces.

Cost is one of the most critical factors to the owner. Although they were provided a GMP by the construction manager, it is important for the project team to aim for the lowest possible price without sacrificing the building's quality. Savings sharing clauses provide added incentive for the CM to satisfy the needs of the owner. Schedule is of much lesser concern to the client. There are no immediate penalties to the construction manager for not completing the project on time. Nonetheless, the project team is dedicated to keeping the project within the confines of their projected schedule and proving to the owner that they do not lack capability in any aspect of their work.

Safety is another huge concern of the owner, not only for workers on site but also for their faculty and residents. With many resident rooms located directly adjacent to where the additions are being erected, precautionary measures such as maintaining adequate egress and monitoring construction dust and debris is of utmost importance. Noise is of further concern to the owner. Construction of the additions and renovations is only allowed to occur during certain hours of the day, so as to reduce the amount of disruption to resident life.

The intricate sequencing process is also of much interest to the owner due to the fact that residents will need to be shifted around as the project progresses through its phases. After the completion of the additions, residents are to be shifted such that their existing rooms can be demolished and relocated to a different area of the building. The first concern of the owner is that health care personnel are easily able to access patient rooms at all times. Secondly, with the demolition of existing rooms it is critical for sequencing to occur in such as fashion that a minimum of 64 bed spaces are maintained at all times. Keeping the owner up to date with each of these issues plays a key role in overall client satisfaction of the project.

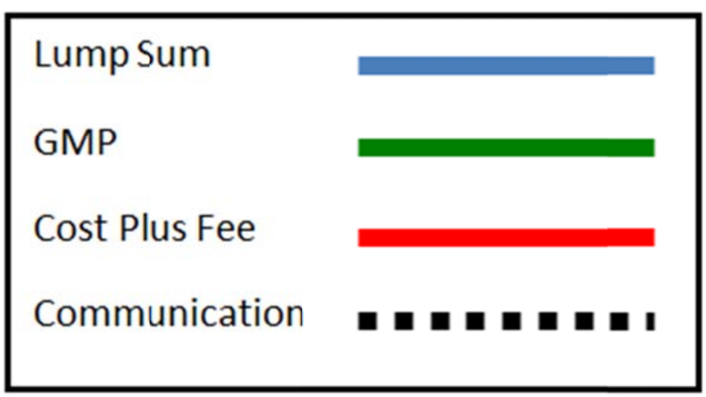
Project Delivery System

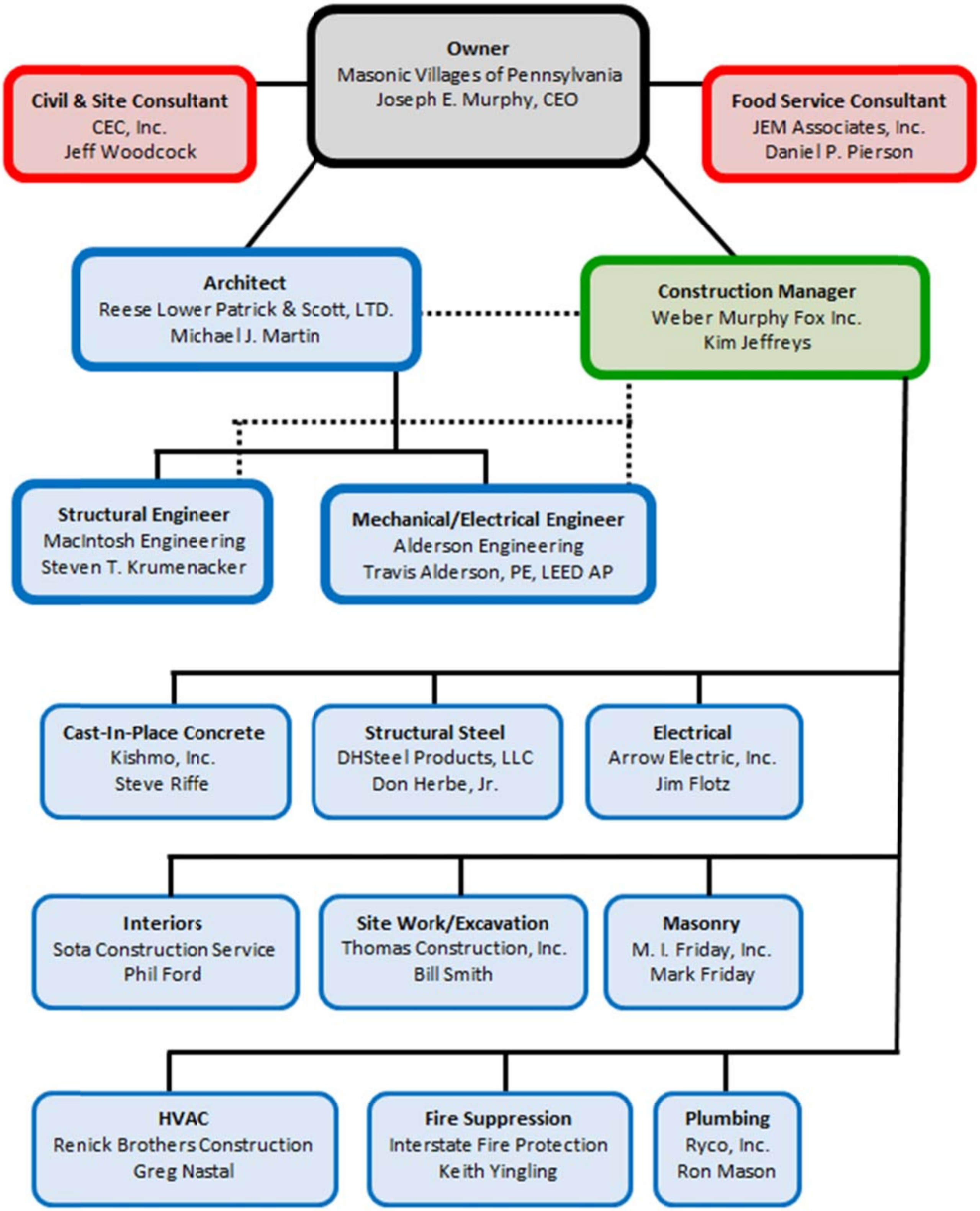
The project delivery system for the construction manager at risk on the additions and renovations of Masonic Village at Sewickley was negotiated through the use of a GMP contract. During the preconstruction phase, Masonic Village added Weber Murphy Fox to a small collection of prospective contractors. Carefully meeting with representatives from each firm, Masonic Village held private interviews to conduct the official selection process. Based on competency, projected fees, quality of previous work, and various other factors, Weber Murphy Fox was selected by the owner as the best CM for the project.

Shortly after being awarded the project, Weber Murphy Fox began to compile a list of qualified subcontractors for the various trades needed for the project. Contractors were then assembled by invitation only and trades were competitively bid. Following the bid, each job was narrowed down to three potential companies. These contractors were not always necessarily the lowest bidders but were who Weber Murphy Fox determined to be the most qualified. A detailed outline of the project delivery system and contract types is illustrated in Figure 13.

No bonds have been required for Masonic Village at Sewickley. The insurance used for the project is Builder's Risk Insurance. It is currently carried by Weber Murphy Fox and covers any mishaps that may occur during the course of construction.

Contract Types:

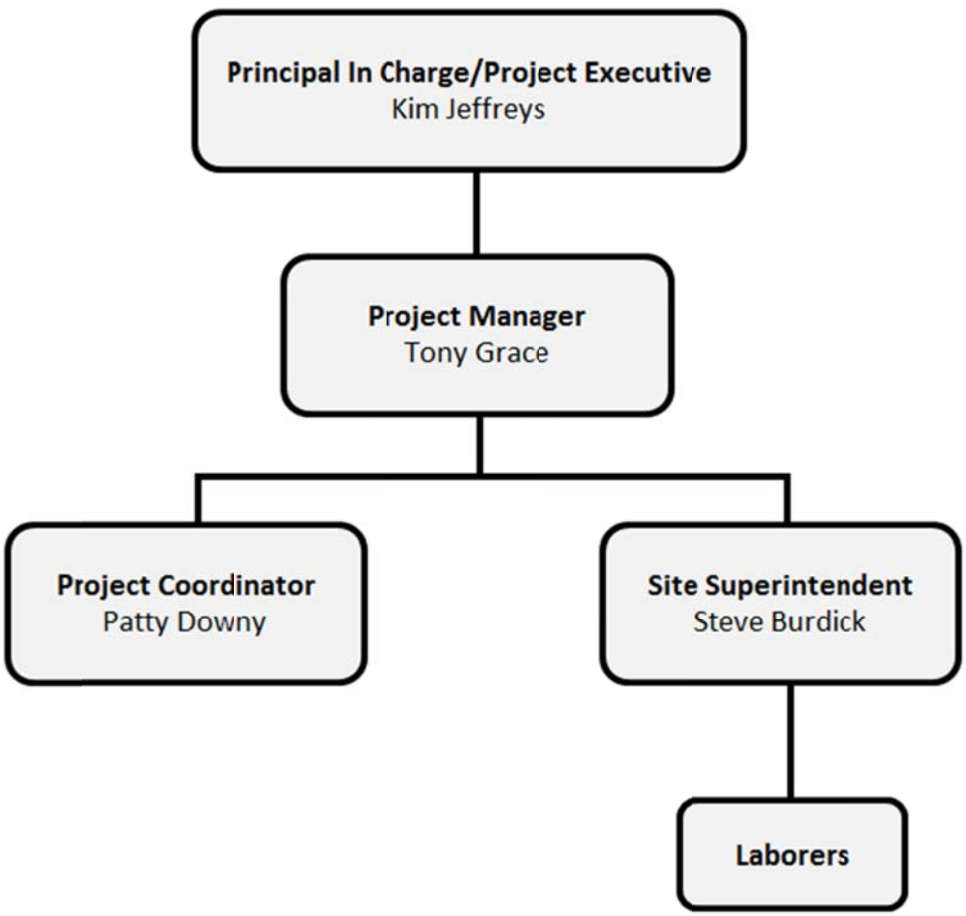




(**Figure 13:** Project Delivery Systems)

Staffing Plan

Given the relatively small size of the project, the staffing plan is fairly straightforward. The Principal In Charge/Projected executive, Kim Jeffreys, primarily oversees the job from Weber Murphy Fox's office headquarters in Erie, PA. Reporting directly to Mr. Jeffreys is Project Manager Tony Grace. Mr. Grace is stationed at one of the company's satellite offices in State College, PA. Although much of his work on the project is office-based, he does make weekly trips to the site and makes sure everything is running smoothly. Residing directly below the Project Manager are two main positions, Project Coordinator and Site Superintendent. The Project Coordinator, Patty Downey, has responsibilities similar to an Assistant Project Manager. She aids Mr. Grace by tracking things like submittals, RFI's, etc. Out in the actual field is Steve Burdick, Site Superintendent. Mr. Burdick is on site every day and supervises each subcontractor's daily activity. Figure 14 depicts a graphic representation of the project's staffing plan.

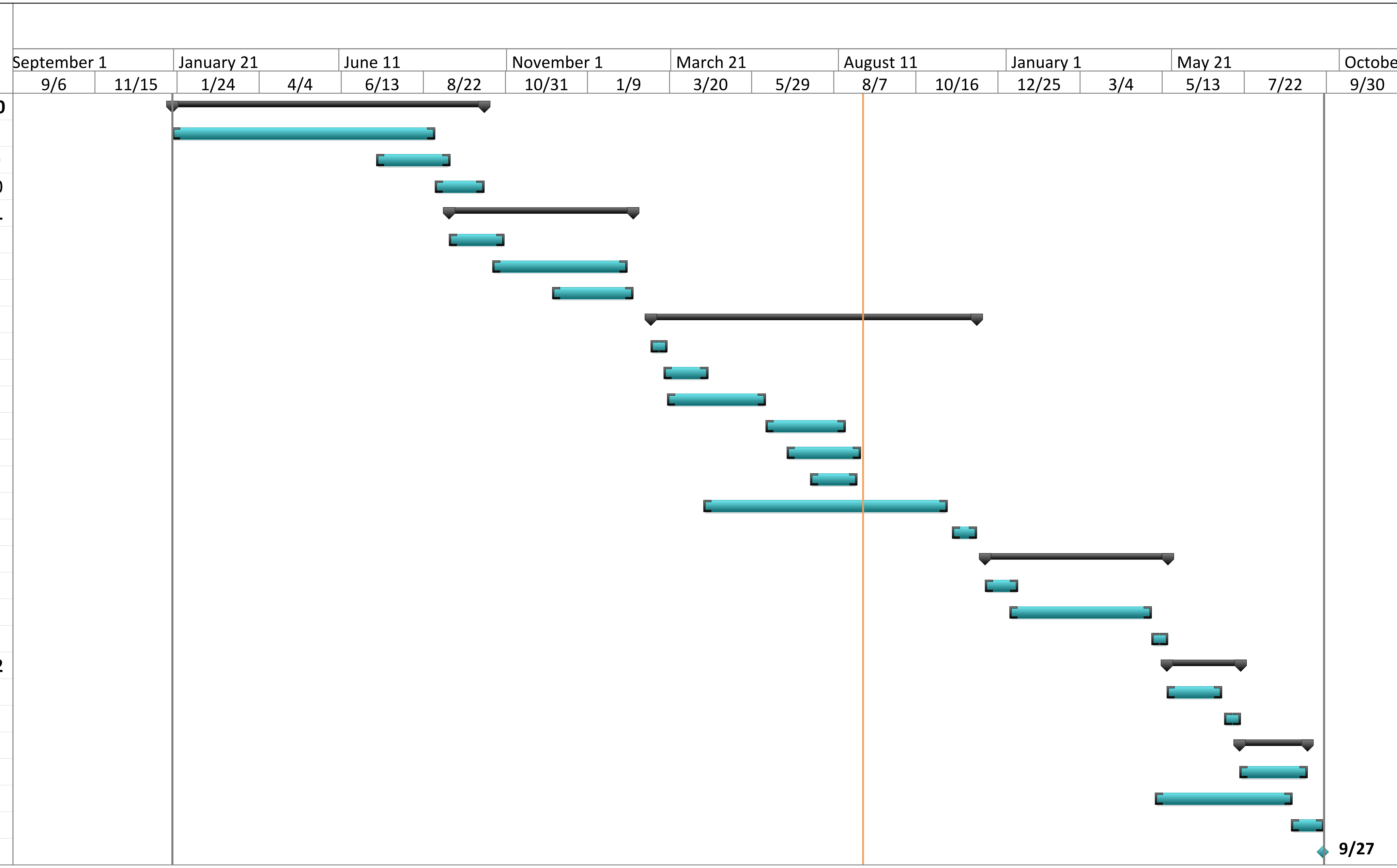


(**Figure 14:** Staffing Plan)

Appendix A

Project Schedule Summary

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Preconstruction/Procurement**	**190 days**	**Wed 1/20/10**	**Tue 10/12/10**
2		Construction Documents	160 days	Wed 1/20/10	Tue 8/31/10
3		Permits	45 days	Tue 7/13/10	Mon 9/13/10
4		Submittals and Procurement	30 days	Wed 9/1/10	Tue 10/12/10
5		**Phase 1 & Foundations**	**113 days**	**Mon 9/13/10**	**Wed 2/16/11**
6		Preliminary Site Work	35 days	Mon 9/13/10	Fri 10/29/10
7		Building B Foundation	83 days	Wed 10/20/10	Fri 2/11/11
8		Building A Foundation	49 days	Fri 12/10/10	Wed 2/16/11
9		**Phase 2 Additions**	**198 days**	**Fri 3/4/11**	**Tue 12/6/11**
10		Slab on Grade	10 days	Fri 3/4/11	Thu 3/17/11
11		Precast Concrete Planks	28 days	Tue 3/15/11	Thu 4/21/11
12		CMU Walls	60 days	Fri 3/18/11	Thu 6/9/11
13		Roof Framing & Covering	48 days	Fri 6/10/11	Tue 8/16/11
14		Brick Casing & Sidings	45 days	Tue 6/28/11	Mon 8/29/11
15		Windows & Exterior Doors	30 days	Mon 7/18/11	Fri 8/26/11
16		MEP Installation	150 days	Mon 4/18/11	Fri 11/11/11
17		Owner Move-in of Phase 2	15 days	Wed 11/16/11	Tue 12/6/11
18		**Phase 3**	**112 days**	**Wed 12/14/11**	**Thu 5/17/12**
19		Demolish Existing Areas	20 days	Wed 12/14/11	Tue 1/10/12
20		Interior Renovations	87 days	Wed 1/4/12	Thu 5/3/12
21		Owner Move-in of Phase 3	10 days	Fri 5/4/12	Thu 5/17/12
22		**Phase 4**	**45 days**	**Thu 5/17/12**	**Wed 7/18/12**
23		Interior Renovations	33 days	Thu 5/17/12	Mon 7/2/12
24		Owner Move-in of Phase 4	10 days	Thu 7/5/12	Wed 7/18/12
25		**Phase 5**	**42 days**	**Wed 7/18/12**	**Thu 9/13/12**
26		Interior Renovations	42 days	Wed 7/18/12	Thu 9/13/12
27		Final Site Grading	85 days	Mon 5/7/12	Fri 8/31/12
28		Punch List & Close Out	20 days	Fri 8/31/12	Thu 9/27/12
29		Owner Occupancy	0 days	Thu 9/27/12	Thu 9/27/12



Project: schedule summary
Date: Thu 9/1/11

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

Appendix B

Square Foot Estimate Data

Square Foot Estimate Data:

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.450** | **Nursing Home**

Costs per square foot of floor area

Exterior Wall	S.F. Area	10000	15000	20000	25000	30000	35000	40000	45000	50000
	L.F. Perimeter	286	370	453	457	513	568	624	680	735
Precast Concrete Panels	Bearing Walls	218.85	209.40	204.60	**196.70**	194.15	192.25	190.90	189.90	188.95
	Steel Frame	222.40	212.95	208.20	200.25	197.70	195.85	194.55	193.50	192.60
Face Brick with Concrete Block Back-up	Bearing Walls	208.25	200.30	196.25	189.90	187.85	186.25	185.15	184.30	183.55
	Steel Joists	212.40	204.40	200.35	194.00	191.90	190.35	189.30	188.45	187.70
Stucco on Concrete Block	Bearing Walls	199.00	192.30	188.90	184.00	182.25	181.00	180.10	179.40	178.80
	Steel Joists	203.15	196.45	193.00	188.10	186.40	185.15	184.25	183.55	182.95
Perimeter Adj., Add or Deduct	Per 100 L.F.	16.00	10.65	8.00	6.40	5.30	4.65	4.10	3.55	3.20
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.90	3.35	3.10	2.45	2.35	2.25	2.15	2.05	2.05
***For Basement**, add $30.45 per square foot of basement area*										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $84.90 to $212.80 per S.F.

Common additives

Description	Unit	$ Cost
Beds, Manual	Each	830 - 2825
Elevators, Hydraulic passenger, 2 stops		
1500# capacity	Each	59,700
2500# capacity	Each	62,900
3500# capacity	Each	65,900
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	299
Nickel cadmium	Each	785
Intercom System, 25 station capacity		
Master station	Each	3125
Intercom outlets	Each	176
Handset	Each	485
Kitchen Equipment		
Broiler	Each	4050
Coffee urn, twin 6 gallon	Each	3325
Cooler, 6 ft. long	Each	5275
Dishwasher, 10-12 racks per hr.	Each	5075
Food warmer	Each	530
Freezer, 44 C.F., reach-in	Each	3275

Description	Unit	$ Cost
Kitchen Equipment, cont.		
Ice cube maker, 50 lb. per day	Each	1825
Range with 1 oven	Each	3275
Laundry Equipment		
Dryer, gas, 16 lb. capacity	Each	915
30 lb. capacity	Each	3625
Washer, 4 cycle	Each	1100
Commercial	Each	1475
Nurses Call System		
Single bedside call station	Each	325
Pillow speaker	Each	265
Refrigerator, Prefabricated, walk-in		
7'-6" high, 6' x 6'	S.F.	173
10' x 10'	S.F.	137
12' x 14'	S.F.	121
12' x 20'	S.F.	107
TV Antenna, Master system, 12 outlet	Outlet	325
30 outlet	Outlet	208
100 outlet	Outlet	200
Whirlpool Bath, Mobile, 18" x 24" x 60"	Each	4950
X-Ray, Mobile	Each	14,700 - 83,000

RS Means Square Foot Cost Data: 2011 (Page 172)

Appendix C
Assemblies Estimate Data

Assemblies Estimate Data:

HVAC

3020 110	Heating System, Fin Tube Radiation		COST PER S.F.	
		MAT.	INST.	TOTAL
Heating systems, hydronic, fossil fuel, fin tube radiation				
Cast iron boiler, gas, 80 MBH, 1,070 S.F. bldg.		12.99	14.21	27.20
169 M.B.H., 2,140 S.F. bldg.		8.20	9.05	17.25
544 M.B.H., 7,250 S.F. bldg.	RD3020-010	6.45	7.70	14.15
1,088 M.B.H., 14,500 S.F. bldg.		5.80	7.55	13.35
3,264 M.B.H., 43,500 S.F. bldg.	RD3020-020	5.05	6.70	11.75
5,032 M.B.H., 67,100 S.F. bldg.		5.70	6.80	12.50
Oil, 109 M.B.H., 1,420 S.F. bldg.		15.10	15.55	30.65
235 M.B.H., 3,150 S.F. bldg.		8.25	9.05	17.30
940 M.B.H., 12,500 S.F. bldg.		6.30	7.25	13.55
1,600 M.B.H., 21,300 S.F. bldg.		6.35	7.20	13.55
2,480 M.B.H., 33,100 S.F. bldg.		6.40	6.85	13.25
3,350 M.B.H., 44,500 S.F. bldg.		5.75	6.90	12.65
Coal, 148 M.B.H., 1,975 S.F. bldg.		10.95	8.60	19.55
300 M.B.H., 4,000 S.F. bldg.		8.65	7.40	16.05
2,360 M.B.H., 31,500 S.F. bldg.		6.50	6.85	13.35
Steel boiler, oil, 97 M.B.H., 1,300 S.F. bldg.		12.35	12.75	25.10
315 M.B.H., 4,550 S.F. bldg.		6.05	6.45	12.50
525 M.B.H., 7,000 S.F. bldg.		7.45	7.45	14.90
1,050 M.B.H., 14,000 S.F. bldg.		6.65	7.45	14.10
2,310 M.B.H., 30,800 S.F. bldg.		6.45	6.90	13.35
3,150 M.B.H., 42,000 S.F. bldg.		6.30	7	13.30

RS Means Assemblies Cost Data: 2011 (Page 319)

D3030 115	Chilled Water, Cooling Tower Systems		COST PER S.F.		
			MAT.	INST.	TOT
1300	Packaged chiller, water cooled, with fan coil unit				
1320	Apartment corridors, 4,000 S.F., 7.33 ton		5.98	7.68	
1600	Banks and libraries, 4,000 S.F., 16.66 ton	RD3030-010	11	8.45	
1800	60,000 S.F., 250.00 ton		7.40	6.75	
1880	Bars and taverns, 4,000 S.F., 44.33 ton		19.50	10.70	
2000	20,000 S.F., 221.66 ton		18.70	8.85	
2160	Bowling alleys, 4,000 S.F., 22.66 ton		12.90	9.25	
2320	40,000 S.F., 226.66 ton		10.40	6.35	
2440	Department stores, 4,000 S.F., 11.66 ton		6.85	8.35	
2640	60,000 S.F., 175.00 ton		6.65	6.15	
2720	Drug stores, 4,000 S.F., 26.66 ton		13.55	9.55	
2880	40,000 S.F., 266.67 ton		10.35	7.20	
3000	Factories, 4,000 S.F., 13.33 ton		9.40	8.05	
3200	60,000 S.F., 200.00 ton		6.60	6.50	
3280	Food supermarkets, 4,000 S.F., 11.33 ton		6.75	8.30	
3480	60,000 S.F., 170.00 ton		6.55	6.15	
3560	Medical centers, 4,000 S.F., 9.33 ton		5.80	7.60	
3760	60,000 S.F., 140.00 ton		5.30	6.25	
3840	Offices, 4,000 S.F., 12.66 ton		9.10	7.95	
4040	60,000 S.F., 190.00 ton		6.40	6.40	
4120	Restaurants, 4,000 S.F., 20.00 ton		11.50	8.60	
4320	60,000 S.F., 300.00 ton		8.35	7	
4400	Schools and colleges, 4,000 S.F., 15.33 ton		10.35	8.30	
4600	60,000 S.F., 230.00 ton		6.80	6.50	

RS Means Assemblies Cost Data: 2011 (Page 324)

Electrical

D5010 120	Electric Service, 3 Phase - 4 Wire		COST EACH	
		MAT.	INST.	TOTAL
0200	Service installation, includes breakers, metering, 20' conduit & wire			
0220	3 phase, 4 wire, 120/208 volts, 60 A	960	920	1,8
0240	100 A	1,150	1,100	2,2
0280	200 A	1,875	1,700	3,5
0320	400 A	4,425	3,125	7,5
0360	600 A (RD5010 -110)	8,275	4,225	12,5
0400	800 A	10,200	5,100	15,3
0440	1000 A	12,400	5,850	18,2
0480	1200 A	15,800	6,000	21,8
0520	1600 A	27,800	8,600	36,4
0560	2000 A	30,600	9,800	40,4
0570	Add 25% for 277/480 volt			
0580				
0610	1 phase, 3 wire, 120/240 volts, 100 A	535	1,000	1,53
0620	200 A	1,100	1,475	2,57

RS Means Assemblies Cost Data: 2011 (Page 354)

D5020 208	Fluorescent Fixtures (by Type)		COST PER S.F.	
		MAT.	INST.	TOTAL
0520	Fluorescent fixtures, type A, 8 fixtures per 400 S.F.	2.71	5.50	[illegible]
0560	11 fixtures per 600 S.F.	2.56	5.35	[illegible]
0600	17 fixtures per 1000 S.F. (RD5020 -200)	2.47	5.25	[illegible]
0640	23 fixtures per 1600 S.F.	2.25	4.97	[illegible]
0680	28 fixtures per 2000 S.F.	2.25	4.97	[illegible]
0720	41 fixtures per 3000 S.F.	2.18	4.97	[illegible]
0800	53 fixtures per 4000 S.F.	2.15	4.85	[illegible]
0840	64 fixtures per 5000 S.F.	2.15	4.85	[illegible]
0880	Type B, 11 fixtures per 400 S.F.	4.90	8.05	[illegible]
0920	15 fixtures per 600 S.F.	4.54	7.70	[illegible]
0960	24 fixtures per 1000 S.F.	4.45	7.70	[illegible]
1000	35 fixtures per 1600 S.F.	4.16	7.30	[illegible]
1040	42 fixtures per 2000 S.F.	4.08	7.35	[illegible]
1080	61 fixtures per 3000 S.F.	4.09	7.10	[illegible]
1160	80 fixtures per 4000 S.F.	3.97	7.25	[illegible]
1200	98 fixtures per 5000 S.F.	3.96	7.20	[illegible]
1240	Type C, 11 fixtures per 400 S.F.	4.06	8.50	[illegible]
1280	14 fixtures per 600 S.F.	3.63	7.95	[illegible]
1320	23 fixtures per 1000 S.F.	3.61	7.90	[illegible]
1360	34 fixtures per 1600 S.F.	3.48	7.80	[illegible]
1400	43 fixtures per 2000 S.F.	3.51	7.70	[illegible]
1440	63 fixtures per 3000 S.F.	3.42	7.60	[illegible]
1520	81 fixtures per 4000 S.F.	3.35	7.50	[illegible]
1560	101 fixtures per 5000 S.F.	3.35	7.50	[illegible]
1600	Type D, 8 fixtures per 400 S.F.	3.66	6.60	[illegible]
1640	12 fixtures per 600 S.F.	3.66	6.55	[illegible]
1680	19 fixtures per 1000 S.F.	3.52	6.40	[illegible]
1720	27 fixtures per 1600 S.F.	3.30	6.25	[illegible]
1760	34 fixtures per 2000 S.F.	3.28	6.15	[illegible]
1800	48 fixtures per 3000 S.F.	3.15	6	[illegible]
1880	64 fixtures per 4000 S.F.	3.15	6	[illegible]
1920	79 fixtures per 5000 S.F.	3.15	6	[illegible]

RS Means Assemblies Cost Data: 2011 (Page 372)

D5020 110	Receptacle (by Wattage)	COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
0190	Receptacles include plate, box, conduit, wire & transformer when required			
0200	2.5 per 1000 S.F., .3 watts per S.F.	.38	1.33	1.71
0240	With transformer (RD5010-110)	.45	1.40	1.85
0280	4 per 1000 S.F., .5 watts per S.F.	.43	1.55	1.98
0320	With transformer	.53	1.65	2.18
0360	5 per 1000 S.F., .6 watts per S.F.	.51	1.83	2.34
0400	With transformer	.65	1.96	2.61
0440	8 per 1000 S.F., .9 watts per S.F.	.53	2.03	2.56
0480	With transformer	.72	2.21	2.93
0520	10 per 1000 S.F., 1.2 watts per S.F.	.58	2.20	2.78
0560	With transformer	.89	2.50	3.39
0600	16.5 per 1000 S.F., 2.0 watts per S.F.	.68	2.75	3.43
0640	With transformer	1.21	3.26	4.47
0680	20 per 1000 S.F.,2.4 watts per S.F.	.71	3	3.71
0720	With transformer	1.33	3.60	4.93

RS Means Assemblies Cost Data: 2011 (Page 357)

D5090 210	Generators (by kW)	COST PER kW MAT.	COST PER kW INST.	COST PER kW TOTAL
0190	Generator sets, include battery, charger, muffler & transfer switch			
0200	Gas/gasoline operated, 3 phase, 4 wire, 277/480 volt, 7.5 kW	1,175	260	1,435
0240	11.5 kW (RD5010-110)	1,075	197	1,272
0280	20 kW	730	129	859
0320	35 kW	495	84	579
0360	80 kW	355	51	406
0400	100 kW	310	49.50	359.50
0440	125 kW	510	46	556
0480	185 kW	455	35	490
0560	Diesel engine with fuel tank, 30 kW	770	97.50	867.50
0600	50 kW	550	77.50	627.50
0720	125 kW	335	45	380
0760	150 kW	320	41.50	361.50
0800	175 kW	297	36.50	333.50
0840	200 kW	268	34	302
0880	250 kW	252	28	280
0920	300 kW	228	24.50	252.50
0960	350 kW	220	23	243
1000	400 kW	239	21.50	260.50
1040	500 kW	240	18	258
1200	750 kW	263	11.30	274.30
1400	1000 kW	244	12	256

RS Means Assemblies Cost Data: 2011 (Page 392)

Plumbing

D20 Plumbing

D2090 Other Plumbing Systems

D2090 810	Piping - Installed - Unit Costs	COST PER L.F. MAT.	COST PER L.F. INST.	COST PER L.F. TOTAL
1940	1-1/2" diameter	15.30	11.85	27.15
1960	2" diameter	23.50	14.55	38.05
1980	2-1/2" diameter	35.50	18	53.50
2000	3" diameter	48	19.85	67.85
2020	4" diameter	86.50	29	115.50
2040	5" diameter	201	32	233
2060	6" diameter	283	42.50	325.50
2080	8" diameter	470	47	517
2120	Type DWV, 1-1/4" diameter	12.15	10.65	22.80
2160	1-1/2" diameter	15.05	11.85	26.90
2180	2" diameter	20	14.55	34.55
2200	3" diameter	37	19.85	56.85
2220	4" diameter	65.50	29	94.50
2240	5" diameter	183	32	215
2260	6" diameter	263	42.50	305.50
2280	8" diameter	630	47	677
2800	Plastic,PVC, DWV, schedule 40, 1-1/4" diameter	5.10	15.25	20.35
2820	1-1/2" diameter	4.98	17.80	22.78
2830	2" diameter	5.45	19.55	25
2840	3" diameter	8.25	22	30.25
2850	4" diameter	10.45	24	34.45
2890	6" diameter	17.70	29.50	47.20
3010	Pressure pipe 200 PSI, 1/2" diameter	3.68	11.85	15.53
3030	3/4" diameter	3.94	12.55	16.49
3040	1" diameter	4.94	13.90	18.84
3050	1-1/4" diameter	5.75	15.25	21
3060	1-1/2" diameter	5.85	17.80	23.65
3070	2" diameter	6.55	19.55	26.10
3080	2-1/2" diameter	10.35	20.50	30.85
3090	3" diameter	11.35	22	33.35
3100	4" diameter	16.65	24	40.65
3110	6" diameter	28.50	29.50	58
3120	8" diameter	42.50	37.50	80
4000	Steel, schedule 40, black, threaded, 1/2" diameter	4.18	10.15	14.33
4020	3/4" diameter	4.80	10.50	15.30
4030	1" diameter	6.75	12.10	18.85
4040	1-1/4" diameter	8.30	12.95	21.25
4050	1-1/2" diameter	9.60	14.40	24
4060	2" diameter	12.60	18	30.60
4070	2-1/2" diameter	19	23	42
4080	3" diameter	24	27	51
4090	4" diameter	35.50	32	67.50
4100	Grooved, 5" diameter	23.50	31	54.50
4110	6" diameter	30	42.50	72.50
4120	8" diameter	45.50	48.50	94
4130	10" diameter	67.50	58	125.50
4140	12" diameter	95	66.50	161.50
4200	Galvanized, threaded, 1/2" diameter	5.65	10.15	15.80
4220	3/4" diameter	11.30	10.50	21.80
4230	1" diameter	8.90	12.10	21
4240	1-1/4" diameter	11.15	12.95	24.10
4250	1-1/2" diameter	13	14.40	27.40
4260	2" diameter	17.15	18	35.15
4270	2-1/2" diameter	28	23	51
4280	3" diameter	35	27	62
4290	4" diameter	50.50	32	82.50
4300	Grooved, 5" diameter	50.50	31	81.50
4310	6" diameter	56.50	42.50	99

RS Means Assemblies Cost Data: 2011 (Page 299)

D2010 924	Three Fixture Bathroom, One Wall Plumbing	COST EACH		
		MAT.	INST.	TOTAL
1150	Bathroom, three fixture, one wall plumbing			
1160	Lavatory, water closet & bathtub			
1170	Stand alone	2,925	2,200	5,125
1180	Share common plumbing wall *	2,525	1,575	4,100

D2010 926	Three Fixture Bathroom, Two Wall Plumbing	COST EACH		
		MAT.	INST.	TOTAL
2130	Bathroom, three fixture, two wall plumbing			
2140	Lavatory, water closet & bathtub			
2160	Stand alone	2,950	2,225	5,175
2180	Long plumbing wall common *	2,650	1,775	4,425
3610	Lavatory, bathtub & water closet			
3620	Stand alone	3,250	2,525	5,775
3640	Long plumbing wall common *	3,000	2,300	5,300
4660	Water closet, corner bathtub & lavatory			
4680	Stand alone	4,300	2,250	6,550
4700	Long plumbing wall common *	3,875	1,700	5,575
6100	Water closet, stall shower & lavatory			
6120	Stand alone	3,075	2,525	5,600
6140	Long plumbing wall common *	2,875	2,325	5,200
7060	Lavatory, corner stall shower & water closet			
7080	Stand alone	3,375	2,225	5,600
7100	Short plumbing wall common *	2,725	1,500	4,225

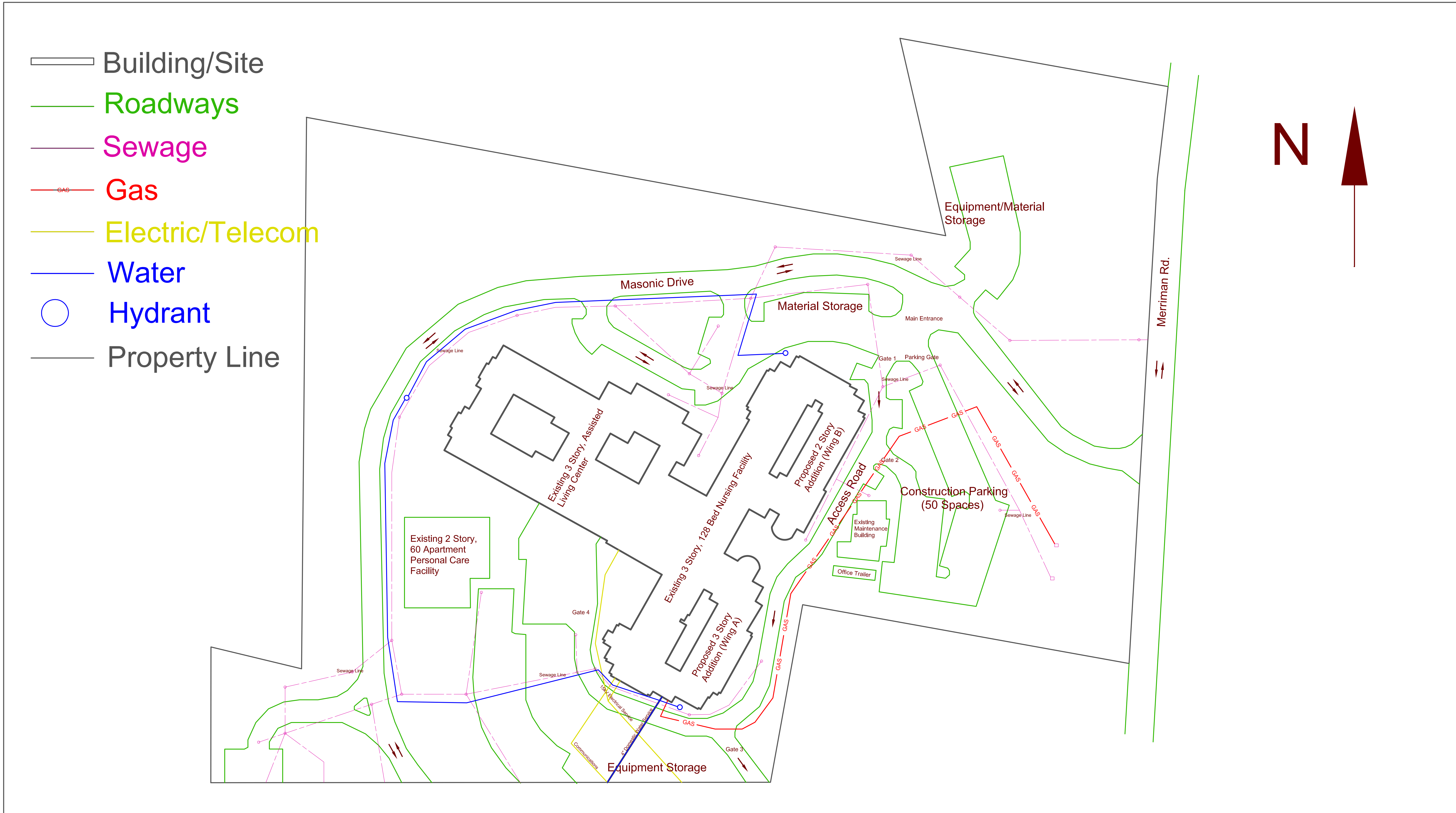
RS Means Assemblies Cost Data: 2011 (Page 281)

Fire Suppression

D4010 410	Wet Pipe Sprinkler Systems		COST PER S.F.		
			MAT.	INST.	TOTAL
0520	Wet pipe sprinkler systems, steel, black, sch. 40 pipe				
0530	Light hazard, one floor, 500 S.F.		2.57	2.90	5.[illegible]
0560	1000 S.F.	RD4010 -100	5.05	3.03	8.[illegible]
0580	2000 S.F.		4.50	3.04	7.[illegible]
0600	5000 S.F.	RD4020 -300	2.23	2.15	4.[illegible]
0620	10,000 S.F.		1.55	1.83	3.[illegible]
0640	50,000 S.F.		1.17	1.63	2.[illegible]
0660	Each additional floor, 500 S.F.		1.34	2.47	3.[illegible]

RS Means Assemblies Cost Data: 2011 (Page 344)

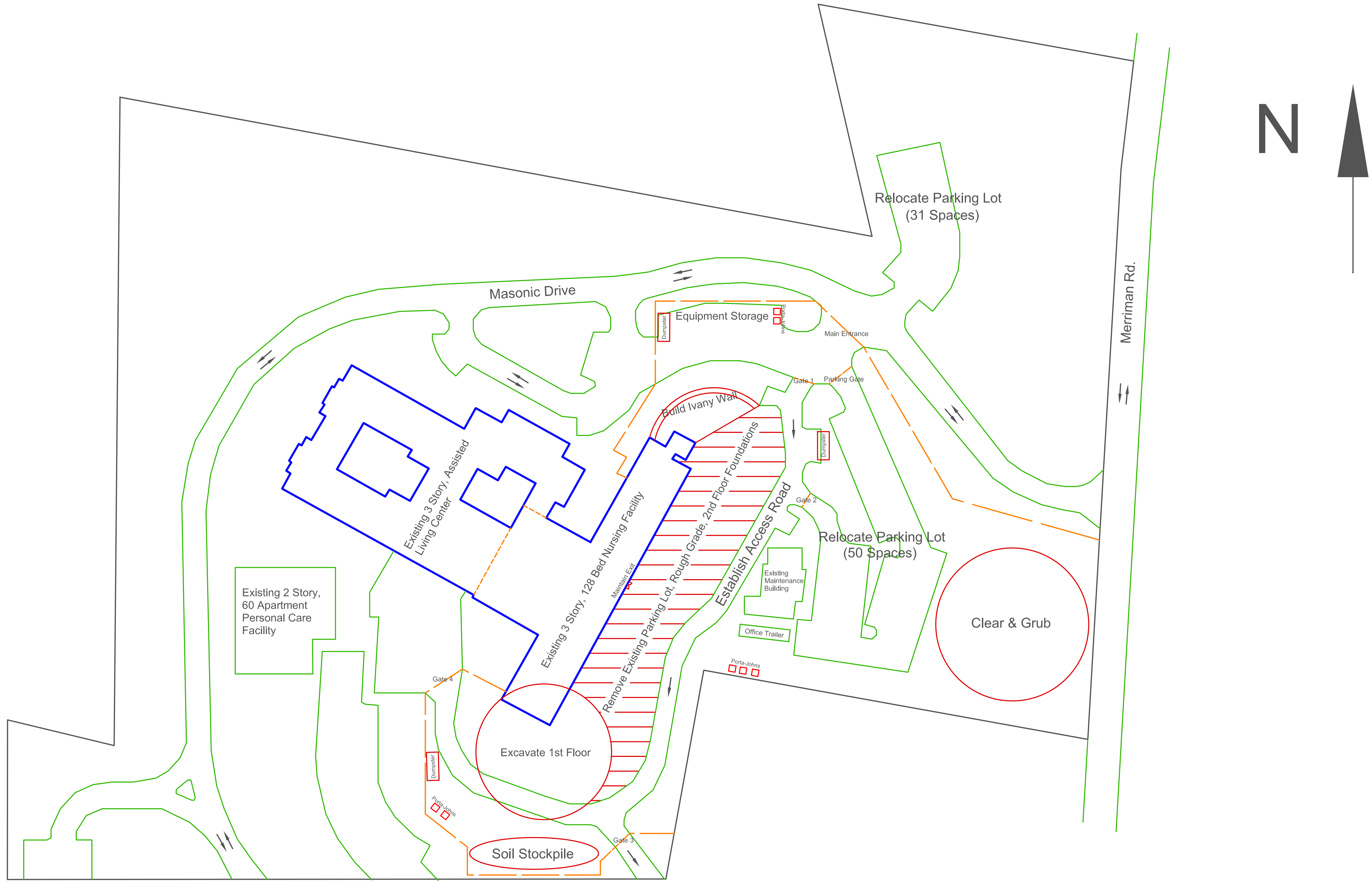
Appendix D
Site/Utility Plan



Masonic Village at Sewickley	Site/Utility Plan	9/23/2011	Jason Drake

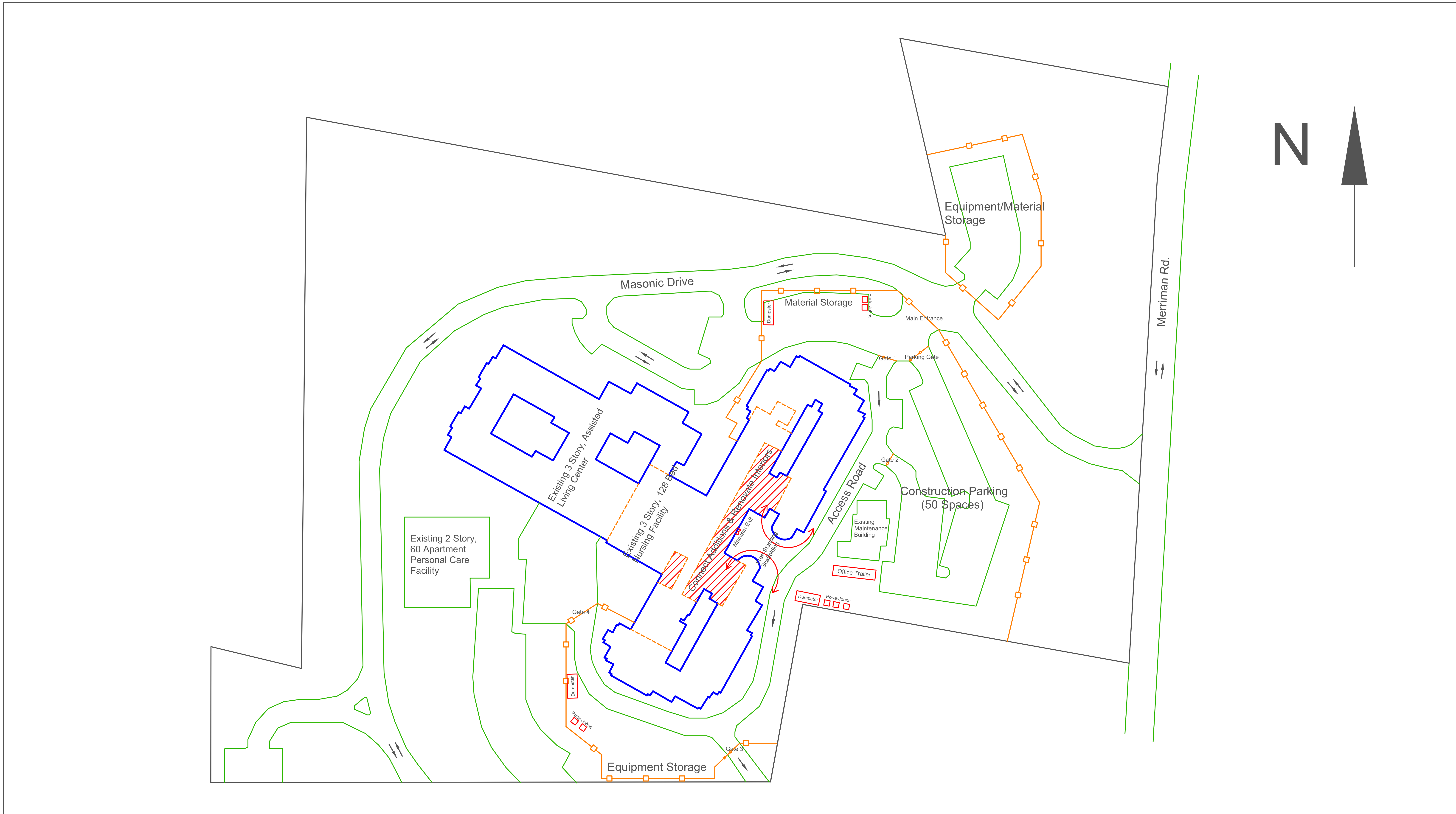
Appendix E

Site Layout Plans



Masonic Village at Sewickley	Layout Plan Phase1	9/23/2011	Jason Drake

Masonic Village at Sewickley	Layout Plan Phase 2	9/23/2011	Jason Drake



Masonic Village at Sewickley	Layout Plan Phase 3	9/23/2011	Jason Drake