New Regional Medical Center
EAST NORRITON, PA

Technical Report
No. 1

September 23

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Department of Architectural Engineering
Construction Management Option

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EXECUTIVE SUMMARY

Technical Report No. 1 focuses on identifying and investigating major influences and characteristics of the construction process for the New Regional Medical Center. This report, developed through exploration into contract documents and discussion with the project teams, delivers a comprehensive summary of the construction project.

The New Regional Medical Center represents the partnership of Albert Einstein Healthcare Network (AEHN) and Montgomery Hospital Medical Center (MHMC). This initiative, developed through AEHN's long-term strategic growth plan and formed through common mission statements, meets the primary goals of the partnership: to focus on serving the community and hosting excellence in clinical care. Together, they are building the first new hospital southeastern Pennsylvania has received in ten years. The site is located at the former location of *Wood's Golf Center* at 559 West Germantown Pike, in East Norriton Township. The facility's architectural design includes 146 patient beds, a state-of-the-art 24 hour emergency department, advanced cancer care, advanced cardiac services, in addition to cutting-edge catheterization and electro-physiology laboratories.

Perkins + Will, Inc. was selected to provide design services for the medical campus due to strong success in the healthcare market. The construction manager was selected at the end of design, through a bid process, resulting in a GMP selection by the Owner. Gilbane Building Company was awarded the project and is acting as a CM at Risk in this agreement. The contract consists of a GMP of $146,741,834 for the construction dates of July 6, 2010 to August 31, 2012. Notice to proceed was issued on July 1, 2010, with enclosure scheduled for August 8, 2011.

This document also includes scheduling and sequencing processes as outlined through the utilization of phase narratives and site logistics plans. Site logistics and coordination were flexible once excavation began due to the open greenfield setting. An in-depth study of the building systems, the design intent captured by Perkins + Will, and the programming elements the project team showcased the major components and supplemented the goal to achieve LEED Certification for the New Regional Medical Center. Project costs are also evaluated using RS Means Costwork program enabling discussion regarding estimate methodology for square footage and system costs. Due to special building systems and additional design implementation on this project, the construction estimate was 33.69% lower the then actual construction costs.

Through the completion of this report, and the distribution of the information contained within, focus will be placed on continued research in the sustainable design of the medical center and mechanical, electrical, plumbing, and fire protection coordination processes during construction. These items, in addition to others, provide a strong lead into project design intent and detailed project scheduling. Analysis of the information contained in Technical Report No. 1 permits a comprehensive understanding of the existing conditions, the constraints, and the opportunities the New Regional Medical Center project team is able to harness for a successful construction process. This knowledge will be the baseline for future developments of Technical Report No. 2, and concurrent thesis research.

THE NEW REGIONAL MEDICAL CENTER

OWNER: THE NEW REGIONAL MEDICAL CENTER, INC.

BUILDING INTRODUCTION

Site Overview

The New Regional Medical Center is located at 559 West Germantown Pike in East Norriton, Pennsylvania (See Figure 1). The selected site is an 84-acre greenfield property, which was previously occupied by an 18-hole golf course, miniature golf course, and auxiliary buildings; this site provides a very accessible and open plan for development. It is located directly off of a main arterial road (Germantown Pike) which bisected half of Montgomery County, and provides access to major roadway systems of neighboring counties. The site design shall preserve over one-third of the property as open green space for patients, visitors, and public walking trails. Along Germantown Pike, on the Southwest and Southeast corners of the property, there are existing establishments that range from restaurants, drugstores, and retail services, as shown in Figure 2.

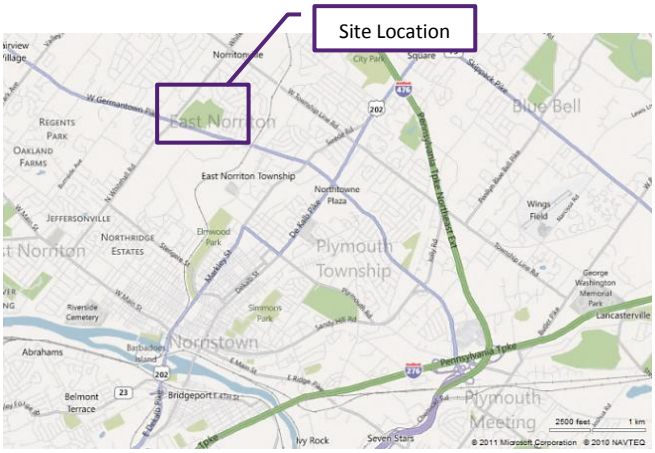

Figure 1: Regional Map | *bing.com*

Architectural Design

The facility's architectural design includes 146 beds: 96-bed medical/surgical, 22-bed intensive care unit, 20-bed obstetrical unit, and an 8-bed neonatal intensive care unit. It also includes a state-of-the-art 24 hour emergency department, advanced cancer care, advanced cardiac services, in addition to cutting-edge catheterization and electro-physiology laboratories (Wooley, 2010). Future campus development plans include direct on-site access to primary care at the adjacent medical office building. The main architectural feature of the project is the five story central patient tower atrium. This atrium serves as the location of the main entrance, and the vertical conveyance systems for the hospital. It also provides a sun-filled space, in which each floor's balcony steps back from the curtain wall to provide an open, large, panoramic view of the surrounding green space and across Germantown Pike onto the preserved lands of the Norristown Farm Park.

Figure 2: Birds-Eye View (Looking North) | *bing.com*

Architectural Materials

The primary building enclosure is a curtain wall system which incorporates precast panels and glazing units, as shown on the following page, in Figure 3. The architectural precast concrete panels are located on the North, South, and East façade of the patient tower, and feature linear windows of consistent size. In order to create aesthetic

variation and texture across the surfaces, sandblasting of varying degree was requested. In addition to this, split-faced concrete masonry units are located on the building at the West, North, and East sections of exterior wall at the Emergency Department and the Central Utility Plant. Metal panel components are located on the building at the West facade of the patient tower in addition to the screen wall surrounding the rooftop mechanical systems for the low roof.

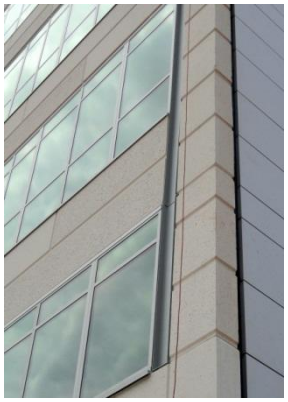

Figure 3: Façade System
Courtesy of Gilbane Building Co.

Sustainability

The New Regional Medical Center is dedicated to implementation of sustainability features within design, construction, and lifecycle of the facility. With consideration for the patients, the community, and the environment, countless steps have been taken by the Einstein-Montgomery Partnership and project team to achieve their goal of a LEED Certified rating for the medical campus. Sustainability features include a land preservation and waste management program, management of solar gain through architectural design and building placement, and design development for implementation of future sustainable technologies.

Construction Programming

The New Regional Medical Center includes 4 stories above grade, with a partial sub-grade ground floor. It will stand at 90'-8" tall, and have a gross building area of approximately 360,000 square feet. The project is being delivered through a construction management at risk contract, under an approximate construction cost of $147 million using a guaranteed maximum price contract.

Construction began on July 6, 2010 and is scheduled to be completed on August 31, 2012.

PROJECT TEAM DIRECTORY

OWNER:	NEW REGIONAL MEDICAL CENTER, INC. [PARTNERSHIP OF ALBERT EINSTEIN HEALTHCARE NETWORK & MONTGOMERY HEALTHCARE SYSTEM]
CONSTRUCTION MANAGER:	GILBANE BUILDING COMPANY
ARCHITECT:	PERKINS + WILL
STRUCTURAL ENIGNEERS:	O'DONNELL & NACCARATO
CIVIL ENGINEER:	BOHLER ENGINEERING
MEP & FIRE PROTECTION ENGINEERS:	PWI ENGINEERING
TRAFFIC ENGINEERS:	TRAFFIC PLANNING & DESIGN, INC
LANDSCAPE ARCHITECT:	WELLS APPEL

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PROJECT SCHEDULE SUMMARY

PRIMAVERA SCHEDULE

The project schedule summary includes an overview of the major activities and milestones associated within the phases of (1) design and preconstruction services, (2) construction activities, and (3) final closeout. Although this schedule is not detailed in trade activities, or direct activity relationship regarding critical path work, it provides a synopsis of the proceeding of the New Regional Medical Center project. The included activities are separated into these three phases which have been recognized throughout the contract documents. In addition to phase dates, individual milestones outlined in the Request for Proposal are included. Utilization of this summary schedule permits preliminary review of trade work that will occur concurrently on the project, and allow the construction management team to properly oversee trade productivity, equipment availability, and resource deliveries. Table 1 and Table 2 are provided below as a supplement to the Primavera schedule.

The summary begins with design and preconstruction services dating back to the original site investigation which began on October 1, 2007. Due to the site condition, programming development, and owner's request, continued site investigation occurred in multiple stages. In the Primavera schedule, the actual dates of site investigation are provided. It is assumed that continued services and discussion occurred between these stages; however, they have been excluded from the summary schedule.

The balance of the schedule is staged in conjunction with the milestone dates, and major phase durations of the New Regional Medical center. Relationships are provided as a reference to the construction logic and site sequencing. On multiple occasions the activities are phased on "start-start" logic, as the size of this project permits and installations by wing and floor level, permitting concurrent construction activities. The construction and closeout schedule totals 647 working days. This translates into 130 weeks, or 31.5 months. This schedule aligns with Gilbane's initial construction proposal of approximately 33 months of on-site services (Packer, 2011).

See **Appendix A** for the New Regional Medical Center's summary schedule.

KEY MILESTONES

Table 1: Milestone Dates

Major Activity	Milestone Date
Issue for GMP, Permits, PADOH Approval	12/09/09
Issue for Early Bid	02/11/10
Issue for FHA Closing	02/18/10
Issue for Construction	03/08/10
Notice to Proceed	07/01/11
Start Construction	07/06/10
Building Enclosure	08/08/11
Substantial Completion	08/31/12
Final Completion	10/15/12

MAJOR PHASES

Table 2: Major Phase Durations

Major Phase	Duration (Months)
Site Investigation	23
Design Services	14
Bid & Preconstruction	7
Site Setup	2.5
Foundation	4
Structure	4
Enclosure	4
Finishes	9
Closeout	2
End-User Training	2

SEQUENCING

FOUNDATION

The foundation systems utilized on the New Regional Medical Center consist of foundation walls and spread footings. The work process for the foundation systems began with the north concrete spread footings and moved south. Foundation work was sequenced directly behind the excavation process, starting with the spread footings to the north, then placement of the wall footings and retaining wall, followed by the spread footings to the south.

STRUCTURAL

The sequence plans for the structural steel of the New Regional Medical Center begins in the south-west corner of the structure and progress east, covering ground level to the second floor of the West Tower (Figure 4 & 5: shown in red). Once this section is complete, the remainder of the building's steel is placed to the same elevation. This phase is represented in orange. The crane returns to the south-west corner after looping the building, and continues to place the final two levels of the West Tower (shown in blue). From here, it travels along the south façade, placing the atrium and high-roof steel (shown in purple), the beginning of the East Tower (shown in green) and concludes with the remainder of the East Tower (shown in brown).

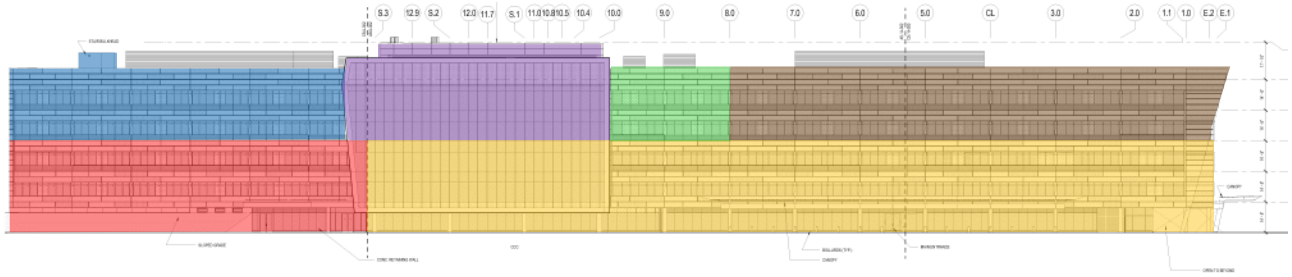


Figure 4: South Elevation

Steel Sequence (Figure 4 & 5)

1 Red
2 Orange
3 Blue
4 Purple
5 Green
6 Brown

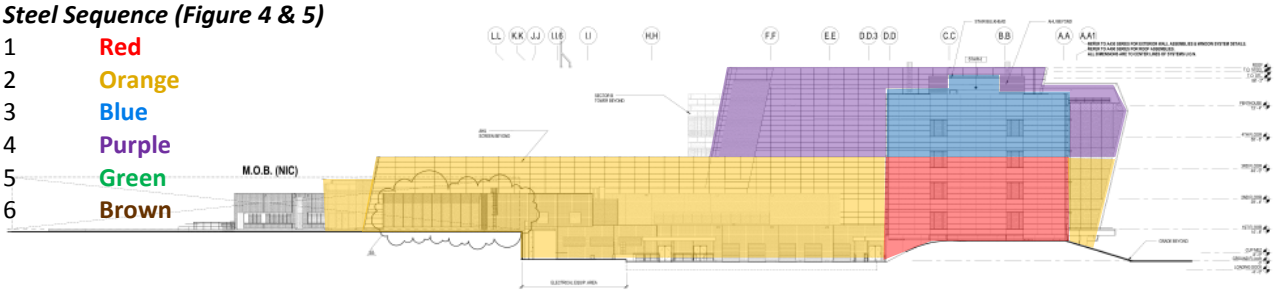


Figure 5: West Elevation

FINISHES

Finish sequencing is planned for a top-down approach. This method permits the trades to work their way out of the building, and depart the medical center on the first floor. Doing so also permits the completed sections of the facility to be locked out and begin closeout review. However, the programming of the facility, places the Emergency Department and Operating Rooms on the ground floor and first floor, respectively, of the north sector of the medical center (see Figures 6 & 7 for details). These two areas involve the greatest focus regarding interior systems and finishes; therefore, a second crew will be dedicated to this space. By working down the East and West Towers, the crews will complete three floors (Fourth, Third, Second); in the same amount of time scheduled for the second crew to complete the ground floor. The goal is for the crews to merge on the first floor and work their way north, finishing the operating room support areas and waiting area last (Packer, 2011).

Note: the colors in Figure 6 & 7 are not associated with the steel sequence in Figure 4 & 5

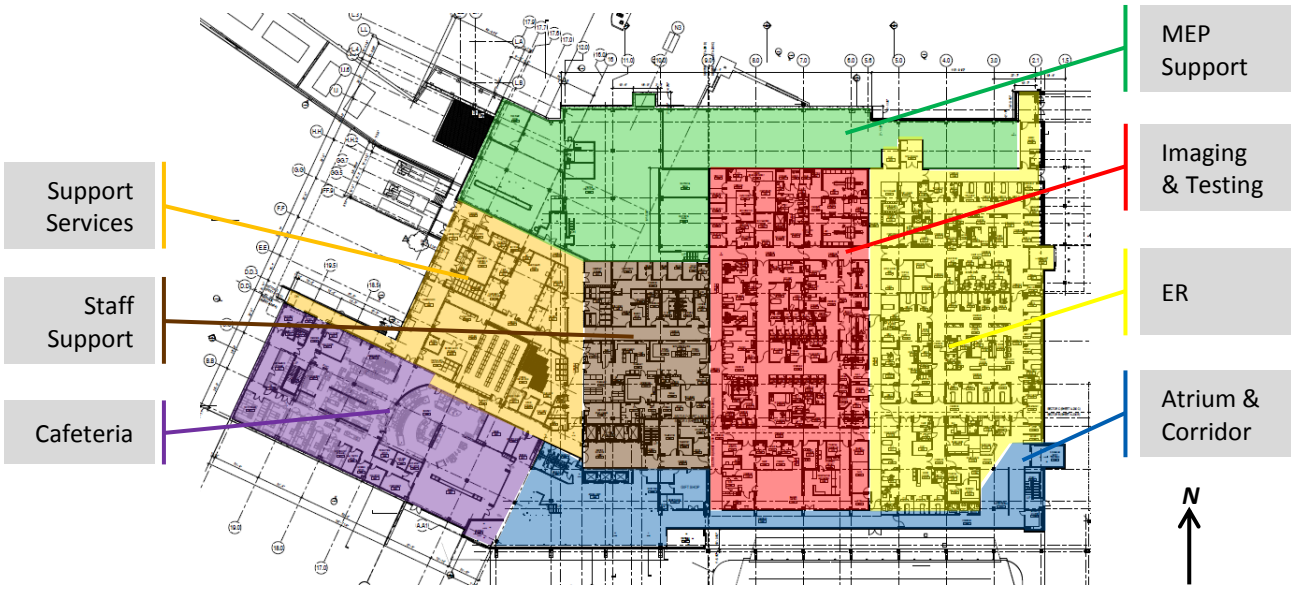


Figure 6: Ground Floor Plan

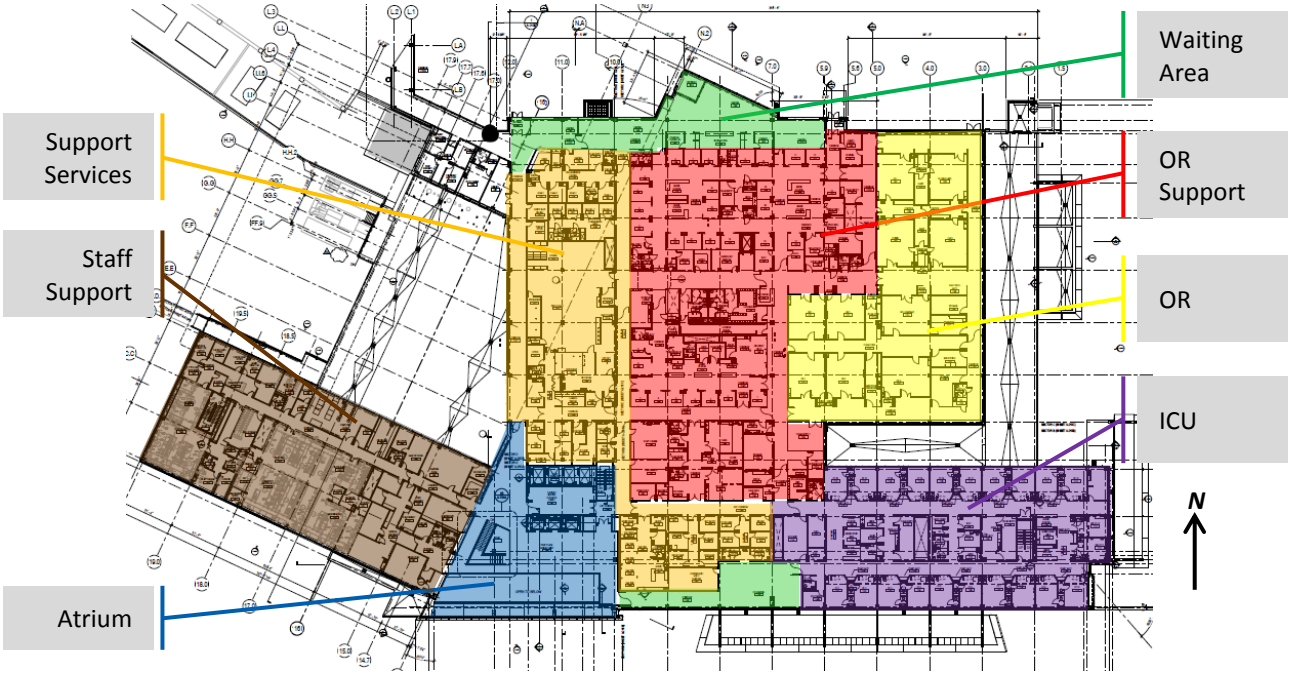


Figure 7: First Floor Plan

BUILDING SYSTEMS SUMMARY

The project development for the New Regional Medical Center includes the construction of a hospital building, a medical office building which adjoins the hospital, a central utility plant located within the subgrade of the hospital, a pumping station, associated driveways and parking fields, and a storm water management system for the site. Table 3 outlines the building systems associated with the construction of the hospital building. All of the designated building systems, except precast concrete, are included in the New Regional Medical Center. In addition to the typical systems, the New Regional Medical Center is dedicated to implementation of sustainability features within the design, construction, and lifecycle of the facility.

This table identifies the key aspects of the design and construction utilized in this project.

Table 3: Building Systems Checklist

BUILDING SYSTEMS CHECKLIST		
Yes	**No**	**Work Scope**
X		Demolition Required
X		Support of Excavation
X		Cast In Place Concrete
X		Structural Steel Frame
	X	Precast Concrete *(excluding curtain wall component)*
X		Masonry
X		Curtain Wall
X		Mechanical System
X		Electrical System
X		Sustainability Implementations

DEMOLITION

Due to existing site features, minor demolition practices occurred. *Wood's Gold Center* included their general facility structure, a miniature golf course, and auxiliary components along the gold course for reference during play. No major issues or remediation occurred during demolition. In fact, current parts of the gold course will not undergo demolition and site work until later on in the project schedule one the interior finishes begin on the medical center and the final site work commences.

SUPPORT OF EXCAVATION

Excavation occurs in three different elements, however on all occasion, benching was use as the support of excavation of the project. Due to the open site plan, the project team was able to utilize this space to meet OSHA requirements of adequate sloping. The three major areas of excavation were (1) column footings, (2) foundation cast-in-place retaining wall on the ground floor, and (3) the central utility plant and utility access. Trench boxes were utilized for major utility and underground work. Although the geotechnical report focuses on various concerns with water on the site, dewatering was not a concern on the project. Due to the proper phasing of the land development plans, the storm basin was in operation as major excavation and construction began on the medical center. However, in areas of over excavation, structural fill was required to achieve the proposed subgrade.

CAST-IN-PLACE CONCRETE

Cast-In-Place (CIP) concrete is utilized in three major aspects of the medical center's structural system. CIP concrete is included in the foundation system, foundation and retaining walls, and the structural slab. Smooth-formed finish concrete is procured through the use of metal formwork (see Figure 8). This style was utilized in the retaining and foundation walls in order to ensure a smooth architectural concrete finish. Formwork for the foundation piers comprised of rough-formed lumber to provide edge work and contain concrete flow during the pours. In many instances, the soil surrounding the foundation element was used as sufficient formwork. All CIP concrete for the medical center was placed through the use of a concrete pump truck (see Figure 9). The slab-on-grade (SOG) and structural slab were placed in sequence with the structural steel assembly.

Figure 8: CIP Formwork
Courtesy of Gilbane Building Co.

Figure 9: Concrete Pump Truck
Courtesy of Gilbane Building Co.

STRUCTURAL STEEL FRAME

The New Regional Medical Center features a structural steel frame which is arranged on a grid pattern of 30 feet by 30 feet bays. The column system includes splices that are placed four feet about first floor, and four feet above the third floor, this permits ease of connection and assembly. The columns are comprised of W12 and W14 which range from 49 lbs/lf to 170 lbs/lf. The maximum load for the interior columns of the building are estimated to be 800 kips, and the maximum load for the exterior columns of the building are estimated to be 605 kips. This project features eight different braced frame configurations which are oriented perpendicular to the south façade in the East and West Towers. The framing plan is generally comprised of W24 girders with W14 beams. All girders have flexible moment connections designed for lateral loads on the structure (see Figure 10 on page 12).

The slab on metal deck varies throughout the structure, and utilizes different assembly configurations; however, all slabs are comprised of composite metal decking, shear studs, and welded-wire-fabric.

A 300 ton 2250 Manitowoc crane will be placing all structural steel. This crawler crane travels around the perimeter of the building per the sequencing narration and the site logistics plans. The complete crane arrived on site via fifteen trucks, and is schedule to perform all major lifts for the duration of the project. The 2250 model features a 500 HP engine and a 300 foot boom, with the option to extend to 400 foot with the luffing jib attached.

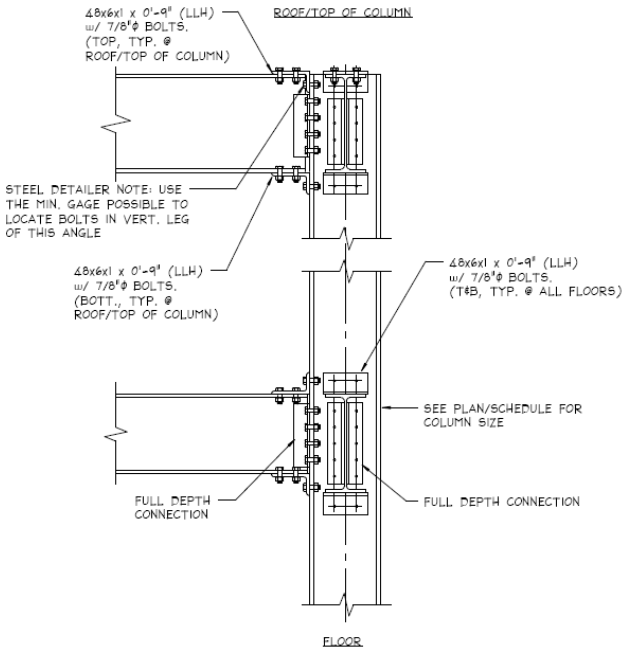


Figure 10: Flexible Moment Connection
Detail from Sheet S-402 | Architectural Plans | Perkins + Will

MASONRY

CMU Walls

Concrete masonry walls are incorporated into the buildings structure, however they serve only as partition barriers which require specific fire rating or acoustic levels per the contract documents, and are typical 8" x 16". These must meet an average compressive strength of 1900 psi and vary in weight class depending on its usage (1) lightweight – parapets and other locations bearing on structure, (2) normal – construction bearing on SOG, and foundation, and (3) Heavy – 4 hour fire rated construction. They are located throughout the structure and are assembled in phase with the surrounding activities per floor. In multiple cases, CMU wall were not placed until the room's equipment was delivered and installed. Temporary scaffolding is utilized by the masons in order to install block walls at elevation. All block walls are interior to the project and require delivery of material into the building. The east facades curtain wall panel remained off of the structure on all four floors to ensure delivery clearance and material access from the exterior scaffolding assembly.

Block Face

Split-faced concrete masonry units are located on the building at the West, North, and East sections of exterior wall at the Emergency Department and the Central Utility Plant. This change from curtain wall to a block face complements the architectural change from a five floor patient towers to the two floor medical surgery and emergency departments. Specific areas of the split face block were prefabricated into wall sections, as shown in Figure 11 on page 13. This prefabrication element was selected in order to secure a higher quality product and faster installation schedule. Prefabricated sections were designed with embedded hangers for steel connection. Individually placed split-faced block occur around the Central Utility Plant and in areas of difficult geometry and crane access. These

prefabricated assemblies are not load bearing; however they are designed for self-load and serve as the exterior weatherproofing layer.

CURTAIN WALL

The primary building enclosure is a curtain wall system which incorporates precast panels and glazing units. In addition to this system, metal panels are also utilized in select areas of the façade. Perkins + Will is responsible for the curtain wall design and system layout. Coordination occurred with the structural engineering and steel fabricator during the design phase to ensure the hangers were adequate and incorporated into the steel shop drawings. The curtain wall sequencing began with the placement of the precast panels utilizing the mobile crane. The work flow path began on the west tower and moved east and up the building. Once placed, the glazing crews followed and placed the horizontal mullions and flashing components. The glazing crew installed the window units from the interior, and connected them with the vertical mullions in sequence of construction.

Figure 11: Precast Split-Faced
Courtesy of Gilbane Building Co.

Precast Panels

The architectural precast concrete panels are located on the North, South, and East façade of the patient tower. They are comprised of a mix of 50% gray cement and 50% white cement in the face mix. The panels contain both face-mixture-coarse aggregates and face-mixture-fine aggregates. In order to create aesthetic variation across the surface, light sandblasting occurred on specific sections, while heavy sandblasting occurred on others. In order to ensure color compliance and aesthetic review, a full-size mockup was built on site, detailing the curtain wall assembly, for approval of the precast coloring and the coordination of steel connections.

Glazing

The window systems included in this curtain wall system consist of 10 different types. Vertical mullions are either 7 ½" or 10 ½" deep, while the horizontal mullions are 2 ½", 7 ½", or 10 ½" deep. Glass components vary per window type, and include horizontal structural glazing, two way structural glazing, and 4 way structural glazing. Each pane is mechanically framed with gaskets on four sides. The glazing was delivered to the site and transported to the appropriate sector of the building for ease of access for the glazing crews.

Figure 12: Metal Panel System
Courtesy of Gilbane Building Co.

Metal Panel

Metal panel components are located on the building at the West facade of the patient tower in addition to the screen wall surrounding the rooftop mechanical systems for the low roof. A detail of this component is shown in Figure 12. The metal panels on the West façade remained off of the

structure until a majority of the curtain wall was assembled on the North and South façade. These panels were then lifted directly from the delivery trailer and onto the structure utilizing the truck crane on site. Façade connection coordination was conducted directly between the architect and the structural engineer. Once detailed and designed, Gilbane assisted in construction coordination with the curtain wall trade, in order to achieve the delivery date windows for crane availability and to meet the building enclosure milestone.

MECHANICAL SYSTEM

The building's mechanical systems are made up of several main components including boilers, custom air handlers, cooling towers, chillers and variable air volume boxes. The central utility plant (CUP) houses all of the major mechanical equipment that is not installed rooftop. The CUP is located at in the north-west corner of the facility and was designed at a lower elevation to permit proper pipe and utility clearances above the equipment. There are four major vertical shafts (150 – 200SF each) that service the East and West wings of the patient tower. In the central core, there are two vertical shafts for MEP distribution for the Atrium and high roof services.

The New Regional Medical Center's mechanical system is serviced by seven custom outdoor air handling units and two indoor air handling units. The outdoor AHU's are located as rooftop units, and the two indoor units are located in the CUP. They operate as variable air volume units. There are three water chillers (825 Ton, 825 Ton, 450 Ton) which service these AHU's cooling conditions, while the building's heating system is serviced by two 500 HP boilers and one 400 HP boiler which are also located in the CUP. Ductwork is utilized to transport the air to each space, and all patient rooms contain VAV boxes for individual controls. Hydronic piping transports the chilled and hot water to each AHU. The Operating Rooms have a dedicated AHU system which features a blow-through arrangement and requires a minimum of 50,300 CFM of outside air in comparison to its 45,000 CFM supply air.

The fire suppression system within the medical center includes a double interlocked deluge preaction sprinkler system. This system corresponds to the facility usage since accidental discharge would be damaging to medical equipment and finishes. Water pressure is supplied by a 1000 gpm, 100 psi boot, diesel engine fire pump and networked though a combined wet standpipe and automatic wet pipe.

ELECTRICAL SYSTEM

The building will have electrical and tele-data components such as backup generators, critical circuitry to help ensure minimal power interruption, nurse call systems for effective communication and code blue systems throughout the campus. The supply power enters the site from the south-west corner, and follows the maintenance road up to the loading dock area of the medical center. This area hosts the backup generators and all utility connection for the facility. This facility has two emergency generators, with space for a third. These generators are 100KW, 1250KVA each and tie into the main power system. There is a third housekeeping pad in place, along with conduit connection available to permit another 100KW, 1250KVA generator if added at a later time.

The power enters the electrical control room through a 5000A bus duct that comes off of a 3750 KVA, 480/277V transformer. The medical center features a redundant supply system in parallel, permitting uninterrupted power supply. Once entering the electrical control room, the 500A, 480/277, 3 phase, 4 wire feed the building systems. The building system is also wired with for critical power, emergency power, and emergency power life safety services directly from the backup generators.

The medical center is serviced by seventy-nine 480/277V and ninety-six 120/208V panel boards which distribute power throughout the building to meet the services need of hospital equipment, staff, and patients.

LEED CERTIFICATION

Consideration have been made for the patients, the community, and the environment, in order to ensure the Einstein-Montgomery Partnership and project team achieve a design and construction process which thrives on sustainability. With sustainability in mind, the project team as a whole shares a common goal to achieve a LEED Certified rating for the medical campus.

Due to the project's Greenfield site, a major goal of the project is land preservation. Through thoughtful design, 30 acres of the 84 acre site will be preserved, and low-maintenance landscaping and public walking trails will be included to reflect the Norristown Farm Park and surrounding region. The construction management team is to coordinate recycling, disposal and waste management during construction, with a goal to recycle 75% of construction waste. Strategic building placement by the design teams enables the facility to take advantage of solar gain and maximize the use of natural sunlight and thermal storage capacity. Due to the influence of selected building materials, color and placement, the design staff is able to capture the natural environment and reduce energy expenses. The operating rooms are serviced through 100% outdoor air, with a heat recovery program to assist in a building-wide energy efficient mechanical system. The designed system is 14% more efficient then required by code. LEED featured designs also incorporate Computational Fluid Dynamic (CFD) and Energy Analysis models, which assist in indoor air quality and energy management. For example, the Smoke Management system for the 5 story Atrium was developed through a CFD model, ensuring high performance and operability. Also, the majority of lighting fixtures in the building incorporate energy efficient compact fluorescent lights. Sustainable design development was also included for future technology. For example, the engineering design incorporates additional items consistent with LEED certification requirements, such as the addition of active solar photovoltaics, and a comprehensive building energy model (Environmentally Friendly Design, 2011).

To ensure compliance with all LEED requirements, the construction manager shall retain an independent and dedicated LEED Compliance Administrator to handle all LEED documents and project controls during construction. In addition to this, a third party commissioning agent will facilitate verification that energy related components meet the owner's needs and project requirements per the contract documents.

PROJECT COST EVALUATION

ACTUAL PROJECT COSTS

BUILDING CONSTRUCTION COST

Building Construction Cost: **$127,653,895.80**

Total Area: 366,780 SF

Building Construction Square Foot Cost: **$348.00/SF**

TOTAL PROJECT COST

Total Cost: **$146,741,834.00**

Square Foot Cost: **$400.10/SF**

PROJECT ESTIMATES

SQUARE FOOT ESTIMATE

RSMeans *Costworks* estimating software was utilized in the square foot estimate calculation. Norristown, PA was designated as the location of the project, as this is the nearest Location Factor available through RSMeans cost resources. Norristown, PA is approximately 2 miles from the project site.

Estimate Name: **NRMC**
New Regional Medical Center Inc
559 West Germantown Pike, East Norriton, PA

Building Type:	**Hospital, 4-8 Story with Precast Concrete Panels With Exposed Aggregate / Steel Frame**
Location:	**NORRISTOWN, PA**
Stories:	**5**
Story Height (L.F.):	**14.67**
Floor Area (S.F.):	**366780**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2011 Quarter 3**
Cost Per Square Foot:	**$229.84**
Building Cost:	**$84,300,500**

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 by RSMeans.**

Figure 13: RSMeans SF Costworks Results

See **Appendix B** for supplementary information regarding the square foot estimate calculations for the project.

ASSEMBLIES ESTIMATE

Building systems cost per square foot withheld in request made by Gilbane Building Company on September 16, 2011. The Assembly estimate process and integration of probable results into a SF Costworks estimate is included in the narrative to supplement the inability to perform a Mechanical, Electrical, Plumbing assembly cost evaluation.

COMPARISON NARRATIVE

Table 4: Construction Cost vs. Costworks SF Estimate

Estimate Process	Cost per SF	Building Cost
Construction Cost	$348	$127,653,895
Costworks SF Estimate	$230	$84,300,500
Difference:	*-33.96%*	*$ -43,353,395*

The project's building cost total to $127,653, 895 for a 366,780 square foot medical center. This hospital features elements that multiple hospitals would network to achieve. As stated, the New Regional Medical Center will feature the leading-edge clinical services and programs, including an ER, OR, Trauma Unit, advanced cancer treatment, cardiac services, and medical offices. This facility not only incorporates these programs, but it provides an extensive growth factor on existing healthcare competitors.

As noted in the Figure 9, the parameters for this facility are not within the ranges recommended by RS Means. The Costworks square foot estimate resulted in $230/SF and a building cost of $84,300,500. This estimate is well below the actual building costs for the New Regional Medical Center. As shown in table 5, the Costworks values were 33.96% lower than the actual value, which leads to investigation of possible reasons and factors for this deviation. The most prominent factor is that the project exceeds RS Mean's data catalog. With a project square footage above the database parameter by 21,780 square feet (database limit is 345,000 SF), 6% of the program's cost is excluded. Although this additional square footage is included in the calculation, essential programming elements which may comprise this space are not included in the building value. In addition to this, MEPF redundancy items are not detailed within the RSMean square foot estimate process. In the New Regional Medical Center, the MEPF system comprises of 38% of the project's total, and there are multiple levels of redundancy and life safety precautions regarding continued provision of electricity to the facility. It is common for hospitals to have redundant systems; however it may not be common to have duel transformers, duel generators, and isolation panels to cover critical systems of the building regardless of the crisis. If the database contains hospitals that do not have as complex redundancy, the value will come in lower, as expected.

In addition to this, specific systems that are included in the report provided by Costworks, do not correspond to actual building systems that the New Regional Medical Center will be implementing. For example, this report accounts for two hospital patient elevators totaling to $2,262,000. This design incorporates four patient elevators, in addition to three standard elevator systems. Also, the report includes four rooftop AHU's, which is five AHU's below the design intention for the medical center. Totaling $14,286,000 for four AHU's in Costworks can be extrapolated to estimate that all nine would amount to approximately $32 million dollars.

There are addition items such as this which cause variation in the results, however these three examples should strongly present that reviewing large project costs is essential to understanding the results of a SF estimate. Utilizing the RS Mean database is essential to gaining the knowledge of the probable costs; however it is advised that the cost report is closely scanned to located incomplete information or quantity differences.

Square foot estimate are typically within 15 to 20% of the actual project costs. Applying this methodology, the baseline for the New Regional Medical Center square foot estimate is $102,123,116. Utilizing the under quantified systems, as mentioned above, and revising major systems, it is attainable to adjust the SF estimate by particular building systems and update the final building cost to obtain a more accurate total. The more detail placed into an estimate, whether a square foot estimate, or an updated assembly cost to merge into a SF estimate, the more accurate the value will be. Utilizing methods and check and verify that the database projects are typical to the application is the initial step in updating and verifying an appropriate estimate report. If the project is atypical or includes special components, it is essential that these items are added to the estimate to account for building specific costs.

SITE PLANS

EXISTING CONDITIONS PLAN

Existing site conditions are narrated within the local conditions section of this report. Refer to page 21 for a comprehensive review of the existing site plan.

See **Appendix C** for the existing conditions plan for the New Regional Medical Center.

SITE LAYOUT PLANS

The attached three phases reference the narration of sequencing provided in the Project Schedule Summary section of the report. This information can be found on page 7, 8, and 9 and will provide sufficient background knowledge to supplement the methodology per phase. Each section below will detail the changes which occurred on site from the prior phase.

SITE MOBILIZATION & EXCAVATION

Site mobilization began with the placement of the perimeter fencing. Although only one-third of the site will be converted into the new medical center, elements of the golf course needed to be removed in addition to balancing of excavation and earth work around the site. In the Mobilization and Excavation plan, the site gate and entrance is defined, and the primary response zone is initiated. This region is designated by Gilbane in order to ensure site and building access for EMT response in the event of an emergency. Excavation also begins on the storm retention basin, which provides water management on the site during and after construction activities. Due to the large amount of earth work on the site, temporary construction offices will be utilized at the perimeter of the site until the foundation work begins. At this time, the temporary stabilization crossings are set, allowing equipment and delivery materials to safety cross the easement of the natural gas pipeline. In addition to safe travels though the jobsite, the haul route map is developed and published at this time in order to provide the approved route of travel to and from the site.

See **Appendix D** for the Site Mobilization & Excavation Phase Plan for the New Regional Medical Center.

STRUCTURE & ENCLOSURE

This phase begins with the move of the field staff out to their project trailers. In addition to this, this phase includes the availability of onsite parking for all project workers. The tool trailers are added as more trades begin arriving to the site, and a secondary site entrance is established for emergency or after-hours use only. With the additional space in the newly built parking fields to the north, material storage for long lead items and recent project deliveries is available. The crane path is established along the south elevation of the medical center. Through the logistical planning and sequencing, this project can be completed per the schedule with one 300 Ton Manitowoc crane with assistance from a smaller truck crane.

See **Appendix E** for the Steel Structure & Enclosure Phase Plan for the New Regional Medical Center.

INTERIORS & FINISHES

The final major stage of site logistics consists of the interiors and finishes work. At this time, the crane is disassembled and removed from the site, and a four level scaffolding system is erected off of the East Tower. Using this process, equipment can still be stored at level, and loaded into the building while permitting the final curtain wall components to be placed for the enclosure milestone. The primary response staging is moved closer to the atrium to permit completion of landscaping and site work. Trade parking shrinks in order to prepare for final parking field topcoats. In addition to this, all of the material stored in the parking field have now been installed or delivered into the building. Equipment staging is now concentrated towards the East Tower, and site work nears completion to the west.

See **Appendix F** for the Interiors & Finishes Phase Plan for the New Regional Medical Center.

LOCAL CONDITIONS

GEOTECHNICAL REPORT

Boring locations were placed across the site of redevelopment. This area includes the parking fields, surface roads, retention basin, and the medical center footprint. Fourteen borings were placed within proximity of the footprint, permitting soil samples to assist in recommendation of foundation system based on the soil bearing capacity.

See **Appendix G** for a plan view of the test borings locations at the site of the New Regional Medical Center.

SITE OVERVIEW

The site is located at the former location of *Wood's Golf Center* at 559 West Germantown Pike, in East Norriton Township. The site comprises 89 acres, and is bordered to the south by West Germantown Pike, and commercial and residential properties border the remaining sides. The terrain and topography of the site is typical of a standard golf course, and the site features multiple existing buildings and structures associated with the facility.

SUBSURFACE & SURFACE CONDITIONS

On August 24, 2007, Chambers Associates, Inc. prepared a *Topographic Survey* which identifies a pipeline which traverses the eastern half of the site in a northeasterly direction. The pipeline enters the site from West Germantown Pike near the entrance to the golf course entrance. This pipeline carries natural gas owned by the Williams Gas Pipeline – Transco, and the right-of-way is 75 feet in width (see figure 14).

Figure 14: Existing Pipeline
From Civil Plans | Sheet 16 |Bohler Engineering

Figure 15: Existing Electric Lines
From Civil Plans | Sheet 16 | Bohler Engineering

The *Topographical Survey* also designates the Philadelphia Electric Company (PECO) right-of-way (ROW) which also traverses the eastern half of the site, also in a northeasterly direction. This ROW is 40 feet in width and includes telephone poles with utility lines within its width (see Figure 15).

Earth Engineering Incorporated (EEI) was contracted to perform geotechnical analysis of the golf course. In June of 2008, EEI learned that various areas of the site are prone to flooding and ponding during severe rains. In fact, the geotechnical report notes that golf cart pathways were added to the facility to prevent golf carts from getting trapped in the saturated soil. The site slopes gradually and irregularly downward from north-west to south-east. The maximum elevation change across the site investigated for the hospital is 58 feet. A majority of the test results returned as Silt (ML) and Silty Sand (SM) in the Unified Soil Classification System (USCS), and returned as Silt with Sand or Silty Sand in the ASTM Classification System.

Site geology is typical of Pennsylvania, and is underlain by the Stockton Formation (T_{RS}). This formation is comprised of red to purple sandstone, share, siltstone, and arkosic sandstone. Excavation of this material varies due to non-typical weathering patterns for the rock. In addition to this, groundwater springs are commonly located within this formation. The soil strata across the site is typical, starting at grade with a 1 to 12 inch thick layer of topsoil, followed by a fill material from 1.5 to 6 feet deep, then two naturally occurring strata (soil at 2 to 18.5 feet deep and weathered rock at 8 to 17 feet deep) before reaching bedrock between 8 and 17 feet deep. Groundwater ranged from 4 to 13 feet below the existing grade and was measured at 8 boring locations. This finding, in addition to the geology typical for this soil, proves that groundwater will potentially be encountered during construction.

The water table was located as much as 9 feet above the proposed finished floor elevation of 235.0 feet at five locations within the proposed footprint of the hospital. Temporary and permanent groundwater control will be required and dewatering measures are highly recommended to the contractor. Extensive dewatering of the excavation was not required due to the phasing of the site work and retention basin construction previous to excavation. In addition to this, the building remained essentially at grade, less the foundation system; therefore, measures were included on waterproofing foundation walls.

LOCAL BYLAWS & PERMITS

When submitting a permit for storm water discharge associated with construction activities to the Department of Environment Protection, the owner is required to submit the application in accordance with the erosion and sediment plans set forth by the civil engineer. However, once the construction manager is hired, it is the responsibility of the owner to transfer or co-permit them into the compliance contract for the permits to remain valid.

Due to the addition of the medical campus to the area, Germantown Pike will be widened in accordance with the contract documents in order to provide additional lanes of travel for the increase in vehicle traffic in the area. The schedule road widening requires the purchase of land along the opposite frontage of the site. However, this land is protected by the Department of Conservation and Natural Resources. The project team was required to investigate measures on how to handle this situation, and successfully negotiated with Montgomery County and Department of Conservation and Natural Resources in order to obtain the rights and permits to proceed with roadwork and utility expansions along Germantown Pike.

All site work is required to be in strict accordance with Township ordinances. Included in this item is the requirement that there will be no “topping out” ceremony at the conclusion of structural steel erection. Site safety and ordinance compliance is ever more prominent in regards to the close proximity of neighboring businesses, residential communities, and public roads.

PREFERRED BUILDING METHODS

BUILDING METHODS

In Montgomery County, Pennsylvania it is typical for a hospital complex to be constructed with a steel framing system and curtain wall façade. Due to the subsurface condition mentioned prior, complexes of this size refrain from including a basement or large subgrade systems because of associated costs. Due to this building being the first medical center for the region in ten years, it is challenging to locate similar projects in the immediate area for a means and methods comparison. With the recent development in healthcare technology and building technology, the existing facilities in southeastern PA will not provide an efficient design and construction processes comparison.

In lieu of limited information, medical centers outside of southeastern PA, yet still within three hours of the New Regional Medical Center site are investigated. Healthcare projects in Voorhees, NJ, Hershey, PA, and State College, PA have recently undergone expansions and new facilities construction. Virtua Voorhees entered a similar partnership to produce a similar medical facility earlier this year. This project had many construction and design methods of which the systems for the New Regional Medical Center mirrored. The prominent similarities include structural steel framing with a curtain wall, consisting of precast and metal panel as façade systems. Hershey Medical Center and Mount Nittany Medical Center, located in Hershey and State College, respectively, have had multiple projects within their campuses in the past few years. In all instances, a structural steel frame has been utilized; however, these facilities typically have a masonry façade due to campus aesthetic plans and existing structures.

Understanding the current state of healthcare construction, and Perkins + Will's expertise, the building methods utilized on the project reflect the current trends in construction within the Philadelphia region.

TIPPING FEES & RECYCLING

The tipping fee for Eastern Montgomery County is $55/ton is billed to the hauler, and $10/ton is billed to the commercial property owner. These values were obtained in regards to the 2011 schedule of values for Montgomery County's municipal waste programming.

The recycling program on site is considered a "Single Stream" process. This permits workers to dispose of waste (including recyclable materials) in common containers. The containers will be transported off-site to be sorted. There will be (1) 20 yard containers for masonry and clean fill, (2) 30 yard container for general debris, and (3) 40 yard containers for metals. Monthly reports are provided with the amounts and types of construction waste processed, in addition to the amount (in tons) of recycled materials versus amount which are disposed of in a landfill. This process permits trades to not impede productivity by focusing on recycling programs and initiatives, and it also assists with LEED points associated with job-site recycling. The project's goal is to divert 75% of the project's waste from landfills.

SITE CONDITIONS

ACCESS

The construction site will be controlled by site fencing and security gate. The jobsite hours are 7:00am to 3:30pm. Utilization of the parking field is encouraged. Construction management staff controls gate access and they

are typically open between 6:30am and 5:30pm. When entering the site for the first time, the security guard provides directions on where to park and how to access the construction management trailers for safety orientation.

PARKING

Due to the extensive size of the site relative to the building footprint, parking is not of concern regarding this project. Specific areas for construction management staff, owner's representatives, trades, and visitors will be coordinated by Gilbane Building Company with approval from the Owner. During excavation and site work, parking will be controlled in order to protect the site features and existing conditions. Once site work is partially completed, the medical center's parking fields may be utilized for construction parking. A parking permit is not required for the site, however all workers and visitors are required to park in the north parking fields due to close proximity to the construction trailers, which is separate from deliveries, equipment storage, and site traffic.

CLIENT INFORMATION

The Owner of the New Regional Medical Center consists of the collaboration and partnership of the Albert Einstein Healthcare Network (AEHN) and the Montgomery Hospital Medical Center (MHMC). The Einstein-Montgomery Partnership is referred to as the New Regional Medical Center, Inc. for the purposes of this report.

Individually, AEHN and MHMC have strong, rich histories regarding healing, healthcare, and service to the Philadelphia region. In 1865, AEHN was founded, and is now regarded as one of the most comprehensive healthcare providers in the region. MHMC has been proving medical care to the region since 1894, in addition to representing the market share in Central Montgomery County community. The partnership is based off of common mission statements, focusing on serving the community and hosting excellence in clinical care. It was carried out through AEHN's long-term strategic growth initiative (Partnership Vision, 2011).

DRIVER FOR HEALTHCARE DEVELOPMENT

Within the past decade, there has not been a new medical center built in southeastern Pennsylvania (Wooley, 2010). The only previous healthcare work during this period consisted of facility renovations and interior upgrades. Currently residents of the Central Montgomery County region must travel to neighboring regions or into the City of Philadelphia to receive care. In order to permit residents to remain in this area and have accessible services, the New Regional Medical Center, Inc. realized that the southeastern Pennsylvania was lacking a modern, technologically-advanced, healthcare campus capable of providing comprehensive care. In addition to meeting the facility needs, through this programming Einstein is able to harness their internal teaching experience in order to provide the latest clinical treatments and a highly skilled staff of physicians in the most advanced hospital in the region.

FACILITY EXPECTATIONS

In order to meet the void in healthcare services for this region, the New Regional Medical Center will feature the leading-edge clinical services and programs. This facility will operate as a full-service, acute care hospital. The program includes a 24-hour emergency care and trauma response, an advanced cancer center, cardiac surgery services, general surgery, and medical offices for primary care and specialist. The New Regional Medical Center is associated with Phase 1 of the medical campus. Additional installations, such as the medical office building will supplement the hospital's services, and provide convenient, on-site access to primary practices and specialists.

The campus is designed as a suburban hospital campus. By working with design professionals and local residents, the site design preserves one-third of the 84 acre property, providing a vast green space setting, complementing the Norristown Farm Park across the street. Through consideration of setting within the architectural design, 75% of hospital rooms will overlook the park.

Due to the high expectations for the facility's performance, the construction's quality and safety are two of the Owner's most valued aspect of the project. Through a GMP contract, any cost risks or concerns have been alleviated. In order to keep the project on schedule and uphold the delivery date of the project, strict liquidated damages have been incorporated to help emphasize the importance of a timely delivery; however necessary time extensions may be negotiated in order to deliver a high-quality facility under safe working conditions. Due to the greenfield site, very few sequencing concerns are present for the project, permitting a very accurate work flow, in addition to timely building turnover. The facility will undergo a single occupancy phase in addition to an Owner and

staff training period. In order to provide complete transparency between the Owner, construction manager, and site activities, the Owner has representatives on site to monitor and assist in the daily activities and approvals required for the project.

OWNER'S EXPECTATIONS

Perkins + Will, Inc. and Gilbane Building Company, were selected by the New Regional Medical Center, Inc. for their design and construction services due to their previous success in the health care market. Perkins + Will is a commercial architecture firm which specializes in health care projects. Gilbane is currently ranked seventh on *Modern Healthcare's* list of top Construction Management companies. With a very strong team in place, various programs and processes were incorporated into the project in order to meet the expectations of the Owner, end-users, and the community. Assembly and room mockups are heavily utilized on the project in order to ensure the facility and systems meet the needs of the staff, in addition to proper work space for the latest hospital equipment to be installed. Figure 16, provides an example of a mockup emergency patient room and a mockup of a general patient room. Three-dimensional modeling and coordination efforts were incorporated through the utilization of Building Information Modeling (BIM) in order to design and coordinate the mechanical, electrical, plumbing, and fire protection systems (see Figure 17). These processes, in addition to strong Owner, A/E, and CM communication, will lead to a successful project and deliver the state-of-the-art New Regional Medical Center in accordance with the vision the Einstein-Montgomery Partnership set out to achieve.

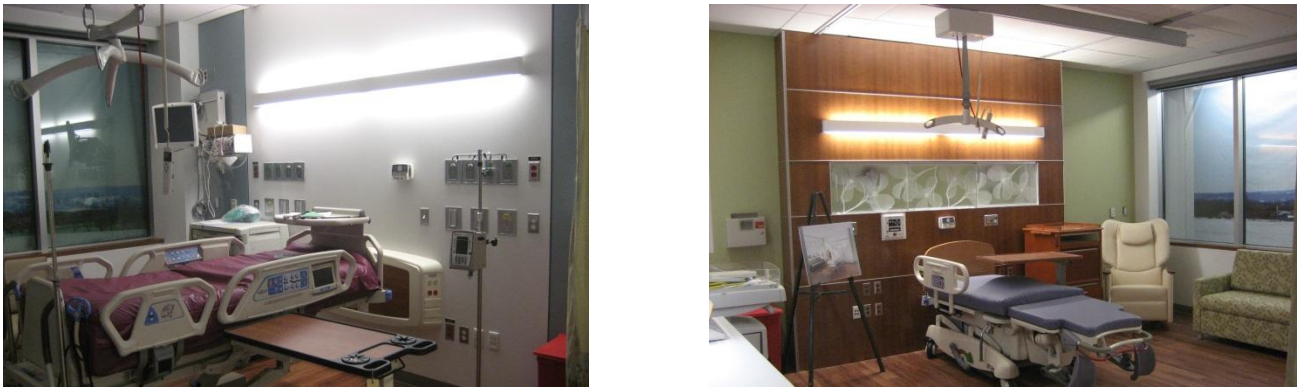


Figure 16: Patient Room Mockups

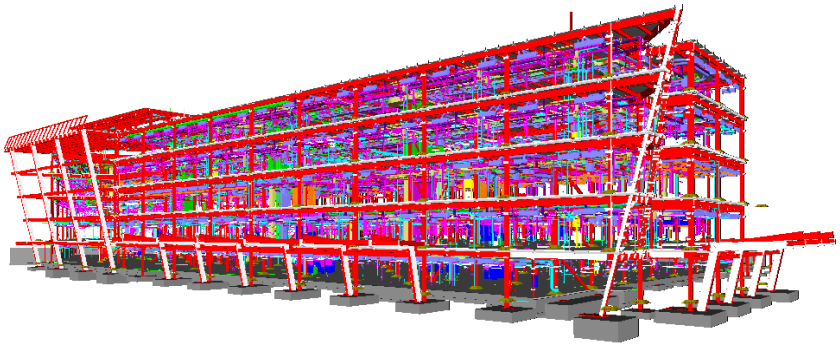


Figure 17: Building Information Model (South-East View)

PROJECT DELIVERY SYSTEM

ORGANIZATIONAL CHART

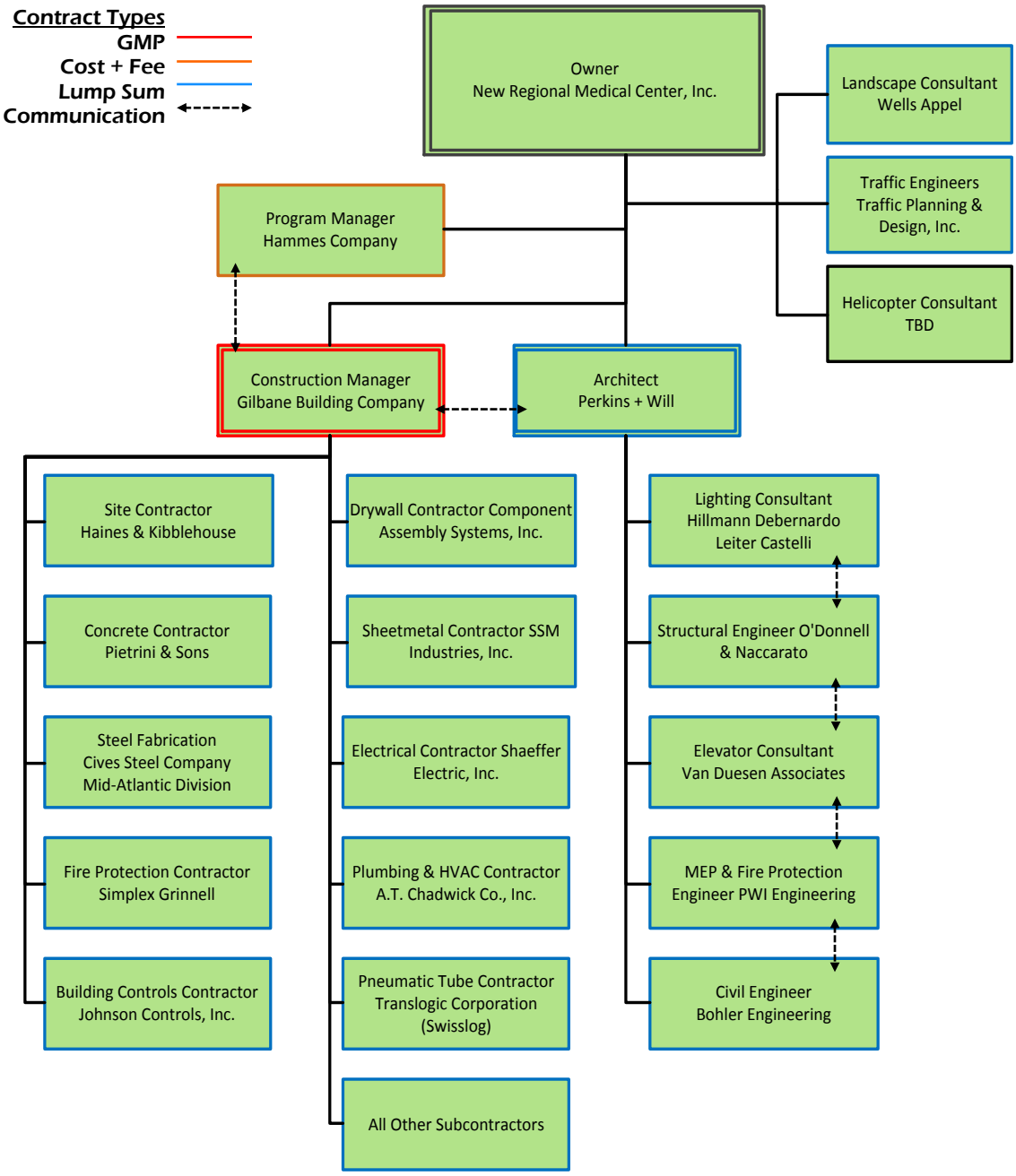


Figure 18: Project Organizational Chart

CONTRACTURAL AGREEMENTS

CONSTRUCTION CONTRACT

The New Regional Medical Center project will be constructed under a single prime contract with Gilbane Building Company. The facility will compromise Phase 1 of the healthcare campus constructed on the 84 acre property. The construction manager was selected through a Request for Proposal process resulting in a GMP selection by the Owner. Gilbane Building Company was awarded the project and is delivering the project through a CM at Risk contract. The contract consists of a GMP of $146,741,834.00 for the construction dates of July 6, 2010 to August 31, 2012. The project is listed as tax exempt. Liquidated damage language includes a fee of $13,607 per day, applied to a late delivery after August 31, 2012. After sixty days late, liquidated damages increase to $50,000 per day. Per the contract, one-hundred percent of cost savings is returned to the Owner. In addition to this, ten percent of Gilbane's fee is retained throughout the project's duration. If the project requires a time extension for unforeseen conditions or at owner's request, time will be granted for delay to critical path items. Compensation on general condition expenses for durations of requested extensions will be considered on a case-by-case basis.

This project delivery and contract method is appropriate for the New Regional Medical Center because the project funding has been acquired through the sale of Federal Housing Administration Insurance Bonds in the amount of $310,000,000. In addition to this, in August of 2010, the U.S. Department of Housing and Urban Development agreed to insure the bonds through FHA's Section 242 Hospital Mortgage Insurance Program (Wooley, 2010). Through utilization of private funding through bond sale, the guaranteed maximum bid process would permit the Owner to properly manage funding and meet the financial goals of the project without hidden or unknown construction costs. Change orders and contract values are separately screened in order to ensure a tight project budget. Gilbane Building Company's experience with healthcare facilities of this size and delivery system produced a strong project team, innovate value engineering methods, and high standards on project safety, in addition to a competitive bid value. These elements assisted in the awarding of the contract.

ADDITIONAL CONTRACTS

Contract documents will be prepared by Perkins + Will, with consultation from a team of design professionals. As shown in Figure 18, Perkins + Will operates by a lump sum and is in contract with their associates. In addition to the Architect, Program Manager, and Construction Manager working under contract of the Owner, three additional consultants are in direct contract with the owner regarding specialty services.

The contract with Gilbane Building Company excludes the following concurrent construction operations at the project site: (1) Geotechnical & Testing Work, (2) Independent Testing, (3) Furniture, (4) Medical Equipment, (5) Communication Equipment, and (6) Nursing Stations. The owner will award separate contracts for these activities.

SUBCONTRACT DEVELOPMENT

The subcontract award process is as follows:

(1) Gilbane prequalifies subcontractors for predetermined bid packages
(2) Subcontractors are invited to place a bid by a predetermined time and date
(3) The lowest qualified bidder is awarded the subcontract

(4) Gilbane releases the bid results with recommendation to the owner for selection and Owner's approval.
Note: Each subcontract is a lump sum contract per the bid package's scope of work.

Once selected, the subcontractor is notified and agreement documents are procured. Ten percent of each trade contractor's payment is retained until substantial completion of scope of work. The Owner reserved the right to reduce retainage at fifty percent completion to five percent. The trade contractors are required to agree and pay for a 100% Performance and a 100% Payment bond, in addition to enrolling in Gilbane CCIP Program.

The Owner will provide Builder's Risk Insurance with a deductible of no more than $50,000. However, Gilbane Building Company is required to maintain a CCIP Insurance Program. This program requires each subcontractor to complete and submit the appropriate paperwork to qualify under their insurance. In addition to this coverage, per the subcontracts, trades must carry workers compensation and employer's liability, commercial general liability, business automobile liability, an umbrella liability, professional liability insurance, and finally contractor's pollution liability.

STAFFING PLAN

ORGANIZATIONAL CHART

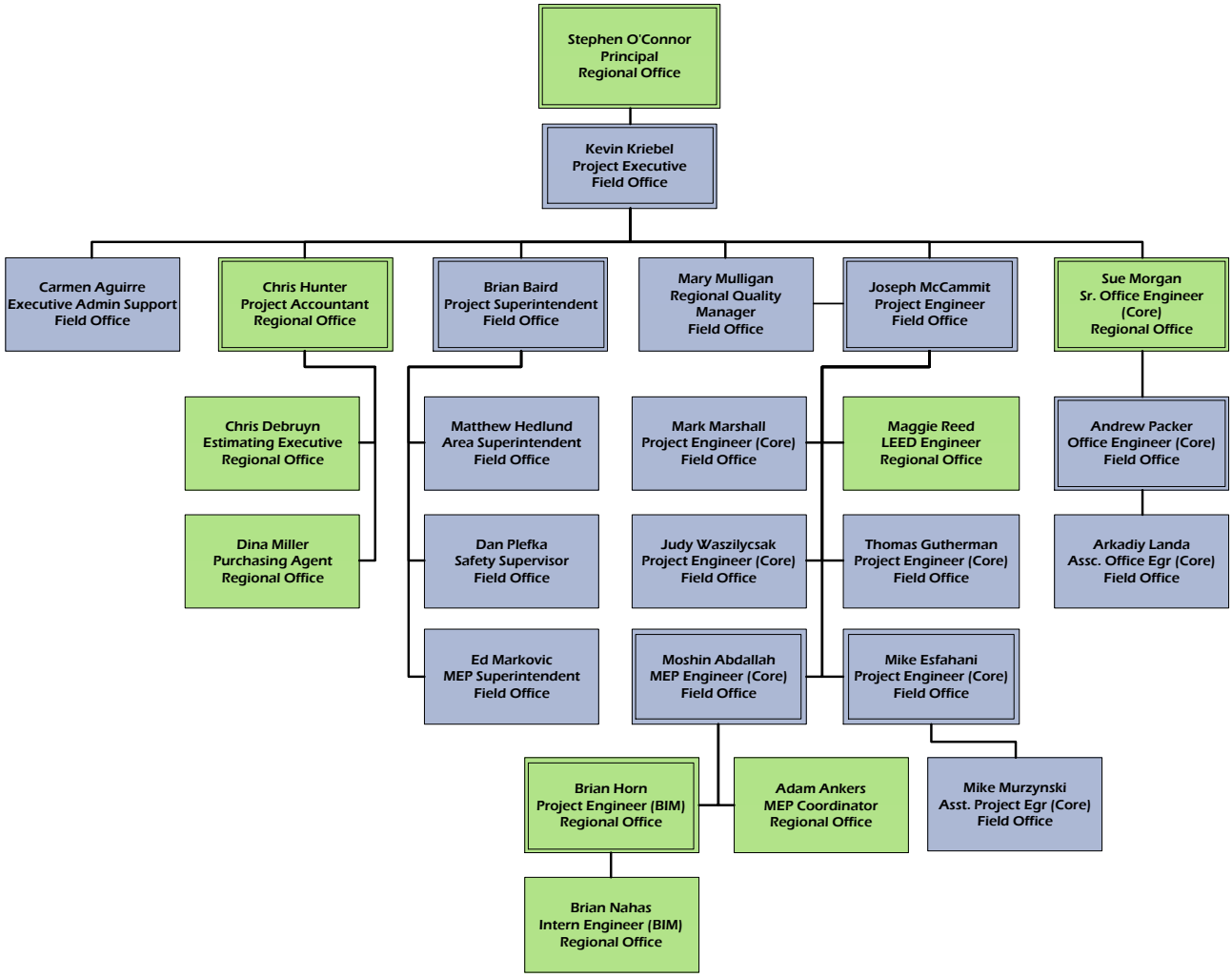


Figure 19: Staffing Plan

PROJECT MANAGEMENT NARRATIVE

The project management system for the New Regional Medical Center is conducted through a full-time field staff, with supplementary support from the regional office. Gilbane Building Company's Delaware Valley Regional Office (DVRO) is overseeing the New Regional Medical Center. DVRO is based in Center City Philadelphia, Pennsylvania, and approximately 23 miles away from the project site, permitting strong support from the regional office.

As shown in Figure 19, the project organization chart represents the interrelationship between the Field Office and Regional Office operations. The Project Executive, Kevin Kriebel, is stationed at the job site to serve as a direct line of communication between the site activities and the Project Principle, Stephen O'Connor. Beneath Kevin is a team of

six members who coordinate the various facets of the project. Their selection for their particular role is based on various measures, including previous job roles and experience in healthcare projects of this scale. Their responsibilities cover the major elements of a construction project from preconstruction through closeout, including administration, accounting, safety, quality, and engineering. As mentioned, the close proximity of the site to the regional office permits strong site support. For example, the MEP and BIM Coordinators for this project work out of the regional office; however they host weekly on-site coordination meetings and building walkthroughs. These meetings included the modeler and/or foreman for the following trades: (1) Sheetmetal, (2) Plumbing/HVAC Piping, (3) Fire Protection, (4) Electrical, (5) Drywall/Ceilings, and (6) Pneumatic Tube, in which constructability conflicts are resolved and work-in-place is reviewed.

Project Superintendent and Project Engineer, Brian Baird and Joseph McCammit respectively, oversee the daily site activities regarding Gilbane's project management. During the lifecycle of the construction process, slight variations of the staffing plan occurred to expedite deliverables and adapt to project conditions; however, the overall structure methodology has remained unchanged from the initial system proposed with the GMP.

APPENDIX A

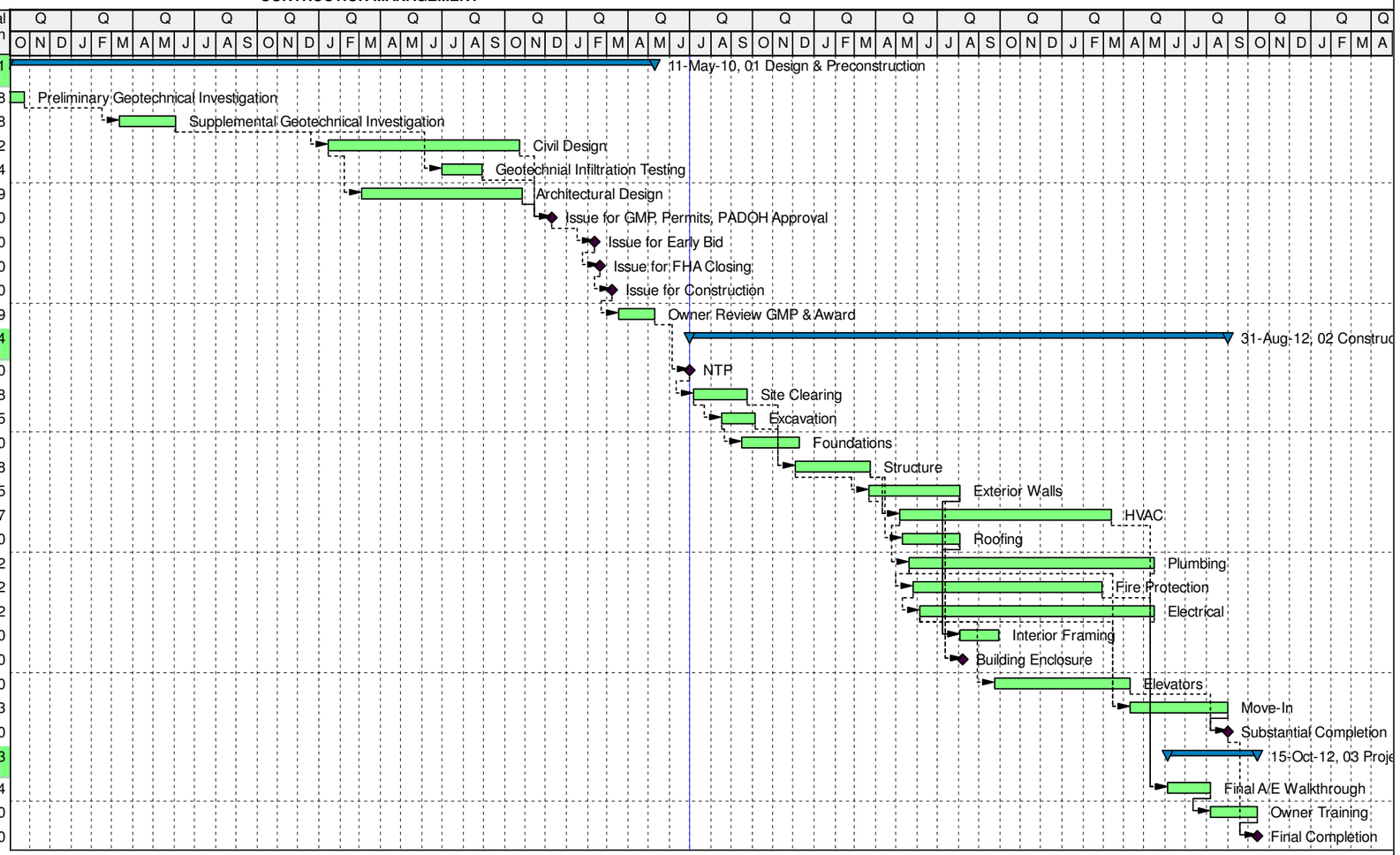
PRIMAVERA SCHEDULE

AE 481W - Senior Thesis

BRIAN NAHAS

CONTRUCTION MANAGEMENT

Activity ID	Activity Name	Start	Finish	Original Duration
01	**Design & Preconstruction**	01-Oct-07	11-May-10	681
01	Preliminary Geotechnical Investigation	01-Oct-07	24-Oct-07	18
02	Supplemental Geotechnical Investigation	13-Mar-08	02-Jun-08	58
03	Civil Design	15-Jan-09	23-Oct-09	202
04	Geotechnial Infiltration Testing	30-Jun-09	28-Aug-09	44
05	Architectural Design	05-Mar-09	28-Oct-09	169
06	Issue for GMP, Permits, PADOH Approval	09-Dec-09		0
07	Issue for Early Bid	11-Feb-10		0
08	Issue for FHA Closing	18-Feb-10		0
09	Issue for Construction	08-Mar-10		0
10	Owner Review GMP & Award	18-Mar-10	11-May-10	39
02	**Construction**	01-Jul-10	31-Aug-12	554
11	NTP	01-Jul-10		0
12	Site Clearing	06-Jul-10	24-Sep-10	58
13	Excavation	18-Aug-10	06-Oct-10	35
14	Foundations	16-Sep-10	09-Dec-10	60
15	Structure	03-Dec-10	24-Mar-11	78
16	Exterior Walls	22-Mar-11	03-Aug-11	95
17	HVAC	06-May-11	13-Mar-12	217
18	Roofing	10-May-11	03-Aug-11	60
19	Plumbing	20-May-11	15-May-12	252
20	Fire Protection	27-May-11	28-Feb-12	192
21	Electrical	06-Jun-11	15-May-12	242
22	Interior Framing	04-Aug-11	29-Sep-11	40
23	Building Enclosure	08-Aug-11		0
24	Elevators	23-Sep-11	10-Apr-12	140
25	Move-In	09-Apr-12	31-Aug-12	103
26	Substantial Completion	31-Aug-12		0
03	**Project Closeout**	05-Jun-12	15-Oct-12	93
27	Final A/E Walkthrough	05-Jun-12	06-Aug-12	44
28	Owner Training	06-Aug-12	15-Oct-12	50
29	Final Completion	15-Oct-12		0



Activity Summary Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

APPENDIX B

SQUARE FOOT ESTIMATE

Square Foot Cost Estimate Report

Estimate Name:	**NRMC** New Regional Medical Center Inc 559 West Germantown Pike , East Norriton , PA
Building Type:	**Hospital, 4-8 Story with Precast Concrete Panels With Exposed Aggregate / Steel Frame**
Location:	**NORRISTOWN, PA**
Story Count:	**5**
Story Height (L.F.):	**14.67**
Floor Area (S.F.):	**366780**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2011 Quarter 3**
Cost Per Square Foot:	**$229.84**
Building Cost:	**$84,300,500**

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 by RSMeans.

		% of Total	Cost Per S.F.	Cost
A Substructure		**1.90%**	**$4.42**	**$1,621,500**
A1010	**Standard Foundations**		**$2.39**	**$877,000**
	KSF, 24" deep x 96" wide			
	8' - 6" square x 27" deep			
	9' - 6" square x 30" deep			
	16' - 0" square x 35" deep			
	10' - 6" square x 33" deep			
	18' - 0" square x 39" deep			
A1030	**Slab on Grade**		**$1.61**	**$591,500**
	Slab on grade, 6" thick, light industrial, reinforced			
A2010	**Basement Excavation**		**$0.04**	**$16,000**
	storage			
A2020	**Basement Walls**		**$0.37**	**$137,000**
	thick			
B Shell		**15.50%**	**$35.55**	**$13,038,500**
B1010	**Floor Construction**		**$17.80**	**$6,530,500**
	Steel column, W10, 200 KIPS, 10' unsupported height, 45 PLF			
	26.5" total depth, 75 PSF superimposed load, 116 PSF total load			
	hour rating, 17 PLF			
B1020	**Roof Construction**		**$1.73**	**$634,500**
	28" deep, 40 PSF superimposed load, 62 PSF total load			
B2010	**Exterior Walls**		**$9.76**	**$3,579,500**
	insulation, low rise			
B2020	**Exterior Windows**		**$3.85**	**$1,413,000**
	Windows, aluminum, sliding, insulated glass, 5' x 3'			
B2030	**Exterior Doors**		**$0.85**	**$312,500**
	6'-0" x 10'-0" opening			
	hardware, 6'-0" x 10'-0" opening			
	0" opening			

B3010	**Roof Coverings**		**$1.52**	**$558,500**
	adhesive			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, copper, no backing, 16 oz, < 500 lbs			
B3020	**Roof Openings**		**$0.03**	**$10,000**
	steel, 165 lbs			
C Interiors		**24.00%**	**$55.14**	**$20,226,000**
C1010	**Partitions**		**$9.43**	**$3,457,500**
	board base, 3-5/8" @ 24",s ame opposite face, no insulation			
	Gypsum board, 1 face only, 5/8" with 1/16" lead			
C1020	**Interior Doors**		**$12.47**	**$4,572,500**
	0" x 7'-0" x 1-3/8"			
	0" x 1-3/8"			
C1030	**Fittings**		**$1.03**	**$376,000**
	Partitions, hospital curtain, ceiling hung, poly oxford cloth			
C2010	**Stair Construction**		**$1.32**	**$484,500**
	Stairs, steel, cement filled metal pan & picket rail, 12 risers, with landing			
C3010	**Wall Finishes**		**$9.14**	**$3,351,000**
	Glazed coating			
	primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		**$12.37**	**$4,537,000**
	Composition flooring, epoxy terrazzo, maximum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		**$9.40**	**$3,447,500**
	crc, 36" OC support			
	channel grid, suspended support			
D Services		**49.00%**	**$112.69**	**$41,331,500**
D1010	**Elevators and Lifts**		**$7.16**	**$2,626,000**
	200 FPM			
D2010	**Plumbing Fixtures**		**$13.97**	**$5,123,000**
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 19" x 17"			
	Kitchen sink w/trim, raised deck, PE on CI, 42" x 21" dual level, triple bowl compartment			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"			
	Bathtub, recessed, PE on CI, mat bottom, 5'-6" long			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**$4.37**	**$1,602,500**
	Electric water heater, commercial, 100< F rise, 1000 gal, 480 KW 1970 GPH			
D2040	**Rain Water Drainage**		**$0.67**	**$246,000**
	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**	**$4.67**	**$1,713,000**
	Hot water reheat system for 200,000 SF hospital		
D3020	**Heat Generating Systems**	**$0.43**	**$156,000**
	Boiler, electric, steel, steam, 510 KW, 1,740 MBH		
D3030	**Cooling Generating Systems**	**$3.02**	**$1,107,500**
	Chiller, reciprocating, water cooled, standard controls, 100 ton		
	Chiller, reciprocating, water cooled, standard controls, 150 ton		
	Chiller, reciprocating, water cooled, standard controls, 200 ton		
D3090	**Other HVAC Systems/Equip**	**$38.95**	**$14,286,000**
	Ductwork for 200,000 SF hospital model		
	Boiler, cast iron, gas, hot water, 2856 MBH		
	Boiler, cast iron, gas, hot water, 320 MBH		
	AHU, rooftop, cool/heat coils, VAV, filters, 5,000 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 10,000 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 20,000 CFM		
	VAV terminal, cooling, hot water reheat, with actuator / controls, 200 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM		
	draft damper, 1500 CFM		
	draft damper, 2750 CFM		
	Commercial kitchen exhaust/make-up air system, rooftop, gas, 5000 CFM		
	Plate heat exchanger, 400 GPM		
D4010	**Sprinklers**	**$3.31**	**$1,213,000**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF		
	10,000 SF		
	Standard High Rise Accessory Package 8 story		
D4020	**Standpipes**	**$0.41**	**$149,500**
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor		
	floors		
	steel door & frame		
	Alarm, electric pressure switch (circuit closer)		
	Escutcheon plate, for angle valves, polished brass, 2-1/2"		
	Fire pump, electric, with controller, 5" pump, 100 HP, 1000 GPM		
	Fire pump, electric, for jockey pump system, add		
	Siamese, with plugs & chains, polished brass, sidewalk, 4" x 2-1/2" x 2-1/2"		
	Valves, angle, wheel handle, 300 lb, 2-1/2"		
	Cabinet assembly, includes. adapter, rack, hose, and nozzle		
D5010	**Electrical Service/Distribution**	**$2.55**	**$936,500**
	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**	**$25.01**	**$9,174,000**
	transformer		
	Wall switches, 5.0 per 1000 SF		
	Miscellaneous power, 1.2 watts		
	Central air conditioning power, 4 watts		
	Motor installation, three phase, 460 V, 15 HP motor size		
	V 15 HP, 575 V 20 HP		
	fixtures @32 watt per 1000 SF		

D5030	**Communications and Security**		**$2.97**	**$1,089,000**
	detectors, includes outlets, boxes, conduit and wire			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**$5.21**	**$1,909,500**
	engine with fuel tank, 100 kW			
	engine with fuel tank, 400 kW			
	kW			
E Equipment & Furnishings		**9.60%**	**$22.04**	**$8,083,000**
E1020	**Institutional Equipment**		**$17.69**	**$6,489,500**
	water, economy			
	Architectural equipment, sink, epoxy resin, 25" x 16" x 10"			
	Architectural equipment, laboratory equipment eye wash, hand held			
	Fume hood, complex, including fixtures and ductwork			
	double door, 28"x67"x52"			
	hospital			
	semiautomatic, 50 racks/hr			
	KW			
	gallons			
	burners, 2 ovens & 24" griddle			
	system, economy			
	Special construction, refrigerators, prefabricated, walk-in, 7'-6" high, 6' x 6'			
	sinks, washers & dry tables			
E1090	**Other Equipment**		**$0.00**	**$0**
E2020	**Moveable Furnishings**		**$4.34**	**$1,593,500**
	room			
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**

SubTotal	**100%**	**$229.84**	**$84,300,500**
Contractor Fees (General Conditions,Overhead,Profit)	**0.00%**	**$0.00**	**$0**
Architectural Fees	**0.00%**	**$0.00**	**$0**
User Fees	**0.00%**	**$0.00**	**$0**
Total Building Cost		**$229.84**	**$84,300,500**

APPENDIX C

EXISTING CONDITIONS PLAN

Marion Ave

Housing Development

Housing Development

Housing Development

Water

Water

Natural Gas Pipeline

Wood's Golf Facility

Golf Course
Driving Range
Mini Golf

New Regional Medical Center

90'-8"

Proposed Utility Lines To CUP

Whitehall Road

PECO Telephone Poles

Retail & Commercial
1 & 2 Story

Germantown Pike

Existing Utility Lines

Additional "legend" services beneath Germantown Pike

Commercial
1 Story

Norristown Farm Park

Symbols

- Fire Hydrant
- Site Fence & Perimeter
- Traffic Pattern
- Existing Bldgs
- Existing Parking
- Existing Golf Cart Path
- Existing Driving Range

Legend

- Water
- Electric
- Storm
- Telecom
- Gas
- Sanitary

New Regional Medical Center

East Norriton, PA

Brian Nahas
Construction Management

Technical Report 1

Existing Conditions

Appendix C

APPENDIX D

SITE PLAN | MOBILIZATION & EXCAVATION

Marion Ave

Housing Development

Water

Temporary Stabilized Construction Crossings (Typical for 3)

Natural Gas Pipeline

Water

Temp Power For Offices

Temporary Construction Offices

Stockpile to new berm

New Regional Medical Center

90'-8"

Proposed Utility Lines To CUP

Site Clearing Topsoil Removal

PECO Telephone Poles

Retail & Commercial

1 &2 Story

Germantown Pike

Whitehall Road

Primary Response

Security & Truck Wash

Demo Existing Excavate & Bench Storm Basin

Additional "legend" services beneath Germantown Pike

Commercial

1 Story

Norristown Farm Park

HAUL ROUTE MAP

Symbols

- Site Fence & Perimeter
- Traffic Pattern
- Field Office
- Equipment Staging
- Site Work & Demo
- Construction Entrance

Legend

- Water
- Electric
- Storm
- Telecom
- Gas
- Sanitary

New Regional Medical Center

East Norriton, PA

Brian Nahas
Construction Management

Technical Report 1

Mobilization & Excavation

Appendix D

APPENDIX E

SITE PLAN | STRUCTURE & ENCLOSURE

Marion Ave

Housing Development

Water

Temporary Stabilized Construction Crossings (Typical for 3)

Material Storage Trade Parking

Natural Gas Pipeline

Delivery Inspection

Construction Offices

Tool Trailers

Temp Power For Offices

Temp Power From OH Lines

Dumpsters Recycling

New Regional Medical Center

90'-8"

Delivery Staging

Dumpsters Recycling

Whitehall Road

Crane Path

Primary Response

Main Entrance Security & Truck Wash

Second Entrance

Retail & Commercial

1 &2 Story

Germantown Pike

Storm Basin In Operation

Additional "legend" services beneath Germantown Pike

Commercial

1 Story

Norristown Farm Park

HAUL ROUTE MAP

Symbols

- Site Fence & Perimeter
- Traffic Pattern
- Field Office
- Equipment Staging
- Crane Path
- Construction Entrance

Legend

- Water
- Electric
- Storm
- Telecom
- Gas
- Sanitary

New Regional Medical Center

East Norriton, PA

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Technical Report 1

Structure & Enclosure

Appendix E

APPENDIX F

SITE PLAN | INTERIORS & FINISHES

Marion Ave

Housing Development

Water

Temporary Stabilized Construction Crossings (Typical for 3)

Trade Parking

Natural Gas Pipeline

Delivery Inspection

Construction Offices

Tool Trailers

Temp Power For Offices

Dumpsters Recycling

New Regional Medical Center

90'-8"

Delivery Staging

Dumpsters Recycling

Primary Response

Whitehall Road

Telephon Second Entrance

Poles 1 &2 Story

Retail & Commercial

Germantown Pike

Main Entrance Security & Truck Wash

Storm Basin In Operation

Additional "legend" services beneath Germantown Pike

Commercial

1 Story

Norristown Farm Park

HAUL ROUTE MAP

Symbols

- Site Fence & Perimeter
- Traffic Pattern
- Field Office
- Equipment Staging
- Scaffolding System
- Construction Entrance

Legend

- Water
- Electric
- Storm
- Telecom
- Gas
- Sanitary

New Regional Medical Center

East Norriton, PA

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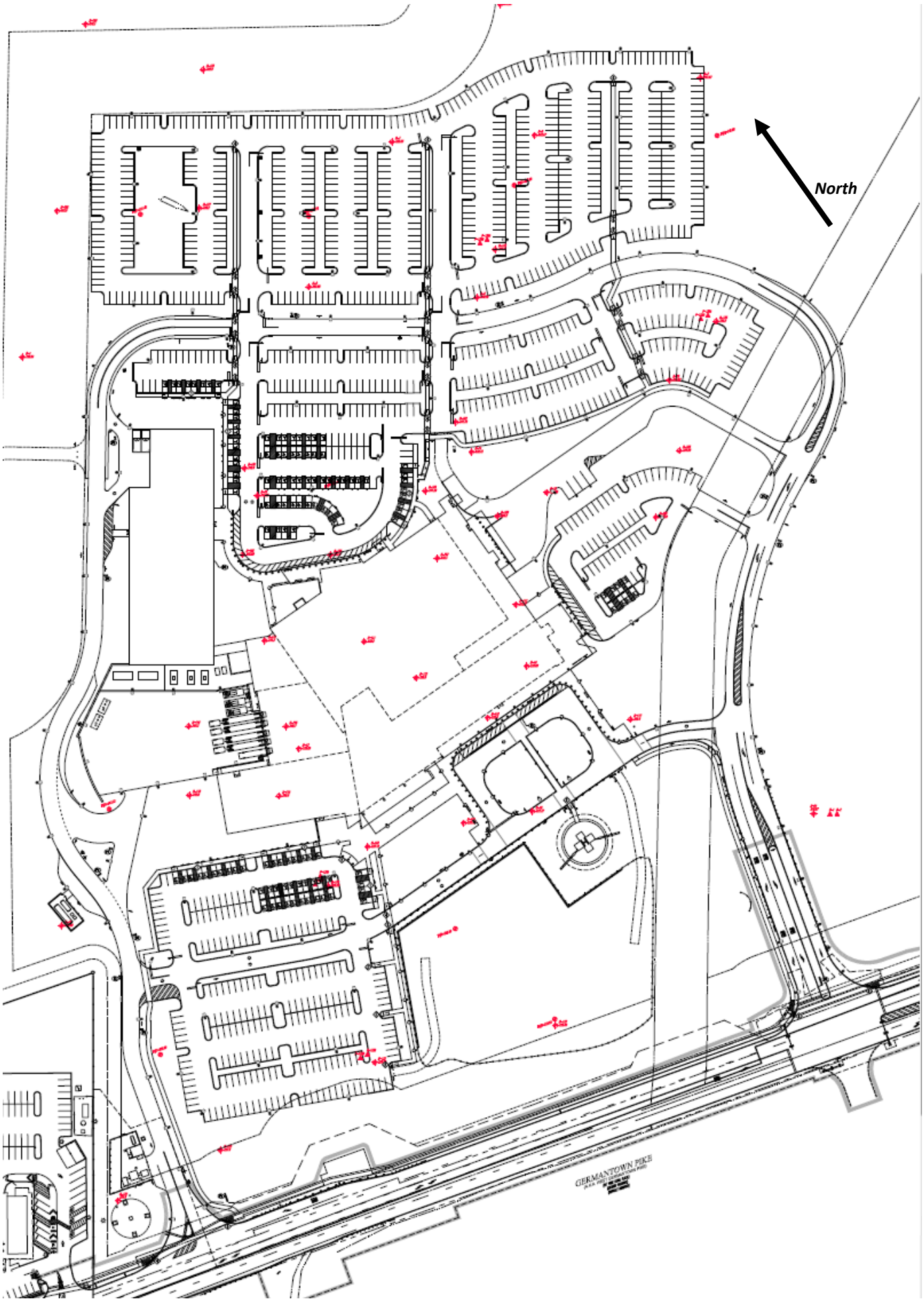
Technical Report 1

Interiors & Finishes

Appendix F

APPENDIX G

SITE PLAN | SOIL BORING LOCATIONS


North
GERMANTOWN PIKE