October 5 2009

CARDEROCK SPRINGS ELEMENTARY SCHOOL

JOSEPH HIRSCH

CONSTRUCTION MANAGEMENT

TECHNICAL REPORT 1

FACULTY ADVISER:
DR. CHRIS MAGENT

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A. EXECUTIVE SUMMARY

The previously existing Carderock Springs Elementary School was built in 1966 and badly in need of modernization to meet the advancing educational needs of today's youth. This technical assignment will discuss various construction management topics including schedule, building systems, project costs, existing conditions, as well as project delivery and staffing.

The new 80,121 square feet Carderock Springs Elementary School is being built on the site of the previous school which has since been demolished. It will feature a new gymnasium, state of the art media center, high technology classrooms, as well as outdoor play spaces with basketball courts and ball fields. The project will cost approximately $21 million and is scheduled to be turned over to the owner, Montgomery County Publics Schools, July 7, 2010. It will open next fall for the beginning of the next academic school year.

The new elementary school is striving to achieve a LEED Silver rating from the U.S. Green Building Council under LEED for Schools guidelines. One of the unique sustainable features of this project is the closed-loop water Geothermal HVAC system which includes 120 wells drilled to a depth of 520 feet. The system will assist in providing efficient heating and cooling as well as significant electricity cost savings to the district. Other notable credits being attempted are construction waste management, regional material extraction, and high indoor environmental quality. Montgomery County Public Schools is one of the largest owners of LEED accredited buildings in the state of Maryland.

The project is contracted under a Guaranteed Maximum Price format to HESS Construction + Engineering Services. It is being delivered utilizing a CM-at-Risk delivery method. HESS construction has acquired a team of 36 subcontractors both from private and public bid. The architect of record is BeeryRio Architect+Interiors. They have consulted Strickler Associates for MEP systems and ADTEK Engineers for civil and structural design.

B. PROJECT SCHEDULE SUMMARY

Foundation Sequence:

The building is divided into two distinct sections, Area A and Area B. The primary scheduling and sequencing are based on Area A activities beginning before Area B. The foundation system consists of continuous strip footings along the exterior of the building to support walls and spread footings placed under all of the interior and exterior columns. Along with the footings, there are a couple of key retaining walls that were placed which required additional labor to form-up and support the walls during curing. The retaining walls were placed first since some of the foundations met up with the walls and required the wall to hold back soil for a logical construction sequence.

Structural Sequence:

The structural steel was delivered for Area A as foundations continued in Area B. Although the site seems relatively large, the amount of concurrent activities taking place simultaneously restricted lay down area for steel and other materials. This required some phasing of steel packages by the steel contractor. The erectors started with columns and proceeded throughout the whole Area A. Some columns spanned 3 floors which allowed for greater efficiency and allowed the steel erector to pick multiple beams at once. Once beams were erected, cross bracing was placed to support the structure from lateral forces. Once moment welds were completed, the bracing would be taken down. Before another level was started, decking would be dropped down and they could continue climbing vertically while placing deck. Once the deck was placed and welded in place, shear studs would be placed for the composite concrete decks. Following the placement of the studs concrete could then be poured after contractors roughed in penetrations through the deck. This sequence was repeated as the steel went around the building to Area B.

Finish Sequence:

The interior wall system of this building consists primarily of 6" CMU walls. Therefore once the enough steel was laid out in front of the mason, their production would be critical to keep the schedule moving. While placing interior walls, MEP contractors coordinated penetrations and interior wall work to keep them from having to open up walls to make installations. Once the walls are in place and the building is enclosed final finishes can begin. First drywall will be placed followed by painting. After paint, ceiling grids can be hung allowing lighting fixtures to be placed and MEP trades to begin trim-out. Once this is complete tiles can be dropped in place. The next activities will include placing cabinets, fixtures, and additional equipment as necessary. The last thing that will happen is the punchlist and turnover of the building to the owner for occupancy. During the latter phases of construction and occupancy, building commissioning will take place to ensure the functionality of all MEP systems.

(See page 22, Appendix 1 for summary schedule)

C. BUILDING SYSTEMS SUMMARY

Table 1 - Building Systems Summary

YES	NO	WORK SCOPE
x		Demolition
x		Structural Steel Frame
x		Cast in Place Concrete
	x	Precast Concrete
x		Mechanical System
x		Electrical System
x		Masonry
x		Curtain Wall
	x	Support of Excavation

Demolition:

To make way for the new building, the old elementary school was demolished. Asbestos was abated first to make the site safe for selective demolition. Next, the "guts" were taken out and salvaged if feasible. Items such as steel ducts and copper wires can be recycled by the demolition contractor. Following the demolition of the inside components, the building structure can be demolished. Care is taken during this stage since steel and concrete can be recycled. Demolition is also organized destruction since operators of the heavy equipment must keep some type of structural integrity while operating in close quarters to large structural elements. Next, foundations will be demolished and crushed using impact hammers. The entire demolition of the existing structures lasted for just under three months

Figure 1 - Existing School

Figure 2 - Demolition of Existing Structure

Structural Steel Frame:

The frame of this building is structural steel. A combination of moment connections and free standing masonry structures (stairways & elevator shaft) provide the lateral resistance to loads. A Manitowoc 8500 crawler crane was used on this project. It has a capacity of 85 tons maximum load and a maximum swing radius of 200 feet. Columns in this building span all three floors. This saves time and money both in manufacturing and also erecting since there are less picks to make. The elevated slabs in this building are composite and are nominally 5 ½" thick. Long spans joists are used in the gymnasium and multipurpose rooms with spans reaching 72' and 78' respectively.

Figure 3 - Steel Frame

Cast in Place Concrete:

Cast in place concrete was used for all concrete applications on this project. The retaining walls, foundations, slabs on grade, and slabs on deck were all cast in place. The concrete specified on this job was normal weight 3500 PSI compressive strength. Formwork was reusable plywood forms. On the slabs, steel pour stops were utilized. The concrete plant used for this project was located about 45 minutes away. However, due to the high volume of traffic in the Washington, D.C. area it took as long as 90 minutes for concrete to reach the project site. Any truck that did not begin its pour before the 90 minute limit was sent back to the plant. This situation was encountered multiple times over the course of the concrete work. Concrete pump trucks were utilized for many applications on this project including elevated slabs and areas that had restricted access to direct chute due to concurrent construction activities.

Figure 4 - Pumping Concrete to Elevated Slab

Mechanical System:

A closed loop water Geothermal system was utilized on this project to assist with the LEED project goals and overall sustainability. There are 120 wells drilled to a depth of 540' into the earth. These wells are then in a series loop with the 49 water source heat pumps located throughout the building. In addition to geothermal there are six rooftop energy recovery units (ERU) that provide additional heating and cooling capacity as well as provide the necessary ventilation requirements. Larger rooms such as the gymnasium, media center and multipurpose room receive its HVAC needs solely from its own respective ERU.

Figure 5 - Drilling Rigs in Geothermal Field

Electrical System:

The overall electrical service to the building is 265/460V, 3 phase, 4 wire rated at a total of 1600A. Secondary service is 120/208V which powers primarily the lighting, computer, and small equipment loads. The building contains 21 panelboards and 7 transformers to step down the voltage to the appropriate level for the intended application. A 100 kW generator will provide backup power to the lighting and life support systems throughout the building.

Masonry:

This building consists of an 8" CMU back-up wall with a 4" brick veneer on the exterior walls. Structural walls in the elevator shaft and stair towers are grouted and have reinforcing Z bars in corners to tie the structure together. Nearly all interior walls and partitions are 6" CMU walls. This was chosen to help with sound transmission goals. Since there is a lot of masonry work, detailed management and quality control of this contractor is critical for success of the project. During the enclosure phases, the masonry will drive the schedule on the critical path.

Figure 6 - Masonry Veneer and Staging Area

Curtainwall:

Curtainwall is utilized in key locations to achieve daylighting and outdoor views. The front entrance of the school is curtainwall to add architectural aesthetics. At the elbow of the building the curtainwall spans 2.5 stories. This will provide the Media Center with expansive views and great daylighting. The curtainwall system being used is specifically engineered for low sound transmission since the Capital Beltway is located very close to the school. The architect has taken great care to ensure that noisy traffic will not be an issue inside of the building and affect the education of the children.

Figure 7 - Curtainwall Elevation, BeeryRio Architect+Interiors

D. PROJECT COST EVALUATION

Table 2 - Building Construction Cost and Building SF Cost, Source: CSES Bid Book

Building Construction Cost and Square Foot Cost		
Building Systems	**Cost**	**Cost/SF**
General Conditions	$2,484,450	$20.79
Concrete	$1,044,350	$13.03
Masonry	$1,974,625	$24.65
Structural	$1,952,070	$24.36
Moisture Protection	$669,000	$8.35
Carpentry	$310,600	$3.88
Openings	$1,758,436	$21.95
Finishes	$871,828	$10.88
Specialties	$221,025	$2.76
Equipment	$236,390	$2.95
Furnishings	$101,000	$1.26
Elevator	$95,000	$1.19
Mechanical	$3,894,487	$48.61
Electrical	$1,303,550	$16.27
Total	**$16,916,811**	**$211.14**

Table 3 - Total Project Cost and Project SF Cost, CSES Bid Book

Total Project Cost and Square Foot Cost		
Building Systems	**Cost**	**Cost/SF**
General Conditions	$1,665,420	$20.79
Site Work	$3,412,850	$42.60
Concrete	$1,044,350	$13.03
Masonry	$1,974,625	$24.65
Structural	$1,952,070	$24.36
Moisture Protection	$669,000	$8.35
Carpentry	$310,600	$3.88
Openings	$1,758,436	$21.95
Finishes	$871,828	$10.88
Specialties	$221,025	$2.76
Equipment	$236,390	$2.95
Furnishings	$101,000	$1.26
Elevator	$95,000	$1.19
Mechanical	$3,894,487	$48.61
Electrical	$1,303,550	$16.27
Allowances	$975,036	$12.17
Total	**$21,304,667**	**$265.91**

Table 4 - RS Means SF Cost Estimate

RS Means Source Year	2009	**Model Number**	M.560
Pages	198-199	**Exterior Wall Type**	Face brick w/ CMU Back-up
Area	80,121	**Frame**	Steel

The area falls between	above	**and**	65000 SF

Base Cost per SF	$163.53
Perimeter Adjustment	$36.67
Story Height Adjustment	$1.30
***Adjusted Base Cost**	$201.50

Base Building Cost	$201.50	x	80,121	=	$16,144,382

(No basement in building)

RS means Additions:		
Clock System (50 Room)	Cost:	$39,100
Flagpole (Alum. 40')	Cost:	$3,475
Kitchen Equipment (Broiler)	Cost:	$4,025
Kitchen Equipment (Dishwasher)	Cost:	$4,950
Kitchen Equipment (Food Warmer)	Cost:	$735
Kitchen Equipment (Freezer)	Cost:	$3,725
Kitchen Equipment (Range)	Cost:	$2,700
Sound System, Speaker, Ceiling (50)	Cost:	$9,550
	Total Cost w/ additions:	$16,212,642
	Location Modifier:	.90
	Total SF Cost for Building:	**$14,591,377.35**

Table 5 - D4 Cost Estimate

D4 Cost Estimate				
Division	**Division Name**	**Percent**	**SF Cost ($/SF)**	**Amount**
01	General Conditions	9.58%	21.18	$1,758,114
03	Concrete	7.06%	15.62	$1,296,460
04	Masonry	11.14%	24.65	$2,045,950
05	Metals	10.02%	22.17	$1,840,110
06	Wood & Plastics	4.61%	10.21	$847,023
07	Thermal & Moisture Protection	3.75%	8.29	$688,196
08	Doors & Windows	6.48%	14.34	$1,190,207
09	Finishes	12.75%	28.19	$2,340,027
10	Specialties	0.97%	2.14	$177,394
11	Equipment	1.77%	3.92	$325,432
12	Furnishings	0.98%	2.17	$179,750
14	Conveying Systems	0.35%	0.77	$63,714
15	Mechanical	21.21%	46.91	$3,893,912
16	Electrical	9.33%	20.63	$1,712,454
	TOTALS	**100.00%**	**221.19**	**$18,358,743**

Table 6 - Major Building Systems Cost, Source: CSES Bid Book

Major Building Systems		
Building Systems	**Cost**	**Cost/SF**
Concrete	$1,044,350	$13.03
Masonry	$1,974,625	$24.65
Structural	$1,952,070	$24.36
Mechanical	$3,894,487	$48.61
Electrical	$1,303,550	$16.27
Total	**$10,169,082**	**$126.92**

Cost Discussion:

Table 7 - Estimate Comparisons

Estimate Comparisons (Excluding Sitework)		
Estimate Method	**Cost**	**Cost/SF**
Actual Cost	$16,916,811	$211.14
RS Means	$14,591,377	$201.50
D4 Cost	$18,358,743	$221.19
Total Average Cost	**$16,622,310**	**$211.28**
Average (Means & D4)	**$16,475,060**	**$211.35**

The above table demonstrates how different media can be used to more accurately estimate the cost of a building. Since RS Means and D4 are not detailed methods, these quick estimates are ways to convey project costs to a potential owner to give them a good outlook of the money that they will have to spend to construct a building.

One of the key areas that brought error to the RS Means estimate was that the model building did not accurately reflect Carderock Springs Elementary. The model building is based on a 1 story 45,000 square foot building while Carderock is a 3 story 80,121 square foot building. Therefore the estimate did not accurately reflect the project.

D4 Cost database has similar scope projects which gave a more accurate estimate than Means. This was expected since it was a better reflection of Carderock Elementary. The interesting correlation between the estimates is taking the average and finding a very similar number to the actual costs. This helps to prove that a variety of estimates and methods should be used to obtain an accurate approximation as to what the actual costs of a building will be on bid day.

(See page 24, Appendix 2 for references used for estimates)

E. SITE PLAN OF EXISTING CONDITIONS AND CONSTRUCTION SITE UTILIZATION

The site utilization is extremely important during the early phases of construction. During the early phases beginning in December 2008 excavation began to prepare the building pad. In March of 2009, both foundations and drilling in the geothermal well field began. All of these

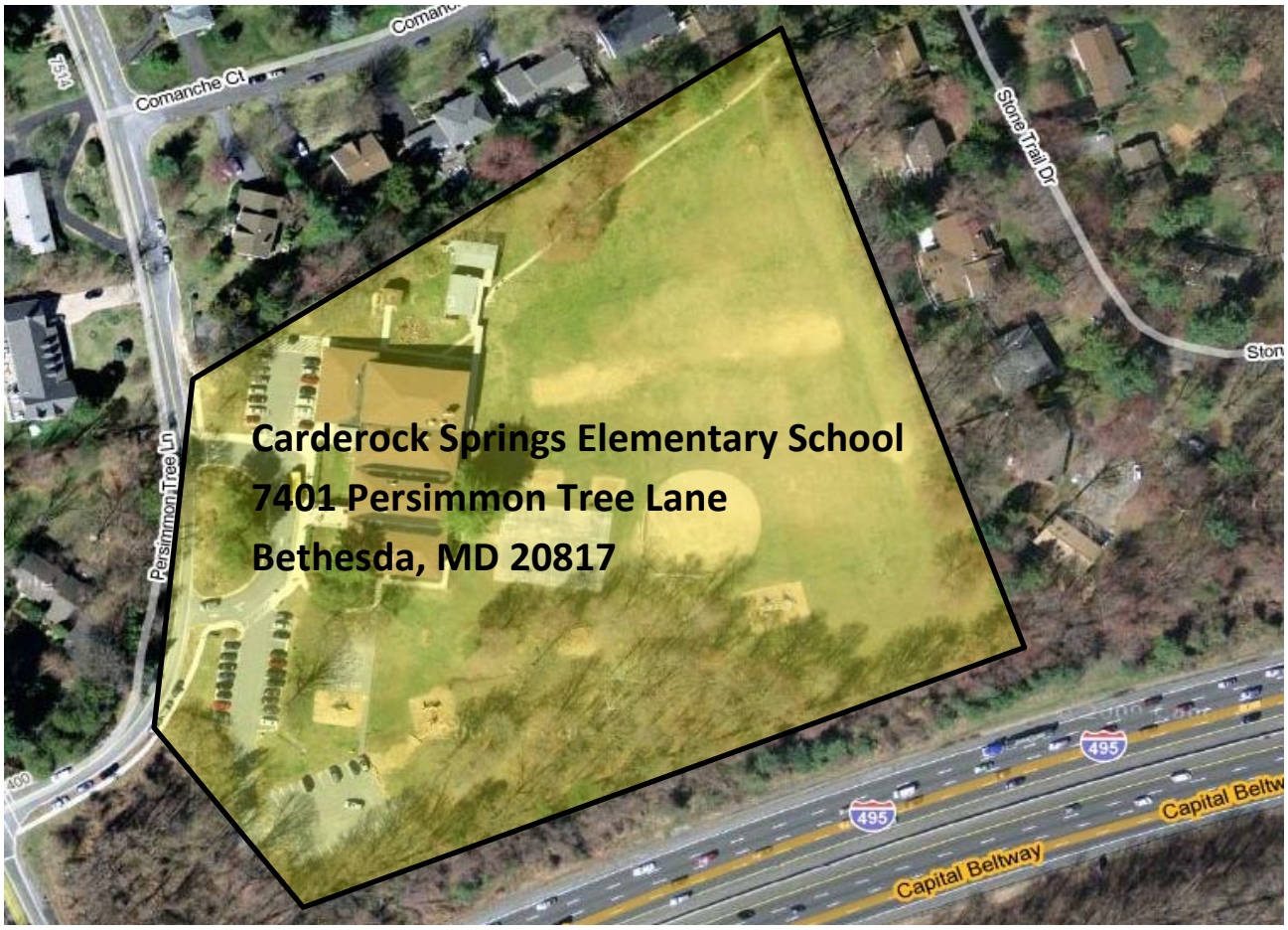


Figure 8 - Satellite Image, Google Maps: This photo shows the site prior to demolition of the existing school to make way for the new facility. It is tucked away in a residential neighborhood and also borders the Capital Beltway (I-495) through a line of trees.

activities require heavy equipment which needs ample room to operate. The high amounts of equipment on site required the temporary access roads to be maintained regularly to ensure easy movement of construction equipment including dump trucks, excavators, backhoes, and telescoping forklifts. This plan represents the early phases and later plans will reflect decongestion as activities are completed and more of the site is available for storage and parking.

(See page 30, Appendix 3 for site plan)

F. LOCAL CONDITIONS

Location:

Bethesda is located in Montgomery County, Maryland along the Capital Beltway Loop (I-495). It is located approximately 30 minutes northwest from Washington, D.C. and about an hour southwest of Baltimore, Maryland. Carderock Springs Elementary School is also located minutes away from the famed Congressional Country Club. This past summer Tiger Woods hosted the AT&T National Golf Tournament which brought in tens of thousands of visitors to the area, introducing traffic congestion problems for construction vehicles. Many of the surrounding roads are residential and restricted to large vehicles. Delivery routes and deliveries must be planned accordingly to maintain community relations.

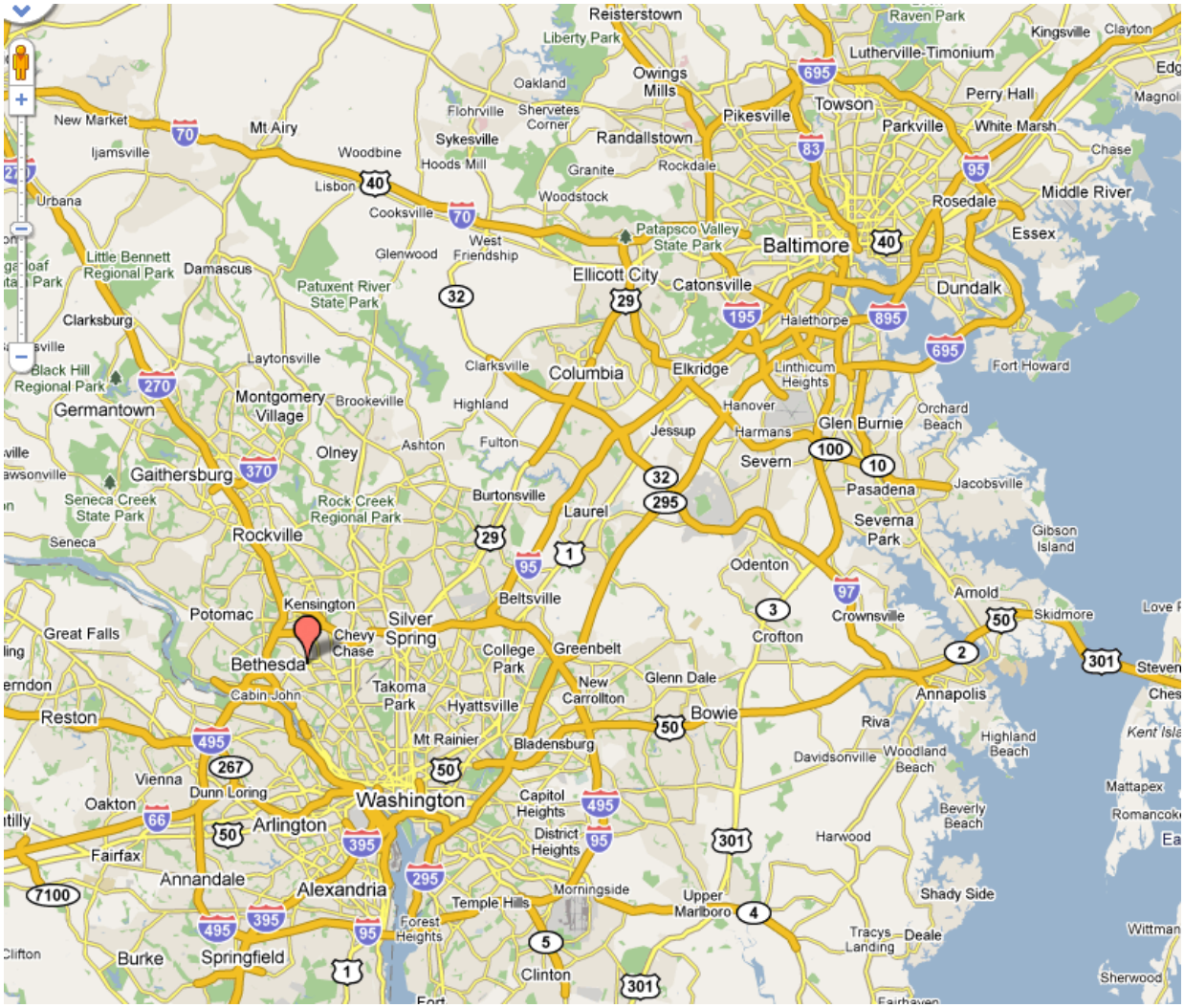


Figure 9 - Map of Surroundings, Google Maps

Soils and Subsurface Conditions:

Figure 10 - Site Excavation

The existing soil and subsurface conditions on this site were good. Conclusions reached in the geotechnical report showed that areas bored generally had firm silt and sand. There was no groundwater present that would complicate construction. The geotechnical engineer concluded that the use of spread footings with a soil bearing pressure of 3,000 PSF would be sufficient on the existing undisturbed soil or compacted fill. Other findings stated that the material found on site would be suitable for reuse as backfill if compacted correctly. The ability to reuse spoils had significant cost savings to the owner.

Construction Services and Workforce:

The availability of construction services is virtually unlimited due to the schools geographic location to Washington, D.C. Trash dumpsters in the area will generally be about $400 per pull for unsorted trash. Recycling and salvage is also readily available. This job is intended to receive a LEED silver rating which requires detailed management over the recycling program.

Parking in this area is extremely constricted. In order to save space on the site carpooling was emphasized to reduce cars on the site. Since the school was located in a residential area, parking on the street was not an option.

The construction workforce in this area is extremely diverse. Many of the workers were of a Latina decent from Central American countries. This introduced challenges due to the language barrier. Although all of the foremen were English speaking, the inability to communicate verbally to all site personnel introduced problems at times.

G. CLIENT INFORMATION

Montgomery County Public Schools (MCPS) is the owner of the new Carderock Springs Elementary School. They service the entire county and operate the 16th largest school district in the Unites States of America. The 2009-10 projected student enrollment for the district is 142,000. The district operates 200 schools amongst its other facilities.

The mission statement of MCPS reads "To provide a high-quality, world-class education that ensures success for every student through excellence in teaching and learning." One way they are meeting this goal is through the Capital Improvements Program which concentrates on modernizing or constructing new facilities for the students of the district. On an approved modernization schedule they have projects planned looking as far ahead as 2018. For the fiscal years 2009-14 there is $1.271 billion allocated for the Capital Improvements Program.

The size of this school district requires very large scale project considerations and planning. Due to the high number of schools currently in planning or under construction, meeting budgets is extremely critical. HESS Construction + Engineering Services was hired as the Construction Manager early in preconstruction phases to offer value engineering suggestions to help meet these goals.

Since MCPS is an experienced owner, they expect top quality work to be completed on their sites. The MCPS Department of Construction is very active in quality control. Since many schools are being built simultaneously or have been recently completed, they have a very clear understanding of what they want on each project. It is not uncommon to receive owner change orders on components that have not lived up to performance on another school they have built.

Another aspect of the Capital Improvements Plan is the commitment to sustainable design. They have two values they expect out of each sustainable project. First, to have a student friendly facility that adds to the district's mission of high quality education. And second, they are interested in the long term cost savings sustainable design can achieve. Many of their new schools feature geothermal HVAC systems and intelligent building monitoring systems.

Every one of their new projects is also commissioned to ensure functionality of the engineered systems.

Overall, Montgomery County Public Schools expects great customer service and value on each of their projects. They have established relationships with many contractors, including HESS, which is very evident in the responsiveness they expect from each individual project team. It is important to maintain these relationships for both parties since the district will be building many schools in the future with construction planned through 2018.

H. PROJECT DELIVERY SYSTEM

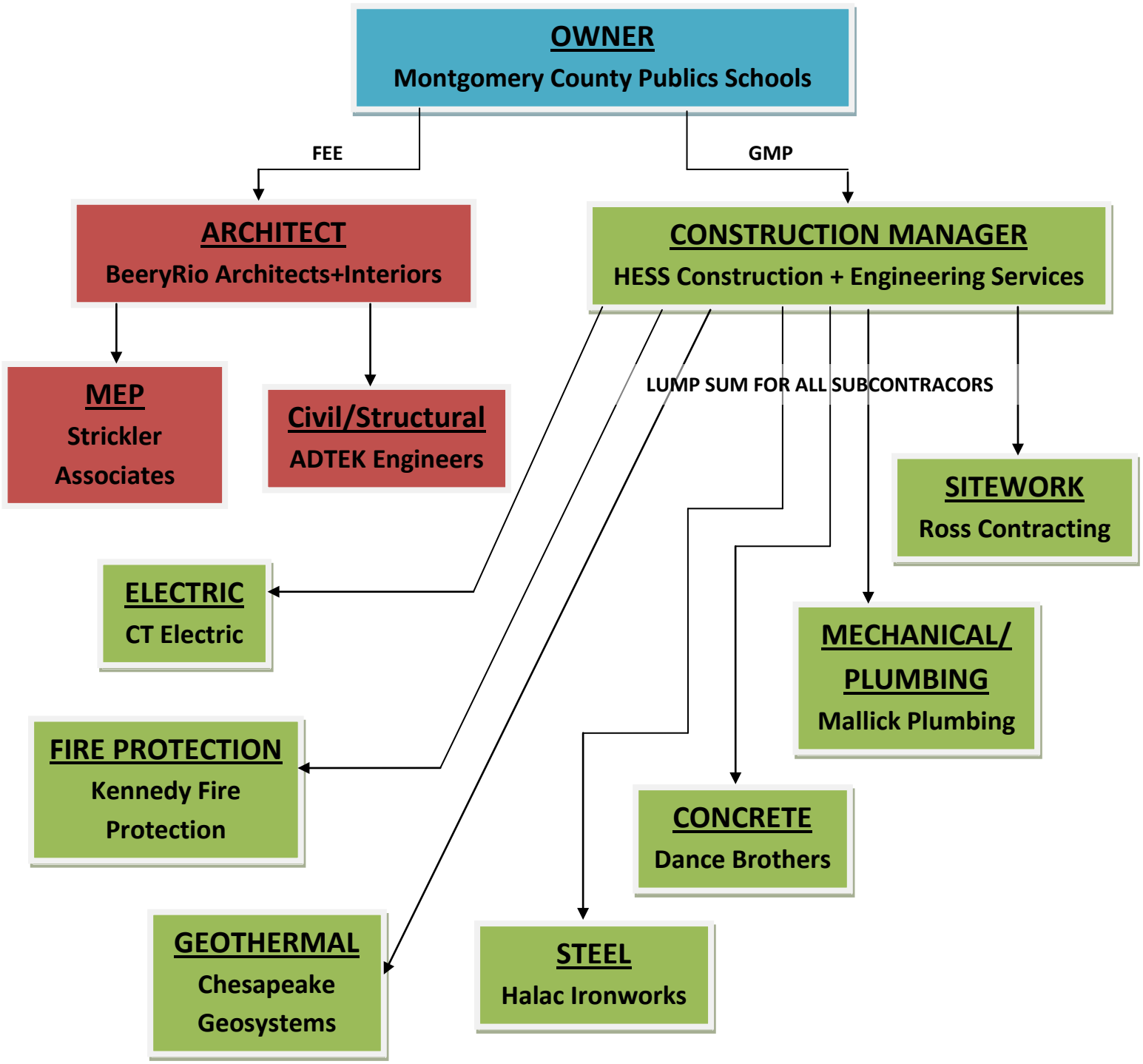


Figure 11 - Project Organizational Chart

Project Organizatiol Discussion:

Montgomery County Public Schools (MCPS) hired HESS Construction + Engineering Services to provide preconstruction services and to be the construction manager for this project. HESS is assuming all construction risk in a Guaranteed Maximum Price (GMP) contract held with the school district. The GMP for this project is approximately $21 million. Since this project is public, certain scopes of the project were required to be public bid by law. All bid scopes were formulated by HESS with approval by MCPS. The scopes that were public bid included sitework, concrete, steel, roofing, drywall, fire suppression, geothermal, mechanical/plumbing, and electrical. Each contractor in the public bid had to be pre-qualified by MCPS to participate. The rest of the scopes were privately bid directly to HESS. Once all bids were received, both public and private, HESS finalized the GMP which was reviewed and ultimately approved by the school district. Every contractor must be bonded and insured and produce all necessary documentation.

Each contract from the bid process is held by HESS. In total there are 36 subcontracts including the 9 subcontracts that were publicly bid. This number seems high, but the reason a General Contractor or Construction manager is hired is to gather skilled labor for high quality craftsmanship that the owner expects. Each bid scope is carefully developed based on the availability of expert construction services in the geographic area. HESS has also developed many relationships with their subcontractors allowing both parties to be competitive and successful in their ventures. These relationships provide increased value to the owner.

Unique relationships that exist on this project are that of the commissioning agent and building controls engineer. The school district holds the contracts with these agents although their work directly impacts construction on site. Collaboration and open communication has been critical in managing these relationships since each party associated has separate financial interests. These two independent contractors must work closely with MEP engineers to achieve the desired controls and automation of the mechanical and electrical systems of the building. The commissioning agent then must carefully review the engineering of these systems to ensure the design intent is met.

All construction projects require high levels of organization and efficient communication. Carderock Springs Elementary School is a very good example of this. Overall this project has over 50 parties with financial stake in the school. Each day the CM, HESS Construction + Engineering Services, must ensure that all parties are receiving the information they need or are connecting parties together to ensure success of the project.

I. STAFFING PLAN

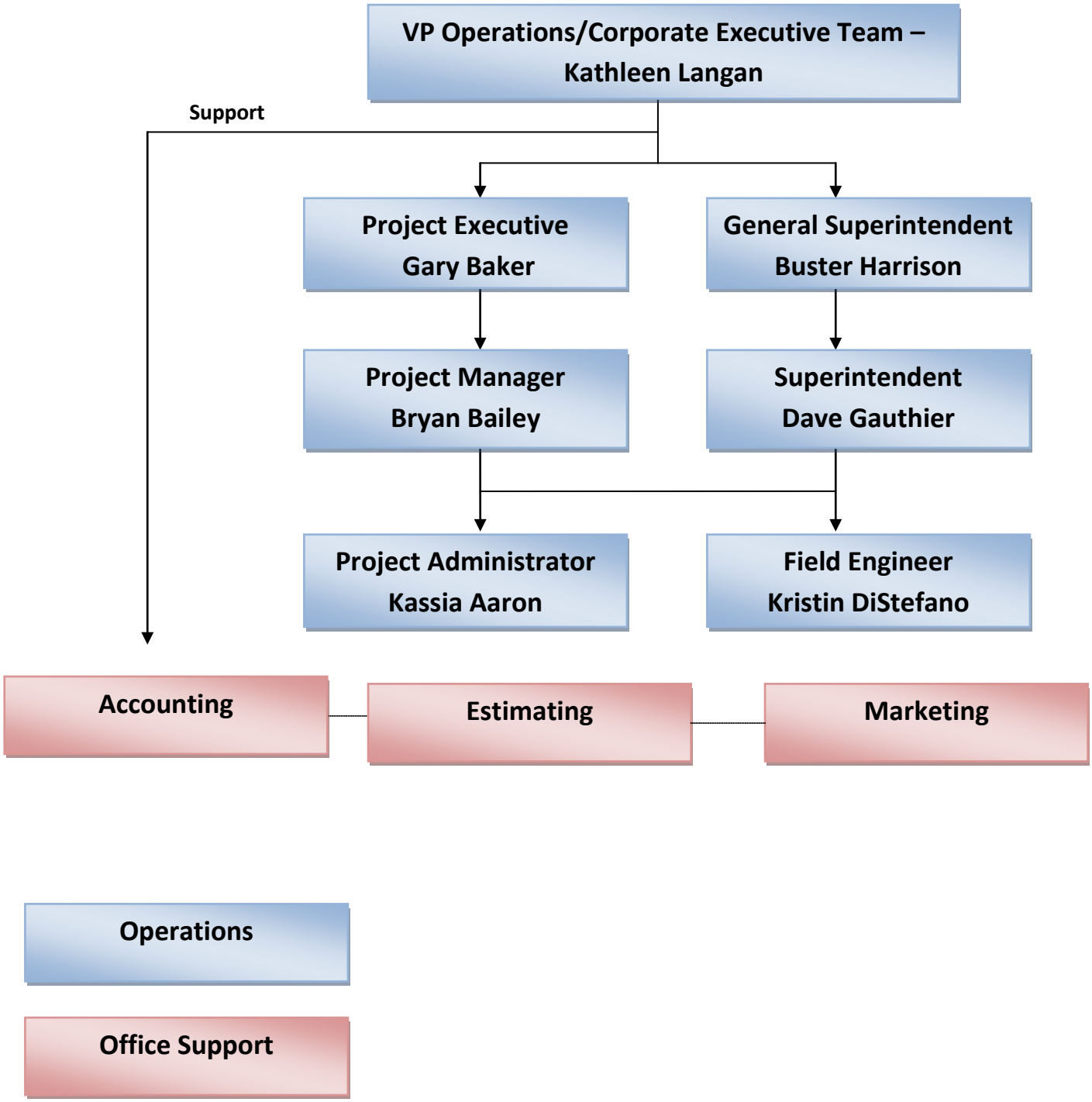


Figure 12 - Project Hierarchy

Project Staffing:

HESS Construction + Engineering Services was hired as the Construction Manager for this project and is assuming all construction risk for the project. They assisted with preconstruction services and will see the project through closeout and commissioning. During the construction phase, the project is staffed by operations on site.

The site team consists of the Project Manager, Superintendent, Field Engineer, and Project Administrator. As is typical in the industry the Project Manager is responsible the financials, approvals of documents, communication, and reporting. The Superintendent supervises field activity, updates the schedule, and is generally responsible for the means and methods of constructing the project. A Field Engineer will support the activities of the Project Manager and Superintendent. In this entry position, there is a focus on learning the responsibilities and participate in all the activities of a project. Lastly, the project administrator takes is responsible to document and organize the flow of information of the project. This position is in support of the Project Manager. All site personnel are responsible for safety but the Superintendent runs the daily program due to his presence in the field. A Safety Manager also performs weekly audits with Superintendent.

The Project Executive and General Superintendent act as supervisors to the Project Manager and Superintendent. They generally support the activities of the site as required. They are responsible for a group of projects and generally are not involved on a daily basis.

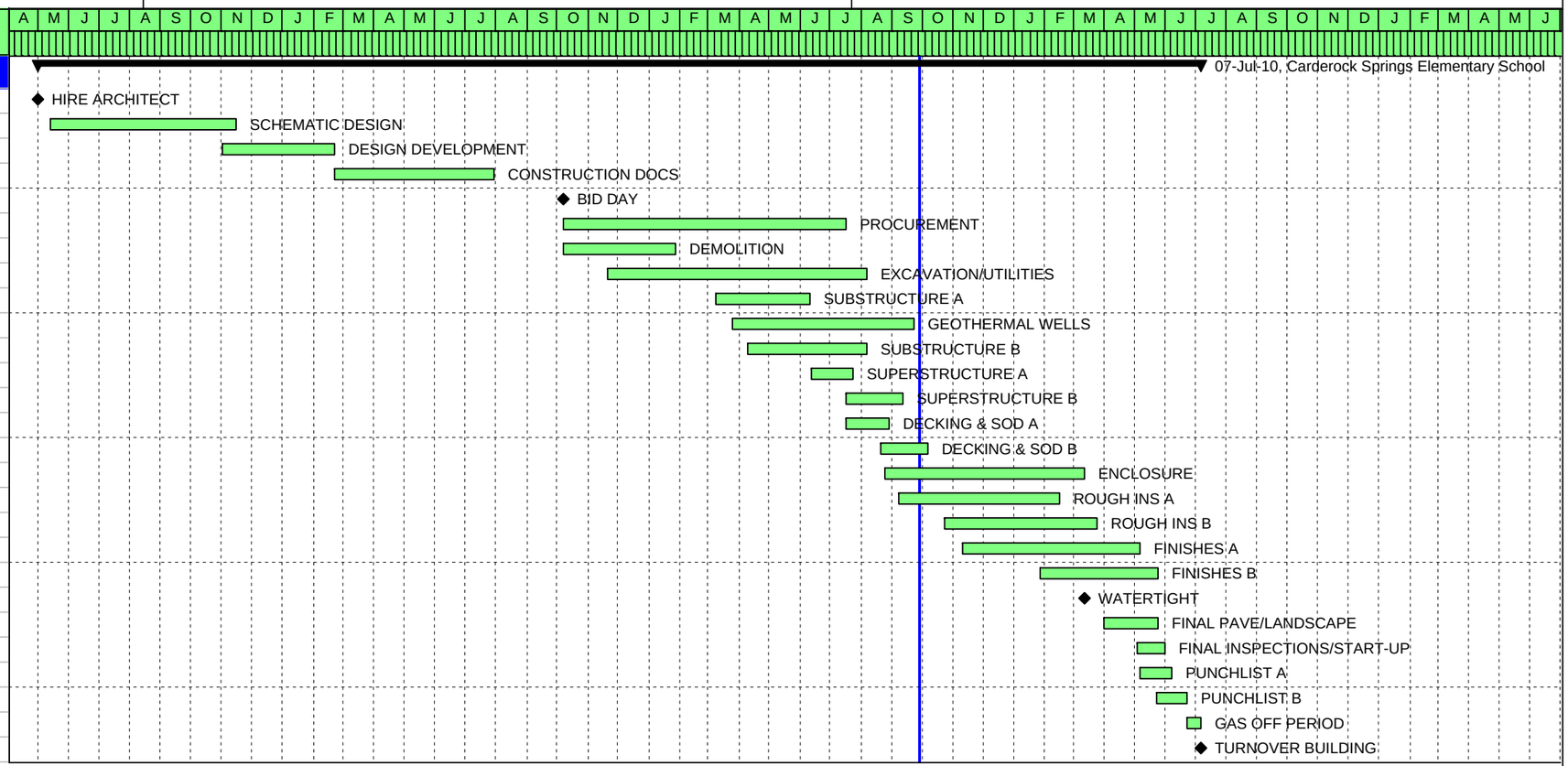
Departments in the office such as Accounting, Marketing, and Estimating assist activities on site. They are utilized as needed. The top Executives at HESS are highly visible. It would not be uncommon to see each member visit the project in the same week to check progress. They generally focus on procurement of new work.

J. APPENDIX 1

The next page contains the project summary schedule.

SCHEDULE SUMMARY | JOSEPH HIRSCH | OCTOBER 5, 2009

Activity Name	Original Duration	Start	Finish
Carderock Springs Elen	832	01-May-07	07-Jul-10
HIRE ARCHITECT	0	01-May-07	
SCHEMATIC DESIGN	134	14-May-07	15-Nov-07
DESIGN DEVELOPMENT	81	01-Nov-07	21-Feb-08
CONSTRUCTION DOCS	114	22-Feb-08	30-Jul-08
BID DAY	0	07-Oct-08	
PROCUREMENT	203	08-Oct-08	17-Jul-09
DEMOLITION	80	08-Oct-08	27-Jan-09
EXCAVATION/UTILITIES	187	20-Nov-08	07-Aug-09
SUBSTRUCTURE A	69	09-Mar-09	11-Jun-09
GEOTHERMAL WELLS	129	26-Mar-09	22-Sep-09
SUBSTRUCTURE B	85	10-Apr-09	06-Aug-09
SUPERSTRUCTURE A	30	12-Jun-09	23-Jul-09
SUPERSTRUCTURE B	41	17-Jul-09	11-Sep-09
DECKING & SOD A	31	17-Jul-09	28-Aug-09
DECKING & SOD B	34	20-Aug-09	06-Oct-09
ENCLOSURE	144	25-Aug-09	12-Mar-10
ROUGH INS A	115	08-Sep-09	15-Feb-10
ROUGH INS B	109	23-Oct-09*	24-Mar-10
FINISHES A	127	11-Nov-09*	06-May-10
FINISHES B	85	27-Jan-10*	25-May-10
WATERTIGHT	0		12-Mar-10
FINAL PAVE/LANDSCAPE	38	01-Apr-10*	24-May-10
FINAL INSPECTIONS/START-UP	21	04-May-10*	01-Jun-10
PUNCHLIST A	22	07-May-10*	07-Jun-10
PUNCHLIST B	22	24-May-10*	22-Jun-10
GAS OFF PERIOD	11	23-Jun-10*	07-Jul-10
TURNOVER BUILDING	0		07-Jul-10



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

CARDEROCK SPRINGS ELEMENTARY SCHOOL

K. APPENDIX 2

The next pages contain references used to estimate project cost.

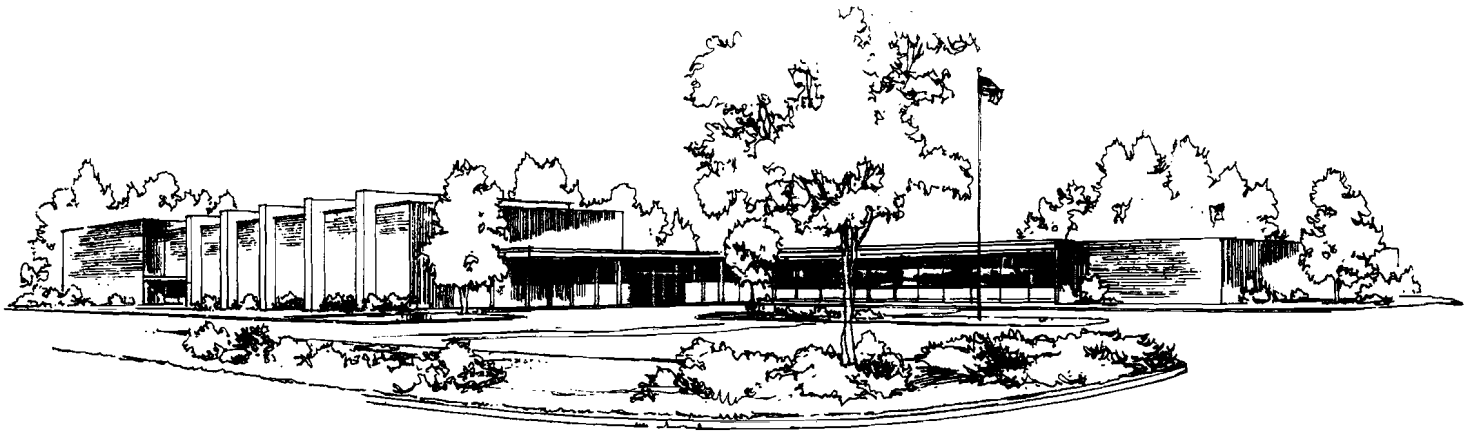
Statement of Probable Cost

CSES - Jul 2010 - MD - Rockville

Prepared By:	**Joe Hirsch** **Construction Management** **University Park, PA 1680** **Fax:**	Prepared For:	 **,** **Fax:**
Building Sq. Size:	**83000**	Site Sq. Size:	**1829520**
Bid Date:	**10/7/2008**	Building use:	**Educational**
No. of floors:	**3**	Foundation:	**CON**
No. of buildings:	**1**	Exterior Walls:	**CMU**
Project Height:	**42**	Interior Walls:	**CMU**
1st Floor Height:	**15.4**	Roof Type:	**BUP**
1st Floor Size:	**83000**	Floor Type:	**CON**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
01	**General Conditions**	**9.58**	**21.18**	**1,758,114**
	Irrigation	0.70	1.54	128,122
	Curb & Gutter	0.40	0.89	74,020
	Fence & Gates	0.23	0.51	42,147
	Landscaping	0.29	0.63	52,488
	Asphalt Paving	1.76	3.90	323,950
	Earthwork	4.52	10.00	829,865
	Utilities	1.68	3.71	307,521
03	**Concrete**	**7.06**	**15.62**	**1,296,460**
	Concrete	7.06	15.62	1,296,460
04	**Masonry**	**11.14**	**24.65**	**2,045,950**
	Masonry	11.14	24.65	2,045,950
05	**Metals**	**10.02**	**22.17**	**1,840,110**
	Steel Supply	5.44	12.03	998,490
	Steel Erection	4.58	10.14	841,620
06	**Wood & Plastics**	**4.61**	**10.21**	**847,023**
	Carpentry	3.85	8.53	707,637
	Architectural Woodwork	0.76	1.68	139,386
07	**Thermal & Moisture Protection**	**3.75**	**8.29**	**688,196**
	Joint Sealers	0.13	0.28	23,515
	Roofing & Flashing	3.62	8.01	664,681
08	**Doors & Windows**	**6.48**	**14.34**	**1,190,207**
	Coiling & Overhead Doors	0.09	0.20	16,236
	Doors Frames Hardware	1.25	2.76	229,271
	Aluminum Windows	3.58	7.91	656,690
	Aluminum Entrances	1.57	3.47	288,010
09	**Finishes**	**12.75**	**28.19**	**2,340,027**
	Acoustical Treatment	1.04	2.31	191,373
	Tile & Stone	2.07	4.58	380,122
	Painting	0.73	1.61	133,507
	Wood Flooring	0.29	0.64	52,953
	Drywall Plaster	7.53	16.65	1,382,316
	Carpet Resinous Flooring	1.09	2.41	199,756
10	**Specialties**	**0.97**	**2.14**	**177,394**
	Lockers	0.42	0.94	77,724
	Folding Partitions	0.26	0.57	47,562
	Display Boards	0.28	0.63	52,107
11	**Equipment**	**1.77**	**3.92**	**325,432**
	Athletic	0.16	0.36	29,892
	Food Service	1.61	3.56	295,541
12	**Furnishings**	**0.98**	**2.17**	**179,750**
	Casework	0.98	2.17	179,750

14	**Conveying Systems**	**0.35**	**0.77**	**63,714**
	Elevators	0.35	0.77	63,714
15	**Mechanical**	**21.21**	**46.91**	**3,893,912**
	Plumbing HVAC	9.18	20.30	1,684,740
	Fire Protection	0.89	1.98	164,138
	Ventilation/Controls	11.14	24.64	2,045,034
16	**Electrical**	**9.33**	**20.63**	**1,712,454**
	Electrical	9.33	20.63	1,712,454
Total Building Costs		**100.00**	**221.19**	**18,358,742**



Costs per square foot of floor area

Exterior Wall	S.F. Area	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	L.F. Perimeter	900	1050	1200	1350	1510	1650	1800	1970	2100
Face Brick with Concrete Block Back-up	Steel Frame	171.80	170.15	168.90	168.05	167.60	166.80	166.35	166.35	165.65
	Bearing Walls	163.25	161.60	160.40	159.55	**159.10**	158.30	157.85	157.85	157.15
Stucco on Concrete Block	Steel Frame	164.50	163.00	161.95	161.25	160.80	160.10	159.75	159.70	159.10
	Bearing Walls	155.95	154.50	153.45	152.70	152.25	151.60	151.25	151.25	150.65
Decorative Concrete Block	Steel Frame	164.45	162.95	161.85	161.10	160.65	159.95	159.55	159.55	158.95
	Bearing Walls	160.40	158.95	157.80	157.05	156.60	155.95	155.55	155.55	154.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	4.30	3.55	3.05	2.70	2.40	2.20	1.95	1.80	1.65
Story Hgt. Adj., Add or Deduct	Per 1 F.	1.55	1.50	1.50	1.45	1.45	1.45	1.45	1.50	1.45

***For Basement**, add $ 24.20 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 $ 78.90 to $ 200.65 per S.F.

Common additives

Description	Unit	$ Cost
Bleachers, Telescoping, manual		
To 15 tier	Seat	115 - 160
16-20 tier	Seat	235 - 288
21-30 tier	Seat	249 - 300
For power operation, add	Seat	45.50 - 71.50
Carrels Hardwood	Each	660 - 990
Clock System		
20 room	Each	16,000
50 room	Each	39,100
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	282
Nickel cadmium	Each	805
Flagpoles, Complete		
Aluminum, 20' high	Each	1650
40' high	Each	3475
Fiberglass, 23' high	Each	1775
39'-5" high	Each	3325
Kitchen Equipment		
Broiler	Each	4025
Cooler, 6 ft. long, reach-in	Each	4925

Description	Unit	$ Cost
Kitchen Equipment, cont.		
Dishwasher, 10-12 racks per hr.	Each	4950
Food warmer, counter, 1.2 KW	Each	735
Freezer, 44 C.F., reach-in	Each	3725
Ice cube maker, 50 lb. per day	Each	1750
Range with 1 oven	Each	2700
Lockers, Steel, single tier, 60" to 72"	Opening	191 - 310
2 tier, 60" to 72" total	Opening	107 - 141
5 tier, box lockers	Opening	65 - 83.50
Locker bench, lam. maple top only	L.F.	21
Pedestals, steel pipe	Each	63.50
Seating		
Auditorium chair, all veneer	Each	238
Veneer back, padded seat	Each	288
Upholstered, spring seat	Each	277
Classroom, movable chair & desk	Set	65 - 120
Lecture hall, pedestal type	Each	227 - 680
Sound System		
Amplifier, 250 watts	Each	2350
Speaker, ceiling or wall	Each	191
Trumpet	Each	365

Important: See the Reference Section for Location Factors

Model costs calculated for a 1 story building with 15′ story height and 45,000 square feet of floor area

School, Elementary

				Unit	Unit Cost	Cost Per S.F.	% of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	5.03	5.03	
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.74	4.74	12.1%
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.17	.17	
2020	Basement Walls	4′ foundation wall		L.F. Wall	78	4.45	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	N/A		–	–	–	4.4 %
1020	Roof Construction	Metal deck on open web steel joists		S.F. Roof	5.19	5.19	
	B20 Exterior Enclosure						
2010	Exterior Walls	Face brick with concrete block backup	*70% of wall*	S.F. Wall	30.85	10.87	
2020	Exterior Windows	Steel outward projecting	*25% of wall*	Each	696	4.57	13.5%
2030	Exterior Doors	Metal and glass	*5% of wall*	Each	3215	.57	
	B30 Roofing						
3010	Roof Coverings	Single-ply membrane with flashing; polyisocyanurate insulation		S.F. Roof	7.78	7.78	6.5%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Concrete block	*20 S.F. Floor/L.F. Partition*	S.F. Partition	8.76	4.38	
1020	Interior Doors	Single leaf kalamein fire doors	*700 S.F. Floor/Door*	Each	875	1.25	
1030	Fittings	Toilet partitions		S.F. Floor	2.03	2.03	
2010	Stair Construction	N/A		–	–	–	21.0%
3010	Wall Finishes	75% paint, 15% glazed coating, 10% ceramic tile		S.F. Surface	4.08	4.08	
3020	Floor Finishes	65% vinyl composition tile, 25% carpet, 10% terrazzo		S.F. Floor	6.87	6.87	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars		S.F. Ceiling	6.38	6.38	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	N/A		–	–	–	0.0 %
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Kitchen, bathroom and service fixtures, supply and drainage	*1 Fixture/625 S.F. Floor*	Each	6394	10.23	
2020	Domestic Water Distribution	Gas fired water heater		S.F. Floor	.48	.48	2.3%
2040	Rain Water Drainage	Roof drains		S.F. Roof	1	1	
	D30 HVAC						
3010	Energy Supply	Oil fired hot water, wall fin radiation		S.F. Floor	3.73	3.73	
3020	Heat Generating Systems	N/A		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	17.9%
3050	Terminal & Package Units	Split systems with air cooled condensing units		S.F. Floor	12.60	12.60	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Sprinklers, light hazard		S.F. Floor	2.33	2.33	2.2%
4020	Standpipes	Standpipe		S.F. Floor	.30	.30	
	D50 Electrical						
5010	Electrical Service/Distribution	800 ampere service, panel board and feeders		S.F. Floor	1.41	1.41	
5020	Lighting & Branch Wiring	High efficiency fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	9.91	9.91	12.4%
5030	Communications & Security	Addressable alarm systems, internet wiring, communications systems and emergency lighting		S.F. Floor	3.37	3.37	
5090	Other Electrical Systems	Emergency generator, 15 kW		S.F. Floor	.08	.08	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	Chalkboards		S.F. Floor	.13	.13	0.1 %
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK							
					Sub-Total	118.93	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	29.76	
	ARCHITECT FEES				*7%*	10.41	
					Total Building Cost	**159.10**	

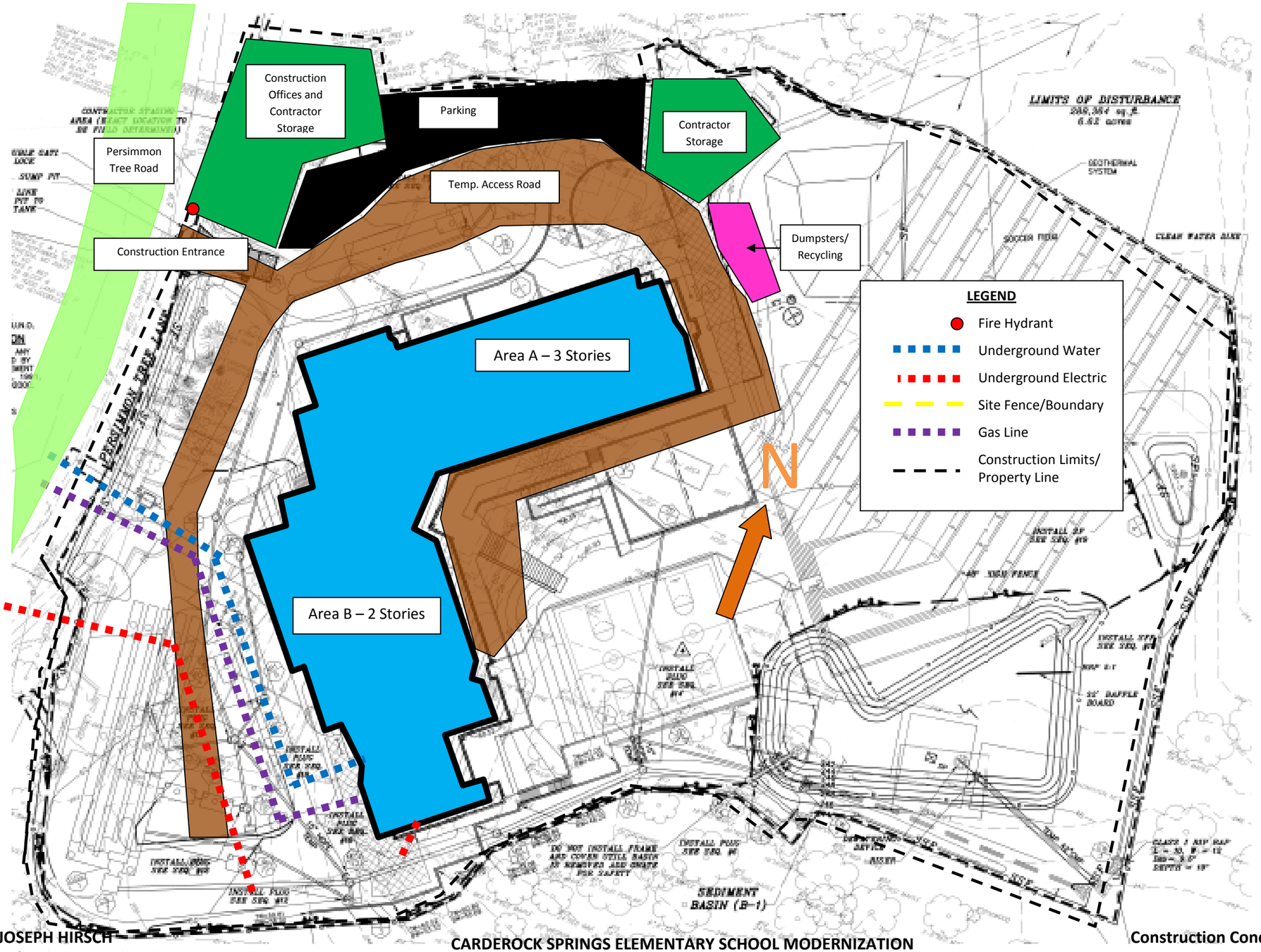
Location Factors

STATE/ZIP	CITY	Residential	Commercial
STATES & POSS.			
969	Guam	.97	1.07
IDAHO			
832	Pocatello	.86	.90
833	Twin Falls	.72	.82
834	Idaho Falls	.74	.83
835	Lewiston	.96	.97
836-837	Boise	.86	.90
838	Coeur d'Alene	.93	.95
ILLINOIS			
600-603	North Suburban	1.11	1.09
604	Joliet	1.14	1.10
605	South Suburban	1.11	1.09
606-608	Chicago	1.20	1.15
609	Kankakee	1.00	.99
610-611	Rockford	1.06	1.05
612	Rock Island	.97	.97
613	La Salle	1.05	1.00
614	Galesburg	.99	.97
615-616	Peoria	1.03	1.01
617	Bloomington	1.01	1.00
618-619	Champaign	1.03	1.01
620-622	East St. Louis	1.01	.99
623	Quincy	.99	.95
624	Effingham	.98	.95
625	Decatur	1.01	.99
626-627	Springfield	1.01	1.00
628	Centralia	.99	.96
629	Carbondale	.95	.93
INDIANA			
460	Anderson	.90	.90
461-462	Indianapolis	.93	.93
463-464	Gary	1.01	.99
465-466	South Bend	.90	.90
467-468	Fort Wayne	.89	.88
469	Kokomo	.91	.88
470	Lawrenceburg	.85	.85
471	New Albany	.85	.85
472	Columbus	.90	.88
473	Muncie	.91	.89
474	Bloomington	.92	.89
475	Washington	.89	.88
476-477	Evansville	.90	.91
478	Terre Haute	.90	.92
479	Lafayette	.91	.89
IOWA			
500-503,509	Des Moines	.89	.89
504	Mason City	.76	.81
505	Fort Dodge	.75	.80
506-507	Waterloo	.78	.81
508	Creston	.79	.82
510-511	Sioux City	.84	.86
512	Sibley	.72	.76
513	Spencer	.73	.77
514	Carroll	.73	.77
515	Council Bluffs	.81	.89
516	Shenandoah	.73	.77
520	Dubuque	.84	.89
521	Decorah	.74	.77
522-524	Cedar Rapids	.92	.91
525	Ottumwa	.82	.85
526	Burlington	.85	.85
527-528	Davenport	.95	.95
KANSAS			
660-662	Kansas City	.98	.96
664-666	Topeka	.79	.85
667	Fort Scott	.87	.86
668	Emporia	.74	.81
669	Belleville	.78	.83
670-672	Wichita	.79	.84
673	Independence	.84	.84
674	Salina	.77	.83
675	Hutchinson	.78	.80
676	Hays	.81	.83
677	Colby	.82	.83
678	Dodge City	.81	.85
679	Liberal	.79	.83
KENTUCKY			
400-402	Louisville	.91	.92
403-405	Lexington	.88	.88

STATE/ZIP	CITY	Residential	Commercial
KENTUCKY (CONT'D)			
406	Frankfort	.85	.89
407-409	Corbin	.75	.81
410	Covington	.97	.96
411-412	Ashland	.91	.94
413-414	Campton	.76	.82
415-416	Pikeville	.83	.89
417-418	Hazard	.72	.78
420	Paducah	.89	.89
421-422	Bowling Green	.89	.90
423	Owensboro	.86	.89
424	Henderson	.90	.89
425-426	Somerset	.76	.82
427	Elizabethtown	.87	.87
LOUISIANA			
700-701	New Orleans	.86	.89
703	Thibodaux	.82	.85
704	Hammond	.77	.81
705	Lafayette	.80	.83
706	Lake Charles	.82	.84
707-708	Baton Rouge	.84	.86
710-711	Shreveport	.78	.81
712	Monroe	.73	.80
713-714	Alexandria	.74	.80
MAINE			
039	Kittery	.86	.85
040-041	Portland	.88	.88
042	Lewiston	.87	.87
043	Augusta	.88	.87
044	Bangor	.86	.87
045	Bath	.86	.86
046	Machias	.87	.85
047	Houlton	.88	.86
048	Rockland	.87	.85
049	Waterville	.86	.86
MARYLAND			
206	Waldorf	.85	.88
207-208	College Park	.88	.92
209	Silver Spring	.86	.90
210-212	Baltimore	.90	.93
214	Annapolis	.84	.91
215	Cumberland	.86	.88
216	Easton	.67	.73
217	Hagerstown	.86	.89
218	Salisbury	.73	.77
219	Elkton	.79	.80
MASSACHUSETTS			
010-011	Springfield	1.04	1.01
012	Pittsfield	1.02	.99
013	Greenfield	1.00	.98
014	Fitchburg	1.11	1.04
015-016	Worcester	1.12	1.07
017	Framingham	1.13	1.07
018	Lowell	1.13	1.10
019	Lawrence	1.13	1.09
020-022, 024	Boston	1.20	1.15
023	Brockton	1.12	1.08
025	Buzzards Bay	1.10	1.04
026	Hyannis	1.10	1.06
027	New Bedford	1.12	1.07
MICHIGAN			
480,483	Royal Oak	1.00	.97
481	Ann Arbor	1.01	.98
482	Detroit	1.06	1.03
484-485	Flint	.97	.97
486	Saginaw	.91	.92
487	Bay City	.92	.92
488-489	Lansing	.96	.96
490	Battle Creek	.92	.92
491	Kalamazoo	.91	.91
492	Jackson	.92	.92
493,495	Grand Rapids	.80	.83
494	Muskegon	.87	.88
496	Traverse City	.78	.83
497	Gaylord	.81	.84
498-499	Iron Mountain	.87	.90
MINNESOTA			
550-551	Saint Paul	1.11	1.07
553-555	Minneapolis	1.15	1.10
556-558	Duluth	1.07	1.02

L. APPENDIX 3

The next page contains the project site plan.



JOSEPH HIRSCH
The Pennsylvania State University
Technical Report 1
October 5, 2009

CARDEROCK SPRINGS ELEMENTARY SCHOOL MODERNIZATION
MONTGOMERY COUNTY PUBLIC SCHOOLS
BETHESDA, MARYLAND

Construction Conditions
Site Plan
C-1.0

M. APPENDIX 4

The next pages contain the Capital Improvements Program of Montgomery County Public Schools.

Appendix E

Modernization Schedule for Assessed Schools

Schools	Year Built	Year Renovated	FACT Score	Approved Schedule
Elementary				
Cashell	1969		1292	8/2009
Cresthaven	1962		1311	8/2010
Carderock Springs	1966		1316	8/2010
Bells Mill	1968		1319	8/2009
Farmland	1963		1417	8/2011
Seven Locks	1964		1344	1/2012
Cannon Road	1967		1357	1/2012
Garrett Park	1948	1973	1388	1/2012
Glenallan	1966		1418	8/2013
Beverly Farms	1965		1427	8/2013
Weller Road	1953	1975	1461	8/2013
Bel Pre	1968		1476	8/2014
Candlewood	1968		1489	1/2015
Rock Creek Forest	1950	1971	1492	1/2015
Wayside	1969		1502	8/2016
Brown Station	1969		1516	8/2016
Wheaton Woods	1952	1976	1525	8/2016
Potomac	1949	1976	1550	1/2018
Luxmanor	1966		1578	1/2018
Maryvale	1969		1578	1/2018
Sandburg	1962		*****	TBD
Middle				
Francis Scott Key	1967		1389	8/2009
Cabin John	1968		1422	8/2011
Herbert Hoover	1966		1427	8/2013
William H. Farquhar	1968		1434	8/2015
Tilden @ Woodward	1966		1455	8/2017
Eastern	1951	1976	1472	TBD
E. Brooke Lee	1966		1479	TBD
High				
Walter Johnson	1956	1977	1405	8/2009
Paint Branch	1969		1425	8/2013
Gaithersburg	1951	1978	*1214*	8/2014
Wheaton	1954	1983	*1220*	8/2016
Seneca Valley	1974		*1254*	8/2017
Thomas S. Wootton	1970		*1301*	TBD
Poolesville	1953	1978	*1362*	TBD
Col. Zadok Magruder	1970		*1471*	TBD
Damascus	1950	1978	*1496*	TBD

Note: Schools were assessed for modernization in 1992, 1996, and 1999. There is some overlap in scores due to the four year gap in dates of the assessments. Schools on the 1992 list would have been four years older and may have had lower scores if the school from both lists were assessed at the same time. No funds have been allocated to complete the assessments of the remaining elementary and middle schools.

TBD Projects that do not have planning and/or construction expenditures in the County Council Adopted FY 2010 Capital Budget and Amended FY 2009–2014 CIP have completion dates to be determined (TBD). This TBD status will be revised in a future CIP.