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# Frederick County School Construction Work Group

## Reducing School Construction Costs While Preserving Excellence in Education



Prepared by:  
**School Construction Work Group**  
February 2017

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## **Members of the Work Group**

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### ***Cover Photograph:***

*Frederick High School Construction (Circa 2016) showing new front entrance, which was designed to replicate original 1939 school building entrance.*

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### **Exhibits**

- A - Suggested Changes to §3-602.1(a)(2) of the State Finance and Procurement Article
- B - Suggested Changes of the Education Article §5-312 (b) & (e)
- C - Suggested Changes of the Education Article §17-201(j)(2)(ii)2
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## Executive Summary

Recognizing that recent statewide increases in school construction costs may ultimately reduce the number of projects that can be funded in Frederick County, Maryland, County Executive Jan Gardner created the School Construction Work Group (SCWG). The group's broad scope of work, included the following.

- Evaluate the cost of school construction in Frederick County with a goal of reducing costs by 8-10%, without sacrificing quality, performance, or the life of the projects.
- Review and discuss mechanisms for construction savings and offer suggestions.
- Review topics such as the bidding process, the construction management approach, and project design.
- Study options for specific bid packages and construction methods.
- Recommend additional areas which should be considered for value engineering, if feasible.
- Make recommendations for potential changes in legislation, policy, or procurement for local and state education/elected officials and to a state task force on school construction.
- Complete the work of the committee and create a summary for presentation to the County Executive within a six (6) months to one (1) year timeframe.

The SCWG met twelve times between March 2016 and February 2017. Meeting minutes from the SCWG meetings are included in Appendix E of the report. The SCWG published an interim report in September 2016, in anticipation of the Maryland General Assembly legislative session, which began on January 11, 2017. The recommendations contained in the interim report are also included in this final report.

This report details the SCWG findings, recommendations and suggestions which the County Executive and others should consider to reduce school construction costs without materially sacrificing quality, performance, or the life of the school projects.

The SCWG focused its attention on three major aspects of school design and construction: **construction technology**, **delivery systems**, and **local, state and federal mandates**. The work group included professionals with specific expertise in school architectural design, civil engineering and site development, building mechanical specialties, project management, as well individuals familiar with state school construction regulatory requirements and community needs.

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The SCWG recognizes that recommendations contained in this report may take several years to implement and result in meaningful school construction cost savings. Implementation of the recommendations will require action by multiple local agencies and the state legislature. Therefore the SCWG strongly recommends that a formal annual update on the progress of these initiatives be provided to the County Executive each year by Frederick County Public Schools (FCPS) and/or County staff that may be involved in these efforts. The update should be a written report detailing which initiatives have been accomplished and to what extent they are effecting reductions in school construction costs. A summary of the work groups recommendations are outlined below.

### **State Legislative Initiatives** (*Amendments to existing Statutes*)

- Seek amendments to the High Performance Building Act (HPBA) to allow local school systems more flexibility to contain school construction costs, while at the same time meeting an equivalent HPB standard.
  - Legislation is needed that would require, by a certain date, the Secretaries of Budget and Management and General Services adopt an equivalent HPB standard that does not require the payment of fees to obtain the certification
  - For example, school systems should be allowed to construct schools using conventional (non LEED Silver) construction if they ensure, through a long term Power Purchase Agreement (PPA), that 100% of the school's electrical energy will come from renewable energy sources.
  - Between 2007 and 2014, the state paid 50% of the local share of the extra cost incurred in design and constructing a new school to meet HPB requirements. The committee recommends reestablishing the State's 50% cost share of the local funding.
  
- Seek amendments to the State Finance and Procurement Article to allow school systems the flexibility to bid and construct schools absent the Prevailing Wage requirement, if local funding is more than 50% of the project costs. FCPS's own experience is that this would reduce construction costs by 11% to 14%.
  
- Seek amendments to the Education Article to allow local governments to retain 100% of any savings associated with value engineering efforts performed by the school system to incentivize value engineering.
  
- Seek legislation requiring the State to develop financial incentives (change cost share) for a local school system using certain efficient and unconventional design/construction alternatives that serve the purpose of reducing school construction costs. Examples

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could include things like tilt-up construction, modular construction, and design-build delivery systems for construction.

### **Other Possible Legislative Initiatives** *(New Legislation)*

- Seek legislation requiring a mandatory delay of legislative changes that affect school construction costs. The work group suggests a three-year delay, so as to not to impact projects currently in the design or bidding process, or alternatively the state could exempt projects with planning approval from meeting legislative changes.
- Seek legislation requiring the State to create and maintain a reserve fund for school construction. The reserve fund would be used to assist local school systems with unexpectedly high increases in school construction costs.
- Seek legislation to create a State Revolving Loan Fund (SRF) for public school construction, which could help provide additional state funding for school construction throughout the State. The fund could assist small counties who cannot forward fund the state share of school construction.
- Seek legislation updating the State funding formulas to recognize changes that have occurred over time and have added to the overall square footage of the building, such as health suites, gymnasiums, and other educational program or community needs that are required and approved since the formulas were established.
- Seek legislation that would allow the State Department of General Services (DGS) and other state agencies to delegate some plan review functions to local school systems, who meet required standards to conduct plan review. This would save time and money, and eliminate additional plan reviews and plan approvals which are already occurring at the local level.

### **School Site Work and Storm Water Management**

- Design funding should be awarded earlier, potentially before the site plan process, so any issues can be addressed before the project design is finalized. The County should work with FCPS staff to determine how this would spread funding within the Capital Improvement Plan.
- The County and Municipal planning staff should work with FCPS staff early in a project to identify project review efficiencies and make those recommendations at the time of review.

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- County staff (and Municipal), FCPS staff, and the civil engineers for a school project should work together as a team during the conceptual design phase to reduce costs and look for efficiencies.
  - Regulations related to storm water management need to be evaluated and clarified to minimize costs while complying with basic requirements.
  - Where appropriate, request developers provide mass grading and utility construction for school sites to reduce site development costs.

### **School Site Acquisition Process**

- The Board of Education should update and establish additional (optimal) guidelines for evaluating school sites prior to their acquisition or acceptance. The school system, County, and Municipal Planning Divisions and officials will use BOE established guidelines when evaluating potential school sites.
- The County should seek agreements with Municipalities to ensure uniform application of all requirements relating to schools.
- The County and Municipalities should reserve water and sewer system capacity for public schools.
- Seek alternatives for school site development, including incentivizing the development community to mass grade school sites.

### **School Construction Technologies and Potential Cost Savings**

- Evaluate the possibility of incorporating bidders assembling products off-site as a means to reduce the amount of regulatory costs (modular construction).
- Use unfinished ceilings in all or portions of the school building, when applicable.
- Reduce the height of roof parapets, when applicable.
- Reduce the amount of the interstitial space between building floors.
- Reduce the overall building volume without compromising quality by reducing the overall height from floor to ceiling to 13'4". This allows for an 8'8" ceiling in most classrooms instead of a 10' ceiling.



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- Explore the use of a Variable Refrigerant Flow (VRF) systems in place of a Geothermal system in the elementary prototype design to save money. This could be done in the redesign of Urbana Elementary School, providing data for future school construction project costs.
  - Continue to use prototype school designs, with updated modifications for sites, etc., when possible.

### **Cooperative Review Process**

- Establish a cooperative review process between FCPS and Frederick County Planning and Permitting, as well as Municipal Planning and Permitting agencies, for public school facility design review and approval.

### **Delivery Methods**

- The SCWG felt that there was no significant difference in cost savings between delivery methods. However, bids must be made more attractive to bidders in order for projects to be competitive.
- Consider a statewide bonding contract for the use of individual bidders, since all contacts must be bonded, and specifically address bonding requirements for smaller companies that have difficulty meeting requirements.<sup>1</sup>

### **Fees**

- Recommend that the Frederick County Division of Utilities and Solid Waste Management (DUSWM) and Municipalities work with FCPS staff to make sure prototype and new school designs do not have unnecessary fixtures that can increase capacity fees.
- Recommend DUSWM determine if water and sewer capacity adjustment factors should be calculated based on school level, Elementary, Middle or High School. Recommend Division of Planning and Permitting complete an analysis of public school permit fee costs to determine if they could waive all or a portion of development review and construction permitting fees.

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<sup>1</sup> For example in January 2017 New Jersey Senate Bill 123 was signed into law, which among other things creates a small business bonding readiness fund that will offer support services and assistance to businesses.

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- Consider having the General Fund pay water and sewer capacity fees directly to water and sewer utility (County or Municipal) rather than awarding that money through the budget process to FCPS to pay those fees.
  - Strive to foster greater cooperation, early in the design phase, among County Divisions (and SHA) regarding permitting and development review/approval of water and sewer and road improvements needed for public school construction.

### **Off-site Improvements**

- If off-site improvements are needed, the cost of such improvements should be coordinated with any County/Municipal CIP projects for the same area.
- If off-site improvements are required, remove the requirement in the County Code that stipulates that improvements must be constructed and operational prior to site plan approval or building permit issuance. This will save significant time during construction.
- Seek the same flexibility to complete off-site improvements while school are under construction within municipalities.
- FCPS's school construction should not have to include off-site road adequacy tests and related road improvements.

### **Local Educational Specifications**

- Recommend that the County Executive request a County staff member participate in the design team while the local educational specifications for a project are being developed. Consider having an experienced staff member from the County's Division of Public Works fill this role.

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The SCWG believes that it has addressed the charge laid out by the County Executive, including the specific charge of finding ways to reduce school construction costs by 8 to 10 percent. Although the SCWG cannot guarantee these savings, we believe the cumulative impact of the recommendations concerning School Construction Technologies, Cooperative Review Process, and Off-Site Improvements should be successful in reaching this goal.

The SCWG further recommends that the FCPS provide the County Executive with an annual progress report and cost savings analysis based on the implementation of the recommendations included in this report.

### Introduction

Recognizing that recent statewide increases in school construction costs may ultimately reduce the number of projects that can be funded in Frederick County, Maryland, County Executive Jan Gardner created the School Construction Work Group. The group's broad scope of work included the following:

- Evaluate the cost of school construction in Frederick County with a goal of reducing costs by 8%-10%, without sacrificing quality, performance, or the life of the projects.
- Review and discuss mechanisms for construction savings and offer suggestions.
- Review topics such as the bidding process, the construction management approach, and project design.
- Study options for specific bid packages and construction methods.
- Recommend additional areas which should be considered for value engineering, if feasible.
- Make recommendations for potential changes in legislation, policy, or procurement for local and state education/elected officials and to a state task force on school construction.
- Complete the work of the committee and create a summary for presentation to the County Executive within a six (6) months to one (1) year timeframe.

This report details the SCWG findings, recommendations and suggestions which may help the Frederick County Public Schools (FCPS) address escalating school construction costs and to achieve an 8% to 10% reduction on school construction cost without sacrificing quality, performance or the schools.

Recognizing the need to review and make recommendations regarding any State Legislative initiatives before the 2017 Legislation Session, the SCWG decided to prepare an Interim Report, before the Maryland Legislative session began, which identifies potential State

Legislative initiatives, which the County Executive may want to consider to help reduce school construction costs. These recommendations are also presented in this final report.

### **SCWG Areas of Focus**

The SCWG decided to establish certain construction related areas that they would specifically focus on. These areas include:

- **Construction Technology** – Including reviewing various mechanical and electrical systems design, structural and non-structural wall types, roofing systems and materials, windows, flooring and other architectural elements.
- **Delivery Systems** - Reviewing various contracting methods used within the State of Maryland and Nationally as well as alternative methods used by the private sector.
- **Local, State, and Federal Mandates** - Identifying any State and Federal mandates that affect school design and cost and suggest changes in law or regulation to reduce the impacts these mandates have on the cost of school construction, however, these suggestions will not be factored into the 8-10% cost reduction goal, which the work group is charged.

### **Legislative Initiatives**

After reviewing the funding and procurement requirements contained in the Maryland State Finance and Procurement Article as well as the Maryland State Education Article §5-301, the SCWG concluded that minor changes to these statutes could have an important impact on slowing or even reducing the recent increases in school construction costs. These legislative changes focus on the following:

**1. *State Finance and Procurement Article (High Performance Building Act §3-602.1)***

**Seek amendments to the High Performance Building Act that will allow local school systems more flexibility to contain school construction costs, while at the same time meeting equivalent HPB standard.**

Since 2008, state law has required all new schools to be certified as LEED Silver, a designation established by the U.S Green Building Council's Leadership in Energy and Environmental Design Green Building Rating System. The law refers to this as High Performance Building (HPB). The statute allows for equivalent(s) to this standard to also

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be used to validate the HPB standard, however approval of these equivalents has not yet occurred by the Secretaries of Budget and Management and General Services as required by the statute.<sup>2</sup>

The statute states that it is the intent of the General Assembly that, to the extent practicable, the State shall employ green building technologies when constructing or renovating a State building not subject to this section; and high performance buildings shall meet the criteria and standards established under the “High Performance Green Building Program” adopted by the Maryland Green Building Council.

State law seems to conflict as to what projects must meet this high performance standard. §§3-602.1(c)(1) indicates that the requirement only applies to (i) capital projects that are funded solely with State funds; and (ii) community college capital projects that receive State funds. However, §§3-602.1(c)(2) states that any construction or major renovations that are 7,500 square feet or greater must meet HPB standards.

There are costs associated with obtaining the LEED Silver certification, in addition to the increased design and construction costs to meet the standard. The cost for obtaining LEED Silver Certification for a typical Frederick County elementary school is \$203,205. Certification of larger schools (middle and senior high) can be much higher. The state’s pursuit of HPB standards, which increases school construction cost, should not cause school construction projects to be delayed. Local school systems need greater flexibility in meeting the HPB standard to help bring down the cost of school construction. SCWG members would like to see relief from language that is in the law, in addition to just relief from the costs for the actual certification. The committee would like the state to come up with alternatives to accomplish the same goals without meeting LEED Silver certification.

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<sup>2</sup> In November 2014, the Maryland Green Building Council adopted the International Green Construction Code (IgCC) as an alternative compliance path to the long standing LEED Silver standard. It is not clear as of the date of this report if the Departments of Budget and Management and General Services recognize the IgCC as an equal to the LEED Silver standard as required by §3-602.1(a)(iii) of the statute.

## RECOMMENDATIONS

- A. One recommendation is for an equivalent process that would still allow for a High Performance Building that parallels LEED Silver certification requirements, but does not require a school system to pay the Green Building Council for the certification to tell them what they already know. In addition, the work group suggests a sunset provision of the requirement for LEED Silver be added to the HPB Act that would eliminate the requirement if building codes ultimately require the same standard, which LEED Silver requires today. This appears to be the direction building codes are taking.
- B. The SCWG also believes that legislation is needed that would require, by a certain date, the Secretaries of Budget and Management and General Services adopt an equivalent HPB standard that does not require the payment of fees to obtain the certification. The cost for obtaining LEED Silver Certification for a typical Frederick County Elementary school is \$203,205. Certification of larger (Middle & Senior High) schools can be much higher. (Source: Ray Barnes, August 23, 2016 LEED Cost Analysis.)
- C. An alternative to LEED certification, an equivalent HPB standard, could be adopted by the Secretaries of Budget and Management and General Services, that would allow school construction to meet some form of an equivalent total carbon emissions basis, thereby allowing each school system greater flexibility to meet the HPB standard at the lowest possible cost.

FCPS staff advised the SCWG that they would like to explore alternatives to expensive geothermal heating and cooling systems. Since they are currently required to meet LEED Silver certification criteria, they are reluctant to try newer technologies e.g. Variable Refrigerant Flow (VRF) systems, which are not guaranteed to be an acceptable technology for meeting the LEED Silver certification. Geothermal systems can be very expensive. In the case of Frederick High School the Geothermal system wells alone represented \$2,255,000 of this school project's construction cost.

- D. The definition of a HPB in the State Finance and Procurement Article §3-602.1 should be amended to recognize alternatives to using expensive (Green) construction technologies to meet the HPB standard. For example, school systems should be allowed to construct schools using conventional (non LEED Silver)

construction if they ensure, through a long term Power Purchase Agreement (PPA), that 100% of the school's electrical energy will come from renewable energy sources. **See Exhibit A - Suggested Changes to §3-602.1(a)(2) of the State Finance and Procurement Article.**

- E. The SCWG also recommends seeking multiple changes to §5-312 of the Education Article to provide the school system the ability, at least for the next few years, to avoid the higher costs associated with designing and building schools that have to meet the current LEED Silver HPB standard. These changes would include modifying §5-312(b) of the Education Article to suspend the requirement that schools be built to HPB standards until 2025 or later. In concert with the changes to §5-312(b) and to incentivize school system to continue to build to the HPB standard during the suspension of the requirement, §5-312(e) could be amended so that the State's 50% local share funding of the extra costs associated with meeting this standard are re-established and extend until the suspension period ends. Between the 2007 and 2014 the State would pay 50% of the local share of the extra costs incurred in design and constructing a new school to meet the HPB requirements. The SCWG suggests that the County seek legislation that would reinstate the State's cost share for meeting this standard until 2025 suspension date suggested above. **See Exhibit B - Suggested Changes of the Education Article §5-312 (b) & (e).**

### ***2. State Finance and Procurement Article (Prevailing Wage Rate §17-201)***

**Seek amendments to the State Finance and Procurement Article to allow school systems to bid and construct schools absent the Prevailing Wage requirements if local funding is more than 50% of the project costs.**

Prevailing wage laws in the U.S. have existed since the Great Depression. They are controversial. In addition to specifying wages, these laws include work rules that enforce or maintain labor standards for the benefit of employees. The federal Davis-Bacon Act serves as the model for the state of Maryland prevailing wage laws. Maryland enacted its prevailing wage law in 1969.

In 2000, legislation was enacted that removed a restrictive requirement for its applicability to school construction projects. Between the years 2000 and 2014 the State Finance and Procurement Article required school construction projects that had



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less than a 50 percent local funding share to be bid and awarded based upon Prevailing Wage Rates. School districts could opt out of the requirement by contributing 51 percent or more of the project's construction costs.

After several attempts by the legislature to return to pre-2000 prevailing wage requirements, in 2013 the legislature established a Task Force to study the applicability of the Maryland Prevailing Wage law. The Task Force's primary purpose was to examine the prevailing wage law and how it applies to school construction projects. This was supposed to include analyzing school construction contracts bid as prevailing wage and non-prevailing wage to determine the effect the (prevailing wage) requirement has on school construction costs and whether project quality varied between prevailing and no prevailing wage construction projects.

The State Task Force's principal conclusion was: *"Without any definitive data on the effect of prevailing wage rates on public work projects, particularly relating to the State public school construction program, the task force was unable to make any specific findings; therefore, the task force made no recommendations."*

According to the report, there was disagreement among members of the task force. Some State Task Force members believed that the "side by side" comparisons, which suggested an approximate 10 percent cost increase, that were reviewed by the task force were a fair reflection of these price differences. Others believed that the Department of Labor, Licensing, & Regulation (DLLR) review of empirical studies that suggested the increase was much lower better reflected the potential costs of a change to prevailing wage law.

Notwithstanding the State Task Force's failure to make any recommendations, the threshold at which the State required prevailing wage rates was subsequently changed from 50% to 25% (State funding) beginning in 2015.

The SCWG believes that the change to 25% effectively eliminated the ability of local school systems to reduce construction costs by bidding and award school construction based on contracts with and without prevailing wage requirements, as was allowed from 2000 to 2014, when the State cost share threshold was 50 percent. FCPS staff indicated that they used to bid their school construction projects with and without prevailing wage and when they did, they found significant enough savings to justify providing 51% local funding for the project to avoid the prevailing wage requirement. According to FCPS staff

the school system has data that shows the average increase across the state from prevailing wage ranges between 10-14%, with an average increased cost of 11.6% statewide.<sup>2</sup>

The SCWG recommends returning the state funding threshold, found in the State Finance and Procurement Article 17-201(j)(2)(ii)2, back to 50% from the current 25% value. This would save on the cost of school construction projects. **See Exhibit C - Suggested Changes of the Education Article §17-201(j)(2)(ii)2.**

If necessary this legislation could include a requirement that the school system that chooses to bid school projects with and without the prevailing wage requirement provide detailed bid and final construction cost reports to the Board of Public Works showing any costs savings. This would help formally document any savings and provide other school systems and the IAC with empirical data on school construction costs savings when projects do not have a prevailing wage requirement.

### **3. *Education Article*** ***(Incentives for School Systems to Value Engineer School Design §5-301)***

**Seek amendments to the Education Article to allow local governments to retain 100% of any savings associated with value engineering efforts performed by the school system.**

Currently there is limited incentive or time to allow school systems or their engineering and architectural consultants to perform comprehensive value engineering of school designs before they are bid and go to construction. In other public works projects, value engineering is usually an integral part of the design. Although school delivery schedules may be more rigid than many public works projects, value engineering can be an important element in keeping school construction costs minimized.

The SCWG recommends the development of an incentive program for counties that reduce school construction costs through value engineering. School systems should be allowed the option to complete a value engineering analysis for each new school construction project after the state budgets funds for the project but prior to bidding the project's construction. Any savings derived through the local school system's Value

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<sup>2</sup> Frederick County's Sugarloaf Elementary School project, which was bid in December 2016, is the most recent example, which confirms FCPS past experience. The cost of this school using prevailing wage rates was 12-13% higher than non-prevailing wage.

Engineering of the project should be retained by that school system or by the county so it can be applied to a future school construction project. One possible way to do this would be for the state to identify (allocate) a cost per square foot for the school when the project is approved. If the school system is able to reduce the cost per square foot from the originally approved value, the school system or county would retain these savings. These savings would supplement Frederick County's funding in future years and not be subtracted from future year allocations.

The SCWG recommends changes to the Education Article to allow counties to retain any construction savings from value engineering performed for the school construction project. Specifically amending the Education Article §5-301 authorizing the local school system value engineering option. **See Exhibit D - Suggested Changes of the Education Article §5-301(d)(3)(vii) and proposed (ix).**

#### **4. Other Possible Legislative Initiatives (Which May Require New Legislation)**

##### ***A. Mandatory Delay of Legislative Changes***

Regulatory changes made during a legislative session are often approved without adequate local review due to time constraints. The cumulative impact of changes in regulations made over several years is often not captured in the review of a single bill during one legislative session. While individually each change in regulation may have a marginal cost impact, the cumulative cost impact adds up. The SCWG suggests that all school systems support legislation to require a delay before implementing changes in regulations that are adopted during the legislative session, so that there is no conflict with bids prepared locally and to give school systems time to adjust bid specifications.

The SCWG believes that any legislation, which impacts the design or construction of schools, should not be implemented for three years (following approval) to allow the school system time to adjust to the new legislation without adversely impacting projects that are already in process.

This could potentially eliminate the situation that occurred when Frederick High School was approved for the state funding share prior to state legislation mandates taking effect and increasing project costs. Alternatively the LEA's should support changes in legislation that will allow projects to retroactively take advantage of new, higher cost per square foot allocations if regulatory changes increase school construction costs.

***B. Recommend Legislation to Require State to Create and Maintain School Construction Reserve Fund***

Recommend legislation that will require the State to create and maintain a reserve fund to help school systems when there are unanticipated increases to costs of school construction. There needs to be a closer connection between what the State has budgeted for school construction costs and what the actual costs are after bids are received.

It is unreasonable for the county to pick up all the additional cost for a school project if bids come in higher than the State rates of compensation provide, which are often estimated many months before bids are received. In some cases it can be a year before bids for projects are received locally. There can be many issues beyond the school system control that impact school construction costs during this time frame, including how many other school construction projects are bidding, which can affect contractor capacity. The SCWG believes that a certain amount of State funds should be reserved each year to allow for adjustments in state compensation based on un-expectantly high bids for a major project or one that has special construction elements affecting its costs.

***C. Recommend proposing legislation to create a State Revolving Loan Fund (SRF) for public school construction.***

The Maryland State Revolving Loan Fund for environmental projects been very successful and allowed many communities to afford critical infrastructure to serve their residents essential needs, such as water supply and wastewater disposal systems.

More funding may be made available to local school systems if the State of Maryland created a Revolving Loan Program. Under an SRF, the state floats a bond and the county pays back the state over 20 to 30 years. SRF loans would be for the local school system portion of project costs. Disadvantaged communities or jurisdictions with special urgent needs could be granted partial loan forgiveness, further reducing the local share of the cost. This concept works very well for other types of major capital project. School systems and local governments may want to investigate this option and propose new legislation to establish a State SRF for school construction. This legislation would help smaller counties who can often not afford to forward fund the State share.

***D. Consider legislation that would require the State to recognize changes in the educational programs, state design guidelines, and community needs***

A State formula dictates how many square feet a school should be designed for based on enrollment. Any additional square footage over that formula is the local government's responsibility to fund. Since the formula was established there has been many changes in the educational programs and design guidelines e.g. all day kindergarten, pre-kindergarten, larger health suites, larger gymnasiums, intervention programs, special education services, etc. The state needs to recognize these changes and adjust their formulas accordingly, first for elementary schools and then for secondary schools.

The SCWG strongly believes that the state design guidelines, and required square footage to meet those guidelines, needs to be consistent. Legislation would require adjustments to the formulas used to determine how large a school should be and how the state's share of construction funding is calculated.

***E. Recommend legislation that would require the State to offer financial incentives if school systems use certain efficient design/construction alternatives.***

Currently, there is little incentive for a local school system to deviate from its classic standard or prototype tried-and-true conventional construction practices. Even if a school system were able to use a newer technology, or innovative construction practices, and potentially save money, the result would be less of a state share. In addition, the school system assumes all of the "risk" of trying something new that may or may not work to build schools sooner or at a lower cost. The SCWG believes that the State could provide an incentive program that would allow a local school system to explore the use of innovative and newer construction methods, e.g., modular construction, pre-engineered buildings, tilt up construction. The committee suggested that the state could potentially consider awarding a larger state share or exempting a local school system from mandated requirements, if the school system volunteered to conduct (Construct) a "study school" for the benefit of the entire state. A local school system would submit a concept proposal to the IAC to qualify.

***F. Consider legislation that would allow or require DGS and other state agencies to delegate school plan review to local school systems that meet certain criteria or minimum requirements.***

The current requirement for DGS to review all school construction plans, including those from larger school systems, increases the time period to deliver school construction projects. DGS's review of school construction plans for larger school systems or those that

have extensive school construction experience seems an unnecessary additional step that can be delegated to the local school systems that meet certain requirements established by DGS. This would save time, money, and avoid duplication. This recommendation is also currently under consideration by the 21<sup>st</sup> Century School Commission.

### ***Overlapping Nature of SCWG Suggested State Legislative Recommendations***

The SCWG understands that seeking changes to the state's Education and Finance and Procurement Articles may be very difficult. Recognizing that such changes would affect all school systems, it may not be realistic to pursue all of the legislative initiatives discussed in this interim report. Therefore the SCWG decided to review several legislative ideas and in some cases overlapping legislative approaches, which the County Executive may want to consider exploring further or directly seeking changes to existing state law, which the SCWG believes may be increasing the cost of school construction in Frederick County and elsewhere in the state.

## Site Work & Storm Water Management Recommendations

The SCWG believes that there is significant potential to reduce the cost of site work; grading, storm water management, and utilities for schools if additional time and resources are spent evaluating new (proposed) school sites. Members of the work group completed a comprehensive site development review of the Sugarloaf and Butterfly Ridge elementary schools' design.<sup>3</sup> Through this review they discovered several design elements that have the potential to increase the cost of the site work at both schools.

The subcommittee that completed this review made several recommendations, which the FCPS considered before bidding the construction of these two schools. To ensure that changes to the designs would not delay the schools' construction, only certain elements of the subcommittee's design recommendations were considered and incorporated into the school bid documents.

The subcommittee's detailed review of these two elementary schools' civil site design is provided in Appendix F. In addition to providing specific recommendations for these two elementary schools, the review provided other valuable information which should be considered when designing future schools. For example:

- Where large retaining walls are being required by school site size limitations or topography, it may be possible to minimize or eliminate retaining walls by obtaining permission from adjacent property owners to change the grade on the adjacent property to tie in grades at an acceptable slope.
  
- Locate and design Environmental Site Design (ESD) facilities so that they do not require large diameter deep pipes. Consider the use of smaller pipes at greater slopes to reduce storm drainage pipe construction costs.
  
- Use on-site regular duty asphalt paving section for bus lanes/bus parking and drive aisles as well as areas defined for future portable classroom. Use light duty asphalt if there will be no heavy bus traffic.
  
- Perform earthwork studies and consult site work contractors early in the design process to evaluate alternatives for managing site earth balance and select optimal construction sequence to ensure efficient on-site management of earthworks.

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<sup>3</sup> SCWG members Jeremy Holder, Dusty Rood, and Jason Wiley.

- Consider using off-site storm water management pond facilities by agreement, if available. Enlarging or modifying existing facilities can result in substantial cost over constructing new on-site facilities, which may be exacerbating other on-site design issues.
- Ensure that storm water management facilities are not over designed. Limit design of landscape planting for the ESD facilities to the minimum required to reduce initial cost and future maintenance costs.
- Require engineer performing school site design work to engage Frederick County or City storm water management review staff early on in the design development to discuss options that can reduce storm water management facility costs.

The SCWG believes that significant project cost is associated with site development and greater focus should be placed on the civil site design elements of school projects. The SCWG recommends FCPS implement an iterative design approach which affords adequate timeframes for the site to be fully evaluated for storm drainage, storm water, earth balance and other constraints prior to finalizing governmental site plan approvals.

Site infrastructure and storm water management construction can represent up to 20 percent of school construction costs. Safe, efficient pedestrian and vehicular ingress/egress as well as adequate recreational opportunity for the student population are key objectives in every design. Even with the use of prototypical school designs each site presents different challenges that require unique design solution tailored to the site. Typical constraints can include soils conditions, extreme topography, site drainage, inefficient geometry, existing physical features or encumbrances, forest conservation or site entrance limitations.

When faced with these challenges the most significant opportunities for cost savings occur in the earliest stages of the design and engineering process and the most efficient designs are often achieved through iterative analysis/cooperative review with the regulating agencies. Unfortunately, the existing school funding/design and construction practices do not afford adequate time in the early design phase to allow or demand this level of analysis from the design team. Additionally, even when possible cost savings efficiencies are discovered in the pre-construction phase, such as the SCWG review of the Sugarloaf Elementary and Butterfly Ridge Elementary school, there is general reluctance to make plan revisions late in the process for fear of delays that will result from the required reviews/re-approval of revised Site Plans and Site Construction Plans.



### **RECOMMENDATIONS:**

**Advance timing of school site design – Work closely with County and Municipal review agencies to find most cost effective storm water and utility improvements.**

The SCWG believes that the timing of site design need to be advanced to afford FCPS adequate time to minimize site work and storm water management expense. Further the SCWG believes that the County Executive and the municipal leaders should direct their plan review staff to place special emphasis on finding the most cost effective storm water and utility improvements for school sites. This will likely require additional time before projects are in the formal plan review stage. The plan reviewers, FCPS staff, and their engineers need to focus on developing lower cost solutions to ensure that the site development costs are kept at a minimum and do not unnecessarily increase the overall school construction costs. The SCWG recommends the County consider the following:

#### ***A. Establish Expectations for the Design Review/Regulators***

Encourage pre-design meetings between the design team and the local authority reviewers/regulators. Specifically discuss site constraints, possible solutions and request insight from the reviewers/regulators as to alternative measures that might result in more efficient use of public funds. In the case of a school being constructed within Frederick County the County Executive should encourage the County Divisions involved in permit approvals provide the maximum assistance possible by offering cost-saving design alternatives which may have been overlooked by the design consultant. When inter-jurisdictional projects require, leadership from both County and Municipal governments should collaborate in setting the expectations for efficient review and cost effective design with a focus on the preservation of public funds.

#### ***B. Be certain that the Design Review Team is designing to appropriate standards and not to the standards of other jurisdictions***

Sometimes engineering and architectural consultants who specialize in the design of public schools often design to a standard established by the most recent jurisdictions in which they worked. A case study example of this was observed on Sugarloaf Elementary where the Environmental Site Design (ESD) Storm Water landscape plantings appeared to be designed to a Montgomery County Standard and were over-designed by Frederick County standards. The County Divisions involved in storm water design review should make this point clear, ideally at a pre-design meeting before the consultant has strayed from the local Frederick County or a municipal jurisdiction's requirements.

***C. Establish a clear understanding of Storm water Management Design Objectives. What does ESD to the Maximum Extent Practicable (MEP) Mean within the jurisdiction where the school will be located?***

The design for Sugarloaf Elementary resulted in storm drainage depths approaching 18'. This is a depth that is not typical for storm drain lines and substantially increases the cost of construction and long term maintenance. Design review conversations in the conceptual stages of the design likely would have resulted in the reduction of the number of facilities, a limitation as to the underdrain depth of facilities at the upstream end of the system and utilization of a combination of structural and non-structural practices that would have substantially reduced the storm drainage system depth and initial storm drain/storm water management construction cost. In doing so the future operations and capital maintenance costs would have been reduced. Similarly, the preliminary design for Butterfly Ridge Elementary presented a plan developed off of the most strict interpretation of the design guidelines and not a design consistent with the intent of the regulations "maximum extent practicable" which in many jurisdictions includes consideration for constructability, extraordinary design constraints, practical inspection/maintenance, geophysical conditions, construction costs and a combination of structural and non-structural micro practices.

**Use site specific pavements designs to lower cost and ensure appropriate pavement life cycle.**

***D. Review pavement specifications to prevent over-design***

Concrete and asphaltic pavements are a very costly component of site development. Often they are over-designed after early pavement failure is observed and in many cases the pavement failure was a result of bad drainage or poor sub-grade preparation. Site specific pavement designs prepared by a geotechnical engineer based on California Bearing Ratios (CRBs) and constructed under the strict inspection of a geotechnical engineer will often reduce the depth/cost of the pavements while resulting in a superior product to installations of greater depths on improperly prepared subgrades or poorly drained subgrades. The review of Sugarloaf Elementary, parking areas for passenger vehicles and several paved play areas which were also planned for overflow passenger parking had been designed to receive a heavy duty pavement sections intended for bus and heavy truck traffic. The use of CRBs and specific site design for these overflow parking areas may also result in savings.

The FCPS should consider discrete pavement designs based on the pavements actual

usage. If necessary these designs could include an appropriate safety factor for unforeseen use of the paved area, such as temporarily parking buses with the understanding that the individual school administration may occasionally need this temporary flexibility.

***E. Provide adequate design timeframes to allow iterative design reviews and negotiated resolutions to design objectives and regulatory requirements***

For lack of better description, there were several instances throughout the SCWG's efforts where acknowledgement was made that money is often thrown at site related problems simply because there isn't enough time to work through alternative resolutions. The site design phase should begin as early as possible to allow time for negotiated solutions and enough design iterations to refine a design into the most cost effective and efficient design possible. Adoption of the Cooperative Review Process described later in this report would further this recommendation.

## **Establish Additional Guidelines to Evaluate School Sites Prior to Their Acquisition or Acceptance**

The civil site work costs necessary to develop some school sites can be significant. In some cases, these costs can represent 20 percent of the entire school project. The process by which the County obtains real estate for new school construction is predominately through subdivision approval, with the landowner (developer) providing the school site if required.<sup>4</sup> In some cases, the Frederick County Board of Education has purchased property for a school and then had to extend the necessary utilities and make road improvements to the property; in some cases at significant cost.<sup>5 6</sup> In other cases, public school sites are acquired as a result of municipal annexation agreements.

Most of the public schools in Frederick County rely on public water and sewer services and all of the new schools built in the last two decades rely solely on County or Municipally provided water and/or sewer services. This trend is expected to continue as new schools are located in Priority Funding Area (PFA) and there is a preference to ensure new (or even renovated) schools are served by public water and sewer services. Although public water and sewer systems are desirable and provide superior public health protection as well as fire protection for the school and their occupants, the cost of public utility services has been increasing over time due to more stringent water quality regulations and the costs to provide these services. In particular, the cost to upgrade or extend water and sewer lines to serve a school site can be significant.

In 2002, due to inadequate sewage conveyance capacity, FCPS had to include the replacement of the County Division of Utilities and Solid Waste Management's King Branch Sewer Interceptor in the Crestwood Middle School construction project, which unexpectedly added approximately \$540,000 to the school project. The site for Crestwood Middle was secured via developer dedication and at the time the extent of the sewer capacity problem was not fully understood. In 2003, FCPS had to construct 2,740 feet of 16-inch water main (offsite) and 1,510 feet of (offsite) sewer to provide public water and sewer service to Tuscarora High School, a site purchased by the FCPS. The Tuscarora High project also required the realignment of Ballenger Creek Pike and the construction of a bridge over Ballenger Creek. Combined, the water and sewer and road improvements cost \$3.4 million. More recently, in 2007, as a part of the Oakdale High construction project, FCPS had to expend \$1.3 million in road improvements to construct a traffic circle on Old National Pike.

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<sup>4</sup> Based on new schools opening after 1990, 62% of the school sites were acquired by developer dedication.

<sup>5</sup> Based on new schools opening after 1990, FCPS has purchased property for 3 Elementary, 2 Middle, and 2 High schools. During that same time period developer dedicated of property for schools has been: 8 Elementary, 4 Middle, and 1 High school.

<sup>6</sup> There was \$3.4 million in water and sewer extension and road realignment costs associated with Tuscarora High School construction.

## Reducing School Construction Cost - Preserving Excellence in Education

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The SCWG believes that the Frederick County Board of Education, in cooperation with the Frederick County Planning and Permitting Division, should review and evaluate the existing School Site Identification and Review Process and develop definitive guidelines that will be used to evaluate future school sites, including those which are offered by a developer during plan approval. Furthermore, the work group believes that uniform policies in this regard should exist throughout the County regardless whether the school is located in an unincorporated area or within a municipality. The SCWG recommends that the County and FCPS seek agreements with the various municipalities to ensure that ready access to water and sewer capacity, under the control of the municipality, is guaranteed through a set aside or reservation for public schools.

Without definitive guidelines, the school site selection process may not recognize civil site design and construction challenges that can increase the cost of a school project. For example, although a 50 acre site may appear to be more than enough land for a high school, if the site is encumbered with various easements, wetlands, and steep slopes that reduce the usable area to 25 acres the additional cost to construct a high school on the *actual* smaller site may add significant costs to the overall school construction costs. A school site that requires the installation of lengthy water and sewer lines to serve the property or a site that is at an elevation which requires the construction of an off-site booster pump or sewage pump station to ensure the school has adequate water pressure or can convey wastewater from the school would be a less desirable location than a site that does not require this additional infrastructure. And since off-site construction is funded solely by the County with no state contribution, the County is impacted by these costs to a greater degree.

The new guidelines would be used to evaluate all school sites, including those sites proffered by developers during the subdivision and/or PUD approval process. The guidelines should apply to all school sites including those located within a municipality. Recognizing that the evaluation of such school sites will require some preliminary engineering or study, FCPS should establish an appropriate budget to ensure that they can secure, if necessary the services of a civil engineering firm to complete these evaluations when school sites are proffered by the development community during the subdivision approval process. Alternatively, the Frederick County Planning and Permitting Division or its equivalent in a municipality could require the developer that is offering the school site to have their engineer complete the evaluation and submit it to the FCPS for site approval.

The requirements that these additional guidelines might include, are summarized below, however they are not absolute and need to be evaluated in their totality.

### Suggested School Site Selection Guidelines

- Establish minimum acceptable sized sites based on actual useable acreage
  - High Schools - 50 acres
  - Middle Schools - 35 acres
  - Elementary Schools - 15 acres
- Require water and sewer and electric and gas utilities are immediately available to site (or within an acceptable distance).
- Ensure that no major upgrades or additional utility infrastructure for these utilities are required to serve the site.
- Require school site to be mass graded during development of subdivision, where possible, or when a certain phase of the development occurs.
- Require Forest Resource Ordinance (FRO) requirements be met by developer, where possible.
- Avoid sites that require significant road improvements or other infrastructure that will increase the costs to develop the school on a particular site.
- Obtain basic geotechnical and environmental information for the site to avoid selecting a site with poor soils, wetlands, or other environmental challenges.
- Ensure that the conveyance of the property to the BOE occurs in a finite time period.

Some of the water and sewer issues that the FCPS encountered in the past have already been addressed. For example to ensure that public buildings are not saddled with the cost to upgrade major water and sewer infrastructure to allow service to their site, in 2002, the BoCC approved changes to the Water and Sewer Rules and Regulations that requires the DUSWM Division Director to set aside 15 percent of the water and sewer system capacity for public buildings (in particular public schools) and health hazard areas.<sup>7</sup> This rule change ensures that existing water and sewer lines are not allocated beyond 85 percent of their capacity for non-public use, preventing a reoccurrence of what happened with the Crestwood Middle school – King Branch Sewer scenario.

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<sup>7</sup> Resolution 02-04 adopted by the BoCC on February 19, 2002

## Reducing School Construction Cost - Preserving Excellence in Education

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It is not clear whether the municipalities in Frederick County have similar requirements in their water and sewer rules and regulations. Or, if they don't, if they would be willing to consider such reservations to prevent the FCPS from being burdened by such offsite improvements to their water and/or sewer systems.<sup>8</sup>

The 2002 rule change however does not address the need to construct new water and sewer lines to potential school sites that do not have ready access to existing utility infrastructure, as was the case with Tuscarora High School. To address this kind of problem it is imperative that the school site selection process include an evaluation of the cost to bring water and sewer utilities (and for that matter electric, and if needed gas utilities) to proposed FCPS acquired or developer proffered school sites. These cost then need to be factored into the school site selection decision.

Although the dedication of school sites in proposed subdivisions provides the FCPS with the real property needed for the construction of schools, the location of dedicated school sites may not always be ideal. In some cases the site can require extensive grading and the extension of water and sewer utilities. The Frederick County Planning and Permitting Division and the FCPS staff have developed procedures for school site identification and selection, which include certain minimum requirements used to identify usable school sites. The SCWG feels that these requirements could be enhanced to allow FCPS to secure not just usable school sites but possibly optimal sites that will have a lower cost to develop and construct the school facilities.

Although most of the public school sites, since 1990, have been secured through developer dedication, a substantial number (13) of the school sites were purchased. The purchase of a school site is often required in areas where there are no residential developments of the size that would compel a site to be dedicated, especially a middle or high school. In light of this the County's Capital Improvement Plan (CIP) needs to include funds to purchase land for future schools where needed. These sites would correspond with locations identified in the FCPS Educational Facilities Master Plan and the County/Municipal Comprehensive Plans.

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<sup>8</sup> The reservation only ensures that system capacity is available. The school or other public building is still required to purchase capacity through the payment of tap or capacity fees.

## **RECOMMENDATIONS**

**Update school site selection Guidelines to ensure the optimal school site selection to help reduce site development costs.**

### ***A. Develop Updated Definitive School Site Requirements***

The SCWG recommends that the Frederick County Board of Education in cooperation with the Frederick County Planning and Permitting Division, review and update the existing School Site Identification and Review Process and include definitive guidelines that will be used to evaluate future school sites, including those which are offered by a developer during plan approval. These guidelines need to not just secure usable sites but optimal school sites to reduce site development costs.

### ***B. Request Municipalities Reserve Water and Sewer System Capacity for Public Schools***

To reduce a FCPS public school project exposure to unforeseen or unanticipated water and or sewer utility upgrade costs, the SCWG recommends that the County request each municipality reserve a minimum amount of water and sewer system capacity to serve public schools. Such reservations do not eliminate the school's requirement to purchase system capacity or pay prevailing utility taps fees, it will however reduce or eliminate the possibility that the school project is responsible for making offsite water and/or sewer system improvements to facilitate school construction.

### ***C. Seek Agreements with Municipalities to Ensure Uniform Application of Requirements***

The work group believes that uniform policies in this regard should exist throughout the County regardless whether the school to located in an unincorporated area or within a municipality. The SCWG recommends that the County and FCPS seek agreements with the various municipalities to ensure that ready access to water and sewer capacity, under the control of the municipality, is guaranteed through a set aside or reservation for public schools.



## Construction Technologies and Potential Cost Savings

One area that the SCWG focused on was school construction technology. Within this broad area the SCWG reviewed various mechanical, plumbing and electrical system design, structural and non-structural wall types, roofing systems and materials, windows, flooring, and other architectural elements. The SCWG reviewed work, which was in draft form completed by the Interagency Committee on School Construction (IAC), which included quantitative (cost) and qualitative school construction considerations for the following school building systems.

### Structural

- Masonry Bearing
- Steel Frame
- Pre-Engineered Metal Building
- Tilt-up wall Construction
- Insulated Concrete Form (ICF)
- Modular Construction

### Mechanical / HVAC

- Variable refrigerant flow (VFR)
- Four-pipe variable flow (VAV)
- Four-pipe fan coil units
- Two-pipe fan coiled units
- Vertical geothermal heat pump units

### Electrical

- Standard fluorescent lighting
- LED Lighting
- Daylight harvesting (lighting)
- MC (metal clad) cable vs rigid conduit
- Aluminum wire vs copper wire mains
- Emergency generator & switch gear

### Plumbing

- PVC vs cast iron (sanitary and storm water)
- Piped secondary roof drainage

### Building Envelope

- Light gauge metal framing w/ brick veneer
- Light gauge metal framing w/insulated aluminum panels

Concrete Masonry Units (CMU) w/ insulated cavity  
Light gauge metal framing w/ exterior insulation  
Pre-cast autoclaved aerated concrete wall panels

### **Windows and Storefronts**

Aluminum frame  
Vinyl frame  
Fiberglass frame  
Vinyl clad wood frame  
Metal clad frame

### **Roof**

Standard 4 ply hot asphalt  
Single ply TPO  
Single ply mechanically fastened EDPM  
Cold 2 ply modified bitumen  
Steel standing seam metal (aluminized steel with Kynar)  
Fluid applied (urethane)

### **Floor**

Conventional vinyl composite tile (VCT)  
Conventional quartz tile  
Carpeted flooring  
Terrazzo flooring  
Epoxy or poured resinous floor  
Finished concrete

### **Wall**

Conventional CMU  
Conventional gypsum wallboard  
High impact gypsum wallboard  
Tiled wall overlayment

### **Ceiling**

Conventional 4' x 2' lay in acoustical tile  
Conventional 2' x 2' lay in acoustical tile  
Drywall  
Perforated metal pan systems

A matrix detailing these considerations is provided in Exhibit G of this report.

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## Reducing School Construction Cost - Preserving Excellence in Education

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The SCWG believes that the comparative construction considerations detailed in this draft information developed by the IAC should be thoroughly evaluated by the FCPS to determine whether they could be applied to school design projects in Frederick County to reduce school construction costs. Rather than duplicate this work, which SCWG found important, the group recommends that the County Executive request that FCPS review these school building considerations and implement those which can reduce school construction costs here in Frederick County.

To obtain a neighboring state's recent perspective and experience on school design and construction, several members of the work group toured the Spring Mills High School, located in Falling Waters, West Virginia.<sup>9</sup> This 1,500-student school was completed in 2013 and to some degree provided a valuable comparison to high schools constructed in Maryland and in particular Frederick County. The school is impressive, particularly the athletic facility and stadium. The General Construction Contractor was Dustin Construction, Inc. of Ijamsville Maryland; they specialize in K-12 school construction. They have built schools in Virginia, West Virginia, and Maryland, many to LEED certification requirements.

Although the Spring Mills High School is not LEED certified, and therefore may not be a direct comparison to schools built to Maryland's HPBA standards, the tour of Spring Mills High School was instructive. The school is of a classic design, two story masonry (Block and Brick) building. It is well appointed with a large theater and extensive athletic facilities.

Total hard costs for school and athletic buildings was \$37,451,166 or about \$150.00 per square foot. The cost for football stadium, synthetic turf field with rubberized track, and baseball fields was an additional \$3,889,113, resulting in a total project cost of \$41,340,279. Dustin Construction, performed general construction services totaling \$17,829,376, which is included in the aforementioned total project cost. The construction duration was 24 months.

The high school is located on an 80-acre site along with a middle school. The high school and its athletic fields are situated on 40 acres of the 80-acre property. Both schools share a storm water management pond, which was funded and constructed by a developer of an adjacent residential community.

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<sup>9</sup> Work group members that attended the tour included Ray Barnes, Chuck Nipe, and Michael Marschner. Roger Fritz (FCPS) and Bret Fouche (DPW) also attended the tour and meeting with Don Zepp, Berkeley County BOE, Clerk of the Works, who was responsible for managing the school construction project .



*Figure 1 Spring Mills High School Front Entrance*

According to Don Zepp, Berkeley County West Virginia Board of Education, Clerk of the Works, the high school is designed for 1,500 pupils (class size of 25 – 30 students) with the ability to expand using the second floor of the athletic center as required.

The total finished area of the school is 225,000 square feet, not including the athletic field house and concession stand which is an additional 25,200 square feet. The school building includes two gymnasiums with the main gymnasium capable of seating up to 2,000 people.



*Figure 2 Spring Mills High School Theater*



*Figure 3 Spring Mills High School Stadium*

According to the Mr. Zepp, cost considerations were a high priority in relationship to education specifications. Although the school was built using prevailing wage requirements, presently prevailing wage is no longer being used in West Virginia for school construction. The school did not have to meet any LEED certifications, procurement and construction administration was provided directly and solely by Mr. Zepp.

Some of the differences noted between the Spring Mills high school and (Linganore) high school construction in Frederick County, occurring around the same time period were obvious such as the absence of high performance building standards or a requirement that the building meet a LEED certification.<sup>10</sup> Other differences were not as obvious such as the differences between hallway wall finishes. Frederick County schools use a ceramic tile over concrete block (CMU), while Spring Mills High School uses painted CMU. Additional differences noted by FCPS staff included:

- Frame – Linganore high School used steel frame whereas Spring Mill HS used Masonry Bearing walls.
- Roofing System - Linganore HS used 4 layer hot asphalt built up roof, which can provide double the life span of a single ply system; Spring Mill HS's roof was single ply EPDM rubber/standing seam metal with an estimated life span in excess of 20 years.

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<sup>10</sup> Linganore High School's construction cost was \$62 million, which included demolition.

- HVAC – Linganore high school has a conventional Variable Air Flow (VAV) system with boilers/water cooled chillers, with an estimated life span of about 35 years. Spring Mill HS has roof top electric heat pumps with DX cooling, with an estimated life span of about 20 years.
- Data systems – Linganore HS is wireless with state mandated hard wired system as backup. Spring Mills HS is wireless only.
- PE Lockers – Linganore HS has separate PE and team lockers, while Spring Mills has shared PE and team lockers
- Phone system – Linganore HS has integrated phone/intercom clock system, required by teachers’ contract for communications between office and classroom. Spring Mills did not include phone system in construction it was added later.
- Emergency generator – Linganore HS meets the COMAR requirements mandating certain “shelter in place” requirements, including things like emergency lighting, data, circulating pumps, intrusion alarms, telecommunications systems, fire alarms etc.; the Spring Mills HS generator was for emergency lighting only.<sup>11</sup>

As previously mentioned it is difficult to compare the Spring Mills High School to Maryland high schools, which have to be designed and constructed to Maryland’s High Performance Building Act. Those standards, which increase school construction costs can, in some cases, reduce long-term school operating costs. For example, FCPS staff completed a rudimentary energy utility cost comparison and did find that the Spring Mills High School, when compared to a Frederick County high school of similar size, such as Linganore High School, appears to use almost twice the electricity. This difference in electricity cost is partially due to the fact the Spring Mills High School is all electric, including heating, while Linganore High School heats with fuel oil. However even after converting these energy values to Thousands of British Thermal Units (KBTU) for a more direct comparison, Linganore High School’s overall energy costs are still about 28 percent lower than Spring Mill based on the period of time evaluated.<sup>12</sup>

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<sup>11</sup> Spring Mill HS electric service appeared to be a two line primary service, which if from separate sources (substations) may provide superior overall back up electrical power supply.

<sup>12</sup> FCPS analysis is was based on the period from January 2015 through June 2015. During that period of time electrical data from the Spring Mill s High School showed significant fluctuations in their cost per Kilowatt Hour (Kwh)from a low of 8.5 cents per Kwh to a high of 26.7 cents per Kwh. Linganore High School Kwh rate for the same time period ranged from 9.31 to 9.65 cents per Kwh.

***Building Volume Reduction***

In an attempt to provide some empirical data on possible architectural design element savings, one of the committee members, who is a licensed architect, reviewed recently completed plans for Sugarloaf Elementary School. This review provided the SCWG with information on potential design changes that could result in measurable construction savings in the construction of a well-designed prototype elementary school. These design suggestions and potential costs savings are summarized in Table 1 below.

The most significant construction cost savings, based on this elementary school example, is the reduction in building volume, which results from using an 8' 8" ceiling height instead of a 10' 0" ceiling height. Additional savings could also be realized by eliminating the lay-in ceilings, at least in certain parts of the school, where the aesthetic impact would be minor. A long-term benefit of reduced ceiling height and building volume would be a reduction in the school's annual heating and cooling operating costs

<b>Table 1</b>	
<b>Design Element</b>	<b>Potential Construction Cost Reduction</b>
The building plan geometry incorporates rotated Classroom wings resulting in complex framing & spaces.	Unknown
The mechanical spaces appear generous and could be evaluated	Unknown
With some redesign of the roof slopes, the parapet system Could be eliminated with the use of gravel stops.	\$45,000
The floor-to-floor height of 14'-8" yields a ceiling height of 10'-0" in the classrooms. If a ceiling height of 8'-8" is deemed acceptable, the floor-to-floor height could be reduced to 13'-4" reducing the building volume. Reduced building volume would also reduce ongoing HVAC operating costs.	\$2,000,000 <sup>13</sup>
Eliminating the lay-in ceilings could be considered along with the building height reduction. The aesthetic impact must be acceptable, however, painted exposed structure is currently widely used in certain areas.	\$320,000

School construction cost trends have historically been expressed as "cost per square foot" and the public school construction system has based their funding on a cost per square foot basis. In the SCWG attempts to analyze the current trends in rising school construction costs it became apparent that we are using a two-dimensional method to quantify a three-dimensional problem. A more accurate means of evaluating true building cost is to apply a cost per cubic foot. For example, two buildings of the same square footage would no doubt satisfy the space requirements for an educational program but the building costs could vary

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<sup>13</sup> Other analysis completed by a FCPS contractor indicated a much smaller savings.

## Reducing School Construction Cost - Preserving Excellence in Education

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significantly if one contains higher ceilings and/or spaces open to several levels. The volume of current school designs have tended to include so-called "atrium" areas and higher ceilings thus contributing to higher construction costs.

Clearly reducing the school building volume will reduce the construction cost. Quantifying the extent of this cost savings is difficult but identifying the cause of "volume creep" is not complicated. There is always a desire to design an architecturally appealing school and it is often the case that design professionals are selected on the basis of their past work in this regard. The SCWG believes that school construction costs saving actually begin with the architect selection and the corresponding expectations of the owners, in the case the FCPS and the Board of Education.

The SCWG believes that the selection of Architects and other design professionals for public school construction projects should be based on their demonstrated ability to meet state school construction standards and local school construction longevity requirements, at an acceptable or lowest cost. Unnecessary (excess) building volume may add to school buildings' beauty but it does not necessary improve the education of the students, particularly if the high cost "beautiful schools" prevent the County from constructing additional schools to ensure appropriate class size. The SCWG believe that the FCPS, and for that matter, school systems throughout the state, review their school architectural and engineering consultant selection criteria and make sure that the proper weighting is placed on cost containment and meeting the minimum state design requirements.

### *Use of Alternative HVAC Systems (Variable Refrigerant Flow (VRF) Technology)*

According to the United States Department of Energy commercial buildings account for approximately 40% of the energy bills and 40% of the carbon dioxide emissions in the United States (USDOE 2012a). According to the General Services Agency about a third of commercial building energy usage is for heating, cooling and ventilation (GSA 2012).<sup>14</sup> Based on this information it is clear that such buildings, including public school buildings should be designed using high efficiency Heating Ventilation Air Conditioning (HVAC) systems, not just so they can meet certain LEED certification requirements but also so they can realize long-term energy savings.

Many believe that the gold standard for high efficiency HVAC systems are geothermal systems. Geothermal systems use either a vertical or horizontal ground loop to utilize the earth's constant ground temperature to provide heating and cooling water to heat pumps

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<sup>14</sup> This work prepared by the Pacific Northwest National Laboratory can be found at [https://www.gsa.gov/portal/mediaId/197399/fileName/GPG\\_Variable\\_Refrigerant\\_Flow\\_12-2012.action](https://www.gsa.gov/portal/mediaId/197399/fileName/GPG_Variable_Refrigerant_Flow_12-2012.action)



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from which the heated or cooled air is provided by ductwork, registers, etc. In the heating cycle the water from the earth loop is used by the heat pumps to extract the heat from the loop and used to heat the space. In the cooling cycle, the process is reversed with the hot air from the conditioned space removed and rejected to the ground loop system. These systems consist of piping in either vertical bores (wells) or horizontal trenches. Supply and return piping is connected to pumps and other required equipment within the building and circulated to the various heat pumps.

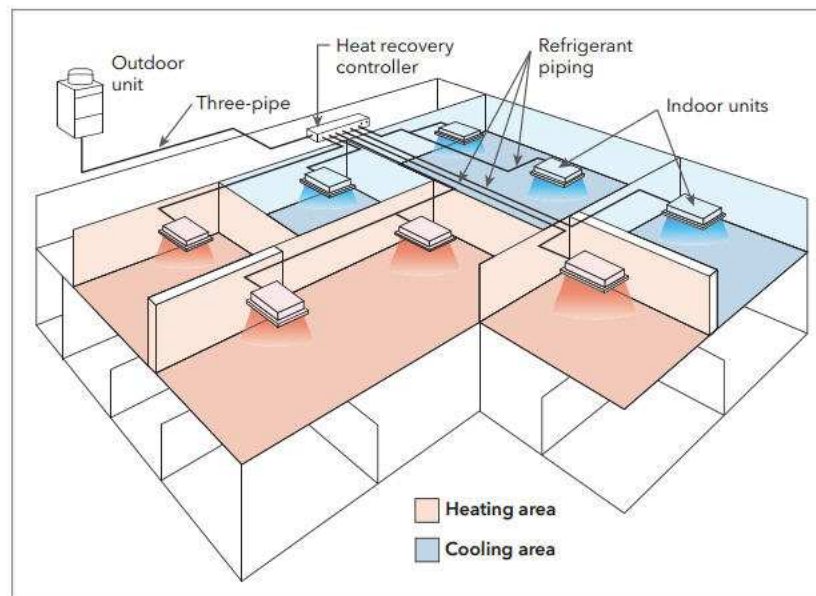


Figure 4 Basic Layout of VRF System

### Outdoor unit

The main heating and cooling plant of a VRF system is usually an outdoor heat pump using ambient air as the source for extracting heat and discharging heat in the cooling season. An indoor heat pump using water from a cooling tower and boiler can also be used as the means to extract heat and discharge heat.

### Branch Controller

Refrigerant from the outdoor or indoor heat pump is pumped to a branch controller and from the branch controller smaller refrigerant lines are ran to indoor fan coil units serving an individual zone in the building.

### Heat recovery controller

A heat recovery controller allows for the simultaneous heating and cooling of several individual zones that are co-located on the same main refrigerant loop.

It has been FCPS's experience that Geothermal HVAC system provide reliable and efficient heating and cooling while helping to ensure that the school construction will meet the State required LEED (Silver) certification. One possible alternative to geothermal technology is VRF technology. VRF systems are essentially large-scale versions of the ductless mini-split

air conditioning systems. VRF systems use a single heat pump condensing unit which can operate at varying speeds depending on the number of the indoor fan coil units in operation at the time. Refrigerant from the outdoor unit is sent to a branch controller and from there smaller refrigerant piping is run to the indoor fan coil units. These systems are also able to provide heating or cooling at the same time to different indoor units. A single outdoor unit now has the capacity to operate up to 50 indoor units with total capacity limited by total amount length of refrigerant run per unit. Delivery of the heated and cooled air can be by single fan coil unit wall or ceiling mounted or concealed fan coil units with ductwork. Figure 4 illustrates a basic layout of a VRF system.

The compressor units are typically air cooled, although water-cooled units are sometimes used and are connected to a cooling tower and boiler. In most installations in the United States, these systems are capable of simultaneously cooling some zones, and heating others. The compressor unit uses variable refrigerant flow and is controlled by a variable-speed drive, which may operate more efficiently than conventional compressors of similar size. The complexity of the variable refrigerant flow compressor and controls results in significantly more expensive compressor units than comparable conventional systems.

As with geothermal systems the required outside air must be delivered to the space through another mechanism. This is usually done with a separate HVAC unit, commonly called a dedicated outside air system (DOAS). As a result it is not clear to what extent the use of VRF technology can help reduce the size of the interstitial space between building floors, which could allow for additional school building construction savings.

VRF systems may be an acceptable alternative to geothermal HVAC systems for new schools. They may be a superior alternative to existing conventional systems when HVAC renovations occur at Frederick County Schools. They are the primary HVAC system choice in Europe, Japan, China, and other parts of the world, and are becoming more prevalent in the U.S. VRF may be particularly appropriate for existing buildings that need HVAC repair and upgrade.

There is data that shows that VFR is not as efficient as Geothermal systems, which is the technology used at the new Frederick High school. For example, analysis completed at the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Atlanta Georgia offices, where a VFR system serves the first floor and the a geothermal system serves the second floor. Based on raw data, it appears that the second floor geothermal system used 29% less energy in the summer and 63% less energy in the winter than the VFR system deployed for the first floor. It is not clear that this was an accurate comparison. For example, a 2013 Technical Article prepared by Daikin, a VRF system manufacturer, suggested that the earlier analysis of the two systems in the subject ASHRAE

building, was not an apple to apples comparison, suggesting that differences found in each systems' energy use did not account for the different load encountered by each system.

The new Jonathan Hager Elementary School in Washington County, Maryland, was constructed using a VRF HVAC system. This school was able to attain the necessary points for LEED silver certification, suggesting that the use of geothermal HVAC is not a prerequisite to meeting the State's Green Building School Construction standards. According to the school's architect (BFM Architects Inc.) the use of VRF HVAC did not have any negative impact on the LEED credits.

The cost of school HVAC systems, for both initial and its long term operating, represents a measurable costs that must be considered when designing a new school or renovating an existing school. The use of geothermal HVAC technology clearly provides an energy efficient system. However, it is not clear if the full life cycle cost of such systems is known or if newer technologies will soon eclipse the anticipated life cycle of this technology. In this regard the

SCWG believes that other mature technology such as VRF systems should be considered for new school construction, and may offer significant advantages for school HVAC renovations projects.

### **RECOMMENDATIONS**

**Reduce building volume, when possible, consider use of Variable Refrigerant Flow systems instead of geothermal HVAC**

***A. FCPS should consider using unfinished ceilings in all or portions of the school building.***

The SCWG recommends that the FCPS consider eliminating the use of acoustic ceiling tiles in all areas of the school where possible or where sound levels are not a concern.

***B. FCPS should consider reducing overall floor to floor height to 13' 4", reducing the interstitial space between building floors and providing a 8' 8" floor to floor ceiling height in classrooms instead of 10' ceiling.***

This change, in conjunction with a reduction in floor to floor ceiling height, will reduce building volume and cost. Reducing the finished floor to ceiling height in classrooms from 10'-0" to 8'-8" will reduce overall building volume without compromising quality.

***C. FCPS staff should evaluate the possibility of allowing bidders to assemble products off-site as a means to reduce the amount of regulatory costs (modular***

*construction).*

This change may reduce construction costs by allowing contractors to fabricate construction elements without having to comply with prevailing wage requirements.

***D. FCPS should consider reducing roof parapet height***

In design today parapets are used to control wind pressure at the edge of the roof that can create differential pressure between the top and underside of the roof great enough to lift the roof of the building. Therefore the use of parapets is very important. However their height may be selected for other reasons i.e. safety.

***E. FCPS should consider modifying the design of a future prototype school to use VRF instead of geothermal HVAC***

This will allow FCPS to evaluate the VRF HVAC technology and possibly compare its energy usage against the same size school that is using geothermal. This could be done in the redesign of Urbana Elementary School, since that project has not yet been designed, and it would provide data for future school construction project costs.

***F. Continue to use prototype school designs, but consider design modifications detailed in this report and specific for new school sites, when possible.***

Although prototype school designs reduce school construction costs, these designs should be reviewed and updated with due consideration to the recommendations contained in this report, as well as any additional cost saving recommendations that come out of the state's 21<sup>st</sup> Century School Construction Commission's work.

## **Consider Establishing a Cooperative Review Process for Local Approval of School Facilities**

One of the greatest challenges that the FCPS faces when undertaking major physical improvements, including modernizations and expansion, to existing schools as well as the construction of new ones, is completing the project prior to classes starting at the end of summer. That completion/opening date is hard and fast and is a significant factor and constraint that drives every decision point on the project; including design, permitting and construction.

FCPS, as a public agency, is required by County regulations and process to submit design and construction plans to the County or the City for review and approval by staff and the planning commission. This is a phase of the project where the opportunity for value engineering is the greatest, but is also where unexpected cost escalations and time delays typically arise. For schools in the County, this review is facilitated by Frederick County's Planning Department with final approval by the Frederick County Planning Commission. For schools in the City, this review is facilitated by the City's Planning Department with final approval by the City's Planning Commission. With final approval resting with both of these bodies, FCPS is required to satisfy their suggestions, requests, and conditions in order to obtain approval, which is necessary to obtain bids from contractors and undertake construction – a critical step in a linear process. In many instances, the review by County and City staff and Commissions produces some meaningful ideas that can improve the project. However, FCPS is often forced to accept requests or conditions that are unnecessary and were not budgeted or exceeds the budgeted amount in order to obtain staff support and/or commission approval.

This costly outcome occurs because FCPS does not have the flexibility and time to work with staff to negotiate a solution that is acceptable to all parties given the absolute time constraints. For example, FCPS was required to construct a \$1.3 million traffic circle at the intersection of Eaglehead Drive and Old National Pike with the construction of Oakdale High School, when other less-costly alternatives were available. Why should FCPS have to bear the entire cost that another County agency should be responsible for? While FCPS is essentially a County agency that utilizes taxpayer funds, certain major associated improvements have a benefit beyond the specific school project and therefore should be funded via other County infrastructure improvement programs. Another example is the significant offsite road improvements to Butterfly Lane beyond what was required for Butterfly Ridge Elementary that the City of Frederick staff and planning commission required. The inability of FCPS to negotiate or develop more cost-effective solutions stems from a hard and fast construction completion date and the excessive

exactions from and lack of control over the development approval process.

Therefore, the SCWG proposes that the County consider establishing a Cooperative Review Process for public school facilities. A Cooperative Review Process is afforded to many public agencies around the country, including in the State of Maryland, whereby the public agency, in this case FCPS, would have 1) the requirement to submit certain plans for professional staff's non-binding recommendation, with a required timeframe to provide those comments by, and 2) the ultimate authority and responsibility to comply with local laws, policies and regulations.

The Frederick County Division of Utilities and Solid Waste Management utilizes a similar approach already for the construction and maintenance of utilities. Similarly, the County Code (1-19-4.110 (C)) provides that any proposed public building or facility owned by, or located on property owned by, the County will be submitted to the FCPC for non-binding review and comment. Also in 1-19-5.300 (F) public buildings or facilities, which are owned by, or located on property owned by, the County are submitted to the Frederick County Planning Commission (FCPC) for nonbinding review and comment. Other counties also utilize a similar process for public schools.

There are a few items that are critical for this process to reduce, and not add, costs. The first is authority. FCPS would need executive authority for compliance with all applicable local laws and regulations in both the County and Frederick City. Enforcement could be retained by the other agencies. The second is that there must be a maximum timeframe that the non-binding recommendations must be provided to the FCPS. This enables FCPS to accurately predict how long the design and review process will take. To facilitate the process, it would make sense for FCPS and the Planning Department to hold a pre-design meeting, to obtain early feedback from the professional planning staff and for FCPS to explain the project goals.

In summary, due to the opportunity for cost savings through value engineering, combined with the history of inflated costs and time delays from the local development approval process and further to facilitate FCPS' ability to deliver their facility needs to support the County's educational priorities, the taskforce proposes the establishment of a Cooperative Review process for the local design, review and approval of schools.

**RECOMMENDATIONS**

**Establish a Cooperative Review Process for local approval of School Facilities – Seek agreements with municipalities to do the same.**

The ability of FCPS to complete school projects on time, to meet the ever-increasing student enrollment, while keeping class size at optimal values, requires school projects to proceed from planning to design to construction at breakneck speed. Design and construction delay can result in serious consequences, including facilities not being ready for students by the beginning of a new school year. To help streamline school construction, other jurisdictions have put in place special review procedures for public schools, which recognize the importance of the public school project over other commercial construction projects. The SCWG recommends that Frederick County consider adopting the following concepts.

***A. Consider instituting a cooperative review process with Frederick County Planning and Permitting Division***

A Cooperative Review Process will allow a thorough review of school construction projects but will limit FCPC action on the project to non-binding comments similar to what is provided for public buildings or facilities owned by, or located on property owned by the County. Determine if existing laws allow for this, and if not, seek necessary legislation to provide for a Cooperative Review Process for public school construction projects that streamline school construction approval.

***B. Seek written agreements with, or if necessary, enabling legislation that will allow municipalities in Frederick County to institute a cooperative review process for public schools***

Since Frederick County’s public schools are also located within municipalities, which control school permitting approval, and since it’s appropriate to have a uniform review process, it would be appropriate to request the municipalities to adopt policies to allow for the Cooperative Review Process in their jurisdictions. The municipal process should mirror the County Cooperative Review Process.

## Delivery Methods

### *Delivery Systems*

Committee member Guyton invited Bryan Adgate, senior preconstruction manager with Morgan Keller, to review construction delivery systems with the SCWG. Various delivery systems, and their differences, were discussed including Construction Manager (CM) Agency as opposed to Construction Manager at Risk. FCPS currently uses the CM Agency method, FCPS has used traditional general contracting methods in the past.

### **RECOMMENDATIONS**

**Establish necessary processes or assistance to increase the number of contractors/sub-contractors that can successfully bid on school construction.**

The SCWG was unable to determine if one Construction Management delivery system was superior to another when it comes to school construction. The recommendation was made to give the CM an incentive to contain project costs. Bid packages must be developed to attract optimal participation. Members of the SCWG also felt that FCPS staff should have more ways to hold the CM accountable for cost overruns instead of FCPS having to find solutions to bring costs down when project costs escalate. No matter what method of delivery FCPS chooses to use, the responsibility for cost control should be well defined so that the CM knows what is expected of them.

The SCWG believes that increasing the number of bidders on school construction contracts will have an impact on reducing costs. To increase the number of bidders the State of Maryland should investigate the possible use of a statewide bonding contract, which could be used by individual contractors, particularly small business that may have difficulty obtaining necessary surety bonds. In January 2017, New Jersey Senate Bill 123 was signed into law, which among other things creates a small business bonding readiness fund that will offer support services and assistance to businesses. Maryland lawmakers should examine this New Jersey law and determine if similar legislation in our state could help small businesses obtain surety bonds for school construction projects to increase bidder competition and help drive down construction costs.



## **Fees**

### ***Consider Waiving or Reduce School Construction Permit Fees***

Public schools are essential services. Maintaining adequate school capacity is important to ensure growth of the community and well educated residents and workforce. The County and all of the municipalities have a vested interest in these objectives. Ensuring that there is adequate sources of funds for school construction is every county resident’s responsibility.

Although school construction projects require engineering and architectural review, the payment of fees to the County or municipality for these services by FCPS inflates the cost of a school construction projects. County permit review fees, which are effectively funded by the County’s General Fund since the FCPS obtains its funding from the County, could be waived to help reduce the overall school construction cost. The City of Frederick already waives these types of fees for County school construction projects. Other jurisdictions in Maryland also waive building permit fees. Table 2 below details how other local jurisdiction handle public school permitting fees.

Permit review fees are different than water and sewer capacity fees. Water and sewer capacity fees are typically paid to separate proprietary utility enterprise funds within the County or municipal government. These fees are used to recover the utilities costs to construct major infrastructure, such as water and wastewater treatment plants, water storage tanks, pumping stations and major sewer interceptors and water transmission lines. Since the utility enterprise receives no General Fund funding for their operation, it would be inappropriate to waive these fees. However, it may be appropriate to have the County, not FCPS, pay these directly to the enterprise fund.

<b>Table 2</b>			
<b>Jurisdiction</b>	<b>Charge Permit Fees</b>	<b>Waive Permit Fees</b>	<b>Comments</b>
Frederick County	X		
City of Frederick		X	
Washington County		X	Other than some “Trade” specific permit fees
City of Hagerstown		X	
Carroll County		X	
City of Westminster		X	All municipalities in Carroll County waive these fees.

One possible drawback to this concept may be the lack of accountability by FCPS to contain (limit) the number of drainage fixture units in the design of the new schools if they are not responsible for the payment of the capacity fees, which in the County and City of Frederick are based on the number of drainage fixture units, which is directly related to the number of plumbing fixtures provided in the school design.

### **RECOMMENDATIONS**

**Consider waiving certain school construction permitting fees and seek agreements with Municipalities to do the same.**

#### ***A. Consider Waiving or Reducing Public School Permit Construction Fees***

The City of Frederick already waives building permit fees for Frederick County public school projects. The SCWG recommends that Frederick County's Planning and Permitting Division complete a cost of service analysis to determine if waiving or reducing permitting fees for public school projects will have a measurable impact on their operating budget. If the impact is *de minimis*, the County Executive should consider a policy waiving these particular fees for public school construction projects. If deemed appropriate, Frederick County should also request other municipalities waive or reduce permit fees for public school construction projects.

#### ***B. If the County decides to waive or reduce Public School permit construction fees Seek Agreements with Municipalities to Waive or Reduce Similar Fees within municipalities***

Since Frederick County's public schools are also located within Municipalities it is necessary to have a uniform review process, which will require the Municipalities to adopt policies to allow for the Cooperative Review Process in their jurisdictions. The municipal process should mirror the County Cooperative Review Process.

#### ***C. Consider having the County General Fund Directly Pay Water & Sewer Capacity Fees to County and Municipal Utility Enterprises***

Frederick County should evaluate if it would be more appropriate and efficient for the County to directly pay water and sewer capacity to the County and municipal utilities instead of FCPS making these payments to these water and sewer utility purveyors.

## Off-Site Improvements

Although the dedication of school sites in proposed subdivisions provides FCPS with the real property needed for the construction of schools, the location of dedicated school sites may not always be ideal. In some cases the site can require the extension of water and sewer utilities and road improvements

### RECOMMENDATIONS

**Eliminate requirement that off-site improvements be complete before issuing school construction building permit**

*A. Consider requiring certain off-site improvements to be completed by others*

If off-site improvements related to APFO are required, perhaps these improvements should be borne by those that triggered the need for the modifications to the school.

*B. Eliminate the requirements that certain off-site improvements be complete before building permit issuance*

If off-site improvements are required, remove the requirement in the County Code for the improvements to be constructed and operational prior to building permit. This will save significant time during construction.

### **Work Group's Conclusion**

The SCWG believes that it has addressed the charge contemplated by the County Executive within the one-year time period provided. The SCWG's efforts, through 12 formal meetings and several separate meetings or efforts by individual and sub-work group members, covered extensive and complicated areas of school construction. With more time, the SCWG could have pursued and evaluated other detailed aspects of school construction, building material selection, and building system longevity. In the future, these areas should be evaluated in greater detail to seek a better understanding of building system first costs and corresponding life cycle costs. The areas detailed in the IAC Quantitative & Qualitative Building System contained in Exhibit G of this report are a starting point for this additional work.

The SCWG also believes that there is value in continuing the group's efforts on a periodic basis to assist FCPS as it evaluates the efficacy of the recommendations contained in this report, as they are adopted, as well as reviewing emerging building system technologies and their application in future school construction, to further the cost containment goals set out by the County Executive. To sustain this effort, the County Executive should consider convening school construction work groups every two years or so to ensure that a focus is continually placed on school construction costs to allow the maximum amount of funding to be available to construct the necessary number of schools for the community.

### **Acknowledgments**

The SCWG would like to acknowledge the contributions and assistance of Roger Fritz, Director, Department of Construction Management, FCPS, Janice Spiegel, Education Liaison, Office of the County Executive, and Bret Fouche, Project Manager, Frederick County Division of Public Works. Their assistance and support to the working group has been important for the completion of the Interim Report and a vital element in the completion of this final report.

**Exhibits**

**Exhibit A**

Suggested Changes to §3-602.1(a)(2) of the State Finance and Procurement Article

**Exhibit B**

Suggested Changes of the Education Article §5-312 (b) & (e)

**Exhibit C**

Suggested Changes of the Education Article §17-201(j)(2)(ii)2

**Exhibit D**

Suggested Changes of the Education Article §5-301(d)(3)(vii) and proposed (ix)

**Exhibit E**

SCWG Meeting Minutes

**Exhibit F**

Sub Committee's Review of Sugar Loaf & Butterfly Ridge Elementary Schools

**Exhibit G**

IAC Quantitative & Qualitative Building System Considerations

**Seek amendments to the High Performance Building Act**  
**(Allow use of Tier 1 Renewable Electricity to satisfy LEED Silver Requirement)**

**Article - State Finance and Procurement**

§3-602.1.

(a) (1) In this section the following words have the meanings indicated.

(2) "High performance building" means a building that:

(i) meets or exceeds the current version of the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) Green Building Rating System Silver rating;

(ii) achieves at least a comparable numeric rating according to a nationally recognized, accepted, and appropriate numeric sustainable development rating system, guideline, or standard approved by the Secretaries of Budget and Management and General Services; or

(iii) complies with a nationally recognized and accepted green building code, guideline, or standard reviewed and recommended by the Maryland Green Building Council and approved by the Secretaries of Budget and Management and General Services; **or**

**(iv) obtains electrical energy to operate the entire building from a Tier 1 renewable electric sources located in the state.**

(3) "Major renovation" means the renovation of a building where:

(i) the building shell is to be reused for the new construction;

(ii) the heating, ventilating, and air conditioning (HVAC), electrical, and plumbing systems are to be replaced; and

(iii) the scope of the renovation is 7,500 square feet or greater.

(b) It is the intent of the General Assembly that, to the extent practicable:

(1) the State shall employ green building technologies when constructing or renovating a State building not subject to this section; and

(2) high performance buildings shall meet the criteria and standards established under the "High Performance Green Building Program" adopted by the Maryland Green Building Council.

(c) (1) This subsection applies to:

(i) capital projects that are funded solely with State funds; and

(ii) community college capital projects that receive State funds.

(2) Except as provided in subsections (d) and (e) of this section, if a capital project includes the construction or major renovation of a building that is 7,500 square feet or greater, the building shall be constructed or renovated to be a high performance building.

(d) The following types of unoccupied buildings are not required to be constructed or renovated to be high performance buildings:

(1) warehouse and storage facilities;

(2) garages;

(3) maintenance facilities;

(4) transmitter buildings;

(5) pumping stations; and

(6) other similar types of buildings, as determined by the Department.

(e) (1) The Department of Budget and Management and the Department of General Services shall jointly establish a process to allow a unit of State government or a community college to obtain a waiver from complying with subsection (c) of this section.

(2) The waiver process shall:

(i) include a review by the Maryland Green Building Council established under § 4-809 of this article, to determine if the use of a high performance building in a proposed capital project is not practicable; and

(ii) require the approval of a waiver by the Secretaries of Budget and Management, General Services, and Transportation.

**Seek amendments to the High Performance Building Act**  
**(Re-establish-Extend State 50% Share to 2020)**

**Article - Education**

§5-312.

(a) In this section, "high performance building" has the meaning stated in § 3-602.1 of the State Finance and Procurement Article.

(b) This section applies to the construction of new schools that have not initiated a Request For Proposal for the selection of an architectural and engineering consultant on or before July 1, 20~~2009~~.

(c) Except as provided in subsection (d) of this section, a new school that receives State public school construction funds greater than 50% of the of the school construction costs shall be constructed to be a high performance building.

(d) (1) The Board of Public Works shall establish a process to allow a school system to obtain a waiver from complying with subsection (c) of this section.

(2) The waiver process shall:

(i) Include a review by the Interagency Committee to determine if the construction of a high performance building is not practicable; and

(ii) Require the approval of a waiver by the Interagency Committee.

(e) For fiscal years 201~~07~~ through 20~~20~~14 only, the State shall pay 50% of the local share of the extra costs, identified and approved by the Interagency Committee, that are incurred in constructing a new school to meet the high performance building requirements of this section.

(f) The Board of Public Works shall adopt regulations to implement the requirements of this section.

**Seek amendments to modify Prevailing wage requirements**  
**(Return State funding Participation Threshold to 50%)**

**Article - State Finance and Procurement**

§17–201.

(a) In this subtitle, unless the context indicates otherwise, the following words have the meanings indicated.

(b) “Apprentice” means an individual who:

(1) is at least 16 years old;

(2) has signed with an employer or employer’s agent, an association of employers, an organization of employees, or a joint committee from both, an agreement including a statement of:

(i) the trade, craft, or occupation that the individual is learning; and

(ii) the beginning and ending dates of the apprenticeship; and

(3) is registered in a program of the Council or the Bureau of Apprenticeship and Training of the United States Department of Labor.

(c) “Commissioner” means:

(1) the Commissioner of Labor and Industry;

(2) the Deputy Commissioner of Labor and Industry; or

(3) an authorized representative of the Commissioner.

(d) “Construction” includes all:

(1) building;

(2) reconstructing;

(3) improving;

(4) enlarging;

(5) painting and decorating;

(6) altering;

(7) maintaining; and

(8) repairing.

(e) “Council” means the Apprenticeship and Training Council.

(f) (1) “Employee” means an apprentice or worker employed by a contractor or subcontractor under a public work contract.

(2) “Employee” does not include an individual employed by a public body.

(g) (1) “Locality” means the county in which the work is to be performed.

(2) If the public work is located within 2 or more counties, the locality includes all counties in which the public work is located.

(h) “Prevailing wage rate” means the hourly rate of wages paid in the locality as determined by the Commissioner under § 17–208 of this subtitle.

(i) (1) “Public body” means:

(i) the State;

(ii) except as provided in paragraph (2)(i) of this subsection, a unit of the State government or instrumentality of the State;

(iii) any political subdivision, agency, person, or entity:

1. with respect to the construction of an elementary or a secondary school for which 25% or more of the money used for construction is State money; or

2. with respect to the construction of any other public work for which 50% or more of the money used for construction is State money;

(iv) notwithstanding paragraph (2)(ii) of this subsection, a political subdivision if its governing body:

1. provides by ordinance or resolution that the political subdivision is covered by this subtitle; and

2. gives written notice of that ordinance or resolution to the Commissioner; and

(v) the Washington Suburban Sanitary Commission.

**EXHIBIT C**



(2) "Public body" does not include:

(i) except as provided in paragraph (1)(v) of this subsection, a unit of the State government or instrumentality of the State funded wholly from a source other than the State; or

(ii) any political subdivision, agency, person, or entity:

1. with respect to the construction of an elementary or a secondary school for which less than 25% of the money used for construction is State money; or

2. with respect to the construction of any other public work for which less than 50% of the money used for construction is State money.

(j) (1) Subject to paragraph (2) of this subsection, "public work" means a structure or work, including a bridge, building, ditch, road, alley, waterwork, or sewage disposal plant, that:

(i) is constructed for public use or benefit; or

(ii) is paid for wholly or partly by public money.

(2) "Public work" does not include:

(i) unless let to contract, a structure or work whose construction is performed by a public service company under order of the Public Service Commission or other public authority regardless of:

1. public supervision or direction; or

2. payment wholly or partly from public money; or

(ii) an elementary or a secondary school if:

1. the school is not in a political subdivision covered under subsection (i)(1)(iv) of this section;

and

2. the State provides less than ~~50~~25% of the money for construction.

(k) "Public work contract" means a contract for construction of a public work.

(l) "Worker" means a laborer or mechanic.

**Consider legislation that would create incentives for LEAs who use value-engineering.**  
**(100% of Savings Reducing County's Share of School Cost)**

**Article - Education**

§5-301.

(a) In this subtitle, "Interagency Committee" means the Interagency Committee on School Construction established under § 5-302 of this subtitle.

(b) (1) For the purposes of this section other than subsection (c), the Board of Public Works shall define by regulation what constitutes an eligible and ineligible public school construction or capital improvement cost.

(2) (i) The Board of Public Works shall include modular construction as an approved public school construction or capital cost.

(ii) The Board of Public Works, at the recommendation of the Interagency Committee on School Construction, shall adopt regulations that:

1. Define modular construction; and

2. Establish the minimum specifications required for approval of modular construction as a public school construction or capital improvement cost.

(3) The cost of acquiring land may not be considered a construction or capital improvement cost and may not be paid by the State.

(b-1) The Board of Public Works, in consultation with the Department of General Services and the Department of Housing and Community Development, shall adopt regulations establishing criteria designed to enhance indoor air quality for the occupants of relocatable classrooms constructed after July 1, 2014, that are purchased or leased using State or local funds, including specifications that:

(1) Require each unit to include appropriate air barriers to limit infiltration;

(2) Require that each unit be constructed in a manner that provides protection against water damage through the use of proper roofing materials, exterior sheathing, water drainage systems, and flashing;

(3) Require that each unit provide continuous forced ventilation when the unit is occupied;

(4) Require each unit to include a programmable thermostat;

(5) Require each unit to be outfitted with energy efficient lighting and heating and air-conditioning systems; and

(6) Mandate that each unit be constructed with building materials that contain low amounts of volatile organic compounds (VOC) in accordance with industry standards.

(c) The State shall pay the costs in excess of available federal funds of the State share of public school construction projects and public school capital improvements in each county if:

(1) The projects or improvements have been approved by the Board of Public Works; and

(2) Contracts have been executed on or after July 1, 1971 for the projects or improvements.

(d) (1) The Board of Public Works may adopt regulations for the administration of the programs provided for in this section.

(2) The regulations adopted by the Board of Public Works may contain requirements for:

(i) The development and submission of long range plans;

(ii) The submission of annual plans and plans for specific projects;

(iii) The submission of other data or information that is relevant to school construction or capital improvement;

(iv) The approval of sites, plans, and specifications for the construction of new school buildings or the improvement of existing buildings;

(v) Site improvements;

(vi) Competitive bidding;

(vii) The hiring of personnel in connection with school construction or capital improvements;

(viii) The actual construction of school buildings or their improvements;

**EXHIBIT D**

- (ix) The relative roles of different State and local governmental agencies in the planning and construction of school buildings or school capital improvements;
  - (x) School construction and capital improvements necessary or appropriate for the proper implementation of this section;
  - (xi) At the recommendation of the Interagency Committee, the establishment of priority public school construction programs;
  - (xii) Development of cooperative arrangements that permit the sharing of facilities among two or more school systems
  - (xiii) The selection of architects and engineers by school systems;
  - (xiv) The award of contracts by school systems; and
  - (xv) Method of payments made by the State under the Public School Construction Program.
- (3) The regulations adopted by the Board of Public Works shall contain provisions:
- (i) Establishing a State and local cost–share formula for each county that identifies the factors used in establishing the formulas;
  - (ii) Requiring local education agencies to adopt educational facilities master plans and annual capital improvement programs;
  - (iii) Providing a method for establishing a maximum State construction allocation for each project approved for State funding;
  - (iv) Referencing the policies stated in § 5–7B–07 of the State Finance and Procurement Article;
  - (v) Requiring local school systems to adopt procedures consistent with the minority business enterprise policies of the State as required under the Code of Maryland Regulations;
  - (vi) Establishing a process for the appeal of decisions by the Interagency Committee to the Board of Public Works; maintenance plans; ~~and~~

(vii) Authorizing the Board of Public Works to withhold State public school construction funds from a local education agency that fails to comply with the requirements of item (vii) of this paragraph. ~~and~~

(ix) Authorizing the local education agency, beginning in FY 2018, the option to complete a value engineering analysis for each new school construction project approved by the IAC, prior to bidding the project's construction, bidding the project with and without the value engineering recommendations (options), and providing that any construction savings derived from the award of the value engineering option(s) will be retained by the LEA. Savings shall be calculated by comparing IAC approved square foot cost to the actual square foot cost with the value engineering options in place.

(4) In adopting any of these requirements, the State Board and the Board of Public Works shall provide for the maximum exercise of initiative by school personnel in each county to ensure that the school buildings and improvements meet both the needs of the local communities and the rules and regulations necessary to ensure the proper operation of this section and the prudent expenditure of State funds.

- (i) Requiring local education agencies to adopt, implement, and periodically update comprehensive

(e) The Board of Public Works shall develop the rules, regulations, and procedures authorized by this section in consultation with representatives of the county boards and the county governing bodies.

(f) The regulations and procedures of the Board of Public Works adopted under this section and their promulgation are exempt from

§ 8–127(b) of the State Finance and Procurement Article.

(g) (1) With respect to public school construction or public school capital improvements, including sites for school buildings, the authority, responsibilities, powers, and duties of the following are subject to the regulations adopted by the Board of Public Works under this section:

- (i) The State Board;
- (ii) The State Superintendent;
- (iii) The county governments;
- (iv) The county boards; and
- (v) All other State or local governmental agencies under this article.

(2) If, as to public school construction or public school capital improvements, there is any conflict between the regulations and procedures of the Board of Public Works and the authority, responsibilities, powers, and duties of the individuals and agencies specified in paragraph (1) of this subsection, the regulations and procedures of the Board of Public Works shall prevail.

(h) The obligation of the State to pay the costs of public school construction and public school capital improvements extends only to those projects or parts of projects that comply with the regulations and procedures of the Board of Public Works.

(i) (1) This subsection does not apply to the proceeds from the sale, lease, or disposition of public school buildings constructed under contracts executed before February 1, 1971.

(2) Consistent with § 4–115 of this article and regulations adopted by the Board of Public Works to implement § 4–126 of this article, the Board of Public Works may require by regulation that the portion of the proceeds received by a county from the sale, lease, or disposal of any public school building that represent State funds provided within 15 years prior to the date of the transaction shall be used solely as part of the State funding of the construction of future public school buildings in the county in which the sale, lease, or disposal occurred, if the public school building was constructed under a contract executed on or after February 1, 1971.

(3) The part of the proceeds from the sale, lease, or disposal of a public school building that fairly represents the appraised value of land and that part of the cost of the public school building that was funded by the county shall remain as the funds of the county.

(4) A transfer of interest in a public school building in connection with a financing of the cost of construction and improvements to such buildings is not a sale, lease, or disposal of the public school facility.

(j) (1) Whether by budget bill or supplementary appropriation bill, all money appropriated to carry out the purposes of this section is a separate fund that shall be administered by the State Comptroller in accordance with the regulations adopted by the Board of Public Works.

(2) Subject to paragraph (3) of this subsection, any unexpended allocations of funds for previously approved projects shall be transferred to the fund established under paragraph (1) of this subsection.

(3) (i) Any funds approved for a county for a project that has not been contracted for within 2 years of the approval of the project, shall be:

- 1. Available for another eligible project in the county in the current fiscal year; or
- 2. Reserved for eligible projects in the county in the next fiscal year, in addition to the new funds allocated for eligible projects in the county in the next fiscal year.

(ii) Any funds reserved under subparagraph (i)2 of this paragraph that have not been used to contract for a project within 2 years of the date the funds were reserved shall be available for allocation to an eligible project in any county.

(4) On or before March 30, June 30, September 30, and December 31 of each year, the Interagency Committee shall report to the General Assembly, in accordance with § 2–1246 of the State Government Article, and the Department of Legislative Services on the balance in the fund as of the reporting date as the result of transfers or reversions required under this subsection and any expenditures.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**April 4, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 7:01 p.m. by County Executive Jan Gardner.  
Attendees present were:

Jan Gardner, Frederick County Executive  
Mike Marschner, Frederick County Special Projects Manager, and facilitator  
Dusty Rood, President of Rogers Consulting  
Jason Wiley, Elm Street Development  
Chuck Nipe, Director of Frederick County department of Public Works  
Jeremy Holder, Ausherman Properties  
Richard Pryor, Pryor Mechanical, retired  
Ray Barnes, Chief Operating Officer, Frederick County Public Schools  
Kyle Bostian, Parent Representative  
Darrell Guyton, Morgan Keller Construction  
Tom King, Noelker & Hull Architects (formerly King Asbury Architects)

Guests – Roger Fritz, Director FCPS Construction Management Department  
Janice Spiegel, Frederick County Education Liaison  
Absent – Joe Dattoli, Frederick County Public Schools, retired

Executive Gardner welcomed the committee members, reviewed the charge of the committee, and gave a brief overview of recent trends impacting school construction in Frederick County.

Mr. Marschner reviewed the requirements for open meetings in the state of Maryland. Six (6) members will constitute a quorum of the committee. The committee as a body will decide whether to accept public comments at each meeting. Minutes of each meeting will be posted on the county webpage after they are approved by the committee.

Mr. Marschner reiterated that the county only has partial control of the school construction process. It is possible future committee recommendations may have to be referred to other legislative or elected bodies for action. The goal is for the committee to complete its work with one (1) year.

Ray Barnes presented an overview of Frederick County's school construction program, recent projects, features of the buildings, and project delivery methodologies. He also discussed how changes in the educational program, size of the buildings, and regulatory requirements have impacted the design and construction costs of schools.

The committee members discussed state requirements and the added costs related to LEED Silver certification. There was a discussion about geo-thermal heat systems and the state's requirements for energy efficiency. There was also a brief discussion about labor market trends in the school construction industry and how the lack of skilled workers in some construction areas is impacting pricing.

Mr. Barnes presented a preliminary handout of cost containment ideas which was generated by a state committee that is studying the same issues. Mr. Barnes answered questions about construction managers versus general contractors, timelines of projects, the bidding process, geo-thermal heat systems, peer review, and how the costs for school construction in Frederick County relate to costs in other Maryland jurisdictions and surrounding areas. The group agreed that increased costs may be attributed to the school system's strategy of investing in high quality, long-term construction materials to reduce future operating costs, especially on-going maintenance costs.

The committee discussed future areas to focus on:

- Review mechanical systems, especially HVAC systems, for cost savings
- Compare costs per square foot for school construction around the state and other similar surrounding jurisdictions
- Study the complexity of state and federal mandates on the square footage and costs of schools
- Review space utilization and space flexibility
- Look at local and state education specifications, or other philosophical decisions, which may impact construction costs
- Review the FCPS process for procurement and design
- Examine public-private partnerships for school construction to see if alternatives may exist. An example given was the Monarch Global School in Anne Arundel County.
- Continue to look for cost saving areas for future discussion

Executive Gardner indicated a desire to review state public policy requirements to see if regulations can be modified to save costs while keeping the overall goal of the public policy intact.

The committee indicated that either day or night meetings may be scheduled in the future. Initially, the committee will meet every two to three weeks. At the next meeting, the committee will narrow the topics further and identify the process we will use to approach a study of surrounding comparable schools and jurisdictions.

**Action Items:**

- The County Executive's office will send out the minutes and work on a future meeting schedule.
- The county will establish a website for information and links.
- Mr. Barnes will provide information his department has gathered anecdotally on costs of school construction around the state and other surrounding areas
- Mr. King will try to get information from Loudon County about a comparison between the costs of a traditionally built school versus a public/private partner-built school.
- Mr. Marschner will send a link to the committee to a document, *Instructions for Submission of FY 2017 Capital Improvement Program*, which gives a summary of basic requirements in Maryland for school construction.

The meeting adjourned at 9:11 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**April 26, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 1:03 p.m. by Mike Marschner.

Attendees present were Mike Marschner, Dusty Rood, Jason Wiley, Bret Fouche (Frederick County Department of Public Works on behalf of Chuck Nipe), Jeremy Holder, Richard Pryor, Ray Barnes, Kyle Bostian, Tom King, and Joe Dattoli.

Guests – Roger Fritz, Director FCPS Construction Management Department and Janice Spiegel, Frederick County Education Liaison

Absent – Darrell Guyton and Chuck Nipe

- I. **Meeting Minutes** – The minutes from the April 4, 2016 meeting were reviewed by the committee.
  
- II. **Action items from Previous Meeting** –
  - **Web site development** – Mr. Marschner announced a link for committee activities on the county's webpage. The link is <https://www.frederickcountymd.gov/7006/School-Construction-Round-Table-Work-Gro>
  
  - **Compilation of Additional State and Surrounding County School Construction Information** – Mr. Barnes provided a handout (**Attachment 1**) showing recent school construction costs from 2012 to 2015 for various projects state school projects.
    - Costs increased from about \$200/square ft. in 2012 to about \$300/square foot in 2015.
    - There was a question about why the cost for the site work at Fairmont Heights HS in Prince George's County was 40% of the project. **Action Item - Mr. Barnes will follow up to see the causes for the high cost of the site work.**
    - There was a discussion about costs included in the construction cost calculation:
      - Construction costs include onsite and offsite improvements, building costs and contingency.
      - The total project cost includes the construction costs plus furniture/equipment, inspections, FRO fees, TAP fees, plan review fees, commissioning (related to HVAC), construction management fees, and design fees.
      - FCPS includes approximately a 4% contingency. Remaining contingency is returned to the funding source at the end of the project.
      - Questions were raised about the bid alternates on the FHS project. **Action Item – Roger Fritz will provide a list of the Frederick High School add alternates at the next meeting.**
    - The group discussed the escalating costs of mechanical systems
      - Mechanical costs are approximately 25% of the project cost, and are impacted by changes in the building codes.
      - Costs for Linganore HS averaged about \$30/hr. for a plumber at prevailing wage rates, while the cost for a plumber for the Frederick High School project averaged \$53/hr. using prevailing wage rates.

- Mr. Rood suggested the committee consider two main themes for organizational purposes: 1) factors impacting school construction costs which are under direct control of Frederick County, and 2) other cost factors not controlled by Frederick County, but for which the group could advocate. The committee generally agreed with this approach.
- The group discussed Bester Elementary in Washington County. The school was opened in 2014 and was much less expensive:
  - The project did not use prevailing wage since it was constructed before the change in the law took effect in July 2014
  - Mr. Barnes thought the project had not met the requirements for LEED Silver certification
  - The project is smaller than a typical Frederick County elementary school
  - The project used a general contractor and not a construction manager.
- The committee discussed using a general contractor as opposed to a construction manager. FCPS has bid projects both ways.
- **Comparison of Loudon County Schools**
  - Tom King reviewed information Loudon County gathered comparing Evergreen Mill Elementary School, a Public/Private turnkey venture, to a traditionally procured elementary school.
  - Loudon County found no significant savings when comparing the Public/Private school to other projects using the same prototype design.
  - The committee discussed labor market impact on school construction jobs
    - Contractors are having problems finding skilled laborers to meet the demand, especially in HVAC areas.
    - There was a question about reducing the number of workers on a job by splitting the contracts to avoid prevailing wage, but Ray Barnes confirmed that the state will not permit that to happen.
    - There was a brief discussion about using some prefabricated mechanical components to reduce labor costs.
  - The committee discussed the storm water management system requirements.
- **Discussion about Spring Mills High School in West Virginia –**
  - Bret Fouche reported that he visited Spring Mills High School in West Virginia with Chuck Nipe
    - The school opened in 2013 with a pupil yield of 1500-1600, slightly smaller than a Frederick County school
    - The building is 225,000 square feet and two-story.
    - Construction costs were \$37,400 or about \$150/ sq. ft and the total project was about \$41M.
    - The project was built using prevailing wage, but WV is no longer using prevailing wage now.
    - Mr. Fouche thought that the committee should visit the school and talk with the construction manager, Mr. Zepp, for more information
  - ***Action Item – committee members who are interested will schedule a visit to Spring Mills High School prior to the next meeting, if possible.***
  - The committee discussed alternatives to LEED certification.



- **Discussion of using a consultant –**
  - Mr. Holder met with Mr. Marschner and the County Executive after the last meeting to discuss the idea of hiring a consultant to assist the committee. The Ausherman Family Foundation would contribute funding, but the county would hire a consultant. **Action item – Mr. Holder will explore the idea of a consultant further with Ausherman Family Foundation and report back to the committee more specific information relating to the cost and time frame.**

### III. Work Group's Area of Focus

- Mr. King suggested to organize by areas of focus:
  - Construction Technology – this would cover mechanical, electrical, wall types, roofing, windows, etc.
  - Delivery Systems – This would address various contracting methods, trends, and design to capture front-end cost savings, and study alternative methods used by the private sector.
  - Impact of state and federal mandates
- In addition to looking at the 3 focus areas, the group will also consider two main themes previously discussed: 1) school construction costs which are under direct control of Frederick County, and 2) aspects of school construction costs not controlled by Frederick County but for which the group could advocate.

### IV. New Business –

- a. **Subcommittees** – the group did not think subcommittees were needed yet, but agreed they may need to form subcommittees in the future to complete the work needed.
- b. **Site tour** – interested committee members will visit Spring Mills HS in West Virginia. This will be scheduled by those members interested.
- c. **Public comment** – the committee will offer the public an opportunity for public comment at the beginning of the meetings.
- d. **Meeting schedule** – the next few meetings will be every 2-3 weeks. A schedule will be emailed. In general, the 4<sup>th</sup> Thursday of the month will not be scheduled due to other committee member's commitments.
- e. **Minutes from the April 4, 2016 meeting** – the meeting minutes were approved by the committee and will be posted on the website.

The meeting adjourned at 3:20 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**May 17, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:03 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Joe Dattoli, Kyle Bostian, Ray Barnes, Richard Pryor, Dusty Rood, Jeremy Holder, Chuck Nipe, Jason Wiley, Roger Fritz and Darrell Guyton (arrived later in the meeting)

Guests: Janice Spiegel, Bret Fouche

- I. **Approval of the Meeting Minutes** – the agenda for the meeting was approved (Attachment 1). The minutes from the previous meeting were approved with changes. Updated minutes will be posted on the county’s web page.
  
- II. **Action Items from Previous Meeting** –
  1. **Fairmount Heights High School** – Ray Barnes provided a handout, *Sample of Recent School Construction Costs*. The same handout was provided at the last meeting, but there was an error in that document reported the site work for Fairmount Heights HS in Prince George’s County as 40% of the cost of the project. Mr. Barnes provided a corrected handout (Attachment 2) which showed the corrected site work cost as 28% of the total construction cost of the project. The corrected site work cost was in line with other projects, but was still the highest for site work in the state. Mr. Barnes explained that this site was a former golf course and most of the soil was contaminated. In addition to these issues, which needed to be remedied for a high school project, the project called for extensive tree removal and a storm water management system. All of this added to the high site work cost.
  
  2. **Spring Mills High School, West Virginia** – Chuck Nipe updated the group about the visit he, Mike Marschner, Bret Fouche, Ray Barnes and Roger Fritz made to Spring Mills High School (Attachment 3). There were several items of note:
    - The storm water management system was \$100,000. The developer built the storm water pond. There was a discussion about possibly of sharing some of these costs when practical.
    - There was a discussion about differences in the HVAC duct system. When the group visited the school they heard complaints about high humidity in the building.
    - Mr. Barnes stated that the bids for Spring Mills should be compared to the bid price of Linganore HS because they are closer to the same time frame.
    - Mr. Marschner was surprised by the \$4M cost of the Athletic fields and stadium. Spring Mills HS shares fields with the middle school. In Frederick County, each school gets fields.
    - Spring Mills had masonry walls, not a steel frame.
    - There were significant curricular differences. Frederick County High Schools have Career Tech programs in the schools (for example, commercial kitchens and other very specialized classrooms), this school did not have those facilities and had more general education classroom areas.
    - Performance lighting in the auditorium was not up to the performing arts standards found in a Frederick County school.

- There were differences in the electrical standards used at Spring Mills versus a Frederick County School. The Spring Mills HS is a (all) electric building; the back-up generator only provides power to certain critical systems in the school.
- Utility cost comparisons between Spring Mills HS and Linganore High School should be made to compare operating costs.
- There are differences in the roofing standards.
- There are differences in the flexibility West Virginia has in dealing with sub-contractors compared to Maryland.

**ACTION ITEM – the group who toured Spring Mills will write a report to drill down on the cost differences between Spring Mills and a typical Frederick County School. FCPS will obtain electric costs for Spring Mills and compare to Linganore HS.**

3. **Frederick High School Add Alternates** - Mr. Fritz provided a handout showing all of the bid add alternates for Frederick High School (Attachment 4). Only bid #13, 16, 17, 18, and 19 were accepted. There was a discussion about bonding capacity for contractors. In some cases contractors do not have the bonding capacity available, which can limit the number of bidders on the project. There was a question about Alt. 22 being a credit.

**ACTION ITEM – Mr. Fritz will check into Alt. 22 for more information.**

4. **Preston Elementary School, Caroline County** – Mr. King discussed Preston ES renovation/new construction project. This was a “construction management at risk” project, which involves the Construction Manager having performance and payment bonds on all the sub-contractors. One advantage to this approach is that sub-contractors who could not normally get bonds, are able to bid on these projects because the Construction Manager has an umbrella bond over the whole project. The project came in over budget initially, so additional cost savings were sought:

- The school did not use a lot of finished ceilings. The less finished ceilings results in reductions in building volume and building height saving costs. There was a discussion about potentially using unfinished ceilings in Frederick County.
- They used a hybrid geothermal system and are still evaluating overall cost savings.
- They combined the gymnasium and the cafeteria into one space to reduce the size of the building.

Mr. King suggested that FCPS look at the efficiency ratio of buildings as part of the design guide, which is the ratio of usable to gross building area. FCPS has an efficiency ratio of about 70-72% for North Frederick ES. Mr. King felt that about 70% is a good target for an elementary school. **ACTION ITEM: Mr. King will provide suggested efficiency ratios for ES, MS, and HS to FCPS for them to consider including the ratios in their design guide for architects.**

5. **Consultant** – the discussion of a consultant was deferred to a future meeting.

### III. Discussion on how to proceed –

#### 1. Construction Technology –

- **ACTION ITEMS: FCPS will explore the possibility of reducing the amount of finished ceilings in buildings. Mr. King will try to get more information about the savings discovered at Preston ES.**
- The committee discussed variable volume refrigerant flow technology (VRF systems) and potential savings. There was some discussion about whether or not these

systems will give enough points for a project to be LEED certified. A VRF system was put in at Sabillasville ES, but the project was not required to be LEED certified.

- Mr. Barnes suggested the committee look at all mechanical systems. There was a discussion about using a combination of VRF and geothermal systems for maximum benefit and cost savings.

**ACTION ITEM: Mr. Pryor will look at value engineering and potentially substituting some specifications/materials, without changing major aspects of the overall design, to reduce some of the costs associated with construction technology specifically for Sugarloaf ES and Butterfly Ridge ES. FCPS will provide him the plans.**

- There was a mention of looking at some other things like tilt up construction, modular construction, and pre-engineering. This will be discussed at a future meeting.

## **2. Delivery Systems –**

- There was a lengthy discussion about using a Construction Manager at Risk versus a Construction Manager Agency and the pros and cons of each.

**ACTION ITEM: The committee will explore product delivery systems and the use of general construction managers or construction managers at risk.**

**ACTION ITEM: Mr. Guyton will check with other groups, for example the Construction Owners of America, to see if he can find more information about the pros and cons of various types of delivery systems. If possible he will try and find someone who can provide the committee a briefing or presentation explaining the differences, advantages and disadvantages associated with each delivery system.**

## **3. State and Federal Mandates –**

- Mr. Dattoli thought the group should look at State mandates first, which could include aspects of COMAR that pertain to school construction, then look at other things like prevailing wage, storm water management regulations, and energy requirements/LEED certification.

## **4. Local -** The group discussed the broad topic of local education specifications and managing community expectations for schools.

- **ACTION ITEM: FCPS will furnish the local education specifications used in Frederick County for the committee to examine.**
- There was also a mention of developing local erosion, sediment control, and storm water protocols for schools (ESD) to decrease costs.

**ACTION ITEM: Mr. Holder, Mr. Wiley and Mr. Rood will look at the site work and storm water management areas for Sugarloaf ES and Butterfly Ridge ES for cost savings. FCPS will provide this group with the sediment control and storm water improvement plans for these schools.**

## **IV. New Business –**

1. The next meeting is June 7, 2016 from 3:00-5:00.
2. Mike Marschner will try to put together an outline of activities for that meeting.

The meeting was adjourned at 5:39 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**June 7, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:04 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Joe Dattoli, Ray Barnes, Richard Pryor, Jeremy Holder, Chuck Nipe, Roger Fritz and Darrell Guyton

Attendees absent were: Kyle Bostian, Dusty Rood, and Jason Wiley

Guests: Janice Spiegel, Bret Fouche,

- V. Approval of the Meeting Minutes** – the agenda for the meeting was approved (Attachment 1). The minutes from the previous meeting were approved with no changes.

**VI. Action Items from Previous Meeting –**

- 1. Electric Comparison – Spring Mills HS compared to Linganore HS** – Roger Fritz provided a handout (Attachment 2) which compared a 6 month time period for energy usage costs between Spring Mills HS, an all-electric school in Berkley County, WV, and Linganore HS. In general, Linganore HS used more equivalent kilowatt hours than Spring Mills, because fuel oil usage must be converted to KBTU and added to the total electric usage for LHS. Once all energy usage is considered, LHS saves about \$86,260 for a 6 month period, or about \$172,000 per year. The square footage of Spring Mills is about 228,000 sq. ft. and LHS is 253,565 sq. ft.

**Comparison of Construction Features** – Roger Fritz provided a handout for the group which compared the construction features of Spring Mills HS to the construction features of LHS (Attachment 3). There were several items of note:

- **Site** - LHS on 50 acres with 2 storm water ponds  
SMHS on 75 acres (shared between 3 buildings) with 1 storm water pond for all 3
- **Frame** - LHS used steel frame  
SMHS used masonry bearing walls
- **Roof** - LHS constructed with 4 ply hot asphalt BUR; double the lifespan of a single ply system  
SMHS constructed with Single ply EPDM rubber/standing seam metal
- **HVAC** - LHS has a conventional VAV system with boilers/water cooled chillers – the estimated life span is about 35 years  
SMHS has roof-top electric heat pumps with DX cooling – the estimated life span is about 20 years
- **Data system** - LHS is wireless with state mandated hard wired system as backup  
SMHS is wireless only
- **PE lockers**- LHS has separate PE and team lockers  
SMHS has shared PE and team lockers
- **Phone system** - LHS has an integrated phone/intercom clock system, required by teachers'

contract for communication between office/classroom  
SMHS did not include a phone system in construction, added later

- **Emergency generator** – SMHS has emergency lighting only  
LHS meets the COMAR requirements mandating certain “shelter in place” requirements, including things like emergency lighting, data, circulating pumps, intrusion alarms, telecommunications system, fire alarm, etc.  
**ACTION ITEM: There was a discussion about trying to quantify the costs that are associated with these requirements and to add this topic to the list of potential legislative items which may be considered by the work group.**
2. Roger Fritz provided another handout for information, ***Construction Costs Impacts on Maryland Public Schools*** (Attachment 4). Mr. Barnes reported that the state’s 21<sup>st</sup> Century School Construction Task Force was created to address some of the areas identified in this document by facility planners around the state.
  3. **Educational Specifications** – Mr. Fritz provided the educational specifications for Sugarloaf ES (Attachment 5) and Frederick High School (Attachment 6). Educational specifications are designed locally and are approved by the state. The state sets minimum design criteria for local school systems; Mr. Barnes stated that FCPS generally adheres to the minimum requirements and does not generally exceed those requirements. There was a discussion about other factors impacting cost:
    - **Time** – since funding comes on July 1 but schools must construct and open by the start of the school year, there is a very tight timeline. This limits the ability of FCPS staff to negotiate over requirements or use other cost saving ideas after the design phase.
    - **Requirements** – school systems and other government agencies are often required to make extraordinary infrastructure improvements. The consensus of the group was that private industry has the ability to negotiate these improvements, but the school system does not. Examples given of extraordinary improvements included major road improvements, a bridge on Ballenger Creek Pike, and a roundabout on MD 144. It is much more expensive for the school system to make major road improvements than for the county or state to make the improvement and the school system to reimburse the cost of those improvements. School systems are generally treated like any developer. These types of improvements add to the total cost of schools.
  4. **Frederick High School Bid Alternates** – At the previous meeting, Mr. Fritz provided a handout showing all of the bid add-alternates for Frederick High School. There was an outstanding question about Alt. 22 being listed as a credit. Mr. Fritz explained that the base bid was for solid wood casework (industry standard). The alternate was for laminate. If the bid alternate was selected, there would be a credit because laminate is less expensive; however, the bid alternate was not accepted.
  5. **Pros and Cons of construction delivery systems** – Mr. Guyton introduced Bryan Adgate, Senior Pre-Construction Manager from Morgan Keller. Mr. Guyton and Brian led a discussion about delivery systems; CM agency versus CM at Risk. FCPS currently uses the CM Agency method. The topic will be discussed further at a future meeting. FCPS is

interested in looking at possible incentives for the CMs to do a more value-engineering during the design phase and also examining if the CM at Risk delivery system garners more bidders than the current system. **Action Item: Mr. Guyton will look at doing a side-by-side comparison of CM Agency versus CM At-Risk, both pros and cons. He will look to find someone, possibly legal counsel, who would know the pros and cons of the owner holding the contracts. He will also look at incentives and potentially bonding issues. This will be discussed on a future agenda.**

6. **Review of site work & storm water management areas for Sugarloaf and Butterfly Ridge ES** – this item was deferred to the next meeting. **ACTION ITEM - Mr. Holder will send information to Mr. Fritz to review in advance of that meeting.**
  
7. **Review of Sugarloaf and Butterfly ES HVAC designs** – Mr. Pryor examined the plans for Sugarloaf and Butterfly Ridge ES. He found that there were some potential cost savings, which could be achieved by changing some mechanical specifications/materials, without changing major aspects of the overall design and still meet LEED certification and other requirements. The letter he provided (Attachment 7) highlighted some areas to consider. Modifications to the specifications would not be possible for Sugarloaf and Butterfly Ridge, but could be incorporated into future projects using the prototype ES design. **ACTION ITEM: FCPS will provide a written response to Mr. Pryor's report.**
  
8. **Discussion of efficiency ratios and the potential of reducing the ceiling in prototype plan** - Mr. King evaluated the Sugarloaf ES drawings and offered some suggestions for potential savings. Things like:
  - Straighten out rotated wings and look at possibly eliminating odd shaped areas.
  - Eliminate roof parapets
  - Adjust the overall height of the building – 14'8" from floor to floor, lowering the height decreases the overall volume.
  - Examine the possibility of eliminating ceiling gridsWhile savings will occur, additional items, like paint and acoustical materials, may need to be added. Overall savings could be \$2-2.5M without largely changing the overall design. **ACTION ITEM: Mr. King will provide the list to Mr. Marschner and the committee for inclusion in the final report.**

VII. **Outline of Committee Activities** – deferred  
**ACTION ITEM: Mr. Marschner will send a draft outline of committee activities electronically for review and to begin the framework of a final report.**

- VIII. **New Business** –
1. Mr. Marschner reminded the committee that Council Member Delauter will be presenting his committee's lease option for schools on June 16, 2016 at 1:30 p.m. in the 1<sup>st</sup> floor hearing room.
  2. The next meeting will be scheduled in about a month. Committee members will be contacted to set the date.

The meeting was adjourned at 5:34 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**July 19, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:03 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Joe Dattoli, Kyle Bostian, Ray Barnes, Jeremy Holder, Chuck Nipe, Roger Fritz, Darrell Guyton, and Jason Wiley

Attendees absent were: Dusty Rood, and Richard Pryor

Guests: Janice Spiegel, Bret Fouche

**IX. Approval of the Meeting Minutes** – the agenda for the meeting was approved (Attachment 1). The minutes from the previous meeting were approved with no changes.

**X. Action Items from Previous Meeting –**

**1. Review Site Work, Storm Water Management areas for Sugarloaf ES and Butterfly ES –**  
A subcommittee of Dusty Rood, Jason Wiley and Jeremy Holder conducted a review of the site development for Sugarloaf ES and Butterfly Ridge ES. A handout was provided with a summary of the subcommittee’s findings and recommendations for efficiencies (Attachment 2). In general, the subcommittee believed that there would be substantial efficiencies if the timing was such that funding for design was available for design sooner, potentially even before the site plan process, so that any issues can be addressed prior to final design. The subcommittee met with FCPS staff to review their recommendations. Long-term design change and review becomes an issue of time; the time line for most projects is very tight. There is also a concern that the regulations are unclear and seem to be in a constant state of flux. There was a discussion about having the committee make a future recommendation that the requirements be clarified. **ACTION ITEM – Ray Barnes and Roger Fritz will review the recommendations and continue discussions with the subcommittee members to see if there are any recommendations that can be pursued further to find cost savings for these two projects. They will report the results of those discussions to the larger committee in the future.**

**2. Review Committee Report Outline –**

Mike Marschner presented an Outline of Committee Activities to provide a synopsis and update (Attachment 3). On the second page, he inserted a section for the committee to review. The section was submitted by Roger Fritz regarding the School Site Acquisition process. Ray Barnes would like to see the committee recommend some minimum site sizes to accommodate the need for larger school sites to deliver the educational program, meet the requirements for storm water management, and provide adequate traffic flow.

There was brief discussion about the school sites owned by the school system and the process for liquidating an unneeded site. The county would have to take the lead on any school system site liquidation. **ACTION ITEM: Mike Marschner requested the committee review the language submitted by Mr. Fritz and also to review the entire document and offer any potential changes at the next meeting.**

**XI. Review Possible Legislative Recommendations –**

Mike Marschner provided a table that summarized the various ideas that the committee discussed over the past meetings impacting legislation or regulation (Attachment 4) and



an accompanying document which highlights the existing legislation that may be associated with that idea (Attachment 5). The committee reviewed the table to discuss potential future recommendations the committee will ultimately make to the County Executive.

**ACTION ITEM: Mr. Marschner will adjust the table to reflect any suggested changes from the discussions thus far, and he will create a draft interim report for the committee to review at the next meeting.**

**XII. New Business -**

- The County Executive will hold a public hearing on her proposed legislative package on October 6, 2016. The committee will need to provide any potential legislative suggestions to the County Executive in September for inclusion in the legislative package. Once the committee finalizes the recommendations for potential state legislative changes, the committee will continue their work on the remaining items in the committee's charge.
- The next meeting date will be decided via email and will be published on the committee's web page.

The meeting adjourned at 5:08 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**August 16, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:08 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Joe Dattoli, Ray Barnes, Jeremy Holder, Chuck Nipe, Roger Fritz, Dusty Rood and Darrell Guyton

Attendees absent were: Kyle Bostian, Jason Wiley and Richard Pryor

Guests: Janice Spiegel, Bret Fouche

The committee had a brief discussion about the cumulative costs of mandates. There is movement to look at how the regulatory frame work aligns with Smart Growth. Dusty Rood stated that the Hogan administration wants to continue the work that was started under the previous administration. There is a desire to know if goals that were desired, for example the storm water management goals, were achieved by the regulations/legislation that was passed by the Legislature.

Janice Spiegel gave a brief update on the 21<sup>st</sup> Century School Facilities Commission.

- I. **Approval of the Meeting Minutes** – the minutes from the July 19, 2016 meeting were approved as amended to correct a typographical error.
  
- II. **Action from Previous Meeting** –
  
- III. **Review Draft Report Regarding Possible Legislative Initiatives** –  
The committee reviewed a draft interim report which focuses specifically on potential legislative recommendations and updates. The goal is to have the interim report to the County Executive by the end of September.  
**State Finance and Procurement Article -**  
Page 2 – **Ray Barnes will try to find the correct date the High Performance Building Act §3-602.1 was implemented.**  
Page 3 – There was a discussion about the cost to obtain LEED Silver Certification. **Roger Fritz and Ray Barnes will research and try to come up with a dollar figure that would encapsulate the cost to obtain LEED Silver certification.** Ray Barnes would like to see relief from language that is in the law, in addition to just relief from the costs for the actual certification. The committee would like the state to come up with alternatives to accomplish the same goals without meeting LEED Silver certification. A suggestion was for an equivalent process that would still allow for a High Performance Building that parallels LEED Silver but does not require a LEA to pay the Green Building Council to tell them what they already know. In addition, the committee suggests a sunset provision of the requirement for LEED Silver if the building codes require the same standards. There is also a typographical error - 2nd paragraph bottom of page 3 – change Exhibit A to Exhibit B.  
Page 4 – FCPS would like to explore other alternatives to Geothermal, but since they are required to meet LEED Silver certification criteria, FCPS is reluctant to try newer technologies that are not guaranteed to be an acceptable alternative to LEED Silver certified. There was a discussion about the length of time to ask for an exemption from §5-312. The committee decided they would recommend from July 1, 2017-July 1, 2025.

Page 5 – In the 3<sup>rd</sup> paragraph, Mr Dattoli requested to change the “opt out” wording. **Mr. Marschner will work on suitable alternative wording and will provide a copy of the state task force report to the committee.** Mr. Barnes said that the school system has data that shows the average increase across the state from prevailing wage ranges between 10-14%, with an average increased cost of 11.6% statewide. **Mr. Marchner will add data supplied by FCPS on prevailing wage to the report.** There was a lengthy discussion about the prevailing wage rate and the impact on costs.

Page 5 – There was a discussion about incentives. The committee is looking for state support to add an incentive for value-engineering after a project is bid. The committee suggests that once the state allocates funds for construction of a project, the state shouldn't be able to take money back as a consequence of the local school system value-engineering the design or construction of the project. Tom King suggested that it could be tied to the cost per square foot that the state identified at the time the funding was approved; if the local school system can better that cost per square foot, they should keep the funding and apply it to a future project.

### **Other Legislative Initiatives**

Page 6 – **Mandatory Delay of Legislative Changes** – the committee discussed the timeline of state school planning approval and subsequent funding. The committee suggested that any legislation approved at the state, which impacts the design or construction of schools, will not be implemented for three years to allow school systems time to adjust to the new legislation without adversely impacting projects that are already in process. Tying legislative changes to a timeline would effectively have all school systems complying at the same time, and it would potentially eliminate the situation that occurred when FHS was approved for the state share prior to state legislative mandates taking effect and increasing costs.

The committee also suggested that if a project comes in over budget, there should be a process established for local school systems to apply to the state to potentially increase their state cost share. **Ray Barnes will review the draft language in the report and offer any suggested changes to capture the idea the committee wanted to stress.**

Page 6 – **Legislation to Require the State Maintain Adequate Reserve Funding** – this idea closely mirrors the committee's prior suggestion to establish a process for local school systems to apply for increased state share if a project comes in over budget due to a change in legislation. The committee was suggesting creating a pool of funds that would not be allocated during the budgeting process, but would be available for local school systems to apply for if costs/budgets increased after the state share was locked in. **The committee will give thought to this concept and see if perhaps the idea could be captured into another suggestion.**

Page 7 – **Consider proposing legislation to create a State Revolving Loan Fund for public school construction** – the committee will offer this as a suggestion to the County Executive, with the idea that she would potentially recommend it to the state 21<sup>st</sup> Century School Facilities Commission. The committee feels that this may not be as much of an issue for Frederick County, but could have implications throughout the state.

Page 7 – **Consider legislation that would require State to recognize changes in the educational programs, state design guidelines, and community needs** – the state’s formula for construction funding has not been adjusted for 20 years, yet many changes have occurred in the state design guidelines mandating increased space for things like all day kindergarten, pre-kindergarten, larger health suites, larger gymnasiums, intervention programs, special education services, etc. The state design guidelines, and required square footage to meet those guidelines, needs to be consistent. The funding should be based on the updated requirements.

Page 7 – **Consider legislation that would require the state to offer financial incentives if an LEA uses certain efficient design/construction alternatives** – right now, there is little incentive for a local system to deviate from their approved prototype design or standard tried and true conventional construction practices. Even if a local was able to use a newer technology, or innovative construction practices, and potentially save money, the result would be less of a state share, plus the LEA assumes all of the “risk” of trying something new that may or may not work to build schools sooner or at a lower cost. The committee is looking for the state to provide some sort of incentive program that would allow a LEA to explore the use of innovative and newer construction methods. The committee suggested that the state could potentially consider awarding a larger state share or exempting a LEA from mandated requirements, if the LEA volunteered to conduct a “study” for the benefit of the entire state. A LEA would submit a concept proposal to the IAC to qualify.

**Mike Marschner will update the draft report with the changes captured, and will send it out to the committee to review electronically prior to the next meeting. The intent is to finalize an interim report to the County Executive by the end of September.**

**IV. Other Site Related costs Associated with School Construction** – the committee briefly began a discussion regarding some of the other costs the school system incurs. The committee deferred this subject to the next meeting.

**V. New Business –**

- Mr. Marschner made the committee aware that he had been contacted by Senator Rosapepe from Prince George’s County to meet with the committee. Mr. Marschner contacted the Senator’s office, but has not heard back.
- The next meeting will be scheduled via email.

The meeting adjourned at 5:10 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**September 20, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:10 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Ray Barnes, Jeremy Holder, Chuck Nipe, Roger Fritz, Dusty Rood, Jason Wiley, Dick Pryor, Kyle Bostian and Darrell Guyton

Attendees absent were: Joe Dattoli

Guests: Bret Fouche and Janice Spiegel

**VI. Approval of the Meeting Minutes** – the minutes from the August 16, 2016 meeting were approved.

**VII. Review Final Interim Report Regarding Possible Legislative Initiatives** –

The committee reviewed a draft interim report, which focused specifically on potential legislative recommendations and updates. Mike Marschner had incorporated into the draft document the changes previously suggested by the committee; he reviewed those changes with the committee. Several additional changes were noted:

- On page 3, footnote 3, the committee would like a range for LEED Silver certification, since the \$200,000 was for an elementary school only.
- On Page 4 – The committee would like the text to state that the well-drilling for Frederick High School alone was \$2,255,000.
- Title Page – The committee requested we add the word “state” in the title.
- There were a few other minor grammatical and title changes suggested by the committee.

**The committee approved all changes by consensus. Mike will make the changes and present the interim report to the County Executive.**

**VIII. Action Items from previous meetings** –

- a. The Committee reviewed the list of suggestions, introduced at a previous meeting by FCPS (School-Site Acquisition Process). They had a thorough discussion and agreed to consider recommending that the Board of Education develop and approve guidelines that the county can use to evaluate school sites.
- b. The more a potential school site adheres to the guidelines, the less costly the site will be to develop.

**Action Item – Mike Marschner will work on developing draft suggestions for guidelines to be included on our list of committee activities.**

**IX. Establish Meeting Schedule and Assignments for Completing the Remaining Items in the Report**

- In general, the committee agrees that the 3<sup>rd</sup> Tuesday of the month, from 3:00 – 5:00 is a good time to meet. That makes the remaining meetings:

**October 18<sup>th</sup>**

**November 15<sup>th</sup>**

**December 20<sup>th</sup>** (tentative, will discuss at the next meeting)

**January 17<sup>th</sup>**

- Mr. Guyton briefly discussed construction delivery methods. In his professional opinion, he felt that using different delivery methods would not create a “significant” cost difference.

- He suggested the real issue is how to make the bid packages more attractive to bidders. There was a discussion about looking at the bid packages to make them more productive or potentially recommending development of statewide bonding contracts for the use of individual bidders. Any school improvement project over \$100,000 is required to be bonded.
- There was a discussion about Public/Private Partnerships and lease back arrangements. The committee was aware that a different committee was looking at the issue locally, but they were more interested in looking at design/build as a delivery method and if there would be savings. Some contractors, especially the mechanical contractors, are assembling parts off-site and avoiding some of the regulatory costs.

**Action Item - Mr. Guyton will check into the delivery methods further and see if there are some preliminary recommendations that can be presented at the next meeting.**

- Mr. Rood offered to provide the committee with information regarding the mandatory referral process, which is used in Montgomery County. This process shortens the timeframe for review with the Planning Commission because county staff reviews the plans and gives non-binding recommendations. We have this in place for water/sewer in Frederick County already, but not for schools. Mr. Barnes saw this as a potential benefit to shorten the overall time line since any site plan modifications made after approval would not have to go back to the Planning Commission for review, potentially saving time and money.

**Action Item – Mr. Rood will work on a draft document about mandatory referral. Mr. Marschner will check with the County Attorneys to see if there is more information available on the county’s mandatory referral program for water/sewer.**

- Mr. Barnes requested the committee discuss some of the recommendations that are coming from a group Dr. Lever put together which focused on similar topics.  
**Action Items – at the next meeting we will discuss some of the recommendations Dr. Lever’s group came up with to save costs as a starting point. Mr. Barnes will provide the document for the committee for the next meeting for consideration.**

- The next meeting is scheduled for October 18<sup>th</sup> at 3:00.

The meeting adjourned at 5:03 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**October 18, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:09 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Tom King, Ray Barnes, Jeremy Holder, Roger Fritz, Dusty Rood, Jason Wiley, Kyle Bostian and Darrell Guyton

Attendees absent were: Dick Pryor and Chuck Nipe

Guests: Janice Spiegel

- X. Approval of the Meeting Minutes** – the minutes from the September 20, 2016 meeting were approved, as amended.

**XI. Review Frederick County Public Schools Permitting and Water & Sewer Capacity Fee Cost Impacts:**

The committee had a lengthy discussion of fees impacting project costs. Roger Fritz provided a handout that highlighted the fees for Sugarloaf ES to date (Attachment 1). Mike Marschner provided a handout with all of the water & sewer capacity fees from 1989 to 2015 (Attachment 2) so the committee could see what has happened to the fees over time. Mr. Marschner provided another set of handouts to show the fixture unit calculations (Attachment 3) and the accompanying rules and regulations for how the fees are assessed (Attachment 4). The handouts showed that schools which are designed to be LEED certified may pay a significant amount less than schools that are not designed to be LEED certified due to modifications in water usage. Mr. Marschner also suggested that FCPS consider examining the number of floor drains that are in projects, since this is an area that generally saves money in commercial buildings. DUSWM staff is willing to look at school plans to see if they are designed to the optimum level without installing unnecessary fixtures, and they could also potentially differentiate between the fees assessed by school level. Since Volunteer Fire Companies have the ability to seek relief from fees, there was a brief discussion about whether the committee wants to consider recommending the following actions related to fees:

- Recommend waiving fees altogether for schools (both permitting and water/sewer). The City of Frederick does not charge permitting fees for schools, the county should consider not charging fees since the school system does not have their own money to pay the fees; in essence the county is assessing fees on themselves since the state does not cost share on any of the fees.
- Recommend that the county pays the water/sewer fees directly to improve efficiencies rather than allocating the money through the budget and then FCPS paying the fees right back to the county. If the committee decides to make a recommendation, the timing needs to be considered, since schools must be delivered on time, and this is partly the reason FCPS likes to be in control of the timing and delivery of projects.
- There was a suggestion to foster more proactive cooperation between departments that deal with permitting & development review and water/sewer & roads early in the planning stages to help deliver the schools at the lowest possible cost and create efficiencies.

**Action Item – Mr. Marschner will work on crafting some draft recommendations for the committee to consider at a future meeting.**

**XII. Review Adtek Engineers responses to SCWG review and recommendations:**

Roger Fritz and Dave Crable met to review and discuss the response to the report from the subcommittee about the site work for Sugarloaf ES and Butterfly Ridge ES (Attachment 5). Mr. Crable is willing to sit down, along with the civil engineer and FCPS staff, during the construction phase of the project and make some red line modifications and make some of the improvements suggested by the subcommittee. In addition for future projects, he is willing to have his staff work with the civil engineers and FCPS staff to look at ways to reduce costs during the conceptual design process. The committee had a discussion about how regulatory agencies implement new regulations and interpret the requirements of the regulations. There is a general tendency for staff at both the county and the city staff to review storm water management projects with an attitude of just pushing the project through in order to not delay the project. The committee is considering a recommendation for the County Executive and City leaders to direct staff to take a closer look at project review for efficiencies and to make those recommendations at the time of review.

There was a discussion about mandatory referral and how that process simplifies and shortens the approval process. Included for the committee was a handout from Dusty Rood about mandatory referral (Attachment 6). The committee felt that the term "mandatory referral" was misleading and preferred the term "Cooperative Review Process". **Action Item – Mr. Marschner will draft a recommendation based on the cooperative review process and use the summary Mr. Rood provided in the supporting text.**

**XIII. Review and consider using information in Dr. Lever's document "Containing the Cost of Construction":**

Mr. Marschner provided a handout which was presented to the 21<sup>st</sup> Century School Facilities Commission by Dr. Lever at their last meeting (Attachment 7), since the handout summarized many of the same broad topic areas the committee has been discussing. **Action Item – Mr. Marschner suggested that the committee review this document and consider if our local committee wants to make any additional recommendations to the suggestions made in the document.**

**XIV. Work Group meeting with Martin Knott:**

Mr. Marschner summarized a meeting the County Executive, Mr. Barnes, Mr. Fritz, Mrs. Spiegel and he had with Martin Knott, chairman of the state's 21<sup>st</sup> Century School Facilities Commission to review the interim report from our committee. Mr. Knott was very appreciative of the committee's work thus far.

**XV. Meeting dates and assignments**

The next meeting is scheduled for November 15, 2016 at 3:00. The upcoming meetings after the November meeting are:

December 20<sup>th</sup>

January 17<sup>th</sup>

The meeting adjourned at 5:03 p.m.



**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**November 15, 2016**  
**Approved Meeting Minutes**

The meeting was called to order at 3:03 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Chuck Nipe, Dick Pryor, Ray Barnes, Jeremy Holder, Roger Fritz, and Kyle Bostian

Attendees absent were: Tom King, Dusty Rood, Jason Wiley, and Darrell Guyton

Guests: Bret Fouche and Janice Spiegel

**XVI. Approval of the Meeting Minutes** – the minutes from the October 18, 2016 meeting were approved, as amended.

**XVII. Review Draft Cooperative Review Process (Mandatory Referral Process) Draft Narrative and Existing Zoning Regulations §1-19-5.300**

Mr. Marschner provided a draft recommendation (Attachment 1) and supporting documentation (Attachment 2) establishing a cooperative review process, which was drafted based on the preliminary conversation from the previous meeting (then called mandatory referral process).

Mr. Marschner made several revisions to the original draft. There is an outstanding question about whether or not the process is already permitted according to the code - are schools considered county buildings, since county buildings are subject to non-binding review and comment by the Frederick County Planning Commission (§1-19-5.300 and §1-19-4.110). **ACTION ITEM: Mr. Barnes will provide the committee with the section in the COMAR that defines whether or not a school is a county-owned building and/or a building in trust.**

There was a discussion about fees paid to the city when FCPS constructs a school project versus fees paid when the county has a building project in the city. The city and the county have an agreement in place so that the county does not pay plan review fees; other fees such as tap fees are waived as well. The school system does not pay building permit fees to the city but they do pay plan review fees, soil conservation fees, and tap fees. There appears to be some inconsistencies relating to city fees. This may be an area the committee wants to explore further. A cooperative review process could reduce the civil fees charged to the school system. ***The committee will include in their comments/recommendations that the City and County should enter into some sort of MOU to outline the timeline for plan reviews. It is particularly challenging for FCPS to build a school and maintain the schedule in the city; there needs to be some sort of review of the City's land management code as it relates to school construction projects.***

There was also a separate discussion about the DGS (Department of Government Services) Review that schools are required to complete. DGS reviews every aspect of the project, and a school system cannot open bids prior to DGS approval. There is a big backlog at the state, so the review takes a long time. In many cases their review is duplicative, especially in larger jurisdictions where those reviews can be completed in house. The biggest challenge to the DGS review for FCPS is time, and any delay in time results in higher costs. Mr. Marschner suggested creating a flow chart to show how the DGS review is redundant to local reviews which are going on concurrently. Mr. Barnes suggested that there should be a process developed that would delegate to the counties the ability to conduct the review if they meet some sort of agreed upon standards or criteria. This would be a regulatory change. **ACTION ITEM: Mr. Fritz will provide a copy of the regulatory requirement for DGS review.**

## XVIII. Review Action Items for the Work Group

1. Construction Technology – The committee discussed some of the suggestions for cost-savings that were submitted by Mr. King at an earlier meeting. Mr. Marschner summarized the suggestions on a handout (Attachment 3). The committee discussed some of the design elements that influence the cost of construction, such as the mechanical systems, building volume, roof parapets, overall ceiling height, exposed beams or the elimination of ceiling tiles. The committee agreed that modifying or eliminating some of the more aesthetic elements of design would save money, but there is a trade-off with other aspects of the building, such as the overall look or needed additional custodial and code costs. The committee's recommendations to look for potential savings in construction technology would not impact the cost of Sugarloaf or Butterfly Ridge ES, since those projects are already designed. Any potential savings would apply to projects not yet under design. The committee will recommend that these suggestions be explored.
2. Alternatives to Geothermal systems - The committee agreed that FCPS should evaluate the use of variable refrigerant heat/cool systems as opposed to the geothermal system we design in buildings now. The general consensus of the committee was that the VRF system would save money because they use less piping and decrease the size of the interstitial space needed in the building (the space between the ceiling and the floor above). In addition, some savings are incurred because the need to drill wells is eliminated. Mr. Pryor felt that FCPS would get more bidders willing to bid a VRF system than a geothermal because the systems are less complicated to install. **ACTION ITEM: Mr. Fritz will make an effort to determine for certain that the system installed in Washington County was LEED certification point eligible and how many points were awarded. Mr. Pryor will write a brief description about each of the systems to help Mr. Marschner – conventional, VRF, and geothermal - to help the public understand in layman's terms the types of systems which will help define the issues the committee has discussed and is including in our recommendations.**
3. Use of Prototype buildings – Mr. Barnes would like the committee to recommend that the school system continue the use of prototype designs because prototypes help save costs in design and the contracting community gets used to building a prototype model, thus reducing potential risks which makes bids more favorable.
4. Education Specifications – There was a lengthy discussion about education specifications and the topic of parity. There is a general feeling that over time FCPS overdesigns schools through the ratcheting up of education specifications. Mr. Barnes and Mr. Fritz explained that each project has a design team that looks at the programs and courses offered at the schools and designs the education specifications to meet the needs of that school. The Board of Education reviews and approves those specifications for each school. Mr. Barnes suggested that a representative from the county could be included on the design team when the education specifications are developed. He also suggested that the more that could be build off site and then brought to the site would keep costs down since labor costs have risen dramatically. **Action Item: Mr. Holder will provide some language expressing the general feeling of concern so it can be incorporated into the committee's recommendations.**

The committee will begin work on their final recommendations at the next meeting.

The meeting adjourned at 5:03 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**January 17, 2017**  
**Approved Meeting Minutes**

The meeting was called to order at 3:04 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Dick Pryor, Jeremy Holder, Roger Fritz, Kyle Bostian, Tom King,

Dusty Rood, and Jason Wiley

Attendees absent were: Joe Dattoli, Ray Barnes, Darrell Guyton, and Chuck Nipe

Guests: Bret Fouche and Janice Spiegel

**Approval of the Meeting Minutes**

The minutes from the November meeting will be approved at the next meeting.

**Review Draft Selections for Final Report**

Mr. Marschner provided a preliminary draft document (Attachment 1) and a draft Executive Summary list (Attachment 2) to use as a guide as the committee discussed the final report. The committee spent the meeting time discussing these two documents. In general:

- The committee would like to see action steps recommended, if possible.
- The committee would also like a section that describes the process the committee used to discuss the charge included in the final report.
- The committee members would like to be updated regularly about progress on the recommendations once they are accepted by the County Executive.

Using the Executive Summary as a guide, the committee:

- I. **Site Work & Storm Water Management –**
  - a. The committee feels that it would be most helpful if, prior to design, county staff, FCPS staff, and the civil engineers worked together during “conceptual design” to look for efficiencies. This could potentially maximize savings. A suggestion was made that perhaps the best time for this to occur would be at the feasibility study.
  - b. Regarding recommendation that site and storm water regulations be evaluated and clarified, the committee further discussed schools are designed to meet the regulations or exceed the regulations.
- II. **School Site Acquisition Process –**
  - a. Another idea is to form a group to evaluate sites as they are proffered for cost savings.
  - b. A program of incentives could be developed to encourage developers to assist in site development and cost efficiencies.
  - c. Options, such as fee in lieu in cases where a school site cannot be proffered that will meet the criteria, should be explored and/or incentives for developers that go beyond the minimums should be encouraged.
- III. **High Performance Buildings –** This topic was primarily addressed in the interim report. Mr. Fritz confirmed that the Jonathan Hager Elementary School in Washington County did achieve LEED Silver Certification.
- IV. **Prevailing Wage –** This topic was covered in the interim report
- V. **School Construction Technologies and Potential Cost Savings –**
  - a. **ACTION ITEM: Mr. King will provide Mr. Marschner with some general wording for VRF systems and evolving technologies.**

- b. Mr. King suggested the committee review the list of efficiencies that Dr. Lever provided to the committee to make sure we have incorporated the concepts in that report into our discussions. **ACTION ITEM: Staff will make this comparison and update the committee at the next meeting.**
  - c. The committee had a lengthy discussion about added construction and maintenance costs for design features, such as the FHS atrium, that are added in response to the community. A suggestion was made to look at cost per cubic foot versus cost per square foot to get a truer sense of useable space within the school building. As the committee discussed previously, a way to reduce costs is to decrease the overall volume of the building.
  - d. Another suggestion is to ask the school system to look at their architect selection metrics to make sure they are utilizing selection criteria with an eye for keeping costs contained. The committee recommends that FCPS instruct the architect/designer to design to a specific budget.
- VI. **State Legislative Changes** – This topic was covered in the interim report.
- VII. **Cooperative Review** –
- a. Action Items: **Mr. Marschner will clarify with the County attorneys whether or not a cooperative review process could be adopted via policy or would require legislation.**
- VIII. **Delivery Methods** –
- a. While the committee cannot support one delivery method over another for cost savings, the committee wants to be clear that delivery methods should be evaluated for each project. There should be an emphasis on budget costs and meeting the educational program. The design method should be chosen based on design efficiencies and operational efficiencies.
- IX. **Fees** – A suggestion was made to move the fees under the cooperative review section of the report.

Mr. Marschner will work on incorporating all of the suggestions and clarifications into the draft report. The committee will continue to look at the draft final report at their next meeting and discuss the outstanding topic areas.

The next meeting is scheduled for January 31, 2017 at 3:00 p.m.

The meeting adjourned at 5:23 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**January 31, 2017**  
**Approved Meeting Minutes**

The meeting was called to order at 3:06 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Dick Pryor, Jeremy Holder, Roger Fritz, Kyle Bostian, Darrell Guyton,

Dusty Rood, Jason Wiley, and Chuck Nipe

Attendees absent were: Joe Dattoli, Ray Barnes, and Tom King

Guests: Bret Fouche and Janice Spiegel

**Approval of the Meeting Minutes**

The minutes from the November 15, 2016 meeting were approved with no changes. The meeting minutes from the January 17, 2017 meeting were approved as amended.

**Page by Page Review Draft Sections of Final Report**

Mr. Marschner provided a draft final report document and the committee spent the meeting time discussing page by page edits to the final draft.

Mr. Marschner will work on incorporating all of the suggestions and clarifications into the draft report. The committee will finalize their final report at their next meeting for presentation to the County Executive tentative scheduled for February 23, 2017.

The next meeting is scheduled will be February 21, 2017 at 3:00 p.m. to approve the final draft of the committee's final report.

The meeting adjourned at 5:17 p.m.

**School Construction Roundtable Work Group**  
**3<sup>rd</sup> Floor Hearing Room, Winchester Hall**  
**February 21, 2017**  
**Approved Meeting Minutes**

The meeting was called to order at 3:09 p.m. by Mike Marschner.

Attendees present were: Mike Marschner, Kyle Bostian, Dusty Rood, Jason Wiley, Chuck Nipe, Joe Dattoli, and Ray Barnes

Attendees absent were: Dick Pryor, Jeremy Holder, Roger Fritz, Darrell Guyton, and Tom King

Guests: Bret Fouche and Janice Spiegel

**Approval of the Meeting Minutes**

The meeting minutes from the January 31, 2017 meeting were approved.

**Review and Approval of the Final Report**

The committee spent the meeting time discussing edits to the committee's final report.

The final report of the School Construction Work Group was accepted by consensus from the committee members present and was approved as the culmination of the committee's work.

Mr. Marschner thanked the committee members for serving Frederick County. The committee's final report will be presented to the County Executive on February 23, 2017 at 10:30 a.m. at a public information briefing. A bound copy of the completed report will be available for the committee members at the public presentation. All committee members are encouraged to attend.

The meeting minutes of the February 21, 2017 meeting were distributed to the committee and approved.

The meeting adjourned at 4:30 p.m.



School Construction Work Group  
Sugarloaf and Butterfly Ridge Elementary Site Development Review  
Summary of Recommendations from June 3, 2016

Sub-Committee Attendees: Jeremy Holder, Dusty Rood, Jason Wiley

**Notes:**

1. The Sub-Committee's recommendations are based on a review of the following plans and associated computations:
  - Sugarloaf Elementary School Site Plan with FCPC Approval Date of September 10, 2014
  - Sugarloaf Elementary School Improvement Plan with Engineering Review Approval Date of March 29, 2016
  - Sugarloaf Elementary School Storm Water Computation Package revised February 2015
  - Butterfly Ridge Elementary School Site Plan dated 01/29/2016
  - Butterfly Ridge Elementary School Improvement Plans dated 01/29/16
2. In some cases, the Sub-Committee's recommendations contained in this document are of a general nature either as a result of the plan status or because formal re-design would be necessary for more detailed recommendations. The members remain willing to meet with the design team, regulators and the project management team to further the implementation of the recommendations.
3. The Sub-Committee recognizes that pursuit of recommendations requiring site plan revision could delay project execution but believes that recommendations pertaining to SWM, storm drainage design, pavement sections and minor grading adjustments could be implemented without delay.
4. The Sub-Committee recommends implementing an iterative design approach which affords adequate timeframes for the site to be fully evaluated for storm drainage, storm water, earth balance and other site constraints prior to finalizing governmental site plan approvals. A great deal of cost savings can be achieved early in the design process if the consulting team is willing and incentivized to be thorough, creative and to explore alternative solutions with regulators.

**Sugarloaf Elementary**

**General Site Design**

The site layout is efficient, compact and appears to have been challenged by the following constraints:

- Sound buffering and future Right-of-Way reservation along I-270
  - Off-site water traveling generally from west to east
  - Existing grade constraints along the eastern edge of the property
  - Frontage on a street with relatively flat slopes
1. Recommendation #1 – Retaining Walls - The engineer has planned a substantial retaining wall along the eastern edge of the property near the SWM Facility controlled by Natelli. This wall could be reduced in length and height by:

- a. Obtaining permission from Natelli to grade onto the SWM parcel to tie-out grades
  - b. Re-grading the parking lots 3,4&5 on the eastern side of the site away from the school with an approximate 4-5% cross slope.
  - c. Explore alternative alignment for path to ball fields /SWM area
  - d. There is also a small retaining wall separating the bus parking/drop off and parking area #2. It appears that this wall could be eliminated with a small horizontal shift of parking area #2 to the south.
2. Recommendation #2 – Storm Drainage -
- a. The buried storm drainage system on the site is excessively deep and very extensive with up to 30” pipe running at depths of 18’ near the outfall and many runs located at the high end of the system averaging 9’ in depth.
  - b. A primary driver of this depth is under-draining the ESD facilities (See Storm Water Management below). We would strongly encourage a redesign of the SWM/Storm Drainage system based on these excessive depths which are neither typical nor “practicable” in the sense of the County’s Storm water standards.
  - c. We believe that substantial time and cost saving are possible here.
  - d. There is potential to downsize pipes with revisions to depths/running slopes (currently pipes are generally running at minimum slope). Computations noted that the ‘n’ value used for HDPE pipes is .013, which we believe could be decreased and further justify reductions in pipe sizes.
3. Recommendation #3 – Site Paving
- a. Use “On-Site Regular Duty Asphalt” paving section for bus lanes/bus parking and drive aisles as well as areas defined for future portable classroom location.
  - b. Do not utilize the same “On-Site Regular Duty Asphalt” for parking areas 2,3,4 &5 as this Section is far too heavy for general parking and the occasion bus, truck or trash truck trip. Either utilize the specified “Light Duty Asphalt” or engage a geotechnical engineer to propose an alternate section specific to the site. We are confident that both meaningful cost savings and long term performance of the pavement section can be achieved.
  - c. Do not utilize the “On-site Regular Duty Asphalt” paving section in the “After Hours Parking”/Play Lot located between the western side of the school and Lot 1.
  - d. Hard play area on east of bldg. doesn’t need to be heavy duty concrete.
4. Recommendation #4 – Site Grading
- a. The preliminary earthworks computations noted on the plan indicate a required import of approximately 8500 c.y.. Import typically costs \$10 to \$20 per yard depending on location and availability. Future considerations for this and future sites:
    - i. Perform earthworks studies and consult with site work contractors early in the design process to evaluate shrink/swell, rock blasting heave, utility spoils and any specific foundation issues that might impact the earth balance. Often several design iterations will result in a balance or much better balanced site.
    - ii. ESD SWM facilities generate excessive amounts of excavation which it typically delayed by the sequence of construction until after stabilization, thereby forcing export of material and work with constrained/built environments which becomes very expensive and time consuming. Work with design consultants to build a sequence of construction that will allow for efficient on-site management of earthworks.
    - iii. Consider construction of certain ESD facilities early in the project and seal them with impermeable membranes that can be removed upon stabilization.



- iv. If the site conditions allow, plan a barrow/waste location (ie. – playing field or green space) that can be adjusted vertically by up to several feet and can be reserved to be graded near the end of the project. This allows the site excavation contractor flexibility and reduces risk of import/export that is built into their pricing.

## Storm Water Management

5. Recommendation #5 - The existing SWM pond located immediately adjacent to the north east corner of the site which is controlled by Natelli Communities has excess capacity that may be able to be utilized by this site. Utilization and/or retrofitting of the SWM to meet channel protection volume in conjunction with approval of Frederick County to meet the minimum Pe of 1.0” could result in significant cost reduction and elimination of long-term ESD maintenance obligations.
  - a. The site identifies and meets a target Pe of 1.8” by providing (slightly more than) 36,895 CF of storage. The minimum Pe to provide water quality is 1.0”, which would have been met through a volume of approximately 20,500 CF. With the existing pond, an argument could be made for meeting the quality requirement onsite and utilizing the pond for the balance of treatment required.
6. Recommendation #6 - The computations identify 16 facility drainage areas, 13 of which are over-designed and provide more storage than can be credited. Of those, 10 facilities are currently designed to the maximum depth of planting media, which is 4’. Each could be decreased by at least 1’, some by 2’ (to the minimum planting media depth). Some or all could also utilize a reduced facility footprint and still provide the maximum credit volumes.
7. Recommendation #7 - Infiltration/Recharge: The report’s narrative indicates that recharge is met through providing ESD, but each individual facility then computes a recharge volume in the stone section of the facility. Since they are currently under-drained, believe recharge would not be computed, and the storage above the underdrain pipe could be added in to the ESD calculations (further reducing facility depth/footprint requirements). Alternatively, a review of the geotechnical report suggests some potential areas of infiltration; these facilities could utilize over-drains with stone storage below, decreasing the depth of the site’s storm drain system.
8. Recommendation #8 - All facilities are designed to a maximum contributing drainage area of 20,000 sqft. It may be feasible to combine facilities in some instances.
9. Recommendation #9 – The landscape planting design for the ESD facilities far exceeds the standards required for ESD techniques in Frederick County and will be nightmarish for FCPS to routinely maintain. We suggest minimization in the number of plantings and utilization of varieties that will have high survivability and require low maintenance.
10. In summary, we believe that substantial savings could be realized without time consuming or costly redesign. We would strongly encourage prompt contact with Natelli to request permission to access the SWM Pond on his property. Substantial initial cost savings and routine maintenance savings could result from storm water redesign and redesign of the associated storm drain system however, this redesign could take several months to complete. We would recommend that a meeting should be scheduled with the design team, Frederick County review staff (and Sub-committee members if FCPS requests attendance) to resolve how their SWM regulations can be met in the context of the recommendations above. For example, if a PE of 1.0” is feasible we would recommend the following:

- Reducing the size of or combining ESD #1,2&3. Reduced depth translates through entire storm drainage system. Dry swale techniques would be ideal as they would minimize storm drain depth and may allow for overland flow in some conditions.
- Combining ESD #5 & 6
- Eliminating ESD #7 & 8 and utilize sheet flow credits
- Using dry scale techniques for ESD # 15,14,13,12,11
- Minimizing plant material and utilizing sod-only where permissible and no landscape design element is required by FCPS.

## **Butterfly Ridge Elementary**

### **General Site Design**

The site layout is efficient and compact. While plans have not progressed as far as the Sugarloaf Plans, the site appears to have been challenged by the following constraints:

- Extended frontage along Butterfly Lane requiring frontage improvements.
  - Intersection improvements at McCain Drive.
  - An exceptionally long storm drain outfall extending onto Frederick City Property
1. Recommendation #1 – Contact Frederick City to resolve whether an open channel storm drain outfall could be utilized in-lieu of burying a 30” pipe which is likely to conflict with their future improvements.
  2. Recommendation #2 – Site Paving - Reduce pavement section depths in general parking areas – See Recommendation #3 for Sugarloaf Elementary.
  3. Recommendations#3 – Storm Drainage - While profiles were not available at the time of review it would appear that the storm drain will once again be driven deep by ESD facilities. Efforts should be made to minimize the depth and number of facilities particularly at the up-stream end of the site. Doing so will reduce the quantity and expense of the storm drain system.

### **Storm Water Management**

4. Recommendation #4 – Without the benefit of computations it would appear that the site is over-designed due to the number of facilities that are planned and the apparent small size of some of the contributing drainage areas to individual facilities.
5. Recommendation #5 – Reduce the depth of the ESD facilities requiring underdrain which drives excessive storm drain depths and investigate the possibility of infiltration which is typically not allowed in karst areas of the City but on this site may be acceptable due to the shale formation.
6. Recommendation #6 – If micro-bioretenion facilities are planned in the parking lot islands, we would strongly encourage looking for alternative design approach. These facilities are generally inefficient and costly to construct due to the site constraints after the site has been stabilized. The should be used as a last resort only particularly given the relatively small size of the contributing drainage areas. Consider utilizing dry-swale treatments in these areas.

7. Recommendation #7 - Meet with Frederick City Engineering to determine whether consideration can be given to reduce the target  $P_e$  for the site. It appears that some room may exist between McCain Drive extended and the site parking for a quantity facility which could allow an approach similar to that outlined by

**INNOVATION AND COST CONTAINMENT - MASTER FORM**

(Facsimile of "Outline of Building Systems" - David Lever, September 15, 2016, Document)

BUILDING SYSTEM	QUANTITATIVE CONSIDERATIONS						QUALITATIVE CONSIDERATIONS				
	CONSTRUCTION COST (\$/s.f. unless otherwise specified; mid-2016)		ANTICIPATED LIFE OF SYSTEM (years)	AVG. ANNUAL M&O (\$/s.f./year)	AVG. ANNUAL LIFE-CYCLE RENEWAL COST (\$/s.f./year)	LIFE CYCLE COST	PROS	CONS	OTHER CONSIDERATIONS	COMMENTS	
	LOW	HIGH									
<b>1 STRUCTURAL</b>											
a.	<b>Masonry Bearing</b> Reinforced masonry bearing walls, open web bar joist roof framing, wide flange beam floor framing	\$23.92	\$26.13	50+ years	Frame does not require maintenance	Frame does not require maintenance	Frame does not require maintenance	Efficient material use; durability; lateral bracing; flexibility of program and system design; fireproof; easily procured in all delivery methods; no column protrusions. Perceived as a more durable wall structure than a steel bearing structure infilled with light gauge construction. May come out of the ground quicker due to shorter lead time for materials.	Slow construction due to steel not being set until masonry walls are constructed; limits future modifications; limited flexibility for openings. Installation requires specific weather conditions, or measures (additional cost) must be taken to continue progress.		Includes cost of CMU walls. HVAC costs are comparable among framing systems, depend mainly on the quality of the system selected.
b.	<b>Steel Frame</b> Steel column and beam frame, open web bar joist roof framing, wide flange beam floor framing	\$26.82	\$36.57	Frame - 50+ y	Frame does not require maintenance	Frame does not require maintenance	Frame does not require maintenance	Quick steel erection; flexibility of building plan independent of columns; infill walls can be less expensive (GWB); extremely flexible for openings; easily procured in all delivery methods. Can be erected in most weather conditions. Often quicker to get building dried in. Less maintenance.	Redundant use of materials (steel frame + infill walls); additional expense of lateral bracing; steel is not fireproof. Initial fabrication time. Can be perceived as less durable depending on exterior envelope selection		Low cost includes frame only; high cost includes 8" non-bearing CMU infill walls. HVAC costs are comparable among framing systems, depend mainly on the quality of the system selected.
c.	<b>Pre-Engineered Metal Building</b> Pre-engineered steel bents for column and roof framing, roof purlins between bents, wide flange beam floor framing	\$23.42	\$32.83	Frame - 50+ years	Frame does not require maintenance	Frame does not require maintenance	Frame does not require maintenance	Can result in lowest initial cost when envelope is entirely provided by the PEMB manufacturer in their design/build delivery method; permits accelerated fast track design/manufacturer/construction schedule.	Associated PEMB system components required to achieve lowest cost are not durable and increase life cycle cost; pre-purchased design/build single source delivery method is difficult to procure for public projects; inflexible to some system types i.e. rooftop units; inflexible to future changes/loading changes; additional expense of lateral bracing; system cannot be fireproofed; angled bents can protrude into spaces.	Design engineer MUST accurately anticipate all structural loads (DL, LL, Seismic, Wind). Should also anticipate future loads for new roofing (re-roofing) and similar systems.	HVAC costs are comparable among framing systems, depend mainly on the quality of the system selected.
d.	<b>Tilt-up Wall Construction</b>	No information at this time; third-party research appears to be lacking. Indications that cost savings accrue above 50,000 sf. Concrete may be less subject to cost fluctuations than steel.		Indefinite for structural components; exterior and interior finishes depend on quality, installation.	No information.	No information.		Speed of building enclosure, with overlapping with sitework; no transportation of exterior wall panels is required; smaller work crews; locally sourced materials; durable and fire-resistant; very low exterior maintenance unless finishes are applied.	Requires large, uninterrupted slab area for onsite manufacture of panels, or construction of separate casting bed; best suited to building types with long straight runs, e.g. warehouses; concrete exterior walls continue to harden throughout life, may limit ability to install new openings for programmatic or building system requirements; limitations on ability to install new wiring etc. on interior. Requires interior finishing with gypsum board.	Early, intensive collaboration of architect, modular manufacturer and onsite contractor is essential. Supply chain is untested for schools in mid Atlantic. May work best under a Design-Build methodology.	HVAC costs are comparable among framing systems, depend mainly on the quality of the system selected. Can accommodate a range of aesthetic approaches to treatment of building envelope.
e.	<b>Insulated Concrete Form (ICF)</b>	No information at this time. May reduce costs through worker productivity gains. Concrete may be less subject to cost fluctuations than steel.		Indefinite for structural components; insulation life will depend on usage and finishes; exterior and interior finishes depend on quality, installation.	No information.	No information.		Very high energy performance due to continuous insulation and thermal mass properties; exterior wall construction and insulation done in single step. Consistent air-infiltration reduction. As a bearing wall system, allows for reduction of structural columns.	Concrete exterior walls continue to harden throughout life, may limit ability to install new openings for programmatic or building system requirements; interior foam thickness is said to accommodate changes to wiring etc., but this will reduce thermal capacity. Requires interior finishing with gypsum board - full height through interstitial. Relatively few area school contractors experienced in this construction technique.	Supply chain is untested for schools in mid-Atlantic. May work best under a Design-Build methodology.	HVAC costs are comparable among framing systems, depend mainly on the quality of the system selected. Can accommodate a range of aesthetic approaches to treatment of building envelope.
f.	<b>Modular Construction</b> (defined as offsite manufacture and assembly of complete wall, floor or ceiling assemblies, or complete spatial units, for assembly onsite)	Insufficient sample to compare to conventional construction; cost difference is likely to depend on design, site conditions, distance of manufacturer from site.		25-50 years, depending on materials, construction.	No information; likely to vary per quality of design and construction.	No information; likely to vary per quality of design and construction.		From a 2015 report comparing modular to conventional construction: Cost savings of up to 16% (but users claim cost effectiveness rather than cost savings, i.e. avoidance of change orders); schedule savings of up to 45% (due to concurrency of sitework with offsite premanufacture and preassembly, avoidance of weather-related delays); improved safety record and quality control; reduced waste and site damage during construction.	2015 report: State highway permitting and transportation requirements of units limits size and may impose delays; lack of flexibility to alter design after initial decisions.	Early, intensive collaboration of architect, modular manufacturer and onsite contractor is essential. Finished building can be indistinguishable from site-built. Available in wood, steel, concrete. May work best under a Design-Build methodology.	May convey a bad image due to poor-quality products from the past; the industry is said to have improved substantially in quality, durability, ability to meet client needs, and acceptance by architectural profession. Used extensively for schools in Alberta, Canada; no recent experience in Maryland.

BUILDING SYSTEM	CONSTRUCTION COST (\$/s.f. unless otherwise specified; mid-2016)		ANTICIPATED LIFE OF SYSTEM (years)	AVG. ANNUAL M&O (\$/s.f./year)	AVG. ANNUAL LIFE-CYCLE RENEWAL COST (\$/s.f./year)	LIFE CYCLE COST	PROS	CONS	OTHER CONSIDERATIONS	COMMENTS	
	LOW	HIGH									
<b>2 MECHANICAL/ HVAC</b>											
a.	Variable refrigerant flow (VRF) with supporting dedicated outdoor air systems (DX cooling + gas-fired heating)	\$40	\$44 - simple system w/ fresh air. \$65 - meets ASHRAE standards	16-20 years (entire system, including piping)	\$0.70	TBD	~ \$6.3M (based on 20-yr LCCA)	Excellent for retrofit and additions projects, as well as administration areas; short lead times; smaller ductwork sizes; flexible design for space zoning; flexible during phased construction; quiet operation; low first cost; good energy efficiency with built-in smart thermostats; space conditioning systems are separate from ventilation systems, reducing size of ductwork; permits independent heating or cooling within each space; distributed system lessens single point of failure, effective in classrooms; energy recovery easily incorporated; easy to maintain.	Controls integration concerns with central energy management systems, intermittent communication with BAS; less flexibility of control; not as effective in very cold temperatures; manufacturer dependency (equipment not interchangeable); limited system redundancy; limited application in large spaces; ventilation system is designed and constructed separately; difficult to expand or modify an existing system once installed; entire system will require replacement at end of its operating life, including refrigerant piping line sets; refrigerant leaks can be difficult to locate.	Great for stand-alone building projects (no central county energy management system). No guarantee refrigerants will be the same in 20 years. Training on equipment is very important. Most manufacturers will provide free training if their system is installed.	Ceiling cassette units lower cost; horizontal ducted units higher cost
b.	Four-pipe variable air volume (VAV) rooftop units with single duct terminal units (need four-pipe arrangement with VAV, unless cooling is DX)	\$48	\$50	25 years overall; 20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.	\$0.75	TBD	~ \$7.2M (based on 20-yr LCCA)	Allows for independent heating or cooling within each space; reduced filter maintenance; less mechanical equipment than other system options; central heating system redundancy easily accomplished; minimal floor area required to support system; "free-cooling" (economizer) available; quiet operation.	High first cost; larger ductwork sizes; difficult for retrofit projects, not as flexible for changes to floor plans over time; space conditioning and ventilation systems are not independent; higher minimum outdoor air quantities; difficult to incorporate energy recovery.	If system is operated as a two-pipe system, the thermal comfort benefit of this system is eliminated; therefore, first cost increase of system (as compared with two-pipe systems) is essentially wasted. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replacement.	Costs assume non-fan powered VAV Units
c.	Four-pipe fan coil units with supporting four-pipe dedicated outdoor air systems	\$45	\$46	20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.	\$0.85	TBD	~ \$7.0M (based on 20-yr LCCA)	Good for retrofit projects; smaller ductwork sizes; good energy efficiency; central heating system redundancy easily accomplished; space conditioning systems are separate from ventilation systems; permits independent heating or cooling within each space; energy recovery easily incorporated.	High first cost; equipment may need to be located outside of classroom area for compliance with LEED acoustical requirements; some maintenance staff not familiar with system operation.	If system is operated as a two-pipe system, the thermal comfort benefit of this system is eliminated; therefore, first cost increase of system (as compared with two-pipe systems) is essentially wasted. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replacement.	
d.	Two-pipe fan coil units with supporting two-pipe dedicated outdoor air systems	\$42	\$43	20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.	\$0.70	TBD	~ \$6.4M (based on 20-yr LCCA)	Good for retrofit projects; smaller ductwork sizes; low first cost; good energy efficiency; central heating system redundancy easily accomplished; space conditioning systems are separate from ventilation systems; energy recovery easily incorporated; lower first cost than four-pipe systems.	Occupant temperature complaints typical during the spring and fall seasons; potential for overheating interior spaces during the winter; equipment may need to be located outside of classroom area for compliance with LEED acoustical requirements.	Occupant thermal comfort must be considered before proceeding with this system. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replacement.	
e.	Vertical geothermal heat pump units with supporting dedicated outdoor air systems (ground source heating and cooling)	\$44 (excludes geothermal field)	\$45 (excludes geothermal field)	20 years equipment, 35-40 years piping and ductwork, 40-50 years outdoor geothermal piping.	\$0.70	TBD	~ \$6.9M (based on 20-yr LCCA)	Smaller ductwork sizes; no central equipment (boilers or chillers); excellent energy efficiency; energy recovery easily incorporated; space conditioning systems are separate from ventilation systems; permits independent heating or cooling within each space; energy recovery easily incorporated; distributed system allows less overall disruption when maintenance needed (no central plant).	High first cost; large "open" site area required, all sites may not support well fields; risk of unforeseen conditions during drilling of geothermal borings; equipment typically located outside of classroom area for compliance with LEED acoustical requirements; fans have limited abilities; some maintenance staff not familiar with system operation; large amount of heat pump machinery to maintain; remediation can prove costly if system is not properly designed.	Operating setpoint of geothermal pumps must be properly established during balancing to provide energy efficiency; reuse of building piping and site piping feasible when other equipment needs replacement. Unknown life cycle of geothermal field, could limit future use of sites depending on location of well field.	Cost of geothermal field ~ \$12 to \$13 per LF of vertical geothermal well. Improvements in equipment and automatic temperature controls, combined with continuing high cost of geothermal wells, makes this option less attractive than it used to be.

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	LOW	HIGH								
<b>3 ELECTRICAL</b>										
a. Standard fluorescent	\$4.00	\$4.50	30,000 hours linear fluorescent/ballast (avg).				Readily available materials and installers. O&M well known.	Shorter life; color quality can be problematic.		
b. LED lighting (vs standard fluorescent lighting)	\$4.10	\$4.60	40-50 years fixture housings; 50,000 hours LED boards/drivers; 20,000 hours fluorescents	Fixture wattage x Hours per Year x Electric Utility Rate	LED / driver replacement every 15- years	First Cost + Lamp & ballast/driver replacement	LED has excellent energy and maintenance considerations; higher efficacy (lumens per watt) and reduced frequency of lamp replacement; tighter and more accurate optic control from lamp source; fewer fixtures needed to achieve same lighting levels (9 LED is equivalent to 12 fluorescent).	LED has higher first cost; bare lamp can create harsh light (glare); color rendition is a challenge in areas with special lighting requirements; dimming systems more expensive than for standard fluorescent bulbs.	LED technology continues to improve and costs begin to align with fluorescent. New fixtures are primarily designed around LED technology; exact life cycle capabilities are unknown. Costs of LED will continue to decline.	10% to 20% premium for LED fixtures, as compared with fluorescent; premium reduced with added level of lighting controls.
c. Daylight harvesting	\$2.00	\$3.00	20 years	Typically an annual service contract is maintained w/ controls manufacturer	N/A	First Cost + Annual Service Contracts	Improves overall energy savings (vs basic controls).	Higher cost than basic lighting controls; May require higher level of programming; Requires proper start-up and commissioning. Increase of window area may require increase of HVAC capacity. With reduced cost and improved quality of LED lighting, advantages of light harvesting diminish.	Required by applicable Energy Codes for most facilities and select space types; required for most sustainable design compliance paths.	
d. MC (metal clad) cable vs rigid conduit	\$0.40/l.f. for MC cable	\$0.50 for rigid conduit	40 years	N/A	N/A	First Cost	Can pull additional or replacement wiring in rigid conduit; Rigid conduit results in cleaner installation; MC Cabling can be installed in tight spaces.	Rigid conduit has higher material and labor installation costs than MC Cabling	This is typically a value-engineering decision for branch circuit installation; not applicable for feeders.	Average costs
e. Aluminum wire vs copper wire mains (From main electrical disconnect to subpanels only)	\$0.60/l.f. for aluminum	\$0.75/l.f. for copper	40 years	N/A	N/A	First Cost	Copper wire sizes typically smaller than aluminum; copper terminations are more durable and do not experience same thermal expansion issues as aluminum.	Copper has higher first cost; aluminum terminations may require regular thermal imaging; larger aluminum wiring size may require increase in conduit size.	This is typically a value-engineering decision for feeders; Not applicable for branch circuits or connections to motors.	Average costs; copper typically a 20%-40% premium; costs highly fluctuate.
f. Emergency generator and switch gear	\$50,000 per installation	\$75,000 per installation	40 years	N/A	N/A	First Cost	Provisions are easy to incorporate in distribution system design for new construction.	High maintenance cost for permanent generator; may be difficult to design in partial renovations or additions; provisions may never be utilized (or underutilized); additional space requirements for generator and distribution equipment; statewide standards for connection points for portable generators (docking stations) have not been created.	Purchase of a generator sufficient in size for shelter use is costly, as well as maintenance. Not installing a generator requires an agreement w/ a rental outfit or another governmental entity to ensure a generator will be available in an emergency. Schools are not high as priority for emergency rental.	Costs based on new construction; \$75,000 - \$100,000 premium for renovations; costs include generator equipment.

BUILDING SYSTEM	CONSTRUCTION COST (\$/s.f. unless otherwise specified; mid-2016)		ANTICIPATED LIFE OF SYSTEM (years)	AVG. ANNUAL M&O (\$/s.f./year)	AVG. ANNUAL LIFE-CYCLE RENEWAL COST (\$/s.f./year)	LIFE CYCLE COST	PROS	CONS	OTHER CONSIDERATIONS	COMMENTS	
	LOW	HIGH									
<b>4 PLUMBING</b>											
a.	<b>PVC vs cast iron</b> (for sanitary and storm water conveyance. Below ground and above ground)	\$34/l.f. (PVC)	\$39/l.f. (cast iron)	35-40 years for both types	N/A	N/A	N/A	Cast iron is typically quieter than PVC (application of piping insulation may help with achieving similar noise levels). PVC has a lower cost, is easier to install, and is typically easier to maintain.	PVC piping is not acceptable for return air plenums, which may be present within retrofit type projects (not new construction).	Always contact maintenance personnel regard piping material preference.	~\$0.40-\$0.60/sf savings with PVC.
b.	<b>Piped secondary roof drainage</b> (internal overflow drains) vs. through-the-wall scuppers	Not available	Not available	35-40 years for piped systems; 20 years for scuppers	N/A	N/A	N/A	Through-the-wall scuppers reduce cost by eliminating secondary drainage piping, saving ceiling space within the building. Piped secondary roof drainage systems provides flexibility in locating roof drains.	Different systems require different roof tapers and slopes; structural steel design (slopes) may not permit through-the-wall scuppers; flashing at scuppers can become problematic over time; scuppers are typically less aesthetically pleasing; require protection of exterior walls from staining and erosion control at ground. Scuppers in lieu of piped secondary roof drainage can provide a visual confirmation of primary drains issues/failure.	Schematic level VE consideration - utilize through-the-wall scuppers in lieu of piped secondary roof drainage. Both require high level of routine maintenance to prevent blockage by leaves, debris.	~\$0.75-\$1.00/sf premium for piped secondary drainage; premium reduced with PVC.
<b>5 BUILDING ENVELOPE</b>											
<b>5A Exterior Walls</b>											
a.	<b>Light gauge metal framing with 4" brick veneer</b> 1¼" air space, 2¼" cavity spray foam insulation with 5/8" gyp. sheathing, 6" metal studs, 5/8" gyp. board	\$31.00	\$33.00	45+ yrs.				Very durable, graffiti resistant, very tight system against wind infiltration, requires little maintenance, not as temperature sensitive as full masonry systems, not subject to UV degradation, wide range of colors,	Spray foam insulation temperature sensitive, veneer temperature sensitive		
b.	<b>Light gauge metal framing with insulated aluminum panels</b>	\$32.00	\$35.00	45+ yrs.				Not as temperature sensitive as masonry systems, good thermal, characteristics,	Metal panels subject to denting, subject to vandalism/graffiti, more maintenance required for caulk joints		
c.	<b>CMU with insulated cavity and 4" brick veneer</b>	\$35.00	\$37.00	45+ yrs.				Provides very durable interior and exterior surfaces	Interior CMU walls temperature sensitive, availability of skilled masons becoming problematic, not as wind tight as other systems, difficult to install utility infrastructure	Most new school masonry is installed in winter. Requires tenting and temperature control	
d.	<b>Light gauge metal framing with exterior insulation and finish system (EIFS)</b>	\$23.00	\$26.00					Framing not temperature sensitive, EIFS finish is temperature sensitive, provides good thermal characteristics, wide variety of color	Very prone to damage/vandalism; colors fade/hard to match color; subject to moss/lichen etc. growth in certain exposures		
e.	<b>Pre-cast autoclaved aerated concrete wall panels with 4" brick veneer (AAC)</b>	\$63.00	\$65.00	45+ yrs.				Easy to work with, pre-cast block very light weight, can be routed to install utilities, excellent thermal properties	Limited suppliers, unfamiliarity in industry		
<b>5B WINDOWS &amp; STOREFRONTS</b>											
a.	<b>Aluminum frame</b> with thermal break & insulated low-E glass	\$975 ea. installed		45+ yrs.				Frames require little maintenance, do not rust like steel, insulated glass and thermal breaks minimizes heat transfer and condensation, frames do not require painting, Low E coating reflects solar UV & infrared energy	Aluminum has a large coefficient of expansion	This is standard system used in commercial construction	All costs based on 3' X 5' window size
b.	<b>Vinyl frame</b> with insulated glass	\$500 ea. installed		10-15 yrs.				Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum	Vinyl doesn't hold up well to UV, becomes brittle, significantly shorter lifespan than aluminum	Typically used in residential construction	
c.	<b>Fiberglass frame</b> with insulated glass	\$600 ea. installed		10-20 yrs.				Dimensionally stable, frames do not require painting, lower first cost than aluminum	Fiberglass deteriorates with UV exposure and exhibits "fiberbloom", shorter lifespan than aluminum	Typically used in residential construction	
d.	<b>Vinyl clad wood frame</b> with insulated glass	\$750 ea. installed		15-20 yrs.				Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum	Vinyl doesn't hold up well to UV, becomes brittle, significantly shorter lifespan than aluminum	Typically used in residential construction	
e.	<b>Metal clad frame</b> with insulated glass	\$675 ea. installed		20-30 yrs.				Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum	Paint fades and chalks from UV exposure, longer lifespan than vinyl and fiberglass	Typically used in residential construction	

BUILDING SYSTEM	CONSTRUCTION COST (\$/s.f. unless otherwise specified; mid-2016)		ANTICIPATED LIFE OF SYSTEM (years)	AVG. ANNUAL M&O (\$/s.f./year)	AVG. ANNUAL LIFE-CYCLE RENEWAL COST (\$/s.f./year)	LIFE CYCLE COST	PROS	CONS	OTHER CONSIDERATIONS	COMMENTS
	LOW	HIGH								
<b>6 ROOF</b>										
a.	Standard 4 ply hot asphalt with CSPE (Hypalon) flashings over sloped structure with 2-part insulation system	\$11 - \$14	\$18 - \$22	25-35+ yrs.			Redundancy, durability, tried and true technology, long lifespan, withstands foot traffic, can obtain 25 year warranty	Higher first cost, more difficult to repair, requires hot asphalt, produces fumes, may require school to be vacated, limiting the time available for installation to summer.	Very few flashing failures with CSPE flashing over the last 25 years	All 1st costs based on 2 layers of R-25 polycyanurate insulation & 1/2" coverboard w/o vapor barrier
b.	Single ply TPO	\$16 - \$18	\$14 - \$17	10-15 yrs.			Low first cost, heat welded seams, 10' wide sheets, less odor than hot asphalt	Only one layer of protection, about 15 yrs. on market, exhibits premature shrinkage, subject to cracking where water ponds (excluded from warranty), subject to UV, requires skill to weld seams, difficult to repair, very slippery, vulnerable to impact (hail, stones, etc.)	Most new school roofing performed during winter. Not conducive to cold adhesives	
c.	Single ply mechanically fastened EPDM	\$10 - \$12	\$13 - \$15	18-20 yrs.			Low first cost, 50 yrs. experience, requires little skill, 10' wide sheets, no hot asphalt odors	Only one layer of protection, prone to seam failures, seams fail "all at once", material shrinks from UV exposure, not as durable as multi-ply systems, cold adhesives temperature sensitive,	Most new school roofing performed during winter. Not conducive to cold adhesives	
d.	Cold 2 ply modified bitumen	\$13 - \$16	\$15 - \$18	15-20 yrs.			lower cost than 4 ply systems, provides better durability than single ply systems, available in light colored granules	Shorter life expectancy than 4 ply systems, granular surface not as protective as stone ballast, granules wear off exposing ply, seams are weak point, cannot fill ponding areas like hot systems	Most new school roofing performed during winter. Not conducive to cold adhesives	
e.	Steel standing seam metal (aluminized steel with Kynar finish)	\$25.00	\$35.00	30-35 yrs.			Very durable, available in range of colors, little maintenance, long life,	High first cost, must be installed over sloped structure, requires snow guards along roof edges, requires external gutter system subject to snow/ice damage, difficult to re-paint finish, large coefficient of expansion	Subject to wind blown leaks at joints. Attic area can be used for mechanical equipment, ducts, piping, etc.	
f.	Fluid applied (urethane)	\$13 - \$16	\$16 - \$19	25-35?			Highly reflective, flexible elastomeric coating withstands expansion/contraction, requires little skill, long life expectancy anticipated.	Temperature sensitive, not a long history with this product	Most new school roofing performed during winter. Not conducive to cold applied products	
<b>7 FLOOR</b>										
a.	Conventional vinyl composite tile (VCT) flooring systems	\$1.50	\$3.00	15			Good wear properties if properly cleaned and maintained. Readily available product and installer base. Large color palette. Relatively quick installation. Understandable O&M requirements. Good hygiene levels.	Relatively short life cycle. Easily damaged soft product, scuffs easily from chairs, tables. Poor acoustic qualities. Requires extensive O&M; chemicals required to routinely strip and wax. Not environmentally/green friendly. Telegraphs subfloor imperfections if latter is not prepared correctly.	Essential to maintain adequate "attic stock" for occasional replacement.	
b.	Conventional quartz tile flooring systems	\$2.65	\$3.00	20			Readily available product. Readily available installer base. Large color palette. Relatively quick installation. Understandable O&M requirements. Good hygiene levels.	Relatively longer life cycle. Not easily damaged. Poor acoustic qualities. Requires moderate O&M. Chemicals required for O&M. Higher initial costs than VCT.	Essential to maintain adequate "attic stock" for occasional replacement.	
c.	Carpeted flooring systems	\$2.50	\$4.40	8-10 to 12-14			Readily available product and installer base. Large color palette. Comes in squares/tiles/rolls. Relatively quick installation. Understandable O&M requirements. Good acoustic qualities. Relatively poor hygiene levels.	Relatively shorter life cycle. More easily damaged. Increased O&M requirements. Damage cannot easily be fixed when rolled goods used. Can promote mold and mildew if not properly cleaned and dried; need to run the A/C and fans to dehumidify and dry spaces post cleaning. Not environmentally/green friendly.		
d.	Terrazzo flooring systems	\$12.00	\$25.00	40-100			High quality product and appearance. Most durable. Easy to O&M. Good hygiene levels.	Higher first costs might be prohibitive. Limited installer base. Longer to install. Weight must be taken into consideration by design team. Limited color palette. Poor acoustics.		



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	LOW	HIGH									
<b>7. Floor (Cont.)</b>											
e.	Epoxy or poured resinous flooring system	\$10.00	\$14.00	15-20				Quality product and appearance. Relatively durable. Large color palette. Relatively easy to O&M. Good hygiene levels.	Higher first costs might be prohibitive. Limited installer base. Longer to install. Limited color palette. Poor acoustics. Not as environmentally green friendly.		
f.	Finished concrete	\$2.50	\$20.00	40 - 100				Very durable product that is very easy to clean and maintain (regular floor cleaning required). Can have an attractive, terrazzo- like finish quality using different aggregates and glass. Excellent slip resistance	Limited number of contractors, quality is contingent on contractor. Grinding process affects the construction schedule. Poor acoustics. Joints may not be aesthetically appealing. Potential visible defects (exposed rebar, foot prints, rust, non-uniform appearance). Floor protection during construction is required (additional cost). Use of burnisher may be necessary to restore finish (gloss). Requires greater shrinkage crack control. Concrete cracks, cracking will show in exposed floor. Control joints will be visible and must be carefully filled. Limited color and pattern options.	Grinding process (wet vs. dry). Consideration of install timing during construction could impact cost. Staining of concrete can provide greater aesthetic options, however stains are not UV stable. Will require refreshing of stain every 10 years	Cost varies by finish: Cream Finish \$4.00-\$6.00/sf Sand Finish \$6.00-\$10.00/sf Exposed \$10.00-\$16.00/sf Several levels of polishing greatly influence initial cost of flooring. Exposed aggregate finishes can mask cracking, however costs approach terrazzo system.
<b>8 WALL (interior)</b>											
a.	Conventional CMU wall systems	\$10.50/s.f. of wall - 8" CMU	\$15.00/s.f. of wall - 12" CMU; as high as \$35.00/sf of wall	40-100	Requires little maintenance			Readily available product and installer base. Rugged and durable product. Good color palette once painted, or with integral color. Low O&M requirements. Can aid in acoustics. Environmentally/green friendly.	Higher first cost. Not as adaptable as drywall partitions. Slower construction speed. Weight must be accounted for by design team.		
b.	Conventional gypsum wallboard (drywall) system	\$7.00/s.f (\$10.50/i.f.)	\$9.75/s.f.	20				Lower first cost. Readily available product and installer base. Quicker installation process. Good color palette once painted. Readily adaptable to changes in space configuration.	High O&M requirements. Can deteriorate quickly under ordinary use in school. Not appropriate for high traffic areas.	Costs are for wall 10'-12' high	
c.	High impact gypsum wallboard (drywall) systems	\$8.25	\$11.00					Relatively higher first cost than conventional gwb/drywall. Readily available product and installer base. Quicker installation process. Good color palette once painted. Readily adaptable to changes in space configuration. More durable than conventional gwb, but appropriate grade of durability must be selected.	High O&M requirements. Requires more O&M than CMU or glazed tile surfaces.		
d.	Tiled wall overlayment systems	\$10.00	\$13.50					Readily available product and installers. Useful in high traffic areas. More durable than drywall alone. Good color palette. Easy to clean. Does not require painting. Environmentally/green friendly.	Higher first cost than drywall alone. Longer installation time than drywall alone.		
<b>9 CEILING</b>											
a.	Conventional 4'x2' lay in acoustical ceilings tile and grid systems	\$2.20	\$3.00					Readily available product and installer base. Reasonable pattern palette. Relatively quick installation. Understandable O&M requirements. Easy to replace tile by tile. Good acoustic qualities. Environmentally/green friendly. Provides accessibility to MEP systems above ceiling.	Relatively soft product. Easily damaged by contact or moisture. Can sag in high humidity environments. Can support mildew or mold growth.		
b.	Conventional 2'x2' lay in acoustical ceilings tile and grid systems	\$2.70	\$3.50					Readily available product and installer base. Reasonable pattern palette. Relatively quick installation. Understandable O&M requirements. Easy to replace tile by tile. Good acoustic properties. Environmentally/green friendly. Provides accessibility to MEP systems above ceiling.	Relatively soft product. Easily damaged by contact or moisture. Can sag in high humidity environments but less so than 4'x2' tiles. Can support mildew or mold growth.		

BUILDING SYSTEM		CONSTRUCTION COST (\$/s.f. unless otherwise specified; mid-2016)		ANTICIPATED LIFE OF SYSTEM (years)	AVG. ANNUAL M&O (\$/s.f./year)	AVG. ANNUAL LIFE-CYCLE RENEWAL COST (\$/s.f./year)	LIFE CYCLE COST	PROS	CONS	OTHER CONSIDERATIONS	COMMENTS
Ceiling (Cont.)		LOW	HIGH								
c.	Drywall (hard) ceiling systems	\$6.00	\$8.75					Readily available product and installer base. Good color palette once painted. Understandable O&M requirements. Good hygiene levels. Environmentally/green friendly. Stable and durable.	Higher first cost. Limits access to above ceiling space and equipment. Can be damaged by humidity and water leaks.		
d.	Perforated metal pan type ceiling systems	\$20.00	\$50.00					Limited product availability. Limited installer base. Understandable O&M requirements. Good hygiene levels. Provides limited accessibility to MEP systems above ceiling. Good acoustic qualities.	High first cost. Limits access to above ceiling space and equipment.		

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