From: James Bubar [mailto:james@bubar.org]
Sent: Sunday, September 06, 2020 10:10 AM
To: Michael Behrendt
Cc: Todd Selig; 'England, Richard'; 'James Sr. Morse'
Subject: Marginal Costs & ORCSD

Please forward the following note along with the attachments to the Planning Board. Thank you.

I support marginal cost concepts. There are ample case studies, practical examples, and educational literature on properly preparing and analyzing an organization's costs, as well as identifying the drivers for those costs. It is an effective managerial tool for improving productivity and expanding margins. I support Professor England's attempt to educate on the

subject and the high-level analysis he conducted on State-wide data and the opportunities that he suggested were available.

The attached Marginal Cost document is an overly simplified example for a two variable environment used to show the concept of step functions, marginal cost analysis, and excess cost. The attached ORCSD Marginal Cost document provides an extremely high level, superficial analysis of ORCSD costs for a 5-year period, ADM census data (proxy for enrollment), and average Towns' assessments over that period. The ORCSD document shows:

- From FY2016 through FY2019 Madbury's ADM declined .4% while their Average Assessment per ADM increased 10.4%. This is to be expected. According to marginal cost concepts, average assessment would increase with a decline in production (ADM), however the scale of this increase was not expected.
- From FY2016 through FY2019 Total ORCSD ADM (including Barrington) rose by 141.14 units or 6.9%. Unexpectedly the Average Assessment per ADM increased by 10.9%. This suggests that marginal cost savings have not materialized on growing production (ADM), and conversely ADM increases may create additional excess capacities and costs on their own.

Marginal cost analysis recommendations can work when management is unfettered and willing to implement those cost saving ideas, whether increasing sales, reducing costs, or reducing capacity. Marginal costs analysis is frequently used in a production setting (manufacturing, airlines, delivery services, etc.) and much less in a service organization (schools, town administration, etc.). The concepts are valid across all industries. Frequently management knows exactly what to do, but is limited by existing union contracts (conductors on passenger-less trains, navigators on commercial airplanes, etc.) or business/regulatory policies (employment for life in Japan, practically impossible to lay off employees in France, limit on work hours for truck drivers in the US, etc.).

I would urge everyone to reread Professor England's conclusions with an open mind, and not one solely intent on building residences of any type.

- Very weak correlation between changes in student population and changes in local education tax rate.
    - Very weak is not no correlation. In principle, I would concur with this statement.
- Need to look at particular circumstances in each district before making dire predictions.
    - I could not agree more, get the data before making any decisions. Dire predictions could be
        - do not increase ADM
        - or could be increase ADM
- Little reason to fear arrival of families with children in most communities.
    - Little to fear is not nothing to fear. When spending other people's money (OPM), a favorite pastime of governing bodies, one should get the facts first, then make the decision. As opposed to collecting random facts that support the decision already made.
- Low average class sizes and recent declines in class sizes as evidence of "excess capacity" and opportunity to school more children at little extra cost.
    - Low average class sizes may be ORCSD policy as well as an unwillingness to reduce course curriculum. The number of teachers associated with these policies may be creating the appearance of "excess capacity".

Professor England's conclusions are well supported by his analysis. In an email to Michael Behrendt he says, in part:

> "The report that I prepared for NHAR did not focus on ORCSD. In that report, I argue and demonstrate that the school tax rate does not necessarily rise if families with school children move into a town. I agree that we need relevant data from the ORCSD before we can conclude with certainty that more kids in Durham would not impact the local education tax rate. The issue at hand is whether to pursue zoning and other town policies that permit family-oriented housing to be built. My belief, pending more detailed analysis, is that we should. "

I will conclude with an apology. I am the person who stated that a child in school costs Durham $17,000 per year. That statement was based on an analysis that I prepared in 2014 or 2015 and would have used FY2013 or FY2014 ORCSD data. The current amount for FY2019 is that it costs Durham $23,455 per student per year. With the current Local School portion of our Town Tax Rate at $15.32, we now need an approximate increase in taxable property valuation of $1,531,000 to support one new student in Durham. I have never been comfortable spending OPM without solid data to support decisions that deliver a more universal community benefit.

James A Bubar

Marginal Cost

Summary

Marginal cost, for all practical purposes, is always less than average cost. The ability to disaggregate costs into like pools and identify discreet drivers for each pool is critical to implementing metric driven operational practices and/or marginal cost pricing. At this point we do not have access to the necessary accounting records and are unsure if the existing records identify costs to the granular degree required for such an implementation. We have too many unanswered questions to make a rational, educated assessment now. Decisions affecting the Town's tax rate should not be made until a more thorough analysis can be prepared.

Background

I have had no formal economic nor accounting education in cost accounting or cost analysis. I do have a BA in Administrative Science, an MBA, and was a Certified Management Accountant (CMA). My experience all came from my work in a rate of return regulated public utility. Initially I was charged with preparing Present Value of Annual Carrying Charge (PWAC) studies to evaluate alternative capital project proposals. That exposure led me to depreciation analysis, the understanding of life cycles, the various drivers for capital costs, and the long-term implications of renewals. Ultimately, as a Management Accountant, I understood the need for identifying cost pools and the drivers for each pool, whether fixed or variable, to improve the quality and effectiveness of our budgets. The real impetus for marginal cost analysis came later as we needed better measurable data to improve our operating margins and achieve heightened productivity gains.

Introduction

Marginal cost is the input required to achieve one or more units of output and, for all practical purposes, is always less than average cost. The only case where this is not true is when full capacity utilization and full productivity occur at the same time. These two events rarely, if ever, occur and are even more unlikely when different inputs have different capacities.

However, the devil is always in the details. It is very unlikely that there will be only one fixed cost pool and one variable cost pool for a single, let alone, multiple product lines. In addition, any serious discussion of fixed, variable, and marginal costs must first settle on the definition of full capacity. For example, if school is in session from 8 am to 4 pm, 5 days a week and every possible seat is full, then the school building is fully utilized for 40 hours in a 168-hour week or operating at less than 24% of capacity. Even if busses are full of children, they are operating at much less than 24% capacity and could be utilized for local public transportation during those times when not carrying children. There are already true urban environments where public transportation serves to ferry children to school and home.

My father managed a lumber manufacturer making reels for the cable industry and supplied Simplex, among many others. In the late 60s and early 70s, with telephone one-party buildouts occurring nationwide, rapidly expanding CATV networks, and the Vietnam war heating up, the mill went from 1 ½ shifts to 3 shifts and employment ballooned to nearly 900. He told me that you could look at the

production records and know which shift it was from: 1st shift was most productive, 2nd less but still worthwhile, and the 3rd shift was shut down as production and quality didn't justify the cost.

Labor costs are variable but so is the labor quality itself. Depending on how highly skilled the jobs are, it just is not as simple to plug in more inputs because that is what the cost analysis says you need. Rarely do we have employees with as varied a background as Ray LaRoche Jr., nor as willing to do whatever task is needed now. Most English teachers are not trained to step in and teach a STEM course.

The Numbers

The following table presents the basics of marginal cost analysis through an overly simplistic example of one fixed cost and one variable cost. Fixed cost of $100 has a full capacity of 10 units and variable cost has full productivity at 4 units. As each cost type reaches ideal productive capacity, the marginal cost for one additional unit increases, but remains below average except for the fixed cost additions. Direct costs have been ignored from this discussion, but if bulk purchasing opportunities exist then they can influence the analysis. Although this table presents variable costs as reacting identically to fixed costs, that is only because of this example. If production did decline, then variable costs would be shed, any idled fixed costs would remain on the books, and the average cost would increase.

You will notice that because of the different productive capacities, perfection only occurs at 20, 40, etc.; the point where units produced is evenly divisible by both fixed and variable costs. Imagine trying to find nirvana with 10 fixed cost pools and 30 variable cost pools, all having different productive capacities.

In my opinion, cost analysis and the identification of the unique cost drivers are critical to improving management efficiencies at public and private organizations. Marginal cost analysis and marginal pricing theory attempt to consume excess capacity with minimal additional costs to achieve higher operating margins.

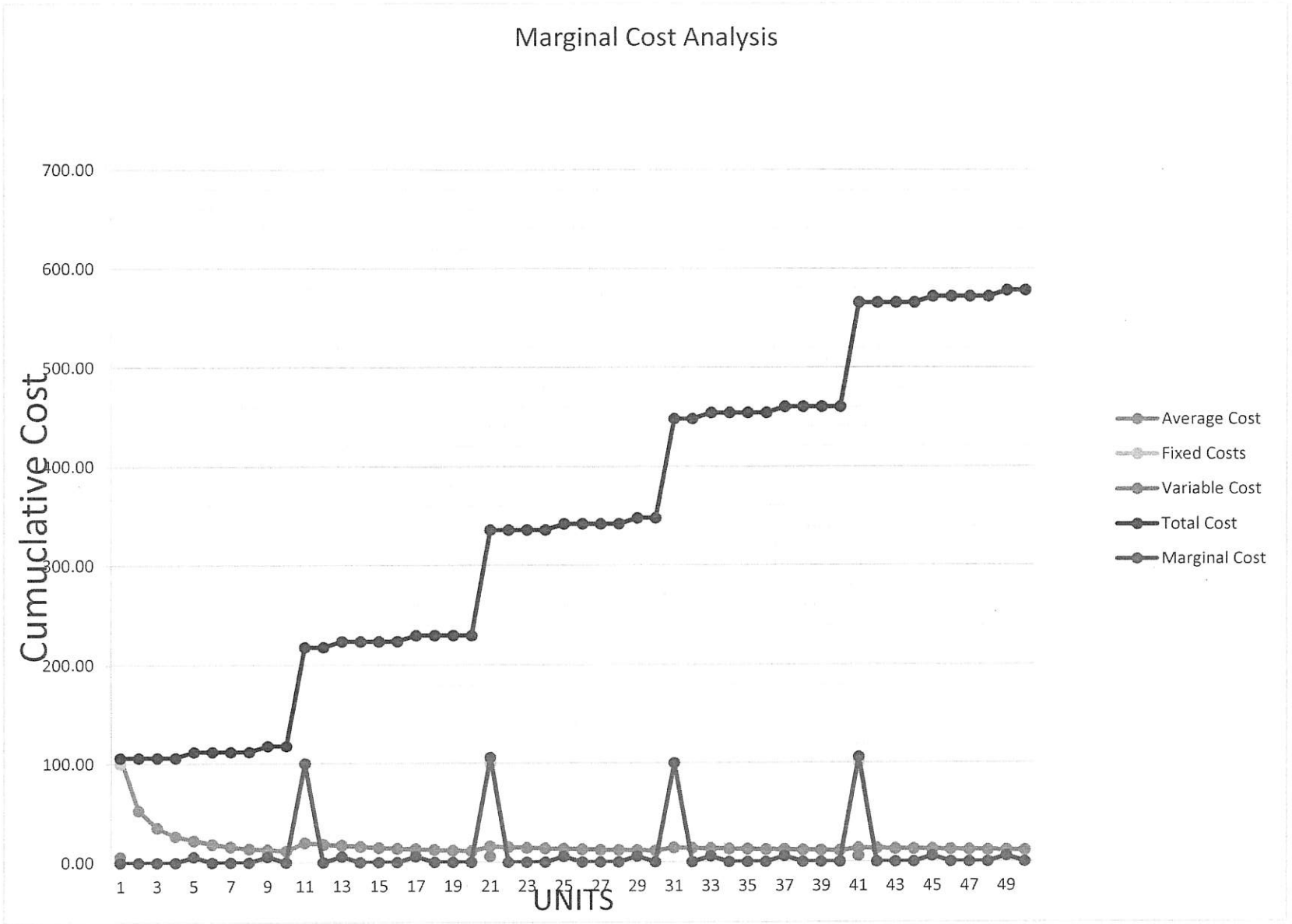
Any attempt to say that Durham should be unconcerned about significant student age population increases because we have the marginal capacity to accommodate those increases could be spun as saying that our school system is woefully undermanaged, hence the excess capacity. Management is easy and often to blame. With the data available that would be a superficial argument.

Page 12 of Professor England's presentation shows the miserable performance of ORCSD's FTE teachers when compared to Dover's. A simple calculation shows that if ORCSD could improve productivity by 1 student to 13 students per FTE, then we could furlough 13.3 FTEs or reduce costs by 5 ½ %, and at the rarefied heights of our neighbor Dover at 14.2 students per FTE we could reduce our FTEs by 27.4 for over 15% savings. The hypothetical savings are of course average and for that reason not necessarily correct. Teaching contracts are issued annually so why are we sitting on 27+ underutilized teachers?

Table 1

Units	Fixed Cost	Variable Cost	Total Cost	Average Cost	Marginal Cost
1	100	6	106	106.00	
2			106	53.00	
3			106	35.33	
4			106	26.50	
5		6	112	22.40	6
6			112	18.67	
7			112	16.00	
8			112	14.00	
9		6	118	13.11	6
10			118	11.80	
11	100		218	19.82	100
12			218	18.17	
13		6	224	17.23	6
14			224	16.00	
15			224	14.93	
16			224	14.00	
17		6	230	13.53	6
18			230	12.78	
19			230	12.11	
20			230	11.50	
21	100	6	336	16.00	106
22			336	15.27	
23			336	14.61	
24			336	14.00	
25		6	342	13.68	6
26			342	13.15	
27			342	12.67	
28			342	12.21	
29		6	348	12.00	6
30			348	11.60	
31	100		448	14.45	100
32			448	14.00	
33		6	454	13.76	6
34			454	13.35	
35			454	12.97	
36			454	12.61	
37		6	460	12.43	6
38			460	12.11	
39			460	11.79	
40			460	11.50	
41	100	6	566	13.80	106
42			566	13.48	
43			566	13.16	
44			566	12.86	
45		6	572	12.71	6
46			572	12.43	
47			572	12.17	
48			572	11.92	
49		6	578	11.80	6
50			578	11.56	

Chart 1


Marginal Cost Analysis
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Cumuclative Cost
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
UNITS
Average Cost
Fixed Costs
Variable Cost
Total Cost
Marginal Cost

The answer lies in that you are looking at a top-level average. Public institutions rarely create their accounting systems to support management cost analysis and responsibility reporting, and teachers are not equivalent units of variable cost. Teachers and courses are not as homogeneous as bus drivers and buses. How many special needs students can a teacher successfully teach? Does it make sense that a STEM class teacher would successfully teach a similar number of students as an experienced English teacher? Without disaggregating the FTE teaching pool into like groups and then deciding on what a successful measure of productivity would be for each group, you cannot begin to decide whether we are looking at poor management or an over worked teaching staff. Perhaps it is simply desired underutilization, not wanting or willing to provide education in 2 shifts to better utilize the fixed costs.

We do not have the fundamental data to determine our cost pools and what drives them. Thus, we resort to Statewide data that is aggregated at a high level and helps to point to directions that might be taken, but is fundamentally unsuited for a rigorous, marginal cost analysis.

Additional issues are the principle of fairness and equity. Page 5 in Professor England's presentation describes a basic example of the difference between average and marginal cost. However, what is not mentioned is whether the fares-plus-subsidies paid by the people already seated cover the average cost or not. If they do, how would you feel after paying your full fare if the bus driver told everyone after you in line that it was now a free bus? Should people from away always pay full fare, while those from within the State are given some recognition for the subsidies that they support? I have not been in a public school since the 8th grade. I have never had children. Is it fair that I have been subsidizing all those folks overpopulating the planet? Why do people in my situation avoid paying school taxes if they live in Riverwoods?

Conclusion and Recommendation

Professor England's presentation should be widely distributed and discussed, as it forms a solid footing for more meaningful discussions. My fervent hope is that the ORCSD Board of Directors and Management read and consider this document with the intent of embracing their fiduciary responsibilities to their stakeholders in Lee, Durham, & Madbury, adjusting their accounting to recognize meaningfully distinct cost centers, and working to identify the significant drivers for each center. Of course, this would have to be discussed within the context of community wide tolerance for change (eliminating language courses, less variety in offerings, eliminating sports, etc.), a consensus on the definition of quality education, and a determination of quality at what price. Education must not be priced beyond the community's ability to pay and should be accompanied by a set of consistent and constant operating management metrics with goals and objectives assigned accordingly.

Unfortunately, I do not see this analysis occurring. It is grueling behind-the-scenes work, and those crucial to a successful implementation of any significant change, often see it as over controlling and limiting their flexibility. People do not want to be driven, managed by a stopwatch, promoted, nor have their compensation based on a set of performance metrics if they can avoid it, more so if they fundamentally disagree with the metrics. The final attribute of a comprehensive operations management plan, performance metrics, and responsibility reporting is thorough industry common-size benchmarking to determine best in class performance.

I remain in the negative camp on expanding student population in Durham until such a time as we have a reasonable analysis of costs, cost drivers, and an operations management philosophy installed with directional metrics. I believe the best course of action for Durham is to purchase 100 acres of developable land outside of wetland/shoreland restrictions in Madbury and build the needed middle income or workforce housing there. Given the socially engineered allocation formula for allocating ORCSD costs to the member communities, there remains a possibility that our school tax would increase with an increase in students in Lee and/or Madbury, while Barrington continues to get a free marginal based ride.

Never has the old management axiom "You can't manage what you don't measure" more aptly applied.

ORCSD Marginal Cost

Average Daily Membership (ADM)

This number represents students in-class for a half-day at various points, usually in October. The calculations are provided to the State Department of Education for approval. It may result in a member community's enrollment number to be understated due to illness or another student absentee issue, but is representative of student enrollment. Students joining at mid-year are not counted in that fiscal year's ADM, but students leaving at mid-year are.

Assessment

This is the amount due from member communities that is included in the respective property tax assessments to property owners in their community. However, the community assessment cannot individually be said to be the costs driven by a community's students, as the assessment is calculated on ORCSD's total expenses less State and Federal Funds, less tuition payments from Barrington, and less any other sources of funds. These remaining net total expenses are then allocated to each member community based on a formula: 50% allocated per ADM and the remainder allocated based on each community's taxable property valuation as a percentage of the combined member communities' taxable property valuation.

At the individual community level, it does not represent the ORCSD costs that were driven by the community, but when combined it is net expenses. The assessment certainly represents tax liability to the individual communities' taxpayers for that year.

The member communities then use their respective assessment and allocate that based on each taxable property owner's valuation. Clearly a social pricing method, the taxes you pay may or may not represent the ORCSD costs that are driven by one's family or the families in one's community.

From Assessment to Your Property Taxes

Durham issues property taxes in December and June. Theses property taxes include their assessment from ORCSD. This presents challenges as ORCSD operates on a Fiscal Year ending 30 June which represents their school year. The Town's approval process for the tax rate requires that ORCSD must submit the assessments by early October to avoid delaying the process. This results in ORCSD using their Fiscal Year 2021 Budget, the ADM measured in the fall of 2019, and the member communities' property valuations from the spring of 2020 to calculate the assessment. The Town's December 2020 and June 2021 taxes include the full school year budgeted expenditures for Fiscal Year 2021 and not their actual expenditures for Fiscal Year 2021.

Exogenous events are significant disturbances, for ORCSD this may result in actual Fiscal Year 2021 expenditures being radically different than expected. See Appendix 1 for an explanation of ORCSD's plan to address unbudgeted COVID-19 FY2021 expenditures.

Fiscal Year Analysis

	Fiscal Year					% Change 2015 vs. 2019
	2015	2016	2017	2018	2019	
ADM						
Durham	927.61	920.06	964.70	963.33	944.84	1.9%
Lee	665.61	648.92	689.74	705.58	709.17	6.5%
Madbury	369.11	359.47	377.68	362.07	367.46	-0.4%
Sub-Total	1962.33	1928.45	2032.12	2030.98	2021.47	**3.0%**
Barrington	85.00	98.00	115.00	138.00	167.00	96.5%
Total	2047.33	2026.45	2147.12	2168.98	2188.47	**6.9%**
Assessment						
Durham	$19,221,996	$19,863,617	$20,999,825	$21,472,336	$22,161,578	15.3%
Lee	$11,186,110	$11,419,658	$11,855,432	$12,068,083	$12,923,528	15.5%
Madbury	$5,829,106	$6,114,274	$6,192,905	$6,390,063	$6,437,041	10.4%
Sub-Total	$36,237,212	$37,397,549	$39,048,162	$39,930,482	$41,522,147	**14.6%**
Barrington [1]	$1,105,000	$1,372,000	$1,699,240	$2,147,556	$2,754,331	149.3%
Total	$37,342,212	$38,769,549	$40,747,402	$42,078,038	$44,276,478	**18.6%**
Gross Cost per ADM						
Durham	$20,722	$21,589	$21,768	$22,290	$23,455	13.2%
Lee	$16,806	$17,598	$17,188	$17,104	$18,223	8.4%
Madbury	$15,792	$17,009	$16,397	$17,649	$17,518	10.9%
Average	$18,466	$19,393	$19,215	$19,661	$20,541	**11.2%**
Barrington [2]	$13,000	$14,000	$14,776	$15,562	$16,493	26.9%
Average	$18,239	$19,132	$18,978	$19,400	$20,232	**10.9%**

[1] Barrington Assessment calculated as equal to (tuition * ADM)

[2] Contractual Tuition

Marginal cost, practically, is always less than average cost. Excess cost is the difference between realized production and productive capacity. Average cost should decline as productive units (ADM) increase.

With Barrington students beginning attendance in 2015, one expected that the argued, existing excess costs would diminish as overall student population increased, and that did occur in 2017, albeit in an unremarkable amount. What is obvious is that average costs with and without Barrington, are

increasing. Given this increasing average cost phenomenon, must we then conclude that each new student (ADM) was brought on board with their own embedded excess capacity? While some of this could be attributable to the disconnect in the fiscal years for the data used, the trend line and growing year-over-year changes in the averages make that less likely.

In a memo that I received from our Town Administrator, responding to my initial notes on Marginal Costs, he wrote, in part:

> "The class size targets are driven by ORCSD policy, which was determined after much research and deliberation years ago (after much discussion on just the points you raise, which was a huge political football for the community at the time and resulted in part in a changeover on the school board and a lot of community animosity that we have I think finally overcome) based on educational research and policy drivers."

This infers that ORCSD Management is driven by a set of management metrics that have, essentially, incorporated excess costs per ADM which results in a situation where, if any meaningful increase in students occurs, then the average costs will continue to rise and minimal to no excess capacity will be utilized.

Cost analysis does not lie. There is no obvious evidence that increasing ADM meaningfully reduces the assessment per ADM. The only answer to the questions posed is a thorough analysis of audited financials and same period metrics (i.e. ADM). With average costs continuing to escalate, you are left with a choice:

- There is no excess capacity
- Management has failed to contain costs
- Board Policies and Metrics are incongruent with a focus on cost-savings generated by greater capacity utilization
- Perform a thorough Financial Analysis, resolve the discrepancies, identify opportunities for utilizing excess capacity, and identify opportunities to eliminate excess capacity

Appendix 1

"Should the federal or state government approved funds for school systems it is unlikely Oyster River will receive much, as evidenced by the ESSA funding we qualify for, a mere $39,000, compared to poorer school systems in NH that received hundreds of thousands of dollars.

You are correct that the impact of COVID on our budget occurred after voter approval, to date we have spent $106,939 specifically tied to COVID. Costs will grow as we move through the school year. As an example, transportation personnel costs. Remote learning will require the busses on the road more often yet carrying fewer children due to social distancing.

Given that there is no mechanism to adjust our budget short of an emergency meeting with the member towns, we have chosen a different path, frugality. We are using several techniques to maintain the integrity of the current budget so that we do not have to reach out to the towns.

1. We are not automatically filling open positions. As an example, given the school system will be largely remote we have chosen not to fill the library aide positions. If we were not to fill all the open positions throughout the year, it could result in a savings of almost $400,000. However, if the Board chooses to change the model to a traditional model, we will only achieve a partial savings.
2. We are capitalizing on savings in specific lines. As an example, we were told by the bond bank we would need $650,000 for the cost of moving forward on the new middle school bond. However, the actual cost was much lower saving the district $257,000.
3. We are carefully monitoring expenses. Again, classroom materials needs are lower given the remote model in grade 5-12
4. Should all our efforts to contain costs result in a potential deficit, we would ask the School Board to release emergency funds approved by the voters. I think, at this point, this is unlikely.

We are fortunate to have Sue Caswell as our Business Manager. She and I work closely together brainstorming ways to save in order to make it through this fiscal year solvent. Collectively we have 78-years doing this work. We have experienced recessions and significant loss of state funding at least three times in our careers and we have never asked for a supplemental appropriation. We are confident, given our collective experience, that we can keep our costs within the approved budget, without going to the Towns for an emergency meeting asking for more money.

Sincerely,

Dr. Jim Morse

Superintendent, Oyster River CSD"