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MEMORANDUM

TO: Barry Fadden, Acting Purchasing Agent; Carl Spector, Executive Director, Boston Air Pollution Control Commission

CC: James Hunt, Chief, Environmental and Energy Services

FROM: Charles Fievet, J.D. anticipated 2013[*]

DATE: May 25, 2012

RE: Guidance for City Procurement to Facilitate Climate Change Adaptation Pursuant to the Mayor's 2007 Executive Order

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I. Overview

Mayor Menino issued an Executive Order on Climate Action in 2007 (the "Order") mandating that the City of Boston ("City") "shall prepare an integrated plan that outlines actions to reduce the risks from the likely effects of climate change."[1] The Order also stated that "[p]lanning for all new municipal construction and major renovation of City-owned facilities and other major municipal projects shall include . . . an evaluation of the risks posed by the likely effects of climate change through 2050 to the project itself and related infrastructure and a description of potential steps to avoid, minimize or mitigate those risks."[2] To facilitate the City's implementation of the Order, the Clinic has developed this proposed guidance document describing strategies for incorporating climate change adaptation into the City's procurement process.

Climate change adaptation involves planning, preparing, and taking action now in anticipation of future impacts of projected changes in climate to enhance resiliency.[3] The purpose of

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[1] Exec. Order of Mayor Thomas M. Menino, *An Order Relative to Climate Action in Boston*, para. 4 (Apr. 13, 2007) ("Executive Order").

[2] Executive Order, *supra* note 1, at para. 5.

[3] Mitigation, by contrast, focuses on reducing the impacts that current practices have on climate change. Improvements to energy efficiency that reduce carbon dioxide emissions is an example of a mitigation effort.

incorporating climate change adaptation into City procurement processes is to maximize value in long-term public investments and reduce future losses due to climate change in order to create a more resilient city.

II. Scope

This guidance document is written to apply to all City departments that engage in the procurement of goods, services, construction or renovation contracts, and/or design contracts. It is intended as a methodology for incorporating climate change adaptation into the existing procurement process and is not intended to displace any federal, state, or local law. It is intended to be implemented in accordance with state and local law governing procurement of goods and services,[4] contracts for public buildings,[5] and contracts for public works,[6] as well as designer selection.[7] Any ambiguities in this document should be construed in accordance with existing law.

III. Climate Change Adaptation and Procurement

Four predicted changes to climate are likely to have the greatest implications for procurement decisions: rising sea level, higher temperatures, increased precipitation, and increased frequency of intense storms.[8] Sea level is already rising and is projected to continue to rise, but predictions as to the amount of change vary greatly depending on future greenhouse gas emissions and polar ice sheet melting.[9] Problems associated with sea level rise include increased flooding in coastal areas, saltwater intrusion into freshwater resources, and higher storm surge.[10] Both average temperatures and maximum temperatures are also expected to rise.[11] Higher temperatures are associated with increased heat waves, increased energy consumption for summertime cooling, and potential health problems for vulnerable communities.[12] Overall precipitation is projected to increase, as is the frequency of intense storms.[13] General precipitation increases have implications for storm water management and decay of buildings and infrastructure.[14] Intense

[4] G.L. c. 30B.

[5] G.L. c. 149 §§ 44A–M.

[6] G.L. c. 30 § 39M.

[7] G.L. c. 7 §§ 38A1/2–O.

[8] Increased flooding is also important as a secondary impact caused by rising sea level, increased precipitation, and/or increased frequency of intense storms.

[9] Mass. Exec. Office of Energy and Envtl Affairs & the Adaptation Advisory Comm., *Climate Change Adaptation Report* 15–16 (Sep. 2011) ("Massachusetts Report").

[10] Massachusetts Report, *supra* note 9, at 16–17.

[11] Massachusetts Report, *supra* note 9, at 14–15.

[12] Massachusetts Report, *supra* note 9, at 14–15.

[13] Massachusetts Report, *supra* note 9, at 17, 19.

[14] Massachusetts Report, *supra* note 9, at 18.

storms are associated with heavy downpours and coastal storm surge. Their increased frequency is likely to cause increased problems due to flooding.[15]

The procurement officer must determine which aspects of climate change, if any, are likely to affect the particular procurement decision. S/he must also evaluate how the anticipated climate change will impact the decision and what alternatives are available to reduce that impact. Methods of qualitatively and quantitatively analyzing climate change impacts are described in detail in later sections of this document regarding planning and developing specifications.

Climate change predictions, particularly at the downscaled site-specific level, are still evolving as scientists continue to compile new information. While impacts may not be predicted precisely, the procurement strategies recommended in this document have been designed to maintain flexibility so that the City can incorporate new information regarding climate change into its procurement process. This flexibility is maintained by using the best available science standard for climate prediction and relying on climate consultants to review the science and, as needed, to make quantitative predictions.

This guidance document sets forth the tools that can be used in adaptive procurement and provides a step-by-step guide to integrating them into the procurement process. In addition, Appendix A provides a list of projected changes in climate that are likely to affect Boston as well as strategies for adapting to those changes. Neither Appendix A nor the discussion in this guidance document are exhaustive of climate changes or adaptation measures that may impact procurement.

IV. The Tools of Adaptive Procurement

Adaptive procurement involves incorporating the following tools into the existing procurement process:

1. Life Cycle Cost Estimates

The adaptive procurement life cycle cost estimate is the estimated cost of installing, financing, maintaining, and replacing a particular good or construction component, including accounting for any changes in maintenance costs, replacement costs or life expectancy caused by predicted climate change. The life cycle cost estimate also includes deductions or additions for any secondary effects of using a particular good or construction component. Secondary effects are costs or savings not directly related to a product, but which are incurred by virtue of using that particular product instead of its alternative. For example, energy savings are a secondary effect of using high-efficiency windows.

The purpose of using life cycle cost estimates is to make procurement decisions that maximize long-term value for the City in light of predicted climate change by comparing options based on all costs over time rather than immediate installation costs. Adoption of this Guidance

[15] Massachusetts Report, *supra* note 9, at 16, 19.

Document would require the City to use life cycle cost estimates as a tool for comparing options in order to select the best long-term option for the City.

Several existing Massachusetts statutes already require the use of life cycle cost estimates in certain situations.[16] The City is currently subject to Massachusetts law requiring life cycle cost estimates for all energy systems in new buildings and replacement energy systems in existing buildings for all publicly awarded projects subject to the bidding requirements of public building construction law.[17] Adaptive procurement life cycle cost estimates recommended in this guidance are independent of any similar requirements under existing law.

2. Warranties and Risk Allocation

A certain degree of uncertainty exists with predicting project-specific climate change impacts. This uncertainty creates the risk that the City will incur costs in order to implement climate adaptation strategies that will not be offset by future adaptation benefits. In procurement decisions, the City can reduce its exposure to risk through contractual risk allocation and warranty negotiation.

Procurement officers should look for opportunities to allocate climate change risk in contracts with service providers. Because the City does not enter into service contracts for longer than three years, long-term climate change risks likely will not significantly affect contracts.[18] However, even short-term contracts may be affected by short-term climate change impacts such as more frequent intense storms.[19] Procurement officers should consider the risk that, over the life of a contemplated contract, the City may be impacted by an unusually high number of intense storms.

Procurement officers should also consider negotiating warranties for goods or construction components to shift the risk of climate change uncertainty. Some goods, particularly construction materials, offer a variety of warranty options. If the City is unsure how climate change will impact a good or if it determines that some aspect of climate change is likely to decrease the life expectancy of a good, it may make financial sense to purchase a longer warranty option.

[16] *See, e.g.*, G.L. c. 7 § 39D(a)–(b) (requiring life-cycle cost estimates of energy systems in new buildings and renovations of buildings owned or operated by the Commonwealth and exceeding $25,000, and mandating minimizing life-cycle costs "by utilizing energy efficiency, water conservation or renewable energy technologies"); G.L. c. 6c § 10 (requiring the Department of Transportation to "utilize life cycle cost modeling in all projects. Life-cycle costs shall mean all relevant costs of a transportation asset's lifespan including, but not limited to, planning, study, design, purchase or lease, operation, maintenance, repair, replacement and disposal.").

[17] G.L. c. 149 § 44M.

[18] *See* G.L. c. 30B § 12(b) ("Unless authorized by majority vote, a procurement officer shall not award a contract for a term exceeding three years . . . .").

[19] Massachusetts Report, *supra* note 10, at 17.

3. Evaluating Alternative Technologies

Evaluating alternative technologies refers to the process of comparing different options that serve the same purpose in light of expected climate change in order to select the option that offers the greatest long-term value to the City. Alternative technologies refers to both new and existing technologies.

Evaluating alternative technologies gives meaning to the life cycle cost estimate by providing the option to choose the product with the lowest life cycle cost estimate. The evaluation may evaluate new products to determine whether they provide better value than standard products, or it may re-evaluate standard products in light of new climate change evidence as it becomes available.

New technologies are constantly changing the array of available options for procurement decisions, and many new products are designed specifically to ameliorate climate change impacts. During the procurement process the City should identify and consider new technologies that may add value to adaptation planning.

4. "No Regrets" Measures

"No regrets" measures are "strategies that are beneficial regardless of climate change that should be encouraged where cost-effective."[20] A procurement option that has a lower life cycle cost than its alternative regardless of projected climate change and would provide benefit over its alternative in adapting to climate change is a no-regrets option.

No-regrets strategies also include low-cost or no-cost decisions that do not involve choosing one good or material over another. These decisions are likely to arise in the context of designing buildings or public works. One example of this type of decision is not placing sensitive equipment in the basement or first floor of a building potentially susceptible to flooding.

V. The Adaptive Procurement Process

This guidance encompasses three classes of procurement: Construction and renovation of buildings and public works; Contracts for Services; and Contracts for Goods and Property. Climate change adaptation should be incorporated into the procurement process in six steps: Planning, Developing Specifications, Designer Selection, Design Review, Contractor Selection, and Evaluation. Each step of the process applies to the different categories of procurement in different ways, and the steps of Designer Selection and Design Review do not apply to services or goods at all. Figure 1 at page 15 below is a diagram of the procurement process as it relates to climate change adaptation.

[20] Massachusetts Report, *supra* note 9, at 28.

1. Planning Phase

The planning phase refers to the initial steps of the procurement process, when the procurement officer identifies the need and develops strategies to meet that need. It is important to consider climate change at this stage, as it will be more difficult to add adaptation considerations later. Particularly in construction projects, vital decisions made early in the process may be difficult to adjust later if they do not consider climate change from the beginning.

In order to incorporate climate change adaptation in the planning phase, procurement officers should perform a qualitative analysis of climate change impacts and adaptation strategies ("Qualitative Analysis") that determines which aspects of climate change, if any, are likely to impact a particular procurement decision, and what options should be explored to minimize those impacts. The procurement officer should conduct the Qualitative Analysis by taking the following steps:

Determine the expected life span of the project, good, or service

The procurement officer should determine how long a product, building, or public works project is expected to last before requiring replacement as well as the desired length of a service contract. Climate change is a slow, long-term process, and its potential impact on a project increases as the life expectancy of that project increases. The life expectancy will therefore largely determine the degree to which predicted climate change will impact a project. Because buildings and infrastructure have long life spans, they are more likely to be affected by climate change than most goods or service contracts.

Determine which aspects of climate change, if any, are likely to affect the project

The procurement officer should use Massachusetts' "Climate Change Adaptation Report" ("Massachusetts Report"),[21] and future updates to the report, to qualitatively assess which aspects of climate change are likely to impact the particular procurement decision. The Massachusetts Report contains a variety of climate change predictions for the state of Massachusetts as a whole. It provides a low-cost source of predictions suitable for the Qualitative Analysis in the planning stage.

Identify potential strategies for resilience to climate change

The procurement officer should identify alternatives for the particular procurement decision and evaluate how each alternative may reduce the impacts of projected climate change. The officer procuring goods should identify alternative products. The officer planning a construction project should identify design elements that may reduce climate change impacts. The designer of a construction project will provide more detailed design alternatives during the design process, but the Qualitative Analysis will allow the procurement officer to oversee the climate adaptation aspects of the design in an informed manner.

[21] *See generally*, Massachusetts Report, *supra* note 9.

The Qualitative Analysis need not necessarily be repeated in full for every project. The Qualitative Analysis from one project should be used to inform subsequent projects and reduce the resources required for adaptive procurement analysis, both within a City department and among departments. Due to the general, non-project-specific nature of the Qualitative Analysis, it is likely that some projects can use prior-developed Qualitative Analyses in their entirety.

2. Developing Specifications

After initial planning, the procurement officer must develop specifications. For construction and renovation projects, developing specifications means deciding the parameters of the building or public works project and the specific tasks of the architect or engineer relative to climate change adaptation. For goods, developing specifications means deciding exactly which product to purchase. For service contracts, it means deciding exactly what the City will require from an agreement with a service contractor.

1) Building and Public Works Construction and Renovation

a. Quantitative Analysis

The procurement officer should require the designer, or her/his designated consultant, to perform a quantitative analysis of climate change impacts and adaptation strategies ("Quantitative Analysis") in the specifications for the design of construction and renovation projects. The Quantitative Analysis consists of the same steps completed in the planning phase, but performed in a more detailed and site-specific manner by design and/or climate experts. The Quantitative Analysis should require the designer or consultant to complete the following steps:

Develop project- and site-specific predictions for climate change based on the best available science

The specifications should require the designer or consultant to develop climate change predictions for the project based on the best available science at the time of the analysis. A best available science standard allows decision makers to incorporate new science and adjusted predictions into procurement decisions. A consultant with climate change experience and expertise should perform this analysis, unless the designer has such expertise, and that consultant shall determine the best available science relative to the project.

Determine the likely impacts of climate change on the specific project

The specifications should require the designer or consultant to determine how the climate change predictions are likely to impact the specific project at issue. This analysis should take into account location and characteristics of the site itself as well as the proposed plan for the site. This requirement is likely a collaborative effort between climate change professionals and design professionals.

Compile potential strategies for reducing predicted impacts of climate change

The specifications should require the designer to develop design solutions to reduce the impacts of predicted climate change on the project. Each aspect of the design that can potentially reduce the impacts of climate change should have at least two design alternatives: a standard option that does not account for climate change and at least one adaptive option. The life cycle cost analysis will be used to choose between the standard and adaptive options.

The Quantitative Analysis, like the Qualitative Analysis, need not be done from scratch for every project. Through inter-project and inter-department information sharing, the Quantitative Analysis from one project should be used to reduce the resources required to perform the Analysis for subsequent projects.

b. Life Cycle Cost Estimates

Specifications for the design of construction and renovation projects should also require the designer to perform a life cycle cost analysis of all design options developed in the Quantitative Analysis. The Annual Life Cycle Cost can be calculated using the following table:

	A	B	C	D	E	F	G	H	I
Design Option	Life Expectancy (years)	Installation Cost	Annual Maintenance Cost	Annual Secondary Cost	Annual Secondary Benefit	Preliminary Annual Life Cycle Cost	Annual Probability of Single-Event Failure	Cost of Failure	Annual Life Cycle Cost

Preliminary Annual Life Cycle Cost

The Preliminary Annual Life Cycle Cost (Column F) is a preliminary estimate of the annual cost to the City of choosing a particular design option. It is intended to account for gradual changes in climate over time such as increased temperatures or increased precipitation, and the values used to calculate Preliminary Annual Life Cycle Cost should be adjusted for those gradual climate changes. Preliminary Annual Life Cycle Cost is calculated by dividing the installation cost of the design option (IC) by its life expectancy in years (LE), then adding expected annual maintenance costs (MC) and secondary costs (SC), and subtracting secondary benefits (SB). Secondary costs (D) are indirect costs caused by the item but not directly related to maintaining the item. For example, locating mechanical equipment on upper floors instead of on a basement level in order to mitigate potential flood damage may have the secondary cost of reducing rentable or useable space. Secondary benefits (E) are indirect savings caused by the item, such as energy

savings accrued by using high-efficiency windows. The life expectancy (A), annual maintenance costs (C), annual secondary costs (D), and annual secondary benefits (E) should include adjustments for anticipated gradual changes in climate. Costs of warranties and financing should also be included in installation costs if they are paid at installation or in maintenance costs if they are paid in annual installments. In terms of the above table, Preliminary Annual Life Cycle Cost is calculated using the following formula:

$$\text{Preliminary Annual Life Cycle Cost (Column F)} = (IC/LE) + MC + SC - SB$$[22]

Annual Life Cycle Cost

In addition to the impacts of gradual climate change, some procurement options may be at risk of single-event failure. A single-event failure is a single climactic event that causes a selected design option to fail, as opposed to gradual climate change causing gradual degradation over time. In addition to causing failure of the design option, single-event failures typically have high secondary costs. The Preliminary Annual Life Cycle Cost (F) does not account for the risk of single-event failure and therefore must be adjusted in projects subject to such risk.

An example of a single event failure with high secondary costs is a flood causing significant damage to a building, but that would have caused no damage if flood control measures had been incorporated into the design of the building. Secondary costs of the flood include costs of repair or replacement of furnishings, carpeting, building materials, mechanical or electrical equipment, or anything else damaged in the flood.

The probability of a single event failure (P) is the probability of such an event occurring in any one year of the design option's lifetime. The designer or consultant should determine the probability of single event failure based on the Quantitative Analysis of likely impacts of climate change on the project. The probability of failure should be adjusted for climate change predicted in the Quantitative Analysis and averaged over the expected lifespan of the building. For example, if the current probability of a proposed building being flooded is 1% in a given year, but due to sea level rise it will be 10% at the end of the building's expected lifespan, then the probability of single-event failure is 5.5%. The cost of failure (CF) is the total cost of that failure including secondary costs. The Annual Life Cycle Cost is calculated using the following formula:

$$\text{Annual Life Cycle Cost (Column I)} = (P \times CF) + ((1-P) \times PALCC)$$[23]

All design options should complete columns A–F. If a project is subject to significant damage from a single climactic event, and one or more of the design options is intended to prevent

[22] The formulas for Preliminary Annual Life Cycle Cost and Annual Life Cycle Cost were developed by Charles Fievet, anticipated J.D. 2013, while working for the Emmett Environmental Law & Policy Clinic in 2011 ("cost formulas"). The formulas are based on basic accounting concepts of risk and expected return.

[23] *See* cost formulas, *supra* note 22.

damage from that event, then complete columns G–I. For the purposes of adaptive procurement, the ideal design option for reducing the risk of climate change and maximizing value for the City is the option with the lowest annual life cycle cost.

2) Procurement of Goods

a. Qualitative Analysis

Because of the expense and expertise associated with the Quantitative Analysis, it is only required for construction projects. The decision to purchase goods is unlikely to benefit significantly from a more refined analysis of climate change impacts and should therefore rely on the Qualitative Analysis developed in the planning stage.

b. Life Cycle Cost Analysis

The procurement officer responsible for purchasing goods should perform a life cycle cost analysis of different product options if he determines in the Qualitative Analysis that alternative products exist that reduce the impacts of climate change. The Life Cycle Cost Analysis for purchasing goods should follow the procedure of calculating Preliminary Annual Life Cycle Cost described above. Because decisions to purchase goods are unlikely to be affected by single event failure, the procurement officer need not adjust the life cycle cost for the probability of such failure.

3) Procurement of Services

a. Qualitative Analysis

Similar to procurement of goods, procurement officers should rely on the Qualitative Analysis for developing service contracts. The decision to enter a service contract is unlikely to benefit significantly from a more refined analysis of climate change impacts.

b. Risk Allocation

The procurement officer should consider allocating the risks associated with extreme weather events between the City and the contractor for service contracts. The goal of integrating predicted climate change into service contracts is therefore, in the case of an extreme climactic event, for the City to avoid either (1) being left without a particular service or (2) being forced to pay high prices for services in high demand. Because of the relatively short terms of the City's service contracts, climate impacts will largely be limited to those associated with erratic weather rather than long-term climate trends. Extreme events associated with erratic weather may include intense rain or snow storms, a series of intense storms, or a severe heat wave.

For example, the City may consider the possibility that it will endure an extremely snowy winter in structuring a snow removal contract. In such a situation, the City might negotiate a scaled pay system into a contract: one price for snow removal up to the average annual snowfall, another price for the next twenty inches, and a third price for snowfall more than twenty inches above

average. In this way, the City can reduce the risk of an extreme winter leaving it unable to remove snow or being forced to negotiate last-minute contracts, while the contractor can be assured to receive higher prices for extra snow removal.

Another example may be contracts for energy services. Summer heat waves are predicted to increase in frequency and intensity, and the City might avoid paying skyrocketing energy rates in the event of such a heat wave by negotiating a range of rates beforehand with energy providers. Because the City is a large consumer, it may be able to negotiate a maximum energy service rate, thereby shifting some of the risk of volatile energy prices to the service provider.

3. Designer Selection

After developing specifications, the procurement officer must select a designer for building and public works construction projects, unless the particular City department performs design work in-house. The officer should take steps to ensure that the qualifications necessary to perform the Quantitative Analysis and life cycle cost estimates are clearly listed and described in the published advertisement for the design contract.[24] The publication should also describe the nature of the Quantitative Analysis and life cycle cost estimate themselves.[25]

Designer selection does not apply to procurement of goods or service contracts.

4. Design Development, Review, and Value Engineering

The procurement officer should take steps throughout the design development and review process to ensure that climate change adaptation issues are properly addressed by the design. The design review process includes selecting design options based on the life cycle cost analyses. The procurement officer should encourage other departments or interested parties who are reviewing the design to consider the adaptation issues surrounding the project. Although it is ideal for adaptation strategies to be considered and incorporated into the design from the beginning, in practice the reviewing parties may have additional concerns or ideas relevant to adaptation goals that were not considered earlier in the process. Any value engineering decisions made at the design review stage should be based on life cycle cost estimates rather than installation cost estimates. The value engineering stage is an ideal place to evaluate no-regrets strategies that may have been overlooked.

Design development, review, and value engineering does not apply to procurement of goods or service contracts.

[24] City contracts for buildings in excess of $100,000 must provide public notice of the contract in accordance with G.L. c. 7 § 38D (incorporating the notice requirements of § 38D). Such public notice must include "the qualification required of applicants for the projects" and "the categories of designers' consultants." G.L. c. 7 § 38D.

[25] *See* G.L. c. 7 § 38K (requiring publication to list "specific designer services sought").

5. Contractor and Vendor Selection

For the purposes of climate change adaptation, it is important at the contractor and vendor selection stage that the procurement officer takes steps to ensure that contractors are able to perform the required tasks. For construction projects, the required tasks may include implementation of new or innovative technologies according to the plans and specifications of the final design. Service contracts may require maintaining or updating new or innovative technologies. Contracts for goods may require an accurate description of the characteristics of the product that are relevant to climate change in order to ensure that any equivalent alternate offered by a vendor is truly equivalent.

For contracts procured according to sound business practices,[26] the procurement officer has the discretion to choose from which vendors or contractors to seek prices or quotes, and the officer should solicit quotes only from contractors qualified to implement any new or innovative technologies required by the design. It is likely that the procurement officer maintains a list of contractors or vendors qualified to perform different types of contracts, and in this case the officer should add ability to implement unique climate change adaptation measures to the vendor's or contractor's qualifications.

For contracts requiring quote solicitation,[27] the procurement officer should ensure that the quoting contractor or vendor is able to implement new or innovative technologies relevant to climate change adaptation. For public building construction contracts requiring public notice, the procurement officer should ensure that the contractor is qualified to construct any new or innovative technologies in the final design by ensuring that those requirements are clearly reflected in the contract and including a description of those requirements in the public notice.

For contracts subject to competitive bidding requirements,[28] the procurement officer should ensure that the contractor or vendor is qualified to construct, maintain, or

[26] Contracts which must be procured in accordance with sound business practices are public building contracts estimated to cost less than $10,000, G.L. c. 149 § 44A(2)(A), and goods and services contracts less than $5,000, G.L. c. 30B § 2, 4(c).

[27] Procurement of goods or services of at least $5,000 but less than $25,000 must be awarded to the responsible person providing the lowest quote on the basis of quote solicitation from at least three providers, G.L. c. 30B § 4(a). Contracts for public building construction projects estimated to cost not less than $10,000 but not more than $25,000 must be awarded to the responsible person offering to perform the contract at the lowest price, G.L. c. 149 § 44A(2)(B). However, the Boston City Charter is currently more stringent than Massachusetts law in requiring competitive bidding for any contract in excess of $10,000, Boston City Charter § 68.

[28] Procurement of goods or services contracts of $25,000 or more generally must conform to competitive sealed bidding procedures, G.L. c. 30B § 5(a). Contracts for the construction or repair of any public works project estimated to cost more than $10,000, and contracts for public buildings estimated to cost not less than $25,000 but not more than $100,000, must be awarded to lowest responsible and eligible bidder on the basis of competitive bids in accordance with G.L. c. 30 § 39M. *See also* G.L. c. 149 § 44A(2)(C). Contracts for all public building projects estimated to cost more than $100,000 must be awarded to the lowest responsible and eligible general bidder on basis of competitive bids according to the procedures of M.G.L. c. 149 §§ 44A–H. G.L. c. 149 § 44A(2)(D). All contracts of the City in excess of $10,000 requiring competitive bidding, Boston City Charter § 68.

otherwise work with any new or innovative technologies required by the project by ensuring that those requirements are clearly reflected in the contract, in the evaluation criteria for awarding the contract, and in the publication advertising the request for bids.

For goods and services contracts exceeding $25,000 where the procurement officer chooses to seek competitive sealed proposals,[29] the officer must establish evaluation criteria by which the proposals will be judged, include those criteria in publicized request for proposals, and award the contract solely based on those criteria.[30] The procurement officer utilizing requests for proposals for projects involving climate change adaptation should therefore ensure that ability to implement or work with new or innovative technologies required by the project be reflected in the proposal evaluation criteria.

For public building contracts procured under prequalified bidding provisions of M.G.L. c. 149 § 44D1/2,[31] the procurement officer should ensure that the ability to implement any new or innovative technologies utilized in the final design is reflected in the point system for evaluating qualifications. The officer should also ensure that the point system requirements are included in the request for qualifications (RFQ). Within the statutory point system for evaluating qualifications, the category most relevant to climate change adaptation is "Similar Project Experience," and the awarding authority should ensure that the ability to implement any new or innovative technologies is reflected in that category. Depending on the degree of unique expertise required to implement the final design, the awarding authority may want to weigh "Similar Project Experience" more or less heavily.

6. Assess the Process Evaluation

The City is considering development of a tracking system to evaluate the performance of the adaptive procurement process in order to inform future decisions. This mechanism should look for inefficiencies in the process, evaluate whether products and contracts perform as expected and whether construction projects are resilient to climate change as expected, and whether life cycle cost estimates are accurate. The review may be stand-alone for the purpose of improving the process in the future or it may be a part of the planning of a specific future project. The review may also track other performance metrics in addition to adaptation and become a full-scale review of procurement decisions. In terms of climate change adaptation, the review can provide a feedback loop to improve future decision-making: the Qualitative and Quantitative Analyses from one decision may inform future decisions of how best to apply the adaptive procurement process.

Until the City adopts a tracking system, individual departments that engage in procurement should use each experience with adaptive procurement to inform the next procurement decision. A department may also share information developed through adaptive procurement with other

[29] G.L. c. 30B § 6(a).

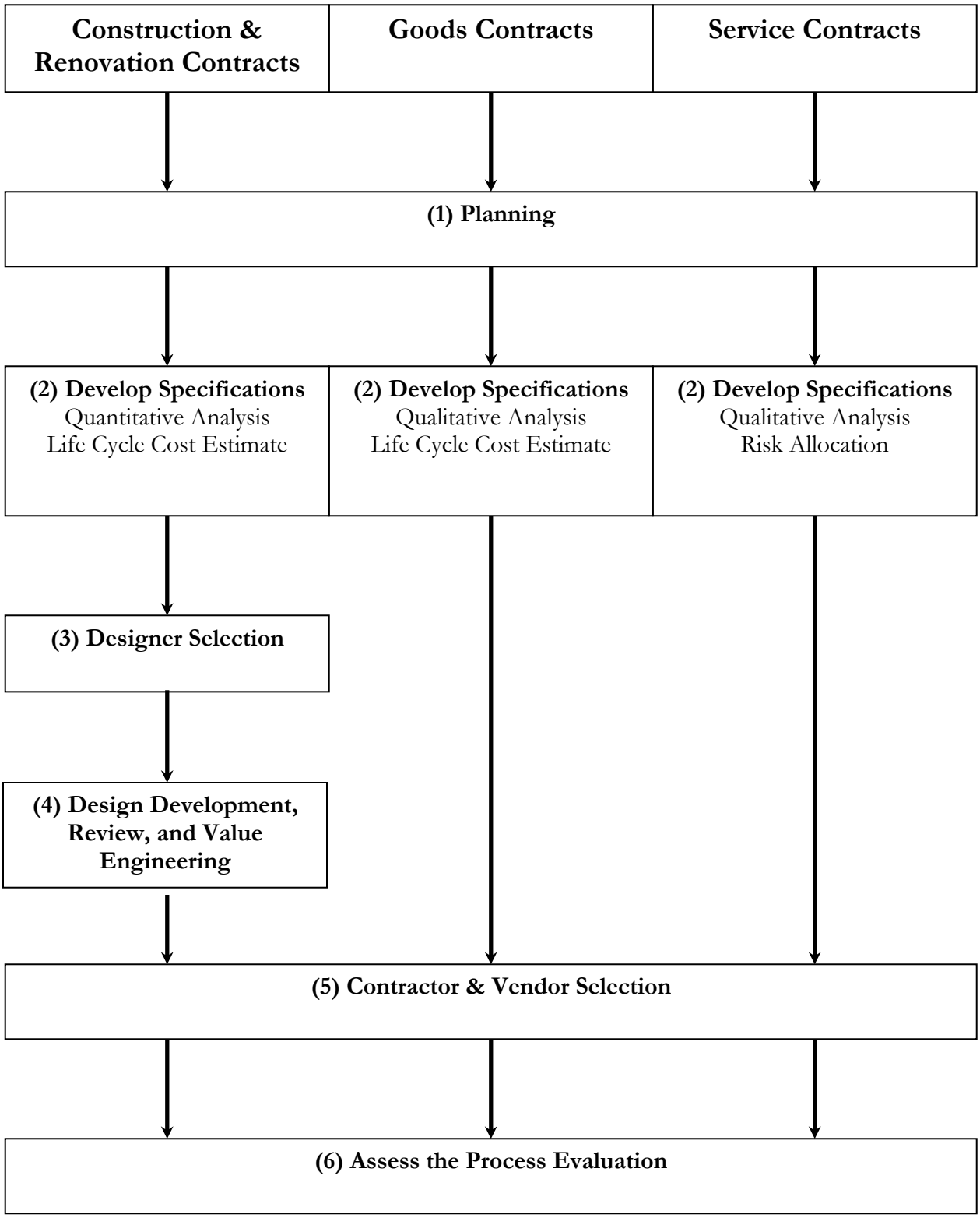
[30] G.L. c. 30B § 6(b), (e).

[31] Prequalified bidding is required for public building construction contracts expected to cost $10,000,000 and above, and is optional for contracts between $100,000 and $10,000,000.

City departments or other cities. Climate change predictions or strategies for resilience developed in one project can be used to reduce the time and resources needed to develop predictions and strategies in subsequent projects. Additionally, efforts that turn out to be futile in one project can be avoided in favor of other methods in subsequent projects.

Figure 1

ADAPTIVE PROCUREMENT PROCESS



Appendix A

Potential Strategies for Adapting to Climate Change Impacts Through Procurement Decisions	
Climate Impact[32]	Potential Strategies
Temperature	
Higher Maximum and Mean Temperatures and More Frequent Heat Waves	• General energy efficiency in buildings (similar to LEED guidelines) • Increase light-colored surfaces such as white roof membranes and light-colored paving materials • Increase vegetative cover through green roofs • Increase green space using heat tolerant plants and trees • Create more shady areas, e.g., by increasing tree planting • Consider decreased efficiency of energy production and distribution systems, as well as increased demand, caused by higher temperatures • Increase opportunities for natural ventilation in structures • Consider potential health effects in vulnerable communities
Seas	
Sea Level Rise	• Consider potential for saltwater intrusion contaminating water supply sources • Also see adaptation strategies for Increased Flooding and Higher Storm Surge
Higher Sea Surface Temperature	• See adaptation strategies for Increased Hurricane Frequency
Precipitation	
More Freezing Rain	• Bury power and communications lines • Keep tree branches pruned around power lines • Consider ice damage in structuring clean-up contracts • Consider increased needs for de-icing of roadways and sidewalks and take measures to increase natural de-icing capacity and decrease associated risks, such as optimized solar exposure and decreased slope
More Droughts	• Implement water conservation measures • Use drought-resistant plants • Implement water conservation recycling mechanisms
Increased Flooding	• Anticipate a shifting 100-year flood line when considering purchasing real property, developing property, and/or reviewing private development • Set floor elevations for new buildings at a higher level than they would otherwise be • Place mechanical and other sensitive equipment on higher floors not susceptible to flooding • Design buildings to maintain structural integrity after flooding • Use flood resistant materials on lower floors/basements • Develop emergency plans, including evacuation plans or emergency housing plans • Consider potential for water supply contamination
Extreme Weather Events	
More Frequent Heavy Rainfall	• Design site drainage to accommodate more intense storm events

[32] The listed qualitative climate impacts are described in the Massachusetts Report.

Potential Strategies for Adapting to Climate Change Impacts Through Procurement Decisions	
	• Design storm water management systems according to more intense precipitation events than indicated by the historical record • Use decay- and mold-resistant materials in design and construction • Also see Increased Flooding adaptation strategies
Stronger Wind Gusts	• Consider potential for extreme wind gusts when designing structural engineering and orientation of buildings • Account for increased and less predictable clean up of damaged or fallen trees
Increased Hurricane Frequency	• See strategies for disaggregated hurricane effects of More Heavy Rainfall, Stronger Wind Gusts, Increased Flooding, and Higher Storm Surge
Higher Storm Surge	• Plan for the potential need to pump seawater • Design floodwalls so that their height can be increased easily in the future • Also see Increased Flooding adaptation strategies
Air Quality	
Increased Smog	• Mitigation of GHG emissions • Consider adverse human health effects • Also see Increased Temperature strategies