

# **INFRASTRUCTURE AND ECONOMIC DEVELOPMENT IN METROPOLITAN BOSTON: A REGIONAL SURVEY**

## **PART I: REGIONAL INFRASTRUCTURE REVIEW**

This is Part I of *Infrastructure and Economic Development in Metropolitan Boston: a Regional Survey*. This study was commissioned by A Better City (ABC), with funding from The Boston Foundation. The research and writing was carried out by the consulting firm AECOM, with guidance from ABC staff and an Advisory Committee which ABC convened for this study. The study seeks to evaluate the state of public infrastructure investment in metropolitan Boston, particularly as it relates to the region's potential for near- and longer-term economic development.

Part I of the study provides a region-level overview of infrastructure issues. It summarizes and organizes a large body of relevant analysis conducted by others and adds current information on key initiatives and concerns.

Part II provides development and infrastructure profiles for 25 areas defined by the study to represent the universe of region-scale economic development opportunities in metropolitan Boston, from the inner core to I-495. Each profile summarizes the key development opportunities and infrastructure needs of the area in question.

Part III presents a set of four geographic Case Studies, which explore in detail the interface of development and infrastructure issues in a diversity of settings. They include the inner core cluster of East Cambridge and East Somerville; the North Shore cities of Lynn, Salem, Beverly, and Peabody; the MetroWest towns of Framingham, Natick, and Ashland; and the I-495 town of Franklin.

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## Preface

The Greater Boston that we know today is the economic product not only of the ingenuity of its people, but of the transformative investments they have made for four centuries in the region's infrastructure. In Boston's core, much of the ground on which we live and work was created by filling Town Cove, Mill Cove, Back Bay, South Bay, Commonwealth Flats, the Miller's River, and other historic waterways. Some of these filled lands were created for maritime, rail, and canal transportation to fuel earlier generations of development. Over time, those tideland transportation facilities have been modernized, or replaced by different technologies, or recycled for the mixed-use, knowledge based urban development of the late twentieth and early twenty-first centuries.

When the Legislature was considering the Massachusetts Water Resources Enabling Act in 1984, the pollution of the harbor—in violation of federal and state law—had the regional economy a step away from a moratorium on sewer connections and, effectively, on normal growth. The region's water supply system was in more precarious condition than generally understood. Three decades and seven billion dollars later, our regional water resource systems are among the nation's best, providing a reliable platform for growth. This transformation is an echo of the work of earlier generations in creating the Cochituate Reservoir and then the Wachusett and then the Quabbin.

Today's regional transit system, for all its needs going forward, stands on a monumental base of investment over the last four decades: the Southwest Corridor and the Orange Line extension to Melrose; the Red Line Extensions to Alewife and Braintree; the creation of the Silver Line; the rebirth of the north and south commuter rail systems and, with them, North and South Stations. These investments reflect Greater Boston's earlier role as a transit pioneer—from the Winnisimmet Ferry to the regional railroads of the 1830s; from the first streetcar lines of the mid-nineteenth century to the Tremont and East Boston subways at the turn of the twentieth. What other American cities are striving for today—a sustainable, competitive pattern of development in dense, walkable communities organized around transit—is what Greater Boston has had for 140 years.

The metropolitan Boston highway system connects the streets of every downtown, neighborhood business district, and industrial park to the interstate highway system. In a sixty-year span, two iconic highway investments helped redefine the socio-economic fabric of Greater Boston and its role in the national economy. Route 128 fueled the rise of high technology and the diffusion of commercial, industrial, and residential capital to what were once the outer edges of the region. The Big Dig reinforced the emergence of the region's historic core as its twenty-first century development frontier, enhancing mobility, Smart Growth, and the attraction of new and old Bostonians to the waterfront and the transit system.

A Better City (ABC) seeks to evaluate the state of public infrastructure investment in metropolitan Boston and to relate it to the region's potential for economic development. The relationship between infrastructure and development is hardly a new topic. It is the subject of many recent analyses and a theme of daunting breadth and depth. The intended contribution of this study is to deepen the discussion by linking infrastructure investments—and the consequences of making or not making them in timely fashion—to concrete economic development agendas in the cities and towns of Greater Boston. ABC's strategy for doing so in this study is to start with a review of infrastructure issues at the regional level and progressively “drill down” to subregional and local examples.

## Introduction

Part I of this study, the Regional Infrastructure Review, summarizes the state of the region’s public infrastructure across four domains: surface transportation, water resources, energy, and telecommunications. This is achieved by reviewing the large body of recent infrastructure analysis done by others, surveying major policy initiatives and concerns, and deriving overall conclusions about investment in the region’s economic infrastructure.

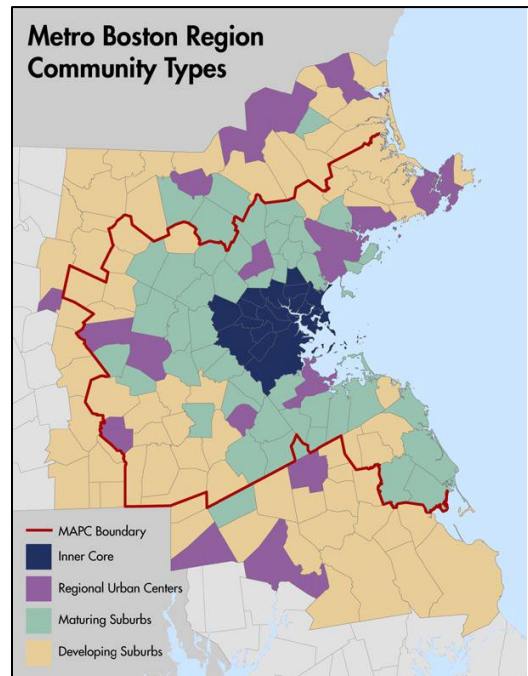
## Defining the Region

For this analysis, metropolitan Boston is defined as the 101 municipalities—22 cities and 79 towns—in the Metropolitan Area Planning Council (MAPC) region, as shown by the red boundary in **Error! Reference source not found.**<sup>1</sup>

For planning purposes, MAPC divides its 101-community region into eight smaller, easily understood sub-regions. Shown in **Error! Reference source not found.**, these sub-regions are used in a variety of contexts in this report.<sup>2</sup> The sub-regions, and the consortia that direct their planning efforts, are as follows:

- Inner Core Committee (ICC)
- Minuteman Advisory Group on Interlocal Coordination (MAGIC)
- MetroWest Regional Collaborative (MWRC)
- North Shore Task Force (NSTF)
- North Suburban Planning Council (NSPC)
- South Shore Coalition (SSC)
- Southwest Advisory Planning Committee (SWAP)
- Three Rivers Interlocal Council (TRIC)

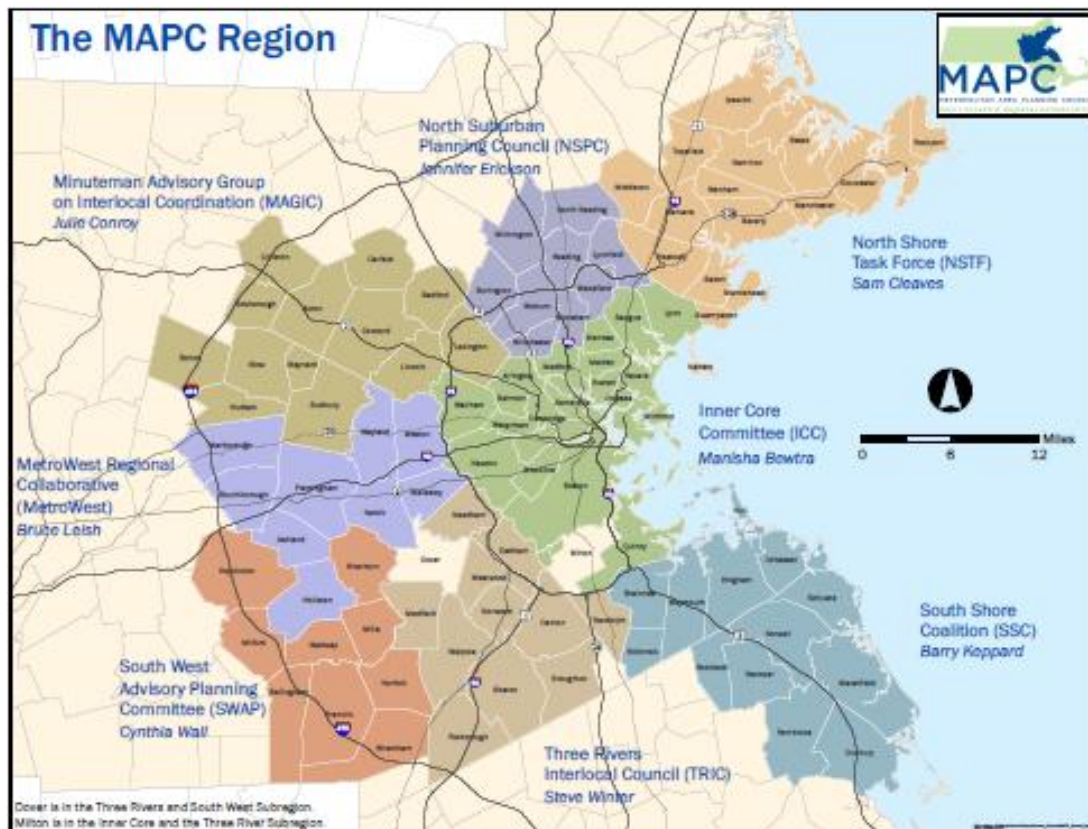
Figure 1: The MAPC Region



<sup>1</sup> Metropolitan Planning Area Planning Council (MAPC), *MetroFuture: Making a Greater Boston Region*, 2008 (hereafter *MetroFuture*). *MetroFuture* covers 164 communities, including 63 which are outside the MAPC boundary; this review is limited to the 101 MAPC member communities.

<sup>2</sup> [http://www.mapc.org/sites/default/files/MAPC\\_Subregions\\_2012.pdf](http://www.mapc.org/sites/default/files/MAPC_Subregions_2012.pdf)

Figure 2: MAPC Subregions



## A Smart Growth Framework

This analysis does not treat all potential infrastructure investment and all potential development uniformly. ABC recognizes Smart Growth as an organizing framework for regional infrastructure and development planning. Smart Growth means, among other things, that new development is concentrated in places where substantial infrastructure is already in place—city and town centers, established employment districts, brownfields, and other places with an existing or historic built environment. New development that does occur outside established built-up areas is concentrated in locations where density, and thus a relatively cost-effective investment in new infrastructure, can be achieved going forward.

The region has a strategy in place to promote a Smart Growth future over the next two decades and beyond—*MetroFuture: Making a Greater Boston Region*, published in 2008 by the MAPC.<sup>3</sup> *MetroFuture* is a planning scenario that departs significantly from current trends to steer development in a Smart Growth direction. While it lacks regulatory authority, it can be used to guide land use and infrastructure decisions by its many stakeholders.

<sup>3</sup> Metropolitan Planning Area Planning Council (MAPC), *MetroFuture: Making a Greater Boston Region*, 2008 (hereafter *MetroFuture*). *MetroFuture* covers 164 communities, including 63 which are outside the MAPC boundary; this review is limited to the 101 MAPC member communities.

MetroFuture sets forth 65 specific, inter-related planning goals, ranging from land use and infrastructure to open space, affordable housing, public health, and historic preservation. The first five of these goals bear directly on this report:<sup>4</sup>

1. Population and job growth will be concentrated in municipalities already well served by infrastructure, with slower growth in less developed areas where infrastructure is more limited.
2. Throughout the region, most new growth will occur through reuse of previously developed land and buildings.
3. Brownfields and other polluted sites will be cleaned up and re-used for parks or development.
4. In suburban municipalities, most new growth will occur near town and village centers.
5. Most new homes and jobs will be near train stops and bus routes, and new growth will be designed to promote transit use.

Among MAPC's strategies for advancing the MetroFuture agenda, two were used by the ABC consulting team to help frame this review. One is the designation of Priority Development Areas (PDAs) and Priority Preservation Areas (PPAs) throughout the region, as illustrated in Figure 3.<sup>5</sup>

The other is the organization of planning and development around transit stations and corridors—the concept broadly known as transit-oriented development or TOD. In its 2012 report *Growing Station Areas*, MAPC categorizes every station in the MBTA system by its contextual type and its potential impact on development, while making the underlying argument that investment in the MBTA system is essential and that other infrastructure investments should reinforce the TOD concept.<sup>6</sup> TOD is by no means the exclusive focus of this review, but it is an important focus, shared by ABC, MAPC, the Commonwealth, numerous cities and towns, the Urban Land Institute, and many developers and major employers.

MAPC's *Development Database* compiles data on 1,700 projects recently completed, in construction, or planned in the MAPC region. The Development Database includes more than 250 TOD projects near subway and commuter rail stations, which collectively would create 36,000 housing units and space for 92,000 permanent jobs. This current pipeline, moreover, represents only part of the potential for transit-oriented development in the region. MAPC's recent *Growing Station Areas* report estimates a potential of 76,000 new residential units and commercial space holding 133,000 jobs to be built near MBTA rapid transit and commuter rail stations by 2035—representing 31% of regional housing demand and 58% of employment growth.<sup>7</sup>

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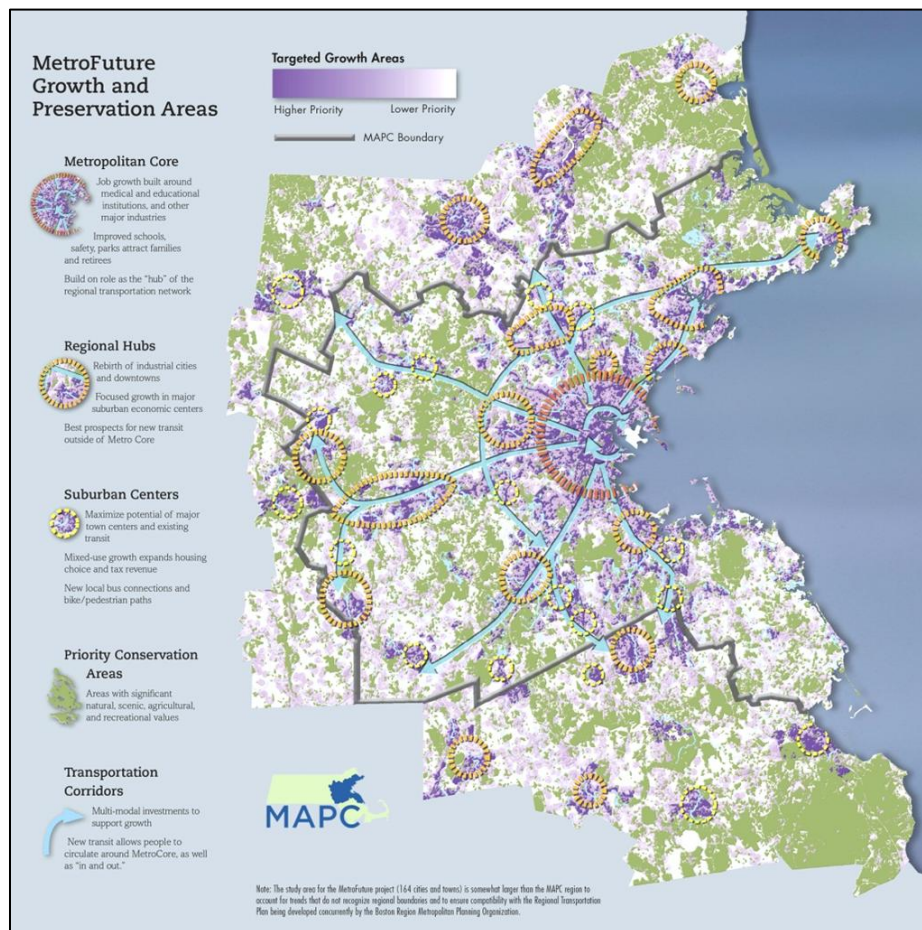
<sup>4</sup> Ibid.

<sup>5</sup> Ibid. See also Commonwealth of Massachusetts, Executive Office of Housing and Economic Development, Metropolitan Area Planning Council, et al., *The 495/MetroWest Development Regional Compact Plan*, 2012, a more recent joint undertaking with the Central Massachusetts Regional Planning Commission, two regional business consortia, and Mass Audubon. This study covers 37 communities along the western arc of I-495, identifying PDAs and PPAs. (Hereafter *495/MetroWest Development Compact*.)

<sup>6</sup> MAPC, *Growing Station Areas: The Variety and Potential of Transit Oriented Development in Metro Boston*. June 2012 (hereafter *Growing Station Areas*).

<sup>7</sup> MAPC Development Database: <http://www.mapc.org/data-services/available-data/devtdatabase>. Analysis: *Growing Station Areas*; and ULI and Northeastern University, *Hub and Spoke: Core Transit Congestion and the Future of Transit and Development in Greater Boston*; June, 2012 (hereafter *Hub and Spoke*).

**Figure 3: MetroFuture Growth and Preservation Areas**



## Summary of Findings

For each of the four infrastructure domains (surface transportation, water resources, energy, and telecommunications), this report presents an overview of what might be called “the state of the system”. The discussion addresses the basic elements of each system, their condition and capacity relative to economic growth needs, and where applicable, any gap between investment needs and identified resources. The four infrastructure domains are addressed in order of complexity, at least with respect to the scope and subject matter of this report.

**Surface Transportation.** Transportation presents the most complex and challenging picture. In the last two decades, Massachusetts has undertaken a generation’s worth of major highway and transit projects, of which the Artery-Tunnel and its associated MBTA improvements are the largest components but by no means the whole story. We have also dramatically improved Logan Airport and the Port of Boston, which although outside the scope of this discussion are integrally related to the highway, transit, and freight networks.

But our transportation infrastructure is at a crossroads. The region cannot remain economically competitive, and local development plans cannot advance very far, unless roadways and bridges are maintained. A regional land use and growth strategy that seeks to maximize transit-oriented development cannot succeed unless the MBTA’s rapid transit, commuter rail, and bus systems are kept in a state of

good repair. Because of well-documented funding and policy issues, at both the state and federal levels, the on-going investment level required for system preservation and state of good repair—just to hold our own—is not currently possible.

Under its current five-year capital program, the MassDOT Highway Division can fund barely 10% of its non-Interstate pavement management needs. The Accelerated Bridge Program, a true success story, is designed to reach only half of the structurally deficient bridges it inherited in 2008. Cities and towns have deferred local roadway maintenance needs that far outstrip the state’s available commitment of Chapter 90 funds. The MBTA’s capital program for the next five to ten years consists almost entirely of state of good repair projects, and that backlog cannot be maintained within existing and anticipated resources. The small set of high-priority, economically crucial enhancement and expansion projects, on both the highway and transit sides, can be undertaken only at the cost of further eroding the resources available to maintain what we have.

On the freight side, nearly 90% of Massachusetts goods movement is by truck; it contributes disproportionately to, and is affected by, the congestion of the highway network. The state’s Freight Plan recognizes that a multi-billion dollar highway capacity program is neither affordable nor environmentally desirable. It recommends a shorter list of high-return, system-level interchange improvements, and a menu of rail, port, and intermodal improvements that could shift a meaningful percentage of freight movement away from congested highways.

Water Resources. The most important regional resources are the MWRA water and sewer systems, whose combined \$7.1 billion investment has cleaned Boston Harbor, stabilized and modernized the drinking water supply, and largely eradicated the combined sewer overflow problem in the region’s core. Without these investments, growth in the region might well have come to a standstill.

However, the reach of the MWRA systems is limited in two ways. First of all, the MWRA is a “wholesale” provider; its customer municipalities control the local or “retail” pipes and pumping stations that draw water from the MWRA supply system or feed the MWRA wastewater system. Second, MWRA covers only part of the region. Nearly half of the MAPC’s 101 communities receive neither water nor sewer service from the MWRA, and only 30 receive both water *and* sewer. The ability of cities and towns to maintain their local systems, or to expand their reach and capacity to serve priority development areas, represents a cumulative region-wide challenge in the billions of dollars.

Stormwater management is emerging as the “next big thing” in water resource infrastructure. Most cities and towns have storm sewers in their developed areas, but these systems are aging and of varying quality. EPA is currently preparing to issue renewed General Permits for stormwater discharges in general and municipal storm sewers in particular; the new “MS-4” regulations will affect 99 of the 101 MAPC communities and could impose significant new requirements for system upgrades, outfall monitoring, and, in some cases, discharge treatment. In the Charles River Watershed, even more extensive long-term measures are under consideration. Cumulatively, stormwater management may represent another multi-billion dollar regional need, with eventual consequences for economic development.

Energy. The availability of adequate electric power is currently a given throughout the region. The principal issues and opportunities related to electric power are those associated with changes in the market, particularly the series of public policy shifts contained in the state’s *Clean Energy and Climate Plan for 2020*. This plan, which is mandated by the 2008 Global Warming Solutions Act, incorporates the state’s pre-existing policies for Renewable and Alternative Portfolio Standards, and includes additional state and EPA policies designed to push the market into generating and importing cleaner power. The Plan sets a 25% greenhouse gas emissions reduction target for 2020 (below 1990 levels), and nearly one-third of this reduction, or 7.7%, is to be achieved through the various electric power policies.



In the coming decade, these policy shifts could affect metropolitan Boston’s economic growth in two ways. At the macro level, the energy market and its regulators must ensure that the replacement of higher-emission power sources by lower-emission, renewable, or alternative sources is as seamless as possible, with no significant gaps. At the micro level, individual power plants may be closed or repowered; the proposal to replace the Salem Harbor Power Station with a new gas-fired plant and redevelop two-thirds of its waterfront site for other purposes is, by itself, a development opportunity of regional significance.

Telecommunications. Broadband telecommunications coverage is nearly ubiquitous across the MAPC region. While there are scattered pockets of wireless-only service, the vast majority of developed territory within the 101 cities and towns is served by both wireless (mostly 4G) and wireline technologies, and in most of the region, wireline service includes cable, DSL, and fiber. By contrast, there are other regions of Massachusetts where broadband coverage is lacking or deficient, creating a significant competitive disadvantage. The Massachusetts Broadband Initiative is addressing these deficiencies through the development of the MassBroadband 123 Network in Western and North Central Massachusetts (including some North Central communities just outside the MAPC region along I-495) and the Open Cape Initiative.

District Infrastructure. Finally, the report takes note that in addition to the region-wide infrastructure systems and their connections to individual localities, there is an additional category of economic development infrastructure that is place-specific and cuts across the four domains. “District infrastructure” is defined as the grid of access roads, streets, and sidewalks; water, sewer, and stormwater pipes; and power and broadband lines that must often be created from scratch in the development of district-size, regionally significant opportunities like the Seaport, Assembly Square, North Point, SouthField, the Lynn Waterfront, or Ashland’s Rail Transit District. This local infrastructure is often achieved through value capture and developer contributions as well as traditional public funding.

## The Regional Infrastructure Review

### Surface Transportation

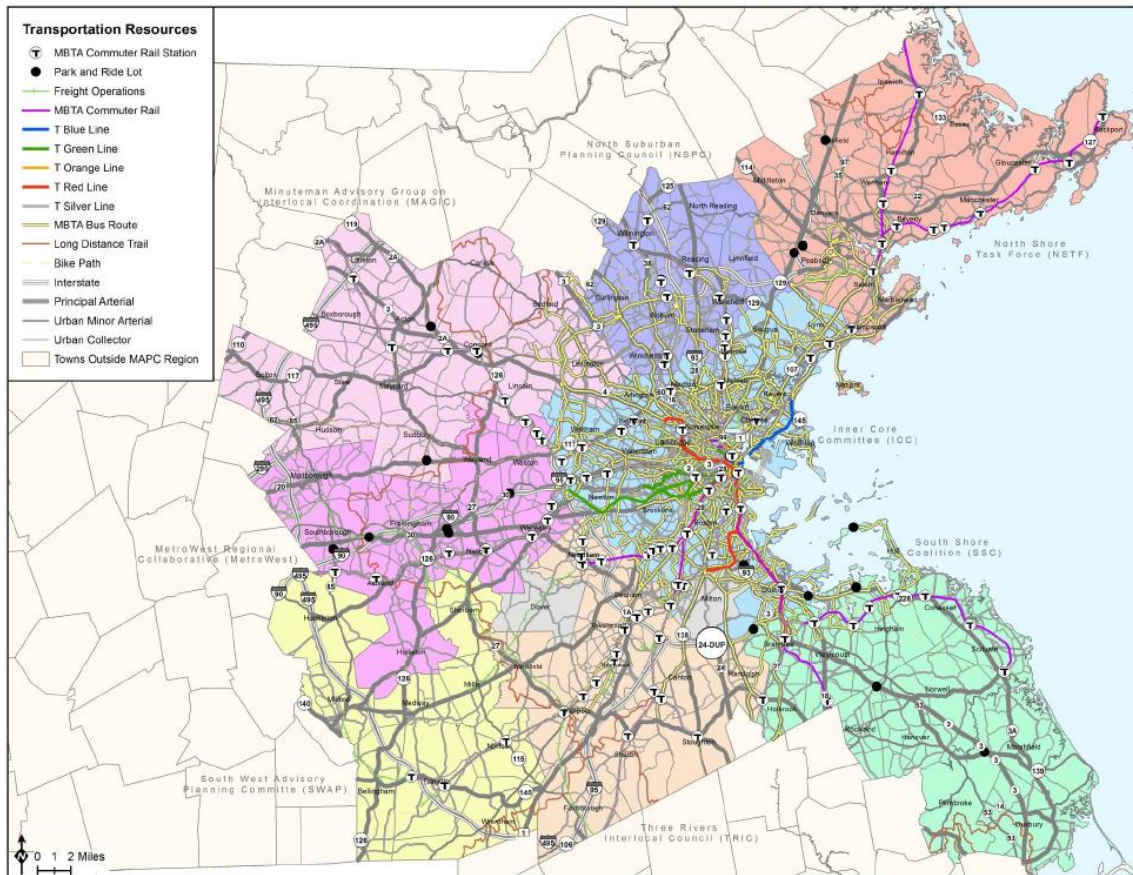
Surface transportation includes roadways and bridges, public transportation (rail and bus), and surface freight movements by road and rail. The relationship between transportation and economic development is universally understood. Development cannot happen anywhere without access by road, transit, or both; goods cannot be manufactured and sold without a freight transportation network; no economic activity can occur without reliable daily movement of employees to and from their jobs and consumers to and from their commercial destinations.

The principal highway and transit assets in the MAPC region are shown in Figure 4.<sup>8</sup> In the last two decades, Massachusetts has added to these assets through a series of major initiatives completed or currently underway: the Artery-Tunnel Project; on-going improvements on Route 128; the Accelerated Bridge Program and a series of high-profile bridge rebuilding projects, including the Longfellow, Whittier, and Fore River Bridges; Silver Line I and II; the Blue Line Modernization; rebuilt stations at Ashmont, Kenmore, Arlington, Charles, and Science Park; the restoration of the three-branch Old Colony rail system; new commuter rail service to Worcester, Newburyport, and Rhode Island and improved service to Fitchburg; expanded commuter rail parking; and successful advocacy for Amtrak’s Acela and Downeaster.

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<sup>8</sup> MAPC.

**Figure 4: Major Regional Transportation Assets (MAPC)**



Nonetheless, the region’s surface transportation infrastructure is at a well-documented crossroads, with a significant and widening gap between needs and resources. In many ways, metro Boston’s transportation problem is part of a larger national crisis of aging assets, expanding need, declining revenues, and policy gridlock; some aspects of our situation are also unique. While a detailed analysis of transportation funding is outside the scope and purpose of this report, an overview of recent analyses is important in understanding the constraints under which highway and transit investment decisions are made.

In 2007, the Transportation Finance Commission empanelled by the Legislature three years earlier issued its report. Although its scope was statewide, it remains the foundational statement of the problem facing metropolitan Boston:

*Since most of the system was built at least a generation or two ago, it seems as if it has always been here and always will be, without requiring any extraordinary attention. But this is not the case. The MBTA, our region’s major transit agency, is over 100 years old and has been under-maintained for at least the last few decades. The Interstate Highway System is 50 years old, and similarly has been under-maintained. It is possible to sustain such a course for some period of time, but not indefinitely. The Transportation Finance Commission has concluded that our system has been neglected for years, and that the system we take for granted will fail if we do not take prompt and decisive action.*

*The Transportation Finance Commission reviewed the most recent actions and decisions of the transportation agencies, spending trends over the past 20 years, and plans for the next 20 years. In each and every instance, we chose to take a very conservative view to make sure we did not overstate*

*the size of the problem. Nonetheless, we estimate that over the next 20 years, the cost **just to maintain our transportation system** exceeds the anticipated resources available by **\$15 billion to \$19 billion**. This does nothing to address necessary expansions or enhancements.<sup>9</sup>*

In the five years since the Commission's report, some things have changed: the MassDOT reorganization was enacted in 2009, resulting in some documented efficiencies and savings. The MBTA and the Highway Division have begun to address their long-term operating cost issues. The Accelerated Bridge Program was created in 2008. But the underlying problems remain:

- Notwithstanding the on-going volume of investment in highway and bridge projects (including the \$1.5 billion transportation bond filed by Governor Patrick and enacted by the Legislature in 2012), MassDOT faces a *multi-billion* dollar gap in needed road and bridge projects. This consists almost entirely of projects devoted to “system preservation”—not expansions or enhancements. In 2010, the MassDOT Highway Division projected a five-year cumulative gap of \$3.67 billion, of which only \$550 million was for system enhancements or expansions. In the toll-funded Metropolitan Highway System (the Turnpike Extension, Artery-Tunnel, Sumner-Callahan, and Tobin Bridge), the five-year investment need is \$667 million, almost all for preservation, safety, and maintenance, of which only 58% was funded.<sup>10</sup> There is also an estimated billion-dollar shortfall in Chapter 90 funds, which cities and towns use to repair and rebuild local roads.<sup>11</sup>

The highway funding gap results from a number of conditions. In the Big Dig era, the state undertook \$1.6 billion in Grant Anticipation Note (GAN) financing—work long completed but still paid for with an annual debt service pledge of \$151 million in federal highway funds, over one-quarter of the state's annual allotment. This burden will end after FY14.<sup>12</sup> The highway program bears the highest proportional debt burden of any highway department in the US, a result of the state share of the Big Dig and a period of several years in which MassHighway (and now the Highway Division) funded much of its operating budget through the capital program. Meanwhile, federal program funding levels are in decline.

Underlying all of this is the inexorable erosion in value of the state gasoline tax (last raised in 1991) and the federal gasoline tax (last raised in 1993); each has lost about one-third of its purchasing power in the intervening two decades and will continue to do so until and unless the gas tax is increased or replaced by an alternative. The federal Highway Trust Fund has staved off insolvency three years in a row only because Congress was willing to fill the gap with General Fund appropriations rather than confront the gas tax head-on. The recent enactment of MAP-21 (a two-year reauthorization of highway and transit programs) defers the revenue issue for that long.

- The MBTA, whose structural deficit underlay the 2012 fare increase and threatened service cuts, is unable to sustainably balance its operating budget; the need to address the issue on a structural rather than a one-time basis is now widely acknowledged. Beyond operations, the MBTA faces a growing state of good repair (SOGR) funding gap. In 2007, the T's projected requirement for annual SOGR investment was \$470 million. The Transportation Finance Commission estimated the real need at \$570 million, and in 2009, the independent review of MBTA finances led by

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<sup>9</sup> *Transportation Finance in Massachusetts: An Unsustainable System*; findings of the Massachusetts Transportation Finance Commission, 2007 (p. 1).

<sup>10</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 4-p. 7).

<sup>11</sup> *Transportation Finance in Massachusetts: An Unsustainable System*; findings of the Massachusetts Transportation Finance Commission, 2007, as estimated at that time.

<sup>12</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 2-p. 7).

David D'Alessandro placed the number going forward at \$694 million.<sup>13</sup> No combination of the T's own current revenues and foreseeable FTA funding levels will support that level of investment. And again, this gap does not include enhancements or expansions.

Like the Highway Division, the MBTA is constrained by the erosion of the federal and state gas taxes and the recent decline in federal spending. But there is more. In the face of the high costs of fuel, health insurance, pensions, and The Ride, the MBTA's yield from the penny of the sales tax dedicated to it in the 2000 Forward Funding legislation has never met original projections; in fact operating costs and sales tax revenues have behaved opposite to what the Forward Funding plan assumed.

Above all, the MBTA has the highest debt burden (currently \$5.2 billion) and highest annual debt service cost of any transit agency in the nation. It currently pays about \$400 million annually in debt service, nearly one-third of its operating budget and barely less than its entire annual farebox revenue. Unless the Commonwealth relieves the MBTA of some of its prior debt burden, funds some of its future capital investment through state sources, or makes annual appropriations for SOGR projects, the MBTA will be unable to keep up with its state of good repair backlog, let alone fund system enhancements or expansions.<sup>14</sup>

In its FY13-17 Capital Investment Program, the MBTA identifies a \$2.9 billion SOGR backlog to be addressed during the five-year span. SOGR represents the lion's share of the whole five-year capital program of \$4.2 billion; setting aside the state's commitment to the Green Line extension, SOGR constitutes virtually the entire five-year program.<sup>15</sup> This program is premised on the MBTA's official \$470 million annual SOGR investment target, rather than the higher levels of need suggested by the Transportation Finance Commission or the D'Alessandro review. Yet the Capital Investment Program states that "without debt relief or more pay-as-you-go revenue... the MBTA will likely be unable to invest the required amounts *included in the CIP*, resulting in an increased backlog of state of good repair needs and unacceptable deterioration of the infrastructure critical to providing reliable service."<sup>16</sup>

## Roadways and Bridges

Roadways and bridges in metropolitan Boston are owned and maintained by multiple jurisdictions. The MassDOT Highway Division, created by the 2009 reorganization, encompasses the former Highway Department and Turnpike Authority; the Highway Division also acquired the Tobin Bridge from Massport and assumed operation and maintenance (but not ownership) of the Department of Conservation and Recreation's parkways and bridges (the former MDC parkway system).

There are approximately 72,000 lane miles of roadway in the Commonwealth. The majority (55,000) are owned and maintained by municipalities, but over 9,500 are owned and maintained by MassDOT.

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<sup>13</sup> David F. D'Alessandro et al., *MBTA Review*, 2009. [http://www.mbtareview.com/MBTA\\_Review\\_2009.pdf](http://www.mbtareview.com/MBTA_Review_2009.pdf).

<sup>14</sup> In 2000, as part of Forward Funding, \$3.2 billion in then-existing state debt for MBTA projects was transferred to the MBTA. In 2009, that amount stood at \$1.68 billion, with another \$1.47 billion in debt for the Artery-Tunnel transit commitments. Together, this \$3.25 in debt represented 60% of the MBTA's then \$5.5 billion total. See David F. D'Alessandro et al., *MBTA Review*, 2009. [http://www.mbtareview.com/MBTA\\_Review\\_2009.pdf](http://www.mbtareview.com/MBTA_Review_2009.pdf); Conservation Law Foundation and Northeastern University, Background Paper on MBTA and RTA Finances, 2010. <http://www.clf.org/wp-content/uploads/2011/04/Background-on-the-Finances-of-the-MBTA-and-Regional-Transit-Authorities.pdf>; and Kane, Brian, MBTA Advisory Board. *Born Broke: How the MBTA found itself with too much debt, the corrosive defects of this debt and a comparison of the T's deficit to its peers*. April 2009.

<sup>15</sup> MBTA *Capital Investment Program, FY13-FY17* (p. 18).

<sup>16</sup> *Ibid* (p. 8-10).

MassDOT’s lane miles predominantly represent the higher functionally classified roads, such as the Interstates and principal arterials. These roadways provide the essential link for interstate commerce and serve long-distance and regional trips for the purposes of commuting, recreation, or commercial activity. Roadways under the jurisdiction of MassDOT account for only 13% of the lane miles statewide, but carry 58% of the annual vehicle miles traveled in the Commonwealth.<sup>17</sup>

MassDOT maintains the highways under its jurisdiction through a combination of federal and state funding and, in the case of the Metropolitan Highway System and the Western Turnpike, toll revenues. A primary method for identifying and prioritizing roadway maintenance needs is a Pavement Management System applied to the National Highway System (NHS) and all other roads under MassDOT jurisdiction.<sup>18</sup> MassDOT assigns a Pavement Serviceability Index (PSI) rating to each road and to the system as a whole. In 2010, 84% of Interstate pavement, but only 68% of non-Interstate pavement, was rated Good or Excellent. The remaining 32% of non-Interstate pavement—one-third of the non-Interstate system—was rated Fair or Poor.<sup>19</sup>

MassDOT has established performance targets consisting of average PSI values of 4.0 for Interstate lane miles and 3.5 for non-Interstate (each target representing the low end of the PSI’s “Excellent” range of 3.5 to 5.0). In 2010, the actual Interstate average was 3.5, and the actual non-Interstate average was 3.0. To achieve the desired targets in the five-year span from FY11-FY15 would require an annual investment of \$128 million on the Interstate side and \$185 million on the non-Interstate side, an annual total of \$313 million. On the Interstate side, 55% of the need is funded. On the non-Interstate side, where pavement deficiencies are more acute, the five-year need was estimated at \$925 million and available funding at \$88 million—*simply put, MassDOT can fund less than 10% of its non-Interstate pavement upkeep needs during this five-year period.*<sup>20</sup>

This situation is summarized in the following table, compiled from statistics provided in MassDOT’s 2010 *Five-Year Capital Investment Plan*, covering FY11-FY15:

	<b>Interstate Highways</b>	<b>MassDOT Non-Interstate Highways</b>
2010: Excellent or Good	84%	68%
2010: Fair or Poor	16%	32%
2010: Average PSI	3.0	3.5
MassDOT Target Avg. PSI	3.5	4.0
Five-Year Investment Need	\$640 million	\$925 million
Five-Year Funding in STIP	\$349 million	\$88 million
Five-Year Gap	\$291 million	\$837 million

Cities and towns, which own 55,000 of the state’s 72,000 total lane miles, rely mainly on real estate taxes and the state’s Chapter 90 program to maintain local roadways. The Massachusetts Municipal Association estimates that cities and towns would need to spend more than \$300 million annually to reconstruct the worst local roads and keep the rest in good condition—well above recent Chapter 90 funding levels, even

<sup>17</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 3-p.3).

<sup>18</sup> Ibid. The NHS is comprised of the entire Interstate Highway System, other major highways such as Route 3 and Route 24, and some major arterial roads such as Routes 2, 9 and 20. Of the 9,500 lane miles of roadways owned by MassDOT, approximately 3,200 are Interstate Highways, 3,000 are other NHS routes, 3,200 are other federal-aid roadways, and 100 are not on the federal-aid system.

<sup>19</sup> Ibid. (Ch. 3-pp. 3ff).

<sup>20</sup> Ibid. (Ch. 4-pp. 3ff).

taking into account the \$200 million for 2012 proposed by Governor Patrick and recently enacted by the Legislature.<sup>21</sup>

There are over 5,000 bridges in the Commonwealth, of which approximately 3,500 are owned by MassDOT and 1,500 are under other agency or municipal jurisdiction.<sup>22</sup> More than 40% of bridges in Massachusetts were built between 1950 and 1970, and the average age is about 45, which means that many will need rehabilitation or replacement as they near the end of their useful lives.<sup>23</sup>

MassDOT is responsible for inspecting its own bridges, as well as those owned by cities and towns and, since 2009, those owned by DCR—in effect, nearly the entire statewide total of 5,000. Bridges are inspected and placed in three categories:

- Non-Deficient: a non-deficient bridge has no serious defects and adequately carries its daily traffic.
- Functionally Obsolete: a functionally obsolete bridge has no serious defects but does *not* adequately carry its daily traffic, including legal weight loads.
- Structurally Deficient: a structurally deficient bridge has one or more serious defects and may or may not adequately carry its daily traffic.<sup>24</sup>

Prior to a rating of structural deficiency, a bridge can be cost effectively rehabilitated, but after such a rating, it becomes more likely that it will need to be replaced or substantially rebuilt. There is thus a constant resource allocation tension between preventative repairs to bridges that have not yet become structurally deficient and the need to rebuild those that already are.

MassDOT's strategy for deteriorating bridges addresses both aspects of the problem. The \$3.0 billion Accelerated Bridge Program (ABP), proposed by the Governor and enacted in 2008, is targeted mainly at structurally deficient bridges. In 2005, of the 4,400 bridges then overseen by Mass Highway, 12% were rated as structurally deficient.<sup>25</sup> Thanks to the ABP, since 2008 the number of former Mass Highway and DCR structurally deficient bridges has dropped from 543 to 439, a decline of 19.2%. As of June 2012 the program has completed 90 bridge projects, with another 72 currently in construction and an additional 25 scheduled to start construction within the next year. Over the course of the eight-year program, more than 200 bridges are planned to be replaced or repaired.<sup>26</sup>

MassDOT's goal is to reduce the number of structurally deficient bridges to zero by 2030. The eight-year ABP, as historic and ambitious as it is, will not reach half of the structurally deficient bridges it inherited in 2008. To replace or rebuild the remaining structurally deficient bridges that already exist, and to minimize the number of additional bridges that will slide into structural deficiency as the inventory ages, the regular (non-ABP) Statewide Bridge Program will require significant on-going investment. MassDOT's 2010 *Five-Year Capital Plan* estimated an annual need of \$155 million in "preservation" funding to bridges that are still non-deficient, and \$150 million for replacement or reconstruction of

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<sup>21</sup> <http://www.mma.org/advocacy-mainmenu-100/exec-directors-reports/6401-transportation-funding-debate-key-to-strong-economy>

<sup>22</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 3-p. 8).

<sup>23</sup> Ibid., and Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Bridges*, 2005

<sup>24</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 3-p. 8).

<sup>25</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Bridges*, 2005. As a result of assuming oversight of the DCR bridges, MassDOT's bridge inventory now includes some 5,000 (MassDOT).

<sup>26</sup> <http://www.eot.state.ma.us/acceleratedbridges/>

structurally deficient bridges—an annual total of \$305 million, or \$1.525 billion for the five years from FY11-FY15. Against this need, MassDOT identifies \$718 million in resources, leaving a five-year gap of \$807 million with a similar gap extending far beyond.<sup>27</sup>

Annual Preservation of Non-Deficient Bridges	\$155 million
Annual Rebuild of Structurally Deficient (non-ABP)	\$150 million
Annual Total	\$305 million
Five-Year Investment Need	\$1.525 billion
Five-Year Funding in STIP	\$718 million
Five-Year Gap	\$807 million

The potential consequences of a perceived lack of bridge safety or reliability is well captured in the statement by a senior MIT executive that “we are terrified something dire may happen to the Longfellow”, a concern undoubtedly replicated wherever economic activity depends on a structurally deficient bridge.<sup>28</sup>

More broadly, highway and bridge congestion imposes a quantifiable cost on the regional economy. In Massachusetts, traffic volumes are growing faster than population (1.3% versus 20% between 2000 and 2006), with VMT anticipated to grow another 20% by 2025. Truck traffic is currently growing at twice the rate of the car traffic.<sup>29</sup> In metropolitan Boston, 58% of vehicle-miles traveled are in congested conditions.<sup>30</sup> According to the analysis provided to ABC by Cambridge Systematics in 2009, the cost of congestion in metropolitan Boston increased from \$550 million in 1991 to \$1.8 billion in 2005—\$895 per driver, reflecting higher operating costs and the value of time delay.<sup>31</sup>

There is a broad policy consensus that regional congestion cannot be overcome by highway system expansion. In its current five-year plan, MassDOT has programmed a short list of key highway widening and capacity expansion projects in the metro region—the Route 128 add-a-lane and I-93/95 interchange, the Route 18 widening, the Saugus Route 1 add-a-lane, the Crosby’s Corner Improvements.<sup>32</sup> Beyond these, the vast majority of planned (and underfunded) highway and bridge investments will be directed at *preserving the system we have, at a higher level of performance than we currently enjoy*. Some of this investment will involve redesigning arterial roads like the Lynnway or the McGrath and O’Brien Highway to better serve economic development through a nominal reduction in capacity.

## Public Transportation

In 2010, the MBTA was the fifth largest transit system in the US, when measured by the total annual number of unlinked passenger trips.<sup>33</sup> The MBTA bus system is the seventh-busiest in the country, with over 182 routes throughout the region. The MBTA’s rapid transit system serves 124 stations deployed along 131 miles of revenue track and another 60 miles of yard and service track; the Green Line is the

<sup>27</sup> MassDOT Highway Division, *Five-Year Capital Investment Plan*, 2010 (Ch. 4-p. 5).

<sup>28</sup> Cambridge Systematics, Inc. *Building Massachusetts’ Economy through Transportation Investment: A Review of Potential New Funding Sources for Transportation*. 2009 (Prepared for “A Better City”). (Also: presentation by Marc Cutler, Senior Vice President, Cambridge Systematics, Inc., March 17, 2009.)

<sup>29</sup> Ibid.

<sup>30</sup> Ibid.

<sup>31</sup> Cambridge Systematics, Inc. *Building Massachusetts’ Economy through Transportation Investment*.

<sup>32</sup> MassDOT, *Five-Year Capital Investment Plan*, 2010 (Ch. 3-p. 17); not all of these are fully funded.

<sup>33</sup> ULI and Northeastern University, *Hub and Spoke*, citing American Public Transportation Association analysis of data from FTA’s National Transit Database.

busiest light rail system in the US. The north and south commuter rail systems serve 123 stations.<sup>34</sup> The MBTA owns 40% of the rail lines in the Commonwealth, including most of the lines inside Route 495. The MBTA operates its commuter system on 650 miles of track, 70% of which is also used by private railroads for freight service.<sup>35</sup>

Institutionally, metropolitan Boston is well served by the fact that a single authority owns and operates the entire multi-modal regional transit system. By contrast, transit in the San Francisco Bay Area is balkanized among nearly two dozen public and quasi-public entities, and, more typically, many large regional transit markets have divided control, with different agencies running the bus, rapid transit, commuter rail, and ferry components.

The MBTA's state of good repair needs touch all aspects of the system—each of the transit modes, and all components of each mode, from fleet upgrade and replacement to signals and power to station accessibility. The efficient operation of the system, possible only if the components are maintained in a state of good repair, is critical to the region's economic growth and competitiveness, not only because it carries over 1.3 million riders every weekday, but because the region cannot solve its roadway congestion issues by building new highway capacity.

Efficiency and capacity in inner core of the rapid transit system are of particular economic importance, for two reasons. First is the ability of the outlying segments of the rapid transit lines, and of the entire commuter rail system, to support TOD at the regionally transformative levels suggested in the recent MAPC report, *Growing Station Areas*. The long-term viability of outlying stations as residential and employment centers depends on the ability of the core rapid transit system to distribute and collect passengers at the Boston or Cambridge end of their commutes.

Second is the unique regional economic role of the core itself, and its profound dependence on the core subway system. The *Hub and Spoke* report published in 2012 by the Urban Land Institute and Northeastern University identifies congestion problems on core segments of the Orange, Red, and Green Lines.

The report focuses on the current five-year increase in MBTA ridership, developing three growth scenarios for the next ten years: baseline, moderate, and high. The corresponding increases in average weekday ridership range from 100,000 to 367,000 in 2021 (on top of today's 1.3 million). One of the report's central points is that congestion at the core of the system could directly inhibit job growth and economic development in the five major "TOD/transit hot spots": the Seaport, Downtown, Back Bay, Kendall, and the Longwood Medical Area (see Figure 5).<sup>36</sup>

Key SOGR investments in the core rapid transit system include replacement of the aging Orange, Red, and Green Line fleets and modernization of the Green Line systems, especially in the Central Subway. Yet in the MBTA's FY13-FY17 *Capital Investment Program*, among the projects either left out of the funded program due to budget constraints, or assigned principally to the out-years when funding is least certain, are the procurement of the Orange Line and Red Line #2 fleet replacements; the replacement of the Green Line's #7 fleet; and the upgrades of the Green Line's power, switching, and signal systems.<sup>37</sup>

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<sup>34</sup> Our Transportation Future, *White Paper: Transportation Investment and the Massachusetts Economy*, 2010

<sup>35</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Freight*, 2008; MBTA *Capital Investment Program, FY13-FY17*.

<sup>36</sup> *Hub and Spoke*.

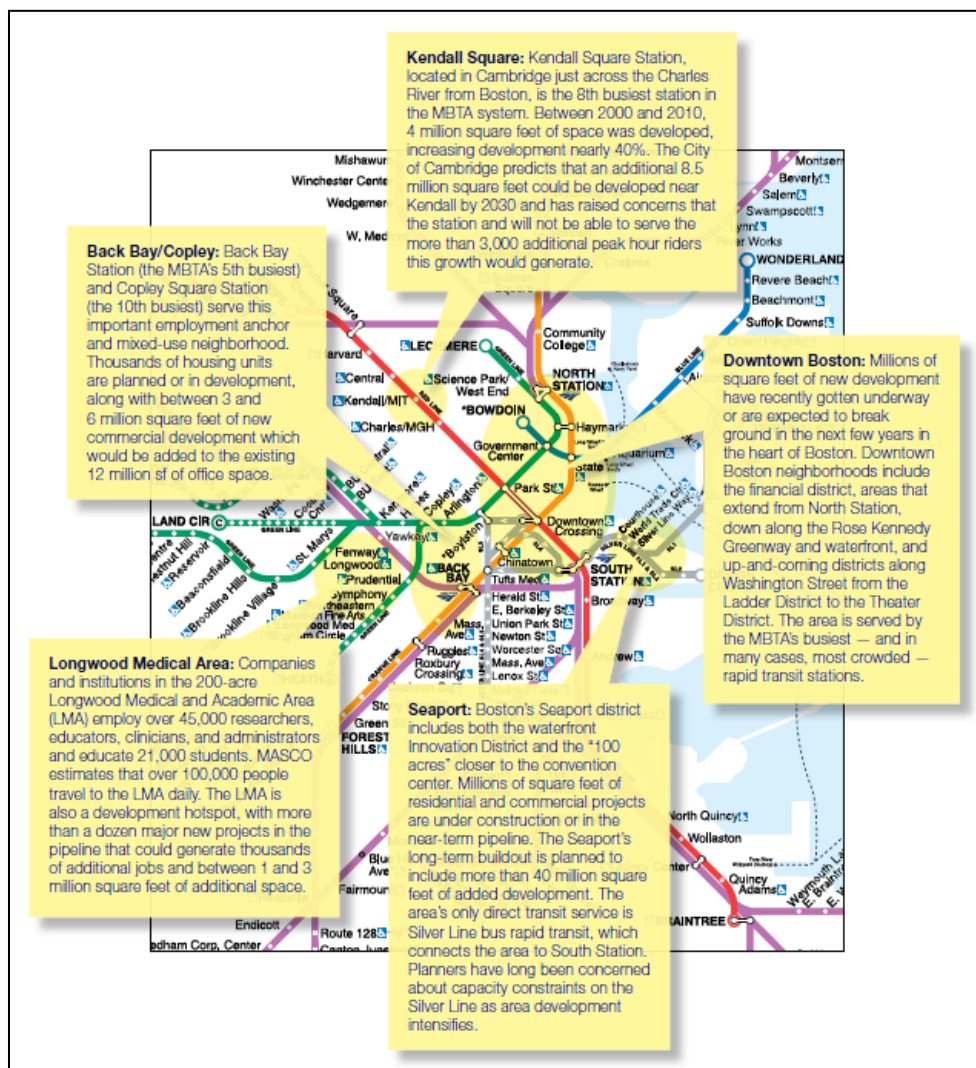
<sup>37</sup> MBTA *Capital Investment Program, FY13-FY17* (p. 11, 54ff, 73ff, 83ff, 95ff). Significant SOGR investments in the commuter rail and bus systems are also deferred.



In addition to state of good repair, the MBTA’s capital program does include a handful of system enhancements and expansions that are underway or imminent. These consist almost entirely of: (a) “state-sponsored projects” funded by the Commonwealth through non-MBTA sources, and (b) projects funded through the American Recovery and Reinvestment Act (ARRA)—a lucrative but one-time source of pay-as-you-go funding. The Commonwealth’s commitment to fund these projects with state, Flex Fund, or ARRA dollars reflects the fact that the MBTA’s financial structure cannot fully address state of good repair needs, let alone support new enhancements or expansions.

State-sponsored and ARRA-funded projects include a number of investments that are integral to regionally significant economic development plans: the Green Line Extension, which will transform the City of Somerville; the Fairmount or “Indigo” Line, which can do the same for Roxbury, Dorchester, and Mattapan; Assembly Square Station; the Wonderland garage and TOD program; the downtown Beverly and Salem garages; and the Fitchburg Branch enhancement and extension.<sup>38</sup>

**Figure 5: Core TOD/Transit Hot Spots (Hub and Spoke)**



<sup>38</sup> The South Coast Rail project, whose planning and design is currently underway along with early-action replacement of three key bridges, is a major state- and ARRA-funded project, for which construction funding has not been identified. This project, while critical to the long-term development of Southeastern Massachusetts, has no direct impact on the MAPC region.

On the horizon are three additional core projects whose outcome will have a significant long-term impact on economic development:

- The expansion of South Station, now in the planning and preliminary design stage through a major grant from the Federal Railroad Administration. This project, with a potential construction cost in the hundreds of millions, is essential to accommodate the simultaneous growth of intercity rail service and of the southside commuter rail system, which in turn affects the development potential of all the southside commuter rail corridors.
- The enhancement or extension of the Silver Line, so that the Seaport District can achieve its full potential. At minimum, grade-separating the Silver Line's intersection with D Street is essential. The much larger Silver Line III project, dropped from the fiscally constrained Transportation Improvement Program in 2009, would expand capacity and connectivity, reducing the need for transfers and shifting them away from Park Street, Downtown Crossing, and South Station.
- The Red-Blue Connector, which would link the employment destinations of both Cambridge and the Financial District to the potential growth of the Route 1A corridor in East Boston, Revere, and Lynn.

## Freight

The freight network in Massachusetts is essential to economic growth. It includes the Port of Boston, Logan International Airport, and several lesser air and sea facilities, but for purposes of this surface transportation discussion, the freight movements of interest are those which occur on the highway and the rail systems. In 2010, MassDOT published a multi-modal Freight Plan in recognition of the importance of goods movement to economic development in the region. The purpose of the Freight Plan was to produce a comprehensive evaluation of the freight transportation system in the Commonwealth in order to identify priorities for investment and regulation change.

In 2007, the last year for which the Freight Plan had data, some 278 million tons of freight moved into, out of, or through Massachusetts, 87% of it by truck. The heaviest corridors for highway freight movement are those carrying trucks eastward and northward into Massachusetts: I-84, I-90, I-95, and the northern arcs of I-290 and I-495. Only 5% of the state's 2007 freight volume moved by rail, and 7.5% by maritime port. Air freight, while proportionately high in value and critical to the regional economy, accounts for a negligible fraction of tonnage.<sup>39</sup>

Because so much of the region's freight moves by truck, the strategic issues confronting freight capacity and efficiency are those affecting the highway system generally. The Freight Plan identifies aging bridges and general traffic congestion as primary freight concerns, and cites the Accelerated Bridge Program and the major regional highway projects cited earlier in this paper (such as the I-95/I-93 interchange improvements and 128 add-a-lane) as important freight projects.<sup>40</sup>

There are 1,153 route miles of rail in the Commonwealth used exclusively or partly to convey freight. The freight rail infrastructure in Massachusetts also includes 24 switching yards and five intermodal yards for rail-to-truck transfers, including the key CSX intermodal yard to be relocated from Boston (Beacon Park) to Westborough. Thirteen freight railroad companies service Massachusetts, led by the east-west CSX and Pan Am Railways and the north-south Providence & Worcester and New England Central. The principal

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<sup>39</sup> Massachusetts Department of Transportation, *Freight Plan*, 2010 (p. ES-21ff).

<sup>40</sup> Ibid. (pp. ES-26ff).

issues confronting the rail side of the freight system are track deficiencies (absence of the now-standard 286k weight-on-track and/or second-generation double-stacking); conflicts with passenger operations on lines controlled by the MBTA or shared with Amtrak; and aging rail bridges.<sup>41</sup>

Highway congestion is caused, to a disproportionate degree, by truck traffic—only 15% of Massachusetts highway volume, and 9% of the volume on major highways in metro Boston, involve trucks, but trucks are larger, and accelerate and decelerate more slowly, than cars. They also inflict proportionally more wear and tear on pavement and bridge structures, leading to additional congestion. Moreover, freight volumes in Massachusetts are projected to increase 70% by 2030, and the overwhelming majority of goods movement will continue to be by truck.<sup>42</sup> The Texas Transportation Institute projects that by shifting 25% of projected truck traffic to freight railroads, workers in the Boston metropolitan area would save an average of 33.2 hours commuting annually.<sup>43</sup> To address long-term constraints, the MassDOT Freight Plan explores five different but not mutually exclusive investment scenarios:<sup>44</sup>

- Truck Freight Improvements, a multi-billion-dollar package of major highway interchange and capacity projects. These would occur statewide, including in the MAPC region along I-495, I-95, and I-93. The Plan recognizes that this scenario is financially unachievable, although a few specific system interchange improvements are identified as particularly cost-effective.
- Northern Tier Rail Improvements, a roughly \$100 million upgrade of the Pan Am main line, including the segment along the northern edge of the MAPC region. This project would create second-generation double-stack clearances all the way across Massachusetts, paralleling the similar improvements already being made on the CSX main line, and would create a major Pan Am intermodal yard at Ayer, similar in function to the new CSX yard at Westborough.
- Boston Core Multi-Modal Freight Improvements, a roughly \$360 million package of port, road, and rail improvements including port dredging and new truck bypass roads around the Seaport District.
- Central and Western Massachusetts Rail Improvements, a roughly \$74 million program falling entirely outside the metro region.
- South Coast Multi-Modal Freight Improvements, a roughly \$158 million package of port, road, and rail improvements capitalizing on the underutilized port facilities of New Bedford and Fall River.

Based on an all-in cost-benefit analysis, the MassDOT Freight Plan recommends advancing a menu of high-return projects drawn from the four non-highway scenarios, while urging that freight benefits be more explicitly considered in evaluating highway and bridge improvements. All of the high-return projects, but particularly those in the Northern Tier and Boston Core, would benefit regional goods mobility in the metro region (and thus general highway mobility and economic competitiveness as well).

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<sup>41</sup> Ibid (pp. ES-21ff).

<sup>42</sup> Ibid. (pp. ES-24).

<sup>43</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Freight*, 2008.

<sup>44</sup> Massachusetts Department of Transportation, *Freight Plan*, 2010 (pp. ES-36-54).

## Water Resources

### Water and Sewer Systems

The water resources infrastructure of metropolitan Boston includes water supply, wastewater treatment, stormwater management, and dams. Since 1985, the region has undertaken, and substantially completed, a massive realignment, expansion, and modernization of its water supply and wastewater systems, through the creation of the Massachusetts Water Resources Authority (MWRA) and its \$7.1 billion investment in the Boston Harbor cleanup and the metropolitan drinking water system.

- The federally mandated 11-year, \$3.8 billion Boston Harbor Project included a new sludge-to-fertilizer facility; the Deer Island Treatment Plant with primary and secondary treatment capabilities; the Inter-Island Tunnel that tied together two separate sewer systems (North and South) into one; and the 9.5-mile Effluent Outfall Tunnel to discharge treated wastewater away from shallow Boston Harbor waters and into the deeper waters and stronger currents of Massachusetts Bay.<sup>45</sup>
- The \$2 billion water system program included the 17.6-mile MetroWest Water Supply Tunnel and the 115-million gallon Norumbega Covered Storage tank in Weston. The last major construction project, a state-of-the-art water treatment plant in Marlborough that uses ozone instead of chlorine for primary disinfection, was completed in July 2005.<sup>46</sup>

In understanding the impact of the MWRA water and sewer investments on regional development, three threshold facts should be considered:

- Without these investments, economic development would have been drastically limited—not only because development needs reliable, high-quality water and sewer service, but because in the case of the sewer system, a judicial moratorium on sewer connections was a step away from reality in 1984. The coalition that successfully pushed for creation of the MWRA included the region's business and labor leadership.
- The MWRA is a *wholesale* provider. The retail connection between the MWRA system and individual homes and businesses is provided by the municipalities themselves or by local water and sewer districts. Consequently, the responsibility to modernize or expand water or sewer lines *in MWRA communities* falls directly or indirectly on those communities.
- While MWRA provides both water and sewer service to virtually the entire Inner Core, it does not by any means serve the entire metropolitan region. It currently provides 43 municipalities with sewer service, 51 with water service, and a total of 61 with either or both; of these 61, only 52 are in the MAPC region. Thus, nearly half of the MAPC's 101 communities receive neither water nor sewer service from the MWRA. Only 30 receive both water *and* sewer, and several of these contract with MWRA for only a portion of their water supplies or their emergency backup.<sup>47</sup>

Outside the MWRA service area, communities maintain their own water supplies or purchase water from neighboring communities. On the wastewater side, non-MWRA communities belong to smaller regional

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<sup>45</sup> MWRA Five-Year Report, 2010. <http://www.mwra.state.ma.us/publications/5yearreport-2005-2010/5yearreport-2005-2010-book.pdf>

<sup>46</sup> Ibid.

<sup>47</sup> <http://www.mwra.com/02org/html/whatis.htm> 6/18/2012

districts (like the South Essex Sewerage District or Charles River Pollution Control District)) or maintain their own treatment facilities. (Statewide, some 435 million gallons of wastewater are treated by 126 state and federally permitted wastewater treatment facilities, most with capacities below two million gallons per day.)<sup>48</sup>

The Massachusetts Water Infrastructure Finance Commission (WIFC) was formed in 2009 to quantify the funding needed to adequately manage water and wastewater infrastructure, and to identify ways to fill the funding gap through proactive planning and reforms. In addition to the on-going investment program at MWRA, the Commonwealth has since 1989 offered low-interest State Revolving Fund (SRF) financing to communities to fund water and wastewater projects implemented by municipalities and regional water supply or wastewater treatment districts.

WIFC estimates that the Commonwealth faces a \$10.2 billion gap in resources for drinking water and a \$11.2 billion gap in resources for wastewater projects over the next 20 years.<sup>49</sup> Through estimates from the American Water Works Association, WIFC projects that costs for pipe replacement and repair in metropolitan Boston will grow to \$5 billion by 2030 based on the estimated age of pipes and their life expectancy.<sup>50</sup> Most water mains installed 100 years ago are still in the ground; 10% of water loss in the Commonwealth is estimated to originate from deteriorating water mains.<sup>51</sup> In some older towns and cities, sewer pipes are over 100 years old, and the service life of these pipes is estimated at 50-75 years.<sup>52</sup>

To further emphasize the importance of drinking and clean water infrastructure in the Boston region, six of the nine action steps identified by the Boston Society of Civil Engineers (BSCES) in response to the American Society of Civil Engineers (ASCE)'s 2009 national report card deal with water related infrastructure.<sup>53</sup>

Economic development relies on the existence of water resource infrastructure and its capacity to meet future demand. While the MWRA has available water supply capacity, its wastewater capacity is nearly taken, due in part to infiltration and inflow. Moreover, according to the 495/MetroWest Compact, the volume of wastewater managed by existing municipal wastewater treatment facilities has been increasing faster than population and employment growth in the MetroWest region.<sup>54</sup>

The relationship between water or wastewater deficiencies and Smart Growth is complex. Portions of some outlying MAPC communities remain unsewered, and in general, Smart Growth principles would dictate that these lands not be considered as future development areas. On the other hand, to the degree that areas appropriate for development lack sewer service, residential growth may fall back onto large-lot, low-density patterns that can get by with septic systems.

With respect to water supply, the full redevelopment of SouthField (the former South Weymouth Naval Air Station) as a Smart Growth village combining densely clustered, mixed-use development with large expanses of open space and commuter rail service, depends on a long-term solution for the district's 1.3 million gallon per day water demand. Weymouth, Abington, and Rockland, the three host municipalities,

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<sup>48</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Wastewater*, 2007

<sup>49</sup> Commonwealth of Massachusetts Water Infrastructure Finance Commission, *Massachusetts' Water Infrastructure: Toward Financial Stability*, 2012.

<sup>50</sup> Commonwealth of Massachusetts Water Infrastructure Finance Commission, *Massachusetts' Water Infrastructure: Toward Financial Stability*, 2012

<sup>51</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Drinking Water*, 2007

<sup>52</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Wastewater*, 2007

<sup>53</sup> Boston Society of Civil Engineers. *Raising the Grade in Massachusetts*, 2009.

<sup>54</sup> *495/MetroWest Development Compact*.

are all non-MWRA water communities. An agreement between the South Shore Tri-Town Development Corporation and Weymouth has enabled the first major phase of development to proceed.<sup>55</sup>

In Framingham, which is an MWRA customer for both water and sewer, the problem of inadequate or deteriorating “retail” connections is illustrated by the successful expansion of Genzyme, whose multi-building campus includes two new LEED Gold structures, the Science Center and the Biologics Support Center. These showcase buildings, as well as the expansion program as a whole, were jeopardized by sewer and water problems in the “9/90” corner of town, a recognized Priority Development Area. The Genzyme program, which proposes to add 750,000 feet of space over the next decade, was able to advance because the Commonwealth, through its Life Sciences Initiative, contributed \$12.9 million in funding to upgrade the sewer and water connections.<sup>56</sup>

## Stormwater

Stormwater management is essential, for water quality and often for flood control, in any area with extensive expanses of impervious land. Most communities have storm drainage infrastructure (storm sewers) in their developed areas, and EPA has regulated stormwater discharges from municipalities and major developments since the 1980s. Stormwater can be a complex and expensive challenge at the regional, municipal, development district, and site-specific levels. Because of pending changes in the national regulatory framework, it may become significantly more so.

One high-visibility, high-impact regional success has already occurred. MWRA has undertaken and largely completed its \$876 million program to eliminate untreated combined sewer overflow (CSO) discharges, a key source of pollution in the inner harbor and its estuaries, including the Charles River. The program is about 75% complete, and includes sewer separation, construction of storage tunnels, treatment of discharges, and elimination of numerous outfalls.<sup>57</sup>

Under the National Pollution Discharge Elimination System (NPDES), EPA has pending a set of renewed General Permits which, if promulgated in their current draft form, would significantly impact the way municipalities manage stormwater. The General Permit for Municipal Separate Storm Sewer Systems (MS4) applies to 99 of the 101 MAPC communities; depending on local conditions, the proposed MS-4 renewal would require upgrading of storm sewer infrastructure; water quality monitoring of outfall discharges, a labor- and technology-intensive process involving dozens of outfalls in a given community; and in some cases, treatment of discharges.<sup>58</sup>

EPA and DEP are focusing on the Charles River Watershed for even higher levels of stormwater intervention, and have chosen the towns of Franklin, Bellingham, and Milford for a joint pilot project to reduce stormwater-conveyed phosphorus discharges. While still preliminary, the capital program involved could exceed \$100 million, affecting individual properties of two impervious acres or more as well as the three municipal storm drainage systems.<sup>59</sup> If similar measures were ultimately

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<sup>55</sup> <http://www.wickedlocal.com/weymouth/news/x874248797/SouthField-water-study-raises-concerns#axzz23ZGY6fq1>

<sup>56</sup> <http://www.businesswire.com/news/home/20120419005115/en/Genzyme%E2%80%99s-Biologics-Support-Center-Achieves-LEED-Gold>; <http://www.wbjournal.com/apps/pbcs.dll/article?AID=/20081124/PRINTEDITION/31124>; [http://www.boston.com/news/local/articles/2010/07/11/a\\_plan\\_to\\_double\\_genzymes\\_campus\\_in\\_framingham\\_would\\_bring\\_new\\_jobs\\_businesses\\_to\\_area/](http://www.boston.com/news/local/articles/2010/07/11/a_plan_to_double_genzymes_campus_in_framingham_would_bring_new_jobs_businesses_to_area/)

<sup>57</sup> MWRA Five-Year Report, 2010.

<sup>58</sup> <http://cfpub.epa.gov/npdes/stormwater/munic.cfm/>

<sup>59</sup> <http://www.epa.gov/region1/npdes/charlesriver/pdfs/20111019-UtilityProjectGPFactSheet.pdf>

Statewide, the WIFC has identified a potential \$18 billion need for stormwater infrastructure investment over the next 20 years, most of it in metropolitan Boston.<sup>60</sup> To help address this, MAPC is developing a Massachusetts Local Stormwater Utility Model to help municipalities or special districts plan, cost, and finance such solutions.<sup>61</sup> Many municipalities across the US have adopted some version of the utility model for their stormwater drainage systems; two are MAPC communities, Newton and Reading.<sup>62</sup>

## Dams

More than half of the dams in Massachusetts are over 100 years old.<sup>63</sup> Of the 2,900 dams in the Commonwealth, 1,680 are judged to pose some level of risk to human life or property, and more than one quarter of jurisdictional dams are judged to be in poor condition or worse (40 of which are determined to be in unsafe condition).<sup>64</sup> All dam owners have been required by the Massachusetts Department of Conservation and Recreation (DCR) Office of Dam Safety to complete a Phase 1 dam inspection.

In 2011, the State Auditor issued a report stating that of 647 municipally-owned dams, 100 are in unsafe or poor condition, posing high or significant hazard, respectively, requiring \$60 million for repair or removal.<sup>65</sup> In January 2013, the Legislature enacted a \$17 million bond issue for dam and seawall repairs; half the amount will go to dams, along with the creation of an interest-free revolving loan fund.

Dam safety is a region-wide concern, but dam issues are place-specific. Where applicable, dam issues that potentially impact economic development are identified in the 25 development area profiles that accompany this report.

## Water Resource Infrastructure

The metropolitan region's water infrastructure includes:

- Dams (over 2,900 dams in the Commonwealth, 56% privately owned<sup>66</sup>)
- Public and private drinking wells (3,708 wells in the Commonwealth<sup>67</sup>)
- Surface water supplies (255 supplies in the Commonwealth<sup>68</sup>)
- Water storage tanks and reservoirs
- Water mains (21,000 miles of water mains in the Commonwealth<sup>69</sup>)
- Wastewater treatment plants
- Sewer pipes (20,000 miles of sewer pipe in the Commonwealth<sup>70</sup>)
- Stormwater facilities
- well fields

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<sup>60</sup> Commonwealth of Massachusetts Water Infrastructure Finance Commission, Massachusetts' Water Infrastructure: Toward Financial Stability, 2012.

<sup>61</sup> For MAPC, see: <http://www.mapc.org/node/1522/view>.

<sup>62</sup> Charles River Watershed Association: <http://www.crwa.org/projects/stormwater/swutility.html>.

<sup>63</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Dams*, 2010

<sup>64</sup> Ibid

<sup>65</sup> Commonwealth of Massachusetts, Office of the Auditor, Local Financial Impact Review, *Massachusetts Dam Safety Law*. July 2011.

<sup>66</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Dams*, 2010

<sup>67</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Drinking Water*, 2007

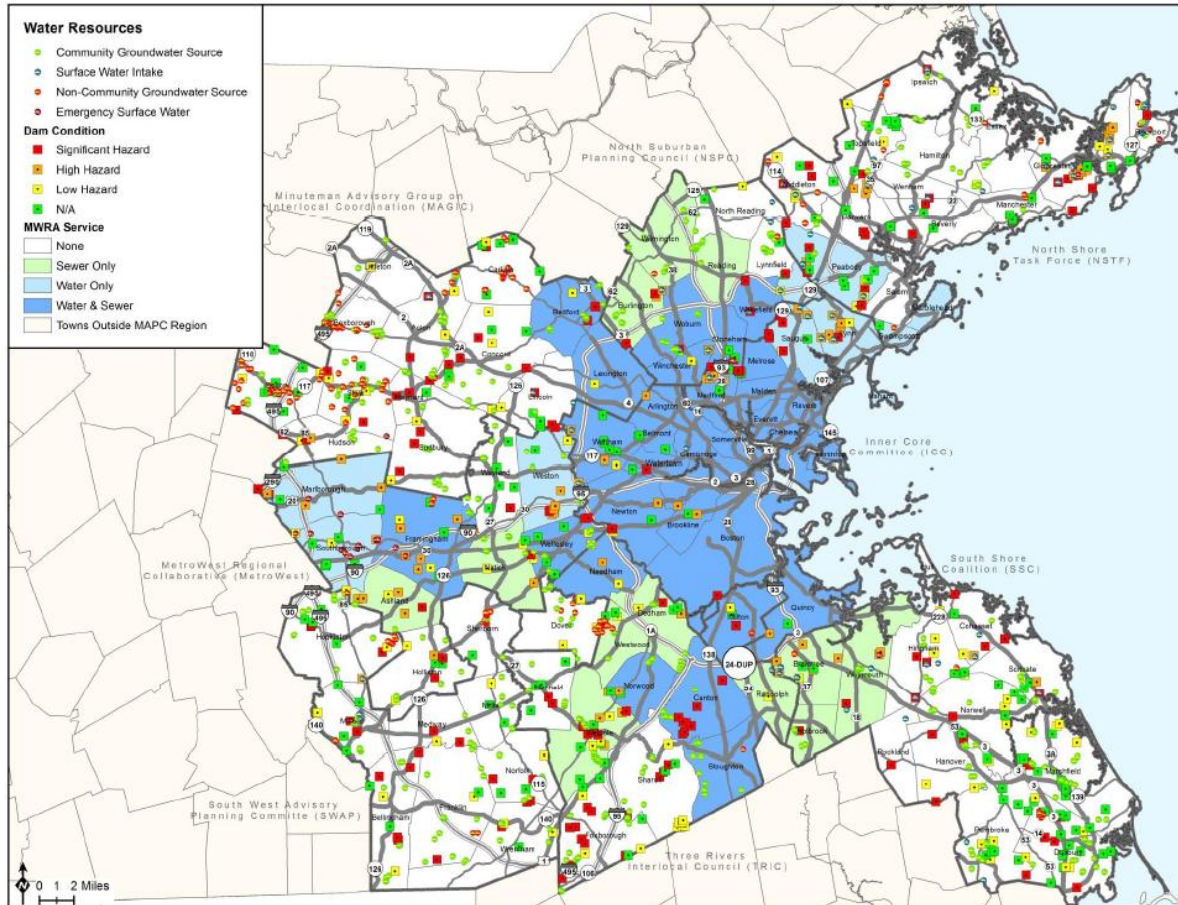
<sup>68</sup> Ibid

<sup>69</sup> Ibid

<sup>70</sup> Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report on Wastewater*, 2007

Figure 6 maps communities with MWRA service and without, dam location and condition, and location of community surface and groundwater sources.

**Figure 6: Water Resource Assets and Services (MAPC)**



## Energy

Energy resources are needed to power businesses and households and to operate other infrastructure systems (transportation, water, telecommunications). Having adequate energy resources, particularly into the future as sources of nonrenewable energy sources are depleted, is vital to economic development. Energy infrastructure in metropolitan Boston is comprehensive and is not currently a major impediment to growth. For new development or redevelopment in the region, other than the cost of distributing electric utility service to the site, there is generally not an energy issue.

That said, the energy market is changing, due in part to long-term shifts in public policy. Moving towards a higher percentage of renewable energy sources is a step towards creating a sustainable energy plan for future development. The Massachusetts Green Communities Act of 2008 expanded the state's Renewable Portfolio Standard (RPS) and created the complementary Alternative Portfolio Standard (APS), both of



which require retail electricity suppliers to buy a growing percentage of their electricity sales from eligible resources.<sup>71</sup>

The Global Warming Solutions Act of 2008 went further, requiring the Secretary of Energy and Environmental Affairs to establish a statewide limit on greenhouse gas emissions of between 10% and 25% below 1990 levels for 2020, on the way toward an 80% reduction by 2050, along with a plan to achieve the 2020 target. In 2010, Secretary Bowles issued the *Clean Energy and Climate Plan for 2020*, which set the 2020 reduction at 25 percent and specified the measures to meet that limit.<sup>72</sup>

Much of the *Clean Energy and Climate Plan* deals with energy issues other than electricity supply: energy-efficient building standards, reduced vehicle emissions, reduced air conditioning and refrigerant emissions, more efficient land use. However, emission reductions of 7.7%—nearly one-third of the 25% total—are attributable to four electricity supply policies:

- the existing RPS and APS portfolio policies, which by 2020 will require that 22% of retail supply be purchased from RPS sources and an additional 5% from APS; the agreement by NStar and Northeast Utilities, as part of their merger approval, to purchase half the power to be generated by Cape Wind is an important part of this strategy;
- the existing Regional Greenhouse Gas Initiative, which began in 2009 and establishes a region-wide cap on CO<sub>2</sub> emissions from fossil fuel-fired power plants, achieving a total reduction of 10% by 2018;
- more stringent power plant emission rules being developed by EPA, which may cause some smaller, older plants to close or change power sources;
- increased import of clean power; a new transmission line being developed by NStar/ Northeast Utilities in partnership with Hydro Quebec could supply 15% of the state's current electricity demand.<sup>73</sup>

In the coming decade, these policy shifts could affect metropolitan Boston's economic growth in two ways. At the macro level, the energy market and its regulators must ensure that the replacement of higher-emission power sources by lower-emission, renewable, or alternative sources is as seamless as possible, with no significant gaps. The construction of transmission lines to bring additional hydro power into New England, or of pipeline capacity expansion or LNG terminals to power gas-fired plants, could prove challenging.

A recent analysis by ISO-New England confirms that the region has become far more natural gas-dependent, for both power generation and home heating; in 1990, 5% of New England's electric supply was gas-fired, in 2011, it was 51% (and 70% in Massachusetts). The ISO analysis identifies potential reliability issues, requiring complex market adjustments or, eventually, expansion of pipeline system capacity.<sup>74</sup>

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<sup>71</sup> Commonwealth of Massachusetts, *Massachusetts Clean Energy and Climate Plan for 2020*, (pp. ES-9-10). A report to the Great and General Court pursuant to the Global Warming Solutions Act (Chapter 298 of the Acts of 2008, and as codified at M.G.L. c. 21N).

<sup>72</sup> *Ibid.* (p. ES-1).

<sup>73</sup> *Ibid.* (pp. ES-9-10).

<sup>74</sup> <http://www.boston.com/business/news/2012/08/22/cheap-plentiful-natural-gas-increases-demand-worries-arise-about-new-england-supply/cjOWemX2fqkh0oOGiAvIGL/story.html>;

At the micro level, at least one power plant in the region, Salem Harbor Station, will be repowered in a transaction that will both maintain its role as a power generator and create a major redevelopment opportunity. Footprint Power LLC, which is buying the plant from Dominion Energy, plans to run the existing coal- and oil-powered plant for two years and then demolish and replace it with a state-of-the-art gas-fired plant 630 megawatt plant. The replacement will leave about two-thirds of the site—a waterfront location just north of downtown—available for new development.<sup>75</sup> The North Shore case study accompanying this report will address this project in its larger context.

## Energy Resource Infrastructure

Energy infrastructure elements include the following:

- Power plants
- Transmission (1,000 miles of interstate gas transmission lines in Massachusetts<sup>76</sup>)
- Distribution (connect to transmission companies pipeline at meter stations)
- Meter Stations
- Natural Gas Pipeline (21,000 miles of mains in Massachusetts<sup>77</sup>)

There are five major electric power plants in or around the metropolitan Boston region (three natural gas, one petroleum, and one coal.)<sup>78</sup> The Commonwealth also uses liquefied natural gas (LNG) and has three import facilities (two offshore and one onshore in Everett). LNG is delivered to the import facilities by ship, and then trucked to LNG facilities.<sup>79</sup> Interstate gas transmission lines in the Commonwealth are owned by three companies (Algonquin Gas Transmission Company, Tennessee Gas Pipeline Company, and Maritimes and Northeast Pipelines Company) and are generally between 12 and 24 inches in diameter.<sup>80</sup>

National Grid and NStar/Northeast Utilities (merger approved by Massachusetts Department of Public Utilities on April 12, 2012) are the major energy suppliers in the Commonwealth. Figure 7 shows the energy (electric and gas) service providers in the region in addition to the location of power lines, substations and gas lines.<sup>81</sup>

## Telecommunications

The availability of high-tech telecommunications infrastructure and high-speed networks is essential to economic development. Telecommunications infrastructure is generally owned and maintained by the service company, and coverage in the metropolitan Boston region is comprehensive. The provision of telecommunications service including cable, broadband, data, telephone, and wireless requires cable, telephone, and fiber optic networks, as well as wireless towers.

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[http://www.iso-ne.com/committees/comm\\_wkgrps/strategic\\_planning\\_discussion/materials/natural-gas-white-paper-draft-july-2012.pdf](http://www.iso-ne.com/committees/comm_wkgrps/strategic_planning_discussion/materials/natural-gas-white-paper-draft-july-2012.pdf)

<sup>75</sup> <http://www.bostonglobe.com/business/2012/08/06/deal-sell-salem-power-plant-closes-new-gas-plant-and-development-planned/2QXaYxH8CEO9pvciaNISuN/story.html>.

<sup>76</sup> Commonwealth of Massachusetts, Department of Public Utilities

<sup>77</sup> Ibid

<sup>78</sup> U.S. Energy Information Administration, 2009

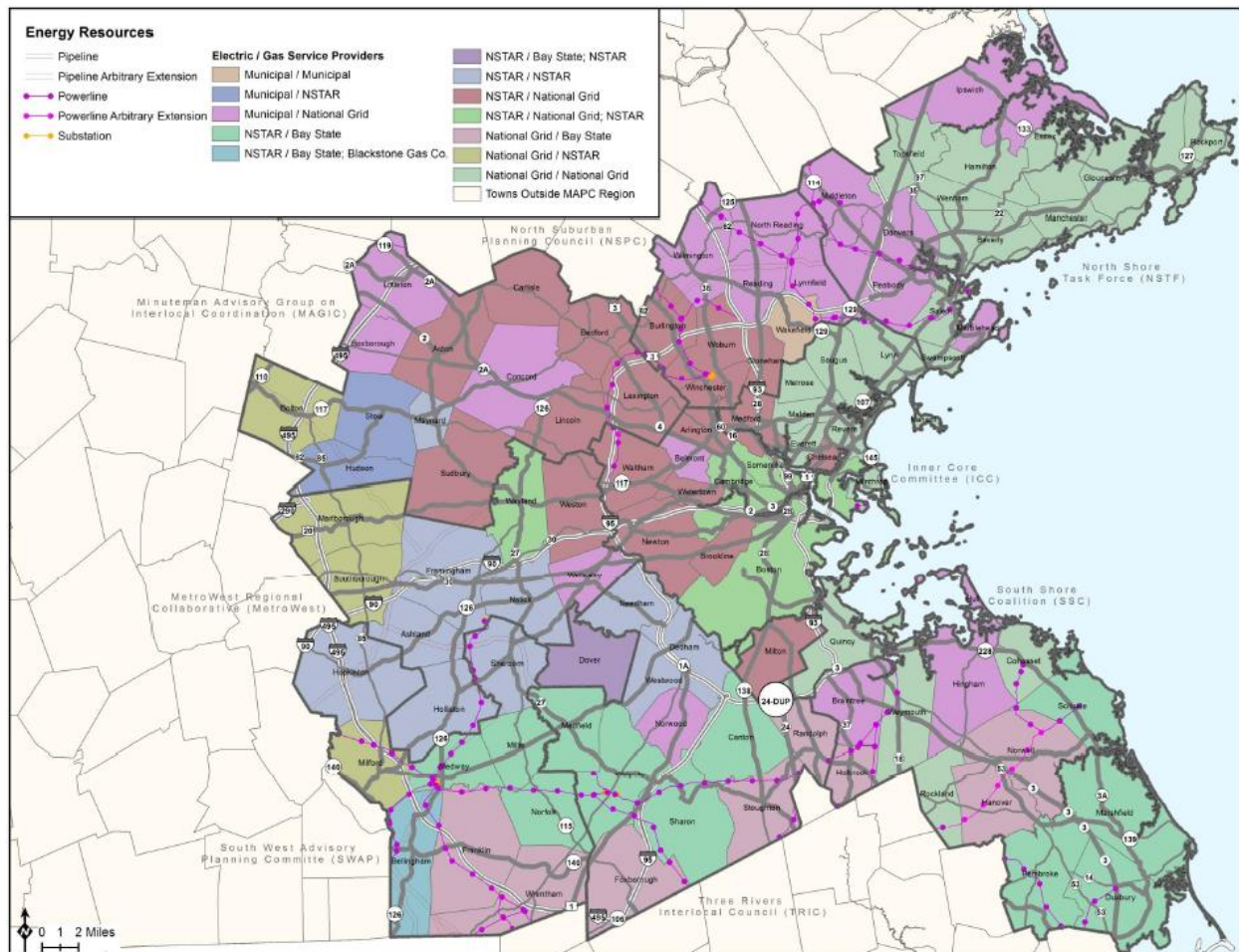
<sup>79</sup> Ibid

<sup>80</sup> Commonwealth of Massachusetts, Department of Public Utilities

<sup>81</sup> MAPC.

In the Commonwealth, there are 11 cable companies licensed to operate service and five incumbent telecommunications operators<sup>82</sup>. In addition to the incumbent service providers, there are also competitive service providers in the region. There are also a multitude of mobile telephone and data carriers in the region. In the Boston metropolitan region, Verizon New England is the largest telecommunications operator. According to Verizon, the company invested \$500 million in the Commonwealth in 2011 on wireline communications networks and IT infrastructure.<sup>83</sup> All communities with Verizon service in the metropolitan Boston region have fiber-optic television (FiOS TV) capability and Verizon is continuing to upgrade its network to all fiber-optic cables to offer additional FiOS services. Cable providers by municipality as of 2008 are shown in Figure 8, as are the locations of cellular telephone towers.<sup>84</sup> The vast majority of the Boston metropolitan region is also in Verizon’s 4G LTE wireless zone.

**Figure 7: Regional Energy Resources (MAPC)**



Simply put, broadband telecommunications coverage is nearly ubiquitous across the MAPC region. While there are scattered pockets of wireless-only service, the vast majority of developed territory within the

<sup>82</sup> Commonwealth of Massachusetts, Consumer Affairs and Building Regulation

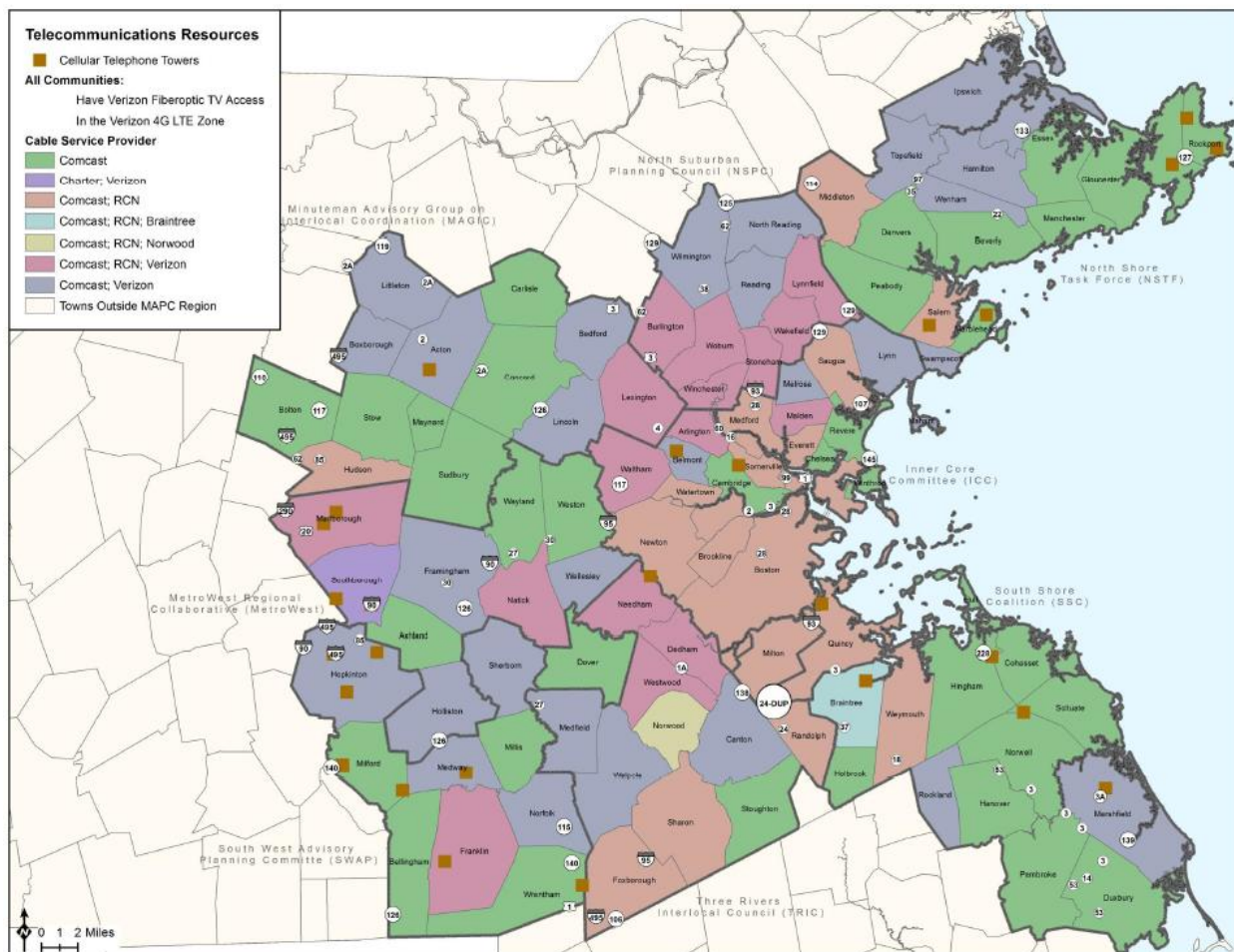
<sup>83</sup> Verizon New England, 2012

<sup>84</sup> MAPC and Massachusetts Department of Telecommunications and Energy, 2008; Federal Communications Commission, 2011.

101 cities and towns is served by both wireless (mostly 4G) and wireline technologies, and in most of the region, wireline service includes cable, DSL, and fiber.<sup>85</sup>

The contrast with other regions of the Commonwealth, where deficient broadband coverage is an issue to be overcome through strategic investment, is instructive. The state’s Massachusetts Broadband Initiative is undertaking the development of the MassBroadband 123 Network in Western and North Central Massachusetts (including some communities that border the MPAC region), as well as the Open Cape Initiative. A Boston Globe article described the degree to which the lack of broadband coverage has limited the growth of knowledge-based businesses on Cape Cod, a critical part of any Cape strategy to increase year-round, non-traffic intensive economic activity.<sup>86</sup> The Open Cape Initiative will help remedy this issue, which does not exist in metropolitan Boston.

**Figure 8: Cable Providers and Cellular Tower Locations (MAPC)**



## District Infrastructure

The preceding review of infrastructure condition and capacity is focused, by nature, on the regional transportation, water, energy, and telecommunications systems. These systems affect economic development at the sub-regional and local levels in a number of ways. The electric power and broadband

<sup>85</sup> See <http://www.massbroadband.org/Availability/gallery.html>, the mapping site of the Massachusetts Broadband Initiative.

<sup>86</sup> Boston *Globe*, “On Cape Cod, upgrades come by the megabyte”; August 12, 2012.

telecommunication systems are region-wide networks that are routinely distributed to virtually every location. Specific highway and transit improvements connect developed and developable places to the regional and national transportation networks. Local water and sewer improvements connect development areas to the MWRA system or, in non-MWRA communities, to local systems.

It is useful to recognize an additional, cross-cutting type of infrastructure investment that occurs in areas of transformative, district-scale redevelopment, such as the Seaport, Assembly Square, North Point, Brickbottom, the Lynn Waterfront, SouthField, the Foxboro Route 1 District, Ashland's Rail Transit District, and many others. In places like these, a suitable grid of streets, sidewalks, open spaces, water, sewer, stormwater, electric, and telecommunication lines typically does not exist before the redevelopment effort begins. This grid must be created, through a master-planned, multi-phase effort involving not only traditional sources of infrastructure funding, but some combination of direct private contribution, value capture, and economic development funding.

This type of "district infrastructure" is usually accompanied by a major public project connecting the site to the regional transportation system—the I-90 ramp system and Silver Line in the Seaport; the Green Line Extension in Somerville, the Route 18 improvements at SouthField, the new Orange Line Station at Assembly Square.

In the case of Assembly Square, the \$53 million Orange Line Station was jointly funded by the developer, MassDOT (using federal "flex funds"), and the Executive Office of Housing and Economic Development. The 65-acre grid of streets, sidewalks, open space, and utilities—a "district infrastructure" platform costing well over \$100 million—was achieved through developer contributions, ARRA funds, and both of Massachusetts' innovative value capture mechanisms: District Infrastructure Finance (DIF) and the Infrastructure Investment Incentive Program (I-Cubed). Both the regional public project (the station) and the "district infrastructure" grid were integral to the successful mixed-use redevelopment, which is now occurring. A number of district infrastructure examples will be addressed in the 25 local profiles and four case studies presented in Part II of this report.