Introduction

What we do:

Southern California is a semi-arid region. Without water, it would be nearly impossible to support its $800 billion economy. To that end, Metropolitan supports this substantial economic activity by importing water from two sources—the Colorado River and the State Water Project, supplying on average more than 6,000 acre-feet per day of treated and untreated water to its member agencies through a conveyance and distribution system consisting of the 242-mile-long Colorado River Aqueduct and its five pumping plants, 775 miles of pipeline, five treatment plants, nine reservoirs used for storage or regulation, clearwells at the treatment plants and numerous regulating structures. In addition, Metropolitan has 16 hydroelectric power recovery plants throughout its system.

Who we serve:

The Metropolitan Water District of Southern California is the nation's largest provider of treated drinking water. Each day during a normal year, the district moves more than 1.5 billion gallons of water through its distribution system, delivering supplies to 26 member agencies. Those agencies, in turn, sell that water to more than 300 subagencies or directly to consumers. In all, 19 million Southern Californians rely on Metropolitan for some or all of the water they use in their homes and businesses. These people live within Metropolitan's six-county service area, which encompasses 5,200 square miles in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties. In geographic terms, that's nearly as large as the states of Connecticut and Rhode Island combined.

Listed below is an estimated direct and indirect impact summary to include 50 year projections for CIP, wages, operating revenue, Business Outreach.

Direct & Indirect Impacts[1]:

- ✓ CIP costs (FY 2000/01- 09/10) totaled $3.2 billion
  - Direct impact: 32,000 jobs
  - Indirect impact: $11B and 110,000 jobs

Direct & Indirect Impacts continued:

- ✓ CIP costs (FY 2010/11 – 15/16) totaled $2 billion
  - Direct economic impact = 20,000 jobs
  - Indirect economic impact: $7B = 70,000 jobs
  - Aggressive Scenario: Cost per job = $100,000 at an annual growth of 3% totals $438,391 in 50 years
  - Conservative Scenario: Cost per job = $100,000 at an annual growth of 2% totals $269,159 in 50 years

- ✓ Estimated 2009 wages = approximately $185 million [2]
  - Total number of employees = 1936[3]
  - Aggressive Scenario: The average annual growth percentage of the total payroll is 3% ending at $ 835,353.3 in 50 years
  - Conservative Scenario: The average annual growth percentage of the total payroll is 2% ending at $ 507,902.7 in 50 years

[1] Source: Metropolitan's Real Property Development & Mgmnt Group ($1M= ten jobs; the multiplier for indirect jobs = 3.5)
[2] Source: Human Resources Group/Total Compensation
[3] Source: Human Resource Group/Total Compensation

- ✓ Professional Services (FY 2010/11) totaled $17 million
  - Direct economic impact: 170 jobs
  - Indirect economic impact: $60M = 600 jobs
  - Aggressive Scenario: The average annual growth percent for professional services is 3% ending at $75,090.2
  - Conservative Scenario: The average annual growth percent for professional services is 2% ending at $46,103.1

- ✓ Fiscal year 2009 Operating Revenues were $1.1 billion[4]
  - Aggressive Scenario: The average annual growth percentage of the total operating revenue is 3% ending at $ 4,966,965.5 in 50 years
  - Conservative Scenario: The average annual growth percentage of the total operating revenue is 2% ending at $ 3,019,961.8 in 50 years

- ✓ Business Outreach costs (Fiscal Years 2002 to 2009) totaled approximately $900 million
  - Direct economic impact: 9,000 jobs
  - Indirect economic impact: approximately $3B = 30,000 jobs
  - Aggressive Scenario: The average annual growth percentage of the total business outreach activity is 3% ending at 4,063,880.9 in 50 years
  - Conservative Scenario: The average annual growth percentage of the total business outreach activity is 2% ending at $ 2,470,877.80 in 50 years

Jurisdiction:

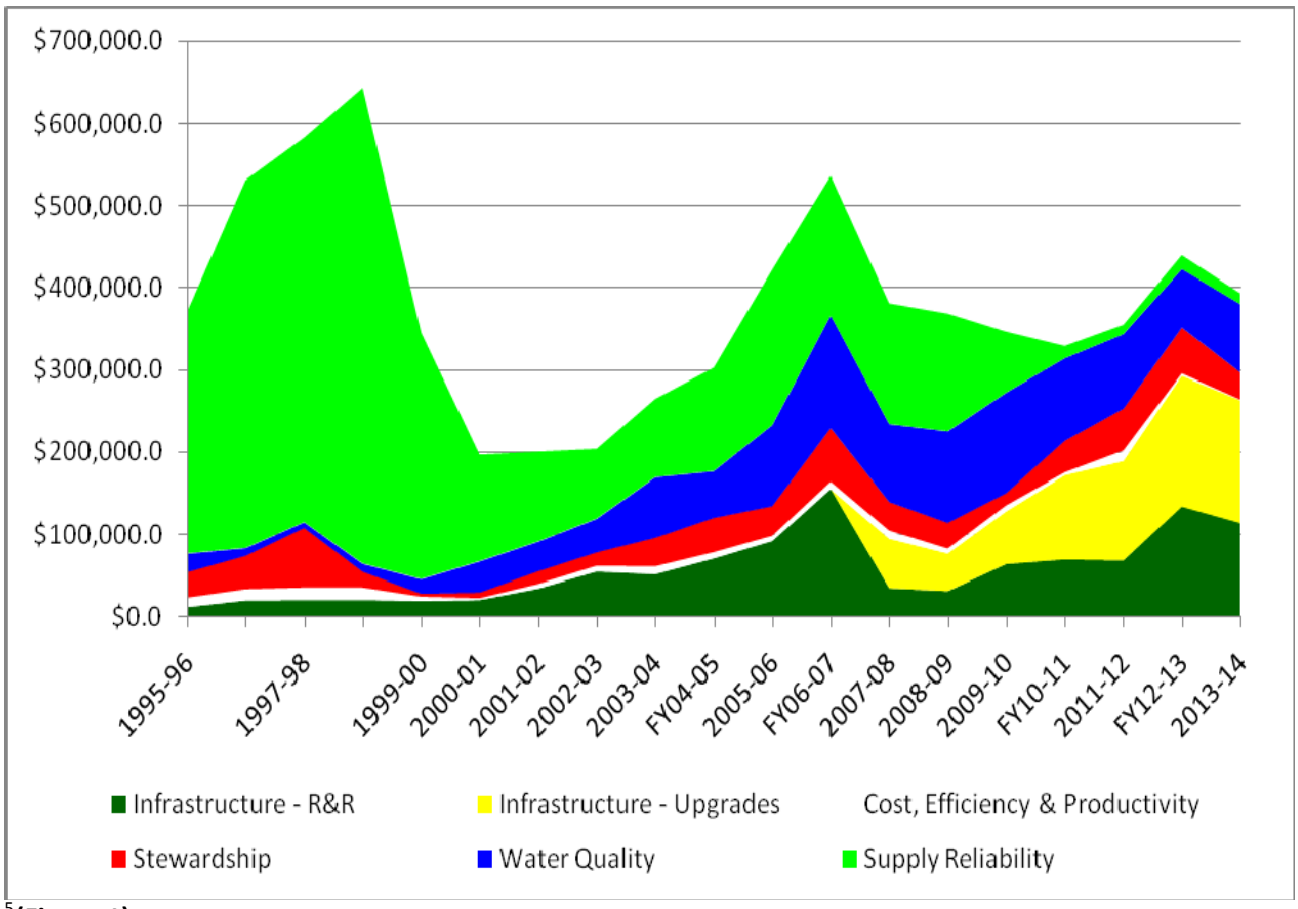
Metropolitan's service area comprises approximately 5,178 square miles and includes portions of the six counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura. Nearly 19 million people reside within Metropolitan's service area. Metropolitan provides between 40 and 60 percent of the water used within its service area, depending on the weather, with individual member agencies relying on Metropolitan to provide between 10 and 100 percent of their water. Metropolitan serves its member agencies as a water wholesaler and has no retail customers. Metropolitan owns or has an interest in over 190,000 acres of land. These properties provide the potential for additional economic value to Metropolitan and the region in areas such as renewable energy, ground leasing or other development.

Capital Improvement Projects

Besides providing the region's water, the second most significant contribution to the regional economy from Metropolitan is its Capital Investment Plan (CIP). On average, Metropolitan annually spends approximately $350 to $400M on capital plans. The projects that comprise the CIP have been identified from many Metropolitan studies of projected water needs that are embodied in Board-approved documents such as the Integrated Resource Plan (IRP), Distribution System Overview Study, and the General Manager's Business Plan. In addition, staff and consultants have studied operational demands on aging facilities as well as new regulations and made recommendations for capital projects that will maintain infrastructure reliability and water quality standards; and studied business and operational processes and made recommendations for programs that will improve efficiency and provide future cost savings.

[4] Source: Metropolitan Basic Financial Statements (year ended 6/30/09)

Figure 1 below shows Metropolitan's annual CIP costs categorized by projected driver for fiscal year 1995 to current as well as projected costs for fiscal years 2010 to 2014.



[5]**(Figure 1)**

[5]Source: Metropolitan's Corporate Resources Group/ Project Coordination Office

A driver is the primary reason a project is being implemented and is identified within the context of Metropolitan's goals of providing a reliable supply of high quality water. The projects in the CIP have been assigned to the following categories: Supply and Delivery Reliability, Infrastructure Reliability, Water Quality, Stewardship, and Cost, Efficiency and Productivity. The definitions for each category are listed below.

Project Driver[6]	Definition
Supply & Delivery Reliability	Implementing the project will improve the capacity of Metropolitan's water supply and delivery infrastructure to meet projected demand increases.
Infrastructure Reliability ➢ Replacement & Refurbishment ➢ Facility Upgrades	Implementing the project will replace or refurbish existing facilities and components in order to continue to reliably meet current service demands. Implementing the project will improve or modify Metropolitan's treatment, conveyance, storage, or distribution facilities to effectively respond to changing operational conditions or requirements, and utilize new processes and/or technologies.
Water Quality	Implementing the project will ensure Metropolitan meets all applicable water quality regulations.
Cost/Efficiency/ Productivity	Implementing the project will provide economic savings that outweigh project costs through enhanced business and operating processes.
Stewardship	Implementing the project will help ensure the protection, safety, and security of Metropolitan's employees, visitors, and all real and intellectual properties and assets. Other Stewardship projects provide for prudent use and management of Metropolitan's assets in compliance with all applicable regulations and codes.

[6]Source: Metropolitan's Corporate Resources Group/ Project Coordination Office

Table 1 below indicates that Metropolitan's CIP costs for fiscal year 2000/01 to 2009/10 totaled approximately $3 billion, and the projected fiscal year costs for fiscal year 2010/11 to 2015/15 total approximately $2 billion.

[7] (Table 1)

CIP Driver Categories	Fiscal Year Costs 2000/01 to 2009/10	Projected Fiscal Year Costs 2010/11 to 2015/16
Supply Reliability	1,266,028.5	110,546.18
Infrastructure - R&R	611,893.6	427,061.42
Infrastructure - Upgrades	169,997.7	680,310.70
Water Quality	806,315.8	456,944.87
Cost, Efficiency & Productivity	60,900.5	15,927.30
Stewardship	304,113.6	202,658
TOTAL:	**$3,219,249.70**	**$1,893,448.47**

[7] Source: Metropolitan's Corporate Resources Group/ Project Coordination Office

Real Property

Real Property is comprised of three primary areas related to Metropolitan's property specific functions and activities: Real Estate Services, Building Management, and Recreation Management. Real Estate Services manages surplus property dispositions and third-party uses of Metropolitan real property through leases, licenses, entry permits, and easements. Building Management provides the services that support the day-to-day activities within Metropolitan's headquarters building at Union Station and the Diamond Valley Lake Visitors Center. These services include administrative support, project management for tenant improvements, management of service contracts, mail services, special event planning, lease administration, tenant relations, management of the Wellness Center and associated programs, furniture procurement, emergency services, and guest and employee parking. Recreation Management manages day-to-day operations and contracts for existing recreation facilities at DVL and Lake Skinner, offering visitors safe, high-quality recreational experiences, while protecting water quality and reliability. In addition to managing the group, the Office of the Group Manager oversees the DVL Property Program and develops real property policies and strategies.

Table 4 below shows a summary of Metropolitan's property by county.

[8](Table 4)

Metropolitan Property Summary by County			
County	**Fee**	**Easement & Water Rights**	**Total**
Imperial	2,790	816	3,651
Los Angeles	1,438	841	2,279
Orange	5,658	3,642	9,300
Riverside	102,707	24,914	127,621
San Bernardino	34,888	8,461	43,349
San Diego	117	176	293
Other	97	2,526	2,623
Total (Acres)	**147,695**	**41,376**	**189,071**

[8] Source: Metropolitan's Real Property Development & Management Group

Business Outreach

Metropolitan was founded on the principal of regional economic development. Water and economy have always been linked to Southern California's overall development strategy and investment in infrastructure. The business community has been a key factor in developing and supporting these goals.

The performance and productivity of economic sectors depend on access to a reliable water supply. Reliable water resources are critical to production processes and sustained economic growth.

Business and economic development are achieved through a variety of innovative approaches and business collaborations. It provides the foundation and opportunities for businesses, entrepreneurs and the community to achieve their goals of creating jobs, effective growth and reinvestment back into the community. It also provides Metropolitan with a viable stream of cutting edge technologies, public/private collaboration, cost savings and sustainable business strategies.

Key points:

- There are 3.3 million small businesses in California. 70 percent of California's workforce is employed by small business owners
- Ninety percent of the venture capitalists in the world are headquartered in California. Over $8 billion was invested into research and new technologies by California based companies last year.

Table 5 below indicates Metropolitan's business outreach activity for fiscal years 2002 to 2009 with an estimated total of approximately $900 million.

[9](Table 5)

Business Outreach Activity Fiscal Year 2002 - 09	
Business Type	**$ Amount**
Minority-Owned Business	42,000,000
Small Business Enterprises	800,000,000
Women-Owned Firms	56,000,000
TOTAL:	**$898,000,000**

[9] Source: Office of the Business Outreach Manager

50 Year Projections to 2060

[10]SCENARIO #1 – Most aggressive

CIP:

- The average annual growth percent of Metropolitan's total annual budget is 5% ending at $24,298,379.3[11] in 50 years
- Trending Metropolitan's total budget at 5% and taking 20% out of the CIP totals $4,739,834.67 in 50 years
- Cost per job = $100,000 at an annual growth of 3% totals $438,391 in 50 years

Professional Services:

- The average annual growth percent for professional services is 3% ending at $75,090.2

Operating Revenue:

- The average annual growth percentage of the total operating revenue is 3% ending at $4,966,965.5 in 50 years

Business Outreach:

- The average annual growth percentage of the total business outreach activity is 3% ending at $4,063,880.9 in 50 years

Annual Payroll:

- The average annual growth percentage of the total payroll is 3% ending at $835,353.3 in 50 years

[12]SCENARIO #2 – Conservative

CIP:

- The average annual growth percent of Metropolitan's total annual budget is 4% ending at $ 14,432,963.2 in 50 years
- Trending Metropolitan's total budget at 4% and taking 17% out of the CIP totals $2,453,603.7 in 50 years
- Cost per job = $100,000 at an annual growth of 2% totals $269,159 in 50 years

Professional Services:

- The average annual growth percent for professional services is 2% ending at $46,103.1

Operating Revenue:

- The average annual growth percentage of the total operating revenue is 2% ending at $3,019,961.8 in 50 years

Business Outreach:

- The average annual growth percentage of the total business outreach activity is 2% ending at $ 2,470,877.80 in 50 years

[10] Source: Village Partners.
[11] Note: dollars in million
[12] Source: Village Partners.

Annual Payroll:

- The average annual growth percentage of the total payroll is 2% ending at $ 507,902.7 in 50 years

Conclusion

Metropolitan sustains Southern California's economy by fulfilling its mission of providing reliable high-quality water at cost-effective rates. Additionally, as a contractor for major infrastructure projects, Metropolitan has been able to leverage its expenditures into numerous local jobs. Metropolitan's business outreach program has been a successful model for ensuring construction and procurement dollars are invested in local, small, minority- and women-owned enterprises. These partnerships will need to be expanded and leveraged in the future to continue Metropolitan's role as a driver of Southern California's economy.

Introduction

Technologies and innovations have increased significantly within the water industry over the past few decades, and the rate of change is expected to continue accelerating as we move into the future. In the past, this change was driven by rapid improvements in processing capabilities that allowed for greater levels of automation, combined with an industry-wide need to comply with increasingly more stringent water quality regulations. In our current environment, the need to control costs while simultaneously addressing aging infrastructure also drove increased implementation of innovative technologies in the water industry. And in the future, the water industry will increasingly turn to innovative technologies in water treatment, conservation, and engineering as it faces future challenges of increasing populations and dwindling water supplies; increased regulations on difficult to treat trace contaminants; aging infrastructure and expectations of high reliability; mandates to address climate change; and the need to continue streamlining operations and reduce administrative costs.

Advantages of leveraging technology recognized

Leveraging technology is essential for an organization to remain successful over the long-term. For Metropolitan, this means making a strong commitment to continued leadership in water industry technology. This document examines the potential technological changes in the following key areas that have the greatest impact on Metropolitan's operational and infrastructure costs as well as business process efficiency and the ability to achieve greater levels of conservation:

(1) Water Treatment and Monitoring

(2) Energy Technology

(3) Water Conservation Technology

(4) Engineering Technology

(5) Information Technology

Metropolitan's recent focus on several of these areas, including water treatment and contaminant detection, information technology, and engineering technologies, has resulted in improved water quality, reduced costs of operation, and enhanced reliability. It is clear that additional benefits may be achieved from continuing these efforts and also more fully exploring other areas such as energy management and conservation.

Increased levels of collaboration and business strategies recommended

To remain a leader in regional water management, Metropolitan must form stronger partnerships with businesses, collaborate more with universities and research organizations, and consider business and staffing strategies. This will allow Metropolitan to remain highly adaptable to changing conditions and continue to provide outstanding service to the region.

Water Treatment and Monitoring

Background

Federal and state drinking water regulations cover treatment processes and set limits for levels of chemicals and microorganisms served to the drinking water community. Since the passage of the Safe Drinking Water Act (SDWA) of 1974, and subsequent amendments in 1986 and 1996, contaminants have been regulated on a constituent by constituent approach, based on risk assessments to the public. These regulations established enforceable maximum contaminant levels (MCLs) for particular contaminants in drinking water or required specific treatment methods to remove contaminants.

As of today, there are 120 state and federal drinking water regulations and 104 constituents under consideration for possible inclusion in future regulatory standards [referred to as the Contaminant Candidate List (CCL), Appendix II]. These regulations have and will continue to shape the treatment technologies and strategies Metropolitan implements to assure compliance and the delivery of high quality water.

Long-Term Regulatory Trends

Increasingly more stringent regulations are anticipated for the future and may be driven by several factors, including:

- **Protection of sensitive populations**. A growing number of consumers fall into one or more sensitive subpopulation categories (e.g. elderly, immunocompromised).
- **Regulation of trace contaminants.** It is now possible to detect trace level contaminants such as pharmaceuticals and personal care products and these may become regulated.
- **Receiving stream standards**. New standards (e.g., Total Maximum Daily Loads) may potentially drive treatment "upstream" to wastewater plants and impact watershed management.

Current Status of Treatment and Water Quality Related Issues at Metropolitan

Metropolitan imports water from the Colorado River to the Southern California region via the Colorado River Aqueduct. In addition, Metropolitan contracts with California's Department of Water Resources (DWR) to receive deliveries of water from Central and Northern California via the State Water Project. These two sources have different chemical characteristics, each with unique treatment challenges: Water from the SWP has higher levels of disinfectant byproduct (DBP) precursors such as total organic carbon (TOC) and bromide, for example, whereas the CRW has significantly higher levels of alkalinity and salinity.

Treatment Strategies

Metropolitan relies on a multi-barrier approach for water treatment consisting of source water protection, conventional treatment technology (coagulation, sedimentation, and filtration) and free chlorine for disinfection. Free chlorine disinfection has been used to improve coagulation

and filtration, and remove algal related taste and odor compounds at Metropolitan's treatment plants.

In 2003, Metropolitan began to replace free chlorine with ozone as its primary oxidant and disinfectant. Ozone was selected to address more stringent regulations for disinfectants and to control undesirable taste and odor compounds produced by certain algae in Metropolitan's reservoirs. The use of ozone has increased Metropolitan's operational flexibility in that all blends of source waters can be treated effectively. Ozone is considered the Best Available Technology (BAT) to address long-term treatment strategies.

Trends in Energy Costs

Advanced treatment processes, including ozone and ultraviolet (UV) treatment, membrane filtration, and reverse osmosis, require more energy than conventional treatment and are generally energy intensive. These treatment processes, if implemented, would increase energy use well beyond current and projected levels.

Invasive and Aquatic Nuisance Species

Invasive aquatic species currently present challenges to water conveyance systems and increase operational costs. For example, Metropolitan is now researching methods to control the growth of quagga mussels and innovative strategies to reduce their impact on Metropolitan's reservoirs and facilities.

Treatment and Water Quality Projections for 2030 and 2060

Future changes in water quality regulations, treatment technologies and compliance strategies will be heavily influenced by a number of challenges, including water scarcity, public perceptions, new and emerging chemicals and pathogens, aging distribution systems, climate change, and uncertain energy markets. Table 1 displays the current challenges in several different areas as well as project challenges for 2030 and 2060.

The general assumptions and underlying trends used to develop this table include:

- **Treatment technology.** Treatment technology will improve to allow cost-effective desalination of ocean water and brackish surface and groundwater sources; treatment of impaired surface and local groundwater to drinking water standards; and treatment wastewater for potable use. Further improvements in analytical technology will support remote, on-line water quality sampling.
- **Regulatory.** Regulatory changes will require, support or mandate increased use of storm water to recharge groundwater basins and the collection and storage of rain water at the community or individual home for non-potable uses within the community (e.g. landscape irrigation and toilet flushing).
- **Societal.** Acceptance or embracement of maximum use of recycled water—direct and indirect potable reuse; extensive use of dual systems for potable and non-potable use of water and effective partnerships between water suppliers and water irrigation systems.
- **Decentralized Treatment.** The water industry will likely move towards more localized treatment and reuse to achieve greater levels of recycling and reuse.

- **Consumer- based standards.** The focus on water quality at the tap will increase, as opposed to the current monitoring system that centers on treatment plant performance.

Table 1. Water Quality and Treatment – Current and Projected Conditions

	2010	2030 - Projected	2060 - Projected
Water Resources	Regional Demand = 4 million acre-ft (MAF)/year or 3.6 billion gallons per day with a per capita use of 190 gal/person/day. Local groundwater = 1.5MAF/year; State Water Project= 1.2; Colorado River = 1.0; Los Angeles Aqueduct= 0.25; Local surface water = 0.1	Treated water demand is supplemented by desalting of ocean water and brackish groundwater and by advanced treatment of local groundwater contamination. This water is delivered into existing treated water distribution systems.	Treated water demand is further supplemented by direct treatment and delivery of impaired or previously unusable water sources to drinking water quality. This supplemental water is then conveyed directly to new or existing treated water distribution systems (direct potable reuse).
	Uses highest quality source water first to minimize treatment costs and public health risks.	Raw water supply is supplemented by treatment of impaired or previously unusable water sources such as agricultural runoff water, impaired groundwater, storm water runoff and wastewater. This supplemental raw water is conveyed to existing centralized treatment (indirect potable reuse).	Building codes/residential or commercial development criteria limit the use of potable grade water for non-potable uses.
Storm Water/ Rain Water	Storm water used for limited groundwater recharge.	Storm water extensively used to recharge groundwater basins.	Legislation in place limiting the use of potable grade water for non-potable uses for new housing developments.
	Rain water collection systems not in use by consumers	Rain water collection systems in limited use by consumers	Rain water collection systems widely used by consumers and required by state ordinances for new housing developments
Water Quality Regulatory Framework	Health-based standards: Risk-based approach to individual contaminants (120 contaminants now regulated).	Shift in emphasis to water quality in the public water system distribution system. Additional protections for sensitive subpopulations.	Shift in emphasis to water quality at the consumer's tap which incorporates microbial degradation, corrosion, and premise plumbing.
	Regulations beginning to consider sensitive subpopulations. Long, costly, and controversial process for establishing new maximum contaminant levels.	Additional protections for sensitive subpopulations.	Regulations focus on treatment technique and use of sentinel compounds for treatment effectiveness and compliance with health criteria.
	Aesthetic-based standards: non-enforceable standards primarily intended to discourage consumers from seeking other water sources which are more aesthetically pleasing but which may be unsafe.	Aesthetic standards not legally enforceable and point-of-use devices more widely available to improve aesthetics. All contaminants currently in regulatory process (CCL3) are incorporated or excluded based on risk analysis.	Regulatory acceptance of direct potable reuse.
Consumer Confidence/ Societal Issues	Public highly influenced by media reports about individual contaminants. Water utilities deemed responsible for providing "completely safe" water.	Public requires more emphasis on wastewater discharge limitations to prevent source water degradation and ecological preservation of aquatic environments.	Increasingly shared responsibilities between wastewater dischargers, public water systems and consumers for minimizing public health risk.
	Substantial public opposition to and regulatory prohibition of direct potable reuse.	Water reuse is broadly accepted for non-potable uses. Increasing public acceptance of indirect potable reuse.	Broad acceptance of direct and indirect potable reuse.

Table 2. Water Quality and Treatment – Current and Projected Conditions

	2010	2030 - Projected	2060 - Projected
Treatment	Centralized facilities consisting of large water treatment plants producing potable water and delivered via existing infrastructure. Currently, the 10 largest water treatment plants in the region can treat the average daily demand of water for 19 million consumers (3.7 billion gallons per day).	Existing infrastructure enhanced by addition of unit processes such as ultraviolet light (for improved disinfection and disinfection by-product minimization) or granular activated carbon (for removal of organic micropollutants or for improved biological stability of water in distribution system).	Depending on source water quality, most infrastructure is upgraded by replacing individual unit processes with more efficient and effective technologies. Some existing infrastructure replaced by advanced treatment as facilities approach end of useful life. Decentralized treatment also available to further treat water downstream of centralized facilities (e.g., at far ends of distribution systems or at point-of-entry into medical facilities).
	9 of the 10 largest treatment plants use ozonation, chemical coagulation, and granular media filtration. One facility includes low-pressure membrane treatment and granular activated carbon adsorption (San Diego County Water Authority's Twin Oaks plant.).	New infrastructure incorporates state-of-the-art membrane treatment along with robust physical/chemical treatment process for oxidation and adsorption of micropollutants and multi-barrier disinfection.	Small community, commercial development, or home point-of-use treatment devices widely available for "designer" water quality as needed to protect sensitive subpopulations or desired for aesthetic reasons.
	No ocean desalination on-line.	Ocean desalination available with desalination plants serving coastal areas. Cost of desalination highly dependent on energy prices.	Reduced cost of ocean desalination more widely available due to new technology through entire region. Ultimate adoption of desalination dependent on availability of low-cost, renewable energy.
	Limited use of low-energy green technology (e.g., biological filtration in water treatment plants which improve biological stability in distribution systems).	Increased use of green technology (e.g., biological treatment of water and wastewater) which reduces energy input and minimizes waste discharges.	Green treatment technology in place and widely used for recycled water, impaired water and non-potable uses. Most facilities move towards zero-liquid discharge.
Decentralized Facilities	Decentralized facilities not available	Initial development of decentralized and community-based drinking water systems which use local sources of previously unavailable or unacceptable supplies	Decentralized use of community or home non-potable systems (rain water, gray water, dual systems for recycled water) for landscape irrigation, toilet flushing, and other non-potable needs for water in communities.
Analytical Technology	Analysis is labor and time intensive Water treatment process control limited to very few on-line parameters which are indirect indicators of quality (turbidity, disinfectant residual).	Advances in multi-parameter technology although still largely functioning within laboratory facilities and not used for on-line process control. Limited on-line monitoring of direct indicators of quality. On-line monitoring supplements grab-sampling based compliance.	Real-time monitoring and reporting technology at the centralized treatment plants, decentralized supplemental treatment plants, and the distribution system. On-line monitoring widely used for process control. On-line monitoring largely replaces use of grab-sample analysis for regulatory compliance.
Indirect and Direct Reuse	Neither indirect or direct reuse supported by public	Water reuse broadly applied for nonpotable uses. Increasing public acceptance of indirect potable reuse.	Indirect and direct potable reuse accepted by the consumer based on approved criteria by regulatory agencies

Strategies to meet Treatment and Water Quality Projections for 2030 and 2060

The general trends will be towards increased use of available local resources: ocean water, brackish surface and groundwater, water recycling, storm water and impaired water sources. This will require technological advances in treatment technology and analytical methodology, and Metropolitan's success will hinge on strategically implementing a flexible and sustainable long-term plan for promoting and developing these local resources. This would include strategies and initiatives aimed at promoting:

- Improved technology to treat local impaired water for either potable or non-potable uses
- Legislative support for increased local uses of water for non-potable use
- Development of decentralized treatment technology & facilities for non-potable water uses
- Health effects research to establish the health impact or health significance of emerging contaminants
- Rapid, multi-parameter, on-line and remotely operated water quality monitoring instruments
- Process control technology and standards for local and remote control of decentralized facilities
- Advancements in renewable energy and low cost energy
- Partnerships with industry and academia and other water industry professionals to keep abreast of global technological developments in treatment, analytical and monitoring technology

Energy Technology

The general trend in the water industry is towards increased use of advanced technologies to treat non-traditional local resources (ocean water, brackish water, storm water and impaired water) which require more energy than conventional treatment. At the same time, traditional energy costs are predicted to increase significantly. As a result, Metropolitan is strategically preparing to invest in renewable energy to help meet its large energy needs while providing for more economic stability.

Current Situation: Renewable Energy

Renewable energy is generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat that which are naturally renewable and therefore easily replenished. In 2006, about 18% of energy consumption worldwide came from renewables, with 13% coming from traditional biomass (e.g., landfills, etc - mainly used for heating), and 3% from hydroelectricity. New renewables (i.e., small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.4% and are growing very rapidly. From an energy generation perspective, the worldwide share is around 18%, with 15% of global electricity coming from hydroelectricity and 3.4% from new renewables.

Wind power is growing at the rate of 30% annually, with a worldwide installed capacity of 121,000 megawatts (MW) in 2008, and is widely used in European countries and to a lesser extent in the United States. Solar power is growing dramatically as well, with the annual manufacturing output of the photovoltaics industry reaching 6,900 MW in 2008 (though less than

500 MW in the U.S.), an annual growth rate of nearly 51% since 2001. Market projections indicate that by 2012-13, worldwide production will increase to 30 GW annually, with thin-film technology (i.e., amorphous silicon, cadmium telluride) taking over the market share from the more traditional monocrystalline silicon PV. Overall, by 2015 panel prices are expected to drop from approximately $4/W to $2/W for monocrystalline silicon PV and from $3/W to $1/W for amorphous silicon, cadmium telluride PV.

Renewable energy technologies are often criticized for being intermittent and inefficient, yet the renewable energy market continues to grow. Climate change concerns, coupled with high oil prices and increasing government support, are driving increasing renewable energy legislation, incentives and commercialization. Although renewable energy is not currently a clear cut option to grid electricity, the market will change over time and will favor renewable energy as it becomes more decentralized. Technological advances in energy storage are expected to help solve the intermittency issue and help drive the movement towards low-cost renewable developments.

2010 - 2030

Emerging Power Generation Technologies

At this time, the core of the renewable energy market is based on solar, wind, and small hydro technologies. The explosive growth of this market will continue to drive technological advances of these technologies and potential breakthroughs in other newer technologies. It is conceivable that newer technologies, coupled with increased efficiencies in solar, wind, small hydro, and energy storage will move renewable energy to grid parity by 2020.

These technologies are still in their infancy with respect to conversion of light or other natural resources into electrical energy but advancements will continue. Breakthrough technology in the future years would provide for the production of large amounts of “green energy” for individual homes and large industries at a substantially lower rate than currently available. Potential future energy technologies identified by the Department of Energy include:

Fusion Energy - The United States Department of Energy Fusion Energy Sciences (FES) program leads the national research effort to advance the knowledge base needed to develop an economically and environmentally attractive fusion energy source. The National Energy Policy states that fusion power has the long-range potential to serve as an abundant and clean source of energy and recommends that the Department develop fusion. The next frontier in the quest for fusion power is a sustained, burning (or self-heated) plasma, and the Fusion Energy Sciences Advisory Committee (FESAC) has concluded that the fusion program is technically and scientifically ready to proceed with a burning plasma experiment and has recommended joining the ongoing negotiations to construct the international burning plasma experiment, ITER. The National Research Council of the National Academy of Sciences has endorsed this strategy. Based in part on these recommendations and an assessment by the Office of Science of the cost estimate for the construction of ITER, the President has decided that the U.S. should join the ITER negotiations.

Energy Storage – A partnership between the DOE and the California Energy Commission (CEC) is underway to demonstrate electrical energy storage as a technically viable, cost-effective, and broadly applicable option for increasing the reliability and electric energy

management of the California electricity system. In response to a CEC Program Opportunity Notice, three major projects totaling $9.6M were selected in 2009. Supercapacitors, zinc-bromine batteries, and flywheels are the technologies represented. DOE, through Sandia National Laboratories, oversees the technical management of these demonstration projects.

Fuel Cells - Devices that use a controlled combination of the two gases to generate current are called fuel cells. This developing technology underlies the vision of a nationwide environmentally friendly "hydrogen economy," in which the only exhaust from fuel-cell-powered distributed generating stations and vehicles would be water vapor.

There are several significant obstacles to achieving that vision. Present fuel cells are too expensive and unreliable for the mass market. And hydrogen is very difficult to store and transport unless it is compressed to thousands of pounds per square inch (psi).

The federal government, particularly the U.S. Department of Energy, is conducting significant research on fuel cells to accelerate their development and successful introduction into the marketplace but this will likely take decades of research and development, as well as changes in the energy infrastructure, before a hydrogen economy on a broad scale can be achieved.

Advanced Coal Technologies - In the endeavor to reduce the emission of CO2 when fossil fuels are burned, coal is a prime target: It accounts for about one-third of the nation's CO2 emissions. New technologies focus on separating, capturing, and safely storing the CO2 before it is discharged from the smokestack. Several approaches have been proposed. One is coal gasification, a process in which coal is converted to a gas (called syngas) before it is burned, making it easier to separate the CO2 as a relatively pure gas before power is generated. Such Integrated Gasification Combined Cycle, or IGCC, plants are projected to be up to 48% efficient, a significant improvement over current coal-power plants, which are about 38% efficient. Another option is to burn coal in oxygen instead of air (as is currently done), to reduce the amount of flue gas—essentially exhaust—that must be processed to isolate CO2. These techniques show promise but require more research and development. They also substantially increase the cost of the electricity produced.

Once CO2 has been captured, it must be permanently stored. Current options focus on such geological formations as oil and gas reservoirs, unmineable coal seams, and deep saline aquifers, all of which are geologically sealed and unlikely to allow injected CO2 to escape. While these technologies are very promising, it still must be proven that large quantities of CO2 can be stored effectively underground and monitored for long periods of time.

2030 - 2060

Technologies Leading to Decentralized Energy Markets

As the emerging power generation technologies unfold, and efficiencies in solar, wind, small hydro, and energy storage continue to increase, the U.S. energy market is expected to become decentralized, with smaller, local generation sites becoming the norm. Most energy experts agree it is now only a matter of time before the electricity grid is completely redesigned to fully integrate widely distributed generation and storage in a unified "Super Grid" or Smart Grid that is far more efficient, less costly, and dramatically more environmentally responsible than today's electrical grid.

The so-called National Smart Grid would:

- Provide for a much more efficient, higher-voltage long-distance transmission lines, connected to all generators of electricity, including intermittent sources such as wind and solar.
- Provide "smart" distribution networks connected by the internet to smart meters at homes, businesses, substations, transformers, and every other element of the national grid.
- Modern, dynamic, and efficient electric-energy storage units placed throughout the transmission and distribution networks, with most storage devices placed near or at the facilities owned by the end user. These storage units will solve the renewable intermittency issues.
- Distributed intelligence with robust, information-rich, two-way, and instantaneous communication throughout the grid to deliver power at the most efficient and timely manners.

Properly designed, a smart grid will be more reliable, more secure, more efficient, and less costly to operate. Our existing gird system in the U.S. is potentially vulnerable to outages that interrupt the electricity supply periodically for millions of people and businesses. The current system is also plagued by congestion because of too little capacity within the grid. With the advent of smart grid features, including use of high-voltage direct current lines to move large-scale renewable energy over long distances with low energy losses, renewable energy will become even more economical, creating a sustainable, low-cost supply of clean energy.

Traditional methods of energy generation will tend to be phased out or end up supplying a very small portion of the energy market. At the same time, additional power technologies and sources could become economically feasible between 2030-60 which may prove beneficial to a regional water supplier such as Metropolitan as it continues to diversify its water supply via desalination, enhanced recycling or other means. Two of the more promising energy technologies are:

1. **Clean Nuclear Technology** – Decades ago, many countries abandoned the idea of using thorium as a replacement for uranium. But long-term proponents believe the thorium fuel cycle could make nuclear energy a safer and more sustainable option. Thorium is seen by some as the nuclear fuel of the future. For a start, there is much more thorium than uranium in the Earth's crust, and all the thorium mined can be used in a reactor (compared to below 1% of natural uranium). Thorium fuel cycles also produce much less plutonium and other radioactive transuranic elements than uranium fuel cycles.

   Uranium-based reactors can be retrofitted, bringing three major benefits – improving security, allaying environmental concerns and improving economics. The fuel cycle can be proliferation resistant to avoid the production of nuclear weapons-usable plutonium. Also, the spent fuel has significantly reduced volume and long-term radio-toxicity which increases safety margins and reduces operating costs.

   While hurdles remain with respect to overcoming negative public perception, environmental effects, and other factors; there is potential for clean nuclear technology to be realized in the future.

2. **Solar Powered Satellites** – Solar-powered satellites could become a major energy source by 2030, according to scientists who testified at a U.S. congressional subcommittee hearing in September 2009, helping to reduce reliance on dwindling fuel supplies. With fuel supplies projected to fall and energy costs reaching historic highs, use of satellites to transmit energy to provide electricity used to heat homes and run appliances would become technologically viable, according to the scientists

   High-voltage solar panels that could handle sunlight during 99 percent of a 24-hour day, wireless transmitters that can beam large amounts of microwave energy, and an "inflatable radiator" to absorb heat in space, are all under development. Relaying power from ground stations to satellites and back to ground stations at another location is another, perhaps more readily available, application. A complete solar power satellite system to produce enough energy to be economically viable may not emerge until 2025 to 2035, but nonetheless is an example of a long-range technology currently being examined by energy giants, such as Pacific Gas & Electric.

Water Conservation Technology

Current Situation

Metropolitan has become a leader in the water conservation efforts through research and by offering incentives for the implementation of water efficient devices. Since 1991, Metropolitan has invested $268 million in water-efficiency retrofits that have since conserved 1.27 million acre-feet of water. Metropolitan has also led the way in promoting water supply reliability by investing over $300 million in water recycling and ground water recovery projects which has yielded a cumulative production of 1.67 million acre-feet from the two programs.

Recently, Metropolitan has partnered with the United States Bureau of Reclamation (USBR) to implement the Innovation Conservation Program (ICP) as a research tool. This program is used to identify new technologies and then test the water savings capabilities and functional reliability of devices to determine their potential impacts throughout the service area. The ICP program budget has been approximately $250,000 annually with Metropolitan and USBR providing matching funds. The research conducted in this program is then used to create new water use efficiency programs or make changes to existing programs. Metropolitan also partners with its member agencies on local projects for water use efficiency including research on new devices and new implementation methods for conservation programs. Metropolitan participates in national committees that focus on water use efficiency research such as the Environmental Protection Agency's Water Sense initiative, American Water Works Association Research Foundation, Irrigation Association's Smart Water Application Technologies, and the Water Research Foundation. This emphasis on water use efficiency will help chart the course for future improvements in conservation.

2010 - 2030

Conservation will increase dramatically over the next couple decades. In a special session, the California State Legislature passed a bill known as "20 by 2020" which requires a 20 percent reduction in urban per capita water use by the year 2020. For Metropolitan's service area, this equates to an approximate reduction of 36 gallons per person per day or 575,000 acre-feet of

cumulative water conservation by 2020. To achieve this goal, Metropolitan will continue its collaborative conservation efforts to identify the most effective ways to achieve significant water savings in a relatively short time frame which may include innovations in the following areas:

- **Industrial practices.** Increasing water rates will increase the awareness of water usage and the motivation for conservation which will lead to refinements to current processes and practices that will yield significant water savings.
- **Industrial technologies.** Heightened concern over water usage by the industrial giants will lead to research and development of new technologies for industrial uses that could yield the greatest conservation efforts. Promising developments include "Clean in Place" technologies could save many acre-feet and new methods of reusing production water onsite will lessen the demand for new imported supplies.
- **Utility bills.** Tiered or more steeply tiered retail water rates could lead to greater conservation levels. A more subtle approach may be use of "Smart" utility bills that include comparative use data which may help encourage high water users to alter their habits in order to become more in line with water usage of their neighbors.
- **Landscaping**. The increasing cost of water will lead some customers to voluntarily alter their landscaping and watering habits.

Although companies and individuals will become more focused on increasing water-use efficiency, Metropolitan can continue to lead in the conservation arena by remaining a vital resource in disseminating information about new technologies and changes in manufacturing processes that can help our region increase water use efficiency. Research will be a key element in meeting the demand for information and the need will be great over the next twenty years.

2030 - 2060

Beyond 2030, additional gains will be achieved in water conservation practices and technology. The drivers will be rising water rates (due to increased reliance on non-traditional water supplies requiring more energy intensive treatment processes) and legislation. The changes in business practices may peak at this time and the emphasis may shift towards the large potential savings in the landscapes of the community. Outdoor irrigation accounts for greater than 50 percent of the water use for the average Southern California home.

During this period there will likely be a significant shift in landscape strategies towards increased use of low water use plants, native vegetation and increased hardscapes. Research and development will be directed towards creating environments that are ascetically pleasing, environmentally responsible, and water efficient. Also, although advances have been made in irrigation controllers and sprinkler systems, there is still room for improvement in the technology and penetration into the market.

Although significant water conservation gains may be achieved through increased use of better landscape controllers, gains are likely to be achieved in several other areas. These will include approaches and technologies that may be in their infancy at this time or others not yet seriously considered. Potential develops beyond 2030 may include:

- **Genetically modified organisms.** Organisms such as slow growing grasses that use less water while remaining green may revolutionize the way the water is applied to our landscapes.

- **Soil amendments.** Soil amendments may be used to capture and retain water in the root zone so that plants can be better utilize available water in residential and agricultural settings.
- **Onsite capture and recycling.** Advances in water treatment technology may lead to increased onsite water recycling or treatment of non-potable sources for ground water recharge. Another avenue to explore is the use of recovered water for waster transport.
- **Sustainable farming practices.** New technologies may allow use of remote sensing technology to identify individual plant needs to reduce water use and increase production.

The key factor for Metropolitan to identify these opportunities will be research on water use efficiency opportunities and the technologies that will achieve the sustainable and efficient use of this finite resource.

Engineering Technology

Current Situation:

Metropolitan's infrastructure is aging. Facilities designed to code normally have a 50-year life, and many of the facilities are over 50 years old at this time. In recognition of its aging infrastructure, Metropolitan has developed an aggressive infrastructure maintenance and rehabilitation management program that will keep the facilities operating reliably and may extend the life of many of the facilities an additional 50 years. This program utilizes the latest practices and technologies, including remote corrosion monitoring and detection, remote robotic stationing to monitor dam deformations, testing to identify effective lining materials, and long lasting protective coatings to ensure extended facility lives.

Metropolitan is also in the forefront of developing technologies to inspect and repair buried pipelines at comparatively low costs. Two of these technologies, Remote Field Eddy Current Testing to inspect prestressed concrete cylinder pipes (PCCP) and the use of composite carbon fiber to repair PCCP, have helped to minimize costs by over 50 percent when compared with conventional excavation methods.

New technologies have also been utilized for voice and data communications, reducing costs and improving Metropolitan's ability to prepare and respond to emergencies such as earthquakes, flooding, and fires. Staff currently use the latest GIS (geospatial information systems) and satellite technologies to provide quicker response to customer requests and cost effective mapping, utilities information, parcel data, etc., to support operations and maintenance and capital work.

2010 - 2030:

Between now and 2030, the focus should be in ensuring a reliable infrastructure to deliver and treat water supplies. Metropolitan has committed expenditures of approximately $176 million for fiscal year 2010/11, and this will escalate to $300 million in the out years. This commitment addresses the bulk of our existing facilities out to the 2030 timeframe, and requires investment in the latest technologies and innovations to meet additional challenges presented by an increased reliance on non-traditional water supplies such as indirect potable reuse, storm water,

and contaminated groundwater. These supplies will require advanced treatment processes and may require new or modified facilities.

During this time period, Metropolitan will most likely adopt aggressive energy management policies, including increasing investments in renewable energy. New renewal energy projects will be built and Metropolitan may shift from power purchase agreements that reduce capital costs towards ownership of the projects, which could even provide long-term steady revenues. Metropolitan will likely retrofit existing hydroelectric plants and evaluate opportunities to build new hydroelectric plants along the existing conveyance and delivery systems.

It is expected that there will be continual advancement in pipe leak detection and composite repairs of PCCP pipelines including even more cost effective repairs using smart robotics to inspect, assess, and make repairs. Technologies such as pipe crawlers and free swimming pipedivers can enter buried pipelines without expensive dewatering operations and provide more accurate assessments of these facilities. Advance coatings will provide for longer life and therefore less maintenance, and technology will enable the neutralization of “hot soils” and stray currents to extend the life of underground pipes and facilities by protecting them against corrosion.

Metropolitan will also build upon current efforts to move towards sustainable design and construction practices that yield energy savings, reduced environmental impacts and increased worker productivity. This would include partnering with member agencies and the Water Research Foundation to help the industry develop sustainability standards, which in turn would lead to the adoption of high energy efficiency goals, increased use of recycled materials, and construction contracts requiring low emissions construction equipment. These efforts will likely be complemented by breakthroughs in the development of low environmental impact construction materials.

Technological developments will also allow for gains in productivity. Using real-time, web-based technologies to manage field inspection and reporting will streamline construction management and reduce costs, for example, and wireless communications will allow for remote access to all project documents through the use of field handheld devices providing. Replacement of aged satellites and new GIS advances will also provide geographical/geospatial data quicker and more accurately and expedite engineering and permitting activities and enhance communications with external agencies and customers.

Data and communication transmission advances will also allow for improved control of water systems in real time. Existing controls systems (SCADA) will be integrated and components will “talk” to one another in order to meet increasingly rigid water quality monitoring and treatment standards. These control systems have a useful life of about ten years and must be upgraded or replaced while the facilities remain in operations, so there will be technological challenges, but the upgrades will lead to improved abilities to monitor conditions and control the system as the capabilities of the components and speed of communication between them improves.

2030 – 2060:

Beyond 2030 and out to 2060, Metropolitan’s primary facilities will be over 100 years old and many may need to be retired or fully rehabilitated. Breakthroughs will likely help extend their useful life, but the rigors of continuous operations may mean that it is more cost effective to

replace a facility, rather than rehabilitate it. This, in turn, could lead to a gradual shift in focus from primarily rehabilitating aging infrastructure to replacing aging facilities with new ones.

Large investments will be required to build new replacement facilities while keeping existing facilities operating. The oldest treatment plant, Weymouth, will most likely be replaced with new facilities, although the historic buildings will hopefully be preserved. Staff will focus on implementing advanced treatment technologies to address new regulations for existing facilities and to treat non-traditional water supplies such as seawater, contaminated groundwater, and recycled water. Portions of the conveyance and distribution system will be replaced as well, and effort that will be facilitated by powerful GIS databases and mapping technologies that more accurately identify existing right-of-ways and easements and the best new alignments as Metropolitan replaces its aging infrastructure.

Advances in construction materials to be more ductile in earthquakes and innovations in structural connections will help Metropolitan to remain operational after a major seismic event. Building codes will be updated to include the new materials and new construction methods to use them.

Fewer staff will be required to operate the plants and water delivery systems as SCADA control systems become further automated. Artificial intelligence software programs will allow some facilities to be fully automated and unmanned. Similar to the energy market, there may be a trend towards decentralized energy efficient unmanned water treatment facilities along the delivery system. These facilities will automatically make adjustments in flow and chemicals to match water demands and water quality requirements, respectively. These smaller facilities will likely be self sufficient with advances in renewable energy facilities incorporated into their designs. These smaller facilities may be built in modular units and transported to the prepared site, resulting in lower overall costs for construction, maintenance, and replacement.

The water delivery system will consist of a combination of existing and new pipes and tunnels constructed using the latest technologies in tunneling methods, tunnel lining, instrumentation, and control system equipment. The applications of new advanced material may require more stringent quality control in producing the pipes and installation but will extend the pipelines' useful life beyond today's 100 years. Other technologies to be developed include remote wireless web based monitoring of pipeline structural integrity and hydraulic performance.

Information Technology

Current Status

Metropolitan has benefited from implementing a number of information technology/automation systems within its water system. For example, the water treatment processes and water distribution systems are controlled by use of a comprehensive, integrated Supervisory Control and Data Acquisition System (SCADA) that adds flexibility and reduces manpower requirements. Water flow meters are automatically read by an Automated Meter Reading system that provides water flow readings to the system operators as well as to the water billing system. In addition, a Laboratory Information Management System is used to track

approximately 50,000 water samples that are collected each year and to capture the results of an estimated 300,000 water quality tests performed on these samples.

Metropolitan has also implemented many self-service based capabilities for staff that have led to higher levels of efficiency and cost savings. These self-service applications include human resources transactions (e.g., on-line benefit enrollment); specialized map generation functions for patrol routes, dig alerts, etc.; network/application password resets; and Member Agency certification requests associated with water billing. New procurement software has led to $2.9 million in annual cost savings as a higher percentage of materials are now purchased through pre-negotiated contracts at discount.

Innovative technology solutions have also increased IT system reliability. A concerted effort has been made to eliminate potential single points of failure in Metropolitan's wide area network, for example, and improvements have been made in Metropolitan's connection to the Internet, with average "up-time" greater than the target of 99.5% during prime business hours.

Information Technology / Business Solutions—Future Directions

Information technology will continue to drive change and efficiency in the business community and at Metropolitan over the next several decades. The rate of technological change in this area continues to increase, making it difficult to accurately forecast much beyond the next decade so. As a result, this section will only cover specifics over the next five to ten years and then offer general comments about possible advances / trends beyond 2020.

2010 – 2020

The following trends are likely to influence the use of technology over the next five to ten years:

- **Demographics**. Significant attrition among baby boomers (born between 1946 and 1964) will occur and the influx of staff will be more comfortable with high technology, the more rapid pace of change and use of digital media channels for research.
- **Automated transactional work.** Routine transactions will be automated and self-service based, driving a shift from administrative staff to "knowledge workers".
- **Full connectivity.** True broadband (4G and far beyond) wireless connectivity from virtually everywhere making wireless connections as fast as wired connections are today.
- **Refined products.** User interface will make it easier to operate electronic devices and engaging visualization methods will improve the presentation and analysis of information.
- **Low-cost software**. More software will be available at a very low cost.
- **Multi-purpose devices**. There will be an increasing desire for individuals to use a single electronic device for personal and business use.
- **Social networking**. Social networking will become common place as a business tool.

Innovation

The workforce will be able to be connected from everywhere and not limited by the bandwidth limitations that exist today. The "virtual office" will be a reality and staff will be able to perform meaningful work from wherever they are located and be able to collaborate. For Metropolitan,

this will mean that telecommuting could easily be supported from a technology standpoint. Metropolitan would be able to expand the use of handheld technology for maintenance workers in the field who will be able to collect and enter information from their field worksites. Unified messaging will allow one "in box" for all messages (voice, video, e-mail, text, etc.) and will be able to be viewed from a variety of electronic devices (computers, smart phones, etc.). Collaboration on projects and other work assignments will be facilitated through the use of advancing technology such as wikis, collaborative websites, webinars, web conferencing and videoconferencing. Videoconferencing will be possible from laptops and smart phones. These technologies will improve collaboration between staff and with externals agencies and other experts around the globe.

Technology can also address the larger challenge of effectively managing a distributed staff. In addition to videoconferencing and unified messaging, technology-enabled techniques such as wikis (interactive websites) can be used to remotely manage staff and promote collaboration and accountability.

With information technology applications automating much of the transactional work, there will be software available to assist staff in analyzing data and trends. This software is referred to as "business intelligence." It will enable staff to drill down into the data to understand the cause of trends and exceptions. This will be particularly beneficial in analyzing information in the water system operations, water resource management, financial and human resources areas. Managing the vast amounts of electronically stored information will become increasingly important.

Software will improve for organizing, searching and managing the vast amount of electronically stored information so that important records are maintained but transitory data is discarded. One of the key software products that Metropolitan will put in place for electronic discovery and management is the single in box for all messages as mentioned above.

Streamlined Operations

Self-service applications will become more and more prevalent in the workplace over the next decade. Metropolitan has already implemented a number of these applications (benefit enrollment, mapping, password reset) but there will be more opportunities to streamline our operations through the deployment of this type of technology. Another technology that will become more advanced is automated workflow that expedites the routing of information and items for approval. There will be opportunity to use this technology in conjunction with reengineering business processes to streamline them and automate them to the degree practicable.

Technical Infrastructure

There are a number of advances being made in the technical infrastructure (data centers, networks, computers, etc.) that make the technology work. One such trend is the convergence of voice (e.g., telephone), video (e.g., videoconferencing, security surveillance) and data (e.g., local area network, wide area network, Internet) onto one network and could easily combined on one device (e.g., smart phone, computer) and in a single application. This convergence has the potential for reducing network maintenance costs. Accordingly, over the next decade, most

organizations will be migrating their telephone systems to the Voice Over Internet Protocol (VoIP) that use the data network.

Another emerging trend is to consolidate infrastructure by using a technique called virtualization. A number of organizations, including Metropolitan are already doing this to consolidate servers in their data centers. This trend is also being applied to personal computers, reducing personal computer costs.

A third trend that is emerging in the technical infrastructure area is a move toward more "green computing." The main focus is in the data centers where the goal is to reduce the amount of power used for running equipment and for cooling.

2020 – 2060:

Innovation

One key trend staff expects to become fully developed near 2020 is "cloud computing." It is in its infancy stage now and has limitations in terms of functionality, internet bandwidth and security, but these challenges will be overcome. It involves different applications / services that are available via the Internet (i.e., the "cloud") and applications such as email, word processing, spreadsheets, may be good candidates for applicability at Metropolitan.

Beyond 2020, IT technological advancements will occur that are difficult to imagine at this time. However, Metropolitan's strategy is clear: monitor developments and deploy innovative technologies that advance operational capabilities. Innovation will provide Metropolitan opportunities to enhance the way District employees work together, improve operational efficiency, and lower costs. This will involve mobile and collaboration technologies, enterprise content management and business intelligence software, and other new enabling technologies.

Streamlined Operations

Beyond 2020, software technology will become more refined and robust in areas of artificial intelligence and neural networking. These advanced logic applications can help streamline Metropolitan's operations. For example, it is expected a neural network control system could be used to optimize the energy and chemical usage associated with the treatment of water using ozone. A relatively small improvement in this area could yield large annual savings in treatment costs.

Other benefits will be realized as processing speeds continue to grow and software advances are made. Metropolitan will take full advantage of these advances and best business practices to streamline operations. This requires an organizational commitment to examine and systematically make business process changes that leverage technological advances in business software.

Technical Infrastructure

The capabilities of technical infrastructure will continue to improve beyond 2020 and will become increasingly efficient as engineering advances are made (e.g., such as a hot aisle – cold aisle technique). It is clear that there will continue to be more options to building and maintaining one's own technical infrastructure by using applications running in common data

centers that are available via the Internet and metropolitan will have to maintain expertise in this area.

Partnerships and Collaboration

Background

Metropolitan will seek to exploit new technologies to meet the future challenges it will face. The process of identifying, developing and implementing promising technologies will require effective collaboration with external partners. Metropolitan must foster and encourage innovation and collaboration among private, academic and public-sector partners to a greater degree than has been done in the past.

Current Partnerships

Metropolitan is continually looking for ways to enhance and improve its operations. One area that Metropolitan has focused significant effort on is working with other public agencies to encourage participation with small business. More than 70 percent of the workforce in California is employed in small businesses, and this sector of the workforce is growing and has the potential to rapidly implement new technology business ventures.

Metropolitan has signed memorandums of understanding with numerous public agencies that enable these partners to share resources and enhance programs to foster job opportunities for these small businesses. These agencies include the State of California Department of General Services, Los Angeles Unified School District, City of San Diego, San Diego County Water Authority, Los Angeles Community College District and the Port of Long Beach. Metropolitan also has signed MOUs with the Small Business Development Center, the California Community College Economic & Workforce Development Program and the Minority Business Development Agency.

Sponsorship and Grant Opportunities

Innovative Conservation Program
Metropolitan, in cooperation with the Bureau of Reclamation and its 26 member agencies, is offering grants to explore the water savings potential and practicality of new water conserving technologies
Click here for more.

Southern California World Water Forum
Click here to learn about grants for colleges.

Community Partnering Program (includes community & education programs)
Click here for details.

Partnership Models

Partnering is common in the water industry but there are several types of partnership models that seem particularly suited to address technological and innovation needs of the future. Two of these are described below.

Sustainable Development Technology Canada (SDTC)

Sustainable Development Technology Canada (SDTC) is a not-for-profit foundation that finances and supports the development and demonstration of clean technologies that provide solutions to issues of climate change, clean air, water quality and soil, and which deliver economic, environmental and health benefits to Canadians.

SDTC operates two funds aimed at the development and demonstration of innovative technological solutions. The $550 million SD Tech Fund™ supports projects that address climate change, air quality, clean water, and clean soil. The $500 million NextGen Biofuels Fund™ supports the establishment of first-of-its-kind large demonstration-scale facilities for the production of next-generation renewable fuels.

SDTC was established by the Government of Canada in 2001 and began operation in November of that year. SDTC's mission is to act as the primary catalyst in building a sustainable development technology infrastructure in Canada. They work closely with an ever-growing network of stakeholders and partners to build the capacity of Canadian clean-technology entrepreneurs, helping them form strategic relationships, formalize their business plans, and build a critical mass of sustainable development capability in Canada.

There are many links in the innovation chain between research and commercialization. Two of the most critical—but traditionally under supported—are development and demonstration. These are the critical stages at which technologies exit the laboratory and prove themselves in full-scale, real-world test situations. SDTC bridges the gap in the innovation chain by fast-tracking groundbreaking clean technologies through development and demonstration, in preparation for commercialization.

One of SDTC's chief aims is to reduce the risk associated with developing clean technologies in a way that will ultimately attract downstream private-sector investment and open up opportunities for commercial success. SDTC does this by employing a stringent due diligence process when selecting technologies to support, and by actively strengthening project consortia—requiring every project to involve representatives from the entire supply chain: researchers, product developers, manufacturers, distributors, retailers and end customers

To date, SDTC has completed fifteen funding rounds and allocated a total of $464 million to 183 projects. That amount has been leveraged with an additional $1.1 billion in funding from other project partners for a total project value of $1.5 billion. Since April 2002, SDTC has conducted sixteen calls for statements of interest (SOIs) and received 1,760 SOIs from across the country, representing some $17 billion in project potential from 5,300 companies and institutions. The ratio of industry-partner contributions to SDTC investment is approximately 2.4:1. Of those contributions, some 82 percent come from private sources.

Clean Tech Los Angeles

CleanTech Los Angeles (CTLA) is a multi-institutional collaboration between the City of Los Angeles, the Community Redevelopment Agency of the City of Los Angeles, UCLA, USC, Caltech, Jet Propulsion Laboratory (JPL), Central City Association, Los Angeles Area Chamber of Commerce, Los Angeles Business Council (LABC) and the Los Angeles Economic Development Corporation (LAEDC) to establish Los Angeles as the global leader in research, commercialization, and deployment of clean technologies.

The goals of Clean Tech LA are to: (1) Create jobs by attracting and retaining clean technology firms to create jobs at all levels; (2) Stimulate demand in the marketplace for clean technology goods and services; and (3) Facilitate environmental solutions by deploying clean technologies to clean the environment, create a better life and surpass regulatory responsibilities.

Partnership Opportunities for Metropolitan—Moving Forward

There are several categories of partners that Metropolitan needs to cultivate and strengthen relations with to promote innovation and technological improvements.

Academic Institutions

Metropolitan's service area is home to many of the world's top universities and research institutions. These include the campuses of the University of California system, University of Southern California, Cal Poly Pomona, California Institute of Technology, the California State University system, Scripps Institution of Oceanography and many others.

Research Organizations and Non-Profits

Metropolitan partners with a number of institutions. The goal of these groups is to sponsor research to enable water utilities, public health agencies, and other professionals provide safe and affordable drinking water to consumers. They accomplish this mission by sponsoring research, developing knowledge and promoting collaboration.

- Water Research Foundation
- WaterReuse Foundation
- National Water Research Institute (NWRI)
- California Water Environment Association (CWEA)
- Others

Private Sector Partners

There are a vast number of consulting firms that have access to capital, resources and capabilities. These entities are currently leading the way for implementing technologies and greater participation from these organizations can quicken the pace of technological improvements.

Utilities

Utility providers understand the importance of the Water and Energy nexus in today's society. They are intimately linked to Metropolitan's success and advancement. They also share a similar goal, which is to save energy, money and the environment. Many of these utility partners have developed water saving rebate programs and offer grants for research and development:

- Edison
- The Gas Company

- Sempra Utilities
- Member Agencies
- Water Authorities
- Municipal Water Districts
- Others

Conclusion

Technology and innovation will drive the water industry in the coming decades. Metropolitan's unique role as a regional provider allows all of Southern California to have cost-effective access to highly specialized services and staff while avoiding duplication of efforts. Partnerships with Southern California's existing institutions, academic and others, will provide our local water industry ready access to research, information and the latest cutting edge technology. A partnership approach will provide Metropolitan and its member agencies with this access without the cost of developing these resources "in-house".