RON GALPERIN
CONTROLLER

October 21, 2016

Honorable Eric Garcetti, Mayor
Honorable Michael Feuer, City Attorney
Honorable Members of the Los Angeles City Council
All Angelenos

Re: Bureau of Sanitation Recycled Water Programs

Today I am releasing an audit that calls for the City to recycle much more wastewater than it does now, helping to decrease dependence on imported water.

The City of Los Angeles, with a population of 3.9 million, used an average of 560,000 acre feet per year (AFY) annually from 2011-2014, of which up to 75% was imported by the Metropolitan Water District (MWD). Only about 10,000 AFY was recycled for irrigation and industrial purposes during that same time period.

Treated wastewater—most commonly used for non-potable purposes such as agriculture and landscape irrigation, indirect potable reuses such as groundwater, and the maintenance of seawater intrusion barriers—can serve an important role in increasing our local water resources. Stormwater diversion can also add to potential recycled water production.

Other parts of the world maximize their local water resources much more than Los Angeles does. Israel treats 86% of its domestic wastewater and recycles to supply about 55% of the water it needs for agriculture. Singapore pioneered direct potable reuse by mixing highly treated wastewater in surface reservoirs that store drinking water.

Locally, the Orange County Water District runs the world's largest indirect potable reuse project, using heavily treated wastewater to replenish underground water supplies in the northern part of the county.

With Los Angeles facing a "new normal" of a persistent drought — California is now in its sixth straight year of severe drought — water supplies will continue to be a challenge. A local water supply will help to meet the needs of a growing population.

The Department of Water and Power's current plans call for increasing recycled wastewater used to offset imports to 59,000 acre feet per year by 2025, and to 75,400 acre feet per year by 2040. But, if Los Angeles is to meet the Mayor's goal of reducing reliance on imported water by 50% from 2014 levels by 2024, the City would have to reduce purchases from our major wholesale supplier, the MWD, from the 2014 level of 442,000 acre feet per year to 221,000 acre feet per year.

Doing What We Can

The City's current water recycling efforts involve the Bureau of Sanitation (BOS), which operates the City's sewer system, and four wastewater treatment plants, as well as the DWP, which distributes recycled and potable water to City consumers.

The Bureau of Sanitation has found reuses for more than 100,000 of the approximately 400,000 acre feet of wastewater it processes annually. It uses this wastewater to cool equipment in its own treatment plants and to maintain environmental habitats such as Lake Balboa and the Los Angeles River.

Overall, the Bureau of Sanitation has done a commendable job operating its current plants effectively. But capacity and technology impose limitations.

BOS also sells treated wastewater to a neighboring water district for more advanced treatments so that it can be used mainly for irrigation and industrial purposes there. And in one case, it treats wastewater to a high enough standard to be injected into the earth to help keep seawater from penetrating underground freshwater supplies. With all that said, the Bureau sends much of the rest--nearly 300,000 acre feet, or roughly half of all the water Angelenos use in a year--out to the ocean.

Because responsibility is bifurcated with the Department of Water and Power (DWP), with DWP providing water to residents and businesses, it is imperative the City also work to incentivize the number of customers willing to use recycled wastewater for irrigation and/or industrial use.

Capturing Stormwater

BOS and DWP both have built projects to capture and infiltrate stormwater into the groundwater for local water supply and have plans to do much more in this area, doubling the City's stormwater capture capacity by 2035. Many of these projects also provide benefits such as green space, recreational opportunities and tree canopy.

However, the City should also look for opportunities to build necessary infrastructure to more efficiently treat stormwater though its wastewater treatment system. The City's treatment plants have the capacity to process and treat much more water than they do. They could process up to 650,000 acre feet per year. However, in the four-year period ending in Fiscal Year 2014-15, they processed about 400,000 acre feet of wastewater per year.

The City should consider taking advantage of this unused capacity by building facilities to funnel more water from its separate storm drain system to its wastewater treatment plants.

Challenges the City Faces

The largest obstacle the City faces in increasing its efforts to reclaim more water locally is the lack of infrastructure at its treatment plants and the funding to build that infrastructure. While there are plans to equip the Donald C. Tillman Water Reclamation Plant in the San Fernando Valley with more advanced treatment systems, there are no detailed plans to upgrade the largest of its four treatment plants – Hyperion Water Reclamation Plan (Hyperion).

The Hyperion plant, opened in 1950, processes more wastewater than the City's three other plants combined. However, it treats sewage only to a secondary level, which is enough to meet environmental standards for discharge to the ocean, but not enough to allow the wastewater to be used for irrigation, industrial purposes or groundwater replenishment. A 2012 study suggested it would cost nearly $1 billion to improve treatment at Hyperion to a level that would allow recycled use.

The City should work to update costs for infrastructure investments at Hyperion, and make it a priority in as much as it can have statewide impact on our water resources.

Lack of Funding

Currently, there are no funding sources available that can provide the amount of investment needed to increase the amount of recycled water. The City is looking at State funding, including the Proposition 1 Water Bond for possible funding. California Proposition 1, the Water Bond (Assembly Bill 1471), was passed by the voters November 4, 2014. It authorized $7.545 billion in general obligation bonds for water projects including surface and groundwater storage, ecosystem and watershed protection and restoration, and drinking water protection.

The Water Recycling Funding Program (WRFP) defined in Prop 1, Chapter 9, includes $725 million for recycled water projects across the State, and provides funding to eligible applicants for the construction of water recycling facilities.

While WRFP Funds will be geographically allocated (with a minimum of 40% of the funds to projects within, Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura Counties) projects are capped at 35% of actual eligible construction costs, up to a maximum of only $15 million.

This creates a real impediment for projects BOS needs to fund to upgrade its treatment plants and increase the treatment of wastewater.

Legislators may propose bills that aim to direct or shape Prop 1 implementation, as long as the new proposal is consistent within the voter-approved framework.

The City should consider taking on lobbying efforts to advocate for new legislation that revisits the formula and criteria for Prop 1 funding and/or future state funding to consider an agency's service population in proportion to the state's population, and removing any funding caps. This would allow for more funding to become available for larger scale projects servicing larger regions--turn, reducing our dependence on imported water and maximizing the impact statewide.

Expanding Relationships with Nearby Water Districts

The City should expand its cooperative relationships with nearby water districts, such as West Basin and Central Basin Municipal Water Districts, developing agreements with the expectation of selling more treated water to those districts or trading more treated water for more access to potable water. It should also explore expanded partnerships with the Metropolitan Water District on local resource development and regional water distribution projects.

This would allow the delivery of more recycled water in exchange for additional imported water rights, contributing to the region's overall local water supply and reduce the amount of treated wastewater discharged into the Pacific Ocean.

In Summary

Water experts say wastewater and stormwater are the southland's water supplies of the future. To this end, the Bureau of Sanitation must increase production, maximize delivery, and create broader regional collaborations.

It is clear that the City of Los Angeles needs to intensify its current efforts to recycle more wastewater-- including groundwater recharge--to lessen our expensive dependence on importing water via aqueducts from sources hundreds of miles away. But it is also clear that there is lack of funding available to invest in the infrastructure needs the City will need to meet its goals.

This audit should be used as an opportunity to create broader regional partnerships, and advocate for State funding to help Los Angeles decrease its dependence on imported water. If Los Angeles is able to maximize its local water supplies, the impact will be felt by many across the entire State of California. For this reason, it is crucial that the State recognize the importance of said investments and make funding available to help make this a reality.

Respectfully submitted,

Ron Galperin
CITY CONTROLLER

RON GALPERIN
CONTROLLER

October 21, 2016

Enrique C. Zaldivar, General Manager
Department of Public Works, Bureau of Sanitation (BOS)
1149 S. Broadway Street, Suite 900, MS 520
Los Angeles, CA 90015-2213

Dear Mr. Zaldivar:

Enclosed is the final report entitled, "Bureau of Sanitation's Recycled Water Programs." A draft of this report was provided to your office on June 29, 2016, and we considered your staff's comments while finalizing the report. In addition, the Bureau's formal response and action plan related to recommendations addressed to the Bureau of Sanitation is included within Appendix V of the report.

If you have any questions or comments, please contact me at siri.khalsa@lacity.org or (213) 978-7391.

Sincerely,

SIRI KHALSA, CPA
Deputy Director of Auditing

Enclosure

cc: Kevin James, President, Board of Public Works
Traci Minamide, Chief Operating Officer, BOS
Ana Guerrero, Chief of Staff, Office of the Mayor
Holly L. Wolcott, City Clerk
Independent City Auditors

RON GALPERIN
CONTROLLER

October 21, 2016

David Wright, General Manager
Department of Water and Power
111 N. Hope Street, MS 800
Los Angeles, CA 90012

Dear Mr. Wright:

Enclosed is the final report entitled, "Bureau of Sanitation's Recycled Water Programs." A draft of this report was provided to your office on June 29, 2016, and we considered your staff's comments while finalizing the report. In addition, the Department's formal response and action plan related to recommendations addressed to the Department of Water & Power is included within Appendix V of the report.

If you have any questions or comments, please contact me at siri.khalsa@lacity.org or (213) 978-7391.

Sincerely,

SIRI KHALSA, CPA
Deputy Director of Auditing

Enclosure

cc: Evangelos P. Ambatielos, President, Board of Water & Power Commissioners
Susan Rowghani, Managing Water Utility Engineer, DWP
William Van Wagoner, Managing Water Utility Engineer, DWP
David Pettijohn, Managing Water Utility Engineer, DWP

RON GALPERIN
CONTROLLER

October 21, 2016

Frank Bush, General Manager
Department of Building and Safety (DBS)
201 N. Figueroa Street, Suite 1000, MS 115
Los Angeles, CA 90012

Dear Mr. Bush:

Enclosed is the final report entitled, "Bureau of Sanitation's Recycled Water Programs." A draft of this report was provided to your office on June 29, 2016, and we considered your staff's comments while finalizing the report. In addition, the Department's formal response and action plan related to recommendations addressed to the Department of Building & Safety is included within Appendix V of the report.

If you have any questions or comments, please contact me at siri.khalsa@lacity.org or (213) 978-7391.

Sincerely,

SIRI KHALSA, CPA
Deputy Director of Auditing

Enclosure

cc: Mel Levine, President, Board of Building & Safety Commissioners
Osama Younan, Executive Officer, DBS

A U D I T

City of Los Angeles

Bureau of Sanitation's Recycled Water Programs

October 21, 2016

RON | GALPERIN

Los Angeles City Controller

LAController.org

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SUMMARY

To grasp the scale of water consumption in the City of Los Angeles, think of the entire City—all 300,000 acres of it, from San Pedro, across the Santa Monica Mountains to Northridge and beyond—as under two feet of water.

That, in the parlance of the water business, would be 600,000 acre feet of water—pretty close to the average of 560,000 acre feet per year (AFY) the City's water users consumed annually from 2011-14.

Because it rains so little here and because we have limited capacity to store the rain we do get, we bring in 85%[1] of our water from three sources -- northern California and the Colorado River and the Owens Valley in eastern California. After using this water, we send about 400,000 acre feet of it into our sewer system as wastewater. Sewers deliver it to treatment plants where solids and some contaminants are removed. Then most of the treated wastewater is dumped into the sea.

This audit examines the City's efforts to recycle more of that wastewater as a way to cut our dependence on water brought into the City via aqueducts from sources hundreds of miles away.

Currently, we recycle 10,000 AFY (or about 9.3 million gallons per day) of wastewater, which is used for irrigation and industrial purposes.

This audit finds that the City has ambitious plans to recycle 59,000 AFY of wastewater by 2025 and use much of it to help replenish groundwater supplies. However, with the amount of wastewater discharged into the Pacific Ocean and underutilized capacity at treatment plants, the City could recycle more.

We urge the City to consider improving its wastewater treatment capabilities —particularly those at its largest and least sophisticated plant—and treating, and then recycling, more stormwater from the City's separate storm drain system. We also urge the City to expand its cooperative relationships with nearby water districts in the expectation that the City could sell treated wastewater or trade it for more access to potable water.

We could cut our need to import so much water if we recycled more of our treated wastewater. Others are ahead of us in this regard. Neighboring Orange

[1] 75% of this imported water is purchased from the Metropolitan Water District.

County has been an internationally recognized leader for years in treating wastewater thoroughly enough to use it to replenish its own aquifers.

The City's Current Water Recycling Efforts

The City's current water recycling efforts involve the Bureau of Sanitation (BOS), which operates the City's sewer system, and four wastewater treatment plants, and the Department of Water and Power (DWP), which distributes recycled and potable water to City consumers.

Recycled wastewater--which DWP is required by law to transmit via separate pipes for restricted purposes such as irrigation and industrial cooling--replaces only about 10,000 AFY of the 560,000 AFY of largely imported water we consume.

The BOS actually reuses more wastewater than that: 17,000 AFY of wastewater is used within its own wastewater treatment plants for cooling equipment and for diluting chemicals used in the treatment process; another 38,000 AFY is sold to neighboring West Basin Municipal Water District for more advanced treatment, and 37,000 AFY more is diverted to help maintain environmental habitats, such as Lake Balboa and the Los Angeles River. However, none of these efforts helps offset our dependence on imported water because DWP does not use imported water for such purposes.

Dramatically Expanding Water Recycling Faces Major Obstacles

The first obstacle in using more recycled wastewater to replace more imported water is that the City's Hyperion Water Reclamation Plant near LAX, the City's largest wastewater treatment facility, is not equipped for it. This plant treats three-fourths of all of the City's wastewater. But the treatment does not produce water of high enough quality to be recycled--even for irrigation or industrial use. Hyperion sells some of its treated wastewater to neighboring West Basin Municipal Water District, which treats it further in a more advanced plant. But Hyperion winds up discharging the vast majority of its treated wastewater into the ocean. A 2012 study put the cost of an upgrade that would allow Hyperion to produce water fit for recycling at just shy of $1 billion.

Almost all of the recycled wastewater the City now makes available to DWP customers comes from its three other water reclamation plants, which together treat only one quarter of the City's wastewater. These smaller plants

treat wastewater to higher standards than Hyperion does. Two of them—one in the San Fernando Valley and the other jointly operated with the City of Glendale—produce wastewater suitable for irrigation or industrial uses.

The City's smallest plant, on Terminal Island in the Harbor, is the only one that currently has the technology to treat water to a standard pure enough for use in replenishing underground water supplies. The City sells some of this treated wastewater from this plant to the Water Replenishment District of Southern California, which injects it into the ground to help buffer a coastal freshwater aquifer from saltwater intrusion.

The City's second major obstacle in replacing more imported water with recycled wastewater is its lack of a broad network of pipes to distribute recycled wastewater. State law requires that recycled wastewater travel to customers through separate pipes. The City currently has 58 miles of such pipe, which largely serve institutional customers such as golf courses, parks, churches, a university, a high school, a sports complex and some cemeteries. The DWP has plans to expand its recycled pipe network to 94 miles by 2022. But to put that in perspective, the DWP maintains about 7,000 miles of regular water pipes to serve its customers.

The City Has Other Plans to Expand

The City also has plans to equip its Donald C. Tillman Water Reclamation Plant in the San Fernando Valley with more advanced treatment systems that will allow it to produce recycled wastewater pure enough to help replenish the City's principal local water source, the San Fernando Valley Groundwater Basin. Recycled wastewater from the Tillman plant would be pumped through separate piping to the Pacoima and Hansen Spreading Grounds. Wastewater would eventually work its way down to the aquifer through these spreading grounds, or open areas, currently in use for capturing stormwater.

Additional Steps the City Should Take

INFRASTRUCTURE: We recommend that the City continually re-evaluate, develop, and adopt recycled water plans, such as long-term concepts for recycled water projects including upgrading Hyperion. The City's evaluation should include a cost-benefit analysis on upgrading wastewater treatments at Hyperion, the plant with capacity to produce the largest volume of recycled

wastewater. The City would still face expensive challenges to pump that water from low-lying Hyperion to higher elevation areas, such as over the Santa Monica Mountains to the San Fernando Valley. As an alternative, the City could consider building what we expect would be less expensive infrastructure to transport the recycled water that Hyperion would generate to other low-lying areas served by the West Basin and Central Basin Municipal Water Districts. Or DWP could put it underground for storage in low-lying areas and build infrastructure to pump it out to its customers.

STORMWATER: If the demand for recycled water exceeds the amount that can be supplied through wastewater going through BOS plants, the City should divert more stormwater runoff to said plants, which have unused capacity. Stormwater consists of rain that the ground does not absorb and other urban runoff that makes its way into the City's storm drain system. Stormwater, like wastewater, could be cleaned and recycled but is now mostly sent untreated out to sea.

LEVERAGING REGIONAL RELATIONSHIPS: The City can do more to expand its relationships with other agencies and jurisdictions to optimize the use of recycled water produced at Hyperion. Expanding agreements with West Basin and Central Basin Municipal Water Districts to deliver more recycled water in exchange for additional imported water rights can contribute to the region's overall local water supply and reduce the amount of treated wastewater discharged into the Pacific Ocean.

GREEN BUILDING CODE: We also suggest that the City take another look at recent building code amendments aimed at requiring certain new buildings to use recycled water to see if it can be more flexible. The amendments require many new buildings located within 200 feet of separate piping system for recycled water connect to that system for 100% of the building's non-potable needs. However, recycled water supplies for certain parts of the City may already be earmarked for customers, or purple pipe connections may not always be feasible (e.g. connecting pipe under railroad tracks or freeways). Allowing City officials the flexibility to determine whether the separate piping system would be economically and operationally feasible is an effective way to meet the City's intent without dissuading developers from building projects in these areas.

MANAGEMENT: While conducting this audit, we also examined whether the Bureau of Sanitation operates its plants effectively. We concluded that it does. However, we also found areas that could be improved. Accordingly, we urge

the Bureau to develop a better overall staffing plan for its treatment plants. To cope with staff cutbacks, particularly at Hyperion, managers have had to resort to increased overtime, with the result that overtime costs have doubled. Continued use of overtime could increase the potential for tired workers making errors may have also increased.

Review of the Report

On May 20, 2016, a draft of this report was provided to the Public Works' Bureau of Sanitation and Department of Water and Power. We met with management and representatives at exit conferences held on June 9 and June 14, 2016, and we considered their comments and additional information they provided as we finalized this report. We also considered comments from the Department of Building & Safety.

Department Comments and Action Plans

Bureau of Sanitation (BOS)

Overall, BOS agreed with the findings and recommendations (See Appendix V). The report included 15 recommendations addressed to BOS management. Based on their response, we consider four recommendations (1.2, 6.1, 6.2, and 6.3) "Implemented" and eleven (1.1, 2.1, 2.2, 4.1, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, and 7.1) as "In Progress".

Department of Water and Power (DWP)

In general, DWP agreed with the findings and recommendations (See Appendix V) and noted that, subsequent to our audit fieldwork, the Board of Water and Power Commissioners adopted the 2015 Urban Water Management Plan (UWMP). The UWMP contains DWP's 25-year strategic plan for recycled water programs, and addresses many of findings and recommendations addressed to DWP.

In response to our recommendations related to amending the City's Green Building Code, DWP stated that they will work with the Department of Building & Safety to implement a written framework with policies that satisfy the intent of our recommendations without a need to amend the City's Green Building Code.

The report included six recommendations addressed to DWP. Based on their response, we consider these recommendations (1.1, 1.2, 2.1, 2.2, 3.1, and 3.2) as "Partially Implemented/In Progress."

Department of Building & Safety (DBS)

In response to our recommendations related to amending the City's Green Building Code, DBS stated that they will work with DWP to implement a written framework with policies that satisfy the intent of our recommendations without a need to amend the City's Green Building Code.

The report included two recommendations addressed to DBS related to recycled water building requirements. Based on their response (See Appendix V), we consider these recommendations (3.1 and 3.2) as "In Progress."

BACKGROUND

The City of Los Angeles purchases 75% of its water from imported sources.

Due to limited local water supplies, the City of Los Angeles (City) relies heavily on imported water to satisfy the City's increasing population and demand. In FY 2013-14, imported water from the Metropolitan Water District (MWD) represented 75% of the City's water supply. The sources of MWD's water include the Sacramento-San Joaquin Delta (Bay Delta) and Colorado River Basin.

The cost of the City's imported water has increased 24% since 2011.

Over the past decade the State of California has suffered a historically severe drought which has restricted the availability of the City's imported water supply and increased its cost. Since 2011, the cost of the City's imported water supply from MWD has increased approximately 24%. Although recent conservation efforts by City residents and businesses have mitigated some of this impact, additional political mandates and government regulations are shifting the way water is managed, delivered, and utilized throughout California.

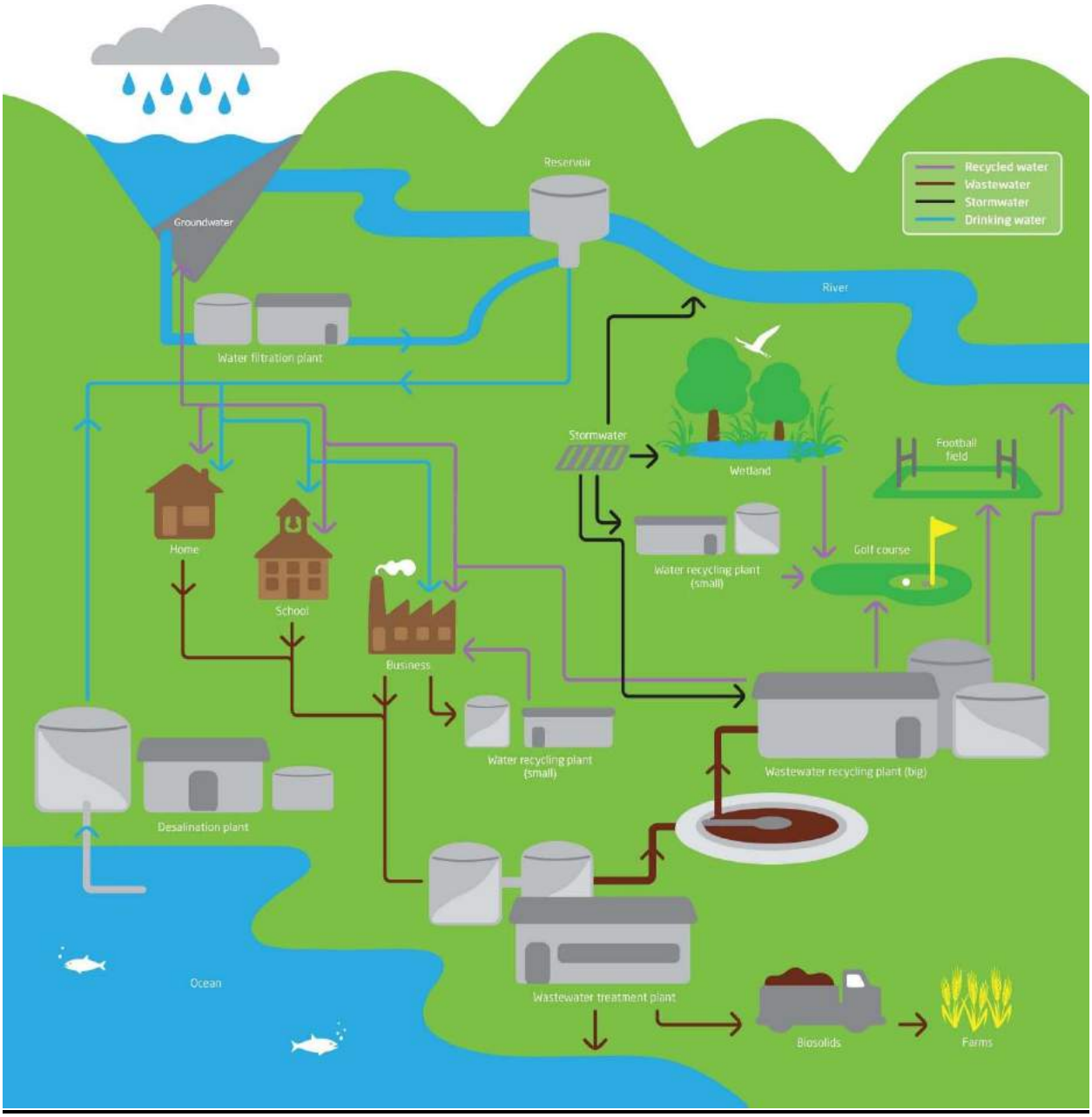
Offsetting imported water requires local water supplies; of the City's existing water strategies, recycled water production is the most drought-resistant.

Increasing the City's local water supply and optimizing its use to offset imported potable water demand requires managing water from various sources, including:

(1) potable water (rivers, lakes, groundwater, etc.);
(2) stormwater (from precipitation);
(3) urban runoff (human use that fills storm drains);
(4) wastewater (human use that fills sewer system), or reused onsite (greywater);
(5) recycled water from the treatment of wastewater, stormwater, or urban runoff at reclamation plants; and
(6) salt water (ocean or brackish–seawater mixed with fresh water) that is desalinated for potable use.

Of the City's existing water strategies, recycled water produced by the Los Angeles Department of Public Works' Bureau of Sanitation (BOS) is the most drought-resistant form of augmenting local water supplies.

Exhibit 1: Example of Managed Water Cycle System[2]



In the example of a managed water cycle above, residents and businesses utilize potable (blue lines) *and* recycled water (purple lines). The wastewater (brown lines) from residents and businesses can then be conveyed to a

[2] Exhibit illustration was adapted from http://www.powerhousemuseum.com/ecologic/the-exhibition/water-management/

wastewater treatment plant where treated wastewater can be discharged to the ocean or recycled at a "recycling plant" (reclamation plants in the City of Los Angeles). The biosolids removed from wastewater can be beneficially reused for agriculture. Additionally, the example depicts stormwater (black lines) as: (1) a source for augmenting potable water sources, (2) "captured" and reused on or near the site for irrigation, and (3) treated at a "recycling plant" and used for irrigation. This example also illustrates ocean water treated at a desalination plant as a source of potable water; but, the City currently does not own or operate a desalination plant.

Exhibit 1 provides information for illustrative purposes only. The scope of this audit includes only recycled water production and delivery, sourced from residential and industrial wastewater, or the stormwater diverted to a BOS operated water reclamation plant.

Bureau of Sanitation (BOS) Wastewater Operations

Per State regulations, BOS must treat all collected wastewater (influent) before it is reused or discharged into bodies of water (effluent). Through the City's sewer system, BOS conveys the City's and Contract Agencies'[3] wastewater to one of four large-scale water reclamation plants:

1) Hyperion Water Reclamation Plant (Hyperion),

2) Donald C. Tillman Water Reclamation Plant (DCTWRP),

3) Los Angeles-Glendale Water Reclamation Plant (LAGWRP), and

4) Terminal Island Water Reclamation Plant (TIWRP).

Each of the BOS plants treat wastewater to a level that is commensurate with federally permitted standards for discharge into neighboring bodies of water.[4] All plants, except for Hyperion, have additional permits to treat wastewater to

[3] Non-City agencies that utilize the City's sewer system to dispose of their wastewater have contracts with BOS for the treatment and discharge of their wastewater.

[4] Both the Hyperion and Terminal Island Water Reclamation plants contain facilities that remove and treat solid materials from influent wastewater. Solid materials are removed and processed into organic compost which is subsequently delivered to the City's Green Acres Farm in Kern County for reuse as fertilizer. Solids from the Donald C. Tillman and Los-Angeles Glendale Water Reclamation plants are returned to the sewer system for treatment at Hyperion plant.

levels acceptable for beneficial reuse outside of the plants (recycled water). The water reclamation plants vary significantly in size, capacity, and cost, yet each plays a vital role to maintain clean and sanitary conditions throughout the region.

In FY 2014-15, BOS' water reclamation plants treated approximately 382,000 acre-feet per year (AFY) of wastewater.[5] In addition, 109,000 AFY (29%) of wastewater was recycled in FY 2014-15 for non-potable use such as irrigation, industrial processes, and habitat restoration through lakes (environmental use), and indirect potable reuse by injecting recycled water into the ground to protect groundwater supplies from seawater intrusion. The City discharged the remaining treated wastewater to the Pacific Ocean, Los Angeles River, and/or the Los Angeles Harbor.

Recycled Water Sources

The primary source for recycled water within the City is wastewater from residents and businesses that flow through more than 6,500 miles of City sewers, into one of the water reclamation plants for treatment and recycling.

In addition to wastewater collected through City sewers, approximately 6,720 AFY of rainfall and urban water runoff captured through the City's storm drainage system is diverted to the Hyperion plant for treatment and potential reuse. This diversion only occurs during the City's dry weather months, typically May through September, and is only for a portion of the City's estimated 49,000 AFY of dry weather urban runoff. During wet weather, rainfall could be captured by large spreading basins for infiltration into the groundwater, or smaller mechanisms (e.g. rain barrels, cisterns, and underground storage tanks, etc.) for direct use on-site. The storm drainage system collects any remaining urban runoff from impervious surfaces and discharges it into local bodies of water such as creeks, rivers, and the ocean. Processes or plans to capture stormwater prior to entering the storm drainage system were not part of this audit's scope.

[5] 382,000 AFY of treated wastewater is an estimate based on data provided by BOS for FY 2014-15. The four year average for treated wastewater during the audit period is estimated to be 403,000 AFY, based on BOS internal documentation on influent flows.

Recycled Water Regulation

Title 22 of the California Administrative Code (Title 22) regulates the treatment, use, and discharge of recycled water. There are two regulated categories for recycled water use: non-potable reuse (NPR), and indirect potable reuse. NPR includes irrigation and industrial use, while indirect potable reuse includes highly treated wastewater discharged into groundwater or surface water sources that will eventually augment drinking water supplies.

The California Department of Public Health developed Water Recycling Criteria, which are enforced by Regional Water Quality Control Boards (RWQCB) through Orders. The Los Angeles-Glendale, D.C. Tillman, and Terminal Island Water Reclamation plants have Orders adopted by the Los Angeles RWQCB guiding the quality and use of the recycled water produced at these plants. All three plants are allowed to produce recycled water for non-potable reuse, while only Terminal Island has a permit for indirect potable reuse. Hyperion does not have a permit to recycle water for beneficial use outside of the plant.

Exhibit 2: Permitted Recycled Water Use for BOS Water Reclamation Plants

Plant	Acceptable Recycled Water Use	Type of Use

Los Angeles-Glendale
 	
D.C. Tillman
 	
Terminal Island
	• Surface Irrigation
	  o Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop;
	  o Parks and playgrounds;
	  o School yards;
	  o Residential and freeway landscaping;
	  o Unrestricted access golf courses; and
	  o Other allowable irrigation applications specified in Title 22
	• Industrial or commercial cooling tower
	• Street sweeping
	• Dust control (e.g. horse ranches, open fields, fairgrounds, etc.)
	• Industrial boiler feed
	• Recreational bodies of water
		Non-Potable Reuse (NPR)

Terminal Island	• Injection into the Dominquez Gap Barrier to protect drinking water in the aquifer from seawater intrusion	Indirect Potable Reuse (IPR)

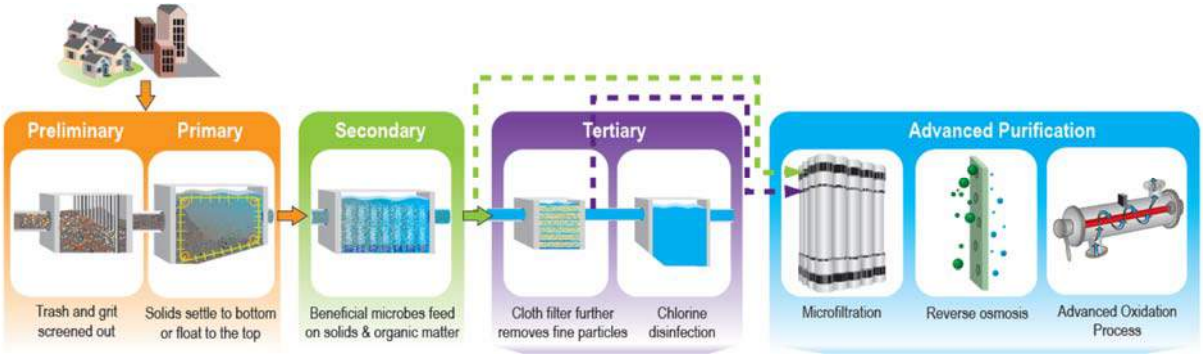
Conveyance of Recycled Water

The City Charter specifies that only the Department of Water and Power (DWP) can sell water in the City, including recycled water. State regulations require that purple pipes for recycled water are completely separate from the potable water system, with no cross connections. DWP is responsible for securing recycled water customers and for constructing the "purple pipe" system for delivery to those customers. As of FY 2014-15, approximately 58 miles of purple pipes exist within the City. With an updated drought response plan, DWP estimates that a total of 94 miles of purple pipes will be constructed within the City by 2022.

Recycled Water Use

Recycled water is categorized differently depending on the treatment processes used, while quality standards vary depending on the permitted use or discharge point. Exhibit 3 below illustrates the processes and quality levels associated with water reclamation processes.

Exhibit 3: Water Reclamation Process

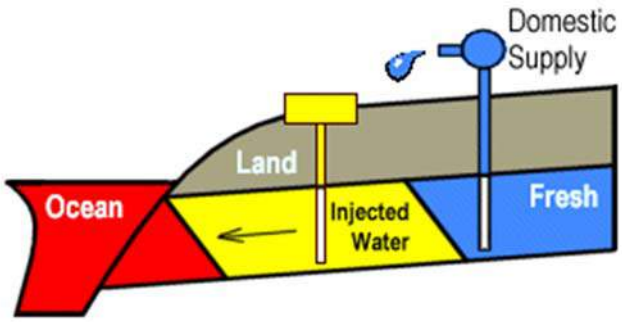


Source: BOS and DWP Recycled Water Master Planning documents

Currently, the City's water reclamation plants produce recycled water at varying levels dependent on specific reuse or discharge standards. Although each of the four water reclamation plants produce recycled water at the secondary or tertiary level, only the TIWRP produces recycled water at an advanced level. Advanced purified water is more costly to produce, but is of much higher quality, water that is typically clean enough to reintroduce into potable water supplies. This makes advanced purified water a valuable asset with a unique potential to offset imported water demand.

Exhibit 4 below illustrates how recycled water injected into an underground aquifer can protect the fresh water supply. The injected recycled water prevents salty ocean water from mixing with an underground water supply, preventing a need for additional treatment when it is extracted from the ground. This process is a form of indirect potable reuse that requires wastewater to be treated at a higher level before reuse. This is the method used by TIWRP for injection into the Dominguez Gap Barrier.

Exhibit 4: Confined Aquifer with Recycled Water Injection



Source: Los Angeles County Department of Public Works

External Sharing of Recycled Water

The West Basin Municipal Water District (WBMWD) and City of Glendale use wastewater treated at City plants for beneficial reuse. While this recycled water use reduces the amount of effluent discharged by BOS into the Los Angeles River or Pacific Ocean, a majority of this recycled water use does not directly offset the City's demand for potable water.

Approximately 38,000 AFY of secondary treated wastewater is pumped from the Hyperion Treatment Plant to the WBMWD-owned Edward C. Little Water Recycling Facility for additional treatment in order to meet state quality standards for sale to WBMWD's recycled water customers. The remainder of Hyperion's treated wastewater is either reused within the plant, or discharged into the Pacific Ocean. WBMWD's contractual agreement with DWP and BOS requires a fixed-rate payment to DWP of $7.50 per AF for secondary effluent received from Hyperion. These funds are meant to be used for recycled water projects.

The existing contract with WBMWD was authorized by City Council on June 13, 1991 for a 25-year term. This contract has been extended to July 2, 2021 to allow for BOS, DWP, and WBMWD to continue negotiations regarding a replacement agreement. The price per secondary effluent should be evaluated to reflect a more current value of water.

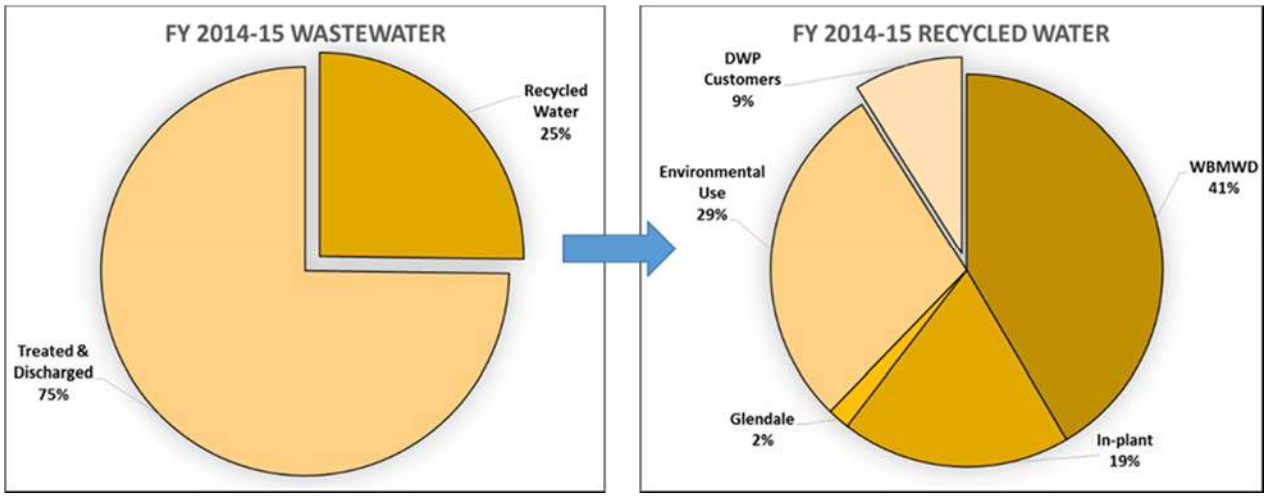
A portion of the recycled water produced by WBMWD is sold to DWP to serve customers in West Los Angeles, while the remaining recycled water helps to meet demand in WBMWD's service area. DWP's recycled water customers in West Los Angeles include parks, golf courses, the Playa Vista Development,

and Loyola Marymount University. In FY 2014-15, 895 AF was delivered to DWP customers in the West Los Angeles area.

The Los Angeles-Glendale Water Reclamation Plant is jointly owned by the City of Los Angeles and the City of Glendale. The plant has a capacity to intake 20 million gallons per day of wastewater and each city is allocated an average influent flow of 10 million gallons per day. In FY 2013-14, the City of Glendale used 1,700 AF of recycled water for its customers.

As shown in Exhibit 5, only about 25% of all treated wastewater by BOS plants is recycled. Of that amount, BOS recycled water is used within each plant, for habitat restoration at lakes (environmental use), and DWP's, WBMWD's, and City of Glendale's non-potable and indirect potable use customers.

Exhibit 5: BOS Recycled Water Production and Distribution



Source: BOS Management's Recycled Water Table

Funding Recycled Water Projects

A combination of fees from sewer and water rate payers fund recycled water projects. Funding from sewer fees pay for treating wastewater at BOS water reclamation plants to meet permit requirements for discharge and/or water reuse. Water fees pay for the purple pipe infrastructure that delivers the recycled water to DWP water customers and indirect potable reuse. Additionally, DWP pays BOS for the recycled water it delivers from the Terminal Island Water Reclamation Plant at a negotiated rate, which is based on the incremental cost to produce advanced treated wastewater.

The State also has funding available for recycled water projects through Proposition 1 (Prop 1) and the Clean Water State Revolving Fund (CWSRF) Program. Approved by voters in November, 2014, Prop 1 provides for $625 million in funding for recycled water projects through loans and grants for planning and construction activities. The CWSRF provides low-interest loans for planning, design, and construction of water recycling projects. Interest rates over the past six years have ranged from 1.5% to 2.7% and there is no maximum funding limit.

Objectives

We reviewed the operations at the four Bureau of Sanitation (BOS) water reclamation plants and the City's use of water recycled by BOS to:

A. Determine if the BOS' water reclamation plants are operating in the most effective manner to produce recycled water; and,

B. Determine if the City is currently maximizing its capacity to produce and deliver recycled water to offset potable demands, and evaluate future plans to increase production and delivery for customer and environmental use.

Because the City Charter grants control over the sale of all water in the City to the Los Angeles Department of Water & Power (DWP)[6], we also examined DWP's role to increase recycled water use including infrastructure plans and user outreach.

Benchmarking & Leading Practices

To benchmark BOS operations with industry leading practices, we identified and surveyed nine regional water and wastewater agencies that operate wastewater treatment and/or reclamation facilities. The results of these surveys are used throughout the report, and summarized within Appendix IV.

To assist with technical and industry specific knowledge related to wastewater treatment and water recycling, we retained the services of Michael Baker International (MBI). MBI is a consulting firm with specialists who are experts in regional water policy and wastewater treatment.

[6] LA City Charter Sec. 677

Other Audits and Reviews

There have been no Controller's Office Audits specific to the BOS Clean Water and Reclamation Program in the past decade.

However, the Controller's Audit Division did conduct a performance audit of the City's wastewater collection systems in 2008, which focused on the upgrade and maintenance of the sanitary sewer system. That audit, issued on January 15, 2009, found that BOS could more effectively plan for infrastructure to reduce the likelihood of sanitary sewer overflows during wet weather flow.

On December 8, 2015, the City Joint Administrators (Controller, Mayor and City Council) released the Industrial, Economic and Administrative Survey of the Los Angeles Department of Water and Power (DWP) that was performed by Navigant Consulting (Navigant). This survey included a review of DWP's strategic and operational readiness to address water supply and storage to reduce the City's reliance on MWD's water by increasing local water supply. During the survey process, Navigant analyzed the City's 2010 Urban Water Management Plan (UWMP), which included increasing water supply from stormwater capture, groundwater, recycled water, and conservation. DWP has since issued its 2015 UWMP, updating the Department's plans to reduce the demand of imported potable water.

FINDINGS & RECOMMENDATIONS

Section I: Recycled Water Production and Delivery

In light of environmental regulations, climate change and a multi-year drought threatening imported water supplies, the Department of Water and Power (DWP), Bureau of Sanitation (BOS), and the Bureau of Engineering (BOE) completed Recycled Water Master Planning (RWMP) documents in 2012. These serve as a roadmap for how the City can deliver 59,000 AFY of recycled water by 2035 to offset the demand for imported potable water.

Subsequent mandates, such as the Mayor's Executive Directive No. 5 and the Mayor's 2015 "Sustainability City pLAn", require the City to be more aggressive in sustaining local water supplies to offset imported potable water demand by 2025. On June 7, 2016, the Board of Water and Power Commissioners adopted a 2015 Urban Water Management Plan (UWMP) that sets a goal of delivering 59,000 AFY of recycled water by 2025, and 75,400 AFY by 2040.

However, the City is not optimizing recycled water production and deliveries, and there are opportunities to increase recycled water use beyond the 2015 Urban Water Management Plan goals. BOS plants discharge more than 297,000 AFY of treated wastewater into the Los Angeles River and Pacific Ocean, but this water could be recycled. In addition, BOS reclamation plants have the capacity to treat an additional 247,000 AFY of diverted stormwater.

However, several challenges exist in optimizing recycled water production and delivery, including a lack of infrastructure and technology, delays in securing customers, the need for cross-jurisdiction collaboration, and different approaches to managing the City's sources of water, such as potential new State regulations that would allow recycled water to be connected directly to the potable water system.

Finding No. 1: The City is not optimizing the production and delivery of recycled water as an alternative water resource to offset demands for imported potable water.

While the City's adopted recycled water projects aim to deliver 59,000 AFY by 2035,[7] there is an additional 297,000 AFY of treated wastewater currently discharged into the LA river and Pacific Ocean; there is also capacity at the plants to treat an additional 247,000 AFY of diverted stormwater. Failure to re-evaluate existing recycled water projects, and develop additional projects, poses a risk. Without change, the City could have insufficient local water supply to meet expected increases in demand.

The City does not Optimize Recycled Water Production and Deliveries

BOS water reclamation plants have a design capacity to treat 650,000 AFY of wastewater (Exhibit 6). However, not all influent can be recycled: the reclamation process produces solids and brine (unsuitable for water use), and environmental requirements to maintain habitats along the Los Angeles River. Despite the available capacity, BOS plants received an average influent of only 403,000 AFY from FY 2011-12 through FY 2014-15, or 62% of available capacity. Further, BOS produced an average of 106,000 AFY of recycled water, or 26% of the annual average influent treated at City plants during the audit period. The remaining 297,000 AFY was discharged to the LA River or Pacific Ocean.

Influent flows have decreased 7.6% over the past three years from approximately 413,000 AFY in FY 2011-12 to 382,000 AFY in FY 2014-15. BOS considers this as a result of recent water conservation. In addition, BOS states that influent flows will likely remain below 400,000 AFY Citywide for several years due to water conservation.

[7] Subsequent to audit fieldwork, the Board of Water and Power Commissioners adopted the 2015 Urban Water Management Plan, which sets a goal of delivering 59,000 AFY of recycled water by 2025, and 75,400 AFY by 2040.

Exhibit 6: Treatment Capacity, Influent Flow and Recycled Water Production, Averages for FY 2011-12 through FY 2014-15

	Dry Weather Capacity		Treated Wastewater Influent		Recycled Water Production			Discharge Point of Remaining Treated Wastewater
	MGD[1]	AFY[2] (x1000)	4 yr avg MGD[1]	4 yr avg AFY[2] (x1000)	4 yr avg MGD[1]	4 yr avg AFY[2] (x1000)	% of Influent	
Hyperion *Secondary Treatment*	450	504	279	313	43	48	15%	Pacific Ocean
Tillman *Tertiary Treatment*	80	90	47	52	34	38	73%	LA River
LA-Glendale *Tertiary Treatment*	20	22	19	21	16	18	86%	LA River
Terminal Island *Tertiary and Advanced Treatment*	30	34	15	17	2	2	15%	LA Harbor
Total	580	**650**	**359**	**403**	**96**	**106**	**26%**	

Source: Auditor generated based on BOS data
Note: This audit does not consider effluent discharged from the Tillman and LA-Glendale plants into the LA River as recycled water because that water could have been used to offset potable water demand for irrigation and industrial use.
[1] MGD – million gallons per day
[2] AFY – acre-feet per year (1 MGD = approximately 1,120 AFY)

Hyperion, which receives the largest amount of wastewater of the City's four plants, does not have the technology and infrastructure to treat wastewater that meets Title 22 regulations for beneficial reuse. Instead, the West Basin Municipal Water District (WBMWD) purchases a portion of Hyperion's secondary effluent from DWP (approximately 38,000 AFY in FY 2014-15) and further treats the wastewater for recycled water distribution to WBMWD and DWP customers. Only a small portion of Hyperion's effluent is recycled for in-plant use (approximately 12,000 AFY in FY 2014-15). The remaining 244,000 AFY of wastewater was discharged into the Pacific Ocean in FY 2014-15.

The Department of Water and Power (DWP) has not secured sufficient customers or end-use for the recycled water produced at BOS reclamation plants. In FY 2014-15, DWP delivered only 10,421 AF of recycled water. Of this amount, only 895 AF was delivered to customers in West Los Angeles using wastewater treated initially by Hyperion, and subsequently by WBMWD. DWP has plans to increase recycled water deliveries to existing West Los

Angeles customers such as the Playa Vista Development and the Los Angeles World Airport (LAX), and secure some new customers, for a total of 2,964 AFY in recycled water deliveries. This is approximately 8% of the wastewater treated at WBMWD, and illustrates challenges in securing non-potable reuse customers in the area surrounding Hyperion.

DWP staff report that their challenge in securing customers for recycled water citywide has been distributing recycled water, which includes building the purple pipe infrastructure from the reclamation plants to potential customers. The Board of Water and Power Commissioners approved a Recycled Water Consumer Capital Incentive Program in 2012 to facilitate recycled water use. However, DWP has found that it takes more time to connect customers for non-potable reuse than anticipated, which includes feasibility studies and retrofits to ensure service through separate recycled water and potable water systems. Finally, some potential industrial and manufacturing customers went out of business before the purple pipe system could be constructed. Accordingly, DWP eliminated a portion of the purple pipe project plans for the downtown area. Given these challenges, DWP should develop additional policies that facilitate securing more non-potable reuse customers.

2012 Planned Infrastructure Developments and Upgrades Address some Deficiencies

The 2012 Recycled Water Master Planning (RWMP) documents developed by DWP, BOS, and the Bureau of Engineering (BOE) address the lack of infrastructure, technology, and secured recycled water customers for some plants. The RWMP serves as a roadmap for how the City can deliver 59,000 AFY of recycled water by 2035 to offset potable water demand. Current RWMP projects to increase recycled water deliveries include:

- Doubling advanced treated recycled water production at Terminal Island, from 6 million gallons per day (MGD) to 12 MGD by 2017;
- Upgrading Tillman to produce advanced treated recycled water to augment groundwater supplies in the San Fernando basin (groundwater replenishment, a form of indirect potable reuse, IPR) by 2022;[8]

[8] Plans to produce 30,000 AFY of recycled water from Tillman for groundwater replenishment require diverting wastewater flows and utilizing 100% of the reclamation plant's dry weather capacity.

- Expanding the purple pipe network in the downtown area so recycled water could be delivered to the Convention Center and possibly the University of Southern California for non-potable reuse (NPR); and,
- Expanding the purple pipe network in the Harbor area to augment Lake Machado and service industrial customers such as refineries (as NPR).

In addition to upgrades included in the RWMP, there are plans to increase recycled water use from Hyperion. These plans are discussed in the 2015 Urban Water Management Plan (UWMP) adopted by the Board of Water and Power Commissioners on June 7, 2016. However, even with these upgrades and plans for increased recycled water use, Hyperion would still discharge approximately 160,000 AFY of treated wastewater into the Pacific Ocean. In-plant recycled water use may increase up to 67 MGD (approximately 75,000 AFY) based on the Digester Gas Utilization Project (DGUP), currently in construction. Recycled water will cool power generation during the processing of biosolids from influent wastewater. Pending negotiations with WBMWD and DWP, the amount of secondary effluent pumped through WBMWD could also increase to 70 MGD (approximately 78,000 AFY).

There is no mandated requirement to update the RWMP documents or report back on the progress towards meeting the 59,000 AFY by 2035 goal.[9] However, beginning in FY 2013-14, DWP has voluntarily produced Annual Recycled Water Reports to show its progress, including actual recycled water deliveries and purple pipe construction for the year, goals for the following year, potential customers for recycled water use by 2035, and the progress of recycled water projects. In DWP's FY 2014-15 Annual Recycled Water Report, staff estimated that DWP will exceed the RWMP goal and achieve 61,000 AFY of recycled water deliveries by 2035.

If Adopted, Long-Term Recycled Water Projects Could Help Exceed City Water Goals

While the RWMP documents included long-term concepts for recycled water projects (50 years beyond 2035), these plans were for policy consideration and have not been formally adopted. Adopting these plans was intended to offset 90 to 100% of potential Metropolitan Water District (MWD) imported water demands by 2085. Therefore, implementing several of the RWMP long-

[9] Subsequent to audit fieldwork, the Board of Water and Power Commissioners adopted the 2015 Urban Water Management Plan, which sets a goal of delivering 59,000 AFY of recycled water by 2025, and 75,400 AFY by 2040.

term concepts within the next nine years could result in exceeding the 2015 UWMP water goals. The plans include:

- Upgrading technology and infrastructure at Hyperion, the plant with the largest capacity to produce recycled water (2012 estimate of $922 million in capital costs);[10]
- Building infrastructure to deliver recycled water from Hyperion to West and Central Basin underground aquifers (indirect potable reuse, or IPR), then subsequently pump, treat (if needed), and deliver potable water to DWP customers;[7] and,
- Building a satellite reclamation plant in the Downtown and East Los Angeles Area for NPR customers and/or IPR.[11]

The 2015 UWMP does not discuss the above RWMP long-term concepts in its Long-term Conceptual Planning Efforts section. However, BOS and DWP are currently exploring the feasibility of these plans, among others, and have noted some challenges that would need to be addressed before full implementation. These include:

- Determining the impact, if any, of upgrading the Hyperion treatment plant on the City's existing relationship with West Basin Municipal Water District, which currently depends solely on Hyperion effluent to produce and deliver recycled water to its customers;
- Improving existing DWP pipes and enhancing pumping wells so that they will be able to handle the added pressure of pumping groundwater from the Central Basin into the potable water distribution system; and,
- Mitigating any potential contamination of groundwater from jurisdictions above in the Central Basin, including building additional groundwater treatment plant(s).

[10] The 2012 Long-Term Concepts Report of the RWMP proposed three projects that consist of upgrading the Hyperion treatment plant, conveying advanced recycled water from Hyperion to the West or Central Basin underground aquifers, and extracting groundwater for potable use. The estimated 50-year lifecycle cost (from 2035 to 2085) for these projects ranged from $1.1 billion to $4.4 billion. The lifecycle costs includes capital construction and post-construction operation and maintenance.

[11] While the 2012 Long-Term Concepts Report of the RWMP explored a satellite reclamation plant in the Downtown and East Los Angeles area, the FY 2014-15 Annual Recycled Water Report states that DWP is conducting feasibility studies for satellite treatment plants in various other locations, including the University of California Los Angeles, MacArthur Lake and Park, and Rancho Park Golf Course.

Additional Stormwater Diversion Could Help Optimize Recycled Water Production

As illustrated in Exhibit 6 above, BOS plants do not receive influent flows to their maximum capacity. Therefore, the plants have additional capacity to treat more influent, thereby producing more recycled water. BOS could look into urban runoff and stormwater from the storm drain system as additional sources of influent for recycled water production.

There are no adopted plans to fully utilize the capacity at treatment plants and increase overall recycled water production by increasing stormwater diversion to the plants. However, BOS is exploring the feasibility of diverting dry weather stormwater to the Tillman plant because it is closer to existing purple pipelines and spreading grounds for groundwater replenishment. However, the feasibility of stormwater diversion must consider:

- *Impact on Treatment Process* - Mixing stormwater with wastewater will impact plant operations (e.g. chemical usage, processes, etc.) because the quality and characteristics of stormwater is different from wastewater. Water from storm drains can be more polluted (e.g. fats, oils, grease, and larger trash debris not found in the sewer system), requiring more intensive treatment processes.

If the City desires to treat stormwater at reclamation plants year-round, it should also consider the following:

- *Lack of Capacity for Stormwater Treatment* - During a rainstorm, the plants would not be able to handle the increased volume of water if stormwater *diversion* (flow from storm drains) is added to influent flows. The volume of influent to the plants already increases during a rainstorm due to stormwater *infiltration* (stormwater that enters directly into the sewer system through cracks, leaks, manholes, and open tanks). The wastewater system was not designed to handle wastewater *and* stormwater. If the wastewater system is inundated with stormwater, there is a greater risk of a sewer spill.

- *Need for Temporary Storage* - During a rainstorm, stormwater *diversion* flows could be temporarily stored, and then diverted to the treatment plants when they have the capacity to treat flows *after* storm events. However, storage infrastructure is an additional cost.

Future Regulation could Significantly Impact the City's Recycled Water Strategy

State regulators are currently considering new regulations over Direct Potable Reuse (DPR) of treated wastewater. Allowing DPR within the State would allow highly-treated wastewater to be reintroduced into existing raw water supplies, or directly into a public water system (pipe to pipe). New regulations could significantly change the City's strategy and pursuit of recycled water projects. For example, rather than conveying advanced treated wastewater from the Tillman plant for groundwater recharge, the City could convey the recycled water to the Los Angeles Aqueduct. This water would then be treated at a DWP water treatment facility and distributed to water customers through existing potable water pipes.

Advantages of DPR recycled water projects include:

- Water being available for use more quickly, as opposed to waiting at least two years for recycled water to percolate through the ground for future extraction;[12]
- Mitigating the risk of not being able to extract all of the recycled water input into an underground basin because of pollutants from above ground contaminating the high quality recycled water over time (as is the current case with approximately two-thirds of the extraction wells for the San Fernando Groundwater Basin); and,
- Cost savings due to building and/or maintaining fewer pipelines, as there will be no need to maintain two separate systems for recycled water and potable water to end users.

There are risks associated with investing in one recycled water project over another though. The technology for advanced water treatment has dramatically improved in the last decade, but its cost and appropriateness depend on the quality of the influent, the end customer, and State regulations. What works best for one of the City's plants may not work for all of them. If the City heavily invests in a project that does not meet new state regulations, those assets may not be used to their full potential. Conversely, if the City waits for regulations to be finalized before making preliminary plans and investments, it risks not having sufficient local water supplies to meet future

[12] Per BOS management, after the first two years of groundwater replenishment the supply of groundwater should be a steady flow, depending on the rate at which users extract groundwater (e.g. extraction does not exceed replenishment volume).

demands. For example, the City built infrastructure to pump recycled water into the San Fernando Groundwater Basin in the 1990's, but amidst "toilet-to-tap" protests, the Mayor stopped these recycled water deliveries. Meanwhile, Orange County invested in replenishing its groundwater basin with recycled water and is now considered an international leader in groundwater management and water reuse.

BOS, in coordination with DWP, other City departments, regional agencies, and stakeholders, is developing an Integrated Resources Plan (IRP) called One Water LA. The plan will provide various scenarios and policy/project options, including capital plans for Hyperion if DPR regulations are adopted. However, in contrast to the last adopted IRP, there is currently no formal requirement for BOS to periodically report back to City Council on the progress of One Water LA after its adoption.

Because several environmental changes and mandates from the Mayor have occurred since the completion of the 2012 RWMP, and with additional potential regulatory changes looming, it is critical for the City to constantly re-evaluate its potential recycled water projects. This would help ensure that the City will mitigate risks and more cost effectively meet the Mayor's goals to reduce imported water dependence and increase local water supplies.

Recommendations

BOS and DWP should:

1.1. Re-evaluate, develop, and adopt recycled water plans according to the following priorities and policy considerations:

a) Implement long-term concepts from the Recycled Water Master Planning documents that promote recycling existing treated wastewater for:

i. Injection or spreading into local groundwater basins with underutilized storage capacity (indirect potable reuse), and

ii. Delivery to industrial and irrigation customers for non-potable reuse. DWP should develop policies that facilitate securing more customers, such as

providing incentives given recent challenges with the non-potable reuse customer base.

b) Once indirect potable reuse and non-potable reuse demand exceeds BOS' supply of recycled water, consider increasing stormwater diversion to reclamation plants for treatment and recycling.

c) Consider alternative recycled water projects if Direct Potable Reuse legislation is passed within the short-term (next five years), and realign the City's recycled water strategy based on new legislation.

1.2 Annually report to City Council on the progress of adopted recycled water projects, including explanations for changes in strategy due to new regulations or technology.

Finding No. 2: BOS is not fully leveraging its City and regional relationships to support the City's goals for recycled water use.

Without strengthened regional relationships, the City is unable to recycle and deliver more than 244,000 AFY of treated wastewater currently discharged into the Pacific Ocean by the Hyperion treatment plant.

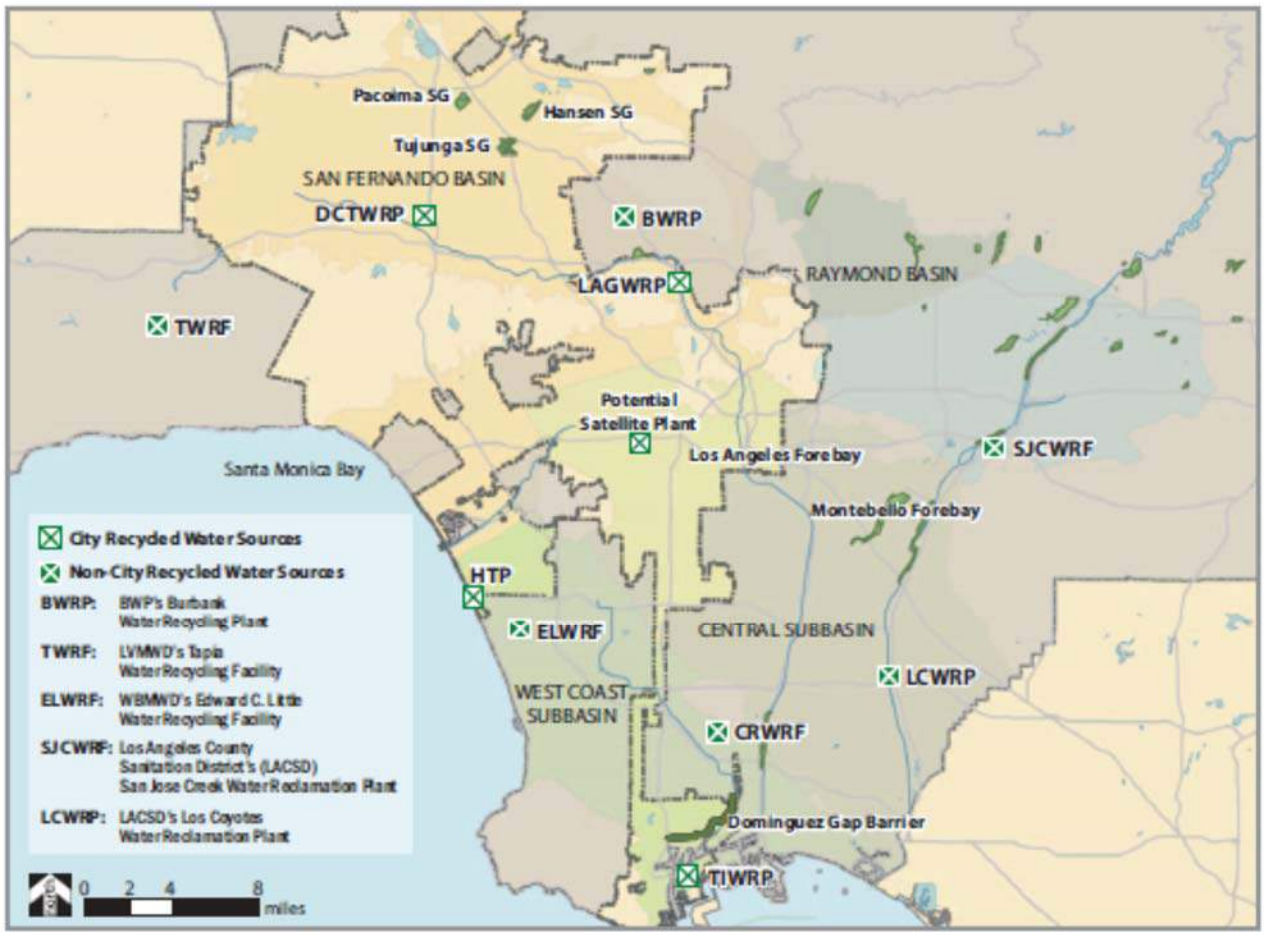
Leadership and Collaboration for Regional Recycled Water Programs is Limited

Optimizing recycled water production and delivery from the Hyperion Wastewater Treatment Plant (Hyperion or HTP) will require cross-jurisdiction and regional collaboration due to its location. Conveying recycled water from Hyperion to the San Fernando Basin, the underground water basin which the City has the most water rights for extraction and potable use, would require pumping recycled water at least twenty miles north and through the Santa Monica mountain range. As illustrated in Exhibit 7 below, Hyperion is closest to the West Coast Subbasin (West Basin) and Central Subbasin (Central Basin) underground aquifers, which DWP has some water rights. As discussed on page 16, if the City upgrades Hyperion to perform advanced wastewater

treatment, it can produce recycled water that can be injected into the West and Central Basins for eventual extraction and potable use (indirect potable reuse). However, conveying the recycled water to these underground aquifers would require building infrastructure that crosses the City's jurisdictional boundaries. Additionally, the 2012 Recycled Water Master Plan estimates that West and Central Basins have a potential to store 115,000 AFY of recycled water, but the City only has rights to extract 18,700 AFY, while other jurisdictions maintain rights to the remaining groundwater. Further, there is no guarantee that the City will always be able to extract up to 18,700 AFY from these basins, as illustrated by the groundwater contamination in the San Fernando Valley.

An agreement with the other jurisdictions should outline how the City and region could benefit from replenishing the basins with the City's recycled water. For example, the West Basin and Central Basin Municipal Water Districts currently supply imported and recycled water to cities and customer agencies in the region surrounding Hyperion. As discussed in Finding 1, securing recycled water customers on the Westside has been challenging. The City should explore leveraging the Districts' existing infrastructure and water customers for delivering recycled water from Hyperion. Additionally, because Hyperion's potential to deliver recycled water exceeds the City's existing water rights to the West and Central Basins, an agreement across jurisdictions could consider exchanging rights to the City's recycled water for rights to other sources of water such as local groundwater and/or imported water. While exchanging recycled water for additional imported water rights may not contribute to meeting the Mayor's goals of reducing imported water purchases, it can contribute to the region's overall local water supply.

Exhibit 7: Map of Wastewater Treatment Plants and Underground Aquifers in the Los Angeles Region



Source: DWP

The City has already established cross-jurisdictional relationships for use of its recycled water from the Terminal Island Water Reclamation Plant (TIWRP) and a portion of its effluent from Hyperion. For example, the City has established relationships with the County of Los Angeles and Water Replenishment District of Southern California to use advanced-treated recycled water from TIWRP to prevent seawater intrusion into underground aquifers along the west coast. As previously discussed, BOS, DWP and the West Basin Municipal Water District (WBMWD) have extended their 25-year contract to continue negotiations for potential upgrades and expansion of recycled water delivery to WBMWD.

However, there is limited local leadership promoting and planning new regional projects across three or more jurisdictions on a frequent basis.

Industry and research associations such as the WateReuse Association and the National Association of Clean Water Agencies facilitate discussion of regional issues, but they do not conduct regional planning. As a result, it is difficult for multiple parties to be held accountable for initiating and implementing cross-jurisdictional projects, such as increasing recycled water production at Hyperion for delivery to non-City customers surrounding the plant.

Promotion of City Recycled Water Programs is Legally Constrained

Wastewater discharged into the City's sewer system is the primary source of recycled water within the City. Approximately 14% of the wastewater within the City's sewer system originates from jurisdictions outside the City. To recover the costs of conveying and treating wastewater, BOS has established long-term agreements with 29 local agencies (Contract Agencies). In general, these agreements are structured so that each Contract Agency is charged equitable rates based on their proportional share of the wastewater flow discharges into the City's sewer system. Through these agreements, each Contract Agency is granted rights to a proportionate share of recycled water produced at BOS reclamation facilities; however, only one Contract Agency (City of Glendale) actually utilizes the recycled water that is produced at one of the City's water reclamation plants.

Exhibit 8: Contract Agency Wastewater Flow Rates and Estimated Billings

Contract Agency[1]	Wastewater Flow Tributary to City of LA (MGD)	Flow % of total Amalgamated System [2]	FY 2014-15 Estimated Billings
Aneta Street Zone	0.05	0.0%	$ 24,794
City of Beverly Hills	5.18	1.5%	$ 2,853,048
City of Burbank	0.83	0.2%	$ 2,885,335
City of Culver City	4.17	1.2%	$ 2,405,481
City of El Segundo	1.31	0.4%	$ 814,259
City of Glendale [3]	13.65	4.0%	$ 5,167,154
City of La Cañada Flintridge	0.11	0.0%	$ 61,669
City of Long Beach	0.03	0.0%	$ 13,943
City of San Fernando	1.90	0.6%	$ 1,433,765
City of Santa Monica	11.34	3.3%	$ 8,298,960
Crescenta Valley Water District	1.33	0.4%	$ 803,498
Federal Office Building	0.01	0.0%	$ 8,861
Karl Holton Camp	0.01	0.0%	$ 12,529
LA County Sanitation District 4	4.47	1.3%	$ 2,277,683
LACSD 5	0.68	0.2%	$ 452,414
LACSD 9	0.25	0.1%	$ 151,964
LACSD 16	0.42	0.1%	$ 259,413
LACSD 27	0.06	0.0%	$ 90,902
Las Virgines MWD	0.34	0.1%	$ 256,757
Marina Del Rey Sewer Maintenance District	1.24	0.4%	$ 698,345
Triunfo County Sanitation District	0.14	0.0%	$ 90,960
Universal City/Studios	0.79	0.2%	$ 422,670
Veterans Administration	0.33	0.1%	$ 198,996
West Los Angeles Community College	0.02	0.0%	$ 24,328
Totals	**48.6494**	**14.1%**	**$ 29,707,728**

[1] Five Contract Agencies (The Army Reserve, Army Training Center, Barrignton Post Office, Veterans Memorial Park, and California National Guard) are not included on this schedule due to insignifcant flow.

[2] Net Amalgamated System Discharge is 344.13 MGD for FY 2014-15

[3] The City of Glendale owns half and pays half of the Operations & Maintenance costs of the Los Angeles-Glendale Water Reclamation Plant (LAGWRP). Half of the City of Glendale's wastewater flows that are treated at LAGWRP (Approx. 9.1 MGD) are not considered part of the amaglamated system for billing purposes. However, the total wastwater flows of 13.65 MGD are considered tributary to the City of Los Angeles' sewer system.

Revenue generated through Contract Agency Agreements are deposited into the City's Sewer Construction and Maintenance Fund (SCMF), and are restricted for sewage-related purposes including, but not limited to, industrial

waste control and water reclamation[13] (recycled water) projects. This allows the use of fees deposited into the SCMF to be used for recycled water, and BOS has directed SCMF funds to pay for construction and upgrades for its water reclamation plants.

However, State law prohibits using SCMF funds for construction of water reclamation plants when the benefits of the facilities are not equitably shared amongst all sewer ratepayers.[14] Considering the diversity and geography of BOS Contract Agencies, along with the complexity and size of the City's wastewater treatment system, assessing an equitable benefit from recycled water produced by BOS for all sewer ratepayers would not be practicable. Due to this circumstance, alternative incentives or funds would need to be established to promote regional agencies to use recycled water produced by BOS.

Opportunities Exist to Collaborate on Large-Scale Regional Recycled Water Projects

On November 10, 2015, the Metropolitan Water District (MWD) Board approved a $15 million appropriation and an agreement between MWD and the Los Angeles County Sanitation District No. 2 (LA County Sanitation) to implement a demonstration project and develop a potential regional recycled water supply. The demonstration project would be located at, and use, secondary-treated effluent[15] from the Joint Water Pollution Control Plant (JWPCP). The plant is located in the City of Carson, south of Hyperion. If a full-scale regional recycled water supply program is pursued by MWD and LA County, MWD would:

- Fund, design, construct, operate and maintain an advanced water treatment facility (AWTF) and delivery system with the capacity to produce 150 MGD;
- Distribute and sell the product water to customer agencies;
- Provide exchange water to LA County Sanitation that is approximately 1% of the product water; and,

[13] LAMC Sec. 64.19.2
[14] Proposition 218
[15] Hyperion effluent is also treated to the secondary level, with approximately 34 MGD conveyed per agreement to the West Basin Municipal Water District for tertiary and advanced treatment.

- Pay LA County Sanitation for land leased for the AWTF.

Because MWD has made a commitment to explore developing recycled water in the LA region with LA County Sanitation, the City of Los Angeles has an opportunity to leverage its long-standing relationship with MWD to similarly promote the sale of recycled water from City plants to MWD's customer agencies. According to BOS management, the City has initiated discussions with MWD. Some considerations for a City collaboration with MWD include whether MWD will pay the City for effluent from its plants, particularly from Hyperion; which entity would own, lead and direct the related infrastructure project(s); whether the City could utilize MWD infrastructure to convey recycled water to non-City customers; and how the relationship would impact the City's access to local water supplies.

Joint Powers Authorities Exist for Wastewater Treatment and Recycled Water

Our benchmarking included two joint power authorities in Southern California for wastewater treatment and recycled water production—South Orange County Wastewater Authority (SOCWA) and San Elijo Join Powers Authority (SEJPA). These authorities charge member agencies for the treatment of their wastewater. SOCWA has ten member agencies: City of Laguna Beach, City of San Clemente, City of San Juan Capistrano, El Toro Water District, Emerald Bay Service District, Irvine Ranch Water District, Moulton Niguel Water District, Santa Margarita Water District, South Coast Water District and Trabuco Canyon Water District.[16] SOCWA reports that it provides recycled water to member agencies at no additional cost. SEJPA treats wastewater from the Solana Beach, Rancho Santa Fe, Olivenhain and Cardiff communities (City of Encinitas) in San Diego County. In contrast to SOCWA, SEJPA's operating revenues come from member agencies' sanitation funds, outside services, *and* the sale of recycled water.

[16] Irvine Ranch Water District (IRWD) is a member agency of the South Orange County Wastewater Authority (SOCWA) because it utilizes its ocean outfall for discharging a portion of treated wastewater from one of its plants. However, as indicated in Appendix IV, IRWD has its own treatment and reclamation plants, and distributes recycled water within its service area. None of IRWD's wastewater is treated by another entity.

The City is Not Sufficiently Leveraging Regional Relationships through One Water LA

One Water LA is the City's effort to adopt an Integrated Resources Plan (IRP) through 2040 with projects and policies to improve wastewater, recycled water, drinking water, groundwater, and stormwater. The purpose of One Water LA is to ensure that existing City plans such as the Recycled Water Master Plan, Stormwater Capture Master Plan, and Urban Water Management, are consistent. Further, One Water LA attempts to identify any gaps or missed opportunities. However, there are two weaknesses in One Water LA efforts that could hinder the promotion of regional recycled water projects.

Weak Regional Participation

Contract Agencies have had limited involvement in the development of One Water LA initiatives. Although regional agencies and contract agencies *appear* to be a part of the One Water LA Steering Committee, BOS confirmed that Contract Agencies are intended to participate in focus meeting(s) that are *still* in development. However, stronger regional participation in One Water LA could help secure new customers for the City's recycled water.

Insufficient Timing for Finalizing Regional Agreements

The goal of completing an updated City wastewater facilities plan by the end of 2016, including any infrastructure upgrades at Hyperion, appears to be too short of a timeframe to diligently work with MWD, Contract Agencies, and other regional entities on a potential agreement or collaboration for regional recycled water projects. BOS management reported that such agreements would have to be negotiated separately from One Water LA efforts.

As illustrated by the opportunities to collaborate with BOS Contract Agencies and MWD, the City could collaborate across jurisdictions to optimize recycled water deliveries from Hyperion. Without stronger regional coordination and collaboration, the City's ability to increase its local water supply and reduce its dependence on imported water sources could be weakened. Continued dependence on imported water sources at its existing rate exposes the City to increased water supply costs, or worse, insufficient water supply to meet future demands.

Recommendations

BOS and DWP should:

2.1. Consider creating joint powers agreements[17] with regional water agencies that incentivize jurisdictions to use recycled water produced by BOS. These agreements should:

a) Ensure that competing beneficial use regulations are satisfied, and allow City sewer and water funds to pay for building or upgrading the City's capacity to produce recycled water; and,

b) Address what the City will get for contributing its recycled water to the regional local water supply (e.g. monetary compensation, exchange of water rights, etc.).

2.2. Develop a plan to more actively include regional agencies and contracting agencies in the development of One Water LA.

City Council should:

2.3 Consider using the General Fund to promote and incentivize recycled water programs with regional agencies, due to legal restrictions that govern the use of SCMF. Any General Fund allocation for this purpose should be specific to expand and encourage recycled water programs that offset regional imported water demand.

[17] The intent of the recommendation is to establish agreements or memoranda of understanding.

Finding No. 3: New requirements recently added to the City's Green Building Code may impact future development and not effectively promote recycled water use to offset potable water demand.

The Green Building Code amendments require 100 percent recycled water use for non-potable purposes when City-recycled water is available for use within 200 feet of the property line, with minimal consideration for the feasibility of such requirements. Based on DWP's experience with current and potential recycled water customers, there may be several challenges in connecting to the purple pipes for non-potable reuse, which could create barriers to development.

The Mayor's Executive Directive No. 5 called for "immediate action" to meet the Mayor's water goals, including requiring the Department of Building & Safety (DBS), in collaboration with DWP and BOS, to propose to City Council a list of potential building code changes for new and retrofitted buildings.

Subsequently, on December 16, 2015, the City Council adopted revisions to the Green Building Code in an effort to reduce the use of potable water related to building construction. The updated Code[18] requires recycled water use for newly constructed low-rise residential buildings and nonresidential high-rise buildings when City-recycled water is available within 200 feet of the property line.[19]

Code Amendments Lack Sufficient Flexibility for the Feasibility of Recycled Water Use

The blanket requirement to use City-recycled water for non-potable purposes when the development is within 200 feet of the purple pipeline does not take into consideration various potential constraints in implementation. For

[18] Los Angeles Green Building Code Sec. 99.04.305.2 and 99.05.305.2.
[19] Recycled water use is required for water closets [toilets], urinals, floor drains, and process cooling and heating. Exceptions include: Additions that use any part of the existing plumbing piping system, alterations that do not include replacing all of the potable water piping, and where City-recycled water quality has been deemed non-suitable for a particular fixture or equipment, the fixture and/or equipment shall be dual-plumbed for future connection.

example, there could be infrastructure within 200 feet of the property line that impedes adequate connection to purple pipes. Additionally, recycled water projects currently in progress could make it difficult for new developments to have sufficient recycled water supply for non-potable reuse. Specifically, plans for the D.C. Tillman Water Reclamation Plant anticipate fully allocating its recycled water for groundwater replenishment, environmental use, and non-potable reuse, without taking into consideration any new development along the purple pipeline in the Valley. The Code amendments state "when recycled water is available," but does not allow for flexibility in situations when a new development subject to Code enforcement is completed prior to fully implementing recycled water projects.

Requiring Recycled Water Use Could Create Barriers for Development

Based on DWP's experience with securing potential recycled water customers for non-potable reuse, issues of recycled water quality and reliability for residential and industrial use could impede future development along existing and planned purple pipes. For example, an industrial customer's equipment and water distribution system may require retrofits in order for the customer to use recycled water in its operations. Although the Terminal Island Water Reclamation Plant treats recycled water to an advanced level, DWP has received feedback from potential industrial customers in the Harbor area regarding a need for infrastructure retrofits.

Additionally, DWP reports that purple pipe infrastructure differs from the City's potable water infrastructure in that, if there is a break in service along the pipeline, subsequent connections will not have access to recycled water until it is repaired. The Hyperion Treatment plant and the Playa Vista development (Playa Vista) are the only DWP customers that use recycled water for toilet flushing. In the past two years, there were instances of recycled water outages in Playa Vista due to broken pipes. DWP notes that, although repairs were made within a 24-hour period, the Playa Vista customers felt the situation was not acceptable. As a result, DWP is now switching Playa Vista customers from recycled water to potable water for toilets. Based on this experience, DWP recommends that industrial and residential customers should have a potable water backup system and supply so they can continue operations and have working toilets when recycled water cannot be delivered.

State regulations regarding indoor use of recycled water requires dual plumbing. According to a study presented by DWP in 2008, such dual plumbing adds an additional 10% to plumbing costs, and 0.3% to overall

project costs. In 2014, BOS reported to City Council that a study of dual plumbing ordinances in other cities indicated that retrofitting existing buildings with dual plumbing may be cost prohibitive, and noted that recycled water use is voluntary in the City.

Due to the additional cost to plan for recycled water use, the current Green Building Code may drive developers to seek exemptions from mandatory recycled water use. Alternatively, developers may search for sites that are more distant from purple pipelines, including outside of the City limits (impacting the City's tax base).

Enforcing the Green Building Code Could Divert Resources from Cost Effective Recycled Water Projects

Requiring DWP to work with every construction and retrofit site subject to the City's Green Building Code for non-potable reuse of recycled water could divert resources from implementing direct potable reuse (DPR) projects, if and when the State passes regulations. As discussed in the previous section, DPR is cost effective because there would be no need to build and maintain two separate piping systems to end users. The area of the City with the largest nexus of potential development and planned purple pipes is Downtown. Recycled water for this area would come from the LA-Glendale Water Reclamation Plant (LAGWRP). However, DWP currently has two potential storage tanks near LAGWRP that could be used if the State adopts DPR regulations. Therefore, if DPR becomes a viable option, the City would have to balance supplying non-potable recycled water to Downtown customers and maintaining purple pipes, per the Green Building Code, with DPR development.

To mitigate against potential constraints on new developments and recycled water projects, the Code should be amended to be more flexible in promoting recycled water use. Additionally, there should be a tool to help assess the feasibility of requiring recycled water for each new development within 200 feet of the purple pipeline, which could include cost-benefit analyses of the availability of recycled water in the near and long-term, as well as potential retrofits and infrastructure challenges for using recycled water.

Recommendations

DBS and DWP should:

3.1. Propose amending the Green Building Code to be more flexible in promoting recycled water use (e.g. not 100% recycled water use, and/or additional conditions for exemptions).

3.2. Implement tools to assess the feasibility of non-potable recycled water use in new developments and identify measures to mitigate negative impacts.

Section II: Recycled Water Operations

More than 400,000 acre-feet per year (AFY) of wastewater was treated on average (over the past four fiscal years) at four water reclamation plants operated by the Bureau of Sanitation (BOS). Due to the high level of public health and environmental risks associated with wastewater treatment and water reclamation, plants are highly regulated, and require considerable resources and specially trained staff to operate effectively.

Over the last four years, BOS has spent approximately $389 million to operate and maintain the City's water reclamation plants. These costs are funded through appropriations from the City's Sewer Maintenance and Construction Fund (SCMF); a special revenue fund generated through the collection of established sewer fees. A cost summary of the operations and maintenance expenditures related to BOS water reclamation plants is presented in Exhibit 9 below:

Exhibit 9: Average Annual Plant Expenditures, FY 2011-12 through FY 2014-15

	Hyperion	Tillman	LA-Glendale	Terminal Island	All Plants	Percentage of All Plant Costs
Labor	$ 29,810,679	$ 5,181,103	$ 1,693,524	$ 4,232,279	$ 40,917,584	42%
Operating Materials and Supplies	14,260,332	2,738,777	859,369	1,605,507	19,463,385	20%
Contractual Services	17,570,101	671,617	68,586	430,613	18,740,918	19%
Utilities	9,894,817	3,975,864	1,453,292	2,214,224	17,538,197	18%
Assets and Equipment	273,760	47,039	19,675	42,968	383,441	1%
Other	241,766	25,545	6,881	13,151	287,343	0%
Total	**$ 72,051,454**	**$ 12,639,945**	**$ 4,101,327**	**$ 8,538,742**	**$ 97,331,469**	**100%**

Source: BOS Financial Management Division

An evaluation of plant operating costs shows that BOS could improve the economy and effectiveness of plant operations. In particular, we found that additional planning, improved management controls, and standardized performance reporting could enhance staffing, maintenance, and procurement of materials and supplies.

Finding No. 4: BOS lacks a comprehensive, multi-year staffing plan that addresses staffing needs in light of plant upgrades, qualification requirements, labor costs, and potential attrition. Without one, the capability of BOS to consistently meet recycled water goals is at risk.

All four BOS plants operate on a continual basis with three eight-hour shifts per day, and State regulations require specially-trained staff to operate these facilities. Regulators classify wastewater facilities by various factors such as size, capacity, location, and characteristics of treatment processes used. Due to the relatively larger size of BOS plants, regulators classify all four plants at the highest level (Class V). Minimum staffing levels for these plants are key for maintaining effective plant operations and mitigating risks associated to potential system outage, wastewater spillage, or system failure.

The State Water Resources Control Board (SWRCB) certifies Wastewater Treatment Operators (WTOs) at one of five grade levels[20] based on an exam and relevant work experience. BOS plant managers assign WTO staff to "station posts" (i.e. area/duty assignments) that reflect the level of operations needed to treat all plant influent. Plant managers determine the *minimum* number of station posts requiring 24/7 operation to satisfy operational requirements.[21] For the purposes of this audit, these station posts are considered "mandatory" for wastewater treatment, and must be staffed with WTOs with adequate SWRCB certification (staffing requirements).

[20] SWRCB certification levels do not necessarily match with the City's established WTO personnel classifications. The City has WTO classification levels of I, II, and III, with additional classifications for Senior WTOs. City classifications have minimum SWRCB certification requirements, but employees may possess higher-level SWRCB certifications than required by their current WTO classification.

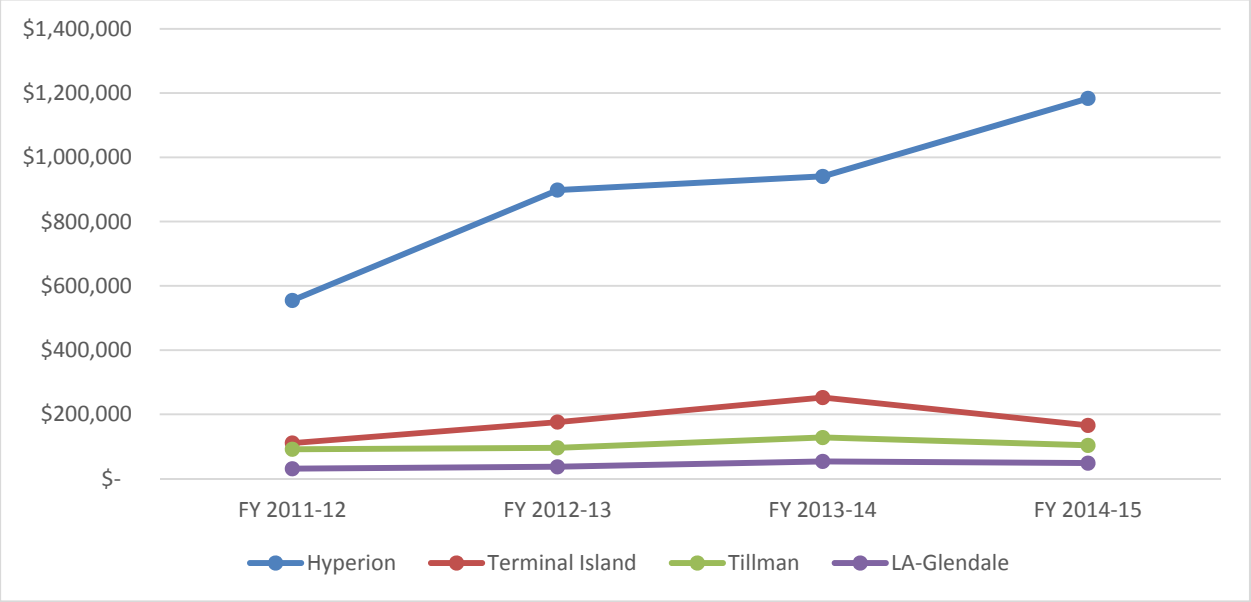
[21] Operational requirements refer to the level of staffing needed to ensure the plants meet wastewater discharge and recycled water permit compliance measures. These measures vary by plant.

BOS Relies on Overtime to Maintain Plant Operations

Authorized (budgeted) staffing for the BOS plants decreased 5% from 543 Full-Time Employees (FTE) in FY 2011-12 to 518 FTE in FY 2014-15. Actual staffing at the plants in FY 2014-15 also decreased by 5% from FY 2011-12. Although the vacancy rate (proportion of unfilled positions to authorized positions) decreased over time, the Bureau-wide, annual average was 11%.

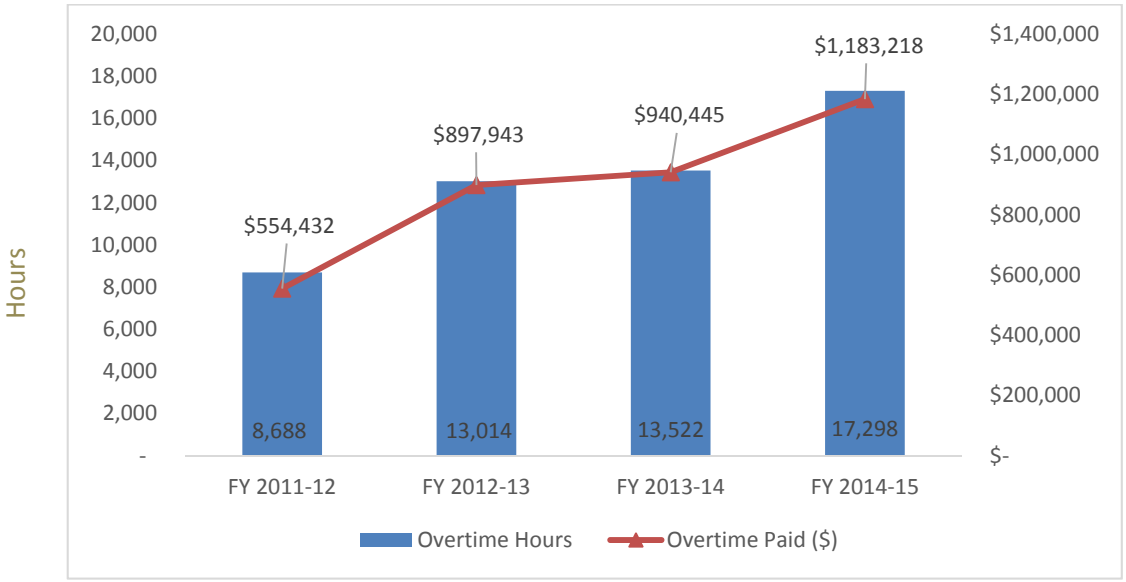
To meet BOS staffing requirements for wastewater treatment, BOS utilized overtime and, in some cases, combined station posts during the audit period. However, the use of overtime to mitigate staff reduction increases labor costs. Exhibit 10 below illustrates overtime expenditures at BOS plants for WTO I, II, and IIIs over the past four fiscal years:

Exhibit 10: Plant Overtime Expenditures (WTO I, II, and IIIs), FY 2011-12 through FY 2014-15



Source: PaySR data

Exhibit 11: Hyperion Overtime Expenditures vs. Hours (WTO I, II, and IIIs), FY 2011-12 through FY 2014-15



Source: PaySR data

As shown in Exhibit 11 above, the amount of overtime expenditure and hours increased by 100% or more at Hyperion— the largest, oldest, and most complex of the City's four plants. Hyperion is also the location where a majority of WTO training occurs. While all BOS plants utilized overtime and need additional staff, these factors contribute to the need for more staff resources at Hyperion when compared to the other BOS plants.

BOS did not exceed authorized expenditures for salaries because salary savings from attrition offset overtime expenditures. However, continuing to use overtime to satisfy staffing requirements is not a good long-term strategy, especially in light of planned plant upgrades. Increasing overtime by WTO's is an indicator of insufficient staffing for recycled water production. Additionally, excessive overtime could lead to more work related injuries and lost work time, further impairing optimal operations.

Challenges Exist to Ensure Sufficiency of the City's Wastewater Treatment Operator Workforce

State regulators note that recycled water production depends on the capability of the operator; it requires specialized initial and on-going training, and a high level of expertise. BOS has determined that WTO IIIs are necessary to operate

the Advanced Wastewater Purification Facility (AWPF) located at the Terminal Island Water Reclamation Plant (TIWRP), in order to consistently meet operational requirements. In light of current AWPF expansion efforts and anticipated operation by December 2016, BOS has requested three additional WTO III positions in its FY 2016-17 operational budget.

To fill the new WTO III positions, BOS must follow requirements to hire or promote from amongst existing staff. Once hired, BOS must train the new WTO III's to operate the AWPF equipment; the staff could already have hands-on training and experience with the AWPF, or BOS will need to give them the standard operating procedures and provide hands-on, site-specific training.

When these existing staff are transferred among plants or promoted to WTO III, BOS must also backfill the newly vacant positions with participants from its entry-level Plant Equipment Trainee (PET) program.

Although BOS management indicate that they have sufficient staff and time to train the new WTO III's to operate the AWPF at TIWRP, there are risks associated with the current strategy for staffing other BOS plants implementing AWPF upgrades.

While BOS conducts staffing analyses based on pending retirements, it has not documented the staffing needs for future upgrades to the D.C. Tillman Water Reclamation Plant (Tillman), the next BOS plant to upgrade to advanced wastewater treatment. Existing plans at Tillman will utilize different technology, equipment, and processes than those currently used at TIWRP's AWPF. Requesting staff through the budget process the year the AWPF is expected to come online may not give enough time to ensure that the new staff are adequately trained to operate the equipment. Further, it is uncertain if the PET program, at its current level, will provide enough staff to backfill vacant positions from attrition and promotions. Finally, while PET has brought in staff with higher levels of certification, it is unknown if BOS will lose these staff members to retirement or competition from other wastewater agencies.

Therefore, it is imperative that BOS develop and document a workforce strategy that considers the level of qualified staff needed to operate upgraded and expanded plants, the timing of hiring and training, and the potential for attrition.

New Recycled Water Regulations and Staffing Requirements Could Impact BOS Staffing Initiatives

As noted in Section I of the report, the State is exploring new Direct Potable Reuse regulations. In anticipation of the new regulations, BOS is collaborating with various water and wastewater associations to discuss new certification and training requirements. Depending on the timing and level of requirements, the Bureau's current staff and PET program may not be adequately trained and certified to operate upgraded plants. While BOS participation in certification discussions is advantageous for the City's recycled water strategy, the Bureau's comprehensive workforce strategy must be flexible enough to incorporate and adjust to new regulations.

Recommendation

BOS should:

4.1 Formally document a comprehensive workforce strategy that accounts for future certification and experience requirements, labor costs, and attrition. These changes should help BOS effectively operate new technology and meet water quality standards.

a) This strategy should be presented to policy makers, along with the City's overall recycled water strategy (See Recommendation 1.3), and updated accordingly as plans for City-wide recycled water production are pursued.

b) The strategy should aim to retain and fill projected staffing needs, and be monitored by BOS to ensure accountability over recycled water production goals.

Finding No. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventative than corrective maintenance.

BOS has focused on corrective maintenance of failed assets rather than completing preventative maintenance intended to ensure assets' optimal use and reliable performance. BOS spent approximately $215 million on maintenance activities over the past four fiscal years. Given that relying on corrective maintenance activities is generally costlier, there are opportunities for long-term savings through changes in the BOS maintenance program.

However, BOS relies on incomplete and unreliable information to manage the City's water reclamation assets. Without accurate reports on maintenance work and costs, BOS will struggle to effectively align its maintenance activities with industry leading practices.

Plant Maintenance Activities Are Not Aligned with Industry Leading Practices

The ratio of maintenance resources expended by BOS at the four plants is the inverse of the industry leading practice. According to our Subject Matter Experts in the wastewater treatment and water reclamation industry, effective and efficient plant maintenance is optimized when resources expended for preventative maintenance activities are twice the rate of corrective maintenance (i.e. 67% preventative maintenance to 33% corrective maintenance). However, BOS spent approximately two-thirds of its maintenance resources on corrective maintenance activity (69% of total costs, and 62% of direct labor hours or "wrench-time"). Furthermore, benchmarking with regional wastewater treatment facilities shows that maintenance costs of wastewater treatment plants within the City of Ventura and Orange County Water District are aligned with industry leading practices (at least two to one).[22] While factors such as facility age, plant design, resource availability,

[22] Operational costs, staffing, maintenance strategies, and other performance indicators for the Orange County Water District are for the Groundwater Replenishment System (GWRS)

and treatment processes vary at each plant, it is prudent for BOS to align with industry leading practices to efficiently use its resources. Because corrective maintenance is costlier, there are opportunities for BOS to save money by changing its maintenance program.

BOS management has indicated that due to staffing shortages among its maintenance personnel, its practice has been to focus resources on corrective maintenance rather than scheduled preventative maintenance. Therefore, scheduled preventative maintenance work orders may be cancelled as corrective maintenance is prioritized. A review of authorized staffing for the Clean Water Program (wastewater collection system, wastewater treatment, and reclamation plants) in budget documents confirm a reduction in staffing since FY 2007-08.[23] Based on EMPAC data, we found that 41,477 scheduled work orders were cancelled by BOS staff due to lack of resources. Considering the significant amount of maintenance work orders that are cancelled, BOS should reevaluate its maintenance plan and methodology to ensure that an appropriate amount of preventative maintenance work is accomplished at each plant.

Incomplete and Unreliable Data Limits the Ability to Optimize Plant Maintenance Activities

BOS has begun to develop an asset maintenance methodology to assist in implementing industry leading practices. However, BOS relies on incomplete and unreliable cost and workload information to manage its assets and equipment. Without accurate information on resources spent on corrective versus preventative maintenance activities, BOS will struggle to effectively align its maintenance activities with industry leading practices and avoid costlier corrective maintenance.

Cost Information Related to Maintenance Activity is Fragmented and Incomplete

BOS has two management systems that track maintenance costs. The Bureau uses data from the City's Financial Management System (FMS) that tracks all financial transactions including labor, overtime, supplies, and overhead. BOS

only. The GWRS takes effluent treated by the Orange County Sanitation District and conducts advanced treatment so that recycled water can be injected into underground aquifers.

[23] The Clean Water Program includes the inspection, operation, and maintenance of wastewater facilities, including collection lines, pumping plants, treatment and disposal facilities. In FY 2007-08, this program had 1,465 authorized positions, but had decreased approximately 15% to 1,251 positions in FY 2011-12.

staff use reports with data from FMS to monitor budgets, track expenditures, and report financial information. BOS also utilizes an Enterprise Maintenance Planning and Control (EMPAC) system to track and monitor maintenance work on its plant assets and equipment.

Maintenance work is tracked within two general categories: preventative maintenance and corrective maintenance. Preventative maintenance work focuses on maintaining assets prior to failure, while corrective maintenance focuses on repairing or replacing assets after they have failed. In general, the use of an effective preventative maintenance program leads to reduced need for more costly corrective maintenance. Therefore, the ratio of resources spent on corrective maintenance versus preventative maintenance offers insight into how BOS manages the maintenance activity at its plants.

Even though plant staff use EMPAC to track direct labor costs ("wrench time") and material costs related to maintenance activity, EMPAC data is limited and does not accurately reflect total maintenance costs. Furthermore, the EMPAC system does not provide BOS management with adequate reports to effectively assess maintenance workload, cost, nor performance.

For example, EMPAC captured the following maintenance cost data and activities (corrective vs. preventative work) for July 2011 through June 2015 contained within the EMPAC system:

Exhibit 12: Summary of Plant Maintenance Workload Data within EMPAC, Work Orders Created or Cancelled July 2011 through June 2015

BOS Plant Maintenance Work	Labor Costs	Materials Costs	Total Maintenance Costs	% of Plant Maintenace Costs	Direct Labor Hours ("Wrench Time")	% of Plant Maintenace Hours	Maintenance Work Orders with Recorded Costs	% of Plant Maintenace Work Orders with Recorded Costs
DCTWRP	**$ 2,457,518**	**$ 892,383**	**$ 3,349,901**	**100%**	**72,327**	**100%**	**13,056**	**100%**
Corrective	$ 1,690,589	$ 705,646	$ 2,396,236	72%	50,475	70%	4,608	35%
Preventative	$ 766,929	$ 186,737	$ 953,666	28%	21,852	30%	8,448	65%
Hyperion	**$ 20,954,782**	**$ 10,462,984**	**$ 31,417,766**	**100%**	**745,531**	**100%**	**38,213**	**100%**
Corrective	$ 13,486,368	$ 7,294,924	$ 20,781,291	66%	443,999	60%	17,859	47%
Preventative	$ 7,468,415	$ 3,168,060	$ 10,636,475	34%	301,532	40%	20,354	53%
LAGWRP	**$ 975,831**	**$ 925,699**	**$ 1,901,530**	**100%**	**28,240**	**100%**	**5,210**	**100%**
Corrective	$ 681,710	$ 869,517	$ 1,551,227	82%	19,603	69%	1,546	30%
Preventative	$ 294,122	$ 56,181	$ 350,303	18%	8,637	31%	3,664	70%
TIWRP	**$ 3,634,369**	**$ 2,456,585**	**$ 6,090,953**	**100%**	**123,309**	**100%**	**6,680**	**100%**
Corrective	$ 2,693,297	$ 2,191,924	$ 4,885,221	80%	84,390	68%	3,987	60%
Preventative	$ 941,072	$ 264,660	$ 1,205,732	20%	38,919	32%	2,693	40%
Grand Total	**$ 28,022,500**	**$ 14,737,651**	**$ 42,760,151**	**100%**	**969,406**	**100%**	**63,159**	**100%**
Corrective	$ 18,551,963	$ 11,062,012	$ 29,613,975	69%	598,466	62%	28,000	44%
Preventative	$ 9,470,537	$ 3,675,639	$ 13,146,176	31%	370,940	38%	35,159	56%

Source: BOS Enterprise Maintenance Planning and Control (EMPAC) system

Note: This table includes all work orders with recorded cost information that were created or closed within EMPAC during the audit period. Active work orders containing recorded costs, as of the data extraction date (October 2015), were included.

Distinct work orders track maintenance activity within EMPAC and are categorized into two general cost categories; direct labor ("wrench time") and materials. During the audit period (Fiscal Years 2011-12 through 2014-15) $42.7 million of maintenance costs were associated with 63,159 maintenance work orders.[24]

However, comparing EMPAC data to FMS data shows that EMPAC data significantly underreports total costs related to maintenance activities. According to FMS, BOS spent $146 million during the audit period on labor costs related to maintenance activity at all four plants.[25] This amount is approximately $118 million more than the $28 million in labor costs recorded in EMPAC during the same period. In addition, the FMS reports show that BOS spent approximately $69 million on materials, supplies, and contract costs related to maintenance at the plants during the audit period. With expenditures related to maintenance at the plants totaling approximately $215 million during the audit period, having only 20% ($42.7 million) of this amount tracked within EMPAC does not provide accurate nor complete cost information for managing plant maintenance activity. Additionally, the FMS reports did not segregate costs by preventative or corrective maintenance activities. While FMS data captures costs not included in EMPAC, information on planning, supervision, and training of maintenance staff, among other costs, are critical for evaluating and planning maintenance resource needs. BOS management should utilize such information, whether provided from one or multiple data sources, to help align the BOS maintenance program with industry best practices.

Erroneous and Incomplete Data Limits the Reliability of EMPAC Maintenance

BOS management relies on data within EMPAC to plan and manage its plant maintenance activities. Based on our review of EMPAC data and discussions with BOS management, we noted more than 20,000 preventative

[24] There was a total of 169,230 maintenance work orders that were closed during the audit period or created, but remained open as of the extraction date (October 2015). Of these work orders, 106,071, or 63%, did not have any recorded costs incurred during the audit period. Approximately 27% of the zero cost work orders were coded as "Completed as Planned", while the remaining were cancelled for other reasons.

[25] The labor costs from the financial system includes costs associated with maintenance staff time on planning, supervision, training, sick, vacation, and other payroll costs, which are not captured in EMPAC's "wrench time" data.

maintenance work orders were generated in error during the audit period. According to BOS management, these work orders were the result of staff error and should not have been generated within EMPAC. In addition, BOS staff indicated that plant personnel do not consistently record hours worked on maintenance work orders in a complete and timely manner. Despite these issues, BOS indicates that management made decisions about maintenance needs based on their experience and operational knowledge. Since BOS management must rely on the data within EMPAC to effectively manage its plant maintenance operations, adequate controls should be in place to minimize the occurrence of erroneous and incomplete data within the EMPAC system.

Opportunities Exist with Maintenance Methodology Shift and Pending Asset Management System Replacement

After approximately two decades of using EMPAC as the Bureau's asset management system, BOS has started to implement a replacement asset management system, Ellipse. As with most systems of this scale, BOS has spent significant time and resources on preparing data and gaining expertise to implement Ellipse.

Hyperion, the largest of the four City water reclamation plants, has begun implementing Ellipse along with a modernized maintenance methodology called Reliability-Centered Maintenance (RCM). RCM is an industry leading practice that significantly differs from the Bureau's current maintenance methodology by focusing all maintenance activities on system preservation, rather than on individual assets. RCM requires plant assets to be independently scored for criticality using characteristics such as system redundancy and the availability of spare parts. According to BOS staff, all current assets at Hyperion have been identified and assigned a "criticality score," and Ellipse can facilitate implementation of the RCM framework for maintenance activities throughout the Bureau. However, while Ellipse will be operational bureau-wide during 2017, there is no timeline for when RCM will be implemented at the other reclamation plants.

While the implementation of RCM and Ellipse for all four water reclamation plants may address several maintenance-related shortcomings identified by this audit, BOS management should take steps to ensure that system and administrative controls related to Ellipse and the RCM framework are adequate to provide a high level of accountability and reliability.

Recommendations

BOS should:

5.1. Prioritize the implementation of Reliability-Centered Maintenance at all four water reclamation plants, and align the Department's asset management with industry leading practices.

5.2. Establish administrative controls to assure that all maintenance activity is recorded within its asset management system after maintenance work is performed.

5.3. Ensure that its new asset management system, Ellipse, provides timely, sufficient and reliable information to monitor and assess maintenance workload and costs.

5.4. Establish administrative controls to approve the quality and validity of all asset data and criticality scores prior to inclusion within Ellipse (both current and future assets), to ensure that the benefits of implementing Ellipse are maximized. In addition, procedural controls should be established to ensure that asset data and criticality scores are routinely re-assessed and updated within the system.

5.5. Ensure that reports produced using data from Ellipse easily identify preventative maintenance and corrective maintenance work. Management reports from Ellipse and/or other systems should also be able to quantify all costs related to the performance of maintenance activity to better evaluate and plan for maintenance resource needs.

5.6. Develop resource and operational plans that shift the Department's maintenance focus from corrective maintenance to preventative maintenance in order to maximize the productivity of water reclamation assets.

a) To align performance of maintenance work with industry leading practices, the long-term goal of these plans should be to achieve a maintenance workload mix of twice as much preventative

maintenance work being performed than corrective maintenance work.

b) Considering the implementation of the RCM framework, maintenance plans should contain criteria that accomplish a reasonable level of maintenance activity; including acceptable backlog levels. Management should ensure that adequate resources are available to attain targeted workload levels, and that staff are held accountable to meet or exceed established maintenance targets.

Finding No. 6: BOS did not obtain a more cost effective chemical for Hyperion's wastewater treatment process when it was available.

The industry standard approach to optimizing chemical usage at treatment and reclamation plants is through controlled testing of chemicals. Two steps test the effectiveness of a chemical. The first step is testing the chemical in small quantities within a laboratory environment ("jar-testing") to determine its effectiveness and identify optimal dosing levels. The second step is in-plant testing where doses of the chemical are used over a period of time, and sampling is performed to quantify the chemical's effectiveness. The type and amount of chemicals used at plants is partially driven by the quality of the wastewater influent, which may vary on a day-to-day basis. The purchasing process should facilitate obtaining a chemical that has been proven to be cost effective for water treatment processes.

Chemicals are supplied to treatment plants based on purchase agreements that are negotiated and procured through the City's General Services Department (GSD). Invitations to bid are generally issued per chemical and the contract is for citywide use.[26]

[26] DWP has a separate procurement department, and GSD staff noted that DWP has been known to piggyback with GSD contracts for chemicals (i.e. benefit from the contract prices established by GSD, but have a separate contract with the vendor that does not impact GSD's contract maximum amounts).

Flexibility to Purchase Cost Effective Chemicals is Inconsistent

In 2008, the City's contract vendor for Ferric Chloride, a chemical used to enhance removal of solids in wastewater, offered the City a cheaper, but lower concentration of Ferric Chloride, called Edgemoor Ferric Chloride (Edgemoor). This chemical was offered after City competitive bidding procedures and the Ferric Chloride contract was awarded. The vendor offered Edgemoor for a price of $468.35 per ton on December 17, 2008, an 11% discounted rate from the $528.35 per ton for the standard grade of Ferric Chloride under the contract at that time. BOS conducted jar tests in 2008 to determine the effectiveness of Edgemoor. Results indicated that the lower concentration (Edgemoor) could remove as much solids from the wastewater as the standard concentration of Ferric Chloride, and sometimes more depending on the dosage. Further, BOS estimated that with the lower price offered for Edgemoor, the City could potentially save $391,474 annually. On September 16, 2009, the vendor increased the price of Edgemoor to $488.35, a 7.6% discounted rate from the original contract price for Ferric Chloride.

However, the supply for Edgemoor was considered unreliable, as it was only available to the contract vendor when there was a surplus of raw materials from suppliers located in the Eastern United States. Therefore, the contract for Ferric Chloride was amended in 2008 to declare that Edgemoor would be purchased *whenever available,* before the standard grade, due to the lower price.

In contrast to the last contract for Ferric Chloride, the current contract does not have an option to purchase the cheaper and effective chemical Edgemoor, whenever it is available. Therefore, when the vendor has a supply of Edgemoor to offer to the City, a separate procurement process must take place that includes purchase requisitions, bidding, and negotiating prices (if needed), in order for BOS to purchase the chemical.

The City Missed Opportunities to Obtain a Cost Effective Chemical and Achieve Cost Savings

The City had at least two opportunities in 2014 to obtain the lower concentration of Ferric Chloride, Edgemoor. GSD had negotiated a price for Edgemoor that was $30 less per ton than the standard grade of Ferric Chloride at the end of FY 2013-14. However, by the time GSD negotiated a price and the purchasing process was near complete, the Edgemoor supply was no longer available. When Edgemoor became available in October 2014, the vendor recalled their bid for unspecified reasons. Had the existing contract

included a statement allowing Edgemoor to be purchased *whenever available,* before the standard grade, due to the lower price, the City could have achieved savings. Actual savings, however, would depend on the availability of the lower concentration and quality of the influent at Hyperion. Poorer quality influent may require a larger volume of chemicals to effectively treat the wastewater.

In addition to chemical cost savings, City staff time and resources directed at procuring Edgemoor would have been reduced if an option to purchase it when available already existed in the current contract. Although Edgemoor is no longer available from the vendor due to the supplier's plant shutting down, having flexible chemical supply contracts based on supported analysis of efficacy and savings, should be consistently pursued.

Recommendations

BOS should:

6.1. Work with General Services Department (GSD) to include amendments to existing chemical contracts when there is a cheaper and cost effective chemical available for purchase from the vendor. These amendments should make it flexible for the City to procure chemical alternatives based on availability and cost effectiveness. Valid jar-testing, in-plant testing, and cost effectiveness analysis must accompany any decision to procure alternative chemicals and/or formulations.

6.2. Continue to monitor the price of chemicals, the volume purchased, and the efficacy of the chemical to ensure that there are cost savings while utilizing them over alternatives.

6.3. Timely notify GSD when the use of chemicals are no longer cost effective in order to make appropriate changes in contracts.

Finding No. 7: BOS management reporting on plant operations is not standardized.

Some plants' reports on monthly operations compare actual costs to budgets and/or past performance, while others do not. Reports that measure performance over time are critical for ensuring efficient and effective operations.

As previously stated, BOS must treat all influent flow into the water reclamation plants prior to beneficial reuse or discharge into bodies of water. The D.C. Tillman (DCTWRP), Los-Angeles Glendale (LAGWRP), and Terminal Island Water Reclamation (TIWRP) plants treat all of their influent to a level that meets State regulations for beneficial reuse, while the Hyperion Treatment (Hyperion) plant cannot produce recycled water that is acceptable for use outside of the plant. The West Basin Municipal Water District (WBMWD) takes a portion of Hyperion's effluent, conducts additional treatment, and sells the recycled water to its customers. Therefore, BOS must rely on DWP, the City of Glendale, and WBMWD to convey recycled water to end users in order to optimize recycled water production and deliveries. Any recycled water that is not used within the plants, for environmental purposes (habitat restoration in lakes and rivers), or delivered by DWP, City of Glendale, or WBMWD is eventually discharged into the Pacific Ocean, Los Angeles River, and/or the Los Angeles Harbor.

Because of the critical reliance on cross-agency collaboration for recycled water production and deliveries, Hyperion, DCTWRP, and LAGWRP do not have any stated goals for recycled water production, though actual recycled water delivery and use is reported annually. In contrast, TIWRP has annual goals for recycled water production because its primary use is injection into the Dominguez Barrier Gap to prevent seawater intrusion. When TIWRP is unable to deliver recycled water for injection into the Barrier, the Water Replenishment District must purchase additional potable water to offset the lack of recycled water deliveries.

BOS has monthly management reports with performance measures that could be used to help ensure the plants are operating effectively and efficiently. As noted in Exhibit 9 in the introduction of Section II, the major components of operational costs are labor, operating materials and supplies (primarily

chemicals), contractual services, and utilities. We reviewed the extent to which management had sufficient information to monitor these cost components.[27]

BOS Management Reporting on Plant Operations is not Standardized

Hyperion's monthly performance report includes several key performance measures for ensuring efficient and effective plant operations that are missing in the other plants' monthly performance report. These performance measures include:

- Chemical purchases compared to:
  - Annual and monthly budget;
  - 12 month moving average;
  - Projected annual expenditure; and,
  - Projected annual amount and percent variance from the chemical budget.
- Utility expenditures compared to:
  - Annual and monthly budget;
  - Projected annual amount and percent variance from the utility budget; and,
  - Parameters/baselines established from the last 36 months of costs.

DCTWRP and LAGWRP monthly performance report included chemical purchases compared to a monthly budget and 12 month moving average, but no annual projections and variances. TIWRP did not include chemical purchases in its monthly performance report.

Apart from Hyperion, none of the other plants included utility expenditures in their monthly performance report. However, we noted that each plant does monitor its power consumption and costs in separate reports. Analysis of those reports revealed that, although electricity costs increased during the audit period, electricity consumption remained relatively stable. Spikes in expenditures were due to DWP billing methodology, as opposed to increased energy consumption. Energy efficiency improved during our audit period.

[27] However, we did not conduct significant analysis of contractual services, because a majority of these expenditures were for solids handling at the Hyperion plant, which auditors determined were fixed costs.

Deficiencies in management information for staffing and maintenance activities were previously discussed within Section II of this report.

According to BOS management, the monthly reports are available for anyone to review, particularly stakeholders outside of the plants. The reports summarize information that Plant Managers, Operations and Maintenance staff review and act upon on a daily basis. Executive Management is made aware of any issues that impact the budget.

Recommendation

BOS should:

7.1 Standardize monthly performance reporting across the plants for common indicators such as chemical and utility costs. However, some performance indicators will differ across plants such as solids handling and advanced recycled water production.

Respectfully submitted,

Paul E. Alberga
Internal Auditor III

Émilyzen Cervantes
Internal Auditor III (former)

Cynthia Varela, CIA
Chief Internal Auditor

Siri A. Khalsa, CPA
Deputy Director of Auditing

GLOSSARY OF KEY TERMS

Acre-feet per year (AFY): *Acre-feet is a common water industry unit of measurement. An acre-foot is 325,851 gallons, or the amount of water needed to cover one acre with water one foot deep. One million gallons per day is 1,120 acre-feet per year. An acre-foot of water serves the annual needs of two typical California families.*

Advanced Oxidation Process (AOP): *Process that destroys trace organic compounds and serves as a final treatment barrier after the reverse osmosis process.*

Advanced Water Purification Facility (AWPF): *A water treatment system that removes additional organics, micro-organisms and salts from wastewater. Example AWP technologies include microfiltration (MF), reverse osmosis (RO), advanced oxidation process (AOP) using ultraviolet (UV) light and hydrogen peroxide, and alternative AOP using ozone and hydrogen peroxide. Only wastewater that has been treated through an AWPF can be used for augmenting underground water supplies through injection.*

Biosolids: *Solid organic material, or sludge, removed from wastewater that is treated and prepared for disposal or compost.*

Corrective maintenance: *Unplanned maintenance that is performed to correct a failing asset or a key operational function. (Also referred to as "emergency repair".)*

Digester gas: *Gas (methane) produced during the wastewater treatment process during the removal of organic solids during the secondary treatment process.*

Direct Potable Reuse (DPR): *The use of recycled water for potable use by connecting directly to the potable water system, or after introducing it into a raw water supply that is eventually treated at a water treatment plant.*

Effluent flow: *Water that flows out of a wastewater treatment plant and is discharged into the environment or treated further for water recycling.*

Groundwater Replenishment (GWR)*: Using recycled water to augment (or replenish) an underground aquifer (groundwater source).*

Impervious surfaces: *Areas that are unable to absorb water into the ground within the City (e.g. streets, parking lots, and concrete).*

Indirect Potable Reuse (IPR): *The indirect use of recycled water for drinking by introducing recycled water to a groundwater aquifer or large reservoir with adequate retention time, typically a minimum of two months.*

Influent flow: *Wastewater that flows into a wastewater treatment or water reclamation facility. This wastewater typically consists of wastewater collected from the City's sewage collection system, but may contain stormwater or urban runoff diverted from the City's storm drain system.*

Jar Testing: *Processes used to test the efficiency and efficacy of different chemicals, processes, and/or formulations used during the wastewater treatment process. Typically performed on a small scale for processes at a specific wastewater treatment facility.*

Microfiltration (MF)*: A pretreatment for sustainable operation of the reverse osmosis process that filters fine particles through a membrane of small pore size (0.1-10 micrometers).*

Non-potable reuse (NPR): *Uses for recycled water that are not for human consumption (i.e. irrigation, industrial cooling, habitat restoration, and toilet flushing).*

Potable water: *Water that meets regulatory standards for human consumption.*

Preliminary Treatment*: The first stage of the wastewater treatment process that screens and removes trash and grit from wastewater. Together, preliminary and primary treatment removes up to 85% of solids that are screened out, settle to the bottom, or float to the top of tanks.*

Preventative maintenance: *Planned maintenance performed on an asset to maintain service-levels and extend asset lifecycle.*

Primary Treatment: *Treatment process to settle solids to the bottom of a tank, or float to the top, and then subsequently removed.*

Purple Pipe: *The color and type of piping required by state regulations to distribute recycled water for a beneficial use.*

Recycled water: *Impaired water, such as wastewater, that has been treated to meet water quality requirements and is reused for a specific purpose.*

Reliability Centered Maintenance (RCM): *A structured framework for analyzing functions and potential for asset failure that focuses on preserving system functions.*

Reverse Osmosis (RO): *Water filtration process that removes a high level of dissolved salts and other contaminants.*

Secondary Treatment: *Treatment process that allows beneficial microbes to feed on suspended solids and organic matter.*

Solids Handling: *The process of removing and safely disposing of solid waste removed from wastewater.*

Station post: *Term used to describe an area of responsibility that is required to be operated by one or more wastewater treatment operators (e.g. control room, AWPF, solids handling).*

Stormwater: *Naturally occurring precipitation/rainfall.*

Stormwater capture: *The process of capturing stormwater after it falls onto the surface.*

Tertiary Treatment: *Removes suspended solids with cloth filters and disinfects with chlorine to kill bacteria, viruses, and other micro-organisms. Tertiary treated wastewater is commonly discharged into lakes, rivers, and oceans, as well as for non-potable reuse that meets Clean Water Act (Title 22) quality regulations (e.g. irrigation).*

Urban water runoff: *A combination of water from industrial and residential sources that is captured by the City's storm drainage system.*

Wastewater: *Water used for a residential or industrial purpose containing concentrations of solid waste, dissolved solids and other contaminants that has entered the City's sewer system.*

Water Reclamation: *The treatment of water of impaired quality, including wastewater and salty water, to produce a water of suitable quality for intended use. This term is also synonymous with water recycling.*

APPENDIX I: ACTION PLAN

	Finding	Page		Recommendation	Page	Entity Responsible for Implementation	Priority
	Section I: Recycled Water Production and Delivery						
1	The City is not optimizing the production and delivery of recycled water as an alternative water resource to offset demands for imported potable water.	12	1.1	Re-evaluate, develop, and adopt recycled water plans according to the following priorities and policy considerations: a) Implement long-term concepts from the Recycled Water Master Planning documents that promote recycling existing treated wastewater for: i. Injection or spreading into local groundwater basins with underutilized storage capacity (indirect potable reuse), and ii. Delivery to industrial and irrigation customers for non-potable reuse. DWP should develop policies that facilitate securing more customers, such as providing incentives given recent challenges with the non-potable reuse customer base. b) Once indirect potable reuse and non-potable reuse demand exceeds BOS' supply of recycled water, consider increasing stormwater	19	BOS and DWP	A

				diversion to reclamation plants for treatment and recycling. c) Consider alternative recycled water projects if Direct Potable Reuse legislation is passed within the short-term (next five years), and realign the City's recycled water strategy based on new legislation.			
			1.2	Annually report to City Council on the progress of adopted recycled water projects, including explanations for changes in strategy due to new regulations or technology.	20	BOS and DWP	A
2	BOS is not fully leveraging its City and regional relationships to support the City's goals for recycled water use.	20	2.1	Consider creating joint powers agreements with regional water agencies that incentivize jurisdictions to use recycled water produced by BOS. These agreements should: a) Ensure that competing beneficial use regulations are satisfied, and allow City sewer and water funds to pay for building or upgrading the City's capacity to produce recycled water; and, b) Address what the City will get for contributing its recycled water to the regional local water supply (e.g. monetary compensation, exchange of water rights, etc.).	27	BOS and DWP	A
			2.2	Develop a plan to more actively include regional agencies and contracting agencies in the development of One Water LA.	28	BOS and DWP	A

			2.3	Consider using the General Fund to promote and incentivize recycled water programs with regional agencies, due to legal restrictions that govern the use of SCMF. Any General Fund allocation for this purpose should be specific to expand and encourage recycled water programs that offset regional imported water demand.	28	City Council	B
3	New requirements recently added to the City's Green Building Code may impact future development and not effectively promote recycled water use to offset potable water demand.	28	3.1	Propose amending the Green Building Code to be more flexible in promoting recycled water use (e.g. not 100% recycled water use, and/or additional conditions for exemptions).	31	DBS and DWP	A
			3.2	Implement tools to assess the feasibility of non-potable recycled water use in new developments and identify measures to mitigate negative impacts.	31	DBS and DWP	A
	Section II: Recycled Water Operations						
4	BOS lacks a comprehensive, multi-year staffing plan that addresses staffing needs in light of plant upgrades, qualification	33	4.1	Formally document a comprehensive workforce strategy that accounts for future certification and experience requirements, labor costs, and attrition. These changes should help BOS effectively operate new technology and meet water quality standards. a) This strategy should be presented to policy makers, along with the City's overall recycled water strategy (See	37	BOS	B

	requirements, labor costs, and potential attrition. Without one, the capability of BOS to consistently meet recycled water goals is at risk.			Recommendation 1.3), and updated accordingly as plans for City-wide recycled water production are pursued. b) The strategy should aim to retain and fill projected staffing needs, and be monitored by BOS to ensure accountability over recycled water production goals.			
5	BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventative than corrective maintenance.	38	5.1	Prioritize the implementation of Reliability-Centered Maintenance at all four water reclamation plants, and align the Department's asset management with industry leading practices.	42	BOS	A
			5.2	Establish administrative controls to assure that all maintenance activity is recorded within its asset management system after maintenance work is performed.	43	BOS	A
			5.3	Ensure that its new asset management system, Ellipse, provides timely, sufficient and reliable information to monitor and assess maintenance workload and costs.	43	BOS	A
			5.4	Establish administrative controls to approve the quality and validity of all asset data and criticality scores prior to inclusion within Ellipse (both current and future assets), to ensure that the benefits of implementing Ellipse are maximized. In addition,	43	BOS	A

				procedural controls should be established to ensure that asset data and criticality scores are routinely re-assessed and updated within the system.			
			5.5	Ensure that reports produced using data from Ellipse easily identify preventative maintenance and corrective maintenance work. Management reports from Ellipse and/or other systems should also be able to quantify all costs related to the performance of maintenance activity to better evaluate and plan for maintenance resource needs.	43	BOS	B
5		38	5.6	Develop resource and operational plans that shift the Department's maintenance focus from corrective maintenance to preventative maintenance in order to maximize the productivity of water reclamation assets. a) To align performance of maintenance work with industry leading practices, the long-term goal of these plans should be to achieve a maintenance workload mix of twice as much preventative maintenance work being performed than corrective maintenance work. b) Considering the implementation of the RCM framework, maintenance plans should contain criteria that accomplish a reasonable level of maintenance activity; including acceptable backlog levels. Management should ensure that adequate resources are available to attain targeted workload levels, and that staff are held	43	BOS	A

				accountable to meet or exceed established maintenance targets.			
6	BOS did not obtain a more cost effective chemical for Hyperion's wastewater treatment process when it was available.	45	6.1	Work with General Services Department (GSD) to include amendments to existing chemical contracts when there is a cheaper and cost effective chemical available for purchase from the vendor. These amendments should make it flexible for the City to procure chemical alternatives based on availability and cost effectiveness. Valid jar-testing, in-plant testing, and cost effectiveness analysis must accompany any decision to procure alternative chemicals and/or formulations.	47	BOS	B
			6.2	Continue to monitor the price of chemicals, the volume purchased, and the efficacy of the chemical to ensure that there are cost savings while utilizing them over alternatives.	47	BOS	B
			6.3	Timely notify GSD when the use of chemicals are no longer cost effective in order to make appropriate changes in contracts.	47	BOS	B
7	BOS management reporting on plant operations is not standardized.	48	7.1	Standardize monthly performance reporting across the plants for common indicators such as chemical and utility costs. However, some performance indicators will differ across plants such as solids handling and advanced recycled water production.	50	BOS	B

A –High Priority *- The recommendation pertains to a serious or materially significant audit finding or control weakness. Due to the seriousness or significance of the matter, immediate management attention and appropriate corrective action is warranted.*

B –Medium Priority *- The recommendation pertains to a moderately significant or potentially serious audit finding or control weakness. Reasonably prompt corrective action should be taken by management to address the matter. Recommendation should be implemented no later than six months.*

C –Low Priority *- The recommendation pertains to an audit finding or control weakness of relatively minor significance or concern. The timing of any corrective action is left to management's discretion.*

N/A *- Not Applicable*

APPENDIX II: FINANCIAL SCORECARD

Finding/Recommendation	Page	Category	Financial Impacts
Not Applicable for This Report			

Cost Recovery: Monies that may be recoverable.

Cost Savings and Efficiencies: Cost savings opportunity and process enhancements.

Cost Avoidance: Monies that are lost but are avoidable in the future.

Increased Revenue: Revenue opportunities.

Wasted Funds: Monies that are lost and not recoverable due to reckless act or mismanagement of funds.

We strive to identify and recommend actions that will result in real financial impact, whereby the City can achieve significantly more through cost savings and/or increased revenue than the cost of the audit function. The above dollar estimates are dependent upon various factors, such as full implementation of audit recommendations and should not be used as guaranteed amounts.

APPENDIX III: AUDIT SCOPE & METHODOLOGY

We reviewed and evaluated BOS' water reclamation plant operations to produce recycled water, as well as BOS and DWP planning documents for recycled water projects. Audit fieldwork was primarily conducted from June 2015 to December 2015 and generally covered BOS and DWP data and activities over the past four fiscal years (FY 2011-12 through FY 2014-15).

This audit was performed in accordance with Generally Accepted Government Auditing Standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides reasonable basis for our findings and conclusions based on our audit objectives.

In accordance with these standards and best practices, we performed the following key tasks:

Interviews and Site Visits:

We conducted interviews with BOS management and staff at the water reclamation plants, as well as various BOS divisions. We also conducted interviews with DWP management and staff. We also spoke with representatives from the Cities of Glendale, Santa Monica, and Culver City; an Adjunct Professor from the University of California, Los Angeles; and management and staff from the Department of Recreation and Parks and Department of Building & Safety.

We toured the Hyperion Treatment Plant, and D.C. Tillman, Los Angeles-Glendale, and Terminal Island Water Reclamation plants.

Data Analyzed

We reviewed key operational wastewater treatment and water reclamation data extracted from WISARD such as influent and effluent flow levels, recycled water production, and chemical usage. We evaluated maintenance work order data from the Enterprise Maintenance Planning and Control (EMPAC) system. We also reviewed Bureau expenditure data, PaySr data on BOS Wastewater Treatment Operators, and Contract Agency flow levels from billing summaries.

Documents Reviewed

We reviewed BOS permits for wastewater discharge and water recycling, standard operating procedures, training documents, contracts with outside agencies for wastewater treatment, sample shift assignments for Wastewater Treatment Operators, Memorandum of Agreements between City departments and with outside water agencies, City Council reports, local ordinances, and State mandates related to recycled water. We also reviewed BOS and DWP planning documents for recycled water projects and other forms of water management (stormwater capture, urban runoff, watershed protection, etc.)

Benchmarking

We prepared a survey questionnaire sent to water and wastewater agencies that operate wastewater treatment and reclamation facilities in the Southern California region with responses shown in Appendix IV.

APPENDIX IV: BENCHMARKING & BEST PRACTICES

We sent surveys to nine regional water and wastewater agencies that operate wastewater treatment and/or reclamation facilities. These agencies are:

- City of San Diego
- City of Santa Barbara
- City of Ventura
- Irvine Ranch Water District
- Los Angeles County Sanitation Districts
- Orange County Sanitation District
- Orange County Water District[28]
- San Elijo Join Powers Authority (SEJPA)
- South Orange County Wastewater Authority (SOCWA)

While our survey included several topics and questions, highlights from the benchmarking survey include cross-agency collaboration, the percentage of treated wastewater that is recycled, cost per million gallon (MG) of wastewater treated, ratio of resources spent on preventative versus corrective maintenance, and extent of the purple pipe network.

Following these highlights is a summary of the jurisdictions' responses.

Cross-Agency Collaboration

Six of the nine agencies surveyed rely on other agencies as the source of wastewater for treatment and/or reclamation, and/or provide recycled water to other agencies.

Orange County Sanitation and Water Districts

Orange County Water District (OCWD) and Orange County Sanitation District (OCSD) jointly-funded the design and construction of the Groundwater Replenishment System (GWRS), which recycles OCSD secondary-level treated wastewater to produce high-quality water that exceeds all state and federal drinking standards. OCWD then conveys the recycled water into injection wells to serve as a seawater intrusion barrier or conveys it to recharge groundwater basins in Anaheim. The GWRS system is the largest system for indirect potable reuse in the world. Additionally, OCWD recycles water for landscape irrigation and industrial uses.

[28] Orange County Water District (OCWD) is included in the benchmarking survey for its Groundwater Replenishment System, which performs advanced treatment on wastewater effluent first treated by the Orange County Sanitation District. OCWD's other water treatment plants are not included in this analysis.

Joint Powers Authorities

San Elijo Joint Powers Authority (SEJPA) and South Orange County Wastewater Authority (SOCWA) charge member agencies for the treatment of their wastewater. SEJPA treats wastewater from Solana Beach, Rancho Santa Fe, Olivenhain and Cardiff communities (City of Encinitas) in San Diego County. SOCWA has ten member agencies: City of Laguna Beach, City of San Clemente, City of San Juan Capistrano, El Toro Water District, Emerald Bay Service District, Irvine Ranch Water District, Moulton Niguel Water District, Santa Margarita Water District, South Coast Water District and Trabuco Canyon Water District. It should be noted that Irvine Ranch Water District treats its own wastewater and only utilizes SOCWA's ocean outfall to discharge a portion of the treated wastewater. While SOCWA reports that it provides recycled water to member agencies at no additional costs, a portion of SEJPA's operating revenues come from the sale of recycled water.

Recycled Water for Other Agencies

The Los Angeles County Sanitation Districts provide recycled water to various cities within the County. Similarly, the City of San Diego provides recycled water to the City of Poway, Olivenhain Municipal Water District and Otay Water District for distribution. The Irvine Ranch Water District provides recycled water to the Orange County Water District when supplies are available.

Percentage of Recycled Water

The plants from benchmarked jurisdictions are compared to plants that treat wastewater to the same level of quality, especially since secondary-level treated wastewater do not meet regulations for most beneficial reuse. The City of San Diego, City of Ventura, Los Angeles County Sanitation Districts, San Elijo Joint Powers Authority, and South Orange County Wastewater Authority have plants that treat wastewater to the tertiary-level. These are comparable to the D.C. Tillman (DCTWRP) and Los Angeles-Glendale (LAGWRP) Water Reclamation Plants in the City of Los Angeles. While DCTWRP and LAGWRP recycle 73% to 86% of its wastewater, the others recycle 8% to 53%.

Irvine Ranch Water District (IRWD) also treats wastewater to the tertiary-level, but reports recycling 100% of its wastewater. However, IRWD differs

significantly from the City of Los Angeles (City) in that water recycling was integrated into the overall design of the community, beginning in 1963. The District developed a dual distribution system, one set of pipes for potable water and another for recycled water. The recycled water distribution reaches most of the IRWD service area. Such a system allows for IRWD to deliver recycled water for irrigation in eligible residential lots, whereas this type of recycled water use can only be found in the Playa Vista Development in the West Los Angeles area of the City. Further, recycled water is used for agricultural irrigation in IRWD, whereas the City does not use it for agricultural irrigation.

Cost per Million Gallons of Wastewater Treated (Influent)

A typical performance measure for benchmarking wastewater treatment and reclamation plants is the cost to operate a plant per million gallons of influent treated. However, due to the differences in treatment levels, amounts of influent treated (which impacts costs) and other factors, the information in the table cannot be used to compare the City's costs to the benchmarked agencies to identify operational efficiencies (see details following Exhibit 13). We present the cost per million gallons of treated influent to show the range of operational costs for the City's plants and the benchmarked agencies.

Exhibit 13 Benchmarking - Cost ($) per Million Gallons of Treated Influent for FY 2014-15

Bureau of Sanitation (BOS)												
Hyperion	D.C. Tillman Water Reclamation Plant	Los Angeles-Glendale WRP	Terminal Island WRP	City of San Diego	City of Santa Barbara	City of Ventura	Irvine Ranch Water District	LA County Sanitation Districts	Orange County Sanitation District	Orange County Water District	San Elijo Joint Powers Authority	South Orange County Wastewater Authority
$786	$822	$703	$1,521	$1,510	$2,314	$1,275	$1,675	$1,336	$887	$2,216	$4,006	$2,123

Various reasons could account for differences in the cost per million gallons of water treated across jurisdictions and plants, including:

- Level of treatment – higher levels of treatment require different and more costly equipment, technology, chemical usage, and lab analysis (for example, Terminal Island is an Advanced Water Purification Facility and Hyperion treats water up to the secondary level);
- Age of assets;
- Inclusion of maintenance costs – all of the BOS plants include maintenance labor, supplies and material costs because each plant has dedicated maintenance staff (although D.C. Tillman and Los Angeles-Glendale Water Reclamation Plants share maintenance resources). The Irvine Ranch Water District and Los Angeles County Sanitation Districts staff numbers do not include maintenance staff shared across plants. Irvine Ranch Water District costs do not include maintenance labor costs.
- Processing of solids – Only Hyperion and Terminal Island WRP process solids in the City, which leads to increased costs for utilities, staff, and contract costs for hauling biosolids to the City owned farm in Kern County. Similarly, plants that also process solids will have higher costs;
- Economies of scale – As the volume of influent a plant treats increases, the ratio of cost per influent treated decreases. For example, Hyperion treated 263 million gallons per day (MGD) in FY 2014-15 at a cost of $786 per million gallons, while the plant for the San Elijo Join Powers Authority treated 3 MGD at a cost of $4,006 per million gallons.

Preventative vs. Corrective Maintenance

As discussed in the body of the report, the ratio of resources for Preventative Maintenance to Corrective Maintenance activities should be 2 to 1, according to leading industry practices (i.e. 67% Preventative Maintenance to 33% Corrective Maintenance). The ratio of maintenance resources expended by BOS at the four plants is basically the inverse of the industry leading practice. The City of Ventura and Orange County Water District are the only agencies that reported Preventative Maintenance and Corrective Maintenance resources (cost) allocations aligned with industry leading practices (at least two to one).

Recycled Water Distribution Network

The recycled water distribution network among the benchmarking cities ranged from two miles in the City of Ventura to 509 miles in the Irvine Ranch Water District (IRWD). As previously noted, IRWD began planning its recycled water distribution network in 1963, with a purpose for dual piping throughout its community. While the City of Los Angeles will have 94 miles of purple pipe by 2022 for 469 square miles of land, IRWD has 509 miles of purple pipe for 181 square miles of land.

City or Agency		City of San Diego	City of Santa Barbara	City of Ventura	Irvine Ranch Water District	LA County Sanitation Districts	Orange County Sanitation District	Orange County Water District	San Elijo Joint Powers Authority	South Orange County Wastewater Authority
No. of Facilities		2	1	1	2	10	2	1	1	4
Level of Treatment		Tertiary	Tertiary	Tertiary	Tertiary	Secondary & Tertiary	Secondary	Advanced	Tertiary	Secondary & Tertiary
Wastewater Treatment and Recycled Water Production in FY 2014-15										
Treated Wastewater (000s of AFY)		27	7	9	25	174	210	146	3	24
Treated Wastewater (MGD)		24	6	8	23	156	187	130	3	21
Total Recycled Water (000s of AFY)		13	0	1	25	88	152	112	2	10
Recycling %		47%	0%	8%	100%	51%	73%	77%	53%	39%
Add'l potential Reuse (000s of AFY)		14	7	8	0	86	57	34	1	15
Add'l Potential Reuse %		53%	100%	92%	0%	49%	27%	23%	47%	61%
Recycled Water Uses										
Irrigation	Agricultural				X	X	N/A			
Irrigation	Non-Residential	X	X	X	X	X	N/A	X	X	X
Irrigation	Residential	X			X	X	N/A	X		
	Industrial	X	X		X	X	N/A	X	X	
	Environmental				X	X	N/A			
IPR	Groundwater Replenishment					X	N/A	X		
IPR	Sea Water Intrusion					X	N/A	X		
Staffing Practices										
Staff FTE		60	28	40	23	81	224	65	20	41
Operate 24/7		yes	yes	yes	yes	yes	yes	yes	yes	Yes
Rely on automation in off peak?		yes	yes	no	yes	yes	no	no	yes	Yes
Other forms of staffing?		Remote monitoring during off hours.	None	none	none	smaller plants have fewer shifts, are automated, and have computer hook-up to the nearest fully staffed facility	use shifts with floating personnel to cover assigned areas	four shifts to ensure 24/7 ops	none	none
Hours per operator shift		10	10	8	9.5 hours	8 hours	12	12	9 hours, 1-8 hour per 2 weeks (9/80)	No response

City or Agency	City of San Diego	City of Santa Barbara	City of Ventura	Irvine Ranch Water District	LA County Sanitation Districts	Orange County Sanitation District	Orange County Water District	San Elijo Joint Powers Authority	South Orange County Wastewater Authority
Operating Costs in FY 2014-15									
Labor	$ 4,096,352	$ 2,145,337	$ 1,744,891	$ 2,779,735	$ 25,050,620	$ 22,230,118	$100/AF	$ 1,700,159	$ 4,651,600
Materials & Supplies	$ 1,919,802	$ 2,482,751	$ 1,594,180	$ 1,639,603	$ 12,392,532	$ 14,919,367	$54/AF	$ 911,432	$ 1,637,315
Utilities	$ 5,178,553	$ 634,887	$ 382,632	$ 4,547,301	$ 15,867,591	$ 5,365,127	$118/AF	$ 648,403	$ 2,367,400
Other Operating Costs	$ 2,002,794	$ 198,017	$ -	$ 4,810,940	$ 22,625,949	$ 18,014,989	$450/AF	$ 572,742	$ 8,006,070
Total Operating Costs	**$ 13,197,501**	**$ 5,460,992**	**$ 3,721,703**	**$ 13,777,579**	**$ 75,936,692**	**$ 60,529,601**	**$722/AF**	**$ 3,832,736**	**$ 16,662,385**
Cost per Treated Wastewater ($/MG)*	$ 1,510	$ 2,314	$ 1,275	$ 1,675	$ 1,336	$ 887	$ 2,216	$ 4,006	$ 2,123
Estimated FY 2014-15 Maintenance Workload and Cost Proportions									
Est. Maintenance Completed by Plant Staff	95%	90%	90%	80%	90%	90%	90%	80%	95%
Est. Maintenance Completed by Contractors	5%	10%	10%	20%	10%	10%	10%	20%	5%
Est. % of Preventative Maintenance Hours	35%	84%	80%	75%	27%	45%	unknown	70%	70%
Est. % of Corrective Maintenance Hours	65%	16%	20%	25%	73%	55%	unknown	30%	30%
Est. % of Preventative Maintenance Costs	25%	No data	80%	60%	25%	35%	70%	60%	unknown
Est. % of Corrective Maintenance Costs	75%	No data	20%	40%	75%	65%	30%	40%	unknown
Est. % of Preventative Maintenance Work Orders Completed	82%	No data	90%	75%	60%	58%	70%	70%	90%
Est. % of Corrective Maintenance Work Orders Completed	18%	No data	10%	25%	40%	42%	30%	30%	10%

City or Agency	City of San Diego	City of Santa Barbara	City of Ventura	Irvine Ranch Water District	LA County Sanitation Districts	Orange County Sanitation District	Orange County Water District	San Elijo Joint Powers Authority	South Orange County Wastewater Authority
Electricity Usage for FY 2014-15									
Actual Kilowatt Hours (kWH) Consumed at Plants	44,150,044	7,300,000	5,565,101	35,728,917	123,477,292	142,843,580	107,886,000	2,725,604	17,608,602
Electricity generation within plants?	No	Yes	Yes	No	Yes	Yes	No	No	Yes
Recycled Water Distribution ("Purple Pipe") Network									
Existing (miles)	92	13.41	2	509	260.1	11.56	35	19	Not Applicable
Planned (miles)	3	0	0.19	36.4	0	0	0	2	Not Applicable
Cross-Agency Collaboration									
Receives effluent from other entitiy?	No	No	No	No	No	No	Yes	Yes	Yes
Provides effluent to other entity for treatment?	No	No	No	No	No	Yes	No	No	No
Provides recycled water to other	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes

Notes:
***Cost per MG** is calculated by auditors, not provided by jurisdictions. To determine this, we multiplied the estimated MGD of wastewater treated by 365 to get an annual estimate for influent (denominator). We then divided the total operating costs for each jurisdiction by the annual MG of influent.

Los Angeles County Sanitation District's operational costs exclude costs for the La Canada Water Reclamation Plant.

Orange County Water District provided operational costs in dollars per acre-feet (AF) of water. We converted AF to million gallons (MG).

Orange County Santiation District's recycled water numbers include in-plant recycling and the effluent sent to Orange County Water District for recycling.

Santa Barbara's tertiary facility was in construction during FY 2014-15. Therefore, no recycled water was produced.

APPENDIX V – DEPARTMENTS' RESPONSES AND ACTION PLANS

As part of our audit protocol, we requested action plans from each Department involved in the audit.

We considered each Department's response and comments and revised the report as necessary. Some information from the Departments' responses is reflected in the Review of Report Section in the Executive Summary. Each Department's complete response is attached in the following section.

FORM GEN. 160 (Rev. 8-12)

CITY OF LOS ANGELES

INTER-DEPARTMENTAL CORRESPONDENCE

DATE: July 13, 2016

TO: Ron Galperin, Controller
Attention: Siri Khalsa, Interim Director of Auditing

FROM: Enrique C. Zaldivar, Director
LA Sanitation

SUBJECT: **AUDIT OF BUREAU OF SANITATION'S RECYCLED WATER**

The Bureau of Sanitation (LASAN) appreciates the opportunity to provide the Controller's Office with its response and planned actions to address the applicable recommendations in the Controller's draft audit report entitled 'Bureau of Sanitation's Recycled Water Programs dated June 18, 2016.

Please contact LASAN Chief Operating Officer, Ms. Traci Minamide at (213) 485-2210, if you have any questions.

TD/ECZ:td

c: Traci Minamide, LASAN
Timeyin Dafeta, LASAN

BUREAU OF SANITATION'S RESPONSE TO THE OFFICE OF THE CITY CONTROLLER'S JUNE 28, 2016 REPORT ON BUREAU OF SANITATION RECYCLED WATER PROGRAMS

Bureau of Sanitation's (LASAN) response to the Office of the City Controller's final draft audit report dated June 28, 2016, containing the Controller's findings and recommendations following an audit of BOS Recycled Water Programs.

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
Finding NO. 1: The City's is not optimizing the production and delivery of recycled water as an alternative water resource to offset demands for imported potable water.	1. Re-evaluate, develop, and adopt recycled water plans according to the following priorities and policy considerations: a) Implement long-term concepts from the Recycled Water Master Planning documents that promote recycling existing treated wastewater for: I) Injection or spreading into local groundwater basins with underutilized storage capacity (indirect potable reuse), and II) Delivery to industrial and irrigation customers for non-potable reuse. DWP should develop policies that facilitate securing more customers, such as providing incentives given recent challenges with the non-potable reuse customer base. b) Once indirect potable reuse and non-	The options the City is working on to significantly increase the production of recycled water beyond projects identified in the audit report are: 1) Los Angeles World Airports (LAWA) and Nearby Uses LASAN, DWP and LAWA have committed to providing recycled water to LAWA. LASAN is preparing a concept study for an advanced water recycling facility at the Hyperion Water Reclamation Plant with a 2.5 MGD capacity expandable to 5 MGD capable of serving LAWA and other nearby needs. Project completion is projected at 2020. 2) Rancho Park Recycled Water Project LASAN is preparing a concept study for a 5 MGD membrane bioreactor (MBR) and Ultra Violet disinfection facility to provide recycled water to Rancho Park Golf Course, UCLA, Veterans Administration,

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
	potable reuse demand exceeds BOS' supply of recycled water, consider increasing stormwater diversion to reclamation plants for treatment and recycling. c) Consider alternative recycled water projects if Direct Potable Reuse legislation is passed within the short-term (next five years), and realign the City's recycled water strategy based on new legislation.	Los Angeles Golf Course and other facilities in the West Los Angeles Area. 3) West Basin Project LASAN in partnership with DWP and the West Basin Municipal District is planning to design and construct facilities at HWRP that would utilize membrane bioreactor (MBR) technology to produce 70 MGD of high quality water for recycling after disinfection by 2026-2027. 16 MGD out of the 70 MGD would be for the Los Angeles Department of Water and Power to distribute to its recycled water customers and 54 MGD of the recycled water would be utilized by West Basin to meet customer demands. The City will continue its engagement with regional partners with the goal to increase recycled water production. Expansion of recycled water production beyond the identified projects would depend on recycled water demand, available financing and distribution network. Significant experience and knowledge of Advanced Water Treatment production is being gained at the TIWRP AWPF project, and the DCT AWPF pilot studies (currently in year one of two year pilot study). Additionally, the HWRP is developing the

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
		concept study for the 5 MGD recycled supply to LAWA. These studies and equipment pilot operations provide valuable knowledge, operating experience, and equipment/unit process operating information from which a scale-up to larger installations could be made if Direct Potable reuse (DPR) becomes a reality in the near future. Response to 1b: Diversion of storm water runoff to reclamation facilities may not be a reasonable method of maximizing this potential. Storm water flow is occasional and non-predictable in nature, occurring only during periods of rainfall within the LA Basin. Although the plants are currently not operating at designed capacity during dry weather, storm water inflow and infiltration do increase plant flows during rain fall events utilizing this capacity. To adequately capture storm water runoff would require the construction of large storage tanks from which captured flow would be rerouted to the treatment plants for re-introduction with incoming sewage for combined treatment. A more economical approach might be to capture the storm water runoff in recharge basins, the pump this water to a stand-alone water reclamation plant or water treatment plant for processing.
Finding NO. 1: The City's is not optimizing	1.2: Annually report to the City Council on	BOS and DWP will report to the City

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
the production and delivery of recycled water as an alternative water resource to offset demands for imported potable water.	the progress of adopted recycled water projects, including explanations for changes in strategy due to new regulations or technology.	Council on the progress of adopted recycled water projects as appropriate based on significant developments.
Finding NO. 2: BOS is not fully leveraging its City and regional relationships to support the City's goals for recycled water use.	2.1: Consider creating joint powers agreement with regional water agencies that incentivize jurisdictions to use recycled water produced by BOS. These agreements should: a) Ensure that competing beneficial use regulations are satisfied, and allow City sewer and water funds to pay for building or upgrading the City's capacity to produce recycled water; and, b) Address what the City will get for contributing its recycled water to the regional local water supply (e.g. monetary compensation, exchange of water rights, etc.).	BOS and DWP will continue to work in conjunction with regional partners to explore new options to increase recycle water production and distribution. The timing and implementation of projects will be based on factors such as recycle water demand, availability of distribution pipelines, regulation, and financing. The strategy by which the intent of this recommendation would be achieved involves meetings with regional partners to determine their recycled water needs and timelines, providing partners with information on the capabilities of the City to produce recycled water, and engaging in discussions on feasible and cost effective means of financing recycled water projects which can sometimes be in the hundreds of millions of dollars. The benefits the City will get for contributing its recycled water to the regional local water supply include the following: • Contributes to a reduction in the amount of potable water imported for use in the City of Los Angeles

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
		• Increases local water supply • Improves water security in the context of climate change • Reduces greenhouse gas emissions associated with imported water purchases from the MWD • Provides a regional strategy for recycled water management The achievement of some of these benefits could be included as goals in recycled water agreements.
Finding NO. 2: BOS is not fully leveraging its City and regional relationships to support the City's goals for recycled water use.	2.2: Develop a plan to more actively include regional agencies and contracting agencies in the development of One Water LA.	The City has initiated discussions with MWD, and discussions are ongoing with West Basin Municipal Water District to increase the supply of recycled water from the Hyperion Water Reclamation Plant. The strategy by which the intent of this recommendation would be achieved involves meetings with regional partners to determine their recycled water needs and timelines, providing partners with information on the capabilities of the City to produce recycled water, and engaging in discussions on feasible and cost effective means of financing recycled water projects. Under One Water LA, a Steering Committee was formed in 2014 to convene City Departments and regional agencies to further opportunities for integration

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
		including maximizing recycled water. Regional agencies that are part of the Steering Committee include MWD, Metro, High Speed Rail, and others. In addition to the Steering Committee meetings, the City is currently evaluating Contract Agency flows and recycled water needs to further maximize recycled water use. Contract agencies have been introduced collectively to One Water LA efforts through an initial meeting. The City will meet individually with contract agencies to discuss recycled water goals, needs and opportunities.
Finding NO. 4: BOS lacks a comprehensive, multi-year staffing plan that addresses staffing needs in light of plant upgrades, qualification requirements, labor costs and potential attrition. Without one, the capability of BOS to consistently meet recycled water goals is at risk.	4.1: Formally document a comprehensive workforce strategy that accounts for future certification and experience requirements, labor costs, and attrition. These changes should help BOS effectively operate new technology and meet water quality standards. a) This strategy should be presented to policy makers, along with the City's overall recycled water strategy (see Recommendation 1.3), and updated accordingly as plans for recycled water production are pursued. b) The strategy should aim to retain and fill projected staffing needs, and be monitored by BOS to ensure accountability over recycled water production goals.	LASAN will formally document the comprehensive workforce strategy to effectively produce recycled water. Some of the concrete measures that LASAN is pursuing to implement the intent of this recommendation are as follows: One of LASAN's goals for FY 16-17 is to establish a workforce development system to draw entry-level employees into our hiring activities using multiple pathways and through collaboration with LA Trade Tech College. LASAN is also working to increase the number of Wastewater Operator Trainee (WOT) positions. This will allow LASAN, based on need, to train up to 40 WOTs to become certified Wastewater Operators within an 18 month period.

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
		LASAN management is actively participating in the statewide initiatives to update qualification requirements for water reclamation plant operators, and will use the information obtained to structure the training and staffing initiatives that are required to ensure the effectiveness and stability of key plant staff, and capability of LASAN to consistently meet recycled water goals. The staffing plan (operation and maintenance) for the TIWRP AWPF was based on benchmarking with similar facilities (MF/RO/AOP and size) to determine appropriate number and qualifications of staff needed to provide secure and efficient operations of the AWPF process components. Similar strategy will be used for projecting staffing for the DCT reclamation facilities (operational 2022) and HWRP. In the case of TIWRP, additional staffing was increased over a two fiscal year timeframe to have adequate staffing resources available for development of start-up and commissioning protocols, with the remaining staff brought on to participate in field training exercises before full AWPF start-up and commissioning. Additionally, the TIWRP AWPF standard operating procedures (SOPs) were modified for selected equipment and processes being tested at the DCT pilot facility. These SOPs are

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
		being used by DCT operation and maintenance personnel to operate the AWPF pilot equipment, providing "hands-on" experience to current staff for use during full start-up and operation of the selected AWT process. Similar strategy will be used at HWRP.
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.1: Prioritize the implementation of Reliability-Centered Maintenance at all four water reclamation plants, and align the Department's asset management with industry leading practices.	LASAN will prioritize the implementation of Reliability-Centered Maintenance at all four water reclamation plants, and align the Department's asset management with industry leading practices as part of the acquisition, upgrade and implementation of the Ellipse Asset Management System. Currently, LASAN is working on an amendment to the existing Software Maintenance and Support contract with ABB (Ventyx) to upgrade the Ellipse Asset Management System to include Reliability-Centered Maintenance support. The Ellipse Asset Management System will be utilized at all four water reclamation plants, and it includes the implementation of Reliability-Centered Maintenance. The contract amendment is expected to be completed before the middle of 2017 with a term of three years. The ABB contract would enable LASAN to prioritize the implementation of Reliability-Centered Maintenance at all four water reclamation plants.

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.2: Establish administrative controls to assure that all maintenance activity is recorded within its asset management system after maintenance work is performed.	The upgrade and implementation of the Ellipse Asset Management System will include the development of a Business Process Document, and Standard Maintenance Procedures that will determine the frequencies for management reports to verify the effectiveness of established administrative controls.
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.3: Ensure that its new asset management system, Ellipse, provides timely, sufficient and reliable information to monitor and assess maintenance workload and costs.	LASAN's new asset management system, Ellipse, is designed to provide timely, sufficient and reliable information to monitor and assess maintenance workload and costs.
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.4: Establish administrative controls to approve the quality and validity of all asset data and criticality scores prior to inclusion within Ellipse (both current and future assets), to ensure that the benefits of implementing Ellipse are maximized. In addition, procedural controls should be established to ensure that asset data and criticality scores are routinely re-assessed and updated within the system.	Standard Maintenance Procedures that include administrative controls to approve the quality and validity of all asset data and criticality scores prior to inclusion within Ellipse (both current and future assets) will be included in LASAN's upgrade and implementation of the Ellipse Asset Management System. The Business Process Document and Standard Maintenance Procedures will establish the process for periodic reviews of the asset criticality scores in the Ellipse.
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.5: Ensure that reports produced using data from Ellipse easily identify preventative maintenance and corrective maintenance work. Management reports from Ellipse and/or other systems should also be able to quantify all costs related to the performance of maintenance activity to better evaluate	LASAN will ensure that reports produced using data from Ellipse easily identify preventative maintenance and corrective maintenance work. LASAN will ensure that management reports from Ellipse and/or other systems will also be able to quantify all costs related to the performance of

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
	and plan for maintenance resource needs.	maintenance activity. Assumptions and factors would be developed to convert the "wrench-time cost" in Ellipse to equate to the fully-burdened cost in SMS. The reporting module in Ellipse is much more robust than that in EMPAC. It provides the capability of trending maintenance activities, costs, work orders, work order types etc. to help identify areas that are or may become problematic.
Finding NO. 5: BOS has not optimized its maintenance of assets and equipment in accordance with industry practices, which focus more on preventive than corrective maintenance.	5.6: Develop resource and operational plans that shift the Department's maintenance focus from corrective maintenance to preventive maintenance in order to maximize the productivity of water reclamation assets. a) To align performance of maintenance work with industry leading practices, the long-term goal of these plans should be to achieve a maintenance workload mix of twice as much preventive maintenance work being performed than corrective maintenance work. b) Considering the implementation of the RCM framework, maintenance plans should contain criteria that accomplish a reasonable level of maintenance activity; including	LASAN's will utilize the implementation of Reliability-Centered Maintenance under the Ellipse Asset Management System as the strategy for achieving the intent of this recommendation which is to increase preventive maintenance and decrease corrective maintenance. However, it is anticipated that significant resources would be needed to continue the repair of ageing equipment at all four reclamation plants while increasing preventive maintenance and decreasing corrective maintenance. Upon the full implementation of the Reliability-Centered Maintenance Program, and the assessment of the data, LASAN will quantify the resources that would be needed to achieve the corrective and preventive maintenance targets set by the

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
	acceptable backlog levels. Management should ensure that adequate resources are available to attain targeted workload levels, and that staff are held accountable to meet or exceed established maintenance targets.	Controller's audit. City of Ventura and Orange County Water Districts were cited in the audit report as examples of organization with maintenance best practices. The prevailing thought is that higher preventive maintenance should result in decreased costs. This does not appear to be the case. As noted in the audit report, the two agencies that were cited as "model maintenance programs" appear to be achieving the preventive maintenance target with significant resource expenditures. For example, although Hyperion's corrective maintenance percentage (60%) is higher than the corrective maintenance percentage (33%) of the "model programs", the $786 cost per MG at Hyperion is significantly lower than the $1,275 cost per MG for the City of Ventura, and the $2,216 cost per MG for Orange County Water District. City of Ventura's cost per MGD is 160% of Hyperion's cost per MG and Orange County Water District's cost is 282% of Hyperion's costs per MG. In addition, both agencies appear to have newer facilities which may account for the lower corrective maintenance data reported.

FINDINGS	RECOMMENDATIONS	LASAN IMPLEMENTATION PLAN
Finding NO. 6: BOS did not obtain a more cost effective chemical for Hyperion's wastewater treatment process when it was available.	6.1: Work with General Services Department (GSD) to include amendments to existing chemical contracts when there is a cheaper and cost effective chemical available for purchase from the vendor. These amendments should make it flexible for the City to procure chemical alternatives based on availability and cost effectiveness, valid jar-testing, in-plant testing, and cost effectiveness analysis must accompany any decision to procure alterative chemicals and/or formulations.	LASAN will work with General Services Department (GSD), if feasible, to include amendments to existing chemical contracts when there is a cheaper and more cost effective chemical available for purchase from the vendor, and ensure these amendments make it flexible for the City to procure chemical alternatives based on availability and cost effectiveness, valid jar-testing, in-plant testing, and cost effectiveness analysis must accompany any decision to procure alterative chemicals and/or formulations.
Finding NO. 6: BOS did not obtain a more cost effective chemical for Hyperion's wastewater treatment process when it was available.	6.2: Continue to monitor the price of chemicals, the volume purchased, and the efficacy of the chemical to ensure that there are cost savings while utilizing them over alternatives.	LASAN has and will continue to monitor the price of chemicals, the volume purchased, and the efficacy of the chemical to ensure that there are cost savings while utilizing them over alternatives.
Finding NO. 6: BOS did not obtain a more cost effective chemical for Hyperion's wastewater treatment process when it was available.	6.3: Timely notify GSD when the use of chemicals are no longer cost effective in order to make appropriate changes in contracts.	LASAN will timely notify GSD when the use of chemicals are no longer cost effective in order to make appropriate changes in contracts.
Finding NO. 7: BOS management reporting on plant operations is not standardized.	7.1: Standardize monthly performance reporting across the plants for common indicators such as chemical and utility costs. However, some performance indicators will differ across plants such as solids handling and advanced recycled water production.	LASAN will work to standardize monthly performance reporting across the plants for common indicators such as chemical and utility costs, while at the same time account for performance indicators that are unique for each water reclamation plant.

July 14, 2016

Ms. Siri Khalsa, CPA
Interim Director of Auditing
Office of the City Controller
200 North Main Street, Room 460
Los Angeles, California 90012
Mail Stop 183

Dear Ms. Khalsa:

Subject: Response to the Los Angeles Department of Public Works Bureau of Sanitation's Recycled Water Programs Audit

The Los Angeles Department of Water and Power (LADWP) is pleased to respond to your June 28, 2016, transmittal of the final audit (Audit) report entitled "Bureau of Sanitation's Recycled Water Programs." Every opportunity is welcomed to improve and optimize the City's recycled water programs to best benefit our residents in ensuring future water supply reliability.

As noted in your Audit report, the Board of Water and Power Commissioners adopted the 2015 Urban Water Management Plan (UWMP) on June 7, 2016, subsequent to the audit fieldwork. Accordingly, many of the findings and recommendations from the Audit report have either been addressed in the 2015 UWMP or are currently in progress of being further evaluated or implemented. A copy of the final adopted 2015 UWMP is available for download at our LADWP web site at www.ladwp.com/2015UWMP.

The UWMP contains LADWP's 25-year strategic plan that significantly expands the use of recycled water and other local water supplies in the areas of conservation, stormwater capture, and groundwater remediation to achieve goals set in Mayor Eric Garcetti's Executive Directive No. 5 and Sustainable City pLAn to further improve the City's water supply reliability in the future. These goals include achieving a 50 percent reduction of purchased imported water from the Metropolitan Water District of Southern California (MWD) by the year 2025, and increasing locally sourced water to

111 N. Hope Street, Los Angeles, California 90012-2607 *Mailing address:* Box 51111, Los Angeles, CA 90051-5700
Telephone: (213) 367-4211 www.LADWP.com

more than 50 percent by the year 2035. The recent five year rate action will go towards funding these local projects.

LADWP is working with the Los Angeles Department of Public Works Bureau of Sanitation (LASAN) and Bureau of Engineering, to develop and implement additional recycled water projects for irrigation and industrial uses as identified in the UWMP. In addition, the City is pursuing a Groundwater Replenishment Project to replenish the San Fernando Basin with purified recycled water by the year 2024. The overall goal is to significantly increase recycled water use to 75,400 acre-feet per year by the year 2040, a 7-fold increase from current deliveries.

Recycled water continues to be a critical resource in helping to reduce the City's reliance on purchased imported water and enhancing water supply reliability. As noted in your Audit, there are a number of recycled water issues and challenges facing Los Angeles in the areas of production, delivery, customer base, regional collaboration, and regulations. LADWP is committed to working with other City departments, regional partners, stakeholders, and regulators to overcome these issues and challenges.

We trust that your Audit and our partnership with your office will continue add value to further developing additional recycled water resources to help achieve a more sustainable water supply for the City. LADWP looks forward to working with your office and our customers to expand recycled water use by implementing recommendations contained in the Audit.

Enclosed are LADWP's responses to the Audit's specific findings and recommendations. If you have any questions, please contact me at (213) 367-1338.

Sincerely,

Marcie L. Edwards
General Manager

DK:yrg
Enclosure

Report Title: Bureau of Sanitation's Recycled Water Program
Report Issuance Date: June 28, 2016
Department responsible for Implementation: **Department Water & Power**
Reported Status Date: July 14, 2016

				DEPARTMENT REPORTED INFORMATION		
Finding Number	**Summary Description of Finding**	**Rec. No.**	**Recommendation**	**Current Status**	**Basis for Status**	**Target Date for Implementation**
Section I:	**Recycled Water Production and Delivery**					
1	The City is not optimizing the production and delivery of recycled water as an alternative water resource to offset demands for imported potable water.	1.1	Re-evaluate, develop, and adopt recycled water plans according to the following priorities and policy considerations:	I	**Balancing recycled water demand, supply, and infrastructure requirements, the 2015 Urban Water Management Plan (UWMP) outlines goals to achieve additional 75,400 AFY in recycled water deliveries by year 2040. Approximately 30,000 AFY will come from indirect potable reuse / groundwater replenishment, and 45,400 AFY will come from non-potable reuse / purple pipe. LADWP will continue to investigate other cost effective opportunities to increase recycled water use beyond UWMP goals, such as One Water LA 2040, and continue to monitor and participate in the development of direct potable reuse regulations.**	**2015 UWMP adopted June 7, 2016.**
		a)	Implement long-term concepts from the Recycled Water Master Planning documents that promote recycling existing treated wastewater for:	I	**Concepts to increase non-potable and indirect potable reuse have been included in recently adopted 2015 UWMP.**	**June 7, 2016.**
		a) i.	Injection or spreading into local groundwater basins with underutilized storage capacity (indirect potable reuse), and	I	**See 2015 UWMP, plans for additional stormwater capture and groundwater replenishment to recharge aquifers.**	**June 7, 2016.**

Finding Number	Summary Description of Finding	Rec. No.	Recommendation	DEPARTMENT REPORTED INFORMATION		
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		a) ii.	Delivery to industrial and irrigation customers for non-potable reuse. DWP should develop policies that facilitate securing more customers, such as providing incentives given recent challenges with the non-potable reuse customer base.	PI	LADWP adopted the Recycled Water Consumer Capital Incentive Program in 2012 to help defray costs incurred by customers for on-site improvements (additional plumbing, permit fees, meter, etc.) for converting over to recycled water. The incentive is tiered and based on the annual amount of recycled water used by the customer. LADWP also provides consultant services to assist customers with retrofit design. Lastly, LADWP assists with securing regulatory approval, including the preliminary review and submission of retrofit design plans. LADWP is open to considering improvements to incentive programs and is currently exploring options to make the program better suited to larger industrial customers who require more substantial on-site improvements.	Ongoing
		b	Once indirect potable reuse and non-potable reuse demand exceeds BOS' supply of recycled water, consider increasing stormwater diversion to reclamation plants for treatment and recycling.	PI	Future additional stormwater capture is currently focused in cost effectively recharging GW basins and directly offsetting potable use. LADWP in cooperation with LASAN is exploring the feasibility of other potential alternatives to capture and treat surface runoff, such as capturing low-flow surface runoff and dry weather flows for treatment and beneficial use.	Ongoing
		c	Consider alternative recycled water projects if Direct Potable Reuse legislation is passed within the short-term (next five years), and realign the City's recycled water strategy based on new legislation.	PI	LADWP hired RMC Water and Environment in 2015 to prepare a report to identify potential options for Direct Potable Reuse (DPR) in the San Fernando Valley. The final report identified four options that appeared technically feasible depending on the final regulatory legislation. LADWP intends to continue exploring options on implementing DPR throughout the City and is monitoring the status of pending DPR legislation. LADWP agrees that alternative recycled water projects may be more economically prudent in the future depending on the eventual DPR regulations.	Ongoing

Finding Number	Summary Description of Finding	Rec. No.	Recommendation	DEPARTMENT REPORTED INFORMATION		
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		1.2	Annually report to City Council on the progress of adopted recycled water projects, including explanations for changes in strategy due to new regulations or technology.	PI	LADWP produces a Recycled Water Annual Report each fiscal year that is published on the LADWP website and distributed to a wide audience. LADWP would be pleased to report annually to the City Council or Energy and Efficiency Committee, as appropriate, to discuss changes to the projects, goals, and overall program to meet the City's sustainability efforts.	Ongoing
2	BOS is not fully leveraging its City and regional relationships to support the City's goals for recycled water use.	2.1	Consider creating joint powers agreements with regional water agencies that incentivize jurisdictions to use recycled water produced by BOS. These agreements should:	PI	The City has a long standing partnership of providing secondary treated wastewater from the Hyperion Treatment Plant to the West Basin Municipal Water District (WBMWD). WBMWD further treats the water and sells recycled water to LADWP and other regional customers. LADWP has an agreement with the Water Replenishment District and the Los Angeles County Department of Public Works for providing advanced treated water for injection at the Dominguez GAP Seawater Intrusion Barrier which provides a regional benefit for all the groundwater pumpers in the West Coast Basin. LADWP also has an agreement with the City of Burbank to exchange Burbank's recycled water for City groundwater extraction credits. LADWP and LASAN are currently coordinating with MWD to explore feasibility and identify potential opportunities to participate in the Regional Recycled Water Program with LA County Sanitation District to recharge basins in Los Angeles, Orange, and San Bernardino Counties, and for use in areas in the City. LADWP is also exploring recycled water partnerships with Las Virgenes Municipal Water District and City of Long Beach.	Ongoing
		a)	Ensure that competing beneficial use regulations are satisfied, and allow City sewer and water funds to pay for building or upgrading the City's capacity to produce recycled water; and,	PI	City sewer funds are used to construct water reclamation plants necessary for regulatory compliance. City water funds are used to construct the necessary infrastructure to deliver recycled water for beneficial use.	Ongoing

Finding Number	Summary Description of Finding	Rec. No.	Recommendation	DEPARTMENT REPORTED INFORMATION		
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		b)	Address what the City will get for contributing its recycled water to the regional local water supply (e.g. monetary compensation, exchange of water rights, etc.)	PI	The City would expect to receive financial compensation, groundwater pumping rights, imported water credits, or other equitable compensation in exchange for contributing towards the treatment and delivery of recycled water for a regional program. In addition, City would help the region achieve increased water supply reliability by reducing dependance on purchased imported supplies.	Ongoing
		2.2	Develop a plan to more actively include regional agencies and contracting agencies in the development of One Water LA.	PI	Potential opportunities are being considered in the development of the One Water LA 2040 plan.	Ongoing
3	New requirements recently added to the City's Green Building Code may impact future development and not effectively promote recycled water use to offset potable water demand.	3.1	Propose amending the Green Building Code to be more flexible in promoting recycled water use (e.g. not 100% recycled water use, and/or additional conditions for exemptions).	PI	LADWP believes amending the Green Building Code is not required at this time. LADWP will develop a written framework, in coordination with Building and Safety, to evaluate the availability of recycled water based on various factors that will be used by Building and Safety and City Planning to implement the Green Building Code.	Ongoing
		3.2	Implement tools to assess the feasibility of non-potable recycled water use in new developments and identify measures to mitigate negative impacts.	PI	LADWP will develop the written framework in Finding 3.1 and will take into consideration water quality, intended water use, infrastructure impediments, construction cost, and available capacity. LADWP is currently working with City Planning and developers on large development projects subject to CEQA under Water Code Section 10910, through Water Supply Assessments, to evaluate feasibility and potential recycled water use on the project to offset potable demands.	Ongoing

I - Implemented
PI - Partially Implemented or In Progress
NI - Not Implemented
D - Disagree

CITY OF LOS ANGELES
CALIFORNIA

DEPARTMENT OF
BUILDING AND SAFETY
201 NORTH FIGUEROA STREET
LOS ANGELES, CA 90012

FRANK BUSH
INTERIM GENERAL MANAGER

August 4, 2016

Siri Khalsa, CPA
Interim Director of Auditing
Office of the Controller
200 N MAIN ST 4TH FLOOR
LOS ANGELES, CA 90012

Dear Ms. Khalsa:

This letter responds to your letter dated June 28, 2016, and Ms. Cynthia Varela's email dated July 25, 2016, regarding the final draft audit report entitled "BOS' Recycled Water Programs." On behalf of the Department of Building and Safety (LADBS), thank you for providing your draft document and for the opportunity to provide a response.

Mayoral Executive Directive No. 5 (ED 5), issued on October 14, 2014, stated that "the Department of Building and Safety, in collaboration with the Department of Water and Power and the Bureau of Sanitation, shall compile and propose to City Council a list of potential building code changes for new and retrofitted buildings. These potential changes shall include, but not be limited to, the following: indoor water fixtures, dual indoor/outdoor water metering, reductions in outdoor water budgets, rainwater and greywater capture and use on site, process water and greywater/blackwater treatment and reuse systems, dewatering, swimming pool covers, and individual water meters or submeters on new multi-family construction."

In response to the Mayor's Directive, the LADBS worked closely with the Department of Water and Power and the Bureau of Sanitation as well as other city departments to draft an ordinance that complies with ED 5 and addresses Council Motions related to water conservation (Motions 14-1291, 15-0458, 14-0078-S6, and 14-0078-S5). The Ordinance (No. 184248) was adopted by City Council on April 22, 2016.

Recommendation 3.1 in the matrix your office provided to LADBS states "Propose amending the Green Building Code to be more flexible in promoting recycled water use (e.g. not 100% recycled water use, and/or additional conditions for exemptions)." Additionally, Recommendation 3.2 states "Implement tools to assess the feasibility of non-potable recycled water use in new developments and identify measures to mitigate negative impacts." LADBS addressed both of these recommendations on July 12,

2016, with the Mayoral Water Cabinet which oversees progress towards meeting the City's stated water goals, implements the Mayor's Executive Directive #5, and is composed of Deputy Mayor for City Services; Chief Sustainability Officer; General Manager, Department of Water and Power; Director, Bureau of Sanitation; Senior Assistant General Manager, Water System, Department of Water and Power; Assistant Director, Bureau of Sanitation; General Manager, Department of Recreation and Parks; One of the City of Los Angeles' representatives to the Metropolitan Water District; and One member of the Proposition 0 Citizens Advisory Oversight Committee. LADBS will follow the recommendations of the Water Cabinet.

As requested by your office, LADBS has completed the response matrix that was provided by your office titled "Bureau of Sanitation's Recycled Water Program." The matrix shows LADBS' response to the draft audit regarding recommendations 3.1 and 3.2. LADBS' response is based on discussions and recommendations of the Mayoral Water Cabinet.

LADBS will be happy to discuss with your office the Department's reported information as well as any related future action.

If you have any questions or need additional information, please contact me at osama.youna@ladbs.org or 231-482-7407.

Sincerely,

Osama Younan, P.E.
Division Chief
Green Building, Electrical and Mechanical Engineering Division

Attachments:
Executive Directive NO. 5
Motion 14-1291
Motion 15-0458
Motion 14-0078-S6
Motion 14-0078-S5
Ordinance No. 184248
Response matrix- Bureau of Sanitation's Recyled Water Program

Report Title: Bureau of Sanitation's Recycled Water Program
Report Issuance Date: June 29, 2016
Department responsible for Implementation: **Building & Safety**
Reported Status Date: August 2, 2016

				DEPARTMENT REPORTED INFORMATION		
Finding Number	**Summary Description of Finding**	**Rec. No.**	**Recommendation**	**Current Status**	**Basis for Status**	**Target Date for Implementation**
Section I:	**Recycled Water Production and Delivery**					
3	New requirements recently added to the City's Green Building Code may impact future development and not effectively promote recycled water use to offset potable water demand.	3.1	Propose amending the Green Building Code to be more flexible in promoting recycled water use (e.g. not 100% recycled water use, and/or additional conditions for exemptions).	PI	The existing language in the Green Building Code provides flexibility in determining the availability of recycled water. LADWP, in coordination with Building and Safety, will develop a framework to evaluate the availability of recycled water based on various factors. Following the development of the framework, LADWP and LADBS will further evaluate the need for a code revision. LADBS worked closely on this item with the Department of Water and Power and the Bureau of Sanitation and this action was taken based on discussions and recommendations by the Mayoral Water Cabinet which oversees progress towards meeting the City's stated water goals, implements the Mayor's Executive Directive #5, and is composed of representatives from the Mayor's Office, multiple City departments, Metropolitan Water District, and Proposition 0 Citizens Advisory Oversight Committee.	
		3.2	Implement tools to assess the feasibility of non-potable recycled water use in new developments and identify measures to mitigate negative impacts.	PI	LADWP will take the lead on this finding, LADBS will collaborate and coordinate with LADWP. LADWP, in coordination with LADBS, will develop the framework in Finding 3.1 and will take into consideration multiple factors to evaluate the feasibility and potential of recycled water use on the project to offset potable demands. This action was taken based on discussions and recommendations by the Mayoral Water Cabinet which oversees progress towards meeting the City's stated water goals, implements the Mayor's Executive Directive #5, and is composed of representatives from the Mayor's Office, multiple City departments, Metropolitan Water District, and Proposition 0 Citizens Advisory Oversight Committee.	

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