Richmond Municipal Sewer District
Water Pollution Control Plant

Utility Analysis for Wet Weather Bypass of Secondary Treatment "No Feasible Alternatives Analysis"

During peak wet weather flow events, the Richmond Municipal Sewer District Water Pollution Control Plant (WPCP) must divert a portion of its primary treated wastewater around the secondary treatment system. The diverted flows are blended with secondary effluent prior to disinfection, dechlorination, and discharge to the San Francisco Bay. The City of Richmond (City) continues to implement sewer rehabilitation programs that will reduce the volume of flow sent to the WPCP. The City's Capital Improvement Projects planned over the next 10 years total approximately $98.5 million. When completed, the sewer rehabilitation efforts will reduce the amount of infiltration/inflow (I/I) to the collection systems and improve operations at the WPCP. As a result, the occurrence and volume of future blending events will be reduced, but not eliminated. As part of the NPDES permit reissuance process, the City requests approval from the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) to continue wet weather diversions and blending based on the information provided in the following paragraphs.

Current Treatment System and Capacity

The City of Richmond and the Richmond Municipal Sewer District No.1 (RMSD) own and manage the RMSD Water Pollution Control Plant WPCP at 601Canal Boulevard in Richmond. RMSD was formed to facilitate allocation of tax money from residents in the area of Richmond covered by this District, but it has no employees and it is operated by the City of Richmond. The WPCP is operated under contract by Veolia Water West Operating Services, Inc. (Veolia). RMSD, the City of Richmond, and the West County Wastewater District (WCWD) are members of the West County Agency (WCA), a Joint Powers Agency. The agencies share use of the West County Agency common outfall that discharges treated effluent to the San Francisco Bay. The discharges are regulated by NDPES Permit No. CA0038539 (currently implemented as Order No. R2-2008-0003).

The WPCP was constructed in 1953 as a primary treatment facility and the plant was upgraded to secondary treatment in 1967. A third secondary clarifier was added in 1990. Upgrades in 2002-2003 involved installation of an influent bar screen and structural repairs to the primary clarifiers and secondary clarifier #3. The digester tanks were also rehabilitated during that time frame. Instrumentation system improvements are being made continuously. Major upgrades to the influent pump station were completed in 2011 and included new pumps, motor control centers and variable frequency drives as well as an odor control system. In 2011 a new digester control building was completed and provides reliable digester heating and mixing. The current average dry weather inflows to the WPCP are 6.5 million gallons per day (MGD), and the service area population is approximately 68,000. The WPCP has an approved design flow rate of 16 MGD (average dry weather flow, ADWF), and wet weather flow rate of 20 MGD based on the hydraulic capacity of the secondary treatment system.

A flow schematic depicting the wastewater treatment processes is presented as **Figure 1.** The current treatment process consists of influent screening, grit removal, primary clarification, secondary treatment with activated sludge, secondary clarification, and disinfection.

Wet Weather Flow Management

During peak wet weather flow events, diversion and blending procedures may be implemented to protect the secondary treatment system. As stated above, the WPCP has a maximum wet weather secondary treatment capacity of 20 MGD. When wet weather inflows exceed 20 MGD, primary effluent flows greater than 20 MGD are diverted to two equalization basins with a total volume of 2 million gallons (MG). If the equalization basins become full, the stored primary effluent flows over a fixed weir to mix with secondary effluent in the chlorine contact basin for disinfection. After the wet weather event concludes, the equalization basins are drained to the headworks of the plant for full treatment. In recent years, peak wet weather inflows of 21.1 to 40 MGD have caused blending events to occur. All blended effluent meets secondary treatment standards and is dechlorinated prior to disposal in the Central San Francisco Bay. The system described above represents the greatest amount of treatment and the highest quality effluent that can be produced at the WPCP using the existing treatment facilities.

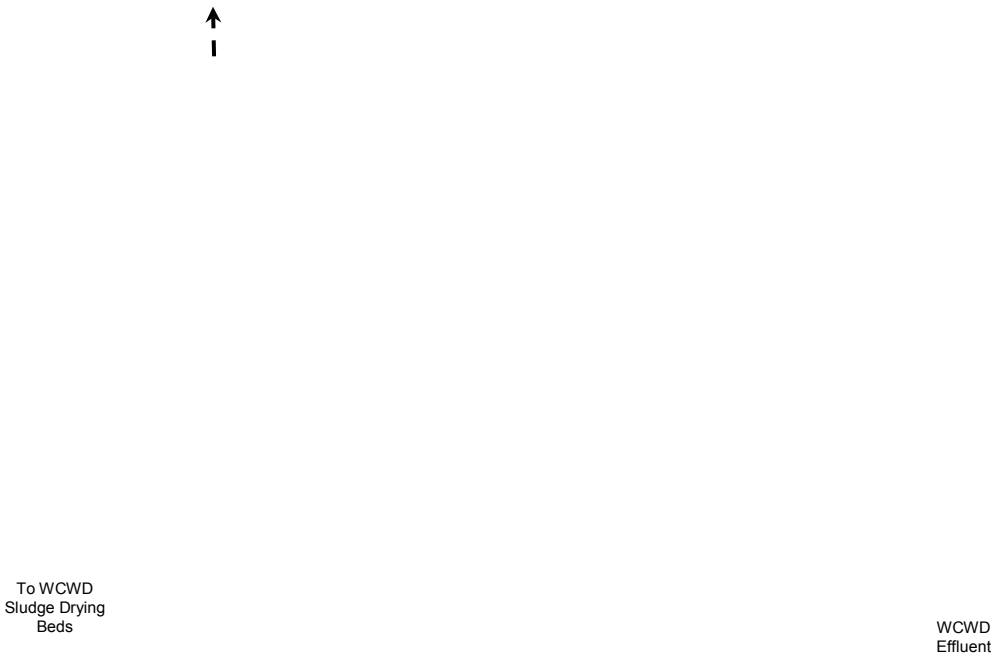

Figure 1. Flow Schematic for the City of Richmond Water Pollution Control Plant (Dashed lines indicate flow direction during wet weather blending events)

No Feasible Alternatives Analysis

The following analysis is conducted to comply with NPDES Permit Provision VI.C.5.c. and to demonstrate that the WPCP has no feasible alternatives to its system of diverting and blending peak wet weather flows. The requests outlined in items *a* through *k* below were excerpted from the proposed EPA policy entitled "*NPDES Requirements for Peak Wet Weather Discharges from POTW Treatment Plants Serving Separate Sanitary Sewer System Collection Systems" (January 2006).*

a. Document current treatment plant design capacity for all treatment units, the maximum flow that can be processed through those units, and the feasibility of increasing treatment capacity and related costs;

The information presented in **Table 1** documents the existing treatment capacity for the City's WPCP. The maximum flow that can be processed through the secondary treatment system is 20 MGD.

Table 1. Existing Capacity of the City WPCP[1]

Unit Processes	All Units In Service(1) (MGD, Avg Day Max Monthly Flow)	One Unit Out of Service(1) (MGD, Avg Dry Weather Flow)	All Units In Service(2) (MGD, Peak Wet Weather Flow)
Bar Screen(3)	--	--	33
Influent Pump Station(3)(4)	--	--	40
Grit Basin(3)	--	--	40
Primary Clarifiers	20	8.75	39
Aeration Basins(5)	12.3	6.5	20
Secondary Clarifiers	12.3	10	20
Chlorine Contact Basin	24	--	72
Outfall(3)	--	--	35
Dissolved Air Flotation	11.0(6)	0(6)	N/A
Thickeners Digesters	9.0(6)	0(6)	N/A

(1) Based on average daily annual flow BOD_5 and TSS concentrations of 250 mg/L and 400 mg/L
(2) Based on wet weather conditions (average day annual flow loadings under higher hydraulic loads)
(3) For simplicity, processes that were designed based on hydraulic capacity were excluded from the average day maximum monthly flow/average dry weather flow
(4) Influent pump station capacity provided by Veolia Water West Operating Services, Inc.
(5) Existing mechanical aeration system is undersized at average day maximum monthly flow and at average dry weather flow if one aeration basin is out of service
(6) Only one DAFT and digester are functional, capacities determined by average dry weather flow

[1] All values (except Influent Pump Station capacity) were excerpted from *City of Richmond Wastewater Treatment Plant Master Plan,* Carollo Engineers, 2010.

To provide secondary treatment of wet weather flows up to 40 MGD, the City has identified the following possible projects to increase treatment capacity. The City has determined that constructing these projects in the near future is infeasible but will reevaluate the feasibility of constructing these projects at the appropriate time:

1. **Convert Existing Equalization (EQ) Basin No. 1 to Third Aeration Basin (AB) -** A third aeration basin would allow the WPCP to treat sustained wet weather flows that occur over consecutive days. The existing EQ basin located adjacent to Aeration Basin No. 2 would be converted to Aeration Basin No. 3. The total cost for this project is estimated at $3,000,000.
2. **Construct New EQ Basin to Replace the EQ Basin that is Converted to AB No. 3 -** If an existing EQ Basin is converted to an aeration basin, a new EQ basin must be constructed to maintain the two million gallons of wet weather storage that is required by the WPCP's current discharge permit. The new EQ Basin would be designed and constructed so that it can be converted to a secondary clarifier in the future, if desired. The total cost for this project is estimated at $6,000,000.
3. **Construct Wet Weather Storage Basin Upstream of Plant** - A wet weather storage basin, with a preliminary volume of 3 million gallons, would be constructed upstream of the influent pump station to reduce the peak flow of 55 MGD to 40 MGD. The total cost for this project is estimated at $9,000,000.
4. **Improve Hydraulics of Clarifier 3** - This project includes the addition of density current baffles and a new energy dissipating/flocculating feed well. These improvements are necessary because solids carryover issues have impacted Clarifier 3 in the past. This project could be implemented in stages. The total cost for this project is estimated at $375,000.
5. **Construct Low Lift Pump Station to Increase Outfall Capacity** - A low lift pump station would increase the hydraulic capacity of the outfall during peak flows and high tides. This would accommodate current peak flows and projected flows from the City's WPCP and WCWD's Treatment Plant. The total cost for this project is estimated at $3,375,000.
6. **Additional Aeration Basin -** A fourth aeration basin would be constructed by restoring the existing EQ Basin No. 2 to its original function as an aeration basin. The total cost for this project is estimated at $3,000,000.
7. **Construct new EQ Basin No. 2 -** A new EQ basin would be required to replace the basin converted to Aeration Basin No. 4. A new structure would be required to replace the volume lost by restoring EQ Basin No. 2 to Aeration Basin No. 4. The basin would be constructed so that it could be easily converted to a rectangular clarifier in the future. The EQ basins would be used for both diurnal and wet weather equalization. The total cost for this project is estimated at $4,500,000.

8. **Convert new EQ Basins to Rectangular Clarifiers** - The capacity of the secondary process would be expanded to 40 MGD by converting the EQ basins constructed under the previously mentioned projects to rectangular clarifiers. In addition, new sludge collection equipment, return activated sludge (RAS) pumps, piping, and valves will be required. The total cost for this project is estimated at $6,000,000.

b. Estimate the frequency, duration, and volume of current wet weather diversions, and evaluate alternatives to reduce the frequency, duration, and volume of such occurrences and related costs;

Wet weather diversions have occurred twenty-seven times since January 2008. These blending events are detailed in **Table 2**. During this period, wet weather diversions occurred approximately six times a year with an average of 11.79 MG bypassing secondary treatment during each event. The largest blending event (41.63 MG bypassing secondary treatment) occurred on March 13, 2012. During this event, the instantaneous peak influent flow rate was approximately 40 MGD. The influent flows exceeded secondary treatment capacity (20 MGD) for a period of approximately 90.5 hours (1645 on March 13th until 1115 hours on March 17th).

In addition to identifying the possible WPCP upgrades described in **item a**, the City has taken steps to reduce the frequency, duration, and volume of wet weather diversions by reducing I/I in its collection system. The City prepared a Sewer Collection System Master Plan[2] (Master Plan) in 2011 and is now prioritizing Capital Improvement Plan (CIP) projects. The City implements its Sanitary Sewer Management Plan (SSMP) as required by the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems[3]. In addition, the City has conducted extensive CCTV inspections of its collections system to identify and repair cracked pipes, offset and open joints, and root intrusion.

[2] *City of Richmond Sewer Collection System Master Plan*, West Yost Associates, 2011.
[3] State Water Resources Control Board Order No. 2006-003-DWQ.

Table 2. Blending Events at the City of Richmond WPCP (January 2008 to Present)

Blending Event Onset Date	Volume that Bypassed Secondary Treatment (MG)	Duration (hrs)
1/4/2008	14.50	17.6
1/5/2008	4.24	7.0
1/9/2008	1.01	4.5
1/25/2008	35.78	64.5
1/31/2008	1.87	4.5
2/2/2008	9.58	17.3
11/1/2008	2.69	8.5
11/3/2008	0.88	2.5
2/13/2009	3.34	12.3
2/15/2009	30.21	67.0
2/22/2009	28.66	65.5
3/2/2009	11.97	37.2
3/5/2009	9.21	23.8
3/6/2009	0.05	0.6
10/13/2009	7.73	15.8
1/20/2010	25.18	73.9
1/26/2010	3.57	19.3
2/18/2011	0.92	0.6
2/19/2011	8.20	11.9
2/25/2011	5.67	12.2
3/18/2011	32.29	63.3
3/24/2011	12.91	24.2
3/26/2011	8.36	13.8
1/20/2012	4.90	9.3
3/13/2012	41.63	90.5
3/24/2012	7.64	12.5
3/27/2012	5.42	9.6
Avg. # = 4.5 events/yr	**Avg. vol. bypassed = 11.79 MG/event**	**Avg. duration = 25.5 hrs/event**

The City has established the following target maintenance performance measures for its sanitary sewer system:

- x Closed Circuit Television
  - 976,800 ft/10 years
  - 488,400 ft/5 years
  - 97,680 ft/year = 10%
  - 8,140 ft/mo = 10%
- x Pipe Cleaning
  - 976,800 ft/4 years
  - 244,200 ft/year = 25%
  - 20,350 ft/mo = 25%

- x Sanitary Manhole Inspections
    - 2,569 every 4 years (40 Inactive manholes added to the total)
    - 643/yr
    - 54/mo
    - 941 Lamp holes/Cleanout/Fittings
    - 235/year
    - 20/month

As reported by the City's contract operator Veolia Water West Operating Services, Inc., the entire sanitary sewer system is cleaned on a four year turnaround cycle. The cleaning program consists of preventive maintenance, corrective measures, service call cleaning program, and hot spot programs. Approximately 66% of the segments scheduled for preventive maintenance fall in the pipe diameter size range of between 6 to 8 inches. About 25% of the segments are classified as "hot spots" and are scheduled to be re-cleaned within a maximum period of nine months. The preventive maintenance program includes setting the cleaning frequencies for various diameters of pipes. For example, 6 to 8 inch pipelines are cleaned on a two year cycle, 10 to 12 inch pipelines are cleaned on a 3-year cycle, and 15 inch and above pipelines are cleaned on a four year cycle. All segments with a repeat period of less than a year are categorized as "hot spots."

From 2007 to 2010, about 1.6 million linear feet of pipeline underwent routine preventive maintenance cleaning, while approximately 0.2 million linear feet of pipeline was cleaned after being designated as "hot spot" segments. Condition assessment of the collection system includes smoke testing, CCTV inspection surveys, dye testing, flow monitoring, and manhole inspections. The City's proactive approach of inspecting each and every part of the collection system has led to the discovery of several critical pipe segments in need of point repair, replacement, and rehabilitation. The City budgets for point repairs and is committed to reducing inflow and infiltration by providing grant funding to help home owners repair their laterals.

The current Master Plan identifies capacity deficiencies within the collection system during 10-year, 24-hour storm events. Projects identified to correct these deficiencies include upsizing several miles of large diameter pipes, installation of duck bill check valves and flap gates, and construction of wastewater storage ponds to bypass flow headed to the WPCP influent pump station. The duck bill check valve and flap gates project was completed in June 2011 and reduces San Francisco Bay water that enters the storm water outfalls to the sanitary sewer system. This project has reduced the volume of wastewater treated during wet weather events.

The Master Plan describes short-term (one to five years) and long-term (10 year) projects for the CIP that will address predicted hydraulic deficiencies under the design storm event. The CIP includes a variety of projects to increase pipe capacity, rehabilitate and replace pipelines to reduce system-wide I/I, and provide wet weather relief and storage. The CIP is used to help provide justification for, and subsequently receive funding from the City's bond funds and sewer service charges.

The City is conducting conceptual design studies to locate wet weather storage at the existing WWTP site. This collection system wet weather storage project involves the Barrett Avenue Relief Sewer and Wet Weather Storage Facility. The pipeline project will convey flow to the wet weather storage facility with an estimated capacity of 8 to 12 million gallons and desired capacity of 10 to 15 million gallons. The storage facility would include pre-screening and a pumping facility to convey flows back to the treatment process after the rainfall event concludes. Storage will involve a process to gain community endorsement and environmental clearance under the California Environmental Quality Act. The conceptual design for the Wet Weather Storage Project is in progress.

The Cutting Boulevard Capacity Improvement Project will relieve capacity issues within the existing trunk sewer through the installation of a 21 to 24 inch diameter relief sewer that follows the existing alignment within Cutting Boulevard between Carlson Boulevard and Harbour Way South. The total project length is approximately 1.2 miles. Pipeline installation must consider heavy traffic patterns on Cutting Boulevard and a railway track crossing at Carlson Boulevard and Espee Avenue. The Hoffman Boulevard Capacity Improvement Project addresses capacity issues within the existing trunk sewer by installing a 15 to 18 inch diameter relief sewer following the existing alignment. The 1.2 mile long pipeline begins at the end of Foothill Avenue and parallels Hinkley Avenue to the intersection of 23rd Street and Potrero Avenue. The pipe turns south to Hoffman Boulevard, then proceeds west on Hoffman Boulevard, turns north onto 13th Street, west on Potrero, and north on 11th Street to Cutting Boulevard. The pipe reconnects with the Cutting Boulevard trunk sewer. The Cutting & Hoffman Boulevard Capacity Improvement Projects will be implemented at the beginning of 2013.

The First Street Capacity Improvement Project will relieve flow within the existing trunk sewer through the installation of a 1.4 mile relief sewer ranging in diameter from 24 to 27 inches. The relief sewer pipeline will being at the intersection of Pennsylvania and 5th Street, and continue west within Pennsylvania Avenue, then south within 4th street, west within Barrett Avenue, south within 3rd Street, west within Nevin Avenue, and south within 1st Street to W. Cutting Boulevard. The Virginia Avenue, MacDonald Avenue, and Carlson Boulevard Capacity Improvement Projects address capacity issues within relatively short sections of existing trunk sewer by upsizing the respective pipelines. The Virginia Avenue Project upsizes 0.2 miles of 10 inch to 12 inch diameter pipe. Similarly, the MacDonald Avenue Project upsizes approximately 0.4 miles of 10 inch to 12 inch diameter pipe. The Carlson Boulevard Project upsizes approximately 0.5 miles of 12 inch to 15 inch diameter pipe. The First Street, MacDonald, and Virginia Avenue Capacity Improvement Projects will be implemented at the beginning of 2013.

The Upper Clinton Avenue Capacity Improvement Project will relieve flow within the existing trunk sewer on San Pablo Avenue through the installation of a new 1.2 mile long relief sewer ranging from 10 to 21 inches in diameter. The new sewer will

follow a new alignment from the intersection of Amador Street and Esmond Avenue through the neighborhoods east of San Pablo Avenue to the intersection of the Richmond Greenway Trail and S. 47th Street. This project includes several additional minor capacity improvements in the vicinity of the described alignment. The final design for the Upper Clinton Relief Sewer Project is in progress and construction will begin in late 2012.

The CIP presents needed rehabilitation and replacement projects on a parallel track with the proposed capacity improvements. Projects and project groupings being considered are listed below:

1. Pipeline emergency repairs and San Pablo Avenue project: These projects included the Sunset Generator and Pennsylvania emergency repair projects, and replacement of failing pipelines along San Pablo Avenue and in the surrounding neighborhoods. These projects have been completed.
2. Keller Beach interceptor replacement project: The Keller Beach interceptor is located several feet off the coast of Point Richmond, and is submerged beneath the San Francisco Bay. The condition of the pipeline is unknown, and manhole lids are corroded, generally prohibiting access for inspection. Sewers upstream of the submerged interceptor have known structural defects and have contributed to SSOs. This project replaces the interceptor and tributary pipelines, in order to avoid potential failure and discharge of raw sewage into the San Francisco Bay. This project replaces the existing submerged gravity interceptor that services the Point Richmond community. The Keller Beach area has the highest levels of rainfall dependent I/I in the collection system. Because the pipe is submerged, failure of this interceptor would directly impact the San Francisco Bay.
3. Cypress Point sewer replacement project: The Cypress Point sewer replacement project is a critical subset of the Keller Beach project. The pipeline is known to have heavy root intrusion and other maintenance and structural issues. This project replaces 750 linear feet of 12-inch diameter pipe.
4. Elimination of storm water inflow: Tidal inflow in the southern portion of the service area adds significant flows to the collection system. This project eliminates direct connections between the City's storm water system and collection system in tidal areas. Reduction of storm water inflow, and more specifically, tidal inflow, will reduce conveyance and treatment needs and create immediate cost savings in the overall CIP. This project, in conjunction with the development of wet weather storage, has been elevated to the highest priority for near-term collection system improvements. The flow monitoring program identified substantial groundwater inflow in the portions of the service area that are adjacent to the San Francisco and San Pablo Bay. A more focused flow monitoring effort identified the lower harbor area, between Canal Boulevard and Marina Way south of I-580, as having a significant tidal

flow response. In 2010, the City completed several projects to reduce the volume of tidal inflow into the sewer system. Projects included the separation of storm drain pipelines (conveying tidal flows) from the sewer system, and the installation of duck-bill check valves on the existing overflow structures to the Richmond Harbor. Flow monitoring conducted in July 2011 confirmed that these projects reduced the volume of tidal inflow into the sewer system. The cost to complete this work is expected to be recovered through the resulting reductions in storage and conveyance requirements.

5. Pipeline Repairs and Replacements: Point repairs and pipeline replacements were identified to eliminate the City's most significant pipeline structural defects, including pipe failures and significant offsets.
6. Miscellaneous projects to correct areas of the system that are currently inaccessible to CCTV equipment: The City has replaced approximately eight miles of pipelines that had structural defects (with National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) structural defect grade 5) that were not severe enough to be considered an emergency condition, but rendered the pipeline inaccessible to CCTV inspection.

The total estimated 10-year CIP cost, including completed projects listed above, is $98.5 million. The total estimated combined cost of priority rehabilitation and replacement projects is $28.3 million and the estimated total cost for design and construction of the wet weather storage facility is $24.4 million.

c. Estimate the potential for future peak wet weather diversions based on information such as predicted weather patterns, population growth, and treatment plant and collection system changes (e.g.; upgrades, extensions, deterioration) and evaluate options for reducing diversions based on these variables;

It is anticipated that weather patterns will remain similar to what has occurred over the past years. During wet weather events, the plant flow can rapidly rise to 36 MGD from a 2-year storm event, corresponding to 1.47 inches of rain in a six-hour period or 2.77 inches of rain in a 24-hour period. Modeling of the City's sanitary sewer system demonstrated that flows as high as 53.3 MGD could occur at the WPCP after or during a 5-year 24-hour storm event. Effluent flow measurements at the WPCP have been higher than 55 MGD. When the influent flowrate exceeds 20 MGD, flow equalization and sometimes blending is required. The WPCP is operated to ensure that all flow, including blended flow during wet weather events, meets effluent limit requirements in the NDPES permit.

To develop alternatives to reduce the number of wet weather blending events, the City assessed the volume of wastewater blended during wet weather events. Based on available data, the maximum storage required is 21 MG to accommodate the design storm event and the WPCP would need to increase storage volume by over 19

MG to ensure that all flow receives secondary treatment. As outlined in **item a** and **item b**, the City is investigating the feasibility of several projects aimed at increasing the storage capacity at the WPCP and in the collection system. Also outlined in **item a**, the City continues to investigate the feasibility of projects aimed at increasing the capacity of the secondary treatment system, although these projects have been deemed infeasible at this time.

Phased installation of four new influent pumps began in 2010. The final influent pump was installed at the WPCP in January 2011. The influent pump capacity was increased to 40 MGD and will impact the amount of wet weather diversions that take place per year. As a result, the wet weather diversion patterns prior to the influent pump station upgrades cannot be used to estimate the potential for future peak wet weather diversions. Wet weather diversions occurred four times during the 2011/12 wet season.

The average dry weather flow to the WPCP is 6.5 MGD and the service area population is 68,285. The population of the City's service area remains stable because all areas are almost completely built out. The Master Plan includes an updated, calibrated fully dynamic hydraulic model developed in Innovyze ® Infoworks ™ CS, a tool that has been used to assess the current capacity requirements for the collection system. The model can also be used to evaluate future conditions, or future connections to the existing collection system. As the City's population is projected to remain virtually unchanged, there is no need for expansion of WPCP capacity in order to accommodate flows from future population increases.

As outlined in **item b**, City has an ongoing I/I reduction program to reduce peak flows to the WPCP. Possible WPCP upgrades will be evaluated based on implementation of the City's I/I reduction programs.

d. Assess existing storage within the collection system or on-site and options for enhanced utilization or expansion (taking into account physical and technological considerations) of storage to reduce the frequency, duration, and volume of peak wet weather diversions and the related costs;

The existing collection system has very little available wastewater storage capacity and surcharging does occur at peak wet weather flows. The existing on-site storage capacity at the WPCP is 2 MG, provided by two equalization basins. The City is investigating the feasibility of expanding storage within the collection system and/or on-site at the WPCP through construction of the following project:

Construct Wet Weather Storage: The currently contemplated location for wet weather storage is on the City's WWTP site. . This collection system wet weather storage project has two components: Barrett Avenue Relief Sewer and Wet Weather Storage Facility. The pipeline project will convey flow to the wet weather storage facility with a minimum capacity of 8 to 12 million gallons and desired capacity of 10 to 15 million gallons. The storage location

would require a pump facility to bring flows to the treatment process after the rainfall event. The total cost for this project is estimated at $24,400,000.

e. Assess other ways to reduce peak wet weather flow volumes, such as limiting collection system extensions or slug loadings from indirect dischargers;

All collection system extensions are be designed and constructed to limit excess flow into the collection system. California Government Code (Sections 54739-54740) grant the City authority to regulate and/or prohibit, by the adoption of an ordinance and by issuance of control mechanisms, the discharge of any waste, directly or indirectly, to the WPCP. The authority also includes the right to: establish limits, conditions, and prohibitions; establish flow rates or prohibit flows discharged to the City sewerage facilities; require the development of compliance schedules for the installation of equipment systems and materials by all users; as well as to take all actions necessary to enforce its authority, whether within or outside the City boundaries, including those users that are tributary to the City or within areas for which the City has contracted to provide sewerage services. Specifically, the City of Richmond Municipal Code (RMC) Article 12, Chapter 12.18.030.4, "Accidental discharge/slug discharge control plan" states:

> "The City Engineer shall evaluate whether each [Significant Industrial User] needs an accidental discharge/slug discharge control plan or other action to control slug discharges. The City Engineer may require any user to develop, submit for approval, and implement such a plan or take such other action that may be necessary to control slug discharges. Alternatively, the City Engineer may develop such a plan for any user. An accidental discharge/slug discharge control plan shall address, at a minimum, the following:
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> A. Description of the discharge practices, including non-routine batch discharges;
> B. Description of stored chemicals;
> C. Procedures for immediately notifying the City Engineer of any accidental or slug discharge, as required by Section 12.18.060.6 of this chapter; and
> D. Procedures to prevent adverse impact from any accidental or slug discharge. Such procedures include, but are not limited to, inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site runoff, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants, including solvents, and/or measures and equipment for emergency response."

f. Evaluate technologies (such as supplemental biological treatment, physical chemical treatment, ballasted flocculation, deep bed filtration, or membrane technology) that are or could be used to provide additional treatment to peak wet weather flows or peak wet weather diversions at

the POTW treatment plant and the costs of implementing those technologies;

The City evaluated expanding primary treatment removal to mitigate the impact of blending. This technology involves the use of a wet weather treatment system, such as high-rate ballasted sedimentation, followed by blending with WPCP secondary effluent. During wet weather events, influent waste streams are dilute with influent BOD_5 concentrations ranging from 100 to 150 mg/L and TSS concentrations ranging from 125 to 175 mg/L. Recorded removal efficiencies of 85 to 90 percent for BOD_5 and 55 to 65 percent for TSS can be achieved with high-rate systems. High-rate sedimentation requires the addition of a coagulant and polymer during wet weather periods. For wet weather treatment, the systems would be used in parallel with the primary/secondary treatment trains. This alternative would cost approximately $12 million. The City did not consider this alternative to be feasible as a long-term solution because, regardless of whether the primary effluent from the high-rate system meets effluent limits, it would not provide secondary treatment of all effluent.

g. Evaluate the extent to which the permittee is maximizing its ability to reduce I/I throughout the entire collection system (i.e., not only the portions operated by the utility, but also portions operated by any municipal satellite community), including the use of existing legal authorities, potential improvement in the timing or quality of such efforts, and options for obtaining or expanding legal authorities to reduce I/I from satellite collection systems;

Through a series of ordinances adopted by the Richmond City Council, and the Richmond Municipal Code (RMC), the City possesses the necessary legal authority to reduce I/I throughout its entire collection system. The specific purpose of the City's Sewer Use Ordinance (RMC Article 12, Chapter 12.18, "Discharges to the Wastewater Treatment System" and RMC Article 12, Chapter 12.17, "Sanitary Sewer Connections") is to prevent the discharge of any pollutant into the sewer system, the storm drain system, or surface waters, which would: 1) obstruct or damage the collection system; 2) interfere with, inhibit, or disrupt the WPCP or its treatment processes; 3) pass through the treatment system and contribute to violations of the regulatory requirements place upon the plant; or 4) result in or threaten harm to or deterioration of human health or the environment.

The City does not currently accept flow from satellite agencies. Therefore, the RMC does not contain language regulating satellite agency flow, and the City has not developed satellite agency agreements.

The City developed a Sewer Lateral Compliance Plan following the guidelines set forth by Regional Water Board Resolutions R2-2005-0059 and R2-2003-0095. Overall, the Sewer Lateral Compliance Plan "…will reduce the leakage of sewage into public receiving waters and the infiltration and inflow (I&I) of storm, ground and tidal waters from private laterals into the City of Richmond's publicly owned sanitary

sewer collection system." The purpose of the Sewer Lateral Compliance Plan "… is to establish fair and consistent policies and procedures for the testing, repair, and replacement of all defective sewer laterals. To affect the purposes of this plan, the [City] may enter upon private property for inspecting, testing, and repair of the sewer laterals."

h. Evaluate peak flow reductions obtainable through implementation of existing Capacity, Management, Operations, and Maintenance (C-MOM) programs and potential improvements in the timing or enhancement of those programs and related costs; or, if no such program exists, reductions obtainable through the development and implementation of a C-MOM program and the related costs;

The City manages sewer collection system operations and maintenance using C-MOM practices that are implemented through the Sewer Collection System Master Plan and Sewer System Management Plan, detailed in **item b.** These plans include on-going repair, replacement, rehabilitation, cleaning, and maintenance projects to reduce I/I, and thus, reduce the need for wet weather diversions. Scheduling and recordkeeping is facilitated through a GIS-based computerized maintenance management system that includes all elements of the City's collection system.

i. Assess the community's ability to fund the peak wet weather flow improvements discussed in the utility analysis, taking into consideration: current sewer rates, planned rate increases, and the costs, schedules, anticipated financial impacts to the community of other planned water and wastewater expenditures, and other relevant factors impacting the utility's rate base, using as a guide EPA's CSP Guidance for Financial Capability Assessment and Schedule Development, EPA 832-B-97-004;

The City increased sewer use fees from $574/Sewer Service Unit (SSU) in Fiscal Year (FY) 2011-12 to $603/SSU in FY 2012-13. The fees will increase in FY 2013-14 to $633/SSU.

Using the EPA's CSO Guidance for Financial Capability Assessment and Schedule Development, EPA 832-B-97-004 as a guideline, the following information was prepared for the City's service area:

1. Total annual wastewater and SSO control cost per household as a percent of median household income: $50.25/mo. x 12 mos/yr ÷ $54,012 (median household income) x 100% = **1.12%**
2. Bond ratings: **A (Standard and Poor's)**
3. Overall net debt as percent of full market property value: **6.99%**
4. Unemployment rate: **17.9%**
5. Median household income: **$54,012**
6. Property tax revenue collection rate: **100%**

7. Property tax revenues as a percent of full market property value: **0.56%**

j. Propose a protocol for monitoring the recombined flow at least once daily during diversions for all parameters for which the POTW treatment plant has daily effluent limitations or other requirements (e.g., monitoring only requirements) and ensures appropriate representative monitoring for other monitoring requirements of the permit, the total volume diverted, and the duration of the peak wet weather diversion event; and

The City currently adheres to its Wet Weather Standard Operating Procedures (SOPs) for monitoring blended flows during wet weather events. As specified the San Francisco Bay Regional Standard Provisions and Monitoring and Reporting Requirements[4], composite samples are collected at the effluent compliance point for the length of the blending event in 24-hour or less increments. Grab samples are collected daily at the effluent compliance points for the length of the blending event. The composite and grab samples are preserved and properly retained for future analysis. An aliquot of the composite sample is analyzed immediately for total suspended solids (TSS). An aliquot of the grab sample is analyzed immediately for Fecal Coliform. If the TSS result exceeds 45 mg/L, the retained samples are analyzed for all constituents with effluent limits except oil and grease, mercury, dioxin-TEQ, and acute/chronic toxicity. All retained samples comply with holding time requirements. The SCADA system continuously monitors and records flow, pH, and chlorine residual for the duration of the blending event. Once a year, retained samples for one approved blending event are analyzed for all constituents with effluent limits, except oil and grease, mercury, dioxin-TEQ, and acute/chronic toxicity.

[4] NPDES Permit Attachment G, Regional Standard Monitoring and Reporting Requirements (Order No. R2-2010-0054).

k. Project the POTW treatment plant effluent improvements and other improvements in the collection system and the treatment plant performance that could be expected should the technologies, practices, and/or other measures discussed in the utility analysis be implemented.

The City is currently implementing its CIP that includes short term (5 year) and long term (10 year) projects which are expected to significantly reduce the volume of I/I and the probability of wet-weather blending events. The details of this plan are discussed in **items b** of the preceding analysis. Although these collection system improvements may reduce the frequency with which blending events occur or the volume of blended effluent produced, the WPCP was designed and constructed to blend and wet weather blending may be necessary to protect the secondary treatment process. However, the total volume of blended effluent will decrease as I/I is reduced. Until the collection system improvements are completed, it is expected that at least four diversion events per year will be necessary.

Conclusions

Peak wet weather diversions are needed at the City's WPCP to protect operation of the existing secondary treatment system. Because the hydraulic capacity of the secondary system is 20 MGD, diversion and blending may be undertaken to prevent solids from escaping the secondary treatment system when peak wet weather inflows of greater than 20 MGD are experienced for an extended period of time. Protection of the secondary system ensures that the microbial population remains constant and helps maintain compliance with permit limits for total suspended solids, BOD, and coliform concentrations.

During wet weather events, the WPCP is run at peak secondary treatment capacity, producing the highest quality effluent that is possible under existing conditions. Additions or expansions of the WPCP treatment units are not feasible at this time. The WPCP operating staff strives to minimize the number of peak wet weather diversions, and ensure that effluent quality is in compliance with permit limits. Important collection system capacity improvement and rehabilitation efforts are underway and will continue to take place as part of the City's CIP. These improvements will not completely eliminate I/I flows in the collection system, but they are expected to reduce the frequency and volume of wet weather diversions at the WWTP. Because storms of a severe magnitude may occur and the WPCP is designed to blend, NPDES permit approval is requested to utilize wet weather diversions and blending and ensure the integrity of the existing secondary treatment system.