



## 2017 Biosolids Management Program Performance Report

The Biosolids Management Program (BMP) approach proved to be a good fit for the goals set by the facility for good quality production of biosolids. Biosolids are the organic products resulting from the treatment of domestic sewage in a treatment facility and are rich in nutrients. According to USEPA, they can be safely recycled and applied as fertilizer to sustainably improve and maintain productive soils and stimulate plant growth.

The BMP is a structured program comprised of elements that cover all aspects of biosolids management including - process efficiency, communication with interested stakeholders, and training along with other crucial factors.

Consistent with the City's Environmental Policy Statement, the Richmond Wastewater Treatment Plant is committed to the following principles of conduct set forth in the Code of Good Practice. The treatment plant focuses its available resources to produce Class B Biosolids. The treatment plant strives to maintain, improve, and protect the environment through its treatment/production of biosolids. The treatment plant makes every effort to ensure that the public is not endangered by the treatment/production of biosolids at the treatment plant during transportation, storage or application at permitted sites. The treatment plant shall obey all applicable federal, state, county, and local laws, rules, and regulations. We pledge to "do the right thing" and uphold the following principles of conduct.

### **A- COMPLIANCE:**

To commit to compliance with all applicable federal, state, and local requirements regarding production at the wastewater treatment facility, the Richmond Wastewater Treatment Plant facility has elected to:

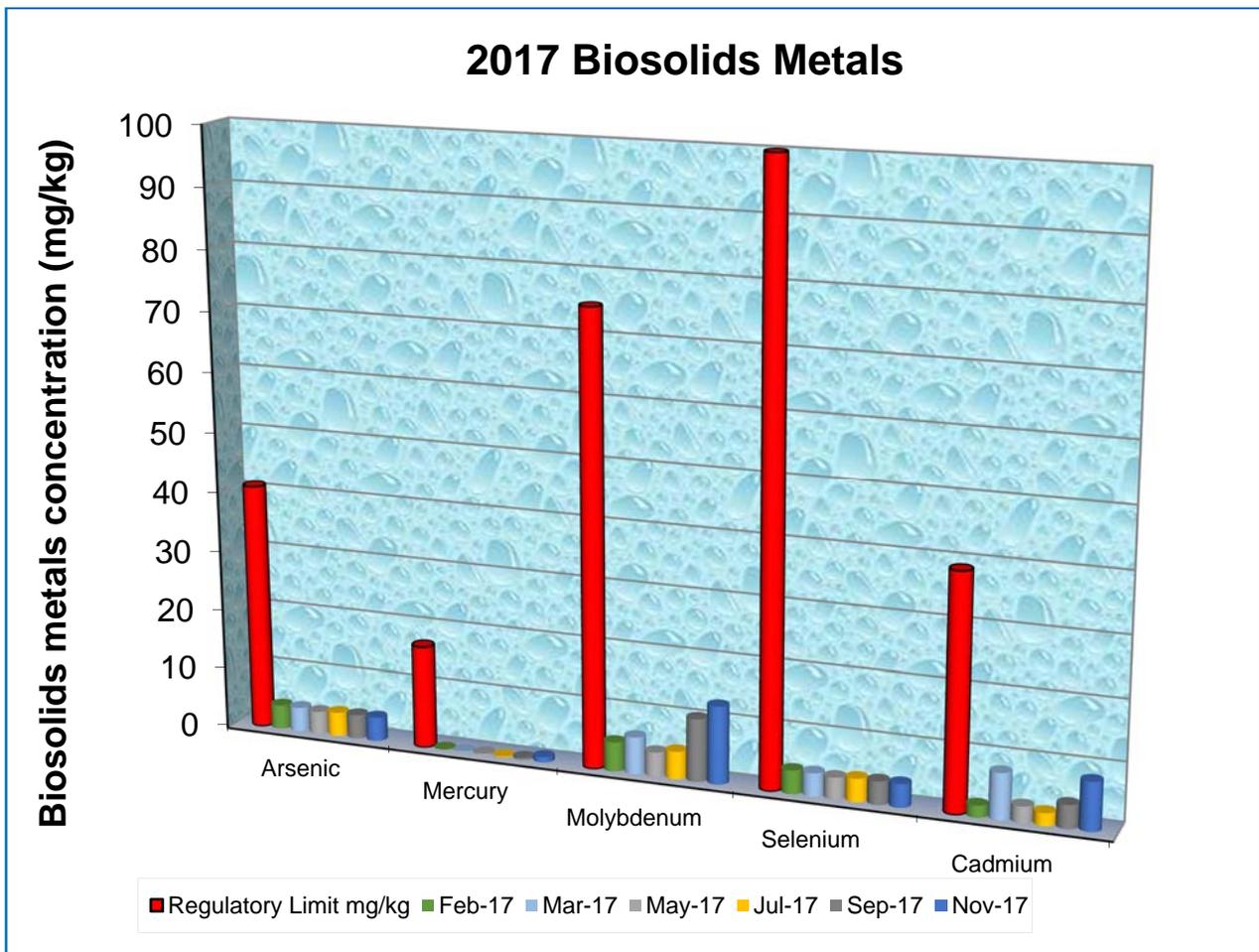
- 1) Meet concentration limits,
- 2) Meet class "B" pathogen standards;
- 3) Achieve 38% volatile solids reduction for vector control

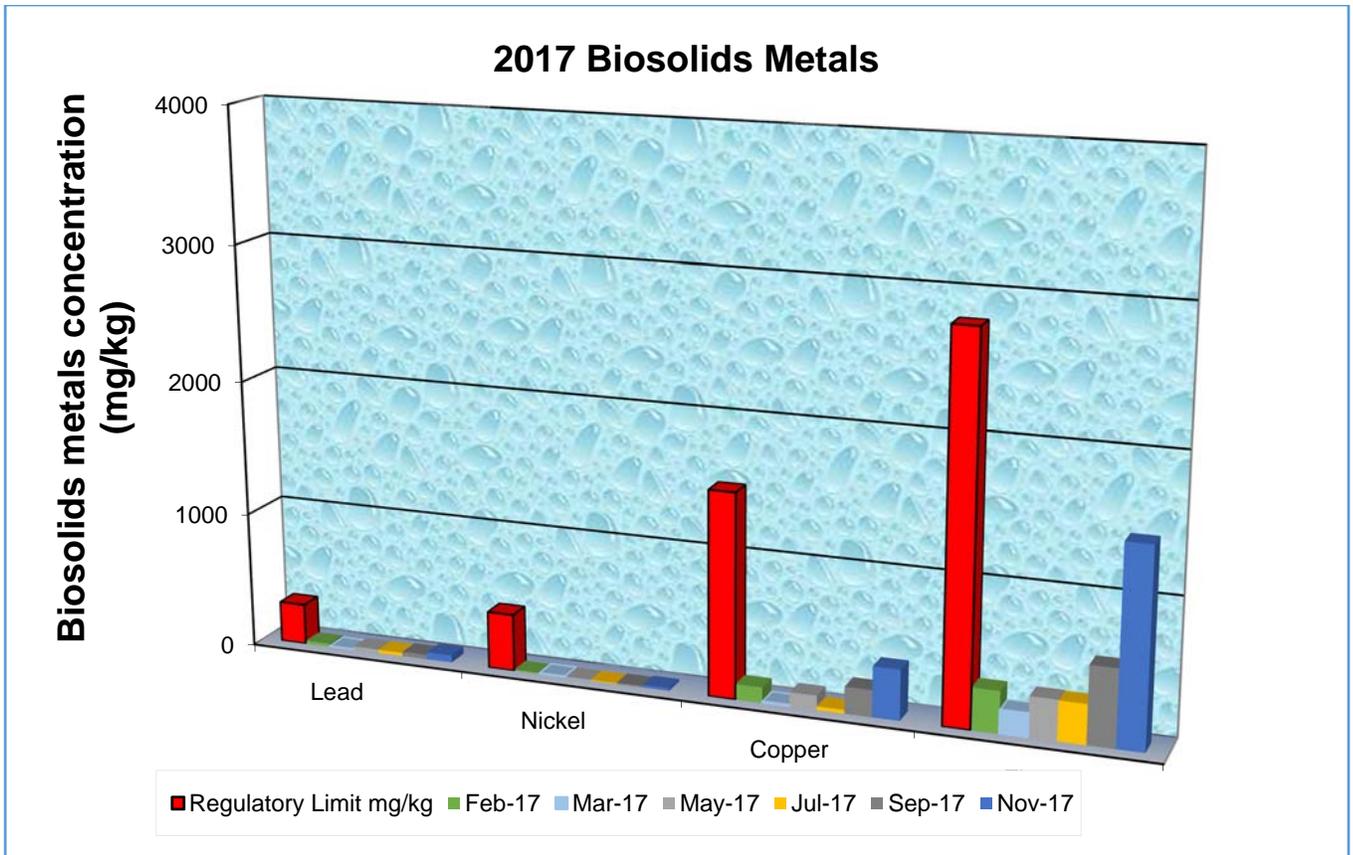
As treatment for its anaerobically digested biosolids, Primary biosolids is collected from our primary clarifiers, grits removed by hydro-grit units and thickened in four gravity thickeners. Waste activated sludge is pulled from the return biosolids stream and thickened in four thickening centrifuges. Biosolids is then pumped to one of the five anaerobic digesters. Overflow from the digesters is stored in one of the 2 biosolids storage tanks and

pumped to one of the five dewatering centrifuges where polymer is added. Once dewatered, biosolids is stored in the plant's storage pads and then hauled to land application site by the hauling/land application contractor.

1- Concentration Limits.

The chart below shows the biosolids metals concentration in 2017 and the concentration limits for Arsenic, Mercury, Molybdenum, Selenium, Cadmium, Lead, Nickel, Copper and Zinc. All metal analytical results are under the required concentration limits.





2- Class "B" pathogen standards:

The temperature optimum required for microorganisms to stabilize the organic matter is 95F.

During this year, the monthly average temperature and detention time were greater than 95F and 15 days respectively and comply with the federal regulation requirements [40 CFR 503.32(b) (3)].

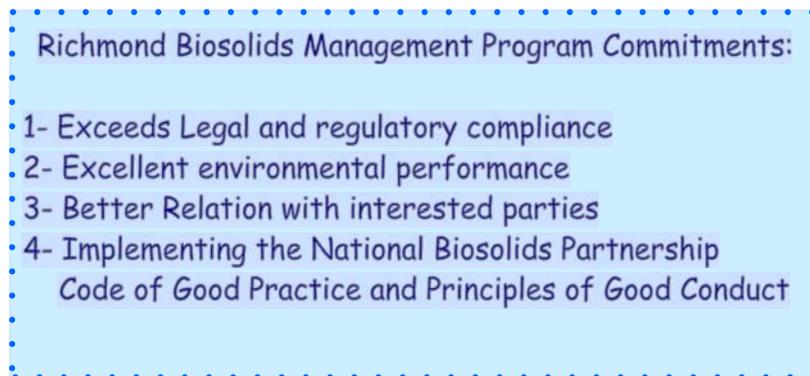
3- Vector Attraction Reduction: [40 CFR 503.33(b) (1)/alt (10)].

Samples are collected bimonthly; the volatile solids reduction must be equal or greater than 38% to allow the biosolids to be land applied. Biosolids failing to meet a 38% reduction are incorporated into the ground within six hours. All samples were above 38% for this year.

## **B- PRODUCT & QUALITY MONITORING:**

To provide biosolids that meets the applicable standards for their intended use or disposal, the Richmond Biosolids program is built around the concept of beneficial reuse of nutrients contained within the biosolids produced from the treatment process. During 2017, we recycled 23476 tons of class B biosolids for our agricultural customers in rural Virginia.

The City of Richmond Biosolids quality meets or surpasses the applicable regulatory compliance requirements, as mentioned in the chart above.



## **C- BIOSOLIDS MANAGEMENT PROGRAM:**

The WWTP has implemented the Biosolids Management Program that includes a method of internal audit and independent third-party verification to ensure effective ongoing biosolids operations.

### **AUDIT FINDING**

In November 2017, the NSF-International Strategic Registrations conducted the sixth Interim Audit for the City, the lead auditor recommended that the City of Richmond maintains its platinum NBP certification.

**Audit's results and actions taken in response to the audit results:**

As a result of the 2017 audit there were no major nonconformance, 1 minor non-conformances and 4 opportunities for improvement.

The table below summarizes the Interim audit's results and the actions taken:

Audit Observation or Opportunity for Improvement	Action Taken
<p>Element 14 requirements - Minor Nonconformance - the NBP standard minimum conformance requirement includes identifying the cause and taking action to correct any noncompliance or nonconformance in addition to identifying the root causes and actions taken to prevent recurrence. Also estimating the completion date, tracking progress of corrective action status and completion. The Richmond Element 14 procedure 6 requires the biosolids supervisor to verify the nonconformance has been completed and closed. A review of several corrective actions identified the following deficiencies: 136 - missing long term solution and no verification of closure; 137 - no verification of closure; 139 - no verification of closure; 140 - no verification of closure; and 141 - target date for closure too broad, i.e. 2017 and no verification of closure.</p>	<p>CAR Ref: 158- Updated the 2016 interim audit corrective actions reports.                      Added long term preventive action, verification and completion dates on CAR 136.                      Added verification and completion dates on CAR 137, 139, 140.                      Added the exact target date for biosolids spill drill and completion date of the CAR 141.                      All future corrective action reports will be checked against the standard to have the verification and completion date when completed, long term preventive action and root causes when available.</p>
<p>Element 5 requirements 5.1 - Opportunity for improvement - Consider establishing a goal and objective for the planned project to construct a covered facility for a wastewater treatment plant on-site biosolids storage area.</p>	<p>CAR Ref: 159- The BMP team will discuss in their next meeting the opportunity to establish a new goal to cover the biosolids pad.</p>
<p>Element 5 requirement 5.2 - Opportunity for improvement - Consider expanding the measurable efficiency of the maintenance</p>	<p>CAR Ref: 160- The Project management analyst collected all 2016 and 2017 data that identify the planned vs actual maintenance hours of</p>

<p>management program goal to include specifically identifying a "planned" labor estimate for each work order assigned and comparing with the "actual" labor required to complete each work order. Measurements to include the number of work orders that include "planned" labor hour estimates verses total number of work orders issued. Also to include comparisons of "actual" labor hours required to close work orders verses "planned" estimated labor hours made.</p>	<p>labor. The biosolids supervisor will discuss the level of improvement needed with the maintenance leaders during next coordination meeting.</p>
<p>Element requirement 16 - Opportunity for improvement - Consider establishing a monthly walk around housekeeping evaluation activity involving a variety of operational personnel to conduct unannounced checks with the results presented in the "monthly chief meeting."</p>	<p>CAR Ref: 161- Generated a housekeeping checklist for operators to achieve better housekeeping in the biosolids area. The plant superintendent 1 and the program Manager will set a meeting to make a housekeeping plan for the whole plant.</p>
<p>Element requirement 17 - Opportunity for improvement - Consider regularly including a status report of the Biosolids Management Program in the Mayor's Cabinet Meeting Briefing, as was proposed management review meeting held September 25, 2017.</p>	<p>CAR Ref: 162- Since October 2017, Ms. Green has been the interim director. The biosolids supervisor will discuss in the next management review meeting with the new deputy director the opportunity to regularly include the biosolids program in the Mayor's cabinet briefing.</p>

Based on the results of the fifth Interim audit, the lead auditor recommended that the City of Richmond retains its Platinum certification level status.

## D- Goals and Objectives:

The City of Richmond Public Utilities Biosolids Management Program continued to improve and redefine its goals and objectives program. The Biosolids team established 8 SMART goals that cover each of the four outcomes focal points of the NBP program as identified below:

- Environmental Performance,
- Regulatory Compliance,
- Relations with Interested Parties, and
- Quality Biosolids Management Practices.

The biosolids team has made some modification to the current goals and added 1 new goal. Below is a summary of goals progress and achievements:

### **08/01/2012 - Reduce Methanol Consumption by 25%**

This goal, originally established in 2012 has been moved forward through 2016. The concept is to convert one of the plant digesters (#6) into a fermentation tank. The process is based on the recovery of carbon sources from primary solids. The recovered carbon from the primary sludge is in the form of volatile fatty acids (VFA). VFAs will be used in the anoxic zones of the Aeration Tanks to support denitrification, reduce the NO<sub>x</sub> load and reduce the methanol used in the Effluent Filters.

The fermentation pumps and associated piping, electrical, etc. were put into service in May 2014; and the foul air control system associated with the gravity thickeners commenced. The system was partially ready to be placed into service but the fermentation pumps had to be upgraded. Additionally through 2015 there were operational difficulties that caused the use of methanol to increase substantially from the baseline average of 2.1 gal/lb. to 3.4 gal/lb. Because of the need for addition of grinders and upgrade of the pumps the system has not been operating as intended, the target date has been stretched to October 2018.

The primary target of this goal is to improve environmental performance through quality management practices and reduce the quantity of methanol purchased. The baseline demand for methanol is 3,000 to 3,500 gallons per day and reduction in methanol consumption by 25% has a highly significant impact on costs. At current rates the overall reduction could be in the range of \$500,000 per year with no loss in quality of product.

This goal results in outcomes in all required areas; namely, environmental performance, regulatory compliance, relations with interested parties, and quality biosolids management practices.

#### **10/01/14 - Improve The Maintenance Management Work Order Processing And Closure.**

The maintenance management continue to improve their response to work requests and keep tracking the work order using the Mainsaver application.

In 2015 the target was to lower the percentage of open work orders closed in 100 days and up, to under 6%, to increase the percentage of work orders closed in less than two weeks to 90%, and to increase the percentage of work orders closed the same day to over 10%. The results thus far in 2015 showed a reduction to 3.9% open after 100 days, 40% closed in less than two weeks, and 9.6% work orders closed the same day.

The results from 2016 showed an increase of work order closed in 100 days as those closed in less than 2 weeks, the only slight improvement was the work order closed same day by 2% improvement.

In 2017 the maintenance leaders and the biosolids team refined this goal and decided to use the average time of completion work orders. The goal was updated to lower the average time required to close open work orders by 5% from 37 days to 35 days for 2017.

The results shows that the average time required to close work orders in 2015 was 84 days, in 2016 was 37 days, in 2017 was 29 days. The 5% improvement expected for 2017 was exceeded to 22%.

The biosolids supervisor will meet with the maintenance leaders to decide the level of improvement to be expected in 2018.

The reduction in time to correct operational deficiencies will improve the environmental performance of the biosolids value chain as well as the entire plant, thus minimizing the time when additional operational complications can develop. This goal also satisfies the requirements of the quality biosolids management practices outcome area.

#### **10/02/2014 - Generate Zero Noticeable Odors in the Gravity Thickening area (In Progress).**

This goal consists in eliminating the odors in the gravity thickening area and maintain zero noticeable odor in the area for 2 years after startup of the fermentation process. In 2013 the WWTP installed an odor control system through covers on the thickening tanks and biofilters and carbon filters. Once fermentation system begin, odor monitoring will be performed twice per day by the shift operators. An Olfactometer was purchased in 2016 to provide an objective numerical readings.

This goal associated with the fermentation operation was delayed due to rags and grit clogging the pumps. The biosolids team will start the Olfactometer and recording the data in 2018.

This goal results in outcomes in environmental performance and quality biosolids management practices. The attainment of this goal will have an impact in the relations with interested parties' outcome area though reducing noticeable biosolids odors on tours.

**01/01/15 - Improve Ratio of Preventive/Corrective Maintenance Work Hours to 70/30 (In Progress).**

This goal is established in 2015, and has long-term implications. To change the ratio of hours spent on preventive work orders to corrective work orders requires a long lead-time to attain. Preventive measures reduce the frequency and resources required for corrective measures however, many assets that have not been properly maintained will fail even if the required preventive measures are introduced. This is due to the fact that the asset may have already sustained damage because of the lack of maintenance. The true savings associated with the improvement in this ratio is the cost reduction in replacement parts, materials and equipment associated with high cost assets.

The results shows that in 2015 the ratio was 28/72 and in 2016: 33/67.

In the early 2017 the maintenance leaders and the biosolids supervisor updated the goal to improve the ratio by 5% from 33/67 in 2016 to 38/62. As of October 2017, the ratio was improved to 37/63.

The maintenance leaders are increasing as much as possible the number of assets in the preventive maintenance program to increase the preventive hours used for maintenance, and hopefully concurrently reduce the corrective hours required in the future.

This goal results in outcomes in environmental performance and quality biosolids management practices.

**02/19/16 - Remove 90% of the influent grit through the new headworks degritting operation**

This is a new goal in 2016, it consist in removing 90% of the grit coming to the plant. The addition of a new headworks operation is the action plan required to ensure this goal and objective is attained. The final engineering design was completed in June 2016. Permitting and approvals were granted in August, In August 2017 eight firms were determined to be qualified contractors eligible to bid on the contract. Construction and project completion is set for August 2020.

This goal and objective will result in outcomes in environmental performance and quality biosolids management practices.

**BMP Element 5.1 — Goals and Objectives for Continual Improvement  
City of Richmond Public Utilities – Wastewater Treatment**

Date of Last Review 10/27/17	Revision 16	Revised By Biosolids Team	Revision Date 10/27/17	Supersedes all previous versions
		Approved By Biosolids Supervisor	Approval Date 10/27/17	

**Table 5.1 – Biosolids BMP Goals and Objectives**

Outcome E.R.R.I.Q	Goal origination date	Goals	Action Plan	Person(s) Responsible	Resources	Target Date	Progress to Date
Outcomes : Environmental performance ( <b>E</b> ), Regulatory compliance ( <b>R</b> ), Relations with interested parties ( <b>RI</b> ), and Quality biosolids management practices ( <b>Q</b> )							
E,R	08/01/12	Reduce methanol consumption from 2 gall per lb. of Nitrate/Nitrite (NOx) reduced to 1.6gall/lb	2/1/2014: placed #s 5-8 pumps into service 5/1/2014: Start-up Fermentation Tank (Digester #6) 5/1/2014: Put in service All six fermentation pumps and associated piping, electrical, etc. in conjunction with the` start-up of the Fermentation Tank 5/1/2014: Complete the foul air system for the Gravity Thickeners Feb-15: Startup Process. May-15: Bypassed the fermentation feed pumps Installed Plant water flushing lines. Recommended to upgrade the pumps. Optimization of the process. Design and install new pumps	Edwin Edmondson Operations Superintendent II	Staff time, financing the project	Oct 2018	9/22/2014: All work in Digester #5 was completed. 10/30/2014: Pumps 1-4 were placed on line. 1/29/2014: Pumps #s 5-8 were placed into service. As Nov-14: System is ready to start and waiting to resolve some issues in the process of gravity thickening. As Dec-14: 2.1 gall/lb used. As of Mar-2015: startup attempt (see summary of actions) As of July-15: 3.4 gal/lb used due to change in the process. Target date was Oct 2015 stretched to 2017. As of July 16: 1.9 gal/lb used. As of April 17: System shut down.

**BMP Element 5.1 — Goals and Objectives for Continual Improvement  
City of Richmond Public Utilities – Wastewater Treatment**

SMART: Specific: the fermentation process will generate Fatty Acids that can substitute the methanol and be used for denitrification process, the plant Manager will ensure all resources needed are available.  
 Measurable: The metric used to measure this goal is the amount of gallons of methanol per pounds of Nitrate/Nitrite reduced.  
 Achievable: An action plan is made available to achieve this goal.  
 Relevant: This goal will enable the plant to use natural source of carbon and It is a rewarding goal, the theoretical annual saving cost can be up to \$500,000  
 Time bound: The original completion date was 2014, However due to complications, it was extended to Oct 2018.

Outcome E.R.R.I.Q	Goal origination date	Goals	Action Plan	Person(s) Responsible	Resources	Target Date	Progress to Date
E- Q	10/01/14	Lower the Average time of completion of Work Order related to the biosolids area by 5% from 37 to 35 days for 2017	Discuss the open WO in weekly meeting Collect the data from the Mainsaver and email a semiannual report.	Cordell Hayes Program manager	Staff time, communication tools	Dec 2017	As dec-14, 8.7% of WO closed in 100 days and up, 7.8% closed the same day 86% closed in less than 1 week. As of Aug-15:- 4% WO closed in 100 days and up – 9.6% closed same day -40% in less than 2 weeks. Nov-16: 13/12/38 As of Feb-17 updated the goal and set 5% improvement. 2015:84 days 2016:37 days June-2017: 33 days. Oct-2017: 29 days.
<p>SMART: Specific; The program Manager will ensure and support the maintenance group to lower the average time of completion of work order in the biosolids area by 5%.                      Measurable: Measured by the average time of completion of W.O.                      Achievable: An action plan with steps established to achieve this goal.                      Relevant: Completing the WO on timely manner will improve the biosolids equipment and run at its optimum level.                      Time bound: The time frame to complete this goal is set as 2016.</p>							

**BMP Element 5.1 — Goals and Objectives for Continual Improvement  
City of Richmond Public Utilities – Wastewater Treatment**

Outcome E.R.R.I.Q	Goal origination date	Goals	Action Plan	Person(s) Responsible	Resources	Target Date	Progress to Date
E- RI	10/02/14	Zero noticeable odors in the gravity thickening area upon the start-up of the fermentation process.	<p>Install a cover on the gravity thickening tanks.</p> <p>Nov-2014: Start-up Fermentation Tank, Start up the odor control system; Bio-filters and Carbon filters</p> <p>Shift operators will check the thickening areas twice per day for any noticeable odor and report to the biosolids sup if there is any.</p> <p>Feb-15: Startup Process attempts. Ragging problem. Awaiting on fermentation startup.</p> <p>Calibrate olfactometer.</p>	Edwin Edmondson Operations Superintendent II	Staff time, financing the project	Dec 2018	<p>-5/1/2014: completed The foul air system for the Gravity Thickeners</p> <p>- As Nov-14: System is ready to start and waiting to resolve some issues in the process of gravity thickening.</p> <p>May-16: odor control system in service.</p> <p>Sept-16 Ordered an Olfactometer.</p> <p>Oct-17: Operator started using the device to be more familiar with.</p> <p>See Odor monitoring <a href="#">log sheet</a></p>
	<p>SMART: Specific; the odor control improvement is related to the biosolids area and specify the responsible person.</p> <p>Measurable: Measured by number of noticeable odor incidents that the shift operator may report.</p> <p>Achievable: An action plan and an odor control system has been installed to achieve this goal.</p> <p>Relevant: the odor control goal associated with the fermentation system will maintain a good and safe work environment and prevent a potential public complaint.</p> <p>Time bound: The time frame to complete this goal is set as 2016.</p>						
E- Q	01/01/2015	Improve the ratio Preventive/ Corrective maintenance work hours to 38/62 for 2017	Put all assets in the system	Cordell Hayes Program manager	Staff time	Dec-2017	<p>-Aug-15: 28/72</p> <p>-Aug-16: 33/67</p> <p>-June-17: 34/66</p> <p>-Oct-17: 37/63</p>
	<p>SMART: Specific; the Program Manager will ensure all resources needed are available to improve the preventive work and lower the corrective work hours by 38/62 for 2017 in the biosolids area.</p> <p>Measurable: the metric to measure this goal is the hours spent in preventive vs corrective work.</p> <p>Achievable: The maintenance manager will ensure that all assets in the system and more focus on preventive maintenance.</p> <p>Relevant: Achieving this goal will improve the biosolids equipment and run at its optimum level.</p>						

**BMP Element 5.1 — Goals and Objectives for Continual Improvement  
City of Richmond Public Utilities – Wastewater Treatment**

Time bound: The time frame to complete this goal is set as 2017.

Outcome E.R.R.I.Q	Goal origination date	Goals	Action Plan	Person(s) Responsible	Resources	Target Date	Progress to Date
RI, Q	02/19/16	Install a new head works to Remove 90% of influent grit.	<p>Establish a system that records 100% of grit removed at wastewater treatment plant by Nov-16.</p> <p>June-16: Final engineering design.            Aug-16: Permitting/Approvals.            Mar-17: Bid and Award.            Aug-19: Construction and Project closeout.</p> <p><a href="#">See Milestone list for details</a>  <a href="#">Grit Sampling Study</a></p>	Alleyne Edward Engineer-Tech services	Finance	Aug-20	<p>As of Feb-16: Preliminary engineers report is available.</p> <p>Oct-16: RFQ phase of the project awaiting work order revisions to cover proposed construction estimated costs.</p> <p>Dec-16: RFQ is currently in Procurement Services, Permit submittals are ongoing, and Grit 1 MCC Amendment proposal is outstanding.</p> <p>As of Aug-17: RFQ phase, selected 8 qualified contractors for IFB.</p>
<p>SMART: Specific: The lead engineer will ensure the project and design cover the wastewater plant need to remove 90% of the grit entering the plant and ultimately the biosolids area.</p> <p>Measurable: Measured by the percentage (90%) of influent grit to be removed.</p> <p>Achievable: The target amount of grit to be removed relies on studies and researches as described, Milestones are available on P-drive.</p> <p>Relevant: The amount of grit removed will improve the process and prevent damage to machinery.</p> <p>Time bound: The time frame to complete this goal is set as 2020.</p>							

**Submitted By: BMP team**  
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