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Secretary for
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State Water Resources Control Board

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Arnold Schwarzenegger
Governor

January 20, 2010

FIRST CLASS AND ELECTRONIC MAIL

Mr. Dennis F. Laniohan, Operational Services Director
Delta Diablo Sanitation District
2500 Pittsburg-Antioch Highway
Antioch, California 94509-1373

CONDITIONAL NOTICE OF APPLICABILITY, DELTA DIABLO SANITATION DISTRICT, CONTRA COSTA COUNTY

On November 21, 2009, Delta Diablo Sanitation District (District) submitted a complete application for coverage under the State Water Resources Control Board's Order No. 2009-0006-DWQ, the General Waste Discharge Requirements for Landscape Irrigation Uses of Recycled Water (General Permit). The application package included the following elements:

- A complete Notice of Intent (NOI) form;
- An Operations & Maintenance Plan;
- Additional technical information on nitrogen loading and antidegradation analysis;
  Administrative Draft Technical Memorandum- Plan for Agronomic Application of Nitrogen; and
- A $2759 application fee.

The District is the Administrator, Producer, and Distributor of the recycled water. It has certified in the Notice of Intent (NOI) that its wastewater treatment facility in Antioch produces disinfected tertiary treated recycled water. The District conveys and distributes the recycled water to the points of use within the jurisdiction of the California Regional Water Quality Control Board, San Francisco Bay (Region 2), and the Central Valley Regional Water Quality Control Board (Region 5). A duly authorized representative signed the NOI form, thereby agreeing to meet terms and conditions of the General Permit to ensure safe and proper use of recycled water in the designated use area.

Existing Requirements

Region 2 currently regulates the use of recycled water under a General Water Reuse Order No. 96-011. Waste Discharge Requirements Order No. R2-2009-0018[1] currently

[1] NPDES Permit Number *CA0038547*; WDID *2 071013001*

prescribes water reclamation requirements associated with the production of disinfected tertiary recycled water. The District has requested rescission of the existing Order No. 96-011 upon obtaining authorization to use recycled water under the subject General Permit. By issuing this Notice of Applicability (NOA), the State Water Resources Control Board (hereafter "State Water Board") requests Region 2 to rescind any duplicative water recycling requirements in the existing Order No. 96-011 or Waste Discharge Requirements Order No. R2-2009-0018. Any requirements that may exist for the production, distribution, or use of recycled water within Region 5 are unknown.

Proposed Recycled Water Use

The District has proposed to use 487 acre feet per year of tertiary treated municipal recycled water to irrigate 115-acres of designated use area. The designated use area consists of approximately 30-acres of golf course, and 85 acres of parks consisting of trees, shrubs, and grasses.

Board staff evaluation of District's proposed project has concluded that irrigation water use of 487 acre feet per year on 115-acres of designated use area exceeds agronomic application rate. Thus, the proposed volume of recycled water for irrigation of golf course and parks would violate agronomic rate requirement of the General Permit (i.e., Specification No. B.4). In addition, 487 acre feet per year of recycled water application is likely to cause excessive nitrogen loading in the designated use area. Consequently, it will have a long term adverse impact on the underlying soils and groundwater resources. Although, subject recycled water use can be authorized under the following limiting conditions (see enclosed Board staff memorandum):

Approved Recycle Water Use

- You are approved to an annual maximum recycled water use of 200 acre feet on 115-acres of designated use area.

- Recycled water use to irrigate 30 acres of golf course must not exceed 52 acre feet per year.

Conditions of Approval

1 In addition, the District must implement the proposed additional monitoring plan and submit reports accordingly.

2. You must not apply any supplemental nitrogen fertilizer in the designated use area since sufficient nitrogen for plant uptake is available in the recycled water.

3. To obtain authorization up to the maximum annual recycled water use of 487 acre feet, the District should submit the following technical reports for consideration:

   - A complete water balance report for the proposed recycled water use area including any additional land purchased or leased for recycled water use, identifying parcels by number showing sufficient disposal capacity. The water balance report must incorporate factors such as rainfall, evaporation, evapotranspiration, soil moisture, and sustainable percolation rate of the use area soils. It must also consider annual storm water that would occur every 100 years, distributed monthly in accordance with historic rainfall patterns.

   - A nitrogen balance report based on optimum hydraulic loading rate including annual nitrogen uptake rate of use area's grasses/crops/shrubs/trees; background soil nitrogen concentration of use area soils, and percolating nitrogen beyond the root zone using appropriate design methodology and assumptions in your calculations.

   - All technical reports shall be prepared by a California registered civil engineer or appropriate licensed professional experienced in the design of recycled water use and disposal facility. Upon acceptance and approval of the technical reports, if it is found that the District has satisfied Specification No. B.4 of the General Permit, a revise Notice of Applicability (NOA) authorizing recycled water use to the proposed maximum amount of 487 acre-feet will be prepared for the Executive Director approval.

Pursuant to California Water Code §13552.5 (d) (3), the State Water Board posted the subject recycled water use application and technical reports on its website on November 24, 2009 for 30 days public review and comments. The comment period ended on December 24, 2009. Except for the California Department of Public Health (CDPH), the State Water Board did not receive any other comments from the public. The CDPH has provided the following specific comments to be included in the NOA as additional conditions for approval:

4. The User Manual indicates only one user supervisor for all sites. The CDPH requires at least one alternate. In addition, field staff acting as landscape foremen should also be trained and given responsibility as recycled water user supervisor.

5. Appendix C of the User Manual, specifies a minimum of one-hour shutdown for a cross connection test procedure for landscape irrigation. CDPH believes that parks can generally be shutdown longer.

6. CDPH requires clarification where step 15 of the test states, "confirm recycled water system is pressurized by operating a few sprinklers." CDPH believes that it means pressurized when the nearby potable fixture is checked for flow.

7 CDPH requests timely notice and invitation for a site inspection including observation of the cross connection control test, and protection of drinking water fountains and eating areas.

8 CDPH has indicated that the Use Permit Section 2.3.1 specifies there shall be no common trench construction. Whereas Appendix F shows a drawing allowing common trench construction. This is not acceptable to the CDPH.

9. CDPH has requested review of the recycled water mains in public streets for 4-foot separation to potable water mains.

10. CDPH requests review of the recycled water tank plans for a possible potable water make-up line requiring a proper air gap.

11. The local CDPH district office has requested that monthly monitoring reports submitted to the Regional Water Quality Control Board shall also be provided to them.

12. The local CDPH district office has requested that whenever specific information on each specific use site is available, the District shall submit it to the local CDPH office for review and approval. In addition, the CDPH requires that subject report must include at least the following:

    - Name and contact information for each user site's supervisor and the training they received with a copy of training certificate (if any);

    - Provide on-site plans for location of signs, drinking water fountains, eating areas, and recycled water lines of use area sites for a 4-feet separation from potable water lines.

This NOA incorporates by reference these additional conditions of approval pursuant to Provision C. 3 of the General Permit. Provision C.3. of the General Permit states the following:

> *"CDPH may identify in its recommendations with respect to the proposed recycled water use any conditions upon which its approval of a proposed project is based. Conditions of approval submitted as part of CDPH's recommendations will be incorporated into a Notice of Applicability for the proposed recycled water use project."*

Spill Reporting

The Administrator must immediately[2] report unauthorized discharge of 50,000 gallons or more of "disinfected tertiary recycled water" to the Regional Water Board of jurisdiction; if the jurisdiction is unclear, a report shall be made to both Region 2 and Region 5 Water Quality Control Boards. A written report must also be provided to the State Water Board within five (5) business days of the time the Producer or Distributor becomes aware of the incident. The Producer or Distributor must also report the unauthorized discharge of 1,000 gallons or more of "disinfected tertiary recycled water' to the Regional Water Board of jurisdiction as soon as possible, but no later then seventy-two (72) hours after becoming aware of the unauthorized discharge.

Applicability

This NOA shall serve as a formal notice to the District that proposed production and distribution of recycled water as identified in their application package including terms and conditions specified herein qualifies it to be enrolled in the General Permit. If the use of recycled water violates the terms and conditions of the General Permit, either the State Water Board or the Regional Water Quality Control Board may take enforcement action against the Producers or Distributors for violations of any part of the General Permit.

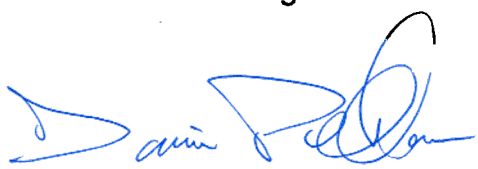
Coverage under the General Permit is not transferable. The Administrator shall notify the Executive Director in writing at least thirty (30) days in advance of any change in ownership related to the Administrator, Distributors, or Producers authorized to use recycled water pursuant to this NOA. To assume operation under this Order, the succeeding owner or Administrator must submit a complete application for coverage under the General Permit. The District shall report promptly to the State Water Board and the Regional Water Board of its jurisdiction in writing for any material change or

[2] As soon as the Producer or Distributor has knowledge of the discharge, notification is possible, or notification can be provided without impeding cleanup or other emergency measures.

proposed change in the character, location, or volume of the recycled water other than what is authorized by the General Permit.

Based on the information provided, the proposed use of recycled water satisfies the eligibility requirements of the General Permit including conditions set forth in this NOA. By issuing this NOA, the State Water Board has enrolled the proposed recycled water use under the General Permit and have set-up the following identification information for the user: General Permit Enrollee No. 2009-0006-DWQ-001, WDID 2 07REC0001.

If you have any questions regarding this NOA, please contact Jagroop Khela at (916) 341-5560. To expedite service, please refer to the identification information listed above when discussing this NOA.



Darrin Polhemus, Deputy Director
Division of Water Quality

Enclosure: (State Water Board staff memorandum "Delta Diablo Sanitation District, Contra Costa County")

cc: **(Via First Class Mail)**

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Ms. Mary Grace Pawson
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Mr. Dennis F. Laniohan
Delta Diablo Sanitation District
WDID No. 2 07REC0001
General Permit Enrollee No. 2009-0006-DWQ-0001

cc: (Continuation page)

bcc **(Via e-mail)**

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Arnold Schwarzenegger
Governor

TO: Darrin Polhemus, Deputy Director
DIVISION OF WATER QUALITY

FROM: Jagroop S. Khela, MS, MBA
DIVISION OF WATER QUALITY

DATE: JAN 2 0 2010

SUBJECT: DELTA DIABLO SANITATION DISTRICT, CONTRA COSTA COUNTY

Delta Diablo Sanitation District (District), submitted an application package including a technical report and memorandum for coverage under the State Water Resources Control Board's Water Quality Order No. 2009-0006-DWQ (General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water).

This memorandum provides a technical discussion on elevated level of nitrogen found in the proposed municipal recycled water to be used for irrigating a golf course and parks. Particularly, it is in response to recently submitted nitrogen sampling results and District's proposed plan for agronomic application of recycled water on 115 acres of parks and golf course (hereafter designated use area). The discussion is primarily focused on the following technical reports submitted by the District:

- Additional technical information on nitrogen loading and antidegradation analysis, December 1, 2009,
- Administrative Draft Technical memorandum- Plan for Agronomic Application of Nitrogen, December 10, 2009,
- E-mail from the District on December 31, 2009 verifying total volume of recycled water and actual acreage of application area.

ISSUE

The District submitted a technical report dated December 1, 2009, including analytical results of effluent samples from the District's disinfected tertiary treated municipal wastewater treatment plant. The report indicates that the proposed municipal recycled water exhibits a total nitrogen concentration of 37 mg/L of which total kjeldahl nitrogen equals to 36 mg/L, and Nitrate-Nitrite equals to 1 mg/L. Based on a total effluent nitrogen concentration, it is expected that proposed recycled water use would contribute

to 379/lbs/acre/year of nitrogen in the designated use area. Further, the report shows that the subject recycled water will be used to irrigate 30-acres of "turf grass" of the golf course and remaining 85 acres of parks consisting of grasses, trees, and shrubs. The turf grass has a nitrogen uptake of 174/lbs/acre/year. Thus, it is fair to state that the proposed municipal recycled water use will contribute approximately **double** the amount of nitrogen than what the turf grass can uptake as nutrient.

In response to my e-mail regarding the analytical results and high nitrogen loading rate, the District's consultant (Winzler & Kelly) submitted a technical memorandum on December 10, 2009 (Plan for Agronomic Application of Nitrogen). The District's technical memorandum provides a brief explanation on fate of nitrogen in treated effluent, agronomic rate for turf grass, plant available nitrogen, application rate calculations, and District's proposed actions. The District states that current analytical results are not enough and definitive to perform agronomic calculations, and plan on collecting additional samples to develop a more comprehensive data set. Although, District is in agreement with Board staff's evaluation and finding that nitrogen uptake rate for turf grass of 174/lbs/acre/year[1] is consistent with various published guidelines.

DISCUSSION

The benefit of using municipal recycled water for landscape irrigation is that nutrients in the water can be taken up by the plants and removed from the designated use area. The nutrients most important to a crop's need are nitrogen, phosphorus, potassium, zinc, boron, and sulfur. Municipal recycled water usually contains sufficient amount of these nutrients to meet crop demand. The most beneficial nutrient is nitrogen but the concentration and form of nitrogen need to be considered in irrigation water. While excessive amounts of nitrogen stimulate vegetative growth in most crops, it could also delay maturity and reduce crop quality and quantity. At times the nitrogen in recycled water may not be present in sufficient amount to produce satisfactory crop yields, and some supplemental fertilizer may be necessary. However, this is not true in District's proposed recycled water use. On the other hand, excessive nitrate in forages can cause an imbalance of nitrogen, potassium, and magnesium in grazing animals. This is a concern if the forage is used as a primary feed source for livestock; however, such high concentrations are usually not expected in municipal recycled water[2]. Excessive hydraulic and nutrient loading due to landscape irrigation uses of municipal recycled

[1] University of Maryland Turf Grass Technical Update, TT118, February 2007, & Guidelines for the Determination of Agronomic Rate for Application of Reclaimed Water Under Colorado Regulation No. 84 (Reference source: Colorado State University Cooperative Extension).

[2] EPA/625/R-04/108 September 2004, Guidelines for Water Reuse, U.S. Environmental Protection Agency Municipal Support Division Office of Wastewater Management Office of Water Washington, DC.

water can result in leaching of contaminants to the groundwater and increase nitrate and salinity levels in the root zone.

Organic nitrogen when added to the soil via the recycled water application is converted into inorganic forms through decomposition. Decomposition in the upper soil layer converts nitrogen found in organic matter from ammonia (NH_3) to ammonium salts (NH_4^+). This process is known as mineralization and it is carried out by a variety of bacteria, actinomycetes, and fungi. Nitrogen in the form of ammonium can be absorbed onto the surface of clay particles in the soil. The ammonium ion has a positive molecular charge and is held by soil colloids. Ammonium is released from the colloids by way of cation exchange. When released, most of the ammonium is often chemically altered by a specific type of autotrophic bacteria (bacteria that belong to the genus Nitrosomonas) into nitrite (NO_2^-). During the wet cycle, ammonium is adsorbed onto the soil in the vadose zone. As the soil dries and oxygen enters the soil, the oxidation of ammonia to nitrate by autotrophic nitrifiers may occur. This process results in a high nitrate concentration at the beginning of the following wet cycle. The nitrate, which tends to be more mobile, is transported with the percolating water deeper into the vadose zone. Once the nitrate reaches an anoxic zone, heterotrophic denitrification may convert the nitrate to nitrogen gas in the absence of oxygen (Gable and Fox, 2000)[3].

The nitrogen gas then migrates through unsaturated soil back to the surface where it is lost to the atmosphere. Some volatilization of the ammonia can also occur at the soil surface. Ammonium volatilization occurs when ammonium converts to ammonia and enters the atmosphere. High temperatures, high pH, and high concentrations of ammonium and ammonia in the irrigation water can all contribute to higher percentage of ammonia volatilization[4]. Further, it is known that another type of bacteria belonging to the genus Nitrobacter converts the nitrite to nitrate (NO_3^-). However, nitrate is very soluble and it is easily lost from the soil system by leaching. Both of these processes involve chemical oxidation and are known as nitrification. Nitrification is a conversion process, not a removal process for nitrogen.

Denitrification is common in anaerobic soils and is carried out by heterotrophic bacteria. The process of denitrification involves the metabolic reduction of nitrate (NO_3^-) into nitrogen (N_2) or nitrous oxide (N_2O) gas. Both of these gases then diffuse into the

[3] Gable, J.E. and P. Fox (2000), Nitrogen Removal During Soil Aquifer Treatment By Anaerobic Ammonium Oxidation (ANAMMOX), Proceedings of the Joint Conference Held by WEF and AWWWA, San Antonio, TX.

[4] Process Design Manual Land Treatment of Municipal Wastewater Effluents, EPA/625/R-06/016 September 2006.

atmosphere. Denitrification occurs when denitrifying bacteria commonly present in the soil are stressed for lack of available atmospheric oxygen gas in the soil air. When the soil is irrigated or when rainfall occurs, the water moves into the soil pores and tends to exclude the air from the same soil pores (Dinnes, et al, 2002)[5]. This water reduces the amount of oxygen gas in the soil. The nitrate-nitrogen contains an alternate source of oxygen which these special denitrifying bacteria can use for growth. As a result, the nitrate-nitrogen is converted to nitrogen gas (N_2).

Denitrification, volatilization, soil storage, and crop uptake are considered true nitrogen removal pathways available[6]. Crop uptake is the major pathway considered in the design of most slow-rate systems, but the contribution from denitrification and volatilization can be significant depending on site conditions and wastewater type. Immobilization and soil storage can be significant with wastewaters having a carbon-to-nitrogen (C: N) ratio of 12:1[7] or more. Both nitrification and denitrification are accomplished by soil bacteria. The optimum temperature for nitrogen removal is 30°C to 35°C (86°F to 95°F). Both processes proceed slowly between 2°C and 5°C (36°F and 41°F) and stop near 0°C (32°F)[8]. Nitrification rates decline sharply in acidic soil conditions and reach a limiting value at approximately pH 4.5. The denitrification reaction rate is reduced substantially by pH values below 5.5[7]. Denitrification losses in the Slow Rate systems are typically in the range of 15 to 25% of the applied nitrogen (EPA 625/1-81-013)[9]. The range of 15 to 25% should be used for conservative design (EPA 625/1-81-013). Ammonia volatilization losses can be higher (around 10%) if the soil pH is above 7.8 and the cation exchange capacity is low (EPA 625/1-81-013). For design purpose the volatilization losses shall be considered inclusive of 15 to 25% used for denitrification (EPA 625/1-81-013).

Thus, both soil temperature and pH must be considered if nitrogen removal is important. Nitrogen removal is also a function of detention time, BOD: N ratio, organic carbon source, and anoxic conditions. The nitrogen present in typical municipal wastewater is usually present as organic nitrogen (about 40 percent) and ammonia/ammonium ions (about 60 percent)[3]. All nitrogen absorbed from the soil by

[5] Dinnes, Dana L., Douglas L. Karlen, Dan B. Jaynes, Thomas C. Kaspar, Jerry L. Hatfield, Thomas S. Colvin, and Cynthia A. Cambardella. Nitrogen Management Strategies to Reduce Nitrate Leaching in Tile-Drained Midwestern Soils. Agron. J. 94:153-171 (2002).

[6] Dinnes, Dana L., Douglas L. Karlen, Dan B. Jaynes, Thomas C. Kaspar, Jerry L. Hatfield, Thomas S. Colvin, and Cynthia A. Cambardella. Nitrogen Management Strategies to Reduce Nitrate Leaching in Tile-Drained Midwestern Soils. Agron. J. 94:153-171 (2002).

[7] Process Design Manual Land Treatment of Municipal Wastewater Effluents, EPA/625/R-06/016 September 2006.

[8] Tchobanoglous, G., F.L. Burton and H.D. Stensel (2002), Wastewater Engineering, Treatment and Reuse, Fourth Edition, McGraw-Hill, New York.

[9] Process Design Manual For Land Treatment of Municipal Wastewater, USEPA, EPA625/1-81-013

plant roots is in the inorganic form (i.e., nitrate or ammonium). Generally young plants absorb ammonium more readily than nitrate; however, as the plant ages the reverse is true. Soil conditions that promote plant growth also promote the microbial conversion of ammonium to nitrate[3]. The design of all land treatment systems, wetlands, and similar processes is based on the *Limiting Design Parameter* (LDP) concept (Crites et al., 2000)[10]. The LDP is a factor, which controls the design and establishes the required size and loadings for a particular system. If a system is designed for the LDP it will then function successfully for all other less-limiting parameters of concern. Nitrogen loading is commonly the LDP in land treatment of wastewater effluents[11].

When the municipal recycled water contains a high carbon to nitrogen (C:N) ratio, significant denitrification and immobilization occurs[12]. Nitrogen in wastewater goes through transformations when applied to the soil matrix. The transformations are both chemical and biological and are a function of temperature, moisture, pH, C:N ratio, plant interactions, and equilibrium with other forms of nitrogen[13]. Because of large influence of organic carbon on available nitrogen, a factor has been developed to account for nitrogen lost to denitrification, volatilization, and soil storage. Nitrogen, phosphorus, and potassium are considered the essential macronutrients and are required at moderately high levels to support a healthy crop. Nitrogen is particularly sensitive because of the potential for this nutrient to migrate through the root zone of plants and to groundwater. Any wastewater treatment operation should include a nutrient management plan that incorporates plans for management of nitrogen, phosphorus, and potassium. Treated wastewater contains many essential nutrients, but in ratios often inadequate for many plants. Prior to developing a nutrient management plan, the form of nutrient present in a wastestream must be determined and specific plans must be developed to assure proper utilization. All crops require a balanced nutrient input: optimum N:P:K ratios are generally 4:1:2[13]. If these ratios are not available in wastewater, adjustments should be made to correct the imbalances.

[10] Crites, R.W., S.C. Reed, and R.K. Bastian (2000), Land Treatment Systems for Municipal and Industrial Wastes. McGraw-Hill Book Co. New York.
[11] Process Design Manual Land Treatment of Municipal Wastewater Effluents, EPA/625/R-06/016 September 2006.
[12] Reed, S.C., R.W. Crites and E.J. Middlebrooks (1995), Natural Systems for Waste Management and Treatment, Second Edition, McGraw-Hill, New York, NY.
[13] Process Design Manual Land Treatment of Municipal Wastewater Effluents, EPA/625/R-06/016 September 2006.

Agronomic Rate

Agronomic rate refers to a specific rate of recycled water application that provides optimum amount of nutrients, which selected grasses/crops require without having any excessive nutrient percolate beyond the root zone. Hence, any application of recycled water beyond what the plants require likely result in nutrients percolating below the root zone and eventually reaching the ground water overtime[14]. Thus it is important to know the amount of nutrient requirement of the use area' grasses/crops; residual nutrient loading in the soils and the nutrient content of the recycled water prior to its use. Thereafter, only the difference between what is needed and what is available in the soil shall be applied.

Agronomic rate also means that hydraulic loading must be determined. Similarly, the hydraulic loading" includes the optimum amount of moisture that the plant needs. Hence, the hydraulic loading also needs to be determined for each land application area prior to irrigation. Soil moisture samples are to be determined prior to irrigation. Water balance shall not begin until the soil water content in the root zone is known. The hydraulic loading method provided by the District for the Golf course is acceptable. However, LDP in District's proposed project is the nutrient loading (i.e., nitrogen loading in particular) not the hydraulic loading.

District's Response to Nitrogen Loading Issue

District estimates that 55% of ammonium nitrogen is available in the recycled water whereas 45% is lost as gas. In addition, the report states that about 35% of the applied organic nitrogen is likely to be present in the recycled water. Based on these assumptions, the District has provided the following agronomic rate calculation:

Total applied nitrogen = 55% of ammonium N + 35% of organic N + nitrate/nitrite N
Total applied nitrogen = 0.55* (76lbs/ac/yr) + 0.35* (303lbs/ac/yr) + 7lbs/ac/yr
Total applied nitrogen = 155 lbs/ac/yr

Comments

The District's assumptions lack technical evidence and are inconsistent with standard design manual(s) or any applicable published technical guidelines. As discussed above, if actual nitrogen losses due to denitrification and volatilization are not based on

[14] Determination of Agronomic Rate for Application of Reclaimed Water under Colorado Regulation No. 84 (Reference source: Colorado State University Cooperative Extension).

field sampling than appropriate design assumptions should be used. EPA's prescribed design manual recommends only 15 to 25% of total nitrogen losses (see footnote 9), which is inclusive of denitrification and volatilization losses for Slow Rate (SR) systems. The proposed recycled water use constitutes an SR system whereby municipal recycled water is being used to irrigate turf grass of the golf course and parks. Based on the current information, it is reasonable to state that proposed amount of recycled water to irrigate 115 acres of parks and a golf course pose a significant long term impact to the underlying groundwater:

Facts Summary

- District's technical report of December 1, 2009 includes a nitrogen balance based on 150 acre feet per year of proposed recycled water use on 30-acres of golf course. The technical report also includes analytical results, which shows a total nitrogen concentration in the proposed recycled water equals to 37 mg/L.

- On December 31, 2009 the District submitted a correction via an e-mail indicating a total use area of 115 acres instead of only 30 acres of golf course with a revised annual recycled water use of 487 acre feet per year.

- The District has not provided a complete water balance and nitrogen balance for 115 acres of designated use area lacking in part, annual irrigation demand of use area grass/plants, type of plants/crop, design percolating nitrogen concentration beyond root zone, and a risk assessment.

Based on the facts listed above following scenarios arise:

Scenario

The proposed recycled water use of 150 acre feet per year on 30 acres of golf course would result in substantial nitrogen overloading in the use area. The desired nitrogen loading should be 174lbs/acre/year or less whereas the proposed application would result in 379 lbs/acre/year. This would likely have a long-term significant impact on the underlying groundwater.

Scenario 2

Based on District's corrected information send via email on December 31, 2009, the use area consists of 115 acres and total annual recycled water use would be 487 acre feet. The District has not provided any water balance or nutrient balance on remaining

(i.e., 115 – 30) 85 acres of designated use area. Based on observed recycled water nitrogen concentration of 37 mg/L and 487 acre feet of water use the proposed project would result in the following:

Calculations

1 million gallons = 3.07 acre feet

Therefore, 487 acre feet = 487/3.07 = 158.631 million gallons (MG)

(158.631 MG/yr) × (37 mg/L) × (8.34) = 48950.63 ~ 48951 lbs/yr

$$\frac{48951 \text{ lbs/yr}}{115 \text{ acres}} = 426 \text{ lbs/acre/year}$$

Let's assume all of the use area is planted with turf grass just like the golf course (i.e., 30 acres), which has an agronomic nitrogen uptake rate of 174 lbs/ac/yr, and assuming denitrification and volatilization losses of 15% (see foot note No. 9):

[426- (15% × 426lbs/acre/year)] – (174 lbs/acre/year) = 188 lbs/acre/year

Thus, the proposed recycled water use would result in approximately **188 lbs/acre/year of excess nitrogen loading** in the designated use area.

Conclusions

1 The District's proposed recycled water use is inconsistent with agronomic rate requirement of the General Permit [i.e., Specification B.4].

2. The nutrient balance included in the technical report contains several deficiencies, which are highlighted in the Discussion section of this memorandum.

3. The proposed annual recycled water use of 487 acre feet per year on designated 115 acres of use area must not be allowed until the District provides a technical report proposing a corrective action including an appropriate nutrient and water balance analysis. The District must demonstrate that the proposed recycled water use meets the agronomic rate requirement of the General Permit.

4. The District has conveyed to the Board staff that even upon issuance of a Notice of Applicability (NOA) by the State Water Board, it would at least require one year for the recycled water system to be fully functional. In the interim, the

District has proposed additional monitoring of nitrogen constituents to address the nitrogen issue. Specifically, the plan entails collecting additional samples and conducting field investigations to determine actual nitrogen content in the recycled water, and determine actual volatilization and denitrification losses.

However, it should be clear that District's proposed additional monitoring plan has no significance on what amount of recycled water use can be allowed under the present circumstances. The fact of the matter is that proposed recycled water use contains elevated levels of nitrogen and exceeds maximum allowable design limit.

5. Presently, the District should be conditionally approved to an annual maximum recycled water use of 200 acre feet on 115-acres of designated use area. This is consistent with agronomic nitrogen loading rate [i.e., $N_{(recycled\ water)}$= 37 mg/L, 115 acres of turf grass with annual nitrogen uptake rate of 174 lbs/ac/yr]. Similarly, proposed recycled water use to irrigate 30 acres of golf course should not exceed 52 acre feet per year. In addition, the District must implement the proposed additional monitoring plan and submit reports accordingly.

6. To obtain authorization up to the maximum annual recycled water use of 487 acre feet on 115 acres of designated use area the District should submit the following for approval:

   - A complete water balance report for the entire designated use area (i.e. 115 acres consisting of parks and golf course), identifying parcels by number, showing sufficient recycled water use/disposal capacity. The water balance report must at least incorporate factors such as rainfall, evaporation, evapotranspiration, soil moisture, and sustainable percolation rate of designated use are soils. It must consider annual storm water that would occur every 100 years, distributed monthly in accordance with historic rainfall patterns.

   - A nitrogen balance report indicating the hydraulic loading rate, annual grasses/crops/shrubs/trees nitrogen uptake rate, background soil nitrogen concentration of designated use area soils, and estimating percolating nitrogen concentration beyond the root zone of plants using appropriate design methodology and assumptions in calculations.

   - The District shall submit requested technical reports to the SWRCB and satisfy Specification B.4 of the General Permit to obtain approval for the maximum proposed annual recycled water use of 487 acre feet.

Suggestions

1 It is obvious that District's wastewater treatment plant is not currently nitrifying/denitrifying its waste stream. As discussed in detail above (see Discussion section), bacteria remove nitrogen from wastewater by a two step biological processes: nitrification followed by denitrification. The District must seriously consider implementing this cost effective biological nitrogen removal processes such as nitrification and denitrification to substantially reduce its effluent nitrogen concentration. This could be a viable long term cost effective option to reduce effluent nitrogen resulting in enhanced use of municipal recycled water with less than significant environmental impacts.

2. The District must not apply any additional nitrogen fertilizers on the designated use area grasses since the recycled water used for irrigation contains abundance of nitrogen.