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NOTICE OF APPROVAL FOR COVERAGE UNDER THE STATE WATER RESOURCES CONTROL BOARD ORDER NO. 2009-0006-DWQ

1. The Delta Diablo Sanitation District (District) is approved up to a maximum of 487 acre feet per year (acft/yr) of recycled water use to irrigate 117.1-acres of designated use area. However, during drought conditions the recycled water use can be increased and adjusted to meet the irrigation demand as specified in Table 1, below.

TABLE 1

Rainfall Condition	Total Rainfall (inches)	Irrigation Demand (inches)	Irrigation Demand Volume (acft/yr)
Drought (1976)	5.9	51.5	503
Average	13.3	46.1	450
100-yr rainfall (1952)	24.0	42.4	413

2. The application of recycled water in the designated use area is limited to a maximum of 4.15 acft/ac/yr. However, during drought conditions the recycled water use can be increased but it must meet agronomic hydraulic loading rate on a per acre per year basis.

3. The District shall implement a two year Supplemental Monitoring and Reporting Program (SMRP) (see enclosed SMRP, Attachment B) and fully comply with report submittal requirements therein. Based on the results of the SMRP, the State Water Resources Control Board (State Water Board) may identify necessary conditions and limitations with respect to recycled water use. These conditions and limitations will be incorporated into the Notice of Applicability for the recycled water irrigation sites.

<u>Conditions of Approval</u>

A. State Water Board Conditions:

1. The District must implement the approved SMRP and submit monitoring reports as specified therein (see enclosed Attachment B).

2. The authorized area of recycled water use is limited to the 117.1 acres of designated use area.

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B. California Department of Public Health (CDPH) Conditions:

The California Department of Public Health (CDPH) has provided the following specific comments to be included in the NOA as additional conditions for approval:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

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

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

8. 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.

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9. 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:

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

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

The additional conditions of approval are incorporated by reference 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."

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SUPPLEMENTAL MONITORING & REPORTING PROGRAM

RECYCLED WATER MONITORING

Recycled water samples shall be collected at the outlet of the recycled water facility after disinfection prior to its use for irrigation of the golf course and parks (i.e., designated use area). Samples shall be representative of the volume and nature of the recycled water. Time of collection of grab samples shall be recorded. Recycled water monitoring shall include the following:

Constituent	Units	Type	Frequency
Flow	mgd	Measured	Monthly
Total Dissolved Solids (TDS)	mg/L	Grab	Monthly[1]
Nitrate-Nitrogen (NO_3-N)	mg/L	Grab	Monthly
Ammonia-Nitrogen (NH_4-N)	mg/L	Grab	Monthly
Nitrite-Nitrogen (NO_2-N)	mg/L	Grab	Monthly
pH	pH Units	Grab	Monthly
EC[2]	µmhos/cm	Grab	Monthly

DESIGNATED RECYCLED WATER USE AREA MONITORING

A. The area of land utilized for water recycling shall be recorded monthly.

B. Representative sampling locations shall be established for soil profile sampling of the designated recycled water use area (i.e., 117.1 acres including a golf course and parks).

[1] Concurrent with EC monitoring
[2] Conductivity at 25° C

C. Designated recycled water use area soil samples shall be analyzed, at a minimum, for the following constituents:

Constituent	**Units**	**Type**	**Frequency**[3]
Ammonium-N (NH_4-N)	mg/kg	Grab[4, 5]	Annually
Nitrate-N (NO_3-N)	mg/kg	Grab[4, 5]	Annually
Nitrite-N (NO_2-N)	mg/kg	Grab[4, 5]	Annually
pH	pH units	Grab[4, 5]	Annually
Exchangeable Sodium Percentage	%	Grab[4, 5]	Annually
EC	µmhos/cm	Grab[4, 5]	Annually
Depth[5]	inches	measured	Annually

REPORTING

The District must submit an annual supplemental monitoring report summarizing/interpreting analytical results of the aforementioned constituents. Annual monitoring reports shall contain all monthly monitoring results for all the constituents at the frequency specified above. Annual monitoring reports shall be submitted by **31 December of each year.**

In reporting the monitoring data, the District shall arrange the data in tabular form so that the date, the constituents, and the constituent values are readily discernible. The data shall be summarized in such a manner that clearly illustrates whether the District complies with its General Permit requirements. The SMRP requirements **are in addition to** what is annually required of the District under the General Permit.

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[3] Samples shall be collected **once prior** to recycled water application in the designated use area, **once after the first full year** of irrigation, **and once after the two full years** of irrigation

[4] The site has been subdivided into sampling zones based on soil type (labeled 1-9 on the sampling map on page A7) and surface types (fairways and greens), forming 18 sampling zones. Five to 20 soil cores will be extracted from each sampling zone (depending on its size). Subsamples for each depth within each sampling zone shall be composited (mixed), resulting in about four composite samples (one for each depth) from each sampling zone, or about 72 samples for analysis.

[5] The **pre application** and **after the first full year** of irrigation soil core grab samples shall be collected at the following depth intervals below ground surface (bgs): a) 0-6 inches ; b) 6-12 inches; c) 12-24 inches; and d) 24-36 inches. After two full years of irrigation the soil core grab samples shall be collected at depths of: a) 0-6 inches; b) 6-12 inches; c) 12-24 inches; d) 24-36 inches; e) 36-48inches; f) 48-60 inches; g) 60-72 inches. No Samples will be taken below the practicable depth by hand probe.

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If the District monitors any other constituent not listed in this SMRP at the locations designated herein, or more frequently than required by this SMRP, the results of such monitoring shall be included in the annual reports.

Within sixty days (**60 days**) **after completion of the SMRP**, the District must submit a technical report which provides findings, analysis, recommendations, and a summary of the monitoring results. If the monitoring results suggest that a corrective action is warranted to satisfy the "agronomic rate" requirement (i.e., Specification No. B.4) of the General Permit, the District must include a corrective action plan with an implementation schedule in the report.

The technical report summarizing the monitoring results, evaluations and judgments must be performed by or under the direction of California registered professionals. Pursuant to the California Business and Professions Code Sections 6735, 7835, and 7835.1, the technical report regarding corrective actions, if warranted, shall be prepared by a California registered civil engineer or appropriate licensed professional experienced in the design of recycled water facilities. 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 final NOA authorizing recycled water use to the proposed maximum amount of 487 acft/yr will be prepared for the Executive Director approval.

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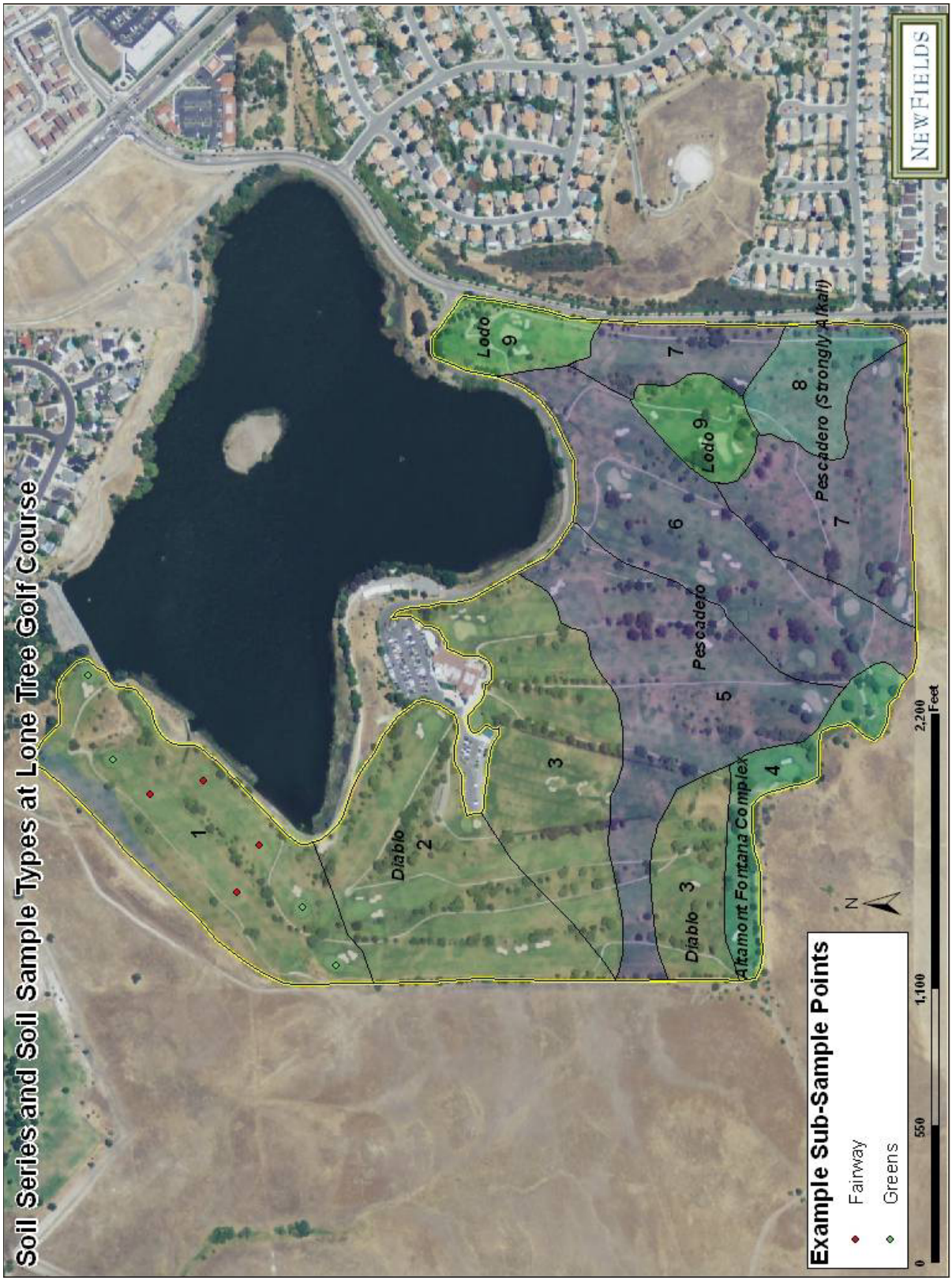

ATTACHMENT - B

PROJECT INFORMATION

Existing Requirements

The District is the Administrator, Producer, and Distributor of the recycled water. It has certified in the Notice of Intent (NOI) that its recycled water facility in Pittsburg produces disinfected tertiary treated recycled water. The District conveys and distributes the recycled water to the points of use within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (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 the terms and conditions of the General Permit to ensure safe and proper use of recycled water in the designated use area.

Region 2 currently regulates the use of recycled water under the General Water Reuse Order No. 96-011. Waste Discharge Requirements Order No. R2-2009-0018[6] currently prescribes water reclamation requirements associated with the production of the disinfected tertiary recycled water.

Based on technical reports and laboratory analysis included in the initial NOI, the State Water Board issued a conditional NOA. The conditional NOA limited the volume of recycled water use and required the District to satisfy certain conditions to obtain approval for the maximum proposed amount (i.e., 487 acft/yr). The decision to limit volume of recycled water use was based on the technical information submitted by the District. Further, in the absence of actual field investigation data, it assured that the approved recycled water use at least met the appropriate design criteria to be consistent with the agronomic rate requirement of the General Permit (see enclosed Staff analysis for technical details).

Current Proposal: The revised NOI contains the following new and revised information:

1. Revised recycled water usage:

TABLE – 1

Rainfall Condition	Total Rainfall (inches)	Irrigation Demand (inches)	Irrigation Demand Volume (acft/yr)
Drought (1976)	5.9	51.5	503
Average	13.3	46.1	450
100-yr rainfall (1952)	24.0	42.4	413

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

ATTACHMENT - B

PROJECT INFORMATION

2. Revised recycled water irrigation sites:

TABLE – 2

Site	Total Acreage	Proposed Irrigation Acres
Lone Tree Golf Course	103.5	103.5
Fairview Park	3.0	1.6
Antioch City Park	---	1.9
Mountaire Park	5.1	2.3
Chichibu Park	6.3	5.8
Median Strips	2.0	2.0
Total	**119.9**	**117.1**

3. Proposed Supplemental Monitoring and Reporting Program (SMRP):

The SMRP proposes to collect sufficient effluent and soil samples so that potential long-term impacts to the underlying soil and groundwater from the subject discharge are adequately assessed, and accordingly an appropriate agronomic rate is determined. The revised NOI contains the following elements:

- Revised water usage and irrigated acreage;
- Water Balance Report; and
- Proposed SMRP

The SMRP specifies the District's plan to conduct monthly recycled water quality sampling and annual soil sampling for two years. Further, it states that soil samples will be collected three times: once prior to application of recycled water in the designated use area; once after a full year of application of recycled water, and finally after two full years of recycle water application. The post application designated use area sampling will be conducted after the irrigation season in the fall (i.e., October/November). The SMRP states that several locations will be selected within each sampling stratum in the designated use area. Within each location, subsamples will be collected at several incremental depths from at least four locations and composited by depth for laboratory analysis.

At the end of the first full year of irrigation, the soil monitoring plan includes sample collections at depths of 0-6 inches below ground surface (bgs), 6-12 inches bgs, 12- 24 inches bgs, and 24-36 inches bgs. The District's consultant stated that the proposed depth ranges were selected to best characterize the upper six inches that is most intensively rooted by turf grass, as well as several deeper layers to provide evidence regarding the fate of applied nitrogen. After the end of the second year of irrigation, additional one-foot segments will be taken up to 6 feet bgs or practicable depth by hand probe. Specific details regarding constituents, sample type, and sample frequency are specified in the SMRP.

ATTACHMENT C

STAFF ANALYSIS

Board staff evaluation of District's revised water balance analysis included in the revised NOI suggests that the proposed recycled water use would likely meet the design hydraulic loading rate. But laboratory analysis of recycled water indicates that the subject discharge would exceed the design nutrient loading rate (i.e., agronomic nutrient rate). The agronomic rate[1] by definition refers to both the hydraulic and nutrient loading rates and any one of them could be a limiting design parameter (LDP). In this particular case, nitrogen appears to be the LDP.

Particularly, the District has not provided any pertinent design reference to support their higher estimates for nitrogen losses (i.e., 50%- 60%) resulting from volatilization and denitrification. Although we concur that in some cases actual nitrogen loss from volatilization and denitrification in the subsurface could be higher than the standard design range of 15-25%[2]. This would depend on effluent characteristics, application method, soil type, and other site specific parameters. Guidance documents suggest that a higher range of nitrogen loss in excess of the design range of 15-25% shall be used **only** upon site specific field investigation and testing.

Nitrogen in wastewater is found in the following forms:

- Ammonia (NH_3 as a gas or NH_4^+ ions)
- Organic nitrogen (urea, fecal material)
- Nitrate (NO_3^-) and nitrite (NO_2^-)
- Total Kjeldahl Nitrogen (TKN) is the combination of ammonia and organic Nitrogen

Nitrogen is an essential nutrient that is required by all plants and animals for the formation of amino acids. In its molecular form, nitrogen cannot be used by most aquatic plants; therefore, it must be converted to another form. One such form is ammonia (NH_3). Ammonia may be taken up by plants or oxidized by bacteria into nitrate (NO_3^-) or nitrite (NO_2^-). Ammonia refers to two chemicals that are in equilibrium in water (NH_3, un-ionized and NH_4^+, ionized). Ammonia (NH_3^+) will react with water to form a weak base.

$$NH_3 + H_2O \Leftrightarrow NH_4^+ + OH^-$$

[1] 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. Similarly, the hydraulic loading" includes the optimum amount of moisture that the plant needs.

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

ATTACHMENT C

STAFF ANALYSIS

On record, the District has submitted a laboratory analysis report of an effluent sample that shows a total nitrogen concentration of 38 mg/L. The sampling results obtained from the District's NPDES monitoring shows unionized ammonia (NH_3-N) less than 1 mg/L (i.e., ranges between 0.0003 – 0.0025 mg/L) and ionized ammonia (NH_4-N) in the range of 29.9 - 47.3 mg/L. The NPDES permit specifies a limit on the unionized form for effluent discharged to the San Joaquin River outfall. Region 2 limits the unionized form of ammonia in the NPDES permit since it is toxic to fish, but allows a dilution ratio of 60:1 for Delta Diablo for ammonia discharged to the San Joaquin River.

The presence of elevated levels of the ionized form of ammonia (NH_4) shown by the NPDES monitoring data differs from the District's claim that most of the ammonia in its effluent is in the unionized form (NH_3), which would be readily lost due to volatilization. Theoretically, the following reactions are likely to occur during nitrification and denitrification processes:

Alkalinity buffering equation

$H_20 + CO_2 \leftrightarrow H_2CO_3 \leftrightarrow HCO_3 + H^+ \leftrightarrow CO_3 + 2H^+$ …… [A]

Nitrification Process:

$NH_4^+ + 1.5O_2 \longrightarrow 2H^+ + 2H_2O + NO_2^-$ …… [B]

$NO_2^- + 0.5O_2 \longrightarrow NO_3^-$ …… [C]

$NH_4^+ + 1.83O_2 + 1.98\ HCO_3^- \longrightarrow 0.021\ C_5H_7O_2N + 0.98\ NO_3^- + 1.041\ H_2O + 1.88\ H_2CO_3^-$ … [D]

$NH_4^+ + 1.9O_2 + 2HCO_3- \longrightarrow 1.9\ CO_2 + 2.9\ H_2O + 0.1\ CH_2 + N^+$ ……. [E]

Denitrification Process:

Denitrification occurs when oxygen levels are depleted and nitrate becomes the primary oxygen source for microorganisms. The process is performed under anoxic conditions. The bacteria break apart nitrate (NO_3^-) to gain the oxygen (O_2), the nitrate is reduced to nitrous oxide (N_2O), and, in turn, nitrogen gas (N_2).

$6NO_3^- + 5CH_3OH \longrightarrow 3N_2 + 5CO_2 + 7H_2O + 6OH$ …… [F]

ATTACHMENT C

STAFF ANALYSIS

Inference:

The unionized form of ammonia (i.e., NH_3) would readily volatilize during land application, but the concentration of NH_3 in the effluent is almost negligible. The ammonium form (i.e., NH_4^+) during the natural nitrification process in the subsurface soils would first break down into nitrite and further oxidize to form nitrate (see equations B & C above). The plants/grasses would absorb ammonium ions as a nitrogen source in the initial growth stage and nitrogen from other forms upon maturity. Nitrification chemistry alone does not allow for accurate estimation of the quantity of nitrogen absorbed by plants or the quantity that would percolate beyond the root zone. Field testing is required to validate the District's assertions. To date, the District has not conducted a site-specific field investigation.

Similarly, the above equations illustrate that denitrification losses of nitrogen are contingent upon the nitrification process to first occur and then anoxic conditions to develop for the denitrification process to take place [see equation F above]. A fraction of the applied nitrogen will evolve as N_2 gas through the reactions shown above. The N_2 gas evolved in the process is eventually lost into the atmosphere.

Combined, the limited available effluent data and lack of supporting site-specific field investigation data do not substantiate the District's assertion that nitrogen in the effluent is mostly in gaseous ammonia form (NH_3) and therefore unlikely to affect groundwater as Nitrate (NO_3^-). There is no technical basis or any statistical significant data available that warrants consideration of nitrogen losses in the range of 50-60% in the design of the recycled water system.

The District's request for recycled water use up to the maximum proposed amount of 487 acft/yr could be conditionally allowed based on the following:

- District has proposed a two year supplemental monitoring program that includes soil and effluent monitoring, and measurement of other site specific parameters to determine the actual agronomic application rate of its recycled water, and

- The two year limited term recycled water use up to the maximum proposed amount is unlikely to cause significant threat to the underlying groundwater.