

## Long-Term Irrigated Lands Regulatory Program Agricultural Watershed Banking Alternative Concept

<b>Program Organization (select one element and provide details)</b>	
<b>Element</b>	<b>Description</b>
All Irrigated Agriculture	A water quality banking program concept fits well with the irrigated agriculture program. It is an incentive based program that is market driven to accomplish program goals and objectives with stakeholder (growers) implementation.
Tailored	The program would be tailored to landowners to improve water quality in an incentive based market program. Credits would be based on need and the specific threat to water quality. Credits would be commodities not unlike other agricultural commodities that are bought, traded, or sold. Program can be implemented and managed by watershed coalitions or third parties with or without support from the Water Board.
<b>Core Requirements</b>	
<b>Element</b>	<b>Description</b>
Standard-based	The banking program would be based strictly on the standards for specific receiving-water, ecological watersheds or subwatershed basins of the Central Valley. Improvements to discharges to watersheds that benefit the receiving waters beyond the legal or target requirements can be banked as credits that can be sold or traded to other permittees who may not be able to meet standards or targets for their discharges. The program requires a method of calculating credits/benefits usually in the form of pounds of pollutants. Other commodities could be water temperatures load reductions, etc. The key to the concept is arrays of agricultural watersheds within ecological watersheds. Ag watersheds would be directly tied to one or more ecological watersheds that have specific standards or targets in the Water Plan.
Plan-based	Individual or groups of agricultural watersheds could provide an overall benefit to a large plan-based watershed and their benefits/credits accounted for on a plan-based level. For example: reductions in nutrients could be accounted for as a watershed-based commodity. Another option is for an ag watershed or group of watershed to get credits for going beyond what they might be required to do and receiving "extra" credits that could be sold or traded on a plan-based scale. In each example the "credits" would be a commodity formally entitled by the Water Board. A credit would be entitled by type

	<p>and service area.</p> <p>Monitoring and accounting are critical elements of the program to ensure credits are defined and benefits accrued as entitled.</p>
Standard+Plan-based	A banking program could be both standard and plan based. Commodities/credits can be defined as either or both.
<b>Lead Entity (select one element and provide details)</b>	
<b>Element</b>	<b>Description</b>
3 <sup>rd</sup> Party	A third party organization could administer the program. A watershed coalition or other agency such as an RCD or water district could administer the program. Private entrepreneurs could also administer a program. Formal entitlement and recognition as well as oversight would be provided by the Water Board.
Direct RB Administration	The RB could administer the program starting with the entitlement process and through accounting, oversight, and monitoring. Growers would apply for entitlement and obtain "certificates" for commodity credits. Bill of sales would be provided to sellers and purchasers. Accounting would be conducted by RB staff.
3 <sup>rd</sup> Party w/JPA	Administration could be shared among the parties with clearly defined responsibilities and accounting.
<b>Monitoring</b>	
<b>Element</b>	<b>Description</b>
Watershed-based/regional	Each Ag watershed would have formal monitoring. Within watershed banking or trading would have to meet requirements of the full watershed. Internal monitoring may be necessary for internal administration and formal credit entitlement.
Farm-based	Farm-based monitoring would not be required except for internal accounting as stated above.

Watershed/ regional+Farm- based	A combination monitoring program would have merits for the formal and internal accounting needs.
<b>Implementation Mechanism (select one element and provide details)</b>	
<b>Element</b>	<b>Description</b>
Waiver	Waivers could be provided at the agricultural watershed or plan-based watershed level based on the performance of the banking or other program elements.
WDRs	WDRs could be provided to specific ag watersheds if all requirements are met for the joint effects of the growers in the watershed. .
Conditional Prohibition	Conditional prohibitions could be made on specific water quality constituents.
Combination- Waiver/WDRs/ Conditional Prohibition	Each ag watershed could have the waiver program administered by one or more of these mechanisms.

## **Alternative Concept – Water Quality Banking Program**

The basic concept for a water quality banking program is that each agricultural watershed represents an Individual Discharger with one or more point source discharges into a state water body. This concept is especially appropriate for the Central Valley with its many agricultural basins isolated from primary watershed rivers, creeks, sloughs, and bays. The banking aspect of the concept pertains to the ability to mitigate within and between watersheds using a banking credit concept sometimes referred to as a water quality trading program.

Trading is simply the concept of individual landowners in a watershed trading benefits to meet their joint requirements. Trading can also occur between watersheds for the same receiving water (ensuring no degradation in any portion of the receiving water). Trading can occur on a formal or informal basis.

Banking is a more formal process where landowners or entrepreneurs can improve water quality above requirements and bank the benefits as credits that can be sold or traded to other landowners or individual permittees that require mitigation. The banking program would have a formal accreditation process that would allow severance of any liability on the part of the permittee or waiver program partner (that is responsibility would lay on the part of the credit seller within constraints of the formal agreement between the banker and RB – similar to wetland and species mitigation banking programs of the National Marine Fisheries Service, US Fish and Wildlife Service, National Resource Conservation Service, California Department of Fish and Game, and the US Army Corps of Engineers).

The goal of the water quality banking program is to obtain high-quality water and habitat improvements for Central Valley watersheds, while minimizing costs to growers and state agencies through a cooperative land-based, permittee based incentive program. At the heart of the program is the ability to cost-effectively construct and manage ecological habitats such as wetlands within or adjacent to agricultural watersheds that effectively treat point and non-point pollution sources in the Central Valley of California. Because of the habitat focus the program would be established with Free Water Surface (FWS) wetlands where water to be treated flows through stands of aquatic plants growing in shallow water, and not wetlands of specialized engineering designs that require significant infrastructure and operations and maintenance.

*Sediment from irrigated agriculture and other land uses are seriously impacting water quality in the valley floor tributaries and mainstream channels. Sediment from irrigated agriculture and other land uses are seriously impacting water quality in the valley floor tributaries and mainstream channels.* If properly built, maintained and operated, treatment wetlands can effectively remove many pollutants -- including suspended solids, pathogens, nitrogen, phosphorus, biochemical oxygen demand, hydrocarbons and some metals and salts -- without compromising habitat value.

The banking program can use a variety of different banking or wetland types depending on the specific agricultural activities in a specific agricultural watershed. For example:

*There are 1702 dairies operating in the Central Valley: 202 dairies are in the Sacramento River watershed, more than 900 dairies are in the San Joaquin River watershed with over 600,000 milk cows, and more than 600 dairies are in the Tulare Lake watershed with around 500,000 milk cows. There are also 400 additional confined animal facilities for other large, non-dairy animals. The waste production at each dairy is equivalent to a small city. Dairy wastes contain ammonia, salts, and pathogens that threaten surface water quality in the event of a direct discharge to surface waters. Nitrates and salts also pose a serious groundwater threat. Providing a habitat treatment process for dairies would be different than for orchards, rice or other crop production types – pastures, row crops, orchards, vineyards, dairies, or feedlots.*

Constituents in water we wish to target for treatment removal include the following:

- nutrients (nitrogen, phosphorous, organic carbon),
- organic and inorganic sediments,
- warm water
- pesticides, herbicides,
- salts, metals,
- EDC's
- pathogens.

Such a program is consistent with other California policies. *Support projects that ensure no overall net loss and achieve a long-term net gain in the quantity and quality, and permanence of wetlands acreage and values in California in a manner that fosters creativity, stewardship and respect for private property (California Wetlands Conservation Policy, Executive Order W-59-93).*

Other indirect banking program objectives include:

- Determine whether treatment wetlands are safe for recreation uses
- Determine the utility of using treatment wetlands in sediment retention basins.
- Develop alternative designs for ag treatment processes.
- Determine the utility of using treatment wetlands for federal CWA, DFG stream alternation and RWQCB permit prescribed mitigation or other requirements.
- Determine potential watershed effects – benefits – Delta Drinking Water Quality – potential benefits to diverters and dischargers.
- Determine the potential for remarketing treated water.

### ***Scientific Support for Banking Program***

There are numerous scientific studies that address benefits of wetlands and other habitats on water quality.

**Source:** *Efficacy of Wetlands to Improve Water Quality of Runoff from Irrigated Pastures.* Knox, A.K., R.A. Dahlgren, K.W. Tate UC Davis, LAWR, 3119 PES building, Davis, CA , 95616. [akknox@ucdavis.edu](mailto:akknox@ucdavis.edu)

**Abstract:** *Wetlands often improve water quality through processes such as*

*sedimentation, nutrient transformations, microbial and plant uptake. Wetlands are prominent features of the range landscape of the Sierra Nevada foothills of Northern California. Tailwater from irrigated pastures may contribute to non-point source water pollution in the form of sediments, nutrients, and pathogens that degrade downstream water quality. We examined benefits to water quality provided by a natural, flow-through wetland and a degraded, channelized wetland situated within the flood-irrigation agricultural landscape. The non-degraded, reference wetland significantly improved water quality by reducing loads of total suspended sediments, nitrate and E. coli on average by 77 %, 60 %, 68 %, respectively. Retention of total N, total P and soluble-reactive P (SRP) was between 35 and 42% of loads entering the reference wetland. Retention of pollutant loads by the channelized wetland was significantly lower than by the reference wetland for all constituents except SRP. A net export of sediment and nitrate was observed from the channelized wetland. Decreased irrigation inflow rates significantly improved retention efficiencies for nitrate, E. coli and sediments (TSS, VSS, NVSS) in the reference wetland. We suggest that maintenance of these natural wetlands and regulation of inflow rates can be important aspects of a best management plan to improve water quality as water runs off of irrigated pastures.*

*Treatment wetlands are constructed wastewater systems that rely on physical, chemical, and biological processes typically found in natural wetlands to treat wastewater. Wetlands are a potential component of desalination systems. Wetlands may be used to grow salt-tolerant plants, thereby aiding in the disposal of brine solutions. Wetlands can also be used to remove inorganic ions from saline wastewaters. Changes in pH and ion content during wetlands treatment can be used to remove ions and reduce salinity.*

### **Banking in the Irrigated Lands Regulatory Program (ILRP)**

Growers with irrigated lands that discharge waste (e.g., tailwater, water from underground drains, operational spills, storm water runoff) to surface waters (canals, ponds, rivers, lakes) have to comply with applicable water quality standards (e.g., chemical, bacterial, salt standards), protect beneficial uses (e.g., aquatic life, drinking water) and prevent nuisance. Growers working through coalitions or with the Central Valley Water Board individually must implement practices to protect water quality, conduct water quality monitoring, evaluate the effectiveness of management practices, and change practices to improve water quality where problems are identified. Growers have the ultimate responsibility to ensure their practices protect water quality. Because the Central Valley basin is unique in that it has large isolated agricultural subbasins with a limited number of discharges to ecological water bodies, growers have the opportunity to work together to meet requirements.

#### **Lead Entity**

A banking program may also provide for lead entities to help the Water Board implement the IRLP. Such entities might come from grower groups, conservation agencies (e.g., RCDs), non-profits, or entrepreneurial bankers. The Water Board could work through

third party groups that do not have direct responsibility for the discharge, but represent the growers. The Water Board could work directly with grower groups, or 3) work with an entity that includes multiple growers and has legal responsibility for the discharge (e.g., certain water districts or a joint powers authority).

### **Bank Service Area**

Each water bank would have a specific service area where the “credits” could be applied, sold, or traded. The service area could be the entire Central Valley, a subbasin, or as small as the specific agricultural watershed in which the bank is located.

### **Affected Ecological Watershed**

Each bank will have benefits to one or more ecological watershed. Benefit might also translate “downstream” in different ways and degrees.

### ***Entrepreneur Banking***

The banking program could accommodate entrepreneurial bankers who would develop banks as a business. Wildlands Inc. is an example of such a banker:

- Incorporated 1991
- First private wetland mitigation bank in California (1994)
- Honored by DFG and American Planning Association
- Over 20,000 acres in ownership/ management

Wildlands designed, permitted, constructed, and operated wetland and species banks that are not unlike the proposed water quality banks. Wildlands Inc. is experienced in the design, permitting, construction, and operation of wetlands.

### ***Coalition Group Banking***

The ILRP has established an effective array of coalition groups who could implement banking programs for their groups. Transactions could be within or between groups, or to outside entities or individual dischargers requiring mitigation.

### ***Other Banking Activities and Benefits***

Conditional waivers of waste discharge requirements for discharges of waste from irrigated lands requires persons who obtain coverage under the waivers to prepare and implement technical reports to monitor surface water; evaluate, monitor and implement management practices that result in attainment of receiving water limitations based on water quality objectives. Banking programs will provide much of these monitoring and reporting requirements.

A banking program will also provide the following benefits:

- Measures of the effectiveness at protecting water quality
- A cost-effective approach for growers
- Reduced cost to the State

- Enforceability
- An effective program administration
- A process that provides fairness to growers and resource advocates
- Lead Entities (coalitions, growers, others)
- Monitoring and Reporting
- Implementation Mechanisms: waiver(s), waste discharge requirements (WDRs), conditional prohibitions of discharge, or a combinations thereof.

### ***Applicability to Regional Water Quality Programs***

The evaluation of alternative approaches to drinking water treatment in the Bay-Delta region including the Sacramento River is a topic of concern of the CALFED Bay Delta Program. Central Valley agricultural watersheds are major sources of organic carbon, sediment, and pollutants to the Bay-Delta. The lower Sacramento River is a source of much of the drinking water supplies in central and southern California. There is a concerted effort on the part of urban water agencies and agricultural interests to keep the pollutants from entering the Bay-Delta watershed. Wildlands and Ducks Unlimited (DU) are two habitat management entities who have joined together with landowners to determine the feasibility of treating poor quality entering Central Valley watersheds. DU's role in regional water quality and land use issues, Wildlands experience in the design, construction, and operation of wetlands, offer a highly qualified team to conduct a pilot effort at a water quality banking program. Water quality technical expertise has been provided by Larry Walker and Associates and Ecologic Engineering. Our team has also addressed water rights implications along with hydrology, flood control, and fisheries, as well as water quality issues.

### ***Program Objectives***

The following are the program objectives:

1. Design, build, and operate treatment wetlands.
2. Determine efficiency of treatment wetlands in removing nutrients, pesticides and herbicides, organic carbon, sediment, and salts.
3. Test various design parameters.
4. Determine potential limiting factors.
5. Determine cost-benefit of treatment wetlands.
6. Determine the most effective design for treatment wetlands.
7. Determine potential effects of treatment wetlands on flood control, water supply, and water quality.
8. Evaluate the potential effects of treatment wetlands on special status fish and wildlife species.
9. Identify and test potential for methylmercury contamination in wetlands.



10. Identify and evaluate the potential landscape management approaches for reducing production and abundance of methylmercury in the ecosystem.
11. Determine the amount of land needed and costs of treating water in wetlands.
12. Identify potential impacts and benefits to landowners and fish and wildlife.
13. Determine the potential effects on water supply and water quality constituents.

### **Conceptual Model**

The Central Valley drains water from agricultural lands, towns and rural communities and managed wetlands in northern and central California. Much of this drainage water is then taken into drinking water intakes for the cities of Sacramento, West Sacramento and the proposed Freeport Regional Water Authority intake at Freeport on the Sacramento River, as well as the federal and state pumps in the Delta. The drain water contains suspended solids, nutrients, agricultural chemicals, metals, salts, and elevated concentrations of organic matter. Elevated levels of organic matter can increase the costs of treatment for municipal users.

Passing agricultural drain water through specially designed wetlands will result in a reduction in pollutant concentrations following the conceptual model in Figure 1. Treatment wetlands are widely recognized as being effective in removing organic matter, suspended solids, and nutrients, but little is known about trace metal removal and long-term accumulations in treatment wetlands. Recent research indicates treatment wetlands can be designed to limit methylation of mercury and remove dissolved organic compounds from the water source. Recent research also indicates that up to 90-95% of dissolved organic carbon compounds can be removed by treatment wetlands, and that the top pollution treating plants are sedges and bulrushes working in warmer water climates treating up to 10 acre-ft of water per acre per week on a year-round basis.

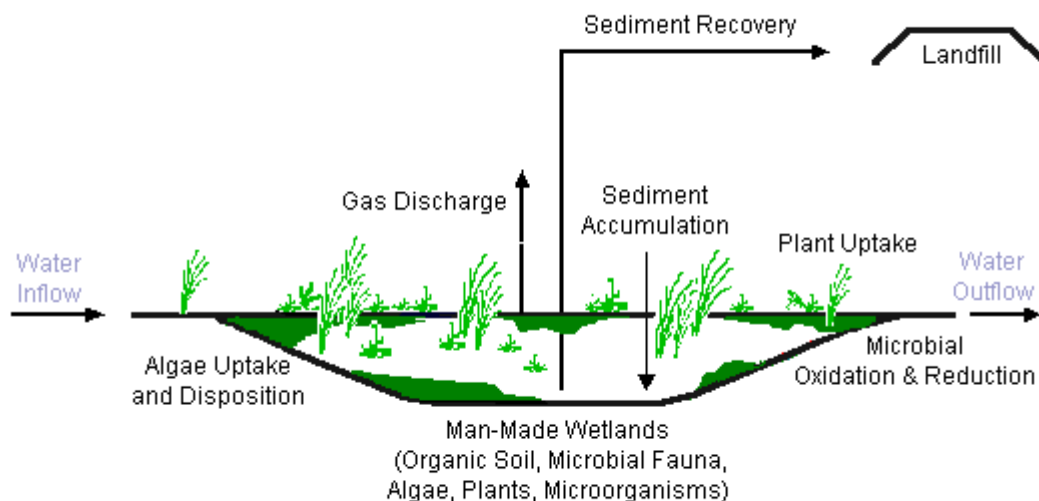


Figure 1. Conceptual model of cycling of constituents through a wetland treatment system.

Treatment wetlands would function year-round except during periods of flooding in the winter-spring when floodwaters may occur in the Central Valley. At such time suspended sediment and nutrients serve to replenish soils in the floodplain and are less of a threat to agriculture or other land uses, or municipal water supplies.

Pollutants of concern (POCs) that the program will address are described here. Removal and transformation of the identified pollutants of concern are also discussed. This discussion pertains generally to wetlands of the type to may be developed in the Central Valley.

- **Total Suspended Solids (TSS):** TSS is often used as an indicator of erosion and sediment transport. Many other POCs are strongly associated with particulates measured as TSS. TSS concentrations fluctuate widely depending on rainfall. Suspended particles are readily removed in wetlands primarily through the mechanisms of sedimentation and filtration through the wetland vegetation. Significant growth of algae within treatment wetlands could increase TSS.
- **Total Dissolved Solids (TDS) and Hardness:** TDS is indicative of salts content, which impacts irrigation and municipal uses. The level of TDS may also reflect high salinity groundwater influences. Central Valley waters occasionally exceed drinking water standards for TDS. Hardness affects toxicity for metals, with lower hardness increasing metals toxicity. The concentrations of these ionic constituents are not reduced through the wetland system. Conversely, concentrations can be expected to increase in proportion to percentage flow lost to evaporation during passage through the wetland system.
- **Organic Carbon:** Organic carbon is an indicator of drinking water and irrigation water quality. Total organic carbon (TOC) concentrations in the Central Valley typically exceed the 4 mg/L Disinfectants/Disinfection By-products (D/DBP) Rule treatment threshold. Background levels of TOC can be expected due to degradation of plant material and wildlife activity
- **Nitrate:** Nitrate is a concern for human health and eutrophication. It is often present at elevated levels in agricultural irrigation tailwater. Nitrates are typically reduced to background levels through the biological denitrification process, which converts nitrates to nitrogen gas and thereby releases nitrogen from the system.
- **Bacteria:** Total coliform, fecal coliform and *E. coli* are used by regulatory agencies as indicators of human pathogens although they may also indicate contamination from domestic animals and wildlife. High levels of coliform and *E. coli* are considered to negatively impact contact recreation and irrigation beneficial uses because of human health concerns. Depending primarily on the influent bacteria concentrations and the detention time in the wetland system, reductions in bacteria indicator organisms can be achieved through a variety of natural mechanisms. However, substantial background concentrations can be expected due to wildlife activity within the improved habitat.
- **Metals:** Aluminum, boron, mercury, and selenium have been detected in the Central Valley at toxic levels. Copper, chromium, and lead have also been detected. Recent

studies using phytoremediation methods demonstrated the ability to remove selenium and boron. Aluminum, iron, and other trace metals can be removed by a variety of processes. Methylmercury, the most toxic form of mercury, remains in fish tissue and then passed upward into the food chain. Wetlands tend to accumulate metals in sediments and can increase or decrease methylmercury concentrations depending on design and operation.

- **Pesticides and Herbicides:** Pesticides are often detected in Central Valley water by existing water monitoring programs. Monitoring programs have detected more historical and presently-used pesticides. Wetlands tend to remove a wide variety of organic compounds through several mechanisms.

## ***Hypotheses***

Hypothesized effectiveness and limitations of treatment wetlands based on scientific literature include the following:

### **Water Quality**

- Treatment wetlands can effectively remove ammonia-nitrate, suspended solids, and organic matter.
- Treatment can be effective at ratios of 2 cfs source water per 10 acres of treatment wetland.
- The potential to remove phosphorous and dissolved organic carbon is limited, but can be increased through special design features.
- Salts are not effectively removed by treatment wetlands; however recent research indicates certain wetland plant species can facilitate removal of some salts.
- An open water design can be effective and reduce the extent of methylation of mercury.
- Open water can maintain higher levels of dissolved oxygen and provide for more effective mosquito control.
- Metals in dissolved form are resistant to removal in wetlands.
- Copper and chromium reduction is on the order of 50%.
- Metals either move through wetlands or accumulated in sediment or tule roots.
- Sediments and tules will be a sink for trace metals potentially leading to toxic conditions.
- Mercury methylation will be minimal, and inorganic mercury will be removed in the treatment process.
- Metal concentrations may be high in Scirpus (tule) rhizomes and require periodic harvesting/removal from treatment wetlands.
- Periodic removal of tules and sediment in addition to reducing metal concentrations may help to maintain high value fish habitat and limit mosquito production.

### **Hydrology and Hydraulics**

- Water loss in treatment wetlands can be on the order of 25% especially in summer.
- Treatment wetlands will not interfere flood control capacity.

### **Biology**

- Treatment wetlands can have moderate to high wildlife values.

- Treatment wetlands can have high aquatic invertebrate production and provide seasonally valuable foraging habitat for juvenile native fish.
- Periodic removal of sediments may limit toxic conditions.
- Treatment wetlands will not interfere with fish passage.

### ***Feasibility***

There is an extensive body of scientific study, experience, and literature on the use of wetlands to treat point and non-point source pollution sources. The practice has not been used extensively in California except for the rare application for treating municipal sewage (e.g., the City of Arcada) because of the high water and land costs involved. Most recently the Sacramento Regional County Sanitation District (SRCSD) completed the Sacramento Constructed Wetlands Demonstration Project (SCWDP), the largest discharge in the Central Valley at 150 mg/d or 232 cfs into Sacramento River at Elk Grove, to determine if treatment wetlands could be used to meet stringent federal metal requirements. Treatment wetlands have four potential uses:

1. polishing secondary effluent prior to discharge into onsite creeks
2. continuing research and monitoring
3. participating in other researchers studies
4. provide treatment of nitrate laden leachate from Dedicated Land Disposal sites (solids disposal sites)

Performance of treatment wetlands at the SCWDP was within expectations for organic matter, TSS, ammonia-nitrogen, and phosphorous removal. The pre-treatment program with wetlands proved effective in reducing metal loadings.

Source water temperature was a problem in the SCWDP treatment wetland experiments as waters warmed in wetlands with high surface area to volume ratio, which affected biologically mediated treatment performance and effluent ammonia toxicity. Generally there was a reduction in temperature through the wetlands because inlet temps were warmer than air temps for most of the year. Water temperature will be an important factor in the study design and analyses.

Based on these results and recent results of studies on mercury methylation in the Delta and elsewhere, it appears feasible to consider treating agricultural return waters with treatment wetlands without creating a problem with methylated mercury.

The program has a three-year project timeline involving a first year of design, permitting, and construction, and two years of experimental testing. Permitting needs are expected to be minimal by limiting construction and operation to existing farming limitations. Reclamation Board standards for floodways will constrain the design and operations/maintenance to a certain extent in floodplains:

### ***General Design and Plan of Work***

The proposed program would entail design, construction, and operation of treatment wetlands over a three-year period including up to two years of experiments to evaluate the feasibility of treatment wetlands applications. The first year will involve design and

construction. The program would be designed and carried out as an experiment with a program team composed of experts in the field with extensive local experience in hydrology, water quality, wetland construction and operation, scientific experimentation, monitoring, and statistical analysis and design. Baseline monitoring would occur during the first year, while operational data will be collected in years two and three.

The design of treatment wetlands will be the first phase of the proposed program. DU and Wildlands staffs include wetland scientists and landscape architects with considerable experience in the design and construction of wetlands. The design will be developed as an experimental design with multiple treatments and replication. The basic program will be wetland design, retention time, and stage of wetland development. Water quality measurements will be made of incoming and out-flowing water. Water quality parameters measured will include total suspended solids, conductivity, salinity, nutrients, metals including forms of mercury, pesticides and herbicides, total organic carbon, dissolved organic carbon, water temperature, turbidity, and dissolved oxygen. The effect of stage of wetland development would be assessed by comparison of post-construction (year 1), year 2, and year 3 monitoring data.

## ***Water Quality Issues***

### **Regional Water Quality Concerns**

- High Organic Carbon (TOC/DOC)
- High Total Suspended Solids (TSS)
- High Total Dissolved Solids (TDS)
- High Salts Bromides
- High Metals
- Pesticides & Herbicides
- Nutrients
- Salinity Control
- Point Sources
- Cumulative Effect of Ag Discharges
- Groundwater Quality
- **Organic Carbon (TOC)** production by wetlands – though wetlands produce organic carbon, they can still be sinks for TOC
- **Methyl mercury** production in wetlands – though wetlands can convert elemental mercury to the toxic form, they can be designed to be sinks for element mercury without the associated methylation.
- **Water Loss** - Loss of water to ground and air – wetlands can use high amounts of water especially to evapotranspiration, but can be designed to minimize the loss to groundwater (clay soil), less plants, type of plant, and shade from sun.
- **Water quality** - can be a problem at certain locations and times of the year (e.g., wetlands can lead to premature warming of water). Solution is to design and operate wetlands so this is not a problem.
- **Mosquito production** - may be a problem. Design and operation are important to limit extent of this problem.

- **Conversion of ag lands to wetlands** – loss of ag lands need not be a problem if we focus on conversion of non-productive ag lands.
- **Cost of operation** - can be high as treatment wetlands have more O&M than standard wetlands.
- **Seepage** onto adjoining ag lands – can be controlled.

Finally, at issue is the potential for treatment wetlands to remove priority pollutants. The following table provides a general answer for specific pollutants.

<i>Pollutant Of Concern</i>	<i>Level (Reference)</i>	<i>Wetland Treatable</i>
<b>Total Suspended Solids</b>	<b>100 mg/l</b> (15 mg/l)	<b>YES</b>
<b>Total Dissolved Solids</b>	<b>400 mg/l</b> (250 mg/l)	NO?
<b>Organic Carbon TOC/DOC</b>	<b>8 mg/l // 6 mg/l</b> (2 mg/l)	<b>YES?</b>
<b>Coliform Bacteria</b>	<b>250 MPN/100mL</b> (200)	<b>YES</b>
<b>Nitrate</b>	1 mg/l N (10 mg/l N)	<b>YES</b>
<b>Pesticides</b>	<b>Detected</b>	<b>YES</b>
<b>Mercury</b>	10/ <b>0.3</b> ng/L (12/0.05)	<b>YES?</b>
<b>Boron</b>	<b>1500 ug/l</b> (600 ug/l)	<b>YES??</b>
<b>Selenium</b>	3 ug/l (5 ug/l)	<b>YES??</b>
<b>Aluminum</b>	<b>2000 ug/l</b> (87 ug/l)	<b>YES?</b>
<b>Copper</b>	4 ug/l (3 ug/l)	<b>YES?</b>
<b>Chromium</b>	5 ug/l (16 ug/l)	<b>YES?</b>
Red = problem Green = natural wetland Blue = experimental wetland		

### **Other State Programs**

Current practice in new Jersey of mitigating stormwater impacts caused by transportation infrastructure projects is established by the newly adopted NJDEP Stormwater Regulations (NJAC 7:8). These rules outline specific processes by which an applicant must evaluate and propose mitigation to offset impacts to water quality, groundwater recharge and peak rate of runoff/runoff volume resulting from the addition of impervious

surfaces. The rules are written to address impacts of each individual project and have no provisions for addressing programmatic impacts of multiple projects, or "banking" of impacts. As such, the **requirement to design and build separate, "on-site" mitigation features for each project results in inefficient and nominally effective results, which can also delay implementation schedules.** Dozens of projects a year must undergo analysis, design, regulatory review and permitting to establish regulatory compliance with stormwater regulations. **Many issues faced by this regulatory program are similar to the evolution of the wetland regulation and mitigation paradigm** which also began with project specific mitigation, resulting in many small created wetland areas which did not provide the anticipated environmental benefits. The need to achieve greater efficiency and environmental and economic benefits of scale led to the creation of **wetland banking, which has now been in place for over two decades and can serve as a useful model for establishing an efficient stormwater banking program.** Since it is often difficult to find appropriate vacant property and unconstrained physical space adjacent to individual projects to mitigate impacts, there is a **clear need to establish a watershed based banking process which can be used as a feasible alternative solution.**

### ***Benefits to Individual Permits***

The agricultural waiver program can provide benefits to individual permittees by providing needed mitigation in their watersheds. For example, along the Colusa Basin Drain there are several municipal permittees that could benefit from the proposed program.

### **Maxwell Public Utility District Wastewater Treatment Plant, Colusa County**

*The Maxwell Public Utility District owns and operates a wastewater collection, treatment, and disposal system, and provides sewage service to the community of Maxwell. The treated municipal wastewater is discharged to an unnamed tributary to Lurline Creek, which is a tributary to the **Colusa Basin Drain**. Maxwell has been unable to comply with a time schedule to upgrade its facility pursuant to Waste Discharge Requirements (WDR) Order No. R5-2002-0022 (NPDES No. CA0079987), and has accumulated numerous effluent limitation violations subject to mandatory minimum penalties pursuant to California Water Code Section 13385. The Discharger has proposed to complete a project to dispose all effluent to land. The proposed Time Schedule Order (TSO) requires full compliance with effluent limitations for BOD, total suspended solids, turbidity, total coliform organisms, and **ammonia**, and other effluent limitations by 18 May 2010, by implementing land disposal of effluent. The TSO provides an exemption from further mandatory penalties for constituents subject to the Order with the exception of **ammonia**.*

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### **City of Colusa, Wastewater Treatment Plant, Colusa County**

*The City of Colusa owns and operates a wastewater collection, treatment, and*

disposal system, and provides sewage service to the City of Colusa. The treated municipal wastewater is discharged to an unnamed tributary to Powell Slough, which is tributary to the Colusa Trough and the **Colusa Basin Drain**. The City of Colusa has been unable to comply with a time schedule to upgrade its facility pursuant to Waste Discharge Requirements Order No. R5-2002-0020 (NPDES No. CA0078999), and has accumulated numerous effluent limitation violations subject to mandatory minimum penalties pursuant to California Water Code Section 13385. The Discharger has proposed to construct a tertiary treatment plant to comply with the NPDES permit. The proposed Time Schedule Order (TSO) requires full compliance with effluent limitations for BOD, total suspended solids, turbidity, total coliform organisms, aluminum, copper, and **ammonia**, and other effluent limitations by 1 August 2008. The TSO provides an exemption from further mandatory penalties for constituents subject to the Order, with the exception of aluminum and **ammonia**.

### **City of Williams, Wastewater Treatment Facility, Colusa County**

The City of Williams owns and operates a wastewater collection, treatment, and disposal system, and provides sewage service to the City of Williams. The treated municipal wastewater is discharged to Salt Creek, a water of the United States and a tributary to Freshwater Creek and the **Colusa Basin Drain**. The City of Williams has been unable to comply with a time schedule to upgrade its facility pursuant to Waste Discharge Requirements Order No. R5-2001-0049 (NPDES No. CA0077933), and has accumulated numerous effluent limitation violations subject to mandatory minimum penalties pursuant to California Water Code Section 13385. The Discharger has proposed to construct a tertiary treatment plant. The proposed Time Schedule Order (TSO) requires full compliance with effluent limitations for BOD, total suspended solids, turbidity, total coliform organisms, and **ammonia**, and other effluent limitations by 1 October 2010. The TSO provides an exemption from further mandatory penalties for constituents subject to the Order.

### **City of Willows, Wastewater Treatment Facility, Glenn County**

*REQUIRING THE CITY OF WILLOWS AND ECO RESOURCES, INC.*

*WILLOWS WASTEWATER TREATMENT PLANT, GLENN COUNTY*

*TO CEASE AND DESIST FROM DISCHARGING CONTRARY TO REQUIREMENTS*

1. The City of Willows owns a wastewater collection, treatment, and disposal system, and provides sewerage service to the City of Willows and the Northeast Willows Community Service District. ECO Resources, Inc. operates the Wastewater Treatment Plant (WWTP). The City of Willows and ECO Resources, Inc. are hereafter collectively referred to as Discharger. The WWTP is located at 1600 South Tehama Street in Willows.

2. On 16 March 2001, the Central Valley Water Board adopted Waste Discharge Requirements (WDR) Order No. R5-01-066, (NPDES No. CA0078034) for the City of Willows which regulated the discharge of wastewater from a municipal wastewater treatment facility to Agricultural Drain C, a tributary of the **Colusa Basin Drain**.



3. WDR Order No. R5-01-066 included pH and temperature-dependent Effluent Limitations for **ammonia** as contained in B.1.A, which reads in part as follows:

4. The existing treatment plant was not capable of consistently meeting the new effluent **ammonia** limits set in Order No. R5-01-066 and on 7 June 2002, the Central Valley Water Board adopted Cease and Desist Order No. R5-2002-0105 for the City of Willows, which cited 39 effluent **ammonia** violations between 17 March 2001 and 31 March 2002. Order No. R5-2002-0105 required the City of Willows to cease and desist discharging and threatening to discharge contrary to WDR Order No. R5-01-066 effluent limitations for **ammonia**; comply with a time schedule for construction improvements for the plant to achieve compliance with the effluent limits for **ammonia** by 1 March 2006; and operate the plant in a nitrification mode to the maximum extent practicable.

### ***Potential Pilot Project***

Wildlands has started a pilot water quality project on the Colusa Basin Drain near Dunnigan. Several agricultural watersheds drain into the CBD at this location (see aerial below) and Wildlands has developed wetlands that receive agricultural drainage and treat it before entering these discharges enter the CBD.

#### *Colusa Basin Drain Studies*

Agricultural runoff and stormwater from towns in the Colusa Basin flow via the Colusa Basin Drain to the Sacramento River upstream of intakes for the cities of Sacramento, West Sacramento, and the proposed Freeport Regional Water Project intake for East Bay Municipal Utilities District (EBMUD) and the county of Sacramento. A group of stakeholders, including CCWD and other urban agencies, are participating in an initial study to characterize hydrology and water quality of the drain, and to evaluate impacts to the Sacramento River and Delta water users. Other stakeholders are expected to participate in this process while alternatives to improve water quality downstream from the drain are developed.



## **Supplemental Funding**

For the proposed program to be successful will require additional funding beyond that available from watershed growers and individual permittees. The following are potential sources of grant funds for treatment wetlands:

- US Environmental Protection Agency Targeted Watersheds Grants Program
- FEMA Hazard Mitigation Grant
- Species Conservation Banking Program
- Wetlands Mitigation Banking Program
- Integrated Resources Management Programs

*The Targeted Watersheds Grant Program is a competitive grant program designed to support the protection and restoration of the country's water resources through a holistic watershed approach to water quality management. One RFP is for implementation projects and the second is for capacity building.*

## **EPA Water Quality Trading Program**

**Federal Register**/Vol. 67, No. 132/Wednesday, July 10, 2002/Notices page **45728**

### **SUMMARY**

: On May 15, 2002, the U.S. Environmental Protection Agency's (EPA's) invited public comment on its proposed Policy on Water Quality Trading ("proposed policy"). Today's action extends the due date for comments to July 15, 2002. The purpose of the proposed policy is to signal EPA support for soundly designed water quality trading programs developed by States and Tribes. Another purpose is to propose program components that EPA believes are appropriate for trading programs to be soundly designed and to operate successfully. In addition, the proposed policy is intended to address issues left open and limitations encountered implementing projects under EPA's January 1996 Effluent Trading Policy and May 1996 draft Framework for Watershed-Based Trading (EPA 800-R-96-001). Water quality trading is a voluntary incentive-based approach to more efficiently protect and restore the nation's waters. The proposed policy addresses trading to maintain water quality in unimpaired waters, trading in impaired waters before development of a Total Maximum Daily Load (TMDL) and trading to meet TMDLs. While the focus is on nutrients and sediment, the policy also discusses the potential for trading other pollutants under certain circumstances. The proposed policy is available for review at <http://www.epa.gov/owow/watershed/trading.htm>

## **SWRCB Agricultural Water Quality Outreach Project**

The SWRCB working with Ducks Unlimited are conducting a water quality outreach effort with growers to help control nonpoint sources of pollution and to enhance water quality and wildlife habitat in the Central Valley. The proposed banking program would help in meeting the objectives of this project.

## Information Sources

- [Constructed Wetlands Treatment Municipal Wastewater and Non Point Source Pollution](#). (0.30 seconds) [PDF] [Do you discharge non-point source pollution to water supplies?](#)  
File Format: PDF/Adobe Acrobat - [View as HTML](#)  
... **Treatment • Industrial Wastewater Sources • Municipal Wastewaters • Federally Owned Treatment Works** ... most technologies, **constructed wetlands** can ...  
enviro.nfesc.navy.mil/ps/eqifs/Section10/wetland.pdf - [Similar pages](#)
- [PDF] [Treatment Wetland Applications](#)  
File Format: PDF/Adobe Acrobat - [View as HTML](#)  
... or a “notice of **non-compliance**” is ... focused on **constructed wetlands** that **treat municipal wastewater**. **Constructed treatment wetlands** were identified by Task ...  
www.state.co.us/oemc/programs/waste/wetlands/Chapter3.pdf - [Similar pages](#)
- [USEPA Region 4 - More than Wetlands - Other approaches to wetlands ...](#)  
... Managing **Wetlands To Control Non-point Source Pollution**. ... **Constructed Wetlands For Wastewater Treatment And Wildlife Habitat**. ...  
www.epa.gov/region4/water/wetlands/approaches/ - 24k - [Cached](#) - [Similar pages](#)
- [PDF] [Project Title: “ Constructed Wetlands in Support of Riparian ...](#)  
File Format: PDF/Adobe Acrobat - [View as HTML](#)  
... as waste water **treatment** facilities or ... Background: **Wetlands constructed** for use with  
three ... stressors (contaminants) in **municipal wastewater** effluents, animal ...  
www.epa.gov/ada/research/eco/research\_16.pdf - [Similar pages](#)  
[ [More results from www.epa.gov](#) ]
- [PDF] [Guiding Principles for Constructed Treatment Wetlands: Providing ...](#)  
File Format: PDF/Adobe Acrobat - [View as HTML](#)  
... problems, invasion of **non-native plants** ... to its entering the **constructed treatment wetland** sufficiently to meet ... **Municipal wastewater** effluent generally must be ...  
www.calpoly.edu/~cri/docs/guidingprinciples.pdf - [Similar pages](#)