FRBSF Weekly Letter

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Irrigation and Water Quality

The availability of water has long been an important issue in the West. In California's fertile Central Valley, imported water allowed agricultural activity on a scale that was impossible when farmers relied on deep water wells. More recently, water quality has become as important an issue to California agriculture as water quantity.

Farmers in the Central Valley have long known that repeated irrigation of their crops can cause salts to build up and to damage the quality of their soil. In the last few years, it has become apparent that in some cases the measures taken to alleviate the salt problem have caused the trace element selenium to accumulate in concentrations that threaten wildlife.

The area currently affected covers 42,000 acres that produced $41.6 million in crops in 1984, of which over half was cottonseed. Other important products included tomatoes, melons, alfalfa, and sugar beets. This part of the San Joaquin Valley represents only .13 percent of California's farm acreage and .29 percent of the state's agricultural output, but at least 500,000 additional acres in California could become embroiled in the same issues. This *Letter* describes the origins of the problem and discusses potential solutions and ways of financing them.

Historical background

The extensive use of groundwater from deep wells made the original agricultural development of California's San Joaquin Valley possible. By the 1950s, the supply of groundwater was seriously depleted and other water sources were needed for intensive farming to continue.

Moreover, repeated irrigation on the west side of Fresno County had caused enough salt to accumulate in the soil to preclude growing tree fruits and grapes. Because the surface water used in irrigation naturally contains salts, it adds to the already saline soil of the region by leaving traces of salt in the soil upon evaporation. If the soil is left untreated, the salt accumulates until the soil becomes useless for growing many crops.

The salt can be leached from the soil by applying large amounts of irrigation water. Without drainage, however, the resulting saltwater sits in the root zone of many crops because an impermeable layer of clay in the San Joaquin Valley prevents the water from percolating further down.

In 1960, Congress passed the San Luis Act authorizing construction of an extensive irrigation system in the Westlands Water District (WWD), which serves 942 square miles in western Fresno and Kings counties. The Act required the federal and state governments jointly to construct drainage facilities that are crucial for alleviating the salt problem.

The San Luis Drain was to begin about 25 miles southwest of Fresno and deposit the drainwater some 200 miles north into the San Joaquin Delta, which runs into the ocean through San Francisco Bay. Kesterson Reservoir, which stood near the halfway point, was supposed to regulate the flow of water to the Delta. The State of California was unable to raise the funds for its contribution to the drainage effort, but the federal government began the project on its own. Between 1968 and 1975, an 85-mile stretch of canal was constructed between the Kesterson site and the southern end of the planned drain.

Meanwhile, the California Department of Fish and Game entered into an agreement with the WWD to manage wildlife at Kesterson subject to the restriction that the reservoir's primary purpose be to manage drainwater on its way to the Delta. The potential toxic effects of selenium on wildlife were not considered when the reservoir and wildlife refuge were established. Indeed, selenium tolerance levels for wildlife and humans still are not well-documented.

A combination of financial and environmental problems stopped work on the San Luis Drain in 1975. Federal funds became more difficult to get, and questions arose about the future repayment of federal loans. In addition, environmentalists expressed concern about the potentially harmful effects of releasing the drainwater into the Delta. They argued that the massive amounts of water entering Delta waterways from the San Luis Drain could considerably alter the ecosystem by making parts of the Delta more saline. As a result, the finished San Luis Drain was an 85-mile canal that ended at the Kesterson Reservoir, rather than the planned 200-mile canal through Kesterson into the Delta.

The selenium problem
By 1982, a wildlife monitoring program revealed that fish in the Kesterson Reservoir had elevated levels of selenium in their bodies. In 1983, water fowl deformities and deaths were linked to toxic levels of selenium. The selenium, which occurs naturally in scattered pockets of San Joaquin Valley soil and is harmless in small amounts, was being leached out of the soil and carried in the San Luis Drain to Kesterson, where it accumulated at dangerously high levels.

In 1984, a petitioner asked the U.S. Bureau of Reclamation (USBR) and other regulatory agencies to enforce water quality standards in the Kesterson Reservoir. If drainage continued, concentrations of selenium, and other trace elements, would increase and further endanger wildlife.

In response, the U.S. Department of Interior and the WWD agreed in 1985 that drainage to Kesterson Reservoir would have to end. Affected farmers could mitigate the need for drainage immediately by conserving irrigation water or recycling their used irrigation water. If these practices by themselves did not stop the flow of drainwater to Kesterson, the underground drains that flowed into the San Luis Drain had to be plugged by June 30, 1986. At present, all drains have been plugged at WWD expense.

On-farm management
The current situation is unsustainable. Conservation and recycling can mitigate the soil and water quality problems only to a limited extent. Reducing irrigation to the point where drainage is no longer required causes salt to accumulate in the soil, while recycling irrigation water causes salt and trace elements (including selenium) to accumulate in the recycled water and ultimately also in the soil. Farmers therefore can recycle water only a limited number of times, and even then must face the problem of disposal. The useful life of drainwater can be extended by mixing it with fresh water in subsequent applications, but adding fresh water creates additional drainage needs.

These problems are severe as the USBR estimates that, with no drainage system, farming in the affected areas will no longer be feasible in about ten years.

Farmers could mitigate problems to some extent by altering crop patterns. For example, they could plant more crops that tolerate high concentrations of salt to alleviate the need to flood and drain the soil. The affected area already produces many relatively salt-tolerant crops, including cotton and grains, but most of these crops are oversupplied worldwide. As a result, their prices are so low that further increasing production is not economically feasible.

Other solutions to the water quality problem are more draconian. They include stopping the delivery of irrigation water altogether and halting agricultural production. Stopping irrigation deliveries, however, would likely deplete groundwater without eliminating the salinity and selenium problems that currently exist. Stopping production is technologically feasible, but would destroy local farms and communities.

A less extreme solution being considered calls for taking out of production only the land in which selenium exists. However, the soil testing in progress is not exhaustive enough to determine the exact location of all selenium deposits. Moreover, the tests conducted so far indicate that this solution would require a large amount of land to be taken out of cultivation.

Long-term solutions
Long-term farming in the area formerly served by the San Luis Drain will require environmentally safe resumption of drainage. Current proposals fall into two general categories: environmentally safe disposal of wastewater and treatment of wastewater to remove harmful agents.

Most of the alternatives calling for disposal raise environmental issues similar to those that have led to the current situation. For example, disposing wastewater either in the Delta or in Monterey Bay would raise the same kinds of questions that halted completion of the San Luis

Drain ten years ago. Alternatively, disposing drainwater either in evaporation ponds on farms or in more remote areas raises the same possibility of selenium toxicity among wildlife that closed the Kesterson Reservoir just a few months ago. The danger would likely be less severe because alternative disposal sites that are not nesting areas could be chosen, although the problem of potential toxicity would remain. In addition, each of the options being studied would cost a minimum of $85 million, and some could run as high as $225 million.

Treatment may provide the more promising alternative although it too involves high costs. Actual costs would depend largely on the standards established for treated water. For one technology, called reverse osmosis, capital costs could vary from $27 to $148 million, while operating costs could be anywhere from $980 to $2,200 per acre-foot of water treated. For comparison, the market value of water has been estimated at $100 to $200 per acre-foot. Several other water treatment options also exist, and WWD is now conducting research on lower cost alternatives to determine their effectiveness.

More information is required before reasoned judgments can be made about the effectiveness of various options. It already is clear, however, that any long-term solution that allows environmentally safe agricultural land use will involve a major investment.

Financing the changes

Historically, the federal government has borne much of the responsibility for water projects in the West, but that arrangement appears to be breaking down. The WWD has agreed to pay some of the costs associated with establishing a new drainage system that includes safe disposal or treatment of wastewater. Each year for the next 20 years, WWD will set aside $5 million to be used for its 35 percent share of up-front construction costs (to a maximum of $100 million). In addition, the WWD will pay all operating and maintenance expenses for the life of the project.

Participating farmers could well end up paying for much of the cost, but some other funding sources are available. For example, California voters approved a bond measure last June that allows water districts to borrow up to $20 million to research water management techniques. WWD currently is using some money borrowed under this program to build and study a small-scale selenium treatment facility.

Another potential funding source is the sale of water. The federal government recently gave local water districts permission to sell their water. The market value of water is estimated to be $85 to $192 per acre-foot greater than the price WWD pays for it. However, because federal government subsidies reduce the WWD's cost, any profits from water sales would likely be split between WWD and the federal government.

Resolving the water quality problem in an environmentally and economically feasible manner poses difficult problems and will involve considerable expense. The resolution of immediate issues faced by the WWD will be watched closely because the roles that farmers, environmentalists, water districts, and the federal government play in the solution are likely to set a precedent for similar problems when they arise in the future.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 12/10/86	Change from 12/3/86	Change from 12/11/85 Dollar	Percent[7]
Loans, Leases and Investments[1] [2]	204,152	65	5,572	2.8
Loans and Leases[1] [6]	183,867	40	3,498	1.9
Commercial and Industrial	51,512	468	– 237	– 0.4
Real estate	67,115	– 19	1,068	1.6
Loans to Individuals	39,558	– 119	1,366	3.5
Leases	5,595	2	182	3.3
U.S. Treasury and Agency Securities[2]	12,746	67	1,978	18.3
Other Securities[2]	7,539	– 43	96	1.2
Total Deposits	209,256	– 1,008	6,049	2.9
Demand Deposits	56,507	– 1,043	5,749	11.3
Demand Deposits Adjusted[3]	39,204	– 13,640	4,839	14.0
Other Transaction Balances[4]	18,822	– 129	4,022	27.1
Total Non-Transaction Balances[6]	133,927	165	– 3,721	– 2.7
Money Market Deposit Accounts—Total	46,830	269	1,023	2.2
Time Deposits in Amounts of $100,000 or more	32,021	– 32	– 6,137	– 16.0
Other Liabilities for Borrowed Money[5]	25,132	– 2,030	1,370	5.7

Two Week Averages of Daily Figures	Period ended 12/1/86	Period ended 11/17/86
Reserve Position, All Reporting Banks		
Excess Reserves (+)/Deficiency (–)	93	66
Borrowings	23	63
Net free reserves (+)/Net borrowed(–)	70	3

1 Includes loss reserves, unearned income, excludes interbank loans
2 Excludes trading account securities
3 Excludes U.S. government and depository institution deposits and cash items
4 ATS, NOW, Super NOW and savings accounts with telephone transfers
5 Includes borrowing via FRB, TT&L notes, Fed Funds, RPs and other sources
6 Includes items not shown separately
7 Annualized percent change