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A Study of Feasibility of State Water User Fees for Financing Water Development

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ABSTRACT

Water user fees imposed by a state on major water uses is a possible new alternative source of state water development funds.

A fee, similar to an excise tax, might be charged for the use of the water resource per se, which in a number of states is declared to be the property of the public or the state.

States generally have not employed such fees as a source of operating funds for water agencies or of development capital. Only in the area of water based recreation—fishing, boating, camping, etc.—have states extensively employed user fees. The revenues from these fees, however, are used only to defray management and operating expenses associated with these activities.

The implementation of user-fee financing would result in some shifts of financing burden connected with water programs from the general taxpayers of the state to specific water users. Although this approach has not been utilized by states to a significant extent, the "user pay" principle is well established in economic theory. The theory indicates that user fees would be an economically more efficient and equitable source for financing water development than general tax revenues.

In the design of fee structures for major water uses, several characteristics of fees are appropriate to consider. Five which were identified in this study are as follows: equity, economic efficiency, allocational effectiveness, administrative simplicity, and revenue generating potential. These were used to evaluate different structures for extracting fees from the user. These rate design considerations may relate only indirectly to a state system of user fees since the state fees envisioned in this study in many cases may be only an add-on or surcharge to a basic charge imposed by a local entity, such as a municipality or an irrigation district.

Revenue generating potential, the last of the five characteristics listed, was of primary interest in this study. Estimates of revenue potential for four major water uses—irrigation, municipal, industrial, and recreation—were made with a formula developed in the study for this purpose. Gross estimates of potential from public supply and irrigation uses were made for several selected states, and somewhat more detailed estimates were made for the four major uses in Utah. The calculations indicated that substantial amounts of funds could be generated with only modest increases in current charges.

A preliminary assessment of legal and administrative implications of implementing water user fees in the State of Utah was made in this study. The results indicated that some fee alternatives probably could be implemented by administrative action; others would require legislative approval. Constitutional issues related to some alternatives would have to be resolved by the state supreme court. New uses associated with developing Utah's vast energy resources appear to offer a particularly promising prospect for instituting a user fee program with minimal legal complications.

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INTRODUCTION

BACKGROUND

In response to rapidly increasing public interest in the quality of our environment during recent years, government legislation and programs have undergone significant changes in scope and emphasis. In the area of water resources development and management, federal funding for large scale storage projects has been diminishing at the same time that funding for water pollution control programs has grown tremendously. The emphasis in federal investment in water development has shifted in the process from direct appropriations to the construction agencies for specific projects to a multitude of grant and loan programs administered by Environmental Protection Agency (EPA), Housing and Urban Development (HUD), and others.

The effect upon the states has been twofold. First, the diminishing availability of federal funds for more traditional development projects is causing states—some with new statewide water plans—interested in water development to look elsewhere for funds. Although past water development has taken many choice reservoir sites, it would be questionable to say that little further development will be required. Projections of capital investment costs based on extrapolation of "needs" in framework studies of the U.S. Water Resources Council indicated that the total costs for water development (exclusive of water quality costs) for the period 1970-1980 will amount to $126.2 billion. Of this amount, $74 billion is non-federal (National Water Commission, 1973 p. 507)

A second effect of the recent trends in federal policy is that the cost sharing provisions of federal grant programs for pollution control make substantial demands on state financial resources. These demands are likely to become more acute in the future as pressure is exerted to pass more costs on to state and local governments. One estimate placed the costs of constructing municipal sewage treatment systems between 1973 and 1980 at $33.8 billion, $12.9 billion of which is to be provided by state and local governments (Administrator of the Environmental Protection Agency, 1974).

The major sources of capital financing available to state and local governments are bond proceeds, tax revenues, and federal financial aid (state aid is also a major source of local government financing). Long-term debt (bonds) has financed the largest share of state and local capital outlays; however, many states have not utilized this source for water development. Legal debt limitations and interest rate ceilings loom ominously in several states. Furthermore, voters in some states hold to a "pay-as-you-go" attitude and are reluctant to incur long-term debt to pay for water projects. Although some states could make more effective use of debt capital, the unprecedented high level of taxation, particularly property taxation, makes this avenue to capital financing difficult.

With costs of education and other urgent state and local programs spiraling, funds for even the most attractive water development projects will be difficult to obtain. Even if all of the currently used sources of funds are used more effectively, they probably will not be sufficient to meet total water development needs. Because of great public concern for pollution control, large amounts of state and local government funds have been contributed in support of this activity. If, as the National Water Commission (1973) suggests, the federal grant program does eventually terminate, state and local governments will have to fill the financial gap in improving and operating pollution control systems.

States may have to consider new and innovative approaches to raising capital to finance water projects. One approach which appears to have merit is the collection of state water-user fees. Municipal, industrial, and agricultural supply uses; fishing, boating, hunting, and other recreational uses; and flow uses including hydroelectric power production, water transportation, and waste dilution all might be charged. In a broad sense, a user fee might be considered as any form of a charge imposed upon a user for the use of a resource. Sales taxes, severance taxes, excise taxes, tolls, entrance fees, licenses, water rates, and so forth could all be considered as a form of user fee under this broad definition. In the case of water uses, fees may be charged on amounts of water actually used or on rights to use water irrespective of amounts used. They may be set to cover the costs incurred in developing and supplying the water or to charge the users for the privilege of utilizing a public resource, unrelated to development costs. For some uses, the charge may be made directly on the quantity of water consumed or diverted; for others the charges may have to be imposed indirectly on products or services related to the water resource.

The type of user fee examined in this study is similar to an excise tax. It is a basic charge or surcharge, as the case may be, for the use of a resource itself. In effect, it might be considered as rent collected by the state for the use of a publicly owned resource.

User-fee financing has some desirable features not found in other methods of capital financing. People pay in proportion to amounts of resources and services they receive. The fees would tend to allocate water resources in an economically efficient manner and to reduce waste. The revenues received would provide financing for a state to implement its development plans and facilitate cost-sharing arrangements with other government entities.

On the other hand, a state imposed water-user fee system constitutes a drastic break with tradition. User fees generally have not imposed at the state level except for certain recreation uses. A number of difficult questions should be answered if a broader utilization of such fees is to be considered: How can fee structures be designed for each of the major water uses? What amounts of funds can be expected from different levels of fees applied to different uses? What economic effects will result? What legal and institutional problems will be encountered and how will these be solved? How will user fees be accepted by various water users and other citizens? What administrative mechanisms will be required to collect fees and administer funds?

RESEARCH OBJECTIVES AND METHOD

The purpose of this research project was to seek answers to two of the aforementioned questions, those pertaining to the design of user fee alternatives and estimates of fund generating potential. The answers were intended to develop information that might be used by state officials in assessing the feasibility of water user fees for water development funding and provide a basis for subsequent studies. Subobjectives designed to achieve this result were as follows:

1. Examine the experience of government agencies, particularly state agencies, with the application of water user fees.

2. Review user fee theory and devise state water-user fee alternatives for the major water uses.

3. Determine fund generating potential of selected water-user fee alternatives.

4. Identify problem areas and future research needs related to this subject.

Since user fees have been applied successfully to some water uses—for example, effluent charges have been utilized in European countries to control waste discharges to lakes and streams—a logical starting point for this project was an examination of water user fee experience. A literature review was supplemented by information from agency officials with experience in administering user fees obtained through questionnaires and interviews.

An advisory panel was organized to examine the findings of the literature review and make recommendations concerning the direction and emphasis of the remaining research. The panel provided expertise in economics, engineering, state finance, and state water planning. Two members of the panel came from Utah state government—one from the executive side and one from the legislative side. The panel provided a coordinating link between state government officials, the potential users of the research results, and the researchers. With respect to the scope of the project, the panel recommended that fund generating potential should be estimated for only four major water uses—irrigation, municipal, industrial, and recreational. The scope of the study was adjusted in accordance with this recommendation, although other major uses are included in the review of pricing policies presented in Chapter III.

In order to devise fee structures for these major water uses, appropriate economic theory was reviewed. Criteria based upon political and economic equity, economic efficiency, allocational effectiveness, administrative simplicity, and revenue generation potential were identified and subsequently used for evaluating fee structures.

A case study approach was used to analyze water-user fee alternatives in Utah. The case studies estimated the funds that might be raised by the various alternatives under different fee levels. Although conditions vary, many of the problems and effects of applying water-user fees in Utah could be expected in other states. A formula was developed for estimating the fund generating potential of user fees (see Chapter V) in other states.

CHAPTER I

EXPERIENCE OF STATES AND SELECTED FOREIGN GOVERNMENTS WITH WATER USER FEES

GENERAL

Various forms of water user charges have been utilized by foreign governments and by U.S. federal government agencies, and sewer and water charges by local governments are common. States generally have not employed water-user fees as a source of operating funds for water agencies or of water development capital. A 1974 survey of state water financing arrangements in connection with this project and in cooperation with the Utah Division of Water Resources revealed that few states are imposing water user charges on uses other than recreation and then on only a limited basis (see Table 1). Just two states reported a fee for water diversions; two others have fees for waste discharges; three reported fees on hydropower; only one has storage fees; and one other state levies fees on water rights from state lands. Nine states sell water from state water projects or from purchased storage in federal projects.

Table 1. State user fee programs.[a]

State	Water Sales	Other[b] User Fees
Arkansas		Storage
California	x	
Hawaii	x	Water Rights[c]
Indiana	x	
Kansas	x	
Louisiana	x	
Michigan		Waste Discharge
Nevada	x	Hydropower & Diversion
New Hampshire	x	
New Jersey	x	Diversion
New York		Hydropower
Ohio	x	
Oregon		Hydropower
Wisconsin		Waste Discharge

[a]Source: Survey of state water-user fee programs conducted in cooperation with the Utah Division of Water Resources, 46 states responded.

[b]Exclusive of one-time permit fees and recreation fees and licenses.

[c]Leases out water rights from state lands.

Although state water sales constitute a different form of payment by users than the user fee (excise tax) being considered in this study, information on water sales is included in Table 1. State experience in structuring and administering water sales may have application in establishing user fee systems. The brief descriptions of various state and foreign government systems which follow are divided into two sections: one on user fees and one on water sales.

Several states have established special revolving water development funds and some states make annual appropriations for state and local water projects. Most, if not all, states have license fees and access fees for fishing, hunting, and various other forms of water recreation. The revenues from these fees, however, ordinarily serve to defray management and operating expenses of the agencies concerned with these activities, and none is made available for water development or for administrative expenses of water management agencies.

WATER USER FEES

Ecuador

The water user fee similar to an excise tax is rare; however, it is being employed in a few places. Ecuador, South America, (Daines and Falconi, 1974) treats water as a publicly owned commodity and charges a concession tax on its use. This tax is not related to maintenance, operation, or the value of the works from which the user benefits, but is a tax on the use of water per se. The amount of the tax varies with the amount of use, and different rates are applied to different uses. Only culinary use is exempt. The tax is based upon metered use or upon the amount awarded in the concession. The funds generated by the tax are used to finance the operation of the government's water agency. See Appendix A for a schedule of charges.

British Columbia

In British Columbia, Canada, ownership of water resources rests with the province, and annual rental fees must be paid for storage and diversion rights for a wide range of uses (Province of British Columbia, 1974). Rentals are payable whether the licensee exercises his rights or not. Current rental rates are presented in Appendix A.

Except for water used for hydropower, the annual rental fees are nominal. Of the approximately $11 million of annual revenue produced by these fees, in 1976 two-thirds came from hydropower. The main purpose of the fees, according to a province water official, is not to generate revenue, but to establish government ownership of the resources and encourage licensees to give up unused rights. The revenues are not earmarked for water development or administration but revert to the general funds of the province.

Arkansas

Under provisions of Act 81 of 1957, Arkansas requires that no person construct or own a dam to impound water exceeding a certain size on any stream until he obtains a permit from the Arkansas Soil and Water Conservation Commission. The act further requires that an annual fee of 2 cents per acre foot be charged for the water stored. The money derived from these fees goes into the Arkansas Water Development Fund which is administered by the Commission. The Commission may use the funds to participate in water development projects through loans, grants-in-aid, and joint ventures.

Hawaii

The Department of Land and Natural Resources leases out water rights from state lands by public auction. The revenues are deposited in the state's general fund.

Michigan

The Michigan Water Resources Commission administers a water quality surveillance fee program. Originally authorized by the State Legislature in 1970, surveillance fees generate approximately $1 million annually. The fees are graduated from $50 to $9,000. They are charged to commercial and industrial facilities which discharge wastewater to the surface or groundwaters of the state. Proceeds are used to reimburse the state for costs incurred in monitoring the discharges.

Nevada

Colorado River water users are charged $0.05 to $0.55 per acre foot surcharge on top of $0.50 per acre foot paid the Bureau of Reclamation for diverted water. These funds are used to cover administrative expenses of the Division of Colorado River Resources, the agency that has responsibility for administering the power resources allocated to Nevada from the Colorado River Storage Project. All contracts executed after 1963 for power generated on the river system provide for a charge of .03 mills per kwh to be deposited into the Division's Research and Development fund. This income (approximately $5,000 annually) is available for water development, and is in addition to income from a 0.1 mill per kwh administrative "surcharge."

New Jersey

Surface water diversion fees, which currently range from $1.00 to $10.00 per million gallons as flows are decreased below minimum levels to zero, were established by statute in 1907. In part, the fees were to provide economic incentive against streamflow depletion; however, the charges are not high enough to meet this objective in today's economic environment. Current annual revenue of approximately $250,000 is returned to the state treasury.

New York

Four hydropower developments utilizing waters in which the state has a propriatory right must pay annual license fees into the state general fund. The first of these licenses was granted in 1896 for perpetuity at a flat rate of $200 per year. The three other licenses, granted in the mid 1920s for terms ranging from 30 to 50 years, pertain to surplus waters of the state canal system. Flat rates charged for these three licenses annually amount to $12,000, $18,000, and $40,000.

Sixty applications for hydropower licenses were received by the state prior to 1930. Some never came to fruition; others expired and were not renewed. No new applications have been submitted since 1930.

Oregon

The state requires hydroelectric power plants to pay annual fees of 20 cents per theoretical horsepower per year and obtains approximately one-half million dollars per year revenue. The proceeds go into a state general fund.

These annual fees have been in effect for several decades, and currently are imposed on 80 private companies and municipalities. According to a state water official, the fees were initially imposed along with limited term licenses on hydropower to constrain the development of monopolies. Hydropower was considered a profitable enterprise, and many different interests were competing to tie up available power sites. The fee was viewed strictly as a tax.

Wisconsin

The Department of Natural Resources administers a monitoring fee on waste discharges. Dischargers of industrial wastes, toxic, and hazardous substances are required to pay a $50 annual monitoring fee plus an additional fee based upon the concentration and quantity of pollutants discharged. See Appendix A for fee schedule.

WATER SALES

California

California sells water developed and delivered under its large state water project. Water supply contracts have been made with 31 local water organizations, representing two-thirds of the state's population and one-fourth of its land area. These organizations have contracted to pay all project costs allocated to water supply—about 85 percent of the total cost. In 1975 it was estimated (State of California, Department of Water Resources, 1975) that total project construction expenditures would eventually reach $4 billion and that an additional $3.9 billion would be required for distribution systems to convey water from project aqueducts to users; this latter amount to be paid exclusively by the local water contractors.

Under the water supply contracts, $71.9 million of local funds were advanced to pay construction costs for delivery structures and excess capacity required locally. Some organizations at the lower end of the project delivery system began making payments several years in advance of water deliveries. The contracts require payments of 1) a Delta water charge and 2) a transportation charge.

The Delta water charge is assessed for each acre-foot of water a contractor is entitled to receive. The charge is computed so as to return to the state during the term of the contract all costs (together with interest) attributed to the reservoirs and other facilities used to store water and release it downstream to the Sacramento River Delta. Costs allocated to flood control, recreation, and fish and wildlife enhancement are not paid under the water supply contracts, but charges for power costs and credits for power revenues are included in the determination of the Delta water charge.

The transportation charge is computed so as to return to the state during the term of the contract the costs of the aqueducts required to deliver the water from the Delta to the respective contractors. Construction costs and operating costs of each aqueduct reach are allocated each year among contractors whose deliveries are or will be conveyed through that reach. Municipal and industrial users repay each year's construction expenditures with interest in 50 equal annual installments. Agricultural users repay allocated construction costs by a uniform charge per acre-foot of water entitlement computed to return such costs with interest during the term of the contract. The publication entitled, Standard Provisions for Water Supply Contracts (State of California Department of Water Resources, 1962) describes the principles used to define the two charges. Current rates are tabulated in Bulletin No. 132-76 (State of California, Department of Water Resources, 1976).

The 31 contractors that purchase water from the State Water Project recover their costs through direct user charges, property taxes, or a combination of the two. The Metropolitan Water District of Southern California (MWD), one of the major contractors, supplies water to agricultural, municipal, and industrial users. The water rates and financing structure of MWD, though not typical of smaller contractors, exemplifies local arrangements for repaying state water contract costs.

The MWD delivers water to six counties in Southern California. The Colorado River and the state project bringing water from Northern California are its two sources of supply. Deliveries may be of raw, untreated water, or filtered water.

The district obtains revenue from water sales, property taxes, annexation charges, and interest income. Water sales and property taxes account for most of the income. In addition to payments for state project water, the District must pay debt service on bond obligations and operating costs.

The distribution of costs between taxpayers and water users is guided by provisions of Resolution 5821 which was adopted by MWD in 1960.

> All payments received by the Metropolitan Water District of Southern California for annexation charges shall be applied first to bond obligations to which they are or become pledged and next to reduce other indebtedness resulting from capital expenditures.
>
> At least one-half of all remaining capital charges plus all operation and maintenance costs of the Metropolitan Water District of Southern California shall be borne by sales of water at uniform rates to constituent members irrespective of the source of point of delivery of the water, except for equitable surcharges to reflect the cost of special services. The rate for water shall be at least as large as the total of all such costs in the three prior fiscal years plus the anticipated cost in the next three years divided by the total quantity delivered to constituent members in the three prior years and that quantity projected for the ensuing three years.
>
> The remainder of all capital charges may be met from tax levies on the basis of assessed values of property within the Metropolitan Water District of Southern California to the extent permitted by law; when the expectancy that this tax burden will diminish progressively as the use of water approaches the total of the Aqueducts' supplies.

According to the resolution, after annexation charges and interest income have been subtracted, the remaining capital costs are divided with one-half or more being assigned to water users and the remaining one-half or less being assigned to taxpayers. The resolution also requires that all operating costs be repaid by water users. These include 1) fixed costs of operating the District systems and the District's obligation to the State Water Project and 2) variable costs, which are essentially power costs, incurred in delivering water through the Colorado River Aqueduct and the State Water Project.

The Metropolitan Water District Act (Chapter 429, Statutes 1927) requires uniform water rates throughout the District except for equitable surcharges for special services or associated with cost differences among the sources from which water is obtained. Under this latter provision, MWD has established a uniform surcharge for state project water above the charge for Colorado River water.

Current water rates of MWD for given classes of service are shown in Appendix A. Water rates for agriculture and groundwater replenishment do not cover the full share of capital and fixed operating costs incurred in providing service. Resolution 5821 states that taxpayers should make up the deficit.

There has been continuing discussion in the District about the division of charges between the general taxpayer and the water user. When the Colorado River Aqueduct was initially put in operation, there were not many users to pay the costs, so a large portion (approximately 90 percent) of the costs was paid by the taxpayers. As years passed, the proportion paid by the water users increased, and a 50-50 split was adopted in 1960. Although the argument has been made each year since that time to increase the proportion paid by users, the split has remained at about 50-50. One of the counter arguments made for keeping a portion of the costs on the general taxpayer is that some of the major regional systems of MWD have considerable excess capacity. This excess capacity might be considered as an investment in meeting future requirements.

Hawaii

The Department of Land and Natural Resources operates three irrigation systems which support farming operations at Waimanalo on Oahu, Lalamilo on Hawaii, and in West Molokai. The Board of Land and Natural Resources has the power to fix and adjust rates and charges so that the revenues derived from the irrigation systems are sufficient to cover the cost of operation, maintenance, replacement, and the capital costs. Water rate schedules for these three irrigation systems are shown in Appendix A.

Indiana

The Department of Natural Resources is empowered to sell water from impoundments constructed by the state or from impoundments of the Corps of Engineers in which the state has acquired water supply storage. Sales have been made from both classes of impoundments and in all cases the sales have been for municipal water supply. Revenues from these sales are deposited in a dedicated water resources development fund to be used for the acquisition of additional water supply storages.

Kansas

In 1974, the Kansas legislature passed legislation authorizing the purchase of water supply storage space in federal reservoirs and the sale of water from this state-managed conservation storage. Provisions in the legislation for setting charges are as follows:

a. Provision for charges, which shall be set by the board, at a rate which the board shall fix of not less than five cents (5¢) per one thousand (1,000) gallons of water at the point of withdrawal from the reservoir and not greater than ten cents (10¢) per one thousand (1,000) gallons of water at the point of withdrawal from the reservoir;

b. Provisions for a minimum charge to be paid in equal annual installments during the term of the contract, the sum of which shall be fifty percent (50%) of the total amount of water contracted for during the term of the contract multiplied by the rate fixed under paragraph (a), and that such minimum charge is to be paid each calendar year whether or not such amounts of water is withdrawn during the calendar year (Senate Bill No. 633).

Louisiana

When the diversion works for the Toledo Bend Reservoir (constructed jointly by Texas and Louisiana) are completed, the state will sell water at a rate of 4¼ cents to 5½ cents per 1,000 gallons. However, the money derived from this project will not be used to support state-wide water development.

Nevada

The Southern Nevada Water System under the Division of Colorado River Resources is financed by Nevada general obligation bonds, and a federal grant from the Department of Housing and Urban Development. Pumping and transmission facilities were constructed by the U.S. Bureau of Reclamation. The bond service and the construction costs of pumping and transmission facilities are being repaid from revenues. Water user fees are not being charged to finance further water development but cover the state's actual cost of operation and maintenance plus debt service.

The Marlette Lake Water System under the Nevada Department of General Services sells water wholesale according to executed contracts with Storey County, Carson City, Lake View Subdivision, and the State of Nevada Department of Buildings and Grounds. The universal wholesale cost to these entities is $0.16 per 1,000 gallons, less 10 percent for evaporation, and revenues are used to pay for operation and maintenance costs.

New Hampshire

The Board of Water Resources operates three water projects:

1. Pittsburg Dam at the headwaters of the Connecticut River which offers conservation storage

for hydroelectric power generation downstream.

2. Lake Winnipesaukee Dam at Lakeport which offers public recreation and water conservation for hydroelectric generation downstream.

3. Greenville Water Supply Reservoir which provides flood control benefits and domestic water supply for the town of Greenville.

Contract sales to water users make the projects self-supporting. "The compensation for the use of the stored water or other benefits created by the project shall be made equitable as between different users" (State of New Hampshire, Revised Statutes Annoted 481:1). Revenue pays for capital costs, interest charges, supervision, maintenance, and operation of the projects with no expense to the state general funds.

New Jersey

The state's major role in water supply is in wholesaling raw water to water purveyors and other public and private users. New Jersey does not construct or subsidize treatment, transmission, or water distribution facilities.

Sources of revenue from water sales from state owned and operated facilities are as follows:

1. The *Delaware and Raritan Canal.* This canal, constructed in the 1930s was rehabilitated in the 1940s with state appropriations to provide a source of raw water supply for public and industrial use. Revenue in 1973 from water sales on a peak demand charge basis amounted to \$555,000 (\$250,000 in excess of operation and maintenance expenses) and this was returned to the state treasury. Cost per million gallons recently was increased from \$35 to \$50 to establish rates compatible with charges on other state projects.

2. *Round Valley Spruce Run Project.* Construction of this reservoir was authorized and funded by the New Jersey Water Supply Bond Act of 1958. The charge for water from this project covers all operating and maintenance costs; however, the state pays the cost for bonding and interest on the unsold balance of water which the project can develop.

Ohio

The Department of Natural Resources supplies water from surface water impoundments constructed by the state or by the Corps of Engineers. When a water customer is identified, treatment and distribution works are constructed and sales begin as soon as the pool reaches the required level. Water supply capacity is sometimes allocated for future expansion and held in escrow until needed. Rate schedules vary from location to location with the amount of available supply and the amount of operation, maintenance, and capital costs assumed by the customer. The general formula for determination of the rate is:

$$\frac{\text{Operation} + \text{Maintenance} + \text{Interest} + \text{Amortization}}{\text{Available supply}} = \text{Unit price}$$

Calculations for Corps projects utilize a 50 year project life, and those for state projects use a 40 year project life. Factors are estimated conservatively so that the program will be self-sustaining when all impoundments are operating. In the beginning, a portion of the operation and maintenance is financed by appropriation from the General Revenue Fund.

The Department of Public Works supplies water to various activities throughout the state from an old canal system and feeder lakes. The major customers are industries. See Appendix A for rate schedules.

A number of cooperative arrangements for water supply have been negotiated between the Department of Natural Resouces and municipalities. For example, the Department agreed with the City of Clyde to share the cost of a reservoir recommended in the Northwest Ohio Water Development Plan. After the final costs were determined, the state's equity in the reservoir amounted to 39 percent of the impoundment space. The state shares operation and maintenance costs on a 39-61 percentage ratio. The state also shares in the receipts from water sales. In 1974, the City of Clyde and the State of Ohio sold an average of 2,500,000 gallons of water per day to an industrial user, Columbia LNG. The arrangement is unique in that the State of Ohio has assured the quality parameters of the water which Columbia LNG withdraws at the reservoir outlet.

Another cooperative arrangement was made between the Department of Natural Resources and Kelleys Island. Until recently, Kelleys Island was using chlorinated surface water from Lake Erie, and the State Park on the Island was one of the largest water users. In this instance the state advanced \$65,913 to Kelleys Island to assist in the construction of a slow sand filter treatment plant. Kelleys Island will repay this advance by giving the State Park "free" water service until such time as the \$65,913 advance funding is repaid.

At Alum Creek Reservoir, the state has undertaken the option of a low interest, 50-year repayment schedule, which the Corps of Engineers customarily offers for water supply storage in Corps dams. The state has contracted with the cities of Columbus and Westerville to provide water from state water supply equity in the impoundment. In this example, the state acts as the middle man, collecting payments from the cities and passing them to the Corps. No state profit or loss is involved.

Ohio regional water plans are designed to provide water needs over a 50-year period. Accordingly, when a multi-purpose water project is recommended in one of the regional plans, it is assumed that the engineers have correctly assessed the amount of water that will become available and the regional needs. State assistance is considered only after the municipality applies for help in the construction of a project identified in the regional plan.

Generally, the state participates in impoundments which include water for recreation, municipal water supply, agricultural irrigation, and sustained stream flow. In some cases, without any charge to downstream landowners, the state intentionally releases water to maintain low flows. However, sustained stream flow releases are not made to dilute waste loads as this would be at variance with the provisions of the Water Quality Act of 1972.

If the state is petitioned to release water for downstream withdrawal for agricultural irrigation, the water is sold to the user at prevailing rates.

Recent Experience of Washington State with Water User-fee Legislation

A bill which would have required irrigators and other water users to pay a fee to the state for the use of water per se was introduced in the 1975 session of the Washington State Legislature at the request of the governor. The governor explained his request as follows:

> In 1917 the legislature passed the water code for the State of Washington and legislatively stated very clearly that 'all waters within the state belong to the public.' We gave it away and have consistently given it away because we thought that it was abundant. But water today, just like land, is scarce.
>
> Fifty-eight years after adoption of our water code we now face a water shortage in essentially every river basin in the state with the exception of the lower Snake and the mid-Columbia. So existing water supplies in many areas of our state are today inadequate. Irrigation is the largest potential use of water in the state. We today use more water for irrigation than for all other purposes combined. Today about a million and a half acres of Washington State land is under irrigation. Ten million more acres are potential for irrigation.
>
> My concern was expressed...in the conversation and agricultural messages I presented to the legislature near the beginning of this session, indicating my belief, which I still hold strongly, that the future of this state is very much involved with the development of agriculture. The agricultural surpluses of a few years ago are now world wide shortages.
>
> The governor explained that his bill specified that 80 percent of the proposed charge for water would go into a fund 'which would be used for a grant and loan program to expand and develop the very thing that we are talking about: the enormous agricultural future of the State of Washington (The Idaho Falls Post Register, September 19, 1975).

The bill (House Bill No. 458; copy in Appendix G) specified that "the fee shall relate only to rights to divert or withdraw and make use of significant amounts of public waters for industrial, commercial, and agricultural irrigation purposes." Initial and immediate opposition arose from irrigation interests. One real estate developer saw the bill as a "socialistic drive" to gain state control of water, and a threat to private development (Tri City Herald-Pasco, Kennewick, Richland, Washington, February 19, 1975). An Eastern Washington legislator said that fee would amount to double taxation, noting that "farmers pay taxes on their land and charging for water would be another tax" (Tri City Herald-Pasco. Kennewick, Richland, Washington, February, 13, 1974). Legislators observed that it was a drastic break with tradition, and that no other states are "taxing farmers for water." One Senator and former Farm Bureau leader expressed concern that the Winters doctrine would apply and that Idaho and Canada could justly come in for a portion of the revenues (Idaho Falls Post Register, September 30, 1975). Some individuals argued that the governor seemed to be overly influenced by environmental and ecology interests (Idaho Falls Post Register, September 23, 1975). Although there was some expressed support for the bill and the user-fee concept within the Washington legislature, the upshot of the adverse publicity and strong special interest opposition killed the bill in committee.

CHAPTER II

THEORY OF USER FEES

ADD-ON FEE (EXCISE TAX)

Introduction

Since the user fees examined in this study are a type of excise tax, the theory on excise taxes is relevant. "Excises" are of two types, a "unit tax" for which the base of the tax is the physical amount of the resource being taxed and an "ad valorem tax" for which the base is the value of the resource. A broad based "ad valorem" tax is generally known as a "sales tax."

Price Effect

The impact of excises on price is a very important consideration in evaluating their feasibility and one which economic theory addresses in detail. If no account is taken of how the money raised by the tax is spent, then the impact depends on who pays the tax. It could be passed along to the consumer in the form of higher prices, absorbed by the producer in reduced profits, or shifted back on to the resource owners in the form of lower wages, rents, royalties, interest charges, etc. The way the tax burden is shared among these three groups depends on the market structure for the industry and the nature of demand. Generally, speaking the more important and essential the good, the more likely the tax will be passed along to the consumer in the form of higher prices; however, the ability to pass the tax along is influenced greatly by market structure. Only in the case of constant production costs and a competitive situation can the tax be passed along fully to the customer. The geometric and algebraic proofs of these statements are found in Appendix F.

In monopoly situations, the prices being charged before the tax are already inflated by monopoly profit. The price increase associated with a tax in this circumstance can be expected to be about one-half of what it would be in the competitive market. More of the tax would be absorbed by the producer out of profits. In general, an excise will be only partially passed along to the customers, and only that part which is passed along will reduce consumption.

Unit Tax and Ad Valorem Tax Compared

A unit tax is based on only one variable—"output" while an ad valorem tax is based on two—"output" and "price." An ad valorem tax will generate larger revenues than a unit tax when demand is high and lower revenues than a unit tax when demand is low. If the purpose of the tax is to curtail consumption of the product, then the obvious choice is the ad valorem tax since it will lead from a similar initial burden to a higher price and a smaller output and use.

Administrative Considerations

The broader the base of an excise tax, the simpler it would be to administer. It is easier to tax all boats than just those used for recreational purposes. The tax is more likely to be passed along to the consumer since the broader base would undoubtedly mean more firms would be involved.

Excise taxes also are subject to geographical considerations. Local excise taxes easily can be avoided by making purchases elsewhere. The opportunity for tax avoidance is reduced as the geographical range of the tax is increased.

Imposition of the Tax

An excise tax can be levied at the manufacturing, wholesaling, or retailing level. The advantages at the retailing level are several. It imposes the tax on the actual selling price so as not to discriminate against the means of production and distribution. Lower rates can be used for the same amount of revenue than at the other levels. It also avoids the problems of tax pyramiding in which the tax is imposed more than once within the productive and distribution processes. The fact that the tax is not hidden in the price encourages uniformity of treatment of customers. The problem of how to handle taxed inventories is removed. The major disadvantage of the retail excise is that the collection process increases the number of taxpayers substantially and makes auditing more costly.

Other Considerations

Excise taxes could in some cases alter the quality of the products produced and the size of market areas if the tax is included in transportation costs. Also, if the tax is hidden, customers may confuse the tax with general inflation and their demand curves will shift accordingly. As a result, prices might rise more than theory would indicate.

FULL COST FEE (PRICING SCHEMES)

When the fee is to cover the cost of the product or service and not just be a percentage additional to the base price, more general micro economic theory is applicable. When the structure, goals, and management of a monopoly water supply system are analyzed, the theory suggests three broad strategies that might be used in relating price to costs of production. These strategies are marginal cost pricing, average cost pricing, and monopoly pricing.

Although the user fees (excise tax) considered in this study for generating state water development funds do not necessarily relate price to costs at the state level, it is useful to examine pricing policies in designing fee structures and establishing fee levels. Local organizations—mutual irrigation companies, municipalities, etc.—that have a state water fee imposed upon them can be expected to distribute this tax burden to their shareholders or customers. The effects of this distribution will depend to some extent on the pricing strategy a local unit employs. The state imposed fee may be considered in effect as an element of operating cost to these local organizations.

Marginal and Average Cost Pricing

Marginal cost pricing is the policy most conducive to the efficient use of resources. This policy sets the price at a level at which the marginal costs and benefits are equal. In other words, the user is charged a price for a resource that is equal to the incremental (marginal) cost of production. In Figure 1 marginal cost is represented by curve MC, average cost is represented by curve AC, and demand is represented by line D.

The most efficient price is located where the MC curve intersects the D curve (P_e). When the price is set below marginal costs (P_1) resources will be overused (Q_1). Alternatively, if prices are set above marginal costs (P_2), resources will be underused (Q_2).

At price P_1 the costs of producing quantity Q_1 far exceed the price and result in a loss. At price P_2, the price far exceeds the cost of producing quantity Q_2. Only at P_e are the costs and revenues equated.

Costs, however, do not always follow the pattern shown on Figure 1 in which marginal costs are increasing where they cross the demand curve. Municipal services are frequently thought to be decreasing cost industries (each additional unit up to the total demand costs less to produce than the previous unit). In this case, pricing at marginal cost will fail to cover the costs of production (Hoggan and Asplund, 1974), competing industries will be forced out of business, and the remaining monopoly will then be able to raise its prices to more than cover its costs.

In Figure 2, AC represents the average cost of producing a commodity and includes a "fair" rate of return on the capital investment. MC represents the marginal cost of producing an additional unit, and D represents the demand of the commodity at any given price. Typically, the regulated price for a monopoly (a decreasing cost industry) allows costs to be recovered, along with a "fair" return on investment. This is referred to as average cost pricing. At P_c, in Figure 2, the firm is covering costs as well as earning a fair rate of return on its investment. The determination of average cost is relatively easy, and given that costs are clearly specified, this approach is straight forward and considered equitable politically. However, if the price is set at the most economically efficient price P_e, the firm operates at a loss equal to the rectangle P_1GHP_e, and a subsidy would be required to maintain production. Either efficient pricing is sacrificed or the utility is subsidized.

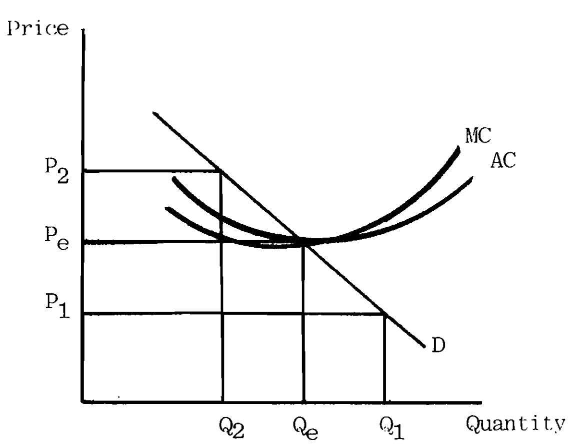

Figure 1. Marginal cost pricing.

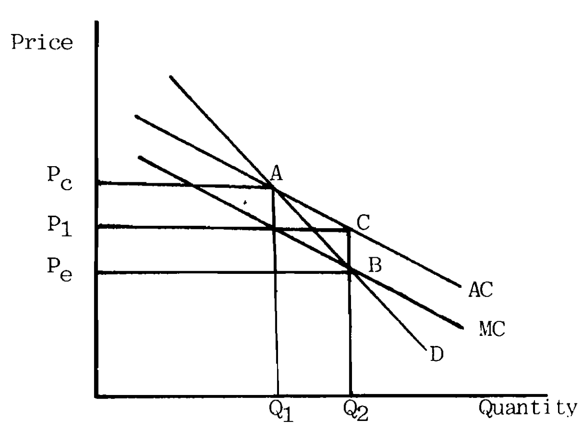

Figure 2. Decreasing cost industry.

Some economists argue that water service, at least in instances where more distant sources must be sought is not a decreasing cost industry. All economies of scale have disappeared due to increasing costs of providing for treatment and for system expansion. Figure 3 graphically represents an increasing cost industry. Setting the price equal to average cost, P_a, encourages over use as Q_a will be demanded. The marginal cost of producing the last unit, however, exceeds the price by P_aP_c. Average cost pricing in this situation is obviously a poor business practice. With the price set equal to marginal cost, conservation is encouraged as the quantity demanded is reduced to Q_e. The price reflects the costs of production, allocates the resource efficiently, and generates a pure economic profit equal to the rectangle P_bP_eAB.

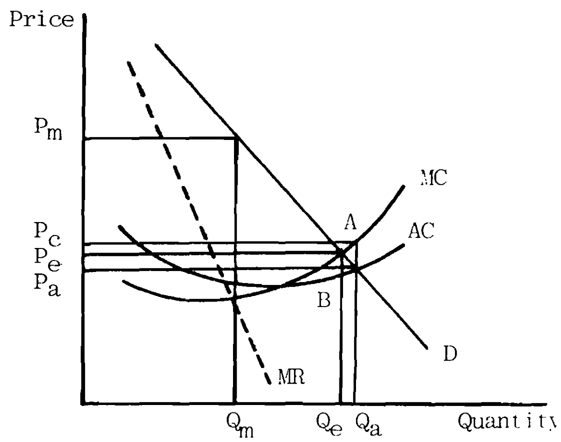

Figure 3. Increasing cost industry.

Monopoly Pricing

When the primary objective of a water utility is to raise money, monopoly pricing is the most effective because it maximizes profit with the firm producing at the point where marginal cost and marginal revenue are equal. If marginal costs are below marginal revenue, selling one or more unit will increase profits. Alternatively, if marginal cost is above marginal revenue, additional units decrease profits. In Figure 4, MR represents the marginal revenue curve. At point G, where marginal cost equals marginal revenue, the price is P_m, the quantity demand is Q_m, and the firm generates a profit equal to the rectangle $ABCP_m$. Clearly, the result of maximizing revenue is under utilization of resources.

Price Discrimination

Some resources are purchased by various distinct groups of buyers (residential and industrial water users, for example). When it is possible to separate markets in this way, it also is possible to practice

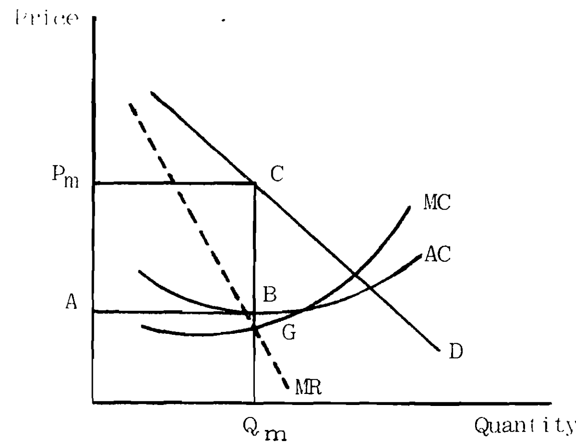

Figure 4. Monopoly pricing.

discriminatory pricing by charging different user groups different prices for the same commodity. Because marginal revenue is a function of demand elasticity, a monopoly can divide the market and allocate output among submarkets equating marginal revenue in each submarket with the aggregate marginal revenue at the marginal cost point. In this situation, price is established by the demand in each submarket. The more elastic the demand in the submarket, the lower the equilibrium submarket price.

Figure 5 shows how profit maximization is achieved with price discrimination. There are two market demand curves. D_1D_1 represents one and D_2D_2 represents another. MR_1 represents the marginal revenue in the first submarket and MR_2 represents the marginal revenue in the other submarket. The curve MR represents the aggregate marginal revenue. By including the aggregate marginal and average cost curves, the profit maximizing prices can be determined. The profit maximizing performance is now reduced to a monopoly problem. The total output should be Q at which MC = EMR.

In submarket 1 the price is set at P_1 and the quantity sold is Q_1. In submarket 2 the price is P_2 and the quantity sold is Q_2.

Marginal revenue in submarket 1 equals marginal revenue in submarket 2 equals r with this sales distribution. If total output and sales were less than Q_1 marginal revenue in one market or the other (or both) would be greater than r and marginal cost less than r. Increases in quantity up to Q would therefore add more to total receipts than to total costs and would increase profits. If total output and sales were expanded beyond Q_1 marginal cost would exceed r and marginal revenue in one or both markets would be less than r. Such increases in production would add more to total costs than to total receipts and would decrease profits.

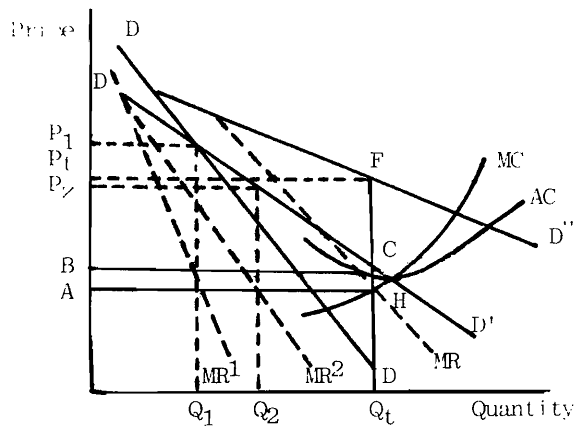

Figure 5. ***Profit maximization with price discrimination.***

SUMMARY

In summary, the theory of excise taxes and user charges suggests that the most efficient approach to collecting user fees to finance additional water resources development programs would be through a full-cost fee rather than through an add-on fee or excise tax. In a competitive pricing situation, rather unlikely for water supply and other water project services, higher charges would alter previous resource allocation, probably in the direction of reduced efficiency. In the more likely monopoly situation, a monopoly position can be used to collect extra revenue, and price discrimination can be used to collect even more. Such additional revenue can be used as capital to finance water resource development. This approach to financing should be more equitable than financing through general tax revenues because having users pay the fixed cost for serving them as a group enhances overall resource allocation efficiency.

CHAPTER III

REVIEW OF APPLICATIONS OF WATER PRICING POLICIES

GENERAL

Prices are used to allocate scarce resources. Buyers offer prices that reflect their valuation of a resource, and sellers quote prices that reflect the costs of production. This suggests that over the long run revenues collected will equal or exceed costs of production (Howe, 1967).

> An increase in the consumption of a commodity produces a benefit to the consumer. Every expansion in output usually requires, however, the withdrawal of resources from the production of some other item. Therefore, the expansion of output entails a cost to the would be consumers of foregone alternate products and services. The general role of prices is to balance benefits and costs at the margin, i.e., to assert proper checks and balances on both production and consumption in any economy. Therefore, prices have two functions: to discourage excessive consumption of a commodity and to induce the desired supply of that commodity. Prices can act not only on the marketing of private goods but also in regulating the production and consumption of certain commodities produced by governments (Hanke and Davis, 1973, p. 808).

User-fees are similar to market prices and provide the best results where the cost of exclusion is low, few or no consumption externalities exist, and the resulting redistribution of income appears favorable.

Chapter II describes such policies as marginal cost pricing, average cost pricing, monopoly pricing, and price discrimination. This chapter looks at the various uses of water and describes the pricing policies for each use. In irrigation and M and I uses, the fees are designed to cover all relevant costs. In pollution and recreational uses, the fee is designed to cover only costs to achieve that benefit and not for the entire project.

IRRIGATION PRICING POLICIES

The federal government has long followed a policy of increasing the productive capacity of agriculture. This policy is based on two goals: first, insuring low food prices through abundant supplies of agricultural products; and second, improving the standard of living for the rural population. When western expansion reached the semiarid regions, the federal government began building irrigation projects. The Reclamation Act of 1902, a major landmark in federal water policy has provided massive support for irrigation of arid lands (Howe et al., 1971).

Irrigation water pricing policy of the federal reclamation program reflected the social goals of settlement and equity of opportunity for the nation's farmer. Evidence of this can be seen in the repayment policies of the reclamation program. First, irrigators are not required to pay interest charges on reclamation project costs attributed to irrigation. Second, there is a waiting period of 10 years after water delivery until the first payments must be made. Third, excess power revenues are employed to cover part of the costs of producing water for agriculture. According to one estimate, farmers pay only about one third of the costs of supplying an acre foot of water (Brown, 1968).

A study by the Stanford Research Institute (1958) indicated that the interest waiver alone reduced the repayment responsibility of the typical irrigator by about half. Further reduction resulted from a policy that the irrigator should not be charged more than his ability to pay. This policy charges more project costs attributable to irrigation to power users and the general tax payer.

Some of the adverse effects of these policies can be readily observed. Since a significant portion of irrigation (project) costs are borne by others, resulting in an inordinately large demand for cheap irrigation water, a disproportionate amount of project water is allocated to irrigation, and water projects may be oversized. "Agricultural output within the project service area is greater than it otherwise would have been implying that the agricultural sector purchases a relatively greater quantity of the scarce resources such as chemicals, machinery, and research talent. Because the quantitative demand for these resources is relatively greater, the other economic sectors using these resources must pay higher prices" (Brown, 1968).

To overcome some of the problems of current pricing policies, Davis and Hanke (1971) recommend cost-based pricing at the source for irrigation water. Beneficiaries of any new development projects would have to pay for the resulting externalities, operation and maintenance, and capital costs. Charges would vary with the distance of water transmission as well as seasonal changes in flow.

Under the present system, efficient water use is not the primary objective of administrative agencies. The legal and institutional constraints on the trading of water rights sometimes make allocation to the most productive uses difficult. Farmers and irrigation districts seek the lowest possible price to the user. In many cases water administrators do not even measure the water delivered (National Water Commission, 1973).

Many state constitutions in the west assert that water resources are owned by the public. Following a policy of promoting economic development, states have not levied fees on the rights to use water (Howe et al., 1971). The doctrine of prior appropriation in water rights was developed on a first-come-first-served basis.

Much of the privately developed water used in agriculture is groundwater. The National Water Commission (1973) suggests that groundwater reservoirs be treated as if in single ownership. Practically, this means the organization of a water management district for allocating the resource. In terms of pricing, this might mean that a pump tax could be levied on each acre foot withdrawn from the underground reservoir to build a development and operating fund.

One arrangement for water pricing in irrigation districts is a combination of land value assessment and a toll for water use.

> The assessment is an integral part of the pricing device of public water districts which also includes a charge per unit used or water toll. These two components jointly determine the payments members make to their district. Assessments are levied annually on privately owned land within the district. The water toll is incident only upon members using water supplied to them by the district. Customarily, the toll is defined in terms of a volume unit, such as an acre foot, although occasionally it is based on the area irrigated with district water. The most usual practice is to specify a seasonal charge for each acre irrigated from the district supply. This may be the same for all crops, but most commonly varies in rough proportion to the relative amount of water applied to each irrigated crop.
>
> The entire payment incident upon a member for a given amount of water may change either in terms of its total magnitude or the proportion that the toll and assessment components bear to each other. Although emphasis is placed on the district assessment, it cannot be considered relevantly in isolation from the water toll (Brewer, 1961).

The following alternatives are used for valuing land within a district: (1) a single value per acre on all land assessed; (2) a set of per acre values, applied to land and water use; (3) a set of per acre values that are relative to the cost incurred by the district for supplying a particular land parcel; and (4) a set of per acre values applied according to the relative soil characteristics of particular parcels.

Generally, the assessment is in dollars per $100 of the property base value; however, procedures for valuing property differ widely among districts and even within districts over time. "Old valuation practices generally used either a flat rate value for all land or some fraction of the value assigned for county tax purposes. Many districts have modified these early methods to make allowance for land of different agricultural potential" (Brewer, 1961).

Another way for recovering costs of water projects was proposed by the Stanford Research Institute.

> It appears that the state must recover all of the costs allocated to water and encourage the maximum use of its water facilities by dividing its water charges into two parts. The first part would be an annual fixed (or capacity) charge, payable by the contracting agency even if it bought no water at all and covering all of the annual capital costs allocated to that agency. The charge would be fixed in the sense that it would depend not on the amount of water actually used by the agency in a given year, although it might vary from year to year because (1) total capital costs are repaid in amounts which change (increase) each year over the lifetime of the project, or (2) because the share of the total annual capital costs allotted to any given agency might be revised to reflect changed conditions. Provision also might be made for the state itself to assume the obligation of repaying the fixed charge allocated to certain public water districts during some initial development period, providing the district agreed in turn to repay the state subsequently with interest.
>
> The second part of the charge would be a variable amount designed to cover the operation and maintenance costs of producing the water actually used by the contracting agency (Stanford Research Institute, 1958).

Three other alternatives are set forth for recovering the costs of irrigation water:

1. The state could market water on a per-unit basis, charging the water user a price designed to recover annual costs under conditions of full capacity operations. Of course, such a policy would not pay for itself until the project reached full capacity operation.

2. The state could set a price designed to cover all costs year by year regardless of the level of operations; however, such a price would be so high at the outset that almost no water would be sold.

3. The state might attempt to set a price to remain unchanged over the lifetime of the project and still recover all the costs over the long run. Such a price would require very difficult forecasts of future use and costs in addition to discouraging the growth of water use in the early years of the project's operation (Stanford Research Institute, 1958).

Municipal and Industrial Water Supply Pricing Policy

Municipal and industrial water supply covers a wide variety of uses. Within cities, uses range from domestic to street and sewer flushing to irrigation of parks. Industries require process and cooling water as well as dilution water for disposing of wastes.

Under the California Water Plan, it was suggested that the beneficiaries of all water supply (municipal, industrial, and irrigation) pay full repayment of costs so that no water users would be subsidized by other segments of society. The hope was that this would promote more efficient allocation of water among agency and user groups.

The revenue to be returned by a public water utility is paramount in establishing rates. In pricing urban water, the base may be determined by the costs incurred by the unit of government to produce the water.

> The standard practice is to classify water supply costs by customer, commodity, and demand. Customer costs increase with the number of system customers, because of counting the meter reading expense. Commodity costs increase with volume supplied, because of costs for treatment chemicals and power. Demand costs are related to the capital investment in the system's capacity and are a function primarily of the maximum demands made upon a system. For example, treatment facilities are generally designed to meet maximum daily demand, so the amortized cost of the treatment plant is considered a demand cost (Mann, 1970).

Another view is that costs incurred by government can be said to consist of two parts, costs at the source (wholesale) and costs at the place of use (retail).

According to Patterson (1962), service costs have three main components. Base water costs are those associated with the average need. Extra capacity costs are those associated with additional capacity built into a system to provide at certain times and to certain customers water above the average or usual demand. Customer costs are those that increase as the number of users increase (e.g., meter reading billing, etc.). The most common water rate structures are presented in Chapter IV.

Water Pollution Control Pricing Policy

Water quality standards generally have been employed rather than effluent charges to control water pollution in this country. However, the National Water Commission (1973) recommended that requiring polluters to pay effluent or user charges would be the most equitable and economically efficient approach. An "effluent charge" is a direct charge, usually proportional to the concentration of waste, for the discharge of a pollutant into a natural watercourse. In contrast, a "user charge," usually proportional to the amount of waste, is levied for the discharge of pollutants into a waste disposal system. Thus, effluent charges are designed primarily to discourse and provide funds to remedy external diseconomies imposed by polluters. User charges provide revenue to pay for the construction, operation, and maintenance of a disposal or treatment system.

Support for such fees is based on two grounds: first, reimbursement of public costs for constructing dams, aeration devices, or other devices which increase a body of water's ability to absorb wastes, and second, inducement of polluters to recognize the costs they impose on downstream users. Either of these charges could be used to make polluters pay the marginal opportunity costs of utilizing a water course for disposing of waste.

In recent years, it has been argued increasingly that polluters should be compelled to bear the social as well as the private costs of their activities. As Charles L. Shultze argues:

> In the field of water pollution control, for example, public policy emphasizes the subsidized construction of waste-treatment plants, dams for low-flow augmentation, and the separation of storm drains from sewers, as a means of treating pollution once created. But it generally fails to consider means of altering the price signals received by polluters through the mechanism of user charges and effluent charges. (Excise taxes may be included in these charges.) Through such charges, industrial polluters would be assessed the social and economic costs of pollution, and in many cases would find it profitable to change their internal processes to reduce the amount of pollution they create. In general, it is cheaper to improve the quality of our streams by combination of prevention and treatment than by treatment alone. But because the private sector is primarily responsible for prevention and the public sector for treatment, public policy excessivly concentrates on the latter aspect. And to the extent it does deal with the prevention aspect of pollution control, it does so by attempting to enforce, through the police power, a set of water quality standards rather than providing economic incentives to individuals which would induce them, in their own interests, to take action to improve water quality (Shultze, 1969).

Recreation Pricing Policy

Water for recreation is used for swimming, boating, water skiing, and fishing, and provides an aesthetic complement to non-water based activities such as camping, picnicking, and hiking. Traditionally in the United States, outdoor recreation has been thought to provide great benefits to society. Consequently, it has been argued that citizens should have unlimited access to recreation areas. Collection of user fees has been opposed by some as a violation of the national tradition of free use of waterways and a congressional commitment to free access to reservoirs. This position has been challenged in recent years by acts of Congress and pressures from state and local governments. Recent federal recreation policy (Land and Water Conservation Fund Act and the Federal Water Recreation Projects Act) stresses the need for the user to pay. Nevertheless, only nominal charges have been employed, usually an entrance fee, and little revenue has been raised. It has been estimated (Davis and Hanke, 1971) that $10 million in fees collected from federal recreation areas amounts to 5 cents for each of the 200 million visitors to national parks and forests.

Davis and Hanke (1971) suggest a two-part fee system for waterbased recreation. The first part would be a user's general pass and the second an additional fee levied at peak periods such as holidays, summer season, and weekends, and for special services such as campgrounds, marinas, swimming areas, etc.

Crutchfield (1962) points out that the fund-raising potential of fees on sport fishing is apparent from the huge rentals paid on land bordering salmon streams in the Canadian Maritimes and the high license fees paid by nonresidents. In England, fishing rights for 1.25 miles on the River Lune were sold at auction in 1961 for *L*20,750 ($54,000). For charging, a recognizable product must be defined and specific users identified. In the case of fishing, the product is fishing and not fish, and the value of fishing areas vary greatly.

Crutchfield suggests several approaches to valuation of sport fishing. A gross value could be estimated by surveys of angler expenditures. The biggest problem with this approach is that it excludes indirect expenditures made by the community or others on behalf of the angler. Out-of-pocket fishing costs cover only the costs of necessary equipment and transportation to the fishing area. Another alternative, the net value approach, attempts to meet this objection by valuing the fishing opportunity at cost, including all costs of providing the fishery, transportation, and equipment. Yet another approach estimates the market value of fish caught as the value of recreational fishing. However, fish are not the product, but fishing. One last approach which Crutchfield discusses is the valuation of fishing time. The basic assumption is that days fishing could have been spent earning income. This method would require lengthly income surveys, and it fails to differentiate between different types of fishing and other nonpriced recreation (Crutchfield, 1962).

In practice, travel cost is frequently used as a gage of the benefit to be applied to recreational use. In using this method, the disutility of overcoming distance should be estimated "to be the sum of at least three factors: money costs, time cost, and the utility of driving or traveling" (Knetsch and Davis, 1966). These benefit estimates provide an upper limit to revenues that could be collected by user fees.

Flood Control Pricing Policy

Traditionally flood control projects have been viewed as a pure public good for which no fair price could be set. Major reservoir projects have generally been provided out of federal revenues on a nonreimbursable basis. Local beneficiaries have been required on minor reservoirs and other flood projects to provide lands, easements, and rights-of-way, and in the case of local protection projects, to operate and maintain the projects after completion. Since occupants of flood prone areas face quantifiable financial risks from flood hazards, user charges for flood protection are possible. Compulsory flood insurance is an example pricing scheme in this area.

Navigation Pricing Policy

Under a policy of subsidization dating back to the Northwest Ordinance of 1787 which states that the waterways shall be free forever, users of the nation's waterways pay none of the costs of inland waterway development. However, the beginnings of a movement toward user-pay principles can be seen in the Presidents budget of 1972 which recommends that users of inland waterways begin sharing part of the costs of waterway development and operation.

User fees for navigation might be set equal to average variable costs to cover the operation and maintenance of facilities. Possibilities for collection of fees include license fees, fuel taxes, and segment tolls. Complementary to segment tolls, a system of congestion tolls could be levied where lock usage is heaviest. Opportunity cost of waiting time could be calculated to arrive at some level of fee (Hanke and Davis, 1971).

The National Water Commission (1973) advocates that carriers maintain a record of their use in terms of ton miles, and periodically submit a report. Along with this report, somewhat like an income tax return, payment could be made according to the number of units reported.

CHAPTER IV

USER FEE DESIGN CONSIDERATIONS

In order to evaluate the various user fee alternatives, a set of evaluative criteria was needed. Those identified were: equity, economic efficiency, allocational effectiveness, administrative simplicity, and revenue generating potential. Through systematic application of these criteria, the different user fee alternatives were analyzed and evaluated.

EQUITY

Two facets to equity are fairness and redistribution. Fairness requires equal treatment of equals. Since this concept is generally accepted by society, fairness principles are concensus criteria. Redistribution, on the other hand, requires income transfers among groups; and no social concensus exists on the ideal division of income. Redistribution principles involve a conflict of interest among groups that pay or receive income.

Shoup (1969) defines six characteristics of equity that pertain to consensus criteria as relevance, certainty, impersonality, continuity, uniformity of mispayment, and uniformity of cost compliance. Relevance suggests that individuals be equally circumstanced with respect to the conditions that the community believes should pertain to any given situation. A community might properly feel that water use charges should be based on the quantity of water used. In communities that meter water, this criterion would be relevant; in communities without a metering system, it would not be. Relevant circumstances need to be defined broadly enough so that impersonality is preserved and precise enough so that an individual can know in advance the consequences of any particular course of action. Certainty is important because an individual will want to be treated equally in successive periods, providing the same relevant circumstances pertain. Impersonality is important because an individual may prefer preferential treatment on an individual basis, but will appreciate impersonality as a general rule. Continuity implies that changes occur only concurrently with changes in relevant circumstances and that these changes would reflect proportionately. In other words, a small change in relevant circumstances would not lead to large changes in payments. Uniformity of mispayment, in principle, suggests that any payment error should be the same for all who make the payment. Uniformity of cost compliance means that the cost for an individual in complying with a law should be the same percent of his tax as it is for all others.

Shoup also identifies five characteristics of equity for conflict of interest or redistribution of income criteria. Because of the conflict, criteria deemed good at some times are deemed bad at others. They consist of:

> (a) Distribution of burdens progressively, and benefits regressively, by income and wealth....(b) Distribution of these benefits and burdens among households of like income or wealth to take account of type of income, size and composition of family, including age and occupation (e.g., clergy) of members and use of income. (c) Distribution of burdens and benefits by geographic area, principally to export burdens to other countries to the degree feasible, and, within the country, to favor depressed regions. (d) Distribution of benefits or burdens in a manner that does not discriminate against ethnic, color, or status groups....(e) Distribution of tax burdens by methods that promote widespread tax consciousness (in some nations the negative of this criterion is the accepted one) (Shoup, 1969, p. 33-34).

These criteria can be used to analyze the characteristics of any tax instrument.

In an analysis of taxes it is useful to consider incidence or who actually pays. The problem of incidence relates to the ability of a taxpayer to shift the burden of a charge to others. For the example of rented housing, if water rates are increased to a landlord, he may choose to increase rents to his tenants. The fairness and redistribution criteria enumerated could then be used to evaluate the equity of a given tax from information on who actually pays in the end.

Fairness or equity are unscientific terms, but the perception of fairness is most important if any tax or fee is to be acceptable and successful. This section has identified several characteristics of charges which determine whether or not people will consider them fair. Some of these are universal standards; others are considered fair by one group but unfair by another, and the viewpoint of a given group may change with time.

ECONOMIC EFFICIENCY

In competitive markets, prices respond to automatic, impersonal market mechanisms that balance the quantity of goods supplied with the quantity of goods demanded. The resulting allocation of resources is considered to be economically efficient.

When government provides goods or services, there is generally no competing source of supply, and thus no forces of competition to establish fair prices and efficient resource allocation. A government policy to set fair prices becomes necessary. As political forces begin to set pricing policy, individuals in their political bargaining find it advantageous to conceal their true preferences thus giving a distorted view of market demand. For example, individuals may seek to enjoy benefits while passing the costs on to society. Government agencies may tend to conceal true price (based on cost) in the interest of expanding programs and influence.

ALLOCATIONAL EFFECTIVENESS

Over the years, the public policy has been to look to many criteria besides economic efficiency in the allocation of water among uses. In the past, the economic development of arid regions on a national scale and a desire of communities to promote attractive landscaping on a local scale have been important objectives. Communities have considered it desirable to require suppliers to provide water to whomever wants it, whenever he wants it, and in whatever amount he wants. Many others have stressed the importance of wise long-term water use. Twenty years ago this meant fuller development for the benefit of future generations, but today the stress is on conservation of the natural environment. No matter which social goals are emphasized, the point is that the chosen goals affect optimal water allocation, and prices charged affect the allocation achieved. Allocational effectiveness, with respect to current social goals, becomes an important consideration in setting user fees.

ADMINISTRATIVE SIMPLICITY

The more uniform or simple fee structures are very easy to administer while efforts to vary fees to promote economic efficiency and allocational effectiveness require more complex fee schedules and become more difficult and costly to administer. The capability of water utilities and related governmental agencies to administer more complex schedules is often a factor constraining the ability to achieve efficiency goals.

REVENUE GENERATING POTENTIAL

The amount of revenue generated to pay for operations, maintenance, debt service, etc. is obviously an important criterion for assessing the merits of a fee structure. The potential of a fee to generate revenue is limited by two effects upon demand of higher fees. The first is a reduction in consumption (except when demand is perfectly price inelastic). The second is substitution of alternative products. A formula for revenue maximization within these limits (Hoggan and Asplund, 1974) is discussed in Chapter V.

RATE STRUCTURE EVALUATION

In this section, some of the more commonly used rate structures are evaluated against the above five criteria. The rate structures evaluated are uniform flat rate, decreasing block rate, constant block rate, increasing block rate, and demand metering and summer differential rates. James and Lee (1971) and Hirshleifer, Dehaven, and Milliman (1960) also discuss these utility rates.

Uniform Flat Rate

The uniform flat rate covers the cost of a water system by charging each user an amount equal to the total revenue required divided by the number of connections (rights to use the system). Every user pays the same fee regardless of the quantity of water used. There is no financial incentive to conserve since the user's marginal cost of consumption is zero. Users are less likely to repair leaks, conserve on sprinkling uses, reduce peak consumption, etc. The results are waste and over-expansion of system capacity.

The flat rate does not allocate resources efficiently and has economic justification only where the costs of installing meters exceed the costs of meeting the extra demand due to nonmetering or where everyone uses nearly the same amount of water.

The most positive characteristic of the flat rate is administrative ease. The flat rate is the easiest charge to administer and is used frequently in small communities in which systems of metering are not available or there is insufficient staff to manage complex billing systems. Because users are assessed monthly, it is a continuous charge system and a user can know in advance what his payment will be and that he will be treated the same in consecutive periods. All customers are charged the same and can be excluded from service in the case of mispayment. This insures that the charge will be uniform and impersonal. Cost of compliance is equal for all who make the payment and because no substantial amount of time is involved, collection costs for the community are minimal.

The conflict criteria are more difficult to apply. The progressivity and regressivity of benefits and burdens depends on the correlation between water charges paid and income. With a flat rate, everyone is charged the same, but everyone does not use an equal quantity of water. This favors large users at the expense of small users. If water use increases with income as has been indicated (Gardner and Schick, 1964) the burden of the flat rate is regressive and the distribution of the benefits is progressive. The poor are subsidizing the rich.

The flat rate cannot distribute benefits and burdens equally among households of like income, size and composition of family, including age and occupation of members, or use of income. The objective of distributing benefits and burdens to favor depressed geographic regions cannot be achieved. For most municipal water works, the depressed regions would be core city areas in which low income families are frequently located. The flat rate penalizes these users and subsidizes the more affluent areas. The suburban dweller uses considerably more water than does an inner city dweller. Sprinkling is the primary use associated with consumption of large quantities of water, and because suburban dwellers have larger lawns and gardens, they are responsible for the peak demands and hence system expansion.

It is desirable that a fee not unduly burden ethnic, color, or status groups directly or indirectly. Since certain groups such as blacks are predominant in core city areas, which have low rates of use, the flat rate indirectly discriminates against such groups.

In summary, the flat rate gets a very good score on the criterion of administrative simplicity and is quite acceptable with respect to the fairness aspects of equity. It cannot promote allocational effectiveness unless the dominant goal is to minimize charges to promote greater water use. The flat rate does not further economic efficiency except in the exceptional situation where the marginal cost of service is approximately equal for all users. The more undesirable effect of the flat rate, however, is its tendency to concentrate the financial burden on the poor and on minority groups.

Modified Flat Rate

The modified flat rate schedule varies from the flat rate charge by varying the rate according to the type of customer. This modification works to allocate payment among user groups more efficiently but within a group produces no incentives to conserve water. Even though large users are charged more, their individual charge is not based on consumption and as individual users they have no economic incentive to hold their use to the point where marginal value received equals marginal cost. The modified flat rate has greater revenue potential (groups with a high ability to pay can be charged more) than a flat rate, but it is not significantly more complex to administer.

A modified flat rate scores well on all consensus criteria except relevance (charge not related to use). Impersonality is preserved because of the equal treatment of equals. Customer classes are assessed and billed the same for consecutive periods. Certainty and continuity are insured because of the predictability of the fee in consecutive periods. There is no mispayment and the cost of compliance is negligible.

The conflict criteria are better satisfied by the modified flat rate than the flat rate. Separating users into customer classes reduces the regressivity of the burden. The charge also narrows the distortion of benefit distribution. Under a modified flat rate, larger users may be charged more and in this way pay more toward the benefits they receive from water use. The extra burden on the poor may be reduced by a modified flat rate if users on the periphery of the city with large yards are assessed more than apartment dwellers of the inner city. The degree of progressivity and regressivity can only be determined by examining how customer classes are separated and how much each is charged.

Because the modification to the flat rate is not based on type of income, size and composition of family, or use of income, it cannot distribute the benefits and burdens in accordance with these principles. It can, however, take account of uses which may be similar because of income and water use correlation.

Widespread consciousness of the charge is not characteristic of the modified flat rate. Because marginal cost is zero, there are no incentives to conserve and because the measure of consciousness is based on marginal use it can be said that there is little consciousness of the charge. If the system capacity is adequate, this may not be of great importance to either users or political leaders who assess the charge, but if the capacity is limited, it will soon become an issue of concern.

Decreasing Block Rates

Decreasing block rates are based on the premise that costs of providing the service decrease with increased volume of use. This is the case for utilities that gain economies of scale from increased production, high density population, and small service areas. If water cost for a municipality follows this type of decreasing cost function, the decreasing block rate is the most economically efficient user fee structure.

One problem associated with the decreasing cost function is that if marginal price is set at marginal cost the utility will have insufficient revenues. In this situation, the utility will either have to be subsidized or it will instead have to practice average cost pricing or some type of price discrimination.

A major advantage of a declining block rate is that it permits a utility both to cover costs and practice marginal cost pricing. In Figure 6, the market demand is represented by line D, average cost is represented by AC, and marginal cost is represented by MC. The efficient price and quantity are P_3 and Q_3, respectively, located at the point where the marginal cost curve intersects the market demand curve. If price is set at this point, however, the utility faces a loss equal to the rectangle P_aGCP_3.

A declining block rate is a form of discriminatory pricing that can generate sufficient revenue to cover this loss. If price P_1 is charged for the initial block quantity OQ_1 the revenue generated will be equal to the rectangle P_1AQ_1O. If the next block quantity sells for price P_2, the revenue is represented by the

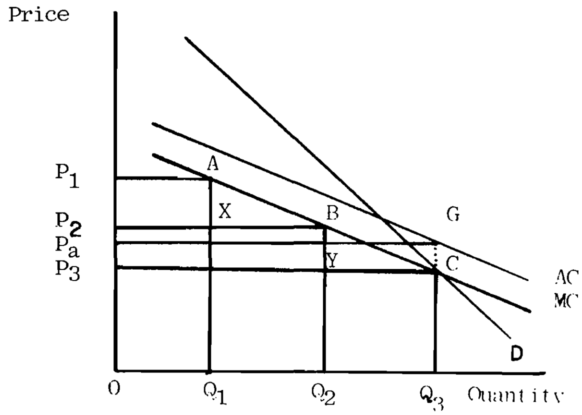

Figure 6. Second best marginal cost pricing in a decreasing cost industry.

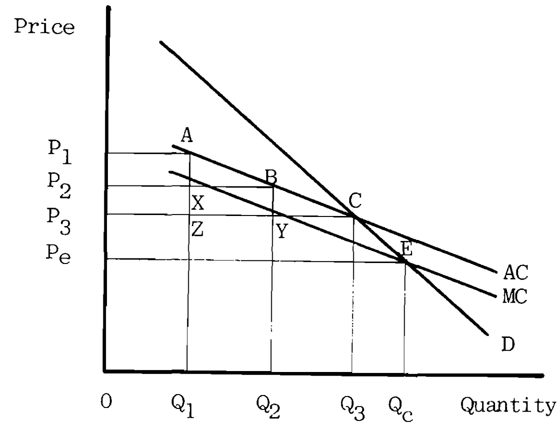

Figure 7. Average cost price discrimination in a decreasing cost industry.

rectangle XBQ_2Q_1. The remaining quantity can be sold for a price P_3 (the efficient price) and the revenue collected is equal to the rectangle YCQ_3Q_2. Notice that in each case the price follows the marginal cost curve and that the total quantity consumed is equal to the efficient level of resource use. Prices and block sizes can be set so that the sum of the revenue rectangles, $P_1AQ_1O+XBQ_2Q+YCQ_3Q_2$, equals the costs represented by rectangle P_aGQ_3O which would cover all costs.

This system charges the most for the initial quantity consumed, but reduces the cost for additional consumption. Large users are given preferential treatment in that they pay a lower marginal cost, but it is also larger users who create the economies of scale which enable the water utility to sell water at this price.

If the utility follows decreasing block prices based on average costs, the revenues far exceed the costs. If the price increments are set equal along the average cost (AC) curve (Figure 7), the total cost is equal to the rectangle P_3CQ_3O. The revenue is equal to the sum of rectangles $P_1AQ_1O+XBQ_2Q_1+YCQ_3Q_2$ and exceeds by the sum of rectangles P_1AZP_3+XBYZ. Not only are revenues substantially above costs, but resources are under utilized by quantity Q_3Q_c. The efficient price and quantity would be P_e and Q_c respectively. If the available supply is limited, this is a good way to reduce use while at the same time generating sufficient revenues to pay for system expansion.

Decreasing block rates have built in conservation incentives because water is metered and priced according to use. This assigns a positive cost to water use, and the marginal cost is equal to the price of each consecutive block. Economic efficiency is also enhanced by the metered water rate scheme. Substantial revenue potential exists without making the system significantly more complex to administer.

Under the consensus criteria of equal treatment of equals, the declining block rate scores well. It is based on relevant circumstances, including volume of water use. It is impersonal yet precise, and a user can calculate his bill or charge in advance. A bill may fluctuate in successive periods; but a user can be certain that it will always be based on the same circumstances.

A declining block rate is progressive in that as use increases, the charge also increases. However, it does not increase proportionately. Those who use more pay more, but have a lower average cost than those who use less. For a declining block rate to be progressive, water use must increase faster than income. Benefits increase with increased use but in a declining marginal benefit way, which indicates that benefits are progressive with income or wealth, providing water use and income are positively correlated.

The declining block rate does not distribute the benefits and burdens equally among households of like income or wealth or take account of the type of income, size and composition of family, or use of income. When a fee is based on volume of use, only by accident are these criteria satisfied. However, because families of like income or wealth tend to locate in close proximity and have similar water use patterns, this type of fee may score better with respect to at least some of the income redistribution criteria.

Poorer social groups may be disadvantaged by a decreasing block rate. Large volume users tend to locate toward the periphery of a city and small volume users, including the poor, tend to locate toward the core. Since small volume users pay a higher average price than do large volume users, it might be argued that the affluent area is being subsidized by the poorer core area. On the other hand, if the large volume users are responsible for scale economies, charging them a higher price would essentially be socializing the costs, which is not economically efficient. Furthermore, if there were no large volume users, the system would be operating at higher overall costs and rates to core city residents might be higher rather than lower as a result.

Consciousness of the charge is high with any metering and block pricing system because as use increases, the user finds that the associated charge also increases.

Constant Block Rate

The constant block rate is the most efficient method of allocation for a utility paying equal unit cost for each increment of water supplied. The determination of the price is simple, and there is no discriminatory pricing. One need only divide total costs by the total quantity used to arrive at the average total cost. Because marginal and average costs are equal in a constant cost industry, average cost pricing is the same as marginal cost pricing.

Under a constant block pricing policy, the water is metered and the marginal cost to consumers is equal throughout the entire range of quantities taken. The incremental cost for additional units consumed though constant, creates incentive to conserve.

The constant block rate may generate revenues above the actual costs of supplying a given quantity of water, However, when revenues are set above costs, there is a distortion of the market system and resources are under utilized.

Under constant costs the constant block pricing policy will satisfy all of the consensus criteria of equity and economic efficiency. It is impersonal, and a user knows exactly what his bill will be with increased use. He also can be certain that the same relevant circumstances will apply in consecutive periods.

The constant block pricing policy is generally more progressive than any of the previously discussed user fee structures and more egalitarian in its distribution of benefits and burdens. Each user is charged according to amount of use and each pays the same average price for units consumed. Water use and income increases have been found to be positively correlated, but the fee is not progressive unless water use increases faster than income. If water use and income increase proportionately the charge is neither progressive nor regressive.

Since this pricing policy does not vary the charge with income, size and composition of family, age and occupation of family members, and use of income, it can satisfy these criteria only by accident. When individuals of similar income characteristics have similar use patterns, their water charge will be similar. However, data are not available for an across the board determination of how user fees and family composition and income are related.

The constant block rate stimulates widespread tax consciousness and provides incentives to conserve found in the marketplace. Each consecutive unit consumed has a positive marginal cost and the marginal costs are equal throughout the range of consumption. With this pricing policy, each individual can consume to the point where his marginal benefit and marginal cost are equal thus maximizing returns.

Increasing Block Rates

Increasing block rates follow a marginal cost curve increasing with volume of water supplied. Such a curve is typical of rapidly growing city facing the increased costs of seeking more distant water sources after exhausting nearer and less expensive ones. Such a city is often also faced with construction of expensive new water treatment facilities and with expanding its distribution system into low density suburban areas requiring more pipe per customer served.

Figure 8 shows an increasing cost function. The accompanying efficient price is located where the marginal cost curve intersects the demand curve at point A. If the price is set at this point, total revenues are represented by the rectangle P_eAQ_eO and exceed costs by the rectangle P_eAHP_c. Thus, the water supply utility is making a pure economic profit. Although point A locates the efficient price and quantity, utilities ordinarily are required to operate on a rate of return basis and are not allowed to make a pure economic profit. In this case, the fee structure that preserves marginal price P_e is obtained by setting price at P_i for the quantity Q_i and then increasing the price in increments (blocks) to the efficient price P_e.

With an increasing block rate, low volume consumers are able to gain from past economies of scale, but large volume consumers, whose use is causing system expansion, pay higher prices.

An increasing block rate pricing policy can meet all of the efficiency criteria and provide marginal cost pricing for a utility that actually has an increasing cost function. It is also an effective conservation tool. The increasing marginal cost to the consumer generates strong incentives to conserve.

Administrative cost is the same for an increasing block rate as for decreasing block rates and slightly higher than for the less complex constant. Metering and billing are the only added functions which the flat rates do not have. Revenue potential increases with increased demands and can be used to generate a pure economic profit by simply applying the marginal cost pricing rule. As is the case with the previous user fee

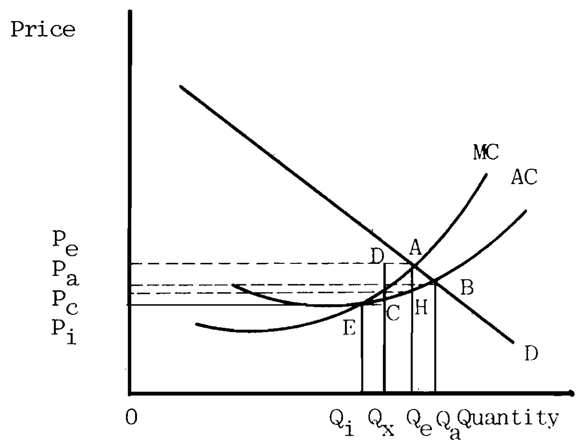

Figure 8. Efficient pricing under increasing costs.

structures, the consumer bears the burden of the charge. He cannot avoid the charge and he cannot shift the burden to others. The increasing block rate satisfies all of the consensus criteria.

With respect to its income redistribution effects, the increasing block rate is generally the most likely to be progressive of the charges discussed thus far. The marginal cost to the consumer increases as water use increases. However, as with other block rates, volume of use must increase faster than income for the charge to become progressive. It allocates resources effectively under increasing cost conditions and assesses the user a charge in proportion to his responsibility for the costs to the system. The increasing block rate as are the other rates is not geared toward the distribution of benefits and burdens among households of like income or wealth nor can it effectively meet these criteria.

An important characteristic of the increasing block fee structure is that it favors low income user groups. Low volume users are typical in these areas and their rates are low on the block scale. An increasing block generates more consumer consciousness than any of the other fees because of the increasing marginal cost to consumers.

Demand Metering and Summer Differential Rates

Demand metering is a complex but rational way to cover the extra cost of providing water during periods of peak consumption. Capacity expansion is generally the result of demands during peak use periods. Under the general policy of supplying all such demands, the system must be expanded to meet future demands when no excess capacity remains.

Demand metering measures peak flows so that users can be charged proportional to the peak demands they place on the system. A summer differential rate follows the same principles without the metering by charging higher rates during summer months when use is generally higher.

A demand metering system is geared to reduce consumption during times of peak demand and raise capital for system expansion resulting from peak demands. It is a complex system to administer, requiring every meter to be set on a time table which allows for calculations to be made monthly. The staff requirements are high and may make this system impractical except for large water users.

Both the summer differential rate and demand metering can be designed to meet the efficiency criteria. Fees which charge higher prices to customers during peak periods increase revenues while limiting use. A fee based on peak demand, however, leaves an element of uncertainty to consumers. An individual can be sure that the charge will increase with increased use, but he may be uncertain what the charge will be in consecutive periods. This is not a problem with a differential rate because although the rate is increased or decreased the consumer knows in advance what the rate will be and for what periods of the billing cycle.

It is difficult to forecast the progressivity charges based on demand metering policy, but the results may be slightly progressive. On the other hand, under demand metering all customers would be penalized for using water during peak periods even though some users may not use more water than they did during winter low use periods. This effect, at least superficially, gives this rate the appearance of being a regressive charge.

The summer differential rate, when increased, penalizes large volume users during peak periods. Individuals with similar use patterns are treated equally, which in essence suggests that this fee scheme satisfies income criteria. The summer differential rate may favor poorer socioeconomic groups. Most of the peak demand can be attributed to sprinkling uses which is not significant in core city areas.

Demand metering promotes the most cost consciousness by increasing marginal costs to consumers. They are aware that their charges will reflect their patterns of use and that when they add to peak periods, they will be faced with a higher per unit rate.

Conclusions of Rate Structure Evaluation

User charges are most effective where the costs of exclusion are low, there are few or no consumption externalities, and any resulting income redistribution is not a major concern. User charges can satisfy economic efficiency criteria without significant effect on income distribution. Although taxes such as the income tax take account of income, size of family, etc., a user charge does not. If distribution of income is to be a factor in the design of a water rate, an increasing block structure is the most effective.

Under any conditions it is possible to practice a discriminatory pricing policy which will allocate benefits regressively and burdens progressively (Figure 9). By setting the initial block quantity price (P_i) below marginal cost, low use customers are given water below their cost to the system. This is essentially a subsidy to low use customers. The next block is priced equal to marginal cost (P_m) which gives those customers in the middle range a subsidy for the initial quantity followed by a charge equal to their responsibility for the costs. The last rate (P_e) is above the marginal cost curve over most of the range and equal to the marginal cost only at the marginal cost-demand intersection (point E). The revenues generated by the third block make up the difference lost by the initial subsidy. The rates then begin as a subsidy for low volume users approach, actual costs at the margin, and finally collect a tax from large consumers to pay the subsidy. The total revenue in Figure 9 is equal to the sum of the rectangles P_iEQ_iO, FDQ_mQ_i, and CAQ_eQ_m, which is equal to the total cost represented by rectangle P_cBQ_eO.

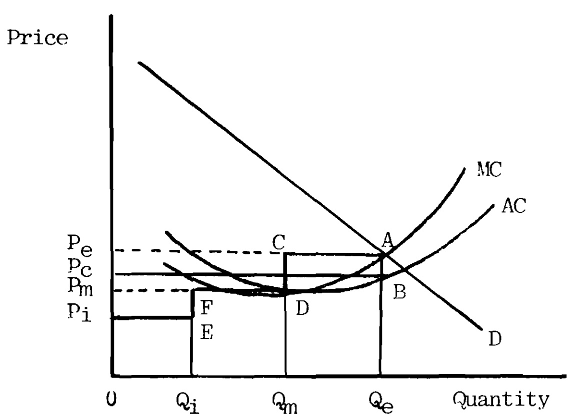

Figure 9. Increasing block rate under increasing cost conditions which accounts for distribution of income.

RATE STRUCTURES IN UTAH

A survey of rate structures used by cities and towns in Utah was conducted in 1975 to sample current practice. A questionnaire designed jointly by the staffs of the Utah League of Cities and Towns and the Utah Water Research Laboratory was used to gather information about user fees and connection charges (where applicable) for three municipal services: culinary water, sanitary sewerage, and solid waste disposal. Participants were also encouraged to provide information regarding their established user fee policies.

The questionnaire was mailed to every city in Utah with a population greater than 1,000 (as reported in the 1970 census) and to other selected municipalities (e.g., Manila and Randolph) included to ensure that each county would be represented. From this sample of 91 cities, 54 responded (59 percent). The information collected was published in a separate report (Houston, Ballard, and Hester, 1975). Only the information on water user fees obtained from this survey will be reviewed here. Appendix B contains several comparisons of water costs derived from this information.

Culinary water in Utah is generally supplied by municipally owned water utilities. All of the utilities which are not publicly owned are subject to regulations by the Utah Public Service Commission at rates based on costs and rate of return on capital investment. Privately owned utilities which sell water on a retail basis are few in number and serve only relatively few Utah residents. However, to get an accurate assessment of service charges in Utah, 6 of the 29 privately owned utilities were sampled.

In a national survey, over 90 percent of the cities were found to be using the declining block rate (Gysi and Loucks, 1971). However, only 23 of the 54 responding cities in Utah used this fee structure. The most common pricing policy in Utah (30 cities) is the constant block rate. The other fee schemes used were, the flat rate, which was found in five cities; the increasing block rate found in two cities, and the summer differential rate, which was found in only one of the Utah cities in this survey. Seven of the survey cities acknowledged using two pricing policies.

The culinary water rates submitted by the 54 municipalities responding to the survey are shown in Table 2. The rates shown in this table do not include hidden water charges such as water conservancy district taxes, etc. Nine monthly water volumes were then selected, and the total cost for each volume in each city is shown in Table 3. In Appendix B, these costs by city are grouped by population of the city (Tables B-1 to B-6) and subareas within the state (Tables B-7 to B-14) for ready comparison. In these tables, each city is followed by several numbers which denote various rates used in that city. The number enclosed in parantheses following the name of a city or town, indicates an unusual rate design upon which the fee is calculated and is explained in the footnotes following Table B-6 in Appendix B.

Declining Block Rates

Only 23 of the responding cities in Utah use the declining block rate structure. For example, the

Table 2. Culinary water rates for 54 Utah cities, 1975.

Name of City	Minimum Charge ($)	Minimum Quantity (1000)	2nd Block Rate ($)	2nd Block Quantity (1000)	3rd Block Rate ($)	3rd Block Quantity (1000)	4th Block Rate ($)	4th Block Quantity (1000)	5th Block Rate ($)	5th Block Quantity (1000)	6th Block Rate ($)
BOUNTIFUL 15	3.00	10.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
CENTERVILLE 1	4.50	10.0 G	.350	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
CENTERVILLE 7	5.00	10.0 G	.350	90.0	.300	100.0	.250	0.0	. 0	0.0	. 0
CENTERVILLE 1 OT	6.75	10.0 G	.450	90.0	.400	100.0	.350	0.0	. 0	0.0	. 0
CENTERVILLE 7 OT	7.50	10.0 G	.500	90.0	.450	100.0	.400	0.0	. 0	0.0	. 0
CLEARFIELD 2357	3.00	10.0 G	.200	20.0	.180	0.0	. 0	0.0	. 0	0.0	. 0
DELTA 27	3.00	8.0 G	.120	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
DELTA 27 OT	5.00	8.0 G	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
EAST CARBON 17	6.30	0.0 G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
EPHRAIM 8	4.50	7.0 G	.200	30.0	.180	0.0	. 0	0.0	. 0	0.0	. 0
FARMINGTON 27	4.00	10.0 G	.250	40.0	.200	50.0	.180	0.0	. 0	0.0	. 0
FARMING (1) 3	8.00	20.0 G	.250	30.0	.200	50.0	.180	0.0	. 0	0.0	. 0
FILLMORE 17	5.00	10.0 G	.150	100.0	.100	0.0	. 0	0.0	. 0	0.0	. 0
HEBER 16	5.00	0.0 G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
HEBER 4	4.00	0.0 G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
HEBER 7	6.50	17.0 G	.220	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
HYDE PARK 2	3.33	20.0 G	.100	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
KANAB 17	4.00	15.0 G	.200	5.0	.250	5.0	.300	0.0	. 0	0.0	. 0
KAYSVILLE 17	2.50	10.0 G	.200	20.0	.180	50.0	.150	0.0	. 0	0.0	. 0
LAYTON 2	3.00	7.0 G	.200	23.0	.180	50.0	.150	0.0	. 0	0.0	. 0
LAYTON 2 OT	6.00	7.0 G	.400	23.0	.360	50.0	.300	0.0	. 0	0.0	. 0
LAYTO (2) 3	5.30	11.0 G	.200	24.0	.180	50.0	.150	0.0	. 0	0.0	. 0
LAYTON 5	3.00	7.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LAYTON 7	3.00	7.0 G	.200	24.0	.180	50.0	.150	0.0	. 0	0.0	. 0
LEHI 17	3.00	7.5 G	.200	92.5	.180	50.0	.160	50.0	.140	0.0	. 0
LOGAN 3/4,1"CON	2.50	10.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 1.5" CON	5.00	22.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 2" CON	9.00	42.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 3" CON	17.00	82.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 4" CON	30.00	152.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 6" CON	61.50	352.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
LOGAN 8" CON	129.50	882.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MANILA 15	7.50	10.0 G	.500	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MANILA 7	15.00	20.0 G	.500	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MANILA (3) 3	11.25	15.0 G	.500	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0

Table 2. Continued.

Name of City	Minimum Charge ($)	Minimum Quantity (1000)		2nd Block Rate ($)	2nd Block Quantity (1000)	3rd Block Rate ($)	3rd Block Quantity (1000)	4th Block Rate ($)	4th Block Quantity (1000)	5th Block Rate ($)	5th Block Quantity (1000)	6th Block Rate ($)
MANTI 8	8.50	10.0	G	.200	45.0	.160	100.0	.140	150.0	.120	200.0	.100
MAPLETON 17	3.63	15.0	G	.120	30.0	.100	20.0	. 60	0.0	. 0	0.0	. 0
MILFORD 17	11.75	0.0	G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MOAB (4) 1	2.50	2.0	G	.220	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MOAB 7	3.50	3.0	G	.300	47.0	.260	50.0	.230	400.0	.190	500.0	.160
MOAB 1 OT	5.00	2.0	G	.440	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MOAB 7 OT	7.00	3.0	G	.600	47.0	.520	50.0	.460	400.0	.380	500.0	.320
MT PLEASANT 8	3.00	5.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
MURRAY (5) 2357	3.00	1.1	CF	.140	48.9	.120	50.0	.100	0.0	. 0	0.0	. 0
MURRAY HOSP	25.00	1.1	CF	.140	48.9	.120	50.0	.100	0.0	. 0	0.0	. 0
MURRAY 2357 OT	4.00	1.1	CF	.200	48.9	.150	50.0	.130	0.0	. 0	0.0	. 0
NORTH LOGAN 27	4.00	8.0	G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
OGDEN 1/2+5/8"	3.10	7.6	G	.250	92.4	.225	100.0	.188	300.0	.150	500.0	.125
OGDEN 3/4"CON	4.05	11.3	G	.250	88.7	.225	100.0	.188	300.0	.150	500.0	.125
OGDEN 1" CON	5.95	18.8	G	.250	81.2	.225	100.0	.188	300.0	.150	500.0	.125
OGDEN 1.5" CON	11.20	37.6	G	.250	62.4	.225	100.0	.188	300.0	.150	500.0	.125
OGDEN 2" CON	17.50	60.1	G	.250	39.9	.225	100.0	.188	300.0	.150	500.0	.125
OGDEN 3" CON	31.85	114.0	G	.225	86.0	.188	300.0	.150	500.0	.125	0.0	. 0
OGDEN 4" CON	51.85	197.3	G	.225	2.7	.188	300.0	.150	500.0	.125	0.0	. 0
OGDEN 6" CON	101.25	446.8	G	.188	53.2	.150	500.0	.125	0.0	. 0	0.0	. 0
OGDEN 8" CON	197.50	1070.2	G	.125	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
OGDEN 1/2+5/8"OT	6.20	7.6	G	.500	92.4	.450	100.0	.375	300.0	.300	500.0	.250
OGDEN 3/4"CON OT	8.10	11.3	G	.500	88.7	.450	100.0	.375	300.0	.300	500.0	.250
OGDEN 1" CON OT	11.90	18.8	G	.500	81.2	.450	100.0	.375	300.0	.300	500.0	.250
OGDEN 1.5"CON OT	22.40	37.6	G	.500	62.4	.450	100.0	.375	300.0	.300	500.0	.250
OGDEN 2" CON OT	35.00	60.1	G	.500	39.9	.450	100.0	.375	300.0	.300	500.0	.250
OGDEN 3" CON OT	63.70	114.0	G	.450	86.0	.375	300.0	.300	500.0	.250	0.0	. 0
OGDEN 4" CON OT	103.70	197.3	G	.450	2.7	.375	300.0	.300	500.0	.250	0.0	. 0
OGDEN 6" CON OT	202.50	446.8	G	.375	53.2	.300	500.0	.250	0.0	. 0	0.0	. 0
OGDEN 8" CON OT	395.00	1070.2	G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
OREM 27	4.65	12.0	G	.150	15.0	.100	0.0	. 0	0.0	. 0	0.0	. 0
OREM (6) 35	8.70	21.0	G	.180	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
OREM 27 OT	9.30	12.0	G	.300	15.0	.200	0.0	. 0	0.0	. 0	0.0	. 0
OREM 35 OT	17.40	21.0	G	.360	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0

Table 2. Continued.

Name of City	Minimum Charge ($)	Minimum Quantity (1000)	2nd Block Rate ($)	2nd Block Quantity (1000)	3rd Block Rate ($)	3rd Block Quantity (1000)	4th Block Rate ($)	4th Block Quantity (1000)	5th Block Rate ($)	5th Block Quantity (1000)	6th Block Rate ($)
PANGUITCH 27	3.00	15.0 G	.150	15.0	.120	20.0	.100	0.0	. 0	0.0	. 0
PARK CITY 1	5.00	0.0 G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PAYSON 8	3.00	10.0 G	.170	90.0	.150	90.0	.125	0.0	. 0	0.0	. 0
PAYSON 8 OT	6.00	10.0 G	.340	90.0	.300	90.0	.250	0.0	. 0	0.0	. 0
PLAIN CITY 2	5.50	0.0 G	. 0	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVIDENCE 17	3.00	10.0 G	.150	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 3/4" CON	3.50	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 1" CON	4.50	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 1-1/2" CON	10.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 2" CON	15.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 3" CON	30.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 4" CON	50.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 6" CON	100.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 8" CON	150.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 10" CON	200.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 12" CON	250.00	1.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 3/4 CON OT	10.50	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 1" CON OT	13.50	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 1-1/2 C OT	30.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 2" CON OT	45.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 3" CON OT	90.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 4" CON OT	150.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 6" CON OT	300.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 8" CON OT	450.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 10" CON OT	600.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
PROVO 12" CON OT	750.00	1.0 CF	.480	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
RANDOLPH 17	3.50	15.0 G	.250	15.0	.100	0.0	. 0	0.0	. 0	0.0	. 0
RICHFIELD 2	3.75	15.0 G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
RIVERDALE 17	3.25	10.0 G	.180	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
RIVERTON 27	4.00	5.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
RIVERTON 27 OT	5.00	5.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
RIVERTON(7) 9	2.00	5.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
ROOSEVELT 17	5.00	10.0 G	.350	10.0	.300	10.0	.250	0.0	. 0	0.0	. 0
ROY 17	2.50	10.0 G	.190	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
ROY 17 OT	6.25	10.0 G	.350	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
ST.GEORGE 1	3.00	3.0 G	.200	197.0	.170	0.0	. 0	0.0	. 0	0.0	. 0

Table 2. Continued.

Name of City	Minimum Charge ($)	Minimum Quantity (1000)	2nd Block Rate ($)	2nd Block Quantity (1000)	3rd Block Rate ($)	3rd Block Quantity (1000)	4th Block Rate ($)	4th Block Quantity (1000)	5th Block Rate ($)	5th Block Quantity (1000)	6th Block Rate ($)
ST.GEORGE 57	3.00	3.0 G	.250	197.0	.220	300.0	.190	0.0	. 0	0.0	. 0
SLC 3/4,1" CON	1.75	1.1 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 1.5" CON	3.50	2.2 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 2" CON	5.60	3.5 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 3" CON	11.20	7.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 4" CON	17.50	10.9 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 6" CON	35.00	21.9 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 8" CON	56.00	35.0 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 10" CON	80.50	50.3 CF	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 3/4,1" CO OT	2.50	1.0 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 1.5" CON OT	5.00	2.1 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 2" CON OT	8.00	3.3 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 3" CON OT	16.00	6.7 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 4" CON OT	25.00	10.4 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 6" CON OT	50.00	20.8 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 8" CON OT	80.00	33.3 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SLC 10" CON OT	115.00	47.9 CF	.240	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SANDY 17	8.00	20.0 G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SANTAQUIN 17	4.15	10.0 G	. 80	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SANTAQUIN 17 OT	8.15	10.0 G	.160	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SMITHFIELD 27	3.00	10.0 G	.150	30.0	.120	50.0	. 80	0.0	. 0	0.0	. 0
SOUTH OGDEN 17	2.25	10.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
S SALT LAKE 27	2.50	12.0 G	.220	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
S SALT (8) 3	4.00	20.0 G	.220	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SPANISH FORK 8	3.50	15.0 G	.150	25.0	.125	20.0	.100	0.0	. 0	0.0	. 0
SUNSET 3/4" CON	3.65	10.0 G	.230	10.0	.210	10.0	.190	10.0	.170	0.0	. 0
SUNSET 1" CON	4.50	10.0 G	.230	10.0	.210	10.0	.190	10.0	.170	0.0	. 0
SUNSET 4" CON	9.15	10.0 G	.230	10.0	.210	10.0	.190	10.0	.170	0.0	. 0
SUNSET 6" CON	13.60	10.0 G	.230	10.0	.210	10.0	.190	10.0	.170	0.0	. 0
SYRACUSE 1	6.15	10.0 G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SYRACUSE 7	6.15	10.0 G	.150	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
TOOELE (9) 2357	2.75	1.5 CF	.175	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
VERNAL (10) 2	3.00	10.0 G	.150	10.0	.200	10.0	.250	10.0	.300	10.0	.350
VERNAL 357	3.00	10.0 G	.150	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
VERNAL (10) 2 OT	6.00	10.0 G	.300	10.0	.350	10.0	.400	10.0	.450	10.0	.500
VERNAL 357 OT	6.00	10.0 G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0

Table 2. Continued.

Name of City	Minimum Charge ($)	Minimum Quantity (1000)		2nd Block Rate ($)	2nd Block Quantity (1000)	3rd Block Rate ($)	3rd Block Quantity (1000)	4th Block Rate ($)	4th Block Quantity (1000)	5th Block Rate ($)	5th Block Quantity (1000)	6th Block Rate ($)
WASHING TER 2	3.75	10.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING(10) 2	4.25	11.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING TER 3	5.75	19.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 3/4" CON	4.25	11.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 1" CON	5.75	19.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 1.5" CON	9.50	38.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 2" CON	14.00	60.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 3" CON	24.50	114.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WASHING 4" CON	39.50	197.0	G	.200	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WELLSVILLE 23	5.00	35.0	G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
W BOUNTIFUL 17	3.00	12.0	G	.230	8.0	.210	10.0	.190	10.0	.170	72.0	.150
WEST BO(10) 2	5.00	22.0	G	.230	8.0	.210	10.0	.190	10.0	.170	75.0	.150
W JORDA(11) 235	4.00	6.0	G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WEST POINT 17	3.80	12.0	G	.250	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
GOLDEN GARDEN 1	6.00	6.0	G	.500	14.0	.450	30.0	.350	0.0	. 0	0.0	. 0
NORDIC VALLEY 1	8.50	10.0	G	.850	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
SUMMIT PARK 1	12.00	12.0	G	.900	28.0	.800	60.0	.700	0.0	. 0	0.0	. 0
TERRA 1	3.21	2.5	G	.350	0.0	. 0	0.0	. 0	0.0	. 0	0.0	. 0
WHITE CITY 1	1.75	1.0	CF	.150	23.3	.120	0.0	. 0	0.0	. 0	0.0	. 0
WOODLAND BENCH1	2.50	1.2	CF	.200	13.8	.170	35.0	.120	0.0	. 0	0.0	. 0

Numbers which are not in parentheses indicate the type or class of customer, as shown below, to which the rate applies.

For example, the numbers "1" and "7" as shown for Centerville indicate the rates that apply to residential units and commercial users respectively. The number "17" as shown for East Carbon indicates that the rate applies to both residential units (1) and commercial users (7). The letters "OT" indicate the rate applies outside of the city limits.

Several cities base their water rates on the size of connection. In these cases the size of connection is noted rather than numerical codes (for example, see Ogden). Occasionally, the information received from the cities did not differentiate enough between types of users to allow proper descriptions. In these cases only those two types of users to which the rate clearly applied were recorded.

Following the column entitled "Minimum Quantity" are the letters "G" or "CF." A "G" indicates that the quantity is expressed in gallons, rates are expressed as dollars per thousand gallons; and block quantites are expressed as thousands of gallons. A "CF" indicates that the quantity is expressed in cubic feet; block quantities are expressed as thousands of cubic feet; rates are expressed as dollars per hundred cubic feet.

1. Charged per residential unit
2. Single residence rate only
3. Multiple units charged per structure
4. Multiple units charged per unit
5. Mobile homes charged per park
6. Mobile homes charged per unit
7. Commercial
8. Charged per meter—no other account
9. Miscellaneous

Centerville declining block rate for commercial users charges a minimum of $5.00 for any amount up to 10,000 gallons. For the next 90,000 gallons consumed, the rate is $.35 per 1,000 gallons; and the rate for additional monthly consumption is $.25 per 1,000 gallons. Figure 10 represents Centerville's decreasing block rate.

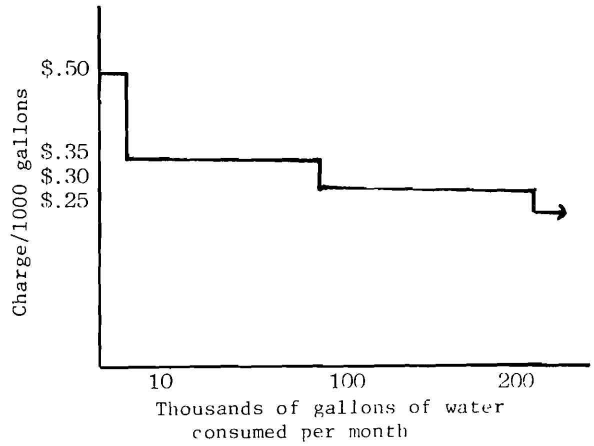

Figure 10. Centerville, Utah, commercial water rate.

Constant Block Pricing

On the national scale, constant block pricing is less popular than the declining block rate. However, 30 of the cities surveyed in Utah use this rate. Provo recently converted to a constant block structure, except for a higher charge for very small uses. Referring again to Table 3, a minimum charge of $3.50 and a quantity of 1000 cubic feet is found for a ¾" connection. For all consumption over 1000 cubic feet, a rate of $.16 per 100 cubic feet is charged as represented in Figure 11.

Uniform Flat Rate

Only five of the municipalities participating in the survey use the uniform flat rate. To illustrate the reduced revenues and greater utilization of resources associated with a flat rate, a comparison might be made between East Carbon and Roosevelt. East Carbon uses a flat rate pricing policy while Roosevelt uses a declining block rate. For fiscal year 1974-1975, East Carbon received a total revenue of $56,008.90 for water services, while Rooselvelt collected $147,881.21 and used less water. The total water consumed by the two communities is 688,890,000 gallons for East Carbon and 421,320,000 for Roosevelt. Although Roosevelt is nearly double the size of East Carbon, its residents used nearly 40 percent less water, while its water rates generated 260 percent more revenue.

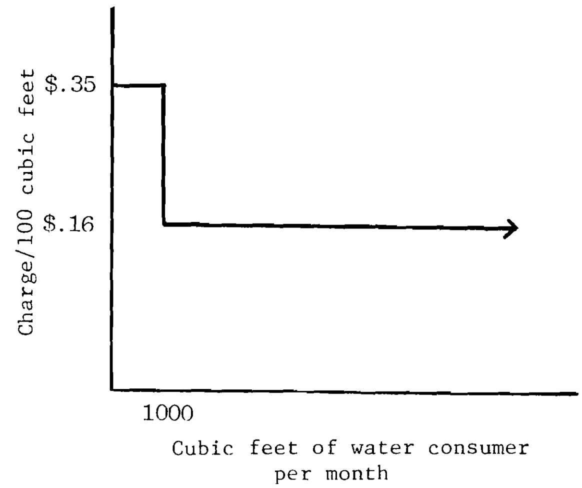

Figure 11. Provo, Utah, water rate for ¾" connection.

Increasing Block Rate

The increasing rate is used in only two of the survey cities: Kanab and Vernal. See Figure 12 for residential rates in Vernal.

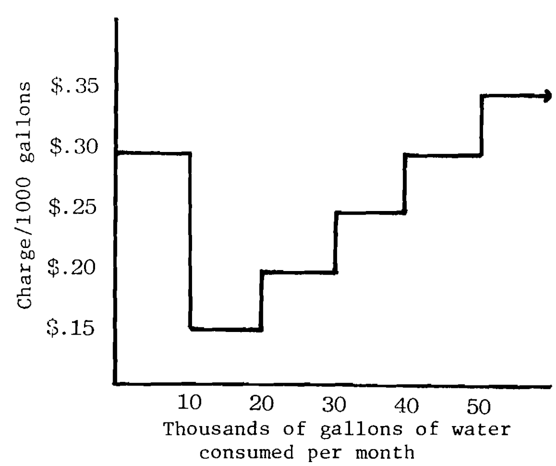

Figure 12. Vernal, Utah, residential water rate.

Demand Metering

Several Utah cities charge a summer differential rate, but these are reduced rates. For example, Provo charges $.01 per 100 cubic feet less during summer months to reimburse customers for the cost of sprinkling city property bordering streets.

Table 3. Comparative culinary water charges.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
BOUNTIFUL 15	3.00	37.9	3.00	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
CENTERVILLE 1	4.50	37.9	4.50	6.55	12.10	24.12	47.23	93.46	185.92	1850.21
CENTERVILLE 7	5.00	37.9	5.00	7.05	12.60	24.62	46.13	82.54	148.59	1337.36
CENTERVILLE 1 OT	6.75	37.9	6.75	9.38	16.52	31.97	60.08	109.71	202.17	1866.46
CENTERVILLE 7 OT	7.50	37.9	7.50	10.43	18.35	35.52	66.94	123.17	228.84	2130.88
CLEARFIELD 2357	3.00	37.9	3.00	4.17	7.31	13.49	25.38	49.15	96.70	952.62
DELTA 27	3.00	30.3	3.00	3.94	5.84	9.97	17.89	33.74	65.44	636.05
DELTA 27 OT	5.00	30.3	5.00	6.88	10.69	18.93	34.78	66.48	129.88	1271.11
EAST CARBON 17	6.30	0.0	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
EPHRAIM 8	4.50	26.5	4.69	6.27	9.44	15.73	27.62	51.39	98.94	954.86
FARMINGTON 27	4.00	37.9	4.00	5.46	9.43	17.21	29.78	53.55	101.10	957.02
FARMING (1) 3	8.00	75.7	8.00	8.00	10.93	18.71	31.28	55.05	102.60	958.52
FILLMORE 17	5.00	37.9	5.00	5.88	8.26	13.41	22.21	35.42	61.83	537.35
HEBER 16	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
HEBER 4	4.00	0.0	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HEBER 7	6.50	64.4	6.50	6.50	9.73	17.29	31.82	60.88	119.00	1165.12
HYDE PARK 2	3.33	75.7	3.33	3.33	4.50	7.93	14.54	27.75	54.16	529.68
KANAB 17	4.00	56.8	4.00	4.17	8.26	18.56	38.38	78.00	157.25	1583.79
KAYSVILLE 17	2.50	37.9	2.50	3.67	6.81	12.99	23.31	43.13	82.75	796.02
LAYTON 2	3.00	26.5	3.19	4.77	7.91	14.09	24.41	44.23	83.85	797.12
LAYTON 2 OT	6.00	26.5	6.37	9.54	15.81	28.18	48.83	86.45	167.70	1594.24
LAYTO (2) 3	5.30	41.6	5.30	6.27	9.44	15.69	26.16	45.98	85.60	798.87
LAYTON 5	3.00	26.5	3.19	4.77	7.94	14.81	28.02	54.43	107.27	1058.29
LAYTON 7	3.00	26.5	3.19	4.77	7.93	14.11	24.46	44.28	83.90	797.17
LEHI 17	3.00	28.4	3.09	4.67	7.84	14.71	27.28	47.48	84.47	750.18
LOGAN 3/4,1"CON	2.50	37.9	2.50	3.67	6.84	13.71	26.92	53.33	106.17	1057.19
LOGAN 1.5" CON	5.00	83.3	5.00	5.00	6.94	13.81	27.02	53.43	106.27	1057.29
LOGAN 2" CON	9.00	159.0	9.00	9.00	9.00	13.81	27.02	53.43	106.27	1057.29
LOGAN 3" CON	17.00	310.4	17.00	17.00	17.00	17.00	27.02	53.43	106.27	1057.29
LOGAN 4" CON	30.00	575.4	30.00	30.00	30.00	30.00	30.00	52.43	105.27	1056.29
LOGAN 6" CON	61.50	1332.5	61.50	61.50	61.50	61.50	61.50	61.50	96.77	1047.79
LOGAN 8" CON	129.50	3338.7	129.50	129.50	129.50	129.50	129.50	129.50	129.50	1009.79
MANILA 15	7.50	37.9	7.50	10.43	18.35	35.52	68.54	134.59	266.67	2644.23
MANILA 7	15.00	75.7	15.00	15.00	20.85	38.02	71.04	137.09	269.17	2646.73
MANILA (3) 3	11.25	56.8	11.25	11.68	19.60	36.77	69.79	135.84	267.92	2645.48
MANTI 8	8.50	37.9	8.50	9.67	12.84	19.27	29.83	48.78	80.83	556.35
MAPLETON 17	3.63	56.8	3.63	3.73	5.63	9.29	13.26	21.18	37.03	322.34
MILFORD 17	11.75	0.0	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75

Table 3. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
MOAB (4) 1	2.50	7.6	3.80	5.55	9.03	16.59	31.12	60.18	118.30	1164.42
MOAB 7	3.50	11.4	4.98	7.36	12.11	21.77	37.98	68.36	127.99	902.95
MOAB 1 OT	5.00	7.6	7.61	11.09	18.07	33.18	62.24	120.36	236.59	2328.84
MOAB 7 OT	7.00	11.4	9.96	14.71	24.22	43.54	75.96	136.72	255.97	1805.91
MT PLEASANT 8	3.00	18.9	3.59	5.17	8.34	15.21	28.42	54.83	107.67	1058.69
MURRAY (5) 2357	3.00	31.1	3.00	4.43	7.39	13.82	26.18	50.90	96.22	737.80
MURRAY HOSP	25.00	31.1	25.00	26.43	29.39	35.82	48.18	72.90	118.22	759.80
MURRAY 2357 OT	4.00	31.1	4.00	6.04	10.28	19.46	37.12	72.43	132.75	965.05
NORTH LOGAN 27	4.00	30.3	4.00	5.96	9.93	18.51	35.02	68.04	134.09	1322.86
OGDEN 1/2+5/8"	3.10	28.8	3.18	5.16	9.13	17.71	33.42	60.76	109.35	715.53
OGDEN 3/4"CON	4.05	42.8	4.05	5.19	9.15	17.74	33.44	60.79	109.38	715.56
OGDEN 1" CON	5.95	71.2	5.95	5.95	9.18	17.76	33.47	60.81	109.40	715.58
OGDEN 1.5" CON	11.20	142.3	11.20	11.20	11.20	18.31	34.02	61.36	109.95	716.13
OGDEN 2" CON	17.50	227.5	17.50	17.50	17.50	18.99	34.69	62.04	110.63	716.81
OGDEN 3" CON	31.85	431.5	31.85	31.85	31.85	31.85	35.92	63.26	111.65	718.03
OGDEN 4" CON	51.85	746.9	51.85	51.85	51.85	51.85	51.85	64.52	113.11	719.29
OGDEN 6" CON	101.25	1691.3	101.25	101.25	101.25	101.25	101.25	101.25	115.50	721.68
OGDEN 8" CON	197.50	4051.1	197.50	197.50	197.50	197.50	197.50	197.50	197.50	724.16
OGDEN 1/2+5/8"OT	6.20	28.8	6.36	10.33	18.25	35.42	66.84	121.46	218.40	1430.76
OGDEN 3/4"CON OT	8.10	42.8	8.10	10.38	18.30	35.47	66.89	121.51	218.45	1430.81
OGDEN 1" CON OT	11.90	71.2	11.90	11.90	18.35	35.52	66.94	121.56	218.50	1430.86
OGDEN 1.5"CON OT	22.40	142.3	22.40	22.40	22.40	36.62	68.04	122.66	219.60	1431.96
OGDEN 2" CON OT	35.00	227.5	35.00	35.00	35.00	37.97	69.39	124.01	220.95	1433.31
OGDEN 3" CON OT	63.70	431.5	63.70	63.70	63.70	63.70	71.84	126.46	223.40	1435.76
OGDEN 4" CON OT	103.70	746.9	103.70	103.70	103.70	103.70	103.70	128.98	225.92	1438.28
OGDEN 6" CON OT	202.50	1691.3	202.50	202.50	202.50	202.50	202.50	202.50	230.95	1443.31
OGDEN 8" CON OT	395.00	4051.1	395.00	395.00	395.00	395.00	395.00	395.00	395.00	1448.31
OREM 27	4.65	45.4	4.65	5.23	7.37	10.80	17.41	30.62	57.03	532.55
OREM (6) 35	8.70	79.5	8.70	8.70	10.63	16.81	28.70	52.47	100.02	955.94
OREM 27 OT	9.30	45.4	9.30	10.46	14.74	21.61	34.82	61.23	114.07	1065.09
OREM 35 OT	17.40	79.5	17.40	17.40	21.25	33.62	57.39	104.94	200.04	1911.88
PANGUITCH 27	3.00	56.8	3.00	3.13	5.45	9.25	15.86	29.07	55.48	531.00
PARK CITY 1	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
PAYSON 8	3.00	37.9	3.00	3.99	6.69	12.53	23.11	41.07	74.09	668.48
PAYSON 8 OT	6.00	37.9	6.00	7.99	13.38	25.05	46.23	82.14	148.19	1336.96
PLAIN CITY 2	5.50	0.0	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
PROVIDENCE 17	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
PROVO 3/4" CON	3.50	28.3	3.60	5.29	8.68	16.03	30.15	58.41	114.92	1132.05

Table 3. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
PROVO 1" CON	4.50	28.3	4.60	6.29	9.68	17.03	31.15	59.41	115.92	1133.05
PROVO 1-1/2" CON	10.00	28.3	10.10	11.79	15.18	22.53	36.65	64.91	121.42	1138.55
PROVO 2" CON	15.00	28.3	15.10	16.79	20.18	27.53	41.65	69.91	126.42	1143.55
PROVO 3" CON	30.00	28.3	30.10	31.79	35.18	42.53	56.65	84.91	141.42	1158.55
PROVO 4" CON	50.00	28.3	50.10	51.79	55.18	62.53	76.65	104.91	161.42	1178.55
PROVO 6" CON	10C.00	28.3	100.10	101.79	105.18	112.53	126.65	154.91	211.42	1228.55
PROVO 8" CON	150.00	28.3	150.10	151.79	155.18	162.53	176.65	204.91	261.42	1278.55
PROVO 10" CON	200.00	28.3	200.10	201.79	205.18	212.53	226.65	254.91	311.42	1328.55
PROVO 12" CON	25C.00	28.3	250.10	251.79	255.18	262.53	276.65	304.91	361.42	1378.55
PROVO 3/4 CON OT	10.50	28.3	10.79	15.87	26.04	48.08	90.46	175.22	344.75	3396.15
PROVO 1" CON OT	13.50	28.3	13.79	18.87	29.04	51.08	93.46	178.22	347.75	3399.15
PROVO 1-1/2 C OT	30.00	28.3	30.29	35.37	45.54	67.58	109.96	194.72	364.25	3415.65
PROVO 2" CON OT	45.00	28.3	45.29	50.37	60.54	82.58	124.96	209.72	379.25	3430.65
PROVO 3" CON OT	90.00	28.3	90.29	95.37	105.54	127.58	169.96	254.72	424.25	3475.65
PROVO 4" CON OT	150.00	28.3	150.29	155.37	165.54	187.58	229.96	314.72	484.25	3535.65
PROVO 6" CON OT	300.00	28.3	300.29	305.37	315.54	337.58	379.96	464.72	634.25	3685.65
PROVO 8" CON OT	45C.00	28.3	450.29	455.37	465.54	487.58	529.96	614.72	784.25	3835.65
PROVO 10" CON OT	600.00	28.3	600.29	605.37	615.54	637.58	679.96	764.72	934.25	3985.65
PROVO 12" CON OT	750.00	28.3	750.29	755.37	765.54	787.58	829.96	914.72	1084.25	4135.65
RANDOLPH 17	3.50	56.8	3.50	3.71	7.42	10.85	17.46	30.67	57.08	532.60
RICHFIELD 2	3.75	56.8	3.75	3.96	7.93	16.51	33.02	66.04	132.09	1320.86
RIVERDALE 17	3.25	37.9	3.25	4.30	7.16	13.34	25.23	49.00	96.55	952.47
RIVERTON 27	4.00	18.9	4.59	6.17	9.34	16.21	29.42	55.83	108.67	1059.69
RIVERTON 27 OT	5.00	18.9	5.59	7.17	10.34	17.21	30.42	56.83	109.67	1060.69
RIVERTON(7) 9	2.00	18.9	2.59	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
ROOSEVELT 17	5.00	37.9	5.00	7.05	11.93	20.51	37.02	70.04	136.09	1324.86
ROY 17	2.50	37.9	2.50	3.61	6.62	13.15	25.70	50.79	100.99	1004.46
ROY 17 OT	6.25	37.9	6.25	8.30	13.85	25.87	48.98	95.21	187.67	1851.96
ST.GEORGE 1	3.00	11.4	3.99	5.57	8.74	15.61	28.82	53.31	98.22	906.59
ST.GEORGE 57	3.00	11.4	4.23	6.21	10.18	18.76	35.27	66.37	123.64	1027.11
SLC 3/4,1" CON	1.75	31.1	1.75	3.38	6.77	14.12	28.24	56.50	113.01	1130.14
SLC 1.5" CON	3.50	62.3	3.50	3.50	6.76	14.11	28.23	56.49	113.00	1130.13
SLC 2" CON	5.60	99.1	5.60	5.60	6.78	14.13	28.25	56.51	113.02	1130.15
SLC 3" CON	11.20	198.2	11.20	11.20	11.20	14.13	28.25	56.51	113.02	1130.15
SLC 4" CON	17.50	308.6	17.50	17.50	17.50	17.50	28.31	56.57	113.08	1130.21
SLC 6" CON	35.00	620.1	35.00	35.00	35.00	35.00	35.00	56.47	112.98	1130.11
SLC 8" CON	56.00	991.0	56.00	56.00	56.00	56.00	56.00	56.51	113.02	1130.15
SLC 10" CON	80.50	1424.2	80.50	80.50	80.50	80.50	80.50	80.50	113.04	1130.17

Table 3. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
SLC 3/4,1" CO OT	2.50	28.3	2.64	5.19	10.27	21.29	42.48	84.86	169.62	1695.33
SLC 1.5" CON OT	5.00	59.5	5.00	5.05	10.13	21.15	42.34	84.72	169.48	1695.19
SLC 2" CON OT	8.00	93.4	8.00	8.00	10.25	21.27	42.46	84.84	169.60	1695.31
SLC 3" CON OT	16.00	189.7	16.00	16.00	16.00	21.11	42.30	84.68	169.44	1695.15
SLC 4" CON OT	25.00	294.5	25.00	25.00	25.00	25.00	42.42	84.80	169.56	1695.27
SLC 6" CON OT	50.00	588.9	50.00	50.00	50.00	50.00	50.00	84.84	169.60	1695.31
SLC 8" CON OT	80.00	942.9	80.00	80.00	80.00	80.00	80.00	84.84	169.60	1695.31
SLC 10" CON OT	115.00	1356.3	115.00	115.00	115.00	115.00	115.00	115.00	169.56	1695.27
SANDY 17	8.00	75.7	8.00	8.00	10.93	19.51	36.02	69.04	135.09	1323.86
SANTAQUIN 17	4.15	37.9	4.15	4.62	5.89	8.63	13.92	24.48	45.62	426.03
SANTAQUIN 17 OT	8.15	37.9	8.15	9.09	11.62	17.12	27.68	48.82	91.09	851.90
SMITHFIELD 27	3.00	37.9	3.00	3.88	6.26	10.63	16.87	27.43	48.57	428.98
SOUTH OGDEN 17	2.25	37.9	2.25	3.42	6.59	13.46	26.67	53.08	105.92	1056.94
S SALT LAKE 27	2.50	45.4	2.50	3.35	6.83	14.39	28.92	57.98	116.10	1162.22
S SALT (8) 3	4.00	75.7	4.00	4.00	6.57	14.13	28.66	57.72	115.84	1161.96
SPANISH FORK 8	3.50	56.8	3.50	3.63	6.01	10.35	16.96	30.17	56.58	532.10
SUNSET 3/4" CON	3.65	37.9	3.65	5.00	8.37	14.38	25.60	48.06	92.97	901.34
SUNSET 1" CON	4.50	37.9	4.50	5.85	9.22	15.23	26.45	48.91	93.82	902.19
SUNSET 4" CON	9.15	37.9	9.15	10.50	13.87	19.88	31.10	53.56	98.47	906.84
SUNSET 6" CON	13.60	37.9	13.60	14.95	18.32	24.33	35.55	58.01	102.92	911.29
SYRACUSE 1	6.15	37.9	6.15	7.32	10.49	17.36	30.57	56.98	109.82	1060.84
SYRACUSE 7	6.15	37.9	6.15	7.03	9.41	14.56	24.46	44.28	83.90	797.17
TOOELE (9) 2357	2.75	42.5	2.75	3.83	7.54	15.58	31.03	61.93	123.74	1236.23
VERNAL (10) 2	3.00	37.9	3.00	3.88	6.93	17.62	40.73	86.96	179.42	1843.71
VERNAL 357	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
VERNAL (10) 2 OT	6.00	37.9	6.00	7.76	13.18	29.02	62.04	128.09	260.17	2637.73
VERNAL 357 OT	6.00	37.9	6.00	7.46	11.43	20.01	36.52	69.54	135.59	1324.36
WASHING TER 2	3.75	37.9	3.75	4.92	8.09	14.96	28.17	54.58	107.42	1058.44
WASHING(10) 2	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING TER 3	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 3/4" CON	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING 1" CON	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 1.5" CON	9.50	143.8	9.50	9.50	9.50	15.11	28.32	54.73	107.57	1058.59
WASHING 2" CON	14.00	227.1	14.00	14.00	14.00	15.21	28.42	54.83	107.67	1058.69
WASHING 3" CON	24.50	431.5	24.50	24.50	24.50	24.50	28.12	54.53	107.37	1058.39

Table 3. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
WASHING 4" CON	39.50	745.7	39.50	39.50	39.50	39.50	39.50	52.93	105.77	1056.79
WELLSVILLE 23	5.00	132.5	5.00	5.00	5.00	12.76	29.27	62.29	128.34	1317.11
W BOUNTIFUL 17	3.00	45.4	3.00	3.89	7.26	13.27	24.09	43.91	83.53	796.80
WEST BO(10) 2	5.00	83.3	5.00	5.00	7.20	13.57	24.65	44.47	84.09	797.36
W JORDA(11) 235	4.00	22.7	4.48	6.46	10.43	19.01	35.52	68.54	134.59	1323.36
WEST POINT 17	3.80	45.4	3.80	4.76	8.73	17.31	33.82	66.84	132.89	1321.66
GOLDEN GARDEN 1	6.00	22.7	6.96	10.93	18.27	32.12	55.23	101.46	193.92	1858.21
NORDIC VALLEY 1	8.50	37.9	8.50	13.47	26.95	56.14	112.27	224.55	449.09	4490.94
SUMMIT PARK 1	12.00	45.4	12.00	15.47	29.73	58.03	107.66	200.12	385.04	3713.62
TERRA 1	3.21	9.5	5.11	7.88	13.43	25.45	46.57	94.80	187.26	1851.55
WHITE CITY 1	1.75	28.3	1.84	3.43	6.61	13.49	26.74	49.92	92.30	855.15
WOODLAND BENCH1	2.50	34.0	2.50	4.34	8.58	17.76	34.62	64.64	114.36	877.21

This table lists the prices associated with the consumption of various quantities of water for all cities according to the same coding as Table 2. For example, a single residence in Bountiful would be charged $7.34 for consumption of 120,000 liters of water. A liter is approximately .25 gallon or .02 cubic foot. In reading Table 3, only those rates for a particular consumer class should be compared.

CHAPTER V

REVENUE POTENTIAL OF WATER USER FEES

REVENUE ESTIMATION AND POTENTIAL

User fees perform two major functions. First, they can be used to allocate resources or control use, such as in pollution control. Second, they can be used to raise capital or revenue to support governmental services. The latter function is of primary interest in this study, and in this chapter estimates are made of amounts of funds that may be generated by fees imposed on major water uses.

At least two options are available for making these estimates. One is to find the maximum revenue-generation possible and then determine the level of fee that is implied. Another method is to select a "typical" or reasonable fee and estimate what amounts of revenue would be generated by it. A simple but appropriate formula has been developed in this research that will allow either type of calculation. The formula assumes that supply will not be affected and that anyone who demands water can get it.

Revenue Potential Formula and a Simple Illustration

A fee levied on a product has two demand effects. One is to reduce consumption because of the increase in price and the other is to induce substitution when alternative products exist. Both of these effects will reduce the revenue generating potential of a user fee or excise tax.

Let q be the quantity demanded before the fee, p be the prefee price, and f be the fee. It follows then that the total revenue raised by the fee:

$$\text{T.R.} = fq - fdq \quad \ldots\ldots (1)$$

From the definition of the elasticity of demand ($e = p/q \;\; dq/dp$), $dq = e(dp)q/p$. For perfect competition and constant costs, $f = dp$ ($dp = \frac{1}{2}f$ for monopoly where marginal revenue equals half of demand).

Substitution in (1) gives:

$$\text{T.R.} = fq - f^2 \frac{eq}{p} \text{ (perfect competition)} \quad \ldots\ldots (2)$$

$$\text{T.R.} = fq - \frac{f^2\, eq}{2p} \text{ (monopoly)} \quad \ldots\ldots (3)$$

Differentiating with respect to f gives:

$$\frac{dTR}{df} = q - \frac{2f\, eq}{p} = 0 \text{ (perfect competition)} \quad \ldots\ldots (4)$$

$$\frac{dTR}{df} = q - \frac{feq}{p} \text{ (monopoly)} \quad \ldots\ldots (5)$$

Setting this equal to zero in order to maximize revenue and solving for f gives:

$$f = \frac{p}{2e} \text{ (perfect competition)} \quad \ldots\ldots (6)$$

$$f = \frac{p}{e} \text{ (monopoly)} \quad \ldots\ldots (7)$$

Thus, the fee which maximizes revenue depends on the price and the elasticity of demand.

To illustrate the concept, suppose that the water monopoly of the City of Logan, Utah, wanted to improve its water system with funds generated by a water user fee. In 1970, the price of 1,000 gallons of water was 15.6 cents and approximately 1,700,000 of these units were consumed. The elasticity of demand for Logan City water is not known exactly, but assume it to be .75 (Gardner and Shick, 1969).

The fee which will maximize revenue is given by:

$$f = \frac{p}{e} = \frac{0.156}{0.75} = 0.21$$

which substituting in Equation 3 makes the maximum revenue potential about $180,216.

Estimates for the United States

For the United States as a whole and several individual states, Table 4 shows the revenue potential from relatively low levels of fees. A sample calculation for the State of Utah is presented in Appendix C. It is obvious that there is a potential for the generation of substantial funds if society should deem it desirable to raise money by this means.

Table 4. Estimated revenue from user fees on public supply and irrigation uses in 10 selected states.

State	Type of Use	Annual[a] Use (mgd) (1000 ac-ft)	Use[b] Fee ($/1000 gal.) ($/acre-ft)	Annual[c] Revenue ($1000's)
Ariz.	Public Supply	470	0.40	34,310
	Irrigation	7,000	2.50	8,750
Calif.	Public Supply	3,400	0.40	248,200
	Irrigation	37,000	2.50	46,250
Fla.	Public Supply	880	0.40	64,240
	Irrigation	2,500	2.50	3,125
La.	Public Supply	380	0.40	27,740
	Irrigation	1,700	2.50	2,125
Mass.	Public Supply	750	0.40	54,750
	Irrigation	65	2.50	81
Minn.	Public Supply	340	0.40	24,820
	Irrigation	23	2.50	29
New York	Public Supply	2,600	0.40	189,800
	Irrigation	31	2.50	39
Okla.	Public Supply	260	0.40	18,980
	Irrigation	920	2.50	1,150
Utah	Public Supply	280	0.40	20,440
	Irrigation	4,100	2.50	5,125
Wash.	Public Supply	910	0.40	66,430
	Irrigation	6,300	2.50	7,875
Total for all states	Public Supply	27,000	0.40	1,971,000
	Irrigation	140,000	2.50	175,000

[a]Source: U.S. Geological Survey, 1972 (public supply figures do not include supplies for rural use).

[b]Fees are illustrative only, computed on the basis of assumed prices for public supply and irrigation of $.30/1000 gal. and $5.00/ac-ft respectively. See Appendix C.

[c]Revenue is calculated with Equation 3 assuming the elasticity for public supply and irrigation uses to be 0.75 and 2 respectively.

ESTIMATES FOR UTAH

Narrowing the focus to Utah, it is possible to get a clearer picture of the generating potential of water use fees. Estimates are made below for water used in agriculture, industry, homes and businesses, and in recreation.

Irrigation User Fees

Much of the water allocated to agriculture in Utah is distributed by mutual irrigation companies. It would be administratively easier from a state perspective to levy a fee against a mutual company than an individual. Under such an arrangement the company would distribute the fee to its stockholders. Companies from two counties, Weber and Utah, were selected to estimate revenue generation if the state were to levy a fee to extract the maximum revenue from each company given present rate structures. To do this, it was necessary to determine the elasticity of demand for irrigation water. Estimated elasticities for various regions of Utah are shown in Table 5. Taking the total amount of water used for irrigation in Utah and the average price and elasticity, it was found that the fee which would generate the most revenue would be $2.50 per acre/ft and it would bring in approximately 5 million dollars annually. Revenue, average fee, and average burden/stockholder, for Weber and Utah counties are shown in Tables 6 and 7.

Some problems would be encountered in establishing and administering a comprehensive system of user charges on irrigation water in Utah. Mutual companies hold water rights and distribute water to users according to the number of shares in the company each user holds. Although records of each company's dealings with the state with respect to water rights are available in the Utah Water Rights Division, the water rights picture is complex and in a state of flux with companies continually making new applications for appropriation and changes in point of diversion. A perspective on this situation may be gained by examining the history of one of the companies, the Alpine Irrigation Company, in Appendix D.

Table 5. Elasticity of demand for irrigation water in Utah by region.

Region	Q_a Actual Quantity Used 1,000 ac ft	P^* Price Read from MVP Schedule at Q_a \$/ac ft	$\hat{Q}$ Quantity Estimate on Regression at P^* 1,000 ac ft	$\eta_{\hat{Q}P^*}$ Elasticity at $\hat{Q},P^*$	$\eta_{Q_aP^*}$ Elasticity at Q_a,P^*	Regression R^2
1 Great Salt Lake Desert	59	\$ 8.80	67.9	-1.49	-1.71	0.88
2 Bear River	354	8.90	394.5	-0.95	-1.05	0.97
3 Weber River	236	14.40	168.0	-2.86	-2.04	0.97
4 Jordan River	310	9.30	367.8	-1.33	-1.57	0.97
5 Sevier River	436	7.30	609.8	-3.07	-4.29	0.92
6 Cedar-Beaver	137	9.20	155.2	-1.43	-1.62	0.89
7 Uinta Basin	293	5.20	369.7	-1.73	-2.19	0.95
8 West Colorado	114	8.70	99.0	-2.46	-2.13	0.98
9 South & East Colorado	30	2.80	65.9	-2.19	-4.80	0.93
10 Lower Colorado	34	9.40	51.2	-2.68	-4.03	0.90
Total or average	2,003[a]	8.64	2,349.0[b]	-2.00[c]	-2.38[d]	

Source: M. H. Anderson et al., 1973.

[a] $\sum_{i=1}^{10} Q_{a_i} = 2,003$

[b] $\sum_{i=1}^{10} \hat{Q}_i = 2,349$

[c] $\dfrac{\sum_{i=1}^{10} \hat{Q}_i \eta \hat{Q}P^*_i}{\sum_{i=1}^{10} \hat{Q}_i}$

[d] $\dfrac{\sum_{i=1}^{10} Q_a \cdot \eta \hat{Q}P^*_i}{\sum_{i=1}^{10} \hat{Q}_i}$

Industrial User Fees

Industrial water-user fee revenues are estimated herein as the sum of those estimated from the present level of industrial use and those from the future increased industrial use. "Present diversions" refer to the summation of water consumption by nine heavy use industries in Utah for 1970. This particular year was selected because of the availability of data. Increased water use after 1970, along with projected future increased demands, are termed "new diversions."

Present level of industrial use

To estimate present industrial water use in Utah, data were drawn from 1968-69 U.S. Bureau of Census records on average national water use for the nine heavy use industrial categories shown in Table 8. From these data, it was possible to derive a coefficient for water use per employee in each of these industries. This coefficient was then applied to the number of employees involved in the same respective industries for the year 1970 in Utah, with a resulting consumptive use figure determined for each industry as presented in Table 9. A summation of these figures yielded a total annual industrial water use of slightly less than 55 billion gallons (168,000 acre feet) and is assumed to be the present level of industrial use for 1970. This quantity of intake, categorized as "present diversion," is presumed to be supplied through existing systems in which the only costs are for system operation and maintenance.

Future increased industrial water use requirements

The projections presented here are not intended to include all future increased industrial requirements for Utah's water. They are based on future diversion requirements of proposed energy development projects (and operational projects completed since 1970) within the state (Table 10). In the case of the Huntington Canyon project, for example, which accounts for the 7,000 ac ft increase in 1974, the system is already operational. Since these requirements are supplemental to the present diversion quantities shown for 1970, they are considered as "new diversions."

The data compiled in Table 10 are taken from the Colorado River Regional Assessment Study prepared by the Utah Water Research Laboratory at Utah State University in June 1975 for the National Commission on Water Quality. The water requirement column in Table 10 represents a cumulative total of increased yearly intake as proposed new energy development projects are completed and commence operation. Increases are shown annually through 1986 and summarized beyond that point. These figures are used as the basis for computing the user fee potential of future increased industrial water consumption.

Industrial water-user fee potential

By reason of the indispensible nature of industrial water use and the relatively small portion of total production costs accounted for by water quantity demanded is not likely to change appreciably with

Table 6. Revenue potential from irrigation user fees (Utah County).

Company	Stockholders	Total Amount Used (acre foot)	Cost per Acre Foot	Tax Rate Per Acre Foot (Dollar)	Revenue[a] (Dollar)	Cost Per Stockholder (Dollar)
Alpine	200	6,125	0.85	0.64	1,960.00	9.80
Alta Ditch	10	1,113	22.21	16.70	9,293.55	929.35
American Fork	1,100	18,386	2.05	1.54	14,157.22	12.87
Cedar Fork	31	1,750	0.52	0.39	314.25	10.14
Coffman Springs	11	339	0.69	0.52	88.14	8.01
Current Creek	28	7,500	1.18	0.89	3,337.50	119.20
Dixon	15	1,100	2.50	1.88	1,034.00	68.93
East River Bottom	70	1,379	0.48	0.39	268.90	3.84
East Warm Creek	12	3,500	0.12	0.09	157.50	13.13
Fairfield	26	2,100	1.63	1.22	1,281.00	49.27
	90	229	0.64	0.48	54.96	0.61
Fortfield-Little Dry Creek	126	3,027	0.99	0.74	1,120.00	8.89
Goshen	115	3,924	0.51	0.38	745.56	6.48
Holladay Fld. Ditch	9	693	0.76	0.57	197.50	21.94
Hollow Water	51	1,925	0.19	0.14	134.75	2.64
Lake Bottom	92	3,535	0.82	0.62	1,095.85	11.91
Lake Shore	110	7,835.6	0.73	0.55	2,154.79	19.59
Lake Side	16	2,345	0.08	0.06	70.35	4.40
Lehi	860	20,580	1.56	1.17	12,039.30	14.00
Lindon Pumping	100	1,365	0.21	0.16	109.20	1.09
Mapleton	450	11,277.1	1.70	1.28	7,217.34	16.04
Matson Spring	10	779	1.77	1.33	518.03	51.80
Mitchell Hollow	39	480	2.10	1.58	379.20	9.74
North Union	354	6,272	1.92	1.44	4,515.84	12.76
Pioneer Pumping	7	525	0.57	0.43	112.88	16.12
Pleasant Grove	782	16,622	1.89	1.42	11,801.62	15.09
Provo Bench Canal	800	40,906	0.49	0.37	7,567.61	9.50
Provo River Water Users	10	75,102	1.66	1.25	46,938.75	4,693.87
Rock Canyon	68	1,855	0.48	0.36	333.90	4.91
Salem	375	8,230.6	1.34	1.01	4,156.45	11.08
Salem Pond	35	2,100	0.40	0.30	315.00	9.00
South Ditch	30	438	4.38	3.29	720.51	24.02
South Fields	15	700	3.85	2.89	1,001.50	66.77
Spanish Fk. South	200	15,301	1.06	0.80	6,120.40	30.60
Spanish Fk. E. Bench	200	15,957.2	1.43	1.07	8,537.10	42.68
Spanish Fk. West	195	16,196.9	0.82	0.62	5,021.04	25.75
Spring Creek	76	2,800	0.71	0.53	748.00	9.76
Strawberry Wat. Users	1,200	70,031	0.91	0.68	23,810.54	19.84
Strawberry Highline	600	48,211.1	1.03	0.77	18,561.27	30.93
Summit Creek	160	12,250	3.95	2.97	18,191.25	113.67
Timpanogus Canal	310	4,314	0.54	0.41	884.37	2.85
Upper East Union	210	4,636	0.56	0.42	973.56	4.64
Utah Lake District	350	16,629	0.76	0.57	4,739.26	13.54
Warm Spring	12	4,550	0.20	0.15	341.25	28.44
Wash Creek	12	931	0.46	0.34	158.27	13.19
West Union	1,030	7,454	4.29	3.22	12,000.94	11.65
Woods Springs	15	1,550	0.57	0.43	333.25	22.22

Other companies exist but either no records were kept or their water was used other than by stockholders.
Total Revenues = $235,607.45

[a] $\text{T.R.} = fq - \frac{f^2eq}{2p}$ $\qquad e = 1.33$

price and thus can be considered relatively inelastic. Since the maximum fee assessable is inversely related to elasticity of demand, the smaller the elasticity the greater the fee that can be imposed. Although low elasticity of demand is probable, a range of values for elasticity is considered in computing user fee capital generating possibilities.

Another major consideration in user fee determination is the cost of supplying water to the user. The costs in Table 11 are generalized estimates for moving water from the source to the user facilities. Storage and collection costs at points of origin and distribution and treatment costs at the point of use are not included.

Table 7. Revenue potential from irrigation water user fees (Weber County).

Company	Stockholders	Total Amount Used (acre foot)	Cost per Acre Foot	Tax Rate Per Acre Foot (Dollar)	Revenue[a] (Dollar)	Cost Per Stockholder (Dollar)
Bambrough	24	1,356	1.56	0.54	366.12	15.25
Co-op Farm	7	2,262.6	2.12	0.74	837.16	119.59
Crooked Creek	7	270	0.14	0.05	6.75	0.96
Davis and Weber Co. Canal	1,700	65,143	1.20	0.42	13,680.03	8.05
Dinsdale Water	102	698.6	3.15	1.10	384.23	3.77
Davis Ditch Water	15	654.6	0.81	0.28	91.64	6.11
Eden	31	8,292	0.59	0.21	870.66	28.08
Evertsen	13	604.2	0.33	0.11	33.23	2.56
Felt, Peterson and Slater	9	952.6	0.46	0.16	76.21	8.47
Glenwood Ditch	78	388.88	0.77	0.27	52.50	0.67
Hooper	545	3,654	1.85	0.65	1,187.55	2.18
Huntsville	300	7,617	0.75	0.26	990.21	3.30
Huntsville So. Bench	25	883.8	6.50	2.27	1,003.11	40.12
Liberty	57	3,359.2	0.45	0.16	268.74	4.71
Marriot	63	2,312	0.57	0.20	231.20	3.67
Mound Fort No. 6	6	373	0.57	0.20	37.30	6.22
North Ogden Irr.	245	8,822.8	1.56	0.54	2,382.16	9.72
Old Wilson	47	926	0.41	0.14	64.82	1.38
Perry	30	1,507.8	0.62	0.22	165.86	5.53
Pioneer Irr. Canal	10	627	0.32	0.11	34.48	3.45
Riverdale Bench	60	2,285	0.90	0.31	354.17	5.90
Shupe & Middleton	16	325.37	0.94	0.33	53.69	3.35
South Weber	23	1,704	0.56	0.19	161.88	7.04
Uintah Central Canal	44	1,009	1.30	0.45	227.02	5.16
Warren	125	19,340	1.01	0.35	3,384.50	27.08
Weber Canal Water	115	242	8.80	3.08	372.68	3.24
Western	310	10,889	1.54	0.54	2,940.03	9.48
Wilson	250	15,642	1.73	0.60	4,692.60	18.77
Total Revenue = $34,950.53						

[a]T.R. $= fq - \frac{f^2 eq}{2p}$ $e = 2.86$

The cost of present diversions relate to distributing water costs for municipal and industrial use through existing facilities for transport. Operation and maintenance costs only are considered. The costs for groundwater include the cost of pumping and the cost required to boost to line pressue.

The cost of new diversions include the costs of constructing and maintaining new facilities for transporting water to the point of use. Capital costs are included with the O and M costs. Cost of pumping and boosting to line pressure is included in the groundwater costs.

In order to estimate the total revenue that can be raised by charging fees for industrial water use, it is necessary to establish appropriate values for price and elasticity of demand for Equation 3. Data drawn from King et al. (1972) indicate an average supply cost for water to industrial users of $23.80 per ac ft for present diversions and $42 per ac ft for new diversions (Table 11). Using these costs as estimates of price (p) and the arbitrarily selected values of e = 0.2, 0.5, and 0.8, as given in Table 12, Equation 3 assuming monopoly conditions yields corresponding fees of $119.00, $47.60, and $29.75 per ac ft for present diversions and $210.00, $84.00, and $52.50 per ac ft for new diversions, as indicated in Table 13.

Assuming that neither the M and I distribution costs (or prices) for both present diversions and new diversions nor the inelasticity of demand for water change, the additional revenues from future water use are shown in Tables 14 through 17. To obtain total revenue for a given year, after 1970 total revenue for 1970 is added to the additional revenue for that year. Two fee alternatives that would raise half this maximum may be calculated if desired. An upper fee and a lower fee both yield half the maximum revenue.

Municipal Water User Fees

It is assumed that most municipal water supply utilities, because they are monopolies, have set prices above the paraeto optimum; and the monopoly revenue formula (Equation 3) is appropriate. By using this formula, the revenue projections are twice as large as they would be under competitive conditions.

Table 8. Heavy water user industries—1968.

Code	Industry Group	Col. 1 Number of Employees (1,000)	Col. 2 Water Intake From Private Water Systems (Billions of Gallons)	Col. 3 Water Intake From Private Water Systems Per Employee (Col.2 ÷ Col. 1)
20	Food and Kindred Products	1,632.4	603.6	369,762.3
28	Chemical and Allied Products	856.3	4,221.9	4,930,398.2
29	Petroleum and Coal Products	141.0	1,252.3	8,881,560.1
32	Stone, Clay, Glass Products	590.1	216.1	366,204.1
33	Primary Metal Industries	1,274.7	4,808.8	3,772,495.4
34	Fabricated Metal Products	1,357.8	20.5	15,097.9
36	Electric, Electronic Equipment	1,882.7	38.0	20,183.7
37	Transportation Equipment	1,887.6	190.8	101,080.7
39	Misc. Manufacturing Industries	430.7	8.2	19,038.7
	All Nine Heavy Use Industries	10,053.3	11,360.2	1,129,997.1

Source: Column 1 is from U.S. Bureau of the Census, Annual Survey of Manufactures 1968-1969, General Statistics by Major Industry Groups.
Column 2 are from U.S. Bureau of the Census, Census of Manufactures 1967, Series No. 67(1)-2.

Table 9. Estimate of industrial water use for the State of Utah, 1970.

Code	Industry Group	Col. A Number of Employees[a]	Water Intake From Private Water Systems (Million Gallons) Col. A x Col. 3, Table 8
20	Food and Kindred Products	6,928	2,561.7
28	Chemical and Allied Products	1,999	9,855.9
29	Petroleum and Coal Products	1,204	10,693.4
32	Stone, Clay, Glass Products	(NA)	(NA)
33	Primary Metal Industries	8,115	30,613.8
34	Fabricated Metal Products	4,093	61.8
36	Electric, Electronic Equipment	9,794	197.7
37	Transportation Equipment	5,405	546.4
39	Misc. Manufacturing Industries	5,417	103.1
	All Nine Heavy Water Use Industries	42,955	54,633.8

[a]Numbers of Employees are from Bureau of Economic Analysis, Regional Economics Information System, Employment by Selected Industrial Sectors (Utah).

In 1974 Bountiful, Utah, sold 1,256,669,390 gallons of water at an average price of 26.8 cents per 1,000 gallons. Assuming the price elasticity of demand to be .75 based on a recent study of urban water use (Gardner and Schick, 1964), the revenue maximizing water user fee would be 35.7 cents per 1,000 gallons. This makes the total rate, including the add-on fee, 62.5 cents per 1,000 gallons and the maximum revenue generating potential $224.315.

Table 16 shows the maximum revenue generating potential for 16 Utah cities which provided enough information about revenues and water volume in the 1975 water rate survey discussed in Chapter IV to enable calculations. These 16 cities with combined population of 133,136, represent 11.33 percent of the projected 1974 Utah population (Utah Population Work Committee, 1975). A multiplier of $10.87/capita was calculated by dividing the sample's total revenue by total population.

Applying this multipier to Utah's projected 1974 population (UPWC, 1975) yields a revenue of $12,771,000. This number, as would be expected, is lower than the estimate for Utah shown in Table 3. Public supplies in Table 3 include quantities for some industrial uses.

Table 10. Future industrial water increases for Utah.[a]

Year	Water Requirement Increases (ac ft/yr)
1974	7,000
1975	7,000
1976	7,000
1977	14,205
1978	21,205
1979	27,965
1980	100,895
1981	131,625
1982	131,625
1983	131,625
1984	131,625
1985	152,625
1986	152,625
Beyond 1986	289,740

[a]Source: Utah Water Research Laboratory, 1975.

Recreational Water User Fees

In the case of recreational fees, the circumstances are different since water is necessary but is not sufficient for a successful activity. Fishing requires fish in the water. The fee, therefore, is calculated on the right to take part in an activity. It is clear from the experience related in Chapter III that more revenue could be generated from fishing, hunting, or camping rights. Frequently, however, such rights are considered as public benefits, like education, which ought to be funded from taxes, at least for local residents. Out of state people are generally compelled to pay a higher fee. High fees on recreational activities would be opposed as a way of rationing poor people out of the market and leaving these activities as a privilege only of the rich.

Table 17 gives some indication of the additional fees which could be collected if the purpose was to extract the maximum amount of rent from the present licensing privileges to fish and hunt. Sufficient data were not available to make estimates for other types of recreation.

Table 12. Total revenue [1970].

Present Diversions

p = cost = \$23.80 per ac ft
q = 168,000 ac-ft

Elasticity	Fee (Dollar)	Total Revenue (Dollar)
0.2	119.00	9,996,000
0.5	47.60	3,998,400
0.8	29.75	2,499,000

Table 13. Additional revenue for 1976.

New Diversions

p = cost = \$42.00 per ac ft
Additional q = 7,000 ac ft

Elasticity	Fee (Dollar)	Additional Revenue (Dollar)
0.2	210.00	735,000.00
0.5	84.00	294,000.00
0.8	52.50	183,750.00

COMMENTS

The preceding very approximate calculations clearly indicate that all of the revenue potential from our public waters are not being captured. If it is felt that the capital to improve and expand the present water system should come from the users, then our analysis has clearly demonstrated that the potential is there. In Utah over two million dollars could be raised annually from agriculture, over 9 million from recreation, just under 13 million from municipal users, and several million more from industry.

Table 11. Water cost per acre foot for Utah in 1970.

Hydrologic Study Unit	M&I Distribution Cost		Maximum Fees					
	Present Diversion (O & M)	New Diversions	Present Diversions			New Diversions		
	Ground-water \$/a.f.	Ground-water \$/a.f.	e = 0.2 \$	e = 0.5 \$	e = 0.8 \$	e = 0.2 \$	e = 0.5 \$	e = 0.8 \$
1	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5
2	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5
3	29.50	49.00	147.5	59.0	36.9	245.0	98.0	61.8
4	29.50	49.00	147.5	59.0	36.9	245.0	98.0	61.3
5	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5
6	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5
7	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5
8	-	42.00	-	-	-	210.0	84.0	52.5
9	-	42.00	-	-	-	210.0	84.0	52.5
10	23.80	42.00	119.0	47.6	29.8	210.0	84.0	52.5

Source: King et al. (1972) page 36.

Table 14. Additional revenue for 1980.

New Diversions		
p = cost = $42.00 per ac ft Additional q = 100,895 ac ft		
Elasticity	Fee (Dollar)	Additional Revenue (Dollar)
0.2	210.00	10,593,975.00
0.5	84.00	4,237,590.00
0.8	52.50	2,648,493.70

Table 15. Additional revenue for 1986.

New Diversions		
p = cost = $42.00 per ac ft Additional q = 152,625 ac ft		
Elasticity	Fee (Dollar)	Additional Revenue (Dollar)
0.2	210.00	16,025,625.00
0.5	84.00	6,410,850.00
0.8	52.50	4,006,406.20

Table 16. Revenue generating potentials in Utah cities.

City and 1973 Population[a]	Quantity of Water Sold Gallons	Revenue $	Average Fee Per 1000 g.	Maximum Fee	Available Revenue
Bountiful 29,220	1,256,669,390(2)	$337,141(2)	$0.268	$0.357	224,315
Clearfield 13,082	408,179,000(3)	155,284(3)	0.380	0.507	103,473
East Carbon 1,894	668,890,000(3)	56,009(3)	0.081	0.108	36,120
Farmington 2,912	243,918,700(2)	60,468(2)	0.248	0.331	40,369
Fillmore 1,626	190,525,000(2)	52,966(2)	0.278	0.370	35,247
Heber 3,488	326,996,400(2)	90,905(2)	0.278	0.370	60,484
Kaysville 7,007	520,708,300(2)	93,824(2)	0.180	0.240	62,485
Layton 15,766	1,298,193,999(2)	288,666(2)	0.222	0.296	192,133
Manila 205	23,389,000(2)	3,871(2)	0.139	0.185	2,163
Moab 4,375	418,014,000(2)	135,025(2)	0.323	0.431	90,082
North Logan 1,540	112,530,000(3)	30,698(3)	0.273	0.364	20,480
Providence 2,167	163,764,000(2)	29,248(2)	0.178	0.237	19,406
Roosevelt 3,431	421,320,000(3)	147,881(3)	0.351	0.468	98,589
Roy 15,643	1,392,705,000(2)	300,000(2)	0.215	0.287	199,853
So. Salt Lake 8,138	940,045,862(2)	126,770(2)	0.135	0.180	84,604
Logan 22,642	1,700,000,000(1)	265,200(1)	0.156	0.208	176,800
TOTAL 133,136					$1,446,613

[a]Source: Bureau of Economic and Business Research (Bird, 1975), (1) 1970, (2) 1974, (3) 1975.

Table 17. Fishing and hunting water user fee potentials in Utah.

1975-1976 Fees[a]			Total Sold	Price Elasticity[b]	Add On Fee	Total Revenue
$ 2.00	Resident Fishing	(12, under 16)	43,041	-0.24	8.33	179,266
$ 5.00	Resident Deer	(16 and over)	82,973	-0.24	20.83	864,164
$ 2.50	Resident Small Game	(12, under 16)	16,522	-0.24	10.42	86,080
$ 4.50	Resident Small Game	(16 and over)	18,836	-0.24	18.75	176,588
$ 5.00	Resident Fishing	(16 and over)	117,925	-0.24	20.83	1,228,189
$ 10.00	Resident Combination	(16 and over)	115,436	-0.24	41.67	2,405,109
$ 2.00	Resident Fishing	(63 and over)	10,796	-0.24	8.33	44,965
$ 6.00	Resident Trapping	(any age)	241	-0.24	25.00	3,013
$ 0.50	Resident Fishing	(Blind-Disabled)	123	-0.24	2.08	128
$ 20.00	Resident Guide	(21 and over)	88	-	-	1,760
$ 3.00	Commercial Hunt Area	(12 and over)	63	-0.24	12.50	394
	Total Resident Licenses Sold		406,044			4,989,656
$ 2.50	Nonresident Fishing - 2 days	(any age)	51,253	-0.24	10.42	267,028
$ 5.00	Nonresident Fishing - 5 days	(any age)	39,456	-0.24	20.83	410,934
$ 15.00	Nonresident Fishing - season	(any age)	5,720	-0.24	62.50	178,750
$ 20.00	Nonresident Small Game	(12 and over)	964	-0.24	83.33	40,165
$ 75.00	Nonresident Deer	(16 and over)	19,757	-0.24	312.50	3,087,031[a]
$150.00	Nonresident Guide	(21 and over)	2	-	-	300
$ 40.00	Nonresident Guide's Agents	(16 and over)	7	-	-	280
	Total Nonresident Licenses Sold		117,259			3,984,489
	TOTAL LICENSES SOLD		523,203			8,974,144

[a]Source: State of Utah Division of Wildlife Resources. July 1974-July 1976 Biennial Report.

[b]Estimated.

CHAPTER VI

PROBLEMS AND POSSIBILITIES OF INTRODUCING STATE WATER-USER FEES

LEGAL IMPLICATIONS

The state must own the water or, at least, have legal control to charge fees for water use. The question of ownership is fraught with uncertainties and complications which may be resolved only through the courts.

A brief treatise by Dewsnup and Jensen on the ownership question and other legal aspects of imposing state water-user fees in appropriation states is presented in Appendix E. General reference is made to this treatise in the discussion which follows; however, a number of extensions and additions have been made and these should not be attributed to the authors of the treatise. Legal problems concerning user fees in riparian rights systems are not within the purview of the appended paper and are not discussed here.

OWNERSHIP OF WATER

Ownership of navigable waters in the United States developed from the law in England. The ownership rights of the Crown and Parliament of England went to the 13 American colonies as a result of the American revolution. Although the colonies granted the federal government regulatory powers over interstate and foreign commerce, they did not surrender ownership of the waters. The concept of state ownership of navigable waters, though never having been precisely defined, was supported by the Supreme Court as related to the regulatory power and duty to protect public uses of the waters and associated beds and shorelands.

There were no public rights to non-navigable waters under the law in England. The waters were considered to be privately owned by riparian land owners. Under the riparian water rights system as developed in England and adopted in the Eastern states of the United States, each riparian owner is entitled to reasonable use of the water to the extent that the flow in the water course is not materially diminished in quantity or quality.

In appropriation states, all waters—both navigable and non-navigable—have been deemed to be owned by the "public," and not susceptible to private ownership while flowing in natural channels.

When the federal government acquired territory by purchase or cession, it acquired the proprietary and regulatory rights connected with the territory, including riparian water rights along water courses. However, in the late 1800s Congress enacted mining and homestead legislation with apparent provision for acquiring water rights under the appropriation doctrines of the various states involved. The Supreme Court later held that these statutes evidenced a congressional intent that water-use in appropriation states be established pursuant to state systems of water rights.

On the other hand, this was not a disclaimer by the federal government of all riparian water rights which it owned. It merely was a declaration that riparian water rights were not conveyed with land patented by the U.S. To obtain water rights, patentees must comply with state laws. Nevertheless, riparian water rights apparently have continued in existence in connection with lands that have remained in federal ownership. A number of court cases beginning with Winters vs United States, 207 U.S. 564 (1908) have in effect upheld the concept of "reserved" federal water rights for Indian and other federal reservations. Thus, one of the uncertainties associated with state ownership of water is how ownership rights of the U.S. are to be correlated with state rights.

WATER SALES AND USER FEES

Legal and quasi legal entities, including municipalities, special districts, and federal agencies, that have acquired appropriation water rights are allowed to sell water or charge fees to users under various arrangements. It appears that a state could likewise charge fees on waters it has appropriated. For example, in Utah the Board (Division) of Water Resources has acquired water rights through filings with the State Engineer. Although the Board of Water Resources has not charged user fees on these waters to date, the Board is not obligated by law to assign these applications or rights of water use under them, to water users free of charge. Apparently the Board of Water Resources could decide administratively to develop waters under its approved applications and impose a system of charges for the use of these waters.

Although unappropriated waters are technically not owned, some legal scholars have suggested that states could establish procedures in interregional transfers for selling unappropriated waters to purchasers in other states. States have the power to create property rights in the waters by establishing procedures for appropriation, and, as mentioned, the state itself can appropriate water. Such sales have been proposed by states within the "area of origin" in connection with interregional transfers. And, if a state is legally empowered to sell its water to another state, there is reason to believe because of the conceptual similarity that the state would also be empowered to impose water user fees within the state. It has also been suggested that it would be legal for states to sell unappropriated water to the highest bidder through procedures similar to those used in leasing state lands for extraction of oil, gas, and other minerals.

In Utah the State Engineer is obligated by statute to process and act on applications to appropriate water, and to charge only a prescribed filing fee. However, it is likely, subject to some constitutional questions yet unresolved, that the state legislature could enact legislation to change the appropriation process and require that all new (future) uses be subject to a water user fee schedule. Under the restricted definition of a user fee as a fee on actual use of something, there seems to be no question that an appropriation state such as Utah could not impose user fees on already perfected water rights. Although no state apparently has attempted to impose such fees, and therefore, the courts have not had an occasion to speak on the subject, it seems clear that such a system of fees would be an unconstitutional interference with property rights under both the Utah and the federal constitutions. "All appropriation states view perfected water rights as property that is entitled to constitutional protection." Pertinent Utah cases are *In re:Bear River Drainage Area,* 2 Utah 2d 208, 271 P.2d 846 (1954); *Salt Lake City v. Boundary Springs Water Users Ass'n,* 2 Utah 2d 141, 270 P.2d 453 (1954); *Logan, Hyde Park, and Smithfield Canal Co. v. Logan,* 72 Utah 221, 269 Pac. 776 (1928) (Dewsnup, 1975).

There are, of course, some nonconsumptive water uses, including recreation, navigation, waste transport, and hydropower generation that do not relate to the water rights issue just described. Furthermore, user fees as narrowly defined above, should be distinguished from regulatory fees, which a state or the federal government can impose under its general police powers to insure that property is used in accordance with particular regulations. Fees may be assessed in amounts sufficient to defray the costs of regulation. This type of fee is quite common. Water right application fees charged by the State Engineer, for example, are designed to cover costs of processing applications.

An expansion in the application of these fees and an increase in the level of the fees imposed by the State Engineer and other water regulatory agencies seems legally feasible. With higher fees and a broader range of application of regulatory (user) fees, imposed by regulatory agencies, a significant shift in funding support of these agencies from state appropriated funds to user fee revenues appears possible. If an analogy is drawn between this type of water user fee and hunting and fishing license fees, it could also be argued that the water user fees might be expanded to provide financial support for other functions of state government. Nonresident fishing and hunting licenses are higher than those paid by residents, and in some cases part of the license fee revenues from one activity, e.g., big game hunting, is used in managing another, such as fishing.

User fees (as defined above in relation to constitutional protections afforded property rights) should also be distinguished from property taxes, which obviously also are quite common. Property taxes have been imposed on land and other property to provide funds for a variety of purposes. It is conceivable that a perfected water right viewed as property might be similarly taxed. That is, the right to use the water might be taxed rather than the use per se. In Utah, however, for irrigation use this would be precluded by a constitutional restriction which stipulates that irrigation water rights cannot be taxed separately (Utah Const. Art. 13, Sec. 2).

Although other states may not have the same constitutional restriction that Utah has, there would still be a question of double taxation to consider in applying a separate property tax to water rights. Some property (farm land, for example) valuations upon which taxes are based reflect the value added by available water supplies. Thus, irrigated land ordinarily is taxed higher than dry farm land. In such an instance, the water use or water right is in effect taxed with the land.

CONSTITUTIONAL QUESTIONS

Basic constitutional questions that would arise from the imposition of state water user fees relate to the concepts of "a guaranteed right of appropriation" and the "public nature of water." Since water traditionally has been appropriated without the payment of user fees, would the imposition of such fees be so fundamentally in opposition to the concept of appropriation that it would be unconstitutional? In some states that have constitutional provisions protecting the right to appropriate, the answer to this question would be extremely significant and would have to come from the respective supreme courts of these states. Of course, to states without this constitutional provision it would pose no problem.

The concept of "public ownership" of water contained in the constitutions of appropriation states may be viewed in at least two different ways. Since private rights to water use under an appropriation system are merely usufructory, i.e., the right to use, not to own outright; the state may be viewed under existing arrangments as providing various individual users with free rights to the use of water that belongs to the public in general. In accordance with this view, the state as the legal guardian and administrator of these rights might logically impose rent or fees on the use of these public resources.

On the other hand, under a somewhat different view of the "public ownership" concept, the state may be viewed as not "owning" the water in the sense that it owns land, buildings, and so forth, but that it merely regulates the water resources for the benefit of the public. In this view, it would only be appropriate for the state to charge regulatory fees as discussed earlier.

Constitutional questions related to the imposition of state water user fees would, in the final analysis, have to be answered by state supreme courts in each of the states where the fees would be imposed.

ADMINISTRATIVE ASPECTS

An important advantage of user fees is their potential to subject government programs and operations to the discipline of a market test, thus replacing in part, if not entirely, a political evaluation process governing resource allocation and utilization. If government programs are subjected to the allocation function of the price system, which is commonplace for most goods and services, overinvestment in many activities can be averted or mitigated and resources can be saved for other uses.

Although there may be major advantages from the employment of fees, there are a number of forces which act to prevent their use or to reduce their effectiveness. The shifting of financing burdens from the general taxpayer to the user will not be easy to accomplish. Although some taxpayers may be convinced that they are subsidizing water users through general taxes, the water user in most cases will contend his water prices are already too high. Then, too, many people simply like to get free goods and services. Indeed the appeal of getting something for nothing is almost universal. Thus it is highly unlikely that any user accustomed to receiving free goods will welcome the imposition of user fees.

According to Stockfish (1967) there are also strong internal forces within government organizations that operate against the rational use of fees. Most administrators prefer to avoid the discipline of external checks or constraints. Bureaus and agencies ordinarily are advocates of their own activities, and with no profit criterion to measure system performance, crude physical output measures become the criteria of system effectiveness. More output is better than less. Charging prices for output curtails demand and hence the size and prestige of the agency. Thus, government agencies are not likely to be sympathetic towards fees unless these fees constitute a source of funds that may facilitate financing an even larger operation.

The imposition of user fees probably would be more acceptable to water users if the revenue produced therefrom were earmarked for water development or water management purposes only. In addition to financing project construction and cost sharing, these earmarked revenues might be employed to fund the operating costs of the state engineer's office and other water administrative agencies in the state. The trade off of course would be less general tax revenue funding required for these operations.

There would be a loss in fiscal control by the legislature in an "earmarking" arrangement. Agencies with access to such committed funds enjoy a great deal of independence from the normal budgeting and appropriation process. A possible middle ground between the alternative of completely circumventing the legislature by funneling user fee revenues directly to water agencies, and the other extreme of merely putting the revenues into the general funds of the state, would be to dedicate the revenues to a central water development fund. This fund, though restricted to appropriate water development and management purposes, could be administered by the legislature or a state board. An example of this type of an arrangement is the highway trust fund used by the federal government.

In establishing a user-fee system in a state, questions concerning measuring, recording, and reporting water uses would have to be carefully considered. If user fees were imposed upon water rights in some form, i.e., as a regulatory fee, property tax, or some other charge, the condition of water rights records would be of interest.

In Utah where progress has been made in defining and recording rights through the adjudication process, the records are far from complete.

In addition to records of adjudication, other records defining rights consist of diligence claims, court decrees, and rights applications. Thousands of rights based upon use prior to the establishment of the administrative water rights system in the state remain unrecorded in any form. It is estimated that perhaps 10 percent are unrecorded. Complete adjudication of rights in Utah is years away given the current level of funding for this activity. Some other appropriation states are not as far along as Utah.

Dewsnup et al. (1971), after analyzing several measures, suggested an "Illustrative State Statute to Require Recording and Quantification of Water Rights." This suggested legislation would require all unrecorded or unfiled water rights to be filed for and recorded by a certain date. Those rights not recorded within the specified time period would lose their priority dates. Procedures also were recommended for clarifying inaccurate and inadequately defined rights. Measures such as these to more accurately define claims to rights of water use were taken as a first step in establishing the user fee or concession tax system in Ecuador, described in Chapter I. In that case, however, a new filing had to be made for all rights whether already recorded or not. The next step was to impose a tax on the rights as claimed.

The problems of imposing fees on the rights to water use in eastern states that adhere to a riparian doctrine of water rights would be quite different than those for appropriation states. The first and most significant action required of these states probably would be the establishment of state ownership of the water and the institution of an administrative rights or permit system. The creation of a permit system in Florida in 1972 represents an eastern states trend toward increased regulation of both surface and groundwater resources. Thus, the prospects for imposing user fees on rights to use water, which, of course, depend upon records will be enhanced.

Since the beneficiaries of municipal water service are easy to identify and those persons not willing to pay for the service can be excluded, this use lends itself to the application of pricing policies. Side stepping the issue of deficiencies in current pricing policies of municipalities, e.g., average cost instead of marginal cost pricing, one might conclude that this would offer the least complications to the state in establishing user fees. The municipality and its existing water rate structure presents an immediately available collection system for a state imposed surcharge. Water rates are by no means uniform across the nation or within a state, and rates could be raised substantially in many cities and still be relatively low. In light of this, a state surcharge could be designed as a "rate leveler," i.e., to be assessed on a graduated scale which would charge low rate payers more than high rate payers. In spite of the possible advantages, the fact that municipal water departments are faced with inflated costs of operation and that city dwellers, wielding substantial voting power, may feel they are paying more than their share of state water development costs through a new state surcharge could make such a course of action difficult.

Instituting fees on navigation uses of water, subsidized by the federal government for almost two centuries, would require a drastic break with tradition. Recently, however, the policy of free use has been questioned, and a number of fee systems are possible including license fees, fuel taxes, and segment tolls. The prospects for the institution of state fees on this use do not appear to be good in light of the dominant federal powers granted by the Constitution. Legal questions pertaining to state rights with respect to navigation would have to be answered to determine if a system of state user fees is possible.

Since occupants of flood prone areas face quantifiable financial risks in connection with property values as affected by flood hazards, the introduction of a system of user charges for flood protection is possible. Compulsory flood insurance is an example of the use of pricing schemes in this area.

Effluent charges have been studied and recommended for controlling waste disposal in water courses. Because of long standing state authority and activity in water administration, states would seem to stand in a good position to impose state user charges not only for control, but for financing construction costs.

Although institutional problems and problems of gaining public acceptance loom large with respect to imposing a new system of state user charges on outdoor recreation, fish and wildlife, hydroelectric power and irrigation use, the legal hurdles do not appear insurmountable. States already collect fees and sell licenses for outdoor recreation and fish and wildlife uses. Mechanically, the imposition of a surcharge for water use per se on top of existing fees would seem to be relatively simple. State charges on power produced from hydro plants appear to be fairly straight forward, too.

Because of the multitudinous and diverse institutional arrangements and inadequate metering under which irrigation water is distributed a comprehensive system for collecting fees from irrigation uses would be difficult to design. However, organized irrigation companies and districts afford a readily available mechanism for imposing charges on a substantial number of rights holders and users. In the case of irrigated uses, in western states there would be a question to settle on the legality of imposing state fees on irrigation supplies provided by federal reclamation projects. Since reclamation law recognizes state systems of water rights the problem may be minimal.

CONCLUSIONS

Because rather drastic changes from traditional ways of paying or not paying for water uses are entailed in instituting a system of state fees on water uses, the short run prospects of implementing a broad system of fees are poor. Implementing legislation would require the support of the public, all of whom are users of water in one way or another.

Recognition that water development benefits bestowed upon a few are being paid by the public in general has not been of sufficient concern to policy makers to date to provide impetus for change. Social goals and political pressures for abundant low cost water are partly responsible. With mounting pressures for additional water and fewer tax funds to pay for it, the long run prospects of implementing water use fees are better.

It seems reasonable for states to move toward a greater role in financing water development, and user charges in one form or another constitute one approach to additional funds for states. The imposition of user fees, if fully understood by the public, may be just as acceptable a source of additional funds as increases in other forms of taxes that would be required if such fees are not used. That is, if it comes to a choice between higher income taxes or higher property taxes on the one hand and the introduction of state user fees on the other in order to fund desired water development, the latter may have a chance.

Fees likely will be more palatable to various user groups if fee levels and the amount of funds to be obtained from a particular use are set to meet specific demands for that use and the funds when obtained are allocated to meet those demands. In order for the states budgetary and appropriation process not to be completely aborted in an earmarking process, arrangements for some degree of legislative control and surveillance of the funds would be appropriate.

Given that many difficult questions must be resolved before introducing state water-user fees, it is apparent from the estimates of fund generating potential in Chapter V that water user fees could produce significant amounts of revenue for states with only modest increases in current prices of water. The increases in many cases would still leave the prices at bargain levels.

In Utah, a particularly promising prospect for instituting a water-user fee program seems to exist in connection with the water needed for developing coal, oil, and other energy resources. Legally, socially, and economically, this is probably the most feasible user fee possibility available.

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APPENDICES

APPENDIX A

WATER-USER CHARGE SCHEDULES

Ecuador

Concession Taxes

a) .0028 cents [.007 sucres] per cubic meter according to the volume specified in the concession for irrigation uses without a measuring device; b) .0045 cents [.0012 sucres] per cubic meter used for irrigation uses with a measuring device; c) .0045 cents [.0012 sucres] per cubic meter used for subterranean irrigation by pumping; d) $1.40 [35 sucres] annually per each horsepower of generating capacity per production of motor force; e) for industries uses according to the following table based on the total amount volume used.

The volume is measured by meters installed at the expense of the user; f) .0028 cents [.0007 sucres] per cubic meter for electrical generation; g) .008 cents [.02 sucres] per .26 gallons [liter] for mineral water which is industrially processed and sold in bottles; h) $40.00 [1,000 sucres] for recreation purposes (Daines and Falconi, 1974 pg. 139)

British Columbia

Clearing-streams Purpose

Annual rental payable in respect of each license $25.00

Conservation Purpose

(a) Where the water is to be or is stored: Application fee and annual rental shall be those fixed for storage purpose.

(b) Where water is to be or is used:
Application fee, payable on the quantity applied for:
10 cubic feet per second or less $10.00
And for each additional cubic foot per second or fraction thereof $1.00
Annual rental payable on the quantity allowed:
10 cubic feet per second or less $10.00
And for each additional cubic foot per second or fraction thereof $1.00

(c) For the construction of works in and about streams for the purpose of conserving fish and wildlife:
Application fee $5.00
Annual rental $5.00

Conveying Purpose

Annual rental $10.00

Domestic Purpose

Application fee, payable on the quantity applied for:
1,000 gallons per day or less $5.00
And for each additional 1,000 gallons per day or fraction thereof $2.00
Annual rental payable on the quantity allowed:
1,000 gallons per day or less $5.00
And for each additional 1,000 gallons per day or fraction thereof $2.00

Fluming Purpose

Annual rental payable on the quantity allowed:
For each cubic foot per second or fraction thereof $1.00
Minimum annual rental $10.00

Ecuador

BASE CUBIC METERS	EXCESS CUBIC METERS	TAX BASE SUCRES (25 to Dollar)	EXCESO C/10000m3
-----	10,000	-----	15 Sucres
10.000	100,000	150 Sucres	12 Sucres
100.000	1,000,000	1,230 Sucres	10 Sucres
1.000.000	10,000,000	10,230 Sucres	8 Sucres
10.000.000	100,000,000	82,230 Sucres	6 Sucres
100.000.000	-----	622,230 Sucres	5 Sucres

Hydraulicking Purpose

Annual rental, payable on quantity allowed: For each cubic foot per second or fraction thereof $10.00

Industrial Purpose (Miscellaneous Uses)

Where water is or is to be used for:

(a) Pulp-mill use:
Application fee, payable on the quantity of water applied for: For each cubic foot per second or fraction thereof $100.00
Annual rental, payable on quantity allowed: For each cubic foot per second or fraction thereof $100.00

(b) Use in sawmills, food-processing plants, other manufacturing operations, and washing sand and gravel:
Application fee, payable on quantity applied for:
For each 10,000 gallons a day or fraction thereof up to 500,000 gallons $4.00
For each additional 10,000 gallons a day or fraction thereof up to 1,000,000 gallons $2.00
For each 10,000 gallons a day or fraction thereof over 1,000,000 gallons $1.00
Minimum application fee $10.00
Annual rental, payable on quantity allowed:
For each 10,000 gallons a day or fraction thereof up to 500,000 gallons $4.00
For each additional 10,000 gallons a day or fraction thereof up to 1,000,000 gallons $2.00
For each 10,000 gallons a day or fraction thereof over 1,000,000 gallons $1.00
Minimum annual rental $10.00

(c) Cooling:
Application fee, payable on quantity applied for:
For each 10,000 gallons a day or fraction thereof up to 500,000 gallons $2.00
For each additional 10,000 gallons a day or fraction thereof up to 1,000,000 gallons $1.00
For each 10,000 gallons a day or fraction thereof over 1,000,000 gallons . . . . $.50
Minimum application fee $10.00
Annual rental, payable on quantity allowed:
For each 10,000 gallons a day or fraction thereof up to 1,000,000 gallons $1.00
For each 10,000 gallons a day or fraction thereof over 1,000,000 gallons . . . . $.50
Minimum annual rental $10.00

(d) Use in hotels, motels, restaurants, stores, service stations and similar enterprises:
Application fee, payable on quantity applied for:
For each 1,000 gallons a day or fraction thereof 5.00
Minimum application fee $10.00
Annual rental, payable on quantity allowed:
For each 1,000 gallons a day or fraction thereof $5.00
Minimum annual rental $10.00

(e) Maintaining ponds for floating logs, fish-culture, and fur-farming:
Application fee $10.00
Annual rental $10.00

(f) Watering ground on golf courses, lawns, and ornamental gardens where such use is not authorized under domestic or irrigation purposes:
Application fee, payable on quantity applied for:
For each acre foot $1.00
Minimum application fee 10.00
Annual rental, payable on quantity allowed:
For each acre foot 1.00
Minimum annual rental $10.00

(g) For all other proposed uses under Industrial Purpose the application fee and the annual rental shall be those fixed by the Comptroller.

Irrigation Purpose

(a) Where the water is to be or is conveyed by a municipality, improvement district, development district, or company for others:
Application fee, payable on quantity applied for per acre-foot or fraction thereof 10
Minimum application fee 10.00
Annual rental, payable on quantity diverted, per acre-foot or fraction thereof 10
Minimum annual rental 5.00

(b) Where the water is to be or is conveyed by other than as set out under (a):
Application fee, payable on quantity applied for per acre-foot or fraction thereof 10
Minimum application fee 10.00
Annual rental payable on quantity allowed per acre-foot or fraction thereof 10
Minimum annual rental 5.00

Land-improvement Purpose

Application fee 10.00
Annual rental 10.00

Lowering-water Purpose

Annual rental payable in respect of each license . . 10.00

Mineral-trading Purpose

(a) Where the mineral water is to be or is sold in bottles or other containers:
Application fee, payable on quantity applied for: 500 gallons per day or less 20.00
And for each additional 100 gallons per day or fraction thereof 1.00
Annual rental, payable on quantity allowed:
500 gallons per day or less 20.00
And for each additional 100 gallons per day or fraction thereof 1.00

(b) Where the mineral water is to be or is used for baths:
Application fee, payable on quantity applied for: For each 1,000 gallons per day or fraction thereof 5.00
Annual rental, payable on quantity allowed:
For each 1,000 gallons per day or fraction thereof 5.00
Minimum annual rental 20.00

Mining Purpose

Where water is or is to be used for:

(a) Hydraulic mining:
Application fee, payable on quantity of water applied for: For each cubic foot per second or fraction thereof 10.00
Annual rental, payable on quantity allowed: For each cubic foot per second or fraction thereof 10.00

(b) Washing coal:
Application fee, payable on quantity applied for: For each cubic foot per second or fraction thereof 100.00
Annual rental, payable on quantity allowed: For each cubic foot per second or fraction thereof 100.00

(c) Processing of ore:
Application fee, payable on quantity applied for: For each 100,000 gallons a day or fraction thereof 100.00
Annual rental, payable on quantity allowed: For each 100,000 gallons a day or fraction thereof 100.00

(d) Where water is to be or is used for generating power:
Application fee and annual rental shall be those fixed for power purpose.

(e) Where the water is to be or is used for cooling engines and compressors in mining operations: Application fee and annual rental shall be those fixed for industrial purpose.

Power Purpose

Application fee payable:
For each kilowatt up to 50,000 kilowatts . . . . . 20 cents
For each additional kilowatt up to 100,000 kilowatts . . . . 10 cents
For each additional kilowatt over 100,000 kilowatts . . . . 5 cents

Minimum application fee payable $10.00

Annual rentals payable on construction capacity:
For each kilowatt . . . . 5 cents

Annual rentals payable on authorized capacity other than construction capacity:

For each kilowatt . . . . 50 cents

Annual rentals payable on output:

For each megawatt-hour . . . . 25 cents

Minimum annual rental payable in respect of each license $10.00

River-improvement Purpose

Application fee $50.00
Annual rental payable on the length of the stream authorized to be cleared and approved: 20.00
For each mile 20.00
Minimum annual rental 50.00

Storage Purpose

Application fee, payable on reservoir capacity applied for:
For 5,000 acre-feet or less 5.00
And for each additional 1,000 acre-feet or fraction thereof up to and including 25,000 acre-feet 50
And for each additional 1,000 acre-feet or fraction thereof up to and including 50,000 acre-feet 20
And for each additional 1,000 acre-feet or fraction thereof over 50,000 acre-feet 10

Annual rental, payable on quantity allowed:
For 5,000 acre-feet or less, per 1,000 acre-feet or fraction thereof 1.00
And for each additional 1,000 acre-feet or fraction thereof up to and including 25,000 acre-feet 60
And for each additional 1,000 acre-feet or fraction thereof up to and including 50,000 acre-feet 50
And for each additional 1,000 acre-feet or fraction thereof over 50,000 acre-feet 40

Minimum annual rental payable in respect of each license 2.00

In addition to the fees, rentals, and charges payable by the holder of a license for storage purpose, where the operation, or intended operation, is made on the basis of an arrangement the purpose of which is the production of benefits at some point outside the Province, there shall be payable on or before the first day of December of each year in which the arrangement is in effect, a fee of forty cents per acre-foot of water-storage space made available. The foregoing provision does not apply to the quantities of storage set forth in Article 11 of the Columbia River Treaty for each of the storage reservoirs described therein.

Waterworks Purpose

Application fee, payable on quantity applied for:
5,000 gallons a day or less 10.00
Each additional 5,000 gallons a day or fraction thereof 1.00

First rental: One-tenth of application fee minimum 10.00

Subsequent annual rentals, payable on quantity diverted:
For each 100,000 gallons diverted 05
Minimum rental 10.00

Provided that where accurate measurements of the quantity diverted are not available, the said quantity may be estimated for rental purpose at 40,000 gallons of water per annum per inhabitant of the area within which water may be distributed.

Permits Over Crown Land

Application fee, per acre or fraction thereof to the area to be occupied 05
Minimum fee 2.00
Annual rental in respect of land used or to be used as the site of any power plant or dam; Per acre or

fraction thereof authorized to be occupied . . 10.00
Annual rental in respect of land on which any ditch, flume, pipe, transmission-line, or other conduit is or is to be constructed: Per acre or fraction thereof authorized to be occupied 1.00
Annual rental in respect of land to be flooded except for the storage of water for power purpose: Per acre or fraction thereof authorized to be flooded 25
Annual rental in respect of land to be flooded for the storage of water for power purpose: Per acre or fraction thereof authorized to be flooded. 1.00
Annual rental in respect of land occupied or to be occupied for any purpose not heretofore mentioned: Per acre or fraction thereof 1.00
Minimum annual rental in respect of any permit . . 2.00
(Province of British Columbia, 1974 pgs. 8-12)

California

Adopted tax and water rates are shown in Table A-1 for the Metropolitan Water District of Southern California.

Hawaii

Waimonalo Irrigation System

Acreage Assessment	$2.50 per acre per month
Water Use Charge	$0.08 per 1,000 gallons

Lalamilo Irrigation System

Acreage Assessment	$2.25 per acre per month
Water Use Charge (Monthly basis)	

Molokai Irrigation System

Hoolcuna

Acreage Assessment	$1.10 per acre per month
Water Use Charge	$0.08 per 1,000 gallons

Molokai Ranch Land East of Kualapuu—No Distribution System

Acreage Assessment	0.85 per acre per month
Water Use Charge	$0.08 per 1,000 gallons

Wisconsin

Persons required to file effluent reports and exemptions. Each person, except a municipality, discharging industrial wastes or toxic and hazardous substances will be required to file an effluent report with the Department if they fall into one or more of the following four reporting categories and are not exempted in any of the following exemption categories.

1. Reporting categories.

(a) Reporting Category I: Persons discharging treated or untreated effluent directly to surface waters of the state.

(b) Reporting Category II: Persons discharging at least 10,000 gallons of effluent per day, one or more days during the year, to a land disposal system or to a municipal sewerage system.

(c) Report Category III: Persons discharging less than 10,000 gallons of effluent per day to a land disposal system or municipal sewerage system, when the Department finds surveillance by the state is required to protect the environment.

(d) Report Category IV: Persons contributing more than 1 million British thermal units (Btu) per day, one or more days during the year, to the effluent discharged to surface waters.

2. Exemption Categories.

(a) Exemption Category I: Persons discharging effluents to which they have contributed none of the industrial wastes or toxic and hazardous substances listed in Table 1, or have contributed none in concentrations or quantities in excess of those listed in Table 1, are exempted from filing reports and paying monitoring fees on such discharges.

(b) Exemption Category II: Persons may subtract concentrations and quantities of industrial wastes or toxic and hazardous substances contained in the influent from those contained in the corresponding effluent prior to determining reporting levels and fees under these rules.

(c) Exemption Category III: All cooling water discharges except those specified in Reporting Category IV are exempted unless substances are contributed to the effluent in concentrations or quantities in excess of those listed in Table I.

(d) Exemption Category IV: Sanitary waste effluents resulting only from sanitary facilities including washrooms, toilets, and kitchens need not be reported. This exemption does not include effluents from laundromats, laundries or other commercial washing facilities.

(c) Exemption Category V: Agricultural land runoff from land used exclusively for crop production need not be reported (Wisconsin Administrative Book, NY 101.03).

Table A-1. Metropolitan Water District of Southern California.

Fiscal Year	Regular Tax Rate		Domestic, Municipal and Industrial Uses			Agricultural Uses			Groundwater Replenishment Uses		
			Untreated	Filtered	Filtered and Softened	Untreated	Filtered	Filtered and Softened	Untreated	Filtered	Filtered and Softened
1964-65	$0.14		$25.00	$30.00	$34.00	$15.25	$20.25	$24.25	$15.25	$20.25	$24.25
1965-66	0.14		28.00	33.00	37.00	16.00	21.00	25.00	16.00	21.00	25.00
1966-67	0.14		31.00	36.00	40.00	17.00	22.00	26.00	17.00	22.00	26.00
1967-68	0.14		34.00	39.00	43.00	18.00	23.00	27.00	18.00	23.00	27.00
1968-69	0.16		37.00	42.00	46.00	19.00	24.00	28.00	19.00	24.00	28.00
1969-70	0.17		40.00	45.00	49.00	20.00	25.00	29.00	20.00	25.00	29.00
1970-71	0.17		44.00	49.00	53.00	21.00	26.00	30.00	22.00	27.00	31.00
1971-72	0.17	C	48.00	53.00	57.00	22.00	27.00	31.00	24.00	29.00	33.00
		S	53.00	58.00	*	27.00	32.00	*	29.00	34.00	*
1972-73	0.15	C	52.00	57.00	61.00	23.50	28.50	32.50	27.00	32.00	36.00
		S	57.00	62.00	*	28.50	33.50	*	32.00	37.00	*
1973-74	0.14	C	56.00	63.00	68.00	25.00	32.00	37.00	30.00	37.00	42.00
		S	66.00	73.00	*	35.00	42.00	*	40.00	47.00	*
1974-75	0.14	C	56.00	63.00	68.00	25.00	32.00	37.00	30.00	37.00	42.00
(to Oct. 1)		S	66.00	73.00	*	35.00	42.00	*	40.00	47.00	*
1974-75 (after Oct. 1)	0.14		56.00	63.00	-	25.00	32.00	-	30.00	37.00	-
1975-76	0.13	C	58.00	67.00	-	25.00	34.00	-	32.00	41.00	-
		S	68.00	77.00	*	35.00	44.00	*	42.00	51.00	*
1976-77	-	C	62.00	75.00	-	29.00	42.00	-	36.00	49.00	-
		S	68.00	81.00	*	35.00	48.00	*	42.00	55.00	*

S = State project water
C = Colorado River water
* = Softening of State project water not required.
- = Surcharge Rate for softening discontinued after 10/1/74

OHIO WATER RATES FOR CANAL WATER USERS

Representative Table:

Millions of Gallons	Cost[a]
Less than 1 Million	$200.00 (Minimum Charge)
1 Million	225.00
10 Million	1,127.67
75 Million	4,620.89
100 Million	5,651.74
1,000 Million	28,325.82
5,000 Million	87,389.95
10,000 Million	141,965.40

Allowances may be made to those users who return the used water to the canal system of up to and including 50% of the total cost for a 10% return of water.

[a] $C = 225\ M^{0.7}$ wherein: C = Yearly Dollar Cost
M = Million Gallons of Water used

Table A-2. Register of Industrial Wastes or Toxic and Hazardous Substances, Wisconsin.

Industrial Waste or Toxic and Hazardous Substance Discharged	Substance Code Number	Reporting Levels: Concentration Added (mg/L–ppm)	Reporting Levels: Quantity Added (lbs/Day)	For the Combined Discharge of all Effluents to a Municipal Sewerage System: Facility Will Report[1]	For the Combined Discharge of all Effluents to a Municipal Sewerage System: Facility Will Pay Base Fee[2] (Dollars)	For the Combined Discharge of all Effluents to a Land Disposal Site or System with No Direct Flow to Surface Waters: Facility Will Report[1]	For the Combined Discharge of all Effluents to a Land Disposal Site or System with No Direct Flow to Surface Waters: Facility Will Pay Base Fee[2] (Dollars)	For the Combined Discharge of all Effluents to Surface Waters Including Effluents to Surface Waters from Land Disposal Systems or Other Treatment Facilities: Facility Will Report[1]	For the Combined Discharge of all Effluents to Surface Waters Including Effluents to Surface Waters from Land Disposal Systems or Other Treatment Facilities: Facility Will Pay Base Fee[2] (Dollars)	For the Combined Discharge of all Effluents to Surface Waters Including Effluents to Surface Waters from Land Disposal Systems or Other Treatment Facilities: Facility Will Pay Additional Fees[3] (Dollars)
Aldrin	39330	.0005	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Ammonia	00610	.2	----	No	----	No	----	Yes	10.00	----------------
Arsenic	01002	.05	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Barium	01007	1.0	1.0	No	----	No	----	Yes	10.00	----------------
Beryllium	01012	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Boron	01022	1.0	1.0	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Cadmium	01027	.05	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Chloride	00940	50	50	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Chlorine	50060	1.0	1.0	No	----	No	----	Yes	10.00	----------------
Chromium	01034	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Cobalt	01037	2	2	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Copper	01042	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Cyanide	00720	.025	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Dieldrin	34380	.0005	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Fecal Coliform Bacteria	31616	200/100 ml	----	No	----	No	----	Yes	10.00	----------------
Fluoride	00951	2	2	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Heptachlor	39410	.0005	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Lead	01051	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Manganese	01055	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Mercury	71900	.0025	.01	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Nickel	01067	.2	.2	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Nitrate Nitrogen	00620	.2	----	No	----	No	----	Yes	10.00	----------------
Nitrite Nitrogen	00615	.2	----	No	----	No	----	Yes	10.00	----------------
Nitrogen (Kjeldahl)	00625	.2	----	No	----	No	----	Yes	10.00	----------------
Oils, Fats, Grease and Other Substances Measured by Oils, Fats and Grease Detection Methods	00550	5.0	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Oxygen Consuming Wastes Measured by the 5-Day BOD Test or Equivalent Tests	00310	5.0	10	Yes	5.00	No	----	Yes	10.00	.04/lb. for an avg. days Discharge
Phenols and Other substances Measured by Phenol Detection Methods	32730	.05	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Phosphorus	00665	.1	----	Yes	5.00	No	----	Yes	10.00	----------------
Polychlorinated Biphenyls	55555	.0005	----	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Radioactive Substances		See Footnote 4	----	---	----	---	----	---	-----	----------------
Selenium	01147	.05	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Sulfate	00945	10	10	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Sulfide	00745	1	1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Sulfite	00740	2	2	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Suspended Solids	00530	10	10	Yes	5.00	No	----	Yes	10.00	.02/lb. for an avg. days Discharge
Thallium	01059	.05	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------
Thermal Discharges	00015	Report temp. & vol. of thermal discharges to surface waters if not exempted in NR 101.03 (1) (d)		No	----	No	----	Yes	10.00	.04/million Btu for an average days Discharge
Zinc	01092	.1	.1	Yes	5.00	Yes	5.00	Yes	10.00	----------------

[1]The facility will report if the concentration and/or quantity reporting level established for each substance in Table I is exceeded one or more days per year.
[2]The base fee shall be charged if the concentration and/or quantity reporting level is exceeded one or more days per year.
[3]An average days discharge shall be calculated by dividing the estimate of the total discharge for the calendar year by the number of days of discharge during the calendar year.
[4]Provide duplicate reports of radioactive materials discharged to the effluent if your facility is required to make such reports to the U.S. Atomic Energy Commission.

APPENDIX B

COMPARATIVE WATER RATES FOR UTAH

(Refer to Table 2, page 28, for coding of numbers and letters following the names of cities.)

Table B-1. Comparative culinary water charges—cities over 53,000 population.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
OGDEN 1/2+5/8"	3.10	28.8	3.18	5.16	9.13	17.71	33.42	60.76	109.35	715.53
OGDEN 3/4"CON	4.05	42.8	4.05	5.19	9.15	17.74	33.44	60.79	109.38	715.56
OGDEN 1" CON	5.95	71.2	5.95	5.95	9.18	17.76	33.47	60.81	109.40	715.58
OGDEN 1.5" CON	11.20	142.3	11.20	11.20	11.20	18.31	34.02	61.36	109.95	716.13
OGDEN 2" CON	17.50	227.5	17.50	17.50	17.50	18.99	34.69	62.04	110.63	716.81
OGDEN 3" CON	31.85	431.5	31.85	31.85	31.85	31.85	35.92	63.26	111.85	718.03
OGDEN 4" CON	51.85	746.9	51.85	51.85	51.85	51.85	51.85	64.52	113.11	719.29
OGDEN 6" CON	101.25	1691.3	101.25	101.25	101.25	101.25	101.25	101.25	115.50	721.68
OGDEN 8" CON	197.50	4051.1	197.50	197.50	197.50	197.50	197.50	197.50	197.50	724.16
OGDEN 1/2+5/8"OT	6.20	28.8	6.36	10.33	18.25	35.42	66.84	121.46	218.40	1430.76
OGDEN 3/4"CON OT	8.10	42.8	8.10	10.38	18.30	35.47	66.89	121.51	218.45	1430.81
OGDEN 1" CON OT	11.90	71.2	11.90	11.90	18.35	35.52	66.94	121.56	218.50	1430.86
OGDEN 1.5"CON OT	22.40	142.3	22.40	22.40	22.40	36.62	68.04	122.66	219.60	1431.96
OGDEN 2" CON OT	35.00	227.5	35.00	35.00	35.00	37.97	69.39	124.01	220.95	1433.31
OGDEN 3" CON OT	63.70	431.5	63.70	63.70	63.70	63.70	71.84	126.46	223.40	1435.76
OGDEN 4" CON OT	103.70	746.9	103.70	103.70	103.70	103.70	103.70	128.98	225.92	1438.28
OGDEN 6" CON OT	202.50	1691.3	202.50	202.50	202.50	202.50	202.50	202.50	230.95	1443.31
OGDEN 8" CON OT	395.00	4051.1	395.00	395.00	395.00	395.00	395.00	395.00	395.00	1448.31
PROVO 3/4" CON	3.50	28.3	3.60	5.29	8.68	16.03	30.15	58.41	114.92	1132.05
PROVO 1" CON	4.50	28.3	4.60	6.29	9.68	17.03	31.15	59.41	115.92	1133.05
PROVO 1-1/2" CON	10.00	28.3	10.10	11.79	15.18	22.53	36.65	64.91	121.42	1138.55
PROVO 2" CON	15.00	28.3	15.10	16.79	20.18	27.53	41.65	69.91	126.42	1143.55
PROVO 3" CON	30.00	28.3	30.10	31.79	35.18	42.53	56.65	84.91	141.42	1158.55
PROVO 4" CON	50.00	28.3	50.10	51.79	55.18	62.53	76.65	104.91	161.42	1178.55
PROVO 6" CON	100.00	28.3	100.10	101.79	105.18	112.53	126.65	154.91	211.42	1228.55
PROVO 8" CON	150.00	28.3	150.10	151.79	155.18	162.53	176.65	204.91	261.42	1278.55
PROVO 10" CON	200.00	28.3	200.10	201.79	205.18	212.53	226.65	254.91	311.42	1328.55
PROVO 12" CON	250.00	28.3	250.10	251.79	255.18	262.53	276.65	304.91	361.42	1378.55
PROVO 3/4 CON OT	10.50	28.3	10.79	15.87	26.04	48.08	90.46	175.22	344.75	3396.15
PROVO 1" CON OT	13.50	28.3	13.79	18.87	29.04	51.08	93.46	178.22	347.75	3399.15
PROVO 1-1/2 C OT	30.00	28.3	30.29	35.37	45.54	67.58	109.96	194.72	364.25	3415.65
PROVO 2" CON OT	45.00	28.3	45.29	50.37	60.54	82.58	124.96	209.72	379.25	3430.65
PROVO 3" CON OT	90.00	28.3	90.29	95.37	105.54	127.58	169.96	254.72	424.25	3475.65
PROVO 4" CON OT	150.00	28.3	150.29	155.37	165.54	187.58	229.96	314.72	484.25	3535.65
PROVO 6" CON OT	300.00	28.3	300.29	305.37	315.54	337.58	379.96	464.72	634.25	3685.65
PROVO 8" CON OT	450.00	28.3	450.29	455.37	465.54	487.58	529.96	614.72	784.25	3835.65
PROVO 10" CON OT	600.00	28.3	600.29	605.37	615.54	637.58	679.96	764.72	934.25	3985.65
PROVO 12" CON OT	750.00	28.3	750.29	755.37	765.54	787.58	829.96	914.72	1084.25	4135.65

Table B-1. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
SLC 3/4,1" CON	1.75	31.1	1.75	3.38	6.77	14.12	28.24	56.50	113.01	1130.14
SLC 1.5" CON	3.50	62.3	3.50	3.50	6.76	14.11	28.23	56.49	113.00	1130.13
SLC 2" CON	5.60	99.1	5.60	5.60	6.78	14.13	28.25	56.51	113.02	1130.15
SLC 3" CON	11.20	198.2	11.20	11.20	11.20	14.13	28.25	56.51	113.02	1130.15
SLC 4" CON	17.50	308.6	17.50	17.50	17.50	17.50	28.31	56.57	113.08	1130.21
SLC 6" CON	35.00	620.1	35.00	35.00	35.00	35.00	35.00	56.47	112.98	1130.11
SLC 8" CON	56.00	991.0	56.00	56.00	56.00	56.00	56.00	56.51	113.02	1130.15
SLC 10" CON	80.50	1424.2	80.50	80.50	80.50	80.50	80.50	80.50	113.04	1130.17
SLC 3/4,1" CO OT	2.50	28.3	2.64	5.19	10.27	21.29	42.48	84.86	169.62	1695.33
SLC 1.5" CON OT	5.00	59.5	5.00	5.05	10.13	21.15	42.34	84.72	169.48	1695.19
SLC 2" CON OT	8.00	93.4	8.00	8.00	10.25	21.27	42.46	84.84	169.60	1695.31
SLC 3" CON OT	16.00	189.7	16.00	16.00	16.00	21.11	42.30	84.68	169.44	1695.15
SLC 4" CON OT	25.00	294.5	25.00	25.00	25.00	25.00	42.42	84.80	169.56	1695.27
SLC 6" CON OT	5C.00	588.9	50.00	50.00	50.00	50.00	50.00	84.84	169.60	1695.31
SLC 8" CON OT	80.00	942.9	80.00	80.00	80.00	80.00	80.00	84.84	169.60	1695.31
SLC 10" CON OT	115.00	1356.3	115.00	115.00	115.00	115.00	115.00	115.00	169.56	1695.27

Table B-2. Comparative culinary water charges—with population between 22,000 and 53,000.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
BOUNTIFUL 15	3.00	37.9	3.00	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
MURRAY (5) 2357	3.00	31.1	3.00	4.43	7.39	13.82	26.18	50.90	96.22	737.80
MURRAY HOSP	25.00	31.1	25.00	26.43	29.39	35.82	48.18	72.90	118.22	759.80
MURRAY 2357 OT	4.00	31.1	4.00	6.04	10.28	19.46	37.12	72.43	132.75	965.05
OREM 27	4.65	45.4	4.65	5.23	7.37	10.80	17.41	30.62	57.03	532.55
OREM (6) 35	8.70	79.5	8.70	8.70	10.63	16.81	28.70	52.47	100.02	955.94
OREM 27 OT	9.30	45.4	9.30	10.46	14.74	21.61	34.82	61.23	114.07	1065.09
OREM 35 OT	17.40	79.5	17.40	17.40	21.25	33.62	57.39	104.94	200.04	1911.88

Table B-3. Comparative culinary water charges—with population between 12,000 and 22,000.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
CLEARFIELD 2357	3.00	37.9	3.00	4.17	7.31	13.49	25.38	49.15	96.70	952.62
LAYTON 2	3.00	26.5	3.19	4.77	7.91	14.09	24.41	44.23	83.85	797.12
LAYTON 2 OT	6.00	26.5	6.37	9.54	15.81	28.18	48.83	88.45	167.70	1594.24
LAYTO (2) 3	5.30	41.6	5.30	6.27	9.44	15.69	26.16	45.98	85.60	798.87
LAYTON 5	3.00	26.5	3.19	4.77	7.94	14.81	28.02	54.43	107.27	1058.29
LAYTON 7	3.00	26.5	3.19	4.77	7.93	14.11	24.46	44.28	83.90	797.17
LOGAN 3/4,1"CON	2.50	37.9	2.50	3.67	6.84	13.71	26.92	53.33	106.17	1057.19
LOGAN 1.5" CON	5.00	83.3	5.00	5.00	6.94	13.81	27.02	53.43	106.27	1057.29
LOGAN 2" CON	9.00	159.0	9.00	9.00	9.00	13.81	27.02	53.43	106.27	1057.29
LOGAN 3" CON	17.00	310.4	17.00	17.00	17.00	17.00	27.02	53.43	106.27	1057.29
LOGAN 4" CON	30.00	575.4	30.00	30.00	30.00	30.00	30.00	52.43	105.27	1056.29
LOGAN 6" CON	61.50	1332.5	61.50	61.50	61.50	61.50	61.50	61.50	96.77	1047.79
LOGAN 8" CON	129.50	3338.7	129.50	129.50	129.50	129.50	129.50	129.50	129.50	1009.79
ROY 17	2.50	37.9	2.50	3.61	6.62	13.15	25.70	50.79	100.99	1004.46
ROY 17 OT	6.25	37.9	6.25	8.30	13.85	25.87	48.98	95.21	187.67	1851.96
SANDY 17	8.00	75.7	8.00	8.00	10.93	19.51	36.02	69.04	135.09	1323.86
TOOELE (9) 2357	2.75	42.5	2.75	3.83	7.54	15.58	31.03	61.93	123.74	1236.23

Table B-4. Comparative culinary water charges—cities with population between 5,000 and 12,000.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
KAYSVILLE 17	2.50	37.9	2.50	3.67	6.81	12.99	23.31	43.13	82.75	796.02
LEHI 17	3.00	28.4	3.09	4.67	7.84	14.71	27.28	47.48	84.47	750.18
PAYSON 8	3.00	37.9	3.00	3.99	6.69	12.53	23.11	41.07	74.09	668.48
PAYSON 8 OT	6.00	37.9	6.00	7.99	13.38	25.05	46.23	82.14	148.19	1336.96
RIVERDALE 17	3.25	37.9	3.25	4.30	7.16	13.34	25.23	49.00	96.55	952.47
ST.GEORGE 1	3.00	11.4	3.99	5.57	8.74	15.61	28.82	53.31	98.22	906.59
ST.GEORGE 57	3.00	11.4	4.23	6.21	10.18	18.76	35.27	66.37	123.64	1027.11
SOUTH OGDEN 17	2.25	37.9	2.25	3.42	6.59	13.46	26.67	53.08	105.92	1056.94
S SALT LAKE 27	2.50	45.4	2.50	3.35	6.83	14.39	28.92	57.98	116.10	1162.22
S SALT (8) 3	4.00	75.7	4.00	4.00	6.57	14.13	28.66	57.72	115.84	1161.96
SPANISH FORK 8	3.50	56.8	3.50	3.63	6.01	10.35	16.96	30.17	56.58	532.10
SUNSET 3/4" CON	3.65	37.9	3.65	5.00	8.37	14.38	25.60	48.06	92.97	901.34
SUNSET 1" CON	4.50	37.9	4.50	5.85	9.22	15.23	26.45	48.91	93.82	902.19
SUNSET 4" CON	9.15	37.9	9.15	10.50	13.67	19.88	31.10	53.56	98.47	906.84
SUNSET 6" CON	13.60	37.9	13.60	14.95	18.32	24.33	35.55	58.01	102.92	911.29
WASHING TER 2	3.75	37.9	3.75	4.92	8.09	14.96	28.17	54.58	107.42	1058.44
WASHING(10) 2	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING TER 3	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 3/4" CON	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING 1" CON	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 1.5" CON	9.50	143.8	9.50	9.50	9.50	15.11	28.32	54.73	107.57	1058.59
WASHING 2" CON	14.00	227.1	14.00	14.00	14.00	15.21	28.42	54.83	107.67	1058.69
WASHING 3" CON	24.50	431.5	24.50	24.50	24.50	24.50	28.12	54.53	107.37	1058.39
WASHING 4" CON	39.50	745.7	39.50	39.50	39.50	39.50	39.50	52.93	105.77	1056.79
W JORDA(11) 235	4.00	22.7	4.48	6.46	10.43	19.01	35.52	68.54	134.59	1323.36

Table B-5. Comparative culinary water charges—cities with population between 2,000 and 5,000.

Name of city	Minimum charge ($)	– quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
CENTERVILLE 1	4.50	37.9	4.50	6.55	12.10	24.12	47.23	93.46	185.92	1850.21
CENTERVILLE 7	5.00	37.9	5.00	7.05	12.60	24.62	46.13	82.54	148.59	1337.36
CENTERVILLE 1 OT	6.75	37.9	6.75	9.38	16.52	31.97	60.08	109.71	202.17	1866.46
CENTERVILLE 7 OT	7.50	37.9	7.50	10.43	18.35	35.52	66.94	123.17	228.84	2130.88
EPHRAIM 8	4.50	26.5	4.69	6.27	9.44	15.73	27.62	51.39	98.94	954.86
FARMINGTON 27	4.00	37.9	4.00	5.46	9.43	17.21	29.78	53.55	101.10	957.02
FARMING (1) 3	8.00	75.7	8.00	8.00	10.93	18.71	31.28	55.05	102.60	958.52
HEBER 16	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
HEBER 4	4.00	0.0	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HEBER 7	6.50	64.4	6.50	6.50	9.73	17.29	31.82	60.88	119.00	1165.12
MAPLETON 17	3.63	56.8	3.63	3.73	5.63	9.29	13.26	21.18	37.03	322.34
MOAB (4) 1	2.50	7.6	3.80	5.55	9.03	16.59	31.12	60.18	118.30	1164.42
MOAB 7	3.50	11.4	4.98	7.36	12.11	21.77	37.98	68.36	127.99	902.95
MOAB 1 OT	5.00	7.6	7.61	11.09	18.07	33.18	62.24	120.36	236.59	2328.84
MOAB 7 OT	7.00	11.4	9.96	14.71	24.22	43.54	75.96	136.72	255.97	1805.91
PROVIDENCE 17	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
RICHFIELD 2	3.75	56.8	3.75	3.96	7.93	16.51	33.02	66.04	132.09	1320.86
RIVERTON 27	4.00	18.9	4.59	6.17	9.34	16.21	29.42	55.83	108.67	1059.69
RIVERTON 27 OT	5.00	18.9	5.59	7.17	10.34	17.21	30.42	56.83	109.67	1060.69
RIVERTON(7) 9	2.00	18.9	2.59	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
ROOSEVELT 17	5.00	37.9	5.00	7.05	11.93	20.51	37.02	70.04	136.09	1324.86
SMITHFIELD 27	3.00	37.9	3.00	3.88	6.26	10.63	16.87	27.43	48.57	428.98
SYRACUSE 1	6.15	37.9	6.15	7.32	10.49	17.36	30.57	56.98	109.82	1060.84
SYRACUSE 7	6.15	37.9	6.15	7.03	9.41	14.56	24.46	44.28	83.90	797.17
VERNAL (10) 2	3.00	37.9	3.00	3.88	6.93	17.62	40.73	86.96	179.42	1843.71
VERNAL 357	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
VERNAL (10) 2 OT	6.00	37.9	6.00	7.76	13.18	29.02	62.04	128.09	260.17	2637.73
VERNAL 357 OT	6.00	37.9	6.00	7.46	11.43	20.01	36.52	69.54	135.59	1324.36

Table B-6. Comparative culinary water charges—cities with population less than 2,000.

Name of city		Minimum charge ($)	quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
DELTA	27	3.00	30.3	3.00	3.94	5.84	9.97	17.89	33.74	65.44	636.05
DELTA	27 OT	5.00	30.3	5.00	6.88	10.69	18.93	34.78	66.48	129.88	1271.11
EAST CARBON	17	6.30	0.0	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
FILLMORE	17	5.00	37.9	5.00	5.88	8.26	13.41	22.21	35.42	61.63	537.35
HYDE PARK	2	3.33	75.7	3.33	3.33	4.50	7.93	14.54	27.75	54.16	529.68
KANAB	17	4.00	56.8	4.00	4.17	8.26	18.56	38.38	78.00	157.25	1583.79
MANILA	15	7.50	37.9	7.50	10.43	18.35	35.52	68.54	134.59	266.67	2644.23
MANILA	7	15.00	75.7	15.00	15.00	20.85	38.02	71.04	137.09	269.17	2646.73
MANILA (3)	3	11.25	56.8	11.25	11.68	19.60	36.77	69.79	135.84	267.92	2645.48
MANTI	8	8.50	37.9	8.50	9.67	12.84	19.27	29.83	48.78	80.83	556.35
MILFORD	17	11.75	0.0	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
MT PLEASANT	8	3.00	18.9	3.59	5.17	8.34	15.21	26.42	54.83	107.67	1058.69
NORTH LOGAN	27	4.00	30.3	4.00	5.96	9.93	18.51	35.02	68.04	134.09	1322.86
PANGUITCH	27	3.00	56.8	3.00	3.13	5.45	9.25	15.66	29.07	55.48	531.00
PARK CITY	1	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
PLAIN CITY	2	5.50	0.0	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
RANDOLPH	17	3.50	56.8	3.50	3.71	7.42	10.85	17.46	30.67	57.08	532.60
SANTAQUIN	17	4.15	37.9	4.15	4.62	5.89	8.63	13.92	24.48	45.62	426.03
SANTAQUIN	17 OT	8.15	37.9	8.15	9.09	11.62	17.12	27.68	48.82	91.09	851.90
WELLSVILLE	23	5.00	132.5	5.00	5.00	5.00	12.76	29.27	62.29	128.34	1317.11
W BOUNTIFUL	17	3.00	45.4	3.00	3.89	7.26	13.27	24.09	43.91	83.53	796.80
WEST BO(10)	2	5.00	83.3	5.00	5.00	7.20	13.57	24.65	44.47	84.09	797.36
WEST POINT	17	3.80	45.4	3.80	4.76	8.73	17.31	33.82	66.84	132.89	1321.66

Coding for numbers in parentheses

[1]Farmington: Computed for duplex; for multiple units add $4.00 per month per additional unit and increase the minimum quantity supplied by 10,000 gallons per unit.
[2]Layton: Computed for duplex; for multiple units add $2.30 per month per additional unit and increase the minimum quantity supplied by 4,000 gallons per unit.
[3]Manila: Multiple rates apply only to duplexes.
[4]Moab: For multiple units on the same meter add $2.50 per month per additional unit and increase the minimum quantity supplied by 2,000 gallons per unit.
[5]Murray: For multiple units add $3.00 per month per additional unit ($4.00 outside city); for mobile homes add $2.25 per month per additional unit ($4.00 outside city).
[6]Orem: Computed for two units; for three or more units add $4.05 per month per additional unit and increase the minimum quantity supplied by 9,000 gallons per unit.
[7]Riverton: Miscellaneous rate is a special "widows" rate.
[8]South Salt Lake: Computed for duplex; for third unit add $1.00 and increase the minimum quantity supplied by 5,000 gallons, thereafter ass $.50 per additional unit.
[9]Tooele: For multiples add $.50 per month per additional unit; for mobile homes add $.75 per month per additional unit.
[10] Various cities: duplexes are charged the same amount as a single residence.
[11]West Jordan: Commercial users are charged $75.00 per acre-foot.

Table B-7. Comparative culinary water charges—Wasatch Front North Planning District.

Name of city	Minimum charge (\$)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft (\$)	60,000 l 15,852 gal 2,120 cu ft (\$)	120,000 l 31,704 gal 4,240 cu ft (\$)	250,000 l 66,043 gal 8,829 cu ft (\$)	500,000 l 132,086 gal 17,658 cu ft (\$)	1,000,000 l 264,173 gal 35,317 cu ft (\$)	2,000,000 l 528,346 gal 70,634 cu ft (\$)	20,000,000 l 5,283,457 gal 706,345 cu ft (\$)
BOUNTIFUL 15	3.00	37.9	3.00	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
CENTERVILLE 1	4.50	37.9	4.50	6.55	12.10	24.12	47.23	93.46	185.92	1850.21
CENTERVILLE 7	5.00	37.9	5.00	7.05	12.60	24.62	46.13	82.54	148.59	1337.36
CENTERVILLE 1 OT	6.75	37.9	6.75	9.38	16.52	31.97	60.08	109.71	202.17	1866.46
CENTERVILLE 7 OT	7.50	37.9	7.50	10.43	18.35	35.52	66.94	123.17	228.84	2130.88
CLEARFIELD 2357	3.00	37.9	3.00	4.17	7.31	13.49	25.38	49.15	96.70	952.62
FARMINGTON 27	4.00	37.9	4.00	5.46	9.43	17.21	29.78	53.55	101.10	957.02
FARMING (1) 3	8.00	75.7	8.00	8.00	10.93	18.71	31.28	55.05	102.60	958.52
KAYSVILLE 17	2.50	37.9	2.50	3.67	6.81	12.99	23.31	43.13	82.75	796.02
LAYTON 2	3.00	26.5	3.19	4.77	7.91	14.09	24.41	44.23	83.85	797.12
LAYTON 2 OT	6.00	26.5	6.37	9.54	15.81	28.18	48.83	88.45	167.70	1594.24
LAYTO (2) 3	5.30	41.6	5.30	6.27	9.44	15.69	26.16	45.98	85.60	798.87
LAYTON 5	3.00	26.5	3.19	4.77	7.94	14.81	28.02	54.43	107.27	1058.29
LAYTON 7	3.00	26.5	3.19	4.77	7.93	14.11	24.46	44.28	83.90	797.17
OGDEN 1/2+5/8"	3.10	28.8	3.18	5.16	9.13	17.71	33.42	60.76	109.35	715.53
OGDEN 3/4"CON	4.05	42.8	4.05	5.19	9.15	17.74	33.44	60.79	109.38	715.56
OGDEN 1" CON	5.95	71.2	5.95	5.95	9.18	17.76	33.47	60.81	109.40	715.58
OGDEN 1.5" CON	11.20	142.3	11.20	11.20	11.20	18.31	34.02	61.36	109.95	716.13
OGDEN 2" CON	17.50	227.5	17.50	17.50	17.50	18.99	34.69	62.04	110.63	716.81
OGDEN 3" CON	31.85	431.5	31.85	31.85	31.85	31.85	35.92	63.26	111.85	718.03
OGDEN 4" CON	51.85	746.9	51.85	51.85	51.85	51.85	51.85	64.52	113.11	719.29
OGDEN 6" CON	101.25	1691.3	101.25	101.25	101.25	101.25	101.25	101.25	115.50	721.68
OGDEN 8" CON	197.50	4051.1	197.50	197.50	197.50	197.50	197.50	197.50	197.50	724.16
OGDEN 1/2+5/8"OT	6.20	28.8	6.36	10.33	18.25	35.42	66.84	121.46	218.40	1430.76
OGDEN 3/4"CON OT	8.10	42.8	8.10	10.38	18.30	35.47	66.89	121.51	218.45	1430.81
OGDEN 1" CON OT	11.90	71.2	11.90	11.90	18.35	35.52	66.94	121.56	218.50	1430.86
OGDEN 1.5"CON OT	22.40	142.3	22.40	22.40	22.40	36.62	68.04	122.66	219.60	1431.96
OGDEN 2" CON OT	35.00	227.5	35.00	35.00	35.00	37.97	69.39	124.01	220.95	1433.31
OGDEN 3" CON OT	63.70	431.5	63.70	63.70	63.70	63.70	71.84	126.46	223.40	1435.76
OGDEN 4" CON OT	103.70	746.9	103.70	103.70	103.70	103.70	103.70	128.98	225.92	1438.28
OGDEN 6" CON OT	202.50	1691.3	202.50	202.50	202.50	202.50	202.50	202.50	230.95	1443.31
OGDEN 8" CON OT	395.00	4051.1	395.00	395.00	395.00	395.00	395.00	395.00	395.00	1448.31
PLAIN CITY 2	5.50	0.0	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
RIVERDALE 17	3.25	37.9	3.25	4.30	7.16	13.34	25.23	49.00	96.55	952.47
ROY 17	2.50	37.9	2.50	3.61	6.62	13.15	25.70	50.79	100.99	1004.46
ROY 17 OT	6.25	37.9	6.25	8.30	13.85	25.87	48.98	95.21	187.67	1851.96
SOUTH OGDEN 17	2.25	37.9	2.25	3.42	6.59	13.46	26.67	53.08	105.92	1056.94
SUNSET 3/4" CON	3.65	37.9	3.65	5.00	8.37	14.38	25.60	48.06	92.97	901.34

Table B-7. Continued.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
SUNSET 1" CON	4.50	37.9	4.50	5.85	9.22	15.23	26.45	48.91	93.82	902.19
SUNSET 4" CON	9.15	37.9	9.15	10.50	13.87	19.88	31.10	53.56	98.47	906.84
SUNSET 6" CON	13.60	37.9	13.60	14.95	18.32	24.33	35.55	58.01	102.92	911.29
SYRACUSE 1	6.15	37.9	6.15	7.32	10.49	17.36	30.57	56.98	109.82	1060.84
SYRACUSE 7	6.15	37.9	6.15	7.03	9.41	14.56	24.46	44.28	83.90	797.17
WASHING TER 2	3.75	37.9	3.75	4.92	8.09	14.96	28.17	54.58	107.42	1058.44
WASHING(10) 2	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING TER 3	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 3/4" CON	4.25	41.6	4.25	5.22	8.39	15.26	28.47	54.88	107.72	1058.74
WASHING 1" CON	5.75	71.9	5.75	5.75	8.29	15.16	28.37	54.78	107.62	1058.64
WASHING 1.5" CON	9.50	143.8	9.50	9.50	9.50	15.11	28.32	54.73	107.57	1058.59
WASHING 2" CON	14.00	227.1	14.00	14.00	14.00	15.21	28.42	54.83	107.67	1058.69
WASHING 3" CON	24.50	431.5	24.50	24.50	24.50	24.50	28.12	54.53	107.37	1058.39
WASHING 4" CON	39.50	745.7	39.50	39.50	39.50	39.50	39.50	52.93	105.77	1056.79
W BOUNTIFUL 17	3.00	45.4	3.00	3.69	7.26	13.27	24.09	43.91	83.53	796.80
WEST BO(10) 2	5.00	83.3	5.00	5.00	7.20	13.57	24.65	44.47	84.09	797.36
WEST POINT 17	3.80	45.4	3.80	4.76	8.73	17.31	33.82	66.84	132.69	1321.66

Table B-8. Comparative culinary water charges—Southeastern Planning District.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
EAST CARBON 17	6.30	0.0	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
MOAB (4) 1	2.50	7.6	3.80	5.55	9.03	16.59	31.12	60.18	118.30	1164.42
MOAB 7	3.50	11.4	4.98	7.36	12.11	21.77	37.98	68.36	127.99	902.95
MOAB 1 OT	5.00	7.6	7.61	11.09	18.07	33.18	62.24	120.36	236.59	2328.84
MOAB 7 OT	7.00	11.4	9.96	14.71	24.22	43.54	75.96	136.72	255.97	1805.91

Table B-9. Comparative culinary water charges—Southwestern Planning District.

Name of city		Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
KANAB	17	4.00	56.8	4.00	4.17	8.26	18.56	38.38	78.00	157.25	1583.79
MILFORD	17	11.75	0.0	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
PANGUITCH	27	3.00	56.8	3.00	3.13	5.45	9.25	15.86	29.07	55.48	531.00
ST.GEORGE	1	3.00	11.4	3.99	5.57	8.74	15.61	28.82	53.31	98.22	906.59
ST.GEORGE	57	3.00	11.4	4.23	6.21	10.18	18.76	35.27	66.37	123.64	1027.11

Table B-10. Comparative culinary water charges—Uintah Basin Planning District.

Name of city		Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
MANILA	15	7.50	37.9	7.50	10.43	18.35	35.52	68.54	134.59	266.67	2644.23
MANILA	7	15.00	75.7	15.00	15.00	20.85	38.02	71.04	137.09	269.17	2646.73
MANILA (3)	3	11.25	56.8	11.25	11.68	19.60	36.77	69.79	135.84	267.92	2645.48
ROOSEVELT	17	5.00	37.9	5.00	7.05	11.93	20.51	37.02	70.04	136.09	1324.86
VERNAL (10)	2	3.00	37.9	3.00	3.88	6.93	17.62	40.73	86.96	179.42	1843.71
VERNAL	357	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
VERNAL (10)	2 OT	6.00	37.9	6.00	7.76	13.18	29.02	62.04	128.09	260.17	2637.73
VERNAL	357 OT	6.00	37.9	6.00	7.46	11.43	20.01	36.52	69.54	135.59	1324.36

Table B-11. Comparative culinary water charges—Bear River Planning District.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
HYDE PARK 2	3.33	75.7	3.33	3.33	4.50	7.93	14.54	27.75	54.16	529.68
LOGAN 3/4,1"CON	2.50	37.9	2.50	3.67	6.84	13.71	26.92	53.33	106.17	1057.19
LOGAN 1.5" CON	5.00	83.3	5.00	5.00	6.94	13.81	27.02	53.43	106.27	1057.29
LOGAN 2" CON	9.00	159.0	9.00	9.00	9.00	13.81	27.02	53.43	106.27	1057.29
LOGAN 3" CON	17.00	310.4	17.00	17.00	17.00	17.00	27.02	53.43	106.27	1057.29
LOGAN 4" CON	30.00	575.4	30.00	30.00	30.00	30.00	30.00	52.43	105.27	1056.29
LOGAN 6" CON	61.50	1332.5	61.50	61.50	61.50	61.50	61.50	61.50	96.77	1047.79
LOGAN 8" CON	129.50	3338.7	129.50	129.50	129.50	129.50	129.50	129.50	129.50	1009.79
NORTH LOGAN 27	4.00	30.3	4.00	5.96	9.93	18.51	35.02	68.04	134.09	1322.86
PROVIDENCE 17	3.00	37.9	3.00	3.88	6.26	11.41	21.31	41.13	80.75	794.02
RANDOLPH 17	3.50	56.8	3.50	3.71	7.42	10.85	17.46	30.67	57.08	532.60
SMITHFIELD 27	3.00	37.9	3.00	3.88	6.26	10.63	16.87	27.43	48.57	428.98
WELLSVILLE 23	5.00	132.5	5.00	5.00	5.00	12.76	29.27	62.29	128.34	1317.11

Table B-12. Comparative culinary water charges—Wasatch Front South Planning District.

Name of city	Minimum charge ($)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
MURRAY (5) 2357	3.00	31.1	3.00	4.43	7.39	13.82	26.18	50.90	96.22	737.80
MURRAY HOSP	25.00	31.1	25.00	26.43	29.39	35.82	48.18	72.90	118.22	759.80
MURRAY 2357 OT	4.00	31.1	4.00	6.04	10.28	19.46	37.12	72.43	132.75	965.05
RIVERTON 27	4.00	18.9	4.59	6.17	9.34	16.21	29.42	55.83	108.67	1059.69
RIVERTON 27 OT	5.00	18.9	5.59	7.17	10.34	17.21	30.42	56.83	109.67	1060.69
RIVERTON(7) 9	2.00	18.9	2.59	4.17	7.34	14.21	27.42	53.83	106.67	1057.69
SLC 3/4,1" CON	1.75	31.1	1.75	3.38	6.77	14.12	28.24	56.50	113.01	1130.14
SLC 1.5" CON	3.50	62.3	3.50	3.50	6.76	14.11	28.23	56.49	113.00	1130.13
SLC 2" CON	5.60	99.1	5.60	5.60	6.78	14.13	28.25	56.51	113.02	1130.15
SLC 3" CON	11.20	198.2	11.20	11.20	11.20	14.13	28.25	56.51	113.02	1130.15
SLC 4" CON	17.50	308.6	17.50	17.50	17.50	17.50	28.31	56.57	113.08	1130.21
SLC 6" CON	35.00	620.1	35.00	35.00	35.00	35.00	35.00	56.47	112.98	1130.11
SLC 8" CON	56.00	991.0	56.00	56.00	56.00	56.00	56.00	56.51	113.02	1130.15
SLC 10" CON	80.50	1424.2	80.50	80.50	80.50	80.50	80.50	80.50	113.04	1130.17
SLC 3/4,1" CO OT	2.50	28.3	2.64	5.19	10.27	21.29	42.48	84.66	169.62	1695.33
SLC 1.5" CON OT	5.00	59.5	5.00	5.05	10.13	21.15	42.34	84.72	169.48	1695.19
SLC 2" CON OT	8.00	93.4	8.00	8.00	10.25	21.27	42.46	84.84	169.60	1695.31
SLC 3" CON OT	16.00	189.7	16.00	16.00	16.00	21.11	42.30	84.68	169.44	1695.15
SLC 4" CON OT	25.00	294.5	25.00	25.00	25.00	25.00	42.42	84.80	169.56	1695.27
SLC 6" CON OT	50.00	588.9	50.00	50.00	50.00	50.00	50.00	84.84	169.60	1695.31
SLC 8" CON OT	80.00	942.9	80.00	80.00	80.00	80.00	80.00	84.84	169.60	1695.31
SLC 10" CON OT	115.00	1356.3	115.00	115.00	115.00	115.00	115.00	115.00	169.56	1695.27
SANDY 17	8.00	75.7	8.00	8.00	10.93	19.51	36.02	69.04	135.09	1323.86
S SALT LAKE 27	2.50	45.4	2.50	3.35	6.63	14.39	28.92	57.98	116.10	1162.22
S SALT (8) 3	4.00	75.7	4.00	4.00	6.57	14.13	28.66	57.72	115.84	1161.96
TOOELE (9) 2357	2.75	42.5	2.75	3.83	7.54	15.58	31.03	61.93	123.74	1236.23
W JORDA(11) 235	4.00	22.7	4.48	6.46	10.43	19.01	35.52	68.54	134.59	1323.36

Table B-13. Comparative culinary water charges—Central Planning District.

Name of city		Minimum charge (\$)	Minimum quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft (\$)	60,000 l 15,852 gal 2,120 cu ft (\$)	120,000 l 31,704 gal 4,240 cu ft (\$)	250,000 l 66,043 gal 8,829 cu ft (\$)	500,000 l 132,086 gal 17,658 cu ft (\$)	1,000,000 l 264,173 gal 35,317 cu ft (\$)	2,000,000 l 528,346 gal 70,634 cu ft (\$)	20,000,000 l 5,283,457 gal 706,345 cu ft (\$)
DELTA	27	3.00	30.3	3.00	3.94	5.84	9.97	17.89	33.74	65.44	636.05
DELTA	27 OT	5.00	30.3	5.00	6.88	10.69	18.93	34.78	66.48	129.88	1271.11
EPHRAIM	8	4.50	26.5	4.69	6.27	9.44	15.73	27.62	51.39	98.94	954.86
FILLMORE	17	5.00	37.9	5.00	5.88	8.26	13.41	22.21	35.42	61.83	537.35
MANTI	8	8.50	37.9	8.50	9.67	12.84	19.27	29.83	48.78	80.83	556.35
MT PLEASANT	8	3.00	18.9	3.59	5.17	8.34	15.21	28.42	54.83	107.67	1058.69
RICHFIELD	2	3.75	56.8	3.75	3.96	7.93	16.51	33.02	66.04	132.09	1320.86

Table B-14. Comparative culinary water charges—Mountainlands Planning District.

Name of city		Minimum charge ($)	quantity (1000 l)	30,000 l 7,926 gal 1,060 cu ft ($)	60,000 l 15,852 gal 2,120 cu ft ($)	120,000 l 31,704 gal 4,240 cu ft ($)	250,000 l 66,043 gal 8,829 cu ft ($)	500,000 l 132,086 gal 17,658 cu ft ($)	1,000,000 l 264,173 gal 35,317 cu ft ($)	2,000,000 l 528,346 gal 70,634 cu ft ($)	20,000,000 l 5,283,457 gal 706,345 cu ft ($)
HEBER	16	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
HEBER	4	4.00	0.0	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HEBER	7	6.50	64.4	6.50	6.50	9.73	17.29	31.62	60.88	119.00	1165.12
LEHI	17	3.00	28.4	3.09	4.67	7.84	14.71	27.28	47.48	84.47	750.18
MAPLETON	17	3.63	56.8	3.63	3.73	5.63	9.29	13.26	21.18	37.03	322.34
OREM	27	4.65	45.4	4.65	5.23	7.37	10.80	17.41	30.62	57.03	532.55
OREM	(6) 35	8.70	79.5	8.70	8.70	10.63	16.81	28.70	52.47	100.02	955.94
OREM	27 OT	9.30	45.4	9.30	10.46	14.74	21.61	34.62	61.23	114.07	1065.09
OREM	35 OT	17.40	79.5	17.40	17.40	21.25	33.62	57.39	104.94	200.04	1911.88
PARK CITY	1	5.00	0.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
PAYSON	8	3.00	37.9	3.00	3.99	6.69	12.53	23.11	41.07	74.09	668.48
PAYSON	8 OT	6.00	37.9	6.00	7.99	13.38	25.05	46.23	82.14	148.19	1336.96
PROVO 3/4" CON		3.50	28.3	3.60	5.29	8.68	16.03	30.15	58.41	114.92	1132.05
PROVO 1" CON		4.50	28.3	4.60	6.29	9.68	17.03	31.15	59.41	115.92	1133.05
PROVO 1-1/2" CON		10.00	28.3	10.10	11.79	15.18	22.53	36.65	64.91	121.42	1138.55
PROVO 2" CON		15.00	28.3	15.10	16.79	20.18	27.53	41.65	69.91	126.42	1143.55
PROVO 3" CON		30.00	28.3	30.10	31.79	35.18	42.53	56.65	84.91	141.42	1158.55
PROVO 4" CON		50.00	28.3	50.10	51.79	55.18	62.53	76.65	104.91	161.42	1178.55
PROVO 6" CON		100.00	28.3	100.10	101.79	105.18	112.53	126.65	154.91	211.42	1228.55
PROVO 8" CON		150.00	28.3	150.10	151.79	155.18	162.53	176.65	204.91	261.42	1278.55
PROVO 10" CON		200.00	28.3	200.10	201.79	205.18	212.53	226.65	254.91	311.42	1328.55
PROVO 12" CON		250.00	28.3	250.10	251.79	255.18	262.53	276.65	304.91	361.42	1378.55
PROVO 3/4 CON OT		10.50	28.3	10.79	15.87	26.04	48.08	90.46	175.22	344.75	3396.15
PROVO 1" CON OT		13.50	28.3	13.79	18.87	29.04	51.08	93.46	178.22	347.75	3399.15
PROVO 1-1/2 C OT		30.00	28.3	30.29	35.37	45.54	67.58	109.96	194.72	364.25	3415.65
PROVO 2" CON OT		45.00	28.3	45.29	50.37	60.54	82.58	124.96	209.72	379.25	3430.65
PROVO 3" CON OT		90.00	28.3	90.29	95.37	105.54	127.58	169.96	254.72	424.25	3475.65
PROVO 4" CON OT		150.00	28.3	150.29	155.37	165.54	187.58	229.96	314.72	484.25	3535.65
PROVO 6" CON OT		300.00	28.3	300.29	305.37	315.54	337.58	379.96	464.72	634.25	3685.65
PROVO 8" CON OT		450.00	28.3	450.29	455.37	465.54	487.58	529.96	614.72	784.25	3835.65
PROVO 10" CON OT		600.00	28.3	600.29	605.37	615.54	637.58	679.96	764.72	934.25	3985.65
PROVO 12" CON OT		750.00	28.3	750.29	755.37	765.54	787.58	829.96	914.72	1084.25	4135.65
SANTAQUIN	17	4.15	37.9	4.15	4.62	5.89	8.63	13.92	24.48	45.62	426.03
SANTAQUIN	17 OT	8.15	37.9	8.15	9.09	11.62	17.12	27.68	48.82	91.09	851.90
SPANISH FORK	8	3.50	56.8	3.50	3.63	6.01	10.35	16.96	30.17	56.58	532.10

APPENDIX C

SAMPLE ESTIMATE OF REVENUE POTENTIAL

I. MAXIMIZING FEE $= \frac{P}{e}$

a). PUBLIC SUPPLY FEE $= f \frac{.30}{.75} =$ \$ .40 PER 1,000 GAL

b). IRRIGATION FEE $= f = \frac{5}{2} =$ \$2.50 PER AC FT

II. TOTAL REVENUE $= f.q - f.dq$

$$= f.q - f.\frac{e.f.q}{2P}$$

$$= f.q - \frac{1}{2P} e.f.^2 q$$

$$= q \left(f - \frac{1}{2P} e.f^2\right)$$

EXAMPLE: FOR THE STATE OF UTAH

a). PUBLIC SUPPLY

q = (280) (1,000) (365) — 1,000 GAL/YEAR

f = .40 — \$ /1,000 GAL

P = .30 — \$ /1,000 GAL

e = .75

$$TR = (280)\ (1,000)\ (365)\ \left[.40 - \frac{1}{2(.30)}\ (.75)\ (.40)^2\right]$$

$$= (208)\ (,000)\ (365)$$

$$= 15,184,000$$

b). IRRIGATION

q = (4,100) (1,000) — AC FT/YEAR

f = 2.50 — \$ /AC FT

P = 5.00

e = 2.00

$$TR = (4,100)\ (1,000)\ \left[2.50 - \frac{1}{2(5.00)}\ (2)\ (\ .50)^2\right]$$

$$= (4,100)\ (1,000)\ (1.25)$$

$$= 5,125,000$$

APPENDIX D

A REVIEW OF ALPINE IRRIGATION COMPANY WATER RIGHTS RECORDS

Alpine Irrigation Company is medium sized (irrigating some 1,750 acres) located near American Fork, Utah County (Haws, 1973). Early settlers in this area used water from Dry Creek and Fort Canyon for irrigation, watering livestock, and domestic purposes. Prior to 1877, Lehi City and the town of Alpine built systems of ditches and diversion works in order to use water from Dry Creek. The community organized and incorporated the Alpine Irrigation Company in 1880 (Company records—State Engineers Office).

At first water was divided on the basis of primary and secondary rights between four major ditches; Fort Ditch, North Ditch, West Field Ditch, and East Field Ditch. These shares were distributed as follows:

Primary shares

Fort Ditch	318 shares
North Field	137 shares
East Field	479 shares
West Field	420 shares
Alpine City, Fort Ditch	50 shares

Secondary shares

North Field	42 shares
East Field	151 shares
Field Ditch	10 shares
West Field	110½ shares
Highland Bench	212 shares

Primary rights were established when a person (a) diverted and used unappropriated water of any stream, watercourse, lake spring, or other natural source of supply, or (b) had "the open, peaceable, uninterrupted and continuous use of water for a period of seven years." Secondary rights were established, "subject to the perfect and complete use of the primary right," (a) when all water from any natural source had been appropriated and used by prior appropriators for parts of a year only, and subsequent appropriations had been made of all or part of the water during any other part of the year; (b) when the average seven years flow of water had been appropriated, and other persons thereafter appropriated an increase over the average flow.

On December 5, 1889, Lehi Irrigation Company entered into an agreement with the Alpine Irrigation Company under which Alpine received one half of all the water of Dry Creek during April, May, June, and July up to and including the 10th of July each year. During the remainder of the year, Alpine Irrigation Company was entitled to all of the waters of Dry Creek. Alpine also enjoyed the total flow of Grove Creek throughout the whole year.

A court decree of July 14, 1893, gave the North Bench Irrigation Company two thirteenths of the rights of Alpine Irrigation Company during the months of April, May, and June. North Bench was given no right during July, August, and September. Then, during October, November, December, January, February, and March of each year North Bench Irrigation Company was given one fourth of the right of Alpine Irrigation Company. This division of the total flow continues to be the basis of distribution among the three companies.

All ditches in the system are filled to capacity during spring runoff. As flow diminishes, distribution is made on the basis of total shares (both primary and secondary). At the point when total flow diminishes to 14 cfs all secondary shares are eliminated. During the hot summer months when Fort Creek carries only a minimal stream, the supply is supplemented by a flow from Dry Creek, which holds up fairly well until late July or early August.

The following diligence claims have been filed on water rights which were in use before 1903.

Claim 797
Dry Creek: North Field Ditch and Fort Ditch
Use
Irrigation 27 sec. ft. from 1 April to 31 Oct.
Stock 3 sec. ft. from 1 Nov. to 31 March
Construction began: 1852 Water first used: 1852

Claim 798
Dry Creek: West Field Ditch
Use
Irrigation 30 sec. ft. from 1 April to 31 Oct.
Stock 2 sec. ft. from 1 Nov. to 31 March

Claim 799
Dry Creek: East Field Ditch
Use
Irrigation 40 sec. ft. from 1 April to 31 Oct.
Stock 2 sec. ft. from 1 Nov. to 31 March

Claim 800
Dry Creek: High Bench Ditch
Use
Irrigation 25 sec. ft. from 1 April to 31 Oct.
Stock 2 sec. ft. from 1 Nov. to 31 March

Claim 801
Grove Spring Stream (tributary to Dry Creek)
Use
Irrigation 6.99 sec. ft. from 1 April to 31 Oct.
Stock 2 sec. ft. from 1 Nov. to 31 March

Claim 802
Fort Canyon Creek: Carlisle Ditch
Use
Irrigation 6 sec. ft. from 1 April to 31 Oct.
Stock 1 sec. ft. from 1 Nov. to 31 March

Carlisle Ditch is classified as a "high water" ditch, that is, when Fort Creek flows in excess of 16 cfs, users of Carlisle Ditch may divert the excess to a total of 3 cfs. There are two exceptions to the rule. First, "the 3 cfs rule is exceeded when the water flowing in

Fort Creek belonging to the Alpine Irrigation is in excess of the need of West Field Ditch users. Carlisle Ditch users have been permitted to exceed the 3 cfs to a ditch capacity of 6 cfs." Second, "users of West Field Ditch may transfer shares from West Field Ditch to Carlisle Ditch to protect Carlisle Ditch crops or whenever water is not needed in the West Field Farms."

In 1963 the Alpine Irrigation Company made two applications to appropriate water from wells. Both were for 6 sec. ft. for irrigation from April 1 to October 30.

On behalf of the Alpine Irrigation Company, the Utah State Board of Water Resources applied to change the point of diversion for the Alpine right as evidenced by diligence claims on water used prior to 1903. As required, the application was advertised publicly from May 7 to May 21, 1970. It was protested by a number of shareholders of the company on the grounds that secondary holders would benefit at the cost of the primary holders; however, the method of allocation is clearly established by the bylawys of the company. The State Engineer approved the application, reiterating that it is not the province of the State Engineer to interfere with the internal organizations of bylaws of individual irrigation companies nor to regulate the distribution of water once it has been diverted from the natural channel or source to the company. (Section 73-3-14, Utah Code Annotated, 1953)

Testimonies of witnesses involved with the Alpine Irrigation Company add interesting insights into the development of the company. In a sworn affidavit of April 21, 1960, Albert J. Adams who was born in Alpine, Utah, July 7, 1868, recalls: "at first there were no turns, each user would take a stream as needed and keep it as long as wanted or until some one else took it, but in later years it was necessary to take turns." He added that, as time went on, people began quarreling over the water.

Another witness, Evan Shepherd, who moved to Alpine in 1932 stated on April 21, 1960, that a board of directors was chosen by voting according to shares. The board then chose a watermaster. He noted that it was the practice to divide water betweeen the North Bench, Lehi Irrigation, and Alpine Irrigation companies to the letter. Any trading was done only through mutual agreement, and there was no share trading between ditches, although trading was permitted within the limits of a ditch.

The records of the Alpine Irrigation Company were relatively brief and simple as compared with those of other companies. In some areas, legal disputes resulted in decreased rights. Furthermore, due to the size of operations of the various companies changes in diversions, appropriations, or arrangements for waters of additional streams, add complexity to the task of sorting out the water rights held by each company. Finally, applications for changes may still be pending.

APPENDIX E

LEGAL IMPLICATIONS OF IMPOSING WATER-USE FEES

by

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October 6, 1975

LEGAL IMPLICATIONS OF IMPOSING WATER-USE FEES

I. Preface

This short paper examines the legal implications which necessarily would be encountered if a State were to implement a program of charging fees for the use of unappropriated water. The term "unappropriated" is used to distinguish such a program from those where fees are charged for water-use after the wholesaler or retailer of water has acquired appropriation rights under state law. The latter situation has been common for many years, by subdivisions of state government and by federal agencies.

It should be noted that this paper does not purport to be an exhaustive analysis of the legal problems identified, but is, rather, intended merely to characterize the nature and substance of the basic legal problems identified. Moreover, problems which are peculiar to States having riparian water right systems are not within the purview of this paper, and any discussion of riparian right concepts of doctrines will be limited to their applicability to the legal concepts applicable to appropriation jurisdictions.

Most of the discussion which follows will be applicable to appropriation States in general, but where specific focus must be drawn on a particular State for emphasis or illustration, Utah is the State most often selected.

II. Ownership of Water

Before anyone is legally entitled to "sell" anything, or to charge fees for its use, he must have ownership or a degree of legal control which justifies the sale or charging fees for use. Thus, an initial question which must be addressed is the extent to which an appropriation State has legal ownership or control of water sufficient to allow it to impose water-use fees. There are a number of doctrines and concepts which must be noted.

A. Source of State Ownership

1. Navigable Waters

One aspect of state ownership is directly related to the concept of navigability. Ownership of navigable waters developed in large part from the law in England, as it pertained to the rights of the public, the Parliament, and the King in such waters (Shively v. Bowlby, 152 U.S. 1 (1894)). The ownership rights of the Crown and Parliament were both in a proprietary and a governmental capacity, but they were subject to certain public uses for public purposes. The king could, at earlier times, make grants of the shores to private parties and extinguish public rights of use therein, but there is no authority indicating that he could sell, grant or otherwise dispose of the waters themselves. (R. Hall, Essay on the Rights of the Crown and the Privileges of the Subject in the Sea Shores of the Realm, 106-08 (2nd ed. 1875).)

As a result of the American revolution, the thirteen colonies superceded the Crown and Parliament in all proprietary rights and regulatory powers over navigable waters; and, when these colonies formed the Federal Union, and thus became the original thirteen States, they did not surrender any *ownership* rights in waters, but they did grant certain *regulatory* power to the Federal Government over interstate and foreign commerce. (U.S. Const., art. I, s 8, Para. 3).

This constitutional power has been held to include regulatory authority over navigable waters (Gibbons v. Ogden, 22 U.S. 1 (1824)), but only over those waters that are directly navigable in interstate or foreign commerce (The Montello, 11 Wall. 411 (1870)).

Waters that are navigable only in intrastate commerce, or from one point to another point within the same State, are not within the regulatory authority of the United States, but are subject to the regulatory authority of the States (The Daniel Ball, 10 Wall. 557 (1870)). These regulatory powers must, of course, be distinguished from ownership rights. This distinction was made clear by the United States Supreme Court in Pollard v. Hagan, 3 How. 212, 229 (1845), wherein the Court said:

> To Alabama belong the navigable waters and the soils under them, in controversy in this case, subject to the rights surrendered by the Constitution to the United States; and no compact that might be made between her and the United States could diminish or enlarge these rights. (See Also, Martin v. Waddell, 16 Pet. 367 (1842)).

The concept of "ownership" of navigable waters has never been defined or clarified with any degree of precision. The Supreme Court of the United States has observed that the state ownership of the water and the underlying soil is closely related to a regulatory power and duty to protect public uses of navigable waters, their beds and shorelands:

> The State holds the propriety of this soil for the conservation of the public rights of fishing thereon, and may regulate the modes of that enjoyment so as to prevent the destruction of the fishery...This power results from the ownership of the soil, from the legislative jurisdiction of the State over it, and from its duty to preserve those public uses for which the soil is held. (Smith v. Maryland, 18 How. 71, 75 (1855)).

2. Non-navigable Waters

Waters that are non-navigable come within different legal rules. In England, there were no public rights in non-navigable waters, and they were considered to be private waters owned by those who owned the adjacent (riparian) uplands (Johnson v. O'Neill, 105 Law Times Rep. 587, 597 (House of Lords, 1911)).

The doctrine of riparian rights, as it developed in England and as it has been adopted by most of the Eastern States in this country, entitles each riparian owner to make a reasonable use of the water so long as the flow of the stream is not materially diminished in volume or unreasonably deteriorated in quality (Shively v. Bowlby, 152 U.S. 1, 18-25 (1894)).

In appropriation States, no material distinction is drawn between ownership of navigable and non-navigable waters, since all waters are deemed to be owned by the "public" in general and not susceptible to private ownership while flowing in natural channels; and in some instances public rights of use for recreational purposes have been recognized in non-navigable waters even though the beds are privately owned (see, e.g., Day v. Armstrong, 362 P. 2d 137, 145 (Wyo. 1961).

The question then arises as to the relationship of state doctrines with respect to the ownership of water to federal ownership interests. These relationships are summarized below.

B. Federal Ownership Interests

When the United States acquired territory by purchase and cession, it acquired all proprietary rights and regulatory authority over the territory acquired. As a landowner, the United States thus acquired riparian rights along watercourses, because the riparian rights regime of water law was the only one in existence at the time these areas were acquired. When the United States subsequently sold lands along watercourses to private persons, and issued patents thereto, the private patentees naturally claimed riparian water rights.

In the West, however, the States had begun to develop appropriation concepts, the basis of which was that the first person to use water for a beneficial use had the prior right to water from the watercourse, without regard to whether he owned any land riparian to the stream. It was natural that conflicts arose between patentees of the Government who claimed riparian rights and those who claimed appropriation rights under state law (see, e.g., Irwin v. Phillips, 5 Cal. 140 (1855); Coffin v. Left Hand Ditch Co., 6 Colo. 443 (1882)).

Congress enacted mining and homestead legislation in 1866, 1870, and 1877, with an apparent authorization for water use under appropriation principles of the various States. In 1935, the United States Supreme Court held that these statutes evidenced a congressional intent that water-use in appropriation States be pursuant to water rights acquired in accordance with state law (California Oregon Power Co. v. Beaver Portland Cement Co., 295 U.S. 142 (1935)).

This apparently was not a renunciation or disclaimer by the United States of all riparian water rights which it owned, but merely a declaration that patentees who received conveyances of land from the United States received no riparian water rights as part of the conveyance; and that if they desired water rights, they would have to proceed in accordance with the requirements of the State wherein the land was located. Thus, if the State recognized riparian rights, the patentee would enjoy such rights as measured by state law; and if the State recognized only appropriation water rights, then the patentee would have to make an appropriation in the manner required by the law of the State.

But, with respect to lands that remained in federal ownership, some species of riparian rights apparently continued in existence. As noted earlier, the doctrine of riparian rights allows the owner of land adjacent to a natural watercourse to make a reasonable use of the water within the watercourse. The first clear evidence of the continued existence of federal riparian rights surfaced in Winters v. United States, 207 U.S. 564 (1908), where the Court held that the creation of an Indian reservation by the United States *impliedly* reserved sufficient water from the Milk River in Montana to satisfy the agricultural needs of reservation lands. This case gave rise to what commonly is referred to as the "Winters Doctrine."

Since the United States has no source of power or control over water other than (1) ownership rights and (2) regulatory authority, it is clear that the Government must have relied on one of these sources of power in withdrawing and reserving water for use on the reservation. And, since a regulatory power does not create ownership rights, it necessarily follows that the Government must have held ownership rights in the Milk River sufficient to allow the withdrawal of water for use on the reservation. The only source of ownership rights which the Government could have had was through riparian rights, since it owned land adjacent to the Milk River but had not made any appropriation under the laws of Montana.

This conclusion seems to have been borne out in Arizona v. California, 373 U.S. 546, 595-601 (1963), which is the Court's most definitive statement of the "reserved" water rights of the United States. There, the Court held that the creation of federal reservations impliedly reserves sufficient water from streams arising on or flowing across the reservations to satisfy the purpose or purposes for which the reservations were created.

The obvious question, then, is how these continuing riparian rights of the United States are to be correlated with state ownership and control of water. The essential answer lies in the "priority date" of rights created by federal reservations, whether for Indian use or for federal purposes. The priority date is the date when the reservation was officially established. This means that water rights held by private persons and initiated prior to the creation of a federal reservation, will be superior to and have a priority over water rights reserved by the creation of the reservation. Conversely, state-created water rights that were initiated after the reservation was created are inferior and junior to the rights reserved by the creation of the reservation, and as the reserved rights are developed and the water put to use, the junior private rights may be impaired or destroyed without compensation.

Thus, the priority of date of federal reserved rights makes the reservation doctrine consistent with the congressional acts of 1866, 1870, and 1877, and with the Supreme Court's opinion in the California Oregon Power case, *supra*. In other words, federal riparian rights were not extinguished in appropriation States, but were simply made subordinate to water rights created under state law. This gives appropriators valid water rights with complete security of title. However, if and when the Government decides to exercise any of its riparian rights, it does so by expressly creating a federal reservation, and this serves as the "appropriation" or "notice" to everyone within the State where the reservation is created that the Government's riparian rights have been exercised to the extent necessary to satisfy the water needs of the reservation.

Sometimes this proprietary arrangement has been characterized as an "offer" by the Government to prospective private water users to acquire rights under state law, and to the extent that the offer is "accepted" through the acquisition of such state-created rights, they cannot be divested; but, to the extent unappropriated water remains in the watercourse, then to that extent the federal offer has not been accepted, and in law an offer may always be withdrawn until it has been accepted. In this characterization, creation of a federal reservation withdraws the outstanding federal offer as to those waters reserved by the reservation, and as to all other waters the federal offer to private appropriators remains open and in effect.

The most difficult aspect of federal and Indian reserved rights is that they are not quantified by the statutory reservation. They are merely *implied* reservations of water, with no mention of water-use and no indication of the volume or amount of use intended by the reservation. Since circumstances change, the extent of possible future development and use of water under reserved rights cannot be predicted. Oil shale and other mineral development, for example, could require water use on Indian lands for purposes not foreseen when the reservations were created.

It seems logical that water use under reserved rights should not exceed a "reasonable use" as measured by state law, because reserved rights are bottomed on riparian rights, and "reasonable use" is always a limitation on the exercise of riparian rights. But no case has yet addressed this questions.

III. Prospects for Sale of Water

As indicated above, uncertainties exist as to the extent that water is "owned" by the States, or by the United States, or by anyone else, while it remains in natural watercourses; and further uncertainties exist with respect to the unquantified nature of federal and Indian reserved rights, as well as to the nature of subordinated but continuing riparian rights of the Government in appropriation States.

Despite these uncertainties, a number of proposals have been made by legal scholars concerning sales of unappropriated water by States. Some of those are noted below, along with further comments about the prospects of water sales or the imposition of water-use fees.

A. Interstate and Interbasin Sales

The question of major interbasin transfers from one region of the Nation to another region has been hotly debated for years, and was one of the reasons for creation of the National Water Commission. One of the most prominently discussed potential transfers was from the Columbia River Basin to the southwest region of the United States.

Professors Charles Meyers and Richard Posner have made the following suggestions:

> Because unappropriated waters are technically not owned, there is a conceptual difficulty in suggesting that the state may sell them. However, since the state has the power to create property rights in the waters by establishing procedures for their appropriation and since the state could itself appropriate the waters, we conclude that the state can establish a procedure by which it sells unappropriated water to a purchaser in another state.
>
> . . .
>
> Another serious problem with any major interregional transfer arises from the fact that the waters to be exported may be shared among several states. The Columbia River Basin, for example, includes portions of Washington, Oregon, Idaho, Montana and Wyoming, as well as Canada. In such cases of multistate basins, the states cannot know in advance of an apportionment how much water they have power to create appropriation rights in—that is, how much they can sell. To resolve this problem, there must be an apportionment—by congressional action, Supreme Court decree, or interstate compact—or a regional entity must be created that would hold title to the waters, effect the sale, and divide the proceeds among the states represented in the entity. The second alternative is probably no simpler than the first because the entity must still conduct an apportionment of sorts when it comes to divide the proceeds of the sale among the participating states. (C. J. Myers and R. A. Posner, Market Transfers of Water Rights, pp. 44-46 (National Water Commission Publication, NTIS ACC. NO. PB-202-620, 1971)).

Interregional transfers and sales of water are not within the scope of this paper, but the fact that proposals have been made for such sales by States within the area of origin are of present interest because of the conceptual similarity to the imposition of water-use fees by a State. In other words, if a State is legally empowered to sell its unappropriated water to another State, then, *a fortiori*, it would be empowered to impose water-use fees on users within the State.

B. Sales Within the State: Public Auction

Legal writers have also suggested that it would be legal for an appropriation State to "auction" unappropriated water to the highest bidder. This proposal would be compared to the procedures used by most States for leasing state lands for oil and gas, oil shale, and other minerals. When the lands are known to contain valuable minerals, then leasing procedures require that public notice be given by publication of the details of the lands to be offered for lease, including the time within which sealed offers will be accepted. At the appointed time and place for opening the competitive bids, the bids are opened and evaluated, and the lease is awarded to the highest qualified bidder.

By analogy, since the State knows that its unappropriated water is a valuable resource, it would be sold to the highest bidder pursuant to competitive bidding procedures similar to those employed for mineral leasing. When the State determined that there was an active interest or market demand for water in a particular river basin, it would determine how much of its unappropriated water should be offered for sale, and proceed to hold the sale. (See e.g., Meyers and Posner, op. cit., supra 39-43.)

C. Sales Within the State: Some Illustrations

1. The Orange County Experience

The water-use fees imposed on groundwater use in Orange County, California, are often cited as an illustration of the economic and practical efficiency with which such a system can work. In barest form, the essence of the system is that any potential water user is entitled to pump water from the underground basin in accordance with the schedule of fees established by the management district for water use; and the district imports water to recharge the basin sufficient to sustain the demands on the basin. The fee schedule for the various users is rather complicated, and to some extent is intended to allow credit to the earlier water users for the seniority of their rights. From a legal standpoint, the interesting features relate to the manner in which such a system came into being.

California originally adopted the absolute ownership doctrine of groundwater, which allowed overlying landowners to make full use of percolating groundwater without regard to other landowners. Then, in Katz v. Walkinshaw, 141 Cal. 116, 74 Pac. 766 (1903), the court adopted the rule of correlative use, which gives all overlying owners common rights to percolating waters beneath their lands. When the supply is sufficient, each owner withdraws water to meet his needs, but in time of shortage each owner is limited to the reasonable quantity of water needed to meet his beneficial needs, subject to similar and equal rights of all other overlying owners.

In water-short Southern California, many underground basins provided a relatively inexpensive supply of water. As the groundwater supply was developed, and more and more uses initiated, the basins were threatened with irreparable damage from salt water intrusion and exhaustion of the basin supply. Underground water basin management programs were initiated, but these were of limited effectiveness until Pasadena v. Alhambra, 33 Cal. 2d 908, 207 P. 2d 17 (1949). In that case, the court noted that the landowners overlying the basin originally had various kinds of rights to withdraw water from the basin, and also underscored the fact that "as between appropriators, the one first in time is the first in right, and a prior appropriator is entitled to all the water he needs, up to the amount that he has taken in the past, before a subsequent appropriator may take any."

However, the court apparently was concerned with the disorganized, happenstance manner in which the basin had been developed and overdrawn, and noted that many of the uses were illegal in that they impaired prior rights. The court compared appropriation and prescription rights in the following language:

> An appropriative taking of water which is not surplus is wrongful and may ripen into a prescriptive right where the use is actual, open and notorious, hostile and adverse to the original owner, continuous and uninterrupted for the statutory period of five years...
>
> To perfect a claim based upon prescription there must, of course, be conduct which constitutes an actual invasion of the former owner's rights so as to entitle him to bring an action...
>
> Appropriative and prescriptive rights to ground water, as well as the rights of an overlying owner, are subject to loss by adverse user. This is in accord with the rule announced in cases dealing with water in a surface stream. (207 Pac. 2d. 17 *et seq.*).

In a rather complicated maneuver, the court then adopted a theory of "mutual prescription" which effectively destroyed priorities between users, and put everyone on a rather equal basis. While that characterization is an over-simplification, it accounts for the fact that the court's decision marked the way for effective and efficient management of groundwater basins in California.

The California Supreme Court reached similar decisions in other cases, and the legislature took cue by enacting various statutes to facilitate groundwater management. In 1951 the legislature provided that use of water to replenish or recharge a groundwater basin was a beneficial (and therefore legal) use of water (Cal. Water Code, sec. 1005.2), further provided that existing rights could be satisfied with imported water (Cal. Water Code, sec. 1005.1), and also conferred authority on the Water Resources Control Board to enjoin harmful pumping which would allow salt water intrusion into basins which were subject to water rights adjudication (Cal. Water Code, sec. 2020).

Thus, it may be said that general management and administration of groundwater basins in California are perhaps further advanced than in any other State in the Union—and water-use fees are undeniably a key feature in the success of the system. But it also must be said that the system was made possible, at least in major part, by the doctrine of mutual prescription as adopted by the state supreme court.

No other state supreme court has applied that doctrine so effectively to groundwater basins, and there is no way that legislation could accomplish the same result. This is so because the adjudication of existing rights in groundwater basins is exclusively within the province of the judiciary, and the legislature cannot constitutionally adjudicate or define the limit of existing property rights.

In short, the success of the California system cannot be exported to other States unless their supreme courts adjudicate a result similar to that reached in the Pasadena case, *supra*. It must be emphasized, however, that these observations relate to developed (or over-developed) groundwater basins, and not to basins which have unappropriated water. In the latter event, imposition of water-use fees would present fewer problems, but, as will be noted below, might not be as simple as with surface watercourses because of the hydrostatic pressure problem.

2. Present "Retail" Water-Use Fees

Purely by way of comparison and illustration, it is to be noted that there are no legal impediments to the imposition of water-use fees by those who have acquired appropriation water rights. While water rights cannot be acquired for speculation or monopoly, public and quasi-public entities are allowed to acquire appropriation water rights and then sell the water in various ways to the users. These entities include towns, cities, water improvement districts, water conservancy districts, metropolitan water districts, federal agencies (notably the Bureau of Reclamation, but also the Corps of Army Engineers), and even private companies operating for profit who have obtained certificates of convenience and necessity from the State (see, generally, E. W. Clyde and D. W. Jensen, Administrative Allocation of Water, p. 77 *et seq.* (National Water Commission, NTIS PB-205-249, 1971).

The entities mentioned above sometimes enter into long-term water delivery contracts for specific annual charges, sometimes charge monthly or periodic rates for household and culinary use, and sometimes "wholesale" the water to other entities for subsequent retail sales to users (most typically the case with the Bureau of Reclamation on large projects). While most of these charges are designed to recoup the cost of construction of facilities and operation and maintenance costs, in some instances the fees are designed to produce a profit (as is the case with private companies operating as public utilities with certificates of convenience and necessity). The only difference between the fees charged by these entities, and potential fees to be charged directly by the State for use of previously unappropriated water, is that the agencies and entities mentioned above have gone through the procedure of acquiring appropriation water rights (without cost, other than payment of a modest filing fee), and have thus acquired a "right" to the use of the water that they sell. The related question is whether the State, which created the water rights in favor of these agencies, has an initial right to sell the water or impose fees for its use—as distinguished from the present practice of simply creating rights of use in applicants.

3. Analytical Position of Utah Division of Water Resources

The Utah Division of Water Resources, as governed by the Board of Water Resources, is authorized to acquire water rights through filings made with the Utah State Engineer (see section

73-10-19, Utah Code Annotated, 1953). Acting in accordance with this authorization, the Board has obtained a number of approved applications, notably on the Fremont, White and Escalante Rivers. Other applications of the Board are pending action by the State Engineer.

At the present time there is an active interest, and, to some degree, a competition among prospective water users to acquire water-use rights under these approved applications. The most significant aspect is that the Board of Water Resources is not obligated by law to assign these applications, or rights of water use under them, to water users free of water-use charges. In contrast, the State Engineer is obligated by statute to process and act on applications to appropriate water, but he may charge no fees other than the prescribed filing fee. Thus, the Board of Water Resources has no such statutory limitations on fees to be charged, and appears to stand in a position similar to that of the Bureau of Reclamation or a conservancy district that has acquired an approved application under state law.

The interesting feature, of course, is that if the Board of Water Resources were to decide, as a matter of administrative policy, to develop water under its approved applications and to deliver such water under a system of water-use fees, then the State would in fact be imposing fees for the use of water. This would be a different institutional arrangement from a hypothetical case in which the State Engineer would be authorized to impose fees on all unappropriated water, because the Board of Water Resources has made the initial step in the appropriation process by acquiring approved applications.

This merely suggests that, among the potential alternatives for imposition of water-use fees, are (1) selective imposition by authorizing a state agency to obtain from the State Engineer approved applications in areas where the public interest is most pronounced, or (2) authorizing or requiring the State Engineer to impose a statutory schedule of fees on all new water applications (and thus eliminating the traditional appropriation system of acquiring water rights).

IV. Summary: Constitutional Considerations

The foregoing discussion has explained in summary manner some of the legal implications of imposing water-use fees directly by the State. A considerable number of minor or tangential problems could be itemized, but problems of such a nature can be resolved when a program of water-use fees is defined with specificity and proposed for implementation. Of present interest are those problems of a major and substantive nature that cast serious clouds on the basic legality of any program to charge water-use fees. And they are the problems that are listed below.

As a preliminary matter, it must be observed that no appropriation State has present legislative authority to impose water-use fees. Therefore, legislation would have to be enacted before such a system could be implemented. Thus, there is little point in itemizing the numerous ways in which such a system would conflict with present statutory law. The salient question, then, has to do with the legal problems that relate to the constitutionality of any proposed legislation to authorize water-use fees by the State. The three most importnat constitutional problems are discussed below.

A. Guaranteed Right of Appropriation

Some appropriation States have constitutional provisions which declare, in substance, that the right to appropriate the waters of the State for beneficial use shall never be denied (see, e.g., Idaho Const., art. XV, sec. 3; Colo. Const., art. XVI, sec. 6). Since the appropriation process traditionally has been one of diverting unappropriated water from watercourses for beneficial use, without payment of water-use fee, the question arises as to whether the imposition water-use fees is so fundamentally in opposition to the concept of appropriation so as to be unconstitutional. If so, then, of course, the state legislature would be without power to authorize water-use fees.

Two observations are in order: (1) this constraint applies only to those States that have such constitutional limitations; and (2) the legal meaning and effect of such limitations, with respect to water-use fees, are open questions, and will remain so until definitively decided by the supreme courts of the States having such provisions. There is no federal question involved, and so the final answer for any particular State must come from the supreme court of that State.

B. Public Nature of Water

It is rather common for the constitutions of appropriation States to provide, in substance, that unappropriated water is the property of the public (see e.g., New Mexico Const., art. XVI; Wyo. Const., art. VIII, sec. 1). The basic concept here is that the State does not "own" water in the sense that it owns land, buildings, or automobiles, but that it merely administers and regulates use of the water resource for the benefit of the public.

A comparable example might be wild game, which is said to be owned by the public and is to be regulated and managed by the State for public use. Thus, the State does not "own" a deer in the forest, but it has the sole and exclusive authority to prescribe regulations for the management and hunting of deer. Of course, statutes require payment of a sort of "use fee" by the hunter who purchases the license. But these fees, in the main, are designed to cover the cost of managing, conserving, and administering the resource and the public use of it—much the same as the water application fees charged by the State Engineer are designed to cover his administrative costs in processing the application.

However, non-resident hunting and fishing license fees are higher than those paid by residents;

and it probably is true that big game license fees underwrite part of the cost of managing the fishery resource. By analogy, it might be said that water-use fees could be implemented at rates that would provide a surplus to underwrite other functions of state government.

In short, the question is an open question that would, again, have to be answered by the supreme court for each State having a constitutional provision declaring that unappropriated water is owned by the public.

C. Hydrostatic Pressure

Groundwater basins pose a separate problem with respect to hydrostatic pressure. As a general rule, an appropriation water right includes a right to the established means of diversion as well as to the amount of water actually diverted for beneficial use. With underground water rights, the pertinent question is whether the hydrostatic pressure in existence at the time that a particular right was acquired becomes a part of that right in that it is an essential feature of the means of diversion employed to obtain the water.

In other words, in some underground basins the early appropriators received sufficient water by artesian pressure, or were required to pump from very shallow depths. As more appropriators withdraw water from the basin, the hydrostatic pressure lowered, and greater pump lifts were required. This has created serious problems in determining whether the early appropriators can enjoin the later appropriators from any further withdrawal of the water from the basin, or whether they are entitled to compensation in an amount that will cover their increased cost of pumping from the greater depths.

The problem is aggravated, from a standpoint of efficiency of use, by higher-valued uses that can afford to pay higher pumping costs. Thus, if irrigation users acquired the early rights in an underground basin, but had not fully appropriated the water within the basin, it would be possible for industrial or municipal users to establish later rights because they would be able to sustain the cost of pumping from greater depths. If there is no protection with respect to the means of diversion (hydrostatic pressure), municipal and industrial users could thus drill new wells and pump water from a depth of, say, 1,000 feet, whereas irrigators could not afford such pumping costs. The water might still be in the basin for the irrigators, but at a depth which, to them, is too costly to obtain. Do they have a legal remedy?

This question is still an open question in most States. In Utah, for example, the Supreme Court has held, with respect to changes in existing underground water rights, that a user does not have an absolute guarantee to hydrostatic pressure, but must suffer some reasonable reduction in that pressure in order to assure maximum beneficial development of the underground basin; and indicated that each user must comply with this standard as a means of employing a reasonably efficient means of diversion (Wayman v. Murray City, 23 U.2d 97, 458, P.2d 861 (1969)).

With respect to a state system of charging water-use fees, it will be necessary to determine whether such fees for water withdrawn will have to be scaled to amounts sufficient to compensate prior users for increased pumping costs made necessary by reduced hydrostatic pressure, resulting from additional water withdrawn by the State for delivery under the water-use fee program. Again, this answer must come from the supreme court of each State that considers implementing a system of water-use fees.

V. Conclusion

Since this paper is designed as a general overview of the major legal implications that will arise from any system to impose water-use fees in appropriation States, the conclusions are tentative. While further legal research could refine the nature of the problems, and forecast with greater accuracy the probable resolution of the constitutional questions, it is likely that definitive answers to the problems set forth above can only be supplied by the supreme court of the particular State that desires to draft legislation to implement a program to charge water-use fees. When that time arises, then careful legal research would be necessary to assess the problems in light of the statutes and decisional law of the particular State.

APPENDIX F

GEOMETRIC AND ALGEBRAIC PROOFS OF EXCISE TAXES

INTRODUCTION

"Excise taxes" can be classified as two types. One type is the "unit tax" or the "straight levy." Under this type, each unit of a taxed commodity or base is taxed a specific amount. A second type, the "ad valorem tax" is calculated as a percentage of the selling price of the taxed item.

Most excise tax theory concerns itself with the effects of excise taxes upon monopolies, oligopolies, monopolistic competitors, and pure competition. Unless otherwise stated, all discussion of theory presented herein is in terms of partial-equilibrium analysis, since very little has or can be said about effects of excise taxes under dynamic-equilibrium. Three publications (Bishop, 1968; Musgrave, 1959; Taubman, 1965) develop the theory of excise taxes in various industries and discuss special cases found in the theory. The discussion which follows is based largely on these works. The economic analysis presented utilizes simplifying functions for ease of understanding. The use of linear functions facilitates not only the mathematical presentation of the theory but also an accompanying graphic analysis. A more rigorous analysis is presented in the articles just cited and can be referred to if the linear assumption is inappropriate.

Given a linear demand function of the form $p = a + bx$ and a supply function of the form $s = c + dx$ and the market equilibrium clearing condition $s = p$, it can be shown that if a unit tax of t is levied, the corresponding change in price (Δp) is given by the expression:

$$\Delta P = \frac{b}{b - (d)t}$$

If $d > o$ and $b < o$ as is the case in Figure F-1, price will go up less than the tax levied ($p_1 - p_0 < t$). This is accounted for by the upward sloping supply curve. As price rises, the quantity taken goes down and part of the tax increase is absorbed in lower production costs.

At this stage it is important to note several things: 1) if the industry is one of constant costs ($d = o$) then price goes up by the amount of the tax no matter what the demand conditions; 2) change in price is dependent only upon the slopes of the demand and supply functions and not their intercepts; and 3) the ratio of the price increase to the unit tax is equal to the ratio of the elasticity of demand over the sum of the elasticity of demand and supply. In mathematical notation:

$$\frac{\Delta p}{t} = \frac{p_1 - p_o}{t} = \frac{\epsilon}{\epsilon + \eta}$$

In the diagrammatic analysis, Figure F-1, initial equilibrium is at M_0 with output of Q_0 and price of P_0. A unit tax of BD is imposed and the new intersection of price net-of-tax and supply is at M_1. Q_1 units are produced and sold at a price of P_1.

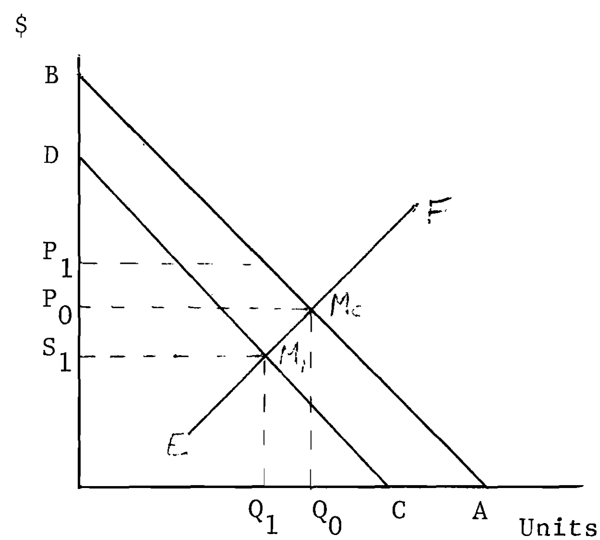

Figure F-1. Competitive Industry.

As shown in Figure F-3, an ad valorem tax can be represented by a downward rotation of the demand curve. If the industry is one of constant costs over the relevant range (d = o) it can be shown that the change in price is as follows:

$$\Delta p = \frac{cr}{1 - r}$$

and thus varies directly with the intercept of the supply function. It is useful to note that in general the price increase is dependent upon both the intercepts and the slopes of the supply and demand equations.

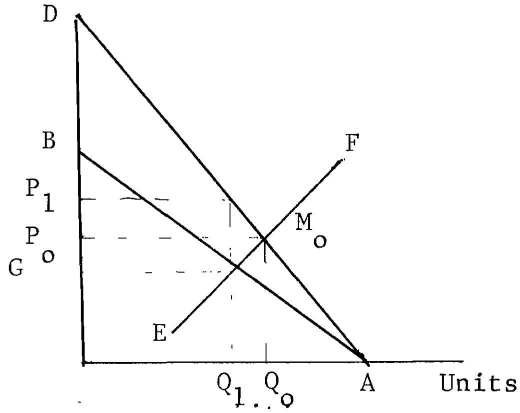

Figure F-3. Competitive Industry.

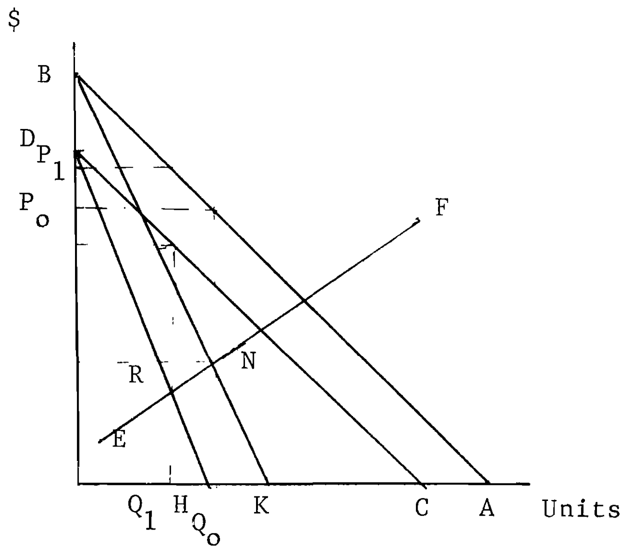

Figure F-2. Monopoly.

MONOPOLY

In the case of the monopoly, if we begin with the demand function p = a + bx and the cost function C = c + dx, and a unit tax of t is introduced, the change in price is as follows:

$$\Delta p = \frac{b}{2(b-d)t}$$

which is one-half the change under the competitive case (this is always true with linear functions since the marginal revenue curve has twice the slope of the average revenue curve). Again for the case of constant cost (d=O) we find that $\Delta_p = \frac{1}{2}t$.

In Figure F-2 the monopoly case is shown with initial demand curve AB, marginal revenue curve BK and cost curve of EF. Initial equilibrium is at N with Q_o being produced and sold at a price P_o. A unit tax of BD is now levied. The new demand curve becomes CD with marginal revenue curve DH. The new equilibrium is at R with Q_1 units produced and sold at a price P_1.

The ad valorem tax under monopoly is illustrated in Figure F-4. With linear cost and demand curves and an ad valorem tax rate r, and with constant cost (d = p) the price change will be:

$$\Delta p = 1/2 \left(\frac{cr}{1 - r}\right)$$

It will be noted that this again represents exactly half the price change noted under the unit tax. Figure F-4 is labeled as the other diagrams and its analysis is similar.

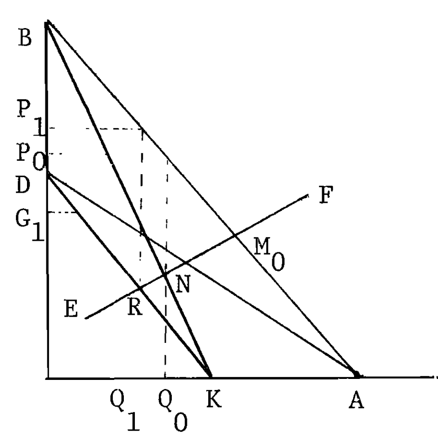

Figure F-4. Monopoly.

The case of monopolistic competition is much more difficult to analyze since the "industry" is comprised of many producers each faced with a highly elastic, yet downward sloping demand curve for their product. With free-entry and no externalities, the equilibrium position exists where the average revenue (of the group-demand schedule) equals the average unit cost of the individual firm. Musgrave (1959) points out that if a unit tax is now imposed, we will witness a contracting of output and perhaps even a slight exodus from the industry. Eventually prices will rise enough to allow those left to recover part of the previous decline. Prices will rise but in the case of monopolistic competition with its limited production differentiation, price rises will fluctuate from firm to firm. A more complete analysis of many of the issues involved with monopolistic competition is discussed in the classic work of Due (1942).

With oligopoly many alternative results are possible depending upon number of firms, shape of cost and revenue curves, and at what point on the curves equilibrium occurs. No attempt will be made to discuss the various alternatives here since they are discussed in some detail in Due (1942) and Sweezy (1939). However, one interesting phenomenon may occur under oligopoly which does not occur under any other market structure. This is illustrated in Figure F-5.

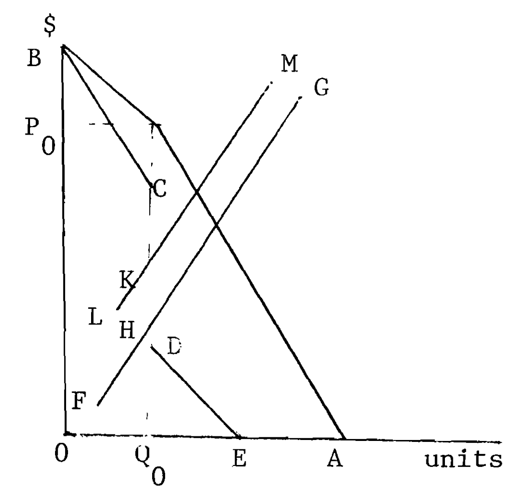

Figure F-5. Kinked demand.

The demand curve is the kinked line AB and the corresponding marginal revenue is represented by the broken line BCDE. The line FG is the oligopolist's marginal cost schedule. A unit tax is now imposed and is represented by an upward shift of the cost schedule to LM. A downward shift of demand curve AB would yield the same result. In this case, however, price remains constant at P_0, and there is no reduction of output. The entire tax is paid for out of the profit of the oligopolist.

Unit tax and ad valorem tax compared

Again using linear schedules it would be useful to compare the effect of a unit tax as compared to an ad valorem tax. How they are to be compared depends upon the purpose of the agent imposing the tax. If the purpose is to raise a certain amount of funds or restrict output to a given level we can compare them using Figure F-6 in the case of a competitive market.

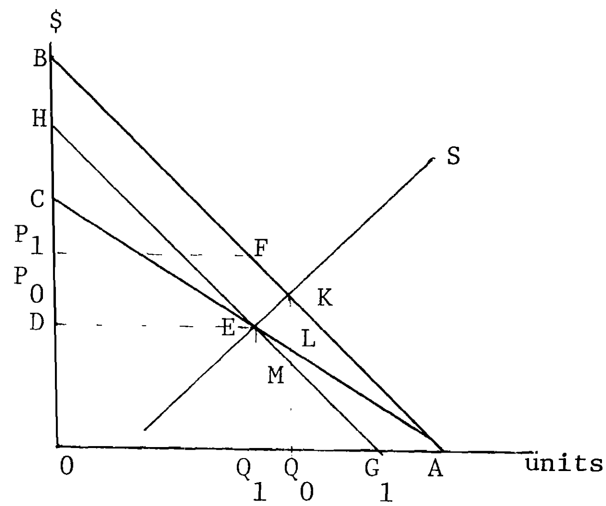

Figure F-6. Perfect competition equal yield.

Initial equilibrium without tax is at K. A unit tax is now levied if BH and new equilibrium is established at E with price P_1. Total tax yield is represented by $DEFP_1$. For an ad valorem tax to provide equal yield, the new after-tax demand curve must pass through E and is represented by the line CA. In either case price, quantity, and yield are the same; however, as we look at the initial position we see that the initial burden was not the same. At the initial price P_0, the unit tax equals MK but the ad valorem tax equals only LK. Since $LK < MK$ the initial burden is greater under the unit tax and an ad valorem tax would be better. If it is necessary or desirable to formulate a tax with equal initial burden, the opposite question may be asked: What is the result when an ad valorem and a unit tax of equal initial burden are levied? As is illustrated in Figure F-7, the ad valorem tax results in a higher price and a lower output. The total yield depends on the elasticities of demand and supply at the various quantities. If the goal of the controlling agency were to curtail consumption of the taxed product; however, the obvious choice would be the ad valorem tax.

In Figure F-8 we can compare the effect of an ad valorem and a unit tax which tax a monopoly in such a way as to generate the same final quantity and price. In equilibrium after the imposition of the tax, the price is P_1 and the quantity if Q_1. One important difference exists however, the total tax yield with the ad valorem

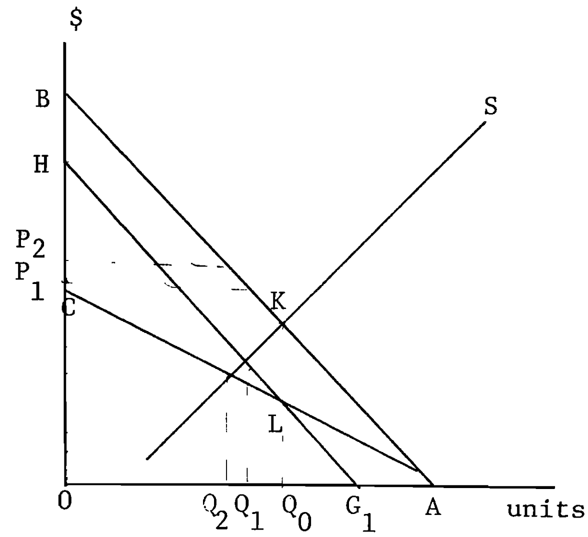

Figure F-7. Perfect competition equal initial burden.

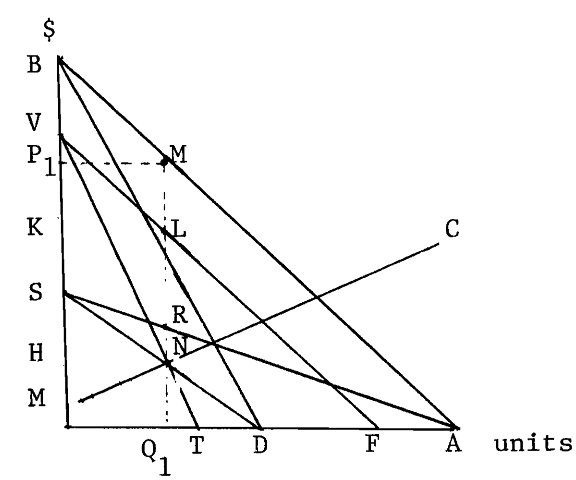

Figure F-8. Monopoly—equal final output and price.

tax is $HRMP_1$, while the unit tax yields only $KLMP_1$. From a revenue generating viewpoint, the ad valorem tax appears the more efficient. All of the above comments in some way depend upon the underlying shapes of the demand and cost (or supply) schedules.

TAX BASE

Several major problems arise with respect to the tax base. By base, in this instance, we mean the group of commodities to which the tax applies. Hatch (1964) indicates that many problems incurred in current excise tax structures could be corrected if administrators would see a broader base. That is, if a tax is to be imposed on recreational equipment as luxury items it would be better to levy the tax on all recreational equipment rather than a more narrow base, say boats only. Shoup (1964) further justifies this policy, arguing that supply of a narrowly defined commodity will be relatively inelastic while close substitutes will cause a relatively more elastic demand schedule. If the factors of production of the specific commodity are specialized, a narrow based tax can be shifted back almost entirely on the factors of production when the purpose is usually to tax the user (consumer) of the taxed item. A broader base alleviates, or at least reduces, the problem. The other problem related to base, relates to base defined not as the commodity to be taxed, but rather the group upon which the tax will fall. The problems are referred to by Due (1971) as the "border city" and "border state" problems. The essence of the problem in either case is that when a tax is levied in any particular state (city), the surrounding states (cities) may not follow suit. If the tax increase is substantial and the transportation costs are minimal or at least less in comparison, then we will see a substantial shift of purchases to the states (cities) taxing at a lower rate. Hamovitch (1966) found that when New York City raised its sales tax, the loss in sales was significantly more than the expected loss due to the substitution or income effects. However, in Alabama where there was little opportunity to substitute for untaxed items, there was no significant loss in sales beyond the income and substitution effects. These results would indicate that a federal excise tax would probably result in better tax control.

Another problem closely related to base is the definitions to be employed. For example, how much fur must a coat have before it is fur coat? In formulating a tax policy there is a tradeoff between the relative ease of defining under a narrow base, and the definitional difficulties of a broad base (but with its other tax advantages).

APPENDIX G
HOUSE BILL NO. 458

State of Washington
44th Regular Session

by Representatives Valle, Pardini and Thompson (by Executive request)

Read first time February 3, 1975, and referred to Committee on Ecology.

An Act Relating to fees for water permits; and adding new sections to chapter 90.03 RCW.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

NEW SECTION. Section 1. There is added to chapter 90.03 RCW a new section to read as follows:

The department of ecology may include, as a condition of approval of an application for a permit now or hereafter filed with department pursuant to RCW 90.03.250 or 90.44.060, any or all of the following in a permit issued pursuant to RCS 90.03.290 and 90.44.060:

1. A condition establishing a reasonable fee to be paid to the state for the use of public waters. In relation thereto:

   (a) The fee, which may be graduated based on increasing volumes of use, shall be set in accordance with general schedules of fees contained in rules adopted by the department;

   (b) No fee may be included as a permit condition prior to the adoption of rules as described in subsection (1) (a) of this section; and

   (c) The fee shall relate only to rights to divert or withdraw and make use of significant amounts of public waters for industrial, commercial, and agricultural irrigation purposes.

2. A condition establishing a date of termination of the permit and the authority embodied therein to divert or withdraw and make use of public waters. In relation therefore:

   (a) The date of termination shall be set in accordance with formulas contained in rules adopted by the department;

   (b) No date of termination of a permit may included prior to the adoption of rules as described in subseciton (2) (a) of this section;

   (c) In the development of rules and the determination of a term of a permit, consideration shall be given, among other factors, to the adequacy of the time period necessary for full development of the use related to the permit taking into account economic factors;

   (d) No permit shall have a term of less than ten years or more than fifty years from the date of issuance; and

   (e) The term shall relate only to rights to divert or withdraw and make use of significant amounts of public water for industrial, commercial, and agricultural irrigation uses.

3. A condition providing that the holder of a permit to withdraw or divert and make use of public waters for beneficial uses shall manage, formally dedicate, or otherwise provide, as the department shall determine in accordance with general rules adopted by the department, portions of the lands or improvements to which the right to use water generally relates so as to promote public interest and values. Public interest and values as used herein shall include, but not be limited to, recreational, scenic, aesthetic, wildlife, and fisheries interests and values. Whenever a condition of management or dedication of lands or improvements or other requirement as provided in this subsection is included in a permit, any fee included under authority of subsection (1) of this section shall be reduced in proportion to the value of the requirement or the former condition.

4. A condition limiting the size of lands to which a permit to withdraw or divert and make use of significant amounts of public waters for agricultural irrigation and other beneficial uses may apply. In relation thereto:

   (a) The limitation shall be set in accordance with formulas and criteria contained in rules adopted by the department; and

   (b) No limitation may be included as a permit condition prior to the adoption of such rules.

New Section. Sec. 2. There is added to chapter 90.03 RCW a new section to read as follows:

The fees paid to the state as provided in section 1 (1) of this 1975 act shall be divided and placed as follows:

1. Eighty percent in the water protection account of the general fund; and

2. Twenty percent in the water resources enforcement account of the general fund.

New Section. Sec. 3. There is added to chapter 90.03 RCW a new section to read as follows:

In relation to the conditioning of permits by terms as authorized under section 1 (2) of this 1975 act, the department shall, at the request of a permit holder, extend the permit as conditioned originally or with new conditions if the department determines that an extension is consistent with the public interest as determined through the application of criteria contained in rules established by the department.

New Section. Sec. 4. There is added to chapter 90.03 RCW a new section to read as follows:

There is established in the general fund the following revolving accounts:

1. The water protection account; the moneys of said accounts to be used by the department either by direct expenditures or through grant or loan or other arrangements to public entities, for the planning for, and acquisition, construction, and improvement of public waste disposal and water supply facilities, including agricultural, irrigation, and water distribution facilities, and land development facilities associated therewith.

2. The water law enforcement account; the moneys of said account to be used by the department to perform administrative and enforcement responsibilities arising under chapters 90.03, 90.14, 90.44, 90.48, and 90.54 RCW.