Department of the Interior, Bureau of Reclamation

IRRIGATION OPERATION AND MAINTENANCE

BULLETIN NO. 69

July, August, September 1969

In This Issue:

The Irrigation Operation and Maintenance bulletin is published quarterly, for the benefit of Irrigation project people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning labor-saving devices and less costly equipment and procedures, developed by resourceful project people, will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

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Division of Irrigation Operations
Office of Chief Engineer
Denver, Colorado 80225

COVER PHOTOGRAPH:

Watermaster for the Frenchtown Irrigation District, Montana, applying xylene to the Frenchtown canal for the control of pondweed and algae. Photo P222-D-50460NA

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INTRODUCTION

This issue of the Bulletin is devoted exclusively to weed control methods and equipment being used on some irrigation projects in the western part of the United States. The use of xylene for the suppression of submersed aquatic weeds in canals and laterals is the subject of an article starting on page 1. Included is a comparison of the cost of pondweed suppression with xylene and the chaining methods.

As a follow-up article to that appearing in Bulletin No. 64 on "Evaluation of Cost and Effecitveness of Canal and Lateral Aquatic Weed Control," the second article in this issue of the Bulletin beginning on page 9, describes the various types of equipment used for weed removal from Salt River Project canals in Arizona. Removal of pondweeds by this method is a necessary part of their operation.

Beginning on page 15, an article by Mr. R. F. Carter, of the Imperial Irrigation District, Imperial, California, describes the hydraulic spraying equipment used by the District that is so necessary in this particular environment on the project. The article describes a unit developed and field tested during the 1967 fall spraying season.

A mechanical trashrack developed and used on the Northport Canal, North Platte Project, Northport, Nebraska, is described and illustrated in an article that begins on page 19.

To prevent frequent shutdowns at the Burbank No. 3 Pumping Plant on the Columbia Basin Project, Ephrata, Washington, a supplemental trashrack was installed. The supplemental rack was built because of a heavy concentration of debris. This problem and the new trashrack are described in a short article on page 23.

On page 24, there is described a scraper for cleaning sediment and algae from canals that was developed and fabricated by the Metropolitan Water District of Los Angeles, California.

The purpose of a cooperative study to determine the fate of various herbicides in irrigation water is the subject of an article starting on page 25. This study is the result of routine herbicide applications made on irrigation systems.

THE USE OF XYLENE FOR THE SUPPRESSION OF SUBMERSED AQUATIC WEEDS IN CANALS AND LATERALS[1]

Over a period of more than 20 years the use of xylene has made it possible for some irrigation districts and canal companies in the Pacific Northwest to deliver adequate quantities of clean water to all farms on their projects. This was not the case when the districts relied on chaining and other methods to control these weeds. This program has been carried out without injury to man, livestock or crops. Only in rare cases of accidental spilling of treated water into natural streams has there been damage to fish.

While the greatest benefit from the use of this product has been in the districts being able to give uninterrupted service of adequate quantities of clean water to all farms, the saving in cost to the water users has been substantial.

Xylene Is Registered and Approved for Use in the Suppression of Pondweeds in Irrigation Systems

All herbicides used for the control of aquatic and terrestrial weeds must be registered by the Pesticide Regulation Division, Agricultural Research Service, U.S. Department of Agriculture. This registration of a product requires the approval of the Pure Food and Drug Administration, Sports Fisheries and Wildlife, National Pesticide Review Board, and others. The Pesticide Registration Committee is staffed with persons having broad experience and training in determining hazards connected with the use of chemicals.

As a prerequisite for registration of a particular herbicide, information and research data must be provided to convince the regulatory government agencies that the use made of the herbicide will not be injurious to man, crops, livestock, wildlife and our environment, and yet be effective on the target organism. Xylene is registered for use in the control of pondweeds in irrigation systems. This registration carries the approval of the departments and agencies mentioned above. Because of the broad use of xylene throughout the world as a pesticide solvent and carrier and because of its safe use on crops, we anticipate that any further consideration by regulatory agencies of its use in irrigation water will place it in an exempt status as far as tolerances are concerned.

Crops Not Injured with Xylene

Irrigation districts, canal companies, county and state governments, Indian Service and the Bureau of Reclamation apply xylene to more than

1/This article was reprinted from a report prepared by Mr. W. Dean Boyle, Regional Agronomist, Region 1, U.S. Bureau of Reclamation, Boise, Idaho, in response to an inquiry concerning the use of this product.

40,000 miles of canals, laterals and drains throughout the Pacific Northwest each irrigation season for the suppression of submersed aquatic weeds. This involves the use of approximately 800,000 gallons in more than 10,000 applications each season. This program was carried out during the irrigation season of 1968 without any report of injury to man, crops, livestock or wildlife.

The xylene is applied to the water in these irrigation channels at 4 to 10 gallons per cfs over periods of 30 to 45 minutes. It is nonmiscible with water and consequently can be dispersed in the water only with the help of an emulsifier. Over 20 years' experience together with extensive research shows that the treated water can be used safely for irrigation of crops. We estimate that 95 percent of the water containing xylene is used for the irrigation of crops. This includes irrigation by sprinklers, furrow, corrugation and flooding. If plants should be covered with the water containing xylene when the concentration is highest, there may be some burning of the plants. However, in most cases they recover quickly. Only small seedling plants are permanently injured or killed from such burning. Farmers avoid flooding such fields.

Crop Tolerance Supported by Research

The experience described above is supported by research conducted by the Agricultural Research Service2/ wherein typical crops were irrigated with water containing various concentrations of xylene. These studies showed that reductions in yields did not occur until concentrations were three times the maximum used by irrigation districts.

Livestock Not Injured with Xylene

Water containing xylene is not palatable and under normal conditions livestock will not drink water containing it. Since application is usually made over a period of 30 minutes, animals at a given location would be exposed to this dosage for considerably less than 1 hour. Accordingly, it is unlikely that animals would be forced to drink the treated water. Experiments were conducted at Utah State University in 1952 in which 32 guinea pigs were confined on water treated with xylene at concentrations of 400 to 800 ppm, the upper range being greater than that applied by irrigation districts. While they drank very little of the treated water during the first 2 days of the trial, on the third day of confinement they drank considerable quantities without visible ill effects.2/

To the extent to which guinea pigs are comparable to livestock, the results of these tests indicate that there is no hazard to livestock from drinking water treated with this material. In this experiment

2/USDA Circular 971, 1955.

the guinea pigs were confined to the treated water, whereas under normal conditions, livestock would have access to treated water for a matter of only minutes two or three times during an irrigation season.

The June 1957 issue of Hygienic Guide Series states that: "No fatal cases from inhalation of vapor consisting wholly or chiefly of xylene have been reported."

Xylene Suppresses but Will Not Kill Pondweeds

Photograph 1 - P222-D-50462NA

Photograph 2 - P222-D-50461NA

Because xylene affects only those portions of the pondweeds above ground, control is temporary. It is necessary to repeat treatment when new growth of the weeds begins to fill the channels. Two or more applications are required during each growing season. Canals and laterals which have been treated for more than 20 years show no reduction in number or size of pondweeds. Pondweeds have clogged this lateral as shown in Photograph 1. However, through the use of xylene the dense growth shown in the photograph could have been prevented. Submersed aquatic weeds are rooted, or attached, to the bottom of canals, laterals, or drains. They grow freely in water, buoyed by air cells in the leaves and stems. The Giant Sago pondweed, shown in Photograph 2, is 12 to 15 feet in length.

Xylene Does Not Remain in Water or Soil

Xylene, like gasoline and other related products, is volatile and evaporates when exposed to air. As pointed out, it can be retained in water for a short period only with the use of selected emulsifiers. Monitoring studies conducted by this office, Bureau of Reclamation laboratories in Denver, Colorado, and the Kennewick Irrigation District, show that 7-1/2 gallons of xylene per cfs (approximately 555 ppm) applied to a canal at two locations was almost completely lost to the air in 24 hours. Twenty-four hours after application, at the end of the channel 17 miles downstream, the water contained .3 ppm xylene. Farm fields which have been irrigated at least twice per season each year for 20 years with water containing xylene show no signs of an accumulation of xylene or any detrimental effects on crop production.

A letter dated January 17, 1969, from one of the leading oil companies in the United States stated that xylene is not retained in the soil. Following is a paragraph from that letter:

> "Should a xylene compounded as a carrier for toxicants or soil fumigants be injected into the soil, the manufacturer of such products normally insists on leaving the treated area untouched for a minimum of five to seven days. The xylene, however, will completely evaporate in 55 minutes at 80° F. No xylene is retained in the soil, if sufficient time for evaporation is provided."

Xylene Is Not Toxic to Soil Bacteria

The following paragraph is quoted from page 28, USDA Circular 971, dated 1955:

> "In connection with the crop-tolerance tests, Jones3/ analyzed soil samples taken from solvent-treated plots at Phoenix, Arizona, and Meridian, Idaho, to determine the possible toxicity of effluent to beneficial soil bacteria. The analyses showed that the activity of ammonifying and nitrifying bacteria in the soil was not affected by aromatic solvents, even at concentrations as high as 2,400 ppm, which were introduced over 30-minute periods. Apparently there is little danger of destroying beneficial soil bacteria through the use of aromatic solvents at rates which presently are recommended for aquatic weed control."

Xylene Characteristics Similar to Gasoline

Like gasoline, cleaning solvent and aromatic solvents, xylene is derived from petroleum oils. As much as 10 percent of "high test" or premium gasoline is xylene. Irrigation districts, canal companies, and governmental agencies handle xylene much in the same manner as they do gasoline.

3/Unpublished data from experiments conducted by L. W. Jones, Bacteriological Department, Utah Agricultural Experimental Station.

Circular No. 58, "Herbicides (How Poisonous are They?)," published by the University of Idaho in 1967, compares the toxicity of various herbicides when injested by small animals. In this comparison the herbicides are given numerical ratings: 1 - extremely toxic, 2 - very toxic, 3 - moderately toxic, and 4 - almost non-toxic. Aromatic solvents (xylene) and gasoline are both rated No. 3. Kerosene is rated No. 2 to 3.

Canals and Laterals Do Not Support Fisheries

The small number of fish found in these channels are there by accident. These channels carry water only 6 to 7 months each year during the growing season, being dry for the other 5 to 6 months. Consequently these waters cannot be used as fisheries. Fish that do enter the irrigation systems are doomed to perish at the end of the irrigation season.

Xylene Is Toxic to Fish. Water Containing Xylene Is Not Permitted to Enter Natural Streams

Xylene is toxic to fish; consequently, irrigation water containing xylene is not permitted to enter natural streams and rivers. As pointed out previously, water which has been treated with xylene is used for irrigation of crops and under most conditions any of the treated water remaining at the bottom of the fields after irrigation has lost the xylene to the air. In the few cases where xylene may remain in the water after irrigation, the water is wasted into holding ponds, or onto noncultivated areas. At the end boundary of some districts, waste water containing xylene can be spilled over drops causing extreme agitation and loss of xylene into the air.

Controlling Pondweed by Drying

During the period of early settlement in the West and until about 1930, water for irrigation was plentiful and the methods of irrigation and the type of crops grown tolerated interruptions in water deliveries. Drying of ditches 4 to 5 days for the control of pondweed was a common practice. The need for maintaining uniform moisture conditions associated with row crop farming and a greater demand for water have made the practice of drying unacceptable to most farmers.

Hand Mowing Pondweeds

During the period preceding 1950, it was not uncommon to find crews of three to six men engaged in cutting pondweeds in the shallower laterals and canals with scythes, as shown in Photograph 3 on the next page. The cut weeds, also shown on the following page in Photograph 4, were collected on trashracks and lifted from the streams. This very costly practice was repeated every 8 to 12 days depending on the severity of the weed infestation, water temperatures, and the demand for water.

Photograph 3 - P3-100-147

Photograph 4 - P3-100-148

Chaining (Dragging) Canals and Laterals

Since the beginning of irrigation in the West, men have tried and under some conditions must continue to remove pondweeds from canals and laterals by dragging these channels with chains, discs, binder wheels and other instruments. Although this method may be repeated every 10 to 15 days throughout the irrigation season, it generally is very ineffective. Only a fraction of the weeds are broken loose and regrowth is rapid. This practice requires collection and removal of large quantities of silt, broken pondweeds, and other debris loosened by the chains. Naturally, this condition interrupts or prevents water deliveries and irrigation. With the advent of sprinkler irrigation and the need for constant supplies of water free of debris, the practice of chaining and dragging was gradually abandoned by many irrigation districts and canal companies and replaced by the use of xylene and other herbicides. This has eliminated use of 1 or more chaining crews, each of which usually include 2 tractors, 2 pickup trucks, and 10 to 12 men. Some of the larger districts employed 2 or 3 crews of this size. One man, 1 truck, and a tank of xylene as shown in the cover photograph does a better job at only a fraction of the cost of chaining, and with the use of xylene it is possible to run the canals and laterals free of debris and with no interruption to the water supply.

Cost of Pondweed Suppression with Xylene Versus Chaining

Submersed aquatic weeds in irrigation systems are suppressed with xylene at only a fraction of the cost of attempted control through mechanical methods such as chaining. The term "attempted control" is used because none of the mechanical methods used were really effective. At best, only a small portion of the weeds were broken loose by the chain or disc. The remainder were only pushed into the mud on the stream bottom where they continued to grow.

Mr. Russell Unrue, Manager of the Bitter Root Irrigation District, Hamilton, Montana, reports that mechanical methods of controlling pondweed would increase the cost of pondweed control 450 percent as compared to present costs of controlling these weeds with xylene. The following paragraph is quoted from Mr. Unrue:

> "Our cost for pondweed control requiring one treatment for 1968 was $1,326 for xylene, emulsifier, labor and equipment for treating approximately 32 miles of canal, delivering 195 cfs for 8,000 acres of irrigable land. The cost for controlling the pondweed in the same canal area by hand labor and chaining operation would be $5,500 to $6,000 and irrigation water turned off for 15 to 20 days or more if sufficient labor is not available at the proper time."

In a paper given at Preston, Idaho, in 1969, Mr. Carroll Wilcomb, Civil Engineer, Bureau of Reclamation, Salt Lake City, reviewed his and his successor's experience in the control of aquatic weeds in canals and laterals operated by the North Side Canal Company, Jerome, Idaho. The following is quoted from Mr. Wilcomb's paper:

> "In 1966 the North Side Canal Company discontinued chain mossing altogether in favor of chemicals. The company presently uses around 20,000 gallons of xylene and 2,600 gallons of acrolein.

Total annual cost in 1968, including material, equipment, labor and overhead was about $25,000 or less than half our mechanical operation in 1955. The cost saving is even greater because of the substantial increase in operating costs since that time."

Through pool purchasing by a number of projects in an area, the cost of xylene and emulsifier per gallon used in the suppression of pondweeds has been reduced 15 percent in the past 10 years. Accordingly, the cost of pondweed suppression with xylene as compared with the cost of chaining if practiced at this time would be much less.

* * * * *

Driving attitudes can contribute to accidents. The following list is excerpted from the National Safety Newsletter as a reminder to drivers. Keep your calm and don't let these attitudes develop:

The "me-first" attitude. Shows lack of concern for others.

The self-important. Rules apply to the other fellow.

The over-confident. I know it all. I never had an accident.

The "live dangerously" type. It can't happen to me.

The fatalist. You go when your number is up.

The hostile type. Constantly angry towards others.

The inferiority type. Please don't push me around!

The competitor. Must always be ahead of the other fellow.

The "tired of living." A need of self-destruction.

The exhibitionist. A show-off.

The sadist. Derives pleasure from hurting or threatening.

The self-righteous. It is always the other fellow's fault.

It is easy to see that the attitude of one person could very well determine his classification as a good driver.

* * * * *

WEED CONTROL AND REMOVAL EQUIPMENT[1/]

Gang Discs and Chain

Gang discs, dragging a loop ot heavy-duty anchor chain, have been found highly successful where mechanical methods are desirable in dislodging aquatic weeds in the Salt River Project canal system. The discs tear up the soil and loosen weeds. Then the chain drags out weeds by the roots and smooths the disced canal bottom.

Two medium duty tractors, one on each side of the canal, pull the equipment upstream and down along the canal bottom to tear out the equatic plants. Figure 1 below shows the gang of heavy discs on the canal bank prior to beginning a weed removal job. Figure 2 on the following page shows how the water is churned up by the discs and anchor chain during the weed removal operation. Up to five or six passes are made in a single treatment.

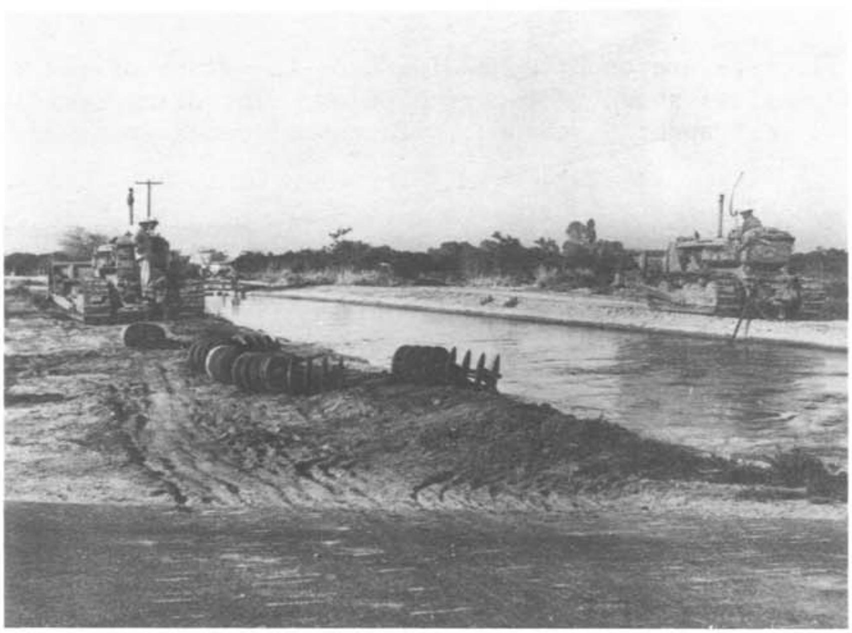


Figure 1 - Photo P25-D-64723

1/This article was written by Mr. W. L. Simser, Superintendent, Construction and Maintenance and Agriculture, Salt River Project, Phoenix, Arizona.

Figure 2 - Photo P25-D-64724D

From 5 to 11 discs are used, depending upon the width of the canal. A single disc unit is shown in Figure 3 below. The discs cost about $350 per unit and last about 3 seasons, with normal replacement and repair of various parts.

Figure 3 - Photo P25-D-64725D

The heavy-duty anchor chain which the project obtained from a salvage yard some years ago, is about 90 feet long, with links weighing 90 pounds each. As the chain wears, the project machine shop rebuilds the metal on each link to retain the necessary weight. The chain also is equipped with three large swivels to permit it to roll without twisting the cable leads.

Portable Trashracks

The dislodged growth floats downstream and is trapped by barriers of pipe grids, Figure 4, temporarily set up at various structures

Figure 4 - Photo P25-D-64726D

along the canal. The temporary trashracks or portable pipe grids for catching the dislodged weeds are 8 to 15 feet long, with a maximum width of 8 feet, so they may be legally hauled along highways. The trashrack is composed of two header bars constructed from 2-inch galvanized pipe as shown in Figure 5, with a hole drilled through one wall of the headers on 5-inch centers. One-inch galvanized pipe is inserted into the holes drilled in each header, then fastened with two each 1/2- by 1/4-inch galvanized bolts. In this way, the 1-inch pipes can be easily replaced, if damaged.

Figure 5 - Photo P25-D-64727D

A mobile crane, as shown in Figure 6 below, is used to set the grids in place against various canal structures or bridges. They are positioned in the water at an approximate 45-degree angle, as shown in Figure 7. Note that the grid is being set into the notches or scallops on the lip of the structure. This holds the grid snugly and resists shifting during the raking operation.

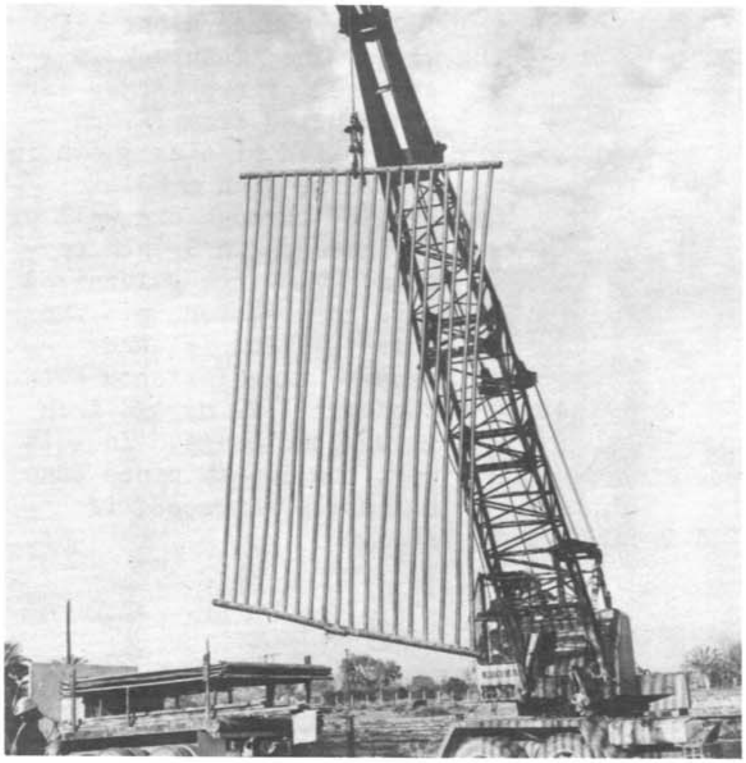


Figure 6
Photo
P25-D-64728D

Figure 7
Photo
P25-D-64729

Figure 8 - Photo P25-D-64730D

Figure 9 - Photo P25-D-64731D

Figure 8, at left is a view of the grid set into the scallops on the lip of the structure, and also it shows workmen securing the grid to the structure chain. Individual 1-inch-diameter pipes are laid in a similar manner near the sides of the canal as shown previously in Figure 4, to fill in the gaps created by the slope of the canal banks. Average cost of the grids is $150 each. They last about two seasons, with normal maintenance.

Weed Bucket

As the dislodged growth floats downstream and begins to lodge against the grids, it is removed by the bucket shown in Figure 9, that was designed and built for this purpose by the project. The bucket is lowered in such a position to permit the bucket teeth to pass between the grid pipes. It is then raised, removing the accumulated growth to the canal bank for partial drying before the weeds are hauled away.

If the crane can be set up directly behind the grids, they can be cleaned by dropping the bucket upstream and pulling it up against them. If it is necessary to work from the side, the bucket has to be lowered carefully on the grids and then pulled upstream and to the side for removal of the growth. This latter procedure requires operating skill to avoid damage to the grids.

Transportation of Equipment

A flatbed truck is used to haul the discs, chains, and grids from station to station on the canals. The discs, chains, and bucket are carried on the bed, while the grids are cradled in a rack built over the bed. Figure 10 below shows a typical flatbed truck used for this purpose. The equipment is offloaded by the same mobile crane which is used to position and clean the grids.

Figure 10 - Photo P25-D-64732D

Costs

The described process, which costs about $170 per mile, is repeated from station to station on the canals during the growing season to maintain full canal capacity.

Anyone seeking additional information should contact the writer at the Salt River Project, Post Office Box 1980, Phoenix, Arizona 85001.

* * * * *

HYDRAULICALLY OPERATED SPRAY RIG FOR WEED CONTROL1/

A combination of fertile soils, water and a year-around growing season have provided the essential ingredients for the thriving agricultural economy of Southern California's Imperial Valley. These same elements, however, also result in an undesirable by-product - weeds of unexcelled luxuriance and stamina.

Through the years Imperial Irrigation District, which operates over 3,000 miles of main canals, laterals, and drains, serving in excess of 500,000 acres of irrigated farmland, has run the gamut in methods of weed control. From the early-day use of labor gangs equipped with shovels, brush axes, and machetes, through the period of extensive use of weed burners, the District has progressed to the present-day method of chemical weed control, employing relatively sophisticated machines for the application of various liquid herbicide mixtures.

Nearly one-half million dollars is expended annually by the District in its weed control program. Such a sizeable expenditure, coupled with the rather extensive area to be covered, demands close attention to efficiency and economy of operation as well as to its overall effectiveness. The District's management team has concluded that the continued spiraling of labor and equipment costs makes it imperative that time-saving innovations be employed.

Imperial Irrigation District, also being in the power generation, transmission and distribution business, utilizes a fleet of line trucks equipped with personnel booms. It was only natural that someone would eventually ask as to why couldn't an adaptation of these hydraulically operated units be used effectively to support a spray bar, as well as put an operator out over his work?

One such unit was developed in the headquarters shops of the District, and field tested during the 1967 fall spraying season. Photograph 1 on the following page shows a full view of the new hydraulic-operated spray truck. The advantages of the automated boom and chemical-flow control were readily apparent. It appeared, however, that by relieving the boom of the weight of the operator and personnel basket, the boom could be lengthened from 20 to 25 feet, plus the addition of a pair of movable spray arms mounted at the end of the boom. These and other refinements were incorporated in a hydraulically operated articulated aerial boom spray rig fabricated at Imperial in the spring of 1968 and placed in service during the summer spraying period.

It will be noted in Photograph 2 also on the following page that the operator sits at a control panel mounted on the swinging pedestal of

1/This article was written and presented for inclusion in this bulletin by Mr. R. F. Carter, General Manager, Imperial Irrigation District, Imperial, California 92251. Inquiries for further information should be directed to Mr. Carter.

Photograph 1 - P214-D-64740D

Photograph 2 - P214-D-64741D

the boom, affording him a full view of his work. The main boom has a 360-degree horizontal swing with a vertical movement of 45 degrees below the horizontal. The two spray arms attached at the end of the boom are hydraulically operated from the control panel and each is capable of a 180-degree horizontal swing and a 90-degree up-and-down movement. This allows positioning of the spray pattern to conform to any normal drain section or canal side slope and berm. Each spray arm is equipped with six nozzles, operated in groups of three by valves operated from the control panel.

Other noteworthy features include the jet-agitated 1,800-gallon tank capable of being filled in 6 minutes, with the 3-inch centrifugal pump using a power takeoff from the truck transmission. Photograph 3 below shows a front view of the spray truck with the liquid herbicide tank clearly visible. One auxiliary gasoline engine powers the spray pump and the hydraulic pump for the boom operation.

The three-axle, 6 by 4 truck is mounted on high-flotation super single tires which will permit it to operate over most canal and drain bank roads under normal conditions.

The total cost of the rig was approximately $19,000, including $10,500 for the truck and $3,500 for the bare boom and pedestal.

The subject machine, along with its immediate prototype developed in 1967, has convinced District personnel that they are on the right track

Photograph 3 - P214-D-64742D

and as each unit of the present fleet of manually operated, swing-boom rigs is phased out it will be replaced by hydraulically operated equipment similar to that described on these pages. Specific nomencalture of the various components of this new rig is listed below:

Truck Specifications

1. Manufactured cab and chassis
2. 39,000 gross vehicle weight
3. Three-axle, 6 x 4
4. V-6 cylinders, 400.9 cubic inches
5. Wheelbase 157 inches with C.A. 84 inches
6. Transmission 5-speed
7. Auxiliary transmission 4-speed
8. Tires 15 - 22.5
9. Minimum speed of 1.5 mph at 1,600 rpm
10. Rear axle heavy duty
11. Addition to rear frame - 16 feet from cab to end of frame
12. Section modulus increased

Tank

1. Shop-built 1,800-gallon tank with baffle

Suction Pump

1. Centrifugal 3 by 3 inches
2. Power takeoff from transmission
3. Tank fills in approximately 6 minutes

Boom

1. With hydraulic control pedestal
2. Two 10-foot 5-inch hydraulic-operated with vertical and horizontal motion
3. Hydraulic controls mounted on boom

Auxiliary Engine

1. Engine rated at 25 hp at 2,400 rpm
2. Engine powers both the spray pump and the hydraulic pump
3. Hydraulic pump rated at 1,200 rpm giving 6-1/2 gpm with a 9-1/2 hp output from engine. Spray pump at 2,400 rpm with maximum 360 gpm using 11 hp from engine

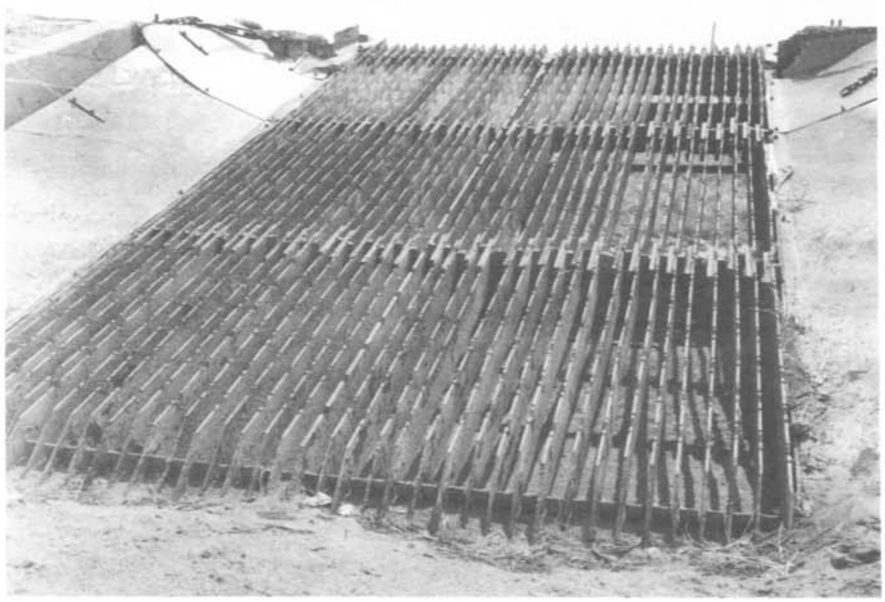
Spray Booms

1. Two 1-inch id by 10-foot 5-inch hydraulically operated booms with six nozzles per boom, producing 3.4 gpm at 30 psi.

* * * * *

This mechanical trashrack used on the Northport Canal, North Platte Project, Northport, Nebraska, is a product of 4 years of experimentation and improvement. Most of the construction and alterations that were necessary for the efficient operation of this device were done by Mr. N. E. Troudt of the Northport Irrigation District, Northport, Nebraska.

It is basically a very simple mechanical device that is reported to operate most efficiently. Photograph 1 below is a view of the trashrack looking up at it from the lower section. The trash moves up the rack and falls on to the conveyor belt which moves it to a depression on the right side of the 60 cfs canal where it has been installed at a drop structure. Photograph 2 at the top of next page shows the eccentrics or camshaft detail. A full view of the mechanical trashrack installation is shown in Photograph 3. Photograph 4 on page 21 looking upstream shows the trashrack as it fits into the drop structure.



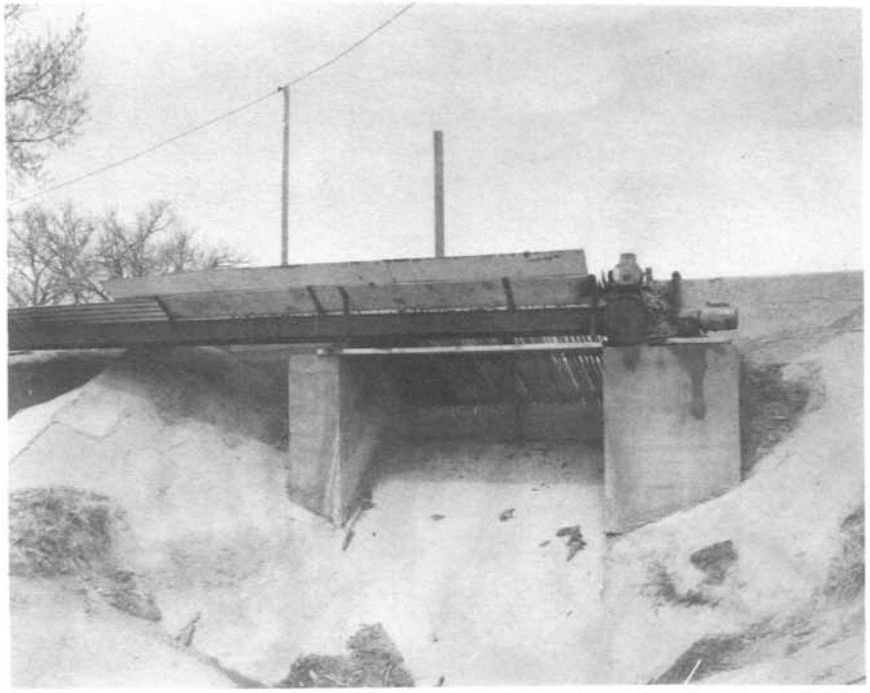
Photograph 1 - P20-703-5845NA

Trashrack Construction

The device is made of a 2-inch steel shaft that has eccentrics or cams keyed to the shaft. These raise and lower alternate steel bars or walkers approximately 2 inches with each stroke. The walkers are made

Photograph 2 - P20-703-5912NA

Photograph 3 - P20-D-64743D



Photograph 4 - P20-703-5840NA

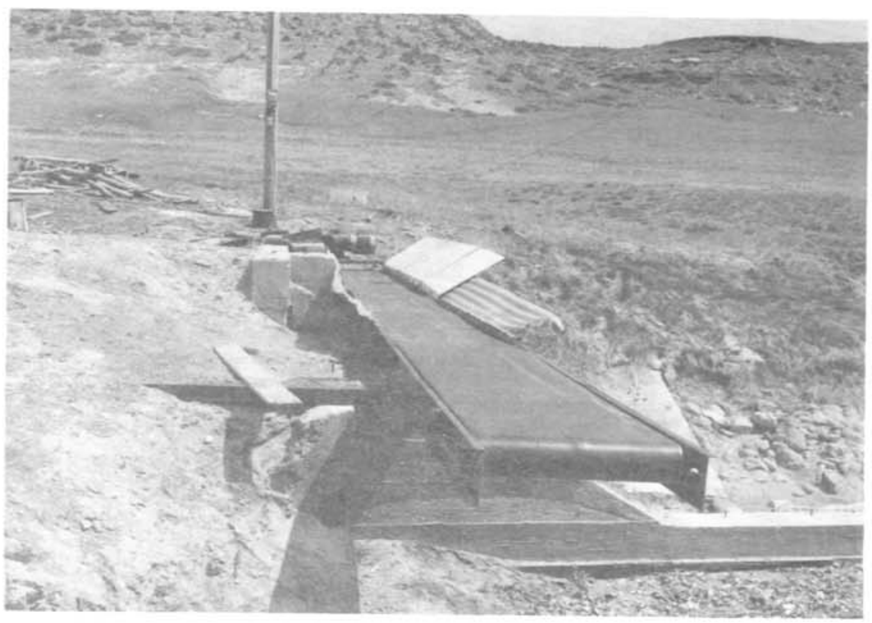
of 3/8-inch steel, 4 inches wide. Each walker is notched at intervals of about 8 inches and has several weld spots to further roughen the top surface and aid in the upward movement of the trash, as shown in Photograph 5 on the next page. The walkers are spaced 1-3/4 inches apart.

A piece of 3/8-inch steel is used on each side of the walker to eliminate lateral movement and also to give a closer fit as the walkers slide in the groove on the eccentric. It was found that better results were obtained if the bearing surface was bronzed at the bottom of the walker where it makes contact with the eccentric. The shaft makes 42 revolutions per minute and is powered electrically with a 1-1/2-horsepower motor. The walker-eccentric contact surface is greased once a day and it was discovered that wheel bearing grease gives the best results.

The Belt Conveyor

The view of the conveyor belt also is shown in Photograph 6 at the bottom of the next page. This particular conveyor belt is 60 feet long and 2 feet wide and also is powered electrically by a 3/4-horsepower motor. The smooth type belt does not move the lighter weight weeds as well as it should. A rough surfaced belt 3 feet wide is recommended. It is believed that the added width is needed to handle longer logs and large objects.

Photograph 5 - P20-703-5844NA



Photograph 6 - P20-703-5842NA

There are no plans of the trashrack available, as it was built and altered as ideas and problems arose. However, if further information is desired, it can be obtained by writing to the Northport Irrigation District, Post Office Box 547, Bridgeport, Nebraska 69336.

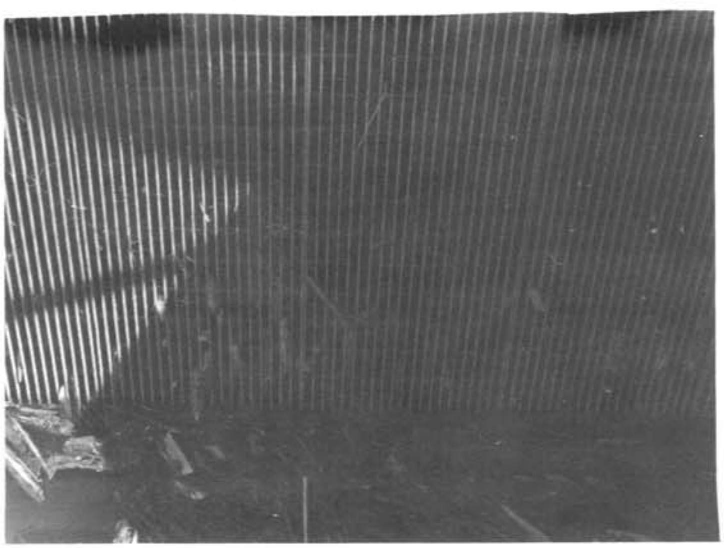
* * * * *

PUMPING PLANT TRASHRACK

A heavy concentration of debris on the trashrack at the Burbank No. 3 Pumping Plant, Columbia Basin Project, Ephrata, Washington, was continually interferring with the flow of water to the pump, causing frequent shutdown at the plant.

In order to eliminate this problem another trashrack as shown in Photograph 1 was constructed approximately 6 feet in front of the original rack.

Photograph 1 - P222-D-64738D



Photograph 2 - P222-D-64739D

Photograph 2 at lower left shows the original trashrack that was built with a 1-7/8-inch spacing on a 1 to 3 slope. The supplemental trashrack with a trash bar spacing of 3 inches, made from 1/2- by 2-1/2-inch steel bars, restricts the larger material to the forebay where it can be removed easily.

The new rack has a much flatter slope which makes it possible to clean both racks at less frequent intervals. This has been made possible because of the heavier driftwood and other large debris being caught by the auxiliary trashrack.

Project field personnel fabricated this new rack and a platform was made from surplus landing mats in which the debris can be piled for removal.

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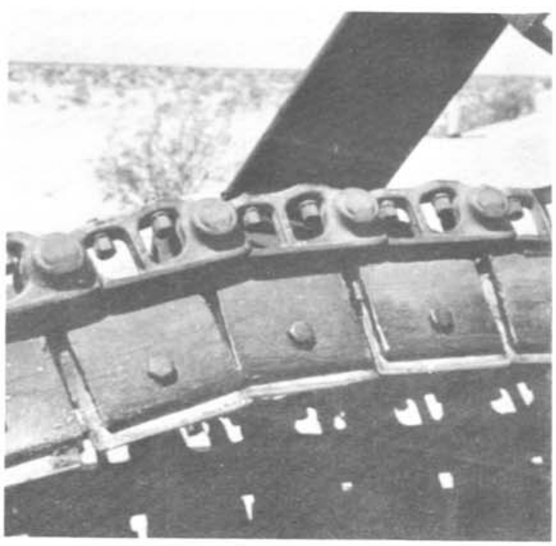
SCRAPER FOR CLEANING CANALS1/

A unique scraper for cleaning sediment and algae from the concrete lining of a canal is used by the Metropolitan Water District of Los Angeles, California. The scraper was developed by the District and consists of an old track from a tractor on which scraper blades have been mounted.

Photograph 1 - P214-D-64736D



Photograph 2 - P214-D-64737D

The scraper blades are about 6 to 8 inches long and are bolted to the tractor tracks, which makes an articulated section. The length is about 6 feet and it is supported on a bar to which it is attached at three points; at both ends and the middle. A sling attached to this bar is then pulled from the crane. Special sheaves at the end of the boom were developed to make this job possible.

Photograph 1 shows the articulated scraper. The frame supports the track at both ends and the center. The sling is attached to the frame. Photograph 2 is a closeup view of the scraper and the hard metal pieces bolted to the track.

Two 25-ton rubber-tire-mounted truck cranes are used continuously to clean the canal linings in the District. The truck cranes drive along the operating roads, which are on both sides of the canal, and drag this particular piece of equipment along the canal lining to remove the sediment and algae.

It takes six passes to clean one reach of canal; two passes for the bottom and two for each of the sides. The passes can be made from either side of the canal.

1/Taken in part from a field trip report by J. K. Shankland, H. E. Pelham, and T. L. Steel of the Office of Chief Engineer, dated June 11, 1969.

HERBICIDE MONITORING STUDY IN IRRIGATION SYSTEMS

Herbicide Residues

A 3-year herbicide monitoring program in cooperation with the Federal Water Pollution Control Administration is in progress by the Bureau of Reclamation to determine the fate of herbicides used on irrigation systems. The program is part of a nationwide study in which the Bureau is participating. Data obtained from the study will be used to support national registration of commonly used herbicides.

Under the Department of Agriculture's compulsory registration program for herbicides used in or near irrigation systems, evidence must be submitted demonstrating that a herbicide can be used to prescribed concentrations without injury to man, wildlife, livestock, or crops before that particular herbicide can be approved. Some herbicides have now been in common use for as long as 20 years with very little documentation having been obtained as to the residues of the herbicides. The purpose of the study is to obtain such documentation.

The Columbia Basin Project in the State of Washington was selected for the field phase of the study because of its broad system of canals, laterals, and drains of various sizes, lengths, and conditions, and the availability of personnel experienced in water monitoring procedures and needs. The program is closely coordinated with the Quincy, East, and South Columbia Basin Irrigation Districts, which actually carry out the weed control operations on the Project.

Technical guidance is provided by the Chief Engineer's Office of the Bureau of Reclamation in Denver, Colorado. The field segment of the work consists of a number of operations required in the program. Some of these include the planning of canal sampling and coordination of it with district personnel making the herbicide application, tracing the movement of water subjected to herbicide application through the use of dyes, collecting water samples periodically at a number of stations along the canal, recording data on all parameters involved, performing the initial steps in the extraction of the herbicide from the irrigation water, and the preparation of samples for shipment to Denver.

The laboratory and data analysis phase of the work are performed in the Research Division, Office of Chief Engineer, as a part of the Bureau's cooperative weed control research program with the Agricultural Research Service of the U.S. Department of Agriculture, Denver, Colorado.

The Study

Since the amine salt of 2,4-dichlorophenoxyacetic acid (2,4-D) is used extensively on irrigation systems of the western states for controlling broad leaved weeds on ditchbanks and it is not registered specifically for use on this type area, top priority is given to this herbicide in the first year of the study. Other herbicides will be monitored as the program develops.

This entire monitoring program follows procedures reviewed and tentatively approved by the Interagency Ad Hoc Committee on Use of Herbicides in Aquatic Sites. The first steps of the analysis are performed in a laboratory on the Columbia Basin Project. Extractions reduce the volume of liquid for shipping from 1 quart to a few ounces and leaves the 2,4-D in a liquid medium resistant to biological activity. On arrival in Denver the samples of extracts are processed and analyzed for 2,4-D content with the gas chromatograph. The data are transferred to punch cards, and an automatic data processing program is used to process these data for future reports and other purposes.

A total of five channels have been sampled. These are selected at random throughout the project to obtain a cross sectional representation of the variability in water conveyance channels and herbicide applicators.

Throughout the sampling program, agronomists will identify and appraise both aquatic and terrestrial vegetation in the sampling areas so that the effect of herbicides at the different sites can be evaluated. Some of the things that are expected to be learned from the study are the extent of dilution of particular herbicides as they move through the irrigation system, the degree of absorption in soils or plant life which takes place, and the amount of loss through evaporation.

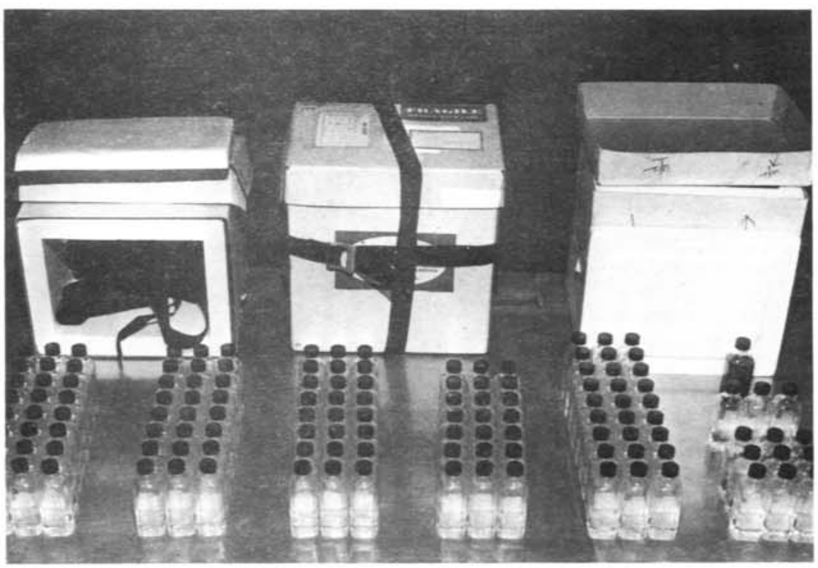
A typical example of collecting a set of three replicated water samples from a canal on the project is illustrated in Photograph 1 at left, and, on the next page, Photograph 2 depicts the manner in which three 1-quart glass bottles are positioned on the sampler so that the three replicates are collected at the same time. Water samples collected are kept under refrigeration until the following day when they are extracted. The extracts are stored under refrigeration in 4-ounce glass bottles fitted with teflon-lined caps until ready for shipping. The bottles

Photograph 1 - P222-D-64735D

Photograph 2 - P222-D-64733D

are packed in sytrofoam containers and shipped to Denver. Samples are in route less than 24 hours by this mode of transportation. On arrival in Denver the samples are unpacked, Photograph 3 below, and stored under refrigeration until the analytical procedures are commenced. The number of samples collected from each canal and included in each shipment may vary from 100 to 150 depending on the number of sampling stations employed which varies with length of the canal.

The analysis of samples from the first two collections are nearly completed but the 2,4-D chromatograms have not been processed. Very low concentrations of 2,4-D are found in most of the samples analyzed.



Photograph 3 - P222-D-64734D

It is planned that this study be continued through 1971. Different herbicides will be monitored during this period. Herbicides selected for future study will be based on the need for this type of information to support their continued use.

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