# Practical Suggestions For A Large Scale Aquatic Weed Control Project

WILLIAM E. WUNDERLICH

*Chief, Aquatic Growth Control Section*

*U. S. Army Engineer District*

*New Orleans, Louisiana*

## FOREWORD

Many hours have been spent at past conferences describing the startling developments of the various research teams and weighing the relative merits of the many herbicides available to us. It is considered appropriate at this time to make some practical suggestions concerning the application of these wonder chemicals on the aquatic vegetation found in the streams of our country.

While laboratory studies are essential and furnish the leads upon which the applicator must depend, it should be realized from the practical viewpoint that the average field worker is not equipped to duplicate this work in the field. They are usually not equipped to measure and dispense the selected herbicide in the same delicately controlled manner envisioned by the technically minded research worker. This highly trained person often becomes enthused with what he has found in his test tubes and growth jars and devises a means of control entirely beyond the capabilities of the field worker. It will probably come as a surprise to the laboratory worker when he hears this. So, to be practical, the laboratory technician must keep his treatment techniques at a level that can be duplicated by the average worker.

Therefore, some time should be given to the discussion of practical field techniques which have been found to be most effective over the years regardless of the chemical being applied at the particular time.

## PLANNING

It is important that the applicator have an adequate knowledge of the overall problems before he starts the work. He should know what vegetation is involved, its general growing habits and its reaction to the herbicide selected for the work. It is extremely important in planning a large scale operation to know the geography of the area and the size, location and importance of all feeder areas with respect to the waterway being cleaned. Based on such knowledge, good operating plans can be completed in advance and followed without confusion to a successful end. It is also considered important that the plans be made by an experienced applicator who knows the problem intimately and understands the limitations of his men and equipment.

Too often, plans made by office personnel and cost experts are successful only when the letter-perfect plan can be applied under ideal conditions to an exceptional stand of vegetation which has not changed between original survey and actual start of operations. The person charged with the actual application should have considerable leeway to change the original plan and should be the final authority on the details of the field work. If you do not have such a competent employee in your organization, it would be wise to exert every effort to find one.

Generally, the plan should include opening the main waterway as rapidly as possible in the public interest. Work

should start in the upper limits of the waterway and proceed downstream wherever possible. Plants which are dislodged and drift away untreated can be sprayed at another time as the work progresses downstream and they are found again at temporary anchor. Trying to treat every plant in the waterway as it drifts by the scene of operations is time consuming and not very effective. Follow-up operations to treat areas which might have been missed in the initial treatment should follow closely on the completion of the first phase of the operation and before attention is shifted to another area.

Attention should be given immediately to the control and destruction of vegetation in the principal feeder areas as soon as the work in the main waterway has been completed. There are those who would limit the work in an area to only those streams that have some commercial value and this can cause prolonged trouble. It is necessary to give some consideration to the overall number of streams and principal waterways that would remain open with little or no attention for long periods if the main feeder streams were cleaned regardless of their present commercial value. In planning a large scale operation, the whole area should be considered rather than the individual streams in the area.

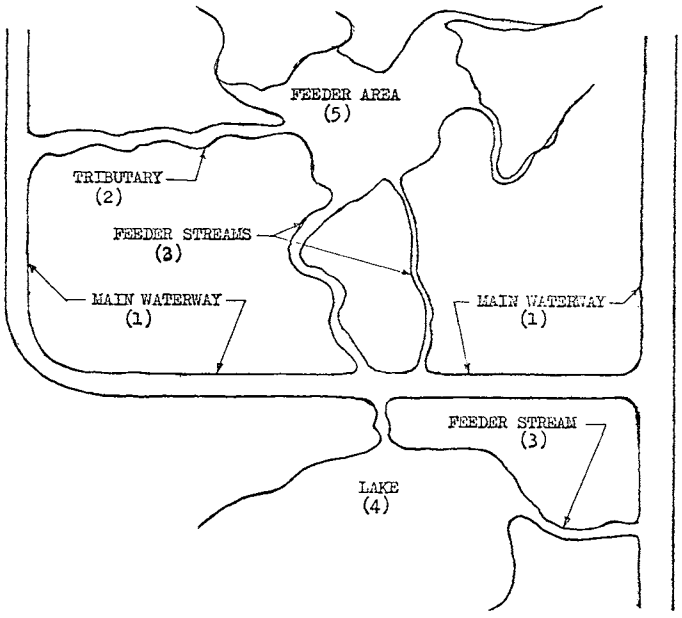



Figure 1. Planning a large scale operation.

1. Operations were conducted first in the main waterways to open them for immediate use.
2. Vegetation in the principal tributary was destroyed next.
3. The operations were then shifted gradually to the feeder streams and the amount of vegetation reaching the main waterways was reduced and controlled.
4. Fringes in the lake were controlled and later destroyed.
5. Operations were then shifted to the main feeder area. Work was concentrated in this area and less work had to be done in the other waterways.

The practice of cleaning the main streams and then shifting to the feeder areas has been used with considerable success in Louisiana. In some parts of the state no work is done in the main streams and all efforts are centered in the back-country feeder streams where the work can be handled at the convenience of the applicator and with no great danger from the drifting of chemicals.

While conducting the spray operations in a stream, it is very important that every effort be made to cover all of the vegetation in the waterway. This is particularly so when it is known that the vegetation reproduces from seed. This reduces the possibility of reinfestation to a minimum and increases the intervals between operations. Spraying just a strip on the outer edges of the growth and then waiting for it to die and sink before renewing the work gives the untreated, inshore plants an opportunity to mature and deposit more seed for the next crop.

## SPRAYBOATS

No one type of boat can be considered as suitable for all aquatic vegetation control operations and care should be exercised in selecting the boat for the job. One should not be influenced by the glamour and thrill of a 40 MPH ride to and from the job only to find that the boat cannot be controlled at the slow speeds which are so essential for good spray operations. Nor should one select a boat that is so slow it requires too much time getting to and from the job site. All types of boats are used in Louisiana including a rolling dolly and amphibious tractor. Each is especially suited for a particular job and the selection of the type of floating plant to be used is governed by the conditions found on the job.

When the large sprayboats are too slow to travel back and forth on the job each day, they are secured at night on the job site and the crews use smaller and faster boats to reach their destination. Airboats, which had their birth in Louisiana many years ago, are no longer used except in some isolated cases when a small outboard, air-screw drive is employed to move light equipment over submersed vegetation. Boats which can be handled at speeds of from 1 MPH to 5 MPH in shallow water are preferred. They can usually follow the shoreline and poke their way into narrow feeder streams and then back out under their own power. This type of operations has been found to give the best opportunity of treating all of the weeds in a given area.

Boats with molded bows opearate better than the square-bow type since they are better able to push their way through floating vegetation. To assist in such an operation, a 24" diameter cut-off saw can be mounted on a hinged frame over the bow of the boat. Such a saw is driven by an air-cooled, gasoline engine through chain and sprockets. The hinged frame allows the saw to be moved up and down in an arc to cut deep when a thick mat is encountered. The molded bow can then push its way through this cut without too much trouble. One such sawboat can be furnished to provide the initial channel cuts for other sprayboats or the saw can be mounted on the bow of the sprayboat when hull dimensions permit.

## CHEMICAL SPRAY PUMP

A good, reliable, piston-type chemical spray pump should be obtained for the work. It is recommended that the pump be capable of delivering 10 GPM at 400 PSI and that it be equipped with a pressure regulator and an accumulator. This size pump will work well in small boats and larger models can be secured when the size of the job indicates that more capacity and pressure may be needed. Several manufacturers build such pumps as stock items. Makeshift pumping units should be avoided. It is cheaper in the long run to buy the best pumps available on the market.

## SPRAY GUN

Several types of chemical spray guns can be obtained on the open market and all will give a measure of satisfaction. After several years of testing under actual operating conditions, a spray gun has been developed in Louisiana which

more nearly meets the needs of the average applicator than those guns of standard manufacture.

This gun is made from a 3-foot long piece of ½" diameter aluminum pipe with a quick-shut-off valve on one end and a standard reducer on the other. A half-union, ⅛" diameter pipe to ¼" diameter copper tube, is fitted in the reducer and serves as a spray tip. The flared type fitting should be used and the nut screwed in place to protect the tip. The size of the copper tube fitting can be varied to suit the type of stream desired. It has been found that the ¼" diameter copper tube fitting will deliver a stream about 60 feet in still air at pressures of about 150 PSI and the last 20 feet will form into large droplets. Very little drift is generated by this spray gun. The gun may be mounted in a swivel atop a deck stanchion to absorb any recoil and make spraying less tiresome for the operator.

## METERING DEVICE

A very simple metering device made of standard pipe fittings was developed in Louisiana and has been in constant use for several years. It permits the concentrated herbicide to be drawn from a small storage tank and mixed in the desired percentage with water from overboard. The mixture is delivered to the gun in a continuous stream and the non-effective time which resulted from mixing individual batches in a tank has been eliminated. Eliminated also is the extra weight of the water which otherwise would have been carried in the boat.

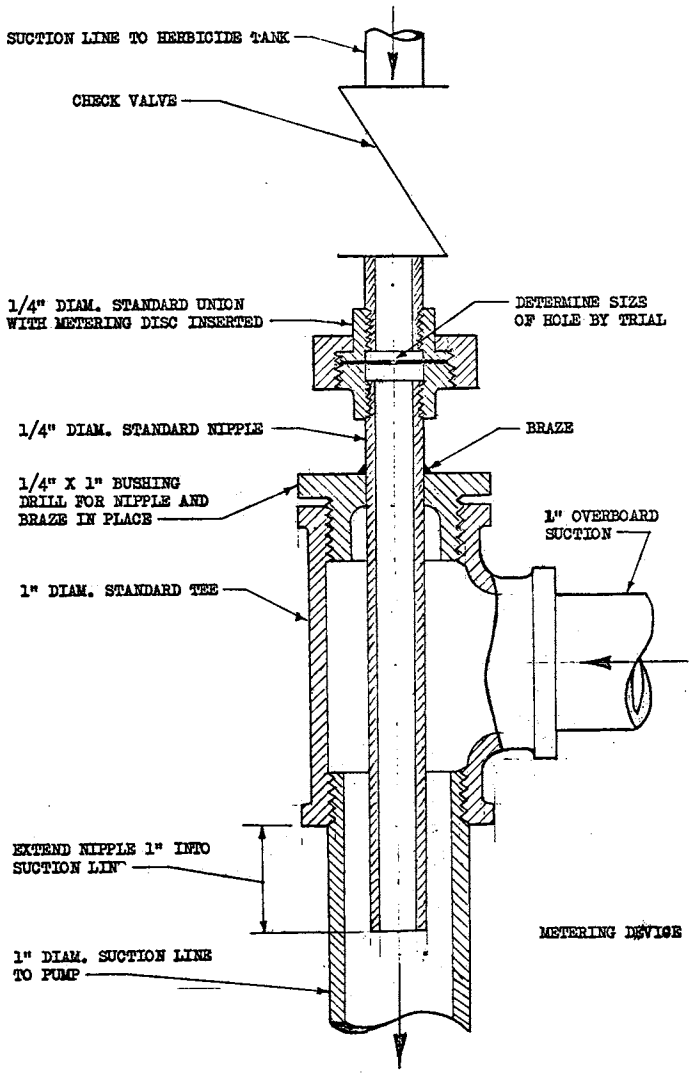



Figure 2. A metering device used for the introduction of chemical into water pumped directly from the stream.

The metering device is made from a 1" diameter standard Tee with the side outlet attached to the overboard water suction line. A standard pipe bushing is put into the end of the Tee and a long ¼" diameter nipple is inserted through the bushing to extend 1" into the pipe line at the other end of the Tee. (Figure 2). The 1" diameter pipe continues on to the pump suction fitting. The ¼" diameter nipple is fitted with a pipe union in which a metering disc has been placed between the halves of the union. A check valve is placed in the line between the union and the concentrate tank to prevent a backflow when the valve on the spray gun is closed. The concentrate line should be flexible so that it can be inserted into the filler opening of a small tank. The percentage of concentration is controlled by the size of the drilled hole in the disc which has been inserted in the union. Final determination of the size of the drilled hole can be determined by trial. If a 10 GPM pump is used, the hole in the disc should be about 1/16" diameter to give a final ½% mixture by weight at the gun when working with the 40% amine salt of 2,4-D. A shut-off valve in the concentrate suction line is recommended.

Many combinations of this simple device were tried before it was determined to extend the small nipple entirely through the Tee and into the flow in the suction line. Results of the various combinations were checked through a large visual tank installed in the line to the pump so that the efficiency of the fitting could be observed. It was found that the arrangement described gave the most uniform mixing under a wide range of operating pressures and volumes.

In adjusting the percentage of concentration wanted, the pump is set to deliver water at the rate of 10 GPM by directing the stream into a container and measuring the time required to deliver a given number of gallons. The amount of concentrate to form the desired concentration is calculated. By calculation, the drawdown in the concentrate tank can be determined and timed accurately with a stopwatch. The hole in the disc is varied until the desired results are obtained. Once this has been done, the percentage will remain fairly constant within very close limitations regardless of the speed of the pump and the number of gallons being delivered.

The by-pass line from the pump should be piped back into the suction line as near to the pump as possible so that the entrapped mixture will circulate through the pump when the valve on the gun is closed. A good strainer on the overboard suction line and on the end of the suction line to the concentrate tank will reduce the possibility of trouble caused by small pieces of foreign matter that may find their way into the system otherwise.

## THE OPERATING CREW

An untrained crew cannot be handed a piece of spraying equipment and be expected to turn in a real finished job. Long and intensive training is required to develop a two-man spray crew into a first class operating unit that can be depended on to turn in a good job time after time under the varying conditions that are met in this kind of work. It has been found in Louisiana that about six months training is required before the average employee can be sent out alone to handle a spray job.

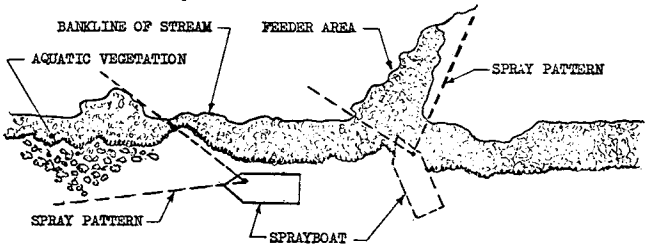
## THE SPRAY PATTERN

After the team has been developed, the spray pattern takes on great importance if the team is to get the most from its efforts. Over 30 years of experience has led to the development of a satisfactory spray technique now used in the major waterways of Louisiana.

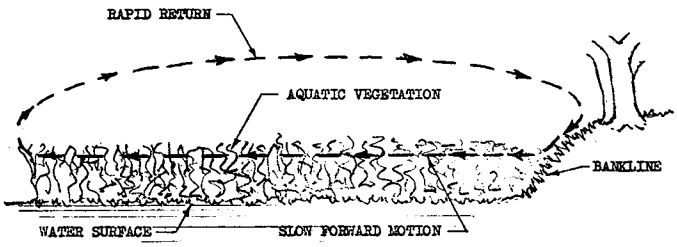
It is important that the spray gun operator be placed in the bow of the boat and well ahead of the boat operator's station. This permits him to have a clear view and to move the gun in a wide arc without the hazard of striking the boat operator with the high pressure stream. It also gives the man operating the boat a clear overall view of the operations and allows him to change course and speed to get the best coverage. Teamwork between the spray man and the boat operator is very important to getting a good job. The spray operator should remain in a standing position for best control of the gun and sitting down while trying to spray should be discouraged.

It is recommended that the chemical stream be confined to the forword quadrant as the sprayboat travels along the offshore edge of the vegetation to produce the most effective coverage. Where the contour is irregular, time should be taken to follow the growth line so that no pockets of untreated vegetation remain. Where wide fringes make complete coverage impossible with one pass of the sprayboat and the area is sufficiently large, two sprayboats should be used in the operations. One should work its maximum reach from the outside edge and the second should travel generally parallel to the first and cover the inshore vegetation not reached by the first boat. The cut-off saw previously discussed may be useful in providing a channel for the inshore boat.

In ordinary single phase treatments the spray stream should start well up on the bank of the stream or as far into the tree line of a swamp as possible. It should travel in a smooth movement roughly parallel to the surface of the water and reaching the foliage in the upper 12 inches of the plant. Having reached the outside edge of the vegetation with this slow, steady stream, the return to the starting point should be rapid and about 24" above the foliage to allow the droplets to rain down onto the leaves of the plants from above. In cross section, the travel pattern would resemble an elipse with the lower side straightened somewhat. This smooth pattern can be likened to painting an area with a 20-foot wide brush on the end of a 50-foot handle. The forward speed of the boat is adjusted to suit the operation and not crowd the spray gun operator.




1. Work downstream so that dislodged plants can be treated later.
2. Confine spray pattern to forward quadrant.
3. Take time to treat all of the feeder areas as you move along.




1. Start well up on the bankline. Direct stream into upper foliage. Sweep spray stream in slow steady motion.
2. On reaching outer edge of vegetation, return rapidly to starting point and allow herbicide to rain down into the vegetation.

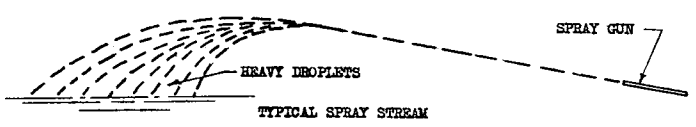



**Figure 3. The spray pattern.**

Spraying at 90° to the travel of the boat requires an up and down movement of the gun to cover the same area and would resemble the same paint job done in multiple pinstripe strokes. It is difficult to control and does not give good results and should be avoided whenever it is possible to do so. Adjusting the gun frequently to change from a single stream to a fan pattern is time consuming and does not always give good results. The expierience in Louisiana over the many years has shown that the best results can be obtained with the single tip gun operated in the forward quadrant of travel in the oscillating pattern previously described.

## SUBMERSED VEGETATION

Work on the submersed vegetation has been under way for more than 3 years in Louisiana and the results thus far show that the best results can be obtained when the herbicide is released about 12" below the surface of the water under high pressure into the upper portion of the vegetation. The high pressure is used to get initial penetration and the normal propellerwash of the boat serves to provide additoinal dispersal of the herbicide. The final area affected has been found to be about 3 times the area covered in the initial treatment in most instances. Good results have been obtained by operating the boat in parallel courses about 10 feet apart, but even better results have been found when the boat is operated in an ever-widening spiral in a body of water when conditions permit such a course to be run.

A cross-boom about the width of the boat and made from ½" diameter pipe and fittings is extended over the stern of the boat and submerged about 12" below the water surface is used for the application of the herbicide. Multiple orifices are provided by drilling ⅛" diameter holes about 6" centers and give good initial distribution of the herbicide. Surface applications have been found to be relatively ineffective and should be avoided.

The spray equipment is the same used for surface applications with the single tip gun except that the cross-boom replaces the hand gun and the application is made over the stern of the boat rather than in the forward quadrant.

## QUESTION OF COST

Many people are confused by the enormity of the problem of keeping open thousands of miles of waterways and do not have a good, clear idea of what is involved or what end results can be expected from the overall operations. These are usually the people who worry about (a) the unit cost, (b) whether the work is justified and (c) whether the stream being cleaned is really the right one in which to work.

The unit cost can be misleading. If all conditions were the same and the vegetation remained in a static condition,

the unit cost system could then be depended upon for comparison. In some instances the unit cost may seem to be high, but consideration of the additional cost of destruction in the same area at a later date will usually show that to wait until a later date to start operations would result in an increased overall cost of maintaining the particular area even though the unit cost might be less. When the whole area involved is considered in working up a unit cost figure and consideration is given to the end results obtained from the limited operations, the unit cost per given square of measurement become negligible. The overall benefits to be obtained from the particular operation should be given consideration rather than the possible unit cost of the limited work in question when trying to make a decision as to whether a certain job should be undertaken.

The fact that the vegetation grows rapidly should make destruction of the growth in any quantity warranted at any time that men and equipment are available. Whether or not a given stream should be cleaned depends on its relative importance as a feeder area to a main waterway. Usually, it is far better to work in the lesser streams in the back country than to wait for them to disgorge the plants into the main streams at a time when mustering a crew of sufficient size to handle the emergency could be embarrassing and costly.

It has been found in Louisiana that by working the back streams in the winter months suitable control can be maintained and the amount of time that must be used to do corrective work in the main streams during the warm season is reduced to an absolute minimum. The idea that plant control is a seasonal job has been disproved and the year-around schedule of operations pays dividends in stream maintenance.

Economy must be practiced every day to hold down the operating expenses to insure that the maximum results can be obtained with the funds available. It is suggested that study of the overall costs of the whole job be the controlling factor and that the unit cost of each operation be considered only as a matter of interest to be used in planning future work. Too much reliance on unit costs can lead to trouble as these costs can and will vary from job to job in a given area as well as differ widely from the cost of similar work in other parts of the country.

The overall costs of maintaining a given area and the benefits to be obtained from the overall project of cleaning this area should be the governing considerations in planning any aquatic vegetation control projects and unit costs should be only a line item in such calculations.