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GUIDELINES FOR PLANTING, ESTABLISHMENT, AND MAINTENANCE OF CONSTRUCTED WETLAND SYSTEMS

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To make a constructed wetland project successful, several factors must be taken into account during the planting, establishment, and maintenance phase of the project. These factors may seem to be fairly simple, but experience has shown that all of them must be addressed during the planning stages of the project. By addressing these factors in the planning stages of the project, one is more apt to make sure they are done when the crews are planting.

Probably the first important step to take is a complete inventory of the potential planting site. The better you do your homework, the fewer problems you will have to deal with at planting time. The Interagency Riparian/Wetland Project Information Series No. 2, *Selection and acquisition of woody plant species and materials for riparian corridors and shorelines* has an excellent section on planning, objectives development, inventory procedures, and species selection not only for woody plants but also for herbaceous plants. Once the planning stage is complete, it is time to consider what needs to be done to the planting site before, during, and after planting.

1. Planting site needs to be weed-free and well packed.

2. Ensure that the wetland bottom is level with no serious undulations which can cause problems with watering after planting.

3. Pre-irrigate the site before planting to ensure the entire soil profile is full of water. This will also allow the soil to settle after construction.

4. Planting plugs can be accomplished in two ways:

    a. Water Planting Method -- Fill the wetland with water to a depth of 2-4 inches. Planters can use their hands to dig the holes to place the plug. After placing the plug in the hole, stomp the soil tightly around it. If the water is deep enough, Styrofoam coolers can be filled with plants and floated behind each planter.

    b. Tree Planter Method -- After pre-irrigating the wetland and allowing it to dry out enough for a tractor to drive on it, use a tree planter to plant the plugs. This will decrease the number of planters needed, but will increase the cost of planting.

5. After planting, care must be taken not to drown the plants. At this stage in the plant's growth, they have not developed the aerenchymous material that can allow the plant to breath in anaerobic soil. Over the course of the first growing season, the level of the water in the wetland should be slowly increased. This will encourage the growth of the above ground biomass, hence the aerenchymous material.

6. One important idea to keep in mind when watering wetland plants that are young and recently planted is that they respond to a fluctuating water level. In nature, rarely will the water level in a wetland or riparian system remain at a constant level. It is constantly rising and falling with natural events. We want to duplicate this condition artificially. In addition, the plants will tend to spread much faster with fluctuating water levels.

7. If the Water Planting Method is used, let the standing water evaporate off down to saturation with no standing water before turning more water into the system. Depending on the soils, climate and daily maximum temperatures, this may take from 5-10 days.

8. If the Tree Planter Method is used, fill the wetland with 2-4 inches of water immediately after planting. Let the soil reach saturation with no standing water before turning more water into the system.

9. The watering frequency should be based on soils, climate and daily maximum temperatures. Generally, water should be filled to a 2-3 inch level then drained down naturally for the first month after planting. Drainage time should take about 1 week to 10 days. Refill the system for 15 to 20 days before draining again.

10. During the second month, increase the filled level to about 6-8 inches. Use the same time frame as the first month.

11. During the third month, increase the filled level to about 10-12 inches. Use the same time frame as the first month.

12. The main factor to keep in mind about the filled water level is that a majority of the plants need to have at least one quarter to one third of their tops above the waterline. Again, this allows the plants to "breathe." Don't be too concerned if the water tops the plants for a day or two. This will not do any major harm. Constantly stressing the plants will cause major dieoff.

13. Weed control will be necessary for the first growing season. It is also a constant maintenance job during the life of the project. Weeds (anything from purple loosestrife to foxtail barley to reed canarygrass) will move into the system especially if the water level is low and fluctuating. The best method of weed control is pulling the weedy plants. The next best method is to wick the weeds with approved chemicals (always follow label directions). Contact the county extension agent for recommendations on what chemicals to use.

14. Watch for small gully formation or rills during the plant establishment phase of the project. This is when the water cuts a gully or rill into the bottom of the wetland before the plants have grown and spread enough to prevent erosion. Shovel work can fix small gullies. Larger gullies may be filled in by using straw bales.

15. Normally, wetland plants should be planted in the spring or the summer in our climate. Research has shown that frost heaves will literally throw the plugs out of the ground when they are planted in the late fall and winter. Wetland plants like warm temperatures, long day lengths, and lots of water. I tend to plant plugs in June when all those factors are the highest. The later in the summer you plant the plugs, the plugs the shorter the establishment season. I have planted as late as August with rhizomatous species with good success; although the plants were much smaller by the end of the growing season, they were still alive the next year.

16. Much has been made about using native plants versus exotic plants when planting constructed wetlands. Wetlands are probably the least understood when it comes to determining what species were "native" to the wetland in the past. The reason is because migratory waterfowl that travel thousands of miles and visit hundreds of wetlands during those travels leave seeds of many different plants that they eat along the way. Suffice it to say that local or adapted plants should be used in planting the constructed wetlands. This ensures that the plants that you are putting into a specific site will grow the best and be able to handle significant fluctuations in temperatures, water levels, soils, pH, and other conditions that are found at your planting site. Ordering plants from nurseries clear across the country from your planting site is asking for trouble. Getting the right species, for the right site, for the right water level is extremely important and is often different from site to site.

17. Should you plant wild transplanted plugs with the soil on the roots or should you wash the soil off the roots? There is a lot of discussion on this point. I have found 20-30% higher survival if the soil is left on the roots. A larger microbial population will be transferred to the new planting site if the soil is left on the roots. However, the transplants will weight more and they will take up significantly more space when transporting them with the soil left on. In addition, if the transplants are collected in weedy areas (e.g. areas with purple loosestrife) then a risk is taken that seeds from the weedy plants will be moved with the transplants.

18. Plugs should be planted about 18-20 inches apart. At this spacing, the plants will grow together in one growing season (assuming that rhizomatous species are used). This, of course, means a significant number of plugs must be purchased or collected. By planting at a wider spacing, the number of plugs needed will be logarithmically reduced. However, the constructed wetland will not function effectively for a longer period of time because of the lack of plant coverage. This is not necessarily bad, however extra planning will be necessary and it may take two growing seasons before allowing the wetland to reach the full water level that was planned for.

19. The size of the plug material, either greenhouse grown or wild transplants, will affect the ease with which the constructed wetland can be planted and maintained. Very small plugs are difficult to plant, extremely difficult to get to grow, and a maintenance nightmare. Our research has shown that the best results were obtained using about 24 in^3 plugs (approximately 2"x 2"x 6"). This size plug will have a good root system and an adequate above ground biomass to allow rapid establishment. Smaller plugs will be slower to establish, have more problems competing with weeds, and take more water management to ensure they don't drown. It is recommended that nothing less than 10 in^3 plug be used, and then only if absolutely necessary. It is worth the money to stay with larger stock.

20. Fertilizer is usually not necessary because the wetland plant plugs can grow in almost any type of soil. However, based on your objectives and the condition of the planting site (a soil sample should always be taken before planting, usually during the planning process). If the plugs are greenhouse grown, have the nursery put a small amount of time release fertilizer (16-16-16 or 20-20-20) into the soil mix. If the plugs are wild transplants, it is more difficult. The fertilizer should be placed in the hole before the plug is planted. Spreading the fertilizer on the bottom of the wetland before planting will cause a rapid flush of weed that can compete with the wetland plants and is usually not recommended. Site preparation well before planting where the fertilizer is worked into the soil and the weeds are killed at the same time is possible.

21. Maintenance is crucial in order for the project to be successful. Weed control has already been mentioned. Another problem is wildlife damage. Fresh plantings of wetland plants are like ice cream to hungry geese. There are a number of options that can be used to keep the geese off the planting until the plants are established. Contact your local Fish and Game Conservation Officer for assistance. Additional problems are beaver, muskrats, and nutria. All of these animals can clean out a newly planted constructed wetland in no time at all. In addition, muskrats can dig holes in the dikes surrounding the wetlands and in some cases cause a blowout. The best control method is trapping. Again, contact your local Fish and Game Conservation Officer for assistance. There are lots of other expensive methods touted by manufacturers, but their effectiveness is questionable (see *View from a Wetland* Newsletter No. 3, 1996-1997) The main thing to remember is that the plants need to be protected for the first growing season or until they have established. After the plants have established, they can usually handle quite a bit of grazing.

If you would like further Information Series technical papers or Technical Notes, write or call:

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