

Smooth Cordgrass Establishment in Tidal Wetlands

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This project, developed by the Delaware Department of Transportation, involves the establishment of smooth cordgrass by various methods in tidal wetlands; it is an ongoing study in the third year of evaluation. This concept represents one phase of an important link to marshland highway-bridge construction activity as a function of mitigation requirements in wetlands.

Beginning in 1983, the Delaware Department of Transportation realigned a 1.5-mi portion of US-113 located 7.5 mi south of the city of Dover in Kent County. The realignment included the upgrading of the roadway from two to four lanes, the removal of the existing bascule bridge, and the construction of a new concrete bridge crossing the St. Jones River and surrounding tidal wetland.

In addition, the construction contract called for the excavation of the existing causeway and restoration of the site to wetlands with suitable native vegetation. These mitigation requirements, as spelled out in the department's subaqueous and wetland permits, served as the basis for planting. For this purpose, a perennial rhizomatous plant known as smooth cordgrass (*Spartina alterniflora* Loisel) was selected. This species is typically encountered in the tidal floodplain throughout the region and recognized as an important link in the Atlantic coastal salt marsh plant community (1, Chap. 2).

MATERIALS AND METHODS

The purpose of this study was to evaluate the possible establishment of smooth cordgrass by direct seeding, transplanting, and planting. The smooth cordgrass establishment was let as a separate contract to be performed concurrently with the excavation.

In this regard, a contract was advertised to provide for the items of work shown in Table 1.

Before planting, a number of ground preparation requirements had to be met. The excavation of the causeway and the adjacent area, herein referred to as a haul road, under the bridge construction contract was carried out in two steps. The causeway portion was begun in 1984 and the haul road was added in 1985. This occurred because of a broader interpretation of the mitigation requirements rendered by the Delaware Department of Natural Resources and Environmental Control, resulting in the addition of the haul road after the excavation work had been initiated on the causeway. Excavation began at the river crossing and proceeded north; a large backhoe, drag line, and the haul road were used to remove excavated material. The total excavation area covered 22,771 yd². Both sites were cross-

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TABLE 1 WORK DETAILS FOR CORDGRASS ESTABLISHMENT

| Proposed Work | Planting Season | Bid Price | Unit of Measurement |
|------------------------------|-----------------|------------|---------------------|
| Smooth cordgrass | | | |
| Planting | 1984 | \$2.72 | Per square yard |
| Planting | 1985 | \$2.72 | Per square yard |
| Transplanting | 1985 | \$2.72 | Per square yard |
| Seeding | 1985 | \$0.56 | Per square yard |
| Aerial herbicide application | 1984 | \$3,388.00 | Lump sum |

sectioned to determine the actual volume for removal and surveyed to ensure compliance with the required elevation. A total of 4,812 yd³ of material was removed from the project.

The required planting elevation of 2.75 ft above mean sea level [National Geodetic Survey 1929 vertical datum base for mean sea level (MSL)] represented an elevation 3 to 6 in. lower than that of the surrounding marsh. Reducing the elevation below that of the surrounding marsh throughout the excavated haul road and causeway allowed the tide to ebb and flow freely throughout the planting area, a requirement critical to the establishment of smooth cordgrass (1; 2, Vol. 1, p. 511).

Establishment of the required elevation is a critical factor, because the ponding or impounding of water over the planting site reduces the survival of smooth cordgrass (1).

The smooth cordgrass planting completed in the summer of 1984 involved the area located at the original bascule bridge crossing site along the St. Jones River. Planting criteria were based on the assumption that the most critical site would be that portion of the excavation subject to the highest erosion potential through tidal action and wave exposure.

The specifications required the use of well-rooted seedlings that had been growing for a minimum of 5 months in peat pots. Seedlings were to be planted between May 15 and October 1 and fertilized with 1 oz of a 3- to 4-month slow-release 19-6-12 analysis fertilizer, or an approved equivalent, placed in the excavated plant pit. The specifications required the contractor to obtain 1985 transplants by thinning the area planted in 1984. However, because identical bids were received for planting and transplanting and the available nursery seedlings were of superior quality, it was decided that the total area specified for 1985 would be planted with nursery stock.

Attempts to provide the proper elevation (2.75 ft MSL) within critical limits utilizing heavy grading equipment

were made extremely difficult by the poor load-bearing capacity of the site. As a result, certain areas of ponding did occur.

An existing ditch line was then extended to the northernmost limit of the project and connected to an active tidal branch along the western boundary. Several interconnecting rivulets to relieve localized ponding were hand excavated during the actual planting. However, the disturbance of the site in this manner made it difficult for the contractor to maintain a uniform grid as bid. As a result, the requirement for all plants to be placed on a 2.0-ft grid was deleted, because it was believed that over the course of several years, all sites other than ditch lines would fill with volunteer smooth cordgrass plants through seed dissemination (1).

Because of the delays mentioned in the completion of the required grading work, the smooth cordgrass seeding specified was not attempted until 1986. Field observation in the spring of 1986, before actual seeding in May, revealed volunteer seedlings randomly covering 15 percent of the proposed site. It was determined that any attempt to prepare the seedbed and avoid the existing seedlings in the process would be impractical. Following seedbed preparation with a harrow, seed was mechanically broadcast during low tide at the rate of 100 seeds per square yard. Soluble fertilizer at the rate of 90 lb of actual nitrogen and 50 lb of actual phosphorus per acre was then broadcast over the seedbed at low tide in late June and again in July. This resulted in a very uniform stand of seedlings when evaluated in late September.

Another method employed to enhance establishment of smooth cordgrass involved the ground application of the herbicide Glyphosate to control a common reed (*Phragmites communis* Thin.) infestation along the western boundary of the planting site. Common reed is classified as a noxious weed in the state of Delaware because it is extremely invasive, spreads rapidly by rhizomes, and offers little in food value to the marsh ecosystem (3). Initially, it was believed that the aerial application of herbicide could be utilized to control the problem. However, it was subsequently determined that the application timing requirements of herbicide (August through September) could jeopardize the initial planting of smooth cordgrass if the herbicide were to accidentally drift over the planted area. To prevent this possibility from occurring, the contractor opted to utilize ground application equipment.

With regard to the attempted eradication of common reed with herbicide, subsequent evaluation in May 1985 revealed a

95 percent level of control, which significantly reduced the species as an encroachment threat on the excavated roadbed.

SUMMARY AND CONCLUSION

To summarize the plant establishment, 3,800 yd² of marshland were planted in 1984, 11,600 yd² in 1985, and 7,291 yd² in the spring of 1986. Utilizing the unit bid prices shown in Table 1, a total cost of \$50,119 was generated for planting and seeding, to include an additional payment of \$3,093 for unanticipated site preparation by the planting and seeding contractor. The earthwork, which included the excavation of the haul road and causeway, trucking, grading, and ditching, totaled \$101,216. Because definitive cost standards for vegetative marshland restoration do not exist, to this investigator's knowledge, no attempt was made to evaluate the cost-effectiveness of the project. Rather, the establishment of a uniform stand of the desired vegetation in compliance with mitigation requirements remained the chief objective.

As an interim observation, it can be stated that smooth cordgrass may be established satisfactorily by direct seeding or through the planting of nursery-grown seedlings.

Further, it is believed that continued monitoring of the site will be necessary to determine whether changes in elevation through the natural movement and deposition of sediments will so alter the site that a uniform stand as planted cannot be maintained.

Given the proper elevation and drainage conditions, continued research into the rate of volunteer smooth cordgrass seedling establishment will be necessary to determine whether a satisfactory stand can be achieved, given the presence of less desirable but highly invasive forms of vegetation.

REFERENCES

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