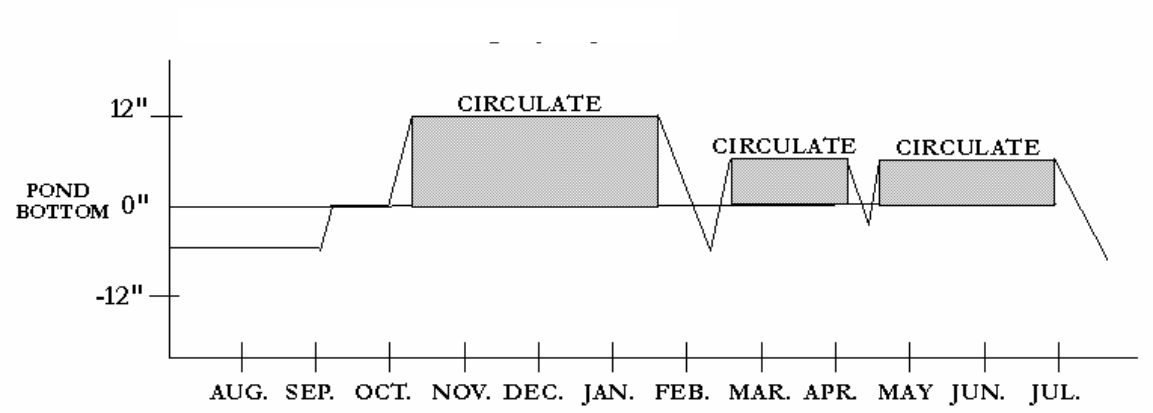
Initial Draft of

SECTION IV. A
MANAGED WETLAND CONCEPTUAL MODEL
WATER MANAGEMENT SECTION

Water manipulation provides habitat managers with an important tool for wetland habitat management. SRCD has developed and presents some management schedules, which typify management schedules used in the Suisun Marsh (Marsh). These schedules are intended to be used as general models. Site-specific regulatory, environmental and physical factors influence actual management practices on individual properties.

A. No Intake Restrictions / Normal Flood Date / Long Hydroperiod



The "No Intake Restrictions/Normal Flood Date/Long Hydroperiod" schedule is designed for those properties unrestricted by chinook salmon and delta smelt water intake closures. These properties are either not located in areas designated for species intake restrictions or are properties affected by closures but have installed fish screens on their intakes. Using this schedule, managers fill the ditches without flooding the ponds on September 1 (per Solano County Mosquito Abatement District (SCMAD) restrictions) and circulate in new water to remove high salinity ditch water. The ponds are fully flooded on October 1 as quickly as possible to allow water to run over the soil surface to suspend surface soil salts and push deeper soil salts further down in the soil (SRCD, pers. communication). If time allows, the property should be drained and reflooded to leach surface salts and decrease mosquito production.

Fully flooded ponds are not deeper than 12" over a majority of the pond when at winter level. Circulation is maintained while water levels are fluctuated between twelve and six inches deep. Water levels are fluctuated as often as is practical given constraints such as applied water salinity. Fluctuating water levels serves two purposes. First, exchanging high volumes of water can help maintain natural soil salinities. Secondly, fluctuating water levels exposes additional edge habitat for feeding and loafing in areas of the pond that were previously flooded or too deep to be useful to wildlife, establishing

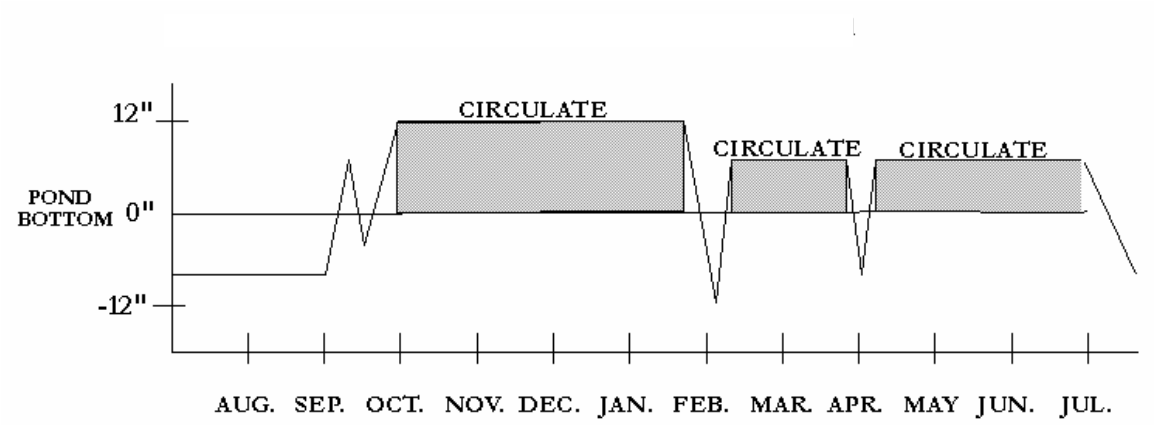
additional wildlife habitat and waterfowl foraging habitat. This water fluctuation technique is used in early winter when high volume water exchanges are most effective at flushing salts and decaying plant materials. When water levels are fluctuated in late winter, water levels are not brought back up to normal winter level manually. Instead, rainfall is allowed to bring water levels back to the normal winter water level. If there is insufficient rainfall to fill the ponds, fresh water is added manually to bring the pond back to winter levels.

In mid-January managers close pond intakes and begin to drain (leach) the ponds. Each property will drain at a different rate depending on pond bottom elevation and topography, facilities, weather, and tides. Weather has the greatest effect on pond drainage rates. Warm or windy weather will dry the soil faster while cold, calm and rainy weather can slow soil drying. Evaporation rates are 4 to 5 times lower in February, during the first leach, than they are in April during the second leach. The goal of draining the ponds is to achieve water levels 12 inches below pond bottom without letting the soil dry**.** Through the draining process soils are not allowed to dry to avoid increased soil surface salinity and expose seedlings to possibly toxic soil salinities.

After the first leach (drain), the pond must remain at least at a mudflat stage to encourage seed germination. When necessary, the ponds are reflooded to approximately 6 inches deep, which should cover 50% to 60% of the ponded area at winter level. Water levels are kept shallow to allow for the greatest diversity of plant communities. Germination rates are highest from February to April, making low water levels critical during this time. Water is circulated as much as possible while keeping 50% to 60% of the ponded area covered. Moisture just beneath the surface of the higher ground will also provide suitable growing conditions for fat hen *(Atriplex triangularis)*, purslane *(Sesuvium verrucosum)*, brass buttons (*Cotula coronopifolia*), and pickleweed *(Salicornia virginica)*. Creating plant community diversity in the ponds is essential to providing suitable wildlife habitat for a diversity of species.

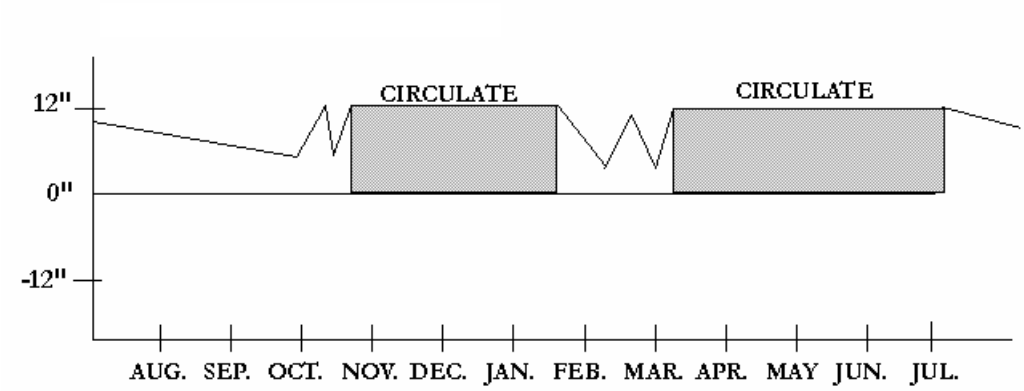
Around April 1 water is drained using the same drainage principals as used during the first leach, again the soils are not dried. If soils do dry, water can be brought back to the appropriate level with circulation. The timing of the final drain for summer is based on slough salinity and seed development. When slough salinity reaches 12 to 15 mS/cm, circulation is ceased and the property is drained. If seeds have not yet developed, the soils are kept moist so plants will not become moisture stressed and cease seed production. Seeds production is the primary concern for timing the final drain of a pond. When seeds are mature, salinity becomes the critical and limiting factor in determining final drain timing.

B. No Intake Restriction/Early Flood/Long Hydroperiod



This water management schedule is virtually the same as "A. No Restrictions," but after an early flood, properties are drained within than seven days. The quick flood-drain time allows for a deeper leach without drying the soil and allows for a partial leach before winter. Leaching before winter will allow salts built up in the soil to dissolve and leach more easily from the soil. Leaching also acts as a mosquito control measure by killing the larvae and instar with water movement and drainage from the pond. If the property is reflooded before the soil dries out mosquito reproduction will be reduced and the property may avoid spraying by SCMAD.

C. Permanent Pond/Brood Pond



Managing an area as a permanent pond will result in establishment of submergent vegetation such as sago pond weed *(Potamogeton pectinatus)* and wigeon grass (*Ruppia martima*) for food and invertebrate production. Tall emergents such as cattail *(Typha spp.)* and tule *(Scirpus acutus)* will also become established, providing cover in the pond.

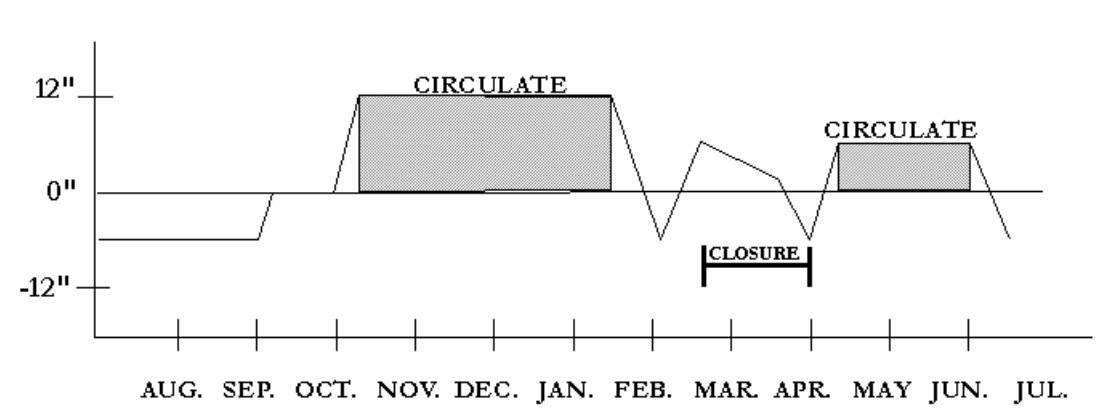
To create the appropriate conditions for desired plant species, pond water salinity must be maintained at low salinities. Low salinities are achieved by exchanging high salinity pond water with the lower salinity channel water. Water exchanges are most

effective when there is high river flows and channel water salinity is low. Water exchanges are conducted as necessary to keep pond water salinity below salinity tolerance levels for desired plant species.

It is critical to establish stable water levels in brood ponds since waterfowl choose a nest sites close to stable or permanent water. Nest site selection starts in early March and continues until May. Permanent ponds are available April through August when broods need water, cover, and food.

Managing a pond with permanent flooding can reduce soil salinity, which allows soils to recover and be more fertile. Since the soils do not dry when managed as a permanent pond, salts do not rise to the soil surface and into plant root zones creating the appropriate growing conditions for food and cover plants. Ponds are kept shallowly flooded to establish emergent cover. Tule root balls are allowed to float freely in pond also aiding in establishment of emergent cover.

D. Juvenile Winter-run Salmon Intake Closure/Long Hydroperiod



This water management schedule addresses need for an alternate management strategy where there are intake restrictions due to the presence of juvenile chinook salmon. Like other management schedules, ditches are filled on September 1 without flooding the ponds and water is circulated through the ditches to flush out high salinity water. The ponds are fully flooded on October 1 as quickly as possible to allow water to run over the soil surface to suspend surface soil salts and push deeper soil salts further down in the soil. If time permits, ponds are drained and flooded to leach surface salts (see “B. No Intake Restrictions/Early Flood/Long Hydroperiod”).

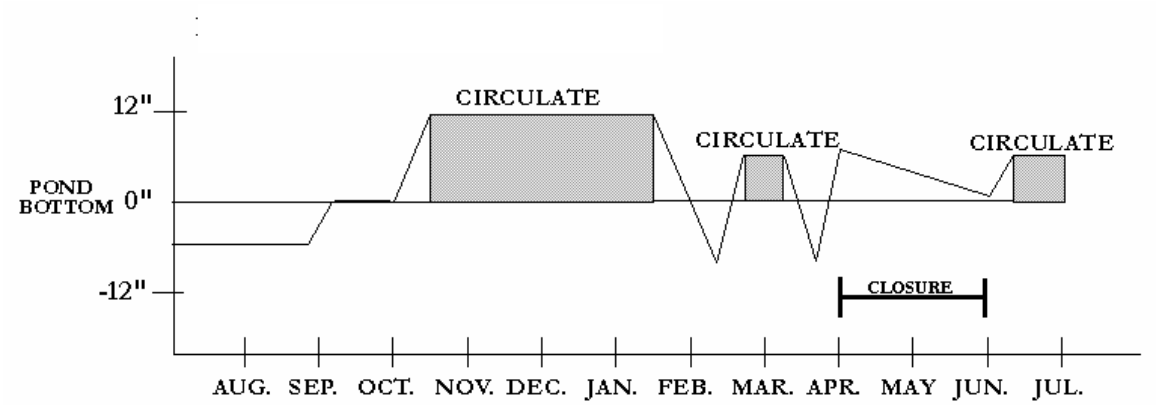
The ponds are flooded to winter level, no more than 12” deep over much of the pond. Water circulation is maintained while appropriate pond levels are also maintained. Throughout the winter, water levels are fluctuated by lowering the ponds to 6” to 8” deep, and then eventually bringing it back up to 12 inches.

In mid-January, intakes are closed and properties are drained. Properties vary in drainage rates depending on pond bottom elevation. If a property takes more than 20 days to drain, then the drainage process should begin the first week of January to allow time to drain the maximum amount of water before reflooding in February. If the

available slough water salinity is too high, the salinity tolerance of seedlings can be exceeded. The property is drained to twelve inches below pond bottom and maintained at that level without letting surface soils dry. If the soil does dry, the pond is reflooded to approximately 50 to 60 percent of the pond area at winter water levels. Before February 21st ponds are reflooded regardless of whether the ponds have fully drained. On February 21st all intakes are closed for the salmon closure.

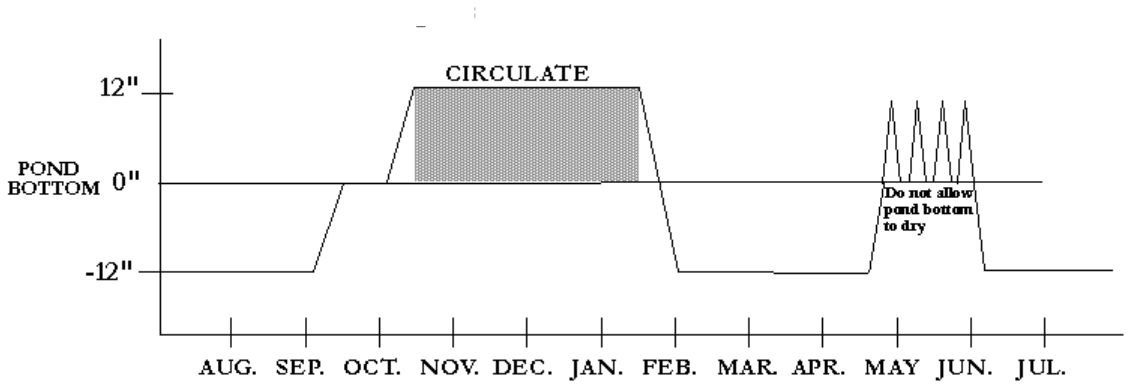
The next 5 to 8 weeks is the most important growth period for food and cover plants. Ponds are drained slowly during the salmon closure (February 21st to April 1st), but not allowed to drain completely before reflooding is allowed on April 1. Ideally, pond water levels have been drained to pond bottom by between March 22nd and 29th. Then the ponds are drained as far below pond bottom as possible without allowing surface soils to dry. If the weather is hot, ponds are not drained below pond bottom until March 26th to 28th. On April 1, ponds are reflooded and water is circulated until slough water salinity rises to 12 to 15 mS/cm. If seed heads are still immature, the water is not drained to allow seeds to develop. Once plants have germinated, they can tolerate slightly higher salinities, however they must have water to develop seed heads and complete the growing cycle. Once seed heads have developed ponds are drained for the summer.

E. Delta Smelt Intake Closure/Long Hydroperiod



A delta smelt intake restriction is in affect April 1st to May 31st. After the first water exchange in February, 50 to 60 percent of the ponded area at winter level is reflooded and water is circulated. The drainage process is begun in early March to allow time to the exchange pond water and reflood before the intake restriction begins on April1.

F. Traditional Watergrass



Traditional watergrass management schedule is not recommended unless the water quality is excellent (under 7 mS/cm) and pond soil salinity is extremely low (under 7 mS/cm). High water quality is needed because this water management schedule does not allow for a leach cycle to drain excess salts from the property. Under this schedule, water is drained in mid-January and the soil is allowed to dry to the point of cracking. Two purposes are served by allowing the soil to dry. First, allowing the soil to dry discourages growth of competitive plants and secondly, it allows equipment to lightly disturb the soil to prepare the seedbed. Watergrass germinates late in the year in areas with low salinity. The highest germination rates of watergrass are achieved when there is low competition from other vegetation. Competition by early germinating plants is avoided by draining the properties at the appropriate time.

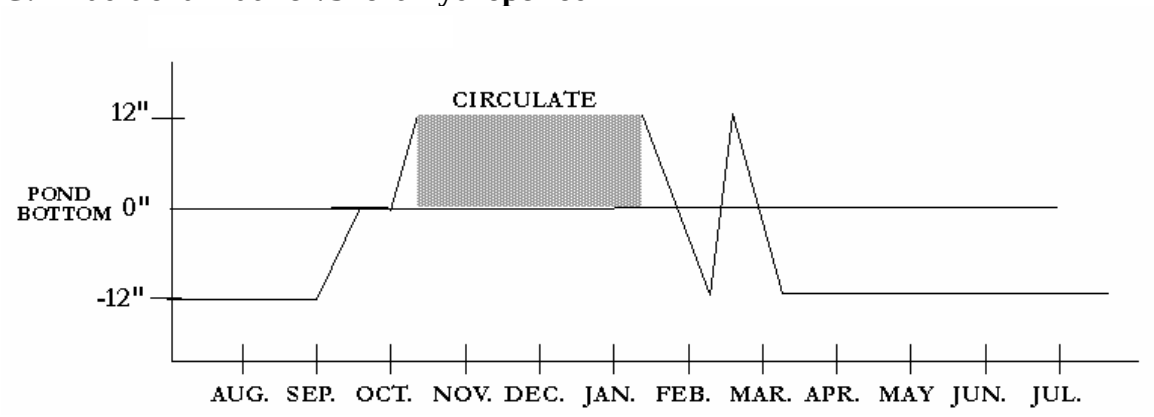
The ponds are reflooded in April and are irrigated several times between April and June. Traditionally properties are irrigated four times, which can result in tall dense stands of watergrass. A denser stand of watergrass is encouraged by irrigating the area a greater number of times to encourage growth of new shoots. If a property is irrigated only twice, it is likely the plants will be 2 to 4 feet high instead of 6 to 8 feet high. Irrigating twice in a season is a more useful management technique because the shorter plants allow the seed heads to be more accessible to waterfowl.

This water management schedule is not recommended for many Suisun Marsh managed wetlands for several reasons. The primary concerns with using this management schedule in Suisun are related to salinity issues. For example, without a leach cycle, soil salinities will rise above natural levels creating an inhospitable environment for seed germination of desired plant species. Also, if channel water salinity rises to the point it cannot be used on the wetlands, ponds will dry and exclude in moist soil plants.

An additional concern for use of the watergrass schedule in Suisun is mosquito control. The watergrass schedule encourages mosquito production by allowing the ponds to dry. With the ponds dry, mosquitoes lay their eggs on the soil surface and hatch when the property is reflooded. If the property cannot be drained in less than 7 days, the property may be aerial sprayed by SCMAD to kill the larvae.

All properties using this schedule must be able to flood and drain the property in less than 10 days to complete this irrigation. If this is not possible, than another water schedule is recommended.

G. Traditional Fat hen/Short Hydroperiod

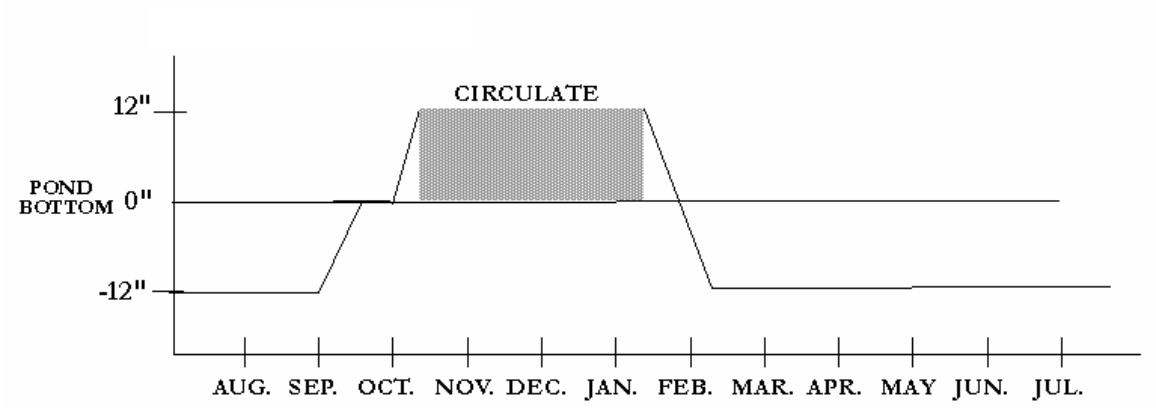


The fat hen schedule is based on a short hydroperiod that inundates the property for less than six months. The short hydroperiod allows salts to rise to the surface, which prevents less salt tolerant plants from germinating and creates a competitive advantage for salt tolerant fat hen. Both elevation and salinity can give fat hen a competitive edge over less salinity tolerant pond bottom plants.

Fat hen areas should be disced or mowed every 4 to 5 years to remove decaying vegetation and control undesirable plants such as saltgrass. Disturbing the soil will create a competitive advantage for fat hen and also create favorable conditions for brass buttons.

Traditional fat hen management limits plant diversity to a couple of salt tolerant species, whereas similar fat hen plant densities can be achieved with more diverse plant communities by using a longer hydroperiod. To achieve a diverse composition of plants and have stands of fat hen, an alternate water management strategy is used where the water is kept at half winter level. Using this strategy, the upper margins of the pond will grow fat hen and pickleweed due to the short hydroperiod (5 to 6 months) on that portion of the pond. If the wetlands are managed properly through hydroperiod and topography, diversity can be achieved.

H. Pickleweed Schedule



Areas of pickleweed habitat within the managed wetlands provide numerous waterfowl and wildlife values. Omnivorous waterfowl species such as wigeon, gadwall, green-winged teal, and northern shoveler utilize pickleweed seed, the populations of invertebrates it supports, and use it as cover in open ponded areas. Pickleweed and associated salt-tolerant plants also provide important habitat for the endangered salt marsh harvest mouse. Maintaining and supporting areas of pickleweed within managed wetlands will provide habitat for this endangered species, while also habitat attractive to waterfowl.

The pickleweed schedule is based on a very short hydroperiod with minimal or no leach cycles. In January properties are drained below pond bottom encouraging salts to rise to the soil surface. Pickleweed will grow in high saline pond bottoms where other plants cannot tolerate the high salinity levels. With higher soil salinity, other less salt tolerant plants will be unable to out-compete pickleweed. Pickleweed growth may also be encouraged by applying water in late summer when the channel water salinities at their highest. Summer irrigations are shallow water applications applied only to those ponds that have good drainage capabilities to avoid mosquito production. Other wetland management strategies can also establish pickleweed and fat hen on pond peripheries where the pond bottom is flooded in winter but dry in spring.

The pickleweed management schedule has the potential to increase soil salinities to levels where salinity negatively impacts pickleweed. In such cases, soil salinities can become so high that patches of bare ground form in the pond bottom. Depending on the salinity of the water applied to the managed wetland, soil salinities can increase gradually over time or may increase quickly in times of drought. Excessive salt accumulation can be minimized through water management activities such as high circulation rates in the fall or by completing a partial leach cycle in the spring. Modifications of water management activities are reassessed annually based upon vegetative responses and habitat quality to management activities.

Conclusion

Weather, tides, water year type, and location in the Marsh dictate the optimal water management schedule for the specific property. Whatever water management schedule a property manager chooses, they must take into account many variables and be

flexible in carrying out their schedules. Each landowner must apply an adaptive management strategy that may change monthly or yearly. Diversity in water schedule will also create species diversity and a more prolific habitat.

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