Platinum TE
PASPALUM

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HURRICANE STORMWATER SURGE: TURFGRASS ECOSYSTEM MANAGEMENT CONSIDERATIONS

Ocean water is extremely high in salinity and specific salt ions (sodium, magnesium, sulfates, chlorides). When a five- to ten-foot wall of ocean water surges onto golf courses and sports fields, the salinity impact is significant on the turfgrass ecosystem.

1. **Lakes on the property can generally be expected to be somewhere between 10,000-20,000 ppm total salts when blended with the irrigation lake water, and depending on how long the water was on the site and the size plus depth of the lake, the salt concentrations could be higher.**

2. **With the storm surge, the depth of the water imposes an enormous amount of weight on the surface and within the upper layers of the soil profile on greens, tees, and fairways. Water tension in the upper soil profile will be elevated, and being able to irrigate to flush and break tension will be extremely difficult unless fresh drinking water can be used initially to try to break tension. (See table below).**

3. **The turfgrass species, depending on the specific cultivar, will have differential salt tolerance capabilities, with seashore paspalum having the highest genetic tolerance to elevated salinity. Seashore paspalum will probably have an initial salt tolerance shock response as the genetics activate to the salinity level from the ocean. Bermudagrass will completely shut down, and the desiccation factor (high total salts, high chlorides) in the ocean water will quickly and negatively impact root survival.**

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4. **Uptake/utilization of fertilizers, even liquid forms, could be negatively impacted, especially if the turf plant is still reacting to salinity shock and the physiological mechanisms in the plant have completely shut down. Expect off-color responses initially on seashore paspalum turf. Applying liquid fertilizer products will probably not be effective until the turf physiological mechanisms have reactivated.**

5. **Unusual observations may occur, such as on sand-based greens, after the wall of water was present on the soil surface. Organic matter in the upper couple of inches in the soil may be depleted (microbial activity from reduced oxygen-tolerant microbes and/or more salt tolerant microbes) and pushed deeper into the soil profile as well as you may observe dark chemical lines in the soil profile as iron or other chemicals were pushed down further in the soil profile by the pressure of the wall of water on the surface.**

6. **Irrigation on seashore paspalum. Do not let the soil profile dry down even if you have to apply saline water initially from your 'lake lagoon' normal irrigation lake.**

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INITIAL QUESTIONS

1. **Do you have electricity?**

2. **Are your pumps still functioning?**

3. **Are you able to apply gypsum (especially the dihydrate-powder products) prior to flushing? The dihydrate gypsum will solubilize quickly with water application and are effective in helping to flush the soil profile in order to reduce the accumulated salt load (especially sodium) in the soil. Regular granular gypsum will pulse-release calcium with each flushing cycle until the prills are completely solubilized.**

4. **If conditions are not too wet, can you aerate to move the gypsum beyond the soil surface? If not, apply the dihydrate or granular gypsum anyway on the soil surface.**

5. **Avoid liquid fertilizers, especially nitrogen, until the salinity shock syndrome has passed since uptake and utilization will generally not be functional due to the plant having most growth and physiological mechanisms shut down.**

6. **Check to make sure that you have functional drainage, especially on greens and low topography areas.**

7. **Check individual off-color plants in green areas in the crown region and primary roots for root hairs to make sure that the plant is still alive. Salts are a desiccant and will kill the root system at high prolonged salt concentrations.**

IMMEDIATE TESTING AND SUBSEQUENT MANAGEMENT OPTIONS

1. **Collect water samples from all your lakes and especially your primary irrigation lake, and test for total salinity and nutrient composition. Ocean water at 34,500 ppm salinity (TDS) deposits 93,840 lbs of salt per acre-foot. That salinity will be blended with the irrigation water in the primary lakes.**

2. **Collect 0-3" and 3-6" soil samples from greens, tees, and fairways and submit for saturated paste extract total salinity impact using distilled water for extraction.**

3. **Implement a regularly scheduled dihydrate or granular gypsum application every 1-2 weeks and attempt to flush. Aerate, if possible, prior to gypsum application to help move the calcium down through the soil profile. Apply weekly for the next month. One meq/L of calcium is required to counter one meq/L of sodium, and ocean water deposits 10,600 ppm Na or 460.87 meq/L. Each acre-inch of ocean water deposits 2404 lbs of Na; each acre-foot of ocean water deposits 28,849 lbs of Na on the turf ecosystem.**

4. **Application of <u>penetrant</u> wetting agents to assist with each flushing process. The wetting agent could conceivably <u>help to</u> break salinity-induced water tension in the soil profile and possibly enhance the flushing efforts.**

5. **Flush with fresh drinking water on greens if at all possible. If you are going to have to use your elevated saline water for flushing, know what the total salinity impact is in that irrigation water that will be applied and adjust accordingly. Contact me (rduncan4612@gmail.com) if you have questions or the flushing is not working. Do not be surprised if your first efforts to flush result in water cascading off the surface and not penetrating the soil surface. Needle tinning might help on the water penetration and surface tension interactions.**

6. **Once flushing has sufficiently reduced the accumulated salt load in the soil profile (remember that critical nutrients will also be flushed), you will need to build back the granular nutrient concentrations in the soil going into the fall /winter season. Build nutritionally from the root system up. Liquid potassium and silicates can be sprayed on the plants if they appear to be recovering from the salinity shock. Be very careful in applying any nitrogen products until the plants have recovered from the salinity shock.**

7. **Clipping counts will be a good indication of improved growth rate and physiological activity following the elevated salinity shock on the turf plant.**

8. **Start collecting plant tissue samples on a frequent schedule when appropriate, and coupled with irrigation water quality plus normal soil fertility data, adjust your fertility program. <u>Do not</u> use saturated paste extract data to adjust your fertility program since you will over-fertilize.**

9. **Do not let the soil profile to drydown if possible since the salt load with the loss of the water molecules will increase the salt concentration in the soil rhizosphere. Plus, dry conditions also enhance the desiccation issues on the turf plant and rhizosphere.**

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Ocean or Irrigation Water (ECw) Surface Tension Comparisons

ECw dS/m	TDS ppm	kPa	PSI
0.78	500	28	4.06
1.56	1000	56	8.12
3.13	2000	113	
4.69	3000	169	
6.25	4000	225	
7.81	5000	281	40.75
11.72	7500	422	
15.63	10,000	563	81.66
53.91 (ocean water)	34,500	1941	281.52

Note: 1 kPa is the pressure exerted by a 10-g mass resting on a 1-cm2 area. 1 kPa is equal to 0.145038 PSI (pound-force per square inch). Ocean water exerts 281.5 psi. Depth of the water and how long the water covered the site is also a consideration.

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OCEAN WATER QUALITY COMPONENTS

Ion	lbs/M/A-F	meq/L	ppm	% of cations	% of total
Cl-	1,185.0	534.6	18,980	---	55.29
Na+	659.0	458.8	10,556	76.9	30.74
SO_{4--}	168.0	56.0	2,690	---	7.75
Mg++	81.4	106.8	1,304	17.9	3.69
Ca++	26.2	21.0	420	3.5	1.18
K+	24.3	9.9	310	0.8	1.14
HCO_3	9.0	2.4	146	---	

Ocean/Sea water has an ECw=54 dS/m, TDS=34,485 ppm, SARw=57.4 meq/L. In order to counter the sodium, 547 lbs./M calcium or 2378 lbs. gypsum/M for each acre-foot of water will need to be applied to the turf ecosystem. Seventy lbs. lime/M/acre-foot will need to be applied to react with 168 lbs. of sulfates, forming gypsum and minimizing potential future black layer challenges.

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