

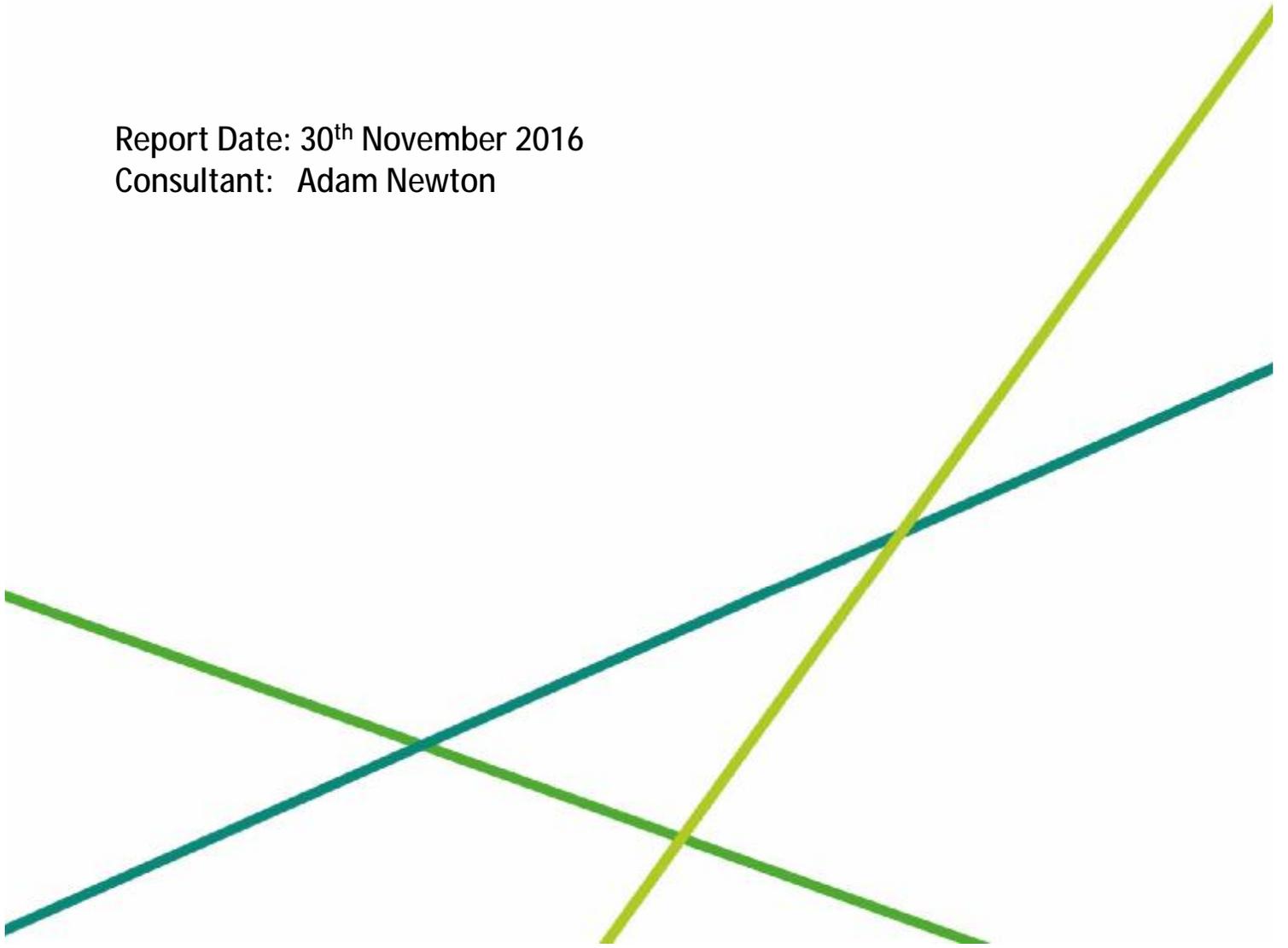


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SCARTHINGWELL GOLF CLUB

Advisory Report on the Golf Course

Report Date: 30th November 2016
Consultant: Adam Newton



Scarthingwell Golf Course

Date of Visit:	Friday 18 th November 2016
Visit Objective:	To review the agronomic condition of the greens and provide recommendations for ongoing improvement.
Present:	Kathy Pick – Course Owner Tony Howarth – Director of Golf John Waite – Head Greenkeeper Dean Gosney – 1 st Assistant Greenkeeper Nigel Booth – Assistant Greenkeeper Joe Monaghan – Assistant Greenkeeper Adam Newton – Turfgrass Agronomist, STRI Ltd
Weather:	Overcast and cold with heavy showers. Temperatures approximately 4°C.

Headlines

- The greens were generally supporting a good body of grass and performing well, however fusarium patch disease has caused some significant scarring on surfaces such as the 6th, 7th and 10th.
- Laboratory testing confirmed that organic matter content beneath the greens is too high. This is holding on to excess water and causing the surfaces to soften, footprint and be particularly susceptible to the development of dry patch and turfgrass diseases.
- Inspection of the underlying soil profiles revealed a silty layer at depth which has been imported with the turf during the original greens construction. This is restricting greens drainage performance.
- Drainage installation to the 9th, 11th, 13th and 15th greens is already proving to be effective and the focus is now on recovering the surfaces for play.
- Future drainage installation is supported but with some slight adjustment to the techniques and materials used. Substantially reducing organic matter levels will also improve greens drainage.
- Turf repair work is required on the drained greens as well as localised areas on the 1st and 6th.
- Some adjustment to the nutritional and water management programmes were suggested moving forward to optimise turf health and performance.
- Tree removal around some of the green complexes was recommended to improve the environment for strong, healthy grass growth and natural drying of the surfaces.

Key Actions

- Cultural (and occasional chemical) disease management through the winter to avoid surface scarring.
- Turf repair and improvement of surface levels on the recently drained greens.
- Re-turfing or transplanting turf is required to damaged areas on the 1st and 6th greens.
- Reduce organic matter levels through a combination of renovation work, sanding and aeration.
- Increase annual sand inputs to the greens to a minimum of 120 tonnes/ha.
- Increase greens aeration inputs to varying depths but aim to apply with minimal surface disruption.
- Future consideration given to upgrading the aeration equipment to improve efficiently and accuracy.
- Deep hollow tining and sanding renovation in September to physically remove and dilute the buried silt layer. Shallower hollow tining and sanding in spring to target organic matter levels.
- Reduce annual nitrogen inputs to 85 – 110kg/ha.
- Improve greens water management through a change in wetting agent and investment in a soil moisture probe. This will help improve turf quality and minimise summer dry patch occurrence.
- Tree removal around the 4th, 8th and 10th greens to increase airflow and sunlight to the surfaces.

Photo Observations and Comments



Figure 1: The putting surfaces were in a strong, healthy position leading into the winter, with good uniformity from green-to-green.



Figure 2: Ball roll qualities were good for the time of year and given the recent heavy rainfall. However, it is clear that the surfaces are vulnerable to softening and footprinting as a result of excess organic matter at the turf base.



Figure 3: The main blemish to the surfaces was that of fusarium patch scarring. This was particularly apparent on greens such as the 10th and 6th but evident on most. Activity worsened near sprinkler heads which indicates a potential relationship with water quality. The disease present was relatively inactive thanks to a recent fungicide application.



Figure 4: Unfortunately, a hydraulic oil leak from the greens mower has resulted in some lost grass cover on the 1st green and front of the 12th. This is an unfortunate accident and some reurfing will be necessary.



Figure 5: The remnants of summer dry patch and anthracnose scarring was apparent on high spots on several greens. Mowing stress is also weakening some of the more acute sections of green perimeters.



Figure 6: Silver thread moss has invaded the gaps in weak areas on the 5th and 16th greens. This is a notoriously difficult specie to control and can rapidly spread if left unchecked.

Photo Observations and Comments (continued)



Figure 7: The green extension on the left of the 6th was constructed with a very sandy material and is vulnerable to excessive drying. Grass cover has been lost in this area as a result of summer dry patch and anthracnose infection.



Figure 8: Where grass cover has retreated, an organic crust has formed at the surface and black algae is proliferating. This is hindering grass regrowth and will need removing culturally.



Figure 9: Inspection of the soil profiles beneath the greens highlighted the same issues across the course. We could see a silty material at depth which has been imported during the original turfing of the greens (see arrow). This is restricting the movement of water to the underlying sandy construction material. Note the blackening of the soil in the photo highlights where water is being retained in excess.



Figure 10: The depth of this silty layer did appear to vary across the course, with it being nearer to the surface on newer greens (e.g. back 9) but deeper on older greens where a greater build-up of topdressing can be seen. See picture above from beneath the 8th green where the layer is occurring at 6 – 7 inch depth.



Figure 11: On greens such as the 16th we can see that the silt layer is much shallower at 4 inches. This will have a negative impact on drainage but will be easier to remedy.



Figure 12: Water ponding on the 16th green following rainfall on the morning of the visit. This highlights the vulnerabilities of this green.

Photo Observations and Comments (continued)



Figure 13: The other key agronomic issue beneath the greens is that of excess organic matter at the turf base. This retains water like a sponge and causes the surfaces to soften down and footprint. This is also an ideal environment for turfgrass diseases and the development of summer dry patch.



Figure 14: We carried out a simple test using a soil moisture probe on the 8th green to illustrate the impact of organic matter and found a 35% reduction in moisture content when the thatch layer was removed.



Figure 15: Rooting depth varied beneath the greens but was generally quite shallow due to the thatch layer holding onto moisture and nutrients and negating the need for roots to search deeper in the soil.



Figure 16: Drainage installation to the 9th, 11th, 13th and 15th greens has been a resounding success and has already notably improved surface drainage and firmness. Organic matter reduction will further improve drainage performance.



Figure 17: Some work is still required to regain grass cover and surface levels over the drain lines. This will be easier in some areas than others but the greens should now be appropriately rested to allow for recovery.



Figure 18: Some imported turf has been used in areas of heightened damage (e.g. centre of 13th). This will take a number of years to blend in with the surrounding turf and it was recommended that this is transplanted to the green perimeters and worked on.

Photo Observations and Comments (continued)



Figure 19: Further drainage installation is planned for next year on the notoriously poorer draining 8th and 16th greens. This is fully supported, however we discussed some slight alteration to the techniques and materials used. This was mostly lifting the turf prior to trenching (to minimise surface damage) and the use of a sand/soil mix instead of straight sand (to avoid turf droughting over drain lines in summer).



Figure 20: Some selective tree removal around some of the green complexes would improve turf quality through increasing sunlight and airflow to the putting surfaces. Examples would include the back of the 4th (pictured) and right of the 8th.



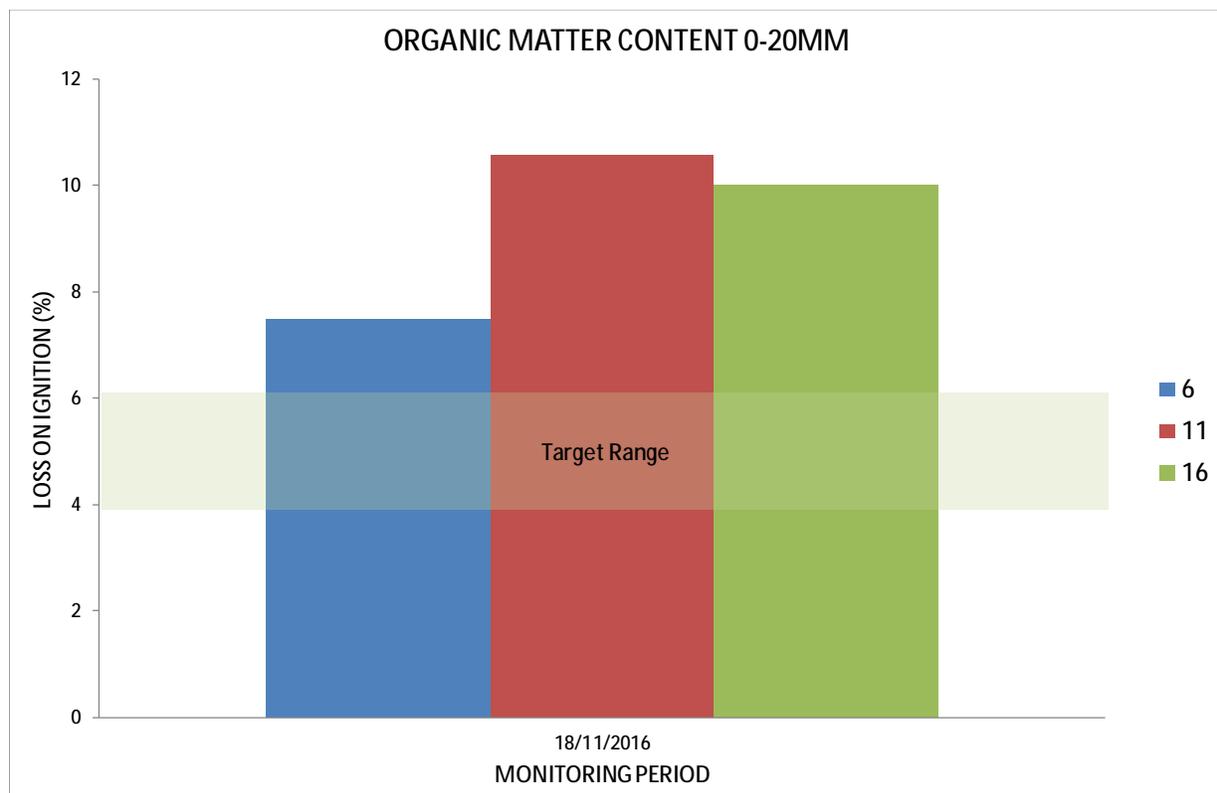
Figure 21: Dense tree populations to the left of the 10th green also notably restrict airflow. Taking the tree line back would improve the environment around this green and make the surface less susceptible to disease.

Organic Matter Analysis

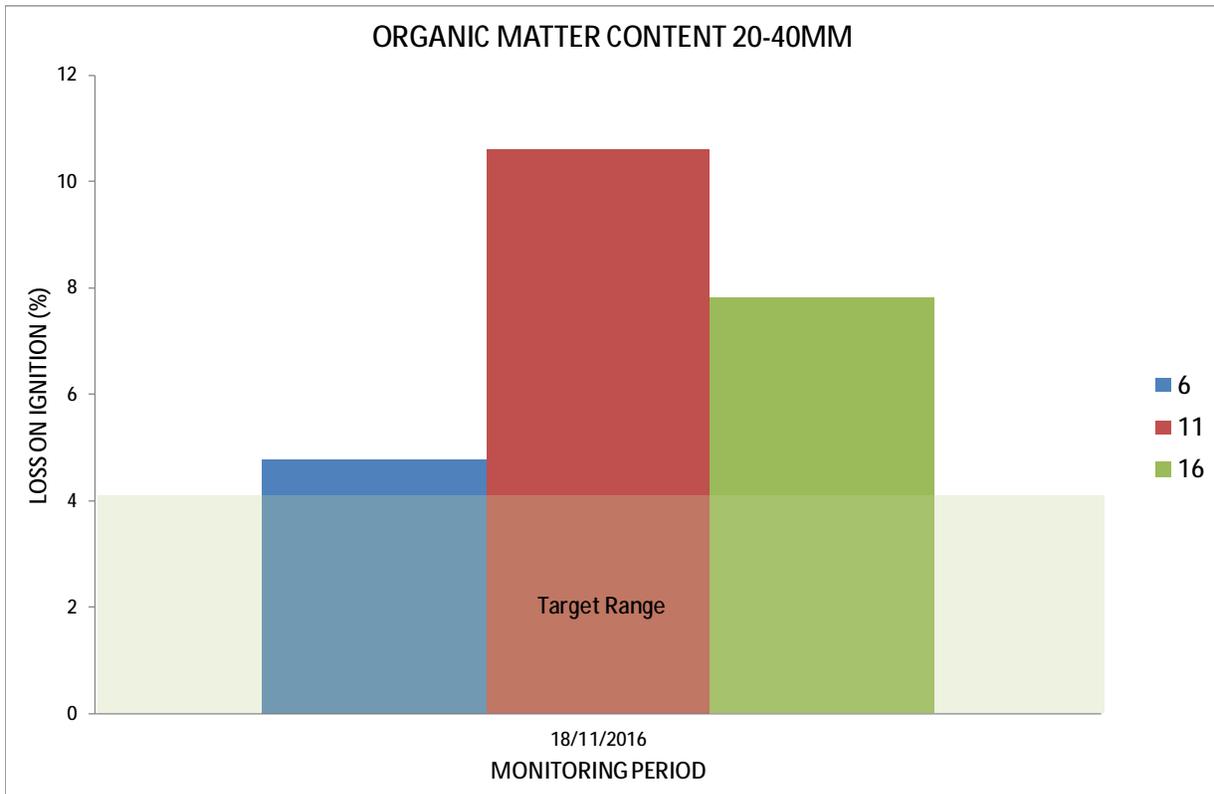
As part of the course review, three indicator greens were identified to represent the overall status and performance of the greens. Soil samples were taken from the 6th, 11th and 16th greens and tested for organic matter content. The cores were split into four depths for clarity and to identify where work may be required. The results were then compared to our target ranges of 4 – 6% at 0 – 20mm depth and <4% at 20 – 80mm.

Organic matter is the biological glue of a soil. It supports microbial life, helps retain moisture and nutrient and binds mineral matter together. However, if it exists to excess it can cause a loss of performance, promote softness in the surface, contribute to thatch production, poor drainage and the promotion of undesirable grasses. It is essential to have knowledge of organic matter levels because these results will impact on topdressing and greens renovation requirements.

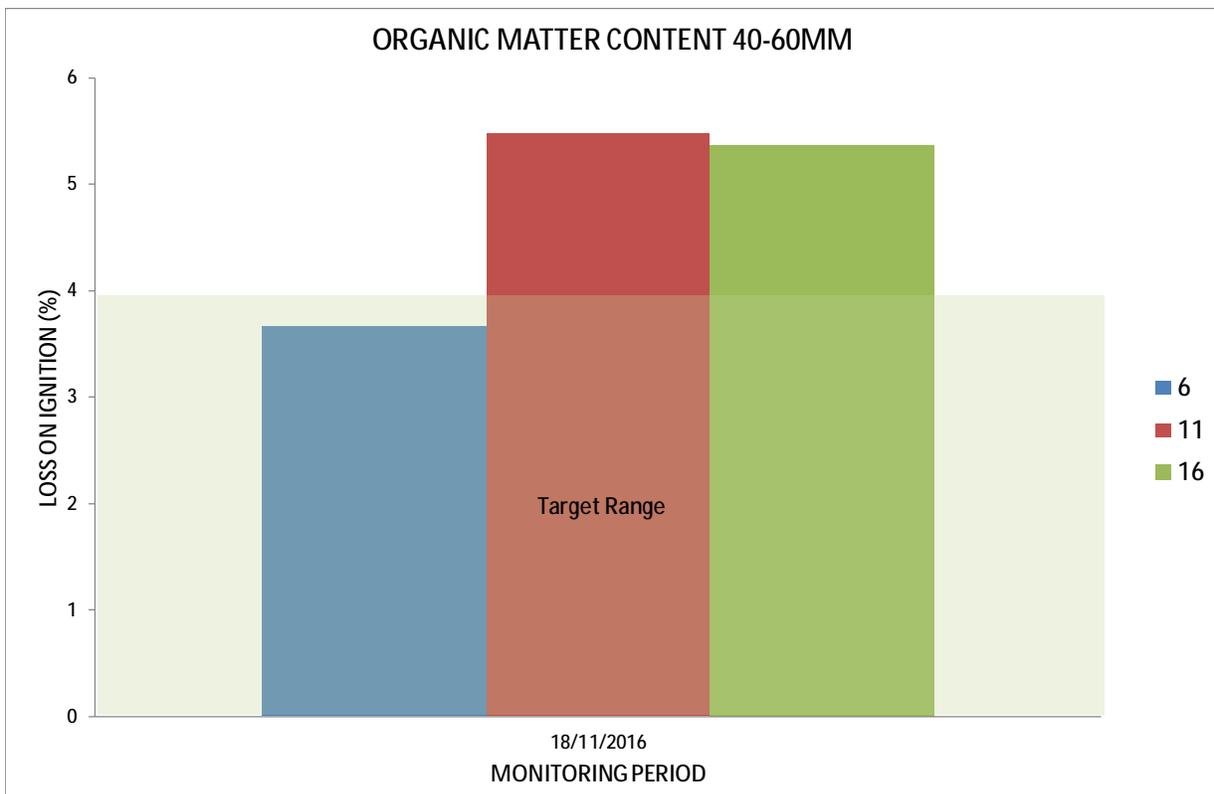
Organic Matter Content			
Loss on Ignition (%)			
	6 th Green	11 th Green	16 th Green
0-20 mm	7.5	10.6	10.0
20-40 mm	4.8	10.6	7.8
40-60 mm	3.7	5.5	5.4
60-80 mm	3.9	5.8	6.7



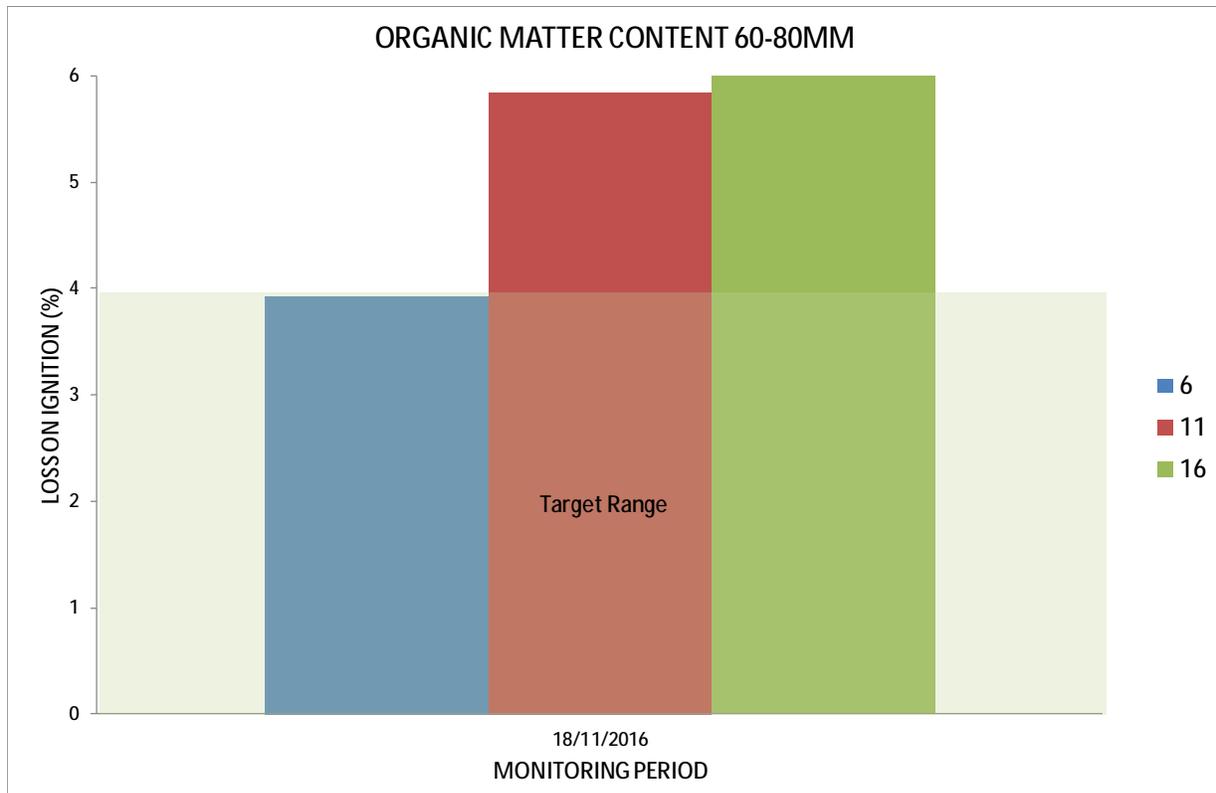
Soils Laboratory Graph 1: Organic matter content in the upper 20mm of the soil profiles was excessively high on the 11th and 16th greens. Although values were lower on the 6th, they were still higher than ideal.



Soils Laboratory Graph 2: Values at 20 - 40mm depth showed a similar trend, with values being excessively high on the 11th and 16th greens but far reduced on the 6th. The 11th green in particular contains very high levels of organic matter which will be one of the key factors affecting its drainage performance.



Soils Laboratory Graph 3: At 40 – 60mm depth, we see organic matter reduce down favourably. Values on the 11th and 16th greens would still benefit from some reduction but the 6th green is ideally situated within target ranges.



Soils Laboratory Graph 4: Finally, at 60 – 80mm depth, organic matter content is still too high on the 11th and 16th greens but adequate on the 6th.

In summary, the results highlight that organic matter levels are too high beneath the greens – in particular the 11th and 16th greens. Our focus must now be on reducing this organic matter build-up with future greens renovation and maintenance work. The focus of this work should be throughout the upper 80mm but with a particular emphasis on the upper 40mm.

Reducing values into target ranges will see the year round performance of the greens improve (particularly firmness and drainage) and will also see the surfaces become less-susceptible to turfgrass diseases and dry patch.

Recommendations

Greens

- The emphasis through the remainder of autumn and winter is on keeping the greens strong, healthy and disease free. The surfaces already contain a number of disease scars (some worse than others) and it is important that a close eye is kept on the outer edges of scars to ensure that reactivity does not occur.
- With this in mind, look to keep up with iron sulphate applications through the winter on a 4 – 6 week basis to acidify the surface and harden against disease.
- The surfaces were strong and healthy at the time of the visit and I would suggest that there is no need for the planned 4:0:24 granular feed at present. Instead, look to apply 10kg/ha of water soluble ammonium sulphate over the coming weeks if the surfaces appear to weaken. This will supply 2.1kg/ha of nitrogen and can be tank mixed with one of the above mentioned iron sulphate treatments. This application should be repeated as required through the winter.
- Keep the surfaces as dry as possible through regular dew removal. Occasional use of dew dispersal agents can be helpful when growth slows down.
- Look to apply a further protectant fungicide over the next 2 – 3 weeks to guard the surfaces through December. With conditions becoming cooler, use of Medallion TL would be a good option. However, this must be applied prior to any disease symptoms at the turf surface.
- If active disease becomes problematic at a later stage in the winter, then look to use a fungicide with good knock-down activity against disease – such as *Iprodione* (Chipco Green) or *Chlorothalonil* (Instrata).
- The current water retentive nature of the soil profiles beneath the greens means that the surfaces will be susceptible to disease invasion. As with move forward with the agronomic improvement programme, it is hoped that we can notably reduce fungicide requirements.

Surface Refinement

- The current mowing height of 4.5mm appeared ideal, with the turf being strong and healthy whilst still retaining good ball roll qualities. Sustain this height for the meantime and lift to 5mm if turf weakening or thinning is observed.
- It would be strongly advised that you invest in a cutting height prism to inform the 'actual' height of cut on the green compared to the 'bench set' height. The two can often be quite different, particularly during the winter when ground conditions can be softer and the units can dig-in and cut shorter than their bench set height.
- Avoid the occasional perimeter cut on the greens through winter – particularly when growth is slow. This will help to rest some of the thinning, weaker perimeters such as the 2nd, 5th and 6th.
- Ensure that good cutting quality is retained at all times as a poor quality of cut will wound the grass plant and increase the likelihood of disease infection.
- Looking to next year, we discussed the need to allow for additional grinding of cutting units due to the recommended increase in sand input to the greens. Unfortunately, this is a natural requirement when applying good levels of sand to greens as sand is abrasive to bottom blades and cutting units.
- Maintaining good levels of surface refinement through the growing season is vitally important to maintain the desired surface texture and ball roll performance. We can discuss the refinement programme in greater detail during my summer visit next year, but I would advocate a slight increase in the level of grooming applied to the surfaces through the growing season next year.

Organic Matter Reduction & Soil Profile Improvement

- Our two key agronomic goals beneath the greens is to reduce organic matter content at the turf base and dilute the imported silty layer at 125 – 175mm depth in the soil profile. Both of these factors negatively impact greens drainage rates, cause soil stagnancy and lead to the putting surfaces softening/footprinting. This environment is also ideal for the development of anthracnose and dry patch in summer, and *Microdochium* patch (fusarium) in autumn/winter.
- It is imperative that we physically remove both the organic matter build-up and silt layer through hollow tining the greens, as well as diluting the soil profile with sand in the process. With this in mind, it is recommended that the greens are hollow tined in early spring using 15mm diameter tines, targeting a depth of 100mm and at close tine spacings of 50x50mm. To achieve such spacings, hire of the Toro Procore may be necessary.
- Following removal of the cores from the surface, apply a heavy sand topdressing and use the contra-rotating brush to fully-fill tine holes to the top.
- Depending on environmental conditions at the time, a preventative fungicide may be required prior to the work to avoid disease occurrence.
- This renovation will target organic matter in the upper profile but will not be deep enough to dilute the silty material at depth beneath the greens. This should be tackled by a further hollow tining and sanding treatment in September but this time using the verti-drain with 17-19mm diameter hollow tines attached.
- Again, we can discuss this renovation in greater detail during my summer visit but our aim should be to achieve the closest possible tine spacing with this treatment and vary the depth of application depending on the depth of the silt layer beneath each green. In preparation for this, we agreed it would be a good idea to measure the depth of the silt layer beneath each green to help accurately inform the depth of treatments.
- After this treatment, it would be worth considering micro solid tining the greens, with the Procore (and needle tines), before a further light sand application. This will help to 'close-in' the larger holes and restore the surfaces quicker for play.
- The requirements for the newer 12th green are different to the others due to this being a newer construction and there being no imported silt layer at depth. There is however a substantial organic matter build-up at the turf base like the other greens. Therefore, the spring hollow tining treatment should remain the same as the other greens but the September treatment should be applied to a much shallower depth (80mm) to this green alone.
- We can also discuss the potential for incorporating an additional scarification treatment to the greens during my summer visit.

Aeration

- Increasing the level of aeration to the greens through the year is also a key recommendation to achieve the desired structure, gaseous exchange and root development in the soils. A well-aerated soil profile will offer better drainage performance and aid the natural, aerobic breakdown of organic matter by soil microbes.
- Aim to micro solid tine the greens on a 4 – 5 week basis moving forward using 6-8mm needle tines and to varying depths. Assess ground conditions prior to treatment through the winter months to ensure that the surfaces are not too soft or saturated.
- Verti-drain the greens in early spring (late February/early March) using 12 – 15mm diameter tines to a depth of 9 – 10 inches with a small amount of heave.

- If conditions are deemed too soft to take the tractor and verti-drain onto the greens at this time, then consideration should be given to hiring in the Air2G2 air injection unit.
- Continue to sarel roll the greens through the year but look to increase the frequency to every 2 – 3 weeks if possible moving forward. Sarel rolling will help aerate the immediate 1-2 inches of the soil profile. This is extremely helpful to organic matter breakdown and the 'keying in' of sand topdressing.
- Presently, the greens are aerated using either a tractor mounted verti-drain or sarel rolling unit. Looking to the future, it would be recommended that the Club look to invest further in the aeration equipment and acquire a modern pedestrian aeration unit such as the Toro Procore. These units are extremely versatile and will help to apply aeration more efficiently and effectively, without needing to take heavy tractors on the greens.

Sand Topdressing

- Sand topdressing is a fundamental part of the greens improvement programme moving forward. Applying sand will crucially help to dilute both the excess organic matter contained at the turf base and the imported silty material at depth.
- This year, only 30 tonnes of sand was applied to the greens which would be deemed far too low. There is a certain need to increase sand inputs and next year we should be looking to apply a minimum of 120 tonnes to the greens. It is understood that this will be costly but is essential if we are to achieve our agronomic goals.
- The bulk of this sand will be applied during the above mentioned greens renovations in spring and autumn but the remainder should be applied through 'little-and-often' light dressings through the growing season. Ideally these lighter dressings should take place on a 3 – 4 week basis and after micro aeration where possible. The contra-rotating brush will be a great asset and help to integrate sand into the turfbase and minimise disruption to play.

Drainage

- The drainage installed to the 9th, 11th, 13th and 15th greens is already paying dividends, with these surfaces draining better and offering improved firmness than before. The focus over the coming months is on restoring grass cover and surface levels over the drain lines in preparation for next season.
- Look to rest these greens over the coming weeks to allow for surface recovery and also for the Greenstaff to work on them. Playing on recently drained greens too early will set back the recovery of the surfaces for the start of the season next spring.
- As discussed, where the turf is proud, a combination of light rolling (with the croquet roller) and localised rootzone removal should take place. Hand forking should follow any rolling to ensure that compaction is relieved.
- Look to stitch together the turf either side of drain lines (where possible) using the hand forks. This is a laborious process but will be entirely worthwhile.
- There is little merit in applying grass seed to the drain lines at this time of year, this should wait until spring when soil and air temperatures improve. If this is needed to localised areas in spring, then hand apply a fescue seed mixture at the recommended rate. Opting for a fescue mix would be recommended over bentgrass, as this will germinate better in cooler temperatures. The fescue may not stick around for long in the sward afterwards but will help achieve some surface recovery whilst the surrounding turf encroaches.

- Ensure that the drain lines are kept well-dressed with sand to smooth-out surface levels.
- There may be a requirement for an additional feed to the drained greens alone in spring. This should be assessed at the time and will depend on the rate of recovery over the drain lines.

Turf Repair 1st & 13th Greens

- I would highly recommend that the imported turf installed to the centre of the 13th green (on the slope) is transplanted to the outer edge of the green and replaced with mature greens turf. Imported fescue/bent turf is not compatible with the current grass mix on the greens and so will take a number of years to mature and blend. This will stand out visually, perform differently and be a headache to manage.
- Repair to the 1st green is also needed following the hydraulic oil spill. I would suggest that the turf is cut from the affected area (using a turf cutter) and replaced with mature indigenous greens turf taken from the chipping/putting green. This should match in appropriately with the rest of the green.
- Tillers Turf have recently started selling a Poa/bent greens turf which will be more in keeping with the grass mix on your greens. This may be a good alternative to transplanting turf from the chipping green or outer perimeters of existing greens, however this will be a fairly costly option.

Turf Repair 6th Green

- We also identified the need to repair the thinning area to the back left of the 6th where the green has been extended. I would recommend that you use a turf doctor to transplant the thinning areas of turf to the outer edges of the green – selecting an area of strong, dense and mature turf. The transplanted weak turf can then be worked on without play interfering. The following should be applied:
 - Look to lightly rake the area with a springbok rake to remove dead organic material and algae from the surface. This is currently restricting regrowth of the turf.
 - Then apply some hand forking and a light sand application.
 - When soil temperatures improve in spring, look to hand fork and overseed the area with fescue to help regain grass cover.
 - Consideration could be given to bringing in the green collar in this area to allow for recovery (as suggested above).
 - In the meantime, avoid pin placement in this area through the winter and early spring.
- The key reason for droughting and anthracnose invasion of the turf in this area of the 6th is that pure sand was used during the green extension. This is struggling to retain moisture and nutrients in sufficient quantities for the turf to prosper – particularly through drier spells in summer.
- A change in wetting agent will help in this regard (discussed below) but I would also suggest that we look to incorporate a 60:40 or 50:50 sand/soil mix into the rootzone here to aid with water and nutrient retention. This should be done following tining on 2 – 3 occasions next year just to this localised area. Ensure that you select the same sand material currently used for topdressing as the sand component of the mix.

Moisture Management

- I would suggest that the current wetting agent programme is adjusted next year to avoid use of the Penetr8 - R product during the main season. This is a penetrant type product which helps to rapidly move water from the surface through soils. This will potentially be beneficial in the autumn/winter when soil moisture levels are higher but will exacerbate the dry patch issues seen through summer e.g. 5th & 6th greens. Changing to a block co-polymer product will help the surfaces retain a better consistency in soil moisture, dry down more uniformly and preventatively manage dry patch development. Example suitable wetting agents would include: Breaker (Rigby Taylor), Primer Select (Aquatrols), H₂Pro (ICL).
- If soils do become hydrophobic through the season, then use of a curative wetting agent such as Aquaduct (Aquatrols) or Breaker Curative (Rigby Taylor) should be used to flush soils and reset the soil moisture balance.
- Penetrant wetting agents have their uses and can be effective through the autumn and winter months to help with greens drainage performance.
- To assist with the moisture management programme on the greens, I would highly recommend that you purchase a soil moisture probe at some point. These are invaluable tools for closely monitoring soils moisture levels and therefore accurately informing irrigation treatments. This helps avoid under or over watering which can be detrimental to turf health and performance. For more information, please visit: www.delta-t.co.uk or www.specmeters.com.

Nutrition

- The greens nutritional programme makes use of good quality products and largely delivers positive results. However, we discussed making some slight adjustment to the programme next year to reduce nitrogen inputs and achieve a more consistent delivery of nitrogen to the greens.
- Approximately 130 kg/ha of nitrogen has been applied to the greens this year and I would suggest that we look to lower this down to 85 – 110kg/ha next year. If nitrogen inputs are too high, then this will initiate too much growth and the production of excess organic matter.
- Anthracnose disease has been an issue on the greens over recent years and I would suggest that if we adopt more of a 'little and often' approach to feeding then this avoid 'peaks and troughs' in growth and reduce anthracnose occurrence.
- We discussed adopting the use of water soluble straight fertilisers within the fertiliser programme moving forward to help reduce costs but also gain a greater control of nutritional inputs. Hopefully the savings made in this area can be invested in the recommended increase in sand topdressing.
- Other potential savings can be made by trimming supplementary products such OxyTurf, Cal-Form and Mag-Form. The requirement for potassium, phosphate, magnesium, calcium and other macro and micro nutrients should be informed by laboratory testing each year. We can carry this out for you at STRI or alternatively I would be happy to provide a second opinion on any testing results undertaken by fertiliser companies.
- To summarise the recommended changes, I have detailed an example fertiliser programme in a separate spreadsheet, which will follow the report. As with all fertiliser programmes, this should be considered a guideline only and the application rates and timings should be adjusted depending on environmental conditions and turf requirements at the time. This is very much up to the expert judgement of the Greenstaff.

Tree Removal

- Creating a desirable environment around each green complex is essential for producing strong, healthy greens. Dense surrounding tree populations will restrict sunlight and airflow from reaching the putting surface. This in-turn will impact turf health and limit natural drying of the surfaces – this is particularly important through the autumn and winter months when disease pressures are high. A good example is the 10th green, where dense tree populations to the left of the green block the prevailing wind. It was therefore no surprise to see that disease activity was at its highest on this surface.
- With this in mind, I would suggest that tree removal is undertaken to the right of the 8th green, back of the 4th and left of the 10th in the near future.

Signed

A handwritten signature in black ink that reads "A R Newton". The signature is fluid and cursive, with a long horizontal stroke extending to the right from the end of the name.

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