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To

KØBELHAVENS GOLF KLUB

Report on the Proposed Management and Re-development of the Golf Course

Inspection Date – 2 May 2007

1.0 BRIEF

1.1 To carry out an agronomic assessment of the golf course and the resources available for its maintenance.

1.2 To comment upon the need to rebuild putting surfaces, green surrounds and tees, and to advise on materials and methods.

1.3 To advise on the management plan.

1.4 To submit a report on findings.

2.0 PRESENT

2.1 The course was inspected with Nikolaj Ipsen and Martin Nilsson.

2.2 Matters arising were discussed with Steen Christian Pedersen and Ole Vagtborg.

3.0 BACKGROUND

3.1 The Club has plans to improve this historic golf course by carrying out minor works to redevelop course features that are in poor condition and to reshape greens and green surrounds to add interest in playing strategy. This is in conjunction with Tom Mackenzie.

3.2 In parallel, a management plan has been set in motion that is intended to develop turf on playing surfaces, which: will be reliable in the face of stress (heat/cold/diseases); will provide better playing surfaces for longer each year; and will have a low requirement for pesticide use.

4.0 REVIEW

4.1 The putting surfaces fall into two groups: those that carry a robust mixture of grass species (e.g. 2nd, 4th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th and 15th); and those that have a grass cover with a high percentage of weak Poa (e.g. 1st, 3rd, 5th, 6th, 16th, 17th, 18th and practice putting green). The primary technical target in developing consistent putting surfaces to a good standard

throughout will be to replace the weak Poa with perennial species (Festuca and Agrostis) in order to match in with the stronger greens. The first turn of the key to achieving this will be to eliminate soil compaction at a depth in excess of 15cm from surface level.

4.2 I did not see any green or greens where I thought it will be essential to reconstruct to produce a stable putting surface for the future. Indeed, on what are currently the weakest greens at the 1st and 18th, reconstruction without relocation away from tree-shaded locations or by removing trees is likely to cause more problems than it solves. However, these greens still have a good potential for improvement *in situ*, even if the possible level of long term success is not as high as elsewhere.

4.3 At the 8th, the rootzone mix installed when the green was rebuilt a few years ago will not react to fertiliser and irrigation in the same way as the older greens and the turf is inherently thinner as a result. Nevertheless, this feature can be adjusted by surface management techniques.

4.4 Although there is no technical need to reconstruct greens at this stage, there will be value in extending the 4th green to create a greater number of pin positions and so lessen the level of focussed wear and tear on this highly undulating putting surface.

4.5 Returning to the management programme: in parallel with extra action to eliminate deep seated soil compaction beneath putting surfaces, more needs to be done to achieve maximum air circulation through the upper profiles by frequent perforation. This is to reduce thatch build up and make the greens much firmer. This will also minimise the adverse effects of sand layers in the upper profiles that cause a capillary break and affect root depth. Beyond that, I advised adjustments to the fertiliser and top dressing plans and some extra overseeding in places.

4.6 As to resources for management of the greens, it was reported the well that supplies water for irrigation is not functioning properly. This is something for urgent correction, because effective and precise irrigation is vital if you are to get the best out of the putting surfaces year round - under supply of irrigation on greens can have as bad an effect as over-watering. It was noted too the layout of the pop up sprinklers around greens gives poor coverage in places (e.g. at the 5th and 7th) and the positioning of the sprinklers at many greens was not thought to be ideal. So, to ensure you get the best out of the putting surfaces for the future I also recommend the Club has the system as a whole reviewed by an independent irrigation engineer to assess what improvements should be made.

4.7 Foregreens should be at a higher standard and to this end they require an intensive maintenance programme that is as close as possible to that applied to the putting surfaces.

4.8 Further out, banks and mounds need to be rebuilt around bunkers where accumulations of sand are causing an inhospitable growing environment (e.g. at the 4th, 10th, 11th, 14th and 15th). This might be tied in with basic bunker improvements along similar lines to those carried out recently at the 5th and 18th, and with relocation of bunkers (e.g. at 8th).

4.9 In addition to basic renovation of weak areas of green surrounds there is plenty of room for improvements or alterations within greensites to give the course a much more links-like characteristic. What is envisaged is to carry out re-contouring to give a capacity for close mowing to fairway level all around greensites. Also, to remove retaining banks at the margins (e.g. at the 9th), to give more potential for balls to run off greens (as can happen at, e.g. the 14th) and to give scope for a greater variety of shot selection to get back on to the putting surfaces. At most holes such work will only be a minor operation (e.g. at the 16th), but more extensive remodelling is needed in places (e.g. at 7th and 8th). This more major work must be done at the right time in dry weather in August and September, not during the winter, if you are to get the best results using simple techniques and least overall disruption to play.

4.10 Do note though if you are to develop greensites as envisaged then you will need an extra (separate) irrigation capacity for green surrounds. Also, extra input into routine maintenance will be needed in the long term, e.g. regular top dressing. Lastly, you must consider how best to manage wear and tear by controlling traffic routes around greensites.

4.11 The fairways need good aeration to achieve a more uniform grass cover of better quality and smoother contours overall. At this stage, the main requirement is to introduce an intensive vertidraining programme for the winter period and to combine this with rolling to smooth out the turf surfaces. At a later stage it may be necessary to introduce a top dressing programme for all fairways, but in the first instance I suggest you limit this to the 1st fairway only.

4.12 To improve local areas of fairway, there are places where new drainage will be necessary, not least on the approach at the 12th. This also may be required in other water collecting places (e.g. on the 2nd), but it will be a case of making an assessment of the improvements to be gained from vertidraining in winter before going ahead on these latter areas.

4.13 Fairway bunkering is a topic to be dealt with by Tom Mackenzie.

4.14 Tees were not good. They have not received basic maintenance in the past and soil compaction problems are severe on what are mostly small platforms. Also, surface levels are uneven (e.g. at the 1st and 12th). However, the poorest tees are the newest ones (e.g. at 8th, 15th and 16th). On these new tees the fault is in the turf, rather than in the structure, and so it may be easier just to replace the surface with new sods. Before taking action on any tees though, seek advice from Tom Mackenzie on platform size and location.

5.0 RESOURCES AND EQUIPMENT

5.1 Comments on the irrigation system have been noted in Item 4.6 above.

5.2 The water supply seemed very clean, but it would be interesting to know the bicarbonate content, given a fairly high pH value (7.6), which could be lowered with benefit.

5.3 A good range of course maintenance machinery is available overall. The one item missing is a means of routine perforation of greens year round, to

maximise air circulation within the upper profile, such as a Star Slitter from Greentek or similar. This is strongly recommended for purchase.

5.4 Beyond that, I suggest the vertidrain machine you own is rather small and not powerful enough for curative operations on greens. Nor is it big enough for use on fairways. You might hire a contractor with a larger vertidrain to carry out treatments on selected greens and fairways in the short term, but for the future the purchase of more powerful equipment, such as a 1.6m Wiedenmann Terraspike or an equivalent Vertidrain, will be a good buy.

5.5 Comments on fertiliser are given in later sections. As to top dressing, I suggest you change the mix used from one that has a compost base to a material that uses sphagnum as the organic matter content. The high cation exchange capacity in the compost will trap water and nutrients too near the surface and this may affect deep root growth.

5.6 I understand the current staffing level is a total of 5. Really you should have at least one more man specifically for the summer period.

6.0 GREENS

6.1 Assessment

Having inspected the greens and discussed the treatment plan, I thought the correct principles are being applied and where changes are needed these are adjustments in focus, rather than anything radically different. The primary items you need to work on over and above those covered by the current plan are soil compaction within the deeper soil profiles and measures to firm and reduce thatch levels, to give firmer greens that drain rapidly throughout the year.

I was supplied with details of chemical test results on soil samples taken from greens. These show the soil pH to be around neutral and thoughts might be given to promoting a higher level of acidity, through treatments using ammonium sulphate and iron sulphate. Phosphorus, potassium and magnesium availability are all good.

However, the really interesting part of the analysis is the level of copper, which is surprisingly high. I suspect this may be present as a result of applications of copper based fungicide in the past. This is highest on the 1st green where (because of shade) disease problems are likely to have been most acute. Whether or not you need to be positive in carrying out measures to offset the potential effects of copper in the soil is debatable at this stage, but it is something to bear in mind. This may be something to return to when the effects of other operations (specifically relieving deep seated soil compaction) have had an effect.

6.2 Treatment recommendations

Where comments were made concerning elements of the current management plan, and where extra treatments were advised, is confirmed as follows:

Strategy. The current policy of working towards the establishment of perennial fine grass types on the greens is the correct one if you are to have:

- The longest possible playing season;
- Good putting surface performance (smooth, quick greens) on average;
- And least potential damage due to stress factors.

The grass mix to look for is a blend of Festuca and Agrostis, with minimum quantities of weak Poa. To achieve this you must create the optimal growing environment for each green and then apply surface management techniques that will promote a competition between species, to the advantage of those grasses that are targeted.

At this stage, a high emphasis is being placed on promoting Festuca, but I would suggest it will be best to use a mixture of a Festuca and Agrostis. Fescue will not grow well in shady circumstances, so there needs to be an input of Agrostis as well, especially at the 1st, 18th and practice putting

green. For this year, I suggest you continue with the Fescue plan overall, but at these shady greens carry out extra overseeding with competitive Agrostis cultivars (such as Denso or Lance) on two occasions during the summer, using the Proseed. For the future, return to a mixture of Agrostis and Festuca all round, but continue to use more aggressive cultivars of Agrostis similar to those noted above.

Vertidraining. On greens of this type it is absolutely essential they are deeply aerated to cultivate the lower soil profile to 25cm on at least one occasion per year, ideally in October, using 12mm diameter pins on a 10cm x 10cm pattern, applying gentle lift without ridging. This will be a minimum programme for greens in general and ideally this should be enhanced with a second pass at the end of winter, on this second occasion missing out the lift

However, where there is a special soil compaction problem the intensity of this work must be increased to create better growing conditions and help you make a start on replacing the Poa present in compacted places. So, when vertidraining Poa dominated greens in October use 20mm diameter pins to a depth of 25cm, applying the maximum tolerable level of lift that can be settled back by rolling afterwards. This is to fracture the underlying soil. Follow up with a second vertidraining using 12mm diameter pins on these weaker greens at the earliest possible date in spring.

As things stand, the Club's vertidrain machine is not up to this vigorous action and you will need to bring in a contractor with larger equipment to make the work effective. Indeed, for the long term I think you could do with a larger vertidrain and this must be considered for future purchase. The vertidrain currently owned will be quite satisfactory for routine preventative aeration treatments, but it is not powerful enough to be curative.

Hollow tining. At the time of the visit work was in progress to hollow tine, top dress and overseed greens. Plan to repeat this process in August along similar lines to that carried out in 2006. Subject to progress over the coming twelve months, hollow tining, overseeding and top dressing in spring and autumn 2008 might be confined to those greens where there remains a high percentage of Poa within the turf and at the 8th.

At the 8th green, after hollow tining and before top dressing, backfill the holes with a material to improve water balance such as Axis or Zeolite. This process must be ongoing in both spring and autumn for the next two years.

Routine aeration. Aeration of greens cannot be confined to major operations such as vertidraining and hollow tining. In between you must plan to use needle (8mm diameter) pins on the small vertidrain at four week intervals year round and then add perforations using a Star Tiner or similar at 1-2 week intervals to maximise air circulation within the turf.

Fertiliser. The main fertiliser element that needs to be supplied is nitrogen, to a maximum of 80kg/ha through the year. Given the analysis results provided, I do not see a need for routine inputs of potassium, phosphorus or magnesium at this stage. As a basic annual package I advise applying ammonium sulphate at 10 g/m^2 in frost free weather in mid to late March, followed on by an application of 8:0:0 at 35 g/m^2 in early May. In mid June, mid July and mid August, apply ammonium sulphate or similar at 5 g/m^2.

Iron sulphate. During the autumn and winter, from say mid October onwards, apply iron sulphate at 5 g/m^2 at 6-8 week intervals.

Top dressing. Following a generous treatment in combination with spring hollow tining, allow for light top dressings at monthly intervals to August, then a final application in conjunction with the planned overseeding.

Verticutting. Prior to each top dressing make a double pass with the verticut units set to 1mm below roller level and remove the arisings. In between verticutting operations, brush the greens twice per week prior to mowing to stand up the grasses.

Mowing and rolling. No variations were recommended to the planned mowing heights. To help maintain good green speed, I suggest that once steady growth is under way you use the vibrating roller units twice per week (on say Tuesday and Friday) as a routine operation, and possibly make extra passes in the week prior to special events.

As to the scope of mowing, it was recommended that where greens tend to be droughty at the margins you reshape to take close mowing within the full scope of the irrigation system (e.g. at 5th and 7th).

Irrigation and wetting agent. During spells of prolonged dry weather keep checking on the profile beneath greens and start irrigation when there is distinct drying through the top 2cm, applying just enough water to top up to a full moisture level without excessive wetness. Between irrigation cycles allow this drying through 2cm to reoccur.

Given the nature of the irrigation system it is likely that you will only be able to use the pop ups for base watering in places well covered. When the weather is warm you will need to follow up on alternate days by hand held hosing extra dry spots, to provide supplementary water without flooding those zones that are already well irrigated.

As a wetting agent programme I recommend three treatments using Revolution during the spring and summer.

Disease control. Although the plan is to develop the greens so there is a very low reliance on pesticides, while there is limited availability of fungicides I suggest you make best use of these. To this end, for outbreaks of Fusarium I recommend using Chipco as the first line of attack. Key EW might be used as a preventative treatment in winter if there is the prospect of prolonged snow cover.

Weed control. Remove patches of mouse ear chickweed on the 4th and 14th greens by spot treatment with selective herbicide at times of steady growth.

6.3 Green extensions

If it is decided to enlarge individual putting surfaces such as the 4th to create a greater variety of pin positions I suggest:

- You strip off the turf and 10cm of topsoil from the proposed extension areas.

- Loosen the underlying soil and rake to the desired contours.
- Make up the deficit in soil depth by adding compost based rootzone mix and firm in.
- Re-establish these areas with turf taken from the practice chipping greens on the Par 3 course.

The greens on the Par 3 course form a valuable resource for turf, both for extensions and carrying out repairs on greens damaged by deer. With this in mind it will be a good idea to extend the Par 3 greens too, by mowing them larger wherever possible.

The turf on the practice greens will need preparation for lifting and moving by scarifying and top dressing in spring and autumn, by routine mowing alongside the main putting surfaces, and by carrying out monthly verticutting as described for the main course greens whenever grass grows is steady. Allow for one spring and one summer fertiliser application.

7.0 GREEN SURROUNDS

7.1 Assessment

There is a lot of scope for better surrounds to putting surfaces by:

- Improving the growing environment around bunkers where there is high sand accumulation beneath the turf.
- Relocating bunkers as advised by TM.
- And by recontouring to achieve gradients for smooth close mowing, to create new interest in strategy for play.

The scope of works needed from hole to hole will be determined by TM, but my impression was that in many cases (beyond adjustments to bunkers) just minor operations are required, such as extending banks to give shallower, smoother gradients and contours. Small works might be done as in-house operations by the Greenkeeping staff. These can be carried out in autumn during spells of open weather, but not when the soil is wet.

However, where green surrounds as a whole are to be recontoured you will need a contractor to help you to carry out the excavation work and shaping, to ensure these works are done quickly and efficiently when the soil is no more than moist (ideally dry). It should feel no more than cool; not wet. This means such operations must be done in August and September. Then you can carry out re-turfing in October and expect the amended holes to be back in play promptly the following spring. I strongly recommend the new areas are re-established by sodding using approved Agrostis and Festuca turf imported from a turf farm.

Assuming a minimum 15cm depth of well structured loamy sand topsoil can be replaced over reshaped on-site subsoil, I do not see a need for soil amendment or amelioration when re-shaping green surrounds. Nevertheless, I would emphasise the soil must not be moved when it is wet and water can be squeezed out of it. It will help if stockpiles of topsoil are covered with plastic sheeting or tarpaulins.

To retain good drainage within reshaped greensites, the soil at the base of slopes must be ripped before final cultivations and turfing. It is important too that swales and hollows are piped drained to take collected water to a positive outfall. The backfilling over such drains should be covered with a minimum 10cm depth of returned topsoil.

If you wish to create deep hollows adjacent to greens, confine this principle to the higher parts of the course and avoid holes such as the 1st, 5th, 6th and 18th. Within such hollows, provide drainage in the form of gulley pots or soakaways with an overflow, just in case. However, I do not see a need for sand capping as well.

Indeed, I do not envisage sand capping of any of the reshaped areas, but I do think top dressing will be a necessary operation on closer mown green surrounds, say twice per year as a routine maintenance operation in the future.

Also with respect to future maintenance, if you are to carry out close mowing on banks and mounds around greens you should allow for the installation of an irrigation system specifically for the green surrounds, separate from that which covers the adjacent putting surfaces. The possibility of installing such a system and its cost might be part of the proposed investigation of the current irrigation system.

A timetable for works on green surrounds can only really be drawn up once the full scope of planned operations has been determined. However, I would envisage this being no shorter than three years and no longer than five years, to get a balance between keeping the course in play and pushing the project through to completion.

7.2 Treatment recommendations

Foregreens. Fringes and aprons to greens should be maintained as per putting surface, other than for height of cut (here I suggest 10-12 mm). Take extra care when applying operations that may damage the irrigation system.

General surrounds. In current circumstances, cut these areas as tightly as practical with a ride-on machine to a height of 30mm +/- 5 mm that avoids scalping and excessive drought damage in summer. Where it is not possible to use a ride-on machine, fill in the gaps by flymo-ing. Allow for one application of slow release fertiliser in spring. Ensure good vertidraining of walkways around greens as part of winter operations on 1-2 occasions, using the more powerful machine advised for works on fairways. I do not advise routine scarifying of these areas.

8.0 FAIRWAYS

8.1 Assessment

The good grass on fairways needs to be strengthened at the expense of Poa. The key item in this respect will be annual vertidraining using a powerful machine with plenty of lift, on a minimum one occasion. At the 1st, and in other places where there is a high concentration of Poa, two treatments per year will be advisable. This is a job to be applied between October and March.

In addition, the fairways need to be smoother. They were very bumpy. When vertidraining in autumn, once the aeration work is completed you might go over the surfaces again with the machine set so that the pins are out of the ground. At a later stage general top dressing of the fairways will be an advantage, but for the present I suggest confining this to the 1st as a spring operation, using sand only, and overseeding at the same time.

8.2 Treatment recommendations

Mowing. Because the fairways are quite bumpy it is not possible to mow very close. I suggest a height of cut in the order of 18-20mm as routine.

Fertiliser. No fertiliser is advised for fairways.

Vertidrain. In autumn, vertidrain all fairways using a 2 metre machine on a powerful tractor, fitted with 20-25mm diameter pins and setting these to have plenty of lift. Once vertidraining is completed you might run over the fairways again with the pins out of the ground to smooth off. Consider repeating this process in spring at the 1st and in other locations where there is a high concentration of Poa, e.g. at the 2nd.

Top dressing. Because there is regular deer damage across the 1st fairway during the winter, plan spring top dressing using sand at 2-3kg per square metre and brush in. Overseeding might be carried out at the same time.

9.0 TEES

9.1 Assessment

The tees need a good basic maintenance programme with plenty of aeration to bring about a general improvement in presentation. This is the baseline to start from. Beyond that you need a plan for rebuilding and relevelling, and enlarging men's tees because these are quite small. Before embarking on relevelling though, make an assessment of tee locations. Tom Mackenzie will be able to advise you on dimensions and possible repositioning.

The weakest tees were the newest because there is a problem with the turf that has been laid. Essentially, the soil that came with the sods has become very, very compacted and this is preventing the grass from growing down into the underlying rootzone material. This feature might be corrected by intensive hollow tining, but this will take a long time and it may be easier simply to strip off the turf back to the rootzone mix and start again with new sods.

9.2 Treatment recommendations

Mowing. Mow tees routinely at a height of cut of 12-15mm, preferably using pedestrian operated equipment on small tees where turning can be difficult.

Hollow tining, **top dressing and overseeding**. Plan a twice yearly programme of coring, dressing and overseeding in spring and autumn.

Routine aeration. Carry out monthly solid tining with the vertidrain machine using 8mm diameter pins.

Fertiliser. Allow for two applications per year of 13.0.15 or similar.

10.0 BUNKERS

10.1 Bunker sand

I thought the sand in bunkers is rather gritty and not a particularly attractive colour. As part of bunker improvements you might think about buying sand with a better grading and a more attractive appearance.

D M STANSFIELD
11 May 2007