Making great sport happen

WEST LINTON GOLF CLUB

Advisory Report on the Golf Course incorporating the STRI Programme

Report Date: 26th November 2021
Consultant: Gary Smith

West Linton Golf Club

Date of Visit:	Thursday 4th November 2021
Visit Objective:	Review condition of the course, take objective measurement of greens performance and confirm maintenance requirements.
Present:	Mr Stuart Ferguson – Course Superintendent Mr Simon Kinghorn – Captain (part) Mr Kerr Middleton – Green Convenor Mr Harry Sim – Secretary (part) Mr Gary Smith – Agronomic Consultant STRI Ltd
Weather:	Sunny. 2°C. 105mm rainfall 7 days pre-visit.

Headlines

- The tested greens rootzone moisture volume averages were above target and expressed value ranges from 31% - 45% volumetric water content and without doubt recent rainfall and elevated organic matter volumes have impacted this set of outcomes. The greens have absorbed a high volume of rainfall in the weeks pre-STRI visit and to have average volumetric water contents at 35% which exhibits the progress being made on the course. The individual surface test results will have been impacted by the recent rainfall and localised surface topography, but the main point of note is the influence the upper rootzone organic matter volume and the variability of it across the greens rootzone profiles is having. With a continued strategic aeration plan, increased microbial inputs, and targeted top-dressing, all greens will further develop into surfaces that look and play in a more uniform style with similar ball roll characteristics. Although average contents of moisture retaining organic matter and moisture content are above targets, there is no doubt the green surfaces at West Linton Golf Club are in particularly good condition, yes! there are pressure points and yes! there are areas of concern, but agronomically and botanically the position is positive.
- The challenges in managing soil moisture during ever changing extremes of weather episodes of wet and dry cycles has been widely seen to fuel increased Basidiomycete activity (fairy ring), the underlying trigger to most pathogenic (disease) outbreaks and developing areas of lingering abiotic and biotic stress. Another discussion that will need to take place is the course wide upgrading of the irrigation system to deal with the potential future extremes of weather. The maintenance team work incredibly hard to produce the fine turf surfaces on display on every section of West Linton Golf Club, but areas without the safety of irrigation are always at the mercy of these extremes of weather. Mitigation must be planned for future years to ensure the longer-term health securities and playing characteristics expected at this illustrious golf club.
- Surface firmness averages were within the target parameters and an excellent result in the very recent poor weather conditions, but like the moisture content results a wide variability in outcome was evident across the playing surfaces. As with moisture volume, the organic matter content and the recent rainfall played their part in this suite of results, but a priority for this Club going forward is to continue to improve firmness consistency across the entire green surface and surrounds.
- Smoothness results averages were within or just above target. This is a test of the vertical deviation a golf ball experiences on the green surfaces during a putt, and these results are an incredibly good outcome at any time of the year, to express such consistency in November after poor weather episodes is outstanding for the maintenance team and a truer reflection of the quality of the putting surfaces at West Linton Golf Club. Continued demanding work by your maintenance team has underpinned these positive results despite the more challenging environmental conditions within the greens surfaces this season.
- Trueness results test the lateral movement the ball will experience on the green surface and in this case, as expected, due to the challenges within the green surfaces this year, all tested greens were above target. A set of results that can be improved upon quickly in season 2022.

- West Linton like so many golf clubs across Scotland has had real extremes in weather episodes to overcome since the spring of last year. The 2020 early season restricted maintenance regimes followed by the explosion in golf play put many grass plant swards under challenging health pressures, likewise the wet and dry cycles experienced throughout that period which preceded, one of the coldest winters on record, which involved unprecedented levels of ice and frost cover, in some cases creating anoxic (lack of oxygen) conditions for many grass plant swards. These swards were only to be further weakened, in some cases to the point of destruction, during a very cold spring in 2021, our traditional regenerative period - which failed to materialise this year.
- Low temperature injury scars, more commonly called Winterkill, are still visible on several grass plants within the green surfaces today, although at a point where they are growing out and should disappear in a matter of weeks. The lesions will have been a major interruption in the grass plants normal growth cycle, however, at the time of STRI visit, I could see no evidence to suggest that the low volumes of still injured grass plants should not make a full recovery.
- Organic matter levels in the tested greens in the 0-80mm horizon are elevated and above target volumes, although, due to the current top-dressing and regular maintenance inputs make this series of tests results only worthy of note and not to the point of real concern, but that will change if the current accumulations increase. The greens will however require some increased maintenance inputs to stabilise and to reduce the organic matter volumes to ensure they continue to perform at their optimum levels and provide the growing environment the desired fine turf grasses thrive in. Planned maintenance will remedy this issue and I have every confidence the maintenance plans of increased aeration, encouraged microbial decomposition and disciplined top-dressing inputs will be adequate to stabilise and reverse the current trend.
- Basidiomycete fungi (fairy ring) activity was still visible on all viewed greens surfaces and surrounds. Surfactant (wetting agent) and appropriate maintenance strategies are in place in most sections and proposals were discussed to increase the surfactant application area covered. These applications, if adopted, will continue to dampen the numerous damaging symptoms expressed by the Basidiomycete fungi activity.
- Michrodochium patch (fusarium patch) was evident across several sections of the course, however at the time of my visit, there was no requirement for an immediate intervention from the maintenance team and all affected sections were expressing positive signs of recovery.
- Foliar Anthracnose (Colletotrichum cereale) although at low levels had had a negative impact on plant health and was apparent on several damaged sections around the clean up cut area and greens collars. It was evident that the management tools adopted by the maintenance team had controlled the outbreak, but due to the high number and variety of pathogen expressions and outside stressful influences, grass plants had been lost.
- Historical Leaf spot disease was evident on a few sections around the golf course and like the other pathogenic activity is an expression due to the particular set of weather episodes we have experienced this year, it further highlights the number of biotic and abiotic stresses the grass plants have had to contend with during the challenging weather periods and is one of a number of circumstance that has caused the majority of grass plant loss at the Club, the damage at the 5th green the most obvious example.
- The wider areas of the course are seen to be presented well, whilst some areas of traffic related wear and stress related thinning have had no additional time to recover during the spring cold period. This annually expected regenerative spring period is a luxury we should not expect in future, as the fickle and ever-changing climatic conditions are proving, so proactive protection of sensitive areas through green approaches, green surrounds and natural pathways across the course needs to be set early this off-season, especially given the increase play courses are experiencing.
- Woodland management is now at a stage where actions will need to be introduced to reduce the impact of increasing shade cover resulting in lower available light levels and restricted air movement across many fine turf surfaces. I would suggest that these works are planned and implemented as soon as possible, as there are many canopies and dense plantations that are negatively impacting grass plant health outcomes, below or surrounding these sections.
- The forward-thinking microbiome stimulant, chemical and organic based nutritional product application choices and application windows are apposite and correct for the conditions at West Linton Golf Club,

although always subject to tweaks and revisions as the maintenance team and the grass plants react and adapt to seasonal changes, the fickle nature of our weather patterns and the environmental stresses both biotic and abiotic attributed to climatic change. A model for the future management of most golfing facilities .

Key Actions

- Achieving increased inputs of surface aeration and top-dressing applications to dilute the organic matter content and to improve surface firmness is a priority this off-season and throughout 2022.
- Introduce more top-dressing to the greens collars and greens approaches.
- Increase all refinement inputs such as brushing and grooming to the greens and always include green surrounds and approaches.
- Plan to add an independent brush system to the maintenance tools, usable on all turf sections.
- Surfactant (wetting agent) usage should be extended into the off-season and to the fairways to alleviate any current and future hydrophobic conditions.
- Plan a woodland management strategy looking to mitigate the shade issues that are having a negative impact on the fine turf surfaces.
- Plan to improve the Club irrigation system.

Objective Measurements

Measurement	Average	Target Range
Soil Moisture (%)	35% (range 31-45%)	15-30%
Hardness (Gravities)	92 Gravities (range 80-99g)	85-120 g
Smoothness (mm/m)	25.7 mm/m	<25 mm/m
Trueness (mm/m)	14 mm/m	<10mm/m
Green Speed	8ft 5in	8-10 ft
Organic Matter 0-20 mm (%)	10.9%	3-6%
Organic Matter 20-40 mm (%)	8.6%	<4%
Soil pH	5.3	5.0-6.5
Phosphate (P_2O_5)	6.4 mg/l	>10 (mg/l)
Potassium (K_2O)	81 mg/l	>30 (mg/l

Key: In Target | Marginal Variance | Out of Target

Photo Observations and Comments

Figure 1: West Linton is presented to the highest standards recent challenging environmental and social conditions allow and is one of the finest examples of a moorland course I have come across.

Figure 2: Michrodochium patch has expressed on many surfaces.

Figure 3: The underpinning Basidiomycete activity has influenced all other pathogenic outbreaks on the golf course greens and surrounds.

Figure 4: Thinning grass plants because of Basidiomycete fungi activity and a secondary Anthracnose outbreak.

Figure 5: The rootzone is evident of an open structured upper layer with well diluted organic matter and slightly more dense but friable lower rootzone aggregate with excellent root growth from the grass plant canopy.

Figure 6,7,8,9,10 & 11: The concerning damage on the greens is primarily on the collars and outer sections of the greens, there is not a single cause to pinpoint for this damage, it is a result of all the abiotic and biotic stresses mentioned in the report exacerbated by much needed regular maintenance such as the clean up cut and surface topography.

Figures 7 & 8: The concerning damage on the greens is primarily on the collars and outer sections of the greens, there is not a single cause to pinpoint for this damage, it is a result of all the abiotic and biotic stresses mentioned in the report exacerbated by much needed regular maintenance such as the clean-up cut and surface topography.

Figures 9 & 10: The concerning damage on the greens is primarily on the collars and outer sections of the greens, there is not a single cause to pinpoint for this damage, it is a result of all the abiotic and biotic stresses mentioned in the report exacerbated by much needed regular maintenance such as the clean-up cut and surface topography.

Figure 11: The concerning damage on the greens is primarily on the collars and outer sections of the greens, there is not a single cause to pinpoint for this damage, it is a result of all the abiotic and biotic stresses mentioned in the report exacerbated by much needed regular maintenance such as the clean-up cut and surface topography.

Figure 12: The bunker complexes are in particularly good condition and once the new sections mature will prove an asset to the golf course.


Figures 13 & 14: The bunker complexes are in particularly good condition and once the new sections mature will prove an asset to the golf course.


Figures 15 & 16: The fairways are outstanding in uniformity and botanical quality at west Linton.


Figures 17 & 18: Stress from Shade is a concern on several sections of the golf course.

Recommendations

Greens

- This off-season look to adopt an aggressive approach to scarification and employ a scarifying unit such as the Sisis or Graden with @1mm blade which can achieve working depths of -20mm and then aim to apply a top-dressing sand coupled with an inter-seeding with a desired cultivar mix coated with a mycorrhizal fungi. These additions to the scarification operations will vastly improve the recovery from the intensive works and increase the regeneration of desired fine turf grass species within the greens surfaces and surrounds.
- Continue to scarify the greens surfaces bi-monthly to increasingly remove organic material in the top 5-10mm of the profiles and replace with sand. These are other opportunities to incorporate a cold inter-seeding with a suitable cultivar mix and mycorrhizal fungi inoculant through the same operation
- The introduction of microbes capable of decomposing Organic Matter, e.g., Symbio Thatch eater or Aitkens T-Thatch is recommended. The additional decomposition of organic matter will support an even more swift reduction in the future need for aggressive maintenance on the fine turf surfaces, more so in the lower horizons, but I will caution that these microbial inputs will only assist if the rootzone is well maintained, aerated/oxygenated and moisture levels managed.
- The greens and surrounds would benefit in many ways if they were inoculated with Mycorrhizal fungi. Mycorrhizal Associations/Mycorrhizal fungi form a mutualistic symbiosis with fine grass plants causing the fungal hyphae to extend the root systems and allow the roots to contact a greater volume of the rootzone and increase the solubilization of nutrients, they also support and regulate intrinsic water use efficiency.
- The addition of monthly applications of Silicon will without doubt help in the removal of any lingering Poa annua (AMG) seed heads and further improve the already particularly good playing characteristics on the surfaces. Beneficial effects of silicon application have been studied extensively in fine turf grasses, and observed outcomes include improved cell wall strength and leaf erectness, increased tolerance to environmental stress, and decreased susceptibility of plants to pests and diseases. Silicon is also known to alleviate numerous abiotic and biotic sources of stress in plants including herbivory, pathogens, drought, and heavy metal toxicity whilst Increased traffic tolerance has been observed following silicon applications.
- As discussed at the time of my visit, adopt the use of Fulvic acid (10lt per hectare) in the off-season, it will prove valuable to the greens condition going forward and will increase positive health outcomes for the grass plants throughout the off-season. Fulvic acid enhances cell division, elongation and root growth is magnified with its obvious benefits to grass plants (so long as moisture and soil structure are appropriately managed), Fulvic acid more importantly increases the plants oxygen uptake capacity with an associated increase in chlorophyll production and the permeability of plant membranes which improves the uptake of all nutrients.
- The addition of monthly applications of seaweed throughout the calendar year will also have a beneficial effect on plant health and is advised. This will facilitate healthy and robust grass plant swards on all fine turf areas of the golf course.
- Within the off-season period, plan to solid tine the greens and collars at a variety of depths using an 8-10mm diameter tine @35mm spacings and backfill the tine holes with a sand top-dressing. Carry this operation out on at least three occasions over this period and on each occasion cold seed using a suitable seed cultivar mix coated with a mycorrhizal fungi.
- Increased aeration inputs must also be achieved to support the current works carried out by the maintenance team, bi-weekly Sarel rolling is requested to continue and will benefit the surface conditions short medium and long term, as is reduced intervals between aeration operations such as solid tine aeration or air injection methods. Another possibility and one that will produce effective results is the usage of the DryJect machine which can deliver a high-pressure jet of water through the dense organic matter and aggregate section within the rootzone (if water pressure is suitable on the course) whilst delivering diluent aggregates such as sands, to the target areas.
- Use of a Turf Iron on a considered use approach will help increase the overall pace of the greens at pressured times of the year. Overuse will no doubt put seedlings under undue pressure, so a disciplined as-necessary regime must be instilled throughout the periods of use

- Inter-seeding should be increased using a variety of methods including the use of disc seeding in the off season with a mix of pot/dimple seeding throughout the busier periods, offering greater influence and improvement in germination and sward transition rates. A suitable cultivar mix with a mycorrhizal coating will expedite a greater response in these areas.

Green Collars, Surrounds and Approaches

- All areas adjacent to the greens considered in play should be developed and receive the exact same maintenance inputs as the green surface. This will enhance the overall aesthetics of the golf course and ensure a much greater consistent playability year-round.
- Inter-seed the surrounds and approaches with a bent/fescue grass and ultra-fine ryegrass mix to facilitate a more resilient and robust grass plant sward which can facilitate year-round golf play, as desired on the greens. Coat these seeds in a mycorrhizal fungi inoculant to promote germination and tillering whilst supporting all round positive plant health outcomes.

Tees, Fairways & Natural Pathways

- Tee markers should be moved every day or as routinely as available surface area and applied rules dictate. Increased traffic wear was evident on several sections, nonetheless, grass cover on the viewed surfaces was admirable considering the extreme conditions this year.
- Introduce a plan of inter-seeding the tees with a bent grass and an ultra-fine ryegrass cultivar mix with an addition of the seeds being coated in a mycorrhizal fungi to accelerate damage recovery and underpin an increase of abiotic and biotic stress tolerance of the tees.
- Going forward the nutrition strategy must be robust enough to support a consistent, hard-wearing, and resilient turf canopy. Use of microbial inoculants such as mycorrhizae is encouraged to further support the growing environment and encourage a hardier turf canopy.
- The programmed use of Growth Regulators on the tees would further support increased resilience and benefit grass plant health through the ever-increasing demand for play.
- Aeration is not frequent enough and I would encourage it continue with increasing operations on the more under pressure tees and all par three tees. Spiking, Slitting or Air injection are all viable options to support oxygenation of the surfaces.
- Top-dressing of weaker areas on the wider golf course will also help them develop, the usage of a Weidenmann TerraRake or similar scarification equipment on all tees, surrounds, fairways, and natural pathways will benefit both in organic matter removal and sward composition improvement. It is suggested surface raking be carried out at least twice per annum. With additional aeration, surface raking and brushing introduced to these sections, they will continue to improve, if sufficient moisture and heat are available. In the meantime, any additional surface oxygenation followed by increased inter-seeding of weaker areas will boost the expected results next year and beyond.
- Look to increase the inputs of both seaweeds and molasses-based products on the fairways with particular attention given to the more pressured natural pathways. Both bio stimulants will naturally improve the capacity for microbiome eco system development and grass plant health.
- Consider the addition of either moisture retentive surfactants or organic material such as seaweed on all tees, fairways, and natural pathways. This will help retain moisture in the rootzone alongside any potential upgrade to the irrigation system. A plan of action regards the widening of natural pathway funnels and potential rerouting options of all golfer's and maintenance staff operations is required for future plant health success and aesthetic presentation at West Linton Golf Club.

Irrigation

- The irrigation application system at West Linton Golf Club is like many within the golfing community, totally adequate to carry out its intended basic uses but under high stress conditions unlikely to provide security for positive grass plant health outcomes.
- The act of irrigating through a bowser or mobile sprinklers is not a position a modern top end golf course, as West Linton is, should be in. The current system requires a review and renewal or potential additions to the system are a must have going forward. Purists among the golfing industry may say that the only use for irrigation systems is really to keep grass plants alive, however water is used in several ways to

affect the characteristics of the playing surface as well as providing security as one of the most critical elements for any living thing.

- Grass plants need air, light, a food source and water, so the act of irrigation effectively supports all these plant mechanisms by providing the moisture plants need when they need it, in the quantity, needed to thrive. When originally designed the current system would have been adequate to keep grass plants alive, golf and maintenance traffic would have been lower, weather patterns more predictable and expectations of golf course quality much lower, however, the system now requires a review and push to install an automated system or at the very least a pipe network able to carry water to all parts of the course.
- Installing any new additions or a completely new system is a huge fiscal outlay for any institution but as the last few years have proven, weather patterns, increased play and the ever-increasing demand for higher standards enveloping the golfing world, the current system at West Linton needs an upgrade review, preferably by a suitably qualified consultant, to suit the modern 365 day a year golfing facility that West Linton Golf Club has become

Woodland Management

- Canopy management and plantation thinning is without doubt an increasing part of all planning going forward at West Linton, especially around the finer turf playing areas. Thinning out or removal of areas of dense plantings and extended canopies increasing the exposure to both light and air movement is paramount and must be carried out as soon as possible. The evidence is clear to prove the extremely negative impact some tree plantings are having on the overall condition of many fine turf grass plant species and the likelihood of further negative outcomes is high unless the shade problem is tackled soon.

Signed

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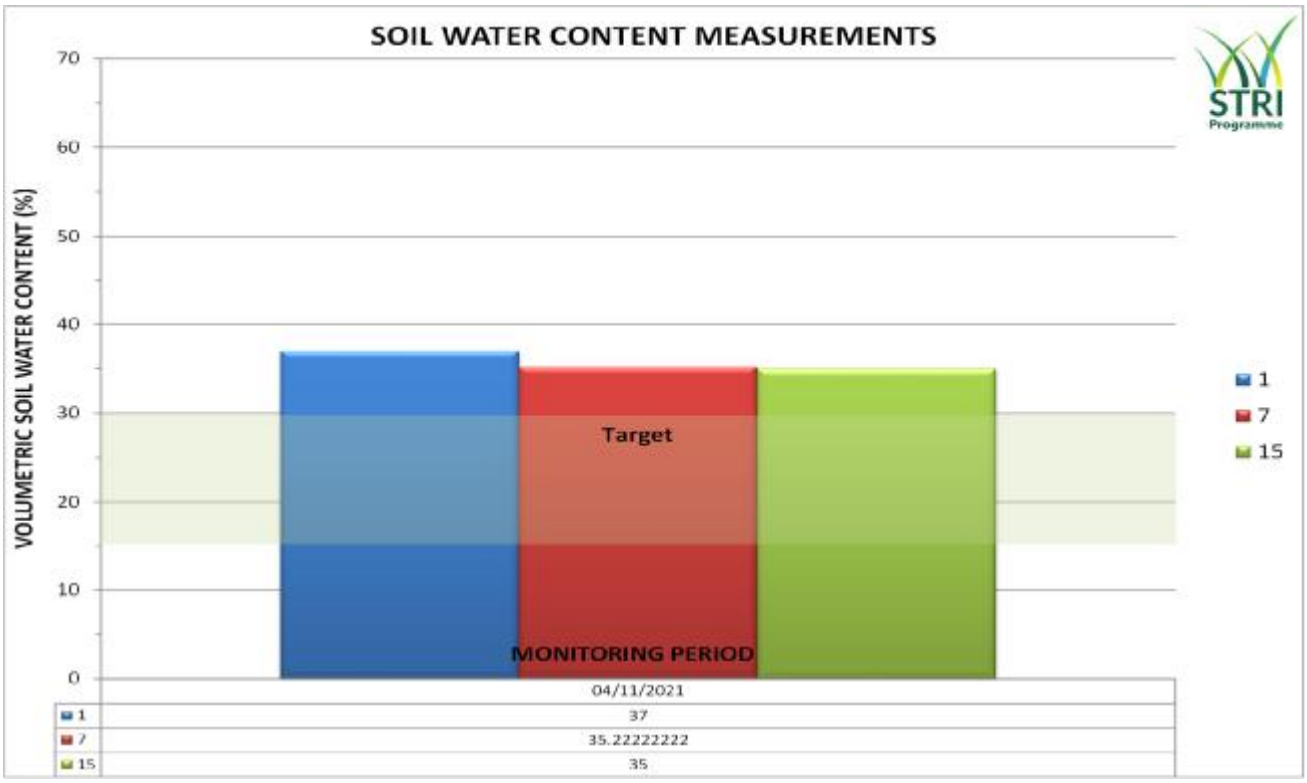
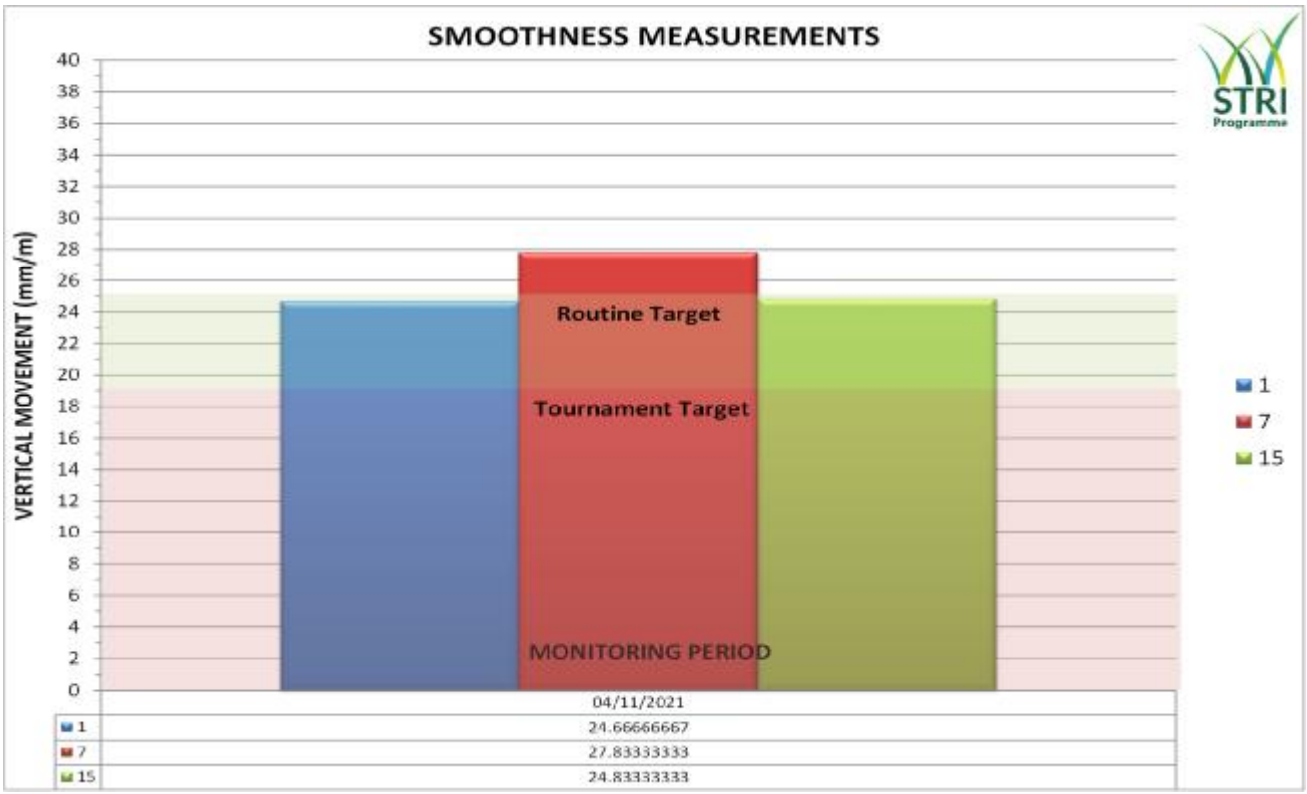
Objective Data

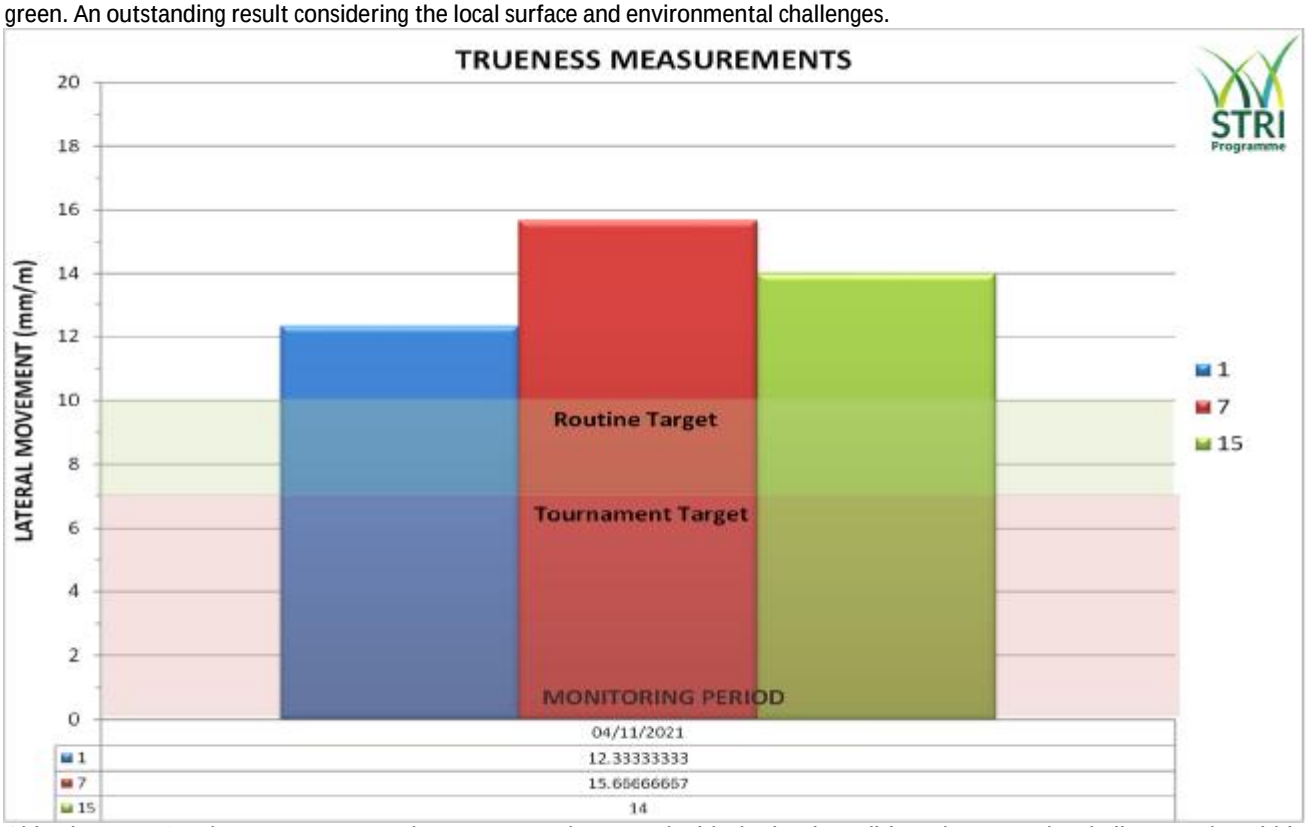


Objective Data Graph 1: Rootzone moisture content was above target, but all surfaces were firm and had absorbed large volumes of rainwater in the days before my visit.

Objective Data Graph 2: Firmness was above target on all greens and again, considering recent rainfall an exceptionally good outcome.



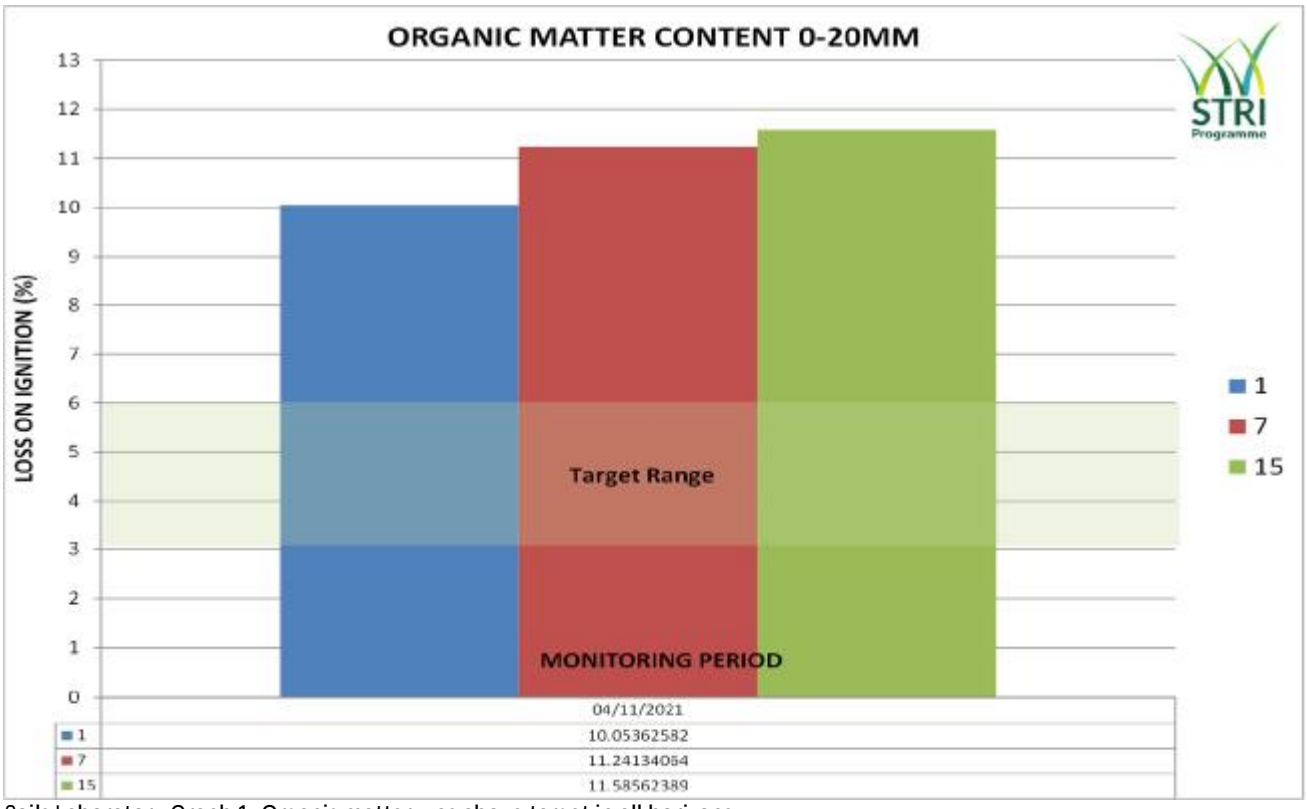
Objective Data Graph 3: Surface smoothness was in target on both the 1st green and the 15th green and above target on the 7th green. An outstanding result considering the local surface and environmental challenges.



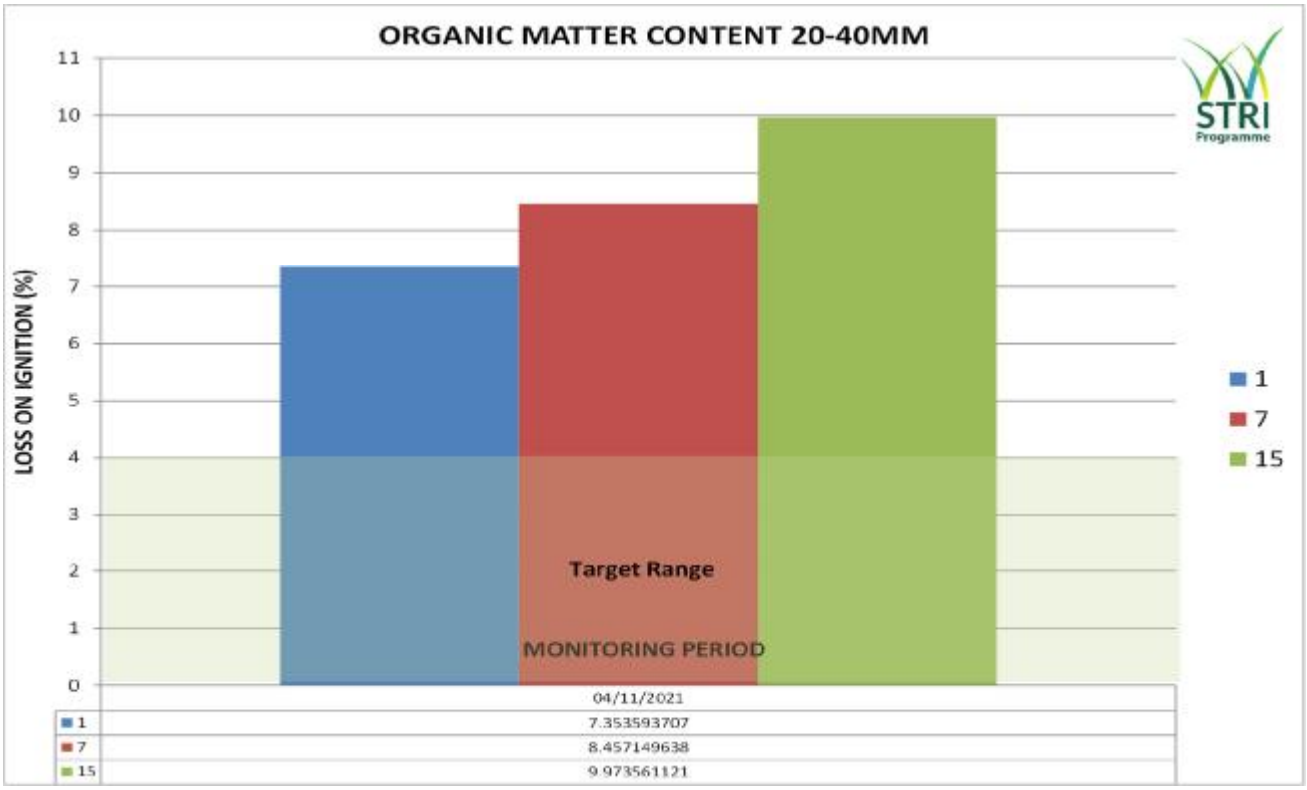
Objective Data Graph 4: Trueness was above target and expected with the local conditions, however the challenge to be within target next season is one this Club should be able to achieve.

Objective Data (continued)

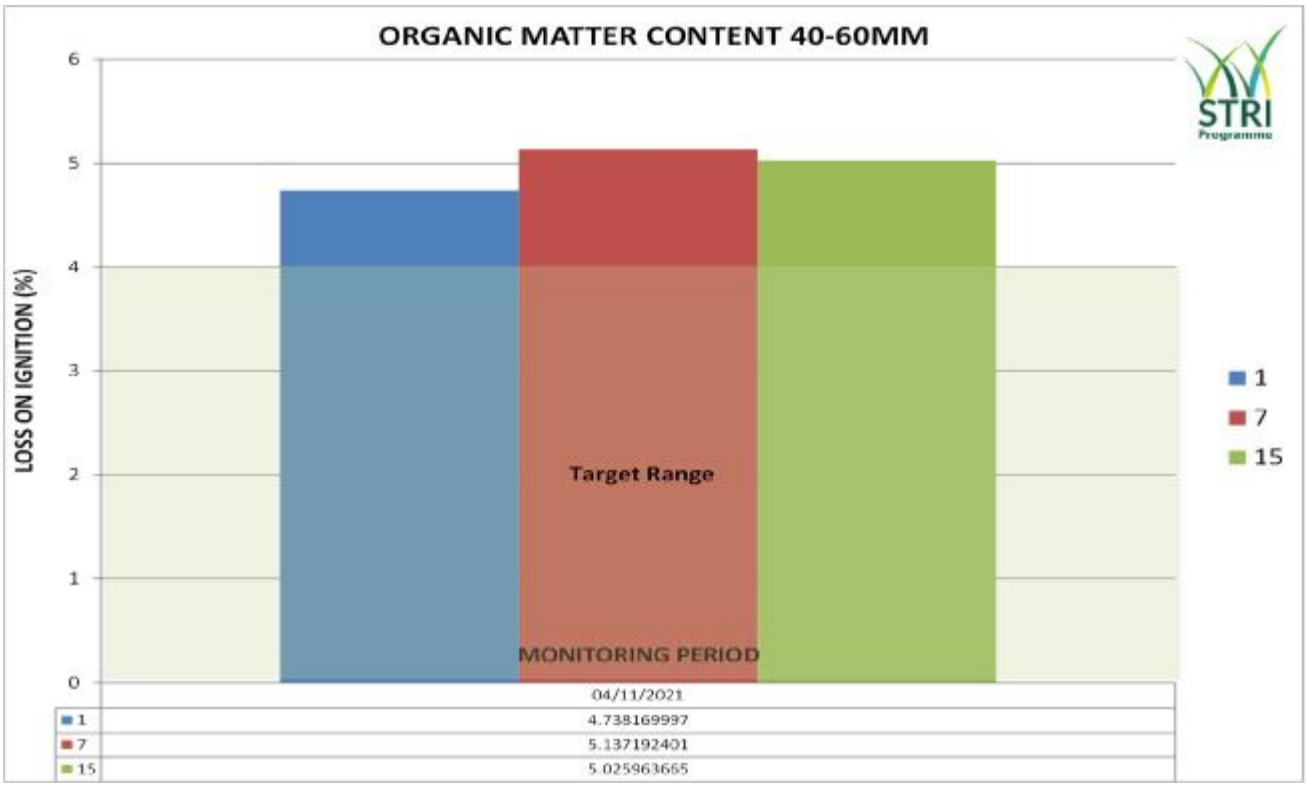
Objective Data Graph 5: Speeds were variable throughout the tested greens.



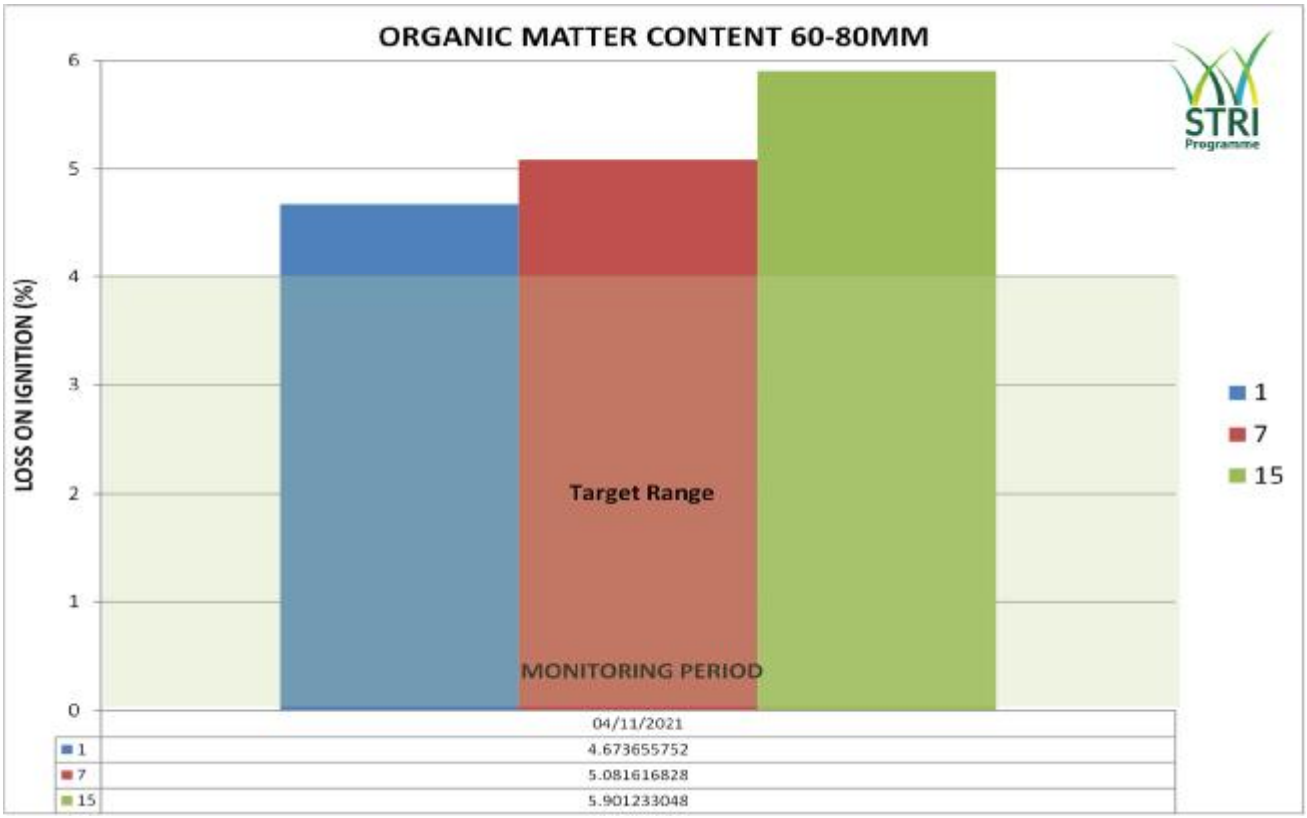
Soils Laboratory Graph 1: Organic matter was above target in all horizons.



Soils Laboratory Graph 2:

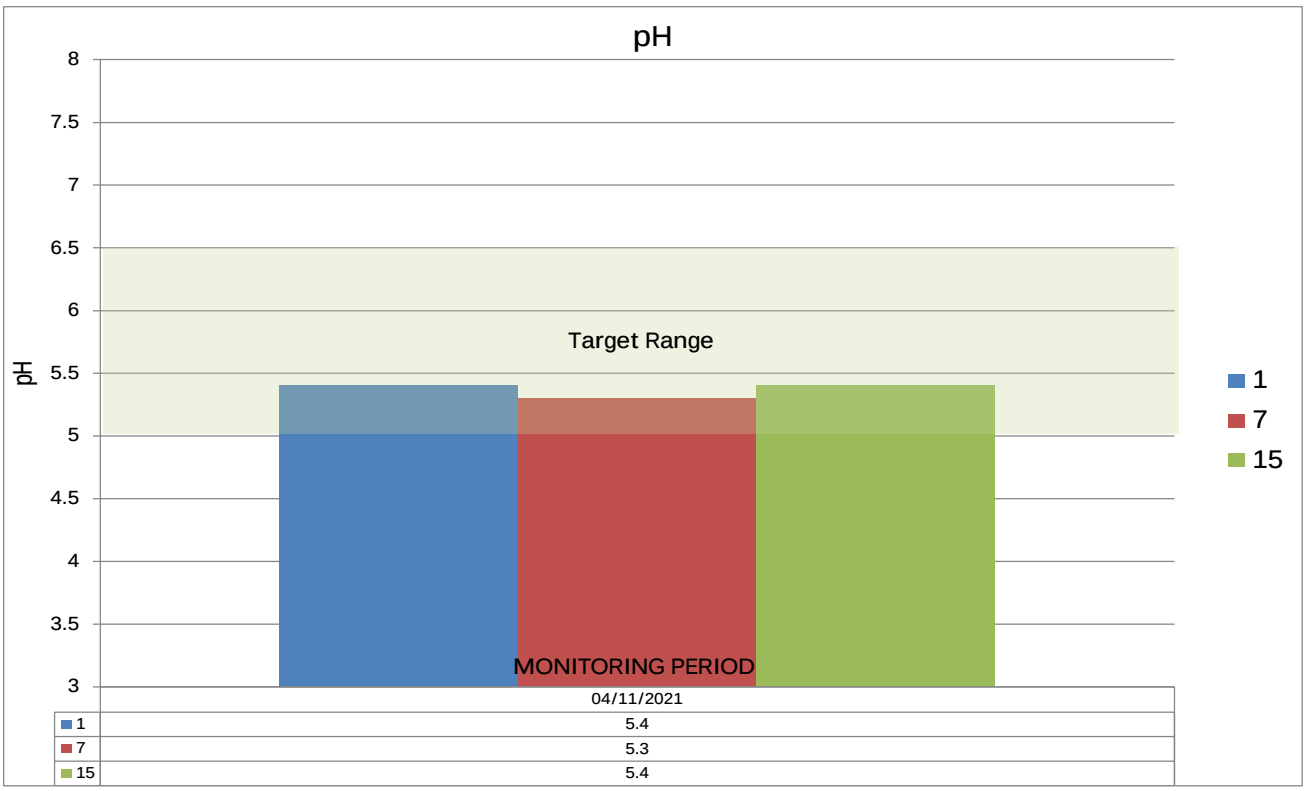


Soils Laboratory Graph 3:



Soils Laboratory Graph 4:

Soils Laboratory Data (continued)



Soils Laboratory Graph 5: pH was within target, and I would hope to see future increase in pH values to provide the optimal growing environment for all desired fine turf grass plants within the swards.

STRI

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ORGANIC MATTER CONTENT

CLIENT: WEST LINTON GC

ADDRESS: MEDWYN ROAD,
WEST LINTON,
WEST LOTHIAN, EH46 7HN

DATE RECEIVED: 08/11/21

DATE REPORTED: 17/11/21

RESULTS TO: GS

TEST RESULTS AUTHORISED BY:

Michael Baines, Laboratory Manager

CONDITION OF SAMPLE UPON ARRIVAL: MOIST

SAMPLE NO	DESCRIPTION		LOSS ON IGNITION (%)*
A19369/1	1	0-20 mm	10.05
		20-40 mm	7.35
		40-60 mm	4.74
		60-80 mm	4.67
A19369/2	7	0-20 mm	11.24
		20-40 mm	8.46
		40-60 mm	5.14
		60-80 mm	5.08
A19369/3	15	0-20 mm	11.59
		20-40 mm	9.97
		40-60 mm	5.03
		60-80 mm	5.90

* ASTM F1647-11 (2018) Standard Test Methods for Organic Matter Content of Athletic Field Rootzone Mixes (Method A)

ACCREDITED

Testing Certificate 2159 - 01

THE RESULTS PERTAIN ONLY TO THE SAMPLE(S) SUBMITTED AND TESTED

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SOIL CHEMICAL ANALYSIS

CLIENT:

WEST LINTON GC

RESULTS TO: **GS**

DATE RECEIVED:
08/11/2021

Lab No.	Source	pH	P_2O_5 (mg/l)	K_2O (mg/l)
A19369/1	GREEN 1	5.4	7	72
A19369/2	GREEN 7	5.3	7	80
A19369/3	GREEN 15	5.4	5	93

Mr M A Baines, Soil Laboratory Manager

THE RESULTS PERTAIN ONLY TO THE SAMPLE(S) SUBMITTED AND TESTED.

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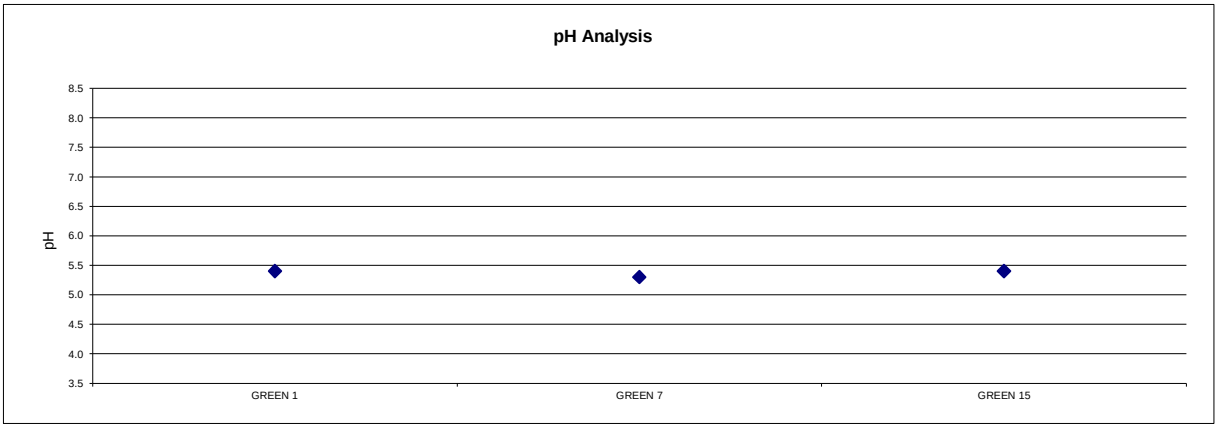
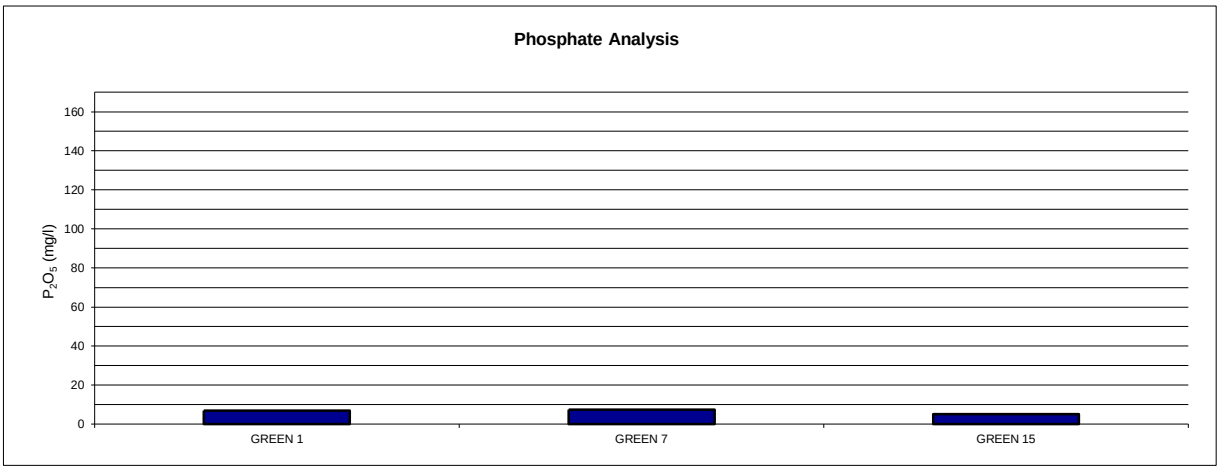
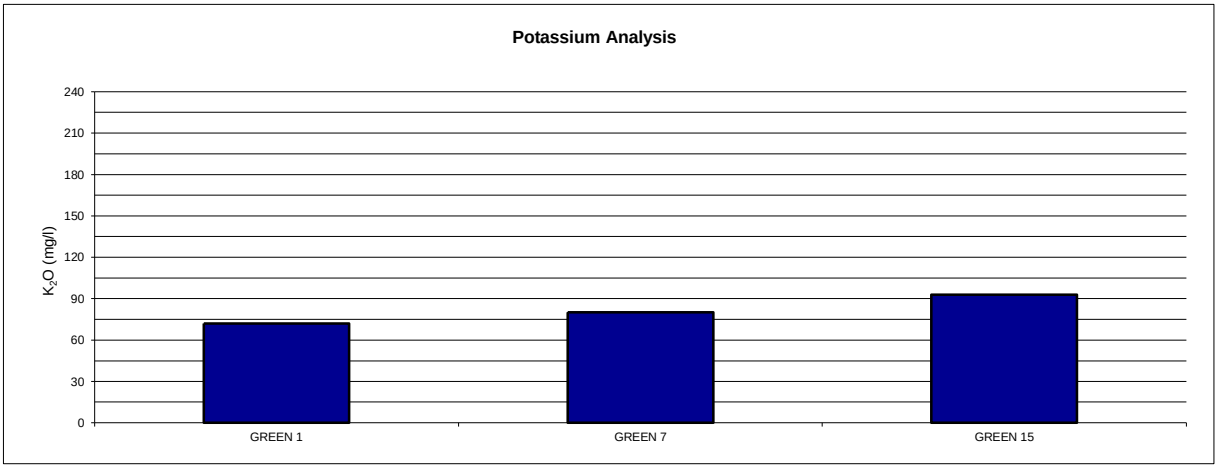
SOIL CHEMICAL ANALYSIS WEST LINTON GC Date: 08/11/21







THE RESULTS PERTAIN ONLY TO THE SAMPLE(S) SUBMITTED AND TESTED.