AN OFFICIAL BOWLS AUSTRALIA PUBLICATION

BOWLS AUSTRALIA

Bowling Green

Construction guidelines

ACKNOWLEDGEMENTS

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A MESSAGE FROM BOWLS AUSTRALIA

It is my pleasure to introduce you to the Bowls Australia Bowling Green Construction guidelines.

The overall purpose of this resource is to provide bowling clubs with comprehensive construction guidelines to guide them through the process of installing or resurfacing natural or synthetic greens. It is a significant investment for any bowling club and this construction guideline is intended to assist bowling clubs (their committees and administrators) to make informed decisions and increase the ease in which the process can be navigated, with the aim of achieving a high quality green on completion.

Bowls Australia has a vision to provide leadership and facilitate a collaborative approach for the growth, development and success of the sport and business of bowls in Australia. In partnership with our state and territory associations and over 1800 bowling clubs, Bowls Australia is striving grow the current regular participation of over 650,000 people.

By adopting the methodologies and techniques described in this construction guideline, bowling clubs across Australia will be confident that their new or resurfaced greens will be of a standard that the bowling club will be proud of for many years to come.

Finally, I wish to make special mention of Keith McAulliffe from Sports Turf Institute who has been instrumental in helping us to establish this resource. His technical advice and expertise has been of great assistance to this project.

Neil Dalrymple

Chief Executive Officer

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE GUIDELINES

Installing a new green, natural or synthetic, or refurbishing an existing green is one of the most important projects a bowling club will undertake. Most bowling clubs operate on a limited budget, so it will be critical to ensure any investment is wisely spent with the risk of something going wrong minimised. Major greens projects involve significant costs - which can escalate or be wasted if badly managed.

A construction or refurbishment project is going to offer a new challenge for most bowling clubs. It will require new skills and ways of working. Although Bowls Australia recognises that it may be preferable for a bowling club to employ specialist personnel with major projects, it is also acknowledged that many bowling clubs have the experience and resources to be actively and directly involved in the construction or refurbishment work.

Regardless of the model used, a key to any refurbishment or construction project is sound planning. Planning is not an added option, but is crucial for the project in order to: identify the key risks, ensuring sound financial management, maintaining a clear focus on essential matters, carrying the project to a successful conclusion and establishing the foundations for effective on-going management.

In approaching the task of planning a major project the bowling club should avoid re-inventing the wheel and look to capitalise on the experiences of others and the national resource provided by Bowls Australia, Sports Turf Institute Aust. and other parties. The primary intent of these construction guidelines is to assemble and pass on the experiences and expertise of others who have embarked on construction work.

1.2 HOW TO USE THE GUIDELINES

Although the nature of a major greens project will vary, the same general procedure can be used to plan and implement the majority of projects. This guideline provides an overview of the process and main considerations when planning a major project.

A project could be broken down into four main phases:

i. Planning/investigation phase

ii. Design phase

iii. Construction phase

iv. Post construction phase

A synthetic turf green

A natural turf green

During the planning phase, it will be necessary to investigate a number of key items, including the costs and benefits of different options (Chapter 2), legal and environmental considerations (Chapter 11) and the required performance standards (Chapter 9). A bowling club embarking on a major project will be able to follow a pathway through the construction guidelines by selecting relevant chapters. For example, a bowling club constructing a new synthetic turf green would refer to the following chapters:

CHAPTER 2

(Overview of options)

CHAPTER 3

(Planning process)

CHAPTER 4

(Design and construction phase)

CHAPTER 8

(Constructing a new synthetic green)

CHAPTERS 9, 10 & 11

(Performance testing, maintenance and environmental/legal)

CHAPTER 2

DEFINING A MAJOR GREENS PROJECT AND FINANCIAL CONSIDERATIONS

2.1 INTRODUCTION

A major greens related project is a capital works program that incurs significant cost and time outlay. Such projects warrant extra resources and planning and the likely involvement of outside expertise. Major greens projects could include:

- Re-surfacing of a natural turf green (Chapter 5);
- Constructing a new natural turf green (Chapter 6);
- Conversion of a natural turf green to a synthetic surface, or vice versa (Chapter 7);
- Construction of a new synthetic turf green (Chapter 8).

Major projects could also include upgrade works such as a greens drainage project, the installation of a roofing structure, the installation of lighting, installation of a watering system or the replacement of the synthetic carpet.

2.2 PLAYING SURFACE OPTIONS

When it comes to the playing surface, there are essentially two main categories of bowling greens – natural grass and synthetic turf. Within each category, there are different construction options/product types available.

Natural turf greens can vary in regard to how the root zone is constructed (e.g. sand or soil), the turf type used (e.g. cool-or warm-season grass type) and the maintenance program. Refer to Chapter 6 for a description of options. Expert advice, coupled with local experience, should be sought in order to identify what will work best for the bowling club location.

Synthetic turf outdoor greens were first introduced into Australia over 30 years ago. There are now several different types of synthetic green products on the market, each with varying performance characteristics.

Tufted synthetic turf, generally sand-filled

Woven mat or carpet

Couch natural grass

Bent natural grass

Needle-punch carpet

2.2.1 Natural or synthetic turf?

The relative merits of natural versus synthetic surfacing for lawn bowls is a hotly debated topic. A bowling club investigating the options will inevitably come up against staunch opinion, one way or the other.

SYNTHETIC TURF GREEN

ADVANTAGES

- More use possible, which can open up a bigger market and bring in extra revenue to the bowling club. Natural turf greens will deteriorate if over-used
- Year round play without damage to surface; natural turf greens require spelling for renovation and over winter when too wet
- Lower maintenance cost (but still requires maintenance)
- Likely to offer more consistent performance, with performance of natural turf greens relying heavily on the greenkeepers' capability
- Lower water requirement, especially new mat systems

NATURAL TURF GREEN

ADVANTAGES

- Lower initial cost, especially if a natural turf green is already there
- Lower, more comfortable temperature on hot days
- Significantly reduced depreciation / replacement cost
- Easier and cheaper to correct any construction faults such as an unlevel base or damage caused by flooding and vandalism
- The traditional surface for bowls

It is recommended visiting neighbouring bowling clubs with different types of surfaces in order to see first hand how each performs.

A synthetic turf green

A natural turf green

The decision on what surface is best will be site specific, and the bowling club needs to complete a feasibility study that evaluates the costs and benefits of the different options (Chapter 3; Appendix 1). Where possible a dollar value should be assigned to all costs and benefits in order to allow a fully objective assessment.

2.3 IDENTIFYING PROJECT COSTS

Identifying the cost of a major construction or refurbishment project and method of funding are key elements of the planning process. The reality is that most bowling clubs have limited funds, so it is critical that the project represents the "best spend".

Although cost over-runs are often unavoidable, systems need to be in place to ensure the budget is well-planned and monitored. It is also important that the bowling club has a high degree of surety about funding sources.

Although this guide offers generic information on costs, it is important to appreciate that costs will vary over time and greatly from one project to another. There may also be costs unique to a particular project.

A summary of project costs is provided below.

SOURCE OF COST	DESCRIPTION
1. Preparatory costs	• **Engineering/agronomy fees** • **Other professional services** – could include lawyers (especially for resource consents), a fund raising co-ordinator, local authority inspectors etc.
2. Project overheads (cost of green construction not included and many of these cost will be incorporated in the entire quote.	• **Project team costs** - Although project team members may be volunteers, they will still incur costs, such as travel and telephone. • **Planning fees** - It is likely to be necessary to apply for local authority planning approval. • **Insurance** - Insurance may be needed to cover the potential loss of any revenues in the event of time over-runs or the likes. In advance of appointment check with the contractor to ensure that they have appropriate insurance. • **Quality control** - Commissioning an independent, sign-off performance testing of the green is highly recommended, and may in fact be a part of the contractual requirement.
3. Construction costs	• **Site preparation** - Preliminary works such as site access, clearance and preparation. • **Sub-base** - It is critical that the sub-base be checked out in advance of construction. Commission a geotechnical study and report. From this geotechnical report, coupled with pricing information from the contractor, it should be possible to get an indication of the cost to establish a suitably stabilised base. • **Mat and shock-pad (optional for a synthetic green)** - The various supply companies should be able to provide an accurate costing for the surface material. • **Other construction components** - What else is required will be project specific. Extras (which might actually represent a major part of the total cost) could include: Greens surrounds (ditching, banks, paving etc.); car parking; watering and water storage system; lighting; shade; storage facility etc. • **Environment** - Consider costs that may be incurred with reinstating surrounding areas which may have been disturbed during the project together with possible landscaping schemes and disposal of construction waste.

4. Operating and maintenance costs	• **Maintenance** - All greens require regular maintenance. Failure to correctly maintain a synthetic turf green will not only affect its playing performance but also its functional life. Even if voluntary labour is used there will be a cost for materials and repairs. • **Repairs** - Repair costs are unlikely in the early stages (unless as a result of vandalism). However it is inevitable that repairs will be needed in time and these should be budgeted for. • **Other operating costs** - Having a new or upgraded facility is inevitably going to incur additional on-going costs, such as: lighting/power; cleaning; land rental/rates etc.

2.4 INDICATIVE COSTS ASSOCIATED WITH DIFFERENT CONSTRUCTION OPTIONS

For an accurate, up to date costing of the different types of green surface, it is recommended to contact the individual supply companies (Chapter 14). When pricing the work ensure you are getting an "apples for apples" comparison. Identify what is or is not included in the pricing.

A 2004 report by Victoria Greenkeepers Association provided some in-sight to the costs of building and maintaining both natural and synthetic turf greens. The report noted:

- A new natural turf green is estimated to cost in the order of $100,000 to build and will vary according to bowling club location, i.e. metro or regional;
- A new synthetic turf green, constructed from scratch with the extras such as pre-formed ditch units, watering system and stable sub-base, is likely to cost in the order of $180,000 to $220,000;
- The cost of re-surfacing a natural turf green with a synthetic surface varies from $120,000 to $160,000;
- The cost of replacement of a synthetic turf carpet/mat is estimated at $75,000 to $90,000 (giving an annual depreciation figure of around $8,000, assuming a 10-year life);
- The cost of re-surfacing a natural turf green (planning and re-grassing) is estimated to range from $7,000 to $21,000, availability of voluntary labour being the main variance;
- The cost of maintaining a synthetic turf green was put at $5,000 p.a.;
- The median cost estimate of maintaining a natural turf green was approximately $20,000 p.a.

Note that costs provided do not include structures such as lighting and will vary according to the bowling club location, i.e. metro or regional.

The Victorian Greenkeepers Association study indicated that there were minimal cost differences between constructing a new natural or synthetic turf green over a 10-year period.

Although this study was carried out in 2004, the relative costs are likely to be comparable.

In a more recent publication, (Dec 2010), the Smart Connection Company estimated the total cost for constructing a new natural turf green at $124,000. In contrast, a new synthetic green was estimated to cost between $186,000 and $214,000, depending on the type of surface used. The reference also provided relative maintenance costs, with a natural turf green costing an estimated $23,000 per year and a synthetic green costing between $9,800 and $14,000 per year (depending on surface type) to maintain. It was also advised that between $9,000 and $11,700 p.a. be set aside for replacement of the synthetic surface.

At a recent workshop on synthetic greens organised by Bowls Australia it was advised that a figure of around $15,000 p.a. be set aside/invested to fund the renovation/replacement of a synthetic surface at the end of its useful life (assumed about 10 years).

2.5 PROJECT FINANCING

The project plan should set out how the project will be funded, both through the development and in relation to operating costs and future replacement of the surface.

2.5.1 Funding options

Funding options could include:

- Federal, state, or local government grants. In a high proportion of cases greens are located on crown (state or local government) owned land, with the potential for grant-aid;
- The national or state sporting organisation;
- Charitable trusts;
- Sponsorship - Sponsorship can take many forms, both in terms of what the sponsor provides and what is expected in return. An example could be advertising boards in and around the facility, or a sponsor acquiring naming rights to all or part of the facility or to an event;
- Donations;
- Contributions in kind - This could include voluntary labour;
- Bowling club funds;
- Commercial or private loans;
- Fundraising.

2.5.2 Revenue opportunities

It may be expected that the new or refurbished facility creates a new or improved revenue stream for the bowling club. Some of the income generating opportunities could include:

- Advertising;
- User fees - Advents such as synthetic surfaces and lighting enable greater usage of a bowling green, which opens up opportunities such as hiring out the greens to non-members (e.g. barefoot bowls);
- Extra bowling club activities – Such as operating a restaurant, or hosting competitions.

Barefoot bowls

2.6 THE FINANCIAL PLANNING CYCLE AND PROVISION FOR REPLACEMENT

The cost and funding of a bowling green project must be planned for the life of the project and any subsequent activity (such as loan repayments) which contributes to it. It will be important to determine accurately both maintenance and replacement costs when first planning the project and to monitor and review these costs continually.

It will also be important to build up reserves and/or to make a provision for future costs, especially the replacement of the carpet/mat and possibly the shock-pad for a synthetic turf green. It is difficult to predict the life span of a carpet/mat, but assuming it is well maintained it should last for at least 10 years.

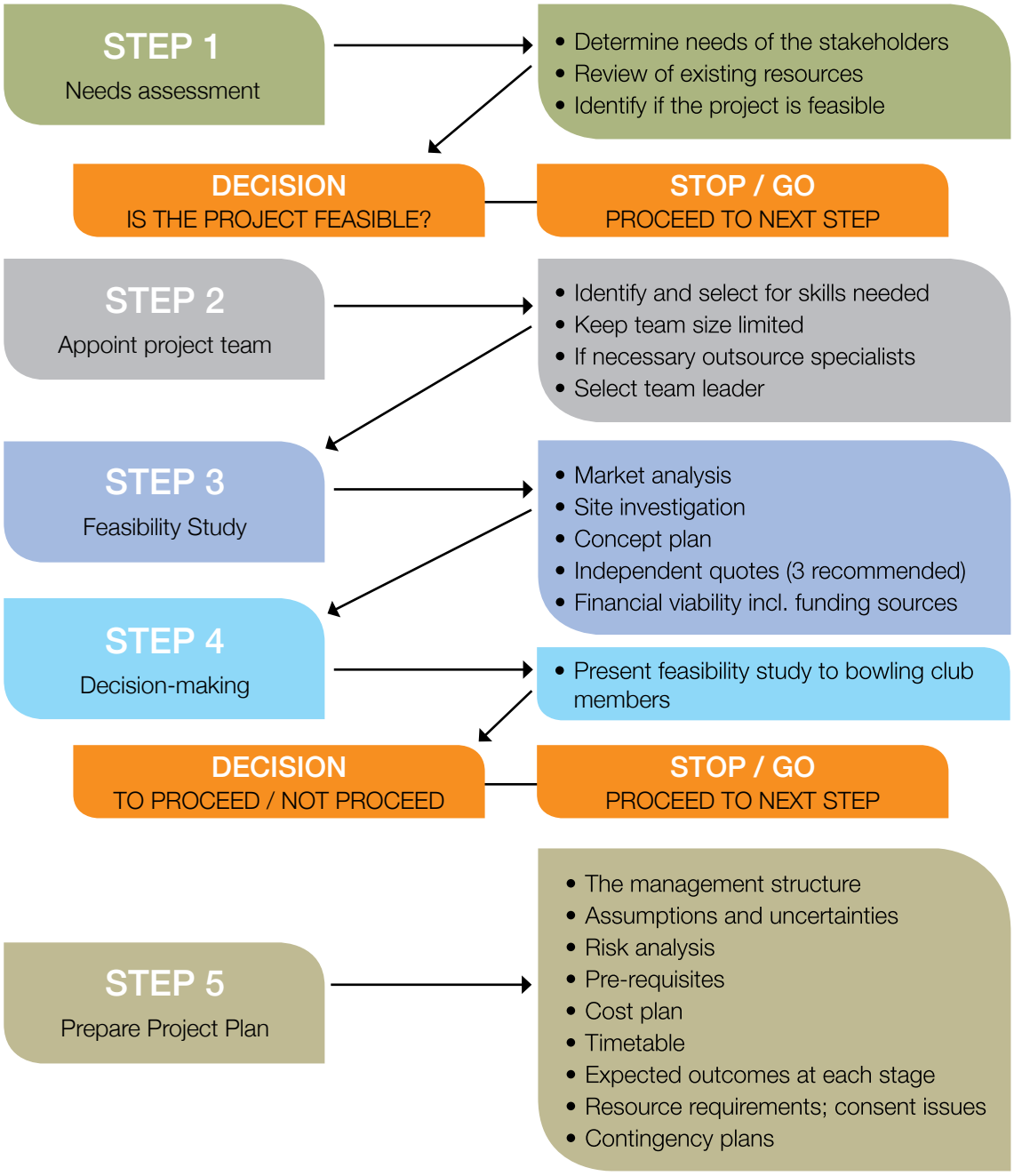
CHAPTER 3

THE PLANNING PHASE FOR A MAJOR GREENS PROJECT

3.1 KEY STEPS IN THE PLANNING/INVESTIGATION PROCESS

There will be many variables to consider along the project path. No two sites and projects will be the same and adjustments will need to be made for site specific conditions. This aside, a standardised approach can be followed when undertaking a major project.

Recommended Planning Process



3.2 STEP 1. NEEDS ASSESSMENT

At the outset and once an improvement concept has been mooted, it is important for a bowling club to identify clearly the need for any change and the proposed investment. A needs assessment must identify:

- The bowling club's strategic direction;
- Reasons for proposed change;
- Benefits/disadvantages to stakeholders;
- Other.

OUTCOME = Report produced by the project team for bowling club outlining the proposed change and requesting a decision by the club committee on whether to pursue the project further.

It is likely the needs assessment will originate from a committee meeting, with a sub-committee tasked with the responsibility of undertaking a preliminary assessment of the proposed development. A bowling club may wish to canvass views of members via a survey or a general meeting.

3.3 STEP 2. APPOINTING THE PROJECT TEAM

Subject to a positive report from the initial needs assessment, the next step is to establish a team that take the project to the next level. Selecting the project team, especially the team leader, is a critical step. The make-up of the planning team will be influenced by a number of factors, including:

- Who are the stakeholders?
- Who is funding the project?
- What expertise is needed?
- What skills are on offer?

Where practical the project team should comprise individuals with appropriate but different skills (e.g. accountancy, engineering, marketing, town planning), and who has the time available. It is best to keep the team to a manageable size (suggest five to eight persons) in order to facilitate communication and decision making. It is recommended to out-source expertise where it isn't available within the bowling club such as project management. In many cases, such as where council ownership or funding is involved, it will be mandatory to commission external expertise and to follow a formal tendering procedure.

OUTCOME = Appointment of a project team and team leader.

3.4 STEP 3. FEASIBILITY STUDY (THE INVESTIGATION)

Before assembling the business case it will first be necessary to conduct what is best termed a feasibility study.

The feasibility study forms the backbone of the investigation process. The feasibility study will involve various parties, including:

- Identifying and interviewing the stakeholders – those from within the bowling club and elsewhere who should be consulted to ascertain requirements and who could offer useful advice;
- Consulting with the sport's governing body or other bowling clubs who can assist and who have been through the same or similar process in order to find relevant data and key contacts;

- Establishing the aims of the project and the intended use of the facility;
- Approaching supply companies and others in regard to options and costs; (Chapter 14, Contracts)
- Investigate funding opportunities and meet with potential funding agencies;
- Meeting with the local authorities and engineers in order to assess matters such as the zoning restrictions, legal and environmental issues associated with the development;
- Investigating the site.

The overall goals of the feasibility study include:

- Evaluating the costs and benefits of different options and the overall viability of the project;
- Identifying risks to the project;
- Investigating technical aspects such as subsoil stability, drainage performance, etc.
- Identifying any legal or planning constraints on the proposed development;
- Determining feasible timescales for the project development and completion. A feasibility study template for constructing a new green is provided in Appendix 1.

Project team meeting

3.5 STEP 4. DECISION-MAKING

Once all the above information is received the bowling club is then in a position to make an informed decision on whether or not to proceed and if so how and when to proceed. Decisions should be based on sound, objective data, rather than 'gut feel'. Ascertain a monetary value on all costs and benefits, where practical. If the decision is in favour of the project going ahead then a start can be made on preparing the project plan.

3.6 STEP 5. THE PROJECT PLAN

The last element in the planning and investigation process is to produce the project plan. This plan will define how the project will be managed and the way forward for the duration of the project. It is essentially about what will be done, by whom, when and at what cost.

The project plan should include the following points

ITEM	DESCRIPTION
1. Management structure	• Composition and main roles of the project team; • Allocation of responsibilities for each of the project components.
2. Project/contract delivery method	• Refer to Chapter 4.
3. Pre-requisites	• Any fundamental requirements needed for the project to succeed (e.g. securing a grant or loan).
4. Assumptions	• Such as securing a grant or loan to fund the project;
5. Contingency plans	• Identifying factors outside the control of the project team but on which the project depends for successful delivery; • Developing risk management strategies.
6. Timetable	• Project stages, milestones, dependencies, tolerances and control points.
7. Expected outcomes	• What will be delivered, when and to what standard, at each of the defined stages.
8. Resources required	• List the resources required, and who is responsible for supplying the resource.
9. Cost management	• Provision of cash flow forecast, financing options and terms, etc.
10. Communication strategy	• Identifying all stakeholders, their specific interest in the project, how to best engage them, framework for meetings and the like.

The project plan is a living document. It is the key working document throughout the life of the project. It must be regularly reviewed at project team meetings. It should form the basis of the agenda for meetings. Any changes must be evaluated and documented if cost over-runs and other pitfalls are to be minimised.

CHAPTER 4

PROJECT DESIGN AND CONSTRUCTION PHASES

Once the project plan has been approved by the bowling club, the next step is to plan the implementation of works. A starting point here is to determine the delivery method.

4.1 PROJECT DELIVERY METHOD

There are three main methods by which a major project can be delivered, namely:

- Option one - Using a specialist designer to prepare detailed specifications and then call for tenders from approved installers;
- Option two - Providing a performance-based design brief and appointing a contractor to install;
- Option three - Appointing a contractor to do both design and install.

The choice of project delivery method will determine the way in which the design and construction team/s are procured. For example, under option one, an independent designer is commissioned to plan and oversee the project, whereas with option three the appointed contractor is responsible for providing design as well as installation.

With option one, the appointed designer will be required to produce tender documentation (Section 4.5) and design specifications (Section 4.6) to allow for competitive tendering, to advise the bowling club on suitable tenders and to project manage operations.

With option two, someone (usually from within the project team) is appointed to produce a design brief (Section 4.4), to seek submissions directly from a range of suppliers, to select a design and then to project manage the successful tenderer.

For option three, the preferred supplier will provide a design-build service, invariably using their own customised specifications for how the green should be built.

Each of the above options has advantages and disadvantages. For example, it would be considered risky engaging an installer under a design and construct approach (option three) if they did not have a proven track record or appropriate professional indemnity insurance.

A bowling club may have previously identified the type of surface they desire, and even the contractor they wish to use, even before the feasibility study is conducted. In this case, option three is viable. In situations where the bowling club has the time and resources to scope the products and suppliers available, and to identify the technical and financial capabilities of prospective contractors, then option two is viable. From this, a short-list of contractors to be invited to tender against the design brief can be produced.

The bowling club is primarily interested in the performance of the green on completion. As such, it is important they protect their investment through having documentation that clearly specifies the required performance standards. Consideration should be give to using the Australian Standard Condition of Contract AS4000 as the basis of the contract between bowling club and contractor.

4.2 COMMISSIONING SPECIALIST PERSONNEL

A major project, such as constructing a new green, generally requires the input of specialist personnel such as project managers, design consultants, engineers, civil works company and installation experts. The appointed body(ies) will be entrusted to ensure the project is handled professionally and that the client's expectations are met. Specialist personnel will need to be outsourced, unless the bowling club has appropriate expertise in-house. Using recognised specialists may in fact be a stipulation from the funding body(ies). The cost of the external consultant will need to be factored into the overall project cost.

4.3 PREPARING DOCUMENTATION

Regardless of the project delivery method it will be important to ensure appropriate documentation is prepared and standard form contracts are used. The form of documentation required will depend on how the project is delivered. At the very least, the bowling club should have documentation that clearly specifies the required performance of the playing surface.

Documentation could include:

- A design brief outlining the expected performance standards, along with other key requirements; A detailed technical specification and drawings which provide a "how to" approach for each facet of the works;
- Tender documentation. It should be borne in mind that any paperwork with contractors and others constitutes a legal document. The club should consider having any legal documents reviewed by a lawyer before they are signed.

4.4 THE DESIGN BRIEF

It is important to start with a clear design brief to ensure the bowling club gets what it wants from the project. The design brief could vary in scope and detail, but will tend to focus on the required outcomes (time frames as well as performance). Where possible the design brief should include objective performance measures (e.g. the playing surface performance shall meet World Bowls Ltd standards). An example of a design brief is provided in Appendix 2.

4.5 TENDERING

The tender documentation includes both the technical specifications and all associated information and requirements. Tender documentation would normally be produced by the appointed designer and forwarded to selected contractors.

The tender documentation would typically include the following:

- A scope of services;
- General conditions of tender;
- A copy of the draft contract;
- Relevant supporting information such as preliminary plans.

It is important that the tender documentation is accurate and avoids ambiguity, as this can open the door for misunderstanding and ultimately dispute and additional costs through variations. After review of tenders a contractor will be selected by the project team against pre-determined criteria. Tenders are typically evaluated using a weighted attribute system where the key criteria are identified and each bid ranked.

Attributes evaluated may include:

- Compliance to tender requirements;
- Experience/track record;
- Methodology and known product performance;
- Presentation and content;
- Price.

Tendering is likely to be compulsory in many projects, given that bowling clubs are often located on council land. Even if tendering is not compulsory, it is recommended in order to ensure the bowling club is getting the best deal.

The project team should compare the tender sums submitted with their own estimate of the works and identify any major discrepancies together with the reasons for those discrepancies.

Remember that the cheapest tender is not necessarily the best option. It is important to respect that tendering is a legal process and that rules cannot be altered unfairly.

4.6 CONSTRUCTION SPECIFICATIONS AND DRAWINGS

In contrast to the design brief (which largely focuses on the result required), construction specifications provide a full and precise description of how to carry out the work. The specifications and associated drawings serve as the blueprint for constructing the green, regardless of who is appointed to undertake the works.

Example of a design specification (for pipe drainage installation in a natural turf green)

1. The existing 200mmADS storm water drain around the perimeter of the green shall be used as the outlet for the internal drainage lines.
2. 100mm diameter perforated corrugated plastic drain pipe shall be used for all internal drains.
3. Drain trenches shall be excavated every 5m on the diagonal across the green, and shall be a minimum of 125mm below the sub-grade level and excavated on a grade of 1 in 200.
4. Specialist junctions must be used to connect the 100mm to the 200mm diameter outlet.
5. Trenching work shall only be undertaken with a laser-graded endless chain trencher device.
6. Trenches for all internal (100 mm dia. pipe) shall be no more than 200mm wide.
7. Trenching shall only be carried out when the soil is in a firm (not wet and sticky) condition.
8. The base of the trench shall be cleaned of all debris before placement of the drain pipe.
9. A 2-8mm angular stone shall be used as backfill around and over the pipe and brought level to the sub-grade.

4.7 CONSTRUCTION PHASE

This is the stage when the physical work commences. Given that construction methodology will largely be site and product specific, the scope of this section is limited to providing general guidelines only. Each product will have its own design requirements, and each installer will have their own methodology for undertaking the works.

Many bowling clubs tend to leave contractors to their own devices at this stage, preferring to reduce expenditure on professional supervision of the work. However, this can be false economy. Inevitably queries and issues will arise on site during the construction period and it is important that a properly qualified or experienced person is available to respond quickly on the bowling club's behalf. Delays in responding can lead to hold-ups and additional costs.

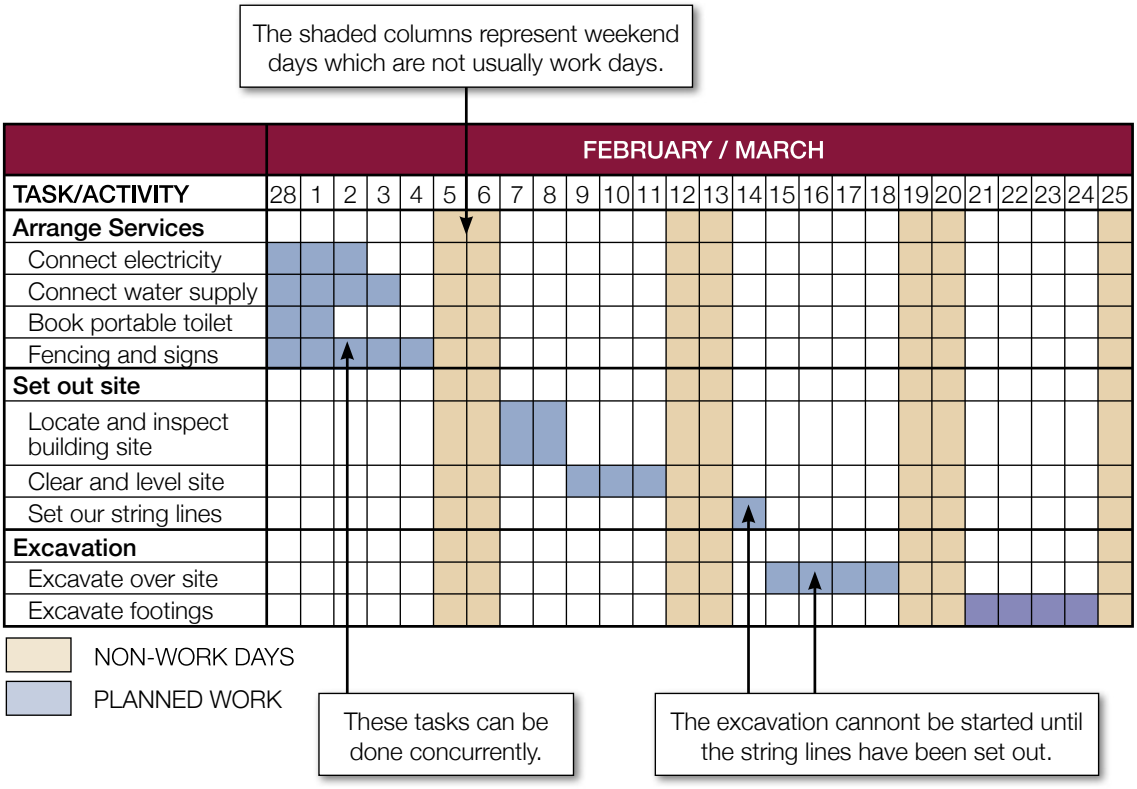
An obvious variable to contend with in a major greens project is the weather. Persistent rainfall and soft working conditions is a common nightmare with earthworks and drainage. It is important to ensure earthworks are postponed in overly wet conditions when the soil is soft and sticky, as this can jeopardise future performance. This point must be referenced in the contract documentation.

The construction period is a time when disturbance can occur to neighbouring areas in the form of increased traffic, noise and dust. Maintaining contact and consultation with these stakeholders is good public relations and may help to keep the peace. Keep them informed and allow organised site visits to view the progress.

Another critical issue with the construction work is to ensure the correctly specified materials, in particular root zone materials, sand or gravel inclusions, are being delivered. Contract documentation should specify the process used to ensure quality control of delivered materials.

Project management is aided by having a construction timetable mapped out. The timetable may be in the form of a "Gantt Chart". The chart will specify the proposed dates for each key item in the program. It may also document other information such as who is responsible for each item.

An example of a Gantt chart



Towards the end of the construction the contractor or appointed consultant should prepare and provide the bowling club full and accurate information on the works (e.g. location, depth and composition of pipe drains, cabling etc.). This could be in the form of scale drawings, photographs or as-built plans.

The final stage of the construction will entail the performance testing of the completed works and sign-off by a qualified testing agency (see Chapter 9).

Depending on the contract terms, the contractor may be responsible for maintenance work (including repairing any defects and completing unfinished items such as full commissioning) for a period of six or 12 months. This period is known as the defects liability period or maintenance period.

CHAPTER 5

RE-SURFACING A NATURAL TURF GREEN

5.1 INTRODUCTION

Re-surfacing a green may be required if the green suffers from one or more of the following problems:

- Surface undulations are too severe to correct by standard renovation and soiling;
- A severe thatch or layering problem;
- An undesirable turf species, variation in turf type (e.g. different types of couch) or a high weed content;
- A playing surface that is too high or banks that are too low in relation to standard guidelines;
- A bad outbreak of nematodes.

5.2 PLANNING THE RE-SURFACING OPERATION

When planning a re-surfacing operation it is important to get a full understanding of the make-up of the green and the resources available to carry out the work. The planning process should evaluate the following:

5.2.1 The existing greens levels/contours

There is a need to get an accurate contour survey of the green in order to:

- Determine the best re-levelling approach (how deep will the cut be);
- Enable an estimate of how much soil will need to be removed (or added);
- Identify whether the plinth boards are level and at the correct height;
- Condition of plinth boards/banks rebound characteristics etc.

5.2.2 The soil profile

A series of deep core samples need to be taken across the green in order to identify key properties, including:

- The thatch depth (and how much material must be removed);
- The depth of topsoil remaining and quality of this topsoil;
- Any impeding layers in the soil profile.

If there is a pan or layering it may be necessary to carry out additional soil physical treatment;

- Drainage status and root zone health.

5.2.3 Labour requirements

Unless there is access to specialised equipment, re-surfacing of a green will be a labour intensive process. It is often left to the bowling club's appointed contractor or green keeper to coordinate the operation.

5.2.4 Equipment needs

There are various options available for re-surfacing a natural turf bowling green. Most modern re-surfacing is done using automated laser grading equipment. However, more labour intensive, traditional methods, such as using pegs and rails, may still be used by some.

If using internal bowling club labour, equipment needs will include:

- At least seven square-mouthed shovels;
- At least four rubber-tyred wheelbarrows;
- Ample string to divide the green into grids;
- Other equipment such as rakes, screeds, fertiliser and soil spreaders etc.

5.2.5 Soil/s and supply

Imported soil or sand will be required as part of the re-surfacing project. Assuming the primary requirement of the imported material is for final seedbed preparation, then in the order of 4 cubic metres will be needed. It will be important to ensure the material used has the right characteristics, including:

- Compatibility with the underlying material;
- Good drainage characteristics;
- Weed and stone-free;
- Free of potential contaminants such as herbicides;
- Dried/sieved.

A natural turf geen being top dressed

5.2.6 Ditches/plinth boards

Removal of say 20-60 mm of existing green surface may require a revision of the ditches, kerb (plinth) boards and base foundations. The specific requirement for ditch/plinth board reconstruction should be done before re-surfacing the green. The condition of the plinth boards will need to be assessed to see if they are in need of replacement.

5.2.7 Timing of works

Re-surfacing will need to be carried out a time that fits in with both the bowls timetable and the climatic conditions. Key considerations include:

- The bowls calendar and planning for the work in the off-season;
- Construction work is best done in dry conditions. This reduces the risk of delays and provides the best chance of achieving a quality job;
- Growth pattern of the preferred turf species. Consider the time of the year when growth occurs to ensure there is adequate recovery before re-use.

5.2.8 Soil moisture

A moist soil condition (down to spade depth) is preferred when re-surfacing a bowling green. Aim to irrigate two to three days before starting operations so the soil is in a moist, but not wet, state.

5.2.9 Plant material

Investigate to find out what grass type will work best. Consider:

- Performance (speed, draw etc.) of each option;
- Tolerance of different turf types to stresses (moisture or temperature stress);
- Cost and availability of root stock material or seed.

5.2.10 Soil testing

Prior to the renovation, collect soil samples from the green and send to a laboratory for a nutrient test. The test will indicate the need for fertiliser or lime supplements.

Example soil testing cores

CHAPTER 6

CONSTRUCTING A NEW NATURAL TURF GREEN

6.1 GENERAL

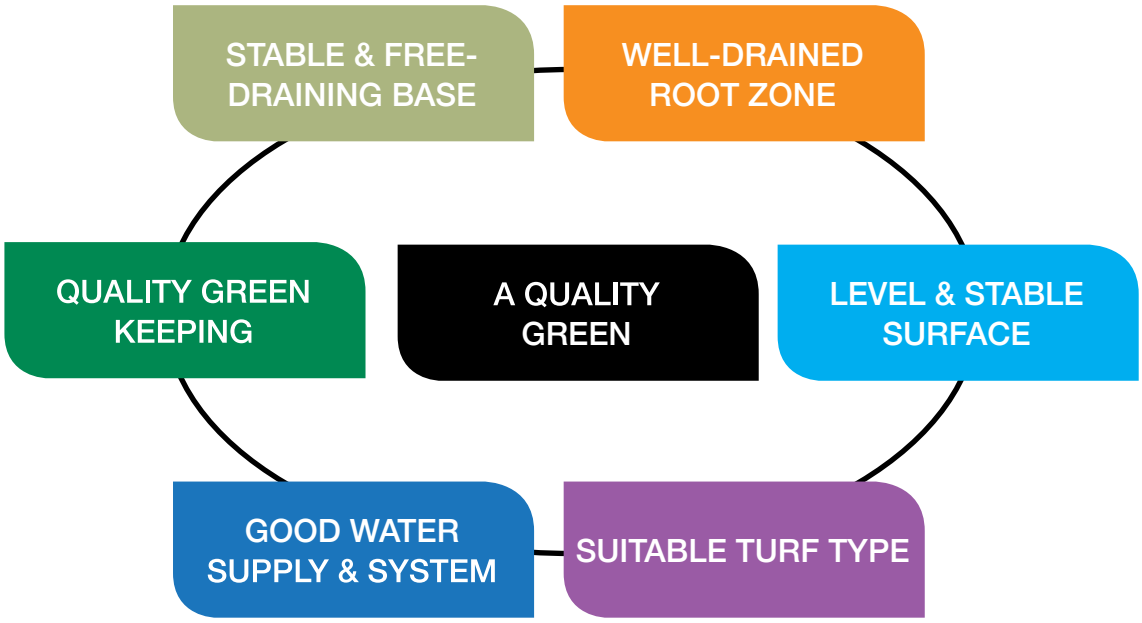
There is no such thing as a standard recipe when it comes to designing and building a natural turf bowling green. As such, it is recommended that an expert agronomist/engineer be commissioned to help plan and design the development. The design detail will need to account for a number of variables, including:

- Quality of existing materials on site, including the stability of the sub-base;
- Allocated budget;
- Requirements of the green (year-round use);
- Climate, especially as it affects the turf types able to be used;
- Availability of water.

The specialist engineer/turf agronomist will be able to provide information on the relative performance of different construction options and can produce specifications for the selected option.

The key components in the design and construction of a natural turf green include:

- Ensuring a stable but free-draining base;
- Providing a suitably drained and aerated root zone;
- Producing a very level surface that will support healthy turf;
- Using a turf type that meets the performance and maintenance needs of the bowling club;
- Providing adequate watering;
- Ensuring quality maintenance.



6.2 THE BASE

Construction of the base and drainage system is a critical part of the construction process. Failure to achieve good base stability can result in on-going settling and poor levels. Conversely, an overly-compacted base will restrict water and root development. Engineering standards can be referenced in order to ensure the sub-base is adequately stable.

Installing a new green should involve a professional investigation of the site and nature of the soil profile. There is always the risk of finding unforeseen ground conditions during an investigation. Although this "bad news" is likely to represent an additional cost, it is critical to address any inherent sub-base issues at the outset. Attention is also drawn to legislative requirements that pertain to earthworks, such as any requirement to have soil tested before it can be removed off-site.

Site problems can include:

- Soft ground resulting from unconsolidated fill material or peaty soil;
- The presence of swelling/shrinking clay, which can cause subsidence if the base dries out;
- Slope stability and erosion issues, especially if the green is located adjacent to a steep slope or water course;
- Contaminated soil. Fill sites are often a journey into the unknown. Again, seek professional help to evaluate what is down there.

Where there is a barrier to sub-surface drainage (such as a site with an impermeable clay base), it will be necessary to install a customised pipe drainage system. Specialist advice should be sought if designing a bowling green drainage system.

6.3 THE ROOT ZONE

Sound root zone design is critical to the long term success of a natural turf green. It is important to ensure the right materials are used. Construction materials should be tested and approved by a reputable laboratory for partical size and drainage performance before use.

Sandy loams or loamy sands are the preferred material for constructing bowling green root zones. Some greens have been built along the same lines as golf greens, using a straight fine to medium grade sand. Although they drain well, these pure sand root zones will generally be more difficult and more costly to manage than using a soil-based media.

Where finer-textured materials are used (e.g. silt loams or clay loams), extra care is required during the construction phase to minimise damage to the soil structure. This will require the careful selection and use of lightweight machinery, and avoiding work in excessively wet conditions.

Couch natural grass

Bent natural grass

6.4 THE TURF

The best grass types for a natural turf bowls green are ones that produces a tight, fine, robust cover that can tolerate low mowing height.

The main grass species used in Australia are generally of either Agrostis (bent grass) spp. or Cynodon (couch) spp. Bent grass is generally

preferred in cooler climatic regions, whereas couch is favoured in the warmer climatic regions.

Within each of the main species, there are various types of grass cultivars. Couch cultivars include names such as Tifdwarf, Tif green and Santa Ana, and bent grass names such as Penncross, Egmont and 1020.

When selecting the turf type, check around the region to see what has stood the test of time and works well at like bowling clubs. Also, refer to your local greenkeeping association for information.

6.5 WATER USE

Natural turf requires water all year round to survive. In the hotter months, a green will typically require in the range of 40m³ of water per week (from rain or irrigation) to maintain turf cover. Considerably less water is needed in cooler months, especially if the cover goes into dormancy (couch greens). The amount and quality of water required will depend to some degree on the turf and soil types used. Couch, being a warm season (C4) grass, has a lower water requirement than bent grass. A straight sand root zone medium will store less water than a finer-textured soil, and as such will require more frequent watering.

6.6 GENERAL MAINTENANCE

The capability of the greenkeeper is a key factor in the success of a natural turf bowling green. The greenkeeper will need to ensure the right decisions are made in terms of mowing, rolling, fertiliser application, watering, spraying etc.

As each natural turf green installation is unique, the maintenance regime will differ. Please contact your local green keeping association for further information on procedure for maintaining a natural turf bowling green.

Rolling a natural turf green

CHAPTER 7

CONVERTING FROM A NATURAL TURF TO SYNTHETIC TURF GREEN

7.1 INTRODUCTION

Having weighed up all the costs and benefits and the decision reached to convert to a synthetic green, the bowling club will then need to initiate the planning process (Chapter 3).

It is generally easier and cheaper to convert an existing grass green to synthetic than to build a new green, given much of the associated infra-structure (ditches, plinths, paving etc.) is already in place.

For the most part, the process involved with a conversion will be the same as used for a new synthetic green construction. As such, reference can be made to Chapter 8 for in-depth discussion.

7.2 KEY CONSIDERATIONS

Considerations before embarking on converting to a synthetic surface include:

- Evaluating the past performance of the (natural turf) green in regard to factors such as shading, drainage, levelness etc. Plan to correct any inherent problems as part of the conversion process;
- The timetable, in particular how long the green will be out of action and the impact this might have on the bowling club (especially significant for a single green bowling club);
- Provisions needed to be made for site access and materials storage during the conversion;
- Addressing key unknowns, especially potential issues with stability of the sub-grade and storm water discharge;
- Consideration to environmental, legal and building consent requirements. For example, ensuring any material to be removed off site has been tested and found to comply with local ruling;
- Maintenance requirements of the synthetic green, equipment needed to be purchased and what training is required to use this equipment.

7.3 BRIEF OUTLINE OF THE CONVERSION PROCESS

Although every site will be different and require variation in approach, there are general points applicable to most conversion projects. Key steps in the conversion process include:

- Preliminary meeting to confirm scope, timetable etc.;
- Excavate to the design depth and prepare a level and stable base;
- Re-build the plinth boards and ditches, if needed;
- Install drainage system (in green and ditch);
- Lay the design engineered base and capping layers;

- Achieve final design levels for the sub-base;
- Lay shock-pad where used and carpet;
- Commence post-installation maintenance.

Further details on the construction process are provided in Chapter 8.

Excavation of an old green prior to laying of sub-base

7.4 CONTROL POINTS

There are several distinct and critical stages during the conversion process at which the works should be checked. These include:

- Post-excavation and formation of the base. The base should be tested for stability and levelness;
- During and after installing pipe drains. Check that the drains are free of any silt contamination and function to the design discharge rate;
- Post-installation of the engineered base. Check for drainage rate, stability and levels;
- Post-installation of the capping layer. Check for drainage rate, levels and load bearing strength and stability;
- Post-laying of the shock pad and carpet;
- Check that the green meets the specified performance standards.

CHAPTER 8

CONSTRUCTING A NEW SYNTHETIC TURF GREEN

8.1 INTRODUCTION

A great deal of information must be gathered before embarking on the construction of a new synthetic turf green (Chapter 3). In addition to the more obvious information, the bowling club will need to identify "unknowns", such as any legal or environmental issues pertaining to the development of a new site (Chapter 11).

Greenfield site

8.2 SITE LOCATION

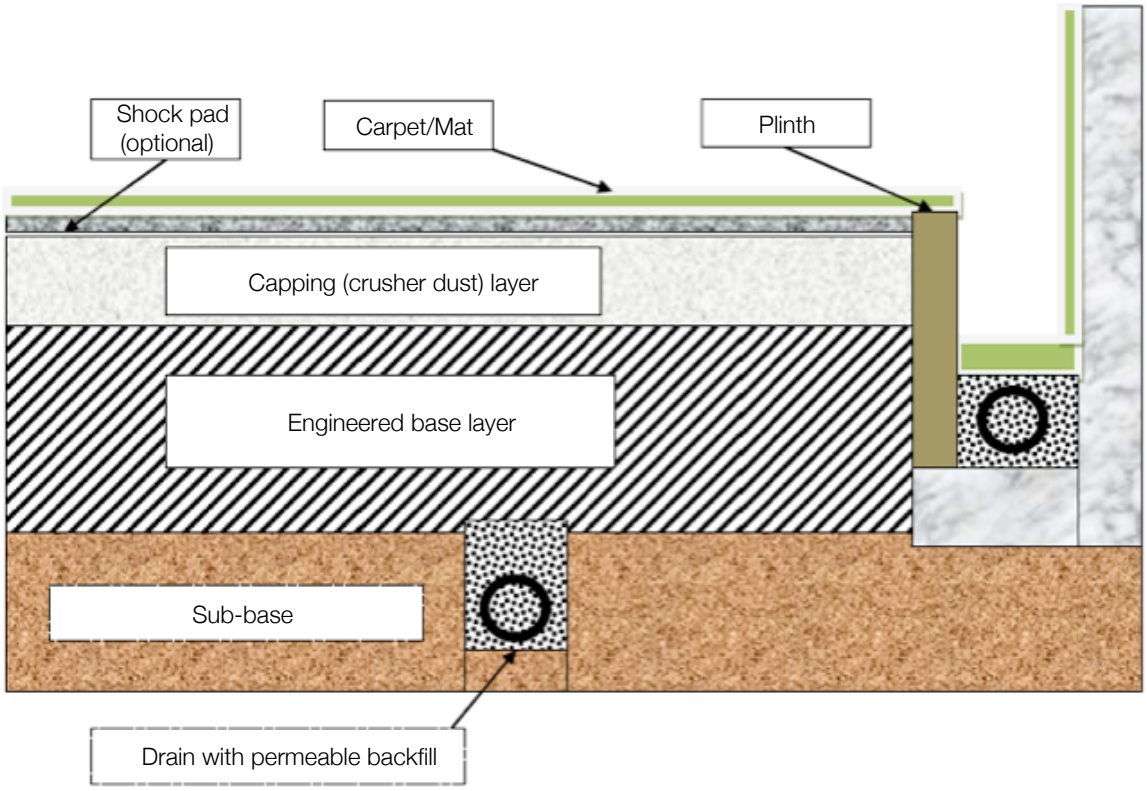
Key considerations when selecting the location for a new bowling green include:

- Ensuring there is sufficient land available to accommodate the required dimensions of the green and its immediate surrounds. Allow for a surround path (usually 1.5–2.0m wide) and outer landscaped area (grass or garden);
- Ideally, avoid sites that might have subsequent problems such as long term subsidence, erosion or flooding;
- Consider the proximity of neighbouring residences and any potential issues arising, such as securing consent for use of lighting;
- Where possible locate the green away from tall buildings and trees that may cast shadows and cause other problems;
- Consider any land ownership or environmental issues that could constrain the development.

8.3 THE BASE

The underlying sub-base is a critical part of the green structure. The base is the most common cause of synthetic green failure. The base must:

- Be able to support the loading placed on the surface over time without subsidence;
- Remain stable and level over time and over a wide moisture content range (shouldn't move upon wetting or drying);
- Provide acceptable drainage performance, especially if the system selected requires a porous sub-base;



Schematic representation of a synthetic turf green general cross-section.

The base of the green is composed of distinct components. Typically there is the underlying sub-base, which has been exposed and levelled to form the foundation for subsequent layers. The next layer is invariably an imported coarse and variable-graded stone material, often termed the engineered base layer. Finally a finer, variable-graded, angular or capping layer is installed in order to provide a finished surface upon which the carpet can be laid. Different suppliers/installers will have their own specifications and construction methods for the engineered base and the capping layer. For example, specialist resins may be used to bind and stabilise the capping layer.

Regardless of the base design specifications the bowling club should ensure that:

- A geotechnical investigation is commissioned at the outset in order to determine the site stability and suitability. Professional testing for ground condition should be a pre-requisite for any new site, given that many Australian soils (such as black clays) are potentially unstable;
- A functional drainage system with an outlet of sufficient capacity is designed;
- Existing utilities (electrical, water supply, waste and drainage) are located;
- Legal issues and costs pertaining to the removal or importation of soil material, removal of trees and other structures etc. are understood and complied with (Chapter 11).

It is worth repeating that a professional investigation of the base composition should be conducted at an early stage of the project. This investigation will provide information on ground stability under load, sub-surface drainage characteristics, depth of any topsoil, soil plasticity and other engineering information such as the presence of fill, reactive soil or buried tree stumps.

Contaminant testing should also be budgeted for, especially in landfill sites.

In engaging a geotechnical consultant the bowling club is advised to investigate ground conditions at a minimum of three locations and to a depth of at least 1m. The ensuing report should provide recommendations on:

- soil profile properties;

- soil shrink and swell characteristics;
- soil permeability;
- contamination assessment (where required);
- comments on any factors likely to affect long term stability, such as presence of fill.

The geotechnical report should be mindful of the demanding levelness and stability requirements when building a synthetic green.

8.4 GUIDELINES FOR CONSTRUCTING THE SUB-BASE

Although most base earthworks will be carried out by the appointed contractor, it is in the bowling club's interest to know what is going on and what can go wrong. Some guidelines include:

- It is important to identify and remove any soil layer that could potentially degrade and settle over time. This includes any organic layer (topsoil) and any layer identified by the geotechnical report as potentially unstable;
- If material is to be transported off site it is likely to require contamination testing. Test results showing potential contamination may require a re-think in the project design and in the budget;
- After identifying any problem layers, work can commence on shaping the base. This could involve a cut operation only, a fill operation only or a combination of cut and fill;
- If the formation of the base requires fill make sure each layer of fill is well-compacted. Fill material must be built up in layers of no more than 150mm (compacted) thickness. Each layer should be compacted to a uniform density as recommended by the geotechnical consultant;
- Should testing find the required density has not been achieved; the layer should be re-tilled and then re-packed;
- The above sequence shall be repeated until the design fill level has been reached;
- Depending on the system used, a geotextile may be laid over the sub-base before placement of the engineered base layer.

8.5 GUIDELINES FOR THE ENGINEERED BASE AND CAPPING LAYER

As mentioned, each installer will have their own recipe and approach for the engineered base and capping (crusher dust) layer. From the bowling club's viewpoint, the type of material used is largely irrelevant, just as long as the installation meets the required performance criteria. Performance criteria include the following:

Laser levelling stone layer

8.5.1 Drainage performance

- Both layers must ensure rapid water flow from the surface to the underlying pipe drainage system;
- As a guideline, the engineered base should have a permeability of at least 200mm per hour and the capping layer (after application of the cementing agent) have a permeability of at least 100mm per hour.

8.5.2 Levelness requirements

- Both layers need to mirror closely the levelness of the finished surface;

- The completed engineered base should have no more than +/-10mm elevation difference across the entire surface and the capping layer no more than +/-5mm elevation difference.

8.5.3 Stability

- Both layers need to be well-compacted and stable so that there is no movement over time;
- The geotechnical consultant will be able to advise on and test for the degree of compaction required for each of the various layers. Given the importance of the base layers to the long term performance of the green, it is strongly recommended that each layer be checked and performance tested before proceeding to the next stage.

8.6 DRAINAGE SYSTEM

It is generally necessary to install an underlying pipe drainage system, as well as a ditch drainage system, given that the majority of synthetic green designs rely on a porous base to clear water after rain.

It is also worth noting that a number of synthetic green installations have been ruined as a result of an inadequate storm water drain system and water back-flowing through the pipes and up into the green. It is recommended that the green drainage system be isolated from any rooftop or other storm water drainage system.

When designing a drainage system for the green, consider:

- Make sure there is a suitable outlet that enables direct exit of water from the pipe drains, has sufficient capacity and which will not reverse flow. In low-lying areas, where there is the possibility of flooding and back-flow, it is a good idea to include a flap gate in the design;
- Use specialist land drainage materials and fittings (perforated corrugated plastic tubing is the most common form of drainage pipe);
- Use a permeable fill around and over the pipe drain in order to link the drain to the overlying permeable base materials;
- Geotextile material is often used below the engineered base and to line the drain trench. It is best to avoid placing geotextile over the pipe drain backfill, as this can ultimately silt up and limit passage of water into the drain.

8.7 THE SHOCK-PAD (UNDER-PAD)

Many bowling greens today incorporate a shock-pad in order to regulate speed and to make the green more comfortable for users. Various forms of shock-pad can be used, from an integrated pad, where the manufacturer bonds the shock-pad to the back of the turf carpet at the factory, to a roll-out pad, which is manufactured and laid separately to the carpet/mat. There is also the potential for an in-situ pad, which is manufactured on site using a hot mix of rubber shred or crumbs, bound with polyurethane, although this technology is rarely used for lawn bowls.

The nature of the shock-pad thickness will impact on green speed, and this should be considered when selecting an appropriate product.

Shock-pad installation prior to synthetic surface

8.8 THE CARPET

Synthetic lawn bowls products have evolved considerably over the years, with design and installation faults (such as lack of UV stabilisation and inadequate drainage), progressively sorted out.

Various types of synthetic turf products are used for lawn bowls and the options seem to be increasing. Options include:

- 'Tufted' synthetic turf, generally sand-filled;
- Woven mat or carpet;
- Needle-punch carpet.

The earlier greens tended to be open weave pile using polypropylene or polyethylene tufting of around 12mm in length, fixed into a polypropylene and latex backing. The tufts are held upright by a sand infill layer, which is top-dressed and drag-matted into the turf after laying. The selection of sand in these systems is critical, as sand-infill should be non-abrasive, non-staining, well-rounded and dust-free material that is non-damaging to bowls.

Woven carpet and needle-punch carpet have gained in popularity in recent years.

Each type of surface has its advantages and disadvantages.

Type of surface	Advantages	Disadvantages
Tufted synthetic turf, (sand-filled)	• Low cost • Ready to go once laid • Can be bowled on in all four directions • If shockpad included, highly comfortable	• Takes time to settle down • Takes more maintenance and critical to keep regularly maintained for consistent play • Can get hot • Can scratch the bowl
Woven carpet	• Consistent performance • Ready to go once laid • No water required • Relative easy to maintain	• Generally most expensive option • Tends to be used in two directions only (perpendicular to seam) • Can get hot • Not easy to repair
Needle-punch carpet	• Lower cost • Ready to go once laid • Generally no water required • Relatively easy to repair if damaged	• Performance (speed and draw) can vary with temperature change such as cloud cover • Can get hot

8.8.1 Selecting the right system

Word of mouth feedback, pricing and required performance (in particular speed) are key factors in determining what type of playing surface to select. A bowling club should look to gather as much information as possible on the different types of surface before deciding on a system. Quite often this involves a reconnaissance visit to other bowling clubs, coupled with an approach to various supply companies.

When assessing performance of greens at neighbouring bowling clubs consider:

- How the green is currently performing (speed, draw, specific characteristics);
- The consistency of the surface under changing weather conditions (wet/dry; cold/hot);
- Whether or not the performance of the green has changed over time with ageing. For example, has the drainage deteriorated?
- The costs of installing and maintaining the surface;
- The expected life of the surface;
- The time frame involved in laying the surface;
- Quality of back up support from the installer;
- How much water is required to maintain the surface (with sand-filled carpets);
- Other, including what went well and didn't go well during the project.

Installation of the synthetic surface is a specialist business, requiring experienced personnel and specialist equipment. The bowling club should ensure the appointed contractor has a proven track record with installing lawn bowls greens.

8.9 LIFE EXPECTANCY

The life expectancy of synthetic lawn bowls surfaces will depend on a number of variables, including:

- The product type;
- Standard of installation (especially the stability of the base);
- Amount of use;
- Standard of maintenance;
- Climate.

There is sufficient evidence to suggest a well-constructed and maintained surface could last at least 10 years.

Given the expected longevity of a synthetic surface might be 10 years; the bowling club will need to budget for its eventual replacement. Knowing the estimated replacement cost, it will be possible to determine how much must be set aside each year to cover the depreciation cost. For example, given a replacement cost of $80,000 and a 10 year life span, the annual depreciation cost would be in the order of $8,000 p.a.

8.10 WARRANTY

It is critical that bowling clubs clearly understand the warranty that is being offered with the synthetic turf green. Terms and conditions of warranty will vary between suppliers.

The warranty may apply to just the condition and performance of the surface carpet layer or could apply to the complete system (e.g. performance of the base). The preference would be to have a warranty that covers the entire system, given that failure of the base is one of the most common causes of a green's failure. Cover could include total making good or just the cost of a replacement carpet.

Take care to check on any clause that voids the warranty (these could include incorrect maintenance, incorrect footwear, excessive dumping, vandalism, floods or the like). Consider seeking professional advice to properly understand the scope and cover of the warranty.

CHAPTER 9

PERFORMANCE TESTING AND PERFORMANCE STANDARDS

9.1 INTRODUCTION

It is strongly recommended that any contract documentation related to a major project, such as construction of a new green, includes reference to recognised performance standards. These standards can be used as the basis for determining if the works is fit for purpose at handover. Performance testing will be an additional cost, but it constitutes a fraction of the total overall cost and represents essential insurance.

Key points of note in regard to standards for lawn bowls surfaces include:

- Currently, the most comprehensive lawn bowls performance standards used worldwide are the World Bowls Ltd standards. A description of these standards is presented in Section 9.3;
- There are some individual associations, such as Bowls Victoria, who have developed their own set of testing criteria (Section 9.4);
- A bowling club may wish to specify modification or refinement to the World Bowls Ltd or any other standards. For example, the bowling club may opt to set the green speed in a more narrow range, say 13-16 seconds;
- Although the World Bowls Ltd standards are primarily designed for synthetic turf greens, they can also be used for natural turf greens. If using the standards for natural turf greens we advise the levelness standards be set for a defined period, say up to four months after renovation;
- A synthetic turf green is expected to perform well for many years, and as such the bowling club may wish to specify that prescribed standards continue to be adhered to for a longer term, not just at the point of hand over;
- The World Bowls Ltd standards do not specify required performance of the base direct; it is assumed the performance of the surface encompasses how the base performs. However, given that the base is critical to long-term performance of a synthetic surface, it is advisable that additional standards be included in contracts to cover base performance and that the base be tested and signed off before laying the carpet.

9.2 REQUIREMENTS FOR THE BASE

The three key components of the base are levelness, drainage rate and stability. Performance standards are required for all three components. These standards for the base need to be matched to the standards used for the completed surface.

9.2.1 Levelness

Levels should be checked after completion of the base works and prior to laying the synthetic turf. The finished level of the green shall not deviate from the design level when measured in accordance with recognised civil engineering practice, using an optical or laser level, by more than ±5mm. The difference in height between adjacent (2m grid) spot levels shall not be greater than 3mm, although variances of up to 6mm may be allowed in places where the trajectory of the bowl is not affected.

9.2.2 Infiltration (drainage) rate

After base works and prior to laying the synthetic turf the base shall have a minimum infiltration rate of 100mm per hour.

9.2.3 Base stability

Base stability encompasses two key components. First, the base must remain stable and level over time. Second, the base should be able to take a certain amount of load bearing without deforming.

Engineering tests are available to derive, objectively, value for both base stability and load bearing. Standards used need to be tight, but not over the top, bearing in mind we are not building a road. The geotechnical consultant will be able to adivce on appropriate guidelines for base stability.

9.3 THE WORLD BOWLS LTD STANDARDS FOR BOWLING GREENS

9.3.1 Scope

This standard specifies requirements for flat green bowls surfaces, in particular synthetic surfaces. The requirements apply to the performance of the system as a whole.

9.3.2. Definitions

For the purpose of this standard, the following definitions apply:

Green speed - The number of seconds taken by a bowl from the time of its delivery to the moment it comes to rest approximately 27m from the mat line (Page 44, BA Officiating Manual, August 2019).

Draw - A measure of the distance between the trajectory of a rolling biased bowl and a straight line between its starting and finishing points. Cushioning - The ability of the surface to deflect and absorb energy as a player walks on it.

Infiltration rate - The rate water enters the green surfacing.

Design level - A comparison of theoretical and actual levels of an installation at defined locations.

9.3.3 Classification

In this standard, surfaces are classified by their performance characteristics. The green speed must be within the range of 10 to 18 seconds. Additionally, it is necessary for the purchaser to specify whether the playing surface and supporting layers is to be permeable or non-permeable.

9.3.4 Dimensions

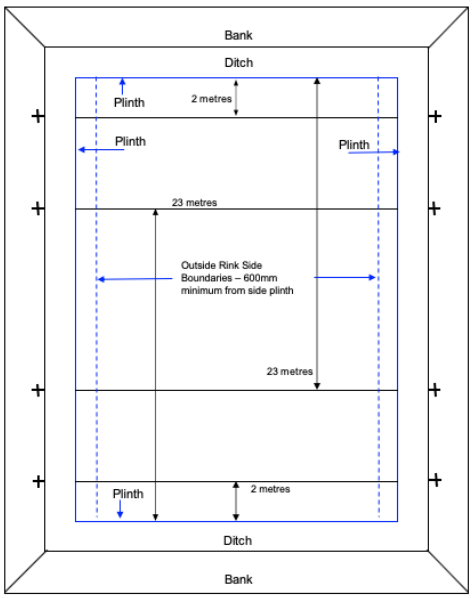
The dimensions of the green shall be as detailed in the Laws of the Sport of Bowls, Crystal Mark 3rd Edition, Version 3.1, April 2019.

The green:

- The green should be either rectangular or square;
- The length of the green in the direction of play shall be between 31 and 40 metres;
- The green should have a suitable level playing surface;
- The playing surface should be either vegetative or a synthetic surface approved by a Member National Authority. For domestic play, Bowls Australia can decide the standards for greens constructed in line with previous editions of this law.

B.4 Distance Charts – (Chart has been Amended for Australian Domestic Regulations)

B.4.1 Pegs or discs fixed against the face of the side banks or on top of the side banks (illustrated by a '+')



* For domestic play in Australia the distance markers should be 23m from the ditch (Plinth)

The ditch:

- The green should be surrounded by a ditch;
- The ditch should be;
- Between 200mm and 380mm wide;
- Between 50mm and 200mm deep;
- The ditch should have a holding surface free from obstacles and made of a material that will not damage the jack or the bowls.

The bank:

- The ditch should have a bank against its outer edge;
- The top of the bank should be at least 230mm above the surface level of the green;
- The bank should be vertical and set at a right angle to the surface of the green, or sloped at an angle of not more than 35° from the vertical;
- The surface of the face of the bank should be made of, or be covered with, a material that will not damage the jack or the bowls;
- There should be no steps interfering with play either cut into or positioned against the face of the bank.

9.3.5 Division of the green (Law 49, Crystal Mark 3rd Edition, Version 3.1, April 2019)

The green shall be divided into sections called rinks, each not more than 5.80m, nor less than 4.30m wide. They shall be identified in order (using numbers) with the centre line and be fixed vertically.

The four corners of the rinks shall be marked by white or brightly coloured pegs made of material which will not damage the jack or bowls and fixed to the face of the bank and flush therewith, or alternatively, fixed on the bank no more than 100mm back from the face thereof (Law 49.3, Crystal Mark 3rd Edition, Version 3.1, April 2019).

There must be a minimum distance of 600mm between the side ditch plinths and the boundary pegs, as indicated by the dotted lines in the above diagram.

9.3.6 Performance

Unless indicated by the manufacturer or supplier, the surfacing shall meet the appropriate parameters in all climatic conditions. It is reasonable to assume the green should be able to meet the standards required for Pennants play as minimum.

Before commencement of verification tests, a facility should be maintained in accordance with the supplier's detailed procedures to the satisfaction of the supplier and facility owners/users.

Greens shall be tested in locations detailed in each test method. If the results obtained are variable or border-line, the test officers shall use their discretion and select additional field locations to evaluate the whole green's ability to comply with this standard.

If a green is only designed to be used in two opposing directions the test locations for green speed and draw shall be adjusted accordingly.

If an installation is not designed as a full green, but only comprises one or more rinks, each rink shall be assessed in the directions of play as appropriate.

Testing green speed

Testing design levels

Green speed

The green speed of the surface when measured in accordance with Test Method WBB-01 shall be in the acceptable World Bowls Ltd competition range of 10 and 18 seconds. The green speed obtained in each test location shall be within ±0.5s of the mean green speed.

For carpet-based systems, the test location is limited to the direction of tournament play, which is across the seams. On a carpet-based system, the green speed obtained from the tournament direction locations shall be ±0.5s of the mean green speed.

It is up to each bowling club and installer to decide what speed is appropriate dependent on the level (international, national or bowling club level events) of use required and the expectations of the end users (i.e. the bowlers).

Surface draw

The maximum draw, when measured in accordance with Test Method WBB-02, of surfaces having green speeds in the range 10 to 14 seconds shall be greater than 750mm, whilst the maximum draw on surfaces having green speeds in excess of 14.1 seconds shall be greater than 1000mm.

The maximum difference between pairs of left and right maximum draws shall be less than 40%.

Surface evenness

Undulations found on the surface shall be no greater than 3mm, when measured using a 3m straight-edge in accordance with test method WBB-03. Undulations of up to 6mm are permissible providing they do not affect the trajectory of a bowl, particularly as it rolls slowly. Undulations greater than 6mm should not occur anywhere on the green.

Design levels

The green shall be level. The finished level of the green shall not deviate from the design level when measured in accordance with recognised civil engineering practice, using an optical or laser level, by more than +/-5mm.

The difference in height between adjacent spot levels shall not be greater than 3mm.

Infiltration rate

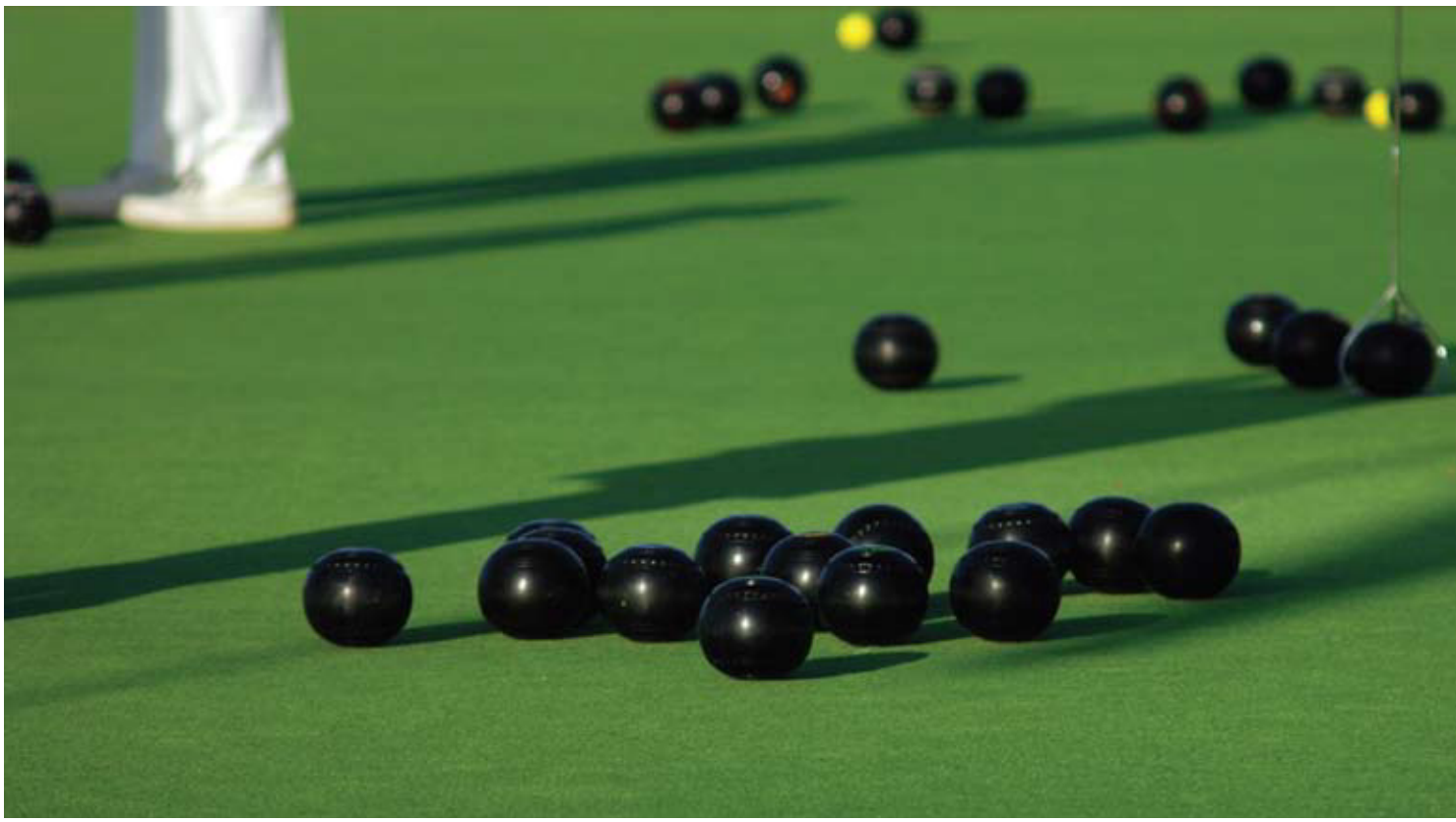
The green surfacing shall have an infiltration rate, at the time of construction, greater than 100mm/hour when tested in accordance with BS 7044 Section 2.5:1991 or WBB-04. The infiltration rate of greens over 12 months old shall be greater than 50mm/hr.

9.3.7 Essential information

The following information shall be supplied by the manufacturer to the purchaser. This information should also, as far as possible, be included in any test reports:

- Details of which types of paint and/or tape can be applied effectively and without damage to the surface or significantly affecting the sports performance and bio-mechanical response, or other marking methods available, e.g. inlaid or woven lines;
- The method and substances to be used to carry out regular maintenance or cleaning of the surface;
- The details of any other periodic maintenance e.g. care during non-playing season, pre-season maintenance, storage, topping up the level of particulate infill and, where appropriate, the materials that may be used;
- An assurance that the surface does not contain in its finished state any substance which is known to be toxic or carcinogenic when in contact with skin and that no toxic or carcinogenic substance(s) will be released as a vapour, dust or solution during normal use;
- An assurance by the manufacturer that the surface is capable of being disposed of in a safe manner at the end of its useful life.

9. 4 CHECK SHEET USED BY BOWLS VICTORIA - see Appendix 3.



A completed green in use

CHAPTER 10

AFTERCARE AND MAINTENANCE GUIDELINES FOR SYNTHETIC GREENS

10.1 INTRODUCTION

How well a green performs over time depends to a large degree on how well the green is maintained. In the majority of cases maintenance of a newly-installed synthetic green is left up to the bowling club, and it is the bowling club's responsibility to ensure it has the appropriate equipment and expertise on hand. Some commercial companies offer maintenance services as an add-on (note that specialist synthetic turf maintenance is becoming a big business in places like the UK).

When determining the maintenance requirement of a synthetic green it is important to appreciate that each type of synthetic surface will have its own maintenance requirements, and that each supplier is likely to offer customised maintenance programming. This program should be delivered and demonstrated to the bowling club prior to the hand-over of the green. A bowling club needs to know its contractual obligations in regard to maintenance as, for one thing, failure to implement the recommended program could be deemed by the supplier to void warranty.

The following is a broad generic overview of the maintenance requirements for a synthetic green. For further details, refer to the specific manufacturer's handbook, or the "Maintenance of synthetic surfaced bowling green's." (NZ Sports Turf Institute publication).

10.2 GENERAL HOUSEKEEPING AND GUIDELINES

Golden rules for good housekeeping of a synthetic green include:

- Avoid unnecessary traffic (foot and machinery) on the green;
- Move rink positions regularly (weekly or more often);
- No smoking or food/drink on the green;
- Use correct footwear (flat-soled shoes; bare feet or stockings);
- No chewing gum;
- Minimise excessive dropping/dumping of the bowl.

It is recommended that the bowling club installs signs around the green informing members of the need to wear appropriate footwear and the rules on food and smoking. Drink should not be consumed on the green. Soft drink products containing various dyes can stain the carpet and the stains can be very hard to remove.

The use of correct footwear on the green is likely to be part of the supplier's stipulations for use of a carpet-type synthetic green. Use of improper footwear on a green may void any claims on warranty.

Chewing gum should be banned from a synthetic green. Chewing gum can be difficult to remove if it gets into the turf of the grass or the weave of the carpet. In the event of gum appearing, one option is to apply ice cubes to harden the gum, as it is more easily removed in a solid form.

10.3 BASIC MAINTENANCE

10.3.1 Watering

A tufted sand-filled green is likely to need watering to maintain the sand base moisture at the correct level and in turn to maintain uniform green speed. A light sprinkling of a few minutes should be sufficient. Fully damper the surface but avoid over watering (flooding).

10.3.2 Rolling (applicable to sand-filled surfaces)

Rolling should only be done at the direction of the installer. Excessive rolling has the potential to increase wear, alter speed and slow down drainage.

10.3.3 Grooming (applicable to sand-filled surfaces)

Correct grooming helps to: maintain the surface drainage, maintain the correct sand level, open up the synthetic pile to reduce compaction, and remove dead algae and moss.

The power brush should be set to penetrate to a depth of about 2 or 3mm into the synthetic surface.

Grooming would generally be carried out monthly or as recommended by the surface supplier.

It is recommended to purchase a leaf blower to keep the green clear of leaves.

10.3.4 Weed/moss/algae control

Control algae and moss before the growth gets out of hand. The treatment procedure usually involves spraying with an approved chemical, as recommended by the surface supplier, then leave until the surface is dry. The surface should then be groomed with the power brush. Small areas can be groomed with a stiff yard broom.

10.3.5 Vacuuming (for woven mat or carpets)

Any loose matter on the surface should be vacuumed using a unit approved by the supplier of the synthetic surface. The vacuuming should be undertaken at walking pace without stopping. Do not over-vacuum and use the vacuum only when the surface is dry.

A more thorough cleaning of the surface is likely to be necessary every six months or so, subject to the installer's advice. This would consist of an initial pre-soak of the surface, then the application of a low foam cleaning solution as recommended by the surface supplier. After the cleaning solution has soaked for one to two hours, the excess water and any dirt build up can be removed using a wet and dry machine. Do not pressure-wash the surface.

Vacuuming a woven turf green

10.3.6 Re-stretching

A woven carpet type synthetic surface will need periodic re-stretching to maintain the desired green speed. While re-stretching is a relatively straight forward process, it is highly recommended this be carried out by the green installation company, at least during the warranty period.

10.4 HEAVY EQUIPMENT

Surfaces can be indented and therefore damaged by heavy or sharp objects standing or dropped on the green. Any such equipment that is required to be placed on the surface should be fitted with pads or boards placed under the legs to spread the load (for example, compressors or scissor hoists for adjusting lights).

Prohibit any narrow and small (less than 50mm diameter) wheeled implements from going on the green, such as roller skates, skateboards, bicycles and, in some cases wheelchairs, that may do damage to the green. Check with the supplier's warranty for exclusions.

10.5 PLANTINGS

Avoid planting shrubs, climbers or trees near the green. Their roots may disturb the green's surface, and leaves can create additional maintenance.

Shrubs, trees and hedges that must be planted close to the green should be carefully chosen to avoid roots getting under and into the green. A root barrier should be installed in cases where aggressive rooting species have been planted nearby.

10.6 VANDALISM

Bowling clubs who install synthetic greens should be aware of the risks associated with vandalism. Vandalism can be reduced by the use of security fencing, motion detector lighting systems, alarms and security checks.

Avoid having heavy but moveable objects, such as chairs and signs, left lying around the green, as these could be used as missiles. Such objects should be bolted down or locked away after each day's play.

Chemicals such as spray paint are extremely hard to remove from synthetic turf, as most of the solvents required to remove paint can also damage the surface.

It is recommended that the bowling club contacts the installer prior to carrying out vandal repairs. Vandalism repairs should be done by the installer and vandalism is not usually covered in the installer's warranty.

10.7 FLOOD

In the instance of flood damage refer to your insurer before contacting your installer.

CHAPTER 11

ENVIRONMENT AND LEGAL ISSUES

11.1 INTRODUCTION

When working with a natural resource like soil or water there will inevitably be environmental and legal requirements. Due consideration must be given to legislation with matters such as:

- Excavation and removal of soil material from the site;
- Importation of fill;
- Removal of vegetation;
- Collecting, storage and re-use of water;
- Wildlife habitat disturbance;
- Noise and dust generation;
- Site traffic;
- Worker health and safety.

The situation on legal requirement's and environmental compliance is complex, and made more so by the fact that there will regulations at federal, state, and local government level.

11.2 WHAT TO CHECK FOR AND WHERE?

Planning laws pertaining to development of any building or land are regulated by the regional shire. It is important the bowling club or its representative meets with a representative from the local shire at the outset. This person should be able to provide information on relevant legislation, or at least know a contact person. Information could also be accessed from specialist environmental/legal firms, or by checking through legislation on the web (e.g. Environmental Protection Act 1994).

Example: *Contaminated sites…….. In NSW, the Protection of the Environment (Operations) Act 1997 regulates all activities that could have harmful effects on the environment, including the excavation and removal of soil from a site. Before excavated soil can be removed and dumped off-site, evidence is required that the fill doesn't contain harmful contaminants.*

11.3 LEGAL CONSIDERATIONS WITH THE OFF-SITE DISPOSAL OF MATERIAL

Under the Environmental Protection Act 1994 polluters of a site are responsible for any contaminated soil which is generated on a property because of their activities. Topsoil material in a bowling green could be considered a potentially contaminated soil, given it has been exposed to pesticide application over the years. Although this may seem "over the top", the reality is that if topsoil is to be cut and dumped off site it is first likely to require testing for contaminants and a disposal permit acquired.

Legislation that could apply to land-based activities such as greens construction includes (but is by no means limited to):

- Environmental Protection Act 1994;

- Sustainable Planning Act 2009;
- The Environment Protection and Biodiversity Conservation Act 1999;
- Occupational Health and Safety Act 1994.

11.4 ENVIRONMENTAL ISSUES PERTAINING TO WATER USE

Much of the relevant environmental legislation in place pertains to the use of water, and in particular ensuring best use of the water resource. In fact one of the drivers for bowling clubs converting to synthetic turf in places like ACT is the reduction in water requirement.

Bowling clubs may, as part of the overall project, opt to include water conservation features, such as a water harvesting system. In this case, a water storage system (possibly located below the green) would be built to capture, store and, later, re-use excess rainfall.

CHAPTER 12

CASE STUDIES & FREQUENTLY ASKED QUESTIONS

12.1 CASE STUDIES

BOWLING CLUB A wishes to convert its only green to synthetic grass, given that they have had trouble maintaining the natural turf green on a limited water supply. The bowling club approached a local synthetic turf installer and secured a price and brief for the works. The quotation received from the installer describes the process involved to prepare the base and lay the carpet, as well as a description of product being installed. There is also a warranty included pertaining to life of the carpet in relation to UV light degradation. The document does not, however, include reference to design performance standards.

Soon after completion of construction, the bowling club becomes increasingly concerned about the uneven nature of the surface, with severe straighteners appearing on several rinks.

Upon approaching the installer they are told the green was installed correctly and that any subsequent defects must be the result of failure to maintain the green correctly. The installer refuses to take any responsibility for the perceived failure. The bowling club is unsure how to proceed. Enquiries indicate there is no legal obligation on the installer to undertake any repair work, given there was no documented design performance standards in the contract. The installer offers to undertake rolling to try to improve levels as a sign of good will, but this has minimal effect.

What can be learned? It is considered important that any contract documentation between a bowling club and installer includes performance standards and having the green professionally performance tested before hand over. Including performance standards in the contract would serve in the interests of both parties. The bowling club will have some form of legally binding assurance that the green will perform to a design standard. The contractor will know what quality standards must be targeted during the installation.

BOWLING CLUB B commissions the construction of a new synthetic green. The site selected is relatively level and doesn't require any imported fill material. Consequently, it is assumed there will be no issues related to base stability. The green performs well for the first couple of seasons, but after a dry summer the green starts to show signs of unevenness. An evaluation reveals that a section of the base is built on subsoil with a high montmorillonite clay content that is shrinking upon drying and causing differential surface subsidence.

What can be learned? It is critical to get a thorough and professional assessment of the sub-base before laying any turf surface. If there is any doubt at all about the makeup of the sub-base and potential stability of the base material, then commission a geotechnical report.

BOWLING CLUB C has embarked on converting a natural turf green to a synthetic green. A local engineering company is contracted by the bowling club directly to construct the sub-base, and a recognised synthetic turf supply company contracted separately to lay a shock-pad and the surface carpet. From day one, the green shows signs of inconsistency, with uneven draw and noticeable small depressions. When approached by the bowling club the carpet supply company states the problem is related to the base. The contractor for the base construction refutes this and blames the inconsistency on the carpet. A long, legal battle is the result.

What can be learned? Unless there are clearly defined performance standards and sign-off points for the different phases of construction, it is best to have one company/one person ultimately responsible for the performance of the green. Minimise any potential loopholes.

12.2 FREQUENTLY ASKED QUESTIONS

Q: What is the preferred direction of play with a green?

A: The predominant direction of play, particularly if playing in only two directions, is north- south (to minimise sun glare). However, there are tolerances to this and these can actually increase with latitude. Sometimes a bowling club has limited space to construct a green, so has no choice with direction of play.

Q: How many different types of approved synthetic surface are there and which one is best?

A: There are several different synthetic surfaces available for greens (and we can expect to see more options in the years ahead). Refer to Chapter 8 for a description of the main products in use. The choice of surface comes down to weighing up several factors, including relative cost, desired performance (especially green speed), local climatic factors and feedback received from other bowling clubs on specific products. No one product suits all situations.

Q: What does Bowls Australia recommend for maintaining greens?

A: Maintenance is just as critical for a synthetic green as it is for a natural turf green. It is critical the bowling club gets specific guidelines from the installer/manufacturer for maintenance (failure to do so may void warranty). Each product will have specific maintenance requirements. Sports Turf Institute Aust has prepared a handbook on maintenance of synthetic greens for those bowling clubs wanting further information (contact advice.sti@gmail.com).

Q: How are greens tested?

A: Performance testing the playing surface a reasonable time after installation is strongly recommended (often best to let the green settle for a month or two after construction before testing). Testing will pick up any defects in how the green has been built as a whole (carpet, shock-pad and base). Who does the testing will depend on what performance standards are specified in the contract documentation. If World Bowls Ltd standards are specified then it will be necessary to employ Sports Turf Institute, as they are the only World Bowls Ltd accredited testing agency in the southern hemisphere. If other standards are referred to, (some local associations may have their own standards), then the testing would be done by their appointed testing agency.

Q: Does an installer offer long term assurance a green will continue to perform?

A: A good question and an important one. Suppliers of the synthetic grass will generally provide a warranty on the product, which offers compensation in the event that the synthetic grass product fails. However, questions need to be asked as to whether or not the entire system - the base performance as well as the completed surface - is covered by warranty.

Q: How long can we expect a synthetic green to last before replacement?

A: Supply companies are currently suggesting a life expectancy of 10 years for the carpet. Provided high quality materials have been installed and to the correct standard then there is no reason why a green will not perform well for at least 10 years. However, we have encountered greens that have failed within the first couple of seasons, which illustrates things can, and do, go wrong.

Q: How much does it cost to build a green?

A: Refer to Chapter 2 as a guide to costs for constructing and maintaining both a natural turf and synthetic green. When building a new green synthetic turf will represent a higher cost outlay, but lower maintenance cost. Over a 10 year period there is likely to be little difference in the cost between the two surfaces.

CHAPTER 13

OTHER ITEMS TO CONSIDER

In addition to the surfacing of a bowling green other major projects may include the installation of lighting, roof structure and watering system. Similar due diligence needs to be carried out.

13.1 LIGHTING

Floodlights are located in positions that will provide the least glare to bowlers by placing the lighting away from normal lines of sight. It is recommended that a corner lighting system is used for outdoor greens. The minimum lux for competition, recreation and training is 100. The minimum mounting height of the pole is 12m.

The design should comply with Australian Standard AS2560.2.8 Guide to sports lighting - Specific recommendations - Bowling greens and bowling clubs should refer to their local council / government for guidelines and permits. It is recommended that bowling clubs choose a supplier that is a Member of the Illuminating Engineering Society (MIES).

At the time of printing, an approximate cost for lighting, including installation, on one green is $50,000.

13.2 ROOF STRUCTURE

A roof structure is a consideration to provide a sun-safe playing environment for members also resulting in interupted play by poor weather conditions, helping keep on schedule.

At the time of printing approximate cost indication for a roof structure is $900,000.

An example of a roof structure

13.3 WATERING SYSTEM

In the case of an existing green an irrigation system may already be in place. For a new synthetic turf green installation approach a contractor to design and install a system for your specific site. Cost and specification will vary depending on site location, water pressure etc.

At the time of printing approximate cost indication for a watering system is $10,000 to $15,000.

CHAPTER 14

CONTACTS AND REFERENCES

14.1 CONTRACTORS

We are in the process of licensing contractors which will provide you with a comprehensive list of contacts. In the meantime please contact Bowls Australia on 03 9480 7100 for details.

14.2 REFERENCES

1. Lawn Bowls Surfaces Study Issues and Actions. Victorian Greenkeepers Association Misc. Publ. 2004.
2. World Bowls Ltd Performance Standards For Flat Green Bowls Surfaces. NZ Sports Turf Institute & CST Ltd. Misc Publ. August 2008.
3. Maintenance of Synthetic Surfaced Bowling Greens. 1st Ed. NZ Sports Turf Institute 2007.
4. Turf surface guide for lawn bowls bowling clubs 1st ed. D. Appleyard, May 2008
5. Establishment and management of natural bowling greens in New Zealand. NZ Sports Turf Institute 2008.
6. The Smart Guide to Synthetic Sport Surface. Misc. Publ. Smart Connection Company 2010.
7. Dept of Sport and Rec Govt of WA book.
8. Laws of the Sport of Bowls, Crystal Mark 3rd edition, Version 3.1, April 2019.

GLOSSARY OF TERMS

Capping layers	The final fine stone layer laid over the engineered base
Clegg hammer	A piece of equipment used to test the hardness of a green
Control point	Certain critical stages of the project when works should be checked
Construction phase	Stage when the physical work commences
Defects liability period	Period of time, usually 12 months, when the contractor is responsible for repairing any defects
Drainage system	Series of pipes to drain the water away from the green
Drag mat	Mat used to maintain a tufted synthetic turf to maintain sand levels and reduce compaction
Engineered base	Layers of selected material laid over the sub-base
Gantt chart	A chart mapping out the timetable of works
Geotechnical report	A specialist survey to determine the underlaying ground conditions and its suitability to support the greens construction.
Geotextile	A fabric layer between the sub-base and engineered base
Infiltration rate	The rate at which water passes through the base
Integrated shock-pad	A shock-pad manufacturers bond to the back of the tufted synthetic turf at the factory
Laser grading	Method of constructing and forming a level base
Levelness	The accuracy of the base levels. The difference in height between adjacent (2m grid) spot levels shall be no greater than 3mm
Maintenance	Upkeep of the surface
Natural grass / turf	Grass species, namely bent grass or couch
Needle punch	Polypropylene needle punch surface
Non permeable	Does not allow water to flow through
Permeable	Allows water to flow through
Polyethylene	Type of product the surface is made from, usually more durable than polypropylene
Polypropylene	Type of product the surface is made from
Roll out pad	Preformed shockpad layer between the base and surface supplied and laid separately

Root zone	Material used for natural grass green base such as sandy loams
Sand filled	A sand layer in between the fibres of the tufted synthetic turf
Shock-pad	Resilient layer between the base and surface to regulate the speed and player comfort
Site preparation	Preliminary works such as access, clearance and preparation
Soil test	A series of core samples taken across the green to identify thatch and topsoil depth
Straight edge	Piece of equipment used to measure levelness
Sub-base	Foundation layer on which engineered base is laid
Tender	Tender documentation includes technical specifications and associated information and requirements to build a green, normally produced by designer and sent to contractor for pricing
Tolerance	Acceptable measure of performance, e.g. levelness
Tufted synthetic turf	A polyethylene or polypropylene surface with sand infill
Woven mat/carpet	A polypropylene woven surface

APPENDIX 1

FEASIBILITY STUDY CHECKLIST

INVESTIGATION	INFORMATION TO SOURCE	PROCESS REQUIRED	CHECK
1. Stakeholder expectations	• Define required standards, including number of greens/rinks required to meet future needs; • Determine volume of use/level of use; plans for centre tournaments etc.; • Identify project time frame; how long before use/re-use; • Define expectations regarding project costings; • Identify impact (positive/negative) on stakeholders.	Overseen by project leader or appointed consultant. Survey members and other stakeholders	☐
2. Sourcing relevant information	• Collect resource information and relevant experiences from bowling clubs who have undergone similar work (seek information on what went well; what would be done differently etc.); • Check on information available from national, state and other bodies.	Contact other bowling clubs who have undertaken similar work. Contact the state and national associations for information and contacts.	☐
3. Identify and evaluate options	• Identify range of options available; • Get product information and pricing; • Consider advantages/ disadvantages, track record; • Seek independent information on product performance (refer to Chapter 2).	Contact supply companies and consultants.	☐
4. Evaluate financial matters	• Identify all related costs, including maintenance and depreciation; • For each option carry out a cost benefit analysis; • Identify financing options such as loans, debentures, funding opportunities etc .	Contact national and state bodies for advice. Check local sponsorship. Check with suppliers and consultants re. maintenance costs.	☐
5. Site history	• If an existing green determine how has it performed in the past;	Bowling club representative could research site history. Interview bodies such as regional council	☐

INVESTIGATION	INFORMATION TO SOURCE	PROCESS REQUIRED	CHECK
	• Determine if there have been any documented problems with subsidence; • Identify land tenure. If leasehold, what is the duration of lease and any constraints; • Determine likelihood of flooding; • Identify how the site and/or its surround are currently serviced with respect to hydraulics, storm water and power.		
6. Composition of the soil profile	• Determine the nature of the existing soil profile and geotechnical features, including whether soil can be re-used or modified and the likelihood of future subsidence (such as if building on a swelling/shrinking clay); • Determine the likelihood of soil contamination from products such as asbestos; cost of disposing of soil (if needed); • Determine the drainage status of the soil and site.	Requires the input of specialists. For the subsoil stability use a qualified geotechnical engineer.	☐
6. Neighbouring features	• Note any adjacent buildings and or trees that could cause problems (e.g. shade or leaf litter); • Identify the potential for tree roots to move under the green.	Investigate the site at different times of the day. Consider future developments in the vicinity.	☐
7. Services	• Determine if there are any buried obstructions/cables/pipes; • Identify if there is a suitable drainage system outlet and what regulations apply for its use; • Identify water requirement, water supply and water storage option; • Locate power supply options.	Meet with local authority and associated engineers.	☐
8. Site geography and geometry	• Consider the topography and how much earthmoving and re-grading will be needed; • Determine the potential risk of erosion and sediment runoff during construction;	Likely to need input from an engineer and a contour survey.	☐

INVESTIGATION	INFORMATION TO SOURCE	PROCESS REQUIRED	CHECK
	• Determine if the size and shape of the site will accommodate the proposal; where to locate features such as access ways, storage tanks, parking space, etc.; • Identify what machinery can/ cannot be practically used in the construction process and any likely limitations with regard to access; • Identify if there are any environmental or cultural issues; • Determine from the site history if it could contain contaminated soils which will need to be treated.		
9. Climate considerations	• Determine drainage requirements; • Carry out a water balance to determine the volume of water needed (for a natural turf green); • Match climate with the turf types able to be grown (for natural turf green); • Determine wind run and the need for shelter provision; • Consider the sun when determining direction of play (North – South preferred).	Access climatic records. Refer to rainfall intensities.	☐
10. Legal, environmental, health and safety	• Identify any resource consent and related issues. This could include aspects such as flood lighting, traffic, noise and dust; • Consider environmental issues especially those that pertain to obtaining consents (e.g. potential for nutrient leaching or sediment runoff into adjacent waterways); • Understand the bowling club's legal requirements with respect to employment of contractors; • Consider planning/building requirements; • Seek advice from a lawyer.	Check with local council. Commission input from local consultant.	☐

APPENDIX 2

EXAMPLE OF A DESIGN BRIEF FOR A NEW GREEN

CLIENT: X Bowling club **LOCATION:** Y **DATE:** Z

BRIEF:

Bowling club X (hereafter called the Bowling club) intends to develop a new 40m x 40m synthetic outdoor bowls green at the above location for the purposes of extending the playing hours and attracting more casual users.

The Bowling club is seeking to engage a suitably experienced and qualified synthetic turf installer (hereafter called the Contractor) to design; cost estimate and project manage the construction of the green.

REFERENCE DOCUMENTATION AND BACKGROUND INFORMATION:

The Contractor will need to demonstrate they have the capability and track record to design and build a green to the required standard. As a minimum, the Contractor is expected to have accessed and understood the following:

- The Bowling club's approved application for the development
- World Bowls Ltd Performance Standard for Flat Green Bowls Surfaces
- Council by-laws pertaining to site works

Note that the above list does not exclude the requirement for the Contractor to comply with other documentation.

The Contractor shall be responsible for all external matters, including legal and environmental issues relating to the works.

SPECIFIC DESIGN CONSIDERATIONS:

The Bowling club has purchased additional land adjacent to its existing green for the purposes of constructing a new synthetic bowls green (refer to map A). A resource consent for this development has been secured (see Appendix B).

The Contractor must ensure that the new green includes:

- A concept plan with drawings to scale, which shows the relationship of the new green to the existing green and surrounding structures;
- A list of surfaces and associated suppliers that can produce a green with a green speed of at least 13 seconds;
- A surface that meets the current World Bowls Ltd performance standards;
- The construction of ditches, banks and adjacent paving should be allowed for in the tender.

CONSULTATION/LIAISON:

The consultation/liaison responsibilities of the Contractor are to include the following:

- Regular liaison with the appointed project manager, or their appointed agent as required;
- Liaise with regulatory agencies as required;
- Attend a project start-up meeting on a date to be confirmed and scheduled weekly meetings during the project works phase;

- Prepare monthly progress reports for the Bowling club.

PERSONNEL AND H&S MATTERS:

The Contractor is to ensure that:

- All personnel used on the project are appropriately skilled for the work in hand;
- Specialist expertise has been accessed for assessing the geotechnical characteristics of the green;
- All personnel employed on site have been appropriately briefed in relation to health and safety requirements;
- All personnel are appropriately supervised throughout the construction works.

PERFORMANCE EXPECTATIONS:

The Contractor shall ensure that:

- The agreed-to timetable (see design brief) is adhered to;
- Performance testing to the contracted standards be carried out within three months of completion;
- As-built drawings and plans for the new construction are delivered to the Bowling club;
- Appropriate training in maintaining the green is given to the Bowling club's green keeper and/or the appointed representative;
- All warranty and other contractual requirements are adhered to.

APPENDIX 3

CHECKLIST USED BY BOWLS VICTORIA

1	THE GREEN LAW 46	Law 46.1 Law 46.2	The green must be either rectangular or square. The length of the green in the direction of play must be between 31metres and 40metres.
2 (a)	THE DITCH LAW 47	Width Law 47.2.1	Between 200mm and 380mm wide
2 (b)		Depth Law 47.2.2	Between 50mm and 200mm deep
3		Holding Surface Law 47.3	The ditch must have a holding surface which is free from obstacles and made of a material which will not damage the jack or bowls. (Specify type, i.e. whether: (S) sand, (C) 35mm pile carpet, (E) egg-shell, or if (O) other – provide full description on front of report).
4	THE BANK LAW 48	Top of Bank Law 48.2	Must be at least 230mm above the surface of the green.
5		Face of Bank Law 48.3	Must be vertical and set at a right angle (90°) to the surface of the green or sloped at an angle of not more than 35° from the vertical.
6		Face of Bank Law 48.4	The surface of the face of the bank should be made of, or be covered with, a material which will not damage the jack or the bowls. Specify: Rubber (R), Carpet (C) - mm pile.
7		Steps Law 48.5	There must be no steps that could interfere with play either cut into or positioned against the face of the bank.
8		Advertising Banners Law 48.6	If advertising banners are fixed to the face of the bank, they must be made of a material which will not damage the jack or the bowls. Also, they must be fixed in a way that makes sure the specifications for the ditch and the bank, as described in **laws 47 and 48**, still apply. The banners will be considered to be part of the face of the bank for all purposes within the laws.
9	DIVISION OF THE GREEN RINKS LAW 49	Rink width Law 49.1.1	Rinks must be between 4.3 metres and 5.8 metres wide for outdoor play. (N.B. Between 4.6m & 5.8m for indoor play – **Law 49.1.2**). (All rinks on a green must be the same width) Insert width of rinks & if differ in N/S or E/W direction make note on front of report.
10		Rink Numbers Law 49.2	Rinks must be numbered in order, with the centre of each rink being marked on the bank at each end by a peg, disc or other suitable device that has the rink number on it and is fixed vertically: **Law 49.2.1** to the face of the bank and flat against it; or **Law 49.2.2** on the top of the bank not more than 100mm back from its face **Law 49.2.3** on the wall behind the bank (for indoor play only) Insert distance pegs are situated back from the face of the bank - mm
11		Four Corners of the Rink Law 49.3	The four corners of the rinks must be marked by white or brightly coloured boundary pegs that are fixed vertically: **Law 49.3.1** to the face of the bank and flat against it; or **Law 49.3.2** on the top of the bank not more than 100mm back from its face.

12	**DIVISION OF THE GREEN** **RINKS** **LAW 49 (cont.)**	**Boundary pegs (Rink) Law 49.4**	**Law 49.4.1** Boundary pegs must be not more than 50mm wide and not more than 430mm high if fixed to the face of the bank of an outdoor green: or
13			**Law 49.4.2** Boundary pegs must be not more than 25mm wide and not less than 600mm high if they are fixed on top of the bank of either an outdoor green or an indoor green (although this height limitation does not apply to flexible boundary pegs containing a spring or similar mechanism in their base that allows them to bend on contact with an object or person); or Indicate whether pegs are flexible (F) and if fixed (FIXED), insert their height - mm.
14			**Law 49.4.3** Boundary pegs must be not more than 25mm wide and the centre of peg must be marked by a thin black line if they are fixed to the face of the bank of an indoor green.
15		**Boundary Pegs (Side boundary) Law 49.6**	The boundary pegs of an outside rink must be: **Law 49.6.1** at least 600 mm from the side ditch for outdoor play; and **Law 49.6.2** at least 460mmfrom the side ditch for indoor play. Insert distance from each side boundary N/S = E/W =
16		**Pegs, Discs & markers Law 5.11**	Pegs, discs and other types of markers used to mark the centre and corners of the rinks must be made of a material which will not damage the jack or bowls.
17		**Distance Markers Law 49.12 & Appendix B.4.1**	White or brightly coloured pegs, discs or other suitable markings must be fixed or marked vertically against the face of the side banks or fixed on top of the side banks in the direction of play to mark distances of 2 metres and 23 metres from the end ditches (see diagram Appendix B.4.1). (Wherever possible these must be the only pegs, discs or markings visible on the side banks).
18		**Centre line Law 49.13 & Appendix B.2.1**	The centre line of each rink can be marked along the surface of the green starting 2 metres from each end ditch and finishing at any point up to, but not less than, 25metres from the opposite end ditch (see diagram B.2.1 in appendix B.2). Whilst the centre line is optional, it is preferred that it should be marked to assist players to place the mat.
19		**Centre line Law 49.14**	The centre line can be marked at a distance of 2 metres from each end ditch (see diagram B.2.2 in appendix B.2) The mark can be: **Law 49.14.1** lines drawn in the form of a "T"; or Insert whether "T", golf tee type peg (BGM) or describe other mark **Law 49.14.2** a small piece of suitable material inserted immediately below the surface of the green (for outdoor play only). E.g. "The Flat Top Bowling Green Marker".

20 (a), (b), (c)	Runs? (Yes / No)		Other irregularities? (Yes / No)		Bank / Ditch rebound? (Yes / No)		
21 (a), (b), (c)	Pace of green (Guidelines= 13-17 seconds) Ramp or Stopwatch?	(Seconds)	Entry into ditch? (Yes / No)		Bowls used	Minimum Bias	
						Standard Bias	

NOTES

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August 2019