Guidance Document for Sports Field Development

December 2019

Contents

Contents ii

Executive Summary 4

Stage One: Needs Analysis 4

Stage Two: Sports Field Options 4

Stage Three: Cost Analysis 5

Stage Four: The Way Forward 5

Conclusion 5

Introduction 6

Background 6

Who is this guidance document for? 6

The Sports Field Decision Making Process 7

Stage 1: Needs Analysis 8

Sports Field Demand 8

Sporting Trends and Demographics 8

Site-Specific and Environmental Factors 10

Stage 2: Sports Field Options 14

Soil-Based Sports Fields 14

Sand-Based Sports Fields 14

Hybrid Sports Fields 15

Artificial Sports Fields 15

Player Safety 16

Sport Field Guidelines / Regulations 20

Stage 3: Cost Analysis 24

Construction Costs 25

Maintenance Costs 26

Hours of Use 27

Cost Per Hour of Play 28

Whole of Life Cost Model for Sports Fields 29

Inputs for the Whole of Life Cost Model 29

Outputs for the Whole of Life Cost Model 29

Stage 4: The Way Forward and Where to Find Advice 30

Consultants 30

Procurement 30

Further Guidance 30

Case Studies 31

Case Study One: Stella Maris Catholic Primary School, Silverdale, Auckland 31

Case Study Two: Westlake Girls High School, Takapuna, Auckland 32

Case Study Three: Trafalgar Park, Nelson 33

Case Study Four: Bruce Pulman Park, Takanini, Auckland 34

Case Study Five: College Rifles, Remuera, Auckland 35

Case Study Six: Scott Point Sustainable Sports Park, Upper Harbour, Auckland 36

Case Study Seven: Nixon Park, Kingsland, Auckland 37

Bibliography 39

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Executive Summary

A considered approach that encompasses the key issues discussed throughout this guidance document will help to achieve a realistic sports field development that meets the needs of the local community.

Generally, it is a representative from the local club, school or authority that is tasked with making decisions regarding the upgrade or development of sports fields in their care. For this one person there are many questions they need to answer before commencing a substantial capital and on-going operational expenditure commitment. Sheppard (2008), suggests that the decision maker must clearly understand the type and amount of sport to be played, and the likely on-going maintenance that would need to be undertaken. Findings from our previous research, workshops and case studies have been updated to identify challenges for sports field decision makers in New Zealand, as described below:

- The inability to find relevant information on sports field development options within New Zealand has meant uninformed decisions have been made;
- Increasing demand (training and competition throughout winter and summer) for natural grass sports fields has led to overuse, resulting in poor quality turf conditions;
- Limited budgets have meant that key elements are often excluded or missed in the sports field design and construction process, which in some cases has led to a less than desirable specification;
- The lack of maintenance knowledge or a limited maintenance budget has led to the deterioration of fields, resulting in decreased field lifespan and limited hours of available for community use;
- A general lack of understanding of developments in sport field technology and;
- Not evaluating and mitigating the environmental impacts relating to sports field development and maintenance.

To help address these challenges, the decision maker/s should work systematically through the following four stages:

Stage One: Needs Analysis

A needs analysis must identify who is using the fields, what they are using the fields for, when they are using them and for what level of need. Specialised tools, such as the supply and demand approach developed by Longdill (2008) should be used to undertake this analysis. The needs analysis stage should also consider other relevant factors including; site specific constraints, environmental factors, national and regional demographics and any other trends which may impact on future supply needs.

"When making the sports field decision it is crucial to assess sports field demand, levels of proposed use, maintenance and management in order to balance risk against demand"
(Sheppard, 2008)

Stage Two: Sports Field Options

This guidance document considers the following sports field surface development options;

- Soil-based field with natural grass;
- Sand-based field with natural grass;
- Sand-based fields with hybrid turf reinforcement;
- Artificial turf.

The fundamental influences essential to successful sports field development including design and maintenance are also identified and addressed in this document.

Stage Three: Cost Analysis

A sports field cost analysis comprises of the following components; construction, maintenance, renewal, decommissioning and cost per hour of use. The cost analysis, which considers a thirty-year lifecycle, provides an indication of the cost per hour of use for each sports field surface type. Note: costs are dependent on-site constraints and type of sports field surface chosen.

To further assist with developing an accurate cost analysis for each sports field surface type, the Sport New Zealand: Whole of Life Costs Model for Sports Fields was developed. An electronic copy can be downloaded from the Sport NZ website: *https://sportnz.org.nz/managing-sport/search-for-a-resource/tools-and-resources/whole-of-life-costs-model-for-sports-fields*.

Figure 1: Westlake Girls High Hockey Turf, Auckland

This model calculates the capital costs, maintenance costs and the cost recovery amount required (per hour of use) to break even over a thirty-year lifecycle. It is recommended that a whole of life cost analysis for all sports field options is undertaken as the cost per hour of use begins to balance out over a thirty-year life span.

Stage Four: The Way Forward

Once the needs analysis, sports field options and cost analysis are complete, it is recommended to commission a qualified consultant to visit and undertake a general site assessment. When the consultant is on site, take the opportunity to discuss the results of the needs analysis, sports field options and cost analysis as this will assist the consultant to recommend the type of surface that will meet the level of demand required and create financial sustainability.

It is also recommended that before choosing a consultant and contractor to commence the design and physical works, undertake site visits to several local sports fields that have similar attributes, and look for good practice which may aid your sports field development.

Conclusion

A considered approach that encompasses the key issues discussed throughout this guidance document will help achieve a sports field development that meets the needs of the local community. The guidance notes for natural turf developed by Sport England (2011) reaffirm this and state that good design needs to be based on a sound understanding of the current trends and practices, developments in the sport and leisure industry and lessons learnt from previous projects. Evaluating the results from the needs analysis, sports field options, cost analysis and gaining qualified advice will ensure an informed sports field decision is achieved.

Introduction

The sports turf industry continues to make significant advances with natural grass options and artificial surface technology. This development leaves the consumer with many choices, but little independent guidance is provided on how to identify the most appropriate choice.

Background

As the level of service expectation from users has increased, so too has the number of sports field surface development options. No longer is the New Zealand sporting community prepared to accept sports fields being closed for weeks or have to play in ankle-deep mud during their weekend sports matches. Instead they are asking for a sports field surface that can be played upon in any weather and provides a safe, high-quality experience. As the number of options available to address this has increased, it has become harder for decision makers to select the most appropriate option for their situation.

Local Government Authorities and schools are responding to the requests for quality sports fields. However, feedback to Sport NZ is that they have limited information to assist them. This guidance document has been produced to assist the selection of the most suitable sports field development options and address any questions that the decision makers may have. The following case studies are used to illustrate the typical options available:

- **Case Study One:** *Stella Maris Catholic Primary School*, Silverdale, Auckland. Natural grass / sand-based sports field.
- **Case Study Two:** *Westlake Girls High School,* Takapuna, Auckland. Artificial sports fields.
- **Case Study Three:** *Trafalgar Park,* Nelson. Natural grass / sand-based sports field using recycled glass sand.
- **Case Study Four:** *Bruce Pulman Park,* Takanini, Auckland. Natural grass / sand-based sports field
- **Case Study Five:** *College Rifles,* Remuera, Auckland. Artificial sports field.
- **Case Study Six:** *Scott Point Sustainable Sports Park,* Upper Harbour, Auckland. Artificial and sand-based sports fields.
- **Case Study Seven:** *Nixon Park,* Kingsland, Auckland. Hybrid sports field.

Who is this guidance document for?

This guidance document has been prepared to assist a wide range of providers, including; local authorities, schools and sports clubs to assess their sports field requirements and make appropriate sports field development decisions.

This document is not intended to provide technical specifications or a detailed methodology of how to design and construct a sports field. It is recommended that a qualified, experienced consultant be engaged to ensure documentation is to the required standard.

The Sports Field Decision Making Process

The sports field decision making process is captured within four stages, as shown in the diagram below. Each stage is discussed in further detail throughout this document.

Stage 1. Needs Analysis

Establish what you have, and what you need

- **Sports Field Demand** - Clearly identify the current levels of use and look to project future use for both summer and winter sports.
- **Sporting Trends and Demographics:** Identify national / regional sporting trends and demographics to assist with sports field demand outcomes.
- **Site Specific and Environmental Factors**: Understand the factors that will influence the design, ongoing field maintenance and long-term performance.

Stage 2. Sports Field Options

Understand your level of service expectations

- **Soil-Based Sports Fields.**
- **Sand-Based Sports Fields.**
- **Hybrid Sports Fields.**
- **Artificial Sports Fields.**
- **Player Safety.**
- **Sports Field Regulations.**

Stage 3. Cost Analysis

Understand your budgetary constraints

- **Construction Costs**: Budget for appropriate design and construction.
- **Maintenance Costs**: Budget for high quality, regular and consistent maintenance, which is crucial to surface performance and lifespan.
- **Replacement Costs**: Allow for surface replacement throughout the thirty-year lifecycle. Including the disposal costs of removed materials.
- **Hours of Use**: The current use and expected demand figures.
- **Cost per Hour of Use**: Aggregate all costs over a thirty-year lifespan and calculate the actual cost per hour of use for each option.
- **Whole of Life Cost Model for Sports Fields**: Depending on the option and overall quality of the design, construction and maintenance, fields will have different lifespans.

Stage 4. The Way Forward and Where to Find Advice

- **Consultants**: Choose a suitably qualified and experienced consultant.
- **Procurement**: Ensure the brief and specifications clearly describe the work to be undertaken, and the level of service expectations.
- **Further Guidance:**
  - **Sport New Zealand (Sport NZ)**: Sport NZ is the government organisation responsible for sport and recreation in New Zealand.
  - **Sports Turf Association New Zealand (STANZ)**: STANZ provides a guidance role within the turf industry
  - **Recreation Aotearoa (RA)**: Recreation Aotearoa RA provides a guidance role within the parks and recreation industry.

Stage 1: Needs Analysis

A needs analysis must identify the training and game allocation, the level of service desired by the community and the resources needed to achieve this level of service.

This section examines the following three issues; sports field supply and demand, future trends that may affect use and site specific and environmental factors that may influence the design and construction methods. The key points discussed in this section provide the foundation needed to determine which sports field development option is most suitable for your requirements.

Sports Field Demand

It is important to develop a comprehensive understanding of the activities being played and / or to be played on the sports field by carrying out a needs analysis. This will identify various factors, such as; what type of sports will be played, what age groups will be using the field, the number of hours the field will be used for, training or competition, and consider both summer and winter users who may have differing requirements.

Longdill and Associates (2008) developed a Sports Field Strategy (SFS) specifically for use in New Zealand, based on a similar system originally developed by Sport England. For further reference the Sport England model can be found at: *https://www.sportengland.org/facilities-and-planning/planning-for-sport/planning-tools-and-guidance/playing-pitch-strategy-guidance/*. The SFS model has been successfully applied to many sports field demand studies for local authorities around New Zealand. By using this method, Auckland Council was able to identify a severe shortage of field space available for training and propose a combination of field upgrades and the development of new fields to keep pace with a growing population and increased demand for sports fields (Longdill, 2011).

Between 2012 and 2020, Auckland Council has invested over $79m capital expenditure as part of a comprehensive sports field capacity development programme. This has delivered over 1600 additional playing hours per week to meet increasing demand for multi-purpose playing fields. A range of projects has been used to provide this capacity, including synthetic surfaces, hybrid pitches, sand carpeting, drainage and irrigation upgrades and training light installations. Targeted investment is expected to continue in order to meet demand.

Sporting Trends and Demographics

An understanding of the regional and national demographics and sporting trends will provide further context for the feasibility of the proposed sports field development. It is important to consider sport growth projections which can be completed by analysing research that is available through; sports organisations, central government, local authorities, sports field suppliers and consultants.

New Zealand Demographics

Consider demographics including population projections early in the planning phase. Statistics New Zealand have projected that three fifths of the forecasted population growth will be in the Auckland region by 2031, and conversely seventeen territorial authorities will have less population than they have now. In Auckland, these projections will result in urban intensification and increased demand for community infrastructure and in contrast, smaller regions may need to optimise sports field provision. Further details on New Zealand demographics can be found at *www.stats.govt.nz.*

Local Authorities (New Zealand's Regional, City and District Councils)

The role of the local authority is to ensure their communities have access to sport fields that meet the required level of service standard. Sports field development and maintenance requires millions of dollars to be invested annually and there are reports and strategies undertaken by local authorities to help understand sports field provision in the community. Further information relevant to the role of local authorities in the sport and recreation sector can be found on the relevant local governments website at *www.lgnz.co.nz*.

Central Government Sporting Body – Sport New Zealand (Sport NZ)

Sport NZ is the kaitiaki (guardian) of the Play, Active Recreation and Sport system in Aotearoa New Zealand. As a crown agency, it promotes and supports quality experiences in Play, Active Recreation and Sport, including elite sport, to improve levels of physical activity and, through this, ensure the greatest impact on wellbeing for all New Zealanders. It is committed to supporting local government, along with national, regional and local sports organisations to deliver community sport and recreation facilities that are affordable, efficient, effective and sustainable.

Sport NZ has recently released its Strategic Plan 2020-2024 – Every Body Active (the strategy). The strategy has committed the funding it receives to re-defining the space in which Sport NZ operates from a focus on sport to play, active recreation and sport. Tamariki (5 – 11 year olds) and rangatahi (12 – 18 year olds) are at the heart of the new Strategy due to evidence that there is a marked decline in physical activity occurring in teenage years.

Between 2020-2024 Sport New Zealand’s priorities are to;

1. Raise the number of hours each week our tamariki are physically active;
2. Reduce the rate of decline among rangatahi;
3. Realise the commitments outlined in the 2018 Women and Girls in Sport and Active Recreation Strategy and;
4. Realise the commitments that are outlined in the Sport NZ Disability Plan (2019).

Accessible quality sports fields play a key role in providing quality play, active recreation and sport opportunities. Sport NZ continues to work with the country’s major participation turf sports to increase the fun and development focus in youth sport. This is in direct response to the declining youth participation rates caused by negative behaviours perpetuated in the youth sport context.

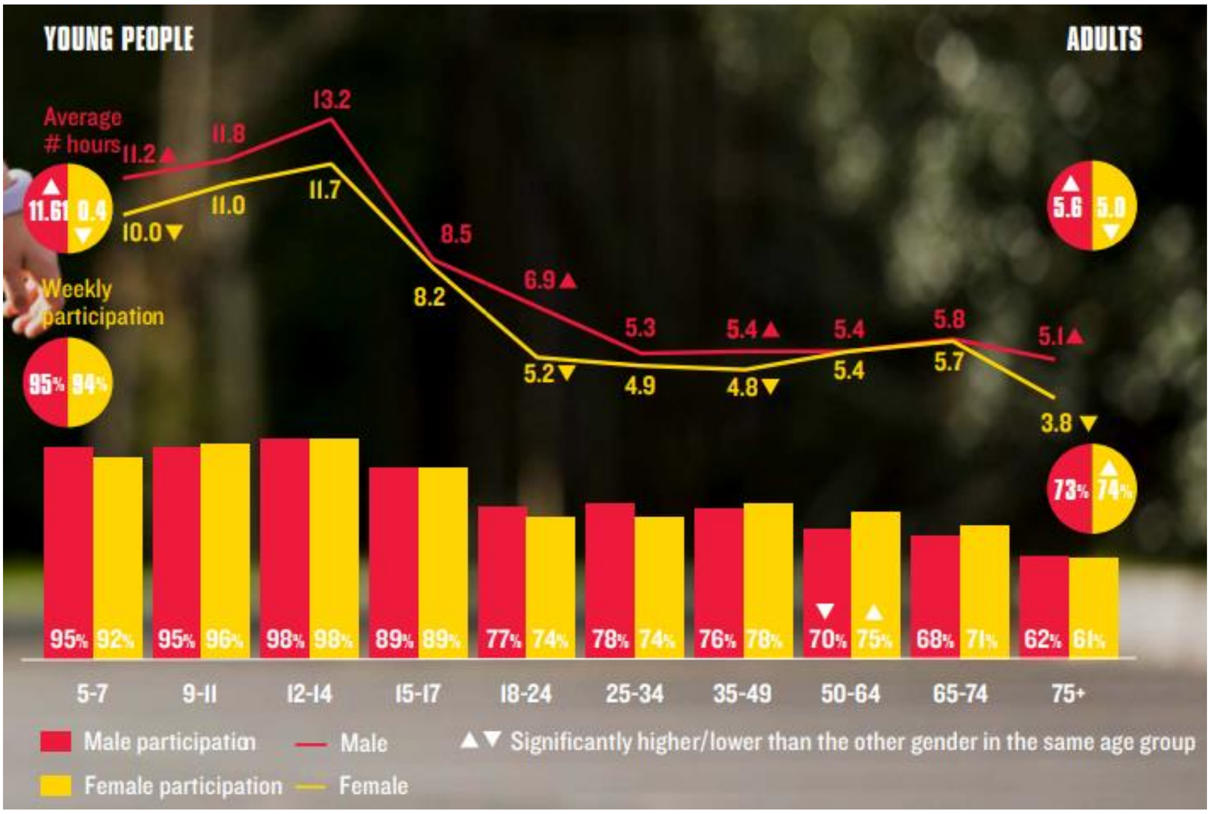

Figure 2: Sport NZ Strategic Plan 2020 - 2024 showing average and weekly participation

Site-Specific and Environmental Factors

Understanding site-specific factors for existing sports fields or proposed sports fields is crucial to the success of the sports field, and knowledge of site-specific factors in the planning phase may mitigate the impact of these factors early in the process. For many, the decision regarding what type of sports field development to invest in will be guided by site-specific and environmental factors as discussed in this section.

Furthermore, informed choices made in the design of a field can have the biggest impact in reducing the embodied carbon of the final asset and the embodied carbon associated with is construction. The use of appropriate materials, and their quantity are the most important considerations; followed by transport emissions. Energy and water use during operation and maintenance of the field are important metrics for asset owners to report on and may be easier to understand by the asset users/ general public. However, it is understood that large reductions in embodied carbon can be made during the design phase as a direct result of the choices made prior to construction (Chapman-Carr, 2018).

It has been shown that artificial fields using sand and styrene-butadiene rubber (SBR) infill from car and truck tyres have the highest embodied carbon, followed by hybrid turfs due to the high use of plastics and rubbers, although hybrid turf fields contain natural turf and therefore sequester carbon, offsetting their own impact (Chapman-Carr, 2018). By reducing the content of a component, or changing the type of material, a carbon saving can be made. Once the minimum material amount is achieved, alternatives with lower emissions can be chosen, such as recycled materials. It should be noted that bringing products from Europe and Asia to NZ has potentially large impacts to the embodied carbon of the park.

Table 1: Site Specific Factors Impacting Soil, Sand, Hybrid Turf and Artificial Fields

Field Type	Soil-based	Sand-based / Hybrid	Artificial
Topography	Undertake a comprehensive topographical survey to assist with an accurate design. Relatively flat land will reduce construction complexity and cost.	Undertake a comprehensive topographical survey to assist with an accurate design. Relatively flat land will reduce construction complexity and cost.	Undertake a comprehensive topographical survey to assist with an accurate design. Relatively flat land will reduce construction complexity and cost. Natural ground is usually stronger than fill as a base for an artificial field.
Climate	Fields will not perform in extreme climatic conditions, including drought, coldness, wind and high rain periods. Good drainage design will prevent flooding issues from arising. Choice of grass species will provide a durable option.	Fields will not perform in extreme climatic conditions, including drought, coldness, wind and high rain periods. Good drainage design will prevent flooding issues from arising. Choice of grass species will provide a durable option.	Fields can withstand extreme climatic conditions including drought, coldness, wind and high rain periods. Good drainage design will prevent flooding issues from arising.
Soil Type	Undertake a geotechnical investigation to summarise the physical properties of the soil on the site. By undertaking geotechnical testing and evaluation at an early stage, an appropriate design for earthworks, drainage and lighting footings can be established.	Undertake a geotechnical investigation to summarise the physical properties of the soil on the site. By undertaking geotechnical testing and evaluation at an early stage, an appropriate design for earthworks, drainage and lighting footings can be established.	Undertake a geotechnical investigation to summarise the physical properties of the soil on the site. By undertaking geotechnical testing and evaluation, an appropriate earthwork and foundation design can be designed. The prepared sub base must be designed and constructed to cope with ground movement and the weight of machinery driving over the surface.

Table 1: Site Specific Factors Impacting Soil, Sand, Hybrid Turf and Artificial Fields

Field Type	Soil-based	Sand-based / Hybrid	Artificial
Heat Factors and Player Health	No heat issues but surface can become unstable when boggy.	No heat Issues but surface can become unstable if the turf is over-used and the sand exposed. Hybrid turf can help to stabilise the surface even if the natural grass is worn away.	Surface retains heat which can lead to heat stress related conditions (this is an issue in warmer climates). Concerns regarding player safety and the environment are frequently raised by the community and currently there is limited data available from research carried out in New Zealand. International research has confirmed that infill materials used in artificial fields are not hazardous to the health of the users or to the environment (NIPH, 2006; USEPA, 2009; NYSDEC, 2009). Independent testing in 2012 which analysed locally-produced infill in a New Zealand-based laboratory to assess air quality showed the chemicals released from the crumb rubber fell well within workplace exposure standards in the laboratory and were orders of magnitude lower than ambient air quality guidelines.
Water Availability	The playability and safety of soil-based sports fields will be adversely affected if they dry out or alternatively if they are over-irrigated. Provide water storage or storm water detention ponds.	The playability and safety of sand-based sports fields will be adversely affected if they dry out or alternatively if they are over-irrigated. Provide water storage or storm water detention ponds.	Some artificial turfs will need an irrigation system to be provided. Irrigation may be required to cool the artificial surface prior to playing. Provide water storage or storm water detention ponds.
Trees	Summer shade can be advantageous but excessive shade in winter is detrimental to grass growth. Tree roots may grow into the drainage system resulting in drainage failure.	Summer shade can be advantageous but excessive shade in winter is detrimental to grass growth. Tree roots may grow into the drainage system resulting in drainage failure.	Overhanging trees can cause increased maintenance costs because of the need to remove leaf litter. Other plant matter can encourage the growth of mould, mildew and algae. If trees are desired, then specify evergreen varieties. Tree roots may grow into the drainage system resulting in drainage failure.
Landfill sites	Landfill sites often have gas emission, subsidence and drainage issues that require careful management.	Landfill sites often have gas emission, subsidence and drainage issues that require careful management.	Sitting artificial sports fields on landfill sites will incur higher construction costs.

Table 2: Environmental Factors Impacting Soil, Sand, Hybrid Turf and Artificial Sports Fields

Field Type	Soil-based	Sand-based	Hybrid	Artificial
Design	Optimise lighting design to minimize pole size, reducing the quantity of steel and size of foundations. Choose LED bulbs over halogens. Carry out minimal earthworks to laser-level the surface only. Include irrigation to help maintain a healthy turf sward and maximise carbon sequestration. Establish a turf type that is appropriate for the conditions and location.	Use crushed glass to supplement quarried sand. The largest contributor to sand carpet embodied carbon is the result of quarrying sand. Optimise lighting design to minimize pole size, reducing the quantity of steel and size of foundations. Choose LED bulbs over halogens. Establish a turf type that is appropriate for the conditions and location.	Use crushed glass to supplement quarried sand. The largest contributor to sand layer embodied carbon is the result of quarrying sand. Choose a hybrid turf product that has an open weave and highly permeable backing (i.e. lower material content) to minimise its embodied carbon content. Optimise lighting design to minimize pole size, reducing the quantity of steel and size of foundations. Choose LED bulbs over halogens. Establish a turf type that is appropriate for the conditions and location.	Having a shorter pile means less infill is required, reducing both plastic of the pile and quantity of infill material, but this may be dictated by the intended sport. Using a shock pad may reduce the quantity of infill required and may remove the need for infill. Alternative infill options should be considered, such as manufactured (virgin) rubber, cork, or other organic materials. Use recycled concrete for aggregate base. Optimise lighting design to minimize pole size, reducing the quantity of steel and size of foundations. Choose LED bulbs over halogens. If soil conditions allow, the subgrade may be stabilised which reduces the volume of cut material, reduced off-site disposal and reduces the quantity of imported material.
Construction	Avoid importing fill: retain all topsoil on-site and re-use it. Carry out minimal earthworks (i.e. laser levelling) to reduce vehicle fuel use and consider biodiesel for machinery.	Avoid the need to import fill material: retain topsoil on-site and use excavated material to backfill where possible. Minimise aggregate and sand material travel distance and carefully backfill to avoid wastage. Carry out minimal earthworks (i.e. laser levelling) to reduce vehicle fuel use and consider biodiesel for machinery.	Minimise material travel distance. Many turf products come from Asia / Europe which results in high embodied carbon through transport emissions. Minimise earthworks to reduce vehicle fuel use. Try to re-use stripped topsoil on-site. Consider biodiesel for machinery. Minimise potable water used for earthworking.	Minimise material travel distance. Many turf products come from Asia / Europe which results in high embodied carbon through transport emissions. Minimise earthworks to reduce vehicle fuel use – stabilise the subgrade where possible. Consider biodiesel for machinery. Minimise potable water used for earthworking.
Operation	Have flexible controls to manage field use and power use e.g. only light half a field	Have flexible controls to manage field use and power use e.g. only light half a field	Have flexible controls to manage field use and power use e.g. only light half a field	Have flexible controls to manage wear on the field e.g. only light half, or only

	at once if being used for training, be able to turn on individual sprinkler heads for high-use areas of field. Collect water from field for re-use on site if a drainage system is installed. Collect water from nearby areas for use in irrigation.	at once if being used for training, be able to turn on individual sprinkler heads for high-use areas of field. Collect water from field for re-use on site. Collect water from nearby areas for use in irrigation.	at once if being used for training, be able to turn on individual sprinkler heads for high-use areas of field. Collect water from field for re-use on site. Collect water from nearby areas for use in irrigation.	operate one or two lights if the field is being used for training. Collect water from field for re-use on site.
Maintenance and Replacement	Reduce areas that need mowing e.g. amenity grass left to be long. Choose drought resistant grass types to account for climate change. Mow, fertilise and carry out general management at appropriate times to maximise field use.	Reduce areas that need mowing e.g. amenity grass left to be long. Choose drought resistant grass types to account for climate change. Mow, fertilise and carry out general management at appropriate times to maximise field use. Manage the build-up organic matter to maximise sand carpet layer lifespan and increase the renewal interval.	Re-use hybrid turf elsewhere once it's reached the end of its usable lifespan. Mow, fertilise and carry out general management at appropriate times to maximise field use. Manage the build-up of organic matter to maximise sand carpet layer lifespan and increase the lifespan of the hybrid turf product.	Re-use shock pad when replacing turf if suitable. Target maintenance in the high-wear areas. Carry out regular maintenance to maximise lifespan and delay replacement.
Decommissioning		During renewal activities, the material stripped from the surface of the sand carpet can be used to top-dress soil-fields. During renewal activities, retain drainage and irrigation infrastructure where possible.	Reuse turf for non-sport uses like amenity grass, for camp sites, erosion control etc. Remove the natural turf element and recycle the hybrid turf – most options are currently off-shore. During renewal activities, retain drainage and irrigation infrastructure where possible.	Re-use turf for lower-grade artificial turf fields, or smaller training areas. Reuse turf for non-sport uses like amenity grass, for camp sites, erosion control etc. Recycle the turf where possible – most options are currently off-shore.

Stage 2: Sports Field Options

Sport England (2011) notes the importance of suitable planning in the early stages of the sports field decision making process and warns that if planning is insufficient the chosen sports field surface may not deliver the required number of hours of play, resulting in lower community participation rates and increased maintenance costs.

Since the early 2000's options to develop sports field have become more obtainable. As the number of artificial and sand-based natural turf sports fields are installed throughout New Zealand, community users appreciate their benefit and expect this level of quality at every field.

Local authorities and schools are responding to the requests for quality sports fields, however, limited information is available to assist them. This guidance document has been developed to address this knowledge gap. This section discusses the typical sports field development options available and provides links to further technical information where appropriate.

Figure 3: Wear and tear showing on the sports field

Sport England (2011) notes the importance of suitable planning in the early stages of the sports field decision making process and warns that if planning is insufficient the chosen sports field surface may not deliver the required number of hours of play, resulting in lower community participation rates and increased maintenance costs. Regardless of the sports field development option chosen it is crucial to note that appropriate renovation and maintenance is essential for ensuring the on-going performance of the sports field, McAuliffe (2011).

Soil-Based Sports Fields

Historically in New Zealand, sports fields have been built using locally available materials, and the performance of these sports fields are governed by a range of geographical and environmental elements. The main limitation of the standard soil-based field is the inability to cope with wet conditions, and in addition, there is also a greater potential for the surface to get overly hard under dry conditions. However, if usage pressures are light, soil-based fields can be laser graded to shed water and an enhanced turf management programme may improve grass cover and playability during the winter months.

Sand-Based Sports Fields

Where usage demands a sports field that can tolerate high levels of winter use, a sand-based field may be preferable. The most common option in New Zealand being the slit drain-sand carpet system. This system as described by Sport Surface Design and Management (2007) uses a network of primary drains (subsoil lateral drains connecting into a main drain) with the addition of secondary drainage which is typically closely spaced with narrow slit drains. Once installed the entire playing surface is topped with a sand layer. The design of sand carpet-based fields is constantly evolving including the appropriate breed of grass and the spacing of slit drains.

Hybrid Sports Fields

A hybrid turf playing surface, is a blend of natural sports turf over artificial fibre. A hybrid turf offers the benefits of both an artificial turf and a natural field, with studies showing that the integration of both types achieves optimal levels of use.

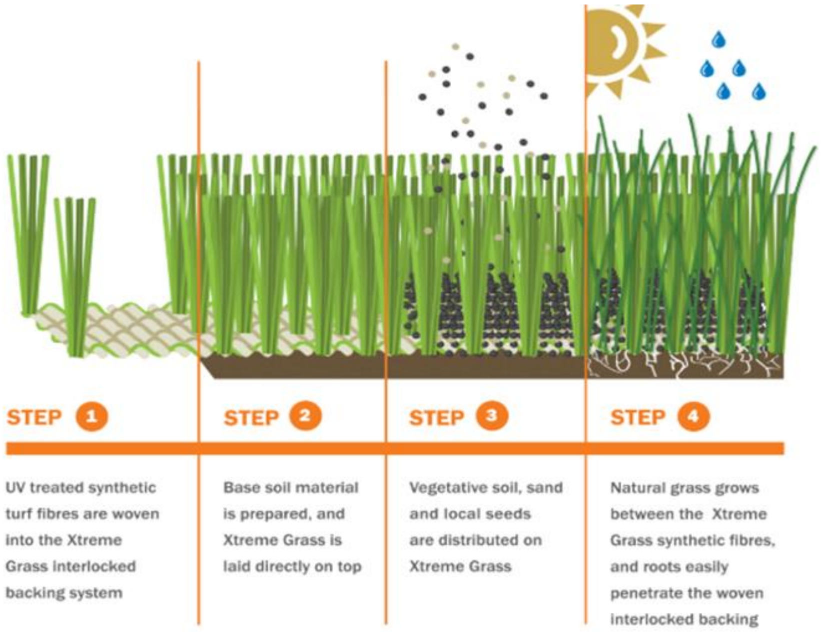

Figure 3 ActGlobal Xtreme Grass: The Hybrid Method

Reinforced turf is new technology and for this reason a case study on Nixon Park, Auckland has been included at the end of this document. Key lessons learnt from this case are;

1. Guidance regarding installation and maintenance are critical to consider prior to proceeding,
2. Regular renovations and maintenance are critical to the success of the turf. If your organization is considering installing a hybrid turf, ensure you know whether there is skilled operators and specialist machinery available in your region (UEFA Pitch Quality Guidelines, 2018).
3. A monitored irrigation programme (especially in the first two years of establishment) are a critical part of ensuring the field meets playing capacity. This is due to the undersowing of rye which needs a lot of water in the summer months to ensure winter play.

Artificial Sports Fields

Development of the first artificial turf surfaces began in the United States of America (USA) in the 1960s and during the 20 years that followed, several high-profile fields were converted to artificial.

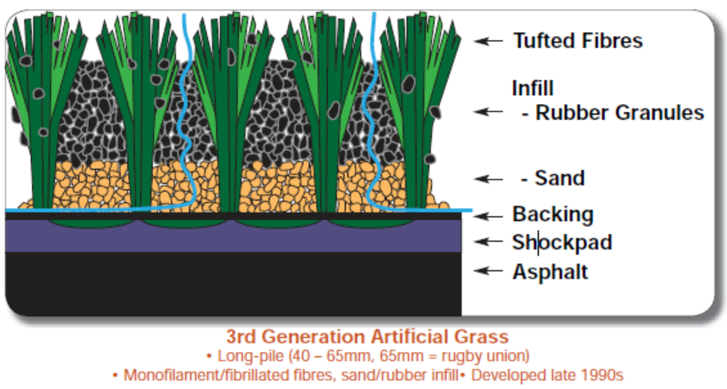

Figure 4: Third generation (3G) artificial surface. Diagram from Artificial Grass for Sport Guidelines (2011).

The continued development of artificial surfaces has meant that the current third generation[1] (3G) artificial surfaces perform similarly to natural turf. However, artificial turf is still considered a recent development for winter sport in New Zealand (except for hockey) and little is known on the lifespan and maintenance costs here. The main advantage of artificial sports fields over natural grass fields is that they can withstand much higher levels of use.

Typically, most artificial surfaces have a warranty for 40 to 50 hours per week. However, collective usage figures show that artificial fields are generally used between 30 to 40 hours per week. In comparison research undertaken by Longdill (2011) suggests that sand-based fields (within the Auckland region) can withstand 18 to 20 hours of use per week, and statistics from Wellington City Council shows some sand-based fields can only manage 4 to 8 hours play per week during the winter months.

Player Safety

Artificial turf surfaces have grown in popularity due to their all-weather usability and enhanced durability, which has resulted in increased hours of use when compared to natural turf surfaces (Ranson, George, Rafferty, Miles & Moore (2018). However, historically artificial surfaces have been linked to an increase in injuries. This link has been argued to be due to the lower shock absorption rate of artificial turf when compared to natural grass (Ataabadi, Sadeghi & Alizadeh, 2017). Research undertaken by Ranson et al, (2018) linked risk of injury to intrinsic characteristics such as age and mobility and extrinsic factors such as environment and playing surface. Therefore, when considering new sports surfaces, athlete wellbeing (awareness of one's own fitness and adequate warm-up sessions) as well as a quality sports field surface should remain at the forefront of decision making.

Surface-caused injuries

Contradiction and opposing results in research indicate how the research can be influenced by many factors including; the health and fitness of the players prior to playing and accurately testing out the effect of the surface from the injury data. This type of research also relies on adequate reporting by players, referees and medical officials which may be biased or influenced by the result of the game (i.e. the losing team blaming the surface). Williams, Akogyrem & Williams (2013) suggested that there could even be a reduced chance of being injured on artificial turf in comparison to natural grass surfaces, and research undertaken by Bianco et al, (2016), concluded that the number of injuries in young football players is not linked to artificial turf fields. This research was supported by the findings of Ranson et al, (2018) who examined the impact of playing surfaces on match injury types within professional rugby union clubs. The findings showed that there was no difference in overall injury risk between the two surfaces (natural grass vs. artificial). In fact, the findings showed a higher rate of concussion and chest injuries on grass, while there was a higher rate of hematoma, foot injuries and tackling injuries on artificial.

Perceived impact on performance

While research has been inconclusive on the impact of artificial surfaces causing injuries, Ataabadiet al, (2017) found that elite soccer players believed, in comparison to natural grass, artificial turf was "too hard/ harder", "flatter" and "more abrasive". Previous research found that the perceived fear of abrasions on artificial turf playing surfaces had led to a negative attitude in the adoption of these surfaces and may have influenced how players play when on these surfaces in order to avoid the risk of injury (Twomey, Petrass & Fleming, 2014). This is contrary to FIFA's own research that indicated there was no statistically significant change in playing performance or tactics on artificial turf compared to natural turf. The report concluded that from a physical performance point of view, the nature of the game is unchanged between surfaces (FIFA, n.d).

Research results on recycled tire crumb used on playing fields

Concerns have been raised about the potential health risks from playing on synthetic turf fields in the U.S. containing tire crumb rubber. Studies to date have not shown an elevated health risk, but the existing studies have been limited. See the research report released by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) and the U.S. Environmental Protection Agency (EPA).For further information:*https://www.epa.gov/chemical-research/july-2019-report-tire-crumb-rubber-characterization-0*

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[1] Third generation surfaces first appeared as fibrillated long pile surfaces with sand and rubber in 1997and in 2005 monofilament fields were introduced and have dominated ever since.

Heat Stress

Heat-stress is a more holistic consideration than just the temperature of the surface and considers; the weather conditions (i.e. humidity), appropriate clothing, appropriate cooling options and the hydration status of players. Heat-stress should be considered a risk to player safety in summer months and precautionary-preventative measures should be established if an artificial turf is to be used during summer. Ataabadi, Sadeghi & Alizadeh (2017) concluded that while there was little difference when considering overall risk associated with playing surfaces, there were correlations between heat-stress when using artificial grass during summer months.

Key Considerations

It is important to consider the changes that occur to artificial turf over time, such as the compaction of infill, loss and displacement of infill and the flattening of fibres, and initiate measures to prevent these situations from occurring (i.e. through appropriate maintenance). Thus, removing or minimising the impact of a worn surface on players. This is particularly important where research on injury potential is contradictory and it is therefore imperative that surfaces are built to the required governing body standards, maintained accordingly and re-tested to demonstrate continued compliance. Heat risk, in the form of heat-stress becomes more prevalent during summer sports, and risk mitigation plans should be implemented during this time.

Table 3: Design Considerations for Soil / Sand-Based / Hybrid Turf Sports Fields

Factors	Soil / Sand Based / Hybrid Turf Sports Field
Site Investigation	During the planning phase it is critical that resources are allocated to undertake investigations of the site. Investigations should include: Topography, Geotechnical conditions, Soil contamination and existing services (gas, electricity, water supply, stormwater and wastewater).
Drainage	Primary subsoil drains are considered the first step in sports field development. This gives only marginal improvements in winter performance, therefore secondary drainage in conjunction with a sand layer will be necessary to significantly improve winter field performance.
Grasses	Warm-season grasses, including Kikuyu and Couchgrass, are turf grasses that form dense, vigorous turf mats which protect the sand layer, helping the field to sustain high levels of wear. They are also drought tolerant. Typical cool-season grasses include Perennial Ryegrass and Tall Fescue and can be grown in conjunction with a warm-season grass in much of New Zealand.
Irrigation	Irrigation is generally required to ensure grass survival and assists with turf management. Vital on a sand-based field, an irrigation system provides an additional management tool on a soil-based field to help ensure adequate grass cover and condition over summer and heading into winter. The available water flow rates and pressures need to be assessed for each site, and there may be a requirement to store collected drainage water on sites for future irrigation.
Maintenance	Maintenance for soil or sand fields include: thatch control, implementing a sand topdressing program, physical treatment, pest and weed management (e.g. earthworm control, Poa annua control), and the repair areas damaged through the playing season. The additional cost of maintaining a sand field over a conventional soil field will vary depending on the age of the sand carpet and the hours of use it is receiving.
Sprays	Removal of undesirable grasses and other weed species throughout the year is a major part of successful turf grass management. Identify which sprays are allowed on the sports field and in the region and whether there are spray restrictions which may influence the selection of one turf grass over another.
Fencing	Fencing retains balls within the playing area, allowing spectators to view the match or training session safely. Fences keep animals off the field and protect the field from vehicle access.
Lighting	Floodlighting systems selected should be appropriate to the projected level of use. Lighting should be planned in accordance with applicable Australian Standards AS2560.1:2018
Renovation	Annual renovation should be anticipated twice per year; in Autumn prior to the Winter season and in Spring prior to the Summer season. Operations may include spraying, scarifying, and applications of sand and grass. For a typical renovation allow for 4-6 weeks for renovation and recovery.
Renewal	Renewal of installed drainage and sand carpet components are typically required between five and ten years after their installation. Causes of deterioration include; the sand carpet and slit drains being clogged by soil from earthworm activity and/or the build-up of organic material from mowing and weed invasion. The renewal process can include renewal of the turf grass, removing the field from use for at least 12 weeks.
Crime Prevention Through Environmental Design (CPTED)	Sports fields and sports facilities that are designed with CPTED guidelines will feel safe and attract activity and positive social interaction. CPTED guidelines are located at *www.justice.govt.nz*
Statutory Planning Issues	Resource consent, building consent and National Environmental Standard (NES) consents may be required. Liaise with the planning department at the local authority to discuss how the siting of the field, fencing and floodlights and earthworks may trigger statutory planning consents.

Table 4: Design Considerations for Artificial Sports Field

<table>
<tr><th>Factors</th><th>Artificial Sports Field Surface</th></tr>
<tr><td>Technical Knowledge</td><td>Technical knowledge of sports field design, construction and maintenance is required to ensure the field performs to the expected level of service requirements. Procure design and maintenance plans from recommended consultants when planning for the sports field. The following factors will ensure the level of service expectations and protection of the asset will be on-going:
• Appropriate design and specification for the sports field;
• Effective monitoring and management during the construction phase;
• Utilisation of reputable contractors and suppliers and materials;
• On-going and appropriate management and maintenance;
• Controlled usage of the fields through good site management.
• Synthetic Sports Surface Feasibility report. Sheppard (2008).</td></tr>
<tr><td>Site Investigation</td><td>Ensure there are sufficient resources allocated to site and location investigation. A thorough investigation of topography, geotechnical conditions and services (gas, electricity, water and wastewater) must be completed. Further information can be found at: Sport England Artificial Surfaces for Outdoor Sport Updated guidance for 2013 Artificial Grass for Sport Guidelines (2011).https://www.sportengland.org/media/4536/artificial-surfaces-for-outdoor-sports-2013.pdf</td></tr>
<tr><td>Drainage</td><td>Artificial grass sports fields should always allow for the rapid drainage of water from the surface either through vertical drainage or horizontal drainage.

Examples of drainage systems can be found at: The Sport and Play Construction Association (SAPCA) Code of Practice / Artificial Grass for Sport Guidelines (2011).</td></tr>
<tr><td>Maintenance Issues</td><td>The amount of maintenance required will depend on the surface type, however, artificial surfaces require on-going maintenance to ensure the fields lifespan.

While full-sized artificial turfs must pass the relevant tests to be used in training and competition, degradation of the quality of the surface over time can affect the performance of players and present an injury risk, Ataabadi et al, (2017). Although there is insufficient research to support this hypothesis (Rennie, Vanrenterghem, Littlewood & Drust, 2016) it is recommended that the infill layer remains topped up.</td></tr>
<tr><td>Irrigation</td><td>Irrigation may improve the frictional and traditional characteristics of the surface, reduce heat build-up in the surface, reduce build-up of static electricity, and improve playing characteristics of the pitch. If irrigation is provided, storage tanks and storm water retention ponds may need to be factored into the design.</td></tr>
<tr><td>Sprays</td><td>Weeds may occur on the surface of an artificial field. Removal of the weeds can be carried out manually or sprayed with an appropriate weed-killer. Occasional use of a sanitiser may be required to control moss, mould and bacteria.</td></tr>
<tr><td>Fencing / Screening</td><td>Fencing will retain balls within the playing area, allow spectators to view the game safely, keep animals out of the fields and protects the field from vehicles. On court divider netting and screening may also be required.</td></tr>
<tr><td>Lighting</td><td>Floodlighting systems selected should be appropriate to the projected level of use. Lighting should be planned in accordance with applicable Australian standards AS2560.2.3:2007</td></tr>
<tr><td>Crime Prevention Through Environmental Design (CPTED)</td><td>Sports fields and sports facilities that are designed with CPTED guidelines in mind will feel safe and attract people, activity and positive social interaction.

CPTED guidelines can be found at www.justice.govt.nz.</td></tr>
<tr><td>Statutory Planning Issues</td><td>Resource consent, building consent and NES consents may be required.

Liaise with the planning department at the local authority to discuss siting and orientation issues of the field, fencing and floodlights. As the artificial field can have longer hours of use i.e. 6am to 10pm, noise may become an issue for the residents. A resource consent for a discretionary activity may need to be acquired.</td></tr>
</table>

Sport Field Guidelines / Regulations

Standards / Guidelines

The following documents provide further guidance on sports fields design:

- Auckland Council – Design Standards for Sports Fields and Sports Field Lighting *http://www.aucklanddesignmanual.co.nz/streets-and-parks/park-design/all-parks/park-elements/design-guidance-for-artificial-turf#/streets-and-parks/park-design/all-parks/park-elements/design-guidance-for-artificial-turf*
- Artificial Grass for Sport, State Government of Victoria (2011) *https://sport.vic.gov.au/__data/assets/pdf_file/0025/55591/download.pdf*
- Artificial Surfaces for Playing Sport (Sport England 2013). *https://www.sportengland.org/media/4536/artificial-surfaces-for-outdoor-sports-2013.pdf*

Table 5: Governing Body Standards / Guidelines for Sports Field Development

Football Regulations FIFA, the governing body of football, has their own certification scheme (the FIFA Quality Programme for Football Turf) which defines standards for community use and professional use (see Figure 5 below). FIFA Quality pitches (previously known as FIFA 1 Star) would be considered most appropriate for recreational, community and municipal football, with 2-3 times the amount of use than a FIFA Quality Pro pitch (previously known as FIFA 2 Star) which is specially designed for professional football.
Links *https://football-technology.fifa.com/media/1026/fifa_quality_programme_for_football_turf.pdf*
Football Testing FIFA's testing scheme for artificial surfaces specifically focuses on the needs of football players. Once tested and certified the pitch must be re-tested: FIFA Quality every 3 years and FIFA Quality Pro yearly. The testing must be carried out by a FIFA Accredited Test Institute.  Figure 5: Field Certification. FIFA Quality Programme for Football Turf Handbook of Requirements (2015).

Rugby Union Regulations

World Rugby (previously known as the International Rugby Board) is the governing body of the sport of rugby union. According to World Rugby, the game (rugby) may not be played on any artificial surface which does not meet the World Rugby Artificial Rugby Turf Performance Specification (see Figure 6 below), the requirements of Regulation 22 and Law 1 of the Laws of the Game.

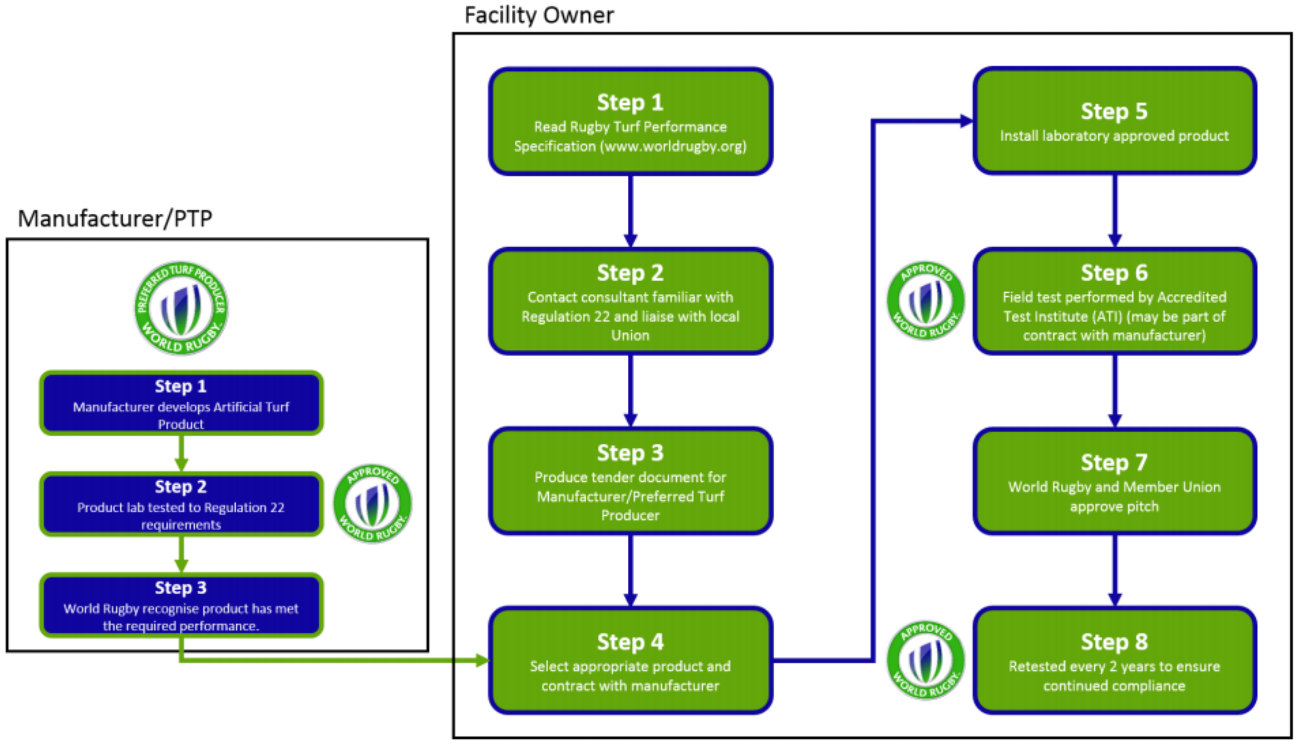

Figure 6: The World Rugby Process to Achieve Successful Field Certification. Rugby Turf Performance Specification (2016).

Links

https://playerwelfare.worldrugby.org/?documentid=57

https://laws.worldrugby.org/?law=1&language=EN

https://www.estc.info/wp-content/uploads/2013/04/Turf_Performance_Tech_Spec_EN.pdf

Rugby Union Testing

World Rugby's testing scheme includes product testing and surface testing. The turf will either receive a pass or fail which will (or won't) allow the surface to certified. Once tested and certified, the pitch must be re-tested every 2 years. The testing must also be carried out by an accredited test institute.

Links

https://playerwelfare.worldrugby.org/?documentid=57

Rugby League Regulations

The Rugby League International Federation (RLIF) which governs the rules of the game does not have regulations for artificial turf or the testing of artificial turfs. However National Rugby League Limited (NRL) has commissioned the development of performance and construction standards for artificial turf pitches used for rugby league. As the Warriors (New Zealand's national rugby league team) play under this framework, the fields should adhere to NRL pitch standards.

It was noted that fields should also adhere to World Rugby's Regulation 22 and appropriate FIFA requirements as these sports would likely be played on these fields.

Links

https://www.estc.info/wp-content/uploads/2013/04/Turf_Performance_Tech_Spec_EN.pdf https://www.playrugbyleague.com/media/1938/nrl14_0846-nrl-synthetic-field-standards_ns_c4_gg_low-res.pdf

Rugby League Testing

Field testing goes through a 3-step process (product type approval, initial facility testing and certification, and pitch recertification). Once tested and certified the pitch must be re-tested every 2 years. The testing must also be carried out by an accredited test institute.

Links
https://www.playrugbyleague.com/media/1938/nrl14_0846-nrl-synthetic-field-standards_ns_c4_gg_low-res.pdf

Hockey Regulations

The International Hockey Federation (FIH) is the governing body for Hockey. Turf Classification (see Figure 7 below) is specific to the quality (only the turf). However final certification includes other factors like line marking and lighting

Classification		Type of Hockey Turf
Global		Non-filled synthetic turf [1]
National	Class 1	Sand dressed synthetic turf
	Class 2	Sand filled synthetic turf
Multi-Sport	Class 1	Sand dressed synthetic turf Sand filled synthetic turf Textile surface (filled, dressed or non-filled)
	Class 2	Sand dressed synthetic turf Sand filled synthetic turf Textile surface (filled, dressed or non-filled)
	Class 3	Long pile synthetic turf (filled or non-filled)

Figure 7: Hockey turf classifications

Links
http://www.fih.ch/media/12500054/introduction-general-guidance.pdf

http://www.fih.ch/media/12500053/requirements-for-hockey-turf-products.pdf

Hockey Testing

Testing must be carried out by a certified company to help ensure the preferred quality of fields is adhered to. The test process is very specific to Hockey, focusing on: ball roll, shock absorption, surface friction etc.

Re-testing is dependent on the field type: global elite, every 2 years, Global, National and Multi-sport 3 years after the first test (if new) and then 2 years periodically after that.

Links
http://fih.ch/media/12500052/requirements-for-hockey-fields.pdf

Table 5: Governing Body Standards / Guidelines for Sports Field Development

Cricket Regulations

The International Cricket Council (ICC) is the governing body of cricket. However, the Marylebone Cricket Club (MCC) writes and interprets the Laws of the game.

In general, artificial turf would only be used for the pitch (wicket) and not for the outer field. An artificial turf wicket would only be used for Junior or social games as most clubs require that that games must be played on grass pitches for Senior grade and above.

In New Zealand pitches must gain a warrant of fitness to host games. The criterion of which is specific to natural grass pitches.

Links
https://lords-stg.azureedge.net/mediafiles/lords/media/documents/2nd-edition-of-the-2017-code-2019_2.pdf

https://www.nzc.nz/media/10250/pitch-prep_p4_digital.pdf

Cricket Testing

There is no formal testing protocol for artificial turfs in Cricket as games are usually played on pitches which are grass based. In the Laws of the Game the only regulation around artificial turfs is the dimensions requirements.

Softball & Baseball Regulations

The governing body for Softball and Baseball is the World Baseball Softball Confederation (WBSC). Formerly known as the International Softball Federation (ISF) and the International Baseball Federation (IBAF) respectively. The organisations merged in 2013 to form the WBSC.

Although artificial turf is used in both sports there are no formal regulations for the use of artificial turf. Most fields are a mixture of grass and dirt.

Links
https://www.wbsc.org/documents

Softball & Baseball Testing
As there are no regulations for artificial turf in baseball and softball, there are no formal testing procedures.

Stage 3: Cost Analysis

Historically, inadequate budgets have led to poor design and insufficient maintenance inputs. To ensure a financially sustainable and appropriate budget is created, this section details the typical range of costs that are incurred through sports field provision.

During the decision-making process there needs to be ongoing discussion and acceptance on the type of sports field surface chosen. The decision made in the early stages of planning will impact the final cost and realistic level of use. Moreover, it is recommended that the final decision is based on meeting the needs, not the wants of the users.

This section discusses a range of sports field costs including; capital costs, maintenance costs and renewal costs. In addition, a whole of life cost model (based on the Victorian State Government Surface Evaluation Model, 2011) has been developed and an electronic copy can be downloaded from the Sport NZ website. This model captures the inputs discussed throughout this guidance document and then factors in a discount rate to determine the cost per hour of each surface option over a thirty-year lifecycle: *https://sportnz.org.nz/managing-sport/search-for-a-resource/tools-and-resources/whole-of-life-costs-model-for-sports-fields*.

A thirty-year planning horizon is common in transport infrastructure and is consistent with the planning horizon required of the Auckland Council Unitary plan. Research released by the Economic Growth and Infrastructure Committee (2013) discusses the importance of long-term planning for long-life assets and recommends that Councils prepare a thirty-year infrastructure strategy and incorporate this into their long-term plan. It is highly recommended to calculate the amount of revenue and costs that will be realised and incurred over a thirty-year lifecycle, as this will provide a sound financial basis for the overall investment Councils or the sports field provider will be making with the facility.

Post construction, it is vital to annually review the lifecycle cost projections to ensure that they are still current and relevant. This can be included in the annual planning process to ensure that the sports field development is in keeping with the initial needs analysis or changed to meet community demand.

Figure 8: Nairnville Park, Wellington

Construction Costs

This section outlines the construction costs for sports field surfaces in New Zealand. To compare capital costs against Australian construction costs is recommended to refer to the recently updated Smart Guide to Synthetic Sports Surfaces, Volume 1: Surfaces and Standards. It should be noted that the overall cost of construction will be dependent on what skills and materials are available locally as the costs of materials for construction, for example sand are far more reasonably priced in Auckland than other regions. Other factors to note when designing the field include;

1. **The greatest risk to a project and the biggest cause of escalating costs is the result of not capturing ground conditions. When choosing your site consider;**
    - Land stability. Make it a priority to investigate the ground conditions to confirm the proposed site will be suitable for your requirements
    - What has the site been used for previously? i.e. landfill or industrial use? The site will be required to be tested for contamination and this may trigger the National Environmental Standard (NES) [2]
    - Is there easy access to the site and does the site have any surrounding infrastructure?
    - Availability of services (water, electricity, wastewater, stormwater etc.).
2. **The level of service and specifications chosen can significantly impact the overall costs:**
    - Does the field need to be designed to meet international sporting federations (FIH, FIFA and World Rugby) regulatory requirements?
    - Are there additional requirements to upgrade amenities including; carparking, pavilion, transformer and water supply (which may incur growth infrastructure charges)?

Table 6: Capital Costs

Item	Soil-based	Sand-based	Hybrid	Artificial
Earthworks	$50,000	$150,000	$150,000	$150,000 - $450,000
Sports field	$120,000	$220,000 - $350,000	$500,000 - $700,000	$800,000 - $1,000,000
Shock pad	-	-	-	$200,000
Surrounds	-	-	-	$100,000 - $150,000
Floodlights	-	$150,000 - $250,000	$150,000 - $250,000	$250,000 - $350,000
Sub-total	**$170,000**	**$520,000 - $750,000**	**$800,000 - $1.1m**	**$1.5m - $2.15m**
Preliminary and General	$10,000	$10,000 - $15,000	$15,000 - $20,000	$100,000
Consents	$10,000	$10,000	$10,000	$100,000
Professional Fees	$20,000 - $40,000	$20,000 - $40,000	$20,000 - $40,000	$100,000 - $200,000
Total	**$210,000 - $230,000**	**$560,000 - $815,000**	**$845,000 - $1.17m**	**$1.8m - $2.55m**

Notes:

1. As a guide an item for earthworks has been allowed for, however, understanding the ground conditions of the site is critical to the success of the project.
2. These construction cost estimates use a single generic sports field size (1 hectare) constructed on an existing flat playing surface and do not include local site-specific factors.
3. The soil-based field construction costs shown is for basic enhancement (i.e. laser-levelling and new turfgrass only) to a more comprehensive enhancement that includes the installation of a primary drainage system.

[2] *The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NES) came into effect on 1 January 2012. For further information go to the following website: http://www.mfe.govt.nz/laws/standards/contaminants-in-soil/*

Maintenance Costs

Sports fields require regular and on-going maintenance to maximise on-going performance and lifespan. Prior to deciding on the final sports field surface, careful consideration should be given to the scheduled maintenance that the sports field requires. Any implications for the club when the natural grass fields are closed for complete renovation and the amount of budget available to maintain the selected sports field should be noted. For example, in a school environment where all the students are running around in flat soled shoes and bare feet, an artificial turf field may require more maintenance to ensure the fibres remain upright. Feedback from New Zealand sports field maintenance providers indicate that maintenance costs for a soil-based grass field is approximately $10,000 per field / per annum and costs for a sand-based grass field sports field can range from $10,000 to $25,000 per field / per annum.

Historically, it has been suggested that maintenance costs required for artificial fields are lower than natural grass fields, however, this is not always the case and is dependent on the field type and level of service requirements. It is generally accepted that most artificial sports fields require daily and routine maintenance, and quarterly specialist service as shown in Table 7 and Table 8 below.

Table 7: General Maintenance Costs

Field Type	Low	Medium	High
Soil-based Fields	$10,000	$15,000	$25,000
Sand-based Fields	$20,000 - $25,000	$30,000 - $35,000	$40,000 - $45,000
Hybrid Fields	$20,000 - $25,000	$30,000 - $35,000	$40,000 - $45,000
Artificial Fields	$15,000	$20,000	$40,000

Table 8: Maintenance Schedule and Indicative Costs for Artificial Fields

Item	Frequency	Rate	Low	High
Specialist Service	Quarterly	$1,500	$6,000	$6,000
Routine Brushing	Weeks (20 to 48 weeks)	$250	$5,000	$12,000
Litter collection and hand grooming of penalty spots	Weeks (30 - 48 weeks, 2 staff, 3 hours)	$140	$2,800	$6,720
Total			**$13,800**	**$24,720**

Hours of Use

Stage one of this guidance document discusses the importance of carefully considering and recording sports field hours of use and demand. The current use and expected demand figures can then be compared with the typical usage data recorded in Table 9 to Table 11 below, and a validity check can be undertaken. International research by Simon (2010) estimated that natural fields (including soil and sand-carpet) provide 80 – 800 hours of use per year as compared to 2,000 - 3,000 hours for artificial turf. This data is comparative to the New Zealand based data, and supports the guidelines produced for the sports field whole of life costs model.

Table 9: Soil-based Sports Fields Hours of Use (per week / 25-week winter season) *

Soil-based Sports Fields	Low	Medium	High
Auckland	6	10	14
Wellington	4	7	10
Christchurch	4	9	14
Average hours over a 25-week period	117	217	317

Table 10: Sand-based Sports Fields Hours of Use (per week / 25-week winter season)

Sand-based Sports Fields	Low	Medium	High
Auckland	15	20	25
Wellington	4	14	24
Average hours over a 25-week period	200	400	600

Table 11: Hybrid sports Fields Hours of Use (per week / 25-week winter season)

Hybrid Sports Fields	Low	Medium	High
Auckland	25	30	35
Average hours over a 25-week period	625	750	875

Table 12: Artificial sports Fields Hours of Use (per week / 25-week winter season)

Artificial Sports Fields	Low	Medium	High
Auckland	20 - 30	30 - 40	40 - 50
Wellington	30	50	60 - 70
Average hours over a 25-week period	688	1063	1375

*based on 2013 figures

Cost Per Hour of Play

Several international research reports (Montgomery County, 2011; Sheehan, 2011) have found that when undertaking a lifecycle cost analysis, despite the higher upfront cost and future replacements costs, an artificial field can provide a lower net cost per hour of play than any of the natural grass options because of the increased hours of use and therefore generate additional revenue. Gibbs (2006) published an article titled 'Natural versus Synthetic Turf' which suggests that the cost per hour of play for an artificial field can be equal or less than for a natural grass field, provided a minimum usage of the field can be guaranteed all year round. However, this data is solely dependent on the amount of usage and therefore increased income to alleviate the increased cost of construction.

As shown in Table 13 below the cost per hour of play (note: no discount factor has been included in these figures) begins to balance out over a 30-year lifespan. For an accurate cost analysis of the proposed sports field it is recommended that the sports field whole of life costs model should be completed to provide sufficient detail on all sports field options.

Table 13: Showing Sport Field Development Options over a 30-year lifespan

Item	Soil-based	Sand-based	Hybrid	Artificial
Earthworks	$50,000	$150,000	$150,000	$150,000 - $450,000
Construction	$120,000	$250,000	$700,000	$1,600,000
Maintenance	$300,000 ($10,000 per annum / 30 years)	$750,000 ($25,000 per annum / 30 years)	$1,200,000 ($40,000 per annum / 30 years)	$750,000 ($25,000 per annum / 30 years)
Renewal[3] (years 1-30)	$50,000	$250,000 (new sand layer, slits & turf grass establishment in Year 11, 21)	$500,000 (reinforcement, sand layer,& turf grass establishment Year 11, 21)	$1,000,000 (infill top up, worn turf renewal & infill in Year 11, 21)
Disposal	-	-	$100,000 ($50,000 per turf layer)	$100,000 ($50,000 per turf layer)
Costs Subtotal	**$470,000**	**$1.4m**	**$2.65m**	**$3.6m - $3.9m**
Hours of Play[4] (winter only)	6,510 (217 hours per annum / 30 years)	12,000 (400 hours per annum / 30 years)	22,500	41,250 (1375 hours per annum / 30 years)
Lifespan	30	30	30	30
Cost Per Hour of Play / Per Field	**$72.20**	**$116.70**	**$117.80**	**$87.30 - $94.54**

[3] *Renewal assumptions for sports field development options and the whole of life costs model are as follows:*
  a. *No allowance has been made for renewals of soil-based fields as it is assumed annual maintenance will be all that is required*
  b. *Sand-based natural fields and artificial sports fields are renewed at ten-year intervals (dependant on level of activity)*
  c. *No allowance has been made to renew the shock pad over a thirty-year period.*

[4] *For the purposes of this table the hours of use have taken the calculated medium amount from tables 9, 10, 11 and 12*

Whole of Life Cost Model for Sports Fields

As a further addition to this guidance document, a whole of life cost model (based on the Victorian State Government Surface Evaluation Model, 2011) has been developed and can be downloaded from the Sport NZ website for your personal use. The model will assist the user to analyse the comparative costs between a natural grass field (soil and sand-carpet) and an artificial sports field over a 30-year life-cycle and work out potential cost recovery required (per hour of play) for all field types.

To assist users with input information for the model, relevant sports field data was gathered from local government, schools and suppliers and presented in Table 14 below to show the range of inputs that can be taken into account when planning for a sports field.

Table 14: Range of Inputs for the Whole of Life Costs Model for Sports Fields

Item	Soil-based	Sand-based	Hybrid	Artificial
Capital Cost	$210,000 - $230,000	$560,000 - $815,000	$845,000 - $1.17m	$1.8m - $2.55m
Maintenance Cost	$10,000 - $25,000	$20,000 - $45,000	$20,000 - $45,000	$15,000 - $40,000
Replacement Cost	$0.00	$125,000	$250,000	$500,000
Replacement Frequency (years)	10 years	10 years	10 years	10 years
Fee Per Hour	$0.00 - $50.00	$50.00	$50.00 - $125.00	$50.00 - $125.00
Hour of Use	4 - 14	4 - 24	25 - 35	20 - 70

Inputs for the Whole of Life Cost Model

For the purposes of this model the 'user defined financial inputs' combine both the discount rate[5] and inflation under 'real discount rate'. If you do not want to use a discount rate, set the real discount rate to zero and insert the rate of inflation you require. This model will calculate the real discount rate on both costs and revenue over a thirty-year period.

The second box is the 'user defined surface inputs' which allows the user to insert the data that has been gathered whilst undertaking the decision-making process; capital cost, maintenance cost, renewal and replacement cost, and hours for both games and training per annum.

The model also allows for the user to insert a targeted net present value (NPV) required over thirty years. It has been assumed that most local authorities, sports clubs and schools require the sports fields costs to equal revenue (i.e. to break even) and therefore if this outcome is desired you do not need to put an amount in this box. If you are aiming to either make a profit or a loss you can insert the required amount into the box and the cost per hour of play to achieve NPV will be adjusted accordingly.

Outputs for the Whole of Life Cost Model

The whole of life model will then calculate the outputs, it should be noted that the whole of life costs model incorporates 'discounted' cash flow which factors in both costs and revenue, allowing for the real value of the dollar over time. For example, rather than just taking in a field's replacement cost in 30 years' time and dividing it by 30 to get the annual cost requirement, the discounted cash flow method allows for factors such as compound interest and inflation to get the actual annual cost requirement. Ensure that the grey buttons are refreshed every time new information is inserted into the table and this will then refresh the cost per hour of play required to achieve the NPV.

5 *For further information on discount rate refer to the Treasury website:* *http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/discountrates*

Stage 4: The Way Forward and Where to Find Advice

Once the needs analysis, sports field options and cost analysis are complete, the following actions are highly recommended;

1. Contact up to three qualified consultants to visit and undertake a general site assessment;
2. When the consultant is on site take the opportunity to discuss the results of the needs analysis, sports field options and cost analysis. This will assist the consultant to determine what type of surface is suitable;
3. Undertake site visits to several local sports fields that have similar attributes and ask for endorsements.

Consultants

A consultant is an individual or company who has excellent understanding and skills regarding design, construction and maintenance and will provide this expertise to a client for a fee. Choosing the right consultant will bring added value to the design, construction and maintenance of the sports field.

Procurement

Historically, an insufficient brief or specifications have meant that some sports fields have failed to perform to the level of service expectations. Several documents have been developed both nationally and internationally to provide guidance on how to develop a good brief and specifications. A general scope of works for artificial fields and procurement information can be found within the following documents:

- Artificial Grass for Sport, State Government of Victoria (2011) https://sport.vic.gov.au/__data/assets/pdf_file/0025/55591/download.pdf
- Artificial Surfaces for Playing Sport (Sport England 2013). https://www.sportengland.org/media/4536/artificial-surfaces-for-outdoor-sports-2013.pdf

Further Guidance

Sport New Zealand (Sport NZ)

Sport NZ is the government organisation responsible for sport and recreation (formerly SPARC). Sport NZ continually undertakes research and has a wealth of information on facility strategies and sporting trends. The following items can be found on the Sport NZ website at *www.sportnz.co.nz*

- Sport NZ: Guidance Document for Sports Field Development
- Sport NZ: Whole of Life Costs Model for Sports Fields
- Sport NZ: Community Sport & Recreation Facility Development Guide. This guide has been developed to help those looking to design and construct a community sports facility.

The Sports Turf Association New Zealand (STANZ)

STANZ provides a guidance role within the turf industry and produces a regular newsletter which is distributed electronically to all members. The newsletter features an update from the STANZ Chair, news and views from members all around the country including local government and suppliers, job vacancies, reports on new products, member profiles, and advertisements. The STANZ website address is: *www.sportsturfnz.co.nz*

Recreation Aotearoa (RA)

RA provides a guidance role within the parks and recreation industry. RA delivers conferences and seminars during the year to assist professionals within the industry with best practice and benchmarking. The RA website address is: *www.nzrecreation.org.nz*

Case Studies

Case Study One: Stella Maris Catholic Primary School, Silverdale, Auckland

Figure 9: Aerial photo of Stella Maris Catholic primary school and sports field, Silverdale, Auckland

Field Type: Sand Carpet Base Construction

Grass: Kikuyu

Cost: $40,000. *Please note*: this does not reflect the true cost of a sand-based field. This case study was used to demonstrate that the financial outlay when developing a sports field can be kept low if the skills and services are available through sponsorship or voluntary means.

Consultant: New Zealand Sports Turf Institute (NZSTI)

Issue: The original construction of the field allowed for stormwater outlet drains to be installed at the perimeter, but no drains were installed in the field itself. This lack of drainage led to notoriously poor drainage of the soil and typically the sports field has not been able to be used over the winter months.

Solution: The school made several decisions to progress the reconstruction of the field which included;

1. Selecting a proficient Project Manager to undertake the task;
2. Deciding on a budget with the priority being minimising cost and maximising value.

Due to the tight budget NZSTI provided recommendations for the most cost-effective option to build and maintain the schools field. A detailed specification of works and drainage (sketch plans) were also provided to the school. The result was a low consultancy cost but effective use of specialist expert input to ensure that the works were completed correctly, and the required results were achieved. Following installation in the summer of 2010/11, the winter in 2011 was exceptionally wet however the field was able to be used.

Lessons Learnt:

1. If the project management is to be undertaken by a person within the School or the local authority, gain independent advice from a consultant before talking to the contractor;
2. Ensure the sports field is designed to suit the environment, in this case the installation of the lateral and slit drains and sand top dressing applications meant the field will perform under wet conditions;
3. Save costs by choosing the appropriate grass cover for the field, in this case Kikuyu was chosen which meant the grass was hard wearing and incurred lower maintenance costs.

2019 Lessons Learnt:

1. Budget was the most sensitive part of this project. Having a limited budget can vary method and scope to a degree. In this case the school was able to do some work themselves which saved a bit of money. Getting expert advice on best way to use that budget ensured cost effectiveness.
2. The effectiveness and life span of slit drains and sand carpets rely solely on on-going maintenance. If there isn't budget set aside for that then they will need to be replaced more frequently.
3. The grass used in this project, Kikuyu, was a great option for the climate and is still a good option for high wear usage in warmer climates.

Case Study Two: Westlake Girls High School, Takapuna, Auckland

Table 15: Westlake Girls High School Field Costs

Item	Cost	Replacement Cost (10 years – 2021)	Maintenance Cost
Two Football Fields (Ligaturf Premier)	$4.8m	$690,000	Night Soccer (per turf): $18,500
Three Netball/ Tennis Courts (Laykold)	-	-	Courts Nights: $23,000 Courts Days: $21,000
One Cricket Pitch (Supergrasse)	-	-	-
Hockey Turf	-	$380,000	Night Hockey: $27,000 Day Hockey: $15,000
Light/ external buildings	-	$344,000	-
Total Complex Cost	**$7.5m**	**-**	**-**

Consultant: OCTA – Project Managers, Sports Technology International (STI) – Contractor

Issue: Originally the Westlake Girls sports fields were sand carpet based which meant the fields were available for limited periods and closed when conditions become too wet. Fifteen years ago, the NZTA required further land to develop a dedicated bus lane. Part of the required land was situated on the Westlake Girls High School site, so NZTA began negotiations with the school. Once an agreement was reached, Westlake Girls elected to invest the capital into developing a world class sporting complex.

Figure 10: Westlake Girls, Artificial Fields

Solution: The Westlake Girls sporting complex includes: a hockey turf, two FIFA quality artificial football fields, a cricket oval, two cricket nets and three dual purpose tennis and netball courts. The fields are fully irrigated and collect water from the catchment area into 100,000-litre tanks. The stored water is used on the hockey pitch and it can be watered with 83,000 litres of water within 12 minutes. Many positive outcomes have resulted from the installation of the fields, one of the key outcomes was role models; the Black Sticks use the facility for training, and, in turn, the students get exposure to the best players in the country. Other positive outcomes have been; more students playing sport, less travel required to alternative venues and potential economic returns.

Lessons Learnt:

5. FIFA requirements: ensure the field meets either FIFA Quality- or Quality Pro requirements;
6. Car parking – allow for extra car parking and provide a good in/out flow;
7. Maintenance – budget for extra maintenance costs.

Case Study Three: Trafalgar Park, Nelson

Figure 11: Trafalgar Park sand-based field

Field Type: Glass based

Grass: Rye

Cost: $1m

Consultant: New Zealand Sports Turf Institute (NZSTI)

Issue: When it came time to returf Trafalgar Park as part of a larger $7.4 million upgrade, a lack of appropriate sand for the drainage medium emerged as a significant issue. Unfortunately, local sand did not meet the stringent grading and quality requirements and proved too expensive to process. Trucking-in quarried sand from Christchurch and boating in sand from the North Island was investigated before the innovative solution of glass was suggested.

Solution: Two thousand, eight hundred tonnes of recycled glass sand was produced by a Christchurch-based recycling operation and transported to Nelson on backloads. The use of glass sand in the $1m turf upgrade is apparently a world-first.

In addition, Trafalgar Park has 20 kilometres of new drainage pipework and slit drains. At the lowest layer is the main drainage pipe and branching out from that a series of lateral subsoil drains wrapped in pea gravel. There are also a series of vertical slit drains, effectively slits cut into the soil and backfilled with pea gravel topped off with blinding sand. To ensure king tide salt water didn't come back up through the drainage system and kill the grass, a system of tidal gates was devised to prevent the ingress of salt water into the turf drainage system.

After 40 millimetres of heavy rain in the morning, which would have previously closed Trafalgar Park, a Super 15 competition game was played, and the new surface coped admirably. In fact, there were horses running across it for the pre-match entertainment.

Figure 12: Photo showing proposed ryegrass, glass sand layer, and drainage options for Trafalgar Park

Lessons Learnt:

1. Consider sustainable options; the sports field used 2800 tonnes of glass sand which equates to seven per cent of the total volume of glass that is collected in South Island per annum;
2. Look to use efficient lighting systems. Trafalgar Park installed motion activated lighting in the building fit outs;
3. Consider water conservation. Water saving flush and tap systems were installed in the new toilet blocks;
4. Re-using 5000 cubic metres of cut-to-waste material for the embankment.

2019 Lessons Learnt:

1. This project was highly successful. However, the cost of using recycled materials has meant it hasn't been done again. When considering an approach like this there must be a local supplier.
2. This field performed as a typical sand carpet field, even though it was manufactured out of recycled glass, not from sand deposits. Much the same as other fields the success of the field is totally dependent on how they are maintained. This field was resurfaced in 2018 which is fairly normal.
3. The same costs were incurred with the resurfacing of this field as what a normal sand-based field would incur.
4. The slits were and drainage of the field has remained successful and has continued to be used during winter months.

Case Study Four: Bruce Pulman Park, Takanini, Auckland

Field Type: Sand based

Grass: Main field – AgriDark and Ryegrass.

Supporting Fields (7): AgriDark

Cost: $1.6m

Consultant: Sports Surface Consultants Ltd.

Issue: In the late 1980's the Papakura District Council purchased the land for the park. Through a unique structure the Bruce Pulman Trust has leased the park from the Council to provide the improvements and amenities. The Trust's philosophy being that everyone in the community irrespective of age, gender, physical ability or nationality can use the facilities and services provided, for recreation, leisure or sporting pursuits.

Figure 13: AgriDark and ryegrass sand-based field. Bruce Pulman Park, Auckland

Solution: The Trust is very conscious of the economic demographics of people who live in this region and therefore the Trust has been set up specifically to maintain and manage the park on a self-funded basis. The park will also operate as a resource centre for the many minor activities and sports throughout the region who may have fields or playing areas but no clubrooms, computers or administration back up to effectively organise and run their activities or train their volunteers.

Eight international standard sports fields have been constructed to provide ideal playing surfaces in all weathers and seasons. All fields are fully drained with irrigation, sand cover with couch grass stabilises the sand. The main field is under sown with ryegrass. The grounds feature a unique environmentally friendly gravity drainage system which drains into an adjacent stormwater retention pond. This water is reticulated and used for irrigation. The irrigation and drainage systems ensure the grounds are of excellent standard during all seasons.

Lessons Learnt:

1. A storm water retention pond is on site which provides for irrigation on the fields, additional water is available from an in ground bore and town supply if necessary
2. The park has its own grounds staff and a high level of maintenance is always provided.
3. Because the sand-based fields have been designed, built and maintained successfully they continue to have up to 20 hours per week played on them.

Case Study Five: College Rifles, Remuera, Auckland

Figure 14: College Rifles Artificial Sport Fields

Field Type: Artificial

Cost: $1.8m

Consultant: New Zealand Sports Turf Institute (NZSTI)

Issue: The previous sand-based field was located over a former peat swamp and underground Local Authority infrastructure. Because of the poor drainage on the site the field was frequently unusable and required high operational maintenance and renovation outlays.

Solution: College Rifles Sports have constructed a synthetic field that boasts a high weekly usage and in addition, maximised onsite building facilities to add to the viability of the facility. This facility is a privately owned yet community shared venue, where it is utilised by both the local authority and community.

The Auckland Council part funded the works, largely to upgrade the pipes beneath the sports fields. This meant that the base earthworks for the project were partly completed by the upgrade.

College Rifles has undertaken surveys on the field which showed that even the thought of going to a different ground that doesn't perform as well as the artificial surface was a disincentive for some of the younger players.

Maintenance: Grooming is undertaken weekly with specialist equipment; every Friday the surface is groomed with a tines and brushes approach, with very fine debris collected into a catcher. Human debris (compounding of human hair) is one of the biggest maintenance issues. Grooming maintains the performance of the materials and ensures the life span of the field.

Lessons Learnt:

College Rifles has the following reasons for their success:

1. Vision, strong governance and organisational structure
2. User Pays approach, including subs being paid in full before the season begins
3. Excellent services and facilities
4. Investment in security and staff (based on site)

2019 Lessons Learnt:

1. In 2019 the fields were resurfaced. This was anticipated as it was based on a 10-year lifecycle. Auckland Council gave funding for the refurbishment for community access. The refurbishment, undertaken by Polytan, went to plan and to budget, and the club is happy with the outcome.
2. The fields still get a high weekly usage and feedback from the players after the resurfacing is that it's much nicer/ softer and there have been no grazes on the new turf whereas there had been on the old turf.
3. The maintenance which the club does in terms of grooming costs roughly 10k annually. The club is hoping to have this granted through local board funds.

Case Study Six: Scott Point Sustainable Sports Park, Upper Harbour, Auckland

Table 16: Scott Point Sustainable Sport Park Field Costs

Item	Cost
Sand Carpet Football Field	$450,000
Artificial Training/ Junior Football Field	$900,000
Natural Turf with BLUE2GREEN Football Field	$2.5m
Baseball Diamond	$50,000
Lighting (5 fields)	$1.7m
Total Complex Cost	**$30m**

Figure 15: Scott Point Sustainable Sports Park

Consultant: Jacobs Engineering & SPORTENG

Issue: Continued urban intensification in Scott Point and the wider Hobsonville has resulted in increased demand for recreation and sporting facilities. At the centre of this development is the 16.4-hectare Scott Point Sustainable Sports Park which will provide for active recreation, informal recreation and an ecological area.

Solution: The sports fields at the park have been designed to cater for the increasing need for football and baseball facilities, for both training and matches. Two baseball diamonds have been designed as well as three natural football fields and two synthetic training/junior fields, 60m x 40m in size. Two of the three football fields are sand carpet fields – one being 110m x 68m and the other 100m x 64m whilst the other is 100m x 68m natural field sitting above the BLUE2GREEN system. The two synthetic fields comprise of a 60mm pile turf to comply with World Rugby and FIFA standards in order to allow social rugby to be played on the fields, and shock pad over a storage cell system as part of the aggregate layer (not BLUE2GREEN however). This storage cell provides additional underground water storage for on-site reuse. All fields are lit with LED luminaires, using 18m-28m permanently sited light poles to reduce maintenance costs. The fields have been lit to lux levels ranging between 75 lux and 200 lux, with the higher lux levels applied to those fields with higher use and where small ball sports will be played and the lower lit fields are those best used for practice.

The two sand carpet football fields are irrigated using conventional permanent irrigation methods. The other full-sized football field has a natural turf build-up however utilises the BLUE2GREEN system for irrigation. This system comprises of an 85mm deep drainage cell at the top of the aggregate layer, in which wicks are situated to draw water stored in the cells up to the root zone. This method of irrigation reduces the irrigation demand through irrigating the roots directly and reduces water loss through evapotranspiration. It also reduces the reliance on the municipal water supply as water can be captured and stored in the cells.

Lessons Learnt:

1. Lighting design catering for both summer and winter sports;
2. Accurate water usage data for determining storage capacity and system reliability;
3. Maintenance – budget for extra maintenance costs.

Case Study Seven: Nixon Park, Kingsland, Auckland

Figure 16: Nixon Park hybrid sports field

Table 17: Nixon Park Field Costs

Item	Cost	Maintenance Cost
Hybrid Sports Field	$600,00	$40,000
Total Complex	**$1m**	-

Consultant: New Zealand Sports Turf Institute

Issue: Over the last ten years Auckland Council has looked for innovative solutions to provide increased hours of play on their intensively used and at times unplayable sports fields. Their initial response led to installation of sand carpet and artificial fields and lighting. Whilst this programme was successful in increasing player hours, Auckland Council have taken their sports fields capacity development programme to the next level by installing two hybrid sports fields.

Solution: Located in the inner city, Nixon Park is under constant demand and badly needed remediation to improve the longevity of the playing surface. Due to the growing population and therefore demand on the sports field, Nixon Park was chosen to have New Zealand's first hybrid sports field. The hybrid playing surface, is a blend of natural sports turf over artificial fibre. A hybrid turf offers the benefits of both an artificial turf and a natural field, with studies showing that the integration of both types achieves optimal levels of use (Hybrid grass, football, and soccer: Can it work? 2014)

Hybrids are separated into two different categories:

1. Below ground stabilisers which bind the base materials together, using amendments to create a more stable surface. These prevent blow-outs, therefore are better at holding the base together.
2. Above ground stabilisers which have some of the material exposed, so they stabilise the top layer of the turf as well as the base underneath.

Further information on hybrids can be found here:
issuu.com/nzsti/docs/nztmj_autumn_2017_flipbook/40

In the case of Nixon Park, the decision was made to go with an above ground stabiliser. The reasoning was that the natural turf had been completely worn out after a winter's play, so then hybrid synthetic/turf fibres in the top layer would be enough to hold the surface together for the season's sport.

With the improved surface and a new training facility proposed by Auckland Council / Auckland Rugby, Nixon Park has an improved facility for sports teams across a number of codes with access to modern changing rooms and a quality field.

Lessons Learnt:

1. Whilst Nixon Park was a pilot project that was installed to fully understand the cost / benefit of the hybrid system, the lessons learnt regarding installation and maintenance are critical to consider prior to proceeding.
2. Regular renovations and maintenance are critical to the success of the turf. If your organization is considering installing a hybrid turf, ensure you know whether there is skilled operators and specialist machinery available in your region (UEFA Pitch Quality Guidelines, 2018).
3. A monitored irrigation programme (especially in the first two years of establishment) are a critical part of ensuring the field meets playing capacity. This is due to the undersowing of rye which needs a lot of water in the summer months to ensure winter play.
4. 20m floodlights have been installed to increase field capacity from around 20 hours to 30 hours.

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