ATM 20.3

RESEARCH PROJECT: COMPARE HOURS OF USE FOR DIFFERENT SPORTS FIELD CONSTRUCTION TYPES AND MAINTENANCE INPUTS. PART 1: SOIL PARAMETERS

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In April 2017 a research project being funded by the Sports Turf Association, Victoria was commenced to study the effects of hours of use on sportsfields of different construction types and levels of maintenance.

The project is being conducted over 18 – 24 months with 7 detailed assessments as well as collating the maintenance information, the hours of use and the level of sport (e.g. junior vs senior). This information will then be compared to the turf quality parameters being measured. Over the research period the results are being provided as interim reports available on the STA website (www. http://vicsportsturf.asn.au/) and presented at STA (VIC) seminars.

This article is the first of a two part series on the study being undertaken and presents the soils data collected over the first 12 months. Part 2 will look at the data collected on surface quality parameters including turf composition, wear, traction and turf health.

FIELDS AND SOIL TYPES

The project is being undertaken on Local Government sports fields that are in play and maintained by the Council or their service provider. The fields being used include sand profiles with a subsoil drainage system and fields constructed with a native soil profile. All fields have an irrigation system.

There are two Santa Ana Couch sports fields of which one is over-sown each autumn/winter with ryegrass and two Kikuyu sports fields. The project has selected both elite sports fields and community fields so that a good comparison can be made in terms of budget, resources and playing surface quality. The description of the sports fields are detailed in table 1.

Table 1: Description of sports fields

Sports field No.1	
Soil type	Sand profile with subsoil drainage
Turf type	Santa Ana overseeded with ryegrass
Cricket	Turf pitch
Sports played	Senior football, Junior football, Auskick, Womans football, Cricket Victorian Amateur Football Association (VAFA) Premier C
Sports field No.2	
Soil type	Fine sandy loam no subsoil drainage
Turf type	Kikuyu
Cricket	Synthetic pitch
Sports played	Junior football, Auskick, Junior cricket
Sports field No.3	
Soil type	Fine sandy loam no subsoil drainage
Turf type	Kikuyu
Cricket	Nil
Sports played	Senior soccer – State League 1 SE, Bayside, Bayside Woman's Premier League
Sports field No.4	
Soil type	Sand profile with subsoil drainage
Turf type	Santa Ana
Cricket	Turf pitch – Premier Grade Cricket (2 XI)
Sports played	Senior football, Junior football, Auskick, Cricket Peninsula Football Netball League - Peninsula Seniors

Each site has 5 sample locations (figure 1) with each sample location being 10m x 10m in which each measurement has been undertaken.

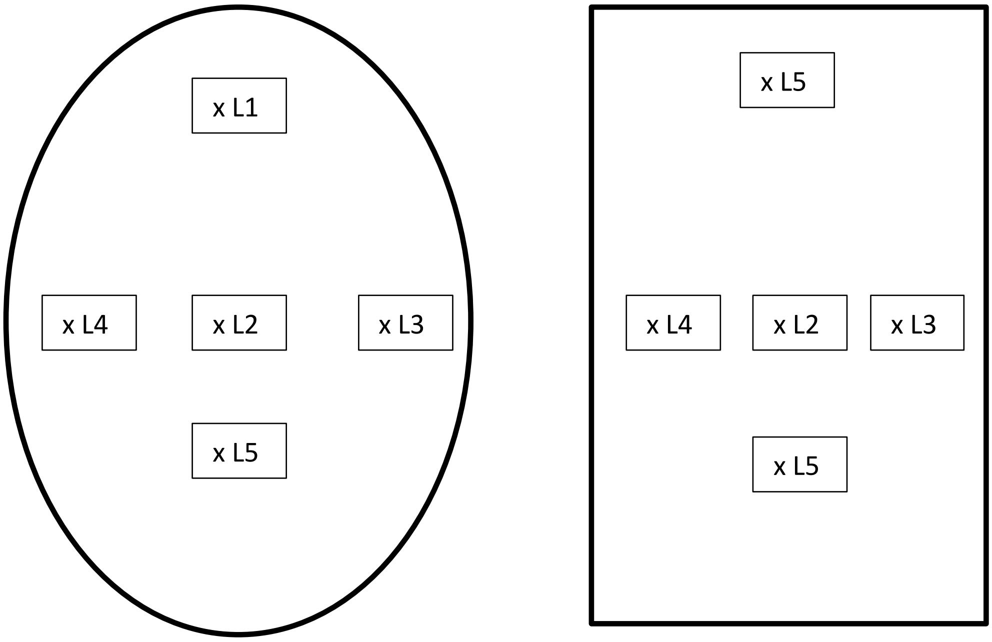


Figure 1: Sample locations

The following soil test parameters have been determined;

- At each sample location profile samples were initially taken to a depth of 300 – 500mm (or to subsoil depth) to describe the soil texture, depth of topsoil, thatch depth, compaction and root growth. At subsequent sample dates thatch depth and root depth have been measured.
- The soil moisture content is measured using a TDR probe at 5 locations in each test area and is related back to the soil type, condition of the playing surface and recent weather conditions (particularly rainfall).
- The soil infiltration rate is measured at each test location using a single ring infiltrometer and is related back to soil type, compaction and thatch depth. It also relates to the effective irrigation of the sportsfield.
- Soil strength/compaction is measured at 5 locations in each test area using the soil penetrometer and is used to gauge the degree of soil compaction.

RAINFALL DATA

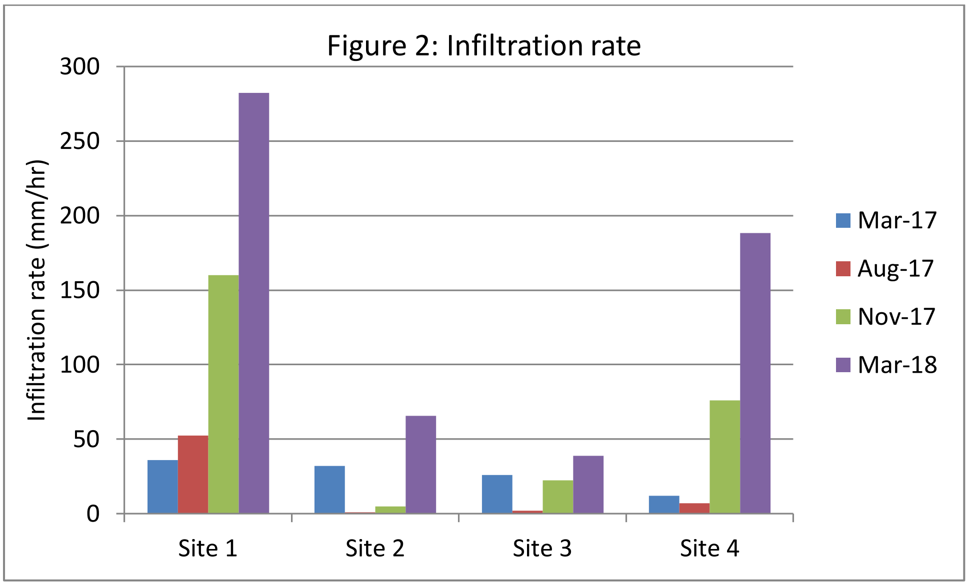
Rainfall data was collected for the closest Bureau of Meteorology sites and the results are detailed in table 2. The weather from March through to November 2017 was relatively dry and the rainfall was below the long-term average for all sites. In contrast December 2017 was wet and the rainfall was well above the long-term average. Through January to March 2018 it has been very dry and the rainfall was well below the long term average.

Table 2: Monthly rainfall data

	2017										2018		
	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Jan	Feb	March
Moorabbin	29.6	94.6	32	15.6	38.2	61	38.6	48.4	31	130	64	1.4	23.2
Long term average	44	63	69	56	62	65.1	64.6	68.8	62.4	60.5	44.4	45	43.7
Mornington	21	12	6	9	9	67.1	73	59.5	66.3	75.6	53.6	5	27.6
Long term average	49	62	70	71	69	71	71.5	69	59.8	53.6	38.4	38.1	44.9
Frankston	26.4	67.3	35.9	23.3	37.3	56.7	57.5	44	33	138.8	52.5	0.8	29.6
Long term average	47	65	68	73	71	65.6	68.9	68.7	60.5	64.2	47.3	48.3	47

SOIL INFILTRATION RATE

The infiltration rate varied across each field and varied throughout the year (figure 2). As would be expected the infiltration rate was highest on the relatively new sand based construction and quite low on the native soils. There was variation in the infiltration rate across each field which was related to thatch depth, soil moisture content and soil compaction at each particular location. Across all sites there was a substantial reduction in the infiltration rate by the end of the winter months, even on the sand based fields. This highlighted the compaction and surface sealing that occurs during winter sports and the importance of the post-winter renovations to restore the infiltration rate and soil aeration. At all sites the soil aeration process improved the soil infiltration rate.

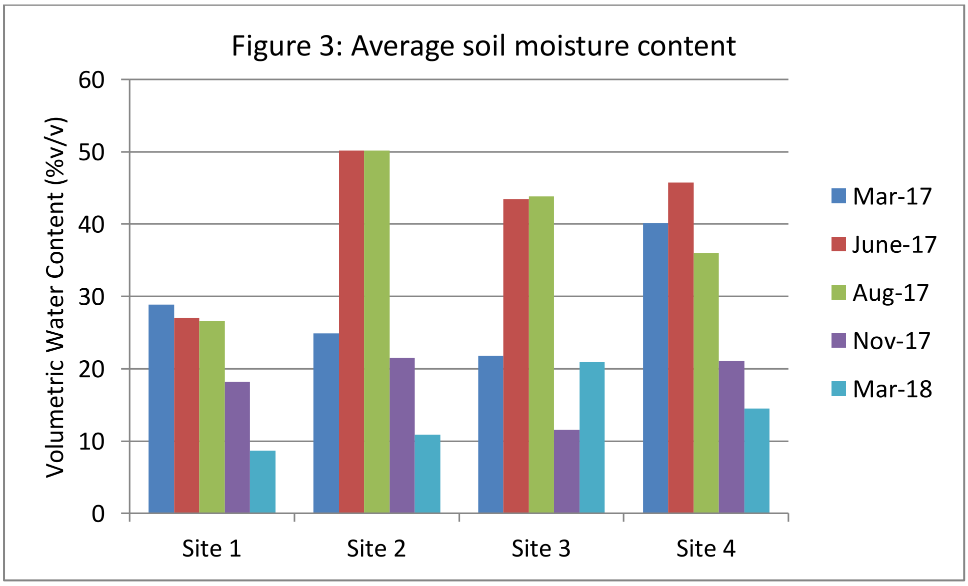


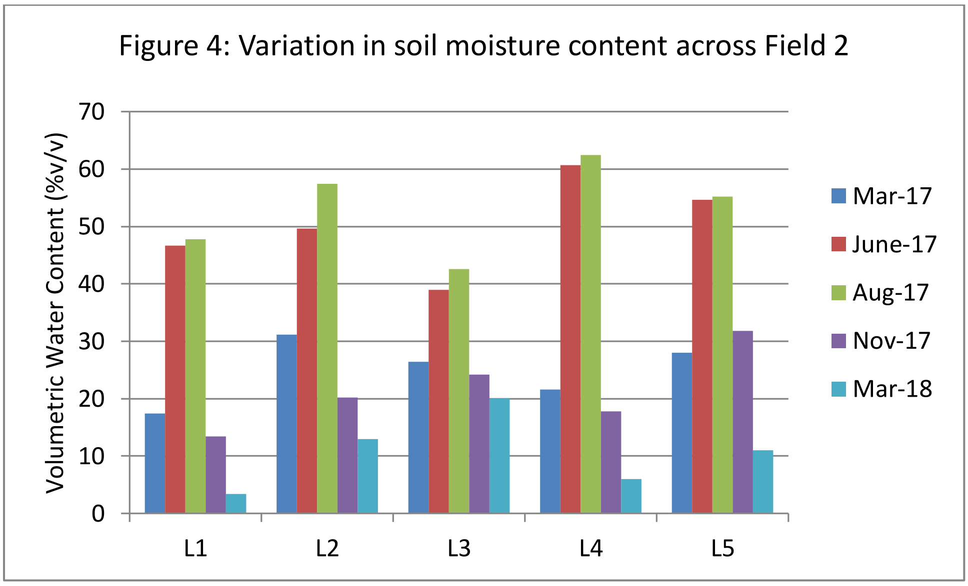
SOIL MOISTURE CONTENT

The soil moisture content varied across each field and varied throughout the year (figure 3). There was variation in the soil moisture content across each field which was related to thatch depth, soil compaction, surface contours and traffic. An example of the variation is provided in figure 4.

There are several observations that can be made from the data collected;

- The sand based field was never at an excessively high moisture content or saturated throughout the year.
- The soil based fields became saturated in June and remained that way through to the late August assessment.
- Fields 1, 2 and 4 were quite dry at the March 2018 assessment and reflected the very dry summer. There were some other compounding factors including poor irrigation coverage and keeping the surface dry to assist in stressing out a persistent *Poa annua* biotype.
- In March 2018, Field 3 was at an expected moisture content due to an increase in the irrigation regime to assist in preparing the surface for high level soccer.
- Figure 4 highlights the potential high variation in soil moisture across a field which in this case reflects the variation in soil compaction, infiltration rate, thatch depth and irrigation distribution.

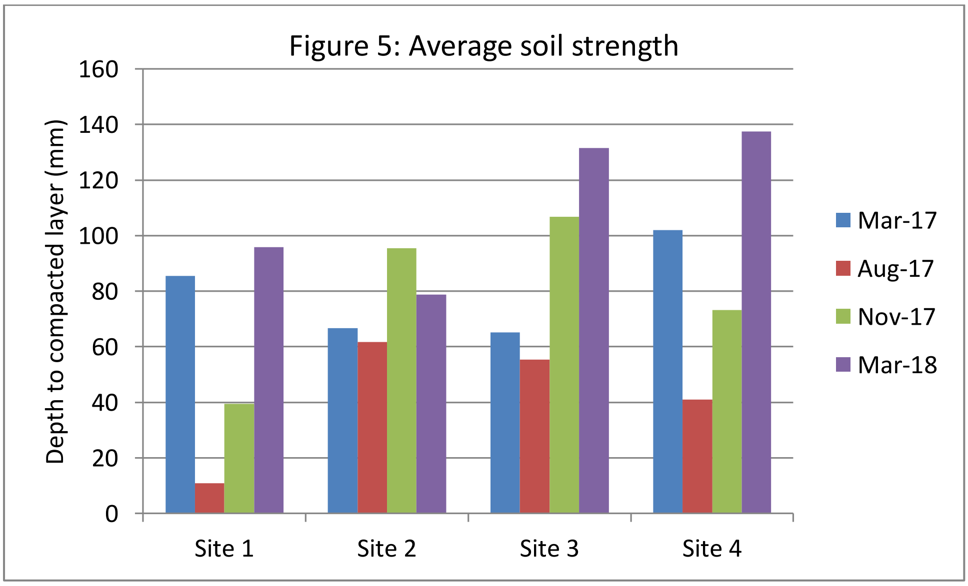




SOIL STRENGTH/COMPACTION

The soil strength and soil compaction was highly variable across most sports fields and was affected by thatch depth, soil moisture content, traffic and soil decompaction practices. All fields had the shallowest compaction layer at the end of the winter sports season (August 2017) and reflect the high traffic and wet soils (figure 5). At site 1 the field was being solid tined mid-winter and when checking the effects of the solid tining there was no positive result and the soil was very compacted at the bottom of the tine hole (i.e. about 20mm). This particular observation highlights the importance of monitoring soil compaction, selecting the most appropriate equipment and reviewing the results of the operation.

Sites 1, 3 and 4 were aerated in spring/summer and this was reflected in an improvement in soil conditions at both the November 2017 and March 2018 assessments.



CONCLUSION

After the first 12 months of the project there are several obvious conclusions regarding the soils and soil management;

1. The oval constructed on a heavy soil type deteriorated very quickly once the rain came in August 2017 and further highlights the importance of a well-drained profile.
2. The thatch depth has a significant influence on surface moisture retention and infiltration rate even on a sand profile.
3. A sand profile that has some drainage substantially improves the ability of the surface to cope with high traffic loads.

4. The increase in soil compaction and reduction in the infiltration rate over the winter months reinforces the need for a targeted renovation program in the spring.
5. Sportsfield 4, while damaged due to high traffic loads and wet soils late in the winter, responded extremely well to the program of aeration and fertiliser applications.
6. The poor water distribution at some sites was affecting the consistency of the soil moisture content and consequently the overall turf health, turf density and root growth.
7. One field was being aerated during the August assessment and provided a good opportunity to assess the effect of the process being undertaken. The field was being solid spiked and the depth of penetration was no more than 5cm. On checking the soil strength (compaction) the spiking process was actually increasing the level of compaction at the bottom of the tine hole. This observation reinforces several important aspects of compaction control and aeration;
   a. It is important to understand where the problem is within the soil profile.
   b. Use the most appropriate equipment e.g. deep compaction control requires a vertidrain or similar with some "kick" to disrupt the compacted layer.
   c. The only way to reduce compaction is to increase soil volume.
   d. Thatch control requires a different process compared to compaction control.
   e. Post-renovation, measure soil strength or infiltration rate (or both) to determine the effectiveness of the treatment.

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