Successful Solutions for Failed Fields

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Hummel & Co Inc.

Objectives

- Learn from other's mistakes
  - So you can prevent it from happening to you
  - So you can go back with options for correcting problems
- Realize that there are often more than one solution to a problem

Common Causes for Field Failures

- Poor Design and/or Construction
- Poor Drainage
- Poor or Inadequate Maintenance
- Over use

Case #1 You Can Pay Me Now or ….

- Three year old soil based fields
- Money for soil improvement removed from budget
- Never had good stand establishment
- Field is hard
- Rocks keep surfacing
- Maintenance adequate
- Shut down fields

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MATERIALS TEST REPORT FOR
Pittsfield Central School District

REPORT TO: Johnny Herne
Pittsfield CSD
Sutherland Street
Pittsfield, NY 14534

DATE RECEIVED: September 5, 2007
TEST DATE: September 11 - 14
REPORT DATE: September 29, 2007
CONDITION OF SAMPLE: Normal

PARTICLE SIZE ANALYSIS (ASTM F-1632)

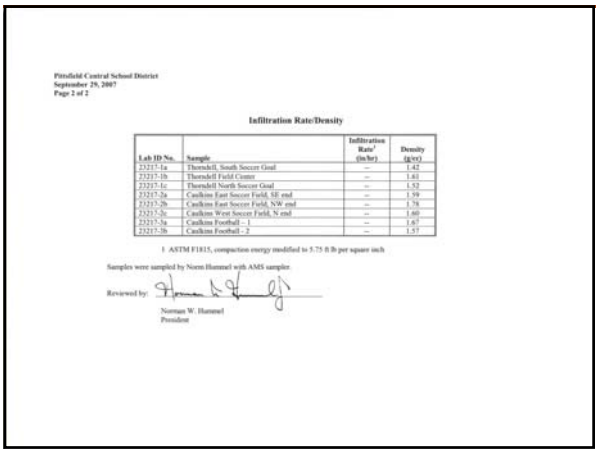
Lab ID No.	Sample	Gravel	Soil Separate % Sand	Silt	Clay	Sieve Size/Sand Fraction Sand Particle Diameter % Retained No. 18 V. coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 140 Fine 0.10 mm	No. 270 V. fine 0.05 mm
23217-1	Thorndell Elementary	11.9	35.3	51.2	13.4	3.0	3.0	4.8	9.8	14.7
23217-2	Caulkins Soccer	5.5	41.7	42.6	15.7	2.5	3.2	6.0	13.2	16.8
23217-3	Caulkins Football	6.6	41.3	43.3	15.4	3.3	3.2	5.7	12.7	16.5

Dispersion Method: Reciprocating shaker

TEXTURAL CLASS /ORGANIC MATTER/pH

Lab ID No.	Sample	pH[1]	Organic Matter[2] (%)	Textural Class
23217-1	Thorndell Elementary	6.9	2.76	Silt loam
23217-2	Caulkins Soccer	6.5	2.36	Loam
23217-3	Caulkins Football	6.8	2.46	Loam

1. ASTM D4972
2. ASTM F1647, method 1



Pittsfield Central School District
September 29, 2007
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Infiltration Rate/Density

Lab ID No.	Sample	Infiltration Rate[1] (in/hr)	Density (g/cc)
23217-1a	Thornhill, South Soccer Goal	--	1.42
23217-1b	Thornhill Field Center	--	1.61
23217-1c	Thornhill North Soccer Goal	--	1.52
23217-2a	Caulkins East Soccer Field, SE end	--	1.59
23217-2b	Caulkins East Soccer Field, NW end	--	1.78
23217-3c	Caulkins West Soccer Field, N end	--	1.60
23217-3a	Caulkins Football – 1	--	1.67
23217-3b	Caulkins Football - 2	--	1.57

1 ASTM F1815, compaction energy modified to 5.75 ft lb per square inch

Samples were sampled by Norm Hummel with AMS sampler

Reviewed by:

Norman W. Hummel
President

Diagnosis

- Turf – predominately perennial ryegrass, poor stand, bluegrass in mix failed
- Soil – fine textured, low organic matter, extremely compacted, very rocky, poor quality

Options to correct

- Program of overseeding, conventional aerification, deep tine aerification, topdressing
- Plow field, rock hound, amend with properly sized sand, compost, reestablish

Lessons Learned

- Be careful where you cut the budget
- Pre-qualify contractors
- Provide project oversight (even if a PM has been hired to do so).

Case #2 It was beautiful until we started using it

- 1 year old sand based field
- Sand grown sod
- Poor rooting
- Poor wear tolerance

Diagnosis

- Everything was done right, except:
  - Did not start on aerification and/or topdressing program
  - Overwatering

Case #3 Dispelling an old myth

- Sand capped field
- Sod grown on silt loam soil
- Divoting, slippery surface

Lessons Learned

- Sodded fields – start on regular aerification program to plug out sod layer as soon as sod can tolerate. If sod is grown on soil, harvest cores if possible.

Drainage Design Pitfalls – Surface vs. Sub-surface Drainage

Sub-Surface Drainage System

- Needed when there is presence of a water table in close proximity to soil surface.
- Needed when sub-soil is considerably less permeable than topsoil
- Will not correct surface drainage problems

Surface Drainage

- Provide adequate pitch or slope to soil based fields (> 1.5%)
- Try to keep spans under 200 ft.
- If pitch not possible, consider by-pass drainage

Case #4: One percent is not enough

- New soil based fields failing
- Poor drainage, one field unusable
- Good turfgrass stand establishment
- Fields built with 0.75% slope, long runs
- Very compacted subsoils

Diagnosis

- Fields built too flat
- Rock Ledge, no subsurface drainage system
- Fine textured soil. Silt loam was specified, sandy loam was used.
- Soil was extremely compacted, especially below 6 inches.
- Found out Caterpillar road scraper used for soil placement and grading

Solutions

- Rebuild fields
- Compaction – core cultivation, Howard Earth Quaker, Aerway Shattertine
- Drainage – bypass drainage system

By-pass Drainage

Lessons Learned

- Make sure architect/designer is familiar with sports field design
- Review specifications
- Pre-qualify contractor

Case #5 - One Failure Isn't Enough

- Three sand based fields built at same time (football stadium, lacrosse/soccer, track and field)
- All failing, poor drainage

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PARTICLE SIZE ANALYSIS (ASTM F-1632)

Lab ID No.	Sample	Soil Separate %			Sieve Size/Sand Fraction Sand Particle Diameter % Retained					
		Sand	Silt	Clay	No. 10 Gravel 2 mm	No. 18 V. coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 100 Fine 0.15 mm	No. 270 V. fine 0.05 mm
	Sample 3 – 4"	86.2	12.4	1.4	4.6	4.1	13.1	43.7	14.3	4.4
	Sample 4 – 7"	84.0	14.2	1.8	4.0	4.7	12.7	43.5	14.2	4.9
	Specifications									

Turf and Landscape Soil Consulting and Testing Services

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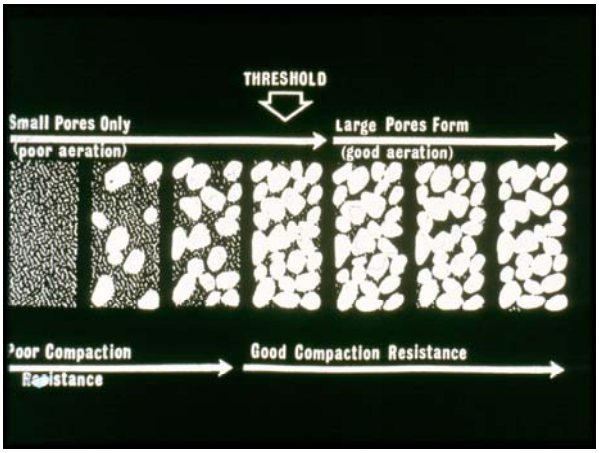
PHYSICAL PROPERTIES (ASTM F-1815)

Lab ID No.	Sample	Particle Density[1] (g/cc)	Bulk Density (g/cc)	Root Infiltration Rate (in/hr)	Total Porosity %	Aeration Porosity %	Capillary Porosity[2] %	Organic Matter[3] %
	Sample 3 – 4"	2.61	1.91	0.1	26.8	0.0	26.8	1.1
	Sample 4 – 7"	2.55	1.87	0.3	26.7	1.3	25.4	0.9
	Specifications							

1 ASTM D5550
2 Determined at 30 cm tension
3 ASTM F-1647, loss on ignition method

Turf and Landscape Soil Consulting and Testing Services



Diagnosis

- Poor root zone specifications
  - Did not define performance parameters
  - Vague in terms of particle size requirements (specified 75-25 sand to soil)
  - No quality control testing
- Contractor was inexperienced – did not recognize problem with specifications

Solution

- Client did not get what they paid for – rebuild the field
- Seven figure settlement reached in mediation
- Two fields were rebuilt

Lessons Learned

- Hire an architect with experience and knowledge designing sand based fields
- Have root zone mix designed by experienced lab and/or consultant
- Hire a contractor with experience in building sand based fields.
  - Some have no clue as to what they are getting into.

Case #6 – This Field Stinks or It's Amazing What Sod Will Hide

- 6 month old sand capped field
- Complaint of poor drainage, standing water, wet conditions on turf area
- Field smelled septic
- Turf in good condition

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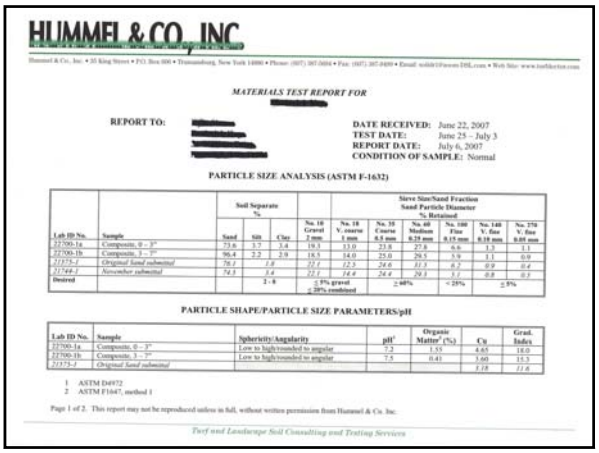
PHYSICAL PROPERTIES (ASTM F-1815, modified for undisturbed cores)

Lab ID No.	Sample	Particle Density (g/cc)	Bulk Density (g/cc)	Ksat Infiltration Rate (in/hr)	Total Porosity %	Aeration Porosity %	Capillary Porosity* %
22700-3a	3rd Base line, 30' from skin, 0 – 3"	2.51	1.50	2.5	42.9	18.1	24.8
22700-3b	3rd Base line, 30' from skin, 4 – 7"	2.67	1.80	2.2	32.8	18.2	19.6
22700-4a	Left Field, 48' from skin, 0 – 3"	2.62	1.49	13.3	43.2	23.5	19.6
22700-4b	Left Field, 48' from skin, 4 – 7"	2.67	1.72	4.4	35.6	21.5	14.0
22700-5a	Center Field, 45' from WT, 0 – 3"	2.62	1.57	8.7	39.9	21.0	18.9
22700-5b	Center Field, 45' from WT, 4 – 7"	2.67	1.75	3.3	34.6	19.5	15.1
22700-6a	Center Field, 50' from skin, 0 – 3"	2.62	1.44	13.5	44.9	22.2	22.7
22700-6b	Center Field, 50' from skin, 4 – 7"	2.67	1.77	4.6	33.6	19.0	14.5
22700-7a	Right Field, 69' from WT, 0 – 3"	2.62	1.51	16.6	42.2	24.3	17.9
22700-7b	Right Field, 69' from WT, 4 – 7"						
22700-8a	1st Base line, 33' from skin, 0 – 3"	2.62	1.56	4.1	40.6	17.5	23.1
22700-8b	1st Base line, 33' from skin, 4 – 7"	2.67	1.78	4.1	36.9	18.1	18.8
22700-1b	Composite, 3 – 7"	2.66	1.70	11.8	38.3	22.7	15.5
	Desired Values			**> 20**	**35 - 55**	**15 - 30**	**15 - 25**

* Determined at 30 cm tension
+ ASTM F-1647, loss on ignition method

Reviewed by: _____

Norman W. Hummel Jr.
President



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MATERIALS TEST REPORT FOR

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REPORT TO: [redacted]

DATE RECEIVED: June 22, 2007
TEST DATE: June 25 – July 3
REPORT DATE: July 6, 2007
CONDITION OF SAMPLE: Normal

PARTICLE SIZE ANALYSIS (ASTM F-1632)

Lab ID No.	Sample	Soil Separate % Sand	Silt	Clay	Sieve Size/Sand Fraction Sand Particle Diameter % Retained No. 10 Gravel 2 mm	No. 18 V. coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 100 Fine 0.15 mm	No. 140 V. fine 0.10 mm	No. 270 V. fine 0.05 mm
22700-1a	Composite, 0 – 3"	73.6	3.7	3.4	19.3	13.0	23.8	27.8	6.6	1.3	1.1
22700-1b	Composite, 3 – 7"	96.4	2.2	2.9	16.5	14.0	25.0	28.5	5.9	1.1	0.9
21375-1	*Original Sand submitted*	76.1		1.8	22.1	12.5	24.6	31.3	6.2	0.9	0.4
21749-1	*November submitted*	74.5		3.4	22.1	14.4	24.4	29.3	5.1	0.8	0.3
Desired			2 - 8		≤ 5% gravel ≤ 20% combined		≥ 60%		< 25%		≤ 5%

PARTICLE SHAPE/PARTICLE SIZE PARAMETERS/pH

Lab ID No.	Sample	Sphericity/Angularity	pH[1]	Organic Matter[2] (%)	Cu	Grad. Index
22700-1a	Composite, 0 – 3"	Low to high/rounded to angular	7.2	1.55	4.65	18.0
22700-1b	Composite, 3 – 7"	Low to high/rounded to angular	7.5	0.41	3.60	15.3
21375-1	*Original Sand submitted*				*5.18*	*11.6*

1 ASTM D4972
2 ASTM F1647, method 1

Turf and Landscape Soil Consulting and Testing Services

Diagnosis

- Sand particle size changed (lack of QC testing).
- Compacted sand below surface (lack of proper oversight).

Possible Solutions

- Reconstruct
- By-pass drainage system
- Use of wetting agents
- Deep tine aerification

By-pass Drainage

Lessons Learned – Sand Capped Fields

- Be careful in design/build situations
- Select sand with high permeability
  - To provide lateral drainage to pipe
  - To compensate for low capacity
- Quality control during construction
- Owners rep to provide oversight

Case #7 Six Months Later, the Field Never Drains

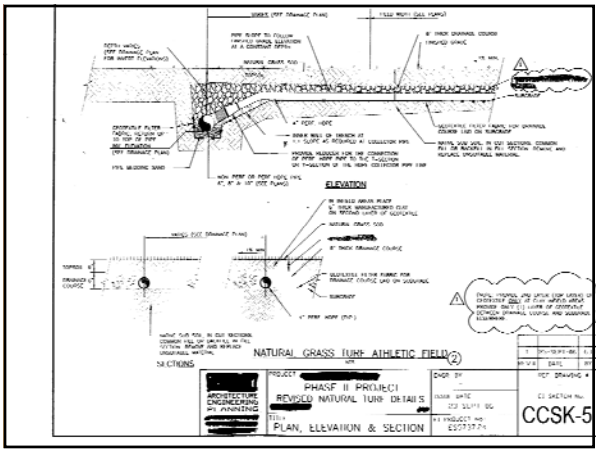
- 6 year old soil based field
- About 1% crown, flat in center
- Silt loam soils
- Drained well first six months, has been bad ever since despite extensive under drainage system
- Opposing teams now refusing to play on field

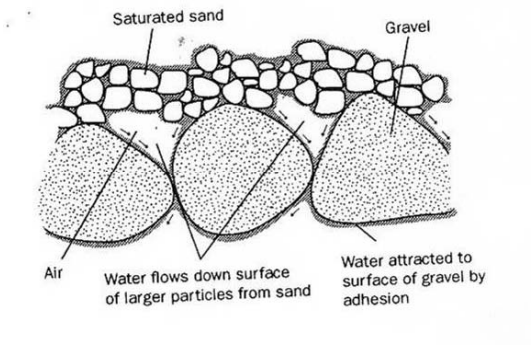
Diagnosis

- Fine textured soils, inadequate surface drainage
- Field flat in center of field
- Severely compacted and poorly graded sub-grade entombing drainage system. Possible soil migration into stone.
- All a result of poor design and design flaws

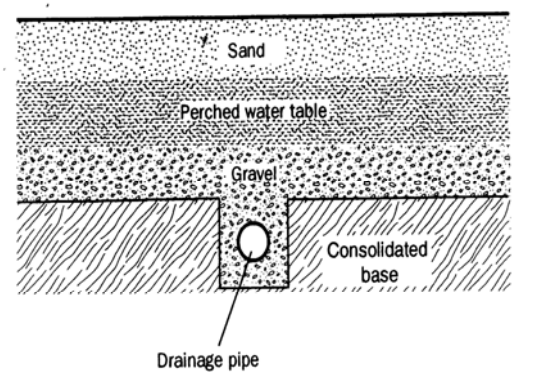
Solution

- Remove sod in center of field, rebuild crown (used amended soil), resodded
- Installed bypass drainage system
- Rebuild field was option but was not selected.





From Practical Drainage for Golf, Sports Turf and Horticulture, McIntyre and Jacobsen



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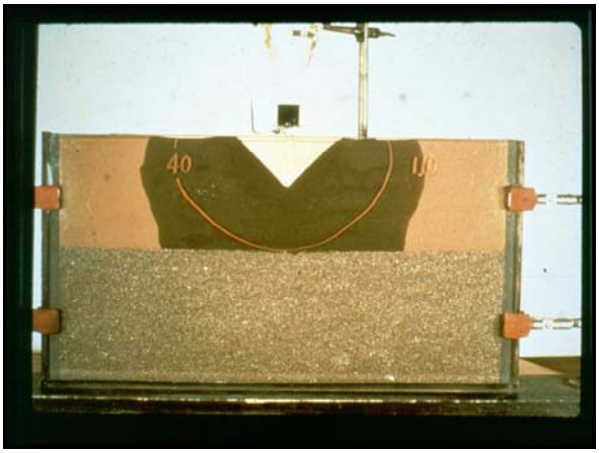

Lessons Learned

- Hire architect with knowledge and experience of sports field construction
- Review specifications prior to requesting bids.
- Under drainage system does not correct poor surface drainage.

Case #8 Something's missing

- 1 year old soil based field
- Extensive under drainage system
- Geotextile fabric separating soil from gravel
- Field performing poorly
- Good maintenance program


Where’s the topsoil??

Case #9 Controlling Use

- Practice fields at major university
- No control over use – used for practices, sports camps, pick up games
- Fields in fair condition, overused

Solution

- AD, coaches, and STM worked together to develop a scheduling program
- Fenced off area
- Moved some camps to other fields in the area.
- Consider synthetic?

Preventing Failures – New Fields

- Review specifications, or have someone knowledgeable in construction to do it for you
- Develop a relationship with the designer
- Provide oversight – be the eyes and ears for your employer – bring any concerns you have to your employer and/or designers