Installation of the "smile" interceptor trench and drain at the low end of a green. ALAN D. HESS

A Quality Control Checklist for Successful Greens Reconstruction

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QUALITY CONTROL. Think about those words for a minute. They describe an effort to control or ensure quality. Now consider the construction of a golf green. Greens construction requires a precise combination of artistic talent, a sound scientific base, and the best in workmanship. The reconstruction of greens is one of the most challenging projects in the life of any course. Reconstruction represents a tremendous opportunity for improvement of the facility. This is the chance to correct agronomic problems such as poor drainage, inconsistency in playing quality, weed and pest infestations, and inadequate cupping area. It is a chance to convert to superior turfgrasses, make the course more attractive, and make it more fun to play for all classes of players.

Unfortunately, there also exist many opportunities to make mistakes. Attempting to cut corners during critical aspects of reconstruction invariably leads to problems with the new greens that soon have every-

one questioning the worth of the project. Building good greens is not as easy as some think. There are many pitfalls that must be avoided.

Since most of us would expect the new green to last at least 20 years and possibly much longer, quality control in the construction of that green is critical. Who should be in charge of ensuring quality control? Ideally, all participants in the project will strive to do the best work possible and will constantly review their own efforts. The architect, contractor, materials supplier, and blender all should have quality control guidelines and procedures of their own. Certainly, it is in their best interest to construct greens that perform properly.

Those who are paying for the new greens also have a responsibility as consumers to be knowledgeable about what they are buying. It is foolish to assume that the quality control efforts of the seller (regardless of what is being sold) are sufficient to completely protect the interests of the buyer. The buyers need someone on the project representing only their interest. That person needs to have a working knowledge of all aspects of the construction of greens. They should know the area well, be in tune with the desires of those who play the course, and have a vested interest in the success of the project. No one fits this description better than the golf course superintendent.

In most cases the golf course superintendent will serve as the "owners' representative" during the reconstruction of greens. On a project of this magnitude there is a wide variety of tasks and procedures that must be accomplished. In most cases, there are numerous ways to accomplish the same goal. It therefore is quite possible for differences of opinion to arise concerning which method is best. For the superintendent to be effective in such circumstances, the owners must give him/her the authority to halt the project if necessary until a consensus of opinion can be reached.

Obviously, there is a great deal to monitor during a project of this size. Very likely it will prove impossible for the superintendent alone to provide such close scrutiny throughout the project, particularly on courses that remain open during construction. It therefore is a very good idea to appoint a member of the maintenance crew as a "clerk-of-the-works" for the duration of the project. This individual should have no responsibilities other than providing a second set of eyes and ears for the superintendent. Using the guidelines provided below as a beginning, the superintendent should prepare a daily "punch-list" for the clerk-of-the-works, detailing specific aspects of the project to be monitored.

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Plywood protects the subgrade surface so that the small skid loader can bring in the gravel and choker layer materials.

What follows is a checklist to help the golf course superintendent make certain that good quality control is maintained throughout every critical phase of a greens construction or reconstruction project. It is important to note that not every step in the checklist will be appropriate for every job. It is equally important to keep in mind that this list is an example only. Every job is different, and consequently every quality control effort must be individually tailored to the specifics of site, individuals involved, materials, etc. For example, on many jobs a great deal of additional testing of materials may be necessary to meet contractual agreements. This is particularly true in areas where the physical properties of materials are inconsistent.

Once prepared, a quality control checklist such as this one will help the superintendent avoid many of the mistakes commonly made during greens construction. Space

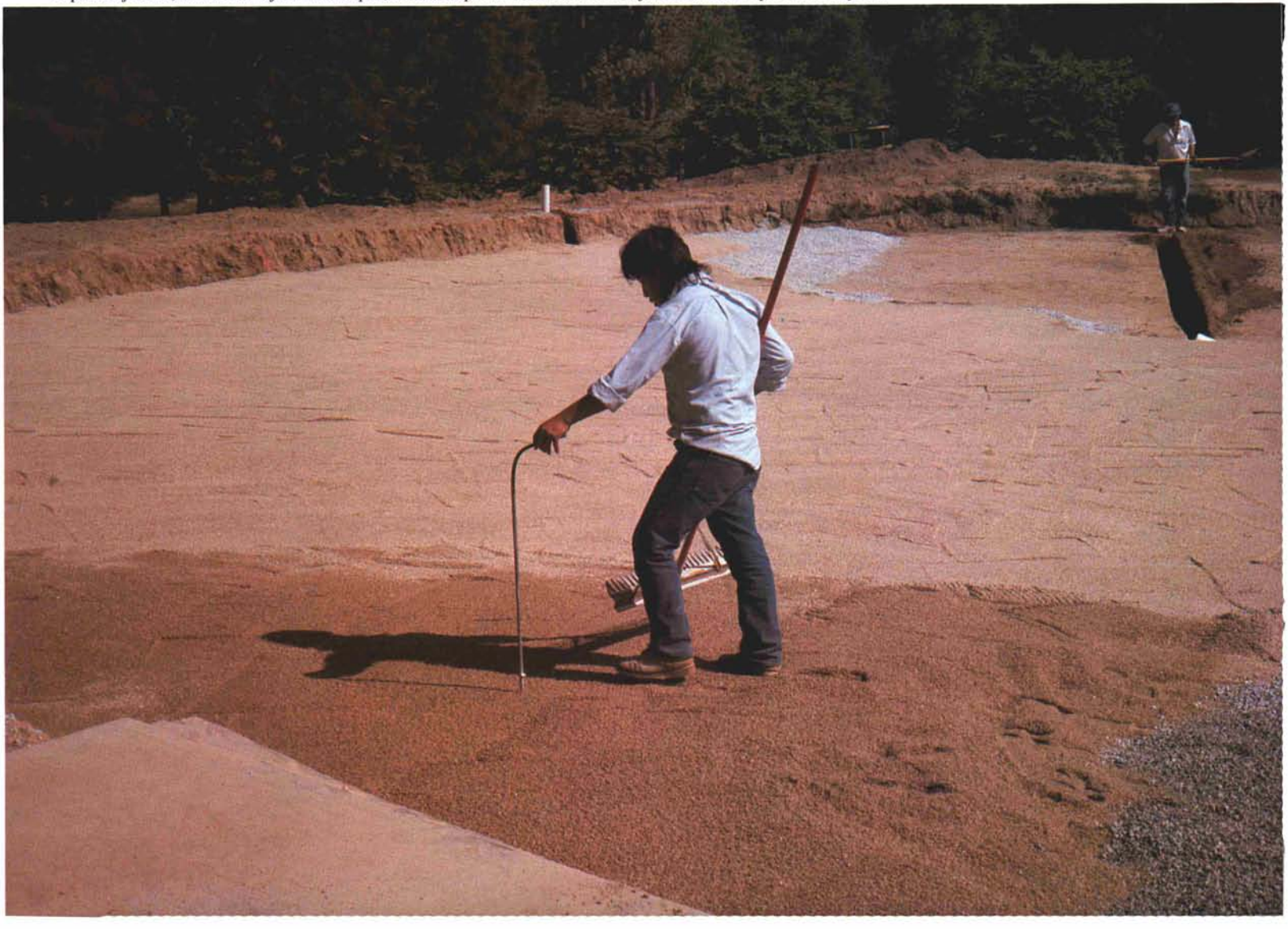
does not permit detailed discussion of each guideline. Refer to the March/April 1993 issue of the *Green Section Record* and call your local Green Section office for additional details.

I. Identification Phase

The first step to take before the reconstruction of greens that have a history of poor performance is to ensure all the factors responsible for that poor performance have been identified. Greens fail for many reasons. While an improved root zone mix can correct drainage problems, it cannot provide light, air movement, or additional surface area. Unfortunately, all too often a new green is built without correcting many of the most limiting factors that caused the old green to fail. The first step should be to make certain that poor construction was the principal reason for the existing green's poor performance. The following questions should be asked:

1. Is surface drainage good?
2. Do the greens drain well internally?
3. Have root zone samples been submitted to a physical soil testing lab for analysis?
4. Are there layers in the profile that inhibit drainage?
5. Has deep-tine aerification been tried?
6. Is the existing root zone high in silt and clay?
7. Is the existing root zone of consistent depth?
8. Have the terminal points of the drainage tile been found and checked for blockage?
9. Has the drain tile system been flushed?
10. Does sufficient light reach the turf surface at all times of the year?
11. Is there sufficent air movement across the putting surface?
12. Is the green large enough to take the traffic?
13. Are there adequate entry and exit points to the green to distribute the traffic?
14. Have nutritional requirements been met?
15. Has there been a check for nematodes?
16. Have irrigation coverage and application needs been met?
17. Could water quality problems (either physical or chemical) be the basis for the problems?
18. Have walk-behind mowers been tried instead of triplex equipment?
19. Are the greens being cut too low and kept too fast?
20. Is the type of grass on the greens appropriate for the demands of your climate?
21. If part of the reason for rebuilding is to eliminate *Poa annua* in the greens, has *Poa* been controlled on the rest of the course?
22. Is the membership happy with the architectural characteristics? Remember, the desire of the players for a better design is as much a justification for reconstruction as poor drainage.

A piece of rebar, marked at a four-inch depth, is used to probe the area to check for consistent depth in the layers. ALAN D. HESS



23. Has your regional Green Section agronomist been asked to examine the greens and help identify and document the problems causing their failure?

II. Selecting Construction Materials

A. Is climate an issue? These questions must be answered prior to selecting construction materials.

1. Will the greens be maintained in a climate of extreme dryness and high evapotranspiration rates?

2. Will the greens be maintained in a climate of frequent and prolonged wet weather, high humidity, and heat?

3. Will the root zone be irrigated with water high in sodium, salts, or both?

B. Selecting materials

1. Have you personally visited local suppliers to collect samples for submitting to a lab?

2. Have you discussed with the supplier the construction of greens so they understand the need for preciseness during the project?

3. What is the source of the material?

4. Is the source consistent?

5. How much notice is needed to guarantee that the required quantity and quality will be available?

6. Can they stockpile the materials at their site throughout the project, or must the stockpile be kept at the golf course site?

7. Is their stockpile area free of weeds and soil?

8. Can they mix organic matter and sand, or will a custom blender be hired?

9. Will they mix the components and then wait until an outside lab tests the mixture?

10. Can they incorporate nutrients?

11. Do they keep "in-house" quality control records?

12. Do they use their own trucks for delivery?

13. How much are shipping costs over FOB?

14. To what other golf courses have they supplied material?

15. Has a physical soil testing lab been located, and have their fees and testing standards been determined?

16. Does the lab test according to the procedures published by the USGA?

17. Have all of the materials (sands, organic matter, and gravel) been submitted to the lab to verify their suitability for the construction of greens according to the USGA Green Section recommendations?

18. Has a sample been prepared according to the lab's mixing ratio to serve as a visual "standard" throughout the project?

19. If because of cost or lack of availability the proper materials cannot be acquired, have you discussed with your Green Section agronomist the possible repercussions of whatever compromises must be made?

20. It is likely that more than one sand and organic matter mixture will fall within the guidelines. Have you discussed the various mixtures available with your Green Section agronomist to help you select the material best suited to your needs?

21. Once a root zone mixture is determined, has a chemical soil test been run to identify which nutrients should be added prior to planting?

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An insulated copper wire, wrapped around the main line, can be used in the future to locate the drainage lines.

III. Monitoring Quality During Mixing

This is one of the most critical phases of a greens construction project, and therefore good quality control efforts are mandatory. What follows is a sample quality control program that will suffice for many projects. However, note that this aspect of your quality control program must be tailored to fit the specifics of your situation. It may prove necessary to include much more testing throughout the project, depending on the consistency of the materials and to meet contractual agreements.

1. Test the first load mixed to verify that the mixing procedure is valid. The project will have to be put on hold for 24 to 48 hours while the lab verifies that the field mixing duplicates the recommendations offered by the lab.

2. Remove samples daily or anytime the mixing operation is interrupted and compare them to the standard.

3. Be prepared to mix as much of the material at one time as possible and stockpile it.

4. Each delivery truck should be inspected as the load is dumped and the mix compared against the standard.

5. Collect a one-gallon composite sample from every green, and label and store it.

6. Submit to the lab a composite sample from every third green built.

7. When moving root zone mix from stockpile into trucks, closely monitor the loader operator to ensure that the bucket is not collecting the underlying soil or asphalt and that cleated tires or tracks are not "tilling" other material into the mix.

IV. Construction

A. Location of the Green

1. Will there be plenty of air movement across the green?

2. Will sunlight be a problem in summer or winter?

3. Will tree roots compete with turf?

4. Will there be good access to the green?

5. Is there room for triplex greensmowers to turn?

6. Is a perimeter irrigation system needed?

7. Is the green site prone to flooding?

8. Is enough surface area provided to withstand anticipated traffic?

9. Are there enough hole locations?

10. If not all the greens are to be rebuilt, does the design of the new greens complement the old greens?

B. Subgrade Checks

1. Are there prior construction problems such as still-functional drain lines from the previous greens?

2. Have the new drainage outlet point(s) been identified?

3. Is the material to be used for the surrounding base of good quality?

4. Is the material free of large organic matter clumps and stone?

5. Is the subgrade smooth and compacted?

6. Are there any water-collecting hollows?

7. Has the architect approved the grades?

8. Has the superintendent approved the grades?

9. Has the club's representative approved the grades?

10. Have the grade stakes been installed and checked?

11. Are the side walls of the cavity stable?

12. Has the plastic barrier been installed along the side walls of the cavity?

13. Has the green perimeter location wire been installed?

14. Have pictures been taken of the subgrade?

C. Tile Line Installation

1. Are trenches at least 8" deep, after cleaning?

2. Are bottoms of ditches smooth and clean?

3. Is enough fall provided?

4. Are the lateral lines within 15 feet of each other?

5. Have "smile" drains been installed at each surface runoff location?

6. Has the subgrade been cleaned of soil displaced during trenching?

7. Has gravel been laid and firmed on the bottom of the trench?

8. Are connections taped or glued?

9. Are all lines completely free of buckles or bridges?

10. Have lines been "shot" to ensure proper grade?

11. Has the tile location wire been installed?

12. Have flush points been installed, capped, and marked with metal for future location?

13. Have the perimeter and tile location wires been brought to the main flush point?

14. Has the inspection drain in front of the green been installed?

15. Have pictures been taken of the finished drain tile system?

D. Gravel Layer

1. Is the gravel clean and properly sized?

2. Has care been taken not to crush drain lines?

3. Have joints been checked to ensure they are intact after gravel has been spread?

4. Is the surface of the gravel smooth?

5. Are grade stakes still intact?

6. Has the finished grade of the gravel layer been checked to ensure it "mirrors" the desired finished grade of the putting surface?

7. Have pictures been taken after gravel installation?

E. Intermediate Layer

1. Has the gravel contour been preserved?

2. Has the sand been kept moist during installation to help prevent occlusion?

3. Have grades been rechecked?

4. Have pictures been taken?

F. Root Zone Mix

1. Is the depth of the root zone mix uniform throughout the green?

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To insure that there are no pockets and that the green has positive surface drainage, a level and transit should be used in conjunction with a mechanical bunker rake.

2. Was the mixture kept moist during installation to help prevent occlusion?

3. Has the mix been firmed?

4. Have all grades been checked?

5. Have amendments been added?

6. Have samples of the mix been collected?

7. Does the finished grade mate well with surrounding soil?

G. Irrigation System

1. Has single-head control been provided?

2. Has coverage been checked?

3. Have quick couplers been installed?

4. Is a perimeter system needed?

5. Have isolation valves been installed?

6. Have all ditches been firmed and leveled?

H. Final Checks Prior to Planting

1. Have all drains been checked?

2. Have all terminal points of drains been protected?

3. Have nutrients been added?

4. Has the root zone mix been compacted?

5. Is the irrigation system completely functional?

6. Have all parties approved of final construction?

7. Is certified seed or sod being used?

8. Has enough root zone mix been stockpiled for the first year's topdressing?

9. Has all heavy equipment damage been repaired?

10. Have the surrounds been sodded to prevent erosion during grow-in?

11. Has fumigation been accomplished in areas prone to nematode, nutsedge, or warm-season grass contamination problems?

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A properly built USGA green can provide many years of dependable, relatively low-cost service. Where problems have occurred with USGA greens, often it was because shortcuts were taken or mistakes were made without someone being aware of what was happening. Developing and following a good quality control program is a small price to pay for ensuring success in the construction of the most important features of the golf course.