

Because it is extremely effective against weeds and brush and relatively inexpensive, the compound is popular with pesticide applicators. These users consider 2,4-D safe and reliable, and have used it for four decades.

Numerous government regulatory agencies and scientific organizations have studied the herbicide's environmental impact on both applicators and manufacturing employees. Their scientific evaluations conclude that 2,4-D can be produced and used with minimal risk when appropriate work practices are followed, according to the Industry Task Force.

Recent studies of Kansas and Nebraska farmers have raised concerns about a possible link between 2,4-D and a rare form of cancer, non-Hodgkin's lymphoma. However, these studies run contrary to the total weight of the scientific evidence supporting 2,4-D, the Task Force states.

Following publication of the Kansas farm worker study in 1986, a number of regulatory and scientific bodies reviewed the evidence on 2,4-D. Their consensus is that the herbicide poses minimal risk to the general public, and any risks to applicators and manufacturing workers can be minimized through good work habits and the use of protective clothing. In addition, the Task Force reports the following:

- The U.S. Environmental Protection Agency concluded that there is insufficient evidence to classify 2,4-D as a carcinogen and that "... continued use [of 2,4-D] while waiting for other data will not pose a significant hazard to the environment or public health." (March 1988)
- A special panel supported by the Canadian Center for Toxicology concluded that "... existing animal and human data are insufficient to support the find that 2,4-D is a carcinogen ..." and found insufficient evidence that existing uses of 2,4-D pose a significant threat to public health. (March 1987)
- An expert panel commissioned by the Council on Agricultural Science and Technology concluded that use of 2,4-D poses minimal risk when appropriate work practices are observed. (December 1987)
- A bulletin issued by Agriculture Canada stated, "... the safety associated with 2,4-D remains acceptable." (February 1989)

A number of studies in four different countries have not found a link between 2,4-D and non-Hodgkin's lymphoma or any other human cancer. These studies would indicate that the herbicide does not pose a threat to public health, even among the most intensively exposed persons.

The most important route of exposure is through the skin. However, studies indicate that only six percent of the 2,4-D that contacts the skin is absorbed into the body. Good industrial hygiene practices, including the proper use of rubber gloves and other safety equipment, can significantly reduce exposure.



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Members and guests of Valley Country Club have a spectacular view of the Rocky Mountains.

# Drainage Project Helps Revitalize Country Club

**C**ountry clubs have been the private parks of millions of American golfers and their families for more than a century. They have provided members with an exclusive life-style filled with amenities, including golf, tennis, swimming, sports instruction, and dining. Membership has always been a privilege, causing many to wait for years and pay tens of thousands of dollars to join.

But the country club life is now being threatened in some areas by depressed economies, shrinking water supplies, and competition from real estate development courses and improving municipal courses. Not all country clubs have waiting lists today. They have to compete for members.

Valley Country Club in Aurora, CO, is a perfect example of a middle-aged country club that has successfully fought to remain competitive. Located southeast of Denver, the club has survived all the challenges listed above by evolving with technology to meet its members' needs.

Despite a sluggish economy since 1984, the 560 members of Valley Country Club have invested millions of dollars in the personnel, equipment, and course improve-

ments necessary to stay competitive. While other courses in the Denver area are perilously close to financial disaster, Valley is healthy and gaining in quality. However, it hasn't been easy.

Golf Course Architect William F. Bell laid out the 6,800-yard course on 165 acres of rolling prairie southeast of Denver in 1955. The site was spectacular for two reasons. First is a magnificent view of the Rocky Mountains. The other is Cherry Creek, which runs through the middle of the property. Melting snow from the Rockies over millions of years carved a wide path through the valley's clay soil and deposited a deep layer of sand. Wells drilled into this alluvial pocket supplied the valley with a seemingly endless amount of water.

Half of the property is located in the floodplain of the creek, while the other half rests on its rolling banks. Bell located the front nine and the clubhouse on the bank overlooking the creek. He placed the back nine in the floodplain, relying on the fact that serious floods occurred only once every 100 years. Nevertheless, he elevated the tees and greens on the back just in case.

To this diverse topography, Bell added doglegs, tight fairways, bunkers, and tall rough to create a challenging yet very enjoyable course to play. Bunkers were positioned near every green and between 150 and 200 yards from the tee on par fours and fives. The former ranchland had few trees for Bell to incorporate into his design.

With Valley Country Club, he was taking golfers a step beyond park-type courses, where much of the rough is in play. He rewarded placement equally to distance on every shot. His approach was to encourage golfers to improve their skills gradually, rather than overwhelm them with hazards or distance.

The course grew tougher over the next 25 years with the addition of more than 2,000 trees and eight lakes. As the trees matured and the lakes were built, the course became tighter and more challenging. Today water comes into play today on all but four holes. Few members finish their rounds without the disheartening sound of a ball splashing into water or ricocheting off a tree. Time and enhancements to Bell's design have given Valley Country Club the distinction of being one of the top four courses in the state.

As the course became more challenging to play, it also became harder to maintain. Serious floods devastated the back nine far more frequently than the expected 100 years. Not only did they force the club to close and repair the course often, they left behind thick layers of silt over the sandy soil.

Strangled by the silt, the Kentucky bluegrass on those fairways could no longer recover from the traffic of players, carts, and maintenance equipment. The problem was compounded by a water table that remained near the surface for much of the year and a quick-coupler irrigation system that was difficult to manage. Annual bluegrass invaded the damp, compacted fairways in the spring and fall, but withered during the summer. Battling the symptoms of poor drainage and root growth became a full-time job for the superintendent.

For 14 years, superintendent Jim McPhilomy struggled to keep the course in shape. He converted the irrigation system to automatic control, experimented with different types of drainage products, and initiated a soil study. He implemented a program of aeration and sand topdressing in addition to overseeding the fairways with perennial ryegrasses. He added lakes to the back nine in the late '70s, when two consecutive years of drought hit the region. Treating the symptoms of poor drainage was a constant battle.

Finally, club authorities approved construction of an earthen dike along the creek. It held the spring floods at bay, but did nothing to rid the course of accumulated rainfall. Sump pumps had to be used to remove standing water trapped on the surface. After the surface water was gone, a high water table remained much of the year.



The problem was so acute that even without heavy rains, normal irrigation often presented drainage problems. Low sections of fairways and approaches were constantly soft and mucky. Carts were restricted from these areas and diseases attacked the turf, leaving it open to encroachment by broad-leaf weeds and annual bluegrass. The condition of Valley Country Club was unquestionably slipping.

Soil tests conducted by Dick Psolla of Brookside Farms Lab Association revealed that toxic levels of salts were accumulating in the soil. The turf, trees, and shrubs were absorbing large amounts of sodium and declining as a result. Psolla concluded that increasing salt levels and decreasing soil oxidation had to be corrected and a drainage system installed.

One option was to continue to treat the symptoms of poor drainage and install cart paths in the worst fairways. The other was to install drainage and forgo building the cart paths. The club also wanted to update its irrigation system. All of these would require a membership assessment to raise the funds.

In 1986, Valley was at a critical point in its history. The economy in Denver had turned sour. The municipal water district had informed the club that its supply of well water would be greatly curtailed in the next few years. Any way they looked at it, costly improvements were needed, yet the timing was terrible for an assessment. In the midst of all this, the club lost both its general manager and superintendent.

However, its luck was about to change. First it hired Manfred Baker, who had been general manager of the 5,000-member Mount Vernon Country Club. He had to appease both the golfing and nongolfing membership. The board was willing to support a plan to improve both the course and the clubhouse, even if it meant an assessment.

Baker reviewed previous proposals by McPhilomy and Psolla to gain an understanding of the course's condition and



Earthen dike holds back Cherry Creek during flood.

drainage problem. He then started looking for a superintendent who could do much of the renovation work in-house. Psolla provided Baker with a list of superintendents in the area who had construction experience. One of them was Gary Grandstaff.

Had the economy not been in such bad shape, Grandstaff would have been busy designing and building golf courses. He had worked for Pete and Roy Dye for 12 years as well as a golf course construction company. The Penn State turf graduate had a number of redesigns to his credit and considered himself as much an architect as a superintendent.

Grandstaff still had to beat out three other strong candidates. His familiarity with drainage and effluent irrigation gave him the edge he needed. But Valley Country Club got a bonus. Grandstaff put together a five-year plan, not just something to correct the drainage and irrigation problems, but an overall redesign of the course. He recommended relocating tees and traps, reshaping the greens, and moving dozens of trees.

"In the past, the club had tried to make changes piecemeal," Grandstaff points out. "They'd correct one hole at a time and then go through the approval process again for the next hole. If the board changed, you had to reexplain what you were doing to win the support of new board members. The five-year plan tied the whole project together so an overall budget could be established."

To settle any fears of the membership, Grandstaff first wanted to demonstrate to the members the effectiveness of renovation. He submitted a proposal to the grounds committee for installation of drainage and received approval. The club's maintenance staff began the project in the spring of 1987.

During the course of installation, Grandstaff was forced to divert his efforts to treating symptoms of poor drainage, including topdressing, reseeding, resodding, deep tine aeration, and applying fungicides and herbicides. By July, only the approach to the 12th green had received new drainage. When a three-inch downpour forced closure of the course on the normally busy Fourth of July weekend, it became clear that an outside contractor was needed to complete the work as soon as possible.

Grandstaff sought proposals from local contractors, suppliers, and manufacturers. He was looking for a way to solve localized drainage problems with the least disruption to play. He also wanted to lower the water table on the back nine.

A proposal by Don Clark of D. Edward Clark & Associates of Sheridan, CO, impressed Grandstaff. Clark recommended using a large amount of narrow, vertical drainpipe. The pipe could be installed in trenches less than two inches wide and as deep as 18 inches with a wheel trencher he had adapted for the purpose.

Ironically, Clark's and Grandstaff's experience with drainage did not come from problems created by old course designs. Instead, they had both devoted

*continued on page 24*



Sump pumps were used frequently to remove surface water from low spots before drainage was installed.





## Why wetting agent users are turning to Pene-Turf soil treatment.

A continually growing problem for turf managers is that of compaction reduces pore space, resulting in decreased air and water movement through the soil. Wettings agents are often used to temporarily relieve the symptoms, but wetting agents work only of the surface tension of **surface water**, improving infiltration in the top several inches of the soil.

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## Drainage Project

*continued from page 23*

much of their time to adapting irrigation and drainage systems to fit the modern designs of Pete Dye, Arnold Palmer and Jack Nicklaus.

Clark had been a designer and installation consultant for a Denver irrigation distributor before starting his own irrigation and drainage firm. It had been his job to solve some of the drainage problems presented by the spectacular creations of big-name architects.

To determine the appropriate routing and depth for flow in areas with little or no fall, Clark surveyed the holes with a transit. Since the course had no as-builts for either the irrigation or drainage, Grandstaff and Clark were at a disadvantage. A layout was completed for the four holes with the most drainage problems: numbers 10, 11, 12, and 17.

Before work began in September, Clark put together an article detailing the proposed drainage work for the club's monthly newsletter. It explained temporary course adjustments, playing suggestions, and the signs that would be used to mark construction areas. Clark went so far as to build a box to demonstrate to the grounds committee how the drainage material worked.

He concentrated his labor force in only one section at any given time. As the trenches were dug, the drainage materials were installed, backfilled with a combination of coarse and fine sand, seeded, and the surface cleaned up. By working out from the main drainlines, each new section was operational by the end of the workday. Catch basins were installed in low spots to catch runoff from storms or irrigation. All trenches were topdressed regularly as they settled.

In two months, nearly 8,500 lineal feet of drainpipe had been installed on the four holes. Grandstaff also aerated the back nine four times that fall to break up the layer of silt, which varied from two to ten inches in depth. "On the first pass the tines only penetrated an inch," said Grandstaff. "By the fourth pass, they were easily going down six inches." The crew now uses an Aerway for the fairways and a VertiDrain for the greens for periodic, deep aeration.

Observation of the course during the winter proved the immediate value of the drainage system and aeration. Playability was noticeably better than that on holes without the drains.

The following spring, Grandstaff took core samples every few days to judge soil moisture and depth. Despite two three-inch rainstorms, the water table stayed beneath the depth of the pipe. The soil was not saturated as it had been in previous springs, but it stayed near field capacity. "Between April and June, the tenth fairway received a total of ten minutes of irrigation," Grandstaff remarked. "The capillary movement of water in the soil and deeper roots generated

*continued on page 26*

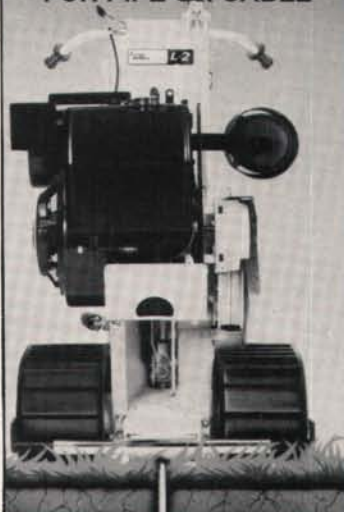
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Clark's crew installed more than 8,000 feet of vertical drainpipe in less than two months.

### Drainage Project

*continued from page 25*

by the turf over the winter were sufficient for growth."

Tests conducted by Psolla that fall after one summer's irrigation revealed a dramatic improvement in soil conditions. The pH had dropped almost half a point to 7.4. The organic matter doubled with a corresponding increase in exchange capacity. Accumulated salts fell by more than 30 percent having been leached through the soil.

"It was the first time in years that members had good turf on the back nine," said Grandstaff. "Even the Poa looked better and made it through the summer in good shape. We started spending less time putting out fires and more time on redesign work. We moved 60 trees and started relocating traps and reshaping greens. The course was definitely turning around, and the members were loving it!"

Baker and Grandstaff had earned the confidence of the membership. The members rewarded them by approving assessments for the course redesign project, a new irrigation system, improving the clubhouse, and creating a reservoir to convert to effluent irrigation. Despite a poor local economy, Valley Country Club was spending nearly \$4-million!

Clark got the go-ahead for another 20,000 feet of drainage. "I was surprised in a way that the club opted to improve its drainage system before its irrigation system," he admits. "But I also know that even the best irrigation system can't solve existing drainage problems, nor can a new drainage system solve problems with an old irrigation system. You need both to get control over water on a quality golf course."

Clark adds that new products are making drainage improvement faster, less disruptive, and more efficient. As a result, it is easier to sell to the membership of private

courses. By using specialized equipment and trained crews, companies like Clark's can provide a valuable service to superintendents whose hands are full with other tasks.

Valley is once again attracting new members. It is also attracting staff. Baker's insistence on hiring experienced personnel is paying off. In 1989, when Dye asked Grandstaff to take over construction of the Pete Dye Golf Club at the Burning Embers Resort in Clarksburg, WV, he couldn't resist. Resort owner James LaRosa also promised Grandstaff he could design a second 18-hole course when he complete the Dye course. "It was just too good to pass up," says Grandstaff.

Rather than leaving Valley in the lurch, Grandstaff contacted John Hoofnagle, superintendent of grounds for the Meridian Golf Club and Denver Tech Center in nearby Englewood. "As John responsibili-

ties grew, he was getting away from golf," explained Grandstaff. "Meridian is a Jack Nicklaus course, so John was very familiar with the challenges presented by championship designs and the irrigation systems they require."

One meeting with Baker was all it took Hoofnagle to agree to the switch. "Valley is a nice family club which has made the commitment to quality golf," states Hoofnagle. "It is providing the weapons it takes to produce that level of play."

Like Grandstaff, Hoofnagle is a graduate of the Penn State turf program and familiar with golf course construction since working for five years with Golf by Al Janis in Berlin, MD. His eventual position at Meridian was proof of his grasp of design, construction, and maintenance.

"We're about halfway through the redesign of Valley," he states. The as-builts from Clark and Grandstaff's five-year plan have been essential to the design and installation of the Toro Network 8000 irrigation system. The system was designed by Rick Robbins, who impressed Baker with his work at Inverness Golf Club in Englewood. Valley Crest Landscaping is installing the system.

"By this June we'll have the whole system up and running," says Hoofnagle. "This winter we got a head start on programming the central computer. The weather station should help us cut our water use and speed up the conversion to effluent."

Baker reports that Valley is close to filling its roster of 530 golfing members. The new clubhouse sits on a ridge above the totally turfed fairways. The effluent reservoir is completed and the club is prepared to function without well water for irrigation. Almost two months have been added to the course's busy golf season.

"Valley Country Club is in good condition today," boasts Baker. "Not all clubs can say that. It's taken a lot of work by the board and the staff to get to this point. Country clubs, if they want to stay country clubs for long, can't stand still. We have to stay competitive to stay alive." ●



Wheel trencher adapted by Clark cuts narrow trenches up to 18 inches deep.



## TURFGRASS INSTITUTE FUND-RAISING CAMPAIGN

With a \$500,000 donation from George M. (Mac) Frost and his wife, Beth, who have owned and operated golf courses in the Toronto area since 1946, the \$1.5-million fund-raising campaign for the Guelph Turfgrass Institute is off to a healthy start.

"Money that is raised by the campaign will provide the institute with a research and information center that will serve as a focal point for the Canadian turf industry and public," said Ron Craig, president of the Ontario Turfgrass Research Foundation. "The new center will provide services to alleviate some of the pressures caused in recent years by the housing boom, increased demand for open park space, and more outdoor leisure activities."

Established in 1987, the Guelph Turfgrass Institute conducts research and extension activities, and supplies information on turfgrass production and management to all sectors of the industry. The center will house world-class facilities for research and education, policy development, conferences, public access to publications, and computer-reference material.

The institute is a joint project of the Ontario Turfgrass Research Foundation, the Ontario Ministry of Agriculture and Food, and the University of Guelph. Recent research carried out by the institute focuses

on turfgrass management and renovation, weed control and growth regulation, pesticide residues, soil and nutrition, and turfgrass seed production.

## NEBRASKA TURFGRASS FOUNDATION ELECTS OFFICERS AND DIRECTORS

The Nebraska Turfgrass Foundation has elected officers and directors for 1990. Hans Bross of Westlawn-Hillcrest Cemeteries in Omaha serves as president. Carlos Stimson, senior technical representative for O.M. Scott & Sons Pro-Turf Division in Omaha, is the new vice president Dale Amstutz, Northern Lawns of Omaha, is secretary-treasurer.

Newly elected board members for a three-year term are Craig Ferguson, golf course superintendent of Lochland Country Club of Hastings, and Bill Jensen, senior territory manager of Big Bear Equipment in Omaha. Reelected for a second term on the board is Twyla Hansen, grounds manager at Nebraska Wesleyan University in Lincoln.

Carryover board members are Bill Bieck, golf course superintendent of Heritage Hills Golf Course in McCook; Dick Neumann,

golf course superintendent of Holmes Golf Course in Lincoln; and Steve Paustian, director of recreation for the City of Grand Island. Larry Hergott, golf course superintendent at Quail Run Golf Course in Columbus, is immediate past president.

## PESTICIDE REGULATIONS RECEIVE SETBACK

In a recent opinion, the Appellate Division of the New York State Supreme Court held that before issuing regulations requiring public notification that pesticides have been sprayed, the state Department of Environmental Conservation (DEC) should have conducted an environmental impact study to assess the economic and social impact of the rules. The ruling was welcomed by farmers, horticulturists, lawn care companies, and restaurateurs, who claimed that the rules would severely hamper attempts to reduce the amounts of pesticides they use.

"The court's decision is a great victory for reason over regulation," said Charles Wills, state Farm Bureau president. "The court's ruling confirms and supports what the Farm Bureau has been saying all along. DEC clearly has limits to its authority."

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# CHALKBOARD

## TIPS FROM THE PROS

### ADVANCES IN ATHLETIC FIELD IRRIGATION DESIGN

**S**afety is the most important consideration in athletic field irrigation design today. Manufacturers, designers, and contractors all want to avoid the possibility of litigation in the event of an injury. But they also have a responsibility to provide irrigation systems that are efficient, reliable, and reasonably maintainable.

The safety debate is not just about sprinkler heads being located on a field. It extends to conditions caused by improper zoning, lack of control, poor spacing, and installation. Add water conservation to these concerns and you can see the justification for the following trends in athletic field irrigation design.

Sprinkler heads aren't allowed on the playing surface of European soccer stadiums, points out Robert Symonds, director of international marketing for Toro Irrigation. Stadiums must therefore use "big guns" on the sidelines and supplement with travelling sprinklers for the center of the field.

This runs against what U.S. irrigation manufacturers are finding as the best way to provide a safe sports surface. "Sports turf managers need the ability to apply water according to wear," says Symonds. "To do this, they need either individual head control or zones arranged to fit areas of similar wear. You don't want to irrigate the goal mouths of a soccer field or between the hashmarks on a football field the same way you do other areas. They don't have the same wear and are likely to have different infiltration rates and water needs."

"The best way to prevent injuries is to keep grass thriving," claims Kirk Thompson of Buckner. "In the past, designers have placed too much attention on precipitation rate. You can't assign one precipitation rate for an entire field and build a system around it. Instead, you need to address the water requirements of each unique part of a field to maintain an adequate amount of soil moisture and acceptable salinity level during the peak growing season. By balancing spacing, pressure, and flow rate for each part of a field, and backing it up with proper controls, the designer provides the best growing conditions for sports turf."

For these reasons, heads must be located on the playing surface. To counter concerns over safety, manufacturers have developed heads with a smaller exposed surface. Examples include the Hunter I-40, the Toro 640, and the Rain Bird R-70. By installing these heads with a rubber cover and flush with the surface, very little of the



sprinkler is exposed. Hunter also offers a sod cap for its I-40 to cover it completely.

"Too much attention is paid to the size of heads," counters Thompson. "Smaller doesn't necessarily mean safer. Tests have shown that a large, rubber-covered sprinkler displaces an impact better than smaller heads. The issue should be how the sprinkler performs, how reliable it is, and how easy it is to maintain. Impact or cam-drive heads may have a larger exposed surface, but they also have a strong record of reliability and uniformity of application."

To achieve more control over irrigation, many sports complexes are installing valve-in-head sprinklers, explains Sally Prusia of Rain Bird. These can be operated individually or in small groups. Pressure-regulating valves on each head provide a constant pressure not available with battery systems.

"The goal today of irrigation is to apply the minimum amount of water to a defined area at the correct intervals for optimum turfgrass growth and safety of use," she summarizes. "Valve-in-head sprinklers run by solid state controllers with water-saving features give precise control."

The norm used to be zones of five or six heads operating at long distances and high pressures. Today, the number of heads per zone is decreasing as well as the operating pressure, says Thompson. "We are now seeing more systems designed with heads operating at 55 to 60 psi with tighter triangular spacing ranging from 50 to 60 feet. More attention is being paid to spray trajectory, droplet size, and overlap. We are using more part-circle heads on sidelines and near skinned areas of baseball fields. It all adds up to greater control and better turf."

"There aren't enough irrigation designers specializing in athletic fields," states Lynda Minchin of Hunter Industries. "Many stadiums and parks have fields which are used for many different sports. Different field configurations have different irrigation needs. Designing a system with enough

flexibility for these facilities takes a professional who understands their needs."

One trend is the increasing flexibility of heads by offering interchangeable nozzles or adjustments for spray arc, radius, and flow. Changes can be made in the field to allow one head to operate in a variety of ways.

Minchin points out that vandalism is often the cause of a malfunctioning head. By enclosing the working parts in a case they are out of reach of vandals. She says that closed-case rotors can be repaired by changing the sprinkler core. This eliminates the need for stocking a wide assortment of repair parts or employing someone with the skill to make repairs in the field in case of unexpected breakdowns.

Other items can help protect heads in the field. Swing joints allow the head to move when hit by players or maintenance equipment. Check valves stop low head drainage and eliminate soft spots near heads. Contamination-proof valves and filtration systems allow sports complexes to use non-potable or reclaimed water without damage to heads.

Flexibility is also an important feature of solid-state controllers. Cycle repeat, water budgeting, moisture sensor overrides, and more precise station programming allow sports turf managers to customize irrigation schedules. Large systems with central computers can also receive feedback from components in the field to alert the manager of malfunctions. The ultimate so far is utilizing feedback from weather stations and pump stations to reduce water and energy consumption.

"The bottom line is safe, durable turf," says Minchin. "That demands greater control and flexibility from irrigation systems. It's important for sports turf managers to stay on top of advancements in irrigation technology. A lot has changed in the past ten years that they need to know about to provide their facility with the safest possible turf."