From Rubbish!
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CHAPTER 4

INTO THE UNKNOWN

Anyone who has made the trip along the upper gullet of the New Jersey Turnpike as it disgorges traffic toward the George Washington Bridge is familiar with the Hackensack Meadowlands. This vast glacial fen runs roughly from Newark, New Jersey, to Nyack, New York, parallel to the Hudson River, and is separated from Manhattan by the Hudson and the long, craggy spine of the Palisades. The southern approach to the Meadowlands is heralded by a grim landscape of chemical plants and refineries, licks of flame dancing beneath the hazy gray of the sky. Across the Meadowlands arc twisted roadbeds at what seem to be arbitrary and unnecessary heights. Below, small pools and channels can be glimpsed among the tall reeds, and there are moments even now, as a turn in the road affords a certain view, when the awesome sweep of this wetland in its nativity can be imagined still.

Such moments, of course, are rare. More commonly the eyes take in the massive mounds of garbage, some of them fifteen stories high, that have been dumped in the Meadowlands—blanketed in some cases by a film of dirt, and picked over every second of the day by a scavenging of gulls. More than a hundred communities once dumped their garbage into the Meadowlands, and garbage dumps cover three square miles of it. Almost all of this garbage was deposited in the days before measures were routinely taken to prevent or minimize seepage (as is now mandated by federal regulations). While systems to vent methane gas and control leachate exist at a few of the Meadowlands repositories, most of whatever is leaking out of the vast majority of them is leaking right into the water—into the Hackensack River, eventually, and then into New York Harbor. All but one of the Meadowlands dumps are now shut down (the last covers a mere seventeen acres) but the damage has been done. The mounds may not be permanent eyesores—skillful landscaping has beautified many such sites—but their contents could foul the area for decades to come.

The Australian archaeologist Rowland Fletcher calls the largest monuments that any society builds for itself MVSes—Monstrous Visual Symbols. Fletcher has noted that over the centuries, as a society's motivating ideals undergo change, so do its MVSes: from, say, temples and cathedrals to bridges and skyscrapers. The Hackensack Meadowlands are a potent reminder that the largest MVSes in American society today are its garbage repositories. Archaeologists believe that the biggest prehistoric MVS in the New World is the Pyramid of the Sun, at Teotihuacan, which was built in Mexico around the time of the birth of Jesus. Its volume is 75 million cubic feet. The garbage dumps in the Meadowlands exceed that volume many times over, as do most big-city landfills. In the San Francisco Bay area, the volume of the Durham Road landfill has already reached 150 million cubic feet; it has been built from the municipal solid waste of three moderate-sized towns over a period of only fifteen years. Fresh Kills, of course, is many times larger still. These MVSes may not be Chartres, but they are not without a certain grandeur. Many are surrounded by low brush which snags the thousands of thin plastic bags of various hues that blow from the dumping site, and at dawn the sun lights this perimeter in vibrant color.

Landfills are fitting symbols of many of the developed world's twentieth-century preoccupations—and they are great wellsprings of mythology as well. It is somehow fitting that the Hackensack Meadowlands Development Commission chose in 1989 to lodge a garbage

museum in the environmental center at DeKorte State Park, which covers a two-thousand-acre tract of not-quite-pristine wetlands that abuts a ridge of dumps. One striking floor-to-ceiling exhibit through which visitors are able to walk is a bright, cavernous jumble of trash. The structure is the work not of a sanitation professional but of a thirty-year-old artist from Newark, Robert Richardson, whose intentions included making visitors feel that garbage was about to engulf American society. "They'll feel that the garbage climbing up the walls is overwhelming and at some point might fall over," Richardson told a reporter. "That's good."

To most visitors the contents of the display no doubt seem visually synonymous with the contents of American garbage in general, and thus with the contents of a typical landfill. Look: There are the empty boxes of Brillo and Tide, the plastic jugs and protective foam cartons, the disposable diapers, the bottles and cans, the fast-food packages—all of these things, assuredly, items that do get thrown away, that one does find in garbage and in landfills. But the popular perception of garbage sometimes does not accord fully with reality. If a worker from the local department of sanitation were invited over to the garbage museum at DeKorte State Park and asked to point out to visitors how the garbage he has to deal with every day differs from the garbage displayed in Robert Richardson's construction, he might note, to begin with, that there seems to be no dirt mixed in with this garbage, and yet each day's deposits in a real landfill are tucked in with a layer of dirt. He might note that there is no construction and demolition debris, and no food and yard waste or, indeed, organic waste of any kind—no grease-soaked newspapers, no discarded trays of kitty litter, no sewage sludge. (He would, of course, understand *why* there was no organic waste at the museum; it is for the same reason that verisimilitude is kept at bay in colonial Williamsburg.) Our visiting sanitation worker might note that there is a good deal more plastic on display at the garbage museum than you would actually find in most landfills, and a lot less paper. He might note that none of the garbage appears to have been crushed, even though most garbage in a real landfill looks as if it has been run over by a forty-two-ton compactor, which it often has. And he might conclude with the obvious observation that the garbage on display gives off no smell—perhaps venturing to remark, and speaking as a connoisseur, that the bouquet of a well-managed sanitary landfill, though it hangs more thickly than more desirable atmospheres, is not entirely unpleasant.

How wide the gap may be between garbage myth and garbage reality surely varies from one specific issue to another, but there is probably no issue relating to garbage where a gap does not exist. In the Meadowlands garbage museum a life-sized, three-dimensional tableau depicts a twentieth-century American family blithely throwing away plastic cups and sheets of aluminum foil; instead of faces, the display's human figures have mirrors, inviting visitors to see themselves in similar situations. Those mirrors are apt symbols of much of the conventional wisdom about garbage, which often simply reflects the misinformation that people bring to the subject. The result, inevitably, is a closed system of fantasy and shortsightedness that both hampers the effective disposal of garbage and leads to exaggerated fears of a garbage crisis. A growing body of research findings from Garbage Project landfill digs and other investigations has begun to provide redress. We will look at that research in a moment, after a brief excursus into the history and architecture of the sanitary landfill.

From the perspective of history, the idea that modern landfills should now be deemed to be a major social problem—which is certainly the widely accepted view—is rather ironic. The sanitary landfill started out in life as a solution to the twin problem of garbage incinerators that befouled the air and the malodorous open dumps that ringed American cities like vile garlands. In the United States there still exist a multitude of open dumps, a few of them official or semiofficial repositories, many more of them representing informal and illegal accretions of garbage. As Garbage Project and other studies (notably John Hohmann's "Trail's End" study mentioned in chapter three) have pointed out, any deserted area where a road suddenly terminates is likely to serve as a local dumping site. The pattern is all too familiar. The immediate roadside area is littered with odds and ends. In a broader circle beyond are beer and soda cans and broken bottles —probably tossed from cars. Beyond them are thrown-away durable goods: abandoned cars, decomposing sofas, rusting mattress springs.

These road-end sites are eyesores at the very least. Those (mostly in rural areas) where organic garbage is still discarded can be disturbing structures indeed, to both eye and nose.

Taken as a whole, illegal dumping sites of one kind or another are surprisingly numerous; one Garbage Project survey by a University of Arizona undergraduate, Steven Clifford, of the accessible desert around Tucson found a total of more than seventeen hundred such sites of various sizes, most consisting of what appeared to be one big load of one household's garbage. But while these dumps may be unsightly and numerous, the percentage of any city's garbage that is disposed of in open dumps is quite small. Most of the garbage now goes instead to that enduring legacy of the Progressive Era, the sanitary landfill, a repository whose operations are today regulated by an increasingly stringent but by no means perfect web of state and federal strictures. Owing to budget constraints and lax enforcement, about half of all sanitary landfills in operation today are operating without permits.

A sanitary landfill, in its simplest form, is one where every day all the new garbage that has been hauled in is covered with six inches or so of some material that is relatively inert and won't decompose: soil, mainly, although crushed glass and even a plastic foam (one brand is called "Sanifoam") have been used. The civil engineer Charles Gunnerson made note, in his study of refuse accumulation in ancient Troy, of the parallel reliance in that city and in cities of our own time on covering garbage with layers of dirt; he found modern landfill management "reassuring" as a result, and indicative of "the role of the earth in assimilating wastes and controlling odors since ancient times." The dirt cover also helps to keep pests to a minimum.

Who invented the modern landfill? Most conventional accounts say that the British did, in the 1920s; the procedure was known in Britain as "controlled tipping." But according to the historian Martin Melosi, one can find examples of something like sanitary landfills in America even earlier: in Champaign, Illinois, in 1904; in Dayton, Ohio, in 1906; in Davenport, Iowa, in 1916. Wherever the concept first happened to appear, the impetus was a concern for public health. Even before the role of bacteria and viruses in the onset and spread of disease was well understood, people had made the connection between sickness in the community at large and the open dumps nearby. This perception inhered in the now discredited "miasmic theory" of disease, which attributed contagion to poisonous gases that were said to emanate from sewage and rotting organic debris. The specter of "miasmas," invoked repeatedly by public-health officials and newspaper editorialists, spurred urban cleanup efforts on a broad front. As is frequently the case in the history of human progress, some good things ended up happening for all the wrong reasons.

The sanitary-landfill idea at first caught on very gradually, though by the 1930s a number of examples could be found on both coasts, in New York and California. The term "sanitary landfill" itself seems to have been coined in the early 1930s by Jean Vincenz, the commissioner of public works of Fresno, California. The procedure received perhaps its biggest boost during the Second World War, when the Army Corps of Engineers adopted it as the disposal method of choice for U.S. military facilities—a move that had the twin effects of making millions of servicemen aware of sanitary landfills and training thousands of people to operate them. Sanitary landfills came to be regarded as an obviously preferable solution to smoke-belching incinerators—the acrid means used by most cities at mid-century for getting rid of the bulk of whatever garbage they managed to collect. And landfills, which were designed to be covered over and landscaped or even built upon once their life as landfills was at an end, could, if placed in the right locations to begin with, help turn marginal terrain, such as wetlands, into productive real estate. The notion that one could both solve a problem and in so doing create wealth has always held powerful appeal for Americans. It is hardly surprising, then, that possession of a landfill was seen as a hallmark of a well-managed city. By 1945, about a hundred American cities had created sanitary landfills. Within fifteen years the figure was fourteen hundred.

The exact recipe for the perfect landfill has changed with time and the popularity of various theories. Many of the basic principles, however, have remained constant. The first consideration—and the one for which the criteria have changed most radically—is the site itself. As noted, it was once believed that sanitary landfills should be situated in such a way as to help reclaim wetlands and other low-

lying areas. This view has turned out to be doubly wrong: Wrong because the environmental importance of wetlands was not well understood, and wrong because the hazards of the liquids that may drain out of landfills were also not well understood. As a result, many of the earliest landfills were put in the worst places imaginable, and we are living with the consequences. Much of the animus directed at new landfills has its origin in the nasty reputation of old ones.

Today the emphasis is on using hydrogeologic studies to site landfills in places where contamination of ground and surface water can be avoided. Rainfall runoff patterns are taken into account, and sites are chosen, ideally, where the underlying matrix—that is, the *configuration* of underlying soil and rock—has a hydraulic conductivity in the range of 10^{-6} or 10^{-7} centimeters per second. The 10^{-6} range would include matrices that consist of silt-clay-and-sand mixtures, silt-and-clay mixtures, laminated sandstone, shale, and mudstone. The 10^{-7} range would include matrices that consist of a formation known as "massive clay," and also large formations of igneous and metamorphic rocks. The point is: The best sites are those where fluids will have considerable difficulty making their way beyond the landfill's boundaries and into bodies of water. Some places in America are so geologically unsuited for landfills—most of Long Island and much of Florida, for example—that building new ones there is virtually out of the question.

At some landfill sites garbage is simply piled on the earth's unbroken surface, but more often the next step is to dig a great hole—one that is usually from twenty-five to fifty feet deep, though it can be deeper. On occasion, a cavity may already exist at an appropriate site: A large number of holes have been dug in the United States—and never refilled—in the course of extracting coal, copper, gravel, and other natural resources. However, these holes are almost always either too far from population centers to serve as convenient landfills or are formed of matrix materials that are just too permeable. Most sanitary landfills have to be dug. If a hole is indeed excavated, the soil is saved to use for the daily cover. Whatever the origin of the cavity, today it will usually be lined before it goes into service, most often with several feet of dense clay and then with thick plastic liners made of strips that have been hot-sealed together. (Because regulations to this effect are recent, two thirds of all sanitary landfills—primarily the oldest ones—do not currently have liners.) When the liner is in place it is covered by several feet of gravel or sand.

Landfills produce a watery potage that drools to the bottom, and this leachate, as it is called, has to be anticipated and dealt with. The bottom contours of the newest generation of sanitary landfills are designed so that fluid, be it rainwater or Lemon Fresh or Budweiser or Olde English furniture polish, will flow toward drains through which perforated pipes have been threaded. The collected liquid is dealt with in a variety of ways, depending on whether the landfill operator subscribes to the "wet-landfill" or "dry-landfill" theory. The wet-landfill theory, which these days is adhered to by a tiny minority, holds that landfills should be saturated with as much liquid as possible in order to promote bacterial growth and biodegradation. Leachate is collected, sometimes treated, and pumped back to the top of the landfill, and thus is constantly recirculating; among other things, it is hoped that much of what is harmful in leachate will be absorbed or degraded as it percolates through fresh dry garbage. Landfills of this kind are illegal in most states and may well soon be extinct.

The dry-landfill theory—the one that the Environmental Protection Agency currently prefers—begins from the assumption that the drier a landfill is the less risk it poses of contaminating ground water. In dry landfills the leachate is collected and most of it does get treated. Some landfills have their own treatment plants; they treat the leachate like sewage, separating out the water, which is purified and released, and either dumping the solid sludge back into the landfill or burning the sludge and dumping the ash back into the landfill. Most landfills, however, send the leachate to the local municipal sewage facility. There, several things can happen to it. The water, of course, is always separated out, cleaned to regional standards, and released into a local river or the ocean. The rest is turned into sludge. The sludge is either dumped in the ocean, dumped in a landfill, burned, or used as fertilizer. If the content of the leachate is deemed hazardous, it is subject to the usual slew of regulations, and is eventually sent, at great expense, to a Subtitle C hazardous-waste disposal site.

Another substance that landfills can be counted on to produce is

methane gas, a byproduct of decomposition. At many new landfills in the United States, within about five years of opening, augers will have drilled holes into the accumulated deposits from surface to bottom. Perforated pipes are inserted into the holes to draw off the methane, and are surrounded by gravel. At some landfills the methane gas sucked into these pipes is simply burned off or released into the atmosphere. At others the vents are connected to a storage station, where the methane is purified and then used to generate power locally or sold as fuel. With the help of engineering maps and accurate measurements of elevation an experienced bucket-auger handler, like the Garbage Project's Buddy Kellett, can drill a methane well with great precision, stopping the bit's advance inches before it pierces the lining, which would compromise the landfill's environmental integrity. (Piercing the liner is the landfill equivalent of a surgeon's accidentally perforating the gastrointestinal tract; neither mistake is necessarily irreparable, but neither should happen.) The operators of some of the newest landfills have begun setting a lattice of methane pipes into place before any garbage has even been dumped. The first pipes to be installed are short ones, and over time the pipes are extended, growing in height at the same pace as the landfill.

The daily tipping of garbage into a landfill is an orchestrated mechanical pavane that may begin as early as midnight (Fresh Kills runs twenty-four hours a day), but more usually starts at around 5:30 in the morning, when big mother-hen packer trucks or rigs pulling rectangular packer rolloffs from transfer stations file in noisily and deposit their cargoes across that day's "open face," in rows of piles, each tens of feet long and ten to twenty feet high. The piles are laid either on the top rim of the existing garbage glacier or in front of the bottom edge of the garbage pack—that is, either on top of or directly in front of the previous day's garbage. Next, bulldozers and machines called compactors that have five-foot-wide studded rollers push or squash the fresh, supple garbage into tight communion with the dirt-covered and somewhat more wilted deposits of the day before. By early afternoon all the garbage from a single day—a "cell" in the jargon of many landfill operators, although the terminology is not universal—has been pressed into place. From the side, the row upon row of cells looks like an arrangement of dominoes on their sides, leaning one against the other as if frozen at the moment of mid-collapse. As the garbage trucks become less frequent, special double-jointed vehicles with bays for bellies crawl up the dirt mounds near the garbage pit, fill up, rumble over to the latest cell, drop their loads, and return for another bellyful. Bulldozers coax the dirt so that it neatly covers the garbage.

In a typical landfill a cell is about twenty to thirty feet thick, twenty to twenty-five feet high, and a hundred feet long. Day by day, cell by cell, garbage spreads across the floor of a new landfill until it hits the far side. At that point a new layer—known as a "lift"—is begun. As a landfill's lifts accumulate, slopes and contours are shaped according to preplanned engineering specifications in order to direct rainfall runoff, give access to trucks and earth-moving equipment, and keep garbage avalanches at bay. Even after the final cap is bulldozed into place (the cap, which lies atop an especially thick stratum of dirt cover, is typically made of the same clays used to line the bottom of the landfill, thus helping to deflect rainwater around the whole structure) and the landfill is officially closed, the site will continue to produce methane gas for another fifteen to twenty years, and methane wells therefore must continue to operate. Nevertheless, soon after closure most contemporary landfills are landscaped and developed, and embark on second careers as golf courses, parks, or industrial estates, with only the methane wellheads, poking up like periscopes, to hint at the location's previous identity. In three or four decades nothing but the wellheads on the ground's surface will suggest to passersby the broken tricycles and crushed cereal boxes and millions of newspapers that lie underfoot. The amount of land that has been "recovered" during the past couple of centuries from landfills and other garbage repositories is extraordinary. The present contours of virtually every portion of New York City and the neighboring parts of New Jersey and Long Island have all been shaped by fill, much of it garbage (see Figure 4-A). Few people today have very much awareness that the local landfill is destined for an afterlife, or that many landscapes they take for granted conceal distinctly checkered pasts.

In many respects, then, our own civilization carries on the tradition passed along by previous ones: Rather than being buried by our garbage, we are rising above it. Modern sanitary landfills are expen-

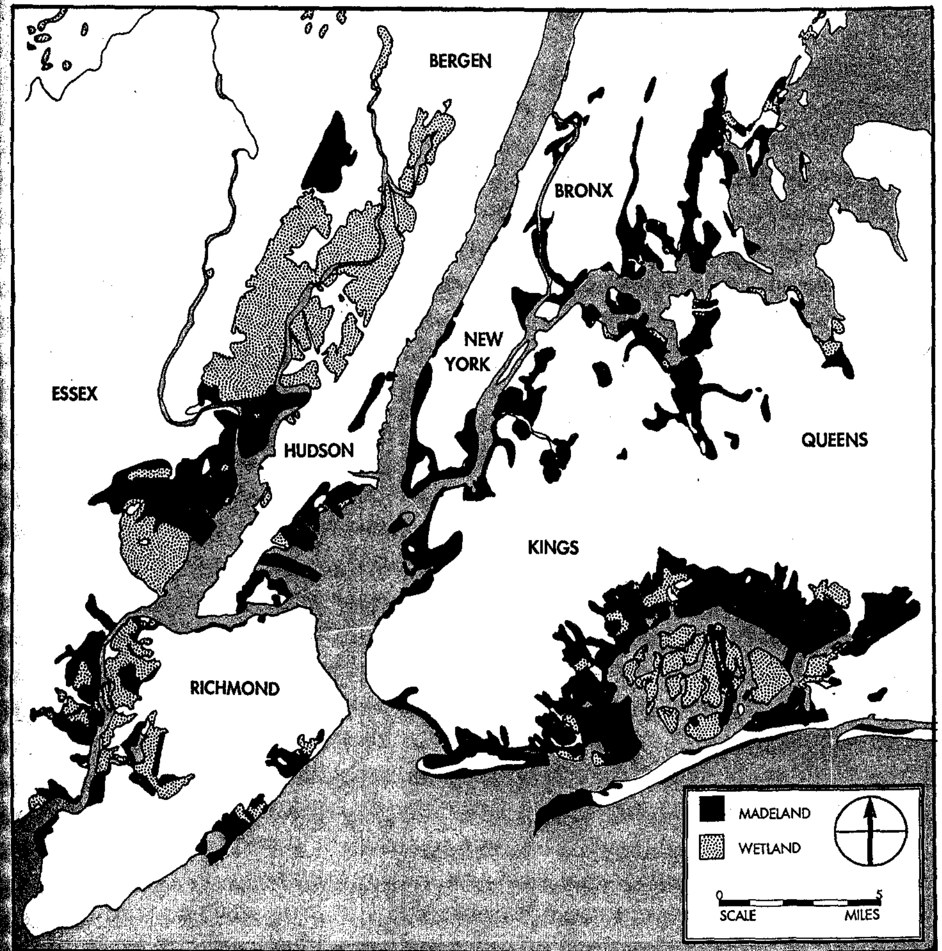

Figure 4-A. The shaded sections represent those parts of the New York metropolitan area—former wetlands, in many cases—that, as of 1966, had been built up into solid land out of various kinds of debris, including large amounts of municipal solid waste.

SOURCE: *Waste Management,* Regional Plan Association, New York, 1968 sive to build—the construction of an eighty-acre landfill (which at present generation rates would serve a community of 500,000 for twenty years) would cost about $33 million, and the cost of closing the landfill when it was filled would be another $8 million. Two facts must be borne in mind. First, there can be no such thing as a world without landfills. They are an inevitable part of any conceivable garbage-disposal regime. Recycling and incineration, for example, both result in the production of wastes that must be landfilled. Second, new landfills are better sited and better designed than old ones. They may not be the most welcome of neighbors, but when we, as a society, decide not to open new landfills, we have also decided, by default, to continue living with the landfills that already exist, some of which may be problematic in character.

The Garbage Project began excavating landfills primarily for two reasons, both of them essentially archaeological in nature. One was to see if the data being gleaned from garbage fresh off the truck could be cross-validated by data from garbage in municipal landfills. The second, which derived from the Garbage Project's origins as an exercise in the study of formation processes, was to look into what happens to garbage after it has been interred. As it happens, the first landfill excavation got under way, in 1987, just as it was becoming clear—from persistent reports about garbage in the press that were at variance with some of the things the Garbage Project had been learning—that an adequate knowledge base about landfills and their contents did not exist. It was during this period that news of a mounting garbage crisis broke into the national consciousness. And it was during this period that two assertions were given wide currency and achieved a status as accepted fact from which they have yet to be dislodged. One is that accelerating rates of garbage generation are responsible for the rapid depletion and present shortage of landfills. The other is that, nationwide, there are few good places left to put new landfills. Whether these propositions are true or false—they happen, for the most part, to be exaggerations—it was certainly the case that however quickly landfills were being filled, the public, the press, and even most specialists had only the vaguest idea (at best) of what they were being filled up *with*. Yes, think tanks and

consulting firms have done some calculations and come up with estimates of garbage quantities by commodity, based on national production figures and assumptions about rates of discard. But until 1987, when the Garbage Project's archaeologists began systematically sorting through the evidence from bucket-auger wells, no one had ever deliberately dug into landfills with a view to recording the inner reality in minute detail.

The Garbage Project was not without some slim archaeological precedent, which dates back to the summer of 1921. While writing up his now-famous dig at Pecos Ruin, on the headwaters of the Pecos River in San Miguel County, New Mexico—a study based on stratigraphic excavation techniques, which established the culture sequence among native peoples in the American Southwest—the pioneering archaeologist Alfred Vincent Kidder worked at Phillips Academy, in Andover, where he was a member of the department of archaeology. Kidder, the first American archaeologist to recognize the significance of stratigraphic layers in ancient ruins and ancient rubbish, became intrigued by a large trench that was being cut through the town of Andover's garbage dump to hold a multicommunity sewer pipe, and he spent a considerable amount of time at the work-site, down in the trench. He was able to see clearly in the strata the transition in light fixtures from whale-oil lamps to light bulbs. He was much taken with Milk of Magnesia bottles, because unlike many bottles the brand name was embossed on the glass, making for easy identification. Just about all archaeological excavations turn up objects whose purpose cannot be determined (these objects, it sometimes seems, always end up being thrown into the catchall category "religious paraphernalia"), and the Andover dig was no exception: Kidder found a large number of mysterious pieces of flat, rusted iron, some twelve to fourteen inches long. "I couldn't imagine what they were," Kidder would later write. "I took one of them and Madeleine [Kidder's wife] didn't know what they were, and I showed them to my mother, who was visiting us at the time. She said, 'Oh, those are corset bones. When your corset wore out we used to roll it up and tie it with a string and throw it in the rubbish.' They were made of metal. The whalebone ones had gotten to be so expensive that no one used them anymore."

Kidder's brief, serendipitous peek inside the Andover dump has become the stuff of archaeological lore—from the Garbage Project's point of view, it holds a status equivalent to Wilhelm Konrad Roentgen's serendipitous discovery of X rays, in 1895, at the Royal University of Wurzburg, or Alexander Fleming's accidental discovery of penicillin, in 1928, at St. Mary's Hospital, in London—but for more than six decades, strangely, no one followed Kidder's lead.

The first landfill excavated by the Garbage Project, in April of 1987, was the Vincent H. Mullins landfill, in Tucson (the landfill is named, appropriately, for a sanitation supervisor who in the early 1970s had delivered fresh garbage samples to Garbage Project crews). In the years since then, eight other landfills around the United States have been opened up and explored. The landfills were selected to represent varying climates and levels of rainfall, varying soils and geomorphology, and varying regional lifestyles; the garbage deposited in these landfills has been accumulating in some cases for more than forty years. As of mid-1991 the sample included two landfills in Arizona (Mullins in Tucson and the Rio Salado landfill in Tempe, both unlined; average annual rainfall, eleven inches; sandy soils used as cover; garbage deposited since 1952). There were two in California, at the southern end of San Francisco Bay (the Durham Road landfill, in Fremont, and the Sunnyvale landfill, in Sunnyvale, both unlined; average annual rainfall, twenty-three inches; gritty, loamy soils used as cover; garbage deposited since 1964). There were two in the Chicago suburbs (the Greene Valley landfill, in Naperville, and the Mallard North landfill, in Hanover Park, lined and unlined, respectively; average annual rainfall, twenty-nine inches; average annual snowfall, thirty-eight inches; dense clay soils used as cover; garbage deposited since 1970). There were two in the vicinity of Naples, Florida (the Collier County landfill, in the Everglades, and the Naples Airport landfill, on the south side of the airport, lined and unlined, respectively; average annual rainfall, eighty inches; sandy, loamy soils that must be trucked in used as cover; garbage deposited since 1974). And there was one in New York City (the Fresh Kills landfill, unlined; average annual rainfall, forty-three inches; average annual snowfall, twenty-eight inches; no soil cover used because the landfill is in operation twenty-four hours a day; garbage deposited since 1948). Additionally, in the pursuance of specific projects there have been limited excavations at two other

U.S. landfills, both in Tucson.* Several major excavations lie ahead. The fond ambition of the Garbage Project's staff is to be able one day to add to this list of excavated sites a garbage-dumping ground outside of London that has been in continuous use since at least the fifteenth century.

In terms of their environmental context, the differences among these landfills are extreme. In the Arizona desert the riverbeds are dry for three-quarters of the year, and then run in torrents during the late summer rainy season. In semitropical Florida, alligators sun themselves within sight of landfills and even bask in the leachate ponds. What is striking, however, is the extent to which the contents of these landfills seem to be relatively uniform from one part of the country to another. During its nine U.S. landfill excavations the Garbage Project retrieved 206 samples from sixty-five auger wells (up to eighty feet deep) and numerous backhoe trenches (dug to a depth of twenty-two feet), and exhumed a total of 28,426 pounds of garbage; the wells and trenches at each landfill were placed to ensure a representative sampling by date of refuse deposition. When commodity categories are compared from one landfill to another, the variance turns out to be negligible. For example, by weight the amount of rubber retrieved from the Mullins, Durham Road, and Greene Valley landfills fell in all cases at between 0.4 and 0.6 percent of the total weight of the refuse samples taken at each place. In all nine landfills textiles varied between 2.1 and 3.6 percent of refuse weight. The similarities extended to paper, plastic, and metals—indeed, to every category available. (Some of the slight differences that did exist, such as the somewhat lower proportion of paper in California's garbage than in that of Illinois, reflect different rates of recycling from place to place.) The lack of much variance is a reassuring indication that the Garbage Project's findings with respect to landfill content are dependable.

One key aim of the landfill excavations was to get some idea of the volume occupied by various kinds of garbage in landfills. Al-

* As noted in chapter one, four garbage sites in Canada have also been excavated, all of them in Ontario. They are the Burlington landfill, in Burlington; the Brock West landfill, in Pickering; the Oakville landfill, in Oakville; and the West Mall dump, in Etobicoke. A total of three tons of garbage was sorted at the four sites. Most of the data remain unevaluated.