

**for
your
information**



**BY WILLY LEY
THE HOME-MADE LAND**

WHEN I, in January 1935, spent two days of sight-seeing in London, a man who showed me around one morning proudly said: "My people built this city." Westminster Abbey and the Houses of Parliament looked very beautiful in the morning sunlight of that clear day and I fully understood how he felt. But aside from that he was simply speaking the truth, cities don't happen by themselves.

I heard a similar statement



many years later near Phoenix, Arizona, when I was shown areas made fertile by irrigation. The man said: "We made this desert into land."

But a Dutchman — and only a Dutchman — could go farther. He could point to an endless meadow, or even just to a map of his country, and declare: "We made this land!" He could even add: "And we'll make more."

The Kingdom of The Netherlands, to give it its proper name, has an area of 12,500 square miles, as any almanac will tell you. What the almanac usually does not say is that if The Netherlands were "untouched by human hands" some 6800 square miles would be under water at high tide, and would thus be uninhabitable because the salty water of the North Sea, if nothing else, would ruin all edible crops.

The Dutch have literally made half of their land themselves. Though the history of The Netherlands has its share of wars, the main enemy since 1200 A.D. has been the North Sea.

The main battleground was the area of the two provinces of North Holland and South Holland. North Holland is the area to the north of the old university town of Leiden (after which the Leiden, or Leyden, jars are named), with Amsterdam in its approximate center. The next

largest Dutch city, Rotterdam, is the approximate center of South Holland.

To the south of South Holland we have the Province of Zeeland, consisting almost exclusively of islands. (The Dutch captain Abel Janszoon Tasman bestowed the name of his native province on islands about as far away from Zeeland as one can be, when staying on the same planet. This is how New Zealand got its name.) Zeeland is the current battleground, as we'll see; the battle of Holland is all but won. It merely needs consolidation.

THE watery geography of the provinces of Holland and Zeeland is determined by three rivers, all of which have their sources outside the country. The northernmost of the three is the Rhine which, as it enters Dutch territory, changes its name to Waal for a distance of about 30 miles. After that it is called by its original name, but in Dutch spelling: Rijn. (Remember Rembrandt van Rijn?) Another arm of the Rhine is called the Lek; but the portion of the Lek near its mouth is called the Nieuw Meuse. (Presumably due to an old misunderstanding, for the Meuse, or Maas, is the river to the south of the Rhine which widens into the Hollandsch Diep before it empties itself into the North Sea.) The

third river is the Schelde, which begins to widen just as soon as it has passed Antwerp.

At one time all this was under Roman occupation, of course. It would be most interesting if some Roman had drawn us a map of the country as it looked when he was commander of a legion. Actually Roman writers say very little about the country . . . most likely because it wasn't worth anything in its natural state. Only three classical sources are known to me, Tacitus (in his *Germania*), Pomponius Mela (in his *De Chorographia*) and, of course, Cajus Plinius Secundus (Pliny the Elder) in his "Natural History". Pomponius Mela has just one sentence for the current Holland: "Then it (meaning the Rhine) is no longer a river but an enormous lake covering a large area, called Flevo." (. . . *sed ingens lacus, ubi campos implevit, Flevo dicitur,*" if you want the original wording.)

The most accurate, as usual, is Pliny. He states that the Rhine in that area has three arms, named Helium (the westernmost), Rhenus (the center arm) and Flevum (the arm that goes to the north.) "In the north the Rhine widens into the lake. In the west it empties into the Meuse." One of the commentators of Pliny added that in 12 B.C. the Roman general Drusus Germanicus (also known as Drusus Senior) "con-

nected Flevo lake with the Rhine, probably following the bed of the river Yssel" (in Dutch IJssel.)

All this is not too helpful now, but a few facts emerge.

River water made a very large lake, probably in the southern part of what later became the *Zuider Zee*, while at least one arm of the Rhine seems to have merged inland with the Meuse. The overall picture is that of an area where a canoe was far more useful than a horse — and which, consequently, did not interest the Romans. They liked firm ground and were partial to paved highways.

Since two Dutch words will crop up all the time in what is to follow they might as well be explained in advance. The word *Zee* (pronounced *Zay*) refers to a body of salt water, while the word *Meer* (pronounced like "mare") means a body of fresh water. This is somewhat confusing, because two German words which look almost the same and sound the same happen to have almost the opposite meanings. A German *See* is a fresh-water lake, if used with the masculine article, and a body of salt water if used with the feminine article. And the German word *Meer* means the ocean. One sometimes feels that a good synonym for "language" would be "chaos."

At any event, the Dutch



The Kingdom of The Netherlands prior to the Zuider Zee plan.

wrested land both from the salty Zee and from freshwater Meer by building dikes, filling in and draining. But, in spite of hard work

through many generations, the overall balance did not look so good. A Dutch government pamphlet states that between 1200

and about 1900 A. D. the Dutch made land to the following extent:

940,000 acres along the sea-shore

345,000 acres by draining lakes

1,285,000 acres.

But during the same time they lost 1,400,000 acres!

The name of that loss was Zuider Zee.

THE formation of the Zuider Zee is easy to explain. The whole area was below sea level all along, with its deepest portion filled by Flevo lake. But a great deal of the Zuider Zee area remained dry land simply because higher land near the shore protected it from the North Sea.

The catastrophe which flooded the low-lying basin with salt water announced itself with a stormy spring tide on All Saint's Day of 1170 A. D. On that day the North Sea tore two pieces of land from the North Holland province, creating the two islands of Wieringen and Texel. Just about a century later, on Christmas Day, 1277, the North Sea finally broke through, flooding the whole area and producing the Zuider Zee.

In 1277 nobody could even think of doing anything about it.

But a few centuries later, presumably encouraged by successful dike building on a smaller

scale, some Dutchman began to wonder whether the work of the North Sea might not be undone. A study by Hendrik Stevin, published in 1667 under the title "How the Fury of the North Sea may be stopped and Holland may be protected against it" may not have been the very first study to consider draining of the Zuider Zee, but it was the first to see print. During the following 150 years the idea of reclaiming the area covered by the Zuider Zee was expounded quite often in the Netherlands (some Germans also gave good advice across the border) but it got to be a theme like the railway tunnel from Calais to Dover: much literature and no action.

The reason why there was no action was very simple: any Zuider Zee plan would require a colossal investment.

If the plan succeeded this investment would be recovered and, in time, large profits would be made. But if it failed for any one of a dozen different reasons the investment would be a total loss.

In the meantime another project simply had to be tackled. There were two bodies of fresh water which offered a threat to Amsterdam, the capital. One of them was the *IJ* (the Dutch treat "ij" as one letter, hence the apparent double capital in words like *IJssel*; the pronunciation is sim-

ply a long I) which had an open connection to the Zuider Zee. The other was the Haarlemmermeer.

To get rid of the menace, the sum of 8,355,000 guilders was earmarked in 1837. Work began three years later and lasted a dozen years. The Dutch government somewhat ruefully stated that it had cost 13,789,377 guilders. But it had been a success, even though another 20 years of work were needed to change the newly won land into fruitful soil.

The Dutch name for reclaimed land is "polder". Reclaiming land is therefore called by a term which can be Anglicized as "inpoldering." While the IJ polder and the Haarlemmermeer polder were still wet, three scientists and engineers, van Diggelen, Kloppenburg and Faddegon, published a similar scheme for the Zuider Zee. An enormous dike was to close the mouth of the big bay, the trapped water was slowly to be pumped out and the two rivers emptying themselves into the Zuider Zee, the IJssel and the Amstel, were to be diverted to go into the North Sea directly.

The cost estimate was 92 million guilders.

AS MORE and more projects were published or submitted to the government in the form of memoranda, the government felt that there should be a body

of experts which could judge the feasibility of the various plans. Thus an evaluation group, the *Zuiderzeevereeniging*, was established.

To see what they would get if they did inpolder the Zuider Zee extensive drilling was carried out. (One source says 2188 test drillings were made.) It became clear that about three-fourths of the area of the Zuider Zee could be made into valuable land.

Especially three men were the driving spirits: van Diggelen, Dr. Cornelis Lely and the head of the evaluation group, Dr. Buma. A complete plan was finished in 1892. But it took time. The turning point was probably the speech made by Queen Wilhelmina of The Netherlands on the occasion of the opening of parliament in September, 1913. The speech contained the sentences: "I consider the time has come to undertake the enclosure and reclamation of the Zuider Zee. The result will be improved water control conditions in the adjacent provinces, extension of territory and a permanent increase in the opportunities of employment."

If times had been normal, the Queen's words would probably have caused quick action. But times were not normal. The First World War was brewing.

The act of parliament which decided to attack the Zuider Zee

was passed on June 14, 1918. The scheme to be followed was that of Dr. Cornelis Lely.

It differed from other and earlier schemes in preserving a body of water in the Zuider Zee area. The older schemes had simply wanted to close up the whole of the bay and to re-route the rivers going into the Zuider Zee so that they would go into the North Sea directly. Dr. Lely pointed out that this might lead

to floods farther inland if, as can happen, a storm-driven flood raises the level of the North Sea for a few days above the level of the rivers. This does not mean, of course, that the level of the whole North Sea would be above that of the rivers; it would only be the level of the sea near the coast. But that is reason for disaster enough. Moreover, Dr. Lely did not want to kill off the Zuider Zee fisheries. Finally, he wanted the



The Delta Plan for the protection of the islands of Zeeland.

newly won land to be accessible by water.

In short: instead of just drying up the whole bottom of the bay, a number of very large islands were to be created in its area.

The overall scheme, then, envisaged first the construction of the main dike, from the island of Wieringen to Friesland at the eastern shore of the Zuider Zee. Then two large polders were to be started, one going south from the island of Wieringen, 49,000 acres in extent. This was first called the northwest polder, but later the name was changed to Wieringermeer polder.

The other polder was to be to the South of Friesland, the north-east polder, 119,000 acres in extent. It is, incidentally, the only one which has retained its original and purely geographical name. Then the southeast polder, the biggest of them all (232,000 acres) was to be tackled. Since then the name has been changed into Flevoland, since this is the probable area of *Flevo Lacus* of the Romans. Also, the job has been subdivided into two phases, East Flevoland and South Flevoland, though this is going to be one polder when finished.

The last of the projected polders was the southwest polder (150,000 acres), now called Markerwaard.

The remaining body of water

would then have an area of nearly 250,000 acres. It had to be fairly large to receive the waters of the IJssel and other smaller rivers, and because of the peculiar and probably unique circumstance that the salt water outside the main dike would often have a higher level than the water inside the dike. No water could then be discharged into the North Sea. And under bad flood conditions this might go on for some time, so there had to be a basin to hold the river water until it could be discharged.

But in the course of time this basin would become fresh water, hence it should no longer be called by the old name: No longer Zuiderzee (the Dutch run words together) but IJsselmeer.

WORK started in 1927. Three things were tackled simultaneously, the main dike, the Wieringermeer polder and a 100-acre trial polder which was named Andijk. The purpose of the trial polder was to have an experimental area for finding out how the land had to be treated after it had been inpoldered.

Obviously you can't go ahead and try to sow wheat or plant beets on land which had been soaking in salt water for six hundred years. Incidentally, the polders to be started later would benefit from the gradual sweet-

ening of the IJsselmeer, since that would leach out salt.

By 1929 the test polder was dry. The next task was to make it into soil which could be useful.

At the German end of the North Sea land had been reclaimed from the sea in the past, too, by inpoldering. There it had been a rule of thumb among the peasants that a new polder, if kept well drained, would become useful in six or seven years time. In half a dozen years enough rain fell on a polder to wash the salt away. The Dutch presumably had done the same in the past, but now they were looking for methods to speed up the natural process. Gypsum was added to the soil, then fertilizers, different fertilizers in different parts of the test polder. Then they experimented with various vegetables to see which would succeed.

The test polder ceased to exist as such on November 1, 1935. It had done its job as an experimental farm. Now it became just a farm.

By that time the main dam was finished, too.

The island of Wieringen served as an anchor. It had been connected to the mainland with a comparatively short dam in 1925. The big job was the dam from Wieringen to Friesland, 20 miles of dam to be built right through the sea. The bulk of the dam is

sand and earth dredged from the sea bottom.

On the inland side the dam has a heavy stone facing. On the seaward side there is a bulge of boulder clay. On top of this clay bulge brushwood mattresses were laid, made by twisting brushwood into heavy rope-like shapes and then weaving these "ropes" into mattresses. On top of the mattresses they dumped heavy boulders, field stones, pieces of old concrete, anything that would weigh a lot and withstand the pounding of the waves for an indefinite length of time.

At first this was just hard work, in the sense that large quantities of clay and rocks had to be moved and put into position. But as the building of the dam progressed, the space through which the tide could flow in and out of the Zuider Zee became narrower and narrower and the current in the remaining gap became more and more violent.

The man who furnished the necessary calculations of what to expect of this current was Hendrik Antoon Lorentz, Nobel Prize winner in Physics in 1902. As the critical period of closing the final gap approached, the expenditure in men and equipment began to resemble that for a real battle. Ten thousand people were on the dam. There were 27 large dredges in action, 13 floating cranes, 132



The Polders in the former Zuider Zee.

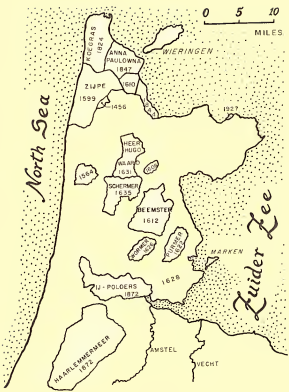
barges and 88 tugs. The closing of the dam was timed like an attack. At such and such a time the current would be near a standstill, then were so and so many hours for plugging the dam. When the tide returned it had to find a solid obstacle.

The dam was finished on May 28, 1932.

AT THAT time the polder to the south of the island of Wieringer, the Wieringermeer polder, was ready to receive its first crop. Since the area was somewhat protected by the island

(and by the beginnings of the big dam), this polder had been finished in 1932. The experience gained on the test polder enabled the Dutch experts to make the land arable within only two years of its being dry.

On this polder — as well as on the ones finished later — the system was to divide it into plots of roughly 50 acres. Each one of these plots had a paved road in front and a large canal in the back, making it accessible both by land and by water. Just in case the main dam might give way, a most unlikely thing, a *ferp* (arti-



ficial hill) was built in the center of the polder. It is high enough to be several feet above the highest recorded flood level of the North Sea, and large enough to protect everything on the polder than can move and climb it. (Somebody calculated that the whole population of Amsterdam would have standing room on top of the terp.)

Two years after finishing the big dam work began on northeast polder, which was ready to bear crops ten years later, in 1942.

Naturally the soil of such a polder is not uniform. As anywhere else the quality varies from area to area. The best land of a polder is used for vegetables, the next best for grain (mainly rye), while the poorest sections are forested.

The largest of the polders, formerly the southeast polder, now Flevoland, has been divided into two phases. East Flevoland was ready in 1957, South Flevoland is expected to be ready in 1968. The Markerwaard polder is expected to be ready in 1978.

When the Dutch started on this enormous project in 1927 they probably expected, or at least hoped, that they could reclaim their Zuider Zee area in about half a century without hav-

ing to worry about many other things. But two major catastrophes happened.

The first was the German occupation of the Netherlands during the Second World War which, naturally, brought everything to a near standstill, though the Germans, at first, did not interfere directly. In fact quite a number of German engineers looked very carefully, if unofficially, at the Wieringermeer polder, because they had had a similar project in mind since about 1932. There had been talk about inpoldering a bay called the Frische Haff (to the east of Danzig) and they wanted to see how it was done.

The Frische Haff project would have been easier than the Zuider Zee for several reasons. To begin with, the bay is nearly fresh water naturally, and because of the geometry of the land only an eight-mile dam would be needed. This project, incidentally, is now dead because the area became Polish after the war. Of course it may be revived as a Polish project.

But near the end of the war the Germans wrecked dikes deliberately to protect their own retreat, especially in the area of the Province of Zeeland. But the dikes wrecked by the retreating Ger-

How the Dutch made North Holland.

The polders prior to the attack on the Zuider Zee.

man armies were repaired and Zeeland lived up to its Latin motto *luctor et emergo*, "I struggle and emerge."

AFTER the damage had been repaired most Dutchmen, including the Zeelanders, would concede that such things could and would happen during a war, but thought that everything was fine with the dikes and the co-existence of the North Sea and the Kingdom of The Netherlands otherwise. The day and night which taught them differently was the first day of February, 1953.

Storm conditions were unusual and intense, the dikes of Zeeland were breached in 67 places, 375,000 acres of land were flooded, 9,000 buildings destroyed and 38,000 more damaged. The death toll was 1800 people.

The overall damage was estimated at over 300 million dollars.

A Dutch agency, the *Rijkswaterstaat* (we would call an equivalent agency, if we had one, the Federal Water Administration), had been worried all along, and had drafted memoranda about things that really should be done. But their warnings had appeared unnecessary.

But after the February flood of 1953 every Dutchman suddenly realized what he had merely

learned in school, namely that 60 per cent of the kingdom's population live and work below sea level. And the *Rijkswaterstaat's* plan was quickly accepted.

Zeeland, as a look at the map will show, consists of half a dozen large and a few small islands, grouped around four major outlets for river water into the sea. But under bad storm conditions these become four major inlets for the sea.

To keep the islands of Zeeland safe as they now are, some 500 miles of dikes would have to be raised by six to seven feet, involving the reconstruction of about a hundred locks, culverts, pumping stations and so forth. The alternative, the Delta Plan, is just to tie the whole complex of islands together into one land by building a total of about 20 miles of dikes, as sturdy as the main dam, across the mouth of the *Zuider Zee*.

The first step of the Delta Plan — now under way — is the so-called three-island plan, a name which is based on the fact that once Walcheren, North Beveland and South Beveland were three islands.

Earlier work has already connected Walcheren and South Beveland. Then the northernmost of those outlets, called *Haringvliet*, is to be dammed. The target date is 1968. Then the second outlet, called the *Brouwer-*

shavensche Gat, is to be dammed; this dam should be completed in 1970. The next dam, and incidentally the longest one in the Delta Plan, will go across the outlet called the Easter Schelde. (It is called that not with the religious holiday in mind but in contrast to the Wester Schelde.) It will seal it off by 1978.

The southernmost of the outlets, the Wester Schelde, must be left open; there is heavy traffic up and down the Wester Schelde to Antwerp, which is not a Dutch city. Here the dike along the southern shore of Walcheren and South Beveland will have to be raised and strengthened. The same is true to the north of Zeeland. The deep channel between Rotterdam and the sea, the so-called Rotterdamsche Waterweg, also cannot be interfered with, so that a protecting dike at or near the southern shore of the Waterweg is indicated.

One of the reasons why the Delta Plan was accepted so fast and is pursued energetically is that the storm conditions of 1953 have been carefully examined. It turned out, to everybody's horror, that the 1953 situation still contained mitigating factors. The flood could have been four feet higher than it was!

The Delta Plan is mainly defensive. It is not aimed at producing much new land. But it has the

secondary aim of producing a large fresh water reservoir. The interconnected bodies of water behind the Delta Plan dams are already referred to collectively as the *Zeeuwse Meer*, the Zeeland lake.

The fact is that The Netherlands, which are always plagued by too much sea water and are seasonally plagued by too much river water too, do need more fresh water in midsummer. The *Zeeuwse Meer* will be the irrigation reservoir for these periods.

THERE are two secondary dams, from Duiveland to Overflakkee and from there to the mainland. Later on they will carry highways, but their primary purpose is to influence the currents in such a way that the main dams will be easier to build.

Another part of the Delta Plan is a most interesting construction to the east of Rotterdam. There is a river coming in from the east called the *Hollandsche IJssel*. Though the name is the same it has nothing to do with the IJssel which puts fresh water into the IJsselmeer. (The latter is sometimes called the *Geldersche IJssel*, to avoid confusion between the two rivers.) What is wrong with the *Hollandsche IJssel* is that it could be a very vulnerable point in case of a bad flood. The sea, racing up in a tidal wave through



Cross section through the big dam across the mouth of the (former) Zuider Zee.

the Rotterdamsche Waterweg could enter the Hollandsche IJssel and pour into the low-lying land to the East of Rotterdam.

What has been built is actually an enormous guillotine, a steel blade as wide as the river, resting in two massive towers. If a wave should come up the Waterweg the steel blade can be lowered within minutes, literally cutting off the flood. The construction is now being finished, but as far as I know it hasn't been needed yet.

As has been mentioned, the purpose of the Delta Plan is not to make more land, but to make the existing land safe. However, between 25,000 and 40,000 acres of new land will be a by-product.

Have the Dutch reached the limit of the new land they can make with the Delta Plan?

By no means. There is another scheme in the future. Dutch government sources are careful to point out that this is in the more distant future — partly, no doubt, to calm the feelings of Dutch tax payers, partly because the Delta Plan should be hurried with all

available means, since nobody can tell when the next big flood will build up.

But that "future plan" is obvious from a glance at the map. There is rather shallow water to the north of the big Zuider Zee dam. The Dutch call it the Waddenzee. To the north of the Waddenzee you have a chain of islands, obviously indicating the original coastline. A dam from North Holland to the island of Texel would not be longer than the average Delta Plan dam, though it may be more difficult to build.

The same statement holds true for the dams between the islands all the way to the island of Ameland, and a dam from Ameland to the mainland would be only about half the length of the Zuider Zee dam.

One Dutch expert, Prof. Thyse, said, "It will be done not later than the year 2000."

Personally I am willing to bet that it will be long finished when that oft-used date comes around.

— WILLY LEY