ecocentre
ispra

A Project Taking Shape

Towards an Economically and Environmentally Improved Site

Second Status Report

JOINT RESEARCH CENTRE
EUROPEAN COMMISSION

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INTRODUCTION

The Idea Behind It All

The Ispra Research Centre was set up by the Italian Government in 1956 as a national nuclear research laboratory and was handed over to the European Atomic Energy Commission (EURATOM) in 1960-62. EURATOM laid it out to be able to accommodate up to 4000 people who would be engaged in strongly technological and "production" oriented, "big science", nuclear R&D. In the event, its actual peak occupancy was never higher than about 2300 (in 1968) and it now hosts even fewer - ca. 1700, including all non-permanent staff, scientific visitors, students, and research fellows.

Since 1973, the Centre has - under the EEC Treaty - seen a progressive shift towards non-nuclear research, which has been evolving towards the topics of "Safety" and "Environment". In future, it is likely that this will focus even further on "soft" research such as Environmental and Life Sciences. The original buildings and services, designed for nuclear research, are not ideal for this new activity which requires smaller laboratories and more offices suitable for data processing. Moreover, having been constructed at a time when there was little public concern for the environment, they are very inefficient in their use of energy. As a result, the Centre produces unnecessarily large quantities of environmental "insults" such as carbon dioxide - CO_2, (ca. 30,000 tonne/yr.), sulphur dioxide - SO_2, (ca. 20 tonne/yr.) and nitrogen oxide compounds - NO_x, (ca. 30 tonne/yr.), both on site and remotely at the power stations which generate its electricity.

The idea that the Centre's environmental impact should be fundamentally transformed, turning it into

Fig. 2 Satellite picture (composed Landsat imagery) of the Alpine arc between Lake Geneva (upper left side) and Lake Como (right), shared by Italy, Switzerland and France. Ispra site is on the eastern shore of Lake Maggiore. Reproduced from Dr. Beckel, Geospace Bad Ischl, Westermann-Verlag.

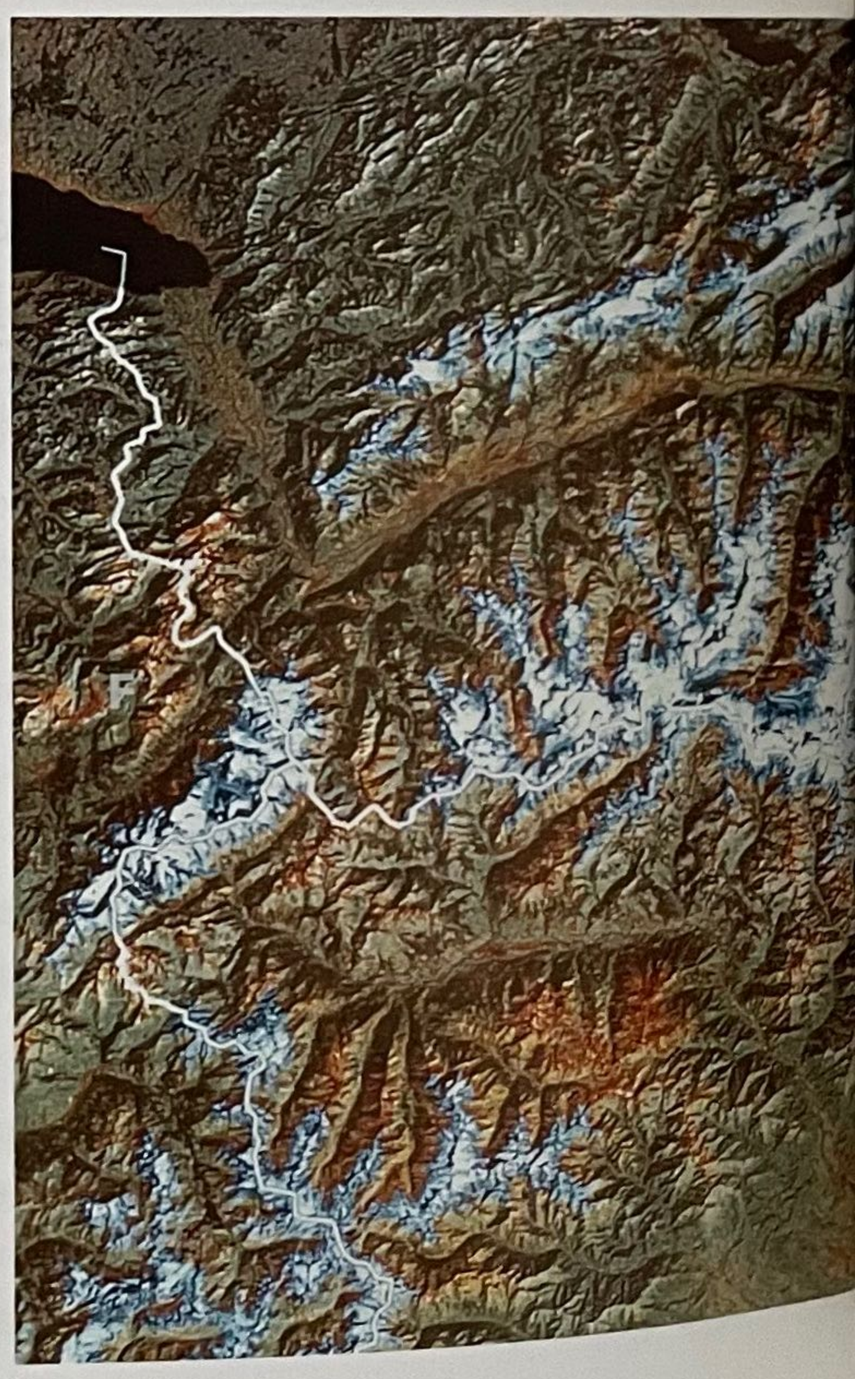


Fig. 1 Detail of an Ordnance survey map giving the Ispra site and its immediate surroundings with an overlay indicating the local hydrological system (design from the contribution to the EcoCentre MasterPlan project by Nuno Leonidas).

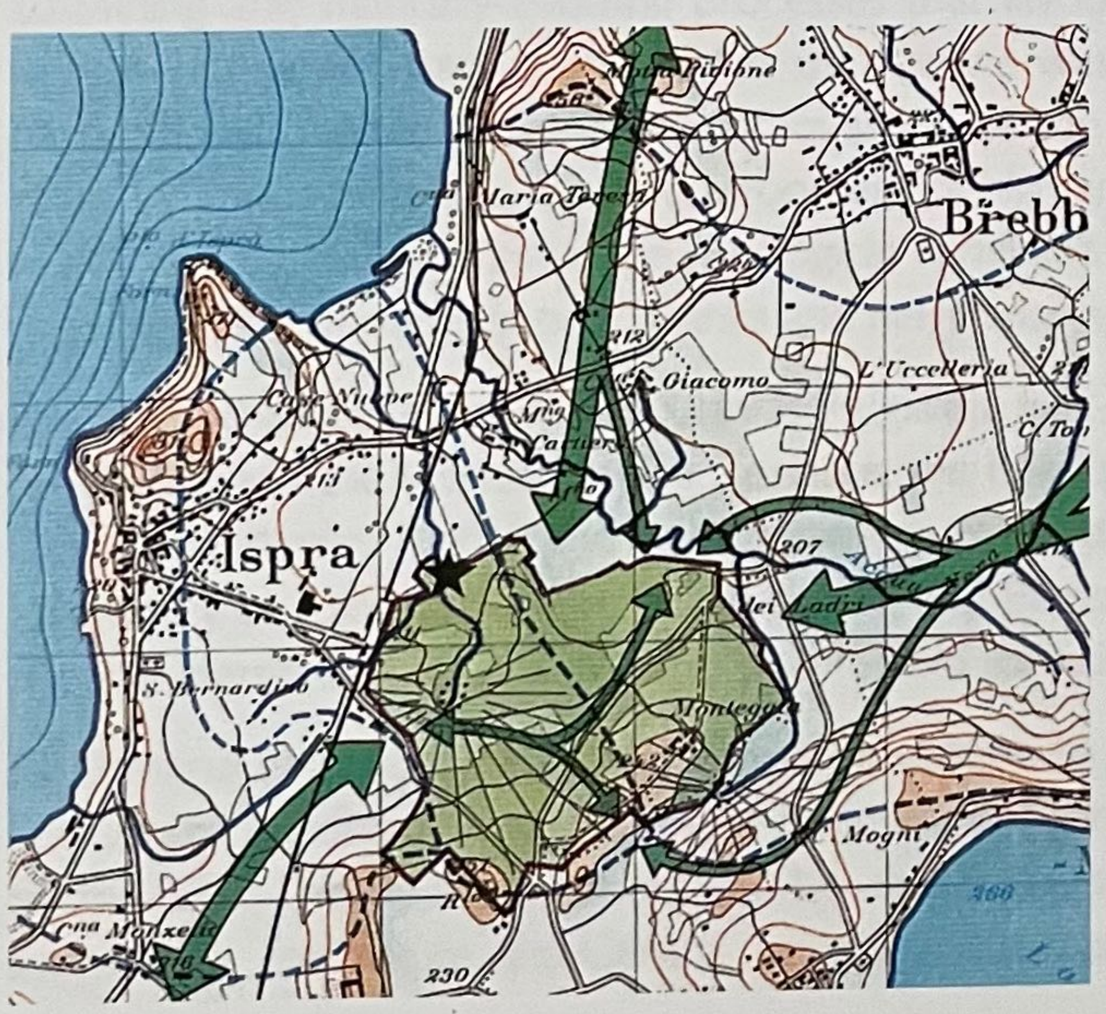
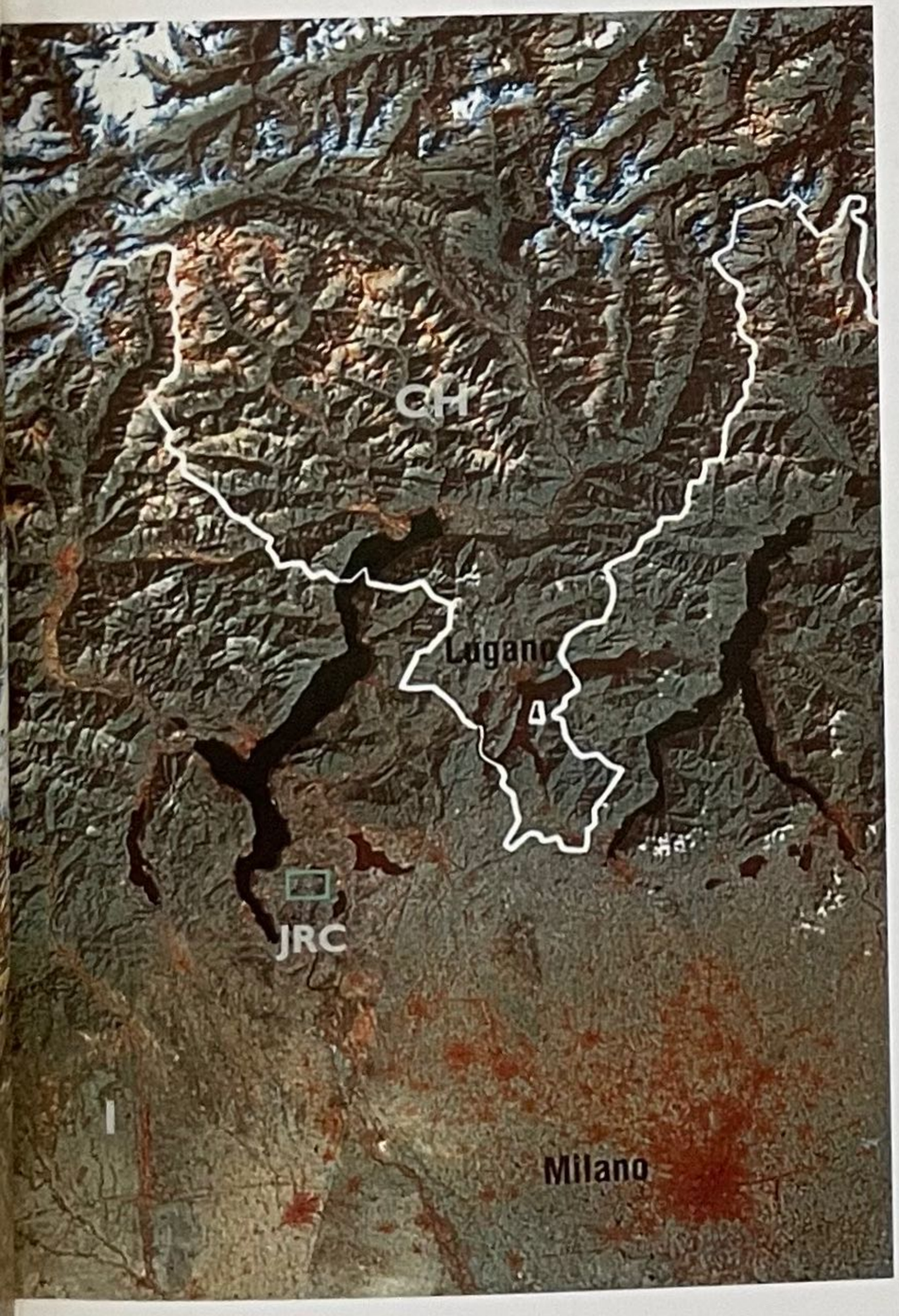


Fig. 3 Arial view, from the east, from Joint Research Centre's Ispra site on the eastern shore of Lake Maggiore in Italy. A north facing view of the Joint Research Centre's Ispra site on the East shores of Lake Maggiore in Italy.



a model for other research centres, originated at the level of the JRC's Board of Governors. The reasons for selecting Ispra for this project, from among the five JRC sites, were that it is by far the largest and it contains the most heterogeneous and geographically dispersed building stock. In addition, many of the buildings and infrastructure installations, having mostly been built over the period 1958-1975, at a time when environmental and energy saving considerations were anything but a prime concern, are now in a condition such that renewal has become essential and urgent. It is also, as mentioned above, the site which has undergone the greatest change in its activities and at which environmental and alternative energy research is concentrated. Given this expertise, it was natural that measures should be suggested which are at the leading edge of current knowledge and technology. These concepts are now being applied to energy efficiency, material recycling, waste disposal, services, work practices and habitat.

An important basis for the project was a 1991-92 study, entitled "Environmental Concept for Research Centres", carried out by the firm Kraftanlagen Heidel-

Table 1 *Facts on the Ispra Site.*

General			
founded by the Italian government	in 1956		
transferred to the Euratom Commission	in 1962		
permanent staff	~1,350		
non-permanent staff	~350		
visitors/year	~7,000		
local budget 1994	188	MECU	
service cars	136		
average number of private vehicles present	~1,000		
geographical elevation	206-244	m	
average temperature	11.5	°C	
average relative humidity	76.1	%	
average cloud cover	4.2	%	
average precipitation	1,650	mm/year	
average wind velocity (predominant direction NNW-NNE)	1.6	m/s	
rain days per year	125		
maximum snowfall per event	0.9	m	
average incidence of solar energy	1,204	kwh/m^{2}y	
Real Estate Assets			
total area	160.0	ha	
built-on area (figures in brackets = percentages of total)	37.5	ha	(23.5%)
of which roads and car parks	25.9	ha	(16.2%)
of which buildings	11.6	ha	(7.3%)
interior floor surface	195,940	m^2	
roads	30	km	
perimeter fencing	5.9	km	
cultivated area	0.3	ha	
grassland	79.7	ha	(49.8%)
woodland	27.8	ha	(17.4%)
total number of buildings	232		
heated buildings	140		
real estate insurance value (without land)	167	MECU	
of which for buildings	133	MECU	
of which for installations	34	MECU	
maintenance cost 1994	4.2	MECU	(2.2%)
Energy / Consumption			
thermal energy production	70,000	MWh/year	
thermal energy transport & distribution losses	10,000	MWh/year	
electrical energy consumption	33,000	MWh/year	
peak power demand	5.4	MW	
total waste	1,180	t/year	
CO_2 emissions on-site + external electricity generation	30,300	t/year	
total water consumption	4.1	Mm^3/year	
cost of electricity from grid	1.9	MECU/year	
cost of methane (1995)	1.0	MECU/year	

Fig. 4 View of a pond at the Ispra site. Art canvas by the Danish painter Nes Lerpa, exhibited at the occasion of the Danish Weeks in 1993.

berg under a contract from the German Federal Ministry for Research and Technology (Bundesministerium für Forschung und Technologie). Basic facts and considerations for the ecological and economic improvement of the Ispra site were set out and made available to the European Parliament and the JRC Board of Governors in two documents of 1992/93 and combined in a Report of 19th February 1993 entitled *"EcoCentre Ispra-* A Proposal for Action". Many of the suggestions contained in that report, such as building retrofitting, improvement of the sewage system, and installation of a cogeneration plant have since been developed further then and progress is described in the present report.

Background information on the Ispra site is presented in *Table 1*, from which the extreme geographical dispersion of the buildings is apparent (234 in all, connected by 30 km of roads in an area of 1.6 km^2). A comparable research centre with a staff of 1700, the GSF at Neuherberg, Germany, has a total built-on area of only 5.4 ha compared with Ispra's 37.5, and only 20% of its roads and parking areas. The average energy consumption, per square metre of floor area, for heating and cooling all buildings on the Ispra site is, at present, two or three times higher than that estimated for the retrofitted and new buildings now under construction. Since the gas bill in 1995 was ~1,0 MECU, this means that around 600 000 ECU more than necessary was spent on methane.
The electricity requirement has a base load of around 3 MW, with a variable component of 1 - 1.5 MW on working days and the electricity bill in 1995 was 1.7 MECU. One might expect to be able to reduce this by up to a third, which means that the Centre may currently be spending another 600 000 ECU/yr.

more than is necessary on electricity. Potential cash savings, therefore, exceed 1,0 MECU/yr. and these would be accompanied by a halving of CO_2 emissions and even larger reductions in SO_2 and NO_x emissions. We return to this point in the section *Freezing in the Dark on page 49*.

Late in 1992, the European Parliament effectively launched the EcoCentre Ispra project, as it was now called, by voting a 5 MECU amendment to the Community's 1993 budget for the purpose. This gave rise to much enthusiasm among the Ispra staff and triggered waves of useful ideas. Since then, a multi-disciplinary group of specialists from the Infrastructure Unit and various Institutes has been preparing the project in close collaboration with external experts. The wide ranging expertise of this team in the fields of cleaner technology and energy and environmental conservation, has been of great value. Construction work started early in 1994 and will continue.

This report presents the state of the EcoCentre Project as of the beginning of 1996 and summarises the achievements to date in *Table 2*. It then deals with the general nature and principles of the new MasterPlan and the reasoning behind it. A bird's-eye view of the site according to the new Plan is inserted in the main text, whilst a reduced-scale copy of the Plan itself can be found in the Annex. Subsequent chapters present, in some detail, the various construction activities of 1995. They deal, in turn, with each of the four buildings being retrofitted and with the two newly completed buildings, to which EcoCentre quality criteria were applied. The report then touches upon features of the *Concentration Zone* (geometries, building density, traffic lanes etc.) within the MasterPlan and describes two new buildings currently under construction (ECB and NW Piazza building). Given the potential and the attractive landscape of the Ispra site, a fair amount of space is devoted to the plan for modifying and further developing it in "Realising the Green Plan". From the outset, a clear goal of the project has been to reduce the number of buildings rather than to increase them and the next chapter describes how this will be achieved.
The last two chapters point the way to future developments of the project: The first of these summarises a separately published *mission statement,* deals with comparative energy saving issues, and a new cogeneration plant that should drastically improve the use of primary and secondary energy. The second, which is also the final chapter endeavours to answer the occasional question as to whether the EcoCentre money has been well spent and the report concludes with considerations on further funding and projects both inside and outside the Community which have similar goals to this project or take their inspiration from it.

ACHIEVEMENTS TO DATE

Where Are We Now?

Apart from a preparatory phase in 1992, the EcoCentre Project did not really get under way until 1993 when, as mentioned earlier, the European Parliament allocated the first of two 5 MECU grants specifically for this project. These funds were in addition to the regular research budget, which was in no way affected. The second 5 MECU grant, was invested in 1994. *Table 2* summarises the present state of the project and *Table 7* the account of expenditures. Since, for administrative reasons, the *MasterPlan* (see below) could not be completed before the end of 1994/beginning of 1995, the bulk of the 1993 investments were used for the innovative, low energy retrofitting of some important existing buildings which were not destined for demolition (see chapter IV, "Fitter Buildings"). The major part of this work will be finished in spring 1996. A second retrofitting phase, for which the plans have already been drawn up,

Table 2 *State of the Project - Winter 1996.*

Projects	State of advancement
Preparation of MasterPlans "Construction" and "Vegetation"	finalised & implemented in March 1995
Contribution to new ECVAM Building 58	completed in May 1994
Contribution to new IAM Building 20i	completed in March 1996
Physical model of high density zone	completed in December 1994
New Building Regulations	produced and implemented in March 1995
Retrofitting of Hall Building 45	completed in March 1996
Retrofitting of Canteen Building 8	under way; completion - March 1996
Retrofitting Administration Building 6	under way; completion - end 1996
Retrofitting Main Store, Building 17	under way; completion - end 1996
Cladding of ELSA, Building 48, with photo-voltaic panels	producing electricity since July 1994
Monitoring of buildings for the Retrofitting Programme	measurement campaign under way
Retrofitting of "hot" labs, Building 46	detailed plans ready
Retrofitting of Meeting Rooms, Building 36	pre-project ready
Retrofitting Medical Service, Building 4	pre-project ready
Preparation of *Cahier de Charge* for new cogeneration plant	completed in May 1995
Demolition of old buildings	2 in 1994, 2 in 1995
International competition for construction of 3 new buildings - ECB and 2 Piazza buildings	completed in November 1994
ECB Building 58 - new	under construction; completion March 1997
Piazza Building 26e - new	under construction; completion March 1997
Pre-project competition for three new buildings	end of 1996

can begin whenever funds become available. The first application of the EcoCentre philosophy was in a review of the specifications of two new buildings which had been commissioned before the project began. EcoCentre funds were provided to make them more environmentally friendly both internally and externally at local and global levels. The buildings were to house the European Centre for the Validation of Alternative Methods (ECVAM) and the Institute for Advanced Materials (IAM). Work started in 1994 and was completed 1996.

Two new buildings, under construction in the *Concentration Zone*, were chosen on the basis of an international competition and will be completed in spring 1997. They are the European Chemical Bureau (ECB) and the western anchor building for the new Piazza defined by the *MasterPlan*. To compensate for this new construction, several dilapidated, old buildings were demolished. Others will follow (see Figures 29 & 30). In 1996 the Central Library was transferred to an existing building in the immediate neighbourhood of the *Concentration Zone*.

MasterPlan ready and accepted

From its beginning, the Ispra Centre has made little of its premium site quality and almost random development took place during the construction period 1958-1975, due to the absence of an overall plan. A diffuse and inhomogeneous building pattern resulted which sprawls over the entire site and is paralleled by an over-sized traffic infrastructure (see figure 35). Vegetation has developed, in a relatively uninhibited and uncontrolled fashion, wherever space was left to it, forming unconnected islands with only a few continuous open spaces. These diffuse features give an impression of disorder and disorient the unprepared visitor.

The 1994 MasterPlan sets the agenda for progressive long-term remedial action, remodelling the site in an ecologically and aesthetically sensitive, yet economically feasible fashion. From the ten companies competing for the preparation of the EcoCentre MasterPlan two, with complementary competence, were selected: the consortium *F&P Architects*, Milano/*Nuno Leonidas* Arquitectos Associados Lda, Lisboa and Eppinger, Schmid & Partners of Leonberg, Germany. Their work is presented further below. Some of the projects out of the ten were published in the first EcoCentre Progress report of 1993.

One of the bidding companies made the somewhat temptingly proposal placing the high density zone on the showy, elevated location just South of the

nuclear reactor area. It would, undoubtedly, have given those working there, wonderful views of the Alpine chain, but, in the end, the proposal was rejected for the following reasons. There is insufficient space to accommodate the whole of the future Concentration Zone on the flatter part of the elevated area not occupied by nuclear installations. Some of the adjacent slopes, on the other hand, are rather too steep for roads and access to buildings, would have been difficult, particularly in winter. Moreover they include some of the best woods on the whole site. This solution would also have separated the new concentration zone from the Infrastructure premises - including the

Fig. 5 Bird's eye view of the Ispra site after the implementation of the EcoCentre MasterPlan. Prepared by Eppinger, Schmid and Partners, Leonberg.

central power plant - by something like a kilometre. From an architectural point of view, it would have been difficult to blend the innovative designs requested for the new concentration zone with the rather dominating block-like appearance of the buildings in the reactor area. A final point against this proposal was that, as a general rule, potential polluters should be placed at the lowest point of a terrain, not at the highest.

Of the other proposals, all but one, which suggested a Barcelona Rambla-type solution with all buildings placed along an existing road (Via Lussemburgo) near the Northern border of the Centre, were in favour of putting the Concentration Zone in the north-western part of the Centre (by the author). Some of them also proposed displacing the entrance to the SW (which is impracticable because of shortage of space). The advantages of the chosen solution are the following:

– Proximity of Infrastructure buildings - including central heating/cooling plant
– Reduction of supply lines
– Easier, less costly maintenance
– Integration with several existing buildings (building density already relatively high)
– Zone includes physical, chemical, and biological foci and technological activities
– Proximity to former Ispra I Reactor, Cyclotron and Remote Sensing buildings.
– Elimination of non-indigenous robinia pseudoaccacia (false accacia) trees
– No "aesthetic pollution" of landscape through reduced visibility
– Mensa at a "healthy" walking distance

The resulting MasterPlan comprises two distinct parts, the **'Construction MasterPlan'** and the **'Landscape MasterPlan'** ('Green Plan'). The former encompasses all built-on areas of the site, i.e. buildings, traffic areas, the adjacent landscaped open spaces, and the water regime, whilst the latter deals with aspects of vegetation and landscape - its ecology and development - and identifies concrete actions. A detail of the Construction MasterPlan is shown in *Fig. 18*, and the full plan is reproduced in the Annex. The Construction Plan is characterised by the concentration of buildings in an urban-like zone of high building density. The concentration of laboratories and facilities with similar uses, the construction of buildings with high standards of energy efficiency and architecture, and the organisation of roads, streets, and footpaths in a way that minimises disturbance of the vegetation are a central concern of the MasterPlan. The drastic reduction of the current 30 km road system that will be made possible by these changes and the footpaths and cycle tracks planned are shown in *Fig. 7a and b* which illustrates the before/after situation well. *Fig. 5* represents a bird's view of how the Ispra Centre will look like, once the MasterPlan is fully implemented.

The MasterPlan is based upon a **Zoning Plan** *(Fig. 6)*, previously prepared by the Centre, that divides the site as follows:

- High Density (Concentration) Zone
- Entrance Zone
- Eastern Zone
- Infrastructure West

Spaces situated outside these four areas are considered to be *taboo* zones, where construction is now prohibited. Existing buildings in these zones should be progressively removed, at the very latest at the ends of their lifetimes. In the **High Density Zone,** which is the location for new laboratories and offices, a fairly compact urban building structure will be developed. No further large halls or infrastructure installations will be placed there, however. The "campus" style will be typified by attractive, innovative architecture and carefully designed communicating open spaces, in which institutes and buildings are connected by pedestrian walkways. This zone will be the core area for the future development and image of the EcoCentre. The architectural and design criteria and other details of the High Density Zone can be found in the chapter "Shrinking upwards" on page 34. **The Entrance Zone** includes the Reception Building, the Mensa and the Administration building. Its appearance is important since it provides the visitor's first impressions of the Centre. Unlike the conspicuous, retrofitted Mensa building *(Fig. 12, 13)*, the "tank-proof" Entrance building makes no more impression than an "autostrada" tollgate which it strongly resembles. A future Visitors' Centre should be located in the **Entrance Zone** and show better architectural quality. The **Eastern Zone,** on the fringe of the site, includes, first of all, the nuclear installations and some infrastructure facilities. In the early sixties it was deliberately assigned to "hot" activities because it lies at some distance from the non-nuclear buildings in the West. This zone is easily accessible yet clearly separated from the High Density Zone. It can accommodate disturbing emitters and those activities that provide relatively few workplaces.

By appropriately fencing this area, in compliance with nuclear safety rules, the security provisions for the rest of the Centre could be relaxed.

All *infrastructure facilities* and buildings can be concentrated in the **Western Zone,** where there is sufficient room for enlargement towards the North.

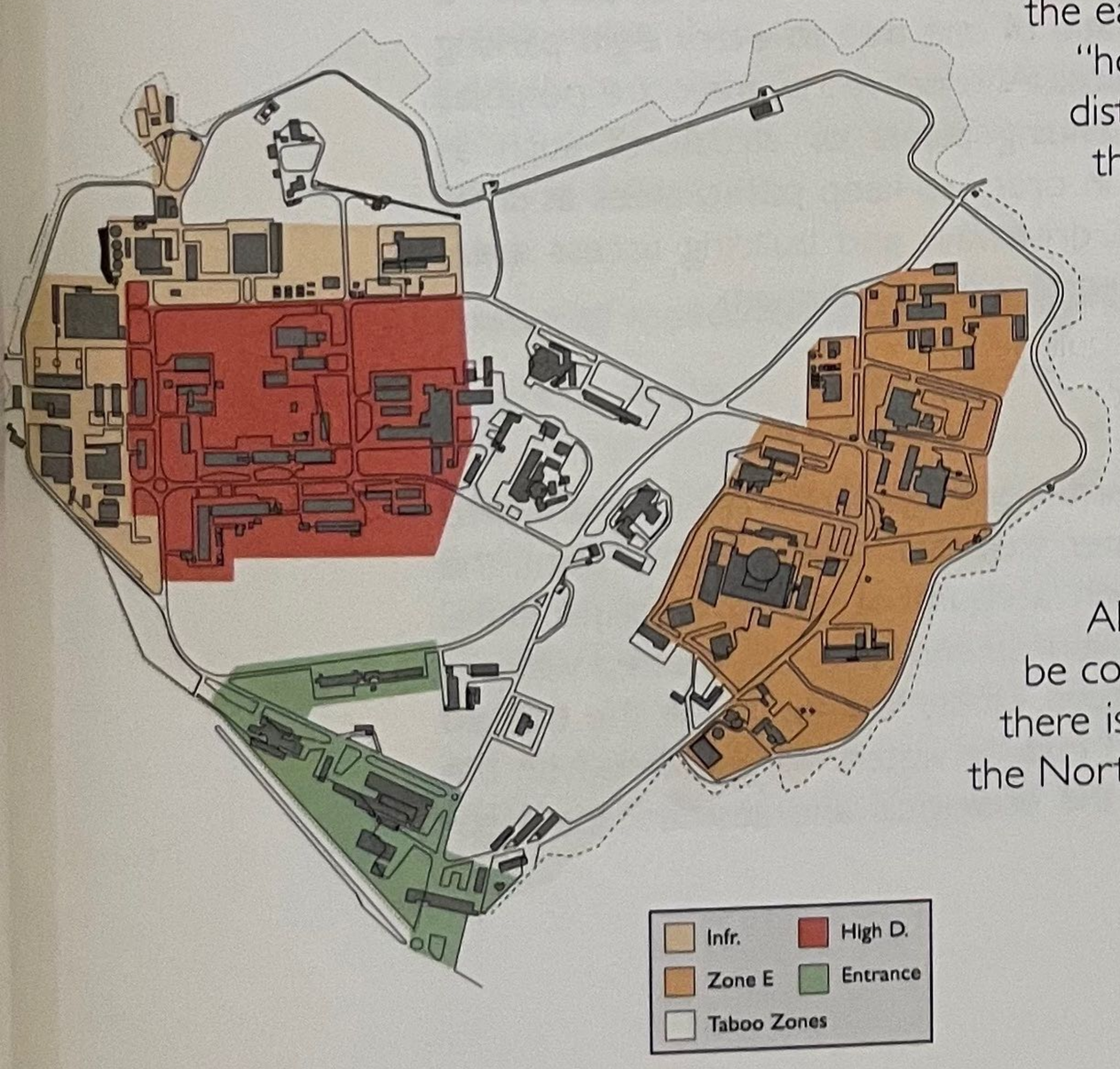


***Fig. 6** New Zoning Plan of the Ispra site.*

Regarding the **Traffic System,** roads that are not instrumental for the proper functioning of the site will, in the medium and long term, be removed or downgraded to cycle and pedestrian paths, thus considerably reducing paved, sealed areas. The *security lane* running along the inner perimeter fence is no longer needed in its present width of four metres and can be reduced to three. At the same time, its impermeable asphalt surface, which is a barrier to small fauna, such as insects, can be downgraded to a gravel road. Moreover, in order to further the natural water cycle, all parking, piazza, access, and storage areas will receive water permeable surfaces such as "Eco-Pavers" with wide joints or tamped ground, enabling rainwater to percolate through them. All traffic lanes, however, will be asphalted. A flexible *parking system* will be introduced featuring space saving, minimum use of sealed ground, shading by trees and pleasing aesthetic qualities.

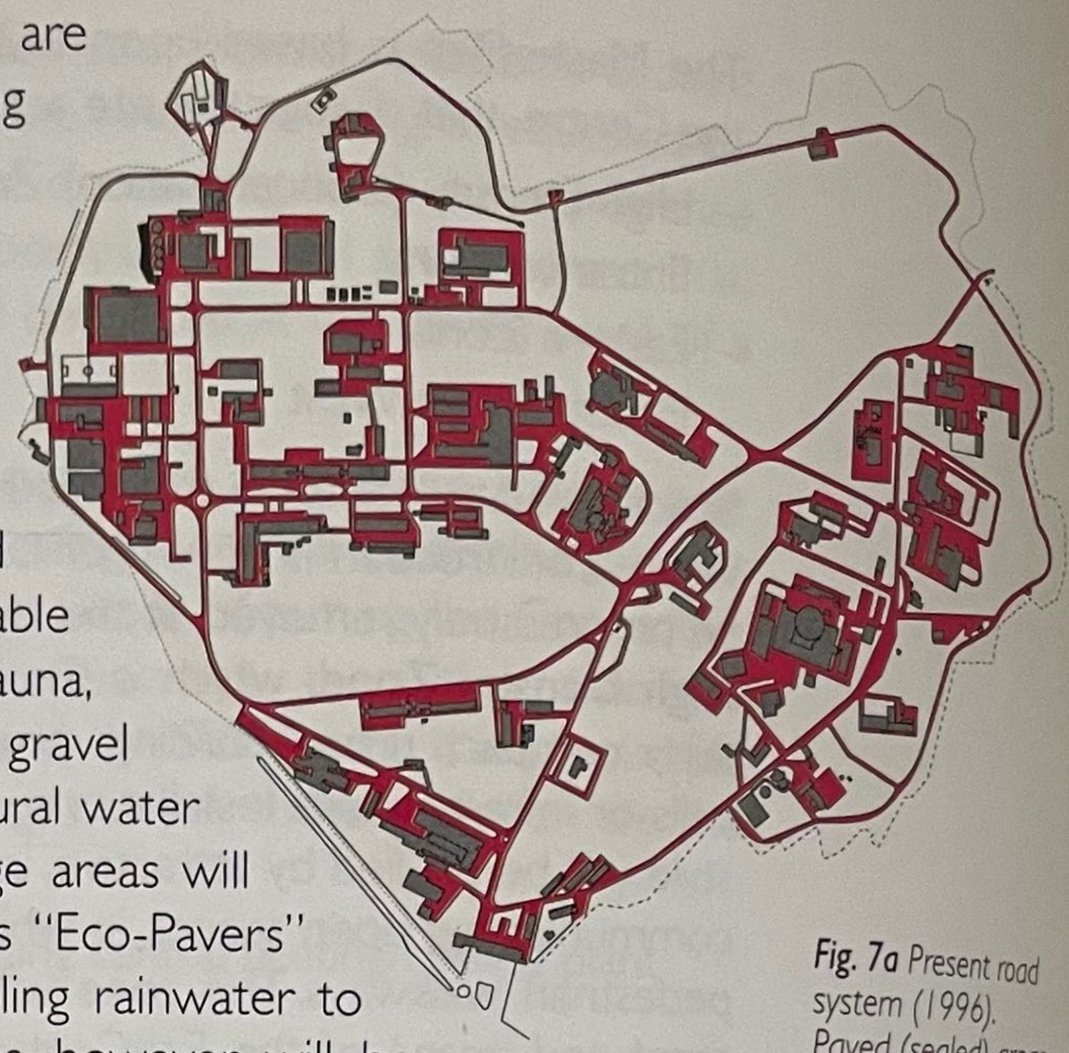


Fig. 7a *Present road system (1996). Paved (sealed) areas in red.*

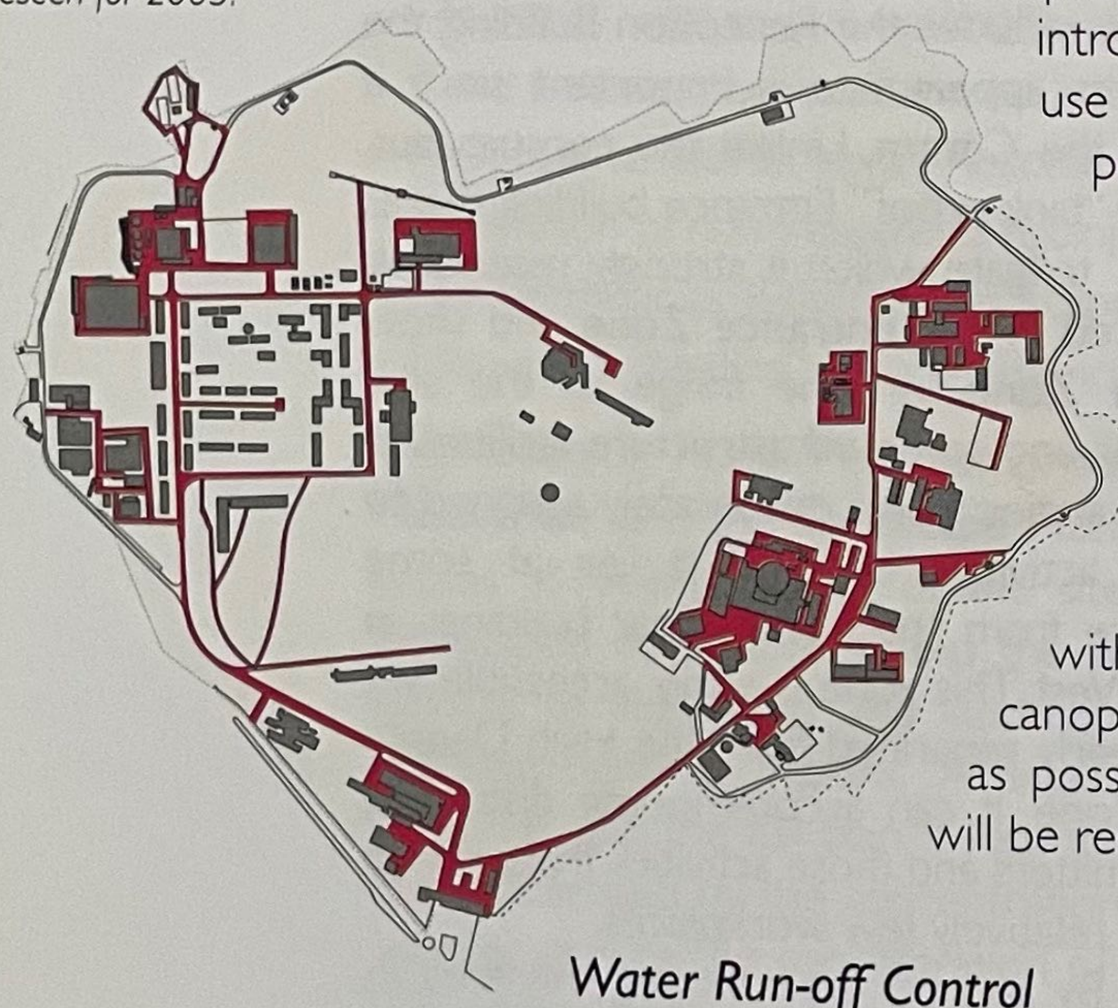


Fig. 7b *Vehicular traffic system foreseen for 2005.*

As a general rule, parking will be *perpendicular to the road sides,* on five meter wide strips, so that no additional access areas will be needed. The shading trees will be planted in these strips, with a ratio of one tree to every eight parking spaces. Alternatives to trees are pergolas with climbing plants or structures such as canopies. In order to keep paved areas as small as possible, driveways and building access areas will be reduced to a strict minimum.

Water Run-off Control

Currently, sewage, used cooling water and rainwater are all channelled underground, to the Centre's waste water treatment plant. At the plant, the mixture is processed very inefficiently on account of its highly dilute state, (overflow remains untreated in case of heavy downpours). The treated water is released, via a small creek, to Lago Maggiore. Under the new Plan, the treated sewage water, together with the rain and cooling water, will be carried on the surface and become a key element for the ecological and aesthetic develop-

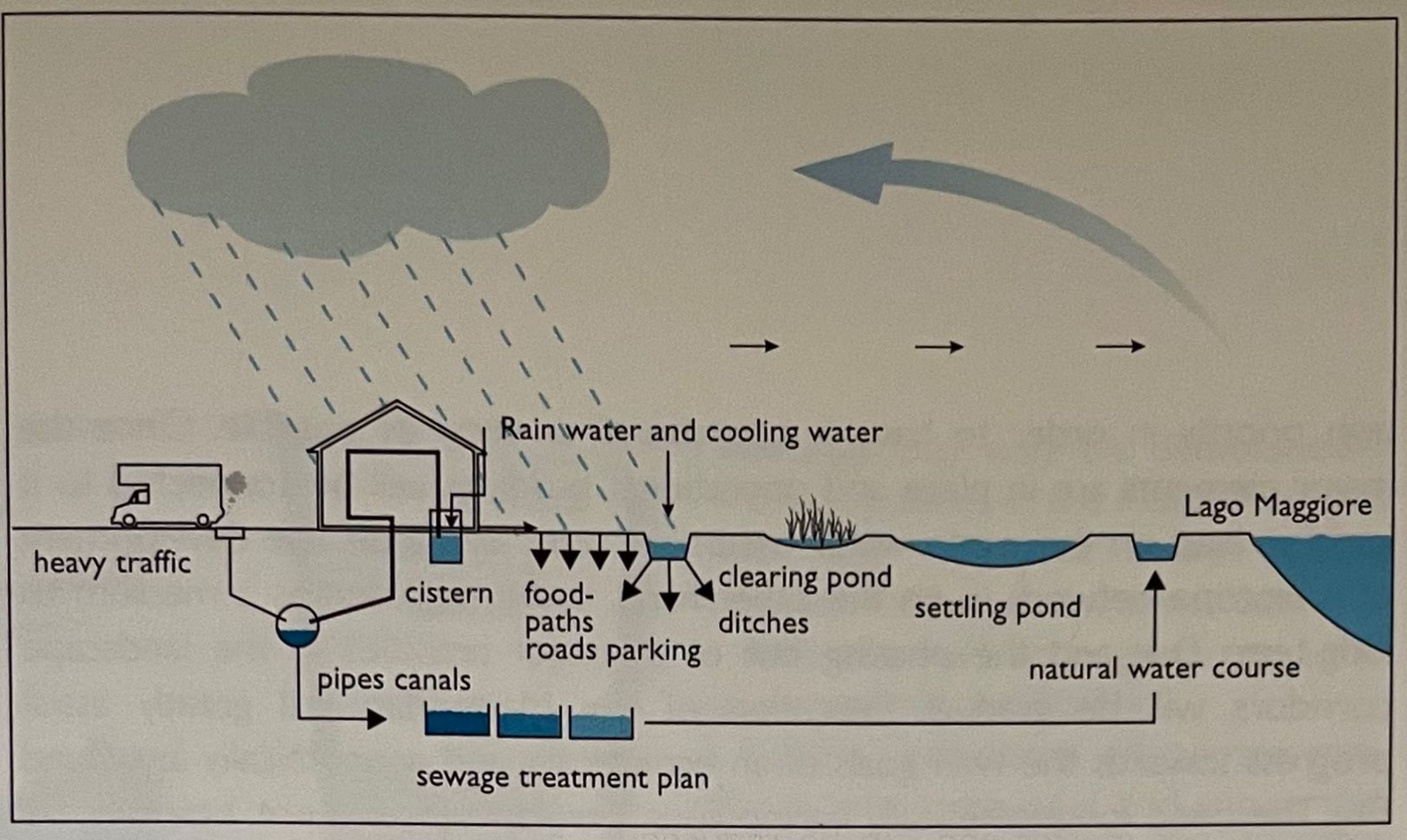
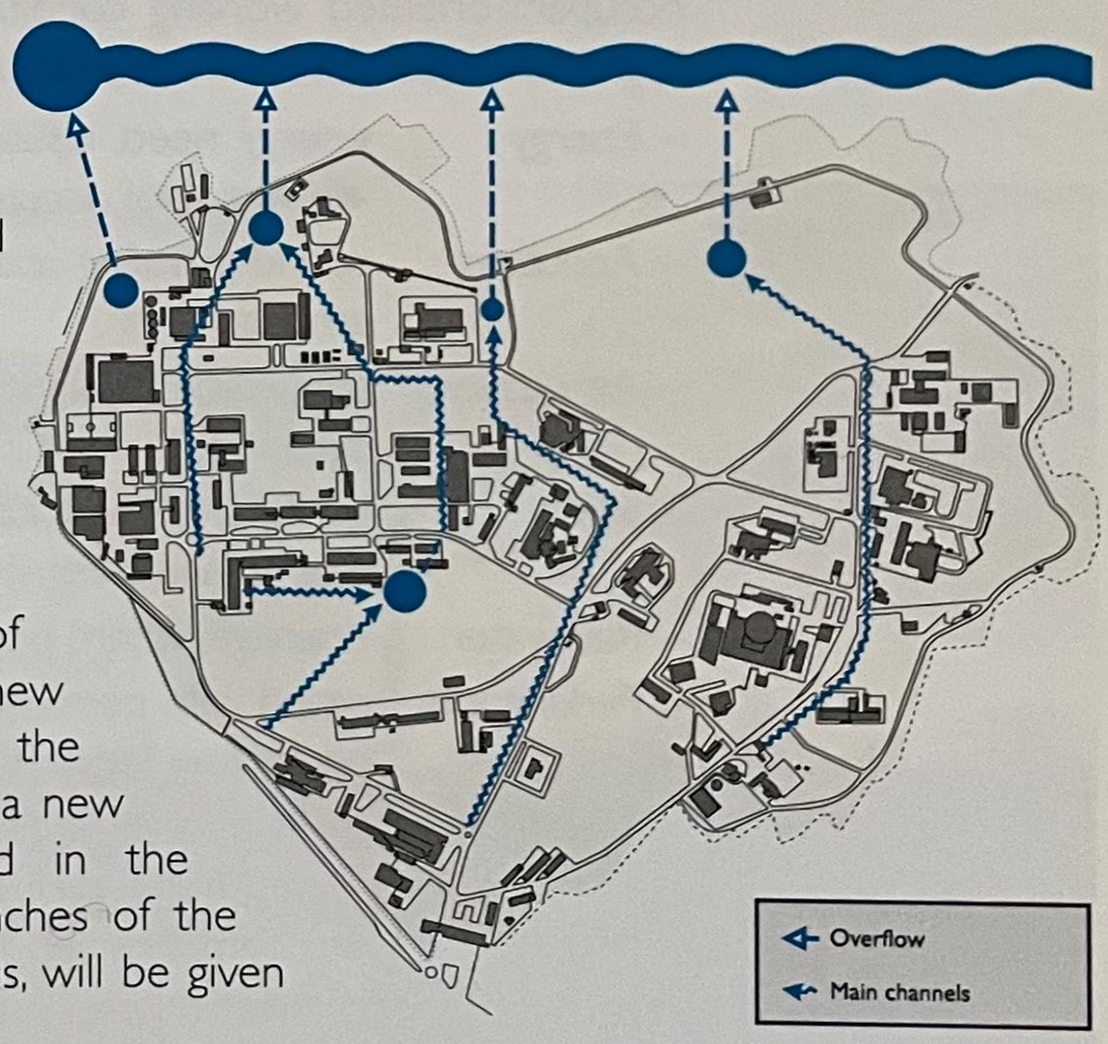


Fig. 8 Drainage of rain water, cooling water and sewage (schematic).

ment of the Centre (see sketches in *Fig. 8* and *9*). The "clean" waters will first be collected in cisterns near the buildings and then run off on the surface via *unlined* ditches and channels, so that water can evaporate and percolate into the ground. In heavy rain, the water flow will be buffered by temporarily retaining it in ponds and lakes. This landscape feature will become a particularly pleasing element in the appearance of the Centre. Water levels in the ditches will vary with the volume of incoming water. This should lead to a changing, although from an ecological point of view, not necessarily deteriorating, vegetation pattern on the banks.

Rain water and used cooling water will be collected in four main channels leading to clearing ponds. From these, the water will be carried, via an overflow, to a natural water course leading into the Acqua Nera stream which flows into Lago Maggiore *(Fig. 9)*. Once the planned cogeneration plant comes into operation, the large quantities of warm water it discharges at 30 °C will have to be cooled down in an economically reasonable manner before being allowed into the Acqua Nera.

Fig. 9 Run-off system for for rain and cooling water.



Phases of realisation of the MasterPlan

Progress towards the goals of the EcoCentre MasterPlan will, of course, be strongly conditioned by the availability of funds. However, from now on, all new construction work will be confined to the Concentration Zone. The construction of a new surface water run-off system, described in the previous section, especially the main branches of the ditches and the settling and buffering ponds, will be given

high priority in order to have it operational as soon as possible. Once the major elements are in place and operational, buildings will be connected to it and the load on the waste water treatment plant alleviated. The development of a biotope network is, on the other hand, to be regarded as a medium to long-term task and the phasing out of all major activities in the landscape corridors will be gradual. Execution of the MasterPlan will greatly assist progress towards the twin goals of an ecologically and economically improved site. The need for aesthetically harmonious development will not, however, be lost sight of in the pursuit of these goals.

New Building Rules Agreed Upon and Applicable

As part of the EcoCentre project, new *Building Rules* have been developed and implemented, which must be observed for all new construction and renovation work on the Ispra site. Only structures with particular experimental/technical requirements such as those pertaining to the nuclear field, where specific regulations apply, are exempted. These rules do not replace the relevant Italian legislation but, rather, complement it by, for example, imposing higher levels of insulation and restricting the use of certain materials. They are based on principles of energy saving, environmental protection, and - last but not least - occupant-oriented working conditions, e.g. optimised bioclimatics. The most important rules concern features such as:

- Energy — energy need, insulation, ventilation rates, water consumption, well-being of occupants
- Acoustics — sound-proofing according to EEC directive 12/5/86 and later amendments
- Air quality — ventilation designed to avoid concentrations of pollutants such as CO and CO_2 and water vapour
- Safety — compliance with Italian laws relating to safety & hygiene in the work place, integrity of structures, fire
- Rainwater — drainage, where possible, via natural routes
- Parking lots — paved with permeable materials, shaded by vegetation; weather protection for motorcycles and bicycles
- Tree felling — must be well justified. Approval only if species is neither protected nor a rare example of local flora and provided fellings are compensated by planting equal numbers of local species of trees (or by paying an environmental fine)

Fig. 10 *EcoCentre Building Rules Publication.*

Buildings may only be demolished if this is stipulated in the MasterPlan (see also page 15) and every building project, whether a new construction or a renovation will undergo Green Label environmental certification.

A Building Commission will oversee compliance with these rules and ensure that *Bio-climatic principles* are observed. The design of new buildings must therefore

- adopt an orientation of the building that minimises energy consumption
- facilitate the installation of solar energy systems
- ensure that shadows do not disturb solar heating systems
- use technical standards that ensure energy saving, and the comfort, health and safety of the occupants

These rules are already in operation and have been applied to all building construction work in the Centre since 1995, e.g. ECB Building.

Fig. 10a *The Concentration Zone in stato nascendi, as of March 1996 (view from west). The orange building in the left middleground: ECVAM; the blue building in the background: Retrofitted Technology Hall (Bldg. 45). The ECB Building will be placed between the two. Compare with Fig.29, taken in 1994 from about the same position.*

THE CONCENTRATION ZONE

Shrinking Upwards

A high density Concentration Zone, with a grid of streets clearly delimiting the spaces, will form the core of the remodelled Ispra site *(Fig. 18)*. *Fig. 19* is a photograph of a physical model of this zone, yellow roofs indicating buildings that will exist by end of 1996, the construction of the yellow shaded ones is planned for the near future. Its concept, traffic system, and "reference system" can be seen in *Fig. 20.* There will be a main North-South axis, running from the present Solar House to a new Piazza and pointing over a new lake, towards the Administration building. At right angles to this will be two new secondary axes, one running from the recently transferred Library past the front of the new ECB building and the other, further south, ending in the Main Piazza. These

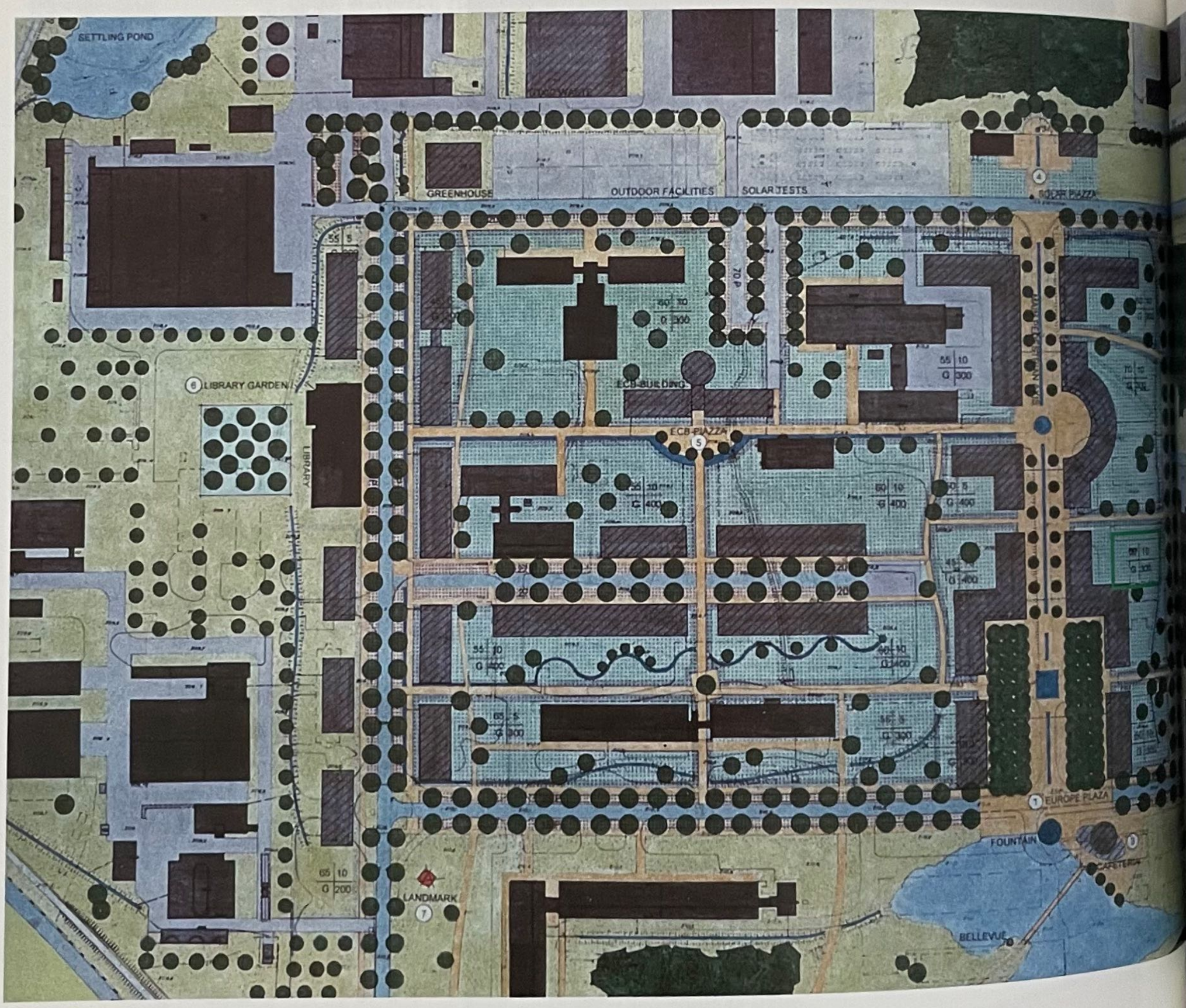


Fig. 18 *Concentration Zone taken from the Construction MasterPlan. Insert: Example of a code key for the arrangement of the green zones between the buildings. Full MasterPlan in Annex.*

three axes will all be *pedestrian streets*, some of them containing pergola covered walk-ways *(Fig. 20* and *21)*.

The MasterPlan, for evident reasons, cannot specify architectural details of the Concentration Zone but outlines the design and ecological details of the open spaces by means of a key *(Fig. 18)*. This key specifies, for instance, the minimum percentage of green area (60%), the maximum percentage of paved area (10%), a tree index, e.g. one tree for every 300 m^2 of green area and the nature of the roofs (e.g. greened or not). It also specifies the location and species of trees to be planted and the nature of the surface of the walking areas.

By mid 1996 there will be three new buildings in the Concentration Zone: the ECVAM building, the ECB building, and a building defining the north-west corner of the Main Piazza. *Fig. 19* shows a *physical model of the Concentration Zone* in which those buildings that will exist by the end of 1996 are indicated by grey roofs.

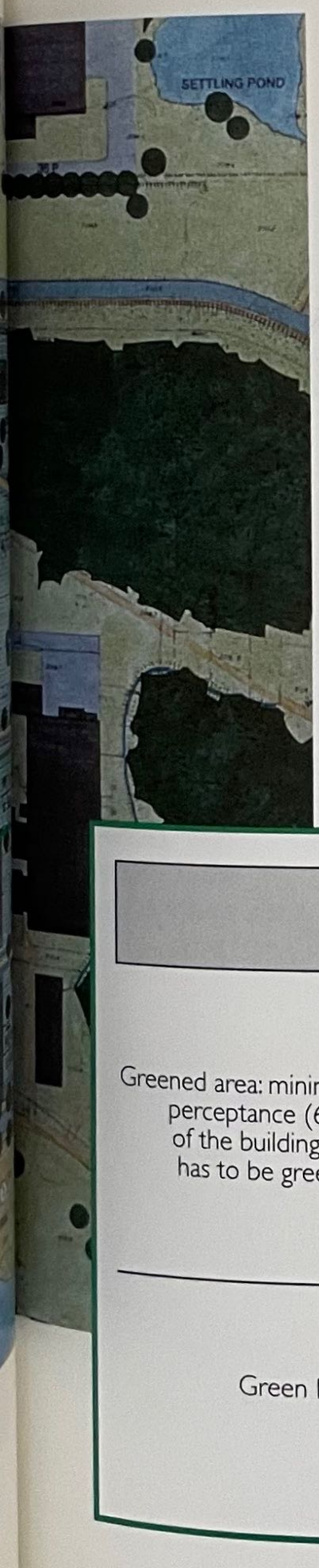


Table 4 *Characteristics of the Concentration Zone.*

Construction density	1.7 m^3/m^2 (currently ca. 0.05 m^3/m^2)
Maximum height of buildings	9.90 m
Parking areas	alongside the streets.
Ground of parking areas	semi-permeable paving
All internal axes	walkways without motor traffic
Area	ca. 15 ha

Surface drainage in the Concentration Zone will be provided by unlined channels running essentially parallel to the lanes. Along the pedestrian ways these will be of a more artistic character whilst in the East-West green spaces the water courses will become intensively landscaped architectural features related to the general landscape design. A high architectural standard will sought via competitions for both the design of new buildings and of open space landscaping. The latter should, in this zone, be aimed more at blending it with the architecture than at giving it a "natural" character.

Fig. 19 Physical model of the Concentration Zone. Yellow roofs indicate buildings existing end of 1996, construction of shaded yellow ones is planned for near future.

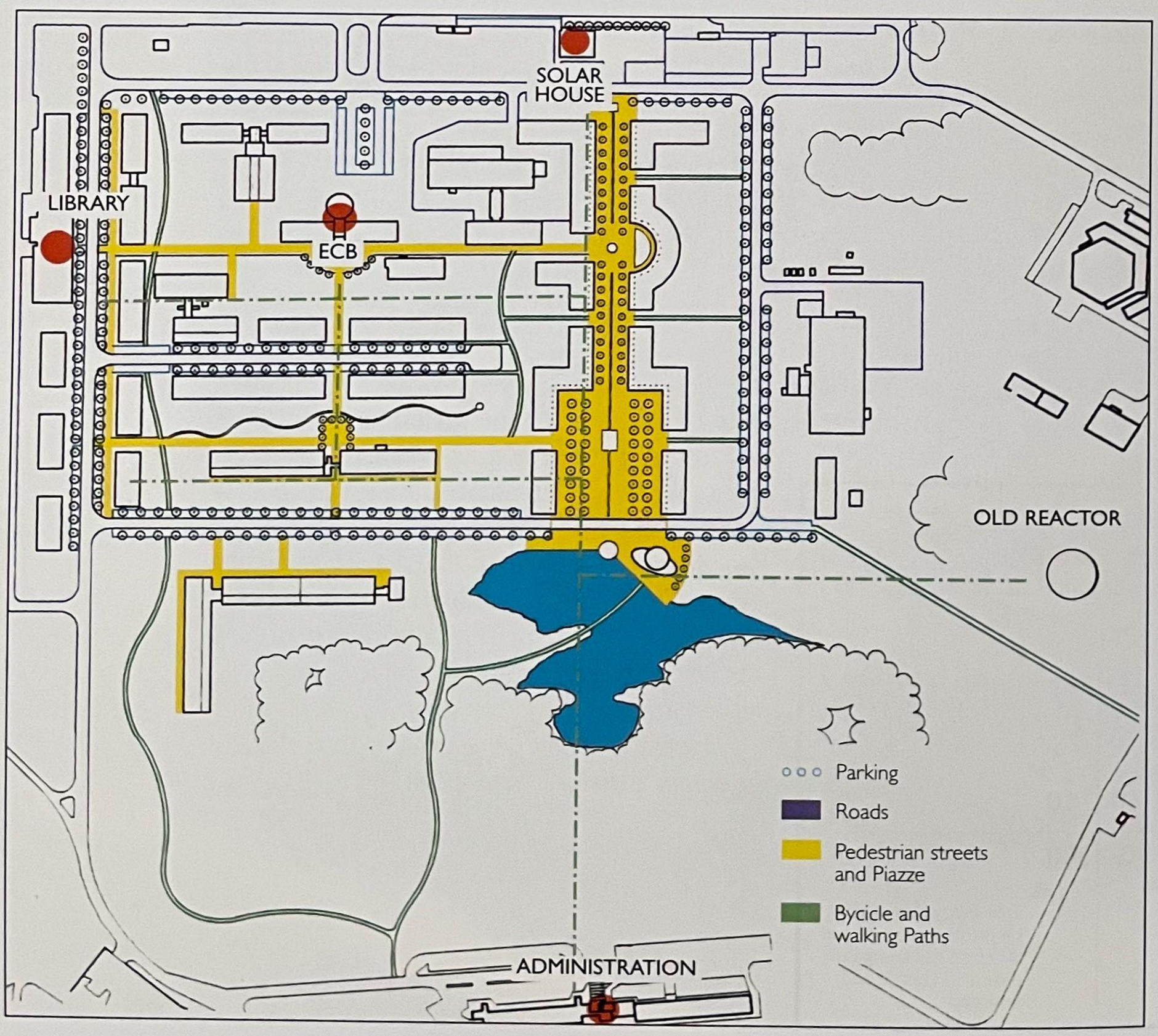


Fig. 20 Alignment of the main axes of the Concentration Zone.

The Main (Central) Piazza

In traditional Mediterranean settlements, the piazza symbolises the town itself. In the Concentration Zone it is designed to be the focal point, where - undisturbed by motor vehicles - employees and visitors can meet each other close to their buildings. It has clear spatial outlines and is formed as a built environment. Balancing the Main Piazza, at the opposite end of the main North-South axis, there will be a smaller, *Solar Piazza,* incorporating the Solar House, which, because of its more modest dimensions, will not rival the Main Piazza. Trees with loose canopies will leave the vista open along the connecting pedestrian way, which will be further accentuated by its central water course providing a pleasant murmur and a degree of cooling in summer. In addition to these two piazzas, there will be a *mini piazza* at the entrance to the *ECB building* which will form an important element in the pedestrian walk-way system. There will also be an enclosed garden adjacent to the Library, for walking and undisturbed reading.

The **Lake** which will form the southern boundary of the Main Piazza provides a transition to one of the more natural areas of the Centre. The planners consider it to be both a static and dynamic element, a generator of vitality and stillness of the MasterPlan. Whilst its northern part will be intensively designed with an accessible, built-up shoreline and fountains, the southern part will be more natural with shallow and steep shores alternating. It will be crossed by a light bridge or pontoon, connecting the Entrance Zone and the Mensa with the Main Piazza. A Cafeteria on the north-eastern lake shore will represent a formal end point of the Concentration Zone. Water for the lake will come from both natural seepage and rainfall. Its overflow will run down the waterway

Fig. 21 *Future walkway, with pergola, in the Concentration Zone.*

through the Centre of the Piazza and along the main North-South axis. It will be joined by water from the channel running along the ECB alley and, just before reaching the Solar Piazza, will veer to the NW before flowing into the water buffering system *(see Fig. 9)*.

Fit for the Job

The ECVAM building completed in 1994

The 1st EcoCentre Status Report pointed out that the design of the new building planned for the European Centre for the Validation of Alternative Methods (ECVAM) had been made prior to the commencement of the EcoCentre project. Its initial energy and environmental aspects were, therefore, those imposed by current Italian regulations. Under the EcoCentre project, the design was reviewed to see whether higher energy and environmental stand-

Fig. 22 ECVAM Building seen from north-east. Insert shows interior of a laboratory.