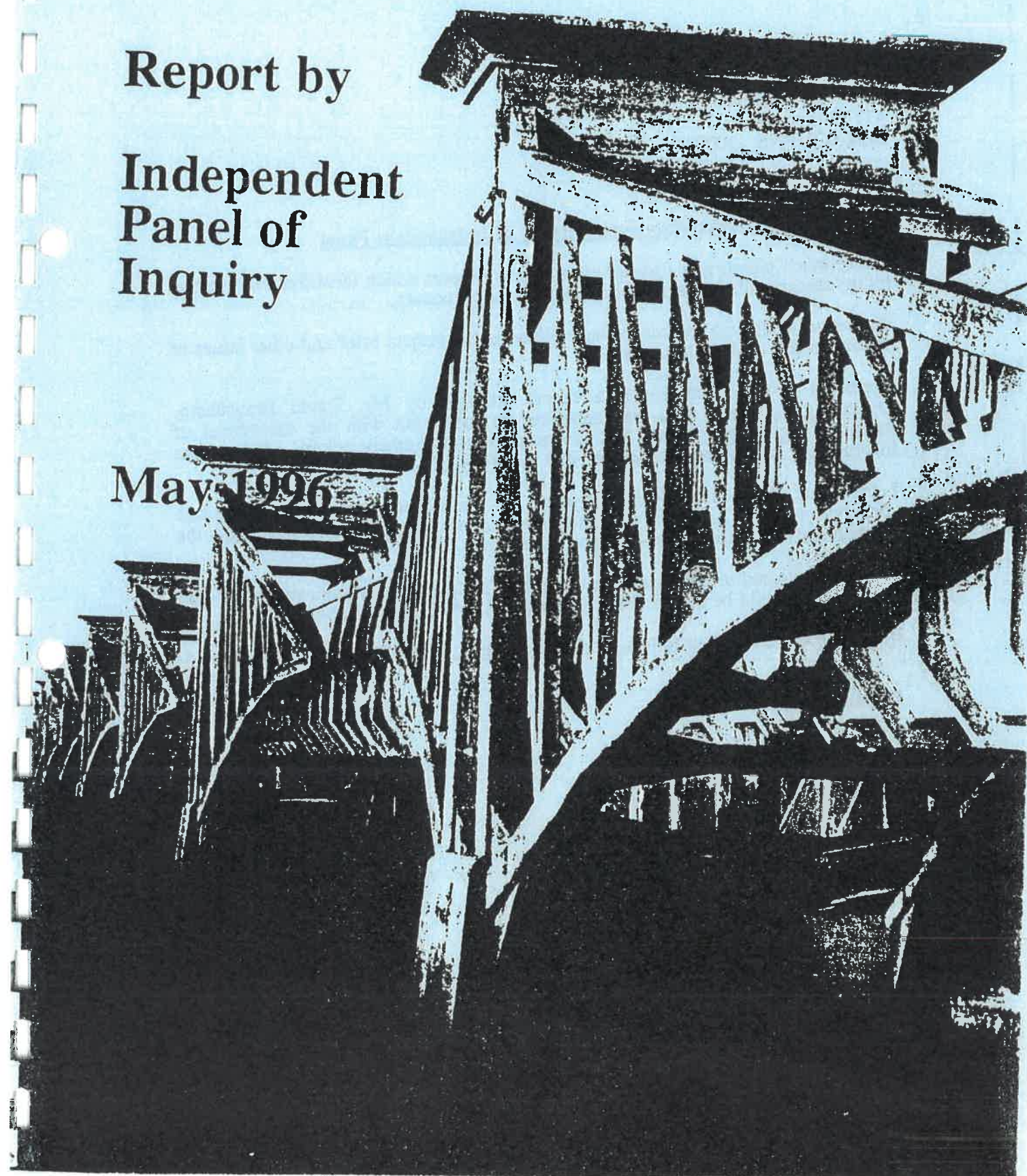


BARWON SEWER AQUEDUCT

Report by

Independent
Panel of
Inquiry

May 1996



23rd May, 1996

The Honourable Robert Maclellan,
Minister for Planning,
477 Collins Street.
MELBOURNE 3000

Dear Minister,

Re: Barwon Sewer Aqueduct - Report of Independent Panel

I have much pleasure in forwarding to you my report which identifies and assesses future conservation management options for the Aqueduct.

The report deals with the key issues outlined in the project brief and other issues of major concern to the submitters.

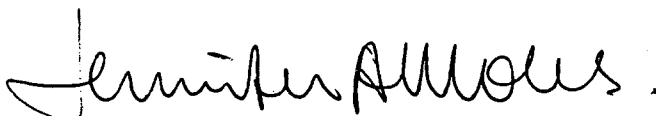
Appended to the document is a report prepared by Mr. David Beauchamp, Consulting Engineer, who was appointed to assist me with the assessment of structural engineering issues. His advice has been extremely helpful. It has been incorporated into my report together with the views of others.

I trust that this independent assessment of the issues surrounding the future conservation of the Aqueduct will assist you in moving the parties forward from the impasse reached at the end of last year.

I would be pleased to brief you directly on my findings and recommendations if you feel that this would be useful. I am also happy to brief local members, etc.

If I can contribute further to this, or similar projects, please let me know.

Yours faithfully


Jennifer A. Moles

EXECUTIVE SUMMARY

A Panel of inquiry was appointed on 22nd December 1995 by the Minister for Planning after an 'impasse' had been reached in the process of identifying appropriate future management arrangements for the Barwon Sewer Aqueduct.

The Panel was directed to investigate:

- * the extent to which the structure can be physically conserved in accordance with the principles of the *Burra Charter*;
- * the financial implications of maintaining the structure;
- * the extent to which the structure can be safely maintained and managed;
- * the role for members of the Geelong community to participate in preservation and management of the structure; and
- * the degree to which the surrounds could be incorporated into a managed recreation and tourism area.

The Panel has conducted a two-pronged inquiry: conducting public hearings of invited submissions, and carrying out its own program of research and interviews.

The issues which emerged where there was consensus by relevant parties were:-

- (1) the need to protect the public from any unacceptable level of risk arising from collapse of the structure or spalling concrete;
- (2) the appropriate methods and costs of repair; and
- (3) the futility of pursuing more elaborate modelling exercises to further define structural integrity.

A fundamental dispute exists within the engineering profession, however, about the level of structural integrity. It is concluded that the structural assessments made by the engineering consultants to Barwon Water were conservative in a number of respects, and their assessment should be seen as one which has responded to the water authority's concerns in relation to issues of public safety. Nevertheless, if a management approach is adopted which excludes the public from walking on or beneath the structure while it remains in an unrepaired state, the debate becomes largely irrelevant.

In relation to the future role of the Aqueduct within a wider planning context, it is clear that a future use which could be made of the structure is as a pedestrian/bikeway river crossing within an expanded openspace/trail network along the Barwon. The plans for the development of openspace along this segment of the river are in their infancy, but it is impossible to ignore the inevitability of open space development in the area given its natural conservation values and strategic links to existing trails and open space reserves.

The report also examines the available repair methodologies and their costs. Conventional 'patch repair' of the entire structure has been estimated to cost an initial \$5.7m with \$2.2m ongoing maintenance costs over 30 years. Most other repair techniques have difficulties in application to this structure.

The Barwon Water proposal to demolish the river spans is assessed and rejected on a number of grounds.

The Panel recommends instead that a staged approach be taken to repair of the structure, which focusses initially on patch repair of the river spans. Repair of these spans is seen as urgent because of demands to re-open the river for safe public use. The retention of these spans is also seen as critical in terms of retaining the cultural significance of the structure and, obviously, in giving the structure a utility as a river crossing. The initial cost of this option is some \$2.4m to \$2.6m.

The report recommends also that management responsibility for the Aqueduct be transferred away from Barwon Water. Having canvassed a range of other options for management and given consideration to the wider implications of the transfer of responsibilities for heritage conservation away from comparable Government agencies, the Panel concludes, somewhat reluctantly, that the best management arrangement would be for the land to become a Crown Reserve under the overall responsibility of the Department of Natural Resources and Environment. It is further recommended that a committee of management be established for the site comprising representatives of the City of Geelong, Barwon Aqueduct Committee, Heritage Victoria and the new Catchment Authority.

In relation to funding of repairs, it is recommended that contributions should come from all levels of government. Only government funding is envisaged for Stage 1. Direct public contributions are seen as an appropriate mechanism for funding later stages of development - once greater public awareness of the existence and significance of the structure has developed.

CHAPTER 1

INTRODUCTION

On the 22nd December, 1995, the Minister for Planning appointed an independent Panel to inquire into future management options for the Barwon Sewer Aqueduct. The Panel was directed to explore the following options for the structure:-

- ** *The extent to which the structure can be physically conserved in accordance with the principles of the 'Burra Charter'.*
- * *The financial implications of maintaining this structure.*
- * *The extent to which the structure can be safely maintained and managed.*
- * *The role for members of the Geelong community to participate in preservation and management of the structure.*
- * *The degree to which the surrounds could be incorporated into a managed recreation and tourism area."*

A full copy of the brief is included in Appendix 1 to this report.

At the outset of this enquiry, as panellist, I commented on a number of occasions to various submitters that I was conscious of the fact that there had already been a long history of investigations into the future management of the Barwon Sewer Aqueduct, and I was, therefore, not about to "re-invent the wheel" insofar as my investigations and recommendations were concerned. Rather, my role was seen as the collation and independent assessment of the issues surrounding the future of the Aqueduct.

The inquiry has indeed revealed that the various issues and problems associated with this structure have been identified for some time: reports going back as far as 1982 make similar recommendations on aspects of management to those included in this report.

Despite the long standing recognition of these matters, however, what can best be described as an impasse was reached towards the end of 1995 concerning the future of the structure. Barwon Water, the current owners and managers of this structure, were and remain of the view that the Aqueduct is in such a poor structural state that it represents a danger to the public, and that the repairs necessary to prevent further deterioration would be so costly, and so extensive and hence unacceptable in conservation terms, that part demolition and fencing-off of the remaining portion allowing it to gradually decline, is the only acceptable management option. Barwon Water have now also indicated that they are prepared to transfer this structure together with some 6-8 hectares of land to another management organisation, and would undertake landscaping works of the environs (a contribution of a total value of \$400,000 is proposed) - but only after the river spans are demolished. Barwon Water maintain that repair of heritage structures lies beyond their responsibilities as a water, sewerage and river management authority.

Against this, conservation interests represented principally by the Geelong Aqueduct Committee, but also by Heritage Victoria and a number of other organisations, insisted that conservation of the entire structure is the only means of preserving its cultural significance, and that this is both financially feasible for, and legally required of, Barwon Water. The Geelong Aqueduct Committee more recently, however, has come to recommend a transfer of this structure away from Barwon Water, continuing to argue for their responsibility for a financial contribution to repair. The Geelong Aqueduct Committee has always maintained that the Aqueduct is not in such a poor structural state as claimed by the water authority, and the public are at no risk if they are excluded from the immediate environs of the Aqueduct until repairs are effected.

Meanwhile, other land management bodies which might take responsibility for this structure, such as the City of Greater Geelong or the State Department of Conservation and Natural Resources (now the Department of Natural Resources and Environment) have shied away from this due to perceived costs and public liability implications.

It seems to me that the 'stand-off' reached was partly as a result of clashes in perceived corporate responsibilities and individual personalities.

In respect to the first issue, it is anticipated that Barwon Water will lose its river management responsibilities when the recommendations of the Consultative Action Team established by the Minister for Natural Resources to recommend a framework for waterway management for the Barwon, Moorabool and Corangamite catchments, are adopted by government. More importantly, Barwon Water have recently become "corporatised", seeking to shed non-core business - which has traditionally been conducted, and adopting stringent financial management policies including a no-new-debt policy and a freeze on tariffs for four years. Others interested in heritage conservation are concerned that this is but one instance how the restructuring of government agencies could have significant consequences for the management of heritage items throughout this State.

In respect to the role of individuals, Professor Lawrie Baker of Deakin University, a Barwon Water Board Member since 1994, who has been heavily involved in the Aqueduct debate, is a constructional engineer whose academic speciality is masonry structures. In contrast, Mr. Dick van der Molen from the Engineering Department at the University of Melbourne and a member of the Geelong Aqueduct Committee, is a structural engineer who has specialised professionally and academically in reinforced concrete structures.

I was frequently struck during the course of this inquiry by the strength of the commitments by the various individuals involved. This is a reasonably small group of people, many of whom wear multi-organisational hats. I also found that even those not directly involved in decision-making on the Aqueduct - where they know of its existence - had strong views for or against conservation. The preservation of heritage in Geelong seems to be an issue on which the local community takes sides.

Despite their differences, however, at least by the conclusion of the hearings, some agreement had been reached by the parties on many of the key issues. In particular, there was consensus about the need to protect the public from any danger including ensuring safe river usage; broad agreement on the costs of repair; and a general accord on the limitations of further theoretical modelling exercises to test structural condition.

Some disagreement remains, however, on the likelihood of imminent collapse and whether or not any collapse would be dramatic. Also there remains a debate on the financial responsibility for the repairs and the utility of the Aqueduct within the wider open space planning framework of the Barwon River environs.

This report describes and endorses the matters of agreement, and provides an independent assessment of the issues which remain in dispute.

The report is divided into eight chapters. Chapter 2 describes the context to the inquiry and provides some background information about the structure and events leading to this report. Chapter 3 outlines the method of inquiry adopted. Chapters 4 to 7 address the key issues in the brief, with Chapter 8 describing and assessing key options for future management.

It is to be noted that the report includes no separate chapter on the role of the Geelong community in the future management of the Aqueduct. This matter is addressed, however, both directly and indirectly throughout the report and in particular in the Chapters 7 and 8 dealing with sources of funds and assessment of options.

There are also a number of appendices to the report. These include a copy of the project brief, the package of documents forwarded to submitters, details of investigations undertaken, a summary of submissions and a report upon the engineering aspects of the Aqueduct prepared by Mr. David Beauchamp, of Beauchamp Consulting Engineers, who was engaged by Heritage Victoria to directly assist the Panel in the assessment of structural engineering issues. The last appendix incorporates correspondence with managers of a similar structure in Ivry-sur-Seine, to the south-east of Paris.

CHAPTER 2

CONTEXT TO INQUIRY

The Barwon Ovoid Sewer Aqueduct was constructed as part of the first Geelong sewerage scheme in 1913 to 1915. It carried sewerage across the Barwon River and its flood plain at Breakwater on the south-eastern outskirts of the city, towards the ocean outfall at Black Rock for almost 80 years. The Aqueduct was decommissioned in 1992. Decommissioning occurred because of Barwon Water's concerns about the structural integrity of the Aqueduct, the costs of repair and the under-capacity of the pipe to carry peak flows, which had been apparent for some time.

Land Ownership, Management and Zoning

The Aqueduct is located principally on land which is either owned, managed or leased by Barwon Water. On the northern bank of the river, the Aqueduct is for the most part on land owned outright by Barwon Water which is included in an Existing Public Purposes Reservation under the Greater Geelong Planning Scheme. Adjacent to the northern bank of the river, however, the Aqueduct crosses an Existing Public Open Space Reservation which extends approximately 55 metres to the north of the bank. This crown land is managed by Barwon Water acting as a committee of management. The Aqueduct then crosses Goat Island, which sits between two branches of the river at this point. The island is similarly zoned, owned and managed.

On the south bank of the river, the Aqueduct crosses a Proposed Public Open Space Reservation which extends approximately 80 metres to the south of the river bank. Beyond this, a short section of the Aqueduct is included on land zoned Rural Floodland. All land on the south side of the river is currently in the private ownership of Mr. Robert Scott, who operates a farming property of some 70 acres. Mr. Scott has advised that approximately 30% of his land is flood liable. The portion of his farm not included in the Rural Floodland Zone is zoned Reserved Industrial.

On the northern bank of the river, too, land in the vicinity of the Aqueduct above the flood line is zoned for and put to industrial use. Land on the northern bank of the river below the flood line is generally undeveloped and used for grazing. Extensive communities of riverine vegetation occur. Barwon Water is also the waterway management authority for the bed and banks of the Barwon River, pursuant to the Water Act of 1989.

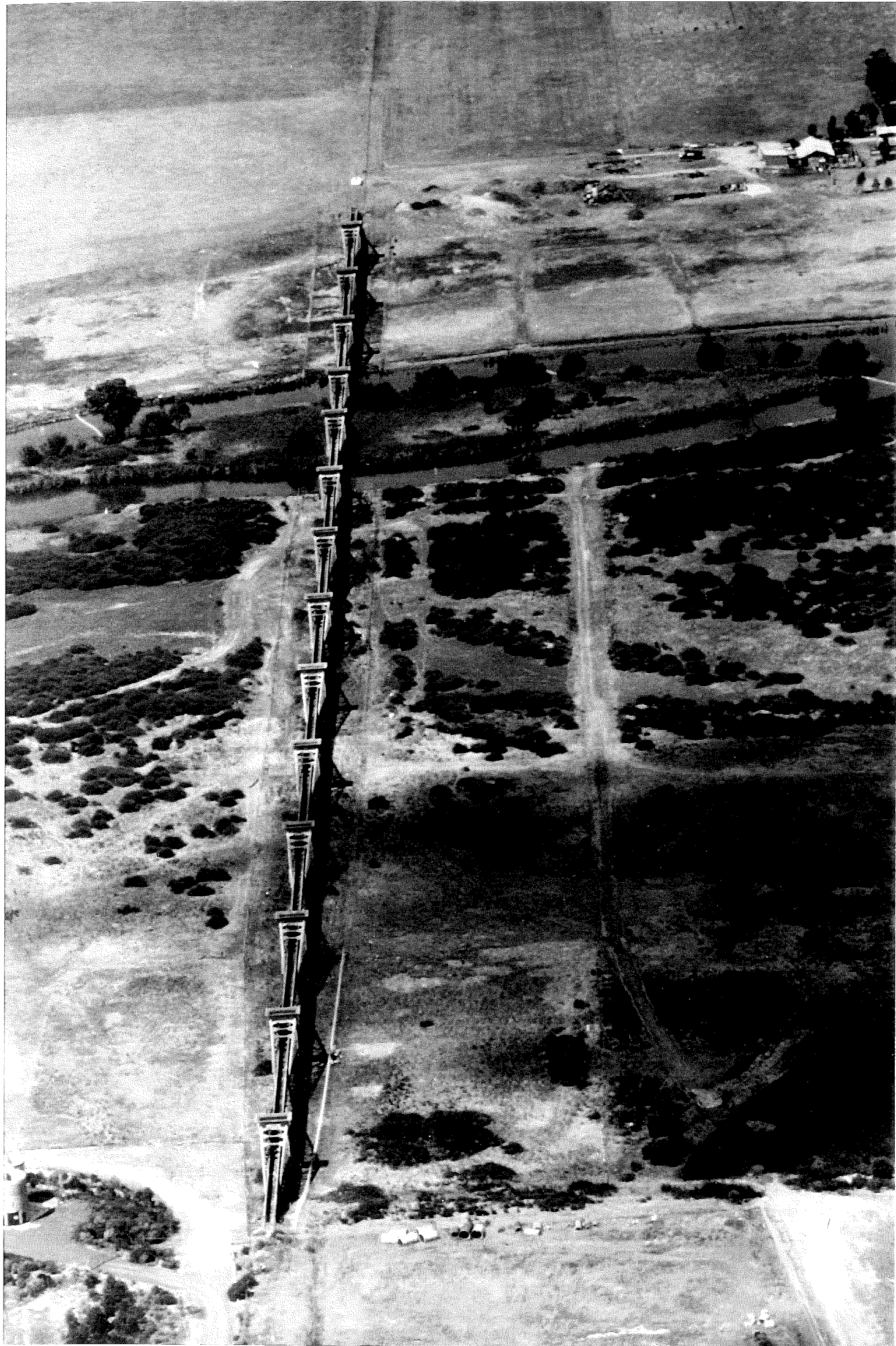
Design of the Aqueduct

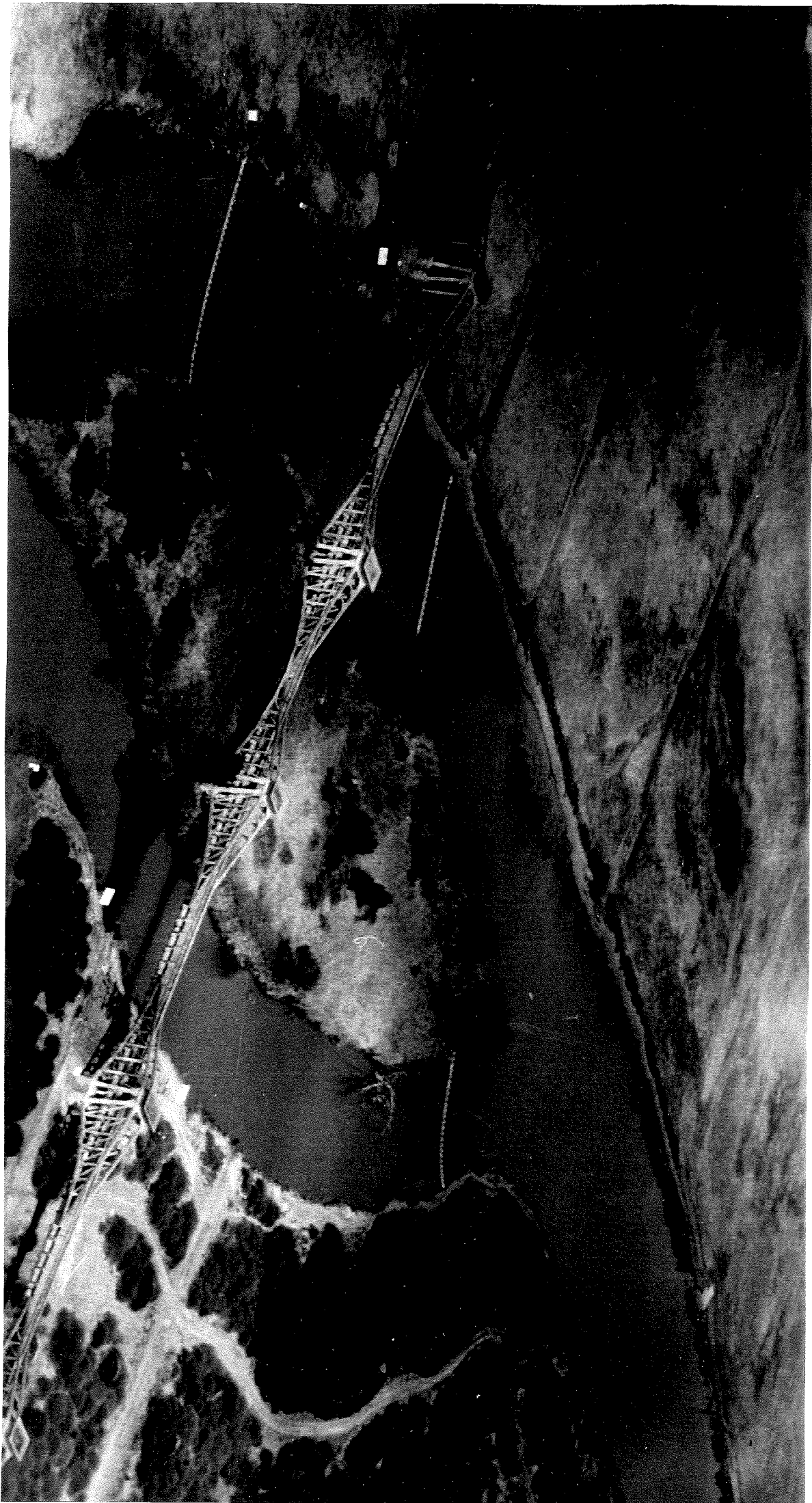
The Aqueduct was designed by the Tasmanian based engineering firm of Stone and Siddeley, who were also responsible for the design of the Bow Truss Building (Dennys Lascelles Wool Store) in Geelong. The Aqueduct is a reinforced concrete structure comprising 14 piers, each with a parallel pair of balanced cantilever trusses. The ovoid sewer is supported beneath a maintenance walkway which runs through the centre of the cantilevered arms.

Each cantilevered arm extends some 21 metres on either side of the pier with a 12 metre gap between the ends of the trusses occupied only by the pipe and walkway. One shortened span occurs at Goat Island. The Aqueduct spans a total of 756 metres.

The upper (tension) booms of the cantilevered arms are straight, while the lower (compression) booms curve both in plan and elevation. The upper and lower booms are connected by vertical members (in compression) and diagonals (in tension). The booms are connected laterally to each other. The walkway and sewer are supported directly from the towers or trusses except for the 12 metres between the ends of the trusses. The booms taper from approximately 400mm square at the tower, to 330mm at the apex. The vertical members and diagonals of the truss are approximately 200mm and 150mm square respectively. The Aqueduct is founded on pre-cast concrete piles driven to rock. The Aqueduct has expansion joints running through the walkway and sewer pipe at each span.

Something of the scale of the Aqueduct is indicated by photographs 1 and 2 on the following pages.





The Aqueduct is constructed using a reinforcing technique developed early this century by Armand Considere of France. The Considere system uses central reinforcing bars surrounded by lighter spiral ligatures in the case of compression members, and square ligatures for tension members, EG. Stone apparently had the Australian rights to the Considere patents. The true Considere method utilises a system of construction of casting compression members first, then loading fully or partially the structure, with the continuous reinforcing bars of tension members taking load without any concrete around them. This allows the steel to align in exactly straight lines in the direction of the load. Concrete is then cast around the steel under load. Generally the loadings increase before casting sufficient to cause all the bars to become straight and taut. After casting and curing the full load is applied to the structure. Considere considered this system reduced the likelihood of cracking in tension members. It seems that this process was not closely followed in the case of the Aqueduct.

While the belief has emerged at least in recent years that the design of the bridge has been drawn from the steel Firth of Forth Bridge in Scotland - a bridge which the Sewerage Trust's Chief Engineer McKay purportedly admired (see Photograph 3) - the Geelong Aqueduct Committee argued at the hearing that the design may well have been drawn from a bridge at Ivry-sur-Seine, a reinforced concrete bridge of Considere design believed by them to have been constructed in 1910. This is especially likely given Stone's patent rights to the Considere reinforcing system in Australia. Photograph 4 is of the Ivry Bridge.

Recognised Heritage Values

The Aqueduct has, in recent years, been recognised as having high heritage values. It is included on the Register of the National Estate, the State Historic Buildings Register (now the Heritage Register), is classified by the National Trust, and is included amongst the list of protected heritage items in the Greater Geelong Planning Scheme.

The bridge is recognised as having this value for a number of reasons. Alan Willingham, an architectural historian, who investigated the heritage values of the structure for the then Geelong District Water Board in 1991 said of it:-

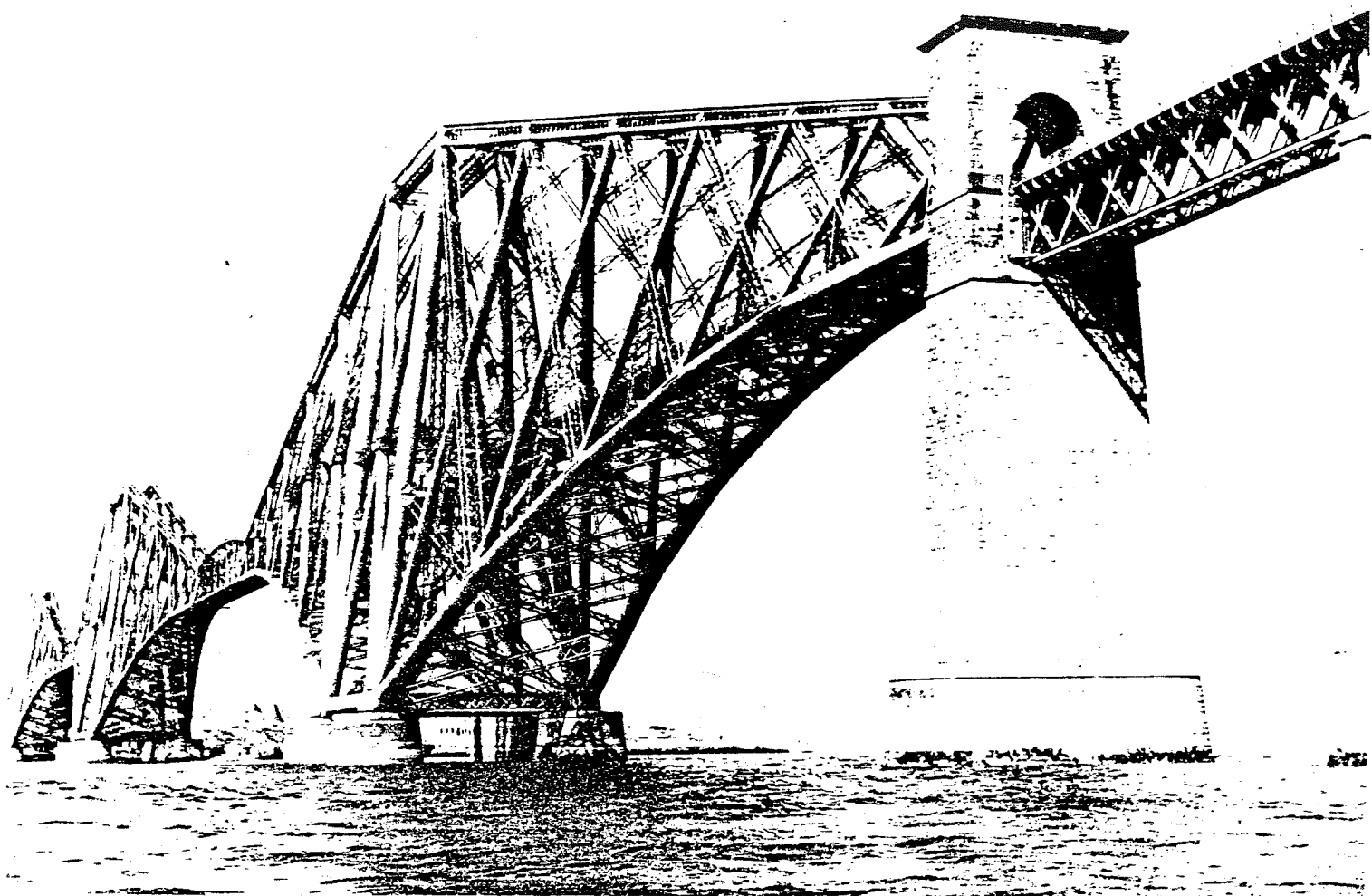
"The Ovoid Sewer Aqueduct ... was an ambitious project which Stone performed with some considerable ingenuity and inventiveness, E.G. Stone's design ... has an aesthetic quality ... and the structure has a strong landscape quality".

The National Trust classification of this structure occurred in 1987. Its citation was as follows:-

"The design was creative and innovative, using the latest techniques of the period. The site of the bridge and its unique design make it of national importance. It is an elegant structure and its members are of delicate proportions".

A 1916 report from "Concrete and Constructional Engineer" at pages 49 - 51 describes some of the creative aspects of the design:

"The accepted structure [in response to the call for tenders] is of reinforced concrete and designed upon the cantilever principle. The structure is economical and the work presents many interesting features. One of the great advantages derived by the use of the cantilever is the fact that any variations due to temperature are horizontal whereas in a series of arches, these movements are vertical and would create a series of undulations throughout its length an undesirable effect, seeing that the grade of the sewer is only 1 in 2500".



73
Forth Bridge as seen from the
landing pier at South
Queensferry.

PHOTO 3 FIRTH OF FORTH BRIDGE



PHOTO 4 PONT D'IVRY SUR SEINE

This report goes on to say:

"In order to take up the horizontal wind stresses adequately and economically, the cantilevers are splayed ... the pipes, all of reinforced concrete, are built into the structure; they do not add to its stability. The pipes are oviform in shape, 8 feet in length, thus the length coincides with the distance between the vertical struts in the cantilevers, thus the transverse webs between the cantilevers strengthen and support the joints of the pipes".

and

"Hand railing is sufficiently reinforced to act as a girder".

Recent History

The bridge has had a long history of ongoing repair since 1922. Barwon Water estimate that some \$1.15 million has been spent on the Aqueduct over the last 45 years. The repairs have been directed towards replacement of spalled carbonated concrete and cleaning or replacement of rusted reinforcement. The poor state of repair of the Aqueduct led Barwon Water to commission various reports by Taywood-Maunsell Engineering Consultants on its structural integrity and options for repair. Maunsell reports were prepared in 1990, 1991 and 1994. Maunsell have serious reservations about the structural integrity of the Aqueduct. This matter is further discussed in Chapter 5.

Barwon Water in April 1994 made application to the Historic Buildings Council to demolish all or part of the Aqueduct. At the same time, however, a working group was established to explore possible options for repair and sources of funding for the restoration, maintenance and use of the Aqueduct. This group comprised representatives of Barwon Water, the Historic Buildings Council and the Geelong Aqueduct Committee, which had been earlier established in February. Unfortunately, the terms of reference for the working party which included looking at partial demolition options were not acceptable to the Geelong Aqueduct Committee, and they withdrew from the working party. An options paper was later prepared by Barwon Water's representative on the working party, Professor Lawrie Baker, with input from the Historic Buildings Council.

Maunsell's 1994 report estimated costs for Professor Baker's various options, utilising conventional methods of "patch repair". The cost estimated by Maunsell for complete restoration using this method, was some \$7.94 million, representing an initial cost of \$5.74 million and a maintenance cost for 30 years of \$2.20 million (in 1994 values).

Around this time, interest also developed in examining other recently-developed techniques for reinforced concrete repair. The Historic Buildings Council in 1994 commissioned a report by Dr. Neil North of M.P.L. Laboratories into these new techniques. The report was received on the 19th May 1995. It identified two methods of realkalisation of the concrete to arrest corrosion of the reinforcing steel. One method was electrolytic (cathodic protection) and the other a chemical process using silicate solutions.

It was as a result of the successful trials of the silicate solution and an estimated cost of the initial application of \$25,000 and \$20,000 for each subsequent application, that successful application was made to the Government's Heritage Buildings Restoration Fund for a grant of \$65,000 over three years for Aqueduct repairs. The grant was authorised on October 11th 1995.

While Barwon Water withdrew their permit application in April 1995 to allow North investigations to continue, nevertheless they continued to have concerns about the structural integrity of the Aqueduct. Later in 1995 Professor Baker proposed a method of periodic test loading of the bridge to establish safety margins and the possible timing of any collapse. Maunsell, however, resisted precise calculations of the time to collapse

given the uncertainty of corrosion assumptions and structural behaviour of the Aqueduct. Maunsell maintained that their investigations indicated that:

"The Aqueduct does not have any significant current margin of safety under its own self weight and the weight of the pedestrian walkway and the empty sewer. Furthermore, they indicate that collapse, were it to occur, would happen with little prior warning.

On these grounds we consider it prudent for the Board to assume that collapse of the Ovoid Sewer Aqueduct could occur at any time."

This advice was provided to Barwon Water by Mr. Louis Walsh of Maunsells on 7th September 1995.

On the 9th October 1995, Barwon Water acting as the river manager under the Water Act, closed the Barwon River beneath the Aqueduct. They also declined to accept the grant from the Government Heritage Buildings Restoration Fund, pending a meeting between themselves, Historic Buildings Council and Heritage Victoria.

This meeting occurred on the 23rd November 1995. The Minister for Planning was present.

The outcome was the establishment of this inquiry by the Minister.

CHAPTER 3

THE INQUIRY PROCESS

The inquiry commenced in earnest in February 1996. It has largely been conducted on a part time basis with only two short periods, each of two weeks, of full time effort. While the originally selected completion date was the end of March, a new completion date of mid May was adopted as the public hearings had run later than intended.

In conducting the inquiry, the Panel adopted a two-pronged approach to its investigations. The first course of action was to advertise for public submissions concerning management options for the Aqueduct. The second course was to seek out information relevant to management of the structure which would not necessarily be forthcoming in the course of invited submissions - at least in full.

Invited Submissions

Public advertisements were placed in 'The Age' and the 'Geelong Advertiser' newspapers on January 13th and 20th. These invited written submissions upon the future management of the Aqueduct by the 16th February 1996. A press release was made at the same time with the 'Geelong Advertiser' carrying an article on January 13th, and a local Geelong radio station running news items on the same day.

Copies of the public advertisement were also forwarded by Heritage Victoria, who has given administrative support to this inquiry, to persons and organisations already known to have an interest in the matter.

Appendix 2 contains a copy of the public advertisement and press release, together with a "Guide to Submissions" prepared by the Panel. All three documents were forwarded to enquirers.

As the written submissions were received, they were included in a Register of Submissions, made available for inspection in Melbourne and Geelong. This was designed to afford submitters an opportunity to respond to the submissions of others.

Submitters were also invited to make oral submissions at the hearing scheduled for February 27th, 28th and 29th. These hearings were held at the Conference Centre of the City of Geelong in Little Malop Street.

In response to the advertisements, twenty-three written submissions were received from groups and individuals in Geelong and elsewhere in Australia. Twelve submitters chose to make oral presentations at the hearings. A summary of all submissions occurs in Appendix 3 to this report.

Following the first three days of hearing, it was decided to conduct another day of hearing devoted solely to structural engineering issues, as these were the source of a fundamental difference between the conservation groups, especially as represented by the Geelong Aqueduct Committee, and Barwon Water and their engineering consultants. This further day of hearing took place on the 20th March. Prior to it, a special hearing was convened on March 14th, chaired by Mr. David Beauchamp, with the purpose of identifying any common ground in relation to the methods of assessing structural integrity and repair options before the hearing before the Panel. Representatives of Barwon Water and Maunsell, the Geelong Aqueduct Committee, the Institute of Engineers and Heritage Victoria attended the meeting. Agreement was reached only on some minor aspects.

The results of this March 14th meeting are not reported separately here but have been incorporated into Mr. Beauchamp's assessment in Appendix 5. A separate report on the March 14th meeting is also included in a bundle of documents which have been collated during the inquiry and forwarded by the Panel to Heritage Victoria.

On the final day of hearing, it was agreed that Mr. Beauchamp's final report to me and some calculations prepared by the Geelong Aqueduct Committee be circulated for comment by other parties with engineering interests. Mr. Beauchamp's final report, which incorporated an assessment of the calculations by the G.A.C., was circulated on

the 10th May and comments on it were received by the Panel on 17th May. In Chapter 5, I address Mr. Beauchamp's report and the comments received thereon.

Panel Initiated Investigations

Numerous meetings and conversations were held by the Panel with persons or organisations from whom further information or assistance to the inquiry was likely to be forthcoming.

Contacts were made with potential land management authorities, with organisations from whom financial assistance might be forthcoming, with legal advisers, with organisations responsible for job training of the unemployed in Geelong, with persons involved in "sister city" and tourism projects, with persons responsible for bridge maintenance who would be able to advise upon the Aqueduct's history, and with individuals concerned with the forward planning of open space and recreation areas in Geelong.

Contact was also made with the works authority responsible for the management of the bridge at Ivry-sur-Seine. A response to our questions was forthcoming from that authority only on the 17th May.

The Panel is grateful, in particular, for the prompt help afforded by officers of Barwon Water and the City of Greater Geelong in filling gaps in factual information. I am grateful also for the assistance given by Mr. Robert and Mrs. D. Garlick, who took the photographs of the bridge at Ivry-sur-Seine in the Easter period.

Three formal inspections of the Aqueduct and surrounds were also conducted, and Barwon Water Board minutes and the original Aqueduct engineering drawings were examined.

An inspection of the San Remo Bridge at Phillip Island was also conducted on 18th May. Remedial Engineering are undertaking repairs to this reinforced concrete structure incorporating cathodic protection.

As I was conscious that in adopting an approach to the inquiry which involved investigations beyond the confines of the public hearing, and this was a departure from the generally accepted formal planning panel processes which seek to ensure natural justice is afforded to participants by restricting deliberation to matters discussed at the hearing, the submitters were advised of the nature of the process at the outset. The public information package which was forwarded to would-be submitters included this advice, and again submitters attending the public hearings were reminded of it. No submitter objected to the process at any stage.

I would say that I nevertheless believe that the method of investigation adopted does not offer any major threat to natural justice for a number of reasons. Firstly, my self-instigated investigations have been directed primarily towards further clarification of the issues raised by submitters. Secondly, any disadvantage for submitters was sought to be overcome by ensuring that any significant new material emerging as a result of these investigations was circulated to them for comment. The most significant factor, however, is the fact that my role in decision making on the future of the Aqueduct is merely an advisory one. No doubt, if any submitter felt that they needed a further opportunity to address the matters which I have investigated, an opportunity will arise in the course of the decision making by others which will follow this report.

Issues Emerging

The written and oral submissions made to this inquiry confirmed that the matters for investigation listed in the brief for the study are indeed the major issues to be addressed. The two issues relating to physical conservation and structural safety listed separately in the brief have been combined, however, and reported jointly in Chapter 5.

CHAPTER 4

STRATEGIC PLANNING CONTEXT

As part of his oral presentation to the hearing, Mr. Ivar Nelsen of the Department of Conservation and Natural Resources (now the Department of Natural Resources and Environment) expressed the view that the Aqueduct had no viable future alone, but it was essential to consider it within a wider planning context.

The Aqueduct is located on the south-eastern periphery of the urban area of Geelong. It forms part of an extensive area generally east of the upper breakwater on the river and north of the river itself, which is zoned for, and used as, general and light industry, storage, warehousing and like activities. This development occurs above the 1 in 100 year floodline. Much of the land in this vicinity has been in industrial use for decades.

Leather Street which runs east/west through this area and from which access to the Aqueduct can be gained, is abutted by recently developed large industrial buildings which, together with the configuration of the land in the vicinity of the river, largely obscure views towards the Aqueduct and river. A Barwon Water works depot is located on Leather Street, and abuts the northern end of the Aqueduct.

The northern flood plain of the river, however, remains largely undeveloped with extensive communities of native vegetation. The Geelong Aqueduct Committee - Landscape Subcommittee's submission described the relatively undisturbed nature and diversity of these communities - some 15 separate types having been identified. Some 66 hectares of this flood liable land located on either side of the Aqueduct was purchased by Barwon Water in January 1994 for \$215,000.

On the southern bank of the river, land generally east of Marshall is principally used for farming purposes. This includes the 70 acre property owned by Mr. Robert Scott onto which the Aqueduct extends. Mr. Scott estimates that some 30% of his farm is flood liable. An extensive tract of land, including much of Mr. Scott's property, and other land east of Kings Lane where it is above the flood line, is zoned for future industrial purposes. The City of Geelong planners advise that this zoning was put in place some 20 years ago and there appears to be little demand to release this land at present. The distance between the Aqueduct and major roadways on the southern bank again largely obscures views to the structure.

Thus, given the surrounding land uses, as one Geelong Councillor described it, the Aqueduct might be regarded as "out in the sticks". If, however, one considers the broad directions for the expansion of the city to the south and east (as defined in the Geelong Regional Commission Strategy of 1987), or, more importantly, if the Aqueduct is viewed, not from the perspective of the developed land but from the perspective of the open space and recreational system of the city, it assumes a more central role.

The Barwon River as it passes centrally through the municipality of Greater Geelong is abutted by existing Public Open Space Reservations which are used for passive or active recreation, for much of its length. In the vicinity of the Aqueduct, an existing Public Open Space Reservation extends along the northern bank of the river from Leather Street to Boundary Road. There is only a short break of perhaps 500 metres in length in the continuity between this reserve and another existing reserve extending northward to the urban areas of Geelong, which commences at the northern breakwater. It seems that in anticipation of completing a link between the two reservations, Barwon Water in 1991 commenced construction of a walking or cycling trail southward from a point opposite the extension of Tannery Road to a point east of the Aqueduct. This project involved D.E.A.T. labour. The project remains incomplete. Any eastward extension of this Public Open Space Reservation on the northern bank would traverse flood land, and could link through to the crown land managed by the Department of Natural Resources and Conservation east of Scotts Road. This crown land is an extension of the reserves around Lake Connemara - a site of high natural conservation importance recognised in the RAMSAR international convention relating to migratory birds.

On the south side of the river, a strip of land from the upper breakwater to the extension of Reserve Road has been included in a Proposed Public Open Space Reservation since 1975. This extends for perhaps 4 kilometres along the river. Southwards of Reserve Road the land is already in public ownership. This Aqueduct is located perhaps 1.5 kilometres southward along the river from waterfront land on the south bank already in public ownership. In the vicinity of the Aqueduct the Proposed Public Open Space Reservation is some 80 metres wide.

Despite enquiries on my part, it remains unclear who the acquiring authority is for the Proposed Public Open Space Reservation in this vicinity. It has been suggested that it is likely to be Barwon Water given that they have acquired other land along the river nearby. I note, however, that most of the land south of the northern breakwater is managed by The Department of Natural Resources and Conservation.

In their written submission to the inquiry, the National Trust made the following observation on the land ownership pattern within the locality:-

"In addition to being of extraordinary intrinsic significance, the Aqueduct has the unusual advantage of being located on public land and has outstanding potential for recreation, education and tourist use".

They went on to suggest:-

"It is widely agreed that the 'highest and best' use of the now redundant structure is as part of a public trail system for the Barwon River parklands".

Numerous submissions to the inquiry indeed identified such a role for the Aqueduct, and the potential for expansion of the already extensive bikeway/pedestrian trail network which extends through the Greater Geelong area. The submitters saw the trails as capitalising on both the numerous historic industrial features along the Barwon River, and the quality of its natural environment.

The submission by the Australian Studies Centre at Deakin University, described the potential for the Aqueduct to be part of an industrial heritage trail which could be promoted along the river. The Geelong Aqueduct Committee, Landscape Subcommittee, described a more extensive system of trails extending into the Bellarine Peninsula and north and west of Geelong. Mr. Mark Trengrove from this group described the pivotal river crossing role of the Aqueduct in his "Three Bridges Recreational Trail". This trail was seen to capitalise on the high natural conservation values of the river environs. The submissions by Mr. Kayak and the Geelong Environment Council also supported the retention of the Aqueduct for use within a bike way or walkway context.

Discussions and research beyond the hearing context also pointed to the utility of the Aqueduct within an open space network. As early as July 1982 a report prepared by the Centre for Environmental Studies at the University of Melbourne for the then Geelong Water and Sewerage Trust entitled "Objectives and Guidelines for the Management of the Barwon River at Geelong", identified historic sites along the river and recommended their interpretation. The report said that this would be assisted by the development of a bikeway and pedestrian path in the river valley. The natural conservation values of areas in the river segment around the Aqueduct were also recognised by the study, which recommended completion of bikeway and walking trails as far south as the lower breakwater. The Aqueduct was seen to have potential as an intermediate crossing site and viewing point.

Discussions with Mr. Bruce Humphries, at the City of Greater Geelong, also suggested that in the context of long term expansion of the open space trail to the south-east of the city, the Aqueduct was located at the most strategically advantageous position for a river crossing given the greater downstream width of the river and abutting farmland; and the opportunities to link into the rail trail network being developed only 3 kilometres to the

north at present. Mr. Humphries noted that money for a purpose-built pedestrian bridge in this location would not likely be forthcoming. While an expanded open space network to the south-east is not yet reflected in any strategic planning documents for the amalgamated municipality, Mr. Humphries advised that funds have been committed by the City of Greater Geelong for the development of an open space strategy for the municipality which will address this issue.

Barwon Water raised a number of arguments at the hearing against this possible role for the Aqueduct.

Firstly, it was suggested that to repair the Aqueduct for use as a river crossing was pointless - it would create "a bridge to nowhere" - given that the land on the southern side remains in private ownership. In my view, this is a somewhat short-sighted perspective which ignores the fact that the land adjacent to the river's southern bank has been reserved for in excess of 20 years for public open space. Further, acquisition of the strip along the river should be assisted by the effects of flood liability on land values and the limited overall size of the Scott's farm which may encourage a change of use for the farm. While it may be that land acquisition on the southern side of the river does not proceed for some years, the possibility also exists of using the restored spans of the Aqueduct across the river as a viewing platform in the meantime.

Secondly, it was argued that the Aqueduct walkway width at some 1.4 metres is narrower than the 1.8 metres standard now prescribed for pedestrian bridges. As was pointed out by a number of submitters, and as is included in the submission prepared by the City of Greater Geelong for the aborted Historic Buildings Council permits meeting of 1994 notes:

"The width of the pathway is almost identical to that of the pedestrian bridge west of the James Harrison Bridge across the Barwon which is adequate for two dismounted cyclists to pass one another".

In my view, the lack of vision expressed by Barwon Water in relation to the expansion of open space trails along the Barwon River is somewhat surprising given the excellent achievements by that authority in relation to the development of the river bank parkland in the past. It would be a sad consequence for the strategic planning of urban Geelong and its surrounds, if the corporatisation of Barwon Water and other government agencies destroyed the vision necessary to strategically plan for the future.

If the Barwon Water recommendations for the demolition of the river spans were effected, it seems to me that there would not only be a loss to our cultural heritage, but a loss to strategic land use planning - a retrograde step would be taken to a position from which it might be difficult to recover.

CHAPTER 5

STRUCTURAL INTEGRITY, REPAIR METHODS AND COSTING

The terms of reference for this Panel inquiry included that exploration was to be made of:-

"* *The extent to which the structure can be physically conserved in accordance with the principles of the 'Burra Charter'*"; and

"* *The extent to which the structure can be safely maintained and managed.*"

Structural Integrity

Concerned about the at least visually-apparent poor structural condition of the Aqueduct, Barwon Water engaged consulting engineers, Taywood-Maunsell in 1989 to assess the structural condition of the Aqueduct and to examine various repair options. Their report of March 1990 was based on an assessment of three representative spans of the structure. The major conclusion was that the concrete had carbonated and is longer protecting the reinforcing steel. Their analysis indicated that all of the reinforcing steel must be assumed to have been de-passivated. They estimated that it was likely that every existing original member will need to be replaced within 25 years, with 25 percent of those requiring treatment within the next 5 years. They suggested that there was a major concern with the lower chord on one of the trusses on tower 14 (the southernmost tower) and "*the possibility of collapse [there and at other locations] could not be entirely ruled out*". Their concerns about corrosion were greatest in the case of the more slender members of the trusses and suggested that the larger main members could suffer major reinforcement corrosion before substantial damage would be apparent. They also noted widespread deterioration to the underside and beams of the walkway, and the pipe supports.

Maunsell conducted a structural assessment using their computer program "Space-Gass" for a fully laden pipe (the Aqueduct still being in service at that time). The concrete strength was assumed to be 14MPa. They concluded that as a result of reinforcing corrosion, truss members have all lost their structural strength to some degree. The analysis nevertheless showed that had corrosion not taken place, there would be more than sufficient reserves in the truss members to carry the maximum loads. They concluded that factors of safety, however, were now approaching unity.

Taywood-Maunsell recommended various repair methods designed to give either a 3 year, 3-10 year, or longer term life to the structure. They calculated that full patch repair would be necessary to minimise the longer term maintenance costs. They also recommended a subsequent realkalisation treatment. Total repair cost for the entire structure was estimated to be \$4,761,000.

In April 1991, Taywood-Maunsell again reported to the Geelong and District Water Board on a more extensive analysis of the structural integrity of the Aqueduct. The Board had asked that four options for future management be assessed and the cost of staging work considered.

In this case, Maunsell conducted a full above ground assessment of the structure and gave each member a damage rating. As Mr. Beauchamp's report in Appendix 5 noted only one member was given a "5" or structurally unsafe rating in a grading of 1:5 (this was the bottom chord in Tower 14). Of the approximately 1,363 elements surveyed on the structure, only 64 members were reported as having a condition of "4" and of these only 38 were truss or structural members. That is to say, less than 5% of the 896 truss members were rated 4 or 5.

In 1994, Maunsell prepared another report on the structure. Based on a visual inspection of randomly selected members, it was considered that there was no need to increase the damage estimate for the trusses, tower and walkway from that given in 1991. Concern was nevertheless expressed about the pipe support brackets, though no comparison was made with the 1991 assessment.

This time, however, Maunsell estimated that full restoration of the Aqueduct by patch repair would cost some \$7.94 million, which represented a cost of \$5.74 million initially with a maintenance cost of \$2.2 million (in 1994 values) for a 30 year period. It is to be noted that the cost of complete demolition of the structure was also revised from earlier estimates of \$540,000 to \$410,000. No reasons were given for this change.

Maunsell again in 1995, in the form of a letter to Barwon Water dated 7th August, analysed the current strength of the Aqueduct. They affirmed their earlier view that the two vertical members closest to the pier are the most critical members of each truss. Their analysis indicated that the application of ultimate applied loads to those members would exceed their capacity under self weight alone, that is, the empty sewer and a live (or pedestrian) load. Their opinion was that the assumed factor of safety in 1992 of 1.1, based on the weight of the sewerage, would have been reduced in the three years since the analysis by corrosion of reinforcing. They indicated that their analysis failed *"to prove any assurance that this structure has a margin of safety under current loading conditions"*.

Then on September 7th 1995, Maunsell advised Barwon Water by facsimile transmission:

"As detailed in our fax of the 10th August 1995 our investigations indicated that the Aqueduct has not had any significant current margin of safety under its own self weight and the weight of the pedestrian walkway and empty sewer. Furthermore, they indicated that collapse, were it to occur, would happen without any prior warning.

On these grounds we consider it prudent for the Board to assume that collapse of the Ovoid Sewer Aqueduct could occur at any time".

The river beneath the Aqueduct was then closed by Barwon Water in October 1995.

Barwon Water's written submission to this inquiry affirmed their concerns about public safety arising from the structural state of the Aqueduct and indicated that the only satisfactory solution was to demolish the river spans and securely fence the remainder. They emphasised the fact that Taywood-Maunsell were internationally recognised expert structural engineers, and their advice could not be ignored. Barwon Water's concerns about the structural safety went so far as to suggest that restoration of the structure could also be dangerous for workers.

The Geelong Aqueduct Committee's Engineering Subcommittee, however, criticised the Barwon Water position on a number of bases. While the subcommittee had no argument with Maunsell's 1991 report which generally concluded that: "most members have a significant reserve of strength", they were critical of the August 7th 1995 report in particular. Their criticisms included that the assumption of a direct relationship between the strength of the compression members and the area of main steel remaining was incorrect, and the application of this incorrect assumption had the effect of underestimating truss member capacities. They also suggested that application of various modern codes to assess the 1915 compression members was inappropriate. Mr. van der Molen suggested that the only appropriate design checks for the compression members were those based on the stability theory of structural mechanics. He was also critical of Maunsell's assumptions about the date of commencement of corrosion and its consequent extent.

The structural debate engaged a considerable amount of the Panel's time in this inquiry. It was thought necessary to do so as there would be little point in attempting to establish a repair program if parts of the bridge were to collapse while the program were in train, or if the bridge was declared unsafe and demolition was required as in the case of the Bow Truss Building. Further, it was thought appropriate to enquire into this matter as Barwon Water had argued that even repair of the Aqueduct would be dangerous for

those working on it, and that public liability insurance would be difficult to obtain given the state of the structure.

Mr. David Beauchamp has provided independent advice to me on this division of views concerning these engineering matters. His report is included in Appendix 5. Rather than repeat the analysis he has conducted, it is only necessary to report that his main conclusion was that the Maunsell 1991 analysis was, in his view, very conservative for two main reasons. The first was that the assumed concrete strength of 14MPa was likely to be well below that of the concrete actually used in the structure. He reports that he has obtained the results of the crushing of some spalled samples of concrete from the Aqueduct which showed strengths of 18.5, 27.0 and 26.0 MPa. Mr. Beauchamp's second criticism was that the assumed effective length of members in the buckling analysis was conservatively calculated as the full length of the member, and allowed for no restraining effect by the fixing of joints by concrete. This approach had been adopted by Maunsell, whereas in the analysis of the trusses, fixing at the ends of members had been assumed. "This is a very conservative approach", Mr. Beauchamp said, "as it assumes that moments can be induced in members and that no restraint is provided against buckling of these members". Mr. Beauchamp's report advises that if a higher strength of the concrete is assumed and the effective length of the members is reduced to a realistic level (which he calculates to be some 0.7 times the actual length), the buckling load for the column increases. Mr. Beauchamp said:

"Applying these factors to 1-1 and 2-2 [the two trusses closest to the tower] means that these members are no longer critical members and a significant loss of reinforcing can occur before they would reach ultimate capacity".

Notwithstanding his view that the structural integrity of the Aqueduct is likely to be higher than estimated by Maunsell, Mr. Beauchamp's report went on to suggest that in order to ensure an appropriate level of public safety, various measures should be put in place. These include more secure fencing and the establishment of a series of levelling points along the bridge to allow measurements to be taken every three months to check for deflections. In relation to the need to reopen the use of the river beneath the structure, Mr. Beauchamp suggested that, if full patch repair could not be undertaken immediately, rather than demolish the spans as suggested by Barwon Water, new temporary hangers could be provided for the pipe, loose concrete removed, props placed under but not in contact with the ends of the trusses, and a net erected to catch any loose concrete that might fall.

As noted earlier, Mr. Beauchamp's report was faxed to persons and organisations who had addressed the engineering issues in this inquiry on Friday 10th of May. An addendum was forwarded on Tuesday 14th May. Comments on the report were invited by Friday 17th May.

In response to the invitation, the Panel received replies from:-

- . Mr. Ken McInnes of the Engineering Heritage Subcommittee of the Institution of Engineers Australia.
- . Mr. Peter Selby-Smith of Corcoran-Shepherd Engineering Consultants (previously with Maunsell).
- . Mr. John Graham of Barwon Water incorporating comments from Professor Lawrie Baker and Mr. Louis Walsh of Maunsell. Comments by Mr. Mike McCoy of Barwon Water were also included.
- . Mr. Dick van der Molen for the Geelong Aqueduct Committee, Engineering Subcommittee who endorsed the report.

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These repairs are included at the rear of Appendix 5. These comments were brought to the attention of Mr. Beauchamp and he has made a number of amendments to the report as calculated to accommodate the corrections identified and some of the comments. I have also discussed the more substantial comments with Mr. Beauchamp. I am content to adopt the views expressed in Mr. Beauchamp's report subject to the following comments and reservations.

1. Mr. McInnes expressed the view that testing of new techniques for repair on the original fabric of the Aqueduct should not adversely affect a significant proportion of it. I believe that Mr. McInnes' outline of the principles which should guide remedial testing are appropriate to adopt viz:

" ... the priorities should firstly be to prolong the life of the whole structure, secondly to conserve as much as possible of the original fabric of the structure. Hence remedial works should not unduly jeopardise original fabric of the structure. Ideally, but it is not always practical or possible, any alterations should be reversible. All changes should be well documented."

Concerning the question of whether propping of Aqueduct spans occurred during construction, Mr. Beauchamp advises that photographs taken during construction show all members of the trusses concreted before the structure was unpropped. Mr. Beauchamp's view is a likely explanation of the early cracking experienced in 1922. This approach is not that recommended by Considere as described in Chapter 2.

2. Mr. Selby-Smith raised for the first time concerns about the foundations of the structure.

An assessment of the foundations was conducted by Maunsell in 1994 and the conclusions were as follows:-

"2.4.3 Tower Bases and Foundations

The 1991 study found that the tower bases were generally in good condition both above and below ground level. The study also found no cause for concern over the durability of the piles, which were estimated to be working to only approximately 22% of the ultimate capacity. Although the foundations of the structure appear to have moved in the past, this movement seems to have stabilised. The foundations should however be inspected periodically to monitor their performance."

Mr. Selby-Smith also had concerns about the present bonding of the concrete to the reinforcing and the dangers of spalling concrete. These are both matters that established methods of repair will address.

Further, Mr. Selby-Smith made the comment that "the difficulties of reinstating the material of the Aqueduct are being overlooked;" and in his view the necessary "repair was to the point of extensive and very expensive reconstruction".

The Panel feels that the difficulties of reinstatement were fully aired at the hearing which was not attended by Mr. Selby-Smith, and the conservation implications of "restoration" rather than "repair" are discussed in this report. The costs adopted for the repair options assessed in this report derive from the Maunsell reports.

3. Barwon Water's submission included advice from Mr. Mike McCoy who was responsible for overseeing repairs to the Aqueduct in recent years. His advice included that propping internal to trusses adjacent to members being replaced had occurred during repair (rather than external propping of trusses, as referred to in Mr. Beauchamp's report). We note his advice.

Professor Baker made numerous comments on the report. Mr. Beauchamp has accommodated some of these.

In relation to his disputing Mr. Beauchamp's assessment that no deformations of the structure occur, I am advised that Mr. Beauchamp's report refers to overall deformation of the alignment of the structure which has not been seriously affected. Professor Baker's slide of bowed reinforcing in a vertical member was, we understand, part of Tower 14 which is acknowledged as in need of repair.

I cannot agree with Professor Baker's comment that the Ivory Bridge is of no relevance to the Aqueduct. It is clearly a bridge of similar age and engineering design. Advice is that this structure is in a good state of repair. There would seem to be opportunities to learn from the management techniques used on that bridge. Contact was made with Parisian authorities responsible for the Ivory bridge as part of this enquiry. A reply was received to our written correspondence only on 17th May.

The correspondence relating to this structure is included in Appendix 6. It is noted that M. Harival suggests the bridge is of 1928 origins only.

Professor Baker also comments that in engineering design the relevant concrete strength to consider is the 'characteristic' value and it should be estimated from the core results from the Aqueduct in accordance with methods given in the current concrete code. Mr. Beauchamp advises that Australian Standard 3600 21.4.3 Tests on cores taken from structures says that "the strength of the concrete in part of the structure may be estimated as 1.1 times the average strength of the cores". This further increases the strength of the Aqueduct concrete above the Maunsell assumption.

A division of views thus remains amongst the engineering fraternity concerning the likelihood of collapse of this structure, though it seems that the calculations by Maunsell are conservative. Mr. Louis Walsh's own submission on Mr. Beauchamp's report acknowledges this. The factors outlined in David Beauchamp's report perhaps hold the explanation of why this structure has not collapsed despite the Maunsell calculations. If there continues to be a controversy on this issue, the Engineering submitters were all of the view that rather than attempt to run more costly elaborate computer models of the structure to assess structural integrity, given the difficulty of identifying accurate assumptions, it would be more useful to directly test load the structure in some way.

Nevertheless, as the inquiry has proceeded, it has become clear that there is also general agreement that it would be inappropriate to open the structure to the public in its current state. It is also agreed that access around and below the structure is inappropriate without certain works being effected, though there are differing views on the nature of those works. What is also clear is that if no action is taken to at least arrest corrosion, that the structure will continue to deteriorate and will even if only eventually, fall down.

Repair Methodologies and Costs

Mr. Beauchamp's report discusses the range of repair methodologies now available which could be deployed to at least arrest further decline in the condition of the Aqueduct and/or restore its structural condition.

The traditional approach to repairing concrete is known as "patch repair" whereby cracked concrete is broken out to expose the main reinforcing bars. It is also necessary to break the concrete away from the rear of the bars to enable the cleaning of rust and priming of the reinforcing. Fresh, highly-alkaline concrete is then used to "patch" the members. If damage is extreme, reinforcing will require replacement and it may be necessary to recast entire sections on site. Selective propping of members is likely to be required in the case of the Aqueduct.

This approach can effectively restore the structure to its original condition. There was no debate at the hearing that if so restored that the Aqueduct would not be structurally sound. This process is relatively labour intensive, with both skilled and unskilled labour requirements. As noted earlier, Maunsell's estimated an initial cost of repair of \$5.7 million utilising this technique in 1994. They also recommended that if the concrete were repaired utilising this method, that it may be appropriate to add an anti-carbonising coating.

Realkalisation through chemical treatment is another option. This involves the application of alkaline silicate solutions to the concrete to increase alkalinity and decrease porosity. Penetration of the solution through sound concrete is relatively slow but is rapid along cracks. The basic formula used is a mix of sodium silicate and sodium hydroxide. Tests were conducted by Dr. Neil North for Heritage Victoria using a silicate solution (though it was one designed for asbestos cement). He reported that the results, while not providing an immediate solution, were sufficiently encouraging to warrant further experimentation. He recommended further tests during dryer months.

This technique for repair is relatively cheap. The silicate solution is approximately 80c per litre only. It could be applied without scaffolding utilising low pressure spraying. Dr. North suggested that it could be done by use of a cherry-picker and a barge or light structure over the river. Dr. North estimated that the total cost for the first application would be some \$25,000, with a cost of \$20,000 for subsequent applications. He recommended that the solution should be applied to the Aqueduct annually for the first three years and then every three years thereafter.

This technique, unlike the patch repair method, is one which can best be viewed as a holding measure, and the structural condition of the Aqueduct would not be improved.

Cathodic protection describes various techniques for the electrolytic control of corrosion. A DC electric current is passed from an anode attached to or imbedded in the surface of the concrete to the steel. The process generates hydroxide ions at the surface of the steel which raises the alkalinity of the surrounding concrete.

Engineering submitters at the hearing agreed that with the view of Dr. North, that the principal difficulty with this method of repair is the need to ensure that the reinforcing steel is electrically continuous. If a piece of reinforcing bar is not connected, then the application of cathodic protection could increase corrosion of that section of the bar due to stray current corrosion.

Another problem with this approach is that if an external current source is applied, the normal process of imbedding the electric leads in slots in the structure may cut into spiral reinforcing. This could be avoided if the conductive coating system, described below, were used.

Remedial Engineering Pty. Ltd. conducted trials of cathodic protection on the Aqueduct in 1994 for Barwon Water. They were of the view that the result showed that this technique can be used successfully. Their report outlined that the current can be applied in essentially two ways: connecting the bar to a sacrificial anode, or by using an inert anode and an external current source (this is known as the impressed current system). Three systems were trialled by Remedial:

An internal anode system. This involved the mounting of platinised titanium anodes in 12mm diameter bore holes in the structure. An anode compound is also inserted which transmits the current from the anode to the concrete. Life expectancy of the anode rod is some 50 years and of the component 15-20 years. Remedial reported that they expected the installation of the anodes in small cross section members in contrast to the bottom cord where this was trialled, would be significantly more difficult.

A slotted anode system. In this method anode strips are imbedded in slots in the concrete. The life expectancy of the anodes is 50 years.

A conductive coating system. Under this method an electronically conductive coating involving noble metal composite wire is used as the current distributor. The coating is top coated with a thin render of concrete. The system has a 20 year life expectancy.

The cathodic protection system does involve "patch repair" but only to areas of active spalling and delamination. Concrete is removed only to the face of the reinforcing but not behind. The reinforcing is cleaned but the concrete is patched with a simple sand:cement mortar of similar strength and characteristics to the existing concrete. The technique is cheaper and less labour intensive than conventional patch repair. Remedial calculated the costs of these approaches to repair of the Aqueduct based on Maunsell's estimates of the repair areas to be treated. They estimated the patch repair cost would be some \$1,400,000 to \$1,800,000; the cathodic protection system which would be a combination of internal anode and paint based systems to be some \$2,000,000 to \$3,000,000; with a \$200,000 access cost. This gives a total initial cost of some \$3,600,000 to \$5,000,000. Remedial estimated that ongoing maintenance costs would be approximately \$40,000 per year for 50 years, giving an overall maintenance charge for that period of \$2,000,000. If the maintenance costs are considered only for a 30 year period in order to enable comparison with patch repair costs estimated by Maunsells, a total cost for 30 years of \$4.8 to \$6.2 million would be involved (cf \$7.94 million).

At the conclusion of the public hearings, the engineering submitters were generally of the view that patch repair was the most appropriate method at this stage. Mr. Beauchamp's report endorses this approach but recommends that experimentation with alternative methods of repair should continue on sections of the bridge to be repaired later. While it is appropriate to assume costs of repair based on full patch repair at the present time, Dr. North's advice in relation to possible development of other methodologies should be borne in mind;

"When considering repair methods it should be remembered that corrosion of reinforcing bars in concrete is a worldwide and growing problem. There is considerable effort being devoted internationally to finding more cost effective means of rectification than the current remove and replace. The use of silicates and cathodic protection being two relatively recent developments in this area. With this amount of effort being devoted to concrete repair, it is highly likely that new methods will be developed over the forthcoming years. With this in mind it would be prudent to confine repairs to those areas where they are required immediately to preserve the structure in basically its present condition whilst leaving any non-urgent repairs for the future when better methods may be available."

Conservation Acceptability of Repair Methods

With the exception of Professor Lawrie Baker, there was little concern raised by any of the submitters about the conservation acceptability of any of the repair methods above. The Burra Charter specifically recognises the applicability of modern repair methods in appropriate circumstances. Article 4 provides:

"Conservation should make use of all the disciplines which can contribute to the study and safeguarding of a place. Techniques employed should be traditional but in some circumstances they may be modern ones for which a firm scientific basis exists and which have been supported by a body of experience".

Professor Baker's objection was directed principally to patch repair, though it seemed that he objected to repair in general. Professor Baker's view was that the extent of repair would be such that little would remain of the original material of the Aqueduct and the structure would be "turned into something it is not". This stems from Professor Baker's view, which was supported by Mr. Louis Walsh of Maunsell, that the structure is in fact an engineering mistake or failure - a poor design necessarily involving unreasonable amounts of maintenance. Professor Baker suggested that it would be "dishonest" to repair the structure. Impliedly they are suggesting that it should be permitted to fall down.

It can be said in response to this position that it seems that the poor structural state of the Aqueduct today can in large measure be attributed to inadequate maintenance by the water authority over many years. Mr. Beauchamp's report details this history of maintenance and its inadequacies. It seems likely that the poor maintenance approach arose at least partly from a lack of knowledge concerning the appropriate treatment of reinforced concrete, as both the G.A.C. Engineering Subcommittee and Barwon Water both submitted. Further, it should be noted in response to the concerns about the extent of patching required, one can observe that patch repair is the traditional method of repair for this structure having been employed from 1922 onwards. Further, if 'reconstruction' were to occur, it would not be the "conjectural reconstruction" rejected by the Burra Charter.

The Panel also had some of its own concerns about the conservation acceptability of the use of cathodic protection. This technique can involve a resurfacing of the structure, and the Panel had concerns that this might affect the appearance of the Aqueduct in much the same way as the "Gunnite" treatment did in the 1950s. Coating the surface of the Aqueduct could also impede interpretation of the structure by hiding the earlier treatments given to the material (see Article 3 of the Burra Charter). An inspection of the repairs to the San Remo Bridge at Phillip Island which are utilising cathodic protection was conducted on May 18th. It is my assessment that the resultant appearance of that bridge is not significantly different from its original appearance, but the concern remains about the covering over of previous work.

Demolition Options

The above discussion of the cost of the various repair methodologies assumes that all of the structure will be retained. Barwon Water, however, are recommending demolition of the river-spans of the structure in the interests of the safety of river users. Their option based on Maunsell demolition costs of \$15,750 for each tower together with the spans, would cost at least some \$63,000. Additional costs for stabilising of the cantilevers of abutting towers by propping may be incurred.

In Chapter 4 of this report I have discussed the reasons why Barwon Water that proposal is strategically unacceptable in planning terms. There was also opposition by submitters to the proposal in conservation terms. It was at least identified as the most unacceptable of all the part-demolition options.

Mr. McInnes' oral submission to the hearing, I believe, encapsulated the objections to demolition of the river spans. He argued that to demolish these spans would take away from the expression of the traditional function of the structure which was to carry sewerage across the river and its associated flood plain. Alternatively, if the river spans are retained, the structure can be adapted to a new role which nevertheless makes reference to its original purpose: it remains as a conveyance across the river.

It is possible also that future management of the structure could incorporate partial demolition of other sections. The report prepared by Professor Baker following the

demise of the joint working party in 1994 describes a considerable number of demolition possibilities. Again, it was argued at the hearings by Mr. van der Molen and Mr. McInnes that the cultural significance of this structure which in part derives from its impressive length of 756 metres would be eroded by only partial demolition of this structure. The retention of the piers for each tower - being one possibility suggested in Professor Baker's report - would perhaps assist to some degree.

Mr. McInnes also argued that it was necessary to maintain the pipe as an element contributing to of the cultural significance of this structure given it again reveals its functional role. Mr. McInnes noted that new pre-cast sections could be inserted in the pipe, as this was the traditional method of construction.

In the final chapter of this report, I have assessed the options for management of the structure against various criteria including their conservation acceptability. I have recommended a staged approach for conservation of this structure which commences with the repair of the river spans. The approach allows the timing of the repair of the remaining segments of this structure to be dictated by the rate of decline and availability of funding. It may be that in the longer term, part demolition of the Aqueduct does occur, however I believe that demolition decisions can be avoided for the time being. I believe that the adoption of such an approach is consistent with the principles of the Burra Charter. The guidelines to the Charter in relation to the development of conservation policy include as Section 4 recommendations concerning the "strategy for implementation of conservation policy". This section provides as follows:

"4.1 Introduction

Following preparation of the conservation policy a strategy for its implementation should be prepared. Strategy is an essential part of any conservation planning. The techniques of strategy preparation are common to many disciplines and are therefore not described here.

4.2 Contents of Strategy

The strategy may include information about;

- *The financial resources to be used;*
- *The technical and other staff to be used (human resources);*
- *The sequence of events;*
- *The timing of events; and*
- *The management structure.*

The strategy should allow the implementation of the conservation policy under changing circumstances, for example, availability of funds. [my underlining]

In conclusion on this matter of demolition, the Panel endorses the sentiments expressed at the conclusion of the Heritage Victoria submission by Ms. Maggie Baron:

"Any management option which did not ensure the retention of the full length of this striking Ovoid Aqueduct, would be an unfortunate loss of an opportunity.

Demolition is not considered the preferred option, and it is important to remember we are the custodians of our heritage resources, our future generations depend on our making considered, astute and wise decisions. A decision to hold the status quo has merit when compared to one to move in an irreversible direction." [my underlining]

CHAPTER 6

MANAGEMENT RESPONSIBILITY OPTIONS

Ever since the decision was made in 1990 to decommission the Aqueduct, the water authority has sought to divest itself of management responsibility for the structure.

The submission prepared by the Geelong and District Water Board for presentation to the 1991 Historic Buildings listing hearing included the following outline of its perceived responsibilities in relation to heritage matters:

"The Board recognises the cultural significance of the Aqueduct ... [and] ... does not oppose its inclusion on the Register providing satisfactory funding and management arrangements can be established by an independent authority other than the Geelong and District Water Board."

and

"... the Board cannot accept the financial burden of retaining the structure indefinitely once it is decommissioned, nor has it the statutory authority to do so."

This view was reiterated in Barwon Water's submission to the present inquiry:

"Barwon Water remains adamant that the ownership of the Aqueduct must be transferred to another organisation if it is to be retained. Reasons for transfer of ownership include:-

- . Maintaining decommissioned assets has been accepted as not being part of Barwon Water's core activities.*
- . Because it is not part of its core business, Barwon Water does not have the expertise to maintain deteriorating structures.*
- . The Water Act 1989 under which Barwon Water operates does not give authority to allocate funds to the continued maintenance of decommissioned assets."*

The Barwon Water submission recommended the transfer of the structure together with 6-8 hectares of land on the northern bank to another State or Federal organisation. Barwon Water insist, however, that demolition of the river spans must occur before transfer, and security fencing for the remainder of the structure must be maintained. The maximum value of the contribution that Barwon Water is prepared to offer is \$400,000.

The argument by Barwon Water that it requires authority to allocate moneys to fulfill its obligations under legislation other than the Water Act, must be viewed as seriously flawed. As Mr. Wight submitted on behalf of the National Trust, there is no legal bar to them taking on heritage asset repair. Certainly, Barwon Water appear to have been prepared to undertake extensive open space planning and developments in the past, and even now are prepared to landscape the environs of the Aqueduct.

Mr. Wight's suggestion that Barwon Water's desire to divest itself of the Aqueduct is more likely a response to concerns about costs, public liability and changed priorities, is one which the Panel endorses. At the hearing, Mr. Graham for Barwon Water was at pains to point out that the Authority was not a "cash rich cow waiting to be milked". Safety issues also featured largely in the Barwon Water submissions, including an outline of Professor Baker's experience as a witness in a court case where the City of Dandenong and its engineer were prosecuted for criminal negligence in relation to the collapse of a swimming pool wall. Barwon Water's written submission also makes it clear that its priorities, at least for the present time, are directed toward other aspects of its operations and an improvement in its environmental performance in particular. Major new treatment plants, for example, are under construction and currently being funded.

There is also a more general cause, I believe, for the desire by the Authority to divest itself of the cost and other obligations of Aqueduct management. Mr. Wight submitted at the hearing that it is "harder and harder to persuade corporatised government bodies to take responsibility for non-core activities". It seems to me that Barwon Water's current position has been at least indirectly influenced by the governmental reform of the water industry and other public utilities. Mr. Graham's submission referred to the string of governmental decisions and policies commencing in 1993 which have led the authority in the direction of debt reduction, shedding of non-core activities, full cost recovery pricing and tariff freezes. The establishment recently of a consultative action team to make recommendations to the Minister for Water Supply concerning a management authority for the combined Barwon, Moorabool and Corangamite catchments, is also an element of this restructuring of the industry. It is recommended that the new catchment management authority take over, inter alia, the management of the 20 kilometres of the Barwon River through Geelong, currently the responsibility of Barwon Water. While the C.A.T. recommendations include the delegation of the new authority's responsibilities back to Barwon Water, the full extent of the reconferred powers remains unclear.

Another argument advanced by Barwon Water was that it would be "financial suicide" for it to undertake responsibility for repair of the Aqueduct. While the G.A.C. Engineering Subcommittee and the National Trust argued that Barwon Water accounts would suggest that they have the financial capability to undertake the repairs, I was persuaded by Barwon Water's submission that their "operating surplus" is committed to payments to the Government of special Government dividends and to the funding of capital works programs. It also seems that "retained earnings" was misinterpreted as profits rather than as equity of proprietorship in the business.

Mr. Wight's submission went on to argue, however, that it would be possible for the Board to introduce a special levy to fund Aqueduct repairs. It was suggested that if only \$6 per year per rate payer were levied for an 8 year period, some \$4.9 million might be raised. This could, Mr. Wight suggested, replace the current environment protection levy of \$65 to \$120 per annum which is funding the upgrading of the Black Rock and Anglesea Sewerage Plants. I have no doubt that if Barwon Water were to retain river management responsibilities through the City of Greater Geelong that such a levy could be imposed even if legislative amendments were required. Further, as was suggested at the hearing, arrangements might be made to reduce the dividends paid by Barwon Water to the Government. For these reasons I do not believe that financial inability should be seen as a reason to divest Barwon Water of the responsibility for the Aqueduct.

I have given much thought to this matter of the divesting of management responsibility by Barwon Water, and in particular the implications of a decision to permit this, for other applications which might be forthcoming from this and other corporatising Government agencies.

On balance, I think that there is a combination of factors which justifies the removal of the structure from the management of Barwon Water. These factors include the very high level of heritage significance of the structure, the not insignificant cost of its repair, its anticipated lack of capacity to generate an economic return, and the pressures of changing corporate responsibilities. Another factor influencing my recommendation is an apparent disinterest by the authority in conserving this item of cultural heritage importance. While it would be possible to ignore Barwon Water's seeming attitude and leave the Aqueduct in their care, to do so, as Mr. van der Molen suggested, would be much like "leaving Dracula in charge of the Blood Bank". In any case, if Barwon Water were to retain full responsibility for the structure, it would seem that the likely next round of the Aqueduct debate would be a reapplication for a permit for demolition from the Heritage Council, at least of the river spans. It is preferable, I believe, to move on rather than backwards. It is also desirable that the strategic planning decisions which must be taken in relation to river planning and the Aqueduct are done so jointly.

The transfer of the structure away from Barwon Water should not, however, for the reasons outlined earlier in this report and in the following chapters, be entirely on the terms which they propose.

Other Land Management Options

If the structure and part of its site are to be transferred away from Barwon Water, the question is to whom.

A range of private and governmental options have been considered by the Panel. Amongst them are the City of Greater Geelong and the Department of Natural Resources and Environment, notwithstanding that both organisations have voiced their opposition to taking on management responsibility for the Aqueduct.

It is appropriate to say at the outset of this section that I believe that the financing of the repairs and ongoing maintenance should not necessarily be sourced from the management body itself.

Secondly, in considering this matter, there is some value in recognising that the Aqueduct is of different cultural value to different communities. While the Aqueduct was in commission, it performed a utilitarian service for the Geelong community alone. It could soon play a utilitarian role for that community again - as a river crossing or feature on an extended open space system along the Barwon River. However, now the Aqueduct is also recognised as of heritage value to the wider State and national communities.

Thirdly, only those management authorities which already have heritage responsibilities and skills, or are agencies with direct land management responsibilities, have been considered here. While it would have been possible to consider a wider range of options, there would be a necessary redefinition of function and reallocation of resources to other types of agencies would seem to be problematic. This is a difficulty, for example, with VicRoads taking responsibility for repair of the structure as was suggested might occur at the hearing.

1. Historic Buildings/Heritage Council

The Historic Buildings Council and now the new Heritage Council, is the independent statutory authority which reports to the Minister for Planning on issues relating to the preservation of historic buildings and structures. The new Heritage Council will consist of ten members possessing skills relevant to cultural heritage protection and conservation. The Council under the Heritage Act 1995 has the power to accept gifts including of land which become vested in the Crown (Ss.139 (1) and (2) of the Heritage Act 1995); and has the power to acquire land pursuant to Section 142. Section 143 confers powers to deal with that land.

While the Council and its staff obviously possess the skills appropriate to manage the Aqueduct's conservation, it seems that in the past when properties have been purchased by the Council, they have been passed on for management to the then Department of Natural Resources and Environment. The report prepared by Jane Lennon for the Department of Conservation and Environment in 1992 entitled "Our Inheritance" reports this happening for Banyule Homstead, Mills Cottage, Day's Mill and Farm. These properties have then been reserved under the Crown Land (Reserves) Act 1978. In my view, there seems little point in transferring the Aqueduct and its land to the Council, if it will inevitably be transferred to the Department of Natural Resources and Environment. A more direct transfer could be effected.

2. The City of Greater Geelong

The City council offers another likely management option for the structure. The council has a range of planning responsibilities and powers, including land acquisition powers under the Planning and Environment Act 1987. Section

12(3)(b) of the Act provides that the Council "... (may) to all things necessary to encourage and promote the orderly and proper use, development and protection of land in the area for which it is a planning authority".

However, it is not recommended that the council assume principal management responsibility at this time. The council staff resources in the heritage area are extremely limited. In addition, the restructure of local government has added to the existing staff loads, including those of the town planning section, where new strategies and schemes for the amalgamated municipality are under preparation.

3. The Trust for Nature

This non-Government, non-profit organisation was previously known as the Victoria Conservation Trust. When first established in 1972, the Trust took over the responsibility for various historic places, including the gardens in the Dandenongs. It retains a charter to manage land for historic, scientific and cultural purposes.

The recent change of name of the organisation, however, reflects the Trust's now almost exclusive focus on places of natural conservation significance. At present, the Trust principally acts as a broker for state and federal purchases of significant conservation properties, offering tax benefits to vendors. More than 3,000 hectares of land have been purchased. Again, however, the land is then passed on for management to other agencies, such as Melbourne Parks and Waterways, Department of Natural Resources and Environment or the National Trust. The land frequently is added to existing public reserves. Further, the organisation's staff resources are extremely limited: only five full time positions exist including that of the director. The organisation has a current operating deficit. It relies on public support and donations.

4. The National Trust (Victoria)

This is a private company limited by guarantee with charitable trust obligations. The Trust owns or manages some 60 properties of which 27 are open to the public. Fourteen Trust managed properties are on crown land, with three of these open to the public.

The Trust's financial resources are not inconsiderable; it has an \$8 million annual budget. Specific allocation of government moneys has been made to the Trust to assist in managing crown land. Government money is generally sourced through the Department of Natural Resources and Environment and through direct sponsorship. The Trust has also received funds from the recently established Community Support Fund (established by government from the proceeds of gambling). The Trust also has clear heritage interests and staff resources.

In my view, given that the Aqueduct is a structure without any apparent prospects for financial return to the management organisation, given the Trust's "business" structure and obligations, it would seem inappropriate to look to them for management.

The establishment of a small separate trust to manage the Aqueduct would seem inappropriate for the same reason.

5. Proposed Corangamite Waterway Management Authority

As noted earlier, a consultative action team was established in 1995 to report to the Minister for Natural Resources concerning a framework for waterway management in the Barwon, Moorabool and Corangamite catchments. The inquiry arose from the perceived need for action to deal with degraded waterway health throughout the region and a need for restructuring of waterway authorities and municipalities to clarify their roles in waterway management issues. The team reported in December 1995 and recommended the establishment of a new

Corangamite Waterway Management Authority. It is envisaged that the roles and responsibilities of the authority would include:-

- . Management of the Barwon River in Geelong; and
- . The protection and enhancement of recreation and tourism values of urban waterways - in conjunction with municipalities.

Despite the incorporation of the above functions, as Mr. Wight for the National Trust suggested at the hearing, heritage preservation is unlikely to be high on the priority list of authority functions, in contrast to issues such as Landcare, environment and water quality. Indeed a much greater component of the list of envisaged functions for the Authority were devoted to such natural environmental matters. Further, this organisation is responsible for river management in both the rural and urban sectors of the river courses: it is to be concerned with whole catchment management. The C.A.T. report also envisages the delegation of the new authority's Barwon River management function back to Barwon Water. The details of this arrangement are not clear at this time.

6. Urban Parks and Waterway Authority?

As part of their submission, the National Trust contrasted the existing arrangements in Melbourne and Geelong for the management of public open space and associated heritage places. The submission described the evolution of the responsibility by Melbourne Parks and Waterways for planning of Melbourne's regional park system. The Trust's submission expressed the view that:

"There is clearly a gap in the management of Geelong's natural and cultural resources. There is no parks and waterways authority responsible for the management, development and marketing of a regional park system, including the restoration and interpretation of heritage structures. While the Greater City of Geelong would be one candidate for this responsibility, the fact that Barwon Water is responsible for 20 kilometres of Barwon River frontage probably makes it the prime contender."

The Trust submission went on to address the matter of the Aqueduct being only one example of the heritage properties along the river which will require longer term management:

"The Aqueduct has raised a more general issue for park and heritage management in Geelong which may require the development of new management arrangements."

The Panel indeed shares the Trust's concerns about the strategic planning for open space and recreation in Greater Geelong. While it seems that there has in the past been a great deal of co-operation between waterways planners at the City, at Barwon Water and in Conservation and Natural Resources, there has yet to be developed a strategic plan for the development of the river. I note that Barwon Water intended to embark on such a project approximately 2 years ago. In the introduction to the "Barwon River Report" prepared for the water authority by a group sponsored by the Australian Council for the Arts in November 1993 to July 1994, Frank De Stephano, Chairman of the Authority, said in the introduction;

"In recognising the future further potential of the river environs to cater for the recreational needs of the community, the creation of a Management Plan for the Barwon in Geelong is planned".

Now I am advised by the Senior Environmental Planner at the City of Geelong that studies for the development of an open space strategy for the municipality are about to commence. Nevertheless, the implementation of such a plan will depend on the continued co-operative efforts of the three organisations involved with management of the river and its environs, and now the further co-operation of the new river management authority. In all of this, one might have to be concerned that the management of heritage structures might fall into a "crack" between the various organisational responsibilities.

Whether there is a need as was suggested by Mr. Wight for the establishment of a new authority is debatable: it was the multiplicity of local government areas in Melbourne which originally led to the establishment of a regional planning authority for Melbourne, including for open space areas, in the form of the M.M.B.W. (later Melbourne Water) which has transferred park planning to Melbourne Parks and Waterways in recent times. Nevertheless, it may be appropriate that some thought is given to legislative definition of the function of park planning in Geelong, including along the river, and its allocation to a specified authority. However, while such new arrangements may emerge in the future, it is unrealistic to consider them to be a short term solution to management of the Aqueduct.

7. Department of Conservation and Natural Resources (now Department of Natural Resources and Environment)

The department is clearly one of the major land management authorities for the State Government: it has responsibilities for national parks and other areas of Crown land.

The provisions of the Crown Land (Reserves) Act 1978 at S.4 enable the creation of "historic reserves" primarily to conserve historic features or associations. Such reserves at present include the Collins Settlement Site at Sorrento, the old Wharf at Sale, Werribee Park and Gulf Station.

The Department also incorporates a Historic Places Branch, which is administered from National Parks but services the entire department. Some of the key activities of this section are to:

- . Provide policy advice for on site conservation and management of historic sites affected by mining and management operations and tourism.
- . Undertake architectural analyses, existing conditions surveys and assessments of significance of historic structures.
- . Prepare specifications and drawings for restoration, conservation and development of historic sites and structures including advice on siting, design and paint colours.
- . Be responsible for historic monuments which are mostly located on Crown Land.

While this section of the Department clearly has expertise in historic conservation matters, it has extremely limited staff numbers and heavy demands upon it in relation to all manner of heritage properties, including the Murtoa Grain Store, recently acquired light houses, and other historic reserves.

Further, budget allocations are also extremely limited to this section and there are no field staff specifically trained in historic site management. Management of sites occurs by National Parks officers as part of public land sub-programs.

The director of the section, Mr. Ivar Nelsen who made the submission for the Department at the hearings, is also responsible for the Historic Buildings

Management Committee Incorporated, which was established in 1986, to assist with the management of surplus or redundant buildings on public land which have historic value. The principal functions of that committee are:

- (a) to make recommendations to the Minister regarding the use of historic buildings on public land, and the approval of management plans for particular buildings; and
- (b) to undertake direct management for particular sites.

This committee provides a forum for discussion and resolution of problems relating to management of public heritage properties, and also a mechanism for conserving historic buildings on public land where there is no ongoing Government operational requirement. Such buildings include de-commissioned Court Houses, Mechanics Institutes and the like. The committee provides advice to local groups who may manage such structures and some financial assistance.

While the functions of this committee dovetail exactly with the management requirements of the Aqueduct, the committee since its inception has operated from an original \$100,000 grant, which it manages to eke out through leasing and resale of buildings.

There is, however, also the prospect of indirect management of a Crown Reserve by the Department of Natural Resources and Environment. This is effected by the establishment of a committee of management under the Crown Land (Reserves) Act. Committees of management can comprise representatives of local interest groups, municipalities, government authorities or the National Trust which, for example, manages 13 properties as a committee of management. On some of these National Trust committees of management, Historic Buildings Council expertise is also represented.

While it was Mr. Nelsen's submission to the appeal hearing, that;

"... as only a small portion of the land upon which the Aqueduct rests is Crown Land, the appointment of such a committee of management would not be applicable in this case"

and

"The act of creating a committee of management will not resolve the outstanding or difficult issues of the Aqueduct without adequate support"

it is my assessment that the transfer of this structure to the Department of Natural Resources and Environment, and the establishment of a committee of management, appears to be the most feasible of the management options at this stage. It seems to me that it would be appropriate that the committee of management include representatives of the City of Greater Geelong, the Geelong Aqueduct Committee and the new River Management Authority. I believe that by sharing the management responsibility for the Aqueduct in this fashion, there is a greater likelihood that a management program will be put into effect.

It is my view also, however, that Mr. Nelsen's submission is correct - that adequate support is required for a committee of management. I believe that it would be necessary to allocate funds to allow the employment of an appropriate officer at the City of Geelong, or the Department of Natural Resources and Environment or in Heritage Victoria to undertake the various tasks necessary to ensure that an ongoing program of repair and maintenance of the Aqueduct occurs. It could also be the responsibility of that individual to undertake the necessary liaison with other agencies and organisations making decisions which may impinge on the Aqueduct management.

Public Liability and Land Management

One of the issues raised by Barwon Water in relation to future management of the Aqueduct was the matter of whether appropriate public risk insurance would be available to the management authority which might cover claims for negligence made against the authority.

The present tests of negligence centre on whether there is a duty of care towards the person or party making the claim, by the occupier of the land. It is recognised that an occupier has a duty of care for the safety of anyone entering their premises, regardless of whether that person is a visitor, a tradesman, or a trespasser. A statutory framework for the assessment of such claims is provided by the Wrongs Act 1958 at S.14A and B. These sections were introduced by the Occupiers' Liability Act 1983 and apply in place of the rules of the common law, which, before that Act, determined the standard of care that an occupier was required to show towards persons entering the premises in respect of dangers to them.

The Department of Natural Resources and Environment has a well established system for minimising public risks and liability claims. Since November 1994, a "*Public Liability Risk Management Manual*" has been available to committees of management, and a similar document from 1988. This manual encourages the establishment of procedures that will help minimise the risk of injury or loss to members of the public. Furthermore, the Department has available to it, public risk insurance which will cover claims against committees of management established under the Crown Lands (Reserves) Act to the value of \$250 million.

It was suggested, in particular, by Barwon Water that while Heritage Victoria had approached Ambro Insurance in October 1995 who had advised that insurance could be arranged specifically for the Aqueduct - covering public liability, physical loss and workers' compensation claims - that that insurance company had not been advised of the structural concerns about the Aqueduct. Despite the fact that the Taywood-Maunsell reports on structural condition remain the most comprehensive available in relation to the Aqueduct, I believe that the process of this Panel inquiry, and in particular the airing of the engineering issues and subsequent reporting by Mr. Beauchamp, offer expert advice which would bear upon an assessment of risk by any insurance company.

In relation to insurance availability and premiums, it is also worth remembering that there is an essential difference between the risk of collapse of the structure and level of risk to the public. Mr. McInnes' oral submissions to the hearing addressed this matter.

I would also record here that that I have informed that the Barwon Water concern about criminal negligence actions against the Aqueduct's management authority, were not raised as a result of any advice from their legal advisers.

It seems that there are a range of insurance companies which offer options for covering public liability claims: the Department of Natural Resources and Environment is insured by Sedgewick Limited Insurance; Ambro insures the National Trust and its properties; and Melbourne Parks and Waterways are insured with Marshall McLellan Insurance.

Intermediate Management

The Panel recognises that even if a decision were to be taken in the immediate future about the appropriate body to manage the Aqueduct, there may well be delays in the process transferring the responsibility to the new agency. If this were to occur, as an interim measure, it would be possible to transfer the Aqueduct and its site to Treasury pursuant to the provisions of S.22A of the Land

Act 1958. Section 22A provides that

"Where any land is vested in an Authority, the authority may notwithstanding anything in any act with the consent of the Governor-in-Council -

- (a) Surrender the land or any part of it to the Crown;*
- (b) Agree with any other authority to transfer the land ... to that other authority."*

CHAPTER 7

SOURCES OF FUNDING

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Costs of Management Options

At the public hearing, Mr. Nelsen of the Department of Natural Resources and Environment observed that for the future management of this structure there is "no no-cost option". In other words, even demolition of the Aqueduct would cost a substantial amount. While Barwon Water have revised their estimates for demolition downwards from \$540,000 (Maunsell 1991 report) to \$410,000 (Maunsell 1994 report), it is likely that there is some truth in the Geelong Aqueduct Committee suggestion that this may well be a considerable under-estimation given the experience of the demolition of the Bow Truss Building. The cost of full patch repair as estimated by Maunsell was some \$5.74m, and the costs of the Barwon Water options are some \$63,000 - \$419,000.

In the following chapter, recommendations are made for the staged repair of the Aqueduct. I believe that this represents a realistic option for the conservation of this structure in the longer term. The recommendation accords with that made orally by Mr. Peter Alsop of the Geelong Historical Society at the hearing, and may be viewed as a variant of that proposed by Barwon Water. Nevertheless the outcome of my recommendations would be the conservation of the structure rather than its staged demise. The recommendation made is that the river spans of the Aqueduct should be (patched) repaired with some urgency, and the remaining portions of the structure repaired by this or other means in the longer term, as funds and land on the south bank become available.

The estimated cost of Stage 1 of the repair of the Aqueduct is some \$2.2 - \$2.4 million excluding ongoing maintenance costs of \$0.68 million for 30 years as estimated by Maunsell. This initial cost incorporates \$200,000 for a ramp to give access to the repaired spans which could act as a viewing platform and a further \$200,000 for a second ramp at the end of Stage 1 assuming that a public right of way is developed on the southern bank. The costs of ramps have been drawn from Maunsell estimates. The repair cost calculations are also based on Maunsell figures as included in the appendix to their 1994 report - Option 3A (I have excluded, however, the demolition costs for the remainder of the structure in that option). The amount I have allowed for Stage 1, therefore, incorporates in excess of 20 percent or \$427,000 for "engineering and contingencies".

It is necessary also to add to this cost, other costs associated with a program to increase public awareness of the structure and to campaign for funds in later stages. It seems to me to be appropriate to set aside an additional \$250,000 for these purposes - which might allow for the engagement of a member of staff by one of the authorities represented on the committee of management to carry out these tasks. Thus the overall initial costs for Stage 1 might be in the order of \$2.65 million (exclusive of ongoing bridge maintenance costs).

Patch repair of the remaining piers of the bridge (if total patch repair costs are \$5.74 million as Maunsell estimate), would be a further \$3.3 million, exclusive of ongoing maintenance costs for all 14 piers of \$2.2 million for a 30 year period.

Funding Options

In considering the possible sources of funding for the Aqueduct repairs and associated works, I believe that it is appropriate to consider only governmental sources for Stage 1. Other sources of funding for later stages are discussed at the end of this chapter.

As part of the submission to the inquiry, the City of Greater Geelong advised that in their view responsibility for ongoing repair, maintenance and any liability claims against the Aqueduct should be forthcoming from a number of levels.

The Panel's view is also that funds for the conservation of the Aqueduct, whether this is of the whole structure or only part, should be drawn from all levels of Government. The Aqueduct has recognised State and national heritage importance and it is appropriate that the Government bodies at those levels allocate resources to assist its conservation. However, funding should also come from local Government, as the Aqueduct has a

particular value to the city, including as a potential river crossing within expanded Barwon River parklands.

Barwon Water Contribution

I believe that firstly a direct contribution should be made by Barwon Water towards the conservation program.

This Authority is at present advising that no funds for the demolition of this structure were set aside in the past. This is despite the Authority's 1993 agreement "*in principle to contribute towards the establishment of an endowment fund for the ongoing management and maintenance of the structure subject to a long term solution being achieved in that regard*", and their advice (as reported in Geelong Advertiser of 9/12/93 and in letter to Director of Historic Buildings from the Secretary of Barwon Water of 17/2/94) that: "*The maximum contribution [was] to be equivalent to the amount which the Board would otherwise incur in demolishing this structure*" (at that time estimated by Maunsells to be \$540,000).

Barwon Water are now advising, however, that they remain prepared to make a contribution to the management of the Aqueduct by another agency, but only to a maximum value of \$400,000 including the transfer of some 6-8 hectares of land on the northern bank of the river, the demolition of the river spans (perhaps \$210,000) and a contribution to the establishment of a park around the remaining fenced-off portion of the Aqueduct.

The Geelong Aqueduct Committee's Engineering Subcommittee submission to the hearing was, rather, that Barwon Water should be required to pay the full cost of patch repair of this structure - estimated to be some \$5.5 million - apparently as some form of recompense for the maintenance they failed to do in the past. The National Trust submission also argued that financial responsibility for conservation of the structure should lie with Barwon Water.

It is the Panel's view that an appropriate Barwon Water contribution to the repair of the structure might be approximately equivalent to, but not less than, the cost of demolition. It seems to me that Barwon Water are now proposing to contribute rather less than the demolition cost to Aqueduct repair as they are now proposing "contributions in kind" in the form of assistance with the development of parkland. It seems to the Panel that it is likely that funds for riverside development may well have been ear-marked in other budgets.

It would perhaps be appropriate to request that Barwon Water directly contribute some \$500,000 to the Aqueduct repair, unless they can confirm that \$410,000 represents an accurate estimation of the cost of demolition.

It should be said that Barwon Water did not provide any advice to the Panel about the source of their proposed contribution. If, as was suggested by the National Trust, a special purpose levy were imposed by the Authority on rate payers, as they have done for the purposes of upgrading the Black Rock and Anglesea Sewerage Plants, or perhaps a portion of the levy of \$15-20 per assessment for the new Waterway Management Authority were allocated to this purpose, notionally the money for repair could instead be seen as a Geelong rate payers' contribution.

Local Government Contribution

It seems appropriate that a direct contribution from the City of Greater Geelong be made in substitution for the "alternative cost" which this organisation would have to bear if a purpose built walkway across the river were to be constructed.

The Panel endeavoured to get some estimates of the cost of such a bridge. An approximate figure was provided by the City of \$1 million which would allow for a 2 metre wide pedestrian path and bikeway. Barwon Water also provided an approximate cost for a high level bridge. This was based on calculations by Gutteridge, Haskins and

Davey Consulting Engineers in February 1990 for a high level structure adequate to act as a carrier for a new Aqueduct. This was estimated to be \$3.8 million (calculated by deduction of the costs of new pipes and connections).

If the cost of a new pedestrian bridge were perhaps \$1 million, and the \$500,000 contribution by Barwon Water were also viewed as a local area contribution, this would leave a further \$500,000 as an appropriate local contribution from the City.

Again the question arises as to the source of the money which might be provided by the City. The Panel is conscious of the difficult financial circumstances of the City of Greater Geelong. It should be noted, however, that it would not be possible to strike a special rate or charge for the purpose of raising the money for the Aqueduct if all rate payers in the municipality were levied equally. It would seem difficult to devise a scheme which differentiates amongst the Geelong rate payers in terms of special benefit afforded by the Aqueduct.

Other Government Funds

If the municipal level authorities provided \$1 million towards repair, a further \$1.66 million would need to be raised from State and/or national Government sources for Stage 1.

Some \$65,000 has already been allocated to the Aqueduct from the Government Heritage Building's Restoration Fund, but a substantial \$1.6 million would remain.

Possible Government sources for future funds are listed below.

1. Government Heritage Buildings Restoration Fund

This State Government program commenced in October 1994, and provides strategic funding for repair and restoration works to historic Government-owned properties. Properties funded range from industrial heritage items to major public buildings. It is noted that the total funds available this financial year were some \$6 million (as advised by Ms. Maggie Baron), though it normally rather less than this. "Making Good Again, published in March 1996 by the state government would appear to indicate that normally some \$3 million is available per annum.

It seems likely that a more substantial grant might be forthcoming from this fund for the Aqueduct provided a clear program of works could be recommended, the level of funding which has already been given to other buildings is quite substantial. The Werribee Park Wool shed, for example, has been allocated in excess of \$200,000 and the Melbourne Observatory, two primary schools, have all received \$200,000 approximately.

2. The National and Estate Grants Program

This is a federally funded financial assistance scheme administered by the Australian Heritage Commission in conjunction, in this State, with the Victorian Department of Natural Resources and Environment.

The primary priorities for allocation of funds are:-

- Conservation management planning, conservation work or site specific studies on places entered on the register of the national state (the Aqueduct is included on this register).

Priority is given for funding where:-

- The place is threatened by people or the forces of natural change (this could be said of the Aqueduct)

- If the item in question is a place and it is one of a class of places generally threatened.
- There is some other strong or relevant reason for urgent conservation action (applicable in this case).
- Volunteers are involved.
- Community interpretation and promotion of places on the Register of the national Estate (required for the Aqueduct).

State departments and authorities, local governments, and legally incorporated non-profit groups such as Historical Societies, National Trust, etc may apply.

Normally \$250,000 is available to Victoria and the maximum grant allocation per annum is generally \$40,000.

4. **The Community Support Fund**

This fund was established recently to allow a portion of the revenue from gaming machines in hotels to be allocated to projects and programs which would benefit the Victorian community. The purposes for which the fund are available, are set down in the Gaming Machine Control Act 1991.

In broad terms, some 70 percent of the fund is made available jointly for sports and recreation clubs or programs; rehabilitation and support for gamblers and their families; and initiatives related to youth homelessness. Some 30 percent of the fund is allocated to promotion of the arts and tourism.

Applications to the fund are made through the relevant Minister.

Information about the fund indicates that the types of programs favoured are:-

- Those with substantial benefit to the Victorian community.
- Of lasting significance.
- Where there is substantial financial investment from non-government sources.
- Those where there are substantial cost benefits.
- Programs not requiring ongoing government funding.

Any funding for the Aqueduct from this source would seem to depend on promoting a larger package of works or activities involving the Aqueduct which might seem to benefit the arts or tourism. It is understood that substantial funds are available.

5. **Better Cities Program**

This was commenced by the Australian Government in 1991 with the aim of the reform of urban management processes through model partnerships between the three levels of government together with the private sector and the community. The program has funded a range of activities but focus has been on programs related to economic gateways, growth management and urban renewal. Area studies have focussed on urban and coastal management and urban design.

Advice from the Victorian Manager of the program is that the second phase of the Better Cities Program is not being proceeded with by the current Australian Government.

6. Other Government Options

- Direct treasury grants from State or Federal Government are possible if political support is afforded.
- Reduction or return of Barwon Water's annual special dividend paid to the State Government might be possible. This was introduced in 1992/1993 and, the National Trust submission advises, amounts to \$3.6 million to \$3.8 million annually.
- Other indirect Government subsidy might be available through the various job training programs which have been operated until recently by the Federal Department of Employment and Training.

These programs included the "Landcare Environment Action Program" for 15-20 year old unemployed persons who were engaged on 6 month projects; the New Work Opportunities Program which was directed to 15-50 year olds; and the Job Skills Program which applied to persons over 21 who had been unemployed for 12-18 months.

Paul Savi from the Commonwealth Employment Service at Geelong advises, however, that no funding has been allocated to these programs this financial year and that it will only be after the Federal August budget that advice may be available about what form any such programs might take in future.

Mr. Savi, nevertheless advised that he had conducted discussions early this year with representatives of Barwon Water and the City of Greater Geelong, and he was satisfied that had the job support programs remained in operation, the Aqueduct offered a suitable program for the training of unemployed persons.

- The Panel also made some enquiries into possible funding at international government level.

The submissions to the Panel by the Geelong Historical Society and the Geelong Aqueduct Committee and the National Trust have suggested that the structure may well have heritage value at an international level.

Formal international recognition of heritage value can be given to places by incorporation on the "World Heritage List". The process of listing involves recommendation by the relevant national government and vetting by the World Heritage Committee. Recognition can be given to cultural items of "outstanding universal value from the point of view of history, art or science".

A World Heritage Fund exists and fund assistance can be given for studies or the provision of experts. The moneys from the fund are available as loans or grants. The impression gained from these enquiries was that little financial assistance was generally forthcoming but listing on the Register may increase the chances of funding by the relevant national Government. It is noted that there are no Australian non-aboriginal cultural heritage sites on the Register at present. It is understood that the Sydney Opera House may soon be recommended.

In summary, then, the broad options for Government funding are as follows:

- Applications for money for repair of the Aqueduct can be made to established heritage fund managers. One would expect that given the high heritage value of

this structure, if an effective management program were articulated to the fund manager, money would be forthcoming. It may be, however, that the quantity would be insufficient to cover the full cost of repairs.

- Applications could be made for funding of promotional/interpretative/investigative programs related to the Aqueduct in the context of a tourism or urban development package. There is no reason not to expect success in this regard, but some effort in developing a package in co-operation with other organisations would be required.
- Applications for direct treasury grants could be made if political support were available.

Community Contributions

It was suggested on a number of occasions at the hearing that money for conservation of the structure might be raised by establishing a public appeal or by invitations to local firms or businesses to act as sponsors. A 1991 edition of the 'Geelong Advertiser' reports Frank De Stephano of Barwon Water suggesting such an appeal.

The Panel, however, does not recommend the institution of such an appeal until at least after Stage 1 of the program of repairs recommended in the final chapter.

The Aqueduct is located in an area which is geographically remote from main access roads. While it is visible from the main Barwon Heads Road near the Marshall rail crossing, the colour and linear configuration of the Aqueduct results in it blending into the background of the scene.

An inescapable conclusion from this Panel's inquiry is that there is a low level of public awareness, even in Geelong, of the existence, let alone the significance, of the structure. As Ros Lewis in a report entitled "Geelong Sewerage Aqueduct, A Heritage Interpretation" (an unpublished/undated report held on the City of Geelong file seemingly of 1994/1995 origins) said:

"It would be fair to say that the vast majority of the Geelong community do not know of the existence of the structure let alone where it is or its historical or architectural significance"..

The Panel made efforts, as part of its inquiry, to obtain a generally available map of the city which indicated the location of the Aqueduct. These efforts were unsuccessful. Publications from which the Aqueduct is missing include, for example, the "Geelong Bike Map" and the "Geelong Visitors Map" provided by the City by the Bay Tourist Association Incorporated.

The dearth of information about the Aqueduct was best illustrated by a visit to the Tourist Information Centre on the Melbourne Road. The staff servicing the centre at the time of our visit were not only unable to provide us with a map, but after telephoning their colleagues in the city centre, were then only able to give us the vaguest directions to what they described as "a bit of an eyesore".

Frank De Stephano of Barwon Water volunteered in an early interview which formed part of this inquiry, that the Geelong community did not really care about the future of the structure. It would be hardly surprising if he were correct, given the paucity of information generally available to them.

It is recommended by the Panel that as part of Stage 1 of the Aqueduct management program, efforts to increase public awareness of the existence and significance of the structure be made. These might include the flood lighting which was recommended by several submitters; the creation of a roadside viewing point as recommended by the Geelong Aqueduct Committee; and/or the publication of a Heritage Trail Brochure based upon the Australian Studies Centre work at Deakin University.

In my view, however, the most successful way to increase awareness and appreciation of this structure would be by completion of the walkway/bike path on the northern side of the river to the east of the Aqueduct. This would give a more attractive approach to the structure as was suggested by Mark Trengrove of the Geelong Aqueduct Committee, Landscape Subcommittee. My own inspections of the Aqueduct and surrounds suggested that the most striking and imposing view of the Aqueduct is obtained from the northern flood plain to the east. If one is able to traverse the almost 0.5 kilometre distance from the river to the northern end, a full appreciation of the scale of this structure is afforded.

It is recommended that after Stage 1 of the works recommended in the following chapter are completed, a public appeal must be launched for contributions from the community. The National Trust and the Trust for Nature both indicated a willingness to lend their name to such a program. Funds raised by public appeal are not insignificant: some \$370,000 was raised in this manner towards the purchase of 174 hectares of heathland at Anglesea from the local community.

CHAPTER 8

A STRATEGIC APPROACH TO CONSERVATION OPTIONS FOR THE AQUEDUCT

Part of the submission to this Panel inquiry by the now Department of Natural Resources and Environment referred to the document entitled "The Conservation Plan" which was prepared by Dr. James Kerr to supplement the Burra Charter. In it Kerr outlines the steps and principles in preparing a Conservation Management Plan.

The submission included;

"A basic principal (sic) behind a conservation plan for any historic place is that following the establishment of the significance of a place, there is an intermediate step before the conservation policies are proposed. That intermediate step considers issues which may influence the policy. In specific, Dr. Kerr mentions a place's physical condition and user requirements as two of those issues. In the case of the Aqueduct, these two issues should significantly influence the conservation policy and possibly highlight the alternative options to restoration ... This could extend, depending upon circumstances, to justify partial demolition."

Mr. Nelsen's oral submission at the hearing went on to say that this Panel process could be viewed as part of Kerr's "intermediate step".

The Panel has indeed endeavoured to assess the main issues which would influence a conservation policy in relation to the Aqueduct. I have, however, endeavoured to give some general strategic advice about the contents of a conservation plan for this structure. I have not proceeded beyond this point, however, as I do not believe that it is my role within the constraints of this inquiry, nor would it be beneficial until decisions are made at least about the extent of funding and management responsibilities.

Criteria for the Assessment of Options

1. Public Safety

Continually throughout the inquiry process, Barwon Water stressed their concerns that the public should not be endangered by whatever management option were adopted for this structure. They went so far as to say that they would be reluctant to hand over the structure to another authority, unless the river spans were demolished. The City of Greater Geelong's submission, too, addressed this matter. During the public hearings, some time was also devoted to examining the issue of the structural integrity of the Aqueduct and the extent and nature of public hazard arising from it.

The Panel agrees with Barwon Water that there is a pressing need to undertake works to the river spans which will enable the opening of the river without unacceptable public hazard.

2. Conservation Acceptability

Perhaps the key principle of the Burra Charter is that included in Article 2, viz;

"The aim of conservation is to retain or recover the cultural significance of a place and must include provision for its security, its maintenance and its future."

Article 3 of the Charter is also a key principle;

"Conservation is based on a respect for the existing fabric and should involve the least possible physical intervention. It should not distort the evidence provided by the fabric."

Article 1 includes a number of definitions and elaborates on the concept of "conservation";

"Conservation means all the processes of looking after a place so as to retain its cultural significance. It includes maintenance and may according to circumstance include preservation, restoration, reconstruction and adaptation and will be commonly a combination of more than one of these."

These and other articles of the Burra Charter require that future management of the Aqueduct if conservation is to be achieved must be done in such a way that any works do not detract from its cultural significance.

3. Functional Utility

Continually throughout the hearing process, the Panel was advised that the potential functional role for the Aqueduct was as a river crossing for pedestrians and cyclists. In Chapter 3 of this report, the Panel describes the basis of its recommendation that the retention at least of the river spans of the Aqueduct is an appropriate strategic approach to open space planning along the Barwon.

4. Financial Management

As noted earlier in this report, the engineering submitters have all agreed that conventional patch repair is the most acceptable repair option for the Aqueduct at present. While other techniques have been developed, most of these have problems with application to the Aqueduct. Nevertheless, as Dr. North indicated, further developments in concrete repair methodologies are to be expected. Like some of the methods already developed, these may well prove to be less expensive than conventional patch repair which is highly labour intensive and employs relatively expensive materials. Whatever approach is taken to the management of the Aqueduct it would be desirable that the opportunity is left open for alternative repair methodologies to be employed as they became available in an endeavour to reduce costs.

Further, it would be appropriate that a management approach be adopted which would allow a more precise definition of costs, than is available at present, to occur. It is clear that the full extent of corrosion will only be able to be assessed when repair commences.

Also, the approach adopted to management, should desirably allow the widest possible distribution of responsibility for funding - to all sectors of the community, including private organisations and individuals.

Options for Management

While there are numerous options for the future management of the Aqueduct which might be assessed, such as the very many alternatives outlined in Professor Lawrie Baker's paper of 1994, which involved demolition of different parts of this structure, I believe that it is most useful to consider only three options:

1. The Barwon Water option now recommended, that is the demolition of the river spans and the retention of the remaining spans in an unrepaired state but securely fenced.
2. An option employing full patch repair immediately.
3. An option involving repair of the river spans immediately as a first stage, and the gradual repair of the remainder of the structure.

Strategic Assessment

The acceptability of these various options for management can be assessed by considering the performance of the option against the earlier identified criteria of public

safety, conservation acceptability, functional utility and an appropriate financial management.

1. **The Barwon Water Option**

This management option performs well in terms of public safety - a high level concern for Barwon Water as the current owners of this structure and river managers - and in terms of cost. As indicated earlier, it is estimated that the demolition of the four river spans would cost some \$63,000 with additional costs associated with stabilisation of the abutting spans. However, the full cost of this option should perhaps be regarded as \$410,000 - the cost of demolition of all of the towers, as this is likely to be the ultimate outcome of this management approach.

This option performs particularly poorly in terms of its conservation implications however. Not only are those spans which make a key contribution to the cultural significance of this structure demolished immediately, but the remaining spans would also be demolished in time. While it might be argued that so long as the entire bridge is not demolished immediately, it might be repaired in future, it seems to the Panel that by having destroyed a key component of the cultural significance of this structure and removed the opportunity for the utility of the structure as a river crossing, further repair would be discouraged.

This option also does not incorporate any opportunity to utilise the structure within a network of bike ways or walking trails along the Barwon.

2. **Immediate Patch Repair of Entire Structure**

This option performs well in terms of conservation acceptability, public safety and utility. However, it is perhaps not only a financially unrealistic option, but a financially unwise one. This approach would not leave the way open for the development of other repair methodologies, nor would it facilitate the funding of repairs being drawn from a wide group in the community. It is the Panel's view, that before financial support can be expected from the public at large, a new perspective on, and wider publicity for, the Aqueduct is required. Under this management option, such public awareness would occur too late to allow any public financial support for repair.

3. **Stage 1 Repair of River Spans and Later Repair of Remaining Structure**

It seems to me that this approach to management has the following advantages:-

- It addresses the urgent need to reopen the river and ensure public safety for river users.
- It retains the option for the Aqueduct to serve as a pedestrian bridge across the river when demand and opportunity to extend the trail onto the southern bank arises.
- It avoids making an irretrievable decision to allow demolition immediately.
- It reduces the initial financial commitment to the project, and enables a better definition of the costs of repair for the remaining section of the bridge.
- It leaves the options open for the development of new techniques which may prove more cost effective.
- It retains a section of the bridge which perhaps makes the most important contribution to its cultural significance by expression of the original function of this structure.

The repaired segment of this structure across the river could have utility as a viewing platform until such time as the southern bank of the river were open to public use.

The approach gives the opportunity to raise funds from a variety of sources, especially private sponsors and the Geelong Community, as awareness of the structure develops.

This approach to the management of the Aqueduct could also have a number of variants depending upon factors such as financial availability.

It would be possible to repair only two, rather than four, of the spans crossing the river. This would allow one branch, rather than two branches of the river to be open. It is recommended that if this approach were adopted that opening of the northern branch of the river would be appropriate given this is the main river branch and the tower on the northern bank is so positioned that it would enable the public to cross beneath the Aqueduct on the land (when it is repaired).

This variant would cost half of the cost of the four span variant of the option.

It would also be possible to undertake minor works as a "holding measure" to enable opening of the river beneath the structure if there were delay in the availability of funds for more extensive repairs. Mr. Beauchamp's report outlines the works that he believes are required to enable the safe opening of one branch of the river. If the level of risk associated with these repair options was regarded as unacceptably high, there is also the possibility of removal of the pipe, and possibly the walkway, for the 12 metre distance between the ends of the trusses, across one branch of the river. This approach is not recommended as the reinstatement would contribute to additional costs in the longer term. Back propping of other trusses would also be required.

The Panel commends to the Minister Option 3 as the most strategically sound approach to the future management of the Ovoid Sewer Aqueduct. It seems to the Panel that the approach is one which incorporates a desirable level of flexibility in terms of responding to the uncertainties of funding, development of open space along the Barwon River, land owners co-operation, and aspects of the structural condition of the Aqueduct which will not be known until break out of the concrete occurs.

The Panel strongly urges, however, that if this approach to the management of the Aqueduct is adopted, it must be accompanied by a program of actions which are directed towards increasing public awareness of the existence and significance of the structure. The biggest single contribution towards public awareness, I believe, would be that made by the opening of the pathway/bike way along the northern side of the Barwon River. This will enable the Aqueduct to be viewed within an open space context, and from a location from which the Aqueduct is seen as its most impressive. It seems that Barwon Water are prepared to allocate funds towards this already and it may be that the City of Greater Geelong could also make a contribution towards this, as part of the implementation of its strategic recreation plan for the municipality now under preparation.

Other components of a public awareness campaign might be:

- the publication and distribution of the industrial heritage trail - identified by the Australian Studies Centre at Deakin University.
- the inclusion of the Aqueduct on publically available maps of Geelong, especially those available in tourist information centres.
- the promotion of the significance of the Aqueduct through newspaper articles, etc.

- . investigation of whether there might be opportunities for, or benefits of, a 'twin city' arrangement with Ivry.
- . the development of a viewing-point near the road with a display of information about the structure
- . Floodlighting?

The Panel also envisages that there is a considerable range of other activities which would be associated with the adoption of this approach to the management of the structure, including preparation of applications for future funding; investigation of international significance; negotiations with nearby landowners; ongoing detailed design of the bikeway; monitoring of advances in repair methodologies; detailed design of access ramps to the structure and the installation of barriers on the remaining walkway, the installation of improved fencing and signage in accordance with Australian Standards; applications for necessary heritage and planning approvals; calling of tenders for repairs; establishment of programs for job training in conjunction with D.E.A.T.; preliminary investigations into establishment of a public appeal; identification of possible sponsors; coordination with wider-area recreation planning actions by the City of Greater Geelong and with policies of any new Catchment Authority, etc.

Given the cumulative time demand of these requirements, the Panel does not believe that it is realistic to envisage that they can be met from within the existing staff resources of the Department of Natural Resources and Environment, as the recommended Management Authority. Nor does the panel believe that such a program can be carried out directly by a Committee of Management, as Mr. Nelsen also observed.

It is recommended, therefore, that a staff position be created at one of the agencies with involvement in future management of the structure - at the Department of Natural Resources, the City or at Heritage Victoria. It is possible that this position could be operated on a part-time basis of perhaps 2-3 days per week. The staff member should, however, be responsible to the Committee of Management.

In summary, I recommend to you a management technique for the Aqueduct which appears sufficiently robust yet flexible to respond to the uncertainty of long term funding, the unknown timing of development of the river valley open space network, emerging techniques of concrete repair and growing awareness by the Geelong and wider community of the existence and significance of the Aqueduct.



Jennifer A. Moles
23rd May, 1996

APPENDIX 1

**BRIEF FOR CONDUCT OF
INQUIRY**

BRIEF FOR THE CONDUCT OF THE INDEPENDENT PANEL INQUIRY ONTO FUTURE MANAGEMENT OPTIONS FOR THE BARWON SEWER AQUEDUCT

Background:

The Barwon Sewer Aqueduct was constructed in 1918. It is a structure of concrete, with reinforcing steel. It lies in the wetlands at the area west of Geelong known as the Breakwater, and traverses the Barwon River for some 800m.

In 1992 Barwon Water took the structure out of active commission after implementing alternate management approaches for the treatment and transport of sewage. Since this time the structure has been unused.

In 1994 Barwon Water initiated dialogue with the Historic Buildings Council in order to ascertain permitting options for works to the structure. Since this time it has become apparent the structure requires works, but that there are a range of options ranging from demolition (or part) through to complete restoration. Additionally, Barwon Water have clearly articulated their core business has changed and as such they do not include maintenance of the structure as an essential business process.

In addition to the views expressed by the owner, other groups which have contributed to the dialogue include:

- Geelong Aqueduct Committee (local interest group with expertise in heritage and engineering);
- City of Greater Geelong;
- Department of Conservation and Natural Resources; and
- Historic Buildings Council.

Extent of inquiry:

Having established the structure is of national significance, and that it is currently provided statutory protection under the Historic Buildings Act, in December 1995 the Minister for Planning undertook to establish an independent inquiry panel to explore the following options for the structure:

- * the extent to which the structure can be physically conserved in accordance with the principles of the *Burra Charter*
- * the financial implications of maintaining the structure
- * the extent to which the structure can be safely maintained and managed;
- * the role for members of the Geelong community to participate in preservation and management of the structure;
- * the degree to which the surrounds could be incorporated into a managed recreation and tourism area;

Process for hearing of submissions:

Submissions will be sought from parties identified as having an interest through the Historic Buildings Council. Additional submissions will be sought through public advertisement in *The Age* and the *Geelong Advertiser*.

Notice calling for submissions to be sent the week 8 January 1996 and advertised 13 and 20 January 1996.

Submissions will close 16 February 1996.

Parties will be heard in Geelong at the
Council Conference and Reception Centre
City Hall
Little Malop Street
GEELONG

and are scheduled for 9.30 am to 4.00 pm, 27 to 29 February 1996.

Panel will report on findings no later than 28 March 1996.

APPENDIX 2

INFORMATION PACKAGE
FORWARDED TO
ENQUIRERS AND PRESS
RELEASE

INTERESTED IN THE FUTURE OF THE BARWON SEWER AQUEDUCT?

INDEPENDENT PLANNING INQUIRY PUBLIC SUBMISSIONS AND HEARINGS

The Minister for Planning has appointed an independent panel of inquiry to examine future conservation and management options for the Barwon Sewer Aqueduct.

The Aqueduct is no longer in service but is included on the State Historic Buildings Register.

The panel has been directed to:

- Identify and assess appropriate conservation options
- Report on the financial implications of the management options
- Identify what role the Geelong community might play in the conservation and future management of the structure
- Examine the future use and management of the aqueduct environs.

Requests for copies of the panel's terms of reference and any inquiries should be directed to:

Maggie Baron
Operations Manager, Heritage Victoria
Department of Planning and Development
5/477 Collins Street, MELBOURNE VIC 3000
Telephone (03) 9628 5125 Fax (03) 9628 5650

The panel invites **WRITTEN SUBMISSIONS** from groups and individuals who have views about the future management of the structure and its site. Three copies of each submission must be forwarded to Ms Baron at the above address by 5.00 pm Friday, 16 February 1996.

A **PUBLIC HEARING** will be conducted by the panel on 27, 28 and 29 February 1996 at the Council Conference and Reception Centre, City Hall, Little Malop Street, Geelong. The hearing will commence at 10.00 am on the first day.

The panel invites **ORAL SUBMISSIONS** to be made at the hearing by interested persons and groups, including those wishing to elaborate on earlier written submissions.

Anyone wanting to make a presentation at the hearing must advise Ms Baron by 20 February 1996, providing a summary and an estimated length of time it will take to present their submission and/or any expert evidence.

A **REGISTER OF ALL WRITTEN SUBMISSIONS** received by the panel will be continuously updated and made available for public inspection at Level 5, 477 Collins Street and the Department of Planning and Development Office, Level 5, cnr Little Malop and Fenwick Streets, Geelong.

Jennifer A Moles, Panellist



Office of
Planning
& Heritage

Department of
Planning and
Development
Government
of Victoria

PARADISES

 **Victoria ON THE MOVE**

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- * the extent to which the structure can be physically conserved in accordance with the principles of the *Burra Charter*
- * the financial implications of maintaining the structure
- * the extent to which the structure can be safely maintained and managed;
- * the role for members of the Geelong community to participate in preservation and management of the structure;
- * the degree to which the surrounds could be incorporated into a managed recreation and tourism area;

Process for hearing of submissions:

Submissions will be sought from parties identified as having an interest through the Historic Buildings Council. Additional submissions will be sought through public advertisement in *The Age* and the *Geelong Advertiser*.

Notice calling for submissions to be sent the week 8 January 1996 and advertised 13 and 20 January 1996.

Submissions will close 16 February 1996.

Parties will be heard in Geelong at the
Council Conference and Reception Centre
City Hall
Little Malop Street
GEELONG

and are scheduled for 9.30 am to 4.00 pm, 27 to 29 February 1996.

Panel will report on findings no later than 28 March 1996.

Barwon Sewer Aqueduct Inquiry

GUIDE TO PRESENTATION OF SUBMISSIONS FOR PUBLIC HEARING 27-29 FEBRUARY 1996

This guide has been prepared by the Panel to assist persons and organisations wishing to present submissions concerning the future of the Aqueduct.

- The Panel will endeavour to advise you before the hearing of the approximate time for your presentation. Please ensure that you supply a contact name, address, telephone or facsimile number, when you register with Maggie Baron.
- Persons or organisations may represent themselves or may have others represent or speak for them. You make like to support your case with experts. If so, they may be subject to cross examination by others. The panel would be assisted if you could tender and read from your submission.
- Submissions might usefully include the following matters:
 - ✓ Your name and, if relevant, the name of the organisation you represent. Your address and if relevant, where you live in relation to the Aqueduct.
 - ✓ The nature of your interest in the Aqueduct and its site.
 - ✓ An identification of those aspects of the Panel's inquiry which you wish to address, which may include: structural aspects/public safety issues, conservation methods, the future use of the Aqueduct, the financing and management of repairs, ongoing management of the structure, the future management and use of the Aqueduct surrounds.
 - ✓ A summary of the recommendations or advice which you wish to present.
 - ✓ A clear statement of the reasons or basis for your recommendations or advice.
- As part of your submission you may like to respond to the submissions made by others. The Register of written submissions is designed to assist you in this.
- The Panel will be informing itself by means other than the public submissions including inspections of the Aqueduct and general locality, by researching relevant documents, and through selective discussions with relevant agencies and groups.
- The panel will be reporting to the Minister for Planning at the end of March 1996.

Jennifer A Moles, Panellist

Friday 12 January, 1996

Call for public input into future of aqueduct

Creative suggestions and lateral thinking are needed to identify a practical and viable future for Geelong's unique Barwon Sewer Aqueduct, independent panellist Jennifer Moles said today.

A public notice in today's newspaper calls for interested persons and groups to make submissions to the independent panel advising the Minister for Planning, Robert Maclellan, on the future of the structure and its environs.

"We are looking for innovative ideas about how the community might conserve and manage the Barwon Sewer Aqueduct, Ms Moles said.

Ms Moles, a town planner, described the task of coming up with real options for the conservation of the structure as an exciting challenge.

The Aqueduct was decommissioned in early 1993 and is registered by the Historic Buildings Council.

Ms Moles said some investigations to date have suggested that the Aqueduct is in need of substantial structural repairs.

She also acknowledged that Barwon Water does not believe it is in its core role to preserve decommissioned assets.

The Aqueduct has, however, been recognised as an historic structure of national significance and worthy of conservation.

Ms Moles acknowledged that there are various community groups interested in the Aqueduct's preservation who could have a role to play in its conservation.

She added, "Clearly there is no doubt about the heritage significance of the Aqueduct."

"What I am looking for is ideas on both how to manage the repair of the structure, and ultimately its long term use," she said.

"It seems to me that the best conservation option may well be found not by considering the Aqueduct in isolation, but by viewing it as part of a wider management plan for the whole area," Ms Moles added.

Media Inquires:	Lisa Vagg	(03) 9628 5448
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APPENDIX 3

**SUMMARY OF PUBLIC
SUBMISSIONS**

**WRITTEN SUBMISSIONS RECEIVED
IN RESPONSE TO
PUBLIC ADVERTISEMENT**

(* - indicates that an oral submission was made by this submitter. Date follows)

1. *Professor Renate Howe* and Ms. Ros Lewis* (28/2)
Centre for Australian Studies
Deakin University, Geelong*

This submission describes a project by the centre entitled "The Barwon River and its Cultural Heritage". This study has identified sites and undertaken preliminary research for the development of an industrial heritage trail along the Geelong section of the river. It is intended that the trail be published. The submitters expressed the view that the future management of the Aqueduct should take place in the context of an overall heritage and tourism strategy for the Barwon River.

2. *Barwon Water* (presentation by Mr. John Graham, Executive Manager Resource Development; Professor Lawrie Baker, Board Member; and Mr. Louis Walsh, Consulting Engineer of Maunsell Pty. Ltd. - 29/2 and 20/3).*

This submission outlines Barwon Water's responsibilities and business policies within an overall governmental context. The history of the Aqueduct is described together with recent events, including the structural condition assessments made by Taywood-Maunsell.

The submission then outlines Barwon Water's recommendation for the future of the Aqueduct, which includes land transfer, demolition of the river spans, and the retention of the remaining section of the Aqueduct, fenced-off from the public, but in an unrepaired stated.

Appended to this submission are the tabled Maunsell reports of March 1990, April 1991 and September 1994. Also appended are statement of opinions by Maunsells of August 1995 and September 1995. Professor Baker's options report is also appended.

3. *The Landscape Committee of the Geelong Aqueduct Committee* - 28/2 - presented by Mr. Mark Trengrove.*

This submission suggests that the bridge could act as a pivotal focus for a regional network of pedestrian and cycle trails. The report notes that a bike trail has already been constructed as far as Goat Island. The report describes the significant remnant vegetation which occurs on the northern side of the river and Goat Island, being Lignum Swamp and riparian communities.

At the hearing, this group also showed a video of an earlier television programme concerning the Aqueduct.

4. *Corcoran Shepherd (Engineering) Consultants Pty. Ltd.*

This submission expresses concern about the extent of deterioration of the structure and outlines perceived causes of this. It notes that much of the structure is no longer there and the integrity of members has mostly gone.

A principal of this firm previously worked for Maunsell and was involved in the assessments of the structural condition of the Aqueduct.

5. *Mr. Rod Charles*
2 Dearnley Street
Manifold Heights

Mr. Charles recommends retention of the Aqueduct, exclusion of the public by fencing, and the installation of netting above pathways beneath the structure.

6. *Mrs. Jan Calaby*
135 Russell Road
Belmont

This submission describes the tourism potential for the structure and recommends that boat trips be introduced on the Barwon River to take advantage of the abundant bird life and the river's unusual feature, being the Aqueduct. She recommends landscape treatment of the area and the retention of the structure until such time as money becomes available for its repair. Mrs. Calaby said;

"To demolish it is both short-sighted and negative with nothing to be gained and everything to be lost."

7. *City of Greater Geelong* - presented by Kevin Krastins, Heritage Planner - 28/2.*

This submission advised the council at its meeting on the 28th November 1995 resolved that they were not prepared to assume ownership of the structure and

- (i) They recognised the historic cultural significance of this structure and supported its ongoing repair for which funding should be forthcoming from a number of levels.
- (ii) They would support the establishment of a trust for the ongoing maintenance of the structure utilising feeding funds the state and federal agencies, the proceeds of a public appeal and the demolition funds set aside by Barwon Water.

They recommend that ownership reverts to the crown or a committee of management.

- (iii) The council recommends that if no money is available to repair this structure that it should be fenced off and allowed to decline.

The submission included that the Aqueduct could form part of the master plan for the banks of the Barwon. A role for adjacent land owners, Barwon Water, the Department of Natural Resources and Environment, the Historic Buildings Council, the National Trust and community groups is envisaged.

8. *Remedial Engineering Group*

This submission presents the view that the Aqueduct can be appropriately rehabilitated using some of the various state of the art rehabilitation techniques, including cathodic protection.

The submission reports on the results of a trial conducted on the Aqueduct in 1994 using cathodic protection.

Remedial also suggested other techniques could be used such as electrochemical realkalisation, corrosion inhibitors and encapsulation of members.

9. *The Geelong Environment Council Pty. Ltd.* - presented by Mrs. Jean Lucas - 28/2.*

This submission was previously that prepared for the abandoned Historic Building Council permits meeting of November 1994.

It is a comprehensive report referring to an earlier river management strategy of 1982 which was prepared by the Centre for Environmental Studies at the University of Melbourne for the then Geelong Water and Sewerage Trust. The report describes the values of the surrounding wetlands to the Aqueduct.

This submission refers to the retention in the archives of Barwon Water of glass plate negatives of work in progress on the Aqueduct. It suggests that a display of photographs and other material might be mounted near the Aqueduct. Public transport accessibility could be improved. Floodlighting of this structure is recommended, and a special newspaper liftout feature. This report notes the lack of attention to the Aqueduct in any existing tourist material available. The submission again identifies the potential to link existing bicycle tracks to a scenic tour of the river.

Included in an appendix is a 1993 report by Beverley Roberts, "The Cultural Heritage of Barwon River", which was a study conducted for the Geelong and District Water Board.

A supporting letter of the 6th May 1994 from Barry Lingham, the Secretary of the Geelong Field Naturalist Club Incorporated was also tendered.

10. *Mrs. Jean Lucas
21 Parvo Street
Belmont*

This was a private submission by Mrs. Lucas, who presented the G.E.C. submission of 9 above.

This submission was a colourful collection of written items, drawings and photographs about the Aqueduct, presented in the form of a comic.

11. *Geelong Historical Society*

This submission addresses the significance of this structure and argues that it should be retained in its entirety. The Society recommends floodlighting at night and transfer of the structure to Crown Land, with Vicroads or another government agency managing the repair. Again the Society recognises the potential role of the Aqueduct in a bike trial for the future.

12. *Geelong Aqueduct Committee - Engineering Sub-Committee* - presented by Mr. J. L. (Dick) van der Molen - 29/2 and 20/3.*

This submission covers the heritage significance of the Aqueduct and suggests a new statement of cultural significance. It suggests that technical processes are available for the restoration of this structure and addresses the management of restoration and future ownership. Importantly, this submission recommends flexibility in the approach taken to restoration of this structure, and estimates total costs of \$5.5 million. Transfer to the crown with a severance payment of \$5.5 million by Barwon Water is recommended.

At the public hearing, this group also showed videos concerning the repair of corroded concrete, and the demolition of the Bow Truss Building. Mr. van der Molen also demonstrated the transfer of forces in a truss, with a balsa wood model.

13. *Geelong Aqueduct Committee.*

This submission in summary advised that:-

The G.A.C. believes that the Aqueduct;

1. Must be preserved in its entirety because of its historical significance.
2. Can be restored to a satisfactory condition at a manageable cost.
3. Can be made the major focal point in a landscape/environmental project encompassing the region from the You Yangs to Queenscliffe.
4. Is a key element in the industrial heritage of the Barwon River and should have an appropriate heritage interpretation program.

The written report indicated that two oral submissions would be made - one from the Engineering Subcommittee who had researched possible restoration techniques; and the Landscape/Environmental Subcommittee who were developing conceptual plans related to forward planning of the Aqueduct environs.

14. *H. (Oz) Kayak**
Senior Research Fellow
R.M.I.T. - 28/2

Mr. Kayak's submission included that the Barwon Sewer Aqueduct has potential to act as a destination site and landmark in recreational and tourist strategies for the Bellarine Peninsula. He suggested that a trail along the river could be linked to the Bellarine Railway Trail to the north. Mr. Kayak was of the view that some of the spans of the Aqueduct could be removed without loss of cultural value. He also suggested that revenue to maintain the structure could be raised by levying visitors.

15. *Institution of Engineers Australia (Victorian Division)* - presented by Mr. Ken McInnes, Chairman, Engineering Heritage Subcommittee - 29/2*

This report addresses the source of the cultural significance of the Aqueduct and the implications of this for conservation options. It addresses the importance of the external form of the pipe to the cultural significance of the structure and its footpath role. It suggested that the Aqueduct's cultural significance lies in the length of its individual spans, the longest of which is 53.7 metres, and the structure's overall length of 756.1 metres, together with the unusual truss design employed.

16. *Department of Natural Resources and Environment* - presented by Mr. Ivar Nelsen, Manager Historic Places Branch - 28/2*

This submission deals directly with the terms of reference of the inquiry. It notes that conservation in Burra Charter is not synonymous with restoration but adaption to suit new uses is also possible. It recommends that any demolition, however, should be kept to the least extent possible and options for the reinstatement of elements in the future should be kept open.

The submission refers to the steps involved in the preparation of the conservation plan as described in James Kerr's "The Conservation Plan". In particular Mr. Nelsen referred to the intermediate step between the assessment of significance and the preparation of the plan, being the consideration of issues which may influence policy, for example, physical condition and user requirements. He was of the view that this intermediate step had a major role to play in the case of the Aqueduct.

The view was also put that if there is a continuing argument about the structural integrity of the Aqueduct, that a second opinion was appropriate given the national importance of the bridge.

Support was given to the various submissions describing the development of walking trails in the vicinity.

17. *National Trust of Australia (Victoria)* - presented by Mr. Ian Wight - 29/2.*

This submission describes the high heritage significance of the structure and notes that it is located within a regional landscape with a potential for recreation, education and tourism.

The submission suggested that Barwon Water currently has and should have the legal responsibility for management and puts the proposition that it is within its financial capabilities.

The submission recommends national, state and local government funding.

18. *Heritage Victoria* - presented by Ms. Maggie Baron, Manager Heritage Operations - 28/2*

This submission outlines the history of this structure, identifies significant events leading to the inquiry and outlines the major issues. The submission cautions:

"A decision to hold the status quo as merit when compared with one to move in an irreversible direction".

**19. *The Historic Buildings Council*
- as above***

This submission outlines the Historic Buildings Council - now Heritage Council - process to date. It refers to the relevant sections of the Act which would be considered in relation to permit applications, and incorporates as an Appendix the Burra Charter and its explanatory guidelines.

**20. *Mr. David Young
Heritage Consultant
Campbell, ACT***

Investigation into cathodic protection and other benign methods of raising the alkalinity of the concrete are recommended, including the use of lime. Reduction of moisture penetration is also a possibility.

**21. *Mr. Arthur McIntyre
116 Tanner Street
Breakwater***

This submission recommends the integration of the Aqueduct into a multi-faceted tourist attraction. It notes that a bikeway already exists from Moorabool Street to Breakwater Road and might be extended. It notes that excellent fishing is available south of the breakwater.

22. *The Geelong and Region Trades and Labour Council*

This submission advises that Barwon Water has told them that it is not possible to save the structurally unsound spans over the river.

They urge retention of the remainder of the Aqueduct on the northern side of the river as a "graceful ruin", incorporated in a river park with a Heritage theme.

They recommend an aim of saving as much as possible of the Aqueduct. They suggest that repair of the Aqueduct and the park development would be incorporated into further training and employment opportunities for Geelong's unemployed.

23. *Concrete Institute of Australia, Victoria Branch (this was a late submission received on the 1st March)*

This submission suggests that the repairs necessary for the conservation of the Aqueduct, and those already done, could be used as a research study on the performance of various repair materials and techniques. In this manner, it is suggested, the ongoing maintenance of this structure could serve the wider community by providing valuable knowledge about the success of various repair procedures.

Note:

In addition to the persons making oral submissions, the hearings were attended by a number of others, either for the hearing's entirety or part of it. These people included:-

- . Mr. Peter Alsop of the Geelong Historical Society and Geelong Aqueduct Committee - Engineering Subcommittee.
- . Mr. Robert Scott
"Barwonside"
Kings Lane
Marshalltown
- The owner of the land on the south side of the river on which the Aqueduct is constructed.
- . Mr. Paul Northey
Barwon Water
- . Ms. Megan McDougall
Heritage Victoria
- . Mr. Randall Bell
Geelong Aqueduct Committee
National Trust (Geelong)
- . Councillor Margo Lewis
City of Greater Geelong
- . Others from the Geelong Aqueduct Committee - Landscape Subcommittee and/or the Geelong Environment Council.

APPENDIX 4

**DETAILS OF
DISCUSSIONS AND
INVESTIGATIONS BY
PANEL**

GROUPS/INDIVIDUALS WITH WHOM KEY DISCUSSIONS WERE HELD

(* - indicates telephone discussion only
- discussions on minor issues not recorded)

22/12/95

Mr. Ray Tonkin
Director
Historic Buildings Council; and

Ms. Maggie Baron 7 & 27/2/96 (Maggie Baron only)

Manager
Heritage Services
Heritage Victoria
- Briefing concerning objects of inquiry.

9.1.96

Ms. Lisa Vagg
Publicity Officer
Department of Planning and Development
- Concerning public advertisement and press release, etc.

11.1.96 (2 & 3 April - Ian McCartney only)

Ian McCartney
Senior Strategic Planner; and

Neil Savery
Manager
Strategic Planning and Urban Design
City of Greater Geelong

5.2.96

Mr. Ivar Nelsen
Manager
Historic Places Branch
Department of Natural Resources and Environment

9.2.96

Mr. Rod Gowans
Manager - Melbourne Region
Department of Natural Resources and Environment

13.2.96 (6.2.96* - Mr. de Stephano)

Mr. Frank de Stephano
Chairman;

Professor Lawrie Baker
Board Member; and

Mr. Dennis Brockenshire
Chief Executive Officer
Barwon Water

20.2.96

Mr. Bruce Humphries
Senior Environmental Planner
City of Greater Geelong

1*, 5*, 6* and 15.3.96
Mr. John Graham
Executive Manager, Resource Development
Barwon Water

4 and 27/3/96 and 8/5/96
Mr. David Beauchamp
Beauchamp Consulting Engineers Pty. Ltd.

5.3.96*
Mr. J. L. (Dick) van der Molen
Geelong Aqueduct Committee - Engineering Subcommittee

6.3.96
Mr. Simon Molesworth
Chairman
National Trust of Australia (Victoria)

6.3.96*
Mr. Ian Rogers
Office of Arts Victoria

6.3.96*
Mr. Peter McEwan
Department of Planning
Better Cities Manager, Victoria

8.3.96
Mr. Warrick Nelson
Harwood Andrews
Solicitors to Barwon Water and the City of Greater Geelong

12.3.96
Mr. Brian Wheelan
Director
Trust for Nature

15.3.96
Mr. Grant Green
Executive Manager, Waterways
Barwon Water

19.3.96*
Mr. Simon Mahoney
Financial Controller
Melbourne Parks and Waterways

1.4.96
Mr. Mike McCoy
Executive Manager, Water Systems
Barwon Water

1.4.96
Mr. Robert Scott
"Barwonside"
Marshalltown

2.4.96*
Ms. Helen Kostiuk
Public Affairs
City of Greater Geelong

2.4.96*

Mr. Roger Grant
General Manager
Geelong Otway Tourism

2.4.96*

Mr. John Dixon
Bureau of Business and Employment
Department of Employment and Training Brokerage

2.4.96*

Mr. Peter Bettess
Director, Planning
Department of Planning and Development

3.5.96*

Mr. John Paraskeropolous
Australian Heritage Commission
Canberra

3.5.96*

Mr. Paul Savi
Commonwealth Employment Service
Geelong

INSPECTIONS AND HEARINGS

1. Inspections of Aqueduct and Surrounds

21.12.95 Informal inspection by Panel alone.

20.2.96 Inspection with:-

- . Maggie Baron, Heritage Victoria
- . Ivar Nelsen, Department of Natural Resources and Environment
- . Peter Kerr, Department of Natural Resources and Environment
- . John Graham, Barwon Water
- . Paul Northey, Barwon Water
- . Kevin Krastins, City of Greater Geelong

7.3.96 Inspection with:-

- . David Beauchamp, Beauchamp Consulting Engineers
- . Paul Northey, Barwon Water

1.4.96 Inspection with:-

- . David Beauchamp - from Robert Scott's land only

2. Other Inspections

17.5.96 Inspection with David Beauchamp of San Remo Bridge, Phillip Island where Remedial Engineering Group are undertaking repairs, employing cathodic protection. Discussion with Mr. Hank Derricks, Foreman.

3. Original Documents Inspection

7.3.96 Original engineering drawings of Aqueduct and Geelong Waterworks and Sewerage Trust Board meeting minutes inspected.

4. Hearings

Public hearings were held at the City of Geelong offices on the 27th, 28th and 29th February and the 20th March 1996. Attendance sheets for each day of the hearing have been retained by Heritage Victoria.

On Thursday, 14th March, a special engineering subcommittee meeting was conducted to attempt to limit the debate on structural engineering issues which was to occur on the 20th March. This meeting was chaired by Mr. David Beauchamp. It was attended by:-

- . Professor Lawrie Baker, Barwon Water
- . Mr. Louis Walsh, Maunsell Engineers

. Mr. Dick van der Molen, Geelong Aqueduct Committee, Engineering Subcommittee

. Mr. Ken McInnes, Heritage Subcommittee, Institution of Engineers Australia

. Ms. Maggie Baron, Heritage Victoria

The results of this meeting were recorded in writing and form part of the background papers to this report.

5. Documents

As a result of this inquiry, an extensive collection of correspondence, study reports, photographs, maps and other documentation has been accumulated by the Panel. All of this has been transferred to the care of Ms. Baron at Heritage Victoria.

APPENDIX 5

**REPORT ON
ENGINEERING ISSUES BY
DAVID BEAUCHAMP
AND COMMENTS
RECEIVED THEREON**



BEAUCHAMP CONSULTING ENGINEERS

ENGINEERING ASPECTS OF THE BARWON SEWER AQUEDUCT INQUIRY

1.0 INTRODUCTION

Evidence has been given on two days of hearing about the structural condition of the Barwon Sewer Aqueduct, the likelihood of collapse and suitable methods of repair. In addition a separate meeting was held at Heritage Victoria to see if agreement could be reached on a number of issues raised during the first day's hearing of the engineering evidence. Additional written submissions have been received on specific items.

As well as the hearings and submission of evidence a meeting was held with Mr. M. McCoy of Barwon Water, who has been involved with overseeing the maintenance of the aqueduct for a considerable length of time. This meeting was to get a background on the repair work that had been done to the aqueduct in the 1980's and 1990's.

Some spalled pieces of concrete have been tested for crushing strength to get an indication of the likely strength of the concrete used in the construction of the aqueduct.

The records for the repairs made in the 1920's were checked to see what repairs were made and their extent.

2.0 EXISTING CONDITION OF THE AQUEDUCT

The aqueduct was designed and built by the firm of Stone & Siddeley as part of the sewerage scheme for Geelong. Construction of the aqueduct took place between 1913 and 1915. The aqueduct remained in use until 1992 when it was decommissioned after a new pipe line under the Barwon River was built to replace the aqueduct. The new pipe line was built because of Barwon Waters concern about the structural adequacy of the aqueduct, the cost of repairs and the lack of capacity of the existing aqueduct to handle peak flows.

Concrete is spalling from the structure at many locations and rusting reinforcement is exposed. In some locations the spiral reinforcement is broken. The smaller vertical members of the walkway balustrade are badly damaged in a number of locations.

In 1990 Taywood Engineering Ltd. and Maunsell Pty. Ltd. prepared a condition assessment of the aqueduct for the Geelong and District Water Board. This report assessed the current condition of the ovoid sewer aqueduct and detailed the various options to keep the aqueduct in service.

The trusses at towers 2, 3 and 14 were chosen for detailed inspection and testing after a visual inspection of the whole aqueduct had been conducted. The report found that it was likely that every existing original member would need to be repaired within 25 years and that approximately 25% of the members would need to be treated in the next 5 years.

BEAUCHAMP CONSULTING ENGINEERS PTY. LTD. A.C.N. 006 965 493
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UNIT 1, 430 RAE STREET, NORTH FITZROY, VICTORIA 3068
TELEPHONE: (03) 9482 2550 FACSIMILE: (03) 9482 2779

DIRECTOR
DAVID BEAUCHAMP B.E., M.I.C.E., M.N.Z.I.E., M.I.E.AUST.

A further report by Taywood and Maunsells dated April 1991 visually assessed the condition of the entire above ground structure. All members were given a condition rating which varied from 1, no visible damage, to 5 considered structurally unsafe due to the extent of damage. Only one member was rated 5 in the survey which was the bottom chord at tower 14. 64 members were rated 4 out of the total of approximately 1363 elements surveyed. Of these 65 members, 12 related to the tops of towers which are non-structural, 12 to the pipe support brackets and 3 to the sewer pipe leaving only 38 that were truss members. The total number of truss members is 896 which means that less than 5% of the truss members were rated 4 or 5.

A further report prepared by Maunsell's in September 1994, entitled "Review of Options for the Barwon River Ovoid Sewer Aqueduct", found that when a random selection of members was subject to examination in 1994 it was considered that there was no need to increase the damage estimate for the cantilever trusses, the tower structure and the walkway. The 1994 investigation found the pipe support brackets were in an advanced state of deterioration. The pipe was displaying longitudinal cracking and the report expected that a reasonably high degree of erosion would have occurred due to sewage attack. No comparison was made with the condition of the pipe support brackets and the condition of the pipe in 1991.

When the aqueduct was visited in March 1996 by Ms. Jennifer Moles and David Beauchamp the damage as described in the Maunsell reports was evident but the aqueduct appeared relatively level and was not subject to any significant deformations. Apart from the ends of the truss at Tower 14 there were no signs that the structural members were in distress from over loading.

3.0 CAUSE OF DEFECTS

The cracking of the concrete and the rusting of the reinforcement could have been due to a number of causes including, inherent faults in the design, poor materials, poor construction techniques, an aggressive environment, lack of maintenance and carbonation of the concrete with time.

The argument was put that using reinforced concrete for trusses is not good practice as approximately half the members of a truss are in tension. Once the tensile strength of the concrete is exceeded, which is usually less than ten percent of the compressive strength, then the concrete cracks and all the stress in the member is carried by the reinforcement. The cracking can allow ingress of moisture which in turn can cause rusting of the reinforcement.

In 1922 it was reported that cracking and rusting of the reinforcement of the diagonal tension members of the aqueduct had occurred and repairs had to be made to these members. If the diagonal tension members had been designed so that the tensile strength of the concrete had not been exceeded then the early cracking to these members would not have occurred.

Some recent photographs of a concrete truss bridge, the Pont d'Ivry, built in Paris in 1910 show little signs of decay which indicates that concrete can perform adequately when used in trusses.

The other defect that was reported in 1922 was the deflection of the pipe line and cracking of the balustrade to the walkway supporting the pipeline between the ends of the trusses. Repairs were instituted by jacking the central section of the walkway, providing additional diagonal reinforcement between the handrail and the base of the walkway and making the balustrade solid concrete instead of being a series of verticals.

The walkway between the ends of the trusses has to carry the pipe loads. For it to act as a deep beam it is necessary for the handrail to be effectively connected to the beam at the slab level of the walkway. The initial design, with a series of verticals, appears not to have been adequate to transmit the shear forces between the top and bottom members of the walkway. This was recognised by Mr. Stone when he designed the strengthening for the central sections of the walkway.

Reference was made at the inquiry that the concrete could have been made using beach sand which would introduce chlorides into the concrete and increase the likelihood of the reinforcement rusting. Tests of the concrete showed that, in all but one sample, chlorides were below the accepted threshold levels required to depassivate the reinforcing. The one high result was from a sample of shotcrete repair material and may have been due to the presence of calcium chloride.

Mr. Stone when contacted about the cracking to the diagonals in 1923 blamed the problem on the poor quality of the cement supplied. Recent tests of samples of concrete from spalled pieces of concrete from the aqueduct gave compressive strengths of between 18.5 MPa and 27 MPa which would indicate that the concrete in these samples was adequate.

In a 1922 report on the cracking it was stated that cover to the reinforcement in the tension members was only 7/16 of an inch. Mr. Stone in a letter to Mr. J. Sharland the Engineer-in-Chief for the Geelong Waterworks and Sewerage Tract, dated the 30th of July 1923, blames the problem of lack of cover to the reinforcement on the fact that only unskilled labour was available to construct the aqueduct. In this case poor construction techniques may have contributed to the cracking.

Other than a reference in a record of an interview with Mr. Stone, dated the 10th of August 1922, where it is stated that "the locality was a bad one from this point of view on account of the salt air coming from the Connewarra Swamps", there is no evidence on how aggressive the environment is.

Another environmental factor may have been the venting of hydrogen sulphide gas from the sewer. Originally there were vents to the sewer every third tower and in the 1930's additional vents were added. Hydrogen sulphide can be converted into sulphuric acid by bacteria which can readily attack concrete. The cracks in the sewer pipe and the deterioration of the concrete to the support brackets for the pipes may well be due to this form of attack. Whether the hydrogen sulphide has contributed to the spalling of the concrete to the trusses is open to question.

After the initial repairs were made in 1923-24 there is no record of further repairs being made until the 1950's, although an inspection report dated 10/4/30 lists 122 members being cracked. If maintenance was not carried out over a thirty year period and cracks were not sealed this could well have contributed to the present day problems of the aqueduct.

The main reason given in the Taywood Maunsell report for the deterioration of the aqueduct is that the concrete has carbonated and is not longer providing an alkaline environment to protect the reinforcing steel from rusting. This finding was not disputed at the hearings.

The rate at which carbonation occurs is a function of time, porosity of the concrete and cement content. As the concrete is now 80 years old and was compacted by hand so that it would tend to be more porous than concrete that is mechanically vibrated, it is not surprising that carbonation to an average depth of 55mm has occurred.

The pipes which were made with a high cement content concrete which was compacted by using compressed air have, by and large, performed better than the truss members despite being subject to hydrogen sulphide from the sewage they transported.

4.0 STRUCTURAL ASSESSMENT OF THE AQUEDUCT

Maunsell's in their April 1991 report undertook a structural assessment of cantilever trusses, the walkway, the pipe supports and the walkway supports.

For the cantilever trusses, the assessment found that the first two vertical members closest to the tower, (1-1' & 2-2') were the critical members which only just satisfied current design standards in their "as-designed" condition. The report found that structural failures of members are likely within 10 years if no remedial work is undertaken. Urgent repairs to the bottom chord at Tower 14 were recommended and propping of the truss did take place.

The walkway was found to be adequate provided at least 21% of the original steel remains effective. The pipe supports were calculated to be adequate provided there is 45% of the steel remaining in the beam under the walkway. The top walkway support beams were calculated to be under capacity at nodes 1, 2 & 3 and bottom beam to be under capacity at node 1.

In assessing the strength of members of the trusses a concrete strength of 14 MPa was used. When the trusses were analysed fixity at the ends of members was assumed but the effective length of compression members was taken as if the members were pin-jointed and the effective lengths were the full length of the members. This is a very conservative approach as it assumes that moments can be induced in members but that no restraint is provided against buckling of these members.

The strength of a compression member is approximately proportional to the strength of the concrete used, therefore if the concrete strength of the aqueduct is higher than 14 MPa the strength of the critical members 1-1' and 2-2' will be correspondingly higher.

Two sets of data suggest that the concrete strength of 14 MPa adopted is very conservative. The first of these are the test results of cores taken from the Bow Truss Building just prior to its demolition. This was built by Stone & Siddeley in 1912 prior to their building the aqueduct. Six cores taken from the ends of the trusses had an average crushing strength of 28.5 MPa. The second set of data was from cores taken from two pieces of spalled concrete collected from under the aqueduct. Three cores were obtained and tested with the crushing strengths being 18.5, 27.0 and 26.0 MPa.

Based on the cores from the Bow Truss building and the cores from the aqueduct a concrete strength of between 20-25 MPa would appear to be more appropriate to use in evaluating the strength of compressive members in the trusses.

AS3600 the Concrete Structure Code gives effective lengths for columns with simple end restraints as well as formulae from calculating the effective lengths for other cases. If the ends of the column are prevented from rotating and from moving sideways then the effective length is 0.70 times the actual length of the column. Members 1-1' and 2-2' are connected to the top chord of the truss at the top and to the walkway support beam at the base. The top chord is prevented from moving sideways by a beam connecting it to the adjacent truss, the walkway beam is likewise held in position. The vertical reinforcement for members 1-1' and 2-2' project into the middle of the top chord of the trusses and there are haunches with additional reinforcement connecting the top chord and these members. At the walkway beam there are also haunches with additional reinforcement. Based on these facts the use of an effective length of 0.7 times the actual length would be a reasonable assumption.

The buckling strength of a long column is inversely proportional to the square of the effective length of the column and approximately proportional to the concrete strength. If the effective length is reduced to 0.7 times the actual length of the column and the concrete strength increased from 14 MPa to 20 MPa then the buckling load for the column increases 2.9 times and hence the factor of safety against failure also increases. Applying these factors to 1-1' and 2-2' means that these members are no longer critical members and a significant loss of reinforcement can occur before they will reach their ultimate capacity.

Mr. van der Molen submitted calculations for the member 1-1' using a concrete strength of 20 MPa and calculating the effective length in accordance with the formulae and charts given in AS3600. With this approach he obtained a factor of safety greater than 3 with only 60% of the reinforcement being effective.

In their comments on Mr. van der Molen's approach Maunsell's maintained that the full length of the column should be taken, this is a very conservative approach.

Concern was raised about the condition of the joints in the trusses and whether, because of corrosion, the reinforcement would not be able to transmit the stresses between the various members at the joints. An examination of the original drawings showed that the reinforcement for the diagonal tension bars was taken right through the top and bottom chord reinforcement and hooked over this reinforcement to give a mechanical anchor. The reinforcement for the vertical compression bars was shown to go into the centre of the top and bottom chords and had 90 degree bend at the ends. In addition there are the additional bars in the haunches which are linked to both the chord members and the internal members of the truss. Unless the diagonal tension bars had corroded at the joints the reinforcement should be capable of transmitting the necessary forces. An examination of a few joints would quickly establish the condition of the reinforcement and whether the joints were constructed as detailed.

The Maunsell investigations looked at what members would be overstressed if the reinforcement area in the members was reduced because of corrosion. What has not been established in any of the evidence was whether collapse of the structure would occur if one member of one of the trusses failed. If a vertical compression member failed then extra load would occur in other members and bending would occur in the bottom chord. Some load distribution would also take place because of the walkway acting as a beam.

Whether collapse of the aqueduct would occur in this instance would depend on the capacity of adjoining truss members to take the additional bending moments. Similarly failure of a diagonal tension member would not necessarily cause a collapse of the aqueduct.

If a section of the top or bottom chord failed then significant deformation of the aqueduct could be expected. Whether collapse occurred would depend on whether alternate load paths would occur. There is the possibility that the walkway could help prevent a collapse if there was failure of the top or bottom chords of the truss. This would depend to a large degree on whether there is a positive tie between the support beams and the walkway. The drawings that are available, unfortunately, do not show any details of the junction of the support beams and the walkway.

There was agreement that any model to assess the collapse mechanism for the aqueduct would have to be a three-dimensional model. The analysis would be complex and costly. The collapse mode would depend on the assumptions made about the condition of the members of the aqueduct.

Load testing was also considered as a means of assessing the adequacy of the aqueduct. While load testing would provide information about that section of the aqueduct that was tested there would still be doubt about other spans because the extent of corrosion and cracking concrete is variable along the length of the aqueduct. Filling the pipe with water to load test the aqueduct would only increase the total load by approximately 15% which would give an assured factor of safety of 1.15 for dead load only.

Rather than spend money on complex calculations which would be based on doubtful assumptions or on load testing the structure, it would be better to spend the money on repairs to the aqueduct or providing temporary propping to the aqueduct if there is concern that collapse might occur.

5.0 REPAIRS TO THE AQUEDUCT

Repairs to the aqueduct were first made in 1923 because of cracking to the diagonal tension members and cracking to the girders of the walkway. These repairs made in 1923 appear to have been fairly successful as only two tension members were rated 4 in the 1991 Maunsell report and only 27 out of the total of 336 diagonal tension members were rated 3.

The repairs to the girders of the walkway were to infill between the top and bottom of the balustrades with concrete and diagonal reinforcing rods anchored in the top and bottom members. When the bridge was viewed in March this year these repairs still seemed satisfactory.

There are no records of any further repairs being done until the 1950's when repairs to members were made with the concrete being applied by the gunite process. By and large these repairs seem to have been fairly successful.

According to Mr. McCoy, in the 1980's the repairs consisted of some patch repairs to balustrades and some re-casting of members. In some cases where members were re-cast the reinforcement was also replaced. Between \$50,000 and \$70,000 was spent per year from 1984 onwards. The propping at Tower 14 cost \$60,000.

When vertical struts were replaced steel propping jacks were installed adjacent to the struts while repairs were carried out but not when other members were replaced. When members were re-cast compression reinforcement was dowelled into the existing concrete, steel shutters were erected and then concrete was pumped into the formwork. The concrete had a high water content and a high cement content to enable it to be pumped into the forms. The repairs were supervised by a technical inspector who reported to a senior engineer.

Because the tops of the towers were regarded as non-structural they were not repaired. When work had to be done in the vicinity of a tower any loose concrete was removed to prevent it falling on workmen. Only one or two chord members were repaired during the 1980's. The walkway was formally closed in the 1970's and the aqueduct was fenced off after Maunsell's reports in the early 1990's.

It is not known if any concrete repair specialists were consulted about how repairs should be carried out. Some of the repairs may have caused increased damage adjacent to the ends of the repairs because of the difference in porosity of the new and the old concrete.

6.0 FUTURE REPAIRS

If the aqueduct is to be kept it is necessary to repair the damaged members.

The consensus of the engineering sub-committee was that the most appropriate method of repair was patch repair. Patch repair is where the cracked concrete is removed, all of the rusting reinforcement exposed, then cleaned of all rust or replaced as necessary, the reinforcement treated to prevent further rusting and then the concrete patched. Major repairs to members will require alternate load paths to be provided while members are repaired or replaced. Usually an anti-carbonation coating is also applied to slow the rate of carbonation of the concrete.

Other possible methods of repair include cathodic protection of the reinforcement. A trial of this method was made by Remedial Engineering which showed that this method could be applicable although repairs of all cracked concrete would still need to be done. Some doubts were expressed about the effectiveness of this method.

Another possibility raised was the re-alkalisation of the concrete. If the pH of the concrete surrounding the reinforcement is greater than 12.5 then corrosion of the reinforcement will not occur. This method has been used successfully on other structures but would need to be tested on a section of the aqueduct before its use could be recommended.

Rather than removing all of the carbonated concrete another approach would be to coat the surface of the members, after repairs to the cracked concrete has been made, with a coating that would prevent moisture penetrating to the reinforcement. The coating would need to be permeable to water vapour to allow moisture to escape from the members otherwise the coating would be liable to lift because of water vapour pressure under the coating.

This approach has been used on the repair of the Colorado Street Bridge in Pasadena, California. This bridge was built in 1912-13 and was subject to spalling concrete and rusting reinforcement. The existing concrete is carbonated to a depth below the reinforcing steel and no longer protects the steel from corrosion. Rather than replacing all of the carbonated concrete the restoration relies on the ability of a water repellent coating to prevent water reaching the reinforcing steel. It is understood from a conversation with Mr. Sven E. Thomasen, one of authors of a paper on the restoration work to the bridge, that after repairs were made a siloxane coating was applied. This has been in place for four years and no problems have been experienced to date.

Concern was expressed that when the bridge was propped to repair or replace members that this action could introduce additional stresses into the bridge. The system of using temporary jacks to take the load, when members have been replaced, appears to have been satisfactory. No evidence was presented that damage occurred to the aqueduct when this method of repair was used.

Concern was also expressed that the bridge was unsafe to work on and that the contractor doing repairs at Tower 14 had refused to do further repairs because of concern about safety. Mr. McCoy's recollection of this was that the contractor thought the concrete was in such a poor condition in this location that extra supports and scaffolding were needed before repairs could be done.

Remedial Engineering who are concrete repair specialists and who know the aqueduct, having done some cathodic protection tests on the bridge, were asked for their comments on whether repairs could be safely carried out. Their reply was, that provided the contractor had the necessary skills and the work was carried out under the direction of a suitably qualified structural engineer then, it would be safe to carry out remedial works on the structure.

A letter from the Concrete Institute of Australia made the point that "the repairs necessary for the long term conservation could be used, with the earlier recorded repairs, as a long term research study on the performance of various repair materials and techniques. In this manner, the on-going maintenance of this valuable structure can also serve the wider community by providing valuable knowledge about the success of various repair procedures".

Because the aqueduct is situated where any danger to public is minimal, provided it is adequately fenced, the structure is ideally situated to be a test bed for various repair methods. Remedial Engineering have already done some tests on cathodic protection without charging for this work and there is the possibility that other firms may be prepared to donate materials to allow their repair products to be tested.

Further testing could show that repair methods, other than the full patch repair method, could be successfully used these methods may provide cheaper repair solutions for the aqueduct as the extent of concrete patch repairs may be minimised.

In addition the structure could be used to train people in concrete repair methods. Provided adequate supervision is provided much of the repair work could be carried out by semi-skilled labour and would provide a suitable training facility for any job training scheme.

The repair of concrete structures is a growth industry as all concrete is subject to carbonation with time and most concrete structures will require repairs if they are to have a reasonably long life.

7.0 IMMEDIATE ACTION REQUIRED TO ENSURE PUBLIC SAFETY

Because the aqueduct is in an open area, well away from the public it is not of danger to the public provided they are excluded from the immediate area. At present the aqueduct has been fenced off with a cyclone wire fence and the river has been closed under the bridge.

The immediate danger to the public is from spalling concrete falling on someone trespassing on or under the bridge. To prevent this a more secure method of fencing should be provided.

As well as fencing off the aqueduct it is recommended that a series of levelling points be established along the bridge and that levels be taken every three months to see if any deformation is taking place. This information could be used to determine whether temporary propping was required at any location until the future of the aqueduct is decided.

Concern was expressed by Barwon Water that once one span started to fail it could have a domino effect causing other spans to fail. Whether this is likely would depend partly on how well the walkway is connected to the trusses. If the walkway is not anchored to the support beams it may well not be capable of transferring load to the trusses. If the structure did start to deflect a series of temporary props would remove the danger of a domino effect causing collapse.

To allow the river to be re-opened there are a number of options. Barwon Water have proposed that the river spans of the aqueduct be removed. If this was done it would be necessary to prop the other ends of the cantilever trusses or provide counter weights on the river ends of the trusses to allow for the effect of removing the walkway and pipe. Unless the ends of the trusses projecting out into the river were demolished, barriers would have to be erected in the river to exclude traffic from passing under the ends of the trusses.

Removing the pipe and walkway may increase the cost of restoration as well as changing the historic nature of this part of the aqueduct.

Another solution to allow at least one of the branches of the river to be opened would be:-

- a. Provide temporary hangers to the pipe at all locations over the river where the pipe brackets are suspect.

(There are already temporary supports for pipe over at least the southern river crossing).

- b. Remove all loose concrete from the underside of the walkway, the pipe support brackets etc.
- c. Place props under but not in contact with the ends of the trusses. If the aqueduct started to deform the load from the walkway section that supports the pipe over the river would be supported.
- d. Place a net under the river section of the aqueduct to catch any loose concrete that might fall off the structure. It should be noted that at Parliament House, where stonework decay was occurring to the parapets, this solution was adopted and the land adjacent to the building continued to be used for vehicle and foot traffic as well as carparking.

A third alternative would be to immediately repair the aqueduct where it crosses the river. Based on Maunsell's 1991 figures it would cost \$922,500 to repair the two sections of aqueduct that span over the northern branch of the river and \$1,841,000 to repair the four sections of the aqueduct that span over both branches of the river.

8.0 ACCESS TO THE AQUEDUCT

A walking and bicycle path has been provided along the northern side of the river. The view has been expressed that if the river crossing sections of the aqueduct were restored this could be used to provide both a river crossing and a viewing point of the river. To do this access would be needed to this section of the aqueduct.

The best place to provide access to the aqueduct is at the towers. Any stair or ramp could be fitted between the inclined end members of the trusses. There is a gap of approximately 1.8 metres between these members which would allow access after the balustrade to the walkway was demolished.

A means of excluding the public from the rest of the walkway would need to be installed. This would best be done on the section of the walkway spanning between the ends of the trusses, as at this location it should be possible to erect a barrier that would prevent people climbing over or around it.

9.0 REMOVAL OF WALKWAY AND PIPE

If the aqueduct is to be left for a considerable length of time without repairs being made to it and if the trusses started to deform then removal of the load of the walkway and the pipe would lessen the load on the trusses and possibly extend the time before collapse occurred.

If the walkway and pipe were removed the cross beams supporting these would have to remain in place as these provide lateral stability to the trusses.

An alternative to removing the walkway and pipe would be to provide temporary propping to prevent the collapse of structure.

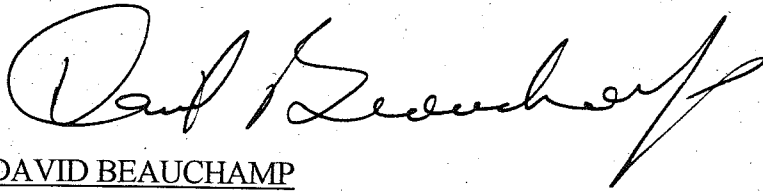
10. SUMMARY

If the Barwon Sewer Aqueduct is to be retained because of its historical significance extensive repairs will need to be made. When repaired the structure of the aqueduct should, if possible conform to the requirements of the relevant codes including the seismic provisions of the loading code. If this is not possible then a dispensation will need to be sought on the grounds that the aqueduct is on historic structure.

The aqueduct represents a valuable resource both for information about the viability of previous repair techniques and for testing new repair methods. In addition it could be used to train people in the methods of concrete repair.

Provided the public is excluded from the immediate vicinity of the aqueduct it represents no danger to the public. It is possible to re-open the river without demolishing the spans over the river.

Repair of at least the river sections would create access across the river and provide a viewing platform of the Barwon River and flood plains.

A handwritten signature in cursive script, appearing to read "David Beauchamp". The signature is fluid and somewhat stylized, with a long, sweeping tail on the final letter.

DAVID BEAUCHAMP

APPENDIX A

- 1. Technisearch Limited - Concrete Core Report**
- 2. Remedial Engineering Group - Letter**
- 3. Photographs of the Pont d'Ivry sur Seine**

CLIENT: Beauchamp Consulting Engineers Pty Ltd.
PROJECT: Barwon Sewer Aqueduct.
JOB NO: 956-628082.
REPORT NO: 628082.
DATE: 1/5/96.

CONCRETE CORE REPORT

Type of Test:		Compression to AS 1012.14-1991 Secured by: Technisearch from concrete blocks supplied by client.									
Identification of Core:		1			2			3			
Location in Structure:		Block 1			Block 2			Block 2			
Date of Test:		1/5/96			1/5/96			1/5/96			
Age at Date of Test (if known):		Unknown			Unknown			Unknown			
Inspection Before Test	Voids	UP TO 12mm			UP TO 8mm			UP TO 4mm			
	Honeycombing	-			-			-			
	Scoring	-			-			-			
Reinforcement:		(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)	
As Received:	Size	mm	-	-	-	-	-	-	-	-	
After Trimming:	Depth	mm	-	-	-	-	-	-	-	-	
Diameter of Core:	Depth	mm	-	-	-	-	-	-	-	-	
Length of Core	As Received	mm	75.4			75.4			75.4		
	Before Cap	mm	260			170			145		
	Length/Dia. ratio	ratio	1.96			1.98			1.60		
Measured Strength:		MPa	18.5			27.0			27.0		
Converted Strength:		MPa	18.5			27.0			26.0		
Density:		kg/m ³	2120			2180			2200		
Moisture Condition when Tested:			Dry			Dry			Dry		
Conditioning Time:			7 days			7 days			7 days		
Type of Fracture: (if unusual)			-			-			-		
Defects:	In Cap		-			-			-		
	In Core		-			-			-		
Remarks											



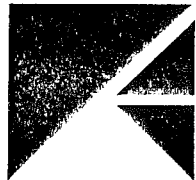
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APPROVED SIGNATORY

AK Gouley

DATE 17/5/96

CC:WW:BEA082DT



REMEDIAL
ENGINEERING
GROUP

96-512.1/MD/da

23 April 1996

Mr David Beauchamp
Beauchamp Consulting Engineers
Unit 1, 430 Rae Street
NORTH FITZROY VIC 3068

Dear David

BARWON SEWER AQUEDUCT

Remedial Engineering Pty Ltd has a sound knowledge of the current condition of the Barwon Sewer Aqueduct and despite the degree of deterioration visible on some elements we are confident that a contractor with the necessary skills and under the direction of a suitably qualified structural engineer could safely carry out remedial works on the structure.

We would have no hesitation on taking on a repair commission on this structure and our standard insurance policies would be sufficient for such a task, being a Public Liability cover of \$20 million, and this could be extended for this particular project if required.

We trust that this information is of use to you and hope that we can be of service in the future.

Yours sincerely

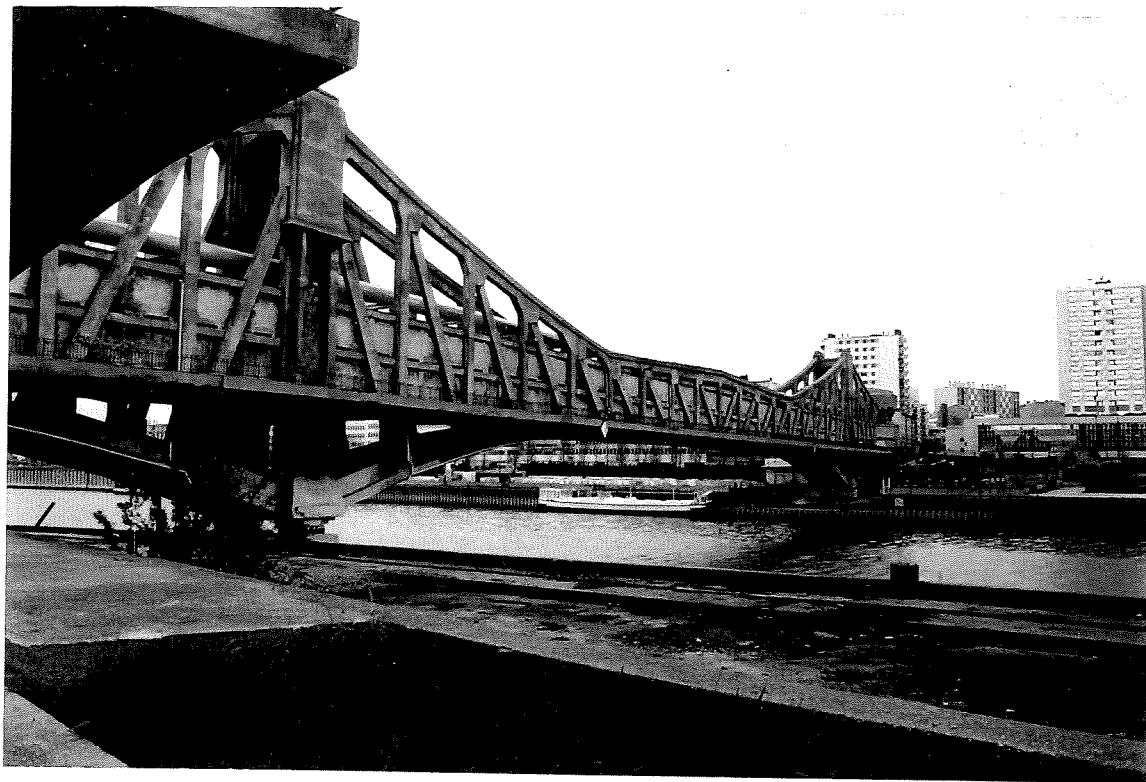
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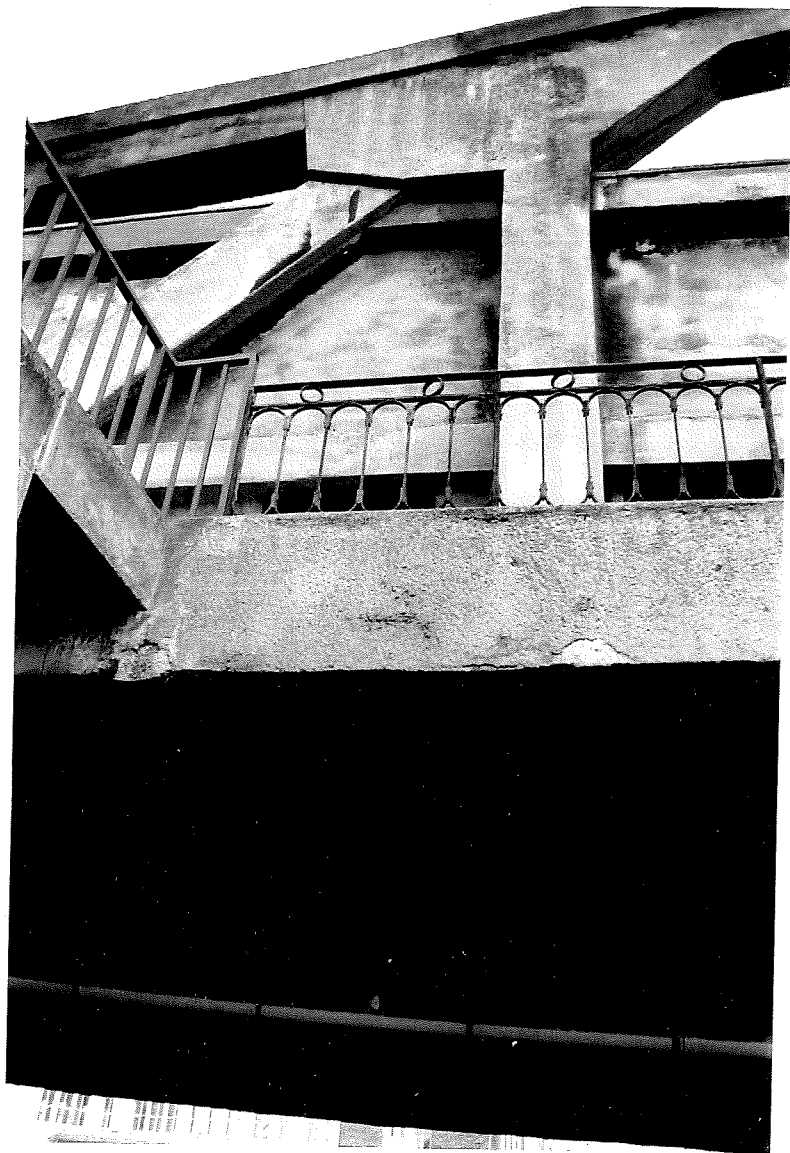
p.p. Miles Dam

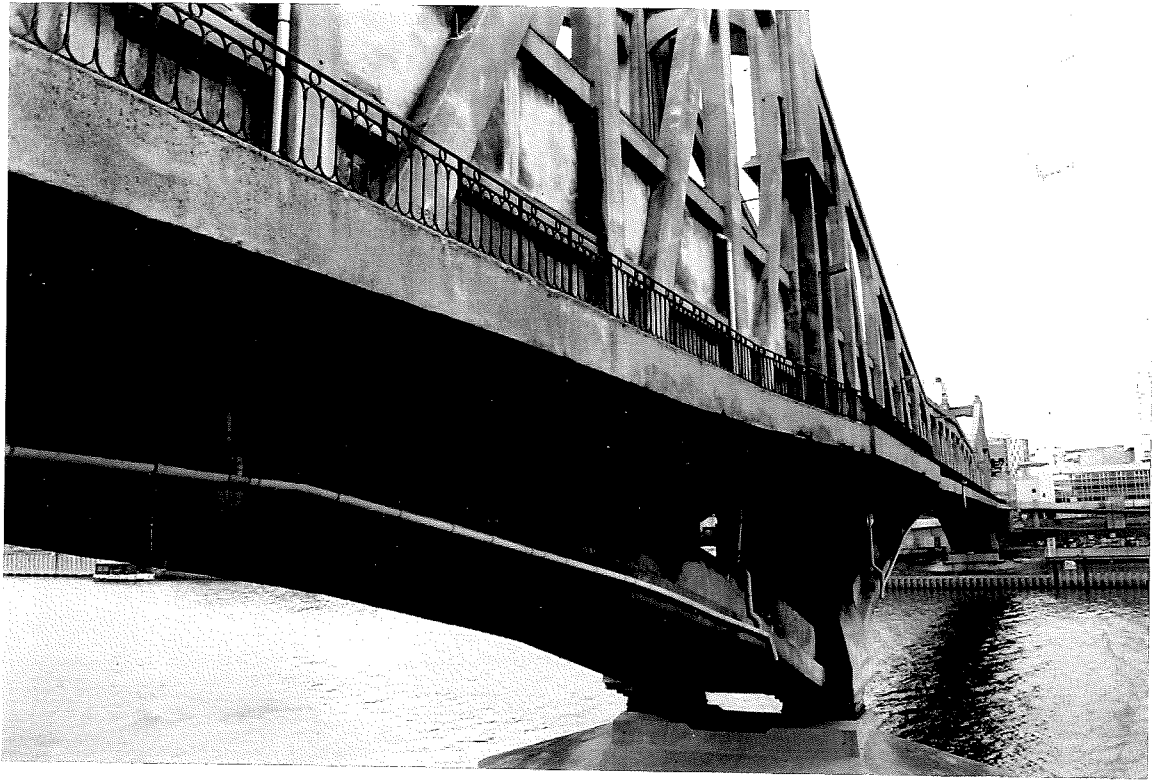
Ian Godson
Managing Director



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**Barwon
Water**

BARWON REGION
WATER AUTHORITY
61-67 Ryrie Street,
(P.O. Box 659)
Geelong, Victoria, 3220
DX 22061 (Geelong)
GEELONG:
Phone: (052) 26 2500
Fax: (052) 21 8236
SOUTH GEELONG:
Phone: (052) 26 9200
Fax: (052) 26 9269

Our Ref: PN/LL 45/140/0001J
Your Ref: -
Enquiries To: Mr. J. Graham

May 17, 1996

Ms Jennifer Moles,
Panelist,
Barwon Aqueduct Inquiry,
Administrative Appeals Tribunal of Victoria,
4th floor, 55 King Street,
MELBOURNE, VIC 3000.

Dear Ms Moles,

Re: Comments on Draft Report by David Beauchamp

I am replying on the above on behalf of Professor Lawrie Baker and Mr Louis Walsh of Maunsell.

Professor Baker and Mr Walsh have both reviewed the Draft Report prepared by David Beauchamp and their comments on it are attached.

Also, on behalf of Mike McCoy, I would like to point out that the reference made to the "propping" of the aqueduct during repair to structural members is not a correct interpretation of the explanation that he gave at the time of the interview.

In cases where it was necessary to rebuild a badly deteriorated vertical compression member, steel propping jacks were installed adjacent to the member to act as a substitute member while repairs were carried out. Propping or support from ground level was not utilised and did not result in any load relief in that part of the structure.

I hope that these comments are of assistance to you in your deliberations.

Yours sincerely,

J.B. Graham,
Executive Manager,
Resource Development.

Attachments:

Comments on Draft Report by David Beauchamp - Professor Baker
Comments on Draft Report by David Beauchamp - Mr Louis Walsh, Maunsell

COMMENTS ON AMENDED DRAFT REPORT BY DAVID BEAUCHAMP

In general I find this a fair report although I have some concerns that there is a bias towards presenting the aqueduct in the best light and an underplaying of some of the safety concerns. Some detailed comments are:

- Page 2 end of first paragraph

However there must be some concern that there are 38 members where failure could be initiated.

- Page 2 paragraph 3

This depends upon the meaning given to "significant" and "relatively". The aqueduct certainly shows deformation in levels obvious to the naked eye, expansion joints closed. A slide that I showed had main reinforcement separated from the concrete and bowed.

- Page 2

The reference to the Pont d'Ivry bridge is of no relevance to the Aqueduct.

- Page 4 paragraph 2

Carbonation is beyond the depth of reinforcement.

- Page 4 paragraph 9

The Bow Truss data is not necessarily an indicator of the strength of concrete in the aqueduct.

In stating concrete strength the characteristic value is the relevant one for engineering design and this is the value that should be estimated from the core results from the aqueduct in accordance with methods given in the current concrete code.

- Page 5

I don't believe that the points made in Maunsell's communication, regarding effective length have been properly considered. I expect Maunsell will elaborate on this point. I will simply point out that we are dealing here with damaged members and the theoretical approach should be tempered on the conservative side in assessing strength. For example the effect of haunches cannot be relied upon when they are cracked.

- Page 6 paragraph 1

Surely the point is not that the failure of a diagonal tension would not necessarily cause a collapse of the aqueduct but that one could not rule out that possibility.

- Page 6 paragraph 2

Similarly the point is not that "there is a possibility that the walkway could help prevent a collapse" but rather that it is probable (if not certain) that the walkway would not prevent collapse if there was failure of the top or bottom chord.

- Page 7 section 6 paragraph 1

It should be stated here that patch repair to be effective requires stress relieving propping of the structure while repairs are carried out.

- Page 8 paragraph 1

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It is assumed here that collapse will be preceded by observable deflections, that procedures and materials for propping are established and that there will be time to implement these prior to collapse.

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Consulting Engineers, Planners, Environmental Scientists & Project Managers

FACSIMILE MESSAGE

SENDER: MAUNSELL PTY LTD: 9th Floor, 161 Collins Street, Melbourne, 3000, Australia. ACN: 004 846 824
Phone: 03 9653 1234 Fax: 03 9654 7117 International Fax: +61 3 9654 7117

To: Barwon Water Fax No: 052 221 815
Paul Northey

From: Louis Walsh Job No: 11896 File Ref: 11896

Date: 17/5/96 No. Pages (including this one): 2

Subject: Ovoid Sewer Aqueduct

Paul

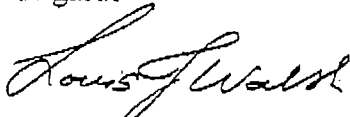
Further to our telephone conversation yesterday, the following are comments on the report on the Ovoid Sewer Aqueduct prepared by Mr David Beauchamp. This report was faxed to us on 10 May 1996 with corrections faxed on 14 May 1996.

- Mr Beauchamp has commented that Maunsell's assumption of 14 MPa concrete strength for the aqueduct is conservative and has suggested that a strength of 20-25 MPa would be more appropriate. Maunsell's various studies of the aqueduct, have adopted a conservative approach consistent with the safety and public liability issues involved. Given the lack of data on actual concrete strengths, Maunsell assumed a concrete which was typical of the nominal mixes used at the time the aqueduct was constructed. If it could be proved that concrete in the aqueduct had a strength consistently greater than 14 MPa, the factor of safety could be increased.
- We concur with Mr Beauchamp that whether or not collapse of the aqueduct would occur when a vertical compression member failed would depend on the capacity of adjoining members to take the additional bending moments. Here it should be noted that the chords are already loaded close to their capacity and that, where the spiral binding reinforcement is severely corroded, their torsional capacity must also be questioned. It should also be noted that the segments of the bottom (compression) chord are not colinear and this casts further doubt on their ability to carry additional loads.
- Restraint to the verticals of the truss is provided by the flexural and torsional resistance of the chords and axial capacity of the transverse members. Maunsell's choice of an effective length factor of 1.0 for the vertical struts was again a conservative assumption based on doubts over the capacity of the members framing into the verticals and the quality of the connections themselves.

- Mr Beauchamp is not quite correct in his statement that in their comments on Mr Van der Molen's calculations, Maunsell maintained that the full length of the column should be taken. Maunsell's comment was that the effective lengths (0.53 Lu and 0.56 Lu) calculated by Mr Van der Molen are only marginally greater than 0.50 Lu which is the theoretical effective length of a perfect, fully built-in strut. Maunsell pointed out that, even in this most favourable of circumstances, AS3600 recommends an effective length of 0.70 Lu and that they could see no grounds for assuming a value less than 0.70 Lu.

- Mr Beauchamp points out that, once restored, the aqueduct will have to conform to the requirements of the concrete code and the loading code including seismic provisions. Maunsell has reservations about the ability of the restored structure to ever satisfy current seismic provisions without significant strengthening measures.

Regards



Louis Walsh

FACSIMILE MESSAGE

CORCORAN SHEPHERD CONSULTANTS

DATE: 16 May 1996 Sent from Fax Number: (+91 11) 623 1766
 TIME: 9:45 AM
 TO: Beauchamp Consulting Engineers Attention: David Beauchamp
 FAX NO: + (613) 9482 2779
 FROM: PETER SELBY SMITH
 REF: PSS:pss
 SUBJECT BARWON SEWER AQUEDUCT
 NO. OF PAGES: 1 (INCLUDING THIS PAGE)

Copied to: Jennifer Moles, Fax +613 9628 9789

Dear David,

Thank you for your fax of 10 May, and your invitation to comment on it. I have not had a lot of time to review your report, but I think that the most important issues are the ones I raised in my own submission to the Inquiry.

The first major point is that structural considerations using standard codes and analytical methods can be used only if the members conform with the assumptions implicit in the codes and analysis which is used. In this case there are questions to be asked about:

- The bond of the reinforcement into the concrete matrix, which incorporates the issues of bond, lap length, anchorage length etc. In this case the reinforcement is rusted and the concrete is detached from the reinforcing in many areas (even many areas where the members appear at first glance to be sound, but in fact there is major delamination of the concrete around the reinforcement cage). There is therefore no guarantee that normal assumptions are acceptable, or that normal design codes and analytical methods will be reliable.
- The area of concrete which is contributing to the strength of a given member.
- The area of reinforcement which is contributing to the strength of a given member.

The second major point is that the structure cannot be opened to the public unless the danger of spalling concrete falling on the public is eliminated. This applies to all components of the structure, and in this structure there are a vast number of individual members.

There is little point in assessing the structural adequacy of the aqueduct without developing a proposal for treating the concrete (and steel) material of the aqueduct so that the danger of spalling concrete is eliminated, and the members' structural areas and behaviour are guaranteed. To do this is very difficult, bearing in mind that the large areas of delamination make both cathodic protection and realkalisation difficult to use. What is required is to patch repair the structure, including cleaning, and in some places replacing the steel, which is a very expensive option, and will require extensive propping.

Another issue which is of some concern is the foundations, which have most definitely deformed as can be seen by looking along the line of the handrails.

In short I feel that the difficulties of reinstating the material of the aqueduct are being overlooked, and I do not share the optimism of Remedial Engineering. I do not see this as a structural analysis problem, but one of repair to the point of extensive and very expensive reconstruction.

Kind Regards,



PSSC350

Ken G. McInnes
DipCE, MIEAust, MACS, CPEng
Heritage, Environment & Systems
53 Aurum Crescent
RINGWOOD VIC 3134

17th May 1996

Tel: +61 3 9870-2541
Fax: +61 3 9870-2541

TO: Ms. Jennifer Moles
Administrative Appeals Tribunal

FAX: 9628-9789

Pages: 2

RE: BARWON SEWER AQUEDUCT

In response to David Beauchamp's report, as amended, on the engineering aspects of the Barwon Sewer Aqueduct, I agree with his findings.

When the Dennys Lascelles Bow Truss building was initially constructed, the diagonal tension members were simply exposed reinforcing rods. The concrete cover was not added until later. It would be of interest to know whether similar procedures were used on the Barwon Sewer Aqueduct, as it was in these members where cracking and rusting of reinforcement was first noted by 1922. However, this knowledge is not critical to the outcome, and is largely academic.

Using the Barwon Sewer Aqueduct as a test site for remedial work is supported. However, as the structure is of high historical significance, any such work should not adversely effect a significant proportion of the original fabric of the structure. I believe that the priorities should firstly be to prolong the life of the whole structure, secondly to conserve as much as possible of the original fabric of the structure, thirdly to restore the original fabric of the structure, and if necessary reconstruct the fabric of the structure. Hence remedial works should not unduly jeopardise original fabric of the structure. Ideally, but not always practical or possible, any alterations should be reversible. All changes should be well documented.

Some minor typographical corrections that might clarify some points:

Page 5, second paragraph, third line

".. prevented for rotating .." should read ".. prevented from rotating .."

Same page, fourth paragraph, last line

".. 60% at .." should read ".. 60% of .."

Same page, sixth para, last sentence

Awkward sentence construction, perhaps should read
"An examination of a few joints would quickly establish whether this original joint detailing was constructed."

Page 6, fifth paragraph, second line

"... or an load testing ..." should read "... or on load testing ..."

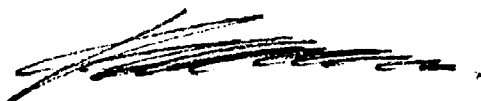
Page 7, last paragraph, fourth line

".. protects the steel for corrosion." should read ".. protects the steel from corrosion."

Page 10, fifth paragraph, last line

".. time fore collapse .." should read ".. time before collapse .."

Regards



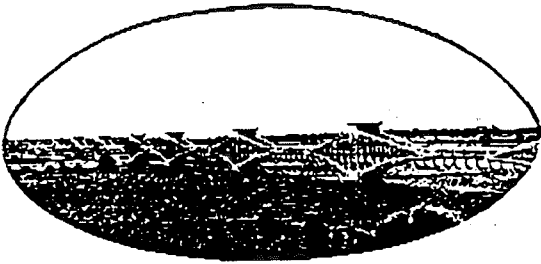
Ken McInnes

cc. David Beauchamp

Fax: 9482-2779

**Geelong Aqueduct Committee
Engineering Sub-Committee**

PFB Alsop, K MacLeod, JL van der Molen



May 21, 1996

Ms Jennifer Moles
c/- Administrative Appeals Tribunal

Fax No. 9628 9789

Dear Ms Moles

Geelong Aqueduct

Mr. David Beauchamp sent us a copy of his comprehensive report on the engineering aspects of the above historic structure. Our Sub-Committee finds nothing in the report with which it would disagree. It is pleased to note that its assessment of the concrete strength has been shown to be of the right order.

We should like to take this opportunity to express our appreciation of the thorough work Mr. Beauchamp performed in reporting on the many and varied historical and engineering aspects of the aqueduct.

Yours sincerely,

Dick van der Molen

J.L. van der Molen

APPENDIX 6

CORRESPONDENCE
CONCERNING BRIDGE
AT IVRY-SUR-SEINE



Administrative Appeals Tribunal
of Victoria

PRESIDENT
4th Floor, 55 King Street,
Melbourne, Vic. 3000

DX 21

7 Mai 1996

Fax: 19 61 3 96289713
Tel: 19 61 3 96289739

M. Daniel Harival
Department Ivry-sur-Seine

FAX 0011 33 1 4682 60 09

Monsieur

Nous faisons un enquête de la part du Ministre d'Environnement de la gouvernement de Victoria en Australie.

L'enquête est au sujet d'un pont à la ville - Geelong - vers le sud-ouest de Melbourne. Je vous envoie un plan pour vous montre cette ville.

Ce pont est construit entre 1912-1915. Le pont s'inscrit dans le registre national historique.

On m'a dit que vous répondiez aux quelques questions à propos du Pont d'Ivry qui traverse la Seine près de la confluence de la Seine et de la Marne entre Bde Col Fabien et Rue du Pont d'Ivry.

Le Pont d'Ivry est construit d'après le dessin de l'ingénieur Armand Considère. Le pont de Geelong est pareil.


La question posé pour cette enquête est "Comment formuler un programme pour la restauration et la conservation du pont à Geelong."

Veulliez-vous me donner des renseignements aux questions suivantes.

Est-ce que le Pont d'Ivry porte les vidanges - (les matières fécales, pourris etc)? On m'a dit qu'il porte de l'eau potable, de la circulation et des piétons? Est-ce que c'est correct?

- (2) Si vous avez un programme pour s'occuper du Pont d'Ivry, veuillez-vous m'en expliquer. C'est à grands frais par an pour le Department.
- (3) Est-ce qu'il y'a, des problèmes de la réparation du pont ces jours-ci?
- (4) Le tuyau indiqué sur la photographie ^csi-jointe, est-il mis en place après la construction du pont, et en quel an?

Veuillez agréer, Monsieur, l'expression de mes sentiments distingués



Mme Jenny Moles

Membre du Tribunal Administratif de Victoria



Administrative Appeals Tribunal
of Victoria

PRESIDENT
4th Floor, 55 King Street,
Melbourne, Vic. 3000

7 Mai 1996

DX 21

Fax: 19 61 3 96289713

Tel: 19 61 3 96289739

M Daniel Harival
Department Ivry-sur-Seine

FAX 4682 60 09

Monsieur

LE PONT D'IVRY

Je vous remercie de vos renseignements au sujet du Pont d'Ivry par le téléphone le 6 Mai 1996.

Puis-je vous présenter ma collaboratrice Mme Moles, qui est siégé à cette enquête environnementale et sociologique pour trouver les meilleurs moyens de conservation de ce pont à Geelong, si ce soit possible du tout.

Je vous en prie de répondre aux ses questions ci-jointes.

Quelle coïncidence de découvrir un autre pont d'après Considère dans les antipodes!

Je vous prie de recevoir l'assurance de mes meilleurs sentiments.

WARREN FAGAN

President du Tribunal Administratif de Victoria



Direction
Départementale
de l'Équipement

Val-de-Marne

Arrondissement
Urbain Ouest 1

Ntre REF. DH/AZ
Suivi : Subdivision Exploitation Entretien
Daniel HARIVEL

Vitry-sur-Seine, le 17 mai 1996

Monsieur le Juge W. CHRISTOPHER FAGAN

Administrative Appeals Tribunal of Victoria

4th Floor, 55 King Street

MELBOURNE, Vic. 3000

Monsieur le Juge,

Suite à votre FAX du 7 mai 1996 que j'ai bien reçu, je me suis aperçu que le Pont de GEELONG était identique à une passerelle située à IVRY-sur-SEINE, nommée "Passerelle des Câbles" et non le Pont d'Ivry où passe la circulation automobile et piétonne, comme je vous l'avais indiqué lors de notre entretien téléphonique du 6 mai.

J'ai essayé de vous joindre par téléphone le 9 mai, j'ai eu Madame MOLES, mais nous n'avons pas pu nous comprendre.

Après recherche, j'ai appris que cette passerelle construite vers 1928 et financée par l'Electricité de France était gérée par la Ville de Paris.

Elle supporte :

- câbles E.D.F. (Electricité de France)
- câbles R.A.T.P. (Régie Autonome des Transports Parisiens)
- conduite d'eau potable (Compagnie Générale des Eaux).

Depuis 1986 le Département du Val de Marne a réalisé deux accès pour permettre le passage des cycles.

Prochainement, je vous ferai parvenir un plan et une photographie, ainsi que des renseignements complémentaires.

Je vous prie d'agréer, Monsieur le Juge, l'assurance de mes sentiments distingués.

L'Adjoint,

D. HARIVEL

Our Ref: DH/AZ
Management: subdivision Works & Maintenance
Daniel Harivel

17 mai 1996

His Honour Judge W C Fagan
Administrative Appeals Tribunal of Victoria
4th Floor, 55 King Street
MELBOURNE, Vic 3000

Your Honour

Following your fax of the 7th May 1996 that I have happily received, I ascertained that the bridge at Geelong was identical to a footway link situated at IVRY-sur-Seine, named "Passerelle des Cables" and not the bridge d'Ivry over which passes automobile traffic and pedestrians, as I indicated to you during our telephone conversation of the 6th May.

I tried to call you by telephone on the 9th May, I got on to someone but we were not able to understand each other.

After research, I learned that this footway constructed about 1928 and financed by l'Electricite de France was managed by la Ville de Paris.

It carries

- cables E.D.F. (Electricity of France)
- cables R.A.T.P. (Autonomous Authority for Parisians Transport)
- a potable water pipe (General Water Company)

Since 1986 the Department of Val de Marne has established two accessways in order to allow the passage of bicycles.

I will send to you a map and a photograph as well as some additional information.

Yours truly

Your assistant

D Harivel