MANAGING SEWAGE DISCHARGES TO INLAND WATERS

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FOREWORD

A critic of waterway management in Victoria once exclaimed "Our rivers are all going downhill – what are you doing about it?"

Although inadvertently comical, the message was serious. In managing our rivers and streams to support our economic activities or engineering them for flood control we have, until recently, overlooked their environmental values.

This has led to a level of degradation that is now impacting on their economic value. Clearly our current practices are not sustainable. We need to take action to restore our rivers and streams to the extent practicable and then manage them to protect both their environmental and economic values.

Since water quality is determined not only by what happens in the river itself but also throughout its catchment, we need to manage the total catchment. Since this involves 'managing' a wide range of activities, many of which are not susceptible to formal regulation, success will only come through widespread community involvement.

While the new Catchment and Land Protection Boards will provide the focus for catchment management activities, the water industry has a special role to play in influencing the way in which water is used and waterways are protected.

As a result of the Government's reform of the water industry, more than 300 public utilities have been replaced with 20 water businesses which are responsible for harvesting, storing and distributing some five million megalitres of water; and collecting, treating and disposing of sewage, industrial wastewater and drainage. These businesses are required to prepare annual business plans, which include plans for managing their environmental responsibilities.

To help water authorities prepare sound business plans, guidelines have been produced by the Department of Conservation and Natural Resources. Guidance on expected environmental performance is also provided through the *National Water Quality Management Strategy* and the *State Nutrient Management Strategy*. Achievement of water quality objectives will be assisted by specific strategies produced by the nine Catchment and Land Protection Boards.

The water quality required to protect environmental values is set out in the State environment protection policy *Waters of Victoria* and discharges of treated wastewater are controlled by licences issued by EPA, which specify minimum acceptable standards.

This publications has been prepared to assist water businesses to plan for and achieve best practice in managing sewage throughout Victoria. Adoption of the principles contained in this paper will assist in long-term planning and in the restoration of sustainability to our waterways.

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CHAIRMAN

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INTRODUCTION

EPA's Inland Water Quality Monitoring Network shows that on a statewide basis, the levels of the nutrients nitrogen and phosphorus are increasing. The recent increases in blue-green algal blooms further highlight the fragility of our waterways and the urgent need for corrective action.

These problems are not confined to Victoria – the picture is much the same throughout Australia. Given the critical role water plays in our health, economy and recreational pursuits, a national strategy has been developed by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) to reverse the trend of diminishing water quality and increase the ecological and economic value of waterways.

The Victorian Government's environment policy *Cleaner, Safer, Better* calls for a collaborative approach to achieve ecologically sustainable development through cleaner production and pollution avoidance. In particular, the policy notes the need to remove sewage effluents from waterways and progressively upgrade urban sewage and stormwater systems.

Under the auspices of the Victorian Government's water industry reform program, *The Working Group Report on Effluent Standards and Compliance for Waterways* was released in July 1994.

Key recommendations of the report were that water authorities which needed to discharge to waterways would be required to:

- demonstrate that total effluent reuse was not practicable or environmentally beneficial and
- submit plans to EPA by December 1995 to ensure the minimisation of nutrient inputs to waterways.

This publication has been prepared to provide guidance to the water industry on:

- issues which need to be addressed when developing wastewater management plans and
- the views EPA has on these issues.

It should be read in conjunction with EPA's Information Bulletin *Sewage Discharges to Victorian Coastal Waters* and EPA’s publication *Preliminary Nutrient Guidelines for Victorian Inland Streams.*

ENVIRONMENTAL POLICY IN VICTORIA

The national strategy framework is similar to that which has already been created in Victoria by State environment protection policies (SEPPs) – the Government's principal tool for formulating environmental policy.

The central policy for managing water quality in Victoria is the SEPP *Waters of Victoria*, which was gazetted in 1988. This policy establishes:

- the ways Victorians want their waterways used
- the water quality objectives that need to be achieved to enable those uses to safely occur and
- the attainment measures that need to be put in place to ensure that these water quality objectives are achieved.

Waters of Victoria recognises that land use practices within a catchment area play a major role in determining the water quality of streams in the catchment. Consequently the policy contains measures to reduce pollution from a range of sources, such as:

- irrigation and stormwater run-off from agricultural land
- erosion controls at construction sites and cleared land
- urban stormwater run-off and
- discharges from intensive animal industries, factories and sewage treatment plants.

While controls on point sources have been progressively improved, those on diffuse sources have been more difficult to achieve. This is largely because of the diverse responsibilities for many of the diffuse sources of water pollution, and the need to gain greater understanding about best-management practices to minimise waste generation from land holders and a commitment to implementing them.

To address the problems experienced with diffuse source controls, the Government has prepared new catchment land protection legislation, based on the principles of total catchment management. This will facilitate a rapid statewide application of the isolated work that has been done by landcare programs and catchment management committees in a few catchments (for example, Latrobe, Yarra, Goulburn).

While recognising that major threats to water quality will vary between catchments, point source discharges to waterways are dominated by effluents from sewage treatment. These effluents tend to be the major source of bio available nutrients in streams under base flow conditions – that is, conditions which are common throughout much of the summer and autumn seasons, and which favour the production of algae, including blue-green algae.

POLICY PRINCIPLES

The national and state policies contain a number of principles which underpin EPA's approach to controlling waste discharges to waterways in Victoria.

1. Generators of diffuse sources of waste should incorporate good source controls and utilise best land use practices, to minimise impact on waterways.

2. Generators of point sources of waste should treat their wastes using economically viable state-of-the-art technologies, with full consideration of waste minimisation opportunities.

3. The requirement to use such technology should be maintained – even when this will result in higher water quality in the receiving stream than may be required by current objectives. This will enhance water quality, reserve capacity for future discharges, maximise present and future uses of the stream and allow for scientific uncertainty in setting water quality objectives.

4. New plants must comply with current technology-based standards from start-up, while existing plants should adopt a program to upgrade to the new standards. Such standards will progressively evolve as better technologies progressively become economically viable. Thus waste dischargers will continuously improve the effluent quality before discharging effluents to streams.

5. Good effluent quality is not necessarily dependant on high cost technology. Equivalent performance may be achievable utilising simple, innovative systems.

6. If stream quality objectives cannot be achieved through the application of technology-based standards, more stringent controls will be required, or in extreme circumstances, the discharge prohibited. In some situations, approval may be given if the discharger can provide off-setting benefits for the stream.

7. The principles of cleaner production waste minimisation must be applied to all waste generating activities. These include:

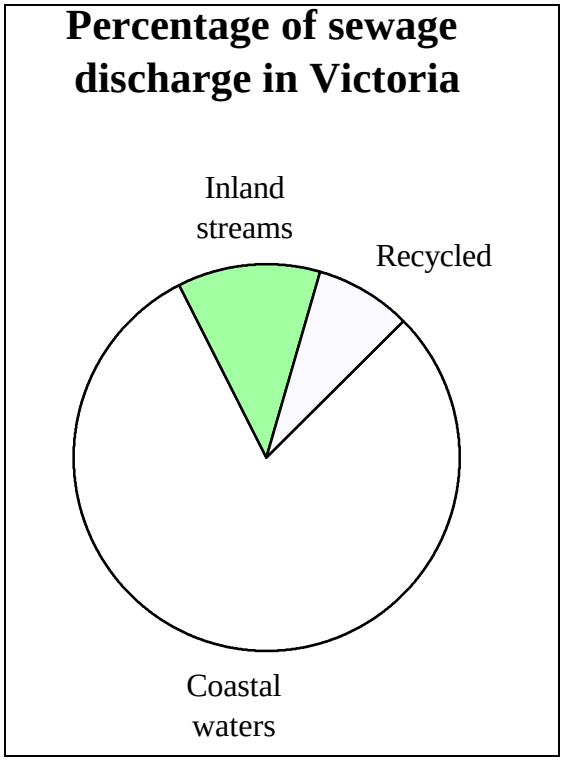
    - avoidance/reduction
    - recycling
    - re-use
    - treatment and
    - safe disposal.

    Accordingly, new and existing dischargers to our waterways need to demonstrate that waste generation has been minimised, and that recycling and reuse have been maximised before considering appropriate treatment and disposal to waterways.

8. Dischargers to waterways should not only monitor the quality of wastes entering a stream, but also the impact the pollutants are having on the receiving stream – ideally by contributions to a catchment-wide monitoring program.

9. Discharging effluents to streams to provide environmental flows could only be considered as beneficial to the waterway if water quality objectives can be maintained. Thus effluents in this category would need to be treated to background or water quality objective standards.

SEWAGE IN VICTORIA

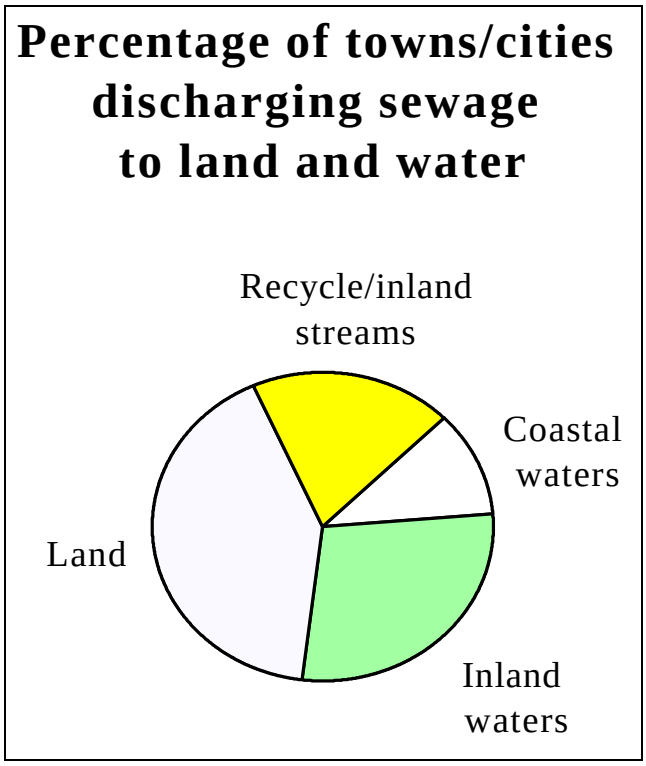


Victorians generate some 1300 ML of sewage daily. About 80% of this is discharged to coastal waters (Melbourne and Geelong account for more than 90% of the total), 12% is discharged to inland streams and 8% is recycled. New recycling schemes planned for implementation should see these last two figures reversed within five years.

Another way to present this data is that 19 towns/cities discharge their sewage to coastal waters, 48 to inland waters, 70 to land and 32 partially recycle to land and discharge the remainder to inland streams.

Sewage also dominates point source discharges of waste to our waterways. More than 70% of EPA wastewater licences are for sewage, while sewage accounts for 90% of licensed nutrient loads to waterways.

Many of our streams and lakes suffer from an excessive level of nutrients. Sewage discharges account for a small proportion of the total nutrients entering our waterways. However in dry weather or low-flow conditions, point sources (sewage) become a major determinate of water quality in streams, and can represent a significant proportion of the nutrient load ending up in terminal lakes and embayments. Nutrients from this source are also in a form which is readily utilised by biota, whereas much of the diffuse source inputs are bound onto sediment particles and hence less readily available.



Sewage is 99.9% water. The remaining 0.1% comprises contaminants which are potentially harmful to waterways and our use of them. These contaminants include:

- pathogenic micro-organisms (bacteria, viruses etc.) which may impact on the health of in-stream fauna, animals drinking the water and people (through direct contact or piped water supply systems)
- oxygen demand substances which may result in low oxygen levels in the water column, or organically rich sediments which deplete oxygen levels in interstitial waters and the water column
- nutrients (especially nitrogen and phosphorus) which may result in a proliferation of algal and weed growth, change of species type and diversity, and a reduction in dissolved oxygen levels. Some algal blooms may also be toxic
- salt at levels which are normally not significant, except for streams where sewage is a major proportion of the stream flow or there are multiple inputs to the same stream and
- toxic substances (including ammonia, surfactants, heavy metals and biocides) which can be harmful to both in-stream life and users of the water – both in the short term and long term. The greatest concern is persistent toxicants which bio-accumulate in the food chain.

In well treated sewage (traditional secondary standard), the level of toxicants present will be five to ten times above the nominal 'safe' level, and typically 10 to 100 times higher than background water quality, while the level of nutrients will be 50 to 200 times higher than background or acceptable levels. Due to the persistence of many of these toxicants, and the seasonal recycling of nutrients, dilution or seasonal discharge practices do not totally overcome the adverse impacts these materials may have on receiving waters.

ECOLOGICALLY SUSTAINABLE SEWAGE MANAGEMENT

1. PROVISION OF SEWERAGE SYSTEMS

There are several thousand allotments in Victoria discharging waste from failing septic tank systems to drains and streams, and more than 600 small package treatment plants servicing minor establishments (for example, hotels, shops caravan parks etc) due to lack of reticulated sewerage.

Sewerage needs to be provided to existing developments which are incapable of retaining their wastes on-site. New developments must not proceed without the provision of sewerage if on-site containment of wastewater is not viable.

This is a mandatory requirement for all water authorities and local governments in Victoria under the SEPP *Water of Victoria* (clause 40). Local authorities need to be pro-active to ensure these requirements are implemented.

2. EFFECTIVE RETICULATION SYSTEMS

Sewage systems need to be designed and operated to ensure overflows are kept to a minimum – nominally to a less than one in five year rainfall event. Options for storing or treating overflows must be evaluated and overflow structures sited in the least environmentally-sensitive areas. Significant overflow points should be telemetered to give immediate notification of overflow events, their duration and volumes spilt to the environment.

The system needs to be regularly checked for leaks, fractures, blockages, ageing and stormwater/groundwater intrusions. Contingency plans must be prepared to ensure an effective response to emergencies.

All water authorities should have an asset management plan which ensures that the system is properly maintained, replacement and upgradings are costed into budgets, and the system's design capacity is not exceeded through population growth in the sewerage district.

3. TRADE AND DOMESTIC INPUTS

Industrial discharges need to be controlled by appropriate trade-waste agreements which ensure industry is implementing waste minimisation practices at source and that resultant unavoidable wastes are appropriately pre-treated to ensure:

- the health and safety of water authority maintenance and operational staff
- the protection of sewers and treatment plants
- reuse of sewage effluent and sludge is not compromised
- EPA licence limits for safe discharge to waterways are not exceeded
- hazardous substances are reduced to the maximum extent practical.

Water authorities must educate the users of the sewerage system on responsible care for that system, including:

- water conservation (for example, dual flush toilets, low usage shower roses)
- waste reduction (compost food scraps rather than utilise insinkerators) and
- banned materials (for example, waste chemicals, oil, plastics etc.).

4. CONNECTION TO SEWER

All domestic premises are required to connect to sewer if sewerage is available.

Industrial process waste waters which cannot be recycled or reused, must be discharged to sewer after appropriate pre-treatment. Wastes too hazardous for disposal to sewer must be taken to licensed waste treatment plants. No process wastewater should be discharged to waterways where reticulated sewerage is available. Industrial premises are required to institute good housekeeping measures to minimise contamination of stormwater run-off from the premises. Open areas

which are subject to unavoidable contamination or a high risk area for spills should be bunded and roofed or treated as process wastewater areas.

Due to the large volumes involved, once-through cooling water may be returned to waterways, subject to EPA approval.

5. SEWAGE TREATMENT AND DISPOSAL

Effective sewage treatment should aim to protect public health, minimise environmental impacts, maximise reuse opportunities and use modern, economically viable technology.

The minimum level of treatment required in Victoria is secondary level treatment to achieve the traditional standard of:

- 20 mg/L BOD (biochemical oxygen demand)
- 30 mg/L SS (suspended solids)
- 1000 org/100 mL *E.coli* (bacteria).

To ensure this standard is achieved, the design and operation of treatment plants should aim to achieve a significantly better standard of performance.

Such effluents are generally non-acutely toxic to aquatic life and suitable for discharge to open coastal waters and for many reuse schemes.

All water authorities are required to maximise the reuse of effluent. The *Waters of Victoria* policy requires that:

> *Wastes should be discharged to land in preference to water wherever practicable and environmentally beneficial. In particular, approval for the discharge or waste to a watercourse shall not normally be given in situations where less than 5:1 dilution is available. A proponent seeking to discharge to a watercourse providing less than 5:1 dilution will be required to demonstrate to the Authority's satisfaction either:*
>
> *i) that land disposal is not practicable and that the discharge would not adversely effect identified beneficial uses of the watercourse; or*
>
> *ii) that the discharge after appropriate treatment, is considered necessary to maintain flow pattens for the protection of aquatic ecosystems in regulated perennial streams.*
>
> *Facilities for the disposal of wastewaters by irrigation should be designed in accordance with the Environment Protection Authority's publication* Guidelines for the Disposal of Wastewater on Land by Irrigation*. In particular:*
>
> *i) facilities for wastewater storage and disposal by land irrigation should be designed and constructed to contain all waste in at least 90th percentile wet year*
>
> *ii) the period and volume of discharge to waters in very wet years should be minimised by optimum management of available wastewater storage and irrigation facilities and*
>
> *iii) persons or bodies employing land irrigation as a means of disposal of wastewater shall seek the advice of the Environment Protection Authority, the Land Protection Division of the Department of Conservation, Forests and Lands, the Rural Water Commission and the Department of Agriculture and Rural Affairs (as appropriate) on the location and establishment of irrigation sites, crop selection and irrigation management, in order to avoid problems of land degradation, including salting*
>
> *iv) persons or bodies employing land irrigation shall ensure that they have made adequate land area provisions for both present and future waste water disposal.*

Like any other agricultural activity, the reuse of effluent must be carefully managed to ensure its long term viability. It must be conducted in a way to avoid:

- excessive accumulation of toxicants and salt in the soil
- contamination of groundwater or crops
- degradation of soils and

- raising of groundwater tables.

However with appropriate site selection and management, reuse of effluent is viable throughout much of Victoria. There are certain areas of the state – such as the alpine area and major cities – where climatic conditions or land availability may limit reuse options. Special care must also be exercised in the irrigation areas of central northern Victoria where rising saline groundwater tables are threatening crops, native vegetation and streams.

If water authorities choose to rely on disposal to streams in the long term – due to the non-practicability of land disposal or the desirability of providing environmental flows to the receiving stream – then such effluents will need to be initially treated to a tertiary standard (that is, employ nutrient reduction techniques). they will also need to be progressively upgraded as improved technology becomes economically available, to produce an effluent quality commensurate with the upstream water quality – that is, an effluent which has no adverse impact on the receiving stream.

Sewage effluents may also be recycled, if they are subjected to advanced treatment, by being returned to water supply reservoirs. This is practised in a number of countries where water supplies are scarce, and in such circumstances is a practical and economic option which has public support..

Sewage effluent may also be recycled by supplying it to residential subdivisions as an alternative to the potable supply for garden watering and toilet flushing. Two such schemes are currently in place in New South Wales and several proposals are currently being evaluated in Victoria. Sewage for this type of reuse should undergo tertiary treatment to provide the high level of disinfection required to ensure the protection of public health and to minimise the impact of run-off water returning to waterways.

Certain areas should be avoided for the disposal of effluent to waterways. These include scientific or educationally important areas such as National Parks, potable water supply off takes and significant recreational (especially swimming) areas.

New treatment plants proposing to discharge to inland waters should, having verified that reuse is not practical, incorporate tertiary treatment. Existing plants planning on continuing to discharge to waterways should upgrade to tertiary treatment within five years. Such treatment plants should achieve the minimum standards for effluent quality detailed in the following table.

Indicator	**Unit**	**Median**	**90 percentile**
BOD	mg/L	5.0	10.0
SS	mg/L	10.0	15.0
Ammonia – N	mg/L	2.0	5.0
Total N	mg/L	10.0	15.0
Total P	mg/L	0.5	1.0
E.coli	orgs/100 mL	200.0	1000.0

As economically viable technology improves these effluent standards will progressively tighten. While these standards are similar to those advocated by ANZECC, the NSW EPA and a number of European countries, they are not as stringent as some areas of North America. British Columbia, for example, sets a limit of 0.3 mg/L total phosphorus and encourages discharges to achieve 0.1 mg/L. EPA will, with the water industry, regularly review and update these technology-based standards.

Where new discharges are proposed, and the above standards do not provide sufficient protection of the receiving stream, more stringent standards will be imposed by EPA, based on achieving water quality objectives set in SEPPs.

Technology already exists to treat sewage to stream water quality now, however the cost is about four times that of conventional secondary treatment and not affordable for broad scale application. Conversely, the cost increase when

moving from secondary to tertiary treatment is about 50% – both in capital and operating costs. This is considered acceptable, given the state of our waterways and the practicability of reuse for many communities.

Although many of our streams are limited by the availability of phosphorus for the growth of plants and algae, most of these streams end up in terminal lakes, the Murray River or coastal embayments, where nitrogen plays an important role in flora productivity. Thus nutrient removal facilities should reduce both nitrogen and phosphorus levels in effluents.

6. WASTEWATER DISINFECTION AND SLUDGE MANAGEMENT

The options for disinfecting sewage effluents is stated in clause 25 of the *Waters of Victoria*.

> *Waste disinfection methods which do not increase discharge toxicity and which constitute the least environmental and human hazards in their production, transport and utilisation shall be employed where practicable. In particular, the use of chlorine as a wastewater disinfectant shall be avoided where there is a practical alternative.*

Most municipal sewage treatment plants in Victoria use detention ponds to achieve disinfection. About 20 rely on chlorination and six use ultra-violet irradiation. Microfiltration and ozonisation are also effective disinfectants. Due to the aquatic toxicity of chlorine residuals and the formation of small amounts of persistent organochlorines, chlorine is not favoured as a disinfectant for discharge of sewage effluents to water.

New sewage treatment should not use chlorine for disinfection unless special circumstances exist and approval is given by EPA. Existing plants should implement dechlorination to reduce the toxicity of chlorine residuals and consider upgrading to an alternative disinfectant. Water authorities reliant on detention ponds for the disinfection of effluent before discharge to a stream must have contingency measures to deal with algal blooms within the pond, especially blooms of blue-green algae.

Sludge is often a forgotten by-product of sewage treatment. The more sophisticated the treatment, the greater the amount of sludge produced. Sludge is rich in organic matter and nutrients and is an ideal soil conditioner and fertiliser. However, it is also the sink of most toxicants discharged to a sewer, highly infectious and ordourous. With careful control of inputs of hazardous substances into the sewer, appropriate treatment to stabilise and sterilise it, and appropriate application rates to protect soils and crops, sludges can and should be beneficially reused. National guidelines for sludge disposal are currently being developed to assist in the proper management and reuse of this material.

7. OPERATOR TRAINING

To ensure sewerage systems and treatment plants maintain optimum performance, sufficient resources must be provided for inspecting, testing, repairing, upgrading and operating the system. Water authority staff or contractors need to be appropriately trained and qualified to perform the allocated work.

8. WASTEWATER MANAGEMENT PLANS

Wastewater management plans should be prepared within the broader framework of an environmental management systems. A good example of wastewater management planning is Macedon Region Water Authority's strategy report of 1993.

Such plans need to be part of an environmental management system which covers the water authority’s:

- environmental policy
- environmental performance monitoring programs
- program for auditing its systems and performance
- training and development of staff
- community education and involvement programs and
- development of environmental management plans, wastewater management plans, contingency plans and emergency plans.

Melbourne Water's *A Guide to Melbourne Water's Environmental Management System* or the Water Services Association of Australia's *Environmental Guidelines for the Australian Water Industry* provide a useful introduction to the development of such a system.

The development of an environmental management system and various plans should be a public process which gains the endorsement of both customers and regulators. Annual reporting should then be against agreed performance indicators, with a single report fulfilling the water authority’s obligations to inform regulators and customers on its performance for the year and intended future works.

SUMMARY

Wastewater management plans, required by the *Nutrient Management Strategy* and the *Working Group Report on Effluent Standards and Compliance for Waterways*, should be prepared in the context of a water authority's overall environmental management system. Plans need to evaluate reuse opportunities which are practical and environmentally sustainable. Where reuse via land irrigation is not viable, and long term discharge to a stream is the preferred option, existing effluents must be treated to a tertiary standard within five years and progressively upgraded to nominally background water quality.

Such plans should be regularly reviewed and updated in response to changing community values and expectations, scientific studies, new reuse opportunities, improvements in waste treatment technologies and new Government policies.

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