

STORMWATER MANAGEMENT MEASURES TO EXISTING DEVELOPMENT TO PREVENT POLLUTION AND ATTENUATE RUNOFF.

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Paper Summary

Manly Council gained Commonwealth Urban Stormwater Initiative funding to use innovative management measures and technologies supported by a research program. This project aims to reduce, assess and evaluate stormwater pollution runoff concentrations and volumes from a sub catchment characterised by existing developments including typically ultra urban residential streets and beachside short term parking.

A Treatment Train approach has been used to minimise stormwater impacts. This approach has provided interventions from the top of the sub catchment to the bottom of the catchment, principally utilising 'At Source' and 'Source' controls. These controls include: enhanced street sweeping, installation of in pit baskets, community and council targeted education programs, installation of pervious pavement and a water treatment system and re-use at North Steyne and retrofitting a bituminised street with pervious pavement.

Introduction

Manly Local Government area is regarded as a leading Australian tourist destination, attracting over eight million visitors per annum to its world famous unspoilt beaches.

Ocean Beach, located on the eastern seaboard at Manly has four stormwater drains on the beach that discharge dry and wet flows onto the beach. The removal of these pipes has been high on the community agenda in terms of visual pollution. In the late 1990's Sydney Water Corporation and Manly Council undertook a desktop study into the cost of removal of these pipes. The desktop study indicated that the proposed relocation costs of the four pipes away from Ocean Beach would be over \$32 million alone, without stormwater treatment. The relocation cost was considered prohibitive with negligible improvement to stormwater discharges.

Project's Overall Objective

Council's overall objective is to:

- attenuate flows in the Smith Street sub catchment
- improve the stormwater quality discharging onto Ocean Beach and
- reduce the potential health risk to the beach users.

Proposal for the Pine Street Sub-catchment

The Stormwater Treatment and Re-Use, "STAR" project involved a pilot stormwater treatment and re-use initiative known as a 'Treatment Train', implemented for the whole Pine Street sub-catchment area. This scheme costing approximately \$1.4 million, is a first step in providing a systematic approach for spatially managing stormwater from the top to the bottom of the sub-catchment. using the

innovative application of 'at source controls' including innovative engineering technologies, with a monitoring component for evaluating the effectiveness of the various interventions and the effectiveness of the 'Treatment Train' approach.

This is to be achieved by:

- Identifying opportunities to reduce pollutants entering the water stream (e.g. enhance the Waste and Cleansing program, education programs, install 'in pit baskets' (to keep collected organics dry), and the addition of infiltration, filtration, retention and detention to runoff patterns).
- Twelve Months Water Quality Monitoring program.
 1. Comparative sub-catchment water quality monitoring and analysis between the treated and untreated catchments.
 2. Monitoring of the effectiveness of interventions used.
 3. Monitoring of the sediments collected.

Purpose of Council's Management Measures is to protect and improve surface water quality by developing sub catchment programs that pursue the following objectives:

- Reduce the pollution load and concentration in stormwater
- Attenuate the flow to reduce flooding
- Infiltrate stormwater to ground water
- Treat, collect and re-use stormwater
- Reduce the transportation of pollutants, and
- Find a cost effective and ecologically sustainable way to achieve these outcomes.

- Develop prototype model for use elsewhere

Improving water quality in ultra urban catchments is increasingly difficult as urbanisation becomes more consolidated and areas of impervious surfaces increase. Increased peak runoff volumes from impervious surfaces result in flooding and transportation of pollutants.

Flooding in the pilot area and transportation of pollutants was managed by the "Treatment Train" process that included major engineering works interventions piloted in two discrete areas of the sub-catchment, which are: Smith Street North and North Steyne.

1. Pervious pavers in Smith Street north, The street was developed in the early 1900's.

Smith Street was selected because:

- the water catchment is a discrete area can easily be monitored
- there would be minimal influence from surface flows developed in other areas of the catchment
- Runoff from this street impacts on the total stormwater flow entering the drainage system that backs up and floods Smith Street south.
- Due to the excavation needed to install the pervious pavers tree root damage to Heritage listed trees was a potential hazard. This street had a reduced risk of tree root damage based on advice from arborists.

Retrofitting Bituminised Smith Street North

Retrofitting in Smith Street North was a process that involved the modification

of existing surface water runoff control structures and conveyance systems that were originally constructed to reduce flooding, not to improve water quality function. The predevelopment site was part of a coastal dual system.

What was done

- Extensive community consultation that involved the 'street community' selecting the colour of pavers, etc. Regular street meetings and newsletters during the 10 weeks of the project
- The existing surface water runoff road structure was modified by changing the inflow and outflow characteristics of the street.
- The road structure now was used to increase runoff detention, retention and infiltration of stormwater. The sub-grade was engineered to contain a 1:10 year storm event, with a 30% storage capacity.
- Gutters were removed but the kerb was retained.
- An overflow bypass was retained at the end of the street sub- catchment
- Service lines were renewed
- Small equipment was used to reduce the vibrational impact from the excavation
- A Monitoring station has been established to measure percolation rate and water quality infiltrating to ground water. This program will continue for 12 months.

Result

- The community is very happy with the visual aesthetics of the street

- The sub grade can store the storm runoff from a 10year ARI event without surcharging through the pavement
- Recent rain events have not provided any surface flows to be monitored but flows to ground water have been monitored
- Flows running along the kerb are a result of 2 sources
 - i. Individual property stormwater discharge pipes
 - ii. Flows from an upstream street that does not have any pits
 - iii. Infiltration from the additional sources is effective.

2. Pervious Pavement, Treatment, Storage and Re-use at North Steyne

Motor vehicles generate runoff pollutants through emission and deposition of automobile exhaust and through discharges of both fluids and solid particles during travel and while braking. It has been found that 44-49 percent of pollutants originate from pavement wear, 28-31 percent from tire wear, and 15 per cent from engine and brake pad wear. Approximately 6 percent from exhaust particulates and 3 percent from atmospheric deposition (Sansalone and Bucherberge, 1997).

North Steyne, short term parking along the Ocean Beach was selected to:

- Manage the stormwater pollution arising from the short-term raised parking. Here it was expected that the typical road contaminants would concentrate due to the short term nature of the raised stationary

- vehicle and constant braking on the site.
- The runoff from this area is closest to the beach which is a high public profile area
- Investigative studies showed that no sanitary overflows known to occur in this location.

What was done?

- Two storage and treatment facilities were constructed on the promenade of North Steyne
- A channel was excavated along the drain that captured the runoff from the eastern camber of the road and from the short term parking
- The channel was installed with the biologically engineered soils to treat the stormwater
- Pervious pavers were installed over the top of the channel
- This channel were linked by pipes to the storage facilities
- Monitoring stations were installed to undertake a twelve-month monitoring program.
- Baseline data was collected and a Risk Assessment was undertaken by UNSW. This initial Risk Assessment suggested that the health risk associated with Stormwater Re-Use was below the generally accepted limits for the reuse of water.
- A pump station was installed and linked to the storage facility.
- Town water was also linked to the irrigation system by mixing fresh town water with treated storm water as a Risk Management precaution and to supplement supply in extended dry periods.

- Preliminary investigations by UNSW indicate that the stormwater that has been treated and stored in the storage and treatment facilities is fit for irrigation.

Conclusion

As a result of the project there has been increased awareness within Manly Council of the broader issues that need to be considered in the sustainable management of stormwater. A more multi-disciplinary approach has developed and resultant increase in capacity of the various professional staff managing stormwater across divisional boundaries.

Community acceptance of the project

- There is still a call from the community in regard to the removal of the stormwater pipes from the beachfront in terms of visual pollution but costs for removal and relocation remain a constraint to further works.
- There is a greater awareness of stormwater issues within the sub-catchment.

Smith Street

- Acceptance has been strong especially due to the reduction in surface flows and potential use in other areas (budget dependent) that experience peak flow flooding.
- Visual appeal of the retrofitted street has been strong with broad community acceptance.

Water Quality and Flow Monitoring

The project has entered the research monitoring and evaluation phase but monitoring results have been delayed due to dry weather conditions

1. Catchment Comparison- pre-data monitoring by AWT-Sydney Water Corporation. Data shows that runoff within expected levels for an urban catchment.

2. Intervention Monitoring. The UNSW Water Quality Monitoring Program has just begun and has been delayed due to dry conditions. The results to date indicate that:

2.1. Smith Street:

- Monitoring Parameters, eg. Lead, Iron, Copper, Manganese and Zinc, etc. are within expected limits for urban surface flows (Ball J. et al, 2000).
- Bore hole-testing results show that there is no change in analytes and contamination is within risk levels.

- Surface runoff reduced by 70 per cent.

2.2. North Steyne-delayed due to design matters.

- Risk Assessment of re-use of stormwater studies indicates that the quality is well within water re-use standards. (J.Ball, WRL, UNSW).

2.3 Sediments. Pre-monitoring results within expected limits for urban catchments.

Final Monitoring data and resultant evaluation including a cost evaluation of the various interventions will be available in September 2003.

References

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Sansalone, J.J., J.M. Koran, J.A. Smithson, and S.G. Bucherberge. 1998. Physical Characteristics of Urban Roadway Solids transported During Rain Events. Journal of Environmental Engineering May: 427-440.

Author Biography

Joanne is Director of Funding Solutions Pty. Ltd consulting principally to Local Government in Total Catchment Management with an emphasis on water cycle and stormwater management. Joanne has worked in Local Government for seven years, prior to this as Business and Project Manager for the Institute for Coastal Resource Management, UTS. Joanne has degrees in Business, Majoring in management and marketing, Master Science, in Coastal Resource Management and is currently undertaking a PhD in Sustainable Stormwater Management. Joanne is currently managing two stormwater project that including the Treatment Train process, that includes Water Sensitive urban design and rigorous water quality monitoring programs in the Manly Local Government area.

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