

9 ASM Paper



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Date	1 May 2018

Applied Fluvial Geomorphology in the 21st Century: embracing a Waterway Asset Management approach

Introduction

Melbourne Water retains significant knowledge and data on waterway geomorphology however this does not cover the entire region and is not readily accessible or consistent in format. Melbourne Water therefore has an opportunity to enhance our understanding of the occurrence and location of reach-scale fluvial erosion and sedimentation processes across Port Phillip and Westernport. This will improve our strategic approach to managing the physical form of waterway assets at the reach-scale, which is required in order to support economic decision making based on risk to service.

The Victorian State Government has mandated that all government authorities achieve full alignment with ISO 55000, the International Asset Management Standard, by 2020. It is therefore a priority for Melbourne Water to have established a Waterways Asset Management framework by this time.

This project aims to develop an asset management framework to support our understanding the spatial distribution of physical form condition (erosion and sedimentation) across the Melbourne Water region. The framework will be critical in linking potential management interventions with achieving physical form based environmental conditions along waterways that appropriately support the defined Levels of Service (LOS) of the waterway.

Melbourne Water is working to improve our understanding of the spatial distribution of the geomorphological processes operating across our network of over 8000+km of waterways. Ensuring that processes that threaten the physical form condition and function of the waterway to a degree that poses an intolerable risk to defined Levels of Service, are managed appropriately, is an imperative. If it is possible to understand where threatening processes occur, the severity of the processes, and the potential for them to impact, we would be able to effectively prioritise the works required to manage the threat, protect built assets, support cultural, social and ecological Key Values, and maintain drainage function. The key project outcome is a model for how we manage waterway assets for physical form.

Physical Form Asset Management Framework

Melbourne Water is currently developing an asset management framework that is focused on the physical form environmental condition of waterway assets. The framework will be completed via a geomorphological assessment of the linear waterway assets within the Melbourne Water region in order to inform Level(s) of Service (LOS) and confirm physical form

attributes that represent the geomorphological baseline for waterway reaches. The LOS could include one or a combination of the following along any particular waterway segment:

- supporting ecological values,
- supporting cultural values,
- providing amenity,
- maintaining flooding and drainage,
- ensuring public safety and
- protecting built assets.

The physical form attribute should take into account the geomorphological characteristics that influence the LOS. The attributes would be used to guide future management interventions.

Error! Reference source not found. provides a schematic of the asset management framework.

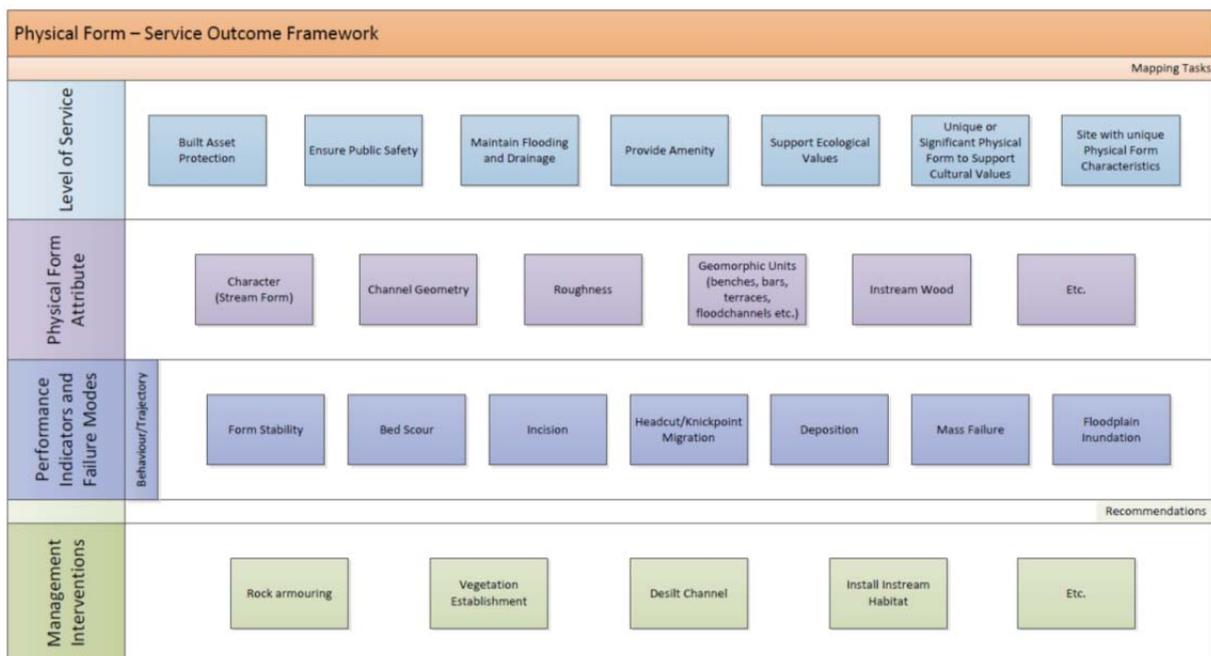


Figure 1 Physical Form Asset Management Framework

The project requires that specific management regimes be recommended to maintain the physical form attribute and support the LOS specified for the waterway segment. Management interventions may include: desilting activities, floodplain inundation, and erosion control works that have the potential to improve attribute condition to continue to support LOS. The LOS and physical form attribute would be defined for waterway assets within Melbourne Water's asset management system MAXIMO to provide a resource for Melbourne Water teams to make appropriate decisions on acceptable management interventions as they relate to geomorphological character, condition and behaviour.

Existing Knowledge Gaps

This project attempts to provide information to fill the following knowledge gaps:

- Where reach-scale erosion and sedimentation is occurring in the Melbourne Water management region

- What type of failure mode / geomorphological process is occurring (incision, meander migration, channel widening, aggradation etc.)
- What stage the erosion is at (e.g. stage of incision, recovery etc.) (trajectory)
- What the scale of the erosion to date is (future erosion trajectory)
- What degree of risk is being posed to the waterway Level(s) of Service

Proposed Project Method

The project will be completed during the 2018/2019 financial year. The approach outlined below is proposed to finalise and complete the framework. It is expected that this proposed approach will be refined as the project continues.

Background Data Review

The conceptual models developed in conjunction with the Healthy Waterways Strategy would be reviewed as a basis to describe the details of the actual relationships between LOS, physical form attributes, failure modes and the management interventions of the Waterway Segment. The nature of the relationships for particular Waterway Segments will depend on the actual or desired LOS in the subject reach and what aspects of the Physical Form - Environmental Condition are relevant.

Existing data including but not limited to the following will be reviewed in order to finalise the framework:

- Previous geomorphological investigations and reports
- Region wide soil mapping
- Land use data
- Earthen drainage capacity mapping

Establish Level of Service

Melbourne Water's role as waterway manager involves asset management responsibilities to protect and renew waterway (river, wetland and estuary) channel form and function. Management of a waterway's physical form aims to:

- Protect the key environmental values, for example, preventing incision from washing sediment downstream and filling in the deep pools where fish live or smothering areas where fish spawn
- Protect critical community assets such as roads, bridges and railway lines from negative impacts of waterway processes
- Protect cultural waterway values
- Ensure public safety by managing bank stability
- Maintain appropriate levels of hydraulic capacity (ensuring that waterways can carry the appropriate amount of floodwater).

In some locations these priorities may conflict or complement one another depending on the landscape context. To best manage Melbourne's waterways the LOS of each Waterway Segment should be specified. The LOS might include one or a combination of biodiversity, cultural values, amenity, flood mitigation, protection of built assets, and public safety. This

information should also help identify which Waterway Segments are more 'critical assets' based on the desired LOS and the consequence should the waterway fail to support it.

Establish Physical Form Attributes

The physical form attribute includes but is not limited to: the geomorphological character, instream habitat and geomorphological units, and the channel geometry and roughness of a Waterway Segment. A geomorphological assessment would be completed for each Waterway Segment within the Melbourne Water management region to establish physical form attributes for each reach that support the allocated LOS. The Healthy Waterways Visions for Stream Form can be used as an input to help define the attribute. The Index of Stream Condition Data will also be useful to support the allocation of physical form attributes to waterway segments. Some site work may be required to field truth Physical Form Attributes of a Waterway Segment. Each Physical Form Attribute will need to be described in terms its character and behaviour in relation to meeting the specified operational LOS, and to what degree, as some stream forms may be better at supporting certain LOS than others. An assessment would be undertaken as to whether this attribute, and likely future changes in condition, is posing or is likely to pose a degree of risk that the LOS might not be met between the current time and 2030.

Performance Indicators and Failure Modes

Potential failure modes and acceptable performance indicators, in relation to the defined physical form attributes of a Waterway Segment, would be established to understand behaviour, potential trajectories and rates of change. Evidence of failure modes is an indication of channel form behaviour. Indicators will be measurable so that it is possible to determine if a waterway segment is behaving within an acceptable range necessary support the specified LOS. Alternatively we would be able to understand to what degree the failure modes, as mapped to specific physical form attributes of the waterway segment, are posing a threat to the LOS. Indicators would be established to measure condition and trigger management works.

Spatial Presentation of Waterway Function

The LOS, the physical form attribute, and performance indicators and failure modes should be mapped across the Melbourne Water region. The mapping tool would facilitate system wide management decisions. Spatial data would be linked to Melbourne Water's asset management system MAXIMO based on location code or asset ID.

Spatial data outputs:

- Waterway Location Code and Asset ID
- Level of Service
- Physical Form Attribute
- Performance Indicators and Failure Modes

Management Intervention

Proposed management regimes and maintenance works would be recommended to enable the maintenance of the recommended physical form attributes for a Waterway Segment. For example a management intervention would be recommended to achieve the assigned physical form attributes for a specific Segment to ensure the physical form attribute of the subject reach remains or varies within the acceptable behavioural range of similar stream form required to support the LOS. The advice would inform future decisions about where and where not to intervene, and how best to intervene.

Expected Project Outcomes

Successful completion of this project will result in extensive spatial mapping data of the LOS, physical form attributes and performance standards as defined for each waterway linear asset. It is likely that the project will be completed via a phased approach or on a catchment by catchment basis which would enable the project team to confirm and finalise the framework prior to application across the greater Melbourne Water management region.

In summary, this project will enable an asset management approach to be developed for physical form and applied to waterway assets.

Additional References

- Smith, L., 2016, A strategic approach to Physical Form asset management across Port Phillip & Westernport, Melbourne Water
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- Melbourne Water, 2013, Healthy Waterways Strategy, Healthy Waterways Visions – Stream Form, spatial data
- Alluvium, 2016, Framework: Physical form environmental condition in the SAMP, spreadsheet tool