Planning guideline to modify or construct an emergency relief structure

1. Purpose
This planning guideline provides a decision-making process for modifying an existing emergency relief structure (ERS) or constructing a new ERS. The process brings together environmental, social and technical considerations.

2. Scope
This guideline covers most situations in which modifying an existing ERS or constructing a new ERS may arise as an option including:

- planning for growth (greenfield or infill)
- addressing customer complaints (internal and external surcharges)
- to improve the environmental performance of the wastewater system
- to protect against structural failure during extreme wet weather events
- to mitigate the effects of blockages on the ERS outlet pipe.

All Sydney Water staff (or people working on Sydney Water projects) involved in wastewater planning work have to follow this guideline including:

- Asset Life Cycle
- Customer Services
- Program Delivery
- Engineering and Technology support.

There is a standard operating procedure (SOP) associated with this planning guideline that provides the technical details required to complete the decision-making process.

3. Objectives
The objectives of this guideline are to:

- provide a transparent process that assists Sydney Water to reach sound, logical and justifiable decisions around the use of ERSs
- ensure Sydney Water complies with the relevant licence and legislative requirements when modifying or constructing new ERSs

give guidance around factors to be considered for the technical viability of ERSs
4. **Background**

4.1 **What is an emergency relief structure?**

ERSs are essential parts of the wastewater system that prevent overloaded or blocked sewers from spilling in an uncontrolled way onto private properties, sensitive sites and public land. Instead, wastewater is directed in a controlled manner to a less sensitive area such as a nearby waterway or stormwater system, thereby protecting public health and the environment.

There are around 3,000 ERSs in the Sydney Water system. The Sydney Water Sewerage Code (*Sewerage Code of Australia, WSA 02-2002-2.2, Sydney Water Edition, Version 2, Water Services Association of Australia, 2006*) states that ERSs should be provided:

- on incoming sewers to a pumping station to enable controlled overflow during facility failure
- along branch and trunk sewers to allow overflow of excessive inflow/infiltration following rainfall events.

The Sydney Water Pumping Station Code (*Sewage Pumping Station Code of Australia, WSA 04-2005-2.1, Sydney Water Edition, Version 1, Water Services Association of Australia, 2006*) states that "pumping stations shall be provided with an ERS which shall overflow from the inlet maintenance hole wherever practicable or alternatively, from the emergency storage".

4.2 **How are emergency relief structures licensed?**

Sydney Water’s sewage treatment systems (STSs) are licensed by the NSW Environmental Protection Authority (EPA) under the *Protection of the Environment Operations Act 1997*. The environmental protection licence conditions vary between systems, but all include requirements for the operation of ERSs in relation to both dry and wet weather overflows. The licence conditions are generally reviewed every five years, or more often as required.

4.3 **How does this guideline fit into Sydney Water’s planning processes?**

This guideline is not a standalone document and is intended to complement existing planning processes. These processes include, but are not limited to the following:

- Asset Creation Framework
- Asset Management Plans
- Sydney Water’s sewerage system and sewage pumping station codes
- Value Management Procedure
- Sydney Water’s Environmental Management System.
- Position Statement – Wastewater Network Compliance – Hydraulic Capacity
- Decision Framework – West Weather Internal Surcharge Program

These guidelines have to be used when an ERS is considered as an option. Depending on the project size and specific needs, the project team can choose to apply the guideline at any time during the planning process. The only constraint is that all the steps must be completed before the detailed design commences.
There are two common stages in the planning process that this guideline can be applied:

- **An ERS is the preferred option:** Planning has been completed and arrived at an ERS as the preferred option. In this case, it is necessary to complete the steps outlined here to check the environmental, social and technical viability of the ERS.

- **Optioneering:** The project team may decide to use this guideline during optioneering to ensure any ERS options are viable and can be fairly compared against other options.

Steps 1 to 5 (Figure 1) outline a methodology to assess the technical, environmental and social viability of the ERS option. Step 6 then gives guidance around integrating the results of Steps 1 to 5 into further planning work.

Planning is often an iterative process and this planning guideline is not intended to be prescriptive and can be altered depending on the project size and specific needs.

Some key points to remember for sustainable planning:

- Clearly defining the ‘problem’ and the objectives of the project at the beginning is vital.
- There is always more than one option (including ‘do nothing’).
- A multi-disciplinary team is essential.
- Financial, environmental, social and technical elements must be considered.
5. Detail

5.1 Steps in the planning guideline

Figure 1 shows an overview of the decision-making steps in the planning guideline.

Figure 1: Steps in the ERS decision-making process.
Step 1: Define ERS objectives
The project team must clearly define the objectives of the ERS including the relevant performance targets it must meet. This should include outlining the ‘design event’ and any other agreed wet weather events in which the ERS is intended to function.

Step 2: Pick preliminary location and design
The project team must decide the optimal location for the ERS. This will involve high level input from both the planners/designers and the environmental specialists as described below. The project team should also check any projects planned or currently in progress in the catchment.

Step 2a: Technical assessment
The planner/designer should consider:
- the location of the nearest waterway or stormwater system
- dry and wet weather flows in the waterway
- constructability
- hydraulics of the system
- the size and location of the stormwater catchment compared to the sewer catchment (for input into the environmental assessment).

The project team must also determine the required size and weir crest level of the ERS that meet the performance targets.

Step 2b: Environmental assessment
The environmental specialist should review the results of the catchment characterisation report with particular attention to:
- location of existing ERSs (upstream and downstream)
- sensitive sites (including heritage)
- health of the waterway
- threatened flora and fauna.

The ERS should be located downstream of sensitive sites where possible.

Step 3: Licence requirements
The licence requirements for all STSs are similar in relation to dry weather overflows. Licence condition L1 requires Sydney Water to ensure no dry weather overflows reach waterways due to the lack of proper and efficient operation and maintenance of the reticulation network.

The licence requirements vary between systems in relation to wet weather overflows and are based on the long term system frequency goals outlined in the Sewerage Overflows Licensing Project Environmental Impact Statements (Sydney Water, 1998) (SOLP EIS). The system performance is measured by the ‘system frequency’ which is the number of wet weather overflows in a 10 year period, as predicted by the approved hydraulic sewer system model. The licence conditions are determined by how each STS is performing against the long term goal.

The project team should find the relevant STS licence (available from the EPA website) and identify the relevant licence conditions that must be met, as outlined in the SOP. The project team must then use the approved hydraulic model to determine the system frequency with the modified or new ERS in place and compare this to the licence target/limit.
If the system frequency is within the licence target/limit, proceed to Step 4.
If the system frequency is above the licence target/limit, the ERS must be reconfigured until the licence target/limit is met. Reconfiguration may include:

- changing the location
- adding in storage
- modifying the weir height or width
- pipe amplifications in the downstream wastewater system.

For the big four systems (the North Head, Malabar, Bondi and Cronulla sewage treatment systems), the EPA has imposed a new risk-based framework and regulatory measure for Wet Weather Overflow (WWO) abatement. The planning team should comply with the new EPL conditions and ensure that the proposed new or modified ERS will not result in increased overflow volume or frequency of the high category overflow points (Category 1, 2 & 3) in the catchment.

**Step 4: Creek levels**

Most of the approved hydraulic models assume a free unrestricted discharge of flow from the ERS. When the levels in the creek (or any other waterway, such as stormwater pipes) are higher than the weir crest level, the functionality of the ERS may be reduced.

The planner/designer must estimate the level in the creek during the largest rainfall event the ERS is required to operate in, as defined in Step 1. To do this, the planner/designer must first define the average recurrence interval (ARI) of the design event, and then estimate the creek level using one of the following methods:

- peak level only
- interpolate council data to determine the peak creek level
- extend existing council model to include the ERS location
- construct a MOUSE and NAM model of the creek
- extrapolate from gauged creek levels.

If the creek levels do not restrict free discharge of flows from the ERS, proceed to Step 5.
If creek levels do restrict the flows, the ERS must be reconfigured until the creek levels do not restrict the discharge. Reconfiguration may include:

- changing the location
- modifying the weir height
- adding a pump
- altering the waterway.
Step 5: Environmental and social checklist

The environmental and community relations specialists should assess the sensitivity of the site to the operation of the ERS. A checklist and scoring system is provided in the SOP. Depending on the sensitivity score, the ERS may need to be reconfigured to lessen the impact. Reconfiguration may include adding a screen or changing the location of the discharge point. This step also includes a number of mitigation measures that should be considered by the project team.

The environmental and social impact of the construction and operation of the ERS should be assessed in line with Sydney Water’s Environmental Management System as and when deemed appropriate by the project team.

Step 6: ERS Design and Valve specification

The ERS should be fitted with back flow prevention valves. There are three types of backflow prevention valves.

1. Back flow prevention valve (Duckbill) in a chamber
2. Backflow prevention valve at the outlet of the discharge pipeline
3. Inline check valve in the discharge pipeline.

Standard design drawings and specifications used in Wet Weather Overflow Abatement program projects should be incorporated in the designs.

A variety of strategies that can be adopted to remediate or introduce an Emergency Relief Structure (ERS) in a wastewater system have been developed and can be summarised into four categories:

Category A: Installing an inline check valve into an existing or new structure.
Category B: Installing a duckbill check valve in a new chamber along the existing relief pipe.
Category C: Constructing a new ERS or relocating an existing ERS. This option requires a new weir to be constructed as well as a duckbill valve chamber. This option may also require decommissioning an existing ERS.
Category D: Solution at the discharge point of overflow into a natural environment. This option requires a headwall structure and a duckbill check valve solution to protect and avoid siltation of the relief pipe.

The following Deemed to Comply (DTC) drawings provide standard design solutions for the above Categories A, B and C:

- DTC/2401 Instructions, General Notes and Drawing List
- DTC/2402 Arrangement 1 – New Valve Chamber
- DTC/2403 Arrangement 2A – New Weir & Valve Chamber (One Structure)
- DTC/2404 Arrangement 2B – New Weir & Valve Chambers (Separate Structures)
Due to site variability, the design solution for Category D cannot be standardised to become a DTC drawing. Instead, this guidance document has been developed to provide the design philosophy for a solution at the discharge point of overflow into a natural environment.

**Headwall Structure**

- A hydraulic assessment (modelling to determine ERS weir crest level, discharge pipe size, overflow frequency and volume) is to be undertaken to determine the level and location of the discharge pipe outlet, which subsequently governs the level and location of the headwall structure. Undertaken by Sydney Water planning and required information provided to guidance user.

- The suitable layout for the structure and the area of disturbance is to be confirmed prior to works commencing.

- When finalising the location of the headwall structure, access for maintenance is to be considered and Sydney Water Customer Delivery and all relevant stakeholders are to be consulted.

- The headwall structure can be either cast in-situ or pre-cast concrete units.

- The headwall structure is to be recessed into the watercourse bank to reduce potential flood interference and the need for discharge flow attenuation measures.

- The headwall apron level is to be above the waterway bed level to reduce the risk of silt build-up in the headwall and backflow prevention valve.

- The headwall structure dimensions should be such as to afford protection to the backflow prevention valve from debris impact and direct water flows.

- The proposed dimensions of the headwall structure for different sizes of discharge pipes are provided on the guidance drawings in Appendix A.

- A geotechnical investigation prior to construction is required to be undertaken to confirm the ground conditions (including soil/rock material properties) in order to inform the design, in particular the foundation requirement of the headwall structure and the embankment stability at the location of the headwall. The results of the ground conditions and required preparation works are to be assessed and verified by a competent geotechnical engineer.

- Global stabilities (including overturning, sliding and bearing) of the headwall structure, temporary and permanent embankment at the location of headwall are to be undertaken based on the actual ground...
conditions revealed from the geotechnical investigation results. The design shall be assessed and verified by a competent geotechnical engineer.

Scour Protection

- Suitable scour protection is to be provided while meeting design requirements consistent with flow velocities and blending into the topography.
- A plume from the valve can potentially impact the stability of the bank on the opposite side of the discharge point, particularly if the outflow is perpendicular to the bank. If that is the case, a suitable solution for energy dissipation is to be adopted to minimise the impact.
- Disturbed vegetation is to be rehabilitated using a mix of local vegetation species planted at an appropriate density. While establishing, plants are to be protected with a mix of open-weave jute mesh.
- For watercourse bank protection and restoration around the headwall structure, gabion walls are to be used.
- Gabion walls to meet TfNSW QA specification R55: Rock Filled Gabions and Mattresses.

Backflow Prevention Device

- The backflow prevention device is to be a Tideflex Duckbill Check Valve - Series 35-1 (flange type) or approved equivalent.
- The contractor is to confirm the size of the discharge pipe and the maximum back pressure that will apply on the valve to ensure the duckbill check valve will be procured with the correct size and pressure rating.
- If the duckbill check valve is to be installed in harsh environment conditions (e.g. high level of hydrogen sulphide, prone to bushfire, etc.), the contractor will need to liaise with the manufacturer to select the suitable material for the valve.
- The installation of the duckbill check valve is to comply with the manufacturer’s requirements.
- The flange of the duckbill check valve is to be secured on the headwall structure by anchor rods. Only chemical anchors are allowed for this application.
- The clearance from the bottom of the flange and the apron to be kept at a minimum of 150-200mm to provide sufficient room for valve installation and maintenance.

Restoration

- Restoration and revegetation are to cover all disturbed areas and comply with requirements of relevant Waterway Management authorities.
6. Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ARI</td>
<td>Average recurrence interval</td>
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<tr>
<td>EPA</td>
<td>NSW Environmental Protection Authority</td>
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<tr>
<td>STS Licence</td>
<td>The environmental protection licences for each sewage treatment system (STS) issued by the EPA under the Protection of the Environment Operations Act 1997.</td>
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<td>Design event</td>
<td>The specific storm event in the approved 10 year time series that is used to design the ERS to meet both licence and performance targets.</td>
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<td>ERS</td>
<td>Emergency relief structure – a designed overflow point in the wastewater system.</td>
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<tr>
<td>Event</td>
<td>A rainfall event in the 10 year time series STS licence model.</td>
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<td>Gully</td>
<td>The mandatory gully trap located on the outside a private property dwelling or building. It is an open grid-drain, usually below an external tap that in the event of the wastewater system surcharging, the surcharge will relieve from the gully point first, rather than inside the building.</td>
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<tr>
<td>SOLP EIS</td>
<td>Sewerage Overflows Licensing Project Environmental Impact Statements (Sydney Water, 1998)</td>
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<td>SOP</td>
<td>Standard operating procedure</td>
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<td>Surcharge- Internal</td>
<td>Wastewater discharges inside the property owner’s dwelling or wastewater service in the property cannot be used due to incapacity of the downstream wastewater system during wet weather.</td>
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<tr>
<td>Surcharge- External</td>
<td>A Sydney Water maintenance hole (or a property gully) spills wastewater on or across a private property due to incapacity of the downstream wastewater system during wet weather.</td>
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7. Context

7.1 Accountabilities

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<tr>
<td>Systems &amp; Asset Planners</td>
<td>• Responsible for reviewing and updating this guideline</td>
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<td>Environmental Services representatives</td>
<td>• Responsible for approving the results of Step 5.</td>
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7.2 References

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<thead>
<tr>
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<tr>
<td>Licence</td>
<td>STS Licence: The environmental protection licence for each sewage treatment system.</td>
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<td></td>
<td>Sydney Water’s Operating Licence including the Customer Contract</td>
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<tr>
<td>Policy</td>
<td>Asset Creation Policy</td>
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<td></td>
<td>Management of internal overflows policy: document number “P Sydney Water 5020 N.0013”</td>
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<td></td>
<td>Australian Rainfall and Runoff guidelines (Institution of Engineers Australia)</td>
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<tr>
<td>Sydney Water guidelines</td>
<td>Trunk and SCAMP modelling procedures and methods</td>
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8. Ownership

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<tr>
<td>Group</td>
<td>Asset Lifecycle</td>
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<tr>
<td>Owner</td>
<td>Natasha Abulafia, Service Planning Lead</td>
</tr>
<tr>
<td>Author</td>
<td>Milroy Jayaveerasingam, Lead Planner</td>
</tr>
<tr>
<td>Approver</td>
<td>Anil Jaiswal, System Planning Manager</td>
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8.1 Change history

<table>
<thead>
<tr>
<th>Version</th>
<th>Issue Date</th>
<th>Approved by</th>
<th>Brief description of change and consultation</th>
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<tr>
<td>1</td>
<td>Oct 2011</td>
<td>W.Eyles</td>
<td>New Document</td>
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<tr>
<td>3</td>
<td>April 2014</td>
<td>Rod Kerr</td>
<td>Changes Business unit names and position names</td>
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<tr>
<td>3</td>
<td>June 2020</td>
<td>Yvonne Sinanovic</td>
<td>ERS design and valve specification has been included</td>
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