Technical Paper

Systems Operations

To: SECTION MANAGER SYSTEMS OPERATIONS

From: HUGH WILLIAMS

Subject: ASSESSMENT OF SPS DIURNAL TRACKING

Date: 30 June 2021

Purpose

To review the rollout of diurnal functionality to the Central Coast Council sewage pumping station (SPS) network and alarm settings to determine the suitability and best use of this technology.

Background/context

As part of the Enforceable Undertaking (EU) from CCC to the EPA, CCC committed to rolling out diurnal monitoring functionality within the existing SCADA network where the hardware allowed and review the suitability of this technology in assessing and predicting potential sewer chokes in the system.

Currently all SPS with compatible hardware have had this technology installed. There are about 11 SPS sites out of about 360 that require further upgrade to be able have the diurnal technology installed. A further undertaking within the EU was to complete the hardware upgrades by 31 December 2022 which is currently on track for delivery.

As part of the rollout of the diurnal functionality, issues with the existing base SCADA templates were identified and a further commitment of $69,600 was made to update the SCADA to in part address these issues. This has been rolled out to about 80% of CCC SPS's.

Timeline of diurnal rollout

- May 2019 – base diurnal code rolled out to SPS's with compatible hardware
- September 2019 – Alarming setup for southern SPS as medium
- November 2019 – Automatic tuning of diurnal predictions set up to update monthly based on the previous months data
- May 2020 – error in code determined as part of daily SPS checks by Systems Controllers resulting in the additional code rollout

Assessment of diurnal functionality

The diurnal functionality is a useful tool in early identification of abnormal inflow and infiltration and potential sewer chokes. Early identification of these can prevent or minimise sewer overflows to the environment.

Review of the operation of the diurnal functionality indicates some limitations in applicability. This is especially the case in SPS's that receive flow from multiple upstream SPS as diurnal variation is not as predictable due to pump runs. In SPS's that receive purely gravity flow, the functionality is very useful in identifying changes in flow behaviour and hence potential issues in the sewer system.

A significant drawback of the rollout is the volume of alarms generated. For example, there were about 1,200 alarms in 2020 and 1,000 in YTD 2021. These require triage from Systems Controllers with the majority being false positives. After SCADA interrogation, 12 alarms were further investigated with a field response. These are summarised in Table 1 below.

Table 1 – Diurnal alarms with further investigation

SPS	Date	Comment	Outcome
SPS U13	23/7/20	Reduced inflows	Dispatched and Sewer choke found between manholes EE01 and EA05
SPS C13	13/6/20	No derived inflow	Eteks resolved issues with code
SPS E2	2/6/21	Infiltration	Raised to assets team for review with infiltration program
SPS WG5A	16/5/21	No derived inflow	Eteks resolved issues with code
SPS N7	29/10/20	Spikes of inflow during storm event	Raised to assets team for review with infiltration program
SPS FB4	14/1/20	Low Inflows	Monitored and Investigated potential sewer choke. No issues found
SPS N3	31/7/21	Low inflows	Monitored and Investigated potential sewer choke. No issues found
SPS KA2	28/5/20	Erratic flow	Increased monitoring. No issues found.
SPS WG12	14/05/2021	Low inflows	Monitored and Investigated potential sewer choke. No issues found
SPS C5B	03/03/2021	Low inflows	Monitored and Investigated potential sewer choke. No issues found
SPS C17	16/09/2020	Low inflows	Monitored and Investigated potential sewer choke. No issues found
SPS WWB3	30/11/20	Large drop in inflows	Monitored and raised infiltration issue with assets team

Whilst the above list of alarms sent for further investigation is a very small percentage of the overall alarm volume, it is noted that the functionality did identify a sewer choke that was cleared on site prior to an overflow event.

In addition to the predicative capability of the diurnal functionality, there are also advantages in identifying increases in system inflows which could indicate deterioration in pipe and manhole condition requiring further investigation and maintenance prioritisation.

Examples of this are SPSWS10 & SPSC9 which identified significant abnormal inflow and infiltration diurnal patterns. This led to site investigations with CCTV identifying pipeline integrity issues and pipeline relining to reduce the infiltration. The results of this are significantly improved SPS performance in both dry and wet weather flows.

SPS WG10 pump long run alarm lead to further investigation of the diurnal patterns. This identified that the long runs and abnormal diurnal pattern correlated with high tides. Site investigation indicated four low lying manholes with defects which were then resealed to prevent ingress of water into the sewer network

SPS WWB3 also highlighted large variations in inflows due to the alarm for further condition assessment and investigation.

Findings/Recommendations

Diurnal functionality has been implemented as part of a suite of SCADA assessment tools and alarms including pressure transducers, pump long run alarms, pump run currents, derived inflow/outflows.

Diurnal alarming is not especially efficient in of itself due to the high volume of alarms generated however is useful in flagging potential issues for assessment with other SCADA tools and possibly site investigations. As noted in Table 1, it has led to the detection of a sewer choke prior to overflow. It is a useful operational investigation tool that Systems Operation are refining how to best use this tool and will continue to use the functionality as part of operating the sewer network.

There are limitations in applicability in SPS's receiving flow from multiple upstream SPS and in commercial areas in predicting regular diurnal performance.

Further actions

There are a number of SPS's where the diurnal functionality is not fully utilised due to lack of survey data for well parameters and overflow and control levels. This is part of an ongoing program of survey work that will be integrated into the SCADA when available.

It has been identified that there are potential advantages in developing further reporting within SCADA to identify potentially high inflow and infiltration based on peak day: average day flow ratio of >1.3 flagging a potential need for further investigation.

CCC are continuing to upgrade both hardware and SCADA code as part of both the EU and code upgrading across the SPS network.

Conclusion

The diurnal functionality in SCADA has been implemented over a two-year period. During this time, this functionality has shown to be a useful system operation tool as part of a suite of other SCADA and system monitoring to flag parts of the network requiring further investigation. CCC intends to utilise this functionality as an improvement to BAU and continue to review and refine its application.

Prepared
Hugh Williams
Network Development Engineer Systems Operations

Reviewed
Allison Cameron
Section Manager Systems Operations