

Belmont &  
Cessnock Inlet  
Works Upgrade



# Introductions and acknowledgements



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Senior Process Engineer /



**Chris Yates**  
Program Controller Infrastructure Delivery



**Trevor Gale**  
Principal Civil Engineer





# Agenda

**The Assets**

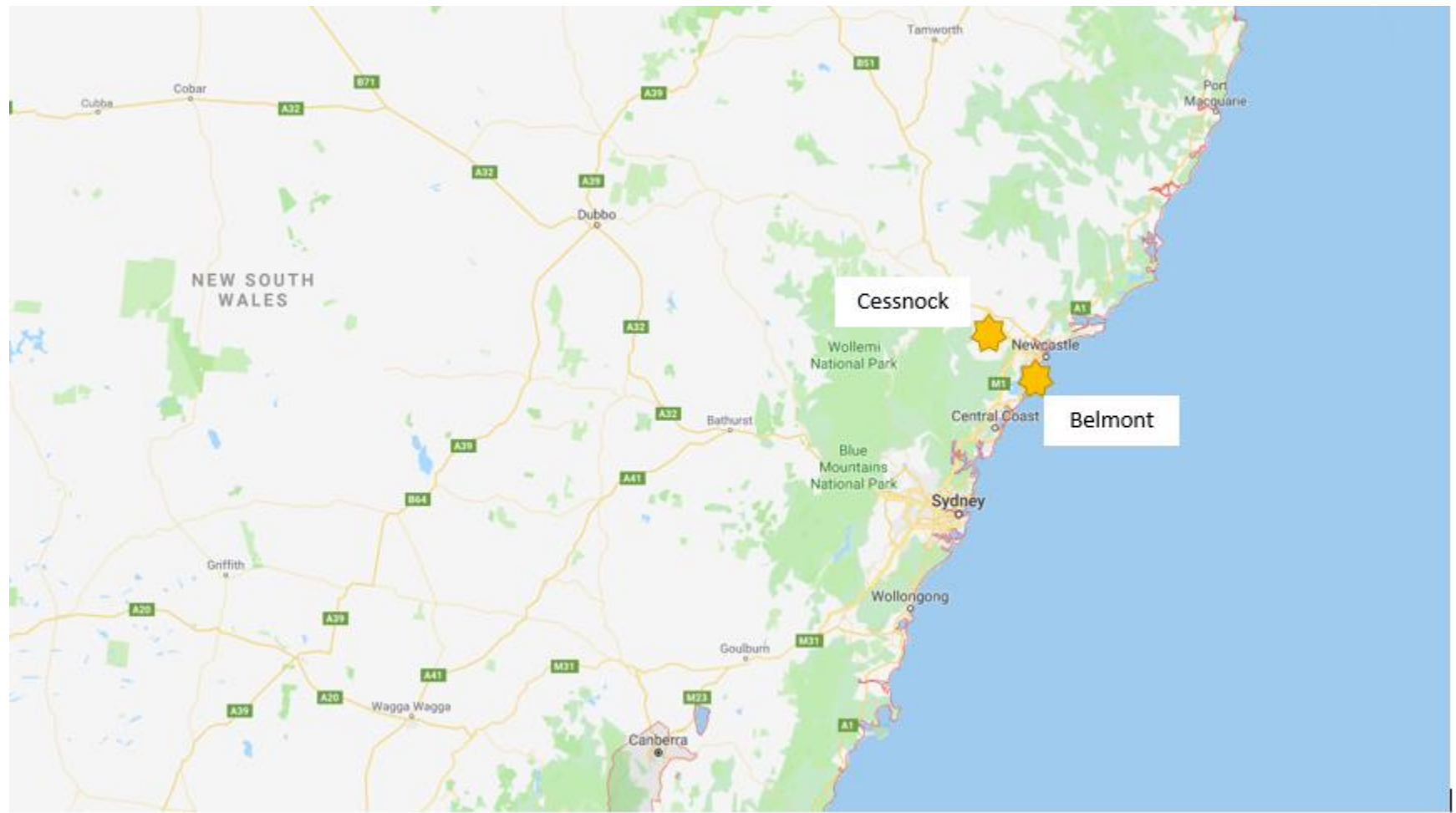
**The Problem**

**Risk Planning techniques**

**Implementation methods and results**



# Where are these projects?







# Belmont WWTW





# Belmont

Belmont:  
>120 000 EP



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Data Source: Hunter Water Corporation (2019)  
Map Date: 17/03/2017  
Scale: 1:92,000  
Datum: GDA94  
MGA Zone: 55

**LEGEND**

WWTW	Named Watercourse	Pump Station
Aquatic Leases	Aboriginal Area	Belmont Catchment
Ramsar Wetland	National Park	Rising Main
SEPP 26	Nature Reserve	Watercourse
SEPP 14	State Conservation Area	
SEPP 71	State Forest	

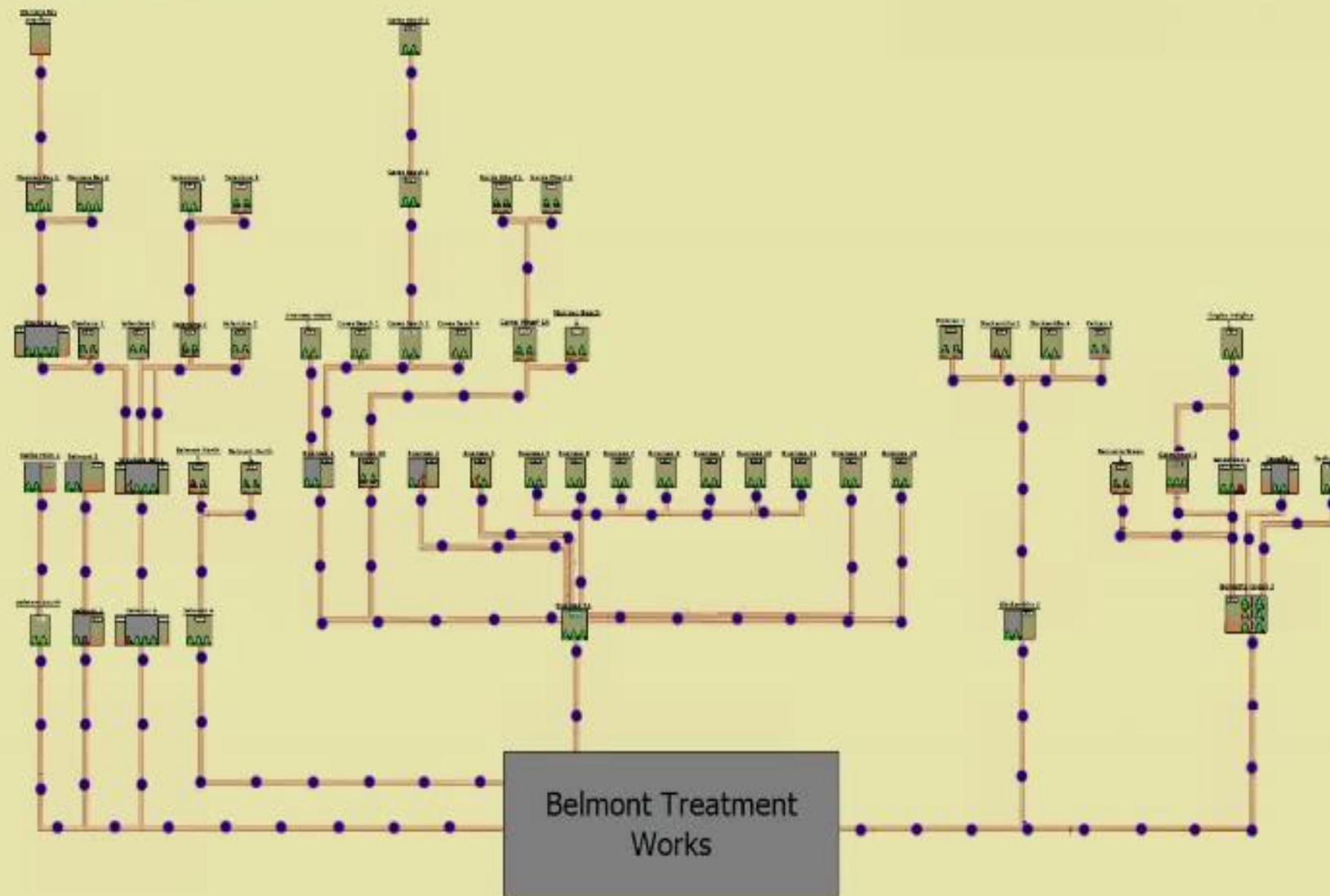
**SCALE**  
0 900 1,800 3,600  
Meters

**HUNTER WATER CORPORATION** ABN 46 226 513 446

**BELMONT SEWER NETWORK CATCHMENT OVERVIEW**

J. Alani	Hunter Water Corporation Network Overview	
Date: 17/03/2017	Drawn: Albert	Scale: 1:92,000

To Catchment Weather Overview



**Belmont:**  
30 ML/d  
54 pump stations.



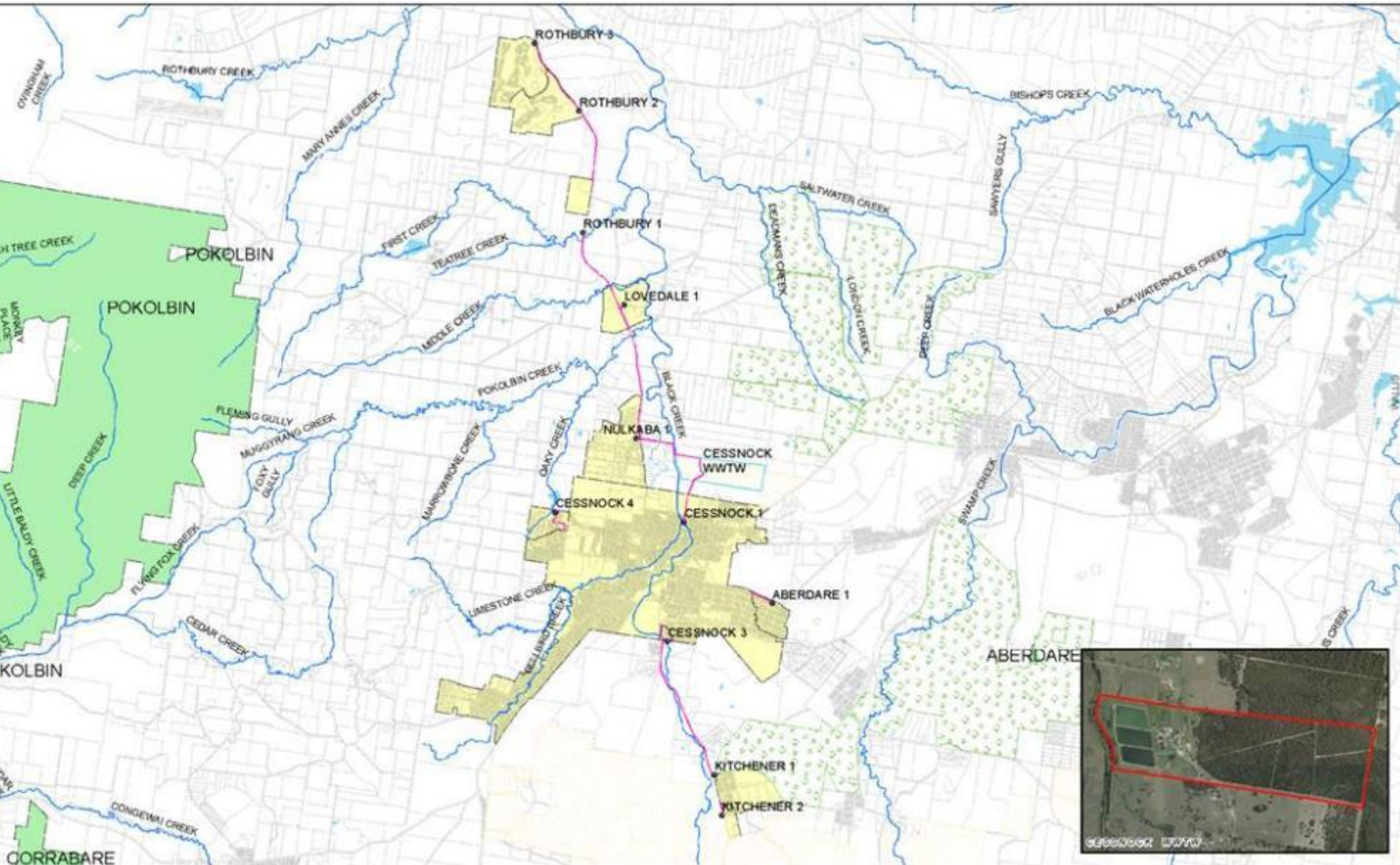


# Cessnock WWTW

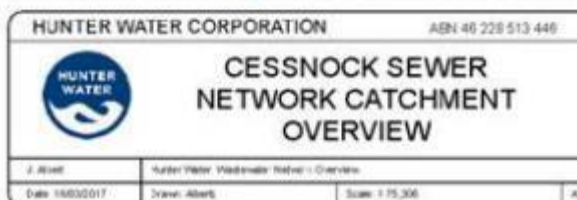


# Cessnock

**Cessnock:**  
>30 000 EP  
11 pump stations  
5.8 ML/d



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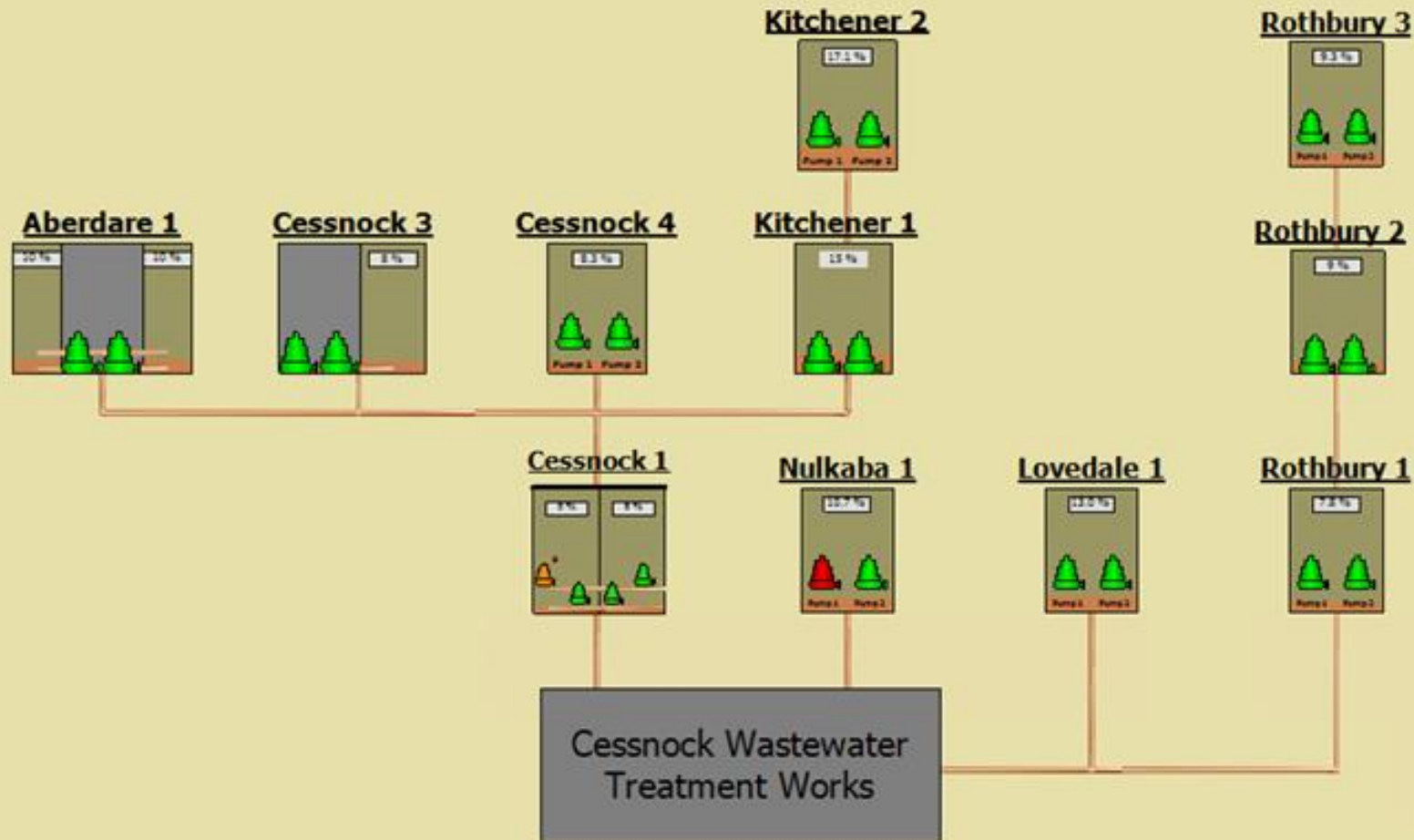






## Cessnock Treatment Works Hydraulic

[To Catchment Weather Overview](#)



**Cessnock:**  
11 pump stations  
5.8 ML/d



# The problem

- Aged assets
- Hydrogen sulfide attack
- Risk of structural collapse  
(extreme safety consequence)
- Risk of environmental discharges







- Exposure of rebar
- Worse condition in turbulent areas











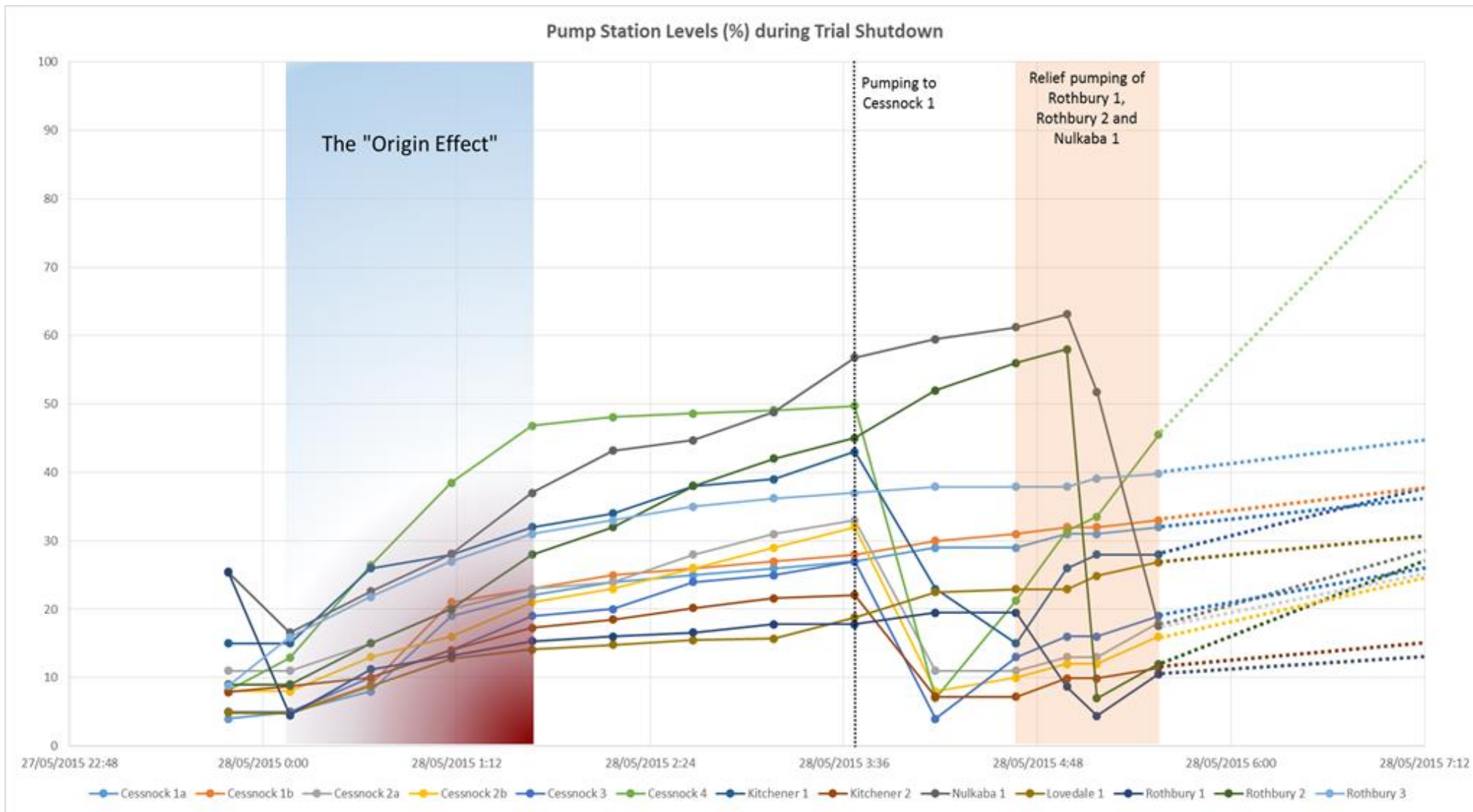
# “Do nothing” not an option

- Sanitation >150,000 people
- Stop overflows at > 65 pump stations and treatment plants
- Mitigate risk of injury (or death) to operators
- Save >\$15m by avoiding construction of new inlet works...

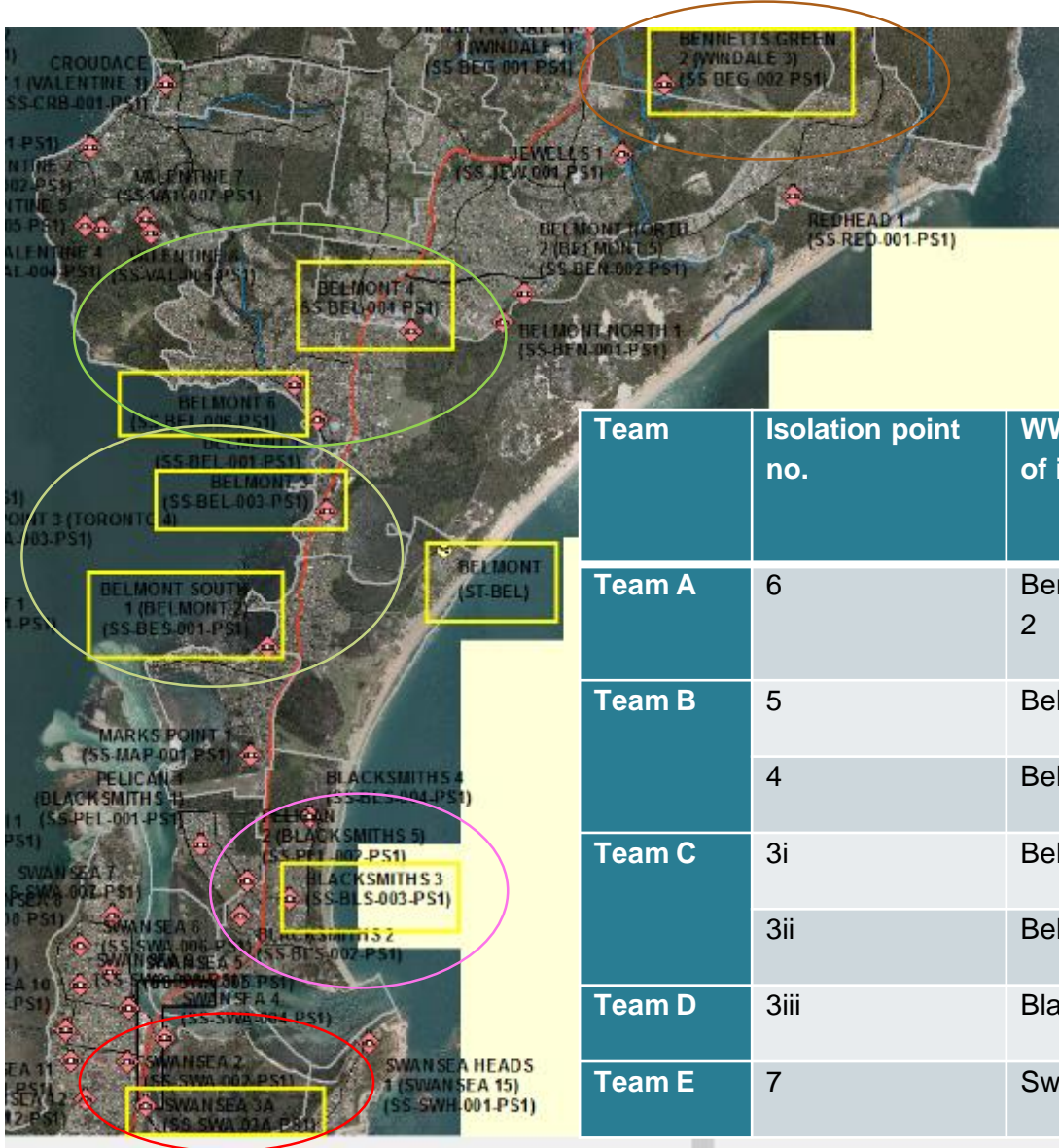




# Planning - Trial shutdowns



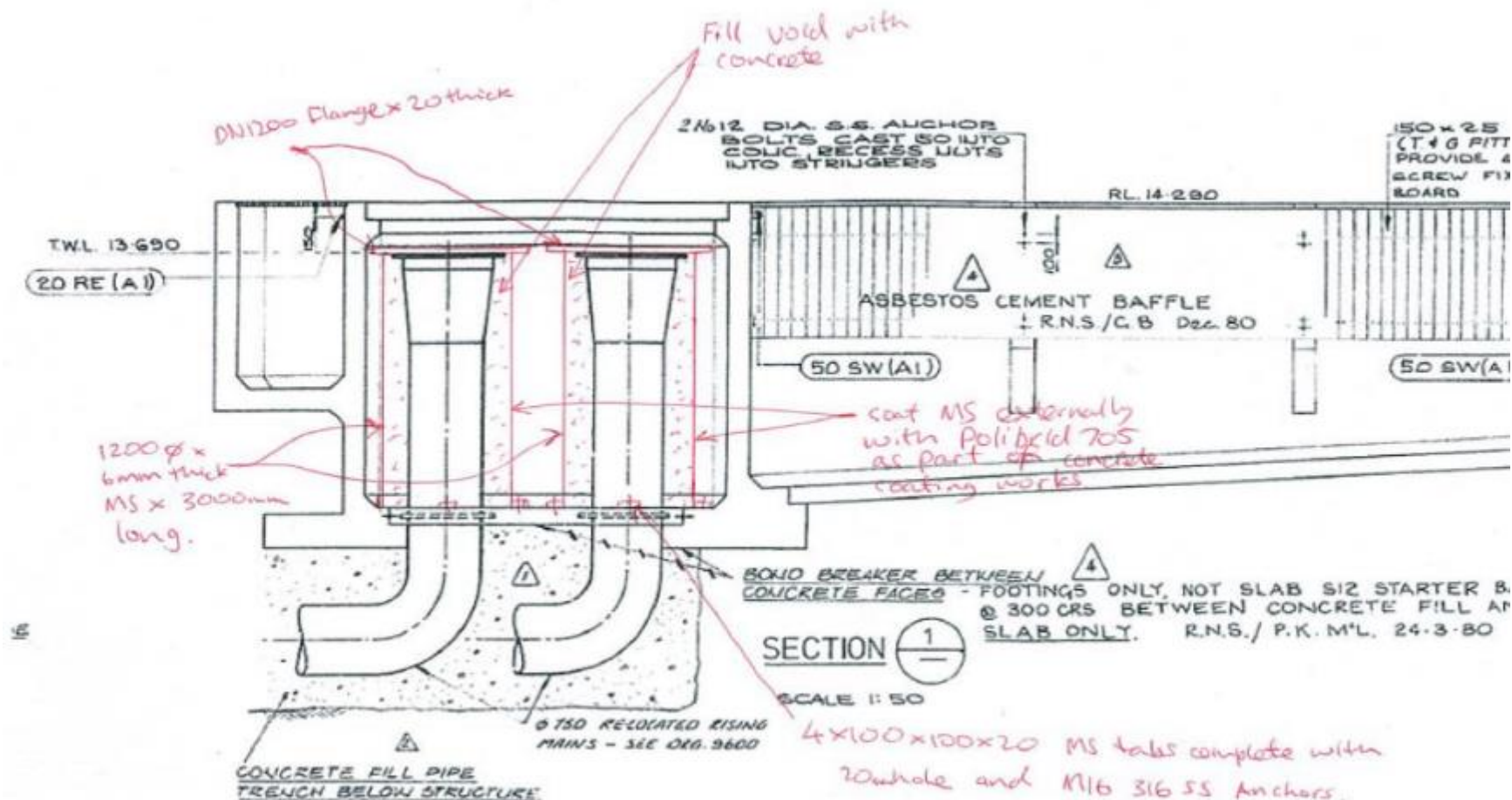
# Geographical Locations of Network Pump Stations

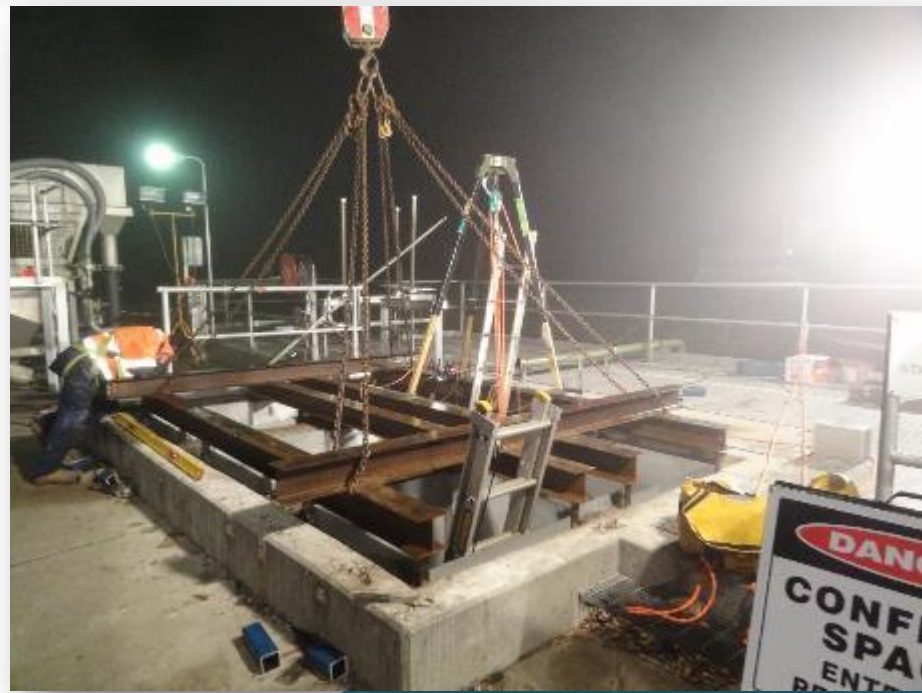
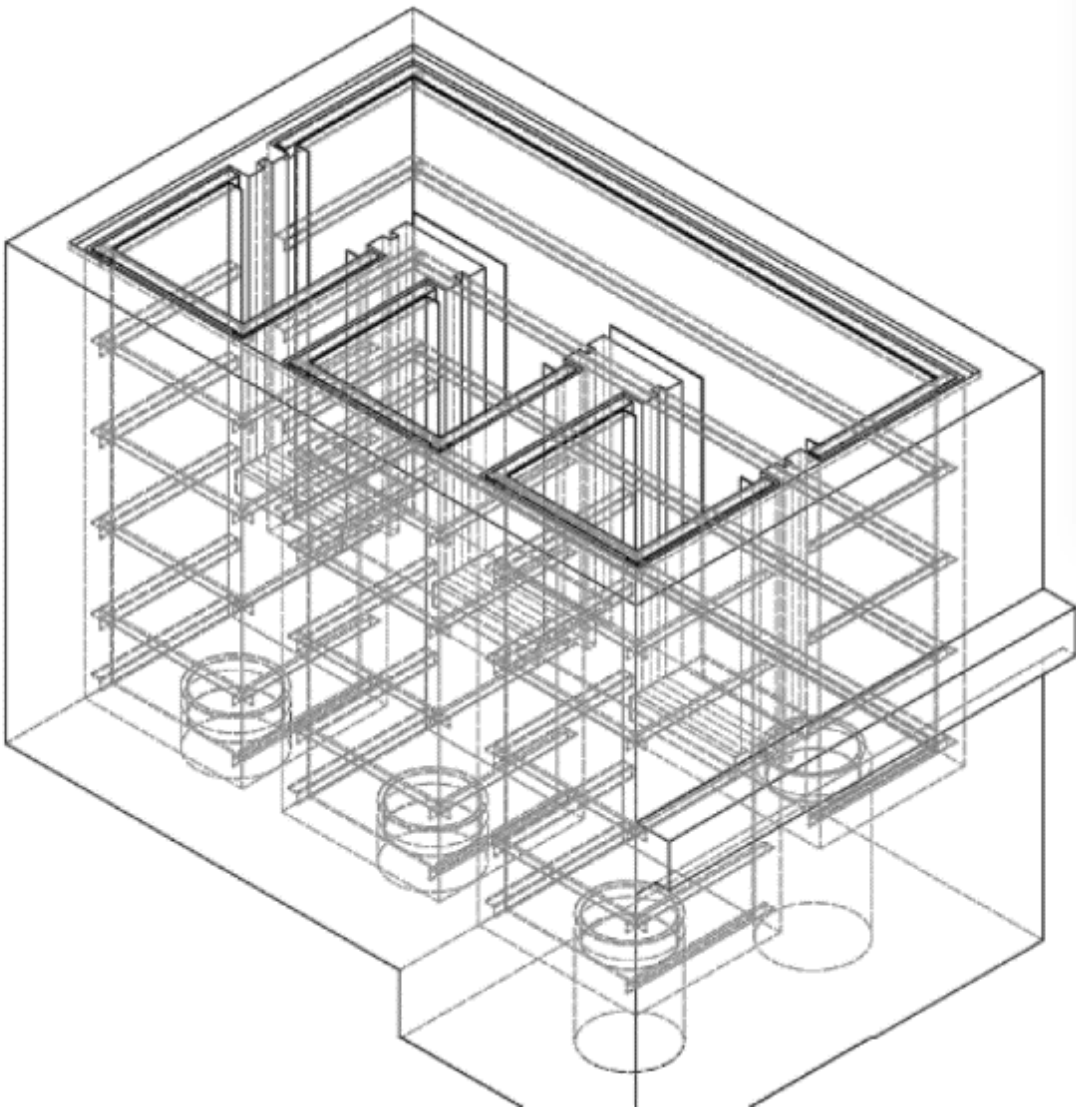


Team	Isolation point no.	WWPS source of inflow	Description of isolation point (refer to photos in Appendix A)	Confined Space Entry req'd?	Estimated Detention Time	No. Team Resources
Team A	6	Bennett's Green 2	6 x pump circuit breakers	N	>6 hrs	2
Team B	5	Belmont 6	4 x pump circuit breakers	Y	>6 hrs	2
	4	Belmont 4	3 x pump circuit breakers	N	2 hrs	
Team C	3i	Belmont South 1	2 x pump circuit breakers	N	5 hrs	2
	3ii	Belmont 3	2 x pump circuit breakers	Y	2.5 hrs	
Team D	3iii	Blacksmiths 3	2 x pump circuit breakers	Y	1.5 hrs	2
Team E	7	Swansea 3A	3 x pump circuit breakers	Y	3 hrs	2



# Planning and designing strategy









- Use of specialist intermediary products to repair concrete
- Polibrid lining
- Workshop trials to confirm effectiveness. Site trials.





3D modelling was used to make sure it would all fit







# Computer modelling for programming

# Monte Carlo assessment of weather

## PEER ASSESSMENT - HIGHWINDS OF RAIN DELAYS AFFECTING SHUTDOWNS AT BELMONT WASTEWATER TREATMENT WORKS PROJECT IN 2002

### Introduction

IWAC has engaged Hunter H2O to prepare a Project Plan for the delivery of an upgrade to Inlet works at Belmont WWTP. The implementation of these works will likely occur during March-June 2012. Following a risk workshop on 31/5/12, IWAC has requested that Hunter H2O consider and build into this plan the likelihood of delays occurring due to various environmental conditions.

Environmental conditions that may affect progress include:

- i) wet weather affecting progress of bypass works or potential shutdown on the day of the actual works;
- ii) wet weather causing a build up of wastewater in the sewer system which may cause a period of 'surge' (i.e. 'backflow') which prevents operational shutdown;
- iii) humidity affecting application of paint;
- iv) windy weather affecting either application of paint or installation of bypass pipework;
- v) windy weather affecting installation or removal of bypass pipework (i.e. M1).

This spreadsheet provides an estimate of the range of impacts for each of these sources of delay using a statistical approach.

### Methodology for shutdown and/or installation of bypass pipework affected by wet weather

Data has been taken from the Bureau of Meteorology in relation to rainfall (25yrs) as well as wind (1yr) for the months from March-June. (Refer to yellow data on subsequent sheets). This data is compared with the following criteria to determine the probability of a delay on any given day on the project.

### Criteria for works to proceed with bypass works (2 shutdowns)

IWAC Network Operations have advised that the Belmont Wastewater network may typically take up to 3 days of dry weather to respond to normal levels after a significant rain event >10mm. IWAC Network Operations have advised that the Belmont Wastewater network may typically take up to 3 days of dry weather to respond to normal levels after a minor rain event <10mm.

Days Event	-5	-4	-3	-2	-1	0
					Dry pre-condition Night of night shutdown	Shutdown
Rain criteria:	<10mm	<10mm	<10mm	0mm	0mm	0mm
On any given day, the probability of these rain conditions being met is:					32%	
Wind criteria to proceed with bypass works (2 shutdowns)						
Sale Island Australia note that many more than sufficient designable waves for a maximum wind speed of 30m/s - 33m/s.						
On any given day, the probability of wind exceeding 30m/s is 12%. As the works primarily occur at night, assume that only about half of these apply (7%).						
Therefore, the probability of wind conditions being met is:					91%	
Local criteria						
The probability of both rain and wind conditions being met is:					96%	

It is assumed that a delay will occur in works being interrupted by 2.5 days (i.e. two times the average), the 75% result for 2 shutdowns is: 47.5 days delay.

### Methodology for shutdown affected by wind and/or humidity

As to rainfall (25yrs) as well as humidity and wind (1yr) for the months from March-June. (Refer to yellow data on subsequent sheets). the probability of a delay on any given day on the project.

	32%
	91%
for rain:	97%
	94%

Simulation on any day, the 75% result for 40 days.

31 days delay





# Co-operative delivery model

## Engineer   Procure   Construction   Manage

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"><li>• Investigate</li><li>• Design</li><li>• Innovate</li></ul> | <ul style="list-style-type: none"><li>• Consult</li><li>• Tender</li><li>• Engage</li></ul> | <ul style="list-style-type: none"><li>• Manage contractor(s) as Principal of the contract</li><li>• Safety, Environmental &amp; Quality Management</li><li>• Deliver final asset to client defect-free</li></ul> |
|---|---|--|

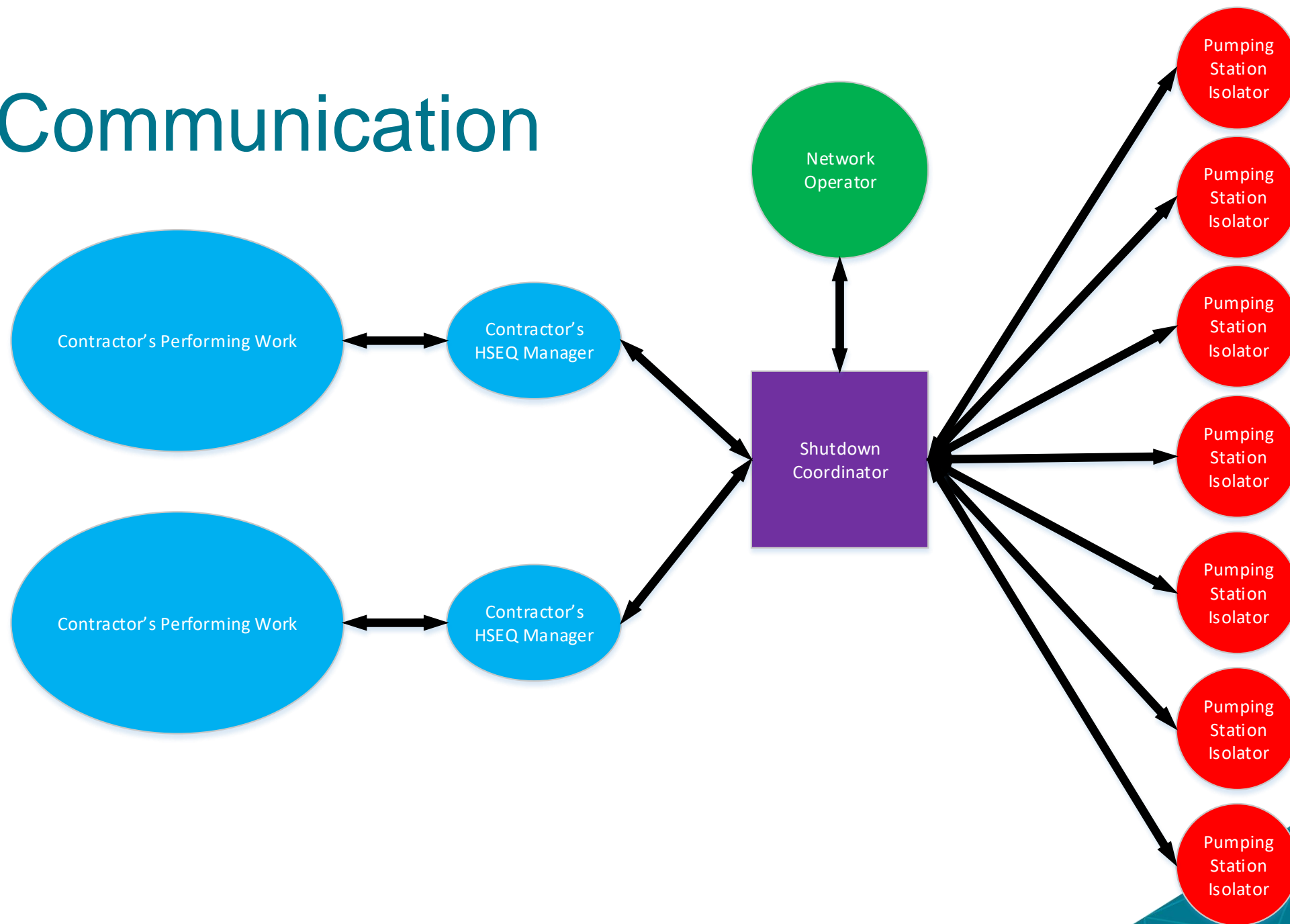


- Agile Post-it Notes
- Sorted the works into a series of <2 hour shutdown periods
- Agile plan: Prioritised tasks according to a critical path





# Communication



Edit Messages

- T

Team A: Bennetts Gr... 17/06/2016 >

Received
- T

Team B: Belmont 6 17/06/2016 >

Received
- T

Team C: Belmont 4 17/06/2016 >

Received
- T

Team D: Bel South 1 17/06/2016 >

Received
- T

Team E: Belmont 3 17/06/2016

Received
- T

Team F: Blacksmiths 17/06/2016

Received
- T

Team G: Swansea 3A 17/06/2016 >

Received
- GC TM

Team A:, Team B:, T... 17/06/2016 >

Okay to deisolate

AEALPHAS

ALFABE PTY LTD

CONFINED SPACE ENTRY

PERMIT

CONFINED SPACE WORK RECORD

SENTRY:  
Each entry is to record personnel below:  
I/We understand the nature and emergency procedure for a entry while people are working in a confined space

Name: Chris Elliott	Date: 12/06/16	Start Time: 12:00	End Time: 02:30	Signature: [Signature]
Name: Vaughan O'Reilly	Date: 12/06/16	Start Time: 12:00	End Time: 02:30	Signature: [Signature]
Name: Chris Elliott	Date: 13/06/16	Start Time: 04:00	End Time: 06:00	Signature: [Signature]
Name: Vaughan O'Reilly	Date: 13/06/16	Start Time: 04:00	End Time: 06:00	Signature: [Signature]

PERSONNEL WORKING IN A CONFINED SPACE:  
Personnel who enter and exit a confined space must record their details below.  
I/We understand the procedure for entry and work in a confined space and the protective measures and equipment to be used.

Name: J. Phelan	Date: 17/06/16	Start Time: 08:00	End Time: 12:00	Signature: [Signature]
Name: A. O'Connell	Date: 17/06/16	Start Time: 08:00	End Time: 12:00	Signature: [Signature]
Name: A. O'Connell	Date: 17/06/16	Start Time: 12:00	End Time: 04:00	Signature: [Signature]
Name: R. Green	Date: 17/06/16	Start Time: 08:00	End Time: 12:00	Signature: [Signature]
Name: A. O'Connell	Date: 17/06/16	Start Time: 12:00	End Time: 04:00	Signature: [Signature]
Name: R. Green	Date: 17/06/16	Start Time: 08:00	End Time: 12:00	Signature: [Signature]
Name: J. Phelan	Date: 17/06/16	Start Time: 12:00	End Time: 04:00	Signature: [Signature]

COMPLETION OF  
Sentry/Stand By Person

GROUP ISOLATION BOARD

[Yellow Sheet with Green Border]

DOCUMENT HOLDER

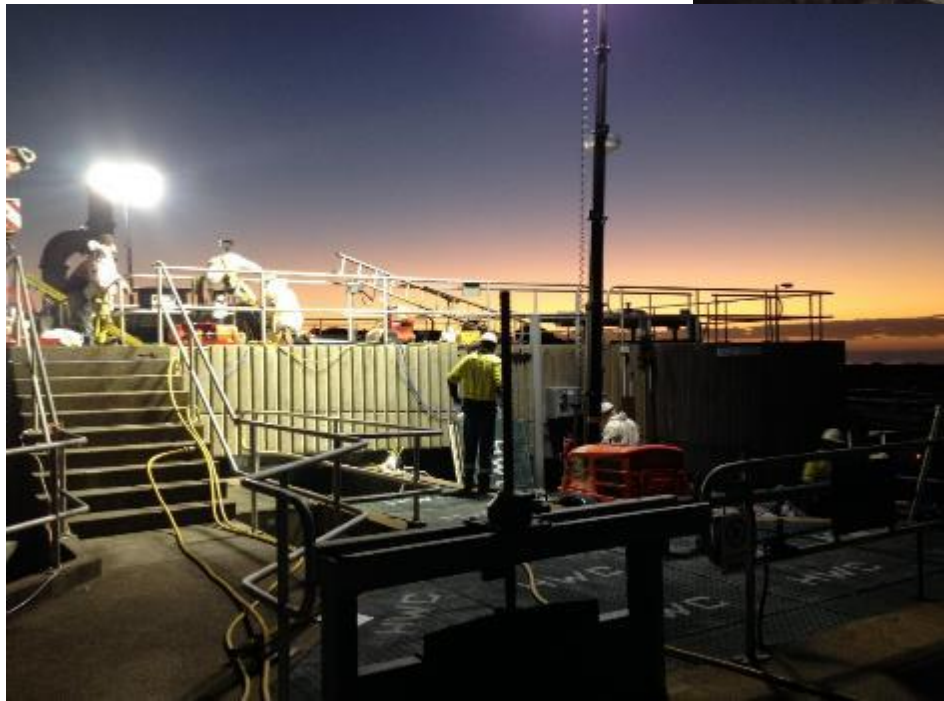
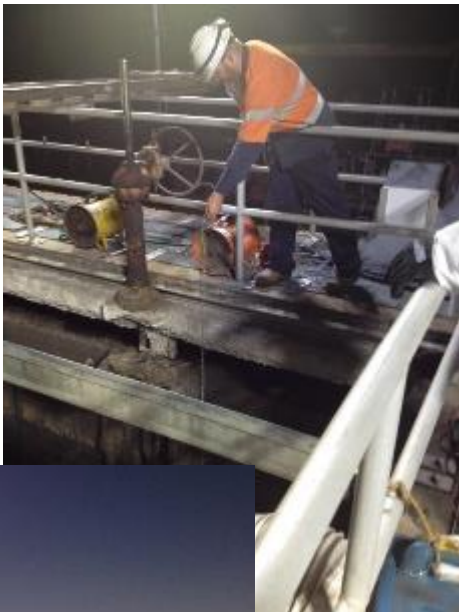
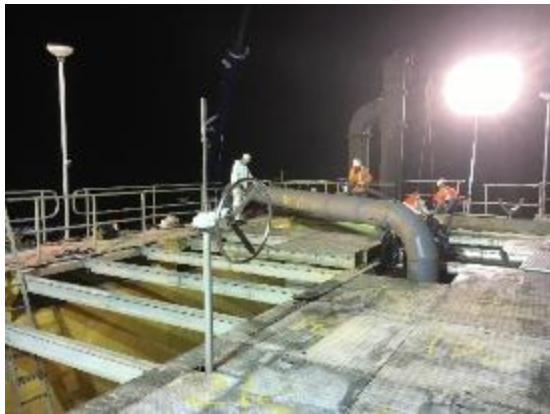
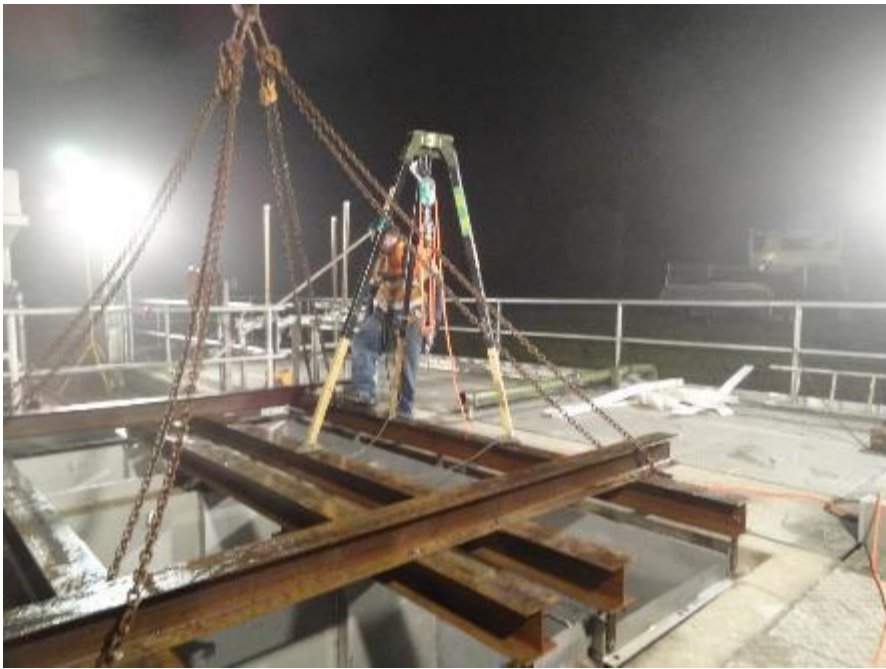




# Outcomes









# Lessons learned about risk planning

- **Macro-planning**

- Spreadsheet models
- Actual trials
- Monte-carlo techniques

- **Microplanning**

- 3D graphics
- Relatable / agile adjustment (post-it notes)

- **Implementation**

- Co-operative and flexible contract models
- Detailed communication plans
- If / then contingencies

