Clear Decisions from Murky Data :

Sediment Pond Rapid Bathymetry Survey and Desilting Prioritisation in Melbourne

Ensuring Greater Melbourne stormwater sediment ponds are routinely cleaned out is critical to maintain their function and protect our waterways and bays from sediment and its associated pollutants.

Melbourne Water

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WATER TECHNOLOGY

WATER_INSITES

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PROJECT OBJECTIVE:

To determine the current sediment accumulation, and therefore asset functional status, of 580 stormwater sediment ponds.

Novel rapid bathymetry assessments were developed to investigate asset function of the stormwater sediment ponds.

Information obtained will guide the sediment removal program.

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Sediment ponds - historical context

- Treatment of stormwater since 1994
- **Statutory obligations** under the Environment Protection Act (2021) and Clause 56 of the Victorian Planning Provisions.
- **Intercept, detain and treat** stormwater containing nutrients (N & P), gross pollutants, and sediment (and its associated pollutants).
- **Protect** associated wetlands and waterways from potentially damaging coarse sediments.

Sediment ponds current status

542 MW INSERVICE

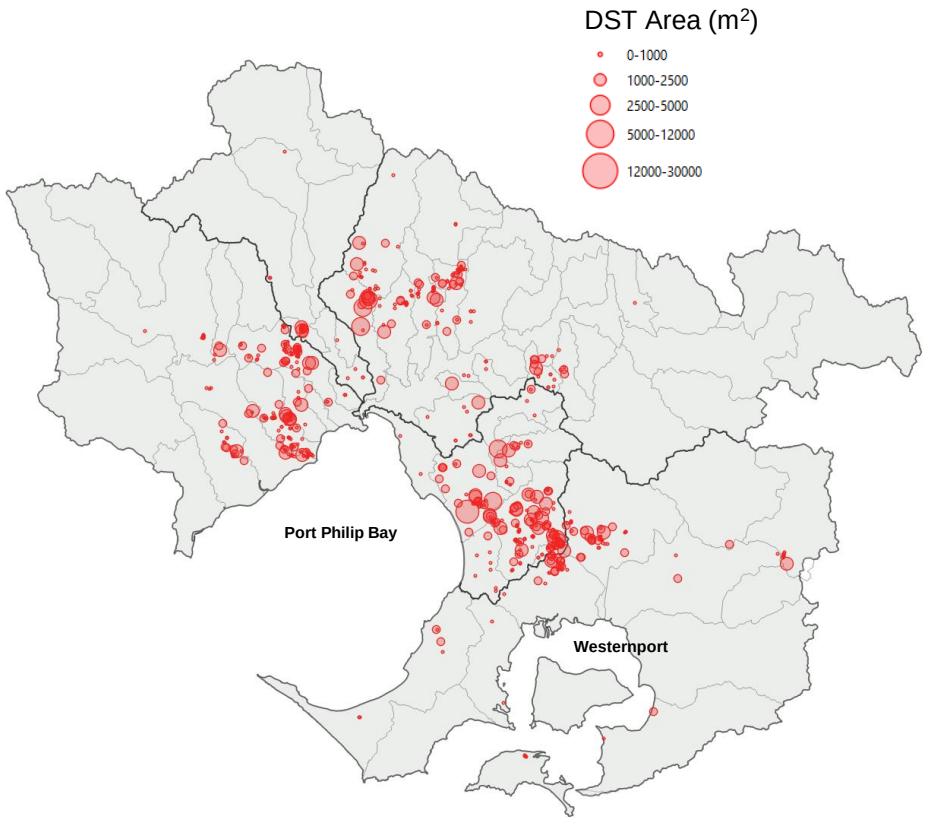
14 INSERVICE (SOON)

41 VARIOUS STAGES OF COMPLETION

597 assets

FUNCTIONAL STORAGE VOLUME (IN-SITU): ~330,000m^3

580 selected for this project



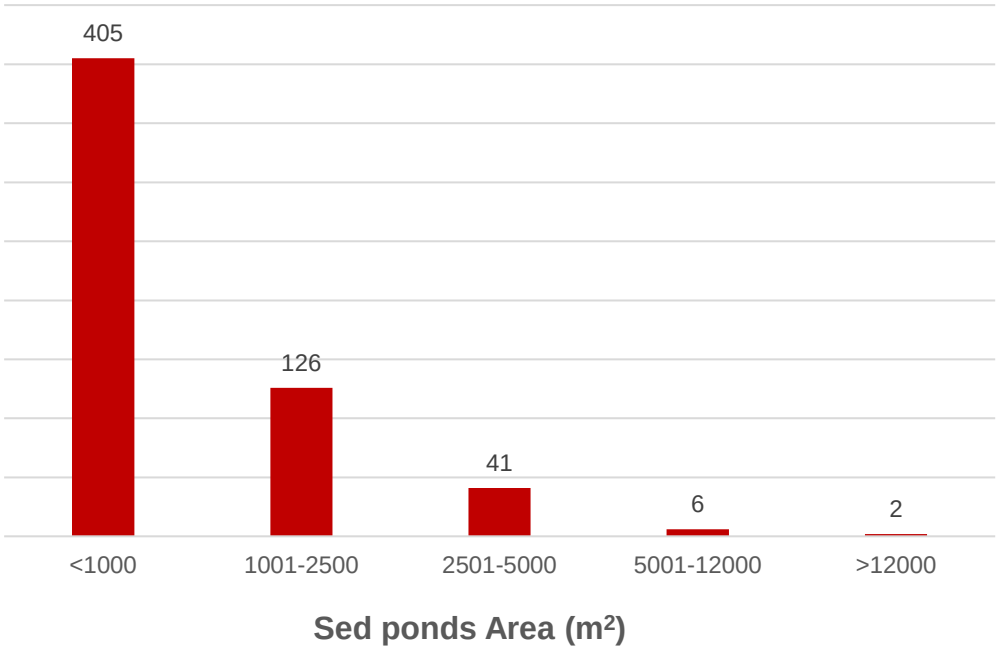
Sediment ponds' (DSTs) recent desilting program

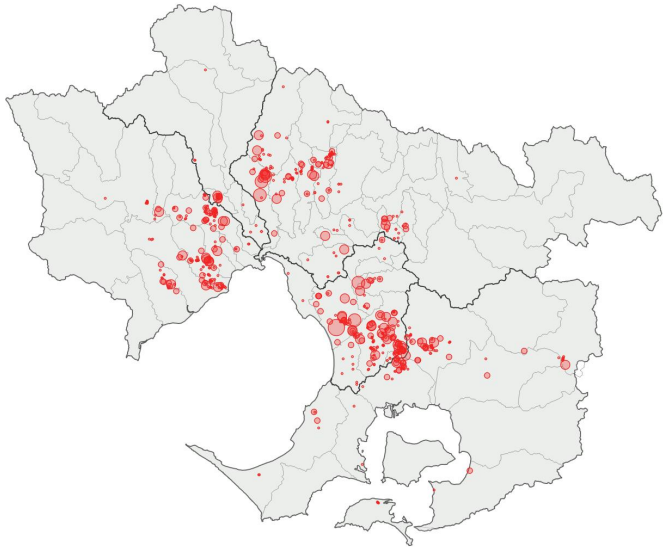
	Sediment removed (dry):	Program cost:
2015/2016	Ad hoc	$0.5 M
2016/2017	10,000 m^3	$2.4 M
2017/2018	10,000 m^3	$2.3 M
2018/2019	17,000 m^3	$5.5 M
2019/2020	35,000 m^3	$8.0 M
2020/2021	21,000 m^3	$6.0 M
2021/2022	22,400 m^3	$6.0 M

Key challenges in asset management

- Historically ad hoc, run to fail
- Variable fill frequency
- Estimating volume of sediment present
- Cost of managing sediment
- Limited knowledge of site conditions
- Understanding of network capacity

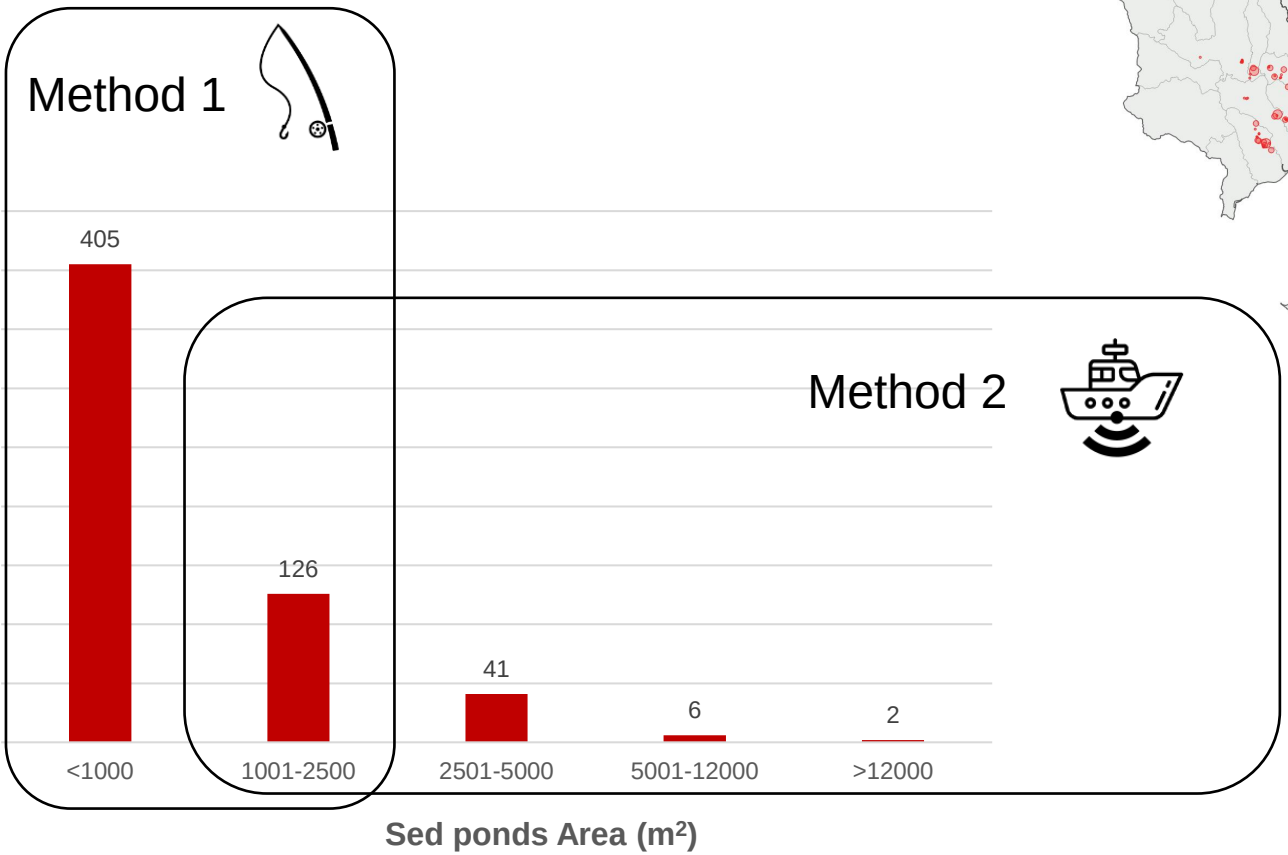
Distribution of asset size

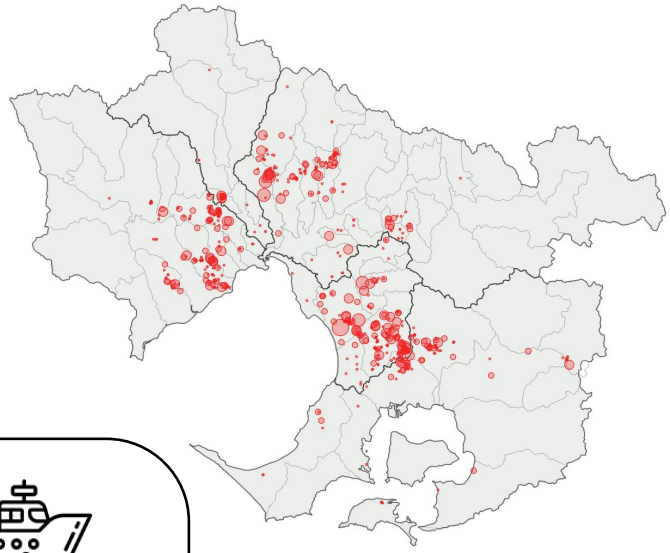




70% of the 580 project assets have a surface area <1,000 m^2

Distribution of asset size and method of assessment





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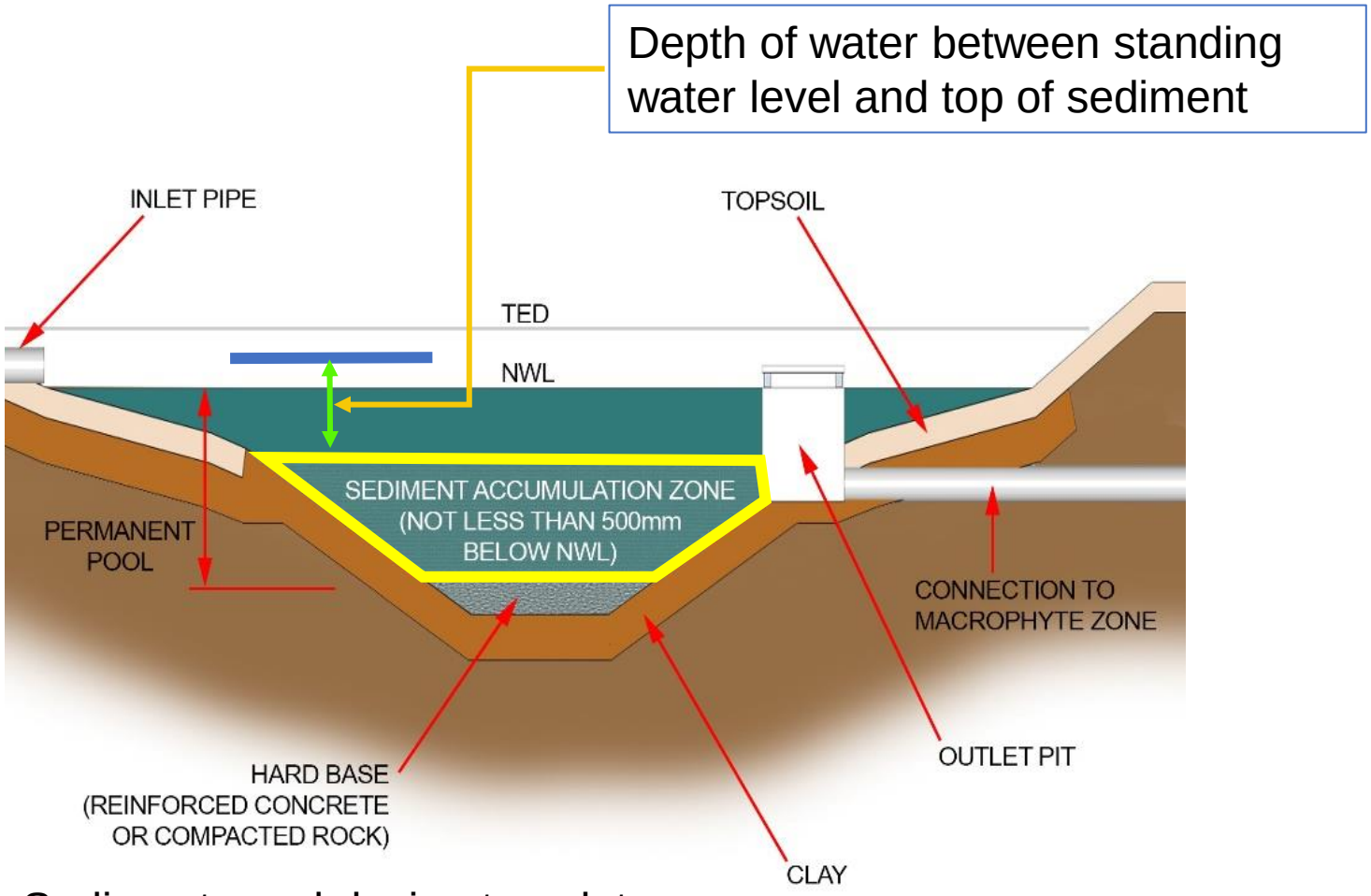
Sed pond design and assessment measurement



Sediment pond design template

Method 1 - Manual water depth measurement

A series of floats above a weighted ball was deployed into the ponds to measure the water depth. Numerous points can be measured rapidly, with a ~100 mm accuracy

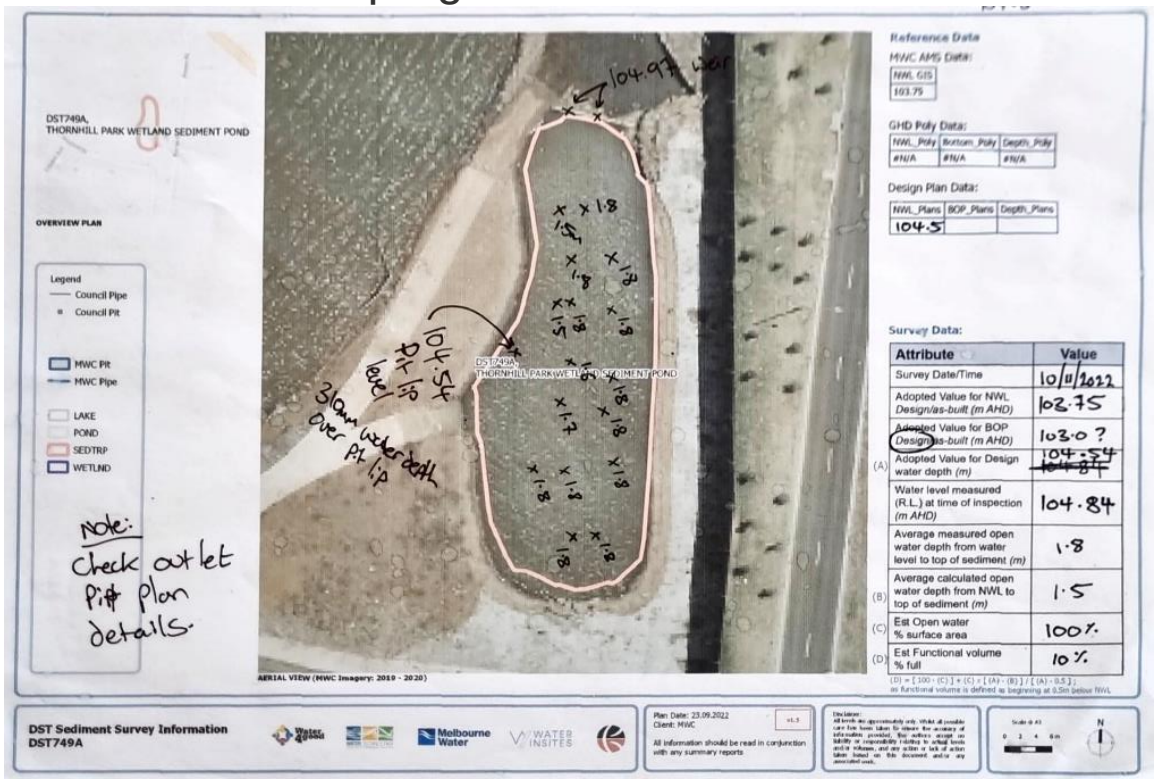
- No access to water body required
- Dense fringing vegetation can restrict access to all areas of pond
- Emergent vegetation (sparse) within pond was generally assumed to be 500 mm deep

Manual method field data records

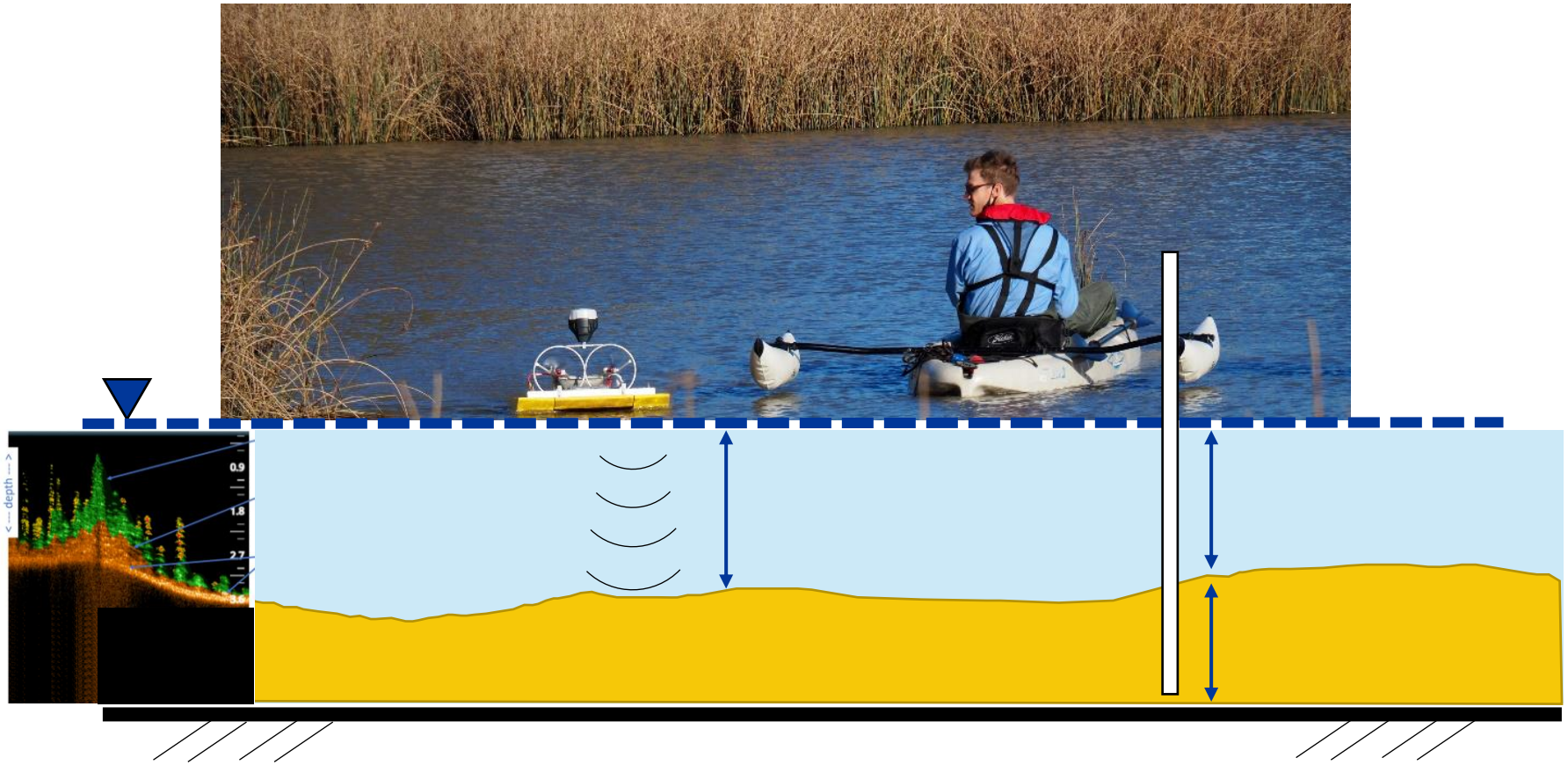
The measurements were documented on a site sheet with observations uploaded onto an **ARCGIS Survey123 form**

Percentage full (sediment accumulation) estimation determines the functional status of the asset and informs the maintenance program.

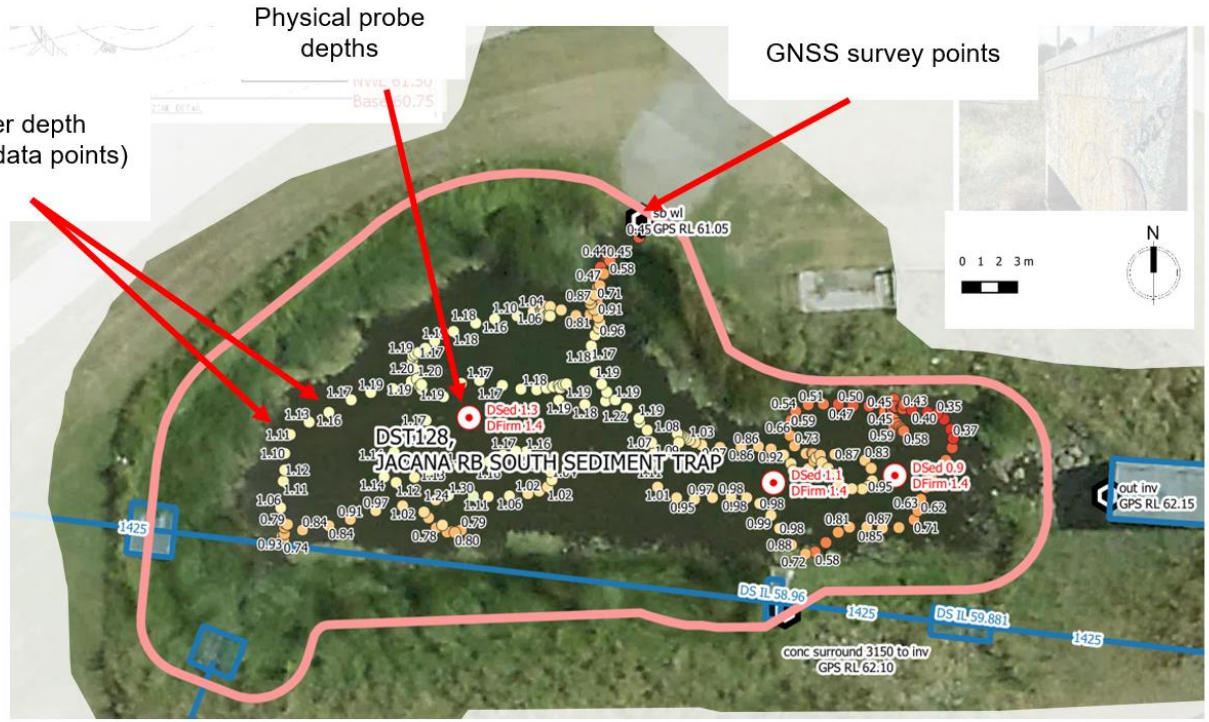
Other details of asset failure or data update requirements can be added to this site sheet for communication to the Asset Manager.



Method 2 - Remote Operated Vehicle (ROV) Echo Sounder Measurement


depth
0.9
1.8
2.7

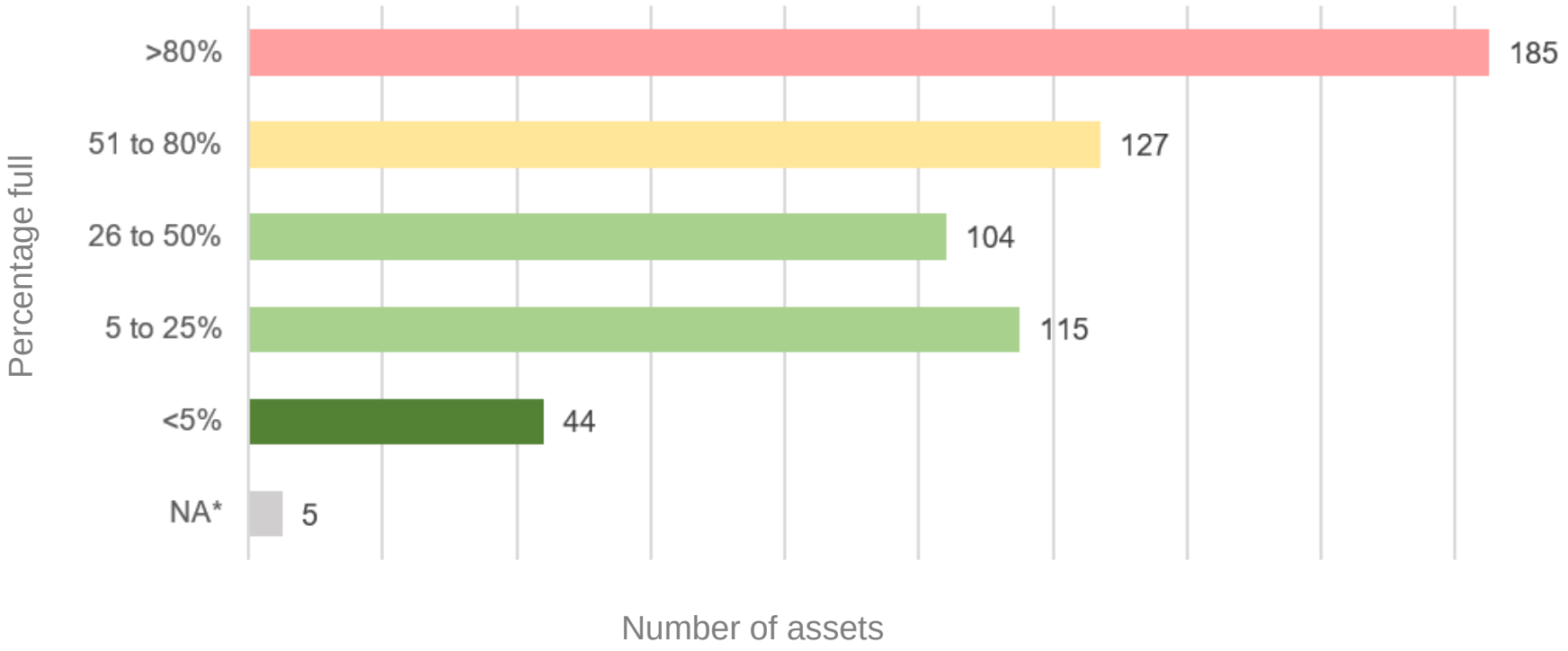
ROV echo sounder measurement records



Key data summary

Attribute	Value
Survey Date/Time	15/03/2022
Adopted Value for NWL *Design/as-built (m AHD)*	61.0
Adopted Value for BOP *Design/as-built (m AHD)*	59.7
Adopted Value for Design water depth *(m)*	1.3
Water level measured (R.L.) at time of inspection *(m AHD)*	61.05 (NWL+0.05)
Average measured open water depth from water level to top of sediment *(m)*	1.2
Average calculated open water depth from NWL to top of sediment *(m)*	1.1
Est Open water % surface area	80
Est Functional volume % full	30-40

Sediment accumulation results



Percentage full vs asset size

	Percent Full						
DST Area (m^2)	**NA**	**<5%**	**5 to 25%**	**26 to 50%**	**51 to 80%**	**>80%**	**Total**
0-1,000	5	32	59	64	83	162	405
1,001-2,500		11	38	23	37	17	126
2,501-5,000		1	14	15	7	4	41
5,001-12,000			3	1		2	6
12,001-35,000			1	1			2
Total	5	44	115	104	127	185	580

Percentage full vs asset size

- **Most DST assets that need cleaning-out/desilting are small assets (< 1,000 m^2).**
- Very few DST assets larger than 2,500 m^2 (only 6) were more than 80% full.
- **The two very large DST assets** (Mordialloc Creek and Dandenong Valley sediment ponds) which comprise together up to 7% of the total DST assets' functional storage volume **had low levels of sediment build-up at the time of the inspection**.

12,001-35,000			1	1			2
Total	5	44	115	104	127	185	580

Percent full vs years since last clean-out

		Percent Full						
Years Since Last Clean-out (as of 23/24)	**Program Year of Last Clean-out**	**NA**	**<5%**	**5 to 25%**	**26 to 50%**	**51 to 80%**	**>80%**	**Total**
1 year or less	2022/2023	data removed*						
2	2021/2022	1	1	13	15	5	9	44
3	2020/2021		6	22	20	18	25	91
4	2019/2020		4	16	16	9	23	68
5	2018/2019	1	8	9	16	19	13	66
6	2017/2018		1		2	3	1	7
7	2016/2017			2	2	1		5
more than 7 or no data	-	3	16	38	23	29	12	121
Total		5	36	100	94	84	83	402

Percent full vs years since last clean-out

		Percent Full						
Years Since Last Clean-out (as of 23/24)	Program Year of Last Clean-out	NA	<5%	5 to 25%	26 to 50%	51 to 80%	>80%	Total
1 year or less	2022/2023	data removed*						
6	2017/2018		1		2	3	1	7
7	2016/2017			2	2	1		5
more than 7 or no data	-	3	16	38	23	29	12	121
Total		5	36	100	94	84	83	402

- **almost half of the DST assets that had been cleaned-out/desilted in the last 3 years were shown to now be more than 50% full**, with 25% shown to be more than 80% full.
- 9 DST assets were determined as being >80% full despite the assets being no more than 2 years since it was last cleaned out/desilted.

Future direction of sediment management program

- Incorporate **survey method into program delivery**
- Further develop knowledge of individual ponds, and overall **functionality and risk profile**
- **Targeted management** to ensure stormwater quality objectives are met
- Potential to deliver the program at lower cost
- **Greater confidence in program forecasting**
- Engineering review of the large assets >5,000 m^2 to ensure they are required in their current configuration

Special Acknowledgements to:

- *Alison Rickard (Melbourne Water)*
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Thank you