Auditing and Maintenance Costing of Gross Pollutant Traps

Protecting our Urban Waterways - Water Quality and Managing Flow Impacts

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Abstract

Blacktown City Council with students completing their final year engineering project (thesis) from the University of Western Sydney conducted an audit and life cycle cost analysis of Council owned gross pollutant traps (GPTs). This project was overseen by Murray Powell from Optimal Stormwater.

The purpose of the project was to assess Council's existing gross pollutant device assets, provide a framework for data collection and interrogation, and provide Council with a series of recommendations for on ground works and an assessment of the cost effectiveness of the 160 GPT's owned, operated and maintained by Council.

Initially the project involved a review of Council's existing practices, and development of record sheets to provide for accurate and efficient data capture. These record sheets were used in a series of field visits for a select number of GPTs.

These field visits revealed a number of issues including access limitations, vandalism, and even lack of maintenance to the point of non-functionality. These issues were documented and later prioritised for action.

Whilst the field visits were conducted, mapping using Council's Geographical Information System (GIS) was used to identify catchment areas for the GPT's and land use types for each catchment.

Microsoft Excel was then used to create a macro enabled database for data capture. A user friendly interface was created to ensure useability whilst ensuring high data integrity. Ultimately this data can be used to determine maintenance schedules, assist with future GPT sizing and assessing the effectiveness of different types of GPTs in different catchments with different land uses. Technical data sheets can now be obtained automatically from the database, which will assist Council and its contractors when conducting inspections and cleaning the GPTs.

The information contained in this database was used to conduct an analysis on the maintenance cost effectiveness of some of the devices.

The outcomes of this project include the ability of Council to accurately monitor, inspect and clean their GPTs to maximise cost effectiveness and better plan for future GPTs.

This paper is presented in two parts, firstly an overview on the project and its stages and secondly an overview on how the database works.

Introduction

The Blacktown Local Government Area (LGA) lies 35 kilometres north west of the Sydney Central Business District. It has a total area of 246 square kilometres and is home to almost three hundred thousand residents, which makes the Blacktown LGA the third largest LGA in Australia by population. The Blacktown LGA is also continuing to grow with over 100,000 new residents expected to call the Blacktown LGA home within the next fifteen to twenty years. There is also a considerable amount of commercial and industrial development also planned.

Blacktown City Council within its boundaries has 160 gross pollutant traps which vary greatly in their size, shape and form. (This figure includes pit traps). A number of these have been installed by Council, however a large number have also been acquired by Council through development approvals. With further development expected in the Blacktown LGA, more GPTs and other water quality treatment measures such as bioretention systems are expected to be acquired by Council as they form a part of the treatment train approach in newly developed areas.

Council is now faced with two major challenges, firstly, can Council financially sustain the maintenance of all current and future GPT's, and secondly, once the GPTs reach their prescribed life expectancy will Council be able to provide for asset renewal.

To address these challenges Council required accurate and detailed information on its assets. To facilitate the gathering and organisation of this information Council engaged fourth year engineering students from the University of Western Sydney to conduct an audit and life cycle cost analysis of its GPTs. Optimal Stormwater Pty Ltd was hired to oversee and facilitate the field visits and provide technical advice for the project.

The purpose of the project was to assess Council's existing gross pollutant device assets, validate the existing information on each device, provide a framework for data collection and interrogation, provide Council with a series of recommendations for on ground works to improve performance, and hopefully provide an assessment of the maintenance cost effectiveness of the 160 GPT's owned, operated and maintained by Council.

This study intended to provide Council with a working knowledge of its GPT's for example removal rates being achieved, how each GPT responds to its catchment size and different land uses, and provide information on the overall cost effectiveness of each GPT.

The outcomes of this project include the ability of Council to accurately monitor, inspect and clean their GPTs to maximise performance and cost effectiveness and better plan for future GPTs.

This paper is presented in two parts, firstly an overview on the project and its stages and secondly an overview on how the database created can be used.

The Project and its Stages

The project included four main stages:

- Understanding Council's existing systems and creating a better solution for data management;

- Conducting field validation of Council's existing GPT assets;
- Conducting catchment mapping; and
- Conducting an analysis of maintenance cost effectiveness.

Understanding Council's Existing Systems and Creating a Better Solution for Data Management

Powell, M (2009) stated that issues understanding stormwater maintenance problems are not only often due to lack of communication between Councils and the private sector, but also the lack of communication between Council staff.

The objectives for the capture of data included:

- A user friendliness;
- The collection of relevant data required for life cycle costing;
- Ensuring a high standard of data integrity;
- Providing flexibility, so a new GPT data can be entered and existing data edited or a GPT can be decommissioned, while retaining all collected data;
- Production of Data Sheets for each device for inspections and cleaning activities; and
- Ability to run predetermined queries of the data

At Blacktown City Council, the Asset Design Section is responsible for the design of GPTs, the Asset Construction Section is responsible for their construction and the Asset Maintenance Section is responsible for inspections, cleaning, general maintenance and corrective works. The Asset Planning and Support Unit are responsible for capture and renewal of information on GPTs from an asset management perspective.

Under the existing system a number of different spreadsheets were used to capture information on the GPTs. These spreadsheets were inefficient and not user friendly. The most problematic issue with the spreadsheets was the integrity and the consistency in data entry. These spreadsheets were also incompatible with Council's Asset Management Database, ensuring all data was being manually entered twice and since 2005, not transferred to Council's Asset Management Database at all.

Through the analysis of the current spreadsheets and their usefulness and informative conversations with relevant Council personnel, solutions were formulated to create a functional database that was communicative with Council's Asset Management Database. Planned upgrades to Council's computer platforms meant that a direct upgrade to Council's Asset Management Database may have been difficult to achieve as such a macro enabled excel database was created to enable a direct data transfer into Council's Asset Management Database. This ensured only minor amendments to the fields used in Council's Asset Management Database were required.

With the data centralised and organised, areas of information that were missing could be identified.

Conducting the Field Visits

The field visits played an integral role in this project as they were used to ensure locations were mapped and accurate, information was recorded on the GPTs such as model, type, capacity, access requirements, maintenance issues, rectification works, works for improved performance, and any other relevant information. The field visits focused on assessing the accuracy of existing data and filling of the information gaps that existed.

The field visits included the following key tasks:

- Ensuring location maps on Council's Asset Management Database were correct. Any incorrectly mapped GPTs were noted and new locations mapped which were recorded by noting information such as distance from cross streets and landmarks.

- Ensuring accurate documentation of the GPT characteristics such as type, and model number. This involved taking measurements such as, depth to base, depth to invert, length & width, screen height, screen width, sump storage volume, pipe diameters and any other relevant information.

- Assessing the adequacy of access for inspection and cleaning. The access requirements such keyed entry, truck access requirements and street of access were reviewed for each site. Any occupational health and safety issues and additions or amendments required for the existing access notes were identified.

- Assessing the inspection and cleaning requirements of each GPT. This included recording equipment requirements such as Gattic Lifters, Allen Keys, Socket Sets and an appropriate survey staff. It also identified where cleaning may require additional actions such as cleaning of exclusion bars, macrophyte removal, dewatering, etc.

- A rectification list was also created that addressed any works required due to vandalism, blockage, cleaning damage, poor access design, hydraulic problems, corrosion, installation contractor errors, screen replacements required, vegetation induced limitations, and uncovering buried access lids.

The field visits were integral to the success of the project and established baseline information from which Council can work. This took 8 days in the field covering between 8 and 12 GPTs per day. (Pit traps were left for Council to inspect later). This provided great capacity building and education of Blacktown City Council staff, and the students, in all facets of GPT design and maintenance.

In some cases GPTs did not exist, in others the structure was not a GPT, some had been approved as one type yet a different device had been swapped by the contractor and the also turned up several GPTs that were previously unrecorded by Council.

With the field validation complete, it was possible to understand which devices were working as desired, and which weren't.

An example of some of the GPTs inspected, a summary of issues and general recommendations is provided in Table 1. This table includes the issues and recommendations for some of the GPTs inspected that required rectification works. Many GPTs were inspected that were in good working order.

In general, about 50% of the devices inspected required structural works and/or extensive cleaning. About 40% required normal cleaning, and about 10% did not require works or cleaning. It is noted however, that Council has a cyclic inspection and cleaning schedule and that the 40% that required normal cleaning may have been due to be cleaned post inspection. It should also be noted that not all 160 devices owned and maintained by Council were inspected.

Table 1 GPTs inspected, their issues and general recommendations

GPT Ref	GPT Type	Location	Issue	General recommendations
01	Skirted boom	Bells Creek Bridge, Richmond Road, Hassall Grove	• The boom is currently not working due to an overload of litter, sediment and vegetation growth. • Sediment build up has caused the skirt to be ineffective as the boom is no longer floating. This is causing a damming effect of the outlets as water cannot flow freely under the boom. Currently the outlets are 50 per cent submerged. • Litter/trash build up occurs at the centre of the boom. The boom is approximately 15 to 20 meters wide making it difficult to reach litter that gathers in the middle of the boom. • No access to the site for cleaning via Richmond Road. Current access is via Colebee Crescent which requires vehicles to traverse 0.5 kilometers along the creek bank.	• An immediate clean to remove the massive build up of litter and sediment. This will require manual cleaning of all litter followed by use of a long reach excavator to remove sediment and reduce vegetation growth. Enough sediment should be removed to ensure the skirted boom is fully floating i.e. approximately one meter in depth. • Sediment removal should be carried out at least annually. • Reconfigure the alignment of the boom to direct floatables towards the bank making it easier to clean. • Create a small offline storage area adjacent to the boom, and a cleared area for vehicle parking. • Provide a stabilised gravel driveway access to the site via Richmond Road on the northern side of the creek.
05	Nicholas Ski Jump	Redgum Circuit, Glendenning	• This device is installed with a mesh panel underneath to trap sediment that drops through the Ski Jump. Whilst full (current state) it cannot be opened as the swinging mechanism is hindered by the sediment build up. • Macrophyte build up at the outlet of the device is impeding the water flow and encouraging ponding. This build up inhibits maintenance and cleaning of	• Repair or replace the missing components of the device. Since the product is no longer sold, custom repairs from a steel fabricator will be required. • Immediately clean the mesh area below the device using suction cleaning. Requires regular future maintenance. • During cleaning need to determine the depth of storage area below the mesh.

			the device. • Device is very exposed to the public and has been subject to vandalism and requires repair. The front overflow flap is missing as is the top section and lid of the storage area. It is representing a considerable occupational health and safety risk.	• Removal of macrophytes to provide for water flow away from the base of the device. This will need to be completed on a regular basis.
32	Pit insert	Main Street, Blacktown	• Device damaged and bag destroyed. This pit trap no longer actually exists.	• Decommission any remaining device components. • No other inlets have pit traps in this location have pit inserts, need to investigate options, as this site also had location difficulties requiring traffic management for cleaning.
38	Pratten Trap	On outlets to Little Creek underneath Jersey Road, Emerton	• The device is undersized. It includes six 600 millimetre diameter Pratten traps to treat, discharge from five outlets including three 2100mm diameter pipes. • System prone to rapid blocking due to the small screening area compared to the potential discharge through the system.	• Pratten traps are already regularly monitored and cleaned to minimise blockage. This maintenance regime should be continued or increased. Blocked cages result in deposition in the upstream system, ponding, then overtopping and loss of floatables and neutrally buoyant pollution. • During cleaning, the area in front of the Pratten traps should be de-watered and cleaned prior to removal of the baskets. This could be achieved using suction cleaning or de-watering with a small submergible pump and cleaning afterwards with a small bobcat or similar machinery. • Revise device type and potentially upgrade to something appropriate to the catchment size, flows and pollution load.
40 and	Ecosol RSF4900	Concrete lined	• The Ecosol RSF 4000 series in their design require flow to enter the device with several meters of	• Move the trash rack/weir six metres upstream and construct a smaller channel that directs flows into the GPT.

103	and trash rack	channel, Quakers Hill	straight flow and with minimal turbulence. In this location, the Ecosol has flow funnelled into it via a weir (which also functions as a trash rack) and is angled across the concrete channel creating turbulent flow that travels down the left hand side. • The exclusion bars have been installed directly over the smallest area on the opening of the device. These are prone to blocking and creating even more turbulence which further inhibits the performance of the device. • One week after cleaning, with one storm having happened, the screens were noted to be blocked, the device was in bypass, and it was less than 5% full. • The GPT is undersized for flows being received from the 4m x2m channel. It is designed for a 900mm pipe.	This will minimise turbulence levels and increase efficiency of the GPT. But this would be at significant cost compared to the benefits • Move the exclusion bars away from the entry of the GPT to between the concrete channel wall and the weir. The area should be significantly increased and a better design used, since the current design is prone to blockage. • Decommission device, trash rack and bandalong (PCD 51) which is providing pre treatment upstream and redesign a larger device that can effectively treat the large flows.
51	Bandalong Litter Trap	Concrete lined channel, Quakers Hill located upstream and acts as a pretreatment to PCD 40	• Bandalong Litter Traps are designed to float in waterways or channels capturing floatables. The current channel has no or minimal low flows leaving the Bandalong Litter Trap stranded on the concrete base. The channel experiences high flows periodically which swamp the device. • The device has been vandalised and has graffiti on it as well as damage to the skirt.	• Decommission Bandalong Litter Trap and move to another more suitable location.

		and 103	• Device mainly traps PET bottles with a large amount of pollutants easily bypassing the device. Unlikely to be providing the required pre treatment for PCD 40 and 103.	
116	CDS	Townsend Road, Ropes Crossing	• Installed to treating stormwater runoff from carpark. However, carpark has been removed and is now a grassland area. • Device was full above invert with pollutants.	• Conduct a thorough clean. • Investigate the local drainage to determine whether GPT is still treating stormwater runoff. If non operational GPT should be decommissioned.
118, 119 and 120	Three Cleansalls	Industrial estate, Arndell Park	• No access due to current construction for a new development. • No maintenance completed. The Cleansalls are non operational as they are full and in complete bypass. • The bypassing is filling the basin with sediment • Basin into which the Cleansalls discharge is leaking on the north eastern side wall.	• Create access for vehicular access. Organise access through property being developed and negotiate access requirements or establishment of an easement. • Conduct a thorough clean and add to maintenance schedule. • A site inspection to determine appropriate course of action in order to rectify the leaking basin.
112	Ecosol RSF4300	Parklea Leisure Centre carpark, Parklea	• The device installed differs from the Works as Executed Drawings submitted for this site • The device is completely full of sediment, indicating it was not cleaned after construction. Due to the nature of the device and the functionality of the screen, it is highly likely that sediment has seeped through the screen and	• Conduct a full clean including removal and cleaning behind the screen if possible, and add to maintenance schedule. This task may not be possible due to the size restrictions. • Should GPT not be possible to clean, it will need to be decommissioned and the originally approved GPT installed. • Remove the concrete in the inlet pipe.

			collected behind them, rendering the device non-operational even if it was emptied. The device is too small for a person to enter and release the nuts holding the screen on. A person cannot get in the 450x450mm access cover over the outlet to get into the back of the device to access behind the screens. • Concrete has set in the inlet pipe (during installation) impacting on inflow.	
No ref.	CDS P2018	Industrial estate, Arndell Park	• GPT was discovered as part of the audit. • GPT is 250% full and has sediment has built up behind the screen. • Limited cleaning access with a locked gate providing access through private property possibly an existing easement.	• Resolve access rights and create easement if required. • Conduct a full clean and possibly replace screen if required. Remove sediment build up behind screen. • Add to PCD listing , monitoring and cleaning program

Conducting the Mapping

Initially, AutoCAD was used to map the catchment boundaries for each GPT. A Blacktown City Council Area map was used, that included information on contours, the drainage network and GPT locations. AutoCAD is a computer aided design or computer aided drafting software application for 2D and 3D design and drafting.

Once the catchment boundary maps were completed, a land use map that was developed for Council's State of the Waterways Management Plan 2005 created an additional overlay.

Once the catchment boundary maps were completed and the land use overlay created, it was imported into ArcGIS and aligned using aerial photography and lot boundaries. ArcGIS is an integrated collection of GIS (Geographic Information System) software products for building a complete GIS.

Each land use was then assigned different percentage imperviousness. Twelve land use classes were defined and have impervious ratings ranging from 5% to 100%. For example, the land use of bushland was assigned 5% imperviousness which means that 5% of the rainfall on this area will flow into the waterways. Roads however were assigned 90% imperviousness, with the remaining 10% accounting for road reserves and median strips that are pervious. The impervious rating for the land use classes was based on the amount of grass or vegetated land and land present in that particular land use type.

The catchment areas and land uses were recorded in an excel spreadsheet. This information was added into the database once created.

Maintenance Cost Effectiveness Analysis

In principle, using a lifecycle cost analysis and removal efficiencies, the effectiveness of each GPT can be determined and this knowledge used to make informative decisions on future GPTs and better plan for future maintenance costs, a critical element which is often overlooked by Councils.

Initially it was planned to base the analysis of lifecycle costs on the Australia Standard for Lifecycle Costing AS4536.1999, and the methodology employed by North Sydney and Willoughby Councils (2004) which assessed the life cycle costs of a number of devices and provides a comparative assessment of different GPTs which defines life cycle cost (LCC) as:

LCC = AC + S&MC + RC + DC

Where:

AC = Acquisition Costs

S&MC = Servicing and Maintenance Costs

RC = Renewal and Adaptation Costs

DC = De-commissioning Costs

Unfortunately due to issues with missing data the accuracy of analysis was compromised. Upon review, the primary concern was the cost of future maintenance and as such, the lifecycle analysis was altered to an analysis of the maintenance cost effectiveness of the GPTs. Additionally, the maintenance cost effectiveness for some GPTs could not be calculated due to inconsistencies in data collection such as maintenance costings and pollutants removed. Generally only maintenance datasets for a GPT were used if they were collected for greater than 12 months and demonstrated consistency in data collection. Council is currently further developing the work done as part of this project with another in-house student from University of New South Wales to fill any data gaps.

As such a cost effectiveness ratio (CER) was employed which is defined by Brisbane City Council (2002) as:

CER = LCC ($/year) / Pollutant Removal Efficiency (tonnes/ha/year)

This was refined to develop a CER purely based on maintenance costs per year such that:

CER = MC ($/year) / PRE (tonnes/ha/year)

CER = Maintenance Cost Effectiveness Ratio

MC = Maintenance Costs per year

PRE = Pollutant Removal Efficiency

The Pollutant Removal Efficiency is calculated through a simple calculation of:

PRE = WPR / CA

PRE = Pollutant Removal Efficiency (tonnes/ha/year)

WPR = Weight of Pollutants Removed per year (Measured in Tonnes)

CA = Catchment Area (Measured in Hectares)

and

Maintenance costs per year were calculated through:

MC = (IC x IF) + (CC x CF) + DC

IC = Inspection Costs ($/inspection)

IF = Inspection Frequency (Amount of Inspections per year)

CC = Cleaning Costs ($/Clean)

CF = Cleaning Frequency (Amount of Cleans per year)

DC =Disposal Costs (Total sum of disposals throughout the year)

These equations provided a maintenance effectiveness ranking that could be used in considering future GPT selection. Generally devices with the lowest CER are preferred, meaning that they captured more pollution and were not excessively priced to clean.

Table 1 illustrates the maintenance CER for the GPTs assessed. Low is good, High is bad

PCD ID	PCD Type	Catchment Area (ha)	Maintenance Costs ($/year)	Pollutants Removed (te/yr)	Pollutant Removal Efficiency (te/ha/yr)	Cost Effectiveness Ratio ($/te/ha)
PCD50	CDS Unit	0.20	1538	1.15	5.75	267
PCD60	Pit Insert	1.35	69	0.20	0.15	466
PCD101	CDS Unit	1.20	672	1.32	1.10	612
PCD61	Pit Insert	1.35	59	0.10	0.07	803
PCD49	Humegard	0.84	1574	1.53	1.83	863
PCD62	Pit Insert	2.25	77	0.20	0.09	866
PCD63	Pit Insert	2.25	59	0.10	0.04	1338
PCD64	Pit Insert	2.25	59	0.10	0.04	1338
PCD36	Ecosol	2.50	2465	2.50	1.00	2465
PCD48	Humegard	1.82	1528	1.05	0.58	2649
PCD05	Nicholas Ski Jump	4.92	561	0.65	0.13	4246
PCD28	CDS Unit	15.17	2319	6.85	0.45	5135
PCD10	CDS Unit	36.58	4247	19.08	0.52	8143
PCD31	Humegard	6.79	4439	3.61	0.53	8350
PCD03	Humegard	12.51	3762	5.16	0.41	9120
PCD18	CDS Unit	28.50	2325	6.92	0.24	9576
PCD02	GPT	60.01	3004	9.28	0.15	19434
PCD53	Humegard	38.89	3557	5.36	0.14	25825
PCD08	Trash Rack	53.19	7182	5.71	0.11	66901

From the above table we note that:

- of the 160 individual devices, a little over 10% had enough *data integrity* on cleaning, costs, removal rates and catchments, to calculate a CER.
- The results varied by more than 2 orders of magnitude.

- Removal efficiencies for the same devices can vary widely for different sites, conditions, sizings, loads, etc. Ie device efficiency is very site related.

- There are only vague trends, that do not support any kind of predictive tool for GPT selection at this time.

- Of note, the most common removal rate in the GPTs was in the order of approx 0.5 te/ha/yr.

This process will have more defined trends and greater validity when the other 90% of devices are monitored and cleaned over the next 12 months, to make the sample size much larger. The quality of cleaning information can also be confirmed during this time.

The data will be able to be further interrogated once the catchment mapping is included. The catchment maps combined with existing land use mapping will assist with prediction of flows and pollution loads based on imperviousness and zoning. This will add another layer of information and assist in explaining any anomalies between similar devices.

Part 2 How the Database Works

The objectives for the development of the database included;

- A form that is user-friendly and easy to use;

- The collection of relevant data that is required for life cycle costing;

- The data integrity is of a high standard;

- A new GPT data can be entered, and also edited;

- A GPT can be decommissioned, while retaining all collected data;

- It can produce Data Sheets for each device; and

- It can run predetermined queries of the data.

To achieve these objectives, the database was created using a range of Excel worksheets which can be stored and manipulated. This includes:

- An Administration form;

- Input sheets for inspection and cleaning; and

- Data sheets.

In the database GPTs are referred to as PCDs or Pollution Control Devices which is how they are represented in Council’s Asset Management System.

Administration form

The administration form has many functions. Its principle function however, is the capture and storage of information on the asset. The form allows new GPTs to be added and all associated relevant data such as model number and catchment size to be captured.

Restrictions have been placed on the database to only accept a certain type or range of values to decrease the risk of human error during data entry. The database is also password protected to further ensure the integrity of the data.

Once the user is logged on the user has four main options to choose from:

- Add PCD;
- Edit PCD;
- Remove PCD; or
- Add items to the drop down menus.

These options are shown in Figure 1.

Figure 1 Screen shot of the four options on the Administration Form

To add a PCD, the user selects the add PCD button. Once selected a screen loads with an array of text boxes and dropdown menus for data entry. These are displayed sequentially, once the first box is completed, the second box appears. Due to the considerable amount of data entry required the screen has been split in two to enhance its user friendliness. Figures 2 and 3 show screen shots of the data entry requirements. The Next button circled in red in Figure 2 takes the user to the next screen.

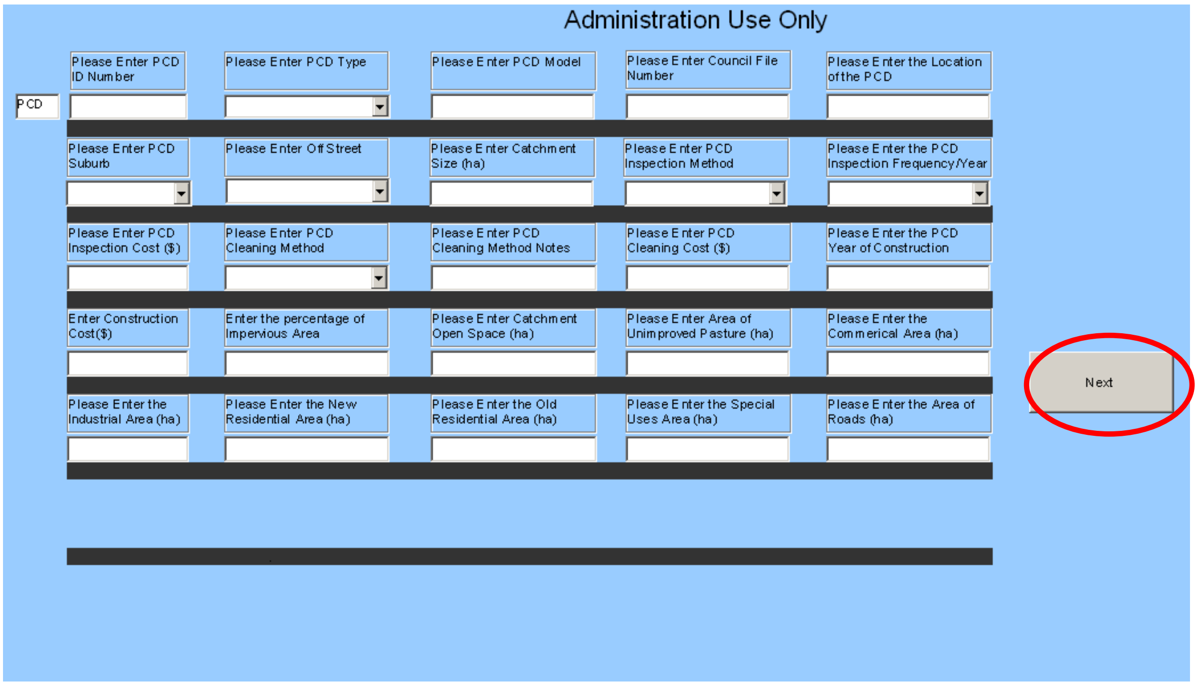


Figure 2 Screen shot of the first screen for adding a PCD

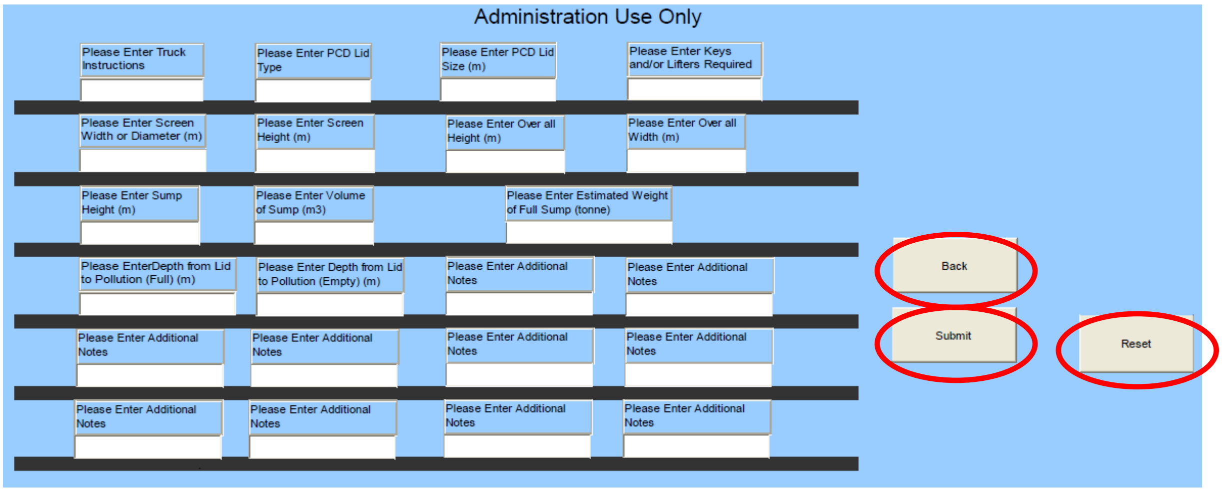


Figure 3 Screen shot of the second screen for adding a PCD

Once all the data entry is complete, the user clicks on the Submit button circled in red in Figure 3. This sends the data to the spreadsheet for record keeping and from which the data can be viewed, amended or queried. The user can use the Back button to return to the previous screen and edit or add further data or can use the Reset button to clear the form and return to the original screen. These are circled in red in Figure 3.

Once the user clicks on the Submit button, the program checks whether that PCD ID already exists. If that PCD ID already exists the user will receive an error message shown in Figure 4 and be prompted to enter a new PCD ID.

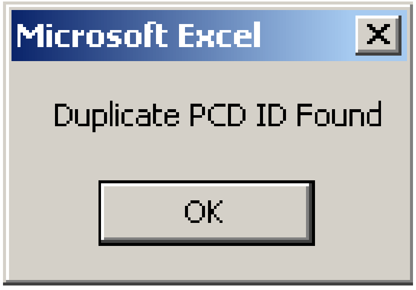


Figure 4 Example of an error message if PCD ID entered already exists

Other error messages also appear such as that shown in Figure 5 to ensure the integrity of the data entered.

Also certain textboxes only allow numerical values, so if the user tries to enter other data types, a message box appears as shown in Figure 5, and the program removes the last incorrect data type.

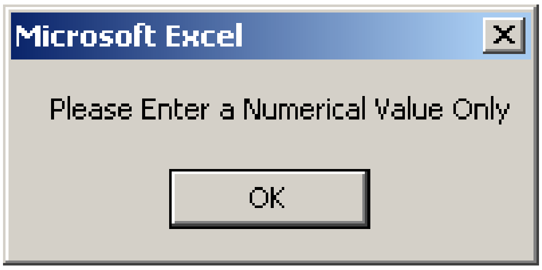


Figure 5 Example of an error message when the incorrect data type is entered

Once the data has been entered the data elements are distributed to a network of spreadsheets that sit behind the database's user interface. For example the PCD ID, PCD Type, Year of Construction and Construction Cost are distributed to a single spreadsheet. This data contained in this spreadsheet can be later interrogated to estimate cost effectiveness of the PCD and validate life cycle costs.

To edit a PCD the user clicks on the Edit PCD as shown in Figure 1. This option allows the user to manipulate the data entered. For example a land use may change from rural to industrial or access instructions may change. Once the user clicks on the Edit PCD option a text box for entering the PCD ID and a Search button appear which are circled in red in Figure 6.

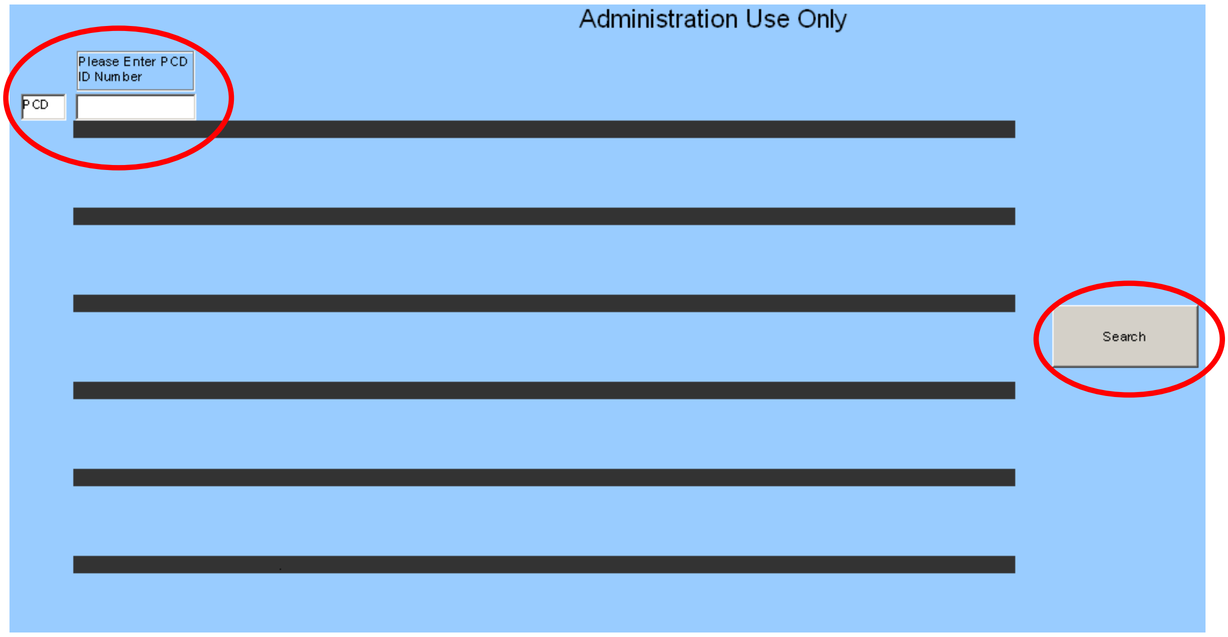


Figure 6 Initial screen shot when editing a PCD

The user enters the ID number of the PCD they wish to edit and then clicks the Search button. The information on that PCD then appears as shown in Figure 7.

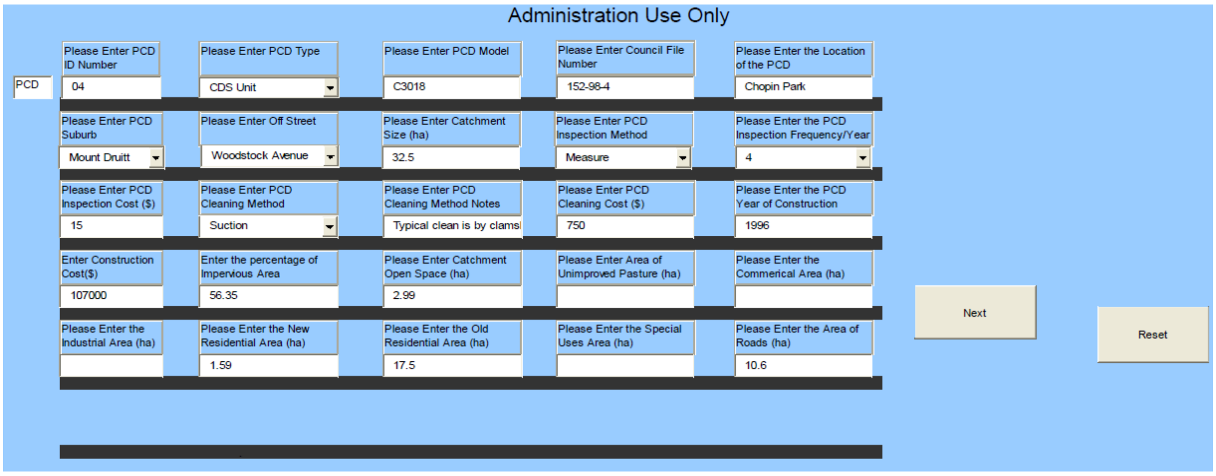


Figure 7 Screen shot for editing of a PCD once a PCD ID has been selected and searched

Once the user has completed the required edits the Next button which is shown in red on Figure 7 and the user is taken to the second edit screen, which is the same screen as shown in Figure 3. Once the user has completed the edits the user clicks on the Submit button as circled in red in Figure 3. The data then follows the same path as if entering a new PCD.

To decommission a GPT, the user selects the Remove PCD button as seen in Figure 1. The same screen shot shown in Figure 6 appears and the user finds the PCD as per the process for editing a PCD. In the screen that appears however, there are two additional text boxes at the bottom of the screen which are circled in red in Figure 8. The user must enter the month and year in which the PCD was decommissioned. The user then clicks the Next button which is circled in red in Figure 8. The PCD however, is not physically removed from the database the program simply recognises its decommissioned status and thereby blocks any editing options and the ability to add any cleaning or inspection data.

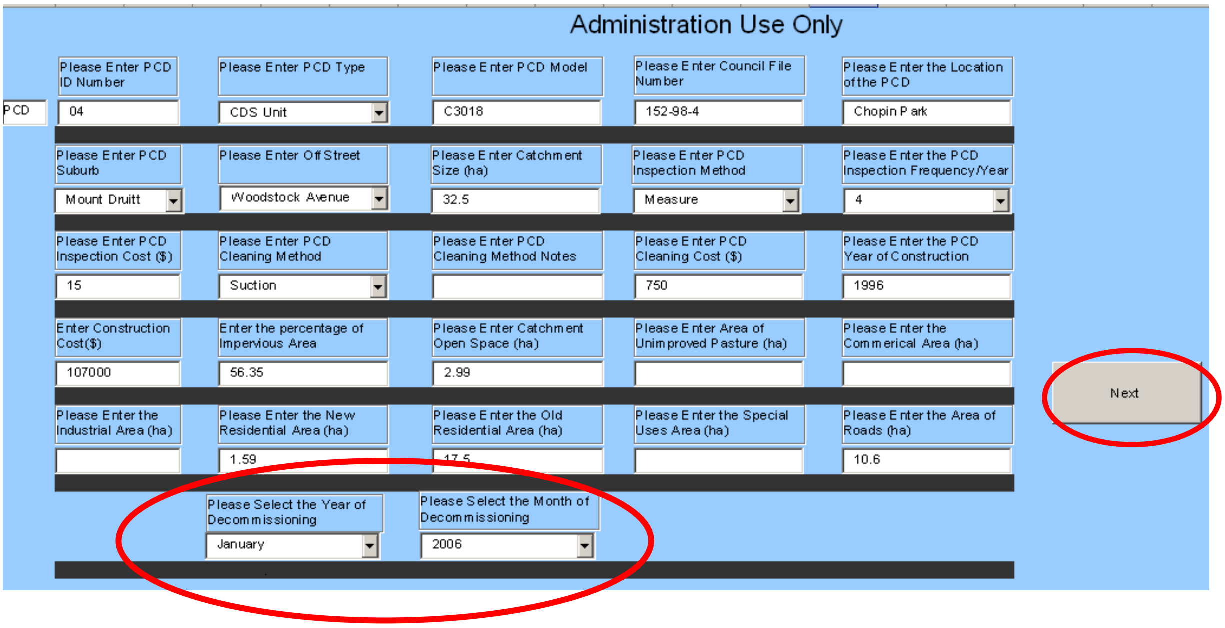


Figure 8 Screen shot when decommissioning a PCD

Once the PCD is removed and the user attempts to access the PCD for editing a message is displayed on the screen advising the user that the PCD has been decommissioned as shown in Figure 9.

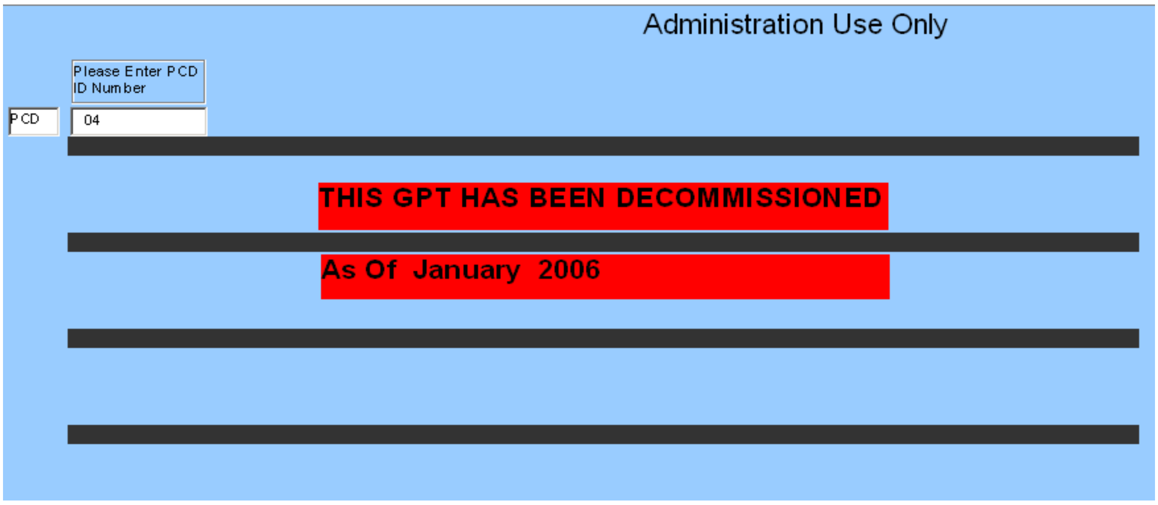


Figure 9 Screen shot once a PCD has been decommissioned

Input Sheet for Inspections and Cleaning

The input sheet is a user interface for the entry of data relating to any inspections or cleaning conducted. The input sheet is a separate tab to the Administration.

When the user clicks on the Inspections and Cleaning tab a screen as illustrated in Figure 10 appears.

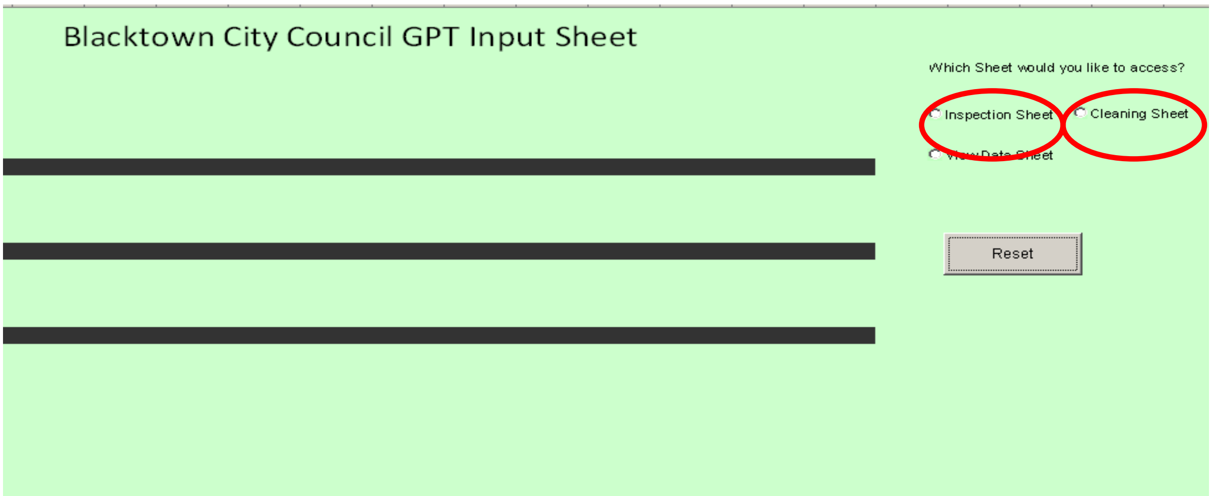


Figure 10 Screen shot of the initial screen for entering inspection or cleaning data

To enter inspection data the user selects the Inspection Sheet button which is circled in red in Figure 10. This sheet records all information from inspections conducted in the field on the PCDs. All of the data fields in the inspection sheet are required to be filled. The program will not accept the form if incomplete. This ensures comprehensive data capture of all relevant information.

The inspection sheet includes:

- Year of inspection;
- Month of inspection;
- The PCD ID;
- A question as to whether a depth to pollution reading has been taken and if yes, requests the depth to pollution from the lid is in metres;
- Contractors name;
- A question on how full the PCD was which is expressed as a percentage (this may be automatically calculated by the database if a depth to pollution from the lid is entered);
- A question as to whether cleaning is required; and
- Cost of the inspection (a default answer on the cost of the inspection from data entered into the Administration form is provided for the user, however the user can amended as required and this will automatically update the inspection cost of that PCD eliminating the need to amend it through the Administration form each time);

Figure 11 illustrates the text boxes for the input sheet for inspections.

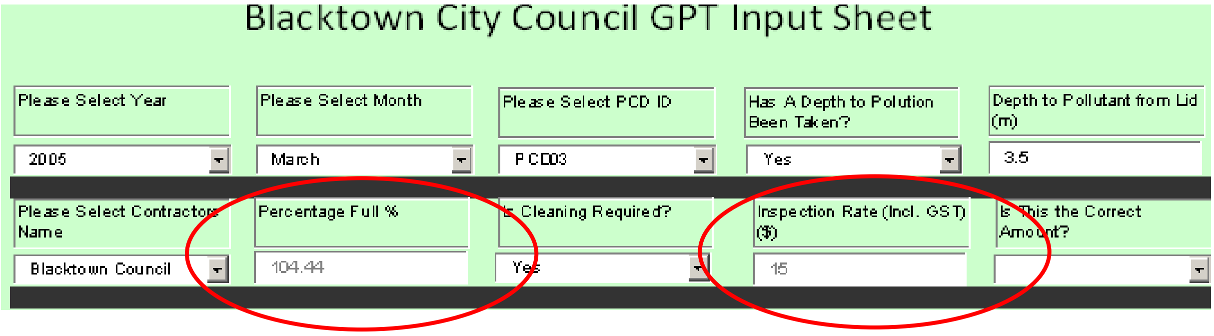


Figure 11 Screen shot of the input sheet for inspections

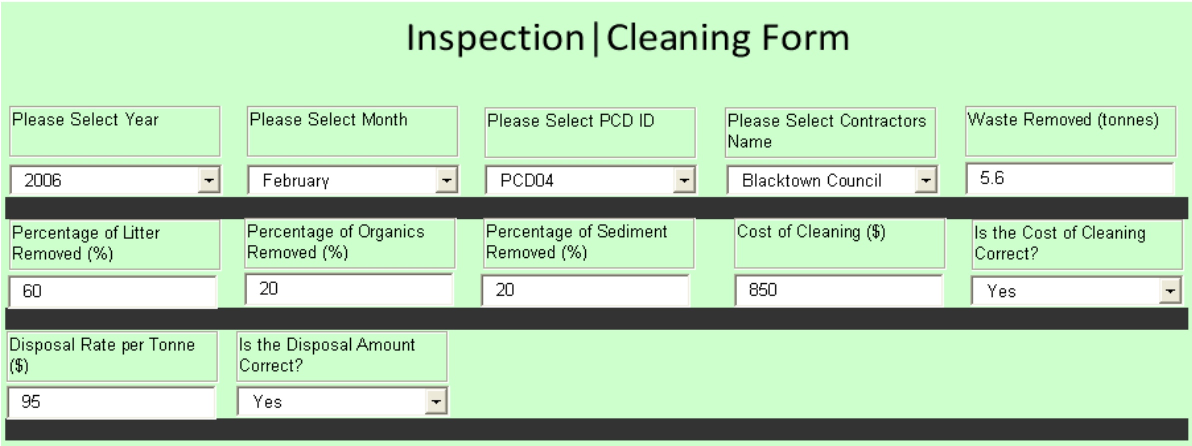
Once the information is entered the data is transferred by the database and the relevant spreadsheets are updated automatically.

To enter cleaning data the user selects the Cleaning Sheet button circled in red in Figure 10. This sheet records all information from cleans conducted in the field on the PCDs. All of the data fields in the cleaning sheet are required to be filled. The program will not accept the form if incomplete. This ensures comprehensive data capture of all relevant information.

The inspection sheet includes:

- Year of the clean;
- Month of the clean;
- The PCD ID;
- Contractors name;
- Amount of waste removed (tonnes);
- Amount of litter removed (percentage of volume)
- Amount of organics removed (percentage of volume)
- Amount of sediment removed (percentage of volume)
- The Cost of the Clean (automatically generated)
- The disposal rate/cost (automatically generated)

Figure 12 illustrates the text boxes for the input sheet for cleaning.


Inspection|Cleaning Form

Please Select Year: 2006
Please Select Month: February
Please Select PCD ID: PCD04
Please Select Contractors Name: Blacktown Council
Waste Removed (tonnes): 5.6
Percentage of Litter Removed (%): 60
Percentage of Organics Removed (%): 20
Percentage of Sediment Removed (%): 20
Cost of Cleaning ($): 850
Is the Cost of Cleaning Correct?: Yes
Disposal Rate per Tonne ($): 95
Is the Disposal Amount Correct?: Yes

Figure 12 Screen shot of the input sheet for cleaning

Once the information is entered the data is transferred by the database and the relevant spreadsheets are updated automatically.

Data Sheets

The data sheets are operational and maintenance instructions for inspecting and cleaning of the PCDs. Essentially they have all the relevant information about the device in a single page. During the project a template was developed for this purpose. This template was incorporated into the database. The data sheet contains pre-programmed cells with titles.

The user can request to view the data sheet from the input sheet for cleaning. The user receives a general concept design of the PCD and a completed data sheet. From here the data sheet can be printed or the user can return to the input sheet for cleaning. The data sheet is illustrated in Figure 13 below.

The aim of having all the PCD information on one sheet, is so that the cleaning contractor can be provided with the Data Sheet for each PCD when quoting, and if they are conducting further cleaning, they will be provided with all Data Sheets in hardcopy to for use on site. This will inform the contractor the necessary key information such as total depth, who has access keys, any dewatering requirements, etc. These are a very valuable tool, to keep the cleaning contractors informed and happy, and to make the cleans fast and efficient.

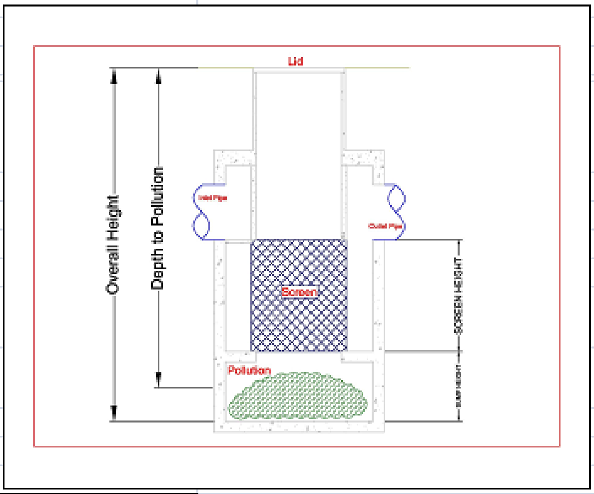
PCD101 CDS Unit Data Sheet

Rooty Hill Road North, Rooty Hill

Owner	Blacktown City Council	Unit Name	CDS Unit
Address	62 Flushcombe Road	Model No.	P0708
	Blacktown 2148	Address	Rooty Hill Road North
Contact:	Babar Sehgol	Site	Rooty Hill Road North near Dutch Place
Phone:	9839 6383	Truck Instruction	Park on road next to unit
Fax	9831 1961	Keys:	17mm Socket and Gattic Lifter
Mobile	0434 183 025	Lid Type	CDS Swirl
		Lid Size	1
		Empty Method	Suction or Grab
		Date Operational	
		Catchment Area	1.2ha

Technical Data

Screen Diameter/Width (mm)	**700**
Screen Height (mm)	**800**
Over all Height (mm)	**4400**
Over all Width (mm)	**1750**
Sump Height (mm)	**900**
Sump Total Volume (m^3)	**1.3**
Estimated Weight of full Sump (m^3)	**1.3**



Depth from Lid to Pollution	Volume (m^3)	Weight (kg)	Percent Full
< 3.5m			**More than 100%**
3.5m	1.30	1300	**100%**
3.59m	1.17	1170	**90%**
3.68m	1.04	1040	**80%**
3.77m	0.91	910	**70%**
3.86m	0.78	780	**60%**
3.95m	0.65	650	**50%**
4.04m	0.52	520	**40%**
4.13m	0.39	390	**30%**
4.22m	0.26	260	**20%**
4.31m	0.13	130	**10%**
4.4m	0.00	0	**0%**

Site Specific Requirements

*	*
*	*
*	*

Figure 13 Screen shot of the data sheet

Summary

In this project Blacktown City Council set out to validate all information on their existing GPTs, and produce a more robust and efficient way of dealing with the ever growing number of devices that Council was responsible to maintain. This was achieved.

A field validation audit was conducted on the vast majority of Council's GPTs, and most of these inspections resulted in amendments to existing data, recommendations for cleaning, rectification works, or other improvements to increase performance or reduce cleaning costs. In some cases decommissioning or replacement were recommended. This very valuable information formed a solid base, on which the database was built. It also acted as a valuable capacity building exercise for Council, learning practical information by engaging a consultant with appropriate qualifications.

After the field validation a review of existing maintenance results over the past several years was conducted which revealed data gaps and data insoncistencies which affected the ability to draw conclusions from the comparison of all GPTs on a Maintenance Cost Effectiveness Ratio.

With new Data Sheets and better controls now established and implemented for maintenance reporting, record keeping and costs, it will be possible over the coming 12 months to compare all 160 GPTs. The higher degree of data integrity will increase the confidence in any data trends observed. This will provide further valuable input into the future decision making processes within Council for new GPTs.

The new Database created provides a very user friendly interface, so that just about anyone can manage and use it. It can produce Data Sheets for each GPT, to assist the cleaning contractors and automatically include and update information on monitoring and cleaning. In the future it will also be able to compare devices on Pollution Removal Efficiency, and Cost Effectiveness. It is a comprehensive tool that will prove very valuable to Council in the future.

Once further data has been collected and analysed Council will provide further information updates at future events that reports on the performance of all its GPTs, that are now being much more effectively monitored, cleaned, reported on and managed. This process and format is believed to be well suited to all Australian Councils for management of their ever increasing pollution control device asset base.

Acknowledgements

The paper could not have been completed without the people who were guiding, compiling and reporting the information received in this paper. Thank you to Paul Khouri, Zubair Khan, Moomtahina Ahmed and Sinan Mutlu, who worked collectively as a team to collect data, produce figures and results that have been reported throughout this paper. Also thank you to Lee Toscan, Stormwater Design Engineer, and Aaron Barnard, Planning and Support Engineer from Blacktown City Council who assisted through the provision of maps, technical advice and guidance for the work.

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Photo Gallery

The following photos, visually show some of the issues Council encountered with the Audit.

Rocks in pipes

A correctly installed and well maintained diversion chamber

Pits were found that required cleaning that were not included on Council's maintenance list

Older style GPTs, can often be upgraded and their performance enhanced

The hydraulics of the Humegards upstream is compromised by the addition of “tidal flaps” that are probably not necessary in this location

The lid to this GPT says Humeceptor, however it’s actually a Humegard. Incorrect product identification (or no product identification) can be a problem

In most locations, other solutions that are more sympathetic to the aesthetic values of the surroundings may be more appropriate

Litter in a gully pit, at a busy shopping centre showing evidence for the need of protection by pit traps, or a GPT

Backwater in this Humegard complicates the cleaning process, because it must be suction cleaned

Some lids can be so heavy that they do not comply with workcover requirements to open them, or like this one, cannot be opened at all.

The surface of this CDS unit was covered in floatable pollution and assessed as 100% full with approximately 10 tonnes contained in the sump, it is working well and ready for a clean

It's important to have the correct tools to access and monitor the GPTs, these include a Data Sheet for the GPT, a staff, gatic lifters, sockets, screwdrivers, allen keys, etc

The mesh in this Enviropod Pit Trap is too fine. The mesh is also torn and there is pollution stuck on the overflow supports suggesting pollution is bypassing. Use of coarser mesh is suggested, plus more regular inspection and cleaning

This Humeceptor has considerable sediment deposition on the fibreglass insert, and requires a thorough clean

Coarse sediment deposited in diversion chambers, can cause water to pool back up the pipes. Inspection and cleaning of chambers should be included as part of the cleaning requirements for all CDS Units and other GPTs as well

This Downstream Defender has a submerged offtake or a blocked offtake and as such, the syringe shown here is likely to bypass the weir and as such modifications to this GPT are required.

Polystyrene from building sites and urban development is very common and this GPT is working well to capture them

The inlet on this Humeceptor is blocked and requires cleaning to reinstate the device to operational

Exclusion bars can be necessary to kids out of some GPTs, but they can also present potential problems for hydraulics, performance and maintenance, if not designed well or poorly located.

The scum on the Humegard boom and “tide line” back up the pipe, indicates this Humegard blocks regularly, so monitoring and maintenance should be increased.

A Humegard screen cleaned and ready for action.

The design of the offtake into this undersized GPT is very poor. This photo was take one week after cleaning. Exclusion bar design can limit GPT functionality if not done well, and be a maintenance nightmare

The Humegard boom is not supposed to overtop, but the plastics caught above show that obviously it did. The boom may be stuck or somehow impeded and requires cleaning and investigation

Massive sediment deposition in all the upstream pipes has resulted when developers failed to clean the GPT downstream

Backwater from downstream has affected the performance and ease of cleaning of this CDS unit. Floatables and macrophytes in the inlet can be seen. Cleaning and downstream works required.