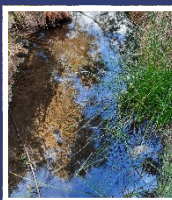
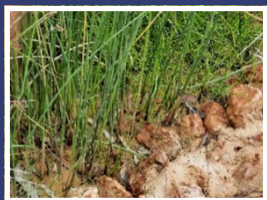
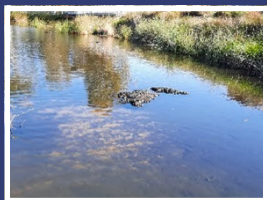


Swan Canning River Recovery Project Three



Sediment Control at Cygnia Cove, Waterford Stakeholder Summary Report



Department of Biodiversity,
Conservation and Attractions



SWAN CANNING
RIVERPARK

Bronwyn Scallan, Sediment Project Manager, Perth NRM

March 2024

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Cover Images

Main Image:

Richard Noble & Company, "The First Cygnets"

Figures (L-R):

Figure 1: Accumulation of builders sand in the Cygnia Cove constructed wetland (after passing through the Gross Pollutant Trap).

Figure 2: Sediment-laden water overflows a rock drain at Cygnia Cove estate after a storm event, discharging into Cygnia Cove wetland reserve.

Figure 3: Sedimentation upstream of the pedestrian bridge, where water flows from the retained wetland into the connecting channel.

Figure 4: Sedimentation downstream of the pedestrian bridge, where water flows from the retained wetland into the connecting channel.

Figures 5 & 6: Sedimentation of Cygnia Cove's connecting channel, prior to draining into the Canning River.

Executive Summary

Sediment laden runoff and sand drift from construction sites can cause pollution when site soil erosion and sediment controls are absent or ineffective, or due to other poor site management practices.

Observations of a housing developments' sediment control during 2020-2023 at Cygnia Cove in Waterford (Perth) was funded by the Australian Government Swan Canning River Recovery Project Three, supported by Perth NRM. The Department of Biodiversity, Conservation and Attractions, Richard Noble & Company, the City of South Perth and other key stakeholders provided in-kind support.

This project was informed by research commissioned by the Sediment Task Force to quantify sediment loss during an urban development. The research, completed in 2020 by the Cooperative Research Centre for Water Sensitive Cities (CRC-WSC) at the University of Western Australia (UWA), determined the effectiveness of sediment control treatments during construction phases by quantifying erosion and sediment runoff from a sample of single residential lots over three years at Heron Park, Harrisdale.

At Cygnia Cove there was interest from some lot holders and builders in using the free erosion and sediment control products offered, and to help determine which were most effective. However, concerns about additional building delays, taking on new or changing building practices, and potential increased labour costs resulted in nil uptake of the products. This outcome provided some insight to barriers in achieving best practice erosion and sediment control.

Project redirection included installing silt sausages at stormwater inlets to quantify sediment prior to entering the drainage network, quantifying sand drift from allotments, developing on-site signage in partnership with a building site supervisor, and awareness raising initiatives.

During this study non-compliance of legislative requirements for sediment control was observed and there was limited voluntary adoption of best practice by the residential builders. Observations of frequent 'minor non-compliance' resulted in cumulative sediment pollution impact. Between 1 November 2020 and 30 June 2023 almost 7.7m³ of primarily imported builders sand and a small amount of soil was collected from the street adjacent to 36 lots under active construction or vacant. Capturing this sand drift on site equated to preventing more than 12 tonnes¹ of sand entering the drainage system.

Acknowledgements

Support received from Yulia Volobueva, Dominic Rogers and Terry Cook at the City of South Perth was invaluable throughout the project duration. This included assistance preparing the project brief, provision of information and advice and investigation into observed major incidents of non-compliance with sediment legislative requirements.

Appreciation goes to Michelle Crow (DBCA) for establishing Photopoint monitoring and for her randomly timed regular site visitations to opportunistically report non-compliance and other issues to PNRM for follow up and to engage with workers and/or lot owners to further our understanding of the building process.

Special mention also goes to Regina Endres and the team at Richard Noble & Company for promoting this sediment research opportunity to land purchasers and to Reece Davenport from Webb Brown-Neaves for his commitment to improving sediment control at his sites and for instigating development of site signage.

1 Calculated volume (m³) and weight (kg/tonnes) adjusted to account for day of collection variability and adapting conversion method in Oldham C.E., Eynon F. and Ocampo, C.J., 2020. Quantifying sediment export from an urban development site: Heron Park, WA.

Background

In Western Australia (WA), the main water quality issues in waterways are salinisation, acidification, eutrophication (nutrient enrichment), low dissolved oxygen, shallow groundwater, and erosion and sedimentation (DWER, 2020).

Sediment runoff from urban environments is a significant source of water pollution and sedimentation. Impacts of sedimentation can include a decline in water quality, loss of critical aquatic habitat such as deep pools, aquatic weed growth, an increase in pathogens, a decrease in the number of natural predators, altered flow regimes and adverse implications to recreational, cultural and aesthetic values of waterways and wetlands and to public health and safety (Scallan, 2021).

Sediment washed off from urban impervious areas can provide a substantial percentage of the sediment load in the stormwater drainage network. Stormwater is a particularly important source of contaminants that can be adsorbed to and transported by suspended sediment. Suspended sediment and the contaminants associated with it can also be transported with groundwater (Gellis et al. 2020).

Sediment accumulation can decrease oxygen availability and habitat diversity (Campbell and Doeg, 1989); alter species composition (Lemly 1982, Doeg et al., 1987); leaf processing rates (Webster and Waide, 1982); decrease primary production through diminution of light to stream-bed (Henley et al 2000); loss of drought refuge for fishes (Bond et al. 2008); and cause infilling (Pen, 1999) and (K. Trayler, pers. comm., 2020).

There is evidence of significant financial benefit in land development and building industries, and initially homeowners, when legislative requirements for erosion and sediment control on construction sites are not complied with. Non-compliance during and after urban development activities result in local and state governments often incurring the costs of sweeping roads, repairing and maintaining stormwater and water sensitive infrastructure, remediating/rehabilitating environmental assets, retrofitting poorly designed or maintained erosion and sediment control infrastructure and compliance enforcement. Examples of expenditure on sediment management by governments across Australia range from \$100,000-\$1,663,400 annually (Scallan B., 2021).

Project brief

The original objective of this project was to improve the health of the Middle Canning River by measuring erosion and sediment runoff during residential building from a sample of single lots to determine the effectiveness of sediment control treatments; and to prevent sediment run off into the drainage network.

It became evident early on that while there was interest in helping protect the Cygnia Cove wetlands and Canning River, homeowner concerns about additional building delays, having to ask their builder to take on new practices and increased labour costs were resulting in nil uptake of the free erosion and sediment control products on offer. In response the project objective was changed to observing sediment control practices and quantifying sediment laden runoff and sand drift from lots where there was no or limited soil erosion and sediment control.

This project built on research completed in 2020 by the CRC-WSC at UWA, to quantify sediment loss during urban development at Heron Park in Harrisdale in 2017 and 2019, as commissioned by the Sediment Task Force. The CRC-WSC/UWA study determined that uncontrolled sediment was being discharged from construction sites at a rate of approximately 17,000 kg per hectare of exposed sand annually, making its way into stormwater drains and polluting waterways and wetlands, and that this was particularly prevalent during significant weather events (Oldham C.E., Eynon F. and Ocampo, C.J, 2020).

The sediment discharge rate at Heron Park compared to measured sediment fluxes of 350 kg/ha/year from an agricultural (grazing) catchment in WA (McKergow et al. 2001); after restoration of the stream riparian zone, this agricultural sediment export reduced to 9 kg/ha/yr (McKergow et al. 2001). The CRC-WSC/UWA researchers noted that the differences between the discharge rate measured at Heron Park, and that measured by McKergow et al. (2001), was broadly in line with the United States of America Environment Protection Agency (2000) estimate that construction activities discharge sediment at rates 10-20 times the rate from agricultural lands, and 1000-2000 times the rate from forested land. For the sites monitored in WA,

land under construction was discharging sediment at approximately 50 times the rate from agricultural land (Oldham C.E., Eynon F. and Ocampo, C.J, 2020).

Extrapolation of CRC-WSC/UWA’s conclusion suggests 79.9 tonnes of sediment was predicted to be discharged from the Cygnia Cove study site (primarily Stage 5A) over 2.5 years. This indicated the sediment quantified during this project represented approximately 15% of the expected weight of sediment runoff and/or sand drift that would actually enter the drainage network over this period.

This project aligned with CRC-WSC/UWA’s Recommendation 3 to address key data and knowledge gaps with short-term targeted monitoring undertaken, of sediment accumulation and export, during and after completion of civil works areas, with exposed sand. Also relevant to this project were CRC-WSC/UWA’s key findings that high levels of sediment discharge are likely due to:

- A) higher volumes of water (primarily rainfall) flushing out sediment previously deposited into the system (the drainage network); and
- B) Increased delivery and accumulation of exposed sand in anticipation of construction work under spring/summer conditions.

Funding and in-kind support

This project was funded by the Swan Canning River Recovery Project Three (SCRR), supported by Perth NRM through funding from the Australian Government via a Direct Action Community Grant of \$28,450.

This project was coordinated and supported by Perth NRM over a three-year duration, with \$23,900 expended on salary and salary on-costs and \$4,550 for operational purposes. An estimated \$8630 of in-kind support was provided by DBCA, Richard Noble & Company (RNC), the City of South Perth (City), Clontarf Aboriginal College, South East Regional Centre for Urban Landcare (SERCUL), Webb Brown-Neaves (WBN), Daly and Shaw Building Pty. Ltd., Trendsetter Homes and the Southern Gazette.

Site description

The field trial was undertaken at Cygnia Cove over the period 01 November 2020- 30 June 2023. It was chosen due to its proximity to the Canning River, the commitment by the land developer to protect environmental values and the existence of baseline data.

Sanctuary in wetland site

THE transformation of more than 5ha of neglected marshland into a thriving wetland bird sanctuary has earned Cygnia Cove estate in Waterford a prestigious landscape-architecture award.

The accolade was awarded to specialist landscape architecture firm Plan E at the Australian Institute of Landscape Architects WA 2012 Project Awards.

The firm undertook a year of planning and site analysis for the wetland transformation, which is now the centrepiece of the 80-hectare estate on the banks of the Canning River created by developer Richard Noble & Co.

Plan E director John Tuzee said it was an honour to receive industry recognition after many years of hard work and commitment.

The judging panel commented on the specialist water breeding habitat integrated into the rehabilitated wetland.



The award-winning wetland at Cygnia Cove. The Sunday Times | 17 June 2012 Weekend Property, Page 7

Richard Noble managing director Alex Gregg said the unique location of Cygnia Cove offered the opportunity to create both a spectacular residential community and a sustainable environment for the local wildlife.

“What makes this rehabilitated wetland truly special is that it will provide opportunities for the future residents of Cygnia Cove to explore the environment while ensuring the safety of the wildlife is maintained,” Mr Gregg said.

Residents will be able to view the wetland from elevated boardwalks and sheltered viewing sites.

There are a handful of Stage 1 lots left at Cygnia Cove. They range from 415sq m (E049000) to 570sq m (S149000).

Homes must be double storey only and built within three years.

For information visit www.cygniacove.com.au or call Martin Hasbani on 0807 945 314.



Cygnia Cove

2014 State Winner
 President's Award for most outstanding Project
 Environmental Excellence
 Residential Development Under 250 Lots

2015 National Winner
 Excellence
 Residential Development
 Environmental Excellence

Richard Noble
 PROPERTY INTEGRITY COMMUNITY
 on behalf of Trustees of the Cleland Brothers in WA (Inc)



Figure 7: Cygnia Cove Promotional webpage (Source: Richard Noble & Company <https://rnoble.com.au>)

Cygnia Cove is a housing estate located in Waterford in the City of South Perth (the City), approximately 8 kilometres (km) southeast of the Perth Central business District. It is bound by the Canning River to the south, Manning Road to the north, Centenary Avenue to the east and the Aboriginal Clontarf Campus to the west. Historically this site was used as farmland, a pine plantation and building infrastructure. In 2005, following a Public Environmental Review, approval was given for the development of the site. To facilitate

the new development, the wetlands originally existing at the site were modified to some extent, with some wetland areas removed and a new constructed wetland with a swan breeding area established in the south-west of the site (SERCUL 2022).

The entire housing estate development (Stages 1-5) now contains a drainage storage area which receives drainage from approximately 12.2 hectares (ha) of the Cygnia Cove estate, connected to a retained wetland, a connecting channel, and a parallel constructed wetland and stream which converge prior to draining directly into the Canning River. Flow entering the Canning River from the wetland system is greater than its surface water inputs, indicating that there is significant groundwater inflow to the wetland system from the Cloverdale superficial groundwater aquifer along its northern boundary (JDA Consultant Hydrologists 2004). Hence, the wetland system could be described as a ‘flow through’ system where water moves through a wetland at the surface of the groundwater table. Additionally, in the south-eastern portion of the site is a small compensation basin that receives a small amount of local stormwater drainage from the Cygnia Cove development, which is also connected to the Canning River (SERCUL 2022).

The natural areas of Cygnia Cove are considered a significant and important part of the City of South Perth’s natural assets, such as the largest freshwater wetland in the City and diverse foreshore remnant vegetation including a nationally-listed and threatened saltmarsh community. In addition to natural assets, Cygnia Cove has a rich cultural heritage with the site being an important ceremonial, knowledge sharing and hunting ground for Noongar people and a religious, agricultural and educational precinct for early European settlers (City of South Perth 2023).

Since April 2015, the City has undertaken general maintenance, weed control and revegetation works at Cygnia Cove and this is ongoing (City of South Perth 2023).

Study area

The study area for all lots included in this project was 1.8799 Ha.

43 site visits were undertaken by PNRM and DBCA staff, with sand measured by PNRM on 31 of these site visits.

Investigation was conducted on 36 lots where building was active, or where a significant volumes of sand drift was occurring from vacant lots.

The research site comprised Lincic Group Apartments (Lots 287 and 288; GHS R80); all 27 residential lots in Stage 5A; Lots 236, 237 and 259 (Cygnus Parade); Lots 238, 256, 246, 247, 251, 252 (Tringa Court); and sand stockpiles and verge landscaping in Crake Court (Stage 4); and lots 122-125 Decelo Vista (Stage 1-3).

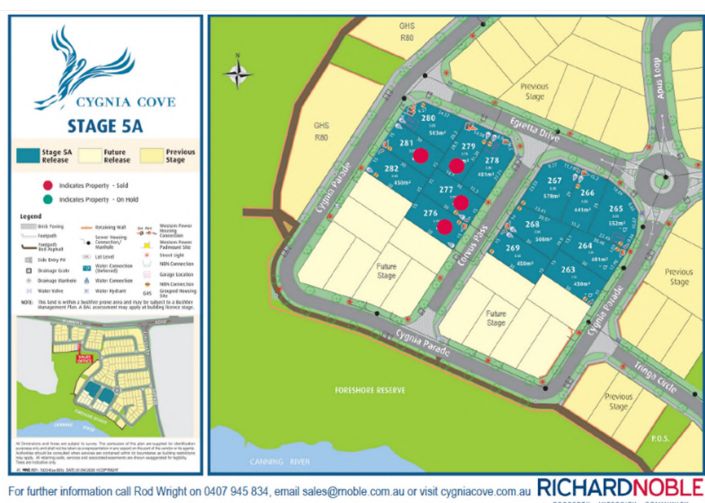


Figure 8: Cygnia Cove Sales Plan Stage 5A 17.11.2020
Source: pers comm Richard Noble and Company



Figure 9: Cygnia Cove Sales Plan Stage 4 17.11.2020
Source: pers comm Richard Noble and Company



Lots 122-125 Decelo Vista, Cygnia Cove (Stage 1-3)

Figure 10: Cygnia Cove Subdivision Plan (Source: Policy P351.14 Cygnia Cove Residential Design Guidelines, City of South Perth, 2016).

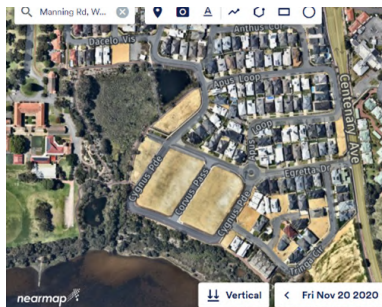


Figure 11: Cygnia Cove Project area at project commencement 20 November 2020
Source: Nearmaps



Figure 12: Cygnia Cove Project Area 30 April 2023 Source: Nearmaps



Figure 13: Cygnia Cove Project Area 14 October 2023 (post project).
Source: Nearmaps

Regulatory Environment

Relevant legislation: City of South Perth’s *Waste Control on Building Sites Local Law*, *Licence to Deposit Building Material on Verge and Building Approval Processes (permits)* and State Government’s *Building Act 2011*, *Building Regulations 2012*, *Environmental Protection Act and (Unauthorised Discharges) Regulations 2004*, *Planning Development Act WA 2005* and *Swan Canning Rivers Management Act 2006*.

Relevant requirements of builders (all trades):

Loose material adequately secured and prevented from becoming wind-borne; all sand deposited on verge remains and is not allowed to spill onto street; no wash-down water allowed to enter the street drains.

The City of South Perth (City) has management responsibility for the constructed wetland, Gross Pollutant Trap (GPT) and surrounding area.

- Builders operating in the study area are informed by the City of the need to prevent sediment loss and sand drift leaving their building sites.
- The City can fine building site supervisors and relevant tradespersons for non-compliance with the City's Waste Control on Building Sites Local Law and can charge builders and other tradespersons for costs incurred to sweep streets of sand and litter and clean out drains.

The City responds to complaints received from the public. General complaints related to sand drift are received verbally, by email, via the City's new 1System and through Facebook posts (the City pers. comm 2022).

During this study, the City's Compliance Officer was observed on several occasions undertaking a drive-by inspection of site management practices. The City's proactive approach to monitoring for compliance, which included investigating public complaints related to sand drift and sediment transport onto roads and into stormwater inlets (drains) and implementing the City's Street Sweeping Program was effective and often resulted in a short-term improvement in sediment management practices at building sites in Cygnia Cove. This was also often the outcome following site visits by PNRM and DBCA staff.

This change in 'builder behaviour' supports the multitude of research that concludes sustained and consistent erosion and sediment control compliance and enforcement activities can result in high levels of effective onsite erosion and sediment control performance within the land development industry, and a notable decrease in sediment load. (B Scallan, 2021).

Building companies operating at this site

There were 17 building companies operating at Cygnia Cove during this project: Aquila Homes, Broadway Homes, Beaumonde Homes, Coast Homes, Daly and Shaw Building Residential Developments, Direct Homes, JFK Custom Homes, Marshall Homes, Plunkett Homes, Pottier Homes, PROGEN Home, Ross North Builders, Ryan Cole Builders, Summit Builders, Trendsetter Homes, Webb & Brown-Neaves and 101residential (Residential Building WA).

The \$5,000 Green Bonus, Fencing and Front Landscaping allowance offered by Richard Noble & Company to lot purchasers resulted in additional sand and soil on the road when some of the contracted landscape gardeners conducted poor sediment management practices.

Methodology (sediment quantification)

- This methodology was determined by the Coordinator and was not adapted from other relevant research.
- 10L of dry, damp, wet and saturated builders sand was weighed to set a baseline and allow adjustment to future calculations which were based on the weight of dry sand.
- PNRM was on-site where possible during and after rainfall and storm events and undertook a trial of 'silt sausages' over one storm event, responded to reported observations of poor sand management practices and made random site visits.
- All site visits involved observing, photographing, sifting and removing mulch, sticks and stones from the sand and soil where necessary by hand, collecting and measuring sediment using a bucket of known volume (L).
- Estimates of the percentage of sand collected were recorded when windy or wet conditions prevented retrieving all sand that had left site from the road.
- Calculated volume (m³) and weight (kg/tonnes) was adjusted to account for day of collection variability and adapting conversion method in Oldham C.E., Eynon F. and Ocampo, C.J., 2020. Quantifying sediment export from an urban development site: Heron Park, WA.
- Builders sand and other sediment collected from around drains and street was either re-deposited onto site or spread finely within existing verge vegetation.

Summary of key project outputs

Project Output 1: Control and prevention of sediment run off into the drainage network.

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
<p>Published and disseminated erosion and sediment control (ESC) trial invitation to seek evidence that effective soil erosion and sediment control infrastructure reduces sediment laden runoff and sand drift.</p> <p>Published and disseminated two follow up fliers offering free erosion and sediment control for lot holders and their builders/building companies.</p>	Perth NRM Comms	Nil	\$320	Unfortunately, no uptake by lot holders or builders on either action as per below.
<p>Measured sand on roads and around drains during site visits from active building lots and from vacant sites where there was significant sediment-laden runoff or sand drift with a suspected known cause (SCRR output 'Debris removal').</p>				7.68766759m ³ of sediment was measured over the entire project. This equated to 12.287 tonnes of sediment prevented from entering the drainage system (see overleaf).

Examples of debris removal:



Figure 14: $0.16\text{m}^3 = 240\text{kg}$ of soil and sand left 462m^2 lot



Figure 15: $0.15\text{m}^3 = 230\text{kg}$ of soil and sand left 575m^2 lot





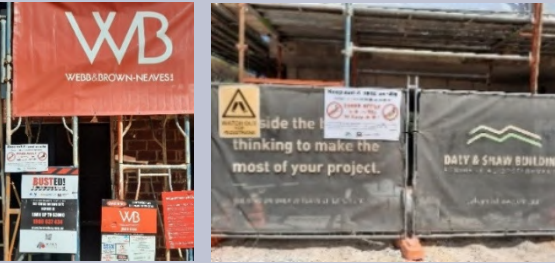
Figure 16: $0.13\text{m}^3 = 200\text{kg}$ of soil and sand left 452m^2 lot



Figure 17: $0.02\text{m}^3 = 30\text{kg}$ of soil and sand left 440m^2 lot



Figure 18: $0.02\text{m}^3 = 30\text{kg}$ of soil and sand left 446m^2 lot
(R. Davenport, site supervisor, WBN)

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
<p>Reported and followed up on suspected breaches of sediment control regulations. (Only for major breaches or when considerable amounts of sand on roads prior to predicted heavy rainfall event, so builder behaviors were not influenced).</p>	<p>DBCA, City of South Perth</p>	<p>Nil</p>	<p>\$480</p>	<p><u>Details of suspected breaches:</u> Sand on road near drains (4) Sediment in outfall rock drain behind Lincic Apartment 1 (1); Water discharge burst retic pipe. Truck delivering sand, dumping onto road (2).</p>  <p><i>Figure 29: Example of sand carrier having dumped sand from its load partially on the road.</i></p>
<p>Worked with building site supervisors to produce and install 20 Keep Sand and Soil On-site signage (KSSOS).</p>  <p><i>Figure 20: Keep Soil and Sand On Site signage developed in partnership with a building site supervisor operating in Cygnia Cove. (Refer to output 3 for further details).</i></p>	<p>DBCA, WBN, Daly and Shaw</p>	<p>\$1,716</p>	<p>\$400</p>	<p>Developed for and with assistance from WBN's site supervisor. Some anecdotal evidence collected from 2 site supervisors that these signs helped reduce sand on roads. Site supervisor won WBN's best signage, advertising and most neatly presented sites award, which focuses on safety and compliance outcomes.</p>  <p><i>Figures 21-22: KSSOS signage was put up at eye-height in areas in the building sites where it could be seen easily from the road, and within the site where it could be seen by site contractors.</i></p>

Project Output 2: Data on sediment load accumulation and export associated with civil works areas and exposed sand.

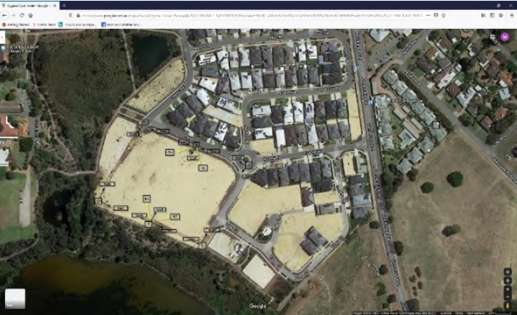



Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Measured sand on roads, around drains during site visits from active building lots and from vacant sites where there was significant sediment-laden runoff or sand drift with a suspected known cause.				(As per Output 1: Debris removal above).
Established a Photopoint Monitoring Program (five 6 monthly reports produced).	DBCA/Perth NRM	Nil	\$400	24 Photopoint Monitoring sites established in Stage 5 by DBCA (12/10/2021). Subsequent Photopoint Monitoring undertaken 23.10.2021 (DBCA), 17/03/2022 (PNRM), 20/10/2022 (PNRM) and 29/03/2023 (PNRM). 
Investigated use of corers to take sediment samples at wetland 'outlet drain/outfall' just before entering the Canning River to determine building sand composition.	DBCA	Nil	\$160	Sought university student to undertake this work in voluntary capacity. Due to time consuming sampling protocols and regulations to undertake sampling in the streambed, limited resourcing and no confirmed commitment by the student, no further action was possible.
Asked City staff to contact PNRM if any major incidences of sediment/sand on roads, overflowing drains or observed in drains s PNRM could visit the site to collect data.	N/A	N/A	N/A	No incidents reported to PNRM.

Figure 23: DBCA Photopoint Monitoring Map 2021. (Also refer to Figure 81).

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Measured sand/soil on road when sand hauling companies did not 'dump' soil stockpiles onto site away from the verge.	N/A	N/A	N/A	<p>Significant impact identified, which could be avoided with best practice erosion and sediment control.</p> <p><u>Examples:</u></p>  <p><i>Figure 23: Sediment deposited onto street was measured to be 0.61m³ = 0.93 tonne of sand.</i></p>  <p><i>Figure 23: 0.53 m³ of sand deposited onto the road (0.81 tonnes). Known cause: order error by sand delivery company. 24 m³ of sand dropped instead of 12m³. There was vacant space on the lot but driver still choose to dump a significant proportion on the road. Sand on road was measured until stockpile threatened to be undermined. 176L sand collected; only one third of sand on road could be picked up. Issue rectified by sand carrier and reported to the City by PNRM.</i></p>

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Assisted with investigation into sand deposition reported at new rock drain installation at Linic Apartment 1 (discharging into the Cygnia Cove wetland reserve).	DBCA/City of South Perth	Nil	\$640	<p>Measured sand and took photos of the new overflow pipe from the drainage system after peak storm events.</p>  <p>Figures 29-31: <i>LHS View of rock drain from the wetland (looking south) 17.03.2022.</i> <i>Mid: Sediment evident around drain and dispersed within sedges.</i> <i>RHS: 25 litres of imported builders sand covered sedges adjacent to right hand side of the rock drain. (Average depth of builders sand was 1cm).</i> <i>(Note that some sediment present may be due to pipe construction).</i></p>  <p>Figure 32: All sediment and builders sand had dispersed from the rock drain prior to 20.10.2022 (within six months).</p>

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Requested City of South Perth data from their Gross Pollutant Trap (GPT) cleaning regime.	N/A	N/A	N/A	No GPT education/cleaning undertaken by the City during this study (unexpected outcome).
Requested details of the City of South Perth's Street sweeping program.	City of South Perth	Nil	\$160	Analysis of the City's data from street sweeping program. Not all volumes were recorded unfortunately and the data available indicates 2-3m3 of sediment being swept up (Refer to figure 88).
Reviewed the City of South Perth's Cygnia Cove Water Quality Reports and Bureau of Meteorology Monthly Rainfall reports (2015- July 2021).				A brief desktop analysis was undertaken which concluded there was increased concentrations of Total Suspended Solids (TSS) recorded following high rainfall events at all SERCUL's four water quality monitoring (WQM) sites within the Cygnia Cove wetland system during 2020-2021. The SERCUL reports noted a high spike in TSS recorded at WQM site CYG02 during both 2020 and 2021. SERCUL noted TSS results recorded in 2020-2021 are somewhat similar to what has previously been recorded at these sites from 2015-2020 with the occasional exceedances in 2016, 2018, 2020 and now 2021. Further investigation would be required to determine if sediment-laden runoff from building sites at Cygnia Cove was contributor to these recorded increases in TSS.
Created maps as a tool for use in this study.	N/A	N/A	N/A	17 Nearmaps, 9 debris removal milestone maps and 9 photo essays compiled to track progress and for SCRR and PNRM quarterly reporting purposes.

Project Output 3: Improved understanding of the costs, design specifications, installation and maintenance requirements and the efficacy of sediment control measures.

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Field-tested the effectiveness of silt sausages to capture sediment laden runoff during storm events.	Richard Noble & Company, City of South Perth, HIA, DBCA	\$1,250	\$1,120	<div style="display: flex; flex-direction: column; align-items: flex-start;">  <p data-bbox="1585 421 2063 496"><i>Figure 33: Silt Sausage trial set up on a single drain in Corvus Pass prior to a predicted heavy rainfall event in May 2021.</i></p>  <p data-bbox="1585 683 2096 758"><i>Figure 34: Silt Sausage trial set up the corner of Egretta Dr and Corvus Pass prior to a predicted heavy rainfall event in October 2021.</i></p> <p data-bbox="1317 874 2074 965">Only a small quantity of sediment was collected in both trials due to the minimal slope of the roads and there being little movement by the saturated sand.</p> <p data-bbox="1317 1002 2119 1061">Snagging River Waste article published in the Southern Gazette 8 July 2021 (Figure 80).</p> <p data-bbox="1317 1098 2089 1252">Unforeseen actions that compromised this trial were street sweeping in the research area prior to the storm event, vandalism (stealing of road indicators) and the leaching of the contents of the silt sausage into stormwater drain via its geofabric membrane during the first trial and ripping of the membrane on the concrete during the second trial.</p> <p data-bbox="1317 1289 2119 1477">Confirmation that the semi-mountable verge curbing at Cygnia Cove is working well to contain sand during heavy rainfall events. Draft article Curbing for sustainable subdivision design to reduce sediment pollution written in conjunction with HIA (WA) 28.02.2024; to be approved by DBCA and submitted to WALGA’s Environews and HIA Australia’s GreenSmart March 2024 newsletters.</p> </div>

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
<p>Scoped the opportunity for Daly & Shaw to trial the Foreign Object Debris System (FODS) rumble mats at Linc Apartment 1 to prevent sediment from being tracked onto the road.</p>	<p>Daly & Shaw Project Manager</p>	<p>Nil</p>	<p>\$240</p>	<p>Secured a free trial offer negotiated with JWA Oil (NSW) for a one-month hire of FODS rumble mats.</p> <p>Sought a proponent at Cygnia Cove and the Daly & Shaw Project Manager was interested in pursuing. Request to run this trial however was declined by the City of South Perth due to this site not being deemed big enough to contain FODS within.</p> <div data-bbox="1312 507 1798 687" data-label="Image"> </div> <p><i>Figures 35-36: FODS in operation in New South Wales.</i> For more info visit www.jwaoil.com/isc-connect-2022/fods-rumble-grid-mats</p>
<p>Offered lot holders, builders and building companies free bulk bags, sediment control fencing materials and/or tarps to building companies and lot holders as part of sediment research trail.</p> <div data-bbox="203 991 383 1230" data-label="Image"> </div> <p><i>Figure 37: One bulkbag with a Keep Soil and Sand on Site stencil ready for a trial to begin.</i></p>	<p>Westslab Maddington</p>	<p>\$180 Keep Soil on Site Stencil</p>	<p>\$150 (Free bulk bag and staff time)</p>	<p>Developed a Keep Soil and Sand on Site stencil and organized for one bulkbag to be painted, ready for trial to begin.</p> <p>Three lot holders were interested in the trial however they had questions/ concerns about cost, access and how this would affect their construction method, and chose not to participate.</p> <p>There was no commitment from builders or site supervisors.</p> <p>The remaining spray paint was donated to Westslab and the unused 750mmx100mm silt fence geotextile is available for trial or donations.</p> <p>This stencil has been offered to builders and building companies as a loan at no cost and the artwork offered at no cost (contacting Perth NRM).</p>



Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
<p>Improved understanding of time and cost involved with sand sweeping to manage sand that has left from individual building sites and vacant blocks.</p>	<p>N/A</p>	<p>N/A</p>	<p>N/A</p>	<p>Discovered for construction staff to manually sweep the road with a broom sand returning soil/sand to site is assumed labour intensive and expensive, with workers costings rate on average \$75/hour in 2023-24 (pers com). Whilst an effective method of removing sand from the road, the collected sand may be contaminated by pollutants, mulch or other debris present on the road, and is considered no longer a viable resource, as only 'clean sand' can be used for bricklaying and building purposes. Therefore, it is considered the risk and cost of being fined, and any additional purchasing of sand outweighs cost savings of manually sweeping the road. Whilst sweeping or hosing of sand off the road into the drains was not overtly observed during this study, evidence of sand near and around drain where there was no obvious site works suggested this was occurring.</p>
<p>Keeping Sand and Soil on Site signage trial</p>	<p>Site Supervisors from Webb & Brown-Neaves, Daly & Shaw and Trendsetter building companies.</p>	<p>As per above</p>	<p>As per above</p>	<p>12 signs were placed on six building sites belonging to Webb & Brown-Neaves, Daly & Shaw Building Residential Developments and Trendsetter Building Company and at two Webb & Brown-Neaves sites adjacent to the Canning River in Wilson.</p> <p>Whilst there is still evidence of sand on roads where signs have been put up, both WBN and DS site supervisors concluded the signs are a really useful tool to point at to remind all trades that a tidy and safe site includes no sand on roads or down the drains and that the government and the community expect this too.</p> <p>Article published on Perth NRM blog (June 2023), WA Local Government Association (WALGA)'s Environews (July 2023) and New WATER Ways newsletter (August 2023). Article submitted for consideration for DBCA's River Guardians (winter edition) and considered for inclusion on the DBCA website & Swan Canning Riverpark page when this site is updated.</p> <p>https://www.perthnrm.com/blog/2023/06/22/stopping-site-sediment-pollution/</p> <p>Copy provided: the City, R.Davenport (WBN), Daly & Shaw & Trendsetters Homes.</p> <p>Signs also provided 30/5/2023 to LGOs attending the Sediment Task Force/ Perth SouthWest 'Sediment Snapshot' and to the Chair of the North Swan LCDC 13/6/23 so they can offer this free signage to builders in their region. 2 signs installed by Progen Building Site Supervisor as part of trial August 2023.</p> <p>Feedback will be provided to the STF Coordinator.</p>

Investigated suitability of trialing drain inserts to measure sediment laden runoff going into drains.	N/A	N/A	N/A	Discovered that drainage inserts proved very costly and require safe opening and closing of drains etc and may be a flooding risk. Cost meant this option was outside of the scope of this study.
Investigated into use of Envirostraw as a measure to capture sediment runoff.	N/A	N/A	N/A	Discovered there is no stock available in WA so this option was outside of the scope of this study.

Project Output 4: Understanding of barriers to achieving best practice erosion and sediment control in a local context.


Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Engaged with lot owners to evaluate interest in the use of sediment control infrastructure.	N/A	Nil	\$240	Conversations with six lot holders. Whilst there was moderate interest, the common responses were questions/concerns about cost, access and how this will affect construction. For example: <ul style="list-style-type: none"> • <i>My build is now delayed one year and I didn't feel like participating in something that may be extra work.</i>
Sought out opportunities to engage with builders, site supervisors, brickies and other trades and lot holders to explain the study and to invite them to participate in the trials.	As above	Nil	\$400	23 conversations with site supervisors, brickies, builders, lot holders and other residents. Examples of contact are: <ul style="list-style-type: none"> • <i>We keep telling everyone to sweep up sand off the roads, but they don't do the right thing</i> (site supervisors) • <i>Are you not supposed to get sand on the road?</i> (builder) • <i>Far too much sand on road and mess from sites</i> (new residents) • <i>Didn't know or understand how soil, sand, silt, mud and mulch run-off impacted water quality</i> (resident) • <i>Can't spend any extra money on erosion or sediment controls which we don't have to have</i> (lot holders (2) and builders (7)) • <i>Someone else's problem</i> (builder) Discovered the impact of the City fining one site supervisor \$500 for non-compliance and collaboratively worked on a solution. (Refer to figure 84).

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Assessed the effectiveness of soil erosion and sediment controls installed by proponents at lots at Cygnia Cove (A).	N/A	N/A	N/A	<p>Analysis found only two erosion and sediment controls other than signage were installed at Cygnia Cove the entire study period.</p> <p>Measure 1: This control was the placement of an inappropriately sized tarp on a sand stockpile in the attempt to stop this sand from running off into the adjacent drain (ongoing lack of regular inspection and maintenance).</p>  <p><i>Figure 38: Significant amounts of sand that left this stockpile was observed on Egretta Drive and inside this drain during four random site visits.</i></p>
Assessed the effectiveness of soil erosion and sediment controls installed by proponents at lots at Cygnia Cove (B).				<p>Measure 2: Gravel driveway at site entrance at Linic Apartment 1.</p>  <p><i>Figure 39: Gravel drive effective when first installed as soil and sand was falling off vehicle's wheels, however a lack of regular maintenance meant effectiveness diminished quickly over time.</i></p>

<p>Observed incidences where lots were being driven on to deliver building materials and for parking.</p>	<p>N/A</p>	<p>N/A</p>	<p>N/A</p>	<p>Discovered many common and recurring incidences of vehicular access onto sites or verges causing sand tracking onto road. <u>Examples:</u></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Figure 40: 158L = 0.16m³ = 242kg of builders sand left this 450m² lot following 1 day of work by this digger to flatten the block.</p> </div> <div style="text-align: center;">  <p>Figure 41: 98L = 0.1m³ = 150kg of soil and sand was transported onto the road by a vehicle from this 455m² lot.</p> </div> </div>
<p>Observed surplus sand at the end of each build on each lot being pushed by machinery onto an adjacent vacant block.</p>	<p>N/A</p>	<p>N/A</p>	<p>\$80</p>	<p>Increased understanding of building stages as was informed by a building site supervisor this was a regular and accepted practice in the residential building industry as at some stage all companies will have to pay to clean up extra sand when it's their turn to be the last block built on.</p>
<p>Advertised an expression of interest via the Housing Industry Association WA (HIA) and Master Builders Association (MBA) newsletters to contract a builder with experience in installing ESC products to help interested builders do this on site.</p>	<p>HIA/MBA</p>	<p>Nil</p>	<p>\$160</p>	<p>No response to job advertisement (Refer to Figure 82). Asked 16 Local Government Officers involved in sediment management compliance to recommend a builder they know is doing best practice ESC however no recommendations could be made.</p>

Project Output 5: Engagement with, and increased awareness and/or education of, homeowners, builders, residents and land developer Richard Noble & Company.

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Developed Cygnia Cove Sediment Research Project Brief (included site meetings).	DBCA, City of South Perth, Richard Noble & Company		\$1,920	Draft completed in consultation with all stakeholders and approved by City of South Perth, enabling this project to commence.
Developed and disseminated flier inviting lot holders and building companies to participate in sediment research. Included information on the environmental, economic, and social benefits of preventing erosion and sediment runoff during building (Refer to figure 82).	Richard Noble & Company		\$160	Richard Noble & Company included PNRM flier in new lot holder information packs. Six responses of interest but no participation as per above.
Sent letter and follow up flier to building companies and lot holders offering free Bulk Bag, sediment control fence and tarps as part of the trial (Refer to figures 86-87).	N/A	N/A	N/A	Four lot holders wanted to find out more about the trial said they didn't want to ask anything more of their builders as their builds were already significantly delayed. No response from any of the 17 building companies contacted.
Developed and disseminated a leaflet for a mailbox drop to homeowners bordering the Cygnia Cove Wetland (information about sediment research project and how residents can care for the Canning River and Cygnia Cove Wetland).	N/A	N/A	N/A	134 houses. Five positive responses from residents. No negative responses.
Undertook a mailbox drop to homeowners bordering the Cygnia Cove Wetland (STF InfoSheets) (What-You-Need-to-Know-About-Sediment-Control; We-Can-All-Stop-Sediment-Runoff-From-Our-Home; and Waterwise-Gardens-are-also-Sediment-Wise)	Perth NRM	N/A	\$160	134 houses. Mixed small number of responses to mailbox drop including 'waste of paper and taxpayers money (1)' to 'very useful and interesting' and 'I want to help look after the wetland and the wildlife' (4).

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Emailed STF Info Sheets to landscaping companies that were installing RNC's \$5000 complimentary verge development package.	Richard Noble & Company	Nil	\$80	<p>Nil response. Observed common poor practices by landscaping companies, with sand being transported from approx. half the lots during landscaping of verge gardens.</p>  <p><i>Figures 42-43: An example of poor sand management during garden landscaping at one site in Corvus Pass. 0.31m³ (0.46 tonne of sand) measured during one random site visit.</i></p>
Provided Richard Noble & Company staff with Sediment Task Force Information Sheets targeted at land developers and the Summary of Economic Costs of Sediment Loss from Construction Sites report.	N/A	N/A	N/A	Positive feedback received and of interest to staff.
Informed all Cygnia Cove building companies of new STF Keeping Soil on Site Information Sheet series.	N/A	N/A	N/A	17 building companies informed. No feedback received.
Sent letter to WBN acknowledging best practice management of sediment and sand on their lots.	N/A	N/A	N/A	Appreciation by site supervisor for it being acknowledged he was doing the right thing. Increased willingness by site supervisor to continue and do more to prevent sediment loss. Increased level of support by his WBN Building Company managers for his time being spent on preventing sand leaving his 6 sites.
Developed draft Sediment loss quantification poster.	N/A	N/A	N/A	To be submitted for approval and Perth NRM Comms to be consulted as to final product to be developed by the Sediment Task Force for dissemination/reference, but only if this will be of value and funds permit.
Installed a weather station neighboring Clontarf Aboriginal College (CAC) as a local weather data source and engaged with CAC staff re potential student learning outcomes for the weather station.	Clontarf Aboriginal College (CAC)	\$200	\$480	Environmental education lessons plans provided to teacher and contact maintained. Unfortunately, no data received, nor proof of student learning outcomes. BOM rainfall data used instead for this report. Weather station donated to CAC.

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Developed and installed Keep Soil and Sand on Site signage				As per above and below.
Observed and reported concrete washdown	N/A	N/A	N/A	Evidence of concrete washdown on three occasions (reported to The City).  <i>Figure 44: Concrete washdown on pedestrian and cycle pathway. Source was Linic Apartment 1 site.</i>
Observed and recorded unforeseen issues and impacts: A) Winter transfer of sand and soil from boots	N/A	N/A	N/A	Site Supervisor at Linic Apartment reports the winter transfer of sand and soil from boots, wheelbarrows and machinery onto the roads can be significant and needs to be better managed.
Observed and recorded unforeseen issues and impacts B) Watering trucks sprayed huge arcs of water onto the verges when watering very young trees, causing sediment runoff of the considerable amounts of sand already present on the roads.	N/A	N/A	N/A	Recommendation to the City to raise awareness of this issue via the watering company's contractual obligations.
Observed and recorded unforeseen issues and impacts: C) Testing of verge reticulation by resident resulting in significant sediment run off into a nearby drain.	City of South Perth/DBCA	N/A	\$240	 DBCA reported water discharging from Lot 259 31/10/2022. PNRM in attendance 01/11/2022 to measure sediment runoff. Sand on road already mostly removed by small street sweeper sent by the City following complaint from resident. (No volume of sand lost recorded). <i>Figure 45: Verge vegetation reticulation system resulted in soil, sand and mulch runoff onto roads and into drains.</i>

Actions (Completed by the PNRM Sediment Action Coordinator unless otherwise stated)	Partnering organisations	Cost (\$)	Estimated in-kind support (\$80/hr)	Key project outputs
Observed and recorded unforeseen issues and impacts: D) Verge vegetation reticulation overwatering observed 3 occasions (assume flow velocity too high).				 <p>Figure 46: Verge vegetation reticulation system resulted in soil, sand and mulch runoff onto roads and into drains.</p>
Observed and recorded unforeseen issues and impacts: E) Sand drift onto roads not swept up by construction and demolition contractors working to claim recyclable materials (e.g. bricks) and clean up sites.				 <p>Figures 47-48: Sediment loss during construction and demolition crew cleaning up site.</p>
Educated stakeholder groups on findings of Cygnia Cove project re Northern Tasmanian Stormwater Working Group & Australian Water Assc Young Water Professionals 2023; Perth South West Group Sediment Snapshot Briefing 2023; Sediment Task Force meetings.	N/A	N/A	N/A	Awareness raising re the quantity and magnitude of sediment leaving a site when there is poor practice at a local scale.
Publication of Snagging River Waste Article	Perth NRM/ Southern Gazette	N/A	N/A	Refer above and below.
Publication of Cygnia Cove Stopping Site Sediment Pollution article	Perth NRM Comms/DBCA	Nil	\$320	Refer above and below.
Draft Cygnia Cove Stakeholder Summary Report	DBCA	Nil	\$320	The City's Compliance Officer provided comments on an early draft and DBCA on the final draft.
TOTALS		\$3,346	\$8,630	

Figures 49-78: Additional photographs of poor sediment management practices commonly observed at the Cygnia Cove Land Development Project Site (various dates over the period early 2021-mid 2023).

Examples of vehicular tracking by earthmoving machinery and vehicles



Examples of poor management of imported sand stockpiles (sand carrier companies and tradespersons)



Examples of poor management of imported sand stockpiles (sand carrier companies and tradespersons)



Conclusions

Most building sites at Cygnia Cove:

- Had downpipes immediately connected from house guttering to stormwater drains when the roof was installed.
- Had no temporary or permanent soil cover/verge to lot groundcover.
- Did not have single, stabilised entry and exit points to prevent soil/sand tracking off sites (Linic Apartment excepted).
- Had no or ineffective covering of soil and sand stockpiles to prevent wind/water erosion.
- Had no preventative on-site soil erosion and sediment controls installed (not even sediment control fences).
- Had at least six incidences of illegal sand dumping on road by trucks delivering sand, which posed a sediment pollution risk as this sand is not being moved off the road onto site.
- Did not have clean water being diverted around the work site, so it ran over soil/sand surface (i.e. no stormwater diversion).
- Had an absence of site supervisors, builders, bricklayers and other trades undertaking regular site checks or sweeping sand off roads and replacing it onto site.
- Experienced vehicle tracking of sand and mulch off site and onto the road (the mulch containing nutrients therefore increasing the risk of eutrophication when mulch was washed into drains and not removed by regular cleaning of the GPT).

Sediment laden runoff and 'sand drift' from construction sites in Cygnia Cove appears to be polluting Cygnia Cove's retained wetland, constructed wetland, stormwater retention basin, drainage channel and the Canning River.

Greater accountability by building industry sectors would reduce Local Government expenditure to 'clean-up' sand and soil and to re-mediate drainage, Water Sensitive Design (WSD) and natural assets impacted by sediment.

Recommendations

Subdivision

1. Leave as much vegetation on the site and street verges as possible during land clearance and subdivision construction to prevent on-site soil erosion and sediment loss and ensure verge reticulation is set to the minimal flow to prevent sediment laden runoff making its way into drains.
2. Consider compulsory use of drain inserts and Envirostraw (or equivalent product/concept) at the cost of the proponent to capture the sediment 'that got away'. (Ensure products are free of contaminants and/or seeds).
3. Consider installation of sediment control fencing on the perimeter of each vacant lot being made a requirement of subdivision. This recommendation is based on the observation that soil erosion and sand drift control measures installed at Cygnia Cove were rendered ineffective well before Stage 5A lots and the remaining lots in Stage 1-4 were offered for sale and/or built on. Notably, the seeded ryegrass was only effective until it died during its first summer due to lack of water, so for most of the time it was not binding any soil or sand during rainfall or wind events. There was also considerable evidence of the absence of or 'systemic breaking down' of hydro mulch for all vacant lots.
4. Semi-mountable verge curbing, as used at Cygnia Cove, could be an 'sustainable subdivision design' option for all new subdivisions of the future as these can act as an effective physical barrier and can prevent a considerable proportion of sediment leaving site. HIA's representative on the Sediment Task Force advised that 'to reduce sediment loss during lot development, consideration could be made regarding both the type of curb and the expected fill level within the verge required by Local Governments at asset handover (as per LGA specifications for road construction). Providing semi-mountable curbs combined with reducing the height of fill expected at the back of them means

curbs can act as a very useful barrier for sediment with good control building practices employed. A majority of this verge-fill soil is often removed for landscaping after handover, meaning this measure to reduce sediment would be cost effective across the entire construction process'. (HIA STF representative, personal comms February 2024)

5. Entry/Exit Rock Pads should be used to reduce the high occurrence and impact from vehicular tracking of sediment onto the road (as per below).
6. Ensure verge reticulation is set to the minimum flow to prevent sediment laden runoff making its way into drains.

Construction of residential housing (lot development)

7. Clarify and strengthen regulations and consider making it a legal requirement for all sites to have an Erosion and Sediment Control Plan that can be used as a benchmark to monitor for compliance. (Example of a high-quality ESC Plan at <https://www.teer.org.au/erosionandsedimentcontrol>)
8. Ensure builders divert clean stormwater around the work site and connect downpipes from house guttering to stormwater drains as soon as the roof is installed.
9. Reduce the potential for vehicles to transport sediment onto road surfaces. Sediment leaving site due to vehicular tracking was a common occurrence at Cygnia Cove, with a greater cumulative impact than previously understood. Consider a requirement to establish and regularly maintain a defined single, stabilised entry and exit point/rock pads (where the driveway will be), to prevent sites from becoming boggy and site access points becoming sources of sediment off the site. As FODs were not deemed suitable for use at Cygnia Cove, consider compulsory requirements to use low-cost and transferrable sediment control products such as the Skudo All-Terrain Mat or FODS where relevant. (Photo below from residential building site in the City of Stirling).

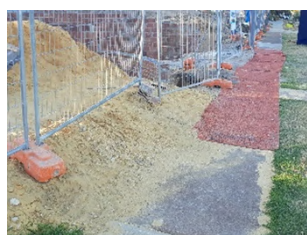


Figure 79: Skudo All-Terrain Mat in-situ at the City of Stirling. Photograph courtesy of Perth NRM.

Further recommended measures for builders/trades are to: restrict vehicular parking on verges and vacant lots; unload equipment onto the road; carry equipment onto site; park vehicle off vacant lots/sites; ensure earth moving machinery contractors visiting site are well informed of their requirement to clean sand up off road and replace it on site before leaving site; and to consider bulk bag sand delivery (with the Keeping Soil on Site stencil on every bag to raise awareness).

10. Ensure building site supervisors and sand deliverers are aware sand needs to be placed on the lot site and well away from the verge, where practicable.
11. The City to sweep/vacuum roads clean prior to watering truck visits, or hose tree roots by hand. (Where sand was already present on roads, the watering of verge trees by watering trucks spraying a large volume of water in a wide arc onto the small verge street trees caused sediment runoff into the drainage network). Consideration by the City of watering trucks applying a wetting agent to ensure maximum absorption when watering street trees is recommended.
12. The City consider street sweeping costs they incur being passed onto the builders responsible. This would act as an incentive to land developers, builders, bricklayers, landscapers, other trades, sand carriers and C&D removal services to improve their sediment management practices, as opposed to the cost of sweeping being absorbed through the City's maintenance budgets.

13. The City adopt an automatic process whereby they can contact building site supervisors when heavy rain/storms are forecast, requesting they immediately attend to their sites to sweep up sediment that has left their sites and to cover sand stockpiles.
14. The City educt the Cygnia Cove Wetland Gross Pollutant Trap regularly and inspect the contents to estimate building sand/soil compositions. This will help better determine the environmental and economic impacts of poor on-site soil erosion and sediment management practices.
15. Installing Keep Soil and Sand on Site signage is included as a condition of building approval for all future building sites within the City's jurisdiction (at least two signs per site). The purpose is to remind all visitors to site of their legal requirements to prevent contamination of drains and waterways and TO NOT hose or sweep sediment into stormwater drains. The sign artwork would be provided at no cost by Perth NRM and the City's logo could be added as well as a phone number for public reporting of the potential for, as well as actual sediment runoff from sites. (The Sediment Task Force also has free artwork for a public reporting sign that can be adapted for use for LGAs). Building companies could be asked to pay for signage as per size/material/specification desired by the City. For durability, transferability to other sites and to minimise risk of vandalism, aluminum signs with pre-drilled holes for attaching with cable ties are recommended. Note: Some councils in Australia make signage such as this a pre-requisite for obtaining a building permit and is a handy and cheap best practice tool for land development and building companies.
16. The City review levels of Total Suspended Solids (TSS) identified in the City of South Perth Cygnia Cove Water Quality Assessment by SERCUL 2021 – 2022 when this becomes available, and act accordingly to prevent poor building practices contributing to further incidences of unacceptable levels of TSS.
17. Dust control should be acknowledged as a form of erosion and sediment control rather than just preventing public nuisance. Conversely, poor dust control practices should be a lever for improving on-site wind-borne soil erosion and sediment control.

References

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Snagging river waste

Sarah Brookes

Sausages are being used in a trial to stop tonnes of construction material ending up in local waterways, including the Canning River, during the building phase for new housing estates and apartments.

Perth NRM chief executive Keith Pekin said recent studies in Perth showed each year 17 tonnes of builders' sand and other construction-related sediment escaped into stormwater drains and rivers for every hectare of building development.

Mr Pekin said once the sediment entered waterways, the environmental damage was significant as well as the cost to remediate, which is usually borne by councils and ratepayers.

"Materials escaping development and construction sites can cause significant damage to the environment when it enters the stormwater system," he said.

"In addition to creating blockages, which can lead to localised flooding in the system, the combined materials become sediment that, once they reach our waterways, smother bottom-dwelling plants and animals, and accumulate in deep, permanent pools of rivers, destroying critical habitat.



Perth NRM project officer Bronwyn Scallan and CEO Keith Pekin at one of the sites trialling silt control 'sausages'. Picture: David Baylis

"Free-floating sediment can clog the gills of fish and reduce the available light required for photosynthesis in aquatic plants, causing ecosystem collapse."

Mr Pekin said sediment could also introduce high levels of nutrients, promoting toxic algal blooms and pollutants in waterways.

It can also increase irritating mosquito and midge populations around rivers.

As part of the Swan Canning River Recovery Stage Three, the Perth NRM has partnered with the City of

South Perth to trial sediment control measures at the Cygnia Cove development site on the riverfront in Waterford.

Silt control sausages are one method of control available, used around drains to capture sediment run-off from lots.

Mr Pekin said introducing basic sediment control measures on building sites was far easier and cheaper than remediating the environmental aftermath of leached sediment.

"Implementing control

measures is a relatively inexpensive affair, but as the cost in lost materials such as sand and rubble during the build doesn't cost very much, it is often implemented poorly, and sometimes not at all," he said.

"Stormwater management and gross pollutant traps are very significant costs.

"Erosion and sediment control measures such as these silt control 'sausages' are an easy way to protect our waterways during development and construction."

Figure 80: Silt Sausages Trial article published in the Southern Gazette 8 July 2021.



SCRR3 Cygnia Cove Photo Monitoring Points.
(GoogleMaps).

Legend

Letters (A,B,C etc) = Monitoring Points

→ diagonals for monitoring points

Author: Michelle Crow, Department of Biodiversity, Conservation and Attractions. Created 24.11.2020.

Figure 81: Cygnia Cove PhotoPoint Monitoring Program Map (DBCA 2020)

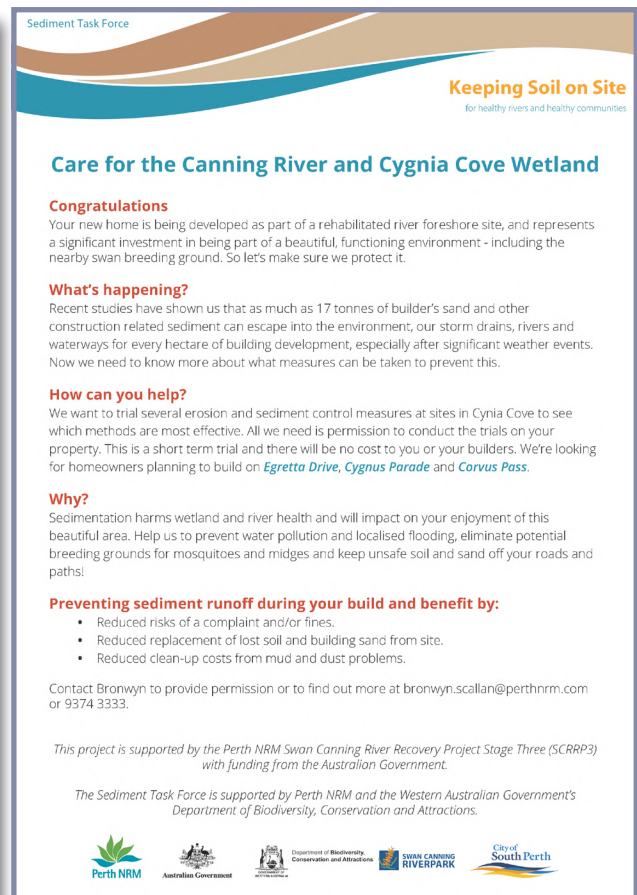
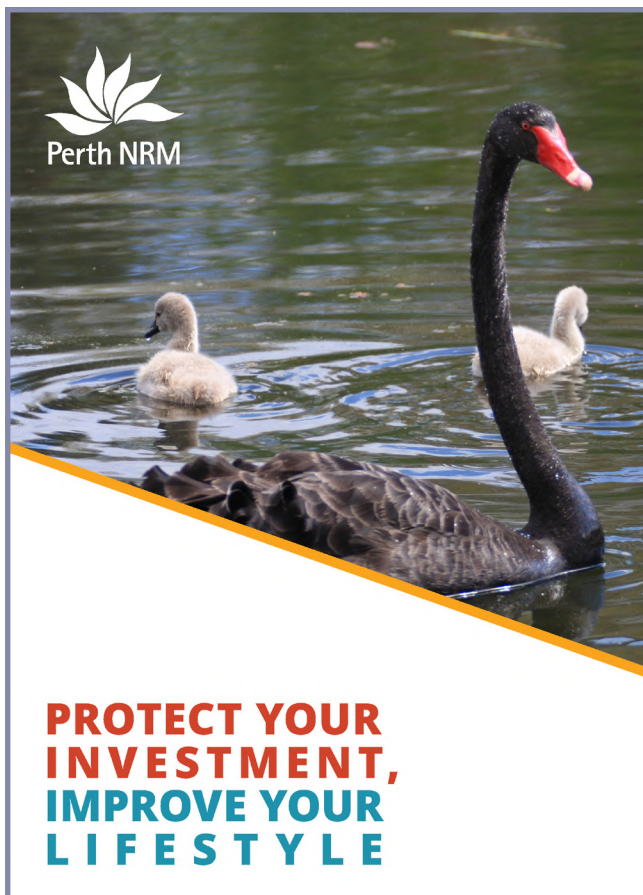


Figure 82: Flier inviting lot holders to participate in erosion and sediment control trials (Pg 1 LHS; Pg 2 RHS).



Figure 83: Flier seeking builder to assist with proposed erosion and sediment control trials (2021).

News >

Stopping site sediment pollution

22nd June, 2023

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Building sand from construction sites can be contaminated with cement and metal cuttings as well as paint, plastics, rubbish and mulch.

When this sediment is flushed by rain or runoff into drains and local waterways, it introduces harmful nutrients, chemicals and hydrocarbons from road surfaces, which causes water pollution.

Sediment can severely impact and destroy critical rivers and wetland habitat. The lightweight floating sand can clog the gills of fish as well as block the transmission of light needed by aquatic plants for photosynthesis. The high levels of introduced nutrients can promote toxic algal blooms leading to an increase in mosquito and midge populations. Not only can all these elements cause catastrophic ecosystem collapse, it also negatively impacts our recreational enjoyment of our waterways.

Recent studies by the University of Western Australia have shown that every year, for every hectare of building development, up to 17 tonnes of building sand and other construction-related sediment enters the environment, via storm drains, rivers and waterways. When considering how much land development is happening and planned for Western Australia – there is a lot of potential for sediment pollution!

A local construction site supervisor has been working hard to protect the environment by sweeping sand at a Cygnia Cove building site. Reece Davenport, from local building company Webb & Brown-Neaves, has been sweeping up the sand, keeping the roads and drains clear, and preventing it from polluting nearby drains.

Figure 84: Perth NRM article published July 2023. A summary of the article and a link to this webpage was published in WALGA's Environews in July 2023 and New Waterways newsletter in August 2023.

1.5 Tonne of FREE Brickies Sand on Offer

Perth NRM is seeking builders working in Cygnia Cove estate who are willing to trial bulk bags to see how effective they can be at keeping soil on site.

The offer

One bulk bag of Brickies sand with a closed top can be delivered to your site by Hiab free of charge. Other types of building sand may also be eligible.

What do I need to do in return?

All you have to do is send us a few photos and let us know how and why using the bulk bag worked well at your site (or otherwise), and if it helped stop sand getting onto the road and into the drain.

Benefits to builders of using bulk bags

- Easy to use and place in the correct location.
- Little chance of cross-contamination of sand.
- Easily moved and relocated to a dry spot with on-site forklift, bobcat with forks or crane.
- Closed top keeps sand dry and lightweight.
- Reduced clean-up costs from sand runoff and dust problems, and for sand replacement.
- Protect the streetscape.
- Reduced chance of causing water pollution.
- Way to show onsite building practice best practice.
- Reduced risks of a complaint and/or fine.



Figure 85: LHS Flier inviting builders operating in Cygnia Cove to participate in a bulk bag sand delivery trial (August 2021).

Why is this free trial being undertaken?

Recent studies in Perth show that 17 tonnes of builders sand and other construction related sediment can escape into stormwater drains, rivers and waterways for every hectare of building development, especially after significant weather events, causing water pollution. We want to know more about what measures can be taken on building sites to prevent soil, sand, silt and mud (sediment) runoff, and loose soil and sand being blown by the wind, so sediment does not negatively impact on the water quality of the Cygnia Cove wetland, and ultimately the Canning River.

What else do you need to know?

Perth NRM accepts no liability for any loss or damage related to the use of the delivered bulk bags of sand.

Contact Bronwyn to find out more at bronwyn.scallan@perthnrm.com or 9374 3333.

This project is supported by the Perth NRM Swan Canning River Recovery Project Stage Three (SCRRP3) with funding from the Australian Government

To all current owners of lots @ Cygnia Cove (Stage 5A and 5B)
C/- Richard Noble & Company

26.10.2021



Free bulk bags of sand, free sediment control fencing and free tarps on offer as part of sediment research at building sites in Cygnia Cove

It's exciting to see all the building action at Cygnia Cove. Congratulations! Cygnia Cove is a beautiful environment and a special place to live.

Thanks to Richard Noble & Company, you will have already received our flier inviting you to be part of Perth NRM's small-scale sediment research project.

Perth NRM are now offering free bulk bags of sand, free sediment control fencing and free tarps for use on building sites in Cygnia Cove where builders/contractors can help with our sediment research trial. In exchange we ask for a few photos and provide some feedback on the advantages (or otherwise) of working with these erosion and sediment control products.

I have also written to your building company about this free offer so they may contact you to discuss it, or you could contact them if you are interested in your building site being included in our research.

The offer

Free building sand - up to 4 bulk bags including delivery. (See attached flier for details).

Free good quality peg down tarps to cover soil/sand stockpiles. These tarps will need to be used when soil/sand is stockpiled on-site before building starts and to cover soil/sand stockpiles immediately prior to forecast windy conditions, rain and/or storms, and if practicable at the end of the working day.

Free premium grade sediment control fence (from a local supplier). This product is "designed to intercept and detain runoff, trapping harmful silt through settlement and filtration before it leaves the site". Perth NRM will provide the silt fence geofabric, stakes, pegs, stake safety caps etc. at no cost to you so your builders can install a sediment control fence(s) on your site(s). Perth NRM will also need to know how much soil/sand was captured in the sediment control fence after a significant rainfall or wind event. This can be measured by Perth NRM with your permission.

Benefits of using bulk bags, sediment control fences and tarps on building sites are:

- reduced clean-up costs from sand runoff and dust problems, and for sand replacement.
- reduced risks of a complaint and/or fine.

Further benefits of using bulk bags are:

- easy to use and place in the correct location.
- little chance of cross-contamination of sand.
- easily moved and relocated to a dry spot with on-site machinery.
- closed top keeps sand dry and lightweight (covering with tarps also keeps sand dry).

Note that Perth NRM accepts no liability for any loss or damage related to the use of products they provide used on your site if you do choose to participate in its bulk bag, sediment control fence or tarps trial.

Thank you very much, Bronwyn.

Bronwyn Scallan | Project Coordinator-Sediment Action | Perth NRM | e: bronwyn.scallan@perthnrm.com p: (08) 9374 3305

Site Manager @ Cygnia Cove

Building Company Name:

Building Company Email:

20.10.2021



Free bulk bags of sand, free sediment control fencing and free tarps on offer

Can your building company/builders/contractors be part of our sediment research trial in Cygnia Cove?

Perth NRM are offering free bulk bags of sand, free sediment control fencing and free tarps for use on building sites in Cygnia Cove where builders/contractors can help with our sediment research trial. In exchange we ask for a few photos and some feedback on the advantages (or otherwise) of working with these erosion and sediment control products.

The offer

Free building sand - up to 4 bulk bags including delivery. (See attached flier).

Free good quality peg down tarps to cover soil/sand stockpiles. These tarps will need to be used when soil/sand is stockpiled on-site before building starts, to cover soil/sand stockpiles immediately prior to forecast windy conditions, rain and/or storms and if practicable at the end of the working day.

Free premium grade sediment control fence (from a local supplier). This product is "designed to intercept and detain runoff, trapping harmful silt through settlement and filtration before it leaves the site". (<https://www.iaybro.com.au/underground-civil/erosion-sediment-control/siltmasta-premium-silt-fence-750mmx100m-85543.html>). **Perth NRM will provide the silt fence geofabric, stakes, pegs, stake safety caps etc at no cost to you** so your workers can install a sediment control fence(s) on your site(s). Perth NRM will also need to know how much soil/sand was captured in the sediment control fence after a significant rainfall or wind event. This can be measured by Perth NRM with your permission.

Benefits of using bulk bags, sediment control fences and tarps on building sites:

- reduced clean-up costs from sand runoff and dust problems, and for sand replacement.
- reduced risks of a complaint and/or fine.

Further benefits of using bulk bags:

- easy to use and place in the correct location.
- little chance of cross-contamination of sand.
- easily moved and relocated to a dry spot with on-site machinery.
- closed top keeps sand dry and lightweight (covering with tarps also keeps sand dry).

Perth NRM accepts no liability for any loss or damage related to the use of products they provide used on your site if you do choose to participate in its bulk bag, sediment control fence or tarps trial.

Please let me know if you or your contractors can help with our research and feel free to get back to me with any questions.

Thank you very much, Bronwyn.

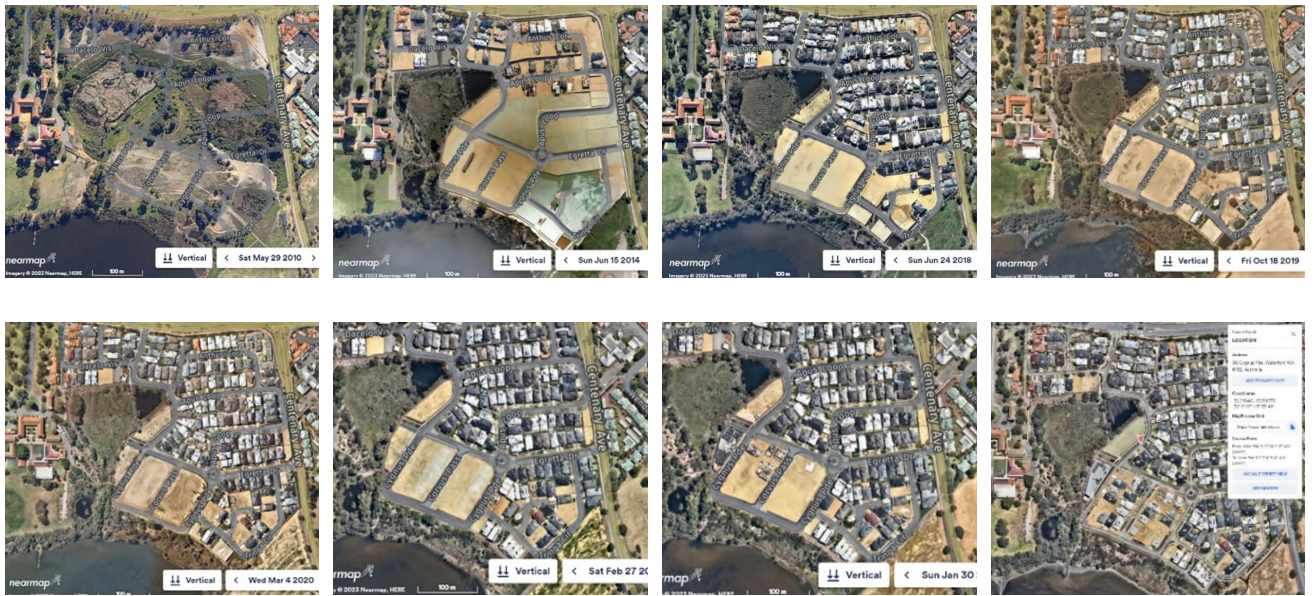
Bronwyn Scallan | Project Coordinator-Sediment Action | Perth NRM | e: bronwyn.scallan@perthnrm.com p: (08) 9374 3305

Perth NRM acknowledges the traditional custodians throughout Australia and their continuing connection to the land, waters and community. We pay our respects to all members of the Aboriginal communities and their cultures; and to Elders past and present.

Figures 86-87: Follow up letters inviting lot holders and builders operating in Cygnia Cove to trial bulk bag sand delivery, sediment control fences and covering of sand stockpiles with tarps to prevent sand drift (October 2021).

Time Period	Reason	Method	Volume
01/11/2020 - 31/10/2021	All streets in the entire City of South Perth jurisdiction are swept 3 times per year	3 x Large Road sweeper contracted by CSP to sweep streets in the entire City of South Perth jurisdiction	No volumes reported
01/11/2021 - 15/11/2022	Request from resident	1 x Contracted large road sweeper for Tringa Cir, Crake Ct, Egretta Dr, Cygnus Pde & Corvus Pass in one sweep.	No volumes reported
01/11/2021 - 15/11/2022	Request from resident	2 x small city owned sweeper Cygnus Pde, Corvus Pass & Egretta Dr in one sweep	No volumes reported
01/11/2021 - 15/11/2022	Request from resident	1 x small city owned sweeper Egretta Dr in one sweep	No volumes reported (retic test discharge)
01/11/2021 - 15/11/2022	Request from resident	1 x small city owned sweeper Dacelo Vista in one sweep	No volumes reported
16/11/2022 – 26/6/2022	All streets in the entire City of South Perth jurisdiction are swept 3 times per year	3 x Tringa Cir, Crake Ct, Egretta Dr, Cygnus Pde & Corvus Pass in one sweep (Request from resident) – Contracted large road sweeper	2-3 cubic metres of sediment
16/11/2022 – 26/6/2022	Request from resident	2 x Cygnus Pde, Corvus Pass & Egretta Dr in one sweep– Small city owned sweeper	1 Cubic metre of sediment
16/11/2022 – 26/6/2022	Request from resident	1 x Crake Crt sweep (Request from resident) – Small city owned sweeper	½ Cubic metre of Sediment recorded
16/11/2022 – 26/6/2022	Request from resident	1 x Dacelo Vista sweep (Request from resident) – Small city owned sweeper	½ Cubic metre of Sediment recorded

Figure 88: City of South Perth Street Sweeping data.
(Source: City of South Perth Roads and Drainage/Infrastructure Support/Compliance Officers)



Figures 89-96: Photo montage of Cygnia Cove subdivision and lot development (pre, during and post study 02.05.2024) (Source: Nearmaps).