

The scope and scale of the problem

(uncontrolled sediment loss during land development)

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& Sediment Task Force Coordinator, Perth NRM

*Aerial view of the sediment build up in the Swan River coming from the Bayswater Brook (formerly known as the Bayswater Main Drain)
Photo credit: City of Bayswater*



Soil and sand reaching waterways can:

- Impact waterbody temperature, channel hydrology & water velocity
- Change benthic structure
- Erode creek and riverbanks
- Interrupt the free movement of water
- Reduce the (water) carrying capacity of wetlands

Sediment pollution following heavy rainfall from site works where sediment controls were absent
Photo Credit: Perth NRM



Soil and sand reaching waterways can:

- Increase weed diversity and growth
- Increase mosquito and midge breeding habitat and populations by:
 - Creating shallow densely isolated habitats
 - Reducing natural mosquito predator access and food sources
- Reduce macroinvertebrates and fish populations by:
 - Covering the macroinvertebrate egg bank
 - Cover the macrophyte seedbank and benthic algae

(SERCUL, 2016)

Sedimentation of Wooroloo Brook, caused by sediment runoff from roadwork site
Photo Credit: Perth NRM



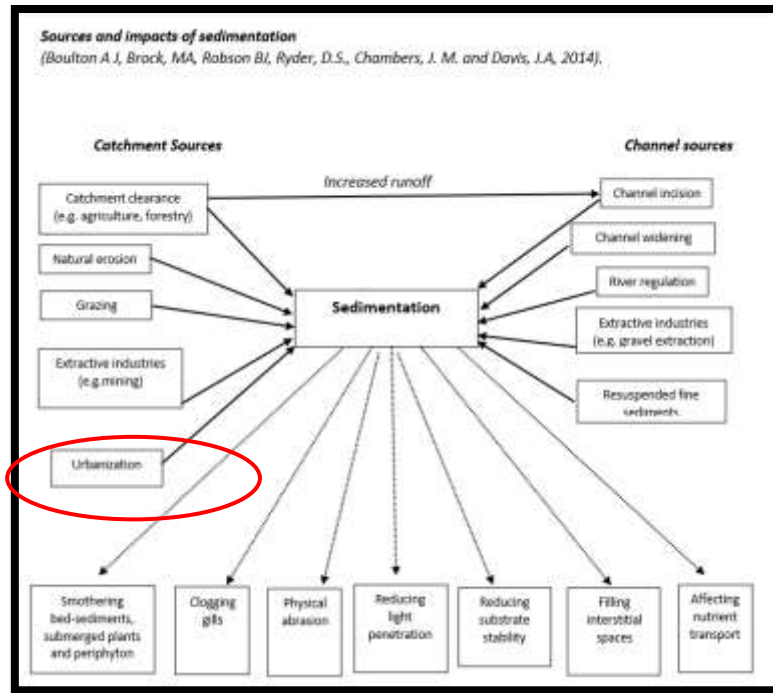
Soil and sand reaching waterways can:

- Contain high levels of introduced nutrients during soil remobilisation, promoting toxic algal blooms
- Contaminate waterways with heavy metals, herbicides, insecticides and pesticides, depending on previous land use
- Negatively impact recreational, cultural and heritage values, aesthetics and tourism
- Result in a failure by governments to meet public expectations for ensuring compliance with environmental legislation and the prevention of unnecessary rate-payer expenditure

Alexandrium bloom in Matilda Bay in the Swan River 2019-2020
Photo Credit: DBCA



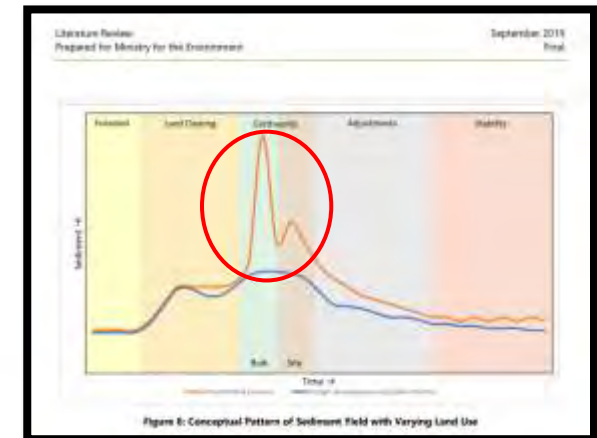
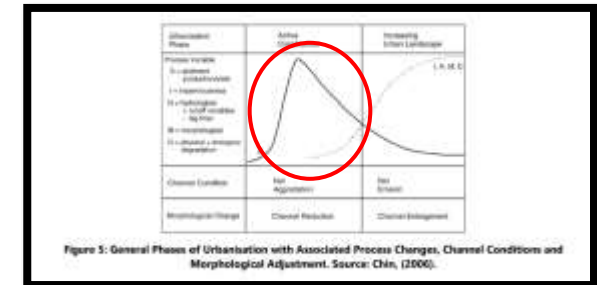
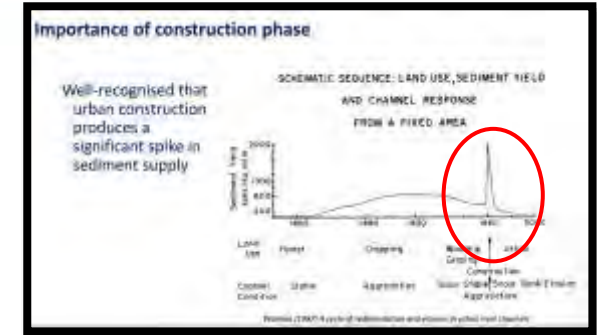
Sediment plumes from offshore gas dredging in Northern WA



“Among the land disturbance activities in cities, construction is one of the most important in altering runoff and sediment production”.
(Wolman, 1967)

“Uncontrolled sediment on construction sites has lasting and far-reaching effects on the ecosystems and societal values of streams and receiving waters”.
(Chin, 2006; Leopold et al., 2005)

“Sediment is the most common pollutant in USA’s rivers, streams, lakes and reservoirs: accelerated erosion from human use of land accounts for 70%”.
(USA EPA, 2012)



- Decades of research, photographic and anecdotal evidence from WA that uncontrolled sediment runoff from construction sites is degrading water quality in WA's waterways results in sediment pollution and sedimentation
- Suggests that regulators cannot rely on the land development industry to comply with environmental legislation related to on-site sediment control or to voluntarily adopt best practice erosion and sediment control measures
- For both disturbed soil (land clearing, bulk earthworks) and use of imported building sand

Sediment plume following heavy rainfall event, attributed to inadequate sediment control on one building site.

Elizabeth Quay, August 2023

Photo Credit: CBRE Retail Property Management



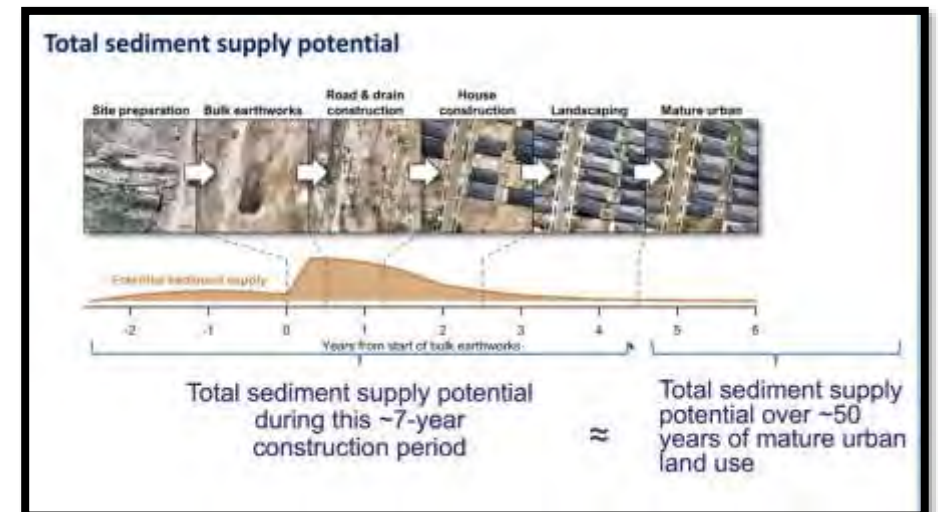
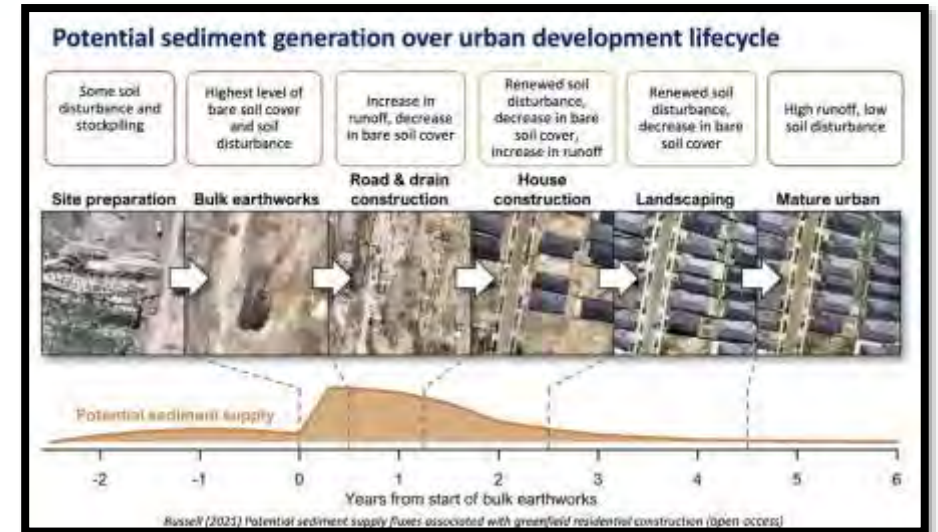
Soil erosion and sediment controls should be a priority to:

- Limit the duration of soil disturbance
- Limit the time bare soil is exposed

For all stages of land development

- Land clearing
- Earthworks
- Roads and drain construction and utilities
- Lot scale (house construction) activities
- Landscaping

(Dr Kathryn Russell and researchers at the University of Melbourne, together with Melbourne Water, 2023)



Sediment in stormwater reduces capacity and effectiveness of Drainage & Water Sensitive Urban Design (WSUD) assets/infrastructure

- Water Sensitive Urban Design assets not designed to cater for large sediment loads
- When on-site sediment loss is not controlled, WSUD infrastructure can become a source of sediment rather than a sediment (capture) sink
- Mobilised soil, sand, silt and debris impacts functionality of WSUD assets
- Regular and costly inspecting and maintaining of WSUD assets essential (accessing and removing sediment) and rectifying of older WSUD assets is often needed



*Accumulation of builders sand in Cygnia Cove constructed wetland (after passing through GPT)
Photo credit: Perth NRM*



*Damaged Sediment Trap, Little Carine Lake
Photo credit: Perth NRM*



*Silt trap and pipe filled with sediment
Photo Credit: Swan River Trust*



*Rain garden impacted by sand drift
Photo Credit: Swan River Trust*



It's too much, but how much is it?
(Photos: examples of poor sediment management on subdivision and roadworks sites in WA)



Sediment Task Force sponsors sediment research

- University of Western Australia-CRC for Water Sensitive Cities @ Heron Park Housing Development (Armadale, Perth) 2017-2019
- Across the 24.5 ha site, the measured sediment discharge rate from Heron Park study area amounted to **460,000 kg (290 m³)** in 2017 and **306,000 kg (190 m³)** in 2019.
- Amounted to approximately **17,000 kg/ha of exposed sand/year**
- No significant difference in sediment discharged per area from sites undergoing residential construction or sites undergoing civil works
- Increased baseflow of sediment due to seasonally high groundwater levels in drains

(Oldham, Eynon and Ocampo, CRC-WSC/UWA, 2020)



“Uncontrolled sediment from construction sites discharges at approximately 50 times the rate from agricultural land in WA”.

(McKergow et al., 2001)

(Confirmed by UWA-CRCWSC Heron Park research)

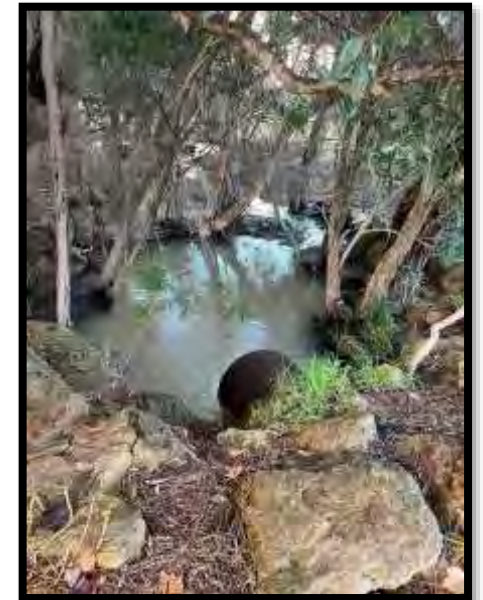
“For every acre under construction, 1.5 dump trucks of sediment washes into waterways if there is no erosion control”.

(City of Alexandria, USA, 2019)

“A burst water main caused a massive amount of sediment to flow into Subiaco lake system in 2022. Drain eduction was required to clear a 600mm depth of sediment from the drainage network”.

(City of Subiaco, 2022)

Sediment laden stormwater runoff into Lake Carine
Photo Credit: Perth NRM



Sediment plume in the Swan River, Woodbridge
Photo credit: City of Swan



Quantifying the magnitude of sediment loss (examples)

“A study following the 2011 Queensland floods estimated discharge from the Brisbane River during the month of January was equivalent to approximately 36% of the volume of Moreton Bay, with over 1 Million tonnes of sediment flushed into the bay over this flood event”.

(Healthy Land Water, 2022)



“A layer of soil one centimetre deep prevented from leaving site from an average house block is equivalent to approximately five trailer loads of soil less being deposited in waterways”.

(Ipswich City Council, 2020).

“Effective control of erosion and sediments on building sites prevents the loss of one tonne of soil on a 500m² lot. (One dump truck load less soil lost for every 10 houses built)”.

(Healthy Land Water, 2019)

Sand drift and erosion to stormwater entry pit
Photo Credit: Swan River Trust



Sediment plumes from two rivers in highly developed urban regions after storm event
(Sunshine Coast City Council, 2016)

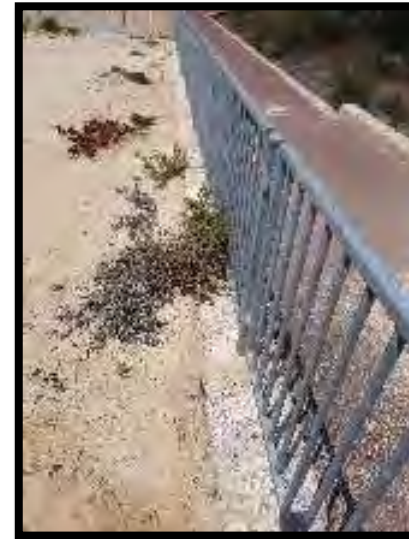


Sediment Control at Cygnia Cove Housing Development (Waterford, Perth) November 2020 - June 2023



Measurement of builders sand drift from one vacant lot at Cygnia Cove over 1.2 years

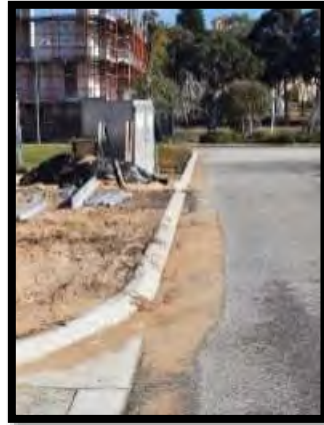
- High limestone wall installed on one property boundary and fence on the opposite property boundary reduced sand drift potential
- Still... 0.95 tonnes of wind-blown sand left this 442m² vacant block lot over 444 days
- Even though the Cygnia Cove subdivision site had:
 - Won multiple awards for Design and Environmental Excellence
 - Hydro-mulch & seeded soil with rye-grass
 - Reduced level of fill behind semi-mountable verge curbing



Sand drift from lots at Cygnia Cove (examples)



240kg (0.16m³) left 462m² lot



230kg (0.15m³) left 575m² lot

Richard Noble \$5000 bonus
free landscaping scheme
**0.5 tonnes of sand left one lot during
landscaping work one day**



200kg (0.13m³) left 452m² lot



30kg (0.02m³) left 446m² lot



Vehicular tracking of sediment at Cygnia Cove (examples)

- Observation of lots constantly being driven on to deliver building materials and for parking.
- Recurring and frequent problem of vehicular access causing sand and mulch (source of nutrients) tracking from sites/verges onto the road.



**242kg (0.16 m³) sand lost
from 450m² lot**



**150kg (0.1 m³) sand lost
from 455m² lot**



Poor practice by sand carriers at Cygnia Cove (examples)

**0.8 tonnes of sand
dumped on road**



**0.9 tonnes of sand
dumped on road**





It's too much and how much does it cost?

(Photos: examples of poor sediment management on residential building sites in WA)

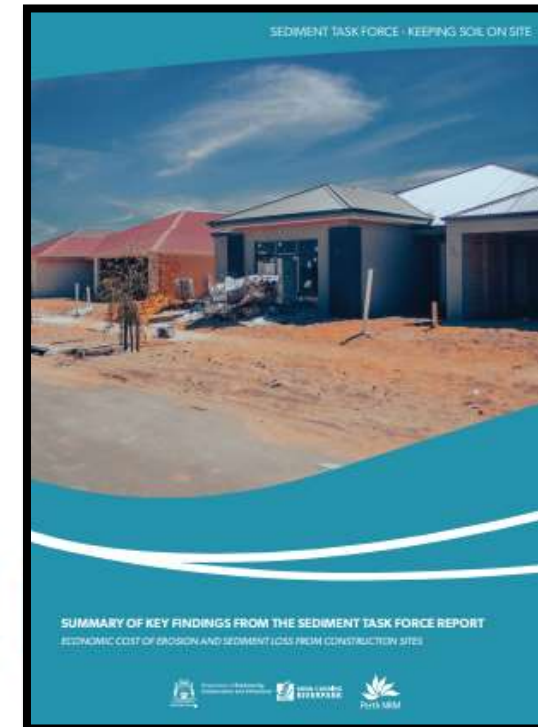
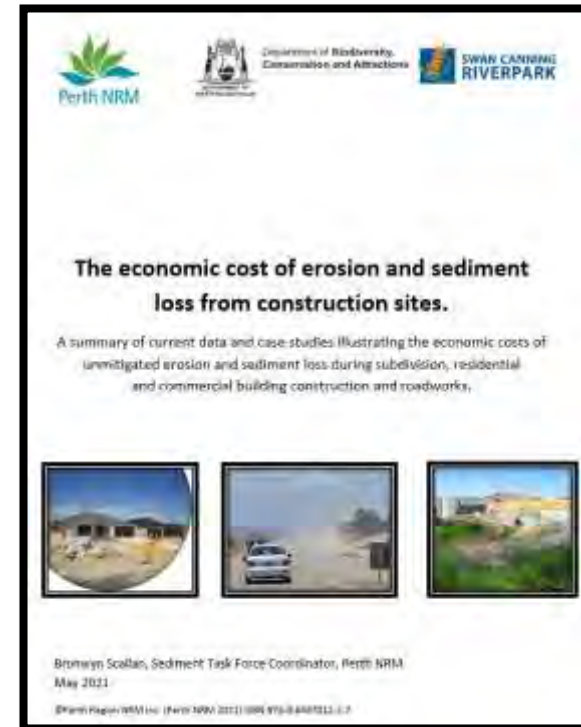


“The private financial benefit of sediment pollution is \$16 billion in environmental damage annually”.

(USA Environmental Protection Agency, 2012)

“If the 766 tonnes of sediment discharged along the Heron Park drain were released to waterways, it would cost up to \$60,000 to remove/dredge”.

((Oldham C.E., Eynon F. and Ocampo, C.J., 2020).

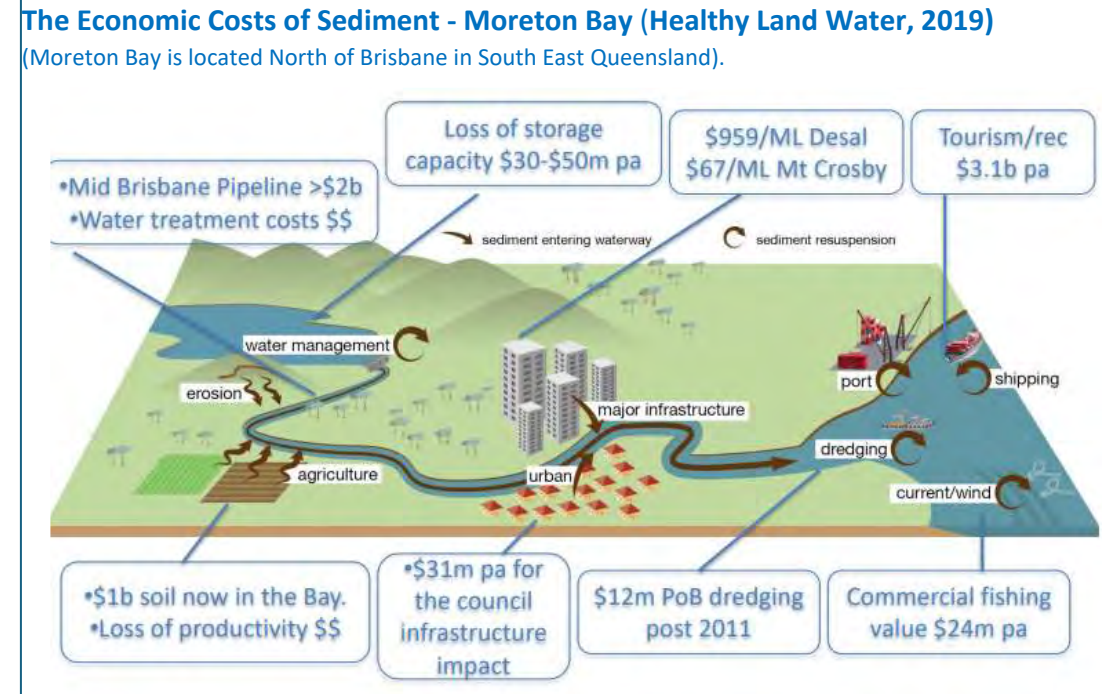


“Average expenditure of \$200 - \$3,000/stream metre on waterway rehabilitation and maintenance costs can potentially be avoided by each South East QLD Council if there was effective sediment control on construction sites”.

(Healthy Land Water, 2019)

“Estimated \$120,000 per annum on average spent by each of the 12 South East QLD Councils to manage measurable biological flow-on impacts of sediment loss from construction sites (e.g., aquatic weeds, algal blooms and fish kills”.

(Healthy Land Water, 2019)



South East Queensland Local Governments ‘Uncontrolled Sediment Bill’

Cost benefit analysis conducted in South East Queensland by Healthy Land Water (2019) estimated:

- Average cost of \$310,000 per SEQ council for ‘direct avoidable impact costs’ from poorly implemented erosion and sediment control
(**Does not include** potential environmental costs, construction delays, regulatory enforcement costs or potential litigation costs)
- Complaints relating to poor sediment control on construction sites for SEQ Councils costing \$800 - \$4,100 per complaint, with larger Councils receiving hundreds of complaints each year
- **SEQ council’s collective expenditure** for direct impacts of sediment upon Council infrastructure assets was **\$31 million per annum**
- Over the next 20 years, SEQ Councils would **avoid costs of \$160 billion** for waterway management if sediment and erosion controls were in place



Economic costs of Street Sweeping (WA examples)

City of Cockburn 2019/2020

- \$1,310,400 sweeping program for internal roads and paths.

City of Cockburn estimated 2024/2025 FY

- \$1,812,931 sweeping program for internal roads and paths.

City of Swan 2019/2020

- \$267,000 per annum budget for street sweeping of new subdivision stages after residential building.

City of Kwinana 2021

- \$80 average cost for road sweeping (includes but not limited to costs of sweeping up sediment runoff from subdivision/ building sites).

Example of poor site sediment management practices commonly observed during the Perth South West region 'Sediment Snapshot' (Photo credit: Perth NRM)



Economic costs of Cleaning/educting/unblocking sediment from drainage infrastructure (examples)

Sediment-laden water running off residential building site, Kalamunda
Photo credit: Perth NRM

City of Armadale 2018

- \$5,400 (\$387 per lineal metre) for cleaning singular pipe blocked by sand & rubble

City of Swan 2020

- \$375,000 per annum budgeted for cleaning drainage pits and lines full of sand within new subdivisions. (462 drainage work requests 2018)

City of Cockburn \$263,000 in 2019/2020

- \$250,000 for the cost of their educting program
- \$103,000 for the costs of waste disposal for sweeping and educting

City of Cockburn \$376,000 (estimated cost for 2024/2025)

\$265,000 for educting program
\$111,000 for waste disposal post sweeping and educting

- \$100,000 to repair or one vegetated stormwater asset (Lake Macquarie CC, 2014)

“The costs of construction and maintenance of WSUD devices can be reimbursed through the benefits of mitigated pollution damage control costs over a period of 5-10 years”.

(NZ Ministry for Environment, 2019)



Drain filled with sediment runoff from construction site, Kenwick
Photo credit: Perth NRM



Economic costs of Sediment removal (WA examples)

City of Canning 2020

- \$100,000 to remove 1200m³ of sediment from Wharf St Stormwater Basin
- The planned depth of the boardwalk and bridge structures had to be increased between 4 - 5 metres due to extensive sedimentation **at extra cost**

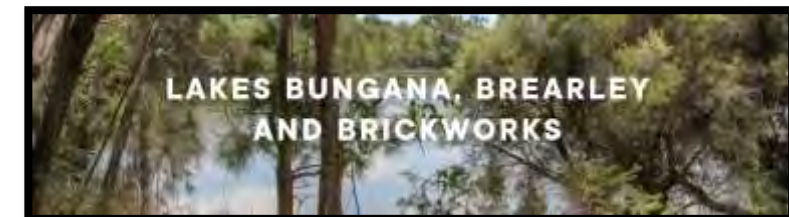


City of Bayswater 2015

- \$16,000 per annum to remove sediment from Gross Pollutant Trap Eric Singleton Bird Sanctuary Wetland Restoration Project.
- \$340,000 spent on the 170,000 plants required to encourage sedimentation at Eric Singleton Bird Sanctuary Wetland.

City of Bayswater 2019

- \$1.2 million to remove 8000m³ of sediment during Maylands Lakes restoration project (\$78/tonne)



Economic costs of Sediment removal (WA example)

City of Busselton 2022

- **Stage 1 - \$1 million (Program and first year sediment removal costs)**

630 tonnes (dry weight) of sediment over seven-week period dredged from the Vasse River
(Causeway Road Bridge upstream from pedestrian bridge on Peel Terrace)

Stage 2 - \$400, 000+ (sediment removal only)

- 670 tonnes (dry weight) of sediments were removed during Stage 2 (Causeway Road to Old Boat Ramp)

Stage 3 - Budget \$407,964 for sediment removal 2024

- Sediment removal planned for 2024 (upstream from Strelly St. Bridge)



Economic costs of Sediment removal (WA examples)

City of Subiaco 2017

- \$5,143/tonne manual “cleaning” Mabel Talbot wetland
7 tonnes of sediments removed
- \$36,000 (single incident)
- Subiaco Common Reflection Pond 2022 (acting as a Gross Pollutant Trap for sediment). Quote for \$50,000+ sediment removal costs stepping stone area alone



DBCA 2020

- \$7448 to remove 74.25 cubic metres from a sensitive site on the Ellen Brook (inert material disposed onsite)



“There is an economic benefit of \$1.20 for every \$1 invested in current best practice erosion and sediment control in Queensland”. (HLW, 2019)

Cease Work/Stop Work notices (examples)

- “Lost time production” to fix poorly controlled stormwater runoff can be very costly quickly
- Work can not resume until erosion and sediment control compliance efforts are sufficient

- **Sunshine Coast City Council 2020**

Cost of \$3.5 million LTP for Stockland Aura Subdivisions after
Development Stop Work Order issued

- **City of Armadale 2023**

Cease work order and infringement issued under the City’s Nuisance Local Law
Served notice requiring specific actions to prevent erosion and escape
of dust and sand (phased approach)
Escalation of regulatory site visits until compliance demonstrated via
updated dust management plan (compliance achieved in less than one week)

*Erosion and sediment runoff into a drain
during subdivision works
Photo Credit: Swan River Trust*



Sustained monitoring for effective erosion & sediment control compliance essential

- Low levels of compliance persist in WA despite clear legislative requirements and simple, affordable, and effective erosion and sediment control practices
- Confirmed by recent 'Sediment Snapshot'
 - 92% of sites inspected reported sediment (including dust) leaving site
 - 62% of sites had no (zero) erosion or sediment controls installed
 - 73% of sites were non-compliant with LG legislative requirements
- Causes:
 - Fines not acting as a disincentive;
 - Low levels of resourcing for monitoring for compliance
 - Enforcement and compliance activities primarily reactive to complaints (nuisance)
 - Costs of enforcement (resource intensive)
 - Perceived housing affordability issue

*Monitoring for compliance with or erosion, sediment runoff, sand drift and dust issues.
Photo credit: City of Kalamunda*



WA examples of better/best practice (subdivision) sediment control

- Controls and practices incorporated during the planning and design phases to prevent soil erosion and surface-water and drainage-water running over sites
- Restrictions on timing and staging of earthworks at times of high risk
- Discharge from sediment basins (<50mg/L TSS)
- Regular monitoring and auditing (corrective action)



Examples of better/best practice (building) sediment control (WA)

- Controls and practices installed to prevent soil erosion and surface-water and drainage-water running over sites
- Regular monitoring and auditing (corrective action)






Regular proactive site inspections and undergoing maintenance is imperative



Local Government Tool for Sediment Management



On-Site Builders Checklist for Preventing Sediment



CHANGING PRACTICE

Results of the Edith Cowan University's survey: LOCAL GOVERNMENTS' RESPONSE TO SEDIMENT LOSS FROM BUILDING SITES



'Sediment Snapshot' Pilot Trial

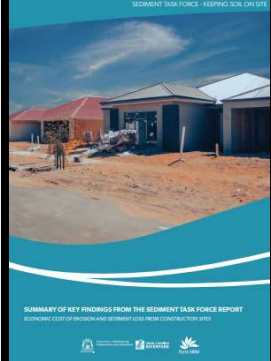
Summary Report



Quantifying sediment export from an urban development site: Heron Park, Western Australia



SUMMARY OF KEY FINDINGS FROM THE SEDIMENT TASK FORCE REPORT



STOP SEDIMENT POLLUTION and SAVE the ENVIRONMENT

Sediment in our wetlands and waterways harms the habitat and health of our native wildlife.

SEE SOMETHING? REPORT POOR PRACTICE



Regulation for Effective Sediment Management

Guidance for Local Governments



TAKING ACTION TO CONTROL SEDIMENT

Simple solutions to protect the health of Perth's waterways



Taskforce Workshop tackles money and sand going down the drain

19th November 2024 | Belmont Ballroom | Sydney | David Stammers | Local Government



Keep soil & sand on site

Comply with environmental regulations

FINES APPLY
Trades will be held accountable



Sustainable subdivision design for sediment



Managing urban development to protect our local waterways

The extent of the problem

Improvements to our existing management regime



Local Government Sediment Forum



Local Government Sediment Forum



Local Government Sediment Forum



Swan Canning River Recovery Project Three

Sediment Control at Cygnia Cove, Waterford

Stakeholder Summary Report



Best practice sediment management in residential developments



VIEW SEDIMENT MANAGEMENT RESOURCES



Use your phone camera to scan the QR Code and view useful resources on how to manage sediment on construction sites to meet legislative requirements for soil erosion, sediment run-off, sand drift and dust.



Effective management determines whether water quality is improved, restored, sustained or degraded.

It's up all of us!

In appreciation

**Shelley Shepherd, Jess Frood, New Water Ways,
Stormwater WA and the team from City of Kwinana**

Sediment Task Force members past and present

DBCA as sponsor of the Sediment Task Force

Perth NRM as project host

