Fine sediment (<20 µm) sources and transport in the Burdekin River catchment

Catchment area upstream of Burdekin Falls Dam

- Contributes **~80%** of annual end-of-river (EoR) discharge*, with the Upper Burdekin River being the dominant contributor
- Contributes an annual average fine sediment load of **1.3 million tonnes delivered to EoR**[1]
- Fine sediment delivery to EoR **is 3.6-fold higher than the Pre-development** load**[1-2], and erosion rates have particularly increased in the Upper Burdekin section[3,13]
- Fine sediment delivery to EoR has **reduced by 60-70% since the BFD** was installed (sediment delivery was up to 9.8- to 12-fold higher prior to the BFD)[1,2,4]

*30-year period 1991-2021
**Pre-European arrival to this catchment

Burdekin Falls Dam (BFD)

- **Overflows every year** since it's 1987 construction, **except** in 1992/93 & 2013/14[5]
- The proportion of sediment trapped depends on grain size; where **most (>95%) sand-sized particles are trapped** and **60-70% of finer particles** (<20 µm fraction) **are trapped**[2,6]

Catchment area downstream of Burdekin Falls Dam

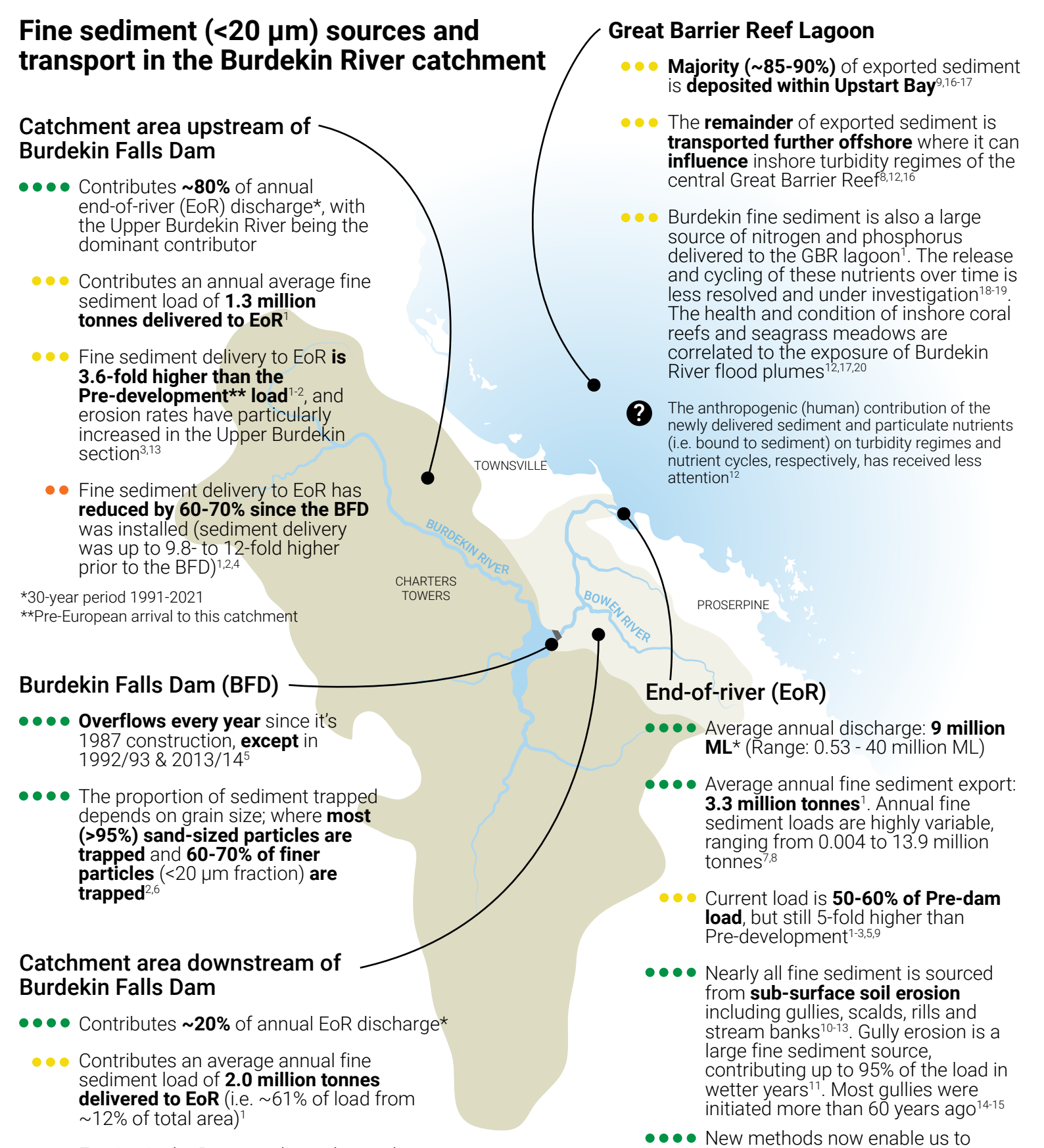
- Contributes **~20%** of annual EoR discharge*
- Contributes an average annual fine sediment load of **2.0 million tonnes delivered to EoR** (i.e. ~61% of load from ~12% of total area)[1]
- Erosion in the Bowen sub-catchment has increased **at least 3 times and up to 7.5 times** natural rates post-development[1,3,13]

Great Barrier Reef Lagoon

- **Majority (~85-90%)** of exported sediment is **deposited within Upstart Bay**[9,16-17]
- The **remainder** of exported sediment is **transported further offshore** where it can **influence** inshore turbidity regimes of the central Great Barrier Reef[8,12,16]
- Burdekin fine sediment is also a large source of nitrogen and phosphorus delivered to the GBR lagoon[1]. The release and cycling of these nutrients over time is less resolved and under investigation[18-19]. The health and condition of inshore coral reefs and seagrass meadows are correlated to the exposure of Burdekin River flood plumes[12,17,20]
- ? The anthropogenic (human) contribution of the newly delivered sediment and particulate nutrients (i.e. bound to sediment) on turbidity regimes and nutrient cycles, respectively, has received less attention[12]

End-of-river (EoR)

- Average annual discharge: **9 million ML*** (Range: 0.53 - 40 million ML)
- Average annual fine sediment export: **3.3 million tonnes**[1]. Annual fine sediment loads are highly variable, ranging from 0.004 to 13.9 million tonnes[7,8]
- Current load is **50-60% of Pre-dam load**, but still 5-fold higher than Pre-development[1-3,5,9]
- Nearly all fine sediment is sourced from **sub-surface soil erosion** including gullies, scalds, rills and stream banks[10-13]. Gully erosion is a large fine sediment source, contributing up to 95% of the load in wetter years[11]. Most gullies were initiated more than 60 years ago[14-15]
- New methods now enable us to identify and characterise individual gullies with large sediment yields for targeting cost-effective erosion control[21-22]
- ? Refining contributions of the BFD, Bowen River and other ungauged/non-monitored area below the BFD to EoR fine sediment loads



Uncertainty

- Measured data
- Multiple lines of evidence (includes proxy/limited measurements & modelling)
- Best estimate using derived data
- Greater uncertainty (e.g. know a likely range but don't know magnitude)
- ? Knowledge gap

- Catchment area upstream of Burdekin Falls Dam (114,700 km²)
- Catchment area downstream of Burdekin Falls Dam (15,200 km²)

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