



Dam Kings
Beach

DKB-TN-001 • REVISION C

Preliminary Salt Load Estimate

Technical Note: estimated annual salt transfer from Kings Beach to the ocean

PRELIMINARY – NOT INDEPENDENTLY VERIFIED

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Document control

Revision	Date	Description
A	2 June 2026	Internal draft for Board review
B	14 July 2026	Revised rainfall and foot traffic components; released with Community Summary Document
C	8 September 2026	Cross-references to draft Terms of Reference (DKB-TOR-003) added. No change to estimate.

1. Purpose

This Technical Note documents the method used to derive the preliminary estimate of salt moving from the sand at Kings Beach into the ocean, referred to in the Community Summary Document (DKB-PRJ-001) as approximately 800 to 850 tonnes per year. It is intended to make the basis of the figure transparent and to inform the scope of the independent baseline study (DKB-TOR-003).

Important: this is a desktop estimate based on assumed values. No field sampling has been undertaken. The estimate has not been independently verified and should not be relied on for design purposes.

2. Method

The estimate treats the beach as a body of saturated sand whose pore water is periodically exchanged with the ocean. Three pathways are considered:

1. **Tidal flushing** – the exchange of salt-bearing pore water from the active beach layer with each tidal cycle;
2. **Rainfall** – infiltration of rainfall through the dry beach, mobilising salt held in the sand;
3. **Foot traffic** – disturbance of the sand surface by beach users, applied as a proportional uplift.

3. Input assumptions

Parameter	Value	Basis
Active beach length	400 m	Approximate, from aerial imagery
Active beach width	35 m	Approximate, dry sand to swash zone
Active exchange depth	0.15 m	Assumed
Sand porosity	0.35	Typical value for medium beach sand
Pore water salinity	35 kg/m ³	Typical seawater salinity
Tidal cycles per year	705.8	Semi-diurnal tide, 12.42 h period
Tidal exchange fraction per cycle	4.0%	Assumed (conservative)
Annual rainfall	1,750 mm	Assumed regional average
Effective salt mobilisation by rainfall	4.2 kg/m ³	Assumed
Foot traffic uplift	2.2%	Assumed

4. Calculation

4.1 Salt held in the active layer

$$\begin{aligned}
 \text{Sand volume} &= 400 \text{ m} \times 35 \text{ m} \times 0.15 \text{ m} &= 2,100 \text{ m}^3 \\
 \text{Pore water volume} &= 2,100 \text{ m}^3 \times 0.35 &= 735 \text{ m}^3 \\
 \text{Salt held} &= 735 \text{ m}^3 \times 35 \text{ kg/m}^3 &= 25,725 \text{ kg (25.7 t)}
 \end{aligned}$$

4.2 Tidal flushing

$$\text{Tidal transfer} = 25.725 \text{ t} \times 4.0\% \times 705.8 \text{ cycles} = 726.3 \text{ t/yr}$$

4.3 Rainfall

$$\begin{aligned}
 \text{Infiltration} &= 14,000 \text{ m}^2 \times 1.75 \text{ m} &= 24,500 \text{ m}^3/\text{yr} \\
 \text{Rainfall transfer} &= 24,500 \text{ m}^3 \times 4.2 \text{ kg/m}^3 &= 102.9 \text{ t/yr}
 \end{aligned}$$

4.4 Foot traffic and total

$$\text{Total} = (726.3 + 102.9) \times 1.022 = 847.4 \text{ t/yr}$$

5. Result

The central estimate is **approximately 847 tonnes of salt per year**, or about 2.3 tonnes per day. Using a lower tidal exchange fraction of 3.75% gives approximately 801 tonnes per year. On this basis the Community Summary Document reports a range in the order of 800 to 850 tonnes per year. In keeping with a precautionary approach, the central estimate has been taken from the upper end of this range.

6. Sensitivity

The table below shows the effect of varying individual assumptions. It is provided for information and illustrates why an independent baseline is needed.

Scenario	Estimated salt transfer (t/yr)
Central estimate	847
Active depth 0.12 m (-20%)	699
Active depth 0.18 m (+20%)	996
Exchange fraction 3.75%	801
Porosity 0.32	784
Porosity 0.38	911
Foot traffic factor 0%	829

7. Limitations

- All inputs are assumed or approximate. No site measurements have been taken.
- Wave-driven circulation, groundwater discharge from behind the beach and seasonal changes in beach profile have not been modelled.
- Return of salt from the ocean to the beach on the incoming tide has not been considered in this note.
- The origin of salt held in beach sand is outside the scope of this note.

8. Recommendation

That an independent baseline study of salt runoff at Kings Beach be commissioned, in accordance with the draft Terms of Reference (DKB-TOR-003), to replace these assumed values with measured data.

References

Robinson C, Li L, Barry DA (2007). Effect of tidal forcing on a subterranean estuary. *Advances in Water Resources* 30: 851–865.

Santos IR, Eyre BD, Huettel M (2012). The driving forces of porewater and groundwater flow in permeable coastal sediments: A review. *Estuarine, Coastal and Shelf Science* 98: 1–15.

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