

Conclusions and Recommendations

Valuation of Water Resources

Eight recommendations. ***Six*** questions. ***One*** work plan.

Kirsten L. L. Oleson (lead)

Silvia Ferrini · Alice Bartolini · Henry Behr · Eli Fenichel · Alec Jacobs · Carl Obst · Vittoria Reas · Michael Vardon · Travis Warziniak

with contributions from Task Team D and the SEEA CF Technical Committee



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What this session needs to leave with

1

Endorse or amend the eight recommendations (§4)

Where consensus exists, they're stated as recommendations. Where **TC direction** is still needed, as proposals for consideration.

2

Resolve six TC Questions (§5.4)

Decisions for **this committee** specifically (distinct from the six GC questions already before the London Group for country input).

3

Assess the Annex A interim approach

Whether the four-step **F_t → V method** (and the Fenichel production-approach alternative) is sound enough for 2028 guidance.

4

Set the 2026–2027 work plan

Eight methodological priorities (§5.5) that need resolving before the update is ready for widespread implementation.

Cluster 1: Scope & Scale

1 Scope of Water Resources

In scope where a use is recorded, or recordable, in the water PSUT, and: an enforceable use right exists, and the use generates SNA-recorded output or measurable access expenditure.

Confirmed in: surface water, groundwater under active abstraction, and in-stream productive uses (hydropower, thermal cooling, canal operation).

Open (GC Questions b, c): soil water and glacier/snowpack boundary treatment.

6 Spatial Compilation

Compile at the **river basin**, the natural hydrological unit *not the nation*. National totals aggregate up from basin-level V and $\bar{p}$, never the reverse.

A national average price is a communication statistic, never the estimation target. It suppresses the scarcity variation the accounts exist to capture (the modifiable areal unit problem).

Australia's National Water Account applies this across 13 basins today.

Cluster 2: Valuation & Methods

2 Valuation targets

Distinguish V , F_t , D_t explicitly and assign each to its account: V for the balance sheet, F_t for the SUT, D_t for NDP/NNI.

4 Method hierarchy

Two tiers plus a conditional sub-tier, organized by proximity to an observed exchange price. Compilers select the highest tier for which conditions hold, and document the choice.

5 Zero and negative rents

Zero or negative rent doesn't end the analysis. Where Tier 1 doesn't apply, compilers try replacement cost or residual value by data conditions, then hedonic pricing and travel cost where conditions hold, with benefit transfer only as a last resort.

For TC consideration, not yet a recommendation: whether Fenichel's production approach to stock valuation (Annex A supplement) belongs in 2028 guidance as an alternative to the Harberger approximation.

Cluster 3: Reconciliation & Quality

3 MSUT / asset account reconciliation

The SUT values extraction at current rent F_t ; the asset account values it at $q_t \times \bar{p}$.

The gap (OCV) is reported in metadata rather than silently dropped. A large or persistent OCV signals that the F_t and V methods need review.

7 Water quality

Physical classification first (salinity, treatment requirement, ecological status), then a monetary adjustment where data support it.

Quality-driven reductions are OCV entries, distinct from the depletion charge.

8 Valuation at the extremes

NEAR EXHAUSTION

Cap both the depletion charge (Case 1) and the Case 3 addition entry at the same substitute-technology price.

GENUINE ABUNDANCE

Zero rent is a valid zero.
It doesn't signal a broken method.

MISSING RECHARGE DATA

Report D_t as NA.
Never as a default zero.

Why the substitute ceiling matters (Annex E, Example 4)

Second fossil aquifer, same $S_0/q/g/r$ as Example 2 but higher rent ($S_0 = 100 \text{ km}^3$, $q = 5 \text{ km}^3/\text{yr}$, $g \approx 0$, $R = \text{Int}\$2.50/\text{m}^3$, $r = 4\%$), two points on its depletion path.

YEAR 4 · BASELINE

$$S = 80 \text{ km}^3 \quad \Delta S/S = 6\%$$

$$\bar{p} = \text{Int}\$1.82/\text{m}^3$$

$$D_t = \text{Int}\$9,103 \text{ million}$$

The Harberger approximation still operates inside its valid range.

YEAR 16.8 · NEAR EXHAUSTION

$$S = 16 \text{ km}^3 \quad \Delta S/S = 31\%$$

$$\bar{p} = \text{Int}\$2.30/\text{m}^3$$

$$D_t =$$

Without cap: Int\$11,519M

With substitute ceiling (Int\$2.00/m³): Int\$10,000M

Beyond this zone, defensible accounts need direct estimation of $p^* = \partial V / \partial S$ instead of the Harberger shortcut.

This is why Rec 8 caps the charge. Beyond this point, the uncapped formula prices scarcity instead of the resource.

Try this scenario yourself

olesonlab.github.io/seea-water-simulator

Regeneration and negative depletion

Under-extraction ($q_{t,\text{net}} < g_t$) for a stored resource is proposed as **negative depletion**, the same SNA 2025 treatment used for fish and timber (§7.288). It raises NDP in the period it's recorded, rather than only adding to the stock.

Water differs from fish and timber in one respect: there's no discrete harvest-versus-growth act. Recharge happens independent of any decision to extract less, which weakens the analogy the treatment borrows.

For a **river without storage**, the surplus exits as downstream flow. No stock addition and no negative depletion get recorded, since no future extractive benefit is retained in the territory.

In the equations: depletion (Case 1) is $D_t = \bar{p} \times (q_{t,\text{net}} - g_t)$. Negative depletion (Case 3, stored resources only) reverses the sign: $-Addition_t = -\bar{p} \times (g_t - q_{t,\text{net}})$.

WHAT WE NEED FROM THE TC

Does this appropriately capture the economics of under-extraction? And how should it interact with GN D4 Option 3, where a reservoir treated as a produced asset would face depreciation and inventory changes instead of depletion and negative depletion?

Negative net natural recharge

g_t is defined as additions from precipitation and inflows minus natural losses (evapotranspiration, natural outflow), which lets g_t fall below zero in a drought year, independent of any extraction.

Equation D.5 ($D_t = \bar{p} \times (q_{t,\text{net}} - g_t)$) doesn't distinguish this from ordinary over-extraction: a **negative g_t** mechanically inflates D_t by the full natural loss, attributing a climate-driven stock decline to the production account as though it were extraction-driven.

Hydrological practice (the USGS SWB model; water table fluctuation method) keeps recharge and discharge as separate, non-negative fluxes rather than netting them into one signed variable. The SWB model floors recharge at zero and tracks the deficit as reduced evapotranspiration instead (Westenbroek et al., 2010); water-table-fluctuation readings below zero are read as discharge, or an estimation artifact, not recharge running backward (Becke et al., 2024; Crosbie et al., 2019).

WHAT WE NEED FROM THE TC

Should negative g_t instead route through the other-changes-in-volume line, leaving D_t to capture only extraction beyond whatever recharge actually occurred?

AN.34 / AN.32 / GN D4 consistency

A hydroelectric site's value can split three ways: the water resource (AN.34, depletion-based), energy generation capacity (AN.32, other-changes-in-volume-based), and GN D4 reservoir infrastructure. AN.34 and AN.32 use different accounting mechanics for the same underlying site. That's a live risk of inconsistent treatment, and of **double- or zero-counting** resource rent, across countries.

This isn't a new ambiguity: under the 2008 SNA, a hydropower or cooling licence could be recorded separately as a contractual use right (AN.2, specifically AN222). SNA 2025 removed that category once resources like hydroelectric potential became economic assets in their own right, and **AN222 no longer exists** (OECD, 2025). A licence's value now sits entirely inside AN.34 and/or AN.32, never in a separate AN.2 line.

WHAT WE NEED FROM THE TC

What changes, if any, are needed in GN D7 guidance to ensure consistent treatment across AN.34, AN.32, and GN D4 infrastructure values?

Specifically: which class should carry the resource rent, and should an additive framework summing to total site value, without overlap, be mandated?

A monetary degradation cost for water quality

Current SNA and SEEA CF practice already records **all quality degradation as OCV**, natural or anthropogenic, charged against the resource owner (SNA 2025 §13.32). Approach B proposes a departure from that single convention for continuous anthropogenic degradation only, not a change to how natural degradation is treated.

Three approaches on the table: (A) quality changes fully captured through OCV stock adjustments, no separate line; (B) a degradation cost calculated and reported as a supplementary item, parallel to but outside NDP, alongside the depletion charge; (C) quality-adjusted depletion replaces the standard quantity-based charge where quality data allow.

This note's **preference is (B)**: it keeps a foreseeable, recurring externality visible at its source, rather than folding it into a volume-change entry against the resource owner's balance sheet.

Approach (A) alone is not recommended for anthropogenic degradation specifically: it misclassifies an economic cost as a natural volume change and breaks the link to the responsible sector.

WHAT WE NEED FROM THE TC

Should the updated SEEA CF introduce this degradation cost at all? If so, does the TC agree with Approach B, or is a case for C, or a hybrid, stronger?

The SNA asset-boundary test for water

This note follows the traditional SEEA CF convention that its monetary scope equals the SNA's: any resource within the proposed AN.34 boundary is treated as meeting the SNA's economic-asset criteria (enforceable ownership or use rights, and expected future economic benefit) by definition.

That correspondence has not, to the authors' knowledge, been rigorously tested against SNA criteria for water specifically, the way it has for other environmental assets with longer-established SNA treatment.

Enforceability itself is set by the **domestic water-rights regime**, and that regime varies by jurisdiction, sometimes within one country (riparian vs. prior-appropriation in the US).

The two regimes don't just differ in detail: a prior-appropriation right is quantified, dated by priority, and often transferable, which can support a market price. A riparian right typically isn't transacted at all, which means **whether "enforceable use right" is even a well-defined test** is in question, not just which valuation tier applies.

WHAT WE NEED FROM THE TC

Does the TC agree the proposed AN.34 scope satisfies the SNA 2025 economic-asset test in practice? And does the test need explicit guidance for applying it across riparian, prior-appropriation, permit-based, and communal or customary regimes, or is that a matter for country-level judgment?

Institutional sector attribution for water

§3.7.4 and Annex F extend SNA 2025's existing **split-asset approach** for minerals and energy (§27.59–27.62) to water: depletion and stock value shared between the legal owner and the extractor, in proportion to the owner's share of resource rent received.

That ratio is observable where a licence fee or royalty is paid. It is not observable where water rights are held communally or under customary tenure with no single identifiable legal owner, or where ownership is split across national, state/provincial, and river-basin authorities.

Annex F worked example: a government water authority (S.13) charges an abstraction licence fee equal to **20 percent of the resource rent**. On a $D_t = \text{Int}\$500$ million depletion charge, S.13's share is $\text{Int}\$100$ million, debited to its capital account; S.11's (the extractor's) residual share is $\text{Int}\$400$ million, the amount that reduces its net lending position. The two shares sum to the full D_t . Neither sector's position can be read off D_t alone without knowing the sharing ratio.

WHAT WE NEED FROM THE TC

Does the TC agree the split-asset approach should extend to water on these terms? How should compilers determine the ownership share when no rent is observed, and what should the default be when it can't be determined at all?

One site, three possible places to record its value

AN.34

WATER RESOURCE

Resource rent, **depletion-based**. This note's valuation methods apply directly.

AN.32

ENERGY GENERATION CAPACITY

AN322S3: hydroelectric potential. Recorded via **other-changes-in-volume**, rather than depletion.

GN D4

RESERVOIR INFRASTRUCTURE

Option 3: **produced-asset inventory**.
Alternative to AN.34, not additive to it.

The critical rule: **avoid double-counting**.

Countries should document which class carries the resource rent for a given site, and ensure summing across classes doesn't count the same economic value twice.

The interim approach from F_t to V

1

Estimate F_t

Highest-tier method with enough data (§3.4).

2

Approximate V

Constant-rent perpetuity, $V \approx F_t/r$:
bounded, biased by design, and
disclosed as such.

3

Derive $\bar{p}$

Harberger average of opening and
closing unit price.

4

Report sensitivity

Discount rate, projection assumption,
bias direction, $r \pm 1\text{pp}$ range.

WARNING: the perpetuity formula $V = F_t/r$ is invalid for fossil aquifers and structurally declining systems. Use the finite-horizon NPV formula ($T = S/q$) instead.

For TC assessment (§5.5 priority 6): whether Fenichel and Abbott's production approach (deriving p^ directly from observable rents and stock dynamics, no discount-rate assumption) should sit alongside this as an alternative in 2028 guidance.*

Eight methodological priorities ahead of 2028 (1 of 2)

1. Own-account abstraction

Most countries lack metering at the resolution the accounts require, though remote sensing (satellite evapotranspiration, radar soil moisture) offers a validated path toward closing the gap without universal metering infrastructure (Filippelli et al., 2022; Karimi et al., 2015).

A priority is a review of current remote sensing practice and the conditions under which it produces volumes reliable enough for national accounting.

2. Spatial disaggregation

National $\bar{p}$ estimates produce accounts that cannot support river-basin-level governance.

Priorities include methodological guidance on river-basin-level price estimation and worked examples from countries with operational river basin accounts, such as Australia's National Water Account.

3. Water quality classification

Current AN.34 and SEEA-Water guidance does not differentiate by water quality, though quality differences carry starkly different resource rent values.

Priorities include guidance on quality-differentiated asset classification (e.g., salinity or treatment-requirement bins), operational workflows mapping these to resource rent estimates, and guidance on when and how to apply quality classification.

4. Price estimation at extremes

The residual value method is sensitive to the assumption that water is the binding constraint on output; at very high extraction rates, scarcity creates general equilibrium effects a sector-level residual cannot capture (Fenichel and Abbott 2014).

A priority is guidance on when partial equilibrium price estimation is adequate and when general equilibrium approaches are required, with empirical benchmarks.

Eight methodological priorities ahead of 2028 (2 of 2)

5. Harberger approximation and reporting guidance

$p^* = \partial V / \partial S$ is the conceptual standard; $\bar{p} = V/S$ is a Harberger approximation valid when $\Delta S/S \approx 0$, but introduces material error for stressed water bodies.

Priorities include criteria for when $\bar{p}$ adequately proxies p^* , how to quantify and disclose approximation error in metadata, and a transition pathway toward routine direct estimation of p^* .

6. Production approach to stock valuation

Fenichel et al. (2016) propose deriving p^* directly from observable resource rents and stock dynamics, without a discount rate assumption (Annex A).

A key priority for 2028 is to assess whether this approach can be validated at scale and incorporated into GN D7 as an alternative to the Harberger approximation (see also TC Question (f) on discount rate practice).

7. Temporal and spatial resolution of the depletion charge

Multi-year averaging (§3.2.3) assumes annual compilation, but basins with strong seasonal draw-down and refill cycles may need sub-annual data. Whether summing depletion across time or space produces a policy-relevant number, rather than an artifact of combining heterogeneous hydrological units, has not been tested.

TC guidance is needed on minimum resolution requirements and whether aggregate totals should be reported at all.

8. Institutional and legal determinants of enforceability and market availability

“Enforceable use right” is set by the water-rights regime in force (riparian, prior appropriation, permit-based, or communal/customary tenure), which can vary within a country as well as across countries (§2.1). This bears directly on why Tier 1 market evidence exists in some jurisdictions and not others (§3.4.2), and on the institutional-attribution questions in §3.7.4, Annex F, and TC Guidance Question 6.

An open question is how much of this the 2028 update should address directly, versus flagging as local context.

What we're asking the TC to decide today

- 1 Endorse the **eight recommendations** in §4, or flag which need revision before Global Consultation opens.
- 2 Take a position on **TC Questions 1–6**: regeneration/negative depletion, negative g_t routing, the AN.34/AN.32/D4 boundary, the quality degradation cost, the SNA asset-boundary test, and institutional sector attribution.
- 3 Assess whether the **Annex A interim approach**, and the Fenichel production-approach alternative, is sound enough to carry into 2028 guidance.
- 4 Confirm the **eight methodological priorities** in §5.5 as the 2026–2027 work plan, or reorder them.

`olesonlab.github.io/sea-water-simulator`

Kirsten Oleson · koleson@hawaii.edu · on behalf of Task Team D