

# OA and Environmental Impact Assessment

Provides guidance on using Ocean Accounts to support environmental impact assessment (EIA) and strategic environmental assessment (SEA) in marine settings.

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## OUTCOME

This Circular sets out how Ocean Accounts support environmental impact assessment and strategic environmental assessment in marine and coastal contexts: which account each stage of the assessment draws on, how to obtain it, and what it can and cannot establish. Effective assessment requires baseline data on environmental conditions, methods for predicting and evaluating impacts, and a framework for cumulative effects; accounts compiled to SEEA standards supply the first and third directly and constrain the second.

Decision use cases. Baseline establishment from extent and condition accounts (Section 3.1); cumulative impact assessment using time series and regional pressure inventories (Section 3.2); ecosystem service valuation for impact quantification (Section 3.3); damage cost estimation for predicted degradation (Section 3.5); and compensatory mitigation and offset calculation (Section 3.7). Section 3.6 maps these onto the screening, scoping, impact prediction, mitigation design and post-approval monitoring phases, with the data access pathway for each, and Section 3.8 works a coastal development assessment through end to end.

Where the methods are specified. The quantitative methods this Circular applies are set elsewhere and are not restated here: the degradation formula, its applicability conditions and the offset equivalence arithmetic in [TG-3.1 Asset Accounts](#) Section 3.5.3; the valuation preference order in [TG-2.4 Environmental \(including Ecosystem\) Goods and Services](#) Section 3.10; residual flow categories and the physical supply and use structure in [TG-3.4 Flows from Economy to Environment](#); and spatial resolution adequacy in [TG-2.12 Spatial Data Frameworks](#) Section 3.3. What this Circular adds is the judgement around them – when the simplified degradation approximation is not defensible, why a damage cost must be presented as a range, and why area equivalence in an offset is not service equivalence.

Related assessment contexts are covered in [TG-2.9 OA and Ocean Risk Assessment](#) and [TG-6.9 Offshore Energy](#).

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DRAFT

## 1. Outcome

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¶4 Related assessment contexts are covered in **TG-2.9 OA and Ocean Risk Assessment** and **TG-6.9 Offshore Energy**.

## 2. Requirements

¶1 This Circular requires familiarity with:

- ¶2 **TG-0.1 General Introduction to Ocean Accounts** – for foundational understanding of Ocean Accounts, the Ocean Accounts Framework, and the relationship between ecosystem accounting and decision support
- ¶3 **TG-3.1 Asset Accounts** – the hard prerequisite for detailed technical guidance on compiling condition accounts (Section 3.4.2) and asset accounts referenced throughout this Circular, including condition indicators, reference levels, condition indices, and asset valuation methods. Practitioners must be familiar with TG-3.1 before applying the baseline, impact prediction, valuation, and offset procedures in Sections 3.1 through 3.8.
- ¶4 **TG-3.2 Flows from Environment to Economy** – for detailed technical guidance on ecosystem service measurement and valuation approaches used in impact quantification

¶5 **Related Circulars:**

- ¶6 **TG-1.9 Safe Usage of Monetary Valuation** – provides guidance on appropriate use and interpretation of monetary values in decision contexts, essential for valuation applications in EIA
- ¶7 **TG-2.9 OA and Ocean Risk Assessment** – provides complementary guidance on hazard and risk assessment that informs the cumulative impact dimensions of EIA
- ¶8 **TG-3.7 Governance and Institutional Accounts** – provides context on the regulatory and institutional frameworks within which EIA operates

¶9 Readers approaching Section 1 for the first time should begin with **TG-1.0 Ocean Accounting and the Blue/Ocean Economy**, the framing circular for the section, which sets out the ocean economy terminology used throughout, what an ocean account can and cannot certify about a blue economy claim, and the map from a policy question to the circular that answers it. It is recommended reading, not a prerequisite.

### 3. Guidance Material

#### 3.1 Ocean Accounts as EIA Baseline Data

¶1 Environmental impact assessment depends on establishing baseline conditions against which potential impacts can be measured. UNCLOS Article 206 establishes that states shall assess the potential effects of planned activities when there are reasonable grounds to believe they may cause substantial pollution or significant and harmful changes to the marine environment<sup>1</sup>.

¶2 Ocean Accounts provide a structured framework for organising baseline data that serves EIA purposes. The SEEA Ecosystem Accounting framework identifies three primary account types that directly support baseline establishment<sup>2</sup>:

¶3 **Ecosystem extent accounts** record the area of different marine and coastal ecosystem types within defined spatial units. For EIA purposes, extent accounts establish the baseline distribution and area of ecosystems such as seagrass meadows, coral reefs, mangroves, kelp forests, and open water habitats within a project's area of influence. The IUCN Global Ecosystem Typology provides the reference classification for ecosystem types, which supports consistency across assessments<sup>3</sup>. Technical guidance on compiling extent accounts is provided in **TG-3.1 Asset Accounts**, Section 3.5.1.

¶4 **Ecosystem condition accounts** record the state of ecosystem assets relative to reference conditions. Following the SEEA Ecosystem Accounting approach, condition is measured through ecosystem characteristics organised into physical, chemical, compositional, structural, functional, and landscape/seascape categories<sup>4</sup>. For marine ecosystems, relevant characteristics include water quality parameters (temperature, salinity, dissolved oxygen, nutrient concentrations, pH), biodiversity indicators (species richness, population abundance, community composition), habitat structural complexity, and connectivity measures. Detailed guidance on condition account compilation is provided in **TG-3.1 Asset Accounts**, Section 3.4.2.

¶5 **Ecosystem services accounts** record the contributions of ecosystems to benefits used in economic and other human activity<sup>5</sup>. For EIA baseline purposes, services accounts document the current flows of provisioning services (fish provisioning, aquaculture production), regulating services (coastal protection, water purification, carbon sequestration), and cultural services (recreation, tourism, scientific research, spiritual and cultural values) that depend on the ecosystems within the project area. Technical guidance on services account compilation is provided in **TG-3.2 Flows from Environment to Economy**.

¶6 SEEA Ecosystem Accounting explicitly recognises EIA as one application of condition accounts, noting that condition data "can be used to inform policy- and decision-making across a range of sectors that impact or depend on ecosystems and natural resources, including land-use planning, environmental impact assessment, agricultural planning and authorization processes, and programmes for ecosystem rehabilitation or restoration"<sup>6</sup>.

#### Application procedure for EIA practitioners

¶1 To access and use Ocean Accounts data for EIA baseline development, practitioners should follow this procedure:

¶2 **Step 1: Identify relevant accounting areas.** Determine which Ecosystem Accounting Areas (EAAs) or Basic Spatial Units (BSUs) intersect with the proposed project's area of influence. Contact the national statistical office or environmental agency responsible for Ocean Accounts compilation to obtain spatial boundary files.

¶3 **Step 2: Obtain account data.** Request the most recent ecosystem extent accounts, condition accounts, and service flow accounts for the relevant EAAs. Ideally, request time series data covering at least two accounting periods to establish baseline trends rather than single-point-in-time values.

¶4 **Step 3: Assess spatial resolution.** Compare the spatial resolution of the accounts, typically compiled at regional or sub-national scale, with the scale of the proposed project. **TG-2.12 Spatial Data Frameworks** Section 3.3 sets the minimum mapping units and BSU resolution the accounts are compiled at, and the tests for whether that resolution is adequate to a given footprint. Where it is not, supplementary site survey is required, using methods consistent with the accounting framework classifications so that project monitoring data can be contributed back to the accounts in a later compilation cycle; where the survey uses remote sensing or geospatial methods, follow **TG-4.1 Remote Sensing and Geospatial Data**. Where account data are used directly as baseline, the resolution and its limitations should be documented in the assessment.

¶5 **Step 4: Extract baseline indicators.** From condition accounts, extract the values of condition variables relevant to the ecosystem types present in the project area. From extent accounts, extract opening extent (hectares or km<sup>2</sup>) for each ecosystem type. From service flow accounts, extract the annual flow rates of ecosystem services potentially affected by the project.

¶6 **Step 5: Document reference conditions.** Identify the reference levels used in the condition accounts and document these as the baseline against which project impacts will be assessed. Where account data are not available or are of insufficient spatial resolution, conduct supplementary baseline surveys using methods consistent with the accounting framework, enabling future contribution of project monitoring data back to the accounts.

### 3.2 Cumulative Impact Assessment

¶1 Marine ecosystems face cumulative effects from multiple activities and stressors operating over extended time periods and spatial scales. The FDES recognises that it is often not possible to establish direct cause-effect relationships between changes in environmental quality and individual human activities or natural processes, because impacts result from combined and cumulative processes and effects over space and time<sup>7</sup>.

¶2 Ocean Accounts support cumulative impact assessment through three mechanisms:

¶3 **Time series analysis:** Ocean Accounts are designed to be compiled regularly (ideally annually) to support ongoing monitoring and trend analysis<sup>8</sup>. This time series structure enables assessment of cumulative changes in ecosystem extent, condition, and service flows over extended periods. Where accounts record declining condition indices or contracting ecosystem extent over successive accounting periods, that record provides evidence of cumulative degradation that individual project EIAs should consider. Where coral reef extent accounts for a coastal region record a decline from 5,000 ha in 2020 to 4,200 ha in 2025, the resulting 16% reduction provides quantitative context for assessing whether an additional coastal development project would contribute to cumulative habitat loss beyond sustainable thresholds.

¶4 **Spatial integration:** The accounting framework integrates data across defined spatial units within Ecosystem Accounting Areas, supporting assessment of how multiple projects and activities within a region combine to affect ecosystem assets. The spatial aggregation from Basic Spatial Units to EAAs enables practitioners to assess whether localised project impacts, when combined with other activities within the broader region, may trigger ecosystem-scale responses.

¶5 **Physical flow accounts:** The SEEA Central Framework establishes accounts for physical flows between the economy and environment, including residual flows such as emissions, wastewater, and solid waste<sup>9</sup>. These physical supply and use tables (PSUTs) enable tracking of pollution loads, nutrient flows, and other pressures that cumulate across activities and time. For marine environments, relevant residual flows include nutrient discharges, sediment inputs, chemical pollutants, marine debris, and greenhouse gas emissions affecting ocean acidification and warming. Compiling PSUTs at regional scale allows practitioners to assess whether a proposed project's incremental loading would exceed assimilative capacity when added to existing background loads.

¶6 Where PSUTs for the relevant marine region have not yet been compiled, practitioners should take three steps. First, use point-source discharge registers and diffuse load models as interim substitutes for regional pollution load data. Second, structure and express results in a format consistent with future PSUT compilation (following the supply-and-use table structure in SEEA Central Framework Chapter 3<sup>9</sup>), so that project data can be incorporated once PSUTs are available. Third, document explicitly in the EIA report that PSUTs were unavailable and describe the substitute approach used. The five-step pollution assessment framework in Section 3.4 provides additional fallback guidance on data sources when PSUTs are absent.

¶7 The Taskforce on Nature-related Financial Disclosures (TNFD) defines impacts as “changes in the state of nature (quality or quantity), which may result in changes to the capacity of nature to provide social and economic functions. Impacts can be positive or negative. They can be the result of an organisation's or another party's actions and can be direct, indirect or cumulative”<sup>10</sup>. This definition emphasises that cumulative impacts manifest as changes in ecosystem state, which condition accounts are designed to measure.

¶8 For cumulative impact assessment in practice, Ocean Accounts support a structured approach:

¶9 **Table 1: Cumulative Impact Assessment Framework**

| Step | Activity                        | Account Reference                                                                                    |
|------|---------------------------------|------------------------------------------------------------------------------------------------------|
| 1    | <b>Regional baseline</b>        | Ecosystem extent and condition accounts for relevant EAA                                             |
| 2    | <b>Trend analysis</b>           | Time series of condition indices and extent changes                                                  |
| 3    | <b>Pressure inventory</b>       | Physical flow accounts for residual loads by source                                                  |
| 4    | <b>Additionality assessment</b> | Project incremental contribution to cumulative pressures                                             |
| 5    | <b>Threshold consideration</b>  | TG-3.1 Section 3.4.2 reference condition methodology; biophysical modelling guidelines (footnote 13) |
| 6    | <b>Impact prediction</b>        | Expected condition change from cumulative pressures                                                  |

¶10 The SEEA EA research agenda identifies the value of understanding ecosystem capacity and thresholds, noting connections to the “critical natural capital” concept in economics and the “planetary boundaries” concept in ecology<sup>11</sup>. Consider a case in which condition accounts record that seagrass canopy density in a BSU has declined to 65% of its reference level, and the reference condition methodology (TG-3.1 Section 3.4.2) identifies 60% as the threshold below which carbon sequestration and nursery services decline non-linearly: an additional project loading that would push condition below this threshold warrants heightened scrutiny in cumulative assessment. The Guidelines on Biophysical Modelling for Ecosystem Accounting provides methods for assessing ecosystem capacity that can inform threshold identification<sup>12</sup>.

¶11 Cumulative impact assessment requirements vary across regulatory frameworks but share common analytical needs that accounts can support. Under the EU Strategic Environmental Assessment (SEA) Directive (2001/42/EC), assessment of plans and programmes must consider cumulative effects on the environment, including biodiversity and ecosystem interactions. Under the United States National Environmental Policy Act (NEPA), agencies must consider cumulative impacts defined as impacts resulting from the incremental impact of the action when added to

other past, present, and reasonably foreseeable future actions. Ocean Accounts provide the time series data, spatial integration, and pressure-state linkages necessary for cumulative analysis in both contexts.

### 3.3 Ecosystem Service Valuation in EIA

¶1 Monetary valuation of ecosystem services can inform EIA by expressing environmental impacts in terms comparable to project economic benefits, and thus support more complete cost-benefit analysis. Readers should consult **TG-1.9 Safe Usage of Monetary Valuation** for detailed guidance on appropriate use of monetary valuation in decision contexts.

¶2 The SEEA Ecosystem Accounting framework establishes exchange values as the appropriate monetary concept for accounting purposes<sup>13</sup>. Exchange values, as defined in the SNA and adopted by the SEEA EA, represent “the values at which goods, services, labour or assets are in fact exchanged or else could be exchanged for cash”<sup>14</sup>. This differs from welfare values commonly used in environmental economics, which include consumer surplus and other non-market values.

¶3 **Clarification on value concepts for EIA practitioners:** Ocean Accounts produce exchange values and nothing else: all account components yield exchange values by construction, consistent with SNA national-accounting conventions. Welfare values (non-use values, consumer surplus, total economic value) are not produced by the accounts, and they require primary valuation studies (stated preference, revealed preference, or benefit transfer) conducted outside the accounts framework. An EIA practitioner using accounts for cost-benefit analysis must supplement with primary welfare-value studies if welfare values are needed. Welfare values cannot be derived from the accounts themselves. Practitioners must always label which value concept is being used and in what context: account outputs should be clearly identified as exchange values, and any supplementary welfare-value analysis should be identified as such and not conflated with the account figures. Cross-reference **TG-1.9 Safe Usage of Monetary Valuation** for detailed guidance on appropriate use and labelling of monetary values in decision contexts. The choice of value concept changes the result. Welfare values (including consumer surplus and non-use values) will typically be higher, and will therefore yield larger estimates of damage and of offset requirements. Misapplying exchange values to analyses intended to capture full social cost will systematically understate environmental damages.

¶4 Valuation methods are ranked by their proximity to observed market transactions. That preference order, the methods at each level, and the methods that are not admissible in accounts are specified in **TG-2.4 Environmental (including Ecosystem) Goods and Services** Section 3.10; **TG-1.9 Safe Usage of Monetary Valuation** Section 3.4 sets out what a decision-maker should ask of any figure produced under it.

¶5 For marine EIA the practical consequence is that most of the services at issue – coastal protection, water purification, nursery habitat – fall at the lower preference levels, where values rest on modelled rather than observed expenditure. A valuation of a coastal development’s impacts will typically combine a level 1 or 3 figure for fish provisioning with level 5 figures for regulating services, and the aggregate carries the uncertainty of the weakest component. Stating the preference level reached for each service, rather than presenting a single total, is what allows a consent authority to weigh the evidence properly.

¶6 For EIA applications, valuation can support:

- ¶7 **Impact quantification:** Expressing predicted changes in ecosystem services in monetary terms enables comparison with project economic benefits
- ¶8 **Mitigation prioritisation:** Valuation identifies which ecosystem services carry the greatest economic weight, and that ranking guides mitigation priorities. Where coastal protection services are valued at USD 12,000/ha/year whilst cultural services are valued at USD 800/ha/year,

mitigation efforts may prioritise protection of reef structures that deliver coastal protection over purely aesthetic considerations.

- ¶9 **Compensation determination:** Where residual impacts require offsetting, valuation informs compensation calculations using asset valuation approaches from **TG-3.1 Asset Accounts**
- ¶10 **Stakeholder communication:** Monetary values can communicate environmental significance to audiences more familiar with economic than ecological metrics

¶11 Important limitations apply. The SEEA EA acknowledges that “monetary values will not fully reflect the importance of ecosystems for people and the economy”<sup>15</sup>. Specific limitations relevant to EIA include:

1. ¶12 Many ecosystem services lack market values or close market analogues
2. ¶13 Non-use values (existence, bequest, option values) are excluded from exchange value accounting
3. ¶14 Indigenous and local community relationships with marine environments may not be adequately expressed through monetary valuation
4. ¶15 Exchange values may understate impacts on ecosystem services that are underpriced or unpriced in existing markets
5. ¶16 Valuation uncertainty may be substantial, particularly for services far from market transactions

¶17 EIA practitioners should use monetary values as one input alongside qualitative and non-monetary quantitative information about impacts. **TG-1.9 Safe Usage of Monetary Valuation** provides detailed guidance on contexts where monetary valuation is and is not appropriate, including the recommendation that physical accounts should always be compiled and published alongside monetary accounts to support appropriate interpretation.

### 3.4 Residual Flows and Pollution Assessment

¶1 Physical flow accounts within the SEEA Central Framework provide a systematic structure for recording emissions and residual flows from economic activities to the environment<sup>16</sup>. For marine and coastal EIA, these accounts support assessment of pollution impacts from proposed developments. The SEEA Central Framework defines emissions as “substances released to the environment by establishments and households as a result of production, consumption and accumulation processes”<sup>17</sup>, distinguishing emissions to air, water, and soil. For marine environments, the relevant residual flows are emissions to water, emissions to air, solid waste, and natural resource residuals such as bycatch discards and processing waste.

¶2 The residual flow categories relevant to marine and coastal EIA – emissions to water, emissions to air, solid waste, and natural resource residuals – and the physical supply and use table structure that records them are set out in **TG-3.4 Flows from Economy to Environment** Sections 3.2 and 3.3, with the source-attribution method in Section 3.5. An EIA draws four things from that structure.

¶3 **Source attribution.** Which activities contribute which loads to the receiving environment. Where a proposed aquaculture expansion is assessed against a coastal embayment in which aquaculture already contributes the largest share of nitrogen loading, the incremental case is materially different from one where the dominant source is land-based agriculture the proponent does not control.

¶4 **Baseline loading.** The total load entering the receiving environment from all sources, against which the project increment is compared. This is the number that determines whether an increment is marginal or decisive.

¶5 **Pathway.** Whether a residual is collected and treated or discharged directly, which is what establishes whether proposed treatment measures are adequate.

¶6 **Pressure-state linkage.** Pairing residual flow accounts with condition accounts gives an empirical relationship between load and ecosystem state in that specific water body, which is a far stronger basis for impact prediction than a generic dose-response relationship.

¶7 The FDES organises environmental statistics relevant to residuals into Component 3, covering emissions to air (3.1), wastewater generation and management (3.2), waste generation and management (3.3), and release of chemical substances (3.4)<sup>18</sup>. These statistics provide source data for compiling SEEA physical flow accounts.

¶8 For EIA application, integration of Ocean Accounts enables a five-step pollution assessment framework:

1. ¶9 **Baseline pollutant loading:** Reference existing physical flow accounts to characterise current residual flows to the marine environment within the project area. If PSUTs are unavailable, request data from environmental agencies on existing pollution loads by source category and discharge location.
2. ¶10 **Incremental loading:** Estimate additional residual flows from the proposed project using emission factors appropriate to the activity type, process technology, and any proposed treatment systems.
3. ¶11 **Cumulative loading:** Sum baseline and incremental loads to assess cumulative pollution pressure. Compare cumulative loading against water quality standards or ecosystem assimilative capacity thresholds.
4. ¶12 **Condition response:** Use established relationships between residual loads and ecosystem condition indicators (from historical accounts or scientific literature) to predict impact on condition accounts. Where historical data indicate that nitrogen loading >100 kg/ha/year correlates with seagrass canopy density <60%, this threshold informs impact prediction.
5. ¶13 **Service effects:** Trace how predicted condition changes may affect ecosystem service flows using the relationships documented in **TG-3.2 Flows from Environment to Economy**.

### 3.5 Ecosystem Degradation and Damage Cost Valuation

¶1 Ecosystem degradation (the decline in ecosystem condition) can be expressed in monetary terms using damage cost approaches that estimate the economic value of lost ecosystem service flows resulting from condition decline. This application is particularly relevant for EIA when quantifying residual impacts after mitigation, calculating compensation requirements, or comparing alternative development scenarios. The SEEA Ecosystem Accounting framework defines **ecosystem degradation** as the decline in the monetary value of an ecosystem asset resulting from declining condition during an accounting period<sup>19</sup>.

#### Applying the degradation calculation in an EIA

¶1 The degradation formula, the three conditions under which its simplified linear form is defensible, the decision checklist for testing them, and the discount-rate sensitivity requirement are specified in **TG-3.1 Asset Accounts** Section 3.5.3. An EIA practitioner applies that method rather than restating it; what follows is what the result is used for and where it fails.

¶2 **Run the applicability checklist before quoting a number.** The linear form assumes service loss is proportional to condition loss. TG-3.1 sets the conditions under which that holds – a small condition decline, no documented threshold response in the predicted range, and a single dominant service. Marine EIA frequently breaches all three at once: reef and seagrass systems have well-documented threshold responses, and a development that matters is usually one predicted to push condition through a range where more than one service changes. Where the checklist fails, a biophysical model is required and the linear figure should not be presented at all, not presented with a caveat.

¶3 **Present the damage cost as a range across discount rates.** TG-3.1 Section 3.5.3 requires sensitivity across rates because the choice materially changes the result – in the illustrative reef case

there, the damage cost varies roughly threefold between 2 per cent and 7 per cent. In a consent process this range is the finding. A single figure invites the decision to turn on an assumption that was never argued, and it will be attacked on exactly that ground.

¶4 **Value each major service separately.** Different services respond differently to the same condition change. Coral cover decline may reduce coastal protection close to linearly whilst reducing habitat services sharply once shelter structure is lost. Aggregating them before applying the condition change buries that difference and biases the total downwards.

¶5 **The damage cost is not the mitigation budget.** It is the estimated value of the loss, which supports comparison against the cost of avoiding it. Where mitigation costs less than the degradation it avoids, the case for requiring it is straightforward; where it costs more, the comparison is a starting point for deliberation and not a decision rule, because exchange values exclude non-use values and distributional effects entirely (Section 3.3).

### 3.6 EIA–Account Integration Points

¶1 The integration of Ocean Accounts into EIA practice follows the standard EIA process phases, with each phase drawing on different account types and data products. Figure 1.6.1 groups the EIA application procedure into scoping, assessment, and decision and monitoring phases. It sets out how each phase draws on multiple ocean account types, with the regulatory decision gate and the adaptive-management feedback loops shown explicitly. Table 4 maps these integration points.

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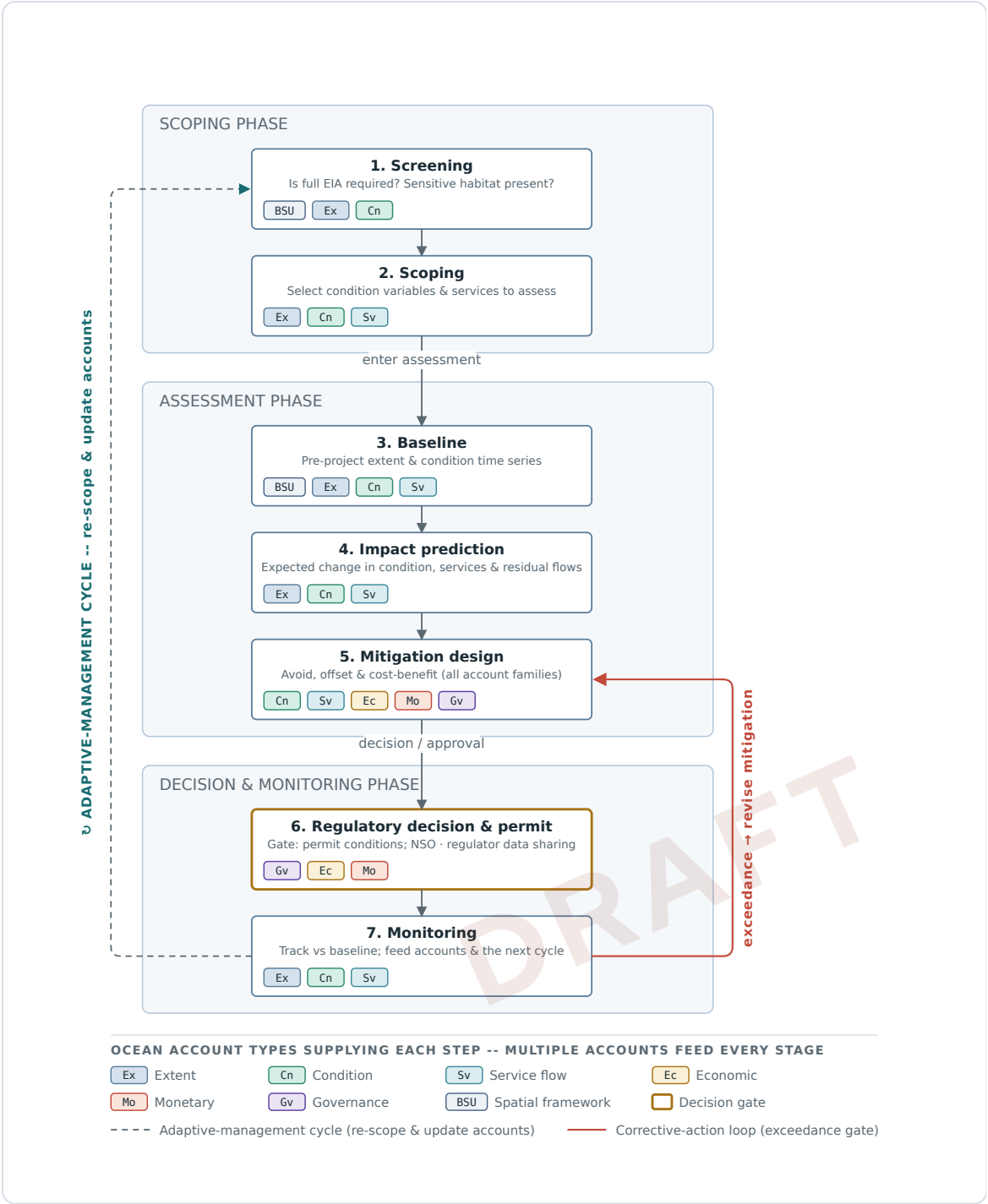


**Figure 1.6.1** Seven EIA steps in Scoping, Assessment, and Decision & Monitoring phases draw on multiple ocean account types at every stage. [a] Colour chips = account types per step. [b] Dashed loops = adaptive management and corrective action. Scope: project-level EIA (SEA in text).

**Source:** TG-1.6 Environmental Impact Assessment, Section 3.6 (EIA phase / Ocean Account mapping, Table 4), Section 3.7 (approval processes, institutional arrangements, adaptive management) and Section 3.8 (worked example).

**Adapted from:** Espoo Convention 1991 (transboundary EIA); EU EIA Directive 2014/52/EU Annexes II.A, IV; SEEA EA 2024 Chapter 12 (applications of ecosystem accounts).

¶2 **Table 4: EIA-Account Integration Points**

| EIA Phase         | Account Input               | Use in EIA                                  | Data Access Pathway                                                                                                                                                               |
|-------------------|-----------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Screening         | Extent accounts             | Identify sensitive ecosystem presence       | Request EAA spatial layers (vector format, polygon boundaries) from the national statistical office (NSO) or designated environmental data custodian                              |
| Scoping           | Condition accounts          | Identify key condition variables to monitor | Request the condition account indicator dataset for relevant EAA from the NSO or national environmental agency; specify ecosystem types present in the project area               |
| Baseline          | Condition + extent accounts | Establish pre-project condition and extent  | Request multi-year condition and extent time series (minimum two periods) from the NSO; where jurisdiction-specific data portals exist, see TG-3.7 for institutional mapping      |
| Impact prediction | Service flow accounts       | Quantify affected services                  | Request ecosystem service flow tables for relevant EAA from the NSO or environmental agency; where pathway varies by jurisdiction, consult TG-3.7 for the responsible institution |
| Mitigation design | Asset values                | Cost-benefit of mitigation options          | Request asset valuation coefficients or apply NPV methods from TG-1.9 using service flow data obtained in the impact prediction phase                                             |
| Monitoring        | Condition indicators        | Track post-project changes                  | Use the same condition indicator dataset and spatial layer format obtained in the Scoping phase; submit monitoring results to the NSO under any established data-sharing protocol |

¶3 During **screening**, ecosystem extent accounts identify whether sensitive or high-value ecosystem types are present within and adjacent to the proposed project area, informing decisions about whether full EIA is required. A simple query to the extent account database (e.g., “Are coral reefs, seagrass meadows, or mangroves present within 5 km of the project footprint?”) provides an efficient screening filter.

¶4 During **scoping**, condition accounts inform the selection of key condition variables to be monitored in project-specific baseline surveys and post-approval monitoring. By using the same condition variables as the national accounts, EIA practitioners ensure that project monitoring data can contribute to updating accounts in future compilation cycles.

¶5 At the **impact prediction** stage, ecosystem service flow accounts enable practitioners to quantify which services may be affected and estimate the magnitude of change. The linkages between condition variables and service flows documented in **TG-3.2 Flows from Environment to Economy** provide the basis for translating predicted condition changes into expected service flow impacts.

¶6 During **mitigation design**, monetary asset values from the accounts support cost-benefit comparison of alternative mitigation measures. Where protecting 10 hectares of reef costs USD 500,000 but provides USD 3,000,000 in avoided degradation (using asset valuation methods), the asset values demonstrate that protection is economically justified. During **monitoring**, condition indicators drawn from the accounting framework provide standardised metrics for tracking post-project changes against the same baselines used in the original assessment. Those metrics support adaptive management.

¶7 Post-approval monitoring can contribute data back to accounts, which establishes a feedback loop between project-level assessment and national accounting. Regulators should establish data-sharing protocols that enable project monitoring data to flow back to national accounts compilers.

### 3.7 Linking Accounts to Approval Processes

¶1 The procedural integration of Ocean Accounts into regulatory EIA processes requires consideration of institutional arrangements, data governance, and the distinct purposes of accounting versus assessment.

¶2 **Institutional arrangements:** Effective integration requires coordination between national statistical offices (NSOs) that typically lead ecosystem accounting, environmental regulatory agencies that administer EIA, and technical agencies that manage environmental monitoring data. The SEEA EA recognises this need, noting that “implementation necessitates a highly collaborative approach and the active participation of representatives of many different agencies and disciplines, including geography, ecology, economics and statistics”<sup>20</sup>. For EIA integration, this collaboration should extend to environmental assessment practitioners and regulators through formal agreements specifying data access, update protocols, and reciprocal obligations.

¶3 **Data access and standardisation:** EIA practitioners require access to Ocean Accounts data in usable formats. This includes:

- ¶4 Spatial data on ecosystem extent at resolution relevant to project scales (ideally vector layers with <1 km<sup>2</sup> spatial units)
- ¶5 Condition account data for ecosystem types within project areas, including raw variable values and normalised indicators
- ¶6 Physical flow data for residual loads in project regions, disaggregated by source sector
- ¶7 Service flow data for ecosystem services potentially affected, including valuation coefficients where available

¶8 NSOs and environmental agencies should jointly develop data access portals or API services that enable EIA practitioners to query accounts by geographic coordinates, ecosystem type, or administrative region.

¶9 **Temporal alignment:** EIA timelines often do not align with accounting periods. Assessments may occur between account compilation years or require baseline data for periods before accounting began. Account data should be supplemented with project-specific surveys while ensuring consistency in methods and definitions with the accounting framework. Where accounts are compiled biennially or triennially rather than annually, interpolation methods may be needed to estimate conditions for intermediate years, with uncertainty clearly documented.

¶10 **Legal and procedural integration:** Formal integration of accounts into EIA requires regulatory recognition. Options include:

¶11 **Table 5: Regulatory Integration Mechanisms**

| Integration Mechanism    | Implementation Pathway                                                      |
|--------------------------|-----------------------------------------------------------------------------|
| Guidance reference       | Revise national EIA guidelines to specify accounts as preferred data source |
| Consistency requirements | Add review criterion to EIA terms of reference                              |
| Significance criteria    | Adopt numerical thresholds linked to condition indices                      |
| Regional assessment      | Compile accounts at EAA scale matching SEA boundaries                       |
| Offset calculation       | Specify valuation methods consistent with SEEA EA                           |

¶12 **Monitoring and follow-up:** Post-approval monitoring can contribute data back to accounts. Where EIA predicts impacts on specific condition indicators, monitoring these indicators strengthens both compliance verification and the accounts themselves. Regulators should establish reporting requirements that standardise monitoring data formats to facilitate integration with national accounts databases. The SEEA EA notes that accounts can support “the design and monitoring of policy responses” including “authorization processes”<sup>21</sup>.

## Environmental offsets and no-net-loss policies

¶1 Where a regulatory regime requires residual impacts to be offset, the offset requirement formula, the definition of the restoration equivalence unit, the side-by-side equivalence check and the treatment of delayed offset delivery are specified in **TG-3.1 Asset Accounts** Section 3.5.3. Three points govern their use in a consent process.

¶2 **The accounts supply the metrics; the regulator sets the policy parameters.** Extent and condition data populate both sides of the equivalence. The multiplier, whether temporal discounting applies to delayed delivery, and whether financial compensation may substitute for a physical offset are matters for the applicable regime, and are not derived from the accounts. An EIA that presents a multiplier as though the accounting framework produced it misrepresents both.

¶3 **Both sides must use the same condition metric.** The requirement is computed from the condition of the habitat lost; delivery is computed from the condition *gain* achieved by the offsetting action. These are different quantities, and expressing one as an absolute index point and the other as a proportional change produces an equivalence that does not hold. TG-3.1 Section 3.5.3 works the arithmetic through, and the recurring finding is that restoration of degraded habitat delivers far fewer equivalence units than its area suggests – protecting high-condition habitat at risk of loss is frequently the only option that meets a requirement of any size.

¶4 **Area equivalence is not service equivalence.** Meeting the hectare-equivalent requirement does not establish that the service flows lost have been replaced. Where the lost habitat supplied coastal protection to a specific settlement, an offset elsewhere in the jurisdiction restores the area but not the protection, and the service supply-use articulation in **TG-3.2** is what makes that visible. Assessments should test both, and report the service test separately.

¶5 Post-implementation monitoring should track the same condition variables, using the same methods, as the accounts – which is what allows offset performance to be verified rather than asserted, and what allows a failed offset to trigger a management response. Offset accounting should remain consistent with the national Ocean Accounts framework so that project-level compensation and national ecosystem reporting stay coherent.

¶6 **Practical considerations for regulatory integration include:**

- ¶7 **Proportionality:** Account-based assessment should be proportionate to project scale and impact significance. Major projects warrant detailed integration. Minor projects may reference summary indicators.
- ¶8 **Uncertainty acknowledgment:** Both accounts and EIA involve uncertainty. Integration should maintain transparency about data quality and predictive confidence, using uncertainty ranges where feasible.
- ¶9 **Adaptive management:** Account time series enable adaptive management by tracking actual changes against EIA predictions, informing management responses when impacts exceed predictions.
- ¶10 **Transboundary considerations:** Marine ecosystems often cross jurisdictional boundaries. Account-based assessment can support transboundary EIA by providing consistent data frameworks across jurisdictions. The primary international framework for transboundary EIA is the Espoo Convention (Convention on Environmental Impact Assessment in a Transboundary Context, 1991), which establishes notification, consultation, and participation obligations among Parties when a proposed activity is likely to have significant adverse transboundary impacts. Regional seas programmes provide additional frameworks for data sharing and coordinated assessment: OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) governs transboundary assessment obligations across fifteen Parties in the North-East Atlantic, and the ASEAN Agreement on Transboundary Haze Pollution offers a regional model for coordinated environmental assessment in Southeast Asian marine contexts. National Ocean Accounts compiled consistently with SEEA EA provide the common data language for applying

these instruments. See also **TG-2.9 OA and Ocean Risk Assessment** for guidance on trans-boundary risk assessment.

### 3.8 Worked Example: EIA for Coastal Development Using OA Data

¶1 This section presents a synthetic worked example demonstrating how Ocean Accounts data support EIA for a proposed coastal resort development. The example illustrates the application procedure described in Section 3.1, the integration points mapped in Section 3.6, and the valuation and offset calculations detailed in Sections 3.3, 3.5, and 3.7.

#### Project description

¶1 A private developer proposes to construct a 200-room coastal resort on a 15-hectare site at Coral Bay, including hotel buildings, marina facilities for 50 vessels, wastewater treatment infrastructure, and beach access amenities. The project is located within the Coral Bay Ecosystem Accounting Area, for which the national statistical office compiles annual ocean accounts.

#### Step 1: Screening and account data access

¶1 The EIA practitioner contacts the NSO to obtain ecosystem extent accounts for the Coral Bay EAA. The extent account records the following within 2 km of the proposed site:

- ¶2 120 hectares of fringing coral reef (condition index 0.72)
- ¶3 45 hectares of seagrass meadow (condition index 0.68)
- ¶4 180 hectares of mangrove forest (condition index 0.75)

¶5 The presence of these sensitive ecosystems triggers full EIA requirements under national regulations.

#### Step 2: Baseline establishment from condition accounts

¶1 The practitioner requests condition accounts for the three ecosystem types. The accounts provide baseline values for six ECT classes<sup>22</sup>:

##### ¶2 Coral Reef Condition Variables (2025 baseline):

- ¶3 A1 Physical: Sea surface temperature 28.2°C (reference: 27.5°C)
- ¶4 A2 Chemical: pH 8.05 (reference: 8.15)
- ¶5 B1 Compositional: Coral species richness 42 species (reference: 55 species)
- ¶6 B2 Structural: Live coral cover 38% (reference: 55%)
- ¶7 B3 Functional: Net calcification 4.8 kg CaCO<sub>3</sub>/m<sup>2</sup>/yr (reference: 7.0)
- ¶8 C Seascape: Connectivity index 0.65 (reference: 0.85)

¶9 These baseline values establish the pre-project state against which impacts will be assessed.

#### Step 3: Impact prediction using condition-service relationships

¶1 The project Environmental Impact Statement predicts that marina construction will directly impact 2 hectares of coral reef and 1 hectare of seagrass through dredging. Indirect impacts from increased turbidity, nutrient loading, and visitor pressure are predicted to reduce coral reef condition index from 0.72 to 0.60 across an additional 8 hectares (total 10 ha affected, with 2 ha direct loss and 8 ha degradation).

¶2 Using ecosystem service flow accounts from **TG-3.2 Flows from Environment to Economy**, the practitioner quantifies affected services:

##### ¶3 Coral Reef Services (per hectare per year):

- ¶4 Coastal protection (avoided damage): USD 8,500/ha/yr
- ¶5 Fish nursery habitat: USD 1,800/ha/yr
- ¶6 Tourism/recreation: USD 3,200/ha/yr

- ¶7 Total annual flow: USD 13,500/ha/yr

#### ¶8 Seagrass Services (per hectare per year):

- ¶9 Coastal stabilisation: USD 2,000/ha/yr
- ¶10 Carbon sequestration: USD 400/ha/yr (at USD 50/tonne CO<sub>2</sub>)
- ¶11 Fish nursery habitat: USD 1,200/ha/yr
- ¶12 Total annual flow: USD 3,600/ha/yr

### Step 4: Degradation and damage cost calculation

¶1 Using methods from Section 3.5:

#### ¶2 Coral reef degradation:

- ¶3  
Extent loss (2 ha): Asset value = 2 ha × (USD 13,500/yr / 0.04) = USD 675,000. Note: extent loss applies the full asset value per hectare regardless of current condition (0.72), consistent with SEEA EA depletion accounting – the entire asset is permanently removed, so the full reference-condition value is the appropriate measure of loss.
- ¶4  
Condition decline (8 ha, a decline of 0.12 index points from 0.72 to 0.60): Degradation = 8 ha × (USD 13,500/yr / 0.04) × 0.12 = USD 324,000
- ¶5  
Total coral reef damage: USD 675,000 + USD 324,000 = **USD 999,000**

#### ¶6 Seagrass degradation:

- ¶7 Extent loss (1 ha): Asset value = 1 ha × (USD 3,600/yr / 0.04) = USD 90,000

#### ¶8 Total damage cost: USD 1,089,000

¶9 This quantification enables cost-benefit comparison with project economic benefits (estimated at USD 8,500,000 NPV over 30 years) and informs mitigation design.

### Step 5: Mitigation design and residual impact assessment

¶1 The developer proposes three mitigation measures:

1. ¶2 Relocate marina to sandy substrate, avoiding direct coral reef impact (saves 2 ha reef, cost USD 400,000)
2. ¶3 Install advanced wastewater treatment to reduce nutrient loading by 80% (reduces condition decline from 8 ha to 3 ha, cost USD 250,000)
3. ¶4 Implement visitor management plan limiting reef access (further reduces degraded area from 3 ha to 2 ha, cost USD 50,000)

#### ¶5 Residual impacts after mitigation:

- ¶6 Seagrass loss: 1 ha (damage cost USD 90,000)
- ¶7 Coral condition decline: 2 ha with a decline of 0.12 index points (damage cost 2 ha × (USD 13,500/yr / 0.04) × 0.12 = USD 81,000)
- ¶8 **Total residual damage: USD 171,000**

#### ¶9 Mitigation cost: USD 700,000

#### ¶10 Avoided damage: USD 1,089,000 - USD 171,000 = USD 918,000

¶11 Cost-benefit analysis indicates mitigation is economically justified (ratio of avoided damage to mitigation cost = USD 918,000 / USD 700,000 = 1.31).

### Step 6: Offset calculation

¶1 For residual impacts, regulators require a 3:1 biodiversity offset (regulator-specified, see Section 3.7 note on multipliers):

¶2 **Seagrass offset:** Applying the full formula:  $1 \text{ ha} \times 0.68$  (condition of lost seagrass, from Step 1)  $\times 3 = 2.04 \text{ ha-equivalents required}$ . The developer commits to restoring 15 hectares of degraded seagrass from condition 0.50 to 0.80. This delivers a net gain of  $15 \times 0.30 = 4.5 \text{ ha-equivalents}$ , which comfortably exceeds the 2.04 ha-equivalent requirement.

¶3 **Coral offset:** For this degradation (not extent-loss) case, the formula factor is the condition decline rather than the condition of lost habitat, treating the calculation as condition-weighted hectares of effective loss:  $2 \text{ ha} \times 0.12$  (absolute condition decline)  $\times 3 = 0.72 \text{ ha-equivalents required}$ . The developer commits to funding a 5-hectare marine protected area expansion. This protects reef at condition 0.75 from fishing pressure that would otherwise reduce condition to 0.55, delivering  $5 \times 0.20 = 1.0 \text{ ha-equivalents}$ . This exceeds the requirement of 0.72 ha-equivalents.

## Step 7: Monitoring using account indicators

¶1 The approved EIA includes monitoring requirements using the same condition variables as national accounts:

- ¶2 Annual monitoring of coral cover, species richness, and pH at 10 fixed stations within 1 km of development
- ¶3 Biennial seagrass surveys measuring canopy density and extent
- ¶4 Quarterly water quality monitoring for nutrients, turbidity, and temperature

¶5 Monitoring data will be provided to the NSO to support future account updates. This allows assessment of whether actual impacts match predictions and whether offsets achieve intended outcomes.

## 4. Acknowledgements

¶1 **Authors:** [To be confirmed]

¶2 **Reviewers:** [To be confirmed]

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0. ¶20 United Nations. (2021). *System of Environmental-Economic Accounting–Ecosystem Accounting*, para 1.52.
1. ¶21 United Nations. (2021). *System of Environmental-Economic Accounting–Ecosystem Accounting*, para 5.126.
2. ¶22 The A1/A2/B1/B2/B3/C1 classification follows the SEEA EA Ecosystem Condition Typology (Table 5.1, SEEA EA 2021) and is developed in detail in [TG-3.1 Asset Accounts](#), Section 3.5.2 (ecosystem condition accounts). The groupings may differ slightly across ecosystem types. TG-3.1 Section 3.4.2 provides ecosystem-specific indicator lists.

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