Absolutely—your approach is right. Before we touch any upstream code we’ll **freeze the contracts** and **map every dependency from M9 back to M0** so nothing breaks when we repair M0–M2.

Below is a **single‑source dependency map + contracts** compiled from the artifacts you’ve run locally (the file names that appeared in your logs), your CI notes, and the module outputs we’ve already validated in this project. I’ve kept **names exactly as they appear today** so we don’t introduce churn. Where a module consumes a value but the precise file name isn’t central (e.g., tax), I lock the **column names** and **join keys**, because those are what downstream code depends on.

**0) Global invariants (apply to all modules)**

**Keys & cadence**

* Month\_Index → integer, 1..N, **primary join key** for monthly series.
* Monthly horizon currently 60 (5y). Yearly views are derived (sum/avg) and **never override monthly**.

**Currencies & units**

* Monetary columns carry a suffix: \*\_NAD\_000 and (when FX‑translated) \*\_USD\_000.
* FX series column name: NAD\_per\_USD (NAD per 1 USD). USD = NAD / NAD\_per\_USD.

**Naming families that must not change**

* Cash‑flow roles: CFO\_NAD\_000, CFI\_NAD\_000, CFF\_NAD\_000, Closing\_Cash\_NAD\_000.
* PL/IFRS helpers: EBITDA\_NAD\_000, Total\_OPEX\_NAD\_000, Total\_Revenue\_NAD\_000.
* BS roll‑ups: Current\_Assets\_NAD\_000, Current\_Liabilities\_NAD\_000, Total\_Assets\_NAD\_000, Liabilities\_and\_Equity\_Total\_NAD\_000.
* Working‑capital stocks (M2): AR\_Balance\_NAD\_000, Inventory\_Balance\_NAD\_000, AP\_Balance\_NAD\_000.

**1) End‑to‑end dependency map (M9 → M0)**

M9.5 (Streamlit app)

└── reads M9.0 pack + M8.Bn + M7.5B artifacts (no recomputation)

M9.0 (Pack & manifest)

├── M7.5B: m7\_5b\_profit\_and\_loss.parquet, m7\_5b\_cash\_flow.parquet, m7\_5b\_balance\_sheet.parquet

├── M8.B1: m8b\_base\_timeseries.parquet, m8b\_fx\_curve.parquet

├── M8.B2: m8b2\_promoter\_scorecard\_monthly.parquet, m8b2\_promoter\_scorecard\_yearly.parquet

├── M8.B3: m8b\_investor\_metrics\_selected.parquet, m8b\_terms.json (context)

├── M8.B4: m8b4\_lender\_metrics\_monthly.parquet, m8b4\_lender\_metrics\_yearly.parquet

├── M8.B5: m8b\_benchmarks.values.parquet, m8b\_benchmarks.catalog.json

└── M8.B6: m8b\_ifrs\_statements.parquet, m8b\_ifrs\_mapping.json, m8b\_ifrs\_notes.json

M8.B6 (IFRS presentation)

└── M7.5B PL/BS/CF (adds mapping & notes; no new calculations)

M8.B5 (Benchmarks)

└── External catalog only (no upstream numeric dependency)

M8.B4 (Lender pack)

├── M7.5B CF/PL/BS (for DSCR/ICR/LLCR/PLCR, leverage)

└── Optional terms (discount rate) via JSON if present; default otherwise

M8.B3 (Investor engine)

├── m7\_selected\_offer.json (frozen selection)

├── m7\_5\_junior\_financing.parquet / .csv (actual injected flows)

├── m8b\_gate\_valuations.json (M24/M36/M42/M48 EVs; if absent: M36 capped 40,000 NAD '000)

└── FX context for ticket translation (NAD\_per\_USD)

M8.B2 (Promoter scorecard)

└── M7.5B PL/CF/BS (computes ratios/metrics; no recomputation of base series)

M8.B1 (Base time engine)

├── M7.5B PL/CF/BS (to replicate monetary series + make USD)

└── FX curve (from M0 lane or pre‑exported; join on Month\_Index)

M7.5B (Rebuild + IFRS helpers)

├── M5 cash‑flow roles (CFO/CFI/CFF)

├── M6 closing cash → BS cash link

├── M2 working‑capital stocks (to build CA/CL)

├── M0 opening cash (M0:Line\_Item='Cash') → opening balance

├── M7.5A junior wiring (optional columns if present)

└── m7\_selected\_offer.json (classification text used in debug)

M7.5A (Junior financing wiring)

└── M7.R1 selection + terms → emits m7\_5\_junior\_financing.\* (consumed by M8.B3)

M7.R1 (Offer ranking)

├── Input Pack “Investor\_500k\_Offer\_Grid” (Ticket\_USD, terms)

└── Emits m7\_r1\_scores.(csv|parquet) and (after freezer) m7\_selected\_offer.json

M6 (Balance sheet)

├── M5 closing cash

├── M2 working‑capital stocks

├── M1 CAPEX & depreciation accumulation

└── M3 financing balances (debt, revolver)

M5 (Cash flow)

├── M1: revenue, opex, maintenance capex, depreciation (non‑cash)

├── M3: financing cash flows (debt draws/repay, interest, equity injections)

└── M4: taxes payable (cash)

M4 (Tax engine)

└── M1/M5 taxable base → emits Tax\_Payable\_NAD\_000 monthly

M3 (Financing engine)

├── Loan & revolver terms from Input Pack

└── Emits schedules: m3\_finance\_index.parquet, m3\_revolver\_schedule.parquet (plus any debt‑service schedules)

M2 (Working capital)

├── M1 revenue/COGS cadence & credit terms (DSO/DIO/DPO)

└── Emits m2\_working\_capital\_schedule.parquet with AR/AP/Inventory

M1 (Operating engine)

├── Input Pack: \*\*Revenue\_Assumptions\*\*, \*\*Rev\_Ramp\_Seasonality\*\*, OPEX & CAPEX sheets

└── Emits:

- m1\_revenue\_schedule.parquet (has \*\*Monthly\_Revenue\_NAD\_000\*\*)

- m1\_opex\_schedule.parquet

- m1\_capex\_schedule.parquet

- m1\_depreciation\_schedule.parquet

M0 (Input/Calendar/FX extractor)

├── Input Pack path

└── Emits:

- m0 calendar helpers (Month\_Index, Calendar\_Date, Year, Quarter)

- FX lane (either `outputs\m0\_inputs\FX\_Path.parquet` or copied to `m8b\_fx\_curve.parquet`)

- Opening cash source (M0:Line\_Item='Cash')

**Key point for the repair**: **Downstream modules NEVER rename upstream columns**—they *add* roll‑ups (e.g., Total\_Revenue\_NAD\_000, Current\_Assets\_NAD\_000) and keep the originals intact. We will hold those names frozen while fixing M0–M2.

**2) Module‑by‑module contracts (filenames & must‑have columns)**

The goal is to give you a checklist you can open next to each runner. If a column is missing, the downstream consumer will break. Everything below is **current‑state canonical** in this project.

**M0 — Input/Calendar/FX**

**Emits**

* outputs\m0\_inputs\FX\_Path.parquet  
  Columns: Month\_Index, NAD\_per\_USD **(must exist; earlier warning showed this was missing Month\_Index)**
* Calendar is synthesized later, but **Month\_Index** must be the key for every monthly file.
* Opening cash source (read by M7.5B): M0/“Line\_Item='Cash'”.

**Consumed by**

* M8.B1 (FX join), M7.5B (opening cash), all monthly joins (via Month\_Index).

**M1 — Operating engine (the one we must fix)**

**Emits**

* m1\_revenue\_schedule.parquet  
  Columns must include: Month\_Index, **Monthly\_Revenue\_NAD\_000** (≥ 0, not empty after Month 6).
* m1\_opex\_schedule.parquet  
  Columns: Month\_Index, Monthly\_OPEX\_NAD\_000 (and breakdowns if any).
* m1\_capex\_schedule.parquet  
  Columns: Month\_Index, Monthly\_CAPEX\_NAD\_000 (split into maintenance vs growth if available).
* m1\_depreciation\_schedule.parquet  
  Columns: Month\_Index, Monthly\_Depreciation\_NAD\_000.

**Upstream inputs**

* Input Pack sheets: Revenue\_Assumptions, Rev\_Ramp\_Seasonality, OPEX/CAPEX definitions.

**Downstream consumers**

* M2 (uses the *shape* of revenue/COGS cadence to build AR/Inventory).
* M5 (CFO base: revenue minus cash costs; CFI for capex; add back non‑cash depreciation).
* M6 (accumulated CAPEX & depreciation).

**M2 — Working capital**

**Emits**

* m2\_working\_capital\_schedule.parquet  
  Must‑have columns: Month\_Index, AR\_Balance\_NAD\_000, Inventory\_Balance\_NAD\_000, AP\_Balance\_NAD\_000.

**Upstream**

* M1 revenue cadence & credit terms.

**Downstream**

* M6 (BS current assets/liabilities), M7.5B roll‑ups (Current\_Assets/Current\_Liabilities).

**M3 — Financing engine (baseline runner)**

**Emits** (observed)

* m3\_finance\_index.parquet (index of instruments/terms)
* m3\_revolver\_schedule.parquet (must include Month\_Index and Closing\_Balance\_NAD\_000; current‑portion may be missing—M7.5B handles it with a policy)
* (Any term‑loan schedules if present; not strictly required by names, but **cash flows** must propagate to M5.)

**Downstream**

* M5 (CFF cash movement; interest into PL).
* M6 (debt balances on BS).

**M4 — Tax engine**

**Emits**

* m4\_tax\_schedule.parquet (name may vary), but **must produce** a monthly series **Tax\_Payable\_NAD\_000**.

**Downstream**

* M5 (cash taxes in CFO).

**M5 — Cash flow**

**Emits**

* m5\_cash\_flow.parquet  
  **Required columns:** Month\_Index, **CFO\_NAD\_000**, **CFI\_NAD\_000**, **CFF\_NAD\_000**, **Closing\_Cash\_NAD\_000**.

**Upstream**

* M1 (operating/capex/dep), M3 (financing flows), M4 (taxes).

**Downstream**

* M6 (closing cash into BS), M7.5B (links CF to BS cash, uses roles for IFRS‑18 CF classification).

**M6 — Balance sheet**

**Emits**

* m6\_balance\_sheet.parquet  
  Must‑have: Month\_Index, Cash\_and\_Cash\_Equivalents\_NAD\_000, total/major lines consistent with M5 closing cash.

**Upstream**

* M5 closing cash, M2 stocks, M1 accumulated CAPEX/dep, M3 balances.

**Downstream**

* M7.5B (ties), M8.B lenders’ leverage metrics.

**M7.R1 — Offer ranking (+ freezer)**

**Emits**

* m7\_r1\_scores.parquet / .csv (full grid, includes Ticket\_USD and terms)
* m7\_selected\_offer.json (after freezer; holds Option, Instrument, key terms)

**Downstream**

* M7.5A (wiring), M8.B3 (investor engine).

**M7.5A — Junior financing wiring**

**Emits**

* m7\_5\_junior\_financing.parquet / .csv  
  Columns vary by instrument, but **must include a monthly injection column**, e.g. Junior\_Equity\_In\_NAD\_000 (what M8.B3 already detected).

**Downstream**

* M8.B3 (uses these actual flows for investor cash‑in/out trajectories).

**M7.5B — Rebuild + IFRS helpers**

**Emits**

* m7\_5b\_profit\_and\_loss.parquet  
  Must‑have: Month\_Index, **Total\_Revenue\_NAD\_000**, EBITDA\_NAD\_000, Total\_OPEX\_NAD\_000, and other PL lines.
* m7\_5b\_cash\_flow.parquet  
  Must‑have: roles (CFO\_\*, CFI\_\*, CFF\_\*), **Closing\_Cash\_NAD\_000**.
* m7\_5b\_balance\_sheet.parquet  
  Must‑have: Cash\_and\_Cash\_Equivalents\_NAD\_000, **Current\_Assets\_NAD\_000**, **Current\_Liabilities\_NAD\_000**, **Total\_Assets\_NAD\_000**, **Liabilities\_and\_Equity\_Total\_NAD\_000**.
* Debug: m7\_5b\_debug.json, smoke: m7\_5b\_smoke\_report.md.

**Upstream**

* M5 roles & closing cash; M6 cash + WC; M0 opening cash; selected instrument for classification text.

**Downstream**

* All M8.Bn modules; M9.0/M9.5.

**M8.B1 — Base timeseries**

**Emits**

* m8b\_base\_timeseries.parquet (calendar helpers + duplicated monetary series)
* m8b\_fx\_curve.parquet (Month\_Index, NAD\_per\_USD)

**Upstream**

* M7.5B PL/CF/BS; FX lane from M0 (or already present as m8b\_fx\_curve.parquet).

**M8.B2 — Promoter scorecard**

**Emits**

* m8b2\_promoter\_scorecard\_monthly.parquet
* m8b2\_promoter\_scorecard\_yearly.parquet

**Columns (examples, required by M9)**

* Unitless ratios: Current\_Ratio, Quick\_Ratio, Gross\_Margin, EBITDA\_Margin, Operating\_Margin, Net\_Margin, Asset\_Turnover.
* Monetary metrics in NAD/USD where relevant, with \_NAD\_000 / \_USD\_000.

**M8.B3 — Investor engine (instrument‑aware)**

**Inputs**

* m7\_selected\_offer.json, m7\_5\_junior\_financing.parquet / .csv, m8b\_gate\_valuations.json (M24/M36/M42/M48 EVs; fallback cap Month‑36 = **40,000 NAD '000** if absent), FX context for translating Ticket\_USD.

**Emits**

* m8b\_investor\_metrics\_selected.parquet (MOIC/IRR/DPI/RVPI/TVPI at gates + monthly trajectories)
* m8b\_terms.json (derived: ticket in NAD '000, ownership approximation basis, gates used)

**M8.B4 — Lender pack**

**Emits**

* m8b4\_lender\_metrics\_monthly.parquet
* m8b4\_lender\_metrics\_yearly.parquet
* Debug: m8b4\_debug.json, smoke: m8b4\_smoke.md

**Columns (expected)**

* Coverage & leverage: DSCR, ICR, LLCR, PLCR, Debt\_to\_Assets, Debt\_to\_Equity, Equity\_Pct, LTV, plus variants.

**M8.B5 — Benchmarks**

**Emits**

* m8b\_benchmarks.values.parquet
* m8b\_benchmarks.catalog.json (metric → ranges, source, audience, display metadata)

**M8.B6 — IFRS presentation (for M9 rendering)**

**Emits**

* m8b\_ifrs\_statements.parquet (tabular long/flat structure with Statement ∈ {PL, BS, CF}, Month\_Index, Line\_Item, value columns)
* m8b\_ifrs\_mapping.json (canonical → IFRS‑18 headings)
* m8b\_ifrs\_notes.json (placeholders for policies, judgments, debt notes, FX policy, CAPEX roll‑forward, etc.)

**M9.0 — Pack & manifest**

**Reads everything above** and emits:

* m9\_0\_pack.xlsx (now requires **XlsxWriter**; already added)
* CSVs (one per major artifact)
* m9\_manifest.json (what & how to present in M9.5)
* Debug/smoke

**M9.5 — Streamlit app (presentation)**

**Reads**

* m9\_manifest.json + referenced artifacts.  
  **Capabilities**
* Interactive charts/tables; **Export**: CSV/Excel already provided by M9.0. For PDF, Streamlit → static HTML → PDF print pipeline (we’ll add a “Download PDF” helper in M9.5).

**3) “Do not rename” list (frozen across modules)**

* Key: Month\_Index
* FX: NAD\_per\_USD
* PL: Total\_Revenue\_NAD\_000, EBITDA\_NAD\_000, Total\_OPEX\_NAD\_000
* CF: CFO\_NAD\_000, CFI\_NAD\_000, CFF\_NAD\_000, Closing\_Cash\_NAD\_000
* BS: Cash\_and\_Cash\_Equivalents\_NAD\_000, Current\_Assets\_NAD\_000, Current\_Liabilities\_NAD\_000, Total\_Assets\_NAD\_000, Liabilities\_and\_Equity\_Total\_NAD\_000
* WC: AR\_Balance\_NAD\_000, Inventory\_Balance\_NAD\_000, AP\_Balance\_NAD\_000
* M1 core: Monthly\_Revenue\_NAD\_000, Monthly\_OPEX\_NAD\_000, Monthly\_CAPEX\_NAD\_000, Monthly\_Depreciation\_NAD\_000
* M4: Tax\_Payable\_NAD\_000
* M7.5A: a junior‑injection column (as emitted today: Junior\_Equity\_In\_NAD\_000)

**4) Where the revenue gap originates (why M1 must be fixed)**

From your tests:

* outputs\m1\_revenue\_schedule.parquet exists but is **empty** (0 rows) with a Monthly\_Revenue\_NAD\_000 column.
* Downstream, m7\_5b\_profit\_and\_loss.parquet contains Total\_Revenue\_NAD\_000 but is **all zeros** (simply echoing M1’s empty feed).

**Likely root causes in M1 (contract breaches to check while repairing):**

1. **Join key misalignment** when expanding seasonality → months (e.g., producing no Month\_Index rows).
2. **Filter gating kills all months** (e.g., implementation ramp expects a different “start month”; all months filtered out).
3. **Sheet name/column drift** between Revenue\_Assumptions and Rev\_Ramp\_Seasonality (case/whitespace, or crops missing in one of the joins).
4. **COGS‑only path accidentally selected** (revenue path not executed).
5. **Unit mismatch** (multiplying by Price\_NAD\_per\_kg but feeding tons, not kg → defended against by contract tests, but if the code bails early, you’ll still get zero rows).

We’ll keep names frozen and rebuild M1 with hard assertions:

* Non‑empty monthly frame (Month\_Index 1..N),
* Sum across crops > 0 by **Month ≥ 7**,
* Annualized revenue consistent with assumptions (± tolerance).

**5) What I will produce next (so you can lock this down)**

1. **Schema registry** (JSON) under outputs/\_contracts/schema\_registry.json listing:
   * Each artifact file,
   * Primary key(s),
   * Required columns (names, types, units),
   * Optional columns,
   * Owning module and downstream consumers.
2. **Dependency manifest** (JSON) under outputs/\_contracts/dependency\_manifest.json capturing:
   * DAG edges (producer → consumer),
   * “Do not rename” families,
   * Version stamp of the contract (so CI can detect drift).
3. **Contract tests** (names only for now; code later when you ask):
   * test\_contract\_m0\_fx\_month\_index
   * test\_contract\_m1\_revenue\_not\_empty\_from\_month\_7
   * test\_contract\_m2\_wc\_columns\_present
   * test\_contract\_m5\_cf\_roles\_present\_and\_cash\_ties
   * test\_contract\_m6\_cash\_equals\_m5\_closing
   * test\_contract\_m7\_5b\_ifrs\_rollups\_present
   * test\_contract\_m8b\_fx\_merge\_and\_usd\_roundtrip
   * test\_contract\_m9\_manifest\_resolves\_all\_paths

These will run as part of your poor‑man’s CI right after each module’s runner, so we catch breaks immediately.

**TL;DR**

* The **contracts above are the freeze point**—we won’t change names while repairing M0→M2.
* The **revenue hole is upstream (M1 empty)**; fixing M1 (with the same output names) will automatically propagate good values through M2, M5, M6, M7.5B, and M8.Bn to M9.
* I’ll now prepare the **schema/dependency JSONs + minimal test scaffolds** when you say “go”, keeping your current names intact.