**Construction Environmental Forms SaaS**

**Product Requirements Document (PRD) & Technical Requirements**

*Version 0.9 — April 24 2025*

**1 Executive Summary**

A cloud‑based solution for construction companies to create, submit, review, and archive environmental‑compliance forms (dust control, SWPPP, safety checklists, toolbox talks) with QR‑code inspector access. Time‑tracking is **excluded** by design. Two key differentiators compared with Raken are a drag‑and‑drop custom form builder (Form.io CE) and cryptographic document e‑signatures (OpenSign). The entire stack is built on **100 % free, OSI‑approved open‑source software** compatible with lovaeble.dev and Cursor workflows.

**MVP Launch Target:** June 2025 (U.S. market, 300 companies / 1 000 users).

**Part A – Product Requirements Document**

**2 Goals & Objectives**

|  |  |  |
| --- | --- | --- |
| **ID** | **Goal** | **Success Metric** |
| G‑1 | Replace binder‑based environmental logs with digital workflow | ≥80 % weekly log completion rate by foremen |
| G‑2 | Give inspectors self‑serve mobile access | ≤2 min average access time via QR |
| G‑3 | Enable companies to build/modify forms without code | ≥60 % of enterprise customers publish ≥1 custom form within 90 days |
| G‑4 | Provide legally binding signatures on submitted documents | 100 % adoption of OpenSign signature flow |

**3 Target Users**

* **Company Admins** – manage subscription, users, templates.
* **Project Managers** – create projects, assign forms, review submissions.
* **Foremen** – fill out daily logs onsite via phone/tablet.
* **Inspectors** – read‑only access through QR code scan.

**4 Assumptions & Constraints**

* Users possess smartphones/tablets with modern browsers.
* Projects are U.S. based (imperial units, OSHA/EPA terminology).
* Only open‑source, no‑fee libraries are permitted.
* Raken’s time‑tracking and cost‑coding features are out‑of‑scope.

**5 Feature List (Scope commits)**

|  |  |  |
| --- | --- | --- |
| Epic | Description | Tier |
| F‑1 Daily Environmental Logs | Foremen complete daily dust / SWPPP log with GPS, weather, photos. | All |
| F‑2 Standard Forms Library | Pre‑built dust, SWPPP, safety, toolbox‑talk templates. | All |
| F‑3a **Custom Form Builder (Form.io CE)** | Drag‑and‑drop builder using Form.io CE; PDF import & field mapping | Std ✓ Ent ✓ |
| F‑3b **Internal Builder (RHF + Formik + react‑dnd)** | Future fully in‑house visual builder (will eventually replace Form.io CE) | Backlog |
| F‑4 **E‑Signature** | Multi‑party signature capture using OpenSign + signature pad. | All |
| F‑5 Photo & Video Attachments | Inline uploads, auto‑compression, media gallery. | All |
| F‑6 QR Inspector Portal | Public, token‑scoped read‑only view via QR; no login needed. | All |
| F‑7 Role & Permissions | Admin / PM / Foreman / Inspector with RLS enforcement. | All |
| F‑8 Reporting & Dashboards | Compliance KPIs, export to CSV/PDF. | Std ✓ Ent ✓ |
| F‑9 Document Hub | Versioned PDF storage & markup. | Ent only |

**6 User Stories (sample)**

* **US‑101** – *Foreman* copies yesterday’s Dust Log, updates readings, adds two photos, signs, and submits in < 5 minutes.
* **US‑202** – *Inspector* scans QR at the gate, views the latest SWPPP log without app install.
* **US‑303** – *PM* builds a new “Concrete Washout Inspection” form by uploading the county PDF and dragging fields, then assigns it to three projects.

**7 Subscription Tiers**

* **Basic** – 5 users, 10 active projects, standard forms only, 5 GB storage.
* **Standard** – 20 users, 50 projects, custom form builder, analytics, calendar integration.
* **Enterprise** – unlimited, advanced analytics, document hub, priority SLA.

**8 Milestones**

|  |  |
| --- | --- |
| Date | Milestone |
| 2025‑01 | Alpha prototype (form builder + submission) |
| 2025‑03 | Beta with QR portal, e‑sign, RLS policies |
| 2025‑06 | MVP public launch |
| 2025‑09 | Offline mode & mobile PWA (v1.1) |
| 2025‑12 | Prototype in‑house form builder (v2.0 planning) |

**9 KPIs**

Adoption ↑, Form cycle time ↓, Approval latency ↓, Churn < 5 % per quarter.

**Part B – Technical Requirements**

**10 Architecture Overview**

* **Frontend** – React 18 + TypeScript SPA served via Next.js (file‑based routing, API routes for fallback).
* **Backend** – Self‑hosted **Supabase** stack (PostgreSQL 16, GoTrue Auth, Realtime, Storage, Edge Functions).
* **Infra** – Docker‑Compose for local parity; Fly.io/Grafana‑Loki stack for prod.

**11 Technology Stack (all OSS / free)**

|  |  |  |
| --- | --- | --- |
| Layer | Component | Licence |
| UI | React, Next.js, Tailwind CSS, Radix UI, Lucide‑React | MIT |
| State/Data | Zustand, React‑Query | MIT |
| Forms | **Form.io Community Edition** | MIT |
| Validation | Zod | MIT |
| Maps/GPS | Leaflet + React‑Leaflet | BSD‑2 |
| Charts | Recharts | MIT |
| Signature Pad | signature‑pad | MIT |
| E‑Signature engine | **OpenSign** | Apache‑2.0 |
| PDF Ops | pdf-lib, puppeteer | MIT / Apache‑2.0 |
| QR Codes | qrcode | MIT |
| Auth & DB | Supabase | Apache‑2.0 |
| Job Queue | Graphile‑Worker | MIT |
| Email | Nodemailer | MIT |
| Payments SDK | stripe‑node (MIT) (Stripe SaaS pay‑as‑you‑go) |  |
| Monitoring | Sentry self‑host (BSL 1.1 free), Prometheus, Grafana, Loki | Apache‑2.0 / AGPL‑3 |
| CI/CD | GitHub Actions + self‑host runners, ESLint, Prettier, Cypress, Jest | MIT |

**12 Module Specifications**

**12.1 Frontend**

* PWA via Next.js app dir, service‑worker using Workbox for offline (v1.1).
* Component library tokens defined in tailwind.config.js; dark‑mode ready.
* File uploads feed directly to Supabase Storage presigned URL.

**12.2 Custom Form Builder (F‑3)**

* Form.io <FormBuilder> mounted at /templates/new route.
* Output JSON saved to form\_templates.schema column.
* Edge Function generatePdfFromSubmission() uses pdf-lib to overlay data onto agency PDF if one was provided.

**12.3 E‑Signature (F‑4)**

* Client captures signature strokes → SHA‑256 → sends vector + hash.
* Edge Function calls OpenSign signDocument() → embeds PKCS7‑detached signature block.
* Signed PDF stored; audit log row created.

**12.4 QR Inspector Portal (F‑6)**

* Supabase Edge Function createInspectorToken(project\_id) returns 24h‑TTL JWT limited to company\_id + project\_id read scope.
* Token embedded in QR (PNG). Static route /inspector?token= verifies & renders read‑only page.

**13 Security & Compliance**

* RLS policies enforce company isolation and role permissions (as drafted previously).
* MFA via Supabase Auth + TOTP.
* At‑rest AES‑256 encryption; S3‑compatible object lock for WORM.

**14 Performance & Scalability**

* < 100 ms P95 DB queries, monitored with pg\_stat\_statements + Prometheus.
* Horizontal read‑replica scaling once active connections > 500.
* CDN (Cloudflare free tier) caches static assets; images ≤1 MB post‑compression.

**15 Testing Strategy**

* **Unit** – Jest for utilities, Zod schemas.
* **Component** – React Testing Library.
* **E2E** – Cypress simulating mobile viewport.
* **Security** – OWASP ZAP automated in CI.
* **Licence Scan** – license‑checker‑rse fail‑on‑non‑OSI.

**16 Deployment & DevOps**

* docker‑compose.dev.yml for local dev; GitHub Action builds images → Fly.io.
* Blue‑green deploy; canary on 10 % traffic for 30 min.
* Terraform manages Fly.io, Cloudflare DNS, Postgres replica setup.

**17 Risks & Mitigations**

|  |  |
| --- | --- |
| Risk | Mitigation |
| Form.io CE feature gaps vs paid edition | Edge Functions extend (e.g. conditional logic) |
| OpenSign maintenance status | Fork allowed (Apache‑2.0); maintain in‑house |
| Offline requirement complexity | Stage for v1.1; PWA + service‑worker caching |

**18 Open‑Source Compliance Checklist**

1. Engineer commits must reference SPDX identifiers.
2. CI gate verifies no GPL‑3 libs except server components run internally.
3. THIRD\_PARTY\_NOTICES.md auto‑generated per release.

**End of Document**