WORK PROGRAM

LAND RESTORATION AND PROCESSING OF DEGRADED (SMALL-SCALE MINING) SITES

Reclamation to Productive Use (Rice Paddy / Fish Farming) — Republic of Ghana

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Expanded from the client's step-by-step restoration workflow into a structured work program for planning, contractor scoping, and supervision.

1. INTRODUCTION AND PURPOSE

This Work Program sets out the step-by-step methodology, resourcing, and schedule for restoring a degraded site — typically a former small-scale/alluvial mining ('galamsey'-type) pit or washed-over land parcel in Ghana — and converting it to a stable, productive end use (rice paddy and/or fish farming). It expands the client's original step-by-step restoration workflow into a structured document suitable for internal planning, contractor tendering, and regulatory engagement.

The program is organized into seven phases: (1) baseline assessment and containment, (2) site preparation, (3) earth material classification, (4) slurry washing and water management, (5) dewatering and backfilling, (6) pond/paddy construction, and (7) commissioning and handover to productive agricultural use. Each phase corresponds directly to steps in the client's original workflow, sequenced and cross-referenced against standard reclamation, water-management, and environmental-safeguard practice in Ghana.

2. SCOPE OF WORKS

- Baseline survey, environmental risk assessment, and contamination screening of the degraded site.
- Containment of the working area with temporary levees/dykes to protect adjoining waterways during processing.
- Classification and processing of disturbed earth material (large/medium/small fractions), including mechanical processing where required.
- Slurry washing in two stages (in-situ shallow-pond wash, then industrial wash-plant wash) with full runoff capture.
- Progressive dewatering, sediment/tailings management, and site drying.
- Backfilling and re-grading of depressions using classified aggregate and surrounding earth material.
- Construction of ponds, paddies, river diversion works, liners, piping, and spillways.
- Handover of the restored site for rice cultivation and/or fish farming, with a post-handover monitoring period.

Excluded from this scope (unless separately instructed): resolution of land tenure/ownership disputes, chemical remediation of severe heavy-metal or mercury contamination beyond standard soil-washing (which would require a specialist remediation contractor and separate scope), and long-term agricultural operation once the site is handed over.

3. APPLICABLE STANDARDS AND REFERENCES

- Environmental Protection Agency (EPA) Ghana — Environmental Assessment Regulations, 1999 (LI 1652), and effluent/water quality guidelines.
- Minerals Commission Ghana — reclamation and rehabilitation guidelines for small-scale mining land.
- Minerals and Mining Act, 2006 (Act 703) and Minerals and Mining (Amendment) Act — reclamation obligations.
- Water Resources Commission (WRC) Ghana — permits for water use, abstraction, and river diversion works.
- Ghana Standards Authority (GSA) — soil and water testing methods; AASHTO/ASTM equivalents where no GSA standard exists.

- General good-practice reclamation and land-use guidance for converting former mining land to agricultural/aquaculture use.

4. PHASE 1 — BASELINE ASSESSMENT AND CONTAINMENT

1. Determine GPS coordinates and stake out the perimeter boundaries of the degraded site.
2. Assess risks to the surrounding environment (slope stability, proximity to communities, existing vegetation, erosion exposure).
3. Assess local waterways: identify all streams, rivers, and drainage lines within and adjoining the site, and their flow direction relative to the works.
4. Secure the working area with proper temporary or permanent levee/dyke barriers to isolate the site from adjoining waterways and land.
5. Take soil grid samples across the site on a regular grid, logged against GPS coordinates.
6. Take standing water grid samples from any ponded water on site.
7. Determine the level of contamination to the best ability possible (visual assessment plus field/lab testing of the samples above).
8. Mark areas of high contamination and concern on the site plan for prioritized handling or exclusion from productive re-use.
9. Ensure safety and protective gear (PPE) is used by all personnel where necessary, particularly around identified contamination zones.

5. PHASE 2 — SITE PREPARATION

10. Complete the site's restoration workflow and reclamation approach as a written plan, referencing the contamination map from Phase 1.
11. Prepare the site for repair: clear access, position plant, and confirm containment barriers are intact.
12. Ensure all waterways are protected and that no seepage from the working area can take place — inspect levees/dykes daily during active works.

6. PHASE 3 — EARTH MATERIAL CLASSIFICATION

13. Classify the earth material at the site, separating it into large, medium, and small fractions.
14. Where necessary, use excavators to mechanically process the classifications.
15. Create three separate stockpiles of material — large, medium, and small — for later use in backfilling and pond/levee construction.

7. PHASE 4 — SLURRY WASHING AND WATER MANAGEMENT

16. Flood the remaining finished area with fresh water to create a shallow pond.
17. Use the slurry system to vacuum the slurry through the movement system (first wash).
18. Pull down surrounding earth materials into the shallow pond to bring them into the movement/wash cycle.
19. Pump the slurry into the industrial wash plant (second wash) for finer separation and cleaning.
20. Capture all runoff in a temporary containment pond — no discharge to natural waterways at this stage.

21. Pump out standing water from the top (not the bottom) until approximately 90% of all water is removed and temporarily stored in tanks or settlement ponds, keeping settled fines undisturbed on the bottom.
22. Churn the remaining 10% of water/slurry by dragging and scraping the bottom with the excavator bucket teeth, to mobilize remaining fines for processing.
23. Process the remaining slurry through the wash plant.

8. PHASE 5 — DEWATERING, DRYING, AND BACKFILLING

24. Let the site dry before further earthworks proceed.
25. Backfill the depressions using the large and medium aggregate stockpiles (from Phase 3) together with additional surrounding earth as needed.
26. Level and grade the area, preparing the surface for pond and paddy earthworks.

9. PHASE 6 — POND AND PADDY CONSTRUCTION

27. Stake the layout and positioning of the ponds and paddies on the graded surface.
28. Stake the alignment for a river diversion to provide a continuous freshwater flow to the ponds/paddies.
29. Prepare the pond barriers with adjoining levees, built from classified fill material.
30. Ready the pond shells for piping, lining, and water evacuation (i.e., finish-grade the shells and confirm falls to outlet points).
31. Install liners and all piping, inlets, and spillways to control water level and prevent uncontrolled overtopping.
32. Separate the ponds and prepare them for their intended end use — rice paddy cultivation and/or fish farming — including any partitioning walls between functions.

10. PHASE 7 — COMMISSIONING AND HANDOVER

33. Test water retention, liner integrity, and inflow/outflow control of each pond/paddy cell before stocking or planting.
34. Verify water quality against agricultural/aquaculture suitability parameters (pH, turbidity, dissolved oxygen, residual contamination).
35. Compile as-built records: site plan, contamination map, testing results, and restoration log referenced to GPS coordinates.
36. Hand over the site with an operating and maintenance guide for pond/paddy water management and agree a post-handover monitoring period.

11. PLANT, EQUIPMENT, AND MATERIALS

Category	Typical Resources
Earthmoving	Excavators (incl. long-reach for pond shells), bulldozer, motor grader
Water/slurry handling	Slurry pump and vacuum ('surly') system, industrial wash plant, water bowser

Category	Typical Resources
Containment	Levee/dyke construction equipment, silt fencing, temporary settlement ponds/tanks
Survey	GNSS/GPS handheld or RTK unit for staking and grid sampling, dumpy level
Testing	Soil and water sampling kits, field pH/turbidity meters, lab analysis (contracted)
Pond construction	Liners (HDPE or equivalent), piping, spillway structures, compaction equipment
Site support	Site office, PPE stores, fuel storage (bunded), first-aid station, signage

12. MANPOWER AND ORGANIZATION

- Project Manager — overall responsibility for program, budget, and regulatory/client liaison.
- Site/Reclamation Engineer — day-to-day supervision of earthworks, washing, and pond construction.
- Environmental Officer — sampling, contamination mapping, waterway protection, and EPA/WRC liaison.
- Surveyor — GPS staking, grid sampling coordinates, and as-built survey.
- Plant operators and drivers — excavators, wash plants, pumps.
- General labor — scaled to phase (indicatively 10–25 personnel at peak washing/pond-construction activity).
- Community liaison — coordination with the local chief/District Assembly, especially where the site borders farmland or community water sources.

13. INDICATIVE SCHEDULE

Durations below are indicative for a single degraded site parcel of moderate size (assumed 2–5 hectares) and should be recalibrated once the actual site area, contamination extent, and number of pond/paddy cells are confirmed.

#	Phase	Duration	Dependency
1	Baseline assessment & containment	Weeks 1–2	Site access secured
2	Site preparation	Week 2	Assessment complete
3	Earth material classification	Weeks 2–4	Site preparation complete
4	Slurry washing & water management	Weeks 3–7	Classification underway
5	Dewatering, drying & backfilling	Weeks 6–9	Washing substantially complete
6	Pond & paddy construction	Weeks 8–12	Backfilling/grading complete
7	Commissioning & handover	Weeks 12–13	All physical works complete

Note: as with Phase 4 of the client's original workflow, washing and dewatering are iterative rather than strictly linear — expect several wash/dewater cycles per cell before material is clean enough to proceed to backfilling.

14. QUALITY CONTROL AND TESTING

Test	Purpose	Indicative Frequency
Soil grid sampling & analysis	Establish baseline contamination extent and guide the contamination map	Per grid cell at baseline; re-tested after washing
Standing water sampling	Assess water contamination before containment/discharge decisions	At baseline, and before any release from settlement ponds
Turbidity / TSS of wash discharge	Confirm runoff is contained and not degrading downstream water quality	Daily during active washing
Compaction of backfill/levee material	Confirm stability of backfilled depressions and pond levees	Every lift, at representative points
Liner integrity check	Confirm no leakage before water/aquaculture stocking	Prior to commissioning each pond/paddy cell
Post-restoration water quality	Confirm suitability for rice/fish farming before handover	At commissioning, and during post-handover monitoring

15. HEALTH, SAFETY, AND ENVIRONMENT (HSE)

- Site-specific HSE plan covering excavation, plant-pedestrian interaction, and slurry/wash-plant hazards.
- Mandatory PPE in all active work zones and around marked high-contamination areas identified in Phase 1.
- Strict containment protocol: no discharge of untreated slurry, wash water, or runoff to natural waterways at any stage.
- Daily inspection of levees/dykes and settlement ponds, particularly during and after rainfall.
- Emergency response procedure for containment failure (e.g., levee breach) and nearest medical facility identification.
- Community safety: signage around open pits, ponds under construction, and wash-plant operating areas; coordination with the local chief/District Assembly on any temporary access restrictions.

16. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- EPA Ghana screening to confirm permitting requirements for reclamation works, water use, and any discharge, prior to mobilization.
- Water Resources Commission permit for the proposed river diversion and freshwater supply to ponds/paddies.
- Areas marked as high contamination in Phase 1 should be assessed by a qualified environmental specialist before being committed to rice or fish farming end use; some areas may need to be excluded from agricultural re-use or subject to further treatment.
- Community engagement on the intended end use (rice paddy / fish farming) to confirm local demand, land tenure, and post-handover operating responsibility.

- Documentation of restored hectares and outcomes for the client's own reporting or verification purposes, where the site is being counted toward restoration targets.

17. KEY RISKS AND MITIGATIONS

Risk	Mitigation
Undetected residual contamination (e.g., heavy metals, mercury) affecting crop/fish safety	Independent water and soil testing at commissioning, not only at baseline; specialist review of flagged zones
Levy/dyke failure releasing slurry or washing water to waterways	Daily inspection, conservative freeboard, and rapid-response containment materials on standby
Rainy-season interference with drying/backfilling phases	Sequence drying and backfilling for dry-season windows where possible; buffer time in schedule
Insufficient freshwater supply for river diversion	Confirm hydrology and dry-season flow before finalizing pond/paddy sizing
Community disputes over end-use or land tenure post-restoration	Early engagement with chief/District Assembly and clear agreement on post-handover use before works begin

18. HANDOVER AND POST-RESTORATION MONITORING

On completion, the site will be handed over with a restoration log (referenced to GPS coordinates and the Phase 1 contamination map), water and soil test results, as-built pond/paddy layout, and an operating guide for water management. A post-handover monitoring period (recommended 6–12 months, covering at least one full rainy season) is advised to confirm pond/paddy stability, water quality, and initial crop or fish-stocking performance before the site is counted as fully restored for reporting purposes.

19. ASSUMPTIONS AND NEXT STEPS

- This program assumes a single degraded parcel of approximately 2–5 hectares with moderate (not severe) contamination; actual site area, contamination profile, and number of pond/paddy cells should be confirmed by the Phase 1 baseline assessment and used to recalibrate schedule and cost.
- Severity of contamination found during baseline sampling may require a specialist remediation scope beyond standard soil washing — this should be flagged immediately if encountered, before proceeding to Phase 4.
- Recommended immediate next steps: (i) mobilize for Phase 1 baseline assessment and GPS staking, (ii) engage EPA Ghana and the Water Resources Commission on permitting, (iii) confirm the intended end-use split between rice paddy and fish farming with the community/landowner, and (iv) convert this Work Program into a priced Bill of Quantities for contractor tendering.