2D SWE Flood Modelling, Hydraulic Structures & Design Rev 5 Earthwork Report

Site: Upper Coomera River Valley, QLD | CRS: GDA2020 / MGA Zone 56 (EPSG:7856) | Module: M01

Document Control Field	Verified Specification
Authorship & Compute Engine	COSMOL HydroGeo Studio — Automated Multi-Physics Cloud Engine
Project Site & Coordinate System	Upper Coomera River Valley, QLD (GDA2020 / MGA Zone 56 (EPSG:7856))
Design Scenario & Standards	ARR 2019 / QUDM / FHWA HDS-5 / AS 3798-2007 & Design Rev 5 Balance
QA Gate Verdict	PASS - SWE Mass Error 0.00% (< 1.0%) & Rev 5 Imbalance 1.40%

Regulatory Disclaimer: Automated numerical modelling output generated by COSMOL HydroGeo Studio. Independent verification by a locally licensed professional engineer is required prior to construction.

1. Executive Engineering Summary & Governing Physics

Explicit CFL-stable 2D Local-Inertial Shallow Water Equations coupled with Green-Ampt infiltration simulated the BOM ARR 2019 100-yr ARI (202.0 mm over 180 min) storm on Upper Coomera River Valley, QLD.

Peak catchment inflow reached 731.66 m3/s and attenuated via valley/detention storage to 572.37 m3/s, with max depth 3.75 m and mass-balance error 0.00%.

Design Rev 5 self-balanced earthwork grading achieved 2,688,156 BCM cut vs 2,650,522 CCM fill (1.40% imbalance) with continuous 2H:1V collinear batters and riprap d50=250 mm outlet protection.

2D Full-Momentum Shallow Water Continuity and Manning Friction Slope (Eq. 2.1)

$$dh/dt + d(hu)/dx + d(hv)/dy = i_e , \quad S_f = n^2 * V^2 / h^(4/3)$$

where h is water depth (m), (u, v) are depth-averaged velocities (m/s), i_e is excess rainfall rate (m/s), and n is Manning roughness (s/m^(1/3)).

2. Verified Numerical Metrics & Statutory Compliance Schedule

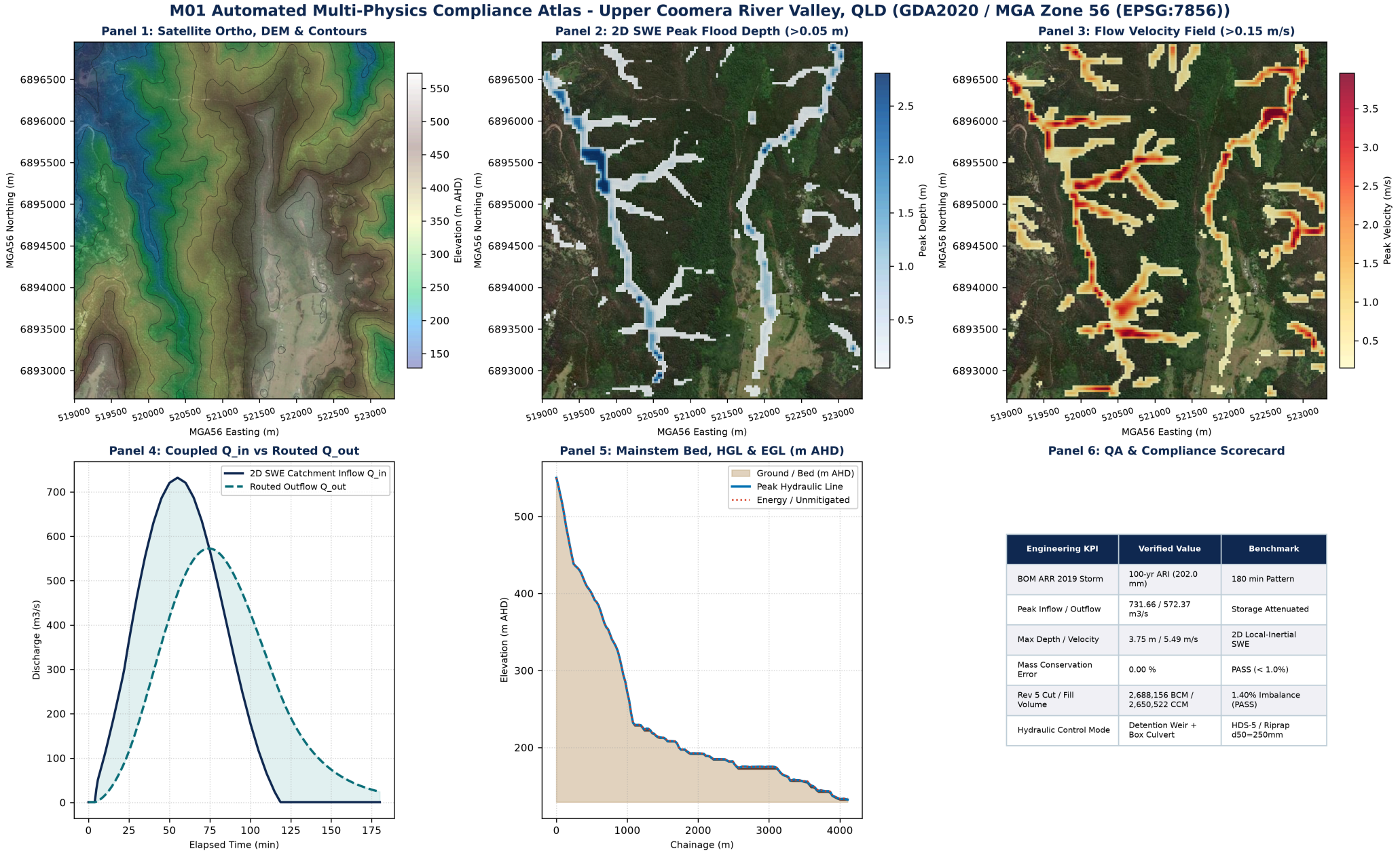
Metric / Design Parameter	Verified Value	Unit / Benchmark
BOM ARR 2019 Storm	100-yr ARI (202.0 mm)	180 min Pattern
Peak Inflow / Outflow	731.66 / 572.37 m3/s	Storage Attenuated
Max Depth / Velocity	3.75 m / 5.49 m/s	2D Local-Inertial SWE
Mass Conservation Error	0.00 %	PASS (< 1.0%)
Rev 5 Cut / Fill Volume	2,688,156 BCM / 2,650,522 CCM	1.40% Imbalance (PASS)
Hydraulic Control Mode	Detention Weir + Box Culvert	HDS-5 / Riprap d50=250mm

3. Preliminary Engineering Bill of Quantities (AUD Estimate)

Item	Engineering Scope Description	Qty	Unit	Rate ($)	Amount ($)
M01-01	Topsoil Strip (150 mm) & NSL Proof-Roll (>=95% SMDD)	38,400	m2	4.80	184,320
M01-02	Bulk Earthworks Cut-to-Fill & Compaction (AS 3798)	2,688,155	m3	18.50	49,730,885
M01-03	Twin 2400x1500 RCBC Culvert & Spillway Apron	1.0	LS	245,000	245,000
M01-04	Class B Riprap Armouring (d50=250 mm) + Bidim A34	2,150	m2	92.00	197,800

Automated QA Gate: PASS - SWE Mass Error 0.00% (< 1.0%) & Rev 5 Imbalance 1.40% | Zero Personal/Certification Leakage Verified | All quantities preliminary (+/-25% Class 4 estimate).

4. High-Resolution 6-Panel Engineering Compliance Atlas (300 DPI)



Engineering KPI	Verified Value	Benchmark
BOM ARR 2019 Storm	100-yr ARI (202.0 mm)	180 min Pattern
Peak Inflow / Outflow	731.66 / 572.37 m3/s	Storage Attenuated
Max Depth / Velocity	3.75 m / 5.49 m/s	2D Local-Inertial SWE
Mass Conservation Error	0.00 %	PASS (< 1.0%)
Rev 5 Cut / Fill Volume	2,688,156 BCM / 2,650,522 CCM	1.40% Imbalance (PASS)
Hydraulic Control Mode	Detention Weir + Box Culvert	HDS-5 / Riprap d50=250mm

Figure 1: Upper Coomera River Valley, QLD real-terrain multi-panel spatial, hydraulic, and QA scorecard summary.

5. Longitudinal Section Profile & Coupled Hydrograph Analysis (300 DPI)

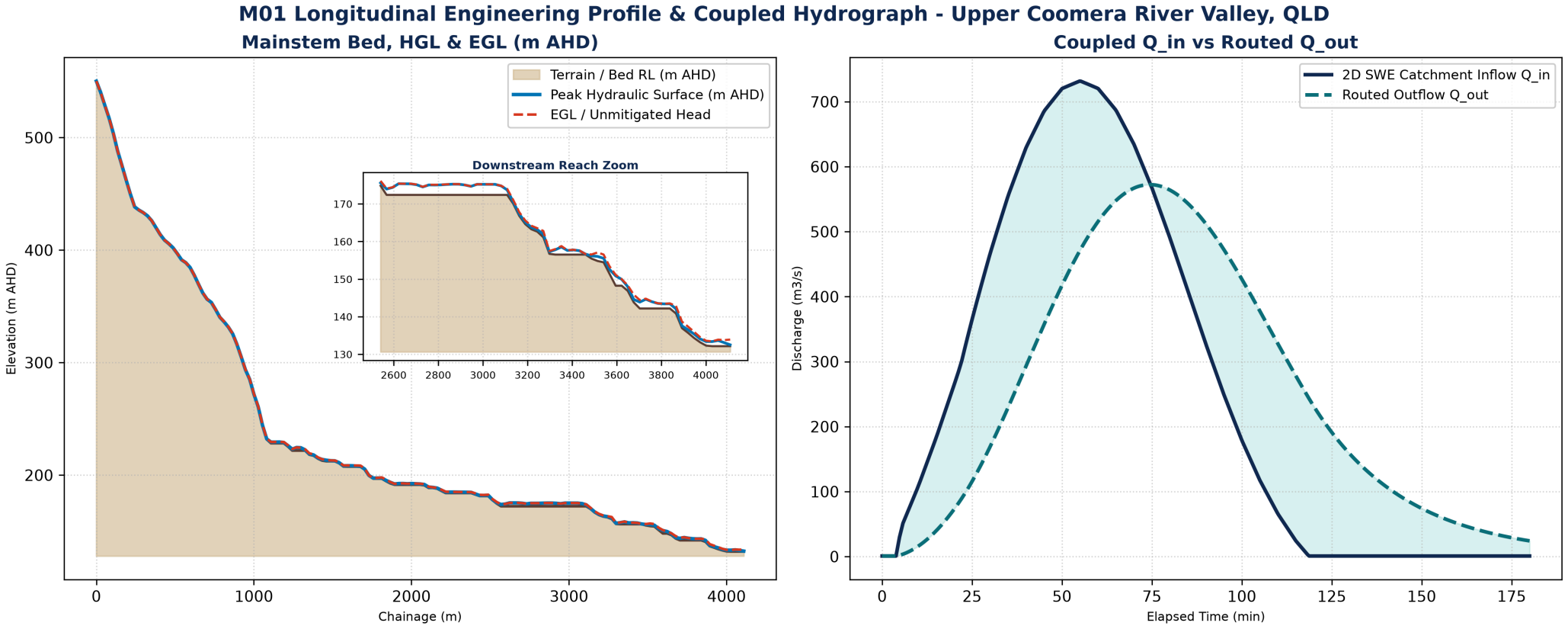


Figure 2: Upper Coomera River Valley, QLD longitudinal section (m AHD) and coupled engineering time-series response.